BIOARCHAEOLOGY OF THE FIRST FARMERS IN THE SONORAN DESERT

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ABSTRACT

Several hundred human burials have been recovered from Early Agricultural period (1200 B.C.-A.D. 50) sites located throughout the Sonoran Desert. These burials represent a substantial sample of the earliest farmers from the North American desert west and provide a unique insight into how the transition to an agricultural lifeway affected the health and lives of these peoples. The burial samples represent similar numbers of males and females of all adult age groups, lack juvenile remains, and demonstrate a wide variety of burial practices. Stature estimates reveal that these were generally relatively tall individuals, and limited evidence of infectious and degenerative diseases indicate the population enjoyed very good health. However, a high rate of trauma, some of which was violent in nature, suggests a significant level of conflict. Oral health was generally poor, although high rates of caries and tooth loss were likely the result of a balanced diet that relied on highly cariogenic resources of local cactus, as well as a reliance on domesticated corn. This mixed subsistence economy appeared to have remained relatively stable for nearly 2,000 years, but evidence from tooth wear indicates mechanical processing of existing resources may have intensified during the Cienega phase (800 B.C.-A.D. 50).

The foraging to farming transition represents one of the most profound changes in human behavior during the last 10,000 years. Ramifications of this change have enduring effects on human health, offering insights into the etiology and distribution of many modern diseases. The global effects of subsistence changes to human health have been well documented in numerous studies of prehistoric burials (for synthetic treatments, see Cohen and Armelagos 1984; Cohen and Crane-Kramer 2007; Larsen 2000; Steckel and Rose 2002). The shift to greater reliance on domesticated cultigens and animals caused a general decline in human health (Cohen and Armelagos 1984), related to increasingly aggregated sedentary populations and changes in diet and nutrition. Larger sedentary populations created poor sanitary conditions, which promoted the spread of communicable diseases (Goodman et al. 1984; Larsen 1997, 2000, 2002). Changes in subsistence activities, dietary breadth, and diet composition caused more dental disease and created nutritional inadequacies (Nelson et al. 1994; Steckel et al. 2002). The primary goal of this paper is to examine a suite of biological characteristics that are often impacted by cultural processes, including demography, health and disease, and diet, to identify patterns associated with the transition to agriculture among the earliest farmers in the Sonoran Desert.

To date, just fewer than 400 human inhumation burials have been recovered from Early Agricultural period (1,200 B.C.-A.D. 50) sites in the Sonoran Desert; these remains represent the earliest PreColumbian inhabitants of the region. Very few burials have been found that predate this Early Agricultural sample, not just within the Sonoran Desert, but throughout the North American desert west (Mabry 1998). Only three inhumations thought to be associated with the Middle Archaic period have been previously identified, estimated to date between about 3,800 and 1,200 B.C. Toward the end of the Early Agricultural period, a major shift occurs in cultural practice of mortuary ritual as cremation burial appears and becomes increasingly common (Mabry 1998; Watson and Cerezo-Román 2010). This pattern continues until inhumation burial again gains some popularity during the Hohokam Classic period (A.D. 1150-1450) (Reid and Whittlesey 1997).

Therefore, the Early Agricultural period burials are extremely important for several reasons. First and foremost, as the largest sample of early inhabitants of the Sonoran Desert, skeletal remains provide an important way to reconstruct population

composition, movement, and relationships with descendant communities. Second, as the earliest farmers and the first people to settle permanent villages in the region, this sample is important to address some of the major questions about human groups, their adaptations, and their diet and health during the introduction of agriculture. Finally, given the dearth of inhumation burials from the Sonoran Desert, the sample is an important source of information about the people who called this area their home.

To date, 14 Early Agricultural period sites from southern Arizona and northern Sonora have produced approximately 387 human inhumation burials (Table 1). Radiocarbon dates directly associated with burials range between 3,100 B.C. and A.D. 200. These span the entire duration of both the Cienega (800 B.C.-A.D. 50) and the San Pedro (1200-800 B.C.) phases, as well as some portion of the unnamed phase (2100-1200 B.C.) just prior. Several other sites with Early Agricultural components have produced fragmented remains, although these are very limited and not useful for reconstructing a larger picture of demography, health, and diet of these early farmers. Additionally, many of these sites produced cremation burials that can be attributed to the terminal end of the Early Agricultural period. However, the fragmented nature of these burials precludes their use in comparisons with the more numerous and temporally expansive inhumation samples.

An examination of Table 1 shows that the majority of the Early Agricultural period burials (n = 286) were recovered from a single site, La Playa, SON F:10:3 (ASM), located in north-central Sonora, Mexico (Figure 1). The next largest skeletal collection is 24 individuals from the Wetlands site, AZ AA:12:90 (ASM) (Guthrie and Lincoln-Babb 1998). Although only 13 of the burials from La Playa have been directly dated to the San Pedro phase, as many as 80 individuals may be associated with this early phase, based on burial depth and stratigraphic association (Watson 2005). Several of these early burials may actually predate the arbitrarily defined start of the Early Agricultural period. These significant disparities in the numbers of burials highlight one of the major differences between La Playa and the other sites.

With few exceptions, the other burials have been recovered from archaeological cultural resource management projects, which are often restricted to the limits of the project area, forcing archaeologists to excavate only a fraction of the site. In contrast, recovery at La Playa has been largely driven by academic research and has been focused equally across the entire expanse of the site, the majority of which is confined to about a 4-km^2 area (Watson 2005). Unfortunately, the large number of burials recovered from La Playa are the direct result of extensive erosion. This has been a limiting factor for the study given that many of the burials, then, have poor context and few direct associations with other features or absolute dates. These erosive processes have vastly limited the contextual control over the burials. This has not been a problem at any of the other Early Agricultural period sites where spatial and chronological controls are fundamental elements to the excavations.

Despite the wide geographic distribution of these Early Agricultural period burials (see Figure 1), many similarities have been identified between these sites and the skeletons recovered from them. As opposed to subsequent occupations in the Sonoran Desert, the Early Agricultural period inhabitants appear to have shared many cultural and biological traits across this expanse (Watson and Cerezo-

Table 1. Early Agricultural period skeletal samples, by site and archaeological phase.

Site Name	ASM Site No.	*n*	Phase	Citation
Clearwater	AZ BB:13:6	2	Cienega	Diehl 1997
Coffee Camp	AZ AA:6:19	3	Cienega	Dongoske 1993
Donaldson	AZ EE:2:30	5	Cienega	Minturn and Lincoln-Babb 1995
La Playa	SON F:10:3	286	San Pedro (13), Cienega (25)	Watson 2005
Las Capas	AZ AA:12:111	15	San Pedro	McClelland 2005
Los Morteros	AZ AA:12:57	3	Cienega	Wallace 1995
Los Ojitos	AZ EE:2:37	10	Cienega	Minturn and Lincoln-Babb 1995
Los Pozos	AZ AA:12:91	23	Cienega	McClelland 2005
Pantano	AZ EE:2:50	3	Cienega	McClelland 2005
Rillito Fan	AZ AA:12:788	2	Cienega	Wallace 1996
Santa Cruz Bend	AZ AA:12:746	8	Cienega	Minturn et al. 1998
Stone Pipe	AZ AA:12:745	1	Cienega	Minturn et al. 1998
Valley Farms	AZ AA:12:736	2	San Pedro	Staten 2000
Wetlands	AZ AA:12:90	24	Cienega	Guthrie and Lincoln-Babb 1998

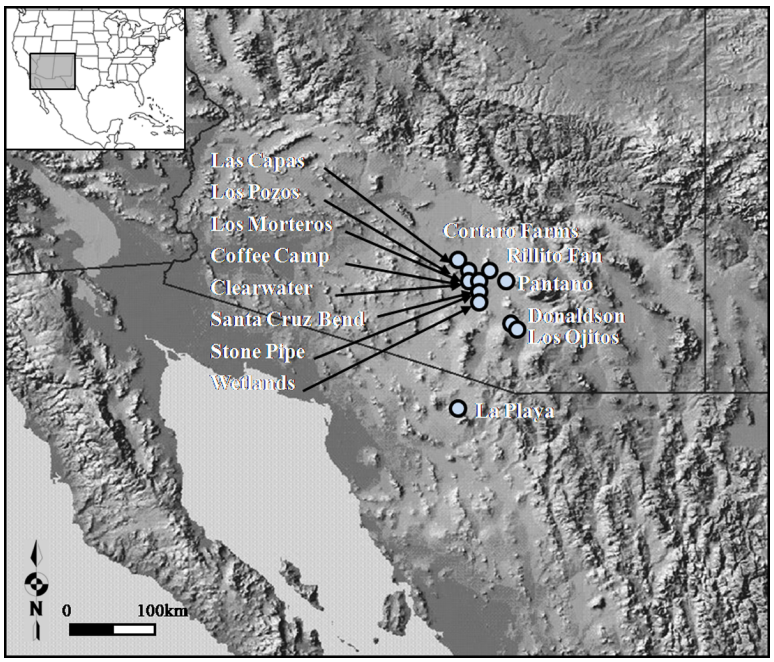

Figure 1. Location of Early Agricultural period sites in the Sonoran Desert.

Román 2010). Some comparisons will be made between site groupings to demonstrate similarities within the region, but the majority of the following analyses and generalizations consider the burials from all the Early Agricultural period sites as one skeletal assemblage, representing a biologically and culturally related population encompassing most of its inherent variability. Preservation of skeletons from these sites is highly variable and largely guided by site-specific taphonomic processes, such as soil chemistry, discovery techniques, and erosion. However, these samples have provided a wealth of information about the early farming populations in the Sonoran Desert.

MORTUARY TREATMENT

The Early Agricultural period mortuary practice is dominated by the almost exclusive use of inhumation burial (Mabry 1998; Watson and Cerezo-Román 2010). This pattern changes during the Cienega phase, however, with the beginning of cremation, after which time cremation becomes equally important or even the dominant form of mortuary treatment (Watson and Cerezo-Román 2010). Cremations likely associated with the terminal portion of the Early Agricultural period have been recorded at three sites, including Coffee Camp, AZ AA:6:19 (ASM) (Dongoske 1993), La Playa (Carpenter et al. 2005; Watson et al. 2006), and Stone Pipe, AZ BB:13:425 (ASM) (Minturn et al. 1998). It is likely, however, that cremations from several of the other sites in the sample could be associated with the transition to the ceramic period, although they have not been directly dated. The nature of, and processes involved in, the transition to cremation burial in the Sonoran Desert have been addressed elsewhere (Watson and Cerezo-Román 2010), and therefore, are not considered here. Further, because the exact timing and extent of cremation burial is inadequately understood, and because cremations compose a very small percentage of burials dating to the Early Agricultural period, the sample considered here includes only inhumation burials.

The predominant patterns of body position at Early Agricultural period sites are flexed (61.2 percent) or semi-flexed (20.1 percent), although there are several variations in how the legs and the arms are placed (Figure 2; Table 2). Distinguishing positions (flexed, semi-flexed, or extended) is commonly associated with the degree of flexure of the femur from the hip. However, flexure of the lower legs, shoulder joint, and arms has been documented to vary 180 degrees in these burials. This pattern is similar between site groups within the region except the Cienega Creek samples, which completely lack flexed burials. When these samples are excluded, there are no statistically significant differences in burial positions between sites in the Tucson Basin and La Playa ($\chi^2 = 3.543$; $d.f. = 1$, $p = 0.315$). Sampling bias due to the limited number of burials from the Cienega Creek sites ($n = 15$) could play a role in the observed differences, or burial practices could differ for the populations who lived in the Cienega Creek area. Although represented to a lesser extent, extended burials (15.5 percent) have also been recorded at several Early Agricultural period sites.

Several individuals (3.2 percent) have been identified as not having been accorded a proper burial; that is, individuals who were placed vertically, head-first in deep pits, or forced into pits that resulted in dislocated joints and postmortem fractures. None of these individuals had any signs of burial treatment, such as ochre staining or associated artifacts, suggesting a very different process and significance in placement of the body. These cases have been referred to elsewhere as body disposals (Watson et al. 2009).

A relatively equal number of individuals were placed on both right and left sides and in a supine position; however, seated and prone placements

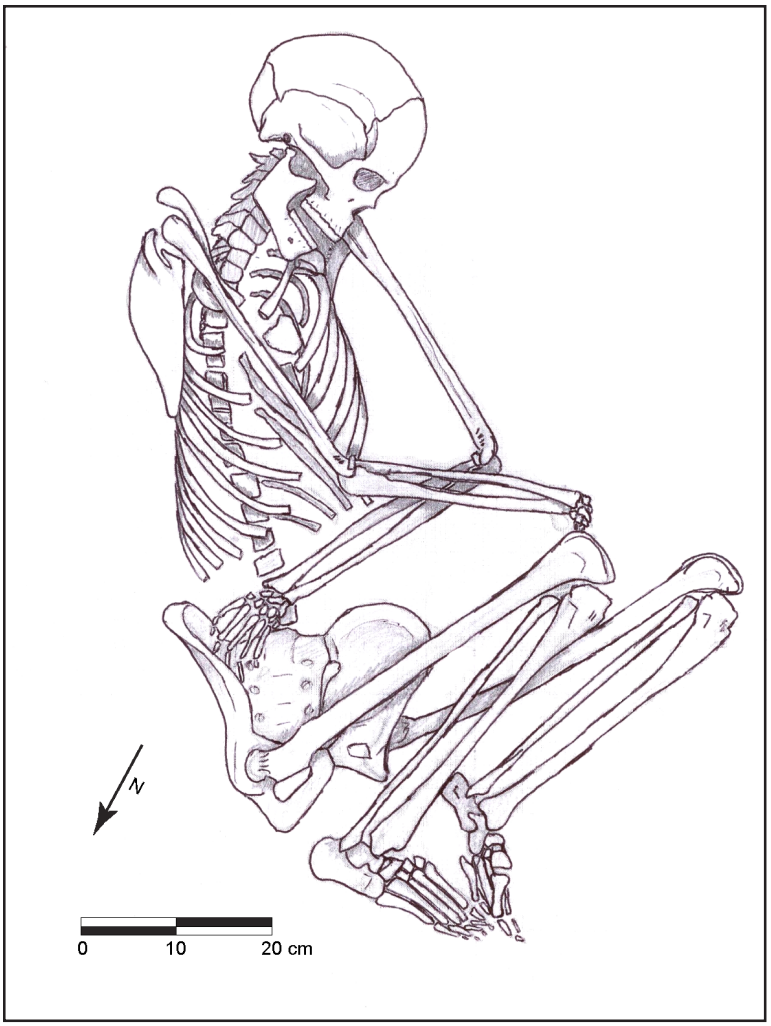

Figure 2. Sketch map of Feature 545B, a flexed inhumation burial, from the La Playa site, SON F:10:3 (ASM), Sonora, Mexico.

were also not unusual (see Table 2). These patterns are similar between site groups within the region ($\chi^2 = 16.857$; *d.f.* = 10, $p = 0.078$). The direction of body placement or cranial orientation varied dramatically among Early Agricultural period burials (see Table 2). Although there is an apparent preference for a western orientation, just less than half (48.5 percent) the burials from the La Playa site were oriented west to some degree, clearly biasing the results for the entire Early Agricultural period sample ($\chi^2 = 26.492$; *d.f.* = 6, $p > 0.001$). Equivalent percentages for burial orientation are observed for the other cardinal directions at La Playa and the Tucson Basin sites, while the majority of burials (66.7 percent) in the Cienega Creek samples are oriented northward. Although there appear to be some differences in body position and placement among sites, the majority of Early Agricultural period burials are likely opportunistic in that the mourners often reused existing features, such as storage pits or ovens, for interment (Watson and Cerezo-Román 2010). Further support for this is provided by the lack of formal cemeteries at Early Agricultural period sites, a characteristic more often associated with later Hohokam and Trincheras sites in the Sonoran Desert (Cerezo-Román and Wallace 2008; McGuire 1992; Mitchell and Brunson-Hadley 2001).

Artifacts associated with Early Agricultural period burials are limited. Just under 12 percent (11.7 percent) of the recorded burials have funerary assemblages, compared with later Hohokam interments, which can vary between 52 percent and 95 percent (McGuire 1992; Mitchell and Brunson-Hadley 2001; Watson and Cerezo-Román 2010). Further, the pattern does not differ significantly between site groups within the region: Tucson, 14.9 percent; Cienega Creek, 14.3 percent; and La Playa, 10.5 percent ($\chi^2 = 1.358$; *d.f.* = 2, $p = 0.507$). The variety of associated artifacts is also somewhat limited. Shell products constitute 39.5 percent of the total artifacts present in Early Agricultural period burials. Most of these shell artifacts are jewelry of various species, primarily beads and some bracelets. Utilitarian ground stone (25.9 percent), such as manos and pipes, and bone (25.9 percent) artifacts are the next most common, followed by projectile points (11.6 percent), and a few other random pieces (9.3 percent), such as quartz crystals, pigment, and plant or fiber objects. Evidence suggests that many of the inhumations were covered in red ochre, likely rubbed on the body shortly after death. Despite the fact that durable grave goods are somewhat sparse among the Early Agricultural period burials, there are some indications that perishable grave offerings may have been abundant.

DEMOGRAPHY

A large segment of the Early Agricultural period burial sample has been dated ($n = 139$, or 62.2 percent), either directly or through association. The majority of these individuals ($n = 109$, or 78.4 percent) date to the Cienega phase (Table 3). Although it is clear that most of the burials date to this late

Table 2. Characteristics of burial treatment within the Early Agricultural period skeletal sample[a].

	Percent	*n*
Position		
Flexed	61.2	143
Semi-flexed	20.1	44
Extended	15.5	34
Other	3.2	7
Side		
Right	30.0	62
Left	28.0	58
Supine	30.4	63
Prone	4.8	10
Seated	6.8	14
Orientation		
North	21.2	51
East	18.3	44
South	18.7	45
West	41.9	101
Treatment[b]		
Ochre	18.5	68
Artifacts	11.7	43

[a]Percentage of individuals with attribute recorded (*n*).
[b]Percentage of individuals with attribute in total sample (*n* = 368).

phase, it is important to note that the individuals in the sample represent the entire duration of, and possibly just prior to, the Early Agricultural period. These remains are critical in understanding how the first farmers adapted to agriculture in the Sonoran Desert, as well as the effects those decisions had on their biology and culture.

Of the 387 inhumations, the majority represent adult individuals (81 percent), including relatively even numbers of males (49.8 percent) and females (50.2 percent) (see Table 3). The equal representation of sexes remains constant among site groups in the region ($\chi^2 = 2.232$; *d.f.* = 2, $p = 0.328$). Most adults survived beyond 30 years of age (58.3 percent), with up to 18 percent living more than 45 years. This distribution identifies the residents of these sites as a relatively "old" population. Except high infant mortality in the sample, a pattern common to most pre-industrial societies, most deaths occur during the fourth decade of life (Figure 3). The comparatively limited presence of juveniles in the sample (19.0 percent) is probably the result of the fragile nature of child and infant bones, the antiquity of the burials, and the various taphonomic processes that work to destroy such fragile remains.

Given the age-biased sample, reconstructing life tables and survivorship curves to consider population compositions in this sample is somewhat limited. Regardless, the sample contains substantial amounts of information about the lives and deaths of the earliest farmers in the Sonoran Desert. The fact that such a large number of older and senescent adults have been recovered indicates the population must have been relatively healthy and that people lived long, productive lives. Additionally, the distribution of individuals by sex and age categories does not vary between phases throughout the Early Agricultural period, suggesting this pattern was rather stable for almost 2,000 years.

HEALTH AND DISEASE

Adult statures varied considerably, ranging from 155 cm to 174 cm for males (5′1" to 5′7"), and from 145 cm to 165 cm for females (4′7" to 5′4"). However, the modes for both sexes were relatively high, indicating a fairly tall population overall. These stature estimates indicate that nutrition and health, at least during development, was adequate. Most of the individuals were rather slender in build, as indicated by long bone robusticity. Long bone robusticity has also been used as a proxy for estimating biological and behavioral differences between individuals and within populations. Cross-sectional measurements of the long bones have been considered in a few studies of Early Agricultural period skeletons.

These studies have consistently demonstrated that males display more elongated femoral cross sections than females, which indicates more long-distance travel over rough terrain, a pattern more often characteristic of dedicated foraging populations (McClelland 2005; Ogilvie 2005). The female cross-sectional measurements are more characteristic of

Table 3. Distribution of Early Agricultural period skeletal sample, by archaeological phase, sex, and age.

Phase	Percent	*n*	Sex	Percent	*n*	Age	Percent	*n*
San Pedro	21.6	30	Male	49.8	139	Neonate	1.1	4
Cienega	78.4	109	Female	50.2	140	Infant	6.5	25
						Child	5.9	23
						Adolescent	5.4	21
						Adult	81.1	314

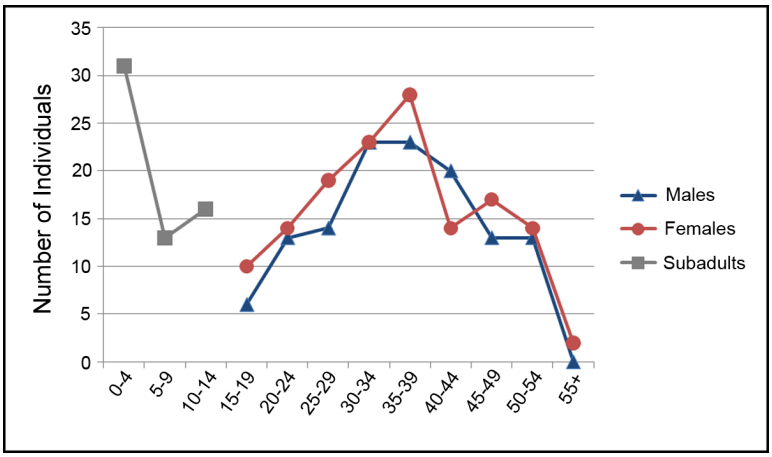

Figure 3. Mortality profile of the Early Agricultural period skeletal sample.

fully sedentary agricultural groups. These analyses offer a glimpse into the nature of sex-based gender roles in this mixed-subsistence economy, in which men likely continued to make long-distance foraging forays while women were more likely to stay close to the village and possibly tend to the fields.

Skeletal lesions (bone pathology) of infectious disease are relatively infrequent in the Early Agricultural period skeletal remains (Watson and Cerezo-Román 2010; Watson et al. 2006). Most evidence for infection was non-specific bone lesions, such as discrete periosteal lesions on long bones (localized infections of the periosteum), and these affected only 13.0 percent of the individuals for which the pathology could be recorded in the sample (30 individuals out of 231). A few adult individuals (n = 15, or 6.5 percent) show signs of more serious systemic infections, including osteomyelitis and reactive bone lesions on ribs, vertebrae, and hip bones, which are probably from tuberculosis (n = 5) (Watson et al. 2006). A female burial from La Playa with extensive lesions suggestive of tuberculosis was dated to the Cienega phase (Villalpando et al. 2002; Watson et al. 2006). Evidence for anemic reactions are also rare, affecting only 11.3 percent of the sample in which the pathology could be recorded (26 of 231 individuals); when present, it is mild to moderate in form. Functional stress and degenerative disease were somewhat more common (33.8 percent), although this is not surprising given the older ages of the individuals in the sample (78 of 231 individuals). However, the sample generally exhibited limited amounts of functional stress with age, indicating a life relatively free from degenerative disease.

Evidence for trauma in skeletal lesions was identified in 23.6 percent of the individuals in the Early Agricultural period sample for which the pathology could be recorded (54 of 229 individuals). An estimated 11 percent of the lesions were clearly indicative of violence (Watson et al. 2009). These patterns are similar among site groups within the region: Tucson, 29.4 percent; Cienega Creek, 33.3 percent; and La Playa, 25.8 percent (χ^2 = 6.358; $d.f.$ = 2, p = 0.199). These lesions include numerous crania, both male and female, and mandibles with trauma of a violent nature, several of which have fatal skull fractures. Unhealed leg fractures, rib fractures, and several back injuries, primarily males, were also recorded. Other evidence for fractures includes arm, wrist, hands, legs, and toe bones. One older female from La Playa has a severed right forearm with osteomyelitis, indicating an amputation of her right hand and lower forearm years prior (Watson et al. 2006).

Overall, the skeletal evidence indicates the early farmers of the Sonoran Desert were relatively healthy. The limited presence of infectious disease and nutritional deficiencies suggest population densities were moderate and food security was relatively good. However, evidence of a considerable level of trauma, having affected almost one-quarter of the individuals in the sample, suggests that, within a mixed subsistence economy, a combination of foraging and interpersonal violence took a toll on the populace. It could also be suggestive of social tensions, especially since much of the trauma appears to have been violent in nature. The transition to permanent settlements and larger communities may have led to increased social density—that is, greater intensity of interpersonal interaction—that resulted in violence.

DIET

The diet of past populations can be reconstructed using numerous methodologies, and direct biological evidence from skeletal remains can contribute significantly to these studies by focusing on skeletal lesions related to nutritional deficiencies, oral health, and bone chemistry. Markers of oral health in the Early Agricultural period have been the focus of several researchers (Gutherie and Lincoln-Babb 1998; Huckell and Huckell 1988; McClelland 2005; Minturn and Lincoln-Babb 1995, 2001; Minturn et al. 1998; Staten 2000; Watson 2005, 2008a, 2008b). Three variables in particular have been commonly used to evaluate the diet and nutrition of early farmers: caries, antemortem tooth loss, and attrition.

The presence and severity of caries lesions are often cited as important indicators of the relative abundance of cariogenic carbohydrates in the diet

(Larsen 1997). Antemortem tooth loss also reflects dietary composition, although it is the result of a cumulative pathological process of multiple etiologies, which can include tooth wear and trauma (Hillson 2001). Rates of dental disease, reflecting overall differences in diet, are generally lower among groups who practiced foraging rather than agricultural subsistence strategies (Hillson 2001; Larsen 1997, 2002; Turner 1979). The rate and angle of tooth wear (dental attrition) has also been demonstrated to reflect the relative consistency of the foodstuffs consumed, and it differs significantly between foragers and agriculturalists (Hillson 2001; Smith 1984).

Carious lesions are relatively abundant in the Early Agricultural period sample, affecting almost 60 percent of the individuals and resulting in an overall caries frequency of 11.0 percent. This pattern is similar between site groups within the region: Tucson, 9.7 percent; Cienega Creek, 9.9 percent; and La Playa, 13.5 percent ($\chi^2 = 6.598$; *d.f.* = 2, $p = 0.159$). This frequency is relatively high when compared with populations that practiced a mixed subsistence economy (0.4-10.3 percent), and it is customarily attributed to the introduction of cultigens and agricultural dependence around the world (Turner 1979). However, several local edible plant species in the Sonoran Desert are equally cariogenic, such as cactus (pads and fruit), mesquite beans, and agave, in addition to the carbohydrate-rich domesticated crops such as maize and beans. Caries frequency did not vary significantly between the San Pedro and Cienega phases, indicating the plant resources being consumed remained relatively constant for the duration of the Early Agricultural period (Watson 2008b). This supports the idea that early farmers continued to practice a mixed subsistence economy.

Antemortem tooth loss was very common during the Early Agricultural period, affecting 45.0 percent of the individuals in the sample, resulting in an overall frequency of 17.0 percent. This pattern is nearly identical among site groups within the region: Tucson, 16.8 percent; Cienega Creek, 16.7 percent; and La Playa, 17.6 percent ($\chi^2 = 1.458$; *d.f.* = 2, $p = 0.659$). The majority of all teeth lost antemortem were mandibular molars, at 39.0 percent. As with caries, this is a high rate of tooth loss that is also traditionally correlated to agricultural dependence, although in this case, it may be more related to the consumption of locally available species (Watson 2008b). Although the prevalence of antemortem tooth loss did not differ significantly between the San Pedro and Cienega phase, it did between sexes in the sample. Females often lost more teeth than males, as much as twice as many in some samples (McClelland 2005; Watson 2005). This pattern has been observed in numerous prehistoric populations from around the world, but is more commonly associated with sedentary agricultural groups (Larsen 1997).

Dental attrition in the Early Agricultural period sample is relatively heavy, but is also extremely variable (Huckell and Huckell 1988; McClelland 2005; Minturn and Lincoln-Babb 1995; Watson 2008a). Attrition scores, which reflect the rate of wear during life, increased with age in the sample, but this did not vary by archaeological phase or between sexes (Minturn and Lincoln-Babb 1995; Watson 2005, 2008a).

The angle of wear on molar occlusal surfaces was measured in small subsamples from the Early Agricultural period sites of Los Ojitos, AZ EE:2:137 (ASM), in Cienega Creek (Huckell and Huckell 1988; Minturn and Lincoln-Babb 1995) and at La Playa in northern Sonora (Watson 2005, 2008a). Steeper wear angles have been shown to be consistent with consumption of a highly processed agricultural diet (Smith 1984). Huckell and Huckell (1988) (see also Minturn and Lincoln-Babb 1995) measured wear angle from four individuals dating to the Cienega phase to demonstrate that the angle fell within the range of dedicated agriculturalists as identified by Smith (1984). Watson (2008a) later measured wear angle in a substantially larger subsample of 84 individuals and found that the angle of wear increased throughout the Early Agricultural period, from the San Pedro phase to the Cienega phase (Figure 4). The steeper slope associated with the Cienega phase subsample fits nicely with the slope observed from the Cienega phase sample from Los Ojitos (Huckell

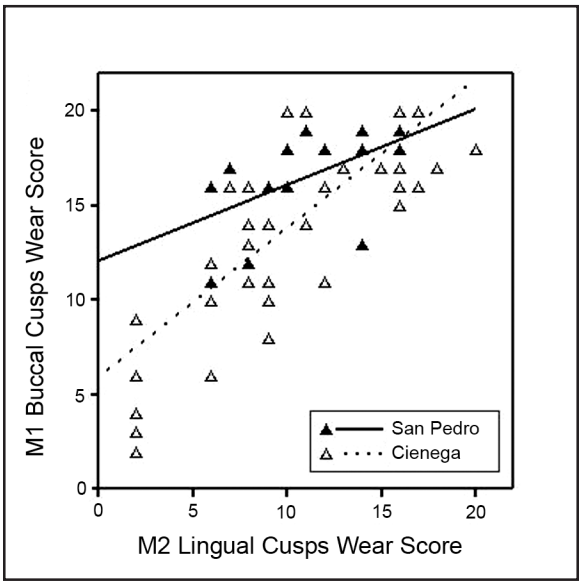

Figure 4. Scatterplot of principle axis slopes associated with molar angle wear in San Pedro and Cienega phase individuals from La Playa, SON F:10:3 (ASM). (Reproduced from Watson 2008a.)

and Huckell 1988; Minturn and Lincoln-Babb 1995). This evidence suggests that, although the overall contributions of plant resources to the diet of these early farmers did not change much for almost 2,000 years, as indicated by stable caries and antemortem tooth loss frequencies, they may have increased the mechanical processing of these resources during the Cienega phase, which would have introduced more stone debris and grit, resulting in more tooth-on-tooth contact and steeper wear angles (Watson 2008a).

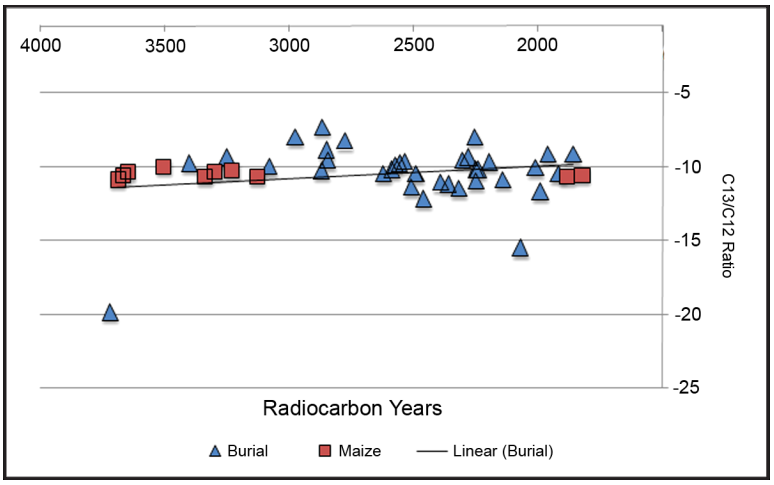

Figure 5. Scatter plot of radiocarbon dates and C^{13}/C^{12} isotope values from six Early Agricultural period burials.

Stable isotopes, particularly carbon and nitrogen, are commonly used to reconstruct diet from ancient skeletal remains (Schoeninger 1995). Isotopic analyses are most effect (9.2-12.2 δ^{13}C ‰PDB); changes in diet composition, such as the transition from wild plant to domesticate species. Preliminary analyses of a small sample of stable carbon isotope signatures from burials at La Playa provide some data to contribute to dietary reconstruction (Figure 5). The majority of the carbon isotope values fall well within the range of corn-based diets (9.2-12.2 ä^{13}C ‰PDB); however, there is a wide distribution of carbon signatures in the burials tested. The carbon signatures of maize remains from several Early Agricultural period sites plot nearly identically and within the range defined by the distribution of burial carbon signatures. This identifies a significant reliance on maize consumption, but also likely reflects the combination of a mixed subsistence economy and a diet based in numerous plants with a CAM photosynthetic pathway, such as various cactus species (which is somewhat similar to that of C4 plants, such as maize). These results further support other skeletal indicators that the population practiced a mixed subsistence pattern.

CONCLUSIONS

In the current study, a brief summary of the information gathered to date from a large sample of inhumation burials (n = 387) from Early Agricultural period archaeological sites in the Sonoran Desert is provided. In conjunction with previous work, the evidence presented here indicates an overarching biological and cultural continuity that connects people living at these relatively distant locations. Several conclusions can be drawn about the lives and deaths of these earliest farmers in the region. There appear to be no securely identifiable patterns to burial internment. Males and females, young and old, those with grave goods and those without all appear to be randomly placed in the ground after death. The population may have had a slight propensity for flexed burials, but cranial orientation varied dramatically, and the variation seen within and between sites suggests no formal pattern directed by particular cultural beliefs.

The remains show very little evidence of disease during life, indicating that populations were relatively healthy during the Early Agricultural period. There is, however, a significant amount of trauma observable in the sample, which may reflect some inherent level of violence in these communities as they transition to more sedentary lifestyles. Further, the dentitions display relatively poor oral health among much of the populace. These seemingly contradictory findings more clearly identify that dietary breadth may have been sufficient to maintain good bodily health, but the subsistence economy was based on foods high in carbohydrates that resulted in an elevated prevalence of dental pathology. Additionally, changes observed in tooth wear angles and stable carbon isotope ratios indicate that, although the overall base of the diet may have remained stable as a mixed subsistence economy for much of the Early Agricultural period, there was likely an increase in mechanical processing of existing resources during the Cienega phase. This appears to mirror changes observed in sites and artifacts from the San Pedro phase to the Cienega phase.

The information recovered from the Early Agricultural period settlements suggests the earliest farming populations residing in the Sonoran Desert maintained a stable but dynamic adaptation to their environment for nearly 2,000 years.

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