THE VIEJO PERIOD IN WEST-CENTRAL CHIHUAHUA, PART 3: ADDITIONAL STUDIES

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ACKNOWLEDGMENTS

For the work reported in this slim volume, we acknowledge Salvador Sotelo, Manuel Alderete, and Essio Jacques for permission to work on, respectively, Ch-272 (the Santa Rosa site) and Ch-312 (the Alderete site) in the Santa Maria valley and Ch-240 in the Santa Clara valley. J. M. Maillol and Dominique Cossu undertook the ground penetrating radar surveys of the three sites. As always, we are grateful to the Social Sciences and Humanities Research Council of Canada for its financial support, to the Consejo de Arqueología, Instituto Nacional de Antropología e Historia (INAH), for permission to carry out work in Mexico, to INAH Chihuahua for the many courtesies extended to our project, and to the many people who made our lives pleasant in the colonias of Oscar Soto Maynez and Santa Clara.

Chapter 1

THE SANTA ROSA SITE

The Santa Rosa Site (Ch-272), recorded in 1999, is located along the Arroyo la Vuelta, some 500 m from its confluence with the Arroyo la Matanza. This location is close to the western margin of the broad Santa María Valley, near the abandoned *ejido* pueblo of Santa Rosa (Figures 1 and 2). The site occupies ejido land assigned to Salvador Sotelo, now of El Molino, Namiquipa. The authorities for Santa Rosa now reside in the adjacent ejido pueblo of El Pelón.

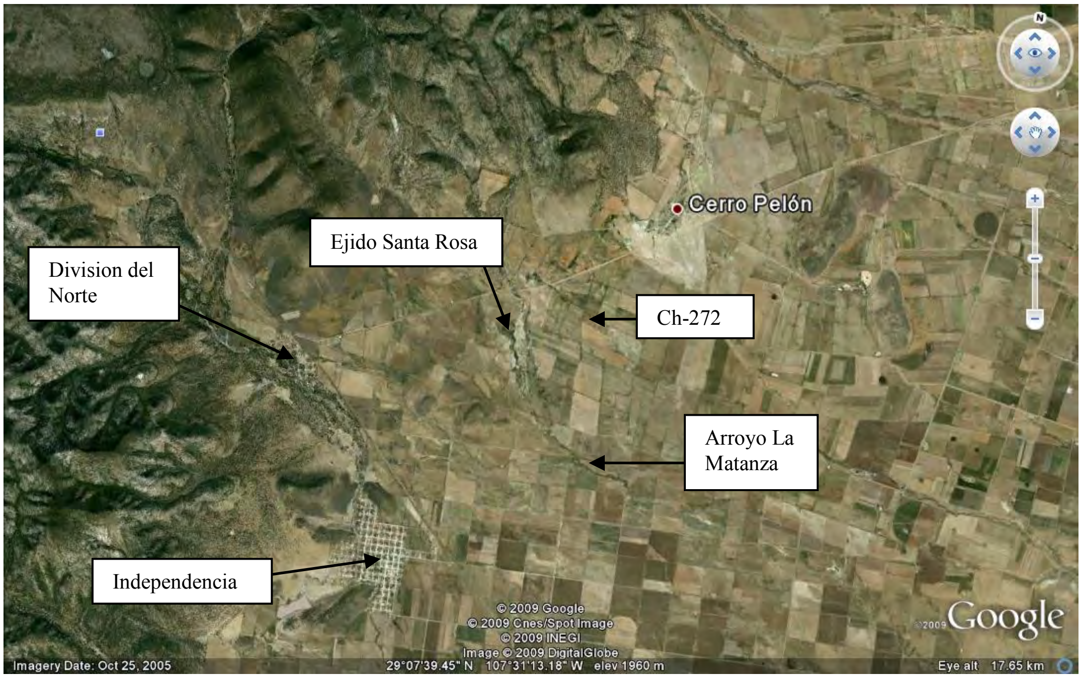

Figure 1. Location of the Santa Rosa site.
Image source: Google Earth.

Figure 2. The Santa Rosa site in 2000. Looking north.

Initial surface collections of brown and red-on brown sherds, in 1999, indicated that this was a Viejo period site. Neither Santa Ana Polychrome nor Mimbres Black-on-white were collected. The collected grooved stone axes (n=2), stone bowl, manos, and flaked stone would have been at home on Viejo or Medio period sites. We noted but did not collect a stone polisher.

In 2000, we returned to the site to verify its Viejo period affiliation through further surface observations and shovel tests. Six test units (T1 through T6) were placed where surface observations and shovel tests indicated the greatest promise of subsurface remains. We did not encounter any architectural remains in the test trenches, but did find an external hearth.

Shovel Tests

Thirty-one shovel tests were placed in surface concentrations of artifacts The result was two groups of shovel tests, one to the east and the other to the west, plus four shovel tests (ST 26–29) in the intervening, low-density area Figure 3). The east group of shovel tests showed the most promise of buried cultural materials; within that group, those on the north seems particularly promising. The shovel tests in the southern part of the east group showed a falling off of artifacts and charcoal; ST 31, with neither sherds nor flaked stone, seemingly was at the edge of the site.

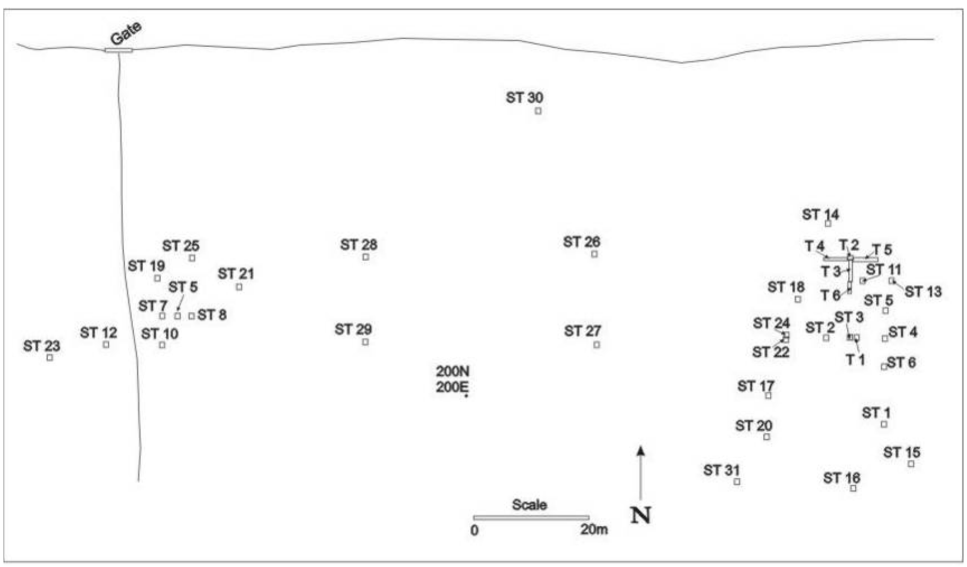

Figure 3. Santa Rosa site: shovel tests in 2000.

The stratigraphy encountered in the shovel tests and six trenches included an upper zone, 30 cm thick, of gray-brown sediments, where most artifacts were found. This zone mostly coincided with the plow zone but (along with artifacts) extended below that zone. A lower layer of red-brown sediment was culturally sterile. See Table 1 for further information about the shovel tests.

Table 1. Santa Rosa Site: 2000 Shovel Tests.

Test No.	Coordinates	Depth (cm)	Lot No.	Sherds (n)	Flaked Stone (n)	Other Artifacts
1	N195 E 270	45	4003	32	10	*Bajareque**
2	N210 E260	64	4004	17	12	Ground stone?
3	N210 E 215	50	4005	77	46	*Bajareque,* fire-cracked rock
4	N210 E 270	62	4006	78	22	*Bajareque*
5	N215 E270	45	4007	33	23	
6	N205 E270	49	4008	24	11	
7	N215 E145	70	4009	22	16	
8	N215 E150	59	4010	39	4	
9	N215 E147.5	43	4011	42	17	Ground stone fragment
20	N210 E145	71	4012	56	26	
11	N220 E266	72	4013	110	59	Fire-cracked rock
12	N210 E135	74	4014	29	10	
13	N200 E271	54	4015	50	17	
14	N230 E260	52	4029	61	17	
15	N188 E275	40	4030	29	26	*Bajareque*
16	N184 E265	48	4031	43	61	Fire-cracked rock
17	N200 E250	51	4032	9	3	
18	N217 E255	53	4033	17	13	
19	N221.5 E144	59	4034	16	14	
20	N193 E280	55	4035	26	13	
21	N220 E158	30	4036	5	6	
22	N210 E153	56	4037	18	11	Mano, 2 other ground stone, adobe, *bajareque*, fire-cracked rock.
23	N208 E125	44	4038	12	7	Ground stone; hammerstone
24	N210.5 E253	46	4039	26	19	*Bajareque,* fire-cracked rock
25	N225 E150	24	4040	7	4	Stone ball
26	N225 E220	31	4041	4	4	
27	N210 E220	22	4042	1	2	
28	N225 E180	29	4043	0	1	
29	N210 E180	27	4044	3	0	
30	N250 E210	9	4045	0	2	
31	N185 E245	36	4046	20	16	

*Baked fragments of daub. Not to be confused with the chunks resulting from load-bearing adobe.

Test Units

Six test units were placed in areas that exhibited the most cultural materials during shovel testing. Five of the tests were placed in a T-shaped pattern that ultimately measured 7 m north-south and 9 m east-west. Figure 4 shows this testing pattern when partly completed.

Figure 4. Santa Rosa Site: Tests 2–4. Test 2 is toward the bottom, Test 3 extends to the left, and Test 4 extends to the right.

Test 1

Located in the northeast part of the site, this 1 by 1 m test was placed along the east-west line of Shovel Tests 2, 3 and 4. Specifically, it was placed next to Shovel Test 3—the shovel test that produced the most sherds. Test 1 was excavated in four levels to a depth of 91 cm BS or 139 cm below site datum.

At the bottom of Level 3, flat-lying sherds suggested an old surface. A long plow scar was visible across this inferred surface.

In Level 4, a small pit was found in the middle of the unit and designated Feature 1. The pit was 18 cm deep and extended into the sterile red soil. Also in Level 4, a darkened area in the northwest corner of the unit was designated Feature 2. This produced charcoal, fire-cracked rock, *bajareque,* and artifacts.

A sherd with a white-slipped interior could be Mimbres, but included no decoration. The sherd came from Level 4. Feature 2 yielded a sherd (tallied under Other) with a polished black interior and exterior and painted red lines on the exterior. The single flaked stone tool was a small core with a bifacially flaked end, rather like a chisel. The unit yielded 126 flakes but no ground stone. No architecture was located, so the testing effort was moved north.

Test 2

A 1 by 1 m unit, Test 2 was excavated in three levels and extended through gray upper deposits into the red culturally sterile soil. Total depth was 88 cm BS (139 cm BD), with cultural deposits extending 82 cm BS. The gray upper zone could be divided into loose plow zone material and more compact material below, but otherwise was uniform. Some structural debris (*bajareque,* charcoal, and adobe melt) was encountered, but no definite features. Sherds were plentiful (n = 564), as was flaked stone (n =183; six utilized). The two Other sherds were a red-on-black and a black-on-brown. No ground stone was found. Because of the large number of artifacts found in the test, it was extended to the south (Tests 3 and 6), to the east (Test 5) and to the west (Test 4). The result was a T-shaped set of units.

Tests 3 and 6

Test 3 (also designated Trench 1 in field records), which began at Test 2, was 4 m long. Test 6 was 2 m long. Both were 50 cm wide. Together they formed the south leg of the T. The area was a promising one for structures or other formal features, so the crew maximized their exposure of the local stratigraphy by using long, narrow units.

One goal of Test 3 was to follow orange fill in the southwest profile of Test 2. Two exterior fire pits were encountered in this unit. The first was an oval pit found in the northeast quadrant of the unit; it extended into the east profile. The pit began 35 to 40 cm below the surface and continued down into the sterile red stratum. The dark fill included fire-cracked rock. The second fire pit was found at much the same depth. Located at the south end of the unit (and continuing into adjacent Unit 6), it also contained dark soil and fire-cracked rock as well as bone, burned seeds, charcoal, and artifacts. The last included 26 sherds (undecorated, red-on-brown, and textured), 10 flakes, and two utilized flakes.

The Test 3 and Test 6 general unit fill (outside the second fire pit) yielded the following remains. Of the 123 sherds, 78 percent were plain, 8 percent were red-on-brown (including a fine-line Mata Red-on-brown), and 14 percent were textured. Flaked stone included 38 flakes, two utilized flakes, five cores (one large basalt, four rhyolite), and a large bifacial pebble chopper (quartzite, 701 g).

Test 4

Test 4 extended west from Test 2 and was 4 m long by 40 cm wide. Test 4 was excavated in a single level in order to expose the local stratigraphy. The resulting profiles were similar to those exposed in Tests 2, 3 and 6, with sterile deposits beginning at 77 cm BS. Above the sterile deposits, the gray soil was uniform except for changes in compaction due to plowing. At 46 cm BS, a possible occupation surface extended 75 cm along the north profile. Sherds, a piece of adobe, and small concentrations of charcoal were present along this surface. Of the 64 sherds from the unit, 66 percent were plain, three percent were black, 13 percent were red-on-brown, and 18 percent were textured. The unit also yielded 24 flakes, two utilized flakes, a core, and a projectile point base.

Test 5

This 4 m long, 50 cm wide trench extended east from Test 2 and, like Test 4, was excavated in a single level. Sterile deposits were found 70 cm BS. An amorphous fire pit was found near the east end of the unit. The pit lay entirely within the upper gray deposits, extending downward from 50 to 60cm BS. The pit contents included dark soil, fire-cracked rock, pottery, and charcoal. Of the 200 sherds, 78 percent were plain, 1 percent were black, 6.5 percent were red-on brown, and 13.5 percent were textured. A partly corrugated olla had red polka dots on the smooth portion of the vessel wall,. Two red-slipped sherds—a rarity—were found. Other artifacts included a fragment of a ground stone slab, a mano fragment, 38 flakes, and three rhyolite cores.

Artifacts, 1999–2000

Pottery

Four Babícora Polychrome sherds were found on the site surface. No Babícora or Santa Ana Polychrome was collected from the shovel tests or test units. A Mimbres Black-on-white sherd came from Shovel Test 4 and an unpainted white-slipped sherd from Test 1, Level 1 is thought to be Mimbres as well.

The sherds from the Santa Rosa site are mostly plain (undecorated brown; n = 1,624; 76.5 percent), red-on-brown (n = 151; 7.1 percent), or textured (n = 240; 11.3 percent) (Tables 2 and 3). Small amounts of black (n = 82; 3.9 percent) and red-slipped (n = 14; 0.7 percent) pottery were found. The site also yielded rare examples of red-on-polished-black, burned-out paint on tan or brown, black-on-brown, and black-on-red. With the exception of the four surface finds of Babícora Polychrome, the assemblage fits well with those from other Viejo period sites of the southern zone.

Table 2. Santa Rosa Site: Pottery from the Surface and Shovel Tests.

Provenience	Lot No.	Undec.	Black	Red Slipped	Red-on-brown	Poly-chrome	Text.	Other	Total
Surface	4002				3	4*	4	1	12
ST1	4003	21	6		1		4		32
ST2	4004	12			2		3		17
ST3	4005	67			4		6		77
ST4	4006	55	1	8	5		8	1	78
ST5	4007	16	13		3		1		33
ST6	4008	19	2		1		2		24
ST7	4009	23					2		25
ST8	4010	34			1		4		39
ST9	4011	33	1		2		6		42
ST10	4012	48			4		3	1	56
ST11	4013	82	6		6		16		110
ST12	4014	24	3		1		1		29
ST13	4015	43			4		3		50
ST14	4029	45	1	1	5		9		61
ST15	4030	22	1		5		1		29
ST16	4031	32		3	4		4		43

Table 2. Santa Rosa Site: Pottery from the Surface and Shovel Tests.

Provenience	Lot No.	Undec.	Black	Red Slipped	Red-on-brown	Poly-chrome	Text.	Other	Total
ST17	4032	9							9
ST18	4033	13			2		2		17
ST19	4034	11	1		1		3		16
ST20	4035	22			2		2		26
ST21	4036	5							5
ST22	4037	15	1		1		1		18
ST23	4038	12							12
ST24	4039	21			1		4		26
ST25	4040	5					2		7
ST26	4041	4							4
ST27	4042	1							1
ST28	4043	0							0
ST29	4044	3							3
ST30	4045								0
ST31	4046	17		1			2		20
Total		714	36	13	58	4	93	3	921
Percent		77.5	3.9	1.4	6.3	0.4	10.1	0.3	100.0

*Babícora Polychrome

Table 3. Santa Rosa Site: Pottery from the Test Units, and Combined Data.

Unit	Level	Lot No.	Undec.	Black	Red Slipped	Red-on-brown	Poly-chrome	Text.	Other	Total
Test Units										
1	1	4016	110	2		3		13	1	129
1	2	4017	46	2				8		56
1	3	4018	18	2		2		1		23
1	3, Fea. 1	4019						1		1
1	3, Fea. 2	4027	9	2		1		1	1	14
2	1	4020	256			22		26		304
2	2	4021	119	29		26		37	3	214
2	3	4028	37	3		3		2	1	46
3	1	4048	96			10		17		123
4	1	4049	44	2		9		12		67
5	1	4050	157	2	1	13		27		200
6	1	4051	18	2		4		2		26
Total			910	46	1	93		147	6	1203
Percent			75.6	3.8	0.1	7.7		12.2	0.5	100.0
Combined Data (Surface, Shovel Tests, and Test Units, 1999–2000)										
Total			1624	82	14	151	4	240	9	2124
Percent			76.5	3.9	0.7	7.1	0.2	11.3	0.4	100.0

Flaked Stone

Flaked stone occurred in most of the shovel tests and in all test units. Shovel Test 30 failed to produce any artifacts, and was regarded as being at the east edge of the site. Of the 932 pieces of flaked stone from excavated contexts, only 39 are possible tools (Table 4), yielding a ratio of 1:23 for shaped or utilized tools versus other flaked pieces. The core:flake ratio is 1:44 (see Tables 5 and 6).

Table 4. Santa Rosa Site: Flaked Stone Tools by Material Type, 1999–2000.

Category	Basalt	Rhyolite	Chert	Obsidian	Quartzite	Total
Possible points or bifaces	2		4	4		10
Choppers		1			1	2
Core hammers	1	1				2
Scraper		1				1
Spokeshave		1				1
Utilized flakes	2	20		1		23
Total	5	24	4	5	1	39

Table 5. Santa Rosa Site: Flakes by Raw Materials, 1999–2000.

Material	No. of Flakes	Combined Weight in Grams	Percent by Number	Percent by Weight
Basalt	175	961	20.1	24.3
Rhyolite	589	2931	67.5	70.5
Chert	63	132	7.2	3.3
Obsidian	32	25	3.7	0.6
Quartzite	13	53	1.5	1.31
Total	872	4031		

Table 6. Santa Rosa Site: Cores by Raw Materials, 1999–2000.

Material	No. of Cores	Combined Weight in Grams	Percent by Number	Percent by Weight
Basalt	3	511	14.3	21.2
Rhyolite	15	1776	71.4	73.7
Chert	1	1	4.8	0.0
Obsidian	1	1	4.8	0.0
Quartzite	1	12	4.8	0.5
Total	21	2301		

Most of the possible projectile points were made on small flakes, with minimal retouch. resulting in asymmetrical forms. One was larger (4.5cm long); it had deep corner notches and narrowed above the tangs (No. 4023-1).

The flaked stone at this site was, as expected, expedient and dominated by locally available materials. This approach required a fair amount of testing of pebbles to evaluate their potential as tool stone. Obsidian was obtained in the form of small nodules ("Apache tears").

Ground Stone

At the Santa Rosa site, manos and metates were rare compared to Ch-254, which had, however, been extensively plowed. Overall, Ch-272 seems to have numbers more like those from Ch-218 and Ch-312. In 1999, ground stone in the surface collections at the Santa Rosa site included one very shallow stone bowl fragment of pink rhyolite, a second stone bowl fragment of pumice, a basalt floor polisher, and two axe fragments (one was full grooved and the other too fragmentary to tell). The 2000 surface collections included 17 manos, three metates, two axes/mauls (one full grooved and the other three-quarter grooved), a stone ball, and five miscellaneous pieces. In 2000 the excavations yielded two manos, a stone ball and five miscellaneous pieces.

Manos varied greatly in size, weight, and degree of grinding surface convexity. Complete or near-complete manos varied from 18.2 to 24.5 cm in length. Many fragments appeared to belong to smaller manos with an estimated original size range of 15 to 18 cm. Some grinding surfaces were almost flat but others were quite convex, suggesting a variety of metate surfaces as was found at other Viejo period sites.

Turquoise

A small piece of turquoise measured 0.7 by 0.6 by 0.4 cm. It is flat on one surface and curved on the other, with an almost triangular cross-section (Test Unit 3, Level 1, Lot 4047).

Botanical Evidence

No macrobotanical samples were collected in 1999; eight samples from 2000 were identified by Karen Adams. Most of the contents were wood specimens. Among the charcoal fragments were *Juniperus* (15), *Quercus* (20), and *Pinus* (8). Three specimens of *Zea Mays* and one of *Phaseolus* were identified. Juniper and oak are available near the site today. If the *Pinus* is piñon, it too can be found nearby. Other species of pine grow in the sierra to the west.

Radiocarbon Dates

Three samples were run from this site, all from domesticated annual plants (Table 7).

Table 7. Radiocarbon Dates from the Santa Rosa Site.

Lab Code	Sample No.	Lot No.	Provenience	Sample material	Conventional ^{14}C Age B.P.	Calibrated Age*
TO-8910	Ch-14C-81	4037	Shovel Test 22, Level 1	*Zea* cob with 3 attached cupules	1220 ± 50	685–898, 0.951
TO-8911	Ch-14C-82	4039	Shovel Test 24 N, Level 1	*Zea* cob with 3 attached cupules	1400 ± 60	538–723, 0.952
TO-8912	Ch-14C-83	4048	Test 3 (Trench 1) Level 1, fire pit	*Phaseolus* cotyledon fragments	960 ± 50	995–1151, 0.991

*2 sigma cal A.D. ranges with the highest probability.

The first two dates (TO-8910 and TO-8911) are outliers to the complete set of dates published as of 2004 (Stewart et al. 2004), as were the earliest date from Ch-159 (Stewart et al. 2005) and from Ch-254 (obtained in 2008). As the dates from different sites occur in multiple Viejo period sites or sites with Viejo period occupations, the evidence for an early beginning to the local Viejo period appears to be more strongly supported than previously thought.

The 2008 GPR Survey

Given the confidence with which the Santa Rosa site was assigned to the Viejo period, based on the pottery collected in 1999 and 2000 and the radiocarbon dates, we conducted a GPR survey of the site in 2008. The individual GPR survey units were 25 by 50 m; they were placed where surface artifacts were plentiful, and in different parts of the site. Four such units were paired, providing coverage of 50 by 50 m areas; three other units were selected to provide coverage of a 50 by 75 m area. Anomalies that could be structures were first encountered at a depth of 45 cm and continued to a depth of 75 cm. No anomalies thought to be archaeological features were encountered below the 75 cm scan.

Six possible structures were noted. Three occurred in a cluster; three others were widely scattered (Figures 5–7). If these anomalies are in fact structures, the latter are farther apart than at other sites surveyed with the GPR.

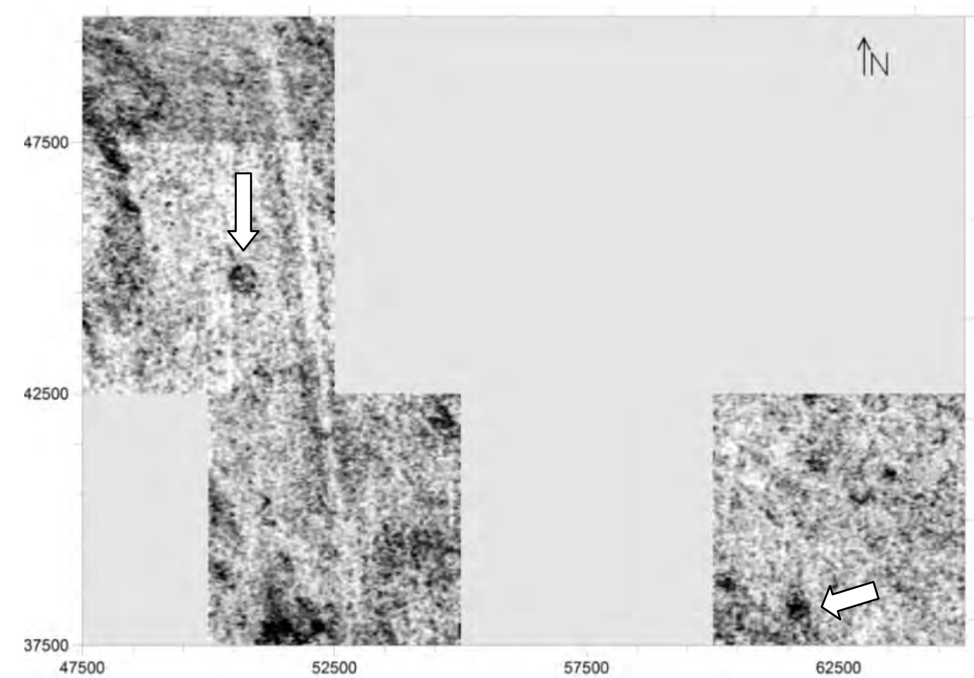

Figure 5. Santa Rosa site: anomalies at a depth of 45 cm. The arrows indicate two possible pit structures. X and Y values are in centimeters.

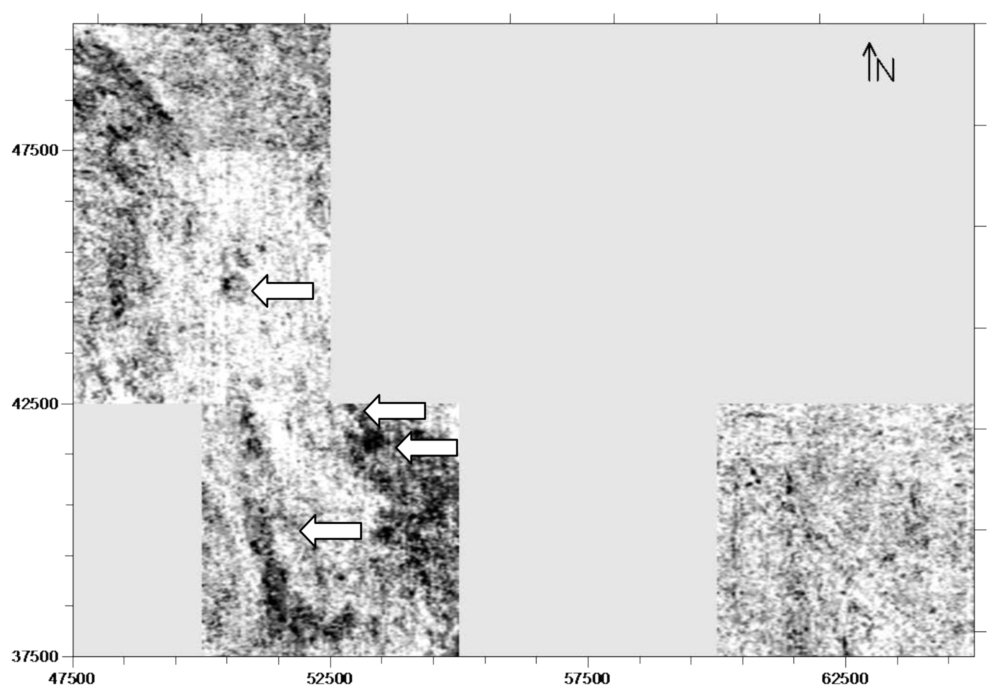

Figure 6. Santa Rosa site: anomalies at a depth of 60 cm.

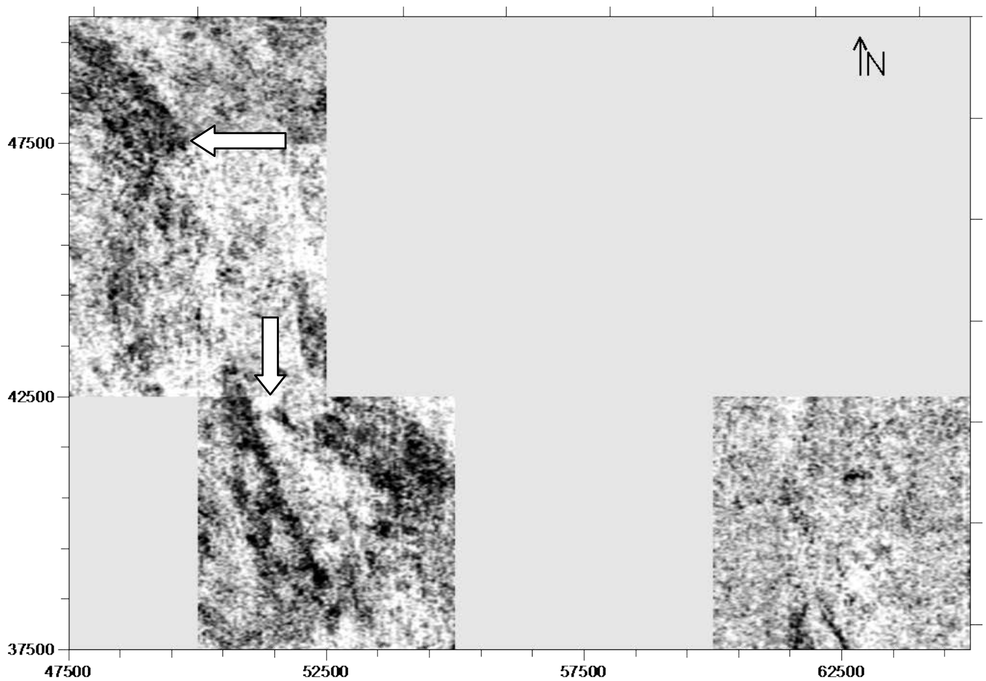

Figure 7. Santa Rosa site: anomalies at a depth of 70 cm.

During the 2008 GPR work, 55 sherds were collected, including 43 plain brown, three red-on-brown, and nine textured. A three-quarter grooved axe was also collected (Figure 8).

Figure 8. Santa Rosa site: axe collected in 2008.

Although the testing in 2000 failed to locate structures, the 2008 GPR survey strongly indicates that scattered round structures are present. We count the site as one of four confirmed Viejo period sites in the upper Santa María Valley.

Chapter 2

THE ALDERETE SITE

Ch-312, the Alderete Site (Figure 9), was recorded in 2005. During that season we had not planned to register new sites; our goal was to test ground-penetrating radar (GPR) on known Viejo period sites. Nonetheless, we visited the site at the invitation of the land owner. Veronica Pacheco, a member of our crew, had been interviewing surviving employees of the old Hacienda de Santa Ana (the Babícora Baja headquarters of the Hearst Ranch) about changes in the local ecology of the area. Among those interviewed was Manuel Alderete, Sr. His son, Ing. Manuel J. Alderete, took us to the site, which continued onto land owned by Sr. Socorro Bustillos.

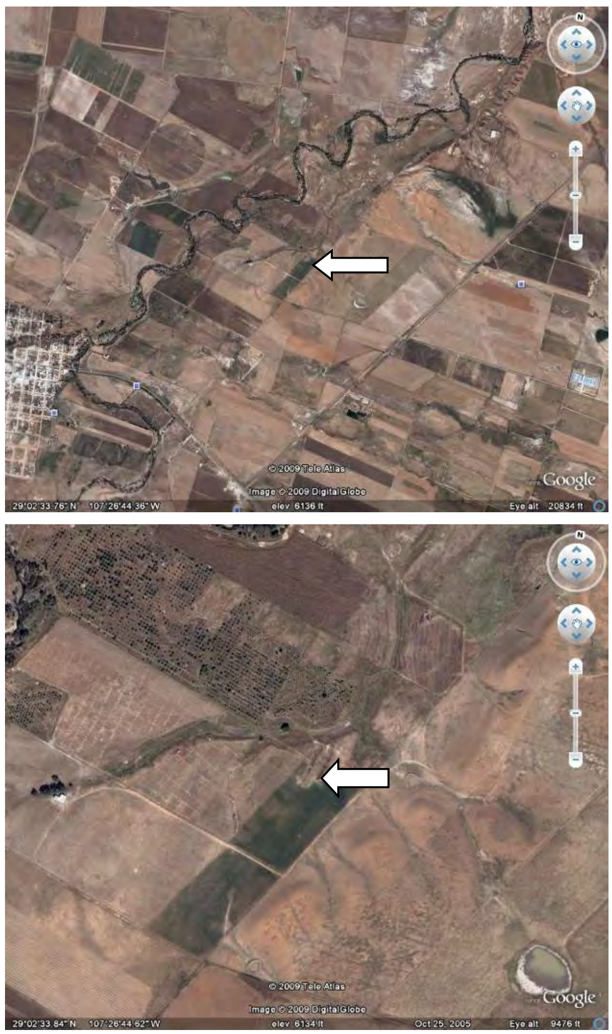

Figure 9. Location of the Alderete site. Top: image showing the edge of Oscar Soto Maynez and the Santa María river. Bottom: the site extends from just north of two visible trenches or *silos* (arrow) across the field to the south and west. Original images from Google Earth.

The site is on a terrace east of the main Santa María drainage, just north of Oscar Soto Maynez. We were told by Ing. Alderete that there was formerly a spring along the low escarpment at the north edge of the site. The site appears to be well protected and there were no visible looter's pits. There are, however, two trenches or *silos* on the north side of the site, where prehistoric cultural deposits have been exposed by erosion. In one of the trenches, a burial was probably being exposed, based on the presence of numerous shell beads.

Six 25 by 50 m areas were covered by the GPR survey. Eleven possible structures and one smaller feature are visible at depths of 40, 50, and 75 cm. In order to ground-truth the imagery provided by the GPR, we selected two houses about 50 cm apart (Figure 10). This paralleled the situation at Ch-254, where we opted to test two "twin" houses. In the case of Ch-312, the GPR indicated that the north house was round, but the south house was less clearly defined and appeared to be somewhat rectangular. Our testing did not allow us to clarify the shape of the southern house, but we are confident that the northern house was more or less round.

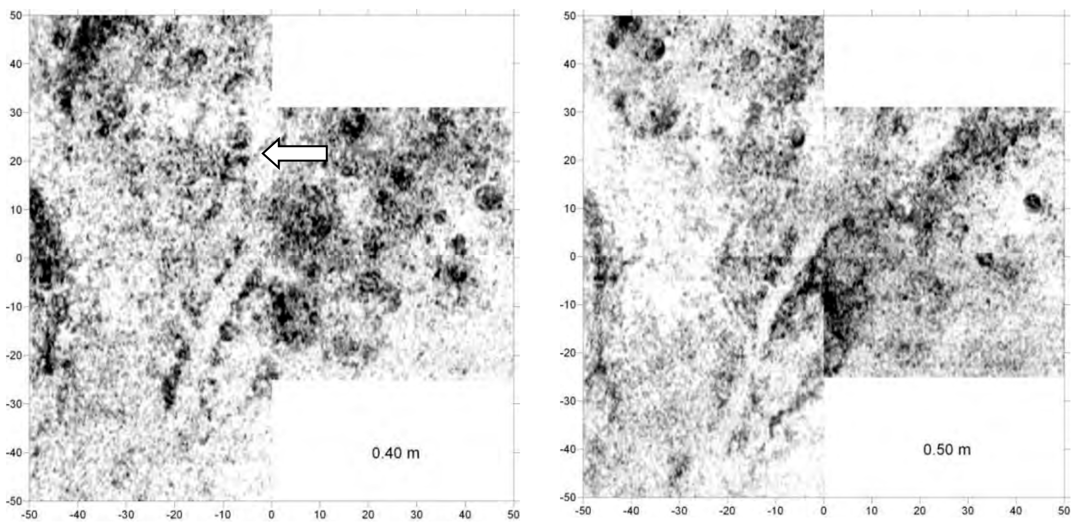

Figure 10. Alderete site: anomalies at depths of 40 and 50 cm. The two anomalies chosen for testing are indicated by an arrow on the left image.

Tests 1 and 2 were each 1.5 by 0.5 m, for a combined trench length of 3 by 0.5 m (Figure 11). The two houses had floors at the same approximate depth, but the deposits seen in profile suggest that the two had independent depositional histories. Each house had an adobe wall base like those found at Ch-254 and Ch-218, but the wall bases at Ch-312 were less continuous than those seen at the other two sites.

The northern house (Structure 1) had a single plastered floor that sloped up 20 cm at its south edge. The adobe wall base was not continuous across the test area, but the plastered floor and its raised edge were intact. A piece of adobe was found in the northwest corner of the unit, Floor features included two rocks (at the north end of the test) and a posthole. The exposed strata indicated that Structure 1 postdated the lower of the two floors in the southern house.

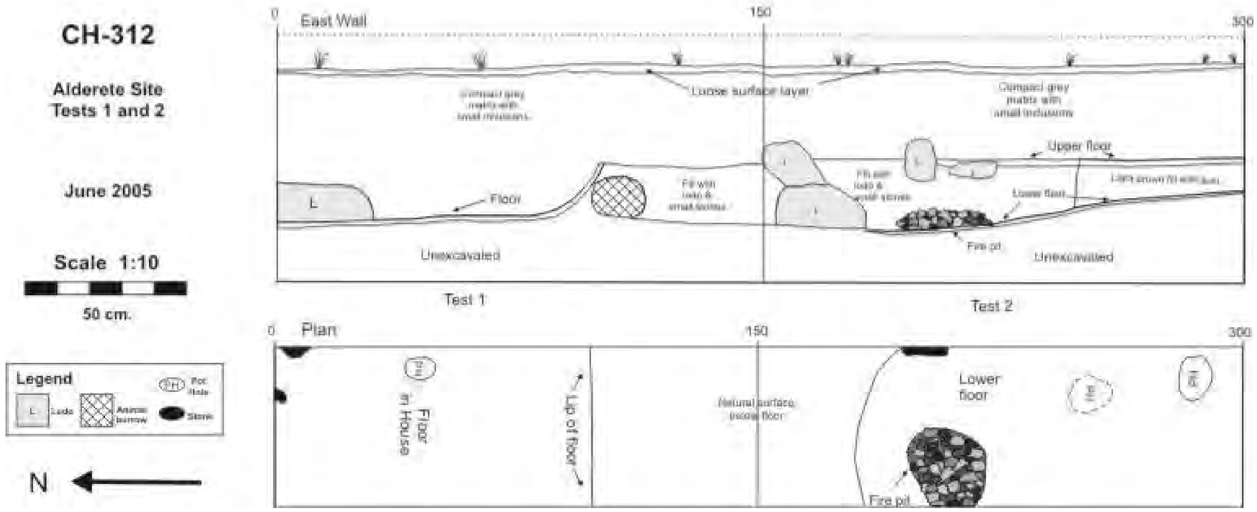

Figure 11. Alderete site: plan and profile of Tests 1 and 2.

The southern house (Structure 2) had two clearly defined floors. As was the case with Structure 1, the adobe wall bases associated with each floor of Structure 2 did not extend across the entire test; however, the edges of both floors could be identified. Echoing Structure 5 at Ch-254, the upper adobe wall base was slightly offset from the lower wall base. The lower floor (Floor 1) began at the south edge of the lower adobe wall base. Floor 1 features included a rock, a hearth filled with fire-cracked rock, and two postholes that might have been associated with either floor. The upper floor (Floor 2) had no floor features except for chunks of fallen adobe. While a 50 cm wide trench provides a very narrow view, it was our impression that the structure associated with the lower floor was demolished to allow construction of the upper structure.

Pottery

Pottery was collected from the site surface and from the test excavations (Table 8). All sherds are consistent with assignment of the site to the Viejo period. The single sherd of Mimbres Black-on-white was made into a sherd spindle whorl. Santa Ana Polychrome is rare. Most of the sherds were collected from the surface (Figure 12) and within this group, the most common category is Undecorated. Among these are white or light gray sherds like those reported from Ch-218 and Ch-254.

Black and red-slipped sherds are common in comparison to Ch-218 and Ch-254. Black sherds were found throughout the tests, but the red-slipped sherds were mostly found on the site surface. The red-on-browns (Figures 12 and 13) include probable Mata Red-on-brown but those from Lot 1513 (Surface) lack the characteristic texturing, and on some the red designs are poorly defined.

Most of the rims collected from the surface pertain to bowls; there is just one jar rim. Five of the rims exhibit red bands at the lip.

Table 8. Alderete Site: Sherds Collected in 2005.

Provenience	Level	Lot No.	Undeco-rated	Black	Red-slipped	Red-on-brown	Textured	Santa Ana Poly.	Mimbres Black-on-white	Other	Total
General	Surface	1513	58	3	12	6	25			3	107
Silo	Surface	1513	27	2	1	2	1				33
Test 1	1	1530	15	3	3			3			24
Test 1	2	1532	8	2		1	4				15
Test 1	3	1533	7	5			1				13
Test 2	1	1534	7	3					1	1	12
Test 2	2	1535	28	6		3	3				40
Test 2	3	1536	4	2			1				7
Total			154	26	16	12	35	3	1	4	251
Percent			61.4	10.4	6.4	4.8	13.9	1.2	0.4	1.6	

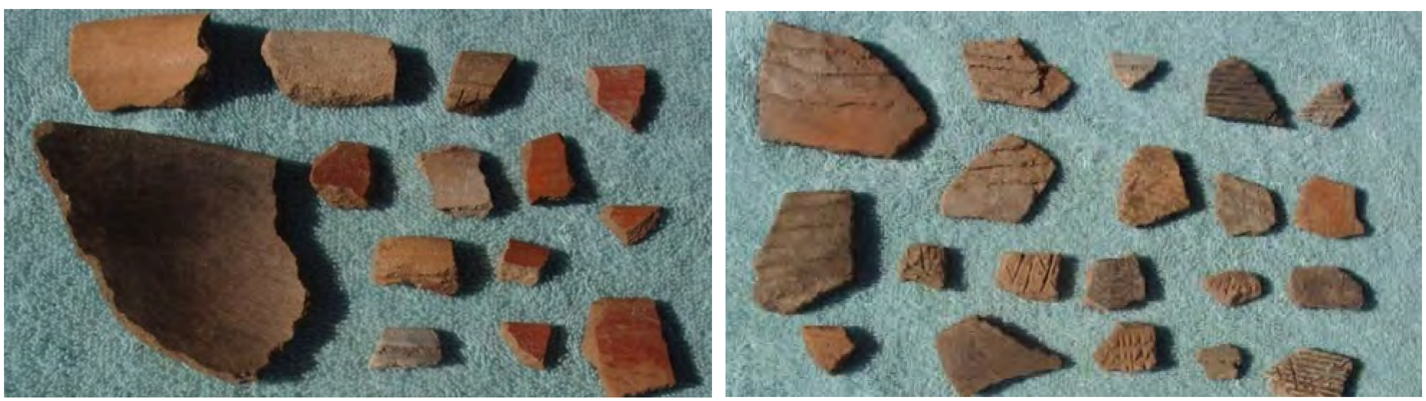

Figure 12. Alderete site: sherds from the site surface. Left: rims from red-slipped and red-on-brown vessels. Right: sherds from textured vessels. All from Lot 1513.

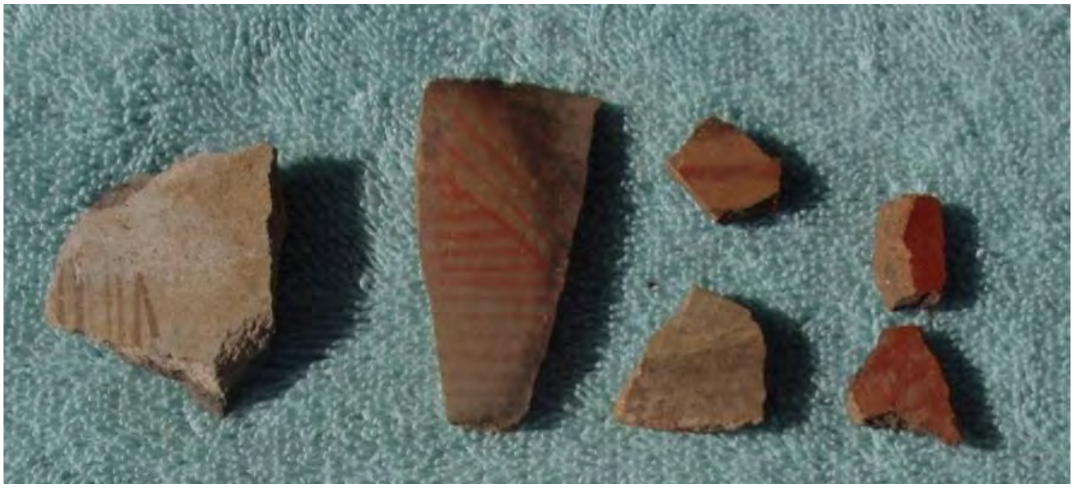

Figure 13. Alderete site: red-on-brown sherds from the site surface. Lot 1513.

Other Artifacts

Flaked stone was scarce on the site surface and in the tests (Table 9). We did not encounter projectile points or other formal tools. Three of the 18 flakes from the site surface were utilized.

Table 9. Alderete Site: Flaked Stone Collected in 2005.

Unit	Level	Lot No.	Rhyolite Flake	Obsidian Flake	Total
General	Surface	1513	18		18
Test 1	Level 2	1532	2		2
Test 2	Level 1	1534	3	1	4
Test 2	Level 2	1535	1	1	2
Total			24	2	26

No ground stone tools were encountered on the site surface or in the tests.

At the west edge of a trench, we collected 14 disk beads measuring 1.5 to 2 cm in diameter, and 16 beads made of the hinges of shells (Figure 14). We suspected that the beads were eroding from a burial, but no human bone was observed. A return visit to the site, in 2007, resulted in the collection of a few more beads from this location. We also collected a small turquoise pendant, a triangular stone bead, and a disk bead from the site surface (Figure 15), at the north ends of the trenches on the Alderete side of the fence.

Figure 14. Alderete site: beads collected from the edge of an existing trench.

Figure 15. Alderete site: shell bead, triangular stone bead, and small turquoise pendant. Found at the north end of the site.

Chapter 3

Ch-240

Ch-240 was first registered during a 1993 on a trip to the Santa Clara valley, in search of two Medio period sites recorded by E. B. Sayles in 1933. We found one of his sites just south of Santa Catarina (PAC Ch-161) but failed to find the other one, which was on the opposite bank of the river. We also visited the site in 1998 and 1999.

In 1993, we moved north along the river from Santa Catarina to the colonia and ejido of Santa Clara (Figure 16), where we recorded a Medio period site (Ch-239) as well as a site (Ch-240) that proved to belong to the Viejo period. Not recognizing some of the pottery collected at the site, we sent some of the red-on-brown pottery to Gloria Fenner, who identified it as Mata Red-on-brown bowls (without texturing).

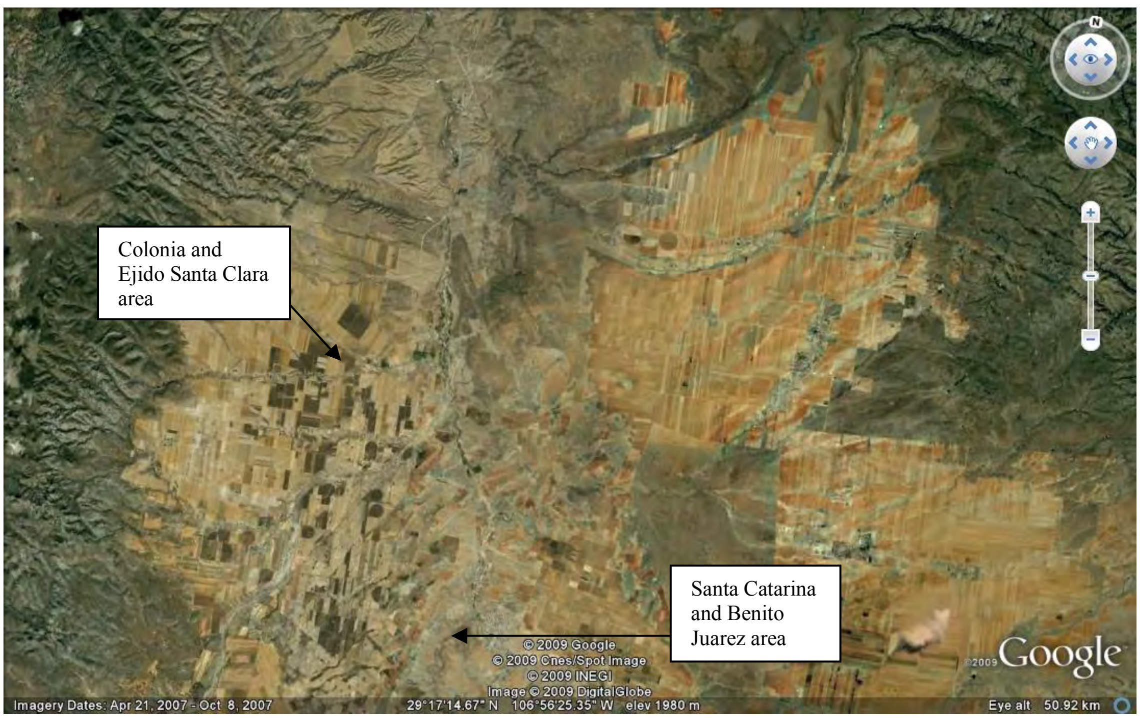

Figure 16. The Santa Clara valley in the vicinity of the colonia and ejido of Santa Clara. Source: Google Earth.

The site is on a west terrace of the río Santa Clara, just south of the homes of the colonia, across the river from the Ejido Santa Clara. The land is owned by Sr. Essio Jacques. The artifact scatter covers much of the field indicated in Figure 17, and extends eastward across the fence dividing the field from adjacent pasture land.

Figure 17. Location of Ch-240. The Colonia de Santa Clara is in the upper left part of the image, on the west side of the Santa Clara drainage. The Ejido Santa Clara is on the right, on the east side of the drainage. The location of Ch-240 is shown with an arrow. Original image from Google Earth.

It has been the practice of those farming the site to throw larger pieces of ground stone into the arroyo that can be seen along the northwest part of the field.

Surface Collections, 1999

In 1993, this site yielded the first major collection of Viejo period pottery made by the PAC that included a good cross-section of the categories. The 137 sherds in Lot 6303 included 62 Undecorated (plain), six Black, five red-slipped, 16 red-on-brown, 25 textured, and 23 Other.

The field was quite muddy at the time we made the collection, and it was difficult to see surface colors and designs. Once the sherds were washed, we were surprised to find that seven fine-line Mata Red-on-brown sherds had been collected. These were identified for us by Gloria Fenner. She also identified a large bowl rim sherd lacking texturing as Mata Red-on-brown. The red-on-brown sherds also include a bowl rim with a red band, the band having a sawtooth lower edge on the interior. Two additional rim sherds had simple red bands on the lips.

The Black sherds include four with polished black interiors and two with polished black exteriors.

The red-slipped sherds include four jar sherds with red-slipped exteriors and brown interiors and one bowl sherd with a red-slipped interior and a polished tan exterior.

The textured sherds include five corrugated, four zoned corrugated, two incised corrugated, four scored, eight incised, two incised and punctate, and one impressed.

The Other category includes 18 sherds with near-white paste, reminiscent of the sherds reported found at sites in the Santa María drainage, a red-on-near-white sherd, and four black-on-red sherds.

Shovel Tests, 2000

In 2000 we returned to the site for testing. We established a grid for the site, with the site datum at 200N 200E. Shovel testing was used to locate areas in which sub-surface features might be present (Figure 18 and Table 10). The eight initial tests were spread over 74 m north-south, at artifact concentrations, in an attempt to identify promising areas for further excavation. The first seven tests did not produce evidence of structures, but a roasting pit was exposed in Test 6 and was such a large feature that the test was expanded. Evidence of a structure was found in Test 8, and that shovel test was expanded into the principal area of excavation (Tests 8A and 11 through 25).

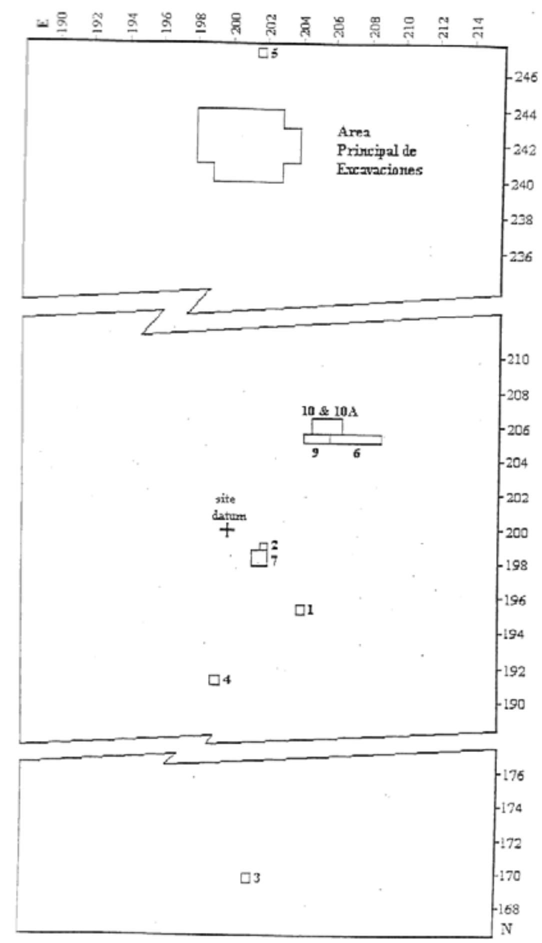

Figure 18. Locations of the shovel tests at Ch-240 in 2000.

Table 10. The Shovel Tests at Ch-240 in 2000.

Test No. (Size in Meters)	Coordi-nates	Max. Depth BS	Lot No.	No. of Sherds	Pcs. of Flaked Stone	Pcs. of Ground Stone	Other Items
1 (0.5 by 0.5)	195.5N 203.5E	39 cm	4063	12	19	0	Adobe, FCR
2 (0.5 by 0.5)	198.5N 202.5E	67 cm	4064 4065	35	32	0	FCR, shell
3 (0.5 by 0.5)	169.5N 201.5E	37 cm	4066	5	0	0	FCR
4 (0.5 by 0.5)	191.5N 199.5E	52 cm	4067	36	4	1	
5 (0.5 by 0.5)	201.5E 246.5N	66 cm	4068	75	0	0	Adobe
6 (0.5 by 3.0)	205.5N 206-209E	15 cm	4069	106	21	0	FCR, shell bead
7 (1 by 1m)	199.5N 202.5E	63 cm	4070 4071 4072	318	29	0	
8	*Expanded into main excavation area. See text.*						
9 (0.5 by 1.0)	205.5N 203-206E	15 cm	4076	61	44	0	FCR
10 and 10A (1.5 by 1.0)	205.5–206.5N 205.25– 106.75E	15 cm	4077 4078	248	81	0	FCR, adobe, shell

*Not collected. FCR = fire-cracked rock.

The upper 30 cm of Shovel Test 1 consisted of a loose soil within the very dark brown, silty and sandy plow zone. Chunks of adobe were present. At the bottom of the dark soil, rocks were present. Below these were orange sandy clay deposits that were sterile except for a stripe of darker soil marking a rodent burrow. Few artifacts were found and culturally sterile soil was reached.

Shovel Test 2, Level 1 was excavated to 50 cm BS. The dark soil included sparse artifacts. At 50 cm BS, artifacts became more common, so a new level was started. However, Level 2 soon ended at the culturally sterile orange sandy clay, at 52 cm BS. At that depth a possible pit was defined, so the work at this location was expanded to include Shovel Test 7. A number of pieces of fire-cracked rock were found next to the possible pit, but the pit itself could not be confirmed.

Due to a sparseness of artifacts, Shovel Test 3 was excavated in a single level. A small, shallow pit was found near the bottom of the cultural deposits, in the northeast corner of the unit. While the macrobotanical remains from most of the test units were derived from wood, this unit also produced *Zea Mays*.

Shovel Test 4 yielded few artifacts and no features. The unit was excavated in a single level to the culturally sterile orange deposits. Charcoal flecks were found throughout the cultural deposits.

Shovel Test 5 was placed where adobe chunks were found on the site surface. The loose plow zone soil, containing artifacts, extended 30cm BS. A more compact brown soil containing artifacts and a fair amount of charcoal extended to 60cm BS, with red-orange, culturally sterile soil below. At 45 cm BS, large chunks of adobe and large bits of charcoal were observed, but were not part of a coherent feature.

Shovel Test 6 was a 3 m long, and 0.5 m wide trench that exposed a shallow roasting pit. Excavated as a unit, the feature was an amorphous shallow pit extending beyond the limits of the shovel test. In response, Shovel Test 9 extended the trench 1 m to the west, resulting in a trench 4 m long and 0.5 m wide. Shovel Tests 10 and 10A, measuring 1.5 by 1.0 m, expanded the test over the main part of the roasting pit (Figure 19). The culturally sterile orange soil began 16 cm BS, and the plowing extended into this soil.

Figure 19. Ch-240, Shovel Test 10, showing the roasting pit.

The roasting pit was shallow; it contained mostly very dark, charcoal-stained soil with large pieces of charcoal. The entire pit was within the plow zone and undoubtedly owed its irregular shape to plowing. The roasting pit was used repeatedly; three 10 gallon (38 liter) buckets of fire-cracked rock were removed from Test 6, another eight and a half buckets from the contiguous units. Some of this rock was recovered from the pit itself but more came from next to the east side of the pit, where it had been dumped.

A preliminary check of the bones found in and around the feature indicated that deer and small birds were roasted here. Artifacts were unusually abundant around this feature. The combined sherd count for the four tests is 415, and the flaked stone count is 146 (including flakes, cores, eight utilized flakes and a crude and thick point with vague side notches). Unworked local shell was present. Macrobotanical remains included *Quercus, Juniperus, Pinus, and Zea mays.*

Main Excavation Area, 2000

A high priority for the 2000 field season was the investigation of Viejo period structures. Accordingly, when Shovel Test 8 revealed complex stratigraphy and structural evidence, the excavation area was expanded to include Tests 8A and 11–23. The units were numbered in the order in which they were opened. Multiple floors and other features rapidly emerged.

At the lowest level, Structure 1 was completely excavated. The Structure 1 floor and northern side wall cut through another floor that we could not follow due to time constraints, but that presumably was older than Structure 1. Following the abandonment of Structure 1, the area was used for trash and ash disposal, and a complex array of pits occupies the intermediate levels of the excavation. Some of the pits were deep enough to cut into the south side of Structure 1. Others bottomed out on the floor of Structure 1. Structure 3, stratigraphically younger than Structure 1, was a small, slightly concave plastered area (possibly from a granary or similar structure). High in the fill, Structure 2 was badly damaged by plow action and only the fire pit and bits of floor and some charred beams remained.

Structure 1

Structure 1 was irregular, one might say informal (Figures 20 and 21). The west and southwest sides of the house pit were excavated into culturally sterile clayey soil. The plastered floor was carried up onto this part of the pit wall. The north side of the house was cut through an older floor; the floor plaster did not curve up against that pit part of the wall. The east wall-floor juncture was equally abrupt. The south edge of the floor had been destroyed by the later pits.

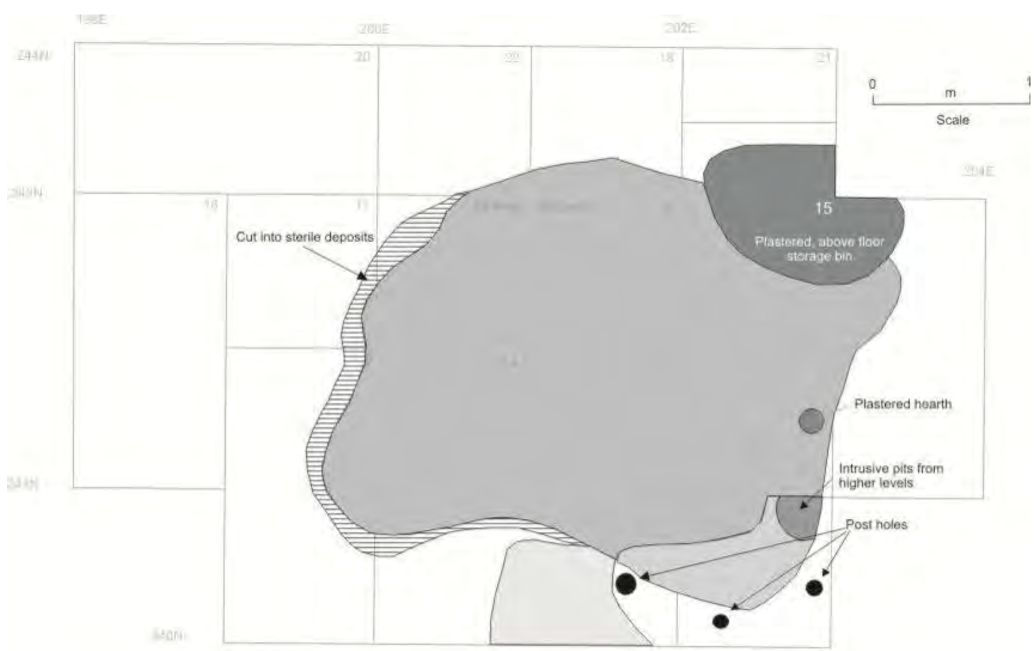

Figure 20. Plan of Structure 1, Ch-240. North is to the top of the drawing.
The darker feature at the upper right is the possible granary base.

Figure 21. Two views of Structure 1, Ch-240, after excavation. Top: view to the west. Bottom: view to the northwest. The possible granary base, partly shaded, is indicated by the arrow.

The small (20 cm diameter), plastered hearth was next to the east wall. No other interior features were found. Three exterior post holes next to the southeast portion of the house may have been wall support posts, but their relationship to the house was obscured the intrusive pits. We wondered whether the southwest corner represented an entryway.

The Middle Levels

The depression left after abandonment of Structure 1 was used for ash and trash disposal, and multiple pits were dug into the accumulating fill (Figure 22). The largest pit had straight sides, bottomed out on the old Structure 1 floor, was not plastered, and contained thin lenses of ash.

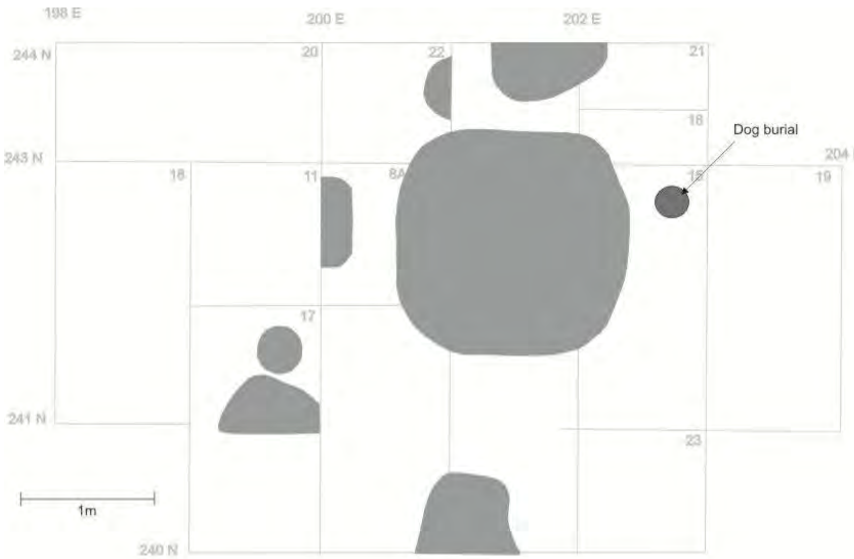

Figure 22. Dog burial and other pits, Levels 3 and 4, Ch-240 main excavation area.

Other pits, used for roasting, contained fire-cracked rock, dark soil, and charcoal. The lower pits on the south side of Structure 1 were pits for obtaining clayey material used as plaster, adobe, and *bajareque.* A puppy or small dog was buried at this depth, above Structure 1. The puppy was placed in a small, shallow, circular pit.

Structure 3

A small, oval, plastered area with definite edges, some 1.5 m in diameter, partly floated over Structure 1 (the remainder was built on firmer, culturally almost sterile deposits) (Figure 23). The feature's small size and its definite floor and edges, caused us to wonder whether it was a storage feature, possibly even a granary. This last speculation is based on the premise that Structure 3 could have been a miniature version of the Chihuahua culture granaries known from the Sierra Madre Occidental, famously at Cueva de la Olla. Structure 3 is also reminiscent of the plastered area outside Structure 6 at Ch-254.

Structure 2

Near the top of the deposits, Structure 2 was fully within the plow zone and was mostly destroyed by plowing (Figure 24). Enough was left to verify that it was indeed a structure. The east side of the house extended over the trashy fill above Structure 1, but most of the house was built on firm, culturally almost sterile soil. The remains of a collared hearth were found in an area of heavily plastered floor. Otherwise, the floor was mostly quite absent. Burned beam remnants were found in Tests 14, 17, and 20. Two post holes were found in Test 17. A roasting pit intruded into the floor of Structure 2, indicating that the site was occupied after Structure 2 had burned.

Figure 23. Structure 3, Ch-240.

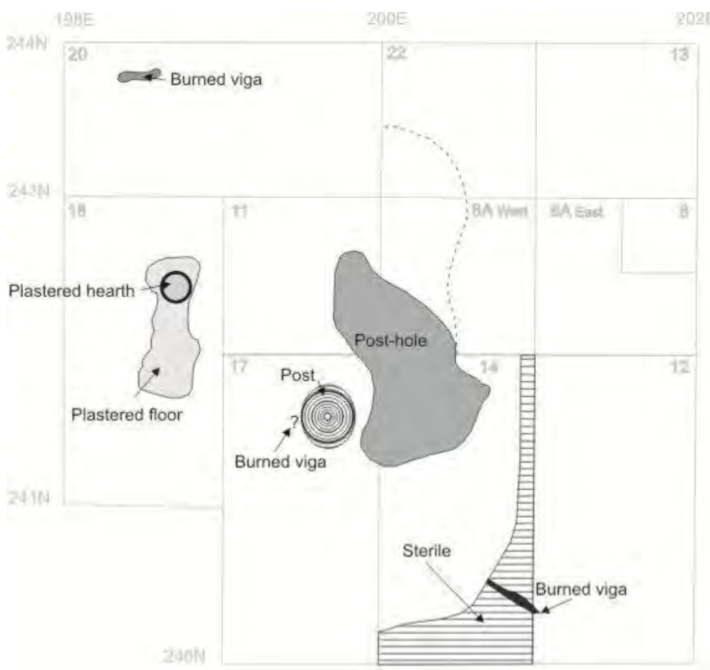

Figure 24. Structure 2, Ch-240.

Discussion

Neither of the two houses was in deep pits. Rather, Structure 1 was in a shallow depression created in part by digging into sterile clayey soil, partly by cutting through an older house (that we did not trace out). The well-preserved floor of Structure 1 gave no indication of internal support posts—but it was a small pit house, whose roof could easily be supported along the edge of the pit. Three posts along the southeast portion of, but outside, the pit reinforce this notion.

Structure 2 may have been a *jacal;* if so, it is the best evidence for a Viejo period surface dwelling found by the PAC. Unfortunately, the structure was badly damaged by plowing and it could instead have been a shallow pit structure.

We can envision two architectural scenarios for the Viejo–Medio transition in the southern zone of the Chihuahua culture. If the northern and southern zones went through the transition in lockstep, Perros Bravos style, late Viejo period surface structures should be present in the southern zone (just as they are in the northern zone) and the PAC's failure to find firm evidence of such surface structures is a disappointment. If, on the other hand, surface architecture developed in the northern zone and subsequently spread southward as part of a Medio period package, we would expect southern zone villages to switch directly from pit houses to the substantial adobe buildings of the Medio period. Under that scenario, the PAC would not find transitional surface architecture because it never existed.

The field crew did its best to distinguish chunks of adobe (load-bearing wall material) from *bajareque* (fragments of daub, that is, of non-load-bearing material applied to a wood and brush framework). Still, it was not always clear which was which, or how each material was being used in a structure.

One unanswered question for the PAC concerns storage facilities. The only unambiguous storage pit we have excavated was a bell-shaped pit at el Zurdo, Ch-159, in the Babícora basin. Here (Ch-240), a concave plastered area in the northeast part of Structure 1 straddled the house wall. We suspect that this could have been the base of a storage bin or granary similar to the famous giant granary in Cueva de la Olla—but in this case, much smaller and built into a house.

If storage facilities are in short supply, external fire/roasting pits seems quite common in Viejo period sites, including this one. The very large pit excavated in Units 6, 9, 10, and 10A produced an abundance of fire-cracked rock, along with animal bone and maize fragments. The pit was used repeatedly, with the fire-cracked rock being dumped to one side. Other fire/roasting pits, such as the one intruded into Structure 2, were considerably smaller.

The main excavation area shows a complex use of a limited area, including construction and abandonment of structures, trash disposal, and the digging of many pits, some of which intersected.

Pottery from Ch-240, 2000

Figure 25 shows three sherds found at C-240 in 2000. The ceramic assemblage from that year includes 6,009 sherds, including 4,407 Undecorated, 242 Black, 208 red-slipped, 416 red-on-brown, 716 textured, and 20 Other. The sherds from different parts of the site appear to be quite similar. No polychromes were collected, in contrast to the situation in the Santa María drainage (where all of the Viejo period sites have Santa Ana Polychrome in at least their upper levels). A single sherd of Mimbres Black-on-white (counted in the Other category) came from lowest level of Test 16 (62 to 73 cm BS) but was not recognized in the field, so it is unclear whether it was associated with or predated Structure 1. The red-on-brown sherds include thin-line (Mata) and broad-line (Anchondo), but many of those sherds are less distinctive. Additional designs seen on textured and red-on-brown sherds include checkerboards, chevrons, and polka dots.

Figure 25. Three sherds from Ch-240. Left: corrugated (Lot 4115). Middle: checkerboard design (Lot 4078). Right: chevron design (Lot 4088).

Flaked Stone

The formal flaked stone tools are summarized in Table 11. Such tools seemed more common at Ch-240 than at the Santa María Valley sites; work in the Santa Clara Valley is in its infancy, however, and this impression could easily change once more Santa Clara sites are excavated.

As is customary with southern zone flaked stone collections, the vast majority of the pieces show no signs of use. Using a fairly liberal definition of utilized flake, some 51 shaped tools and utilized flakes were found, as opposed to 1,722 flakes (weighing 11622 g) and 33 cores (weighing 2192 g). The non-tool flakes were made of rhyolite (49 percent), basalt (20 percent), chert/chalcedony (20 percent), quartzite (9 percent), and obsidian (2 percent). In the Santa María Valley, rhyolite was much more common and chert/chalcedony and quartzite much less common, reflecting differences in the availability of those raw materials in the two valleys.

The projectile points from Ch-240 are mostly small, although one fragment (No. 4062-1) is from a mid-sized point (Figure 26). Shallow corner notches, deep corner notches, and side notches are present. One point, associated with the floor of Structure 1, is a Harrell or Plains side-notched.

Table 11. Shaped Flaked Stone from Ch-240, 2000.

Lot No.	Provenience	Level	Item	Description	Size (cm)	Material	Weight (gm)
4062	N300, E240	Surface	Projectile point fragment	Base of medium size corner- notched point	n/a	White chert	
4062	N240, E220	Surface	Worked flake	Bifacial, broken, narrow	1.7 by 1.2 by 0.4	Obsidian	
4071	Test 7	Level 2	Small point	Asymmetrical	11.5 by 0.8 by 0.4	Fine-grained black basalt	1
4073	Test 8A E	Level 1	Utilized/worked flake	With cortex	2 by 1 by ?	Obsidian	
4073	Test 8A E	Level 1	Utilized/worked flake	Retouch is bifacial	2.8 by 2.5 by ?	Fine-grained rhyolite	
4074	Test 8A E	Level 2	Bipolar, broken	Apache tear	?	Obsidian	
4074	Test 8A E	Level 2	Projectile point	Corner notched	1.6 by 0.6 by 0.2	Fine-grained black basalt	0.6
4074	Test 8A E	Level 2	Projectile point; broken	Lacks base. Fine flaking.	1.5 by 1.0 by 0.2	Obsidian	0.6
4074	Test 8A E	Level 2	Utilized flake	Polished convex edge	4.5 by 1.6 by 0.9	Coarse chert or quartzite	4.8
4074	Test 8A E	Level 2	Borer/chopper?	Pebble with one end bifacially flaked to create an edge that narrows to a smoothed tip that is 0.8 cm wide. Proximal is cortical.	7.0 by 5.9 by 3.2	Rhyolite	104.4
4074	Test 8A E	Level 2	Utilized flake	Secondary flake with use along one edge	3.4 by 2..1 by 1.7	Chert	5.4
4074	Test 8A E	Level 2	Utilized flake	Flake with cortex; one edge used	5.0 by 3.9 by 1.1	Rhyolite	21.5
4074	Test 8A E	Level 2	Utilized flake	Secondary flake used on one edge	3.6 by 2.2 by 0.9	Fine-grained rhyolite	6.9
4077	Test 10	Level 1	Projectile point	Crude, asymmetrical, vague corner notch on one side	1.6 by 0.6 by 0.2	Rhyolite	0.2

Table 11. Shaped Flaked Stone from Ch-240, 2000.

Lot No.	Provenience	Level	Item	Description	Size (cm)	Material	Weight (gm)
4078	Test 10A	Level 2	Apache tear flake	No cortex	1.1 by 0.7 by 0.4	Obsidian	
4078	Test 10 A	Level 2	Utilized flake	Blocky flake with use on distal end	5.7 by 4.3 by 1.6	Rhyolite	44.1
4078	Test 10 A	Level 2	Utilized flake	Secondary flake with use along one edge	4.2 by 2.9 by 0.9	Rhyolite	13.2
4079	Test 11	Level 1	Projectile point, complete	Corner notched with broad base. Thin, with fine edge flaking	1.6 by 1.4 by 0.3	Dark chert	0.3
4081	Test 12	Level 2	Flake, worked?	Crude, with some patina	1.6 by 0.8 by 0.2	Obsidian	0.8
4081	Test 12	Level 2	Biface fragment	Heat cracked	3.3 by 3.8 by 1.6	Rhyolite	13.1
4086	Test 13	Level 1	Utilized flake	Utilized edge is steep		Rhyolite	38.2
4086	Test 13	Level 1	Projectile point, broken	Rounded base, shallow notches; crude	2.1 by 0.8 by 0.9	Fine-grained basalt	1.0
4094	Test 14	Level 2	Worked flake	Retouched around the convex end. This thin flake is scraper-like.	1.6 by 1.3 by 0.4	Translucent chert	
4096	Test 15	Level 2	Utilized flake	Scraper?	4.0 by 3.1 by 1.7	Rhyolite	26.1
4097	Test 15	Level 3	Projectile point	Crude. Slightly curved in profile. Base broken.	2.2 by 0.9 by 0.5	Fine-grained basalt	1.5
4097	Test 15	Level 3	Utilized flake	One convex edge was used.	2.9 by 3.2 by 0.9	Rhyolite	8.6
4097	Test 15	Level 3	Utilized flake	One edge was used.	4.6 by 3.5 by 1.1	Rhyolite	16.8
4103	Test 17	Level 1	Utilized flake ?	Heat-treated	2.5 by 2.5	Rhyolite	3.8
4103	Test 17	Level 1	Utilized flake?	Triangular cross-section. Fine retouch along two edges.		Rhyolite	10.1

Table 11. Shaped Flaked Stone from Ch-240, 2000.

Lot No.	Provenience	Level	Item	Description	Size (cm)	Material	Weight (gm)
4101	Test 16	Level 4	Utilized flake	Some retouch/use wear		Quartzite	2.5
4104	Test 18	Level 1	Utilized flake	Secondary flake with possible edge retouch		Quartzite	8
4105	General site	Surface	Utilized blade	Both long edges are retouched	4.4 by 1.8	Fine-grained quartzite	5
4111	Test 14	Level 4	Plano scraper?	Broken pebble with steep edge that may have been used as a scraper	3.8 by 3.5 by 3.1	Rhyolite	52
4111	Test 14	Level 4	Projectile point	Small point, possibly heat treated. Convex base. Shallow corner notches. Bifacially flaked.	1.4 by 0.8 by 0.3	White chert	
4111	Text 14	Level 4	Point mid-section	Has unusual incrustation.	2.0 by 1.3 by 0.4		
4121	Test 23	Level 5	Worked flake	One retouched edge	2.5 by 1.5 by ?	Banded chert	3.6
4125	Test 8A W	Level 5	Possibly worked edge	Fragment of a thin tabular stone, with flakes removed from one edge	2.3 by 1.2 by 0.8	Rhyolite	3
4126	Test 8A W	Level 5, Structure 1 floor	Projectile point	Side notched, flat base, sharp tip. Harrell point. Flaking to midline.	2.3 by 1.4 by 0.3	White chert	
4128	Test 11	Level 3	Utilized flake	Two edges used	3 by 2 by ?	Chert	3.8
4128	Test 11	Level 3	Utilized flake	Edge wear	?	Chert	3.2
4132	Test 19	Level 3	Tiny point	Asymmetrical, slanted base, possibly one shallow corner notch	1.3 by 0.6 by 0.3	Fine-grained black basalt	
4133	Test 19	Level 4	Utilized flake	Cortical flake; cortex removed along edge by retouch	4.1 by 2.8 by 1.0	Rhyolite	6.5
4134	Test 20	Level 1	Utilized flake	Primary cortical flake with one steep edge	4.2 by 2.5 by 0.9	Rhyolite	10.4

Table 11. Shaped Flaked Stone from Ch-240, 2000.

Lot No.	Provenience	Level	Item	Description	Size (cm)	Material	Weight (gm)
				retouched			
4134	Test 20	Level 1	Utilized flake	Secondary flake with one thin edge showing fine retouch (?)	2.4 by 2.8 by 0.6	Rhyolite	4.2
4136	Test 21	Level 2	Small point or biface	Asymmetrical base	2.5 by 1.2 by 0.7	Translucent	
4138	Test 21	Level 4	Small point or biface	Lacks notches. Narrows to base with cortex.	1.6 by 0.6 by 0.4	Obsidian	
4139	Test 21	Level 5	Utilized flake	Edge use or retouch on two edges	4.6 by 3.8 by 11.5	Basalt	23.6
4144	Test 23	Level 2	Possible scraper	Steep-edged flake, flat on one side, with modified edge	4 by 3 by ?	Rhyolite	34.6
4144	Test 23	Level 2	Large utilized flake	Boomerang-shaped piece with utilized edges	6.9 by 5 by ?	Yellow chert	62.0
4145	Test 23	Level 2	Point with broken base	Short, wide point with one corner of base missing	1.5 by 1.3 by 0.4	Obsidian	
4151	Test 8A W	Level 3	Retouched flake	Retouch around the sharp point of a flake	1.9 by 1.3 by ?	Fine-grained quartzite	1.7

Figure 26. Examples of flaked stone from Ch-240, recovered in 2000. Photographs, left to right: Lots 4078, 4062 (two items), 4136, and 4111 (two items). The drawing at right shows a point from Ch-5, in the Bustillos basin, that is 2.2 cm long (Lot 8165-1). The point is comparable in size to the large point fragment from Lot 4062-1 (not shown here), and has an almost identical base.

Ground Stone

The ground stone assemblage for 2000 included 11 manos, ground stone fragments that could have been part of metates, full-grooved axes, and a stone ball (Table 12). We were told that large pieces of stone were usually thrown into a nearby arroyo. We saw no metates in that arroyo, but any stone artifacts deposited there could have washed downstream.

Bone Tool

A scapula (probably of a deer or antelope) had most of the process cut away. The remainder of the process had 14 notches and could have served as a rasp.

Ornaments

Six ornaments were collected, two of them from the surface. These included a turquoise pendant, disk beads, an *Olivella* bead, and a thin shell bead (Table 13).

Radiocarbon Dates

Four radiocarbon dates were obtained from the 2000 excavations at this site (Table 14). All came from maize cob fragments recovered in the main excavation area. This area appears to have been occupied in the 1000s and 1100s.

Table 12. Ground Stone Tools from Ch-240.

Lot No.	Proven-ience	Level	Item	Material	Measurements (cm)
4072	Test 8	1	Mano fragment	Vesicular basalt	11.7 by 12 by 8.9
4067	Test 21	1	Mano fragment	Vesicular basalt	14.8 by 11.0 by 5.9
4073	Test 8A	1	Full-grooved axe, bit broken	Fine-grained basalt	17.2 by 9.1 by 6.1
4074	Test 8A	2	Possible mano	Rhyolite	8.0 by 5.5 by 5.0
4074	Test 8A	2	Small mano fragment	Rhyolite	5.5 by 6.0 by 3.0
4080	Test 12	1	Mano fragment	Basalt	11.5 by 7.0 by 1.0
4086	Test 13	1	Full-grooved axe	Basalt	13.8 by 7.8 by 6.4
4996	Test 15	2	Stone ball	Basalt	6.0 by 6.8 by 5.4
4099	Test 16	3	Possible mano frag.	Basalt	7.0 by 3.5 by 3.0
4100	Test 16	3	Possible mano frag.	Basalt	8.5 by 6.5 by 33.5
4104	Test 18	1	Ground slab frag.	Basalt	12.7 by 7.9 by 4.0; ground area 7.1 by 6.4
4104	Test 18	1	Ground fragment?	Rhyolite	4.8 by 3.0 by 2.7
4110	Test 12	5	Metate fragment?	Basalt	5.9 by 4.7 by 10
4116	Test 17	2	Thin, flat, mano	Basalt	15 by 8.9 by 2.4
4120	Test 23	4	Midsection of full-grooved axe or maul	Poor grade rhyolite	5.4 by 4.7 by 3.0
4123	Test 8A W	4 (pit)	Cobble mano, convex grinding surface	?	16.0 by 11.0 by 7.4
4129	Test 14	3	Mano fragment	Basalt	8.4 by 3.9 by 9.2 thick
4134	Test 20	1	Ground stone fragment—flat slab?	Basalt	7 by 7.2 by 4.3
4123	Test 20	1	Cobble mano, convex grinding surface	Basalt	12.8 by 11.8 by 8.9; ground area 17.4 by 9.4
4139	Test 21	5	Broken cobble, slightly ground on one surface	Rhyolite	5.5 by 7.7 by 4.5

Table 13. Ornaments found at Ch-240 in 1998.

Lot No.	Provenience	Level	Item	Measurements
4062	General	Surface	Flat, rectangular turquoise pendant; upper and side edges beveled; biconical hole	1.7 by 1.1 by 0.5 cm; hole tapers from 0.20 to 0.15 cm in diameter.
4062	General	Surface	Disk bead	0.70 to 0.75 cm in diameter, 0.23 cm thick. Hole 3 cm in diameter.
4097	Test 15	3	*Olivella* bead	1.3 by 0.7 cm
4097	Test 15	3	Bead made with thin, curved piece of shell	0.8 to 0.9 cm in diameter. Shell is 0.1 cm thick but curvature results in height of 0.2 cm. Hole is 0.2 cm in diameter.
4069	Test 6	1	Disk bead. Tuff? Hole not biconical; drilled at a slight slant.	1.4 by 1.3 cm in diameter, 0.4 cm thick. Hole is 0.4 cm in diameter.
4132	Test 19	3	Shell bead. Perhaps from a land snail?	1.1 by 0.7 by 0.5 cm

Table 14. Radiocarbon Dates from Ch-240, from 2000.

Lab Code	Sample Code	Lot No.	Context	Conventional age BP	Calibrated Date*
TO-8913	Ch-14C-84	4112	Test 14; N240–242/E200–201; 94–118 cm BD; fire/roasting pit just extending down to floor of Structure 1	980 ± 50	995–1191
TO-8914	Ch-14C-85	4098	Test 15; N241–243/E200–203; Level 4, 89–119 cm BD; Feature 8, hearth fill, above floor of Structure 1	920 ± 40	1024–1193
TO-8916	Ch-14C-87	4074	Test 8A; N242–243333/E200-203, east half; Level 2, 65–121 cm BD. Trashy deposit.	950 ± 50	1015–1192
TO-8917	Ch-14C-88	4109	Test 11; N242–243/E199–200; Level 5, 94–118 cm BD. From ashy fill above Structure 3 (Feature 5) floor. Sample taken from 89–91 cm BD.	980 ± 40	991–1160

*2-sigma calibrated age AD. ranges with the highest probabilities.

The 2005 GPR Survey

The 2005 GPR survey (Figures 27–29) took place partly on land belonging to Sr. Essio Jacques, and partly in a pasture to the east. The blank strip on the images represents the fence dividing the two properties. The left sides of the image are of Sr. Jacques' land, where there is an unplowed strip along the fence. Recent plowing of the rest of the field made it unsuitable for GPR survey. The images represent a part of the site not previously investigated.

Six anomalies were interpreted as possible structures. Of these, four have the size and shape to be Viejo period residences. The largest anomaly is of the size to be a community house. A rectangular anomaly is particularly interesting, as it could be part a shift from round to rectangular structures, while maintaining the pattern of scattered houses.

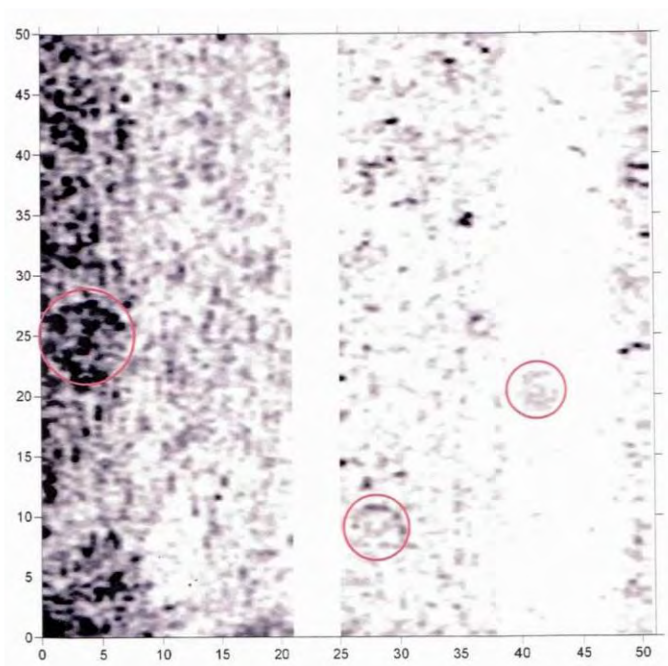

Figure 27. Ch-240, GPR scan at a depth of 25 cm. Three anomalies (circled) are thought to be houses. The largest anomaly, west of the fence, is a possible community structure. The grid is oriented with north at the top.

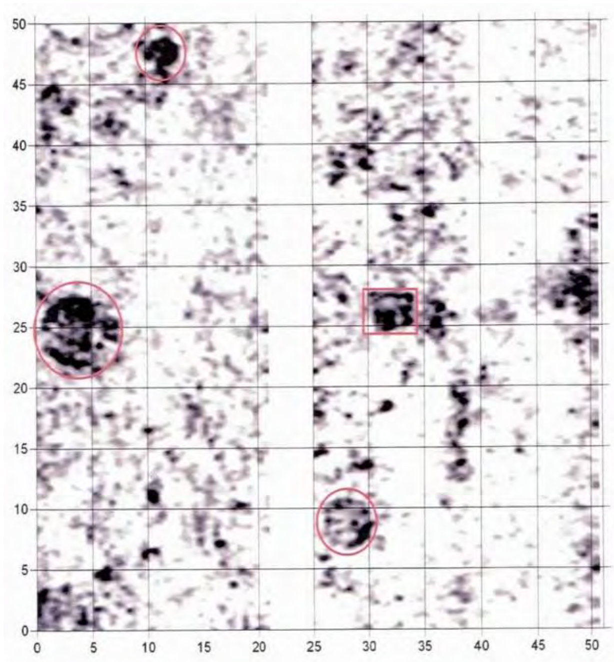

Figure 28. Ch-240, GPR scan at a depth of 40 cm. This image also shows the possible community house and one of the two smaller houses seem at 25 cm. A rectangular anomaly is also present.

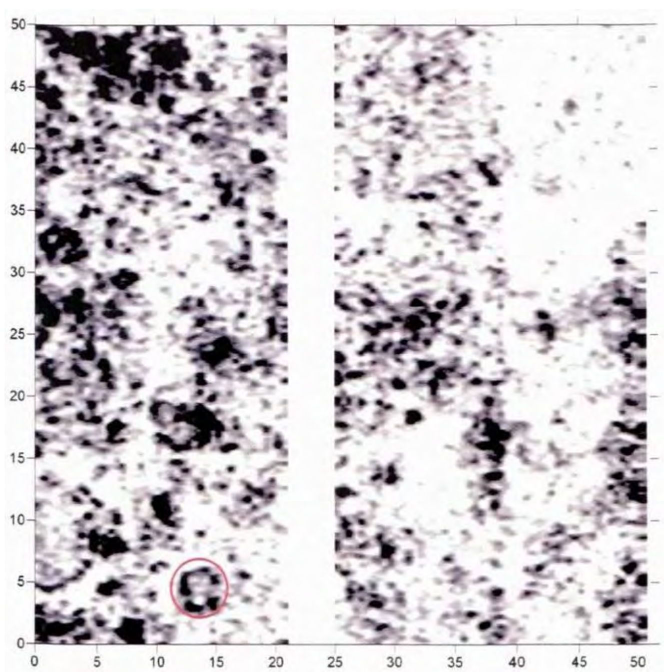

Figure 29. Ch-240, GPR scan at a depth of 60 cm. A single possible house is circled on the image.

Additional Studies in 2010 and 2012

In 2007, J. Cunningham assumed responsibility for the PAC investigations in the Santa Clara Valley, expanding the reconnaissance and site recording effort. He found mostly Medio period sites (including Ch-315, the Ciénega Apache site, which has an I-shaped ball court as well as Viejo period pit houses and Medio period structures). His work continues under the rubric of PCSC (Proyecto Chihuahua Santa Clara) and is being reported separately. However, his 2010 and 2012 work at Ch-240 can be mentioned here.

The square image on the 2005 GPR scan was excavated in 2010 and proved to be a storage/work space next to a round pit house with an adobe wall base; the pit was excavated in 2012. The rectangular structure (which probably had *jacal* walls rather than more substantial Perros Bravos type walls) burned with contents in situ (Figures 30 and 31). Six jars, two bowls, a pinch pot, a ceramic scoop, a metate, and other artifacts were found, along with a basket-like storage feature, on the pit house floor and on the floor of a "porch" (exterior space) on the north side of the structure. The vessel contents included beans, maize, and a variety of wild plants that are still being analyzed.

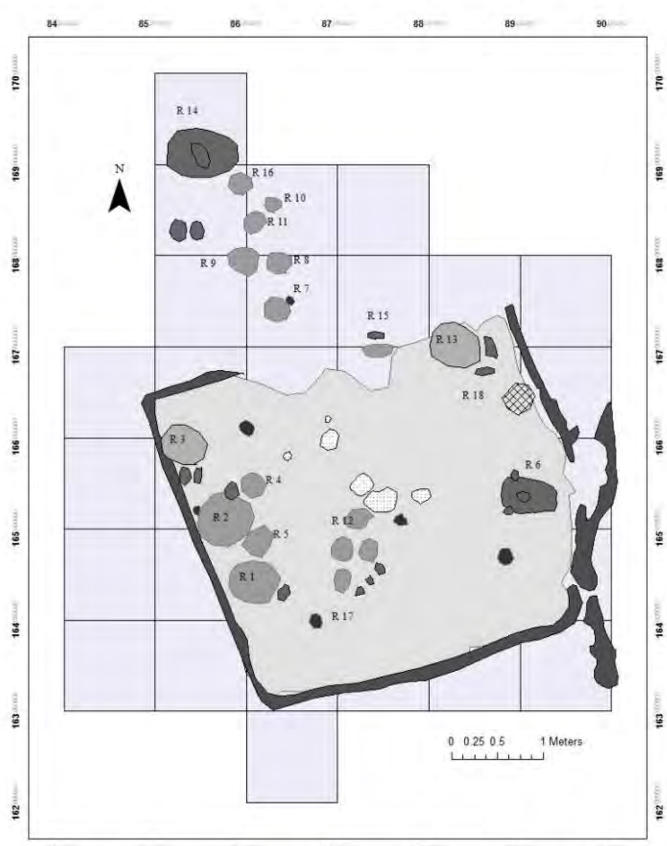

Figure 30. The rectangular storage/work area structure at Ch-240. The edge of the adjacent pit house is at the right of the plan.

Figure 31. Two reconstructed vessels from the rectangular storage/work area structure at Ch-240.

Six radiocarbon dates, all derived from annual plant parts in the crushed pots in the rectangular structure, were run at the Chrono14 Laboratory at Queens University, Belfast. At the 2 sigma range, the calibrated dates fall between A.D. 1015 and 1157, firmly placing the structure in the late Viejo period (Table 15).

Table 15. Radiocarbon Dates from Ch-240, from 2010.

Lab Code	PAC Sample	Context	Material	Conventional Age BP	Calibrated Date*
UBA-16335	2010-5	Feature 5	Charcoal	942 ± 28	1026–1157
UBA-16356	2010-6	Feature 1	Carbonized seed or husk	969 ± 21	1019–1153
UBA-16357	2010-7	Feature 8	Carbonized seed or husk	947 ± 21	1026–1155
UBA-16358	2010-8	Feature 13	Carbonized seed or husk	977 ± 23	1015–1154
UBA-16359	2010-9	Feature 2	Carbonized seed or husk	957 ± 24	1022–1155
UBA-16360	2010-10	Feature 3	Carbonized seed or husk	948 ± 26	1024–1155

*2-sigma calibrated age AD. ranges with the highest probabilities.

Chapter 4

ANÁLISIS PALEO-ETNOBOTÁNICO, TEMPORADAS DE 2008 Y 2010

Natalia Martínez Tagüeña

Este reporte presenta los resultados del análisis macro botánico de la temporada de campo 2010, más 16 muestras de carbón recolectado *in situ* durante la temporada del 2008, proveniente de los sitios excavados Ch-218, Ch-240 y Ch-254. Las muestras analizadas fueron recuperadas por medio de dos técnicas. Durante la excavación, los fragmentos visibles y reconocibles de plantas carbonizadas fueron recolectados *in situ* o en el momento de cribado. Al excavar e identificar los pisos de las casas en pozo, se pudieron recolectar vigas y postes carbonizados que formaron parte del sistema constructivo; además, en el sitio Ch-240 se encontraron vasijas completas que contuvieron en su interior restos carbonizados. Cuando no fueron visibles a simple vista, se obtuvieron muestras de tierra para ser procedas por medio de la técnica de flotación. Las muestras de tierra presentaron un volumen variable de 1 a 5 litros dependiendo su contexto de procedencia; se originaron del relleno de diversas unidades, suelos de ocupación, elementos arqueológicos como fogones, entierros y del interior de vasijas completas. En total se analizaron 17 muestras recolectadas *in situ* y 18 muestras de flotación. Los resultados indican la presencia de 15 taxones diferentes en donde el maíz y el frijol común son las únicas plantas domesticadas. También se identificaron cuatro tipos de madera que los habitantes del sitio emplearon para construcción de hogares o utensilios, además de cómo combustible (Tabla 16).

Metodología

Los restos macro botánicos recolectados durante la excavación son envueltos en papel aluminio y colocados en bolsas o en recipientes de plástico. No fue necesario su lavado para la identificación porque simplemente se realiza un corte transversal fresco en los pedazos de carbón. Las muestras de tierra se procesaron en campo por medio de un proceso de flotado simple, donde por medio de la agitación manual de la tierra, inmersa en un contenedor de agua, los restos se desprenden de la tierra y flotan hacia la superficie. Estos se recolectan y se dejan secar para poder ser identificados con la ayuda de un microscopio.

La identificación de los macro-restos se realiza por medio de comparaciones de uno a uno, entre la colección de referencia y los materiales arqueológicos desconocidos. El primer paso consiste en separar la muestra en diferentes tamaños por medio de un tren de criba: (1) mayor de 3.36 mm, (2) entre 3.36 y 1.68 mm, (3) entre 1.68 y 0.5 mm, y (4) menor a 0.5 mm. El segundo paso consiste en la observación del material con un microscopio binocular de aumento 10–70X; al separar la muestra por diferentes tamaños homogéneos, la observación en el microscopio se facilita. Cabe recordar que únicamente se tomaron en cuenta los restos carbonizados suponiendo que son resultado de actividades prehispánicas.

Tabla 16. Resultados del Análisis Macro Botánico.

Espécimen Identificado	Nombre Común	Parte Identificada	Ubicuidad Ch-254	Ubicuidad Ch-240
Tipo *Arcotstaphylos/Arbustus sp.*	Manzanita, Madroña	Madera		
Tipo Cheno-ams	Amaranto, Quelite	Semilla	50%	25%
Tipo *Erigeron* sp.	Pazotillo	Aquenio	10%	10%
Tipo Gramineae	Pastos	Grano	10%	63%
Tipo *Juniperus* sp.	Junípero, Enebro	Madera y semilla	30%	
Tipo *Lagenaria* sp.	Bule, Jícara	Semilla	10%	8%
Tipo Leguminosae	Leguminosa	Semilla	10%	
Tipo Monocotiledón	Pasto	Tallo	10%	
Tipo *Oxalis* sp.	Trébol amarillo	Semilla		8%
Tipo *Phaseolus vulgaris*	Frijol común	Semilla	10%	
Tipo *Phragmites* sp.	Carrizo	Tallo		
Tipo *Pinus* sp.	Pino	Escama y madera	10%	
Tipo *Portulaca* sp.	Verdolaga	Semilla	20%	
Tipo *Quercus* sp.	Encino	Madera	30%	
Tipo *Zea mays*	Maíz	Olote, cúpula, tallo	60%	

Debido a las alteraciones que sufren los restos macro botánicos al carbonizarse, la identificación se realizó en su mayoría a nivel de género y familia. Las identificaciones taxonómicas presentadas en el texto, van precedidas por la palabra "tipo" y se refiere a que si bien el espécimen asemeja al taxón nombrado, también podría asemejarse a otros especímenes relacionados, o no relacionados. En el apéndice A se pueden consultar detalles adicionales de la presente investigación..

Ch-218

El sitio Ch-218 correspondiente al periodo Viejo, se encuentra ubicado en una terraza aluvial del río Santa María en donde una amplia variedad de recursos silvestres asociados al río y la posibilidad de cultivo fueron accesibles en sus inmediaciones. El presente análisis consta de una muestra de flotación proveniente de la Unidad 1 con las siguientes coordenadas N153.5 E72.6, en donde se identificaron 5.1 gramos de fragmentos de madera de pino (*Pinus* sp.). Aunque únicamente se determinó el género, es posible que esta muestra corresponda a *Pinus cembroides, Pinus leiophylla chihuahuana* o *Pinus engelmannii*; especies identificadas por Karen Adams y Phyllis Doleman en las bajadas de los cerros próximos a Oscar Soto Máynez en el valle de Santa María cerca del sitio en cuestión. Cabe mencionar que el análisis previo de la temporada 2008, para este sitio se identificó madera de junípero (*Juniperus* sp.); dado que estás maderas no se encuentran en la planicie aluvial donde el sitio está ubicado, es probable que los habitantes las adquirieron en la tierras más elevadas al oeste del sitio.

Ch-254

El sitio CH-254 también ubicado en el valle de Santa María, sobre la primera terraza del arroyo El Pino, corresponde temporalmente a el Periodo Viejo. Las muestras provienen de una estructura que cuenta con tres episodios superpuestos de ocupación. Al igual que el sitio CH-218 los habitantes tuvieron acceso a una variedad de recursos silvestres asociados al arroyo y amplias tierras cultivables. Se analizaron 16 muestras recolectadas *in situ* durante la excavación de la Estructura 6, con el propósito de obtener fechas de radiocarbono y la identificación de maderas empleadas para construcción y combustible. Todas las muestras conciernen al Nivel 4 excavado, correspondiente al piso de ocupación de la estructura; provienen de las unidades: 2, 3, 4, 7, 8, 10, 18, 19, 20 y 31; y de los elementos 5, 6, 7, 9 y 74. Del total de las muestras, el 75 por ciento corresponde a madera de pino (*Pinus* sp.) (12 muestras de 16; 3347 gramos) y el restante 25 por ciento a madera del arbusto manzanita o madroña (*Arctostaphylos* sp./*Arbustus* sp.) (cuatro muestras de 16; 373 gramos).

Para la utilización de madera de pino, ocho muestras correspondieron a postes y las otras cuatro muestras a vigas. La mayoría de las vigas se encontraron totalmente carbonizadas con excepción de una en el Elemento 7, muestra Lot 2838, en donde únicamente algunas partes están quemadas y su preservación es muy buena (Figura 32).

Figura 32. Viga de madera de pino sin carbonizar.

Todas las muestras de madera de manzanita o madroña fueron identificadas como postes, seguramente provenientes de hoyos en poste excavados en la superficie de ocupación. Aunque la identificación en este análisis se realizó únicamente a nivel de género, las especies recolectadas en Oscar Soto Máynez por Karen Adams y Phyllis Doleman corresponden a *Arctostaphylos pungens* (con una elevación de 1980 a 2000 msnm) y *Arbustus xalapensis* (con una elevación de 2200 msnm). Cabe mencionar que ambos recursos, además de proporcionar madera también cuentan con frutos comestibles (Moerman 2009).

De la misma manera que en el sitio Ch-218, estás maderas no se encuentran en las inmediaciones del sitio en la planicie aluvial del arroyo, sino que los habitantes tuvieron que visitar las áreas de mayor elevación próximas al sitio donde se encuentra el bosque de pino y encino. Sin embargo, se identificó además un fragmento de tallo de carrizo (*Phragmites* sp.) en la muestra Lot 2750, que es un pasto perenne que se encuentra a las orillas de los ríos y lagos, crece sobre del agua ya que sus raíces siempre quedan sumergidas, llegando a medir cerca de 2 m.; asemeja a la planta bambú y ocurre en elevaciones alrededor de 1,000 m (Rea 1997:102), siendo un fuerte indicador de agua durante todo el año en el arroyo cercano al sitio. Aunque ningún uso es documentado con relación a la alimentación, aporta información sobre el conocimiento y la relación del ser humano con su medio. Relatos etnográficos describen la utilización de tubos hechos de una sección de carrizo (*Phragmites communis*), a manera de pipa para fumar tabaco silvestre (Castetter y Underhill 1935:27, 68) más sus varios usos medicinales. También son empleados para la fabricación de flautas, petates, canastas, cañas de pescar y otras herramientas (Moerman 2009).

Para este sitio se analizaron 10 muestras de flotación y se identificó la presencia de 12 taxones diferentes, en donde todas las muestras presentan restos identificables (Tabla 16).

Las partes identificables de las plantas carbonizadas fueron semillas, granos, frutos o aquenios, tallos y madera. Las semillas se definen por su composición, ya que se conforman de un embrión en estado de vida latente o amortiguada, acompañada o no de un tejido nutricio y protegido por el epispermo (Font 1993:977). Los tallos que no se pueden clasificar a nivel de género quedan dentro de la categoría de las monocotiledóneas; éstas son las plantas con un cotiledón (Font 1993:729), que es la parte del embrión (y de la semilla) que dará origen a la primera hoja (Calderón y Rzedowsky 2001:1307). La madera es la parte sólida de los árboles debajo de la corteza; se conforma de dos partes, el centro o corazón y la periferia llamada albura o alburno (Font 1993:680). Como se mencionó anteriormente únicamente se identificaron los restos carbonizados y se emplea la palabra "tipo" ya que los restos de plantas carbonizadas sufren alteraciones y pueden también asemejarse a otros taxones. A continuación se presenta una breve descripción de la planta y sus posibles usos, la parte identificada y los contextos que la contienen.

Plantas Domesticadas

Tipo *Zea mays* (Maíz). De las tres subespecies reconocidas existe una (*Z. mays* ssp. *mays* o el "maíz") que en la actualidad es un cultivo universal (Valdés 2001:1114). A diferencia del análisis de la temporada 2008 en donde todas las muestras contuvieron maíz, en la temporada de 2010 únicamente se recuperó en el 60 por ciento de las muestras. Cabe mencionar que las cúpulas son las partes más duraderas del olote y suelen preservarse cuando otras partes desaparecen (Adams 1993:199), quizás por este motivo sobresalen en cantidad. Sin embargo también se identificaron granos y fragmentos de olote. La presencia de olotes y de cúpulas siguiere la reutilización del maíz como combustible (Adams 1980). El procesamiento de maíz con fuego crea condiciones favorables para su almacenamiento y para facilitar la molienda (Adams 1980:47). Otra manera de procesar el maíz fue hirviendo el elote con cenizas, después se secaba, se limpiaba y luego se asaba con brasas sobre el fuego; este proceso se hacía para preparar pinole (Russell 1975[1908]:73). Muchas comunidades han empleado el maíz para diversos propósitos como alimento, bebida, medicina, materia prima para herramientas y combustible, entre otros usos (Moerman 2009).

Tipo *Phaseolus vulgaris* (Frijol Común). Es una planta anual de un cotiledón herbácea que en la actualidad es intensamente cultivada desde la zona tropical hasta las zonas templadas, siendo un alimento básico como principal fuente de proteína. Únicamente se identificó un fragmento en el Elemento 1, muestra Lot 4294, correspondiente a una ubicuidad de 10 por ciento. Ya que debió de haber sido consumido ampliamente en el pasado, se piensa que la escasez en el registro arqueológico se debe a que este recurso se hierve y únicamente en ocasiones donde alguno hubiera caído al fuego accidentalmente se podría carbonizar, además se piensa que tiene mala preservación en comparación a partes del maíz que son más duraderas (Adams 1993).

Plantas Silvestres

Semillas Tipo Leguminosae (Leguminosas). Esta familia contiene árboles, arbustos o hierbas tendidas, trepadoras o erguidas; contiene 500 géneros y alrededor de 17,000 especies, comprendiendo gran número de plantas útiles en lo que se refiere a la alimentación y las maderas (Espinosa 2001:251). Las semillas de esta familia se transformaron al carbonizarse, tuvieron cambios morfológicos y se fragmentaron, por lo que no se pudieron clasificar a nivel de género. En las recolecciones realizadas para el centro y el oeste de Chihuahua, Karen Adams y Phyllis Doleman identificaron varios tipos de mimosas y acacias (sobre todo Mimosa dysocarpa) y también mezquites (Prosopis juliflora).

Aunque solamente el Elemento 9, muestra Lot 4363, presentó esta especie, cabe resaltar que por lo menos 35 semillas fueron registradas. Estas leguminosas se encuentran asociadas a granos de maíz y tres fragmentos de olotes. Muchos grupos indígenas en el norte de México y Sudoeste de Estados Unidos han basado históricamente su dieta en leguminosas más que en granos o carnes; tanto en las leguminosas silvestres como en las cultivadas el uso de semillas y vainas es singular, ya que pueden ser almacenadas durante largos periodos de tiempo al procesarlas de la siguiente manera: las semillas secas son asadas y molidas creando una harina para después consumir en una mezcla dulce como el pinole o para la realización de pasteles (Nabhan et al. 1979:172–173, 179).

Semillas de Cheno-ams (Quelites, Amaranto). El término Cheno-am se refiere a semillas que pertenecen a dos géneros, Chenopodium y Amaranthus. Las semillas de ambos son muy similares, por lo que su identificación individual requiere de un microscopio con mayor magnificación (Huckell 1995:86). Su identificación individual no es crucial para una correcta interpretación sobre el papel de estas plantas en la economía de subsistencia, ya que su estacionalidad, hábitat de crecimiento, parámetros ambientales y la preparación y consumo demostrado por la etnobotánica es el mismo (Huckell 1995:86). Las plantas de los géneros Chenopodium y Amaranthus son hierbas anuales o perennes, suelen aparecer entre 2,250 y 2,600 m de altura, pero sí ocurren en elevaciones menores (Calderón 2001:117, 125). El género Chenopodium comprende 200 especies de amplia distribución mundial, algunas de ellas son comestibles, se usan como condimento o en la medicina vernácula (Calderón 2001:117). Ambos géneros prosperan en zonas donde fue reducida la competencia con otras plantas; en zonas alteradas por el ser humano, como suelos alrededor de caminos, arroyos y en tierras de agricultura y pastura (Huckell 1995: 86). Para la zona centro de Chihuahua, Adams y Doleman (1992) realizaron una recolección de plantas para ser identificadas en el herbario. Sus enlistados indican las especies Chenopodium berlandieri y Amaranthus palmeri.

El 50 por ciento de las muestras contiene estas semillas y cabe mencionar que el Elemento 16, muestra Lot 4563, cuenta con 19 de ellas. Las muestras presentaron muchas semillas de este tipo sin carbonizar indicando su ubiquidad en el área para el día de hoy. Esto no es sorprendente ya que el sitio se encuentra en un campo de cultivo cerca de un arroyo, hábitat favorito de estas especies. Los quenopodios y amarantos no sólo proveen semillas sino hojas, siendo ambas altamente nutritivas, proporcionando aminoácidos, vitaminas y minerales para la dieta (Adams 1980:21). Estas plantas tienen una estacionalidad desplazable por lo que las hojas eran recolectadas desde primavera hasta otoño y las semillas durante el verano y el otoño (Adams 1980:21; Orth y Epple 1995: 55–60). Las semillas son muy pequeñas y producidas en grandes cantidades; tanto en el pasado como en la actualidad, estas plantas han sido recolectadas y en ocasiones hasta cultivadas por diversos grupos. Muchos grupos indígenas utilizaban rutinariamente las semillas de algunas especies de estos géneros; dentro de las más valiosas es el Amaranthus palmeri (Bell y Castetter 1937:62; Castetter 1935:23; Rea 1997:200). Aunque la mayoría de usos para estas plantas son alimenticios, también cuentan con amplias propiedades medicinales (Moerman 2009).

Aquenios Tipo *Erigeron* (Pazotillo, Zarzilla). Es una planta herbácea o rara vez arbustiva o subarbustiva; este género contiene 350 especies en su mayoría americanas (Rzedowski 2001:828). La especie Erigeron neomexicanus es una especie restringida al norte de México y suroeste de Estados Unidos, aparece en pastizales y matorrales, en claros en medio de bosques de Quercus y Pinus, preferentemente en lugares perturbados, a veces a la orilla de caminos y campos cultivados (Rzedowski 2001:828–829). Cabe mencionar que esta planta, a pesar de asociarse a bosques, también se relaciona a matorrales xerófilos (Rzedowski 2001:831); esto es un término de clasificación ecológica que se emplea para designar a las plantas y comunidades vegetales adaptadas a vivir en medios secos (Calderón y Rzedowski 2001:1330).

Únicamente se encontraron tres aquenios en el Elemento 1, muestra Lot 4294. Los relatos etnográficos indican mucho usos medicinales, donde en la mayoría de las ocasión se realiza una decocción (líquido que resulta de hervir toda la planta) bebible contra remedios gastrointestinales o untada sobre la piel y los ojos (Moerman 2009). En la actualidad esta planta crece en las inmediaciones del sitio ya que prefiere las áreas alteradas por actividades humanas como lo son los campos de cultivo. Es muy probable que también haya crecido en el pasado cerca del sitio, al igual que en el bosque de encino y pino que los pobladores visitaban regularmente para obtener otros recursos mencionados en el presente informe.

Semillas Tipo *Portulaca* (Verdolaga). Este género comprende hierbas anuales o perennes, frecuentemente rastreras. La especie Portulaca oleracea es una hierba anual carnosa, comestible, que en la actualidad se cultiva en la zona de las chinampas; es una maleza arvense y ruderal que suele ocurrir entre 2,250 y 2,350 msnm (Calderón 2001:146). Este recurso presenta varias ventajas: su contenido de hierro es altísimo, se puede recolectar desde junio hasta septiembre y tiene buena reproducción, ya que las uniones de los tallos al contacto con la tierra producen raíces. Al igual que varias plantas ya mencionadas, también esta planta puede aparecer asociada a zonas de cultivo y a las orillas de caminos (Calderón 2001:146).

El 20 por ciento de las muestras presenta estas semillas, identificados en los Elementos 1 y 4. También se identificaron semillas sin carbonizar que evidencian la presencia de esta planta en la actualidad, dato no sorprendente debido a las preferencias de esta planta en asociación a zonas de cultivo. Tanto las semillas como las hojas han sido recolectadas por diversos grupos históricos del sudoeste de Estados Unidos. Aunque la utilización de sus hojas y tallos es más común y continua en la actualidad, también se consumían las semillas en el pasado. Los usos más comunes son alimenticios pero también existen evidencias de su empleo medicinal para problemas intestinales y como analgésico (Rea 1997:206; Russell 1975 [1908]:75; Moerman 2009).

Granos de Tipo Festucoideae (Zacate, Pasto). Son pastos silvestres que corresponden a la Familia Gramineae; en esta familia hay plantas herbáceas, anuales o perennes, o bien, en ocasiones leñosas que contienen más de 600 géneros y 10,000 especies (Herrera y Rzedowski 2001:999). Las especies maduran en diferentes tiempos, desde los finales de la primavera hasta el otoño (Herrera y Rzedowski 2001:999). La identificación de granos de pastos es complicada debido al gran número de géneros y de especies en esta familia, y porque existe un traslape considerable entre las características de los granos de los diferentes géneros y especies (Martin y Barkley 1961:133). La presente investigación siguió la metodología propuesta por John Reeder (1957), que permite dividir en dos grupos los granos de pasto: Festucoideae y Panicoideae.

Únicamente fueron identificados en el Elemento 4, muestra Lot 4351, representando una ubicuidad de 10 por ciento. Aunque algunos granos están completos también se identificaron varios fragmentos. Los relatos etnográficos apoyan la idea de que los pastos silvestres son importantes para la dieta de muchas sociedades, siendo fuente importante de carbohidratos que pueden ser recolectados y almacenados en grandes cantidades (Huckell 1995). Ciertos relatos indican su uso como petates para dormir y tapetes, en ocasiones como ropa para infantes (Moerman 2009).

Semilla Tipo *Lagenaria* (Bule, Jícara). Género de plantas trepadoras suelen ser todas perennes (con excepción de la especie Lagenaria siceraria que es una planta anual) que ha sido cultivada durante milenios en regiones tropicales de América. Éstos pueden cosecharse verdes como alimento o bien, maduros y secos, para ser empleados como recipientes (Teppner 2004). Cabe advertir al lector que únicamente se identificaron fragmentos, por lo que su identificación es viable pero tentativa. Estos fragmentos corresponden al Elemento 1, muestra Lot 4294, en asociación a otras plantas identificadas: maíz, frijol común, quelites, verdolaga y pazotilla; sin duda siendo el elemento con mayor diversidad de recursos.

Los relatos etnográficos indican que solamente ciertas especies sirvieron como alimento y contaron con propiedades medicinales como remedio para la piel. Comúnmente estas plantas son empleadas como recipientes, herramientas para cocinar o realizar juguetes e instrumentos musicales, en ocasiones de uso ceremonial (Moerman 2009).

Semilla y Madera Tipo *Juniperus* (Junípero, Enebro). Género perteneciente a la Familia Cupressaceae que se compone de árboles o arbustos siempre verdes que miden desde 50 cm hasta 20 m o más de altura, su tronco puede variar desde unos cuantos cm hasta 1 m. Este género está representado por unas 70 especies ampliamente distribuidas en las regiones templadas del

Hemisferio Norte (Espinosa 2001:53). Adams y Doleman (1992) enlistan para la zona central de Chihuahua, en el área de Oscar Soto Maynez, la especie Juniperus deppeana. Esta especie ocurre en elevaciones entre 2500 y 2850 msnm, en sitios con vegetación de bosque de pino, encino y oyamel, a veces se encuentra formando bosques puros y abiertos (Espinosa 2001:55). En la comunidad biótica "Madrean Evergreen Woodland" (bosque siempre verde de la Sierra Madre) aparte de esta especie también aparece representada la especie J. monosperma (Brown 1994).

El 30 por ciento de las muestras contuvieron fragmentos lo suficientemente grandes para ser identificados como junípero. Además de los fragmentos de madera, el Elemento 20, muestra Lot 4607, presenta una semilla de junípero, más cuatro fragmentos. Este arbol ha sido empleada por comunidades de Apaches Chiricahua y Mescalero, y por los Navajo y Yavapai, entre otros, sus frutos como alimento y bebida, y la madera como combustible (Moerman 2009).

Escamas de Corteza Tipo *Pinus* (Pino, Ocote). Este género corresponde a la Familia Pinaceae y se caracteriza por árboles siempre verdes, o rara vez arbustos, más o menos resinosos, de altura variable desde 1 hasta 50 m. El tronco suele tener corteza generalmente lisa y delgada en los árboles jóvenes y gruesa y rugosa en los adultos. Este género consta de por lo menos 90 especies distribuidas en su totalidad en el Hemisferio Boreal, muchas son de gran importancia económica en la producción de madera (Espinosa 2001:46). El registro etnobotánico sugiere diversos usos como combustible, materiales de construcción, utensilios (Adams 1992). Para la zona de estudio, en Oscar Soto Maynez, Adams y Doleman (1992) registraron la presencia de las siguientes especies: Pinus cembroides, P. leiophylla chihuahuana, P. engelmannii y P. arizonica. En la comunidad biótica "Madrean Evergreen Woodland" se identifican las siguientes especies principalmente: Pinus cooperi, P. durangensis, P. engelmannii, P. leiophylla chihuahuana, P. lumholtzii y P. ponderosa arizonica (Brown 1994).

En el análisis de esta temporada únicamente se identificó una escama en el Elemento 16, muestra Lot 4536. Sin embargo para el informe pasado se registraron 15 escamas de corteza más 17 fragmentos, provenientes de los Elementos 14, 55 y 58. La identificación de escamas de corteza sugiere la presencia de troncos de pino de buen tamaño con corteza (Adams 1992), pero se desconoce a qué especie puedan pertenecer. En la actualidad no se aprecia ninguna especie de Pinus sp. en las inmediaciones del sitio, pero sí en los alrededores no tan lejanos al oeste.

Madera Tipo *Quercus* (Encino). Este género pertenece a la familia Fagaceae y consiste de árboles y arbustos con unas 1000 especies casi todas en el Hemisferio Norte (Espinosa 2001:83). En el área del proyecto, en la zona de Oscar Soto Maynez, Adams y Doleman (1992) identifican las especies *Quercus arizonica, Q. viminea, Q. rugosa y Q. hypoleucoides*. Para la comunidad biótica "Madrean Evergreen Woodland" se enlistan las siguientes especies: *Quercus albocincta, Q. arizonica, Q. chihuahuensis, Q. chuchuichupensis, Q. durifolia, Q. emoryi, Q. epileuca, Q. fulva, Q. grisea, Q. hypoleucoides, Q. oblongifolia, Q. pennivenia, Q. rugosa, Q. santaclarensis, Q. toumeyi y Q. viminea.*

En el sitio CH-254 el 30 por ciento de las muestras de flotación analizadas presentaron carbón de suficiente tamaño para ser identificable. Esta madera se identificó en los Elementos 16 y 20, también en la Unidad 40 en donde algunos fragmentos estaban redondeados probablemente por movimiento de agua. La ausencia de bellotas indica el uso de esta madera como combustible o como material constructivo. Para la especie Quercus emoryi las evidencias etnobotánicas de los Papagos, Yavapai y Apache indican el uso de la madera como combustible y de las bellotas como alimento (Moerman 2009).

Tallos de Monocotiledónea. Como se mencionó anteriormente, las monocotiledóneas son las plantas angiospermas que presentan únicamente un cotiledón (Font 1993:729). El cotiledón es la parte del embrión (y de la semilla), que dará origen a la primer hoja. El número de cotiledones es un carácter tan constante en las angiospermas, que sirve de base para distinguir grandes grupos (Calderón y Rzedowski 2001:1307). Se encontraron pequeños fragmentos de tallos que pertenecen a este grupo amplio de plantas, los criterios de identificación en vista transversal fueron los siguientes: son fibrosos, esto es que presentan fibras (Calderón y Rzedowski 2001:1313); y son vasculares, esto significa que poseen vasos, el vaso es una célula alargada que al morir se vuelve tubulosa y hueca, convirtiéndose en un elemento conductor (Calderón y Rzedowski 2001:1330). De hecho, debido al arreglo de los vasos, en ocasiones se puede identificar el taxón, como se apreció en el tipo *Phragmites* (Adams 1994: A-8). Únicamente el Elemento 6, muestra Lot 4322, contiene un fragmento de tallo, correspondiente a una ubicuidad de 10 por ciento.

Ch-240

Este sitio se encuentra en el valle del río Santa Clara en la segunda terraza de la planicie aluvial. En donde se excavó una casa en pozo con un cuarto asociado (posiblemente de almacenamiento). Al igual que en los sitios Ch-218 y Ch-254, sus habitantes tuvieron acceso a una variedad de recursos silvestres asociados al arroyo y amplias tierras cultivables. La diversidad y cantidad de árboles a las orillas del río indican la presencia de agua durante todo el año. Este análisis corresponde a ocho muestras de flotación provenientes de los elementos 6, 7, 9, 11 y 12. Se identificó la presencia de por lo menos seis taxones diferentes (Tabla 16), en donde todas las muestras presentan restos identificables. Las partes identificables de las plantas carbonizadas fueron semillas, granos, o aquenios; desafortunadamente no se obtuvo carbón de tamaño suficiente para lograr su identificación y tampoco se recuperaron fragmentos de tallos. También cabe resaltar que no se identificaron plantas domesticadas para este sitio; futuras investigaciones clarificarán este punto ya que probablemente se deba a la escasez de muestras más que a su falta de uso en la antigüedad. Cabe mencionar que la muestra Lot 2562 contiene material orgánico heterogéneo carbonizado que posiblemente sea masa de maíz, pero desafortunadamente su identificación certera solamente se puede establecer por medio del análisis químico.

A continuación se presentan los resultados encontrados, en donde a las plantas descritas anteriormente para el sitio Ch-254 solamente se presenta su ubicuidad y contexto.

Plantas Silvestres

Semillas de Cheno-ams (Quelites, Amaranto). Dos de las ocho muestras contienen estas semillas. Las muestras presentaron muchas semillas de este tipo sin carbonizar indicando su ubiquidad en el área para el día de hoy; esto no es sorprendente ya que el sitio se encuentra en un campo de cultivo cerca de un arroyo, hábitat favorito de estas especies.

Aquenios Tipo *Erigeron* (Pazotillo, Zarzilla). Únicamente se encontró un aquenio en el elemento 13, muestra Lot 2604, que corresponde a la vasija 3. Dentro de ésta, además de esta planta también se encontraron restos de quelites o amarantos, bule o jícara y una semilla de trébol con flor amarilla; sin duda, siendo el elemento con mayor diversidad de recursos para este sitio.

Granos de Tipo Festucoideae (Zacate, Pasto). Cinco de ocho muestras presentan este tipo de granos. Aunque algunos granos están completos también se identificaron varios fragmentos. Cabe resaltar que el elemento 7, muestra Lot 2564, contiene más de 15 granos y varios fragmentos, cantidad sobresaliente en comparación a las otras muestras de todos los sitios analizados.

Semilla Tipo *Lagenaria* sp. (Bule, Jícara). Cabe advertir al lector que únicamente se identificaron fragmentos, por lo que su identificación es viable pero tentativa. Como se mencionó anteriormente, únicamente se encontró un fragmento en el elemento 13, muestra Lot 2604, que corresponde a la vasija 3.

Semilla Tipo *Oxalis* sp. (Trébol de Flor Amarilla). Género de la familia Oxalidaceae de aproximadamente 900 especies conocidas que aparecen en gran variedad de hábitats pero preferentemente en las zonas tropicales. Pueden ser plantas anuales o perennes. Sus hojas son semejantes a los tréboles pero en realidad son plantas distintas, sus flores varían de color blanco, rosa, rojo y amarillo. Sus flores y semillas brotan desde la primavera tardía hasta el otoño. Para el sur de Chihuahua se ha identificado la especie *Oxalis decaphylla*; sin embargo, la morfología de la semilla registrada se asemeja mucho a la especie *Oxalis stricta* (Martin y Barkley 1961) que se asocia a bosques, zonas de pastizal y áreas alteradas por el humano. Como se mencionó anteriormente, únicamente se encontró una semilla en el elemento 13, muestra Lot 2604, que corresponde a la vasija 3. El principal uso de esta planta es alimenticio, en donde sus tubérculos son altamente nutritivos. También sus hojas son comestibles con propiedades medicinales que favorecen la digestión y tienen propiedades desinfectantes con alto contenido de vitamina C (Moerman 2009).

Discusión

La presente discusión se centra en los sitios Ch-254 y Ch-240, ya que para el sitio Ch-218 únicamente se analizó una muestra. Como se mencionó anteriormente, aunque en diferentes valles, ambos sitios se encuentran junto al río en la planicie aluvial en lo que en la actualidad son campos de cultivo que han modificado considerablemente el terreno, por lo que la flora actual no representa directamente la flora en el pasado. Sin embargo, ciertas plantas observadas en la actualidad posiblemente ocurrieron en el pasado, como es el caso de los ambientes húmedos cerca del río. Se pudo apreciar árboles como álamo (*Populus* sp.) y sauce (*Salix* sp.), arbustos como escobilla (*Baccharis* sp.) y mimosa (*Mimosa* sp.). Y otras plantas con flor amarilla (Compositae), calabazas silvestres (*Cucurbita* sp.) y trompillo (*Solanum egaliflora*).
Estos sitios se ubican en la comunidad biótica “Madrean Evergreen Woodland” definida por encinos con hojas perenes, pero también por la presencia de juníperos y diferentes pinos, en donde varias especies de cada género están representadas. También se caracteriza por tener

inviernos ligeros y veranos húmedos. Su ubicación principal es la Sierra Madre Occidental pero llega hasta el sudeste de Arizona y el sudoeste de Nuevo México por medio de montañas. En la parta de baja elevación el bosque de encino es típicamente abierto, conforme la elevación aumenta el encino se mezcla con pinos hasta llegar al cambio de comunidad biótica, el bosque de pinos. Aunque no son criterios diagnósticos, cabe mencionar que ciertas especies de cactáceas y arbustos de chaparral son también comunes. Entre estos destacan especies de chollas, agaves y yuca, al igual que arbustos como ramón, manzanita y sumaco.

Las evidencias de restos de plantas carbonizadas indican que los antiguos pobladores emplearon mayoritariamente recursos de esta comunidad biótica como la madera de los árboles encino, junípero, pino y del arbusto manzanita (evidencias del sitio Ch-254, ya que el sitio Ch-240 no contuvo madera del tamaño suficiente para ser identificada). Estas maderas posiblemente fueron empleadas como combustible, pero también como materia prima para utensilios y para la construcción por medio de postes y vigas. La presencia de una semilla de junípero señala el posible empleo de esta planta como alimento o bebida. Las evidencias también indican el aprovechamiento de los recursos a las orillas del río, el carrizo (*Phragmites* sp.) pudo haber sido empleado para formar techos de las estructuras o para otros utensilios necesarios. Cabe resaltar que los árboles más cercanos al sitio son álamos y sauces y al parecer no fueron seleccionados por los pobladores de los sitios, se piensa que ellos preferían recorrer más distancia o intercambiar recursos de más elevación, a conformarse con maderas de menor calidad de las inmediaciones del río.

En cuanto al alimento principal, existe una diferencia importante entre estos sitios, ya que para el sitio Ch-240 no fueron identificados restos de plantas domesticadas (Tabla 16). A diferencia del análisis de la temporada anterior para el sitio Ch-254, ahora se cuenta con una ubicuidad de 60 por ciento para maíz, donde muy probablemente se emplearon olotes como combustible. Cabe resaltar la presencia de un fragmento de frijol común (*Phaseolus vulgaris*), previamente no identificado en este sitio. Con la ubicación del sitio, no es sorprendente encontrar recursos cultivados en las muestras analizadas: razón por la cual, sí es sorprendente su ausencia en el sitio Ch-204, donde futuras investigaciones serán necesarias para entender porqué esta casa en pozo no contó con maíz.

En cuanto a los recursos silvestres, sobresalen los granos de pasto en el sitio Ch-240, donde no sólo se registraron muchos granos sino que este recurso representa una ubicuidad del 63 por ciento. Aunque su ubicuidad es menor en el sitio Ch-254 (10 por ciento) también fueron identificados. Otro recurso abundante, esta vez en ambos sitios, son las semillas de de quelites o amarantos. Evidencia que no es sorprendente ya que seguramente fueron ampliamente empleadas por los pobladores del sitio. Estas semillas, junto con las semillas de verdolaga y pazotilla implican un aprovechamiento de plantas arvenses que proliferan en zonas alteradas por el humano, como lo serían las zonas habitacionales, a las orillas de los caminos o en los campos de cultivo.

Aunque son pocas las muestras de flotación analizadas proporcionan una lista de posibles plantas empleadas por los pobladores de los sitios Ch-254 y Ch-240. Estos taxones indican el empleo de recursos alimenticios, medicinales, restos de combustible, materiales de construcción, posibles instrumentos musicales, petates y herramientas, entre otros usos. Evidencia del uso de plantas accesibles localmente y en las cercanías del sitio. El estado de preservación de los restos de plantas carbonizadas fue variable pero generalmente bueno, algunos carbones de menor tamaño presentaron evidencias de efectos postdeposicionales como el paso de agua.

Chapter 5

STARCH GRANULE ANALYSIS OF ARTIFACTS

Sonia Zarrillo and Monica Nicolaides

Four potsherds and one ground stone tool were processed for the recovery of microbotanical remains. The artifacts are from sites Ch-218 and Ch-254, both near Santa Ana de Babícora, also known as Oscar Soto Maynez, in the state of Chihuahua, Mexico. The artifacts were recovered in the 2010 field season and were subsequently sampled for residues at the University of Calgary. The goals of this analysis were to determine the feasibility of microbotanical research with ceramic and lithic artifacts from the sites and to make recommendations for sample collection during future excavations.

Starch granules are complex organic polymers formed in the roots, stems, leaves, seeds, and fruits of plants. Plants synthesize two types of starch granules: transitory starch and storage starch. As the name suggests, transitory starch granules are formed and stored in leaves and green stems but are utilized by the plant on a daily basis. These starch granules have not thus far been shown to be diagnostic of different plant species. In contrast, storage starch granules are synthesized by plants for long-term energy storage to support regrowth and seed germination (Banks and Greenwood 1975:1; Haslam 2004:1716; James et al. 1985:162).

Plants parts with concentrations of storage starch granules (for example, roots and seeds) are targeted by humans for food and other uses, so the identification of storage starch granules (from here on, referred to as starch granules) has great potential utility in reconstructing past human economic and social activities. Starch granules have semi-crystalline (birefringent) properties, producing a visible and distinctive extinction cross when viewed microscopically under cross-polarized light (Banks and Greenwood 1975:247; Calvert 1997:338; Cortella and Pochettino 1994:177; Guilbot and Mercier 1985:241; Loy 1994:89; Moss 1976:5). The presence of the extinction cross that rotates allows for the positive identification of starch in samples obtained from archaeological contexts (Cortella and Pochettino 1994:177; Loy 1994:89–90; Moss 1976). Distinctive features of storage starch granules are genetically controlled and when carefully observed can be used to identify plant taxa (Banks and Greenwood 1975:242; Cortella and Pochettino 1994:172; Guilbot and Mercier 1985:240; Loy 1994:87–91; MacMasters 1964:233; Reichert 1913:165; Tester and Karkalas 2001:513). Starch granules may become trapped in crevices on tool surfaces during food processing, protecting the starches from degradation. These protected remains are thought to endure for extremely long periods and provide direct evidence of past human uses of plants (Loy 1994:110–111; Pearsall et al. 2004:437; Perry 2001:186; Piperno and Holst 1998:768, 772; Zarrillo and Kooyman 2006:484). In order to assist the reader in understanding starch granule terminology, the end note to this chapter includes definitions of terms used throughout this report.

Phytoliths are minute particles formed in cells and in spaces between cells by the accumulation, and subsequent solidification, of soluble minerals (usually silica, but sometimes also calcium oxalate) taken up from ground water by a plant while it is alive. Silica phytoliths vary in size and shape depending on the plant taxon and plant part. Certain phytolith shapes are considered to be diagnostic to specific taxa, allowing for identification based on morphology (in some cases, coupled with statistical analysis) (Pearsall 2000; Piperno 2006). In general, phytoliths are very robust and survive well in most soils and sediments. They can be used to reconstruct plants present at a site even if all other plant parts have decayed. Phytoliths can document economically important plants as well as those indicative of the environment at a particular period, depending on the context from which the samples originate. Phytoliths may be recovered from many sources: dental calculus; food preparation tools such as grinding stones and scrapers; coprolites; cooking or storage containers; ritual offerings; and agricultural areas (Pearsall 2000; Piperno 2006).

The identification of starch granules and phytoliths from archaeological contexts requires an extensive comparative collection that includes modern plant species from the local area as well as domesticated species. The work of characterizing starch granules and phytoliths distinctive to different plant taxa in a region is an immense undertaking. For this analysis, focused on starch only, published descriptions and photographs of economic species known to have been utilized in the region were used to make tentative identifications in the absence of an extensive reference collection specific to the area of study.

Methods

The potsherds presented for potential analysis had been washed; none had any appreciable amount of charred residue remaining on the interior surfaces (which would represent cooking residues). The sherds were carefully examined under low-powered magnification and four sherds representing the *best* possibility for recovering cooking residues were chosen. Figures 33 through 36 show the four sherds sampled for interior charred residues. Each sherd selected was rinsed with deionized water and allowed to air dry, to decrease the possibility that recovered starch was a result of incidental contamination (during handling, or from the adhesive on the envelopes some sherds were stored in [many adhesives contain starch]). Once dry, the interior of each sherd was sampled for charred cooking residues using individual sterilized dental picks. Residues were weighed (all of the samples were very small; see Table 17) and placed in individually labeled centrifuge tubes. Published methods (Zarrillo et al. 2008) for isolating starch granules from charred ceramic residues were used, with modifications based on the nature of the samples. In short, gentle oxidation to disaggregate starch from the charred matrix was followed by heavy-density liquid separation to isolate starch granules (and any other particles) with a density below 1.8 (starch granules have a specific gravity [s.g.] of about 1.6). The heavy-density liquid flotation procedure was performed twice in an effort to decrease the number of charred particles (which obscure microscope viewing) present.

One ground stone tool (Figure 37) was randomly selected from the three small mortars that were submitted for possible testing. It appeared that none of the stone artifacts had been washed and each had been stored in a separate zip-lock polyethylene bag. Three samples were obtained from the stone mortar: a dry-brush sediment sample; a wet-brush sediment sample; and a sonicated sediment sample (Pearsall et al. 2004). Adhering sediment was removed from the utilized surface of the mortar with tooth brush.

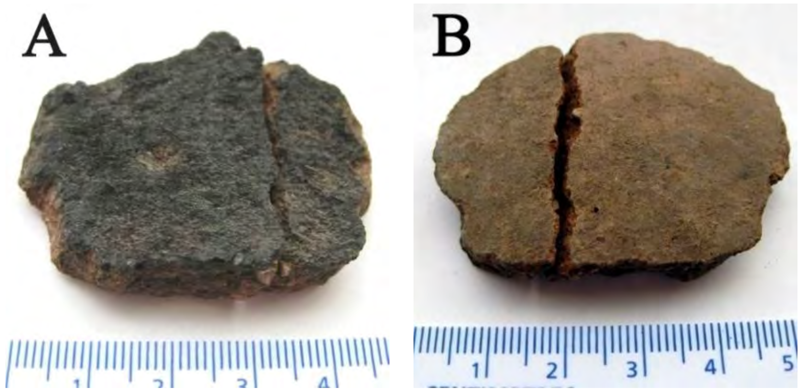

Figure 33. Ch-218, Unit 44, Level 3, sherd sampled for interior charred residues. In this figure and the next three, Side A is the interior surface. Sample CR-59.

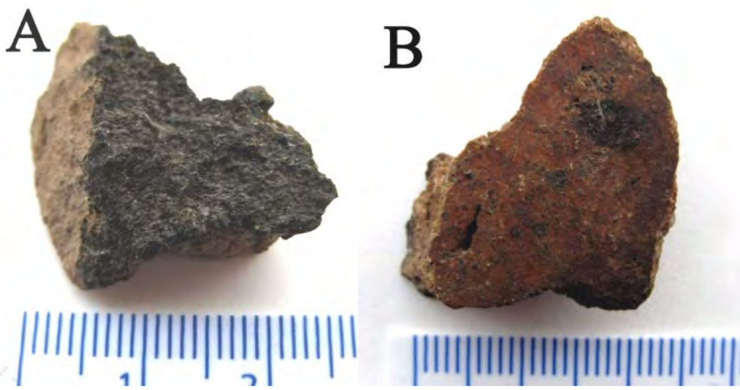

Figure 34. Ch-254, Unit 52, Level 2, sherd sampled for interior charred residues. Sample CR-60.

Figure 35. Ch-254, Level 2B, Feature 1, sherd sampled for interior charred residues. Sample CR-61.

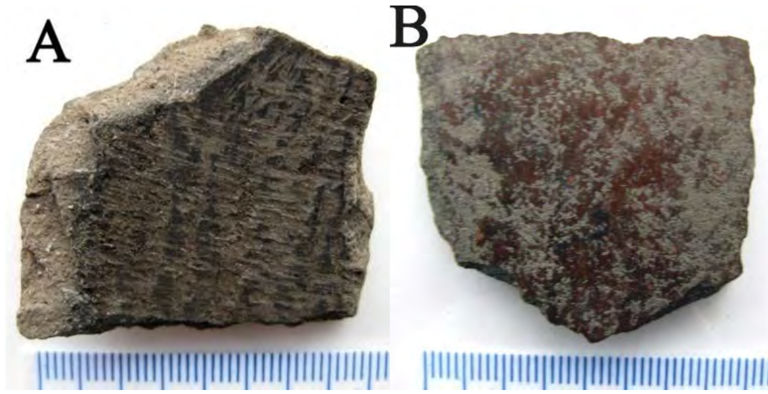

Figure 36. Ch-254, surface, N120 E20, sherd sampled for interior charred residues. Sample CR-62.

Figure 37. Ch-254, surface, N60 E0, stone mortar. Sampled for dry brush sediment, wet brush sediment, and sonicated residues.

Table 17. Starch Granule Analysis Samples.

Provenience	Catalogue No.	U. Calgary Sample No.	Sample Type	Weight (g)
Ch-218, Unit 44, Level 3	4579	CR-59	Charred cooking residue	0.1059
Ch-254, Unit 52, Level 2	4287	CR-60	Charred cooking residue	0.4740
Ch-254, Level 2B, Feature 1	4355	CR-61	Charred cooking residue	0.1954
Ch-254, surface, N120, E20	4214	CR-62	Charred cooking residue	0.0215
Ch-254, surface, N60, E0	4202	STR-84	Dry-brush sediment	N/A
Ch-254, surface, N60, E0	4202	STR-85	Wet-brush sediment	N/A
Ch-254, surface, N60, E0	4202	STR-86	Sonicated sediment/residues	N/A

The process was then repeated with another tooth brush, this time using deionized water while gently scrubbing the interior surface of the mortar. Finally, the mortar was submersed upside-down in a container of deionized water and sonicated for 30 minutes to remove sediment strongly adhering to the utilized tool surface as well as residues deeply embedded in cracks and crevices. The results obtained from the sonicated sample are the most representative of tool use. Figure 37 shows that the sonication was successful in removing remaining adhering sediment, as some remaining adhering sediment can be seen in the center of the mortar depression not reached by deionized water during sonication. Each of the samples (dry-brush, wet-brush and sonicated) were processed to remove clays, then gently oxidized, and then a heavy density liquid (1.8 s.g.) was used to isolate the starch microbotanical remains.

Microscope slides were prepared for viewing by placing an aliquot of extract on a clean, labeled slide, adding 50:50 glycerine:water as a mounting medium, and sealing the coverslip with nail polish applied with separate applicators to avoid cross-contamination. For the charred ceramic residues, two slides were prepared for each sample. One slide was prepared for each of the stone tool residue samples. Slides were scanned in their entirety under cross-polarized light with a research-grade Nikon transmitted light microscope. Photomicrographs were taken with a CCD camera that enabled live-viewing capture by a computer.

The remaining isolated fractions as well as the remaining greater than 1.8 s.g. residues for the sherd and mortar samples have been retained at the University of Calgary for future analysis—these could be processed for phytolith recovery, for example.

All of the laboratory containers, centrifuge tubes, pipettes, and microscope slides used in this analysis were sterilized prior to use by boiling in acetic acid for 30 minutes in a pressure cooker to destroy/gelatinize any incidental starch. In addition, the artifacts were handled while wearing powder-free gloves (powdered gloves contain starch). Finally, blank controls were used during the processing procedures to test for incidental starch contamination from labware, reagents, etc.

Starch Identification and Comparative Collections

Identifications of starch granules in this report are based on comparing multiple three-dimensional characteristics of the archaeological starches to modern comparative starches when possible. When archaeological starch granules possessed diagnostic characteristics—size, shape, pattern of the extinction cross, presence or absence of fissures, lamellae, etc.—they were identified to family, genus, or species based on morphology. Where archaeological starches lacked one or more of diagnostic characteristics (excluding presence of the extinction cross), "cf." was used to indicate that the taxon was not confirmed. At this time the primary analyst (Zarrillo) does not have access to a comprehensive comparative collection of starches from non-domesticated plants native to the region, except for *Cenchrus brownii*. *Cenchrus brownii* is a common pan-tropical (Clayton et al. 2002) non-*Zea* grass that has starch granules in its seeds similar in size and shape to those of domesticated maize, but its starches can be distinguished from those of maize based on granule characteristics (Holst et al. 2007:1760). Published descriptions (especially Holst et al. 2007) were also used, in particular to distinguish maize starches from those of other *Zea* species.

Results

All of the ceramic charred residues contained abundant altered starch, but we found few starch granules that had retained their shapes and diagnostic features. The identified granules include ones derived from *Zea mays* (maize) and Fabaceae (bean and pea family). Good starch granule recovery was realized from the ground stone tool, with maize present as well. As was noted previously, blank controls were processed along with the archaeological samples. Two of these controls tested positive for starch: one starch granule was observed in the refloated ceramic residues samples, and one from the stone tool residue samples. Neither of these two starch granules was *Zea*-like.

CR-59: Ch-218, Unit 44, Level 30

No identifiable individual starch granules were observed in either of the two microscope slides prepared from this sample. Abundant partly gelatinized and retrograded starch aggregates were observed, indicating that starch-bearing plant parts were cooked in this vessel. Figure 38 shows a typical example of the many observed gelatinized and retrograded starch aggregates, compared to cooked and cooled corn starch.

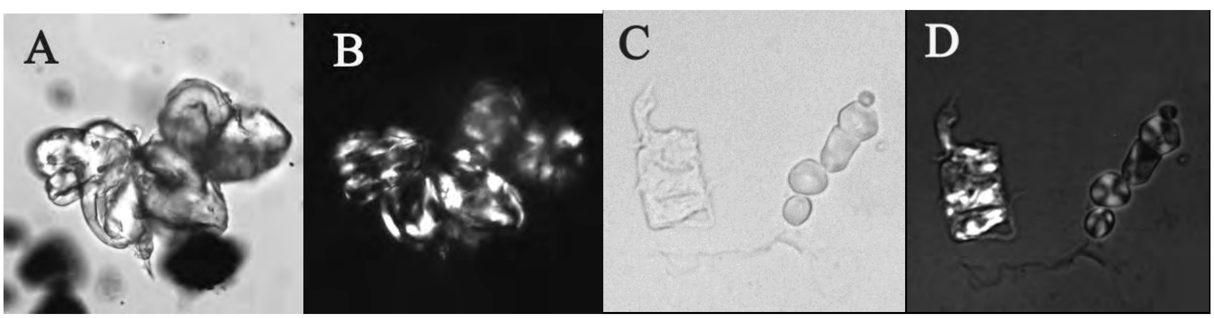

Figure 38. Partly gelatinized starch aggregate from CR-59, Ch-218. Image A is plane-polarized; Image B is cross-polarized. Images C and D are cooked and cooled corn starch (plane-polarized and cross-polarized views, respectively). The left aggregate in Image C shows a fully retrograded starch aggregate, while the right aggregate shows a group of starch granules that are in the transition from intact to gelatinized starch.

When starch is cooked in excess water above the gelatinization temperature (which is species-specific), gelatinization occurs. Gelatinization is the disruption (collapse) of the molecular orders within a starch granule, resulting in irreversible changes—swelling of the granule, loss of birefringence (because the semi-crystalline structures within the granule are disrupted), and eventual starch solubilization (Thomas and Atwell 1999:26). Gelatinization results when complete dissolution of the starch granule is realized. In Figure 38, Images C and D show starch aggregates at two different stages of this process. The starch aggregate in the right half of Images C and D shows starches that are beginning to swell, and that are losing their semi-crystalline structure, but are not fully gelatinized (the starch granules are still intact and the extinction crosses still mostly visible, as is shown in the right half of Image D).

Once gelatinization occurs, when solubilized starch polymers and the remaining insoluble fragments of the starch granule are cooled, the polymers have a tendency to reassociate and form crystalline aggregates. This is called retrogradation (Thomas and Atwell 1999:28) and this phenomenon is shown in the left starch aggregate shown in Images C and D. Although the starch polymers have reassociated to form a crystalline structure (seen in cross-polarized Image D, left), the granular form is no longer present. Images A and B shows an aggregate of starch granules that are partially gelatinized; They have swollen and lost most but not all of their semi-crystalline structure (Image B) and are "glued" together by soluble amylose and amylopectin polymers leached out of the granules. Although some of the semi-crystalline structure remains (as is seen in Image B), the granules are altered to the point where taxonomic identification is not possible. The starch aggregate shown in Images A and B are in a transition state between the right (initial stage of gelatinization) and left (retrograded) starch aggregates shown in Images C and D. As was noted, these starch aggregates are not identifiable to taxa, but do indicate that starchy plant parts were cooked in the vessel. Both partly gelatinized and retrograded starch aggregates were abundant in the residues, but no intact starch granules were observed.

CR-60: Ch-254, Unit 52, Level 2

The charred residues from this sherd also contained abundant partially gelatinized and retrograded starch aggregates, indicating that starchy foods were cooked in the vessel. Only two intact starch granules were observed (Figure 39). Although these starch granules are similar in shape and other characteristics (location of hila, pattern of the extinction crosses) to domesticated maize starch, they are lacking key features that would allow for a secure identification. They are identified as Poaceae (grass family) starches, *Zea mays* spp. (domesticated maize and teosinte). Based on the granule morphology, size, and surface characteristics, these starch granules did not originate from other grass species, including *Cenchrus brownii*, *Tripsacum* spp., *Anthephora hermaphrodita,* and the reputed early Mexican cultivar *Setaria parvifolia* (based on modern reference samples and published sources [Holst et al. 2007:17609–17611, SI Figures 4 and 7]). Attributes absent to distinguish these starches from *Zea mays mays* (domesticated maize) and other *Zea mays* subspecies (especially *Zea mays mexicana*) are overall size and transverse fissuring at the hilum. The overall size of both the starches is 12µ, which overlaps with the mean length for teosinte, and had transverse fissures been present they would have been more diagnostic for domesticated maize (particularly due to their irregular, vs. round, shape) (Holst et al. 2007:17609-17611 and SI).

CR-61: Ch-254, Level 2B, Feature 1

Three starch granules consistent with *Zea mays* spp. were observed in this sample. Given the maximum size (<18µ) and lack of transverse fissure at the hilum, the starch granule shown in Figure 40 (Images A and B) can only be domesticated maize (*Zea mays mays*) or teosinte.

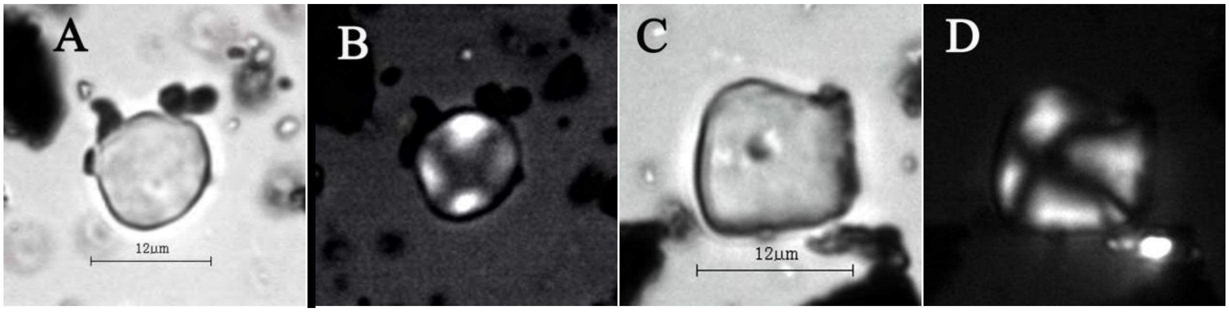

Figure 39. *Zea mays* starch granules from CR-60, Ch-254. From Unit 52, L2. Images A and C are plane-polarized images of the two different starch granules, while images B and D are the corresponding cross-polarized images. These starch granules cannot be identified to the subspecies level, so are either domesticated maize or teosinte

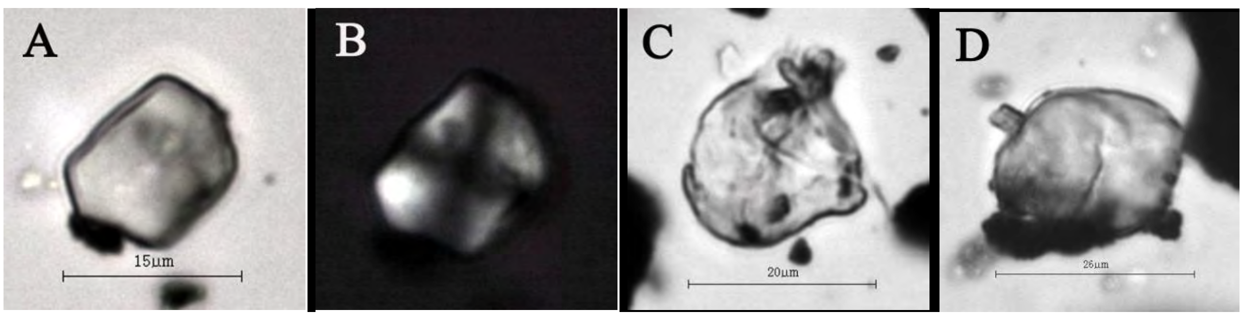

Figure 40. *Zea mays* starch granules from CR-61, Ch-254. Level 2B, Feature 1. Images A and B (plane-polarized and cross-polarized images, respectively) are *Zea mays* but not identifiable to subspecies. Image C is *Zea mays mays,* as is Image D. Given the greater overall maximum width and presence of transverse fissures at the hila, the starches in Images C and D can be identified as probable domesticated maize.

However, the greater overall maximum width, coupled with transverse fissures at the hila, irregular shape, and deep compression facets, allow the starch granules shown in Figure 40, images C and D, to be identified as probable domesticated maize. Abundant partially gelatinized and retrograded starch aggregates were also observed in this sample.

CR-62: Ch-254, Surface, N120, E20

The results from this sample were similar to those for CR-59, Ch-218 in that two starch granules observed were consistent with *Zea mays* but the size of the granules (<18µ) and lack of further defining characteristics precludes identification to the subspecies level (Figure 41, Images A and B).

Figure 41. Maize and bean starch granules from CR-62, Ch-254. Images A and B show *Zea mays* starches. Images C and D show the same starch granule, cf. *Phaseolus vulgaris* starch granule. Surface, N120, E20.

A third starch granule is consistent with the Fabaceae (bean and pea family) (Figure 41, Images C and D). The oval shape of this granule (regardless of orientation), ragged longitudinal fissure, and other features allow for an approximate identification, cf. *Phaseolus vulgaris* (based on modern reference samples and published sources [e.g. Hoover and Sosulski 1985:183–184; Paredes-López et al. 1988:12–13; Reichert 1913:65, 211]). Finally, and as was the case for other ceramic charred residue samples, abundant partly gelatinized and retrograded starch aggregates were observed in this sample but could not be identified to taxon.

STR-84, -85, -86: Ch-254, Surface, N60, E0

The results for the dry-brush (STR-84), wet-brush (STR-85) and sonicated (STR-86) samples from the mortar were ideal in that the number of starch granules observed increased in number from the dry-brush sample to the sonicated sample (dry-brush, n=3; wet-brush, n=6; sonicated, n=13). The major handicap to microscopic analysis of the residues was the tremendous amount of charred particles in all three types of sample, as can be seen in Figure 42. This limited the amount of residue that could be mounted on a slide. As such, the observation of 13 starch granules on one slide represents quite good recovery.

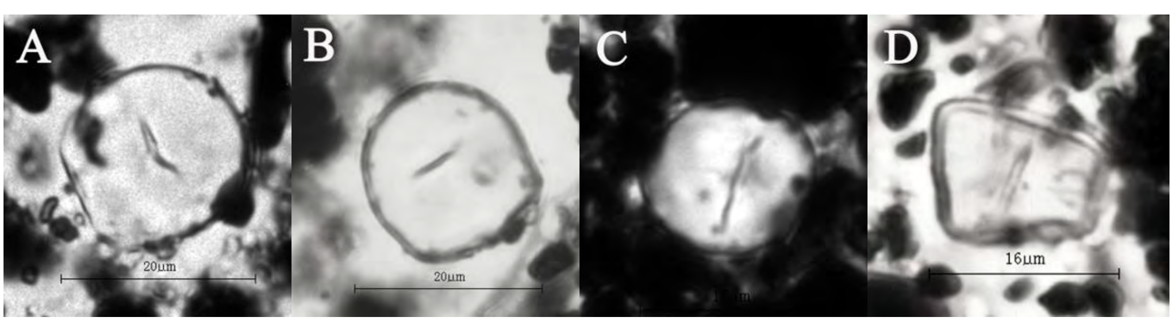

Figure 42. *Zea mays mays* starch granules from sonicated sample STR-86, Ch-254. The size of the granule in image C is 20µ. Note the irregular shape, compression facets, and transverse fissures at the hila for all granules.

As was noted earlier, if a stone tool has been used to process starchy plant parts (seeds, tubers, etc.) more starch granules should appear in the sonicated sample (being residues from the tool's surface, plus residues from cracks and crevices) and such samples should best represent starches from tool use (Pearsall et al. 2004). This was the observed pattern. While it may be that all of the starch granules recovered, regardless of sample type, are from actual tool use, it is also possible that some or all of the starches in the dry-brush and wet-brush samples are from sediment that adhered to the tool surface *after* tool use. Although only the results from the sonicated sample will be discussed in detail, the nine starches observed in the dry-brush and wet-brush samples included six identified as *Zea mays.* The remaining three are too indistinct to make a determination (one may be a non-*Zea* grass, another may be a tuber starch, and the third could not be identified at all).

Of the 13 starch granules observed in the sonicated (STR-86) sample, 12 are *Zea mays*. The thirteenth is identified as a Poaceae (grass family), Triticeae grass tribe (wild wheat, ryes and barleys). The 12 *Zea mays* starch granules recovered from the sonicated sample allowed for a more secure identification of *Zea mays mays* (domesticated maize) based on the entire assemblage. All 12 of the *Zea mays* starches are irregular in shape with pressure facets (some deep, as would be expected with domesticated maize); there were no oval or bell-shaped granules to indicate the presence of teosinte. The presence of a transverse fissure on six of the 12 granules increases our confidence that the entire assemblage consists of *Zea mays mays* starches (Holst et al. 2007:17611 and Table 3).

Discussion And Conclusions

Identification of archaeological starch granules is based on comparing multiple three-dimensional characteristics of those granules to those of modern comparative samples. Ideally, the work is done using a collection of modern plant species from the region of study, inclusive of as many different species as possible. It is also important to have a comparative collection from regions where native (wild) plant species were utilized; differences in starch granule morphology between closely related native species may not be as well-defined as they may be between a domesticated plant species, its wild progenitor, and non-domesticated congenerics (with size being the principal change between wild vs. domesticated species). Although the primary analyst (Zarrillo) does not have an extensive reference collection of wild taxa for the area, the archaeological starches described here were identified based on the detailed and comprehensive research of others (Holst et al. 2007).

In addition to requiring a broad and inclusive starch comparative collection, the identification of an archaeological starch can be restricted by a low recovery rate of similar starches. To put it differently, the more starch of the same type found in an archaeological context, the greater the confidence in identification. This is an assemblage-based approach, whereby archaeological starches that are similar in morphology are compared as a group to different reference samples. There are few instances where a starch granule is so unique in morphology for a given region that it can be confidently identified with only a few archaeological starch granules present (and even here starch analysts are cautious). An example of this might be *Canna edulis* (achira), whose starch granules are so large (up to 180μ) that they are unlikely to be confused with anything else. This latter approach to identifying archaeological starches is a diagnostic-based approach, whereby a particular form of starch granule is unique to a taxon. But there is natural variation in starch granule morphology, even within a species (not every starch granule from a species will display all of the diagnostic characteristics), so the most common and prudent method in starch analysis is assemblage-based—and if few archaeological starches of a similar type are recovered, the analyst is less certain of her identifications.

The low recovery rate from the ceramic charred residue samples in particular was the greatest handicap in making secure identifications. While *Zea mays* (domesticated maize or teosinte) starches are likely present, only two could be identified as probable *Zea mays mays* (sample CR-61, Ch-254, Level 2B, Feature 1). However, if one considers the starches from all of the ceramic charred residues as an assemblage (n=7, excluding the cf. *Phaseolus vulgaris* granule), the likelihood that these seven starches are domesticated maize increases. They are all irregular in shape, with pressure facets (some well-defined, as would be expected with domesticated maize), with no oval or bell-shaped granules that would indicate the presence of teosinte. Moreover, two of the seven had transverse fissures, which is a higher proportion than expected when dealing with teosinte starches (Holst et al. 2007:17611 and Table 3). Nonetheless, *Zea mays mexicana* (especially Nobogame teosinte) has a limited modern distribution in southwest Chihuahua state (e.g., Fukunaga et al. 2005:2241–2242 and Figure 1; Matsuoka et al. 2002:Figure 1), so the analysts are unwilling to make a more secure identification of the starch samples as coming from domesticated maize. To do so, they would need to know more about the distribution of teosinte (present and especially past) in the study region.

With only one starch granule identified to Fabaceae (bean and pea family), cf. *Phaseolus vulgaris*, the confidence in this identification (to the species level) is lowered. Because the sherds were stored in paper envelopes with an adhesive strip, small numbers of starch granules may have originated from the paper, the adhesive, or both (this possibility was reduced by rinsing all of the sherds with a strong stream of deionized water prior to sampling). The final caveat is that, as was noted previously, one of the two blank controls from the ceramic residue sample processing procedures was positive for one starch granule, which is not uncommon. Because of this, the senior author considers five starch granules to be the minimum threshold for positive identifications. While the starch granule from the blank control was not *Zea*-like, blank control samples in other analyses have yielded *Zea*-like starch granules. The most cautious interpretation of the results from the ceramic residue samples is that starchy foods were undoubtedly cooked in all of the vessels (based on the abundance of retrograded and partially gelatinized starch) and that *Zea mays* and Fabaceae starches may be present.

The evidence for *Zea mays mays* (domesticated maize) starch in the stone mortar sonicated residue sample (STR-86) is detailed above. Because more than five starch granules were recovered from the sample, which is most representative of tool use, the fact that the blank control sample tested positive for one starch granule is not a concern. Although the number of starch granules in the assemblage is higher than that for any of the ceramic charred residue samples (so the possibility is much greater that the entire assemblage represents starches from domesticated maize), we cannot fully discount the possibility that teosinte starches are also present in the sample. The field investigators are in a much better position to determine the possibility of teosinte occurrence in the region of the archaeological sites.

Because the artifact was collected from the surface of site Ch-254, there also remains the possibility that all of the starches recovered are a result of modern contamination. The fact that the number of starches recovered increased from the dry-brush to wet-brush to final sonicated sample reduces the likelihood of starch transference from sediment to tool surface; starches tend not to survive in sediments (Zarrillo and Kooyman 2004:484-485). Nonetheless, without a general site sediment sample to test, it is impossible to rule out contamination from sediment.

In conclusion, although few starch granules were recovered, the results do show that starches can be recovered from ceramic charred residues and stone tools in the region of study. With respect to the ceramic charred residues specifically, the low number of starches recovered was most likely due to processing. All of the sherds were previously washed, leaving only a very thin layer of charred residues.

The fact that numerous partly gelatinized and retrograded starch aggregates were observed in all of the ceramic charred residue samples indicates quite conclusively that starchy foods were cooked in the vessels. Phytolith analysis of the remaining residues from the samples might help resolve the issue of domesticated maize versus teosinte, but we would not propose such an approach; the risk of false-negative results due to the small size of the remaining (>1.8 s.g) residue samples is great.

The starches recovered from the stone mortar were predominantly *Zea mays mays*—which is surprising, considering the small size of the stone mortar. Perhaps small amounts of maize were ground for specific uses (as a thickener or additive, for example). If so, the use of a small mortar would have been easier than using a metate, and would have done a better job of collecting the resulting meal.

We suggest the following approach to sampling and preserving artifacts for future starch analysis.

1. Sherds with cooking residues identified for possible starch analysis should not be placed in paper envelopes, whether or not they include an adhesive; both paper and adhesive are potential sources of modern starch contamination. Instead, sherds should be individually wrapped in aluminum foil.

2. If sherds must be cleaned to determine whether interior charred food residues are present, cleaning should be limited to rinsing with distilled or purified water, with no scrubbing. Allow the sherds to dry before wrapping them in aluminum foil.

3. Stone tools selected for starch analysis should not be washed. If damp, they should be allowed to dry. The tool should be wrapped in aluminum foil or placed in a new plastic artifact bag (used bags may be contaminated with modern starch).

4. A minimum two general site sediment samples should be obtained as controls, one from the site surface and one from a general (non-feature) cultural stratum.

5. If teosinte is (or may have been) present locally, phytolith analysis should be considered to complement starch analysis, in order to better discriminate between teosinte and domesticated maize.

End Note: Starch Granule Terminology[1]

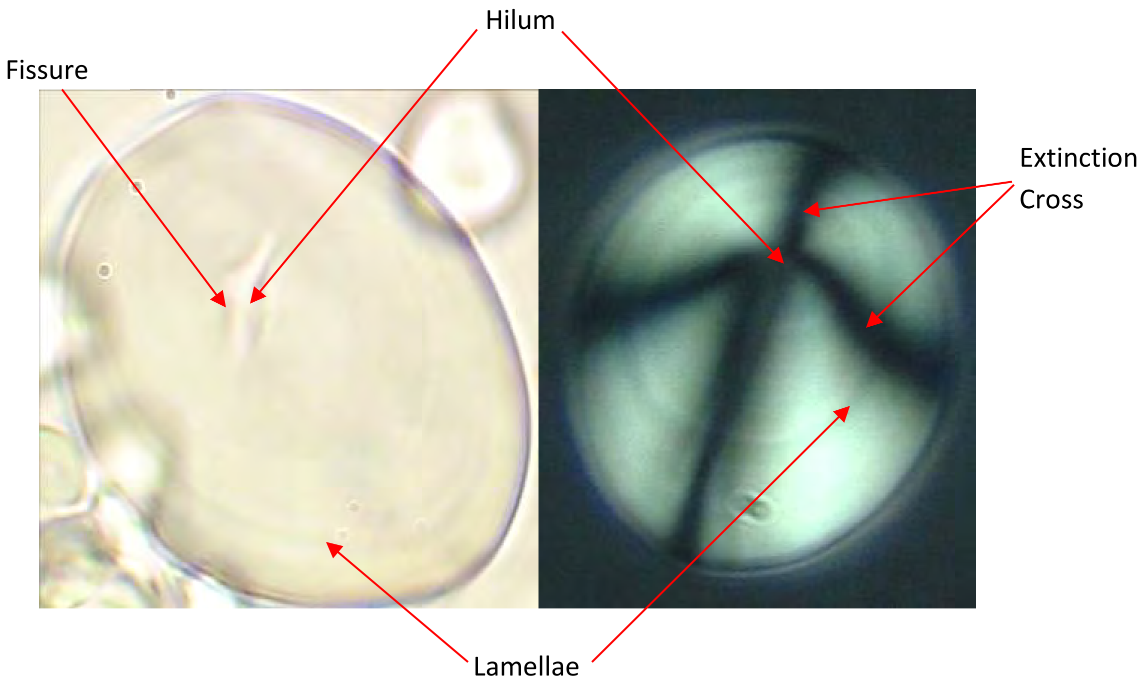

Figure 43. Characteristics of a starch granule.

Compound Grains/Granules: starch granules that form in clusters. In archaeological samples, compound starch granules are most often found singly, having separated from the original cluster.

Extinction Cross: optical interference pattern that usually appears as a dark "X" and is seen on the starch granule when viewed under cross-polarized light. It is created as the semi-crystalline starch granule refracts light. The arms of the extinction cross usually meet (cross) at the hilum.

Fissure: small cracks that radiate from the hilum; one or many may be present, or such cracks may be absent altogether.

Hilum: the botanical center of the starch grain. It is the point around which layers of amylose and amylopectin (the organic polymers that are the primary constituent of starch granules) are

[1] See also Perry (2001).

deposited. The hilum is not always visible in a plane-polarized view, but is usually located where the arms of the extinction cross meet in a cross-polarized view.

Lamellae: concentric lines around the hilum that are sometimes visible on the starch granule. Lamellae result from the layering of the amylose and amylopectin polymers during grain formation.

Pressure Facets (Facets): flat or curved, sometimes sharp, edges of a starch granule that are created on compound granules where the individual granules attach to one another, or in simple granules that are tightly packed during formation. (Not illustrated.)

Simple Grains/Granules: Starch granules that form without primary attachments to other granules.

Chapter 6

NOTES ON DATING

Possible Viejo Period Radiocarbon Dates from Medio Period Sites

Table 17 summarizes radiocarbon dates derived from Medio period sites, but having a high probability of falling before A.D. 1200. Most of the following dates are from Ch-159, El Zurdo (Kelley 2008, 2009a, 2009b). Lower cultural deposits exposed along the Arroyo Zurdito are thought to be of Viejo period age, but none of the dates from those deposits is associated with architecture. Work at the site did expose one example of Perros Bravos style architecture (i.e., from the Viejo period, but a surface dwelling) but unfortunately, we have no radiocarbon date for that structure. Ch-152 and Ch-156 are Medio period sites in the Santa María valley that were tested. In neither case, is the date in Table 17 associated with Viejo period artifacts or architecture. Still, the dates suggest that certain locales had occupations beginning in the Viejo period and continuing into the Medio period.

Table 17. Possible Viejo Period Radiocarbon Dates from Medio Period Sites.

Lab Code	Sample Code	Site Ch-	Lot No.	Context	Sample Material	Raw Date (BP)	Calibrated Age*
TO-2557	Ch-14C -02	159	1276	Arroyo wall, 140–150 cm BS	*Zea* kernel	1100 ±50	856–1022 (0.936)
TO-2877	Ch-14C -11	159	2156	Test 7, Level 7	*Zea* cob	940±40	1019–1189 (0.996)
TO-2878	Ch-14C -13	159	2179	Test 7A, Level 6	*Zea* cob	1060±50	878–1042 (0.967)
TO-2880	Ch-14C -14	159	2203	Test 7A, Level 7	*Zea* cob	1050±40	886–1044 (0.941)
T0-5040	Ch-14C -42	152	3166	Subfloor, room block	*Zea* cupules	1070±60	806–1042 (0.954)
TO-5042	Ch-14C -44	156	3427	Floor of Rm 1	*Phragmites* stem	1110±70	769–1036 (0.983)

*2 sigma cal A.D. ranges with highest probability. See Stewart et al. (2004, 2005) for additional probability data.

The Earliest Dates

The earliest date from Ch-254 was associated with a hearth underlying the several incarnations of Structure 5. The date was first seen as a statistical outlier, given of the substantial collection of dates from that site. Early dates from two other sites were similarly interpreted. Now that three sites have exhibited this pattern, we now consider the early dates to be worthy of serious consideration, as evidence of earlier occupations at the sites. They extend the idea of importance of place and of continuity of occupation. Unfortunately, none of the earliest dates from the three sites are associated with architecture—but have Viejo period (or even earlier?) pottery associated with the contexts from which the dates come. For the sake of completeness, the four early dates are brought together in Table 18.

Table18. Four Early Radiocarbon Dates.

Lab Code	Sample No.	Site Ch-	Lot No.	Context	Material	Raw Date (BP)	Calibrated Age*
TO-8910	Ch-14C-81	272	4037	Shovel Test 22	*Zea* cob and cupules	1220±50	685–898 (0.951)
TO-8911	Ch-14C-82	272	4039	Shovel Test 24	*Zea* cob and cupules	1400±60	538–723 (0.952)
Beta-44458	Ch-14C-01	159	1283	Arroyo Test 2, burned zone at base of arroyo Zurdito, 2 m BS	*Zea* cob	1340±80	561–886 (1.00)
UBA 10675	2885	254	2885	Hearth in Unit 2, Level 9	Unidentified wood charcoal with a $\delta^{13}C$ value of -27.7‰.	1269±20	678–776

*2 sigma cal A.D. ranges with highest probability.

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Apéndice A

DETALLES ANATÓMICOS Y MORFOLÓGICOS DE LOS RESTOS ARQUEO BOTÁNICOS

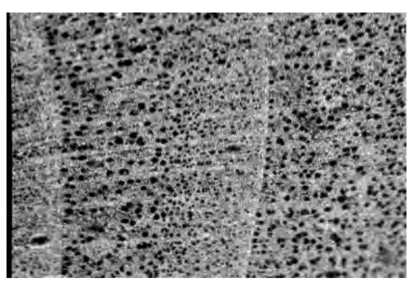
Natalia Martínez Tagüeña

Los analistas de restos arqueo botánicos deben reportar rutinariamente los detalles anatómicos y morfológicos de los restos antiguos. Al publicar los criterios de identificación se logran las siguientes funciones: primero, se le permite a otros investigadores corroborar la identificación presentada; segundo, se crea la posibilidad para otros investigadores de identificar las semillas no identificadas; y por último, los detalles métricos permiten la realización de modelos basados en cambios anatómicos y morfológicos (Adams 1980).

A continuación se presentan las descripciones de las semillas, granos, frutos o aquenios, los tallos de plantas monocotiledóneas y las descripciones de las maderas. Los taxones se enlistan en orden alfabético. Los criterios de identificación comúnmente empleados son: las descripciones morfológicas y anatómicas, de aspectos generales y de algunos atributos en específico; y el tamaño en milímetros de los especímenes. Como complemento a la información se incluyen sus fotografías para obtener un mejor registro.

Tipo *Arcostostaphylos/Arbustus*

Esta madera presenta vasos de diferentes tamaños que suelen ser más grandes en los anillos tempranos. Estos vasos son aislados y solitarios que suelen agruparse en los hileras radiales en donde de dos a cuatros vasos aparecen entre los rayos. Los rayos se aprecian y pueden ser delgados o anchos. Los límites entre anillos son delgados y distintivos en corte transversal.



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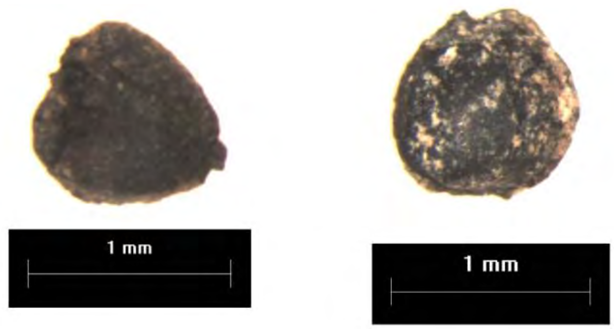
Tipo Cheno-ams

Las semillas de los géneros *Chenopodium* y *Amaranthus* se parecen mucho, dificultando la identificación individual (Bohrer y Adams 1976:8). Por lo que se emplea el término Cheno-ams para designar a especimenes arqueológicos que se asemejen a cualquiera de los dos géneros (Adams 1993:203). Estas semillas se definen por un pericarpio (cubierta del fruto) (Calderón y Rzedowski 2001:1322), liso a rugoso con una semilla erguida, lenticular, comprimida, lisa o ligeramente ornamentada. La carbonización de estas semillas produce fragmentación exponiendo el embrión, volviendo a éste crítico para la identificación; el embrión es anular (Calderón 2001:125).



Tipo *Erigeron*

A estas semillas se les conoce como aquenios y los de este tipo son oblongos a obovados, comprimidos y pequeños, presenta una serie exterior de cerdas bastante diagnóstica. Este género suele presentar cerdas capilares pero este criterio no aplica cuando hay carbonización (Rzedowski 2001:828). Las semillas midieron dentro de un promedio de 1.2 mm de largo, 0.4 mm de ancho en la parte más amplia y 0.4 mm de grosor en la parte más gruesa.

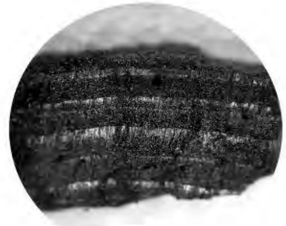
Tipo Gramineae

El fruto de la Familia Gramineae se conoce como cariopsis o grano, este fruto es seco, indehiscente (no se abre, aún en la maduración) y contiene una sola semilla, totalmente soldada a las paredes del fruto (al pericarpio en específico) (Calderón y Rzedowski 2001:1304). El embrión basal pequeño es sumamente característico (Herrera y Rzedowski 2001:999). Siguiendo la metodología propuesta por Reeder (1957:758), se pueden clasificar los granos de pastos en dos grupos, en base al tamaño relativo del embrión en relación al resto del grano: *Festucoideae* corresponde a los granos cuyo embrión basal es relativamente pequeño en comparación al resto del grano; y en cambio, en el grupo *Panicoideae*, el embrión ocupa más de la mitad del grano. Los granos midieron generalmente 1.2 mm de largo, 0.5 mm de ancho y 0.4 mm de grosor.

Tipo *Juniperus* sp.

El presente análisis identifico muchos restos de madera pero también una semilla correspondiente a este género. Primero se describirá la semilla y después la madera. Las semillas de junípero son ovoides, duras y con paredes anchas. Cuando se parten por la mitad se puede apreciar una parte central hueca. La semilla identificada mide 0.4 por 0.5 cm.

La madera se caracteriza por la falta de poros y canales de resina, en ocasiones se aprecian algunas poros pero son creadas por situaciones traumáticas. La madera vieja es muy angosta en comparación con la madera joven que es ancha y ocupa casi todo el anillo, pero sus límites están muy bien demarcados.



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Tipo *Lagenaria* sp.

Únicamente son fragmentos y su identificación no es certera. Se piensa que pueden corresponder a este tipo dado que son fragmentos sumamente delgados y corresponderían al tamaño diagnóstico de las semillas de este género. También la morfología densa del tejido de la testa (cubierta) de la semilla indica este género. Lamentablemente no se aprecia con claridad el tejido marginal de los bordes de la semilla que corroboraría esta identificación).

.

Tipo Leguminosae

Las semillas son comprimidas, ovada o elíptica, todas las especies de esta familia tienen marcadas ambas caras de la semilla con una línea elíptica concéntrica (Martin y Barkley 1961:167). Tienen el funículo por lo común expandido, formando un árilo carnoso (esto es una excrescencia de la semilla a manera de apéndice, en ocasiones como cubierta externa; casi no tienen endosperma (Espinosa 2001:251). Muchas de las semillas tienen forma ovalada, comprimida, de forma de frijol; el hilo aparece sumamente notorio, esto es la cicatriz indicadora de la unión de la semilla con el funículo y con la placenta (Calderón y Rzedowski 2001:1316). El funículo o cubierta exterior, suele ser liso, delgado y resistente (Martin y Barkley 1961:167). El promedio de las mediciones dio como resultado, 6 mm de largo, 5 mm de ancho y 5 mm de grosor. Cabe mencionar que muchos especimenes son fragmentos, ya que si hubieran estado completos, quizá se abría podido identificar el género. A veces aparece la semilla sola y en otras ocasiones se aprecia la cobertura exterior.

Tipo Monocotiledóneas

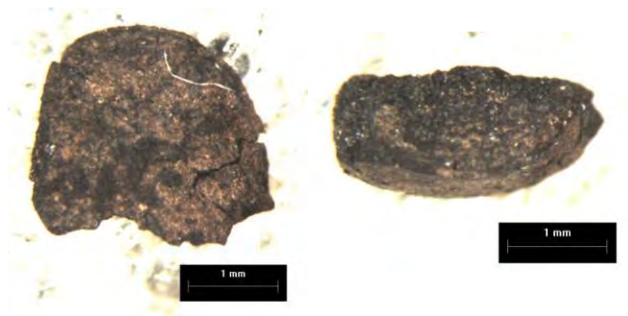
Las monocotiledóneas son las plantas angiospermas que presentan únicamente un cotiledón (Font 1993:729). El cotiledón es la parte del embrión (y de la semilla), que dará origen a la primer hoja. El número de cotiledones es un carácter tan constante en las angiospermas, que sirve de base para distinguir grandes grupos (Calderón y Rzedowski 2001:1307). Se encontraron pequeños fragmentos de tallos que pertenecen a este grupo amplio de plantas, los criterios de identificación en vista transversal fueron los siguientes: son fibrosos, esto es que presentan fibras (Calderón y Rzedowski 2001:1313); y son vasculares, esto significa que poseen vasos, el vaso es una célula alagada que al morir se vuelve tubulosa y hueca, convirtiéndose en un elemento conductor (Calderón y Rzedowski 2001:1330). De hecho, debido al arreglo de los vasos, en ocasiones se puede identificar el taxón, como se apreció en el Tipo *Phragmites* (Adams 1994:A-8).

Tipo *Oxalis* sp.

Semilla pequeña de forma ovalada con ápice muy pronunciado. Su morfología es muy plana y cuenta con una superficie reticulada muy diagnóstica que crea un borde ondulado. Lamentablemente no se aprecia con claridad en la fotografía.

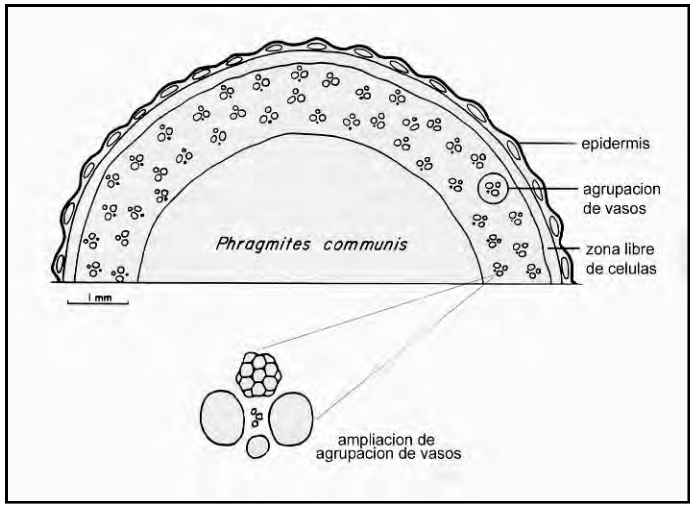
Tipo *Phaseolus vulgaris*

Fragmento de cotiledón que presenta el exterior redondeado y el interior plano, su tamaño sugiere que se puede referir al frijol comúnmente empleado por poblaciones prehispánicas (Adams 1993). Otras características diagnósticas como el hilio y la carúncula no son aparentes. La foto presenta una vista plana y la otra en corte para poder apreciar su morfología y tamaño.



Tipo *Phragmites* sp.

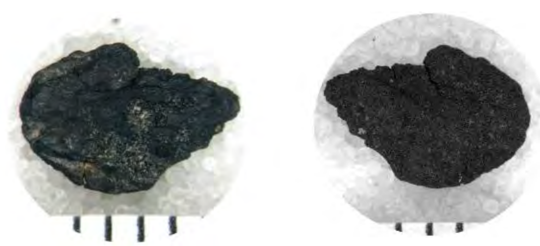
Con la ayuda de la Dra. Karen Adams (comunicación personal 2009), se identificaron segmentos de tallo, por medio de su apreciación en corte transversal. El tallo es fistuloso o hueco (Calderón y Rzedowski 2001:1313). Se observó la epidermis (tejido que envuelve o protege el cuerpo de la planta [Calderón y Rzedowski 2001:1310]), que rodea a los vasos y al tejido de soporte (Adams 1994:A-8). El vaso es una célula alargada que al morir se vuelve tubulosa y hueca, convirtiéndose en un elemento conductor (Calderón y Rzedowski 2001:1330). Los vasos se agrupan y forman patrones, en este Tipo forman un patrón bastante regular a lo largo del tallo, apareciendo en dos o tres hileras concéntricas que lo rodean; cada agrupación de vasos se conforma de dos vasos adyacentes y un floema (Adams 1994:A-8). El floema es un conjunto de hacecillos conductores constituido por tubos cribosos, células anexas y parenquimáticas (Font 1993:483). Los hacecillos o fascículos son conjuntos de elementos conductores que forman un haz (Font 1993:543); criboso se refiere a que los tubos o vasos están provistos de tabiques perforados a modo de cribas (Font 1993:280); la parénquima es el tejido fundamental de las plantas (Font 1993:803). No se logró una fotografía en donde se aprecien los criterios, pero se presenta un dibujo con el corte transversal.



Dibujo del corte transversal de *Phragmites communis.*
Escaneado y modificado de Adams (1990:129).

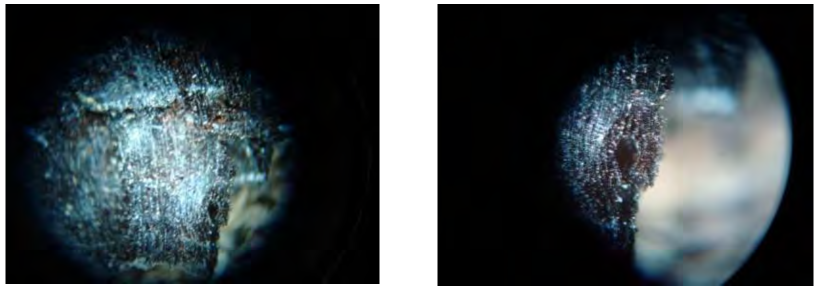
Tipo *Pinus* sp.

Este género se representa por medio de la identificación de escamas de corteza. Estas escamas son planas y varían en tamaño aunque generalmente no llegan a ser más largas de un centímetro. Su grosor aumenta desde el delgado contorno hacia su más ancho centro. El contorno es apreciable por ser más delgado y tener algo de pendiente hacia el margen. En algunas ocasiones se aprecian huecos minúsculos causados por actividades de diversos insectos. Algunas de las especies que presentan escamas con este tipo de contorno son *Pinus edulis* y *Pinus ponderosa*.



20X

La madera se caracteriza por su falta de vasos y la presencia de canales de resina a lo largo del anillo. La zona de madera tardía es más ancha en comparación a la madera de junípero. Los límites entre anillos son distintivos y la transición entre la madera temprana y la tardía es muy abrupta. Para la identificación a nivel de especie, en base a la morfología de los ductos de resina, es necesario emplear microscopios de mayor aumento al empleado en este análisis (Adams 1993).



20X (izquiera), 32X (derecha)

Tipo *Portulaca*

Las semillas son redondeadas, más bien reniformes, con la testa (cubierta de la semilla) tuberculada. En este género, los tubérculos no son individuales forman unas especies de crestas o hileras (Calderón 2001:146). Tienen embrión periferial que es bastante diagnóstico. Del promedio de las mediciones se obtuvo lo siguiente: miden 1 mm de largo, 0.8 mm de ancho y 0.7 mm de grosor.

Tipo *Quercus* sp.

Se identificaron fragmentos de madera de este género. La identificación se baso en los siguientes criterios básicos. Esta madera corresponde al tipo anillo poroso, que significa que el tamaño de los poros, de grande a chico, no está distribuido de manera gradual a lo largo del anillo. Sino que hay una diferencia clara entre la madera temprana con poros grandes y la madera vieja con poros pequeños. En ocasiones, la distribución de los poros pequeños en la madera vieja puede ser errática. Los rayos son grandes y visibles, únicamente no se aprecian hacia el centro del tronco.

20X (izquierda), 32X (derecha)

Tipo *Zea mays*

Para este taxón se identificaron tres partes diferentes: varias cúpulas, un fragmento de olote con cúpulas adheridas y un tallo. Aunque la identificación es incierta y debió establecerse como tejido fibroso, es posible que se hayan encontrado fragmentos de glumas. A continuación se describen los criterios de identificación para cada parte identificada.

La cúpula de maíz es una estructura en forma de contenedor que sujeta dos espigas que a su vez cada una detiene un grano (Adams 1993:199; Valdés 2001:1114). La cúpula es la estructura más duradera del olote, al carbonizarse se preservan más que cualquier otra parte; a esto se puede deber su alta aparición en el registro arqueológico (Adams 1993:1114). Las cúpulas varían en tamaño, miden 0.6 cm de largo, 0.5 cm de ancho y 0.4 cm de grosor en promedio; 0.4 por 0.3 por 0.4 cm en promedio; 0.8 por 3 por 3 cm en promedio.

También se identificaron tres fragmentos de olote con algunas cúpulas todavía adheridas. El olote es la estructura reproductiva femenina del maíz, que contiene diferente número de hileras con granos. En los casos donde se cuenta con todo el olote bien preservado, es posible calcular el número de hileras. Sin embargo, en los olotes carbonizados que no se encuentran en buen estado de preservación es muy difícil calcular el número.