EL ZURDO: A SMALL PREHISTORIC VILLAGE IN WEST-CENTRAL CHIHUAHUA, MEXICO

PART 3: MATERIAL CULTURE AND CONCLUSIONS

Jane H. Kelley

Maxwell Museum Technical Series No. 9, Part 3

Maxwell Museum of Anthropology
MSC01, 1050, 1 University of New Mexico
Albuquerque, New Mexico 87131-0001
www.unm.edu/~maxwell


MAXWELL MUSEUM OF ANTHROPOLOGY

TABLE OF CONTENTS

Page

TABLE OF CONTENTS, continued

Page

TABLE OF CONTENTS, continued

Page

FIGURES

Page

FIGURES, continued

Page

TABLES

PREFACE

It was my privilege to work as a volunteer crew member at el Zurdo, and a pleasure to accept the report for the *Maxwell Museum Technical Series.* For too long, however, the report lay in limbo, through nobody's fault but my own. To break the logjam I proceeded with editorial production of part of the manuscript, including an introduction to the site and descriptions of units excavated in 1991, as Maxwell Museum Technical Series No. 9. Jane Kelley's acknowledgements may be found in the same report, which appeared in 2008. Part 2 of the report, which appeared a year later, included descriptions of the 1992 excavation units and an appendix on collections from the site surface and miscellaneous contexts. This is the third and final part of the manuscript, and provides the analyses and project conclusions. In submitting the manuscript, Jane Kelley assumed that readers would have the whole thing before them. She is blameless for any problems caused by reorganization and segmentation of the report.

David A. Phillips, Jr.
Series Editor

Chapter 1

INTRODUCTION

In 1991 and 1992, the Proyecto Arqueológico de Chihuahua tested El Zurdo in the Babícora Basin of west-central Chihuahua, Mexico (Figure 1.1). The testing was part of a multi-year project permitted by the Instituto Nacional de Antropología e Historia and funded by the Social Sciences and Humanities Research Council of Canada, the University of Calgary, and Lakehead University. The first part of the site report (Kelley 2008) describes the project context and the tests placed in the site in 1991. The second part of the report (Kelley 2009) describes the 1992 tests and miscellaneous collecting activities. This part of the report presents the results of analysis, and assumes that the reader is familiar with the previously published sections.

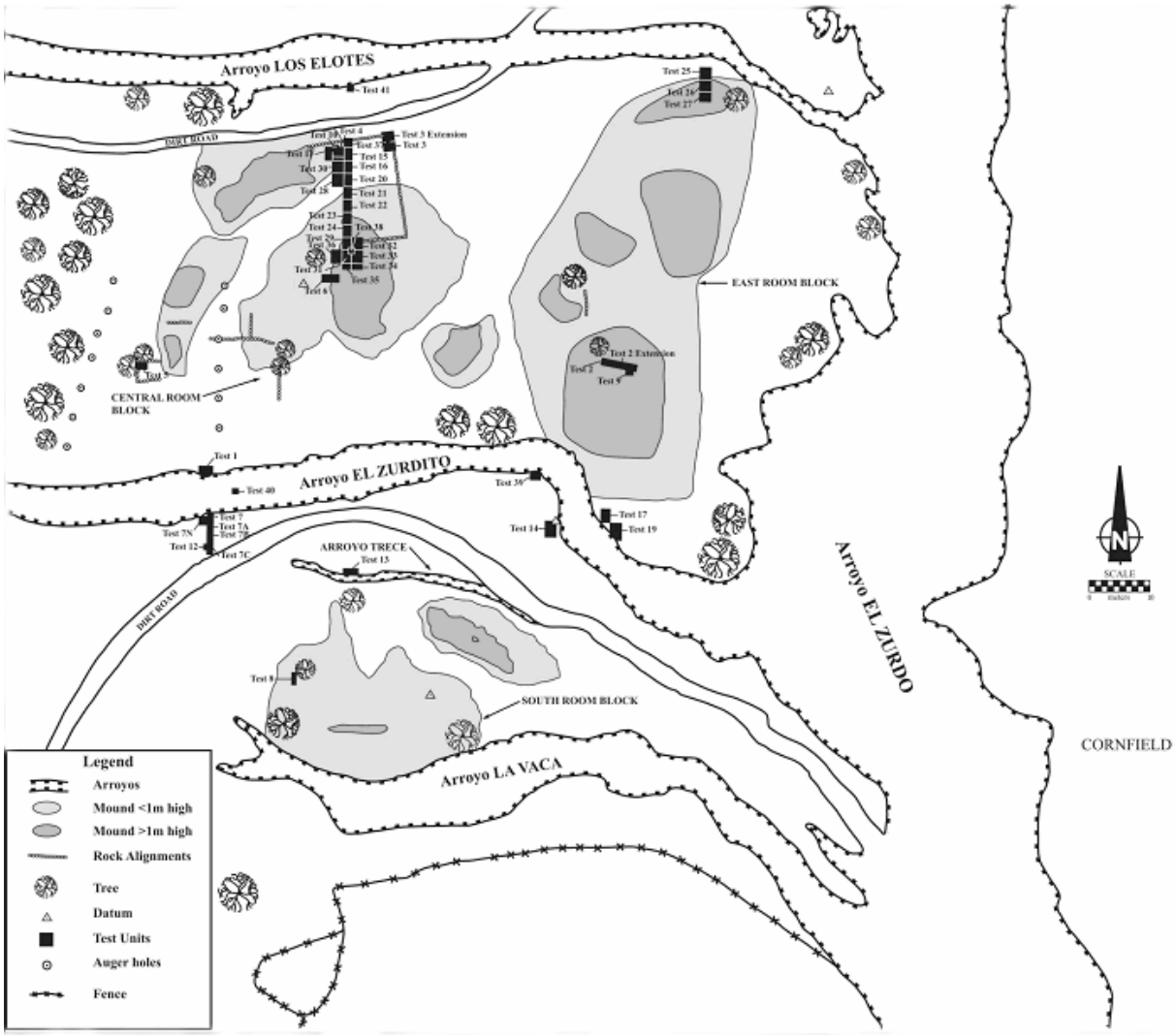

Figure 1.1. El Zurdo. Reproduced from Hill (1992), with the author's permission.

Briefly, El Zurdo is a small village of the Medio period, with extensive underlying midden deposits dating to the Medio and Viejo periods. As is common on Medio period sites, El Zurdo was characterized by carefully prepared adobe walls (in this case, often incorporating rocks in the foundations and wall fill) forming multiple room blocks, by exterior attached courtyards, by brown pottery that sometimes included textured or polychrome designs, and by refuse indicating a reliance on both domesticated and wild food species. The site is in gently hilly terrain with tall pines, shrubs, and grasses. The local arroyo flows south from the Puerto El Zurdo, entering the north edge of the Las Varas valley on its route to the Babícora Basin. Ch-159, on the west bank of the main arroyo (arroyo El Zurdo) at El Paraíso del Zurdo, is the largest site in the local drainage and the only known large site in this locality outside the main Las Varas Valley.

Basic Laboratory Procedures

In the field, preliminary sorting of items from each collection unit (which could be a general surface survey of a site, cleaned segments of Arroyo el Zurdito, or individual levels in test units) occurred at the time items were bagged. The bags were labeled with the name of the site, the designation for the collecting unit, and the category of item. Flaked stone, sherds, faunal materials, ground stone, shell, and flotation and soil samples, were bagged separately. Bagged materials were transported to the lab, where they were sorted by provenience, and lot numbers were assigned.

The lot number was the individual number assigned to each separate collection unit (such as a level in a test unit). In the early 1990s lot numbers were coded by year: the 1000s pertain to 1990, 2000s to 1991, and 3000s and 5000s to 1992 (two sets of numbers were used in 1992 to make it easier to separate collections being made by two widely separated crews). Ideally, the various bags of specimens from each collection unit were assigned the same lot number, though a few exceptions slipped by us (later materials coming into the lab from the same collection unit were given different lot numbers). The few cases of a single collection unit with more than one lot number were easily accommodated.

Once lot numbers were assigned in a master lot book, and the lot numbers written on each bag from that collection unit, materials were processed through the lab at the project field headquarters. The initial, time-consuming step was to wash, dry, and rebag materials needing this treatment. Each bag or specimen was then taken up by one of two lab analysts and spread out on a table. Sherds were sorted into piles according to the main classification categories, and rims were separated from body shreds. Sherds reserved for further analysis were given catalogue numbers consisting of the lot number and a specimen number. Worked sherds were usually also catalogued, along with modeled and fired clay items. Projectile points, bifaces, and other flaked stone exhibiting formal preparation or use were catalogued, as was all ground stone brought to the lab.

Separate artifact notebooks were maintained during each field season for pottery, flaked stone, ground stone, and flotation samples, while less common items (such as shell and minerals) were recorded in another notebook.

These notebooks represent the basic data sets and, in some cases, the only data sets, for the artifacts, as few of the artifacts could leave the country for further analysis. Although we attempted to provide adequate photographic coverage of the artifacts, those attempts were considerably less successful than we had hoped—something not realized at the time, but evident in the variable quality of photographs included in the reports. We often sketched individual sherds or artifacts, and these sketches, while not done by artists, were nonetheless of great importance as visual records of collections that passed fairly quickly across our tables. We have never doubted that any single bag could have been, and still could be, much more fully studied.

The Data Sets: Pottery

The pottery from El Zurdo is tabulated and analyzed in several different data sets. The only one of these that was subjected to extensive statistical analysis is the one created by Warren Hill, who used the 1991 collections for his 1992 MA thesis at the University of Calgary (Hill 1992).

The Ceramic Notebooks

During each field season, all of the recovered pottery from that year was processed through the field lab. Sherds were separately bagged by category and by lot. Thinner plastic bags were used for the smaller collections, but heavy plastic bags were used for the larger collections and the combined lot bags. These were then turned over to INAH in Chihuahua City. The sherds from the 1990 field season were put in temporary storage for a year and suffered rodent damage. For several years thereafter, the collections were stored in INAH regional office in the Palacio Federal. When that office was moved to its present location, the PAC collections were moved to the basement of the Palacio Federal and then into a rented storage facility in Chihuahua City, where they remain to this day.

The results if ceramic processing were recorded on notebook paper, which was organized in three-ring binders. The actual classification of each sherd depended in part on the knowledge that each analyst had built up, and all of the analysts knew more at the end of the project than they did at the beginning. Our collective knowledge of Viejo pottery was close to nil during the early years of the project. This lack of knowledge is important with regard to stratigraphic Tests 1, 7, and 14, each of which included deposits from the lower levels along the arroyo el Zurdito. That lack of knowledge was partly compensated for by Loy Neff's analysis, discussed below.

Once cleaned, the pottery from each collecting unit (lot) was sorted into major categories: undecorated plain brown, black, red, red-on-brown, polychromes, and so on. Rims were separated from body sherds and were recorded individually on rim forms. Each pile of sherds was counted, weighed, and entered into the notebook under the lot number. Rim profiles were sometimes sketched, as were noteworthy sherds and vessel profiles (the last when enough of a vessel wall was present to indicate vessel shape).

Hill's Data Set and Key Conclusions

Warren Hill used the pottery from the 1991 field season for his master's thesis (Hill 1992:75–92). His first task was to take the counts and descriptions from the ceramic notebooks and distill a series of mutually exclusive variables that could be assigned numerical values. At first, he treated rims separately from body sherds because there was more detailed information about each sherd. Hill coded 11,562 sherds for color, texture, treatment, and type. This information was entered into a Microsoft Works database for the Apple Macintosh, and subsequently imported into Excel. Hill used SPSSx 4.0, on a mainframe computer, to conduct cluster analyses, and imported the results into Microsoft Word.

Cross-tabulations were used to identify ceramic trends within each level of each unit. The number of potential cross-tabulations was so great that the pottery was grouped into general classes (plain, textured, red, black, and painted) in order to identify variables for further analysis. Both rims and body sherds could be coded in this way and so were considered together. After eliminating samples smaller than 25 sherds, Hill proceeded to cluster analysis using the squared Euclidean distance method to create groups based on the five selected categories. Out of 54 initial clusters, Hill selected an eight cluster solution for the next step, which was to relate the groups to the archaeology of el Zurdo site. Hill also examined other PAC sites, as well as Di Peso's (1974; Di Peso et al. 1974) Casas Grandes area sites, in order to see how much agreement there was between his results for El Zurdo and patterns elsewhere.

Most members of Cluster 1 were from the Test 7 group of units, which Hill called a "midden" area. He stressed that Test 1, directly across the arroyo El Zurdito from Test 7, was conspicuously absent from this group. The absence was due, he argued, to Test 1 having been excavated in arbitrary units, thereby mixing sherds, while the Test 7 group was excavated by strata, using lessons learned from Test 1. Tests 3, 11, and Test 13 were also represented in Cluster 1, suggesting that these spaces (the patio and a room) shared similarities in the ceramic assemblages with the "midden." The heterogeneity of Cluster 1 suggested that both spatial and temporal differences affected the outcome, and that the two sides of the Zurdito arroyo exhibited different formation processes.

In order to refine temporal control, the Test 7 group from the "midden" was looked at separately. The new cluster showed a steady increase in plain wares through time, along with a decrease in textured wares. Painted wares remained reasonably constant. An attempt to refine the pattern, by looking at different kinds of textured wares, was unsuccessful. Nonetheless, the relative frequencies of plain and textures wares proved to be the best temporal indicator for the site as a whole. When Hill (1992) examined developments at Paquimé and in other Viejo and Medio period assemblages in the Casas Grandes valley (Di Peso 1974; Di Peso et al. 1974), the same basic pattern could be seen.

Black pottery was an important component in the Viejo period contexts as defined by Hill. Such pottery declined in frequency during the Medio period. Black sherds were absent from five of six of Hill's uppermost and presumably latest assemblages within the Medio period cluster. This contrasts markedly with the pattern at Paquimé, where black wares increased during the same period. Hill suggested that the black pottery may have originated in the southern zone.

Within el Zurdo, two major clusters were thought to correlate with the Viejo and Medio periods. Tables 1.1 and 1.2, which summarize the major clusters, include sites from the Casas Grandes and Santa María Valleys used to check the El Zurdo results. The table entries are arranged with the lowest frequency of plain wares at the bottom, and the highest frequency of such wares at the top (showing, presumably, a seriation from older to [bottom of table] to younger [top of table]). The test and level numbers follow the site designation. I have added uncorrected radiocarbon dates to the appropriate units. These dates were not available to Hill when he wrote his thesis. As can be seen, Hill's two clusters resulted in some dates being out of sequence, with two of the dates that ought to pertain to the Medio period being placed near the bottom of the list.

In Hill's analysis, the rock-lined pit features in Tests 3 Ext., 7B, 7C, and 12 were associated with the Viejo period, as was the partially mummified burial in Test 6, the partial room of Test 13, and lower midden deposits in Tests 1 and 7. The upper levels of the patio, the upper levels of the deposits along the Arroyo Zurdito, and Test 2 in the east house block pertained to the Medio period. Information obtained after 1991 complicates this picture, as will be discussed later in this report.

The Wheeler and Williams Data Set

Judy Wheeler and Cati Williams entered 1990–1992 ceramic data from several sites (including Ch-159) into Reflex. The Reflex files were later migrated to Excel. Wheeler and Williams based their data entry codes on lab tabulations and notes. Rim sherds were entered separately from body sherds. Although numerous combinations of slips and decoration were originally recorded, this data set did not consider such combinations. Instead, the codes focused on interior and exterior finishes, rim treatments, types of "small finds" (ladles, worked sherds, appendages), and lot weights.

The Wheeler and Williams data set was useful for (1) finding general trends in the data and (2) obtaining a breakdown of different forms of texturing for the site as a whole. Their coding was later superseded by subsequent analyses.

In an unpublished report based on the data set, Williams perceptively noted differences in ceramic terminology from year to year. "Jar" was the word of choice for globular vessels in 1991, but "olla" and "olla/jar" were favored in other years. She felt that the variability in combinations of decorative techniques (such as painting plus texturing) was much more pronounced at El Zurdo than at other sites, even considering the sheer size of the Zurdo collections relative to other collections.

Loy Neff's 1995 Restudy

Loy Neff intended to use PAC pottery for a Ph.D. dissertation and returned to Chihuahua in 1995 to re-examine sherds from the earlier field seasons. While circumstances have forced him to change his plans, at least for the time being, he very generously provided his personal research notes for PAC use.

Table 1.1. Hill's Ordering of Ceramic Assemblages (Viejo Period).

Ch-159-1-8 (latest)
Ch-D-9-14V (Los Reyes 2)
Ch-159-7-3
Ch-159-12-2
Ch-159-3E-3
Ch-159-7A-5
Ch-159-7C-K1
Ch-159-7C-5
Ch-159-1-10
Ch-159-7A-8
Ch-159-12-1
Ch-159-1-9
Ch-159-3-A
Ch-159-8-3
Ch-159-7A-6 (raw radiocarbon date 1050±50 BP. Also, one raw date from Ch-159-7A-7, eliminated from the cluster for sample size, of 1060 ± 50 BP.)
Ch-159-7-9
Ch-159-7-F-1
Ch-159-8-4
Ch-159-7-8
Ch-159-13-1
Ch-159-7C-3
Ch-159-2-7
Chih-D-9-2V (Convento)
Ch-159-8-5
Ch-159-7A-4 (raw radiocarbon date of 640 ± 40 BP)
Ch-159-7N-F1-
Ch-159-7X-3
Ch-159-7-7 (raw radiocarbon date of 940±40 BP)
Ch-159-6-1
Ch-159-13-2
Ch-159-6-2
Ch-D-9-13V (Los Reyes 1)
Ch-159-7N-3 (raw radiocarbon date of 640 ± 50 BP)
Ch-159-7-F2
Ch-159-7C-4 (earliest)

Note: assemblages (e.g., "Ch-159-12-2") are indicated first by site ("Ch-159"), then by unit number ("-12"), then by level ("-2").

Table 1.2. Hill's Ordering of Ceramic Assemblages (Medio Period).

Ch-159-1-5 (latest)
Ch-159-11-1
Ch-159-1-3
Ch-151-1-3 (Buena Vista)
Ch-159-1-4
Ch-11-13-2 (Raspadura)
Ch-11-2-2
Ch-159-8-2
Ch-159-7-2
Ch-159-7A-2
Ch-159-7C-2
Ch-159-1-7
Ch-159-10-1
Ch-159-5-3 (Level 4, eliminated from cluster because of sample size, produced two raw radiocarbon dates: 670 ± 50 and 600 ± 50 BP)
Ch-151-4-1
Ch-11-3-1
Ch-159-4-1
Ch-159-1-6
Ch-159-4G
Ch-159-3-2
Ch-159-8-1
Ch-151-2-1
Ch-11-2-6 (Santa María Valley)
Ch-159-4-2
Ch-11-2-5
Ch-11-1-1
Ch-151-3-1 (Santa María Valley)
Ch-159-7B-2
Ch-159-7N-2
Ch-11-2-3
Ch-159-2-1
Ch-159-10-2
Ch-159-3E-2
Ch-151-1-1
Ch-11-4-2
Ch-11-8-1
Ch-11-6-1
Ch-159-11-2
Ch-11-15-2
Ch-D-9-1M (Paquimé)

Neff used the type descriptions in Di Peso et al. (1974) as the basis for his identifications, which were on selected assemblages of PAC sherds retrieved from storage at the Palacio Federal in Chihuahua City. When the Di Peso et al. types did not seem to fit the local assemblage, Neff resorted to descriptive terminology (thus referring, for example, to "generic" red-on-browns). He examined the sherds in Cuauhtémoc and Chihuahua City during an extended visit in 1995. There were, unfortunately, no direct ties between Loy's observations and the original detailed breakdowns, so it can be difficult to know which of the categories used in the field lab correspond with his descriptions.

Neff expected to recognize temporal trends primarily through the relative frequencies of painted versus textured wares—the two categories that he re-examined for Ch-11, 144 (Ch-12), 151, 152, 156, 159, and 180. His treatment of Ch-159, El Zurdo, was by far the most extensive part of his study. Neff had worked at the site and it was the largest PAC ceramic collection from any single site. Within the Ch-159 collection, Neff re-examined painted and textured sherds from Tests 1, the Test 7 group, and Tests 5, 6, 8, 13, 14, 19, 20, 25, 38, and 40.

Careful comparisons between the lab tabulations and Neff's restudy showed discrepancies that can only cleared up only by looking at the sherds in Chihuahua City. In particular, the numbers of red-on-brown sherds did not jibe. In the unit-by-unit discussions in Parts 1 and 2 of this report (Kelley 2008, 2009), Neff's comments were handled separately from the lab tallies because of the lack of obvious one-to-one links between the two sets of information.

Neff's notes contained more information than appears here. He usually discussed paste and temper, distinguishing fine sand temper from medium or course sand temper, and "typical" paste from others. He also took notes on luster, polishing, and whether or not polishing was done over the paint or the other way around. He defined what he regarded as "typical" Babícora, and identified all of Di Peso et al.'s (1974) Viejo period red-on-brown and red-on-brown textured types—many clearly in Medio period contexts. He also provided tabulations for the different kinds of textured wares, using the Di Peso et al. terminology, and his detailed comments on textured wares remain a resource for future work.

Data Revisions for this Report

I re-tabulated the pottery from el Zurdo several times, most recently in 2003–2004, by returning to the original lab tabulations and notes (see Table 1.3). These data were used in the ceramic tables in Parts 1 and 2 of this report. I also included Neff's comments on pottery in the unit descriptions, especially when there appeared to be differences of perception or opinion. There were, undoubtedly, such differences when it came to red slip versus red paint. Some analysts simply missed faded paint, and the 1991 and 1992 lab work definitely fell short in recognizing Viejo period types. Even so, the degree of overall agreement among the data sets is encouraging.

Table 1.3. Summary of El Zurdo Sherd Counts.

Test	Undec	Bk	R sl	R/br	Text	Poly	Other	Combo	Total
1	2581	77	61	36	939	108	12	55	3869
2	502	93	4	4	106	42		12	763
3	1076	89	27	21	135	76	21	10	1455
4	795	128	11	13	120	67	41	7	1182
5	84	12		1	17	2	1	2	119
6	42	30			18			9	99
7	859	221	51	16	290	92	37	23	1589
7N	166	44	6	2	76	24	15	1	334
7A	585	235	11	21	153	50	8	12	1075
7B	72	12	1	1	23	2	2	1	114
7C/12	418	114	9	16	160	20	11	5	753
8	268	69	7	10	52	8	6	9	429
13	988	350	10	30	385	80	38	94	1975
14	965	369	9	8	395	102	16	18	1882
17	508	116	3	2	130	35	11	7	812
19	706	189	6	2	195	110	15	5	1228
25	34	8			3	1	3		49
26	35	3	1		10	4			53
27	116	14	2		15	6	3		156
39	1	1							2
40	86	46	5		45	2			184
42	108	23		1	28	11	7		178
15	372	141	4	1	78	63	14	2	675
16	677	197		8	147	80	10	1	1120
20	605	162	1	3	97	95	15		978
21	521	129	3	2	98	65	6	1	825
22	431	84	1		50	42	9	1	618
23	313	77	1	3	55	24	3	2	478
24	274	120	1	3	105	21	7	2	533
28	864	301	5	6	222	115	17	8	1538
29	172	57	1	2	47	9	2	1	291
30	568	172	4	1	110	100	9	2	966
31	121	41	2		36	7		1	208
32	105	38	1		43	7	2	2	198
33	82	58	2		31	8	4	3	188
34	70	62		6	32	9	2		181
35									0
36	298	136	10	1	100	36	4	1	586
37	20	7			22	3	4		56
38	191	116	6	1	52	40	2	2	410
Not excavated	447	124	4	9	344	64	49	18	1059
	449	125	4	9	365	75	50	18	1127
Totals	17128	4263	270	230	4985	1637	407	317	29292

Pottery Weights

Part of the procedure for analyzing pottery was to weigh the sorted piles by categories and lot, on beam balance scales. A few sorted piles were not weighed, as the scales were sometimes unavailable or that step in the recording process was overlooked. Whole lots were also weighed. Some 167,148 grams (167 kilos, or 368 pounds) were tabulated. This does not include the surface collections made in 1990, 1991 or 1992, the arroyo el Zurdito profile collections, or other miscellaneous collections (which are, however, tabulated elsewhere).

Data Sets: Flaked Stone

The flaked stone data were not of high quality, despite an enormous investment of time and energy in lithic analysis. During the 1990, 1991, and 1992 seasons, most of the flaked stone was examined individually by one of several analysts, whose work ranged from excellent to marginal. Their efforts resulted in four main sources of flaked stone data. Two sources were prepared at the ends of the 1991 and 1992 seasons, as analysis time ran short and some of the remaining flaked stone was sorted, counted, and weighed by classes—the "bulk lithics."

Coding sheets: a flaked stone coding sheet was designed at the beginning of the project, and was used to code 12,075 artifacts from different sites (including 4,698 were from el Zurdo). The coding sheet was slightly modified in 1992, to allow direct coding of unit numbers. The data were entered into dBase; more recently the files were migrated into Excel. For all of the coded units, most of the items appearing in the lithic notebooks were included in the database, introducing redundancy but also opportunities for cross-checking.

Lithic notebooks: certain flaked stone artifacts—the formal tools, objects showing informal modification or use wear, and any other objects of special interest—were given individual catalogue numbers and recorded in the lithic notebooks. Many of those items were drawn. The drawings were of variable quality, but most were good enough for basic inferences to be drawn.

The 1991 "bulk lithics" notes: these notes, by Cathy Williams, emphasized counts of flakes and cores, with some notes on worked flakes. Some catalogued items from specific units were noted.

The 1992 "bulk lithics" notes: similar notes in spiral notebooks, primarily by Hugh Gibbins and Judy Wheeler, were prepared in 1992 The tabulations also emphasized flakes and cores but contained much more information on raw materials. Again, some catalogued items were also noted, but not consistently.

In 2003, I set about reconciling the four data sets. Because the "bulk lithics" were recorded sequentially as bags crossed the lab table, I entered the 1991 and 1992 data on cores, flakes and utilized flakes into a combined "bulk lithics" Excel File. I then created a master file, also in Excel, that gave the counts of flakes, blades, cores, utilized flakes, shaped tools, shatter, and other categories as provided in the various databases, identifying where specific lithic data had originated and eliminating redundancy. The level of available detail varied enormously, affecting the consolidation process. Only one analyst recorded shatter consistently, for example, so in most

cases it seemed prudent to add shatter to a generalized category (“flake”) in order to make the data more consistent (if nothing else, anything in the “flake” category was detached and not obviously worked). For the most part, I have refrained from major changes, feeling that the less I tampered with an already stressed data set, the better.

As is noted in other parts of the report, almost all of the lithic raw materials were igneous and demonstrated varying fracturing qualities—many were quite coarse. In most cases, evidence of utilization or shaping was sought using the naked eye, or with a 10 or 20 power hand lens. Only rarely was flaked stone placed under the microscope. The tabulations undoubtedly underestimate the frequency of modified or utilized flakes, but the local flaked stone industry was rather expedient and a more careful examination of individual objects would not change that fact. Even so, the current project took little advantage of the research potential of the flaked stone now in storage.


MAXWELL MUSEUM OF ANTHROPOLOGY

Chapter 2

POTTERY: INITIAL CLASSIFICATION

General Thoughts

My sense is that the local brown ware pottery served as a canvas on which potter-artists could make decorative statements based on elements drawn from a "design pool" of textures, colors, and paint combinations. McIntosh's (1989) concept of a symbolic reservoir, which he applied to Africa, might be useful for this pottery tradition, as it would capture the mix-and-match quality of the assemblages. We rejected the idea of creating new "types" for each new combination of elements in local potters' stylistic repertoire, though that may yet come to pass. I was interested to see that Robert Leonard, in his cluster analysis of 103 whole pots (mostly Chihuahua polychromes), suggests that "many pots identified as belonging to the same types actually more closely resemble pots belonging to different types!"(Leonard 2001:87).

Our initial goal was to block out major categories: undecorated or plain (which included a range of browns, tans and occasional grays, as well as undecorated portions of decorated vessels), black, red or red-slipped, red-on-brown, textured, presumed local polychromes, and named imported types. Unusual sherds and presumed imports were separated and given type names if possible. This approach resulted in almost no "unknowns" in the usual sense, among the sherds of presumed local manufacture. I am aware that this is not a problem-free strategy. An early decision was taken to take fairly detailed notes on each pottery lot, but to simplify the major categories for summary tables, thereby oversimplifying the actual variability. In the paragraphs that follow, the categories refer to presumably local made sherds unless noted otherwise.

Comments on Locally Made Pottery, by Initial Class

Plain Brown

The plain or undecorated category (Figure 2.1) comprised the most common category of sherds at El Zurdo. This was essentially a pool of sherds in shades of brown to tan to gray that lacked other identifying characteristics such as paint, slip (in colors other than brown to tan), and texturing. Differences in temper composition and size, hardness, and surface colors may well prove to be significant, but we lacked the time or facilities to pursue such distinctions. A number of gray sherds were flagged, but ultimately were included in the "undecorated" category as falling within the range of possible color outcomes given local clays, variability in firing, and heat alterations. (Neff frequently noted heat-altered sherds.) The "undecorated" category included undecorated parts of textured and painted vessels. We noted a decided tendency to decorate only the upper parts of vessel bodies, along with the necks and rims. The implicit assumption made about the undecorated, mostly brown pottery was that it was probably local, and most of it probably was. Some undecorated sherds appeared to be imported, however (see below for a summary of a preliminary sourcing study).

Figure 2.1. Part of a plain brown olla. This section was 31 cm across. Lot 3238, Zurdito profile. PAC 92C-53-69.

Textured

Textured sherds represented the second most numerous category within the site assemblage. The local potters had an appreciation of the plasticity of their clays and the technical knowledge to control that plasticity. At times it seemed as if they were deliberately playing with the plasticity to achieve unusual effects. One sherd was not only corrugated, it had pseudo-corrugations created by pressing fillets of clay onto the surface of the vessel, above the honestly corrugated portion (see the top example in Figure 2.2). Other sherds suggest that the surface was manipulated while unusually damp, to allow the kinds of impressions that we now see.

According to the Wheeler and Williams data set, 14 percent of the body sherds were textured, along with 33 percent of the rims. If one includes the Wheeler and Williams' "rough" rims with the textured ones, slightly more than half of the rims were textured. An idea of the relative numbers of different kinds of texturing can be obtained from the same data set. "Corrugated" and "altered corrugated" accounted for 55 percent of the textured wares. "Brushed and striated" (or B&S, as we called it; rendered as "brushed and scored" in the reports) and "scored" (using Di Peso's terminology) accounted for 25 percent of those wares. "Incised" and "parallel incised" accounted for 14 percent, and "punctate" for 4 percent. Both the project's and Neff's records indicate that a more detailed study of texture and slip combinations could be done, from the project records, the sherds, or both.

Figure 2.2. Examples of textured sherds from the Zurdito profile. Top sherd: Lot 3074 (PAC B/W 92-49-07). Bottom group of sherds: Lot 3219 (PAC 92-35-10).

A certain amount of ambivalence attended the classification of rims with little of the vessel body attached to them. Some plain vessels had textured rims, for example, and some textured vessels had plain rims. The "plain" and "textured" categories shared vessel forms, and exhibited the same size range, the main difference being in the exterior treatment of the body, so perhaps this is not a matter of grave concern.

Black

The "black:" category was worrisome. Tabulations under that heading included deliberate black slips (on the interior or exterior or both), polished black shading into brown, and sherds blackened from usage. There was, without question, an unbroken progression from one of these groups to the next. In response, on some days I felt that we should throw all "black" sherds into the undecorated category, on the grounds that there no differences in form or finish, except for the final color (whether due to firing in a reducing atmosphere or to post-firing carbon deposition).

The problems are reflected in the numbers for black sherds in the Wheeler and Williams data set as opposed to those in the pottery tables in this report. Wheeler and Williams classified 8 percent of the sherds as black. Under the more liberal interpretation applied to the lab notes, black sherds were 14 percent of the total.

A few sherds from partly slipped black vessels were identified, and others may have been mistakenly identified as sherds with black paint. Most of the time, however, any black sherds were black all over, as was the case for red-slipped sherds.

Plain Red

Red-slipped wares formed a minor, but fairly consistent part of the assemblage (Figure 2.3). They were most common in earlier deposits along arroyo el Zurdito.

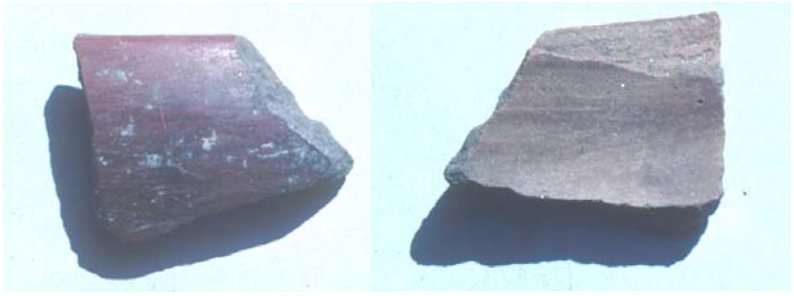

Figure 2.3. A red-slipped, incurved bowl rim. Left: bowl exterior. Right: bowl interior. Collected from the surface (Lot 1245). PAC 90C-12-25 and -26.

Red-on-brown

Red-on-brown sherds, a hallmark of the Viejo period in northwest Chihuahua, were most frequent in the lower levels of units along arroyo el Zurdito. There, they may well have come from Viejo period assemblages. Nonetheless, red-on-brown sherds, including ones that Neff gave Viejo period type names, occurred in clearly Medio period deposits.

In analyzing the pottery from el Zurdo, Neff identified every named Viejo period Red-on-brown type used by Di Peso et al. (1974). Almost all other PAC Medio period collections also contained red-on-brown sherds, so their presence in el Zurdo's Medio period deposits was not due solely to mixing. The red-on-brown sherds represent a significant difference in the Medio Period assemblages of the culture's northern and southern zones.

Black-on-red

There were, undoubtedly, locally made black-on-red types that have not been named. All of the laboratory analysts, as well as Neff, identified some black-on-red sherds as locally made. Among the named black-on-red types (Madera and Ramos), some were presumably imported and the problem lay in sorting local variants from the imports. In the absence of source studies, it is probably best to conclude that both local and imported black-on-red sherds are present in the assemblage, without putting much weight on individual identifications.

In addition, and in retrospect, the distinctions between Ramos Black-on-red and Madera Black-on-red were not fully appreciated and analysts tended to use one term or the other.

Polychromes (and Bichrome Variants)

Santa Ana Polychrome was not described until 1999 (Larkin et al. 2004), so was not part of our analytical repertoire as el Zurdo collections passed through the field lab. (The initial suspicion that Babícora Polychrome had a direct ancestor came from observations of sherds from el Zurdo, as those came out of the ground, but it took several years to convert that suspicion into certainty.) As a result, all sherds in the Santa Ana–Babícora continuum were classified in the lab as Babícora polychrome. Looking back, we can see that drawings of individual polychrome sherds attest to the presence of Santa Ana Polychrome in the lower deposits along arroyo el Zurdito. Those sherds (particularly the ones from the lower levels of Tests 1, 7, and 14) need to be reevaluated—as would probably be a good idea for the entire ceramic assemblage.

As was the case with the black-on-red sherds, it could be difficult to distinguish members of the local polychrome tradition from imports. In particular, we are reluctant to designate "local variant" Ramos and Villa Ahumada Polychrome without sourcing studies.

Most of the Babícora group of painted sherds must be of local origin. We often found examples of Babícora Polychrome (Figures 2.4–2.7), but also examples of what we called Babícora Black-on-tan (Figure 2.8) and Babícora Red-on-tan. We were quite confident about Babícora Black-on-tan, because we have found large enough pieces of vessels (such as a surface find at Ch-152) to convince us that this was a legitimate variant within the Babícora decorative tradition. We were less convinced by our supposed examples of Babícora Red-on-brown, and Neff had grave doubts about the category. Nonetheless, analysts in the field lab repeatedly distinguished Babícora from other red-on-brown sherds, and comments such as "not Babícora" were interspersed among the tallies of red-on-brown sherds. It may be relevant that in the Ramos tradition, a black-on-tan variant occurs with some frequency but a red-on-tan variant does not.

The "classic" Babícora was a tan vessel, most commonly in the form of jars with sloping shoulders and low centers of gravity. Open bowls and incurved bowls (*tecomates)* occurred. Decoration was usually confined to the upper bodies of jars and to the interiors or exteriors (or both) of bowl walls.

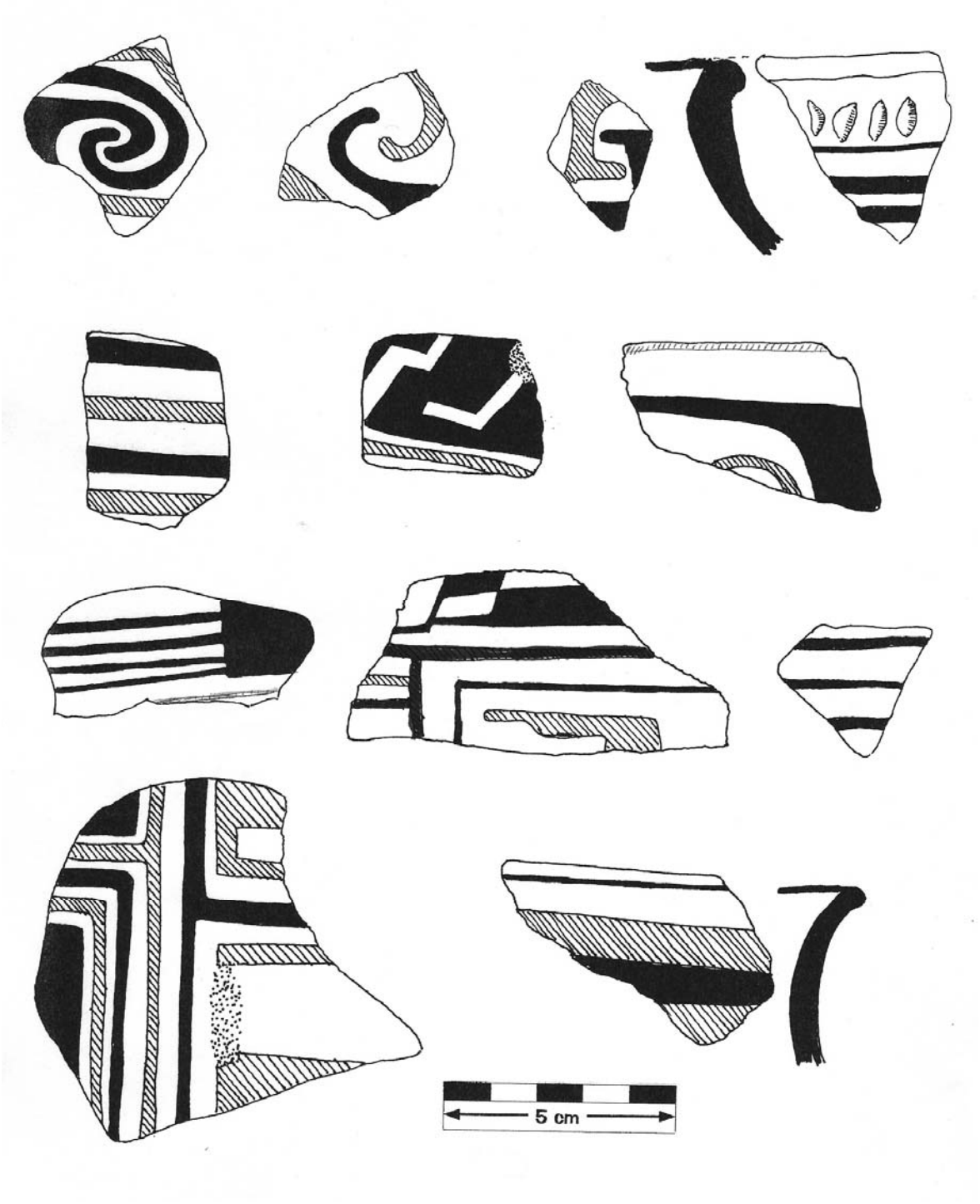

Figure 2.4. Babícora designs. Listed left to right, by lot or object numbers. Top row: 3202 (Test 30, Level 6), 3190 (Test 28, Level 5), 3230 (Zurdito profile), 3199 (Test 30, Level 3). Second row: 3207 (Test 32, Level 1), 3138 (Test 21, Level 3), 3336 (Test 37, Level 1). Third row: 3200-100 (Test 30, Level 4), 3068 (Test 19, Level 7), 3129 (Test 23, Level 4)—exterior of a black-on-tan incurving bowl or *tecomate.* Bottom row: 3227-100 (Zurdito profile), 3129 (Test 21, Level 4)—jar rim with fading burned-out paint on a dark brown background.

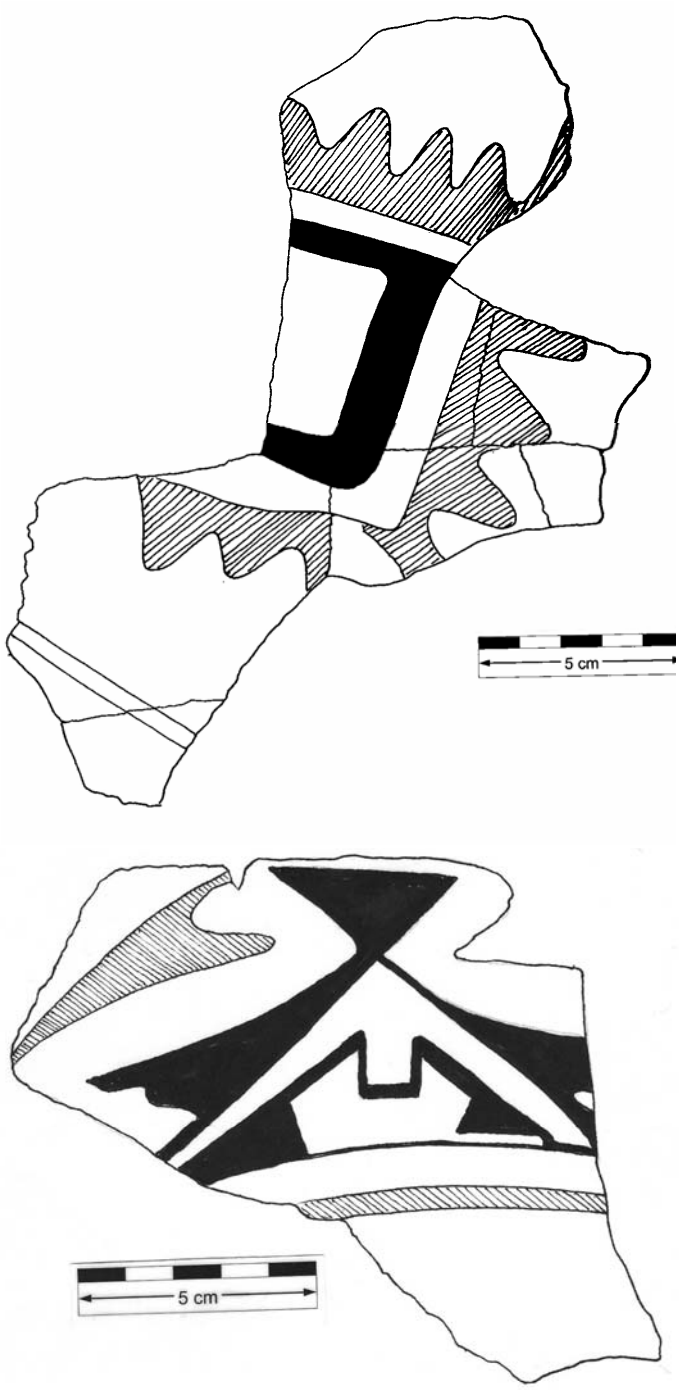

Figure 2.5. Unusual Babícora polychrome designs. Top: Lot 3034 (Test 14, Level 8). Bottom: Lots 3201 and 3202 (Test 30, Levels 5 and 6).

Figure 2.6. A selection of Babícora polychrome designs.; Top, left to right: Lot 3071 (Test 20, Level 4), Lot 3056 (Test 16, Level 6), Lot 3068 (Test 19 Level 7). Middle left: Lot 3129 (Test 23, Level 4). Middle right: a "typical" Babícora design (sherd not collected; photo by S. Abonyi). Bottom: an unusual design (Lot 2056, Test 2, Level 2; PAC 91C-34-16).

Figure 2.7. A Babícora Polychrome pot found with a double burial in Test 5. Left: at the time of excavation, showing the design around the upper shoulder (Lot 2184, PAC 91C-7-12). Right: drawing of the pot by S. Abonyi.

Figure 2.8. Babícora Black-on-tan. Lot 2055, Test 2, Level 1
PAC 91C-34-.14.

Background colors usually ranged from gray to tan. Some vessels had a polished dark brown background color, but were otherwise similar to more typical Babícora sherds. We are still uncertain whether this was a fire-darkened version of the type, as Neff tended to think, or a deliberate use of a darker background. It was not given a new type name, instead being noted as possible Babícora.

Babícora rims could be plain, or could carry a red slip band on the lip interior. Some exhibited texturing at the neck. Some Babícora bowls had black-slipped interiors. In the unit tables these distinctions were not made, but they are mentioned in the accompanying ceramic notes.

The vast majority of sherds classified as local polychromes were quite small, usually carrying only alternating red and black lines or limited sections of motifs. Our preconceptions about local polychrome designs involved interlocking spirals and lines framing panels of perhaps elongated triangles. On larger sherds where more of a design was visible, we were surprised to find more angular designs than we had anticipated.

"Combos"

As the analyses evolved, I became interested in combinations of attributes—texturing combined with smoothed but slipped or painted areas, for example (Figure 2.9). I therefore created the category "Combos." Given my overwhelming impression that the assemblage had a strong mix-and-match quality, I was surprised by how few actual sherds were tallied as "Combos"—slightly more than 300, or barely more than 1 percent of the total. However, the exclusion of combinations of texturing techniques (subsumed under "texturing") and slip combinations (such as red-slipped interior versus brown-slipped exterior) diminished the number of sherds assigned to the "Combos." By considering those sherds along with ones with texturing and slip combinations, the mix-and-match quality of the assemblages becomes more evident—as can be seen in the pottery discussion for Test 1.

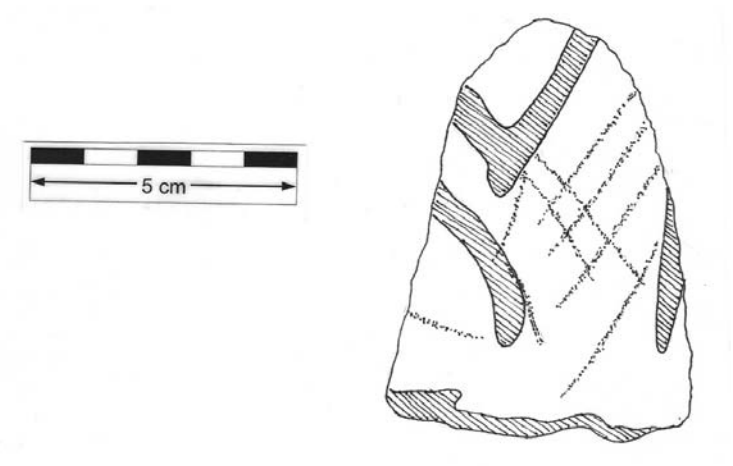

Figure 2.9. A red-on-tan scored sherd. Collected from the site surface, south of arroyo el Zurdito. Lot 3438.

Rims with red bands on the lip or rim interior of were included with the categories for the sherds on which the red bands occurred. Such sherds were separated in the rim tabulations (Chapter _) and are mentioned in the notes for the test units. Interior lip and rim bands occurred on plain brown, black, textured, and Babícora Polychrome pottery. Red bands on plain brown lip interiors correspond to what Di Peso et al (1974 6:75) called Pilón Red Rim, a Viejo period type, but at el Zurdo such rims were found in both Viejo and Medio period deposits. El Zurdo yielded 32 "Pilón" rims, 63 red slip bands on textured rim interiors, a few red slip bands on black-slipped rim interiors, and similar bands on Babícora painted variants. Black and brown bands were noted in the same positions, and one rim sherd was recorded as having a yellow lip band.

"Other"

The "Other" category included unusual sherds. A white-slipped sherd, for example, could have came from one extreme of the brown-to-tan continuum, or it may have significance not yet revealed to us. The category also included presumed or possible imports, albeit those are broken out separately, below. Presumed local variants of exotic types (for example, a presumed locally made Ramos Polychrome) were also tallied under this category. Finally, some "Other" sherds could only be given descriptive labels, such as the red-on-black sherd in Figure 2.10. Most "Other" sherds were described individually in the lab notes, as is apparent from the unit descriptions.

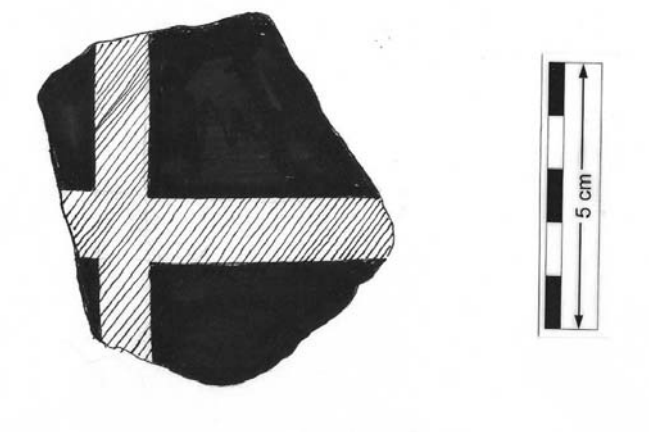

Figure 2.10. A bowl sherd with a red-on-black interior. Collected from the Zurdito profile, from the lower or eastern part of the drainage. Lot 3216.

Imports

Any possible import of Ramos Polychrome, Villa Ahumada Polychrome, and Ramos or Madera Black-on-red designated was tallied in the "Other" column and described. The same was done for two possible Jornada painted sherds (from Test 7, Level 9) and one Chupadero Black-on-white sherd (from Test 8). Only the last type clearly originated beyond Chihuahua; it must have come through other parts of the Chihuahua Culture area to reach el Zurdo. The Jornada sherds could easily have come from the Villa Ahumada area, where it was a major type (Cruz and Maxwell 1999). The PAC observed Jornada sherds on Santa Clara valley sites upstream from Villa Ahumada.

Six sherds were deemed to be Ramos Black because of their thinness, hardness, and fine polishing. These came from Tests 1, the Test 4 group, and Tests 14 and 34.

Neff identified one sherd as possible Playas Red Incised, but added a note: "probably not."

The most common of the named and presumably non-local types, Madera Black-on-red, included 107 definite examples and a few tentative ones. These had a broad spatial distribution. The scattered units included examples in Tests 1 and 3, the Test 4 group, and Tests 7, 7A, 7B, 8, 14, 17, 19, 25, 27, and 42. The long trench units included examples in Tests 15, 16, 20, 21, 22, 23, 28, 30, and 33. The largest concentration of Madera Black-on-red sherds was in the Test 4 group.

Although 25 Ramos Polychrome imports (Figure 2.11) were reported, only one (from Test 8) was of the pale paste that characterizes Ramos Polychrome at its finest. A sherd tabulated as unknown black-on-white had such a finely drawn design that it might be a second example of "high end" Ramos. Ramos Polychrome sherds come from Tests 1, the Test 4 group (which had the largest number), 8, 13, 14, 19, 25 and 27 of the scattered units, and form Tests 15, 20, 22, 29,30, 34, and 36 of the long trench.

Figure 2.11. Ramos Polychrome sherd. Lot 3156 (Test 22, Level 3). PAC 92C-57-35.

Fourteen Villa Ahumada Polychrome sherds were tallied from Tests 7, 7N, 7A, 7C, 8, 13, 14, and 17, and from the Zurdito profile (Figure 2.12). The distribution suggested that Villa Ahumada might be somewhat earlier at the site than Ramos Polychrome. Neff suggested that one of the sherds might be Huerigos Polychrome (the slipped version of Carretas Polychrome). Some of the eight "white" sherds might also be Villa Ahumada.

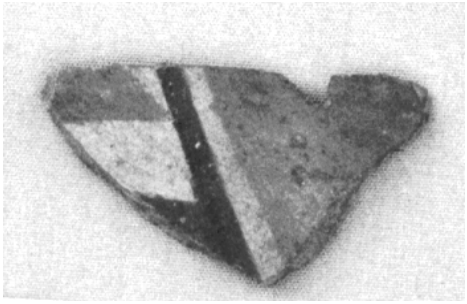

Figure 2.12 A shaped sherd of Villa Ahumada Polychrome. From the Zurdito profile (Lot 3219). 92B/W-35-18.

A rim sherd from Test 1, Level 9 might be classed as Dublan polychrome.

Neff also identified Escondida Polychrome from Test 1, Levels 6 and 9. This was one of several occasions when Neff's named types did not entirely correspond to those assigned in the field lab. Clearly, a more detailed study of the pottery from el Zurdo would be beneficial.

Chapter 3

POTTERY: GENERAL OBSERVATIONS

This chapter deals in part with uncommon vessel forms and with modeled appendages, which in practice were linked: attachment scars from broken-off appendages became an unexpectedly important source of information. The appendages were individually modeled pieces attached to vessels as lugs, handles, supports, and various kinds of appliqué.

Vessels with Shoulder Flanges

Sherds with "shoulder flanges" were uncommon, but occurred on Babícora Polychrome, red-slipped, and plain brown sherds (both at El Zurdo and at other PAC Medio period sites). Shoulder flanges are unlike flanges in other ceramic traditions; here the flange is vertical or nearly so, giving the vessel a composite appearance. This vessel form may mimic a practice in which the neck and shoulder of a jar was worked smooth and used as a sort of lid for a bowl. A complete Babícora Polychrome example is present in the collections at the Museum of Indian Arts and Culture/Laboratory of Anthropology, Santa Fe (Figure 3.1). The Ledwidge collection at the El Paso Museum of Archaeology includes eight shoulder-flanged vessels (Catalogue Nos. 59-9-164, -210, -390, -602, -860, -891, -900, and -984). Clearly, shoulder-flanged pots are an uncommon but widespread vessel type in the Casas Grandes repertoire.

Figure 3.1. Shoulder flanges. Left: Babícora Polychrome flanged vessel, MIAC/Lab # 20560/11. Photo by D. Phillips; Right: Babícora Polychrome flanged sherd from Lot 2040 (Test 1, Level 8). PAC 91C-35-16.

Effigy Vessels

Sherds from hooded effigy vessels were extremely rare in the PAC collections. The only sherd definitely from such a vessel came from a late Viejo or transitional Viejo–Medio site, Ch-254, in the Santa María valley. Presumably, the form was uncommon in the southern zone of the Chihuahua Culture (but we do not know how selective removal of objects during looting has affected the PAC collections). At El Zurdo, one sherd from Test 14 could have been part of a hooded effigy vessel.

Various kinds of zoomorphic and anthropomorphic vessels were seen in local private collections. The most impressive pieces we saw came from the Rancho San Juan site, belonging to a resident of Gomez Farías (Figures 3.1–3.6). Two of three pots found with a burial at that site were Babícora polychrome, while the third, a hooded effigy vessel, was Ramos polychrome. These show that a complete inventory of pottery from the southern zone would include a greater variety of forms than the PAC collections document. Such vessels shared symbolic content with the better-known pots of the lowlands (see VanPool 2001), such as the checkerboard, button, and macaw motifs. Pots in private collections also give an indication of how successful looters have been in extracting burial pots from known sites and preventing their entry into systematic archaeological collections.

The largest of the above three vessels is unique in our experience, in having a modeled head attached to the interior of the neck—and in having a deep depression behind the head, as is visible in the rear view of the pot (Figure 3.2). The figure is a female who is holding her breasts. The female genitalia are painted rather than modeled, which is atypical of human effigies of the Chihuahua Culture. At first I thought that the pot represented a dead female. When I showed the photographs to Mesoamericanists who were in Calgary for a Chacmool Conference, they were unanimous in suggesting that the vessel represents a woman in childbirth.

The turban-like headdress or headband is atypical of Chihuahua Culture dress, but simple and stepped headbands are depicted on pottery. The face paint or tattoos on both cheeks (although difficult to see in the photographs) is, in contrast, almost universal on the hooded effigy vessels. In this case the cheek decorations consist of black squares connected by black lines.

A Footed Effigy Vessel

A. C. MacWilliams found a whole vessel buried in the sand at the bottom of the arroyo el Zurdito in 1990 (Lot 1292; Figure 3.7). The vessel was 17.5 cm tall and 18.5 cm in diameter at its widest. The external rim diameter varied from 13.5 to 14 cm, and the internal rim diameter varied from 11.3 to 11.5 cm. The bottom of the pot had four attachment scars where supports had broken off. The attachment scars were more or less round, and each was about 5 cm in diameter, suggesting rather globular feet. Attachment scars were also found on each side of the body, suggesting where the head and a tail of the animal had been. At the area where the presumed head was attached, a hole penetrated the vessel wall, suggesting an open mouth or a spout. The hole was halfway down the body of the vessel. The tail attachment was less obvious.

Figure 3.2. Three views of the female effigy vessel from the Rancho San Juan Site. Top: two frontal views, at slightly different angles. Left photograph by D. Zborover. Right photograph: PAC 92C-21-13. Bottom: back of the vessel.
Photograph by D. Zborover.

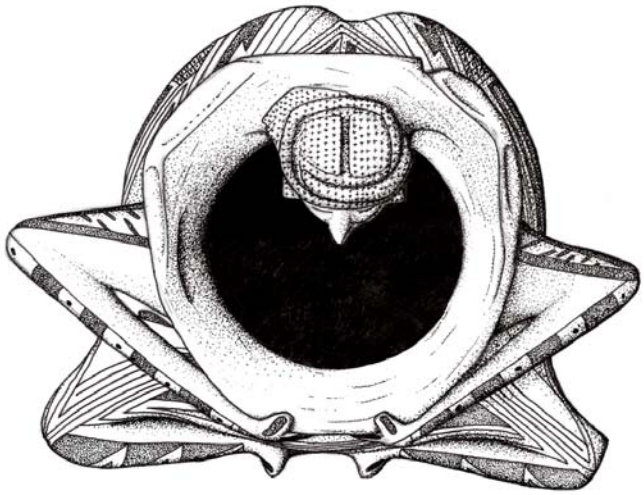

Figure 3.3. The female effigy vessel, as seen from above. Drawing by H. Gibbins.

Figure 3.4. Close-up of the face of the effigy vessel. On the cheeks, rectangles of black paint are connected by lines. The facial markings could be tattoos or temporary face paint.
PAC CP 98-10-8.

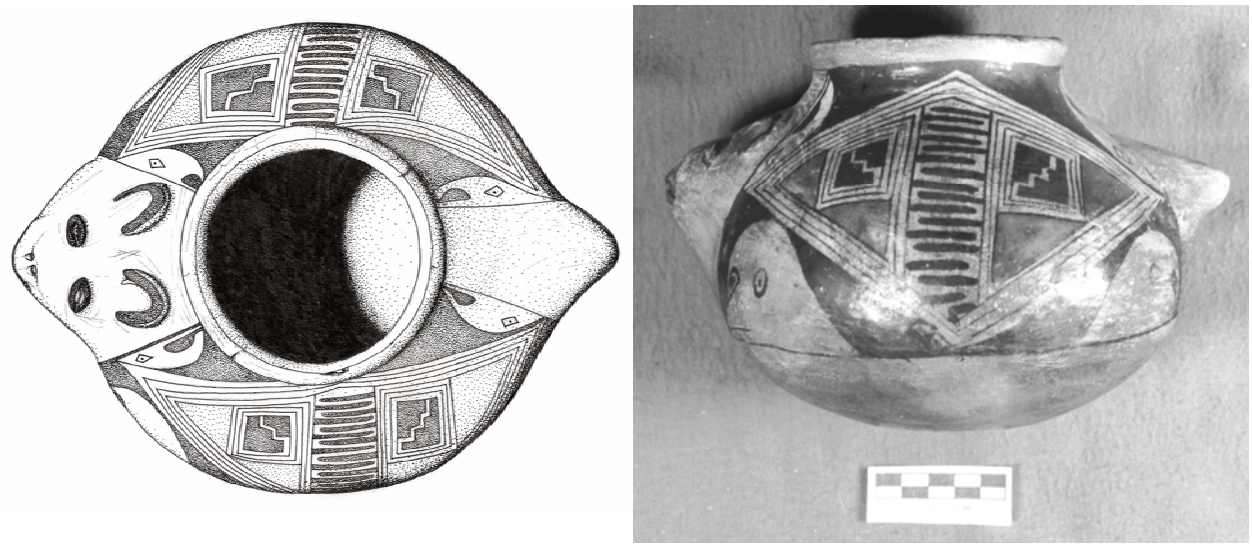

Figure 3.5. The second Babícora Polychrome vessel from the Rancho San Juan Site. Drawing by H. Gibbins. Photograph: PAC 92B/W-21-18.

Figure 3.6. Ramos Polychrome hooded effigy vessel from the Rancho San Juan Site. Photograph: PAC 92B/W-21-21. Drawing by H. Gibbins.

Figure 3.7. Four-legged effigy vessel from arroyo el Zurdito.
Lot 1292. Photographs by A. MacWilliams.

The rim exhibited three cracks as a result of being exposed in the arroyo bottom. The pot was covered in a greasy, sooty material, obscuring the painted design (the pot was not washed, to allow the future identification of the surface material). To the extent the design can be seen, it is a crude ladder- or lattice-like pattern about 4 cm wide, painted in red and circling the pot at its shoulder. The background color is a reddish brown. Although the vessel falls within the Chihuahua Culture's red-on-brown tradition, we were unable to assign it to a named type.

The vessel could not have been water-transported any great distance, or it would have broken. When found, it was full of sand matching that in the arroyo bottom.

Possible Effigy Vessel Appendages

The parts missing from the four-legged effigy vessel would fall into this category, had they been found. Test 1 yielded what looked like a modeled paw (if so, it was probably attached to a vessel wall, not to a leg). A second possible paw (or else a hand) came from the Test 3 Extension. The only unequivocal appendage from an effigy vessel found by the PAC came from a T-shaped room at Ch-11 in the Santa María Valley.

Handles and Lugs

Here, "handle" means an elongated grip attached at both ends, and "lug" means a short grip attached at one end (see Figure 3.8). Seventeen handles and lugs were recorded, as well as an item described as a "possible handle or support" and one thick, coiled piece that seemed to lack the curvature needed for a handle.

Figure 3.8. A handle and a lug. Left: a from a plain brown jar. Right: a lug from a black-on-red vessel, probably Madera Black-on-red. Lot 1246 (1990 surface collection). PAC 90C-37-19.

Seven handles were from plain brown jars. Most were attached from the lip to the lower part of the short neck (Figure 3.8, *left*), creating a rounded aperture with a diameter of 0.5 cm or slightly larger. Two black-slipped vessels had horizontal lugs and a black-slipped coil handle was also recorded. One heavily slipped, reddish brown handle was reported, and a black-on-red sherd had a horizontal lug or tab. A black-on-tan sherd had an attachment scar suggesting the former presence of a handle. A Babícora Polychrome lug (No. 3200-100; Test 30, Level 4) was unusual in that the lug was carefully painted in a flag-like design in black, with a thin red line encircling the base of the lug. A possible Babícora rim had a coiled handle like those on the brown jars, and the complete Babícora pot found with the double burial in Test 5 had two coiled handles.

Modified Sherds

Several categories of modified sherds (Figure 3.9) were defined: drilled sherds, partially drilled sherds, a cut sherd, shaped sherds that were not been drilled, and sherds that had worked edges but were mostly unshaped.

Drilled Sherds

Thirty-three drilled sherds were recorded. One of these (No. 2023-1) was a pendant. Others could be from cracked vessels with lacing holes. Most, however, appeared to be more or less centrally drilled. Although the records were not as detailed about the edges of these pieces as they should have been, it seemed that many did not have finished edges and perhaps were broken in manufacture. Several were broken across the drilled hole.

Incised arcs on the surfaces of some sherds (for example, a fragment of a drilled sherd from Test 7, Level 9, Lot 2164) suggested that these were guide lines for making well-shaped drilled sherds, but that the item broke before being completed.

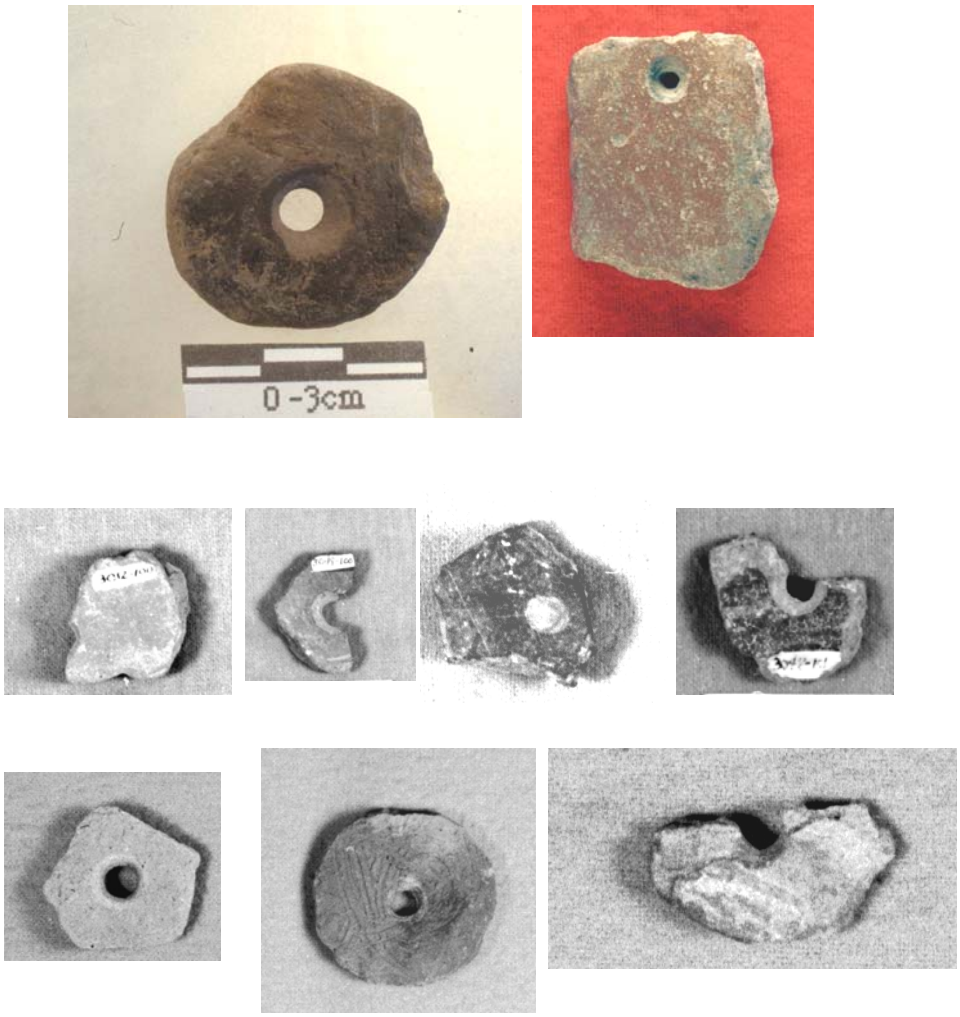

Figure 3.9. Modified sherds. Top row, left to right: (1) drilled sherd from Test 2, Level 2, No. 2056-2 (PAC 91C-35-21); (2) drilled sherd pendant of plain brown pottery, No. 2009-1, surface (PAC 91C-26-20). Middle row, left to right: (1) notched and shaped sherd, No. 3012-100, Test 14, Level 5; (2) drilled sherd, No. 3048-100, Test 17, Level 4; (3) partially drilled sherd, No. 3047-100, Test 17, Level 3; (4) No. 3048-101, Test 17, Level 4 (all images in row: PAC 92B/W-19-19). Bottom row, left to right: (1) drilled sherd, No. 3055-100, Test 16, Level 5; (2) No. 3074-100, arroyo el Zurdito profile; No. 3084-100, Test 20, Level 7 (all images in row: PAC 92B/W-49-7).

Five partially drilled sherds (Nos. 3085-102, 3091-100, 3137-101, 3127-102, and 3226-100), as well as a sherd with holes begun from both surfaces that failed to meet (No. 3242-100), were probably also casualties of the manufacturing process.

The process for making drilled worked sherds began with drilling a hole in a conveniently shaped sherd. Most of the holes were biconical, but one was drilled through from the interior surface. After successfully drilling a hole, the outer edge of the sherd was shaped and ground,

perhaps with an incised line as a guide. Only 11 drilled specimens appeared to have reached the final stage of preparation, having ground outer edges.

If the drilled sherds were in fact used as spindle whorls, the size of the hole must have correlated closely with the material being spun. The holes ranged from 4 to 8 mm in diameter (the diameters of the broken drilled sherds had to be estimated), with a cluster at 5 mm. Apertures in this range could indicate the spinning of cotton, while spindle whorls with larger holes might have been used for coarser fibers.

Shaped Sherds

Twenty-three sherds shaped on all edges, but not drilled, could have been used as gaming pieces or for other purposes. Ten of these were complete. The shapes were pentagonal (No. 3055-100, Test 16, Level 5), round to oval (Nos. 2041-11 [Test 1, Level 9], 3227-102 [arroyo el Zurdito profile]; 2178-1, [Test 7A, Level 5], 2238-4 [Test 13, Level 1], 3015-100 [Test 15, Level 3], and 3374-100 [Test 38, Level 4]), and rectangular to subrectangular (Nos. 2041-12 [Test 1, Level 1] and 2059-9 [Test 2, Level 1], both fragmentary). Sixteen of these shaped sherds (often recorded as sherd disks) were made on undecorated brown pottery, one on Babícora Polychrome, one on a black sherd, two on textured sherds, and three on red-on-brown sherds.

Larger shaped sherds may have been used as pot lids. No. 2041-10 (Test 1, Level 10) had one ground edge. A large Babícora sherd (No. 3227-100, arroyo el Zurdito profile) with a ground edge appeared to have been part of a larger piece with ground edges.

Cut Sherd

A rim sherd (No. 3063-100, Test 19, Level 5) was cut into a stepped pattern.

Sherds with Worked Edges

Eighteen sherds had worked edges that were not from an attempt to shape the sherds into spindle whorls or other formal artifacts. The single ground edges were sometimes beveled. In most cases, the exact nature of the worked edge was not specified, but enough pieces were adequately described to show that sherds were being used for scraping or abrading.

Other sherds had straight edges ground perpendicular to the vessel surface. These reminded us of “drum” edges found at Ch-156 and Ch-011 in the Santa María Valley. At those sites, damaged jars appear to have been cut in half at vessel mid-height. Project members speculated that the modified jars served as ceramic drums.

Ladles

Four ladle bowl fragments of ladles and three ladle handle fragments were found (Figure 3.10). One of the ladle handle fragments was "channeled." In other parts of the culture area, handles with such wide channels were from ladles mimicking ladles cut from gourds.

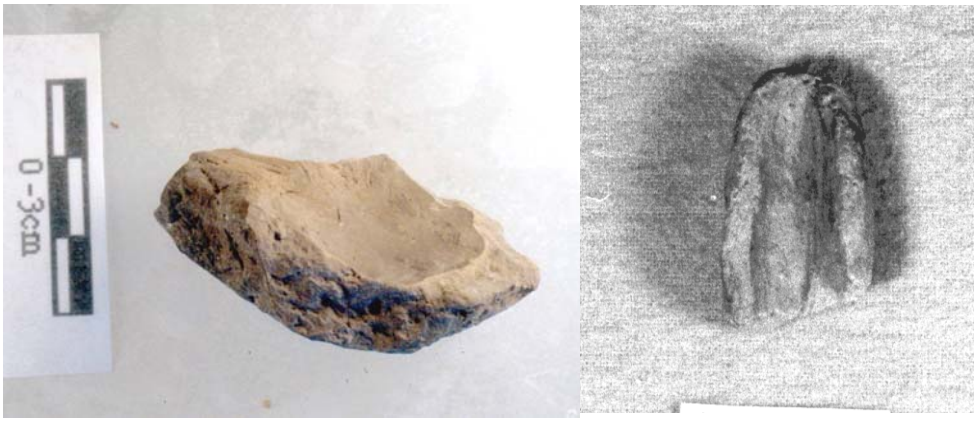

Figure 3.10. Two ceramic ladle fragments. Left: No. 2040-1, from Test 1, Level 8 (PAC 91C-27-23). Right, No. 3155-100, a channeled handle, from Test 23, Level 6 (PAC 92B/W 49-07).

Possible Colanders

Two sherds were from vessels with holes made in the vessel wall prior to firing. These might have come from colanders. One was from Test 2; the other was from the fill of the pit feature in Test 3.

Miniatures

The line between modeled miniature vessels and very small coiled vessels is not clear from the records. Seven examples of sherds believed to be from modeled miniatures were reported; most were found along arroyo El Zurdito. One sherd was described as a "coiled miniature." Clearly, small modeled pots occurred at the site, but were rare.

Possible Ceramic Pipes

Two fragments of plain brown pottery could have been the ends of ceramic pipes. One came from the long trench (Lot 3148, Test 24, Level 4), the other from a unit offset from the Zurdito arroyo (Lot 3063, Test 19, Level 5). As no definite pipes were found by the PAC (here or elsewhere), the evidence that pipes were used at this site is weak.

Observations on Pottery Manufacture

Few studies of Chihuahuan pottery speak to manufacturing and sourcing (but see Woosley and Olinger 1993; Triadan et al. 2005). Some information on those subjects was gleaned by examining sherds from the study areas, and through the observations of the project geologist.

Clays and Temper

The most extensive comments on ceramic pastes and temper were in Neff's notes. There, he usually described paste as "typical" or not, and temper as fine, medium, or coarse sand. In going over his notes, I failed to find any mention of principal mineral temper other than sand. He did note rare occurrences of mica in Babícora sherds, and less rare occurrences of mica in black-on-red, red-on-browns, and textured sherds.

Neff's notes aside, the lab notes sometimes noted the presence of mica in pastes, and any unusual temper was mentioned. Sherds with very fine temper or with unusually large temper inclusions were also noted, and the larger pieces of temper were sometimes measured.

Hydrogen peroxide is a cheap and widely available chemical. Our experiments suggested that clays did not foam upon application of hydrogen peroxide, but that any organic component did foam. Neff used this test to identify black bits in the paste of sherds as organic or inorganic.

Possible fiber temper was noted for a sherd from Test 19, Level 4 (Lot 3062). In other, rare cases, burned-out impressions of organic inclusions were seen in sherds. One sherd with deep horizontal incisions showed impressions from a grass stalk (as identified by Karen Adams) in the bottom of one of the incisions.

As was just noted, Neff classified the principal temper in the local pottery as sand. A visitor to the project in 1991 examined a number of the sherds using a microscope, and pronounced the local pottery to be characterized exclusively by crushed rock temper. We became quite interested in the issue; among other things, the difference would be significant in planning any sourcing studies. Archaeologists often use the angularity of temper as a way to separate sand from crushed rock, and most of the PAC sherds had fairly angular temper, but there were also sherds with very rounded temper. One might be led to conclude that crushed rock temper dominated local ceramic production, but that on occasion sand temper was used.

Philip Fralick, a geologist, joined the project in 1990, when we were mostly working in the Bustillos basin. Most of the sherds he examined in 1990 came from the Bustillos area, but one section of his report dealt with pottery from Ch-11 in the Santa María basin. In 1992, Fralick visited El Zurdo and examined pottery from the site at the El Terrero lab. The following comments derive from notes I wrote during conversations with Fralick, and any errors are mine rather than his.

Most mono-mineral sand grains derive from granitoids and gabbro, and most multi-mineral sand and rocks derive from rhyolite and basalt. Rhyolite breaks down into smaller grains of rhyolite

that can be rich in quartz and feldspar. While rhyolites can have abundant feldspars, the feldspars are, for the most part microscopic to very fine, although occasional larger crystals occur. The larger grains of quartz and feldspar seen in local sands (and pottery) are probably largely derived from granitoids and gabbros. These may be extrusive units that crystallized at depth, or they could be sub-volcanic intrusives. Basalt tends to break down into smaller grains of basalt.

When Fralick and other project members walked streams from head to mouth (as they did around Laguna Bustillos), they did not find granite or gabbro sources, even though rocks of those materials were present in the arroyos. Fralick assumed that the sources were small and localized, and the failure to find any along the arroyos supports that assumption.

Mica would usually have come from granites. Where mica and rhyolite occurred in the same sherd, they could not have come from the same rock. To get a mixture of rhyolite, quartz, feldspar, basalt and mica, multiple rock sources would be involved. This was quite different from our sourcing study for the Capitan, New Mexico area, where single rock sources could account for much of the temper (Stewart et al. 1990).

Larger basins, such as Bustillos and probably also Babícora, act as settling ponds where very high quality clays develop. Some montmorillinite or smectite clays from Bustillos are greasy and incredibly plastic, but would have shrunk far too much to be useful for potting unless they were modified. Clays in the smaller valleys and arroyos were mixed with sand and silt, and Fralick believed that the arroyo and small valley clays were the principal ones for potting. It is thus possible, even probable, that most temper was not added, but came with arroyo clays.

Fralick reasoned that if temper had been added to “pure” clay, sherds would show a bimodal distribution of particles by size: (1) microscopic clay particles and (2) prepared temper with a limited size range. What he actually saw in the sherds was major gradation in particle size—and, with increasing magnification, an increasing proportion of non-clay particles. When using SEM, he found that there might only be 10 to 15 percent actual clay in his samples. Other small, opaque particles turned out to be tiny sands and silts. Fralick’s detailed examinations thus supported the idea that non-“pure” clay, with built-in non-plastic inclusions, was being used.

Fralick found several reasons for rejecting the hypothesis that crushed rock temper was being used.

1. Minerals found in the same sherd cannot have come from the same rock. If they were crushing rocks for temper, they were crushing multiple kinds of rocks to make each pot.

2. Many arroyos in the area are not very long, resulting in shorter transport distances and less rolling. Short arroyos produce fairly angular sands, even at their deltas. The main arroyo at El Zurdo is not very long, and the sand is angular where it passes the site.

3. The temper suite in the pottery often closely approximates the local sand, and vice versa.

4. The local crushed rock should yield a very low frequency of mono-mineral grains, but mono-mineral grains were common in many sherds.

5. Feldspars can and do survive in the arroyos. Fralick saw minimally weathered feldspars in the arroyo sands.

6. Rhyolite is difficult to crush. It is easier to use sand.

In other words, rock crushing seems to be a non-parsimonious explanation for most of the sherds Fralick examined. In particular, Fralick examined 17 sherds from El Zurdo, all from Test 14, Level 6 (Lot 3013). He concluded that 16 of them were sand tempered, but one sherd had temper most likely derived from grinding a rock from a quartz vein with metal sulfides.

The abundant mica in a few sherds is a problem. In west-central Chihuahua, the mica presumably came from granitoids. (Micas also come from metamorphic rocks, but our geological map of Chihuahua shows the closest metamorphics to be located near General Trías.) Mica is not a major component of most granites, so one would have to grind a "mountain" of granites to get the amounts of mica seen in the sherds. Water transport nicely sorts mica, which will settle in low velocity parts of an arroyo. For mica, therefore, as well as for other kinds of temper, arroyo sand appears to offer the most likely source.

Paint Recipes

Early in the project we noted examples "burned out" paint, which we presumed had been black. We speculated that some of that paint was organic, or that an organic binder was used. All of the paint that Stewart examined using the SEM at Lakehead University proved to be iron-based.

The use of hydrogen peroxide to identify organic temper was mentioned earlier. While the fieldwork was still going on, Loy Neff and Warren Hill also used hydrogen peroxide to identify organic versus mineral paint. Both found that the local red paint never reacted to hydrogen peroxide. Most black paints did not, but some did. What we therefore presumed to be organic black paint was seen on some Babícora sherds, on some examples of Madera Black-on-red, and on some examples of black-on-red sherds not classified as Madera. Otherwise, no pattern was seen in the presence or absence of a reaction to hydrogen peroxide. Getting back to the sherds that inspired the tests, an entirely organic paint could burn out completely, leaving a "negative" design as was sometimes seen, or it could become pale and faint. Similarly, a paint combining mineral colorants and an organic binder could burn out and leave a weak-looking line. If this is the case, however, it is not clear why all of the sherds examined at Lakehead University had iron-based paint. Clearly, much more work is needed on the local paint recipes.

Pottery Sourcing

Following the successful pottery sourcing study we conducted in the Capitan, New Mexico, area (Stewart et al. 1990), and based on our preconceptions about the Chihuahua Culture area (molded by what we knew of Paquimé), we anticipated that pottery sourcing would be a major part of the PAC research effort. Once Fralick visited the area, looked at the pottery, and evaluated the local geological picture, he was quite dubious about sourcing. Two factors, he

argued, conspired against our being able to differentiate manufacturing centers within the study areas. First, the entire area was volcanic in origin, with the same basic minerals occurring throughout. Second, the bulk of the pottery he examined could have been made in the exact place in which it was collected, using inclusions from the local streambeds.

In spite of these initial reservations, Joe Stewart and Fralick analyzed 103 sherds from the PAC project area, using ICP-AES equipment at Lakehead University (Fralick and Stewart 1999). The Santa María Valley and Babícora Basin sherd and sand samples showed an overlap in their composition, but also provided suggestions for more in-depth analysis. The pattern for Babícora Polychrome suggested production at a few locations, as opposed to most of the pottery, which was probably produced on a local basis. Three sherds that were unusually rich in strontium were thought to have originated outside the study area. These were an undecorated brown sherd from El Zurdo and a Madera Black-on-red sherd and an undecorated brown sherd from Ch-11 in the Santa María valley. We thus have a hint that ordinary pottery moved round, not just the obvious candidates such as the polychromes or Ramos Black.

The PAC preliminary study yielded no evidence of extremely localized production of specific types, as Woosley and Olinger (1993) found for Ramos Polychrome. Still, Daniela Triadan (2005) has thus far failed to confirm Woosley and Olinger's model for Ramos Polychrome, so perhaps the southern zone does not stand out in this regard.

A sourcing study currently underway at Lakehead University, following up on the preliminary work just mentioned, should provide a firmer basis for looking at local patterns of pottery manufacture and distribution. For the moment, it appears that communities made most of the pottery they used, with slightly more restricted production of Babícora Polychrome.

Chapter 4

OBSERVATIONS BASED ON RIM SHERDS

Figure 4.1. shows jar rim forms encountered by the project.

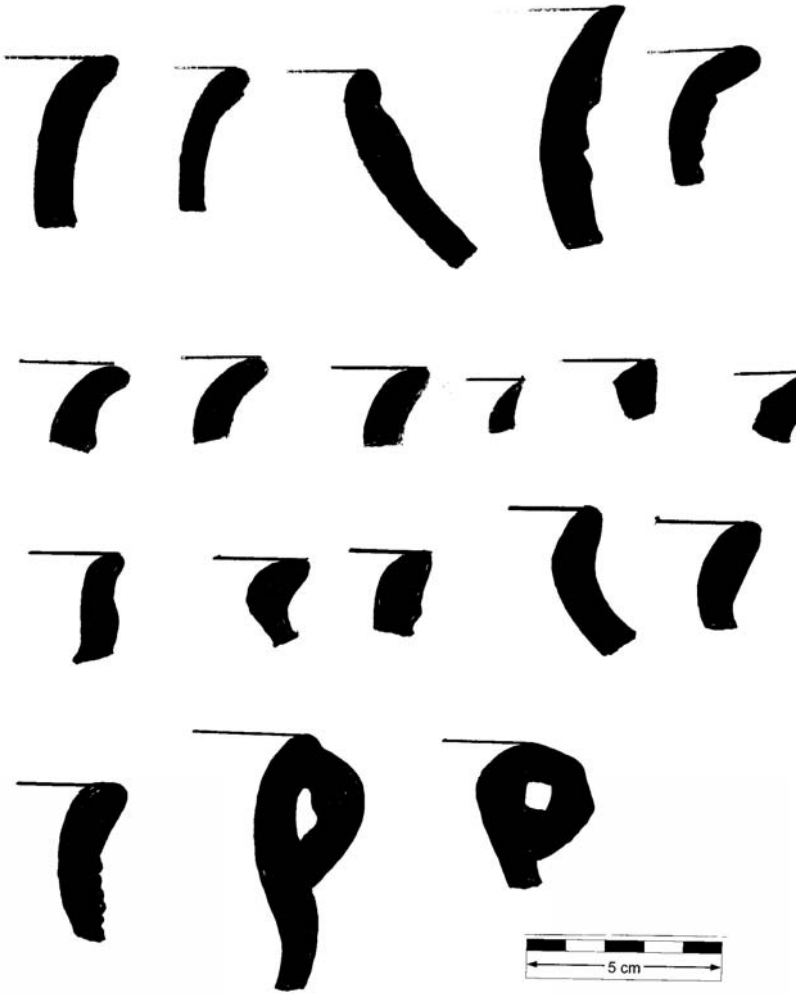

Figure 4.1. A range of jar rim forms.

Body Versus Rim Sherds

Table 4.1 looks at body versus rim sherds for the standard categories used during the project. The lowest ratio was for "Combos," which largely involved red or black slip or paint combined with texturing. The uppermost parts of otherwise plain vessels could be decorated in this fashion, so some of the sherds from the vessels are not captured by the ratio in Table 4.1.

Table 4.1. Body Sherds Versus Rim Sherds.

	Undec	Bk	R-sl	R/Br	Text	Bab	Other	Combo	Total
Body	16279	4095	225	215	4400	1523	369	276	27342
Rims*	876	167	51	21	583	109	36	71	1915
Body:Rim	18.5:1	24.5:1	4.4:1	10:1	7.5:1	14:1	10:1	3:1	14:1

* Pilón rims were counted with undecorated rims, and textured rims with red slip bands on the interior were counted with the textured rims.

The “red-slipped” category had the second lowest ratio of body sherds to rims, suggesting that few vessels had the red slip carried over the entire interior or exterior (or both) of the vessel (although some clearly did). Instead, red slips tended to be placed in broad bands on the upper parts of the bodies of both jars and bowls.

The low “textured” ratio was difficult to interpret. However, textured rims were known to have occurred with plain bodies, and texturing that extended beyond the rim often appeared to be restricted to the upper part of the vessel. Nonetheless, some corrugated vessels clearly had the texturing carried over most of the vessel.

The ratio for Babícora sherds ranked below the average for the assemblage. Although some undecorated body sherds judged to be examples of the type (the amount of polishing is a giveaway) were included with the Babícora body sherds, other undecorated sherds from Babícora vessels undoubtedly ended up in the “undecorated” category.

Sherds in the “other” category included presumed imports such as Ramos Polychrome, Villa Ahumada Polychrome, and Madera Black-on-red, as well as rarities (for example, the local red-on-black pottery). The ratio was lower than the assemblage average, suggesting that in this case as well, undecorated parts of vessels were placed in other categories.

The ratio for red-on-brown sherds came out the same as the ratio for the entire assemblage, so perhaps more of the surface of red-on-brown vessels was decorated, on average, than was the case for other decorated vessels.

The “undecorated” category included sherds from vessels with undecorated bodies and rims, with undecorated bodies but with textured rims, and from the lower, undecorated portions of decorated vessels.

The very high ratio of black body sherd to rims must reflect the inclusion of fire-blackened as well as black-slipped sherds, due to the difficulty in distinguishing between these (especially on small sherds). The black rim sherds are probably a better guide to the frequency of black-slipped vessels than the raw counts of black sherds.

Rim Sizes and Vessel Forms

Although the sherds found by the project tended to be small, we attempted to examine rim diameters as a function of vessel form. The following charts should be regarded as preliminary estimates, based on rim sherds arbitrarily chosen as "large enough." Of the 1,828 rims selected for measurement, only 1,452 were classified as to vessel form (Figure 4.2), and many of the assignments were followed by question marks.

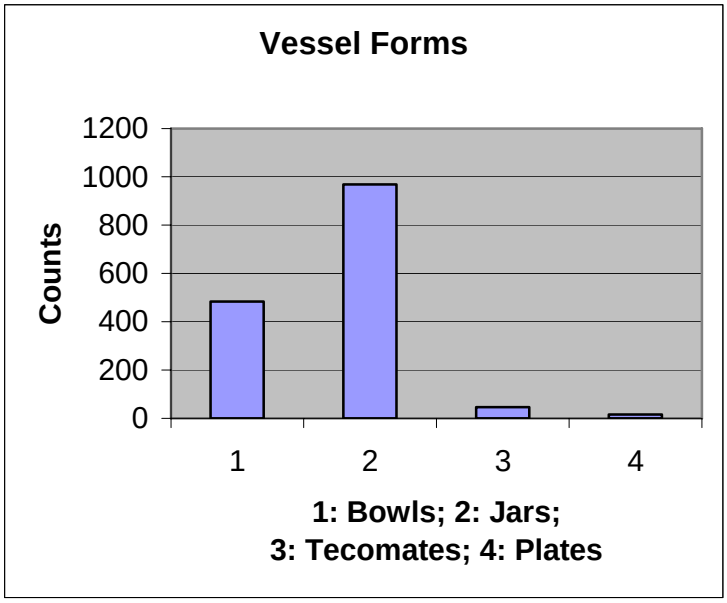

Figure 4.2. Counts of rim sherds by vessel form.

Tecomates (n = 47) are bowls whose walls curve inward, so that the exterior has a smoothly convex surface and the rim diameter is smaller than the maximum diameter. If the resulting orifice is especially small, such bowls are sometimes known as seed jars. *Tecomates* occurred in all local categories, including Babícora Polychrome.

Based on the few complete vessels and the somewhat more numerous large sherds, the most common vessel forms were jars, with (1) bodies with a maximum diameter well below mid-height or (2) fairly globular forms. For bowls, the profile curvature seemed to range continuously from *tecomates* through open bowls (i.e., the maximum diameter was at the rim), to a few extremely open vessels that might be called plates (n = 16).

Rim diameters were estimated using concentric arcs drawn at 1 cm intervals, sectioned to indicate the approximate percentage of the vessel rim represented by each sherd. Many rim sherds represented less than 5 percent of the total rim. The resulting tabulations support our impressions that few large vessels were being used. Because of the many question marks that followed the vessel form designations, in Figure 4.3 the rim diameters are not separated by form.

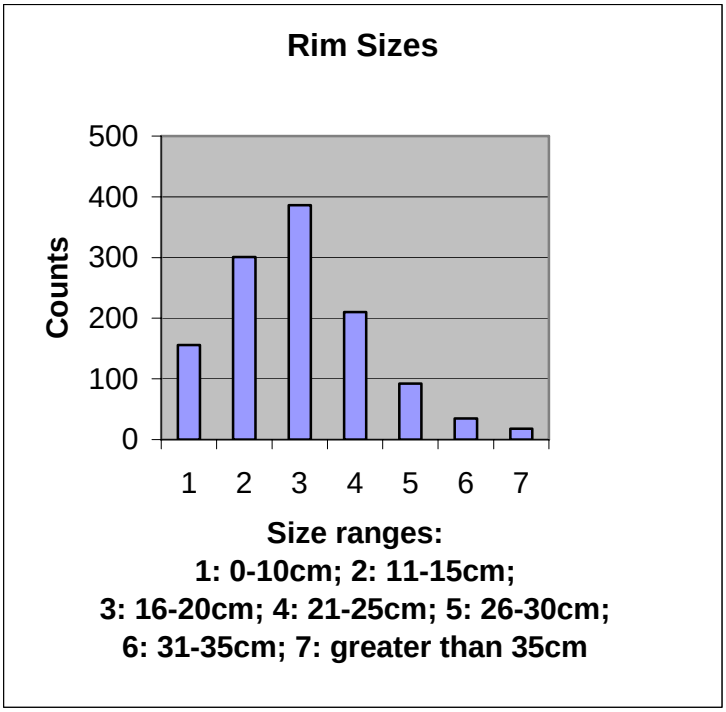

Figure 4.3. Counts of rim sherds by rim sizes.

Ignoring the question marks, the data indicate that while rim diameters of bowls and jars overlapped, most sherds indicating rim diameters of more than 30 cm (and all but one indicating rim diameters of more than 35 cm) came from bowls. Nonetheless, large serving or mixing bowls were rare. The large vessel rims were mostly indicated by sherds from units along the arroyo el Zurdito, with only one from Test 2 in the east room block, one from Test 15 in the patio, and one from Test 23 in the 1992 long trench.

Thickened Rims

Thickened rims (which we called "folded") seemed especially plentiful at El Zurdo compared to other sites excavated by PAC. These thickened rims, mostly from jars but also from bowls, were usually finger-impressed (or, less often, tool-impressed). They were more frequent in the lower levels of units along the arroyo el Zurdito. Such rims accounted for 25 to 39 percent of rims in the lower levels of Test 1, and for 35 percent of the rims from Levels 1 and 2 of Test 13 (thereby lending support to the notion that Test 13 pertains primarily to the late Viejo period). Textured thickened rims occurred in lesser frequencies in the plaza area, in Test 2 of the east house mound, and in the central room block. We suspect that these rims were most common during the earlier occupation of the site, but were present throughout the history of the site.

Thickened rims appear to be unevenly distributed in the southern zone of the Chihuahua Culture; they were much less common in sites of the Santa María Valley than at El Zurdo (Larkin et al. 2004). Sayles's Las Varas-Babícora surface collections, now at the Arizona State Museum, as

well as our surface collections from other Las Varas-Babícora sites, also show fewer of these rims than would be expected on the basis of the El Zurdo assemblage. Ch-180, on the upper Las Varas (above the village of the same name) appears most similar to El Zurdo in this regard (and in other ways). The significance and full distribution of this rim form await clarification.

An Unusual Thickened Rim

One rim, from what was most likely a very open and shallow undecorated vessel, was thickened over what appeared to be a handle extension of the rim (Figure 4.4). This vessel may have been a *comal* or griddle.

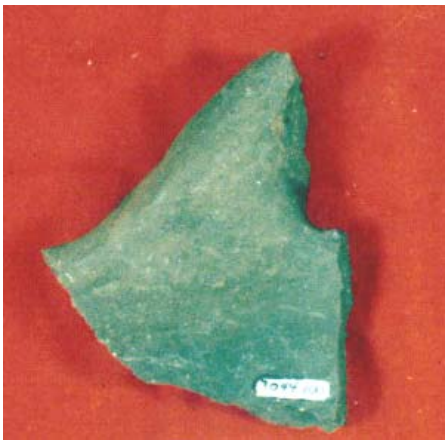

Figure 4.4. Thickened handle of a possible *comal.* No. 3044-100, Test 16, Level 3 (PAC 92C-44-20).


MAXWELL MUSEUM OF ANTHROPOLOGY

Chapter 5

POTTERY AND CHRONOLOGY

It was perhaps inevitable that clearly differentiated Viejo and Medio period assemblages would not be identified. While looting served to mix deposits, the basic factor at work seems to be the lack of a sharp transition between the two periods.

In some cases, however, disturbance may be the best explanation for observed patterns. While imported Medio period pottery clustered in the upper levels of tests, in appropriate Medio period contexts, Ramos Polychrome occurred in Level 8 of Test 1, in what would otherwise be thought of as pre-Medio deposits.

Hill's (1992) sequence of levels captured the major trends within the site. His placement of some levels reverses their stratigraphic order, however, and the radiocarbon dates received after he completed his study do not always support his sequence. In order to take a further look at changes in pottery types, I defined four pottery "series" and charted their occurrences in the levels of selected units (Figures 5.1–5.5). Series 1 consists of undecorated sherds (including sherds from completely undecorated brown ware vessels but also the undecorated parts of decorated vessels. Most of these sherds were brown but shaded into terracotta, gray, and black). Series 2 consists of black sherds. It may be that some of the sherds should instead fall into Series 1, as they may be from vessel areas with firing clouds or blackening from cooking. Series 3 is textured sherds. Series 4 is everything else: unknown, red-slipped, red-on brown, polychrome, and anything unusual.

As anticipated, plain (mostly brown) sherds were usually less common in presumed older levels. Still, as Figures 5.1–5.5 show, there was never a smooth progression from low frequencies (in the lowest levels) to higher ones (in the highest levels). Instead, the lowest percentage of plain sherds in a given unit usually occurred somewhere in the lower part of that unit, while the highest frequencies of plain sherds tended to occur in the unit's upper levels.

Black pottery was most prominent in the lower, older levels, as were textured wares. Red-on-brown sherds were more common in the lower, older levels, but that decorative style clearly survived into the Medio period. Red-slipped sherds, less than 1 percent of the total (n = 211), were rare at all times. (Test 1 contained the most red-slipped sherds (n = 61), while the Test 3 group had the second largest number (n = 27). Tests 5, 6, 34, and 37 lacked red-slipped wares.) Painted wares tended to cluster in upper levels, with Villa Ahumada apparently being the earliest of the polychrome imports.

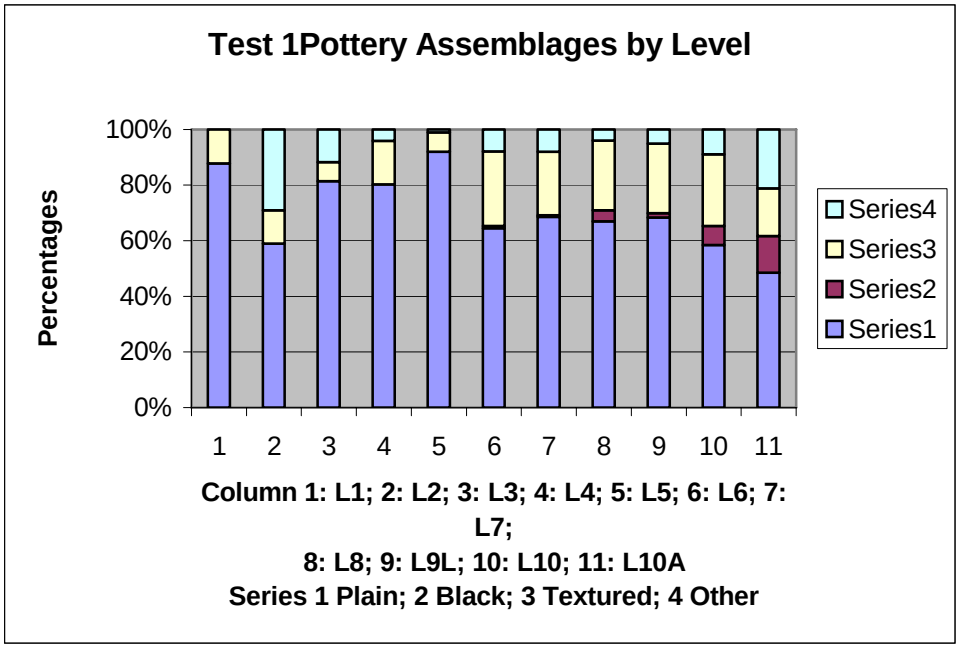

Figure 5.1. Test 1 pottery series by level. See text for definition of series.

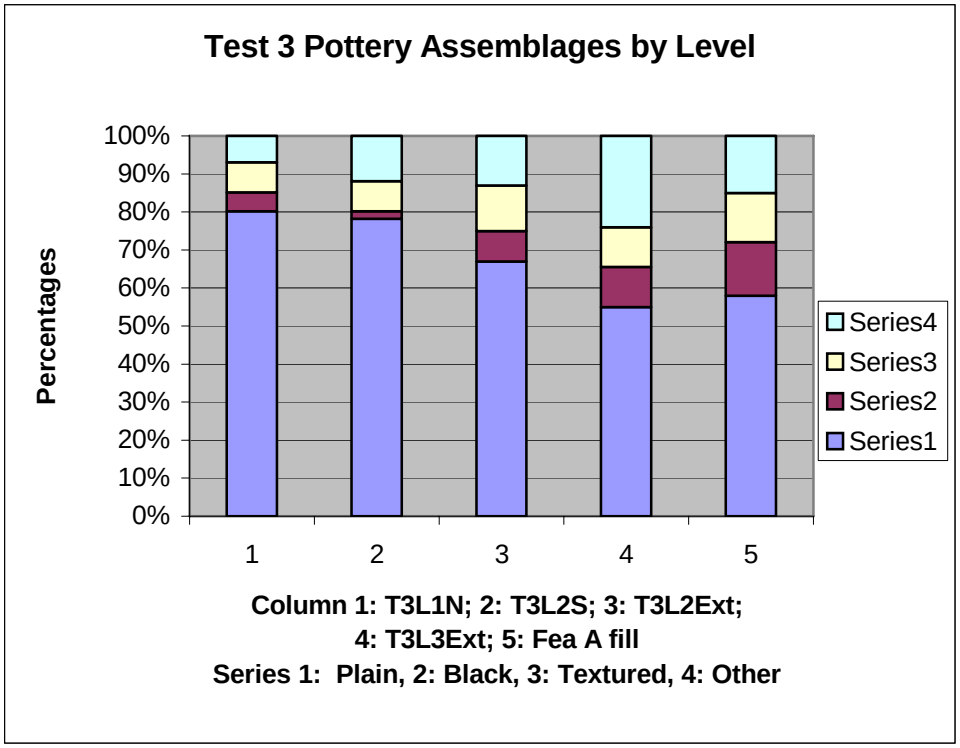

Figure 5.2. Test 3 pottery series by level.

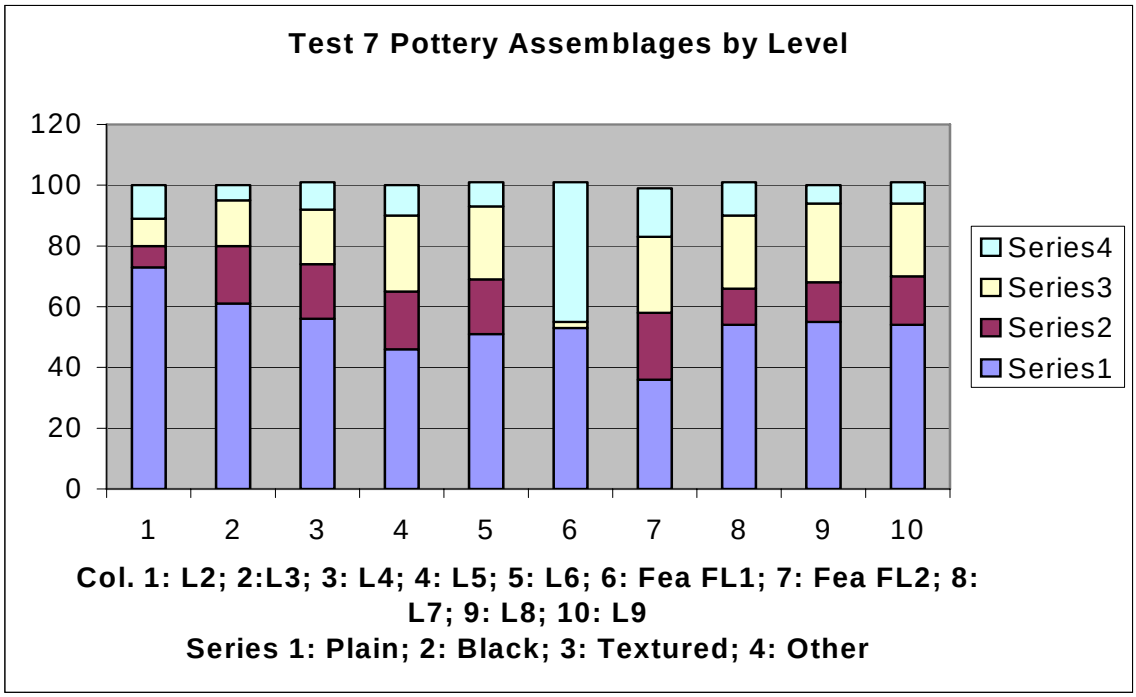

Figure 5.3. Test 7 pottery series by level.

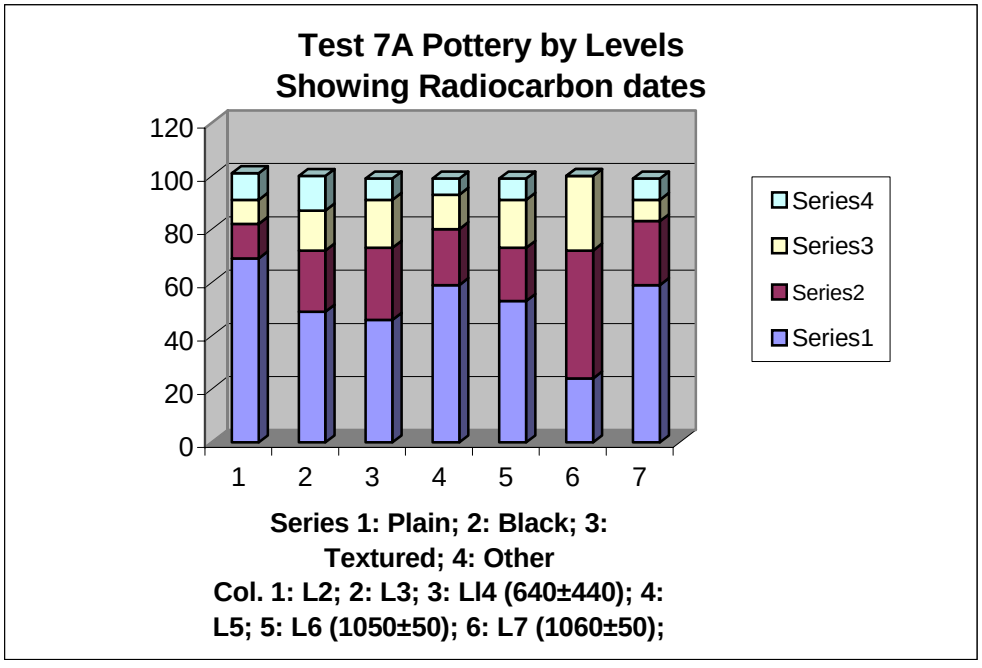

Figure 5.4. Test 7A pottery series by level.

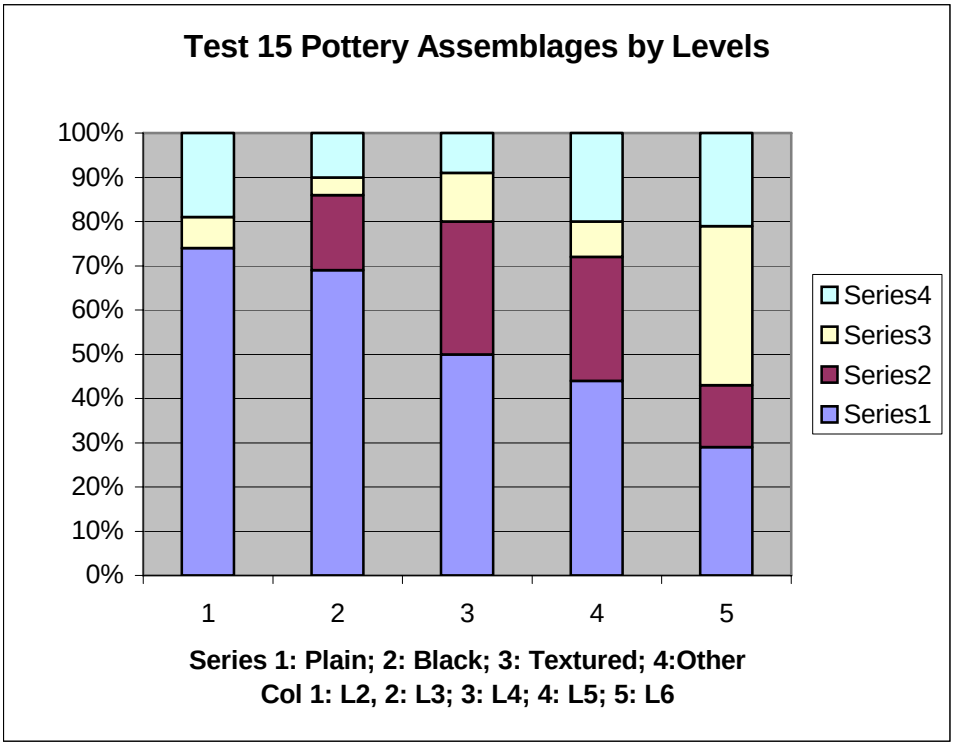

Figure 5.5. Test 15 pottery series by level.

Chapter 6

FLAKED STONE

The vast majority of cores and flakes were made of medium-grained to coarse-grained volcanics, especially rhyolites and basalts. The formal tools were mostly made of better quality materials such as fine-grained black basalt, chert, and chalcedony. Because most of the raw material was coarse, it was difficult to detect use wear. Even so, a more thorough examination using a high power microscope would doubtless enhance our knowledge about this industry.

Flaked stone was found across the site, as one would expect. The flaked stone tabulations included 137 lot numbers, of which 118 were from excavation units. The other 19 lot numbers were for auger holes and for specialized collections such as soil samples. Of the 9,375 tabulated pieces, 1.25 percent were shaped tools, 2.48 percent were utilized flakes, 0.06 percent were blades (but none were Mesoamerican-style prismatic blades), 4.39 percent were cores, and 91.17 percent were unmodified flakes and miscellaneous pieces. These figures were not out of line with those obtained by the project for other sites, and reflect the expedient flaked stone technology that characterized the entire area.

Large pieces of stone suitable for flaking were present on the site surface, showing that large cobbles had transported to the site for use in tool production (probably from the extensive outcrops and testing areas around Cerro de la Bandera. Most of the excavated flaked stone was fairly small, however. The Test 1 data show (Table 6.1) that the average weight per piece of flaked stone was 3.22 g. Many items weighed less than one gram. The largest item, a core, weighed just under 70 grams.

Table 6.1. Test 1: Weight of Flaked Stone by Level.

Level Lot	L1 2015	L2 2016	L3 2025	L4 2029	L5 2030	L6 2031 2032	L7 2039	L8	L9 2040	L10 2064	L10A 2065	Total
Number	10	8	13	12	19	545	114	98	274	160	15	1268
Weight (grams)	8.05	86.25	24.7	18	32.8	1327.03	364.4	360.5	1068.9	7792.9	76.8	4083.53

Projectile Points

These pieces exhibited the best workmanship of the flaked stone categories, which is not saying much. The variety of forms and sizes, can be seen in Figures 6.1 through 6.4. A few larger points would not be out of place in late Archaic period assemblages. Several of the larger points were collected from the surface, but No. 3039-8 was found at some depth.

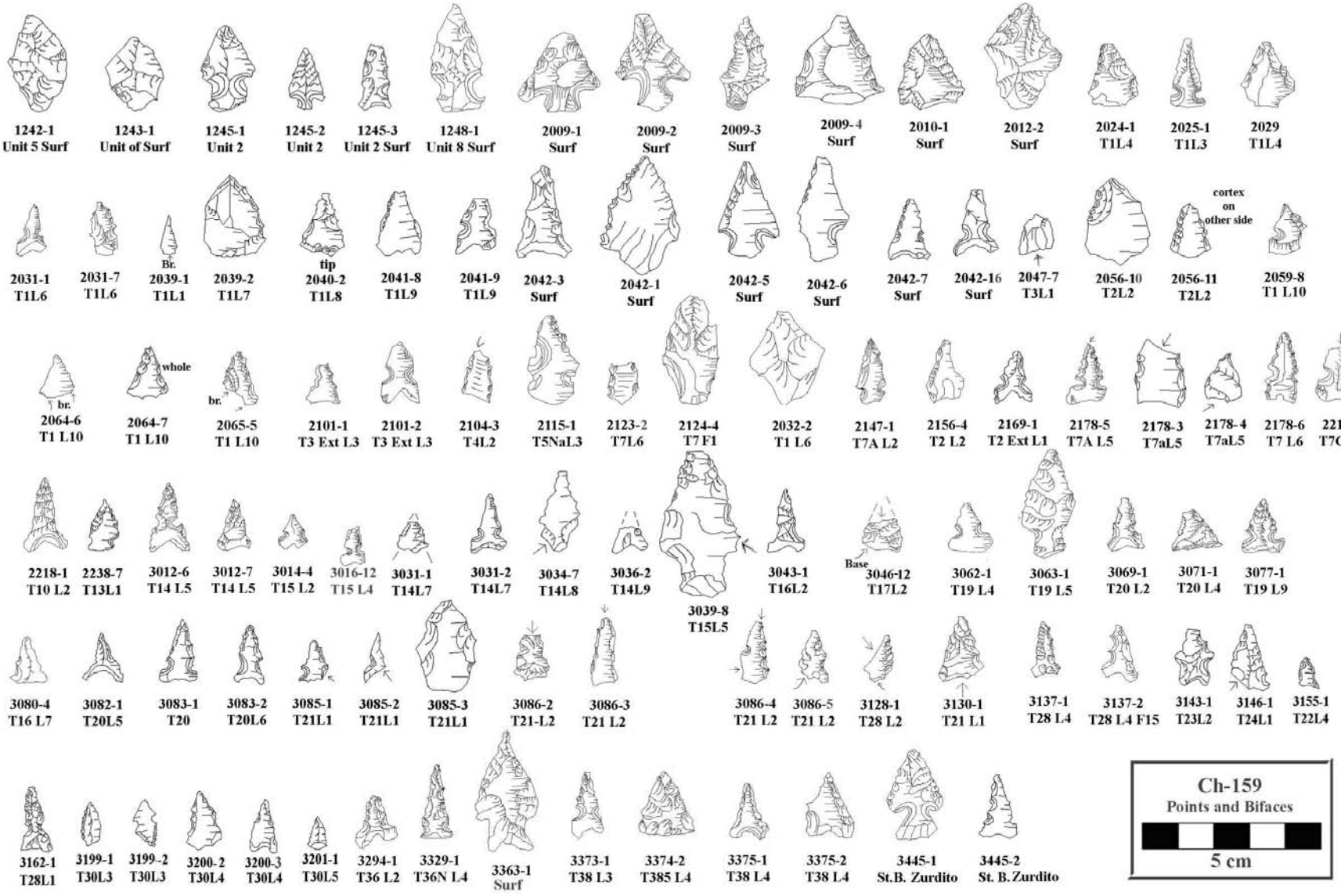

Figure 6.1. Sketches of a selection of points, possible points, and bifaces from El Zurdo.

Figure 6.2. Larger projectile points. Top row, left to right: No. 1245-1, surface (PAC C90-16-37); No. 1248-1, surface (PAC C90-16-37); No. 3039-8, Test 15, Level 5; No. 3085-3, obsidian point or biface, Test 21, Level 1 (PAC 90C-48-9); NO. 3063-1, basalt stemmed point, Test 19, Level 5 (PAC 90C-48-9); No. 2042-3, obsidian, surface (PAC 91C-34-02); No. 2042-1, surface (PAC 91C-27-17). Bottom row, left to right: No. 2009-8, surface (PAC 91C-26-22); No. 2009-3, surface (PAC 91C-26-23); No. 2009-4, surface (PAC 91-26-22); 2042-5, surface; No. 2042-6, surface.

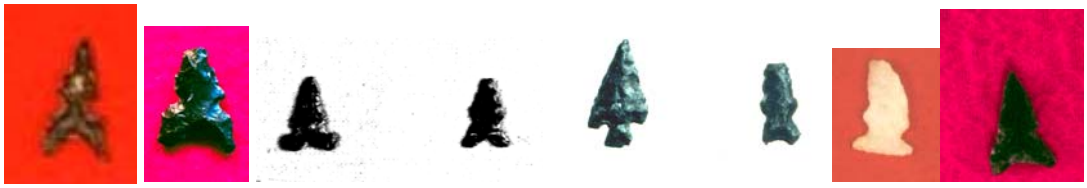

Figure 6.3. Smaller projectile points. Top row, left to right: No. 3012-6, Test 14, Level 5 (PAC 92C055-30); No. 2046-9, black basalt, Test 1, Level 9 (PAC 91C-34-05); No. 3083-1, Test 20, Level 6, (PAC 92C-21-07); No. 3083-2, Test 20, Level 6 (PAC 92C-21-07); No. 1245-2, surface (PAC 90C-16-37); No. 1245-3, surface (PAC 90C-16-37); No. 3039-8, white chert, Test 15, Level 5 (PAC 92C-55-30); No. 2042-7, surface (91C-29-22).

Figure 6.4. Triangular projectile points. Nos. 2064-5, -6, -7, Test 1, Level 10 (PAC 91C-26-24).

Archaic point forms were found by the PAC at all Medio period sites where a large flaked stone collection was made. We speculated that atlatls may have continued in use after the introduction of the bow and arrow, but we encountered no evidence that would settle the issue.

Side-notched points with mostly concave bases were the most numerous (n = 28) of the point forms. In eastern New Mexico some of the points would fall within the Harrell group. Collected farther out on the Plains, they would have been called Plains Side-Notched. The points graded from the emphatically side notched into shapes with wider, shallower notches.

The second largest group (n = 17), many of them fragments, consisted of roughly triangular points with no notching and with variously shaped, but often concave, bases. These were even more expediently shaped than the side-notched examples.

A. C. MacWilliams suggested that one point form (widest at the convex base; wide, shallow notches or above the base, and a narrow blade) was particularly associated with the Viejo period sites (see Figure 55).

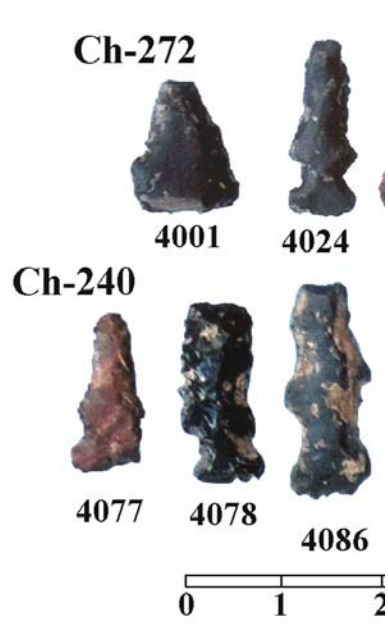

Figure 6.5. A point style possibly diagnostic of the Viejo period. Ch-240 is a Viejo period site in the Santa Clara valley. Ch-172 is a La Cruz site in the Bustillos basin. Photograph by A. C. MacWilliams.

Few of the points would have won prizes at a Medio period 4-H Fair. As a group, the points were often quite expedient, with the shape of the flake usually contributing in decisive ways to the final shape of the point. As one consequence, most of the points were to some extent asymmetrical. The secondary flaking was often minimal, with only the edges retouched in some cases. Others had retouch only on the dorsal face, and still others had virtually no edge retouch.

Bifaces

Most bifaces were made on fairly thick flakes, for example, Nos. 1242-1 and 1243-1 in Figure 6.6. The only broad, thin biface was No. 3050-2, collected from the arroyo el Zurdito profile (also shown in Figure 5.6). Some items were possible knives or bifaces (for example, No. 2124-4 from Test 7, Feature 1; No. 1243-1 from the surface of Test 4; No. 1242-1 from the general site surface).

Some less thoroughly flaked but bifacially modified specimens tended toward an ovoid shape and were often entered in the tabulations as "biface preforms." In these cases, the shape was due primarily to flake selection.

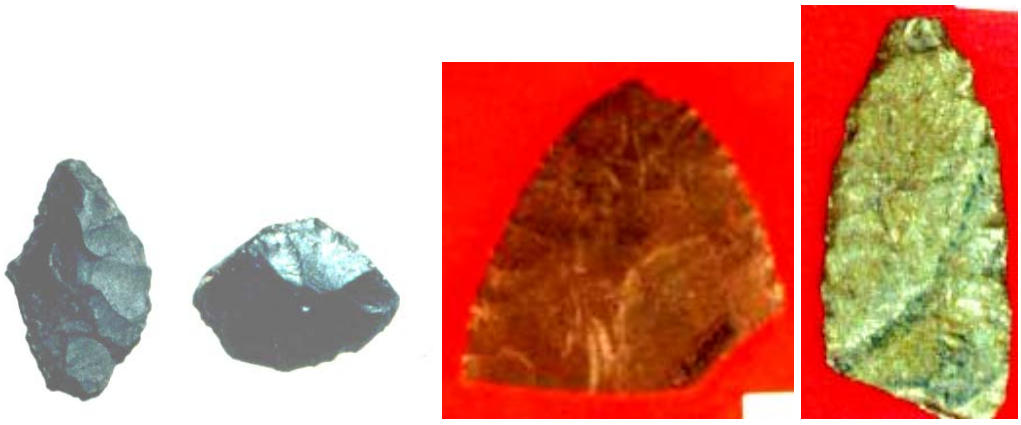

Figure 6.6. Bifaces. Left to right: No. 1242-1 (PAC-90-16-37); No. 1243-1 (PAC-90-16-37); No. 3050-2 (PAC 92C-46-24); No. 3050-3 (PAC 92C-55-35).

Utilized Flakes and Miscellaneous

Other tools were made on flakes whose shape was not been seriously altered. Both unifacial and bifacial edge retouch occurred. Some large, thick flakes had bifacially shaped edges suitable for chopping. Others had unifacially shaped edges, in some cases creating plano-convex profiles (e.g., No. 3012-5), and were used for scraping. Most flakes classified as utilized were, however, small and thin, with unifacial edge-bites or retouch (or both), providing straight, near-straight, and convex edges for cutting or scraping.

Some analysts, especially Hugh Gibbins, identified small, more or less rectangular flakes with a straight edge, and with bifacial retouch, as "wedges" (e.g., Nos. 3042-2 and 3055-1). This identification was more common for the 1992 "bulk" flaked stone than for the individually recorded specimens.

No. 3373-3 is the only possible candidate for a spokeshave. Possible spokeshaves were uncommon in the PAC lithic collections. No possible drills were found. Some of the small, sturdy flakes may have served as gravers.

The ratio of flakes to cores was 35:1. Neither flakes nor cores were studied in detail by the project, so the collection remains understudied in terms of reduction practices (but see MacWilliams 2008).

Forty-two additional pieces of flaked stone noted during the 1991 non-collecting survey included large flake and core choppers, core hammers, cores, and unworked chert and perlite nodules. Fourteen of these items measured between 11 and 16 cm across. Flaked stone of such large size was rare in the excavated materials.

Raw Materials

Table 6.2. provides a summary of the 1992 "bulk" cores and flakes by raw material. I would have guessed that rhyolites outnumbered basalts, but either I was wrong or the classification of igneous materials was quite variable. Be that as it may, volcanics were the most commonly encountered materials at El Zurdo, as at other PAC sites.

Table 6.2. Flaked Stone Raw Materials, Based on the 1992 "Bulk" Tabulations.

Raw Material	Flakes	Percent	Cores	Percent	Both	Percent
Rhyolite	330	6.35%	5	3.29%	335	6.27%
Coarse Basalt	1089	20.97%	1	0.66%	1090	20.39%
Fine-grained Basalt*	2358	45.40%	130	85.53%	2488	46.54%
Obsidian	58	1.12%	3	1.97%	61	1.14%
Chert	1093	21.04%	11	7.24%	1104	20.65%
Quartzite	37	0.71%		0.00%	37	0.69%
Other	229	4.41%	2	1.32%	231	4.32%
Total	5194	100.00%	152	100.00%	5346	100.00%

*The category "siliceous basalt," used in the field, was combined with fine-grained basalt in this table and in the unit descriptions.

An unusual amount of chert was recorded at El Zurdo. Other PAC sites often had no more than 1 to 2 percent chert.

Discussion

The flaked stone from El Zurdo is reminiscent of that from Galeana, where "The inhabitants used locally available lithic raw materials to produce flakes for use as expedient tools. Production of formal tools (projectile points, scrapers, and drills) was barely detected in the flaked stone assemblage" (VanPool et al. 2000:169).

The raw materials at Galeana included far less chert and obsidian than at Paquimé (VanPool et al. 2000). The southern zone upland sites, including Zurdo, had far more volcanics (basalt and rhyolite) than either lowland site, and far fewer examples of obsidian and chert.

The picture of southern zone flaked stone procurement is one of minimal movement of raw materials, and a heavy reliance on locally available raw materials. Fralick et al. (1998) analyzed 77 pieces of obsidian from the PAC study areas and found that nine-tenths of them were collected in areas which matched the local geochemistry. Indeed, the authors of the analysis believed that most of the obsidian was collected within 1 Km of the site on which it was found, so that even the obsidian was mostly locally obtained. Flaked stone thus show the pattern seen in other artifact categories: a decidedly parochial economy, with little evidence of trade with other cultures or even with the northern half of the Chihuahua Culture.


MAXWELL MUSEUM OF ANTHROPOLOGY

Chapter 7

GROUND STONE AND HAMMERSTONES

Grinding tools were made from local rhyolite and basalt in expedient ways. Manos were primarily made from cobbles of convenient sizes and shapes, as were metates and grinding slabs. The most carefully formed pieces of ground stone were axes (all were broken and many reworked), stone bowls (less common at El Zurdo than at other PAC sites) and "macaw stones." Stone pendants were rare, as were all forms of personal adornment. Ground stone exposed by looters and left at the site greatly expanded our information about this artifact category.

Excavated and collected ground stone is noted in the descriptions of the individual units, in Parts 1 and 2 of this report. Excavation yielded few metate fragments and no complete ones. Excavated manos were more plentiful, as were a number of nondescript fragments of ground stone. Stone bowls, axe fragments (mostly from the bit end), shaft straighteners, a possible atlatl weight, and two macaw stones came from excavated contexts. Three other macaw stones lying on the site surface were collected.

The 1991 Non-collection Survey

In 1991, the crew made a non-collection survey of ground stone on the site, and also recorded large pieces of flaked stone and samples of lithic raw lithic materials. Each specimen was temporarily marked with chalk to eliminate double recording. In subsequent years, we witnessed the on-going degradation of some of the pieces left on the site surface, as well as the disappearance of others.

In all, 219 items were recorded. When multiple pieces of a single artifact were recognized, they were counted as a single item. A few additional pieces may have come from the same artifact, but the broad scattering of specimens made it likely that most items recorded separately represented different artifacts.. In the discussions that follow, items recorded during the 1991 non-collection survey are considered along with the collected ground stone.

Surface Collections

Some pieces of ground stone were collected from the site surface, and are listed in Table 7.1.

Table 7.1. Collected and Catalogued Surface Finds of Ground Stone.

Cat. No.	Part of Site	Item	L x W x T; weight	Description
1252-4	General	Axe frag.	7 x 5 x ? cm; 2.3 g	Fine-grained basalt frag. with part of groove
2012-1	NE sector	Axe frag.	10.2 x 8.8 x 5.2 cm; 789.5g	¾ grooved frag. with broken and battered bit end; butt end also broken and battered.
2023-2	South part of site	Stone pendant	2.3 x 0.8 x 0.6 cm; 1.5 g	Tapering pendant of fine-grained basalt with full groove around larger end.
2042-4	General	Macaw stone	31 x 22 x 18.5 cm; no wt.	Flat bottom; broken across aperture. Latter est. 17.5 to 18 cm diameter, very slightly convex surface perpendicular to faces. Red rhyolite. Thickest of macaw stones.
2042-8	SE corner of site	Macaw stone	26 x 35 x 6 to 9 cm; no wt.	Flat bottom, broken across aperture, with est. aperture of 16–16.5 cm. Layered rock, probably "flowstone."
2042-15	NE corner of site	Macaw stone	30 x 35 x 7 cm; no wt.	Possibly made of tuff. Cannot estimate size of aperture, which was more angular than on most specimens. Worked hole perpendicular to rock faces.
2042-10	In S bank of arroyo La Vaca	Shaft straightener	9.3 x 7.8 x 3.1 cm; 454.7g	Complete specimen with transverse groove 7 cm long, 1.3 cm wide and 0.3 cm deep. Bottom very flat. Battered around edges.
2042-13	General	Shaft straightener	6.9 x 7.4 x 4.1 cm; 329.1g	Broken shaft straightener with groove 0.7 cm wide and 4 cm long. Fine-grained basalt. Flat bottom.
2042-1	General	Slab	18.4 x 9.3 x 2.0 cm; no wt	Stone slab of even thickness; one flaked edge, other edges broken. Hatch cover?
2042-9	Near Test 7	Mano frag.	13.5 x 11.2 x 3.0 cm; 634.2 g	¾ of a thin, flat mano with chipping on thin edge; opposite edge is perpendicular to faces. Both faces well ground. Possible remnants of red paint on one face. Fine-grained basalt.
3050-200	Zurdito profile cleaning	Polisher?	9.2 x 7.9 x 3.6 cm 564.3 g	Fine-grained basalt pebble flaked on one edge and ground smooth on two opposing faces.
3212-200	Near Test 25	Ground slab	15.6 x 10 x 3.1 cm; 770.6 g.	Basalt slab ground on each face; one partial edge was also ground; other edges broken.
3212-201	Near Test 25	Mano	23.8 x 14.6 x ? cm; weight > 3 Kg	Complete, broad mano on an andesite pebble. Two grinding areas on one face separated by an unaltered zone. Ground areas were triangular.
3438-200	Looter's backdirt from south of a. el Zurdito arroyo	Stone pendant	3.2 x 2.9 x 0.5 cm; no wt.	Thin, naturally triangular pebble biconically drilled at apex, and incised with a series of lines 0.5–0.7 cm long, around the edge of the "front" surface.

Metates

Of the 219 pieces of ground stone recorded during the 1991 non-collecting survey, 80 were classed as metates/grinding tools. Only a few of these were complete enough to be informative about size and form (Table 7.2 and Figure 7.1).

Table 7.2. Non-collected Metates for which Size and Shape Could be Estimated.

Number	Size in cm, L x W x T	Depth of ground area	Description
No. 42	36 x 20 x 15	12 cm	Distal end and entire side of trough present
No. 45	52.5 x 36 x 12	Shallow	Shallow open-ended trough; in 2 pieces; ground area 41.5 x 25 cm
No. 59	33 x 40 x 18	9 cm	Large cobble; trough and pecked mano rest
No. 64	57 x 47 x 19	12 cm	Rounded proximal end; shaped steep trough side walls, 7–8 cm thick.
No. 65	58 x 41 x 16	12 cm	Steep sided trough; bottom 3.5 cm thick
No. 169	48 x 35 x 20	?	Unshaped cobble with shallow oblong ground area
No. 191	46 x 24 x 5	?	Complete side wall of large trough metate broken longitudinally

Figure 7.1. Non-collected ground stone. Photographs by S. Abonyi.

The dominant metate form was a trough on an otherwise unshaped cobble. Some metates may have had lightly shaped side walls. Trough metates often had flat surfaces at the proximal end, which may have served as mano rests, but only three specimens had pecked or shaped mano rests (non-collected Nos. 59, 77, and 197). While the most complete specimens were open-ended, 13 of the non-collected specimens were described as dish- or basin-shaped. Other notes on the non-collected specimens document varying degrees of wear and reuse. These include “original

ground face was quite shallow, but a secondary ground area is nearly ground through"; "very thick cobble with barely ground beginning of trough"; "longitudinal fragment with bottom ground through"; "side wall and part of floor of a trough metate that is worn very thin"; "flattish, thin, shallow, well ground metate fragment"; "mid-section of a thin, ca. 4 cm thick, metate floor"; and "palette depression 11 cm dia. and 2.5 cm deep placed in ground face of metate fragment."

We did find the proximal end of a deep, carefully squared metate of the sort made at Paquimé (see VanPool and Leonard 2002, Figure 2). Only two confirmed examples were observed during the entire PAC; the second one was found at Ch-12 in the Santa María valley. A possible third squared metate was photographed at Ch-11 in 2005. These rare cases of deep, squared metates indicate that a few ground stone items moved from the northern zone to the southern zone, or else that that a few carefully shaped metates were made in the southern zone. Either way, the special importance of the squared metates is evident.

Only four fragments of ground stone from excavated contexts were classified as being from metates. Three of the fragments (from Tests 1, 7C, and 23) were described as trough metates, while the fourth (from Test 14) was described as having a very slightly ground surface. The largest excavated metate fragment (from Test 23; Figure 7.2) was incorporated into a wall. Undoubtedly, many of the small fragments of ground stone recovered during excavation came from metates.

Figure 7.2. Metate fragment used as a building stone. No. 3446-2200; found in the north wall of Room 1, in Test 23.

Manos

Counting fragments, the non-collection survey included fewer manos (n = 62) than metates (n = 80), but excavation yielded more manos (n = 24) than metates (n = 4). The manos were mostly cobbles with single slightly convex grinding faces. Tabular manos, manos with pronounced convex profiles, shaped manos, and manos with two grinding faces were also found, suggesting a range of shapes in nether stones that was not reflected among the metates observed on the sites surface. The complete manos from the non-collecting survey (n = 26) varied in length from 5 to 25 cm (Table 7.3). Twenty of the 26 fell between 13 and 22 cm, with a fairly continuous distribution in that range. Seven complete excavated manos fell in the same general size range. The larger manos weighed 3 kg or more (the weight limit on our scales). Many of the manos did not have fully developed grinding faces, and only a few were worn out.

Table 7.3. Lengths of Whole Manos.
(N-C = non-collection survey; Exc. = excavation; lengths in cm)

	<7	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	>24
N-C	1	1	1		1	1			1	2	3	2	1	3	2	2	3			1
Exc.						1	1	1				2						1	1	
Total	1	1	1	0	1	2	1	1	1	2	3	4	1	3	2	2	3	1	1	1

Working with a different collection, Robert Hard (1990) found that mano length accounts for 83 percent of the variability in mano grinding areas, and that mean mano length from representative samples “can be used as an approximate relative index of the use of agricultural (maize) dependence” (Hard 1990:147). Although the mano inventory from El Zurdo is quite diverse in terms of shapes, and while the sample may not be representative, the mean length of whole specimens falls at about 17 cm, which by Hard’s method indicates 35–75 percent reliance on maize. This estimate is lower than one derived from isotopic analysis of human remains, as is discussed later in the report.

Food Grinding Locations

Formal spaces for grinding were not observed. Instead, metates and other grinding tools were portable.

During the 1991 field season, and including slabs and fragments, grinding tools were recovered form Tests 1, 2, 7, 7A, 7B, 7C, 7N, 8, 10 (part of the Test 3 group of units in the patio), 14, 19, and 25, and were absent from Test 3, the Test 4 group of units, and Tests 5, 6, 13, 17, 26, and 27. As Test 4 was part of the patio testing that produced grinding tools in other units, and as Tests 17 19 were contiguous, and as Tests 25, 26, and 27 were contiguous, the potentially interesting absences were limited to Tests 6 (central room block), 8, and 13.

During the 1992 season, such grinding tools were recovered from Tests 16, 21, 22, 28, and 30 of the patio, as well as from the patio wall trench. Within the central room block, no grinding tools

were recorded for Room 1 (Test 24), but they did occur in Room 2 and in the northern portion of Test 36 in Room 3. The most grinding tools were found in Test 14, in what was exterior space.

The distribution of grinding tools was uneven across the site, but no clear spatial pattern emerged. The distribution of manos may instead offer the best guide to the location of corn grinding areas. Assuming that complete manos were found close to grinding areas, the 11 from excavated contexts occurred mostly in exterior space (n = 9), while two come from Room 2 in the central mound. None was associated with a floor or occupational surface; instead all the finds came from fill. While no convincing pattern for corn grinding locations could be identified, the data hint that outdoor spaces may have been used for this purpose. In 1991 and 1992, Phillips noticed a thin scatter of artifacts extending away from the main part of the site, and wondered whether the scatter represented outdoor work areas. Given the local tree cover, working outside would have been a pleasant option.

Axes

Eleven axe fragments came from excavation units, but only one from the non-collecting surface survey, suggesting that axes (even broken ones) were collected by looters. We often saw axes in private collections, and several without proveniences were donated to the PAC. All of the axes from El Zurdo were fragmentary. Usually only the bit was present, and most of those fragments showed a great deal of battering at the bit. The recovery of so many battered bits indicates that axes were re-shaped rather than discarded after bits broke off. One example was complete enough to show that it was full-grooved (Figure 7.3). Another was three-quarter grooved.

Figure 7.3. Fragment of a full-grooved axe of black basalt.
No. 2012-1, site surface. PAC 91C-28-14.

Shaft Straighteners

In addition to the shaft straightener recovered from Test 30, Level 6 (the fill of the borrow pit at the north end of the 1992 long trench), two others were collected from the site surface (Nos. 2042-10 and 2042-13), for a total of three from this site. No. 2042-10 had eroded from the south wall of arroyo la La Vaca at the south end of the site. The provenience of No. 2042-13 was given only as "surface." The excavated specimen had a longitudinal groove that was wider in its middle section. The two surface finds had transverse grooves of even widths.

Macaw Stones

"Macaw stones" functioned as the fronts of macaw cages, and were fitted with cylindrical stones to plug the apertures (Minnis et al. 1993). The function of such stones is based on evidence from Paquimé, where macaw pens are well documented (Di Peso 1974; Di Peso et al. 1974). Several macaw stones were collected by the PAC, at Chihuahua Culture sites as well as at La Cruz sites in the Bustillos basin. One possible plug stone was found on a southern zone sites producing macaw stones, but not in association with a macaw stone. No macaw bones were found among the PAC faunal assemblages (though not all were studied as thoroughly as the Zurdo collection). In the absence of direct faunal evidence for macaws, it is wise to keep an open mind about the function of the macaw stones in the study area.

Macaw stones are large, rather tabular stones with carefully worked apertures roughly in their centers, connecting the two flat faces. The aperture wall can be perpendicular to the stone, or it can be rounded to beveled. The El Zurdo examples, and others found elsewhere in the southern zone, had central holes measuring about 16 to 20 cm in diameter. Although the openings are typically round, one was squared.

El Zurdo yielded five macaw stone fragments, three of them from the site surface. No. 2042-15 came come from the northeast quadrant of the site, No. 2042-8 came from the southeast quadrant of the site, and the provenience of No. 2042-4 was simply "surface." The examples from excavated contexts include one from Test 4 (patio) and another from Test 32 (Room 2 of the central room block). Figure 7.4 shows three of the macaw stone fragments from the site.

The raw materials were described as rhyolite, basalt, "flowstone," and "consolidated ash" (most likely tuff), but it would be useful to have a geologist re-examine these objects.

Three additional samples of "flowstone" were found on site. Two lacked a central hole but showed signs of shaping. A third, unworked piece was found in the bottom of the main arroyo, suggesting that this stone could be obtained as cobbles. If this interpretation is correct, all of the raw materials indicated for the macaw stones were local.

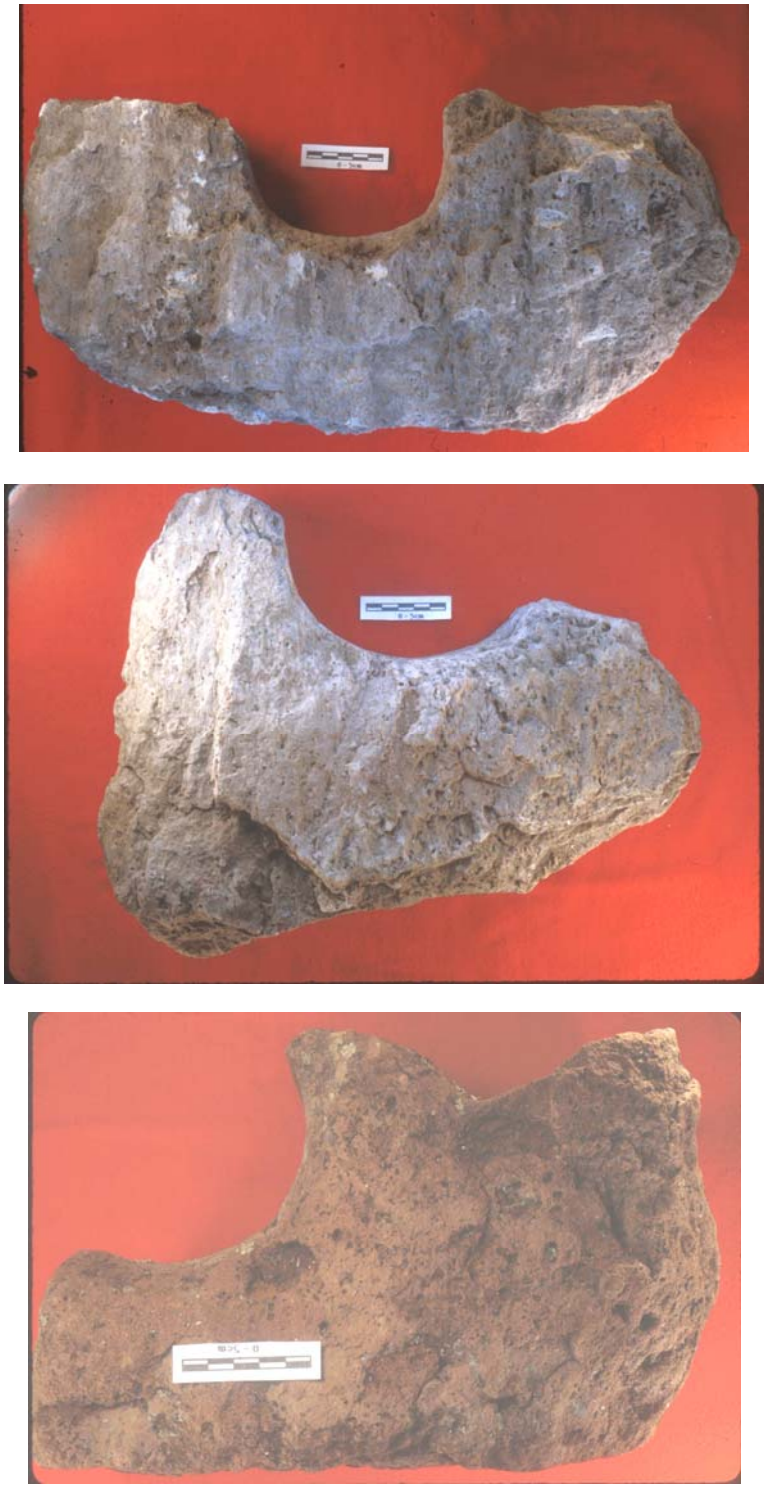

Figure 7.4. Three macaw stones. Upper: No. 2089-1, Test 4 (PAC 91C-31-13). Lower two stones were surface finds. Middle: No. 2042-8 (PAC 91C-31-13). Lower: No. 2042-4 (PAC 91C-29-4).

Mortar

One mortar noted during the non-collecting survey was a cobble measuring 40 by 36 by 18 cm. The mortar hole tapered from 18 cm to 13 cm in diameter and was 11 cm deep.

Stone Bowls

When a piece of ground stone had a depression that took up most of the face, and had evenly shaped sidewalls, the object became a stone bowl in PAC parlance. Remarkably few of these were recovered from Ch-159, considering how many are in private collections all over the PAC study area. A complete stone bowl was found in Test 29, Level 6 (Room 2, subfloor; Figure 7.5). A possible side wall of a stone bowl was found Test 14, and a stone bowl was noted during the non-collecting survey.

.

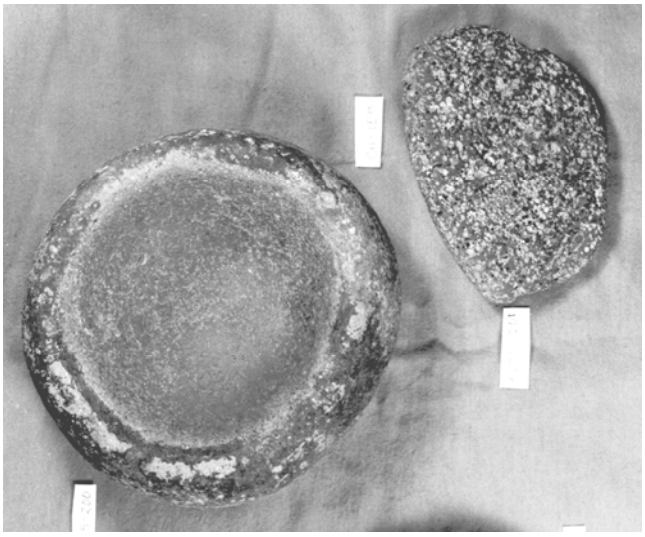

Figure 7.5. Stone bowl and mano from Test 29, Level 6. Lower left: No. 3195-200. Upper right: No. 3195-201. PAC 92B/W-22-14.

Pieces with Ground Depressions

Shallow ground depressions occurred on slabs, broken metates, and cobbles and pebbles. One specimen from the non-collecting survey had a depression 11 cm in diameter and 2.5 cm deep, on a metate fragment (No. 23). Five otherwise unworked cobbles and slabs in the non-collecting survey contained shallow depressions ranging from 3 to 10 cm in diameter.

Small depressions in the bedrock along lower arroyo el Zurdito could have been utilized when the bedrock was exposed (as it was in 1992), but the depressions might have been natural.

Pendants

A turquoise pendant was recovered from Test 30 and is included in the unit description. Two pendants were collected from the site surface (Figure 7.6) and are described below.

Figure 7.6. Two pendants from the site surface. Left: No. 2023-2 (PAC 91C-35-25). Right: No. 3438-200 (PAC 92-23-13).

No. 2032-2, found in the south part of the site in 1991, was an elongated pebble of fine-grained stone that tapered to a point. The pebble was polished and had a groove completely encircling the larger end (2.3 cm long, 0.8 cm in diameter, 1.5g).

In 1992, No. 3438-200 was recovered from fresh looter's backdirt south of the road on the south side of arroyo el Zurdito. The pendant was made from fine-grained volcanic rock with sanidine phenocrysts and a piece of bronzite. This naturally thin pebble, somewhat egg-shaped in plan, was biconically drilled at the narrow end. The "front" was incised around the edge with 24 lines extending 0.3–0.9 cm from the edge toward the center of the piece (3.2 by 2.9 by 0.5 cm, not weighed).

Miscellaneous Ground Stone

Several possible "floor polishers" were collected in 1992 (from Test 14, Test 33, and the arroyo el Zurdito profile). Two additional examples were noted during the 1991 non-collecting survey (Nos. 147 and 171). Some were battered after being broken. Most were made on basalt and rhyolite; one was said to have been made on "mudstone." These stones had one to five polishing facets.

The single burnishing pebble was mentioned in the discussion of Test 39. An unusual pumice object with a groove around its midsection (unconvincingly suggested to be an atlatl weight) was noted in the discussion of Test 30. It is possible that a small, more or less round piece of pumice

(2.5 by 2.2 0.8 cm) with a biconically drilled central hole and an aborted hole at the edge (Figure 7.7) functioned as a spindle whorl (see the discussion of Test 28).

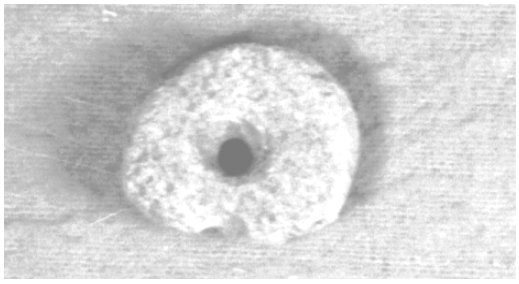

Figure 7.7. Large stone bead or spindle whorl? No. 2162-200, Test 28, Level 1. PAC 92B/W-21-07.

Discussion of Ground Stone

For a culture that was quite dependent on maize (to judge from the isotopic data from human skeletal remains), the grinding tools were remarkably variable and expedient in nature. Apparently such tools were able to process substantial amounts of corn. Perhaps the Basketmaker II–III ground stone assemblages, from a similarly maize-dependent culture in the U.S. Southwest, should be kept in mind.

On the other hand, expedient ground stone in a maize-heavy diet may have to do with foodways, as David Phillips suggested to me during the project. The Tarahumara consume a great deal of pinole, tortillas, and beer, and perhaps these habits are carryovers from prehistoric times. Pennington (1983:280) describes the Tarahumara pinole as made from "parched and burst corn grains," while the *masa* for tortillas was ground from softened corn and corn beer could be made from sprouted corn. All of these are different from the Pueblo habit of grinding dried corn flour before doing anything else with it. If Medio period inhabitants of the southern zone brewed corn beer, there may have been corn consumption involving no grinding at all. Pennington (1983, Figure 3, lower left) shows a woman making *masa* using a mano not unlike those at El Zurdo.

The single squared metate should be kept in mind as possible evidence of exchange with the northern zone, or as conscious replication of ground stone used in that zone. Given the effort involved in either transporting or replicating the metate, the squared form must have had special meaning.

Axes, probably underrepresented because of their appeal to collectors, were nonetheless sufficiently numerous to indicate their importance for dealing with wood. Of the various stone tools in the local assemblages, axes required the most labor to produce, given their careful shaping, grooving, and finishing. Between that labor input and the unusually hard, fine-grained stone used in their production, axes are a candidate for specialized production and exchange.

Although a number of projectile points came from the site, shaft straighteners were rare. Perhaps the main shafts of the local arrows were made from reeds.

Items of personal adornment were rare, whether of ground stone or any other material.

Hammerstones

The five excavated hammerstones (which seemed remarkably few) included one each from Tests 4, 7N, and 17 and two from Test 16. All were from exterior spaces: three from the patio and two from units along the arroyo el Zurdito. Eleven additional hammerstones were noted during the 1991 non-collection survey.

Most of the hammerstones were battered cores but a few appeared to have been battered nodules. It is doubtful that looters collected hammerstones so their rarity may indicate that reduction often took place off-site.

Chapter 8

BONE AND SHELL ARTIFACTS AND MINERALS

Bone Tools

Faunal materials were bagged separately in the field. Those bags were usually not opened in the field lab, but were kept together to pass on to Jon Driver, the faunal specialist. Twenty-six bone tools were found among in the faunal materials but only three were also catalogued in the field lab (having been brought to the lab separately from other faunal materials). Yet other bone tools, identified and separated in the field, seem never to have been sent to Driver, or at least they were not in Hodgetts' database. As can be seen in Table 8.1, Hodgetts' recognition of bone tools in the faunal collections greatly increased the number of known bone tools from the site.

Table 8.1. Bone Tools.
(Artifacts without catalogue numbers were identified during the faunal study.)

Lot No.	Test	Level	Description	Catalogue No.
2064	1	10	Rib or long bone worked to spatula shape.	2064-8
2102	3 Ext.	2	Prob. medium artiodactyl, long bone fragment worked to a point	2102-1
2103	3	Fill	Long bone fragment, worked smooth	2103-2
2125	7	F-2	Long bone fragment with rounded end	
2144	7N	3	2 pieces that refit; worked smooth	
2144	7N	3	Long bead or tube; long bone fragment	
2150	7N	F-1	Worked to a point	
2150	7N	F-1	Worked smooth	
2168	6	2	Awl fragment (shaft)	
2122	7C	5	Awl fragment (shaft)	
2238	13	1	Awl fragment (tip)	
2238	13	1	Awl fragment (tip)	
2238	13	1	Medium artiodactyl rib with series of incised lines	
3016	15	5	Awl fragment (shaft)	
3031	14	7	Awl fragment	
3036	14	9	Scapula "music maker" with 4 grooves	
3042	16	1	Awl fragment (shaft)	
3043	16	2	Awl fragment	
3066	19	6	Awl fragment (shaft)	
3080	17	7	Unknown element with drilled hole	
3082	20	5	Awl (tip)	
3086	21	2	Awl fragment; 2 pieces that refit	
3086	21	2	Medium artiodactyl antler, flaked at tip	
3137	28	4	Long bone fragment worked to a point	
3199	30	3	Bird bone bead fragment	

Table 8.1. Bone Tools.
(Artifacts without catalogue numbers were identified during the faunal study.)

Lot No.	Test	Level	Description	Catalogue No.
3219	Zurdito	Profile cleaning	"Music maker" with 4 parallel grooves, made on a medium artiodactyl scapula	
3053	16	3	Polished awl tip with linear striations	3053-201
3090	Zurdito A420.30	Profile cleaning 3.30 MBD	Polished bone awl, almost complete; chipped at base (7.38 cm long)	3090-200
3123	23	3	Bone "point" with concave base (1.9 by 0.4 cm, 0.8 g).	3123-200
3287	36	7	Complete shaped piece of bone (gaming piece?) with two grooves across each end on one face. (6.1 by 0.7 by 0.3 cm, 4.3 g).	
3294	36	2	Polished bone fragment; both ends broken (2.8 by 0.4 cm by 0.2 cm; 0.5g).	3294-200
3294	36	2	Small piece of chipped bone. Intentional? (1.0 by 0.8 by 0.3 cm; 0.1 g).	3294-201
3294	36	2	Awl tip, burned; striation or shallow, thin grooves on one face. (1.2 by 0.6 by 0.3 cm; 0.3 g).	3294-202
3369	29	Basal Midden	A bone was broken at both ends, polished, and burned. (4.1 by 1.1 cm, tapering to 0.9 cm at small end, 4.8 g).	3369-200
3441	39	Fea. 92-23	Worked scapula with process cut off. From burial in Zurdito. Red ocher over back of skull as well as over this worked scapula.	3441-200

Most of the tools recorded in Hodgetts' faunal database were coded as "unknown" with regard to source element and taxon, but most probably came from artiodactyls. The bone artifact count for the site included 13 awls or awl fragments, two specimens described as "pointed" (awl tips?), two scapula "music-makers," another worked scapula, two tubes or beads (one from a bird bone), a grooved rib (another "music-maker"?), one bone with a spatulate end (Figure 8.1), one with a rounded end, three polished bones, and a possible gaming piece (but this last was much longer than other gaming pieces I have seen).

Most of the bone tools came from exterior spaces, not from structures. Three items from Test 13, Level 1 (two awls and a grooved rib), an awl from Test 6, Level 2, and four items from Test 36, Level 2 (from either Room 3 or Room 4) came from interior spaces, and all seemed to be in fill. Identified functions included awls, rasps, and beads. Between the faunal analysis and specimens recognized and catalogued in the field, a variety of uses for artiodactyl bone could be identified. Hodgetts (1996:162) noted that artiodactyl metacarpals were disproportionately represented, suggesting that metacarpals were brought to the site as well as gleaned from hunted animals.

Figure 8.1. Bone tool with spatulate end. No. 2064-8, Test 1, Level 10. (PAC 91C-26-14.

Shell

Ronna Jane Bradley identified the shell from the PAC project. Only four pieces of marine shell were identified from El Zurdo (Table 8.2). One was collected from the surface in 1990, two *Glycymeris* bracelet fragments (one incised; see Figure 8.2) were recovered in 1991, and a discoidal bead and a tubular bead were collected from the surface in 1992. The scarcity of marine shell contrasts markedly with the abundance of such shell at the late Viejo Calderon Site (Ch-254) in the Santa Maria valley.

Table 8.2. Marine Shell.

Lot	Provenience	Taxon	Item	Size in cm.
1252-9	Surface	*Laevicardium elatum*	Bead	1.3 by 1.1 by 0.2
2156-2	Test 7, Level 7	*Glycymeris gigantea*	Bracelet frag.	3.7 by 1.0 by 0.2
2129-5	Test 2Extension, Fill	*Glycymeris gigantea*	Incised bracelet frag.	9.5 by 3.9
3138-200	Test 21, Level 4	Vermetid	Tubular Bead	1.5 by 1.4 by 0.3

Figure 8.2. Incised *Glycemeris gigantea* bracelet fragment. No. 2129-5, Test 2 Extension, fill. PAC 91C-29-16.

During the PAC, the only other *Laevicardium elatum* piece came from Ch-11 in the Santa Maria Valley. *Glycemeris* specimens were collected at Ch-254 (n = 3), Ch-151 (n = 2) and Ch-11 (n = 2).

Fresh-water shell included No. 2050-7 (Test 13, Level 2) and an example from Lot 3034 (Test 14, Level 8). Land snails were included No. 2250-7 (Test 13, Level 2), Lot 3125 (Test 22, Level 5), and Lot 3083 (Test 20, Level 6).

Marine shell seems to have been more widely available in the southern zone of the Chihuahua during the Viejo period than during the Medio period (albeit only one of the four samples from El Zurdo was from a Viejo period context). The reasons for this shift are unclear, but the contrast with Paquimé and its enormous hoards of shell (Di Peso 1974; Di Peso et al. 1974) is striking.

Mineral Samples

Few minerals were recovered from Ch-159 (Table 8.3). Four of the items came from Test 14, near the middle section of the arroyo el Zurdito. Two items came from Test 16 in the patio; the "green crumbly stuff" was also found in the patio. A quartz crystal and a small malachite nodule came from the room block. Test 14 was the site of three turkey burials, but the minerals and turkey burials were not associated.

Table 8.3. Mineral Samples

Cat. No.	Test	Level	Description	Dimensions, Weight
3031-200	14	7	Galena (?)	1.5 by 1.3 by 1.1 cm; 4.4 g
3031-201	14	7	Coal	1.9 by 1.2 by 0.8 cm; 1.5 g
3034-200	14	8	Malachite?	0.9 by 0.6 by 0.5 cm; 0.5 g
3034-201	14	8	Hematite	Two small nodules, 0.4 g total
3053-200	16	3	18 gray-black cubes; galena?	Total weight 23.7 g
3055-200	16	5	Quartz crystal	2.2 by 1.0 by 0.9 cm
3137-200	28	Fea. 4, Lev. 4	"Green crumbly stuff"	Weight less than 0.1 g.
3211-201	33	4	Small nodule, malachite?	0.5 by 0.6 by 0.4 cm
3287-200	36	7	Quartz crystal	7.9 g (not measured)

The liberal amount of red ocher found on the back of the skull of the burial in Test 39, and on the worked scapula placed at the back of the skull, should be mentioned here.

The level form for Test 23 mentions the collection of possible potting clay from the basal midden.

Chapter 9

HUMAN REMAINS

Human remains are included in the unit descriptions. A summary is included here. Human bone was found scattered on the site surface, as a result of the extensive looting. The surface occurrences were not recorded, with the exception of a human tooth (Lot 1239). Cleaning of the arroyo el Zurdito profile (Lot 3218) yielded fragments of a neurocranium from a child 5 to 10 years of age. Also, for the east section of the Zurdito profile (Lot 3050), the lot book noted "isolated human" under "Bone."

Eighteen test units (Tests 2, 4–6, 10, 15, 16, 19, 20, 24, 25, 28–31, 33, 36, 38, and 39) and the patio wall trench produced human bone that was later examined by Sylvia Abonyi, the physical anthropologist in 1992. Few of these bone samples were associated with burials. Even in units producing burials, isolated bones were usually found.

Six intentional or probable burials were documented, but several of these were in too poor condition to excavate. The burials included (1) the double burial in Test 5; (2) a disturbed burial above the floor in Test 5 (limb bones in anatomically proper position); (3) the poorly preserved, deep, sub-floor burial in Test 6; (4) the partly exposed burial in Test 25; (5) the burial eroding into the arroyo el Zurdito; and (6) the deep burial in Test 36. In addition, during our first visit to the site in 1990, we observed a grave eroding into arroyo Los Elotes at the north end of the site. This burial was no longer present when we worked at the site.

Burials occurred under room floors (Tests 5 and 6), in architectural fill (Tests 5 and 25), and in exterior space (Test 39 and the burial observed eroding into arroyo Los Elotes). If modern looting is intended to find pots for sale, and if the locations of looters' are thus a proxy for the locations of burials, the last are most numerous in rooms.

The upper reaches of the Zurdito swale, on the west edge of the village, appears not to have been used for burials, as no human bone was reported from Test 1 and the Test 7 group, or from the upper Zurdito profile. Human bone was reported from Tests 14 and 19, and human bone was eroding from two points in the mid-section of the arroyo el Zurdito, and one burial (Test 39) was exposed by the arroyo.

Poor preservation and extensive disturbance (by both pothunters and rodents) made it difficult to reconstruct the disposition of certain individuals. The 14 infant bone fragments in a poor state of preservation in Test 16, Level 7 (Lot 3080), within the lower fill of the borrow pit, were not within a recognized grave. Sylvia Abonyi noted that that a bone from Test 2, Level 2 (Lot 2056) was possibly burned, and that a poorly preserved cranial vault fragment from the Test 2 Extension, Floor (Lot 2134) appeared to be charred. Whatever the cause, there were numerous isolated human bones, bones of several individuals mixed together, and human bones mixed with animal bones.

Number of Individuals

I estimated the number of individuals represented by the project data—a risky exercise. My estimate, which was designed to fall on the conservative side, was 20 individuals (Table 9.1). Other than the male and female identified in the Test 5 double burial, the information for adults was not specific as to sex. Fifteen individuals were adults, four were children, and one was a fetus.

Table 9.1. Estimate of Number of Individuals.

Provenience	Comments	Total Individuals
Test 2 and the Text 2 Extension, Levels 1 and 2	At least two adults and one child	3
Tests 4 and 10	The three elements could have belonged to the same 5 to 8 year old individual.	1
Test 5	The double burial yielded reliable data. A third, partial burial was found above the floor. A rib found in another part of the room could have come from a third individual.	3
Test 6	A deep burial of an adult; a number of bones at a higher level that suggested that a second individual was buried in this area	2
Tests 13 and 14	Human bones were reported in the lot book for this test, but no other information was available. Test 13 is so far away from other tests that it seems likely that this comes from an individual not otherwise represented in the collections. However, Test 14 is close enough to Test 19 where other human bones are reported to be skeptical about counting that occurrence as a separate individual	2
N. end of long trench	Several individuals appeared to be present, particularly in the area of the borrow pit. Test 15 produced human bones from Levels 4 and 5, all of them possibly from a single adult. Test 16, next to Test 15, also produced adult human bone from Levels 4 and 5. As there were no duplications in the reported elements, these could be from the same individual. The infant bones from Test 16, Level 7 were clearly to be counted separately. Test 28, just west of Test 16, also produced bones that should probably be counted with the adult individual—note that the lumbar vertebra in Test 16 showed severe osteoarthritis, as was the case for the two thoracic vertebrae from Test 28. From Test 30, next to the south edge of Test 28, and from Test 16 to the east, came bones of an adult, a child and a fetus. If we assume that the infant bones from Test 16, Level 7 are from a different individual than the fetus, at least	4

Table 9.1. Estimate of Number of Individuals.

Provenience	Comments	Total Individuals
	four individuals were represented by these four tests. The foot bones from Test 20 (just south of Test 16), could be related to the bones in Tests 15 and 16.	
Test 19	Found along the arroyo, human bones from Levels 3 (cranial) and 5 (a rib) came from one or adult. However, given Test 19's proximity to Test 14, it may be incorrect to count these remains separately.	1
Test 25	The bones in this test, in a room in the NE part of the site, came from at least one adult.	1
Central Room Block	The deep burial in Test 36 was one individual. An infant cranium came from Test 29, Level 4, and an infant neural arch came from Test 36, Level 6. Several adult bones came from Test 31, Levels 3 and 5 (with no duplication of bones between the two levels). A cranial vault (age not specified) came from Test 31, Level 4. Adult teeth came from Test 36, Level 2. An adults calcaneus came from Test 38.	3
Total		20

Grave Offerings

The double burial (Feature L) in Test 5 included two pots. The burial in Test 39 included a worked scapula covered with red hematite pigment, at the back of the skull (the back of the skull was also covered in the red pigment). Based on the amount of looting directed toward acquiring pots, and based on the local lore that whole pots were most likely to be found in graves, grave offerings must be far more common than the PAC records indicate.

Age and Health

The condition of the human remains was such that full physical observations could not be carried out. This was puzzling, as the faunal remains were mostly in good shape. The best information was obtained for the double burial found in Test 5. Those remains were in fairly good condition and could be removed for study. Human remains are described, to the extent possible, in the unit descriptions.

Fetuses, infants, children, and adults up to the age of at least 35 to 45 were represented, as were both males and females. The double burial was of a female placed over a male in the same grave. The woman's shoulder girdle was probably damaged as her corpse was forced into the grave.

Observed pathologies included dental problems (tooth wear, calculus build-up, caries, abcesses, and one case were a tooth was coming in directly over another (thereby rendering the bite one-sided). Osteoarthritis, and possibly porotic hyperostosis, were noted.

Chapter 10

SUBSISTENCE

Botanical Studies

Karen Adams (1992) examined 90 macrobotanical specimens and analyzed 60 flotation samples, from 24 units. Her identifications for the individual units are provided in the discussions of those units. She previously reported:

> Plant remains of prehistoric cultivated plants at this site include: (a) corn (*Zea mays*) type cupules, kernel fragments, cob fragments and segments, and stem segments; (b) tepary bean (*Phaseolus* cf. *acutifolis–vulgaris*) type cotyledon fragments; (c) a common bean (*Phaseolus vulgaris*) type cotyledon; (d) a very well preserved squash (*Cucurbita pepo*) type seed; and (e) a short (l cm long) and narrow (1 mm diameter) 2-ply S-twist cotton (*Gossypium*) twine fragment. The variety of corn parts recovered suggests that corn fields must have been relatively close to the site in prehistory, just as they are today. The inhabitants of this area probably also grew tepary beans and squash; whether they grew or traded for cotton twine is unknown [Adams 1992].

Adams (1992) also found charred seeds of weedy plants that do well in disturbed ground (such as in agricultural fields, on trash heaps, along footpaths), including cheno-am (*Chenopodium* or *Amaranthus* or both) and groundcherry (*Physalis*) seeds. Those foods would have been available by late summer and through the fall. A diversity of pine (*Pinus*) parts, such as bark scales, cone scales, charcoal, needle fragments, and nutshell fragments, confirm the local availability of pines in prehistory. Likewise, the recovery of juniper (*Juniperus*) charcoal, twigs, seeds, and seed halves suggests ease of access. Oak (*Quercus*) and manzanita (*Arctostaphylos*) or madrone (*Arbutus*) charcoal reflects the ready availability of other local woodland resources.

The next few paragraphs look at Adams's analysis in slightly more detail. The analysis examined 13 of the 14 units excavated in 1991, and 11 units excavated in 1992. The reduced intensity of analysis in 1992 was due to two factors. First, the 1991 results provided a consistent botanical picture, suggesting that fewer samples could be processed during the second season. Second, El Zurdo was one of several sites requiring botanical analysis in 1992. The El Zurdo samples selected in 1992 had good contextual information and came from a variety of units.

Fourteen of the 60 flotation samples contained no charred plant materials, or else the materials were too small to identify with confidence. Of the tests excavated in 1991, only Test 2 yielded no plant remains—and in that case, three floatation samples were processed. For the 1992 tests, we lack botanical information for some patio units in the long trench, and for most of the units pertaining to Rooms 1 to 4 in the central house mound (with the exception of Test 24, within Room 1, and Test 38, the subfloor test in Room 2).

For the 24 units included in the analysis, the two most ubiquitous plant taxa were *Pinus* (present in 22 units), primarily representing fuel and other non-food needs, and *Zea mays* (in 21 units), suggestive of heavy reliance on agriculture. Probable food plants included the cheno-ams present in six units, probably reflecting the harvest of weeds from farm plots and other disturbance settings. *Physalis* was present in three units, and one seed was believed to be domesticated squash, *Cucurbita pepo*. Seeds in three units suggested grass (Graminae) use. A piece of cotton twine came from the arroyo el Zurdito (see below).

Charred wood fragments were much more common than food remains. The ubiquity of pine was noted above. Oak *(Quercus)* occurred in 17 units, juniper *(Juniperus)* in 14 units, and manzanita (*Arctostaphylos*) or madrone (*Arbustus)* in five. In most of the units with wood remains, at least two taxa were found within the same unit. Only Unit 38 (the Room 2 subfloor test in the central room block) failed to yield wood remains. The ubiquity of wood is not surprising for a site located in a woodland.

In addition to botanical remains coming from the numbered units, 11 samples (all collected during preliminary visits to the site in 1990, and analyzed with the 1991 materials) came from the arroyo el Zurdito, the surface of Collection Unit 6, and arroyo Los Elotes. This group of samples yielded the single example of *Gossypium* (a piece of cotton twine). Cotton does not grow at the elevations found in the Babícora area, so this specimen must have been imported. Other remains from outside the numbered units included juniper (three samples), pine (seven), oak (five), maize (five), *Physalis* (one), and Leguminosae (one). Finally, a *Phaseolus vulgaris* cotyledon fragment came from a collecting station at 160–180 cm BS in the arroyo el Zurdito in 1991 (Lot 2024).

Farming in the Zurdo Valley and the Babícora Basin

Other than a few possible spreader dams on the main arroyo el Zurdo arroyo, no water control devices have been recognized in the southern zone of the Chihuahua Culture. The apparent scarcity of such devices is in marked contrast to the northern zone, where canal irrigation and other water control strategies are well documented.

A 1990 INEGI report, *Estudio Hidrológico de la Alta Babícora, Chihuahua,* shows the Zurdo valley as having a mean annual temperature of about 10 degrees C (10.8 degrees C at Gomez Farías, based on 5 years of records). Frost-free days at Gomez Farías range from a minimum of 107 days to a maximum of 183, with an average of 148.

The area receives about 500 mm precipitation annually (based on 5 years of records, the average precipitation at Gomez Farías based is 507 mm). Precipitation peaks in July and August, but is common in September, after which it tapers off until reaching a minimum in April. The pattern is one of late summer moisture and dry winters and springs.

The 1990 INEGI report regards the Babícora basin as having a more extreme hydrologic deficit than either of the other two basins making up the Alta Babícora area (which includes the Madera

and Zaragoza basins). Figure 10 of the INEGI report shows the Babícora basin as having only two months in which the soil has enough humidity to grow crops (*suelo a capacidad de campo*).

Today the Babícora basin is home to a number of "dry-land" farmers, some of whom discussed their work with us. They report that the basin edges are not subject to salinization, but the center of the basin is a different story. The INEGI report notes that the lake bed and basin floor have both high *salina* and *sódica salina*.

Water-logging of fields is a problem in wet years. At Rancho San Juan at the eastern margin of the basin, the water table was about 2 m deep in 1991, but had been both higher and lower during the tenure of the present landowner. In fact, there had been years when his fields could not be planted because of the high water table levels.

We were told that hybrid maize cannot be grown in the Babícora basin because the growing season is too short, in contrast with the Santa María Valley where hybrid maize is a big business. The roughly two months of sufficient soil moisture for commercial dry-land farming imposes limitations on farmers today, as must have been the case in the past. One Babícora basin farmer we met sometimes rents land in the nearby Santa María Valley to spread his risks across different elevations. Other Babícora farmers have made this limitation into a commercial asset by growing Native American style corn for the U.S. organic food market.

On both sides of the basin, farmers who use modern equipment gave us estimates of between two and four tons per hectare. Our own observations of conditions since 1989 have showed us how uneven the precipitation, and thus yields, can be. In several of the drought years that occurred during the project, farmers reported substantial reductions in yields and even crop failures.

Faunal Remains

Lisa Hodgetts' 1995 honors thesis at Simon Fraser University, her faunal spreadsheet, and her 1996 article form the basis for the following discussion. In her thesis and in the article, Hodgetts examined faunal remains at the site level. The faunal spreadsheet provides the link between proveniences (lot number, unit, level) and specimens, and was used to create the unit by unit tables in Parts 1 and 2 of this report. On the spreadsheet, Hodgetts carried identification of each element to the most precise taxonomic level possible. Her categories are repeated in each of the unit-by-unit tables. Table 10.1 provides a summary of the distribution of selected faunal remains across the site. All of the identified animal species found by the project are found today, or were found recently, no more than 10 km from the middle of the Babícora basin.

In a letter dated August 4, 2004, Hodgetts remarked that breaking down the faunal assemblage in terms of individual tests resulted in very small samples. Many lots have fewer than the desired 100 identified specimens per analytical unit. Few faunal analysts would attempt to look at the relative importance of taxa with assemblages smaller than about 500 identified specimens. Taken as a whole, however, the El Zurdo assemblage was large enough to allow identification of uncommon taxa including fox, bobcat, badger, mountain lion, and bear.

Table 10.1. Distribution of Selected Species by Units.

Taxon	No. of Units with Taxon	Tests for Which Taxon is Reported
Jackrabbits	31	1, 2, 3, 4 group, 5, 6, 7, 7N, 7A, 7B, 7C, 11, 13, 14, 17, 19, 15, 16, 20, 21, 22, 23, 24, 28, 30, 31, 33, 36, 38, 40, and the Zurdito profile
Rodents	29	2, 3, 4, 7, 7N, 7A, 7C, 13, 14, 17, 19, 21, 22, 25, 26, 27, 40, 15, 16, 20, 23, 24, 28, 29, 30, 31, 33, 36, 38
Cottontails	28	2, 3, 4, 7, 7N, 7A, 7B, 7C/12, 13, 14, 19, 25, 26, 27, 15,16, 20, 23, 24, 28, 29, 30, 33, 36, 37, 38, 40 and the Zurdito Profile
Deer/antelope/artiodactyls	26	1, 2, 7, 7N, 7A, 7C, 8, 12, 13, 14, 19, 40, 15, 16, 20, 21, 22, 23, 24, 28, 29, 30, 31, 38, 42, and the Zurdito profile
Turkey (other than burials)	24	1, 2, 3, 10, 5, 7, 7N, 7C, 8, 14, 17, 19, 42, 15, 16, 20, 21, 24, 28, 29, 30, 31, 36, 42
American Coots	20	1, 2, 7, 7N, 7C, 13, 14, 17, 19, 42, 15, 16, 23, 24, 28, 30, 32, 33, 37, 38
Dog/wolf/coyote (mostly presumed to be dog)	17	1, 3, 7, 7N, 7A, 7C, 13, 14, 16, 19, 20, 21, 28, 30, 36, 40, 42,
Anserinae (Geese and Swans)	12	1, 3, 7N, 7A, 7C, 13, 14, 16, 17, 19, 21, and the Zurdito profile
Quail	13	1, 13, 14, 15, 16, 19, 20, 24, 28, 29, 30, 38, 42
Badger	6	1, 7N, 13, 14, 21, 30
Fox	2	19, 30
Bobcat	2	1, 19
Mountain Lion	2	20, 28
Bear	1	42
Fish	8	7A, 14, 16, 20, 21, 28, 31, 33
Turtle	4	20, 28, 30, 33
Reptile	4	16, 22, 31, 36
Frog	1	31

Hodgetts argued that meat was not an important part of the diet, but a valued addition to what was presumably a heavily maize-based diet. Consistent with that claim, faunal remains were not numerous in any unit, but occurred in all of them. The clear pattern was a diversity of taxa and a low incidence of elements for each of Hodgetts' categories within levels and units. With a few exceptions relating to the obvious or possible burial of turkeys (in Test 14; near that test in the south face of arroyo el Zurdito; in Unit 8) and a canid (probably a dog, in Test 21), no unit yielded more than 14 elements from any category. Usually, no more than three elements attributable to a category were present per level. The observed pattern suggests that garden hunting was the norm, not only for lagomorphs and rodents but also for other animals (such as artiodactyls and even water birds) that would have been attracted to fields.

Mammals

Lagomorph elements were found in most of the units. Only five units lacked lagomorphs (Tests 8, 9, 10, 34, and 35). Of those, Tests 34 was reported as having no faunal remains and no faunal collection was made from Test 35. (It was possible that Lot 3332, assigned in the faunal database to Test 36, was actually from Test 34; see the unit discussion for Test 34 in Part 2 of this report).

The presence of both jackrabbits and cottontails suggests hunting in more open terrain (such as cultivated fields, for jackrabbits) and also in more covered areas near the site (for cottontails). Hodgetts (1996:158) noted that faunal studies by Hastorf (1980), Szuter (1991), and Nelson and LeBlanc (1986) indicate that jackrabbits can be expected to increase with increased cultivation and with garden hunting strategies. Jackrabbits outnumbered cottontails at Zurdo, but a complicating factor was preservation and recovery. Cottontail bones were less likely to survive through time, and more likely to escape the quarter-inch screens used in the field. Hodgetts argued that body parts in the study collection correlate well with bone size, so it seems likely that cottontails were underrepresented in the counts.

The eternal question about rodent bones is whether they are due to human consumption or natural activity. Hodgetts was inclined to think that some were utilized by the villagers. At least one rodent bone was burned. If rodents were hunted, the hunting probably took place near the site. Prairie dogs, pocket gophers, ground squirrels, large rodents such as woodrats, and Muridae (deer mice and voles) were present. Of these, pocket gophers were the most numerous, with a MNI of 14.

Hodgetts noted that both white-tailed and mule deer inhabit forest edges in the vicinity of the site. Nineteen *Odocoileus* (deer) elements were identified from 11 different units. Medium artiodactyl elements (most likely from deer) came from 24 locations including the arroyo el Zurdito profile. All of the *Odocoileus* identifications came from units that also yielded medium artiodactyl elements. Hodgetts further suspected that many of the medium mammals elements were in fact from deer. Thus, deer were probably responsible for elements found in more than half of the units, but were usually represented by a few elements in each unit. Test 21, Levels 1 and 2 was an exception, yielding two cranial fragments, a metacarpal, three thoracic vertebrae, a fourth vertebra, and 14 ribs from deer, medium artiodactyls, or medium mammals.

Three antelope elements were found in two widely separated units (an ulna and a metacarpal in Test 14; an innominate bone in the borrow pit in Test 28). The lower, grassy portion of the Babícora basin would have provided the nearest good habitat for this species.

Hodgetts noted that artiodactyl foot, neck, and axial bones were underrepresented, and lower forelimb, upper hindlimb, and lower hindlimb bones were overrepresented, suggesting a selection of parts to be returned to the village. The shortage of foot bones is probably related to skinning practices. While metacarpals may have been brought to the site for use as tools, Hodgetts felt that there were not enough bone tools to allow a convincing argument. The bone tools made from unidentified species were most likely from artiodactyls.

Most or all of the canid elements are assumed to be from dogs. Besides being tabulated as *Canis* sp., dog remains were probably classified as small to large carnivore. Hodgetts gave an MNI of 8 for these categories. They were found in 16 locations, usually with one to five elements per unit. Test 21 had 53 elements (10 in Level 1, 43 in Level 2) probably representing a single dog.

Wild carnivores were unlikely to have been taken through garden hunting strategies. Mountain lion elements were present in Test 20 (a proximal phalanx) and Test 28 (a metacarpal). A single black bear carpal was found in Test 42 (the trench outlining the patio compound wall). Fox elements were found in Test 18 (cervical fragment) and Test 30 (a carpal). Badger elements (n = 9) were found singly in Tests 1, 7N, 13, 14, and 30, while four badger elements (a mandible, teeth, and phalange) came from Test 21. Two bobcat or lynx elements—a humerus from Test 1, and an ulna from Test 19—came from widely separated units along the arroyo el Zurdito.

Birds

A great variety of birds was found at the site (Hodgetts 1996). Of the 697 bird bones, 370 were identified to at least the family level. Setting aside turkey bones for the moment, waterfowl made up more than half of the identified bird bones. It seems that waterfowl were hunted in the Babícora basin in antiquity, as they are today.

Although many of the large bird elements identified by Hodgetts were undoubtedly turkeys, others must have been water birds, and Hodgetts occasionally specified that a particular large bird element was “not turkey.” It therefore seems likely that water birds were even more important than the data indicate.

Water Birds

Waterfowl would have nested at the shallow Laguna Babícora, which would have been from 6 to 10 km from the site (assuming that the lake level and areal extent varied as it does today). During the day they would have been attracted to fields even closer to the site, and the main arroyo el Zurdo and the Rio Las Varas (with their permanent water) might also have drawn waterfowl.

Fifteen elements possibly from the same goose or swan (Anserinae) were found in Test 19, Level 9. Two additional elements assigned to this taxon came from the same test, from Levels 8 and 10. There was no obvious duplication of body parts among the 17 elements. Three humeri were listed but two were proximal ends and one was a distal end. The other 21 elements identified as Anserinae are distributed among 12 units in the patio, in the central mound, and along the upper (western) and middle sections of the arroyo el Zurdito arroyo.

Five elements from mallards and their relatives (*Anas*) were tabulated from five tests (1, 17, 24, 28, and 30). Six elements of large *Anas* (mallards or larger) were found in Tests 7N, 17, 19, and 30 and in Feature 92-1. Five elements of medium-sized *Anas* were found in Tests 7A, 13, 15, 21, ad 28. Six elements of small *Anas* were listed for Tests 6, 7C, 14, 17, 21, and 38. Elements identified only as surface feeding ducks (Anatini) were represented by three elements from Tests 7C-12, 13 and 31. One element from a Redhead (*Aythya*) came from Test 38.

Two elements identified as waterfowl (Anseriformes) came from Test 15, Level 5. Thirteen additional elements of Anseriformes (small to large) were found in eight tests (2, 17, 20, 28, 13, 16, 38 and 40).

One element classed as Charadriiformes (plovers and their relatives) came from Test 19. Two elements from Ciconiiformes (storks and their relatives) were tabulated for Tests 7N and 19. Four elements of Gruiformes (cranes) come from Test 6 (two elements, a radius and an ulna probably from the same bird), and from Tests 14 and 30. Six elements from grebes (Podicipediformes) came from Tests 1, 14, 15, 20, and 24 (two elements, an ulna and a tibia). The four rail (Rallidae) elements come from Tests 14, 15, and 16.

American Coots (*Fulica Americana*) were present in more of the units of any of the other bird except turkey. American Coots are not ordinarily found on archaeological faunal lists in the region, nor were they reported from Paquimé, but American Coots make up 27 percent of the bird bones analyzed by Hodgetts (slightly trailing turkeys at 29.5 percent, not counting the turkey burials [Hodgetts 1996:164]). Although American Coots occur over much of Mexico and the United States, they prefer specific ponds and lagoons to which they returned annually (Blake 1953). Laguna Babícora was ideal coot habitat. American Coots are easier to hunt than other species of waterfowl, at they find it difficult to become airborne and must run across the water before taking off (Hodgetts 1995:53).

Land Birds

Domesticated turkeys must have been kept at the village. Two markedly different forms of disposal suggested that turkeys functioned in both the secular and the sacred domains. Turkey burials and probable burials—birds buried in one piece, with the meat on the bones—suggested ritual usage. Turkey burials occurred at several levels in Test 14, indicating a continuing practice, and appeared to be localized, occurring in the southern portion of the Zurdito swale. The El Zurdo turkey burials are reminiscent of those at Paquimé, where turkeys were apparently used for ceremonial purposes alone (Breitburg 1993).

Unlike at Paquimé, at El Zurdo the distribution of individual turkey elements indicates that turkeys also used as a day to day resource—for feathers and food, and possibly also for hollow long bones for sucking tubes or beads. The practice at Zurdo thus resembles the mixed ritual-secular pattern that Breitburg (1993) notes for the Southwest in general.

Quail were represented by 22 specimens in 12 units: one element each from Tests 1, 13, 14, and 15; two elements from Test 16; seven from Test 20 (Levels 4–7); one each from Tests 24, 28, and 42; and two each from Tests 29, 30, and 38.

One dove (Columbiformes) element came from Test 38.

Three Raven (*Corvus corax*) elements came from Tests 22 and 33.

One Sparrow Hawk (*Falco sparvarius*) element came from Test 30. Otherwise, Falconiformes was represented by 22 elements from 10 tests. These were tabulated as (1) Falconformes not

broken down by size (one element from Test 19); (2) large Falconiformes (larger than vultures; one element from Text 6, four from Test 7A, and one from Test 7N); (3) medium Falconiformes (larger than the Prairie Falcon; five elements from Test 6, one from Test 7, two from Test 7A, one from 7C, and one each from Tests 14, 16, and 22); (4) small Falconiformes (the size of a Prairie Falcon or smaller; one element from Test 14, one from Test 17, and two from Test 30).

Perching birds (Passeriformes) were found in Tests 15, 17, 19, 20, and 30. Woodpeckers (Pictiformes) were represented by two elements, one from Test 28 and the other from the basal midden in Test 24. One owl (Stringiformes) element came from Test 14.

Fish

Fifteen fish elements were recovered eight units: two partial crania, two vertebrae, two spines, and nine unknown body parts. The fish elements came from Tests 7A, 14, 16, 20, 21, 28, and 33. Four of the specimens came from Test 20 (Levels 3, 5, and 7) while three units yielded two fish bone each (Tests 28, 31, and 33). The mostly likely source of the fish would be Laguna Babícora, but I have no information about native fish in that lake. Small fish were probably also available in the Rio Las Varas and possibly even in the arroyo el Zurdo—in which case they were practically at residents' doorsteps. Turtles (present in four units) were probably acquired locally. The reptiles (present in Tests 16, 22, 31, and 36) and frog (from Test 31) could have been present naturally.

Modifications to Bone

Hodgetts (1996:166) found very little evidence of butchering or cooking. For the birds, she noted a goose radius, an ulna from a medium-sized bird, and a quail femur with cut marks. She also noted bone alterations probably due to cooking on three coot bones, five waterfowl bones, a turkey bone, a medium-sized falconiform bone, and the single owl bone.

The database did not make note of cut marks, charring, or discoloration due to cooking for the lagomorphs or artiodactyls; such alterations would have been noted had they occurred. There were, however, examples of bone splitting, and of pieces of bone that refit. One note for a medium-sized carnivore noted that a canine root tip had been sawed off diagonally. A woodrat (*Neotoma*) ulna had "burning indicated at break."

Immunological Analysis

Margaret Newman of the University of Calgary subjected 32 stone tools from various PAC sites to immunological analysis (Newman 1991). Of these, six tested positive to antisera for different animals or groups of animals (the antisera for rabbits and canids did not distinguish between species).

One sample revealed human blood residue (from Ch-192), which could, of course, reflect an accidental wound of the sort often experienced by flintknappers. Two tools tested positively for rabbit (from Ch-216 and Ch-159), one for mouse (from Ch-11), and two for canid (both from Ch-159). Thus, three positive tests for rabbits and canids came from El Zurdo, where they are amply represented among the faunal remains. The positive response for rabbit came from Test 1, Level 3, while the positive reaction for canids came from Test 5, Level 3 and Test 7, Level 2.

Indications of Seasonality and Sedentism

Karen Adams assumed that the villagers' agricultural fields (along with botanical species that thrive in disturbed habitats) would have been near the village. Some people must have been in the village during planting (late spring) and harvesting (late fall).

In 2004, Lisa Hodgetts provided me with data on epiphyseal closure, instances of advanced age, and instances of fetal and neonatal bones. Two elements from medium-sized artiodactyls were from fetal or neonatal individuals. Immature individuals indicated by unfused epiphyses included two birds, two medium-sized birds, a lagomorph, a jackrabbit, two cottontails, three medium-sized artiodactyls, and three medium-sized mammals. Four elements with unfused epiphyses could not be identified. Other elements from immature individuals include two immature cottontails, a squirrel, and a badger. Older animals were indicated by notations such as "fused thoracic fragment from a large bird" and "fused thoracic from a turkey."

Responding to my request for inferences about seasonality, and drawing on Hale (1949) and Lewall and Cowan (1963), Hodgetts noted that the distal radius of black-tailed deer begins to fuse at about 34 months in males, and at 36 to 60 months in females. Incompletely fused epiphyses thus indicate individuals under 60 months old—not useful with regard to seasonality. For cottontails, fusion of most elements occurs during their first winter, but since the timing of spring births varies by up to 3 months, unfused bones from the same cohort can span a full year. The neonatal or fetal artiodactyl elements reflect a late winter to spring occupation, but otherwise the elements just listed were not very informative.

El Zurdo's occupation can be extended into the winter months by virtue of the seasonal habits of migratory water birds. During the summer, collection of local wild foods, garden hunting, and care of growing crops were motivations for remaining in the village. Turkey flocks would have required year-round care. Major resources (farmland, water, wood, settings for garden hunting, and habitat for waterfowl) were all located a short distance from the village, so there is no obvious reason to postulate seasonal absences from the village.

We are left with a picture of possible year-round occupation of the village during the Medio period, with no evidence to the contrary. The evidence for year-round site use is probably stronger at El Zurdo than at many other sites in the region, because a winter occupation (which is notoriously difficult to verify) is indicated by the remains migratory waterfowl.

Stable Isotope Analysis and Dietary Inferences

Monica Webster's (2001) stable isotopic analysis of human bone examined both carbon and nitrogen. She focused on human samples from the Laguna Bustillos area but also did a background study of some 50 modern plant species (mostly collected in the Bustillos Basin, with the help of Karen Adams) and 13 faunal species (from archaeological collections). She constructed 20 dietary models using different combinations of C3 and C4 plants and meat. The model that best fit the data from the Viejo period site of CH-254, in the Santa María Valley, was her Model 20: 72 percent maize, 8 percent beans, 10 percent meat from C4 eaters, and 10 percent meat from C3 eaters.

Webster compared the Ch-254 dietary picture to the isotopic results from two Medio period sites in the Babícora basin, including the assays previously carried out by Sylvia Abonyi at the University of Calgary (from the Zurdo double burial in Test 5, and on a sample from a disturbed burial at the San Juan site). The Babícora population showed stable carbon isotope values similar to those seen at Ch-254, but the lower stable nitrogen values suggested lower meat comsumption for the Medio period Babícorans. As Katzenberg and Webster (2004) subsequently noted, some of the plants in the modern Bustillos collection had higher than usual nitrogen values. More meat in the Bustillos diet, as well as greater aridity in that region (where most of the tested plants originated) might account for the differences in nitrogen values between the two areas.

Hodgetts had access to the Babícora isotopic data run at the University of Calgary, and discussed the results on the two skeletons from the double burial in Test 5 (Hodgetts 1996:167). She saw little room in the stable carbon isotope results for a large meat component, but noted that if people ate turkeys fed on corn, their C4 values might be enhanced. The isotopic evidence for little consumption of meat was consistent with the relative scarcity of faunal remains, and thus supported Webster's conclusions.

Adams' botanical identifications identified a number of C3 plants that could have been used as food, including *Physalis,* grasses, *Chenopodium, Amaranthus,* and *Portulaca.* Domesticated squash was also identified. These must have been used as food, but the isotopic dietary models left little room for them in the diet. The available evidence instead suggests that the inhabitants of the southern zone of the Chihuahua Culture consumed a diet rich in C4 foods.

Chapter 11

SUMMARY AND INFERENCES

El Zurdo is part of the Las Varas site group, the largest of three major site clusters in the Babícora Basin. El Zurdo is unusual for its location on a spring-fed side drainage, where it is somewhat isolated from the other Las Varas sites and from sites in the rest of the Babícora Basin. El Zurdo is not, however, the only site outside the open bottom of the basin. On the east side of that basin, Ch-230 is on the arroyo Mulato, above the site at San José Babícora. There are undoubtedly other sites in side valleys that we did not record.

El Zurdo is the largest site along the relatively short Zurdo drainage, with much smaller satellite sites to the north and south. Field houses that might have been associated with the site occur along the drainage, which is flanked by outcrops that include the fine-grained black basalt used in the more carefully made flaked stone tools.

El Zurdo is a badly disturbed site. In recent decades, arroyos have cut through the deposits. More recently, construction of an earthen stock tank and removal of several tall pines from the northeast part of the site have altered the site surface. The real problem is, of course, looting. El Zurdo is on the commons for Colonia Esmeralda and is obvious to all members of the colonia who graze cattle there or use the road through the site to reach fields or firewood, but the site is also isolated enough to allow undetected looting. The general site condition and the patterning of the looting suggest that the site has produced enough whole vessels to encourage looters to engage in further prospecting. Other sites in the basin with similar scales of looting include the easternmost site along the arroyo Las Varas (Ch-179; Sayles I:9:4 and I:9:5), Ch- 180 in the upper Las Varas valley, the Alamillo site (Ch-160), and San Jose Babícora (Ch-155; virtually destroyed). Years of active farming at other Las Varas sites (and the Rancho San Juan site) have caused some damage but the more continuous human presence at those sites has discouraged looting. On the whole, sites on actively farmed properties have not experienced the level of destruction seen at sites such as El Zurdo.

The work carried out by the PAC could not be on a scale equal to the potential of the site. We might well have continued excavations in subsequent years had not the warning conveyed to us ("There is no law west of Gomez") been shown to contain an element of truth. As it was, we spent two field seasons testing the site. I wish that we had been able to follow up on the initial stratigraphic approach by clearing larger areas, in order to gain information about architecture and household units within the room blocks.

Despite El Zurdo's location in a side valley, and the lack of lines of sight to other villages in the Las Varas group (as was the case in the main valley), the site appears to have had adequate access to arable land, to sources of stone, and to the waterfowl and other game animals in the main part of the basin and surrounding hills. El Zurdo had immediate access to firewood, albeit that commodity is never far away in the Babícora area.

The depth and extent of the site's presumed Viejo deposits suggests that during that period, the site was a permanent settlement rather than a temporary camp or intermittent use area. If so, it is unlikely that the site was due to settlement expansion, based on a shortage of arable land in the main valley. Given that the other site thought to have a substantial Viejo component, Ch-180, is well up the Las Varas drainage, if anything we have the opposite pattern: expansion from the wooded margins of the basin onto the open basin floor.

We cannot tell whether El Zurdo was continuously occupied village. Our testing yielded evidence to suggest occupation through each season of the year, but this begs the question of continuity over the years. In addition, it is not clear where the Viejo period structures might have been, nor do we know where the Medio period habitations were located that led to the Medio period midden deposits under the central room block.

Based on our geologist's examination, the arroyo El Zurdito, a swale during the occupation of the village, first formed during the late 1800s. This natural erosion was a boon to understanding the stratigraphy at the site, and showed that there had never been any structures built along the length of the swale. It was instructive to observe the changes in the shape and depth of the arroyo between 1990 and 2008. When we first saw the site, the arroyo was highly actively and was deeper, with fairly vertical walls, but in subsequent years the arroyo banks eroded to more gentle angles and the channel partly refilled (Figure 11.1).

Figure 11.1. Changes in arroyo El Zurdito. Left: 1990. Right: 2008.

Radiocarbon Dating

The evidence for a Viejo period occupation includes (1) radiocarbon dates and (2) pottery from the lower levels of the arroyo El Zurdito and from Test 13 along arroyo Trece. With the exception of the Perros Bravos-like architecture found in Test 13, no Viejo period structures or Viejo-Medio transitional structures were identified. All of the tested rooms, as well as the patio, date to the later Medio period occupation. The dense midden underlying the central room block belongs to an earlier Medio period occupation for which no structures have been identified.

The radiocarbon dates from El Zurdo have been discussed elsewhere, as part of the suite of PAC dates then available (Stewart et al. 2004, 2005). Individual dates have been discussed in Parts 1 and 2 of this report, as part of the unit descriptions. Table 11.1 lists the El Zurdo radiocarbon results, ranged from early to late. See Stewart et al. (2004, 2005) for a more complete discussion of the dates.

Table 11.1. Radiocarbon dates from Ch-159, El Zurdo.

Lab Code	Sample Code	Lot No.	Context	Sample Material	Conventional Age BP	2 sigma cal A.D. Age
Beta-44458	Ch-14C-01	1276	Base of arroyo El Zurdito in 1991	*Zea* cob	1340 ± 80	561–886
TO-2557	Ch-14C-02	1276	Zurdito wall, 140–150 cm BS	*Zea* kernel	1100 ± 50	856–1022
TO-2879	Ch-14C-13	2179	Test 7A, Level 6	*Zea* cob	1060 ± 50	872–1042
TO-2880	Ch-14C-14	2203	Test 7A, Level 7	*Zea* cob	1050 ± 50	886–1042
TO-2877	Ch-14C-11	2156	Test 7, Level 7	*Zea* cob	940 ± 40	1019–1190
T0-4123	Ch-14C-31	3037	Test 14, Level 10	*Zea* cob	820 ± 60	1152–1290
Beta-52998	Ch-14C-17	2184	Test 5, Lev. 1, Fea. L, double burial	Individual 1	670 ± 50	1336–1401
TO-2878	Ch-14C-12	2177	Test 7, Level 4	*Zea* cob	670 ± 40	1342–1396
TO-2875	Ch-14C-09	2144	Test 7, Level 7	*Zea* cob	640 ± 50	1284–1403
TO-4125	Ch-14C-33	3374	Test 38, Level 4, under room block	*Zea* cob	620 ± 60	1284–1417
Beta-52997	Ch-14C-16	2184	Test 5, Lev. 1, Fea. L, double burial	Individual 2, bone collagen	600 ± 50	1295–1418
Beta-65675	Ch-14C-21	3077	Test 19, Level 9	*Zea* cob	570 ± 50	1300–1373
TO-4124	Ch-14C-32	3084	Test 20, Level 7	*Zea* cob	560 ± 60	1299–1375
TO-4126	Ch-14C-34	3374	Test 38, Level 4	*Zea* cob	520 ± 50	1383–1455

The radiocarbon assays span the Viejo and Medio periods. The site appears to have been established before A.D. 1000, possibly as early as the 800s, and continued in use until the 1300s, possibly until the early 1400s. The first sample in Table 11.1 corresponds to the early Viejo period and at the time the dates were run, that early result appeared to be a statistical outlier. Since then, comparable dates obtained from Ch-254 and Ch-272 in the Santa María Valley strengthen the case for an early Viejo period occupation in the southern zone of the Chihuahua culture.

The next three samples listed in Table 11.1 also correspond to the Viejo period, while the following two may relate to the Viejo–Medio transition and the final eight samples correspond to the Medio period.

Based on all evidence, the most intensive use of the site came fairly late in its history. None of our dates is directly associated with the tests in the central room block. The most relevant dates are from the double burial in Test 5, and from the midden under the central room block. This midden dates to the 1200s and 1300s, and must precede construction of the central room block.

In the arroyo El Zurdito, a break between the cultural deposits of Stratum B and the overlying silt levels corresponds to the break between occupational and post-occupational deposits.

Architecture

Except for the Perros Bravos-like architecture in Unit 13, north of the arroyo el Zurdito, our only information about architecture comes from the later Medio period room blocks. We tried various approaches to estimating room numbers, including walking over the site to delineate walls and dividing mound areas by estimated room size. None of these attempts was satisfactory, but our best guess is that the site included 75 to 100 ground-floor rooms during the later Medio period. Not all of those rooms were occupied at the same time, however. El Zurdo falls towards the middle of the size range for Medio period sites in the southern zone.

Sayles (n.d.) contrasted El Zurdo's rock and adobe walls with the all-adobe construction found in sites along the main Las Varas drainage. Our excavations confirmed the extensive use of rock in the walls of the room blocks.

El Zurdo appears to have included two or three large room blocks, with additional smaller units. Given the heavy disturbance of the area between our central and east room blocks, those two room blocks may have been a single larger unit. The southern room block was indicated by the thickness of the cultural deposits and widely spaced rock alignments. The single unit excavated in that part of the site, Unit 8, failed to produce structural remains.

The central room block included an exterior patio (i.e., one not surrounded by rooms) abutting the north side of the central room block. The perimeter wall created a limited-access area where items were stored in pits and other domestic activities occurred. Other long alignments of rocks may have been parts of other patios (or sections of unrecognized room blocks).

No special function rooms, no ball courts, and no platform mounds are known from this site or from any other site in the Babícora Basin. This negative evidence may be indicative of local social realities, or maybe not. In 2008, the discovery of a ball court in the Santa Clara Valley suddenly altered our understanding of society on the southeastern frontier of the Chihuahua culture. Given how little scientific work has been done in the Babícora Basin, similar discoveries could still happen there.

Foreign Goods

The southern zone Medio period sites have yielded few outside goods. Joe Stewart and I have been struck by the fact that the roughly coeval sites in the Sierra Blanca region of New Mexico (the scene of our previous joint project) were far more active in regional exchange networks than was the southern zone of the Chihuahua Culture. Until the recent work at the Viejo period Calderón site, the artifact assemblage from El Zurdo was the largest one generated by the PAC, and the list of imported items is quite short. The entire effort at the site yielded four pieces of marine shell, and no freshwater mussel shell.

The PAC identified very few sherds from outside the culture area. At El Zurdo, one Chupadero Black-on-white and a couple of Jornada painted sherds were found. Most of the non-local pottery came from other zones of the culture. These imports included Ramos polychrome, Ramos Black, Madera Black-on-red, and Villa Ahumada Polychrome.

No copper items were found at the site, but they do occur in the southern zone. In a 1933 letter to Gladwin, Sayles mentions a copper ornament left out of his main shipment of Chihuahua materials to Gila Pueblo.[1] It appears that the copper ornament in question was lost before the Gila Pueblo collections were transferred to the Arizona State Museum. Withers (1946) reports a single copper bell from the "Santana" (Santa Ana) Ranch (in the Santa Maria Valley), indicating that a second copper object was collected from the region.

A Proxy Measure of Space Utilization

In an attempt to better understand what kinds of activities were reflected by the different test units, we created the "density" proxy used in the unit descriptions in Parts 1 and 2 of the report. The volume of each level was calculated, and the artifacts and faunal materials were tabulated. The numbers of artifacts and faunal remains per cubic meter were then calculated.

In general, the lowest densities of remains were found in the room blocks, the highest in exterior space, with the patio figures falling between the two extremes. Presumably, density figures are linked to disposal patterns as well as to locations of activities including habitation. The highest densities would be expected in trash disposal areas and for activities such as knapping that, if done away from living quarters, might result in debitage being left where it was created. Conversely, living areas might be kept clear of trash, and thus have low density measures. The highest value for an entire excavation unit came from the sub-floor midden under the main room block in Unit 38 (1,533 artifacts/m^3). The highest values for individual levels came from units without architecture (i.e., external space) along arroyo El Zurdito, with density measures from 2,999 to 2,986 artifacts/m^3.

The densities for Medio period room interiors varied from 16 artifacts/m^3 (Test 6) to 331/m^3 (Test 27), the latter being in a structure in the northeast part of the site. It is tempting to interpret the low densities for in Tests 2 and 6 as reflecting rooms occupied late in the sequence, thus not

[1] Letter from E. B. Sayles to H. Gladwin, El Paso, Texas, July 31, 1933. E. B. Sayles Papers, Arizona State Museum Archives, MS 1, Sg2, Series 1, Folder 1, Correspondence.

used as trash disposal areas. In contrast, the density figure for Unit 13 (the room with Perros Bravos-like architecture) was higher than for any Medio period room (762 artifacts/m³), suggesting that this older structure had been used for trash disposal. The intermediate patio unit densities ranged from 418 to 1,934 artifacts/m³.

Turning to flaked stone counts as another indication of activity areas, about half of the inventory of flaked stone came from the borrow pit at the north end of the long trench (Units 16, 20 ,28, and 30; n = 2,288), Test 1 (n = 1,268), Test 28 (n = 970), and Test 14 (n = 723). Knapping may have occurred at or near these trash disposal areas.

The rather odd distribution of recorded metates—a fair number observed on the surfaces of looters' pits, but only a few fragments found in excavated contexts—does not help us understand the spatial distribution of maize grinding. Manos were quite widely distributed in the site, however, so perhaps shows that maize grinding was an equally widely distributed activity.

Making a Living

The residents of El Zurdo were farmers. Isotopic remains of human skeletal materials indicate a major dietary reliance on C^4 plants or animals that fed on C^4 plants, or both, with only minor reliance on C^3 plants or animals that fed on C^3 plants. The abundance of grinding implements and turkeys further supports the inference that these people were dependent on a diet in which *Zea mays* figured prominently. We assume, but cannot prove, that the village's fields were somewhere near the settlement, and that farming was either *de temporal* (rainfall-based) or made use of the small spreader dams along the main Zurdo drainage. Hunting could have occurred in various contexts, including in the disturbed habitats produced by fields and in the marshy bottom of the main basin. Animals represented by rare faunal elements, such as bear, were probably more opportunistically hunted in the adjacent hills or even farther afield.

Today, the Babícora Basin is regarded as having a more problematic climate for farming than the adjacent Zaragoza and Santa María drainages. This is due to a slightly higher elevation and growing seasons that are often cut short by early frosts. The drought of the 1990s affected the Babícora Basin as much as adjacent areas.

Aside from the food quest, life in the Babícora Basin was probably not a challenge. Cobbles for building, and for expedient flaked and ground stone tools, were available in local arroyo bottoms. Rhyolite and basalt, including a fine-grained black basalt preferred for points, were exposed nearby. The site and its environs today support tall pines, oak, and a variety of other trees and shrubs, so that wood for construction, fires and other purposes was readily available. Riparian resources were available along streams and in marshes within 10 km of the site.

A Paradox

The Zurdo ground stone assemblage (like most assemblages from the southern zone) appears quite expedient. As Bob Hard remarked, while visiting a site in the Bustillos Basin, the

assemblage he saw was more like that from the SU Site than assemblages from later Puebloan sites north of the border. Hard's (1990) criteria for evaluating ground stone suggest limited reliance on crops processed by grinding. On the other hand, the isotopic analysis of samples from two individuals (the double burial in Test 5) indicate a major dependence on C^4 plants. Estimates of the contribution of hunting to the diet (see Hodgetts 1996) are quite compatible with the isotopic results. Either the southern zone residents (including those at Zurdo) ground a great deal of maize using an expedient technology, or they processed a fair amount of maize in other ways. The Tarahumara (Rarámuri) use fairly expedient grinding tools to process maize, and also use a great deal of whole kernel corn in foods such as *pozole* and drinks such as *tesguino*. Perhaps this culinary tradition has some antiquity in the southern zone.

Aviculture

Turkeys were apparently used for both secular and sacred purposes, to judge by the distribution of turkey bones in domestic fill and the burial of whole birds.

The PAC found a number of so-called macaw stones on site surfaces and during excavation. All but one of the examples date to the Medio period deposits; the exception, from the Bustillos Basin, is contemporary with the Viejo period. If these stones are indeed the front stones of macaw pens, two kinds of aviculture involving larger birds was practiced. The lack of macaw bones in the faunal assemblages suggests other possibilities, however. Can wild birds be kept in pens with "macaw stone" openings? Bones from waterfowl were fairly common at El Zurdo, and may have been kept alive, as a source of feathers, instead of being consumed solely for their meat.

Handling Death

The scant burial information from El Zurdo represents a fair fraction of the total obtained by the PAC from the southern zone. Considerably more burials were dug by early archaeologists, whose work indicates a pattern of flexed burials aligned in various directions, with pots as a grave offering. The intensity of looting at El Zurdo and the scattered human bone at the site suggest that grave offerings were sufficiently common to justify repeated looting episodes. Local informants have told us that El Zurdo was a good place to prospect for saleable pots. Thus, even though the PAC encountered only four non-looted burials at El Zurdo, the looting and scattered bone indicate the much larger mortuary population that is to be expected at a village occupied for many generations.

Most of the looting has been concentrated in the central and eastern room blocks, leading us to believe that burial in room fill and under floors was fairly common during the Medio period. The double burial in Test 5 was accompanied by two pots, and red ocher was used liberally at the head of the partial burial eroding from the face of arroyo el Zurdito. We assume that burials without grave offerings also existed, as they certainly did in the Santa María Valley.

The Babícora Settlement System

We are aware of three major site clusters in the Babícora Basin, but lack the information needed to discuss whether there were site hierarchies within or among those clusters. The largest cluster was the Las Varas group, which includes El Zurdo.

Within the basin as a whole, Rancho San Juan may have served as a principal center. The site appears to be quite large, it reportedly yielded a copper artifact, and it also yielded the "twin" points and unusual human effigy pots shown elsewhere in this report.

At a smaller scale, the side valley containing El Zurdo valley contained a village (El Zurdo), two small satellite habitation sites up and down the valley, field houses, and extensive lithic procurement and testing areas.

The Southern Zone in the Chihuahua Culture

Insofar as can be determined by radiocarbon dating, general developments in the Babícora Basin and the upper Santa María Valley parallel those in the Casas Grandes area. Remains in both areas can be assigned to either the Viejo period or the Medio period, and those periods appear to begin and end at roughly the same time. Although the southern zone lacks sites of the size of Paquimé, the size range of southern sites otherwise seems comparable to that for sites in the lower elevation grasslands to the north. The shared village culture extends to the use of adobe room blocks, certain construction techniques, and similarities in pottery, flaked stone, and ground stone.

Nonetheless, there are differences. In the southern zone, sites appear to be less numerous and more clustered than in the north (see Whalen and Minnis 2001). No large water control devices have been identified in our study area. Evidence for specialized craft production has not been found, in contrast with the northern zone's specialized production of items including deep squared metates (VanPool and Leonard 2002) and Ramos Polychrome (Sprehn 2003; Woosley and Olinger 1993). The southern zone also saw much less pottery from outside the Chihuahua culture area than other zones of the culture. As far as we can tell, the production and consumption of pottery and other artifacts was remarkably localized.

For some scholars, the most telling difference between the northern and southern zones is the lack of hallmark Paquimé traits such as platform mounds and ball courts. We had concluded that there were no ball courts in the entire southern zone until one was found in the Santa Clara valley in 2008. None has yet been reported from the Babícora Basin or the upper Santa María Valley, however. Nor have we found large pit ovens (*hornos*) such as those at Paquimé and La Tinaja, where agave was prepared for feasting. Relative to the northern zone, the PAC study area continues to be lacking in architecture related to public ritual.

Distances between points can be used as proxies for travel times and, with caution, for frequency of interaction. Following Drennan (1984) and Wilcox (1995), a person carrying a pack could cover 35 km (22 miles) a day. Applying this scheme, the upper Santa María sites were about a

day's travel from the nearest sites in the Babícora Basin, and a day and a half from the Las Varas sites. El Zurdo was about 3 ½ days from Paquimé, and upper Santa María valley sites would have been some 4 ½ or 5 days from that regional center and about 3 ½ days from Galeana. Much of the travel time between site clusters would have been through areas without known Chihuahua culture habitation sites. Thus, some of the apparent cultural isolation or even "backwoods" flavor of the southern zone may be a simple matter of the distances involved.

Nonetheless, it is possible to overemphasize the differences between north and south. Only a few Medio period rooms have been excavated in the south, and floor plans of entire room blocks are virtually unknown (the exception being Carey's [1931] plan of a room block in the Las Varas Valley), so it is not yet possible to assert that the southern zone's architecture is a pale reflection of the norm to the north. The T-shaped room at Ch-11 (the Raspadura site in the upper Santa Maria valley), along with an *adorno* and ceramic drum recovered from that room, suggest that unusual room forms are not unknown in the south. In any case, many medium-sized and smaller sites in the northern zone also lack elaborate architectural features (Whalen and Minnis 2001), so the southern zone is not as different from the northern one as it appears when using the site of Paquimé as the basis for comparison.

Although Di Peso (1974) included the southern zone in Paquimé's area of resource exploitation and control, the current evidence indicates that the southern uplands were not dominated by that center. In general, recent views about Paquimean economic and political control differ radically from Di Peso's (1974) vision of domination by Mesoamerican merchant-warriors. Whalen and Minnis (1996, 2001) argue that only sites within a 30 km radius of Paquimé were directly controlled by that site. Other authors also question the regional primacy of Paquimé (Douglas 1992, 1995; LeBlanc 1986; Mathien 1986; McGuire 1986, 1993; Vargas 1995). The Villa Ahumada sites are now seen as politically independent from Paquimé, and more aligned with the Jornada Mogollon than with Paquimé (Cruz A. and Maxwell 1999). Wilcox (1995) differentiates local, regional and macro-regional systems. No one in recent years has proposed a single model for the entire Chihuahua culture area but any such attempt would need to accommodate the increasingly apparent local diversity within that culture.

The southern zone has yielded much less representational art than the Casas Grandes area, so it is difficult to talk about similarities or differences in belief and ritual systems, but the pots from Rancho San Juan and the Fresno petroglyph boulder suggest that there was considerable continuity between the two zones (also see Schaafsma 1997). Di Peso (1974), Fish and Fish (1999), Pasahow (1993) and Van Pool (2001) have drawn attention to shared symbols within the Chihuahua culture. In their discussion of the northern part of the Chihuahua culture, Fish and Fish wonder whether the degree of symbolic sharing was a "phenomenon broader than religion per se, perhaps in the realm of 'world view'" (1999:40).

The Chihuahua culture may have been multi-ethnic, the same way that modern Pueblo culture is made up of multiple groups speaking various languages. Baltasár de Obregón, the chronicler of Francisco de Ibarra's 1565 expedition, describes arriving at the "tablelands occupied by the Querechos" who had been at war with the Cumupa to the west (Hammond and Rey 1928:127–128). Hammond and Rey identify the "tablelands" as the Babícora basin area. While the exact location of the Querechos has been debated, with some favoring a more northern basin such as

the Zaragoza, this early account gives an account of two ethnic groups in the general vicinity of the PAC study area. Later, Spanish missions were placed to gain access to the Tarahumara and Conchos, two groups of Uto-Aztecan speakers (Gerhard 1982). The poorly documented Sumas and other early historical groups are generally thought of as being on the northern edge of the area formerly occupied by the Chihuahua culture. With the revised dating of Paquimé (Dean and Ravesloot 1993; Ravesloot et al. 1995), the gap between the end of the Medio period and the earliest historical records is not as large as Di Peso (1974) proposed.

The issue of Mesoamerican-Southwestern relationships is not front and center for current scholars the way it was for Charles Di Peso and J. Charles Kelley. Carroll Riley (2005) continues to explore these topics, however, and some younger researchers are beginning to show an interest in this topic and are learning about northwestern Mesoamerican areas such as Sinaloa and Durango-Zacatecas. Research in the southern zone has little to contribute to debates about how Mexicanized the Chihuahua culture was, or about the processes that led to the adoption and acceptance of traits from western Mesoamerica, except in a negative sense. No trade pottery from Mesoamerica has been identified within the southern zone, with the single exception of a probable Sinaloa sherd in the Sayles collections from the Las Varas Valley. If there were any trade routes across the southern zone, they left no obvious traces (Kelley 2009).

The PAC research in the southern zone, of which El Zurdo work is a hefty part, has documented regional variability within the Chihuahua culture sphere. It has done so by looking at an area that shared a basic culture with the lowlands to the north, but that held itself aloof from the developments that made Paquimé famous. We hope that the PAC's efforts will contribute to a better understanding of the Chihuahua culture in all its variations.

REFERENCES CITED

Adams, Karen R.
1992 Archaeological and Modern Ecological Perspectives on Ancient Sites in West-central Chihuahua, Mexico. Preliminary Report of the 1990 and 1991 Field Schools. On file at Department of Archaeology, University of Calgary, Calgary.

Blake, Emmet R.
1953 *Birds of Mexico.* University of Chicago Press, Chicago.

Breitburg, Emanuel
1993 The Evolution of Turkey Domestication in the Greater Southwest and Mesoamerica. In *Culture and Contact: Charles Di Peso's Gran Chichimeca,* edited by Anne I. Woosley and John C. Ravesloot, pp. 153–172. Amerind Foundation, and University of New Mexico Press, Albuquerque.

Carey, Henry A.
1931 An Analysis of the Northwestern Chihuahua Culture. *American Anthropologist* 33:325–374.

Cruz Antillón, Rafael, and Timothy D. Maxwell
1999 The Villa Ahumada Site: Archaeological Investigations East of Paquimé. In *The Casas Grandes World*, edited by Curtis F. Schaafsma and Carroll L. Riley, pp. 43–53. University of Utah Press, Salt Lake City.

Dean, Jeffrey S., and John C. Ravesloot
1993 The Chronology of Cultural Interaction in the Gran Chichimeca. In *Culture and Contact: Charles Di Peso's Gran Chichimeca,* edited by Anne I Woosley and John C. Ravesloot, pp. 83–104. Amerind Foundation and University of New Mexico Press, Albuquerque.

Di Peso, Charles C.
1974 *Casas Grandes: A Fallen Trading Center of the Gran Chichimeca* (Vols. 1–3). Amerind Foundation, Dragoon and Northland Press, Flagstaff.

Di Peso, Charles C., John B. Rinaldo, and Gloria C. Fenner
1974 *Casas Grandes: A Fallen Trading Center of the Gran Chichimeca* (Vols. 4–8). Amerind Foundation, Dragoon and Northland Press, Flagstaff.

Douglas, John E.
1992 Distant Sources, Local Contexts: Interpreting Nonlocal Ceramics at Paquimé (Casas Grandes), Chihuahua. *Journal of Anthropological Research* 48:1–24.

1995 Autonomy and Regional Systems in the Late Prehistoric Southern Southwest. *American Antiquity* 60:240–257.

Drennan, Robert D.
1984 Long-Distance Transport Costs in Pre-Hispanic America. *American Anthropologist* 86(1):105–112.

Fish, Paul R., and Suzanne K. Fish
1999 Reflections on the Casas Grandes System from the Northwestern Periphery. In *The Casas Grandes World*, edited by Curtis F. Schaafsma and Carroll L. Riley, pp. 27–42. University of Utah Press, Salt Lake City.

Fralick, Philip W., and Joe D. Stewart
1999 Un Informe sobre Análisis Composicional de Pastas Cerámicas de Chihuahua Oeste Central. Paper presented to "La Cerámica Prehispánica de Chihuahua." II Conferencia de Arqueología de la Frontera, Museo de las Culturas del Norte, Casas Grandes, Chihuahua. On file at Lakehead University, Lakehead and the University of Calgary, Calgary.

Fralick, Philip W., Joe D. Stewart, y A. C. MacWilliams
1998 Geochemistry of west-central Chihuahua obsidian nodules and implications for the derivation of obsidian artefacts. *Journal of Archaeological Science* 25:1023–1038.

Gerhard, Peter
1982 *The North Frontier of New Spain* (revised edition). University of Oklahoma Press, Norman.

Hale, J. B.
1949 Aging Cottontail Rabbits by Bone Growth. *Journal of Wildlife Management* 13(2):216–225.

Hammond, George P., and Agapito Rey (translators and editors)
1928 *Obregon's History of 16th Century Explorations in Western America, Entitled Chronicle, Commentary, or Relation of the Ancient and Modern Discoveries in New Spain and New Mexico, 1584.* Wenzel Publishing Co., Los Angeles.

Hard, Robert J.
1990 Agricultural Dependence in the Mountain Mogollon. In *Perspectives on Southwestern Prehistory*, edited by Paul E. Minnis and Charles L. Redman, pp. 135–149. Westview Press, Boulder.

Hastorf, Christine A.
1980 Changing Resource Use in Subsistence Agricultural Groups of the Prehistoric Mimbres Valley, New Mexico. In *Modelling Change in Prehistoric Economies*, edited by Timothy K. Earle and Andrew L. Christenson, pp. 79–120. Academic Press, New York.

Hill, Warren D.
1992 Chronology of the El Zurdo Site, Chihuahua. MA thesis, Department of Archaeology, University of Calgary, Calgary.

Hodgetts, Lisa M.
1995 Faunal Exploitation at the El Zurdo Site (CH-159), A Horticultural Village in North-Central Chihuahua. Honors Thesis, Simon Fraser University, Burnaby.

1996 Faunal exploitation at the El Zurdo site (CH-159), a horticultural village in north-central Chihuahua. *The Kiva* 62:149–170.

Instituto Nacional de Estadística Geografía e Informática (INEGI)
1990 *Estudio Hidrologico de la Alta Babicora, Chihuahua.* Instituto Nacional de Estadística Geografia e Infomatica, Aguascalientes.

Katzenberg, M. Anne, and Monica Webster
2004 Stable Isotope Ecology and Palaeodiet in Chihuahua, Mexico. Paper presented at the 37th Annual Chacmool Conference, University of Calgary, Calgary.

Kelley, Jane H.
1991 Proyecto Arqueológico Chihuahua, Trabajos de Campo 1991. In *Consejo de Arqueología, Boletin 1991*, pp. 157–161. Instituto Nacional de Antropología e Historia, México.

2008 *El Zurdo: A Small Prehistoric Village in West-central Chihuahua, Mexico, Part 1: Introduction and 1991 Field Studies.* Maxwell Museum Technical Series No. 9. Maxwell Museum of Anthropology, University of New Mexico, Albuquerque.

2009 *El Zurdo: A Small Prehistoric Village in West-central Chihuahua, Mexico, Part 2: 1992 Field Studies.* Maxwell Museum Technical Series No. 9, Part 2. Maxwell Museum of Anthropology, University of New Mexico, Albuquerque.

Kelley, Jane H., Joe D. Stewart, A. C. MacWilliams, and Loy C. Neff
1999 A West Central Chihuahuan Perspective on Chihuahuan Culture. In *The Casas Grandes World*, edited by Curtis F. Schaafsma and Carroll L. Riley, pp. 63–77. University of Utah Press, Salt Lake City.

Larkin, Karin Burd, Jane H. Kelley, and M. J. Hendrickson
2004 Ceramics as Temporal and Spatial Indicators in Chihuahua cultures. In *Surveying the Archaeology of Northwest Mexico*, edited by Gillian Newell and Emiliano Gallaga, pp. 177–204. University of Utah Press, Salt Lake City.

Le Blanc, Steven A.
1986 Aspects of Southwestern Prehistory: A.D. 900–1400. In *Ripples in the Chichimec Sea: New Considerations of Southwestern-Mesoamerican Interactions*, edited by Frances Joan Mathien and Randall H. McGuire, pp. 105–134. Southern Illinois University Press, Carbondale.

Leonard, Robert D.
2001 Evolutionary Archaeology. In *Archaeological Theory Today*, edited by Ian Hodder, pp. 65–97. Polity Press and Blackwell Publishing, Cambridge.

Lewall, E. F., and I. McT. Cowan
1963 Age Determinations in Black-Tailed Deer by Degree of Ossification of the Epiphyseal Plate in the Long Bones. *Canadian Journal of Zoology* 41:629–636.

MacWilliams, Arthur C.
2001 *The Archaeology of Laguna Bustillos Basin, Chihuahua, Mexico*. Ph.D. Dissertation, University of Arizona, Tucson.

2008 Identifying Differences in Expedient Flaked Stone Technology from Four Sites in West Central Chihuahua, Mexico. In *Celebrating Jane Holden Kelley and Her Work,* edited by Meade F. Kemrer, pp. 103–119. New Mexico Archeological Council Special Publication No. 5, Albuquerque.

MacWilliams, A. C., Joe D. Stewart, and Jane H. Kelley
2002 Past Boundaries and Frontiers in Chihuahua. In *Boundaries and Territories: Prehistory of the U. S. Southwest and Northern Mexico,* edited by Elisa Villalpando, pp. 117–128. Arizona State University Anthropological Research Papers No. 54, Tempe.

Mathien, Frances Joan
1986 External Contact and the Chaco Anasazi. In *Ripples in the Chichimec Sea: New Considerations of Southwestern-Mesoamerican Interactions,* edited by Frances Joan Mathien and Randall H. McGuire, pp. 220–242. Southern Illinois University Press, Carbondale.

McGuire, Randall H.
1986 Economies and Modes of Production in the Prehistoric Southwestern Periphery. In *Ripples in the Chichimec Sea: New Considerations of Southwestern/Mesoamerican Interactions,* edited by Frances Joan Mathien and Randall H. McGuire, pp. 243–269. Southern Illinois University Press, Carbondale.

1993 Charles Di Peso and the Mesoamerican Connection. In *Culture and Contact: Charles C. Di Peso's Gran Chichimeca,* edited by Anne I. Woosley and John C. Ravesloot, pp. 23–38. Amerind Foundation and University of New Mexico Press, Albuquerque.

McIntosh, R.
1984 Middle Niger Terracottas before the Symplegades Gateway. *African Arts* 22(2):74–88, 103–104.

Minnis, Paul E., Michael E. Whalen, Jane H. Kelley, and Joe D. Stewart
1993 Prehistoric Macaw Breeding in the North American Southwest. *American Antiquity* 58(2):270-276.

Nelson, Ben A., and Steven A. LeBlanc
1986 *Short Term Sedentism in the American Southwest*. University of New Mexico Press, Albuquerque.

Newman, Margaret E.
1991 Immunological Analysis of Artifacts from Chihuahua, México. Manuscript on file at the Department of Archaeology, University of Calgary, Calgary.

Pasahow, Edward
1993 Semantics of the Effigy Mounds of Casas Grandes. In *Rock Art Papers, Vol. 10*, edited by K. Hedges, pp. 7–16. *San Diego Museum Papers* No. 29. Museum of Man, San Diego.

Pennington, Campbell W.
1983 Tarahumara. In *Southwest*, edited by Alfonso Ortiz, pp. 276–289. Handbook of North American Indians, Vol. 10, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Ravesloot, John C., Jeffrey S. Dean, and Michael S. Foster
1995 A New Perspective on the Casas Grandes Tree-Ring Dates. In *The Gran Chichimeca: Essays on the Archaeology and Ethnohistory of Northern Mesoamerica*, edited by Jonathan Reyman, pp. 240–251. Avebury Press, Aldershot.

Riley, Carroll
2005 *Becoming Aztlan: Mesoamerican Influence in the Greater Southwest, A. D. 1200-1500.* University of Utah Press, Salt Lake City.

Sayles, E. B.
1936 *An Archaeological Survey of Chihuahua, Mexico.* Medallion Papers No. 22. Gila Pueblo, Globe.

Sayles, E. B.
n.d. Survey records, site records, camp logs, and correspondence pertaining to the Gila Pueblo Chihuahua Archaeological Survey, 1933. E. B. Sayles Papers, Arizona State Museum Archives, University of Arizona, Tucson.

Schaafsma, Polly
1997 Rock art Sites in Chihuahua, Mexico. *Archaeology Notes* No. 171. Office of Archaeological Studies, Museum of New Mexico, Santa Fe.

Sprehn, Maria
2003 *Social Complexity and the Specialist Potters of Casas Grandes in Northern Mexico.* Ph.D. dissertation, University of New Mexico, Albuquerque.

Stewart, Joe D., P. Fralick, R.G.V. Hancock, Jane H. Kelley, and Elizabeth Garrett
1990 Petrographic Analysis and INAA Geochemistry of Prehistoric Ceramics from Robinson Pueblo, New Mexico. *Journal of Archaeological Science* 17:601–625.

Stewart, Joe D., Jane H. Kelley, A. C. MacWilliams, and Paula J. Reimer
2004 Archaeological Chronology in West-Central Chihuahua. In: *Surveying the Archaeology of Northwest Mexico,* edited by Gillian E. Newell and Emiliano Gallaga, pp.205–246. University of Utah Press, Salt Lake City.

2005 The Viejo period in Northwestern Mexico: Recent Excavations and Radiocarbon Dating. *Latin American Antiquity* 16:169–192.

Szuter, Christine R.
1991 Hunting by Hohokam Farmers. *Kiva* 56:277–291.

Triadan, D., M. J. Blackman, E. C. Gamboa, and R. L. Bishop
2005 Sourcing Casas Grandes Polychrome Ceramics. Paper presented to the 70th annual meeting of the Society for American Archaeology, Salt Lake City.

VanPool, Christine S.
2001 Flight of the Shaman. *Archaeology* 55(1):40–43.

VanPool, Todd L., and Robert D. Leonard
2002 Specialized Ground Stone Production in the Casas Grandes Region of Northern Chihuahua, Mexico. *American Antiquity* 67: 710–730.

VanPool, Todd L., Christine S. VanPool, Rafael Cruz A., Robert D. Leonard, y Marcel Harmon
2000 Flaked stone and social interaction in the Casas Grandes region, Chihuahua, Mexico. *Latin American Antiquity* 11:163–174.

Vargas, Victoria D.
1995 Copper Bell Trade Patterns in the Prehispanic U. S. Southwest and Northwest Mexico. *Arizona State Museum Archaeological Series* No. 187. University of Arizona, Tucson.

Webster, Monica
2001 Prehistoric Diet and Human Adaptation in West Central Chihuahua, Mexico. M.A. thesis, Department of Archaeology, University of Calgary, Calgary.

Withers, Allison C.
1946 Copper in the Prehistoric Southwest. M.A. thesis, University of Arizona, Tucson.

Whalen, Michael E., and Paul E. Minnis
1996 Ball courts and political centralization in the Casas Grandes region. *American Antiquity* 61:732–746.

2001 *Casas Grandes and its Hinterland: Prehistoric Regional Organization in Northwest Mexico.* University of Arizona Press, Tucson.

Wilcox, David R.
1995 A Processual Model of Charles C. Di Peso's Babocomari Site and Related Systems. In *The Gran Chichimeca: Essays on the Archaeology and Ethnohistory of Northern Mesoamerica*, edited by Jonathan E. Reyman, pp. 281–319. Aldershot, Avebury.

Woosley, Anne I., and Bart Olinger
1993 The Casas Grandes Ceramic Tradition: Production and Interregional Exchange of Ramos Polychrome. In *Culture and Contact: Charles C. Di Peso's Gran Chichimeca,* edited by Anne I. Woosley and John C. Ravesloot, pp. 105–132. Amerind Foundation and University of New Mexico Press, Albuquerque.