

Appendix D

Mortuary Analysis

This appendix is a version of a paper entitled *The Social Legacy of Tiwanaku in the Cemetery at El Algodonal*, expected to appear in **Bioarchaeological Studies in the South Central Andes**, edited by Jane Buikstra. It reconstructs aspects of the social organization of the Ilo-Tumilaca/Cabuza group through the analysis their burials in the cemetery at El Algodonal.

In order to understand the Ilo-Tumilaca/Cabuza and Chiribaya groups and their interactions, the clearest possible picture of how they were organized is needed. Many archaeologists (O'Shea 1984; Ravesloot 1988; Tainter 1975a,b, 1976, 1977a,b; Peebles 1971; Binford 1971; Saxe 1970; etc.) have noted that information recovered from burials is particularly suited to shed light on social organization, since funerary activities are likely to be influenced by many or all of the deceased's social roles, and because these activities often result in remains clearly associated with a single person. On the other hand, burial remains are the result of intentional behavior, which adds a degree of complication and uncertainty to their interpretation. The archaeologist cannot know how the funerary ritual reflected the needs of the living as opposed to those of the deceased, nor the extent to which it responded to ideals or beliefs as opposed to physical and social reality (Ucko 1969, Hodder 1982, Pearson 1982).

Despite the caveats, mortuary evidence is one of the best sources of information about past social organization. This analysis addresses three specific issues, framed in terms used by Saxe, O'Shea, Tainter, and others. First, how socially complex was the Ilo-Tumilaca/Cabuza group, as suggested by the number of distinct social roles or specializations available to people? A complex society, in these terms, is one in which

there are many different and possibly independently cross-cutting roles that a person might play. Such roles might be economic specializations (farmer, potter), societal functions (priest, warrior), or family or life-history roles (child, mother). A simple society is one in which there are fewer such roles, or where most of the roles are uniformly played by most of the people such that they are not distinct.

Second, to what extent was the society "ranked," that is, to what extent was access to some roles limited not by ability or interest but by genealogy? Highly ranked societies are often considered more complex or organized, although that need not be the case.

Finally, how did the society's organization change over time? In Chapter 7, we saw that the Chiribaya population expanded dramatically, and they apparently developed increasing degrees of occupational specialization and a wealthy elite while the two groups shared the valley. If the Ilo-Tumilaca/Cabuza group did not change in the same way, there must have been some difference between the groups or asymmetry in their relationship that could provide clues to the processes of their interactions and development.

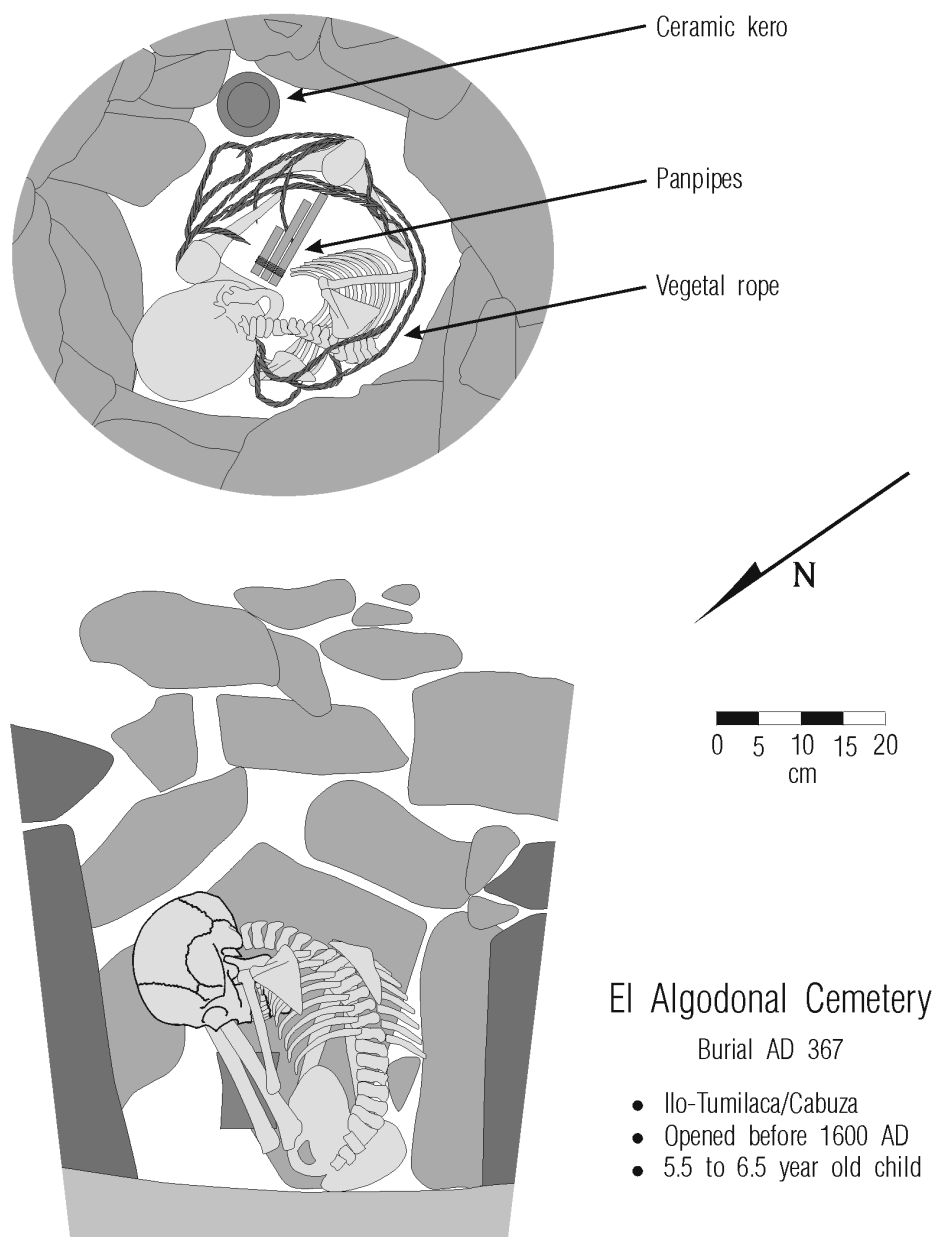
The cemetery at El Algodonal

The cemetery at El Algodonal occupies about 0.15 ha on the eastern end of the site, where the former Algodonal Early Ceramic habitation terraces were deeply buried under a steep gravelly talus slope. An unknown fraction of the cemetery has been eroded away by the river in recent times. The cemetery has been heavily looted, but otherwise the preservation of textiles, wood, plant material, and human and animal tissue is very good. Sherds of the Ilo-Tumilaca/Cabuza tradition were common on the

looted surface. Despite the plentiful evidence of Chiribaya occupation in the terraced western portion of the site, we did not encounter a single Chiribaya sherd, diagnostic Chiribaya textile, or rectangular tomb typical of Chiribaya burials during weeks of work in the cemetery. The Algodonal Early Ceramic domestic habitation component is physically below and artifactually distinct from the burials in the cemetery. All the mortuary material from the cemetery, including burials without diagnostic ceramics and surface collections, can be attributed with confidence to the Ilo-Tumilaca/Cabuza tradition.

The burials, about half in simple pits and half in roughly cylindrical, stone-lined tombs (Figure D-1, Table D-1; burial data tables are arranged from poorest to richest within subadult and adult categories), were dug into the 20 to 30 degree talus slope without any apparent surface markers. The tombs range from 28 to 78 cm in diameter and 46 to 91 cm from the slightly concave dirt floor to the top of the walls, and were originally sealed with large capstones. Some are dry laid stone, many are mortared with a pinkish clay, and two were dry laid with broad tree leaves layered between the stones. The local workmen identified these leaves as pacay (*Inga* sp.), which fits well with Towle's (1961) comments on pacay leaves observed in Paracas mummy bundles and packed around cadavers in the Chillón valley. Some tombs have large stones set vertically as the lowest course of the tomb wall, with smaller stones in random or horizontal positions forming the upper courses. The tombs were capped with a few large stones. Two burials were pits with a few mortared stones forming a poorly defined lip and tomb cap.

The human remains were tightly flexed, completely enveloped in one or more large wool shirts or sacks, and bound on the outside in often complex patterns with



Fragments of deteriorated textiles and mummified tissue are omitted for clarity. Only major bones are shown. The vegetal ropes and panpipes are shown only in plan view.

Figure D-1. A relatively small and simple cylindrical stone lined tomb. [The north arrow is correct here. It was backwards in the dissertation as it was filed.]

Burial ID	Disturbance	Stone lined or Pit	Orientation	Sex	Age group	Adult/subadult
338	sealed, intact	P	NE	-	2	S
371	sealed, intact	P	SW	-	1	S
382	sealed, intact	P	E	-	1	S
342	sealed, intact	P	?	-	1	S
357	opened, unknown date	S	SE	-	1	S
368	medium disturbed	S	SE	-	1	S
376	sealed, intact	P	E	-	1	S
377	sealed, intact	P	E	-	1	S
380	sealed, intact	S	NE	-	1	S
336	severely disturbed	S	?	-	1	S
365	severely disturbed <1600	S	SE	-	1	S
390	slightly disturbed	P	?	-	1	S
367	opened <1600	S	E	-	2	S
370	medium disturbed	S	E	-	1	S
379	sealed, intact	S	NE	-	1	S
363	sealed, intact	P	E	-	2	S
366	medium disturbed <1600	S	E	-	1	S
362	medium disturbed	S	?	?	-	?
335	severely disturbed	S	?	M?	-	A
386	sealed, intact	P	E	F	5	A
520a	medium disturbed	P	?	F	6	A
334	sealed, intact	P	NE	F	5	A
348	sealed, intact	P	E	M	3	A
354	opened, unknown date	S	W	F	6	A
389	severely disturbed	S	?	?	-	A
341	severely disturbed	S	?	F	5	A
369	sealed, intact	P	E	F	4	A
381	opened <1600	P	E	F	5	A
519	sealed, intact	P	S	M	5	A
361	medium disturbed	S	?	?	-	A
520b	slightly disturbed	S	E	M	4	A
339	severely disturbed	S	?	F	4	A
378	medium disturbed	S	?	M?	-	A
383	opened, unknown date	S	E	M	5	A

Table D-1. Burial types, conditions, and demographics of analyzed burials.

twisted vegetal fiber rope, with or without additional wool rope ties. The bodies were not obviously treated in any way prior to being wrapped, except that a few had quids of coca leaves in their mouths, and one had a mass of plant fibers in its nose (Aufderheide n.d.). These may have been inserted after death. The elaborate braided and plaited hairdos may also have been fashioned after death, since they are generally in good condition and show no signs of growing out (Karl Reinhard pers. com.). A few individuals had a dark blue to green thread around the crown of the head outside the cloth wrappings, sometimes with four slender cane or reed segments five to ten cm

long held in vertical positions by the thread and spaced equidistantly around the head. The mummy bundles were placed in upright, seated positions, with the torso (pelvis, chest cavity, and shoulders) facing within 45 degrees of east in all but three cases that could be identified. The few crania that were in their original positions and not obscured by textiles were not turned, but faced down rather than looking forward towards the east.

Grave goods varied considerably in type and number (Tables D-2, D-3, D-4), and it is the variability in these items that provides grist for most of this analysis. Typical items included one or two decorated ceramic vessels (no cooking pots), a basket, a decorated cloth bag generally containing coca leaves, a pair of sandals, the head and mandible of a camelid, often with skin and fur, a whole guinea pig with skin and fur, a wooden spoon, a wad of raw wool, whole yuca roots (*Manihot* sp), corn cobs (*Zea mays*), often with kernels and sometimes unhusked, seeds and pods of pacay (*Inga* sp), beans (*Phaseolus vulgaris*), and bolls, fibers, and seeds of cotton (*Gossypium barbadense*). All the cloth in the cemetery is wool (Boytner 1992a,b), even though scraps of complex, decorated cotton textiles were recovered from midden contexts at the Ilo-Tumilaca/Cabuza site of Loreto Alto just across the narrow valley. The plant inventory was more limited than that of Chiribaya tombs; for example, no lucuma (*Lucuma bifer*a), guava (*Psidium guajava*), or ají peppers (*Capsicum* sp.) were encountered although all are common in Chiribaya burials (Dendy pers. com.).

Six of the seven stone lined tombs with large upright stones around the base contained subadults. Both stone lined tombs with leaves rather than mortar between the stones contained small children with relatively few grave goods. Both pits with mortared stone margins and caps contained old females. These patterns hint at some

Table D-2. Plant and animal offerings in analyzed burials.

Burial ID	Coca (g)	Corn (g)	Corn cobs	Yuca (g)	Pacay (g)	Bean (g)	Achira (g)	Cotton (g)	Raw wool	Camelid heads	Cuyes	Bird	Shell
338	-	-	-	-	-	-	-	-	-	-	-	-	-
371	-	-	-	-	-	-	-	-	-	-	-	-	-
382	-	-	-	-	-	-	-	-	-	-	-	-	-
342	-	-	-	-	-	-	-	-	-	-	-	-	-
357	-	-	-	-	-	-	-	-	-	-	-	-	-
368	-	-	-	-	-	-	-	-	-	-	-	-	-
376	-	-	-	-	-	-	-	-	-	-	-	-	-
377	-	-	-	-	-	-	-	-	-	-	-	-	-
380	-	-	-	-	-	-	-	-	-	-	-	-	-
336	0.5	-	-	-	-	-	-	-	-	-	-	-	-
365	-	-	-	-	-	-	-	0.3	X	-	-	-	-
390	-	-	-	-	-	-	-	-	-	-	-	-	-
367	-	-	-	8.8	-	-	-	-	-	-	-	-	-
370	-	4.5	2	17.9	-	-	-	-	-	-	-	-	-
379	3.8	114.5	5	-	-	-	-	-	X	-	-	-	-
363	-	1.1	-	-	0.7	-	-	0.5	-	-	-	-	-
366	25.0	-	-	27.8	0.3	-	-	0.2	X	1	1	-	-
362	0.6	44.8	12	299.4	-	-	3.8	-	X	-	1	-	-
335	-	-	-	-	-	-	-	-	-	-	-	-	-
386	-	-	-	-	-	-	-	-	X	-	-	-	-
520a	-	-	-	-	-	-	-	-	-	-	-	-	-
334	-	-	-	-	-	-	-	-	X	-	-	-	-
348	-	-	-	-	-	-	-	-	X	-	-	-	-
354	12.6	-	-	-	-	-	-	-	X	-	1	-	-
389	-	0.6	1	-	-	-	-	-	X	-	-	-	-
341	-	14.7	4	-	1.5	0.7	0.4	-	-	-	-	-	-
369	19.3	-	-	-	-	-	-	-	X	-	-	-	-
381	-	-	-	-	-	-	-	-	-	-	1	-	-
519	-	9.8	10	41.7	0.4	-	-	0.5	-	-	-	X	4
361	-	29.2	6	9.5	-	-	-	-	X	1	1	X	2
520b	18.4	-	-	78.6	-	1.0	-	-	X	1	1	X	1
339	-	6.2	2	8.8	-	0.2	0.2	0.3	-	1	1	-	-
378	-	15.4	4	0.2	2.1	1.1	-	0.2	-	3	1	-	2
383	107.6	38.4	11	0.4	4.7	0.5	-	0.4	X	-	1	X	1

Table D-3. Craft goods in analyzed burials.

Burial ID	Ilo-Tumilaca pots	Ilo-Cabuza pots	Bowls	Tazones	Jars	Keros	Other pot forms	Baskets	Spoons	Gourds	Head thread	Sherd	Sandals
338	-	-	-	-	-	-	-	-	-	-	-	-	-
371	-	-	-	-	-	-	-	-	-	-	-	-	-
382	-	-	-	-	-	-	-	-	-	-	-	-	-
342	-	-	-	-	-	-	-	-	-	-	A	-	-
357	1	-	-	-	1	-	-	-	-	-	-	-	-
368	-	-	-	1	-	-	-	-	-	-	-	-	-
376	-	-	-	-	-	-	-	-	-	-	A	-	-
377	-	-	-	-	-	-	-	-	-	-	B	-	-
380	-	-	-	-	-	-	-	1	-	-	-	-	-
336	-	-	-	-	-	-	-	-	-	-	-	-	1
365	-	-	-	-	-	-	-	-	-	-	-	-	-
390	-	-	-	-	-	-	-	-	-	-	D	-	2
367	-	-	-	-	-	1	-	-	-	-	-	-	-
370	-	-	-	-	-	-	-	-	-	-	-	-	2
379	1	-	-	-	-	1	-	-	-	-	-	-	-
363	1	-	-	-	-	1	-	-	-	-	B	-	-
366	-	-	-	1	-	-	-	-	C	-	C	1	-
362	-	1	1	-	-	-	-	1	N	-	-	-	-
335	-	-	-	-	-	-	-	-	-	-	-	-	-
386	-	-	-	-	1	-	-	-	-	-	-	-	-
520a	1	-	-	-	1	-	-	-	-	-	-	-	2
334	1	-	-	-	1	-	-	-	-	-	-	-	2
348	-	-	-	-	-	-	-	-	-	-	-	-	2
354	-	1	-	1	1	-	-	-	-	-	-	-	-
389	-	2	1	-	1	-	-	-	-	-	-	-	2
341	-	-	-	-	-	-	-	-	-	-	-	-	-
369	-	-	-	-	-	-	-	-	-	-	A	1	-
381	1	-	-	1	-	-	1	1	C	-	-	-	2
519	-	1	-	-	1	-	-	-	-	-	-	-	-
361	-	-	-	-	-	-	-	-	C	-	-	-	-
520b	1	-	-	1	-	-	-	-	-	1	-	-	-
339	-	2	1	-	1	-	-	1	N	-	-	-	2
378	-	2	2	-	-	-	-	1	N	2	-	-	-
383	2	-	-	1	-	1	-	1	C	-	D	-	-

Burial ID	Narrow striped textile	Loop stitch band	Other decorated textile				Tied ornaments
				Shirts	Bags	Beads	
338	-	1	-	1	-	-	-
371	-	-	1	-	-	-	-
382	-	-	-	-	-	-	-
342	-	-	1	3	-	-	-
357	-	-	-	-	-	-	-
368	-	-	-	-	-	-	-
376	-	-	1	-	-	-	-
377	-	-	-	-	-	-	-
380	1	-	-	-	-	-	-
336	-	-	3	2	-	-	-
365	-	-	-	1	-	-	-
390	-	-	1	-	-	-	-
367	-	-	-	-	-	-	-
370	2	-	2	1	-	10	-
379	-	-	-	-	-	-	-
363	-	-	-	2	-	-	-
366	-	-	4	-	1	-	3
362	1	-	-	-	-	-	-
335	-	-	-	-	-	-	-
386	-	1	-	2	-	-	-
520a	-	-	-	-	-	-	-
334	-	-	-	1	-	-	-
348	-	-	1	2	-	-	1
354	-	-	2	-	1	-	-
389	-	-	-	1	-	-	-
341	-	-	-	-	-	-	-
369	-	1	1	2	1	-	-
381	-	-	-	-	-	-	-
519	3	1	-	1	1	-	-
361	2	-	-	-	2	-	-
520b	1	-	3	1	2	-	-
339	-	-	-	-	-	-	-
378	-	-	-	-	-	-	-
383	1	-	2	2	2	6	1

Table D-4. Textiles and personal adornments in analyzed burials.

complex and specific ideas about appropriate funerary practices, but the details are probably unrecoverable.

Many of the burials were severely disturbed by modern looters. Fortunately, the looters often toss the mummy bundle intact or only partially damaged into their backdirt. For this reason, the sample of usable human remains, and of textiles with direct age and sex associations, is larger than the sample of reasonably intact burials.

Some tombs were encountered with their capstones removed, yet with the contents of the tomb largely or entirely intact. In the most striking cases, the human remains were clearly in their original positions, with fragile vegetal ropes still in place, ceramic vessels and baskets upright at the bottom of the tomb, spoons resting in bowls, and so on. In several cases this treatment can securely be dated to before the historically documented eruption of the volcano Huaynaputina, which blanketed the region with volcanic ash in AD 1600. No other such event is known from historical or archaeological sources. An undisturbed layer of this Huaynaputina ash rested on the gravel slope above four of the opened burials. These opened burials had been covered without a trace by slumping gravel before the ash fell.

Dauelsberg (1985) suggests that analogous cemeteries in the Arica area (those with "Loreto Viejo" and "Cabuza" ceramics) were systematically looted in antiquity, although they were apparently more severely disturbed in the process. He suspects that the prehistoric looting reflected the attitudes of local people towards the intrusive Tiwanaku-related foreigners. The same might hold true in the coastal Osmore, although here the undisturbed tomb contents suggest some respect or fear, as well. It is also possible that carefully opening some tombs was part of the ritual system of the very group that interred them.

Field and lab methods

Fieldwork at El Algodonal was divided between the habitation areas and the cemetery, including the Algodonal Early Ceramic habitation terraces below it. Two stone lined tombs (AD 520a and AD 520b) and a pit burial (AD 519), all with Ilo-Tumilaca/Cabuza ceramics, were excavated in the habitation area, and are included in the analyzed sample. The rest of the burial sample is from the cemetery.

In the cemetery, relatively intact mummy bundles and concentrations of human remains were collected from the looted surface and the looters' backdirt. A 5 X 5 m area just inside the looted area was cleared down to undisturbed soil, exposing additional looted material and several intact burials. Additional areas were then stratigraphically excavated in the undisturbed talus immediately upslope from the looted area. The excavated and cleared areas total 91.5 square meters, or about 6% of the extant cemetery area. Additional burials were salvaged from the eastern end of the cemetery, where they had been exposed by erosion (Figure D-2), for a total of 34 burials sufficiently intact for analysis.

All soil except some overburden layers was screened through 1/4" screen. The fill in the bottoms of burials was collected as soil samples for finer screening or flotation later. Most of these samples have been processed and rough sorted, and unsystematic inspection suggests that they contain little more than small fragments of the macroscopic artifacts collected during excavation. None of this floated material is included in the present analysis.

In the lab, intact and partially intact mummy bundles were recorded and unwrapped by Juana Lazo (Universidad Católica Santa María, Arequipa). Human

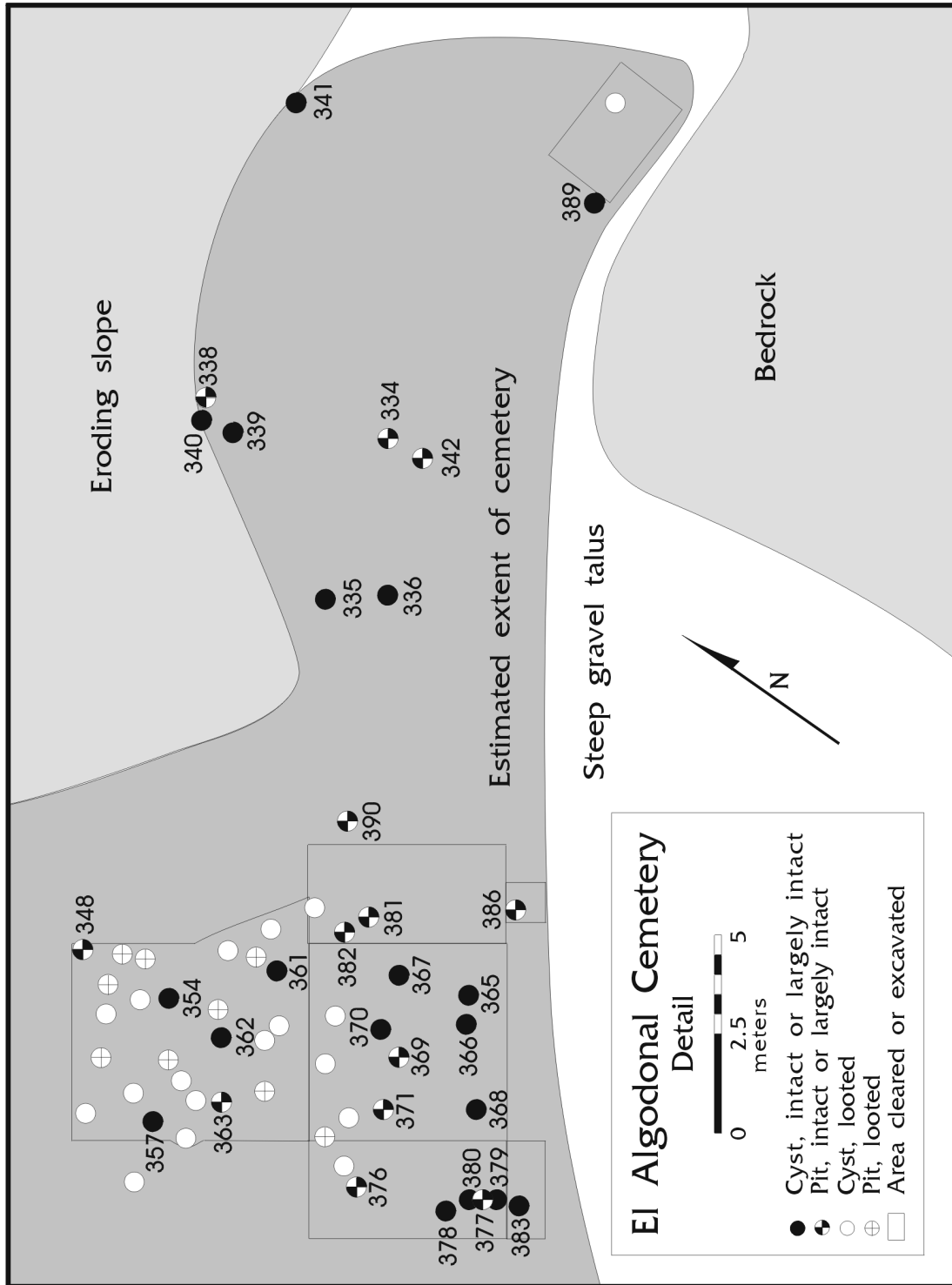


Figure D-2. Detail map of the cemetery at El Algodonal.

remains with good soft tissue preservation were dissected by Dr. Arthur Aufderheide (University of Minnesota, Duluth), who recorded age, sex, pathology, and cadaver treatments. Dr. Sloan Williams (Los Alamos National Laboratory) and Phil Hartnady (University of Missouri) made preliminary age and sex observations, and Shelley Burgess (University of Chicago) did the final detailed analysis of all the human bone which provides the demographic data used here. Ran Boytner (University of California, Los Angeles) recorded, analyzed, and curated the textiles with help from Cecilia Quequezana (Instituto Nacional de Cultura, Arequipa). Fibers were identified by the smell of burning tiny samples and by inspection with a 45 X stereo microscope.

I identified the plant remains by macroscopic and microscopic comparison with specimens identified when fresh by local people, archaeological plant material identified by John Dendy (Washington University) for the Chiribaya Alta project, and published sources, especially Towle (1961). I identified the animal remains by comparison with modern complete guinea pig, rat, lizard, frog, and fish skeletons. Most of the bird material from burials was unmistakable since it consisted of feathers. Fish were generally represented only by isolated vertebrae, and so were excluded from the analysis as probably being contamination from fill. Shell from burials was not further identified, and may also represent fill contamination. The distribution of shell in burials proved to be highly patterned, however, and since its presence or absence in the analysis has little effect on other results, it is included with the caveat that it could be spurious.

Analytical methods

Despite the popularity of principal components analysis and cluster analyses among archaeologists who analyze mortuary data (O'Shea 1984; Tainter 1975b;

Richards 1984; Ravesloot 1988; Pearson et al. 1989; etc.), in the interest of wider understanding and accurate critical assessment, this analysis emphasizes several simple techniques that aid in an essentially manual inspection of the data for intelligible patterns. Principal components analysis is a late step in this analysis; at least in this case, it tends to corroborate patterns already detected by simpler methods, and serves primarily as a heuristic to suggest a refined lumping of categories for a final bout of simple tests.

Both qualitative (presence/absence) and quantitative (number and mass) data were recorded as appropriate; these data were reduced to presence/absence for some purposes, and retained as quantitative values for others. Data management and statistical analyses were done using SAS statistical software, especially the FREQ (Fisher's exact test), TTEST, CORR, and FACTOR (principal components) procedures.

Interesting results in other contexts have been achieved by categorizing grave goods as "sociotechnic" versus "technomic" (Tainter 1975b; Peebles 1971; Binford 1962) in function, but in this sample it proved impossible to categorize more than a handful of objects in this way. Similarly, contrasting local versus imported goods may be useful (Tainter 1975b; Peebles 1971; Arnold 1980), but with the possible exception of coca leaves (John Dendy, pers. com.), there are no clearly imported goods in these burials. Even the rare colorful feathers could be from local wild "parrots" still found in the valley (Manuel Pacheco, pers. com.). Tainter (1977a,b, etc; see also Arnold 1980 and Pearson et al. 1989) suggests estimating the labor costs of grave goods and lots, but these estimates also proved virtually impossible to make with a useful degree of precision (see Charles and Buikstra 1983).

Since more sophisticated approaches could not be applied, summary variables were calculated based on simple counts, masses, and presence/absence of artifacts and artifact types, weighting all equally (Table D-5, Table D-6). This approach is certainly inaccurate, since some items were undoubtedly more economically or symbolically important than others, but at least it avoids introducing additional errors. Finally, since preservation of textiles was variable, totals were calculated both with and without textiles included.

The first and simplest analytical method was to print tables of the burial data sorted by categories such as sex, age, pit versus stone lined tomb, and so on. A second round of sorting by multiple keys further clarified some relationships. Inspection of these sorted tables suggested many of the patterns which were later borne out by more detailed analyses.

Second, the sample was divided into groups according to dichotomous variables such as male vs. female or pit vs. stone lined tomb and the presence or absence of each grave good type or characteristic was tabulated for each group. Since the sample size is small, Fisher's exact test was used to assess the significance of any differences in percent presence in the two groups. Two-tailed probabilities of less than .10 were considered significant for all tests.

Third, the quantitative data were divided according to the same variables, and the means of each group compared using a t test. (An approximate t test was used where the groups' variances differed significantly [$p < .05$] based on the folded form F statistic [SAS Institute 1988:943]). A significant difference in the mean amount of an item could indicate a difference in the frequency that the item is present at all, a

Lumped variables	Definition
Animals (MNI)	Camelid head + cuy + bird
Plant taxa	Number of the following present: achira, yuca, coca, maize, pacay, bean, cotton
Food plant mass	Achira + yuca + maize + pacay + bean
Pots	Bowls + tazones + keros + jars + other forms
Textile items	Shirt + bag + panuelo + other textile forms (does <i>not</i> include textile fragments of unknown form)
Decorated textiles	Narrow striped cloth items + items with loop stitch bands + items with other decoration (mostly elaborated selvages and seams) (counted even if form is unknown)
Misc. items	Model boat + gourd + shell + metal + leather + leaf cylinder "cigarette" + tied "ornament" + raw wool + panpipes + number of the following present: sandal, bead, thread around head with or without canes, sherd placed as grave good (Note that some of these types are also analyzed separately.)
Animal-plant	Number of the following present: achira, yuca, coca, maize, pacay, bean, cotton, bird, camelid head, cotton, shell
Textile-coca	Decorated textiles plus the number of the following present: shirt, bag, coca, raw wool
Summary grave wealth variables	Definition
Total items	Pots + textile items + animals (MNI) + basket + spoon + misc. artifacts + plant taxa
Total items no tex	As above, less textile items
Total types	Textile items plus the number of the following present: basket, sandal, leather, achira, coca, maize, yuca, pacay, bean, camelid head, cuy, bird, spoon, raw wool, cotton, zampona, boat, bead, gourd, shell, metal, leaf cylinder "cigarette", tied "ornament", bowl, tazon, kero, jar, other form of pottery, thread around head with or without canes, sherd placed as grave good
Total types no tex	As above, less textile items

Table D-5. Definitions of lumped and summary variables.

Table D-6. Lumped and summary variables for analyzed burials.

Burial ID	Total pots	Misc. items	Animals MNI	Food plant taxa	Food plant (g)	Textile items	Decorated textile items	Total items	Total items, no textiles	Total types	Types, no textiles	Animal-plant	Textile-coca
338	-	-	-	-	-	1	1	1	-	1	-	-	2
371	-	-	-	-	-	-	1	-	-	-	-	-	1
382	-	-	-	-	-	-	-	-	-	-	-	-	-
342	-	1	-	-	-	3	2	4	1	2	1	-	2
357	1	-	-	-	-	-	-	1	1	1	1	-	-
368	1	-	-	-	-	-	-	1	1	1	1	-	-
376	-	1	-	-	-	-	1	1	1	1	1	-	1
377	-	1	-	-	-	-	-	1	1	1	1	-	-
380	-	-	-	-	-	-	1	1	1	1	1	-	1
336	-	1	-	1	-	2	3	4	2	3	2	1	3
365	-	1	-	1	-	1	-	3	2	3	2	2	2
390	-	2	-	-	-	-	1	2	2	2	2	-	1
367	1	1	-	1	8.8	-	-	3	3	3	3	1	-
370	-	2	-	2	22.4	1	4	5	4	5	4	2	2
379	1	1	-	2	114.5	-	-	4	4	4	4	2	2
363	1	1	-	3	1.8	2	-	7	5	6	5	4	1
366	1	7	2	4	28.1	1	4	16	15	14	13	6	4
362	1	1	1	4	348.0	-	1	9	9	9	9	4	3
335	-	-	-	-	-	-	-	-	-	-	-	-	-
386	1	1	-	-	-	3	1	5	2	4	2	-	3
520a	1	1	-	-	-	-	-	2	2	2	2	-	-
334	1	2	-	-	-	1	-	4	3	4	3	-	2
348	-	4	-	-	-	2	1	6	4	5	4	-	3
354	2	1	1	1	-	1	2	6	5	6	5	1	4
389	2	2	-	1	0.6	1	-	6	5	6	5	1	2
341	-	2	-	4	17.3	-	-	6	6	5	5	4	-
369	-	5	-	1	-	3	2	9	6	8	6	1	5
381	2	1	1	-	-	-	-	6	6	6	6	-	-
519	1	5	1	4	51.9	2	4	13	11	10	8	7	3
361	-	3	3	2	38.7	3	2	12	9	9	8	5	3
520b	1	3	3	3	79.6	3	4	13	10	12	10	6	5
339	2	1	2	5	15.4	-	-	12	12	12	12	7	-
378	2	4	4	5	18.8	-	-	17	17	12	12	8	-
383	2	5	2	6	44.0	4	4	21	17	19	17	9	5

difference in the amount of the item when present, or both. In order to separate the effects of differing presence/absence from differing amount when present, the same tests were repeated using only burials that contained the good in question.

To avoid overlooking important patterns, correlation coefficients were calculated for all pairs of burial variables. Variables that correlated with others in intelligible ways or that correlated with many other variables were used to divide the burials into contrastable groups for the simple tests described above. None of these less-obvious dichotomizing variables resulted in independent conclusions important enough to report here.

After the obvious patterns had been found, the burials were divided into two groups by the most influential factor identified manually, adult versus subadult, and the presence/absence data for each of the two groups were subjected to principal components analysis. Principal components were inspected directly and after each of three different rotations (varimax, quartimax, and procrustean oblique on a varimax prerotation; SAS Institute 1988). The factors contributing to the two most important principal components were used to create two new summary variables by which the burials were divided for a final round of simple dichotomous tests.

The point of principal components analysis is to identify groups of variables that covary independently of other variables. Each group of covarying traits is taken to represent one social role, or "social dimension" in Saxe's (1970) terms. There are both conceptual and technical weaknesses to this approach (Braun 1981 discusses some of them), but judiciously applied, it still provides a useful exploratory tool.

Quality of the sample

The sample used for most of the analyses presented here comprises 34 burials that are sufficiently intact for analysis. Additional individuals from looted contexts are used for the overall demographic profile of the cemetery (83 total), while the relatively intact mummy bundles from the looted surface are added to the burial sample for considerations of the age and sex associations of textiles used to wrap cadavers (61 total).

Though small, the sample is not seriously biased by age, sex, or pottery style (Table D-7). Females tend to be somewhat older than males. Stone lined tomb burials are significantly more often disturbed than are pit burials. Since stone lined tomb burials tend to contain more grave goods, the sample suffers from an indeterminate underrepresentation of burials with large grave lots, a common problem which must be taken into account when considering the overall distribution of goods in the burial population. Ilo-Cabuza ceramics are found only with adults, while Ilo-Tumilaca ceramics are found with subadults as well. Although this may indicate a temporal change in burial practices, to avoid confounding age and temporal effects, comparisons of burials based on pottery styles is limited to burials of adults only

Demography and population estimates

The demographic data for the 83 ageable individuals recovered from excavated and looted contexts conform to Weiss's (1973) model life table MT:22.5-50, which is towards the high mortality end of the normal range of variation for preindustrial populations (Table D-8; Figure D-3). Despite the tuberculosis and anemic disorders noted by Burgess (1992), the group's overall mortality pattern was still better than

Adult /Sub-adult	Age Group	Yrs	Female		Male		Probably Male		Unknown sex		Ilo-Tumilaca		Ilo-Cabuza		Total	
			#	%	#	%	#	%	#	%	#	%	#	%	#	%
			Subadult	1	0-4	-	-	-	-	-	-	14	70	2	25	-
Subadult	2	5-14	-	-	-	-	-	-	3	15	1	13	-	-	3	9
Adult	3	15-24	-	-	1	25	-	-	-	-	-	-	-	-	1	3
Adult	4	25-34	2	25	1	25	-	-	-	-	1	13	1	17	3	9
Adult	5	35-44	4	50	2	50	-	-	-	-	3	38	1	17	6	18
Adult	6	45+	2	25	-	-	-	-	-	-	1	13	1	17	2	6
Adult	?	?	-	-	-	-	2	100	2	10	-	-	2	33	4	12
?	?	?	-	-	-	-	-	-	1	5	-	-	1	17	1	3
Total			8	24	4	12	2	6	20	59	8	24	6	18	34	-

Table D-7. Demographic data and ceramic style for analyzed burials.

some other prehistoric Andean populations (Owen and Norconk 1987), and comparable to some provincial Roman populations (Weiss 1973). This population could be considered stressed, but not unusually so.

No age group or sex is disproportionately represented or missing; the cemetery was evidently used by a complete population. Saxe (1971) suggests that this result indicates an egalitarian society, in the sense that people were not divided into categories sufficiently marked to require separate cemeteries. A more cautious interpretation is that if there were specific categories of people who were buried in other places, they must have included either a small number of individuals or a complete mix of demographic types, such as an entire settlement or a chiefly family. Given that there were evidently a limited number of higher-status burials with Ilo-Tumilaca pottery at Chiribaya Alta, the cemetery at El Algodonal can reasonably be taken as representative of the general Ilo-Tumilaca/Cabuza population with the

Adult/ SubAdult	Age Group	Years	Female		Male		Unknown sex		Total	
			#	%	#	%	#	%	#	%
Subadult	1	0-4	-	-	-	-	27	64	27	33
Subadult	2	5-14	-	-	-	-	9	21	9	11
Adult	3	15-24	1	4	3	20	-	-	4	5
Adult	4	25-34	9	35	1	7	-	-	10	12
Adult	5	35-44	5	19	3	20	-	-	8	10
Adult	6	45+	5	19	3	20	1	2	9	11
?	?	?	6	23	5	33	5	12	16	19
Total			26	31	15	18	42	51	83	-

Table D-8. Demographic data for all aged or sexed individuals represented by ≥ 10 bones.

exception of a limited number of higher status individuals or families.

No spatial patterning could be detected in the distribution of ages, sexes, pits, stone lined tombs, pottery styles, or overall richness of burials within the cleared and excavated areas of the cemetery (see Figure D-2). There is no indication that the location or limited area of collection introduces any bias into the sample.

El Algodonal has the largest visible Ilo-Tumilaca/Cabuza cemetery in the valley, yet it represents only a tiny population. The areas cleared and excavated were chosen in part because they appeared to have the densest mortuary remains. Assuming for the sake of argument that this density holds for the entire cemetery area, and that fully one half of the original area has been eroded away or buried by talus, then as a generous upper limit the cemetery originally held a maximum of 1600 burials. A minimal estimate is 200 burials, and a best guess calculation yields 600 to 800, which still seems high based on field impressions. Radiocarbon dates and pottery associations suggest that the cemetery was used for the full duration of the Ilo-Tumilaca to Ilo-

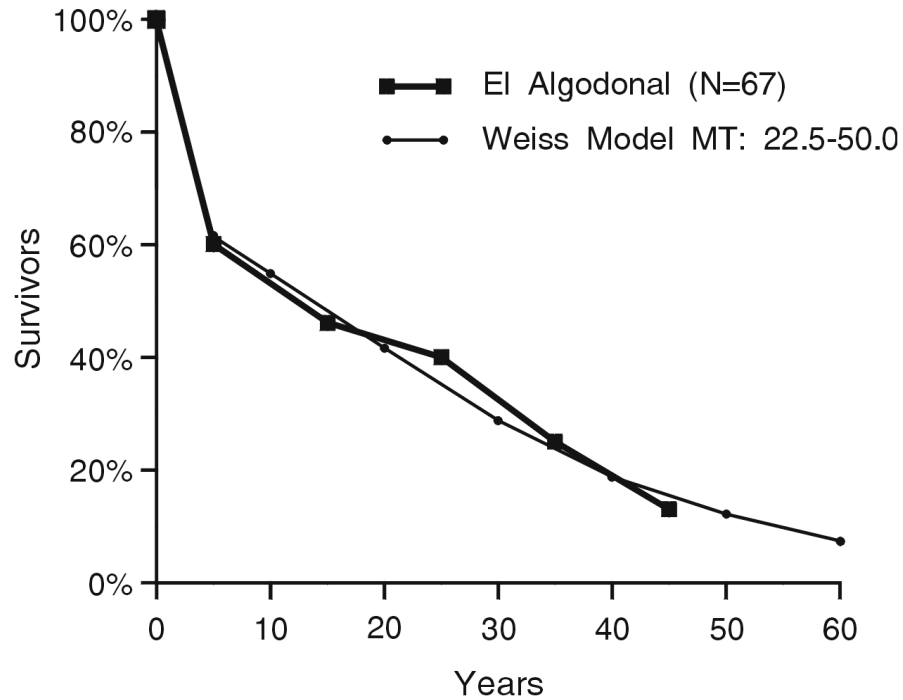


Figure D-3. Survivorship curve with best fitting model life table data.

Cabuza development. Estimating this period as 300 years, there were a maximum of 5.3 burials per year, a minimum of .7, and most likely 2 to 2.7 burials per year. The best fitting model life table from Weiss (1973) implies a crude death rate of .0495 deaths per person per year, which in turn implies that the population using the cemetery comprised at most 108 people, minimally 14 people, and most likely 40 to 54 people at any given time. Even if the period of use of the cemetery is significantly overestimated, the cemetery still represents at most a small hamlet.

Pottery style and social change over time

This analysis treats the entire cemetery as representative of a single population. This treatment is justifiable only if there was little temporal change in relevant traits during the period of the cemetery's use. Four radiocarbon dates from burials at El Algodonal and four dates from domestic midden at the site of Loreto Alto indicate a long period of use of the cemetery and occupation of Loreto Alto by people using the

same styles of pottery, lasting from around AD 950 to 1250 (Appendix B). The dates suggest a temporal development in the pottery styles, with the fine, Tiwanaku-like Ilo-Tumilaca style lasting from about AD 950 to 1050 and grading into the cruder Ilo-Cabuza style, lasting from about AD 1000 to 1250.

Adults with Ilo-Tumilaca pottery and those with Ilo-Cabuza pottery do not differ in presence/absence or amounts of virtually any artifact or burial trait, and there is no significant difference in the overall richness of adult burials with the two styles of pottery (Table D-9). Although it was originally suspected that the cruder Ilo-Cabuza pottery might be the lower-quality end of a spectrum of contemporary pottery variation, the lack of any significant difference in the amount of associated non-ceramic goods suggests that there was no marked status difference between the two styles. Since there is no indication of any significant change over time in types or quantities of grave goods placed in burials, it is reasonable to analyze the entire cemetery as a unit, despite its extended period of use.

The two significant correlations to the stylistic change in pottery are exceptions that prove the rule. First, the wooden spoons found with Ilo-Tumilaca pottery have the profile of a camelid cut into the handle, like the wooden spoons from Tumilaca phase contexts in Moquegua. The wooden spoons found with Ilo-Cabuza pottery have geometric notches similar to spoons from Chiribaya contexts. Second, the rounded ceramic bowl form is unknown in the Ilo-Tumilaca style and the Moquegua Tumilaca style, but is common in Ilo-Cabuza and Chiribaya style ceramics. These variations in spoon styles and bowl forms are exactly what would be expected if the Ilo-Tumilaca pottery style were earlier and more directly related to Moquegua Tiwanaku traditions and the Ilo-Cabuza style were later and more local, that is, more like Chiribaya.

Item	Presence/Absence					Amount present (only in burials with item)						T test 2-tailed p=	
	Ilo-Tumilaca Adult N=5		Ilo-Cabuza Adult N=5		Fisher's Exact test 2-tailed p=	Ilo-Tumilaca Adult			Ilo-Cabuza Adult				
	#	%	#	%		N	Mean	Std	N	Mean	Std		
Head string ± canes	1	20	0	0	1.0								
Sherd as offering	0	0	0	0	-								
Ilo-Tumilaca pottery	5	100	0	0	-								
Ilo-Cabuza pottery	0	0	5	100	-								
Ilo-Tumilaca/Cabuza	1	20	2	40	1.0								
Bowl (rounded)	0	0	3	60	.17	-	-	-	3	1.3	.58	-	
Tazon (angular)	3	60	1	20	.52								
Kero	1	20	0	0	1.0								
Jar	2	40	4	80	.52								
Pots, any type	5	100	5	100	-	5	1.4	.55	5	1.8	.45	.24	
Spoon with llama	2	40	0	0	.44								
Spoon with notches	0	0	2	40	.44								
Spoon, any type	2	40	2	40	1.0								
Basket, any type	2	40	2	40	1.0								
Sandal(s)	3	60	2	40	1.0								
Gourd	1	20	1	20	1.0								
Shell	2	40	2	40	1.0								
Bead(s)	1	20	0	0	1.0								
Tied ornament (?)	1	20	0	0	1.0								
Cloth-narrow stripes	2	40	1	20	1.0	2	1.5	.71	1	3.0	-	.33	
Cloth-loopstich band	0	0	1	20	1.0								
Cloth-other decorated	2	40	1	20	1.0	2	2.5	.71	1	2.0	-	.67	
Cloth-all decorated	2	40	2	40	1.0	2	4.0	0	2	3.0	1.4	.50	
Shirt	3	60	2	40	1.0	3	1.3	.58	2	1.0	0	.50	
Bag	2	40	2	40	1.0	2	2.0	0	2	1.0	0	-	
All cloth items	3	60	3	60	1.0	3	2.7	1.5	3	1.3	.58	.23	
Camelid head	1	20	2	40	1.0								
Cuy	3	60	3	60	1.0								
Bird/feathers	2	40	1	20	1.0								
All animals (MNI)	3	60	4	80	1.0	3	2.0	1.0	4	2.0	1.4	1.0	
Raw wool	3	60	2	40	1.0								
Cotton	1	20	3	60	.52								
Maize (grams)	1	20	4	80	.21	1	38.4	0	4	8.0	6.2	.02 *	
Maize cob (number)	1	20	4	80	.21	1	11.0	0	4	4.25	4.0	.23	
Yuca root (grams)	2	40	3	60	1.0	2	39.5	55.3	3	16.9	21.9	.55	
Bean (grams)	2	40	2	40	1.0	2	.75	.35	2	.65	.64	.86	
Pacay (grams)	2	40	1	20	1.0	1	4.7	0	2	1.25	1.2	.26	
Achira (grams)	0	0	1	20	1.0	-	-	-	1	.20	0	-	
Coca (grams)	2	40	1	20	1.0	2	63.0	63.1	1	12.6	-	.63	
All plants (grams)	2	40	5	100	.17	2	61.8	25.2	4	21.7	21.6	.11	
Pit	1	20	1	20	1.0								
Stone lined tomb	2	40	4	80	.54								
Lumped and summary variables below are based on all burials, with or without item													
Animal-plant						5	2.6	3.4	5	4.7	3.1	.28	
Textile-coca						5	1.9	2.1	5	2.0	1.7	.91	
Total artifacts						5	9.2	7.8	5	10.8	4.8	.71	
Total artifacts, no textiles						5	8.6	6.9	5	10.0	5.1	.52	
Total types						5	8.6	6.9	5	9.2	3.0	.86	
Total types, no textiles						5	7.6	6.1	5	8.4	3.5	.81	

Table D-9. Selected grave goods by ceramic style.

The Ilo-Tumilaca style is thought to have lasted about 100 years in the valley, while the Ilo-Cabuza styles lasted much longer, about 250 years. Yet more burials with Ilo-Tumilaca pottery were found than with Ilo-Cabuza pottery (Tables D-7 and D-9). This biased representation of styles may indicate that the population using the cemetery was larger in the earlier time period, and declined into the later Ilo-Cabuza times.

The cemetery at El Algodonal says nothing about temporal changes among people buried elsewhere. If my impression is correct that only Ilo-Tumilaca, and not Ilo-Cabuza, burials are found at Chiribaya Alta, then there could have been a marked demotion or the complete loss of the category of Ilo-Tumilaca/Cabuza people important enough to be buried at the valley's principal place. This change, if it occurred, did not visibly affect the burial practices of the more ordinary people interred at El Algodonal.

Gender roles

The sample of adults of known sex is small, but nonetheless it shows some strong patterns. Only males were buried with shell, feathers or complete birds, and the ornaments (ritual objects?) that are made of bone, wood, or cane wrapped with string. Burials of males were significantly more likely to include yuca, shirts, textiles with narrow multicolored stripes, and decorated textiles in general (Table D-10). These sex biases in access to textiles were also significant in the larger sample that includes relatively intact mummy bundles from looted contexts (Table D-11). Almost all of the non-significant differences in artifact frequency favor males. Burials of males had significantly higher total plant mass (excluding coca), and significantly higher total

Item	Presence/Absence				Fisher's Exact test 2-tailed p=	Amount present (only in burials with item)						T test 2-tailed p=
	Female N=8		Male N=4			Female			Male			
	#	%	#	%		N	Mean	Std	N	Mean	Std	
Head string ± canes	1	13	1	25	1.0							
Sherd as offering	1	13	0	0	1.0							
Ilo-Tumilaca pottery	3	38	2	50	1.0							
Ilo-Cabuza pottery	2	25	1	25	1.0							
Ilo-Tumilaca/Cabuza	2	25	0	0	.51							
Bowl (rounded)	1	13	0	0	1.0	1	1	-	0	-	-	-
Tazon (angular)	2	25	2	50	.55							
Kero	0	0	1	25	.33							
Jar	5	63	1	25	.55							
Pots, any type	6	75	3	75	1.0	6	1.5	.55	3	1.3	.58	.68
Spoon with llama	1	13	1	25	1.0							
Spoon with notches	1	13	0	0	1.0							
Spoon, any type	2	25	1	25	1.0							
Basket, any type	2	25	1	25	1.0							
Sandal(s)	4	50	1	25	.58							
Gourd	0	0	1	25	.33							
Shell	0	0	3	75	.02 *							
Bead(s)	0	0	2	25	.33							
Tied ornament (?)	0	0	2	50	.09 *							
Cloth-narrow stripes	0	0	3	75	.02 *	0	-	-	3	2.0	1.0	-
Cloth-loopstich band	2	25	1	25	1.0	2	1.0	0	1	1.0	-	-
Cloth-other deco	2	25	4	75	.22	2	1.5	.71	3	2.0	1.0	.59
Cloth-all decorated	3	38	4	100	.08 *	3	1.7	.58	4	3.3	1.5	.15
Shirt	3	38	4	100	.08 *	3	1.7	.58	4	1.5	.58	.72
Bag	2	25	3	75	.22	2	1.0	0	3	1.7	.58	.22
All cloth items	4	50	4	100	.21	4	2.0	1.2	4	2.8	.96	.36
Camelid head	1	13	1	25	1.0							
Cuy	3	38	2	50	1.0							
Bird/feathers	0	0	3	75	.02 *							
All animals (MNI)	3	38	3	75	.55	3	1.3	.58	3	2.0	1.0	.37
Raw wool	4	50	3	75	.58							
Cotton	1	13	2	50	.24							
Maize (grams)	2	25	2	50	.55	2	10.5	6.0	2	24.1	20.2	.46
Maize cob (number)	2	25	2	50	.55	2	3.0	1.4	2	10.5	.71	.02 *
Yuca root (grams)	1	13	3	75	.07 *	1	8.8	-	3	40.2	39.1	.56
Bean (grams)	2	25	2	50	.55	2	.45	.35	2	.75	.35	.49
Pacay (grams)	1	13	2	50	.24	1	1.5	-	2	2.6	3.0	.83
Achira (grams)	2	25	0	0	.52	2	.30	.14	0	-	-	-
Coca (grams)	2	25	2	50	.55	2	16.0	4.71	2	63.0	63.1	.40
All plants (grams)	4	50	3	75	.58	4	2.8	2.1	3	4.3	1.5	.32
Pit	3	38	2	50	1.0							
Stone lined tomb	3	38	2	50	1.0							
Lumped and summary variables below are based on all burials, with or without item												
Animal-plant						8	1.6	2.6	4	5.5	3.9	.06 *
Textile-coca						8	1.8	2.1	4	4.0	1.2	.07 *
Total artifacts						8	6.3	3.1	4	13.3	6.1	.02 *
Total artifacts, no textiles						8	5.3	3.2	4	10.5	5.3	.06 *
Total types						8	5.9	3.0	4	11.5	5.8	.05 *
Total types, no textiles						8	5.1	3.2	4	9.8	5.4	.09 *

Table D-10. Selected grave goods by sex.

Item	Presence/Absence					Amount present (only in burials with item)						
	Female N=17		Male N=9		Fisher's Exact test 2-tailed p=	Female			Male			T test 2-tailed p=
	#	%	#	%		N	Mean	Std	N	Mean	Std	
Cloth-narrow stripes	1	6	3	33	.10	1	1.0	-	3	2.0	1.0	.48
Cloth-loopstich band	4	24	1	11	.63	4	1.0	0	1	1.0	-	-
Cloth-other deco	6	35	8	89	.01 *	6	1.2	.41	8	3.3	4.8	.26
Cloth-all decorated	7	41	9	100	.004 *	7	1.7	.76	9	3.7	4.5	.23
Shirt	10	59	9	100	.06 *	10	1.7	1.1	9	1.6	.7	.74

Table D-11. Textiles by sex, including looted mummy bundles.

grave wealth by any of the four measures. On the other hand, a number of artifact categories, including ceramic vessels, plants, raw wool, and animals, appear have been buried equally with both sexes, and there is no detectable difference in burial treatment such as orientation or burial in stone lined tombs versus pits. Males more often had coca bags and coca leaf, but the difference was not statistically significant (see Cartmell et al. 1991). No artifact type or category was preferentially buried with females.

The bulk of the patterning is in the frequency of presence of specific goods; the amount of most items interred with males averaged more than the amount interred with females, but not significantly (Table D-10). The gender differences noted are mostly quantitative, not qualitative; there were few goods and no textile traits (Boytner 1992a,b) that were strictly limited to one sex, but males were generally buried with more goods than females. The gender difference is generally most pronounced in textile clothing (not including coca bags); the feathers and tied ornaments uniquely associated with males may also be articles of clothing or personal adornment. Although the hair styles of these cadavers have not been studied, the preliminary impression is that the more elaborate braided and plaited styles were generally on males (Aufderheide n.d. and pers. com.).

Interpretation of these mortuary differences by gender is difficult, since we have no access to the beliefs and motivations of the people who selected and placed the grave goods (Pearson 1982; Hodder 1982). Nevertheless, this analysis proceeds from a conventional assumption that is probably more often right than wrong, in order to suggest some reasonable if unprovable conclusions based on the information available. The assumption is that the grave goods interred with a person's cadaver reflect in a general way the person's real or idealized condition in life (Saxe 1970, 1971; Binford 1971; Tainter 1977; Peebles 1971; Arnold 1980). Given this assumption, it appears that in Ilo-Tumilaca/Cabuza society there were not rigidly differentiated male and female roles, but rather a tendency for males to have greater access to goods and/or varied social roles than females.

That the gender differences should be strongest in aspects of clothing, and especially decorated clothing and adornment, might suggest that in general males were more involved in activities that involved personal display, either to impress others or to identify status or affiliation. Perhaps males moved about the countryside more than females, making it more important for them to wear clothing that offered cues about affiliation or status to strangers (Wobst 1977). This prehistoric gender bias is diametrically opposed to the distribution of elaborate clothing, ornaments, and hairstyles among many traditional Andean people today. Modern Andean females may well be more mobile and/or more involved in social or economic relations mediated by personal display than are males. It is possible that these gender roles have reversed since prehistoric times.

Age roles

The sample of sufficiently intact burials is too small to be effectively split into the six age categories used for the demographic analysis, or even into a three-way subadult/adult/old division (Table D-8). This analysis divides the population simply into adult and subadult age categories.

Burials of adults were significantly more likely than burials of subadults to include many artifact types (Table D-12). Even where it is not statistically significant, the difference almost always favors adults. Coca is an exception; there is no significant difference in the presence or absence of coca between burials of adults and subadults (see Cartmell et al. 1991). Burials of adults have significantly greater grave wealth by any of the four measures (Table D-12). The difference is primarily in the frequency of presence of various artifacts; although the mean amount of many items when present is higher in burials of adults, only in the case of ceramic vessels is the amount found with adults significantly greater than the amount found with subadults.

Although textile clothing, especially decorated textiles, was strongly patterned by gender among adults, textiles were distributed more evenly across age classes (Table D-12). In the larger sample that includes the relatively intact looted mummy bundles (Table D-13), adults are significantly more likely to have shirts, and have more of them, but decorated textiles of all kinds still appear to have been distributed independently of age category. It may be that access to decorated textiles was determined in part by sex from an early age, while access to other categories of goods was related to other roles or other aspects of gender roles that were not adopted until adulthood.

Item	Presence/Absence					Amount present (only in burials with item)						
	Adult N=16		Subadult N=17		Fisher's Exact test 2-tailed p=	Adult			Subadult			T test 2-tailed p=
	#	%	#	%		N	Mean	Std	N	Mean	Std	
Head string ± canes	2	13	6	35	.23							
Sherd as offering	1	6	1	6	1.0							
Ilo-Tumilaca pottery	5	31	3	18	.44							
Ilo-Cabuza pottery	5	31	0	0	.02 *							
Ilo-Tumilaca/Cabuza	3	19	2	12	.66							
Bowl (rounded)	3	19	0	0	.10	3	1.3	.58	0	-	-	-
Tazon (angular)	4	25	2	12	.40							
Kero	1	6	3	18	.60							
Jar	7	44	1	6	.02 *							
Pots, any type	11	69	6	35	.08 *	11	1.6	.52	6	1.0	0	.02 *
Spoon with llama	3	19	1	6	.34							
Spoon with notches	2	13	0	0	.23							
Spoon, any type	5	31	1	6	.09 *							
Basket, any type	4	25	1	6	.18							
Sandal(s)	6	38	3	18	.30							
Gourd	2	13	0	0	.23							
Shell	5	31	0	0	.02 *							
Bead(s)	1	6	1	6	1.0							
Tied ornament (?)	2	13	1	6	.60							
Cloth-narrow stripes	4	25	2	12	.40	4	2.0	.82	2	1.5	.71	.51
Cloth, loopstich band	3	19	1	6	.34	3	1.0	0	1	1.0	-	-
Cloth, other decorated	5	31	7	41	.72	5	1.8	.84	7	1.9	1.2	.93
Cloth, all decorated	8	50	9	53	1.0	8	2.5	1.3	9	2.0	1.3	.45
Shirt	8	50	6	35	.49	8	1.5	.53	6	1.7	.82	.65
Bag	6	38	1	6	.04 *	6	1.5	.55	1	1.0	-	.44
All cloth items	10	63	7	41	.30	10	2.3	1.1	7	1.6	.79	.14
Camelid head	4	25	1	6	.18							
Cuy	7	44	1	6	.02 *							
Bird/feathers	4	25	0	0	.04 *							
All animals (MNI)	8	50	1	6	.01 *	8	2.1	1.1	1	2.0	-	.92
Raw wool	9	56	3	18	.03 *							
Cotton	4	25	3	18	.69							
Maize (grams)	7	44	3	18	.14	7	16.3	13.2	3	40.0	64.5	.59
Maize cob (number)	7	44	2	12	.06 *	7	5.4	3.2	2	3.5	2.1	.53
Yuca root (grams)	6	38	3	18	.26	6	23.2	31.2	3	18.2	9.5	.80
Bean (grams)	5	31	0	0	.02 *	5	.70	.37	0	-	-	-
Pacay (grams)	4	25	2	12	.40	4	2.2	1.8	2	.50	.28	.29
Achira (grams)	2	13	0	0	.23	2	.30	.14	0	-	-	-
Coca (grams)	4	25	3	18	.69	4	39.5	45.5	3	9.8	13.3	.33
All plants (grams)	10	63	7	41	.30	8	33.3	25.3	5	35.1	15.6	.93
Pit	5	31	8	47	.48							
Stone lined tomb	9	56	9	53	1.0							
Lumped and summary variables below are based on all burials, with or without item												
Animal-plant						16	3.1	3.4	17	1.1	1.7	.05 *
Textile-coca						16	2.2	2.0	17	1.3	1.2	.13
Total artifacts						16	8.6	5.6	17	3.2	3.8	.003 *
Total artifacts, no textiles						16	7.2	5.1	17	2.5	3.5	.004 *
Total types						16	7.5	4.7	17	2.8	3.3	.002 *
Total types, no textiles						16	6.6	4.4	17	2.4	3.1	.004 *

Table D-12. Selected grave goods by adult vs. subadult.

Item	Presence/Absence					Amount present (only in burials with item)						
	Adult N=33		Subadult N=28		Fisher's Exact test 2-tailed p=	Adult			Subadult			T test 2-tailed p=
	#	%	#	%		N	Mean	Std	N	Mean	Std	
Cloth-narrow stripes	6	18	6	21	.76	6	1.7	.82	6	1.2	.41	.21
Cloth-loopstich band	5	15	2	.07	.44	5	1.0	0	2	1.0	0	-
Cloth-other deco	14	42	11	39	1.0	14	2.4	3.7	11	1.6	1.0	.50
Cloth-all decorated	18	55	18	64	.60	18	2.7	3.3	18	1.6	1.0	.21
Shirt	21	64	10	36	.04 *	21	1.6	.87	10	1.6	.70	.93

Table D-13. Textiles by adult vs. subadult, including looted mummy bundles.

The total grave wealth among subadults is relatively uniform and low, while among adults it is more broadly dispersed, possibly multimodal, and higher (Figures D-4 and D-5). Two modes in the distribution of goods among burials of adults appear to correspond to a distribution with a lower central tendency for females, and a different distribution with a higher central tendency for males. One interpretation of these distributions is that subadults were relatively undifferentiated socially and played a limited range of roles, while adults achieved variable numbers and types of roles, strongly influenced but not simply determined by gender.

These patterns create the impression that most people's social roles were achieved in adulthood, rather than ascribed from birth. The unusually rich burial of a 3 to 3.5 year old Ilo-Tumilaca child (AD 366) might, however, indicate that some social roles or statuses were ascribed. Additional evidence of ascribed rank may be systematically missing from the sample, because high ranking people may have been interred at Chiribaya Alta.

Other roles and principal components analysis

Inspection of crosstabulations, correlation coefficients, and numerous runs of the simple tests used above failed to detect clear patterning within the adult and subadult

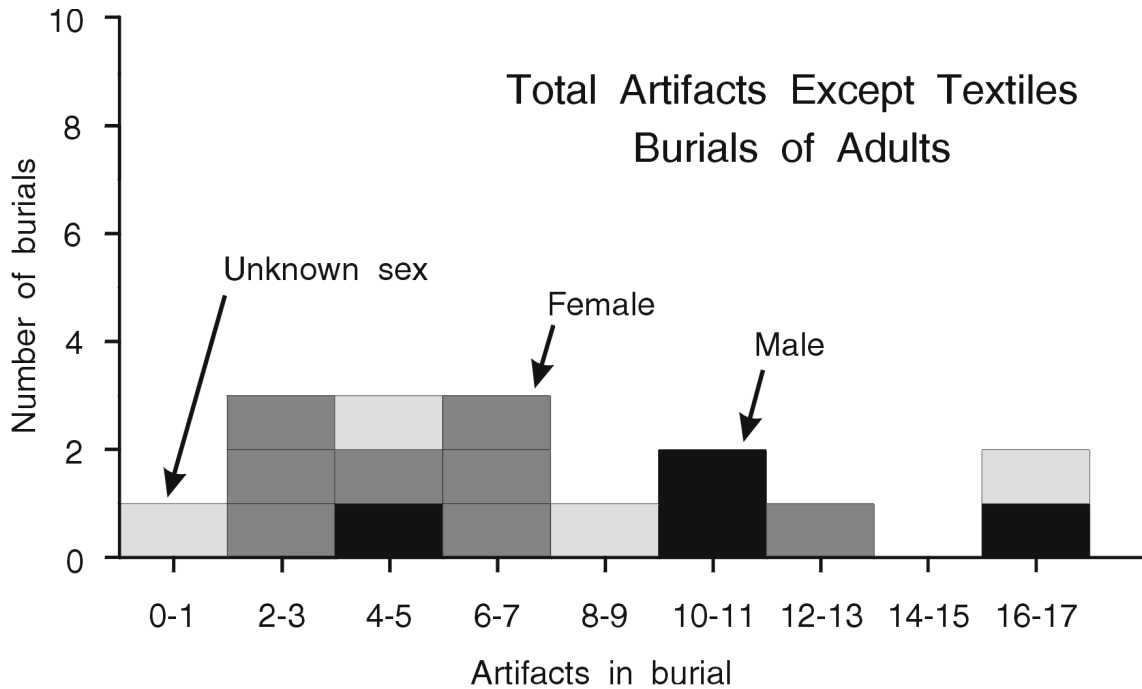


Figure D-4. Grave wealth distribution among adults.

age categories beyond the gender effects already noted. This may be due in part to the reduced sample size in each of the age categories, but it might also reflect a genuine lack of additional strong patterns. It did appear, however, that several textile variables and coca seemed to vary quite independently of the trends in plant, animal, and other artifacts which tended to loosely covary along with the summary wealth measures. These two groups of covarying artifacts could represent additional "dimensions of variability" or social roles available to adults.

To explore this pattern and to seek others that might have been missed in the simple analyses, the presence/absence data for adult and subadult burials were separately subjected to principal components analysis using several coding and lumping schemes and various different factor rotations. The different factor rotations produced very similar results, but increased lumping of variables clearly reduced the intelligibility of the results. Only the most intelligible results are reported here.

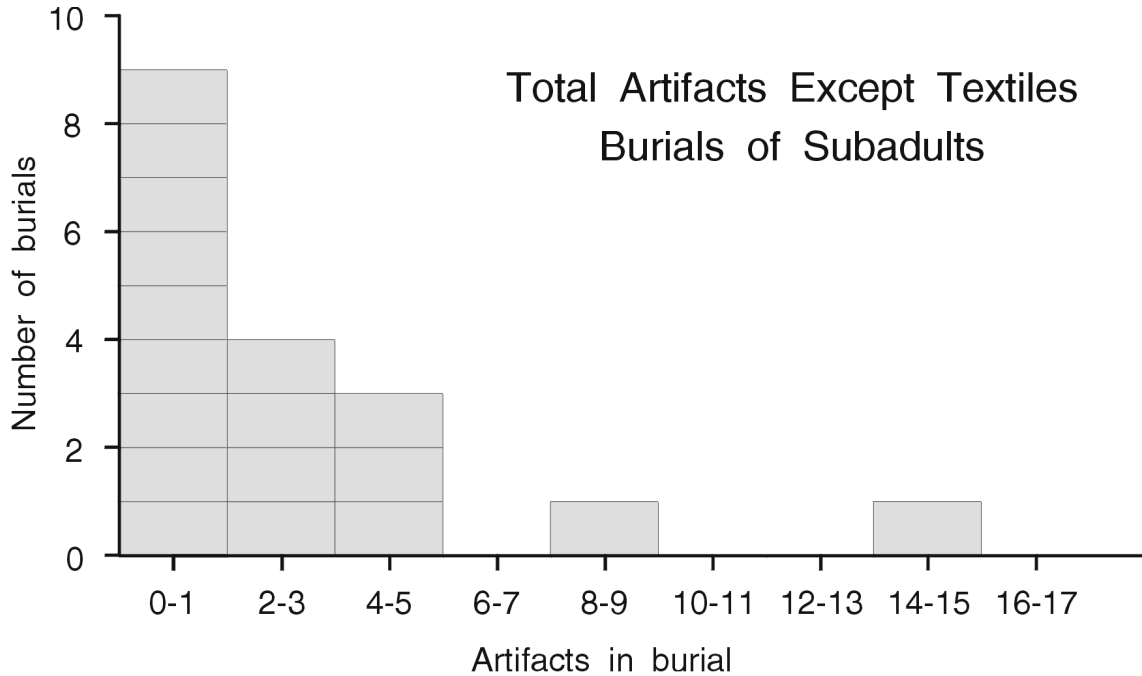


Figure D-5. Grave wealth distribution among subadults.

Among burials of adults, the strongest patterns were exactly those noted in the manual analysis (Table D-14). Principal component one seems related to subsistence production, since it is largely comprised of plant and animal goods, including shell. Three confusing additions are wooden spoons, bird material (representing birds hunted for food?), and a strong negative loading on raw wool. Principal components are independent, so wool's role in component two does not explain its negative loading in component one. Principal component two seems related to personal effects and clothing, largely measuring coca and coca bags, shirts and decorated textiles, raw wool (raw material for textiles), and bird material (representing feathers used for personal decoration, maybe sewn on textiles?). The one confusing element in this component is shell. Cotton loads strongly on the subsistence production component, rather than the textile component. In these burial contexts cotton is always raw fiber or string, never cloth, so it fits comfortably with the crops of component one rather than the textiles of

Item, Adults only	Component 1 "Subsistence"	Component 2 "Coca/ decorated clothing"	Component 3	Component 4	Component 5	Component 6
Maize	* 81	-14	14	3	7	2
Yuca	* 82	34	* 40	-7	0	-15
Minor plants	* 83	-3	18	11	25	2
Camelid head	* 42	18	* 59	* -47	-1	-24
Bird	* 57	* 69	6	4	5	-21
Cuy	21	18	* 91	-2	11	-20
Cotton	* 85	-10	24	28	-5	13
Spoon	* 40	-15	* 71	15	-22	-37
Shell	* 71	* 51	20	-2	7	-30
Raw wool	* -39	* 76	6	21	-6	16
Shirt	2	* 59	-36	* 38	-25	36
Decorated textiles	1	* 88	-12	19	8	-11
Bag	19	* 78	8	14	* 41	-9
Coca	-17	* 57	27	* 44	* 55	8
Basket	37	-37	* 69	* 38	-17	-11
Kero	31	18	20	* 83	6	-6
Bowl or tazon	13	-3	* 86	15	15	29
Jar	2	-5	-14	-25	-15	* 86
Tied ornament (?)	6	22	2	* 73	-35	-19
Head string ± canes	2	26	-1	* 81	25	-11
Sandal	-28	-37	15	-2	* -70	34
Stone lined tomb	29	-5	* 51	-10	* 54	-8

Table D-14. Principal components factor loadings, adults only.

component two.

The eigenvalues of the principal components drop off dramatically after the second principal component (Figure D-6), indicating that the first two components are the most important for understanding this data. One can invent interpretations for the subsequent principal components, but both the difficulty of interpreting the associations of items and their lower eigenvalues suggest that they may be spurious. In any case, the burials do not suggest any clear specialist roles beyond the general subsistence and display roles of the first two principal components. By contrast, a number of specialized activities appear to be represented in contemporary Chiribaya burials (Jessup 1991, pers. com.).

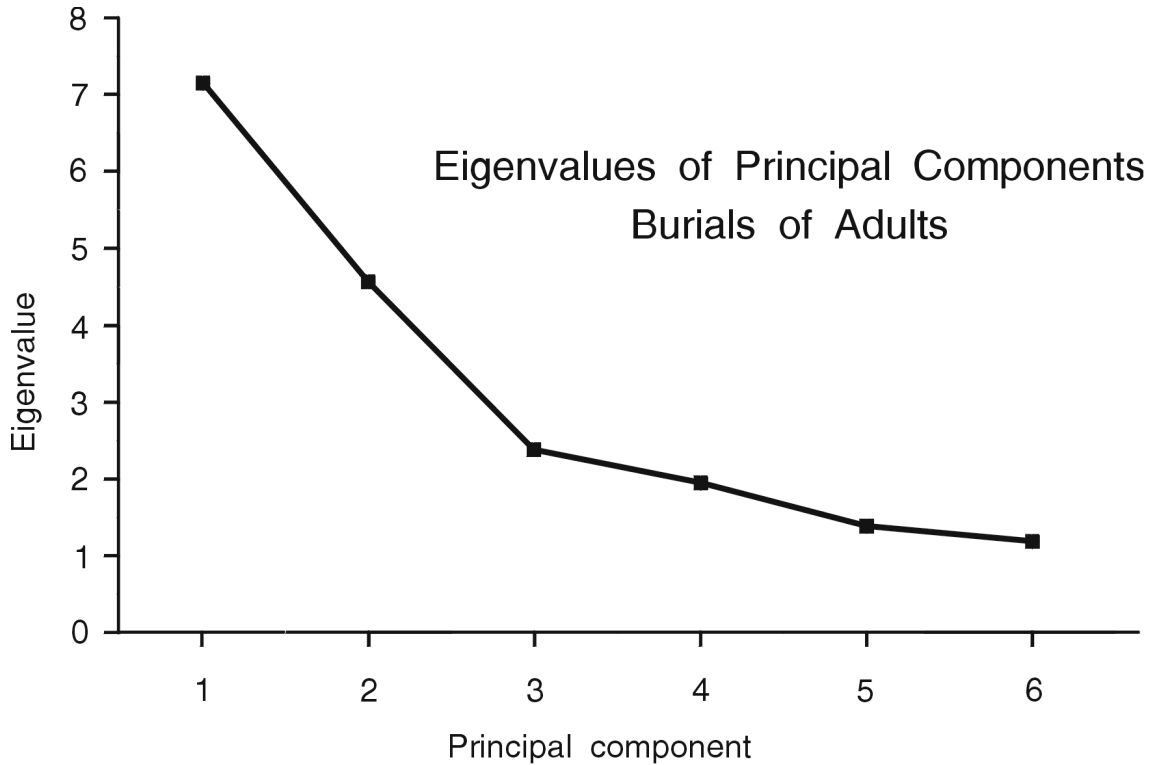


Figure D-6. Eigenvalues of first six principal components, adults only.

In order to evaluate the two principal components in simpler terms, the variable loadings were used to create two lumped categories of artifacts, animal-plant and textile-coca (Table D-5). As expected, the two new variables do not correlate significantly with each other (Table D-15). That they do not correlate suggests that the two sets of artifacts may in fact be two discrete assemblages that were associated with people for different, independent reasons. Both variables are significantly higher in burials of males than females (Table 10).

The animal-plant variable correlates highly with all the grave wealth variables, while the textile-coca variable does not (Table D-15). All of these variables are

(Adults)	Pots	Textile-coca	Animal-Plant	Total items	Items, no textiles	Total types	Types, no textiles
Pots	1.0 0	-.09 .75	.29 .26	.37 .16	.46 *.07	.44 *.09	.48 *.06
Textile-coca	-.09 .75	1.0 0	.15 .59	.39 .13	.18 .50	.43 *.09	.28 .29
Animal-Plant	.29 .26	.15 .59	1.0 0	.91 *.0001	.94 *.0001	.88 *.0001	.90 *.0001
Total items	.37 .16	.39 .13	.91 *.0001	1.0 0	.97 *.0001	.98 *.0001	.96 *.0001
Items, no textiles	.46 *.07	.18 .50	.94 *.0001	.97 *.0001	1.0 0	.94 *.0001	.97 *.0001
Total types	.44 *.09	.43 *.09	.88 *.0001	.98 *.0001	.94 *.0001	1.0 0	.98 *.0001
Types, no textiles	.48 *.06	.28 .29	.90 *.0001	.96 *.0001	.97 *.0001	.98 *.0001	1.0 0

Table D-15. Pearson's correlations and significance for summary variables, adults only.

calculated from combinations of the same artifact counts, so they are not independent. Nevertheless, it seems that the overall richness of the burial relates more to the representation of the "subsistence" role than to the "personal effects and display" role. Perhaps overall status as measured by the quantity of grave goods had more to do with subsistence production than with the social interactions that might be indicated by elaborated clothing.

Among burials of subadults, a single principal component dominates all the others (Figure D-7, Table D-16). Not surprisingly, the lumped animal-plant and textile-coca variables which were independent among adults are significantly correlated among subadults, and both correlate significantly with the overall richness variables (Table D-17). These results accord with the earlier indications that subadults were undifferentiated in their social roles; the primary variability is not in which items, but rather how many items they were buried with. Both the principal components and the lumped-variables analyses suggest that the "subsistence" and "personal effects and display" roles were only played in adulthood, giving the impression once again of

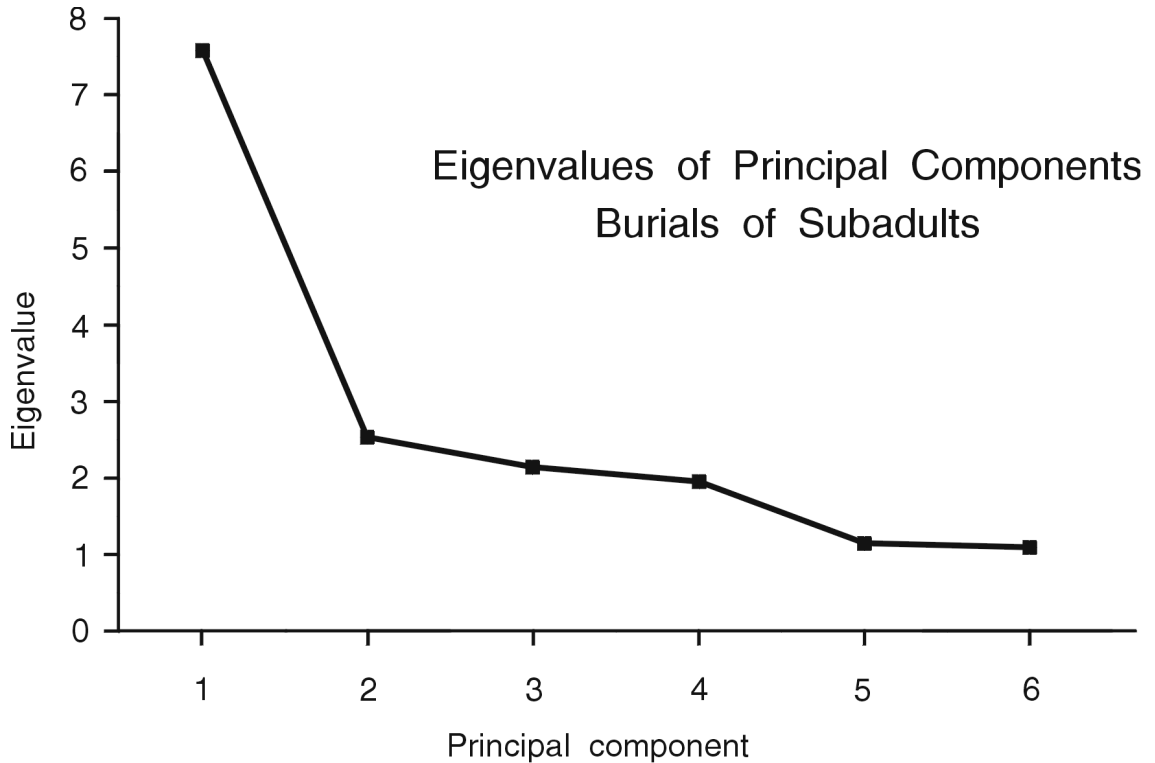


Figure D-7. Eigenvalues of the first six principal components, subadults only.

achieved rather than ascribed roles.

Social stratification

The degree of socioeconomic stratification in archaeological populations is often assessed by considering the shape of the distribution of overall wealth or energy expended in burials (e.g. Binford 1971; Tainter 1977; Arnold 1980; Pearson et al. 1989). Distinguishable modes in the distribution of grave wealth are taken to indicate discrete socioeconomic strata, while a smooth distribution suggests a less formally stratified society. In this analysis, the four wealth measures produce very similar results. These results (Figures D-4 and D-5) have already been assessed in terms of age and sex patterns, which seem adequate to explain much of the variability.

The principal departure from a smooth distribution seems to be due to gender

Item, Subadults only	Component 1	Component 2	Component 3	Component 4	Component 5	Component6
Maize	-8	* 82	7	15	26	-2
Yuca	* 55	* 37	17	* 39	-25	-7
Minor plants	* 70	* 37	-34	-17	27	1
Camelid head	* 99	-5	-3	2	0	2
Bird	0	0	0	0	0	0
Cuy	* 99	-5	-3	2	0	2
Cotton	* 56	21	-11	-34	* 62	-2
Spoon	* 99	-5	-3	2	0	2
Shell	0	0	0	0	0	0
Raw wool	* 57	19	* 38	-28	* 39	1
Shirt	-20	8	-4	33	* 82	-4
Decorated textiles	18	* -38	-22	* 68	7	* 42
Bag	* 99	-5	-3	2	0	2
Coca	* 56	21	* 37	20	17	2
Basket	-8	-16	23	-13	-16	* 84
Kero	-6	* 91	4	-26	-5	-1
Bowl or tazon	* 73	-13	10	-12	-15	-7
Jar	-8	-26	29	-24	-17	* -55
Tied ornament (?)	* 99	-5	-3	2	0	2
Head string ± canes	33	4	* 81	1	6	-3
Sandal	-11	2	10	* 87	12	-9
Stone lined tomb	29	14	* 89	4	-3	2

Table D-16. Principal components factor loadings, subadults only.

differences among adults. The standard deviations of the wealth measures are comparable for males and females, which suggests that neither sex was particularly more stratified than the other. The richest burials appear not to be extreme outliers that might indicate distinct social strata, but rather simply the high end of a unimodal distribution of male grave wealth. These burials would probably appear even less distinctive if looting had not preferentially destroyed stone lined tomb burials, which tend to be richer than pit burials.

The only suggestion of marked stratification in this population is the unusually rich burial of the subadult AD 366, although as Peebles and Kus (1977) noted, one rich child burial does not necessarily indicate a ranked society. There were apparently

(Subadults)	Pots	Textile-coca	Animal-Plant	Total items	Items, no textiles	Total types	Types, no textiles
Pots	1.0 0	-.08 .75	.49 * .04	.43 * .09	.50 * .06	.46 * .06	.51 * .04
Textile-coca	-.08 .75	1.0 0	.61 * .01	.72 * .001	.63 * .01	.69 * .01	.63 * .01
Animal-Plant	.49 * .04	.62 * .01	1.0 0	.93 * .0001	.92 * .0001	.95 * .0001	.94 * .0001
Total items	.43 * .09	.71 * .001	.93 * .0001	1.0 0	.97 * .0001	.99 * .0001	.97 * .0001
Items, no textiles	.50 * .04	.63 * .01	.92 * .0001	.97 * .0001	1.0 0	.99 * .0001	1.00 * .0001
Total types	.46 * .06	.69 * .01	.95 * .0001	.99 * .0001	.99 * .0001	1.0 0	.99 * .0001
Types, no textiles	.51 * .04	.62 * .01	.94 * .0001	.97 * .0001	1.00 * .0001	.99 * .0001	1.0 0

Table D-17. Pearson's correlations and significance for summary variables, subadults only.

richer Ilo-Tumilaca/Cabuza burials at Chiribaya Alta, so additional evidence of one or more small but elevated socioeconomic strata may simply be missing from El Algodonal.

Conclusions

A number of methodological conclusions come out of this analysis. Fortunately for archaeologists who wish to compare disparate published burial analyses, it made little difference whether the number of artifacts or the number of types was used as a summary measure of grave richness, largely because few items that were counted were commonly represented by more than one example. (Many plant and animal remains that might have varied more in quantity were treated only as presence/absence data because of variable preservation.) Principal components analysis proved to be a useful exploratory tool, although it revealed little that had not already been discovered using simpler techniques.

Unfortunately for archaeologists working in regions with poorer organic preservation, textiles and perishable plant material proved to be very important in the analysis. Ceramic vessels, the mainstay of many archaeological analyses, turned out to be almost incidental. Pottery did not play a role in gender differences, was only one of many variables contributing to the age dependent patterning, and did not enter into any of the usable principal components. Pottery was significantly correlated with three of the four overall grave wealth measures (Tables D-15 and D-17), so it could have served as a rough surrogate for them had the preservation not been so exceptional. However, since no burial contained more than two vessels, an analysis limited to pottery could not have produced overall grave wealth histograms of any utility.

The first goal of this analysis was to assess the social complexity of Ilo-Tumilaca/Cabuza society in terms of numbers of distinct social roles or "dimensions of variability". The burial data suggest only a few such dimensions, specifically adult versus subadult, adult male versus adult female, and two adult dimensions of variability apparently related to subsistence production and to personal effects and decorated clothing. There is no indication of specific economic or other specializations, nor of distinct socioeconomic stratification, although people of high socioeconomic status might be selectively missing from the sample due to their use of the cemeteries of Chiribaya Alta. The impression is one of relatively few social roles, suggesting a simple, homogeneous social organization.

The second goal was to consider the degree of ranking, or limitation of access to certain roles by factors such as genealogy. Since the few dimensions of variability among these burials seem to be largely explained by the life-history variables of age and sex, there is little indication of ranking. The relative uniformity of subadults'

grave goods in comparison to those of adults also suggests that the few differences that did exist were achieved in adulthood rather than ascribed at birth. A single subadult buried with an unusual number of grave goods may indicate an occasional case of ascribed status, and once again, evidence of the upper, potentially ascribed ranks may be found elsewhere at Chiribaya Alta.

The final goal was to evaluate any temporal changes in social structure. None at all were detected. In general, the Ilo-Tumilaca/Cabuza people of El Algodonal seem to have changed little over some 300 years of occupying the valley. There might have been changes within, or even the loss of, an upper social stratum buried at Chiribaya Alta, but they did not visibly affect the rest of the population.

Admittedly, this analysis tries to squeeze a great deal from an inadequate burial sample. Still, the results suggest, however tentatively, a reasonable picture of the aftermath of Tiwanaku's collapse and the rise of Chiribaya complexity. The small number of settlers from the fragmented middle Osmore valley were relatively unorganized, probably community-level agriculturalists, with at most a thin stratum of leadership remaining from their Tiwanaku state heritage. There was little economic specialization among them, nor did ascribed rank limit individual achievement within the narrow range possible in their society, with the probable exception of the apparently small highest social stratum. Males probably played more, or at least more materially recognizable, social roles, although females were probably not excluded from any. With the possible exception of the loss of the top social stratum, little changed among these people from the time they arrived in the valley, through their apparent decline in population, to their eventual disappearance from the archaeological record.

The society of the Ilo-Tumilaca/Cabuza inheritors of Tiwanaku could hardly be in greater contrast to that of the Chiribaya. Based principally on his analysis of the contents of tombs at the site of San Geronimo, Jessup (1990a,b, 1991) concluded that Chiribaya society become increasingly stratified, developing at least part-time specialization in distinct pursuits such as fishing, herding, pottery making, and metalworking. The physical center of Chiribaya ideology and power seems to have been the site of Chiribaya Alta, an impressive settlement on a bluff, demarcated by banks and ditches and surrounded by vast cemeteries where people were buried with quantities of textiles, ceramics, food, and other offerings. At Chiribaya Alta, extremely rich tombs were concentrated in cemetery four (Williams and Buikstra, n.d.), which contains only stylistically late Chiribaya ceramics (Jessup 1990b). The dramatic wealth and late date of these tombs suggests that political ranking and leadership also increased, and eventually involved impressive trappings and presumably some degree of power (see Williams and Buikstra, n.d.).

Sharing the valley with the Ilo-Tumilaca/Cabuza settlers, and possibly even descended from them, the Chiribaya population grew larger over time (Chapter 7), developed an entirely new iconography, and changed in the course of a few hundred years from their presumed village agriculturalist roots to a partially occupationally specialized society with extreme wealth or status differences and possibly social ranking, all strong indications of an elaborated chiefdom organization. The legacy of the collapsed state was simplicity and stasis, while renewed complexity arose, if not from different roots, at least in a new and distinct idiom