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In a Spring 2021 article by Rogers et al., the institutional affiliation of a contributing author, Andy Ward, was incorrectly listed as Arizona State Museum, University of Arizona on page 123. Andy Ward is an Independent Researcher.

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THE SPREAD OF MAIZE FROM MEXICO TO THE NORTH AMERICAN SOUTHWEST

Alan R. Schroedl

This analysis reviews the current information on how and when maize reached the American Southwest from Mexico. In the mid-twentieth century, researchers speculated that maize arrived in the American Southwest via a highland route from Mexico based on Mangelsdorf's incorrect belief that prehistoric maize at Bat Cave dated to about 5,000 years ago and originated from a wild variety in South America. Although a recent genetic analysis of aDNA from prehistoric maize cobs from highland sites in the Southwest appears to support the hypothesis that maize was first introduced into the region through the Mexican highlands, direct radiocarbon dating of early maize specimens demonstrates that the earliest maize in the American Southwest arrived at lowland sites in the Tucson Basin prior to being grown at higher elevations in the Southwest. Another aDNA analysis suggests that by the time maize reached the American Southwest, it was still adapting to a temperate climate. While the lowland route of arrival of maize to the American Southwest is confirmed, it is still a question where tropical maize from Mexico finally adapted to a temperate climatic regime along its route northward.

The timing and route or routes of introduction of maize (*Zea mays* ssp. *mays*) into the American Southwest has been debated by archaeologists and botanists for decades (Berry 1985; Kohler et al. 2008; Mangelsdorf and Lister 1956; Vierra and Carvalho 2019). Understanding the spread of maize is not just an archaeological problem but is complicated by the fact that the biological aspects of maize must be factored into the explanation of the origin and spread of maize into the American Southwest (Bennetzen et al. 2001; Zeder et al. 2006). The domestication and productivity of maize involves a complex interaction of internal genetic variation coupled with conscious and unconscious human selection (Pressoir and Berthaud 2004) of phenotypic traits for agronomic benefits or other cultural factors over the past 9,000 years.

The advent of direct radiocarbon dating of maize specimens has provided a large corpus of data to address the issue of the timing of the introduction of maize into the Southwest. Additionally, advances in agronomy, botany, and plant genetics provide insights into the classification of maize varieties, the process of domestication, and the biological distinction between highland and lowland maize that may help determine the route of introduction of maize into the American Southwest.

BACKGROUND

Since the 1950s, an implicit assumption among archaeologists is that the earliest maize in the American Southwest was first grown on the uplifted Colorado Plateau and entered the region through a highland route based on the discovery of "primitive" maize at Bat Cave in New Mexico (Mangelsdorf 1950) and pre-ceramic maize at Tularosa Cave nearby (Martin et al. 1952). Based on undated maize from Swallow Cave, a deeply stratified cave site in northern Mexico, Mangelsdorf and Lister state "It is postulated that the highlands of northwestern Mexico served as a corridor for the northward diffusion of maize" (Mangelsdorf and Lister 1956:176). Ford also believed that maize entered the Southwest via a highland route: "Mountainous regions about 2000 m with sufficient precipitation for dry farming in southwestern New Mexico and southeastern Arizona were the first areas where crop plants from Mexico became established in the Southwest" (Ford 1981:7). The hypothesized highland route of maize diffusion from Mexico has continued to be repeated in the literature over the past decades (e.g., Dello-Russo 2008:18; da Fonseca et al. 2015:1). However, the advent of direct radiocarbon dating of maize specimens and advances in research of the genetics of modern maize challenge these earlier researchers' supposition that the first maize to arrive in the Southwest was a highland-adapted wild variety.

In the early twentieth century, botanists, e.g., Mangelsdorf and Reeves (1938) and Beadle (1939), who were interested in determining the geographic origin and evolutionary sequence of the ancestor of maize before it became a cultivated crop had to rely on archaeologically dated maize remains. The first calendar date on prehistoric maize was obtained from Du Pont Cave, a Basketmaker cave in southern Utah (Stallings

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1941). The Basketmaker maize at this site was comparable to modern varieties with high cob row numbers, large ears, and large kernels, clearly recognizable as domesticated maize. The tree-ring date of AD 217 demonstrated that domesticated maize had arrived in the American Southwest almost 2,000 years ago.

For maize researchers interested in the origin and evolution of maize, it was apparent that archaeological maize samples dating much earlier than the 2,000-year-old Basketmaker maize would be needed to establish an evolutionary maize sequence. Primitive-looking maize cobs from the lower levels of Bat Cave were associated with one of the very first radiocarbon dates in the 1950s (Mangelsdorf 1950). According to Mangelsdorf (1954:409–410), the 5,000-year-old associated radiocarbon date supported his claim that the maize from the site was a primitive pod corn that had evolved from wild maize. The specimen from Bat Cave remained one of the earliest maize samples dated by association for decades.

In the 1980s, the development of AMS dating allowed for the direct dating of maize specimens and spurred extensive direct dating of maize. One of the "primitive" cobs from the lower levels of Bat Cave produced a radiocarbon determination of 3740 ± 70 radiocarbon years (Table 1), several thousand years younger than expected, thus undermining Mangelsdorf's primitive pod corn evolutionary sequence.

Until the 1990s, the earliest radiocarbon determinations on maize in the American Southwest were samples from sites on or near the uplifted Colorado Plateau that seemed to support the highland route hypothesis. However, archaeological research in the Tucson Basin beginning in the late 1990s has since identified some of the earliest dated maize in the American Southwest, all at lower elevations and all earlier than sites with dated maize on the Colorado Plateau.

Table 1 presents currently identified sites in the American Southwest and northern Mexico with directly dated maize samples earlier than 3,100 radiocarbon years BP (cf. Merrill et al. 2009). For each site only the earliest dated sample is listed. The calibrated 2-sigma date range is provided in the table and the median cal BC/AD dates are discussed in the text. Radiocarbon determinations in Tables 1 and 2 were calibrated by OxCal 4.4 and IntCal20 (Bronk Ramsey 2009; Reimer et al. 2020).

The earliest dated maize specimen is from the Las Capas site in the Tucson at about 3690 cal BC. Vint (James Vint, personal communication 2021) is hesitant to accept this early maize date, as well as the second earliest maize date at the site (4460 ± 30 BP [Beta-333931]) because of concerns they were recovered from redeposited contexts. However, by 5,000 years ago, maize was a fully domesticated cultigen dependent on human dispersion for propagation (Benz 2001). These early maize specimens at Las Capas were a result of human activity, not natural dispersion. They may represent early failed experimentation with local maize gardening prior to the later establishment of maize growing communities in the Tucson Basin. There must have been some passage of time for local Archaic populations to incorporate maize into their subsistence patterns before prehistoric maize-growing communities are established several hundred years later as recognized in the archaeological record.

As shown in Table 1, there are several locally contiguous sites in the Tucson Basin where maize specimens are dated earlier than 3,100 years ago compared to other widely scattered upland sites with similar dates. Significantly, all of the sites outside of the Tucson Basin, even the earliest at the Old Corn site at 2260 cal BC, appear to represent experimentation with maize in these areas, rather than evidence of intensive maize gardening or horticulture.

The sites in the Tucson Basin all lie at elevations of less than 750 m asl, while the oldest upland site, the Old Corn site, lies at an elevation of 1,910 m asl. The radiocarbon ages indicate that maize was being cultivated in a lowland setting between 300 to 1,400 years earlier than at highland locations such as the Old Corn site and Bat Cave. The discovery of early horticultural lowland communities in the Tucson Basin raises questions about the route of introduction of maize into this region from its place of origin in Mexico.

DATING THE EARLIEST MAIZE IN MEXICO

While prehistoric maize macrofossils are common in the American Southwest, early maize macrofossils from Mexico are rare. The earliest domesticated maize cobs recovered to date are two rowed cobs from Guilá Naquitz Cave in Oaxaca, Mexico. A pair of overlapping radiocarbon determinations on the maize specimens date to about 4280 cal BC (Table 2). Purportedly earlier dates on maize were reported from sites in the Tehuacán Valley of Mexico (Mangelsdorf et al. 1964).

Mangelsdorf and colleagues (Mangelsdorf et al. 1964) claimed the maize specimens assigned to the Coxcatlan phase (7800–6150 BC) in the Tehuacán Valley were more than 7,000 years old based on the preceramic chronology of the Tehuacán project. Johnson and MacNeish (1972) developed a cultural sequence of archaeological phases for the Tehuacán Valley spanning more than 9,000 years derived from radiocarbon dates, stratigraphy, and the chipped stone assemblages for the preceramic phases. Based on the Tehuacán Valley phase

Table 1. Sites with Directly-dated Maize Specimens in the American Southwest and Northwest Mexico Older than 3100 Radiocarbon Years BP

Site Name	State	Region	Site Number	Elevation (m)	Lab No.	Conventional Radiocarbon Age	Two Sigma Cal BC Date Range	Median Cal BC Date	Reference
Las Capas	AZ	Tucson Basin	AZ AA:12:111(ASM)	680	Beta-344171	4930 ± 30	3780–3640	3690	Vint 2015
Los Pozos	AZ	Tucson Basin	AZ AA:12:91(ASM)	690	CAMS-34923	4050 ± 50	2860–2460	2590	Gregory 2001
Old Corn	NM	Colorado Plateau	LA137258	1,910	Beta-185023	3810 ± 50	2460–2060	2260	Huber and Van West 2006
Bat Cave	NM	Colorado Plateau	LA4935	2,130	A-4187	3740 ± 70	2440–1940	2150	Wills 1993
Clearwater	AZ	Tucson Basin	AZ AA:13:6(ASM)	7,20	Beta-175842	3690 ± 40	2200–1950	2080	Mabry 2006
El Taller	AZ	Tucson Basin	AZ AA:12:92(ASM)	680	Beta-161850	3730 ± 40	2290–1980	2130	Wöcherl 2007
McEuen Cave	AZ	Colorado Plateau	AZ W:13:6(ASM)	1,340	CAMS-43177	3690 ± 50	2280–1930	2080	Merrill et al. 2009
Montoya	NM	Colorado Plateau	LA88891	1,830	Beta-330166	3640 ± 30	2140–1900	2000	Laumbach 2014
Three Fir Shelter	AZ	Colorado Plateau	AZ D:7:618(ASM)	2,240	Beta-26275	3610 ± 170	2470–1540	1990	Smiley 1994
Square Hearth	AZ	Tucson Basin	AZ AA:12:745(ASM)	690	AA-13257	3505 ± 65	2030–1630	1830	Mabry et al. 1997
Lukachukai	AZ	Colorado Plateau	AZ I:39:53(ASM)	2,000	AA-9317	3445 ± 45	1890–1620	1760	Gilpin 1994
Cortaro Road	AZ	Tucson Basin	AZ AA:12:232(ASM)	650	Beta-168799	3320 ± 40	1740–1500	1590	Hesse and Lascaux 2005
Tornillo Shelter	NM	Mesilla Basin	NMSU1541	1,490	GX-12720	3175 ± 240	2030–830	1440	Upham et al. 1987
Valley Farms	AZ	Tucson Basin	AZ AA:12:736(ASM)	650	AA-28496	3145 ± 50	1510–1280	1420	Roth and Wellman 2001
Cerro Juanaqueña	MX	Northern Mexico	–	1,440	NSRL-12484	3130 ± 55	1510–1260	1400	Hard et al. 2001
San Luis De Cabezon	NM	Colorado Plateau	LA110946	1,870	AA-34173	3125 ± 45	1500–1270	1390	Vierra and Ford 2006

sequence, Mangelsdorf and colleagues (Mangelsdorf et al. 1964) identified an evolutionary sequence of corn, Wild, Early Cultivated, and Early Tripsacoid, that supported Mangelsdorf's tripartite hypothesis of the origin and evolution of maize (de Wet and Harlan 1972).

With the development of AMS dating, there was a renewed interest in the 1980s to directly date early maize specimens from the Tehuacán project. Richard MacNeish, the director of the project, selected 12 maize cobs for AMS dating from Coxcatlan Cave and San Marcos Cave that he believed represented the earliest maize specimens at these sites. Long and colleagues (Long et al. 1989) directly radiocarbon dated these maize specimens and determined that the earliest maize from these sites were four statistically contemporaneous specimens from San Marcos Cave dating to 3450 cal BC, much later than the stratigraphically-derived estimates.

Additionally, there was a broad range of more recent dates on the remaining supposedly early maize specimens; the sample with the most recent radiocarbon determination dated to 450 ± 40 radiocarbon years BP. Long and colleagues (Long et al. 1989:1037) diplomatically avoided questioning "the credibility of the previous dates or their interpretation," however, Hardy's (1996, 1999) reanalysis of the stratigraphy and chipped stone typology calls into question the validity the entire cultural sequence of the preceramic portion of the Tehuacán Valley chronology. The evolutionary sequence of maize types from the El Riego and Coxcatlan phases through Abejas phase (7200–2300 BC) promoted by Mangelsdorf and colleagues (1964:Figure

Table 2. Radiocarbon Dates Associated with the Domestication of Maize in Mexico

Site	Region	Approximate Elevation (m)	Lab No.	Sample Material	Radio-carbon Age	Two Sigma Cal BC Date Range	Median Cal BC Date	Reference
Xihuatoxtla Shelter	Balsas	960	Beta-203459	Charcoal	7920 ± 40	7040–6650	6800	Ranere et al. 2009
Guilá Naquitz	Oaxaca	1930	Beta-132510	Maize cob	5410 ± 40[a]	4350–4060	4280	Piperno and Flannery 2001
			Beta-132511	Maize cob	5420 ± 60[a]	4360–4060		Piperno and Flannery 2001
San Marcos Cave	Tehuacán Valley	1480	AA-3305	Maize cob	4700 ± 60[b]	3640–3360	3450	Long et al. 1989
			AA-3311	Maize cob	4700 ± 110[b]	3710–3100		Long et al. 1989
			AA-3304	Maize cob	4680 ± 50[b]	3630–3360		Long et al. 1989
			AA-3310	Maize cob	4600 ± 60[b]	3530–3100		Long et al. 1989
San Marcos Cave	Tehuacán Valley	1480	Beta-320309	Maize stalk	4190 ± 30[c]	2900–2630	2790	Vallebueno-Estrada et al. 2016
			Beta-320315	Maize cob	4240 ± 30[c]	2920–2700		Vallebueno-Estrada et al. 2016
			Beta-320310	Maize stem	4220 ± 30[c]	2910–2670		Vallebueno-Estrada et al. 2016
			Beta-320314	Maize cob	4180 +30[c]	2890–2630		Vallebueno-Estrada et al. 2016
Romero's Cave	Ocampo	1500	Beta-85431	Maize cob	3960 ± 50[d]	2620–2290	2420[e]	Smith 1997
Valenzuela's Cave	Ocampo	1500	Beta-85433	Maize cob	3890 ± 60[d]	2570–2150		Smith 1997

a,b,c,d Statistically contemporaneous specimens

e Median date for the samples from two adjacent sites

2) is not supported by the radiocarbon record, nor is the identification of a "wild" maize variety in Tehuacán Valley (Benz and Iltis 1990).

Smith (1997) reports on two contemporaneous dates of 2420 cal BC on maize from Romero's Cave and nearby Valenzuela's Cave in the Ocampo municipality in the state of Tamaulipas in northeastern Mexico, samples originally collected in the 1950s (Mangelsdorf et al. 1967). Since these excavation projects in Mexico more than 40 years ago, there have been no major additional archaeological finds of early maize macrofossils from central Mexico (Rosenswig 2015).

There are several sites with maize in northwestern Mexico that are south of the Tucson Basin. In northwest Mexico, Mangelsdorf and Lister (1956) reported on potentially early maize macrofossils from Swallow Cave, although none were subsequently dated. Mangelsdorf identified several varieties of maize at this site, one, Harinoso de Ocho, he believed was evidence of diffusion from South America, in keeping with his position that maize in the Northern Hemisphere was derived from wild maize in South America. It is also in this report that they suggested a highland route of maize into the American Southwest.

Another highland site in northwestern Mexico on the east side of the Sierra Madre Occidental is Cerro Juanaqueña (Hard et al. 2001) about 300 km southeast of the Tucson Basin. The earliest maize at this site dates to about 1400 cal BC, too late to be an early maize donor to the Tucson Basin. La Playa, a lowland site in the Río Concepción Basin on the western flanks of Sierra Madre Occidental, was occupied perhaps as early as 3,720 radiocarbon years ago based on a radiocarbon determination from a burial (Carpenter et al. 2015). Although maize was recovered from the site, no dates on early maize specimens have been published. Because maize from the Tucson Basin is currently several hundred years earlier than the earliest radiocarbon date at this

site, this site cannot shed light on the arrival of maize in the Tucson Basin at this time. Currently, maize from the Tucson Basin is the oldest dated maize north of central Mexico. Figure 1 depicts the location of archaeological sites with early dated maize in the American Southwest including northwestern Mexico and other early sites in Mexico.

Large areas in northern Mexico either in the lowlands or the highlands have not been systematically examined for potentially early sites with preserved maize macrofossil specimens. Although more than 2,100 km separates the early maize macrofossils in Oaxaca and the Tehuacán Valley from those in the Tucson Basin, a lowland route of arrival of maize in the Tucson Basin is inferred as discussed below. First, it necessary to discuss the domestication of maize.

DOMESTICATION OF MAIZE IN MEXICO

Mangelsdorf (1950, 1954, 1958) promoted his wild maize origin hypothesis for decades based on limited archaeological data from Bat Cave and Mexico. However, it was the Mendelian experiments of George Beadle in the 1970s that demonstrated that teosinte was the ancestor of maize despite the stark differences in the phenotypic morphology of the ears of teosinte and maize (Doebley 2004:43). A teosinte ear contains 5-10 cupulate fruitcases which enclose an almost inaccessible kernel, while domesticated maize contains numerous "naked" accessible kernels on an ear. Beadle determined that only a few genetic differences separated the two subspecies.

More recently, based on DNA microsatellite analysis of more than 250 maize and teosinte samples, Matsuoka and colleagues (Matsuoka et al. 2002) confirm that the ancestor of maize is teosinte (*Zea mays* ssp. *parviglumis*), a wild grass found in Michoacán and Guerrero states in southwest Mexico. They note that all maize arose from a single area of domestication in the c grass *Tripsacum* but entral Balsas River drainage of southwest Mexico about 9,000 years ago. Ssp. *parviglumis* is endemic in the low- to mid-lands with the highest frequency of occurrence of modern teosinte at elevations between 150 m and 1950 m (Sánchez González et al. 2018). These DNA results refute Mangelsdorf's tripartite hypothesis of the origin of maize (Mangelsdorf and Reeves 1945). There is no wild maize from South America that is a progenitor of maize, nor is teosinte a hybrid of wild maize and the grass *Tripsacum* but, rather, it is the ancestor of maize.

Smalley and Blake (2003) hypothesize that maize and its ancestor in the Balsas region were first gathered for their sweet sugary stalks in addition to the encased seeds. Wang and colleagues (Wang et al. 2005) note that a single gene freed the maize kernel from the hardened case allowing for the full-scale domestication of maize as a seed crop; Iltis (2000) suggests that the mutation that freed the kernel from the fruitcase may have occurred in a single plant (a maizoid "Eve"). Doebley (2004:42) indicates that the domestication of maize may have occurred only once in a small population of plants in a single localized area in the Balsas region in Mexico.

While genetic c Balsas River drainage of southwest hanges from teosinte ears to maize cobs may have occurred too quickly to be discernible in the archaeological record, there were slow continuous changes in morphological ear traits over a long period suggesting a gradual rather than abrupt process by which maize became a productive food source after escaping the fruitcase (Benz 2001).

Benz and Iltis (1990) reexamining the maize specimens from the Tehuacán Valley determined "The single most important realization gained from this analysis is that the earliest maize from the Tehuacán Valley could not have been wild. . . . These archaeological cobs exhibit all attributes of cultivated maize" (Benz and Iltis 1990:505). In 2001, Benz (2001) compared the early maize cobs from Guilá Naquitz and the Tehuacán Valley and noted the morphology of the maize cobs were statistically indistinguishable among these two upland maize populations even though the maize specimens from Guilá Naquitz are more than 800 years older than those from the Tehuacán Valley. Both sets of specimens demonstrate that besides being selected for naked grains (accessible kernels), maize was also being human-selected for inflorescences (cobs) that stayed on the plant until harvested, and paired spikelets which allowed for an increase in four or more rows of grain (Benz 2001). DNA analysis of an early maize specimen from the Tehuacán Valley demonstrated this upland specimen is closely related to the ancestor of all modern maize, yet distinct from *Zea may*s ssp. *parviglumis*, the closest living relative to maize (Ramos-Madrigal et al. 2016).

Citing the analysis of Matsuoka and colleagues (Matsuoka et al. 2002), maize researchers (van Heerwaarden et al. 2011) recognized a botanical (and archaeological) paradox for early maize in Mexico. The DNA data indicates that the maize was domesticated in the lowlands of the Balsas region from ssp. *parviglumis,* however, highland maize is believed to have given rise to all cultivars currently grown throughout the Americas, a position bolstered by the presence of early dated maize macrofossils in Oaxaca and the Tehuacán Valley of the Mexican highlands. They reconciled this botanical paradox of the genetic ancestry of modern maize by invoking highland introgression with *Zea mays* ssp. *mexicana,* a subspecies that does not exist in the lowlands.

The archaeological aspects of this paradox are a function of *preservation bias* and *discovery bias*.

Figure 1. Archaeological sites in Mexico and southwestern United States with directly dated early maize in relation to the Northwest Sierras region of maize biodiversity. The arrow depicts the direction of lowland maize spread to the American Southwest. Preservation and discovery biases account for dated maize sites from higher elevations and latitudes.

Vagaries of preservation determine whether or not organic remains such as maize plant parts are found in an archaeological site regardless of its geographic location. Such archaeological data are rare from either highland or lowland contexts in Mexico. Blake (2006:Table 4.1) identifies only eight sites in Mexico with dated maize macrofossil remains; one of which from La Playa is not confirmed. Maize researchers are still relying on archaeological specimens that were recovered more than 50 years ago on the Mexican Plateau, e.g., Guilá Naquitz and the Tehuacán Valley (Jaenicke-Després and Smith 2006). While genetic analysis of prehistoric maize cobs from the highland of Mexico can provide insights into the genetic changes in early maize (da Fonseca et al. 2015), these macrofossils represent samples that had already been domesticated for thousands of years. By the time the maize cobs at these highland prehistoric sites were harvested, maize had already been undergoing genetic changes due to human selection for several thousand years prior in the Balsas lowlands. There are currently no comparably early maize macrofossils, i.e., cobs or kernels, suitable for genetic analysis from lowland sites in the Balsas region.

Discovery bias reflects the differential identification of archaeological sites with varying data potential across regions. Differential identification of archaeological sites may result from varying geomorphic circumstances, research orientations, funding inadequacies, or other factors. The lack of maize macrofossils in the Balsas region does not mean there is a lack of archaeological evidence of maize domestication in the area. At least one site, Xihuatoxtla Shelter, has been excavated that provides evidence of maize microfossils, starch grains and phytoliths, in the early archaeological record in the Balsas lowlands at an elevation of about 690 m.

Xihuatoxtla Shelter is an archaeological site containing stratified Archaic deposits with the earliest artifact assemblages more than 9,000 years old (Ranere et al. 2009). Although the site lacks maize macrofossils, the same researchers (Piperno et al. 2009) conducted separate microfossil analyses of starch grains on artifacts and phytoliths present in the deposits. Distinguishing between short-cell phytoliths diagnostic of the glumes and cupules of maize cobs and the long-cell phytoliths of teosinte, the researchers demonstrated that maize rather than ears of teosinte were exploited at the shelter throughout its period of early occupation. The earliest evidence of maize phytoliths at the site was identified both beneath and from the level that produced a radiocarbon determination of 7920 ± 40 BP (see Table 2). The presence of maize at the earliest levels at the site was corroborated by the identification of maize starch grains on the grinding implements and chipped stone artifacts recovered from within or below the stratum with a radiocarbon determination of 7920 ± 40 BP, about 6800 cal BC. This date is congruent with the estimated 9000 BP date of the divergence ssp. *mays* and ssp. *parviglumis* noted by Matsuoka and colleagues in the Balsas region (Matsouka et al. 2002). Microfossils from Xihuatoxtla Shelter confirm that maize was domesticated in the lowlands before spreading southeast to the highland areas in Oaxaca and the Tehuacán Valley.

From the Balsas River drainage, maize horticulture spread quickly across the highlands and lowlands of Central and South America (van Etten and Hijman 2010). By about 2300 cal BC, maize was sufficiently domesticated to be a staple food crop in Honduras (Kennett et al. 2017), more than 1,200 km to the southeast of the Balsas region. With maize being domesticated in the Balsas region by at least 6800 cal BC, its arrival in the Tucson Basin more than 1,900 km north by the fifth millennium BC is unremarkable and attests to the genetic ability of prehistoric maize to quickly adapt to local climatic conditions at more northerly latitudes.

MODERN MAIZE DIVERSITY IN MEXICO: HIGHLAND VERSUS LOWLAND

Modern maize landraces or varieties in Mexico are usually distinguished by growing altitude; highland versus lowland, or sometimes segregated by three elevation zones: lowland (1–1,200 m), midland (1,200–2,000 m), and highland (> 2,000 m) (Jiang et al. 1999; Mercer et al. 2008:491). Eagles and Lothrop (1994) note that modern highland maize in Mexico has distinct plant morphology, karyotype, and isozyme frequency and is superior to maize from temperate, mid-altitude tropical, and lowland tropical regions for seedling emergence. It is adapted to cool areas and has better frost and hail tolerance, but is poorly adapted to high temperatures greater than 17°C. The lowland Balsas region has an annual average temperature of 25°C and the modern Tucson Basin has an average temperature of 21°C suggesting that the earliest maize to arrive in the American Southwest in the Tucson Basin was more likely a lowland rather than a highland variety (Jiang et al. 1999)

Additionally, Mercer et al. (2008) compared the fitness of modern lowland-, midland-, and highland-adapted races in elevationally separate maize gardens in Chiapas, Mexico, grown at 700 m (lowland), 1,500 m (midland) and 2,150 m (highland). Their results showed that lowland modern landraces had the greatest proportion of plants that produced good quality seed regardless of the elevation, and that midland landraces produce well in both the midland and highland elevations. In contrast, modern highland races only produced well in the higher elevations. Analysis of the fitness of lowland, midland, and highland modern maize landraces (Mercer

et al. 2008:494) indicates highland landraces are disadvantaged outside their usual altitude (i.e., > 2,100 m) again making it likely that lowland and midland maize varieties were the first to be introduced from Mexico into the North American Southwest at lowland sites in the Tucson Basin (< 750 m).

ANCIENT MAIZE DNA

The lack of archaeological evidence of maize between the highlands of Mexico and the Tucson Basin requires considering other data to determine the route of maize arrival in the American Southwest. As noted above, Mangelsdorf continued to promote the tripartite hypothesis of the origin and evolution of maize, based solely on associated radiocarbon dates from Bat Cave and Tehuacán Valley, dates that are now known to be too early.

Although Mangelsdorf's search for modern descendants of wild maize were unsuccessful and his hypothesis later debunked (Bennetzen et al. 2001), he dominated the thinking about maize evolution among archaeologists for decades. He even motivated maize researchers (Wellhausen et al. 1952) to designate several landraces as ancient landraces although there were no chronological or archaeological data that supported attributing these modern maize varieties to the prehistoric past.

Mangelsdorf and other researchers classified prehistoric maize macrofossils into maize landraces based on the phenotypic traits of archaeologically recovered kernels and cobs. However, maize landraces were originally based on the whole range of living maize plant characteristics including morphological characteristics, internal cytological features, physiological characteristics, and agronomic characteristics such as earliness, resistance or susceptibility to disease, and yield (Wellhausen et al. 1952), not just kernels and cobs.

Initially about 30 landraces of maize were identified in the 1950s (Wellhausen et al. 1952), however the number of modern landraces or separate maize populations varies today between 50 and 200+ depending on the researcher. Because modern maize populations in Mexico show large phenotypic variation in quantitative traits, it is unreasonable to expect that named modern landraces today have remained unchanged for hundreds and even thousands of years and can be traced back to their progenitor ancestors based solely on phenotypic and morphological characteristics given the promiscuous reproductive nature of maize.

For the past 40 years, parallel research in the field of genetics have expanded the understanding of the genetics of maize and allowed for statistical differentiation that can be interpreted chronologically. Based on genetic distance of DNA differences, Matsuoka and colleagues (Matsuoka et al. 2002) were able to estimate that ssp. *mays* and ssp. *parviglumis* diverged about 9,000 years ago without reference to archaeological data or a radiocarbon chronology. Zeder and colleagues (Zeder et al. 2006) note that although there has been an increase in research on domestication in the disciplines of genetics and archaeology, there has been limited cross-over between the disciplines recently. Doebley and colleagues (Doebley et al. 2006) discuss how current genetic research can help understand the process of domestication of both plants and animals around the world. By 2011, researchers demonstrated the plausibility that ancient DNA (aDNA) could be extracted from prehistoric maize kernels (Arvila-Arcos et al. 2011).

Only limited research has been conducted on aDNA from prehistoric maize. Based on three different genetic loci that distinguish maize from teosinte, researchers (Jaenicke-Després et al. 2003; Jaenicke-Després and Smith 2006) investigated prehistoric maize cobs dating to about 4,000 years ago from the Ocampo Caves in Tamaulipas. The analysis showed that alleles at three genetic loci were likely the result of human selection at that time, and by 4,400 years ago, early farmers had already had a substantial homogenizing effect on allelic diversity of genes associated with maize morphology and its biochemistry.

In another study of aDNA from prehistoric maize specimens from San Marcos Cave in Mexico, the authors note that the specimens were not fully domesticated and exhibited genetic variations that are not found in modern maize populations apparently as a result from inbreeding of local populations (Vallebueno-Estrada et al. 2016). All of the maize specimens from the cave were newly recovered and radiocarbon dated. Four of the early analyzed specimens (SM3, SM5, SM9, and SM10) were statistically contemporaneous with a date range of 4840–4650 cal BP, erroneously reported by the authors as 5300–4970 cal BP. The high degree of genetic similarity (> 97%) across their genome is reflected in contemporaneity of these specimens.

One of the earliest aDNA studies of maize in the American Southwest (da Fonseca et al. 2015) suggested that maize originally entered the United States via a highland route by 4,000 years ago and subsequently received gene flow from lowland maize via the Pacific coastal corridor starting around 2,000 years ago. These researchers analyzed aDNA from maize specimens from four sites in the American Southwest and several sites in Mexico and Chile. The maize specimens from the four sites in the American Southwest, Bat Cave, McEuen Cave, Tularosa Cave, and Turkey House, were selected to provide a temporal continuum of specimens. Bat Cave and McEuen Cave were allocated to the SW3K group, sites about 3,000 years old. Some early dated specimens

from Tularosa Cave were allocated to the SW2K group, about 2,000 years old, and later dated specimens from Tularosa Cave and Turkey House sites were allocated to the SW750 group, specimens dating more recent than AD 500.

These researchers contrasted the aDNA of the archaeological specimens from the American Southwest along several genetic dimensions with DNA samples of modern highland and lowland maize. From their analysis, they deduce that the earliest maize to arrive in the American Southwest was a highland-adapted variety, with a lowland-adapted variety arriving about 1,000 years later based on radiocarbon dates associated with the aDNA.

While not disputing the aDNA comparisons of prehistoric specimens with modern landraces, the analysis by da Fonseca and colleagues suffers from sampling bias. First, none of the analyzed prehistoric samples represent the earliest maize specimens from the Southwest. The earliest radiocarbon dated maize in the American Southwest was recovered from the Tucson Basin (see Table 1) and statistically dates from 400 to possibly 1,500 years earlier than Bat Cave, the site with the oldest dated maize in their analysis. Second, all four archaeological sites in their aDNA analysis are highland or midland sites, Bat Cave (2,130 m), McEuen Cave (1,340 m), Tularosa Cave and Turkey House (2,060 m each); samples from earlier lowland sites were not included in the analysis for comparison. Seven of the sites in the Tucson Basin with maize date earlier than 3,100 radiocarbon years ago and lie at elevations of less than 750 m (see Table 1), although the earlier maize samples from these sites may not have been suitable for aDNA analysis.

Third, as discussed above, besides genetic differences, highland and lowland maize varieties express phenotypic patterns consistent with local adaptation and have higher fitness values when grown at their native elevation (Janzen 2019; Janzen et al. 2021). For maize, increases in latitude can elicit changes similar to increases in native elevation. Each of the four sites are higher in altitude than sites in the Tucson Basin. However, as maize spread further north into the temperate zone, both tropical highland and lowland maize would need to adapt.

In contrast to the da Fonseca and colleagues' results, Swarts and colleagues (Swarts et al. 2017) accept that lowland maize varieties were the first to be introduced in the American Southwest in their analysis of aDNA from maize cobs from Turkey Pen Shelter in southeastern Utah. These researchers (Swarts et al. 2017) conducted aDNA analysis of 15 maize cobs from the site which lies at an elevation of about 1,810 m. Although recovered from different stratigraphic levels, 13 of the 15 radiocarbon dated cobs are statistically contemporaneous with a median date of cal AD 170, the middle of the Basketmaker II period. Swarts and colleagues conclude that 2,000 years ago, maize at this site had not completely adapted to a temperate environment. This contrasts with the results of DNA comparisons of modern tropical/subtropical and temperate maize populations which suggest a tropical-temperate divergence event initiated 4,958 years ago from an ancestral population (Li et al. 2017).

It is not clear that the application of modern DNA molecular procedures applied to prehistoric maize aDNA can be easily interpreted because of preservation bias and sample bias. DNA classification results are greatly dependent on the initial samples incorporated into the analysis, as well as the outgroups, as demonstrated by the maize paradox of highland versus lowland origin of maize (van Heerwaarden et al. 2011). Based on modern DNA analysis, a principal components analysis by Matsuoka and colleagues (Matsuoka et al. 2002) indicates the basal maize types, the closest modern maize descendants of ssp. *parviglumis*, are samples from the Mexican highlands as depicted in their rooted tree diagram (2002:Figure 4).

Although not discussed, Matsuoka and colleagues also note two lowland maize plants of Elotero de Sinaloa and Reventador that are genetically early as well, grown at elevations of less than 100 m asl, and geographically associated with lowland western and northern Mexico. The genetic heritage of early lowland maize in northern Mexico needs to be considered in determining the route of introduction of maize into the American Southwest.

Further analyses of modern maize DNA and aDNA of older maize specimens from the region could address the issue of which arrived first, highland or lowland maize. Because maize was first domesticated in and dispersed from the lowlands of Mexico, a more parsimonious explanation for the well-adapted maize that supported the earliest agricultural communities in the Tucson Basin at 600–750 m in elevation is that lowland and midland maize germplasm arrived via a corridor along the western Sierra Madre Occidental, rather than highland maize varieties arriving via the Mexican Plateau and then readapting to a lowland environment. It is not clear where maize became climatically adapted to the temperate zone along the route of introduction from Mexico into the American Southwest.

DISCUSSION

The identification of which route or routes from which maize may have spread north into the American Southwest is hampered by the lack of chronological and archaeological data in the region between the Tucson Basin and the southwestern highlands and lowlands of Mexico. That lack of data also precludes any discussion about changing climatic conditions or constraints in the past that may have affected the spread of maize northward.

Without prehistoric maize macrofossil samples from this large region, DNA analyses of modern maize varieties can only act as proxy measures. DNA analysis of modern maize varieties only illuminates successful lineages of prehistoric maize manipulation and does not identify the full range of past diversity due to extinction, abandonment of unproductive lineages, genetic drift, and continued human selection (Ramos-Madrigal et al. 2016). Additionally, if maize phytoliths, rather than maize macrofossils, are recovered from early archaeological contexts in this region they can only confirm the presence of maize at a site. Although RONDEL phytoliths can distinguish domesticated maize from teosinte (Piperno et al. 2009), they are not able to distinguish different modern landraces (Yost et al. 2021) and thus are unlikely to aid in resolving the highland-lowland conundrum nor can they provide maize aDNA for analysis (cf. Elbaum et al. 2009).

Modern research on indigenous farmers in Mexico (e.g., Perales et al. 2003) and native tribes in the American Southwest (e.g., Soleri and Cleveland 1993; Whiting 1939) indicates that these native groups routinely grow several varieties of maize and are continually experimenting with and crossing them to produce new varieties to protect against local production shortfalls and to minimize the risk of seasonal crop failure from any one variety (cf. Perales et al. 2003:13).

Although prehistoric horticulturalists and farmers were unaware of the concepts of genetic drift, bottlenecks, and founder effects, they were likely aware of the negative consequences of these processes when growing and harvesting small populations of maize plants. To counter these effects, prehistoric gardeners or horticulturalists probably also grew multiple varieties of maize, experimenting, cross breeding, and selecting for productive phenotypes or other agronomic variables. To insure continued successful and productive maize harvests, prehistoric people in the American Southwest needed access to a pool of maize germplasm; from local relatives, neighbors, and possibly distant kin. In an analysis of maize landrace diversity, Vigouroux and colleagues (Vigouroux et al. 2008) caution that modern maize varieties cannot be differentiated at a geographic scale of less than 50 km indicating that extensive seed exchange occurs within this geographic radius, a practice that likely occurred in the prehistoric past. Additionally, the scale of exchange of maize germplasm could be much farther depending on local geography and social and cultural relationships.

A modern analog to regional pools of prehistoric genetic variation are areas of high maize diversity as noted by Perales and Golicher (2014). It is likely that areas of maximum maize diversity today also represent locales where maize was well diversified in the prehistoric past. Perales and Golicher (2014) identify six biogeographic regions in Mexico that are also diversity centers of maize, i.e., areas with a larger number of modern landraces with differential racial compositions from other biogeographic regions in Mexico. The Northwest Sierras biogeographic region is a 1,000-km long, lowland area varying in width from 30–130 km and ranging in elevation from 100–1,200 m in northwest Mexico, west of the Continental Divide (see Figure 1). This region contains the largest number of modern maize varieties in all of Mexico (Gonzalez 2018:108).

The Northwest Sierras biogeographic region straddles the ecotone between the Tropical Dry Forests ecoregion and the Temperate Sierras ecoregion to the east (Omernik and Griffith 2014). The forests of the Tropical Dry Forests are characterized by warm year-round temperatures (with only a mild seasonality of temperature at the far north end of this region), but a strong seasonality of rainfall (Siyum 2020). The higher sierras and plateaus of the Pacific slope of the Sierra Madre Occidental to the east represent the Temperate Sierras. This region is characterized by a temperate climate with mild summers and dry winters (Wiken et al. 2011). The climatic and elevational variability between these two ecotones may have provided a rich environment for experimentation and cross breeding of maize; the area likely functioned as a conduit north for novel prehistoric maize germplasm in the past. Maize may have also adapted to the temperate zone from its tropical homeland in this area or farther north (Li et al. 2017).

The lack of archaeological maize micro- and macrofossils from the Pacific coastal zone or Northwest Sierras biogeographic region does not negate the possibility that this area was the nexus for the spread of one or more lowland maize varieties into the Tucson Basin. It may be that lowland maize was the first to arrive in the American Southwest, and later, through random crossing, experimentation, hybridization, or the introduction of highland and other germplasm, prehistoric populations may have produced maize varieties that eventually became suitable for cultivation at higher elevations and more northerly temperate latitudes. The development

of these later highland or temperate adapted varieties enabled maize agriculture to spread north across the uplands of Colorado Plateau into regions with shorter growing seasons giving rise to the Ancestral Puebloan culture of the Four Corners region.

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PAḌ ’AANGAM: PROTOHISTORIC LANDSCAPE ARCHAEOLOGY AND ETHNOHISTORY IN THE ’O’ODHAM CREATION TRADITION

J. Andrew Darling and Harry J. Winters, Jr.

The history of Paḍ ’Aangam is part of the oral historical traditions of the ’O’odham of Arizona, known as the Hoho’ok ’Aagida, examples of which were written down in the late nineteenth and early twentieth centuries. The Paḍ ’Aangam tradition is uniquely important in its realism and depiction of the protohistoric period in southern Arizona (AD 1450–1700). The tradition identifies numerous historical ’O’odham leaders and clearly establishes the existence of ’O’odham settlement along the lower Salt River and in the Queen Creek watershed soon after the fall of the Hohokam vapaki (ancient ceremonial houses). It further documents the initiation of hostilities between the ’O’odham and Yavapai, which resulted in the relocation of the ’Aangam ’O’odham to their present location in the Sif Oidak District, Tohono O’odham Nation, prior to European contact. Ethnogeographic and linguistic details are considered in a discussion of the implications for ’O’odham historical memory and for future research that places ’O’odham historical traditions at the forefront of archaeological and ethnohistoric investigations of the prehistoric to historic transition in southern Arizona.

Paḍ ’Aangam, the son of a Yavapai father and an ’O’odham mother, embodied the fighting qualities of the *vishag*, the Prairie Falcon: ferocity, speed, agility and formidable persistence in attack. He is referred to as Vishag Namkam, Prairie Falcon Meeter, since he “met” the *vishag* in a physical or supernatural encounter and in combat he demonstrated its fighting qualities. He is a unique culture hero of the ’O’odham communities of southern Arizona. Celebrated in the ’O’odham creation traditions, Paḍ ’Aangam’s life offers a bridge between protohistory and history that engages ethnohistorical themes of Hohokam and ’O’odham continuity, the founding of the Tohono ‘O’odham village of ’Aangam (Anegam on maps), and historical practices of warfare.

Multiple versions of the Paḍ ’Aangam tradition were received from ’O’odham informants in the early twentieth century including Juan Dolores (Saxton and Saxton 1973:169–189), Thomas Vanyiko (and William Blackwater) (Benedict 2001:133–144), Thin Leather (Lloyd 1911:166–188; Russell 1908:228–230), and Juan Smith (and William Allison Smith) (Bahr et al. 1994:254–260; Hayden 1935). Juan Gregorio shared a version with Bahr in 1968 (1971:261–263) and the tradition is celebrated in speeches and songs that traditionally preceded going to war (Densmore 1929:175–179; Russell 1908:353–356).[1]

In this paper we explore the richness of this often-ignored account from the perspective of time, historical revision, geography and protohistoric landscape archaeology. In our opinion references in the Paḍ ’Aangam tradition to warfare and counter-raiding with the ’Oob, refer to the Yavapai, specifically the Kwevakapaya band, not to Apaches, and to the initiation of hostilities with the Yavapai on the northern frontier of ’O’odham territory soon after the destruction of the Hohokam *vapaki* (ancient ceremonial houses).[2]

THE PAḌ ’AANGAM TRADITION

The formal telling of ’O’odham traditions (’O’odham Hoho’ok ’Aagida) was, historically, and still is, an activity that takes place during the winter months and traditionally would last four nights. Today much of the original oral content has been lost. This is unfortunately true for the tradition of Paḍ ’Aangam, which in the past was told on the third night and featured narrated sections accompanied by songs (Barnaby V. Lewis, personal communication 2016; Lloyd 1911:173–190). Juan Dolores (1880–1949), an early 20th century Tohono ’O’odham linguist, transcribed one of the most complete versions in the early 1900s (Kroeber 1949). This version was later translated and published by Saxton and Saxton

1 Winters (2020c) provides a summary of the Paḍ ’Aangam tradition in his history of the Sif Oidak District, Tohono O’odham Nation. The tradition is also summarized in unpublished reports by Darling (2017, 2020).

2 Va’aki (*vapaki*, pl.) is an ’O’odham word meaning ceremonial house, which they continue to use in a variety of contexts today (Winters 2020a:770–771). In the historical traditions, such as the ’O’odham Hoho’ok ’Aagida, *va’aki* is used to identify large, multi-story constructions with or without platform mounds that were inhabited by religious leaders (sivañ, sing.; *sisivañ*, pl.). These are sometimes referred to in the historical or archaeological literature as platform mounds or great houses.

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(1973:169–188) under the subtitle, "The O'odham Scout the Enemy (Mash g O'odham Gidahioppo)." Very importantly, to the best of our knowledge Juan Dolores (Figure 1) and Dean Saxton are the only two of the above transcribers who spoke 'O'odham fluently. Dean Saxton still does. Saxton's *gidahiop* is the plural of a verb that means to go to war. His translation, "scout," is reasonable. If you are going to attack the enemy, first you must find him. In the nineteenth century, Native Americans employed by the U.S. Army in combat patrols against the Yavapai and Apache were generally referred to as "scouts."

Our summary of the tradition draws on multiple renditions but is closest to the Juan Dolores version (Saxton and Saxton 1973). The action takes place just after the destruction of the Hohokam *vapaki* (*va'aki*, sing.). In archaeological parlance this signaled the demise of the Classic Period Hohokam material culture (AD 1150–1450/1500) and the emergence of the 'O'odham, or at least their archaeological recognition (Fish and Fish 2009; Haury 1976; Loendorf and Lewis 2017; Wells 2006:5). Each event transpires within timeframes that, in our opinion, are realistic and historical. Unlike some parts of the Hoho'ok 'Aagida, the setting and pace of the Paḍ 'Aangam tradition adheres closely to the timing and geographical setting of what has been called the protohistoric period (AD 1450–1700), or the two and a half centuries that preceded the first written accounts by Europeans. The men and women who appear in the tradition were real persons whose actions make sense in the context of history and geography.

In our summary of the tradition, we have written all 'O'odham words in an alphabet that comes as close as possible to what someone who has learned to read English in American schools would expect. One difference is that the English vowel "e" is used for the 'O'odham vowel that sounds like the "oo" in "book". This is the alphabet used in Winters (2012:xxxix-xlii) and Winters (2020a:xlv-xlviii). To the extent possible, our spellings of the names of people and places correspond to the 'O'odham pronunciation, including the addition of glottal stops (') at the beginning of certain words, which are often left off. We also provide translations and background for 'O'odham terminology, especially when it seems relevant to understanding the history and the names of the individuals, who are identified. With a few exceptions transcribers in the past have not done the best job of this, if they did it at all.

The Paḍ 'Aangam tradition begins with 'I'itoi (also called Se'ehe or Elder Brother) leading the Wuushkam to the north, fighting as they go. The ancestors of the 'Akimeli 'O'odham have asked 'I'itoi, a person with great natural and supernatural powers, to help them get rid of the *sisivañ*, the men who rule over the *vapaki* on the Middle Gila and Salt rivers. The 'O'odham believe they are malevolent witches who are harming them by such actions as causing sickness and crop failures. These are evils which the 'O'odham also will attribute to their own *sai jukam*, witches with the power to kill, who existed into the twentieth century. Wuushkam comes from the verb *wuushañ* meaning to come out or go out. The Wuushkam are 'O'odham who came out from wherever they were when 'I'itoi sent for them, for example from canyons or mountain passes, not necessarily from underground. They are the forerunners of the modern 'O'odham. They successfully attack the *vapaki* using military force and the power of their *sai jukam* to kill or drive away the *sisivañ*. Some scholars interpret this

Figure 1. Juan Dolores, Tohono 'O'odham (1880-1948) (Phoebe A. Hearst Museum of Anthropology, https://portal.hearstmuseum.berkeley.edu/catalog/33204115-7a96-4c7a-89dd-67d58821c60d, © 2020 The Regents of the University of California).

event as a conquest. Donald Bahr describes it as a fraternal civil war (Bahr et al. 1942:2). But in our opinion, it resembles a large-scale witch purge. The attacks were tactical in nature with the limited purpose of taking out specific targets, the *sisivañ,* and scattering their power base.

Among the Wuushkam is a man called S-'Uuvañ Maakai, a man who, as a *maakai*, has certain natural knowledge and supernatural powers that, for example, enable him to cure 'O'odham sicknesses. S-'Uuvañ comes from the verb *'uuva* that means to give off an odor (not a particular odor; just an odor). His name means Maakai Who Gives Off An Odor or Maakai Who Smells.

Before traveling north to participate in the war against the *sisivañ*, S-'Uuvañ Maakai first claims the land around today's 'Aangam village by driving a stake upright in the ground there. 'Aangam means Place Where Desert-willow Trees Grow In Abundance. The scientific name of this tree is *Chilopsis linearis* (Rea 1997:164–165). This village is spelled Anegam on maps. We do not know if he names the place 'Aangam at this time or later, but as explained below, he probably does it later. 'Aangam village is in the southern end of today's Sif Oidak District of the Tohono O'odham Nation, north of the large village called Santa Rosa in the Gu Achi District.

With the *sisivañ* eliminated, many of the Wuushkam 'O'odham spread out over the desert and claim additional lands for farming. They also claim watering places in the nearby mountains, other natural resources such as saguaro groves and areas with abundant mesquite beans, and outcrops of clay suitable for making ollas. S-'Uuvañ Maakai establishes farms in the Queen Creek *vo'oshañ* (floodplain) north of the Gila River. Some sources suggest that S-'Uuvañ Maakai settled on the Salt River, although Hayden (1935:55) specifically identifies the vicinity of Gook Vapchki (Two Ponds), an ancestral 'O'odham village, located east of the town of Higley in the Queen Creek watershed. *Vapchki* is the plural form for 'O'odham *vachki*, meaning a manmade reservoir. For reasons we will give below, however, we believe that the place where he settled in the Queen Creek floodplain was called 'Aangam.

One day after he moves to the Queen Creek *vo'oshañ*, S-'Uuvañ Maakai finds a boy who is apparently lost in the desert. The boy is an *'oob*, a term we explain later. S-'Uuvañ Maakai takes him in and cares for him. He gives the boy the 'O'odham name Kokoñip. *Kokoñ* is an old 'O'odham word meaning raven. Pennington (1979:27) has it as "Cuervo. coconi." for the seventeenth century Pima Bajo in Sonora. *Kokoñ* is still used by the Pima Bajo of Ónavas, Sonora (Amadeo Rea, personal communication Sept. 2021) and by the Mountain Pimas (Luis Barragan, personal communication Sept. 2021). It is still used by the Tepehuán of Baborigame, Chihuahua (Bascom and Molina 1998:99), as well as "kokóóñi (ave) s el Cuervo," and by the Tepehuán of Santa María Ocotán, Durango, as *kakoon* (sing.) and *kokkon* (pl.), *cuervo* and *cuervos*, respectively (Willett and Willett 2016:110). *Kokoñ* is no longer heard in Arizona. The 'O'odham word for raven today is *havañ*, a word recorded as early as the mid-eighteenth century (Rea 2007:215; Winters 2020a:688–689). In our opinion, Kokoñip, the boy's name, is a contraction of *kokoñ(i)* and *'oob*, affected by vowel harmony, and means Raven 'Oob.

The 'O'odham word *'oob* means enemy; not the scoundrel who danced with your sweetheart, but a member of an enemy nation. At the time of the events we are describing, the 'Akimeli 'O'odham applied the word *'oob* to the Yavapai. Until recently the Yavapai still referred to the 'Akimeli 'O'odham as the *jahwa kahana*, the "main (original) enemy," even though hostilities between the two ended in the 1870s.

To return to the history of Paḍ 'Aangam, S-'Uuvañ Maakai is not the only 'O'odham living in the Queen Creek floodplain. Sometime after he finds the boy, he gives him to another 'O'odham *maakai*, Gook Si'isiwulik, Two Whirlwinds, to raise. Gook Si'isiwulik lives alone at the foot of a mountain, or generally towards the edge of enemy territory. Just the fact that S-'Uuvañ Maakai gives the boy to Gook Si'isiwulik implies that he expects Gook Si'isiwulik to pass his knowledge (*ha'ichu maachig*) and powers (*gevkdag*) on to him. Gook Si'isiwulik foresees his own violent death at the hands of the 'Oob so he gives his medicine basket (*vasha*) to Kokoñip and instructs him on what to do when they attack, including making the choice whether to return to the Yavapai or to live with the 'O'odham. As Gook Si'isiwulik lies dying, Kokoñip breathes in his adoptive father's powers. He then seeks out S-'Uuvañ Maakai.

S-'Uuvañ Maakai takes him in and eventually gives him his daughter, Pul Ha'akam, in marriage. *Pul* is the name for a plant with a flower like clover. Juan Dolores (1923:5) translated it as clover (with a question mark). Pul appears in the 'O'odham words for alfalfa, *spulwam*, and wild tobacco, *vivpul*. *Ha'a* means olla. The *-kam* shows we are talking about a person. We won't go far wrong by calling her Clover Olla. Pul Ha'akam becomes pregnant. One day, Kokoñip travels north to the McDowell Mountains, called *Vaapk* in 'O'odham, to collect greens for his wife to eat. *Vaapk* is the common reed or carrizo, *Phragmites australis*. Kokoñip is ambushed by the Yavapai. After a lengthy battle he is killed, and his body is mutilated. The narrative tension of this event would not have escaped 'O'odham listeners who understood that this adopted son of Gook Si'isiwulick was, himself, born a Yavapai.

S-'Uuvañ Maakai learns of Kokoñip's gruesome death and decides to lead his people to a safer place; a place where he had claimed land before, near the present-day village of 'Aangam. Soon after their arrival, Pul Ha'akam gives birth to a son, who is named Paḍ 'Aangam. This name has been translated by some non-'O'odham as "Homely Desert Willow," which is incorrect. *Paḍ* does not mean homely. Instead, it means ruined, destroyed, in bad condition, abandoned and fallen into ruin, etc. Also, 'Aangam does not refer to an individual *'aan* (willow tree); it means a place where those trees grow in abundance. As recently as 10 years ago, an octogenarian of Koahadk village explained to one of us that the reason 'Aangam has its name is because there are lots of those trees along the wash there. It is very likely that S-'Uuvañ Maakai's old village in the Queen Creek *vo'oshañ*, where stands of *'aan* are also very common, was named 'Aangam, as well.

Understanding the meaning of Paḍ 'Aangam's name anticipates the events that follow in the historical tradition and would have been readily apparent to 'O'odham audiences. First, Pul Ha'akam's son is named Paḍ 'Aangam in recognition of the fact that he was conceived at the old village, before his mother moved with her father to the south. Second, relocation of villages in response to enemy threats was a practice that has been historically documented (Winter 1973), the villages sometimes retaining the name of the previous village. Paḍ 'Aangam's status of being conceived in one village and born in the other sets the stage for his leadership role in retaliatory campaigns against the 'Oob.[3] But first, he must convince the 'O'odham to go to war.

Paḍ 'Aangam, Kokoñip's son, clearly has inherited the powers that his father received from Gook Si'isiwulik, and possibly received instruction from S-'Uuvañ Maakai, Pul Ha'akam's father. In time, his mother tells him about Kokoñip's gruesome death, which saddens and enrages Paḍ 'Aangam. Although he is still young, Paḍ 'Aangam delivers the first war speeches that convince the people to take him seriously and to accompany him to avenge the death of his father and his grandfather. Having won their support, Paḍ 'Aangam leads the 'Aangam 'O'odham on four victorious and bloody campaigns against the Yavapai during which Paḍ 'Aangam demonstrates his formidable supernatural powers. His abilities in combat earn him the title Vishag Namkam.

Different versions of the tradition have alternate endings. One version told by Thin Leather (Lloyd 1911) tells of Paḍ 'Aangam's later accomplishments until he is presumably bewitched, becomes ill, and gradually dies. The Juan Dolores account, however, ends with his victories in battle that are followed by a separate narrative, which Saxton and Saxton (1973:189–209) identify as "The Apache's Son is Hawk Man (Oob Alidag ash wuḍ Wishag Namkam)." This account parallels the Paḍ 'Aangam tradition and introduces a different hero, who like Paḍ 'Aangam, is originally the son of an enemy. After several encounters with the *vishag* (Prairie Falcon) and the *ba'ag* (Golden Eagle), he receives their powers, which he then uses in battle (as a Vishag Namkam or Ba'ag Namkam, Saxton and Saxton 1973:199). The Saxtons' title more accurately should be "The Yavapai's Son is Prairie Falcon Meeter," in reference to someone who meets or has encounters with the *vishag*.

The Vishag Namkam tradition is essentially an elaboration on the nature and origin of Paḍ 'Aangam's abilities and it also suggests that there were additional episodes or adventures in the life of Paḍ 'Aangam that may have been part of the 'O'odham historical tradition but were told separately. Like the many stories about 'I'itoi, we wonder if the oral history of Paḍ 'Aangam could have been considerably longer than is remembered today.

LANDSCAPE IMPLICATIONS

The Paḍ 'Aangam tradition is important because of its geographic specificity. Place names and routes of travel are identified. Of particular interest to us are the routes that the 'Aangam 'O'odham used to reach enemy territory during their campaigns in the north. This information clearly establishes ethno-geographical ties between the Queen Creek area north of the Gila River on the border with Yavapai Territory and the present-day village of 'Aangam, located in the Tohono 'O'odham Nation approximately 113 kilometers (70 miles) to the south (Figure 2).

Table 1 provides a summary list of the place names located along the route of Paḍ 'Aangam's campaigns. Two routes are identified that pass through the land of the 'Akimeli 'O'odham in the middle Gila River Valley with stops at Todsidk (Place Where Somebody or Something Startled Someone), the site of an old well on the east side of present-day Sacaton. One route passes in sight of the little buttes, 'Aji and Bibjulik (Figure 3, Gila Butte on maps), and bends around the west end of the Santan Mountains until it reaches the Queen Creek area near the historic village of Gook Vapchki (Two Ponds).[4] From this point the raiders could reach enemy territory and launch their attacks in the direction of Vi'ikam Gakoḍk (Superstition Mountains) and as far north as

3 The authors had the opportunity to discuss this with several 'O'odham from the Sif Oidak District while standing in a circle near a grove of *'aan* in the Queen Creek *vo'oshañ*. After some discussion they agreed that this well could have happened.

4 Archaeologists identify Gook Vapchki (Two Ponds) as AZ U:10:43(ASM), which is also known as the Midvale Site.

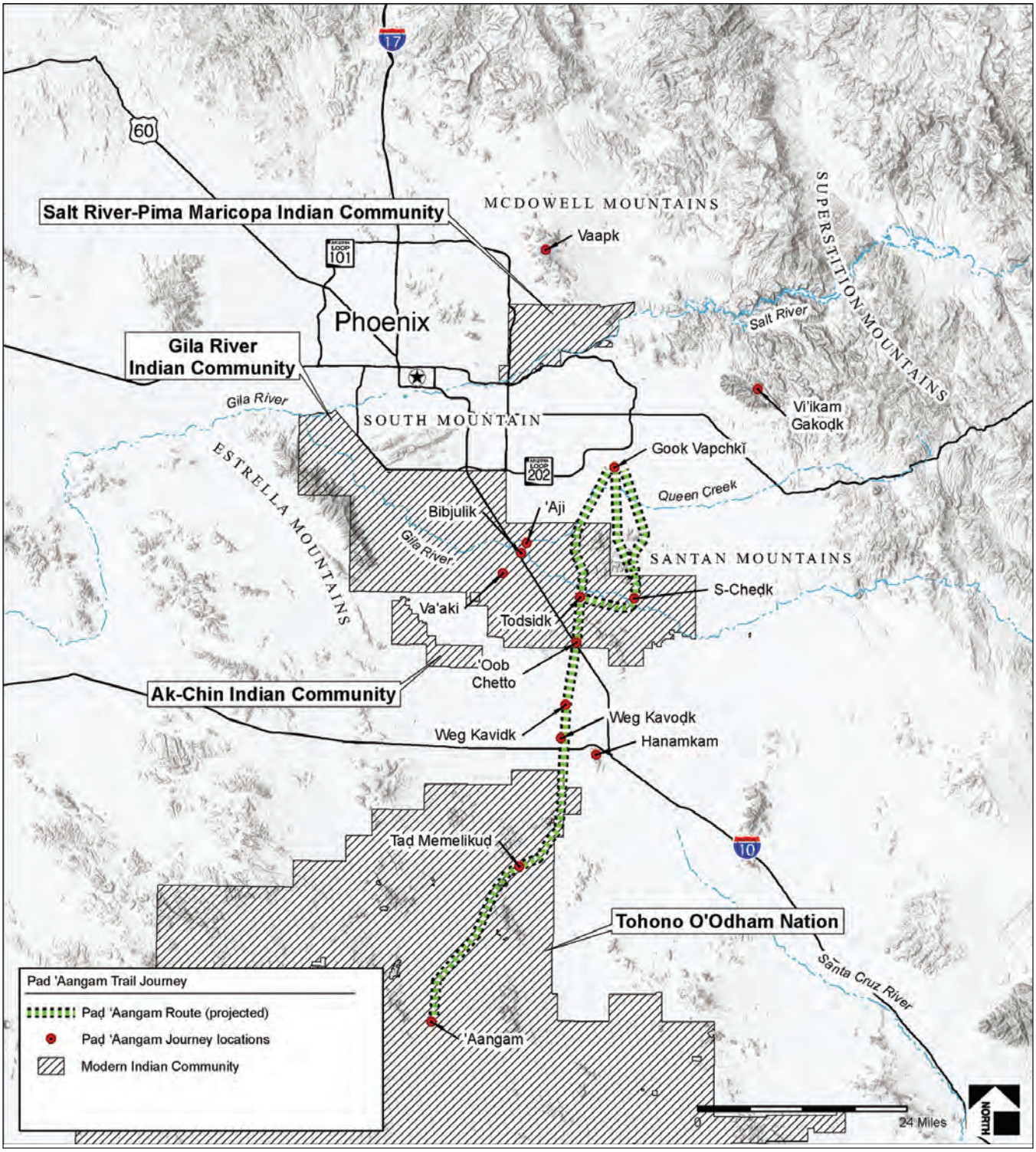

Figure 2. The ethno-geography of the Paḍ 'Aangam Tradition based on identifiable place names (Map by Justin Rego. Courtesy of Logan Simpson, Tempe, AZ).

Table 1. 'O'odham Place Names Associated with the Route of the Paḍ 'Aangam Tradition[1]

O'odham	English	Type	Reference
Vaapk	Carrizo, reed, Phragmites australis (McDowell Mountains)	Mountain	Lloyd 1911; Winters (2012:453, 2020a:603)
'Onk Akimel	Salt River	River	Lloyd 1911; Russell 1908; Winters 2012:42, 2020a:49
Vi'ikam Gakoḍk	Remainder Bent (Superstition Mountains)	Mountain	Lloyd 1911; Winters 2012:180, 2020a:239–240
Gook Vapchkĭ	Two Ponds (Reservoirs)	Village	Bahr et al 1994; Hayden 1935; Winters 2020a:781–782
'Aji	Thin [Mountain] or Mountain that stands by itself (Gila Butte)	Butte	Winters 2012:26, 2020a:27-28; Barnaby V. Lewis (personal communication 2021)
Bibjulik	Concave Upwards (Shape of the top of the south butte of Gila Butte)	Butte	Winters 2012:105–106, 2020a:134–136
Va'aki	Ancient Ceremonial House (Casa Blanca)	Village	Hayden 1935:54; Winters 2012:580, 2020a:772
S-Cheḍk	Rough Surface Hill (Granite Knob)	Butte	Lloyd 1911; Winters 2012:110, 2020a:140
Todsidk	Place Where Somebody or Something Startled Someone, (Sacaton, east side)	Village	Lloyd 1911; Winters 2012:555, 2020a:736
'Oob Chetto	Enemy's Cooking Pit	Enemy camp	Lloyd 1911; Winters 2012:406-407, 2020a:529-530
Weg Kavidk*	Red, ramp-shaped hill	Mountain	Winters 2012:264, 2020a:342
Weg Kavoḍk*	Red, round-topped hill	Mountain	Winters 2012:681, 2020a:901
Hanamkam*	Place Where Cholla Cactus Grows in Abundance	Mountain	Winters 2012:425, 2020a:563
Taḍ Memulikuḍ	Place Where A Foot Ran	Playa	Lloyd 1911; Saxton and Saxton 1973; Winters 2012:542–544, 2020a:721–722
'Aangam	Place Where Desert-willow Trees Grow In Abundance (Anegam)	Village	Benedict 2001; Saxton and Saxton 1973, Winters 2012:413–414, 2020a:541–544

[1] See Figure 2, from north to south
*Located on the route but not identified specifically in written accounts of the Paḍ 'Aangam tradition

Vaapk (McDowell Mountains). The other route passes by the butte called S-Cheḍk, Granite Knob on maps, a butte that sits on the northern edge of the Gila River floodplain and takes its name from its rough, boulder-covered surface. The route then turns north following trails through the eastern end of the Santan Mountains before passing into the Queen Creek watershed from which Gook Vapchki or locations in enemy territory, north of the confluence of the Salt and Verde Rivers, could be accessed. (Darling 2009:75; Darling and Lewis 2007; Winters 2020:139–140, 736).

After each campaign, the enemy attempted to retaliate. The Yavapai gave chase, heading south, deeper into 'O'odham territory, while stopping at named places along the way. Ultimately, due to their lack of knowledge about trails and water sources, the Yavapai were unable to follow the 'O'odham as far as today's 'Aangam village. Named places include 'Oob Chetto (Enemy's Cooking Pit) near the southern end of Fivemile Peak and Taḍ Memelikuḍ (Place Where A Foot Ran), spelled Tat Momoli on maps. The latter is a large playa, which is crossed by an important travel corridor or trail that is remembered as the place where an enemy was killed, dismembered, and his foot was used to make footprints in the sandy surface (Figure 4). Winters recalls talking with an elderly lady from Koahadk who used to ride to Casa Grande in a wagon with her family. The trip took two to three days one way across Taḍ Memelikuḍ. The first night out from Koahadk they camped in the desert nearby. The second day they traveled across the playa to the Armenta ranch, a Mexican ranch on the north side, where they spent the second night. The third night they were in Casa Grande. The Koahadk people refer to the playa as a *jeg*, meaning naturally open ground. An 'O'odham village just south of the playa is also called Taḍ Memelikuḍ (Winters 2020a:529–530, 721–724).

LINGUISTIC IMPLICATIONS

As we have described, the 'O'odham word, '*oob*, is another key feature of the tradition. 'Oob means enemy, not a personal enemy but a hostile tribesman. It is most often and stereotypically translated as Apache (Densmore 1929:175; Saxton et al. 1983:47). This has been going on since the mid-nineteenth century when American trappers and prospectors appeared on the scene. At the time of the events of the Paḍ 'Aangam tradition the 'Akimeli 'O'odham used the word '*oob* for the

Figure 3. The Gila Buttes, ʼAji and Bibjulik, on the Gila River Indian Community (Photograph by J. Andrew Darling, low elevation aerial view facing southwest).

Yavapai. The ʼAkimeli ʼO'odham only began applying *ʼoob* to the Apaches when they became active participants in the conflict, presumably after they became close allies of the Yavapai (see also Benedict 2001:129–133).[5] Parallels occur in the Piipaash (Maricopa) language in which the words for 'enemy Yavapai' (*Yavapai ahuach*) likely preceded the arrival of the Apache but were later used by the Piipaash to refer to the San Carlos Apaches as well (Spier 1933:8). The word *ahuach* is derived from the Piipaash word *hwe*, which means enemy.

Based on the Paḍ ʼAangam tradition, the initiation of hostilities with the Yavapai in the northern frontier of ʼO'odham territory takes place after the historical destruction of the *vapaki*. Paḍ ʼAangam's war speeches clearly point to the pursuit of mountain people, and it makes sense that the early historic ʼO'odham, who had claimed land in the Queen Creek area, might find a lost Yavapai child. The conflict between the ʼAkimeli ʼO'odham and the Yavapai lasts for centuries, and historic descriptions of this conflict are many and brutal (Braatz 2003:45; Burns 2010; Harrison et al. 2012).

Unfortunately, the Paḍ ʼAangam tradition does not provide us with any direct insight regarding Athapaskan protohistory or when the Apache might have entered the conflict. Radiocarbon dating for Western Apache occupation in east-central Arizona (east of Payson) confirms their presence by AD 1650, and allows for the presence of mobile groups, probably Athapaskan, prior to the seventeenth century (Herr 2009:5, 2013:681). Paleo-ecological evidence of Apachean land management strategies also suggests the presence of Apache-like peoples in central Arizona prior to AD 1600 (Eiselt 2012:54–55; Roos 2008:81). If, as the narrative suggests, the events of the Paḍ ʼAangam tradition preceded the arrival of the Apache in sufficient numbers to engage in the conflict, then conceivably they could have taken place during the sixteenth century or even earlier.

ʼO'ODHAM REGIONAL CONTINUITY NORTH OF THE GILA RIVER

Additional details of ʼAangam ʼO'odham ethnohistory based on ʼAkimeli ʼO'odham and Tohono ʼO'odham oral accounts also have implications for reconstructing regional continuity north of the Gila River (Bahr 1971:261–263; Rea 1997). These, of course, not only resonate with some details of the Paḍ ʼAangam tradition, but they also document a persistent identification

5 The Yavapai word for themselves is *baaja* (people).

Figure 4. The playa at Taḍ Memelikuḍ (Photograph by J. Andrew Darling, facing east, inset satellite image from Google Earth).

by the ʼO'odham with ancestral lands in this area to this day. This is especially true of the tradition that links the village of ʼAangam in the Tohono O'odham Nation with the Queen Creek watershed.

As summarized by an 'O'odham elder, the late Joseph Giff:

> ʼAangam, they used to talk very slow, but not now. ʼAan is a plant, a weed [Desert Willow]. They say there is plenty from where they migrated from—not where they are [now]. They are not Papago [Tohono 'O'odham]. I don't know what they are. Somewhere back on Queen Creek somewhere—that's where 'aan was—that's why they call them ʼAangamt'am ʼO'odham. You see, they're different people than the Tohono ʼO'odham. They say they were back in there somewhere along Queen Creek …. [There were] twin ponds—gook vapchkĭ—water always there; a vachkĭ is a pond.
>
> And that's where the man turned to Eagle, and flew up on top of Weaver's Needle, and the rock standing up there—that's where they killed him, see. When he was up there, he swoops down, killing the people, and that's why the ʼAangam moved, they moved away from there. He was one of them. They say you can still see those ponds—those depressions—water standing all the time, year round. Weaver's Needle is close to it. They went over to Vav Giwulk [Baboquivari Peak] (Rea 1997:165).

Amadeo Rea (2007:237), in his discussion of the ʼO'odham tradition, "Kingfisher Young Woman [Ba'ivchul ʼUvĭ]," about a girl from Gook Vapchki (Two Ponds) village, also observes that "The people living …on the upper Queen Creek drainage actually did abandon their settlement, according to Pima oral tradition, settling just north of the Santa Rosa village on the Tohono O'odham Nation, where they are found today as the ʼAangam (Desert-willow) People."

Ecological details further support ʼAkimeli ʼO'odham elders' statements regarding the historical ʼO'odham occupation of the Queen Creek floodplain. The lower Queen Creek watershed is distinguished by surface water flows across broad alluvial fans or in shallow channels where multiple prehistoric and protohistoric occupations were located and interspersed by canals, ditches, reservoirs, and other water control features (Chenault 2018; Dart 1983; Teague and Crown 1984). Such locations for the ʼO'odham are excellent for traditional farming and small-scale settlement. They are called *vo'oshañ*, which is often construed as a riverbank but is defined as "…a floodplain downstream of the mouth of a major wash" in which the water "…fills the channels and overflows them, running in a wide thin sheet (*komalim memeḍa*) (Winters 2012:673–674)."

As remembered by the late ʼO'odham elder, Sylvester Matthias, "We used to live in Queen Creek and we go chop those ʼaan, Desert-willow, to make our vatto [ramada] in camp. It grows there in Queen Creek," (Rea 1997:165). Rea (1997:38–40, 388–389) also identifies historical grasslands, *vashaikam* (Winters 2012:456), that existed in the lower Queen Creek drainage before the expansion of non-Indian farming and urban development. Based on Sylvester Matthias' testimony, Rea identifies a place in the Queen Creek watershed near the city of Chandler named Toota Muḍadkam (1997:39), which is probably the name for a species of tasseled perennial grass that is found in alluvial, well-watered bottomlands. *Muḍad* is heard in the names of other tasseled grasses. Such areas would have been conducive, if not ideal, for protohistoric ʼO'odham farming, and they would have provided ample grazing for ʼO'odham livestock after AD 1740 (Ezell 1961:26, 45).

Archaeological evidence for protohistoric ʼO'odham occupation is currently limited. Nevertheless, for archaeologists, occupations in the Queen Creek delta after AD 1400 were instrumental in establishing the controversial Polvorón phase from AD 1350/75–1450, which has been cited in reference to the cultural transition from prehistoric Hohokam to historic ʼO'odham (Sires 1984:316–324; Wells 2006:5).[6] Additional research is needed to further evaluate existing evidence and to improve the archaeological recognition of early ʼO'odham occupations during the late fifteenth through the seventeenth century, especially the presence of ʼAangam ʼO'odham settlements in the Queen Creek area.

ʼO'ODHAM REGIONAL CONTINUITY ALONG THE LOWER SALT, THE MIDDLE GILA AND POINTS SOUTH

The period during which the Tohono ʼO'odham originally laid claim to the lands that they occupied from the fifteenth to seventeenth centuries occurred just after the ʼO'odham assaults on the *vapaki* on the Middle Gila and Lower Salt rivers, more than two centuries prior to the arrival of Spanish missionaries and other explorers. This gap in the historical record

6 Portions of the *Paḍ ʼAangam* oral history are set north of the middle Gila River Valley in the Queen Creek watershed and Salt River Valley where sites like Siphon Draw (AZ U:10:6[ASM]), El Polvorón (AZ U:15:59[ASM]) and Frogtown (AZ U:15:61[ASM]) have been used to define the late prehistoric to protohistoric transition archaeologically (Wells 2006; see also Chenault 1993, 1996, 2000).

is easily filled by oral traditions and historical memory of the ʼO'odham, whose ancestors actually witnessed these events and later relayed their knowledge to their descendants by way of oral tradition. These traditions may be discounted or even ignored by archaeologists and historians as unverified and irrelevant, but they do so at great risk of losing continuity with the prehistoric past. ʼO'odham land legacy, which is directly tied to oral history and traditional place names, was no trivial matter to the ʼO'odham who remembered the locations of traditional homelands that may have been vacated, temporarily, under threat of aggression from their enemies to the north. This is clearly demonstrated by the traditional history of S-ʼUuvañ Maakai and his descendants, who returned to the lands of the present-day ʼAangam ʼO'odham, following the death of Kokoñip, and whose grandson, Paḍ ʼAangam, waged the first retaliatory campaigns in a conflict to retain ʼO'odham claims to the land along the lower Queen Creek and Salt River.

In the nineteenth century this conflict culminated in especially bloody attacks and counter attacks that were fueled by the adoption of the horse and subsequent U.S. military intervention, which contributed weaponry and supported the military alliance between the ʼO'odham and Piipaash in their campaigns against the Yavapai and Apache (Underhill 1983). The war ended only after significant escalation and brutal loss of life (see, for example, Burns 2010:26–35). During this process, concentration of ʼO'odham population in large villages on the south side of the Gila River beyond the threat of attack was only meant to last as long as the danger remained.

In the waning years of the nineteenth century and the first years of the twentieth century, the ʼO'odham returned to long-remembered homeland villages, wherever possible (Wilson 2014; Winter 1973). However, by that time, U.S. appropriation of land and water and the institution of federally mandated reservations had already transformed the cultural and political landscape. It was by their own force of will, self-determination and the need for survival that the ʼAkimeli ʼO'odham were able to return to villages within existing reservation lands on the north bank of the Gila River and to take back a fraction of their lands located along the banks of the Salt River. The Queen Creek was not reoccupied, although ʼO'odham continued to go there seasonally to live in work camps and provide agricultural labor (Waddell 1969).

To the south, following ʼI'itoi's attacks, lands also were acquired in the traditional way by various groups of Tohono ʼO'odham. For example, the lands of ʼAji in the Santa Rosa Valley were claimed by one group, those of Gagga and its vicinity by another group, those of Chukuḍ Kuuk by another group, those of Koahadk by another group, and so on. Families within each group staked out, developed, and owned agricultural fields within the area claimed by the group. Natural boundaries such as divides between watersheds came to be recognized as boundaries of these areas. When the Europeans first explored these lands, they recognized certain villages that were important population centers. The explorers referred to these villages as pueblos and acting for the Spanish government recognized the titles of the ʻO'odham to the land and appointed various civil officials from among the ʼO'odham of each pueblo. On October 4, 1698, while at ʼAji, Kino gave the staff of "governador" to someone from ʼAangam, presumably the headman of the village (Winters 2020a:541–542). When the reservation was formed and the district boundaries were laid out, the Tohono ʼO'odham had detailed knowledge of exactly where those historical boundaries of the lands of these several groups were located.

Based on discussions with Tohono ʼO'odham elders, according to tradition, the people that they displaced from the lands that they now occupy were called Chuuv Ko'adam, Jackrabbit Eaters, and they fled to Sonora where they may still live today (see Bahr et al 1994:218; Bayman 2002:86; Saxton and Saxton 1973:376–377; Teague 1993:444). They are said to have been short in stature and at least in some instances, they abandoned their lands in advance of the on-coming ʼO'odham. The ʼO'odham have no idea what language they spoke. One of us has been told this repeatedly in recent decades in the Hickiwan District of the Tohono ʼO'odham Nation. We know of no specific accounts of battles, but according to certain elders, the Tohono ʼO'odham immigrants killed all those Chuuv Ko'adam who did not flee. Tohono ʼO'odham in recent times have mentioned sealed ollas containing seeds hidden in holes or rock shelters, for example in the mountains southwest of Santa Rosa. They believe these were hidden by the fleeing Chuuv Ko'adam in the hope that they would be able to return to their farms before too long. This, of course, did not happen.

According to the Pad ʼAangam tradition, S-ʼUuvañ Maakai did much the same thing. As the leader of a group of ʼO'odham he claimed lands suitable for farming in the Santa Rosa Valley, before heading north to the Queen Creek. He may have found much of the best farmlands already occupied, for example those of the Koahadk people on Koahadk Wash and those of the ʼAji people (Winters 2020c). However, most likely with their consent, he and his group took up lands between the two, where they live today and are remembered as the people from the north, who continue to speak in a way that for one Tohono ʼO'odham elder sounds like "Pima" (ʼAkimeli ʼO'odham). In fact, it is interesting that when S-ʼUuvañ Maakai and his people returned to ʼAangam

after their time in the Queen Creek floodplain, their claims were respected; and yet, centuries later, in the twentieth century, at the time that the district boundaries were drawn on the map, they were included within the boundary of the Koahadk people's lands in the Sif Oidak District. This was probably done with the consent of the 'Aangam 'O'odham.

TOHONO 'O'ODHAM LAND LEGACY IN ACTION

The Paḍ 'Aangam tradition is an important piece of history. It touches on the claiming of land by the protohistoric 'O'odham and it acknowledges that 'O'odham were living in the lower Queen Creek watershed and along the banks of the Salt River, not long after the purge of the witches, the *sisivañ*, and the destruction of their ancient ceremonial houses, the *vapaki*. It reveals how ancient the historical troubles between the Yavapai and 'O'odham were, and it identifies an historical route or trail that was still in use during the late nineteenth and early twentieth centuries. This tradition provides information on the origin and antiquity of place names and the ritual speeches used by the 'O'odham in the course of preparations for war. Finally, it offers a depiction of the protohistoric past, between AD 1450–1700, not available to western historians and archaeologists, who continue to be challenged by the absence of eyewitness, colonial accounts or lack the diagnostic tools needed to identify the 'O'odham presence in these areas archaeologically (Loendorf and Lewis 2017); but this, too, is beginning to change (Ossa and Gregory 2018; Schaafsma and Countryman 2018).

Our analysis also suggests that past translations of the Paḍ 'Aangam tradition are misleading, whether intentionally or not, in that certain details may have been translated to fit the assumed ethnic identity of the actors, be they enemies or allies, and that this has implications for how the historical traditions are interpreted today. For example, during the early twentieth century, 'O'odham translation of the word for enemy (*'oob*) as Apache made sense, especially so soon after the cessation of Apache-'O'odham raiding and counter-raiding in the 1870s. However, our reinterpretation on linguistic and historical grounds is not only consistent with what we currently know about the archaeology and ethnohistory of the region, it also provides us with an opportunity to consider aspects of Yavapai and 'O'odham history prior to European and Athapaskan contact.

Such endeavors are not trivial or simply academic as the Tohono O'odham Nation has demonstrated recently. On September 10, 2016, representatives of the Sif Oidak District formally recognized the lower Queen Creek as the "Anegam Ancestral Homeland" and in turn, on October 21, 2016, the Legislative Council for the Tohono O'odham Nation, by resolution, also concurred. In this respect, ethnohistorical endeavors have the potential to play an especially important role in revitalizing Tribal historical memory. This, in turn, supports the perpetuation of cultural heritage and enhances Tribal capacities to express their concerns about the future disposition and preservation of ancestral lands and the role of archaeological research (Darling et al. 2015).

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GEORGE HAMLIN'S RELIEF MINE AND ARCHAEOLOGICAL INVESTIGATIONS AT AZ T:8:177(ASM)

Mark R. Hackbarth

Archival and archaeological investigations at the Relief Mine, AZ T:8:177(ASM) in northwestern Maricopa County, reveal the interplay of national and international events that affected capitalization and development of mining claims from 1893 to 1916. This period is the apex of change as the nation developed from an agrarian society with household production into an industrial powerhouse. Business excesses during the Gilded Age were supplanted by the reformist Progressive Era as industrialization boosted consumerism among the working and middle classes who demanded political and economic changes. Extensive archival information about George Hamlin, Relief Mine finances, employees, purchases of food, and milling provides evidence of racial, class, gender, and wage inequalities that pervaded Arizona and the nation while archaeological data from the mine provides nuances about consumerism within a male-dominated work camp at the Relief Mine.

America experienced enormous change as it transitioned from the Gilded Age's era of robber barons, free markets, and political bosses in the 1870s-1890s (Calhoun 2007; Trachtenberg 2007) to the early twentieth century's expansion of democratic institutions, overseas engagement and colonialism, and increased role of federal government that comprise the 1890s-1910s Progressive Era (Gould 2014; McGerr 2003). This transition was neither smooth nor universal in the maelstrom of political, economic, legal, and social spheres that resulted in the creation of the modern United States and Arizona.

This history of the Relief Mine (later known as the Sunrise/Relief Mine or AZ T:8:177[ASM]) explores the economic head winds and social changes a small mine in Maricopa County encountered at the turn of the nineteenth to twentieth century as the Gilded Age was eclipsed by the Progressive Era. Archival and archaeological evidence demonstrates that the mine's owners employed Gilded Age strategies to develop the exploratory mining industrial setting using workers that comprised a male-dominated, transient population of consumers.

The Relief Mine began operations a short time after the Western Frontier closed (Turner and Bogue 2010) and extension of Manifest Destiny beyond the continent brought raw materials and labor into the nation from newly acquired colonies. National growth spurred by capitalist developments eliminated craft production in agrarian households in favor of industrial factories that fueled consumerism by all segments of society (Mullins 2011). These landmark changes affected Arizona as its population grew from fewer than 7,000 in 1860 (excluding Native Americans) to 334,162 residents in 1920 (Forstall 1996:3).

The growing Arizona population largely followed nationwide trends in negotiation of race, gender, class, and political power structures, although Arizona was in the forefront of mine safety (Clements 1994). Arizona's earliest population was heavily weighted towards Hispanic families that had moved north from Tucson and the former Mexican Republic's lands that became part of the United States with the ratification of the Treaty of Guadalupe Hidalgo and the Gadsen Purchase (Luckingham 1994). Rapid immigration from the eastern reaches of the nation, however, quickly swamped the Native Americans and Hispanic groups and shifted political and economic power to Anglos that codified laws favoring themselves. One example of this shift is codification of mining district rules of operation from 1860–1880s that excluded Mexicans, Chinese, and other groups that might take jobs for low wages (McClain and McClain 1991). Racial biases and stereotypes were evident in later mining industry contexts at large mines where "whites" occupied the more favorable jobs and were paid more than other groups for the same work (Kluger 1970). Large and small mines alike segregated work crews by ethnic groups and mines often hired members of different ethnicities to break strikes, keep wages low, and weaken efforts to organize labor unions (Larkin and McGuire 2009; Lens 1974; Roller 2013). Worker's resistance to the power exercised by mine owners often took the form of leaving employment (Silliman 2006) or high grading – theft of valuable nuggets (Young 1987). The role of women at western mining camps is largely unexplored (Rose 2013) partly because economic and gender inequities in the mining industry

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excluded women. This paper examines these trends at the Relief Mine.

HISTORICAL BACKGROUND

Mining in central Arizona began in 1863 when prospectors set out from the Colorado River to exploit gold placers at Rich Hill near Wickenburg and Big Bug and Lynx creeks near Prescott (Johnson 1972). Prospectors expanded their search for mineral wealth across the territory to include the foothills and mountains surrounding the Salt River Valley. When valuable ore was found the General Mining Law of 1872 allowed them to establish claims that could not exceed 1,500 by 600 ft. and required proof of $500 improvements per year to perfect a patent. Mining claims could be declared abandoned and returned to public domain if six months lapsed without work at the mine (Stein and Skinner 1997). Once a claim was patented the owner held the mine as private property.

Prospectors often completed minimal work to demonstrate a lode mine's potential and then provided assays of ore from claims to entice mine promoters and investors to either purchase or lease the claims from the prospector. High quality ore recovered close to the surface was often the most profitable and attracted mine promoters. In turn, the mine promoter sought out wealthy investors that could support construction of an expensive physical plant that included hoisting equipment and a mill to crush and treat the rock. Wealthy investors, banks, and trusts on the east and west coasts, as well as England provided the development funds for lode mines and mills (Spence 1997). Businesses that promoted mines to the public and investors included such firms as the George Treadwell Mining Company in New York City, a company that offered expert advice about mine values and helped to create companies that sold stock to investors.

Gilded Age stock offerings in mining companies often used a prospectus to describe in glowing terms rich ore bodies only a few feet below the ground. Newspaper boosters often reported wildly speculative claims in prospectus as if they were facts, contributing to egregious frauds of investors. Naïve persons unfamiliar with Western geology, mining engineering, and the intricacies of milling were often duped into purchasing stock in the hopes of getting rich. Strict accounting and disclosure of business transactions were lacking in mining companies and a laissez-faire government policy towards investment companies was a reliable shield against victims of financial manipulation seeking restitution.

Economic conditions of the day, especially the nation's money supply and economic panics also played a role in obtaining funds to develop mines. Federal monetary policy in the mid- to late nineteenth century involved minting specie (coins) to repurchase paper money (greenbacks) that the federal government began circulating during the Civil War. The amount of silver purchased by the government varied in response to political decisions to use gold as specie (a conservative monetary policy) or expand the amount of money in circulation by minting silver coins (an inflationary monetary policy). Inflation decreased the par value of paper money by redeeming paper money with less costly silver, which stimulated precious mineral production in Arizona and the American West. Economic panics frequently roiled financial markets that caused investors to withdraw their money precipitously. Contraction of the money available for loans reduced the ability of mine owners to pay for development. Economic panics were usually followed by corrections in the markets that were remedied with tight fiscal policies that used gold to back the value of paper money.

Three economic panics occurred in the late nineteenth century that had negative effects on the Arizona mining industry. The Economic Panic of 1873 was precipitated by failure of Jay Cooke and Company, an investment company heavily invested in railroad development; recovery after the panic was partially fueled by the Bland-Allison Act of 1878 that required the government to purchase 2–4 million ounces of silver per month (Richardson and Sablik 2015). Recovery from the panic after 1874 propelled much of Arizona's growth including the ranching industry, construction of the Arizona Canal (1883–1885), and sale of irrigated agricultural land. However, a panic in 1884 delayed completion of the Arizona Canal that expanded irrigation northwest of Phoenix to lands as far as the Agua Fria River. Afterwards, the farming community of Peoria was founded in 1886 close to the future location of the Relief Mine (Gilbert 2004). Additionally, severe droughts in the late 1880s and early 1890s caused a decline in ranching and farming properties in the territory.

The Sherman Silver Purchase Act of 1890 required the government to purchase 4–4.5 million ounces of silver each month, which boosted the mining economy but created a glut of silver that led to a decline in the price of silver (Miller 1991; Richardson and Sablik 2015). The combined impacts of drought and silver glut contributed to the federal government's decision in 1893 to stop redemption of greenbacks with silver and return to a gold standard. The Economic Panic of 1893 began in January 1893 and depressed the national economy until June 1897. The reduced economic activity across the nation was the most severe shock to the nation's economy up to the time and created unemployment that reached as high as 25% in some locations (Leonard

1949). The economic hardship was felt immediately in the American West's mining communities as the decline in silver prices and high cost of operating lode mines and beneficiation plants made mining operations unprofitable. The impact of unemployment fostered an interest in labor unions, creating conflict between mine owners and workers that broke out into armed conflict that continued sporadically for decades (Larkin and McGuire 2009; Lens 1974; Roller 2013). Arizona's mining industry in the late nineteenth century recovered because of diversification away from gold and silver and the rise of new industries. The decade-long recovery after June 1897 benefitted from the development of industries that required copper for use in electric motors, telephone lines, and automobiles. The move away from precious metal mining to base metal was accompanied by the need for even greater amounts of capital to finance underground and open pit copper mines and complex mills.

Speculative investments by trusts and banks in western mining properties proved unsupportable triggering an economic panic in late 1906 that lasted until early 1907 (Richardson and Sablik 2015). Investors withdrew their money from trusts that invested in mines, with the result that runs on banks depleted cash reserves and left less-savvy investors holding worthless stock. The national economy did not completely recover until late 1908 (Morrow 1943), followed by a gradual economic recovery (Pape 1987). In the following decade, precious and base mineral prices increased, and Arizona's mining economy reached a peak during World War I (WWI) as government spending to finance the war effort raised prices for a wide range of goods including lead and copper. Mineral prices plummeted after WWI and the national economy entered a depression in 1919 with only slow economic growth through the 1920s (Marrow 1943). The down-cycle repeated itself again when the October 1929 stock market's selloff ushered in the Great Depression that lasted until 1934 but tapered off until demand for commodities increased during World War II (WWII).

Development of the Relief Mine in Maricopa County had to contend with the aforementioned events and the fact that its ore was not exceptionally rich. However, the mine did have a mine promoter that hyped its potential. The discovery of gold in the low hills near Peoria was a readymade paradise for George Hamlin, a self-taught mining engineer residing in Phoenix. Hamlin made confident statements to newspaper reporters about the quality and quantity of gold in the Relief Mine and implied he would work it "for all that is in it" (*Phoenix Daily Herald* 5 April 1894 [4:3]), possibly to create interest among local investors that were looking for opportunities to "strike it rich." Hamlin's statements were typical of mine promoters who exuded confidence to bolster their personal and business personae that was essential to gaining access to investments that funded development of mines. In this respect, the Relief Mine's development trajectory was typical of the Gilded Age.

HELEN HAMLIN ALLEN COLLECTION

Information about the Relief Mine is available in the Helen Hamlin Allen Collection (HHAC) at the Tempe Campus of the Arizona Historical Society (AHS). The extensive HHAC includes 5 cu. ft. of photographs of the Salt River Valley, mining, scrapbooks, post cards, tax statements, canceled checks, and correspondence related to the Relief Gold Mining Company (see www.arizonahistoricalsociety.org/wp-content/upLoads/library_Allen-Helen.pdf). This resource is the basis for this article and includes untapped information about the Relief Mine and Arizona's mining history.

The Relief Mine is the largest claim in the Agua Fria Mining District (also called the Relief District) located 11 miles north of Peoria, Arizona. The archaeological site number AZ T:8:177(ASM) refers to the combined Sunrise/Relief Mine but this paper focuses on archaeological excavations at the 1893–1930 Relief Mine, cyanide plant, and habitation camp.

Relief Mine Archives

The first General Land Office (GLO) plat map for T4N, R1E (Number 00158, survey completed September 1894) does not depict the Relief Mine but it does show Frog Tanks Road running southeast to northwest less than two miles east of the mine (Figure 1a). A second GLO plat for the township (Number 00157, drafted 1904) and Mineral Survey No. 1614 (completed in late December 1901) depicts three patented mines within the district with the mine names Venus (37), Relief (38), and Relief No. 2 (39) (Figure 1b). The 1901 Mineral Survey mentions ten shafts were excavated. George Hamlin was listed as "attorney in fact" for the Relief Gold Mining Company on the October 1901 GLO Mineral Survey No. 1614.

In 1893, George Hamlin reported finding gold in northern Maricopa County about six months after the start of the 1893–1897 economic panic and recession (*Phoenix Daily Herald* 10 July 1893 [2:1]). Hamlin was described as a "post-graduate of Nature's mining course" (*Arizona Republican* 11 April 1911 [7:4]) and other newspaper accounts record his activity at the Relief Mine (Table 1).

Hamlin was born in Baltimore, Maryland and served in the Union army before mustering out with the rank of sergeant. Hamlin had one child named Helen from a marriage to his wife, also named Helen. George died

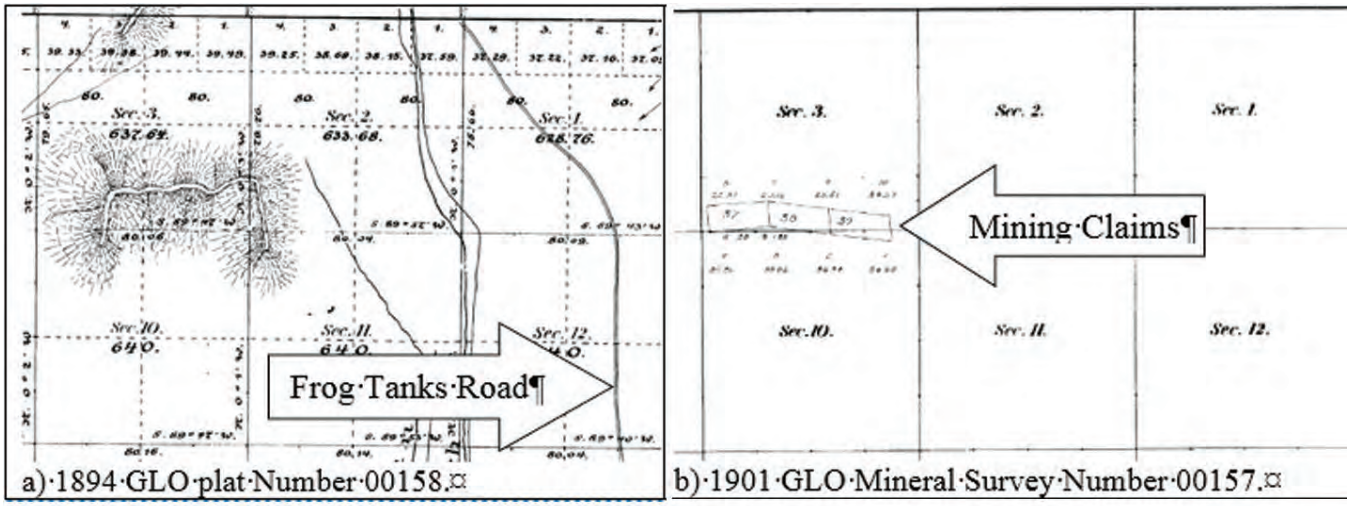


Figure 1. General Land Office maps for T4N, R1E: a. 1894 GLO plat Number 00158, b. 1901 GLO Mineral Survey Number 00157.

of cancer on May 6, 1925 at the age of 85 while living at 1139 East Monroe in Phoenix, Arizona and is buried in Double Buttes Cemetery in Tempe. He was survived by his wife Helen Hamlin, his daughter (Helen, wife of James H. Allen), and his brother John Hamlin living in New York (*Arizona Republican* 7 May 1925 [4]). His records of the Relief Mine were donated to the Arizona Historical Foundation at Arizona State University and subsequently transferred to the AHS as part of the HHAC.

FINANCING THE RELIEF MINE

Hamlin's involvement with the Relief Mine begins when he acquired a power of attorney from John H. Leibold and Alexander Munro in 1893 that gave him the authority to direct work at the Relief and Venus mines (*Phoenix Daily Herald* 17 July 1893 [4:3]). Leibold and Munro were likely prospectors that initially located the mine, possibly in exchange for financial support from Hamlin. Leibold is listed in later documents as an employee of the Relief Mine between 1902 and 1905.

Initial excavations at the Relief Mine were labor intensive and completed under Hamlin's direct supervision. An 1894 news article and the 1916 prospectus used rather ennobling language to describe the early work as, "working with one assistant, Hamlin sank an incline shaft 200 ft. deep with nothing but a homemade bucket and windlass to hoist out the muck (Glendale Mining and Milling Company 1916). (He decided to) work it for all there is in it" (*Phoenix Daily Herald* 5 April 1894 [4:3]).

Hamlin's initial exploitation of the ore body using his own resources could be explained either by his inability to obtain financing during the 1893–1897 panic and recession or else he wanted to recover the high-grade ores that were close to the surface for himself. Evidently, the richness of the ore body did allow Hamlin to prosper somewhat despite the economic hardship affecting the nation. In mid-1901, Hamlin's solitary effort to work the Relief Mine ended when he sold the mine to Schulyer S. Moore and Professor George A. Treadwell, New York investors in mining properties. In a letter dated May 4, 1901 to Sam F. Webb, Maricopa County Treasurer, Moore outlines his plan for the mine: "Our plan is to form a company, call it the Relief Gold Mining Company of Arizona, Capital, 20,000 shares, par value $10 per share. . . . $200,000. 10,000 shares in the treasury for working capital" (Moore 1901a).

Moore and Treadwell were well-known Gilded Age promoters of mines that earned money from the buying and selling of mining claims as well as selling advice to banks and investment houses about which mines could be profitable investments. Professor Treadwell operated the George Treadwell Mining Company from offices in New York City where he offered expert advice about mine values and sold stock in his company directly to the public (*New York Times* 17 November 1901 [18:1–3]). The first of three prospectuses for the Relief Mine was 16 pages long and printed in 1901, likely by the George Treadwell Mining Company. In 1903, a perspective drawing was made of the mining property and in 1908 a two-page prospectus offering treasury shares for the mine was printed, also by the Treadwell company. A final prospectus dated 1916 was prepared for the reorganized mining property.

Hamlin's sale of the Relief Mine was completed by July 1901 when the Relief Gold Mining Company was incorporated in West Virginia. The company was managed by committee with Treadwell the Treasurer and

Table 1. Newspaper accounts related to the Relief Mine and persons associated with mine

Article Summary	Significance of Information
George Hamlin working at Contention Mine 16 miles north of Phoenix (*Phoenix Daily Herald* 10 February 1887 [2:3]). Most likely this mine is near Cave Creek.	Evidence of Hamlin's involvement with numerous Arizona mines.
George Hamlin traveled to Yuma Copper Mines to help install new smelter. Power plant fueled by coke (*Phoenix Daily Herald* 20 May 1889 [3:2]).	Evidence of Hamlin's knowledge about the smelting process.
A $6,300 bond for a deed to the Maricopa Mine in Cave Creek District was issued from McDonald and Shaw to George Hamlin (*Arizona Republican* 25 June 1890 [4:2]).	Hamlin had mining interests elsewhere in Maricopa County.
George Hamlin is exploring mines in the Cave Creek vicinity (*Arizona Republican* 15 August 1890 [4:3]).	Hamlin visiting Cave Creek vicinity is mentioned again.
Maricopa Mine excavation reached 35 ft. deep (*Tombstone Epitaph* 5 July 1890 [2:3]).	Development work required less than two weeks of excavation to reach 35 ft. deep.
George Hamlin secured bond on Red Rover Mine in vicinity of Cave Creek, 50 miles north of Phoenix (*Phoenix Daily Herald* 24 June 1891 [3:2]).	Demonstrates his activity as a mining investor in Arizona.
George Hamlin found gold around the margins of the Salt River Valley (*Phoenix Daily Herald* 10 July 1893 [2:1]).	First mention of what is likely the Relief Mine.
"George Hamlin came in last night from his Relief Mine. Work is going on steadily at the camp and the ore body is growing richer and more extensive as the shaft goes down" (*Phoenix Daily Herald* 31 August 1893 [4:2]).	Mining started during major economic panic (1893–97).
"George Hamlin brought in today from his Relief Mine a sample of a new find which he found cropping from the ground while clearing the brush for a connecting shaft. Like all the ore on that claim it is fine milling and goes $40 to the ton. George has a good thing in the Relief and intends to work it for all there is in it" (*Phoenix Daily Herald* 5 April 1894 [4:3]).	Mining continued during economic panic. The owner intended to work the property without benefit of outside investors.
"George Hamlin returned yesterday from his Relief Mine and reports having struck $100 rock. The find was made in the east drift at the 100 level and was a surprise. No indications were to be seen of the ledge until they were into it. Three shots opened up the vein about 18 inches and the rock on being horned showed up splendidly" (Phoenix Daily Herald 5 May 1894 [4:2]).	Drifting east was not continued in spite of the rich ore discovery. Exploration methods involving explosives reached 100 ft. deep in less than 9 months.
"George Hamlin's camp, at the Relief Mine, 20 miles northwest of Phoenix burned down Sunday afternoon Reedy Tweed and James Murphy had just gone back to work at the mine, 500 yards north of the camp after a hearty diner, and paused to take a breath as windlassed to the surface from the 130 feet shaft a bucket of fine $40 free-milling gold ore. Looking down to their canvas and ocatilla (sic) quarters they saw flames suddenly leap up. Over $200 worth of provisions not to mention bedding, cooking, and mining utensils, disappeared entirely. Murray in trying to save a favorite rifle of Hanlip's (sic) burnt his hands severely and lost some $90 worth personal clothing. The two miners were compelled to walk to Phoenix over the hot desert in order to get food. They arrived here about two o'clock Monday morning. Yesterday Mr Hamlin rustled a new outfit and starts for the mine again today. Work will be prosecuted without interruption as the property looks better than ever before." (*Arizona Weekly Citizen* 7 July 1894 ([1:5]).	The work camp and mine of the Sunrise/Relief Mine was assigned site number AZ T:8:177(ASM). Evidence of burning was recognized at Features 4, 8, and 9 during archaeological investigations (Gomez et al. 2008:92, 99, 67, respectively).

continued

Table 1. Newspaper accounts related to the Relief Mine and persons associated with mine

Article Summary	Significance of Information
"Excellent ore has again been struck in George Hamlin's Relief Mine, in Maricopa county (sic). The queer, granite rock is literally speckled with visible free gold. It was encountered in the main shaft at a depth of 160 feet." (*The Oasis* 23 February 1895 [6:1]).	Commentary about how unusual it was to find "free" (milling) gold in granite.
"George Hawlin (sic), of the Relief Mine, is in town. He says thing are looking away up on his property…Work is a little slow, which of a necessity it must be when I have only an 'arm strong' hoist to pull dirt of a hole 180 feet deep." The article continues with several comments about the valve of ore found across the property (*Arizona Weekly Citizen* 7 September 1895 [1:6]).	Excavation of main shafts and drifts is minimally 80 ft. in four months (compare to *Phoenix Daily Herald* 5 May 1894 (4:2).
George Hamlin reports that his incline shaft on the Relief Mine is down about 400 ft. He states that he is making about 2½ ft. per day and plans to "keep digging until he strikes water or runs out of cable before he begins cross-cutting." *Arizona Republican* 26 May1902 [5:3]).	Evidence that the Relief Mine shaft was 400 ft. deep by May 1902.
Application for Venus and Relief mines patents advertised publicly (*Arizona Republican* 5 September 1902 [7:4] and subsequent dates).	Public notices for issuing patents for Venus and Relief mines.
George Hamlin states that the incline shaft of the Relief Mine is down 455 ft. The article proclaims "the purpose for sinking the shaft was first to find water and secondly to get a proper opening for the working of the mine." It also states that "the Relief is capitalized for only $200,000, and all stock sold has been at par value, ten dollars a share." At the time of the article, no stock was for sale (*Arizona Republican* 12 July 1902 [2:3-4]).	Evidence that the Relief Mine shaft was at least 455 ft. by July 1902. Also demonstrates that the mine was not experiencing financial problems during this time.
Description of a plan to obtain a cyanide mill (*Arizona Republican* 25 March 1903 [3:4]).	No mention of a mill or other physical plant prior to this time.
George Hamlin placed a newspaper ad to the effect that, "I can sell a few shares of Relief Gold Mine Company's stock." He provides his street address of 1261 East Lincoln, Phoenix to allow people to contact him directly (*Arizona Republican* 9 September 1903 [8:2]).	Hamlin sold stock he received in payment for the mine. His sale directly to the public implies his Mine Superintendent wages were inadequate or were only on paper.
"Cave In Shaft At The Relief Mine/ No One Hurt and the Work Goes Rapidly On/ George Hamlin came in from the Relief Mine Sunday … Mr. Hamlin says he is making good progress in getting the mine cleaned up for work again but several days ago there was a bad cave in one place in the incline shaft that set things back some though it will be better than ever when it is fixed up. The object he is working for is the opening up of the 400 foot level which he believes will show a bigger and better body of ore than any above. When this is done and he has enough good ore exposed to keep a big mill running he will undertake the work of securing a bigger mill. The little one now on the property but little more than pays expenses when it is worked ….The incline shaft is about 500 feet deep and the pump is 34 feet from the bottom, the lower part of the shaft or sump being used as a reservoir to supply the camp with water. About 30 feet above the pump and about opposite the projected station on the 400 foot level the recent cave occurred. Mr. Hamlin is now engaged in putting in new and heavy timbers at that point, the cave being caused by the rotting of some of the older and smaller timbers, and the ground at that point being soft anyway… Five men are now working." (*Arizona Republican* 27 December 1910 [8:4])	Dangers of underground work indicated by a cave-in at the main shaft. Condition and structure of the mine is described for 1910. Blame for the low profit of the company is the small size of the mill. Re-timbering the inclined shaft with larger elements.

continued

Table 1. Newspaper accounts related to the Relief Mine and persons associated with mine

Article Summary	Significance of Information
Shaft was cleaned out after a rock fall, 400 level was expanded for a landing, distillates for the hoist were purchased, dewatering the shaft from a sump at the 500 level, and timbering "soft ground" with a crew of five people (*The Oasis* 14 January 1911 [1:1-2])	Partial collapse of the shaft created delays and unplanned expenses.
"At present he is running a shift of five men at the five hundred level of the Relief Mine" (*Arizona Republican* 11 April 1911 [7:4]).	Flowery language praising Hamlin; personal history indicates he arrived in Arizona from New York in 1867 without formal training as a mining engineer.
"Once more the Relief Gold Mine, 25 miles northwest of Phoenix, is coming to the front as a producer after several years of hard sledding due to the impossibility of raising sufficient funds for operation. The mine was developed some years ago and equipped with a roller plant with which considerable gold was taken out but the plant was too small and paid but little more than cost of its operation, considerable values being lost in the tailings. After many tests it was demonstrated that not only the tailings but the ore would yield readily to the cyanide process. Sufficient capital was secured to put up a cyanide plant and operations on the tailings were begun about six weeks ago. Twenty-five tanks of tailings were worked during the first month and a $1,800.00 bar of bullion has just been sent to the mint, as the proceeds of the first clean up. It is figured that $2.12 per ton were secured from the tailings work, that being about 80 per cent of the value shown in the assays. By the time the tailings dump has been reduced it is confidently believed sufficient money will have been secured to equip the plant for working new ores in a quantity that will make it a profitable undertaking. It has been demonstrated that the ores will go at least $6.50 per ton higher than the tailings which will of course greatly increase the proceeds of the plant."	Unattributed magazine article dated 1913 found in the Helen Hamlin Allen Collection. Note the mention of a cyanide plant starting work six weeks prior to publication.

Moore the Chairman. Hamlin's role in the company was outlined in a 1901 letter that states upon delivery of the deed for the mines Hamlin would receive $15,000 in cash and 3,000 shares of stock in the company. Moore and Treadwell were to receive $5,000 in cash and 1,500 shares of stock in compensation for their services; money was to be raised from the sale of company stock. This plan was solidified in a memorandum of agreement signed by all three parties on May 14, 1901. After July 1901, the mine's deed was transferred to Schulyer S. Moore and Professor George A. Treadwell in exchange for $10,000 paid to George Hamlin.

A public solicitation of funds to capitalize the mining property appears in a prospectus released on May 15, 1901. The prospectus encouraged potential shareholders to invest quickly and offered an incentive—all stock purchased within the first sixty days would be at a rate of $5.00 per share, half the amount the shares were expected to fetch on the open market. The prospectus predicted these shares would be worth $50.00 each within a comparatively short time as "the property would be worth $1,000,000 within a few months after reduction works were started" (Moore 1901b). Despite the prospectus' optimistic claims, fundraising efforts had only limited success. In a letter to the Valley Bank of Phoenix dated July 22, 1901, Moore (1901c) writes that $10,000 would be wired from American Exchange National Bank of New York on July 29 for payment to Hamlin, exactly sixteen days past due and $5,000 less than what was agreed upon in the purchase agreement. According to the letter, the money was to be paid to George Hamlin on receipt of the deeds for the Relief, Venice, and Relief No. 2 mining claims. The letter also states that Treadwell would be personally responsible for the remaining cash balance due to Hamlin for the purchase of the mine. Company ledgers for November 1901 indicate Hamlin was employed as the Mine Superintendent receiving a salary of $100 a month.

Following sale of the Relief Mine, Hamlin was employed to further develop the mine. The eastern investment group, however, had considerable control governing day to day operations for the property. A letter written on January 21, 1908 by Moore (1908a) advises Hamlin to be careful in his hiring practices, "It would seem as though you could run two shifts, but I would not employ more than 10 or 11 men under any

circumstances." The company's financial backing allowed Hamlin's hand-operated windlass to be replaced with a hoist house serving an inclined shaft (Figure 2).

Partners in the mine went without compensation for extended periods of time. A 1907 company report states that, "Superintendent Hamlin has drawn nothing on his salary account during the last two and a half years. The amount due him April 1, 1908 is $3,000." The report further clarifies that Moore also was due $6,634 in back pay from May 1, 1907 (Moore 1907; Relief Gold Mining Company 1908a). These financial hardships were predicted to be overcome with the addition of a cyanide processing mill.

Weekly correspondence between Moore and Hamlin indicates that raising additional funds from shareholders was a high priority. The letters demonstrate that work in the mine recovered enough ore to pay for some capital improvements and worker's wages. However, the 1906–1907 Economic Panic undoubtedly reduced investments and delayed development of the mine and mill.

In 1908, a two-page prospectus was published seeking additional investors for the Relief Gold Mining Company to improve the mine through the sale of Convertible Certificates. The certificates were bonds that would mature every six months, beginning in January 1908, not stock in the company. The bonds would pay 6% interest but could only be converted into stock or cash almost a decade later – after January 15, 1917. The sale of certificates at $10.00 each was designed to raise $200,000 of additional capital that would be used to "further develop the ore bodies, install power drills, enlarge the mill capacity to at least 100 tons a day, and for the general benefit of the Company" (Relief Gold Mining Company 1908b). The power drills and upgraded mill were expected to increase efficiency; the mill would use ground water pumped out of the 500 level of the mine. Water would be used on the surface in tanks near the mill (Figure 3).

The inability to obtain additional capital forced Hamlin to shut down the Relief Mine around the end of May 1908. A letter dated May 28, 1908 to the stockholders described the dire financial condition of the company as, "We are unable to give Supt. Hamlin any help from this end. There is no demand for treasury stock even at $3.00 a share. This mill cannot work at a profit when operated on an average of about 13 days of 12 hours each per month. The conditions forced us to shut the mill down on the 15th inst. and discharge all of our employees, except a watchman" (Relief Gold Mining Company 1908b).

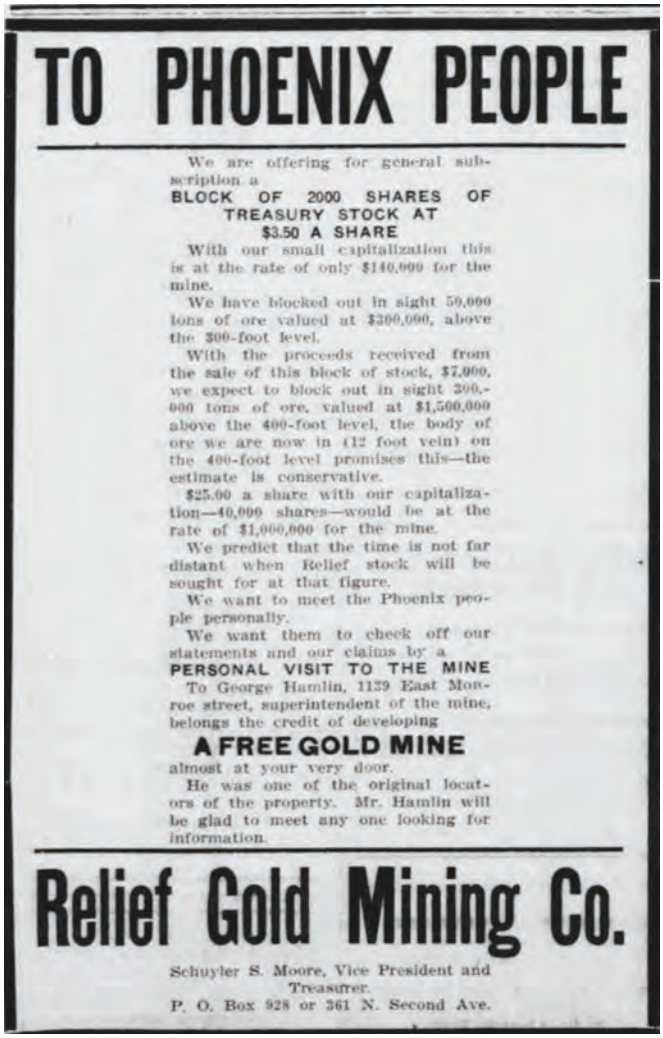
The Relief Mine remained closed until July 1908, when Moore (1908b) writes Hamlin advising him to hire three men to resume work at the mine. Correspondence between Moore and Hamlin during this time suggests that the work was designed to make the Relief Mine appealing to potential buyers, not to return to full production. Work at the mine continued with seven employees until October 1908. From January 1909 to November 1910, time ledgers indicate that only a watchman—Noah Green, the former cook—remained on the premises.

Figure 2. Hoist house at the Relief Mine, no date (courtesy of AHS HHAC MSS 11 FP-HA-13).

As part of the effort to attract buyers for the mine, three additional unpatented mining claims were established and became part of the Relief Gold Mining Company property in 1909 (Bailey 1909). The three claims—tellingly called the Pick Me Up, Last Chance, and S.S.M.—created a continuous 6,000-foot-long claim covering the lode. Work at the Last Chance mine started as early as January 29, 1908. At this point, the mine included the Venus, Relief, Relief Mine Number 2, plus six unpatented claims defining the lode's projected location at the base of the mountain north of the original claims. Two claims, the Banden and Banden No. 2, are south of the original patented claims.

The *Arizona Republican* published an article on the mine in 1912 entitled "Condition of the Relief Mine" that indicates that Moore, now vice president and treasurer of the Relief Gold Mining Company, had moved from New York to Arizona to be closer to the operational headquarters of the mine and to be "in close touch with the property "(*Arizona Republican* 22 February 1912 [3:1]). Moore is described in the article as being both anxious and enthusiastic over the prospects of the mine. Moore's move to Phoenix was accompanied by advertisements offering to sell shares to local investors (Figure 4). The price of $3.50 listed in the newspaper for Treasury Stock was slightly higher than what they

Figure 3. Interior of the Relief mill, no date (courtesy AHS HHAC FP-HA-7).



TO PHOENIX PEOPLE

We are offering for general subscription a

BLOCK OF 2000 SHARES OF TREASURY STOCK AT $3.50 A SHARE

With our small capitalization this is at the rate of only $140,000 for the mine.

We have blocked out in sight 50,000 tons of ore valued at $300,000, above the 300-foot level.

With the proceeds received from the sale of this block of stock, $7,000, we expect to block out in sight 300,000 tons of ore, valued at $1,500,000 above the 400-foot level, the body of ore we are now in (12 foot vein) on the 400-foot level promises this—the estimate is conservative.

$25.00 a share with our capitalization—40,000 shares—would be at the rate of $1,000,000 for the mine.

We predict that the time is not far distant when Relief stock will be sought for at that figure.

We want to meet the Phoenix people personally.

We want them to check off our statements and our claims by a

PERSONAL VISIT TO THE MINE

To George Hamlin, 1139 East Monroe street, superintendent of the mine, belongs the credit of developing

A FREE GOLD MINE

almost at your very door.

He was one of the original locators of the property. Mr. Hamlin will be glad to meet any one looking for information.

Relief Gold Mining Co.

Schuyler S. Moore, Vice President and Treasurer.
P. O. Box 928 or 361 N. Second Ave.

Figure 4. Advertisement for Relief Gold Mine treasury shares (Arizona Republican, 6 March 1912 [7:1–2]).

considered in 1908 as a rock bottom price for the same shares. The disingenuous advertisement implies the 2,000 shares they were selling would capitalize the mine for $140,000, without mentioning that the treasury stock was not ownership shares in the company; nor did the article mention maturity dates or interest payments.

The Relief Gold Mining Company's economic difficulties came to a head in 1915. Indebtedness of the company reached $46,000 with an additional $28,400 worth of convertible certificates, plus interest, due by 1917 (Daley 1915). To worsen matters, no cash was left in the treasury, a number of creditors were insisting on settlement, and a request for judgment was soon to be filed against the company by an angry investor. Under these circumstances, the original stockholders realized that it was only a short time before the company was forced into the hands of a receiver and the property sold at public auction.

To forestall lawsuits and foreclosure, the shareholders unanimously resolved to reorganize the company on October 26, 1915. Charles S. Daley, New York attorney, sent guidelines for the company's reorganization to all Relief Gold Mining Company stockholders and creditors on November 15, 1915 (Daley 1915). The reorganized property was established in 1916 as the Glendale Mining and Milling Company and after 1916, the property's name was changed to the Sunrise/Relief Mine. On May 13, 1916 the Glendale Mining and Milling Company was formed under the laws of Arizona to take over the assets of the Relief Mining Company (Arizona Corporation Commission Number 27623, Docket Number 4476 C 27623). The Glendale Mining and Milling Company operated from 1916 to 1917 and filed only one annual report, in 1916. The company's statutory agent was George Hamlin.

The 1916 prospectus for the Glendale Mining and Milling Company offered bonds at a low par value and a maturity date two decades in the future. The mortgage bonds were set up to pay 6% interest with a maturity date of June 15, 1936. These bonds had a par value of only $1.00 per share, and like the 1907–1908 and 1912 offerings, were not shares of stock in the company. The low cost of the bonds and long maturity date suggests they were unlikely to return any money to investors. More to the point, the prospectus' text mentioned the bonds had "speculative potential" (Glendale Mining and Milling Company 1916). Persons listed in the prospectus as owners of the mine were speculators from the east coast and prominent residents of Phoenix. The prospectus refers to many of the Phoenix residents as either Board of Trade members or stockholders in the company. The 1916 prospectus solicited investors for two properties: the Relief and Advance mines. The

Advance Mine is in Graham County and its purchase by the Glendale Mining and Milling Company allowed it to be bundled together with the Relief Mine, making it appear as the sale of a new company.

Correspondence between Hamlin and Moore between 1916 and 1918 suggests some work was conducted at the mine, but in a sporadic manner. In a letter from Moore to Hamlin on December 22, 1917, Moore writes that work at the Relief Mine should discontinue on January 1, 1918 due to the company's inability to "raise a dollar" (Moore 1917). He also instructed Hamlin to sell equipment, such as the balances, small scales, and anything else that could be disposed of at a fair price for the purpose of paying the last two Relief Mine employees their December wages. Moore continues: "We all want you to assume charge, and direction of the mine and personal property, so far as you can, without expense to the company. This of course carries no responsibility, on your part, beyond what personal property you may dispose of, but we feel that there is someone in Phoenix, interested as we are, that is looking after the best interest of the Company. Any expense you may necessarily incur will be provided for in some way" (Moore 1917).

Glendale Mining and Milling Company experienced the same financial difficulties as the Relief company. On May 1, 1922, a letter from Moore was sent to the Glendale Mining and Milling Company stockholders. In the letter, Moore solicits investors for financial help to pay the December 1920 taxes, due the following month and to pay for an annual assessment of the property. Sometime after this date, the Glendale Mining and Milling Company divested itself of its ownership in the Relief Mine property. The Arizona Corporation Commission issued a final decree closing the Glendale Mining and Milling Company on August 23, 1927.

Ownership of the mine is unclear after 1920 but a plat map dated August 1, 1923 indicates David Kile owned 240 acres in Section 3, T4N, R1E that surrounds the Relief Mine. Kile appeared in the 1916 Glendale Mining and Milling Company's prospectus as a miner from the Phoenix area and his name also appears in newspaper articles as an individual that located at least two other mines (*Arizona Weekly Journal-Miner* 8 February 1899 [4:1] and 15 March 1899 [4:1]). Additionally, time ledgers from the Relief Mine indicate that Kile worked for the mine in 1903 as a miner. In 1907, he received a $1.00 raise, and by 1911, he was foreman for the underground workings. Kile continued to work for the Glendale Mining and Milling Company as late as 1920, when he is credited with performing annual work on the S.S.M. and Last Chance claims.

The mine remained closed until 1928. A prospecting report was prepared in anticipation of re-opening the mine and described in a series of letters written from R. H. Dickinson to Ezra W. Thayer, Sr. Dickinson's mining report to Thayer involved examination of the surface, focusing on the area between what was then called the Red and Black shafts. No explanation was provided to cross reference these names with the earlier names of the shafts.

Thayer was a Phoenix businessman with interests in dry goods retail and grocery stores (McLaughlin and McLaughlin 1970). Ezra W. Thayer was listed as the president, vice-president, and secretary-treasurer of Sunrise/Relief Mines, Inc., a company organized on January 12, 1928. Thayer filed annual reports for the company from 1928 to 1934, but the Arizona Corporation Commission revoked its status on October 29, 1952 for failure to file annual reports (Number 33278, Docket Number 4370). Thayer died of carcinoma in 1937 at the age of 55 years.

Dickinson's prospecting report cautions that working the low-yielding rock would require tight technical and economic control to make future mining profitable. The proposal to reopen the mine in 1928 was accompanied with an estimate of camp construction logistics and mine operation costs. Reopening the mine to the 200 level was estimated to cost $24,300, followed by another $25,000 to reach the 500 level (Dickinson 1927). This prediction included the costs for surface equipment to support the mining operation. Archaeological evidence from AZ T:8:177(ASM) indicates the mine was reopened but the impact of the Great Depression likely forestalled extensive mining efforts at the Relief Mine.

LABOR AT THE RELIEF MINE

As with all industrial endeavors, labor is the essential ingredient that made the Relief Mine operational

Figure 5. Workers at the Relief Mine, no date (courtesy AHS HHAC FA-HP-10).

(Figure 5). The 1910 U.S. Census Schedules identified two individuals associated with the Relief Mine: George Hamlin and Noah Green. Both individuals were listed in the census as "miners" although company documents indicate Green was the Relief Mine's cook and watchman and Hamlin was the mine superintendent. In the 1910 census records, Green was recorded as a 65-year-old, white widower born in Texas, but his death certificate indicates his birth was in Nova Scotia, Canada.

Workers at the Relief Mine and mill were employed in difficult and dangerous tasks that demanded specialized skills. Thirteen job titles in the HHAC indicate activities were divided into belowground workers and aboveground workers (Table 2). Power drills were one item the Relief Gold Mining Company (1908b) prospectus suggests would be purchased to improve efficiency, suggesting the large number of workers before 1908 used hand tools to drill holes for blasting.

An engine tended by a fireman was used for hoisting aboveground. Water for the engine and use in the mill was a critical resource that was difficult to obtain in the arid desert, although flooding in the shaft provided a ready water source on site, so long as the pump worked. The mention of "distillates" for the hoist (*The Oasis* 14 January 1911 [1:1–2]) probably refers to fuel for a gasoline engine. Rock was passed through a Lane rock breaker before further processing using a Joplin Roller with a revolving screen in the mill. A small cyanide plant was established in 1913. The waste rock raised from the shaft was moved via a wheeled track to the tailings pile (see Figure 2).

Specialists were needed aboveground to sharpen and temper drill steels (blacksmith), cut, fit, and install timber shoring (carpenter), and after pneumatic drills were installed, a mechanic to keep the ventilation, pumping, and drilling equipment working. A cook was employed to feed the workers (Tables 2 and 3). Six of the skilled employees and managers were paid at a monthly rate but the other workers were paid at a daily rate (Bailey 1909).

The mine's records for the years 1901 to 1912 list 243 employees by name and provide some demographic information. The youngest employee was 16 years of age, and the oldest, 70 years; the modal ages were 31 and 35 years old and the average age at the time of their hire was 38 years old. Employees in the younger age groups were typically identified as miners, hoist men, muckers, car men, and blacksmiths, whereas those in the older age groups filled less strenuous aboveground roles, such as watchmen, cooks, and engineers (see Table 3). All workers were male, except Nora Spear, who served as cook between 1907 and 1908. Nora Spear was the wife of Alex Spear, a foreman at the Relief Mine from 1905 to 1907 and again in 1912. At the start of their employment, Nora was 40 years old and Alex was 42. Alex was employed at the Relief Mine five months prior to Nora's date of hire and he continued working at the mine for 10 non-consecutive months after Nora's employment ceased.

Peak employment at the mine was 25 employees in September 1904 and the average number of employees during years with the highest employment was in 1906 (13.2 employees per month), 1907 (12.0 employees per month), 1902 and 1904 (10 employees per month), 1905 (9.8 employees per month), and 1908 (8.9 employees per month). These numbers may be misleading because this is a sum of all employees and may include employees that left and their replacements. The number of hired workers and individuals that were fired or quit is unknown from the mine's records. Indeed, the listing of five firemen working in 1907 (see Table 2) imply replacement of individuals was common. The period 1904–1907 was the peak of employment at the mine and spans the era shortly after Hamlin sold the mine to New York investors and the 1906–1907 Economic Panic. After 1909 the mine was shut and only a night watchman was employed until October 1910.

Of the 243 workers listed in company time ledgers for the Relief Mine between 1901 and 1912, the national origin of 121 workers, or 50% of the workforce, was identified using Arizona's birth and death records. Thirty-four workers from ten different countries were present, but the largest proportion of workers at the Relief Mine was listed in the records as "white" and presumably native born (Table 4). Nineteenth century hiring practices at mines favored Cornishmen because of a widely accepted stereotype that they were the masters of underground lode mining (Alden 2007); the eight Englishmen listed might be from Cornwall. The low number of Italian, Greek, Hispanic, and African America (a combined 2.4% of total known employees) suggests hiring practices were heavily weighted in favor of native born and "white" groups in Arizona. Arizona's electorate passed an initiative called the Kinney Bill in November 1914, which required businesses with more than five employees to employ at least 80% U.S. citizens (Luckingham 1994:29). Relief Mine's archives do not cover the period when the initiative was in effect, but pre-1912 hiring patterns suggest a bias in favor of native-born employees.

EMPLOYEE WAGES

Wages paid to Relief Mine employees were identified in company time ledgers, correspondence files, and financial statements. Wage information in the 1904 ledger listed 56 employees that worked a cumulative 112 months—or on average, were employed for just

Table 2. Cumulative Record of Workers from 1901 to 1912 Ledgers

Year	Total Workers[a]	Belowground Workers	Aboveground Workers
1901	6	—	—
1902	50	Foreman (1), miner (2), mucker (1)	Cook (1), engineer (1)
1903	28	Foreman (1)	Cook (1), engineer (1)
1904	63	Foreman (1), miner (4), car man (2)	Cook (2), engineer (1), mill man (1), blacksmith (1)
1905	37	Foreman (3), miner (5), mucker (1)	Cook (3), rock breaker (1) mill man (1)
1906	45	Foreman (2), miner (20), mucker (2), car man (2)	Cook (3), engineer (1), mill man (1), tailings (2), hoist man (1), rock breaker (2)
1907	45	Foreman (2), car man (1)	Cook (1), mill man (1), fireman (5), hoist man (2), tailings (1)
1908	21	Foreman (2), mucker (1)	Cook (1), mill man (1), tailings (1), hoist man (1)
1909	1	—	Cook (1)
1910	3	Foreman (1)	Cook (1), mill man (1)
1911	11	Foreman (2), miner (4), mucker (1)	Cook (1), mill man (1), hoist man (2)
1912	3	Foreman (1)	Hoist man (1)

[a] Excludes George Hamlin, mine superintendent

Table 3. Employment Titles, Average Age of Employee, and Length of Employment at the Relief Mine

Position	Number of People Employed	Average Age at Time of Employment	Average Length of Employment (months)
Blacksmith	1	18	2
Car man	5	26	3
Cook[a]	4	56	4
Engineer	4	48	20
Fireman	6	40	2
Foreman	6	46	15
Hoist man	5	37	9
Mill man	2	38	37
Miner	32	34	4
Mucker	3	25	11
Rockbreaker	2	69	6
Tailings	3	—	7
Watchman[a]	1	59	111

[a] Noah Green

Table 4. Composition of Work Force at the Relief Mine

Nationality		Race
Irish (11)	Swedish (2)	"White" (83)
English (8)	Swiss (1)	African American (2)
Canadian (4)	German (1)	Hispanic (2)
Scottish (3)	Italian (1)	
Dutch (2)	Greek (1)	

2 months. Workers at the lower end of the wage scale (i.e., miner, fireman, car man, blacksmith, rock breaker, foreman, and cook) earned only $2.00 per day and had an average length of employment of 2.6 months. In contrast, skilled workers that were employed aboveground were paid more than $2.00 per day (engineers, hoist man, fireman, foreman, or mill operator) and were employed for an average of 10.8 months. Underground workers were the first to be discharged because when the mill stopped working, the recovered gold needed to pay wages was unavailable.

A summary of wage information for the period between 1901 and 1912 was recorded in a letter written by Minnesota investor C.E. Bailey (1909) on behalf of the Relief Mine. The generalized pay scale for mine employees was $1.50 per day for car men, $2.00 per day for miners and carpenters, and $3.00 per day for engineers, amalgamators, and mill men. Bailey noted that these wage rates did not include the $1.00 per day that was charged for room and board, which reduced their wages further. The company ledgers indicate wages paid to Relief Mine workers between 1901 and 1912 ranged from $0.50 to $3.00 a day, with approximately 73% of workers receiving $2.00 per day. The lowest paid positions were mucker, tailing, car man, cook, and one individual that was a miner. One person earned $0.50 per day (Harry B. Bernstein) but his role at the mine was not identified although it presumably involved menial work aboveground, possibly in the kitchen. The short periods of employment may represent a resistance strategy on the part of workers who were willing to leave a job that paid little (Taksa 2005) or else reflective of frequent mine shutdowns, or both.

Employee loyalty and longevity led to promotions and increases in pay. Workers employed less than 10 months occasionally returned to work at the mine after a period of employment elsewhere. Eight of these employees earned between $2.50 and $3.25 per day, suggesting they were skilled, aboveground employees. A total of six Relief Mine employees were listed in the company time ledgers with multiple job titles. The average age of the six men was 52 years and their average length of employment was 36 months. Due to their multiple roles and above-average lengths of employment, it is likely these men held skilled jobs. Two of these "long-term employees", John W. Moudy and Will H. Brashear, were listed as mill men and engineers. In 1903, John W. Moudy received a $0.25 raise followed by a $0.50 raise approximately one year later. Other long-term employees were William T. Hewitt, a mucker and fireman employed for a total of 24 months over a 4-year period. John W. Lively, aged 69 years, was employed as a rock breaker and foreman in 1906. Frank Bowen worked as a hoist man and engineer for 5 months in 1911. Noah Green, cook and watchman for the Relief mine, was employed for a total of 111 consecutive months over a 10-year period but was among the lowest paid employees. Green was the only employee, aside from Hamlin, to work at the Relief Mine for a long duration.

SUBSISTENCE AND 'MINING' THE MINER'S PAY PACKET

The top three expenditures for mine operation were boarding, wood for timbering and fuel, and other mine development expenses. The mine's ledgers indicate that accommodations and meals were provided on the property beginning in late 1901 shortly after the Relief Gold Mining Company was incorporated. Two items considered boarding expenses in the ledgers were $5.00 of bedding that was purchased on December 4, 1901, and five comforters purchased on December 22, 1901 for a total cost of $6.75.

Secretary and Treasurer Reports (Relief Gold Mining Company 1908a) provide summary information about boarding expenses. The May 1907 Secretary and Treasurer's Statement reported the average cost of room and board at the Relief Mine was $72^{4}/_{5}$-cents per man per day. The following year, boarding house expenses were $975.46, comprising approximately 11% of the budget. From April 1, 1907 to April 1, 1908, boarding house expenses totaled $2,182.87, or approximately 15% of the Relief Mine's entire budget for the fiscal year. Notice that the expenses paid by the company on a "per person per day rate" were less than the $1.00 per day that was withheld from the employee's pay, which demonstrates the mining company made a small "profit" from its employees. The relatively meager pay and high room and board costs probably contributed to the short duration that employees worked at the mine.

The inventory of purchased materials indicates efforts to control costs and suggests what items probably were resold to raise capital when the company was liquidated. For archaeologists, it also identifies materials that could become artifacts at the site. Purchasing records indicate 11 cases of oysters were bought. Purchases on

June 10, 1904 and July 2, 1904 documented $7.00 was spent in June to purchase "1 case" of oysters and in July the same amount was used to purchase "4 dozen cans" of oysters. In other words, the same amount of money was expended for 1 case as for 48 cans; therefore, one case of oysters probably included 48 cans. A total of 11 cases of oysters were purchased, which equals a minimum of 528 oyster cans that were consumed at the site and presumably discarded nearby.

An inventory of the kitchen items at the Relief Mine dated December 1901 included a steel cooking range with a water reservoir and heater. Smaller items were cross-referenced in the 1901 ledger with their costs (Table 5). Kitchen supplies that were listed in the December 1901 inventory without a corresponding cost include a stew kettle, tea kettle, steel serving spoon, dipper, bean pot, coffee pot, 2 teapots, a dish pan and bread pan, 3 drip pans, 3 fry pans, 2 water buckets, a meat saw, buck saw, cleaver, ladle, 2 canteens, 6 water barrels, 2 lanterns, 2 funnels, a flour sieve, cake turner, and a chop bowl; inventoried kitchen wares mention 2 platters, 2 syrup cans, 2 salt cans, 6 bowls, 2 pitchers, 2 sugar bowls, and plates, soup bowls, and cups. Tablewares listed in the 1901 inventory without a price were 12 each of knives, forks, tea- and tablespoons, plates, cups, and soup bowls. Later inventories indicate that 6 galvanized iron tubs and 1 boiler were purchased before January 22, 1902 and a porcelain pot was added on November 24, 1902. Twelve place settings of tablespoons, teaspoons, and pie plates were added on December 24, 1902, seven months after the mine first employed more than 10 miners. Presumably, these items were stored and used in the dining hall. A 1908 photograph of this building depicts a modest structure lacking embellishment (Figure 6). A porch with a brush arbor shade and an adjoining ramada suggests meals were consumed outdoors.

Food purchases were recorded from 1901 to 1904 when intensive exploration was underway with an average employment of nine workers. A second period with food purchase records is from June 1912 through August 1913 when few employees worked (only two in 1912 and an unknown number in 1913). However, information about 1912–1913 purchases was for meat consumption only, no other foods were identified. Grocery store invoices, company check stubs, and ledgers for the period 1901 to 1904 indicate that employees of the Relief Mine were provided a relatively diverse diet (Table 6). The weights or amounts of food are generally not given, but the associated costs in the ledgers suggest bulk purchases.

Purchases of fresh foods were made from at least five suppliers in 1912–1913. The ledgers list the cost of beef supplied by the Glendale Meat Market and S.J. Tribold. The store of R.T. Stauffer supplied meats as well as milk, butter, apricots, and corn meal (Table 7). Items purchased from Goldman and Company and M. Jacobs were a wide range of dry goods, as well as vegetables and canned food, but the records lacked prices and are not included herein. Cost and volume measurements for specific grocery items are compared to the average costs of some food items assembled from retail prices in selected cities using Morton (1975:213) and Department of Labor records (1905). Compared to the Relief Mine records, prices paid by the mining company were slightly higher for the Phoenix area, compared to the rest of the nation, despite bulk purchases (Table 8).

The amount of meat consumed by the Relief Mine

Table 5. December 1901 Kitchen Supply Costs

Item	Cost ($)	Item	Cost ($)
Steel spoon	0.20	12 teaspoons a	0.50
7-inch knife	0.50	Tea pot	0.35
8-inch knife	0.65	2 pitchers	1.00
2 agate wash basins	0.70	2 sugar bowls	0.40
Funnel	0.25	1 dipper	0.65
12 tablespoons	0.70	Oil cloth	1.50
Broom	0.65	—	—

[a] Additional spoons were purchased in 1902

Figure 6. Relief Mine dining hall in the background, May 5, 1908. Left to right: John Orme, J.H. Kibbey; Bishop Atwood; Gen. A.J. Sampson; Col. L.W. Coggins; Ezra W. Thayer; W.A. Giles (courtesy McClintock Photo Collection, Box 8, 16:58. Arizona Room, Phoenix Public Library).

Table 6. Commodities Regularly Purchased and Consumed by Relief Mine Employees, 1901–1904

Meat	Dairy/Fats	Fruits	Vegetables and beans	Grains	Other	
Corned beef	Milk	Lemons	Potatoes	Rolled oats	Vinegar	Sauerkraut
Bacon	Cheese	Apples/ dried apples	Corn	Rice	Tapioca	Pickles
Salmon	Lard	Peaches	Peas	Crackers	Pepper	Syrup
Oysters	Butter	Apricots	Tomatoes	Macaroni	Salt	Raisins
Sardines	—	Prunes	String beans	Flour	Baking soda	Baking powder
Ham	—	Grapes	Onions	Flaked wheat	Coffee	Ketchup
Codfish	—	Pears	Beets	Cornmeal	Plum pudding	Mustard
—	—	Oranges	Navy beans	—	Tea	Sugar
—	—	Currants	Baked beans	—	Catalina (canned cherries)	Yeast foam
—	—	Crabapples	—	—		Jelly
—	—	Cherries	—	—		

Table 7. Receipts from Markets

Company	Check amount ($)	Date	Commodity
Glendale Meat Market	2.70	June 25, 1912	Beef
R. T. Stauffer	4.60	June 25, 1912	Milk and apricots
R. T. Stauffer	2.30	July 6, 1912	Cornmeal and butter
S. J. Tribold	18.74	June 30, 1912	Butcher bill
S. J. Tribold	44.04	December 11, 1912	5-month butcher bill
S. J. Tribold	18.09	March 1, 1913	3-month butcher bill
S. J. Tribold	14.18	April 1, 1913	1-month butcher bill
S. J. Tribold	15.16	May 7, 1913	1-month butcher bill
S. J. Tribold	28.62	June 1, 1913	1-month butcher bill
S. J. Tribold	18.18	June 30, 1913	1-month butcher bill
S. J. Tribold	14.64	August 7, 1913	1-month butcher bill

Table 8. Average Costs Per Pound for Comestibles, 1901–1904

Commodity	Relief Mine Cost Per Pound	U.S. Cost Per Pound[a]	Arizona Price Difference
Sugar	$0.07	$0.06	+ $0.01
Lard	$0.15	$0.10	+$0.05
Potatoes	$0.03	$0.02	+ $0.01
Bacon	$0.16	$0.18	- $0.02
Tea	$0.50	$0.15	+$0.35
Coffee	$0.14	$0.07	+$0.07
Rice	$0.11	$0.03	+$0.08
Flour	$0.03	$0.03	$0.00
Butter	$0.35	$0.29	+$0.06

a Prices from Morton 1975

workers from June 1912 to July 1913 was established from the company's ledgers. The Relief Mine spent $174.35 on beef over 18 months. While company invoices do not indicate the cuts of beef purchased, it is possible to approximate beef consumption at the Relief Mine using company invoices and historic economic statistics. Morton (1975) indicates that during 1913 the retail prices for round steak and chuck roast in the U.S. were $0.23 per lb. and $0.16 per lb., respectively. Using these average prices as the basis for modeling beef purchases, Relief Mine workers could have consumed approximately 13.58 lbs. of round steak or 18.94 lbs. of chuck roast a week if round steak and chuck roast were purchased at the national costs. Company records indicate that only three workers lived at the Relief Mine during this time; therefore, each employee could have been provided as much as 0.65 lbs. (10.4 oz.) of round steak or 0.90 lbs. (14.4 oz.) of chuck roast per day.

In addition to freshly butchered beef, the mine purchased bacon and a variety of dried and canned meats from 1901 to 1904. Bacon purchases were listed for five months in 1904—a total of 548 lbs. was purchased—for a period of time when a cumulative 64 employees, or fewer, worked at the mine. On average, this is prorated to 1.7 lbs. per worker per week. Other regularly purchased items included canned oysters and salmon. Oysters, although a relatively costly item, were bought on a regular basis while canned salmon was less costly than oysters but purchased less frequently.

Dairy products purchased for the mine workers included milk, cheese, and butter. The purchase of milk by the case is evidence that canned or evaporated milk was transported to the mine, not fresh milk. Company invoices listing the purchase of chicken feed imply that chickens were kept on the Relief Mine property in 1911. Eggs were never listed in any company ledger, invoice, or receipt, suggesting the hens kept on the property provided eggs for the miners.

In summary, food listed in the company's ledgers represents a minimum of goods consumed by the miners; individual miners may have purchased additional foods or leisure/recreational items (tobacco and alcohol) for their own personal use that are not listed in the documents. The written records do not address whether food was provided seven days per week, or only for the days they worked. Neither do the records inform about consumption of food and drink off-site.

ARCHAEOLOGICAL RESOURCES AT AZ T:8:177(ASM)

Archaeological investigations at AZ T:8:177(ASM) were conducted in response to the planned 300-ft-widening of Happy Valley Road between 83rd Avenue and Lake Pleasant Parkway in Peoria (Figure 7). Archaeological survey in the vicinity of the site initially recorded isolates related to the mine (Wenker and Mitchell 2000). The next survey of the proposed road alignment recorded Locus A with 12 features and two tailing piles that extended 1,115.5 ft. along the planned roadway (Courtright 2003). Archaeological monitoring of 13 geotechnical boreholes in Locus B added the Sunrise shaft and four features west of Locus A (Hackbarth 2005). Data recovery in 2007 was completed in Locus A (Gomez et al. 2008). Decades of trash dumping and off-road driving have erased some historical features, as did soil remediation of the mine's tailings piles in 2005 that removed four tailings piles with elevated levels of arsenic (Tanner 1984). The upper tailings pile was the largest and covered 34,550 ft.^{2} with a maximum height of 20 ft. The lower tailings pile covered 34,925 ft.^{2} and ranged from 1 ft. to 10 ft. high (Deatherage 2005).

A judgmental sample of surface artifacts in Locus A was inventoried using eight observation units (OUs) placed within artifact concentrations. Only materials in Locus A are reviewed herein; for a complete site discussion see Gomez and colleagues (2008). Analysis of 492 artifacts in the OUs determined an artifact function could not be recognized from their small size. However, temporal information indicates some materials were associated with the mine's dates of operation (1894–1929).

Several of the recorded archaeological features could be matched to the 1903 perspective drawing of the mining property (compare Figure 7 with Figure 8). The 1903 perspective drawing shows the Pick Me Up, Last Chance, Relief No. 2, and Venus mining claims along the 6,000-ft.-long lode but it does not show the cyanide

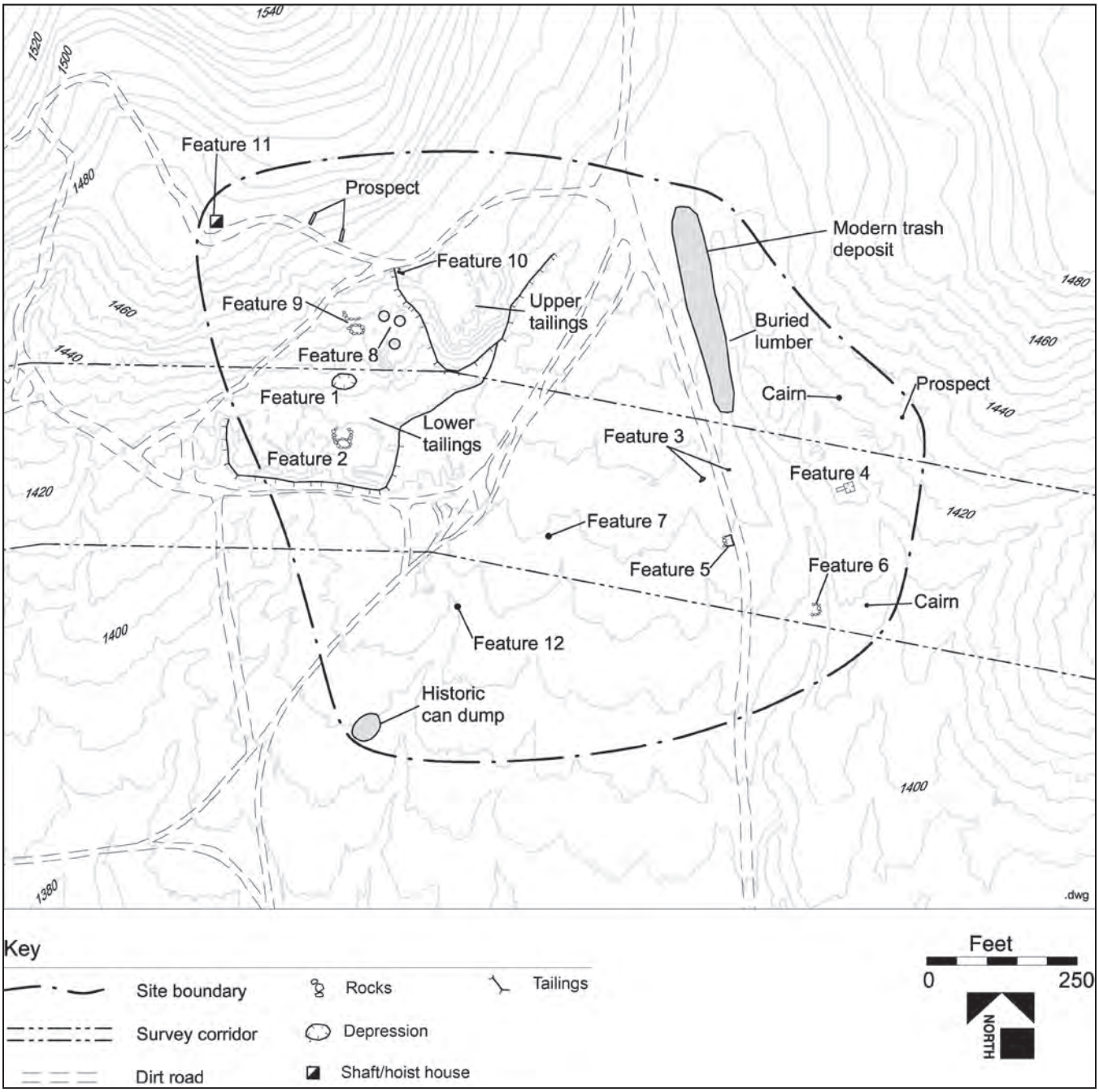


Figure 7. Archaeological features in Locus A of the Relief Mine, AZ T:8:177(ASM) (source: Gomez et al. 2008).

plant, which was constructed in 1913.

Feature 1 had sun-colored amethyst (SCA) glass (pre-1917) and Feature 3 had green transfer print sherds, redware teacup fragments, a bowl rim with gilt decoration, a whiteware bowl with decal decoration and gilt, and a whiteware saucer with stamped and hand painted decoration. Gilt decoration on ceramics was common after 1894 and the transfer print sherd was likely from a revival style popular after 1880; decal decoration became popular after 1902 (Henry and Garrow 1982). Feature 5's surface artifacts included modern refuse that were mixed with a colorless glass canning jar, a pressed glass bowl, "Levi Strauss & Co." metal rivets, a key strip turnkey, a "Rauf Co./Prov, RI" lead rivet, colorless bottle fragments, and amber bottle fragments that are likely related to the mine.

Locus A had 12 archaeological features (Table 9) of which Features 1, 2, 4, and 8–12 were destroyed before

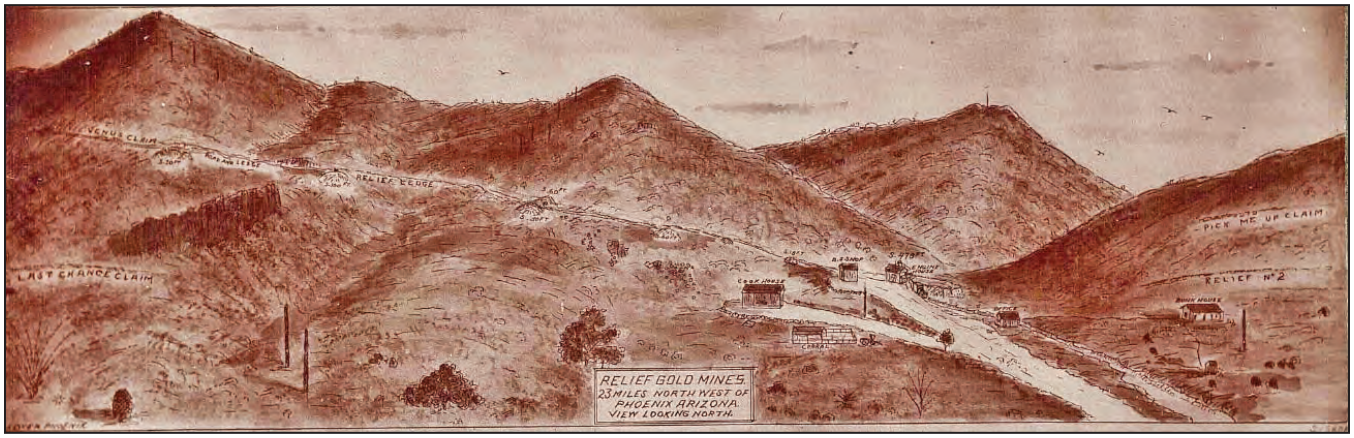


Figure 8. Perspective drawing of Relief Mine ca. 1903 (courtesy AHS HHAC FP-HA-14).

data recovery; descriptions of these eight features use survey records (Courtright 2003). Four features remaining after soil remediation were tested during data recovery (Features 3, 5, 6, and 7).

Feature 1 was an irregular rock-lined oval depression (Figure 9) with a wall of native rock forming three sides. The wall was composed of rough-hewn granite blocks and unmodified rock cobbles laid two courses high to create a 20-inch-high wall. An earthen berm was set against the rock wall's south side. The SCA glass artifacts suggest Feature 1 predated 1917. The drawing in the 1903 prospectus suggests Feature 1 was the Cook House; a retouched drawing of the perspective map dated 1908 suggests that a porch was added to the southwestern corner of the cookhouse. A 1916 photograph of the cookhouse described the building as a store house (see Figure 6).

Feature 2 was a stone-lined structure's foundation with two conjoined rooms built on the south end of the lower tailings pile. No definitive association with structures on the 1903 drawing could be made; however, it may be related to the 1913 cyanide mill. The feature probably was destroyed during soil remediation.

Feature 3 consisted of two concrete steps and concrete foundation piers separated by a dirt road. East of the road one concrete step was near a dense concentration of window glass, nails, and car seat springs in an area cleared of large rocks. A former wood structure with a raised floor probably covered the clearing. The second concrete step was west of the road and was near two concrete piers. Both piers were displaced from their original location and were not embedded in the ground. Randomly scattered fragments of concrete were west of the second step. One of the concrete steps had three floated sides and a floated, round edge. The fourth side of the step was irregular indicating wet concrete poured against a building.

The area around Feature 3 was littered with modern beer and soda bottle glass, as well as a few pieces of SCA glass, one ceramic electric insulator, one wire coat hanger, and a large quantity of modern shotgun shells and broken clay pigeons that postdated the mine's operation. Glass shards recovered from Feature 3 were machine-manufactured, which indicated a post-1904 date. One bottle fragment had embossed letters reading, "Not To Be Refilled," a phrase on bottles manufactured after the 1930s. The maker's mark on this vessel was a block letter "L" inside a circle, a mark used by the Libbey Glass Company after 1937 (Toulouse 1971:327). Most cut and wire nails were bent indicating loss or discard when the building was dismantled. Machine-cut nails were in the minority with drawn wire nails more common. Most nail manufacturers had switched to wire nails by 1899 (Gillio et al. 1980) and the relatively few machine-cut nails in Feature 3 could represent reused items or nails purchased from hardware stores that retained old stock. Either scenario could produce a time lag between the manufacturing date and discard of the nails.

Feature 4 was a mineshaft in Locus A with burnt shoring. The shaft was filled with rock and an earthen berm surrounded the depression. The wood collar of reused railroad ties could indicate the shaft dated to recent mining operations.

Feature 5 was a rectangular clearing west of a dirt road with a cobble alignment bordering its western edge. The clearing had a level surface with randomly scattered cobbles. A moderate- to low-density artifact concentration of historic ceramics, glass, metal, and nails was inside the feature. The structure formerly occupying the Feature 5 location was likely the Bunk House depicted on the 1903 perspective drawing. Southwest of the cleared area was a northwest-to-southeast trending line of cobbles that was part of the trail system that entered

Table 9. Features Reported at AZ T:8:177(ASM) Correlated with Perspective Drawing*

Perspective Drawing Caption	Feature	Archaeological Feature Type and Age	Comment
"Cook House"	1	Possible cookhouse or storehouse; 1901–1914	Extensive rock terrace as depicted in 1903 perspective drawing of the mine was not present archaeologically; destroyed, in remediation zone
Not present in 1903 drawing	2[a]	Stone-lined structure foundation with two conjoined rooms; age indeterminate	On lower tailings so possibly related to the mill; destroyed, in remediation zone
"Office"	3	Two concrete pads of office building; post-1903.	Tested
Not present in 1903 drawing	4	Mine shaft; 1970–1980s	Possibly Relief No. 2 shaft
"Bunk House"	5	Cleared tent pad bordered by cobble alignment; 1880–1930s	Tested; south of Relief No. 2 and Pick Me Up Claim; The ash lens could be from 1894 fire that destroyed the habitation "arbor."
Not present in 1903 drawing	6	Rock-lined privy, rectangular; 1920–1930s	Tested; 1929 outhouse suggested by newspaper; close to bunk house
No label on 1903 drawing, but fence suggests corral	7	Circular depression; age unknown	Tested; possible corral suggested by lack of artifacts
Not present in 1903 drawing	8[a]	Three steel tanks; post-1914	Cyanide mill or water storage tanks; destroyed, in remediation zone
Not present in 1903 drawing	9[a]	Two disconnected stone-lined structure pads	Possible mill; age indeterminate; destroyed, in remediation zone
Not present in 1903 drawing	10[a]	Two concrete pads; age indeterminate	Concrete motor mounts; destroyed, in remediation zone
"Engine House"	11[a]	Mine shaft; 1893–1934	Relief Mine shaft and hoist house; destroyed, in remediation zone
Not present in 1903 drawing	12	Depression, circular; pre-1920s to post-1934	Trash dump probably associated with wastes discarded from Cook House
Not present in 1903 drawing	13-23[b]	Features associated with Sunrise Shaft and between Locus A and B	Outside of Locus A

*(source: Gomez et al. 2008)

[a] Feature descriptions from Courtright (2003)

[b] Features located between Locus A and Locus B

the site from the south. The trail extended southward 50 ft. (15 m) before disappearing at its junction with a modern two-track road.

Two excavated levels in Feature 5's test unit had artifacts confined to the upper 4 cm to 8 cm of unconsolidated sand. A thin, discontinuous layer of ash was 6 cm below the ground surface and may have been derived from the habitation arbor's destruction during a fire in 1894 that burnt provisions, bedding, cooking, and mining utensils (*Arizona Weekly Citizen* 7 July 1894 [1]). The artifact assemblage included Bristol-glazed stoneware sherds, SCA bottle glass, straight (unbent) wire nails, and non-diagnostic metal artifacts. One maker's mark on an H.J. Heinz ketchup bottle indicates manufacture by the Owens Illinois Glass Company between 1929 and 1930, suggesting it was a late addition to the site.

Feature 6 was a rectangular depression lined on three sides with rocks that formed a foundation. A low pile of dirt next to the west edge of the feature was spoils from its historical excavation inside the rock

Figure 9. Feature 1, facing southeast.

outline. Feature 6's two archaeological excavation units each had five 20-cm-thick levels. Level 1 consisted of very loose, light brownish gray silt with large rocks and pieces of lime. Soil in Levels 2, 3, and 4 was fine, light gray loose fill, with large fragments of lime, small rocks and gravel, and newspaper fragments. Excavations stopped 92 cm below the ground surface at sterile gravel. Large amounts of newspaper were in both Feature Units. The newspaper fragments were fragile and ranged in size from 0.5 inches to 1.5 inches. Most of the newspaper either adhered to lime fragments, or in some cases, newspaper ink was transferred to the lime, leaving a negative of text or images on the lime. The newspaper fragments mainly had advertisements for comestibles, clothing, and dry goods. One piece of newspaper was an obituary published in 1929.

Other artifacts from Feature 6 included historic ceramics, glass, metal, and faunal bone. Ceramics included undecorated mugs and whiteware sherds from embossed plates, and sherds from an enameled yellowware teacup. Both types of ceramics were manufactured beginning in the mid–nineteenth century (Henry and Garrow 1982). Diagnostic glass artifacts included the base of a Ball canning jar (1932–1956), a Clorox bleach bottle base (1937–1956), and a food bottle base (1929–1956); all manufactured by the Owens-Illinois Pacific Glass Company. A soda bottle base, manufactured by the Hazel-Atlas Glass Company, was dated between 1920 and 1964 (Toulouse 1971). One medicine bottle fragment had manufacturing seams indicative of manufacture between 1880 and 1920 (Olive and Jones 1989); however, all other glass artifacts were machine made and postdate 1904. The machine-made glass vessels included canning jars, cosmetic containers, lamp chimneys, and various tablewares. Metal artifacts from Feature 6 included hole-in-top, sanitary, and unidentifiable can fragments, crown bottle caps, staples, wire fragments, wire nails, and miscellaneous items. Except the nails and tin can fragments, all the other metal artifacts were functionally non-diagnostic. Hole-in-top cans may have been manufactured as late as the 1920s (Rock 1984). Faunal bone was present including large mammal fragments, likely cow (*Bos taurus*) or pig (*Sus scrofa*). The large mammal bone fragments were sawn with a handsaw and have evidence of burning.

Feature 6 was a privy, as suggested by the lime and newspaper fragments. A privy was depicted in the 1903 perspective drawing of the mine, but it was east of a wash, whereas Feature 6 was west of the wash. Its location relative to the wash may be artistic license or, more likely, was just one of several privies on the Relief Mine property. The feature's period of use was the late 1920s and 1930s when Ezra W. Thayer, Sr. owned the mine, although the ceramics could imply an earlier date. However, ceramics often have substantial time lag between manufacture, use, and discard (Hill 1982), as much as 15–20 years (Adams 2003).

Feature 7 was a circular depression lacking surface artifacts. One excavated test unit had no artifacts. The depression most likely represents the corral depicted on the perspective drawing of the mine (see Figure 8).

Uninvestigated features in Locus A included Feature 8 which consisted of three steel tanks located on top of the lower tailings pile near its west edge. These tanks were from the cyanide plant constructed in 1913 and were removed during soil remediation.

Feature 9 consisted of two unconnected stone-lined pads near the upslope edge of the lower tailings pile, probably a structure's foundation. Burned brick fragments litter the ground near Feature 9, suggesting an oven or furnace, possibly associated with roasting ore. The feature was removed during soil remediation.

Feature 10 was a concrete pad with anchor bolts for a machine attachment. Feature 11 was the Relief Mine shaft and was backfilled with tailings piled around three sides. Both features were missing after soil remediation.

Feature 12 was a circular depression along a road approaching the mine from the south. Modern construction debris was scattered in the depression and in nearby piles. Historic artifacts, mainly metal cans manufactured during the early twentieth century, were scattered up to 98 ft. away from the depression. Historic artifacts in the scatter were in the minority, but include hole-in-cap cans, quart-size metal containers, steel beer cans, lard/salmon buckets (at least 2½ quart size), coffee tins (half with solder seams), an aspirin tin, a condensed milk can, a sardine/oyster can and glass. Ceramics were uncommon and had an orange exterior glaze; no interior glaze was present. Solder seams on the metal cans

suggested an age predating the 1920s; however, beer cans in the trash postdate 1934.

A series of faint trails near Locus A entered the locus from the south and probably connected the mine to the nearby historic community of Peoria. The trails and roads were not deeply incised and were occasionally bordered by cobbles pushed aside from the paths. Two narrow rubber truck tires along one trail had the name and size designation "Socony Mobil/6.70–15/ Mobil Cushion/Rayon." Socony (Standard Oil Company of New York) was a name in use after the 1911 breakup of the Standard Oil Company. In 1920, the company registered "Mobil" as a brand name and in 1931 a merger changed the company's name to Socony-Vacuum, which ended the use of "Socony Mobil" (*New York Times* 18 May 1966 [84]). The tires were possibly deposited when Thayer's mining operations were underway.

Locus B of AZ T:8:177(ASM) was almost ¾ mile west of Locus A and had five features including the Sunrise shaft. The Sunrise shaft was not connected underground to Locus A's Relief Mine but tapped the same ore-bearing seam. Artifacts in Locus B included a 5-gallon vegetable oil can, steel beer cans, amber glass, and coffee can lids. One artifact was clearly associated with underground mining activities—the 10-inch-diameter can lid had a handle in the center and embossed on the lid "CARBIDE OF CALCIUM/Shawino Can/Made in U.S.A./SHAWINIGAN PRODUCTS/CORPORATION/NEW YORK." Shawinigan Products originally started operations in 1904 in Canada and manufactured carbide for use with acetylene lamps. The company was purchased and reorganized as an American corporation in 1924 (Marsh 1985:443, 1793). Based on this date, Locus B probably was excavated when Ezra W. Thayer Sr. owned the mining claims in the late 1920s and 1930s. In conjunction with the newsprint dated 1929 in Feature 6, this evidence indicated work possibly continued as late as the Great Depression.

DISCUSSION

The financial history of the Relief Mine exhibited a common Gilded Age pattern of early hype and high expectations followed by increasing difficulties for workers and investors alike. Its origin as a property exploited by the self-taught mining engineer, George Hamlin, begins just as a nation-wide economic panic reduced the chances for obtaining financing. Hamlin's confident statements of rich ore deposits may have been an attempt to entice investors that would pay for the mine's development. The property's development began in earnest after the property was sold in 1901 and the national economy recovered from the 1893–1897 depression. Less than five years later the mine struggled to pay wages while plans were floated to expand the mill and develop deeper portions of the ore body.

The 1906 economic panic left the mine in dire economic straits with Hamlin and directors of the company unable to collect a salary. Dividends were sent to investors but wages for the aboveground and belowground workers for most months in 1902–1912 consumed what little returns were made from the small mill. Expansion of the mine in 1913 included adding a cyanide mill that left large waste piles, water storage tanks, and the development of other mining claims. This work, however, was mainly to attract a buyer for the property. The mine's nadir was reached in 1916 when the mining company was reorganized to forestall a bankruptcy sale or court judgments in favor of creditors and investors. Several owners held the property after 1916 and it wasn't until 1928–1934 that the mine was worked by a local grocery retailer, Ezra W. Thayer Sr., before the Great Depression closed the mine.

Racial animus is evident from the demographic profile of workers at the Relief Mine. Most workers were described as "whites" although 4% of the workers were from the eastern Mediterranean and African Americans. Notably lacking were individuals with Hispanic surnames and only one woman was employed. The oldest employee of the mine, Noah Green, was employed longer than any other employee but worked low paying jobs such as cook and night watchman during periods when the mine was closed.

The national economic conditions probably affected the composition of the work force. Most workers were young or middle age "white" workers that were employed for no more than three months at a time. This rapid turnover of employees reflects their lower-than-prevailing wages and high costs charged by the company for room and board. The longest serving employee, Noah Green, completed menial jobs and may have had limited employment options given his advanced age. Although Green was employed longer than any other employee except George Hamlin, he received the lowest wage.

The mine's workers consumed a varied diet that included canned and fresh meat, vegetables, dairy, and even canned seafood. Significantly, metal food cans and other containers were relatively rare at the site and the number of cans found in the project area were nowhere near the numbers that could be expected based on the list of purchased goods in the archives. Purchasing records document that 528 oyster cans were provided the workers. Purchases of 26 cases of canned salmon, corn beef, and deviled ham would amount to 624 more cans delivered to the site, for a total of 1,152 food cans. Far fewer metal cans were observed at the site, which may suggest metal cans were recycled during WWII

scrap metal drives. However, glass and ceramic artifacts were also rare at the site. This lack of cans suggests trash may have become buried under spoils piles from the mill that were removed during soil remediation. Further depauperization of the mine's possible artifact assemblage is evident from the correspondence that instructed Hamlin to sell all of the portable materials to recoup some of the money the company spent to create a functioning mining camp. Bent nails at the location of a structure suggest even the wood from frame buildings was salvaged, possibly for resale.

Material culture from AZ T:8:177(ASM) was sparse, but what remained was indicative of food consumption and habitation activities with lesser amounts of architectural materials and transportation items. The artifacts and archives were indicative of consumerism at a remote, male-dominated, industrial work camp where workers had a high protein diet. Ceramics used at the site had dates of manufacture that indicated a time lag from manufacture to discard on the order of decades. Presumably, the old ceramics were inexpensive and their use at a mine camp where breakage was unavoidable was an effort to minimize costs. The large number of kitchen goods listed in the mine's inventories but not found archaeologically likely represents items that were resold to recoup some money for the investors when the mine was closed. Removal of these artifacts at site abandonment left the archaeologists with a minimal assemblage.

Twelve archaeological features at Locus A of AZ T:8:177(ASM), the Sunrise/Relief Mine, were recorded. Despite the 1903 drawing exaggerating aspects of the site, some features could be correlated with the bird's-eye perspective map of the camp. In a case of serendipity, a fire in 1894 mentioned in a newspaper article was confirmed from archaeological evidence at Feature 5. Excavations at Feature 6 documented activity at the mine in 1929, after Hamlin died.

CONCLUSIONS

Twenty-two years of George Hamlin's life were spent exploiting the ore body at the Relief Mine. As a self-taught mining engineer and superintendent, he was familiar with the workings of lode mines and proved to be a capable and conscientious worker. However, he was unable to overcome the vagaries of the ore body and the historic events that buffeted Arizona's mining industry from 1894 to 1916. During this time the nation moved away from the Gilded Age's laissez-faire excesses in banking and investment businesses towards more federal government regulation of the money supply. Financing the small Relief Mine during upturns in the national economy was possible but these good times were punctuated with severe and moderate economic downturns that left the mining industry reeling. Coping with these events left the mine's owners seeking funds from numerous sources, often employing misleading or questionable strategies common to the Gilded Age.

On average, a dozen workers were employed at the mine during periods of production. Hiring practices at the Relief Mine followed trends in the national economy and employed a homogeneous group of men classified as "white" and native born workers, with only four employees identified as either from eastern Mediterranean countries or African Americans. Workers were mainly in their 30s and 40s, and only a few older persons were employed. The older group of workers tended to be more skilled than their younger compatriots but compensation for all was below the prevailing local wage.

Consumption of mass-produced material goods increased across the nation during the Gilded Age as the nation industrialized. Archaeological and archival observations confirm the Relief Mine's encampment included a habitation component where male workers lived and consumed foods widely available throughout the nation. However, few artifacts were present in archaeological contexts at the site, and they represent only a small fraction of goods that were identified in company inventories. Workers at the Relief Mine were transients and largely at the mercy of employers and company owners that squeezed profits from any and all sources. The mine's purchasing records indicate the costs of comestibles provided to workers were slightly higher than the cost of items available nationwide. Additionally, workers were charged a per day fee for room and board that exceeded the mining company's costs. Resistance to this form of worker exploitation was evident from the short term of employment for most workers.

As an example of Arizona lode mines, the Relief Mine follows a common pattern of development, exploitation, and decline affected by national and international events. Workers, managers, and investors experienced variable levels of success but in the end they all failed to make a lasting impact to the territorial and state economies. Nevertheless, they typified the struggles of a nation as it changed from an agrarian society to an international industrial powerhouse.

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FORT MOUNTAIN: A PREHISTORIC ASTRONOMICAL OBSERVATORY AND CEREMONIAL SITE IN THE HOHOKAM NORTHERN PERIPHERY

Scott M. Kwiatkowski

The Fort Mountain site was an early Classic period (ca. A.D. 1150–1300) "hilltop retreat" located in the Hohokam Northern Periphery that was studied by Archaeological Research Services, Inc., in 2004. A focus of the project's research design was to collect data to evaluate several, contemporary, competing hypotheses for the functions of these types of sites in central Arizona. Rather than functioning primarily for defense, much more evidence was found for this site having served as both an astronomical observatory and as a ceremonial center. Fort Mountain was located at a natural observation point for determining winter solstice. Ceramic analysis results indicated that groups of people, both locals and also those from outside the immediate area, were likely congregating there and sharing food. The presence of petroglyphs hints at a non-utilitarian functional aspect. Potential ritual paraphernalia, including pigments and pebbles possibly used in gourd rattles, were recovered. Wild tobacco, known to have been ceremonially important historically, was observed growing at the site and could represent a relict from plants that grew there prehistorically. Similarly, the two most frequently occurring ethnobotanic pollen types recovered from the site, maize and cattail, both represent plants that were used ceremonially, and their historically documented ritual patterns would have resulted in pollen being shed near where they were used. Several aspects of the site's structure, including a view-obscuring outer site wall, a possible ceremonial storage and staging room, corridors, possible ceremonial houses, and a possible basket rest located in precisely the hardest-to-access part of the site, are each remarkably consistent with components of historically documented Tohono O'odham Wi:gita ceremonies.

A series of prehistoric, walled, hilltop sites exists throughout central Arizona, with some occurring within the Hohokam Northern Periphery culture area (see Hackbarth et al. 2002:ix ; Whittlesey 1997), and some extending beyond it (Wilcox et al. 2001). Although most are poorly dated, they generally appear to have been in use between around A.D. 1150 and 1300 (Wilcox et al. 2001). Spoerl (1979, 1984) and Wilcox et al. (2001) have divided these into several types, depending upon characteristics such as site size, the number of rooms present, and artifact density. With its few rooms, low artifact density, and its tall, outer, encircling wall, the Fort Mountain site has been classified as a "hilltop retreat." Similar structures have been interpreted in the past as having served primarily defensive functions (e.g., Midvale 1970a; Simmons ca. 1936; van Waarden 1984; Wilcox et al. 2001), although other possible uses, including habitations, ceremonial sites, storage locations, signaling sites, nodes along trade routes, and astronomical observatories also have been posited by archaeologists over the years (see, e.g., van Waarden 1984). Wilcox et al. (2001) has presented a compelling case that at least some of these sites may have served as nodes within a widespread prehistoric communication system, given both their line-of-sight relationships and also the documented use of smoke signaling among the historic Native American residents of the area, the Yavapai. Also in 2001, Bostwick (2001; see also Bostwick and Plum 2005) published a study on the Shaw Butte site, another hilltop retreat visible from and located near (11 km to the south-southwest of) Fort Mountain, in which he concluded that this site functioned, at least in part, as an astronomical observatory, marking the locations of solstices and equinoxes with light and shadow alignments.

It was against this backdrop that Archaeological Research Services, Inc. (ARS), was afforded the opportunity in 2003 and 2004 to conduct investigations at the

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Fort Mountain site, AZ T:8:5 (ASM) and AZ T:8:34 (ASU), so that its landowner, Superstition Crushing, LLC, could mine the mountain and sell its aggregate to the Arizona Department of Transportation (ADOT) (Kwiatkowski 2010). While six research domains were considered for the ARS study, the most profitable one, which forms the basis of this paper, concerns site function. Separately, ARS undertook excavations at five sites at the base of Fort Mountain (Curtis and Wright 2012), including three habitations that were likely related to the Fort Mountain site.

Fort Mountain was actually a steep-sided volcanic butte, situated immediately west of the Cave Creek floodplain, within the lower portion of this drainage, at the southern end of the Union Hills physiographic area (Trap and Reynolds 1995), in the City of Phoenix, Maricopa County, Arizona (Figure 1). The butte was composed largely of basalt formed by volcanic activity during either the Tertiary or the Quaternary periods (Holloway 1999; Wilson et al. 1957). The site appears to have been located near the center of an early Classic period (ca. A.D. 1150–1300) agricultural community that grew crops using a variety of methods, including irrigation canals, hillside terraces, and rockpile fields (Curtis and Wright 2012).

ARCHIVAL, ANALYTICAL, AND FIELD STRATEGY OVERVIEW

The Fort Mountain site has been known to archaeologists ever since it was visited by the Hemenway expedition in 1888 (Hinsley and Wilcox ca. 2004). The notoriety of this site was a mixed blessing. On one hand, its local prominence led many archaeologists to visit the site and to record it to varying levels of detail (e.g., Curtis 2003; Hinsley and Wilcox ca. 2004; Holiday 1974a, 1974b; Midvale 1970 a, 1970b; Simmons ca. 1936; Smith 1974, 1978), thus preserving some information that was no longer extant by the time of ARS's 2003–2004 investigations. On the other hand, its fame led to its partial destruction, most notably the disappearance of many of its previously documented rock art elements. The archival study concluded that the Fort Mountain site remained in relatively pristine condition for approximately 700 years, from the time it was abandoned around A.D. 1300 until the 1970s, after which it sustained significant damage on several occasions.

Because previous studies had assigned numbers to the site's features several times in the past, the current one attempted to correlate these as much as possible. Accordingly, feature numbers originally assigned by Susan La Follette are prefixed with an "L" (e.g., L-4), those given by Landon Douglas Smith are "S" features, those designated by James B. Rogers are "R" features, those allocated by Ross S. Curtis are "C" features, Todd Bostwick's are "B" features, and those numbers provided in 2004 are "K" features.

Probable or definite rooms were completely excavated, with all excavated fill screened through either one-quarter-inch or one-eighth-inch mesh. About half of each room was excavated below its presumed prehistoric floor level to bedrock. Other open-air spaces within the site boundaries were sampled, typically with 1.0 m by 2.0 m excavation units taken to bedrock. Areas immediately exterior to room doorways were identified as "courtyards" and were sampled through test excavation units. The outer site wall was investigated in two places by removing sufficient rocks to create two profiles.

Petroglyphs were traced on mylar, transit-mapped, their vertical and horizontal-facing angles were recorded, and they were photographed using both black-and-white print and color slide film.

Photographs of various parts of the Fort Mountain site that had been taken between 1928 and 1997 were used to reconstruct parts of the site that had been previously disturbed. To the extent possible, the areas depicted within each old photograph were relocated and re-photographed using camera lenses as close as possible to the originals to document visible changes to the site over time.

A primary focus of the ceramic studies was to use tempering materials to better understand their source location(s). This analysis (Abbott 2012b) found that the local ceramics (i.e., those made in the lower Cave Creek drainage) were tempered with shiny-black-chunky phyllite.

Given that prior studies (Bostwick 2001; Bostwick and Plum 2005) had found evidence that a similar, nearby site had astronomical significance, ARS retained the archaeoastronomer Stanley B. Plum to examine the Fort Mountain site for similar use.

FIELD WORK RESULTS

The previous studies were used to reconstruct the Fort Mountain site to its appearance around the time of its abandonment (Figure 2). Thirty-two archaeological features were identified (Table 1). The site's architectural features were each constructed of boulders of the locally available volcanic material, with smaller rock chinking, which had been dry laid to form walls. Some of these walls were noted as standing up eight feet tall in 1888 (Hinsley and Wilcox ca. 2004). Petroglyphs were also pecked onto this same volcanic material, typically—but not always—on boulders that were too large to be easily moved. The site's original boundary was defined by its outer encircling wall (Feature K-23), oval in plan

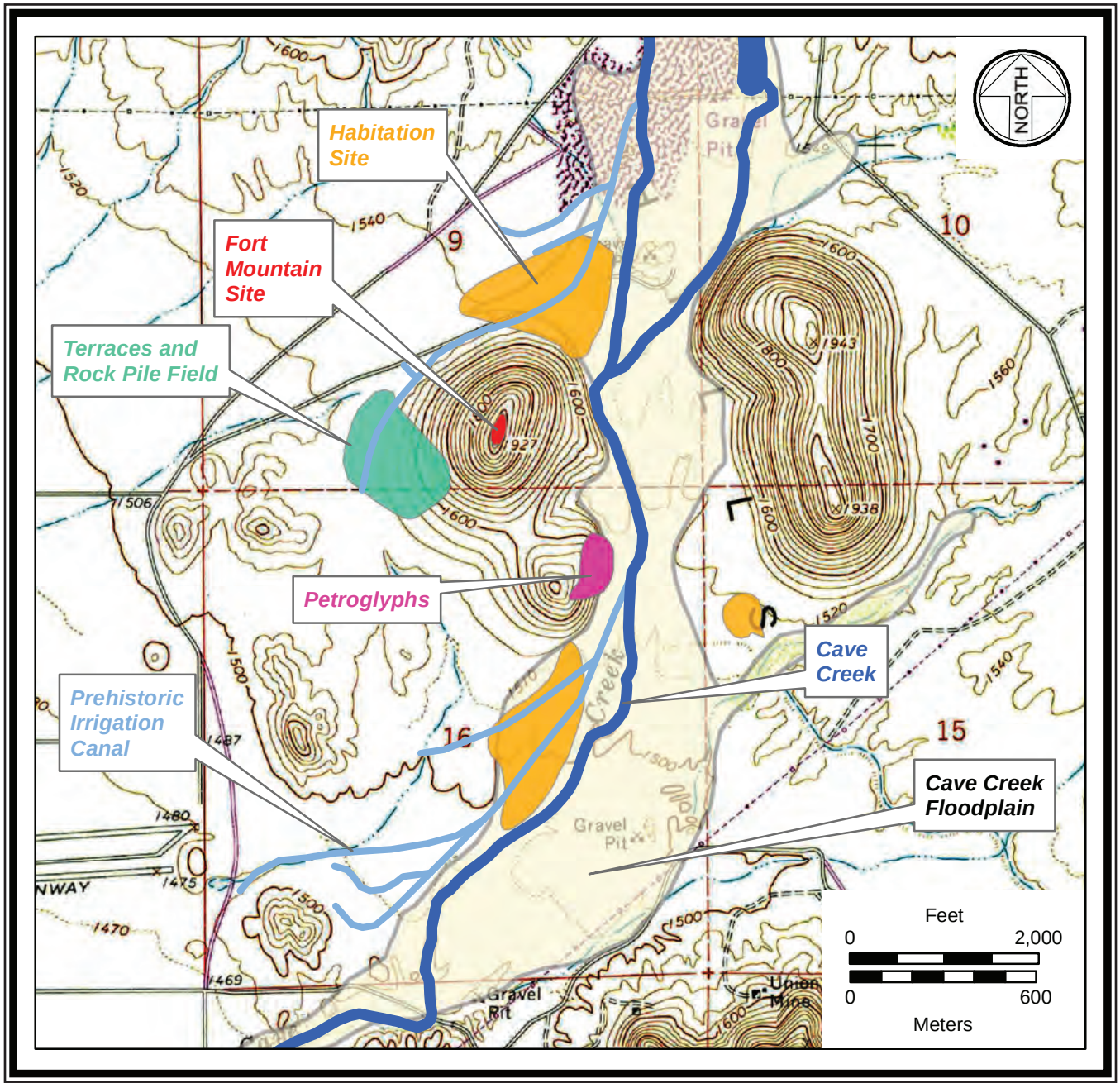

Figure 1. Approximate Configuration of the Early Classic Period Fort Mountain Community. Map sources: USGS 1973; Midvale 1968; AZSITE 2021; USDA Natural Resources Conservation Service 2021.

view, with an overlapping entry located at its northeast end.

The site's interior was subdivided into a number of spaces based primarily on topography, and secondarily by their presumed functions (see Figure 2). There was a large, relatively flat, open area ("plaza") immediately adjacent to the entryway (K-22). A short ascent to the south led to a second large extramural space (K-21). The areas immediately exterior to possible storage/staging room C-14 and possible ramada C-15 were identified as courtyards (K-24 and K-25). Two, linear, elongated areas, formed by the site's natural contours on the west and the outer site wall on the east, formed "corridors"; the northeastern one (K-29) connected possible storage room/staging area C-14 with the northern plaza, and the southeastern one (K-30) connected the southern end of the site with possible ramada Feature C-15 (see Figure 2). Other site features included two surface artifact concentrations (K26 and K-27) and a petroglyph concentration (K-31).

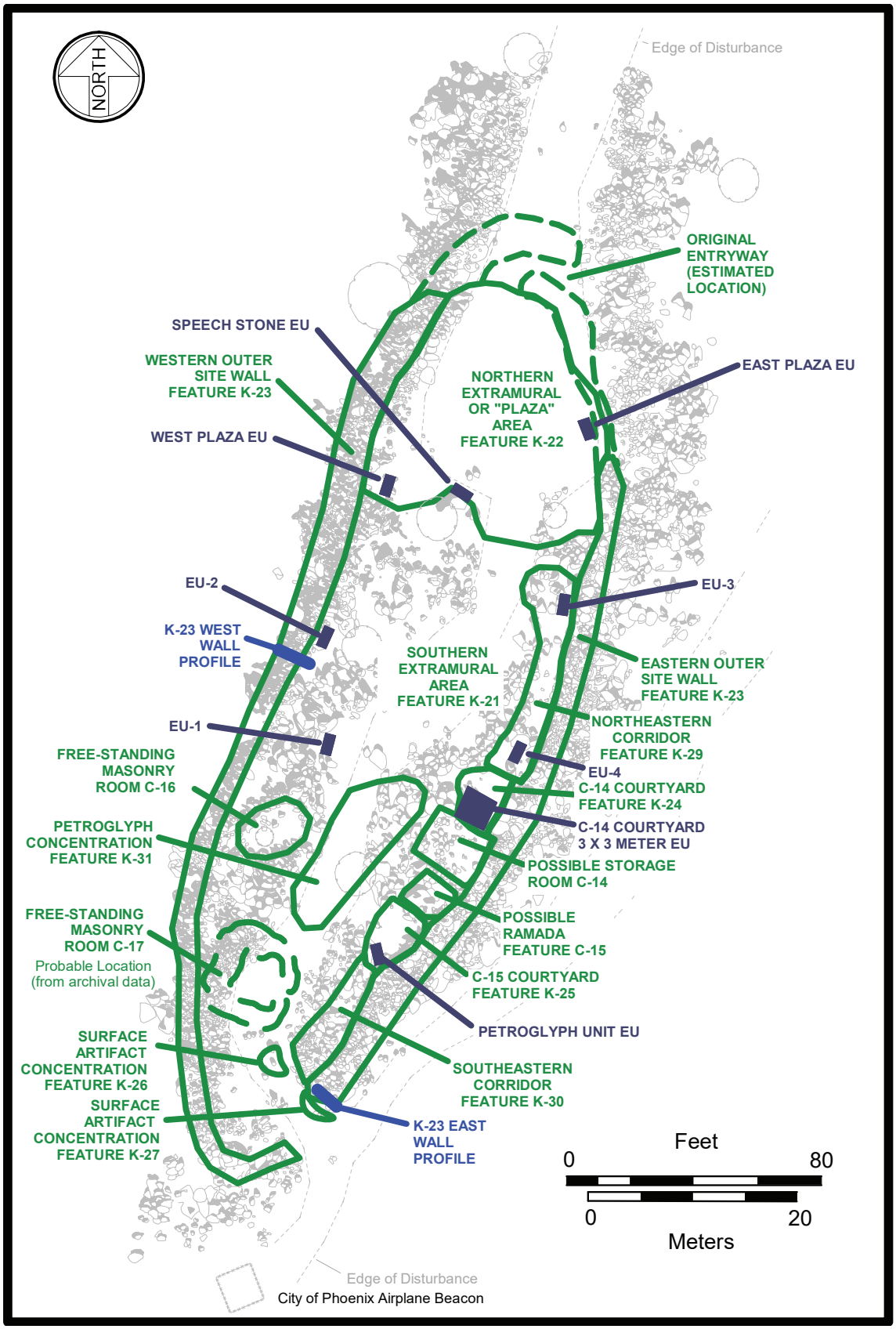

Figure 2. Features and Test Units at the Fort Mountain Site (excluding petroglyphs).

Table 1. Archaeological Features Identified by Type and Quantity

Featue Type	No.	Feature Nos.
Petroglyph boulders	18	C-1, C-5, C-8, K-28, L-3/R-15/C-7, L-4/R-6, L-7/R-16/C-9, R-3/C-10, R-7, R-9/C-3, R-11/C-12, R-12/C-4, R-13/C-6, R-14, R-19, R-21/C-2, R-29/C-13, R-30/C-11
Surface artifact concentrations	2	K-26, K-27
Corridors	2	K-29, K-30
Free-standing masonry rooms	2	C-16, C-17
C-14 courtyard	1	K-24
C-15 courtyard	1	K-25
Masonry room attached to outer site wall (possible storage/staging room)	1	C-14
Northern extramural ("plaza") area	1	K-22
Outer site wall	1	K-23
Petroglyph concentration	1	K-31
Possible ramada	1	C-15
Southern extramural area	1	K-21
TOTAL	32	

Architectural Features

The site's overlapping entryway, which was destroyed in the 1970s, was described in field notes by Arizona State University archaeologist Susan La Follette in 1970 as being "some-what maze-like," composed of two overlapping walls, 10 m long and about 4.5 m wide.

The two largest features areas at the site were a lower northern plaza (K-22) and a higher southern extramural area (K-21). Both were expansive, open-air locations that had unplastered use surfaces and generally low artifact densities. The plaza, which was the first space encountered upon passing through the entryway, was flat enough that multi-family gatherings, such as dances, could have occurred there. Petroglyphs were notably rare within this space. The southern extramural area (K-21) occurred in proximity to each of the site's structures, its corridors, and it had a petroglyph concentration (K-31) and two surface artifact concentrations (K-26, K-27), and it was typically about two meters higher in elevation than the plaza. Based both on the sparse surface artifact density as well as the low artifact density in test units (Table 2), there was little evidence that outdoor activities were common within this southern extramural area.

Three indisputable interior structures were located in the southern half of the site. They included two free-standing masonry rooms in the site's southwest quarter (C-16 and C-17), and a relatively large masonry room (C-14)—which may have functioned more for storage and staging than habitation—was attached to the eastern outer site wall. Room C-17 was so poorly preserved that in 2004 little information could be gleaned from it. The rooms were rectangular in plan view, their floors were unplastered, and none appear to have burned. Based on archival photographs, the exterior walls of each structure were originally full height; coverings of perishable material were likely affixed to their tops. Rock walls were generally constructed directly on the prehistoric ground surface, although larger, naturally occurring boulders were occasionally incorporated into the walls, and the base of the eastern wall of Room C-16 may have begun slightly below the prehistoric ground surface in an attempt to lessen the slope of the structure's floor. The only clearly prehistoric subfloor features identified within the structures were two post holes in the largest one (C-14). The entryway of Room C-16 was a break in the eastern (long) wall, which also included a ramp that sloped down into the structure. A large, flat rock was found near the entryway to C-16; if flipped up onto one of its edges, it was capable of partially closing the entrance (although no use-wear was evident on it).

Room C-14, the possible storage/staging room, abutted the eastern outer site wall. Based on abutments, the outer site wall was built before this room was constructed. Its two interior postholes were positioned to represent roof supports. Notably absent was any evidence of an interior firepit or hearth. An unplastered, break-in-wall entryway without a step occurred along the structure's north wall; it led directly into the northeastern extramural corridor (K-29), which, in turn, connected to the site's northern plaza (K-22). The relative abundance of jar sherds, the large size of this room, and the lack of evidence for an interior hearth or firepit were all consistent with C-14 functioning as a storage room. Given its location connecting to the site's plaza via a corridor, however, a second, more speculative function can be proposed: it could also have functioned

Table 2. Feature Artifact Densities

Feature	Artifacts[1]	Excavated Fill (m^3)[2]	Density (artifacts/ m^3)
Possible ramada (C-15)	446 C	1.05	432
	7 L		
	1 GS		
Possible storage/staging room (C-14)	742 C	5.54	135
	4 L		
Feature C-15 courtyard (K-25)	112 C	1.04	120
	12L		
	1 GS		
Free-standing masonry room (C-17)	114 C	2.93	43
	12 L		
	1 GS		
Outer site wall (K-23)	88 C	3.65	25
	3 L		
Free-standing masonry room (C-16)	40 C	1.99	22
	3 L		
Feature C-14 courtyard (K-24)	14 C	1.40	10
Northern extramural area (K-22)	3 C	1.10	3
Northeastern corridor (K-29)	1 C	0.66	2
Southern extramural area (K-21)	1 C	0.70	1

[1] Artifact Codes: C - Ceramic sherds; GS - Ground stone; L - Chipped stone

[2] Volumes of excavated fill approximate; very few artifacts visible on surface at time of fieldwork

as a staging area for activities occurring on the site's plaza. Ethnobotanic pollen types recovered from C-14 were maize, cattail, large grass, paloverde, mint family, and cactus family. All but one of the ceramics recovered from this room were plainwares; the exception was a redware. Almost half of the analyzed plainware sherds from this feature appear to have been locally made, with an additional sherd coming from a vessel probably made along the Middle Cave Creek drainage; the sources of the other sherds were either indeterminate or unknown. One-third of the sherds of determinable vessel form from this project were recovered from C-14. Two represented medium-sized bowls, while the remaining 14 were from jars. The preponderance of jar sherds over bowl sherds (7:1) in this feature is most consistent with an emphasis on food storage, as opposed to meal preparation and serving activities. The jar sherds, however, were not from especially large vessels, as might be expected if one of the main functions of this feature was long-term food storage. Thus, while the ceramic data was consistent with this room being used, at least in part, as a storeroom, it did not appear to be the major, long-term (e.g., winter) food repository for the Fort Mountain community.

An enigmatic space, which might have been a fourth structure, was identified as a possible ramada (C-15). It was located immediately to the south of possible storage/staging room Feature C-14, although it does not appear that these two features were mutually accessible. Instead, Feature C-15 was bounded on its north by the south wall of C-14, on its east by the eastern outer site wall (K-23), on its west by a steep slope up, and on the south by an apparent low rock retaining wall. It appeared unlikely that C-15 ever had four masonry walls like the three definite structures at the site. Archival sources imply that C-15 was never a well-preserved room like features C-14, C-16, and C-17 were during the early twentieth century, even though it was evidently rectangular in plan view. Either it was altered prior to 1918, or—more likely—it never had high western or southern walls. Its south wall was evidently a low (ca. 50-cm-tall) retaining wall that would have to have been crossed over to enter the feature. A possible basket rest was located in its northeast corner (Figure 3). Feature C-15 had the highest artifact density at the site (see Table 2). Notable cultural material included two pieces of hard red hematite (possible pigments) and a battered schist (?) possible rattle pebble. Of the sherds examined for temper-type analysis, about half were locally made, while the others exhibited several temper types that all probably represent Middle Cave Creek source locations. The sherds yielding vessel form data had a jar-to-bowl ratio of 1.4:1. The bowl sherds with measurable diameters came from small, large, and very large vessels. It is interesting that the two bowls recovered from the possible storage/staging room (C-14) were both medium-sized vessels, which was a size class missing from Feature C-15. Also, all but one of the bowl sherds represent pots that were probably made in the Middle Cave Creek area. This feature therefore included more evidence for food preparation and serving than did Room C-14. Given its relatively small size, as well as the apparent presence of a large basket rest within it, however, it is unlikely that food was ever prepared and/or served for a large number of people within C-15. None of the three pollen samples analyzed from Feature C-15 contained cultivar pollen. Instead, the ethnobotanic taxa identified were cholla, cattail, grass, cactus, paloverde, and mint family. The sample from the possible basket rest yielded

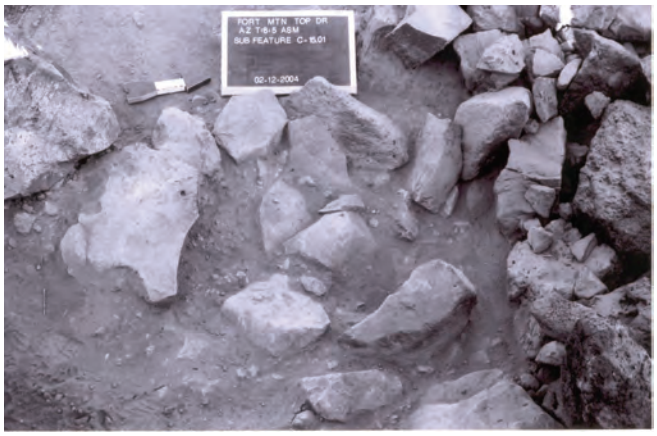

Figure 3. Possible Basket Rest in the North Half of Possible Ramada Feature C-15 (after excavation, view facing west).

the highest pollen concentration, by far, of all analyzed samples. Given the pollen types present, the putative basket may have been made from willow and lined with grass. Additionally, because of its relatively hard-to-access location within the site, Feature C-15 may have served some sort of special function.

The area defined as the courtyard in front of the possible ramada (K-25) exhibited the highest site petroglyph density (Table 3), and all of its panels were still in situ (Figure 4). Given the large size of some of the petroglyph-bearing boulders, this rock art was clearly meant to stay in place. Almost all of the sherds examined for temper-type analysis were found to represent imports from the Middle Cave Creek drainage. Eighty percent of the sherds classifiable to vessel form were from jars. One sherd was from a jar with a 34 cm diameter and a 20 mm tall neck, which was the second largest jar represented at the site; the only other jar that seems to have been larger was one with an estimated "very large" orifice diameter of 42 cm that was collected by Arizona State University in 1970 somewhere within the southern half of the site. The chipped stone debitage recovered from this feature was the most diverse at the site in terms of raw material types. It is therefore possible that K-25 may have been one of the main areas where stone-tool-related activities took place. The overall low lithic artifact density was not, however, consistent with a stone-tool reduction workshop.

Like the masonry structures, the outer site wall (K-23) was made from dry-laid, locally available igneous rock that began on the prehistoric ground surface. The wall was positioned along the mountain slope such that its exterior base was approximately 75 cm lower than its interior bottom. Given this, its historically documented height of eight feet likely applies to its exterior faces; this further implies that the interior wall height would have been on the order of 1.69 m, which means it would have been difficult for an adult to see over it during prehistoric times. It was noted during excavations that the walls tended to become unstable with contact, and the taller the wall, the more likely the rocks were to become dislodged. It therefore seems likely that the rock walls at this site required periodic, probably annual, maintenance prehistorically to keep them in their intended appearance.

The two site corridors connected extramural areas with either a structure or a possible structure (see Figure 2). Both were located along the eastern site edge, both probably originally had some petroglyphs within their boundaries, both were bounded on one side by the eastern site wall and on the other by a steep slope up, and both had unplastered use surfaces.

Finally, the surface artifact concentrations (K-26 and K-27), were located near each other on a historically disturbed (bladed) surface.

Petroglyphs

The most numerous archaeological feature type consisted of petroglyph-bearing boulders (see Figure 4). This is thought to be significant because there is no inherent reason why rock art would need to be present at a "hilltop retreat" site if it indeed functioned primarily for defense. At least 32 petroglyph panels were known to exist at the site, although only 10 were still in situ by 2004. Fourteen were missing, and eight others had been moved from their original locations. The original orientations of 23 of the petroglyphs could be determined. The majority of these faced the compass quadrant between north-northeast and east. A chi-square goodness-of-fit test (Ott 1988:221) indicates that this distribution is significant (x^2=12.65; 3 *df*.; *p*=.0055). One obvious explanation for this pattern is that these petroglyphs would have received more sunlight, and therefore would have been easier to see for more of the day. These preferred petroglyph orientations might also have facilitated light-and-shadow patterns. Other explanations for this result are, of course, possible. Cave Creek is, for example, located due east of the site (see Figure 1).

Petroglyphs were present in seven locations within the site, and each panel typically contained fewer than three elements (see Table 3). The courtyard immediately exterior to possible ramada Feature C-15 contained both the highest density of petroglyph boulders per square meter and also the highest density of petroglyph elements per square meter. In contrast, the northeastern site corridor (K-29) and the petroglyph concentration (K-31) were both characterized by low densities of petroglyph boulders and elements. Given its location in the highest part of the site, it is possible that the petroglyph concentration may have been the primary

Table 3. Summary Data on Petroglyph Densities by Location

Location	No. Elements	No. Boulders	Area (m²)	Ratio Elements: Boulder	Boulders/ m²	Elements/ m²
Courtyard in front of possible ramada C-15 (K-25)	13	7	24.82	1.9:1	0.28	0.52
Possible ramada (C-15)	8	3	23.83	2.7:1	0.13	0.34
Southeastern site corridor (K-30)	10	5	35.53	2.0:1	0.14	0.28
Petroglyph concentration (K-31)	10	8	85.01	1.3:1	0.09	0.12
Northeastern site corridor (K-29)	7	3	69.52	2.3:1	0.04	0.10
Exterior to eastern outer site wall	13	2	–	6.5:1	–	–
Southern site end	5	1	–	5:1	–	–

viewing area for some or all of the astronomical events that were prehistorically observed at the site.

The most common petroglyph element was the circular spiral, although quadrupeds, anthropomorphs, circles, concentric circles, and lizards were also well represented (Table 4).

The most striking petroglyph panel included the "Watcher" element, which occurred on an east-facing boulder located a short distance (<10 m) outside the eastern outer site wall (Figure 5). Frank Midvale gave the Watcher its name, along with a fanciful interpretation in 1970: "Built strong and massive by [the Watcher's] comrades, steep walls enclosing the entire mountaintop! At the north end was a small over-lapping stone-wall entrance—narrow and dark. This was the only access to the sanctuary. The structure was a masterpiece of strategic planning and design. Twenty armed warriors standing within it could easily hold off an army (Midvale 1970a). The Watcher petroglyph panel was stolen from the site shortly after Midvale published this account.

The Watcher petroglyph panel feature consisted of 11 elements. The Watcher itself was an anthropomorphic figure with its right hand to its head and its left hand on its hip; the placement of its arms in this way formed a figure eight. The Watcher had feet, a somewhat stout mid-section, a circular head, and a curved line above its head that probably represented a headdress, perhaps a feather. To the left of the Watcher was the feature's largest or most dominant element, a clockwise spiral consisting of four and one-half revolutions. Above and to the right of the Watcher was a zoomorphic figure representing a north-facing quadruped with a long, upturned tail, a hollow and relatively slender body, pointed ears, and a head with a snout. Paws were indicated by three digits on each of two visible legs; perhaps this figure represented a canid. Below and to the right of the quadruped were two square scrolls, one clockwise, and one counterclockwise. Between the Watcher and the square scrolls was a small dot-in-a-circle element. Below the Watcher was a combination curved and straight line reminiscent of a horizontally oriented question mark, with its curved side facing up. Below the square scrolls were two small squares and a curve. The final element present on the Watcher petroglyph is difficult to describe and interpret. It consisted of two parallel lines oriented slightly to the right of vertical, with a perpendicular line passing through the other two lines, and small, fringe-like endings at all but the lowest two ends of each line; Simmons (ca. 1936) suggested that this element resembled a compass rose.

Archaeoastronomical Study

As part of the astronomical study, the site was visited at sunrises and sunsets on both solstices and on an equinox to determine whether any astronomical alignments were apparent (Plum 2010). One such alignment was observed (Figures 6 and 7). At sunrise on winter solstice, when one stood at the doorway to Room C-16, the sun could be seen rising on the horizon within a natural notch formed between the Superstition Mountains on the north and the Usery Mountains on the south. A volcanic butte in the foreground pointed up to this notch. Determining the timing of solstices in this way, i.e., by observing the position of the rising sun in relation to fixed points on the landscape, was a historically documented method used by both the Yavapai (Gifford 1932:248) and the Akimel O'odham (a.k.a. Pima) (Castetter and Bell 1942:143–144). It is important to note that other celestial markers may once have been present at Fort Mountain but were obscured at the time of field work because of the substantial disturbances that had occurred to it during historical times. Potential light-and-shadow markings on the rock art at key times of the year (see Bostwick 2010) were not systematically investigated at the site.

Other Field Observations

Certainly, the Fort Mountain site had several traits that can be considered defensive, such as its tall, outer, encircling wall, and it would have been spacious enough

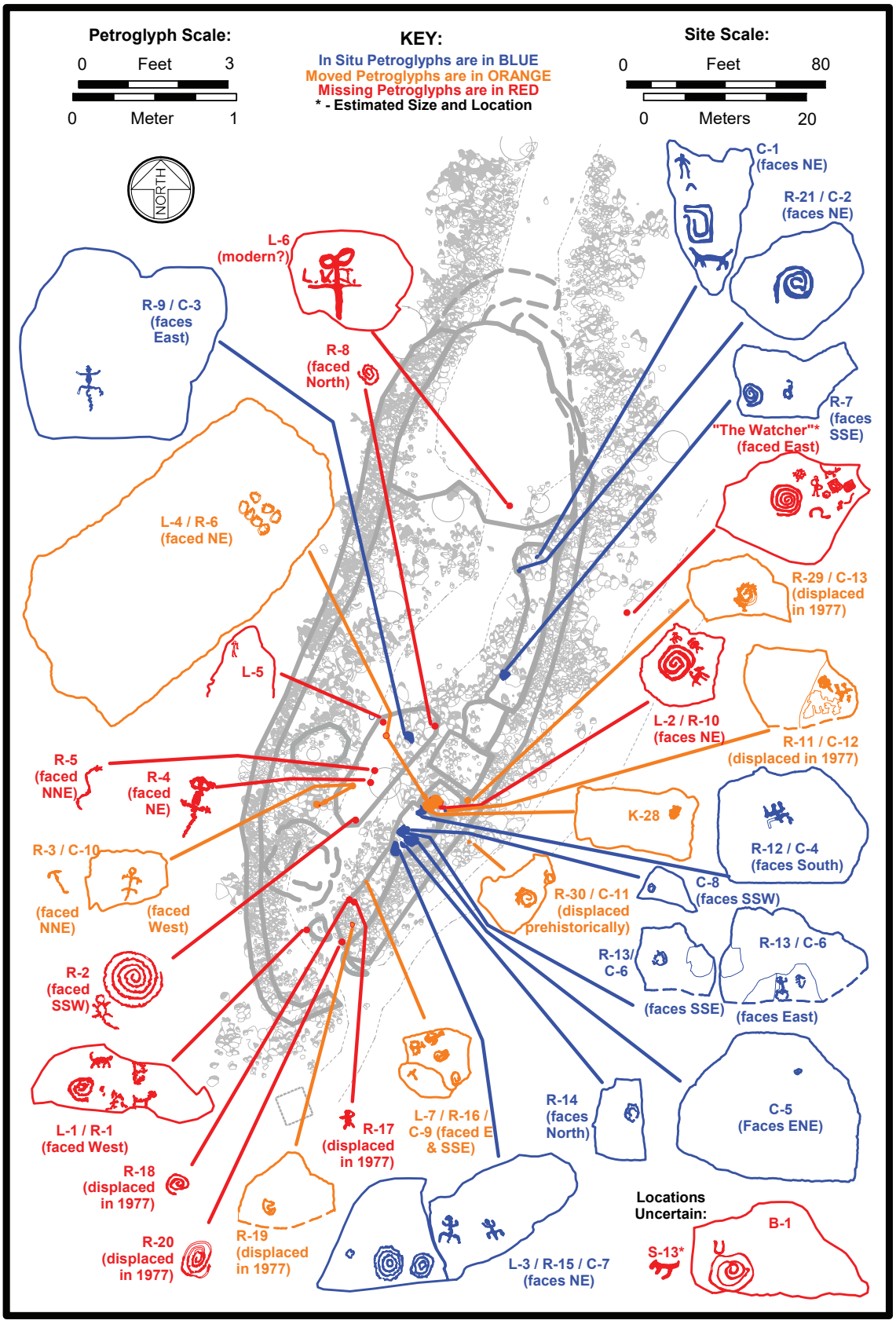

Figure 4. Current and Former Petroglyph Locations.

Table 4. Tabulation of Petroglyph Elements

Element	Count	Percent
Circular spirals	12	18.2
Quadrupeds	6	13.6
Anthropomorphs	6	13.6
Circles (free-standing, not grouped; open or filled)	5	7.6
Concentric circles	5	7.6
Lizards	4	6.1
Lizard men	3	4.5
Rectangular scrolls	3	4.5
"Spirits"	3	4.5
Dot-in-circle	1	1.5
Group of circles	1	1.5
Possible bow and arrow	1	1.5
Snakes	1	1.5
Other geometric	7	10.6
Other unidentified	8	12.1
TOTAL	66	99.9

to accommodate hundreds of people. The site's entryway, however, was located in the easiest—not hardest—to access part of the site. There were no boulder stockpiles, projectile point caches, burned rooms, or walls that had tumbled down in antiquity. The outer site walls were so tall that anyone inside would have had to work essentially "blind" to defend themselves (no loopholes were either observed or reported in the outer site walls). While the Fort Mountain site was located in an ideal setting for smoke signaling, no evidence was found for this practice (although such evidence may have been lost due to historical disturbances).

Additionally, it was noted that wild tobacco (Nicotiana trigonophylla), a plant with ancient ceremonial ties, grew on the Fort Mountain site in 2004.

ANALYTICAL RESULTS

The photographic archival study found that at least three human-caused impacts to the site occurred

Figure 5. The Watcher Petroglyph, about 1930 (Simmons ca. 1936:1922).

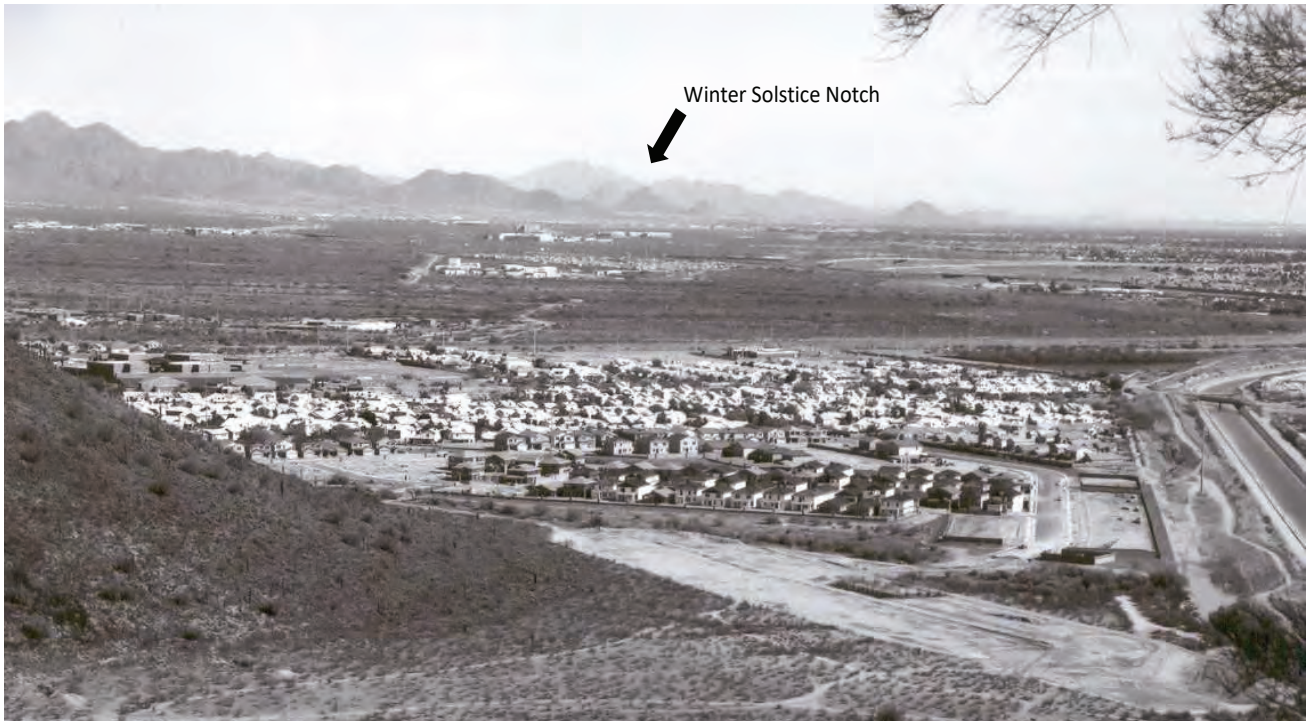

Figure 6. 2004 Daytime View of the Fort Mountain Winter Solstice Notch (from C-16).

between 1970 and sometime after 1997. Natural site deterioration appeared to have consisted primarily of the higher wall rocks falling down, creating vertically lower but horizontally more spread-out walls over time.

A total of 1,800 ceramic sherds (1,789 plainwares, 9 redwares, 2 buffwares) was recovered from the site (Kwiatkowski and Abbott 2010). Most were from ARS's 2004 excavations, but 203 were collected during earlier studies. The great majority of the sherds were recovered from subsurface contexts. The ceramic assemblage was generally consistent with the Hohokam Classic period (ca. A.D. 1150–1450), based on the predominance of sharp-shouldered jars tempered with phyllite and the relative rarity of decorated ceramics, especially Hohokam buffwares.

Almost half of all sherds collected by ARS came from the possible storage/staging room (C-14), although the highest sherd density was within the possible ramada (C-15). Free-standing masonry room Feature C-16 was noteworthy for its low ceramic count. A surprisingly large quantity of sherds (n = 88) was collected while cutting two sections through the outer site wall.

It is noteworthy that less than one-third of the sherds subjected to detailed analysis were believed to have been made locally. Equally as common as the local sherds were ones presumed to have been manufactured just upstream along the Middle Cave Creek drainage. It is possible that as many as two-thirds of the ceramics recovered from the site could have been made elsewhere. Thus, the results of the ceramic sourcing study found considerable evidence for regional trade and interaction. This is a different pattern than was observed for the habitation sites at the base of Fort Mountain (Abbott 2012a). There was surprisingly little evidence, however, for interaction with the large, contemporary villages of the Salt River Valley Hohokam,

Figure 7. The Fort Mountain Winter Solstice Notch on Winter Solstice Sunrise, 2003 (from C-16).

several of which were located within a day's walk from the site.

Abbott summarized the results of ceramic-sourcing study with:

> Rather than emphasizing relationships with a particular population, the hill-top ceramics seem to reflect equal participation by various populations in the activities conducted atop the mountain. If true, we may interpret those elevated pursuits as those that brought together and, thus, integrated in some overarching sense various and dispersed sets of people. Those people probably included the local inhabitants of the lower Cave Creek vicinity, residents from the middle Cave Creek district, and whomever was represented by the Category 4 pottery (presumably people from somewhere in the northern uplands) (Abbott 2012b:65).

A sample of 151 ceramic sherds was subjected to detailed analysis. Smudging was found to have been rare. Jar sherds outnumbered bowl sherds by a ratio of 2:1. Jars typically had sharp shoulders and were notably skewed to those with smaller apertures and probably also those with relatively short necks. It was suggested that this pattern was not consistent with the long-term storage of large amounts of foodstuffs. A relatively large percentage of the bowl sherds, on the other hand, came from vessels that can be classified as either "large" or "very large" (i.e., orifice diameters > 31 cm). Interestingly, all of these large or very large bowls appear to have been made non-locally in the Middle Cave Creek area. One possible interpretation for the relatively large percentage of large bowls at the site is communal food sharing.

Forty-one chipped stone and five ground stone artifacts were recovered from the site (Christenson 2010). Activities involving stone tools were clearly limited compared to nearby sites. Some knapping—mostly free-hand, hard-hammer percussion, but also some bipolar—occurred there. Much of this involved local basalt, but some was from materials that would have been brought up from below. At least one biface was shaped. Processing activities included cutting and wood scraping. Tool maintenance included resharpening scraper edges and a ground stone (?) tool whose use is unknown. The one mano clearly indicated use within a trough metate, a tool strongly associated in the Hohokam region with processing cultivars and cacti. Two, small, rounded pebbles exhibited pitting striations that could have been produced by use within a gourd rattle. A third, similar pebble, which exhibited no use-wear, also was recovered from the site.

Eleven pollen samples were analyzed from the Fort Mountain site (Smith 2010). The two most frequently occurring ethnobotanic pollen types were maize and cattail. Other potentially ethnobotanic taxa were large grass type, paloverde, and mint family. The presence of cattail pollen in 54 percent of the samples likely indicates the presence of a local riparian community along Cave Creek and perhaps also along the adjacent prehistoric irrigation canals. As will be noted below, cattail pollen has also served ritual functions historically in central Arizona.

When combined with pollen data from ARS' work at the base of Fort Mountain (the flotation analysis yielded no clearly prehistoric remains; Huckell 2010), it is clear that the residents of this area grew maize, cotton, squash, and probably agave. Maize and cotton were grown nearby in terraces, and agave, maize, and squash were probably grown in rockpile fields. They also gathered a variety of native plant resources, including cholla, other cacti, lily family, goosefoot/pigweed, grass, paloverde, cattail, and at least one member of the mint family. The Fort Mountain site was located within a prehistoric farming community that appears to have specialized in the production of cotton, agave, and a variety of cactus products, possibly for trade, during the Hohokam late Sedentary and early Classic periods (Curtis and Wright 2012).

Faunal remains were rare (Kwiatkowski et al. 2010). Only five faunal elements were recovered from the site, and just one of these, a calcined cottontail pelvis fragment found in the fill of possible storage/staging Room C-14, appears to represent the remains of a prehistoric meal. Over 100 whole and fragmentary *Helisoma*-type land snail shells were recovered. The most likely explanation for these shells is that they represent prehistoric "hitchhikers" that affixed themselves to either water containers or aquatic plants (e.g., cattails) that were carried to the site; their original source location is presumed to have been Cave Creek. Fifteen specimens of possible pigment (white caliche, hard red hematite, and soft red ocher) were recovered as were four possible fire-altered rocks, each of an indeterminate volcanic type. Finally, it was noted that historic/recent artifacts were much more common on the ground surface than prehistoric ones. Alcoholic beverage cans, bottles and gun-related items were best represented.

Space syntax analysis is a way to estimate the depth of space within an archaeological site (Hillier and Hanson 1984). An analysis found that possible ramada C-15 was the hardest-to-access part of the site from its entryway. In order to reach this feature, one would have had to enter the site through its overlapping entryway, cross through the northern plaza (K-22), travel up to and across the southern extramural area (K-21), and

traverse southeastern corridor (K-30) before reaching this feature. In one comparative study, only Room G within Compound A at Casa Grande Ruins took more steps to access (Shapiro 1999). Like possible ramada Feature C-15, Room G also was relatively small and also was probably not used for habitation (Fewkes 1912:89).

Based on the lack of formal hearths and the low artifact density, the Fort Mountain site does not seem to have functioned as a long-term habitation. Although the site appears to have had a storeroom, the ceramics artifacts recovered from it, with their relatively small jar orifice diameters, were not consistent with it being the primary storage facility for the entire Fort Mountain community.

INTERPRETATIONS

Rock Art

While Southwestern archaeologists generally will not attempt to interpret the cultural meanings inherent in rock art images, since they typically are not part of that culture and therefore could provide only limited insights, it would, in the author's opinion, be remiss not to make a few speculations about some of the glyphs present at the Fort Mountain site. In his experience, there is enough inter-tribal consistency in the interpretations of at least some rock art elements to be useful, although the fullest, best possible interpretations of their meanings would require apprenticeship to a spiritual master.

The Watcher petroglyph element itself may have an astronomical association. The configuration of the Watcher's arms, in a figure eight, is reminiscent of the path that a gnomon stick's shadow makes at noon over the course of one year (Nancy Lee Hayden, personal communication 2004). Additionally, the "question mark" symbol in the Watcher glyph resembles the winter solstice notch observed at the site (cf. Figures 5 and 7).

Both clockwise and counterclockwise circular spirals were present in Fort Mountain's rock art. Circular spirals have several different but related associations to Native Americans. They may be migration markers (Lee Wayne Lomayestewa, personal communication 2004), or they may represent one's path in life (Ramson Lomatewema, personal communication 2005). In a more general way, circular spirals have been associated with different types of movement and the passage of time to Native Americans (Nancy Lee Hayden, personal communication 2004). Using this logic, spirals associated with solar events would be expected to be most often clockwise, because this is the direction that the sun takes in the sky. It is therefore noteworthy that the spiral directly associated with the "Watcher" element was clockwise. Additionally, it seems more than coincidence that beginning at the southern end of the site (i.e., at Petroglyph L-1/R-1), and continuing into the corridor leading to possible ramada Feature C-15 (i.e., Petroglyph K-30), a relatively large number of circular spirals occurred *(n* = 4), and each of these was counterclockwise. Interestingly, a counterclockwise movement would have been required to access the possible ramada from the southern end of the site.

The only place where concentric circle elements were found inside the walls of the Fort Mountain site was in the courtyard to possible ramada Feature C-15 (Feature K-25), i.e., the part of the site with the highest petroglyph density. Hopi tribal member Donald Nelson (personal communication 2004) shared that one of the functions of concentric circles was to mark the observation point from which to watch the winter solstice. As noted above, this was also the only petroglyph-bearing area that did not contain spirals. One possible interpretation for these two co-existing patterns is that motion was no longer necessary (no spirals) because the viewing destination (i.e., the concentric circles) had been reached.

Interestingly, each of the depictions of reptiles, either lizards (*n* = 4) or a snake (*n* = 1), occurred only in the petroglyph concentration (K-31), which was located on the highest part of the site. A trait that each of these animals share is that they can live either on the ground surface or underground, i.e., they can exist in two worlds (Loendorf and Loendorf 1995), just like the sun does from the human perspective of standing on the ground. "Lizard men" refers to a group of three stick-figures that had bent arms and legs, round heads, with the arms bent up and "tails" shorter than their legs. They could either represent lizards, men, or lizard men per se. Possible "spirit" glyphs consisted of three figures that could represent heads, arms, and bodies with no legs. Lizard men glyphs occurred only in the courtyard (K-25) to the possible ramada, and spirit glyphs occurred either in the corridor (K-30) leading to the possible ramada (C-15) or within the room itself. The latter two glyph types stand in contrast to the others at the site in that they appear to represent life forms, but not ones found in nature.

Evidence for Ceremonialism

The Fort Mountain site can be considered public architecture, and mass gatherings are implied by the presence of a plaza. Several aspects of the site's features and artifact assemblages hint at function(s) transcending the secular realm. A primary example is the substantial quantity of petroglyphs. The presence of pigments and possible rattle beads could represent ritual accoutrements. Additionally, while the presence

of a solstice observation point, the relative abundance of non-local (but not long-distance trade) pottery, and a tendency for bowls to be very large all could represent purely secular activities, they seem to fit better within a more religious or ceremonial milieu.

Tobacco

A plant with ceremonial ties (wild tobacco, *Nicotiana trigonophylla*) was observed growing at the site in 2004. Although the O'odham considered domesticated tobacco (*Nicotiana rustica*) superior in both strength and quality to desert tobacco (Castetter and Bell 1942:237), Rea (1997:237) notes that the Akimel O'odham living along the Gila River seem to have long maintained some ceremonial uses for desert tobacco. Smoking tobacco from a reed grass (*Phragmites communis*) cigarette was ritually important to the O'odham: "Any special gathering for the good of the tribe or ceremonial occasion demanded that smoking be done with only the reed grass cigarette…To both tribes [i.e., the Akimel O'odham and the Tohono O'odham (formerly Papago)], smoking was essentially a ceremonial performance, and it had to be tobacco (*Nicotiana*) that was smoked, for it was regarded as having power and no other plant possessed equal efficacy" (Castetter and Bell 1942:217–218). Castetter and Bell continue with their understanding of the role of tobacco in O'odham ceremonies, which includes an interesting solar connection:

> In ceremonies or meetings, each man blew the smoke upward to a Spirit in the heavens, whom he was calling for help or guidance in making decisions. Some informants, particularly among the Pima, asserted the great power called upon was the sun. Smoking, both group and individual, was regarded as a sort of prayer—a medium of communication between the smoker and the Great Spirit, while the smoke itself was a means of gaining an audience, as well as the bearer of messages (Castetter and Bell 1942:219).

Numerous instances exist of the descendants of prehistorically economically important plants—so-called "relict plants"—found growing on archaeological sites in the American Southwest. Examples include *Agave parryi* (Minnis and Plog 1976), and *Agave delamateri* (Hodgson and Slauson 1995), as well as others such as goosefoot (*Chenopodium* spp.), Four Corners potato (Solanum jamesii), wolfberry (*Lycium pallidum*), and sumac (*Rhus trilobata*) (Pavlik et al. 2021).

Two Possible Historical Ceremonial Analogs

Archaeologists know well that cultures change over time, and it is therefore to be expected that ceremonies conducted over 700 years ago might differ in some substantial respects from contemporary ones. Nevertheless, if, in fact, the Fort Mountain site was a locus of prehistoric ceremonies, there ought to be ethnographically documented analogs that are generally consistent with the architecture present at the site. The project area was located near the historical boundary of two ethnic groups, the Yuman-speaking Yavapai to the north and the Uto-Aztecan-speaking O'odham to the south. Because both of these people conducted some of their ceremonies within enclosures, two of these rituals are considered next for comparative purposes. It is noted that the ways described below in which both cattail (*Typha* sp.) and corn (*Zea mays*) were used ceremonially should have resulted in their pollen being shed onto the ground near their locus of use, when viewed from the perspective of behavioral chain analysis (Schiffer 1975).

The author's Yavapai elder acquaintances have been unanimous in their assertion that the Mountain Spirit Dance was their most ancient and sacred cultural ritual (the closest contemporary analog visually is the Apache Crown Dance). Mike Burns (ca. 1864–1934) provided Gifford (1932:236–238) an account of this ceremony around 1930. A medicine man would call upon the Mountain Spirits to perform a curing ritual, which was held at night, usually in the autumn. Eight fit men were selected to transform into Mountain Spirits. Changing in secrecy, they donned white buckskin masks, small fiber aprons, belts, and small bags carrying cattail pollen. They painted themselves white, each carried a white stick in each hand, and each held a cane whistle in their mouths. The ceremony took place within a diamond-shaped brush enclosure, about 15 m across, that was open at each of the cardinal directions. The medicine man summoned the Mountain Spirits with a bullroarer, who then entered the enclosure, with a characteristic lilting gait, from south to north, and then from east to west, thus tracing a huge cross upon their entrance (the equilateral cross is a sacred symbol to the Yavapai). They clapped their sticks together while making sharp turns. Next, the Mountain Spirits circled the outside of the enclosure four times, and then entered. They bowed to those assembled with their hands spread open, palms down, and danced in a counterclockwise direction inside the enclosure before treating the sick while the medicine man and his apprentice stood in the center of the enclosure. The ceremony began just after dark and lasted all night. All spectators had to remain seated inside the enclosure while the sick lay near one of the brush fences. Each Mountain Spirit made a cross of cattail pollen on the medicine man's head before treating the sick, and again afterward. The Mountain Spirits kept together, with each of the eight treating the infirmed in quick succession. Each would press four times on a

pained area, make crosses of cattail pollen on the tops of the patients' heads, shoulders, chests, on their seats of pain, and then put a pinch of cattail pollen inside their mouths. Eagle feathers and tobacco were not used during this ceremony. The ritual would be repeated if it initially proved ineffective.

The O'odham are one people with a number of distinct historical subgroups (Fontana 1983). One of these, the Tohono O'odham, practiced the Eagledown Festival, which is known as *Wi:gita* or *Vikita* in their language (depending upon orthography). Its purpose was to ensure well-being and prosperity for all, to enhance hunting, and to end bodily suffering (Galinier 1991:486). It was both a thanksgiving feast and a crop blessing (Underhill 1940:47). Underhill (1940:47–50) provided a description of how this ceremony was practiced at Gu Achi in the 1930s, which followed the autumn deer dance. There was a multi-day preparation phase before the main ceremony. Its participants were the residents of several inter-related villages. From the oldest village in the group, 10 days before the actual ceremony, its main leader summoned a representative from each of the other villages to distribute small prayer sticks with eagle tuft feathers to all who would attend the feast. These prayer sticks had been stored within a sacred basket. Then, at each of the younger villages, men built a special round enclosure where they would work. Each village leader would compose eight songs, and then teach them to the young men of the village. They would also direct the construction of a huge, food-related icon. The young men worked all day within their village's enclosure, within which no women were allowed to enter. Food was left for the workers outside the enclosure. At this time, each village had their own clowns outfitted with white buckskin masks and short, white kilts. It was their duty to visit each house and solicit food for the working men. The clowns were incarnations of holy beings, from a magical place, who spoke an indecipherable language, and had the ability to take away disease through touch. Additionally, there were Cornmeal Sprinklers, who stood at the doorway of the enclosure and sprinkled blessings upon anyone entering or leaving the enclosure.

The day before the actual *Wi:gita* ceremony, people from all the satellite villages assembled at the oldest village. There, a huge round enclosure had been built so that the singers from each village might camp with their leaders. The women from each village preceded the singers, brought firewood, and stored it in the part of the enclosure that had been assigned to them. The clowns from each village were eventually driven off by those from the host village in a mock battle. Singers camped within the enclosure, while everyone else camped outside. The ceremony began at sunrise the next morning. Two masked men with shields, one representing the sun and the other the moon, walked out just as the sun was rising and then circled the enclosure, stopping to bend in imitation of the movements of heavenly bodies. Behind them came the Cornmeal Sprinklers, who blessed them with cornmeal. After this, a series of processions lasted all day. Each village's participants would take turns staging in the enclosure, then they performed their songs and danced in the village square while from eight to 10 men supported the icons they had made on platforms. Cornmeal Sprinklers blessed each procession, and the host village performed first. A ceremonial house off the village square had been prepared; two young men and women stood and danced in front of it all day long, holding arrows and ears of corn which symbolized meat and vegetable food. Feasting occurred throughout the day. The processions paused at noon for an appearance of the clowns. At the end of the day, the prayer sticks from the sacred basket were distributed. Planting a prayer stick within a farm field would distribute the power of growth and life that had come from the ceremony into the field.

A Model for Site Structure

Combining the architectural studies, artifact analyses, and ethnographic information allowed for some speculations on the prehistoric use of space at the Fort Mountain site (Figure 8). The tall outer site wall (K-23) and its overlapping entryway were likely meant to conceal activities, such as ceremonial preparations, which occurred within the enclosure.

Upon entering the site, one encountered a large, relatively level, open space (K-22), that would have been suitable for mass events, e.g., a dance plaza and/or meeting area (we know from the ceramic analysis that people from other, adjacent regions were likely visiting this site). The lack of petroglyphs in the plaza might indicate that this was a more public space, one where people not initiated into esoteric symbolism could congregate.

A two-meter slope up separated this possibly more "public" part of the site from its possibly more restricted southern part (K-21). The southern half of the site contained all of its structures, possible structures, corridors, a petroglyph concentration, and almost all of the site's rock art. The largest structure at the site, a possible storage/staging room lacking a hearth (C-14), was connected to the plaza by a corridor (K-29). If the storage/staging room did, in fact, serve as a staging area, one could easily imagine that a procession proceeding from it to the plaza would have produced a dramatic effect (envision a procession beginning at Tina (Carpenter) Hart in Figure 9 and coming toward the viewer).

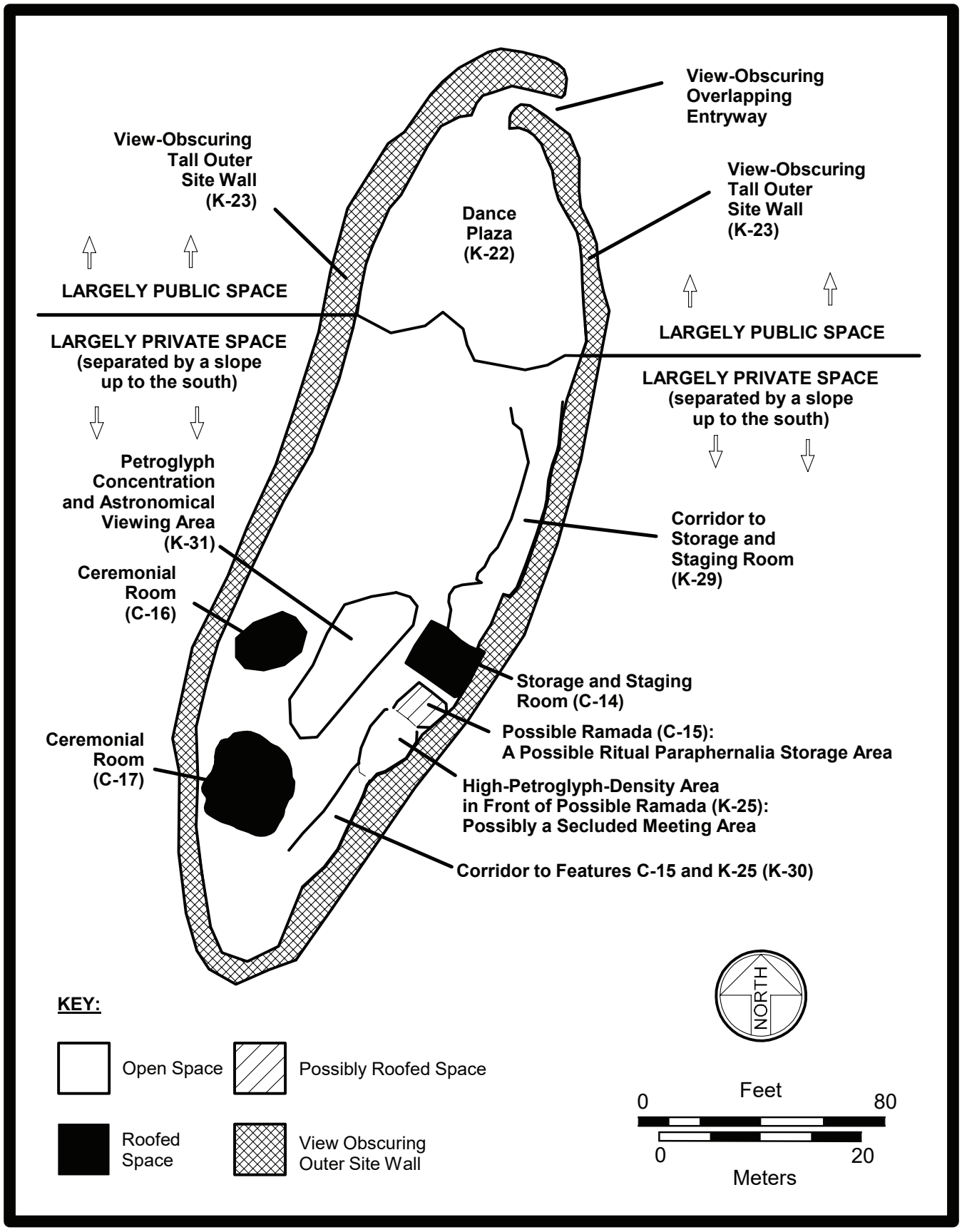

Figure 8. A Speculative Model for the Prehistoric Use of Space at the Fort Mountain Site

Given the lack of evidence for formal hearths in rooms C-16 and C-17, these structures were probably used for temporary or specialized habitation. One likely use of these features would have been as sleeping quarters associated with monitoring celestial events such as the solstices (we know that this site was an excellent place from which to determine the winter solstice). Another function could have been ceremonial structures (e.g., the ceremonial house of the *Wi:gita* ceremony).

The petroglyph concentration (K-31), located at the highest part of the site, could have been a primary observation area for celestial events (unfortunately, this area had been significantly damaged prior to fieldwork).

A southeastern corridor (K-30) connected the southern end of the site with a possible ramada (C-15). A space syntax analysis found that the possible ramada was the hardest-to-access part of the site. The possible ramada contained a possible basket rest, which is reminiscent of the sacred basket used in the O'odham *Wi:gita* ceremony (it is expectable that ritual paraphernalia should be held within a relatively inaccessible area). This feature also contained the highest artifact density, including a relatively high percentage of ceramics that were not locally made, as well as several sherds from large and very large bowls (which would be consistent with food sharing and reminiscent of the *Wi:gita* feast).

The courtyard (K-25) immediately exterior to the possible ramada was characterized by a high petroglyph density, mostly non-local ceramics, and a large jar sherd. The petroglyphs lacked spirals (possibly movement indicators) but contained concentric circles (possibly winter solstice markers). Using the *Wi:gita* ceremony as an analogy, it is possible that some important ceremonial function (e.g., the distribution of prayer sticks) could have occurred within this area.

Finally, it is noted that Fort Mountain, with its outer encircling wall, overlapping entryway, corridors, and structures, is reminiscent of the O'odham legend of Elder Brother's house (Shaw 1968:15–16). This motif is so important to the contemporary Akimel O'odham that its image forms the central part of the Salt River Pima-Maricopa Indian Community's tribal seal. One might therefore expect some prehistoric architectural analogs for this important legend.

Figure 9. Tina (Carpenter) Hart Standing at the Southern End of the Northeastern Corridor (K-29), View Facing South (March 2004).

CONCLUSIONS

Synthesizing the results of field studies with archival research, artifact analyses, and ethnographic information, it was concluded that the most likely functions for the Fort Mountain site included: (1) an astronomical observatory with a clear winter solstice marker; (2) specialized, short-term habitation (Rooms C-16 and C-17); and (3) ceremonial use. The site can be characterized as having a relatively "deep structure" using the lexicon of space syntax analysis. There are a number of remarkable similarities between the layout of the Fort Mountain site and the historically documented use of space during the O'odham *Wi:gita* ceremony, e.g., the tall outer encircling wall with an east-facing entryway, the possible basket rest located in the hardest to access part of the site, a large structure that could have been a changing/staging area, corridors suitable for processions, possible ceremonial structures, possible ritual accoutrements (e.g., rattle pebbles, pigments, and tobacco), and ceramic evidence of communal food sharing and visits by people from adjacent regions outside the immediate community. The astronomical observatory and ceremonial functions of the site may, in fact, have been interrelated, e.g., the observatory aspect of the site may have signaled when, during the course of the year, certain ceremonies would take place. Although the ceremonial parallels implied by the archaeological record are numerous, they are not perfect, but this is to be expected given the passage of time. Finally, a speculative model for the use of space at the site was developed. This model divided the site into parts that were used primarily as public space from those that perhaps were more private (i.e., intended principally for ritual practitioners).

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Stanley B. Plum and Dr. David R. Abbott, respectively, both proved indispensable to our understanding of the prehistoric functions of the Fort Mountain site. The way I interpret Arizona's prehistoric archaeological sites, including Fort Mountain, has been influenced substantially by my time working both with and for Native people. In this regard, I single out Nancy Lee Hayden, the former Culture Research Department Director for the Yavapai-Prescott Indian Tribe, for teaching me some of the meanings inherent in petroglyph panels, as well as helping me to better understand the importance of sky-watching as a calendrical tool to Native people. Thanks also to all the Native people who have allowed me to pick their brains over the years (and please let me know what you think about this article). I thank Myron Jones of Superstition Crushing, LLC, for allowing me to undertake this study, and my friend and mentor, Dr. Lyle M. Stone, President of Archaeological Research Services, Inc., for supporting this and other high-quality cultural resource management studies in Arizona for more than a generation. Finally, insightful reviews by Douglas R. Mitchell, Dr. J. Simon Bruder, and Dr. Todd W. Bostwick have each greatly improved this article.

NOTE

The full Fort Mountain data recovery report (Kwiatkowski 2010) is available through the Digital Archaeological Record (tDAR), www.tdar.org.

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INVESTIGATING SETTLEMENT HIERARCHY IN THE PUEBLO VIEJO DISTRICT, SAN CARLOS SAFFORD AREA, SOUTHEAST ARIZONA

Joseph S. Crary, Thatcher A. Seltzer-Rogers, and Stephen Germick

Before the rapid commercial development of the Gila River floodplain in the Pueblo Viejo District of the San Carlos Safford Area, mid to late nineteenth century accounts describe the presence of at least ten large prehispanic villages referred to as "towns." Leading two significant early archaeological expeditions, Fewkes and Hough tested several multi-story structures, which we term Big Unit Structures, at the Epley's and Buena Vista ruins. Fewkes reported subtle differences between these multi-story buildings within the San Carlos Safford Area and platform mound compounds in the Phoenix Basin. We review excavation notes, maps, photos, and reports from excavations during the 1930s and 1970s to define the design of these structures. We develop a chronology for their construction, occupation, and abandonment and suggest construction started in the early to mid-thirteenth century. We assess their functionality and distribution to better understand the attributes of this geographically restricted phenomenon, as well as contextualize its occurrence within broader trends during the late twelfth and thirteenth centuries. These data lead us to conclude the emergence of a multi-settlement system within the San Carlos Safford Area and suggest the emergence of elite individuals who conducted activities within and occasionally inhabited these Big Unit Structures.

In this article, we focus on the Buena Vista Ruin (AZ CC:2:3[ASM]), one of the largest prehispanic habitation sites in the San Carlos Safford Area (SCSA), and argue for the emergence of a multi-tiered settlement hierarchy in the thirteenth century. We accomplish this through an assessment of early historic accounts of Epley's Ruin (AZ CC:2:64[ASM]) and other sites with evidence for a distinctive type of architecture, before providing a detailed description and interpretation of data and images from investigations within the Buena Vista Ruin by archaeologists in the late nineteenth century, the 1930s, and the 1970s. We investigate the types of ceramic types to determine when the temporality of several compounds at the Buena Vista Ruin based on data provided by Mills and Mills (1978). A key research question is when big unit structures (BUSes) date in the SCSA, as previous researchers (e.g., Crary and Rogers in press; Mills and Mills 1978; Neuzil and Woodson 2014) hypothesize they date to the late thirteenth or more likely fourteenth century, given similarities to large structures in the Tonto and Phoenix basins. Then, we investigate the frequencies of ceramic types and architectural features to discern changes in occupations within those compounds, before finally assessing the functionality for the largest and most elaborate of these compounds, which we term BUSes as compared to the smaller, common compounds that we term small unit structures (SUSes). Our investigation of function relates to our assertion that elite individuals or lineages emerged during the Bylas phase (Crary and Rogers in press). Finally, we relate the emergence of such a settlement hierarchy within the SCSA within a broader anthropological and regional context and suggest that it was a distinctively local occurrence but not necessarily independent of similar processes within Chaco Canyon and the Phoenix Basin.

THE PUEBLO VIEJO DISTRICT IN THE SAN CARLOS SAFFORD AREA

Situated within the eastern portion of the SCSA the Pueblo Viejo District represents a large geographic study unit we designed to address the variability found throughout the easternmost extent of the Hohokam culture area (Crary and Rogers in press). As one of twelve districts that comprise the SCSA, the Pueblo Viejo District includes the floodplain, terraces, and lower bajadas that extend from Sanchez to Fort Thomas and encompasses approximately 448 km^2 (Figure 1). Here, prehispanic sites similar in size and organization to those found in the San Carlos District (see Black and Green 1995) occur at relatively even intervals on either side of the Gila River. However, unlike those in the San Carlos District, rapid development for commercial agriculture in the 1880s leveled most of the large prehispanic sites within the Pueblo Viejo District. Nevertheless, recent archaeological investigations show that some features, namely the remnants of larger compounds, associated with these sites remain partially intact below the plow zone. Consequently, we focus our investigation upon historical descriptions and early investigations within the SCSA.

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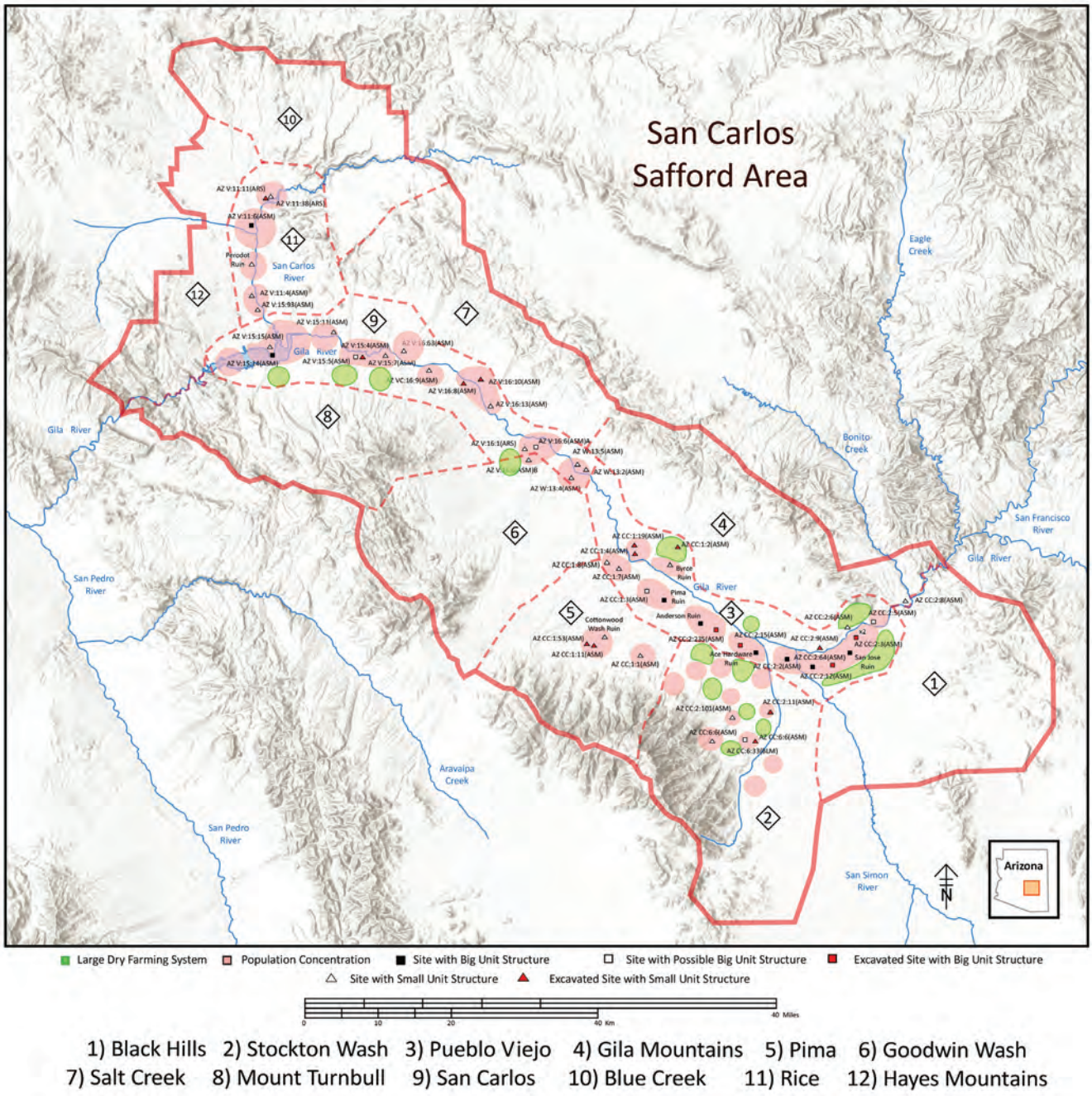

Figure 1. Map of the San Carlos Safford Area showing the location of SUS and BUS sites mentioned in the text, as well as the twelve districts comprising the SCSA as defined by Crary and Rogers (in press).

HISTORICAL DESCRIPTIONS AND INVESTIGATIONS IN THE SAN CARLOS SAFFORD AREA

Between 1883 and 1887, rapid development for commercial agriculture of nearly all of the floodplain and lower terraces within the Pueblo Viejo District occurred (Williams 1937). As many of the large prehispanic sites were leveled during these four years, the written accounts that describe these sites before 1883 represent an extremely important source of information. These include the accounts of William Emory (1848) and Hiram Hodge (1875a, 1875b, 1877), who were US Army officers with practical experience in reconnaissance, cartography, and structural engineering. John Wasson, who served as the territory of Arizona Surveyor-General and Continental Commissioner, as well as the publisher and editor of the Arizona Citizen from 1870 to 1875, provided additional information. Another important source

is the primary and secondhand accounts reported by Adolph Bandelier (1892:406, 409).

Based on observations made by Emory (1848), Hodge (1875a, 1875b), Fewkes (1904), and Hough (1907), we note that there are at least ten large site groups with surface architecture indicative of BUSes within the Pueblo Viejo District, and several others in the San Carlos District (Table 1). Found between the Buena Vista Ruin and the town of Pima, each of these site groups contains a centrally located BUS, or something matching such a description (Editor Citizen 1873; Fewkes 1904; Hodge 1875a, 1875b; Hough 1907). Hodge (1877), stationed at Fort Thomas in 1873, provides the most detailed accounts. He characterizes the extensive ruins as "towns" and mentions kilometers of prehistoric canals. Furthermore, he identifies each ruined town as composed of numerous small structures or compounds with a massive central structure similar to the Big House at the Casa Grande Ruin, which he assumed represented a temple. Although Hodge was not a trained archaeologist, he spent a significant quantity of time exploring prehispanic sites in the Phoenix Basin Area. We point out that Hodge perceived no significant difference in the general layout of prehispanic Phoenix Basin Area sites as compared to those in the Pueblo Viejo District.

These early accounts also provide detailed information about certain sites, such as the Epley's Ruin, locally known as "Pueblo Viejo." The Arizona Citizen, a weekly Tucson Newspaper where Hiram Hodge posted accounts while serving at various military postings throughout Arizona, specifically mentioned the Epley's Ruin; however, John Wasson, who was interested in land speculation, wrote the articles attributed to Editor Citizen. Wasson was a member of a group of Tucson businessmen who sponsored the construction of the Montezuma canal designed to grow crops to feed the rapidly expanding mining community in the Clifton Area. However, as of June 1873, the Pueblo Viejo District remained part of the White Mountain Apache Reservation, meaning a prohibition on Wasson to contract with recently arrived settlers to survey land claims (Editor Citizen 1873). The subsequent entries refer to the Epley's Ruin in general terms, as well as a new settlement founded in 1873 and named Munsonville. At this time, Munsonville was composed of only an adobe house and the Munson and Fairbanks mercantile store, and being located between two large prehistoric ruins, the local Spanish-speaking population referred to Epley's Ruin as "Pueblo Viejo."

From these descriptions, we discern that the general layout of the Epley's Ruin includes a large number of SUS compounds scattered over a huge area with interspaced open areas, canal alignments, and reservoirs covering approximately 650 acres (see also Jones and Montgomery 2014; Lascaux et al. 2019 for earlier dating components at Epley's Ruin). Figure 2 provides a map of the Epley's, Solomonville, San Jose, and Roadside ruins with the associated canal alignments and dry farming sites based on Fewkes's description, recent surveys, excavations, and Google Earth archival satellite photographs (2011a, 2011b, 2011c, 2019). Important for our study is the presence of a massive structure with unusually large rooms (see Lascaux et al. 2019). Located a few miles to the northeast, Fewkes (1904:176) described the Buena Vista Ruin similarly. However, to glean a sense of scale, accounts suggest the latter ruin is comparable, yet smaller and covering only about 20 acres. Williams (1937) refers to a reconnaissance conducted by Mormon colonists from the middle Colorado River valley in 1878. At that time, the Buena Vista Ruin was known as "San José Pueblo Viejo." Williams remarks that the scouting party believed the BUS was an old adobe fort. Bandelier's (1892) 1883 reference to the Buena Vista Ruin as San José del Pueblo Viejo confirms this name change. However, due to confusion surrounding the presence of two large ruins, the name for Epley's Ruin shifted to Solomonville Ruin around the same time. Nevertheless, based on excavations done at Epley's Ruin, Fewkes (1904) and Hough (1907) provide general descriptions of what they call a central structure.

Both archaeologists describe the ruins situated on either side of Solomonville with slightly greater detail. Fewkes (1904) locates the Epley's Ruin on Epley's ranch east of Solomonville and extending north and south of Clifton Road that continued east to San Jose. His description of the structural units located south of Epley's farmhouse indicates that one unit is a massive structure already partly leveled, partly excavated by a Mr. Adams of Solomonville, and partly used as an adobe quarry. However, a portion of this structure remained intact, and largely due to its accessibility, Hough (1907) and Fewkes (1904) initially concentrated their efforts therein. This is part of the same structure Editor Citizen (1873) mentions. Between the massive structure and the adobe manufacture area, Fewkes (1898) mentions a large depression similar to the one he saw at the Buena Vista Ruin. This may represent a Late Formative period ballcourt dating between AD 800-1070 (see Wallace 2014). These early descriptions demonstrate that Epley's Ruin is certainly the most extensive and complex prehispanic site group in the Pueblo Viejo District. Hough (1907) and Fewkes (1904) also mention Solomonville Ruin as located to the west of its namesake small town along the road to Safford. Here are the remains of another partly eroded massive structure with room interiors exposed by the periodic floodwater from the San Simon River.

Although Fewkes (1898) conducted only a brief reconnaissance with the aid of local informants, he visited several sites with BUSes between the Buena Vista

Table 1. List of Big Unit Structures Identified in the SCSA from Various Investigations

No.	Site Name	Site No.	SCSA District	BUS Size Class	Type of Investigations	Investigators
1	Epley's Ruin	AZ CC:2:64(ASM)	Pueblo Viejo	Large[1]	Excavation[2]	Fewkes, Hough
2	Buena Vista Ruin	AZ CC:2:3(ASM)	Pueblo Viejo	Large, Small	Test Excavation[2]	Fewkes, Hough
					Excavation	Russell, Tatman, Mills and Mills
3	San Jose Ruin	-	Pueblo Viejo	Large	Excavation[3]	Fewkes, Hough
4	Solomonville Ruin	AZ CC:2:12(ASM)	Pueblo Viejo	Large	Reconaissance[2]	Fewkes, Hough
5	Place-Lone Star Ruin	AZ CC:2:2(ASM)	Pueblo Viejo	Large	Reconaissance[2, 4]	Fewkes, Hough
6	Methodist Church-Beebe Ruin	AZ CC:2:15(ASM)	Pueblo Viejo	Large	Reconaissance[2, 4]	Fewkes, Hough
7	Anderson Ruin	AZ CC:2:31(ASM)	Pueblo Viejo	Large	Reconaissance[2]	Fewkes, Hough
8	Pima Ruin[5]	-	Pueblo Viejo	Large	Reconaissance[2]	Russell
9	Daley Ruin	AZ CC:2:235(ASM)	Pueblo Viejo	Large	Reconaissance[2]	Fewkes, Hough
10	Pomeroy-Ace Hardware Ruin	-	Pueblo Viejo	Large	Reconaissance[2]	Fewkes, Hough
11	-[5]	AZ CC:1:3(ASM)	Pueblo Viejo	Small	Reconaissance[2]	Russell
12	McEuen Flat Ruin	AZ CC:2:5(ASM)	San Carlos	Small	Survey[2]	Crary
13	Geronimo Bluff Ruin	AZ V:16:6(ASM)	San Carlos	Small	Survey[2, 4]	Crary
14	Gila Bank Ruin	AZ V:15:5(ASM)	San Carlos	Small	Excavation[2]	Hands
15	San Carlos Agency Ruin	AZ V:15:14(ASM)	San Carlos	Large	Survey[2]	Bandelier
16	Rice Ruin	AZ V:16:6(ASM)	Rice	Small	Excavation, Survey[2]	Hrdlička, Schmidt
17	Olney Ruin	AZ CC:6:33(BLM)	Stockton Wash	Small	Reconaissance[2]	Fewkes, Hough

[1] Based on site descriptions, several BUSes likely present
[2] Architectural mound
[3] San Jose Wash exposed rooms within mound interior with walls of 6.1 m in height
[4] Looting exposed rooms within the mound interior
[5] Two BUSes in this vicinity: a large BUS at the Pima site on the east side of the lower Cottonwood Wash and a small BUS at AZ CC:1:3(ASM) located on the west side

Ruin and the town of Pima. Fewkes (1898) mentions a site with a large partly eroded mounded structure 3 km northeast of Solomonville at the town of San Jose. This corresponds with the Lone Star-Place Ruin, centered within the University of Arizona's Safford Agricultural Center. Hough (1907) appears to have confused the location of the Anderson Ruin BUS as located west of Solomonville, whereas it is actually east of Safford near the Thatcher High School. Regardless of this misplot, Hough (1907) mentions a series of large sites clearly with BUSes situated between Thatcher and Pima. Fewkes (1898, 1904) and Hough (1907) also describe a large, mounded structure at the Olney Ranch Ruin located about 12 km southwest of Solomonville in the Stockton Wash District. In the San Carlos District, Bandelier (1892) mentions a large prehispanic site on the terraces to the northwest of the confluence of the Gila and San Carlos rivers. Here, he recorded a central, massively built multi-story structure some 37 m long and 16 m wide with connections to other structures by walls that enclosed plazas and courtyards. In 1926, while investigating at the Rice Ruin, Schmidt documented the presence of a similarly large multi-story structure (Hohmann and Kelley 1988:113–115). Finally, various fragmentary references suggest there may also be a BUS at the Gila Banks Ruin (Cummings 1953; Hands 1929; Sauer and Brand 1930), as well.

In summary, our examination of early historical accounts suggests there are at least ten large and three small BUSes within the Pueblo Viejo District. Of these, archaeological excavation or survey confirms the presence of two large and two small BUSes. The remaining eight large and one small BUSes mentioned in historic accounts or archaeological reports require further investigations to relocate them and ascertain their condition. To these we add the small BUS Fewkes (1898) mentions in the Stockton Wash District, the two large BUSes reported by Bandelier's (1892) survey and Schmidt's (Hohmann and Kelley 1988) excavations in the San Carlos and Rice districts, and a small BUS at the Gila Bank Ruin based on excavations near the Natches Siding historic Arizona Eastern Railroad loading station. Overall, this gives us a count of at least twelve large and six small BUSes concentrated primarily in the Pueblo Viejo District (see Figure 1 and Table 1).

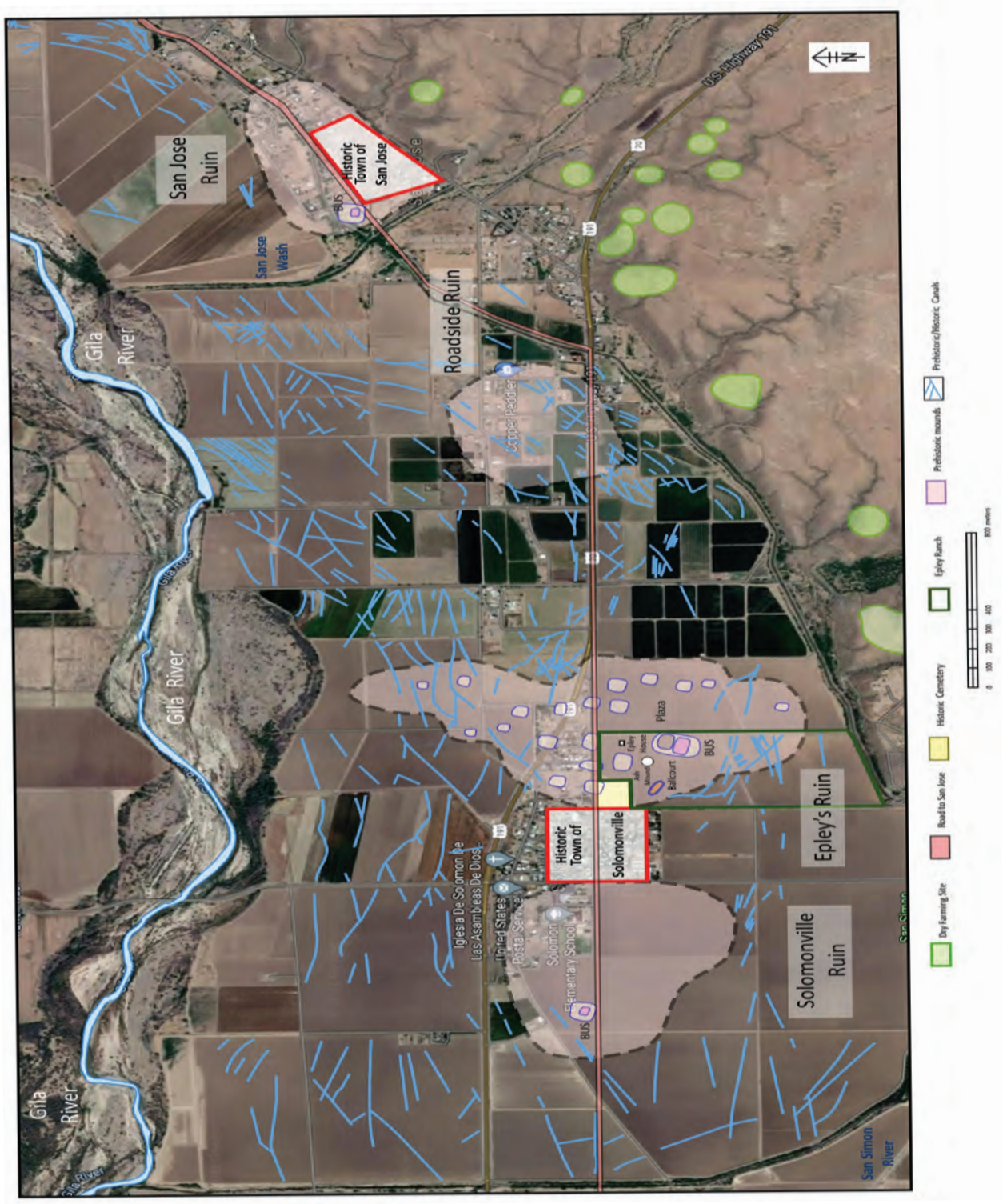

Figure 2. Map showing the Epley's, Solomonville, Roadside, and San Jose ruins. Aerial imagery from Google Earth (2019).

Besides the two investigated at the Buena Vista Ruin, two small BUSes likely remain mostly intact. Unpublished archaeological surveys by the senior author (Crary 1999) conducted in 1989 and 1998 identified and redocumented the condition of them. One BUS is at the Earven Flat Ruin (AZ CC:2:5[ASM]) near the town of Sanchez, in the eastern portion of the Pueblo Viejo District. Tuohy (1960:21) and later Brown (1973:14–20) initially documented the Earven Flat Ruin as located on an alluvial terrace north of the Gila River. These early investigators made ceramic collections composed primarily of decorated types and both researchers described the BUS as a large roomblock. Brown claimed there were 170 rooms and two plaza areas; however, the 1989 resurvey found it to be a large rectangular compound with 22 rooms, a large plaza, and several courtyard areas (Crary and Rogers in press). Within the southeast portion of the compound, the small BUS consisted of a low mound with about eight rooms arranged around a courtyard area. Apart from the BUS, upright rocks, or *cimientos*, outlined most of the compound and it is unclear why Brown greatly overestimated the room count. A large, on-site sherd count occurred as part of the resurvey and reported a more diverse assemblage than initially recorded (see Crary and Rogers in press). Finally, the recent survey identified repeated disturbance events by looters and earthmoving equipment, resulting in the removal of the southeast corner of the compound and part of the BUS.

The second site with a small BUS is at the Geronimo Bluff Ruin (AZ V:16:6[ASM]), located south of the Gila River near the historic town of Geronimo. Situated on a steep ridge that protrudes onto the floodplain, Sauer and Brand (1930:422–423) describe a large rectangular compound and a small ceramic collection primarily made up of diagnostic types, similarly undertaken by Tuohy (1960). Resurvey of the site occurred in 1998 and the senior author conducted an on-site sherd count. The unpublished results of that survey determined that the Geronimo Bluff Ruin is composed of at least three structural units, with the main unit being a large rectangular compound covering 3,250 m^2 with at least 21 rooms, a large plaza, and several courtyard areas. Near its center seven rooms occurred in an arrangement around two courtyards. Two of these rooms are large, massively built, mounded, and extensively pot-hunted, with the amount of rubble suggestive that they were likely multistory structures. Three SUSes are located nearby, and each contained upwards of a dozen rooms arranged around one to two courtyards.

The general structure and configuration of rooms, courtyards, and plazas at the Geronimo Bluff and Earven Flat ruins are similar, yet smaller to those Mills and Mills (1978) identify at Houses I and IV at the Buena Vista Ruin, which we discuss later in this paper. Moreover, given the bias towards decorated pottery, pottery types collected by Tuohy (1960:34) and Brown (1973:Tables 1-2) are remarkably similar to the sherd count data recorded later (Crary and Rogers in press). Only the surface collection Sauer and Brand (1930:Figure 2) made at the Geronimo Bluff Ruin differed from Tuohy's collection and the senior author's sherd count data. Although the description and photograph of the Geronimo Bluff Ruin (Sauer and Brand 1930:422, Plate 56a), as well as the map location, match Tuohy's AZ V:16:5(ASM) and the resurveyed site, Sauer and Brand's collection may have come from AZ V:16:7(ASM) (Tuohy 1960:7), the Geronimo Terrace site, a large masonry roomblock located about a half-mile to the southeast on a low terrace east of Goodwin Wash. A comparison of the diagnostic ceramics collected by Sauer and Brand (1930:Table 1) to those found at AZ V:1:7(ASM) showcases that the two are highly similar (Tuohy 1960:34) (Table 2). Excluding Sauer and Brand's collection, Tuohy's diagnostic collections and the more proportional sherd count data are notably similar to the Buena Vista Ruin sherd count data from House I Group B as recorded by Mills and Mills (1978) and discussed later in this paper. Given the similar constellation of diagnostic decorated pottery, this seems to indicate that the construction and occupation of these three BUSes, as well as the House IV BUS at the Buena Vista Ruin, occurred during the mid to late Bylas phase (AD 1180-1300) as revised by Crary and Rogers (in press). Furthermore, it is also likely significant depopulation, if not full-scale abandonment, for many BUSes coincided with the onset of the Goat Hill phase (AD 1280-1310/1325) as revised by Rogers and colleagues (2021), however; in the case of Houses I and IV, we note the continued habitation of BUSes until the beginning of the Safford phase (AD 1300-1450), a trend we suggest is likely shared at yet-unexcavated BUSes in the SCSA.

Based on survey and excavation investigations, Bylas phase residential sites are composed of groups of SUSes, which represented small and medium-sized compounds (Black and Green 1995; Crary and Rogers in press; Fewkes 1904, 1909; Hough 1907; Johnson and Wasley 1963; Mitchell 1986). These rock-reinforced adobe compounds include single-story, rectangular surface or pitrooms with utility structures arranged around courtyards and plaza areas. Individual compounds commonly associate with discrete mortuary and trash areas, as well as in some instances, several SUSes clustered around a BUS. Furthermore, the BUSes are structurally similar to the smaller residential compounds, differing only in scale, massive dimensions, and presence of multiple stories. Finally, a synthetic analysis of Bylas phase (Crary and Rogers in press) determined that the types of diagnostic decorated pottery associated with SUSes and

Table 2. Ceramic Types Identified at AZ V:16:6(ASM) and AZ CC:2:5(ASM) During Archaeological Survey

	Utility Ware				Decorated Ware									
SCSA District/Site No.	Plain	Red	Corrugated	Other	Hohokam Buff Ware	San Simon Brown Ware	Mimbres Black-on-white	San Carlos Red-on-brown	Cibola White Ware	White Mountain Red Ware	Salado Polychrome	Other Polychrome	Total	Survey Reference
San Carlos/AZ V:16:6(ASM)	-	4	9	-	14	8	-	-	-	2	41	-	78	Sauer and Brand (1930)
	3	-	13	-	-	1	-	25	21	3	1	-	67	Touhy (1960)
	354	7	342	3	75	12	4	65	43	11	-	1	917	Crary (1999)
Pueblo Viejo/AZ CC:2:5(ASM)	8	9	29	9	11	-	-	-	45	3	-	-	114	Tuohy (1960)
	5	2	28	3	11	29	7	-	43	9	-	-	137	Brown (1973)
	415	10	378	15	15	21	18	14	52	41	-	-	979	Crary (1999)
Total	785	32	799	30	126	71	29	104	204	69	42	1	2,292	-

BUSes indicates these structures were contemporaneous, a similar situation we discuss later and identified in Chaco Canyon (Lekson et al. 2006; Vivian 1990).

THE BUENA VISTA RUIN

One of the largest BUSes we can identify is located high upon a terrace overlooking the active floodplain at the Buena Vista Ruin, the only large archaeological site of this kind in the entire Pueblo Viejo District that remains mostly intact after the significant disturbance or leveling of the floodplain in the 1880s (Figure 3). The Buena Vista Ruin represents the residential component of the much larger Curtis Site Group, which extends onto the upper Holocene terraces to the south and east. Overall, the various loci that compose the Curtis Site Group cover an area of approximately 2 km^2. Fewkes's (1904) and Hough's (1907) reports, with Brown's (1973) and Tyberg's (2000) review of Tatman's (1931) excavations, as well as the Jack and Vera Mills (1978) Curtis site report represent some of the few published accounts of the many archaeological projects conducted throughout the Pueblo Viejo District (see Neuzil 2008; Neuzil and Woodson 2014). Therefore, the importance of the investigations conducted at the Buena Vista Ruin is indispensable and of paramount importance to the archaeological study of the area. One of the most significant results of investigations at the site is the excavation of two massively built multi-story BUSes. For the remainder of this paper, we use the naming system employed by each respective investigation and provide the following concordance, which is also found in Figure 3: Tatman's House 1 is Mills and Mills's House II, Tatman's House 2 is Mills and Mills's House I (also termed the Big House), Tatman's House 3 is Mills and Mills's House IV, and Mills and Mills's House III has no mention in Tatman's records. As a structural concept, we identify BUSes in the Pueblo Viejo District based on our review of previous archaeological investigations conducted at the Buena Vista Ruin and other sites, together with the chronological revision of the Bylas phase (AD 1180-1300) (Crary and Rogers in press).

Investigations of Big Unit Structures at the Buena Vista Ruin

In 1969, Jeffrey Brown conducted archaeological investigations in the Pueblo Viejo District. In all, Brown's efforts included excavations at two sites, testing and survey of six sites, and the partial documentation of several privately-held collections. Brown's research, published in his 1973 dissertation, also included a review of Oscar Tatman's (1931) unpublished Buena Vista Ruin (also known as Solomonville and termed as such by Tatman) field notes and artifact collections. Brown used these data to support his Salado Origin hypothesis, which sought to relate the expansion of Salado polychrome, and associated cultural practices, to the arrival of northern Ancestral Pueblo migrants, primarily from the Point of Pines and Kayenta areas. Brown's presentation of Tatman's unpublished work at the Buena Vista Ruin represents a significant data source for our study and other's investigations into late prehispanic trends within the SCSA (Neuzil and Woodson 2014).

As the story goes, following Sauer and Brand's (1930) survey of southeastern Arizona in 1929, Earl Morris learned about some exposed wooden posts embedded in the walls of a massive structure at the Buena Vista Ruin. As an ardent supporter of Andrew

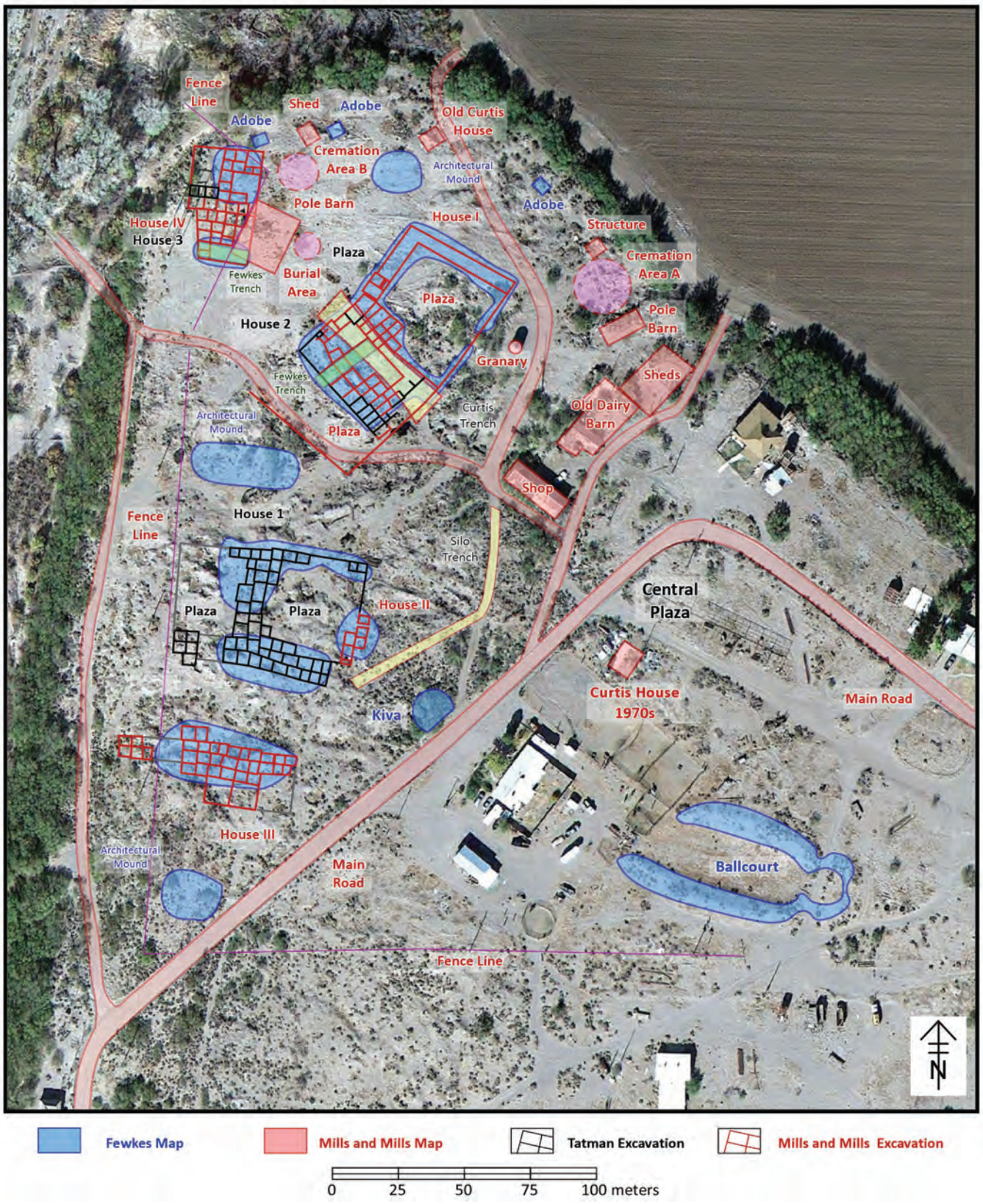

Figure 3. Map of the Buena Vista Ruin showing the various prehistoric and historic structural units identified and investigated between 1898 and 2021. Aerial imagery from Google Earth (2011a, 2019).

E. Douglass's efforts to establish a Southwestern dendrochronology, Morris, who was an employee of the University of Colorado, sent Oscar Tatman, his most reliable crew-chief, with a field technician to excavate part of the Buena Vista Ruin in 1931 to collect dendrochronology specimens as well as learn about the massive structure itself. Tatman spent most of his time excavating his House I, a large adobe structure with rooms and walls that enclosed a central plaza. After excavating 34 rooms, Tatman shifted his attention to Fewkes's central structure, which he labeled House 2. After excavating eight rooms, he concluded the abandonment of this massive multi-story building occurred with the floor assemblages cleaned out, and that shortly thereafter, the entire southern part of this structure burned as described in the following quotation.

The south wall of the main structure is 3 feet thick and composed of adobe mud with river boulders forming the core. All cross walls were of the same construction, with occasionally small timbers embedded upright in the walls. Practically all timbers used in roof and as posts seem to be of juniper. Fire has destroyed most of the south half of the building, which was either abandoned at the time of fire or looted most systematically, as no pottery was found on the floor. [Tatman 1931, published in Brown 1973:99]

Additionally, Tatman reported the burned, unburied remains of three adult individuals on the floors of two rooms within the southwestern section of House 2. Three extended subfloor, subadult individuals were present within three of the rooms as well. Tatman suggested that in the portion of the structure burned, sometime after the construction of the ground floor rooms, the construction of a second story occurred. From the floor of a second-story room, he recovered a partial Maverick Mountain Black-on-red bowl. It was at this point the landowner terminated Tatman's excavations, and Tatman had to abruptly leave the site. Although his investigations ended prematurely, the artifacts collected by Tatman indicate he primarily focused on procuring exhibit-quality items for the Museum of Colorado (presently the Museum of Natural History at the University of Colorado). Between this investigation in 1931 and 1971, we cannot identify any formal excavation or documentation of a BUS.

The Larger Big Unit Structure: Excavations within House I

In 1971, about a year after Brown completed his work in the Safford area, Jack and Vera Mills commenced excavations at the Buena Vista Ruin (also known as Curtis Site and termed as such by Jack and Vera Mills in their 1978 publication). Betty Lee, affiliated with Eastern Arizona College (EAC), initially took them on a tour of the site, and after they showed interest, the landowners, the Curtis family, invited them to excavate the remaining structures. Over the next four and a half years, Mills and Mills (1978) investigated five architectural units and two discrete mortuary areas (i.e., cemeteries). In the process, they documented a significant number of archaeological features and recorded a substantial number of artifacts, resulting in the publication of a notably high-quality report for an avocational project with limited support. More importantly, the various structural units they investigated represent the only detailed work undertaken at a large site in the Pueblo Viejo District that chronologically spanned the Late Formative and Classic period sequence. Therefore, the data generated by their excavation is instrumental in establishing the histories of BUS use at the Buena Vista Ruin, and we hypothesize similar trends are likely present for BUSes throughout the SCSA. This hypothesis needs future investigation. The data Mills and Mills (1978) provide form the main dataset in our assessment. Fortunately for our study, they initially concentrated their efforts on the main structure, their House I. Here, they excavated two temporally discrete components, one superimposed above the other.

Mills and Mills (1978) identified the Early Component, which they dated to between AD 950-1150 based on diagnostic ceramic types, under the floors and massive rock-reinforced walls of the BUS. Features dating to the Early Component include fragments of five pitrooms, three extramural pits, one roasting pit, and a trash area. Additional features are likely present; however, Jack and Vera Mills only excavated below the floors of the structures when some kind of disturbance indicated the presence of subfloor features. For instance, the only pitroom fragment, Room 18, was composed of parts of three walls and much of the floor area. Mills and Mills report three mortuary features a short distance northeast of House I in an area where a historic pole-barn collapsed during their excavations. They believed these mortuary features date to the Early Component; however, the presence of a misidentified Maverick Mountain Black-on-red bowl and the tight cluster and similar head orientation indicate these extended, supine inhumations associate with the Late Component at the site.

In contrast to the relatively small and heavily disturbed Early Component pithouse village, the Late Component, which they dated to AD 1150-1400 based on diagnostic ceramic types, contained a massive multistory BUS, of which they excavated 17 rooms, sampled two courtyard areas, and trenched a plaza. The BUS, as Mills and Mills (1978) describe, is composed of two groups of rooms located on both sides of a large trench used by the Curtis family as a bunker silo for grain

storage. They note that Maxwell Curtis excavated the trench using heavy earthmoving equipment sometime between 1932 and 1960. Mills and Mills indicate that most of the rooms on the northeast side of the trench were two- or three-story in height, with possibly even including four three-story rooms (Figure 4). They also mention that although most of the rooms south of the trench were single-story, several in the south portion of the BUS were two-story. Both Mills and Mills (1978) and Fewkes (1904) identify a large plaza area northeast of the rooms that were north of the silo trench. They mention that walls enclose this area, and a line of single-story rooms exist on the northwest and northeast sides. Hodge (1875a, 1875b) refers to this enclosed area as a fortress, whereas Weech (Williams 1937) called it an old adobe fort, and Fewkes (1904) says that due to the heaped rock this area was used as a corral before 1898. Finally, Mills and Mills (1978:97) claim that there was a second plaza area located between House I and House IV, which was located to the west. They also describe a compound wall that extended from the BUS an unknown distance to the west and towards House IV.

Mills and Mills identify two types of wall construction at House I. The first is a massive rock-reinforced adobe wall a meter thick at the base that tapered upward. They note that the thickness was achieved by abutted two walls bounded together using large river cobbles. The second type is composed of thick adobe courses reinforced with upright juniper posts set at intervals along the wall alignment. In both types, photographs attest to repeated plaster events (Mills and Mills 1978). Finally, shallow footings composed of puddled adobe mixed with rock and numerous rounded pebbles supported these walls. The entries are generally small and located solely in the ground floor rooms, typically to provide access between such rooms. We note only one case in which an entry in this structure provided access into the BUS. Entries are commonly rectangular or trapezoidal-shaped with horizontal lintels; however, excavations identified one arched entry and three sealed entries. We assume that ladders and hatchways facilitated entry from the ground floor to the upper stories, although we lack any clear data to support that. Excavations by Mills and Mills (1978) resulted in the identification of ten infant mortuary features within five of the excavated rooms. The interment of these individuals occurred as extended, supine inhumations within shallow subfloor pits.

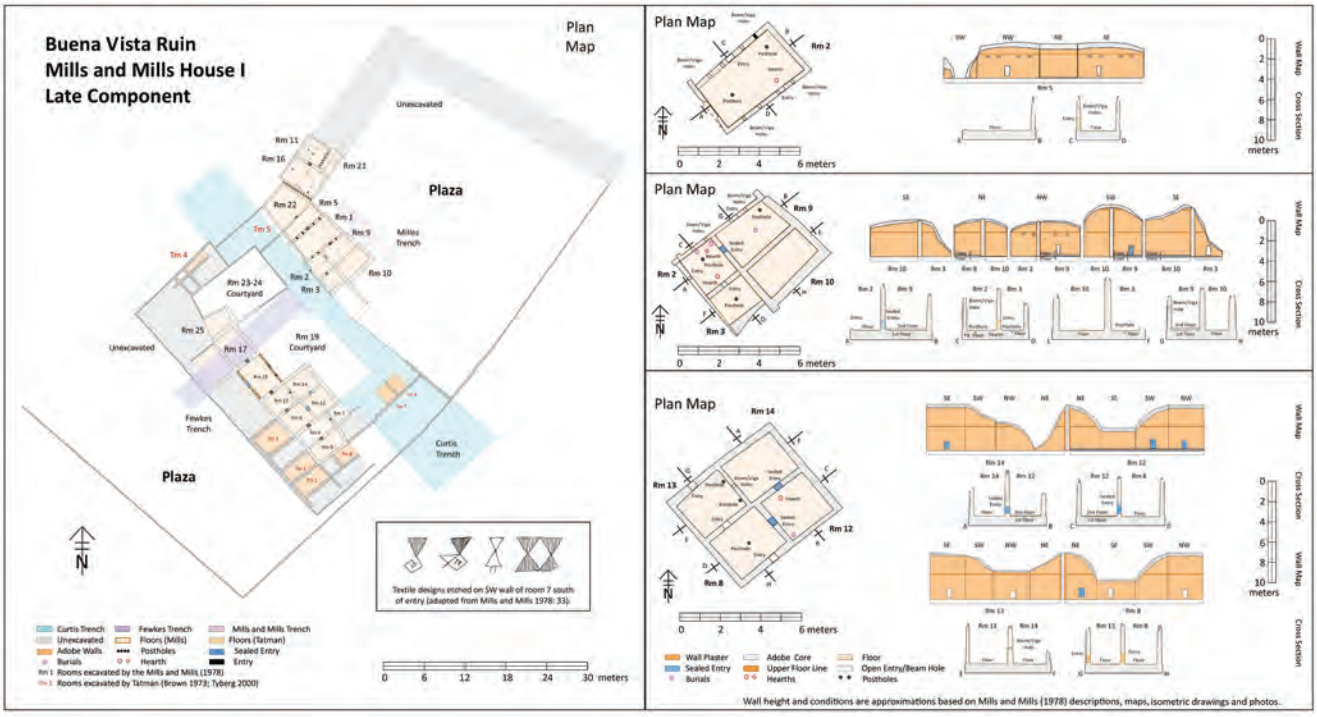

Figure 4. House I BUS late component plan map with reconstructions of select rooms cross-sections and wall maps based on Mills and Mills (1978).

The Smaller Big Unit Structure: Excavations within House IV

Mills and Mills (1978) also excavated a sizable portion of House IV, where they identified a smaller BUS. Based on the room configurations and the sherd count data, there appears to have similarly been an Early and a Late Component (Figure 5). The Early Component included Rooms 3, 4, 8, 25, and 26 arranged around two courtyards and a large plaza, as well as a cluster of two-story rooms (12, 13, 17, 20, and 24), a small courtyard (Room 22), and an isolated two-story storage room (Room 28) centered within a separate courtyard. Unfortunately, the excavators did not specify how they determined rooms contained more than one story. Furthermore, their map of House IV lacks a scale, and they did not include room cross-sections, profiles, isometric drawings, or dimensions. We assume they relied on wall height and thickness, together with the presence of a second floor to indicate the presence of a second story. To this, we add several upper story rooms to the Early Component based on the presence of shared two-story walls. Along the southern edge of House IV, they noticed a large trench that had all but destroyed two additional early rooms. Although Tatman excavated in this general area, Mills and Mills (1978) assume Fewkes excavated the trench.

During the Late Component, occupation continued in the existing rooms, as well as in at least 14 rooms constructed in the courtyard and plaza areas. Compared to the Early Component, our understanding of the House IV Late Component remains poor, and we disagree with some interpretations by Mills and Mills due to missing or inconclusive data in their report. For example, a map by Mills and Mills (1978) shows two unnumbered, undescribed rooms and they vaguely allude to other rooms situated outside of the area they excavated. They further mention a series of rooms located along the exterior of the plaza's west wall, as well as two rooms at the south end of the compound and situated west of the exterior wall. Trench descriptions by Mills and Mills and the absence of discernable features suggests, however, that these inferred rooms were likely rather courses of a fallen exterior compound wall. In comparison to the absence of such features, we note that numerous postholes, circular clay-lined hearths, and a single stone-lined rectangular hearth occur in the floors of several Late Component rooms. Finally, a similar mortuary pattern of subfloor inhumation continued into the Late Component based on Mills and Mills's excavations of one subfloor adult and seven subfloor infant inhumations located between two floors. They report only one other mortuary feature, an infant inhumation located in the southeastern corner of the plaza.

Investigations of Small Unit Structures at the Buena Vista Ruin: Excavations within Houses II and III

In addition to the two BUSes excavated by Mills and Mills, excavations occurred within large plaza-oriented compounds, which we distinguish as a SUS (Crary and Rogers in press). For instance, south of the Mills and Mills House I, Tatman excavated 35 rooms within his House 1 (Brown 1973; Tyberg 2000). Across from House 1, on the east side of the plaza, Mills and Mills (1978) dug three rooms within House II. About 10 meters south of Tatman's House 1, they also excavated 23 rooms within what was ostensibly a large, linear fourteenth century roomblock. Diagnostic decorated pottery and the ceramic seriation indicate the presence of Bylas phase occupations at both SUSes that were overlain by larger Safford phase components. For instance, the Bylas phase occupation within House 1 and House IV likely included as many as 20 rooms. However, the residential compound at House III seems to have had seven habitation rooms (7, 9, 10, 19, 21, and two unnumbered rooms) and two utility rooms (14, 20) arranged around two courtyards. Overall, the size and basic plan of this SUS are remarkably similar to the examples excavated at the Bylas sites (Johnson and Wasley 1966), the Stone Frog site (Hands 1929), and the Owens-Colvin site (see Crary and Rogers in press), as well as House IV at the Kuykendall Ruin in the Aravaipa Sulphur Springs Area (Mills and Mills 1969). Fewkes's (1904) map shows several other architectural mounds interspaced between the known SUSes and BUSes. This suggests the presence of at least three other SUSes at the Buena Vista Ruin, which we note corresponds to observations by Fewkes (1904, 1909) and Hough (1907). It also supports a proposed thirteenth century two-tiered hierarchical settlement system within the SCSA (Crary and Rogers in press). We provide plan maps of the SUS occupations of House II and III in Figure 5 in support.

CHRONOLOGY OF BUENA VISTA RUIN BUSES

To provide a relative ceramic chronology for the construction, use, and abandonment of the House I and IV BUSes, we sequenced and seriated sherd count data Mills and Mills (1978) report. We investigate these data to determine the relationship of the BUSes to other structural units investigated at the Buena Vista Ruin. We collectively grouped the samples from House I and IV together with those from House II and III as subsets according to their general provenience. Individual samples are composed of the pottery recovered from discrete contexts such as rooms, courtyards, plazas, and

Figure 5. House IV (Mills and Mills 1978) BUS A) Early Component, B) Late Component; C) House 1/II and House III (Brown 1973; Mills and Mills 1978) Early Component, D) Late Component. Second story BUS rooms identified in House IV Early and Late Components. Note expansion of compounds between Early and Late Components, as well as dismantling of rooms in House IV and addition of a kiva near House 1/II.

pits. We sorted samples according to plain, red, corrugated, and decorated ware. Although the attributes of plain, red, and corrugated ware are somewhat self-explanatory, the decorated ware included Hohokam Buff Ware, Mogollon Brown Ware, Mimbres White Ware, Cibola White Ware, and White Mountain Red Ware. The Maverick Mountain types include Maverick Mountain and Tucson Black-on-red and Polychrome, as well as Nantack and Prieto Polychrome. Although we group the Salado polychrome, also known as Roosevelt Red Ware, Mills and Mills (1978) do not identify the subtypes defined decades later (see Neuzil and Lyons 2005); these include Pinto, Gila, Tonto, Cliff, Nine Mile, and Dinwiddie Polychrome. We note that results from a more recent survey of Buena Vista Ruin by Anna Neuzil (2005) identified Gila, Cliff, and Tonto Polychrome; however, none of the terminal fourteenth century types are reported. The other ceramic grouping is a mixture of minor types such as incised, impressed, and painted corrugated pottery, as well as Zuni Glaze Ware, El Paso Polychrome, and Chihuahuan polychrome (e.g., Ramos Polychrome).

We grouped various samples within each subset according to their stratigraphic relationship. For example, samples from features identified under the House I BUS we considered to be earlier than those within the overlaying BUS rooms. Furthermore, we grouped samples within each subset according to known trends in ceramic production and procurement (see Crary and Rogers in press). Samples dominated by decorated types used before AD 1150, such as San Simon Series, Mimbres Black-on-white, and early Cibola White Ware form one group. Similarly, samples dominated by San Carlos Red-on-brown, later types of Cibola White Ware, and White Mountain Red Ware produced until AD 1300 form another group. Accordingly, we grouped samples with Maverick Mountain types and minimal corrugated pottery separately, as well as samples dominated by Salado polychrome. Once we grouped and ordered the individual samples accordingly, we compared the various sequenced subsets.

However, we encountered a complication upon evaluating the classification of Maverick Mountain pottery by Mills and Mills. This issue likely stems from a limited familiarity with Maverick Mountain pottery, which they often misidentified as either Salado or White Mountain Black-on-red types (e.g., St. Johns Black-on-red, Wingate Black-on-red). This became evident when Neuzil and Lyons (2005) analyzed the Mills Collection curated at EAC and correctly retyped vessels classified as being Gila Black-on-red as Maverick Mountain Black-on-red. A recent investigation determined that Maverick Mountain Black-on-red is common throughout the SCSA, whereas Pinto and Gila Black-on-red are exceedingly rare to absent across the twelve districts (Crary and Rogers in press). Therefore, following Neuzil and Lyons (2005), we reclassify the 66 sherds from House I initially typed as Gila Black-on-red as Maverick Mountain Black-on-red. For dating purposes, we relied upon cross-referenced tree-ring dates for decorated ceramic types associated with the BUSes (Table 3).

RESULTS

In all, the Buena Vista Ruin sherd count data from Mills and Mills (1978) represent 85 distinctive samples based on provenience. We divided these between four subsets recovered from features associated with each of the four investigated structural units. We refer to these as the House I, II, III, and IV subsets, which include 28, 3, 25, and 29 individual samples, respectively. Based on their provenance, we placed the 12,579 sherds that composed the 28 samples of House I within five groups, labeled A through E. Figure 6 provides the sequenced sherd count data recovered from the Buena Vista BUSes as compared to ceramic assemblages from Eden (AD 1100-1180), Bylas, Goat Hill, and Safford phase sites. Group A samples (n = 4) represent sherds from features associated with the Early Component underneath the BUS and the midden area north of House I. The dominance of early Hohokam Buff Ware, Mogollon Brown Ware, and Mimbres Black-on-white with a small amount of red and full corrugated pottery characterize Group A. Overall, this assemblage is similar to those found in features at AZ CC:1:52(ASM) Locus A, AZ CC:1:52(ASM) Locus B, AZ CC:1:43(ASM), and AZ W:13:14(ASM), which are Two Dog and Eden phase sites.

The House I Group B samples (n = 5) includes a mix of pottery dominated by late Hohokam Buff Ware, San Carlos Red-on-brown, late Cibola White Ware, and White Mountain Red Ware with moderate to large amounts of corrugated pottery. This assemblage is similar to those from other Bylas phase sites found throughout the SCSA. Group B samples from the Buena Vista Ruin came primarily from a group of burned rooms located in the southwest portion of the BUS and the courtyard area located west of the Curtis Trench. The Group C samples (n = 6) includes a mix of pottery types nearly identical to those found in Group B. However, Group C samples also includes larger quantities of White Mountain Red Ware with a consistently small amount of Maverick Mountain Black-on-red. Samples from the Buena Vista Ruin came from a cluster of rooms located immediately northeast of the Curtis Trench. Group D samples (n = 8) came from the courtyard area and a separate group of rooms located southwest of the Curtis Trench. One sample represents a feature found in the cremation area located to the east of House I. Collectively, Group D samples includes

Table 3. List of cross-referenced tree-ring dated decorated ceramic types associated with the Buena Vista BUSes*

Ware/Series	Type	Initial Use	Terminal Use	Reference
Hohokam Buff Ware	Casa Grande Red-on-buff	AD 1150	Indet.	Heckman et al. 2000; Wallace 2004
San Carlos Red-on-brown	--	AD 1150	Indet.	Heckman et al. 2000; Wallace 2004
Cibola White Ware	Snowflake Black-on-white	AD 1175	AD 1300	Wood 1987; Zedeño 1994
	Reserve Black-on-white	AD 1000	AD 1200	Carlson 1970; Wood 1987; Zedeño 1994
	Tularosa Black-on-white	AD 1150	AD 1300	Kintigh et al. 2003; Rinaldo and Bluhm 1956
	Pinedale Black-on-white	AD 1275	AD 1325	Wood 1987; Zedeño 1994
White Mountain Red Ware	Wingate Black-on-red/ Polychrome	AD 1030	AD 1200	Carlson 1970
	St. Johns Black-on-red/ Polychrome	AD 1175	AD 1300	Carlson 1970
	Pinedale Black-on-red/ Polychrome	AD 1275	AD 1325	Carlson 1970
Zuni Glaze Ware	Heshotauthla Black-on-red/ Polychrome	AD 1275	Indet.	Carlson 1970; Woodbury and Woodbury 1966
	Kwakina Polychrome	AD 1280	Indet.	Carlson 1970; Woodbury and Woodbury 1966
Maverick Mountain Series	Maverick Mountain Black-on-red/ Polychrome	AD 1275	AD 1310	Haury 1958; Lindsay 1987
	Tucson Black-on-red/Polychrome	AD 1275	AD 1375	Wilson 1998; Wood 1987
	Nantack Polychrome	AD 1275	AD 1325	Neuzil and Lyons 2005
Roosevelt Red Ware / Salado Polychrome	Pinto Black-on-red/Polychrome	AD 1275	AD 1325	Reid et al. 1992
	Gila Black-on-red/Polychrome	AD 1295	Indet.	Dean and Ravesloot 1993

* Indeterminate terminal use indicates that although archaeologists have approximate estimates for when these types ceased in production, cross-referenced tree-ring dates are absent for this type.

a mix of pottery types dominated by White Mountain Red Ware, Maverick Mountain Black-on-red, and a mix of other ceramic types such as El Paso Polychrome. This assemblage also contains a small quantity of Salado polychrome restricted to a single room. Finally, the Group E samples (n = 5) represent the rooms and plaza located in the northeast portion of House I. The Group E pottery types include a mixture of White Mountain Red Ware, Maverick Mountain, and Salado polychrome, with other types such as El Paso Polychrome present in small amounts. The occurrence of significantly lower frequencies of corrugated pottery characterize Group E samples as compared to assemblages associated with the other four groups. Consequently, we were successfully able to subdivide the ceramic assemblage from the large BUS at the Buena Vista Ruin into five groups indicative of either diachronic occupation shifts or shifts in deposition and refusal disposal within the BUS. Given Mills and Mills did not differentiate between floor and room fill sherds, both are possible; however, we believe the former more accurately accounts for the sequenced results.

The House IV subset includes 5,771 sherds comprising 29 samples placed within four groups. The mix of pottery types is similar to those found in House I; however, rather than being sequential, the results suggest each group came from contemporaneously occupied room sets. They collectively exhibit a similar sequence of ceramic change over time. The presence of late Hohokam Buff Ware, San Carlos Red-on-brown, late Cibola White Ware, and White Mountain Red Ware represent the Early Component within House IV. However, the predominance of Maverick Mountain types with small amounts of corrugated pottery and Salado polychrome indicates a much more extensive Late Component. We determined that only the House I Group E assemblage is similar to the various assemblages that comprised the House IV subset. Moreover, the low level of corrugated pottery in many of the individual samples is similar to the individual room sherd counts found at the Goat Hill site, and this may represent occupation during the Goat Hill phase (Rogers et al. 2021).

For comparison, the House II subset is composed of only three samples of 2,246 sherds with a mix of pottery types. These include a significant quantity of full corrugated pottery. Furthermore, the dominant decorated types are Salado polychrome rather than Maverick Mountain. Our final subset, for House III, includes 25 samples of 15,003 sherds. The ceramic mix seems similar to that associated with House II. Again, Salado polychrome overwhelmingly predominates with small

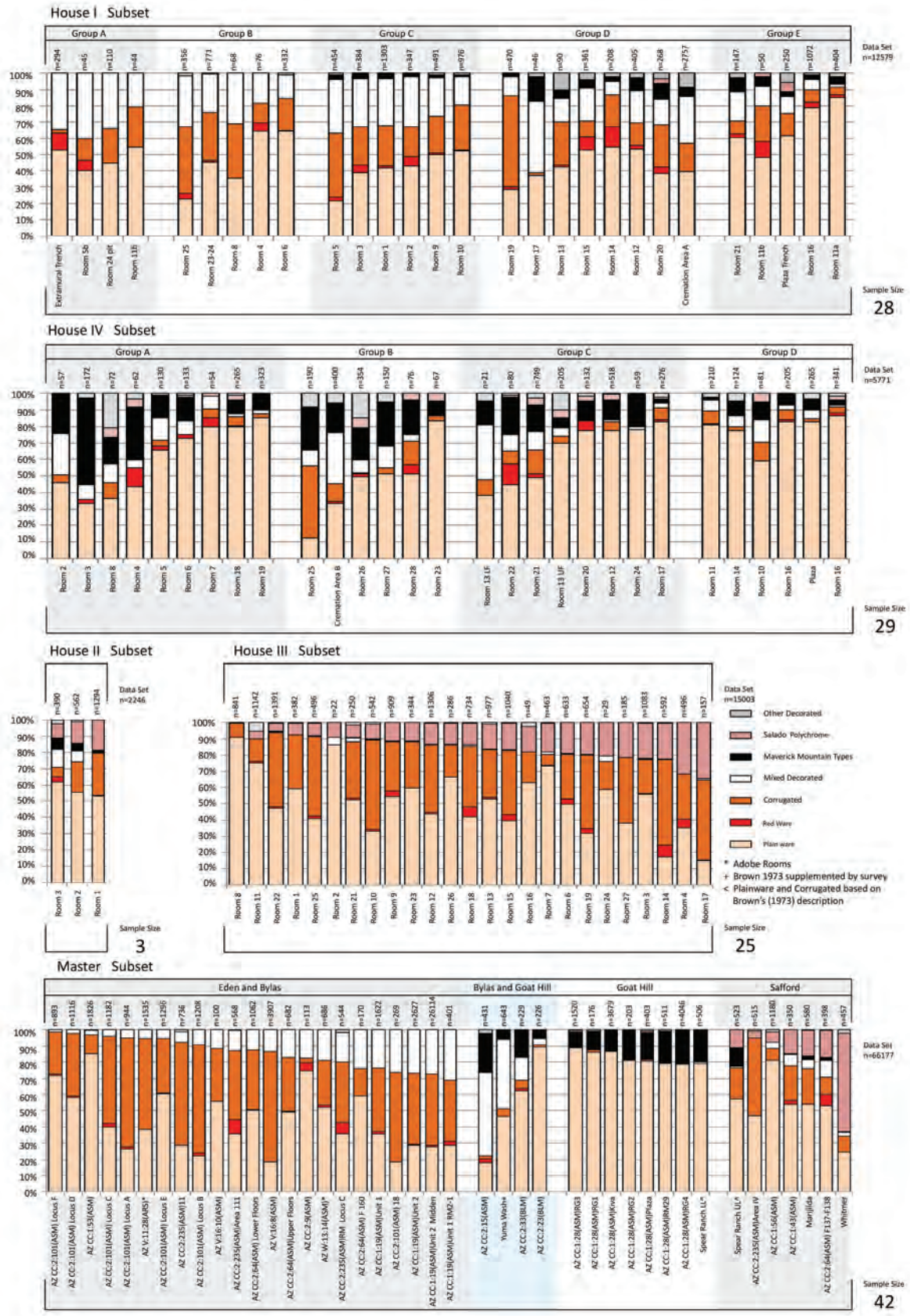

Figure 6. The sequenced sherd count data from the excavated Buena Vista Ruin BUSes compared with ceramic assemblages from Eden, Bylas, Goat Hill, and Safford phase sites.

quantities of Cibola White Ware, White Mountain Red Ware, Maverick Mountain, and other pottery types present.

DISCUSSION

Chronologies for Buena Vista Ruin Structures

We base the relative chronology for the Buena Vista Ruin BUSes and SUSes on the stratigraphic and ceramic data provided by Mills and Mills (1978). Overall, we identify that a pattern of occupational termination and then reoccupation during the AD 1180-1300+ time period within the four compounds excavated by Mills and Mills as follows: expansion of House I into a BUS sometime in the early to mid-1200s with a termination by AD 1275; construction of Houses II and III around AD 1200 and continued habitation beyond AD 1300 with a brief AD 1275 to ca. 1300 hiatus at House III; and construction of the House IV BUS around AD 1250 with a fairly continuous occupation to around AD 1325, with termination thereafter. Analysis of the ceramics from the House I subset Group A compared to the Group B assemblage indicates that the construction of the House I BUS initiated after the Eden phase. These decorated types include Sacaton Red-on-buff, Encinas Red-on-brown, and Mimbres Black-on-white, as well as Puerco and Reserve Black-on-white. Moreover, given the mix of decorated ceramic types that date between AD 1150 and 1300, together with large amounts of corrugated pottery in Group B, this indicates the construction of this BUS occurred during the Bylas phase. Furthermore, the vast majority of the decorated pottery in Group B consists of Casa Grande Red-on-buff, a few San Carlos Red-on-brown, with Wingate and St. Johns Black-on-red, as well as Snowflake, Reserve, and Tularosa Black-on-white. This mix indicates the likely construction of the House I BUS was before AD 1250 with occupation continuing thereafter given production for many of these types continues after AD 1250.

Relative means and associated tree-ring dated decorated pottery support our proposed construction date for the House I BUS as between AD 1200 and 1250. Throughout his work at the Buena Vista Ruin under Morris's direction, Tatman collected several wood specimens for tree ring analysis. As mentioned previously, exposed architectural wood at the Buena Vista Ruin led Morris to send Tatman to the Pueblo Viejo District in the first place. Sauer and Brand (1930) noticed the wood during their survey of southeastern Arizona in 1929 and sent a letter to Andrew Douglass discussing the importance of excavating at the site with the objective to recover a large number of dateable specimens. As Douglass was in Washington, D.C. at the time, his secretary replied that he would be interested. In the interval, Douglass or Sauer likely contacted Morris who sent Tatman with instructions to collect wood suitable for analysis; however, according to Jeffrey Dean's notes (personal communication, 2020), when Tatman left the Buena Vista Ruin he only had two wood specimens, both likely from House 1 where his excavations initiated.

Yet, Morris wrote Douglass to notify him of a delivery of a large quantity of dendrochronology specimens for analysis. Subsequent lab records show 84 specimens from the Buena Vista Ruin attributed to Tatman's excavation (Jeffrey Dean, personal communication, 2020). The records also mention that Dorothe Knipe recovered the vast majority of these from Tatman's backdirt piles in 1932. Therefore, the provenience of these samples remains a bit murky; however, we attempt to clarify their likely provenience. Brown (1973) stated that the landowners suddenly stopped Tatman's excavations, and he hurriedly departed. We know that directly prior to his departure, Tatman excavated at least eight rooms in the BUS Mills and Mills referred to as House I. Within these rooms he found charred wood laying directly upon the floors of several burned rooms. However, the speed of his departure indicates that when Tatman left, he lacked time to collect all of the exposed tree-ring specimens from House I. We infer that after the specimens Morris sent to the University of Arizona Laboratory Tree-Ring Research failed to produce dates, Knipe visited the site to collect the specimens Tatman failed to take to Colorado in his hasty departure.

In all, there are four datable dendrochronology specimens recovered during Tatman's investigations (Table 4). Although they lack clear provenience, several factors indicate they came from House I. First, the results of the tree-ring analysis provided a close cluster of dates between AD 1230 and 1238 (Jeffrey Dean, personal communication, 2020). Of the 84 tree-ring specimens from the Buena Vista Ruin in the University of Arizona Laboratory Tree-Ring Research collections, four pinyon specimens provide dates. These are CUR 45, 33, 80, and 65 and they provide dates of 1200vv, 1219vv, 1238v, and 1239vv, respectively. The near-to-cut date for CUR 80 and noncutting date of CUR 65 place wood procurement and construction within the late 1230s, or certainly prior to AD 1250. We eliminate the SUS Tatman listed as House 1 from consideration because the diagnostic pottery date construction of these rooms after AD 1300 (Brown 1973; Tyberg 2000). Excavations by Mills and Mills at Houses II and III confirm that House 1 SUS postdates AD 1300. Consequently, only the House 1 BUS remains as a potential origin for the tree-ring specimens.

Based on the tree-ring dating for the advent of Maverick Mountain Black-on-red, we interpret that the

Table 4. Tree-ring dates from the Buena Vista Ruin[a]

Specimen No.	Inside Ring Date (AD)	Pith Ring[b]	Outside Ring Date (AD)	Status
CUR 33	1179	P	1219	vv
CUR 45	1113	P	1200	vv
CUR 65	1165	P	1239	vv
CUR 80	1181	P	1238	v

[a] Adapted from Tyberg (2000)
[b] P = pith ring present, v = near cutting date, vv = indeterminate number of rings removed

abandonment and burning of rooms in the south part of the House I BUS occurred between AD 1275 and 1290, and certainly by AD 1300 given the near absence of Salado polychrome. In support of this, we note that excavations there recovered only a few Maverick Mountain Black-on-red sherds and a partial bowl. Based on a similar mix of pottery types, we infer the termination of occupations with rooms located east of the Curtis Trench a few years after the burn event. At this point, habitation of only a few of the BUS rooms west of the Curtis Trench continued. However, given the presence of only a few Salado polychrome sherds, which only occurred in a single room, it is likely depopulation of the BUS was effectively complete by AD 1300, or shortly thereafter. Furthermore, use of the cremation cemetery located east of House I, which showcases a sequence of use dating back to the Two Dog phase, likely terminated at the same time. Finally, the presence of a small number of Maverick Mountain Black-on-red sherds, with slightly more Salado polychrome sherds, in several rooms around the northern plaza, indicate this area continued in use after AD 1300.

In contrast, the mix of pottery types associated with House IV includes a high percentage of White Mountain Red Ware. This indicates the construction of the House IV BUS within an existing compound occurred after AD 1250 yet prior to the advent of Maverick Mountain Black-on-red around AD 1275. The distinctive predominance of Maverick Mountain Black-on-red with low amounts of corrugated pottery contrasts with assemblages associated with other structural units. For instance, compared to House I, which primarily dates before AD 1300, as well as Houses II and III, both of which primarily date after AD 1300, the occupation of House IV appears to span the mid-thirteenth to early fourteenth centuries. Therefore, habitation of House IV ceased sometime after the advent of Salado polychrome, perhaps around AD 1325 based on the higher frequencies of Maverick Mountain Black-on-red and low frequency of Salado polychrome. House IV has a strong signature for the Goat Hill phase and may represent an intrusion of Ancestral Pueblo groups into the site (Neuzil 2008; Rogers et al. 2021). Although the data from House IV are limited, it is possible it may have replaced House I as the primary Buena Vista Ruin BUS after AD 1275. Finally, the ceramic assemblages indicate the presence of Bylas phase structural components at Houses II and III, which showcase evidence for occupation up to the late thirteenth century, followed by a hiatus within House III given the absence of Maverick Mountain Black-on-red, and then reoccupation after AD 1300 given the abundance of Salado polychrome. By the mid-fourteenth century, expansion of these SUSes occurred, and these became the center of the Safford phase (AD 1300-1450) occupation at the Buena Vista Ruin.

Compound Occupation Histories

Based on investigations by Tatman (Brown 1973; Tyberg 2000) and Mills and Mills (1978) at the Buena Vista Ruin, we outline the following construction and abandonment sequence. First, the tree-ring analysis indicates leveling of a group of earlier structures occurred, with the House I BUS built over these remains ca. AD 1250. Next, around the mid-thirteenth century, modification of the House IV compound west of House I into a small BUS occurred, possibly as an extension of the House I complex. Following this, we suggest a brief occupational termination of House I with floor assemblages systematically removed shortly after the advent of Maverick Mountain Black-on-red. A Goat Hill phase affiliated group occupied the BUS, with mortuary features identified beneath of the floors of several rooms. This occupation was apparently brief; however, as the southwest portion of the BUS contains evidence for a destructive event based on extensive burning. We suggest this event was the result of increased conflict (see Crary and Rogers in press; Rogers et al. 2021) and coincided with terminating occupations within the House III and potentially also House II compounds, and the shift of the House IV BUS into a Goat Hill phase roomblock occupation.

The sherd count data indicate the occupational termination of several rooms not destroyed in the House I fire, yet sporadic occupation persisted in another group of rooms. The rationale for this divergence remains unclear and may remain unresolved given the data currently available. Nevertheless, the final termination of occupations within House I and possibly House IV

closely coincided with the advent of Salado polychrome and the rapid decline in use of Maverick Mountain Black-on-red. At around the same time, we, and Mills and Mills (1978), note the occupation of House II and a significant expansion of it into a large roomblock built over a Bylas phase compound at House III. Finally, our examination of internal trends in ceramics, architecture, and tree-ring dates suggests the construction of a kiva in the late thirteenth century based on the presence of a large circular depression located near Houses II and III and mapped by Fewkes (1904); however, without further investigation this remains tentative.

Functionality of the BUS

Although construction of the SUS was certainly within the means of an extended family, the planning, cooperation, material procurement, scheduling, and intrinsic architectural skill required for a BUS represent an extraordinary investment in labor and materials. We suggest this divergence relates to a greater emergence of local managerial elite individuals and lineages (Crary and Rogers in press). Therefore, to explore the functionality of the BUS, we provide a brief survey of the artifacts and architectural elements found at the Buena Vista Ruin BUSes. First, we note the general similarity of artifact assemblages from Houses I and IV, with both containing similar types of ceramic, chipped stone, ground stone, mineral, marine shell, jewelry, faunal bone, floral remains, textile, and copper artifacts, including four complete copper bells associated with cremated mortuary features in Room 24 (Mills and Mills 1978). There are, however, some differences in the quantities and specifics given the earlier and longer history of occupations within House I and the presence of a *Strombus* shell trumpet in Room 23 at House I. Another example are the sole occurrences of Mogollon-style palettes within House IV. The decorated pottery is composed primarily of Hohokam Buff and Brown Ware, with lesser quantities of Cibola White Ware and Maverick Mountain Black-on-red, although House IV does contain a greater proportion of Maverick Mountain Black-on-red than House I. A relatively smaller set of artifact types came from House I, suggestive of some systematic clearing of rooms. Nevertheless, the remaining artifacts included utilitarian pottery, hammerstones, ceramic disks, spindle whorls, bone awls, bone needles, maize kernels, manos, a pestle, metate fragments, a stone bowl, a projectile point, cordage, turquoise pendants, and beads, as well as worked and unworked marine shell, polishing stones, kaolin clay, pigments, and copper bell fragments. The spindle whorls, bone awls, and bone needles suggest textile manufacture, something we hypothesize (Crary and Rogers in press). Other activities present include potential shell and prestige good manufacture or caching and ceramic production. One unusual artifact, a human cranium fragment modified into a disk and perhaps representing a trophy, came from House I Room 19 (Mills and Mills 1978:46). Except for the marine shell and copper bells indicative of wealth and status differences, and the more anticipated maize and pestles, the House IV assemblage was similar. One unusual aspect of the House IV assemblage was a large quantity of cottontail, jackrabbit, mouse-eared bat, rodent, and deer bone liberally scattered throughout twelve rooms. Descriptions of similar dense collections of faunal remains from a BUS room at the Epley's Ruin are known (Editor Citizen 1873). Similarly, House I and House IV contained a macaw or thick-billed parrot mortuary feature, respectively (Emslie and Hargrave 1978). The macaw or thick-billed parrot from House I was recovered from the cremation area and likely dates to the Late Formative period, likely the same time as the ballcourt, whereas the exotic bird from House IV was recovered from below the floor of Room 21 and likely dates to the mid- to late-thirteenth century.

Our survey of SUS structural elements includes twelve Bylas phase compounds which compare favorably to the BUSes Mills and Mills (1978) refer to as Houses I and IV. Overall, the structural elements include entries, hearths, postholes, pits, mealing bins, and mortuary features. The SUSes and BUSes are similar in most respects. For example, only a few mealing bins are found among the SUSes and Mills and Mills identified one in House I, and postholes are rather common in both types of structural units. However, pits are more common in SUS than BUS rooms. Another difference is the recovery of subfloor infant mortuary features which occurred in twelve rooms at House I and in five rooms at House IV, whereas no similar mortuary features were present in the excavated SUS rooms. However long in duration, these appear to be associated with Goat Hill phase occupations as Rogers et al. (2021) revise. These features help date the occupational termination for the southwest portion of House I and suggest a residential use for the Buena Vista Ruin BUSes restricted to the Goat Hill phase, with House IV extended into the early fourteenth century.

However, the most significant distinction between the SUSes and BUSes is the entry placement and the presence or absence of hearths. For the SUSes, a wall entry facilitated access into a single dwelling or two-room suite, where hearths are frequent, suggesting the pairing of two habitation rooms to a common courtyard. In contrast, few hearths are located in the rooms at the House I BUS. Moreover, the layout of the BUS supports intentionally restricted exterior access into the ground floor rooms, with large groups of interior rooms interconnected by wall entries, and access to

the upper stories gained exclusively via hatchways in the lower floor roofs. It also appears that inhabitants sealed the entries when the occupation ceased. Thus, the BUS acted as space inaccessible to most members of the community. Figure 7 provides access diagrams for the West and East Room groups and a House I plan map showing rooms with hearths and multiple stories. Overall, the pattern that emerges is that of an architectural maze of ground-floor rooms without hearths interspaced between rooms with hearths that commonly provided access. We infer this intentional restriction of space to elite actions that may include ritual activities that underpinned their authority.

As the excavation of the House IV BUS came at the end of Mills and Mills's investigations at the Buena Vista Ruin, we assume this work was rushed and not well documented. In part, we infer this due to the brevity of their feature descriptions and the sketchiness of the plan map. Unlike those provided for the other structural units, the House IV map was not compiled using a plane table and alidade, is crude, lacks precision, an external reference, dimensions, or even a scale. Mills and Mills also did not employ blowing equipment, which would have greatly facilitated the identification of abutments, bounding, and sealed entries. Therefore, unlike the House I BUS, we assume the excavators perhaps missed some sealed entries at House IV, or less likely but possible merely did not report them, and access was initially similar to that found at the Bylas phase compounds given the placement of early rooms. Therefore, the ground floor roof facilitated access to the upper story. However, with the Goat Hill phase occupation, we note the sealing of ground floor entries, resulting in access exclusively gained through the roof or upper stories. Nevertheless, similar to House I BUS, only a few hearths are present in the House IV rooms.

Overall, only 25 percent of the rooms at the Buena Vista Ruin Houses I and IV BUSes have hearths. This is similar to the Early (34 percent) and Late (28 percent) Component rooms with hearths at the large central Bylas phase compound at AZ V:16:10(ASM) Unit 2. This is the inverse of the vast majority of Bylas and Safford phase compounds used in the survey, with an average of over 65 percent of the rooms with hearths. If rooms with hearths represent habitation structures, we assume rooms without hearths acted as spaces for work activities and storage. Another interesting feature found in one room at the House I BUS is an informal decoration panel with at least four textile designs of various sizes etched into the wall near the entry (Mills and Mills 1978:33).

Given these patterns, we suggest that BUSes functioned as places for activities undertaken by emergent elites, including ritual, but not as elite residences. It is possible that some rooms in the Buena Vista Ruin BUSes functioned as residences; however, the low occurrence of hearths suggests this was not the primary role. Rather, we argue BUSes acted as spaces for elite managerial and administrative roles, including as places of ritual authority underpinning elite individuals or

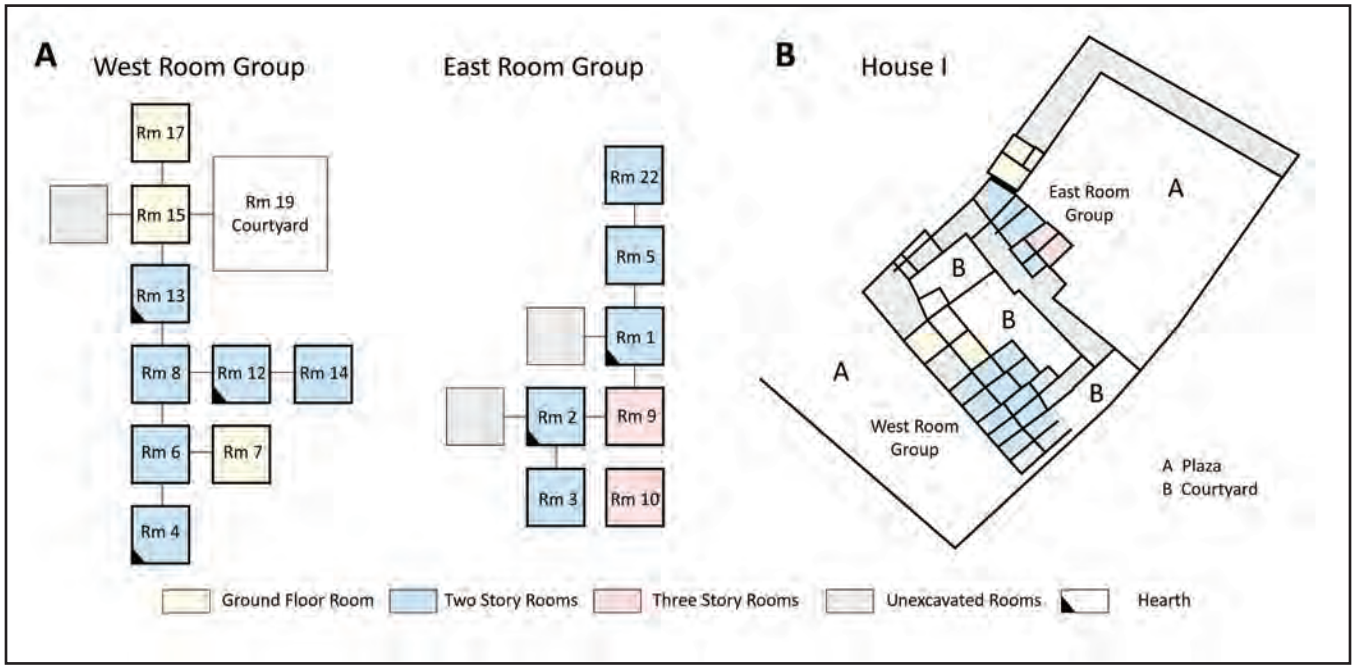

Figure 7. Access diagrams for the House I West and East Room groups with a plan map of House I showing rooms with hearths and multiple stories.

lineages, potential storage of maize for redistribution, storage of status items such as *Strombus* shell trumpets and copper artifacts, and production of cotton textiles. These conclusions fit well with similar assessments in other areas of the SW/NW as discussed below. The use of rooms within the BUS or the larger compound for interment of the deceased, which showcases minimal variation in treatment of the individuals interred outside of the BUS, we interpret as providing direct, ancestral ties to larger land use rights. Significant shifts in the BUS-SUS dichotomy during the Goat Hill phase and certainly the Safford phase may indicate the dissolution of these authorities and preference for different forms of community organization (see Crary and Rogers in press; Neuzil and Woodson 2014; Rogers et al. 2021).

COMPARISONS BETWEEN BIG UNIT STRUCTURES AND SIMILAR COMPOUNDS IN THE SW/NW

Despite differences in construction material, Fewkes (1904) compares the general configuration of the Pueblo Viejo Ruin BUSes to large, late prehispanic plaza-oriented roomblocks in the Silver Creek Area. Admittedly, there are superficial similarities in general design; however, archaeological investigations conducted at hundreds of sites scattered throughout eastern Arizona and western New Mexico, together with Douglass' tree-ring chronology (McGraw 2000), offers a complex, nuanced understanding. For instance, we know that by AD 1250 the construction and occupation of the Pueblo Viejo Ruin BUSes initiated but occurred primarily in the second half of the thirteenth century. In contrast, whereas small incipient plaza-oriented roomblock sites such as the Broken K Pueblo (Hill 1970) were contemporaneous, the large plaza-oriented roomblocks Fewkes mentions date to the fourteenth century (Reid et al. 1996).

Unlike the plaza-oriented roomblocks, numerous SUS compounds surround each multi-story BUS. We interpret this combination to represent a hierarchical two-tiered community with residential compounds (i.e., SUSes) surrounding an administrative center (i.e., BUS) associated with production, processing, procurement, and the storage of surplus. This grouping of small and big structural units is similar to the Bonito phase settlement system identified in Chaco Canyon and the San Juan Basin, with small residential roomblocks associated with Great Houses (Kantner and Mahoney 2000; Lekson et al. 2006). The multi-story Great Houses also tend to contain large groups of interconnected ground floor rooms with few hearths (Bernardini 1999; Durand 2003; Lekson 1986). Durand (2003) argues that the preponderance of the evidence supports the primary role of Great Houses was as ritual centers that underpinned the broader Chacoan system. We call attention to the presence of strikingly similar examples at the Kiatuthlanna Ruin (Roberts 1931) and Village of the Great Kiva (Roberts 1932) in the Zuni Cibola Area. However, these Chaco Canyon and Zuni Cibola Area Great House structures primarily date from the tenth to the mid-twelfth century (Fowler et al. 1987; Kantner and Mahoney 2000; LeBlanc 1989), a century prior to the construction of the Buena Vista Ruin House I BUS. Consequently, we do not perceive these as related phenomena.

Another similar system of SUSes surrounding plazas and platform mounds is in the Phoenix Basin Area. However, the massively built Casa Grande Ruin postdates AD 1300 (Wilcox and Shenk 1977), although the use of adobe compound architecture likely predates that by 25 years (see Clark 1995; Doelle et al. 1995; Gregory 1987). A somewhat similar and contemporary hierarchical settlement system with SUSes and BUSes developed in northwest Chihuahua along the Casas Grandes Valley, centered at Paquimé. Situated on a terrace above the broad San Miguel River floodplain, the Medio period settlement system differs from that we identified within the SCSA as the former is composed of a single massive multi-story structure surrounded by only a few smaller, yet massively built, compounds, open plazas, ballcourts, ceremonial mounds, and large roasting pits (Di Peso 1974). Several much smaller, yet often massively built structural units associated with I-shaped ballcourts occur across northwest Chihuahua (Whalen and Minnis 2001, 2009). However, these structural units typically lacked surrounding smaller residential units and, although large Medio period compounds contain numerous interconnected rooms, hearths were relatively common as compared to BUSes in the SCSA. Although somewhat contemporary, given the differences, any relationship between the SCSA BUSes and the monumental architecture at Casas Grandes is unclear. Finally, we draw attention to a similar contemporary, two-tiered settlement system with monumental architecture found in the adjacent Tonto Globe Area. Here, Early Classic period communities composed of numerous residential compounds clustered around a large, edified structure (Craig et al. 1998; Doelle et al. 1995). However, instead of a BUS, these central structures are platform mounds that are composed of either a walled base or group of ground floor rooms that were filled to form a platform upon which the construction of a group of second-story rooms occurred. Platform mounds, particularly those from the Phoenix Basin, however, also served as community foci for elite or ritual power and authority (Downum 1998; Gregory 1987; Haury 1945), although instances from the Tonto Globe Area suggest they acted differently as integrative facilities (Craig et

al. 1998). As a result, although we can contextualize the occurrence of a two-tier settlement hierarchy within several nearby contemporaneous, slightly earlier, or slightly later dating systems, we lack an amply comparable system suggestive of its origin. We suggest that although the BUS-SUS dichotomy within the SCSA was not unique given the parallel occurrences, particularly in the Tonto Globe and Phoenix Basin areas, its specific development was locally contingent and represents an integral factor in many of the historical processes that characterize the Bylas phase.

CONCLUSION

We synthesized historic accounts and archaeological research spanning 170 years to demonstrate the presence of an underrecognized example of prehispanic monumental architecture referred to as Big Unit Structures. Overall, we identified 17 of these BUSes within the SCSA of southeast Arizona. Although concentrated in the Pueblo Viejo District, others occur in the Stockton Wash, San Carlos, and Rice districts. Initially, we hypothesized a strong similarity to platform mounds, such as those found in the Phoenix Basin and Tonto Globe areas. We initially believed that they had been built in the fourteenth century. However, upon a careful reading of Fewkes (1898) and the detailed review of Mills and Mills (1978) investigations at the Buena Vista Ruin, it became obvious these massively built multi-story structures are something different. The SCSA BUSes represent enormous investments in materials, labor, and time, as well as requiring a high degree of engineering expertise. This far exceeds the limited resources of the Bylas phase household or extended family. Building projects on this scale also requires planning, cooperation, scheduling, and elites able to organize and task the acquisition and transport of materials, and direct construction. However, it is unlikely elites emerged as the result of building BUSes. Rather the opposite is proposed; that the rise of the BUSes is directly due to the emergence of managerial elites.

Of course, this begs the question of how and why a hierarchy of managerial elites emerged from what was essentially an agricultural-based egalitarian society with minimal evidence for preexisting social hierarchies (see Neuzil and Woodson 2014). Although far exceeding the scope of the current study, several converging lines of evidence suggest the emergence of elites in the SCSA, and more specifically the Pueblo Viejo District, developed from a combination of factors that initially stemmed from the expansion of Hohokam culture and ballcourt system in the Formative period (Crary and Rogers in press; Wallace 2014). Another factor is the development and management of large, disarticulated irrigation systems located on the Gila River floodplain (see Doolittle and Neely 2004; Neely 2005). We suggest that the demand for raw materials and high-status items associated with the rise of Chaco Canyon as a polity in the eleventh century triggered a far-reaching socio-economic chain reaction, impacting groups as far away as in the SCSA (see Lekson 2009). We suggest the increased demand for high-status items beginning in the Late Formative period motivated the construction of large dry farming systems located on the terraces and lower bajadas, and extensive irrigation systems on the northern slopes and upper bajada of Mount Graham, such as those Neely and Lancaster (2019) document. We (Crary and Rogers in press) propose elsewhere that these agricultural systems focused at least partially on the high-risk cultivation of cotton ultimately for export as either an unspun raw material or finished, woven textiles.

We suggest another factor in the development of a nascent market associated with a complex exchange network linked to areas that surrounded the SCSA. We hypothesize this involved reciprocal trade in commodities; however, the data currently available are ambiguous. We suggest, though, that this trade included several high-status items such as turquoise, decorated pottery, marine shell, copper bells, and exotic birds found at Chaco Great Houses (Watson et al. 2015), the latter three of which originated in southwestern Sonora or Sinaloa. We suggest that lacking access to other trade goods within the SCSA, the principal item of exchange was cotton (Crary and Rogers in press) and that this underpinned the economic wealth of elite individuals or lineages. By around the early-thirteenth century, the combination of these intermingled factors led to the emergence of managerial elites and the construction of BUSes.

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