TIME AND PROCESS IN AN EARLY VILLAGE SETTLEMENT SYSTEM ON THE BOLIVIAN SOUTHERN ALTIPLANO

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The emergence of sedentary village lifeways occurred in many regions of the world, and was one of the most significant landmarks in prehistory. Traditionally, archaeological research has concentrated on understanding the origins of village life and its evolution into politically ranked chiefdoms and states. Relatively less attention has been paid to the many regions of the world where village society did not lead to the formation of more complex political organization. The current research is a diachronic study of some very long-lived village settlements known as the Wankarani Complex in the Oruro Department of Bolivia. It is focused on change and continuity within a persistently small-scale village settlement system over the course of more than a millennium. Rather than studying one of the early prehistoric village societies that gave rise to complex societies and asking "why?," this study centers on a very resilient early village society that did not give rise to ranked polities and asks "why not?."

Excavations at two Wankarani sites that were occupied for more than a millennium during the southern Andean Formative Period (1800 BC – 200 AD) were directed toward obtaining sizeable samples of artifacts from all phases of occupation in order to detect changes in subsistence, economy, and socio-economic and political organization. Results suggest considerable changes in subsistence and economy, including a trajectory of increasing importance of herding and agriculture and the development of long-distance trade networks in which these early villages

participated. Despite these changes, growth of the political economy was minimal, and did not result in the emergence of marked social ranking or economic inequality.

The Wankarani trajectory provides an excellent comparative perspective on Formative Period social evolution in the Lake Titicaca Basin, where early village society led to the rise of larger settlements, politico-religious centers, and eventually centralized polities. The different trajectory followed by the Wankarani Complex may be a function of an extremely risk-minimizing agro-pastoral system that inhibited the growth of both the regional population and the political economy.

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1. TIME AND PROCESS IN SMALL-SCALE SOCIETIES

1.1. Introduction

The appearance of sedentary village life is a phenomenon witnessed in the archaeological record of most regions of the world. The origin of village life is typically associated (though not absolutely correlated) with the development of agriculture, animal herding, increased sedentism, and population growth. This suite of traits defines a 'neolithic' lifeway, and in many regions of the world the shift to sedentary village life was the precursor to the later development of socio-economic and political inequality, and eventually centralized political hierarchies (chiefdoms and states). Working from a cultural evolutionary point of view, the majority of archaeological studies of neolithic societies have focused on the transformations that led to the origin of village life (the Neolithic revolution)(e.g., Flannery 1972b; Henry 1989; Meggars, et al. 1965; Pearsall 1999), or those transformations of village societies into larger-scale, politically integrated socio-cultural systems, generally referred to as chiefdoms and states (e.g., Drennan and Quattrin 1995; Earle 1997; Earle 1991; Feinman 1995, 2000; Haas 1995; Hayden 1995; Sanders and Webster 1978). From this perspective, it is easy to be left with the impression of village societies as representing a way station, or stage in the development of politically centralized, complex societies. Of course, this perspective can be misleading, since the transformation from village society to ranked society was not universal in prehistory, just as the neolithic revolution did not occur universally.

With some noteworthy exceptions (e.g., the American Southwest), relatively less archaeological interest has been focused on those regions where village-based society did not lead to the autochthonous development of politically centralized complex societies. Perhaps even more importantly, such regions of long-lived small-scale societies have not been exploited for what they might be able to teach us about cultural evolutionary processes. In terms of cultural evolution, these societies seem to represent examples of stalled evolutionary processes. Archaeologists interested in the evolution of complex societies posit a number of causes and factors that drive the evolutionary process (e.g., see overviews in Flannery 1972a, 1995; Johnson and Earle 2000; Sanders and Webster 1978; Wright 1986), and persistent village-based societies seem to become, by default, places where those causes and processes were not operative. But can archaeologists assume that long-lived village societies are simply those cultures where cultural evolutionary processes stalled? Even if this is true, the implication is clear that persistent village-based systems have something to teach us about how and why changes in economy and social organization come about.

The stage and static views of village society are logical results of archaeologists' widespread interest in major socio-cultural transformations. This has long been the focus of cultural evolutionists, but it is clear that the emphasis is still prominent among more recent theoretical trends, including agent-based models. Agent-centered approaches focus on individuals as interacting agents whose behaviors lead to many of the same socio-cultural transformations that have been of central interest to cultural evolutionists (e.g., Brumfiel and Fox 1994; Clark and Blake 1994; Clark 2000; Pauketat and Emerson 1997). In agent-based models, village societies often appear to be the 'matrix', in which emergent aggrandizers seek opportunities to accumulate both social and economic capital. Agent-based archaeological models that seek to explain major prehistoric transformations, like cultural evolutionary approaches, have generally neglected what societies that lack these classic prehistoric transformations might have to teach us about those transformations.

It seems clear that characterizing village societies as stages or as evolutionary dead ends glosses over significant variability both within and between such societies. Equally unsatisfactory is the notion that such societies lack the AAA or aggrandizing personalities that characterize early ranked societies. As a number of archaeologists and anthropologists have pointed out in recent critiques, the persistence of egalitarian social organization should be treated as problematic, rather than being treated as a natural or default condition in human societies (Boehm 1999; Flanagan 1989; Flanagan and Rayner 1988; Paynter 1989). Rather, this maintenance of egalitarian social organization should be seen as a form of social process in its own right, and one that might not simply be equated with stasis. In fact, significant change in socio-economic organization is possible within a small-scale or tribal society, even if such change does not result in the full-scale social transformations that have captivated archaeologists, such as the origin of formally ranked societies (Braun and Plog 1982 provide an excellent example of how such diachronic study of small-scale societies may be approached). In short, there is no reason to accept that the persistence of village-based organization represents either an absence of cultural processes of interest to archaeologists or the absence of ambitious agents.

Most importantly, I would argue that the notion of village societies as either static or stage has obscured what these small-scale societies have to teach us about complex societies and the processes that drive cultural evolution. In fact, persistent village-based socio-cultural systems should serve as ideal laboratories for testing both cultural evolutionary and agent-based models of the origin of socio-economic and political inequality. It is not sufficient for archaeologists to posit causes and processes that lead to socio-economic and political inequality and then examine whether such processes were at work prior to the emergence of these social transformations. The further logical step is to observe the absence of those posited causes and processes in those cases where the emergence of institutionalized socio-economic and political inequality did *not* emerge. Simply put, our understanding of socio-cultural transformations stands to benefit greatly by examining those societies where no such transformations occurred (Drennan 1996a, 2000).

In the current research, I pursue the study of a specific socio-cultural trajectory of a long-lived village-based society. This specific trajectory must be seen as one among many others that, in principle at least, could have occurred in the past. Alternative trajectories in village societies are many, and may include: the evolution of politically ranked societies (vertical complexity), the development of socio-economic specialization and interdependence (horizontal complexity), some complex and/or 'heterarchical' combination of the previous two (Crumley 1995), or even a disintegration of the village system and return to mobile hunting-and-gathering. If we are willing to assume, as I am, that all village societies likely contained an assemblage of self-interested agents, then each of these potential trajectories must come about as a result of an interacting set of cultural, historical, and environmental conditions (Drennan 2000). Much recent research in politically complex societies has emphasized the variability, or multilineal nature, of these societies (Blanton, et al. 1996; Drennan and Peterson 2006; Earle 1997; Feinman and Manzanilla 2000; Peterson and Drennan 2005; Sanders and Webster 1978). The current research represents a similar effort in the area of small-scale village societies, but understanding these alternative trajectories always has implications for our understanding of all societies.

1.2. Investigating a Persistent Village-Based Society

The above discussion calls for the investigation of persistent village-based societies both as interesting phenomena in their own right, and as opportunities to learn about the social transformations relevant to other socio-cultural forms. Ideally, such an investigation should have a strong diachronic focus in a region where hierarchical political organization either never developed or was very slow in developing from village-based social forms. In addition, the ideal investigation should be sensitive to a number of dimensions of social, economic, and political organization in order to test models that posit one or more of these dimensions as key elements in the political economies of egalitarian and ranked societies. These dimensions include: the degree of supra-household and supra-community interaction, such as the exchange of goods and public ritual activity; the degree (or absence) of social and economic inequality, reflected in the controlled access, distribution, and consumption of goods; and the distribution of these lines of evidence, whether highly centralized or decentralized at the local and regional scales. By looking at each of these dimensions of socio-economic organization, this approach can identify correlations (or the absence of correlation) between dimensions. This approach acknowledges some of the critiques made by advocates of the concept of heterarchy (Crumley 1987; Crumley 1995), where societies are modeled as systems of numerous independent, contextually-defined rankings rather than systems governed by a single centralized hierarchy.

From the diachronic perspective, these dimensions of socio-economic organization must be approached with attention paid to the timing, rate, and overall trajectory of socio-cultural change. These diachronic factors correspond to what Spencer and Redmond (2001) call timing, tempo, and trend. Simply stated, these aspects of a diachronic study draw our attention to the temporal coincidence (or the absence of coincidence), the relative speed, and the directionality of change. So for example, the emergence of sedentary lifeways and population growth are changes that could coincide or occur in succession. These changes could in turn accelerate the rate of social change in other variables, producing a directed trajectory of socio-cultural change that is often described by cultural evolutionary theory.

The present study is an application of this approach using the diachronic study of a Formative Period settlement system on the southern *altiplano* of western Bolivia, known as the Wankarani Complex (Guerra Guttierez 1995; Ponce S. 1970)(Figure 1.1). This archaeological complex is represented by a number of deeply-stratified mounds up to 6 m high and of relatively small size (generally less than 2 ha.). These mounds represent some of the earliest sedentary, pottery-producing, farming settlements in the southern Andes. In contrast to its neighbors in the Titicaca Basin to the north, Wankarani society appears to have maintained a village-level of organization for as long as two millennia, from at least as early as 1500 BC until perhaps as late as 400 AD. The very long-lived nature of the Wankarani Complex has led archaeologists to characterize this society as an essentially conservative, stable adaptation to the marginal environment of the southern *altiplano* (Kolata 1983, 1993; Ponce S. 1970, 1980). This characterization of stability is based solely on the absence of autochthonous political development of chiefdoms and states, as no diachronic study of Wankarani has taken place to test the proposition.

It is clear that the Wankarani Complex never saw the evolution of the kinds of highly developed political economies and political organizations evident in the Lake Titicaca Basin to the north (Kolata 1983, 1993; Ponce S. 1970, 1980; Stanish 2003). Recent investigations, however, have suggested that there may have been a considerable degree of economic specialization and long distance trade in a variety of products in the Formative Period southern *altiplano* (McAndrews 1998, 2001, 2005; Rose 2001a, 2001b). Because economic specialization and long-distance trade require surplus production and levels of organization beyond the household and community levels, these factors suggest that some kind of evolutionary processes were at work in the region.

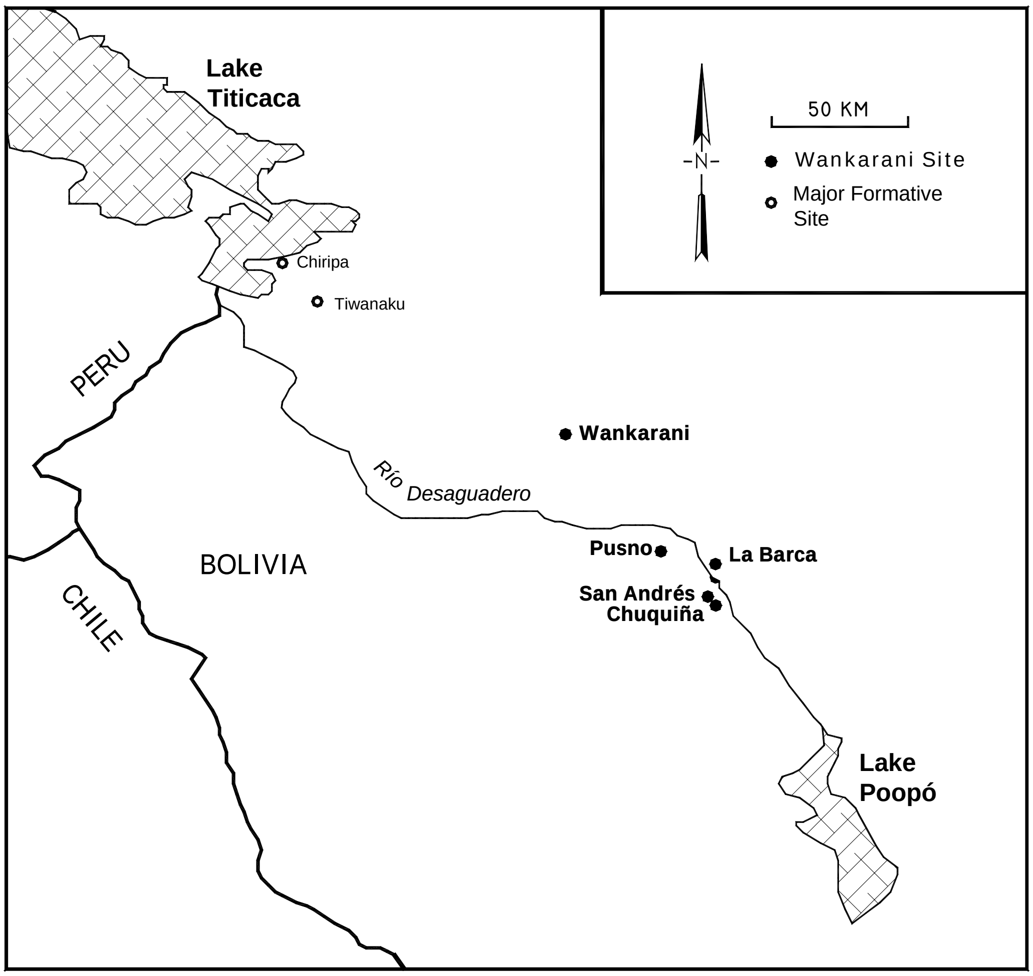

Figure 1.1. Map of the Southern Altiplano in Western Bolivia with Important Formative Period Sites Mentioned in the Text.

The Wankarani Complex serves as an ideal opportunity to investigate a persistent village-based settlement system from a diachronic perspective. The deeply stratified sites guaranteed large, longitudinal sample sizes from small, economical excavations. In addition, the proximity of contrasting cultural trajectories makes the Wankarani Complex amenable to comparative study with the Titicaca Basin, with the objective of illuminating the socio-economic processes and conditions that affected the specific paths of each of these regional sequences.

1.3. An Alternative Trajectory: The Lake Titicaca Basin

Although the earliest agropastoral villages of the Titicaca Basin probably emerged autochthonously from the Late Archaic, a period that is particularly well-represented in the lake basin (Stanish 2003:101-102), the earliest Formative Period settlements appear to represent a similar lifeway to that of the Wankarani. Defined in the southern basin on the basis of distributions of Pasiri style pottery, Stanish posits that the Early Formative Period (2000-1300 BC) settlement in the Titicaca Basin was focused on circum-riverine and circum-lacustrine locations (Stanish 2003:99-106). These early village settlements would have employed a subsistence strategy focused on a mix of agricultural, pastoral, and lacustrine resources. Studies of lithic materials from the Pasiri sites of Ch'uxuqullu and Titinhuayani on the Isla del Sol indicate that both tools and raw materials were widely exchanged in the basin during this period, and obsidian was imported from as away as the Colca Valley (Stanish 2003:106-107).

During the Middle Formative (1300-500 BC), the Titicaca Basin saw the emergence of more settlements, increasing settlement sizes, and a settlement hierarchy topped by a handful of regional centers including Qaluyu (Stanish 2003:112-113), Pucara (Lynch 1981), Chiripa (Hastorf 1999; Hastorf, et al. 2001; Stanish 2003:115-117), and Tiwanaku (Stanish 2003:117), among others. Settlement continued to be concentrated along streams and especially the lake litoral itself; Stanish (1997; 2003:123) estimates that 85% of the total population of the basin was concentrated along the shoreline of Lake Titicaca during the Middle Formative. Stanish also argues that during the Middle Formative intensive agriculture in the form of raised fields and slope terrace farming emerged in the basin, both agricultural methods that generated much of the surpluses that underwrote political economies in subsequent cultural developments (Stanish 2003:134).

The emergence of labor organization above the household level, in short the growth of political economies, accelerated late in the Middle Formative Period. In the Late Middle Formative, a distinctive suite of artifacts with a fairly well-defined set of stylistic attributes emerged in the Titicaca Basin. These include a ceremonial architectural style featuring the sunken court temple-storage complex, carved stone stelae, distinctive painted serving ware, tubular ceramic 'trumpets', and "supernaturalistic" iconography (Bandy 2004; K. L. M. Chávez 1988; S. J. Chávez 1988; Chávez and Chávez 1975). Karen and Sergio Chávez dubbed this ceremonial suite the Yaya-Mama Religious Tradition, which they saw as a regional religious movement.

Bandy (2004), following an argument put forward by Adler and Wilshusen (1990), has argued that the artifacts and facilities of the Yaya-Mama Religious Tradition indicate a shared ceremonial experience that served to integrate the communities of the Taraco Penninsula and the larger Titicaca Basin. In Bandy's model, a Neolithic Demographic Transition had fueled a rapid rate of population growth during the Early and Middle Formative, driving a process of growing scalar stress and resultant community fissioning (Johnson 1978, 1982). Bandy argues that the integrative function of the Yaya-Mama Religious Tradition served to dissipate scalar stress in communities, allowing settlements to grow to much larger sizes, effectively retarding the fissioning process (Bandy 2004:330-331).

Stanish (2003:132) further argues that the emergence of the Yaya-Mama Religious Tradition represents the earliest emergence of a new “elite ideology” and social ranking in the Titicaca Basin. Stanish envisions this as a pan-regional ideology that fueled elite competition at a handful of sites where stone stelae were located in a symbolic show of participation in the system. He characterizes these regional centers as the seats of a group of competing simple chiefdoms. Under these early leaders, long-distance trade networks intensified in the Titicaca Basin, as evidenced by the spread of similar styles of pottery and other artifacts that extended as far as the Peruvian Coast (Silverman 1996 cited in Stanish 2003:135).

With the start of the Upper Formative (ca. 500 BC), the Titicaca Basin saw the rise of at least two regional polities centered at what Stanish calls the “primate nonurban centers” of Pucara and Tiwananaku (Stanish 2003:137-138). These two settlements were orders of magnitude larger than others in the Upper Formative Titicaca Basin, and Stanish envisions them as the seats of competing peer polities at the level of complex chiefdoms. Stanish estimates the size of Pucara to be about 2 km^2 at its height around 100 AD, when the site would have dominated the entire northern Titicaca Basin (Stanish 2003:142-146). Estimating the size of the Tiwanaku center is difficult given that subsequent growth and urbanization at the site destroyed much of the Upper Formative Period materials at the site, but Stanish (2003:149) estimates that the site was at least 1 km^2 in area. No other site in the Upper Formative Basin was much larger than 10 ha, hardly one tenth the size of the primate center at Tiwanaku (Stanish 2003:Table 7.1).

Most archaeologists agree that the polity centered at Tiwanaku had flourished into a fully state-level society some time after about 400 AD, and certainly by 500 AD (Kolata 1993: 85-86; Stanish 2003:168-169). Overall, this trajectory of chiefdom (or ranked society) and state development in the Titicaca Basin is contemporaneous with the Formative Period Wankarani of the southern *altiplano*. And the rise of the expansionist state in Tiwanaku is approximately coincident with the demise of the Wankarani Complex, suggesting that populations on the southern alitplano may have abandoned the area and were drawn into the growing polity to the north. The contrast between this trajectory of growing political economy and that of the Wankarani is obvious, and is most traditionally attributed to the more favorable and highly productive conditions of the Lake Titicaca Basin (Kolata 1983, 1993; Richardson 1994). It is worth noting, however, that this proposition has never been rigorously tested. In fact, little empirical analysis has focused on the environmental differences in the two regions at all.

1.4. Models of Inter-Community Relations

At the inter-settlement scale, a range of socio-economic relationships may be posited between villages in a settlement system. These range from complete community independence to strong systems of interdependence and integration. At the simplest end of this range would be communities operating in an essentially domestic mode of production (sensu Sahlins 1972). At the other end of the scale are communities linked into well-defined integrative systems of trade and interaction or even political domination. Conditions of community independence lead us to predict that each site was essentially providing for its own needs of production, distribution and consumption. This is not to say that there was no interaction, only that the great majority of a community's social and economic functions were conducted independently of its neighbors. Archaeologically, this relationship should be reflected in a high level of functional similarity in artifact and feature assemblages; each site should contain evidence of the full suite of economic activities.

There are many kinds of interdependent community relations that might link villages within a settlement system, but all involve the differentiation and specialization of community functions.

It has been posited that community interdependence is likely to arise in conditions of environmental and resource heterogeneity (Arnold 1995; Service 1975) as a means of minimizing risk or maximizing efficiency (Braun and Plog 1982; Hegmon 1991). An interdependent relationship between communities requires social and/or economic mechanisms of integration that link complementary specialists and consumers, since the risk of specialization can only pay off in conditions where the specialist can be reasonably sure of gaining access to the products of other neighboring specialist producers. Under these conditions, growth in a peer community in a settlement system could result in that community absorbing social and economic functions of its neighbors, eventually leading to the emergence of a regional settlement hierarchy.

Flannery posited another way that small-scale village communities might be integrated: as a result of parent-daughter community history (Flannery 1976). In this model, the functional differences and interdependence between communities are the result of a historical relationship between communities. Sites settled early in the history of the region are expected to be larger. As these sites grew in size, they generated the founding of smaller, daughter communities made up of individuals that broke away from the parent community. Given the nature of their history, parent communities may exhibit greater functional diversity, and may act as central places of ritual and exchange activities for one or more daughter communities. They may also be in an advantageous position to take “administrative priority” over daughter communities, raising the possibility that the seeds of settlement hierarchies are planted at the point of origin in early village settlement systems (Flannery 1976:162).

1.5. Models of Socio-Cultural Change

In addition to these sets of possible inter-community relations, this study pays special attention to how these relations changed over time. In this diachronic approach, various cultural trajectories may be defined on the basis of the tempo, timing, and trend of socio-cultural change (Spencer 1990; Spencer and Redmond 2001). For example, one possible trajectory is one of truly static inter-community relations, where one of the above models of community interaction (independence, interdependence, parent-daughter) remains stable over long intervals of time. This would correspond to a condition where the tempo of evolutionary change has either stopped or proceeds at such a slow pace as to be negligible. An alternative scenario is one where a village society was on a slow, but continuous trajectory toward greater centralization and inequality. This would be an example of a very slow tempo of evolutionary change, but with a clear trend in development along the lines of what Flannery has called 'general evolution' (Flannery 1983, 1995). Still another alternative would be represented by a pattern of rapid cyclicity. In the case of the Wankarani Complex, this could take the form of rapid population growth and frequent cycles of village fissioning over the course of two millennia. Such a trajectory would be characterized as having a high tempo of change, but no clear trend over the long-term.

1.6. Research Questions

1.6.1. Research Question 1

What was the nature and degree of socio-economic specialization and integration between Wankarani settlements? How did the degree of specialization and integration change over time, and did this change reflect a degree of cyclicity or trend?

It is clear that social and economic specialization can only occur in the presence of supra-household and supra-community mechanisms of integration. Thus, the functional differentiation of households and communities is evidence of integrative mechanisms that facilitate exchange and interaction between lower-order units (Johnson 1977). Cultural evolutionists have long posited that integration represents an important functional component of political hierarchies. Supra-community integration itself is seen as 'adaptive' in many circumstances, as it facilitates the exchange of goods and services, the minimization of subsistence risk, the development of alliances for mutual protection, and the processing of environmental and social information. In the absence of political leadership, supra-community integration takes the form of kinship networks, ritual sodalities, warrior societies, and other associations. Of course, in a scenario of community independence, there should be little or no evidence of either integrative organizations or socio-economic specialization. On the other hand, if Wankarani communities were well-integrated into regional socio-economic networks in the absence of political leadership, it seems clear that political leadership represents only one possible integrative solution to the problems posed by subsistence risk (Spencer 1993), mutual defense (Carneiro 1981, 1998), and information processing (Johnson 1978, 1982).

1.6.2. Research Question 2

Is there evidence of significant economic inequality within or between Wankarani settlements? Is the development and presence of economic specialization and inter-community integration associated with evidence of economic inequality?

Social and economic inequalities are most often detected archaeologically through distributions of high-cost, craft produced items and exotic goods. Patterns of food consumption may also indicate socio-economic status, as elite individuals are known to have access to both higher quality and higher diversity diets ethnographically. Domestic architecture is a third category of evidence indicating differences of socio-economic status. Typically, economic inequality is viewed as a result of some households or individuals having unequal control over the products of subsistence production or long-distance exchange. If marked patterns of economic inequality can be identified in the Wankarani archaeological record, this would run counter to models that argue that economic control is always tied to the development of political leadership (Earle 1991). If economic inequality did occur in the Wankarani sequence, its timing and trend in relation to evidence of socio-economic specialization and integration may be important, as aspiring elites often use economic surplus to attempt to control external trade and interaction.

1.6.3. Research Question 3

To what degree was this Wankarani settlement system centralized, politically, socially, and economically? Did one community have functional priority (a greater range of functional activities) over another? If centralization occurred, did it apply to the full range of social and economic activities (e.g., exchange, ritual, craft production, etc.) or only certain spheres? Was there a correspondence over time between socio-economic centralization, specialization, and inequality?

The centralization of socio-economic functions at a single settlement is diagnostic of a settlement hierarchy and centralized leadership. This relationship should appear as a trend between two communities, with one absorbing more functions over time at the cost of the other. In the absence of such a trend, centralization of this type may only be indicative of the parent-daughter form of community relationship outlined above. The timing and trend of centralization also has direct implications for testing models that favor economic control as the basis of institutionalized political hierarchy

2. CULTURAL AND ENVIRONMENTAL CONTEXTS

2.1. Environmental Setting

2.1.1. Physical Geography and Climate

The *altiplano* is a closed drainage basin for the surrounding Andean cordilleras (the occidental and the oriental). The study area of the current investigation is centered in the southern *altiplano* of western Bolivia, in the zone between Lakes Titicaca and Poopó (Figure 1.1). At about 3700 masl, the *altiplano* in western Bolivia is extremely flat, open grassland with numerous isolated volcanic hill groups dotting the landscape. These hill groups rise from 20-1000 m above the surrounding *altiplano*. The region lies along the margins of the Andean temperate and subtropical ecological zones, and is generally characterized by a cool dry climate; average daily temperature is about 9.5°C. As would be expected at this semi-tropical latitude and high altitude, diurnal temperature fluctuations are high, with estimates ranging from 14-20°C (Cochrane 1973; Montes de Oca 1989), while the mean seasonal temperature fluctuation is slightly lower at 11°C (Binford, et al. 1997; Cochrane 1973; Montes de Oca 1989). Aridity and risk of frost are persistent problems for food production on the *altiplano*, and as a result non-native crops often do not fare well in this environment. The suite of native domesticates tend to be frost-resistant grasses and tubers. In general, this temperature regime has been relatively stable since the onset of the Holocene, encompassing the entire span of historic and prehistoric occupation of the region.

2.1.2. Hydrology, Precipitation, and Risk

The southern *altiplano* becomes increasingly arid along a north-south gradient (Table 2.1). Annual precipitation in the Titicaca Basin, for example, is about 750 mm (Binford, et al. 1997), while La Paz receives about 600 mm (Tomka 1994), and Oruro receives just 300-400 mm. The majority of precipitation on the *alitplano* is tightly clustered during the wet season months of December-March, and this is especially true in Oruro (Tomka 1994; Vose, et al. 1992)(Figure 2.1). During these months precipitation can come in dramatic episodes, threatening to inundate and drown cultivated plants. During the dry months, the only reliable sources of fresh water are the few perennially flowing streams and subterranean aquifers. Principal among these is the Río Desaguadero, which drains Lake Huyñamarca, the southern component of Lake Titicaca. The Desaguadero then flows southeast some 400 km before emptying into Lake Poopó. The river is the most important source of fresh water for inhabitants of the *altiplano* zone between the two lakes. In addition to making direct use of water from the river, many communities also depend upon the subterranean aquifers that are recharged by its waters. As McAndrews (2005) has discussed in detail, the southern outlet sill of Lake Huyñamarca lies at approximately 3800 masl. Thus Lake Titicaca levels must be maintained at this minimal level or all lake discharge into the Desaguadero stops. A number of studies have shown that lake levels in the Titicaca Basin have fluctuated a great deal from year to year and from century to century. However, much of the most dramatic variation in lake level can be seen in the seasonal discharge rates of any given year (Abbott, Binford, et al. 1997; Abbott, Seltzer, et al. 1997; Binford, et al. 1997).

Table 2.1. Precipitation Data from the Research Zone in the Department of Oruro and from Other South Andean Locations at Similar Elevations.

Location / Elevation	Mean Annual Precipitation (mm)	Constancy (C)	Contingency (M)	Predictability (P)	C/P	M/P
Oruro[1] 3700 m	400	.27	.22	.49	.55	.45
Oruro[2] 3708 m	340	.18	.30	.48	.38	.63
La Paz[2] 4105 m	590	.01	.57	.58	.02	.98
La Paz[2] 3632 m	-	.03	.41	.44	.07	.93
Osmore[3] 3650 m	250	.17	.26	.43	.40	.60
Guaqui[4] (Titicaca Basin) 3840	580	-	-	-	-	-

[1]Calculations made from data in Vose et al. (1992).
[2]Predictability calculated by Tomka (1984).
[3]Predictability calculated by Aldenderfer (1989).
4Data from Binford et al. (1997)

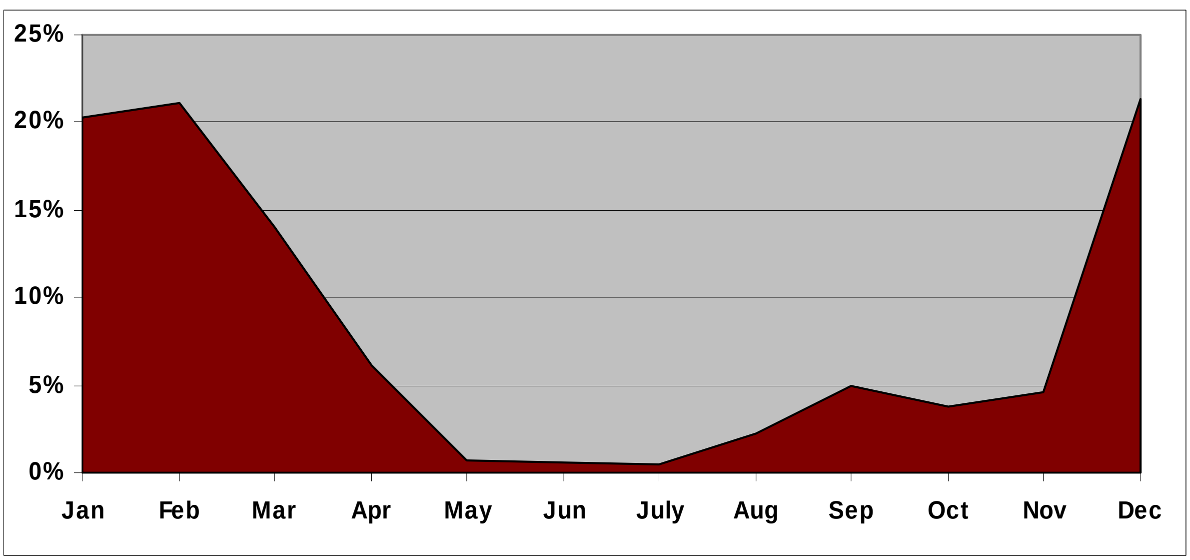

Figure 2.1. Area Graph of Mean Percentage of Monthly Precipitation in Oruro (data from Vose et al. 1992; includes data collected during nineteen years of study from 1955 to 1988)

During both the prehistoric and historic periods, reduced lake levels and discharge into the Río Desaguadero presented considerable hardships to plant and animal communities that depended on the southern *altiplano*. This variation in lake levels also has major impacts on human subsistence and settlement. In the Titicaca Basin, variation in lake levels has been correlated with the cultural fluorescence and collapse of the Tiwanaku State (Binford, et al. 1997; Kolata 1993). Importantly, the highest levels of lake output into the Desaguadero occur during the months of January to July, with April being the peak (Roche, et al. 1992). These months of high stream levels could have ameliorated the stress and risk of the early dry season for *altiplano* agropastoralists. When lake discharge is extremely high, it also can result in larger riverine plant, fish, reptile, and bird communities, thus providing an additional set of seasonal resources to complement the agropastoral system. Although no studies have been conducted to test the effects of lake output on wild and domesticated camelid herds, it seems likely that periods of high stream level would have produced zones of better pasture in the vicinity of the Desaguadero.

Of course, the opposite would be true during periods of low lake levels in the Titicaca Basin and correspondingly low output rates from Lake Huyñamarca. When water levels in the Titicaca Basin dropped to below 3800 m, all output would have ceased, marking dramatic reduction in the riverine resource base. Detailed studies of ice and lake cores from Andean lakes in Peru and Bolivia have resulted in a relatively fine-grained history of water levels in Lake Titicaca and other highland lakes around La Paz (Abbott, Binford, et al. 1997; Abbott, Seltzer, et al. 1997; Binford, et al. 1997; Roche, et al. 1992). This evidence has been summarized in detail elsewhere (McAndrews 1998, 2005), so I will limit myself to discussing the most important conclusions for the current study. According to the best available lake core data, major rises in the level of Lake Titicaca led to the overflow of Lake Huyñamarca into the Río Desaguadero beginning around 1500-1300 BC (Abbott, Binford, et al. 1997:177-178). This overflow would have resulted in higher riverine output and higher riverine biotic productivity, though as discussed above, the seasonal fluctuation in this output would have been significant. Interestingly, this coincides with much of the early Wankarani settlement of the southern *altiplano*, raising the hypothesis that sedentary settlement of the southern *altiplano* may have only been made possible by this output from Lake Huyñamarca. Given the scant cultural evidence from the very late Archaic and very early Formative periods, this is advanced as a hypothesis only.

After this overflow began at about 1500 BC, Abbott *et al.* (1997) note that at least three low lake-level intervals occurred during the Formative Period. These three low-lake stands occurred at about 900-800 BC, 400-200 BC, and 1-300 AD, respectively (a fourth beginning at 1100 AD has been implicated in the decline of Tiwanaku). It is important to note that these three low lake-stand levels represent periods when low lake levels persisted long enough to leave clear signatures in the lake core database. But even outside of these sustained low lake-level periods, annual fluctuation in Titicaca lake levels would have been quite dramatic. Data from the last 100 years (a period of relatively high precipitation and snow melt) show annual fluctuation of as much as 6 m (Abbott, Binford, et al. 1997:177) in lake levels. This means that even several consecutive years of favorable lake levels and riverine output from the Titicaca Basin would not allow reliable prediction of lake level and stream output in a subsequent year. Such fluctuation would have had a major impact on the reliability of riverine resources, as well as groundwater levels, all over the southern *altiplano*. Any successful subsistence strategy would have to take this high level of risk and unpredictability into account.

Of course, the risk posed by fluctuating lake outputs from the Titicaca Basin would have been mitigated to some extent if rainfall levels were both abundant and reasonably predictable.

Precipitation on the southern *altiplano*, however, exhibits neither of these characteristics. Precipitation is scarce in the region, even by highland Andean standards, with only very few years ever producing more than 500 mm of total annual accumulation (Table 2.1). This average is significantly more arid than available data suggest for the *altiplano* around La Paz to the north (Tomka 1994), but not so arid as the Osmore in Peru (Aldenderfer 1989a). Low annual precipitation is further complicated on the southern *altiplano* by its uneven temporal distribution over the year. On average, more than 240 mm, or about 65%, of total annual precipitation falls during the wet season months of December, January, and February (Figure 2.1).

In addition to rainfall being both scarce and limited to a short wet season, its extreme variation at seasonal and annual time scales introduces an additional element of risk, especially for farmers, on the southern *altiplano*. High degrees of variability from year to year mean relatively low levels of predictability in the timing and amount of precipitation. Colwell (Colwell 1974) has provided a useful means of quantifying the degree of predictability in ecological phenomena, which represents a major component of environmental risk. Predictability is a mathematical index of variation in the occurrence of a "periodic phenomenon," calculated using a frequency matrix. Predictability (P) is the sum of two variables: constancy (C) and contingency (M). Constancy and contingency each vary between 0 and .5. When summed, these two measures are equal to a number between 0 and 1, which represents the frequency with which the phenomenon at hand can be predicted at some given level of periodicity. Thus, a predictability of 0 is equal to complete randomness (the absence of predictability) while a sum of 1 would represent 100% accuracy in predicting the phenomenon (Aldenderfer 1998:3).

The first, constancy, refers to the ability to predict the state of a phenomenon at any given point in time. So for example, constancy is an indicator of how well can we predict whether it is precipitating at a randomly selected point in time. Examples of highly constant environments include deserts and tropical rainforests, where temporal fluctuation in environmental conditions is minimal (Aldenderfer 1998:3). Highly seasonal environments, on the other hand, have relatively low constancy as a result of annual weather cycles. Contingency refers to the ability to predict the state of a phenomenon at non-random points in time (e.g., time of day, time of year, etc.). Seasonal environments, which have low measures of constancy, may have very high measures of contingency if seasonal weather changes occur in fairly fixed temporal patterns.

In order to measure the predictability of precipitation levels for the study region, data from the National Climatic Data Center (NCDC, a division of the Department of Commerce)(Vose, et al. 1992) were used to produce the matrices needed for Colwell's measure of predictability (1974). The results are included in Table 2.1, along with comparative data from similar elevations near La Paz and Osmore, Peru (Aldenderfer 1989a; Tomka 1994) as well as annual precipitation from Guaqui in the Lake Titicaca Basin (Binford and Kolata 1996).

First, these data show that predictability with regard to precipitation varies around .5 in all of these south Andean cases. In most of these southern Andean cases, the great majority of predictability is a result of a fairly high measure of contingency. The high contingency value is an effect of the relatively regular occurrence of the tropical wet/dry seasonal cycle. Oruro differs in this regard, with the average of data from the two stations showing a fairly even relationship between constancy and contingency. This is a reflection of the fact that the Oruro area is more arid on a year-round basis, which blunts the effects of regular seasonal patterns (contingency) in the frequency matrix. Overall, it is clear that predictability as well as total accumulation of precipitation would have posed a considerable challenge to prehistoric agropastoralists on the southern *altiplano*, and this challenge was greater than that faced by people living in the Lake Titicaca Basin and even those on the *altiplano* slightly to the north.

2.2. The Formative Period Southern *Altiplano* and the Wankarani Complex

The Formative Period in the highland Andes is usually thought to begin at least as early as 2000 BC, although to date no sites from that earliest time period are known in Bolivia (Figure 2.2). The end of the Formative is generally associated with the rise of Tiwanaku influence in the southern *altiplano* and the emergence of the site of Jachakala in La Joya. The exact timing of the end of the Formative Period is not clear; with estimates ranging from ca. 200-500 AD in Oruro, but several centuries earlier in La Joya (Beaule 2002:35; McAndrews 2005:6). The Formative Period settlement on the *altiplano* is broadly categorized under the Wankarani Complex. This set of sites is distributed throughout the *altiplano* in the western departments of La Paz and Oruro (Figure 1.1). The Complex derives its name from the type site, located south of the city of La Paz. Wankarani sites are noted for being mound formations of accumulated adobe melt and anthropogenic debris that rise as much as 5 m above the surrounding terrain.

2.2.1. Early Investigations

Prior to the 1970's only a few preliminary investigations were made into Wankarani sites. Several researches conducted informal surveys in Oruro, noting the existence of mound sites associated with carved stone effigies of feline and camelid heads (Ibarra Grasso 1965; Lopez Rivas 1959; Metraux 1933; Metraux and Lehmann 1937, 1953). It was not until 1970 that Ponce Sanginés defined this assemblage of sites as members of the Wankarani Complex, a cultural manifestation that predated Tiwanaku and was thought to be contemporary with Chiripa (Ponce S. 1970). Ponce's syntheses of Bolivian prehistory included discussion of the Wankarani Complex (Ponce S. 1970, 1980), which he based primarily on excavations at the type site of Wankarani and the site of Uspa Uspa (Walter and Trimborn 1994; Wasson 1967).

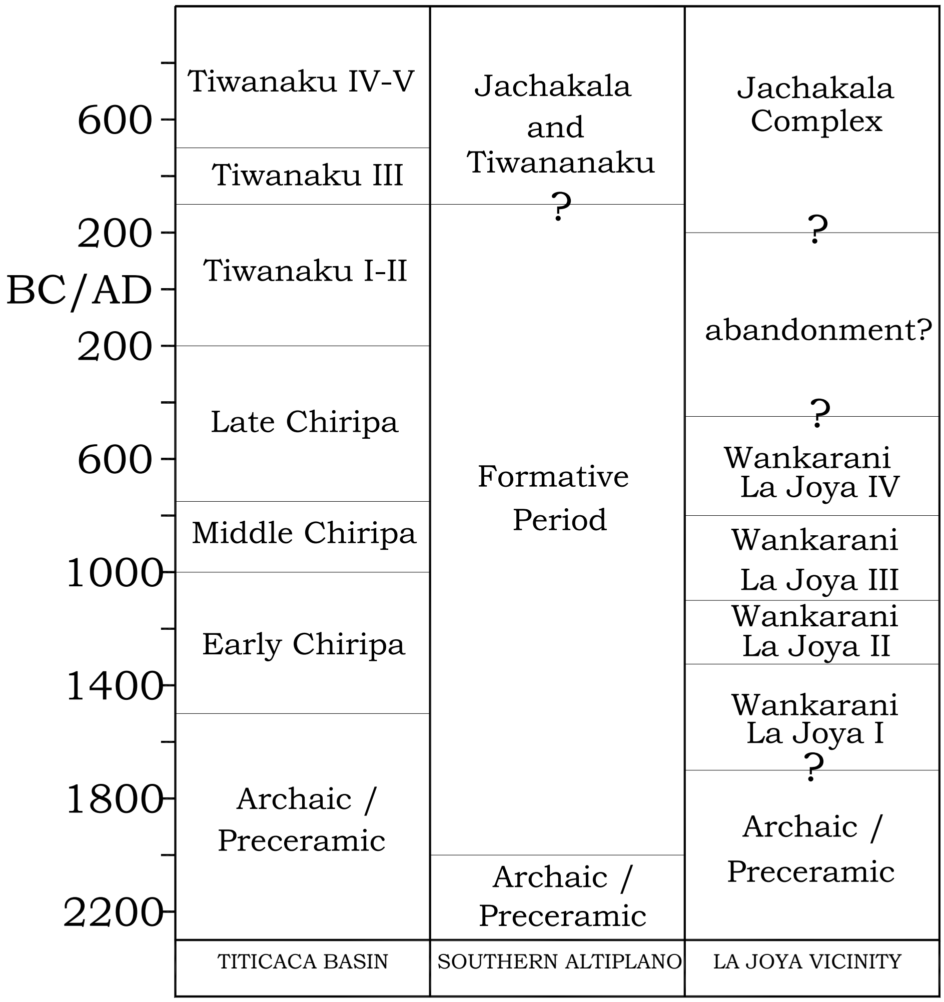

Figure 2.2. Cultural Chronology of the La Joya Study Area and the Surrounding Region.

Ponce's reconstruction of Wankarani lifeways emphasized the small-scale nature of the settlements and their lack of corporate ceremonial architecture, an especially striking contrast with the Formative Period developments at Chiripa and other sites in the Lake Titicaca Basin. He attributed this difference to the cold and arid conditions of the southern *altiplano* (Ponce 1970: 13-14). He also noted the high density of relatively simple, round residential structures common in these sites, a residential pattern he compared to the modern Chipaya people of Bolivia (Gisbert 1988). Given the small size of domestic structures (<6 m in diameter) and their rather uniform nature, he argued that Wankarani villages were egalitarian in organization, with no formalized leadership or decision-making apparatus (Ponce 1980:13-18). He further argued that artifactual evidence suggested that these were self-sufficient agropastoral communities. These would have been the earliest known sedentary, food-producing communities in Bolivia, and among the earliest such societies in the Andes.

Although he viewed them as egalitarian communities, Ponce's description of Wankarani settlement sizes ranging from 15 to 3900 persons (Ponce S. 1980:14) led some researchers to posit the possibility of a settlement hierarchy among the sites and the possible existence of chiefly leadership (Kolata 1993:61-62). However, most researchers have come to agree that these population estimates are far too high and that most Wankarani sites were probably only partially occupied during various parts of the Formative Period (Bermann 1995; McAndrews 2005). It is unknown how settlement size changed through time, whether through a process of continuous growth, growth punctuated by settlement fissioning, or some other pattern. Addressing growth of settlements and the settlement system was one objective of the current research.

Among the most provocative discoveries in Wankarani sites included the presence of escoria thought to be the result of copper smelting in the basal layer of the type site of Wankarani. This discovery suggested the possibility of craft specialization within Wankarani communities, an attribute usually associated with more complex societies. Ponce noted that there seemed to be no evidence of marked technological or social change revealed at Wankarani or Uspa Uspa, though he did describe a chronology based on a seriation of subtle ceramic change. This chronology included three phases, which he called inferior, media, and superior (1970:32-33; 1980:18-21). He estimated that Wankarani culture emerged by about 1300 BC and probably disappeared by about 300 AD, when it was eclipsed by the expansion of the Tiwanaku State into the southern *altiplano* (1980:21). The ceramic changes discussed by Ponce have proven difficult to replicate in more recent investigations. This issue is addressed in greater depth in Chapter 5, where I develop an alternative approach to dating sites using ceramic attributes. Ponce's synthetic works remained the state of the art in the study of the Wankarani Complex throughout the 1970's, 80's, and early 90's (Kolata 1993:59-63). During those years, no new investigations took place.

2.2.2. The La Joya Settlement System

Beginning in the early-mid 1990's, a series of investigation have focused on the Wankarani Complex in the western Department of Oruro (Bermann 1995; Bermann and Estevez C. 1992, 1993; Estevez C. and Bermann 1996, 1997; Fox, et al. 2004, 2005; McAndrews 2001, 2005; Rose 2001a, 2001b), of which the current research is a part. Taken together, these studies have shed new light on Formative developments in the area, and allow us to consider Formative Period culture of the south-central Andes in considerably more detail than was possible a decade ago. McAndrews' survey project in the western Department of Oruro was the first to systematically map and collect surface assemblages from a large sample of Wankarani sites. The survey results reveal three clusters of Wankarani settlements in his study region (Figure

2.3), of which the La Joya settlement system (Figure 2.4) is by far the best studied as it has been supplemented with excavations at La Barca (Rose 2001a, 2001b), Chuquiña (Estevez C. and Bermann 1996, 1997), and San Andrés (Bermann and Estevez C. 1995).

2.2.2.1. Settlement Patterns

In his analysis, McAndrews (1998, 2005) found that sites tend to be located in areas of relatively easy access to a variety of resources including water, diverse agricultural soils, and pasture. Most sites are located at the bases of isolated hill groups that dot the landscape, locations that provide a degree of shelter from the harsh *altiplano* sun and winds. This pattern of site location is consistent with traditional interpretations of Wankarani sites as fully or semi-sedentary agropastoral communities, engaged in cultivation of potatoes and chenopods as well as camelid herding (Kolata 1983, 1993; Ponce S. 1970, 1980). McAndrews points out that sites at the bases of hill groups would have had access to upland soils favored for potato cultivation as well as flatland soils for cultivation of quinoa, tubers, and potatoes as well (McAndrews 2005:57). Proximity to slopes may also have provided a natural opportunity to accumulate fresh water from runoff to water fields and gardens. All sites in the La Joya system are located quite close to the Río Desaguadero, with the farthest site (Pusno) still lying only about 5 km from the river.

Like most Wankarani sites, those in the La Joya settlement system generally range from 0.5 to less than 2.0 hectares in size and rise from 1.0 to 5.0 meters above the surface of the surrounding *altiplano* (Table 2.2). Some of these very nucleated villages may have had low surrounding walls enclosing them (Escalante Moscoso 1994), though this is not well documented at many sites. The extreme depth of many Wankarani sites and a growing database of radiocarbon dates (Table 2.3) show that many villages were occupied more or less continuously over very long periods of time, with some occupations spanning as long as 1500

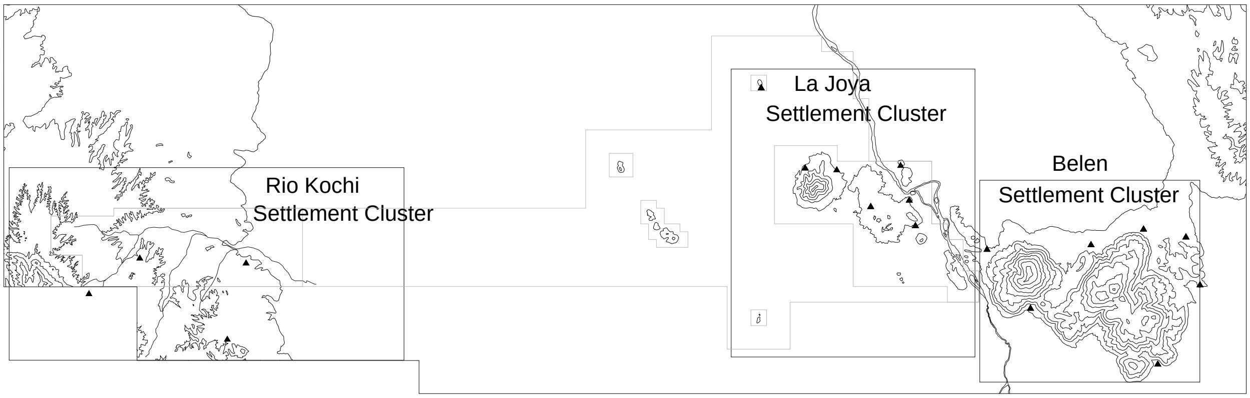

Figure 2.3. Map of McAndrews' Survey Area (Modified from McAndrews 2005)

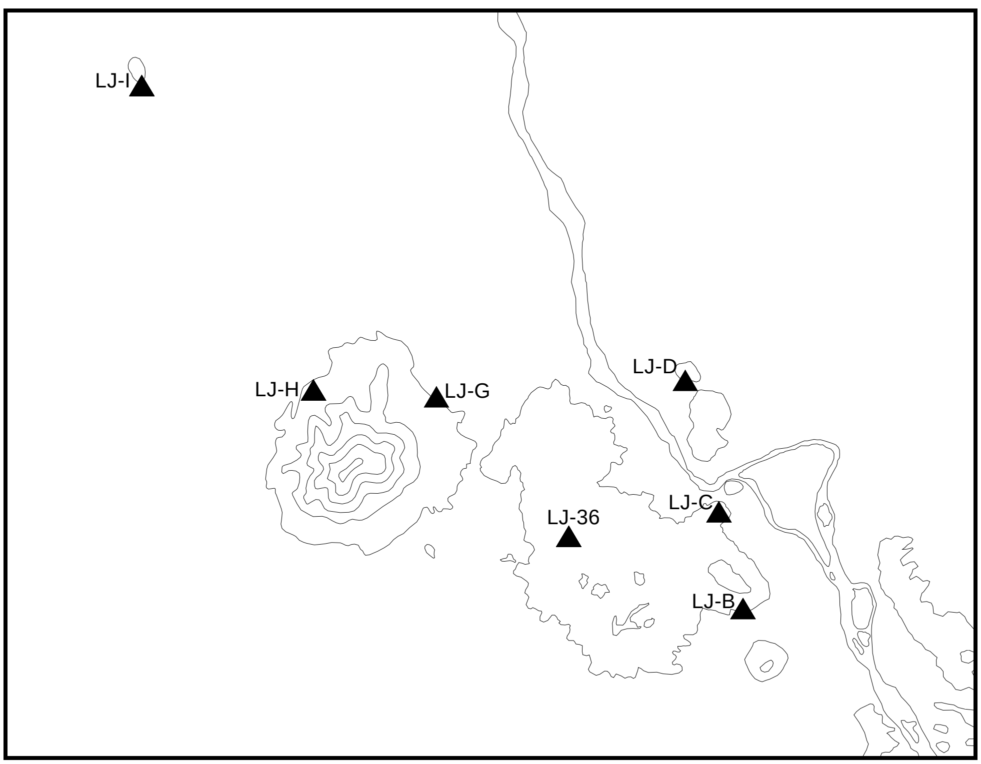

Figure 2.4. Map of the La Joya Settlement System (modified from McAndrews 2005).

Table 2.2. Wankarani Sites in the the La Joya Settlement System.

Site Name	Area (ha)	Height (m)	Distance to Río Desaguadero (km)	Elevation (masl)
Chuquiña (LJ-B)	1.60	5.0	1.6	3710
San Andrés (LJ-C)	0.25	3.0	0.6	3725
La Barca (LJ-D)	0.71	3.0	0.6	3710
Pukara Uno (LJ-G)	0.79	2.5	2.5	3720
Pukara Pukara (LJ-H)	0.80	3.0	4.6	3730
Pusno (LJ-I)	0.60	2.0	5.0	3720
Llallavi (LJ-36)	0.74	3.0	2.2	3740

Table 2.3. The Radiocarbon Database from Wankarani Sites.

Lab	Site	Unit	Level	Inv	RCYBP±1 Sigma	Calibrated Date
Univ of AZ	Chuquiña	2-C	15	Fox	2380±85	552±152 BC
Univ of AZ	Chuquiña	2-C	25	Fox	2905±60	1104±92 BC
Univ of AZ	Chuquiña	2-C	42	Fox	2995±55	1226±88 BC
Univ of AZ	Chuquiña	2-T	16	Fox	2975±80	1191±120 BC
Beta Analytic	Chuquiña	E310,N304	3	Bermann[1]	2580±90	676±132 BC
Beta Analytic	Chuquiña	E310,N304	20	Bermann[1]	2840±80	1026±107 BC
Beta Analytic	Chuquiña	E300,N310	3	Bermann[1]	2490±70	610±125 BC
Beta Analytic	Chuquiña	E300,N310	12	Bermann[1]	2820±70	995±93 BC
Beta Analytic	Chuquiña	E300,N310	16	Bermann[1]	2880±50	1063±76 BC
Beta Analytic	Chuquiña	E300,N310	28	Bermann[1]	3160±90	1420±101 BC
Univ of AZ	Pusno	4-D	7	Fox	2935±150	1151±185 BC
Univ of AZ	Pusno	4-D	11	Fox	2940±65	1149±102 BC
Univ of AZ	Pusno	4-D	16	Fox	3070±55	1325±67 BC
Beta Analytic	San Andrés			Bermann[2]		1195±130
Beta Analytic	San Andrés			Bermann[2]		1070±160
Beta Analytic	San Andrés			Bermann[2]		2430±335
Beta Analytic	La Barca			Rose[3]		1735±?
Beta Analytic	Kella Kellani			McAndrews[4]		1150±130
Beta Analytic	Kella Kellani			McAndrews[4]		1265±90
Beta Analytic	Kella Kellani			McAndrews[4]		1245±135

[1]Estevez C. and Bermann 1996, 1997
[2]Bermann and Estevez C. 1995
[3]Rose 2001
[4]McAndrews 1998

years. The long occupations produced the abundant adobe melt and anthropogenic debris that fueled the process of mound formation. In some cases, it is possible that the mounds were intentionally built up, possibly to assist with drainage.

At the supra-community level, archaeologists have commented on the presence of a site size hierarchy among Wankarani sites (Bermann 1995; Kolata 1993:62-63), which suggests the possibility of centralized political hierarchy (Wright and Johnson 1975). However, McAndrews' (1998) analysis revealed little evidence of functional hierarchy or wealth inequality between Wankarani sites. Further, functional differentiation between sites did not correlate with variability in site size, as would be predicted by a straight forward settlement hierarchy (McAndrews 1998:141-142). Thus, settlement data offers little support to the notion of an integrated regional political hierarchy.

At this point, nucleated villages represent the only type of Wankarani site yet recorded. Given our knowledge of pastoral societies, this is somewhat surprising. No non-residential herding or agricultural facilities of any kind have been located. This lack of non-residential and logistic site types can probably be attributed to one or more of several factors. First, it is possible that such sites were located in areas of poor preservation and/or rapid soil formation. It is also possible that such logistic sites are composed of minimal material culture, making them relatively ephemeral in the archaeological record and hence less likely to be detected in archaeological investigation.

Another explanation for the absence of non-residential logistical sites is that such sites either did not exist or never composed a significant component of the Wankarani settlement pattern. If true, this conclusion would also have a strong bearing on another unresolved aspect of Wankarani settlement – mobility. In the absence of other types of sites, we might be tempted to conclude that Wankarani people lived a completely sedentary life in nucleated villages. It has been argued that complete sedentism is unlikely for prehistoric Andean agropastoralists, given the distance between key agricultural and pastoral resources in the Andes (Parsons et al. 1997). However, these distances are minimized on the *altiplano*, where villages could be situated to optimize access to both farmland and pasturage.

The strong tendency toward nucleated settlements among the Wankarani has been explained as a result of conflict and warfare (Ponce Sanguinés 1970), and also with reference to "centripetal" social forces (McAndrews 1998). With the exception of some evidence for small retaining walls at a few sites, direct evidence of warfare among the Wankarani is absent. Weaponry (projectile points and sling stones) does not comprise a noteworthy proportion of the material culture reported from any sites, and low retaining walls do not appear to be effective defensive structures. Perhaps most importantly, Wankarani sites are not located in the most defensible locations. As noted above, most Wankarani sites are found at the bases of hill groups rather than in or on top of the hills themselves, where they would have had better defensive advantage and still had relatively convenient access to pasture and farm lands as well as fresh water. Such a pattern is well-documented in the south-central Andes during the Late Intermediate Period, when pukara sites were constructed with series of defensive walls. For these reasons, I would argue that the nucleation seen in Wankarani communities is more parsimoniously explained with reference to other economic factors, such as the need for supra-household labor pooling during bottlenecks in the agropastoral annual cycle.

2.2.2.2. Subsistence Practices

As has been noted above, Wankarani communities are thought to have pursued a mixed agropastoral subsistence strategy, supplemented with contributions of wild plants and animals. To date, no paleoethnobotanical analyses have been conducted, but it is likely that agricultural production among Wankarani communities was focused on native varieties of chenopods (quinoa and cañahua), potatoes, and other tubers. The chenopods are nutritious cereal grasses that are amenable to the difficult conditions of the *altiplano*. The grain from these grasses today is cooked into soups an stews, and is occasionally ground to make a flour for cakes and breads (Montes de Oca 1989:383). Potatoes have provided a rich source of carbohydrates and calories for historic and prehistoric Andean peoples. Potatoes are a highly frost-resistant crop, and can be freeze-dried to produce chuño. In this form, potatoes are easily stored and transported long distances. Their shorter growing cycle and relatively simple planting needs also make potatoes more amenable to intensification than the chenopods (Montes de Oca 1989).

Herding was focused on the llama and alpaca, camelids that were likely domesticated at least as early as 4000 BC in parts of the Andes, and possibly quite earlier (Aldenderfer 1989b, 1998; Kuznar 1989). Both animals make an excellent source of high protein meat – another form of storable and highly mobile wealth for Andean peoples. In addition, both animals are a useful source of secondary products in the forms of wool, hides, and dung used for fertilizer (Aldenderfer 2001). The llama is the only native domesticated animal of the Americas used as a beast of burden, though they have a relatively low weight limit when compared with the old world bovids and equids; informants in the field have shown me that most llamas simply will not carry a load exceeding about 30 kg. Camelid herding would have provided a critical means of risk reduction for Formative Period peoples. By having a mobile source of food on hand for periods of low agricultural productivity or complete crop failure, agropastoralists would have the flexibility to maximize agricultural production in favorable years while maintaining the flexibility that a mobile herd could afford in bad years.

A major objective of McAndrews' (1998) survey was to evaluate the relationships between settlement and resource catchments. Using population estimates of approximately 10-100 persons per hectare (with the median estimate of 50 accepted as the most likely) and estimates of agricultural productivity, McAndrews (1998:203-204) was able to show that Wankarani populations remained well below the carrying capacities of their respective catchments throughout the sequence of Formative occupation. Given the relative state of resource abundance, he explains the typical distance between Wankarani sites (usually more than 2 km) as a function of a socially defined threshold for village distance (McAndrews 1998:104-105). However, as Rose (2001:67) points out, McAndrews' site catchment calculations are based solely upon potato production, and do not account for the pasture needs of substantial herds of domesticated camelids. Bermann (1995 and personal communication) and Rose (2001:67) have suggested that the relatively dispersed spacing of villages may have been a function of guaranteeing sufficient high-quality pasture for camelid herds. These herds would have provided an important resource pool of 'wealth on the hoof,' a mobile insurance policy against the risk of drought that threatened the agricultural system.

Beyond the contribution of the agropastoral system, the role of wild resources in the Wankarani subsistence economy is not well understood at this time. Artifact assemblages from Wankarani sites typically include small numbers of projectile points and sling-stones, suggesting some degree of importance of hunting and possibly of spear-fishing as well (McAndrews 1998). Rose (2001:Table 4.5) found that wild species of small game (waterfowl, reptiles, and rodents) made up a major portion of faunal assemblages from domestic contexts. Fish bone has been recovered from some sites (Bermann and Estevez C. 1995; Rose 2001a), and fresh water shell fragments were noted on the surface of the site of San Andrés by McAndrews (1998:129). It is likely that aquatic resources played an important role in the Wankarani subsistence system. Access to the Río Desaguadero ensured not only a source of fresh water, but also the many riverine plants and animals discussed above.

A number of archaeologists have suggested that rich patches of aquatic resources played a central role in the development of political economies in the Lake Titicaca Basin during the Formative (Kolata 1993; Richardson 1994; Stanish 2003), an argument that echoes Moseley's maritime hypothesis for the origins of complex societies on the Peruvian coast (Moseley 1975; Moseley 1992). Presumably, the absence of such rich circum-lacustrine resources would have been an obstacle to political economic development on the southern *altiplano*, but no systematic study of human exploitation of the circum-riverine resource zone has been conducted to date. McAndrews reports from personal communications that both modern productivity and human exploitation of the Río Desaguadero are closely tied to lake levels and discharge rates from the Titicaca Basin (McAndrews 1998:77-78); and this would have been the case prehistorically as well.

While it is relatively clear that the Wankarani subsistence system would have relied on the economic triad of farming, herding, and wild resources, the important and difficult issue for archaeologists is defining the degree of reliance people had on each of these components (Stanish 2003:108-109). This can be very difficult to estimate in the absolute sense of how many calories were extracted from each component, but it can be estimated in a relative sense across space and time when sites, regions, and phases are compared. Through surface collected artifact assemblages, McAndrews (1998, 2005) recovered some evidence of specialization in subsistence practices between Wankarani sites. A comparison of proportions of bifacial stone hoes and the debitage associated with their production revealed statistically significant differences between some sites in the La Joya settlement system. His results suggest that some degree of specialization may have existed in the subsistence economy, where sites positioned with relatively favorable access to the Río Desaguadero, volcanic hills, and high quality soils engaged in more intensive agricultural activities (McAndrews 1998:181-182), while sites on the grasslands with relatively lower frequencies of agricultural implements focused more intensively on camelid herding.

2.2.2.3. Residential Patterns

Excavations of Wankarani sites have revealed long sequences of domestic architecture and midden deposits. Domestic structures are typically round, with floors dugout slightly below ground level and usually ranging from just a few to nine meters in diameter (Bermann and Estevez C. 1995; Ponce Sanguinés 1970; Rose 2001a). Walls were of mud brick adobe with stone foundations. Structural walls of this sort can be seen on the surface or immediately below the surface of many Wankarani sites. These house structures were probably roofed with thatch from wild shrubs and native paja grasses, producing a structure that is often compared to the modern houses of the Chipayas in northern Bolivia (Condarco C. 2002; Ponce S. 1970, 1980).

At La Barca, Rose (2001) found a consistent pattern of circular residential structures each attached to a smaller ancillary facility, presumably used for storage. Dwelling units each contained a single hearth, and caches of groundstone *manos* and *batans* (grinding stones or *metates*) were recovered from dwelling interiors (Rose 2001:100-101). Exterior areas showed evidence of household activities and midden deposits. Given the small size of domestic structures, Rose suggested it is unlikely that each housed a complete nuclear family. Thus, the coresidential household would have occupied more than one such structure. Storage pits were also located inside and outside of dwelling units. Similar patterns of round and oval structures have been noted on the surface of many Wankarani sites (McAndrews 1998) and in test excavations at the sites of Chuquiña and San Andrés (Bermann and Estevez C. 1995; Estevez C. and Bermann 1996, 1997).

2.2.2.4. Socio-Economic Organization and Political Economy

As Rose (2001:145-149) points out, the distributions of dwelling units and storage facilities described for La Barca and other Wankarani settlements do not correlate clearly with what some archaeologists have predicted for early villages (Flannery 1972b; Wills 1991). Small, circular dwelling units arranged in compounds suggest a communal form of socio-economic organization, but this is inconsistent with the large proportion of private storage at La Barca. Kolata has suggested that nuclear families might have lived in groups of these small round structures and that the larger settlement might correspond to a collection of families linked to a larger kin unit along the lines of an extended lineage group like the historic *allyu* (Kolata 1993:62-63). One thing is clear; Wankarani domestic structures show a very low degree of variability in size and construction, indicating that wealth differences between houses must have been minimal.

Artifact assemblages have shown only slightly greater evidence of inequality. Rose (2001a) found spatial differences in consumption of high quality meat packets and exotic basalt artifacts at La Barca. Unfortunately, it is difficult to assign these differences directly to household wealth or status since contemporaneity between domestic zones could not be firmly established at La Barca (Rose 2001:137-138). If contemporary, it is also possible that some of the differences observed by Rose are attributable to differences between residential and non-residential zones of the site. If these differences are between contemporary households in the La Barca community, they are clearly of the most subtle variety, and do not indicate the kinds of markers of social inequality usually associated with ranked societies.

If the differences in artifact assemblages noted by Rose are a result of comparing domestic and non-domestic contexts, then the differences illustrate a contrasting set of community activities that would have included members of one or more households. There is also architectural evidence of community-level activities at La Barca. Rose has provided the best evidence yet of public space and architecture in a Wankarani site. Her investigation at La Barca uncovered evidence of at least three suspected non-residential structures; these were called structures 2-A, 3-A, and 4-A (Rose 2001a). All three of these were distinguished from dwelling units on the basis of low proportions of domestic refuse such as groundstone and midden accumulation. Structures 2-A and 3-A were of similar oval form, with floor areas of about 12 and 23 m^2 respectively, and each had an attached smaller enclosure that was free of artifacts (Rose 2001a:77-81). Structure 4-A stands out as truly unique among known Wankarani structures. This structure was also roughly oval in floor plan, but with a much larger floor area of 68 m^2, and no associated storage facilities (though the entire structure was not excavated). High concentrations of artifacts that were otherwise unusual at La Barca were recovered from 4-A, including decorated sherds, figurine fragments, and ceramic and bone tubes (*trumpets*) (Rose 2001a:96-97). Public ceremonial contexts, especially those involving feasting, are viewed by many archaeologists as important opportunities for aspiring leaders to self-aggrandize and accumulate prestige and debt (Stanish 2003). Such aspiring leaders may have lived in these Wankarani communities, though their actions in these contexts do not appear to have translated into any form of permanent wealth inequality.

Another way that aspiring elites are known to further their own interests and accumulate debt in a society is by controlling access to exotic goods acquired through long-distance trade networks. McAndrews (1998:184) found extremely low frequencies of such exotics that could have underwritten a strong political economy. Small numbers of marine shell fragments and obsidian were recovered from a few sites (McAndrews 1998:129) and Rose (2001a) recovered just a few fragments of these materials as well. Basalt appears to have been an important imported commodity in the area, as it was used to fashion bifacial hoes and other stone tools, which are among the most common elements in assemblages. McAndrews (1998) found that although proportions of basalt artifacts varied from site to site, this variability was more likely related to relative degrees of agricultural activity than to differential access to trade networks.

Mortuary evidence also points toward an egalitarian model of Wankarani society. Early investigators documented burials in floors of domestic structures, with nothing in the way of grave goods or evidence of elaborate mortuary ritual (Escalante Moscoso 1994; Guerra Gutierrez 1995). Two of the burials excavated by Rose were located in the floor of an oval non-domestic structure called 3-A, and a third burial was located outside of this structure (Rose 2001a). The two interior burials were very poorly preserved preventing full excavation. Both bodies were flexed, laying on their left sides, and facing north (Rose 2001a:81-82). The third body was located to the north of structure 3-A, also in flexed position and facing southwest. Rose (2001a:93-94) notes the significant cranial deformation of this individual; a common trait among Wankarani crania. No grave goods were recovered from any of these burials. The only other well-documented Wankarani burials were excavated by Bermann at Chuquiña (Estevez C. and Bermann 1996, 1997). Bermann's excavation on the southeast slope of the Chuquiña mound revealed several adult females and children interred in a simple cemetery context, not associated with grave goods or with domestic structures.

Given the evidence of egalitarian social organization discussed here, it is somewhat surprising that there are indications of considerable economic specialization in Wankarani society. This evidence comes primarily from McAndrews' surface collections, which revealed differential distributions of certain artifacts. Carved sandstone llama heads have been reported from many Wankarani sites, but McAndrews was able to record the distribution of prepared llama head "blanks" and sandstone debitage – giving an unambiguous indicator of production loci for these artifacts. These carved effigy heads sometimes measure more than 50 cm in height, and have been excavated at the site of Uspa Uspa in domestic contexts (Wasson 1967). In McAndrews' survey, llama head blanks were completely restricted to the Belén region of Oruro (McAndrews 1998:137-138); only finished examples of carved effigy heads have been recovered from the La Joya and Río Kochi areas. The site of Jaquesaña in Belén contained the highest proportions of sandstone debitage as well as two llama head blanks (McAndrews 1998:138). Collections at Jaquesaña also recovered a puma head effigy and a relief carving, both made of white granite. In short, it appears that individuals at some communities in Belén may have specialized in the production of carved effigy heads for trade with other Wankarani communities.

The distribution of a peculiar frothy-green escoria on some Wankarani sites has been the subject of considerable speculation. Some fieldworkers have interpreted the material as slag from copper smelting. If true, the very limited number of sites with high concentrations of the this escoria could represent specialialized metallurgical locales. Only three sites in McAndrews' survey zone, Pusno, Pukara Pukara, and Pukara de Belén have reported evidence of copper slag on the surface (McAndrews 1998:135-136). Green escoria has also been reported in the deepest levels of the Wankarani type site. The density of surface slag fragments (as high as 50/m^2) at sites like Pukara Pukara and Pusno suggest that these communities may have engaged in specialized production of copper artifacts, which would have been exchanged for other goods or services with nearby communities. The relative rarity and small size of copper fragments recovered from Wankarani sites, combined with the relatively high labor investment of smelting, would suggest that smelted copper artifacts would carry considerable value as prestige objects.

2.2.2.5. Ceremonial Life and Shared Ideology

A number of aspects of Wankarani material culture point to a shared ideology and ceremonial/religious tradition that linked communities and households into what may have been a loose regional confederation (Kolata 1993:63). Rose's discovery of possible public architecture at La Barca suggests that ceremonial life may have extended beyond the mere household level to include the community, and possibly multiple communities. The widespread carved stone effigy heads have been reported from numerous sites (Bermann and Estevez C. 1995; McAndrews 1998; Wasson 1967), suggesting the existence of a shared ideology. Other ritual paraphernalia recovered from Wankarani sites include: clay figurines (Bermann and Estevez C. 1995; Rose 2001a); stone, ceramic and bone *trumpets* (also called *trompitos*) (Bermann and Estevez C. 1992, 1995; Estevez Castillo and Bermann 1996; Wasson 1967). Bermann and Estevez (1995) described possible ritual collections of basalt bifaces from beneath a house floor at San Andrés. The association of ritual with these artifacts comes as a result of the absence of wear and tool polish that typically appears on these items when used as hafted hoes. With the exception of the public structures excavated by Rose at La Barca, all of these ritual materials have been reported from in and around domestic structures (Bermann and Estevez C. 1995; Escalante Moscoso 1994; Ponce Sanguinés 1970).

Though more excavation is needed, the evidence from both household and possible public ritual contexts suggests one of two possibilities. First, it is possible that ritual was an important activity at both the household and community levels. If this is the case, then archaeologists should seek to clearly define the contexts of ritual in either setting, as this will provide important clues to social organization. A second possibility is that the public structures located by Rose are in fact from a relatively late period in Wankarani occupation, and that what we are seeing is a change over time from ritual activities focused on the household level to those conducted on a public level. This latter interpretation is plausible given the relatively shallow excavations in which Rose documented these unusual structures.

2.3. Summary

It is clear that the southern *altiplano* posed greater levels of risk and probably lower overall levels of primary productivity during the Formative Period than the Lake Titicaca Basin. Risk came in the form of unpredictable late and early frosts, shorter growing seasons overall, lower levels and predictability of precipitation, and unpredictable fluctuations in stream levels in the Río Desaguadero. One way for agropastoral Wankarani communities to cope with this may have been to increase their relative dependence on herding, which would allow them to maintain higher levels of flexibility in settlement transhumance as well as a larger reservoir of 'wealth on the hoof.' This flexibility would mitigate risk of bad year for agriculture, which would be more sensitive to fluctuations in precipitation and stream levels of the Río Desaguadero.

McAndrews has argued that Wankarani settlement systems grew through a process of community fission, with the earliest and largest sites acting as 'parent' communities that gave rise to smaller order sites. Given their size and depth of deposits, Chuquiña and Llallavi have been suggested as parent communities in the La Joya settlement system, with other communities (Pukara Uno, Pukara Pukara, Pusno, and La Barca) being daughter communities and San Andrés a possible 'grand daughter' community. This model of settlement system evolution posits a fairly steady rate of population growth that eventually led to community fissioning. Given the wide spacing and ample catchments of La Joya Wankarani communities, this fissioning would not have come as a result of need for more agricultural land. Rather, it could have been driven by internal social stresses in communities or it may have been the product of a need for greater areas of pasture. The very dispersed settlement pattern and wide spacing between communities may have been the result of a risk minimizing strategy, where larger than optimal herds were maintained (Bermann 1995; Rose 2001a) as insurance against bad years. Alternatively, villages may have fissioned as result of intra-community scalar stress, often expressed as an irritation coefficient as population rises in egalitarian communities (Johnson 1978, 1982). Bandy (2004, 2006) has proposed that scalar stress was the driving mechanism of settlement system growth on the Taraco Penninsula in the Titicaca Basin and in other village societies around the world prior to the emergence of integrative social institutions.

In sum, the evidence discussed here presents a picture of the La Joya Wankarani settlement system as a long-lived network of agropastoral villages that interacted socially and economically both among themselves and with the larger Andean region by means of long-distance trade networks. There is some evidence that communities differed in their subsistence pursuits depending on the particularities of local catchments. This local subsistence specialization may have been geared toward surplus production for trade with nearby and distant communities, since there must have been a relatively brisk trade in some foreign products, including basalt. There also appears to have been a surprising degree of specialization in craft production for such a small-scale society. Specialized production of stone sculpture and possibly copper smelting are evidenced by the very discrete distribution of production debris (stone debitage and copper escoria) at only a handful of sites. Only excavation is likely to reveal other spheres of craft specialization – in weaving and textile production, for example.

A shared ceremonial tradition appears to have been one force for integration of these communities, though evidence of conspicuous public ceremony is scarce. At present, there is no compelling evidence of wealth inequality or centralized political leadership, observations that have led archaeologists to characterize the Wankarani Complex as a highly stable, 'conservative' adaptation to the high risk environment of the southern *altiplano* (Kolata 1983). It should be noted that this notion of stability is based only on the fact that no chiefdom or state appears to have developed during the Formative Period; no truly diachronic studies have yet been conducted. The current research is an attempt at such a diachronic study in order to document the Formative Period trajectory more clearly and to evaluate the proposition of Wankarani as an essentially conservative, stable cultural adaptation.

A major stumbling block to the diachronic study of the Wankarani Complex has been the lack of a ceramic seriation. Wankarani ceramic assemblages are made up almost entirely of undecorated utilitarian vessels, lacking virtually any stylistic elements that could be used for such a seriation. Although Poncé (1970; 1980) describes stylistic phases of pottery for the Wankarani Complex, this chronology has not been replicated by other investigators. Bermann found a strong correlation between olla rim thickness and time at the site of Chuquiña, suggesting that this metric attribute might be useful in dating Wankarani assemblages. However, the correlation was based on only a small number of test pits and until recently it had awaited further testing. Excavation samples from the sites of San Andrés (Bermann, personal communication) and La Barca (Rose 2001a:134-136), the only two sites where the method has been tried, were too small to test the strength of the correlation. Obtaining larger samples to test this correlation was an important objective of the current study (see Chapter 5).

3. SAMPLING AND EXCAVATION METHODS

For the purposes of this study, the La Joya settlement system was selected for a number of reasons. First, the sites in the La Joya area showed considerable variability in terms of surface artifact assemblages. This variability suggested that La Joya Wankarani communities may have been economically specialized, a characteristic not generally expected in a small-scale, egalitarian society. Second, several archaeological sites in the La Joya settlement system had already been the subjects of some previous and on-going excavation projects (Beaule 2002; Bermann and Estevez C. 1992, 1993, 1995; Estevez C. and Bermann 1996, 1997; Rose 2001a, 2001b). There was an obvious advantage in being able to situate the investigation and results in the context of what was already known about the area. So for instance, it was thought that my own small but deep test excavations would provide a complementary perspective to the relatively broad but shallow excavations by Rose (2001a) and the on-going work of Bermann at La Barca, as well as the regional surface analysis by McAndrews (2005).

3.1. Sampling the La Joya Settlement System

The La Joya Wankarani settlement system consists of seven known sites (Figured 2.4), though it is possible that modern mining activity or other processes have obscured or destroyed additional sites. In order to investigate inter-community socio-economic differences in a diachronic perspective, representative artifact assemblages would be needed from a sample of sites. Obtaining assemblages representative of a community, especially a long-lived one like a

Wankarani village, requires more extensive sampling than a test pit or two. But the time and financial constraints on a short-term dissertation project made test excavations at all seven mounds impossible. The problem then, was to develop a method of investigation that would answer the research questions in as economical a strategy as possible.

Fortunately, McAndrews' study of surface materials provided a means of developing such a method. Since the regional survey had revealed that Wankarani sites exhibited significant differences in proportions of certain artifacts, it was reasoned that one way of investigating differences between settlements would be to select just two of the most disparate sites in the system and conduct systematic excavations to assess the kinds and degrees of differences in material culture over time. The shortcoming of this approach is that two sites is a quite small sample. However, by selecting the two most disparate sites in the system for analysis, it was clear that if inter-community differences were in any way important, then these communities were the most likely illustrations of those differences. Limiting the investigation to just two sites also offered the benefit of being able to put more excavation into each, increasing the likelihood of obtaining representative spatial and temporal samples of assemblages from the sites.

For these purposes, the sites of Chuquiña and Pusno were selected for sampling. Several characteristics make the two sites stand out as especially different. These differences include geographic features, including distance to the Río Desaguadero and location in relation to major hill groups. They also include differences in mound size and surface artifact assemblages. Each of these sites and their local settings are described in detail below.

3.2. Chuquiña

The site of Chuquiña is both the talles and the largest of the Wankarani mounds in the La Joya vicinity. The mound rises about 6 m above the natural ground surface (Figure 3.1). The site is located on the property of the modern Inti Raymi commercial gold mine, which has mined the sediments of the area for several decades. The height and size of the mound have been modified as some years ago the Inti Raymi mining company bulldozed the top of the mound, covered it with a layer of construction fill, and flattened it to make a parking area. While this surely destroyed some archaeological deposits, the construction fill also formed a strong cap of overlying material that now protects the subsurface deposits. Thus, at the apex of the mound, it is possible that as much as a meter of archaeological deposits have been lost.

At the base of the mound slope, the site is surrounded on three sides by modern roads and to the east/southeast by the historic period village of Chuquiña. The roads, especially along the west and south sides of the mound, have also destroyed some archaeological deposits, though these must have been relatively shallow sections of the site (Figure 3.2). The historic village also probably covers some prehistoric deposits. Abundant prehistoric pottery can be seen in the adobe bricks of the historic village, indicating that prehistoric deposits have been quarried from the mound. The historic village of Chuquiña was abandoned years ago, when the Inti Raymi Gold Mine bought out local residents and constructed a settlement for them several kilometers to the south. Several of the elder members of my work crews remembered when their families lived in the historic village. These Aymara people regard the inhabitants of the prehistoric mound as their ancestors.

Chuquiña is located across the road from Inti Raymi's main sediments processing facility (Figure 3.3). Like all Wankarani sites in the area, Chuquiña is located close to the base of the southern slope of a hill group (Cerro Chuquiña), which would have given the community good visibility of

Figure 3.1. The Mound of Chuquiña, Viewed from the Southwest.

the surrounding terrain as well as shelter from the scouring winds of the *altiplano*. This location also would have been a reasonably defensible location if raiding and warfare were an issue, though clearly a place higher up into the hill group would have been even more defensible. As discussed in Chapter 2, this location also would have provided convenient access to abundant agricultural land and pasturage, as well as reasonably easy access to the Río Desaguadero, some 1.5 km away. Finally, proximity to a major slope would provide the natural opportunity to collect precipitation runoff as a secondary source of fresh water.

In addition to agropastoral resources, the residents of Chuquiña also relied on wild game and plants, probably with a particular emphasis on riverine species. Analysis of faunal material from Chuquiña suggests that fish, waterfowl, and small terrestrial fauna were all important components of the subsistence system, though all were secondary to camelids (see Chapter 7).

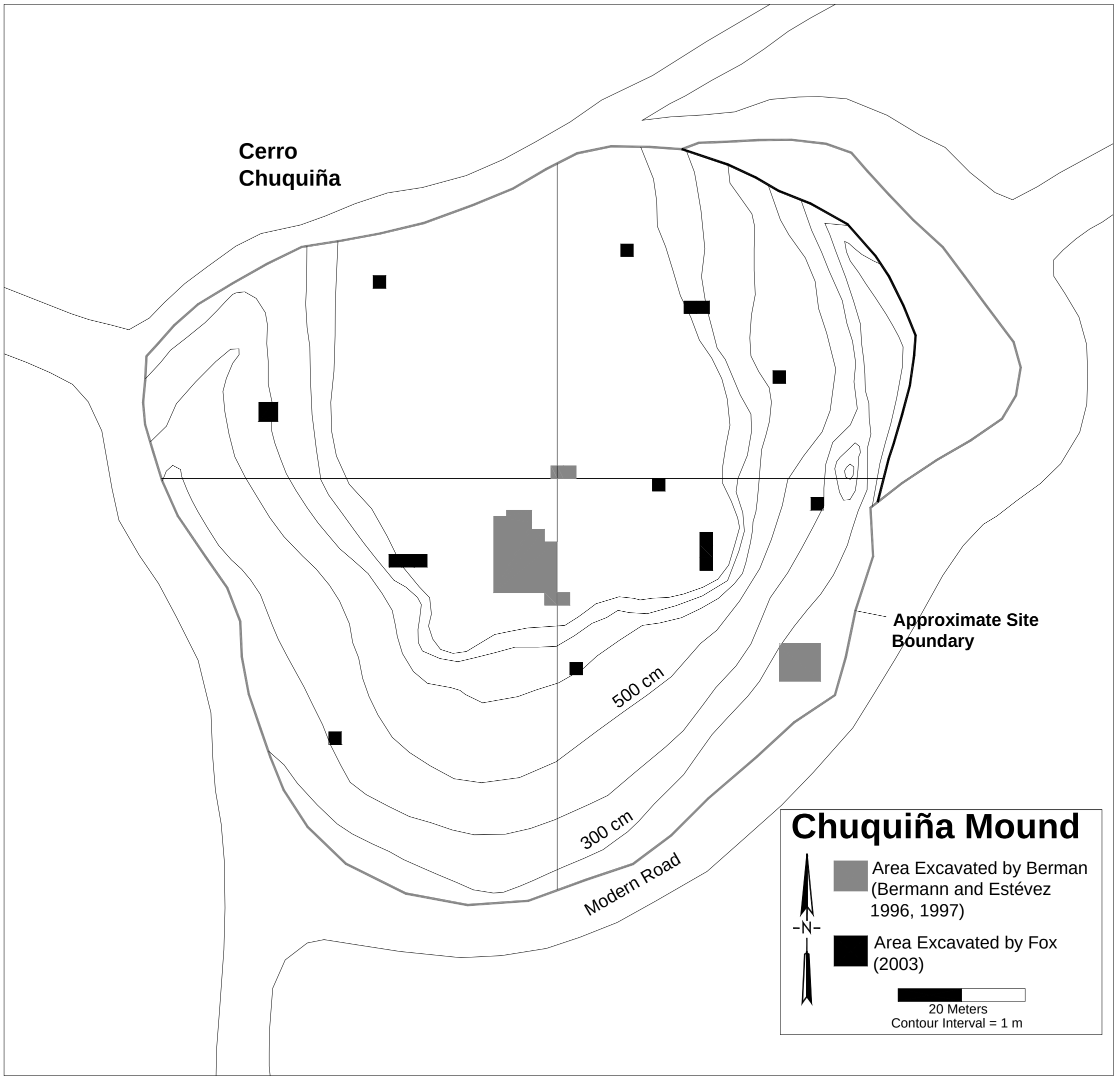

Figure 3.2. Map of the Mound of Chuquiña Showing Excavations by Fox (2003) and Bermann.

Because Chuquiña lies in the densest part of the settlement system, the site had the smallest catchment estimate of all La Joya sites in McAndrews' study. This is to some extent an artifact of the catchment calculation method, which simply defined the catchment radius as the distance to the nearest site divided by two. Therefore, McAndrews' estimate that the residents of Chuquiña would have had an available catchment of 225 ha should be taken as an absolute minimum. McAndrews' preferred population estimate for the site is 80 persons, based on a

Figure 3.3. View of the Chuquiña Mound from the Northeast Showing the Facilities of the Inti Raymi Gold Mine in the Background.

hypothesized 50 persons per hectare. I regard the 50 persons per hectare estimate as a reasonable one for Wankarani sites in the study area. Of course, prior to this investigation it was completely unclear how much of the site area was occupied at any given point in time during the Formative.

As noted above, McAndrews' estimate of the potential catchment available to the Chuquiña community is probably quite conservative. Yet, based on estimates of highland potato production, even this conservative estimate of available catchment would have far exceeded the minimum needed for a population of 80 persons at Chuquiña by about nine fold. In short, even if McAndrews' population estimate is considered conservative, and even if we assume a fairly high level of fallowing in the agricultural system, the Chuquiña community would have had ample land for cultivation to support the resident population. In fact, the local agricultural resource base likely could have supported substantial population growth.

Surface collections of artifacts from Chuquiña provided some of the initial insights that led to the site being selected for testing in the current project. McAndrews' analysis showed that the surface materials at Chuquiña included a typical density of utilized lithic bifaces as well as the debris of biface retouch and maintenance (McAndrews 2005:69-73). These lithic bifaces are an artifact category associated with agricultural activities. The presence of basalt artifacts on the surface indicate that the site was linked with long-distance regional trade networks. Finally, Bermann's excavations at the site revealed that the mound contained a long sequence of stratified cultural deposits, including a dense residential zone and areas of cemetery and midden (Estevez C. and Bermann 1996, 1997). It was also in Bermann's initial investigations at Chuquiña in the 1990's that a relationship between time and ceramic metric attributes was originally noted.

For the purposes of this investigation, Chuquiña was viewed as the single best candidate to be central place or a 'parent' community in the La Joya system. The site is located in a typical ecological zone for a Wankarani site, at the interface of the foothills and the *altiplano* within easy reach of the Río Desaguadero. The site's relatively large size and great depth of deposits marked it as likely to be among the oldest sites in the La Joya settlement system, with Llallavi being its only near competitor in these variables. Finally, surface collection and test excavation had shown that the site contained a stratified residential component and that subsistence practices there probably fit nicely within the 'normal' range of Wankarani subsistence pursuits.

3.3. Pusno

Pusno is among the smallest of Wankarani sites in the La Joya area, measuring only about .7 ha in size. Despite this modest size, the site rises more than 2 m above the surrounding *altiplano*, culminating in a two-peaked mound (Figures 3.4 and 3.5). The Pusno site is approximately 13 km northwest of Chuquiña (Figure 2.4). Unlike Chuquiña, Pusno has not been impacted by modern mining activity. However, some disturbance of the site has occurred as a result of local residents 'quarrying' the mound for stones for construction of modern llama corrals on the slopes of Cerro Pusno. The effect of this disturbance of the site appears to be concentrated on the main mound, where several borrow pits could be seen on the surface. In other parts of the site, circular wall foundations of prehistoric structures can clearly be seen.

Figure 3.4. The Mound of Pusno Viewed from the Northeast.

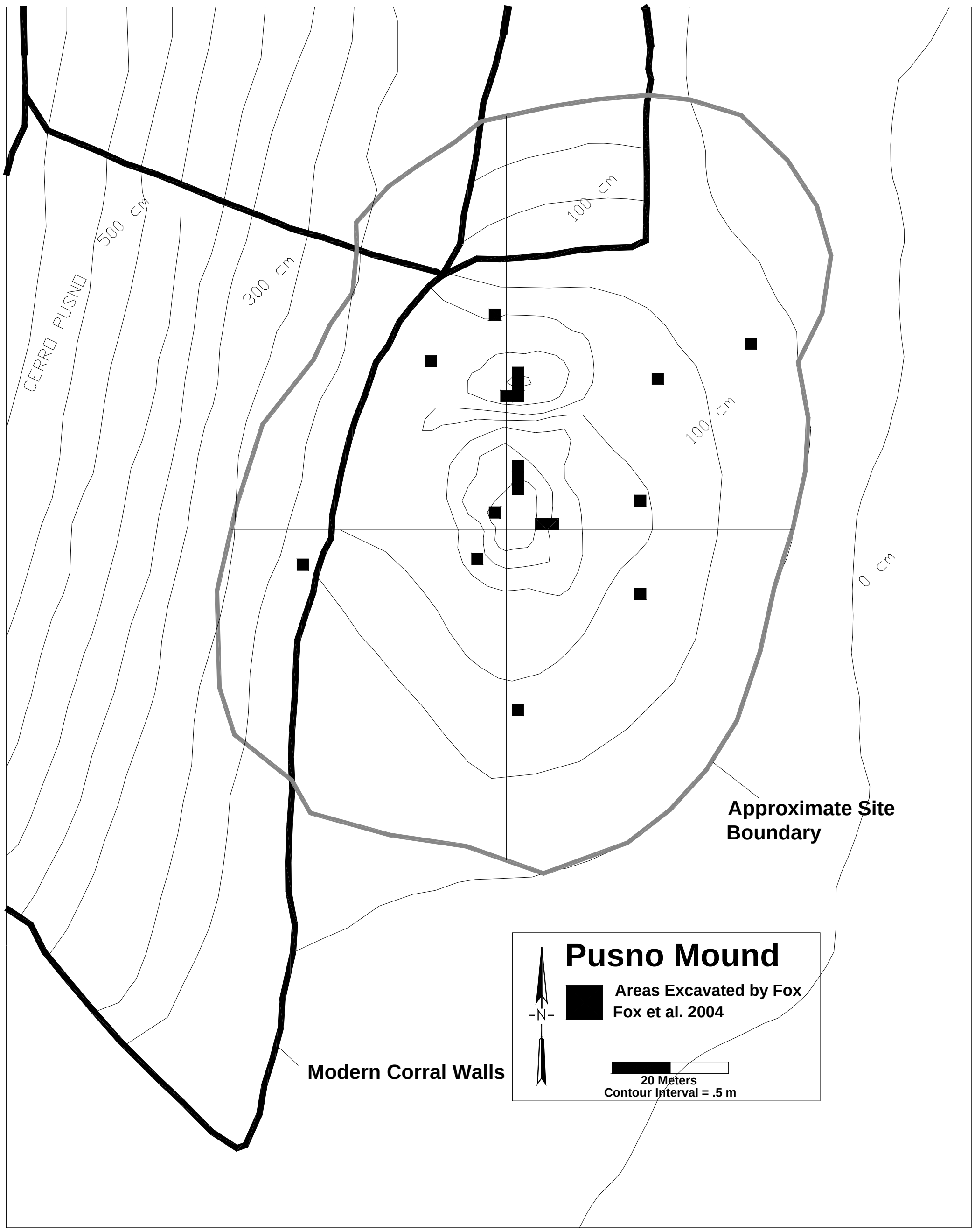

Figure 3.5. Map of the Pusno Mound Showing Excavations in 2003.

Like most Wankarani sites, Pusno is located at the base of a hill (Cerro Pusno). However, Pusno's location is rather different than most other sites in the La Joya settlement system, especially Chuquiña. First, Cerro Pusno is a particularly small, low hill group, which is surrounded by the open flatland of the *altiplano*. This setting would have allowed ample access to the open plain, but the much smaller outcropping of Cerro Pusno would have allowed access to far lesser amounts of hill soils when compared to Chuquiña. More importantly, the Pusno mound is about 5 km from the nearest access point to the Río Desaguadero. This relatively distant location, combined with the smaller slope with which to catch runoff, could have placed a premium on fresh water for the residents of Pusno. Certainly the location poses significant problems for irrigation of any kind. It also would have resulted in reduced access to the kinds of riverine resources (fish, reeds, etc.) that were so easily accessible for residents of Chuquiña and other circum-riverine communities.

Because of Pusno's remote location, away from the higher density areas of the La Joya settlement system, the site enjoys unfettered access to a very large catchment zone. Using McAndrews' estimate of 50 persons per hectare, the population of Pusno could have been as high as 35 persons, assuming that the entire site area was occupied at some point during the Formative. Regardless of how conservative this population estimate might be, the surrounding catchment zone would have provided far more than enough land for agriculture and pasturage even allowing for a high degree of fallowing. Thus, even more so than in the case of Chuquiña, it is clear that the Pusno catchment zone could have supported considerable population growth. But the community never reached anywhere near its population potential.

Other than surface collection by McAndrews, there has been no prior archaeological investigation of Pusno. Surface collections found that the site contained relatively low densities and proportions of utilized bifaces compared to other La Joya Wankarani sites, suggesting that agricultural intensity in this community was lower than some others. Like Chuquiña, the site had a number of imported basalt artifacts on the surface, showing that this community too, had access to long-distance trade networks. The most unusual aspect of the artifact collections at the site was the extremely high density of green escoria on the surface.

As discussed in Chapter 2, burned surfaces and escoria of various kinds are frequently associated with Wankarani sites. However, an unusual frothy, glassy, green escoria has been recovered in considerable quantities from a handful of sites, including Pusno and Pukara Pukara in the La Joya area and Pukara de Belén in the Belén area. Some scholars have interpreted this green escoria as slag from copper smelting, though this interpretation remains equivocal. The interpretation of copper escoria receives at least some support from a few reports of copper artifacts from Wankarani sites (McAndrews 2005:79-81). If this material does represent slag from copper smelting, it provides convincing evidence of metallurgical craft specialization – and a degree of economic complexity all together unexpected in an early village society like the Wankarani. The investigation of this possibility was a major factor in selecting the Pusno mound for the current investigation.

The location, size, and characteristics of Pusno suggest major differences in site functions when compared to Chuquiña. Given that access to sufficient fresh water is widely regarded as a serious challenge for farming in the highland Andes, the initial impression of the Pusno site is that it was located in a less than optimal location for agriculture. At least two possible explanations might be offered for this. First, the site vicinity offered other economic advantages that outweighed its disadvantaged access to water. These advantages might be related to the resources required for craft specialization. Alternatively, Pusno could have been a daughter settlement founded at a time when the best land in the area was already occupied, and thus not available. This second possibility could come as a result of a continuous pattern of population growth and community fission, as inferred by McAndrews for the La Joya settlement system. Further reinforcing this point, the olla rim sherds collected from the surface of the site were relatively thick, suggesting that the site might date to the later part of the Formative (if Bermann's observations of increasing olla rim sherd thickness are valid). For these reasons, Pusno was identified as one of the most likely candidates for a 'daughter' settlement in the La Joya settlement system, possibly one that focused on a rather different subsistence niche and a more specialized economic activity than parent communities like Chuquiña.

3.4. Sampling and Excavation Strategies

During the early conceptual stages of this investigation, a series of four or five strategically-placed trench excavations were planned at each mound. This strategy clearly could result in a fairly limited spatial sample from each site, but the approach did offer some advantages (discussed below under *Trench Excavations*). However, in the field this strategy was modified to a considerable degree. The reasons for this are discussed below. In the end, three different excavation strategies were used: small, strategically-placed trench excavations; randomly-selected 2x2 m test pit excavations; and strategically-placed 2x2 m test pit excavations. Each of these three strategies served a different purpose, as discussed below. This change of strategy resulted in much more robust artifact samples from a much broader spatial sample of units. In addition to three trenches at each site, eight randomly-selected 2x2 m test pits were excavated at each site, and two strategically placed 2x2 m test pits were excavated at Pusno.

All excavations were conducted with a combination of pick, shovel, and trowel. Whenever possible, units were excavated in natural or cultural stratigraphic levels except when these levels exceeded 10 cm in depth. Sediments were screened through 3 mm metal mesh.

Whenever observed in good context, organic materials were collected and bagged separately in aluminum foil, especially charcoal samples for radiocarbon dating. In addition, soil samples were collected in volumes of 5 liters from every other excavation level as well as from all floor and fill features. These samples are stored at the repositories in Chuquiña and La Joya, and are available for future macrobotanical and sedimentological analyses in the future.

3.4.1. Trench Excavations

A series of four or five large trench excavations at each site was initially proposed for this investigation for several reasons. First, trenches would expose large sections of stratigraphy that would provide clues to processes of mound formation. Second, it was hoped that long sections of stratigraphy exposed in trenches could be correlated with each other across each site. Finally, long trench excavations were chosen instead of test pits because trenches would allow the opportunity for a 'stepped' excavation that would permit penetration to greater depths than would be possible with 1x1 or even 2x2 m test pits. In order to maintain a degree of spatial control in the trench excavations, each was planned as a contiguous row of 2x2 m units.

However, early in the excavation process at each mound, it became clear that some of these objectives were not well-served by the trench strategy. These mounds are comprised of a complex sequence of spatially-limited microstratigraphy that is not easily correlated between excavation units. At no point in prehistory was the entirety of either site occupied contemporaneously, and in most periods only a relatively small portion of the total mound area was subject to human occupation. For this reason, correlating stratigraphic deposits between units that are only a few meters apart was both difficult and highly suspect. This undermined the second objective of the trench strategy.

It was also clear that mound deposits were composed of significant volumes of dense adobe melt, a matrix that supported extremely durable sidewalls in excavations. Exposed sidewalls of up to 5 m depth were not in any way prone to collapse. It became clear that there was no need for the gradual, stepped depth of a trench when smaller size test pits would suffice. In addition, the use of test pits would allow a substantially larger and more randomized spatial sample from each site, which in turn increased the probability of obtaining more representative artifact samples across both time and space.

For these reasons, the trench strategy was modified in the field. Instead of four or five large trenches, three small (4-6 m long) trenches were placed at each site where the slope adjoined the apex of each mound. These trenches were used to assess macrostratigrapy and mound formation processes, as well as producing assemblages of relevant artifacts and features. The time and labor saved by minimizing the trench strategy were then used to pursue both randomly and strategically placed test pits across both sites.

Most trenches were excavated to a level sufficient to expose a range of stratigraphy and then were narrowed. In most cases, a single 2x2 unit within each trench was excavated to sterile sediments. Many of these had to be further narrowed in order to reach the depth of excavation necessary, sometimes as much as 6 m depth. For analytical purposes, it was these deep units from each trench that were used for artifact analysis. This avoided over sampling of artifacts from the trench excavations, which by virtue of size alone would have unduly affected the total artifact assemblages from each site.

3.4.2. Random Test Pit Excavations

As all people know, and as archaeologists must be acutely aware, human settlements are not spatially homogeneous. For this reason, archaeologists must give serious consideration to effective sampling when the objective of the investigation is to characterize an entire community. This is exactly what I hoped to accomplish more effectively by adding randomly-selected test pit excavations to my strategy at these mounds. While no form of sampling can guarantee a representative sample, random sampling strategies offer us the greatest probability of obtaining them.

In order to assure a reasonable spatial distribution of test pits, I elected to use a form of stratified random sampling. To achieve this, I subdivided each site into four 'zones' that acted as sampling strata. In defining these zones, they were not designed to be of absolutely equal size, but they were chosen to incorporate roughly equal portions of the high-density areas of each site. I then used folded pieces of paper selected from a hat to determine the easting and the northing of potential test units. In total eight randomly-selected test pits were excavated at each site, two in each zone. There was just one exception to this pattern, at Chuquiña, the second random test pit in Zone 3 turned out to be in an area of high disturbance. As a result, an additional random test pit was excavated in Zone 2 (Unit 2-E). All randomly selected test pits were excavated to sterile sediments, and the full sequence of materials from each was included in the artifact analyses.

3.4.3. Strategically-Placed Test Pits

Three strategically-placed test pits were excavated at Pusno. As excavation progressed, a few problems presented themselves at Pusno. First, more than halfway through the work at the site, no unit had yet produced a long sequence of architecture and other features. This concerned me in that it seemed likely that we had somehow 'missed' the residential core of the site. It also posed a problem because the lack of architectural features also meant a relative paucity of good contexts for collection of charcoal and other organics for radiometric dating. Finally, despite its abundance on the surface of the main mound at Pusno, we had not encountered any green escoria (copper slag?) *in situ* in any excavations, making it likely that we had also missed the spatial focus of this hypothetical craft activity.

For these reasons, a single test pit (Unit 4-D) was used to extend Trench 3 at Pusno, because evidence of floors and structural features could be seen in the west sidewall of that trench. A second test pit (Unit 1-L) was placed to partially intersect with a stone curvilinear wall visible on the surface, thought likely to be a domestic structure. A third test pit (Unit 4-B) was placed on the top of the main mound of Pusno, directly in the densest surface deposits of green glassy escoria, thought to be copper slag. Since this material was at the top of the mound, it could not have eroded from elsewhere, suggesting that an associated feature was likely in this location.

Both Unit 1-L and Unit 4-D were incorporated in the artifact analysis. In fact, the assemblages from Unit 4-D were used to represent Trench 3, resulting in the exclusion of the other trench units from artifact analysis. Because Unit 4-B was ended before reaching sterile sediments and because it was very close to Trench 2, it was excluded from the artifact analyses.

3.5. The New La Joya Chronology and Summary of Sampling and Field Methods

As noted in Chapter 2, the lack of a ceramic chronology for the Wankarani Complex has been a major stumbling block to diachronic study. Clearly, the development of such a chronology had to be a major objective of the current research. Through a combination of stylistic and metric attributes correlated with the radiocarbon database from the Wankarani Complex, I was able to develop a four-phase chronology of ceramic change (see Chapter 5). These four phases, along with their corresponding excavation levels at Chuquiña and Pusno are shown in Table 3.1. It is important to note here that most of these phases are defined on the basis of what appears to

Table 3.1. Stratigraphic Components Assigned to Four Occupation Phases at Chuquiña and Pusno by Unit.

Time Period	Site	Unit	Levels	Mean Olla Rim	Aboriginal Grit %	Orange %
LJ-I > 1325 BC	Chuquina	2-C	43-54	7.50	10%	0%
	Chuquina	2-F	28-32	7.61	10%	1%
	Chuquina	Trench 2	22-32	8.23	13%	0%
	Pusno	Trench 1	17-25	7.33	2%	0%
	Pusno	1-G	7-14	6.87	4%	0%
	Pusno	4-A	11-17	6.69	2%	0%
	Pusno	1-L	1-15	7.19	3%	0%
	Pusno	2-B	7-11	no data	91%	0%
	Pusno	3-C	1-11	7.14	6%	0%
	Pusno	4-C	14-20	8.11	19%	0%
	Pusno	Trench 3	12-17	7.49	0%	0%
LJ-II 1325-1100 BC	Chuquina	Trench 1	23-29	7.90	0%	1%
	Chuquina	1-C	16-21	8.05	0%	1%
	Chuquina	2-C	36-42	8.28	3%	1%
	Chuquina	2-E	22-47	8.42	1%	1%
	Chuquina	2-F	12-33	7.88	0%	3%
	Chuquina	Trench 2	10-21	7.54	1%	1%
	Chuquina	3-C	42-46	8.34	8%	0%
	Pusno	Trench 1	9-16	8.30	0%	0%
	Pusno	Trench 2	13-26	8.41	0%	0%
	Pusno	1-G	1-6	7.74	0%	0%
	Pusno	4-A	1-10	7.84	0%	0%
	Pusno	2-B	1-6	8.47	0%	0%
	Pusno	3-B	1-13	7.68	3%	0%
	Pusno	4-C	1-13	7.96	0%	0%
	Pusno	Trench 3	1-11	7.64	0%	0%
LJ-III 1100-800 BC	Chuquina	Trench 1	7-22	9.09	0%	3%
	Chuquina	1-C	11-15	9.12	0%	5%
	Chuquina	1-D	1-14	9.15	0%	7%
	Chuquina	2-C	18-35	7.99	5%	1%
	Chuquina	2-E	14-21	8.93	0%	19%
	Chuquina	2-F	1-11	8.77	0%	7%
	Chuquina	Trench 2	8-9	9.20	0%	1%
	Chuquina	Trench 3	15-41	8.88	0%	3%
	Chuquina	3-D	13-22	9.08	0%	10%
	Chuquina	4-A	11-22	9.56	0%	1%
	Pusno	Trench 1	5-8	9.22	0%	2%
	Pusno	Trench 2	4-12	8.66	0%	2%
	Pusno	1-K	1-7	9.13	5%	0%
	Pusno	2-A	1-4	9.11	1%	0%
LJ-IV <800 BC	Chuquina	Trench 1	1-6	10.44	0%	10%
	Chuquina	1-C	1-10	9.54	0%	6%
	Chuquina	2-C	1-15	9.77	3%	4%
	Chuquina	2-E	1-13	10.66	0%	8%
	Chuquina	Trench 2	1-7	10.54	0%	11%
	Chuquina	3-C	1-14	9.86	0%	13%
	Chuquina	3-D	1-12	10.20	0%	8%
	Chuquina	4-A	1-10	11.06	0%	0%
	Chuquina	4-B	1-7	11.48	0%	1%
	Pusno	Trench 1	1-4	9.80	0%	1%
	Pusno	Trench 2	1-3	9.94	0%	4%

be continuous metric variation, and so the boundaries between phases should not be taken as marking major shifts in the archaeological record. I have chosen to refer to these four phases of occupation as La Joya-I through La Joya-IV, or simply LJ-I through LJ-IV. My choice of the La Joya name to designate the phases reflects my own recognition that this chronology is based entirely on data collected from sites in the La Joya settlement system, and so the applicability of this chronological system outside of the region is not certain.

The methods of investigation discussed here were designed to assess socio-economic and socio-political change over time in a village-scale Formative Period settlement system. Instead of attempting to characterize all sites from the system, I chose a more economical approach that targets two sites that are the most likely to illustrate the kinds of inter-settlement dynamics that characterized the system. The mounds of Chuquiña and Pusno represent two of the most likely candidates to be a ‘parent’ and ‘daughter’ community, respectively. Each of these sites was subsequently sampled using three different strategies in order to produce a broad spatial sample from each.

4. EXCAVATION OF THE CHUQUIÑA AND PUSNO COMMUNITIES

4.1. Introduction

The purpose of this chapter is simply to summarize the excavations conducted at each site, including the architecture and other features revealed by those investigations. Excavations units at each site are summarized by phases of occupation that were defined by the ceramic analysis, described in detail in Chapter 5. At the end of this chapter, patterns of settlement organization and population scale are discussed with reference to the central research questions.

4.2. Excavations at Chuquiña

In total, 11 test excavations were undertaken at Chuquiña, including three small trenches and eight randomly-selected 2x2 m test units (the selection process was described in Chapter 3). Of the eight randomly-selected test units, seven were excavated to culturally sterile deposits. Only Unit 4-B was discontinued prior to reaching sterile deposits because the excavation centered on a major cemetery area that did directly serve the objectives of the project. All units were named using an alpha-numeric system that corresponds to the zone of the site and the number of the unit. For example, the third unit excavated in Zone 1 was designated Unit 1-C. Throughout the descriptions I make a distinction between 'natural' occupation surfaces, which are unprepared surfaces, and 'floors', which are prepared architectural surfaces of clay or other material.

4.2.1. Trench 1 (comprised of Units 1A & 1B)

Surface Dimensions: 2x4

Selection: Random

Maximum Depth: 365 cm

SW Coordinate: E330, N346

This trench was strategically-placed in order to assess mound formation processes in the northeast zone of Chuquiña. In general, deposits in this area are comprised of relatively undifferentiated midden and anthropogenic sediments with a high degree of insect bioturbation. This results in very thick strata of mixed ash and midden with high artifact densities and relatively low concentrations of adobe melt in the Trench 1 (Figures 4.1 and 4.2). The depositional process here is very similar to that seen in Unit 1C and Unit 4A to the west. It seems that much of the northern section of the Chuquiña mound was used for waste disposal. Although the stratigraphy in Trench 1 is rather undifferentiated, a significant number of articulated faunal elements as well as artifact analyses suggest that the artifacts from this excavation are essentially in situ (see Chapter 5).

Analysis of olla rims suggest that materials from Trench 1 date from LJ-II through LJ-IV, approximately 1300-500 BC. Although several ephemeral occupation surfaces were documented in this excavation, the only two architectural features of note were encountered. Feature 2 was a collapsed adobe wall with stone foundation at a depth of approximately 130 cm below surface, which dates to some time during LJ-III (Figure 4.4). Unlike the walls of most domestic structures, this wall foundation was composed of unusually large rocks over 50 m in diameter.

Figure 4.1. South Wall Profile of Trench 1 at Chuquiña.

Figure 4.2. North Wall Profile of Trench 1 at Chuquiña Showing Excavation to Sterile Soil.

Figure 4.3. Feature 2 in Trench 1 at Chuquiña.

Figure 4.4. Feature 1 in Trench 1 at Chuquiña.

At its thickest point, this wall was at least 80 cm thick, but probably did not stand more than 60-80 cm high based on the volume of adobe melt. This wall also appears to run approximately parallel to the slope of the mound, suggesting that it may be a retaining wall of some sort. Perimeter walls have been described, but poorly documented at other Wankarani sites in Oruro and La Paz departments. Feature 1 was a more typical curvilinear wall only partially exposed in the sidewall of the unit. This appears to be a typical Wankarani domestic structure (Figure 4.4)

A section of this trench was excavated to more than 3.5 m below surface before reaching a sterile silty clay alluvial deposit. This appears to be the natural landform on which the Chuquiña community was originally founded, probably an alluvial bench that provided a raised area with access to the river and sheltered from the *altiplano* elements by the slope of Cerro Chuquiña.

4.2.2. Unit 1C

Surface Dimensions:	2x2
Selection:	Random
Maximum Depth:	240 cm
SW Coordinate:	E320, N355

This unit was selected at random for investigation, and is located on the level upper surface of the Chuquiña mound in the northeast zone (Zone 1). As noted previously, this area was leveled and capped with approximately 50 cm of dense construction fill for a parking lot by the Inti Raymi Gold Mine. While this construction probably destroyed the uppermost layers of deposits, it also provided a strong protective layer of sediment across the top of the site.

As in Trench 1, the deposits in Unit 1C were comprised of largely undifferentiated ash and midden with modest proportions of adobe melt and other anthropogenic sediment (Figure 4.5). Signs of insect bioturbation were significant, with many beetle casings and micro-tunnels visible

Figure 4.5. South Wall Profile of Unit 1-C at Chuquiña.

in the matrix. However, as was also noted for Trench 1, faunal remains with articulated elements were commonly encountered in Unit 1C and artifact analysis also suggests that the assemblages from this excavation were largely in situ. Based on rim sherd metrics, the deposits in Unit 1C appear to date to LJ-II through LJ-IV. Only a single clear occupation surface could be discerned in excavation, and it was an unprepared natural surface. No architectural features were documented at all.

4.2.3. Unit 1-D

Surface Dimensions: 2x2

Selection: Random

Maximum Depth: 180 cm

SW Coordinate: E344, N335

Among the most shallow excavations undertaken at Chuquiña, Unit 1-D is located on the lower part of the northeast slope of the mound. The center of this unit was slightly more than 2 m below the apex of the mound. Given its location on the slope, it is likely that some overlying culture materials have eroded away. This is made all the more likely since the sediments in this area of the site include a lower proportion of adobe melt, which forms a more dense and stable deposit. Like the matrix in Trench 1, Unit 1-C, and Unit 4-A, the sediments in Unit 1-D are predominantly ash and midden when compared to excavation units in Zones 2 and 3, for example (Figure 4.6). Rim sherd analysis suggests that all of the deposits in 1-D date to LJ-III. Only ephemeral, apparently natural surfaces were documented in this excavation. There was no evidence of architectural features of any kind.

4.2.4. Trench 2 (comprised of Units 2A, 2B, & 2D)

Surface Dimensions: 2x6 m

Selection: Strategic

Maximum Depth: 732 cm

SW Coordinate: E332.5, N305.5

Trench 2 was the deepest excavation conducted at Chuquiña, reaching sterile soil only after excavation of over 7 m of modern construction fill as well as prehistoric floors, architectural

Figure 4.6. Excavation of a Natural Occupation Surface in Unit 1-D at Chuquiña.

features, midden, and other anthropogenic deposits. Unlike other parts of the mound, the area of Trench 2 is capped with a very loose, poorly consolidated construction fill of sandy silt. This material reached a depth of about 260 cm. Beneath this cap of fill, the archaeological deposits were comprised of very compact layers of adobe melt, with numerous complex layers of architectural elements and midden (Figure 4.7). It was at the base of the sterile modern construction fill that we began truly archaeological excavation designated 'Level 1.' For this reason, level numbers in Trench 2 appear to be very low, despite the fact that the trench was excavated to such a considerable depth.

Unlike excavations in Zone 1 (Trench 1, Unit 1-C, and Unit 1-D) the substantial deposits of dense adobe melt in Trench 2 appear to have resulted in reduced insect bioturbation and much better preservation of natural stratigraphy (Figure 4.8).

Figure 4.7. Excavation of Trench 2 at Chuquiña.

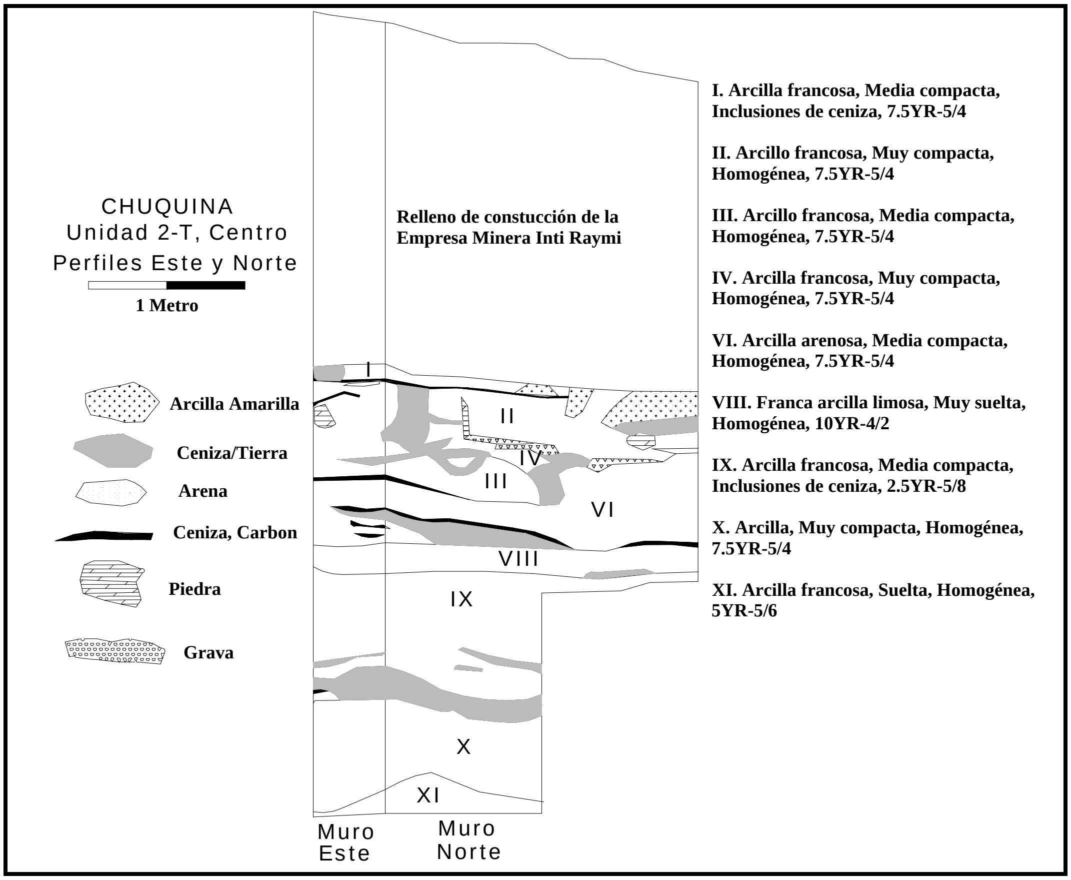

Figure 4.8. East and North Wall Profiles of Trench 2 at Chuquiña.

4.2.4.1. <u>LJ-I in Trench 2</u>

Based on rim sherd analysis and proportions of coarse Aboriginal Grit pottery, levels 22-32 date to LJ-I. Levels 29-32 had extremely low artifact densities, made up almost entirely of a few lithic flakes and bone fragments. No architectural features are present, and occupation surfaces in these layers are almost indiscernible. Levels 22-28 had more visible occupation surfaces, though none of these were prepared floors of clay. Because of the extreme depth of this excavation, the size of the Trench had narrowed considerably by Level 22, to only 2x0.5 m. One projectile point from Level 29 is foliate in shape (another was recovered from Level 20), appearing generally similar to some of the Type 3 (especially Type 3D) (Figure 4.9) preceramic projectile points described by Klink and Aldenderfer (2005: Table 3.4) from the highlands surrounding the Lake Titicaca Basin. This raises the possibility of a very early, though quite ephemeral occupation of Chuquiña during the Archaic Period. Additional radiocarbon dating from these deep levels should resolve this.

In sum, the evidence from the deepest portions of Trench 2 suggest that this part of the Chuquiña mound was occupied during this early period and possibly even during the Archaic. This occupation appears to have left a relatively ephemeral 'footprint' however, as indicated by light artifact densities and few architectural domestic features and floors.

Figure 4.9. Foliate Points of Possible Archaic Type Recovered from Chuquiña.

4.2.4.2.

LJ-II in Trench 2

Levels 10-21 in Trench 2 correspond to LJ-II. As in LJ-I, the deposits in these levels comprise mostly natural occupation surfaces but with higher artifact densities than seen in LJ-I. No clear architectural features were detected in these levels, but it should be noted that by Level 21 Trench 2 had been narrowed to 2x1 m. A sample of charcoal in an adobe melt deposit in Level 16 yielded a calibrated radiocarbon date of ~1190 BC.

4.2.4.3. LJ-III in Trench 2

Only Levels 8 & 9 produced ceramic assemblages associated with LJ-III in Trench 2. Only one architectural feature was encountered in these levels – Feature 6 is a wall laminar, upright sandstones running roughly east-west across the narrow part of the trench (Figure 4.10). On one side of the wall and slightly below the floor associated with the wall, was a deposit (an offering?) of artifacts that included an entire olla, numerous groundstone tools, camelid bone, and fish bone. While this cache of artifacts is certainly noteworthy, the composition of the artifact assemblage does not suggest anything other than domestic activities. The wall of laminar sandstone may be a connecting wall between a house and ancillary facility or it may represent a corral wall.

4.2.4.4. LJ-IV in Trench 2

LJ-IV is represented by levels 1-7, and was the most intensive phase of occupation documented in Trench 2. It is possible that additional deposits dating to LJ-IV in this zone of the site have either eroded away or been bulldozed in the preparation of the parking lot on the top of the mound. At least three different, super-imposed construction episodes can be documented during LJ-IV. Feature 5, the earliest of these was a stone wall foundation only very partially exposed. Feature 2 was another stone wall foundation of undetermined function with an associated clay floor; this wall does not take the curvilinear form that is typical of domestic structures, but this may be a result of minor disturbance (Figure 4.11). Immediately superimposed on Feature 2 is Feature 1, a round structure with well-defined interior clay floor and defined by a stone wall foundation and melted adobe superstructure (Figure 4.12).

Figure 4.10. Feature 6 in Trench 2 at Chuquiña.

Adobe melt from all of these features contained significant flecks of charred plant material and charcoal, suggesting that these structures may have been burned in order to clear space for subsequent construction. While the clay component of adobe is clearly not combustible, the thatch roofs that likely topped these structures would have burned in addition to the considerable amounts of fibers and organics incorporated into the adobe walls themselves. Burning of structures could have been of ceremonial significance, in addition to clearing an area of insects, pests, and accumulated refuse.

Figure 4.11. Feature 2 in Trench 2 at Chuquiña.

Figure 4.12. Feature 1 in Trench 2 at Chuquiña.

4.2.5. Unit 2C

Surface Dimensions: 2x2

Selection: Random

Maximum Depth: 475 cm

SW Coordinate: E312, N289

Unit 2-C was randomly selected from Zone 2 and excavated to nearly 5 m depth. At that depth, small amounts of cultural material were still being recovered in the excavation, but these did not include ceramics. Excavation had to be terminated at that point due to safety considerations about the sidewalls of the test unit. Unit 2-C is one of the only excavations at Chuquiña that includes components from all four La Joya phases. The unit produced an abundance of evidence in the form of features and artifacts. It also contained good preservation of stratigraphy, resulting in numerous charcoal samples for radiocarbon dating (Figures 4.13 and 4.14).

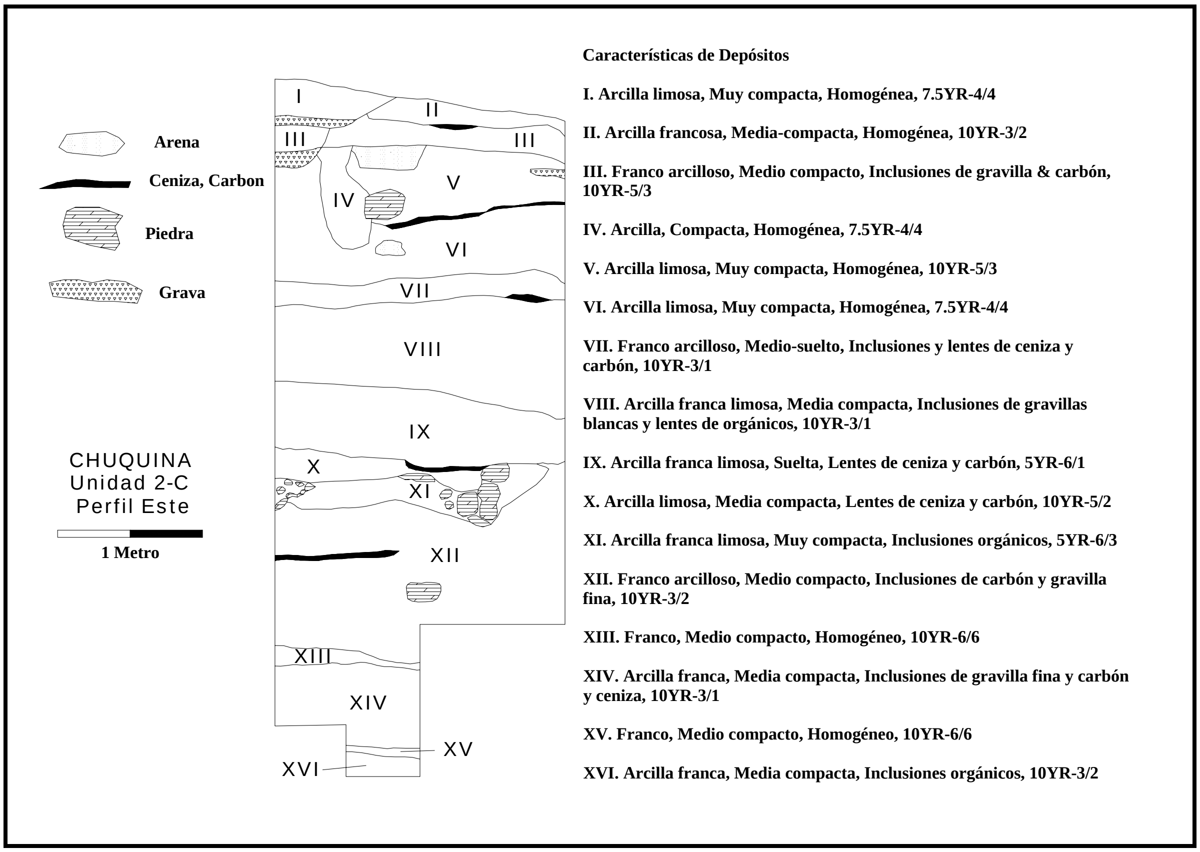

Figure 4.13. East Wall Profile of Unit 2-C at Chuquiña.

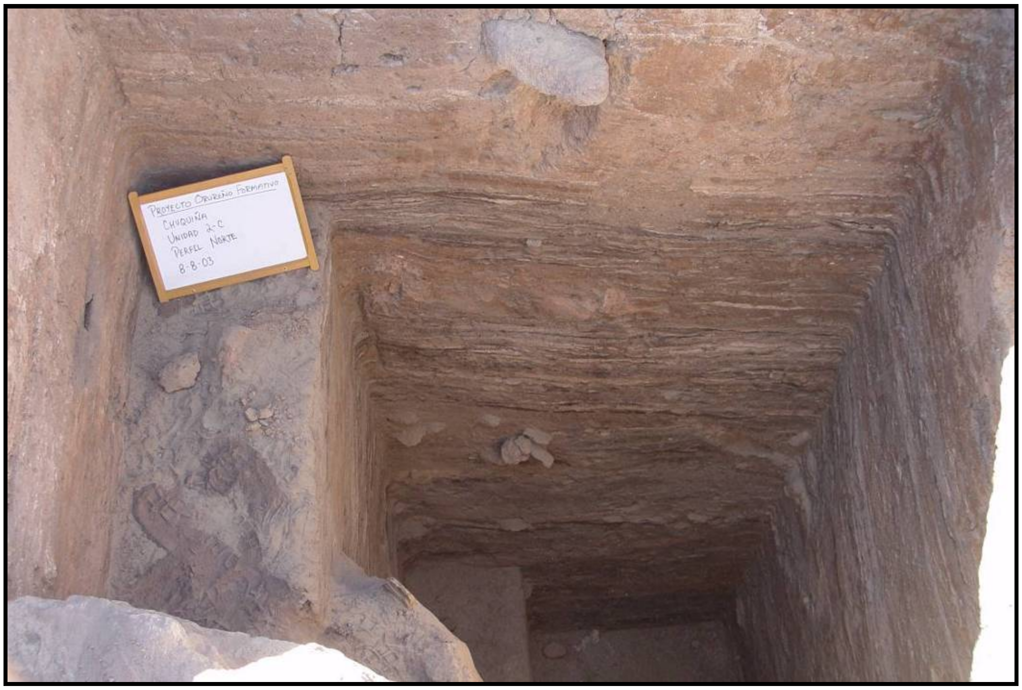

Figure 4.14. North Wall Profile of Microstratigraphy in Unit 2-C at Chuquiña.

4.2.5.1. <u>LJ-I in Unit 2-C</u>

Levels 43-54 comprise the LJ-I Phase in Unit 2-C, but the lack of ceramics in some of the lowest levels combined with the presence of two projectile points with Archaic characteristics suggests that there may be an Archaic Period occupation in Zone 2 at Chuquiña. All levels from LJ-I in this unit were composed of high proportions of midden and ashy sediments, including significant volumes of charred earth and escoria. Clearly fires of considerable temperature burned in this area of the site during LJ-I. Unfortunately, because Unit 2-C had narrowed to the size of a 2x1 m and eventually 1x1 m size in these levels, it is difficult to discern the nature of features and surfaces at this depth. Still, when viewed in light of evidence from other Zone 2 units (Trench 2 and Unit 2-E especially) it seems clear that this area was probably the core of the Chuquiña settlement during LJ-I.

4.2.5.2. LJ-II in Unit 2-C

Comprised of Levels 36-42, the LJ-II component in Unit 2-C appears relatively brief. Although these levels contain no evidence of structural walls, they are characterized by a very complex sequence of floors and burned earth surfaces like that represented by Feature 9 (Figure 4.15). A charcoal sample from an ash lens immediately beneath the clay surface in Feature 9 produced a calibrated radiocarbon date of ~1225 BC.

4.2.5.3. LJ-III in Unit 2-C

Levels 18-35 in Unit 2-C correspond to LJ-III. These levels were comprised of more layers of ash and midden with bands of adobe melt and several natural occupation surfaces. Two prepared clay surfaces occurred with Features 4 and 5. Feature 5 was a hearth in a midden and ash-covered clay floor in Level 24 (Figure 4.16). Immediately below this dense clay floor, a charcoal sample from an isolated ash lens yielded a calibrated radiocarbon date of ~1100 BC. Feature 4 was another curvilinear stone wall foundation with associated adobe melt encountered in the northeast corner of Unit 2-C, Level 18 (Figure 4.17). Overall, the artifacts and features encountered in these levels are consistent with a sequence of domestic occupations. Artifact densities in these levels were very high, and included abundant ceramics, animal bone, and chipped-stone tools. Adobe melt throughout these levels included significant flecks of charred organics, and this is interpreted as episodes of structure burning in preparation for new construction episodes.

4.2.5.4. LJ-IV in Unit 2-C

The LJ-IV occupation in Unit 2-C includes Levels 1-18. Because this unit is located on the slope of the mound, it is likely that some deposits toward the late part of the sequence may have eroded away. These levels included many very thick bands of adobe melt flecked with charred

Figure 4.15. Feature 9 in Unit 2-C at Chuquiña.

Figure 4.16. Feature 5 in Unit 2-C at Chuquiña.

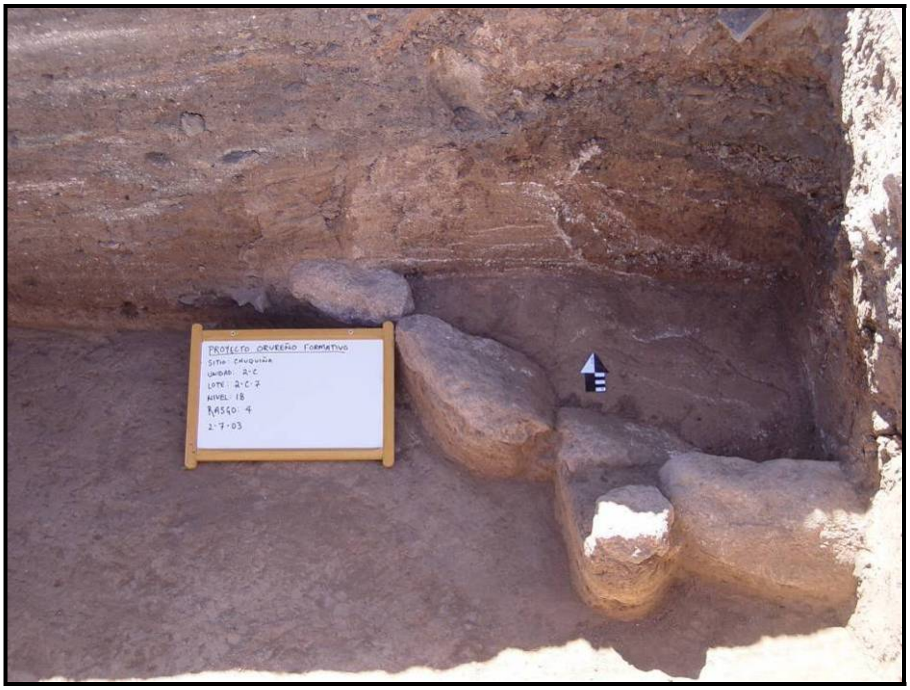

Figure 4.17. Feature 4 in Unit 2-C at Chuquiña.

organics overlying a complex series of natural and at least one prepared surface. The prepared surface was a clay floor with two associated round structures with an exterior clay hearth between them (Features 1, 2, and 3) (Figure 4.18). One structure, in the northeast corner of the excavation, appears to be a typical round domestic structure with stone wall foundation and adobe superstructure. The second structure, in the southwest corner, has a curvilinear wall of up-turned laminar sandstones. This latter may represent a corral or some other type of structure. Given the close proximity of the structures and their shared exterior hearth, it is reasonable to posit that they were part of a single domestic unit. A sample of charcoal from an ash deposit about 1 m below these features yielded a calibrated date of ~550 BC.

Figure 4.18. Features 1, 2, and 3 in Unit 2-C at Chuquiña.

4.2.6. Unit 2-E

Surface Dimensions: 2x2

Selection: Random

Maximum Depth: 590 cm

SW Coordinate: E325, N318

Excavated to a depth of nearly 6 m, Unit 2-E represents one of the longest sequences of deposits encountered at Chuquiña. As in other areas at the top of the Chuquiña mound, the upper ~50 cm of deposits here are construction fill used to build a parking lot. Beneath that cap of fill, Unit 2E is comprised of a very complex sequence of cultural features including domestic structures, clay floors, and midden deposits (Figure 4.19).

Figure 4.19. North Wall Profile of Unit 2-E at Chuquiña.

4.2.6.1. <u>LJ-II in Unit 2E</u>

The deepest levels in Unit 2E (levels 48-49) contained only a few ceramic sherds, including a few examples of the very early polished Aboriginal Grit ware that is common in LJ-I. Sherds from these earliest levels however, were simply too few in number to be taken as a reliable temporal marker. Based on rim sherd metrics, levels 22-47 appear to date to LJ-II. These levels are comprised of intermixed layers of midden and ash with adobe melt. Several occupation surfaces were documented in these levels, including one exterior floor with clay hearth (Feature 4), and a curved wall foundation of what was probably a domestic structure (Feature 5).

4.2.6.2. LJ-III in Unit 2E

Rim sherd analysis places levels 14-21 in Unit 2E in the LJ-III Phase. During this interval, there is evidence of a complex sequence of relatively ephemeral occupation surfaces with only possible prepared clay surface alternating with thin layers of ash and midden deposits. No wall features of any kind are present during LJ-III, but artifact densities were quite high, providing an wealth of information about the LJ-III occupation at Chuquiña.

4.2.6.3. LJ-IV in Unit 2E

Based on rim sherd metrics, levels 1-13 date to LJ-IV. These levels include two, probably contemporaneous, adobe structures with stone wall foundations (Figure 4.20). Feature 1 is a section of a very robust stone wall foundation along the west edge of the excavation. Unfortunately, the exposed section here is too small to estimate the size of the structure. Feature 2 is a structure dominating the southeast portion of the excavation. The very thin line of stones extending out from the larger structure in Feature 2 may be the type of wall that connects what Rose (2001) has called ‘ancillary’ facilities to domestic structures. As can be seen, the space between these two structures includes a number of well-used surfaces with abundant micro-lense deposits of ash and midden. The artifact assemblages from this area contain the full range of a typical deposit of domestic refuse, supporting the inference that Feature 1 and Feature 2 represent domestic structures. Given the very close proximity of the two structures, it is possible that they represent parts of a single household unit.

Figure 4.20. Features 1 and 2 in Unit 2-E at Chuquiña.

4.2.7. Unit 2-F

Surface Dimensions: 2x2

Selection: Random

Maximum Depth: 390 cm

SW Coordinate E350, N315

The location of Unit 2-F was randomly selected for investigation. The unit is on the lower east slope of the mound, about 25 m east of Unit 2-E. Like other excavations on the east slope of Chuquiña, this excavation lacked clear evidence of architectural features. Levels 12-33 yielded a series of ephemeral natural surfaces, midden deposits, and some adobe, with ceramic rim sherds indicating an association with LJ-II. Similar deposits in Levels 1-11 produced rim sherd measurements consistent with LJ-III. Overlying materials dating to LJ-IV were not encounted, though this could be as a result of erosion on the slope zone.

4.2.8. Trench 3 (comprised of Units 3A, 3B, & 3C)

Surface Dimensions: 2x6

Selection: Strategic

Maximum Depth: 560 cm

SW Coordinate: E283.5, N306.0

This strategically-placed trench, like the other trench units, was located where the apex of the mound meets the slope in the southwest (Zone 3) of Chuquiña. A single 2x2 m section of this trench was excavated to sterile alluvial deposits at a depth of nearly 6 m below the surface. Trench 3 revealed a sequence of occupation surfaces and architectural features similar to those seen in the excavations in Zone 2. As in the Zone 2 excavations, the stratigraphy of Trench 3 is horizontal, illustrating that the high part of the mound was once more extensive than it is today. This part of the mound is overlain by nearly 1 m of dense construction fill, used to prepare the surface of the modern parking lot on the top of the mound (Figures 4.21 and 4.22).

4.2.8.1. LJ-II in Trench 3

Levels 42-47 comprise the LJ-II occupation in Trench 3. In this deep portion of the excavation, only a handful of ephemeral natural surfaces were observed. Sediments were dominated by midden, ash, and small amounts of adobe-like clay loam. Artifact densities were fairly low.

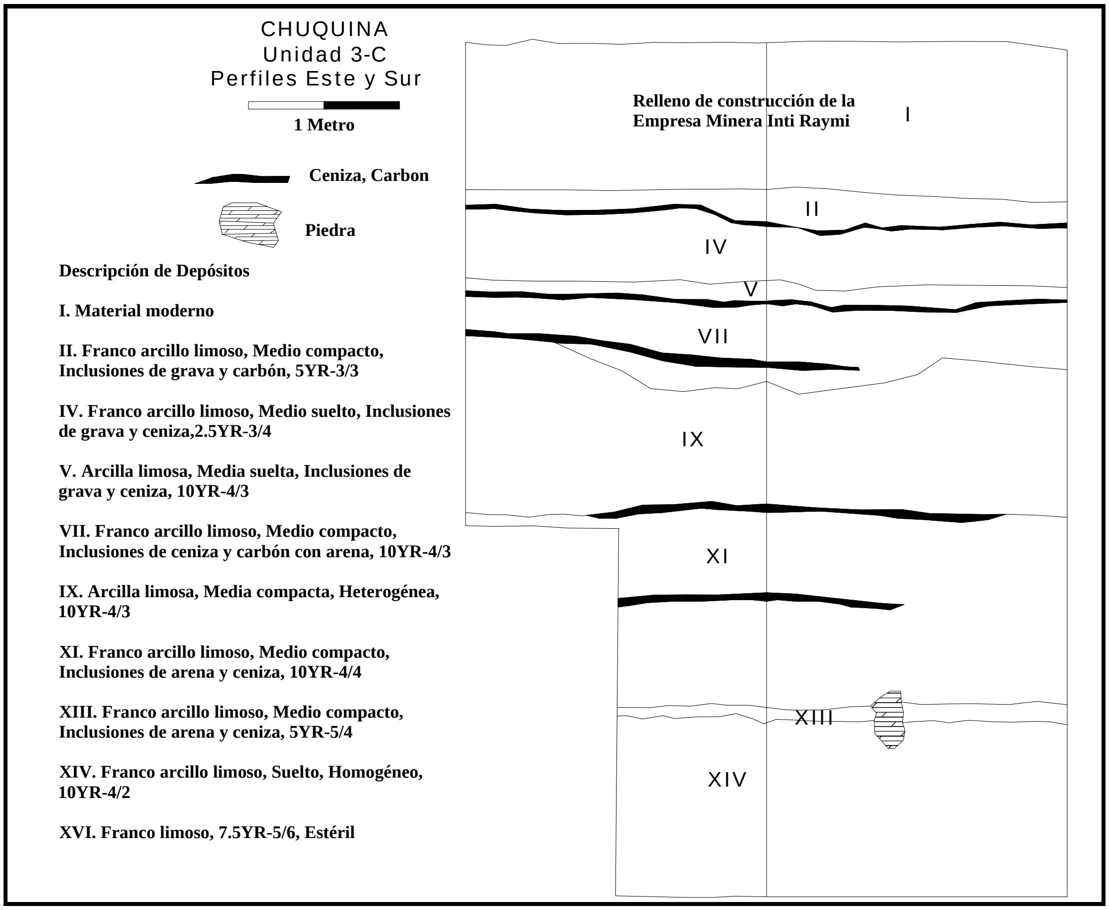

Figure 4.21. East and South Wall Profiles of Trench 3 at Chuquiña.

4.2.8.2. <u>LJ-III in Trench 3</u>

LJ-III is well represented in Trench 3, with Levels 15-41 corresponding to this time period. As in Zone 2, it seems that this phase must have been a period of relatively rapid deposition, presumably as a result of more intensive occupation than earlier time periods. In addition to several ephemeral natural occupation surfaces, these levels included at least three prepared floors associated with structures. Feature 5 was a segment of sandstone wall foundation discovered in Level 41, at the very base of the LJ-III deposits.

Figure 4.22. South Wall Profile of Trench 3 at Chuquiña.

Feature 4 was a pair of parallel curvilinear walls of a structure discovered in Level 25 (Figure 4.23). The thin, interior wall serves an unknown function, and is an unusual elaboration in Wankarani architecture. It may serve as an entry way of some kind, though this is only speculation. Also contributing to the extraordinary nature of this structure is its considerable size. Using the arc of the exterior wall to estimate total size, the structure probably had a diameter approaching 5 m. This would make the total floor area approximately 18 m^2, the largest structure yet excavated at Chuquiña. There is little about the artifact assemblage associated with the structure or this phase in general in Trench 3 to distinguish it as a non-residential structure. Nonetheless, the unusual nature of this building makes one of the best candidates for a public space at Chuquiña. Feature 3 represents an occupation surface that formed over the adobe melt and wall collapse of the Feature 4 structure later in LJ-III (Figure 4.24).

Figure 4.23. Feature 4 in Trench 3 at Chuquiña.

Figure 4.24. Feature 3 in Trench 3 at Chuquiña.

LJ-IV in Trench 3

Levels 1-14 in Trench 3 represent LJ-IV. These levels included a complex set of surfaces, midden deposits, and wall collapse. Three structural walls were detected in these levels. Uncovered in Level 12, Features 1.1 and 2 comprised a round stone wall foundation and adobe melt flecked with charred organics from a typical domestic structure and an adjoining straight stone wall foundation of unknown function (Figure 4.25). The adjoining straight was was very robust by Wankarani standards, as it was at least two courses of fieldstones thick. This straight wall ran perpendicular to the slope of the mound, suggesting that this may have been a retaining wall. The round structure falls within the normal range of a domestic structure, with an estimated floor area of ca. 9.6 m^2.

Figure 4.25. Features 1.1 and 2 in Trench 3 at Chuquiña.

Feature 1 is the curvilinear wall a structure excavated in Level 8 of Trench 3. With a diameter of ca. 4 m, this structure's floor area is estimated to be about 12.6 m^2. This is large compared to most Wankarani domestic structures, but not completely outside the normal range. Interestingly, the adobe melt and collapse from this structure appear to represent a terminal occupation of this portion of the site. This is based on two observations. First, there are no significant overlying midden deposits above the structure. Second, the adobe melt and wall collapse from this structure does not contain charred flecks of organic materials as was observed in structures from LJ-III and in other parts of the site.

4.2.9. Unit 3D

Surface Dimensions:	2x2
Selection:	Random
Maximum Depth:	250 cm
SW Coordinate	E274, N278

This randomly-selected test unit was located on the southwest slope of the mound where cultural deposits are not as deep as other parts of Chuquiña. No architectural features and very few occupation surfaces were detected in this unit. This is the only excavation unit with sloped stratigraphy (Figures 4.26 and 4.27) indicating that the southwest portion of the site was sloped during the Formative Period.

4.2.9.1. <u>LJ-III in Unit 3-D</u>

Levels 13-22 correspond to LJ-III in this unit. As noted the above, the stratigraphy in this levels is sloped, and includes several layers of midden, silty clay adobe melt, and slope wash. These levels contained extremely high densities of camelid bone, including many articulated elements.

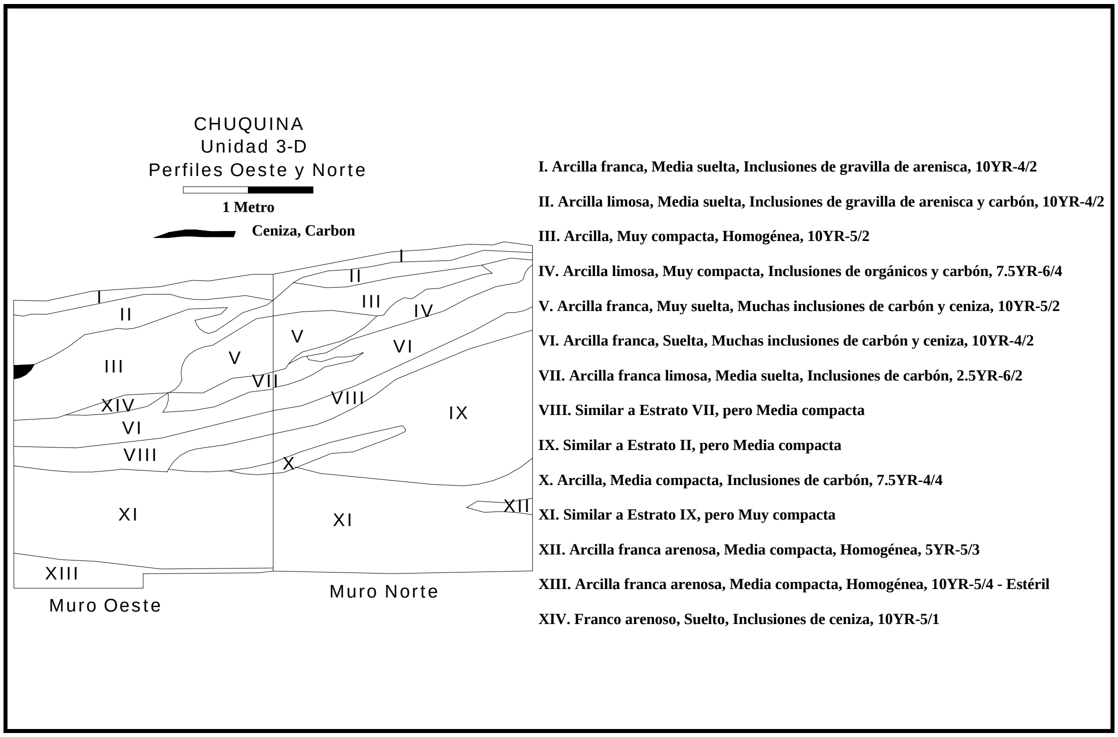

Figure 4.26. West and North Wall Profiles of Unit 3-D at Chuquiña.

Figure 4.27. East Wall Profile of Unit 3-D at Chuquiña.

At the base of Level 22, the sterile homogeneous alluvium was encountered, similar to other units at Chuquiña. This stratum of sterile alluvium was not sloped in orientation, but indicates the horizontal surface of the natural landform underlying the Chuquiña mound.

4.2.9.2. LJ-IV in Unit 3-D

Levels 1-12 correspond to LJ-IV. Like lower levels, the stratigraphy in this part of the excavation was markedly sloped, roughly paralleling the modern mound surface. Interchanging layers of mixed ash, midden, and adobe melt slope wash produce a very uniform sequence of sediments. Camelid bone was included in these deposits in high volumes. No architectural features of any kind were encountered, though several ephemeral sloped surfaces were observed.

4.2.10. Unit 4A

Surface Dimensions:	2x2
Selection:	Random
Maximum Depth:	245 cm
SW Coordinate	E281, N350

This randomly-selected test unit was located on the top of the Chuquiña mound in the northwest quadrant of the site. The unit was excavated to sterile levels at approximately 2.5 m below the surface. Like excavations in some other units on the north side of the mound (Trench 1, Unit 1-C), the stratigraphy in Unit 4-A has been obscured by significant insect bioturbation (Figure 4.28). This appears to be a result of relatively little deposition of dense clay loam adobe melt that characterizes the sediments in Zone 2 and parts of Zone 3. The sediments in Unit 4-A are predominantly ash and midden deposits, with no discernible cultural features of any kind.

Figure 4.28. East Wall Profile of Unit 4-A at Chuquiña.

4.2.10.1. LJ-III & LJ-IV in Unit 4-A

Despite the lack of clear stratigraphy and considerable bioturbation, the presence of articulated faunal skeletal elements encountered during excavation suggested the artifacts themselves in this unit were not significantly disturbed. This was confirmed through artifact analysis, which showed that the rim sherd metric trend was well established in excavation levels from Unit 4-A. For this reason, it was possible to assign Levels 11-23 to LJ-III and Levels 1-10 to LJ-IV. Overall, the excavation of Unit 4-A confirmed that the north side of the Chuquiña mound, comprising much of Zones 1 and 4, was never a significant location for residential occupation. Rather, this zone is overwhelmingly an area of refuse accumulation from the residential areas in Zones 2 and 3. Unit 4-B also revealed a cemetery in the northwest side of the mound, discussed below.

4.2.11. Unit 4B

Surface Dimensions: 3x3 m

Selection: Random

Maximum Depth: 75 cm

SW Coordinate E263, N329

Located on the northwest side and approximately half way down the slope of the Chuquiña mound, Unit 4-B was randomly selected. Beginning as a 2x2 m test pit (Figure 4.29), this unit

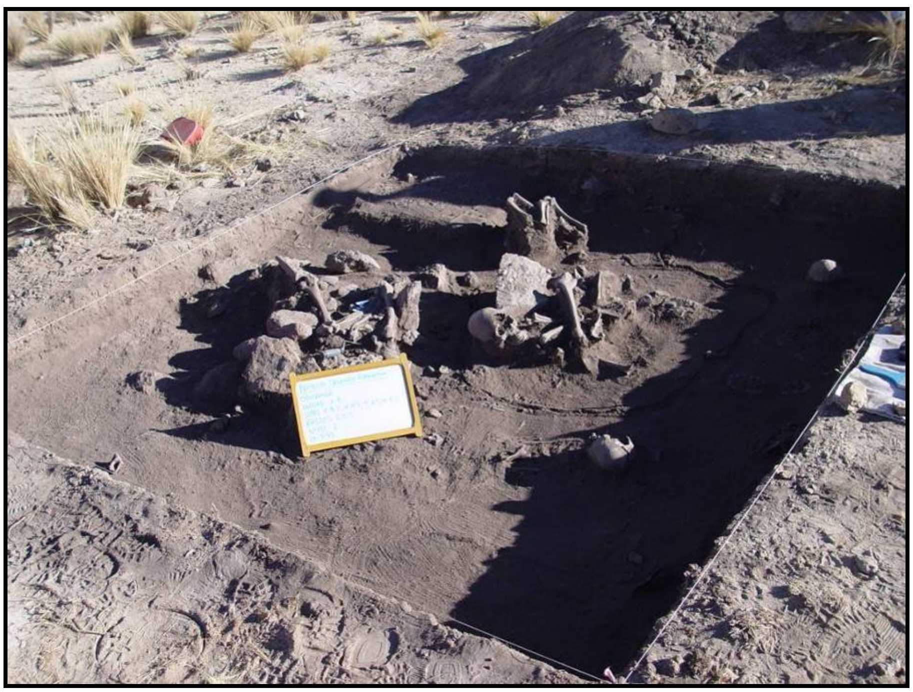

Figure 4.29. Cemetery Revealed in Unit 4-B at Chuquiña.

was immediately expanded to a 3x3 m square when several near-surface burials were encountered. Initially, we planned to remove these burials and proceed with excavation to sterile. However, more human remains were discovered in every portion of the unit, indicating a large community cemetery area. These included both in situ and secondary interments, principally of adult males and children. Because the time-consuming process of excavating burials was not an objective of the investigation, the exposed burials near the surface were excavated and collected, and then the unit was backfilled. These burials are described in detail in Chapter 7.

The proximity of these burials to the surface combined with extremely high artifact densities indicate that significant wind deflation, and to a lesser degree slope erosion, have lowered the surface on this side of the mound considerably. This erosion has created mixed artifact assemblages in this unit, but rim sherd metrics indicate that the assemblage collected in Unit 4-B most likely dates to LJ-IV. Of course, because excavation of this area was stopped, it is uncertain whether earlier occupations underlie the cemetery in 4-B.

4.3. Excavations at Pusno

In total, 14 test excavations were undertaken at Pusno. These included three small trenches, eight randomly-selected 2x2 m test units, and three strategically-placed 2x2 m test units. Of the 14 excavations, 11 were excavated to the depth of sterile deposits. All test units were given an alpha-numeric name, just as was used at Chuquiña.

4.3.1. Trench 1 (Comprised of Units 1-A and 1-B)

Surface Dimensions:	2x4 m
Selection:	Strategic
Maximum Depth:	300 cm
SW Coordinate	E305, N300

Trench 1 was strategically placed to dissect the main mound at Pusno across the east-west access in order to assess mound formation processes and the function of the central mound. The matrix in this part of the mound consisted of a dense clay-loam material of adobe melt and fill with abundant inclusions of organics and ash (Figure 4.30).

4.3.1.1. LJ-I in Trench 1

Levels 17-26 in Trench 1 correspond to LJ-I. These levels included a variety of natural occupation surfaces, many of which had evidence of burning. Numerous pieces of escoria and baked earth fragments were recovered in these levels. Only one architectural feature was documented. Feature 4 was a small curvilinear row of stones on a prepared clay surface. The floor area of this structure was likely less than 2 m^2, suggesting that it was probably too small to be a residential building.

4.3.1.2. LJ-II in Trench 1

Levels 9-16 correspond to LJ-II, and contained a continued series of ephemeral occupation surfaces. The matrix in these levels appears to contain high quantities of adobe with flecks of carbon, but no architectural features could be detected. Because no natural process of deposition could have gone on this high up on the Pusno mound, it seems likely that these sediments were transported onto the site as mound fill.

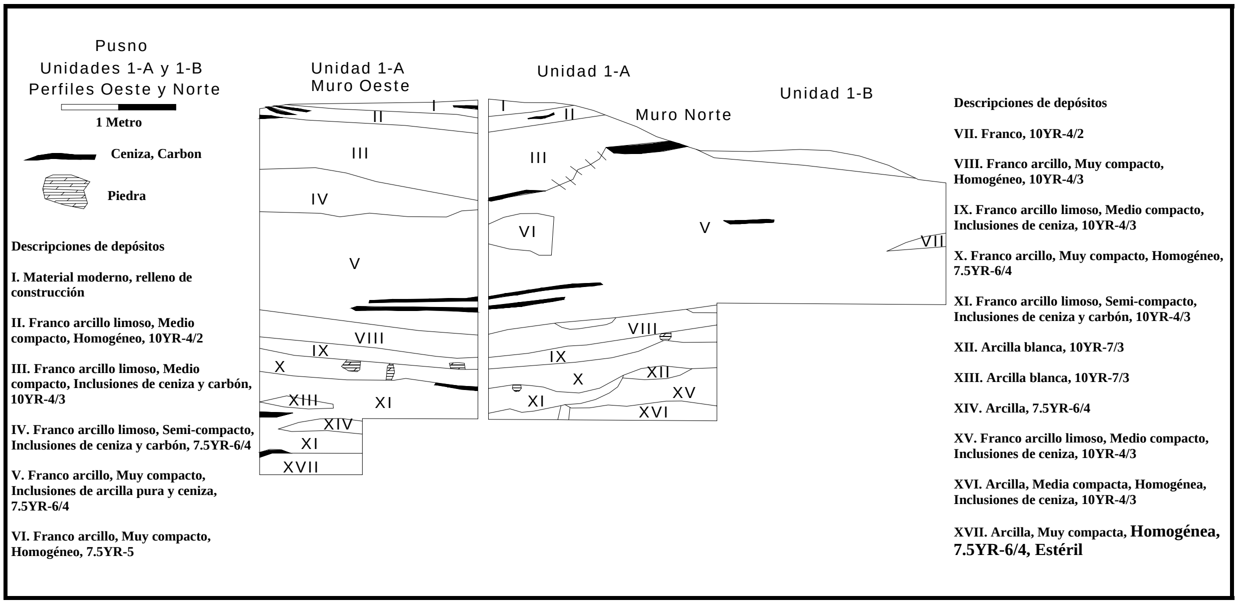

Figure 4.30. West and North Wall Profiles of Trench 1 at Pusno.

4.3.1.3. <u>LJ-III in Trench 1</u>

Levels 5-8 correspond to LJ-III in Trench 1. At the boundary between LJ-II and LJ-III deposits in Trench 1 (Levels 8/9), we encountered the most significant architectural element anywhere on the Pusno central mound. Feature 1 was the stone foundation to a major wall, at least 50 cm thick, running roughly perpendicular to the slope of the mound (Figure 4.31). This wall foundation was associated with abundant adobe melt and collapse. The relatively straight line of the wall, its location at the edge of the mound slope, and its substantial size all suggest that it may have served as a retaining wall.

4.3.1.4. <u>LJ-IV in Trench 1</u>

Levels 1-4 appear to represent the terminal occupation of the central mound at Pusno, and rim sherd metrics suggest these level correspond to LJ-IV. These levels represent only a series of

Figure 4.31. Feature 1 in Trench 1 at Pusno.

ephemeral natural surfaces with abundant carbon, escoria and charred earth, and lenses of ash/midden. There is no evidence of architectural features at all during this phase in Trench 1.

4.3.2. Trench 2 (Comprised of Units 1-C, 1-D, and 1-E

Surface Dimensions: 2x6 m

Selection: Strategic

Maximum Depth: 250 cm

SW Coordinate E301, N306

Trench 2 was the second trench placed on the central mound in Pusno in order to investigate the mound along its north-south access. Considering that this excavation was only a few meters from Trench 1, its contrasts with that first trench are striking. The deposits in Trench 2 contained virtually no evidence of adobe melt, but rather a sequence of prepared surfaces of colored clays (Figures 4.32 and 4.33). The extreme contrast between deposits in the two trenches is clear evidence that the central mound of Pusno was in fact intentionally constructed in a series of episodes, rather than simply emerging as a result of refuse and adobe accumulation. Like Trench 1, this excavation showed no evidence of domestic structures of any kind. The deepest levels in Trench 2 had extremely low artifact densities, and as a result it is impossible to document an occupation during LJ-I on this part of the mound.

4.3.2.1. LJ-II in Trench 2

Levels 13-26 correspond to LJ-II in Trench 2. Of these, levels 15-26 had such low artifact densities and so few ceramics, that their temporal association remains uncertain. Levels 16-26 were comprised of a homogeneous clay loam with charred organic inclusions and sparse artifacts. This appears to be fill material, probably associated with the earliest construction of the raised mound at Pusno.

Levels 13-15 included two natural surfaces on compacted clay loam fill, which incorporated very high volumes of camelid bone and groundstone artifacts. There is no evidence of walls or other architecture, further confirming that the central mound at Pusno was constructed as a raised platform of non-domestic function during LJ-II.

4.3.2.2. LJ-III in Trench 2

Levels 4-12 in Trench 2 correspond to LJ-III. During this phase, a series of prepared surfaces were constructed on this side of the mound. These surfaces occur in alternations of colored clays, especially red and green clays that must have been transported to the site from unknown locations (Figures 4.32 and 4.33). At least four such clay floors were built during this phase, and each episode of renovation incorporated significant volumes of camelid bone, groundstone,

Figure 4.32. East Wall Profile of Trench 2.

Figure 4.33. Colored Clay Floors Visible in the East Wall Profile of Trench 2 at Pusno.

and other artifacts. These materials appear to have been incorporated into the clay material, rather than being remains on the surface that were simply covered over. Lenses of ash and carbon suggest that the clay surfaces were burned like so many other surfaces at the site, which may have contributed to the very hard and durable nature of the matrix in Trench 2. As in LJ-II, there is no evidence of walls or other architecture associated with this period.

4.3.2.3. LJ-IV in Trench 2

Only levels 1-3 in Trench 2 yielded a ceramic assemblage apparently associated with LJ-IV. These levels were moderately disturbed by modern foot traffic over the mound. A disturbed burial was located very near the apex of the mound, close to the south wall of the trench (Figure 4.34). This burial was immediately beneath the surface, and is probably modern. Its presence so close to the surface suggests that some erosion of the mound top at Pusno has occurred, possibly as a result of the site being quarried for fieldstones for construction of modern corrals.

4.3.3. Trench 3 (Comprised of Units 1-F, 1-H, and 1-I) and Extension (Unit 4-D)

Surface Dimensions:	2x6 + 2x2 m
Selection:	Strategic
Maximum Depth:	225 cm
SW Coordinate	E299, N322

Trench 3 was placed across the north-south axis of the smaller mound at Pusno. Originally excavated as three 2x2 m units in a row, this trench later included a western extension of a 2x2 m square. This actually extended part of the trench into Zone 4 of the site. The extension was added after deep excavation of part of the trench (Unit 1-I) revealed evidence of a long

Figure 4.34. Feature 1 in Trench 1.

architectural sequence in the western sidewall of the unit (Figure 4.35). The extension of trench 3 was used to investigate that architectural sequence in the hope of obtaining radiocarbon samples from sound contexts. In the end, the extension yielded a substantial number of charcoal samples for dating. Two units within the trench were excavated to sterile layers, 1-F and 4-D.

4.3.3.1. LJ-1 in Trench 3 Pusno

Levels 12-17 correspond to LJ-I in Trench 3. Excavation stopped at the base of Level 17, where sterile alluvium was encountered. Immediately above this, in Level 16, Feature 4 was documented. This was an irregular baked clay surface with abundant charred earth, escoria, charcoal and ash deposits. A small wall of baked adobe extended out from the west wall of the unit, and marked the boundary around a particularly dense deposit of ash and charred earth in

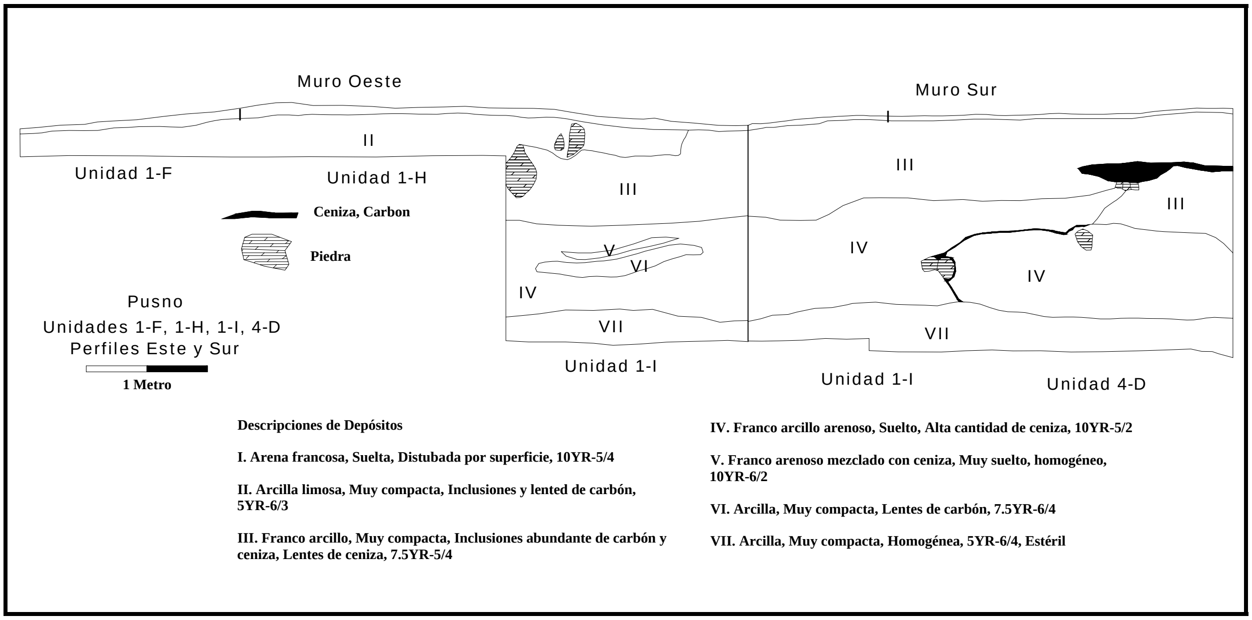

Figure 4.35. West and South Wall Profiles of Trench 3 at Pusno.

the northwest corner of the trench extension. This hearth or oven area covered about .5 m^2 in the excavation, but its boundary extended well outside of the sidewalls of the unit. Compared to other hearths documented in Wankarani sites, this represents a particularly large example and is very different than the small clay-lined hearths encountered in and around domestic structures (see description of Unit 2-C Chuquiña above). This feature may have been a ceramic production area, though this interpretation is problematic in the absence of clear wasters. In any event, it is clear that the feature was exposed to frequent burns of considerable temperatures. A charcoal sample from Feature 3 yielded a calibrated date of ~1325 BC.

4.3.3.2. <u>LJ-II in Trench 3 Pusno</u>

Levels 1-11 correspond to LJ-II in Trench 3. These levels include a complex series of natural and architectural occupation surfaces. At the base of these in Level 11, Feature 2 was small round structure (~1.2 m diam.) with a sunken baked clay floor (Figure 4.36). The boundary

Figure 4.36. Feature 2 in Trench 3 Extension at Pusno.

around this sunken floor was marked with a course of small pebbles. Two very small cobble walls extended out from this structure, and a broken pot was recovered at the confluence of these walls. The interior of the structure contained dense deposits of ash, escoria, and carbon, indicating repeated episodes of high-temperature burns. The high temperatures make it tempting to interpret this structure as a ceramic work shop, located immediately above the earlier feature documented for LJ-I. As in the earlier feature however, there is no evidence of misfired sherds. A charcoal sample from this feature yielded a calibrated date of ~1150 BC.

Above Feature 2, a sequence of ash lenses and adobe deposits form a handful of ephemeral natural surfaces. Level 8 marked a more formal floor of clay, Feature 1.1 (Figure 4.37). This floor was most visible as a circular feature in the northwest section of the unit, possibly delineating a round structure. No stone wall foundations were seen, however. The floor contained abundant groundstone artifacts, mostly *mano*s, and a high density of sherds. Baked

Figure 4.37. Feature 1.1 in Trench 3 Extension at Pusno.

clay and adobe agglomerations were also abundant. At the perimeter of the floor, close to the west wall of the trench extension unit, a broken olla was recovered nearly complete. The function of Feature 2 is uncertain at this point. The context does not appear consistent with domestic areas documented in other parts of Pusno and at Chuquiña. A charcoal sample from a deposit of adobe melt in Level 7, immediately above Feature 1.1, yielded a calibrated date of ~1150 BC.

Level 3 in Trench 3 marked the floor zone of an extremely large oval structure, designated Feature 1.2 (Figure 4.38). This structure had a thick clay floor. The stone wall foundation had considerable abobe melt around it. Unlike many Wankarani domestic structures, the stone wall foundation was not comprised of low, round boulders. Instead, the walls were based around large upright stones that were spaced about 10-20 cm apart. The diameter of the structure is

Figure 4.38. Feature 1.2 in Trench 3 at Pusno.

estimated to be about 6 m, making its total area ~30 m^2, easily one of the largest Wankarani structures ever excavated. Only Rose's excavations at La Barca have revealed a larger structure. The floor of this structure had only sparse artifacts, making the function of the building even more obscure. Overlying this structure were layers of relatively pure adobe collapse with little or no inclusions of trash or charcoal, demonstrating that this structure represents the terminal occupation in this part of the Pusno mound. The unusual character of the structure strongly suggests that it did not serve a residential/domestic function. This leaves two possible explanations – the structure could have served a public function for fairly large groups of people or it could have been a llama corral. I regard the first explanation as more plausible for two reasons. First, the unusual wall construction and thick clay floor hardly seem necessary for an ordinary animal corral. Second, there was no accumulation of llama dung, a material that accumulates quickly wherever llamas are housed. Even if dung were removed frequently for use as crop fertilizer, it seems unlikely that some degree of accumulation would not result in formation of organic micro-stratigraphy.

4.3.4. Unit 1-G

Surface Dimensions: 2x2 m

Selection: Random

Maximum Depth: 190 cm

SW Coordinate E322, N304

Unit 1-G was randomly selected and was located on the lower east slope of the Pusno mound. No architectural features were uncovered in this excavation, though several natural surfaces of occupation were documented (Figure 4.39).

4.3.4.1. <u>LJ-I in Unit 1-G</u>

Levels 7-14 correspond to LJ-I. The base of level 14 is the sterile natural land form, comprised of an extremely compact clay loam alluvium. Visible in this culturally sterile sediment, Features 1 and 2 are pits excavated into the surface by the earliest inhabitants of the Pusno site. These pits are plainly visible in the unit profiles (Figures 4.39 and 4.40). The two pits at the base of Unit 1-G contained midden and ash deposits as well as several groundstone artifacts. Surrounding the pits during LJ-I there is a well-used occupation surface as indicated by midden and ash deposited in a sequence of microstratigraphy. This surface is capped by a thick layer of clay loam adobe melt. There is no evidence of walls associated with this phase of melt.

Figure 4.39. Wall Profile with Pit Feature in Unit 1-G at Pusno.

Figure 4.40. Wall Profile with Second Pit Feature in Unit 1-G at Pusno.

4.3.4.2. LJ-II in Unit 1-G

Levels 1-6 correspond to LJ-II. These levels are comprised of a sequence of natural occupation surfaces with abundant midden and ash inclusions. There is no evidence of architectural features of any kind.

4.3.5. Unit 1-K

Surface Dimensions: 2x2 m

Selection: Random

Maximum Depth: 90 cm

SW Coordinate E341, E331

Unit 1-K was a randomly-selected unit on the very low section of the northeast slope of Pusno. The sediments in this excavation appear as a low-density midden and ash mixed with some natural slope wash (Figure 4.41). Based on rim sherd metrics, all seven levels of this unit appear to correspond to LJ-III. No architectural features or surfaces of any kind were detected in this unit; it appears to simply be a light midden accumulation at the periphery of the Pusno settlement.

4.3.6. Unit 1-L

Surface Dimensions: 2x2 m

Selection: Strategic

Maximum Depth: 165 cm

SW Coordinate E325, N325

This test pit was placed to strategically investigate a curvilinear stone wall foundation visible on the surface (Features 1 and 2 in Figure 4.42). All 15 levels in this unit correspond to LJ-I. The

Figure 4.41. West Wall Profile in Unit 1-K at Pusno.

Figure 4.42. Features 1 and 2 in Unit 1-L at Pusno.

wall appears to be part of a small domestic structure, measuring only about 5.5 m in diameter. The floor of the structure was badly disturbed as a result of its proximity to the surface. This structure probably also dates to LJ-I. This is somewhat surprising considering that nearby Unit 1-L produced sherds that only appear to date to LJ-III. This illustrates the sporadic usage of the far northeastern portion of the site during the Formative. Beneath the structure, a sequence of midden deposits and slope wash colluvium with several ephemeral surfaces were excavated before reaching sterile alluvium at about 160 cm below the surface.

4.3.7. Unit 2-A

Surface Dimensions:	2x2 m with 1x1 m extension on west wall
Selection:	Random
Maximum Depth:	45 cm
SW Coordinate	E301, N268

This unit was randomly selected for excavation in Zone 2, but excavation was halted after a number of burials were discovered here. This appears to be a community cemetery area, similar to that seen in Unit 4-B at Chuquiña. Preservation was very poor in this cemetery. All four levels in this excavation likely correspond to LJ-III based on rim sherd metrics. Because excavation of burials was time consuming and not a central objective of the current study, this unit was closed without reaching sterile deposits. The burials themselves are described in detail in Chapter 7.

4.3.8. Unit 2-B

Surface Dimensions: 2x2 m

Selection: Random

Maximum Depth: 160 cm

SW Coordinate E322, N288

This randomly selected unit was located on the southeast slope of the site. The deposits in this zone include a series of informal surfaces interfaced with midden and ash deposits (Figure 4.43). No formal architectural features of any kind were recorded, but cache pits similar to those documented in Unit 1-G.

4.3.8.1. LJ-I in Unit 2-B

Levels 7-11 correspond to LJ-I in this unit. These levels include the earliest occupation at the site, which included almost entirely the coarse Aboriginal Gritware pottery described in Chapter 5. At the base of these levels, an occupation surface is defined by the natural alluvial and colluvial deposits of the landform. Pits filled with ash and midden debris and containing numerous well-used groundstone tools were dug into this sterile material. These cache pits are very similar to those seen in Unit 1-G to the north, and are plainly visible in excavation profiles (Figures 4.43 and 4.44).

Above this original surface, there is a series of more ephemeral surfaces covered with low density adobe melt with ash and midden deposit. The LJ-I Phase ends in this unit with the deposition of a relatively thick, dense, deposit of adobe melt. There is no evidence of walls or structures of any kind associated with this melt deposit.

Figure 4.43. West Wall Profile of Unit 2-B at Pusno.

Figure 4.44. East Wall Profile of Unit 2-B at Pusno.

LJ-II in Unit 2-B

Levels 1-7 comprise the LJ-II component in Unit 2-B, a series of ephemeral surfaces and ashy midden deposits mixed with low density adobe melt and colluvium. While artifact density was fairly high in these levels, there was no evidence of walls, structures, or any other form of architectural feature. A large sandstone effigy head, apparently of a reptile, was found on the surface adjacent to this unit.

4.3.9. Unit 3-B

Surface Dimensions:	2x2 m
Selection:	Random
Maximum Depth:	190 cm
SW Coordinate	E294, N294

This randomly-selected test unit was located on the southwest slope of the main mound at Pusno. All levels in this unit appear to correspond to LJ-II. The unit included a curvilinear stone wall foundation visible on the surface. The wall appears to be part of a small domestic structure with a significant deposit of adobe wall collapse over a clay floor (Figure 4.45). Beneath this structure, Levels 4-14 comprise at least two episodes of adobe/fill deposition with ephemeral surfaces intervening between them. Some of this material appears to be adobe melt and debris accumulation, but it is likely that some of it is also a result of fill being deposited on the main Pusno mound during LJ-II.

Figure 4.45. Feature 1 in Unit 3-B at Pusno.

4.3.10. Unit 3-C

Surface Dimensions: 2x2 m

Selection: Random

Maximum Depth: 155 cm

SW Coordinate E264, N293

This randomly-selected test pit was located in the southwest portion of the site, close to modern llama corrals. The deposits in this area comprise a sequence of ephemeral, natural occupation surfaces. A single surface with a few sandstones and a band of adobe melt is the only evidence of architectural features, but this is poorly preserved. Stratigraphy is horizontal here, with many lenses of ash and midden included in between bands of adobe melt (Figure

Figure 4.46. West Wall Profile of Unit 3-C at Pusno.

4.46). Analysis of rim sherd metrics indicates that the entire assemblage from this unit dates to LJ-IV. Levels 11-14 in Unit 3-C had extremely low artifact densities, and no ceramics were recovered from Levels 13-14. The presence of any artifacts in those deep levels is likely a result of mild disturbance and bioturbation mixing cultural materials into the underlying alluvium.

4.3.11. Unit 4-A

Surface Dimensions: 2x2 m

Selection: Random

Maximum Depth: 200 cm

SW Coordinate E286, N328

Initially and mistakenly designated Unit 1-J, this randomly selected test unit was located to the northwest of the main mound, close to the slope of Cerro Pusno and a series of modern llama corrals. Preservation of prehistoric materials was quite good in this zone, with a series of preserved surfaces and at least one structure evident in Unit 4-A (Figure 4.47). Levels 11-17 correspond to LJ-I, while Levels 1-10 correspond to LJ-II. Thus, this unit appears to have roughly contemporaneous deposits to nearby Units 4-C, 4-D, and Trench 3.

4.3.11.1. LJ-I in Unit 4-A

Levels 11-17 correspond to a series of occupation surfaces including at least one large hearth on a surface completely defined by a bed of charred organics. These levels are contemporaneous with charred surfaces with abundant escoria and baked earth in Units 4-C and 4-D. This material may be the byproduct of ceramic production, though clear evidence of wasters and oven structures is lacking. What is clear is that a great deal of material was burned during the occupation of these surfaces, some of it at sufficiently high temperature to produce thick bands of white ash and escoria.

4.3.11.2. LJ-II in Unit 4-A

Levels 1-10 comprise a very different depositional process than that seen in the LJ-I levels. These levels exhibit much higher levels of adobe melt accumulation with fewer bands of ash and midden. A single curvilinear stone wall foundation and an associated clay floor (Features 1 and 2) were encountered in Levels 3-5 (Figure 4.48). This is likely a domestic structure given its small estimated size (ca. 5.5 m^2) and shape.

Figure 4.47. East Wall Profile of Unit 4-A at Pusno.

Figure 4.48. Features 1 and 2 in Unit 4-A at Pusno.

4.3.12. Unit 4-B

Surface Dimensions: 2x2 m

Selection: Strategic

Maximum Depth: 150 cm

SW Coordinate E297, N302

Unit 4-B was strategically placed for a single purpose; the objective was to investigate the highest density surface scatter of green escoria discussed in the site description for Pusno. Despite the abundance of this peculiar escoria on the surface of the central mound at Pusno, excavations in Trenches 1 and 2 yielded no samples from secure archaeological contexts. Given the important implications of copper-smelting escoria for a small-scale society like the Wankarani, determining the origin of this material was a priority. The surface of Unit 4-B was literally covered with fragments of this escoria, so we hoped to investigate the archaeological features associated with its provenience here.

About 15 levels were excavated in Unit 4-B. Although some burned chunks of earth were recovered from a series of clay surfaces in the excavation, none of these were the green frothy escoria observed on the surface. The surfaces excavated in this unit were continuous with those seen in Trench 1; a series of prepared clay floors with high densities of camelid bone and groundstone artifacts (Figure 4.49). No other architectural features were observed. Because of the close proximity to Trench 1 (less than 2 m away) and the continuous nature of the deposits in the two excavations, the unit was closed before reaching sterile sediments. In addition, artifacts from the unit are excluded from further analysis discussed here.

Figure 4.49. North Wall Profile of Unit 4-B at Pusno.

4.3.13. Unit 4-C

Surface Dimensions: 2x2 m

Selection: Random

Maximum Depth:

SW Coordinate

This randomly-selected test pit was located on the northern slope of the smaller north mound at Pusno, part of the most intensively-occupied portion of the site. Like excavations in Units 4-A, 4-D, and Trench 3, this unit revealed a sequence of intensive occupation that included many burned natural and prepared surfaces (Figure 4.50).

Figure 4.50. South Wall Profile of Unit 4-C at Pusno.

4.3.13.1. LJ-I in Unit 4-C

Levels 14-20 correspond to LJ-I. These levels comprise a series of natural occupation surfaces with lenses of ashy midden and adobe melt. No clear evidence of architectural features was seen. These levels had particularly high densities of early pottery (Aboriginal Grit, discussed in Chapter 5).

4.3.13.2. LJ-II in Unit 4-C

The LJ-II Phase is represented by Levels 1-13 in this unit. In addition to several natural ephemeral occupation surfaces, two structures were encountered in these levels. Feature 2 in Level 7 was a curvilinear stone wall foundation with associated adobe melt and clay floor (Figure 4.51). This structure was very small (ca. 4.5 m^2), and appears to be typical of domestic

Figure 4.51. Feature 2 in Unit 4-C at Pusno.

Wankarani structures. The most noteworthy aspect of this structure was the associated cache of broken and whole groundstone tools immediately outside the wall.

Feature 1 was a mass of adobe melt in Level 2 that appears to represent a collapsed wall but without the usual associated stone wall foundation typical of Wankarani structures. The lack of a stone wall foundation makes exact definition of the wall angle very speculative, rendering it impossible to estimate the size of the structure as well.

4.4. Summarizing the Two Village Sequences

4.4.1. The Chuquiña Community – Site Formation and Settlement Pattern

The mound of Chuquiña is a natural remnant stream terrace (bench) at its base. This naturally elevated area then accumulated centuries of adobe melt as structures were built, burned, and leveled to create new surfaces for construction. There is limited evidence in two excavation units (Trenches 1 and 3) of substantial retaining walls that may have been constructed in order to build up the level of the village and to prevent erosion of the mound. If there were more such walls lower on the slope, they could have formed a series of residential 'terraces' – level areas of land for houses and perhaps house gardens. Excavations on the east and south slopes of the mound reveal horizontal stratigraphy – this could only be the case if the mound were once much larger than it is today or if the slope were broken into a series of relatively level surfaces. It is unclear why the residents of the site would have invested labor in constructing retaining walls simply for the purpose of allowing the settlement to literally grow upward.

The excavations at Chuquiña reveal a remarkably stable village settlement pattern. Throughout the sequence at Chuquiña, the southern portion of the central mound and the southern slope appear to have formed the residential core of the site. This residential core lies mostly in what I have designated Zones 2 and 3. The northern side of the central mound as well as most of the eastern and western slopes, appear to have been used for non-residential purposes, including interment of the dead and disposal of refuse. This pattern of village spatial organization appears to have endured for at least 1000 years, and possibly much longer.

Like the overall settlement pattern, village architecture also appears to have remained very stable over time. Residential structures followed what is generally regarded as the typical Wankarani pattern – round houses with smaller associated structures, hearths, and exterior activity areas. These house structures were densely nucleated in the core residential zone of the site.

4.4.2. The Pusno Community

The Pusno settlement was initially founded on an alluvial plain on an elevated area close to the foot of a bedrock outcropping (Cerro Pusno). Cache or storage pits excavated into this natural sediment are roughly contemporary with at least one residential structure and several non-residential structures. Unlike Chuquiña, adobe melt does not appear to have played a central role in the accumulation of the central mound at Pusno. Rather, this mound was built up intentionally in a series of construction episodes that spanned late LJ-I through LJ-III. There is evidence of one possible retaining wall in Trench 1 on the central mound. The smaller northern mound at Pusno does appear to have developed as a result of accumulation of adobe melt from deteriorating structures.

The village settlement pattern at Pusno presents some marked contrasts with Chuquiña. From its earliest founding, residential structures at Pusno were dispersed around the perimeter of the central mound of the site, which appears to never have been used for residential space. The central mound of Pusno appears to have been constructed for some special functions, possibly ritual in nature, while the smaller northern mound peak was a residential location and possibly a ceramic workshop. The latter interpretation is highly speculative, but it is clear that many burns in pit features occurred in the northern mound area, producing partially vitrified baked earth and escoria deposits in abundance. In short, the settlement pattern at Pusno is precisely the opposite of Chuquiña where the center of the mound formed the residential core.

Over time, residential features become less and less common at Pusno. In terms of architecture and other features, there is evidence of a very limited residential population that dwindled over time. By LJ-IV, the residential population may have consisted of only 5-10 persons. It appears that the site gradually evolved into a special function location of some kind, possibly both economic and ritual in nature.

4.4.3. Settlement Size and Population Estimates

The investigations at Chuquiña and Pusno allow me to refine estimates of site size and population discussed in Chapters 2 & 3. In his survey of the region, McAndrews estimated the areas of Chuquiña and Pusno as 1.6 and 0.6 ha, respectively. My own estimate of area of the Pusno site is somewhat larger, at ca. 0.75 ha.

Table 4.1 summarizes the number of excavation units discussed above at each site with evidence of occupation during each of the four phases. The percentage of excavation units occupied during each phase is then used to estimate settlement size during each phase using the same methods employed by McAndrews (Tables 4.2 and 4.3). The first set of estimates in Table 4.2 are derived from Hastorf's (1993) work in the Mantaro Valley, and are based on an estimated 50 domestic structures per hectare and six residents per structure. However, I agree with McAndrews' (2005:59) point that these estimates are certainly too high for Wankarani villages. Thus, the estimates in Table 4.2 represent an absolute maximum population estimate.

A more likely population estimate based on site size comes from Sanders et al. (1979), using their index of nucleated village settlements. Using those indices, we can estimate 10-100 residents per hectare. Following McAndrews, I simply rounded these figures to an estimated 50

Table 4.1. Number of Units Excavated Showing Evidence of Occupation During Four Phases.

		LJ-I		LJ-II		LJ-III		LJ-IV	
Site	Modern Area	Occupied	Total	Occupied	Total	Occupied	Total	Occupied	Total
Chuquiña	1.60 ha	3	10	7	10	10	10	9	11
Pusno	0.75 ha	8	11	7	11	4	12	2	12

Table 4.2. Population Estimates for Four Occupation Phases Using Estimates Following Hastorf (1993).

	LJ-I		LJ-II		LJ-III		LJ-IV	
Site	Low	High	Low	High	Low	High	Low	High
Chuquiña	67	96	157	224	224	320	183	262
Pusno	77	110	67	96	35	50	18	25

Table 4.3. Population Estimates for Four Occupation Phases Using Nucleated Village Indices Following Sanders et al. (1979)

	LJ-I		LJ-II		LJ-III		LJ-IV	
Site	Low	High	Low	High	Low	High	Low	High
Chuquiña	5	48	11	112	16	160	13	131
Pusno	5	55	5	48	3	25	1	13

residents per hectare. Using error ranges based on the proportion of units with evidence of occupation, settlement size estimates for the four phases are also shown in bullet graph form (Figure 4.52).

These estimates run counter to what is predicted for a parent-daughter settlement growth model (see discussion in Chapters 2 and 3). Rather than a pattern of early settlement, growth, and eventually fission at the site of Chuquiña, the pattern here suggests early settlement followed by a slow and fairly continuous process of growth at Chuquiña. Meanwhile, the hypothetical daughter community of Pusno actually begins as the larger of the two communities

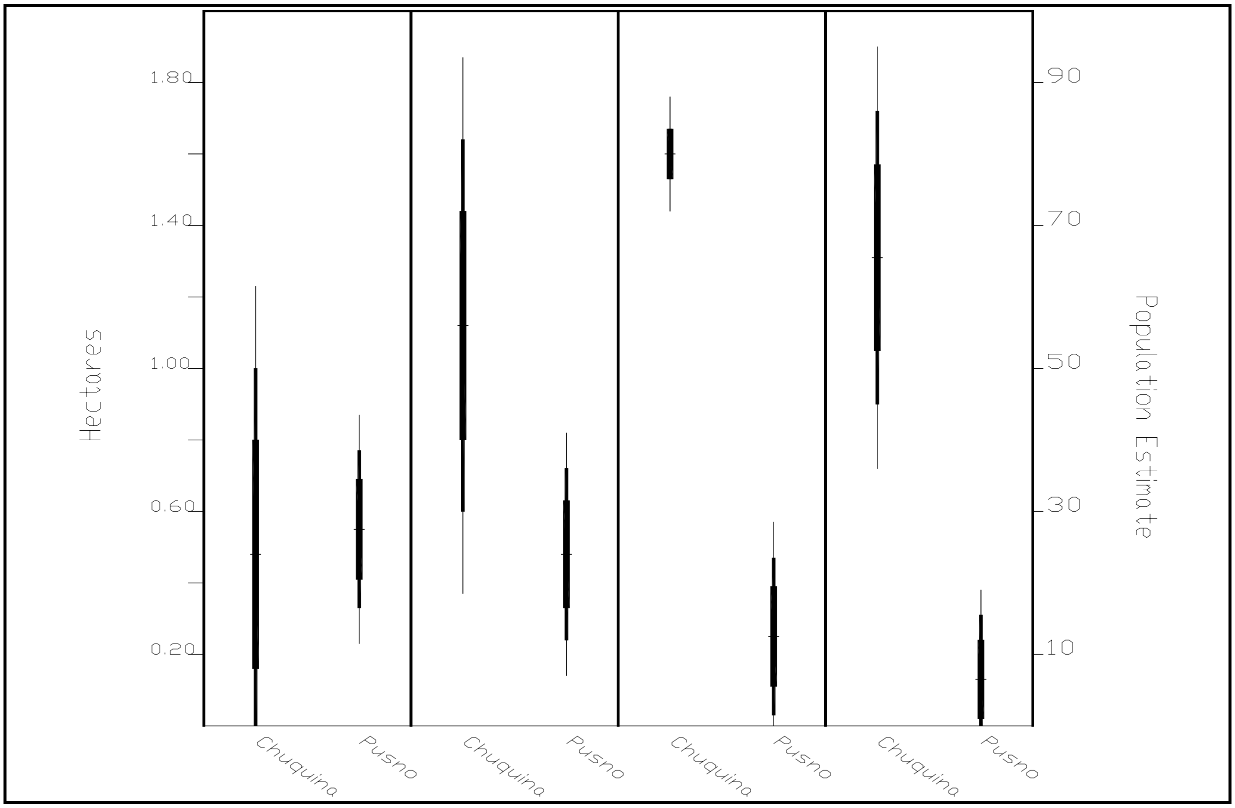

Figure 4.52. Bullet Graphs of Settlement Size Estimates.

during LJ-I and gradually diminishes in size over time. This may have to do with the relocation of some of the population into Chuquiña, a process of nucleation that is exactly the opposite of the process described by the parent-daughter growth model.

Besides the decreasing area of the site, there is some additional evidence that the Pusno site became an increasingly specialized location, with relatively low levels of permanent residential occupation. Not only does the site become smaller, but the later phases at the site have no clear evidence of domestic structures and very little evidence of architectural elements of any kind. For analytical purposes, here I regard hearths, prepared floors, walls of all kinds, and storage pits as architectural elements. These types of features become less common at Pusno. The opposite appears to be true at Chuquiña, where evidence of domestic architecture and

Table 4.4. Numbers of Units with Architectural Evidence During Four Phases at Chuquiña and Pusno.

Site	LJ-I		LJ-II		LJ-III		LJ-IV	
	Domestic	Other	Domestic	Other	Domestic	Other	Domestic	Other
Chuquiña	0	0	3	0	3	2	6	7
Pusno	1	7	3	4	0	3	0	1

other features are greatest in the later phases. Table 4.4 summarizes the feature data described above. These data are too few for rigorous quantitative analysis, but they do suggest a pattern of residential centralization at Chuquiña, possibly at the direct expense of the Pusno population. By LJ-IV the only architectural features seen at Pusno appear to be special function facilities like the clay-floored platform on the central mound and the large public structure/corral on the smaller north mound. The subsequent artifact analyses shed considerable additional light on these patterns.

5. CERAMIC ANALYSIS: DEVELOPING LOCAL CHRONOLOGY AND INVESTIGATING CERAMIC TECHNOLOGY AND USE PATTERNS

As noted previously, the lack of an artifact-based chronology has been a major obstacle to the diachronic study of the Wankarani Complex. For this reason, one of the principle goals of this investigation was to develop a chronology that would permit the division of the nearly two millennia sequence into contemporaneous segments. Bermann's (1999; 1997) investigations at Chuquiña revealed a relationship between olla rim sherd thicknesses, depth below surface, and radiocarbon dates. He found that olla rim sherds at the site became progressively thicker over time. While Bermann's analysis showed that this relationship was statistically significant in the test units he excavated at Chuquiña, the small number of test pits and their location at a single Wankarani site meant that the utility of mean olla rim sherd thickness as a regional chronological indicator remained largely hypothetical. In addition to noting the trend in olla rim sherds, Bermann also noted the presence of an unusual pottery type at the base of several of his test pits. Called 'Aboriginal Grit' (Bermann, personal communication), this apparently early pottery type offered another opportunity to identify a chronological marker in the Wankarani sequence.

In this chapter I discuss the analysis of ceramics from the 2003 excavations at Chuquiña and Pusno. This begins with a basic description of the ceramic materials and paste characteristics. I then describe a fine-grained attribute analysis that was performed in order to test the hypothetical ceramic changes proposed by Bermann. Finally, the chapter concludes with a discussion of the ceramic formal analysis.

5.1. Description of Wankarani Ceramic Materials

In general, Wankarani ceramics are remarkably consistent across both time and space. The great majority of sherds have micaceous sand and grit temper, and pastes that vary from brownish-gray to orange-brown. While some sherds are burnished or lightly polished, the overwhelming majority have no decorative treatments such as incision or painting. Early in the analysis of materials from Chuquiña, a pilot study was conducted on ceramic materials from the very deep test pit 2-C. The objective of the pilot study was to identify ceramic attributes that might be time-sensitive. All rim sherds from Unit 2-C were included in the pilot study, and a sample of 10 randomly-selected body sherds from each excavation level were included as well. Attributes studied included paste color, degree of oxidation, surface treatment, surface decoration, vessel form, tempering material, temper texture, vessel wall thickness (in the case of body sherds), rim thickness and orifice diameter (in the case of rim sherds) (see Appendix A for a detailed description of how these variables were coded and recorded).

Perhaps unsurprisingly, the pilot study of ceramics from Unit 2-C confirmed what most researchers have noted in the past: Wankarani ceramic materials are remarkably uniform in terms of materials and technology, as well as decorative elements. This pilot study did, however, suggest that Bermann's characterization of mean olla rim sherd thicknesses increasing over time was correct (see Figure 5.1 and Table 3.1). It also confirmed the presence of what Bermann called 'Aboriginal Grit' sherds in the deepest sections of the excavation, though these sherds occurred in very small numbers.

The pilot study also demonstrated that the pastes of Wankarani pottery appear to have become progressively more orange over time. This change appears very gradual, with many sherds from any given stratigraphic layer having intermediate colors ranging from brownish-gray to bright orange. This color variability can even be seen in individual sherds. Yet, over the long-term

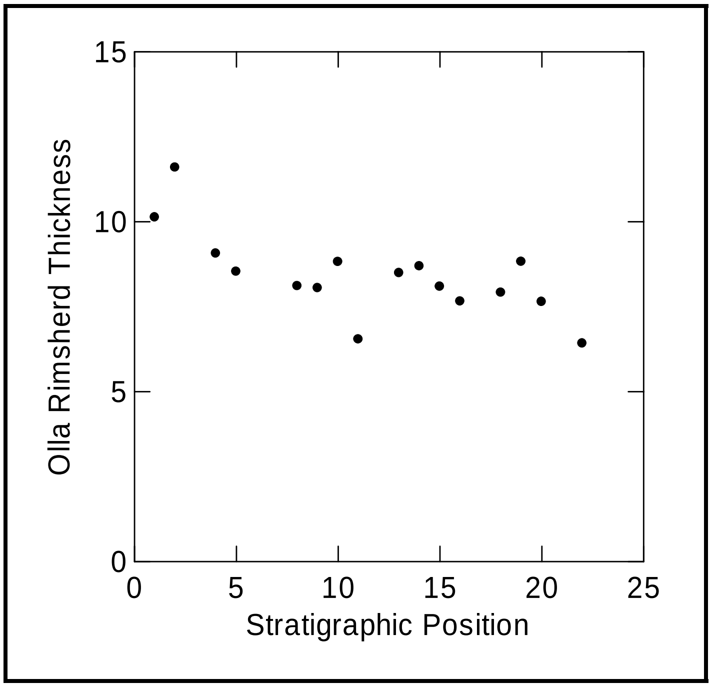

Figure 5.1. Scatterplot of Mean Olla Rim Sherds by Level from Unit 2-C at Chuquiña.

sequence, it is clear that the trend toward a brighter, orange-buff colored paste is present. The shift toward more orange pottery does not covary with any other variables (e.g., temper characteristics), with the exception of olla rim sherd thickness. There are several possible explanations for the trend toward progressively more orange pastes. First, it may reflect changes in clay sources, though there is no other observable change in paste to suggest this. It may be due to changes in firing methods and/or technology; firing at higher temperatures should produce greater oxidation of organic materials in the paste, producing brighter, more orange pots. A third possibility is that the change represents shifts in the use of vessels. Vessel use may introduce more carbon smudging into the paste after production, as would be the case on some cooking pots, for example. In the absence of fine-grained sourcing and microscopic studies of paste characteristics, testing each of these hypotheses is not possible. However, the general paste color of a Wankarani ceramic assemblage does appear to be an indicator of relative time period (albeit a very coarse indicator) of deposition. Overall, the pilot study at Unit 2-C and subsequent analysis of other units revealed just two general ceramic types, which form the basis of much of the discussion here.

Aboriginal Grit

This type of pottery was first described by Bermann (Bermann and Estevez C. 1993), and consists of a low-density black to brown colored paste. Temper is of a very coarse black or dark gray grit, possibly basalt or andesite, but certainly of igneous origin. Unlike most Wankarani pottery, Aboriginal Grit is frequently highly burnished and/or polished, producing a lustrous surface. This pottery is also unusual for its high frequency of incised and punctuate decoration, usually observed around the rims and shoulders of vessels. Like all Wankarani pottery, the most common vessel form of this ceramic type is the olla. Aboriginal Grit is generally encountered in early Wankarani contexts as the subsequent analysis will show. It is very uncommon on the surface of mounds, except at margins where the deepest stratigraphic layers are eroding out. It was encountered at both Chuquiña and Pusno, and was associated with some of the earliest radiocarbon dates recovered from the two sites (Table 3.1).

5.1.1. La Joya Orange-Brown

This is the most common type of Wankarani pottery. It consists of pastes of variable color, ranging from grayish orange-brown to bright, creamy orange. This color variability is observed even within some reconstructed vessels. Tempering material universally has a significant mica component with varying proportions of sand and grit included. Light surface burnishing is sometimes observed, but this is generally rare. This type of pottery is almost never decorated with incision or painting. The most common vessel form is the olla, though bowls and a few jars were also recovered. Orange-Brown Wares are encountered throughout the Wankarani sequence, and the mean thickness of rim sherds of this type of pottery has proven the most useful in charting chronology (see below). This type of pottery becomes increasingly orange over time in the Wankarani sequence, culminating in a late transition to bright orange cream color.

Thus, Bright Orange sherds may simply be from vessels that were fired at higher temperatures or that were used in such a way as to not incorporate post-production organics. Bright Orange sherds never have carbon streaks or smudges. As a general rule, Bright Orange sherds are encountered late in the Wankarani sequence at Chuquiña, and were not found in any significant numbers at Pusno (Table 3.1).

5.2. Developing Ceramic Chronology

Three primary tools were available for developing the ceramic chronological indicators applied in this research. These include the ceramic paste varieties described above, a sample of radiocarbon dated materials from the excavations at both sites, and mean thickness measurements of olla rim sherds. To begin developing a chronological sequence, it was first necessary to combine many of the small natural and arbitrary levels that were used in the field. This was necessary in order to boost sample size and also to reduce the 'noise' created by excavation units that had up to 50 natural and arbitrary levels. Thus, artifacts collected from contiguous layers in each unit were combined using stratigraphic drawings, which illustrated major shifts in depositional processes that served as convenient chronographic markers. In the vast majority of cases, the decision to combine a set of levels was based on major 'natural' shifts in stratigraphy and depositional processes. So for example, 50-100 cm of midden deposit might terminate in an occupation floor with associated architectural features, forming a useful stratigraphic break. In a few excavations, however, this was not possible. Excavations on the north side of Chuquiña (Units 1-A, 1-C, 4-A) were comprised of 1-3 m of undifferentiated, relatively loose ash and midden deposit. As noted in Chapter 3 however, these deposits did appear to be relatively undisturbed, though significant biological activity in the soils had obscured stratigraphy. In these cases, the deposits were arbitrarily divided into approximately equal segments comprising about 40-60 cm. The combining of materials from contiguous natural and arbitrary levels resulted in the identification of 1-10 chronostratigraphic units in each test pit.

Olla rim sherds from nearly every test pit at both Chuquiña and Pusno confirmed what Bermann had previously observed; while there is great variability in thicknesses of olla rim sherds in any level or stratum, the mean olla rim sherd thickness in most test pits increased over time. This diachronic trend is shown with reference to Orange-Brown olla rims in Figures 5.2-5.12. These graphs illustrate this relationship between stratigraphic position and mean olla rim thickness in a number of the deepest test pits excavated at the two sites. Each graph also shows the best-fit line of regression for the relationship between variables. It is clear that the trend toward thicker olla rims over time occurs in all of these units. The exact slope of the line varies, but this is to be expected even if the change in olla rim thickness occurred at a similar pace across both sites. The variation in angle is produced based on the varying depth of different excavations, the duration of occupation in each, and the rate of deposition, variables that are not likely to have been uniform across the two sites.

These data illustrate that the Wankarani sequence might be divided into chronostratigraphic units on the basis of ranges of mean olla rim thicknesses. But what is needed to accomplish this is a second method of dating, which would allow us to tie at least some of the metric data to absolute dates. This is accomplished with the addition of radiocarbon dates. Seven charcoal

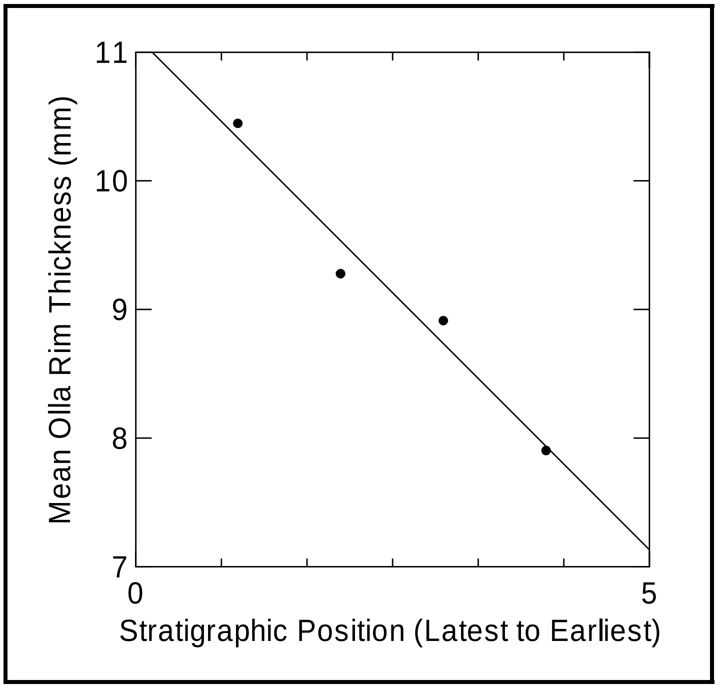

Figure 5.2. Regression of Mean Olla Rim Thickness by Stratigraphy in Trench 1 at Chuquiña.

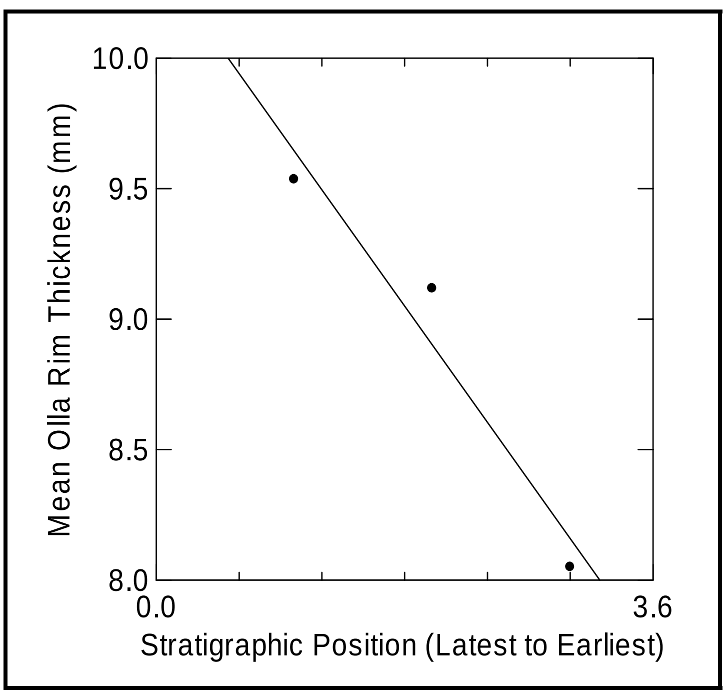

Figure 5.3. Regression of Mean Olla Rim Thickness by Stratigraphy in Unit 1-C at Chuquiña.

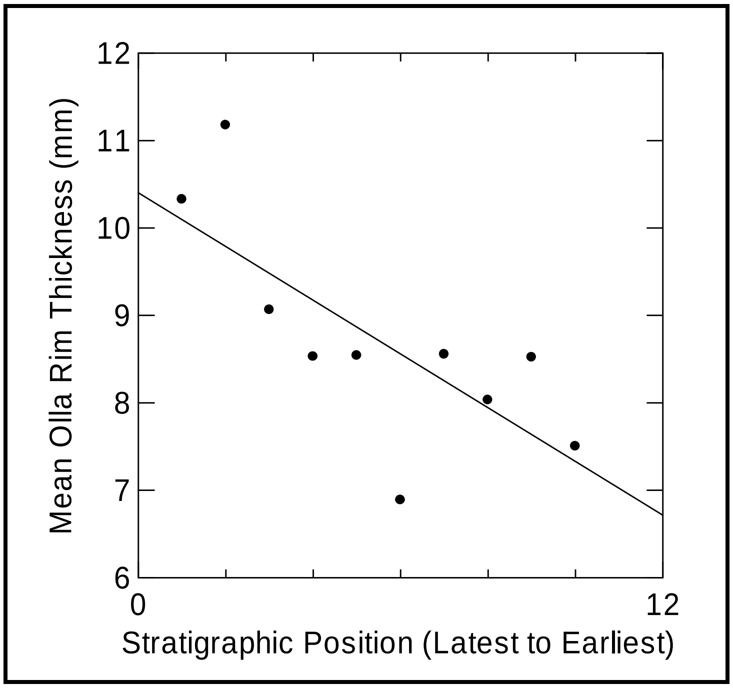

Figure 5.4. Regression of Mean Olla Rim Thickness by Stratigraphy in Unit 2-C at Chuquiña.

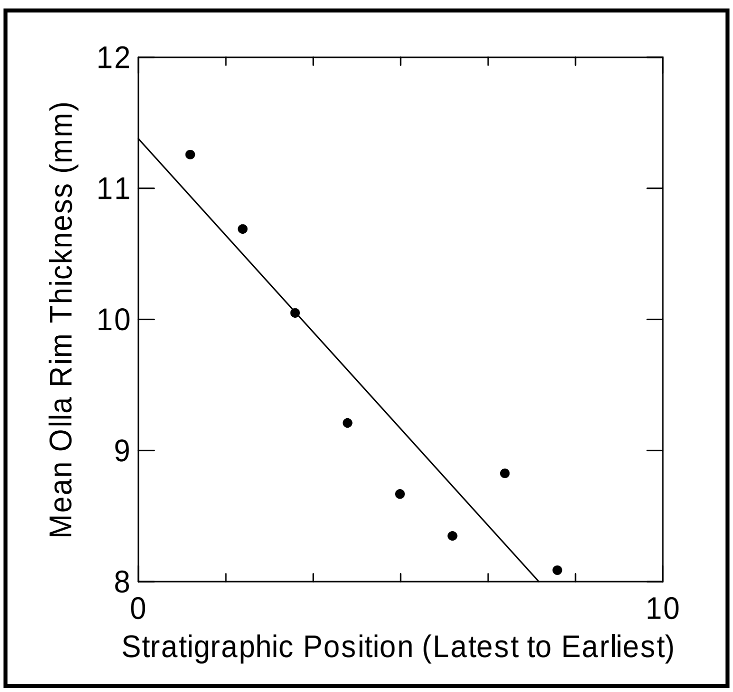

Figure 5.5. Regression of Mean Olla Rim Thickness by Stratigraphy in Unit 2-E at Chuquiña.

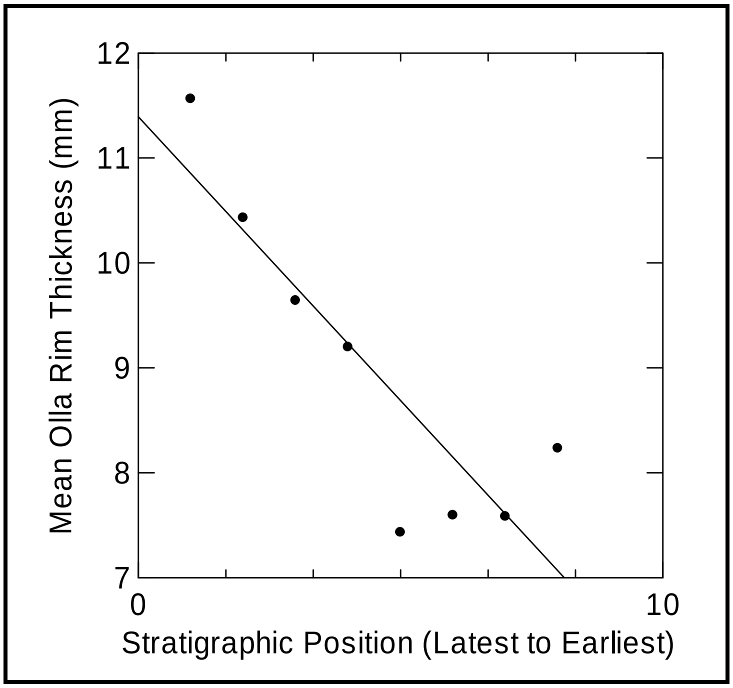

Figure 5.6. Regression of Mean Olla Rim Thickness by Stratigraphy in Trench 2 at Chuquiña.

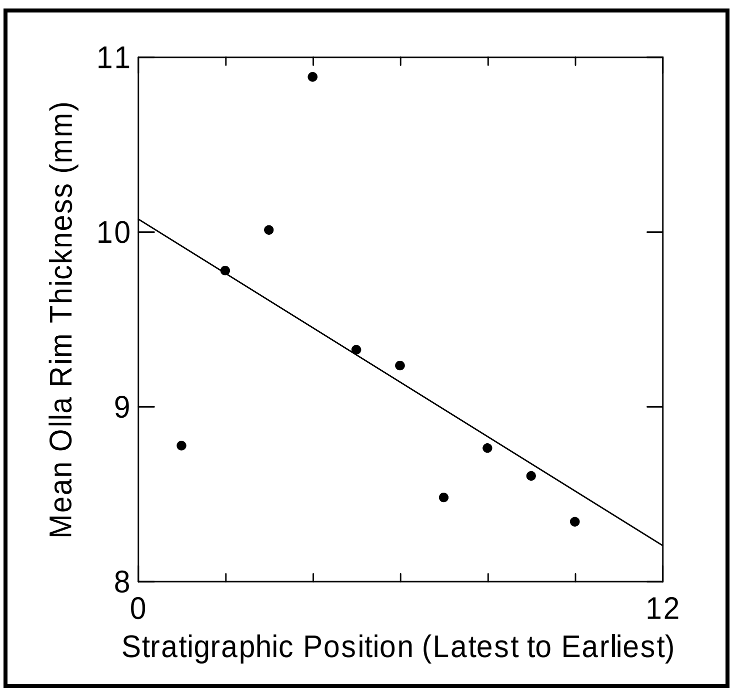

Figure 5.7. Regression of Mean Olla Rim Thickness by Stratigraphy in Trench 3 at Chuquiña.

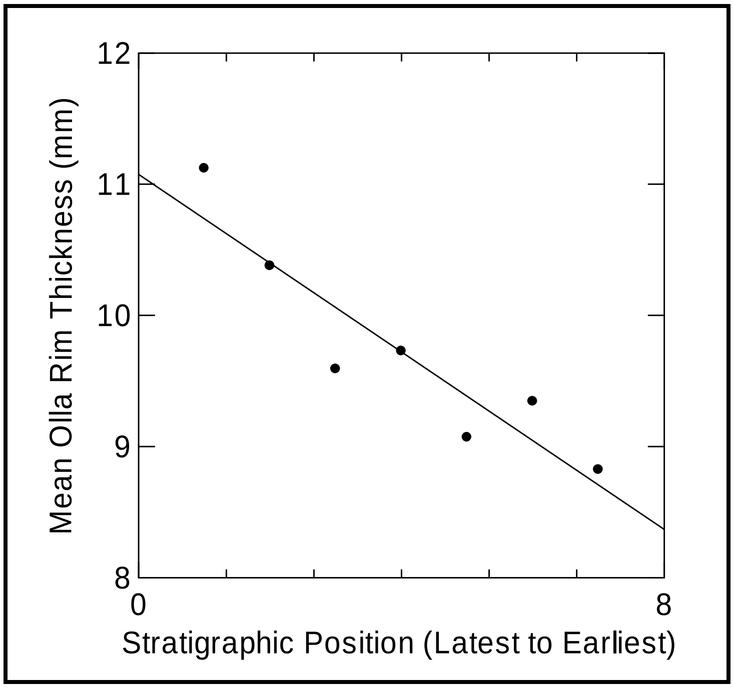

Figure 5.8. Regression of Mean Olla Rim Thickness by Stratigraphy in Unit 3-D at Chuquiña

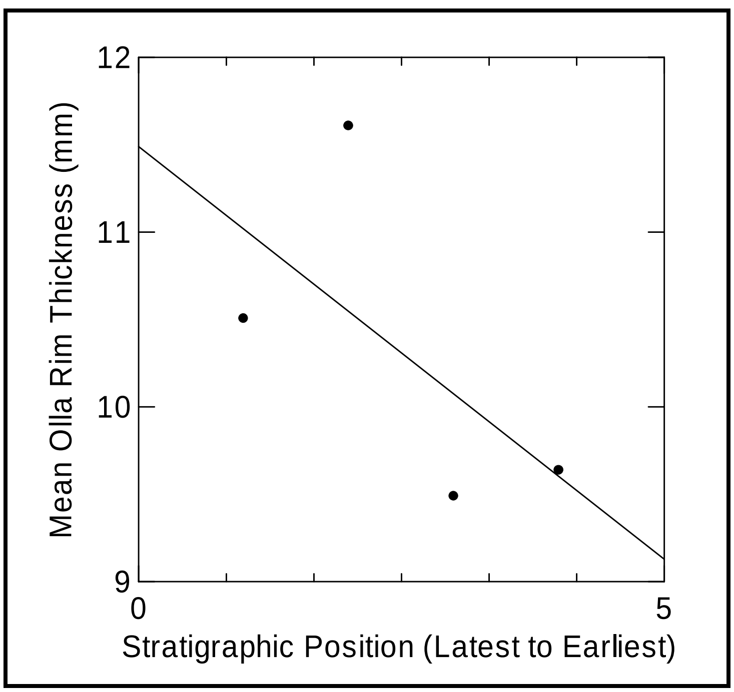

Figure 5.9. Regression of Mean Olla Rim Thickness by Stratigraphy in Unit 4-A at Chuquiña.

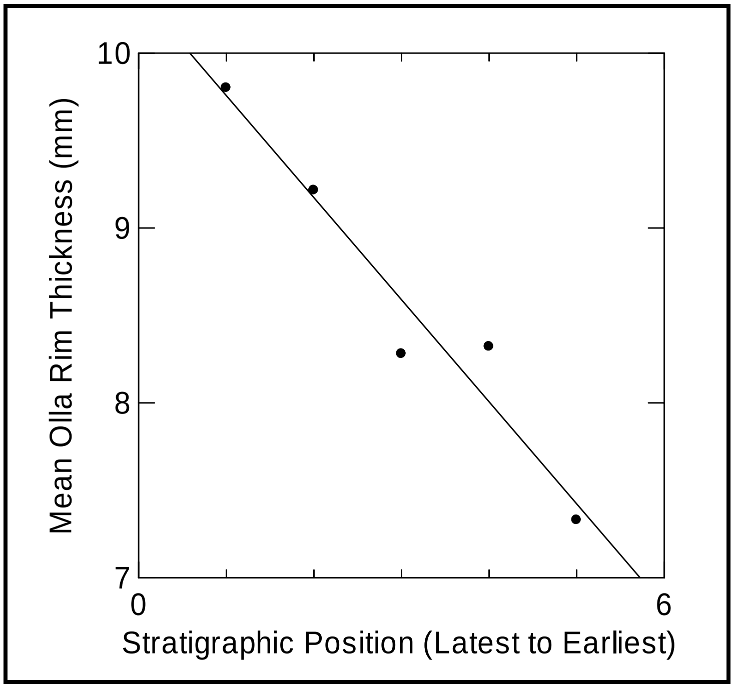

Figure 5.10. Regression of Mean Olla Rim Thickness by Stratigraphy in Trench 1 at Pusno.

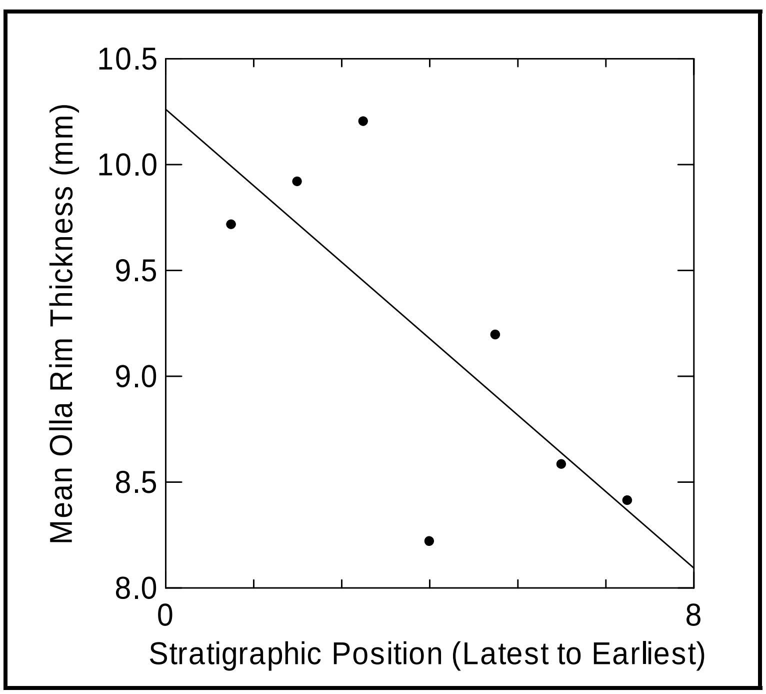

Figure 5.11. Regression of Mean Olla Rim Thickness by Stratigraphy in Trench 2 at Pusno.

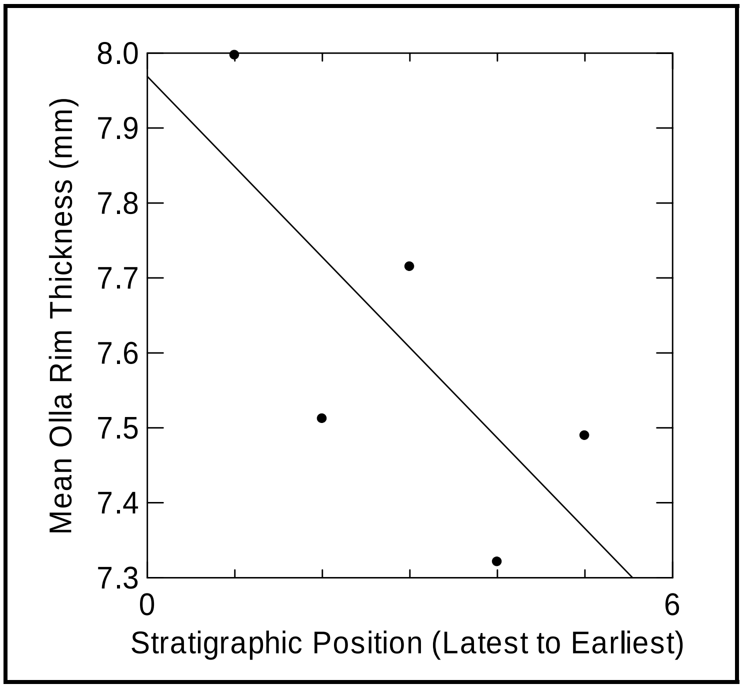

Figure 5.12. Regression of Mean Olla Rim Thickness by Stratigraphy in Trench 3 at Pusno.

samples were selected from the current excavations, and this data is augmented by previous samples collected by Bermann (1999; Bermann and Estevez C. 1995; 1997). These radiocarbon dates were included in Table 2.3, and were used in a regression analysis against mean olla rim thicknesses from associated ceramic assemblages (Figure 5.13).

Figure 5.13 plots the 'best-fit' linear regression of calibrated radiocarbon dates and their associated mean olla rim thicknesses (r^2=.602, $p<.002$). This regression shows an extremely strong and statistically significant relationship between time and mean olla rim thicknesses. The analysis shows that about 60% of the variation in mean olla rim thickness is explained by this temporal relationship, and it is vanishingly unlikely that this relationship could be due simply to the vagaries of sampling. It is also apparent, however, that the regression is negatively affected by two outliers. These outliers are associated with the dates of 552 BC and 1063 BC and the mean olla rim thicknesses of 8.53 and 6.80 mm, respectively. Both of these outliers come from

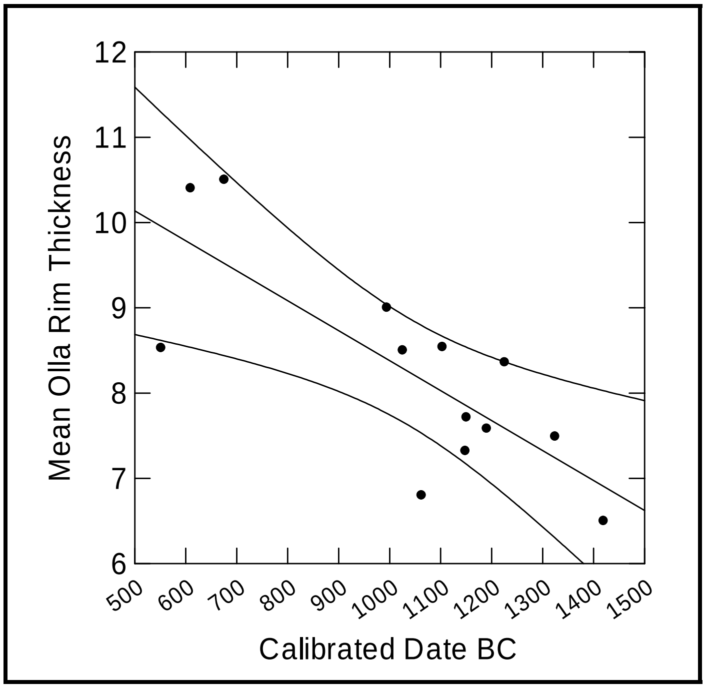

Figure 5.13. Regression with 95% Confidence of Mean Olla Rim Sherd Thicknesses and Calibrated Radiocarbon Dates from Wankarani Sites.

the site of Chuquiña; the former is based on a charcoal sample collected by this project in 2003, while the latter is from a charcoal sample collected by Bermann in 1996. These outliers could be the result of ordinary variation and sampling, or by anomalous metrics in the charcoal and/or sherd samples. Given that both of these radiocarbon samples fit nicely within the overall stratigraphic columns from which they come, it appears most likely that these dates are associated with rather unusual sherd samples.

Although radiocarbon dating is prone to a number of errors in precision and confidence, and at least one of the outlier samples in Figure 5.13 has a rather large standard error (over 150 years), it is highly unlikely that these dates are completely anomalous. Both dates come from stratified sequences of archaeological deposits that included collection of several radiocarbon samples. Both dates are logical, indeed quite plausible, given the other dates obtained from samples above and below the context from which they were collected (see Table 2.3).

On the other hand, in both cases it seems quite likely that the olla rim sherd assemblages associated with these dates are in fact, not typical. The sample of rim sherds from Chuquiña 2-C has a mean rim thickness of 8.53 mm, while the assemblage of olla rims from the 60 cm above the sample have a mean olla rim thickness of 9.97 mm. The assemblage of olla rims from the 60 cm of deposits immediately below the 2-C sample have a mean thickness of 8.54 mm. These comparisons suggest that the Chuquiña 2-C rim sherds associated with a radiocarbon date of 552 BC are in fact not typical of the time period in which they were deposited. This is also true of the assemblage of olla rims collected by Bermann and associated with a date of 1063 BC. Bermann's sample comes from level 16 of his excavation E300, N310. When this sample of olla rims is compared to those from adjacent excavation levels, it can be seen that the sample has anomalously thin rims (Estevez C. and Bermann 1996: Figures 13 and 15).

On the basis of the regression shown in Figure 5.13, and the proportions of Aboriginal Grit pottery, a series of four phases were defined and used to divide the materials from Chuquiña and Pusno (Table 3.1). It is important to note that I do not maintain that these periods represent 'phases' in the traditional archaeological sense. That is, there is no reason at this point to suspect that any of these represents a distinct behavioral suite of traits or a stage cultural development. As the regressions above have shown, the variability in olla rim sherd thickness, on which much of this chronology is based, is not only subtle (with means varying only between only 6 and 11 mm over more than a millennium), but also appears fairly continuous. With the exception of the first phase (LJ-I), the definition of these phases is in some sense arbitrary – given the continuous variability in rim sherd thicknesses, a plausible argument could be made for any number of periods. The number four was selected for pragmatic reasons. First, it guaranteed significant sample sizes in artifact assemblages for all periods at both sites. In addition, it broke the Wankarani sequence into segments of 2-3 centuries, a level of resolution that would serve well the objectives of the current study. In short, the use of four periods represents a balance between the need for good diachronic resolution, and the need for sound sample sizes to represent each interval. This approach has both costs and benefits.

On the cost side, it must be remembered that a set of artifacts included in a given phase in this analysis will include artifacts from super-imposed occupation surfaces. Obviously, such materials cannot be absolutely contemporary. However, this approach is very useful in comparing the long-term trajectory of activities at the two sites and in the settlement system overall. Given the history of Wankarani research, this chronological tool is a significant step forward. Below, I describe the four periods used throughout this research, and the means by which materials were assigned to each period. The determinant characteristics of ceramic assemblages and their assignment to the four-part temporal sequence have been summarized in Table 5.1. As noted earlier, the phases defined here were named after the La Joya locality because of the uncertainty of the applicability of this chronological tool to Wankarani sites in other regions.

5.2.1. La Joya I Period (LJ-I)

Assemblages were assigned to this period on the basis of several criteria. Beginning at the base of each excavation (the stratigraphically deepest deposits), any assemblages having a mean olla rim thickness of less than 7.5 mm were assigned to LJ-I. After identifying these assemblages, it was observed that all contained between 5% and 90% Aboriginal Grit. This suggested a second criterion for the identification of the earliest Wankarani occupation: the percentage of Aboriginal Grit, a rare and strictly early ceramic type. Assemblages containing at least 10% Aboriginal Grit.

Table 5.1. Characteristics of the

Phase	Site	Mean Olla Rim	# of Olla Rims	La Joya Period	Orange-Brown	Aboriginal Grit	Bright Orange
LJ-I	Chuquiña	7.46	73	I	89.17%	10.69%	0.14%
	Pusno	7.26	197	I	95.17%	4.81%	0.02%
LJ-II	Chuquiña	7.90	700	II	97.40%	1.01%	1.59%
	Pusno	8.00	494	II	99.53%	0.35%	0.12%
LJ-III	Chuquiña	8.96	1018	III	93.73%	0.41%	5.87%
	Pusno	9.03	564	III	97.66%	0.59%	1.75%
LJ-IV	Chuquiña	10.40	652	IV	93.31%	0.44%	6.25%
	Pusno	9.87	129	IV	97.37%	0.00%	2.63%

This resulted in the inclusion of 2 additional assemblages: one from each site. In general, LJ-I ceramics are dominated by Orange-Brown Type (>89%), with a significant proportion of Aboriginal Grit. Bright Orange Type is completely, or very nearly, absent. Overall, materials from three different excavation areas at Chuquiña, and from six different excavation areas at Pusno, were identified as LJ-I Period materials. Based on the current radiocarbon database, LJ-I can be preliminarily associated with the earliest part of the Wankarani sequence, prior to ca. 1325 BC.

5.2.2. La Joya II Period

Assemblages with mean olla rim thicknesses 7.5-8.45 mm were assigned to the LJ-II Period. However, assemblages could not placed in this time period of doing so would violate the principle superposition. Thus, an assemblage with a mean olla rim thickness of 8 mm would not be assigned to this period if it were located beneath a deposit that had been assigned to LJ-I (violating the principle of superposition). As it happened, no assemblages violated the principle in this way, further reinforcing confidence in the reliability of mean olla rim thickness as a chronological indicator. Generally speaking, assemblages from the LJ-II Period are comprised of more than 95% Orange Brown Ware, few representatives of Aboriginal Grit Ware (<5%) and even more are Bright Orange Ware (<1%). Based on the regressions of radiocarbon dates and rim sherd thicknesses, the LJ-II Period is assigned to the interval of ca. 1325-1100 BC. In total, seven excavation areas at Chuquiña and eight excavation areas at Pusno yielded assemblages dated to this period.

5.2.3. La Joya III Period

Assemblages with mean rim sherd thicknesses of 8.5-9.49 mm were assigned to LJ-III. One exception should be noted: the assemblage from levels 18-35 in Unit 2-C at Chuquiña had a mean olla rim thickness of 7.99 mm, but were assigned to this period in order to avoid violation of the principle of superposition. No other assemblages required this accommodation. In general LJ-III assemblages, like all Wankarani materials discussed, have very high proportions of Orange-Brown Ware (>90%). Some assemblages have small numbers of Aboriginal Grit and Bright Orange wares, but generally these are below 5%. A total of ten excavation areas at Chuquiña and four at Pusno yielded assemblages assigned to this time period. Based on the regression of radiocarbon dates and mean olla rim thicknesses, this period is preliminarily assigned to the interval 1100-800 BC.

5.2.4. La Joya IV Period

Assemblages with mean olla rim thicknesses of >9.5 mm were assigned to this period. This metric distinction did not violate the principle of superposition in any cases. Most assemblages assigned to this period have significant proportions of Bright Orange Ware (>5%), though this type is rare at the site of Pusno. While the presence of Aboriginal Grit Ware in some excavations was used previously to assign some assemblages to the LJ-I Period, similar use of the Bright Orange type was not appropriate for two main reasons. First, as discussed above, Bright Orange pottery is in many ways highly continuous in most attributes with Orange-Brown

Ware. It’s characterization, therefore, is less reliable than that of Aboriginal Grit as a discrete type and as a discrete temporal indicator. In addition, while Aboriginal Grit seemed a reliable indicator of the earliest period of Wankarani occupation, the distribution of Bright Orange is associated with the latest occupations at both sites. These overlying deposits have a greater likelihood of becoming mixed with deeper deposits, making the mere percentage of Bright Orange Ware less reliable than mean olla rim thickness. A total of nine excavation areas at Chuquiña, and only two at Pusno, yielded assemblages assigned to LJ-IV. Based on regression of mean olla rim thicknesses and radiocarbon dates, LJ-IV corresponds to the period after about 800 BC. The latest calibrated date is from 552 BC, and this is one of the latest Wankarani dates yet obtained. Thus, the end of LJ-IV is questionable, and may coincide with the demise of the Wankarani Complex as a whole.

5.3. Formal Ceramic Analysis

Beyond counts of sherds by type, the ceramic analysis focused on the only diagnostic class of sherds that was available in any significant number: rim sherds. Combined, shoulder and base sherds comprise less than 1% (n=34) of the diagnostics from both sites. Why this is so is addressed below, but for the moment it is sufficient to say that rim sherds comprise the only category of diagnostics that could be meaningfully subjected to formal analysis. Based on the rim sherd analysis, Tables 5.2 and 5.3 show the percentages of vessel forms during LJ-I – LJ-IV at Chuquiña and Pusno, respectively.

Ollas are easily recognized in Wankarani assemblages as a result of their characteristically restricted necks with flaring rims. These comprise the overwhelming majority of vessels throughout the Wankarani sequence, and this observation is consistent with analyses of

Table 5.2. Percentages of Vessel Forms Based on Diagnostic Sherds from Chuquiña.

Form	La Joya I	La Joya II	La Joya III	La Joya IV	Total
Ollas	72.6	71.2	68.2	63.5	67.7
Bowls	19.4	16.4	14.1	17.0	15.7
Jars (not ollas)	1.6	1.3	0.2	0.4	0.6
Spoons	1.6	0.5	0.3	0.3	0.4
Unknown / Unidentified	4.8	10.7	17.2	18.8	15.7
n =	62	635	1018	718	2433

Table 5.3. Percentages of Vessel Forms Based on Diagnostic Sherd from Pusno.

Form	La Joya I	La Joya II	La Joya III	La Joya IV	Total
Ollas	68.4	79.0	78.2	83.7	77.6
Bowls	18.9	10.7	5.3	1.6	8.8
Jars (not ollas)	2.6	0.2	0.9	0.0	0.8
Spoons	0.0	0.0	0.0	0.0	0.0
Unknown / Unidentified	10.2	10.1	15.5	14.7	12.7
n =	196	486	547	129	1358

assemblages from other Wankarani sites as well (McAndrews 1998, 2001; Rose 2001a, 2001b). Bowls form the second largest category of identified vessel forms, and this is the category in which the greatest differences are observed between the two sites. While a number of ceramic spoons were recovered from Chuquiña, these were almost completely absent from Pusno. Given the paucity of spoons, and their high frequency of decoration, these artifacts are discussed in the chapter on 'special' finds, located in Chapter 8.

In order to evaluate the strength and significance of differences in percentages of ceramic forms between time periods and between sites, chi-square analysis was chosen. This required that categories be 'collapsed' in order to produce meaningful results, as the expected values of the 'jar' category would frequently be below 5, jeopardizing the reliability of significance tests (Drennan 1996b:196-197). Because ollas are, in fact, a form of jar, these two categories were combined. In addition, rims of unidentified vessel forms were removed from the analysis, so that only the two most meaningful categories could be examined in isolation – bowls and jars (including ollas).

Results of the diachronic analysis of bowls and jars from Chuquiña show that there is a broad continuity over time in vessel forms (Table 5.4). The percentage of bowls at the site varies only between about 17 and 21 percent, and chi-square analysis confirms that the differences observed are neither very strong nor statistically significant. The results from Pusno present a sharp contrast to this pattern (Table 5.5). At Pusno, there is a steady and quite dramatic decrease in bowls over time, and this decrease produces statistical results that are both strong and highly significant. This may possibly suggest a change in site function at Pusno that began as early as 1300 BC (during LJ-II).

Table 5.4. Percentages of Vessel Forms Based on Diagnotstic Sherd in Collapsed Categories from Chuquiña.

Form	La Joya I	La Joya II	La Joya III	La Joya IV	Total
Bowls	20.7	18.4	17.1	21.0	18.7
Ollas and Other Jars	79.3	81.6	82.9	79.0	81.3
n =	58	564	840	581	2043

Pearson Chi^2 = 3.535, p = .316

Table 5.5. Percentages of Vessel Forms Based on Diagnotstic Sherd in Collapsed Categories from Pusno.

Form	La Joya I	La Joya II	La Joya III	La Joya IV	Total
Bowls	21.0	11.9	6.3	1.8	10.1
Ollas and Other Jars	79.0	88.1	93.7	98.2	89.9
n =	176	437	462	110	1185

Pearson Chi^2 = 40.334, p < .0005

During LJ-I, both sites appear virtually identical in their proportions of bowl and jar vessel forms (Table 5.6). Over time however, it is seen that the proportion of bowls drops continuously at the site of Pusno, producing stronger, more significant statistical results with each subsequent period (Tables 5.7 - 5.9). Frequently, archaeologists have used bowl: jar ratios as indicators of when and where feasting activities may have been focused. In this case, the percentage of serving vessels at Pusno decreases markedly over time, a trend that might suggest that feasting activities had either moved or were being intensified at another location. The evidence from Chuquiña, however, suggests a relative continuity in the importance of serving, as indicated by very stable percentages of bowls and jars. Given the evidence of decreased residential usage of the Pusno site during LJ-III and LJ-IV discussed in Chapter 4, it seems likely that the diminished importance of serving vessels at Pusno had to do with a change in site function toward greater storage and less on-site consumption.

Table 5.6. Percentages of Vessel Forms in LJ-I Based on Diagnostic Sherds.

Form	Chuquiña	Pusno	Total
Bowls	20.7	21.0	20.9
Ollas and Other Jars	79.3	79.0	79.1
n =	58	176	234

Pearson Chi^2 = .003, p = .957

Table 5.7. Percentages of Vessel Forms in LJ-II Based on Diagnostic Sherds.

Form	Chuquiña	Pusno	Total
Bowls	18.4	11.9	15.6
Ollas and Other Jars	81.6	88.1	84.4
n =	564	437	1001

Pearson Chi^2 = 8.006, p = .005

Table 5.8. Percentages of Vessel Forms in LJ-III Based on Diagnostic Sherds.

Form	Chuquiña	Pusno	Total
Bowls	17.1	6.3	13.3
Ollas and Other Jars	82.9	93.7	86.7
n =	840	462	1302

Pearson $Chi^2 = 30.543$, $p < .0005$

Table 5.9. Percentages of Vessel Forms in LJ-IV Based on Diagnostic Sherds.

Form	Chuquiña	Pusno	Total
Bowls	21.0	1.8	17.9
Ollas and Other Jars	79.0	98.2	82.1
n =	581	110	691

Pearson $Chi^2 = 25.334$, $p < .0005$

5.4.Summary and Conclusions

The ceramic analysis presented here has demonstrated the utility of the use of mean olla rim sherd thickness as a relative dating technique at Wankarani sites in the La Joya vicinity. Olla rim sherd metrics, identification of a distinct pottery type (Aboriginal Grit) early in the Wankarani sequence, and radiocarbon dating have in combination produced the first practical ceramic chronology for the Wankarani Complex. These methods have shown that the sites of Chuquiña and Pusno were occupied contemporaneously, albeit not always at similar intensities. Based on the number of contexts identified from each time period at the two sites, it is clear that both were occupied from a very early point (certainly well before 1350 BC). The presence of at least 1 m of cultural deposits overlying a level dated to ca. 550 BC suggests that Chuquiña continued to be occupied throughout the LJ-IV period. This is not surprising, as Chuquiña is one of the deepest, longest-lived Formative Period sites in the region. Pusno, on the other hand appears to have been the locus of very little residential activity during LJ-IV, a topic that will be addressed further in subsequent chapters.

It is important to note that the ceramic chronology presented here leaves significant lacunae in the Formative Period of the Bolivian southern *altiplano*. The Wankarani Complex has been posited as enduring from as early as 2000 BC to as late as 200 AD, when the Jachakala Complex appears in the La Joya region (Beaule 2002; Bermann and Estevez C. 1993). In addition to the dates by Bermann (Estevez C. and Bermann 1996, 1997) and Fox (2004; 2005) discussed here, there are a number of other radiocarbon dates reported from Wankarani sites (Table 2.3). These include a single radiocarbon date from the La Joya site of La Barca (Rose 2001a), a series of three dates from the La Joya site of San Andrés (Bermann and Estevez C. 1995), and a series of three dates from a Wankarani mound in the Río Kochi vicinity (McAndrews 1998). All of these reported dates cluster into the general interval of ca. 1500-500 BC. This growing database suggests that the Formative Period in general and the Wankarani Complex in particular, may not extend for the full 2+ millennia that archaeologists have thought (ca. 2000 BC – 300 AD). The complete absence of dates later than 500 BC suggest that there may be an occupational hiatus between the later Wankarani sequence and the earliest Jachakala occupations in the region (Beaule 2002; McAndrews 1998). In addition, the antiquity of the earliest Wankarani occupation may not date as early as 2000 BC.

6. THE LITHIC ASSEMBLAGES

Lithics represent one of the largest categories of artifacts recovered from Chuquiña and Pusno. This chapter approaches the chipped-stone and groundstone assemblages from the sites with several key objectives. The lithic assemblages provide evidence of the relative importance of different subsistence activities at each community and how these changed over time. Combined with other lines of evidence, those relating to the nature and intensity of different subsistence activities can indicate whether communities were independently pursuing different subsistence strategies or whether differences are in fact due to economic integration that permitted a degree of specialization in communities participating in an exchange or redistribution system.

Economic specialization is also examined here with reference to lithic reduction and production of tools. Such specialization can only occur under conditions of economic integration, where producers are assured of access to consumers. In the absence of such specialization, it can be assumed that members of each community would produce the lithic tools they needed. Finally, lithic raw material distribution is examined in order to evaluate the hypothesis that one community or the other was differentially involved in long-distance trade networks. If the flow of imported lithic material was controlled by individuals at a single community, this would provide a strong impetus toward economic integration of neighboring communities. It could also present one possible avenue toward political leadership and economic inequality.

6.1. Chipped-Stone Assemblages

6.1.1. Densities of Chipped Stone Artifacts

While chipped-stone represents an important category of artifacts at both sites, it is clear that chipped-stone was more abundant generally at Chuquiña than at Pusno. Density can be measured in a number of ways, standardized to account for the differing volumes of excavated areas at each site. Table 6.1 shows measures of the abundance of chipped-stone artifacts relative to the total number of ceramic sherds, which can generally be assumed to represent a static index of the intensity of occupation at each site. The index used in Table 6.1 is based on the formula <# sherds / # chipped-stone artifacts>. Thus, the larger the index number, the less abundant chipped-stone artifacts are in the assemblage and the less important this category of artifact can be inferred to have been.

As the data illustrate, chipped-stone artifacts appear to have been a far more important category of artifact at Chuquiña than at Pusno. This is true in all four time periods, though some changes over time are clearly noteworthy. For example, indices at Chuquiña appear remarkably stable during LJ-I – LJ-III, while the indices at Pusno fluctuate more. In addition, both sites have a markedly lower index during LJ-IV, suggesting an increase in the abundance and importance of chipped-stone artifacts relative to ceramics during this latest time period in both communities. This result may appear counterintuitive during the Formative, when we might expect an increase in the importance of ceramic technology over time. This is a point that I return to in the discussions below.

Table 6.1. Sherd Density Indices of Total Chipped-Stone Artifacts.

Phase	Chuquiña	Pusno
La Joya I		
Total Chipped Stone	123	142
Total Sherds	1450	4989
Sherd: Chipped Stone Index	11.8	35.1
La Joya II		
Total Chipped Stone	1236	671
Total Sherds	14426	12259
Sherd: Chipped Stone Index	11.7	18.3
La Joya III		
Total Chipped Stone	1968	446
Total Sherds	23271	13281
Sherd: Chipped Stone Index	11.8	29.8
La Joya IV		
Total Chipped Stone	3319	241
Total Sherds	19535	3160
Sherd: Chipped Stone Index	5.9	13.1
Total (La Joya I-IV)		
Total Chipped Stone	6646	1600
Total Sherd Count	58682	33689
Sherd: Chipped Stone Index	8.8	21.1

6.1.2. Formal Chipped-Stone Tools

While the chipped-stone tools from both sites had a great many utilized flakes and other forms of expedient tools, the artifacts that could be categorized as formal tool types were of a remarkably low number of different forms. The great majority of formal chipped-stone tools consist of large bifaces, thought to have been hafted and used as hoes or cultivators (see discussion below), and small bifacial projectile points. The majority of formal tools are comprised of pointed flakes, often called awls or burins, and a few retouched flakes that probably served as scrapers. However, as Table 6.2 shows, the overwhelming majority of formal tools is comprised of large bifaces and projectile points. Both of these tool types are

Table 6.2. Percentages of Formal Chipped-Stone Tool Types.

Phase / Tool Types	Chuquiña	Pusno
La Joya I		
Bifacial Hoes %	42.9	28.6
Projectiles %	57.1	71.4
Other Formal Tools %	0.0	0.0
Total Tools	7	7
La Joya II		
Bifacial Hoes %	89.9	51.9
Projectiles %	7.4	40.7
Other Formal Tools %	2.7	7.4
Total Tools	149	27
La Joya III		
Bifacial Hoes %	94.6	55.6
Projectiles %	3.3	44.4
Other Formal Tools %	2.1	0.0
Total Tools	242	18
La Joya IV		
Bifacial Hoes %	98.2	69.2
Projectiles %	1.4	30.8
Other Formal Tools %	0.4	0.0
Total Tools	281	13
Total (La Joya I-IV)		
Bifacial Hoes %	94.6	53.8
Projectiles %	4.0	43.1
Other Formal Tools %	1.5	3.1
Total Tools	679	65

closely associated with subsistence activities. Thus, while it is clear that many informal and expedient tools could have been used for any number of purposes, the main objective of lithic reduction was the production of just two subsistence-related tool types.

In general, the abundant large bifaces found in Wankarani assemblages are regarded as the remains of stone hoes, which were presumably hafted on wooden shafts. The interpretation of these bifaces as hoes is consistent with ethnographic examples of stone hoes used in the highland Andes. These bifaces are also usually recovered in broken condition, with breaks occurring transverse to the long axis of the tool. This breakage pattern is also consistent with what would be expected in hafted hoes. For these reasons, large bifaces have been used as an index of agricultural intensity in Wankarani studies (Bermann and Estevez C. 1995; McAndrews 1998, 2001), an approach that is also used here.

Projectile points on the other hand, may be taken as indicators of the relative importance of hunting activities. Although low walls surrounding the mounds have been documented at some Wankarani sites (now including Chuquiña and Pusno), there is little no evidence that warfare was a major factor for residents of the La Joya settlement system. The possible surrounding walls found at Chuquiña and Pusno were too low to serve as effective defenses, and appear more likely to have served as retaining walls, possibly for the purpose of supporting small residential terraces. The location of the La Joya Wankarani sites are also not the most defensible that their residents could have chosen; placing settlement higher up in the hill groups rather than at the base of hill groups would have provided similar access to resources with far greater defensive advantages. Finally, while mortuary evidence from Wankarani sites consists of a relatively small sample size, there is no evidence from graves to support the notion that warfare was endemic or internecine. For these reasons, it seems reasonable to view projectile points as indicators of hunting activities rather than conflict at the two communities.

Two immediate observations can be made regarding the proportions of bifaces and projectile points (Table 6.2). First, there is a marked contrast between the two sites. In all time periods, the Chuquiña assemblages have markedly higher proportions of large bifaces. This is a strong indicator that agricultural intensity at Chuquiña was greater than at Pusno throughout the sequence. We can also see that the proportions of large bifaces increase over time at both sites, with a particularly dramatic rise between LJ-I and LJ-II. This may be a result of an initial shift toward greater agricultural intensity shortly after the early founding of Wankarani communities in the area. This rise in the proportion of large bifaces, of course, comes at the expense of proportions of projectile points, suggesting a sharp drop in the importance of wild game beginning in LJ-II. The error ranges associated with this proportions indicate that the differences between the two communities and the long-term trends discussed above are almost certainly not due to the vagaries of sampling. The only exception to this pattern of high statistical significance is in LJ-I, where small samples of formal tools result in low confidence in observed differences.

6.1.3. Chipped-Stone Raw Materials and Long-Distance Trade

It is known that both during and after the Formative Period, the exchange of stone raw materials was an important element of the economies of many societies in the south-central Andes (Bandy 2001; Burger, et al. 2000; Giesso 2000). Previous studies in the La Joya area have shown that Wankarani and Jachakala communities were obtaining lithic raw materials from relatively distant sources, especially basalt and obsidian (Beaule 2002; McAndrews 1998; Rose 2001a). The presence of these, and other, exotic materials demonstrates that Wankarani communities had access to long-distance trade goods, but it remains a largely open question how intensively these networks operated during the Formative Period, and how much bulk material could really be moved by such trade networks. For the purposes of the present study, the distribution of lithic raw materials is especially important as an indicator of the function of these long-distance trade networks and whether the activity of these networks intensified, diminished, fluctuated, or remained stable over time. In addition, the distribution of raw material may also indicate whether one community or the other had greater access to long-distance trade networks.

All lithic materials were categorized according to a number of characteristics, including color, texture, inclusions, and hardness. Materials were then combined into one of six principle categories, corresponding to broad classes of lithic material. Each of the six raw material types used in this analysis were classified according to their availability to the Formative Period people of the La Joya area. Locally available materials include those that could be procured from within 5 km of Wankarani communities. Regionally available materials include those that could only be procured by traveling more than 5 km or by trade with neighboring communities and people. Finally, long-distance materials include those that could only be obtained from distances greater than 100 km distant. The raw material categories discussed here are summarized in Table 6.3.

Siltstone and sandstone are the most common sedimentary rocks in the La Joya area; and these comprise an important category of lithic raw material at both Chuquiña and Pusno. These locally-available sedimentary rocks are actively eroding out of the hillsides immediately adjacent to both sites, and thus probably represent the most readily-available source of lithic raw material for Wankarani communities. Local sedimentary rocks were primarily used for production of flakes and expedient tools, though these were also sometimes used for production of bifacial hoes.

The most common lithic raw material at both Chuquiña and Pusno is comprised of some variably light to medium-dark grey intrusive igneous rocks (called 'Local Igneous'). These materials are most easily characterized as andesite or dacite, being of medium-fine to medium texture, with few crypto-crystalline inclusions. Definitive identification of these rocks awaits geochemical analysis. The use of andesites as raw materials for production of bifacial hoes is documented throughout the south-central Andes, particularly in the Titicaca Basin (Bandy 2001; Bermann and Estevez C. 1995; Giesso 2000; Steadman 1995). Bandy suggests that this material may have been traded over long distances, beginning in the Middle Formative (2001:147-148). Andesites and dacites are locally available in the La Joya area, and were the most commonly used raw materials for the production of bifacial hoes.

Table 6.3. Percentages of Raw Material Types Among Chipped-Stone Artifacts.

Raw Material Group	Procurement Category	Chuquina %	Pusno %
Sedimentary Rocks: Mudstones and Siltstones	Local Availability	22.4	24.3
Local Igneous Rocks: Andesites & Dacites	Local Availability	62.2	61.3
Chert	Regional Availability	3.6	3.8
Basalt: Vitreous Black Basalt	Long-Distance Availability	11.3	7.6
Quartzite	Long-Distance Availability	.3	2.4
Obsidian	Long-Distance Availability	.2	.5
n=		6646	1600

Artifacts of vitreous black basalt are found in many Wankarani sites, including Chuquiña and Pusno. As has been noted by others, the nearest known source of vitreous black basalt is located to the southwest of Lake Poopó, some 200 km from the La Joya settlements (McAndrews 1998; Rose 2001a). Given this great distance, it is likely that this material was imported to La Joya in a 'semi-reduced' state, that is, in the form of cleaned tool blanks and macroflakes without cortical waste (Aoyama 1995; Fox, et al. 2004; McAndrews 2001). The black basalt found at the La Joya sites is highly vitreous and produces sharp flaked surfaces, suggesting that it would have been a valued commodity to consumers. The importance of this basalt in the La Joya area appears to have been particularly marked during the Late Intermediate Jachakala Period, as indicated by Beaule's work at the type site (2002). Indeed, the site of Jachakala is notable for the abundance of dark black basalt on the surface, despite numerous archaeological surface collections and excavations (Beaule 2002; Bermann and Estevez C. 1993; McAndrews 1998) in the past. Given the complete absence of vitreous basalt sources in the La Joya area, this raw material is categorized as a long-distance good. While basalt was used to produce bifacial hoes at Wankarani communities, very few such bifaces are usually recovered. This is a result of continued reduction of broken hoe fragments for production of projectiles and other tools. Analysis of basalt debitage, however, makes clear that this was an important raw material for making bifacial hoes (see discussion of debitage analysis below).

The remaining three categories of raw material occur in very low proportions in the Chuquiña and Pusno assemblages. Chert occurs in many parts of the *altiplano*, though no local sources are known in the La Joya area. Most chert artifacts from Chuquiña and Pusno are brown, though many color varieties occur in the assemblages. Cherts represent a regionally available source of material in the La Joya area. Quartzite, a metamorphic rock, has no known sources in the region, and represents a long-distance material obtained through trade or considerable travel. Finally, obsidian was traded from considerable distances, probably from the area of Lake Poopó or greater distances.

In order to assess the role of long-distance trade in lithic raw materials, all chipped-stone artifacts were collapsed into two categories: materials that could be procured either locally or regionally, and those that could only be acquired via long-distance trade (basalt, quartzite, and obsidian). The results of this analysis by time period are shown in Table 6.4. At both sites, the proportion of long-distance chipped-stone material varies between about 7 and 13%. During some periods, the differences in proportions between the two sites are as much as 5.5%, but chi-square analyses show that only during LJ-II and LJ-III are these differences statistically significant. The differences in LJ-I and LJ-II are difficult to interpret, since they are not particularly strong differences; the statistical significance of the differences is simply the product of very large sample sizes and not the strength of the differences. And while Chuquiña has a higher proportion of imports in LJ-I, it is Pusno that has the higher proportion in LJ-II.

Across all time periods, the percentages of long-distance lithic materials recovered from Chuquiña and Pusno are 11.8% and 11.5% respectively, with little statistical significance

Table 6.4. Percentages of Chipped-Stone Raw Materials Across Four Phases.

Phase / Procurement Category	Chuquiña	Pusno
La Joya I	n = 123	n = 242
Locally & Regionally Procured	91.9	87.6
Long-Distance Exotics	8.1	12.4
Pearson Chi^2 = 1.521, p = .217		
La Joya II	n = 1236	n = 671
Locally & Regionally Procured	92.6	87.9
Long-Distance Exotics	7.4	12.1
Pearson Chi^2 = 11.293, p = .001		
La Joya III	n = 1968	n = 446
Locally & Regionally Procured	88.0	93.5
Long-Distance Exotics	12.0	6.5
Pearson Chi2 = 11.212, p = .001		
La Joya IV	n = 3319	n = 241
Locally & Regionally Procured	86.6	86.7
Long-Distance Exotics	13.4	13.3
Pearson Chi^2 = .352, p = .553		
Totals	n = 6646	n = 1600
Locally & Regionally Procured	88.2	88.5
Long-Distance Trade	11.8	11.5
Pearson Chi^2 = 1.832, p = .176		

associated with this difference. In short, the totals of regionally or locally procured and long-distance traded chipped-stone raw materials provide very little evidence of differential access to trade networks at the two sites. Based on this line of evidence, both communities seem to have had relatively equal access to high quality, long-distance traded raw materials.

There is evidence that the level of long-distance trade increased over time in the settlement system as a whole (Table 6.5). There was gradual, admittedly modest, increase in the proportion of exotic lithic materials at both sites over time. The exception to this pattern occurs in LJ-I, which has a surprisingly high proportion of exotic materials. This exception, however, is associated with a relatively small sample and a high standard error, resulting in a very large error range around the estimated proportion of 11%. In short, we can have very little

Table 6.5. Proportions and Confidence Intervals of Chipped-Stone Raw Materials from Both Sites Across Four Occupation Phases.

Procurement Category	La Joya I	La Joya II	La Joya III	La Joya IV
Long-Distance Exotics	11.0	9.1	11.0	13.3
95% Confidence Interval of the Percentage	7.8-14.2	7.8-10.4	9.7-12.2	12.2-14.4
n =	365	1907	2414	3560

confidence that the estimated proportion of exotics in LJ I is an accurate representation of lithics at the two sites. The trend toward increased proportions of exotic lithic materials is best seen in the 95% confidence intervals for LJ-II, LJ-III and LJ-IV. Note that these 95% confidence intervals exclude the best proportion estimates from other time periods. In short, we can state with greater than 95% confidence that the increased proportions of exotic lithic materials seen in the transitions from LJ-II to LJ-III and subsequently to LJ-IV, reflect actual differences over time and are not simply the result of sampling vagaries. Despite this high level of confidence, of course, we should note that the change observed is not dramatic. The overall change from LJ-II to LJ-IV is only of about 4%, and this change would have occurred over more than 800 years.

6.1.4. Biface Production and Consumption

The great majority of chipped-stone materials from Chuquiña and Pusno were used to produce large bifaces. To date, no microscopic use wear studies have been done on Wankarani bifaces, but it seems likely that these tools were used for a number of functions, the most important of which was presumably as hoes. Bifaces were principally produced from local sedimentary stone that was available in the immediate vicinity of communities, from local igneous rocks that were available within a few kilometers of communities, and from vitreous basalt that was imported from considerable distances. None of these three raw material types occur in the Wankarani sites in ‘natural’ form; that is, all of these materials were reduced at least partially before being brought on site in the form of large, lightly-worked cores or macroflakes.

Analysis of lithic debitage can reveal whether one community or the other was the primary locus of biface production. Such specialization would indicate that bifaces were then traded to the sister community in exchange for some other, as yet unidentified, goods. In order to pursue this question, it is necessary to distinguish between classes of debitage associated with production and those associated with use and maintenance of tools. Following the approach outlined by Parry (1987), all debitage from Chuquiña and Pusno were sorted into a number of identifiable classes. Classes of debitage were then combined according to whether they are associated with biface production, consumption, or if the debitage class was ambiguous.

Production residues included the following categories of debitage: primary flakes and other pieces that included cortex, macroflakes, ordinary and bifacial thinning flakes, broken and complete biface ‘roughouts’ or tool blanks. In the case of local igneous and sedimentary rocks, a small number of cores were also included in the category of production debris. In the case of basalt, the only cores recovered were very small, and consisted of broken biface fragments that were continually reduced for the production of projectile points and other tools. For this reason, basalt cores are actually considered evidence of consumption, rather than production.

Consumption residues included actual bifacial tools as well as the debitage categories associated with biface use and maintenance. These categories included: small retouch flakes (<2 cm width), flakes with evidence of tool polish/use wear, and fragments of bifaces subsequently used as cores. Angular fragments, often called ‘debris’ or ‘shatter,’ are generally produced during all stages of lithic reduction, and so were categorized as ambiguous for the purposes of analysis.

6.1.4.1. Basalt

Basalt artifacts represent the only major category of chipped-stone lithic material that was imported from long distances. Thus, differences in proportions of basalt debitage may represent not only economic specialization in the production of chipped-stone bifaces, but may also reflect differential access to long-distance trade networks at one community or the other.

For LJ-I, no basalt artifacts associated with procurement and biface production were recovered from either site, but sample sizes were too small for this observation to be meaningful (n=3, n=4). In LJ-II – LJ-IV, the assemblages from Chuquiña contain higher proportions of basalt debitage associated with procurement and biface production (Table 6.6). The differences between the two sites' assemblages vary between about 7 and 10%, with the most marked difference observed in LJ-III. This supports the hypothesis that the Chuquiña community was more intensively involved in basalt biface production than Pusno. While it is important to note that the estimated proportions of basalt biface production debris have strong differences between sites, it is also true that the estimates for Chuquiña lie within the 95% confidence intervals of the estimates for Pusno. Thus, we cannot be 95% confident that these differences are not due to the vagaries of sampling.

6.1.4.2. Local Igneous Rocks

As was the case with basalt, sample sizes of local igneous rock debitage are relatively small during LJ-I. This is especially true for the site of Chuquiña (n=12), resulting in large error ranges associated with the 95% confidence interval for proportions of debitage associated with procurement and production (Table 6.7). For this reason, estimated proportions of debitage during LJ-I are not reliable for intersite comparison. During LJ-II and LJ-III, estimated proportions of local igneous debitage are nearly identical for the two sites, and the 95% confidence intervals show that each estimate is well within the error range of the other. This

Table 6.6. Proportions of Basalt Debitage Indicative of Biface Production with Confidence Intervals.

Phase	Chuquiña	Pusno
La Joya I	0	0
95% Conf	*	*
La Joya II	18.9	11.7
95% Conf	9.8-28.0	3.4-20.0
La Joya III	14.3	5.6
95% Conf	9.1-19.5	-5.8-16.9
La Joya IV	19.3	10.5
95% Conf	15.3-23.4	-4.3-25.3

Table 6.7. Proportions of Local Igneous Debitage Indicative of Biface Production with Confidence Intervals.

Phase	Chuquiña	Pusno
La Joya I	50.0	22.5
95% Conf	18.2-81.8	12.6-32.5
La Joya II	14.3	13.5
95% Conf	11.2-17.5	9.7-17.2
La Joya III	14.8	14.2
95% Conf	12.6-17.1	10.0-18.5
La Joya IV	19.2	11.7
95% Conf	17.6-20.8	6.7-16.6

Table 6.8. Proportions of Sedimentary Debitage Indicative of Biface Production with Confidence Intervals.

Phase	Chuquiña	Pusno
La Joya I	19.4	40.2
95% Conf	9.3-29.4	30.3-50.1
La Joya II	20.6	35.2
95% Conf	17.3-24.0	27.8-42.6
La Joya III	20.2	28.8
95% Conf	17.0-23.5	18.6-38.9
La Joya IV	22.3	17.6
95% Conf	17.0-27.7	-2.0-37.2

supports the notion that both sites were reducing local igneous rocks for biface production at similar levels of intensity throughout these two periods. This pattern differs during LJ-IV, when the intensity of production increased at Chuquiña and diminished slightly at Pusno. Since this raw material was available within a few kilometers of both sites, the intensity of biface production here cannot be indicative of control of trade networks. It may be a result of local need, where a community's greater need for agricultural implements results in higher intensity of tool production. Alternatively, it may come as a result of one community specializing in the production of bifaces, which are then traded to neighbors in exchange for other goods. I evaluate these alternatives in the concluding section of the chapter.

6.1.4.3. Local Sedimentary Rocks

As Table 6.8 shows, evidence for production of bifaces from local sedimentary materials is markedly higher at Pusno than Chuquiña during all phases except LJ-IV. Error ranges associated with 95% confidence also suggest that these differences are probably not a result of sampling vagaries, but represent real differences in the communities' assemblages. During LJ-IV, the estimated proportion of sedimentary biface production debitage is slightly greater at Chuquiña compared to Pusno, though the 95% confidence interval shows that the difference between sites during this period is not statistically significant. Overall, the clearest pattern evidenced in Table 6.8 is that the proportion of sedimentary biface production debitage at Chuquiña remains relatively constant over time, while decreasing at Pusno.

6.1.5. Other Forms of Lithic Reduction

6.1.5.1. Chert

Chert is the only chipped-stone raw material category not associated with bifacial hoe production with sample sizes sufficient for debitage analysis. As noted above, chert was a regionally available raw material that was primarily reduced for the production of projectile points. No chert bifacial hoes or hoe fragments were recovered from either site. As Table 6.9 illustrates, in all time periods the community at Chuquiña has more evidence of primary chert reduction and chert tool production than Pusno. This is despite the fact that projectile points, the most important chert tool type, were far more abundant at Pusno than at Chuquiña. Although the differences in chert production debitage proportions are not significant at 95% confidence, the fact that these differences are present during all four time periods suggest that the differences are probably 'real' and not simply the result of sampling vagaries.

6.2. Groundstone Assemblages

Groundstone artifacts were studied with respect to several characteristics. These include: raw material type, artifact shape, tool type (if identifiable), condition, artifact size, and type of wear present. While groundstone artifacts were common at both sites and in all time periods, Table 6.10 illustrates a few major differences in the frequency and density of groundstone artifacts. Using the total number of ceramic sherds/total number of groundstone artifacts again provides a neutral index of the density of groundstone, with lower sherd:groundstone indices indicating greater densities of groundstone. Two observations are clear from Table 6.10. First, the density

Table 6.9. Chert Debitage Associated with Lithic Reduction and Tool Production as Proportions of Diagnostics with Confidence Intervals.

Phase	Chuquiña	Pusno
La Joya I	46.7	20.0
95% Conf	28.1-65.3	-8.6-48.6
La Joya II	52.1	30.4
95% Conf	37.5-66.7	10.5-50.3
La Joya III	46.3	14.3
95% Conf	32.7-59.9	-18.1-46.6
La Joya IV	34.9	0.0
95% Conf	22.9-46.9	-

Table 6.10. Counts and Density Indices of Total Groundstone Artifacts.

Phase	Chuquiña	Pusno
La Joya I		
Groundstone Artifacts	35	182
Sherd:Groundstone Index	41.4	27.4
La Joya II		
Groundstone Artifacts	150	263
Sherd:Groundstone Index	96.2	46.6
La Joya III		
Groundstone Artifacts	85	78
Sherd:Groundstone Index	273.8	170.3
La Joya IV		
Groundstone Artifacts	75	24
Sherd:Groundstone Index	260.5	131.7
Total		
Groundstone Artifacts	345	547
Sherd:Groundstone Index	170.1	61.6

of groundstone at both sites decreased over time. Second, the density of groundstone at Pusno is much higher than Chuquiña during all four time periods. In fact, this difference between the two sites could clearly be seen during excavation in the field, when large amounts of groundstone were removed from most units at Pusno. Some of these groundstone implements were recovered in considerable numbers from storage pits and other features. This has already been discussed in greater detail in Chapter 4.

6.2.1. Raw Materials

Groundstone implements from both sites are composed of local materials in all periods. Local sedimentary rocks (siltstones and sandstones) comprise more than 80% of the groundstone implements at both sites during all periods, while the remainder of groundstone is predominantly of local igneous materials (dacites and andesites). It seems clear that both communities would have had virtually unlimited access to suitable raw materials for the production of groundstone tools.

6.2.2. Tool Forms

The most important tool categories for groundstone artifacts from both sites are *manos* (handstones) and *batán*s (i.e., metates or grinding stones)(Table 6.11). *Manos* were categorized according to their overall shape into one of four possible groups: spheroids, ovoids, diskoids, and eccentric/irregular pieces. Fragments that were too small for definitive shape determination were included in the eccentric/irregular category. *Manos* from Pusno and Chuquiña measure at least 80 mm in largest dimension (for broken pieces, the minimum size of

Table 6.11. Formal Tool Types as Proportions of Total Groundstone Tools.

Phase	Chuquiña	Pusno	Total
La Joya I			
Manos	28.6	57.1	52.5
Batáns	51.4	26.4	30.4
Pebbles	14.3	11.5	12.0
Others	5.7	4.9	5.1
La Joya II			
Manos	54.0	44.9	48.2
Batáns	29.3	35.0	32.9
Pebbles	11.3	15.2	13.8
Others	5.3	4.9	5.1
La Joya III			
Manos	56.5	41.0	49.1
Batáns	23.5	41.0	31.9
Pebbles	16.5	12.8	14.7
Others	3.5	5.1	4.3
La Joya IV			
Manos	52.0	75.0	57.6
Batáns	21.3	16.7	20.2
Pebbles	26.7	4.2	21.2
Others	0.0	4.2	1.0
Total			
Manos	51.6	49.7	50.4
Batáns	28.4	32.2	30.7
Pebbles	16.2	13.2	14.4
Others	3.8	4.9	4.5

the original tool was estimated). While many *manos* were made from stones that were already the shape of the tool, many others show obvious evidence of shaping prior to use by means of pecking, grinding, and/or flaking.

Batáns (called metates in other parts of Latin America) consist of tabular groundstones used as flat work surfaces (passive use) for pounding or grinding with or without the use of a *mano*. These large tools are almost always broken when recovered. For purposes of analysis, when more than ½ of a broken *batán* was recovered, the tool was categorized as "broken," while those pieces that were less than ½ of a complete *batán* were categorized as "fragments." Some degree of shaping was evident on nearly all *batán*s recovered. However, the labor required for shaping was undoubtedly minimized by selection of pieces from the many flat-bedded outcrops of local sedimentary and igneous rock in the La Joya area.

A third category of groundstone implement is the pebble. Like *manos*, pebbles were categorized into speroids, ovoids, diskoids, and irregular pieces. Two main distinctions can be made between pebbles and *manos*. First, all pebbles are less than 80 mm in largest dimension, while *manos* are all larger than this. The other difference is in formation – the groundstone pebble tools from Chuquiña generally show no evidence of being shaped prior to use. That is, these tools probably began as relatively round gravels, and were essentially ready for use once collected. Pebbles may have had a number of uses, such as smoothing the surfaces of pots, but their most frequent function was probably as sling stones for hunting small game. As discussed below, surficial analysis reveals that the uses for pebbles were quite distinct from those of *manos*. Besides *batáns*, *manos*, and pebbles, the remainder of groundstone tools include mortar bowls, unidentifiable fragments, and cone-shaped pieces (probably weights), all of which occur in very low proportions in both sites and all time periods.

While there are differences in proportions of groundstone tools between the two sites during some time periods, there are few clear patterns in groundstone distribution between sites and over time. The most marked differences in proportions are also suspect, as they are associated with a small groundstone sample size at Chuquiña in LJ-I and a similarly small sample from Pusno in LJ-IV. The most common pattern seems to be an assemblage of about 45-50% *manos*, 25-35% *batáns*, and about 15% pebbles. With only a few exceptions, that pattern appears common to both sites and time periods.

6.2.3. Functional Analysis

While the assemblages from the two sites and all four time periods exhibit similar proportions of tool types, it remains an open question whether groundstone tools were used for the same purposes at both sites. While archaeologists often associate groundstone implements with food preparation, particularly preparation of domesticated grains, these tools may also be put to a number of other uses. In fact, the most important domesticated seed in the Wankarani subsistence system is quinoa, which may be cooked without grinding (to produce a porridge) or which may be ground for flour. Groundstone is not needed for any of the most common preparations of potatoes and other tubers – the domesticated plants that likely were most important in the Wankarani subsistence system. Thus, unlike most sequences of neolithic societies from around the world, groundstone implements actually become less common over time as agricultural intensity increased.

Other uses of groundstone tools likely included, but might not have been limited to: crushing and grinding of ceramic tempering materials; cracking of bones for extraction of marrow; hide smoothing; polishing or burnishing of ceramics before and after firing; grinding of roots, tubers, grass-fibers, and other plant materials; and use of small *manos* and pebbles as hammer stones for chipped-stone tool production. In the absence of microscopic studies of tool surfaces, it is difficult to identify the specific functional uses of groundstone implements. Overall, I view the density of groundstone implements as an index of wild plant exploitation, the use to which I believe most of these tools were put.

Two analyses made it possible to categorize groundstone tools into different functional categories. First, all *manos* were sorted according to overall shape. Second, *mano* size was compared between the two sites. Maximum length of each *mano* was used as a proxy indicator to tool size for purposes of this analysis. While all *batáns* are of similar form and function, *manos* appear in a variety of forms at both sites. For purposes of formal analysis, all *manos* were placed in one of four categories: discoid, ovoid, speroid, or irregular. It was hypothesized that if groundstone *manos* were put to different uses at the two sites, there should be significant differences in the shapes of these tools.

The results of this analysis show that there is remarkable continuity in the proportions of differently shaped *manos* both between sites and over time (Figures 6.1-6.4). Disk- and sphere-shaped *manos* combined represent about 80% of *manos* at both sites during most time periods. The only major divergence from this pattern occurs in the assemblage from Chuquiña during LJ-I. This assemblage of *manos* is very small however (n=10), and chi-square analysis reveals that the differences seen during LJ-I may be due to sampling vagaries (chi-square=5.281, p=.152).

Manos from both sites were also measured, and differences in *mano* functions between the two sites should also be evident in tool metrics. Only complete *manos* were used in this analysis, in order to ensure accuracy in recording the maximum tool dimension. This same analysis was repeated for groundstone pebbles. This analysis was not performed on *batán*s, as so few complete *batán*s were recovered that comparison was not meaningful. The results of the metric analyses are shown in Tables 6.12 and 6.13. The metric comparisons of groundstone tools from

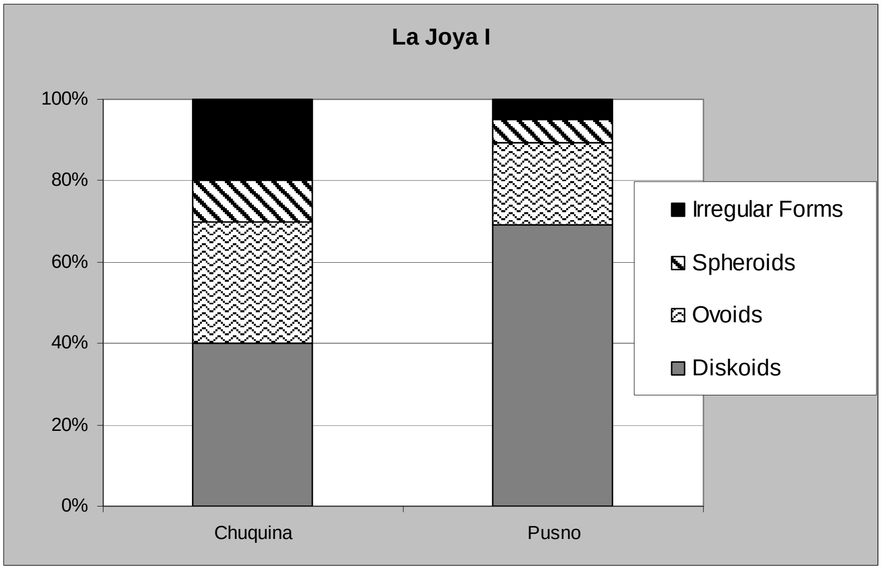

Figure 6.1. Stacked Bar Charts of Groundstone Tool Forms During LJ-I.

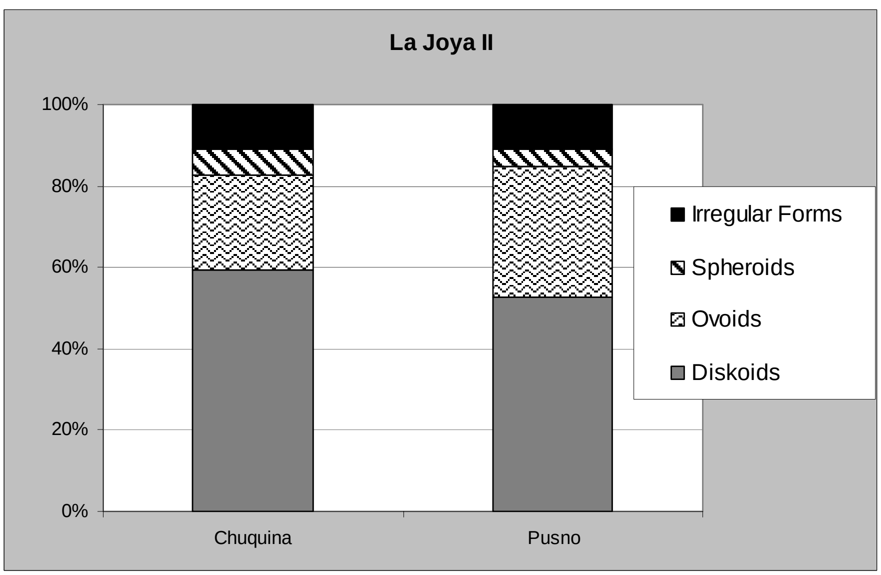

Figure 6.2. Stacked Bar Charts of Groundstone Tools Forms During LJ-II.

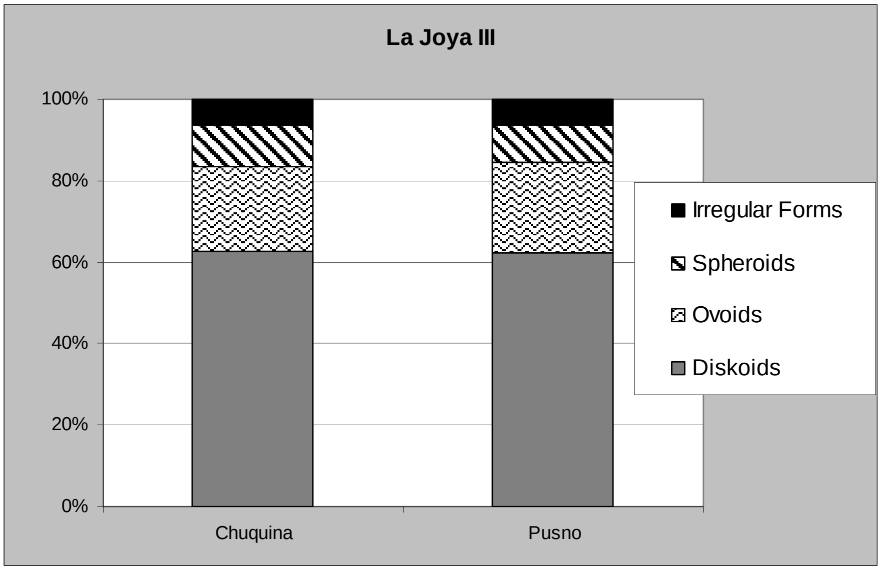

Figure 6.3. Stacked Bar Charts of Groundstone Tool Forms During LJ-III.

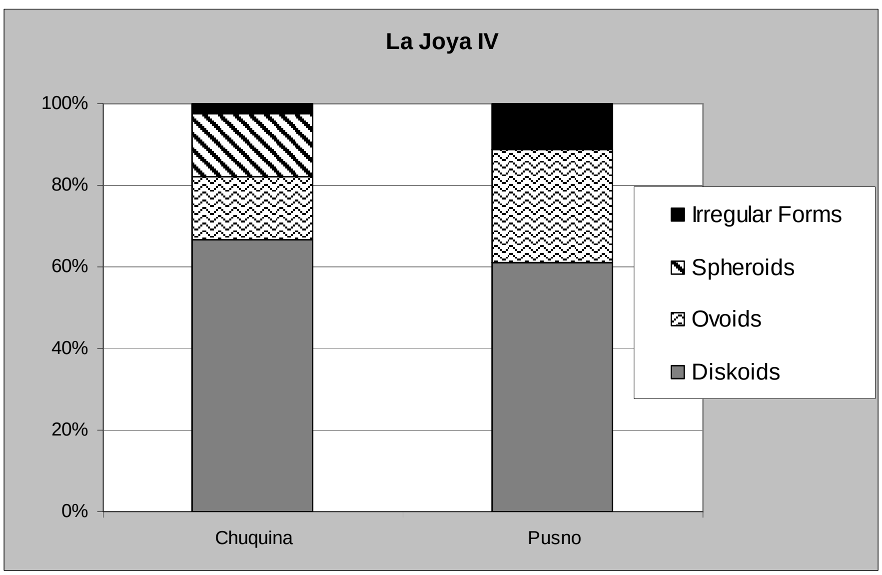

Figure 6.4. Stacked Bar Charts of Groundstone Tool Forms During LJ-IV.

Table 6.12. Mean Maximum Dimensions of Groundstone Manos with Between-Site t-Tests.

Phase	Chuquiña	Pusno	Student's t-statistic	p-value
La Joya I	94.0 n=4	102.2 n=57	1.101	.258
La Joya II	101.9 n=37	101.9 n=67	0.000	.999
La Joya III	103.9 n=33	94.6 n=11	1.492	.143
La Joya IV	105.0 n=19	98.8 n=4	0.556	.584
Total	102.9 n=93	101.3 n=139	0.695	.497

Table 6.13. Mean Maximum Dimensions of Groundstone Pebbles with Between-Site t-Tests.

Phase	Chuquiña	Pusno	Student's t-statistic	p-value
La Joya I	37.2 n=5	42.3 n=16	0.693	.497
La Joya II	42.3 n=12	47.8 n=39	0.926	.359
La Joya III	34.1 n=10	40.6 n=9	0.793	.439
La Joya IV	44.1 n=14	57.0 n=1	*	*
Total	40.3 n=41	45.6 n=65	1.565	.121

the two sites not only lack statistical significance, but the differences in mean maximum dimension are probably far too small to support the hypothesis of different tool functions at the two sites. There also appears to be very little change in mean maximum dimension over time.

In sum, it seems clear that analyses of tool forms and sizes do not provide any evidence to support the notion that groundstone tools served different functions at these two Wankarani communities. Nor does this line of evidence suggest any significant shift in groundstone use and function over time in the settlement system as a whole. It is clear, however, that the importance of groundstone overall decreased over time in both communities and probably in the settlement system as a whole. I interpret this as a diminishment in the importance of wild plant processing in face of the growing importance of domesticated species and greater agricultural intensity.

6.3. Conclusions

To summarize and expand upon the discussions presented above, analysis of lithic materials shows that the primary objective of lithic reduction in these Wankarani communities was the production of subsistence-related tools, especially bifacial hoes. If bifacial hoes can be used as an index of agricultural activities, the evidence suggests that while agriculture was practiced at both sites, the community at Chuquiña engaged a higher intensity of agricultural production. Since most lithic reduction was oriented toward the production of bifacial hoes, the greater density of chipped stone at the site of Chuquiña is also explained by the greater levels of agricultural intensity practiced by that community during all time periods. Proportions of bifacial hoes indicate that these tools also became more important over time at both communities, with a particularly dramatic shift apparent between LJ-I and LJ-II, which corresponds to approximately 1300 BC. The growing importance of agricultural activities culminates in hoes representing over 98% and nearly 70% of the tools at Chuquiña and Pusno, respectively, during LJ-IV. Since these tools appear to represent the most important end goal of lithic reduction, their growing importance also explains the increased density of chipped-stone debitage over time at both communities over all.

The second most common chipped-stone tool type is the projectile point. Since projectile points are associated with hunting activities, the high proportions of this artifact type at both communities during LJ-I suggests that hunting was more central to the Wankarani subsistence economy during the early part of the Formative. These proportions drop continuously throughout the sequence however, reflecting perhaps the ever-greater reliance on agricultural and herding activities which was supplanting the importance of hunting. By LJ-IV, projectiles represent a mere 1.4% of chipped-stone tools at Chuquiña, but 30% of chipped-stone tools from Pusno are projectile points during the same period. Thus, hunting appears to have remained relatively important for the community of Pusno, even as late as LJ-IV.

Groundstone tools also indicate that there were important differences in site function. The overall density of groundstone tools at Pusno is much higher than that of Chuquiña during all time periods. This result is contrary to archaeologists' frequent assumption that groundstone technology is generally associated with processing agricultural products. If groundstone were simply correlated with agricultural processing, then we would expect much higher densities of these tools at Chuquiña, the more agricultural of the two villages. Further underscoring this is the general decline in groundstone tool density over time at both sites despite other evidence indicating rises in agricultural intensity. The Wankarani Complex may represent a paradoxical case where groundstone tool production and consumption is more closely related to the procurement and processing of wild resources rather than the processing of agricultural products.

While distributions of raw materials vary between the two sites, the analysis here provides no evidence to suggest differential involvement by one community or the other in long-distance trade networks. Assemblages from both sites contain modest proportions of exotic stone materials, including obsidian, chert, and especially basalt. When the assemblages of both sites are considered together, there is evidence to suggest that long-distance trade activity intensified over the course of the Formative Period, with proportions of exotic lithic materials increasing from 9% to about 13%. This increase in trade activity is obviously a modest shift, and the evidence suggests that it occurred in a gradual incremental process.

Lithic debitage analysis suggests that bifacial hoe production was more intensive at Chuquiña than at Pusno during most time periods, though there is more evidence of bifacial hoe production using sedimentary rocks at Pusno in many time periods. However, none of the differences observed are strong enough to suggest a pattern of specialization, where one community produced hoes or other chipped-stone tools for trade and consumption elsewhere.

Overall, this study of the chipped-stone and groundstone tool assemblages demonstrates that these two communities likely procured, produced, and processed rather different sets of subsistence products. In other words, the two pursued rather different subsistence strategies. What has not been established is whether there are marked differences in consumption at the two sites. If differences in consumption were parallel to those documented here for subsistence activities, that would suggest that these communities were essentially self-sufficient in terms of subsistence. If however, consumption did not mirror these differences in subsistence strategy, then the resulting conclusion would be that these Wankarani communities produced surpluses of specialized subsistence products for exchange at either the local or long-distance scale. Such subsistence surplus may have been the commodity that Wankarani communities had to trade in exchange for vitreous basalt, obsidian, and other long-distance trade goods.

7. THE FAUNAL ASSEMBLAGES

7.1. Introduction and Methods

The analysis of faunal materials from Chuquiña and Pusno focused on comparison of consumption behavior between the two communities. This focus was determined for several reasons. First, for the purposes of this investigation, the most important aspect of the faunal analysis was to understand *relative* differences in subsistence practices between the two sites. Thus, for this purpose the calculation of *absolute* values (e.g., MNE and MNI) is not of central importance. In addition, the faunal assemblages from the two sites are extremely fragmented. This high degree of fragmentation makes calculation of MNE and MNI difficult at best, and quite unreliable at worst. Finally, there is the difficulty of differentiating the related camelid species (alpaca, guanaco, llama, and vicuña) from each other and from the herbivorous cervids (e.g., *taruca*) of the *altiplano* in such a highly fragmented assemblage. Such differentiation would require a regional faunal specialist. Despite these difficulties, meaningful comparison of the assemblages from the two sites was still possible using measures of number of identified specimens (NISP) by taxonomic group. While identification to the species level was not possible, more than 67% of all bones recovered from the two sites were classified according to a set of aggregated taxonomic groups shown in Table 7.1.

The inter-taxa analysis is based simply on the NISP of the aggregated taxa (e.g., camelids vs. small terrestrial animals vs. birds), an approach that is useful given the highly fragmented

Table 7.1. Aggregate Faunal Taxa Used in the Analysis.

Aggregate	Members
Avian Aggregate	All Species of Bird
Small Terrestrial Aggregate	Rodents & Reptiles
Camelid (Large Terrestrial Fauna)	Camelids & Cervids

condition of much of the faunal assemblages. In order to assess relative differences in consumption patterns of large mammals (especially camelids), the large mammal aggregate taxon was also analyzed by assigning each identifiable bone to a class of element associated with a particular faunal utility index (FUI). FUI's are applied according to meat 'packets', following the ethnographically derived categories based on butchery practices used by Aldenderfer (1998:105-107)(Figure 7.1). Higher FUI's are associated with meatier, high-utility cuts of the animals. Hence, higher proportions of FUI's in an assemblage suggests better access and possibly higher economic or social status.

Before proceeding with discussion of the results of the faunal analysis, several caveats and assumptions that arise from the methods used here must be made clear. First, the analysis applied here assumes that taphonomic processes functioned approximately the same at the two sites over time. I argue that this assumption is warranted given the similar environmental and cultural context of the two sites, which suggests that processes of deposition, decay, and scavenger activity probably affected assemblages similarly. A second issue is presented by the aggregate taxa used (Table 7.1). The large mammal aggregate taxon incorporates several different, potentially important species. First, the aggregate taxon incorporates two domesticated species (llama and alpaca), and two wild species, of camelid. In addition, some of the remains in this aggregate taxon are not camelid at all, but are the remains of wild cervids of the *altiplano* (e.g., taruca).

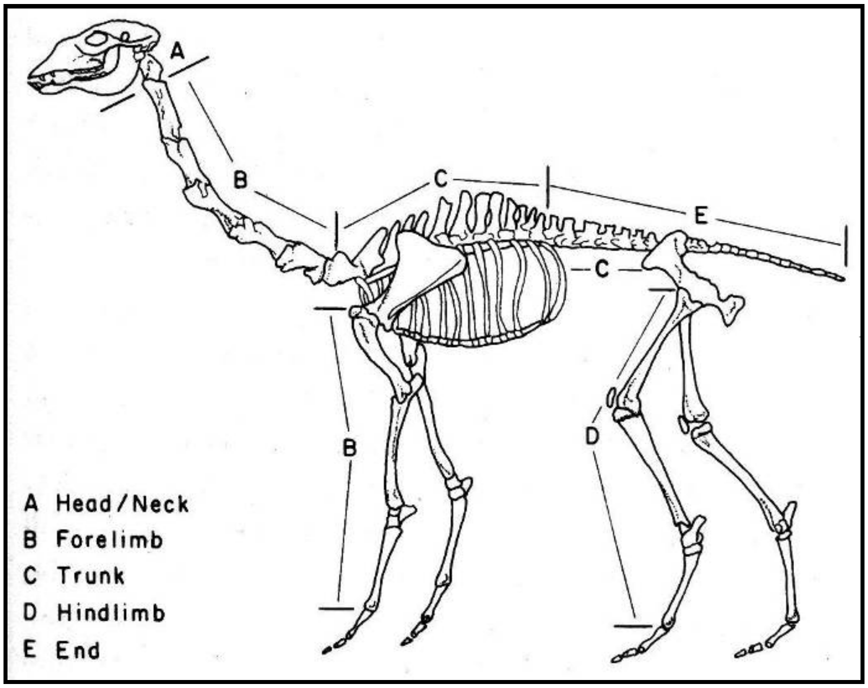

Figure 7.1. Anatomical "Packets" Corresponding to Different FUI Rankings (modified from Aldenderfer 1998:107)

The combination of four camelid species is the less problematic of these two issues. First, based on both ethnographic and archaeological case studies, it is likely that llama comprises the overwhelming majority of the camelid remains recovered. Second, while the FUI's of packets associated with these four species differ to some extent, the relative importance (ranking) of packets between these species is quite consistent. Finally, as a practical matter the mixing of these species probably cannot be helped; even in modern collections, the bone elements of these four species are very difficult to differentiate. The likelihood of confusing these species increases in prehistoric assemblages, where the domestication process was more proximate in time. In most cases identification is not possible in assemblages as highly fragmented as those from Chuquiña and Pusno.

The inclusion of cervids in the large herbivore aggregate could be a greater problem. Fortunately, however, tooth and antler fragments diagnostic of cervid species account for less than .5% of the large herbivore cranial fragments recovered from either site during any time period. This suggests that cervids probably comprise a very small part of the assemblages overall and probably do not pose a major challenge to the analysis employed here. Given the rarity of cervids in the assemblages, I will hereafter simply refer to this large herbivore taxonomic category as the 'camelid aggregate taxon.' In addition to camelids and non-camelid birds, reptiles, and mammals, fish bones were recovered in considerable numbers. Because these bones were recovered haphazardly, rather than systematically, they were analyzed in terms of ubiquity (presence/absence) instead of counts (NISP). Fish remains are discussed after the terrestrial fauna.

7.2. Comparing Faunal Assemblages

7.2.1. Faunal Density

The first means of assessing differences in faunal assemblages is in bone densities at each site. As in previous analyses, the use of bone density as a function of soil matrix is not a reliable index for comparison, given the different rates of adobe and natural sediment deposition at the two sites and in different parts of the sites. For this reason, I have calculated a faunal density index (FDI) based on the total number of bones and the total number of utilitarian sherds from each site. In Table 7.2 and Figure 7.2, higher numbers indicate a lower density of bones, while an index of one (1) would indicate an exceptionally high density of bones (equal to the number of recovered utilitarian sherds). In all time periods, the densities of bones are higher at

Table 7.2. Sherd Density Indices of Total Faunal Remains.

Phase	Chuquiña	Pusno	Total
La Joya I			
Total Faunal Bone	259	485	744
Total Sherds	1450	4989	6439
Sherd: Bone Index	5.6	10.3	8.7
La Joya II			
Total Faunal Bone	1426	222	1658
Total Sherds	14426	12259	26685
Sherd: Bone Index	10.0	55.2	16.1
La Joya III			
Total Faunal Bone	3510	1173	4683
Total Sherds	23271	13281	36552
Sherd: Bone Index	6.6	11.3	7.8
La Joya IV			
Total Faunal Bone	3657	447	4104
Total Sherds	19535	3160	22695
Sherd: Bone Index	5.3	7.1	5.5

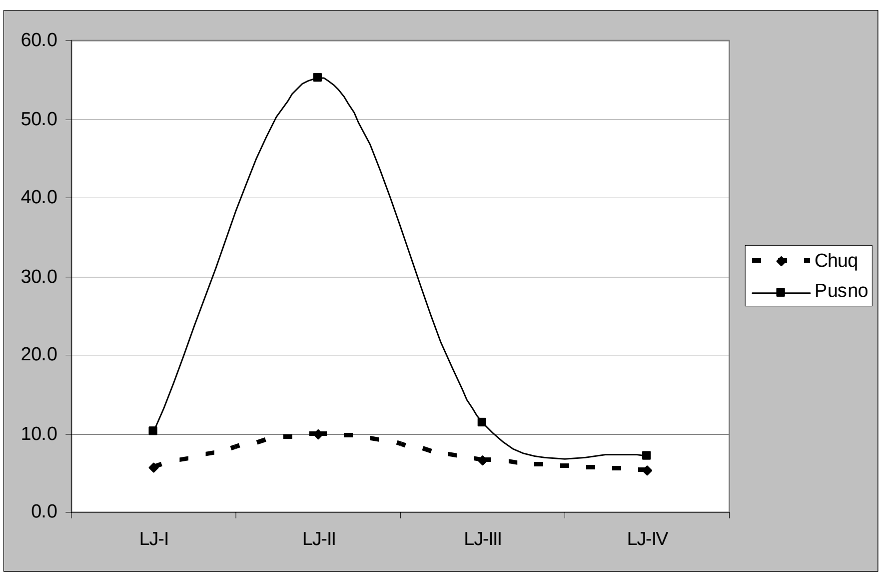

Figure 7.2. Line Graph of Sherd Density Indices of Total Faunal Material.

Chuquiña than Pusno, though the difference is most pronounced during LJ-II. During all other periods, the FDI is about two to five points lower at Chuquiña than at Pusno. Statistical analysis of these differences would be superfluous, given that such high sample sizes would guarantee statistical significance.

7.2.2. Comparing Distributions of Taxa

Differences in proportions of identified elements from the three aggregate taxa at the two sites are illustrated in Figures 7.3-7.6. These graphs suggest clearly that camelid consumption became more important over time at both sites, with decreasing emphasis over time of bird and small mammal species. The distributions of taxa appear roughly similar at the two sites during LJ-I, but the differences are marked during LJ-II and LJ-III, when the proportion of camelid elements rises dramatically at Pusno. Note that during LJ-I, proportions of camelids at the two sites are virtually identical, with only moderate differences in the proportions of avian and small animal taxa. In subsequent periods, the proportions of camelids from Chuquiña remain relatively stable before increasingly dramatically in LJ-IV. In contrast, the proportions of camelid remains increase dramatically at Pusno during both LJ-II and LJ-III, culminating in over 96% camelid bone comprising the faunal assemblages in LJ-III and LJ-IV. It is worth noting that avian and small animal fauna from Pusno during LJ-III and LJ-IV are not only small in proportions, but also in absolute number. These categories represent a sum of only 40 and 15 total elements recovered from the LJ-III and LJ-IV periods, respectively.

In order to more rigorously test the differences between the two sites, chi-square analyses were performed on the proportions of camelid vs. non-camelid elements recovered from each site (Figure 7.7). Based on Figures 7.3 and 7.7, it is not surprising that chi-square analysis shows that the very small differences in proportions of camelid elements from the two sites

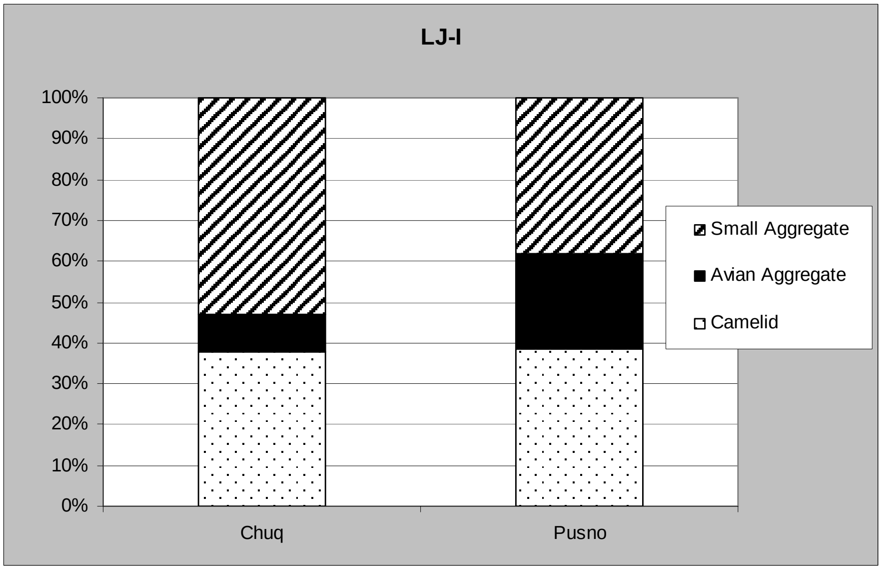

Figure 7.3. Stacked Bar Chart of Aggregate Taxa as Proportions of Total NISP During LJ-I.

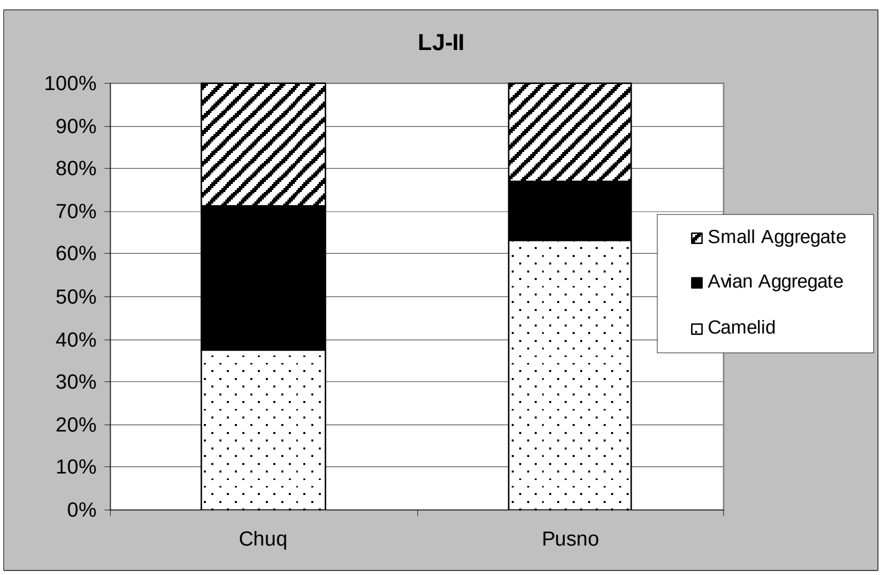

Figure 7.4. Stacked Bar Chart of Aggregate Taxa as Proportions of Total NISP During LJ-II.

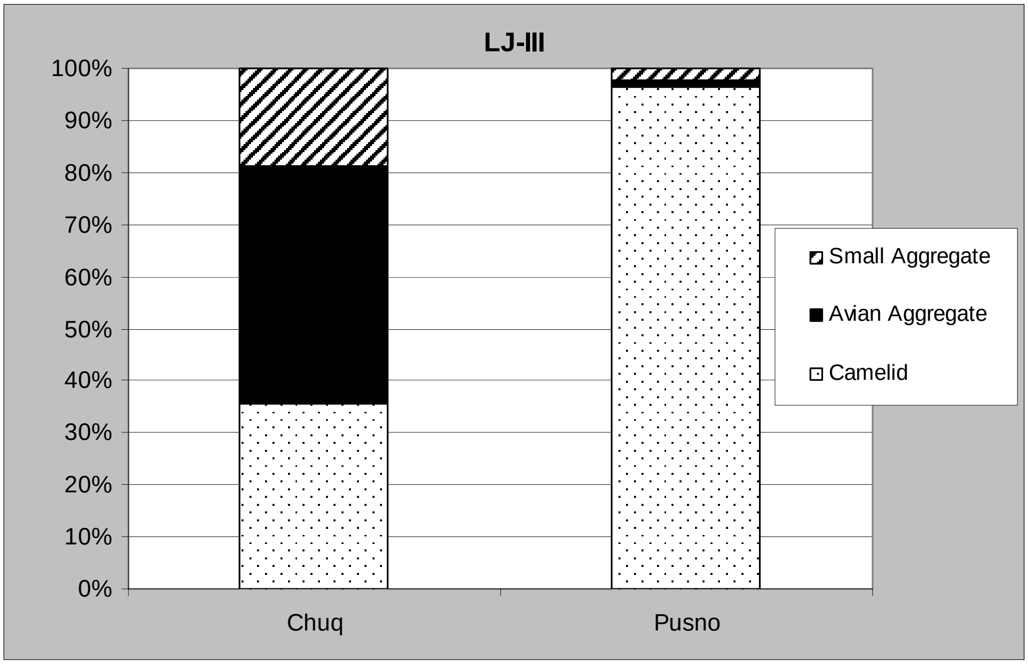

Figure 7.5. Stacked Bar Chart of Aggregate Taxa as Proportions of Total NISP During LJ-III.

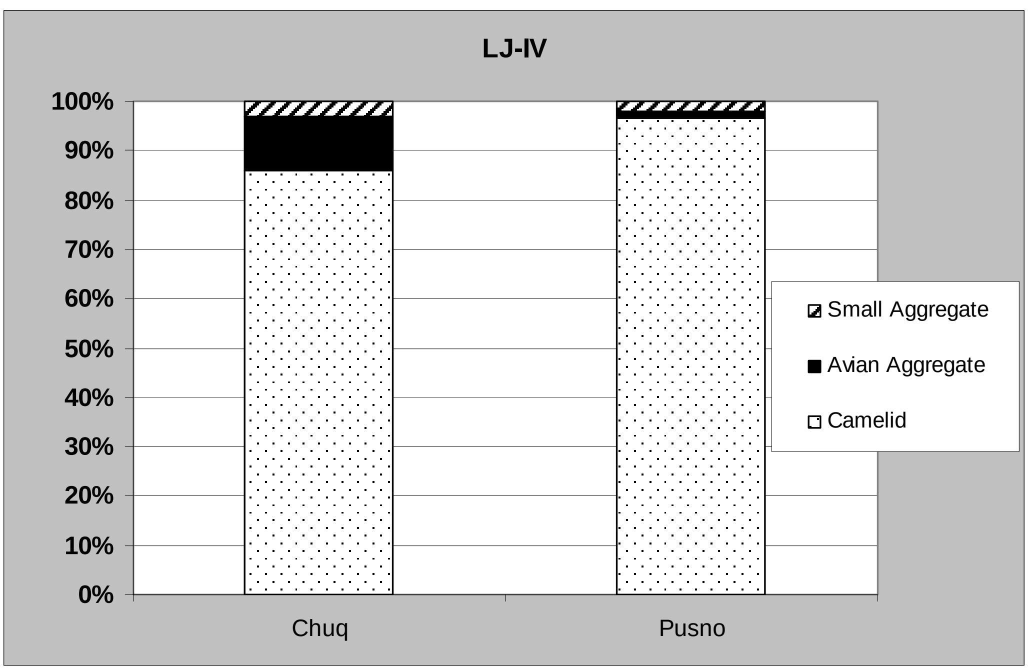

Figure 7.6. Stacked Bar Chart of Aggregate Taxa as Proportions of Total NISP During LJ-IV.

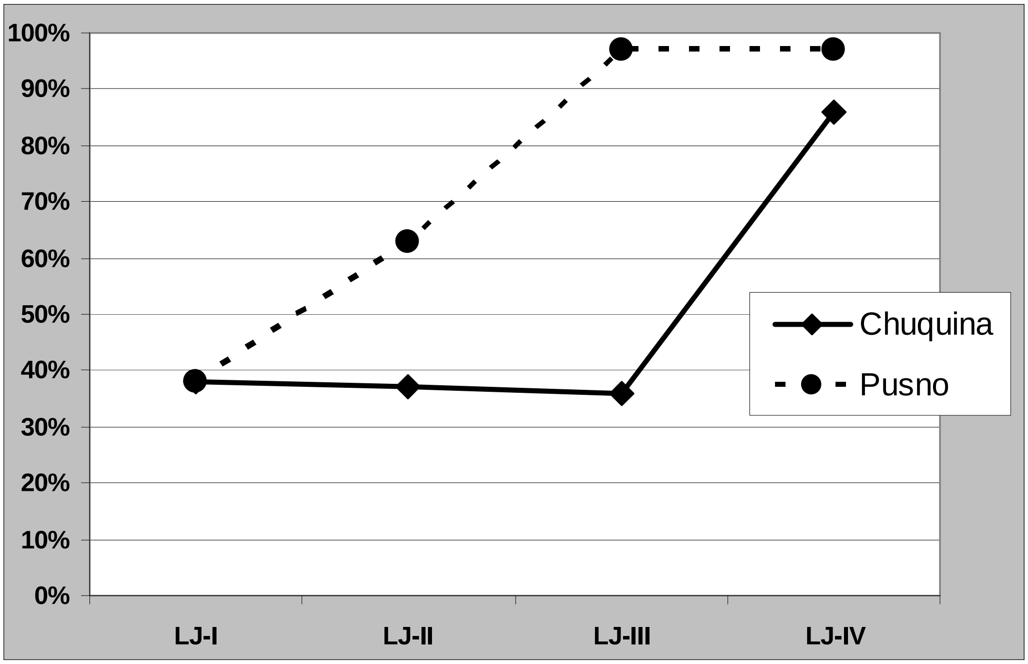

Figure 7.7. Line Graph of Total Camelid Elements as Proportions of Total NISP.

during LJ-I are of very little statistical significance. The differences in proportions of identified camelid elements during LJ-II and LJ-III, however, are both strong (about 26% and 61%, respectively) and statistically significant, strongly suggesting that these differences are a reflection of real contrasts in the compositions of the faunal assemblages. During LJ-IV, the proportion of camelids rises nearly to that of Pusno, though the difference remains of moderate strength (about 11%) and high statistical significance.

Two possible interpretations could be drawn about the differences in taxa proportions discussed here. An argument could be made that the differences in taxa proportions between sites could be function of site depositional processes. So for example, the higher proportions of avian and small terrestrial faunal elements at Chuquiña could be a result of those small animals living in higher concentration around a larger sedentary community when compared to Pusno. However, this argument is somewhat undermined by the fact that during two time periods, the distributions of taxa between the sites are very similar (indeed virtually identical during LJ-I), despite the fact that Chuquiña was a smaller community during one of these phases (LJ-I) and a larger community during the other (LJ-IV). For these reasons, the notion that one site was an inherently more attractive place as a habitat for micro-fauna seems unlikely.

For this reason, I favor a second interpretation – that the differences in aggregate faunal element proportions reflect actual differences in consumption patterns between the two communities. The data suggest that after LJ-I, the community at Chuquiña employed a more diverse subsistence strategy than that of Pusno, especially during LJ-II and LJ-III. Whether this greater diversity was a reflection of limited access to camelids at Chuquiña or a reflection of greater access to other taxa (birds, reptiles, rodents) will be addressed at greater length in Chapters 8 and 9. The aggregated taxonomic data demonstrate clearly that importance of camelid consumption increased over time in the settlement system as a whole. The overall proportion of camelid elements in the settlement system increases steadily and continuously over time.

7.3. Camelid Utilization

Table 7.3 shows the element compositions, associated FUI's, and summed FUI's of the five camelid faunal packets used in this study (see also Figure 7.1). These ranked packets are used here to assess differences in camelid consumption patterns and, by extension, the access that communities at different sites enjoyed to camelid packets of varying utility. To illustrate these differences most clearly, the faunal assemblages from each site are shown in bar graphs where the bars represent, from left to right, the highest to lowest utility camelid packets (Figures 7.8-

Table 7.3. Composition of Faunal Packets and Associated FUI's in Rank Order.

Faunal Packet	Skeletal Elements	Element Utility Indices	Summed Packet FUI
Packet C – Trunk	Ribs	100.0	343.1
	Pelvis	40.2	
	Scapula	41.7	
	Thoracic Vertebrae	61.8	
	Sternum	99.4	
Packet B – Forelimb	Cervical Vertebrae	64.2	130.4
	Humerus	36.7	
	Radius/Ulna	23.0	
	Metacarpals	6.5	
Packet D – Hindlimb	Femur	75.9	130.4
	Tibia	43.0	
	Matatarsals	11.5	
Packet E – Ends	Lumbar Vertebrae	77.9	77.9
Packet A – Head	Cranium	14.8	33.3
	Axis/Atlas	8.6	
	Mandible	9.9	

7.11). Viewed in this way, bar charts with a downward slope from left to right are indicative of the highest utility camelid bone assemblages, while those with an upward slope from left to right are indicative of low utility assemblages. Figures 7.8-7.9 suggest that all of the faunal assemblages from Chuquiña and Pusno are of relatively high utility, with large proportions of high-utility trunk elements occurring in both sites in all time periods. It is difficult however, to identify any clear pattern in differences between contemporary assemblages, largely due to the presence of five utility categories. For this reason, chi-square analysis was again used on collapsed categories of 'trunk' (high utility) and 'non-trunk' (low-med utility) faunal elements (Figures 7.12-7.15).

Pusno is the community with higher utility faunal assemblages in most time periods. During LJ-I, the difference seen is moderately strong (ca. 27%) and statistically significant (chi-square = 4.83, $p < .03$). During LJ-II, the strength of the difference between sites is greatly diminished (only 7%) and chi-square analysis shows that there is a greater than 1 in 4 probability that this

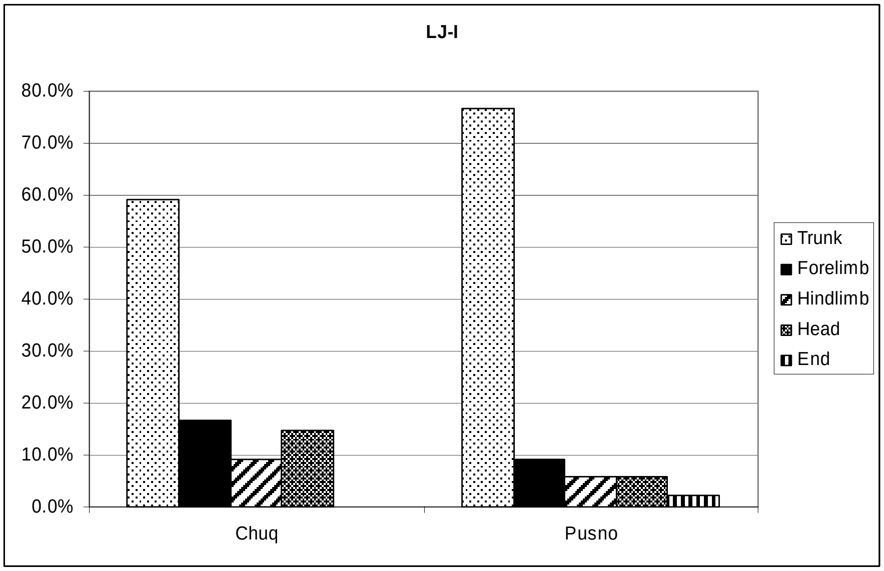

Figure 7.8. Bar Charts of Camelid NISP by Packet During LJ-I.

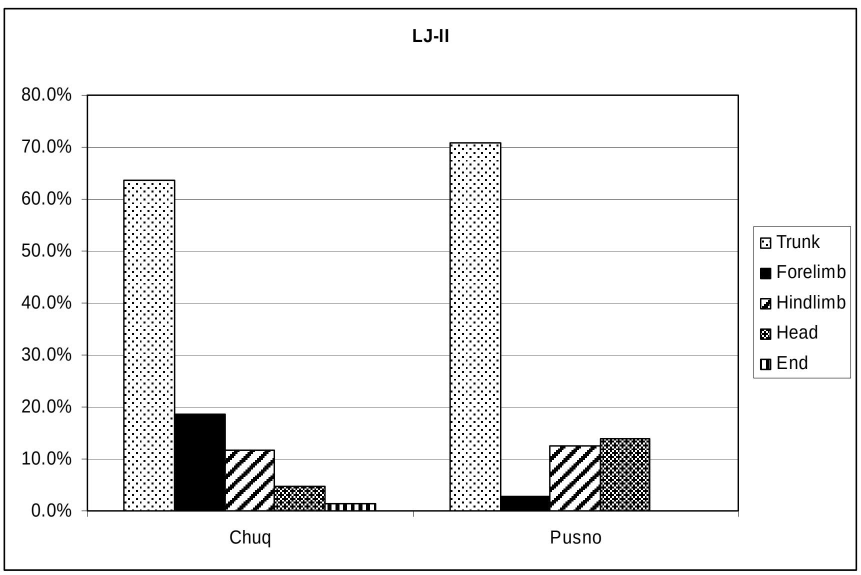

Figure 7.9. Bar Charts of Camelid NISP by Packet During LJ-II.

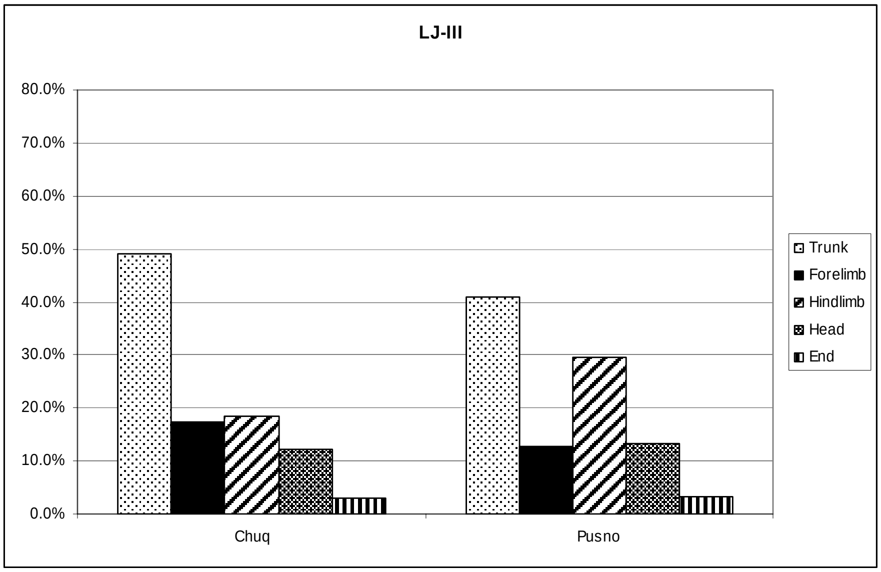

Figure 7.10. Bar Charts of Camelid NISP by Packet During LJ-III.

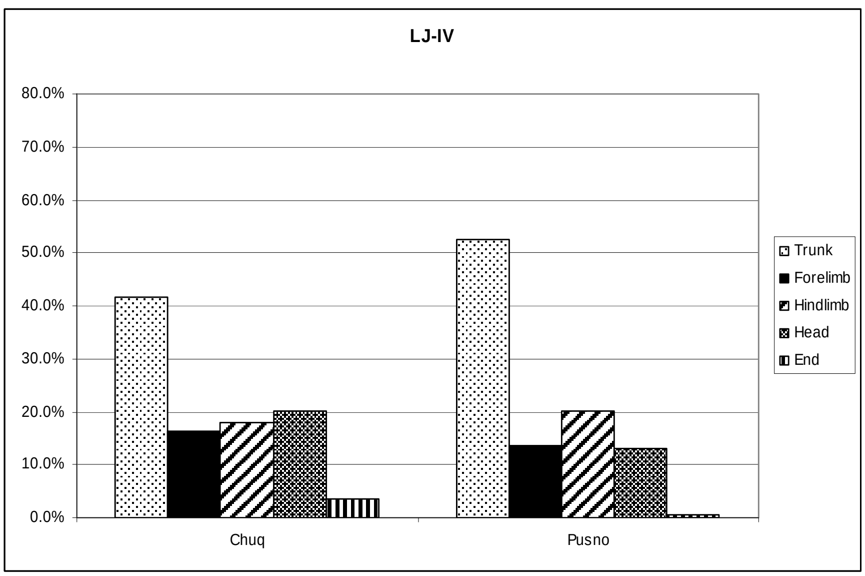

Figure 7.11. Bar Charts of Camelid NISP by Packet During LJ-IV.

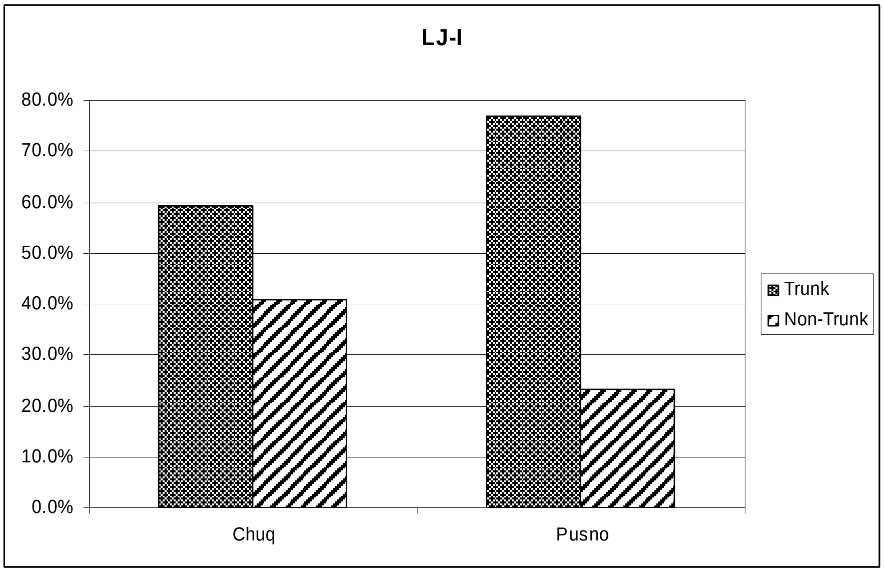

Figure 7.12. Bar Charts Showing Proportions of Trunk (High Utility) and Non-Trunk (Low Utility) by NISP During LJ-I.

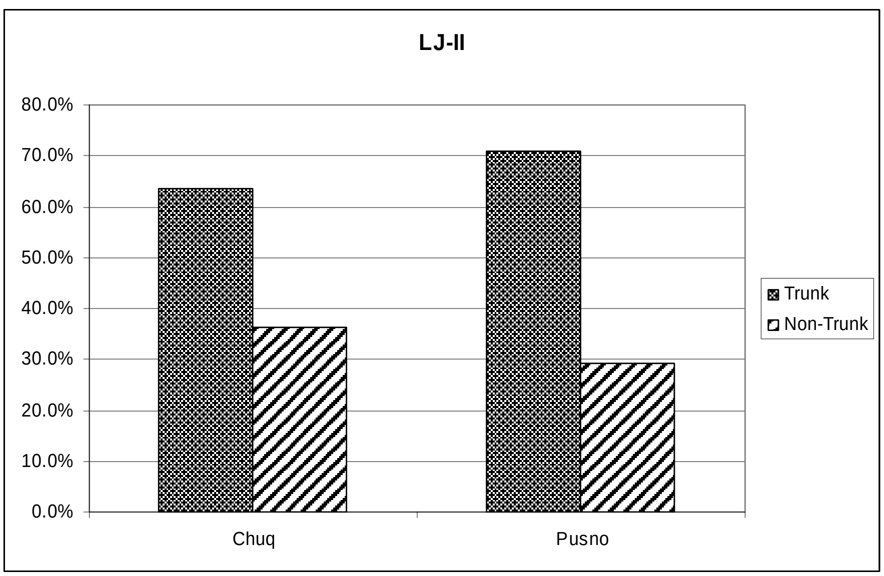

Figure 7.13. Bar Charts Showing Proportions of Trunk (High Utility) and Non-Trunk (Low Utility) by NISP During LJ-II.

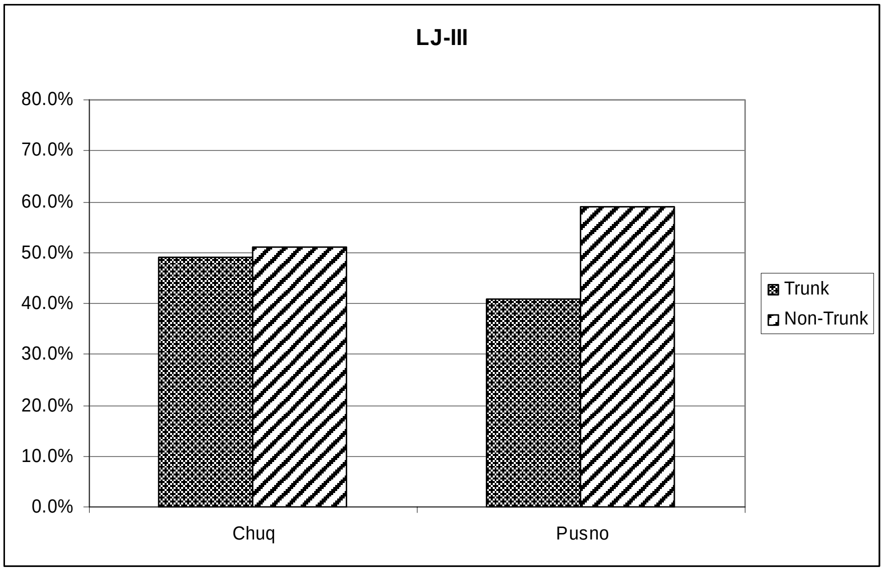

Figure 7.14. Bar Charts Showing Proportions of Trunk (High Utility) and Non-Trunk (Low Utility) by NISP During LJ-III.

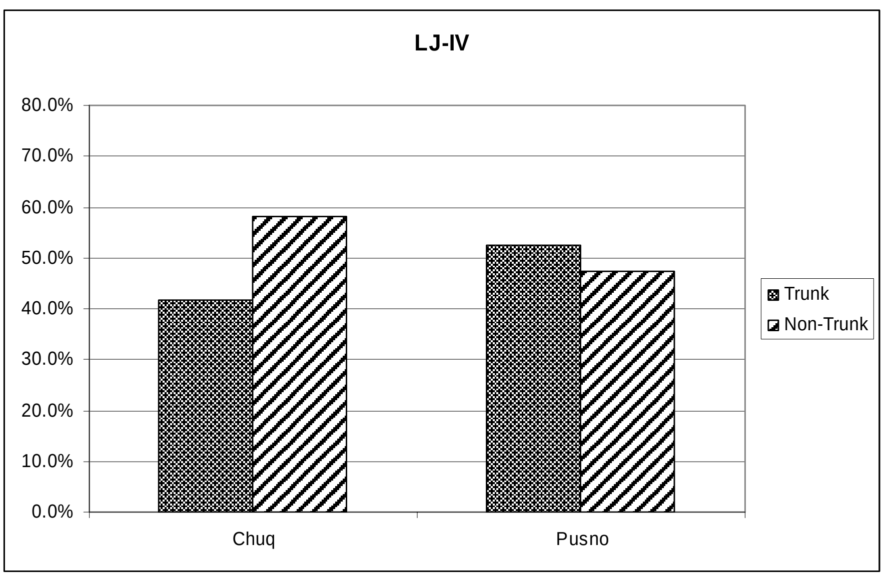

Figure 7.15. Bar Charts Showing Proportions of Trunk (High Utility) and Non-Trunk (Low Utility) by NISP During LJ-IV.

difference is due only to the vagaries of sampling (chi-square = 1.26, $p < .26$). LJ-III is the only time period for which the Chuquiña faunal assemblage is of higher utility than that of Pusno. The strength of the difference in this time period is modest (ca. 7%), though statistically highly significant (chi-square = 6.96, $p < .01$). During LJ-IV, the Pusno assemblage again has the higher proportion of high utility elements, and the difference is of moderate strength (ca. 11%) and high statistical significance (chi-square = 8.53, $p < .003$).

Finally, it is interesting to note that the overall proportion of high utility camelid elements diminishes over time in the settlement system. It is tempting to interpret this difference as a function of trade activity in high-utility camelid parts with settlements outside the La Joya settlement system. The higher proportions of high-utility elements early in the sequence could be interpreted as evidence of importation of choice parts in exchange for some other goods. Alternatively, and more likely in my opinion, is that the decrease in high-utility camelid parts is evidence of increased export of choice parts in exchange for long-distance goods from neighboring populations.

7.4. Ubiquity Analysis of Fish Remains

Based on previous studies (Bermann and Estevez C. 1995; Estevez C. and Bermann 1996, 1997; McAndrews 2001, 2005; Rose 2001a, 2001b) it was not expected that fish bone would be recovered in significant amounts from Wankarani sites. The 3 mm mesh used in the fieldwork was entirely insufficient to guarantee the systematic recovery of fish bones, most of which are from small riverine fin fish. However, fish bone was frequently seen both during excavation and during sediment screening, and at these times it was bagged and documented. Generally, this method of recovery is probably adequate for simply documenting the presence or absence of fish remains. Minimally, the fish bones recovered reflect the relative abundance of these remains, since sediment characteristics and excavation strategy were virtually identical at the two sites. This form of data cannot reliably be used however, to measure absolute quantities of fish remains, since there is no way of accurately accounting for what proportion of fish bones were missed during excavation and screening. For these reasons, a simple ubiquity analysis was employed to measure the relative abundance of fish remains at the two sites over time. The results are shown in Table 7.4.

Table 7.4 shows the number of contexts (in the form of excavation units) excavated at each site during each time period, as well as the number and percentage of such contexts where fish remains were recovered. With the exception of LJ-I, the proportions of excavated contexts with fish remains are higher at Chuquiña during all time periods. This result is consistent with the

Table 7.4. Ubiquity Analysis of Fish Remains.

Phase / Site	Number of Units with Associated Contexts	Number of Units with Fish Remains	Proportionate Ubiquity of Fish Remains
La Joya I			
Chuquiña	3	0	0
Pusno	8	2	25%
Mean			13%
La Joya II			
Chuquiña	7	6	86%
Pusno	7	0	0%
Mean			43%
La Joya III			
Chuquiña	10	4	40%
Pusno	4	0	0%
Mean			20%
La Joya IV			
Chuquiña	9	6	67%
Pusno	2	0	0%
Mean			33%

fact that Chuquiña is currently within 1 km of the modern Río Desaguadero, while Pusno is more than 5 km from the nearest leg of the river. However, no geomorphological studies have been conducted in the La Joya locality to identify the prehistoric route of the Desaguadero. But this analysis makes clear that from LJ-II through LJ-IV (ca. 1325 to at least 500 BC), there is evidence of frequent consumption of riverine fish at Chuquiña and there is literally no evidence of this resource being consumed at Pusno during the same interval. The data in Table 7.4 also suggest that stream fish were exploited at greater intensity over time, though this surely always represented a supplemental food source and not a staple food.

7.5. Conclusions

While the ceramic and lithic artifact analyses discussed in Chapters 5 anf 6 reflect the material correlates of human subsistence activities, the faunal remains from Chuquiña and Pusno represent direct evidence of on-site consumption of animal products. The analysis presented here points to several important conclusions. First, it is clear that consumption of camelids increased over time in both communities, with dramatic shifts occurring at different times in each community. The increased importance of camelids occurs across all time periods in Pusno, while it occurs largely all at once at Chuquiña with the transition to LJ-IV. As noted in previous chapters, this coincides with the demise of Pusno as a residential site in LJ-IV.

In general, wild animals and fish were consumed in much greater proportions at Chuquiña than at Pusno. This almost certainly is a result of Chuquiña's proximity to the Río Desaguadero and Pusno's very isolated location on the pampa. The river would have provided access to a variety of microfauna including reptiles, waterfowl, and small mammals. Interestingly the consumption pattern in fauna is exactly the opposite of the pattern seen for plant processing. In Chapter 6, lithic evidence suggested greater reliance on domesticated plants (agriculture) at Chuquiña and wild plants at Pusno. Here, we see a greater level of consumption of domesticated animals (camelids) at Pusno with greater reliance on wild faunal species at Chuquiña.

Differences in faunal assemblages clearly demonstrate that Wankarani communities were exchanging subsistence products, probably among themselves as well as with more distant peoples from whom they obtained long-distance trade goods like vitreous basalt. Long-distance trade of camelid meat would likely have taken the form of the dried 'jerky' known as ch'arki. The production of ch'arki using specific choice camelid elements would result in assemblages of camelid elements skewed toward those elements consumed locally and not used for ch'arki production. However, documenting the exact patterns expected in camelid assemblages between sites that export and import ch'arki (the "ch'arki effect") is widely debated.

8. SPECIAL FINDS AND BURIALS

The vast majority of material culture recovered from excavations falls into the categories addressed in previous chapters: ceramics, lithics, and faunal remains. This chapter deals with the remaining evidence that was recovered in much more modest amounts. However, some of these artifact categories are especially important as they serve as indicators of particular activities including a range of social, economic, and ceremonial functions.

8.1. Artifacts Associated with Textile Production

Textile production has long been known to be an important activity throughout the Andes, as finished textiles were often of major social and economic importance. Traditionally and ethnohistorically, Andean textile production was an activity of women, who produced these goods at the household level as well as in roles of state-sponsored specialists in the case of the Moche, Chimú, and Inka states. Throughout the Andes, elaborate textiles have been used to distinguish people of various ethnicities and allyus, statuses and ranks, and also as a form of reward for the loyal service of lower and middle level elites. The raw material for textile production prehistorically was primarily cotton and camelid wool, both native domesticates. In the highlands, raw material would have been largely restricted to the wool of domesticated llamas and alpacas. Unfortunately, preservation of the textiles themselves is not good on the *altiplano*, as opposed to the arid coast. This makes identifying textile production archaeologically very difficult.

At Chuquiña and Pusno, the archaeological evidence for textile production is limited to only a few artifact types. These include bone wichuñas, typically produced from the metatarsals of camelids. Wichuñas are weaving tools, used to pound and to pick the threads of wool on the loom. They have a characteristic form of being broad on one end and ground/polished to a dull point on the other (Figure 8.1). Other artifacts associated with textile production include bone needles and piercers (Figure 8.2), and spindle whorls of bone, ceramic, and stone (Figure 8.3). All of these artifact types occur in very small numbers at both sites (Table 8.1). In order to assess these artifact types quantitatively, they were summed and converted to a density index using the total number of sherds from each assemblage (as was used in Chapters 5, 6, and 7). Due to the small number of implements, this index was then multiplied by 100 (Figure 8.4).

Figure 8.4 clearly shows that there is broad similarity not only in the weaving density index, but also in the overall trend of the index over time during LJ-I through LJ-III. During LJ-IV there is a rise in the index at Pusno, but this rise is associated with a small sample size (n=6) and large error ranges. Therefore, the rise in the index at Pusno during LJ-IV is difficult to interpret and may only be due to sampling vagaries. The trend illustrated in LJ-I through LJ-III, however, is associated with reasonable sample sizes and significance levels. These data suggest that both communities were actively producing textiles at similar intensities during LJ-I, and that this intensity of production dropped precipitously after LJ-I. This dramatic drop in intensity may have to do with changing methods of textile production, in which case the shift is likely to be observed at all Wankarani sites. A second, and more likely inference in my opinion, is that weaving activity became increasingly specialized at a different Wankarani community for which we do not yet have a sample. Specialized textile production would result in an easily exchangeable product that could have been traded for a variety of long-distance trade goods,

Figure 8.1. Worked Bone *Wichuñas* and Other Weaving Implements.

Figure 8.2. Worked Bone Needles Used in Weaving.

Figure 8.3. Ceramic Spindle Whorls and Disks.

Table 8.1. Counts of Implements Associated with Textile Production.

Phase/Site	Bone Needles & Piercers	Bone Wichuñas	Spindle Whorls	Total
La Joya I				
Chuquiña	8	0	0	8
Pusno	20	13	0	33
La Joya II				
Chuquiña	13	4	2	19
Pusno	1	6	5	12
La Joya III				
Chuquiña	13	8	7	28
Pusno	2	0	0	2
La Joya IV				
Chuquiña	6	5	2	13
Pusno	1	2	3	6

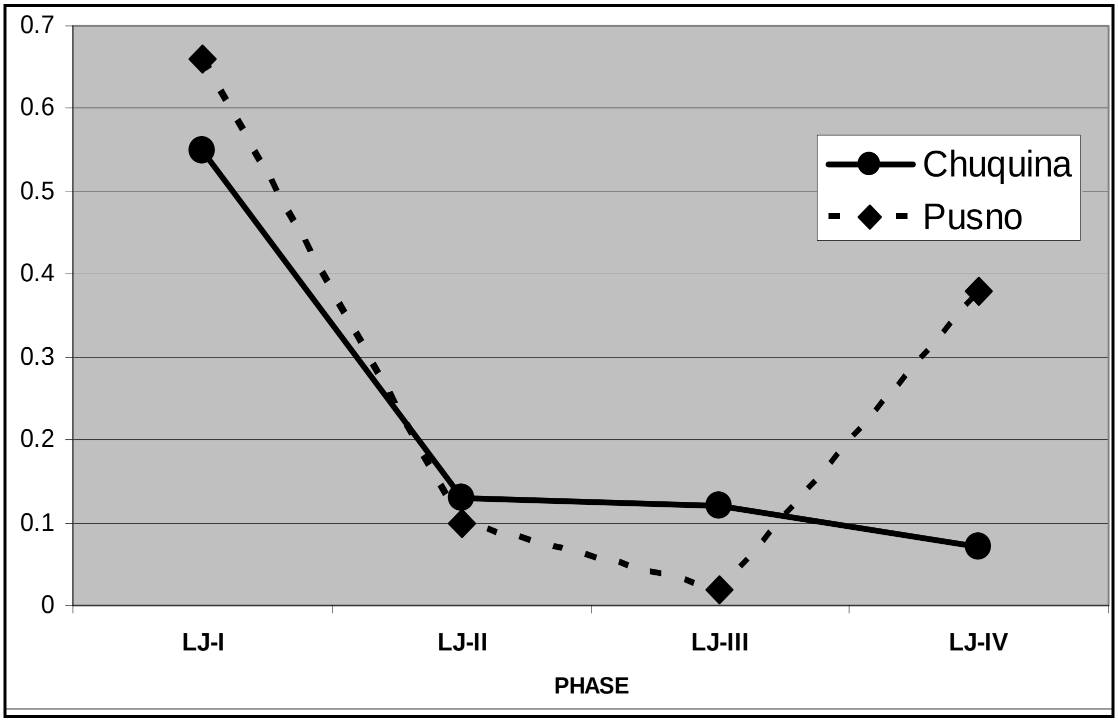

Figure 8.4. Line Graph of Sherd Density Indices of Textile Production Tools.

including fine-grained basalt and other lithic materials as well as subsistence products. Once textiles were being produced in surplus for exchange to distant areas, it would have been only a small step for such surplus production to become the basis of local textile consumption as well.

8.2. Artifacts Associated with Ceremonial Activities

Among the most important ceremonial activities for archaeologists to document is feasting. As noted in Chapter 5, evidence of bowl proportions from Chuquiña and Pusno do not appear to show a pattern of feasting at one or the other community. On the other hand, the analysis in Chapter 7 showed that there is some evidence that the central platform at Pusno was the site of high levels of camelid consumption that resulted in large amounts of bone being incorporated into the construction materials. Here I address several other categories of relatively rare artifacts thought to be associated with ceremonial activities in Wankarani communities. These items are divided into six categories: musical instruments, trumpets, spoons, decorative ceramics, stamps and plaques, and sculptures. Each of these groups is defined and described below.

Several musical instruments were recovered from Chuquiña and Pusno. These include bone flutes and worked camelid tarsals that I have interpreted as whistles (Figures 8.5 and 8.6). Two of these instruments date to LJ-II, as early as 1300 BC, making these among the most ancient musical instruments ever documented in the Andes. Music of course, plays a central role in modern ceremonial activities in the Andes, and musical instruments have been documented in later archaeological periods as well.

Figure 8.5. Musical Instruments (Flute and Whistles) of Worked Bone.

Figure 8.6. Worked Bone Flute from Chuquiña.

Among the most intriguing ceremonial artifacts from Chuquiña and Pusno are the ceramic trumpets, sometimes called *trompitos* or *sopladores*. These artifacts first appear in Chuquiña during LJ-II, and become abundant during LJ-III. These ceramic trumpets are often decorated with designs of punctations and incisions, including some that form a serpentine image (Figure 8.7). Many of these design impressions contain paint residues. The exact function of these artifacts is unknown, but they are frequently associated with other ritual elements of the Yaya-Mama Religious Tradition, which arose at Chiripa and other Lake Titicaca Basin sites beginning about 800 BC (Bandy 2004; Chávez and Chávez 1975; Stanish 2003). The appearance of these trumpets during LJ-II and LJ-III makes these the earliest known trumpets, which may have subsequently diffused to the Titicaca Basin.

A number of ceramic and bone spoons were recovered from Chuquiña and Pusno, many of which are decorated or of elaborate designs (Figures 8.8 and 8.9). Included among these are

Figure 8.7. Ceramic Trumpets (*Sopladores*).

Figure 8.8. Ceramic Spoons.

Figure 8.9. Worked Bone Spoons and Beads.

several effigy spoons in images of camelids and reptiles. These factors combined with the relative rarity of these artifacts when compared to the overall ceramic and worked bone assemblages, suggest that spoons represent a ceremonial category of artifact rather than a utilitarian category. Some spoons, especially from the worked bone assemblage, are very shallow and spatula-like in form, suggesting that they would have functioned as snuff spoons rather than for consuming liquids. Others, especially some of the ceramic variety, are of fairly large size, with volumes of up to 2.5 oz.

A variety of fancy ceramics were also included in ceremonial materials. These included a very few figurine fragments and all pots that had any form of decoration, including incising, punctation, or paint. As noted in Chapter 5, decorated pottery is very uncommon throughout the Wankarani sequence, but it is most frequent in the earliest phases of occupation. This is due to the relatively high frequency of burnishing and incision in the Aboriginal Grit pottery that is most common during LJ-I.

Three ceramic plaques or stamps were recovered from Chuquiña levels corresponding to phases LJ-III and LJ-IV. One of these was clearly a stamp that had abundant paint residue stuck in its grooves (Figure 8.10). Given the rarity of embellished ceramics, this stamp was likely used to decorate hide, cloth, or skin for prominent display. The other two objects are well-fired ceramic plaques of unknown function. They include incisions and punctations in deliberate designs.

Figure 8.10. Ceramic Stamps and Plaques.

Stone sculptures were rare in the current study, but they have been encountered in considerable numbers by other investigators at Wankarani sites (McAndrews 2005; Wasson 1967). McAndrews (2005) recovered several sculptures, and has commented on some similarity between a Wankarani stone sculpture recovered in Belén and the sculptures of the Yaya-Mama Religious Tradition from the Titicaca Basin. The bas relief sculpture described by McAndrews, however, is not typical of Wankarani stone carving. Most Wankarani sculptures are effigies of camelid heads, of which there are many examples from the site of Uspa Uspa and other sites in the Belén to the east of the La Joya settlement system (Figure 8.11). Of the four sculptures recovered from Chuquiña and Pusno, three appear clearly reptilian in form while the fourth may be camelid or reptilian (Figures 8.12 and 8.13). Two of the four were encountered on the surface, and all four were encountered in contexts likely to date to LJ-III-IV. Thus, in La Joya, it appears that the tradition of stone carving may be limited to the later part of the sequence.

Figure 8.11. Wankarani Carved Stone Llama Heads in the Museum in Oruro (modified from Bermann and Estevez 1995)

Figure 8.12. Carved Sandstone Reptilian Head, Found on the Surface of Chuquiña.

Figure 8.13. Carved Sandstone Reptilian Head, Found on the Surface of Pusno.

Because each of these artifact types associated with ceremonial activity occurred in relatively small numbers, they were summed for each site and occupation phase in order to quantify the intensity of ceremonial activity at each site over time (Table 8.2). The density index was quantified in a similar manner to density indices in Chapters 5, 6, and 7. The results are shown in Figure 8.14. These density indices indicate that neither site saw higher intensity of ceremonial activity than the other for any two consecutive phases. During LJ-I and LJ-IV, Pusno appears to have been used more exclusively for ceremonial purposes than Chuquiña, which saw relatively greater ceremonial intensity during LJ-II. During LJ-III, the distinction between the two communities is not statistically significant.

There are however, more subtle distinctions in the ceremonial artifact assemblages from the two sites. For example, while ceramic trumpets appear at Chuquiña during LJ-II and become the most common ceremonial artifact type in LJ-III (Figure 8.15), trumpets are completely absent from the Pusno assemblages. Even for a rare artifact type, the complete absence of

Table 8.2. Counts of Ceremonial Artifacts Recovered from Chuquiña and Pusno.

Phase/Site	Musicals	Trumpets	Spoons	Ceramics	Stamps & Plaques	Sculptures	Total
La Joya I							
Chuquiña	0	0	0	2	0	0	2
Pusno	2	0	7	3	0	0	12
La Joya II							
Chuquiña	2	2	23	1	0	0	27
Pusno	0	0	3	0	0	0	3
La Joya III							
Chuquiña	2	16	9	2	2	0	31
Pusno	7	0	2	4	0	2	15
La Joya IV							
Chuquiña	2	2	4	0	1	1	2
Pusno	0	0	1	0	0	1	2

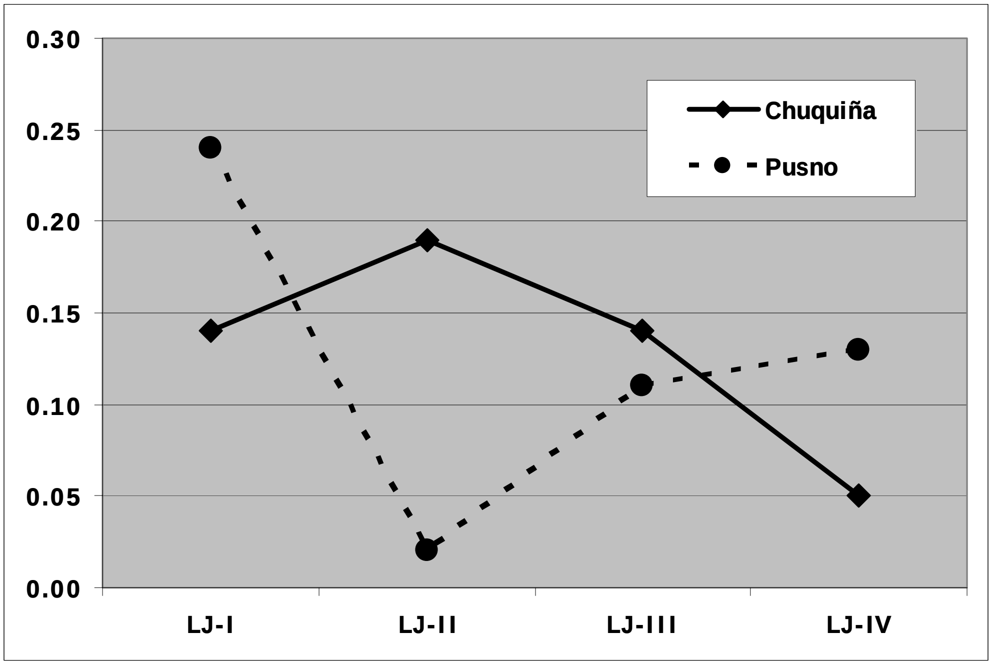

Figure 8.14. Sherd Density Indices of Ceremonial Artifacts.

Figure 8.15. Line Graph of Trumpets as a Proportion of Total Ceremonial Artifacts at Chuquiña.

trumpets from Pusno cannot easily be attributed to sampling vagaries. The far more likely explanation for their absence is that trumpets simply were not a part of ceremonial (or any other) activities at the Pusno settlement. Exactly what this difference implies about the actual content and conduct of ceremonial activities at these sites is unclear. What is clear is that while both sites saw similar, albeit varying, degrees of intensity of ceremonial activity over the course of the Formative Period, in some ways the type of ceremonial activity conducted at each was distinct. I am not aware of this kind of discrete distribution of trumpets in sites in the Titicaca Basin, where trumpets became increasingly elaborate over time as part of the evolving Yaya-Mam Religious Tradition.

8.3. Long-Distance Trade Goods

As discussed in Chapter 6, by far the most common long-distance trade good in Wankarani sites is vitreous basalt, probably traded from the known sources near Lake Poopó. Analysis of the basalt material suggests that both communities had access to the trade network that supplied basalt. Other lithic long-distance trade materials include quartzite and obsidian, which were recovered in extremely small numbers at Chuquiña and Pusno. Even when summed and converted to a density index, it is clear that these two lithic raw materials occurred in extremely small amounts (Figure 8.16). Given these very small amounts of exotic lithics, it is clear that we should not assign meaning to the differences observed between sites. More noteworthy is the marked drop in the density of these materials at both sites with the end of LJ-I. It is clear that less of this material was traded into the settlement system after LJ-I. This drop may be related to the reduced importance of projectile points as both communities shifted increasingly away from hunting and gathering wild species in favor of farming and herding.

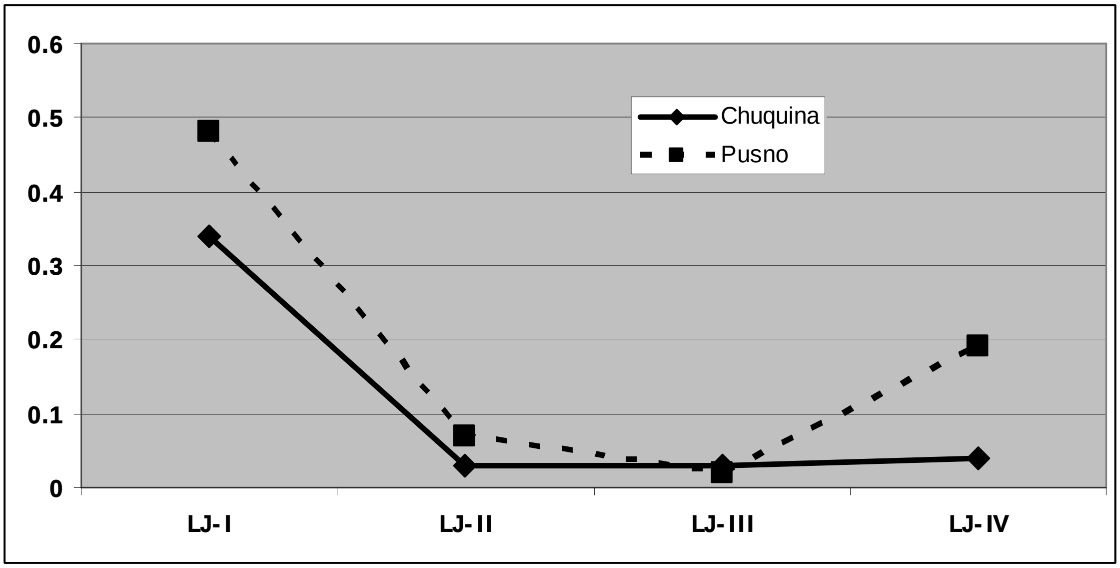

Figure 8.16. Line Graph of Sherd Density Indices of Non-Basalt Long-Distance Trade Items.

The only other category of long-distance, exotic trade good recovered from Chuquiña and Pusno is marine shell. Shells were generally encountered in very small fragments, and in many cases these it could not be absolutely ascertained that they were shells of marine, as opposed to terrestrial or riverine, mollusks. A variety of riverine and terrestrial snails can be found in the study area today, and many more varieties may have existed in the past. Lake Titicaca may also have been a rich source of fresh water mollusk shell (Dejoux 1992). As a result of the high degree of fragmentation of most of the recovered shell, only four samples could be definitively identified as marine in origin. These included one polished and perforated shell pendant from LJ-IV in Unit 3-C at Chuquiña, one fragment from LJ-II in Unit 2-F at Chuquiña, one fragment from LJ-II in Unit 2-C at Chuquiña, and one fragment from LJ-IV in Unit 1-C (Trench 2) at Pusno. These quantities are clearly much too small to be compared either between sites or across time. They can be taken as a general indication that these Wankarani communities were probably in contact with down-the-line trade networks that extended to the Pacific Coast.

8.4. Burials

One Formative Period cemetery area was encountered at each site. These were encountered in Unit 4-B at Chuquiña and Unit 2-A at Pusno. As discussed in Chapter 3, Bermann previously excavated a different cemetery area at Chuquiña. As noted in Chapter 4, recovery of human remains was not an objective of this project and so excavations in these cemetery areas were terminated after the first exposed burials had been excavated and recovered. In addition to these two Formative Period cemeteries, a single burial was excavated very near the surface and close to the top of the main mound at Pusno in Trench 2. This burial was badly disturbed, and was probably a modern or historic intrusive deposit.

8.4.1. The Chuquiña Cemetery

As discussed in Chapter 4, the deposits in Unit 4-B were the result of extreme deflation of the west side of the Chuquiña mound. Artifact densities were extremely high in the upper levels of this unit as a result of deflation of sediments. These artifacts included abundant utilitarian ceramics and extremely high proportions of camelid bones. High densities of camelid bones were documented in another cemetery at Chuquiña by Bermann (Estevez C. and Bermann 1996, 1997). Several cranial fragments and other miscellaneous human elements were recovered in this deflation zone that could not be clearly associated with any particular burial. More human bone was observed downslope of the unit, indicating that deflation of the surface eventually led to some materials eroding down hill with slope runoff. Excavated burials with Wankarani cultural affiliation are summarized in Table 8.3.

Table 8.3. Summary of Formative Period Burials Excavated at Chuquiña and Pusno.

Site	Unit	Feat / Burial #	Phase	Sex	Age
Chuquiña	4-B	1 / Ch1	LJ-IV(?)	M	Adult
Chuquiña	4-B	1 / Ch2	LJ-IV(?)	?	Infant
Chuquiña	4-B	2 / Ch3	LJ-IV(?)	M	Adult
Chuquiña	4-B	3 / Ch4	LJ-IV(?)	?	Child
Chuquiña	4-B	4 / Ch5	LJ-IV(?)	?	Infant
Chuquiña	4-B	5 / Ch6	LJ-IV(?)	M	Adult
Chuquiña	4-B	6 / -	LJ-IV(?)	?	?
Pusno	2-A	1 / P1	LJ-III	?	Adult
Pusno	2-A	2 / P2	LJ-III	?	Adult
Pusno	2-A	3 / -	LJ-III	?	?
Pusno	2-A	4 / -	LJ-III	?	?

8.4.1.1. <u>Feature 1: Burials Ch1 & Ch2</u>

Feature 1 (Figure 8.17) was a very well-preserved double burial of an extremely unusual nature. This interment included an almost complete skeleton of an adult male (Burial Ch1), face down with one leg extended and one leg flexed at the knee. The cranium was extremely deformed in typical fashion of Wankarani crania. The legs were elevated as they were lying on top of two curvilinear stone walls that may have been part of cyst burials predating Feature 1. The arms were folded in front of the chest, and subsequent excavation showed that in fact there was an infant, probably no more than six months of age, held in the fold of the arms (Burial Ch2). There was no evidence of tomb architecture, and given the very mixed nature of the sediments in this level no burial pit outline could be detected. The extremely high artifact density from deflation of the surface also makes it impossible to determine if any kind of burial offerings were included with the interment. It is clear, however, that if any offerings were included, they were of a relatively ordinary and utilitarian nature as the artifacts from this area

Figure 8.17. Burials Ch1 and Ch2 (Adult Male and Infant) in Unit 4-B at Chuquiña.

are typical of those in the site as a whole. Olla rim sherd measurements suggest that the assemblage is from LJ-IV, but the very mixed nature of the deposit from deflated levels above makes it impossible to rule out that it could be slightly earlier, perhaps LJ-III.

8.4.1.2. Feature 2: Burial Ch3

Burial Ch3 was also in the deflation zone of the upper levels of Unit 4-B (Figure 8.18). This burial was badly disturbed, but did include articulated elements. It may have been a secondary interment, though the poor context of the sediments makes it impossible to say. Based on the cranial traits, this burial appears to be an adult male. Like other burials in the deflation zone of this unit, this burial probably dates to LJ-IV.

Figure 8.18. Burial Ch3 in Unit 4-B at Chuquiña.

8.4.1.3. Feature 3: Burial Ch4

Burial Ch4 was an isolated set of articulated leg bones of a child (Figure 8.19). It is likely that the upper part of the body eroded away when the upper layers of this part of the mound deflated. Like Burials Ch1, Ch2, and Ch3, this burial likely dates to LJ-IV.

8.4.1.4. Feature 4: Burial Ch5

Burial Ch5 was an infant burial in situ, but with bones in an extremely friable state (Figure 8.20). The burial was located immediately at the base of the deflation zone at the base of Level 6 at a depth of about 30 cm. The infant was laid on the left side, with legs and knees slightly flexed. The burial pit of this interment could be discerned from the surrounding matrix. Because

Figure 8.19. Burial Ch 4 in Unit 4-B at Chuquiña.

Figure 8.20. Burial Ch5 in Unit 4-B at Chuquiña.

of the extremely friable nature of the bones, the burial was photographed, mapped, and backfilled without further excavation. Within the burial matrix and above the burial itself was an extremely high density of camelid bones, including some articulated elements.

8.4.1.5. Feature 5: Burial Ch6

Like Burial Ch5, this burial was located at the base of the deflation zone in Level 7 (Figure 8.21). Vague outlines of a burial pit could be seen in some of the surrounding matrix. This burial may have once been a stone-lined cyst burial, given its location on the inside angle of a partial curvilinear wall. If so, this stone lining must have been looted prehistorically, as this burial is beneath Features 1 & 2. The body itself was partially disturbed and the cranium was missing entirely. Based on the remains of one side of the pelvis, this appears to be an adult male.

8.4.1.6. Feature 6: Stone-Lined Cist Burial?

This feature was curvilinear stone wall enclosing a small area that probably contains a burial, but was not excavated (Figure 8.22). This would represent the only known burial of its kind from a Wankarani site. Although this tomb would represent an important discovery, it was clear that excavating it would require significant westward expansion of the excavation unit and it appeared highly likely that not one, but several additional burials would likely be encountered in and around the tomb. The cost and time requirements of this excavation could not be accommodated in the current project.

8.4.2. The Pusno Cemetery

Excavation in Unit 2-A at Pusno immediately revealed the presence of another cemetery area. Unlike that of Chuquiña, the preservation in this part of the Pusno mound was very poor and

Figure 8.21. Burial Ch5 in Unit 4-B at Chuquiña.

Figure 8.22. Feature 6 in Unit 4-B at Chuquiña.

human remains were all extremely friable and at times had become part of the soil matrix. Two burials were documented here before the unit was backfilled, but it is likely that many more interments were present. The time and budgetary needs of burial excavation simply were not a part of the current project. An interesting aspect of the excavation in this unit was that burials were capped with ollas as grave markers/offerings. It seems likely that these ollas would have contained something, either solid or liquid, that was presented as a burial offering. The soil contents of all the ollas discussed here were kept for possible future chemical and botanical analyses.

8.4.2.1. Feature 1: Burial P1

Burial P1 was a badly disturbed, possibly secondary interment of a single individual (Figure 8.23). Only the cranium, which showed evidence of deformation, and a handful of fragments were recovered. Preservation was far too poor for sex determination.

8.4.2.2. Feature 2: Burial P2

This burial was that of a poorly preserved individual of undetermined sex interred in a shallow burial pit and capped with a large, globula olla (Figures 8.24 and 8.25). The cranium showed minor deformation. This burial extended partially into the unit sidewall, but given the extremely friable nature of the bone the decision was made not to expand the excavation in order to recover the rest of the burial. Experience at Chuquiña had shown that expanding the excavation would almost certainly result in the discovery of still more nearby interments. The presence of the olla offering on top of a burial is unique among documented Wankarani burials.

Figure 8.23. Burial P1 in Unit 2-A at Pusno.

Figure 8.24. Complete Ceramic Olla atop Burial P2 in Unit 2-A at Pusno.

Figure 8.25. Burial P2 with Olla Removed in Unit 2-A at Pusno.

8.4.2.3. <u>Feature 3: Additional Burial?</u>

This feature was a semi-complete, upturned, globular olla. It is possible that a burial was present beneath this vessel, but excavation was halted before we encountered the burial (Figure 8.26).

8.4.2.4. <u>Feature 4: Additional Burial?</u>

Like Feature 3, this was a complete, globular olla, probably placed as a grave offering (Figure 8.27). However, excavation was stopped immediately after removal of the olla and before any burial was encountered. This olla was located immediately beneath Burial P1, which is the bone seen extending partially from the sidewall above the vessel.

Figure 8.26. Feature 3, a Upturned Olla Possibly Covering an Additional Burial in Unit 2- A at Pusno.

Figure 8.27. Feature 4, a Complete Olla Possibly Covering an Additional Burial in Unit 2-A at Pusno.

Other Burials at Pusno

Two intrusive burials of historic or modern vintage were documented near the top of the main mound at Pusno in Units 1-C (Trench 2) and 4-B. As can be seen in Figure 3.5, these two units are very close to each other. They are also located in some of the highest density scatters of green escoria. This suggests that the highly vitreous escoria that has been interpreted as Wankarani copper escoria at Pusno may be a product of later activities on the site.

8.5. Conclusions

A number of other special find items are inventoried in Appendix B. The largest category of these materials is worked bone of unknown function. Most of these special items occur in numbers too small for meaningful comparison, including a small handful of artifacts that might be noteworthy as wealth indicators if they occurred in larger numbers. These include some clay and stone beads as well as a small handful of copper artifacts.

In general, the analysis of special finds has reinforced some of the propositions that have already been made in the current research and in the work of others. Based on proportions of exotic lithic materials and marine shell, there appears every reason to believe that these two communities enjoyed similar access to long-distance exotic trade goods. This result is consistent with what has already been seen for basalt. There is also no convincing evidence of craft specialization, based on the distribution of tools associated with textile production. Weaving implements become extremely rare in both sites' assemblages with the transition from LJ-I to LJ-II. It remains a possibility that textile production became a specialized part of the economy of a third, as yet uninvestigated, community. This would explain the dramatic and simultaneous drop in the density of textile producing tools at Chuquiña and Pusno.

The burial practices described here are completely consistent with what we would expect in an egalitarian society – the lack of wealth differentiation among the living is also reflected among the dead. In fact, there is little to distinguish any form of status differentiation within the burials from each site, except by gender. There are, however, marked differences between how the dead were handled at the two sites. The inclusion of ollas with each interment at Pusno is a pattern that has not been seen at any other Wankarani site. There are also no children included in that cemetery, a sharp contrast with the pattern seen at Chuquiña. Of course, the sample size from Pusno is small, but in excavations of both the male and female cemeteries at Chuquiña, children were immediately identified and were encountered in considerable numbers.

In addition to these contrasts in burial practices, there appears to have been major differences in ceremonial life at the two communities. Both have evidence of ceremonial activities at similar degrees of intensity throughout the sequence, but the kinds of artifacts associated with each are quite different. Moreover, as we have already seen, these differences in artifact assemblages must be viewed in the context of different kinds of facilities at each site. While only one structure has been documented as a possible public structure at Chuquiña, one very large oval structure was atop the north mound at Pusno in addition to the raised clay platform of the main Pusno mound. Like the burial patterns discussed above, this result was not expected. The evidence suggests not that one site was more ceremonially important than the other, but that the kinds of ceremonial activities conducted at each were really quite different. And remarkably, the proposed ceremonial facilities at both of these sites differ complete from those proposed by Rose (2001) at the site of La Barca. At that site, a very large rectangular structure was the largest Wankarani construction ever documented and looked nothing like the facilities at either Chuquiña or Pusno. These differences may suggest that residents of different communities identified themselves through extremely localized ceremonial (and probably other) practices, a topic to which I return in Chapter 9.

9. CONCLUSIONS: THE LA JOYA WANKARANI SETTLEMENT SYSTEM TRAJECTORY

9.1. Research Questions

The current study was begun with several specific objectives. First, this study sought to provide the first comprehensive diachronic study of the Wankarani Complex, an endeavor that has been frustrated by the difficult nature of the sites (mounds) and the artifacts (lacking ceramic style markers) that characterize the complex. The ultimate goal has been to identify and track the trajectory of two communities within the local La Joya settlement system over the course of nearly two millennia. The analysis has illuminated the relationship between communities within the settlement system as well as relations with the broader Andean world. Specifically, I have sought to develop our understanding of the Wankarani Complex as a comparative database for the study of change and continuity in small-scale societies with reference to the following research questions.

Research Question 1. What was the nature and degree of socio-economic specialization and integration between Wankarani settlements? How did the nature and the degree of specialization and integration change over time? Was there a trend in the trajectory of these patterns of inter-community relations?

Research Question 2. Is there evidence of substantial economic inequality within or between Wankarani settlements? Is the development and presence of economic specialization and inter-community integration associated with evidence of economic inequality?

Research Question 3. To what degree was this Wankarani settlement system socially and economically centralized? Was one community functionally dominant, acting as a centralized location for a greater range of functional activities? If such centralization occurred, did it apply to the full range of social and economic activities (e.g., exchange, ritual, craft production, etc.) or only certain spheres? In terms of both timing and trend, was there a correspondence between socio-economic centralization, specialization, and inequality?

9.2. La Joya I: (~1700? BC – 1325 BC)

9.2.1. Socio-Economic Specialization and Integration in LJ-I

This study has demonstrated that the Chuquiña and Pusno communities pursued different subsistence practices during LJ-I, a contrast that remained in place throughout the sequence. While both communities exploited a subsistence strategy that blended agropastoral and available wild resources, the lithic and faunal assemblages from Chuquiña and Pusno illustrate that each pursued a different mix. From the LJ-I Phase, agriculture was a more important component of the subsistence system at Chuquiña than at Punso, based on proportions of bifacial hoes (43% vs. 29%, respectively) in the lithic assemblages. Groundstone artifacts on the other hand, provide a relative index of reliance on wild plant species. Beginning in LJ-I, Pusno has a much greater density of these artifacts, illustrating that the residents there were more intensively exploiting wild plant resources. Thus, it is clear that plant cultivation was important at both communities, but was practiced at somewhat higher intensity at Chuquiña than at Pusno.

With regard to animal exploitation, domesticated camelids played a critical role in both communities from the early LJ-I Phase, when camelid elements represent just under 40% of the identified specimens from each site. The remaining ~60% at both sites is composed of wild birds and small terrestrial species. However, proportions of camelid elements indicate that during LJ-I, the community at Pusno enjoyed greater access to higher utility parts of camelid carcasses (the trunk elements). Two out of four excavations dating to LJ-I at Pusno also had fish bone in them, while no evidence of fish was recovered from the two test units dating to the period at Chuquiña.

The evidence of specialized production at the inter-site level is not convincing for LJ-I. Forms of production in which we might expect to see incipient specialization in the Andes are stone tool production, ceramic production, and textile production. During LJ-I, there is no evidence of true craft specialization in any of these activities. Lithic materials from both sites show evidence of similar stages of lithic reduction. A hearth feature at Pusno may represent a ceramic manufactory during LJ-I, but this facility was clearly for small-scale production of the household sort, not specialized large-scale production for trade. And the density indices of artifacts associated with textile production are also similar at both sites. As discussed in Chapter 4, the investigations at Pusno raise serious doubts about the cultural association of slag thought to be the remains of copper smelting at Wankarani sites.

Taken together, these data illustrate a key point of interest; during LJ-I, the Chuquiña and Pusno communities exhibit marked differences in the realm of domestic economy, but there is no convincing evidence of craft specialization for trade during this period. Contrasts in subsistence practices thus provide the best evidence of an early form of inter-community integration in the La Joya settlement system.

Subsistence differences between Chuquiña and Pusno may be explained by the rather different local environments of the two communities, discussed in Chapter 3. Based on economic principles of optimal foraging and optimal farming, it is likely that each community emphasized the resources most easily available to its members in the local catchment. This resulted in one community emphasizing a relatively high reliance on agricultural and riverine products (Chuquiña) while the other relied more heavily on wild terrestrial plant species and perhaps camelid herding (Pusno). If this subsistence specialization resulted in similar differential patterns of consumption at the two communities, then it suggests that subsistence goods exchange played no role in economically integrating the LJ-I communities.

However, I would argue that it is likely that subsistence goods were exchanged between these communities, and possibly to a very significant degree. The best evidence of consumption at the two communities comes from camelid remains, which represent similar percentage of NISP from each (ca. 40%). Given that evidence of subsistence production is so different at the two sites, we would not expect consumption evidence to be so similar unless significant intensity of exchange were occurring, allowing both communities similar levels of access to the full range of subsistence products. Differing proportions of camelid packets during some phases also demonstrates that meat was being exchanged, probably between Wankarani communities as well as via long-distance trade networks. This degree of exchange implies that the La Joya settlement system was reasonably well-integrated for the purposes of trade during the LJ-I, but this integration did not extend much beyond subsistence goods into the realm of a true political economy. The relationship between the two sites appears to have been one of ecological and subsistence complementarity, where each was able to optimize production of its local resource base as a result of being integrated into exchange networks that extended into other zones.

This complementarity between Chuquiña and Pusno occurred at the very local level, but both communities benefitted by being plugged into complementary communities in much more distant regions.

In addition to local subsistence specialization, LJ-I communities enjoyed considerable access to long-distance trade goods in the form of fine-grained basalt as well as smaller amounts of obsidian and marine shell. Both the obsidian and shell could have found itself to Wankarani communities via indirect down-the-line trade. The most likely source of basalt, on the other hand, is the quarry at Querimita on the southwest shore of Lake Poopó some 200 km from La Joya. This lithic material was imported in flat, prepared 'blanks', principally for production of bifacial hoes (Aoyama 1995 cited in McAndrews 2005:31). The existence of this long-distance trade network implies that Wankarani communities produced surpluses, probably of subsistence products, for external trade.

9.2.2. Socio-Economic Inequality in LJ-I

One means by which early village communities may be integrated into local and regional networks of trade and interaction is through socio-political leadership. However, there is no evidence of significant socio-economic inequality between communities during LJ-I. The evidence from domestic structures from this period at Chuquiña is very limited, but in general these architectural features appear typical of what is seen at Pusno and other Wankarani sites. Relatively simple, small round structures of adobe are the norm. This pattern is also seen in the artifact assemblages.

Neither community had significant proportions of labor-intensive goods during LJ-I. The most abundant product that could fit this category is the polished and often incised Aboriginal Grit ware pottery associated with the phase, which occurs in similar proportions at both sites. The limited evidence of consumption from faunal remains indicates that the residents of Pusno consumed greater amounts of choice camelid parts compared to their contemporaries at Chuquiña. The differences are not very dramatic, but they do represent a difference in how camelids were consumed. Rather than being an indication of wealth, this is probably an indicator of one community trading select parts of camelids. High-value exotic goods were not encountered in significantly higher proportions at either community. Moreover, the vast majority of exotic materials were basalt for production of utilitarian tools, not sumptuary or prestige goods. At this point, no burials can be reliably dated to LJ-I, but no Wankarani burials from this study or any other have suggested significant degrees of status or wealth differentiation.

In short, if nascent or established leaders existed in these LJ-I communities, they were unable to control the surplus production and labor and trade networks that could have taken their leadership to the supra-local (beyond their own very small communities) level. Indeed, there is little evidence of wealth or social inequality either within or between communities.

9.2.3. Centralization and Community Function in LJ-I

During LJ-I, the Chuquiña and Pusno communities appear to have been of approximately equal size (ca. 0.4-0.5 ha). Based on McAndrews' population estimates (see Population Estimate 'B' in McAndrews 2005:59, also see my discussion in Chapters 3 and 4), this size suggests very nucleated communities of perhaps 20-30 persons each. Both sites have similar densities of architectural features as well, suggesting that the degree of nucleation at each was probably similar. There is no evidence that one site or the other served as a residential central place in the settlement system. Each community appears to have exhibited a similar range of domestic functions.

Like population, community functions also appear to be decentralized during LJ-I. This has already been noted in the discussion of craft production, but it can also be seen in proportions of artifacts associated with ceremonialism. While rare in the assemblages overall, both sites produced remarkably similar proportions of these artifact types. Proportions of bowls in the ceramic assemblages also show that serving, which can be an archaeological correlate of ceremonial feasting, occurred equally at both communities. Taken together, the evidence of population and community functions do not support the model of Chuquiña and Pusno as a 'parent' and a 'daughter' community, respectively. Rather, the two appear more like 'peer' coomunities that were integrated solely on the basis of subsistence complementarity and exchange of subsistence products.

9.3. La Joya II (1325 BC – 1100 BC)

9.3.1. Socio-Economic Specialization and Integration in LJ-II

As in LJ-I, the LJ-II Phase was characterized by a continuation of the complementary subsistence relationships seen in LJ-I. However, there is evidence of considerable shifts in subsistence strategies at both communities, which probably reflect shifts in the settlement system overall. One trend that is evident at both communities is a shift toward greater intensity of agricultural production, as reflected in proportions of agricultural tools. This change, however, is much more dramatic at Chuquiña than at Pusno. In the former, bifacial lithic hoes represent the overwhelming majority of chipped-stone tools, while projectile points continue to be an important lithic category at the latter.

Groundstone tool densities also illustrate the relatively greater emphasis on wild plant resources at Pusno. It also appears that the Pusno community began consuming much larger proportions of camelids, as indicated by the very high density of remains both as proportions of the faunal assemblage and the total assemblage. It is clear that a major shift in consumption patterns occurred at Pusno in LJ-II. I will return to this point below. Other than the increased intensity of agricultural production, subsistence practices at the site appear fairly consistent with LJ-I. The proportions of camelids vs. wild riverine and terrestrial fauna remained relatively unchanged, though there is increased evidence of fish remains at Chuquiña.

As in LJ-I, there is no evidence of specialized craft production of lithic, ceramic, or textile artifacts at either site. It is likely that craft were produces in a very decentralized way at the community or even household level. In sum, inter-community complementarities documented in LJ-I appear to have intensified during LJ-II. Residents of these communities were now practicing increasingly divergent subsistence practices, suggesting that exchange of subsistence products had probably intensified.

Faunal evidence shows that while the Pusno community may have been consuming more camelid meat than Chuquiña (and even more camelid meat than LJ-I), the differences in access to high utility parts at the two communities actually decreased slightly during LJ-II. Thus, if Pusno was a community that specialized in camelid herding during this period, there is evidence that the residents were trading more choice parts of their animals than they had before. It is possible that these choice parts were leaving the settlement system by entering the long-distance trade networks.

9.3.2. Socio-Economic Inequality in LJ-II

As in LJ-I, there is no convincing evidence of marked socio-economic inequalities in the La Joya settlement system. Both communities continued to enjoy equal access to trade networks, and there is no concentration of prestige goods at either community. In fact, LJ-II assemblages (which lack the polished Aboriginal Grit ware pottery of LJ-I) contain very few artifacts with which to discern economic or social inequality of any kind.

9.3.3. Centralization and Community Function in LJ-II

LJ-II appears to have been a time of significant growth in the Chuquiña community. Based on test units with evidence from this phase, the community probably doubled from previous LJ-I to nearly 1 ha. Meanwhile, the Pusno community seems to have contracted slightly, dropping to barely more than 0.4 ha. Population estimates for these communities are thus about 45-55 and 20-30, respectively. In addition, the density of architectural features from LJ-I remained stable at Chuquiña but dropped considerably at Pusno. The Chuquiña community population may have grown at the expense of settlements like Pusno, a process of centralization that continued after LJ-II.

Along with growth in population, there is limited evidence to suggest that the Chuquiña community had also begun to take a functional priority over the Pusno community. The density of ceremonial artifacts increased at Chuquiña during this time, while decreasing at Pusno. Included among the ceremonial artifacts from Chuquiña are several musical instruments, as well as the ceramic tubes known as trumpets. Formal ceramic analysis also shows that while the Chuquiña community's proportions of serving vessels remained stable from LJ-I, Pusno's dropped precipitously.

Finally, during LJ-II the function of Pusno's central mound appears to have changed. Beginning in LJ-II, a platform with prepared clay surface was constructed near the center of the site. The platform was subsequently resurfaced numerous times, with alternating layers of red and green clays brought in from off site. Incorporated into these floors are extremely high densities of camelid bones, which account for the high density of camelid remains from Pusno as whole during this period. This platform and the associated camelid remains incorporated into it may represent a special function form of feasting that occurred in conjunction with construction of the mound. However, this feasting did not result in high frequencies of serving dishes at Pusno; those artifacts are more common at Chuquiña during LJ-II.

The construction of the platforms at the Pusno mound is the first unambiguous evidence of community labor mobilization and hence, emergent political economy. What is most surprising about this pattern is that this public construction took place at a community that was contracting in size and not at the growing village of Chuquiña, where we would be more likely to expect the emergence of public ceremonial space.

9.4. La Joya III (1100 – 800 BC)

9.4.1. Socio-Economic Specialization and Integration in LJ-III

The pattern of subsistence complementarity seen in LJ-I and LJ-II continued to intensify during LJ-III. While proportions of agricultural tools increased by about 4-5% at both sites, the Chuquiña community remained much more agriculturally-oriented than the Pusno community where relatively high proportions of projectile points and groundstone point to the continued importance of wild plants and animals at that site. In terms of faunal consumption, the patterns at Chuquiña remain relatively unchanged from LJ-II; camelids represent almost 35% of NISP with small terrestrial and riverine fauna and fish making up the remaining contribution. At Pusno, by contrast, there is a dramatic increase in the proportion of camelids in the assemblage – over 95%. This high proportion of camelid remains is again associated with the central mound portion of the site, where high densities of camelid remains were incorporated into construction materials.

As in previous phases, LJ-III specialization among communities appears to have been completely focused on surplus production of subsistence goods for exchange with neighboring settlements and with groups from neighboring regions. Communities continued to produce their own craft goods, such as ceramics and textiles, at the local level.

9.4.2. Socio-Economic Inequality in LJ-III

As in LJ-I & II, the only evidence of socio-economic inequality between sites comes from faunal consumption patterns. During LJ-III, the proportion of high utility camelid parts in the Pusno assemblage drops below that of Chuquiña for the first time. While the difference between the two communities is not dramatic, the change at Pusno from LJ-I & LJ-II to LJ-III is more than a 30% decrease in high utility parts consumed. This is a dramatic change that may be a result of the Pusno community trading larger amounts of its high utility parts to other communities and other regions. If true, then the decreased in choice part consumption may not reflect a straightforward measure of economic status, but rather is directly related to the subsistence goods exchange system. The excavation of a section of a public cemetery dating to LJ-III at Pusno revealed two adult skeletons in poor preservation. The very plain, communal nature of the graves and the simple offerings of one utilitarian olla with each burial lends further support to the notion of basically egalitarian social organization of Wankarani communities in LJ-III.

9.4.3. Centralization and Community Function in LJ-III

The LJ-III Phase saw the continuation of population trends seen in LJ-II; the Chuquiña community grew to its largest extent (ca. 1.4 ha), while the Pusno community continued to contract (<0.25 ha). Population estimates put these communities at about 70-90 and 5-10 persons, respectively. Thus, there is every reason to suspect that the growth of the Chuquiña community came at the expense of surrounding settlements like Pusno. Architectural density at Pusno continued to be very low during LJ-III, further reinforcing the inference of the very small size of the permanent residential group. Finally, the proportion of serving vessels at Pusno drops again in LJ-III, suggesting a ceramic assemblage overwhelmingly devoted to storage and transportation, with relatively little serving.

Once again, ceremonial evidence points to some continued functional differentiation between these communities. Densities of particular ceremonial artifacts continue to be higher at Chuquiña, especially trumpets and musical instruments, which are extremely rare at Pusno. The central mound at Pusno appears to have continued to serve some special function, perhaps as a gathering place and/or a place for llama feasts. During LJ-III, the platform of the central mound was again resurfaced with colored clay that incorporated enormous amounts of camelid bone and groundstone tools. The single structure visible on the surface to the north of the central mound is among the largest Wankarani structures yet documented. Based on subsurface materials, the structure may date to this period and may represent either a public/ceremonial structure or a corral.

9.5.La Joya IV (800 – 500(?) BC)

9.5.1. Socio-Economic Specialization and Integration in LJ-IV

The patterns of subsistence complementarity seen in previous phases continued in LJ-IV. Agricultural intensity increased at both communities, though to a far greater degree at Chuquiña, where bifacial hoes represent over 98% of the formal lithic tools recovered. Diminishing proportions of projectiles and groundstone tools suggest the decreasing importance of wild resources to the community at Pusno, though these remained relatively important in comparison with Chuquiña.

As in LJ-III, camelids represent more than 95% of the NISP from Pusno. There is a dramatic shift in the faunal component from Chuquiña, where the proportion of camelid NISP jumps from barely 35% in LJ-III to more than 85% in LJ-IV. Clearly, the subsistence strategy of both communities made camelids a central component of the diet.

9.5.2. Socio-Economic Inequality in LJ-IV

During LJ-IV, there is no convincing evidence of socio-economic ranking or inequality between these communities. The proportions of high- and low-utility camelid parts shift slightly in this phase, but there are no dramatic differences between communities or in comparison to LJ-III. Both communities continued to enjoy access to long-distance trade goods in the form of primarily fine-grained basalt. The excavation of two public cemeteries at Chuquiña, both of which contained simple burials with few or only simple offerings and that were organized solely on the basis of gender and age further supports the contention that there was no significant socio-economic differentiation in Wankarani society.

9.5.3. Centralization and Community Function in LJ-IV

During LJ-IV, the Pusno community appears to have shrunk to its smallest extent – barely 0.13 ha. The Chuquiña community, meanwhile, appears to have stayed about the same size or contracted slightly to ca. 1.25 ha with a population estimate of perhaps 60-70 persons. At this point, the Pusno 'community' consisted only of the central mound – a platform-like construction that has no evidence of domestic occupation at all. It is possible that there was no permanent residential population of the site at all. Only about 20-30 cm of deposits on the central mound appear to be associated with this period. As noted in LJ-II and LJ-III, the materials from this central mound area are overwhelmingly dominated by camelid bone and groundstone artifacts – the majority of subsistence information available from Pusno in LJ-IV. The almost complete absence of serving vessels from the site in this period is further evidence that Pusno had become a special-purpose location, and perhaps should not be thought of as a community in the true sense at all.

9.6. Summarizing the Wankarani Trajectory

The evidence from Chuquiña and Pusno tracks the trajectory of domestic and political economy in the La Joya settlement system over the course of more than 1000 years. In terms of domestic economy, this trajectory is one of a mixed agropastoral subsistence system organized primarily at the local and household levels. The exact configuration of the agropastoral strategy pursued by Wankarani people clearly varied both in space and time, with considerable flexibility not only in the agropastoral mix, but also in the use of wild resources like fish, waterfowl, and terrestrial game and plants.

It is clear that virtually from their inception, Wankarani households and communities exploited somewhat different resource zones, producing relatively specialized sets of subsistence products. Moreover, these were produced in surpluses sufficient for exchange in both inter-community and long-distance trade networks. This complementarity and interaction implies a form of economic interdependence that integrated Wankarani communities, undermining the notion that communities and households were fully self-sufficient units. Exchange networks at the regional scale would have been facilitated by mating and kinship networks with deep histories, as well as by the shared religious and ceremonial traditions represented in Wankarani iconography.

These exchange networks could have formed the basis of a nascent form of political economy (*sensu* Johnson and Earle 2000) – a level of exchange and interaction at scales extending well beyond the simple reciprocity and sharing at the household level (Hegmon 1991). However, these exchange networks do not appear to have intensified over time, and never appear to have incorporated craft specialty items and prestige goods. In other words, the presence of an integrative exchange network did not lead to growth of the political economy as is often predicted by cultural evolutionary theory. For example, there does not appear to be a significant increase in the overall proportion of exotic materials imported to these sites, nor is there a growing emphasis on exotic goods that can serve as 'prestige' items. In addition, communities appear to have remained self-sufficient in terms of craft produced items, which never appear to have entered the trade networks in significant portions.

While this study has documented a considerable degree of economic integration in the form of trade and interaction at the regional and long-distance scales, there appears to be no evidence during any phase of the Wankarani sequence of significant socio-economic or socio-political inequality. Evidence from cemeteries, domestic structures, and artifact assemblages all suggest that households and communities interacted on a more or less equal footing.

The ceremonial evidence emerging from studies of the Wankarani Complex have begun to show some particularly surprising patterns. McAndrews, for example, documented the abundance of stone llama head carvings associated with Wankarani sites in the Belén area to the east of La Joya. Those kinds of carvings are relatively rare in La Joya sites, but the few recovered by this project were not of camelid heads but of reptile heads. So there is evidence of a shared tradition of stone carving, but with differing symbols used in effigies. In addition, the ceremonial facilities discussed at the sites of La Barca, Chuquiña, and Pusno differ markedly from each other. The analysis presented in Chapter 8 further shows that the ceremonial artifact assemblages from Chuquiña and Pusno also vary to a marked degree. This diversity in the archaeology of ceremonialism of the Wankarani Complex sets the Formative Period southern *altiplano* apart from the Lake Titicaca Basin, where a regional religious tradition known as the Yaya-Mama Religious Tradition introduced a suite of relatively standardized artifacts and architectural elements that are found in large number of sites across the region.

Finally, there does appear to have been a process of population nucleation at work within the Wankarani settlement system. However, rather than simply being a process of one community assuming greater centralization of functions, in this case it seems that the Chuquiña community actually began to emerge as a demographic center, perhaps drawing population in from what were to become peripheral communities like Pusno. During LJ-II and LJ-III, the community at Pusno shrunk to such an extent that by LJ-IV the mound is more easily interpreted as a special purpose logistic and ceremonial site that supported only a very modest permanent residential population. The Pusno mound does appear to have been an important place in the settlement system, possibly used as a herding stand and ceremonial location by residential groups at Chuquiña and other villages. The Pusno mound may have had a small permanent residential occupation or it may have only been seasonally occupied when pasturage was in highest demand. Based on the overall trajectory of ever-greater agricultural intensity, the process of nucleation at Chuquiña may well have come in response to the appeal of arable farmland in proximity to the Río Desaguadero. But given the very nucleated settlement pattern at the site, we must also infer that the place held some high degree of social importance as well, which lured people to live in close quarters despite the abundance of surrounding territory available. This process of nucleation appears to have occurred in the absence of any form of political centralization, which archaeologists often predict to occurr in the emergence of central place settlements.

It is unclear why this process of nucleation ended, but it was interrupted at some time after about 400 BC. As noted previously, the lack of radiocarbon samples from Wankarani sites dating later than ca. 500 BC may in fact indicate that parts of the southern *altiplano* were depopulated during this time. Later settlement of Jachakala Period sites shifts away from earlier Wankarani locales. This depopulation may be a result of emigration to the Titicaca Basin, where marked population growth has been documented during the Late Formative.

9.7. Explaining the Persistence of the Wankarani Complex

The La Joya Wankarani trajectory represents a long-lived village scale society that never gave rise to chiefly or state-level organization. This is despite the presence of many components that archaeologists often view as central to a nascent political economy – long-distance trade, a sustained trade in subsistence goods, an apparently sedentary lifeway, etc. Despite these factors, the political economy in these early village communities did not evolve and grow to any significant degree. The relative stasis of the political economy is contrasted by the considerable flexibility and dynamism of the agropastoral domestic economy. I have argued that in order to understand how prehistoric political economies grew, eventually leading to chiefly and state-level societies, archaeologists must also pay more attention to those cases where political economy 'failed' to grow.

How can such persistence be explained? Certainly the Wankarani example lacks some of the usual factors that are thought to drive the evolution of complex societies. The most basic such factor is population growth. Especially following the introduction of productive agricultural strategies, archaeologists have argued that population growth fuels resource imbalances, intra- and inter-community conflict, and the demand for greater degrees of labor organization and leadership (Carneiro 1998; Sanders and Webster 1978; Wright 1986). Bandy (2006) has argued that the introduction of agriculture in the Titicaca Basin resulted in a 'Neolithic Demographic Transition', a rapid phase of population growth fueled by sedentism and food surpluses.

At present data from the Wankarani Complex provide only crude demographic estimates of population size change over time. The current evidence from La Joya, however, suggests that there was only very limited population growth on the southern *altiplano* over the course of the Formative Period. This pattern does not square well with many current views of researchers interested in early agricultural societies, where the notion of a Neolithic demographic transition has received increased attention in recent years (add refs). How then, can this lack of local population growth be explained? Two possible explanations present themselves in the La Joya case.

First, it is possible that La Joya communities did in fact experience the 'NDT' and that this population growth resulted in the fission-growth settlement model proposed by Bandy (2004) and others (McAndrews 2005). However, given the lack of convincing evidence for parent and daughter communities in the La Joya area, to posit significant population growth requires the further supposition of significant emigration from the La Joya study area. While this is certainly possible, we are not currently in a position to evaluate this emigration hypothesis. Emigration of this sort could be detected in at least two different ways. A regional study at a larger scale that included the area to which people were emigrating would be one means. A more economical study might be conducted by investigating the demographic age profiles in Wankarani cemeteries, which are abundant were easy to identify in Pusno and Chuquiña.

The second possibility, which I regard as more likely, is that La Joya Wankarani communities in fact only experienced a very slight trend in population growth. In this scenario, we must posit that some of the changes thought to coincide with the emergence of an agricultural lifeway must have been muted or did not occur at all. These changes include the accumulation of food surpluses leading to reduced mortality and increased fertility. Further increases in fertility also result from the relaxation of birth spacing and early weaning of infants in sedentary conditions. These changes are in turn encouraged by increased demand for agricultural labor at the household level.

In either case, the absence of population growth likely would inhibit the ability of aspiring leaders to accumulate social and economic influence. What factors might have inhibited population growth in Wankarani communities? The answer may lie in the nature of the agropastoral subsistence system. Agropastoral peoples, more than many so-called 'neolithic' societies, are sometimes not easily characterized by a simple dichotomy between residential mobility and sedentism. A form of seasonal transhumance, where settlement is stable during some parts of the year but more ephemeral in others, might inhibit some of the processes that lead to increased fertility and decreased mortality in many neolithic populations.

Archaeologists have long suggested the conservative nature of Wankarani social organization might be due to the extremely arid and high risk environment of the southern *altiplano*. A good deal of climatological data supports this view of the southern *altiplano*. In general, the southern *altiplano* is a region of relatively low primary productivity and high risk of drought and frost. To date however, no comparative and systematic study of productivity and risk assessment for human subsistence systems in varying Andean environments has yet been conducted. It is a truism that the Lake Titicaca Basin, for example, has higher levels of rainfall in addition to the resource base associated with the lake itself. What is not clear is whether those factors were central in driving population growth and political economies during the Formative Period.

If environmental factors limited population growth among Wankarani settlements, then it is likely that productivity of the agropastoral system was not to blame. Historic and ethnohistoric evidence supports the view that agropastoral strategies are quite productive on the *altiplano*. The high risk of the environment, however, may have played a greater role, by encouraging a flexible degree of seasonal residential transhumance. Under such conditions, even in the face of food surpluses, population growth could be inhibited as a result of incomplete sedentarization. A high degree of transhumance during bad years would encourage the maintenance of birth spacing of longer intervals. That same mobility could have preserved individual families' abilities to 'vote with their feet,' a powerful check against the activities of aggrandizers or 'Type AAA' personalities who seek to accumulate wealth and social power that can be lorded over their sedentary neighbors.

The evidence of ceremonialism and mortuary practices discussed here suggests that residents of Wankarani communities may have identified themselves with very local, even community-specific, cultural practices. While Wankarani communities must have shared a great deal in common in terms of subsistence and economy, perhaps even worldview, we are struck by the extent to which ceremonial behavior is reflected in site-specific ways in the archaeological record. The structures, facilities, artifacts, and even the symbolism of ceremonial behavior appear to vary considerably from one site to another. This suggests the absence of a uniform regional religious tradition that could have acted as an integrative mechanism as envisioned by Stanish (2003) and Bandy (2004).

9.8. Directions for Future Research

The current investigation points toward several directions of future research that could fruitfully build upon this project. I have argued that the peculiarly long-lived nature of the Wankarani Complex is likely rooted in two key phenomena: the high risk environment of the southern *altiplano* and the highly flexible agropastoral subsistence system that could have preserved levels of residential mobility. This flexibility in residential mobility, in turn, could have inhibited the most dramatic population growth that some associate with a typical neolithic sequence while also preserving the ability of individuals and households to 'vote with their feet.' While various approaches to Andean pastoralism and agropastoralism have been studied in the past, the topic has received relatively little attention on the southern *altiplano*. Future research into the agropastoralism of the southern *altiplano* must focus on issues of settlement patterns, mobility, resource structure and use, in tandem with the study of environmental and ecological data. All of these variables are ones that create the conditions within which social organization takes form.

The southern *altiplano*, and the La Joya area in particular, may represent a rare opportunity to study evolution of agropastoral systems in the very long-term. There is some evidence to suggest that sites like Chuquiña may contain Archaic Period components. This is noteworthy not only because virtually nothing is known about the Archaic Period on the southern *altiplano*, but also because Archaic Period components in Wankarani sites would suggest continuity in settlement organization between the Archaic and Formative. Such continuity in settlement would be striking, considering that the Formative Period marked the beginning of sedentary agricultural lifeways on the *altiplano*, a transition that is often thought to produce major changes in virtually all aspects of people's social and economic lives. The Archaic Period in La Joya offers the opportunity to study the transition from early herding lifeways and the origin of the agropastoral lifeway.

Another useful comparative perspective could be gained by studying the later agropastoral peoples of the southern *altiplano*. McAndrews has documented a number of sites from later time periods, and subsequent survey is likely to reveal more such sites in other areas of Oruro. The Jachakala Complex has only been identified recently (Beaule 2002; Bermann and Estevez C. 1993; McAndrews 1998), and represents a group of settlements contemporary with the Tiwanaku State of the Titicaca Basin. These communities may represent continuation of settlement from the Formative Wankarani Complex, or they may have taken root after a brief abandonment of at least some areas.

Perhaps more important for understanding the nature of the agropastoral economy are the many Late Intermediate Period sites in the region. These are particularly promising for comparison with the Wankarani Complex because during the Late Intermediate the southern *altiplano* was settled by agropastoral groups of the historically-known Aymara people. In Oruro, the artifacts from these sites show that there was a close affiliation with the Aymara señorios of the Lake Titicaca Basin. While ethohistoric sources suggest that these were political centralized 'kingdoms' at the state scale of organization, the archaeological record suggests levels of organization more along the scale of chiefdom organization even for the largest señorios like the Lupaqa and Colla (Stanish 2003:235). McAndrews notes that these Late Intermediate Period sites exhibit a dramatically different settlement pattern than that seen during the Formative, with the majority of Late Intermediate sites being individual farmsteads and farmstead groups dispersed across the landscape. This is despite the fact that the Late Intermediate was time of internecine warfare and raiding prior to the Inka expansion to the Lake Titicaca Basin in the late 15th century (D'Altroy and Earle 1985:63; Stanish 2003:237).

In short, there is a great deal of variation over time in the social organization, settlement, and subsistence strategies of this sequence of agropastoral societies on the southern *altiplano*. Such variability within one geographically constrained area has great promise for furthering the development of models for early Andean pastoral and agropastoral societies. If the high risk environment and agropastoral adaptation of the Formative Period southern *altiplano* was a factor in the apparently conservative nature of the Wankarani Complex, then the study of the Jachakala and Late Intermediate Periods may hold the key to how these ecological constraints were eventually overcome.

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