

Appendix C

Radiocarbon dates and stylistic chronology

The interpretations presented in this dissertation are heavily dependent upon the chronological relationships of ceramic styles and associated social groups. Prior to this work, the consensus opinion was that the coastal Osmore ceramics that resembled Tiwanaku models probably dated to Tiwanaku V, and that the Chiribaya tradition developed out of this style and was temporally later. The Ilo-Cabuza style was not recognized as a distinct category in the coastal Osmore valley, but the extremely similar Cabuza style in the Azapa valley was dated rather improbably to AD 400 or earlier (Dauelsberg 1985) and as late as AD 1200. Maitas (or Maytas), the early variant of Chiribaya in the Azapa valley, was also dated as early as AD 700, and was considered to be a late Tiwanaku style (Dauelsberg 1985).

Even before starting the PCCT fieldwork, it seemed that the simple Tiwanaku-to-Chiribaya sequence did not hold up well. The Tiwanaku-related ceramics of the coastal Osmore more resembled Goldstein's post-Tiwanaku Tumilaca phase (Goldstein 1985, 1989a), leaving a relatively short period of time for the proposed radical transformation from Tiwanaku-like to Chiribaya decoration. Moreover, there are extremely few vessels known that might be transitional between Tiwanaku and Chiribaya traditions. The surface preservation of sites with the Tiwanaku-related and Chiribaya ceramics was similar enough to suggest that one style might not be markedly older than the other. The published radiocarbon dates for late Tiwanaku-related and "Loreto Viejo" ceramics overlapped substantially with Chiribaya dates (see Tables C-3 and C-4 below). Both in Chile and in the coastal Osmore, the Cabuza (analogous to Ilo-Cabuza) and Loreto Viejo (analogous to Ilo-Tumilaca) styles are

found in the same cemeteries with similar burial practices and nonceramic grave goods, suggesting that they might be contemporary or closely related. No cases of stratigraphic superposition that might resolve the chronological issues have been published. Some of the radiocarbon dates reported from Chilean excavations of supposedly Chiribaya and Tumilaca-phase contexts are confusing and I suspect that they may be based on material from mixed midden and looted tomb contexts.

In order to resolve the chronological problems in the region, I submitted 16 samples of charcoal, twigs screened from middens, wood, and wool cloth to Beta Analytic for radiocarbon dating with ^{13}C corrections. Funds for these dates were generously contributed by the UCLA Friends of Archaeology, the Wenner-Gren Foundation, UCLA's Latin American Center, and Guy Pinneo, a project volunteer. This appendix reports the radiocarbon results, along with limited but corroborating other lines of evidence, that form the basis of the chronology used throughout this dissertation.

Tables C-1 and C-2 list the raw and corrected radiocarbon dates and related details. The date(s) in parenthesis is (are) the corrected date(s), including ^{13}C adjustments, calibrated using Stuiver and Reimer's (1986) University of Washington Quaternary Isotope Lab Radiocarbon Calibration Program (CALIB) Rev. 2.0, bidecadal atmospheric data, intercept method A. The dates before and after the parentheses indicate the date minus and plus the corrected 1-sigma error, respectively. These corrected errors include both the measurement error and the calibration data error, so the ranges are not symmetrical. Reversals in the calibration curve occasionally produce several possible corrected dates for a single radiocarbon measurement; the error range is based on the earliest and latest calibrated dates when

Culture or style	Context	Material	Provenience	Beta ID	Dendro-corrected years AD	¹⁴ C years AD, ¹³ C adjusted	¹⁴ C years AD, raw	¹³ C / ¹² C ‰
Post-Algarrobal Chiribaya sherds	Ashy midden layer high in LV 2505 strata	Twigs	LV 2505-5-6	51073	1252 (1272) 1285	1220 ±60	1190 ±60	-26.3
Post-Algarrobal Chiribaya sherds	Ashy midden layer low in LV 2505 strata	Twigs	LV 2505-9-11	51074	1047 (1182) 1246	1090 ±60	1070 ±60	-26.4
Post-Algarrobal Chiribaya sherds	Bottom of midden above Chiribaya tomb	Twigs	AD 522-5-1	51066	1043 (1169) 1230	1080 ±60	1070 ±60	-25.6
Post-Algarrobal Chiribaya sherds with some Ilo-Tumilaca/Cabuza	Midden that crosses above wall trench associated with post AD 525-15-11/1	Twigs	AD 525-7-1	51067	1182 (1245) 1270	1150 ±60	1120 ±60	-26.9
Tumilaca style cane house construction	Post assoc. with wall trench below midden AD 525-7-1	Wood post	AD 525-15-11/1	51068	960 (1012) 1039	930 ±80	850 ±80	-30.0
Ilo-Tumilaca/Cabuza	Dense midden deposit near a multi-roomed cane structure on upper central ridgeline flat	Twigs	LA 1506-5-2	51069	1169 (1230) 1267	1140 ±60	1080 ±60	-28.3
Ilo-Cabuza	Floor around hearth below midden with Ilo-Cabuza <i>kero</i> sherd; same house as LA 1530-5-4	Wood charcoal	LA 1525-5-1	51071	1162 (1216) 1253	1110 ±50	1090 ±50	-26.2
Ilo-Tumilaca/Cabuza	Wall trench fill, same house as LA 1525-5-1	Twigs	LA 1530-5-4	51072	1007 (1035) 1169	1000 ±80	960 ±80	-27.6
Ilo-Tumilaca/Cabuza	Hearth in kitchen of multi-roomed cane structure	Wood charcoal	LA 1518-2-2	51070	998 (1021) 1039	960 ±50	910 ±50	-28.0

Table C-1. PCCT radiocarbon dates, page one of two.

[Raw dates are given here as years AD (1950-years BP), not BP as is conventional.]

Culture or style	Context	Material	Provenience	Beta ID	Dendro-corrected years AD	¹⁴ C years AD, ¹³ C adjusted	¹⁴ C years AD, raw	¹³ C / ¹² C ‰
Ilo-Cabuza, crude variant	Tomb with jar in crude variant of Cabuza style	Wool textile	AD 339.01	51059	1043 (1169) 1230	1080 ±60	1170 ±60	-19.8
Ilo-Cabuza, similar to Arica-Cabuza	Tomb with jar similar to Arica-Cabuza style	Wool textile	AD 354.06	51060	1012 (1030) 1160	990 ±60	1070 ±60	-19.7
Ilo-Tumilaca, local variant	Tomb with <i>kero</i> in variant of Moquegua-Tumilaca style	Wool textile	AD 363.05	51061	960 (999) 1024	910 ± 60	970 ± 60	-20.7
Ilo-Tumilaca, very like Moquegua-Tumilaca	Tomb with <i>kero</i> virtually identical to Moquegua-Tumilaca style	Wool textile	AD 383-1-1.10	51065	900 (991) 1021	900 ± 60	980 ± 60	-19.8
Algodonal Early Ceramic sherds	Midden compacted onto informal floor, lower terrace	Wood charcoal	AD 376-6-9	51064	220 (253, 304, 315) 372	200 ± 60	130 ± 60	-29.2
Algodonal Early Ceramic sherds	Informal floor deposit with compact surface, upper terrace	Wood charcoal	AD 375-8-1	51062	77 (123) 215	80 ± 50	0 ± 50	-29.9
Algodonal Early Ceramic sherds	Informal floor deposit with compact surface, upper terrace	Twigs	AD 375-8-1	51063	97 BC (1) 66 AD	50 BC ± 60	80 BC ± 60	-26.5

Table C-2. PCTT radiocarbon dates, page two of two
 [Raw dates are given here as years AD (1950-years BP), not BP as is conventional.]

multiple dates are listed within the parenthesis.

Tables C-3 and C-4 list comparative published radiocarbon dates and their calibrated ranges using the same procedures as applied to the PCCT dates. I assume here that the published dates are reported raw and uncalibrated. All of the following Figures and discussion are based on calibrated dates. The PCCT dates are plotted graphically in Figure C-1, and the suggested durations of the various styles are plotted in Figure 1-5. The suggested chronological phases are rather generous in length, including most of the 1-sigma error bars, on the assumption that I probably do not have the very earliest or latest dates for any phase.

Algodonal Early Ceramic style

The Algodonal Early Ceramic habitation terraces that were excavated at El Algodonal were clearly stratigraphically much earlier than the Ilo-Tumilaca/Cabuza cemetery above them. The habitation terraces had eroded along their front edges and been completely covered by unbroken, parallel, inclined layers of gravelly talus by the time that the Ilo-Tumilaca/Cabuza tombs and pit burials were dug into the talus slope. Many of the tombs did not reach deep enough to even touch the Algodonal Early Ceramic terrace surfaces, some cut through them, and one incorporated a large stone in the retaining wall of the lower terrace into the bottom course of the tomb wall without disturbing its position. Nevertheless, the absolute date of the Algodonal Early Ceramic material and the duration of the terraces' occupation was unknown, and three radiocarbon dates were submitted to resolve these questions.

Analysis of the stratigraphic profiles suggested that the upper of the two terraces excavated at El Algodonal was built on top of strata that had buried the lower terrace.

Culture or style	Context	Material	Provenience	Lab ID	Dendro-corrected years AD	¹⁴ C years AD, as reported	Reference
Maytas-Chiribaya	Tomb	Unknown	Azapa-71, tomb 480	I-11,641	1262 (1280) 1379	1255 ±75	Focacci 1981
Maytas-Chiribaya	Tomb	"Coronta y camote"	Azapa-6, tomb 141	I-11,622	1210 (1276) 1394	1235 ±130	Focacci 1981
Maytas-Chiribaya	Unknown	"Sorona"	Azapa-71	I-11,621	1216 (1264) 1281	1185 ±75	Focacci 1981
Chiribaya? [Correction: Ilo-Tumilaca/Cabuza?]	Looted cemetery surface collection, 10 m from Hv-1091	Human hair and tissue	Loreto Viejo, probably cemetery 1	Hv-1081	1229 (1267) 1281	1200 ±60	Geyh 1967
Chiribaya			Yaral	Beta-22846	1246 (1252) 1270	1160 ±50	Stanish and Rice 1989
Maytas-Chiribaya	Tomb	Coca leaves	Azapa-6, tomb 141	I-11,625	990 (1058, 1078, 1125, 1136, 1156) 1260	1040 ±145	Focacci 1981
Chiribaya			Yaral	Beta-22845	1012 (1027) 1153	980 ±50	Stanish and Rice 1989
Chiribaya? [Correction: Ilo-Tumilaca/Cabuza?]	Looted cemetery surface collection, 10 m from Hv-1081	Cloth (must be wool)	Loreto Viejo, probably cemetery 1	Hv-1091	990 (1024) 1157	970 ±70	Geyh 1967
Chiribaya			Yaral	Beta-19323	999 (1020) 1166	990 ±80	Rice et al. 1990
Maytas	Unknown	"Sorona"	Playa Miller 9	I-11,624	893 (988) 1026	895 ±80	Focacci 1981
"Loreto Viejo" style	Tomb	Human tissue	Azapa-71, tomb 1	I-11,447	1190 (1259) 1278	1170 ±75	Focacci 1981
"Loreto Viejo" style	Tomb	Human tissue	Azapa-71, tomb 3	I-11,446	977 (1018) 1152	950 ±75	Focacci 1981

Table C-3. Published comparative radiocarbon dates, page one of two.
[Raw dates are given here as years AD (1950-years BP), not BP as is conventional.]

Culture or style	Context	Material	Provenience	Lab ID	Dendro-corrected years AD	¹⁴ C years AD, as reported	Reference
Tumilaca phase ceramics [Correction: Chen Chen phase?]	Tomb	Charcoal	Chen Chen cemetery, 70 m from Hv-1076	Hv-1077	1020 (1043, 1105, 1112, 1150) 1175	1020 ±65	Geyh 1967, Disselhoff 1967
"Asoc. Tiwanaku"	Tomb	Cloth (probably wool)	Pica-8, tomb 7-6	IVIC-792	985 (1021) 1135	960 ± 70	Rivera 1978
Tumilaca phase ceramics [Correction: Chen Chen phase?]	Tomb	Cotton cloth	Chen Chen cemetery, 70 m from Hv-1077	Hv-1076	956 (999) 1026	910 ± 65	Geyh 1967, Disselhoff 1967
Tumilaca phase	Structural post for cane-walled house, possibly reused	Wood	Omo M11-1406, Structure 5, Room C4, Square S20E30	Beta-26649	776 (883) 961	780 ± 70	Goldstein 1989
Chen Chen phase	Structural post for cane-walled house	Wood	Omo M10-1758, Structure 13 (subphase A)	Beta-26650	880 (897) 986	830 ± 60	Goldstein 1989a
"Alta Ramírez? Asoc. a Tiwanaku"	Unknown, probably burial offering	Basketry	Cáñamo-3	Tk-101	772 (830, 859) 894	760 ± 60	Rivera 1978
"Alta Ramírez /Tiwanaku"	Unknown, probably burial offering	Charcoal	Azapa-83	GaK-5810	724 (830, 859) 897	760 ± 70	Rivera 1978
"Tiwanaku"	Unknown, probably burial offering	Cloth (probably wool)	Azapa-6	GaK-5917	681 (785) 892	730 ± 80	Rivera 1978

Table C-4. Comparative published radiocarbon dates, page two of two. [Raw dates are given here as years AD (1950-years BP), not BP as is conventional.]

For this reason, I hoped that dates from the two terraces would show a considerable spread, and perhaps suggest part of the duration of the style. Unfortunately, the dates came out in reverse order, with the upper terrace dating earlier than the lower one (see Table C-2). This may be due to errors in recording or interpreting the complex stratigraphy, to contamination, or to the stochastic nature of radiocarbon dating itself. Two of the dates came from the floor of the upper terrace, one run on charcoal and the other on woody twigs both screened from general floor deposits with compacted surfaces suggesting that they had been trampled during the terrace's use. Although they were collected from the same, seemingly good context, these two dates do not overlap at the 1-sigma level. Again, the reason for this discrepancy is unknown.

Since the Algodonal Early Ceramic dates are not internally ordered or concordant, they should be taken as general estimates only. Based on these dates, I suggest that the Algodonal Early Ceramic style was in use minimally from about 100 BC to AD 400, and probably longer. This range is in reasonable agreement with dates for related early ceramic material including Huaracane at AD 50 (Goldstein 1989a), Alto Ramírez at 500 BC to AD 200 (Muñoz 1987), Site 55 in the Carrizal spring system at 186 BC (Bawden 1989a, Bolaños 1987) and Wawakiki at AD 340 (Buikstra n.d.). Given the long gap between the last Algodonal Early Ceramic date and the first Ilo-Tumilaca/Cabuza and Chiribaya dates, the paltry few BR Early Ceramic sites that are supposed on stylistic grounds to represent the intervening occupation seem inadequate. For this reason, in the chronological chart of Figure 1-5, I rather arbitrarily extended the transition between the two Early Ceramic styles to after AD 650, but flagged it with question marks.

Ilo-Tumilaca and Ilo-Cabuza styles

One issue to be resolved concerned whether or not the makers of the Tiwanaku-derived ceramics in the coastal Osmore valley were in fact a single ethnic and chronological unit. Excavations showed that their garbage and burial offerings included pottery that ranged from pieces very similar to the finely made Tumilaca style of the middle valley, which is clearly derived from Tiwanaku traditions, to relatively cruder variants of the northern Chilean Cabuza style. Since the entire range was found in the same habitation sites and cemeteries, associated with the same house types, tomb types, and artifact assemblages, and since they appeared to comprise a continuous spectrum of variation from one to the other, I suspected that these ceramics could be treated as markers of a single group of people.

In order to test this interpretation, I dated plain, featureless fragments of wool textiles from four tombs that contained highly diagnostic, intact ceramic vessels: a *kero* in a style very similar to the Moquegua-Tumilaca style (AD 383), a *kero* in a slightly aberrant Tumilaca style (AD 363), a jar very similar to the better-made Cabuza style vessels from northern Chile (AD 354), and a crude jar evidently derived from the Cabuza-like style (AD 339). Textiles were selected because very similar textiles are available from many tombs, allowing for the strictest comparability of results, and because a reasonably large sample could be consumed for dating without materially diminishing the information available from the tomb. I expected all four dates to cluster tightly.

Instead, the four tombs fell out in chronological and stylistic order with the fine Tumilaca-like *kero* earliest, the variant *kero* just slightly later, the Cabuza-like jar later yet, and the crudest, most "derived" jar latest. I still believe that these styles are parts

of the same tradition, but the evidence strongly suggests a chronological development within that tradition, starting from an elaborated, closely Tiwanaku-derived style with correlates to be found over a broad area of the south-central Andes, and ending with a crude, local style that does not even relate closely to its contemporaries a few valleys to the south in Chile. (This style may actually be present in northern Chile, but overlooked due to its unimpressive quality.) These radiocarbon results supported the impression that the Ilo-Tumilaca and Ilo-Cabuza styles could be separated both stylistically and chronologically.

The suggested order of Ilo-Tumilaca followed by Ilo-Cabuza is supported by one small piece of stratigraphic data. Tomb AD 389 was apparently reused in antiquity. An Ilo-Tumilaca *tazon* and a human scapula were found embedded in a thick layer of compacted earth that formed the floor of the reused tomb, but clearly overlay an earlier floor. The burial above this layer included an Ilo-Cabuza bowl and jar.

The four tomb dates are plotted graphically at the bottom of Figure C-1, under the heading "El Algodonal cemetery". Several additional dates bear on the Ilo-Tumilaca to Ilo-Cabuza development. First, all four dates from the residential site of Loreto Alto fall within the same general span as those from the El Algodonal cemetery. The ceramics from Loreto Alto are exclusively from the Ilo-Tumilaca/Cabuza tradition. Second, a structural post associated with a cane-walled house in units AD 525, 529, and 530 at El Algodonal also falls in the same range. This house is built in the style observed by Goldstein (1989a) at the Tumilaca phase site of Omo M11, in the middle Osmore valley: it has small posts located on either side of the trench for the cane wall. Later Chiribaya cane walls in the coastal Osmore valley often have larger posts

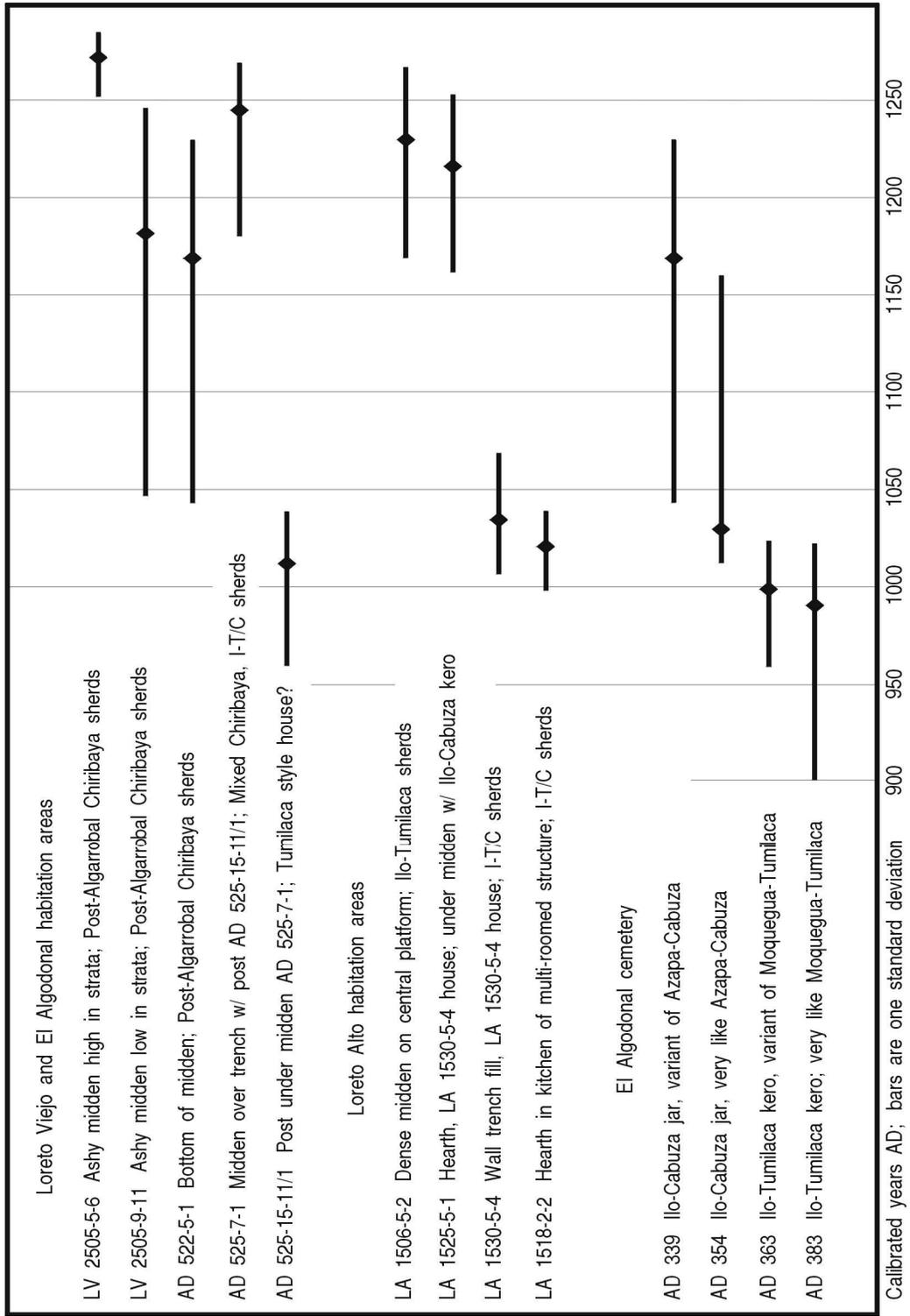


Figure C-1. PCCT radiocarbon dates.

located directly in the wall trench. This change in house construction style may not coincide exactly with the Tumilaca/Chiribaya distinction, however, since García (1988) illustrates cane wall construction with a few small posts alongside the wall trenches from one compound excavated at Yaral in the middle Osmore valley, apparently associated with early (Algarrobal phase) Chiribaya ceramics.

The two latest dates from Loreto Alto suggest that the extension of the Ilo-Tumilaca/Cabuza tradition to perhaps AD 1250, which is considerably later than expected, is well founded. One of these late dates is from a hearth directly below a midden that contained a large fragment of an extremely crude Ilo-Cabuza *keró*. The late date associated with a stylistically extreme *keró* are exactly what would be expected for the end of the Ilo-Tumilaca/Cabuza tradition.

However, the other late date is from a midden that contained burned sherds of two separate Ilo-Tumilaca vessels, not of the finest finish, but clearly from the supposedly earlier end of the range of variation. Because the date itself is so well corroborated by the one from the hearth, I suspect that the midden is properly dated, but that the Ilo-Tumilaca style sherds were either curated items or were redeposited with later material, perhaps in the course of a reconstruction or cleaning event. An even later date from a tomb with supposedly similar ceramics is reported from the Chilean site of Azapa-71 (I-11,447, in Focacci 1981; see Table C-4). This coincidence of two apparently incorrect dates is disturbing, but I suspect that the Azapa date, too, is in error.

My interpretation of these dates is that the Ilo-Tumilaca style, associated with the first Moquegua area settlers in the valley, lasted from about AD 950 to 1050. The same group, living at the same sites and using the same cemeteries, gradually shifted

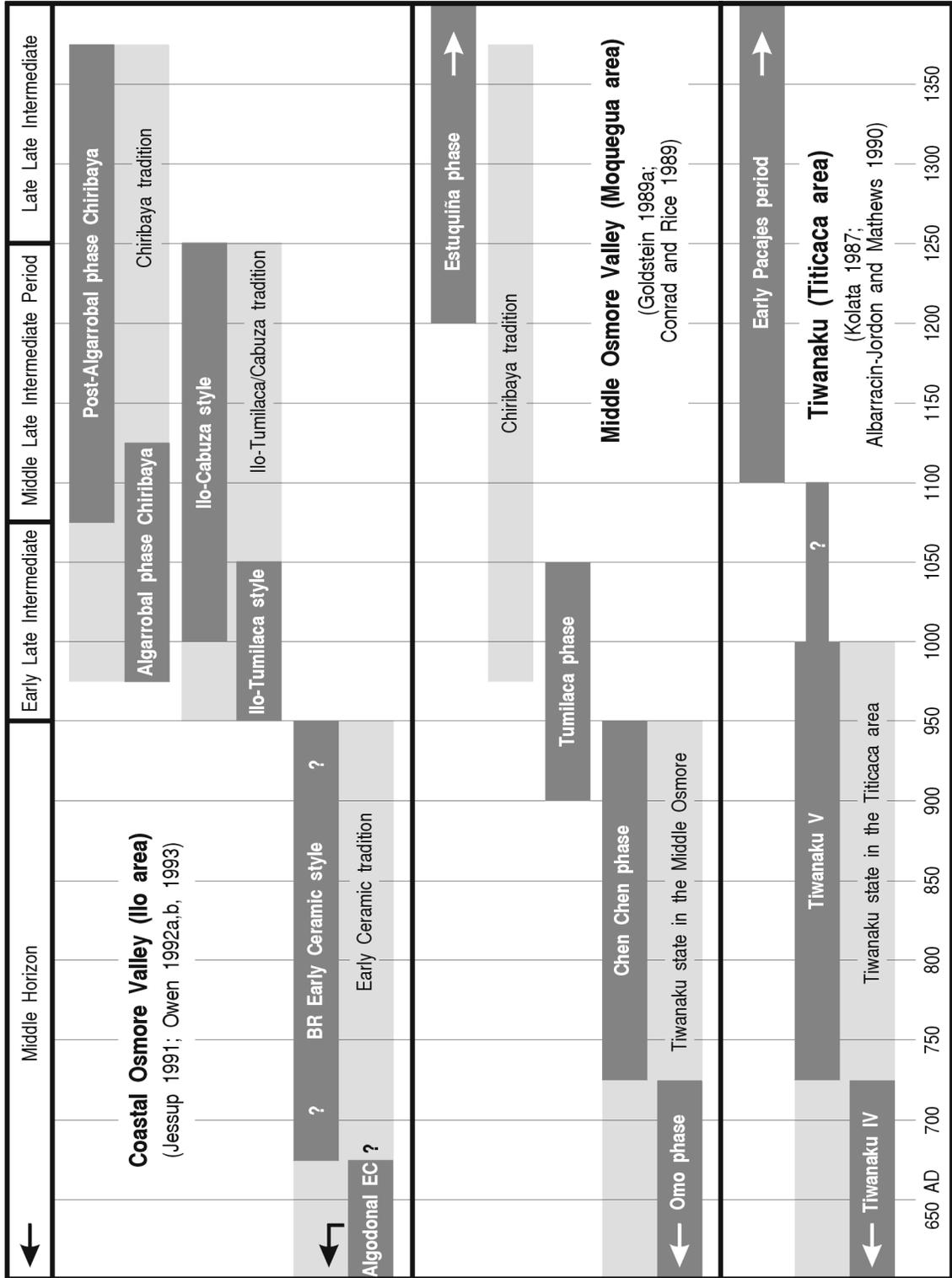


Figure C-2. Suggested durations of styles in calendar years.

to the Ilo-Cabuza pottery style, lasting from about AD 1000 to 1250. For the purposes of excavations in residential areas, these two styles are rarely distinguishable, but instead must be generally be lumped as the Ilo-Tumilaca/Cabuza tradition, lasting from AD 950 to 1250. The suggested durations of the various styles are plotted graphically in Figure C-2.

Chiribaya styles

The distinction of Algarrobal phase Chiribaya and Post-Algarrobal phase Chiribaya, based on Jessup's (1990b, 1991) work, is discussed in Appendix B. PCCT excavations in habitation areas encountered only post-Algarrobal phase Chiribaya deposits. Two samples from post-Algarrobal phase contexts at El Algodonal and two from Loreto Viejo were dated as shown in Table C-1 and Figure C-1. These dates overlap almost completely with the Ilo-Cabuza dates, suggesting that the late portion of the Ilo-Tumilaca/Cabuza tradition was contemporary with the middle to late portion of the Chiribaya tradition. The end of the post-Algarrobal Chiribaya phase is a bit speculative. I have put it at AD 1375 in order to accommodate the 1-sigma error bars of two published dates from northern Chile (I-11,642 and I-11,622, Focacci 1981), and to concord with hypotheses by Moseley, Satterlee, and Tapia (n.d.) based on geological observations that place the end of the Chiribaya phase slightly after a large flood that probably occurred around AD 1350.

Despite the overlapping dates, both the raw chronological data and the population reconstructions elaborated in Chapter 7 suggest that most Chiribaya people lived after most Ilo-Tumilaca/Cabuza people, and especially that most Post-Algarrobal phase Chiribayas lived after most of the Ilo-Tumilaca. There are two small stratigraphic hints that this might have been the case. The first is an odd Ilo-Tumilaca or possibly

even Tiwanaku V miniature jar that was found in a subfloor, probably ritual context at El Algodonal in unit AD 514. Four excavation units testing the deposits in and above this floor found virtually pure Post-Algarrobal phase Chiribaya material overlaying the Ilo-Tumilaca jar. The second is the radiocarbon dated quincha structure at El Algodonal in units AD 525, 529, and 530. As noted above, this structure was built in the style noted by Goldstein for Tumilaca houses, and the associated radiocarbon date corresponds to the suggested Ilo-Tumilaca time period. It is covered by midden that contains roughly half and half Ilo-Tumilaca/Cabuza and Post-Algarrobal phase Chiribaya sherds. On the other hand, the very mixing of Post-Algarrobal phase Chiribaya and Ilo-Tumilaca/Cabuza ceramics in this and most other middens excavated at El Algodonal suggest that the styles were either in use at the same time and in close physical proximity, or that one occupation followed rapidly upon the other at the very same sites.

Since the Algarrobal Chiribaya phase is earlier than the dates from my Chiribaya contexts, it must be contemporary with the earlier part of the Ilo-Tumilaca/Cabuza tradition. Table C-3 lists two published dates from the Chiribaya habitation area of the middle-valley site of Yaral (Beta 22854 and Beta 19323, in Stanish and Rice 1989) that fall within the hypothesized duration of the Algarrobal phase. Yaral is known from earlier work (Garcia 1988) and recent cemetery excavations by Jane Buikstra's Chiribaya Project to have a substantial Algarrobal phase Chiribaya component. Another published date that falls in the inferred Algarrobal phase (Hv 1091, in Geyh 1967) is from the cemetery at Loreto Viejo, which my limited excavations found to contain some Algarrobal phase Chiribaya burials. The beginning date of the Algarrobal phase is highly speculative; the Algarrobal phase could have started even earlier than the Ilo-Tumilaca style if the Chilean date from Playa Miller 9 (I-11,624,

Focacci 1981) is good. Although there are as yet no dates that can be definitely associated with Algarrobal phase ceramics, since that stylistic distinction was not recognized when the existing samples were collected and published, the dates shown tend to support a hypothetical Algarrobal phase lasting from about AD 975 to 1125. I interpret these dates to suggest that the Algarrobal phase (early Chiribaya) lasted from about AD 975 to 1125, and that the post-Algarrobal phase Chiribaya styles lasted from about AD 1075 to 1375. It is still possible, although I suspect unlikely, that the Chilean interpretations are correct for their Maitas-Chiribaya material, and that the Chiribaya style developed prior to the collapse of Tiwanaku in northern Chile before appearing in southern Perú.

Stable isotope results

An interesting incidental finding is that the $^{13}\text{C}/^{12}\text{C}$ stable carbon isotope ratios for the four samples of wool cloth are dramatically higher than those of any of the other samples, which were all from burned or unburned woody plants. This difference was expected, and tends to confirm the hypothesis that the camelids that provided this wool ate significant quantities of "C4" plants, which for biochemical reasons have higher ^{13}C contents than most other ("C3") plants. In the Andean highlands, corn was the only common "C4" plant in the prehispanic Andean human diet, and at least in the central highlands, there are not normally any "C4" plants in camelid diets, either (Hastorf 1990). On the coast, however, the desert conditions probably favor other, non-corn C4 plants that camelids might eat, so the isotopic data do not necessarily imply that camelids were foddered with corn plants or allowed to graze on corn stubble, as they would in the highlands.

More importantly, it is clear that the dates from this animal material would *not*

have been comparable to the wood and charcoal dates if the stable carbon isotope ratios had not been measured for all the samples (see the corrected and uncorrected dates in Tables C-1 and C-2). The difference between the mean stable isotope corrections for the two materials in this particular study amounts to approximately 115 radiocarbon years; the difference between the largest corrections in these samples is 170 years. The presumed absence of stable carbon isotope ratio corrections in most or all published dates makes their utility for detailed comparisons questionable. In fact, the lack of stable isotope corrections might partially explain some of the anomalously late dates from northern Chile (such as Focacci's "Loreto Viejo" date from Azapa-71, tomb 1, shown in Table C-3), many of which were run on human tissue or wool textiles that may have had severely distorted isotopic compositions relative to wood-based samples.

Conclusions

The radiocarbon dates and a few stratigraphic and stylistic arguments clearly support a reconstruction of the culture history of the coastal Osmore valley in which a group of settlers from the Moquegua area moved to the coastal valley around AD 950, right when the Tiwanaku state was breaking up. Concurrently or shortly thereafter, the Algarrobal Chiribaya style began to develop, and both were in use at the same time in the coastal valley. As time passed, the two groups' ceramic styles diverged ever further, leading to the post-Algarrobal phase Chiribaya styles and the Ilo-Cabuza style. The absolute dating and relative positions of these styles are summarized in Figure C-2.