Population and History in the Ancient Titicaca Basin

by

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Abstract

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Our understanding of the processes leading to the emergence of the Tiwanaku state around 500 A.D. has been severely hampered by a lack of information on the long Formative Period (1500 B.C. - 500 A.D.) which preceded it. This thesis develops an agent-centered approach to studying prehistoric settlement system formation and transformation. It is argued that any adequate understanding of settlement dynamics must consider varying settlement growth rates as resulting from the concrete and historically contingent residential decisions of a regional population. Thus, regional settlement dynamics can be read in such a way as to reveal broad, aggregate patterns of prehistoric decision-making. Agency may be studied in the absence of a well-defined agent.

This approach is then applied to the problem of the southern Titicaca Basin Formative Period. The evolution of the regional settlement system is traced from the establishment of sedentary agricultural villages (1500 B.C.) through the early Colonial Period (1600 A.D.). Significant milestones include: 1) the evolution of a system of permanent autonomous villages (beginning 800 B.C.), 2) the development of a multi-community polity, which I term the Taraco Peninsula Polity (250 B.C.), 3) Tiwanaku regional dominance and eventual state formation (beginning perhaps around 400 A.D.), 4) Tiwanaku collapse (1100 A.D.), and 5) conquest by foreign powers (ca. 1450 A.D.). These developments are interpreted in light of the decision-making patterns revealed by settlement dynamics, as well as significant changes in regional exchange systems, political relations, subsistence regimes, and the level of Lake Titicaca. A new account of Tiwanaku state formation is finally presented, one which stresses cross-cultural processes as they were played out against the field of Titicaca Basin environmental, economic, and demographic history.

Professor Christine A. Hastorf
Dissertation Committee Chair

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Chapter 1

Introduction: states, chiefdoms, and social evolution

The state is surely one of the great ciphers of intellectual history. Speculation as to its origins, function and legitimacy has most likely taken place in every place and every age in which human beings found themselves 'caged' (Mann 1986) within these peculiar and bewildering social formations. Within the conventional genealogy of Western intellectualism, abstract thinking about the state dates at least as far back as Aristotle (Weissleder 1978) and can be traced through both the Christian and Islamic worlds to the present day (Service 1975 Chapter 1, Service 1978). Anthropological theories of the state and its origins, however, may be traced to the writings of "a group of speculative lawyers" (Kuper 1988: 8) in the second half of the nineteenth century. First among these, chronologically, was Henry Maine whose *Ancient Society* was published in 1861.[1] This book was soon joined by the works of Bachofen, McLennan, Tylor, Morgan, Lubbock and others. As a body, these works directly inspired the discipline of anthropology, primarily through the methodology of kinship analysis, and contributed significantly - through the later writings of Durkheim - to sociology as well. On a crude level, the theories of all these authors had in common:

[1] This discussion is in large part based on Kuper's excellent treatment of nineteenth-century evolutionism (Kuper 1988).

1. a distinction between 'primitive' (Morgan's 'societas') and 'civil' (Morgan's 'civitas') societies, the former based on kinship (blood), the latter on contract (soil),

2. the notion that 'civil' society had in some manner developed from 'primitive' society, and

3. the conviction that contemporary 'primitive' societies represented various stages in this evolutionary chain.

Primitive society thus became the privileged object of anthropological inquiry.

If this specific formulation of primitive society was to have a long and checkered history, the prospects for evolutionism itself seemed much less certain. By the turn of the century, the Boasian critique had essentially rendered evolutionism a dead issue in America. It lingered several decades longer in Britain, finally to be put to the sword by Malinowski. Social evolutionism would have remained a curiosity of anthropological history, then, had it not been for a revivalist movement in the United States in the 1940s and 50s led by Leslie White and Julian Steward. Social evolution in archaeology is generally considered to have stemmed from the work of these two authors, and from that of Elman Service, a student both of White and of Steward. This being the case, I consider it worth exploring in some detail the roots of their thought and the meaning they attributed to the term 'evolution.'

1.1 White's 'neo-Lamarckism'

Many archaeologists seem to be laboring under the significant misapprehension that the evolution of Steward, White, and Service derived from Darwinism. Thus, Price, for example, writes:

> What may generally be called adaptive models have had considerable impact throughout American anthropology, at least since the work of White and Steward. Such models are derived ultimately from the paradigm of Darwinian evolution; they are based upon the observed occurrence of random variation, the differential survival of which is non-random, governed by the principles of adaptation and selection (Price 1978: 162).

Leaving aside the fact that no ‘principle of adaptation,’ of equal standing with that of natural selection, may be located in the writings of Darwin, it must be objected that this description of social evolutionism has little to do with what White actually wrote. In fact, White has little to do with Darwin at all. His theory rather represents a curious *pastiche* incorporating elements of Morgan (and the nineteenth century evolutionists in general), Marx and Herbert Spencer.

As a rough approximation of the influence of various writers on White, we may take the number of pages in his *The Evolution of Culture* (White 1959) on which each author’s name is mentioned. We see, then, that Darwin’s name is mentioned on seven pages of the 370-page book (and these references have primarily to do with his views on ‘primitive promiscuity’), while Morgan and Tylor merit fifteen pages apiece. Moreover, the term “natural selection” receives not a single mention in the entire volume.[2]

That White in no way conceived of his thought as related to Darwinism is also apparent in the fact that he accepts ‘neo-platonism’ and ‘neo-Lamarckism’ as “valid terms” (White 1959: ix) for his Science of Culture. No, his conception of evolution as “a temporal sequence of forms” (White 1959: 30) is clearly based on his reading of the nineteenth century social evolutionists. Indeed, “the theory of evolution set forth in [his] work does not differ one whit from that expressed in Tylor’s Anthropology in 1881” (White 1959: ix). The evolutionary sequence he developed is formally quite similar to that set forth by Morgan in *Ancient Society*, comprising a series of stages distinguished by the acquisition of one or more technological and/or ‘integrative’ traits, to use the term preferred by Service.

White’s debt to Marx is less explicit but no less significant. Writing as he was in the United States in the 1950’s, he was understandably reticent in drawing attention to this fact.[3] Service however, writing in a relatively less oppressive climate, relates that White taught Marx in his classes in the thirties at the University of Michigan (Service 1975: xvi). The debt is obvious in White’s “theory of technological determinism” (White 1959: 24).

[2]Belaboring the point, we might add that Darwin appears in neither the index nor the bibliography of Steward’s *Theory of Culture Change* (Steward 1955). Neither does he appear in Service’s *Primitive Social Organization* (Service 1962), and he is mentioned only once in *Origins of the State and Civilization* to quote a short passage on social equality "retarding" civilization (Service 1975: 50).

[3]Marx appears on fewer pages even than Darwin: exactly one.

The form of Marxism which he adopts is, however, a nondialectical, substantivist one, borrowing Marx's model of society but putting aside his theory of history. This is, as Price notes, a "classical heresy", and one which she herself adopts (Price 1978: 163). White even betrays himself in certain turns of phrase. For example, he writes: "The families were in association with one another like marbles in a sack; they were not knit together by specific and particular ties between their respective constituent members" (White 1959: 81). This immediately calls to mind, of course, Marx's famous passage from *The Eighteenth Brumaire of Luis Bonaparte* in which he likened the French peasantry to "potatoes in a sack" (Marx 1963: 124).

White's peculiar ideas about thermodynamics he borrows from Herbert Spencer, apparently by way of Schrödinger (Carneiro 1973). He asserts that life in general, and human social life in particular, is a form of reverse entropy, a mechanism for capturing and containing energy, temporarily and locally reversing the inexorable progress of the Second Law of Thermodynamics (White 1959: 34-36). Thus his evolutionary stages are defined according to levels of energy capture, each being defined by a broad category of technology; the first by human labor power, the second by the addition of domesticated animals and plants and the third by the use of fossil fuels.[4] Each stage is associated with a particular form of social organization; the first with *societas*, the second with *civitas* (archaic states and empires) and the third with that curious variant of civitas known as industrial society. Social change thus took two forms:

1. technological revolutions, in Childe's sense of the term, each followed by

2. a gradual expansion to the energetic limits of the new social form, a process conceptualized in terms of gradually increasing efficiency.

The relation is made clear by the following passage from Herbert Spencer:

> The formula finally stands thus: Evolution is an integration of matter and concomitant dissipation of motion; during which the matter passes from an indefinite, incoherent homogeneity to a definite, coherent heterogeneity; and during

[4] It was while explaining this scheme that Sahlins and Service coined the sublimely absurd phrase "thermodynamic accomplishment" (Sahlins and Service 1960: 33).

> which the retained motion undergoes a parallel transformation. (Spencer 1862, part ii. chap. xvii. p. 396)

Civilization as a kind of potential energy. Thus, while White no doubt profited from the Modern Synthesis by association, his theory, as Dunnell has done more than anyone to point out, bears no relation whatsoever to evolutionism in the contemporary biological sciences (e.g. Dunnell 1996). That we ever imagined such a theory, which moreover “average[s] all environments together to form a constant factor which may be excluded from our formulation of cultural development” (White 1959: 39), to be in any way Darwinian can only be attributed to a profound uncertainty as to the meaning of the term ‘evolution.’

1.2 Evolution as such

The Oxford English Dictionary lists no fewer than twelve separate definitions for the word ‘evolution’ in an entry which runs to 2500 words. We can recognize many of these various senses of the term in almost any discussion of social evolution; often, it seems, in defiance of the expressed intention of the authors. The word is a willful one, and resists disciplined use. Some scholars (e.g. Shennan 1993) argue that the term itself is so freighted with innuendo, so unruly and polysemous, that we should abandon the use of it altogether.

Giddens’s discussion is in some ways typical. After reviewing a selection of definitions of social evolution, “culled more or less at random” (Giddens 1984: 230), he proceeds to explore the possible meanings of a social theory that could be called ‘evolutionary.’ His first contention, which leads to and justifies the remainder of his argument, is that ’evolutionary theory’ in the social sciences, in order to have a “distinctive meaning” (Giddens 1984: 231) - that is, to be distinguished from the study of social change in general - must have “at least some conceptual continuity with biological evolution.” Otherwise the use of the term would be “gratuitous.” It will be informative, then, to consider the meaning accorded the term in historical biology.

Ernst Mayr contends that “Darwinism” has a much more restricted meaning for the modern biologist than for the world at large (Mayr 1985). ’Darwinism,’ for the specialist, is apparently "the theory that attributes evolutionary change to selection forces" (Mayr 1985: 755). Evolutionism itself has a much broader meaning. Mayr distinguishes five components to Darwin's theory of evolution. These are:

1. 'evolution as such,'
2. common descent,
3. gradualism,
4. the multiplication of species, and
5. natural selection.

Darwinism, then, is a composite theory. The theory of evolution is only one component of Darwinism, and is thus not restricted to Darwinism. Indeed, Mayr defines evolution simply as: "the theory that the world is neither constant nor perpetually cycling but rather is steadily and perhaps directionally changing, and that organisms are being transformed in time" (Mayr 1985: 757). This view, he contends, was fairly widely accepted among continental intellectuals before the publication of *The Origin of Species*. Darwin's genius lay in elaborating the mechanisms of this process of "transformation in time" in order to provide a coherent theory of biological evolution. Are we to cease calling Lamarck an evolutionist because he did not credit natural selection? Mayr concludes:

> Evolution is not a theory for the modern author. It is as much a fact as that the earth revolves around the sun rather than the reverse. The changes documented by the fossil record in precisely dated geological strata are a fact that we designate as [biological] evolution. (Mayr 1985: 758)

Given this definition, evolution must be entirely unobjectionable to the social scientist. The changes documented by the archaeological record in precisely dated strata are a fact that we designate as social evolution. Social evolution and biological evolution are simply two instances of a more general notion, that of 'evolution as such.' This can be clearly seen if we consider the range of theories to which we apply the label 'evolutionary.' They are, minimally:

1. the nineteenth-century evolutionists (Morgan, Tylor, Maine, etc.),
2. Darwinism, and
3. non-Darwinian biologies (Lamarck, Agassiz, etc.).

The only theoretical postulate that could possibly be shared by these three bodies of thought is precisely ‘evolution as such.’ Any more specific use of the term would preclude its application to one or more of the three. If the term ’evolution’ is to have any meaning in scholarship, then it must be this.

1.3 Society: primitive and civil, chiefdom and state

It will be objected at this point that I have simply shifted the meaning of the term ‘evolution’ and have thereby, through sleight of hand, avoided the real issues involved in the debates surrounding social evolutionism. Not so. I have simply argued that we should not allow the pervasive and mistaken conflation of the word ’evolution’ with Darwinism (cf. Dunnell 1996) to prejudice us against the use of the term. This is not to say that earlier theories of social evolution have been unproblematic. Quite the contrary, in fact.

As Kuper has eloquently chronicled, and as was touched upon earlier, the origins of social evolutionism coincided with the invention of a particular way of classifying human social systems (Kuper 1988).[5] Thus, all peoples of the world, and of the distant past, were arrayed on either side of a great divide, the great watershed of world history. Primitive Society was constituted as the antithesis of Civil Society, and the two forms were opposed to one another point for point. In the process, notions of both ‘the primitive’ and ‘the civilized’ were transformed, and each came to be constituted as an object of scholarly inquiry. Thus sociology and economics, prominently, devoted themselves to the study of Civil Society, while anthropology took Primitive Society as its special domain.

[5] I will not be concerned here with the various distinctions that have been made between cultural evolution, social evolution and political evolution. For the purposes of this essay they are taken to be synonymous.

This primal dichotomy has subsequently undergone a complicated series of transformations, reformulations and ramifications, generating endless specialized vocabularies. The ease with which these subsequent terms may be related in a logical diagram is a testament to their common origin. Thus:

Primitive : Civil :: blood : soil ::	
kin society : class society ::	
egalitarian society : stratified society ::	Fried
societas : civitas ::	Morgan
Gemeinschaft : Gesselschaft ::	Tönnies
mechanical solidarity : organic solidarity ::	Durkheim
folk : urban ::	Redfield
sacred : secular ::	Becker
affectual : contractual	Weber

While each of these oppositions is in some sense unique, since each has a somewhat different emphasis (see Loomis 1957 for a discussion of some of these schemes in sociology; see also Netting 1990: 22), all refer ultimately to the primary distinction of Primitive : Civil. This is the founding myth of the social sciences.

An excursion into the checkered history of the chiefdom concept illustrates the way in which this primary dichotomy has structured and in significant ways guided the subsequent course of social thought.[6] The term chiefdom, in its modern sense, was introduced by Oberg (Oberg 1955). Initially the term was invented for taxonomic purposes and employed to describe the distinctive sociopolitical organization of some protohistoric circum-Caribbean groups. It was used in this way also by Steward in a survey of South American ethnology (Steward and Faron 1959). Neither Oberg nor Steward used the term to denote an intermediate stage in the band-state continuum, employing for this purpose the word 'Formative.' In fact, Steward and Faron explicitly state that "...the chiefdoms do not represent a developmental stage in any large scheme of South American culture history. They do not necessarily exemplify an early phase of cultural development in the Central Andes or a potential development of the tropical forest farmers or the food hunters and gatherers"

[6]Carneiro provides an illuminating discussion of the history of the chiefdom concept in anthropology (Carneiro 1981).

(Steward and Faron 1959: 178). ‘Chiefdom’ in this formulation was a strictly taxonomic term, with no evolutionary significance.

The ease and rapidity with which ‘the chiefdom’ was assimilated as a stage in universal evolution is symptomatic of the tendency, in social evolutionary thought, for taxonomy to be transformed into phylogeny, for time and space to be conflated. This critical though entirely predictable step was taken by Service (Service 1962). The need for an intermediate stage between Primitive and Civil society resulted from a characteristic notion of gradualism on the part of Service. In this he followed most of the nineteenth-century evolutionists and, of course, more directly, White and Childe. But the problem of origins derived, at its root, from the fact that Primitive and Civil society are each the logical antitheses of the other. The fundamental contradiction in imagining an ‘evolution’ from Primitive to Civil Society is that Primitive and Civil are essences; they are (cosmo)logically discontinuous categories, and, as Mayr has noted, “an essence cannot evolve” (Mayr 1985: 758).[7]

The postulation of intermediate stages, such as the chiefdom, “rank society” (Fried 1967), what have you, might seem at first blush to provide a way out of this difficulty.

> Many important theories and debates connected with the origin of the repressive state have been handicapped because it is so difficult to account convincingly for its appearance out of the matrix of egalitarian society. But modern ethnohistorical records argue powerfully for the presence around the world of varyingly developed chiefdoms, intermediate forms that seem clearly to have gradually grown out of egalitarian societies and to have preceded the founding of all of the best-known primitive states. (Service 1975: 15-16)

In fact, however, the postulation of intermediate forms simply provokes a recursive iteration of the original opposition. This situation can be represented as follows:

Primitive : Civil ::
band/tribe : chiefdom ::
chiefdom : state

[7] White said that Morgan’s primitive and civil societies are logically distinct categories, "... just as reptile and mammal are" (White 1959: 302). Lowie called this “palpable nonsense.”

Bourdieu: “Nothing is more misleading than the illusion created by hindsight in which all the traces of a life ... appear as the realization of an essence that seems to pre-exist them” (Bourdieu 1990: 55).

The chiefdom thus occupies a logically ambiguous status in general evolution. It is at once Primitive and Civil, and at the same time is neither. This logical ambiguity, inherent in the idea of an intermediate stage in general evolution, clearly accounts for the extensive controversies surrounding the chiefdom in the archaeological literature. The concept, by its very nature, is endlessly malleable and endlessly problematic.

In fact, some subsequent attempts to clarify the idea of the chiefdom have pursued precisely the strategy of Service and have proposed various stages within the transitional stage itself! Steponaitis and Milisauskas for example, suggest a distinction between simple and complex chiefdoms (Milisauskas 1978, Steponaitas 1978, Steponaitas 1991). This is obviously a futile exercise, as it simply represents a further structural iteration:

> Primitive : Civil ::
> band/tribe : simple chiefdom ::
> simple chiefdom : complex chiefdom ::
> complex chiefdom : state

The same can be said of Carneiro's minimal, typical and maximal chiefdoms (Carneiro 1981: 47), though the resulting diagram would be somewhat longer. In fact, a general evolutionary continuum, as is evoked by White, Service and many subsequent authors, is nothing more than the infinite recursion of the original structure. Civil and Primitive Society.

In a very real sense, then, the idea of the chiefdom as a general evolutionary stage is inherently paradoxical, and the extensive controversy revolving about the concept clearly derives much of its vigor from this fact. The history of the chiefdom, from the 1960's to the present day, may from this perspective be seen simply as *bricolage*, an exploration of the semantic space defined by the Primitive-Civil dichotomy.

Any evolutionary scheme which incorporates the Primitive-Civil dichotomy will produce a 'world growth story.' Shennan, recognizing this, concludes that "social evolutionary approaches are inherently ideological" (Shennan 1993: 53). However to say that social evolution is ideological is to say very little indeed. As Kuper has shown, one of the strengths of the idea of Primitive Society is that it "yielded an endless succession of transformations which could accommodate any special interest" (Kuper 1988: 239). For Henry Maine, Primitive Society was a means to refute Utilitarian claims of the corruption of the English state. For Morgan, it served to demonstrate the moral order of history, the unfolding of the 'Supreme Intelligence.' And, of course, for Marx and Engels Primitive Society, in the guise of primitive communism,[8] stood as the first term in their dialectic of history, promising the future advent of socialism and an end to class domination.

It must be noted, also, that recent attempts to correct the excesses and distortions of social evolutionary theory have often failed to escape entirely from the limits imposed by the Primitive-Civil dichotomy. Michael Mann, for example, has provided many useful suggestions as to how we might conceptualize power and social change. However, his generalizations, as he presents them, are restricted to societies on the late side of the Primitive-Civil divide. Thus, "[n]one of the ... evolutionary theories bridges the gap...[b]etween rank and stratified societies... All the theories are wrong because they presuppose a general social evolution that had, in fact, stopped. Local history now took over" (Mann 1986: 62). Primitive Society, then, precedes history itself. The phrase 'people without history' takes on new and sinister dimensions in this light.[9]

Giddens's brief history of the world claims that prior to the genesis of the 'class-divided civilizations' "there is little discernible progression with respect of either social or technological change: a 'stable state' would be a more accurate description" (Giddens 1984: 238-9). For Giddens, history begins with the state, as for Mann. Many students of forager societies would no doubt take issue with these interpretations, and Mann and Giddens no doubt speak from a position of relative ignorance in this regard. But what is important for us to note is that these critics of 'social evolutionism' reproduce the Primitive-Civil dichotomy even as they attempt to dismantle its theoretical superstructure.

Any 'world-growth story,' at least as produced by the social sciences to date, is inevitably ethnocentric, as the 'West' invariably is placed at the summit of the 'evolution-

[8]Interestingly, the phrase 'primitive communism' can be traced to Morgan, who called it "communism in living" (see Lee 1990: 232).

[9]It is sometimes startling how effortlessly such phrases as 'primitive religion,' 'primitive economies' and so on seem to flow from Mann's pen.

ary stepladder' (Yoffee 1993).[10] This alone is reason enough to abandon Primitive Society. It is important also to realize, however, that Primitive Society has no empirical existence. Recent scholarship pertaining to so-called 'egalitarian societies' (this term also is a legacy of the Primitive-Civil dichotomy) has begun the task of dismantling the notion (cf. Flanagan 1989, Spielman 1986), but much work remains to be done. For, as Kuper puts it, "The theory of primitive society is about something that does not and never has existed... [it] is our phlogiston, our aether ..." (Kuper 1988: 8). He concludes: "Anthropologists developed the theory of primitive society, but we may make amends if we render it obsolete at last, in all its protean forms" (Kuper 1988: 243).

I am no devotee of penitential scholarship. Nevertheless, Kuper's point is taken. The Primitive-Civil dichotomy is one of the deep structures of social scientific thought, and one of its principal points of articulation with the public and with other scientific discourses. If we wish to approach more nearly a scientific account of human history and culture, we must attempt to do away with this most fundamental of mythologizing oppositions.

1.4 Steward's 'phenomena of limited occurrence'

Sahlins and Service, in order to effect a rapprochement between the theoretical works of White and Steward, introduced a distinction between two kinds of evolutionary theory. The first of these they called 'general evolution.' This is the perspective, championed by White, that "general progress ... occurs in culture, and it can be absolutely, objectively, and nonmoralistically ascertained" (Sahlins and Service 1960: 27). It is precisely the perspective that produces the 'world growth stories' we have just been discussing. It is transhistorical, referring to a broad, total movement in Human Culture from its very beginnings and far into the future, and making no reference to actual people or to actual societies except insofar as they serve to exemplify the Progress of Culture.

Steward's approach was very different. Sahlins and Service dubbed it 'specific evolution,' and characterized it as "a connected, historic sequence of forms"

[10]White provides perhaps the most succinct example of such a 'world growth story': "The crest of the wave of cultural development has been moving westward ever since the Pyramid Age" (White 1959: 369).

Steward	unilinear evolution	multilinear evolution
White	evolution	history
Kroeber	-	history
Murdock	-	evolution
Sahlins and Service	general evolution	specific evolution
Yoffee	neoevolutionism	new social evolutionary theory

Table 1.1: Two kinds of social evolutionary theory

(Sahlins and Service 1960: 33). Their conception was that general evolution understands societies in terms of their ontogeny, while specific evolution does so in terms of their phylogeny. Steward himself termed this approach 'multilinear evolution' (Table 1.1). This he distinguished from -and proclaimed superior to - the 'unilineal evolution' of White. The focus of multilinear evolution is "the search for laws which formulate the interrelationships of particular phenomena which may recur cross-culturally but are not necessarily universal" (Steward 1955: 29). Steward explicitly eschewed the grand pretensions of general evolution, asserting that his "delimitation of problem and method precludes all efforts to achieve universal explanations or formulations of human behavior" (Steward 1955: 7).[11] He chose instead to study particular developmental sequences in particular geographical locations. These varied sequences are then compared to one another in order to divine certain processual regularities that might be used to understand yet other similar cases, the objective being "to formulate the conditions determining phenomena of limited occurrence" (Steward 1955: 8).

It is clear that Steward's formulation of 'multilinear evolution' evades the many pitfalls of general evolution. At the same time it avoids the twin traps of particularism and historicism. It understands particular societies to be the product of particular, unique historical trajectories, while simultaneously recognizing that similarly-organized social groups in similar physical environments will often undergo similar evolutionary processes. Thus parallelism and the study of parallelisms are the analytical core of multilinear evolution.

[11]"A formula that explains the behavior of all mankind cannot explain culture" (Steward 1955: 8).

1.5 Longitudinal studies

Typology is the method of general evolution. For Sahlins and Service, the “taxonomic innovation that is required for the study of general evolution” is to “... arbitrarily rip cultures out of the context of time and history and place them, just as arbitrarily, in categories of lower and higher development” (Sahlins and Service 1960: 32). Steward also used social typology, but of a different order. The social type, for Steward, does not necessarily represent or capture the essence of a society or culture. Rather, social types may be defined according to analytical convenience; they are not considered to be natural categories. This is very different from White’s position that one social type was as different from another “as reptile and mammal are” (White 1959: 302). Steward himself defined two kinds of social types (Steward 1955: 88): area types, defined on the basis of uniformities and presumably resulting from direct inheritance or diffusion, and cross-cultural types, defined on the basis of “regularities” - or “causally interrelated phenomena."

Steward’s case studies typically involved relatively short time spans, on the order of a century or less, and employed historic and ethnographic data. However, there are many evolutionary processes which occurred in the past which may not be studied using Steward’s methods. It may be the case, in fact, that there exist many societies in the archaeological record for which there are no true analogues in the ethnographic record. This is so on the one hand because all modern groups - and probably all ethnographic groups, as well - are integrated to a greater or lesser extent into the modern world system and have been transformed in significant ways as a result (Wolf 1982). Thus, they cannot be easily employed as analogues for prehistoric societies. On the other hand, the smaller-scale societies we know ethnographically - such as those which have been used to define the ‘chiefdom’ social type - may in fact be very different from many prehistoric groups. The modern groups are ethnographic ‘chiefdoms’ precisely because they were not transformed into larger-scale social formations, and because they did not disintegrate into simpler, more egalitarian communities. This alone is some indication that they differ in some significant way - particularly in terms of stability - from the Formative period societies which were the precursors of the great prehistoric states in the Americas and elsewhere (Yoffee 1993).

Finally, as Feinman and Neitzel put it, social typology and studies of ethnographic and historical cases "can only demonstrate correlations and cannot reveal historical or causal processes responsible for societal variation" (Feinman and Neitzel 1984: 78). In order to understand how social evolution actually took place - and is still taking place - over long time periods it is necessary to study long sequences of social change (cf. Drennan 1987, Drennan 1991). In the case of primary state formation, of course, these data may only be obtained archaeologically.

Settlement archaeologists working in the mode of general evolution developed their own set of correspondences to social typology. The analytical mode of much of settlement archaeology has been, ironically, predominantly synchronic. By this I mean to say that settlement analysis has often been undertaken in such a way as to constitute a regional sequence as a succession of synchronic forms, correlated with particular social types. Thus, a three-tiered site size hierarchy is taken to indicate a complex chiefdom (Anderson 1994, Wright and Johnson 1975; also see Peebles and Kus 1977), as opposed to the two-tiered hierarchy of simple chiefdoms. In this mode, the salient property of a regional sequence is the temporal sequence of forms which it reveals. The longitudinal study, by contrast, must consider much more carefully the manner in which the settlement system changes from one phase to the next. For this reason, much of the effort in my own analysis will be devoted to examining such measures as population growth, abandonment and site foundation rates, and the relative growth rates of specific sites within the region. These are inherently diachronic measures.

If social typology is the method of general evolution, then the longitudinal study is the method of multilinear evolution. A number of studies of such long regional archaeological sequences have been developed and presented for various parts of the world. It is my intention here to present one for the southern Lake Titicaca Basin, the heartland of the prehispanic Tiwanaku state.

1.6 The Tiwanaku state

The Titicaca Basin, situated on the boundary between the modern states of Peru and Bolivia, represents one of the relatively rare instances in world prehistory of the pristine (Fried 1967) development or evolution of the state. This state, which we know as Tiwanaku, has been the subject of a considerable amount of research over the past fifteen years. Various projects have elucidated the nature of Tiwanaku urbanism and the settlement hierarchy of its core area (Albarracín-Jordan and Mathews 1990, Albarracín-Jordan 1992, Albarracín-Jordan et al. 1993, Albarracín-Jordan 1996b, Albarracín-Jordan 1996a, McAndrews et al. 1997, Bermann 1990, Bermann 1994, Janusek 1994, Kolata 1982, Kolata 1993, Stanish 1989), the operation of its agricultural surplus economy (Kolata 1986, Kolata 1991, Kolata et al. 1996), the functioning and spatial organization of its ceremony and ritual (Alconini Mujica 1995, Manzanilla 1992, Vranich 1999), and the relations between Tiwanaku and its various peripheries, colonial and otherwise (Bandy et al. 1996, Bermann and Castillo 1993, Cohen et al. 1995, Bermann et al. 1989, Goldstein 1989b, Goldstein 1993b, Goldstein 1993a, Higueras 1995, Oakland Rodman 1992).

What we still know very little about, however, is the process by which it came to be. We know that the site of Tiwanaku rather abruptly became an urban center sometime in the Tiwanaku III phase. We know that some of its monumental architecture - the semi-subterranean temple - probably predates this urbanism, as does some of the stone sculpture. We know something about the ceramic sequence, as well, though how much is actively debated. But we know very little about the varied political formations which populated the 1800 years of settled agricultural village life before Tiwanaku's rise to regional preeminence. When did Tiwanaku begin to be regionally dominant? What were its relations with neighboring polities? When indeed did multi-community polities begin to emerge in what later became the core area of Tiwanaku? How should we characterize the social matrix from which Tiwanaku developed? To these and to many other important questions we have only vague and unsatisfactory responses.

It is an exciting time to be working on the Titicaca Basin Formative. The last decade has seen the completion of a number of significant projects, and the inauguration of many more. Of great significance have been the regional settlement surveys completed in recent years. Among these we may count those of Albarracín-Jordan and Matthews in the Tiwanaku Valley (Albarracín-Jordan 1992, Mathews 1992), of Charles Stanish in the Juli-Pomata area (Stanish 1994, Stanish et al. 1997, Stanish and Steadman 1994), of Aldenderfer and Klink in the Ilave drainage, of Kirk Frye near Chucuito, of Janusek in the Pampa Koani (Janusek and Kolata 2001), and of Carlos Lémuz in the Huatta area of Bolivia (Lémuz Aguirre 2001). Several other surveys have begun in the last few years or are slated to begin soon (cf. Cohen 2001, Plourde and Stanish 2001). We will soon have a very substantial settlement dataset from the Titicaca Basin, totaling well over 1000 km2 of complete pedestrian coverage, which should permit comparisons of regional developmental trajectories and help to answer many of the questions about the rise of the Titicaca Basin complex societies.

Many of these projects have taken the Formative as their focus and have been undertaken in areas of special interest to the “formatólogo”. As a result, we find ourselves in the somewhat unexpected position of knowing less about the Formative in the nuclear area of Tiwanaku than in other areas, such as Juli-Pomata. This is partly so because the one published survey of a portion of the Tiwanaku heartland - Albarracín-Jordan and Matthews’s milestone publication of 1990 (Albarracín-Jordan and Mathews 1990)- treated the Formative as a single long, undivided phase, giving very little indication of historical development internal to the period; and as it turns out, it is partly because the Tiwanaku Valley, including Tiwanaku itself, was a rather peripheral area in the Early and Middle Formative periods; sites there were few and small.

Since the work of Albarracín-Jordan and Matthews, however, Lee Steadman has produced a quite usable ceramic chronology for the Early and Middle Formative periods in the Southern Basin (Steadman 1999). Janusek and Lémuz have independently produced the beginnings of a usable chronology for the Late Formative (Janusek 2001, Lémuz Aguirre 2001). This work has made possible detailed and relatively - relatively - fine-grained settlement analysis of Formative period communities in the Tiwanaku heartland. It was to undertake such an analysis that I began - in August of 1998 - an archaeological survey of the Taraco Peninsula. This volume reports the results of my research.

1.7 This volume

Chapter 2 presents an introduction to the physical landscape of the Taraco Peninsula and to the history of archaeological research in the immediate vicinity. The following chapter, Chapter 3, concerns the methodology employed in the collection of the settlement dataset. It includes a discussion of what I consider to be a significant methodological innovation in dealing with mixed surface collection assemblages. The method, termed frequency profile analysis, is a technique which allows for estimation of the relative proportions of various temporal components in a temporally mixed assemblage. It is used in this study in order to identify the sizes of various occupations of a given site, and thereby to permit calculations of rates of population growth or decline through time on both the site and regional scales.

The topic of Chapter 4 is the manner in which settlement data will be used in my analysis of Taraco Peninsula social evolution. The first half of the chapter consists of the development of a method of deriving a population index from the Taraco Peninsula settlement data. It should be emphasized that I make no attempt to estimate actual population values for settlements. Rather, I outline a method that produces population index values approximately *proportional* to population values. This means that my population index values may be used for internal comparisons, and perhaps for comparison between the Taraco Peninsula data and other Titicaca Basin datasets produced and normalized using the same techniques, but not for comparison with datasets from other parts of the world. However, rates of change within the Taraco Peninsula settlement system, especially rates of population growth, should be directly comparable cross-culturally. Also significant here is that my method has the property of reducing the disproportionate significance accorded to smaller and more ephemeral components of a settlement system by most population measures.

The most important part of Chapter 4 is my discussion of the meaning of intraregional variation in population growth rates. This discussion stems from the observation that at certain time periods certain sites or groups of sites seem to have grown at radically different rates, differences which cannot be attributed to differential fertility or mortality. The only possible explanation for these differences is therefore movement of population between sites and communities. This being the case, it becomes clear that the evidence of population growth rate differentials in effect provides a record of aggregate human decisions regarding the location of their residence. The disproportionate growth of one site, say, is evidence of a systematic bias in residential decisions on the part of the prehistoric inhabitants of the region. It therefore becomes possible to adopt an agent-centered approach to the interpretation of settlement data. The interpretive approach developed underpins the entirety of my subsequent historical reconstruction. The discussion begins on page 74. This section must be read in order to appreciate the arguments as a whole. I suggest that it be read before proceeding to the particulars of the archaeological sequence.

Following are Chapters 5 through 10, which present the Taraco Peninsula archaeological sequence itself. Chapters 5 and 6 discuss the Early and Middle Formative periods, when the settlement system was characterized by small, autonomous villages. Chapter 7 covers the Late Formative, and charts the local development of a multi-community polity and the early indications of Tiwanaku regional dominance. Chapter 8 describes the Tiwanaku period itself, when the Taraco Peninsula was reorganized as a heartland province of the Tiwanaku state, and Chapter 9 the period following its collapse. Finally, in Chapter 10, the conquest of the Titicaca Basin, first by the Inka empire and later by the Spanish, is discussed. Chapter 11 presents concluding remarks and observations.

Chapter 2

The Taraco Peninsula

The Taraco Peninsula is an East-West trending spit of land projecting into Lake Wiñaymarka, the southern arm of Late Titicaca (Figure 2.1). It is located within the modern state of Bolivia, though its western tip is less than 4 km from the Peruvian border. Administratively, it pertains to Canton Taraco, Provincia Ingavi, and the Department of La Paz. The principal town is Taraco, though a smaller town, Santa Rosa, is located on the tip of the peninsula.

2.1 Geology

The spine of the peninsula is formed by the *Lomas de Taraco* - the Taraco hills. These are low, rolling hills whose peaks rarely exceed 4000 m.a.s.l.[1] Geologically, the Taraco Hills are formed by the Taraco Formation.

> The Taraco Formation ... consists of conglomerates approximately 200 meters thick lying in discordance over the Middle Miocene Kollu Kollu Formation. Gravels predominate in clasts with diameters up to 20 centimeters embedded in a sandy-clayish matrix ... The clasts are formed of Devonian mudstones, quartzites, vein quartz, Permian calcareous rocks, and ganodiorites. ... [I]t has been assumed that these deposits belong to the Pliocene, dated in other locations to 5.4 million years. (Argollo et al. 1996: 69)

[1] The modern lake level average is approximately 3810 m.a.s.l. Thus, the peaks of the Taraco Hills are rarely more than 200 meters above modern lake level.

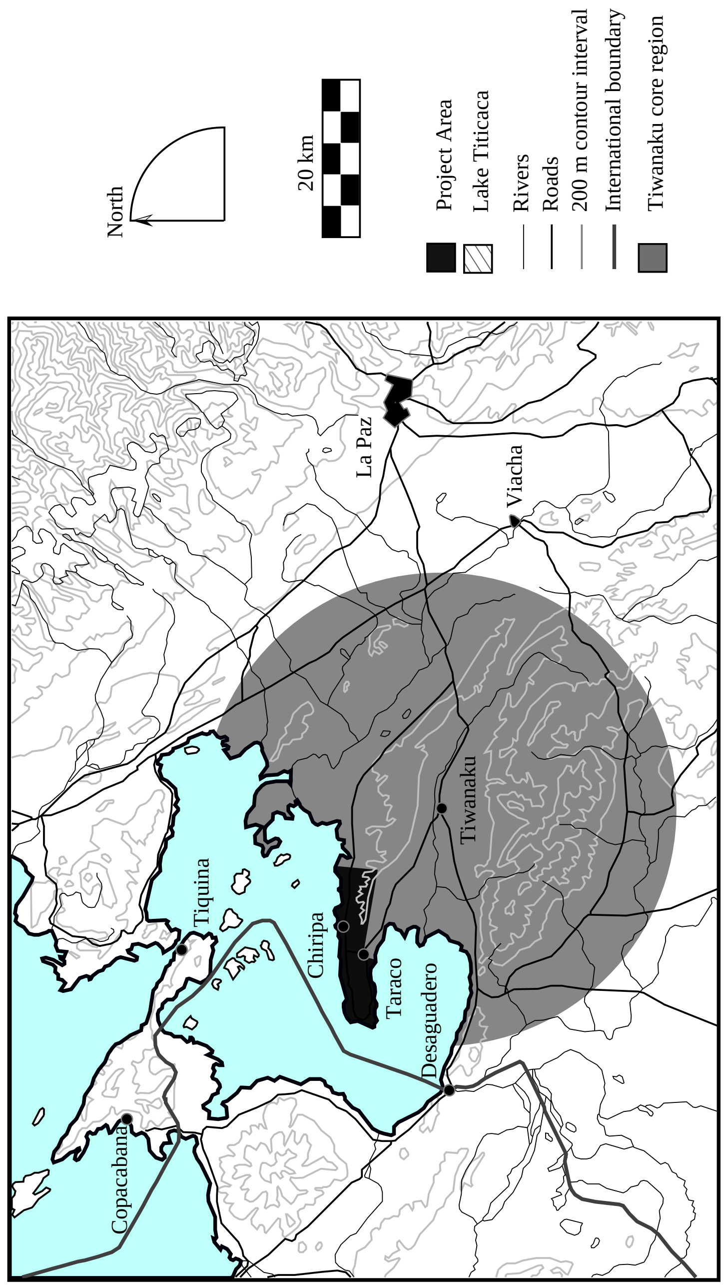


Figure 2.1: The Southern Lake Titicaca Basin

The elevation of the Taraco Hills tends to decrease from south to north, and for this reason most watercourses run in this direction. The interior of the peninsula is therefore dissected by deep gullies or *quebradas* running from south to north, interspersed with high ridges (see contour map in Figure 2.2).

The conglomerates of the Taraco Formation, at least where they are exposed on the surface, are composed predominantly of quartzite cobbles. The ground surface over most of the peninsula is littered with quartzite cobbles of all sizes. However, the formation also contains large quantities of chert pebbles and cobbles. These are smaller than the quartzite cobbles, rarely exceeding 8 cm or so. These chert nodules were frequently worked using a hammer and anvil bipolar technique to extract short small flakes. I have also collected samples of chalcedony from the hills near Chiripa. All of these materials were used in an expedient manner by the prehistoric inhabitants for the production of stone tools, predominantly informal flake tools. This kind of extensive quarrying activity has been practiced since the first human occupation of the region. As a result the entire surface of the peninsula is a low-density lithic scatter. Within this scatter it is very difficult to discern any true concentrations, and this long-term quarrying has no doubt obscured some more concentrated activity. This is possibly one of the reasons why no preceramic sites have been reported from the peninsula, despite finds of Archaic Period projectile points in the Chiripa excavations and in other regional surveys (Albarracín-Jordan and Mathews 1990: 51).

Finally, the quartzites of the Taraco Formation not uncommonly contain fossils, frequently trilobites. There can be no doubt that the prehistoric inhabitants of the peninsula remarked the existence of these fossils and accorded them some importance. Fossils are found with some frequency on the surface and in the deposits of sites, indicating that they were collected in prehistory. The significance which the inhabitants of the peninsula attributed to these objects cannot be known with certainty.

The Kollu Kollu Formation is located below the Taraco Formation.

> It is composed of conglomerates, red sandstones, clayish mudflows, and alluvial clays intercalated with acid tuffs. Swanson et. al. ... assigned [middle Miocene] radiometric dates of 18.3 to 16.6 million years to this formation. (Argollo et al. 1996: 69)

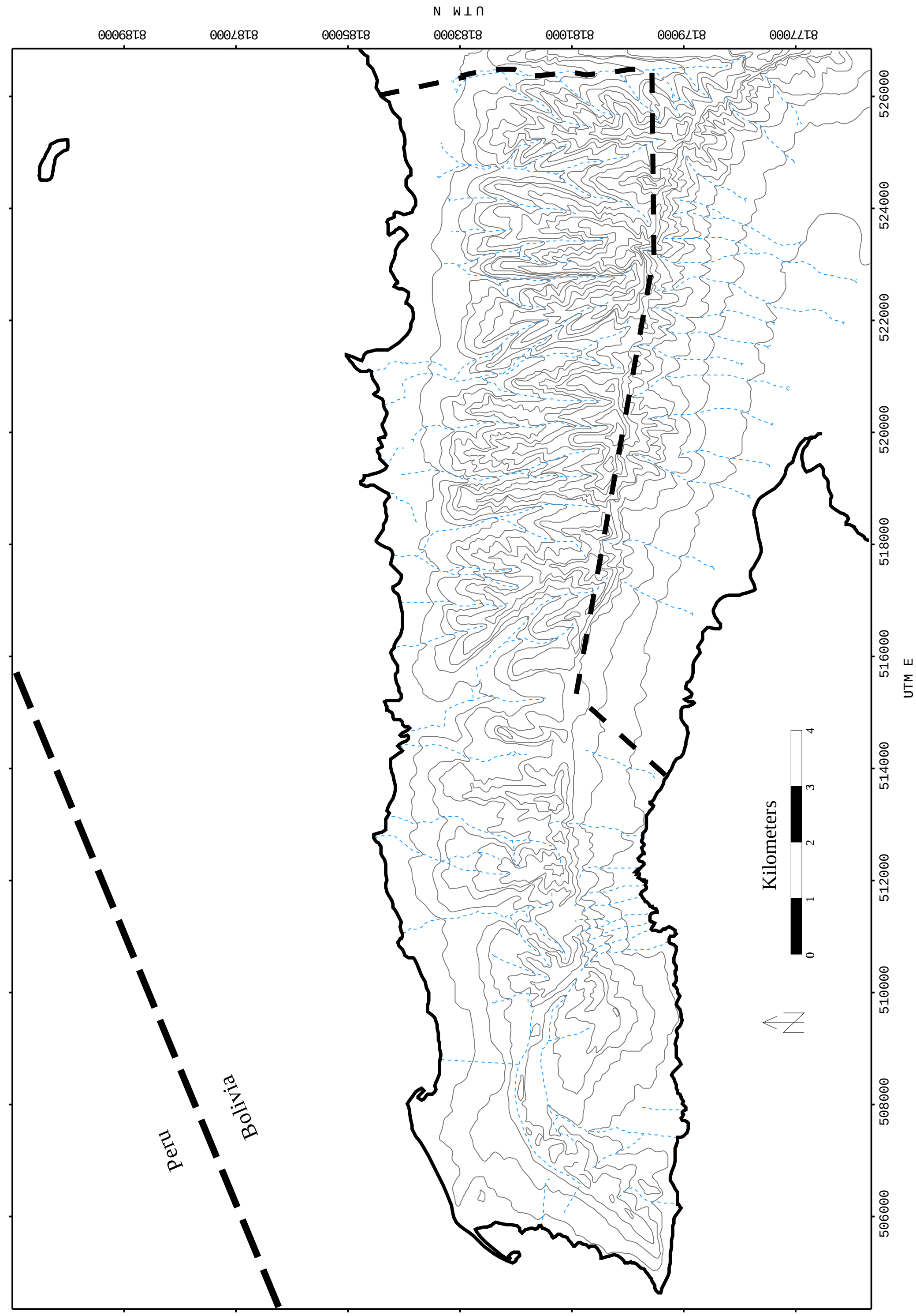


Figure 2.2: Map of the Taraco Peninsula

This formation was used in several ways by the prehistoric inhabitants of the Taraco Peninsula. Most importantly, it was the source of all the clays which they used to manufacture their ceramics. The red, yellow, and white pigments used on ceramics of the Chiripa culture were slip paints, and so were extracted from the Kollu Kollu Formation, which contains clays of all these colors. These clays were also used to produce colored plaster used to decorate buildings and to lay prepared clay floors. In short, the presence of red, yellow, and white clays in the Kollu Kollu Formation determined the color palette of Chiripa Culture architectural and ceramic decorative art. Less importantly, the tuffs encountered in the Kollu Kollu Formation were used locally in the Late Formative and Tiwanaku periods for the manufacture of an enigmatic class of stone tools known to archaeologists as *trompos* (see Bermann 1994: 61 for illustrations).[2] The function of these small, conical artifacts remains uncertain, though it is debated wherever Titicaca Basin archaeologists gather.

The interface between the Taraco and Kollu Kollu Formations is generally located slightly above the modern lake level. I have not made a formal survey, but the Kollu Kollu deposits frequently appear in the bottom of quebradas near the base of the hills on the northern side of the peninsula. It is also exposed on the surface over portions of the western half of the peninsula, particularly in the modern communities of Nachoca, Ñacoca, and Santa Rosa. My informal observations indicate that the elevation of this geological boundary is typically between 3820 and 3840 m.a.s.l. A published geological section from somewhere in the western Taraco Peninsula - probably close to the 508200 E meridian - shows that the boundary in fact slopes down from south to north,[3] with the Taraco/Kollu Kollu interface at approximately 3850 m.a.s.l. on the southern side of the hills, and approximately 3820 m.a.s.l. on the northern side (Argollo et al. 1996: 75).

This geological boundary has one important implication for human occupation of the Taraco Peninsula. The underlying Kollu Kollu Formation, being compact and composed primarily of fine sediments and of clays in particular, is much less porous than are

[2] *Trompos* are also produced from quartzites, andesite, and a wide variety of other materials. However, in the Taraco Peninsula sites tuff is the most common material. This may be a clue to their function, since these tuffs are extremely low density, and the resulting artifacts very lightweight.

[3] As does the upper surface of the Taraco Formation. See my description of the Taraco Formation above.

the Taraco Formation conglomerates. This creates a situation in which the groundwater trapped in the natural aquifer of the Taraco Formation is forced to the surface where the Taraco/Kollu Kollu Formation interface intersects the modern ground surface. This effect creates a zone of springs and water sources in the lower slopes of the Taraco Hills and in *quebradas*. On the northern side of the peninsula, this zone is located at approximately 3820-3830 m.a.s.l., and is somewhat higher on the southern side. Surface water on the Taraco Peninsula is for this reason very abundant. At no point within this elevation range is one more than a kilometer from a spring anywhere on the peninsula. It should come as no surprise that this distribution of surface water is a significant determining factor in Taraco Peninsula settlement systems. The majority of the population lives in the 3810-3850 m.a.s.l. elevation range today, and has for the peninsula's entire history.

A final note on springs: since the volume of the Taraco Formation deposits on the peninsula is actually relatively small as aquifers go, it can discharge its water content fairly rapidly. I have observed spring flow over an annual cycle, and it is clear that discharge rates begin to drop dramatically toward the end of the dry season, and some springs even dry up. Typically, the aquifer is recharged by the annual rainy season. However, given prolonged drought conditions it is possible that the aquifer could be depleted altogether and most of the springs could be dry for most of the year. This would present difficulties as far as continued occupation of the Taraco Peninsula is concerned.

2.2 Climate

The climate of the Titicaca Basin is dominated by typical tropical wet-dry seasons. The majority of the precipitation is derived from warm air masses arriving from Amazonia, to the east. Located as it is between two major weather systems, the Atlantic-Amazonian and the Pacific, climate in the Titicaca Basin is highly variable, and "[i]nterpretation of long-term climate averages must be tempered with the understanding that interannual variability is expressed by standard deviations ranging from 20 to 70 percent of the average means" (Binford and Kolata 1996: 30).

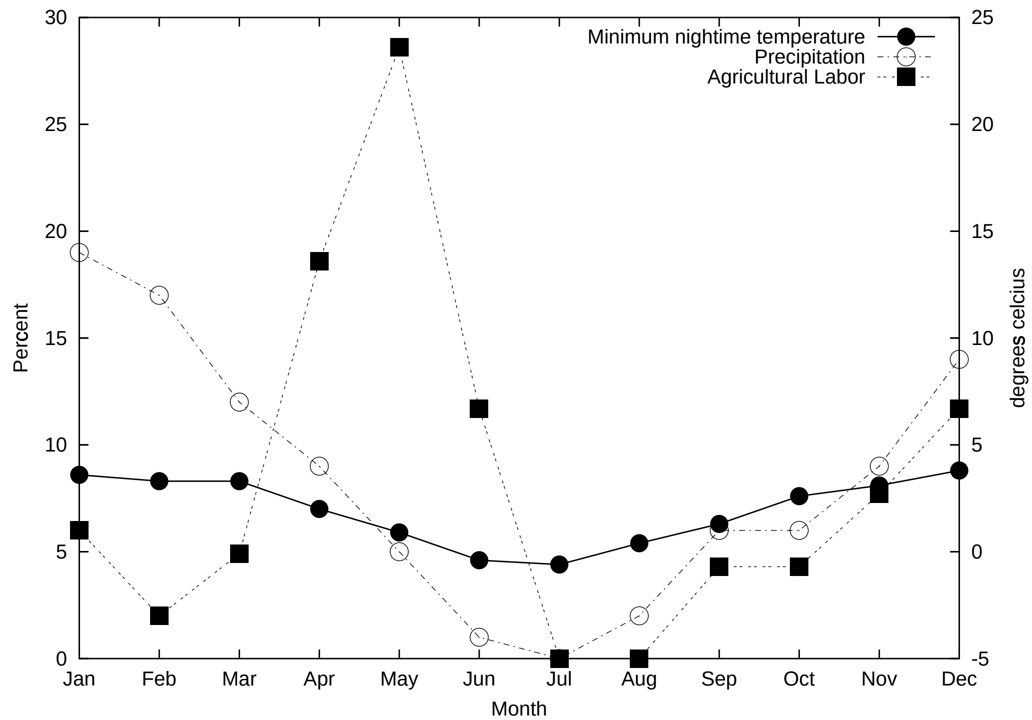


Figure 2.3: Precipitation, temperature, and agricultural labor by month

The average annual precipitation at the town of Guaqui, which is probably very similar to that of the Taraco Peninsula, is 581 mm (Binford and Kolata 1996: 31), most of which falls between December and March (Figure 2.3; for more detail see Binford and Kolata 1996: 31-32). Average temperature in the dry season season is between $-14°$C and 22°C, and in the rainy season between $-5°$C and 23°C (Albarracín-Jordan 1996a: 9). Therefore, frost can occur at any time of year, though it is more likely in the dry season, and especially in June and July when the minimum nighttime temperature averages 0°C or less (Figure 2.3). This is one of the principal factors which makes the Titicaca Basin a risky environment for agriculture. Frost is more likely in certain locations such as the bottom of *quebradas* or on the lake plain. These locations are often avoided, with gentle slopes being the preferred agricultural locations.

2.3 Micro-environmental zones

Albarracín-Jordan and Mathews, as a part of their respective studies of Tiwanaku Valley settlement systems, formulated a typology of micro-environmental zones (Albarracín-Jordan and Mathews 1990, Chapter 1). Although the Taraco Peninsula is somewhat different from the Tiwanaku Valley in these respects, it is similar enough for me to use some of their zones, and I have done so for the sake of comparability. Albarracín-Jordan and Mathews defined seven micro-environmental zones:

1. Upper Colluvial Zone (UCZ),
2. Lower Colluvial Zone (LCZ),
3. Springs and Grass Zone (SGZ),
4. Alluvial Plain (AP),
5. Lacustrine Zone (LZ),
6. Terrace Zone (TZ), and
7. Intermontane Zone (IZ).

The Taraco Peninsula is a considerably less varied area than is the Tiwanaku Valley, and only three of these zones are present. They are described below.

2.3.1 Upper Colluvial Zone (UCZ)

This zone is located in the higher elevations, on exposed erosional surfaces of the Taraco Formation. Though it was originally said to exist from 3975-4100 m.a.s.l., my own elevation distribution places it as low as 3860 m.a..s.l. (Table 2.1). The zone is dissected by deep, steep-sided *quebradas*, normally running from south to north, as discussed above. The ground in these areas is extremely rocky, and the soils are thin. Nevertheless, they are used for agriculture, though less so than lower and less rocky areas (contra

Elevation	Springs and Grass Zone	Lower Colluvial Zone	Upper Colluvial Zone
3800	95	140	
3820	11	301	
3840	1	135	5
3860		78	7
3880		10	23
3900		2	13
3920			1
3940			
3960			
3980			2
4000			

Table 2.1: Sector count by micro-environmental zone and elevation

Albarracín-Jordan and Mathews 1990: 16). Principal crops seem to be cereals, including barley (*Ordeum* spp.), wheat (*Triticum* spp.),[4] *quinoa* (*Chenopodium quinoa*), and *cañawa* (*Chenopodium pallidicaule*); the Andean tubers seem to fare less well here than at somewhat lower elevations. Vegetation is sparse, and consists mostly of brushy shrubs. These include *khoa* (*Menta pulegiur*, *Satureja boliviana*), *añahuaya* (*Adesima spinossisima*), *khanlla* (*Tetraglochin cristatum*) (Albarracín-Jordan 1996a: 11). Bunch grasses are also present in low densities.

2.3.2 Lower Colluvial Zone (LCZ)

The LCZ is located at lower elevations than is the UCZ, generally between 3820 and 3880 m.a.s.l. (Table 2.1). The zone was described by Albarracín-Jordan as follows:

> This area is characterized by colluvial fans, which are intersected by the *quebradas* of the Upper Colluvial Zone (UCZ). These *quebradas*, however, are much wider in this area, and, during the rainy season, they become true streams, transporting water, sand, and mud.The soils of the colluvial fans are deep and fertile. (Albarracín-Jordan 1999: 4)

[4] Wheat and barley are, of course, European introductions.

Most of the vegetation present in the UCZ is present in the LCZ, as well. In addition, we see *yawarilla* (*Aristida* spp.), *sanu-sanu* (*Ephedra americanus*), and *chillihua* (*Festuca dolichophylla*) (Albarracín-Jordan 1996a: 13). The LCZ is the principal agricultural zone on the peninsula, and the full range of crops is planted. It is presumably for this reason, and for easy access to water, that the majority of archaeological sites are located in this zone. So too are the majority of contemporary residents of the peninsula.

Though Albarracín-Jordan does not mention this fact, it is also the case that the average clast size is smaller in the LCZ than in the UCZ. I believe this to reflect the fact that in actuality the LCZ is composed mostly of quaternary lacustrine deposits, and thus is entirely distinct geologically from the UCZ. This is made very clear by a published geological section of the Taraco Peninsula (Argollo et al. 1996, Figure 3.7). This profile clearly shows terraces deposited by the paleolakes Tauca, Minchin, and Ballivian overlying the slopes of the Taraco Formation at depths of up to 20 meters. The maximum clast size of these lacustrine terrace deposits, which show evidence of wave action, is only about 6 cm (Argollo et al. 1996: 75), which is considerably smaller than the 20 cm clasts which occur in the Taraco Formation (Argollo et al. 1996: 69). Thus the difference between the UCZ and the LCZ is not that the latter represents colluvium derived from the former, as Albarracín-Jordan suggests. Rather, the UCZ represents eroded exposures of the Taraco Formation, while the LCZ represents relict paleolake terraces and related lacustrine deposits of more recent origin. Whatever the case, however, the two zones are clearly distinguishable.

2.3.3 Springs and Grass Zone (SGZ)

The SGZ is distinguished primarily on the basis of vegetation, and especially by a cover of very dense bunch grasses. These grasses include *cachu-ch'iji* (*Muhlenbergia fastigiata*, *Paspolum pygmaeum*), *orko-ch'iji* (*Distichlis humilis*), *ch'iji* (*Boutelova simplex*), and *yawara (Nasella* spp.) (Albarracín-Jordan 1996a: 13). This zone also frequently includes swampy areas - *pantanales* or *bofedales* - which are formed by the presence of numerous springs and poor drainage conditions. These areas include more a variety of other plants, many of which are useful as fodder for livestock, as well as abundant and varied avian life.

The soils of the SGZ are well-developed and deep. A thick humus and root zone is common, and the texture at times approaches peat. Indeed, the ground often has a "springy" texture when walked across. Geologically, this zone sites atop deep quaternary lacustrine deposits.

As is evident from Figure 2.1, most of the sites in the SGZ are located below 3820 m.a.s.l. The few exceptions are located in the bottoms of *quebradas* or in one of the major inland valleys of the peninsula. These areas have similar soils and vegetative communities to those of the lake plain which in fact makes up most of the area of the SGZ.

The heavy soils of the SGZ made it difficult to work with traditional Andean agricultural tools, and, indeed, with the introduced oxen-plow as well. Recently, however, tractors have arrived in the *altiplano*, and the SGZ has been brought under production in a significant way. Mostly introduced cereals are planted in the lake plain. The Andean tubers are still planted mainly in the LCZ. As I mentioned above, the lake plain is more prone to frost than are the lower slopes of the hills, and this may be a factor, especially since the introduced cereals are usually grown for cash sale, while the tubers are intended at least in part for the sustenance of the cultivating household itself.

2.4 Previous archaeological research

The first published indication that there were ancient remains of antiquarian interest on the Taraco Peninsula came in the *Boletín de la Sociedad Geográfica de La Paz* in 1920.[5] In this volume, Padre Pedro Marabini described the mound at Chiripa in the following terms:

> Se trata aqui de un pequeño cerrito ó en su circular enteramente rodeado de menhires profundamente plantados en el suelo del que sobresalen medidas desiguales, debido quizás a la desigualidad de la erosión por las diferentes clases de piedras. (cited in Ponce Sangines 1957)

[5] This discussion draws heavily on my published account of the history of investigations at the site of Chiripa (Bandy 1999a).

> We are speaking of a small mound entirely encircled by columns deeply set in the earth; these project to different heights, owing perhaps to unequal erosion of the different stone types.

He also described another “cerrito” about 2 kilometers away, in the direction of the lake. Given that the mound is currently less than 1 kilometer from the lake, it is not clear to what he was referring. Elderly residents of the area have informed me that the lake level was very low in the 1920s. Perhaps, then, this reference is to the site of Chiaramaya, approximately 2 km to the east, on which is located a substantial prehistoric mound construction. He concludes with a suggestion that scientific work be conducted on the mound:

> ... no dudamos de que también aquí como en Huacullani una excavación metódica pudiera ser de muy buenos resultados para la ciencia arqueológica. (cited in Ponce Sangines 1957)
>
> ... we do not doubt that both here [Chiripa] and in Huacullani a methodical excavation could produce very good results for the science of archaeology.

It would be 14 years before Marabini’s suggestion was taken - though probably unknowingly - by Wendell Bennett. Bennett was at the time employed by the American Museum of Natural History in New York. His Bolivian expeditions of 1932 and 1933-34 included excavations in numerous regions (Bennett 1933, Bennett 1934, Bennett 1936). In the *altiplano*, he excavated at Tiwanaku, Pajchiri, and Lukurmata, and on several islands in Lago Wiñaymarka. He stayed in Chiripa - on the Taraco Peninsula - for five weeks, living in the now-ruined hacienda house. Using the materials from his Tiwanaku excavations, Bennett elaborated a three-phase ceramic chronology: Early Tiwanaku, Classic Tiwanaku, and Decadent Tiwanaku (Bennett 1934). These phases correspond roughly to what I call the Late Formative, and to the earlier and later parts of the Tiwanaku period (see Figure 2.4).

Bennett recognized that the ceramics of the Chiripa culture were different from those he had excavated at Tiwanaku. At first he though they should be placed between Classic and Decadent Tiwanaku. This was based on a stratigraphic column he excavated on the island of Pariti in which “the Chiripa level [was] ... above a Classic Tiahuanaco grave and below a Decadent Tiahuanaco level, thus establishing its chronological position” (Bennett 1936:

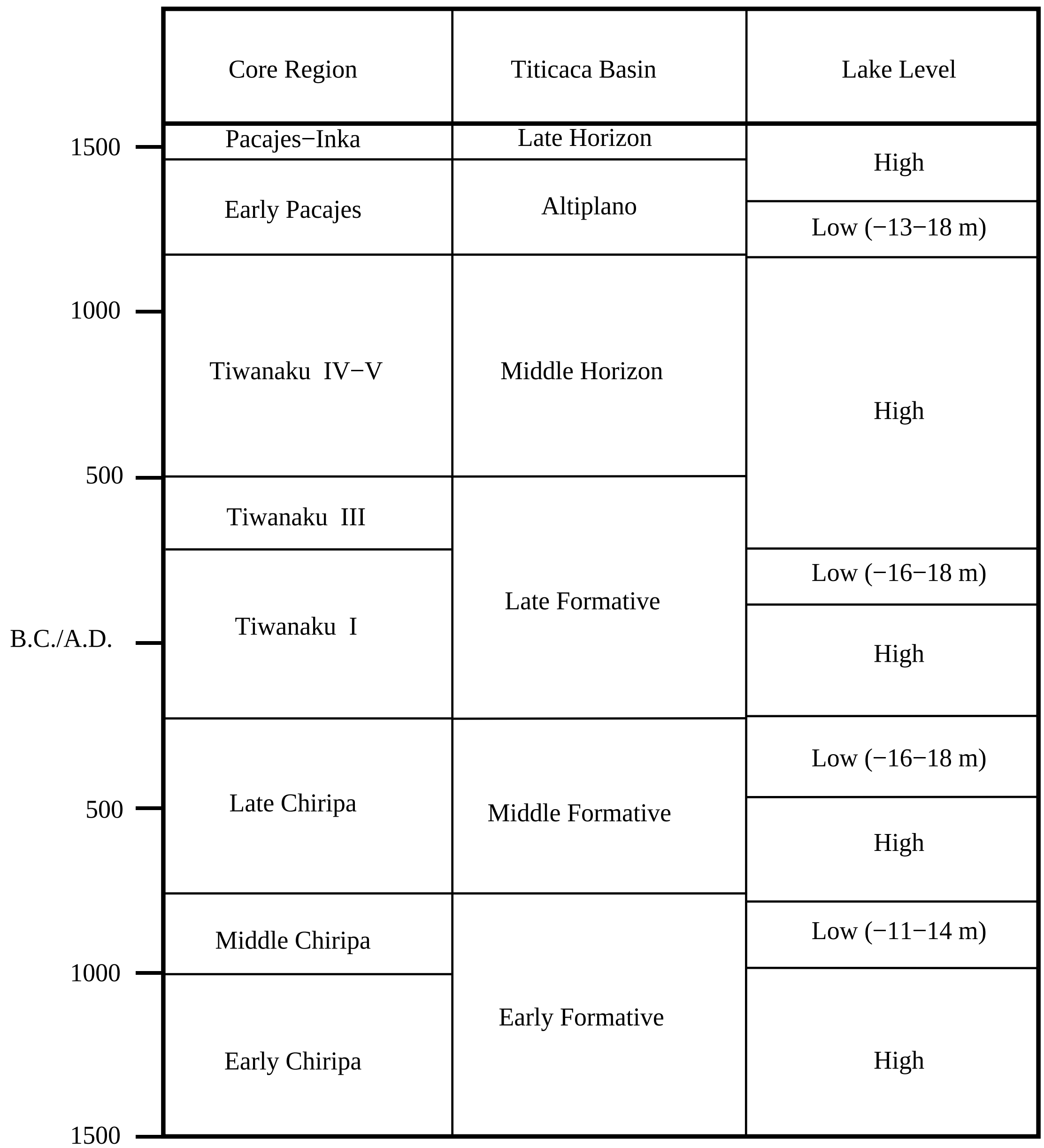


Figure 2.4: Tiwanaku Core Region chronology

Phase	Date	Span (years)
Late Pacajes	1540-1600 A.D.	60
Pacajes-Inka	1450-1540 A.D.	90
Early Pacajes	1100-1450 A.D.	350
Tiwankau (Tiwanaku IV-V)	500-1100 A.D.	600
Late Formative 2 (Tiwanaku III)	300-500 A.D.	200
Late Formative 1 (Tiwanaku I)	250 B.C. - 300 A.D.	550
Middle Formative (Late Chiripa)	800-250 B.C.	550
Early Formative 2 (Middle Chiripa)	1000-800 B.C.	200
Early Formative 1 (Early Chiripa)	1500-1000 B.C.	500

Table 2.2: Tiwanaku Core Region chronology

451). However, the work of Kidder in the northern Titicaca Basin caused Bennett to revise his sequence, placing the Chiripa culture before Early Tiahuanaco. With the publication of this revised sequence, the chronology of the southern Titicaca Basin assumed roughly its contemporary form (compare Bennett 1948, Table 3 to my Figure 2.4). The excavations of Bennett, and his meticulous and timely publications provide the baseline for our knowledge of the Chiripa culture.

The next persons to carry out archaeological work on the Taraco Peninsula were Maks Portugal Zamora and María Luisa Sánchez Bustamente de Urioste. There is some confusion as to the exact date when these two carried out excavations at Chiripa. This is compounded by the almost anecdotal evidence that their project did, in fact, take place. This work is known, to my knowledge, only through a four-page 1940 report to the Bolivian Minister of Education entitled *Los Hallazgos de la Hacienda Chiripa* (Portugal Zamora 1940). This report was used by Portugal Ortíz (Portugal Ortíz 1992) in an article published in the Universidad Mayor de San Andres's journal, *Textos Antropológicos*. In addition, Javier Escalante has published a plan derived from these excavations (Escalante Moscoso 1994, Figure 56). The work is also referenced in an unpublished report by Gregorio Cordero Miranda.

According to the Portugal Zamora report, he and Sra. Bustamente were sent on a reconnaissance expedition to the Taraco Peninsula by the Bolivian Ministry of Education. They were charged specifically with investigation of Chiripa and of Huacullani, and of prospecting for additional sites in the area. Indeed, Portugal Zamora is the first to clearly mention the site of Chiaramaya, near Chiripa, which is only mentioned again in an unpublished report from the 1970's (Erickson 1975). They also apparently discovered the stone stela - the famous *ídolo de Cala Cala* - at the site of Waka Kala in the modern community of Cala Cala (Portugal Ortíz 1998: 102). Portugal Ortíz, who obviously was in possession of the Portugal Zamora report and quoted from it at length and verbatim (Portugal Ortíz 1992), states that the work took place in 1940. Cordero Miranda, on the other hand, states that Portugal Zamora and Bustamente were present in Chiripa in 1937. Given that Cordero's report was probably written in 1955 or 1956, I am inclined to credit his date and to assume that Portugal Ortíz simply took the date of Portugal Zamora's report to be the year of the excavations. In terms of the work itself, Portugal Zamora and Bustamente cleaned some of Bennett's trenches, and excavated another structure on the Chiripa mound. Beneath the floor of this structure they apparently uncovered a series of interments, some of which have been described in print (Portugal Ortíz 1992). Their results have never been properly published, however.

There followed a 15-year hiatus in which, to my knowledge, no archaeologist worked on the Taraco Peninsula. The next project was that of Alfred Kidder II in 1955. Kidder was employed at the time by the University of Pennsylvania, and had just completed a series of excavations at Tiwanaku. He was accompanied by his wife, Mary, and various students and colleagues, one of whom was Bolivian archaeological pioneer Gregorio Cordero Miranda.

Very little information on this project has been published. The only sources of which I am aware are a short piece by Kidder in the *University Museum Bulletin* (Kidder 1956) and the very important article by Karen Mohr Chávez (Chávez 1988) based on the access of that author to Kidder's unpublished material. In addition, Cordero Miranda prepared a nine-page typewritten report on his part in the excavations, which remains in typescript form, and Chávez's (then Karen Mohr) M.A. thesis (Mohr 1966) contains some additional information.

Kidder's project excavated portions of at least three of the Chiripa culture structures first discovered by Bennett. and cleaned the previously-excavated remains of others. Through careful observation of profiles and earlier excavations, Kidder et. al. were able to reconstruct with remarkable precision the form of the entire complex, still buried beneath a meter of later fill. Their excavations beneath structure floors also revealed a large mortuary assemblage, including some examples with relatively elaborate treatment. Finally, excavating below the upper structures, they encountered an earlier layer of structures, entombed by the remains of the later ones discovered by Bennett. Using this three-stage stratigraphic sequence (Upper House, Lower House, and Pre-Mound Levels), Karen Chávez elaborated a three-phase ceramic sequence, comprising Early, Middle and Late Chiripa (Mohr 1966, Chávez 1988). Though limited by very small sample sizes for the earlier phases, this was an important advance in our understanding of the Formative Period chronology of the southern Titicaca Basin.

It was another twenty years before another archaeologist was to excavate on the Taraco Peninsula. David Browman of Washington University carried out two seasons of excavations, in 1974 and 1975. He was accompanied by Gregorio Cordero Miranda, the same Cordero who had participated in Kidder's excavations. Also present were a trio of Browman's students from Washington University, Clark Erickson, Charles Miksecek and Jonathan Kent, who went on to advanced studies in Andean prehistory.

According to Browman, the work consisted of "two seasons of clearing at the temple of Chiripa, including three stratified cuts testing earlier deposits" (Browman 1978a: 807). Interestingly, this was the first project at the site which did not excavate any of the "Upper House Level" structures originally discovered by Bennett. Instead, Browman devoted his efforts to the clearing of the sunken court located in the center of the mound - from which some 1450 cubic meters of fill was eventually removed (Browman 1978a: 811) - as well as to the excavation of a several deeper test pits. Despite heavy disturbance related to recent stone robbing, Browman was able to associate the upper sunken court with a Late Formative occupation. He also discovered another sunken court below the visible on, which he assigned a Middle Formative date. He argued that this earlier structure was contemporary with the occupation of the Upper House Level. Like earlier investigators, Browman continued to think of the Chiripa mound as a small villages of 14-16 houses. However, he did interpret at least the later sunken court as a special purpose structure - a "temple" - and identified an associated Late Formative 2 (Tiwanaku III) habitation area in an off-mound area.

Although Karen Chávez never actually conducted research in the area - she worked instead with Kidder's collections - no account of Taraco Peninsula research would be complete without mentioning her very important 1988 article (Chávez 1988). This article singlehandedly and completely changed archaeologists' conceptions of Chiripa. Where other scholars had interpreted the mound with its enclosure of structures as a small village, Chávez interpreted the mound, enclosure, and sunken court together as a "temple-storage complex" (Chávez 1988: 17). In an exhaustive analysis, she argued that these structures were not in fact used for habitation. Rather, their architectural properties, together with their associated sculptural, ceramic, and botanical assemblages all indicated use for storage and ritual. Further, a careful consideration of stylistic relationships indicated that the Chiripa complex was antecedent to the temple structures of the later Pukara culture. She also associated Chiripa ceramics, architecture and sculpture with the early Yaya-Mama stone sculptural style (Chávez and Chávez 1970, Chávez and Mohr Chávez 1975). Together, all of these features comprised the "Yaya-Mama Religious Tradition" (Chávez 1988: 17). At a stroke, the "houses" of Bennett, Kidder, and Browman became special use structures, employed for the storage of ritual goods, foodstuffs, or even ancestral mummies, and central to the ceremonies and rites which unified ancient Titicaca Basin populations. The Upper House enclosure was no longer a village, but rather a public ceremonial complex located at the center of a village, the remains of which were scattered in the surrounding agricultural fields.

Following the established frequency of one archaeological project every 15-20 years, the Taraco Archaeological Project (TAP) began work on the peninsula in 1992. This project, directed by Christine Hastorf of the University of California, Berkeley, excavated in 1992, 1996, 1998, and 1999 at Chiripa.[6] TAP began excavations, as noted, only four years after the publication of Chávez's article, and the excavation strategy was guided by her conclusions. Excavations were designed to recover the remains of domestic houses and middens (Hastorf 1990b), and for this reason were all initially located off-mound. While ample evidence of domestic occupation was encountered - in the form of refuse deposits and middens - poor preservational conditions made it impossible to excavate domestic architecture. What was preserved, however, was a series of public architectural constructions which predates the Upper House Level enclosure (Bandy 1999b, Bandy et al. 1998, Dean and Kojan 1999, Paz Soría 1999). Over four seasons of excavation, TAP has managed to define a sequence of 5 separate public architectural complexes beginning as early as 1000 B.C. This sequence is described in some detail in section 6.3.

Almost seventy years of sporadic archaeological research has therefore demonstrated that the Taraco Peninsula was an early locus of settled village life. The region also saw very early development of public architecture and ritual paraphernalia. Many of the features proved to be very long-lived, far outlasting the culture that invented them. Echoes of Chiripa Culture art and architectural practices can be discerned in the later Pukara, Tiwanaku, and even perhaps Inka corporate styles. However, all research had been conducted at the site of Chiripa itself. Many questions remained regarding the regional context of these developments. A longitudinal study of settlement and demography on the Taraco Peninsula promised to be relevant to questions of the development of social complexity and social evolution generally. I resolved to undertake such a project; this document reports its results.

[6] I participated in all of these seasons; and as co-director since 1998.

Chapter 3

Field methodology and ceramic phase identification

Between July of 1998 and July of 1999 the Catastro Arqueológico Taraco (CAT), under my direction, undertook a full coverage archaeological survey of the Taraco Peninsula. The survey area covers approximately 85.22 km^2. It may be found on Hoja 5844 IV of the Carta Nacional of the Instituto Geográfico Militar de Bolivia. The project area is located mainly in Canton Taraco, Provincia Ingavi in the Department of La Paz, though a small portion of Canton Huacullani, Provincia Los Andes was also surveyed. In the course of the work the project registered 476 prehistoric sites dating to all periods of the region's human occupation (Figure 3.1 and Appendix A).

The CAT survey of the Taraco Peninsula extends what is becoming a very important settlement dataset in the southern Lake Titicaca Basin. This includes surveys of the Tiwanaku Valley by Juan Alabarracín-Jordan and James Matthews, and of the Pampa Koani by John Janusek. Together with the Taraco Peninsula, these surveys have covered about 600 contiguous square kilometers and have registered nearly 2000 archaeological sites. This makes the southern Titicaca Basin one of the best-studied areas in South America.

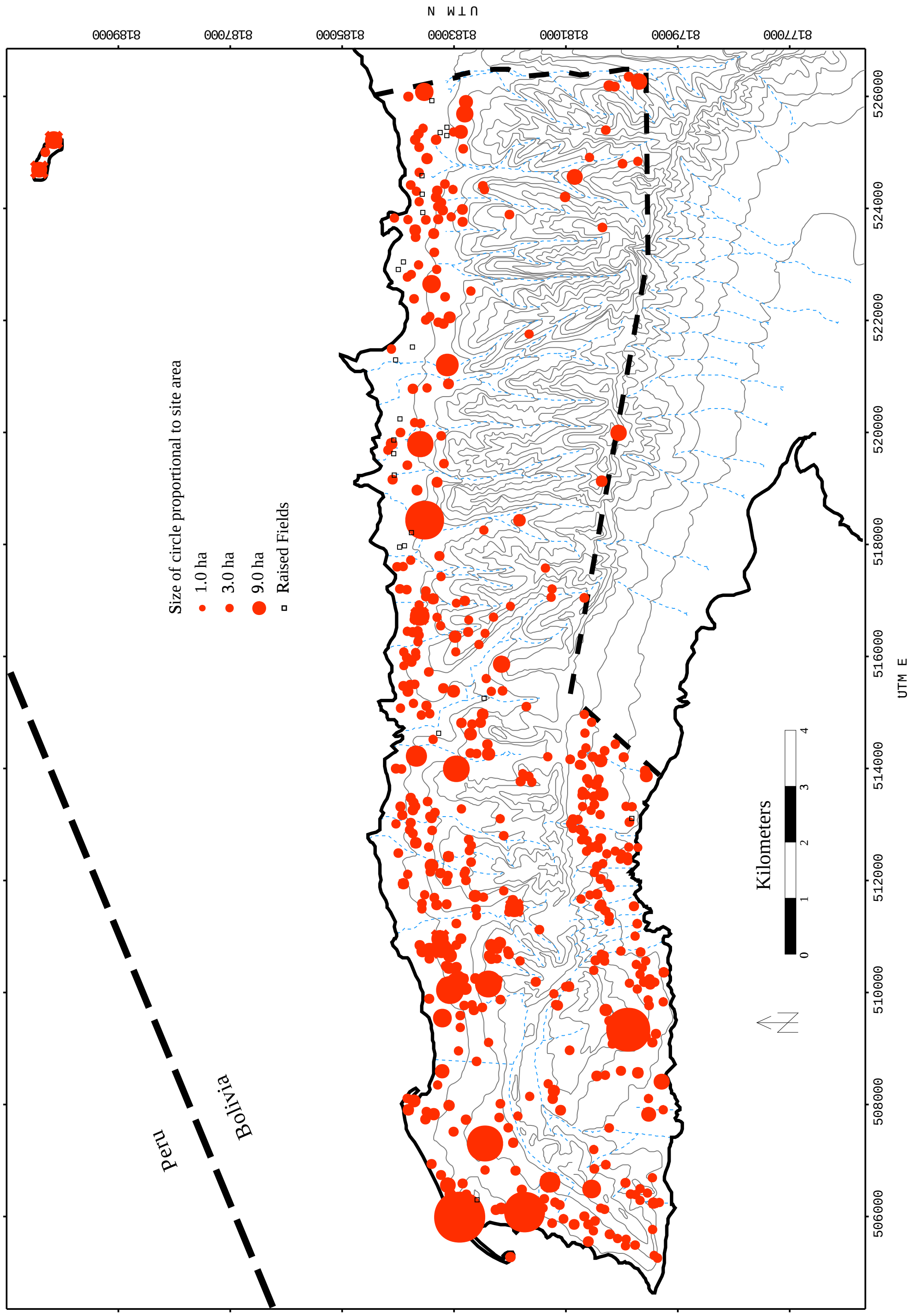


Figure 3.1: Project Area: All Registered Sites

3.1 Survey and site definition

The methodology employed in site location and initial recording was the orthodox methodology developed for total coverage pedestrian archaeological survey in arid and semi-arid areas, and is therefore broadly comparable to that of prior settlement research carried out in the Titicaca Basin (See Albarracín-Jordan and Mathews 1990, Mathews 1992, Albarracín-Jordan 1996a, Stanish et al. 1997, Stanish 1994) and in much of the Americas (cf. Fish and Kowalewski 1990, Parsons 1976). Coverage was achieved by walking parallel North-South transects with a crew of between five and seven persons. Crew members were spaced at 30 meter intervals. When prehistoric cultural materials were encountered I personally inspected the potential site.

Most sites consisted of ceramic scatters. Some agricultural features were observed and were assigned site numbers. These were unusual, however.

3.1.1 Ceramic scatters

As no aceramic habitation sites were encountered, the sole criterion used to define non-agricultural sites was the density of the prehistoric sherd scatter. I am aware of the artificiality of the site concept, and of attempts that have been made to remedy it. However, as the research progressed several things became clear which compelled me to adopt a site-based approach to settlement research. First, all previous surveys in the region had adopted such an approach, and I wanted to ensure compatibility with existing data sets. Second, it rapidly became apparent that the quantity of prehistoric material in the research area was quite extensive (almost 500 sites were eventually identified) and that without the shorthand recording method of “the site” it would be quite impossible to document this material with the limited resources at my disposal. Third and finally, it was clear that certain clusters of ceramics in the study area were much more dense than others. While the entire Taraco Peninsula is one large, low-density ceramic scatter, certain areas within it do stand out as being more dense than others. This observation was made some years earlier in my surface collection of the site of Chiripa (Bandy 1999d). I finally decided to use a density of 0.1 sherds per square meter over an area of at least 100 square meters as the minimum site definition, the same site definition criterion I had earlier decided upon for Chiripa. While this figure is indisputably arbitrary, it does nevertheless seem to have some real significance, as the empirical evidence from the systematic surface collections will show. The smallest possible site using this definition would be 10 sherds in a 10x10m area. In actual fact, almost no sites approached the minimum, the vast majority covering at least 1000 square meters with 100 or more sherds.

When a site was encountered - that is, a concentration of ceramic fragments in which those pertaining to a single time period attained a density of at least 0.1 sherds per meter squared over an area of at least 100 m^2 - then the point of greatest density was located. This was used as the site center, and was located in space using a Magellan GPS receiver (set to the South American provisional datum of 1956). The dimensions of the scatter were then determined by pacing North-South and East-West from this center. The area of the site is calculated as the product of the length of these two axes. If ceramics from multiple prehistoric time periods were present, then multiple sectors were defined.

“Sector” is best understood as a “site within a site,” and is conceptually similar to the common usage of “component” or “occupation.” Indeed, I will use all of these terms interchangeably. A sector is an area containing a continuous distribution (at least 0.1 sherds per m^2) of ceramics from a single prehistoric time period. Sometimes multiple sectors overlap, and together form a site. A site, then, could also be defined as one or more overlapping sectors. As will become apparent later on, the sector represents the truly fundamental unit of my analysis, the site being simply a convenient recording mechanism. It is important to note at this juncture that agricultural features can be sectors, as well. Thus a scatter of Early Pacajes sherds adjacent to a small raised field group would constitute a single site but two sectors. These two sectors would have distinct sizes and phase attributions, and would therefore be entirely separate analytically.

Site recording involved location, measurements and sector definition, as described above. Additional information recorded on the site form included community, property owner, time period, a basic site typology (useful for distinguishing habitation sites from agricultural features, primarily), microenvironmental zone (as defined in the Chapter 2), local resources (springs, viewshed properties, access limitations, etc.), modern disturbance, agricultural history, ground cover and so on. A small sample of representative diagnostic sherds was also recovered, along with any exotic lithic materials or prehistoric metal objects (extremely rare) encountered. In general I tried to collect a minimum of 30-40 phase-diagnostic sherds from a given site, though this often proved to be impossible on the smaller sites.

3.1.2 Agricultural features

Agricultural sites were almost exclusively remnant raised fields, though one small set of probable prehistoric agricultural terraces was recorded. Raised fields are a common sight in the Titicaca Basin, distinguishable as low, fairly subtle swales and dips in marshy flat areas (Erickson 1994, Lennon 1982, Lennon 1983, Smith et al. 1968). These features were typically photographed and were measured by pacing. They were given site numbers continuous with those of the ceramic scatters. It is worthwhile to note that raised field groups on the Peninsula were relatively uncommon and relatively small (< 1 ha) compared to those in the adjacent Pampa Koani, where raised field groups are numerous and very large (cf. Kolata 1986, Kolata 1991, Seddon 1994a). This is an immediate and compelling fact and is very informative when considered in light of other differences between these two areas. This will be discussed at considerable length in later chapters.

3.2 Systematic surface collection

The method outlined above for determining the dimensions and centers of the various sectors that make up a site worked well on small sites and on sites with relatively short-term occupations. In the case of larger sites, however - in the 5 to 15 ha range - with very long-term occupations this method proved to be untenable. In order to collect detailed occupation information over the entire occupation span of these larger sites, comparable to that easily obtained for smaller sites, a program of intensive systematic surface collection was carried out. The methodology employed was the same as that I had used earlier at the site of Chiripa (Bandy 1999d) and, with Paul Goldstein, at the site of Chen Chen (M-1) in the Moquegua Valley of Peru (Bandy et al. 1996).

The surface collection was begun typically at the point of greatest ceramic density within the site, as determined in the initial recording of the site, as described above. Around this point, a circle with a radius of 3.99 meters (that is a 50 m^2 circle) was scratched into the surface, and all ceramics in this area were collected and assigned an arbitrary and sequential number which I refer to as a locus number. Locus numbers allocated for the surface collection program were between 4000 and 4999, assigned arbitrarily, and were therefore continuous with the locus numbers used in the various excavation seasons of the Taraco Archaeological Project at Chiripa (0-3999). Each surface collection locus, therefore, refers to a 50 m^2 circular area within a site with a center defined in terms of a master site grid. This grid was laid out on every site in which we undertook systematic surface collection. It was oriented to the cardinal directions (though note that in the 1998-1999 surface collection program this grid was laid out using a magnetic compass and without correction for declination; North in this case is magnetic North). The central point of the site, as defined above, was typically assigned the coordinates 1000N/1000E. Additional surface collection loci were collected at 50 meter intervals until the whole area of the site had been sampled (that is, until the surface density of prehistoric ceramics had dropped below 0.1 sherds per m^2, equivalent to 5 sherds in the 50m^2 circle). Each locus, or collection unit, sampled an area of 50x50m or 0.25 ha. Thus, a 5 ha site, when surface collected, would comprise 20 collection loci. The ceramic data resulting from these surface collections are summarized in Appendix B.

All ceramics within each locus were collected, washed, sorted and analyzed; almost 100,000 sherds altogether. Though I would like to have collected all lithics from each locus as well, this proved to be impossible. The density of debitage in most sites, particularly Formative period ones, was such that systematic debitage collection would quickly have exhausted my resources for both analysis and curation. This being the case, I decided that only formal tools and debitage of non-local origin were to be collected; flakes and shatter of quartzite and local cherts were noted in a general way on the locus form but were not recovered. Faunal material was not collected due to the fact the rapid deterioration of bone when exposed to sunlight and to the elements and to the continued deposition of modern faunal remains on site surfaces. Metal objects of clear prehistoric origin were collected, though these were quite rare. Human skeletal material, encountered occasionally in disturbed contexts, was not collected out of respect for local sensibilities and appreciation of the evident curation difficulties. I wished to avoid associations with huaqueros or looters and therefore avoided human remains as much as possible.

All told, 420 loci were collected in the course of the work (in addition to the 154 loci of the 1996 Chiripa surface collection programme which were reanalyzed for the present study), comprising over 1 km^2 of systematically collected total site area. Even so, there were some sites - T368 and T319 spring immediately to mind - that really should have been systematically collected but were not due to lack of time and money. With these few exceptions, though, every multicomponent site in the survey area larger than 5 ha was systematically surface collected. In addition, many smaller Formative period sites were collected. This is so because it proved to be impossible to distinguish Early and Middle Formative occupations without systematically collected assemblages. Therefore all sites with Early and Middle Formative occupations were collected - again with a few exceptions.

It is worth noting that the systematic surface collection program and analysis of the resulting materials accounted for well over 2/3 of my total time in the field. Though this method produces excellent fine-grained settlement data it must be acknowledged that it requires a quite substantial investment of time and resources.

3.3 Ceramic phase identification

Analysis of the ceramics produced by both general and systematic surface collection of sites was oriented almost completely toward chronological questions. The goal of the fieldwork as a whole was to produce as temporally and spatially fine-grained a settlement dataset as possible, and the goal of the ceramic analysis was the same.

Fortunately, quite a lot of work has been done on the ceramics of the region obviating the need to produce an entirely new chronology. In particular, the Early and Middle Formative period chronology of Steadman (Steadman 1999) proved to be quite workable (though with some modifications as outlined below), as did the Pacajes chronology (Late Intermediate Period/Late Horizon/Early Colonial Period) of Albarracín-Jordan and Mathews (Albarracín-Jordan 1992, Mathews 1992, Albarracín-Jordan and Mathews 1990). My Early and Middle Formative and Pacajes chronologies as presented here are basically simple adaptations of these previous works.

Other time periods proved to be less tractable. I found that, like other settlement archaeologists working in the Titicaca Basin, I was unable to distinguish between Tiwanaku periods IV and V (see Ponce Sangines 1981) on the basis of surface materials. It is becoming increasingly clear that neither the Wila Jawira chronology adapted by Kolata and associates from Ponce's work (Ponce Sangines 1981) nor the modified Bennett (Bennett 1934, Bennett 1936, Bennett 1948) sequence of Albarracín-Jordan and Mathews (Albarracín-Jordan 1992, Albarracín-Jordan 1996a) is a tenable chronology for settlement survey. Goldstein's chronology (Goldstein 1985, Goldstein 1989a) from the Moquegua Valley, Peru is likewise unusable in the altiplano, though it does appear to be useful for Moquegua. Burkholder's recent work (Burkholder 1997) has promise, but seems - like other chronologies - to rely on relatively intact decorated specimens, always a rarity in surface assemblages. A new highland Tiwanaku chronology designed with mixed and fragmentary surface materials in mind would be most welcome and would be a positive boon to research in the South-Central Andes. Lacking this, however, I was forced to combine all Tiwanaku IV-V materials into a single Tiwanaku phase, as unsatisfactory as this may be.

Also problematic were the Late Formative phases. Ponce originally defined the Tiwanaku I-III phases based on his excavations at Tiwanaku and on the prior definition by Bennett of an 'Early Tiwanaku' phase. They have bedeviled archaeologists since. The principal difficulty, as others have pointed out (c.f. Janusek 2001, Mathews 1992), is that Ponce's phases were defined in terms of decorated wares: zoned-incised in the case of Tiwanaku I, polychrome painted in the case of Tiwanaku III. This is even more problematic in the case of the Late Formative than in that of Tiwanaku IV-V, as the relative abundance of decorated wares in the later Tiwanaku periods contrasts with their extreme scarcity in the Late Formative. To resolve this difficulty John Janusek and Carlos Lémuz have both produced Late Formative plainware ceramic chronologies for the southern Titicaca Basin based on excavated materials (Janusek 2001, Lémuz Aguirre 2001). These chronologies are at present in a tentative state. The rudimentary plainware chronology employed here, and described in the Late Formative chapter (Chapter 7), is my own invention, though produced in close consultation with both Janusek and Lémuz who very generously shared their insights and unpublished data with me. It is consistent with both of their chronologies, though more limited in scope and focused on a restricted range of common paste types.

In short, then, my ceramic analysis was oriented to the identification of assemblages from the various time periods. These assemblages differ radically. Perhaps even more significant, the existing chronologies for the various phases diverge considerably in emphasis and focus. Thus the Early and Middle Formative chronology is focused largely on plainware pastes, while the later period chronologies (Tiwanaku and Pacajes) center on decorated wares. The Late Formative chronology is minimally developed. This situation made it necessary to adopt different strategies for the identification of assemblages of the various phases. Though this matter will be discussed in later chapters as well, here I provide a brief summary of the methods and techniques I developed to distinguish occupations of various phases in mixed surface collection assemblages.

3.3.1 Identifying Early and Middle Formative period ceramics

The Early and Middle Formative periods, as I define them here, correspond to the Early, Middle and Late Chiripa phases as defined by Steadman (1999). The many attributes employed by Steadman include paste, firing, slip, finish, rim form and diameter, and decoration, among others. Each phase is identified by a particular combination of attribute ranges. The key point here is that there are very few attributes that are unique to any given phase. A particular paste, for example, will be most common (say 40%) in one phase, but will also occur in lower frequencies (say 5-10%) in other phases as well. Of the few attributes that are truly diagnostic or phase-specific (such the neckless olla form for the Early Chiripa phase [Steadman 1999: 62-63 and Figure 22]), all are quite rare, so that they may be observed on only a small percentage of an assemblage. This means that while Steadman's chronology is quite directly and easily applicable to unmixed assemblages (assemblages representing a single phase), it is more difficult to apply to mixed assemblages. Since the vast majority of the Early and Middle Formative Period sites encountered in the survey were multi-component, I was forced to devise a method for distinguishing relative percentages of phase-specific attribute frequency profiles in mixed assemblages. I term this method *frequency profile analysis*.

Frequency profile analysis

Frequency profile analysis consists in comparing a series of attribute frequency profiles. These profiles are of two types: *index profiles* and *assemblage profiles*. An index profile is an 'ideal' profile which analytically identifies a phase.[1] Let us say that our ceramic analysis involves a single attribute with three possible states. A phase index profile consists of the percentages of each of those attribute states in a given phase. So the index profile of Phase 1 would be in the form A-B-C, where A is the percentage of attribute state A, B the percentage of attribute state B, and C the percentage of attribute state C in an unmixed Phase 1 assemblage. Thus a possible Phase 1 index profile would be 30-60-10, meaning that in Phase 1 assemblages 30% of sherds have attribute state A, 60% have attribute state B, and only 10% have attribute state C.

An assemblage profile consists of the relative frequencies of possible attribute states within a given empirical assemblage, such as the ceramics from a surface collection or excavation locus. The assemblage profile therefore represents an empirical frequency dis-

[1] What Kohler and Blinman call a "calibration data set" (Kohler and Blinman 1987: 2). I am aware of two previous attempts to mathematically separate mixed archaeological assemblages. One (Kohler and Blinman 1987) employed multiple linear regression to separate mixtures of six phases each defined in terms of relative frequencies of 18 ceramic types. Their case is considerably more complex than my own. The other attempt (Stahle and Dunn 1982) used regression to estimate the contribution of various stages of biface manufacture to a mixed debitage assemblage.

My own solution to the mixture problem relies on the computational brute force made available by recent personal computers, rather than on the more elegant statistical analyses of earlier researchers.

tribution, as opposed to the ideal frequency distribution of the index profile.

The method of frequency profile analysis is to generate a series of hypothetical assemblage profiles - one for every possible combination of the predefined index profiles. In the case of my surface collection ceramic analysis, the index profiles represented the various ceramic phases defined for the region, and the hypothetical assemblage profiles were every possible mixture of these phases, ceramically defined. The empirical assemblage profile is then compared to the full range of hypothetical assemblage profiles. The closest match is found and this is taken to indicate the specific mixture of ceramic phases represented in a particular empirical assemblage.[2] Matching between the hypothetical and empirical assemblage profiles is accomplished automatically by computer using a simple recursive algorithm. The algorithm attempts to minimize the quantity d:

$$d = \frac{abs(H_1 - E_1) + abs(H_2 - E_2) + ... + abs(H_n - E_n)}{n}$$

where E = empirical assemblage profile
H = hypothetical assemblage profile

Thus, the best match is the hypothetical assemblage profile with the lowest average departure from the frequencies recorded for the empirical assemblage profile. The short program I have written for the analysis of the surface collection materials - which performs this operation - is included as Appendix C.

Paste classification

Clearly frequency profile analysis may be applied to very complicated index schemes involving multiple attributes and attribute states. For the analysis of the Taraco Peninsula surface data, however, I designed a very simple index scheme, which is outlined below. Given that I had a limited amount of time to complete the analysis of a substantial ceramic dataset (approx. 94,000 sherds) I decided to use only a single attribute in defining the

[2] Frequency profile analysis is superficially related to standard seriation practice (Marquardt 1978), but only superficially. Kohler and Blinman: "Unlike seriation, which would normally force a mixed collection into a single position on a linear continuum usually interpreted as time, this approach identifies mixing, if present, and apportions the collection into one or more temporal components" (Kohler and Blinman 1987: 2-3).

phase index profiles. The attribute I chose was paste, for two principal reasons; first, Lee Steadman had already demonstrated that there were quite significant shifts in the relative frequencies of pastes between the phases of her Chiripa sequence; second, simple paste classification is a very rapid process and enabled me to complete the analysis within the available time.

My paste classification, designed as it is simply to distinguish the three phases of the Chiripa sequence, is considerably less elaborate than that of Steadman (see Table 3.1 for the relationship between my paste groups and Steadman's pastes). As Cowgill has observed with reference to seriation, "often one can throw away much of one's information and still obtain a good chronological ordering" (Cowgill 1972). Thanks to Steadman's work, I was able to avoid collecting much ceramic information at all, and focus instead on only a few factors known to have chronological significance. Thus the attribute "paste" has in the present analysis only four states: paste groups 1, 2, 3 and other. It should be emphasized that all of these paste groups are subsets of Chiripa ceramics; thus, all are fiber-tempered.[3]

1. Paste Group 1: Any sherd containing one or more large, opaque, angular quartz fragments. This group is similar to Steadman's Paste 21, which as she says accounts for 48% of the Late Chiripa assemblage (Steadman 1999: 66). This paste group is easily identified without magnification. Composed principally of Steadman's Pastes 19 and 21. Identified without magnification.

2. Paste Group 2: Any sherd not fitting the description of paste group 1 which has translucent, rounded quartz inclusions. These inclusions are the predominant tempering agent. This paste group is most common in the Middle Chiripa phase. Composed principally of Steadman's Pastes 19 and 26. Identified under 10X magnification.

3. Paste Group 3: Any sherd not fitting the description of groups 1 or 2 which has a large amount of mica visible in the matrix and on the surface. This paste group is most common in the Early Chiripa phase. Composed principally of Steadman's Pastes 17, 18 and 19. Identified without magnification.

[3] See Steadman 1999 for a much more detailed account of Chiripa ceramic chronology.

4. Paste Group Other: Any Chiripa sherd not belonging to any of the three paste groups defined above. Principally, in my sample, Steadman's Pastes 16, 19 and 23.

The analytical process which I applied in order to generate counts for each of the four paste groups is represented schematically in Figure 3.2. It is important to note that in my scheme no sherd can belong to more than one group, and the determination of group membership must be made in a particular order. Thus, a sherd with both angular opaque quartz inclusions and abundant mica in the paste would, according to my process, be classified as paste group 1, not as paste group 3. This is because the assignment to paste group 1 comes earlier in the analytical sequence. My classification is therefore a taxonomy, in Dunnell's sense of the term (Dunnell 1971).

I would like to emphasize again that my paste groups differ from Steadman's pastes in several ways. Though I use some of the same attributes she uses to defined pastes, I evidently construe them more broadly than she. For example, the presence of transluscent, rounded quartz inclusions is used by Steadman to define her Paste 26. The same attribute is also used by myself to define my paste group 2. And, indeed, as Table 3.1a shows, virtually all of Steadman's Paste 26 sherds (over 90%) fall into my paste group 2. However, many other sherds from other pastes also fall into paste group 2, especially sherds Steadman had classified as Pastes 19 and 30. This would seem to indicate that I am including a broader range of objects in my definition of "transluscent, rounded quartz inclusions" than is Steadman. The same is true of the other attributes I use for the other paste groups. This is not a real problem, of course, but it is yet another indication that anyone wishing to duplicate my methodology will need to obtain a bag of pasted ceramics and generate their own index profiles for the Chiripa phases beforehand. A calibration step is apparently necessary for each analyst.

For the purposes of my analysis, only sherds of paste groups 1-3 were counted. Therefore, if a is the number of sherds of paste group 1, b the number of sherds of paste group 2, c the number of sherds of paste group 3 and n equals $a+b+c$, then a frequency profile takes the following form $\left(\frac{100a}{n}\right)$-$\left(\frac{100b}{n}\right)$-$\left(\frac{100c}{n}\right)$ where '-' is used as a delimiter and not as a subtraction operator. Therefore, if a particular group of sherds has 21 of paste group 1, 46

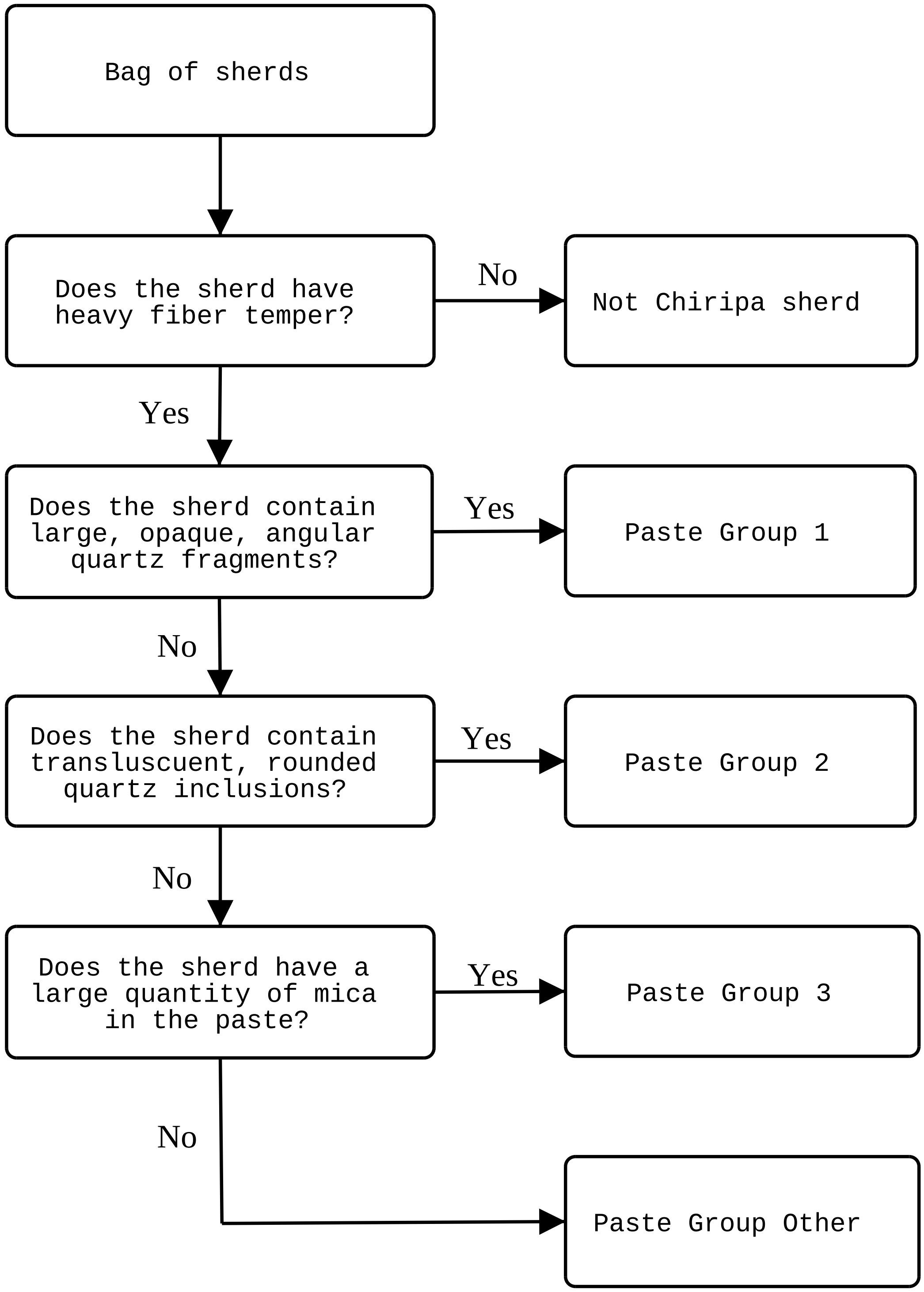


Figure 3.2: Chiripa ceramic analysis process flow chart

- a) counts

Steadman Paste	Paste Group 1	2	3	Other Chiripa	Total
16	0	5	1	10	16
17	0	13	144	7	164
18	6	10	51	2	69
19	21	79	65	40	205
20	0	9	12	4	25
21	72	0	0	0	72
22	0	1	2	0	3
23	1	4	5	8	18
24	0	0	1	3	4
25	0	2	20	2	24
26	1	90	1	0	92
30	0	12	6	0	18
Total	101	225	308	76	710

- b) proportions

Steadman Paste	Paste Group 1	2	3	Other Chiripa	Total
16	0.0	2.2	0.3	13.2	2.3
17	0.0	5.8	46.8	9.2	23.1
18	5.9	4.4	16.6	2.6	9.7
19	20.8	35.1	21.1	52.6	28.9
20	0.0	4.0	3.9	5.3	3.5
21	71.3	0.0	0.0	0.0	10.1
22	0.0	0.4	0.6	0.0	0.4
23	1.0	1.8	1.6	10.5	2.5
24	0.0	0.0	0.3	3.9	3.6
25	0.0	0.9	6.5	2.6	3.4
26	1.0	40.0	0.3	0.0	13.0
30	0.0	5.3	1.9	0.0	2.5
Total	100	100	100	100	100

Table 3.1: Correlation of CAT Paste Groups and Steadman's Pastes.

Early Chiripa	2-27-71
Middle Chiripa	7-75-18
Late Chiripa	68-18-14

Table 3.2: Index Profiles for the Chiripa phases

of paste group 2, 14 of paste group 3 and 25 of paste group other, the assemblage profile would be $(\frac{100*21}{21+46+14})$-$(\frac{100*46}{21+46+14})$-$(\frac{100*14}{21+46+14})$ or 26-57-17.

Early and Middle Formative period index profiles

The basic paste group descriptions were derived from the published and unpublished materials of Steadman. The decision to use paste as the key attribute was determined by her work on excavated Chiripa ceramics. However, the paste groups described above do not correspond to any of Steadman's pastes. Rather I arrived at them by performing a reanalysis of a series of bags of ceramics from the Chiripa excavations which Steadman had recommended to me as unmixed examples of the three Chiripa phases. These bags were from loci 2298 (435 sherds, Early Chiripa), 2299 (153 sherds, Early Chiripa), 2156 (214 sherds, Middle Chiripa), 2295 (113 sherds, Middle Chiripa), 2034 (305 sherds, Late Chiripa), 2036 (106 sherds, Late Chiripa), 2244 (207 sherds, Late Chiripa), 2247 (162 sherds, Late Chiripa) (see Hastorf 1999, Hastorf and Bandy 1999 for a description of the TAP excavation and provenience system). The index profiles for the Chiripa phases were therefore based on an analysis by the author of 588 (Early Chiripa), 327 (Middle Chiripa) and 780 (Late Chiripa) sherds. While this is obviously not optimal, it does provide a usable baseline for frequency profile analysis.

The index profiles for the Chiripa phases derived from this work are shown in Table 3.2. It is clear from these profiles that the frequencies of the three paste groups differ rather drastically from phase to phase. It is equally clear, though, that all paste groups are represented in all phases. Therefore, the find of a particular paste group on the surface of a site is not sufficient to indicate an occupation from any of the Chiripa phases. This situation is what makes frequency profile analysis necessary in the first place.

Again I must stress that my paste groups are not the same as Steadman's pastes. However, three of the bags which I analyzed (loci 2247, 2295, 2298) had previously been sorted for paste by Steadman. It is therefore possible to correlate my paste groups with her pastes. This is summarized in Table 3.1. It is clear, then, that my paste group 1 is strongly correlated with Steadman's Paste 21. My paste group 2 is composed primarily of Steadman's Pastes 19 and 26 (26 is characteristic of the Middle Chiripa phase), and paste group 3 is related to Paste 17, most common in the Early Chiripa phase. My paste groups therefore capture the crudest chronological implications of Steadman's paste chronology, while not pretending to the precision of her classification.

Assemblage profile matching

Having defined the index profiles for the Chiripa phases, it remained only to produce an algorithm to find the closest match to specific assemblage profiles from among the 5151 possible combinations of the three index profiles. To this end I wrote a simple program in Perl, reproduced as Appendix C. This program presents a simple interface in which the user enters the details of an assemblage composition. The program then constructs an appropriate assemblage profile and compares this to the 5151 possible combinations of the three index profiles. It reports all matches deviating from the assemblage profile by less than 3 percentage points. Finally, it reports the closest possible combination, as a percentage of the three Chiripa phases and the number of sherds from the assemblage which would pertain to each phase. The output from a sample run of the program is given below. The example given is from surface collection locus 4339, a 50 m^2 collection unit at the site of T-394 (Janko Kala) in the community of Zapana.

```
   [/home/inti]> perl frequency_profile.pl
   Enter Paste Group counts in the assemblage to be
analyzed:
           Paste Group 1:  61
           Paste Group 2:  37
           Paste Group 3:  21
           All others:  31
   Summary of data:
```

```
                Group 1 Group 2 Group 3 Other
Count           61      37      21      31
% of Total      0.41    0.25    0.14    0.21
% of three      0.51    0.31    0.18
Press ENTER to continue
Matches with error less than or equal to 1:
LC%     MC%     EC%     error   LC      MC      EC
71      21      8       0.9     107     32      12
71      22      7       0.7     107     33      11
71      23      6       0.7     107     35      9
71      24      5       0.8     107     36      8
72      20      8       0.9     108     30      12
72      21      7       0.6     108     32      11
72      22      6       0.3     108     33      9
72      23      5       0.4     108     35      8
72      24      4       0.7     108     36      6
73      19      8       1       110     29      12
73      20      7       0.6     110     30      11
73      21      6       0.3     110     32      9
73      22      5       0.2     110     33      8
73      23      4       0.5     110     35      6
73      24      3       0.9     110     36      5
74      20      6       0.7     111     30      9
74      21      5       0.6     111     32      8
74      22      4       0.6     111     33      6
74      23      3       0.9     111     35      5
75      20      5       1       113     30      8
Best match:
LC%     MC%     EC%     error   LC      MC      EC
73      22      5       0.2     110     33      8
Would you like to process another surface collection
unit?  (y/n)no
Done.
Press Enter to Exit
[/home/inti]>
```

In this case the best match was a mixture of 73% Late Chiripa, 22% Middle Chiripa and 5% early Chiripa. The numbers on the right are the number of actual sherds in the unit from each phase, assuming that the best match actually represents the given mix of phases. Given my earlier definition of a site (0.1 sherds/m^2) and the dimensions of the circle (50m^2), I conclude that this particular unit lies within the boundaries of Early, Middle and Late

Chiripa occupations (sectors) of the site - though the Early Chiripa occupation in this unit is tenuous. In fact, this unit is from near the edge of the Early Chiripa sector. This is the method by which I defined occupations and sectors of the Early and Middle Formative Periods - the Early, Middle and Late Chiripa phases.

The method outlined in the foregoing is rather labor-intensive and not as precise as I would like. However, at present it is the only method ever proposed for distinguishing occupations of the various Chiripa phases using mixed surface assemblages. I have described it in such detail in the hopes that others may build on this work and hopefully supersede it.

As a final note, I should add that it is very difficult to learn to distinguish the various paste groups as I have described them here. They really cannot be conveyed satisfactorily in writing. I strongly urge anyone planning to employ this method to obtain a reference collection of unmixed Chiripa phase assemblages and to develop their own index profiles for the phases, as I did. The index profiles I have presented above will not be precisely valid for anyone but myself.

3.3.2 Identifying ceramics of the remaining periods

The Late Formative, Middle Horizon, Late Intermediate, Late Horizon, and Early Colonial Periods presented fewer difficulties in terms of ceramic identification. In none of these cases was frequency profile analysis employed. This was so for two reasons. First, no sufficiently detailed frequency seriation exists for these periods to allow such an analysis to be undertaken. The work of Steadman is unique in the region. And, second, it was possible to identify ‘markers’ or ‘diagnostics’ for each of these phases which were sufficiently common to permit the identification of sectors within multicomponent sites using surface collected material. In the case of the two Late Formative phases, these are plainware diagnostics. In the case of the later periods, painted sherds and distinctive rim forms were more useful, though in each a restricted range of plainware pastes could be used, as well. The details of the ceramics for each of these later periods will be presented in the corresponding chapters of this document. With the exception of the Late Formative period, they presented no real difficulties.

3.4 The dataset

The end product of the survey, the program of systematic surface collection and the ceramic analysis is a fine-grained settlement dataset, spanning the period from the first intensive human occupation of the region (around 1500 B.C.) through the first century of Spanish colonial rule (ca. 1600 A.D.). The minimal unit of this particular dataset is the sector, a spatially discrete cluster of archaeological materials pertaining to a single historic or prehistoric phase. For each sector we have recorded its location, size, dimensions, and any information that may be evident on the surface, such as the presence or absence of mound architecture or visible (disturbed) tombs. Sectors of various phases which overlap one another spatially are grouped together into units called 'sites,' which are numbered sequentially from T-1 to T-476. A site, as the term is used here, is nothing more than a collection of spatially contiguous sectors. For each site we have recorded information pertaining to its locality, such as the proximity of water sources and arable land and topographical defensibility.

This dataset - a list of sectors and their various properties - is the basis of the analysis that follows. The later chapters of this document discuss what this dataset reveals about the demographic, economic and political dynamics of Taraco Peninsula prehistory. First, though, it will be necessary to discuss in some detail the theoretical and methodological concerns relating to the use of this dataset. Most important will be the question of how the sector database may be used to measure prehistoric population. This is the theme of the next chapter.

Chapter 4

Interpreting settlement data

The methodology described in the preceding chapter is an excellent procedure for precisely defining the distribution in space of a determinate set of ceramic attributes. Concentrations of sherds with these attributes which satisfy an explicitly-stated test (in this case, the 0.1 sherds/m^2 rule) are recorded with respect to their location and a range of ancillary variables (topography, architecture, etc.). The register of these concentrations, or 'sites,' together with a much smaller list of other culturally significant spatial loci (agricultural features, rock art, the like) constitutes a settlement dataset, of which Appendix A is an example.

The dataset at this point has a strictly descriptive function. As yet it has acquired no interpretive significance. Between settlement data and settlement analysis yawns the chasm of "middle-range theory" or "bridging arguments." For the purposes of settlement analysis, crossing this chasm requires that the objective ceramic attribute distributions recorded in the dataset be correlated with relevant analytical categories. Standard practices exist for bridging the gap in settlement analysis, and these have become sufficiently transparent to archaeological practitioners that they are frequently allowed to remain implicit. The bridging arguments I intend to use here, however, differ somewhat from received theoretical practice. For this reason, I wish to describe them as explicitly as possible.

As I emphasized in the introductory chapter, I am interested primarily in the analytical categories of time and of population. Connecting ceramic attributes with the dimension of time is a relatively straightforward business, well-studied in archaeology (for a review see Marquardt 1978; for recent south-central Andean examples see Alconini Mujica 1995, Goldstein 1985, Steadman 1995), and my chronology will be a basically conventional one. Ceramic chronology will be discussed in the various chapters to follow. Connecting ceramic attribute distributions to measures of human population, however, and derived measures of demographic process, is a more difficult and disputatious matter. It is to this question that the present chapter is devoted.

4.1 Correcting site sizes

The process of relating the size of a sector (as defined in Chapter 3) to the size of the resident human population may be conceptualized algorithmically; that is as a series of operations performed upon an initial state or value (in this case, the sector size in hectares) which produce a desired final state or value (the number of human residents in a location at a given time). I refer to this process as "site size correction." Each step in the correction process involves the postulation of a series of assumptions and relationships, which I will attempt to spell out in what follows. It is worth emphasizing that site size correction procedures will vary drastically with settlement system type and with local circumstances and cultural peculiarities. The method I use in this study is limited in a double sense. First, it is particular to the Titicaca Basin. Second, it is based on very incomplete information. I expect this procedure to be considerably revised as reliable information on prehistoric household and village configurations comes to light.

That said, I here present a schematic formulation of the procedure - a simple enumeration of the steps involved in traversing the void between raw data and analytically useful information - which I subsequently explain in more detail.

Summary formulation

1. Assume that ancient household units are roughly comparable to modern ones.

2. Correct sector size for artifact "splash zone" in order to eliminate the influence of post-depositional processes on the extent of the sherd scatter.

3. Assume "point contemporaneity" of occupation within the sector.

4. Calculate total number of households for the sector.

5. Calculate a "sector population index" for the sector.

6. Calculate a "phase population index" of the region.

Each of these point will be addressed in turn in the sections that follow.

4.1.1 Assume that ancient household units are roughly comparable to modern ones

This is far from a safe assumption. First of all, as the archaeological literature on households clearly demonstrates, household configurations can change drastically over time (cf. Ashmore and Wilk 1988, Netting 1989, Wilk and Netting 1984). Secondly, there is concrete evidence of a significant shift in residential patterns at the end of the Tiwanaku period (ca. 1100 A.D.). Before this time, at least in the southern Titicaca Basin, people lived almost exclusively in sedentary villages. I have referred to this pattern as "nucleated habitation" (Bandy 1999d:24). After the collapse of Tiwanaku, however, people began to live in small isolated farmsteads. That is, people inhabited small clusters of one or a few households, separated from other such clusters by substantial tracts of uninhabited land, a pattern I have called "dispersed habitation" (Bandy 1999d:24).[1] This is how the majority of the regional population still lives today. Apparently, therefore, residential patterns changed significantly over time.

However, there is some evidence that while residential patterns shifted from nucleated to dispersed, the configuration of the actual household remained consistent. At present,

[1]This "nucleated" vs. "dispersed" distinction is of course not a new one. Drennan, for example, captures the same dimension of variability in his "compact" vs. " dispersed" settlement patterns (Drennan 1986).

local residents live as do most Aymara communities in the Bolivian highlands. A single family group - a married couple together with unmarried children and frequently with elderly relatives - will inhabit a small compound of structures (perhaps 3-5 rooms altogether), often enclosed by an adobe wall, and separated from other such compounds by cultivated fields (cf. Arnold 1988, Chapter 9).[2] Figure 4.1 is a schematic representation of a typical residential compound. Each of these compounds is adjacent to outdoor activity areas - much of the daily work of the household takes place out of doors - where activities such as threshing, chuño processing, weaving and so on take place. There are no well-defined middens, and this entire inhabited area contains a sufficient density of cultural material to qualify as a "site" according to my working definition.

To date, very few post-Tiwanaku, prehispanic household units have been excavated in the southern Titicaca Basin. Those that have been excavated seem to indicate a residential pattern broadly similar to that of the present day. The Late Intermediate Period structures excavated at North Point in Lukurmata are tentatively interpreted by the excavator as forming a "compound containing a number of houses and enclosed by a large wall" (Wise 1993: 111). A Late Horizon residential compound was excavated at the same site, comprising at least two fieldstone structures and a fieldstone corral, all enclosed by a compound wall (Wise 1993:109).[3] The limited information at our disposal therefore seems to indicate that the post-Tiwanaku household form has remained relatively stable, and has been broadly similar to that observed among the modern inhabitants of the area.

Somewhat more archaeological evidence exists for the Tiwanaku period although the excavated sample is still very small.[4] Marc Bermann (Bermann 1990, Bermann 1993,

[2] "The Aymara household, although variable, typically consists of a nuclear or extended family living together in an architecturally defined compound, or at least near one another in a nucleated compound cluster. Household members ... ideally share a common patio and other outdoor spaces ..." (Janusek 1994: 35).

[3] The record from the Juli-Pomata area for this time period is somewhat better understood (Stanish et al. 1993, Stanish et al. 1997). However, the sites from the western basin may not be directly compared to the southern case. This is because the basic organizational unit of LIP domestic groups in the western basin is the domestic terrace, and terracing is conspicuously absent in the South.

[4] The specific conditions of the southern Titicaca Basin - relatively high rainfall, soil erosion, intensive agriculture, high population density and the use of adobe for domestic architecture - conspire to make the identification and excavation of prehistoric residential structures an extremely difficult undertaking.

Ironically, the best-documented Tiwanaku architecture is not from the *altiplano* at all, but from the coastal

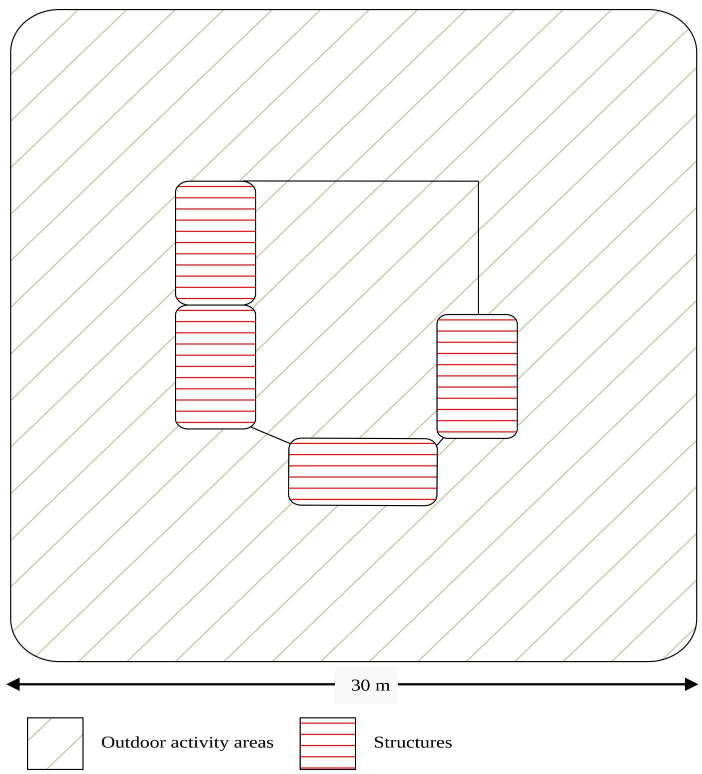


Figure 4.1: Schematic representation of a contemporary Aymara residential compound.

Bermann 1994, Bermann and Graffam 1989) excavated a long sequence of domestic architecture from the site of Lukurmata. Though his sequence begins in the early Late Formative and continues through to the LIP, the bulk of his data pertains to the Tiwanaku III-V periods (LF2 and Tiwanaku periods, in my chronology). He excavated several examples of what he considers to be household compounds dating to these period. He describes the typical Tiwanaku household unit at the site as "a house compound with three structures, two primarily used for a wide range of domestic tasks or as a dwelling, and one for specific and different purposes [storage, sleeping, etc] ... The household unit also included a small enclosed patio used for most activities" (Bermann 1993: 128). Janusek has excavated similar compounds at Tiwanaku and the Misitón area of Lukurmata, these with clear enclosing walls (Janusek 1994). The excavations of the Proyecto Wila Jawira in the La Kkaraña area of Tiwanaku have suggested household compounds in the early Late Formative, as well (see Escalante Moscoso 1994). The domestic residential compounds built and inhabited by the modern Aymara can be traced with some certainty at least to the Late Formative period.

Sufficient evidence therefore exists for me to propose that the observable shift in residential patterns at the time of the Tiwanaku collapse reflects a change in the external rather than the internal configuration of household compounds. That is to say that the Tiwanaku and Formative Period villages were composed of agglomerations of many household residential compounds, and that the dispersal of population during the Early Pacajes period is best understood as a dispersal of household compounds. In the Tiwanaku period and earlier the compounds were grouped into large clusters which we refer to as "villages," while more recently they have been scattered individually among agricultural fields.

I will proceed, therefore, on the assumption that during all periods of the area's prehistory people lived in household compounds as described above, and that towns and villages essentially comprised dense concentrations of such units.[5]

Moquegua Valley. Here the Tiwanaku state established a series of colonial enclaves, and the architecture at these sites is relatively well-preserved (cf. Goldstein 1989a, Goldstein 1993a). However, I believe that these colonies were populated by a rotating labor force, and not by long-term inhabitants (see Bandy et al. 1996). Therefore, these households are not in any way comparable to *altiplano* ones, and cannot be used for my purposes here.

[5] Bermann (Bermann 1993: 125) contends that the household compound came into being in the Late Formative, and that in earlier phases people lived in single-structure domestic units. The data for this are

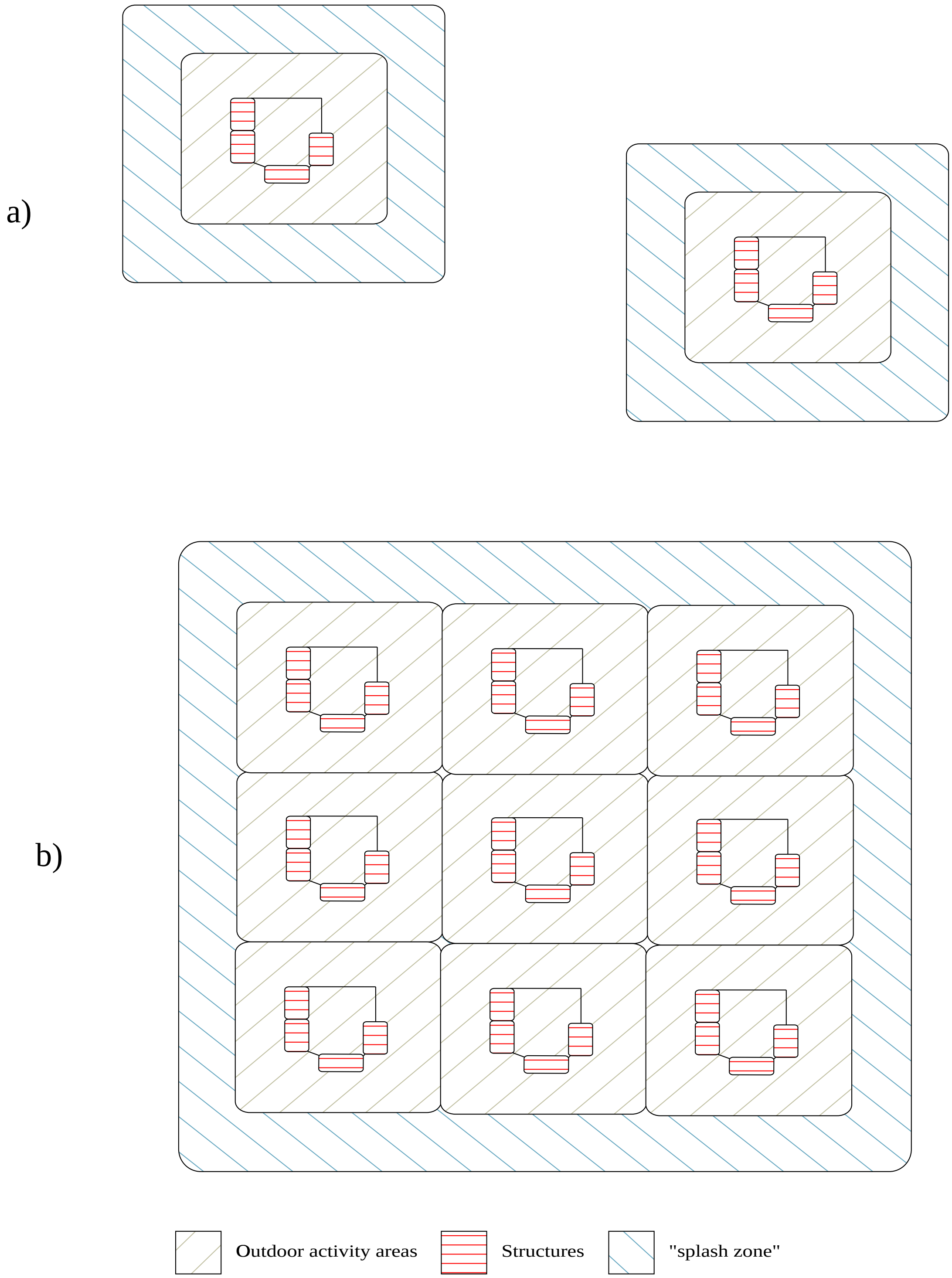
4.1.2 Correct sector size for artifact "splash zone"

Remember that we are considering a household compound to be composed of a small number of adobe structures together with associated unenclosed activity areas. In the present, these activity areas include places for storing agricultural by-products and firewood, as well as for tethering animals, threshing and winnowing cereals and for other domestic tasks. The human activities in these structures and activity areas generate debris, some of it durable, like ceramics. This debris is the source of the artifact scatters by which we identify archaeological sites.

However, the correlation between the extent of the artifact scatter and the extent of the habitation area (structures and unenclosed activity areas) is not direct. This is so for two reasons. First, deposition of refuse is not restricted to habitation areas, though it is certainly concentrated in habitation zones. Second, debris is subject to post-depositional processes which tend to disperse what may initially have been a relatively discrete concentration. These processes include trampling and kicking by livestock and humans (cf. Nielsen 1991) and, perhaps most important on the Taraco Peninsula, displacement due to the plowing of agricultural fields (cf. Roper 1976). The result is that an artifact scatter (archaeological sector) will include both a habitation area and its associated "splash zone," a corona of displaced and peripheral artifacts deriving from that habitation area. This is illustrated in Figure 4.2. The first area directly represents human occupation; the second does not. To arrive at a population estimate we must therefore subtract the splash zone from the total area of the sherd scatter in order to derive the habitation area.

The simplest case is that illustrated in Figure 4.2a. This is the isolated household compound, surrounded by cultivated fields. I personally observed a number of such cases in the field, and I took informal measurements on the habitation area and the area of the sherd scatter. I refer to the house compounds of the present-day Aymara inhabitants of the region, discussed in preceding paragraphs. My observations indicated that the average habitation area was no less than 30x30 meters (0.09 ha) in area. This seems to be broadly consistent with what we know of prehispanic household compounds as well. For example, the

extremely tentative, however, and I consider the question open.



a) dispersed and b) nucleated residential patterns

Figure 4.2: Habitation area and “splash zone”

Pacajes-Inka compound partially excavated by Wise at Lukurmata consisted of at least three rooms and seems to have been enclosed by a stone wall (Wise 1993). It is therefore very similar to modern compounds. The compound measures 16 m on one side, though the other dimension could not be determines. Assuming it was square, the architectural compound alone covered 0.03 ha.[6] Since this was an isolated household ("dispersed habitation") man of the activity areas would have been located outside of the architectural compound itself, as is the case with modern houses.

At least some Tiwanaku urban household compounds - those excavated by Janusek at Tiwanaku - were considerably larger than this, suggesting that household activities were more contained within the architectural limits of the compound wall. Excavations in the AKE1-M and AKE-2 areas revealed very large residential compounds. These pertained to the Tiwanaku IV phase. They were delimited by large encircling compound walls, and contained a variety of domestic structures and outside activity areas. These are examples of household compounds in a nucleated habitation context. The dimensions of the compounds themselves are somewhat difficult to determine, since Janusek excavated only portions of them. However, the eastern wall of the AKE1-M compound seems to be at least 25 m in length, and the width of the compound could be no less than 8 m (Janusek 1994, Figure 7.1). The absolute minimum size for the compound, then, would be 0.02 ha. However, its known dimensions are consistent with an area of 0.06 ha - 25 m square - or even more; roughly the same size in terms of total habitation area as the modern and late prehispanic household compounds discussed above.

A habitation area of 30x30 m is, in my small sample of modern household compounds, associated with an artifact scatter of approximately 50x50 m (0.25 ha). That is to say that

[6]There are some indications that in certain times and places in prehistory the amount of habitation area per compound was greatly compressed. Bermann, for example, excavated two patio groups at Lukurmata which averaged only 0.02 ha (160 m^2) of total occupation area each (Bermann 1994: 178, 194). However, he takes no account of public space, walkways or roads in these figures. The fact remains, though, that using a constant figure for habitation area per household for all periods in prehistory may well have the effect of decreasing population estimates of urban or nucleated habitation contexts as opposed to rural or dispersed ones. Though the problem is at present without a solution, this fact should not be forgotten in the analysis to follow. Bermann's estimate of 376 persons in a 0.60 ha area (Bermann 1994: 178), however, is almost certainly greatly exaggerated.

the splash zone extended for approximately 10 meters on any side of the habitation zone. I consistently found this figure to be a good descriptor of the splash zones in modern houses, so I will use it here.

If we measure area in hectares and model the plan of the artifact scatter as a square, then:

$$H = \frac{\left(\sqrt{A*10000} - 20\right)^2}{10000}$$

where A = scatter area
H = habitation area

Figure 4.2b shows the more complicated case of nucleated habitation in towns and villages. In this case we have densely-packed habitation areas (residential compounds) with overlapping splash zones. Almost all of the interior of the settlement is habitation area, with a rim of uninhabited splash zone around the edge.[7] If we view a village in this way, then we can apply exactly the same correction equation to it that we applied to the isolated household compound. Therefore, there is no need to distinguish between different residential patterns in order to correct for the splash zone.

The actual correction method I used in my settlement database therefore consisted of three steps:

1. Derive the habitation area from the scatter area using the equation given above.[8]

2. Make sure the corrected size of a sector is no less than the area of a single habitation unit (0.09 ha, as above).[9]

3. Do not apply the correction to sites that are not artifact scatters (in this case, raised fields or terrace groups).[10]

---

[7] Excepting non-habitation space occupied, for example, by public architecture, plaza space, and so on. For present purposes this complication will be ignored, though I acknowledge the difficulty of identifying habitation vs. non-habitation space in sites without preserved surface architecture.

[8] The actual SQL command used in constructing the database (see schema in Appendix F) is given below. All table and column names are references to the database schema documented in Appendix F.

UPDATE site SET area_corrected=((sqrt(area*10000)-20)*(sqrt(area*10000)-20))/10000 WHERE area >= 0.25;

[9] UPDATE site SET area_corrected=0.09 WHERE area > 0 AND area < 0.25;

[10] UPDATE site SET area_corrected=area WHERE type IN ('Raised Fields','Terraces');

The correction method described here has the salutary effect of reducing the relative importance of small sites at a regional scale. When applied to a regional settlement dataset, the cumulative habitation area ("corrected area") of small sites is reduced relative to that of larger sites. This corrects an error which has been common in Titicaca Basin settlement archaeology, and reverses some prior conclusions regarding the demographic effects of the Tiwanaku collapse. This particular case will be discussed at more length in Chapter 9.

Of course, matters are never this simple. Habitation density (persons per hectare) may vary in contexts of nucleated or dispersed habitation, so that the relation between population and habitation area is not direct. Other factors can affect the relation, as well. For example, habitation density will typically be higher in walled settlements than in unwalled ones (Wenke 1975), as people exchange living space for a reduction in collective labor investment. However, to derive a useful relation empirically would require very extensive horizontal excavations (or excellent surface visibility and architectural preservation; see Montmollin 1987 for a Mesoamerican example). This has been accomplished in some contexts (see Milner and Oliver 1999: 90-93 for an example from Cahokia) with excellent results, but we are very far from this point in Titicaca Basin archaeology. Mississippian or Mesoamerican data clearly cannot be used directly. Such measures are specific to particular historical contexts. The method I use here for calculating habitation area is dramatically simplified, but is consistent with what little we know of contemporary and prehistoric habitation in the region and therefore serves as a useful starting point. I fully expect it to be replaced by a more reliable correction method when the necessary data become available.

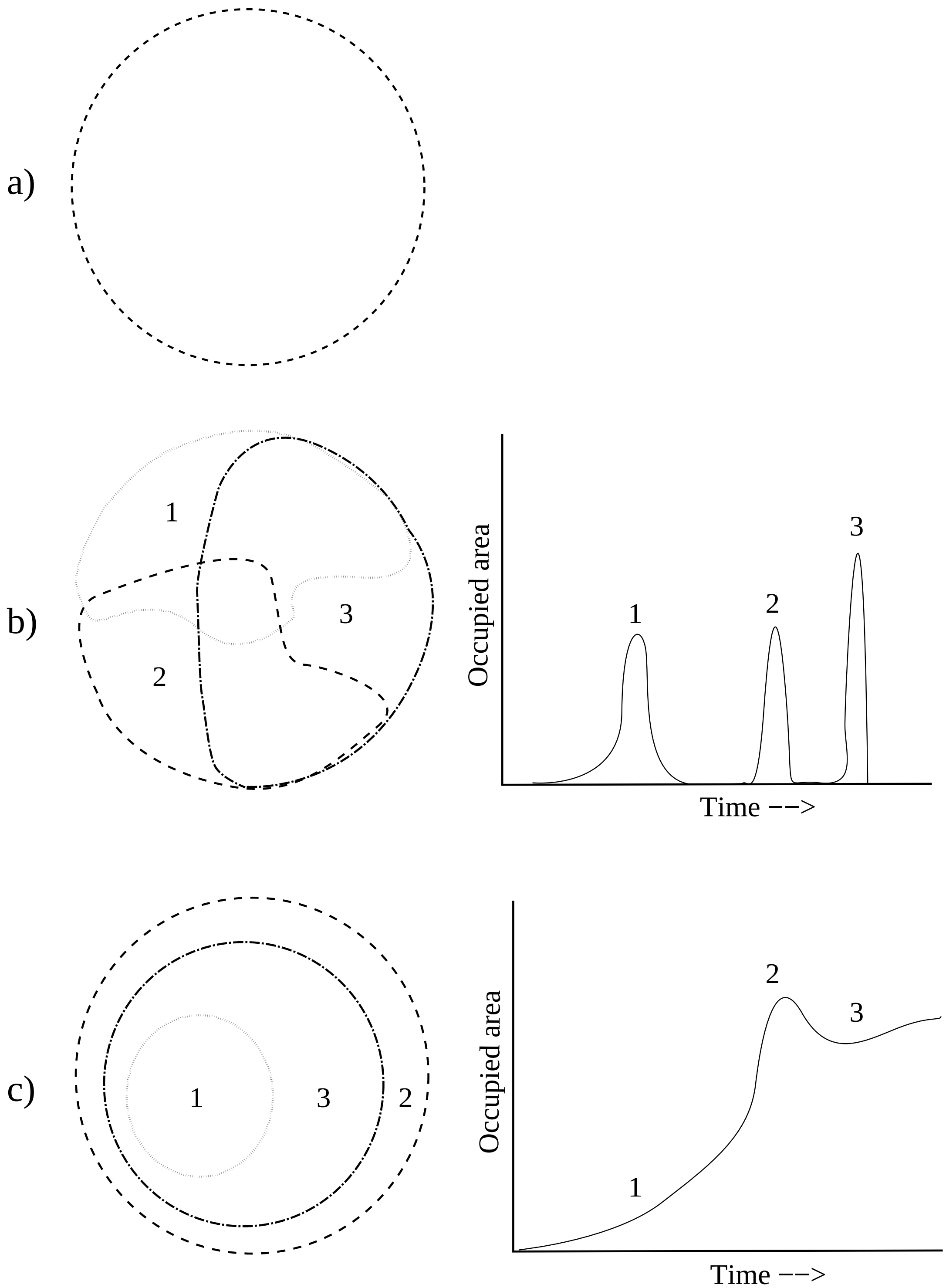
4.1.3 Assume "point contemporaneity" of occupation

Large scale artifact scatters can often be thought of as palimpsests. That is, they may actually be composed of a series of smaller overlapping artifact scatters formed at different points in time. A good example of this is the so-called 'standard model' of Amazonian settlement (per Meggers 1991, see DeBoer et al. 1996, Heckenberger et al. 1996 for refutations). This model holds that the inhabitants of Amazonian villages practice swidden agriculture and are therefore obliged to relocate their villages periodically. Over time, localities preferred for settlement may accumulate a substantial cultural overburden and comprise artifact scatters of considerable extent, even though they in fact represent nothing more than a superposition of many small settlements occupied at different points in time.[11]

Among truly sedentary societies, such as the Titicaca Basin lacustrine civilizations, large artifact scatters often do in fact reflect large villages, towns or cities. They are not palimpsests in the same sense as the Amazonian sites as understood by Meggers. However, it is undoubtedly the case that the size of these settlements fluctuated over time as the social units that inhabited them grew, fissioned, migrated or were decimated by disease, famine or warfare. Therefore, the corrected size of a sector represents not the occupied area of the settlement for the entire phase in question, but rather its occupied area at the moment of its maximal extent. Thus, “point contemporaneity.” Under this assumption sectors are not palimpsests, and the occupied area of the sector directly reflects the number of resident households at the time of the “local maximum” (see Figure 4.3 for an illustration of the difference).

Assuming point contemporaneity does seem to be reasonable at least for the phases (pre-Pacajes) characterized by nucleated habitation. In these periods, the villages and towns undoubtedly grew and contracted; however there is no indication that they moved from place to place and back again. In the Pacajes phases, the matter is less certain, since dispersed residences were probably occupied for shorter periods of time and were considerably more mobile. The small size - equivalent to only one or a few households - and low density of most Pacajes sites would seem to indicate very limited within-phase sector abandonment and resettlement, especially since the adobe structures endure no more than a few years if uncared for (see Bermann 1994 for a discussion of the decay process of adobe residential structures). The point contemporaneity assumption is therefore preferable to the palimpsest assumption for all phases of the region’s settlement history.

[11] Sites which have accumulated over very long time periods are also palimpsests (Foley 1981).



a) the sector, b) the palimpsest scenario, c) the “point contemporaneity” scenario (“local maximum” at Time 2).

Figure 4.3: Scenarios for the formation of an archaeological sector

4.1.4 Calculate total number of households for the sector

This step is straightforward. The corrected area of the sector (derived in section 4.1.2, above) is divided by the average area of the household compound (the basic residential unit, described in section 4.1.1). Under the point contemporaneity assumption (section 4.1.3) this yields the number of households occupying the site during a phase-specific local maximum (the time of a site's maximum occupied extent within a given chronological phase). As I mentioned in the discussion of section 4.1.2, above, observation and cursory measurement of about a dozen modern Aymara residential compounds yielded an average occupied area of 0.09 hectares per compound. This seems to be consistent with the small set of prehispanic household data which is available in the published literature. I emphasize again that this figure excludes the splash zone as described in section 4.1.2.

The number of households in the sector is calculated using a simple equation:

$$H = \frac{A_s}{A_h}$$

where H = number of households
A_s = corrected area of sector
A_h = average household compound area

4.1.5 Calculate a "sector population index" for the sector

A population index for the sector is obtained by multiplying the number of households for the sector's local maximum (obtained in section 4.1.4) by an average number of persons per household. The same set of informal observations used to establish an average residential compound area also yielded an average of 6 persons per compound. This concurs approximately with ethnohistoric information. For example, at the time of Viceroy Toledo's visit to Tiwanaku in 1574, a total population of 4329 was recorded for the *repartimiento* (Choque Canqui 1993: 81). Among these were 868 *tributarios* (heads of household). This yields an approximate ratio of 4.99 persons/household.

Therefore:[12]

[12] The SQL statement used combines the steps from sections 4.1.4 and 4.1.5 for habitation sites only:

$P_s = H * P_h$

where P_s = sector population index
H = number of households in sector
P_h = persons per household

This sequence of steps eventually returns a sector population index of 42.67 for a one hectare sherd scatter, and of 66.67 for a hectare of occupied area. These numbers are definitely on the low end of the range of numbers typically used to derive population estimates from site area. Adams, for example, used a figure of 200 persons/ha in his study of Mesopotamian settlement (Adams 1965), This was based on modern population densities from the old quarters of Baghdad and from other local examples. Kramer's ethnoarchaeological study of modern settlements in Southwest Asia yielded an average of 120 persons/ha (cited in Hassan 1981: 66-67). Similarly, the classical city of Melos has been estimated to have contained between 130 and 200 persons/ha within its walls (Whitelaw and Davis 1991: 280). While my numbers therefore seem low compared to figures employed in the analysis of Mediterranean and Near Eastern urban settlements, they fall within the 25-50 persons/ha range of Basin of Mexico "High Density Compact Villages" (Parsons 1976: 72). My numbers are also considerably lower than the 100 persons/ha used by Parsons to estimate the population of Tiwanaku (Parsons 1968). Finally, 42-66 persona/ha falls into the middle of the range of Drennan's "compact settlement" category of Mesoamerican archaeological sites (Drennan 1986: Table 13.1). [13]

The sector population index, while not a direct measure of population, can be used as a proxy measure. This is so because the index should vary directly with actual population. In the remainder of this analysis I will use this index in place of actual population figures. At no point should it be forgotten, however, that the measure I am using here is a provisional one, and that it could stand a great deal of improvement. Finding better and more phase-specific values for all of the variables employed is the only way in which this index will

UPDATE site SET pop_index = (area_corrected / 0.09) * 6 WHERE type NOT IN ('Raised Fields','Terraces');

[13] Incidentally, 50 persons/ha seems to be a comfortable settlement density worldwide (see Fletcher 1995: 75, 107).

ever come to be trusted as a direct population estimate.

4.1.6 Calculate a "phase population index" for the region

While the sector population index is useful for intra-regional analysis - comparing sectors within the region - an aggregate measure is needed for comparisons between regions. This is the "phase population index", and it consists simply of the sum of the sector population index values for all of the sectors within a region pertaining to a particular chronological phase. As a measure derived from the sector population index, the phase population index inherits all of the problems and ambiguities of its parent. In addition, it suffers from the problem of sector contemporaneity. Sanders puts it thus:

> A major methodological problem is chronology. Most researchers deal in blocks of time involving hundreds of years. Conceivably in the history of an area, there could have been a period in which settlements were less sedentary and village sites were frequently shifted, followed by a period in which people lived in more stable communities. In this case a simple calculation of the total amount of habitation area *[as I use here]* or number of ruined houses of the various sites from each period would not give an accurate picture even of the relative population size of the two periods. (Sanders 1972: 102)

The percentage of sectors within a single given phase which are occupied simultaneously at any point will vary from phase to phase, and also between different types of sites within a single phase. In the present case it seems likely that a large percentage of the sectors were occupied simultaneously and continuously throughout the Formative and Tiwanaku periods on the Taraco Peninsula, since most of these sites were large villages, and they are few in number. In the Pacajes phases, however, most sites represent individual household compounds, probably occupied for no more than a generation or two, notwithstanding a small number of Pacajes villages, which were probably continuously occupied.

The phase population index as defined here - as a simple sum of sector population index values per phase - will therefore tend to exaggerate the contribution of small and ephemerally-occupied components of a total settlement system relative to sedentary and continuously-occupied components. In other words, farmsteads will count for relatively more than will villages, towns and cities. It will also tend to exaggerate the population estimates for phases characterized by predominantly transitory settlement *vis a vis* more settled or urban phases. In the present case, this means that the phase population index values of the post-Tiwanaku phases will be inflated relative to those of the Formative and Tiwanaku phases. These are caveats which must be remembered when using the phase population index for analytical purposes. These distortions may of course be corrected given accurate information on average occupation spans of different types of sites for a given phase. At the moment, however, we lack the fine-grained excavation data necessary for such calibration, and I will be forced to do without.

4.2 Interpreting (corrected) sector sizes

I have by now managed - with some contortions - to arrive at indices of population for individual archaeological sectors and for regional settlement systems. The real goal, however, is to analyze patterns of change in population though time and across space. In order to do this, a series of additional metrics and analytical techniques are necessary. These fall into three main categories: measures and techniques which analyse changes in population through time, ones that measure changes in population over space, and ones that combine changes through time and over space. These are described and discussed in this section.

4.2.1 Population through time

Population, be it of a sector, a square kilometer, an entire region, or even only of a single structure or room, is a quantity. Analyzing population change through time is therefore simply a matter of tracking the increases and decreases of this quantity as it pertains to a particular unit of analysis. The most convenient way to do this - since the time periods used in this study are of unequal length - is by calculating for each phase an annual rate of population growth relative to the previous phase. This is done using the following equation

(Hassan 1981: 139):[14]

$$r = \frac{1}{T} \ln \frac{P_f}{P_i}$$

where r = annual rate of population change
T = number of years
P_i = initial population index value
P_f = final population index value

Multiplying the derived value of r by 100 yields an annual percentage rate of population growth. This is the figure which I will use in this study to measure rates of population growth or decline, since growth rates seem often to be reported in terms of annual percentage rates (e.g. Hassan 1981: 140). Cross-cultural comparisons and archaeological studies have shown that an annual growth rate of approximately 0.1% characterizes non-industrial agricultural village populations worldwide (Hassan 1981: 220, 234; also Carneiro and Hilse 1966, Cowgill 1975).[15] This accords almost perfectly with the population growth rates calculated for the various Taraco Peninsula phases.

Intraregional population growth differentials

It has been generally recognized at least since the '70s that different villages within the same region can have very different patterns of growth over time (cf. Winter 1976). This is certainly the case on the Taraco Peninsula. We will see many examples in which different villages and site clusters and even regions grow at drastically different rates during the same phase. How are we to interpret these differences?

[14] My own calculations were originally carried out in the field using an equation I derived without benefit of reference material. Though unwieldy, it is equivalent to Hassan's.

$$r = \left(\frac{P_f}{P_i}\right)^{\frac{1}{T}} - 1$$

[15] This is *contra* Schlanger, who estimates that the intrinsic growth rate of Colorado Plateau Anasazi populations was on the order of 2.4% annually (Schlanger 1985, Schlanger 1988: 786). Her estimate, equivalent to a doubling time of less than 30 years, is almost certainly much too high. It is roughly the same as the modern world population growth rate.

A particularly striking - though by no means unique - example is the LF1 period described in Chapter 7. At this time, one site in particular grew very rapidly, at a rate of 0.17% annually. This is more than twice the growth rate of the population of the Taraco Peninsula as a whole (0.08%, Table 7.2). There are three factors that can affect population growth rates:

1. a change in fertility rates,
2. a change in mortality rates, or
3. population movement (immigration/outmigration).

It is extremely difficult to imagine that in the LF1 one village on the Taraco Peninsula experienced greatly increased fertility or reduced mortality while at the same time the remainder of the villages, roughly equivalent in the previous phase, experienced the opposite. This is, after all, a small area with a uniform climate and relatively uniform distribution of resources. The average distance between the villages in question is on the order of only 4 km. Though appeal can always be made to acts of god, it is hard to think of any phenomenon which could plausibly create such an effect. More parsimonious, then, is to postulate that all of the villages on the peninsula experienced roughly similar rates of fertility and mortality, and that the observable difference in population growth rates can be attributed to movement of persons from the shrinking villages to the growing one.

We are now presented with the difficulty of explaining what form this population movement took, and what were the specific motivations of the persons who chose to change their residence. There are many possible explanations, of course. On the one hand, it is easy to imagine a situation in which people are forced to move from one place to another. This almost certainly accounts for some of the dramatic population movement which occurred when the Inka Empire conquered the Titicaca Basin (this is discussed in Chapter 10). The Inka empire was certainly acquainted with the practice of forced relocation of populations. However, it is difficult to imagine forced relocation of population in the absence of a state structure, as was the case in the Formative Period Titicaca Basin. The observed population growth differentials can therefore only be interpreted as the result of human individuals or small groups deciding to leave one settlement or community and take up residence in another.

Given the long time periods involved, such population growth differentials would not even necessarily imply the relocation of established households from one community to another. For example, if we imagine that post-marital residence rules were at least somewhat flexible, and that village exogamy was a common practice, we could postulate a slight preference on the part of newlyweds to establish a new household in the village of one of the partners rather than in that of the other. Over centuries, this could certainly produce the observed effect, but as a result only of a systematic bias in decision frequencies within a particular social frame. I believe this type of process was probably more common than was mass relocation, particularly earlier in the Formative Period, before large political formations had come into being (see especially Chapters 6 and 7).

The point of the preceding paragraphs is this: the unequal growth rates which can be documented in various phases in the Taraco Peninsula archaeological sequence are evidence of systematic biases in human decision-making. We are observing the results of *people* making *decisions* within a determinate economic, social, and cultural *context*. We have therefore, somewhat inadvertently, entered into a discussion of the role of *agency* in human history and in social evolution (cf. Dobres and Robb 2000), and have stumbled upon a truth: settlement systems have no autonomy; they are created, in their every detail, by the informed, motivated and historically situated action of human beings. Surprisingly, then, we may use settlement data to address questions of human agency and choice. The dynamics of the settlement system, particularly relative rates of population growth of the various sites, informs us of broad patterns of bias in decisions regarding residential location.

Of course, this is a very restricted domain of agency, and would seem to be atypical in some regards. We are discussing a single kind of decision: residential choice. While many kinds of activity seem to be routinized and are undertaken with little or no discursive awareness (cf. Dietler and Herbich 1998), residential choice is a kind of decision which only occurs rarely, in many cases only once or twice in a lifetime. In addition, residential choice has significant ramifications for the future possibilities of a household or individual. The decision affects future social and alliance relations, as well as ease of access to a wide array of spatially concentrated or restricted resources, social, cultural and economic in nature. This being the case, it is likely that residential choices are virtually always made only subsequent to a conscious evaluation of the various alternatives and their implications. Thus, residential choice may respond to short-term conditions and political realities in a way that many kinds of human behavior do not.

Why might inhabitants of the Taraco Peninsula have systematically chosen to locate their households in one particular village more often than they chose to live in others? What are the factors which might have entered into their decision-making process? There are many possible answers to this question, of course, but I would like to discuss one in particular, since I will make use of it later on to interpret actual patterns of unequal population growth: redistribution.

Redistribution

What Carneiro calls "the shibboleth of chiefly redistribution" (Carneiro 1988: 500) was an important component of some early formulations of the chiefdom concept. Sahlins and Service, particularly, in influential statements, characterized chiefship as a functional institution which served to redistribute goods and to pool subsistence risk across a heterogeneous territory (Service 1962, Sahlins 1958, Sahlins 1963, Fried 1967).[16] Redistribution was such a central concept for Service that he defined chiefdoms as "redistributional societies with a permanent central agency of coordination" (Service 1962: 144).

The concept of chiefly redistribution suffered the reverses of functionalism generally in the '70s and '80s. Various researchers pointed out that in fact many of the goods collected by chiefs from their subject population were never redistributed at all, or were distributed only to a restricted circle of other elites in a politically opportune manner (summarized in Earle 1987a). That is, that chiefly redistribution was not in fact functional but rather was

[16]This was a development of Polanyi's concept of redistribution (Polanyi 1944).

oriented to the aggrandizement of the chiefly personage him- or herself.

Whether chiefly redistribution was, in fact, an adaptive mechanism or simply tribute, the fact remains that chiefs - or more generically, leaders - in small scale societies world-wide collected and the redistributed ("dissipated", as Spencer would have it [Spencer 1998]) a portion of the agricultural and other products of the populace at large. It is important to remember, however, that the surplus agricultural product collected by leaders was eventually *eaten*. It was not, as a matter of course, destroyed. What this means is that the chief or leader supports other people, to a greater or lesser extent. The distribution of this surplus could take many forms. The chief could take many wives and support a large household, as was commonly the case. Or the chief could support retainers or artisans, and participate in a system of wealth finance (Earle 1997). Alternatively, the chief or leader could distribute at least a portion of the surplus in massive acts of generosity (Hayden 1996a, Dietler 1996). Most empirical cases will involve many different strategies employed in varying combinations. In all of these cases, however, the chief or leader acquires dependents.

Conceptualized in this way, a chief or leader is a point resource on the landscape. S/he is a location from which goods emanate, and proximity to this location could prove advantageous to other persons. It is in this way that the location of certain chiefs or leaders can become a settlement determinant. And it is in this way that the differential success of leaders can lead to the kind of unequal population growth rates that we observe in Taraco Peninsula prehistory. To return to the example, if the leaders of one village are more successful than are those of surrounding villages, then access to these leaders will be an inducement for some people to establish their residence in the first village. I emphasize that this effect does not have to be a strong one, nor does the difference in chiefly success between villages have to be pronounced. The slightest difference might be enough to produce a systematic bias in residential decisions which over the course of centuries could produce the observed population growth differences between villages.

Ritual and esoteric services

There are of course other possible factors which enter into residential decisions than considerations proximity to a prominent and generous personage. Among these are access to certain ritual of religious services considered essential to health and prosperity. Atkinson provides a protracted discussion of shamanism and leadership among the Wana of inland Sulawesi (Atkinson 1989). In her account, popular or renowned shamans constitute settlement determinants in their own right.

> The immediate neighbors of a prominent shaman stand to benefit most from his skills. Their advantage is not only logistic but also political. Established shamans use their reputations to attract people to their settlement, for only those who live nearby have primary claim on a shaman's services. ... [A] powerful shaman can serve as an enticement and a justification for residence choice... [Atkinson 1989: 271]

It should be noted here that Wana shamans perform no redistributive function whatsoever. The various services provided by Wana ritual specialists, all of which are apparently significant consideration in residential choice, include farming magic, legal knowledge and counsel, and shamanic prowess, concerned primarily with health and healing. Successful shamans, says Atkinson, "can combat the centrifugal tendencies of Wana communities by encouraging the dependence of others on their skills" (Atkinson 1989: 269).

Thus, if the ritual efficacy of a particular community were to be considered superior to that of its neighbors, this efficacy could itself have the sort of effect of residential choice that we are discussing. That is it could, over a long time span, produce unequal rates of population growth in different settlements due to systematic bias in residential decisions. Individual shamans, of course, are unlikely to have such an effect over a long period of time, since their career is limited by their lifespan. However, special efficacy could also come to be attached to totemic figures, idols, monoliths, or ancestral mummies, all of which would be included in the Andean concept of *huaca*. The efficacy of these entities is of course not limited by the human lifespan.

There are many other possible explanations for differing rates of population growth, of course. However, the ones I have outlined above, and especially the concept of redistribution, are of particular interest. I will use them on several occasions in the course of my analysis. That is why I have discussed them at such length here.

4.2.2 Site size hierarchy

The kinds of population growth differentials that I have just discussed are of course distributed across space. Sustained for centuries they can produce settlement systems with various tiers of site sizes. Typically, following the assumptions of central place theory (cf. Haggett 1965, Johnson 1972, Johnson 1977, McAndrews et al. 1997), these site size hierarchies are taken to indicate various types of political organization (Anderson 1994). Thus, a two-tier hierarchy indicates a simple chiefdom, a three-tier hierarchy a complex chiefdom, and a four-tier hierarchy a state.

This kind of mechanical correspondence between settlement configuration and political organization cannot of course be assumed. However, the fact remains that site size hierarchies are often produced by the kinds of population growth differentials that I discussed above. And if large settlements are those which house the most successful leaders, as I proposed above, then a hierarchy of leaders could in fact correspond to a hierarchy of population growth rates and therefore to a hierarchy of site sizes. This scenario is overly precise, but something similar seems to have taken place on the Taraco Basin in the Late Formative period. At any rate, I have included site size hierarchies among the measures I use to monitor settlement dynamics over time, mainly because it has become standard practice to do so.

I have made one small modification to the presentation of site size hierarchies, however. The traditional way to represent these hierarchies is with a histogram, the x axis of which represents site size intervals, and the y axis of which represents a count of sites in each category. Instead, I have used the x axis to represent intervals of the population index, and the y axis to represent a sum of the population index value for all the sites in each size class (see Figures 5.4, 6.9, and 7.6 for examples). This has the salutary effect of correcting the common problem of being unable to discern the upper tiers of the site size hierarchy due to their low count, despite the fact that they often represent the majority of the regional population.

4.2.3 Population density

The population growth differentials discussed above, and site size hierarchies, both produce and are reflected by the regional pattern of population density. In order to allow visual inspection of population density over the Taraco Peninsula in a given phase, I wrote a small program in the Perl programming language to extract this information from the settlement dataset. The source code to that program is included in Appendix D. When run, it prompts the user to name a file containing the raw sector data to be analyzed, and a file to which the density information should be written. The program takes as input a three-column tab-delimited text file containing one row per sector. The columns are UTM North, UTM East, and population index value. A sample run of the program is shown below.

```
   [/home/inti]> perl density.pl
   Name or path of input file:  mf-sites.TAB
   Name or path of output file:  mf-density.TAB

   Select an area for which to calculate occupation
density:
   1:  Taraco Peninsula
   2:  Lower Tiwanaku Valley
   3:  Middle Tiwanaku Valley
   4:  Pampa Koani

   Selection:  1
   Grid dimensions (meters):  500

   Working...

   Okay.  All done.
   Press Enter to Exit
   [/home/inti]>
```

When it runs, the program divides the survey area into squares with the dimensions specified by the user (500x500 m, in the example). It then processes the input file, and adds the population index value of each sector to the total population index value of the grid square in which it is located. When it finished, it outputs a three-column tab-delimited file containing one row for each grid square. The columns are UTM North, UTM East, and population index value. The UTM values in the output file are those of the center of the grid square. The data in the output file can then easily imported into any mapping program capable of representing surfaces.[17] Using this process, I generated population index surface maps for each phase in the Taraco Peninsula sequence (see Figures 5.5, 6.10, and 7.7 for examples). All of my maps use a 500x500m grid, so each grid square represents 25 ha, or 0.25 km^2

4.2.4 The site founding index

Three of the measures I use to monitor settlement dynamics have both a spatial and a temporal component. They are described individually below. The first two have no direct relationship to patterns of population growth or decline, being strictly derived from site occupation and abandonment data. The third, however, is a way to monitor changes in population density across the survey area.

The site founding index measures the percentage of sites in a given phase which were not occupied in the preceding phase. Thus:

$$I_{sf} = 100\frac{S_n}{S_{n+}S_p}$$

where I_{sf} = site founding index
S_n = number of sites occupied in phase not occupied in the previous phase
S_p = number of sites occupied in phase also occupied in the previous phase

Obviously, a high value means that many news sites were founded in a phase, and a low value means few new sites were founded.

4.2.5 The occupation continuity index

The occupation continuity index measures the percentage of sites occupied during the preceding phase which continued to be occupied during the phase in question. Its comple-

[17] I used Surfer and Scigraphica. Many GIS and mapping programs can do this, however.

ment is thus the percentage of sites occupied in the preceding phase which were abandoned in the current phase.

$$I_{oc} = 100\frac{S_{po}}{S_{pn}}$$

where I_{oc} = occupation continuity index
S_{po} = number of site occupied in previous phase still occupied in phase
S_{pn} = number of sites ocupied in previous phase no longer occupied in phase

Obviously, a high value means there was great occupation continuity from the preceding phase, whereas a low value indicates low continuity between phases.

Both the site founding index and the occupation continuity index were calculated using a simple Perl program, the source code to which is in Appendix E. When run, the program prompts the user for the name of an input file and two phases, earlier and later. The input file has two columns and is tab-delimited. The two columns are site number and phase (my phase coding conventions are defined in Appendix A). The program returns values for the site founding index and occupation continuity index, as well as some general information about the two phases selected. A sample run is shown below.

```
   [/home/inti]> perl continuity.pl
   Input file must be tab-delimited, and must contain 2
columns:
       1) Site, 2) Period

   Name or path of input file:  site-phase.TAB

       1:  Early Formative 1
       2:  Early Formative 2
       3:  Middle Formative
       4:  Late Formative 1
       5:  Late Formative 2
       6:  Tiwanaku
       7:  Early Pacajes
       8:  Pacajes-Inka
       9:  Late Pacajes

   Calculate occupation continuity from:3
```

```
To:  4

Working...

Results:
    Total sites with a 2.0 occupation:  30
    Total sites with a 3.1 occupation:  54
    Sites with both 2.0 and 3.1 occupations:  22
    73 percent continuity between 2.0 and 3.1
    27 percent site abandonment rate
    59 percent new site founding rate

Would you like another?  n

Okay.  All done.
Press Enter to Exit
[/home/inti]>
```

The example is of the Middle Formative (2.0) and Late Formative 1 (3.1) phases (see Table 7.2). In this case, the results are a high rate of occupation continuity, and a moderate rate of site founding, indicating a stable and expanding settlement system.

4.2.6 Population density change

A final technique I have developed for analyzing population movement over time and space is the population density change map. Examples are Figures 5.6, 6.11, and 7.8. In section 4.2.3, I described how a population density dataset is generated. It consists essentially of a grid within which each square has a total population index value. A population density change dataset is generated by subtracting one of these population density datasets from another. That is, a new grid is generated within which the value of each square is equal to the difference between the values of the same square in the two population density datasets.

$$D_c = D_1 - D_2$$

where D_c = grid square value in population density change dataset
D_1 = total population index of same grid square in phase

D_2 = total population index of same grid square in previous phase

The resulting dataset is then used to produce a surface in the same manner as was done with the population density datasets.

The population density change map is actually a very useful tool for visual inspection of changes in population across space and through time. For example, Figure 5.6 is a settlement density change map for the Early Formative 2. The value of the z axis is the grid square population index value for the EF2 phase minus the population index value of the same grid square in the EF1 phase. It is immediately apparent that most sites in this period experienced healthy growth, but that sometime late in the EF1 phase (before the EF2 phase began) three sites experienced population declines. Two of these turn out to have been abandoned (the ones near the tip of the peninsula), while one fissioned into at least two separate sites (the one that lost the least population, roughly in the middle of the peninsula). This example is discussed more thoroughly in Chapter 5 . My intention here is only to show the usefulness of the population density change map. Another very striking example is Figure 9.5, which eloquently captures the wholesale depopulation of the peninsula in the Early Pacajes phase.

4.3 Caveat

Clearly all of the population indices, measures, and associated interpretive methods laid out in this chapter are fraught with empirical and theoretical difficulty. The derivation of population estimates or indices from surface data is a difficult and contentious undertaking (cf. Fish and Kowalewski 1990, Tolstoy and Fish 1975). Nothing about it is straightforward. Like Flannery, though, I prefer to light one small candle rather than curse the darkness (Flannery 1976a: 165). The method I have described in this chapter for generating both sector and phase population indices produces values which are sufficiently proportional to actual population to be useful, at least in the Titicaca Basin context. Some of the patterns they reveal are very illuminating indeed, as I hope to show in the remainder of this study.

Chapter 5

The Early Formative: initial settlement and population growth

After 2000 B.C., there was a major change in the lifeways of Titicaca Basin peoples. Browman notes “the adoption of new technologies such as ceramics, the development of new techniques in architecture, and the increasing reliance upon a wide range of domesticated plants” (Browman 1984:119). We refer to this time of early time of agricultural, ceramic-using and occasionally village-dwelling peoples as the Early Formative Period. This cultural and economic watershed, which occurred locally around 1500 B.C., also marks the first definable occupation of the Taraco Peninsula.

There seems to have been no detectable occupation of the Taraco Peninsula during the long preceramic or Archaic period of Titicaca Basin prehistory. In the entire survey not a single aceramic debitage scatter nor a single Archaic style point was recovered. Although this contrasts sharply with reports of intensive Archaic period occupations in other parts of the Basin, it is consistent with the fact that Albarracín-Jordan and Mathews (Albarracín-Jordan and Mathews 1990: 51-53) found only two isolated Archaic points in their Tiwanaku Valley survey. Although a small number of Archaic period points were recovered from the excavations at Chiripa, these were highly worn and were encountered in Formative levels; they seem to have been collected and curated by Formative Period inhabitants. In sum, there is no evidence for a measurable human presence on the Taraco

Peninsula (indeed, in the Tiwanaku heartland) during the Archaic period.

There are several reasons why this might be the case. First, recall that the spine of the Taraco Peninsula is formed by the Taraco Formation, a loose and poorly sorted deposit of fluvial origin. The hills of the peninsula are covered with nodules of quartzite and chert, and the entire area constituted an extensive quarry during the whole prehispanic period. That is to say that the entire peninsula is a low-density debitage scatter. This would have the effect of obscuring ephemeral Archaic period lithic scatters which might be identifiable in a different geological context. This cannot account for the extreme rarity of Archaic period projectile points, however.

Second, geologists have demonstrated (Abbott et al. 1997a, Abbott et al. 1997b) that the little lake (Lago Wiñaymarka) was completely dry prior to about 1500 B.C. In the Archaic period, then , the peninsula would have been considerably colder and less hospitable to agriculture than it is today, lacking as it would have the climatic amelioration effects of the lake. Also, the area of the lake now covered with water would have been a vast pampa or grassland. Since pastoralism seems to have been the primary focus of the economy, at least in the later or terminal Archaic, it could be that the local inhabitants lived on these pampas, perhaps near the small meandering rivers, as was the case in the Ilave valley. If this was so, then the remains of their settlements and camps would now be inundated and archaeologically invisible.

Although it is impossible to evaluate this archaeologically at present, it is possible to imagine what could have happened when the lake abruptly rose to near-modern levels around 1500 B.C. We may postulate a landscape populated by small pastoral groups practicing a very extensive form of tuber agro-pastoralism on the vast pampas of what is now Lake Wiñaymarka. The rise in lake level - which seems to have been relatively abrupt - would have 1) eliminated a vast expanse of grazing land, 2) made available rich lacustrine resources, in the form of fish and lake birds, and 3) created a climate more amenable to agricultural production, as a result of the thermal effects of the lake. All of these changes would have encouraged the development of a more sedentary fishing and agricultural economy by simultaneously lowering the region's carrying capacity for a primarily pastoral economy and raising it for a mixed lacustrine and agro-pastoral economy. Assuming that adjacent grazing areas were already populated - thus limiting the possibility of outmigration - this would have constituted a strong incentive for local populations to intensify their fishing and agricultural activities. Furthermore, since the Taraco Peninsula *is* a peninsula, pastoral groups inhabiting the entire surrounding pampa would have been forced onto what became a narrow spit of land with very poor grazing potential. This is the sort of situation we might imagine resulting in relatively dense populations (relative to the rest of the Titicaca Basin) and a marked economic shift away from pastoralism and toward agriculture and lacustrine fishing/collecting.

Testing of this model is, of course, impossible since sites of this terminal Archaic time period - if they do exist - are submerged. It is nevertheless compelling since it explains several otherwise anomalous archaeological facts. First is the lack of any evidence of an Archaic period occupation on the Taraco Peninsula. In the scenario outlined above virtually all such evidence would be inundated at the present time. Second, it explains the character of the Early Formative occupation of the peninsula, which, as we shall see shortly, does not correspond to what we might expect of an initial colonization of a region.

5.1 Phase definition

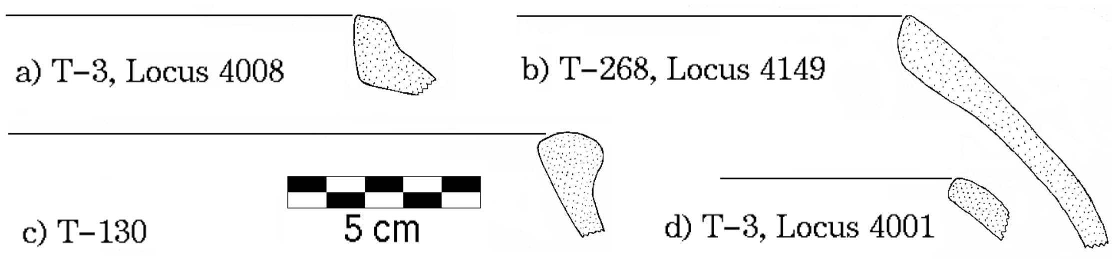
In my chronology the Early Formative is divided into two phases. The Early Formative 1 is equivalent to the Early Chiripa phase, while the Early Formative 2 is equivalent to the Middle Chiripa phase. It is worth noting here that these two phases are used here as defined by Lee Steadman (Steadman 1999) using data from recent excavations at Chiripa (1992-1998) of the Taraco Archaeological Project (see papers in Hastorf 1999). They are therefore equivalent neither to the Early and Middle Chiripa phases of Kidder and Mohr (Mohr 1966, Chávez 1988), nor to Browman's Condori and Llusco phases (Browman 1978a, Browman 1980). Rather, they constitute new phase definitions based upon an enlarged ceramic sample. Early and Middle Chiripa occupations were identified using a frequency profile analysis of surface ceramics, as explained in detail in Chapter 3.

5.1.1 Early Chiripa

The Early Chiripa Phase is the earliest of the three Chiripa phases defined by Steadman (Steadman 1999). Based on the Taraco Archaeological Project's work, this phase has been dated to approximately 1500 - 1000 B.C. (see Whitehead 1999 for dating of the Chiripa phases). Ceramics of the Early Chiripa phase are mostly dark in color and tend to be unslipped. Wiped finishes are more common in this phase than later, when burnishes predominate. 100% of the sherds from this phase are fiber-tempered, though the fiber seems to be chopped finer than it is in later periods. Micaceous pastes predominate. The most common forms are the short-necked olla and the neckless olla - the latter being unique to this phase.

There are certain similarities between Early Chiripa ceramics as defined here and the ceramics of Browman's Condori phase. Among these we may number the use of micaceous temper, the presence of the distinctive neckless olla - or *olla sin cuello*, see Figure 5.1 - vessel form, and the frequent occurrence of interior and exterior rim thickening (Browman 1980). It seems likely that, despite some differences, Steadman's Early Chiripa and Browman's Condori are describing similar and probably related assemblages.

It should be made clear at this point that the Early Chiripa of Karen Mohr Chávez (Chávez 1988) is absolutely unrelated to the Early Chiripa phase as employed here. Early, Middle and Late Chiripa were used by Chávez to describe the ceramics (Mohr 1966) from Kidder's Sub-Lower House Level, Lower House Level, and Upper House Level (Kidder 1956, see also Bandy 1999a), respectively. From recent excavations in the Chiripa mound (Bandy 1999b), we know that the Lower House Level corresponds to the earlier part of Steadman's Late Chiripa. Therefore, Chávez's Early Chiripa is probably contemporary with Steadman's Middle or even Late Chiripa. When I use Early Chiripa in this discussion I am referring to the phase as defined by Steadman.



a) short-necked olla, b-d) neckless ollas

Figure 5.1: Early Formative Ceramics

5.1.2 Middle Chiripa

Middle Chiripa is Steadman's second Chiripa phase, and has been dated to 1000 - 800 B.C. Middle Chiripa ceramics are generally dark in color and unslipped.[1] Olla forms tend to have higher and more flared necks than was the case in the Early Chiripa phase. Neckless ollas are present, but rare, and vertical strap handles appear for the first time. Middle Chiripa ceramics are primarily of a set of non-micaceous pastes tempered with translucent, rounded quartz inclusions. These pastes cannot be readily identified in the field, but are easily identifiable with a loupe. Taken together, they comprise paste group 2 in my frequency profile analysis of surface ceramics (see Chapter 3).

Painted ceramics appear for the first time in the Middle Chiripa phase. These ceramics most definitely anticipate the classic Late Chiripa red on cream wares. Middle Chiripa painted ceramics, however - at least the few that have been collected, as they are very rare[2] - are usually slipped with a kaolin clay, producing cream-colored slip that is painted with designs in a red clay slip. Middle Chiripa seems therefore to be characterized by red on cream, and red on unslipped brown ceramics, quite the inverse of the Late Chiripa cream on reds. These red on cream wares have not been reported by other investigators at Chiripa,

[1] As always, see Steadman 1999 for a detailed description of the Chiripa ceramic phases.

[2] Steadman reports only a single red on unslipped brown sherd from two seasons of excavation at Chiripa (Steadman 1999: 64). Several more sherds were encountered in the 1998/1999 seasons (Steadman pers. comm.) and in my surface collections of the site of Alto Pukara (T-430).

although I have recovered a few examples in my surface collections at nearby sites. At Camata in the western Titicaca Basin, the Qaluyu Red on Cream style dates exclusively to the contemporaneous Early Qaluyu 2 phase (Steadman 1995: Table 33; roughly 1050 - 850 B.C.), and is quite possibly related to the Middle Chiripa wares.

Steadman's Middle Chiripa phase shares no features with Browman's Llusco phase (Browman 1978a), and the two seem to be describing entirely different assemblages.

5.2 Principal sites

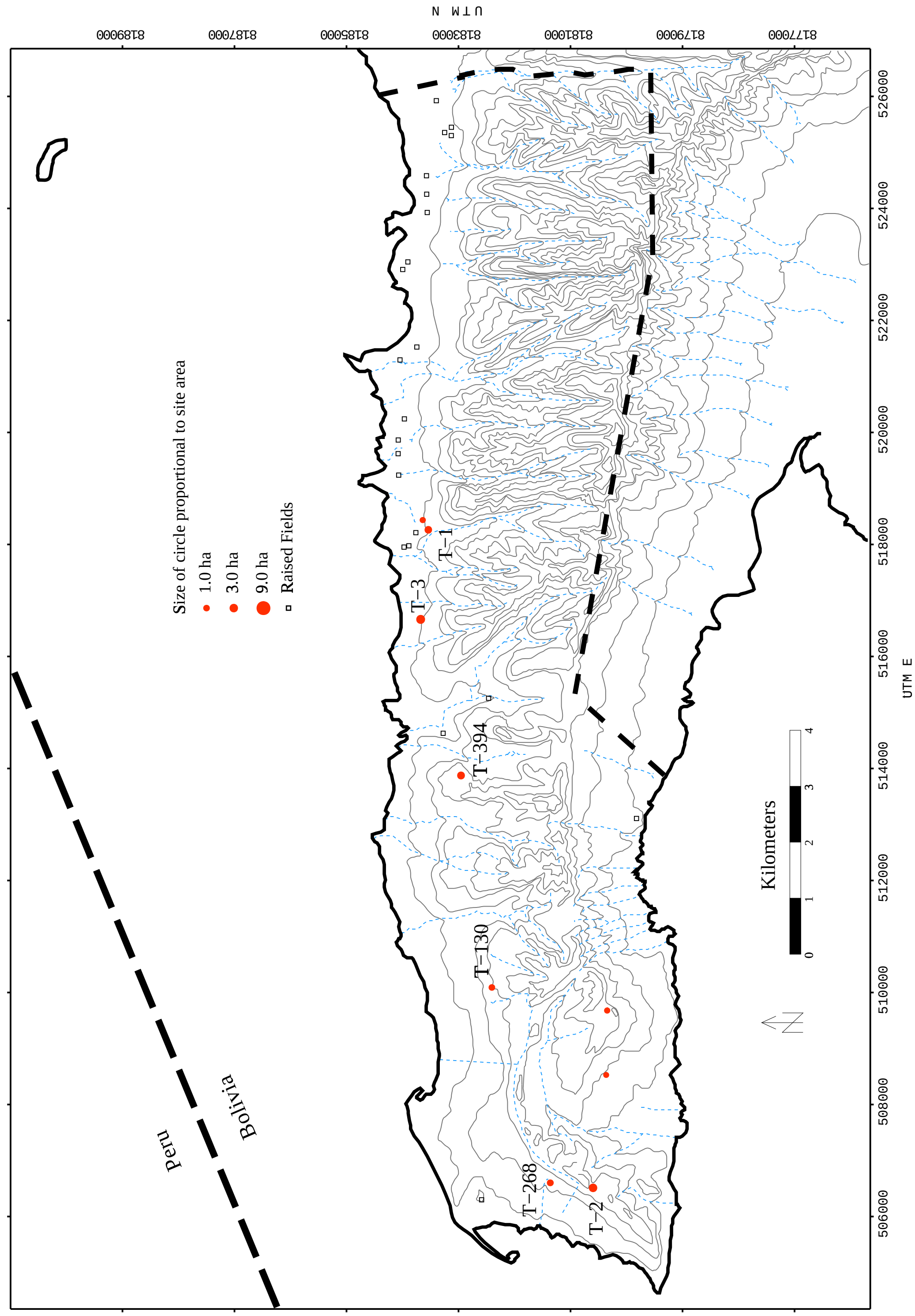
5.2.1 Early Formative 1

Eight sites in the study area were identified as having Early Chiripa components. One of these sites (T-1, Chiripa) had two Early Chiripa sectors, making a total of nine sectors pertaining to this phase. Of these, six were greater than one hectare in area and can be considered small villages or hamlets. These six are indicated on Figure 5.2, and are described below. The smaller sites are not described.

T-1B (Chiripa)

Sector B of Chiripa is one of two Early Chiripa components on the site, and covers 2.0 ha. Sector A is much smaller (0.5 ha) and is located in the northeastern corner of the site. Sector B is located below and to the north and east of the Chiripa mound, the site's principal archaeological feature. No architecture of any moment has been discovered associated with either of these sectors.[3] This is the earliest occupation at Chiripa, and has been well-dated as beginning near 1500 B.C. (Whitehead 1999). Early Chiripa deposits were encountered directly overlying sterile soil, so it seems unlikely that evidence of any earlier occupation will come to light. Sectors A and B have a combined population index value of 115, probably representing a small village. Figure 6.4 is a map of the site.

[3] Nor has any been associated with any Early Chiripa site in the southern Titicaca Basin.



Numbered sites are discussed in text.

Figure 5.2: Early Formative 1 (Early Chiripa) Settlement Pattern

T-2A (Cerro Choncaya)

Cerro Choncaya is an Early and Middle Formative Period site that lies on the modern boundary between the modern communities of Coa Kkollu to the East and San José to the West, though the majority of the site lies in Coa Kkollu. It was discovered by myself and several companions on a drive around the peninsula in 1996.[4]

The site itself comprises a dense scatter of ceramics and lithics covering 4.25 ha. Sector A covers 3.0 ha. There is no indication of corporate architecture in any form at the site. It is located on a low pass through the Taraco hills, a small saddle at approximately 3870 m.a.s.l. This location affords excellent views both of the lake itself and of the approaches from the East and North-West. For this reason the site may be considered strategic, though it is by no means defensive. No evidence of fortifications were encountered, and its location in a saddle would have exposed the site to attack from adjacent hilltops. The site has been cut by the modern road leading from Taraco to Santa Rosa. The road cut reveals no deep deposits. This is unsurprising, considering the topographical location of the site, which has exposed it to severe erosion. Apart from the road cut, little modern disturbance is in evidence, and the site seems to be quite well-preserved. Very little modern material was found; indeed, almost no material post-dating Late Chiripa is present on the site. The Early Chiripa occupation has a population index value of 157; larger than Chiripa, and the second-largest site in the Early Chiripa phase.

T-3A (Chiaramaya)

Chiaramaya is a major Formative Period site located approximately 1.5 km west of the Chiripa site. The modern road cuts the site, as it does Chiripa. The modern school overlies archaeological deposits, but the bulk of the site lies to the north of the road. Immediately to the north of the road is a broad terrace, approximately 50 by 50 meters, and 3 meters high on the downslope side. This terrace probably dates to the Late Chiripa phase, since its configuration is very similar to that of the Chiripa mound at that time.

[4] Amanda Cohen and Bill Whitehead.

The Early Chiripa occupation (sector A) extends approximately 200 meters north from the road, covering 3.5 ha. It has a population index value of 186, and is the largest Early Chiripa site discovered on the peninsula or indeed anywhere in the southern Titicaca Basin to date.

Chiaramaya was first mentioned as an archaeological site by Portugal Zamora and Bustamente in their report on their excavations at Chiripa (see Bandy 1999a for a discussion of this expedition).[5] Since then it has been mentioned by Clark Erikson in a brief report on an informal survey he undertook in 1975 (Erickson 1975).[6] The site itself has recently been disturbed by construction of a community meeting hall on the main platform, and it has been the subject of intense ownership disputes in recent years. It is also the site of an annual ceramics fair, attracting potters and vendors from the area around Batallas. The fair is widely attended by the inhabitants of nearby communities. For this reason the main platform is covered with a quite dense scatter of modern, republican and colonial ceramics. The Formative Period site nevertheless does seem to be well-preserved, and would be a prime spot for excavation.

T-130A (Yanapata)

Yanapata is another major Formative Period site that lies on the boundary between the modern communities of Nachoca and Ñacoca. The bulk of the site lies in Nachoca. It is located at the base of the Taraco hills, approximately 200 meters to the south of the modern road. The site covers 8.0 ha, and is visible from the road as an area of dark soil.

The site has a large terrace, 50 by 40 meters, similar to that described for Chiaramaya, above. This terrace was apparently once faced with stone on its downslope side. One large limestone pillar remains in place in approximately the center of the terrace wall. I was informed by the landowner that a great deal of worked stone was pulled from this area and taken by truck to Taraco to be used in repairs to the church there. Apart from stone-robbing,

[5] However, a brief reference in Padre Pedro Marabini's 1920 article in the *Boletín de la Sociedad Geográfica de La Paz* may also refer to Chiaramaya. Writing of Chiripa, he noted in passing another "cerrito" about 2 kilometers away, in the direction of the lake. Since the lake seems to have been very low at this time, he may have been referring to Chiaramaya, which is located 2 km to the east of Chiripa (Marabini 1920).

[6] He was a student at the time, working on Browman's project in Chiripa.

modern disturbance of the site in minimal, and is limited to a single house immediately to the east of the main terrace.

Sector A covers a single hectare located south and west of the main terrace. With a population index of 43, this is one of the smaller Early Chiripa sites.

T-268A (Sunaj Pata)

Sunaj Pata is located above the modern town of Santa Rosa, near the boundary between the communities of Santa Rosa and San José. The entire site lies within San José, however. The sherd scatter - which is very dense - covers 5.0 ha. Very little modern material is present, and there is little modern disturbance apart from agricultural activities.

The site has two features which might be large artificial terraces, like those at Chiripa, Chiaramaya and Yanapata. They are not sufficiently well-preserved to permit a positive identification, however. Additionally, a large rectangular stain of ash, charcoal and burnt earth is present in the northern portion of the site in a plowed field. Its dimensions (approximately 20x20 m) and shape would suggest that it might be a sunken enclosure, similar to the Llusco structure at Chiripa (see Paz Soría 1999). Again, this must be confirmed by excavation. Some monumental construction at the site would seem to be suggested by the presence of numerous large, worked blocks of non-local limestone in rockpiles resulting from field-clearing in the northern part of the site.

Sector A extends over 1.25 ha and has a population index value of 56, similar in size to sector A at Yanapata.

T-394A (Janko Kala)

Janko Kala is located on a prominent hill in the community of Zapana. It is cut by the modern road as it crests the hill to the west of the schoolhouse and community hall. Like most major Formative Period sites, it is visible from a distance as an area of darkly-stained soil, standing out against the natural red. The name means 'white stone,' after an upright block of limestone located slightly offsite on a ridge to the Southwest. This block is certainly imported and worked, and its presence would seem to indicate some form of corporate construction at the site. However, the site has been remodeled extensively by recent agricultural activities, and it is impossible to identify a mound, platform or monumental terrace with certainty. Test excavation, magnetometry, or a more detailed topographical analysis would possibly find one or more terraces, as are present at Chiaramaya and elsewhere.

The sherd scatter extends over 7.75 ha and is very dense. All periods are represented, but especially notable are the Formative period and Late Horizon (Inka) occupations. Sector A covers 2.25 ha and has a population index value of 113.

5.2.2 Early Formative 2

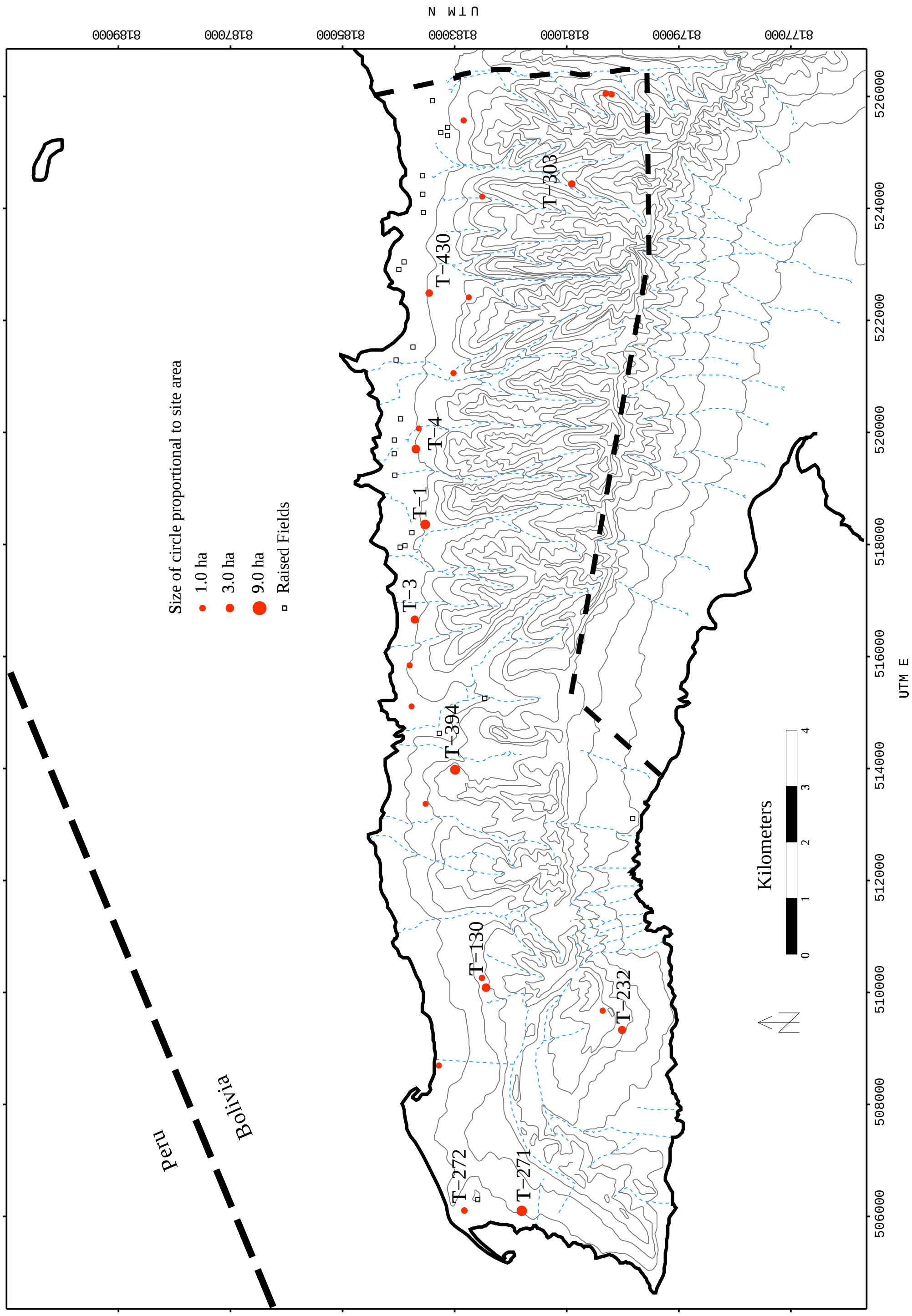
Twenty-three sites in the study area were identified as having Middle Chiripa components, a substantial increase over the nine Early Chiripa sites. Of these, ten were greater than one hectare in area and can be considered small villages or hamlets. These ten sites are labeled on Figure 5.3, and are described below.

T-1C (Chiripa)

In the Middle Chiripa phase, Chiripa itself grows rapidly from a combined Early Chiripa population index value of 115 to a Middle Chiripa value of 231 (4.25 ha). This equates to an annual growth rate of 0.35% and a population doubling time of 199 years, and is roughly even with - or a bit below - the average population growth rate for the phase as a whole (see Table 5.1).

In the case of Chiripa, as a result of the recent excavations, we can say a bit more about this period than is possible at other Middle Chiripa sites. During the Middle Chiripa phase - and probably early in the phase - a sunken court was constructed in the area of the site we refer to as Santiago.[7] Figure 6.4 shows the northern and eastern wall of this structure, in the Santiago area. This court, which we call the Choquehuanca structure, was

[7] Many of the details of early construction at Chiripa were revealed in the 1998/1998 field season. These have yet to be published, though we did submit a fairly comprehensive report to the National Geographic Foundation (Hastorf et al. 1998).



Numbered sites are discussed in text.

Figure 5.3: Early Formative 2 (Middle Chiripa) Settlement Pattern

cut through Early and Middle Chiripa fill. Its walls were lined with unworked cobbles and plastered with yellow clay (Dean and Kojan 1999). The floor was a prepared clay floor. In plan, the structure is trapezoidal, wider to the south than to the north. It is approximately 14x14 m (Whitehead in Hastorf et al. 1998), and has a shallow niche in the eastern wall (Dean and Kojan 1999: Figures 10-11). It should be emphasized that this is the earliest example of corporate architecture known from the Titicaca Basin and anticipates 2000 years of sunken court construction. In addition to the Choquehuanca structure, a large adobe wall was excavated in 1998/1999 immediately to the east of the mound. This is the area known as Montículo 1. This wall may or may not represent another complex of public architecture (Bandy in Hastorf et al. 1998). It does however, date to the Middle Chiripa phase.

T-3B (Chiaramaya)

If Chiripa experienced normal growth in the Middle Chiripa phase, Chiaramaya experienced a demographic decline. Sector B covers only 2.5 ha, with a population index of 127. This represents an annual growth rate of -0.19%.

T-4A (Chiripa Pata)

Chiripa Pata is a large site located approximately 15 km east of Chiripa (T-1) on the main road. It lies near the boundary of the modern communities of Chiripa and Pequery, though the entire site falls within the boundaries of Chiripa. Running along a natural ridge, the sherd scatter extends almost 300 m north of the road to the *pampa*. Several modern houses are located on the site, and it has been extensively plowed for agriculture.

The site seems to have four very broad terraces descending from the road to the pampa. On the uppermost of these terraces I observed large monolithic blocks of sandstone and limestone, almost certainly indicating the presence of some sort of platform or sunken court. No such structure could be discerned using surface indications, however. The principal occupation of the site is during the Tiwanaku Period. It is to this time that the monolithic blocks probably pertain. The first occupation at the site, however, is during the

Middle Chiripa phase. The Middle Chiripa scatter at Chiripa Pata extends over 3.25 ha, with a population index of 171.

While the Taraco Archaeological Project was working at Chiripa, we hear constant reports of tombs opened by plowing at Chiripa Pata. I myself have seen several freshly opened stone-lined cysts on the site, and mortuary inventories from several others. There seem to be a large number of graves present at the site. Moreover, discussion with local landowners led to the discovery that the cemeteries seem to be arranged in a ring around the main body of the site. That is, tombs almost always appear around the fringes of the sherd scatter. this observation is consistent with the structure of the Chen Chen site in Moquegua (Bandy et al. 1996), which I helped map in 1995. This may or may not be a broader Tiwanaku mortuary pattern, but the parallel is certainly suggestive.

Given the importance accorded both to mountains and to sightlines in the Andes generally, the location of Chiripa Pata may have been of some importance in the past. If one walks from the West (Chiripa, Taraco or Santa Rosa) toward La Paz along the modern road,[8] it is precisely as one enters the site of Chiripa Pata that one catches one's first glimpse of the peak of Illimani, the 6000+ meter peak overlooking the city.

A final historical note: in 1934 Wendell Bennett - in the same season in which he excavated the famous Houses 1 and 2 on the Chiripa mound - excavated a test trench "at the old Chiripa ranch, about one mile east of the present hacienda" (Bennett 1936: 415). The 'old Chiripa ranch' is almost certainly Chiripa Pata, especially as the only material recovered there by Bennett pertained to the Tiwanaku Period.

T-130B (Yanapata)

Yanapata experienced rapid growth in the Middle Chiripa phase, with an annual population growth rate of 0.65%, almost twice that of Chiripa. Sector B extends over 3.0 ha with a population index value of 157.

[8] This almost certainly follows the course of the prehistoric road since it intersects virtually every major prehistoric site on the peninsula and in the Katari Basin.

T-232A (Kala Uyuni)

Kala Uyuni is a very large site located in the community of Coa Kkollu. It occupies the flanks of Cerro Achachi Coa Kkollu. The sherd scatter covers 15.25 ha between the modern road (immediately to the south) and the flanks of the hills to the north. An active spring is located at the base of the hill behind the site. There are a considerable number of worked stones present on the site, most incorporated into modern agricultural rockpiles. The site topography would seem to indicate some kind of platform/terrace complex in approximately the center of the site and backing up against the hill. This may be a two-tiered stepped platform, but it is impossible to define architecture with any confidence based on the existing surface remains. A detailed topographical map and test excavations would be required. This is a priority for future research on the peninsula. No stone sculpture of any kind was observed or reported by the local landowners.

The principal occupation of this site is in the Late Formative 1 period. However, its first occupation was in the Middle Chiripa phase. Sector A covers 2.5 ha and has a population index value of 127. The Middle Chiripa occupation is probably deeply buried by later deposits here, and is visible only as a thin sherd scatter on the surface.

T-271A (Sonaji)

A portion of this site is located under the modern town of Santa Rosa. The main architectural complex is a large platform, about 50 meters square, with terraces descending to the lacustrine plain below. The platform itself is adjacent to the Santa Rosa cemetery. The site lies on the boundary between the modern communities of San José and Santa Rosa. The platform lies in San José.

The entire site covers approximately 13.75 ha. The main occupations are from the Tiwanaku and Early Colonial Periods. However, the site's first occupation dates from the Middle Chiripa phase. The Middle Chiripa component, sector A, covers approximately 5.0 ha (population index value of 276), and therefore counts as the largest Middle Chiripa site encountered in the survey. This occupation is deeply buried by later deposits, however, and I am not entirely confident of its precise boundaries. This is a question to be resolved by subsurface testing. There can be no doubt, however, that this is a major Middle Chiripa site.

T-272A (Kumi Kipa)

Kumi Kipa is located in the community of Santa Rosa, on the extreme tip of the Taraco Peninsula. It is situated on a low ridge running north-south from the lakeshore. There are two low mounds on the crest of this ridge that seem to be artificial. The southern one is approximately 20 meters square, 2 meters and roughly rectangular. The northern feature is much smaller and ovoid. It is quite possibly a recent agricultural rockpile. The principal occupations at the site date to the Late Formative and Tiwanaku Periods. Sector A, however, is a minor (1.0 ha, population index 43) Middle Chiripa site, probably associated with the larger occupation at Sonaji (T-272).

T-303A (Quiswaran)

Quiswaran is located in the community of Queruni. It is unusual for Formative Period sites in that it is not located on the edge of the lacustrine plain, but rather somewhat inland. It is situated on the slopes of a ridge at the confluence of two large *quebradas*. On the edge of the site is a large active spring which is currently being used to irrigate a small agricultural area. This spring probably provided ample water for the prehistoric inhabitants of the site.

The sherd scatter covers 3.0 hectares. Sector A, however (the Middle Chiripa occupation) covers only 1.75 ha. The site has been only minimally disturbed by agriculture and the construction of one nearby house. On the whole, it is quite well-preserved.

The upper (southern) portion of the site contains a modest terrace/platform, about 30 meters square. This could well represent corporate architecture, albeit probably from a later (Late Chiripa) phase.

T-394B (Janko Kala)

Janko Kala grew at an annual rate of 0.39% during the Middle Chiripa phase, comparable to Chiripa's growth rate. Sector B covers 4.5 ha.

T-430A (Alto Pukara)

Alto Pukara is located immediately below (north of) the modern road, in the community of Cala Cala. The principal occupation (covering 3.5 ha) pertains to the Late Chiripa and Late Formative 1 phases. The Middle Chiripa occupation (Sector A) covers only 2.0 ha, and is the first occupation of the site. The sherd scatter extends from just north of the modern road to the edge of the *pampa*. The site comprises three broad habitation terraces rising from the *pampa* (see Figure 6.5 for a rough map of the site). Above the habitation terraces lies a smaller terrace/platform which probably represents some form of corporate construction, similar to the Chiripa mound but more modest. This was excavated in 2000 by Robin Beck of northwestern University, and will be the subject of his forthcoming dissertation. He uncovered two well-preserved structures fronting an open plaza, suggesting an architectural complex conceptually similar to the Lower or Upper Houses of Chiripa, though not identical.

The site is very well-preserved and its excavation has yielded excellent results.

5.3 Settlement and population

The first fact worthy of note, as mentioned in the introduction to this chapter, is that the inhabitants of the Taraco Peninsula seem to have lived in relatively large settled villages from very early in the Early Chiripa phase. As may be see in Table 5.1, the average Early Chiripa sector population index is 77 (phase population index/number of sites=1752/23=77). This probably represents an average of more than 10 households per village. On the face of it, this is not a large number. Compared to other areas of the Titicaca Basin at this time period, however, it is very high.

	EF1 - Early Chiripa	EF2 - Middle Chiripa
Number of sites	9	23
Phase population index	693	1752
Annual population index growth rate	-	0.47
Occupation continuity index	-	63
Site founding index	-	78

Table 5.1: Early Formative: Metrics

As an example we may take sites of the Pasiri Period in the Juli-Pomata area. Pasiri ceramics are somewhat similar to early Chiripa ceramics - though they remain relatively poorly described - and they seem to be diagnostic of Early Formative sites in the southwestern Titicaca Basin (Stanish et al. 1997: 40). Pasiri sites average 0.8 hectares in size (Stanish et al. 1997: 51). If corrected in the same manner as my own data, this yields an average population index of 32. Early Formative sites on the Taraco Peninsula, therefore, are on average more than twice the size of those in the Juli-Pomata area.

Furthermore, Early Formative occupation is much more dense on the Taraco Peninsula than in Juli-Pomata. Ten Pasiri sites were encountered in the Juli-Pomata survey (Stanish et al. 1997: 40). This project intensively surveyed 300 km^2. Early Formative population density in Juli-Pomata - when the figures are corrected using my method - may therefore be estimated to be approximately 1.0/km^2. The same calculation on the Taraco Peninsula data (85.22 km^2 surveyed) produces a figure of 8.1/km^2.

It is apparent that the Taraco Peninsula was exceptional from the very beginning of its occupational history. No other known area in the Titicaca Basin has Early Formative populations this dense or Early Formative villages this large. This Early Formative exceptionalism clearly set the stage for the continuing precocity of the Taraco Peninsula villages throughout the Early and Middle Formative Periods. It may be explained, as I suggested in the introduction to this chapter, by the 1500 B.C. lake level rise which first created Lake Wiñaymarka. As the lake rose, groups of extensive agro-pastoralists (we may imagine small, mobile communities such as the Late Archaic sites investigated by Aldenderfer and Klink in the Ilave River drainage) occupying the vast grassy plain that then existed would have been increasingly concentrated on the narrow spit of land that was to become the Taraco Peninsula. If we imagine that possibilities for outmigration were limited - by, for example, territorial claims of adjacent groups - these conditions would have created powerful incentives for these people to focus their subsistence activity very strongly on agriculture and lacustrine resources (fish, birds) at the expense of herding or hunting. Such a rapid subsistence shift - this could all have taken place within a generation - could certainly account for the exceptional density of Early Formative population on the Taraco Peninsula relative to areas - such as Juli-Pomata - where the impact of the lake's rise was less pronounced.

Whatever the case, a stable system of permanent villages was established on the Taraco Peninsula in the Early Chiripa phase. This settlement system was to prove very stable; it changed only incrementally for over 2500 years, until the collapse of the Tiwanaku state.

Figure 5.4 shows that the settlement systems of both the Early and Middle Chiripa phases are characterized by a unimodal site size distribution.[9] The majority of the population in the Early Chiripa phase resided in sites with a population index in the range of 100-200. The Middle Chiripa pattern is basically identical, but the average site size has increased. Most people now lived in sites with a population index between 200 and 300. The unimodal site size distribution in both phases strongly suggests a system of autonomous villages. No single village of group of villages seems to have been even locally dominant during the Early Formative.

Table 5.1 shows that the Early Formative settlement system was not only very stable (the occupation continuity index is well over 50% for Middle Chiripa), but also that it was growing rapidly. The annual population index growth rate was 0.47%, which is quite close to Hassan's estimate of 0.52% for the maximum growth rate of prehistoric agricultural populations (Hassan 1981: 140). This is the highest growth rate in the entire settlement history of the area excepting the Late Horizon and Early Colonial Periods, where there

[9] Figure 5.4 is a variation on the conventional site size histogram. The difference is that the vertical axis does not represent the count of all sites in that size range, but rather the sum of the population index of these sites. This chart displays the distribution of population across the various size ranges.

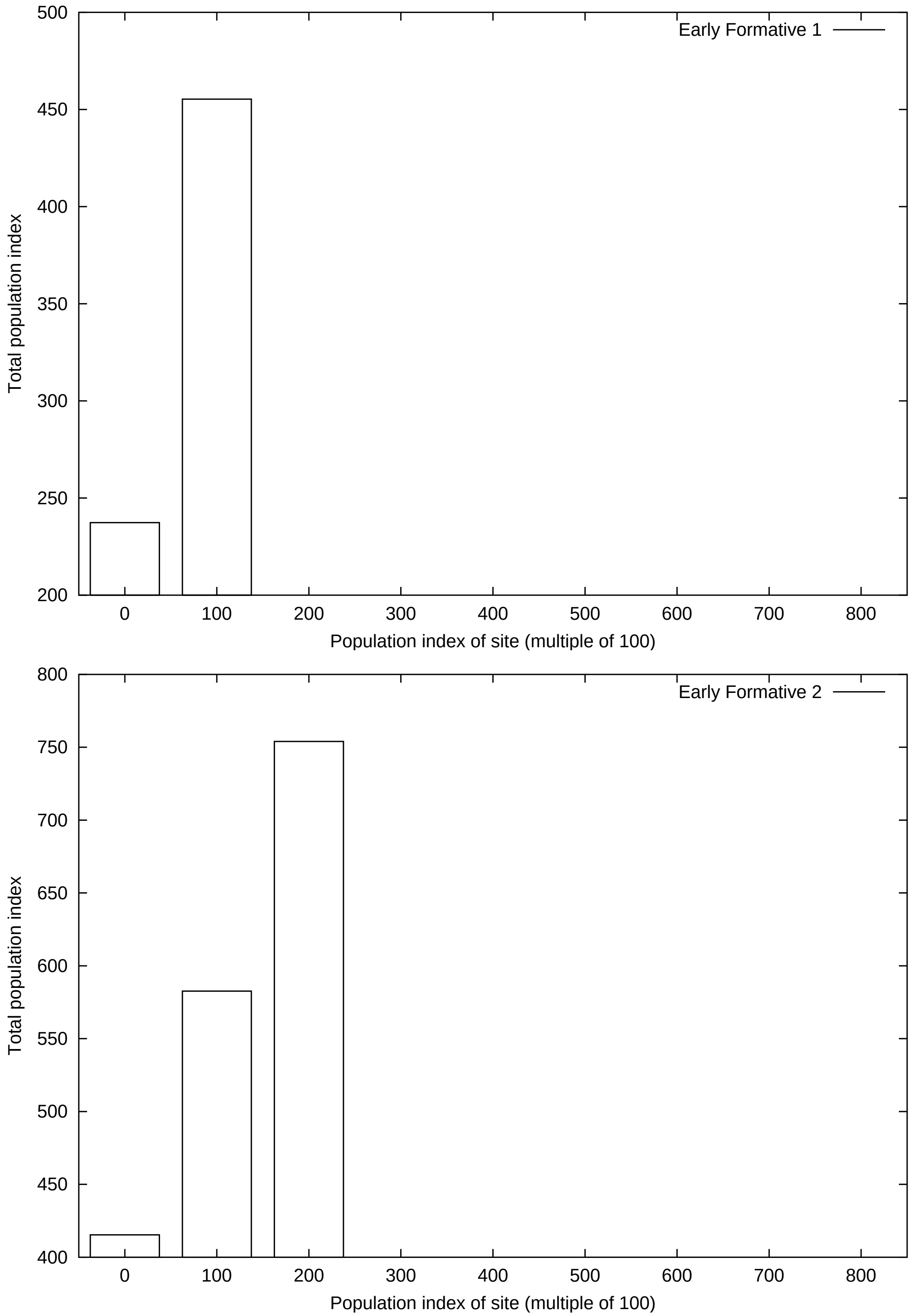
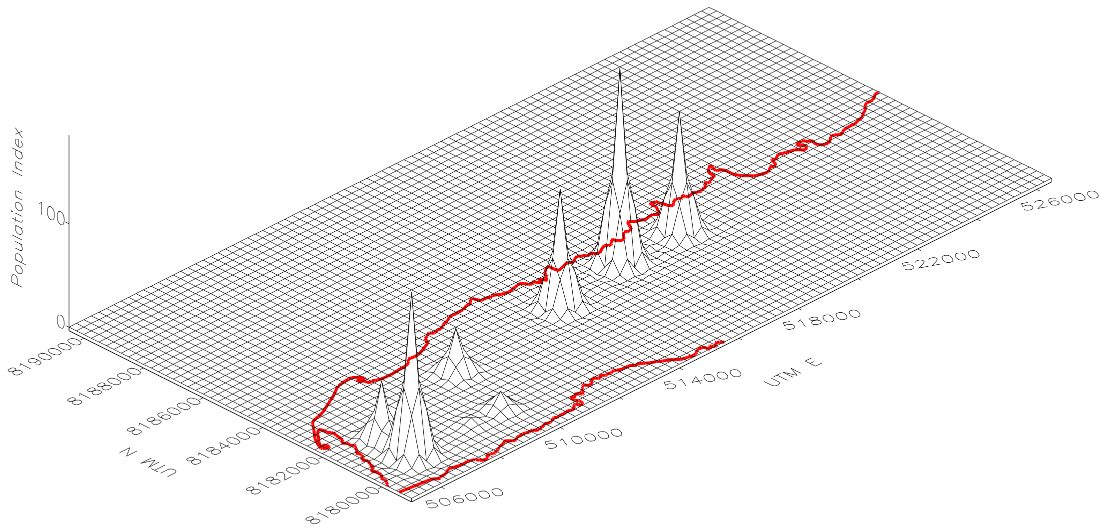


Figure 5.4: Early Formative site size distributions

- a) Early Formative 1



- b) Early Formative 2

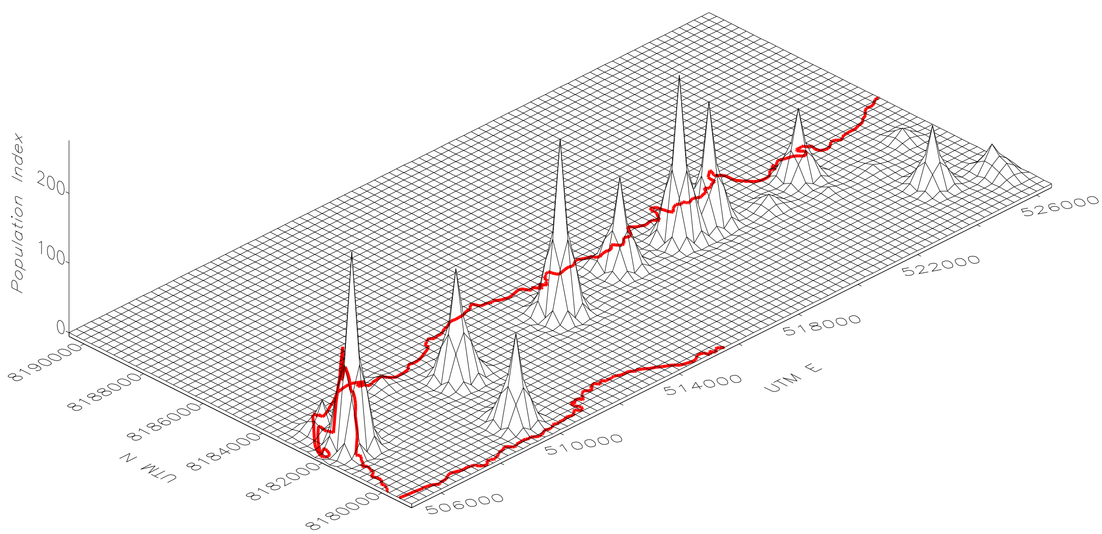


Figure 5.5: EF: Sum of phase population index per 0.25 km^2

is clear evidence of widespread immigration. Additionally, the site founding index for the Middle Chiripa phase is 78%, a very high value. The general picture that emerges from this information is one of relatively small, autonomous villages growing rapidly and fissioning when their population passes a certain critical threshold. Indeed, two such instances of village fissioning seem to be observable in the Early Formative on the Taraco Peninsula. Interestingly, the two villages in question were the two largest sites during the Early Chiripa phase.

Figure 5.5 is not a settlement pattern map. Rather, it is a population density map. The survey area has been divided into 0.25 km^2 squares (squares 500 m on a side). The population index values of all of the archaeological sectors falling within each square for a particular time period are summed. This summed population index is represented by the z axis. So higher spikes represent higher local population densities.

A visual inspection of Figure 5.5a reveals two spikes in population density on the peninsula in the Early Chiripa phase. These correspond to the sites of Chiaramaya (T-3) and Cerro Choncaya (T-2). By the Middle Chiripa phase, however, (5.5b) these two sites are no longer the loci of highest population density on the peninsula. Cerro Choncaya has been abandoned, and Chiaramaya has shrunk dramatically in size. Three new sites have come to the fore: Chiripa (T-1), Janko Kala (T-394) and Sonaji (T-271).

Figure 5.6 graphically represents the spatial shifts in population that occurred in the Middle Chiripa phase. It was produced by subtracting the sum of Early Chiripa population indices for a given 0.25 km^2 block from the sum of Middle Chiripa population indices for the same block. Essentially, it was produced by subtracting Figure 5.5a from Figure 5.5b. The vertical axis therefore represents the number of hectares by which the cumulative population index of the block increased or decreased during the Middle Chiripa phase. A raised spike indicates a population increase in a block, which a sunken area represents a decrease. A flat surface indicates no change.

Figure 5.6 shows that only three localities experienced population declines in the Middle Chiripa phase. These were the two sites of Cerro Choncaya and Chiaramaya (mentioned above), together with the site of Sunaj Pata (T-268), located very near to Cerro Choncaya.

- Early Formative 2

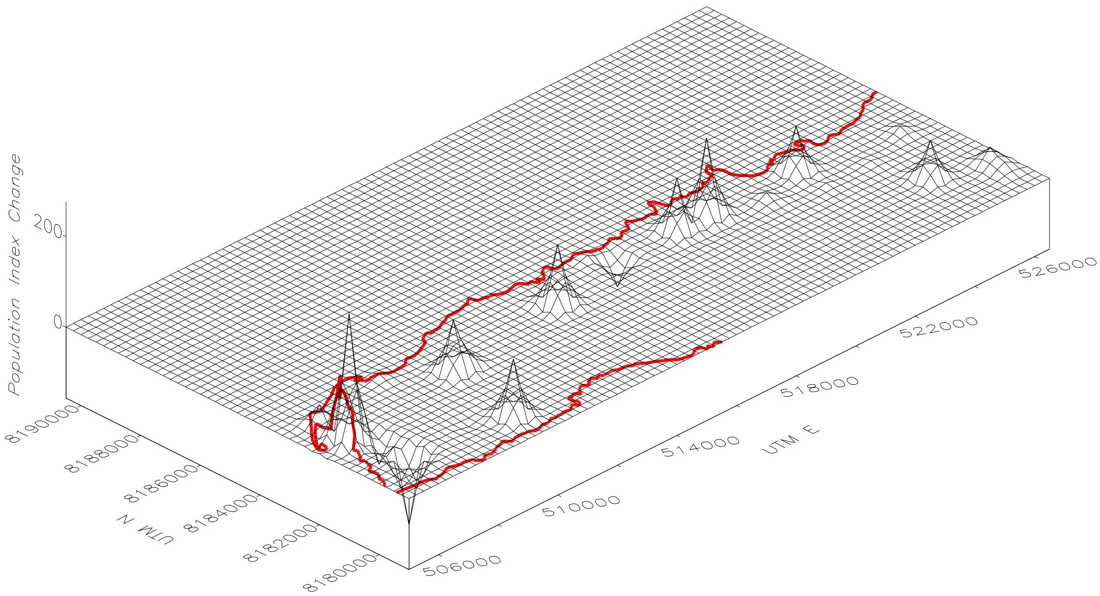


Figure 5.6: EF: Change in phase population index per 0.25 km^2

At the same time, however, a number of new sites were founded and experienced very rapid growth. Among these were Chiripa Pata (T-4), Sonaji (T-271), Kumi Kipa (T-272), Kala Uyuni/Achachi Coa Kkollu (T-232/T-225), Alto Pukara (T-430) and Quiswaran (T-303).

The overall population growth rate for the Middle Chiripa phase was 0.47%. The Early Chiripa villages that were not abandoned in the Middle Chiripa phase experienced growth at a comparable, if somewhat slower rate (0.35% at Chiripa [T-1]; 0.39% at Janko Kala [T-394]).[10] Interestingly, if we combine the population indices of Chiaramaya with those of all the newly-founded Middle Chiripa sites to the east of Taraco (Chiripa Pata, Alto Pukara and Quiswaran),[11] we arrive at a combined growth rate of 0.47%, identical to the gross phase rate. Combining the population indices of Cerro Choncaya and Sunaj Pata with the new Middle Chiripa sites west of Taraco (Sonaji, Kala Uyuni, Achachi Coa Kkollu, Kumi

[10] Yanapata (T-130) is the exception, with the much faster growth rate of 0.65%. It may have experienced a modest influx of immigrants from Cerro Choncaya/Sunaj Pata.

[11] Early Chiripa: 186; Middle Chiripa: 481.

Kipa)[12] produces a growth rate of 0.35%, identical to the growth rate of Chiripa, and similar to the phase average.

To me, these figures strongly suggest a set of actual events; concrete population movements. I would reconstruct them as follows:

- The village of Cerro Choncaya split into two groups. The first of these moved to the east and founded the site of Kala Uyuni and its outlier Achachi Coa Kkollu. The other group moved a short distance to the north and west, combining with the prior population of Sunaj Pata to found Sonaji and its outlier Kumi Kipa.

- The village of Chiaramaya split into two or more groups. The first of these groups moved to the east, leapfrogging over the adjacent site of Chiripa to found Chiripa Pata. Smaller groups may have continued eastward and founded Alto Pukara and Quiswaran. A small percentage of the Early Chiripa population of Chiaramaya remained in the village, which continued to be occupied, though on a much-reduced scale.

The fact that the two villages that fissioned in the Middle Chiripa phase were the two largest in the Early Chiripa phase is almost certainly not a coincidence. This is exactly what one might expect in a relatively lightly-populated and unbounded landscape. The growth of villages led to internal strife and factional conflict (and all of the factors implicated in Johnson's term 'scalar stress' [Johnson 1982]), resulting in village fissioning and relocation. The data suggest that the critical threshold - in terms of my population index - in the Middle Chiripa phase was something on the order of 150.[13] When Early Formative settlements surpassed this size, their inhabitants apparently chose to split the community and relocate a portion of it, presumably as a response to increasing internal conflicts. This is a very low threshold indeed, and in subsequent periods we will see it rise considerably as

[12] Early Chiripa: 230; Middle Chiripa: 464.

[13] Interestingly, this is very close to Fletcher's first C-limit of 1-2 ha for the transition from mobile hunter-gatherers to sedentary villages (Fletcher 1995: 89-90). The villages were 3.0 ha (T-2, 2.39 ha corrected) and 3.5 ha (T-3, 2.75 ha corrected) respectively before they fissioned. The Early Formative is the time that this C-limit was overcome, so some village fissioning would be predicted by Fletcher's model.

the people of the Taraco Peninsula came to have fewer and fewer possibilities of relocation, and became better equipped to minimize and resolve intracommunity conflicts.

Chapter 6

The Middle Formative: emerging complexity

In the Middle Chiripa phase we witnessed the first appearance in the southern Titicaca Basin of decorated serving ceramics and public architecture in the form of the sunken court. The meaning of this remains obscure, of course, and cannot be established on the basis of our present knowledge. However, we may suggest, following Hayden (Hayden and Gargett 1990, Hayden 1993, Hayden 1996a) and others - and ultimately, of course, Mauss (Mauss 1967) - that the appearance of these things reflects the advent of "competitive feasting", an elaborate form of what Dietler calls "commensal politics" (Dietler 1996, Dietler 1999). The core concept of commensal politics is that giving establishes obligation on the part of the recipient. This obligation may be later redeemed to the original donor's advantage. Thus, competitive feasting:

> ... ambitious [persons] try to give away as much food and as many goods as possible in order to earn interest on their gifts and establish a debt hierarchy. Desirable foods and exotic decorative items were also given to supporters as rewards for their help in raising the capital for these feasts (Hayden 1993: 255).

The significance of competitive feasting in the Early and Middle Formative context is precisely that it represents a mechanism by which conflicts may be resolved and personal and structural antagonisms pursued in a manner that is not destructive to the social body.

> The critical point to retain is that commensal hospitality centering around food and drink distribution and consumption is a practice which, like the exchange of gifts, serves to establish and reproduce social relations. This is why feasts are often viewed as mechanisms of social solidarity that serve to establish a sense of community. (Dietler 2001)

It would not be at all surprising, then, if we were to see an intensification in the scale and elaboration of commensal activities at the same time that villages are first experiencing the stresses that arise when group size increases to unprecedented levels (cf. Johnson 1982). It seems that the beginnings of such a process are evident in the Middle Chiripa phase.

As population increased, and as the landscape of the Taraco Peninsula began to fill up, the difficulty and costs of village fissioning and relocation rose, while scale-related stresses and conflicts also increased. This will become apparent when the overall demographic patterns of the Middle Formative are discussed later in this chapter. This being the case, it is not surprising that we witness an increase in the scale and elaboration of the hypothetical correlates of competitive feasting. Decorated serving ceramics (bowls) become common in the Late Chiripa phase, accounting for as much as 6.5% of some assemblages (Steadman 1999: 66). Throughout the Late Chiripa phase we also see a steady increase in the size and elaboration of public architectural complexes, as, I document at length in section 6.3.

Another significant point of this chapter is that political units integrating large populations over significant geographical areas - multi-community polities - had yet to emerge. I make this statement in order to correct some common misconceptions regarding the nature of the Chiripa political formation. I refer specifically to Browman's concept of a "Chiripa polity"[1] integrating much of the southern Titicaca Basin. This conception of Upper House Level-contemporary political organization has recently been echoed by Stanish, who sees multi-community polities emerging earlier in the southern Titicaca Basin than in adjacent areas, largely on the basis of his interpretation of the Chiripa sequence (Stanish et al. 1997: 11). Much of this chapter will be devoted to refuting this hypothesis, using the evidence of

[1] Browman's most explicit formulation of this thesis has been in unpublished essays and conference papers. However, there are clear references to a Chiripa polity in published sources (c.f. Browman 1981:414).

the Chiripa architectural sequence, and, especially, the properties and dynamics of the Middle Formative settlement system. My basic contention is that during the Middle Formative Period the Taraco Peninsula communities participated in a continuous regional escalation of commensal politics and of external exchange relations. These developments set the stage for the emergence of true multi-community polities, which occurred, in fact, early in the following Late Formative Period.

6.1 Phase definition

The Late Chiripa phase is the last of the phases defined by Steadman in the Chiripa sequence (Steadman 1999). In my analysis, Late Chiripa occupations were identified using the frequency profile analysis technique, as described in Chapter 3. Essentially, the Late Chiripa phase is characterized by high frequencies of large angular quartz fragments as temper. Over 50% of sherds from this phase have this temper. This paste is quite easily identifiable with the naked eye. Flat-bottomed bowls become common in this phase, represented by both vertical- and slightly flaring-walled examples. Two new forms include vessels with low ring bases and ceramic trumpets, both central to the definition of Yaya Mama religious tradition (Chávez and Mohr Chávez 1975, Chávez 1988), and both illustrated in Figure 6.1g and k. Additionally, ceramic figurines seem to appear in this phase, though they are exceedingly rare (only one has been reported from the Taraco Peninsula to date; it is illustrated as Figure 6.1l).[2]

Another oddity that merits mention, if only for its rarity, is the sherd illustrated in Figure 6.1d and e. This is an example of a "zoned-excised" sherd. The term is intended to convey the fact that the different color zones are placed on different surface levels. In the illustrated example, on the exterior of the vessel (Figure 6.1e), the "sunken" area is slipped cream, and

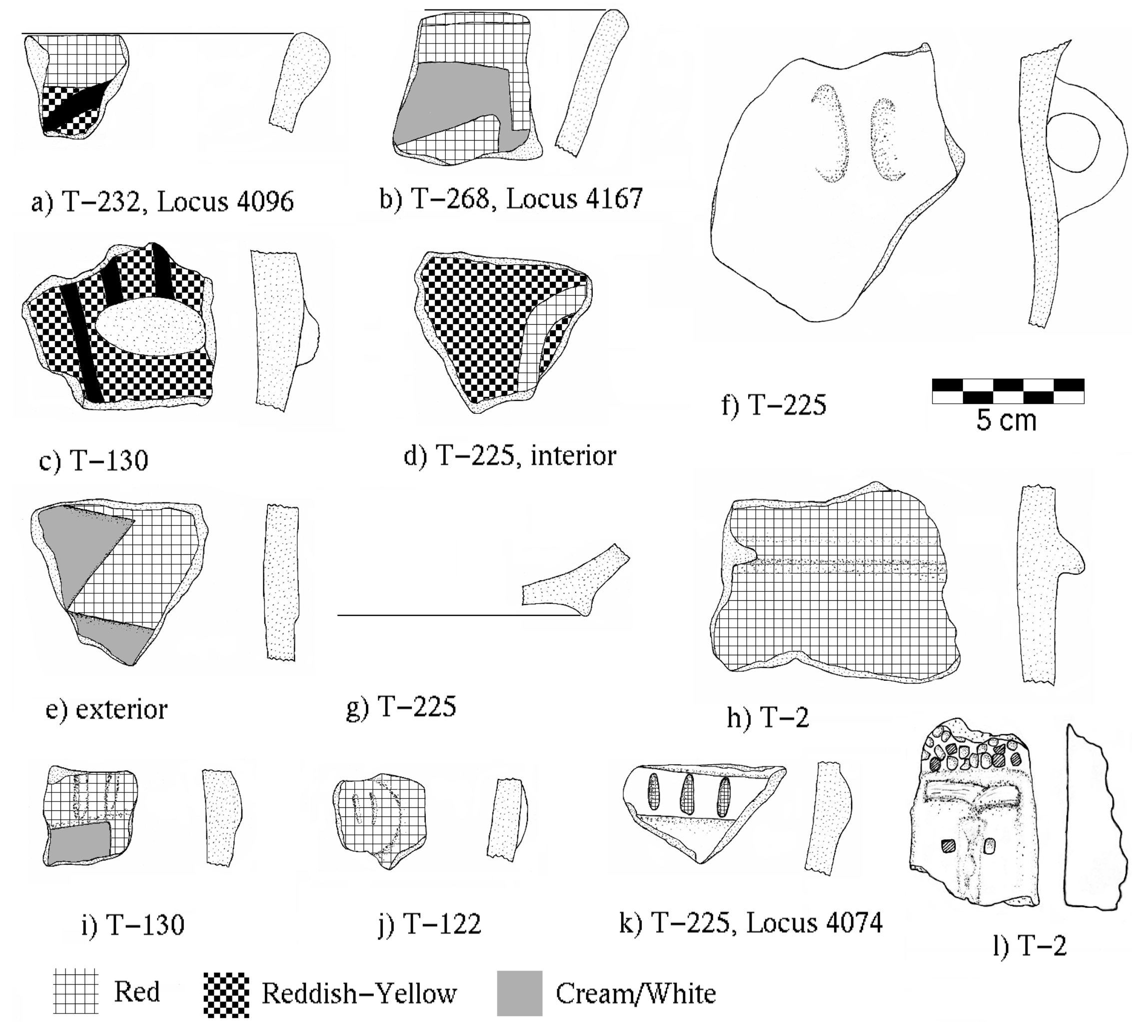
[2]The figurine illustrated in Figure 6.1l is very interesting. It can be considered a pun or joke using ceramic technology as its medium and referent. Its eyebrows are formed by use of more dense than usual fiber temper. Its eyes and "turban" are formed by careful placement of the angular quartz chunks which are characteristic of most Late Chiripa ceramics. Thus, the normal tempering agents used during this phase become design elements, and are foregrounded by their careful arrangement. To one familiar with Late Chiripa ceramics, this figurine is really quite witty and surprising.

the “raised” area is slipped red.

Decorated ceramics also become common for the first time in the Late Chiripa phase. The most common decorated wares are bowls manufactured in a micaceous paste. The most common color combination is cream on red (e.g. Figure 6.1b), though other colors include black and a reddish-yellow or orange. Zoned incised wares are rare but not unknown. In all these respects, Steadman’s Late Chiripa phase is identical to Chávez’s Late Chiripa (Mohr 1966, Chávez 1988) and Browman’s Mamani (Browman 1978a, Browman 1978b, Browman 1980) phases. All of these seem to be describing the same general ceramic assemblage.

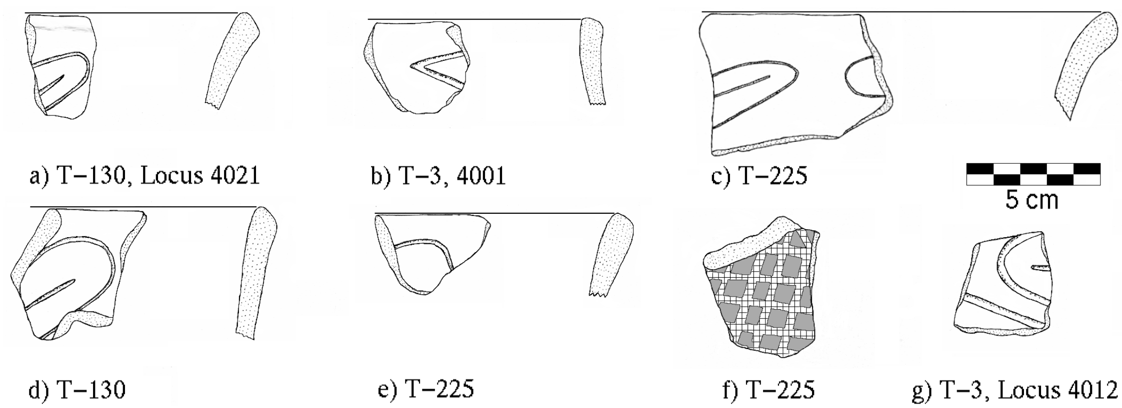
There is also some support, for the first time, for the hypothesis that decorated ceramic serving wares and public architecture are somehow indicative of competitive feasting and commensal politics. Steadman notes that the frequency of decorated Late Chiripa ceramics on the Chiripa mound is more than three times their frequency in the site considered as a whole, and as much as twenty times their frequency in certain domestic middens (Steadman 1999: 66).

There are many indications that the Taraco Peninsula villages participated in a Titicaca Basin-wide exchange system in the Middle Formative. This topic will be discussed more thoroughly later in this chapter. For now, however, we may note the - admittedly sparse - presence of ceramics relating to the northern Titicaca Basin Qaluyu tradition. Some examples are illustrated in Figure 6.2. Most of these are classifiable as Qaluyu Wide-line Incised (Steadman 1995, see also Stanish and Steadman 1994: Figure 97). This style dates to the Late Qaluyu 1 and 2 phases at Camata (Steadman 1995: Table 35), or approximately 850-400 B.C. (Steadman 1995: Table 3). These sherds (Figure 6.2a-e, g) are decidedly non-local, manufactured as they are in an exotic mineral-tempered paste. The one painted example bears a common Qaluyu Polychrome motif (see Steadman 1995: Figure 45 for an example). This style dates to the same time period as Qaluyu Wide-line Incised, which is to say the Late Qaluyu 1 and 2 phases (Steadman 1995: Table 34). This sherd (Figure 6.2f) may also be imported. Though its paste is fiber-tempered, the red paint applied over a cream background sparkles and probably contains powdered hematite. This is definitely



a-c) painted, d-e) "zoned-excised", f) olla, g) ring base, h) applique fillet, i-i) modeled decoration, k) "trumpet" with post-fire paint in incisions, l) anthropomorphic figurine with quartz inlay

Figure 6.1: Middle Formative ceramics



e-e) and g) Qaluyu Wide-line Incised, f) Qaluyu Polychrome-related
See Figure 6.1 for color coding.

Figure 6.2: Qaluyu-related Middle Formative ceramics from the Taraco Peninsula

a northern basin trait. However, the particular colors used (red as opposed to brown on cream) are more southern than northern, and may identify the piece as a local imitation of a Qaluyu Polychrome design.

The chronological placement of the Late Chiripa phase remains somewhat problematic. The "official" dates of the Taraco Archaeological Project are 800-100 B.C. (Whitehead 1999: 20). Fixing the beginning of the Late Chiripa phase is problematic due to an extended plateau in the radiocarbon calibration curve (Whitehead 1999: 21), which gives dates in the range of 800-400 B.C. or so extraordinarily large error ranges. Nothing at all can be done about this, but it does seem that 800 B.C., give or take a bit, is a legitimate point of demarcation between the Middle and Late Chiripa phases.

The end of the Late Chiripa phase is another matter altogether. 100 B.C. is a conventional date and has been used by many commentators on Chiripa, including Browman (Browman 1978a: 809) and Chávez (Chávez 1988: 18). This conventional date is primarily based on dates from Kidder's excavations at Chiripa, and intends to date the time of the burning of the Upper House Level. All investigators seem to agree that this event marks the end of the Late Chiripa phase, since the superposed mound structure seems to be Late

Formative in date (Browman 1978a).[3]

One of the principal contributions of the Taraco Archaeological Project's excavations at Chiripa has been the improved dating of the Chiripa phases. Over 40 AMS dates on annual plant remains have been run (Whitehead 1999). Of the more than 15 of these dates that pertain to the Late Chiripa phase, only one has a mean calibrated age more recent than 250 B.C. This one more recent outlier is clearly an aberration, since it is form a Lower House structure (Locus 1386) and is bracketed by a whole series of dates older than 350 B.C. Additionally, we have three dates on floor materials from House 5, firmly dating the burning and abandonment of that structure to approximately 270 B.C. (Bandy 1998), plus or minus a few decades. It should also be noted that there are very few dates from other projects which would be later than this. The two Kidder dates that fall after this time (P-117 and P-118; see Ralph 1959), are clearly erroneous[4], since they are identical or prior to the very same event - the burning of House 5 - as are the three TAP dates mentioned in my discussion of the Chiripa architectural sequence (section 6.3).

All of the above data indicate that there is no evidence placing the end of the Late Chiripa phase later than 250 B.C. In the present analysis, therefore, I place Late Chiripa at 800-250 B.C.[5] It should be noted, though, that no good stratigraphic column has yet been published from the southern Titicaca Basin that spans the Late Chiripa/Kalasasaya transition. This is clearly a priority for future research in the region.

6.2 Principal sites

Ten sites in the survey area had Middle Formative Period occupations greater than or equal to 3.0 hectares. These were all good-sized villages. They are located on Figure 6.3, and are described below. This period witnessed the development of a two-level site size

[3] See my section in Hastorf et al. 1998 for some discussion of post-Upper House Level mound stratigraphy.

[4] Karen Mohr-Chávez recognizes the outlier status of these dates explicitly (Mohr 1966: 162).

[5] The contemporary Early Sillumocco phase in the Juli-Pomata area has been dated to 900-200 B.C., though solely on the basis of stylistic cross-dating and a single radiocarbon date from Tumatumani (Stanish and Steadman 1994).

hierarchy (see below and Figure 6.9). The sites may therefore be classified as first-tier sites (population index values between 400 and 500) and second-tier sites (population index values between 200 and 300).

T-1D (Chiripa)

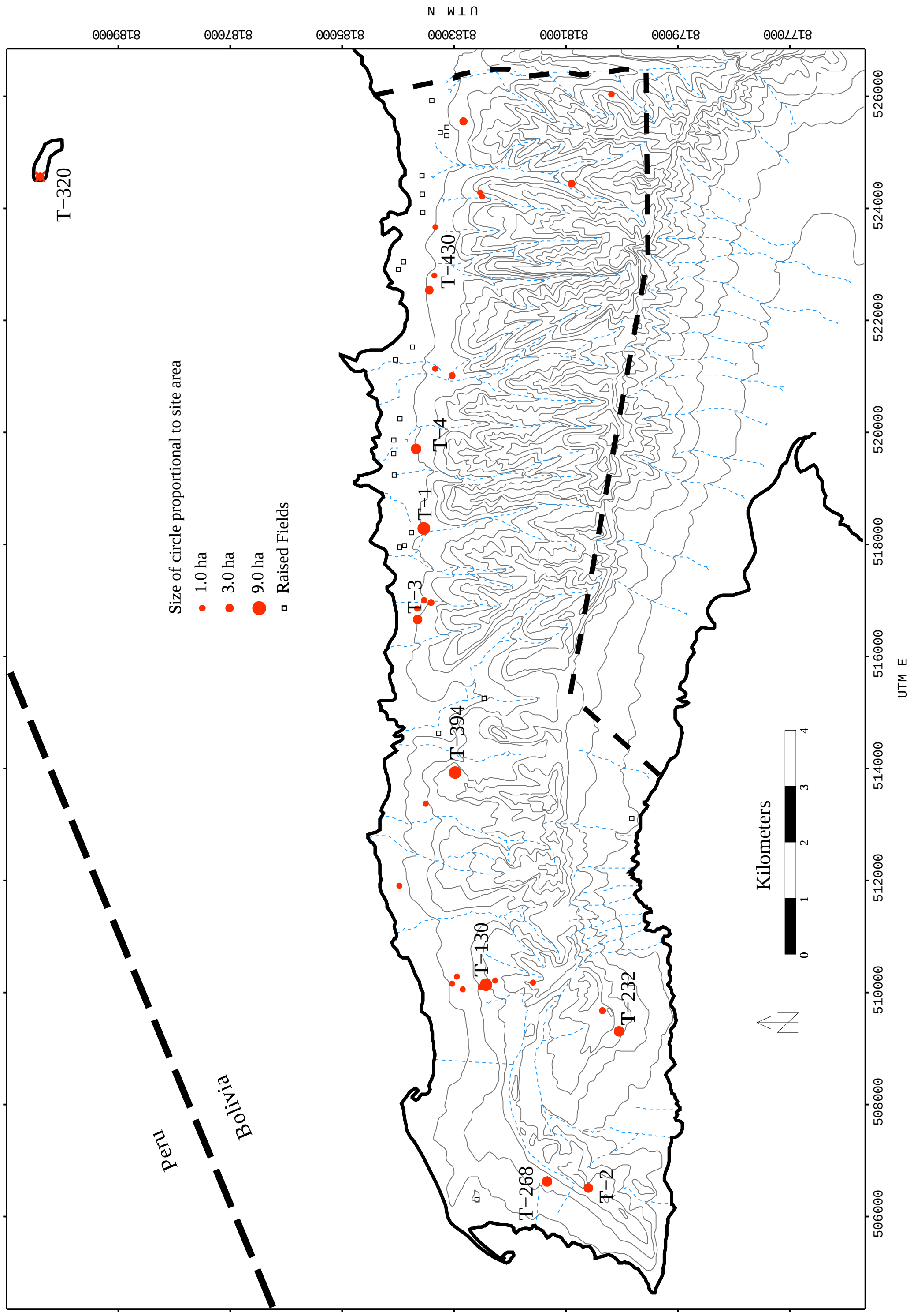
In the Late Chiripa phase Chiripa's population index grows to 445, a rate of 0.11%. This is roughly equivalent to the overall Middle Formative population growth rate of 0.13%. Sector D covers 7.7 ha. Early in the Late Chiripa phase the Llusco sunken enclosure was constructed (Paz Soría 1999). The Lower Houses date to the middle of the phase, while the Upper Houses and the mound proper (Figures 6.4, 6.6) were later constructions, probably built during the last century of the Late Chiripa phase (Bandy et al. 1998, Bandy 1999b). During this phase, Chiripa was one of the four principal villages on the Taraco Peninsula.

T-2B (Cerro Choncaya)

After being completely abandoned during the Middle Chiripa phase, Cerro Choncaya was reoccupied during Late Chiripa. Its reoccupation was almost certainly related to the breakup and abandonment of Sonaji (T-271). For a more detailed consideration of this hypothesis, see the description of T-268, below. The Late Chiripa sherd scatter (Sector B) extends over an area of 4.25 ha. The site has a population index value of 231. It is a second-tier Late Chiripa site.

T-3C (Chiaramaya)

Chiaramaya continued to be occupied through the Late Chiripa phase. During this phase it grew at an annual rate of 0.10%, very close to the phase average. Sector C extends over 4.25 ha and has a population index of 231. The large terrace/platform at the site probably dates to this phase.



Numbered sites are discussed in text.

Figure 6.3: Middle Formative (Late Chiripa) Settlement Pattern

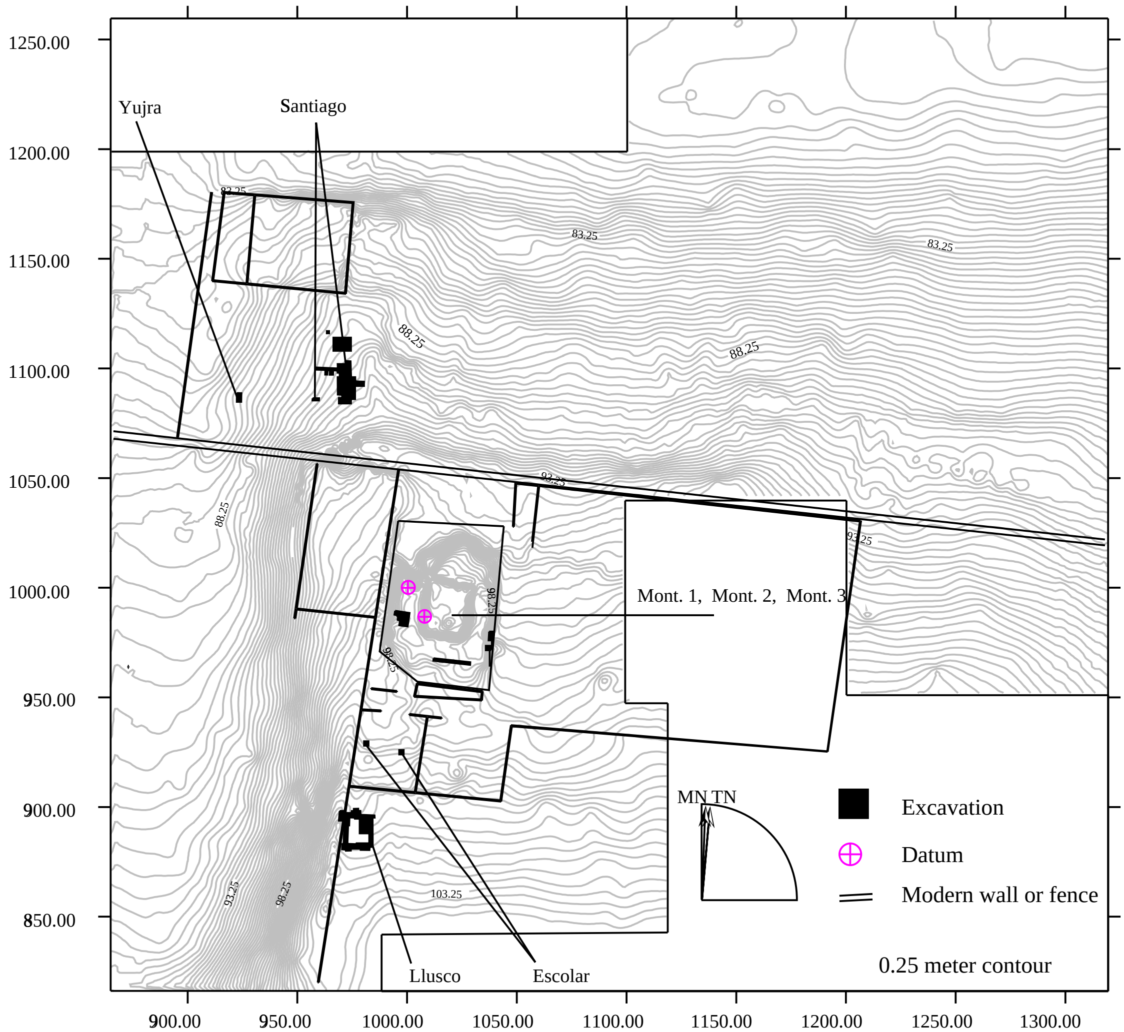


Figure 6.4: Plan of Chiripa (T-1)

T-4B (Chiripa Pata)

Chiripa Pata grew to 5.0 ha (population index: 277) in the Late Chiripa phase, an annual rate of 0.08%, somewhat below the phase average. The upper terrace may or may not represent a corporate construction similar to those at Chiripa, Chiaramaya, Yanapata, Alto Pukara and elsewhere.

T-130D (Yanapata)

Sector D at Yanapata covers 7.50 ha, and has a population index of 429. Its Late Chiripa growth rate was 0.14%. This is slightly higher than the phase average, but Yanapata's growth is no longer exceptional, as it was during the Middle Chiripa phase. At least one large terrace platform is present at the site, and possibly two, which probably date to this phase.

T-232B (Kala Uyuni)/T-225(Achachi Coa Kkollu)

In the Late Chiripa phase, these two sites should be considered as composing a single community. Sector B at Kala Uyuni covers 5.25 ha, and seems to be a strictly domestic occupation with no indications of corporate architecture as yet. Sector C at Achachi Coa Kkollu covers 1.5 ha, and clearly has a terrace (with several large limestone pillars still in evidence on the surface) and quite possibly a sunken court as well. This site would seem to represent a ceremonial or public ritual area, containing as it does corporate architecture and located as it is on a high hill overlooking the main body of the village below. It was probably functionally equivalent to the large terrace/platforms at Chiaramaya, Chiripa and Yanapata. This spot is still used for agricultural ritual. Recording it I met with a small party of men digging up and upending one of the large limestone pillars from the Middle Formative structure. Reportedly, flipping this pillar - known as 'the Colonel' - brings rain. This has been the custom in the community of Coa Kkollu as long as any of these men - some quite elderly - could remember.

At any rate, the two nearby sectors have a combined population index value of 361, placing them among the first rank of Late Chiripa sites. In the Late Chiripa phase, they grew together at an annual rate of 0.15%. This is faster than most sites of this period and 50% more than the phase average. The combined community may have received some immigrants fleeing the fissioning of Sonaji (T-271), but this must remain hypothetical.

T-268B (Sunaj Pata)

After being completely abandoned during the Middle Chiripa phase, Sunaj Pata, like Cerro Choncaya (T-2), was reoccupied during the Late Chiripa phase. Its reoccupation was almost certainly related to the breakup and abandonment of Sonaji (T-271). The Late Chiripa sherd scatter (Sector B) extends over an area of 5.0 ha. The site has a population index value of 277. It is a second-tier Late Chiripa site. The (hypothetical) sunken court at this site may be Late Chiripa in date.

The Middle Chiripa population index of Sonaji was 277, while the combined Late Chiripa population index of Sunaj Pata and Cerro Choncaya if 508. This represents an annual population index growth rate in the Late Chiripa phase of 0.11%, very close to the phase average. I consider this to be strong evidence that the Middle Chiripa village of Sonaji did indeed fission, and that it broke into two segments, one of which settled in Sunaj Pata and the other at Cerro Choncaya. It is interesting that the community of Sonaji was initially formed by a fusion of these two villages. It seems likely that the distinction between the two groups was maintained even during their period of coresidence at Sonaji, and that this distinction was the cleavage plane along which the village split at the beginning of the Late Chiripa phase.

T-320A (Sikuya Oeste)

It is during the Late Chiripa phase that we have the first evidence for the occupation of the island of Sikuya. This earliest site on the island, Sikuya Oeste, is heavily disturbed by modern habitation. It lies directly underneath the modern town. There is no discernible surface indication of any sort of platform or corporate architecture. However, any such traces would almost certainly have been erased by the very intensive Late Horizon, Colonial, Republican and modern occupations of the site. Also, it was impossible to obtain good surface collection from the site. It is therefore impossible for me to rule out the possibility of an Early or Middle Chiripa occupation that I overlooked.

For the same reason, I am not overly confident of my estimate of the size of any of the various occupations. Nevertheless, I estimate Sector A's size at 3.0 ha. It is a second-tier Late Chiripa phase site.

It should be noted that during the entire Early and Middle Formative Periods Sikuya was not, in fact, an island (see Figures 6.7 and 6.8). This site was, rather, another lakeshore settlement, very like Chiripa and other contemporary sites.

T-394 (Janko Kala)

Janko Kala continued to grow steadily through the Late Chiripa phase. Sector C covers 7.5 ha and has a population index of 429. It is one of the four first-tier Late Chiripa sites. The growth rate of Janko Kala in the Middle Formative was 0.09%, somewhat below the phase average. It also seems to be the only one of the large MF villages which is lacking clear evidence of public architecture.

T-430 (Alto Pukara)

Alto Pukara continued to be occupied into the Late Chiripa phase. Sector B grew to 3.25 ha (population index: 171), at an annual rate of 0.09%. This is comparable to the phase average. It was probably in this phase that the site's terrace/platform was constructed. This feature is visible on Figure 6.5 as a rectangular feature on the southern (upper) portion of the site. Robin Beck's work at this site will hopefully shed some light on its architectural sequence.

6.3 Architectural evolution

As mentioned in the introduction to this chapter, there is evidence for a gradual and continuous increase in the elaboration and scale of public architecture on the Taraco Penin-

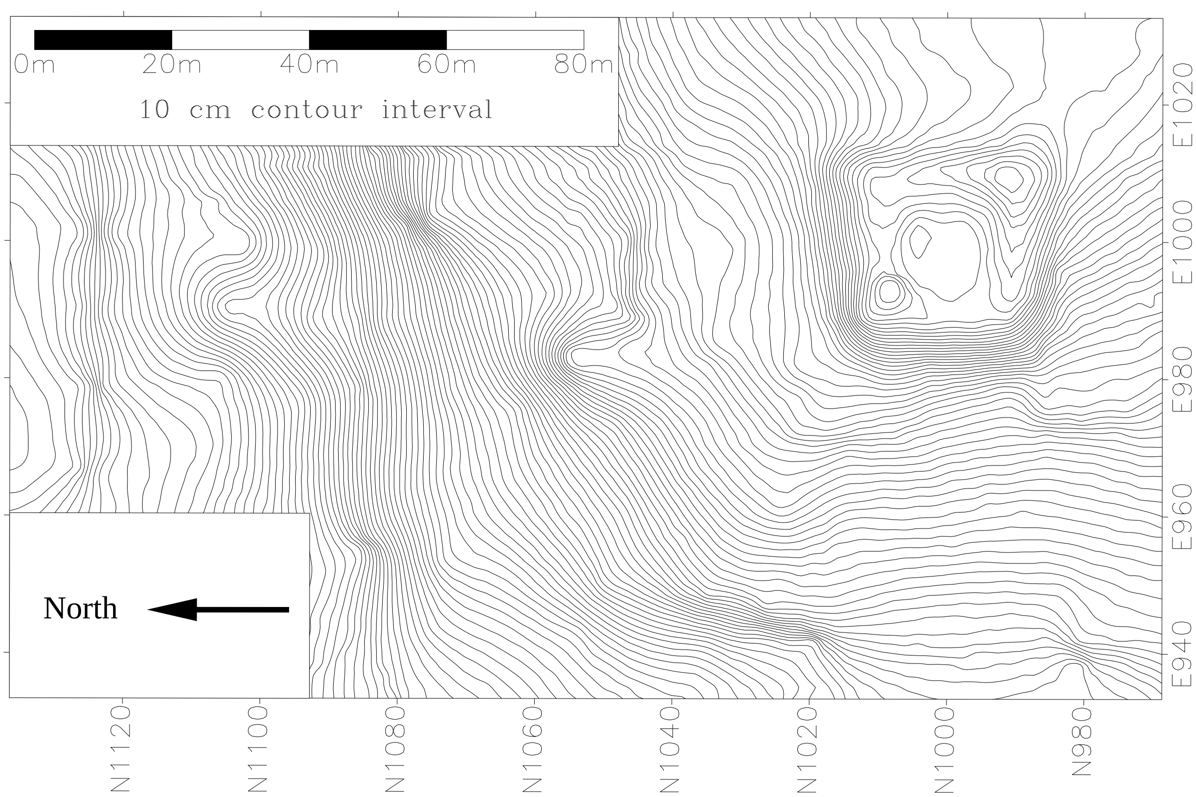


Figure 6.5: Plan of Alto Pukara (T-430)

sula during the Middle Formative Period. We have a fair grasp of the sequence at Chiripa, so I will take it to be representative of similar sites on the peninsula.[6]

6.3.1 The Llusco Structure

Toward the beginning of Late Chiripa, the Middle Chiripa Choquehuanca structure was abandoned and gradually filled with a Late Chiripa domestic midden (Whitehead in Hastorf et al. 1998). At this time another sunken court structure was constructed to the south of the mound, in the Llusco area (Paz in Hastorf et al. 1998, Paz Soría 1999; see Figure 6.4). This structure measured approximately 13x11 meters. The walls, like those of the Choquehuanca structure, were made of unworked alluvial cobbles set in a mud mortar. The structure had a prepared floor of compact white clay, and a subterranean drainage canal was found in the northwest corner, the earliest example of a drainage feature associated with a corporate construction. It was abandoned in approximately 600 B.C. There are no indications of associated surface structures, though these would almost certainly have been destroyed by modern plowing.

6.3.2 The Lower House Level

The third public architectural phase at Chiripa is what Kidder called the Lower House Level (Kidder 1956).[7] Before the 1996 excavations of TAP, this phase was known only through the 1955 excavations of Kidder and Bolivian archaeological pioneer, Gregorio Cordero Miranda. They - or rather, William Coe, the actual excavator - uncovered the remains of two fieldstone structures below the location of Bennett"s Upper Houses 2 and 3, on the northwest corner of the mound. The details of this excavation have never been properly published, though the structures seem to have been constructed of alluvial cobbles, as were the Upper Houses. In the 1996 TAP excavations, in a level stratigraphically below the Upper House Level, I located the remains of at least three Lower House Level

[6]This discussion is largely a reprise of a presentation made by myself and colleagues at the 1998 meetings of the Institute for Andean Studies in Berkeley, CA (Bandy et al. 1998).

[7]For a detailed discussion of pre-TAP excavations at Chiripa, see Bandy 1999a.

structures. These three structures (see Bandy 1999b) were constructed primarily of adobe - encountered as both bricks and as *tapia*, or puddled adobe - and were superimposed one on top of another. In one of these structures, walls were covered with a thin wash of red clay, and the finds of small bits of red plaster on other floors suggests that this was the case with the other structures, as well.

These three Lower House Level structures were built one on top of the other, the upper portion of the existing structure being destroyed in order to make way for the walls of the new one. The resulting rubble was used to create a platform for the construction of the new structure. Apparently, the abandonment of one floor and the construction of another was accompanied by a specific ritual practice. First, a thin cap of fill - generally derived from midden or other cultural deposits, in one case sterile sand - was placed over the old floor. On top of this fill level, a fire was kindled. Evidence of fire is present on top of the fill levels covering at least six of the eight floors in the sequence. For the moment, we interpret these burning events as elements of a standardized ritual practice associated with the closing, or "killing," of an old floor, and the construction or opening of another. Immediately following the termination of this"burning ritual," a new floor was constructed of clean yellow clay. The floor was placed immediately on top of the ash deposit resulting from the burning episode. This cycle was repeated at least eight times in the sequence of structures, and would seem to indicate a long-term ritual use of the mound area long before the construction of the Upper House Level.

The earliest of these three structures was constructed in approximately 600 BC, and the last was abandoned in approximately 400 BC. (Bandy et al. 1998). This is based on a series of seven radiocarbon dates taken from the Lower House Level sequence. It appears, then, that the Lower House Level structures were occupied for approximately 200 years. Given this fact, and the fact that there are eight floors in the sequence, we can suggest that the proposed "burning ritual" - the replacement of a floor, and at times an entire structure, with another - took place at approximately 25-year intervals. The correspondence of this figure with the length of human generations would seem to be more than mere coincidence, and I propose, though I am unable to demonstrate this, that the reconstruction of these special-purpose structures was associated with generational succession; perhaps with the death of one leader and the naming of another[8]. Since there are various Lower Houses, probably arranged in an enclosure around a sunken court, as suggested by Browman (Browman 1978a: 808), this would in turn imply that each structure was associated with a lineage or kin group, and that the “burning ritual” took place at the time of the death of a lineage elder or leader. At present, this is entirely speculation. However, it does cast an interesting light on later developments at the site.

6.3.3 The Upper House Level

After the final abandonment of the uppermost structures of the Lower House Level, a thick layer of intentional fill was placed over their remains, creating a roughly level earthen platform. This is the first example of true platform architecture at the site. It should be noted, however, that there were no true “mounds” on the Taraco Peninsula until the Late Formative period. The Chiripa mound in the Middle Formative was more properly a monumental terrace. That is, it was a large roughly level terrace, the upslope side of which was a ground level. As the terrace is located on a slope, however, and since the structure was approximately 30 meters from north to south, the downslope side of the terrace was probably elevated 2.5-3 meters above the natural ground surface.[9] This was still an imposing structure when viewed from downslope, and would have required steps or a ladder to climb the facing wall. And these structures were built to be viewed from downslope. In every well-preserved case the terrace is located in the highest area of the site, with the bulk of the habitation areas located downslope.

[8] It should be noted that the wide error ranges of the dates in question make it impossible to have total confidence in this scenario. It remains, nevertheless, and intriguing possibility. See Bandy 1999b for more on the problems of dating these structures.

[9] Browman recognizes but does not emphasize the fact that the Upper House level platform is located on a terrace and not on a true mound:

> The temple was placed in the center of a larger mound... The larger mound measures 50 m on a side; three sides on a downhill slope were faced of and revetted with a fieldstone wall up to 3 m high. (Browman 1981: 414)

On top of this monumental terrace, the Upper House Level structures were built. This almost certainly took place relatively soon after the abandonment of the Lower House Level structures, or sometime around 400 B.C. The Upper House Level complex was first discovered by Bennett, who excavated Houses 1 and 2 (Bennett 1936, see Figure 6.6 for excavation locations on the Chiripa mound). Other houses were subsequently excavated by Portugal Zamora (Portugal Zamora 1940, Portugal Ortíz 1992) and by Kidder (Kidder 1956). The houses excavated by Bennett have proven to be representative of all of the Upper Houses so far discovered, as they seem to be highly standardized.

The Upper Houses are rectangular structures made of rounded cobbles set in a mud mortar. The plan of the structures is unique, and may be appreciated on Figure 6.6. The structures are all double-walled, with an empty “bin space” between the inner and outer walls. The bins were partitioned by a series of short crosswalls connecting the inner and outer walls of the structures. Access to these bins was through elaborate windows or niches, decorated with molded plaster step-fret motifs on their upper corners. The house were colorfully plastered in red an yellow, as were the Lower House structures, and were almost certainly thatched with *totora* reeds. Apparently at least a part of the courtyard enclosed by the structures was also surfaced with colored clay. Under the floors of at least some of the structures were found numerous human burials (13 in the case of House 2 [Bennett 1936: 432-433]; none in House 1), frequently accompanied by wealth items including gold and copper objects. Also uniquely, the Upper Houses seem to have been equipped with sliding doors. To one side of the principal entryway of each structure is a deep, narrow groove which would have held a recessed panel, probably of wood and reeds or cloth. These panels could have been pulled from the grooves to close off the entrances.

The number of house in the Upper House complex has been the subject of some controversy. Bennett originally estimated that there were 14 of the structures (Bennett 1936), Kidder estimated 15 (Kidder 1956) and Browman went as far as 16 (Browman 1978a). It is now possible to say with reasonable certainty that Bennett was in fact correct, and the enclosure consisted of 14 structures with openings to the North and South.[10] This is so

[10] And with this I hope to lay to rest Conklin’s erroneous reconstruction drawing of the Upper House complex (Conklin 1991: 287-8) which has been popularized in Moseley’s generally excellent textbook

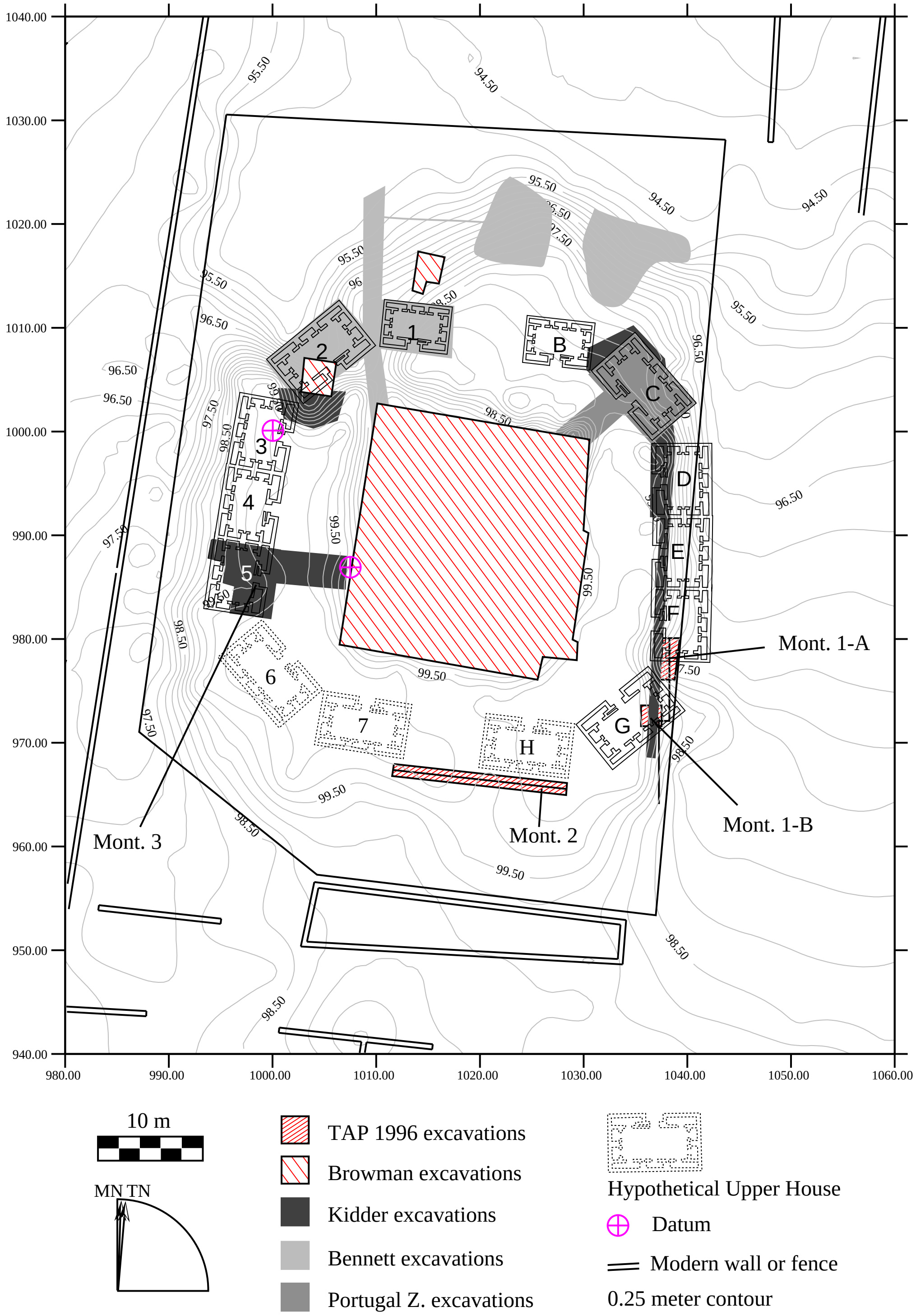


Figure 6.6: Upper House Level with excavations (T-1, Chiripa)

because:

1. Bennett excavated Houses 1 and 2.

2. Portugal Zamora excavated House C, bringing the count to 3.

3. Kidder and Cordero Miranda excavated House 5 and portions of Houses 3 and 4, bringing the count to 6.

4. Alan Sawyer, working on Kidder's expedition, cleared House C, and exposed portions of Houses B, D, E, F and G, bringing the count to 11.

5. Geophysical survey on the mound carried out by TAP in 1998 (Johnson in Hastorf et al. 1998) clearly indicated the presence and positions of the as-yet unexcavated Houses 6, 7 and H. This study also indicated that no structure was present between Houses 7 and H. The enclosure was therefore open to the South. This conclusion was strengthened by excavations by myself and Christine Hastorf in the Montículo 2 area in 1996 (*contra* Bandy in Hastorf et al. 1998) and 1999, which failed to yield any evidence of a collapsed structure in this location. This brings the total count to 14.

6. Karen Chávez (pers. comm. 1999) has pointed out that Bennett's plans show that the eastern wall of House 1 was in fact finished on the exterior. Therefore, it was not connected to another house to the east, as, for example, Houses 4 and 5 are connected and share a common exterior wall. This means that the enclosure was open to the North, with no structure located between Houses 1 and B. The count remains at 14.

It should also be noted that, as shown in Figure 6.6, the Upper House complex is in the form of a trapezoid opening to the South. It is not, after all, a rectangular enclosure. This is of particular interest, since the Choquehuanca structure is also trapezoidal

(Moseley 1992: Figure 59) and elsewhere (Conklin and Moseley 1988: Figure 5.6). I have the utmost respect for Conklin's substantial contributions to Andean studies, but this particular reconstruction is clearly incorrect.

(Dean and Kojan 1999: Figure 10), and the Llusco structure may be.[11] The trapezoidal arrangement of the Upper Houses was portrayed correctly by Karen Chávez (Chávez 1988: Figure 3), though she did not remark upon it. It is also interesting since the later Enclosure 2 at Pukara is likewise trapezoidal in plan (Chávez 1988: Figure 9), yet another point of similarity between the Pukara Kalasasaya enclosures and the Chiripa Upper House complex.

The labor and care invested in the construction of the platform, the fourteen structures, and probably in the sunken court in the center of the enclosure (Browman 1978a) represents a substantial elaboration of public architectural space above and beyond any Lower House Level precedent.

The form and function of the Upper House Level structures has been considered most systematically by Karen Chávez (Chávez 1988). She argues that the fact that the 'bins' in the structures take up close to half of the potential interior floor space indicate an unusual focus on storage as opposed to habitation, while the very ornate decorations and elaborate construction, together with 'ceremonial' sculptural and iconographic associations, suggest a non-domestic use. I agree completely with her on these points, and would add that her reasoning has been confirmed by the very high frequencies of decorated pottery associated with mound structures relative to quotidian domestic middens.[12] It has become clear the Bennett's interpretation of the compound as a circular village - which was subsequently echoed by Kidder and Browman (Browman 1981:414, Kidder 1956) - is untenable. The Upper Houses are not houses after all. Chávez suggests rather that the Upper House complex as a whole represents a "temple-storage complex" (Chávez 1988: 25).

I agree with Chávez's assessment, and it is wholly compatible with my own views concerning the intensification of competitive feasting and commensal politics throughout the Middle Formative. I would add to her observations that the architecturally redundant nature of the Upper House complex - multiple nearly identical structures, symmetrically arranged - seems to suggest that the structures and the activities which were carried out in and around

[11] Several of the Llusco structure's walls are too badly destroyed to allow a precise determination of its plan. I believe it to have been rectangular, however.

[12] See my brief discussion in section 6.1 (also Steadman 1999: 66).

them, represent a segmentary social structure. That is, each structure would be associated with a lineage, kin group, or other kind of social segments of the village. If this is in fact the case, then it is interesting to observe that while the Upper Houses themselves are all basically identical, they differ in the number and in the richness of their associated burials.[13] Thus some structures have more burials than others, and some have none at all. The burials from some structures contain more wealth items than burials from other structures. If the structures were indeed associated with different lineages then this seems to indicate that leaders and their constituencies had begun to differentiate, with some commanding more wealth, labor, prestige and authority than others. Again, this is consistent with my hypothesized intensification of commensal politics and status competition.

6.3.4 Other sites

No structure directly comparable to the Chiripa Upper House structures has been excavated at any other site. It would be a mistake, however, to interpret this fact as indicating the Chiripa was in some way exceptional during this period. On the contrary, three other sites are of equal size in the Late Chiripa phase, and two of these have surface indications of substantial corporate constructions.

A monumental terrace, very similar to the terrace on which Chiripa Upper House complex was situated, is located at the site of Yanapata (T-130) . This terrace measures approximately 50 by 40 meters, and is located against the base of the hill behind the site. That is, it occupies a location within the site analogous to that of the Chiripa mound, with the habitation areas mostly downslope. This terrace was apparently once faced with stone on its downslope side. One large limestone pillar remains in place in approximately the center of the terrace wall. I was informed by the landowner that a great deal of worked stone was pulled from this area and taken by truck to Taraco to be used in repairs to the church there. There is no indication of summit structures, but the top of the terrace has been extensively damaged. It had recently been tractor-plowed for the first time when I visited in 1998,

[13] Upper House burials were excavated by Bennett (Bennett 1936), by Portugal Zamora (Portugal Ortíz 1992), and possibly by Kidder and Cordero Miranda in House 5 (Layman and Mohr 1965, see Table 1).

exposing many large sherds and a few nearly-complete vessels. Some burned adobe was also encountered, perhaps indicating burned structures. Nothing further can be said without excavation, however. Based on its similarity to the Chiripa mound, I believe the Yanapata terrace to be late Middle Formative in date.

The site of Achachi Coa Kkollu (T-225), which, as mentioned in Chapter 5, seems to have been a ceremonial precinct associated with Kala Uyuni (T-232), also has evidence of corporate construction. It is located high on a hill overlooking the habitation sectors of Kala Uyuni below. This site clearly contains a terrace, faced with limestone blocks, though it is smaller than those at Yanapata and Chiripa. There may also be a sunken court present, though this is uncertain. No summit structures are in evidence, though again I would not expect them to be given the effects of millennia of erosion and agricultural tilling. The stone-faced terrace almost certainly dates to the Late Chiripa phase, since this is the only phase in which there is a substantial occupation of the site.

Some smaller Late Chiripa sites - those in the second tier of the settlement size hierarchy - have similar corporate constructions. Most notable is Chiaramaya (T-3), which has a very large monumental terrace, perhaps as large as that of Chiripa. In 1998 I observed informal excavations on this feature when the community constructed a new meeting hall. Dense cultural debris was unearthed, including many large chunks of burned adobe. This is suggestive of burned summit structures, though excavation or geophysical survey would be necessary to confirm this. The form of this terrace, like that of the Yanapata terrace, suggests contemporaneity with the Upper House complex.

Another similar terrace, though smaller, was found at the site of Alto Pukara (T-430). This terrace is quite small, perhaps 20 x 20 meters. This feature was excavated in 2000 by Robin Beck (pers. comm. 2001). He encountered 2 structures arrayed on either side of an open plaza area. The structures were detached, and although they did have interior niches, lacked the bins, stepped entries and other elaborate features characteristic of the Chiripa Upper House structures. It should be noted that no sunken court was encountered in the plaza area. This group of structures may be contemporaneous with the Upper House complex or slightly earlier. More details will be forthcoming in Beck's dissertation.

The site of Quiswarán (T-303) also seems to have a small terrace, perhaps similar to the Alto Pukara feature. Verification will require excavation, however. Tilata (T-368) has a true mound, though this probably dates to a later period of the site's long occupation span. One of the landowners at Tilata informed me that he had a sculpted stone piece in his house. I was unable to view this at the time, however, since it was covered by his annual dung fuel reserves, it being early winter. I have as yet not returned to photograph the piece.

Two other small sites potentially have sunken courts without terraces. At one of these, Sunaj Pata (T-268), a possible court was identified by a rectangular stain in the topsoil of a tractor-plowed field. This is the same manner in which we initially identified the Llusco structure at Chiripa in 1992. Sunaj Pata has only Early Chiripa and Late Chiripa occupations, so the court - if it is a court - is almost certainly Middle Formative in date. The other, Millón Jawira (T-476), is a small but very dense scatter of which Late Chiripa is the only Formative occupation. There is a rectangular sunken area near the middle of the sherd scatter. Local residents informed me that very large stones are frequently removed from this area while plowing.

It is clear, then, that terraces and sunken courts - and perhaps elaborate architectural enclosures - are quite widespread in the Middle Formative. Even relatively minor sites like Chiaramaya or Alto Pukara have impressive monumental architecture. The scale of corporate features seems to coincide roughly with site size; larger sites have larger constructions.[14] This is far from a neat correlation, however, and is complicated especially by the case of Chiaramaya.

In short, there is no one site which is clearly exceptional in terms of the scale or elaboration of its public architecture in the Middle Formative. This realization directly contradicts a common assumption in the literature that - due to its elaborate public architecture - Chiripa was in some way exceptional for its time, a ceremonial center or locus of paramount chiefly power. For example, Mathews, in his survey of the middle Tiwanaku Valley, noted

[14]The exception here, of course, is Janko Kala (T-394). This is one of the four principal Late Chiripa sites on the peninsula, and yet it has no clearly discernible corporate constructions. The surface of the site is heavily disturbed, however. It may be that more careful topographic work will reveal features too subtle for detection by the cursory investigation which I was able to undertake.

that Middle Formative sites were not randomly distributed, but rather were clustered. Thus:

> ...the Chiripa-associated sites do not appear to be random settlements, but rather suggest a higher degree of settlement organization, possibly directed by the administrative leadership of Chiripa itself. The exact nature of their control is unclear ... Given Chiripa's manifestation of the earliest public architecture in the region, however ... a scenario of direct contiguous control of the Tiwanaku Valley by the Chiripa polity is not outside the pale of possibility. (Mathews 1992: 68)

Stanish arrives at a similar conclusion:

> I argue that the construction of this major corporate architecture [the Upper House complex] correlated with the development of a complex chiefdom at Chiripa. (Stanish et al. 1997: 115)

Browman sees Chiripa as a center similar in principle to Pukara and Tiwanaku:

> Pucara dominated the area north of Lake Titicaca ... while first Chiripa and later Tiwanaku dominated the area immediately south of the lake. (Browman 1981: 413)

What has become clear from this investigation is that a number of other sites very like Chiripa existed at the same time, and that Chiripa was in no way unique in having elaborate public architecture. The preservation of the Middle Formative architecture at Chiripa *is* exceptional - owing to its burial and protection by a subsequent mound construction episode - but on present evidence it seems as if the architecture itself was not unusual in the context of the contemporaneous Taraco Peninsula villages. Chiripa was one - not first - of many.

6.4 Lake level change

Near the end of the period in which the Lower Houses were occupied, around 450 B.C., a very dramatic environmental event took place in the Southern Titicaca Basin. For reasons that are not entirely clear, the level of the lake dropped to about 16 meters below its modern level. This is the third low stand of Lago Wiñaymarka identified by Abbot and colleagues during the late Holocene (Abbott et al. 1997a: 179, also Figure 4; low and high lake stands are indicated also in the right-hand column of Figure 2.4). Using data from multiple cores of lake bottom sediment, they have determined that the lake during this approximately 200 year period (450-250 B.C.) was 10-12 meters below overflow level, equivalent to 16-18 meters below the average modern lake level of 3810 m.a.s.l. This is probably related to a prolonged drought, though factors other than reduced rainfall could produce extreme lake level fluctuations.

At any rate, the effects of this event were dramatic. Since the southern part of Lake Titicaca - Lago Wiñaymarka or the little lake - is very shallow - almost all of it is less than 20 meters deep - it became almost completely dry at this time. The lake that the visitor sees today did not exist. In its place was an immense grassy plain, crossed by small, meandering rivers and dotted with marshes.

Figure 6.7 shows the reconstructed shorelines of Lago Wiñaymarka for its minimum and maximum depths during the late Early Formative (Middle Chiripa) and the early Middle Formative Periods. The basic outlines of the lake were approximately those of today (the modern shoreline is indicated on the figure by a dotted line). Figure 6.8, however, shows the lake's reconstructed upper and lower shorelines during the latter two centuries of the Middle Formative. At this time Lago Wiñaymarka was reduced to two small lakes, one near the modern town of Yunguyu, and the other - still connected to the Lago Mayor, since the Straits of Tiquina were not dry - near the Bolivian town of Achacachi.

The drying of the lake had three immediate effects on the local economy, apart from the obvious agricultural effects of what may have been a severe drought:

1. Opportunities for fishing were greatly reduced. Although people still ate fish, they either had to trade for them or had to travel quite substantial distances to fish in waters which were much reduced in extent and certainly also in yield.

2. Vast new grazing lands were created, allowing for an increase in llama and alpaca herding.

3. The possibility was created for llama caravan commerce directly between the Taraco

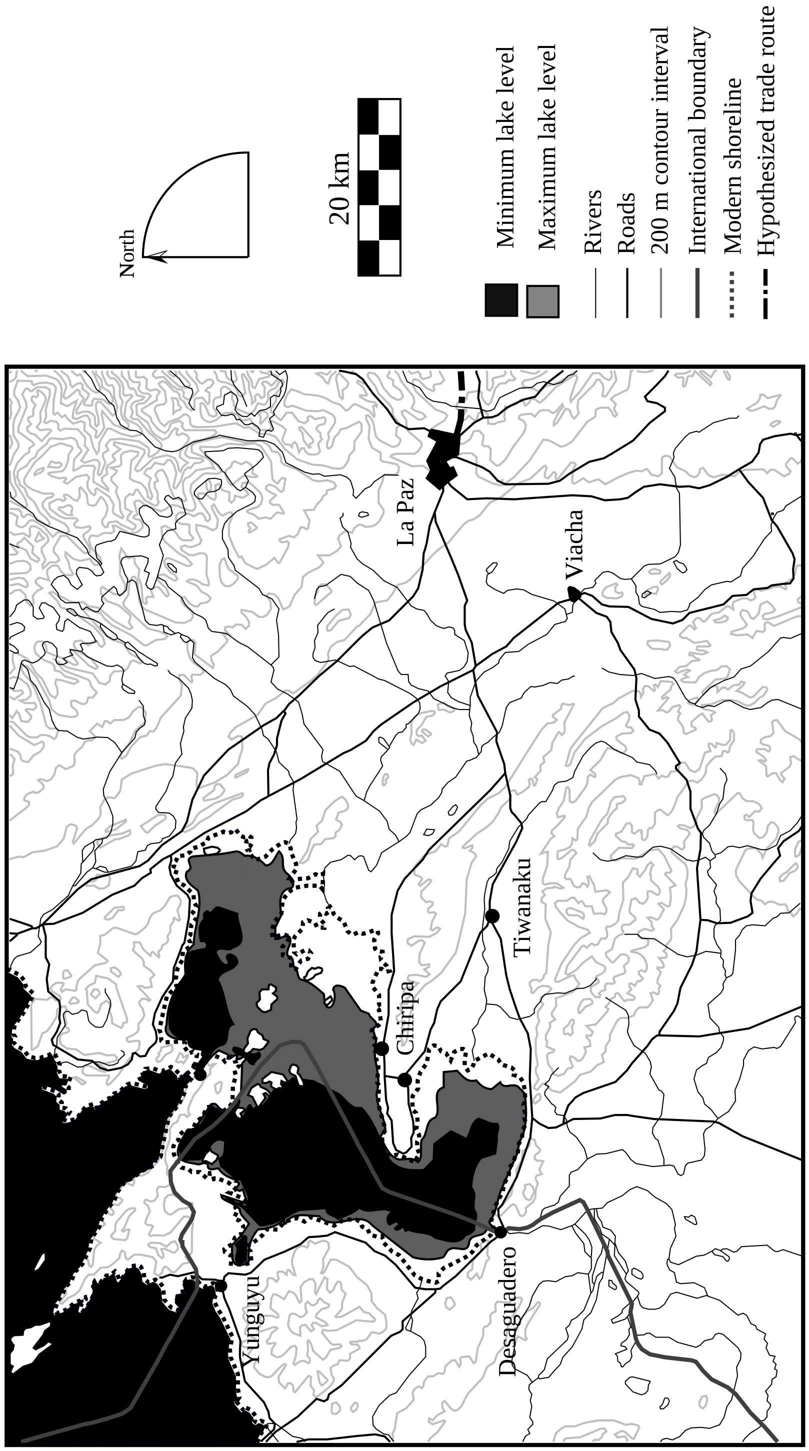


Figure 6.7: Reconstructed shoreline of Lago Wiñaymarka, 1000 B.C.- 450 B.C.

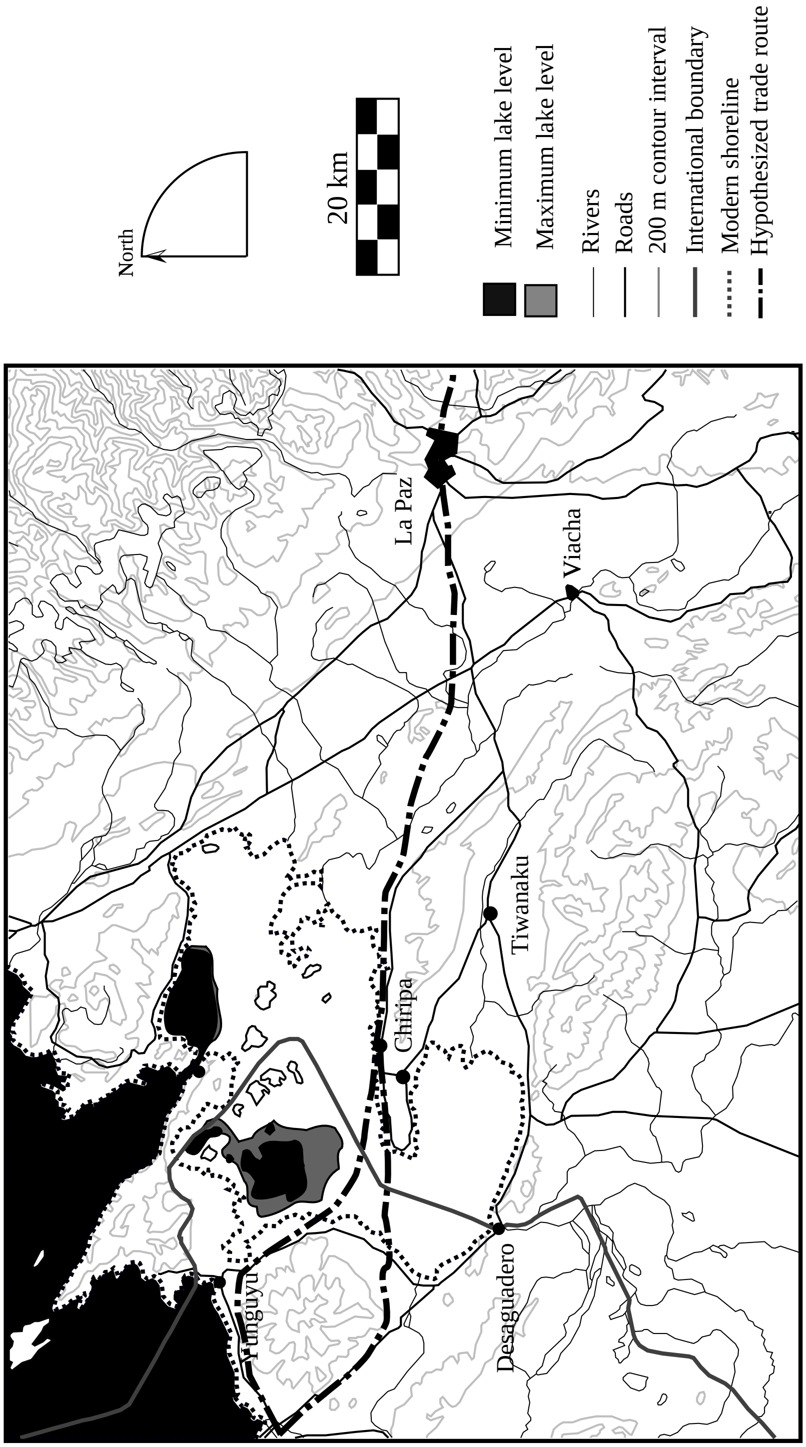


Figure 6.8: Reconstructed shoreline of Lago Wiñaymarka, 450 B.C.- 250 B.C.

> Peninsula and the western side of the Basin. Since the little lake was mostly dry, it was possible to walk directly from Chiripa to the Yunguyu area (see Figure 6.8), and from there to the important population centers to the south of modern Puno.

It seems clear the the inhabitants of the Taraco Peninsula at this time were forced to shift the focus of their subsistence activities. We may suppose that the importance of fishing and lacustrine collecting was greatly reduced, while herding and agriculture were intensified to compensate. This assertion has yet to be demonstrated archaeologically. It is a reasonable supposition given the drop in the lake level and concomitant contraction of the shoreline of Lake Wiñaymarka (see Figure 6.8). Further research is needed to verify this scenario, however.

It is probable, then, that as agriculture was rapidly intensified - this shift may have taken place over the course of a few decades or even less - fallow cycles were shortened and new land, previously unworked, was brought under cultivation (Boserup 1965). This shift in emphasis of the subsistence economy was undoubtedly a very significant event. Equally significant, however, was the simultaneous expansion of trade relations within the Titicaca Basin, and the increasing importance of the Taraco Peninsula communities within them.

6.5 Exchange

The Taraco Peninsula villages were engaged in long-distance trade and exchange from the very beginning of settled life; that is, from the Early Chiripa phase. The evidence for this early trade is the occurrence of three exotic materials in Early Formative Period (and MF) contexts.

1. Cylindrical sodalite beads are frequently encountered as mortuary goods in both Early and Middle Formative contexts. This material - often identified as lapis lazuli - is occasionally found at Chiripa and at other sites in the form of unworked chunks as well as finished beads. The source of this material remains unclear - Browman suggests Cerro Sapo in Cochabamba (Browman 1981: 414) - but it is certainly exotic. In

four seasons of excavations - from 1992 to 1999) only 108.6 grams of this material were recovered at Chiripa, the majority of it from Early Chiripa contexts.

2. Obsidian is also found in both Early and Middle Formative contexts. It is clear that obsidian was obtained in the form of finished bifaces since very little debitage has been recovered, and virtually no cortex flakes. I have yet to perform characterization studies on the obsidian recovered from Chiripa. Browman, however, reports materials from the Titicaca Basin source - recently located in the Colca Valley near Arequipa and renamed the Chivay source (Brooks et al. 1997, Burger et al. 1998, Burger et al. 2000) - and from another source which has yet to be located (Browman 1981: 415). The Collca Valley is more than 300 km northwest of Chiripa. Like sodalite, obsidian was imported in small quantities; we have recovered no more than 87.1 g in four excavation seasons.

3. Finally, trace amounts of sea shell are also encountered, normally as tiny discoidal beads in mortuary contexts. These shell beads also occur in both Early and Middle Formative contexts, but are exceedingly rare. TAP has to date recovered only 5.3 g of this material.

Small fragments of silver, copper, and gold are also found, though very infrequently. Normally these are located in burial contexts.

It is clear, then, that long-distance trade in mortuary and prestige items took place as early as the Early Chiripa phase. Equally clear, however, is that this early exchange involved very small quantities of the objects in question. This trading would seem to have been very sporadic and infrequent. There is no evidence in the Early Formative Period for the sort of regular caravan trade postulated by Browman (his “altiplano mode”; see Browman 1981: 414-415).

6.5.1 Olivine Basalt

In the Middle Formative Period this earlier far-flung and low-intensity trading network remained active. In addition, however, there is evidence for intensification of exchange within the Titicaca Basin itself, and probably also of trade with immediately adjacent regions. This evidence takes the form of large quantities of a particular kind of rock, an olivine basalt exotic to the Taraco Peninsula which was imported in the form of finished agricultural hoes.[15]

In my analysis of the lithic artifacts from the TAP excavations, I designated the two varieties of this olivine basalt as Raw Material Types (RMT) 61 and 65. Both are fine-textured, homogeneous gray stones with few crystalline inclusions. Both include green-colored olivine phenocrysts. RMT 61 is distinguished from RMT 65 by having larger and more frequent olivine phenocrysts, but is otherwise identical. Both of these materials differ from the more common andesite (RMT 62), which has a very similar color but contains frequent plagioclase feldspar inclusions as well as some biotite, and is generally more porous and coarse-grained. Feldspar is not present in the basalt materials. Titicaca Basin archaeologists have normally grouped the olivine basalt and andesite as I have described them here under the single term "andesite". Thus, frequent references in the literature to "andesite hoes" (cf. Steadman 1995, Seddon 1994b) are quite possibly references to what I am calling olivine basalt. Other types of basalt are present at Chiripa, including a black, vitreous variety, but these are less frequent and are not relevant to the present discussion.

Table 6.1b shows the occurrence of this rock (olivine basalt) in unmixed proveniences of the three Chiripa phases[16] (counts of which are given in Table 6.1a). It is clear, despite a sub-optimal sample size, that the stone type in question occurs only in the Late Chiripa phase. This corroborates my own rather more informal observation that this rock is a Middle Formative marker throughout the southern and western Titicaca Basin, at dozens of sites in the Chucuito, Ilave, Juli,[17] Yunguyu and Desaguadero areas, as well as in the

[15] I would like to thank Sergio Chávez (pers. comm. 1999) for helping to show me the importance and wide distribution of this rock type.

[16] As identified by Lee Steadman (pers. comm. 2000). Note that the table only tallies artifacts from ceramically unmixed proveniences; the large majority of RMT 61 and 65 artifacts were recovered from plow zone and from mixed fill.

[17] Seddon reports that a "gray andesite", quite possibly the same material I am discussing here, makes up upwards of 90% of the lithic sample at the Early and Late Sillumocco and Tiwanaku site of Tumatumani, near Juli (Stanish and Steadman 1994: 70). The mixed nature of the excavated fill deposits precludes any determination of when the material appeared and/or disappeared at the site.

a) Number of unmixed proveniences by phase

Phase	Number of unmixed loci
Early Chiripa	65
Middle Chiripa	45
Late Chiripa	186

b) Count and weight of raw materials 61and 65 from unmixed proveniences

Phase	Count	Weight (g)
Early Chiripa	0	0
Middle Chiripa	0	0
Late Chiripa	69	1301.1

Data from TAP excavations at Chiripa, 1992-1998

Table 6.1: Occurrence of exotic olivine basalt in the Chiripa phases

Site	MF m^2 collected	LF1 m^2 collected	weight (g)	g/m^2
T-268	1000	0	2977.5	2.98
T-272	0	2200	1654.4	0.75

Table 6.2: Surface densities of exotic olivine basalt at selected Taraco Peninsula sites

Tiwanaku Valley, Taraco Peninsula and Pampa Koani of Bolivia. The same rock has also been observed on Middle Formative sites in the vicinities of Puno (Carol Schultz pers. comm. 2000) and Pukara (Amanda Cohen pers. comm. 1999) in the northern Titicaca Basin. I have personally inspected samples of the material from these latter two localities and can confirm they are visually identical to the material from the southern and western Titicaca Basin and from Chiripa.

Carlos Lémuz reports "andesite" hoes from the area of Santiago de Huatta, to the North of the Taraco Peninsula. He reports not only agricultural implements, but also local sources of the material (Lémuz Aguirre 2001: 179). Since I have not personally inspected these materials, I cannot say whether they are the same as the olivine basalts present in the Taraco Peninsula sites. They may in fact be a local andesite. Other data certainly suggest that the lithic sequence of the Santiago de Huatta Peninsula is very different from that of the southern Titicaca Basin generally. For example, Lémuz reports high frequencies of "andesite" hoes through the Tiwanaku period, by which time stone agricultural implements had largely disappeared from Taraco Peninsula and Tiwanaku valley sites (Lémuz Aguirre 2001: 179-181).

The TAP excavation data demonstrate convincingly that RMT 61 and 65 did not occur in the Early Formative. No comparable data exist to show whether or not the material was present in the area in the subsequent Late Formative Period. This would require excavation of comparable volumes of intact LF deposits. However, I can say that surface densities of RMT 61 and 65 on non-MF sites is much lower than on MF sites. As an example, we may compare the cases of Sunaj Pata (T-268) and Kumi Kipa (T-272). These two sites are located with a few kilometers of one another on tip of the peninsula near the town of Santa Rosa (see Figures 6.3 and 7.3). The former has a significant MF occupation, but no LF1 occupation. The latter is the opposite, with no MF material, but a substantial LF1 sector. Both sites were systematically surface collected. As may be appreciated in Table 6.2, the surface density of RMT 61 and 65 is almost four times higher at the MF site than at the LF1 site.[18] This would seem to indicate that trade in this rock type either diminished significantly or ceased altogether in the LF1 period.

Long-distance exchange in the Early Formative seems to have involved small numbers of very small items: finished obsidian projectile points and beads of shell and sodalite. The quantity of RMT 61 and 65 hoes that was imported to the Taraco Peninsula in the Middle Formative represents a volumetric increase of several orders of magnitude over the goods imported through the Early Formative exchange system.[19]

[18]Recall that this rock is found in the form of hoes, mostly broken. Since the "use locus" of hoes is agricultural fields, we can expect that much of the breakage and discard of these tools took place off-site, outside of the village. The inhabitants of Sunaj Pata in the MF were almost certainly farming the area that was later to be the village of Kumi Kipa. It is therefore not surprising to find broken hoes in that area. Indeed, they are found over the entire peninsula, on- and off-site.

[19]The total weight of RMT 61 and 65 excavated from Chiripa by TAP is 5361.8 g. This compares to 87.1 g of obsidian, 108.6 g of sodalite and 5.3 g of shell, as detailed earlier.

6.5.2 Estimating total olivine basalt imports

It is possible to estimate the total amount of RMT 61 and 65 present on the surface of the Taraco Peninsula. By doing so we can perhaps measure the degree of intensity of exchange in this time period.

1) on-site surface olivine basalt quantity

$$S = \frac{W * T}{C}$$

where W = total RMT 61 and 65 weight (kg) = 23.43 kg
T = total MF habitation area (ha) = 65.84 ha
C = total collected MF habitation area (ha) = 0.97 ha

Total on-site surface weight of RMT 61 and 65 is therefore estimated to be 1590 kg, or approximately 1.6 metric tons.

2) on-site subsurface olivine basalt quantity

Altogether at Chiripa TAP excavated an area of approximately 496 m^2, and recovered 4979 g of RMT 61 and 65 from those units. The same units yielded 383 g of the material from the surface. This produces a surface density of 0.77g/m^2, or 7.7 kg/ha, significantly lower than that calculated for the peninsula as a whole in step 1 (24.2 kg/ha), and a surface/subsurface ratio of 0.08. Using this ratio produces an estimate of 19875 kg or 19.9 metric tons of on-site subsurface RMT 61 and 65 on the Taraco Peninsula.

It may be that the surface of Chiripa has been relatively more cleared than the surface of other sites. This is probably the case, since some of the areas we excavated included a soccer field and the surface of the Chiripa mound. These would necessarily have fewer materials evident on the surface than would a plowed field. We may therefore use the peninsula-wide average surface density of 24.3 kg/ha to retrodict a total surface weight of 1200.3 g for the 496 m^2 excavated at Chiripa. This produces a surface/subsurface ratio of 0.24, and a total on-site subsurface estimate of 6625 kg (6.6 metric tons) for the whole Taraco Peninsula.

We may consider these numbers - 19.9 and 6.6 metric tons - as possible maximum and minimum values.

3) off-site surface olivine basalt quantity

This number is very difficult to estimate, and at present it is impossible to produce a reliable estimate. We must remember, though, that a significant amount of RMT 61 and 65 is found off-site, since the rock was used for agricultural hoes which were utilized - and broken and discarded - primarily off-site. The only possibility of an estimate at the moment comes from the three sites which were surface collected and did not have a MF occupation: T-213, T-271 and T-272. Altogether at these sites I collected 6400 m^2. These units yielded a total of 4328.4 g of RMT 61 and 65, for a surface density of 0.67g/m^2, or 6.7 kg/ha.

Since the total surveyed area of the Taraco Peninsula was approximately 9875 ha, this would produce an estimate of 66162 kg of off-site surface RMT 61 and 65. However, all three of these sites are located in prime agricultural land, and near to MF settlements. Only about 25% of the surveyed area can be considered good agricultural land. I will therefore revise this estimate to 16541 kg or 16.5 metric tons of total off-site surface RMT 61 and 65. It must be remembered, however, that this estimate is extremely vague and can in no way be considered authoritative.

4) total olivine basalt quantity

I therefore estimate the total amount of exotic olivine basalt imported to the Taraco Peninsula in the Middle Formative to be at an absolute minimum 8.2 metric tons (on-site surface + minimum of on-site subsurface), probably more like 21.5 metric tons (on-site surface + maximum on-site subsurface) and possibly as much as 38 metric tons (on-site surface + maximum on-site subsurface + off-site surface). Given that whole hoes of this material on the Taraco Peninsula weigh on average approximately 100 g, this would translate to 82000, 215000 or 380000 hoes, respectively.

6.5.3 Source of exotic olivine basalt

It is certain that the olivine basalt (RMT 61 and 65) that appears on the Taraco Peninsula in the Middle Formative is of exotic origin. There is no such material present in either the Taraco or the Kollu Kollu formations (see section 2.1). Although its source cannot at present be determined with certainty, I would like to venture an educated guess. The only documented quarries of this raw material type are located in the vicinity of Chucuito, south of Puno on the western side of Lake Titicaca. These quarries were discovered by Kirk Frye in his dissertation research. The nearby sites of Incatunahuiri and Dos Suches are both covered with literally hundreds of tons of hoes, debitage and manufacture failures of this material (Frye and Steadman 2001). I have visited these sites, and can attest that the stone there is visually identical to the RMT 61 and 65 objects from the Taraco Peninsula and other areas.

Further evidence is provided by Steadman. In her excavations at Camata, located somewhat south of Chucuito, and possibly within the Middle Formative political radius of Incatunahuiri, she finds that hoes of this material - which she terms “gray andesite” - first began to appear in limited quantities in the Early Qaluyu 2 phase (1050-850 B.C.) (Steadman 1995: 32). This “gray andesite” became progressively more popular through time at Camata, finally accounting for almost 90% of the lithic sample by the Pucara 2 phase (100 B.C. - 100 A.D.). This process began in the Middle Formative, in the Late Qaluyu 1 phase (850-650 B.C.), roughly contemporary with the earlier part of Late Chiripa. Steadman interprets the increased hoe production at Camata in the Middle Formative as reflecting agricultural intensification and raised field construction (Steadman 1995: 41). Given the data from the southern basin, however, I believe this intensified hoe production reflects instead production for export to other areas of the Titicaca Basin, as part of a regional exchange system.

Frye and Steadman (Frye and Steadman 2001) argue that Incatunahuiri was the production center for these hoes, and an important hub of an exchange network extending across the entire Titicaca Basin. Geochemical characterization of hoes from throughout the basin will be necessary before this hypothesis can be proven conclusively, and I plan to undertake such a study in the very near future. For the moment, however, I will provisionally accept Incatunahuiri as the source for the olivine basalt on the Taraco Peninsula sites.

6.5.4 Discussion

There is solid evidence, then, for a significant intensification in the Taraco Peninsula communities' participation in a regional exchange network in the Middle Formative. There are also indications of the formation of something like a pan-Titicaca Basin exchange system at this time, in which the inhabitants of the Taraco Peninsula took part. It is important, however, to think about this exchange sphere in the larger context of the south-central Andean region.

It is possible that this olivine basalt was being traded from the western Basin. It was certainly being imported from outside the Taraco Peninsula. Probably, though, it was only a part of a much more elaborate trading system, other items of which have not been preserved in the Titicaca Basin environment. To the east of the Titicaca Basin, crossing the *Cordillera Blanca*, lie a series of warm, humid, middle-elevation valleys known as the *yungas*, or *valles mesotermales*. And beyond the *yungas* lies the rain forest itself, the *selva*. These two areas, the *yungas* and the *selva*, are the source of a number of items which have always been in demand in the cold, arid and high-altitude *altiplano* (Browman 1981: 414, Murra 1968, Murra 1985). Examples include cultivated and wild plants, such as coca, cotton, *ají* (chili peppers) and a variety of hallucinogenic drugs. I should also mention various animal products such as feline pelts[20] and the brightly-colored plumage of tropical birds.

Today most trade between the *yungas* and the western Titicaca Basin passes through La Paz to Tiwanaku and across the Desaguadero River at the Peru/Bolivia border (see Figure 2.1). If, however, the little lake were dry the shortest route would pass from La Paz through the area of Chiripa and across the plains - now under water - to Yunguyu (Figure 6.8). Thus in the late Middle Formative (450-250 B.C.) the Taraco Peninsula may suddenly have found itself located on a major trade route, one that, if it existed before this time, had

[20]The skirt on the Ponce Monolith in Tiwanaku (Ponce Sangines 1995: Figures 146-148) and the Bennett Monolith currently in La Paz (Bennett 1934) almost certainly represent spotted feline pelts. Many Pukara textiles also depict pelage markings using crosses, dots, or rhomboid shapes (Conklin 1983).

previously passed by some distance to the south. Thus, the Taraco Peninsula communities would have suddenly found themselves in a position of influence in a regional exchange system. Local leaders - if they did not mount trading expeditions themselves - certainly used their geographic importance to extract favorable terms from passing llama caravans, and so gained increased access to exotic goods, from both the *yungas* and the western Titicaca Basin.

The distribution of these exotic goods imported in large quantities - the olivine basalt from Chucuito being the only archaeologically visible item - almost certainly became incorporated into the system of competitive generosity by which political influence was established and maintained in these communities. As part of the same process, emerging leaders in the Taraco Peninsula villages came to depend to a greater or lesser degree on social contacts external to their own communities for the maintenance and reproduction of their authority (Helms 1979, Helms 1993). We may imagine that the distribution of these exotic hoes and other imported goods was incorporated into existing commensal institutions. Feasting came to include "gifting" as well. This growing dependence of local leaders on external exchange partners was to have significant repercussions, as I will discuss in the following chapter.

6.6 Settlement and population

The Middle Formative settlement system of the Taraco Peninsula differs in several important ways from that of the Early Formative. Three of these differences are particularly instructive. They are: 1) a reduction in the rate of population growth, 2) increased stability in the settlement system and 3) the emergence of a two-level site size hierarchy. I will discuss each of these in turn.

6.6.1 Decreasing population growth rate

It may be recalled that the population growth rate in the Early Formative, at 0.47% annually, was quite high, close to some estimates of the maximum possible for agrarian

	MF - Late Chiripa
Number of sites	31
Phase population index	3507
Annual population index growth rate	0.13
Occupation continuity index	64
Site founding index	55

Table 6.3: Middle Formative: Metrics

populations (Hassan 1981: 225). This is as might be expected of an initial colonization of a region by agricultural peoples. That is, either abundant resources were available for the taking, allowing the maintenance of large families and therefore rapid population growth, or considerable immigration was taking place from other areas. Whatever the case, the overall population index growth rate slowed dramatically in the Middle Formative to 0.13% (Table 6.3). This latter figure is more in line with global estimates of agrarian village population growth rates, which, according to Hassan, seem to average out at around 0.1% annually.

6.6.2 Increasing settlement system stability

In addition to a reduced population growth rate, the Middle Formative settlement system also demonstrated greater stability compared to that of the Early Formative. While the occupation continuity index remained stable at a relatively high 64 (compared to 63 for Middle Chiripa), the site founding index decreased greatly, from 78 to 55. On the whole, then, throughout the Middle Formative Period, the inhabitants of the Taraco Peninsula continued to live in the same villages as previously, with a very low abandonment rate. It was, however, becoming increasingly difficult to found new villages, as reflected by the drastically reduced site founding index. Indeed, there is only one likely case of village fissioning in the Middle Formative.[21] Compare this with the two very clear cases of villages fissioning in the Middle Chiripa phase, which lasted for only approximately 200 years. If

[21] I refer here to the abandonment of Sonaji (T-271) at the beginning of the Late Chiripa phase, and the simultaneous reoccupation of Sunaj Pata (T-268) and Cerro Choncaya (T-2). This event is clearly evident in Figure 6.11.

we calculate a rate of village fissioning in terms of events per century, we would say that this rate fell dramatically in the Middle Formative, from 1.0/century (Middle Chiripa), to 0.18/century (Late Chiripa).

In fact, however, this would be to downplay the radical nature of the change. I suggested earlier that in the Middle Chiripa phase there existed a settlement size threshold beyond which fissioning became extremely likely. This threshold was empirically located, in terms of my population index, at approximately 150, quite a small village.

The last instance of Formative Period village fissioning on the Taraco Peninsula seems to have taken place at the beginning of the Late Chiripa phase. From that point on, the existing villages continued to grow throughout the Middle Formative without fissioning or relocating. This fact would seem to indicate that by early in the Middle Formative mechanisms - institutions, practices - were developing to deal with the stresses and pressures that arise in large, permanent villages.[22] This was in fact a significant evolutionary milestone in its own right.

Together, the decrease in the population growth rate and the increase in settlement system stability can be taken as an indication that the landscape of the Taraco Peninsula was beginning to fill up in the Middle Formative. That is to say that the territory of the peninsula was by this time claimed in its totality, and being utilized in some manner by its inhabitants. The difficulty of village fissioning and relocation increased substantially in the Middle Formative, tethering the local population to its villages.

6.6.3 Two-tiered site size hierarchy

The third significant fact about the Middle Formative settlement system is the emergence of a two-tiered site size hierarchy. This can clearly be appreciated in Figure 6.9, which indicates a bimodal population distribution. This is plainly distinguishable from the Middle Chiripa site size histogram, shown on the same figure for comparison. In the Middle Formative Period, then, population was more or less equally distributed between a group of larger villages with population index values of 350-450, and a group of smaller

[22] Which is to say that Roland Fletcher's first C-Limit had been successfully overcome (Fletcher 1995).

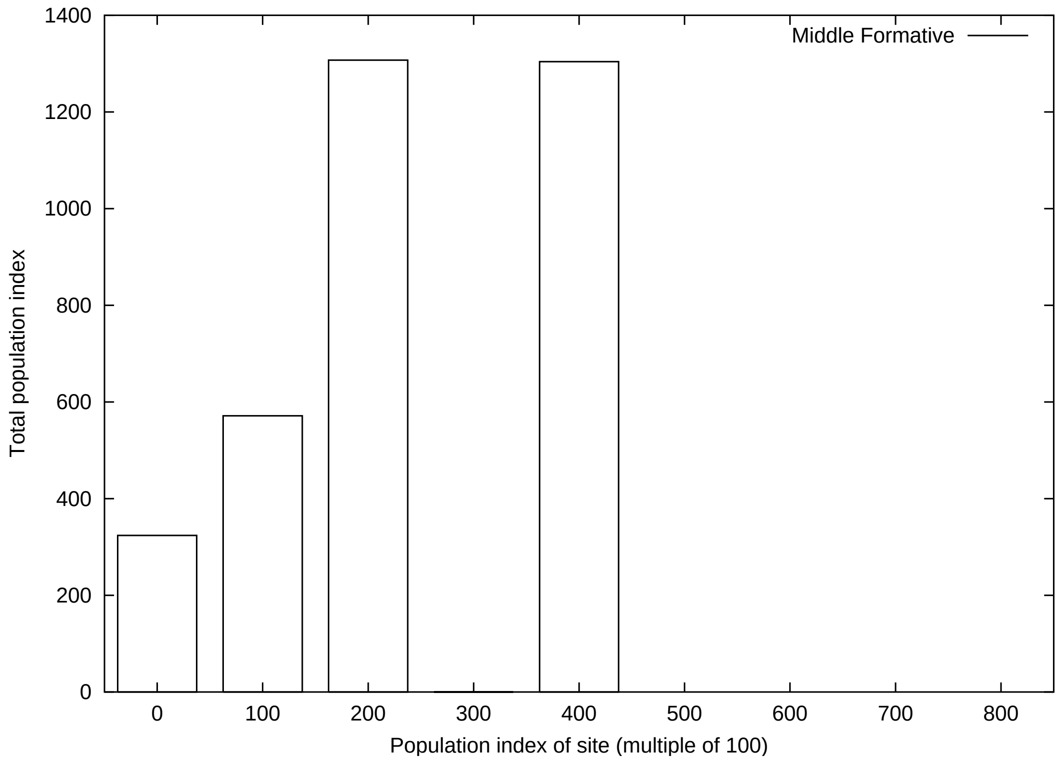


Figure 6.9: Middle Formative site size distribution

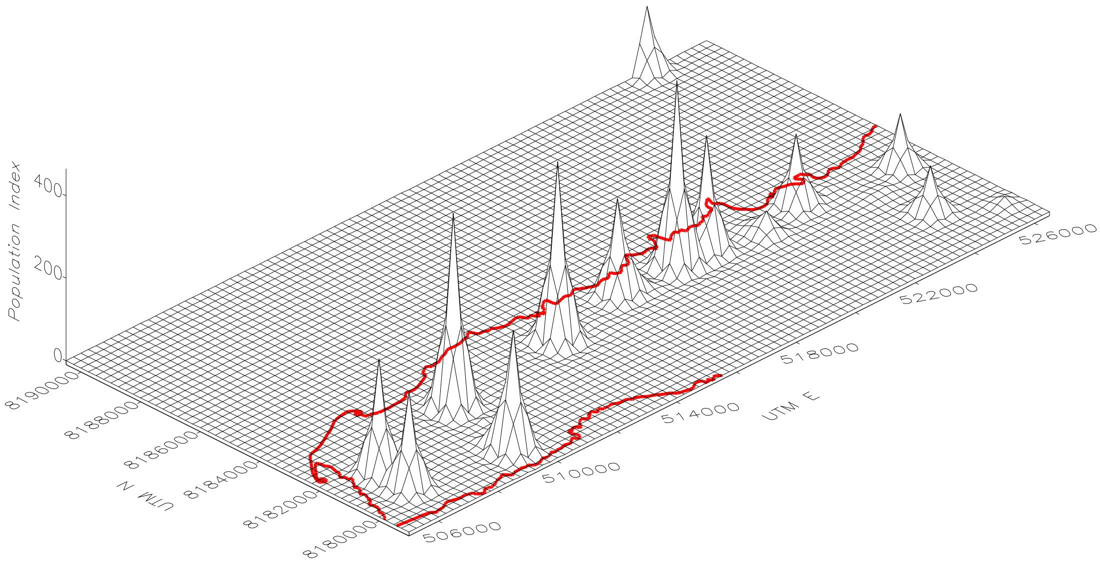


Figure 6.10: Middle Formative: Sum of phase population index per 0.25 km^2

villages with population index values of less than 300.

Further, the larger sites are distributed on the landscape in such a way as to suggest the formation of a set of small polities. That is, they are located at regular intervals along the lakeshore, generally with smaller sites interspersed between them. This pattern is fairly clear in Figure 6.10. In this figure, three of the four large sites are clearly distinguishable as higher peaks, surrounded by lower. These are Chiripa (T-1), Janko Kala (T-394) and Yanapata (T-130). The fourth first-tier community is formed together by Kala Uyuni (T-231) and Achachi Coa Kkollu (T-225), and therefore does not appear as a single peak on Figure 6.10. The Kala Uyuni community is also the smallest of the four large villages, with a combined population index value of 361.

Some archaeologists would view this settlement configuration as an indication of the emergence of a series of "simple chiefdoms", or those characterized by a two-level decision-making hierarchy (Anderson 1994, Wright and Johnson 1975). However, there are several ways in which site size hierarchies can come about.[23] On the one hand, they may - as generally is assumed in archaeological analyses of political structure - reflect the

[23] I touched upon this topic in Chapter 4.

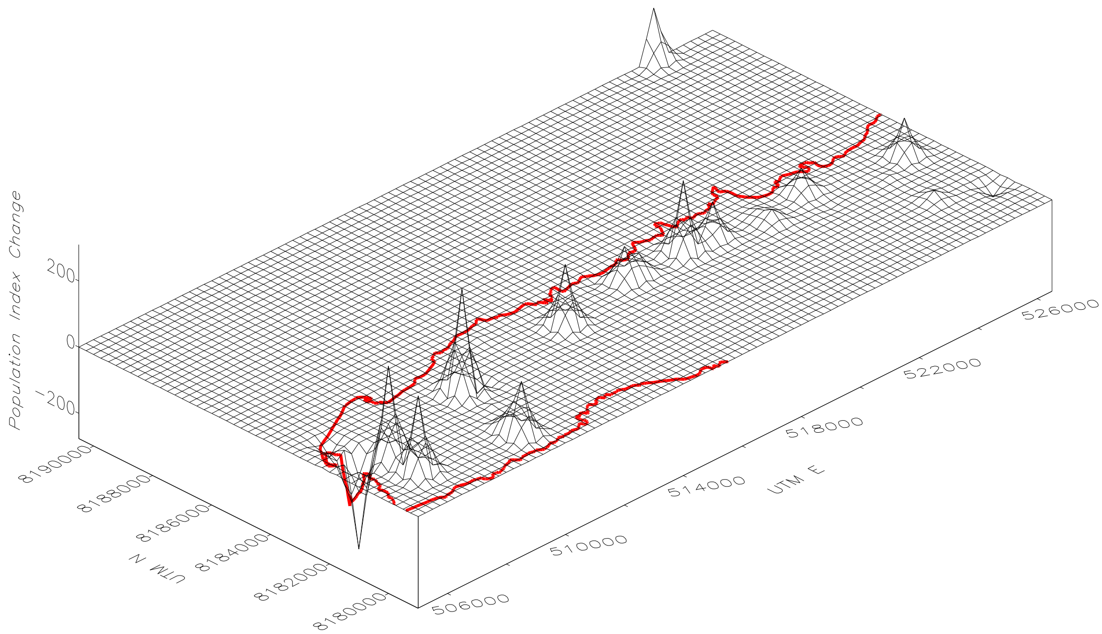


Figure 6.11: Middle Formative: Change in phase population index per 0.25 km^2

movement of population from smaller sites, or from outside the study region, to larger ones; that is, they may result from faster population growth rates at the larger sites. Such movement can be motivated by many factors, but are usually related to elements of the political economy. On the other hand it is possible for such hierarchies to emerge organically and entirely accidentally from the process of village fissioning. That is, some villages within a settlement system fission while others do not. The villages which do not fission come to comprise the group of first-tier sites, using the terminology I have already employed, and the group of fissioned villages together with their daughter communities form the group of second-tier sites. Given time, this process could conceivably produce elaborate, multi-tiered settlement size hierarchies without any of the institutions normally considered to accompany these settlement system configurations. That is, it is possible for settlement hierarchies to arise in the absence of political or economic hierarchies.

The difficulty, then, is in distinguishing between these two scenarios. Does the two-tier settlement hierarchy evident in the Middle Formative Period reflect intentional, motivated movement of persons from smaller sites to larger sites, or does it simply reflect the fission-

	Site Number	Site Name	MF growth rate (%)
First-tier sites	T-1	Chiripa	0.13
	T-130	Yanapata	0.14
	T-394	Janko Kala	0.09
	T-232/T-225	Kala Uyuni	0.15
average			0.13
Second-tier sites	T-3	Chiaramaya	0.10
	T-4	Chiripa Pata	0.08
	T-430	Alto Pukara	0.08
average			0.09
phase average			0.13

Table 6.4: Rates of annual population growth in the Middle Formative

ing of some communities and the non-fissioning of others? One way to answer this question is to compare population growth rates of the larger villages with that of the smaller villages. If there was motivated, intentional population movement into the larger villages, then their growth rate should be higher than that of the smaller villages. If the configuration is accidental then the growth rates of the two groups should be comparable.

Figure 6.11 shows change in population density over space during the Middle Formative Period. In general, the peaks for the larger settlements are higher than the peaks for the smaller settlements, indicating more rapid population increase in the former group. One must remove from the analysis, of course, villages resulting from the fissioning of an older Early Formative settlement. For this reason Cerro Choncaya (T-2) and Sunaj Pata (T-268), both located near the end of the peninsula, must be discounted, since they resulted from the fissioning of the Early Formative 2 village of Sonaji (T-271).

A systematic comparison is made in Table 6.4. It includes all Middle Formative sites which were also occupied during the Early Formative and which do not seem to have experienced any fissioning event. That is, they all seem to have grown without interruption throughout the Middle Formative Period. As the table shows, three quarters of the first-tier sites grew at a rate greater than or equal to the phase average of 0.13%,[24] while all three of

[24]The exception in Janko Kala (T-394). It is exceedingly interesting that it is also the only one of these four large sites which lacks clear evidence of Middle Formative public architecture.

the second-tier sites had growth rates below the phase average. The average growth rate of the first-tier sites was 0.13%, 44% higher than the second-tier site average growth rate of 0.09%.

These data indicate that the two-tier settlement hierarchy observed in the Middle Formative was not, in fact, an accidental configuration, but rather resulted from the intentional and motivated movement of people from the smaller sites to the larger sites. The rate of this population transfer was slow, of course, but it was enough to materially affect the growth rate of the two groups of sites. The meaning of this population flow is less than obvious. However, it is very suggestive when considered in relation to the previously presented data concerning the development of material culture, public architecture and exchange systems. For the moment, however, we can suggest that during the Middle Formative Period resource concentration and distribution by community leaders and prominent individuals - as discussed in Chapter 4 - became, for the first time, a settlement determinant. This in turn would suggest at least sporadic surplus flow from smaller to larger villages, and therefore at least some level of political integration above the level of the individual village.

6.7 Discussion

To sum up the contents of this chapter, six key historical processes have been identified during the Middle Formative Period:

1. a gradual elaboration of public architecture, culminating in the Upper House complex at Chiripa and probably similar features at other sites,

2. the appearance of a Titicaca Basin-wide stone sculptural style (variously called Yaya Mama [Chávez and Mohr Chávez 1975, Chávez 1988, Chávez and Chávez 1970, Rowe and Donahue 1975] or Pajano [Portugal Ortíz 1981, Portugal Ortíz 1998]),

3. the appearance and elaboration of a complex of ceremonial artifacts, including ceramic trumpets, ring-base burning bowls and decorated serving wares,[25]

[25]These first three points basically define what Chávez and Chávez have called 'the Yaya-Mama Religious

4. an increase in the material wealth and therefore probably social status and power of some individuals or social groups, as indicated by relatively wealthy burials in the Upper House Level at Chiripa,

5. the probable emergence of a regional exchange system involving the Titicaca Basin and the eastern valleys, the *yungas*, within which the Taraco Peninsula communities were advantageously situated , especially after the 450 B.C. lake level fall, and

6. a modest movement of population from smaller villages to larger, producing a two-tier site size hierarchy.

These processes are all interrelated, and in the manner of their articulation we may appreciate something of the very significant social transformation which took place at this time.

At the beginning of this chapter I proposed that the Middle Formative Period on the Taraco Peninsula witnessed an intensification of commensal politics. The development of a ceremonial complex including architectural, sculptural and ceramic elements was associated with this intensification of competitive feasting activity. This complex - which Chávez and Chávez call the “Yaya-Mama Religious Tradition” (Chávez 1988) - essentially defines the Titicaca Basin Middle Formative Period and comprised the ideological and social matrix from which the later Pukara and Tiwanaku polities emerged.

The settlement dynamics outlined in this chapter and in Chapter 5 point up some interesting facts about the context in which the Yaya-Mama Religious Tradition emerged. In the Middle Chiripa phase, the Taraco Peninsula villages began to reach a size which gave rise to scale-related stresses and conflicts. These stresses caused a number of village fissioning events in the Middle Chiripa phase and early in the Late Chiripa phase. The founding of new villages, however, raised the costs of village fissioning and relocation by increasing the distance groups would have to move in order to found a new village. The landscape, in other words, was filling up. And as it filled up, the options of the members of the Taraco Peninsula communities were reduced. No longer could they easily move a few kilometers

Tradition” (Chávez 1988).

and found a new village. Instead, they might have to move as far as twenty kilometers, and lose direct access to the lakeshore in the process. Therefore, local communities and their members had a great incentive to find ways to reduce or mediate the scale-related stresses to which their communities were being exposed.

What emerged, of course, was to become the Yaya-Mama Religious Tradition. The process by which this ideological and sociological transformation was played out remains - and may forever remain - obscure to the modern analyst. What seems certain, however, was that the solution involved an intensification of ritual activity - and probably also of an associated commensal politics - and the embedding of these politics into a cosmological idiom of reciprocity and exchange. It is in this way that we come to see symbols of natural fertility (Portugal Ortíz 1992, Portugal Ortíz et al. 1993) iconographically linked to the generosity and largess of prominent community members, as manifested in ceremonial competitive hospitality.

Whatever the precise nature of the solution, it is clear that it was successful in mitigating scale-related stresses in the Taraco Peninsula communities. One instance of village fissioning can be shown to have occurred early in the Late Chiripa phase. Throughout the remainder of the Middle Formative, however, the villages continued to grow at a regular pace and *did not fission*. This is despite the fact that many of them reached populations well over four times what seems to have been the fission threshold during the Early Formative. Villages continued to grow, but they did not fission. Fletcher's first C-limit had been decisively overcome.

At the same time that the ideological/ceremonial complex of the incipient Yaya-Mama Religious Tradition was successful in mitigating scale-related social friction, it also opened up new opportunities for an expansion of the scope of status competition. Through the sponsorship of community-wide ceremonial events embedded within the developing religious tradition, ambitious individuals (Hayden's "accumulators," or "Triple A individuals" [Hayden and Gargett 1990, Hayden 1996b]) were able to increase the scale of their hosting and gift-giving activities, and thereby engender broader and deeper social obligations among their neighbors and affines.

This is not to say that the one led to the other in some deterministic fashion. It is rather to say that this expansion of community ritual and probably also of commensal politics served a perceived social need, and was therefore tolerated by the communities at large. Over time, of course, this process took on a dynamic of its own, as the community ritual occasions and their associated set of propositions about the world came to form an established matrix of "rules and resources for action" (Giddens 1984); a 'structure.' Thus a process which had its roots in a perceived social problem and a convenient solution came to take on a certain autonomy. Pauketat calls this process, by which individuals acting of their own volition establish a structure which functions to limit their future autonomy, the "tragedy of the commoners" (Pauketat 2000).

The earliest indications we have of this process appear in the Middle Chiripa phase, and include the introduction of decorated serving ceramics, heretofore absent, and the construction of the first public architectural features, exemplified by the Choquehuanca structure at Chiripa. These ceramics and structures were probably the product of early experimentation, which was not entirely successful, as is shown by continuing village fissioning through the early Late Chiripa phase. Early in the Middle Formative, however, the developing complex of competitive ceremonialism and its associated ideological forms stabilized and was to endure for more than 500 years, though with continual modifications and adjustments.

One of the adjustments of the system seems to have occurred around 450 B.C. when the level of Lago Wiñaymarka dropped drastically (see Figure 6.8). As I argued earlier, this lake level drop could have led to a shift in the trade route between the western basin and the *yungas*. The Taraco Peninsula communities suddenly found themselves occupying a strategic position in a regional exchange network. We may imagine that the emerging community elites of these villages exploited their relationships with extra-local exchange partners to obtain significant quantities of exotic goods. The olivine basalt hoes - possibly from Incatunahuiri - are the visible example of these goods, but we may suppose that other exotic items were involved as well, such as coca, ají, feathers, animal pelts, precious metals and hallucinogenic drugs.

Thus, to the pre-existing system of competitive feasting and ritual sponsorship was added the procurement and strategic distribution of desirable exotic goods. In other words, a limited system of wealth finance was folded into the political economy. As has been noted by other investigators (Earle 1997; D'Altroy and Earle 1985), the procurement and control of exotic exchange items permits a degree of autonomy to an emerging elite not possible in a pure system of commensality. The source of wealth no longer derives from the labor of a single household or group of related households. Rather, astute dealings with exchange partners can tap into a regional network of surplus production oriented to exchange - a "collective power network" (see Mann 1986). This in turn permits a degree of wealth differentiation not possible in a purely commensal system.

The political economy of the Taraco Peninsula communities was thereby transformed in the middle of the Late Chiripa phase. Some individuals, families or lineages in some villages were able to gain access to significant quantities of desirable exotic goods. These goods were then distributed strategically, probably within the existing context of ceremonial occasions and festivals, in order to increase the social leverage of the groups involved.

Relations of dependency were thus expanded in the Taraco Peninsula villages, allowing certain groups and individuals to lay claim to the reciprocal labor services of their neighbors. A portion of the surplus labor harnessed in this way was fed back into the system via the construction of increasingly elaborate ceremonial facilities and related items of material culture. This is documented by the increasing scale of labor investment in public architecture, stone sculpture and ceremonial ceramics throughout the Middle Formative.

As discussed in Chapter 4, through their disproportionate ability to collect and distribute exotic items and agricultural surplus, certain individuals and groups came to function as point resources on the social landscape, and in this way became a settlement determinant. This accounts for the emergence of a two-tier site size hierarchy in the Middle Formative. The inhabitants of the Taraco Peninsula communities were selecting the location of their residences in order to increase their access to the developing system of competitive generosity. This produced the differential population growth rates of the various communities. Those which were the place of residence of the more successful members of the emerging elite attracted population from the surrounding settlements. In the terminology of systems theory, this was a positive feedback loop, since competitive success in this kind of system is critically scale-dependent.

In this way, it was possible for a site size hierarchy to emerge on the Taraco Peninsula in the absence of political integration.[26] It is possible that as the villages in question increasingly diverged in size that the larger villages began to assert coercive influence over the smaller. At present it is impossible to confirm or deny this possibility. However, political control and tributary relations were not the cause of the site size hierarchy, but rather its consequence. Toward the end of the Middle Formative simple multi-community polities may have emerged, with one or two smaller villages paying tribute to the leaders of an adjacent larger village. This is another possibility which cannot at present be evaluated. However it makes very little difference in terms of the overall historical trajectory.

I would like to offer a concluding observation: by including the procurement and strategic distribution of exotic goods into the existing system of competitive generosity, the emerging elites of the Taraco Peninsula exposed themselves to a new kind of risk (e.g. Earle's discussion of the economy as a source of social power [Earle 1997, Chapter 3]). Any disruption of their access to these goods would undermine the basis of their legitimacy and influence, and throw the entire political economy into crisis. This vulnerability was to have very important ramifications in the following Late Formative Period, as I will discuss in the following chapter.

[26]If I have not stated it explicitly enough, I will do so now: Chiripa (T-1) was *not* the seat of a complex chiefdom or multi-community polity in the Late Chiripa phase, or at any point in its history. There is positive evidence to the contrary. This was an early interpretation which should now be laid to rest.

Chapter 7

The Late Formative: multi-community polities and state formation

The Late Formative, as I define it here, refers to the period of time between the rise of the Pukara polity in the northern Titicaca Basin and the beginning of the classic Tiwanaku period in the South. The rise of Pukara is usually dated to around 200 B.C. (see Mujica 1987, also Chávez 1988). This beginning of this period coincides neatly with the transition from Late Chiripa to Kalasasaya ceramics in the South, which I have placed at 250 B.C. (see Chapter 6 and below).

In the southern Titicaca Basin, the Late Formative period saw two major political and cultural developments. The first of these was the rise of the first multi-community polities, around 250 B.C. At this time the site of Kala Uyuni (T-232) on the Taraco Peninsula came to dominate its immediate neighbors. The resulting social formation, the Taraco Peninsula polity, was characterized by a three-tier site size hierarchy. Its formation coincided with that of Pukara in the northern basin, and apparently also with that of Tiwanaku in the Tiwanaku Valley. The Taraco Peninsula Polity - identified her for the first time - was probably roughly the same size as the Tiwanaku polity during the earlier part of the Late Formative. The formation of an unoccupied buffer zone between the Taraco Peninsula and Tiwanaku polities would seem to indicate that they were competitors. The Taraco Peninsula polity existed from 250 B.C. to approximately 300 A.D. This period will be referred to as the Late Formative 1 (LF1).

Around 300 A.D. the Tiwanaku polity, heretofore more or less an equal competitor of the Taraco Peninsula polity, became suddenly dominant. Over the following two centuries the site of Tiwanaku rapidly grew to cover approximately 1 km^2. Ponce has aptly termed this period the "estadio urbano temprano," the early urban stage of Tiwanaku (Ponce Sangines 1981). I refer to it here as the Late Formative 2 (LF2). The drastic increase in the rate of population growth at Tiwanaku itself was paralleled by a more or less radical depopulation of its hinterland. Though the radius of Tiwanaku's initial political expansion early in the LF2 is poorly defined, the Taraco Peninsula definitely fell within its orbit at this time. The population of the peninsula as a whole decreased during this period for the first time in the occupational history of the region. This population decline was near-universal on the peninsula, with only a very few sites remaining constant or experiencing very slight growth. This flow of population from the Taraco Peninsula - and other adjacent areas - into Tiwanaku is one of the most interesting and perplexing events in Titicaca Basin prehistory, and one of the most important for our understanding of Tiwanaku state formation. It will be considered in as much detail as the limited data at our disposal allow. The LF2 ends with the appearance of classic Tiwanaku ceramics throughout the Titicaca Basin around 500 A.D.

7.1 Phase definition

Late Formative ceramics in the southern Titicaca Basin were first identified by Wendell Bennett in his excavations at Tiwanaku (Bennett 1934).[1] In deep midden buried by later deposits, Bennett identified a group of ceramics he called "Early Tiahuanaco". These consisted mostly of plainwares, together with "clay buttons" (Figure 7.1v-w), bowls with horizontal handles attached to the rim, and two sets of decorated wares which we now call "Kalasasaya" and "Qeya." Early Tiahuanaco levels were subsequently excavated by Rydén and Kidder at Tiwanaku and elsewhere (Kidder 1956, Rydén 1947), though they

[1] In discussing Late Formative ceramic chronology, I will closely follow the work of John Janusek (see especially Janusek 2001 for a recent statement; also Janusek 1994).

contributed little to the definition of the phase. The Bennett sequence was later refined by Dwight Wallace's formal seriation (Wallace 1957).

Ponce Sanginés's later chronology took the work of Bennett as a starting point, but considerably modified and extended Bennett's original phase definitions (Ponce Sangines 1981). As far as the Late Formative is concerned, Ponce divided the "Early Tiahuanaco" phase into three separate phases, Tiwanaku I, II, and III. While Ponce's sequence was explicitly designed around a conception of Tiwanaku political evolution, and therefore was not strictly a ceramic chronology, he did note correlations between ceramic style and his broader cultural and political epochs. He correlated Tiwanaku I with the first of Bennett's Early Tiahuanaco stylistic groups, the Kalasasaya style (Ponce Sanginés 1976). This group was characterized by zoned-incised pieces, clearly related to the northern basin Pukara tradition. His Tiwanaku III was associated with Bennett's second group, Wallace's Qeya style, distinguished by a distinctive vessel shape assemblage and color palette.[2] Ponce's Tiwanaku II apparently contained only undecorated sherds, and was poorly defined (Ponce Sangines 1981).

Recent investigators have tended to dismiss the Tiwanaku II phase as a fiction, while debating the chronological relationship between the two stylistic groups of Early Tiahuanaco, Tiwanaku I and III. The problem has been particularly acute for settlement research, since decorated ceramics of both the Kalasasaya and Qeya styles are quite rare and are very infrequently encountered on the surface of sites. Further, in contrast to the earlier Chiripa and later Tiwanaku decorated ceramics, the distribution of Late Formative decorated materials - Kalasasaya and Qeya wares - seems to have been highly restricted. That is, they occur only infrequently at major sites and political centers, and almost never at smaller habitation sites. Reliance on this sequence for chronological control has been the source of major problems for some recent Tiwanaku-area settlement surveys (Albarracín-Jordan 1992, Albarracín-Jordan and Mathews 1990, Albarracín-Jordan 1996b, Mathews 1992).

Application of the Ponce Tiwanaku I-III sequence to regional settlement survey was so problematic, in fact, that Mathews advocated a return to Bennett's inclusive Early Tiahua-

[2]Ponce apparently never made this association himself. Rather, it seems to have been made by Luís Lumbreras (Lumbreras 1974: 143-144; see Janusek 2001).

naco phase (Mathews 1992: Chapter 4). Based on his survey and limited excavations, he suggested that Tiwanaku I and III were two components of a single "cultural stage," and that the categories had no real chronological significance. This interpretation was shared by Albarracín-Jordan (Albarracín-Jordan 1992, Albarracín-Jordan and Mathews 1990).

More recent research, and more careful consideration of a range of datasets, has shown Mathews's conclusion to be incorrect. It is indeed possible to distinguish between earlier and later ceramic complexes within the Late Formative. What is more, thanks to the work of John Janusek (Janusek 2001) and Carlos Lémuz (Lémuz Aguirre 2001), it is now possible to speak of differences in plainware pastes and vessel shape, in addition to changes in the decorated wares.[3] Following Janusek, I have divided the Late Formative into two phases, the Late Formative 1 (LF1), which can be equated with Tiwanaku I at Tiwanaku, and the Late Formative 2 (LF2), including Tiwanaku III and Qeya ceramics. While my own work draws heavily on that of Janusek and Lémuz, I have adapted their sequences to the ends of settlement research. What follows, then, will emphasize a few common plainware pastes at the expense of a detailed seriation of attributes such as vessel form or firing.

In comparison to the Chiripa phases, the Late Formative phases are poorly-defined. This is obviously a priority for future research in the region. It should be possible to subdivide the LF1 at least, since Bermann's work at Lukurmata has demonstrated substantial changes in assemblage composition during this period (Bermann 1990, Bermann 1994, see also Janusek 2001).[4]

7.1.1 Late Formative 1

Janusek dates the LF1 from 200 B.C. to 300 A.D. (Janusek 2001). I have used these dates, while moving the initial date to 250 B.C. to accord with my hypothesized terminal date for the Late Chiripa phase (see Section 6.1).

[3] Janusek and Lémuz have apparently developed substantially similar Late Formative chronologies independently, Janusek using his materials from Tiwanaku and from the Katari Basin, and Lémuz using his data from the Santiago de Huatta Peninsula.

[4] Indeed, Janusek has suggested precisely such a division (Janusek 2001). I have found his formulation to be difficult to apply to surface ceramic assemblages, however, and for this reason make no use of it here.

I consider three groups of ceramics to be diagnostic of the LF1 phase. These are:

1. Kalasasaya style zoned-incised ceramics (Figure 7.1a-l),

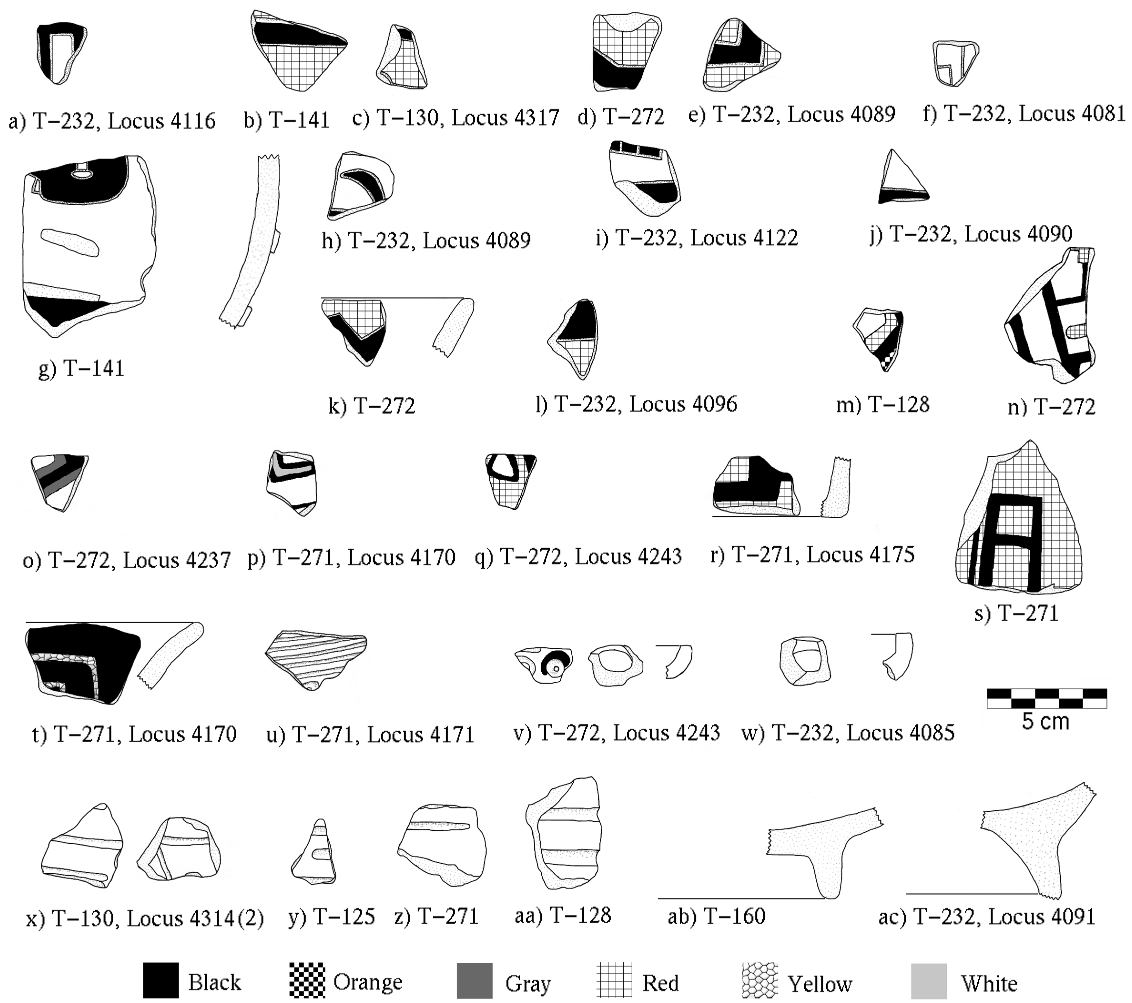
2. Kalasasaya style hemispherical bowls with red-painted rims (Figure 7.2r-u), and

3. a distinctive fiber-tempered paste, termed Paste Group 6 in my analysis.

The Kalasasaya zoned-incised group is the most familiar, and the rarest, of the three. It was first identified by Bennett at Tiwanaku (Bennett 1934). The best-known examples of the style were excavated by Ponce from several tombs underlying the Kalasasaya structure at Tiwanaku (Ponce Sanginés 1976); thus the name. Examples have been found at other sites in the Tiwanaku heartland area by Mathews (Mathews 1992), Bermann (Bermann 1990), Janusek (Janusek 2001), and myself (Figure 7.1a-l). These vessels present a high burnish on the exterior, and the incisions delimit color zones. Representations of geometric motifs - most commonly the "step-fret" - predominate, and zoomorphic and anthropomorphic motifs exist as well. Designs are usually painted in black. The rest of the vessel is commonly unslipped, but red slips are relatively common, and other slip colors are known.

Kalasasaya zoned-incised ceramics are very rare. The examples illustrated in Figure 7.1 represent the majority of the specimens recovered in the survey, out of a sample, it will be recalled, of almost 100,000 sherds. They are also very spatially restricted. Examples were recovered from only four sites, of the 54 sites with documented LF1 occupations. Most of these are from T-232 and T-272, the two largest sites during this phase. Another two are from T-141, which seems to have included a relatively high-status LF1 cemetery. This observation agrees with that of Janusek, who found that at the Katari Basin site of Kirawi, 90% or more of elaborate decorated LF1 sherds were located in a single outdoor midden (Janusek 2001). Thus these materials were concentrated at a regional scale - they are found almost exclusively in the largest and most important sites - and on an intra-site scale as well - they are located in very restricted contexts within individual sites. This is an important observation, and a major departure from Middle Formative precedent.

The second group of diagnostic LF1 ceramics are small hemispherical bowls with red-painted rims (Figure 7.2r-u). These are commonly referred to as "Kalasasaya bowls."



a-l) Kalasasaya Zoned-Incised (LF1), m-q) Qeya polychrome on unslipped buff (LF2), r-s) black/red (LF2), t) yellow/black (LF2), u) Qeya incised (LF2), v-w) ceramic “buttons”, one cane-stamped and painted (LF1 and LF2), x-aa) incised “trumpet” fragments (LF1), ab-ac) annular bowls (LF1 and LF2).

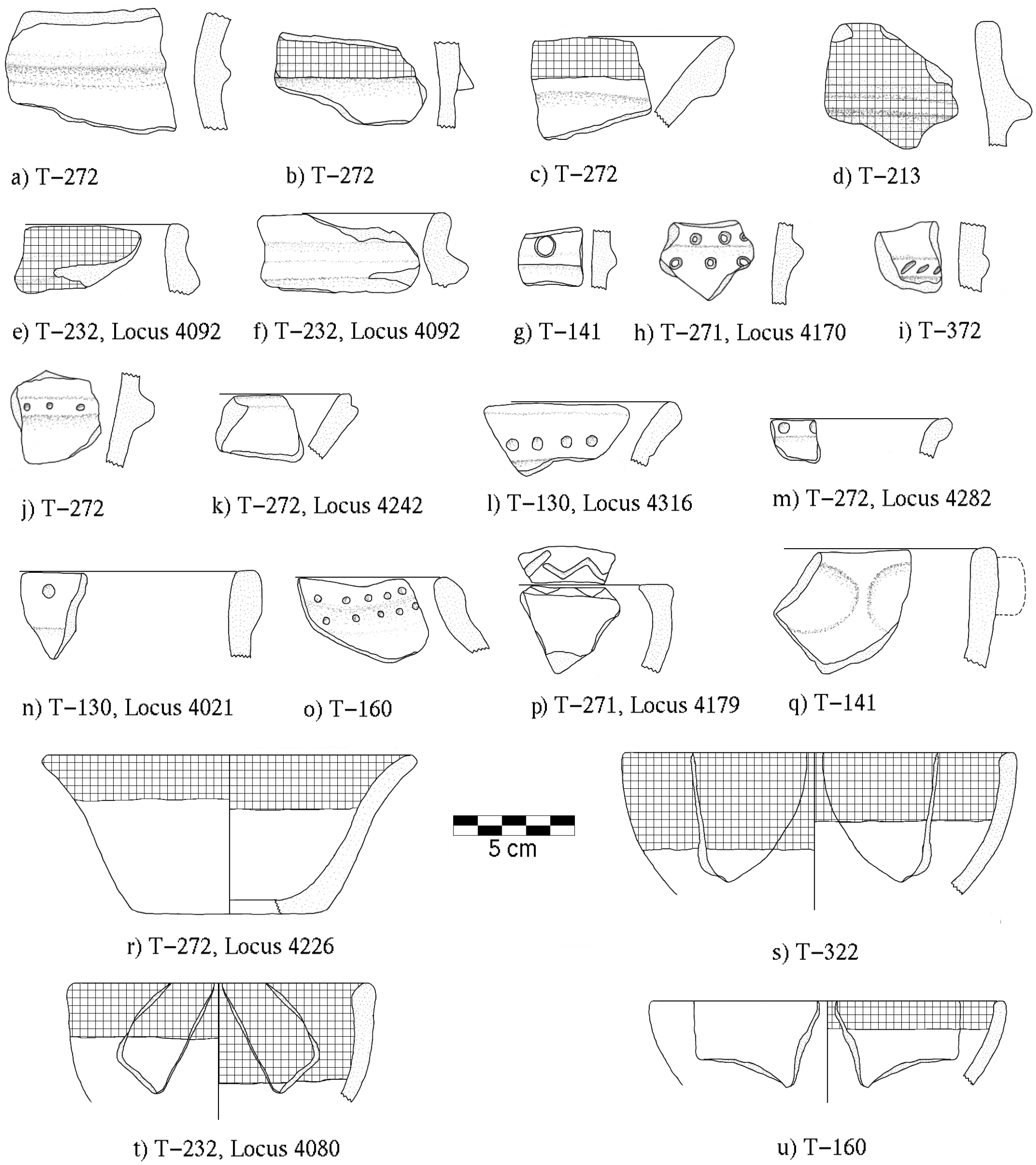
Figure 7.1: Late Formative ceramics

Bermann calls these “chestnut bowls” (see Bermann 1994: Figure 5.4 for a photograph). The examples I encountered on the Taraco Peninsula have a very fine, compact and light-colored paste, often with small red mineral inclusions. In this they resemble the bowls from Tiwanaku more than they do those from Lukurmata, which seem to be more brown. They are often highly eroded, as the paste is usually very soft, with an almost soapy texture. Rims are usually rounded and direct, though one flared-rim specimen was recovered (7.2r). The bowls are typically painted on both the exterior and interior rim, though significant variation exists in this regard. The paint employed is normally a very dark red, almost purple (7.5 YR 3-4/4-6).

Kalasasaya bowls are much more common than are the zoned-incised sherds, and they were found on virtually every site with a LF1 occupation. There is some evidence that they were used in ritual or public consumption contexts. At Lukurmata, Bermann found that in the second occupation Kalasasaya bowls were predominantly associated with a single, elaborate outdoor hearth, to the exclusion of other more quotidian hearths nearby (Bermann 1994: 72). Janusek makes a similar observation with respect to his excavations at Kirawi (Janusek 2001). Bermann suggests the bowls were employed in “offering/prestation activities” (Bermann 1994: 76).

The third group of diagnostic LF1 ceramics are those manufactured of my Paste Group 6. This is a semi-compact paste with a very finely-chopped fiber temper. This is easily distinguished from Middle Formative fiber temper, which is invariably much more dense and coarse. Sherds of this paste are normally oxidized - though they commonly have a slightly reduced core - and are a red-brown color. Small gold mica fragments are also present in quantity. Most distinctive, however, is the use of significant amounts of biotite in the temper. The tiny black flecks in the red-brown matrix impart a very distinctive appearance. Sherds of this paste are typically extremely eroded when encountered on the surface, and are broken into small fragments.

This paste is extremely common in the LF1. All sites with Kalasasaya sherds also have great quantities of Paste Group 6 on the surface. No site was located which simultaneously had Kalasasaya ceramics and lacked Paste Group 6 sherds. I have used it as a diagnostic



a-f) appliqué fillet (LF1), g-h) appliqué fillet, cane-stamped (LF1), i) appliqué fillet, obliquely incised, j) appliqué fillet, punctate, k) grooved rim bowl (LF1), l-n) thickened rim, punctate (LF1), o) punctate rim (LF2), p) incised rim (LF2), q) horizontal handle on rim (LF1), r-u) red-rimmed buff bowls (LF1).

See Figure 7.1 for color coding.

Figure 7.2: Late Formative ceramics

for this reason.[5] It is easily distinguishable from Middle Formative ceramics. While fiber-tempered ceramics continued to be used in small quantities in the subsequent LF2, and even into the Tiwanaku Period, they were much rarer in these later phases, and seem to have been restricted to large storage vessels and annular bowls. In the LF1, by contrast, Paste Group 6 was employed for ollas and jars, as well as for annular bowls. Further, the distinctive biotite temper is lacking in the later phases.

If present at Lukurmata, Paste Group 6 has probably been included in Bermann's "Lorokea Fiber" type (Bermann 1990: 78). Paste Group 6 is much more specific than Lorokea Fiber, however, since this type seems to simply aggregate all fiber-tempered sherds recovered in Bermann's excavations. Lorokea Fiber is a generic type and is therefore of limited utility.

Finally, Carlos Lémuz's Paste 18 is I think very similar to my own Paste Group 6. Paste 18 is, according to Lémuz, "the paste most representative of the Early Pana phase" (Lémuz Aguirre 2001: 162), his local LF1 phase designation for the Santiago de Huatta Peninsula. It apparently occurs only in Early Pana contexts, disappearing in the LF2 and Tiwanaku period. Paste 18 contains fiber temper, mica and, significantly, biotite, and is fired in an oxidizing atmosphere. Paste 18 makes up less than 10% of the ceramic sample from Lémuz's excavations (Lémuz Aguirre 2001: 162); however I believe Paste Group 6 to be much more common than this on the Taraco Peninsula.

Several other ceramic attributes may be diagnostic of the LF1 phase, though they were not employed as such in the present study. These include triangular ("pointed") appliqué fillets on the exterior of vessels (Figure 7.2a-h). These fillets are frequently decorated with oblique incision, cane-stamping (Figure 7.2g-h;l see also Lémuz Aguirre 2001: Figures 8.53a-b, 8.54a, d) or punctation. Many vessels with these fillets - apparently predominantly large bowls - are also painted on the rim with the same dark red paint which is used on the Kalasasaya bowls (Figure 7.2b-e).[6]

[5] I should note that both Janusek and Lémuz have inspected my type collection of this paste and agree that it dates to the LF1.

[6] Comparing the illustration in Figure 7.2 to those provided by Mathews for his "Early Formative Lateral Banded Incised" group (Mathews 1992: Figures 3.11-3.13b), I am forced to conclude that his LBI ceramics date, in fact, to the LF1 and that his column at T'ijini Pata (TMV-79) was at least partially stratigraphically

Also common is a thickened vertical rim with punctation (Figure 7.2l, n), horizontal handles on the rim of large bowls (Figure 7.2q), and latitudinally-grooved bowl rims (Figure 7.2k). These last three traits seem to also be present in the LF2, however, and are therefore probably not diagnostic for the LF1.

Finally, it should be noted that the manufacture and use of ceramic "trumpets" continued into the LF1 (7.1x-aa; also Bermann 1994, Figure 5.5c). These may easily be distinguished from the earlier MF trumpets by their lack of fiber temper and their very compact paste. These do not seem to extend into the following LF2 period (witness their complete absence in the LF2 levels at Iwawe [Burkholder 1997]), but this is not sufficiently certain at present to allow them to confidently be employed as LF1 diagnostics.

7.1.2 Late Formative 2

Janusek dates the LF2 from 300 A.D. to 500 A.D. (Janusek 2001). I have retained these dates in the present analysis.

Considered in ceramic terms, the shift from LF1 to LF2 consisted of the gradual disappearance of the Kalasasaya red-rimmed bowls, the abrupt replacement of the Kalasasaya zoned-incised complex with a new set of decorated ceramics grouped under the name "Qeya", and a partial change in plainware pastes.

I consider three groups of ceramics to be diagnostic for the LF2. They are:

1. Qeya polychrome ceramics,
2. Qeya incised ceramics, and
3. a distinctive thin, reduced micaceous ware I called Paste Group 13 in my ceramic analysis.

Qeya polychrome ceramics were first noted by Bennett as a stylistic component within his Early Tiahuanaco phase (Bennett 1934). The name "Qeya" was apparently attached to the style by Dwight Wallace (Wallace 1957). It refers to the site of Qeya Qollu Chico

inverted.

on the *Isla del Sol*, where Bandelier collected some specimens of the style early in the century (Bandelier 1910; photographs of some specimens collected by Bandelier have been published in Bauer and Stanish 2001, Figures 4.4-4.8). The Qeya style is quite elaborate, with a wide range of unusual vessel shapes and iconography. Forms include burnished, scalloped annular bowls often with modeled feline heads on the rim, *kero*-like cups, and tall, flaring-rim bowls called *escudillas*. These vessels are frequently decorated with a variety of geometric, zoomorphic and anthropomorphic motifs, including a front-faced figure with rays radiating outward from the face, clearly prefiguring the Tiwanaku Gateway God motif.

Qeya polychrome ceramics were formally defined by Dwight Wallace (Wallace 1957). Wallace characterized them as having a fine, light-colored paste, sometimes micaceous, unslipped and painted in a variety of colors. Qeya ceramics also exist in a variety of unusual forms. From the perspective of the survey archaeologist, however, Qeya polychrome ceramics may be summarized simply as "polychrome on unslipped buff". Fragments of these vessels are quite rare on the surface, and they seem to be restricted both regionally and locally (that is, on both the intra- and inter-site scales), as was the case in the LF1. Examples recovered from the survey are illustrated in Figure 7.1m-q.

In addition to the polychrome on buff sherds, some black on red sherds are also present in this phase (see Albarracín-Jordan 1996a: 131 and Figure 7.7; Figure 7.1r-s).[7] One yellow on black rim was recovered which is probably LF2 in date (Figure 7.1t). These sherds do not fall within Wallace's definition of Qeya, but they do seem to pertain to the LF2.

Qeya incised ceramics were also identified by Wallace. These sherds display a very closely-spaced pre-firing incision, typically comprised mostly of parallel lines. This is a very widely distributed style, having been found in the Tiwanaku heartland (Bermann 1990: Figure 77b, Bermann 1994: 135, Figure 9.5b;), in the Juli area (Stanish and Steadman 1994), at Camata (Steadman 1995: 392, Figure 70d), on the Santiago de Huatta Peninsula (Lémuz Aguirre 2001: Figure 8.60d-f), and in the northern Titicaca Basin and as far away as Cuzco (Chávez 1985). They are even more rare than Qeya polychrome ceramics. Only one example was recovered during the survey (Fig-

[7]These sherds are distinguished from later Tiwanaku wares by the "fugitive" quality of the red slip and by a very fine, soft and light-colored paste.

ure 7.1u). Flattened or “shelf” rims incised with parallel or zig-zag lines appear to be distinctive of this phase as well (see Figure 7.2p; also Burkholder 1997: 170 and Figures 6.10, 8.2), as do lobes on the rims of hyperboloid bowls, incised with 2-4 parallel lines (Lémuz Aguirre 2001: Figure 8.55a-b).[8]

Since Qeya polychrome and Qeya incised ceramics are so rare, they cannot be used to reliably define LF2 occupations in Taraco Peninsula sites. For this purpose it was necessary to identify a plainware ceramic paste distinctive of the phase. Paste Group 13 serves the same purpose for the LF2 as Paste Group 6 did for the LF1.

Paste Group 13 consists of thin, reduced sherds, brown to dark gray in color, mostly of cooking ollas, which are tempered with a great quantity of mica. The density of mica in these sherds is very high, and may be considered distinctive of the phase. Paste Group 13 did not comprise the majority of the LF2 ceramic assemblage. However, it was sufficiently common to be useful as a temporal marker in surface collections. For example, Janusek found that a “brown” paste and a “dense mica” temper characterized 14% of the LF2 assemblage at the site of Kirawi on the Pampa Koani. He also notes that at this time “ollas with thin walls and high densities of fine mica became common” (Janusek 2001). A similar pattern may be observed at Tilata, in the Tiwanaku Valley. Further, Mathews notes that the blackware of the “Kallamarka style” (Portugal Ortíz and Portugal Zamora 1977: 260) represents “a probable Tiwanaku III domestic ware” (Mathews 1992: 223). This last assemblage may or may not correspond to what I have termed Paste Group 13. Finally, Carlos Lémuz has stated that nearly 20% of LF2 (his ‘Pana Tardío’ phase) ceramics on the Santiago de Huatta Peninsula can be classified as his Paste 12, which is “very dark” and contains significant quantities of mica (Lémuz Aguirre 2001: 159). [9]

[8] It is my belief that Burkholder’s Huchani A, B and C styles all belong to the LF2 period. In her dissertation, Burkholder places the Huchani materials from “some time after 1000 B.C. and ... before AD 600” (Burkholder 1997: 172, also 168, 170). The early end of this range is owing to a radiocarbon date (925 ± 85 B.C., calibrated) obtained by Albarracín-Jordan in his earlier excavations (see Albarracín-Jordan 1992: 148, Albarracín-Jordan 1996a: 133). It has since become apparent (though not yet in print, unfortunately) that this date is an anomalous outlier, and that the initial occupation of Iwawe actually dates to somewhere around 300 A.D. If this is true, then the Huchani ceramics are LF2 in date, as indeed their stylistic attributes would suggest.

[9] Curiously, however, no dark, micaceous paste is included in Burkholder’s catalog of wares from the site of Iwawe (Burkholder 1997: Chapter 5). Since LF2 levels were clearly excavated (the Huchani styles,

Summarizing the LF2 ceramic evidence, I am forced to admit that this phase is the most tenuously identifiable. The truly diagnostic ceramics (the Qeya polychrome and incised wares) are very rare indeed. The only apparently diagnostic plainware type (Paste Group 13) is uncommon, comprising - if I may extrapolate from Janusek's excavation data[10] - no more than 10-20% of the total plainware assemblage. I believe that my definition of the phase has been adequate to satisfactorily identify LF2 occupation components using mixed surface assemblages. However, it is abundantly clear that much more work is required and that the LF2 is the most problematic phase in the regional sequence.

7.2 Principal sites

7.2.1 Late Formative 1

Twelve sites were identified with LF1 occupations greater than or equal to 3.0 ha. These are numbered on Figure 7.3 and are described below.

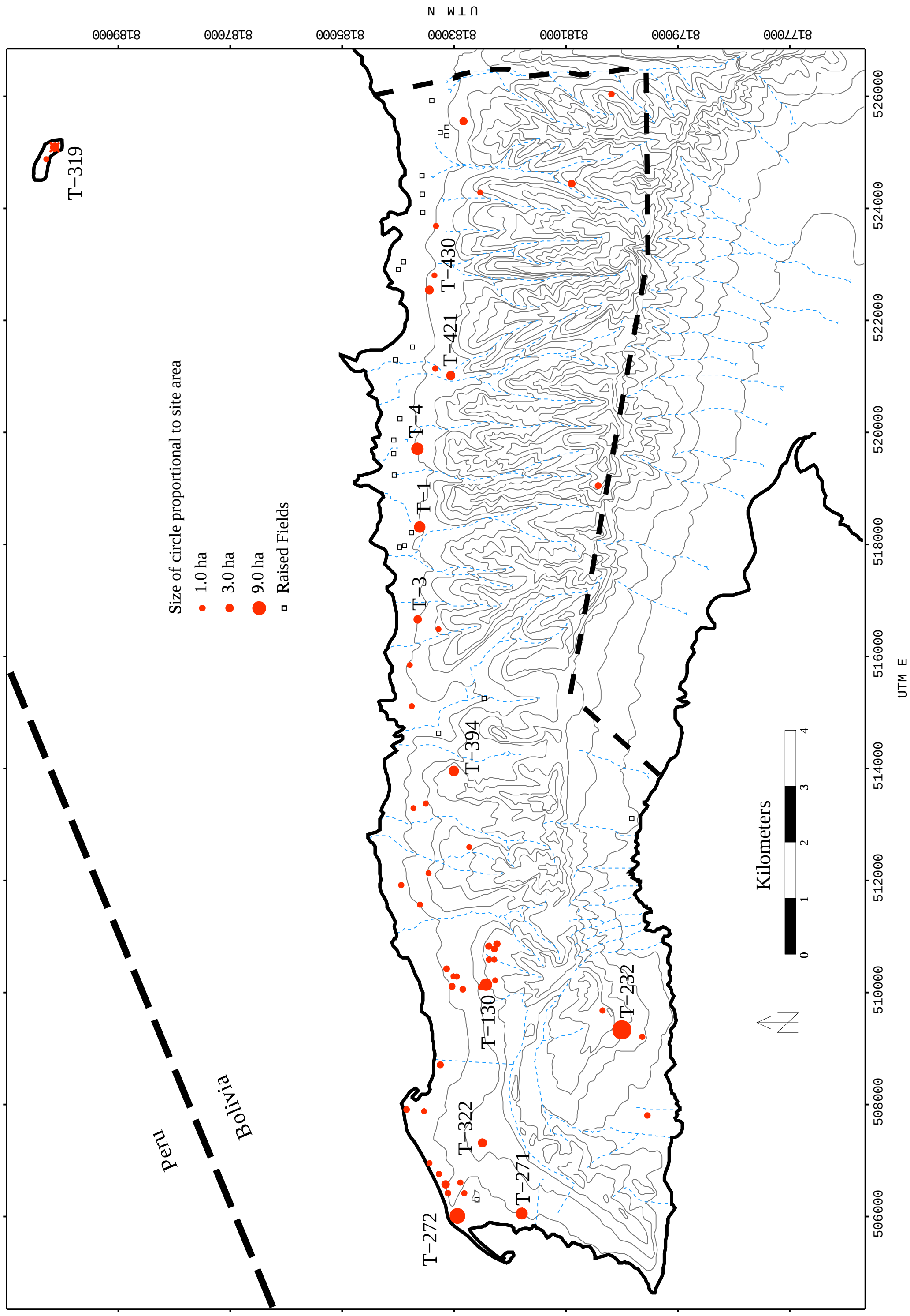
T-1E (Chiripa)

Like most of the old villages of the Taraco Peninsula, Chiripa shrunk during the LF1. Sector E has a population index value of 353, while Sector D (MF) has a value of 445. This represents a population index growth rate of -0.04% annually, the first time during its history in which the population of Chiripa declined.

Monumental construction continued, however. The Upper House Level structures (see section 6.3) were burned and demolished at the beginning of the LF1, and a large earthen mound was constructed over the resulting rubble. This mound is the mound that is visible today at Chiripa. This mound was then faced with cut stone, and an elaborate sunken court was constructed on top, again using large quantities of imported cut

Burkholder 1997 Figures 6.8, 6.9, 6.10, 8.1, 8.2), as witness finds of Qeya polychrome (Burkholder 1997 Figures 6.12, 8.4) and incised sherds, this must remain for the moment an unexplained anomaly.

[10] Janusek's data agree with my own observations of the ware's low frequency.



Numbered sites are discussed in text.

Figure 7.3: Late Formative 1 (Tiwanaku I/Kalasasaya) Settlement Pattern

stone (Bennett 1936). There were apparently summit structures associated with this mound (Chávez 1988), though we know little about them.

T-3D (Chiaramaya)

The population of Chiaramaya also declined in the LF1. Sector D has a population index value of 157 (3.0 ha), as opposed to 231 (4.25 ha) for Sector C (MF). This is an annual population growth rate of -0.06%, similar to that of Chiripa (T-1).

T-4C (Chiripa Pata)

Chiripa Pata is one of the very few sites on the Taraco Peninsula which increased in size during the LF1. Sector C has a population index value of 414 (7.25 ha), as opposed to 277 (5.0 ha) for sector B. This is equates to an annual growth rate of 0.07%, far less than that of the principal LF1 sites (Kala Uyuni, T-232), and slightly below the phase average of 0.08%, but still remarkable in a phase in which most sites lost population.

T-130E (Yanapata)

Yanapata also lost population in the LF1. Sector E has a population index value of 414 (7.25 ha), as opposed to 429 (7.5 ha) for the MF Sector D. This is a growth rate of -0.01%, a slower decline than many sites (such as Chiripa), but a loss of population nevertheless.

T-232C (Kala Uyuni)/T-225D (Achachi Coa Khollu)

Kala Uyuni was probably the principal LF1 site on the Taraco Peninsula. It increased from a combined MF population index of 362 (T-232B, T-225C) to a combined LF1 value of 900, an annual growth rate of 0.17%. This is more than twice the phase average.

Kala Uyuni was the center of a multi-community polity encompassing all of the Taraco Peninsula communities. I propose that it was a competitor of Tiwanaku and of Lukurmata, at least the first of which seems to have been about the same size during the LF1. If this is the case, we may expect significant public architecture at the site. No excavations have ever been undertaken here, however, so it is not possible to confirm or deny this hypothesis at present.

T-271B (Sonaji)

After being abandoned in the MF, Sonaji was reoccupied in the LF1. Sector B has a population index of 429 (6.75 ha), making it a very significant center indeed. I suggest that it was associated with the nearby sites of Kumi Kipa (T-272) and Kollin Pata (T-322).

T-272B (Kumi Kipa)

Kumi Kipa, unoccupied in the Middle Formative, is colonized and comes to be a significant settlement during the LF1. Sector B has a population index of 647 (11.0 ha). There is little evidence of public architecture, only two small mounds being in evidence. I suggest that Kumi Kipa formed part of a larger site complex including T-271 (Sonaji) and T-322 (Kollin Pata). This group of sites will be referred to as the Santa Rosa group.

T-319A (Sikuya Este)

In the LF1 on the island of Sikuya population shifted to the eastern end of the island. T-320 (Sikuya Oeste), occupied during the MF, was abandoned, the population relocating to T-319. T-320A has a a population index value of 157, compared to 204 for T-319A (3.8 ha). This represents an annual population growth rate of 0.05%. While below the phase average, this growth could suggest that Sikuya lay outside the radius of the LF1 Taraco Peninsula polity.

It should be noted, though, that Sikuya was not at this point an island. Lower lake levels (see below) mean that during the LF1 T-319 as a lakeshore settlement much like Chiripa, Chiaramaya and others.

T-322A (Kollin Pata)

Located in the community of Ñacoca near the modern town of Santa Rosa, Kollin Pata is first occupied during the LF1. It eventually grew to be a significant Tiwanaku Period site. The site itself is located on the top of and on the North-facing slopes of a low natural rise above the lake. It lies to the North of the modern road. The site is intervisible with the other major LF and Tiwanaku Period sites in the Santa Rosa area: Kumi Kipa (T-272) and Sonaji (T-271).

The top of the natural hill on which the site is located seems to have been terraced, forming a large mound. This feature may or may not have been of ceremonial significance, and this issue will only be clarified by excavation.

Sector A extends over 3.50 ha and has a population index value of 186.

T-394D (Janko Kala)

Like the other old villages, Janko Kala experienced a population decline in the LF1. Sector D has a population index value of 277 (5.0 ha), as opposed to 429 for the MF Sector C, an annual population growth rate of -0.08%. This is the same rate at which Chiripa (T-1) lost population in this period, suggesting that the two sites were subjected to similar sets of pressures and possibly tribute exactions.

T-421E (Waka Kala)

Waka Kala had minor occupations during the Early and Middle Formative Periods. In the LF1, however, it grew relatively rapidly into a moderate-sized village. The MF Sectors B and C have a combined population index value of 73. By contrast, the LF1 Sector E has a population index value of 201 (3.75 ha), an annual growth rate of 0.18%. Thus growth rate is quite high and leads me to suggest that some of this population may have derived from elsewhere, perhaps from some of the many Taraco Peninsula sites which declined in population at this time.

The site itself is located on a North-facing slope above the lacustrine plain in the community of Cala Cala, near the border with Pequery. The modern road to Taraco cuts across the lowermost portion of the site. In the uppermost portion of the site, several hundred meters to the South of the modern road, the remains of a sunken court structure may be discerned. The principal occupation seems to have been Pacajes-Inka, covering 5.5 ha with a very dense sherd scatter.

The sunken court is in the LF1 style, bearing some resemblance to the Semi-Subterranean Temple at Tiwanaku. Like the Semi-Subterranean Temple, and like the contemporaneous sunken court at Chiripa, the Waka Cala court is internally faced with stone, with large stone pillars placed at regular intervals. Some of these upright "monoliths" are visible on the surface today. Another point of resemblance is the presence of tenoned head sculptures. Two of these heads - one of sandstone and one of limestone - were observed by the author in rockpiles near the sunken court. There are probably many more present below the surface, as the structure has never been excavated. The heads are of the same style as those found in the Semi-Subterranean Temple at Tiwanaku.

Finally, the Waka Kala structure is associated with a stone stela, the only one known from the Taraco Peninsula. This is the stela which Portugal refers to as "el ídolo de Cala Cala" (Portugal Ortíz 1981, Portugal Ortíz 1998: 102). This piece was discovered by Maks Portugal Zamora in 1940, in the same field season in which he excavated at Chiripa (Portugal Ortíz 1998: 102; see also Bandy 1999a).

The stela is composed of a slab of red sandstone, approximately 60 cm wide by 40 cm deep by more than 190 cm high. On it is represented a human figure viewed from the front with arms extended alongside the body. The feet are represented with toes turned outward. This human figure sports a "skirt", an unusual feature in this style. Below the human figure's feet is a profile body, front-face feline, typical of this style. On either side of the slab is carved an elongated serpent with the head facing upwards. The uppermost portion of the stela, including what must have been the head of the human figure, has been broken off. It most likely was the victim of decapitation at the hands of the colonial *extirpación de idolotría*, as were countless such local sacred objects throughout the Andean region.

T-430C (Alto Pukara)

Alto Pukara experienced slight growth during the LF1, its population index value increasing from 171 (Sector B) to 186 (Sector C; 3.5 ha). This represents an annual growth rate of 0.02%.

7.2.2 Late Formative 2

Eight sites were identified with LF2 occupations greater than or equal to 3.0 ha. These are numbered on Figure 7.4 and are described below.

T-1F (Chiripa)

The population of Chiripa declined further in the LF2, as did that of virtually every site on the Taraco Peninsula. Sector F has a population index value of 322 (5.75 ha), down from 353 for the LF1 Sector E, an annual growth rate of -0.05%. This is not as precipitous a decline as the phase average of -0.12%, but it is a decline nevertheless.

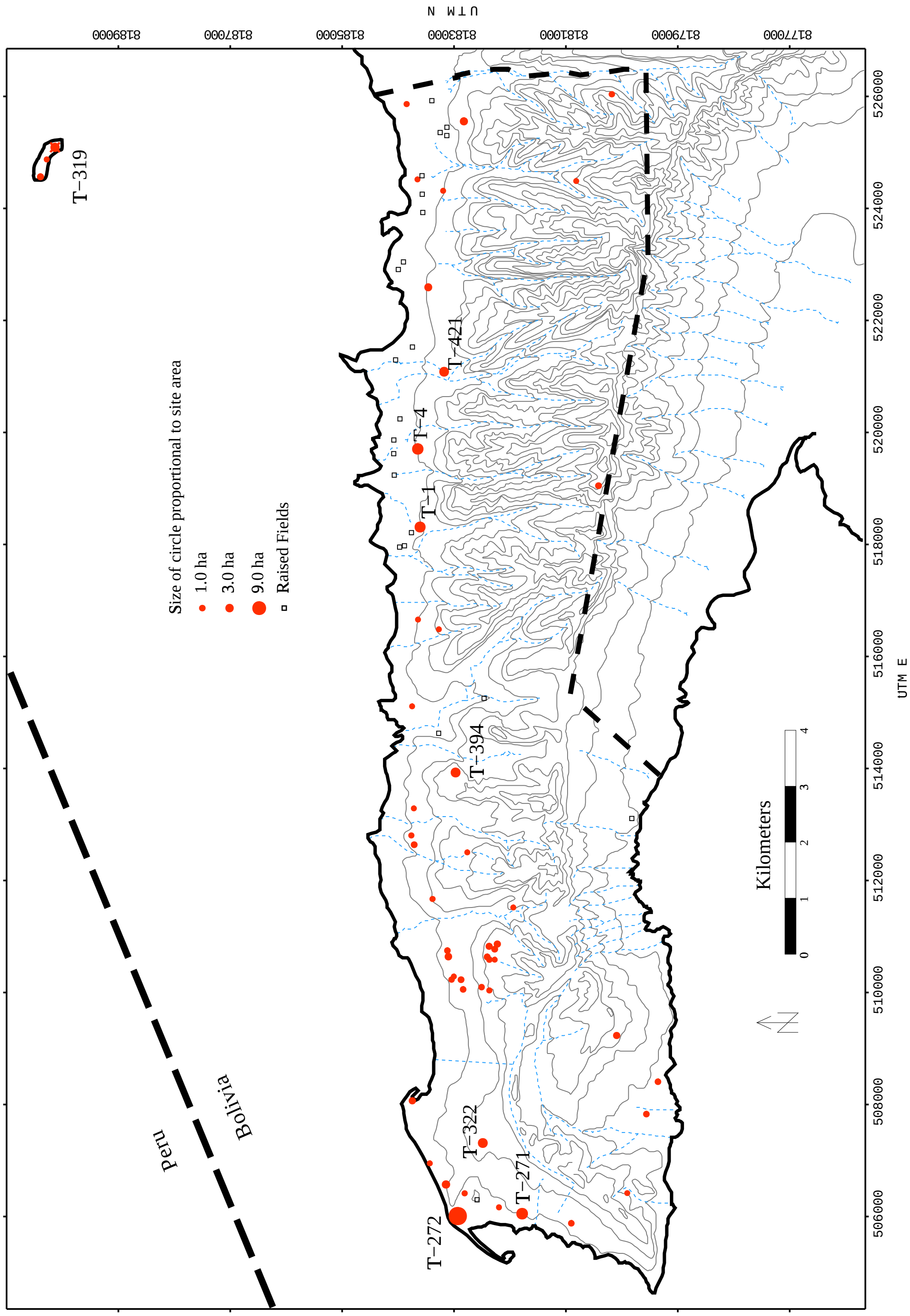
As far as public architecture is concerned, the mound and sunken court at Chiripa apparently continued to be utilized into the phase. Browman found “a couple undisturbed pockets” on the floor of the temple which yielded Tiwanaku III ceramics (Browman 1978a: 810).

T-4D (Chiripa Pata)

Sector D at Chiripa Pata has a population index value of 353 (6.25 ha), down from 414 for the LF1 Sector C. This is an annual growth rate of -0.08%, comparable to that of Chiripa.

T-271C (Sonaji)

Sonaji experienced only slight depopulation during the LF2. Sector C has a population index value of 368 (6.5 ha), as opposed to 383 for the LF1 Sector B. This is an annual growth rate of -0.02%, less than half the rate of Chiripa. Most of that decline may be



Numbered sites are discussed in text.

Figure 7.4: Late Formative 2 (Tiwanaku III/Qeya) Settlement Pattern

attributed to a movement of population to adjacent sites which experienced growth, especially Kumi Kipa (T-272) and Kollin Pata (T-322).

In the LF2, and possibly during the LF1 as well, Sonaji seems to have been integrated with Kumi Kipa and Kollin Pata, forming a single community. While the latter two sites seem to have been primarily residential, with little evidence of elite or ceremonial architecture, Sonaji itself seems to have been relatively specialized, as ceramics and architecture seem to show. It may very well have been the residential locus of a local elite, as well as the location of the principal public architectural complex on the Taraco Peninsula. This situation remained unchanged into the Tiwanaku Period. The three sites of Sonaji, Kumi Kipa and Kollin Pata will be referred to collectively as the Santa Rosa group (see sections 7.2.1,).

T-272C (Kumi Kipa)

Kumi Kipa is one of the very few Taraco peninsula sites which experienced growth during the LF2. Sector C has a population index value of 836 (13.75 ha), up from 821 for Sector B, for an annual growth rate of 0.01%. This is very slow growth, to be sure, but in light of the generalized decline in population during the LF2 on the peninsula it is noteworthy.

T-319B (Sikuya Este)

The LF2 occupation of Sikuya seems to have remained the same as for the LF1. That is, it seems neither to have increased or decreased. Sector B has a population index value of 204, (3.8 ha) the same as Sector B. It must be remembered, however, that this site was not systematically surface-collected, and these data are therefore less than absolutely reliable.

Also noteworthy is the fact that it is probably during the LF2 when the level of the lake achieved and possibly surpassed modern levels for the first time, isolating Sikuya from the mainland. Its long and sporadic history as an island had begun.

T-322B (Kollin Pata)

Like Kumi Kipa, Kollin Pata also experienced growth during the LF2. Sector D has a population index value of 246 (4.5 ha), up from 186 for Sector A. This is an annual growth rate of 0.14%, by far the fastest growth of any site on the peninsula. As mentioned above, it sees to have formed part of a single community together with Kumi Kipa and Sonaji, described above.

T-394E (Janko Kala)

Like most Taraco Peninsula communities, Janko Kala experienced population decline during this period. Sector E has a population index value of 246 (4.5 ha), down from 277 for Sector D, a rate of -0.06% per annum. This is comparable to Chiripa's growth rate.

T-421F (Waka Kala)

Waka Kala is one of the few sites to have experienced growth during the LF2. Sector F has a population index value of 246 (4.5 ha), up from 201 for the LF1 Sector E. This is an annual growth rate of 0.10%. It is unknown whether or not its sunken court continued in use at this time.

7.3 Lake level change

The beginning of the LF1 coincided with a dramatic rise in the level of Lago Wiñaymarka. In the latter part of the Middle Formative, as discussed in Chapter 6, the level of the lake was 10-12 meters below its overflow level, or 16-18 meters below its modern average of 3810 m.a.s.l. (Figure 6.8). Around 250 B.C., however, at the beginning of the LF1, the lake level rose abruptly to approximately 1-7 m below its modern level, and remained in this range for the next 350 years or so (Abbott et al. 1997a: 179 and Figure 4). The reconstructed shoreline for Lago Wiñaymarka at these levels is presented in Figure 7.5. Around 100 A.D., late in the LF1, the lake level fell again to the same level as in the

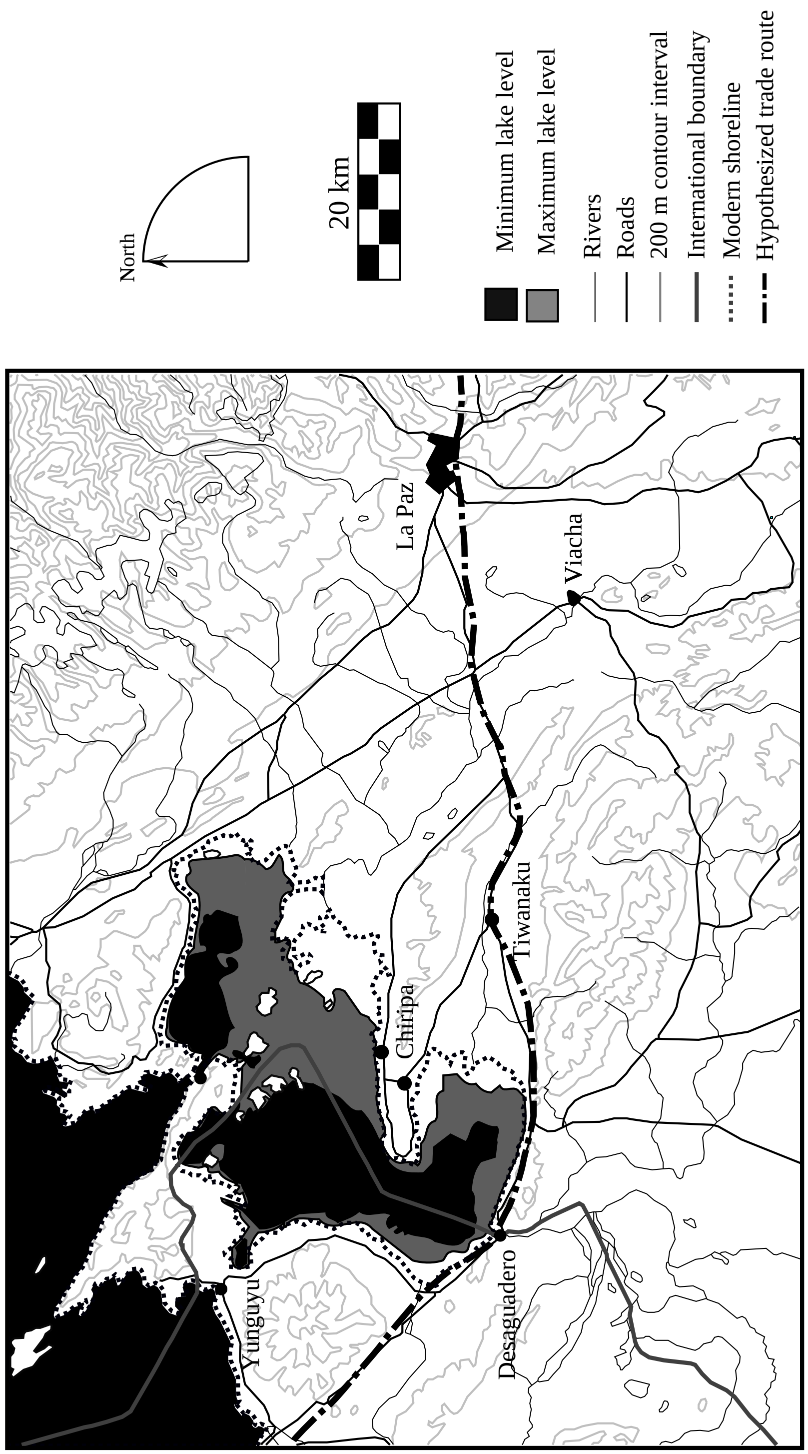


Figure 7.5: Reconstructed shoreline of Lago Wiñaymarka, 250 B.C.- 150 A.D.

later MF (illustrated in Figure 6.8). This low stand, the fourth in Abbott et. al.'s sequence (Abbott et al. 1997a: 179), lasted only about 200 years. At the end of this period, around 300 A.D., the lake level rose again, this time to modern levels or even slightly above. Lake levels remained at this level throughout the LF2 and Tiwanaku Periods.

Thus, there were three main periods within the Late Formative from the standpoint of lake levels.

1. Lake levels were relatively high (3803-3809 m.a.s.l.) from 250 B.C. to A.D. 100. This represents the earlier portion of the LF1 period.

2. In the last two centuries of the LF1 (100-300 A.D.), lake levels dropped precipitously, to 3792-3794 m.a.s.l.

3. Throughout the LF2 (300-500 A.D.) lake levels were higher, remaining above the overflow level of the Desaguadero River and perhaps surpassing the modern average (indicated by the dotted line on Figure 7.5). The probable range for this period is 3804-3811 m.a.s.l. (Abbott et al. 1997a, Figure 4).

Perhaps more to the point, there were three principal changes in lake level:

1. A sharp rise ca. 250 B.C. (beginning of the LF1)

2. A sharp drop ca. 100 A.D. (middle of the LF1)

3. A sharp rise ca. 300 A.D. (LF1/LF2 transition)

As I pointed out in my discussion of the Middle Formative (Chapter 6), it is an interesting fact of southern Titicaca Basin prehistory that rises in lake level appear on the whole to be more disruptive to local social systems than do drops in lake level. This generalization certainly holds true in the case of the LF. The two rises in lake level correlate with significant changes in material culture and settlement. The first (250 B.C.) corresponds to the transition from the MF to the LF1, and the second (300 A.D.) to the LF1 to LF2 transition. The sharp decline in lake level around 100 A.D., on the other hand, does not seem to be related to any significant cultural or social changes, at least not that I can distinguish at this time.

7.4 Exchange

The lake level rise in 250 B.C. seems to have been of particular significance. I argued in Chapter 6 that sometime in the later MF, around 450 B.C., Lago Wiñaymarka became mostly dry. This fact made possible a shorter trade route between the Western Titicaca Basin and the *yungas* than the one used today (see Figure 6.8). This shorter trade route would have passed along the Taraco Peninsula. The new proximity of the Taraco Peninsula villages to what undoubtedly was one of the principal regional trade routes is reflected in the large amount of imported exotic goods in these settlements - archaeologically represented mostly by imported stone hoes.

The lake level rise at the beginning of the LF1 (250 B.C.) would have had the effect of of shifting the trade route back to its prior (and recent) path, passing through the Tiwanaku Valley and crossing the Desaguadero River - probably flowing for at least part of the LF1 - at the modern Peru/Bolivia border. This had the effect of isolating the Taraco Peninsula communities, and neutralizing any advantage which they may have gained from their previously strategic location.

The fate of the MF exchange network in the LF1 and LF2 is a difficult issue. Since MF exchange was identified primarily through basalt hoes - the most common exotic items encountered archaeologically in the southern Titicaca Basin (see Chapter 6) - it should be interesting to analyze the frequency of lithic raw material on the LF1 in comparison to the MF. However, the TAP excavations at Chiripa sampled no intact LF levels. The only available data which bear on this question are Janusek's excavations at various Pampa Koani sites (Janusek 2001, Janusek and Kolata 2001). These are presented in Table 7.1.

In the table, the "other" category, according to Janusek, consists primarily of "andesite and basalt". Since his excavations are located very near to the Taraco Peninsula I will assume that the lithic assemblage is similar, and that the "other"category consists almost entirely of imported basalt. Viewed this way, Janusek's data indicate a dramatic decline in imported lithic materials in the LF, from almost 40% of the entire assemblage in the MF, to 10% or less. This is entirely consistent with my own surface collection results, reported in

Period	Site	%quartzite	%slate	%other
MF	Qeyakuntu	49	14	37
LF	Qeyakuntu	55	36	9
LF	Urikatu	0	100	0
LF	Kirawi	2	88	10

Table 7.1: Raw material frequency of lithic agricultural implements on the Pampa Koani

Table 6.2.[11]

This decline in exotic raw material frequency indicates either

1. an overall decline in regional trade, probably related to the formation of the Pukara polity in the northern Titicaca Basin, or

2. increased relative isolation of the Taraco Peninsula/Pampa Koani, resulting from the 250 B.C. lake level rise and subsequent relocation of the *yungas* trade route,

or both. In any case, it seems likely that the significance of regional exchange for the Taraco Peninsula communities was greatly decreased. I will discuss the importance of this fact at the end of this chapter.

7.5 Settlement and population

The settlement systems of the LF1 and the LF2 on the Taraco Peninsula are completely distinct. In the LF1, we observe population growth and the emergence of a three-tier site size hierarchy. In the LF2, however. population decreases significantly and site abandonment increases to a previously unknown rate. These differences suggest that completely distinct historical processes were operating in these two periods.

[11]The data available on exchange in the LF are extremely sparse. No firm conclusions can be reached in this regard without further research, specifically designed to study regional exchange. However, the suggestions offered here are certainly provocative, and will hopefully inspire more fieldwork.

	LF1	LF2
Number of sites	54	51
Phase population index	5581	4387
Annual population index growth rate	0.08	-0.12
Occupation continuity index	73	60
Site founding index	59	37

Table 7.2: Late Formative: Metrics

7.5.1 Late Formative 1

The LF1 settlement system clearly displays strong continuities with that of the MF. For the most part, the same villages remain prominent as in the MF. The LF2 settlement system may be described in terms of five processes: 1) decreasing population growth rate, 2) increasing settlement system stability, 3) an increase in the rate of founding of small settlements, 4) the emergence, for the first time, of a three-tiered site size hierarchy and 5) population decline or stagnation outside the major centers. I will discuss each of these in turn.

Decreasing population growth rate

The annual population growth rate in the LF1 decreases from the MF rate of 0.13% (Table 6.3) to 0.08% (Table 7.2). This is simply a continuation of a trend already observed in the MF. The value of 0.08% annual growth is comparable to Hassan's estimate of 0.1% annual population growth for preindustrial agrarian societies.

It is possible that the decrease in the population growth rate in the LF1 is no more than an analytical artifact. Since the population in the LF1 was becoming increasingly concentrated in larger sites (see below), and since larger sites are probably slightly underrepresented in my population estimates (see Chapter 4) the decrease in the growth rate could be an analytical artifact. Whatever the case, the population growth rate was roughly comparable to that of the MF and in line with expectations derived from cross-cultural comparisons. Thus, there is no reason to suspect that either immigration or outmigration

Period	a: Pop Index Hamlets	b: Phase Pop Index	a/b
EF1	237	693	0.34
EF2	415	1752	0.24
MF	324	3507	0.09
LF1	882	5581	0.16
LF2	1071	4387	0.24
Middle Horizon	1153	6923	0.17
Late Intermediate Period	1046	1408	0.74
Late Horizon	2156	3676	0.59
Early Colonial Period	4172	5021	0.83

Table 7.3: Hamlets as percentage of total phase population index, all periods

were taking place at significant rates.

Increasing settlement system stability

In the LF1 the occupation continuity index increased to 73% (Table 7.2), from its MF value of 64%. While this is not a terribly dramatic change, it does indicate that the process of "filling up" of the landscape, which I noted in my discussion of the MF settlement system, continued in the LF. Site relocation was very rare, since suitable locations for new villages were becoming scarce.

Increasing founding rate of small sites

On the other hand, the site founding index also increased slightly, from a MF value of 55% to 59%. These two facts appear to be contradictory. If the landscape of the Taraco Peninsula was filling up, why then do we witness an increase in the rate of founding of new sites? The solution to the conundrum is this: the increase in the site founding index is produced by the resurgence of a category of settlements I will call "hamlets". These are small settlements, inhabited by no more than a few families. For present purposes, and entirely arbitrarily, I will identify a hamlet as a sector with a population index value of less than 100.

Table 7.3 displays the ratio of total hamlet population index - so defined - to phase population index for each of the periods of Taraco Peninsula prehistory. The final column of the table represents the percent of the estimated population of the peninsula during a given period which was living in hamlets. Clearly, the percentage of the population living in hamlets hit an all time low in the MF. This is probably due to the existence of multiple competing polities on the peninsula (as discussed in Chapter 6), a situation which probably involved some degree of armed conflict and/or sporadic raiding. In such a context, living in hamlets in the countryside is rather more hazardous than joining a larger village community. In the LF1, however, the majority of the peninsula was politically unified (as I will argue below), thus making hamlet living a tenable option once more. Thus, the evident resurgence of the hamlet as a settlement category.

Three-tiered site size hierarchy

The EF2 settlement distribution was clearly unimodal, and the MF one was just as plainly bimodal (Figure 6.9). The LF1 settlement hierarchy, however, is more complex. The LF1 settlement distribution, shown on Figure 7.6, clearly displays two tiers of smaller sites. The smallest group consists of sites with population index values of less than 200, and the second group of sites have population index values between 200 and 500. However, there are two sites which are much too large to belong to either group. The larger of the two is Kala Uyuni (T-232), with a LF1 population index value of 883. The smaller is Kumi Kipa, with a population index of 647. Both of these sites grew much faster than any other sites on the Taraco Peninsula during the LF1 (see Figure 7.8a for a graphical representation). In fact, the growth rates of each exceeds the probable natural rate of increase, suggesting that considerable numbers of people moved to these locations from other villages on the peninsula. T-232 grew at an annual rate of 0.17% during the LF1. No growth rate can be calculated for T-272, since its has no MF occupation. However, the Santa Rosa group as a whole (T-268/T-271/T-272/T-322) grew at an annual rate of 0.29%[12] in the LF1.

What then is the relation between the Santa Rosa group and Kala Uyuni? My proposal, which must await evaluation by future excavations, is that the two are more sequential than

[12]The Santa Rosa group has collective population index values of 277 for the MF and 1216 for the LF1.

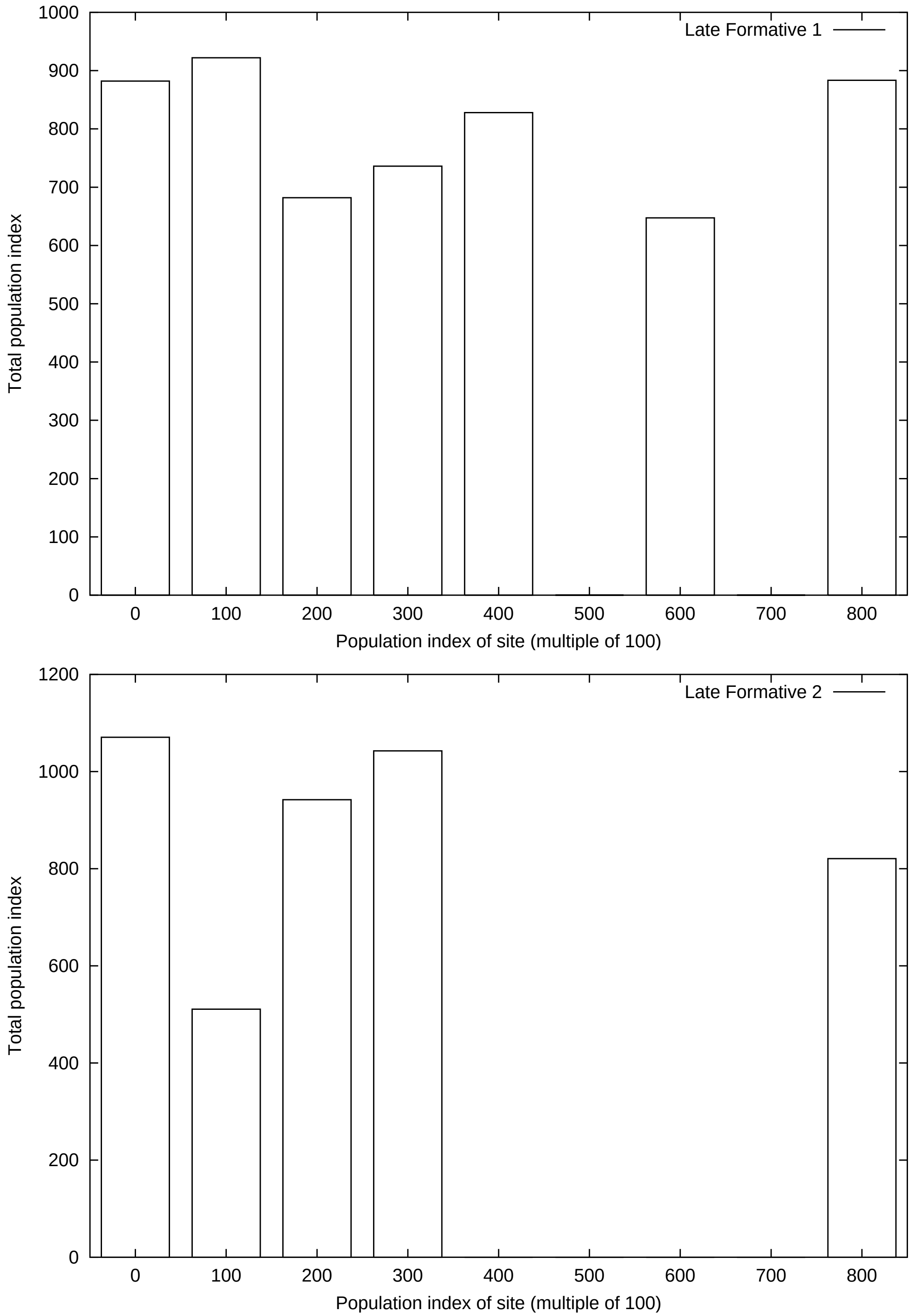


Figure 7.6: Late Formative site size distribution

contemporaneous. Put plainly, I believe that Kala Uyuni grew very rapidly in the earlier part of the LF1. At this time, the Santa Rosa group consisted probably of only Sonaji (T-271), then a small village relocated from the nearby MF site of Sunaj Pata (T-268). At some later point within the LF1, Kala Uyuni was almost completely abandoned, and the bulk of its population was relocated to the Santa Rosa group. This population relocation accounted in part for the very rapid growth of the Santa Rosa group. This scenario is lent further support by the fact that Kala Uyuni has large MF and LF1 occupations, but almost no LF2 occupation, while the Santa Rosa group was very small in the MF, but a major population center in the LF1 and LF2 periods.[13] The site size distribution presented in Figure 7.6 therefore represents the superposition of two sequential settlement hierarchies within the LF1 Period. Both of these hierarchies had three tiers of sites. The earlier had its center at Kala Uyuni, and the second at Sonaji/Kumi Kipa.

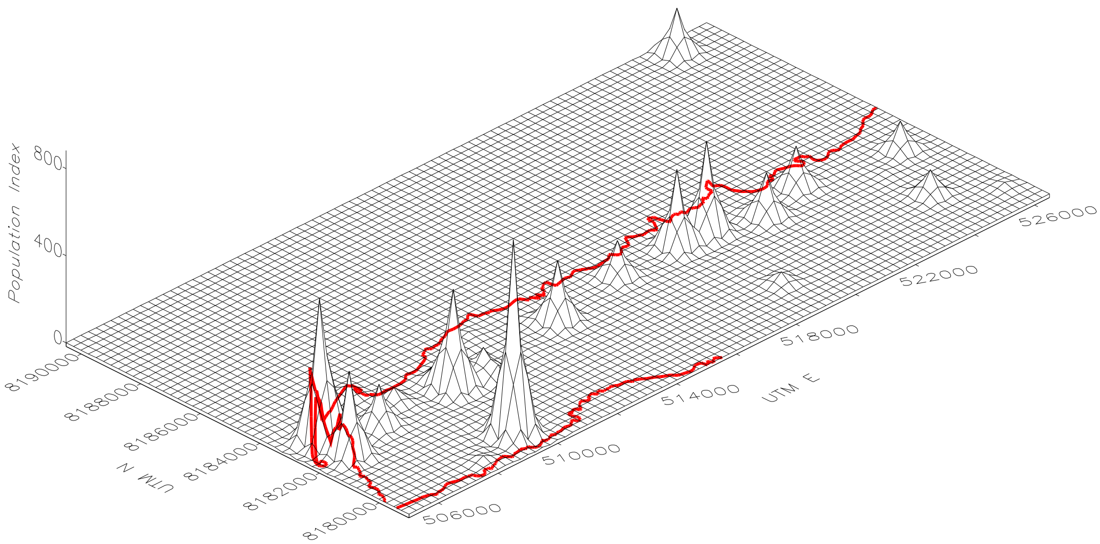
Population decline outside of the major centers

The rapid growth of the two sequential LF1 centers stands in sharp contrast to the remainder of the ancient Taraco Peninsula villages. As is clearly shown in Figure 7.8a, almost all the other sites in the survey area either lost population in the LF1 or grew at rates well below the phase average. All three of the major MF centers apart from Kala Uyuni (Chiripa, Yanapata and Janko Kala) lost population in the LF1. Most of the smaller villages decreased in size, as well. It is worth noting that this was the first time in the long history of human occupation on the peninsula that population growth had been so concentrated in such a small number of sites.

Taken together, the abnormally rapid growth of the center and the decrease in population elsewhere on the peninsula, as well as the emergence of a three-tier site size hierarchy, suggests the emergence of the first multi-community polity on the Taraco Peninsula. I will term this the “Taraco Peninsula polity”, since it seems to have had two sequential centers. Tribute and redistributive activity (read: ceremonial feasting) became increasingly concentrated in a single regional center. The independent competing leaders of the MF villages

[13] This population relocation was quite possibly associated with a lake level drop around 100 A.D.

- a) Late Formative 1



- b) Late Formative 2

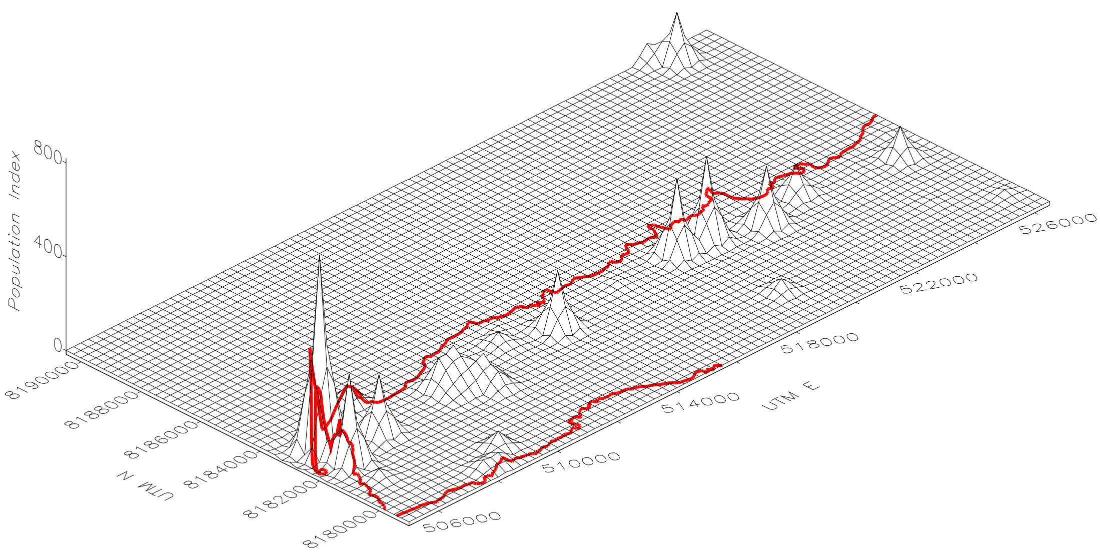
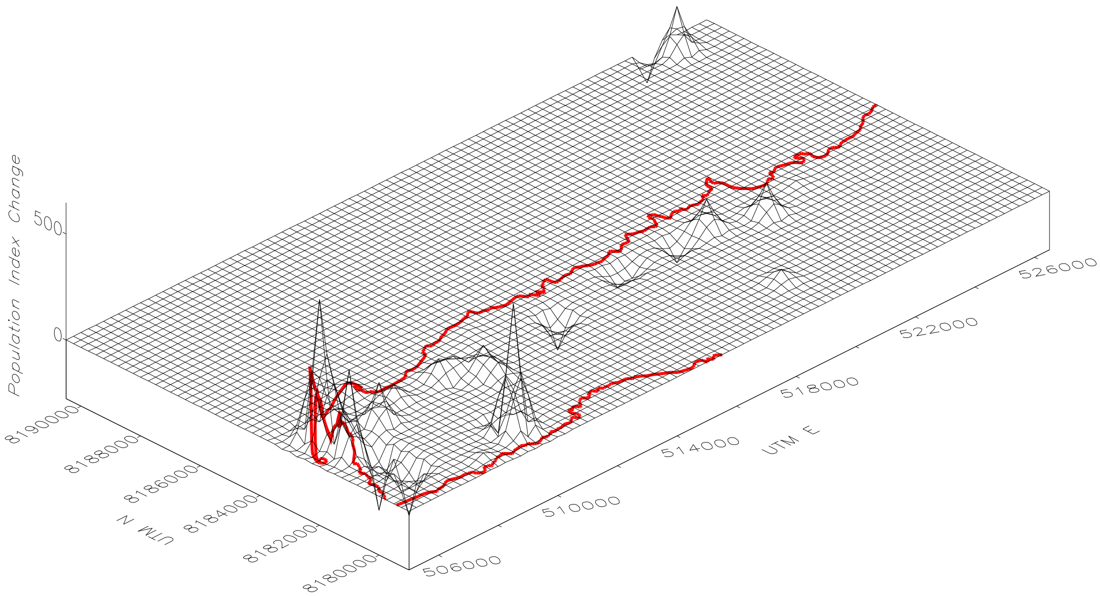


Figure 7.7: Late Formative: Sum of phase population index per 0.25 km^2

- a) Late Formative 1



- b) Late Formative 2

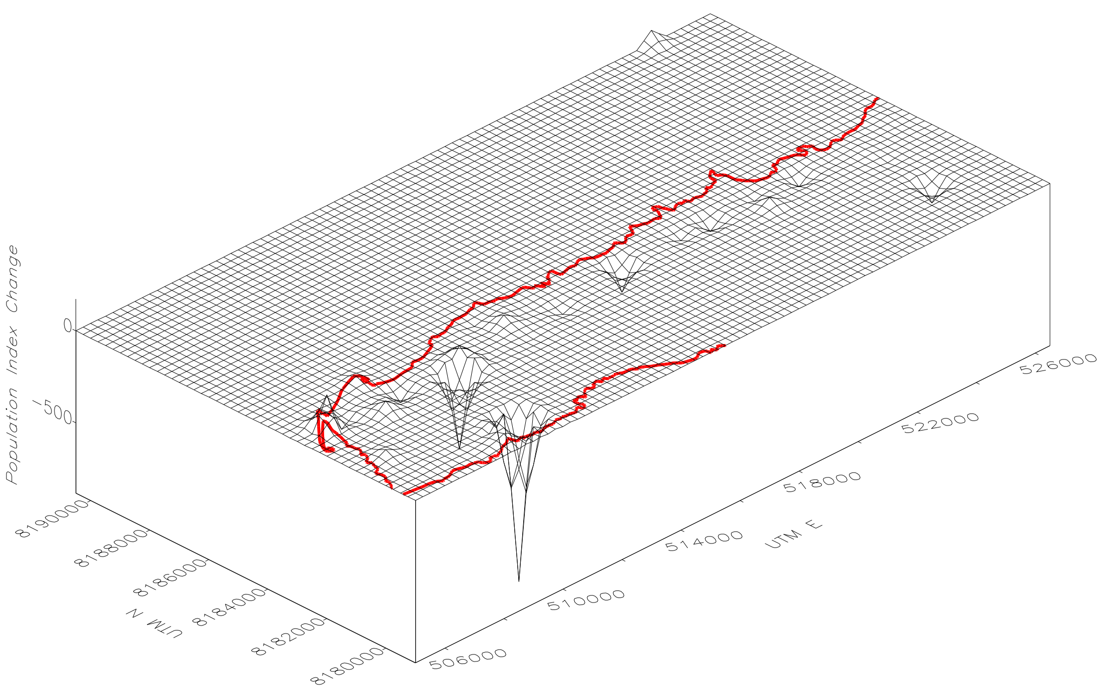


Figure 7.8: Late Formative: Change in phase population index per 0.25 km^2

were usurped by a more concentrated and powerful group of elites who resided at a single regional center. The mechanism by which this usurpation came about remains a mystery. It may or may not have involved force of arms. In any case, the increased spatial concentration of surplus collection and redistribution came to be a powerful settlement determinant, stimulating asymmetrical population growth.

This asymmetrical population growth need not have involved the active relocation of entire families or communities As I mentioned in Chapter 6, it could also be produced by an asymmetry in post-marital residential preference over a long period of time. However, in the case of the LF1 the fact that most smaller sites not only grew more slowly than the center, but actually decreased in size, strongly suggests at least some active relocation of established households from the smaller sites to the center.

Finally, there is one group of smaller sites within the project area which did not decrease in size during the LF1. These sites are all located in the north-eastern corner of the survey area, in the modern communities of Chiripa, Cala Cala, Huacullani and Sikuya. Considered together, these sites[14] have a collective population growth index value of 0.09% in the LF1. This is roughly comparable to the phase average of 0.08%. This group of sites, then, located on the eastern extremity of the survey area, does not seem to have experienced depopulation during the LF1, as did almost all sites located closer to Kala Uyuni/Santa Rosa. I interpret this fact as a relatively strong indication that these sites lay beyond the direct political control of the Taraco Peninsula polity. Thus, a line drawn between the "peaks" and the "troughs" on Figure 7.8a may indicate a boundary of sorts for the Taraco Peninsula polity. One of these independent sites is particularly interesting. Waka Kala (T-421) grew at an annual rate of 0.18% during the LF1, twice the phase average. Moreover, a public architectural complex was built on the site at this time, comprising a sunken court and several pieces of stone sculpture at minimum. [15] The construction of this architectural complex may be another indication of the site's political independence.

[14]Which include Chiripa Pata (T-4), Waka Kala (T-421), Alto Pukara (T-430) and what is now the island of Sikuya (T-319/T-320). At the time, of course, Sikuya was not an island, but a lakeshore site, the lake level being considerably lower than it is today (see Figure 7.5).

[15]This site is discussed in considerably more detail earlier in this chapter.

The existence of this small cluster of autonomous villages beyond the direct control of the Taraco Peninsula polity suggests a heterogeneous social landscape during the LF1 - at least at the regional scale - with occasional multi-community polities arising from a field of competing autonomous villages and village clusters. Archaeological survey of a larger contiguous area would allow us to discern exactly how common these polities were at this time in the greater region. At present, we can say for certain that at least two existed in the LF1 in the southern Titicaca Basin: the Taraco Peninsula polity, and the Tiwanaku polity. Others may have existed as well;[16] it is impossible to say given the current state of our knowledge.

7.5.2 Late Formative 2

The changes in the Taraco Peninsula settlement system which took place in the LF2 can only be described as catastrophic and unprecedented. For the first time the region's history, the entire peninsula suffered a population decline. The population index of the peninsula as a whole increased at a rate of -0.12% annually. Figure 7.8 shows that population decline took place across the entire peninsula. The only major village which was spared was the Santa Rosa group, which grew at an annual rate of 0.08% during the LF2.

In other words, the asymmetrical population growth discussed for the LF1 period continued into the LF2, with the Santa Rosa group growing at a rate disproportionate to that of the remainder of the Taraco Peninsula communities. Moreover, the three-tier site size hierarchy first observed in the LF1 continued into the LF2 as well (see Figure 7.6), with basically the same sites occupying each tier.

The difference, however, is that in the LF2 the growth rates of both the center and its tributary villages are much lower than in the LF1. This fact must be considered in light of the phenomenal urban growth that took place in Tiwanaku at this time. In the

[16] In fact, I believe I encountered the center of such a polity in 2000 while traveling with Kirk Frye south of Yunguyu. At the site of Kanamarka/Lakaya (see Stanish et al. 1997:92-93 for a brief description and photographs of part of the site). The LF1 component at the site seems to be at least 12 ha in area. An effigy mound, in the form of a stylized catfish (approximately 60X25 meters), was evident on the surface, and zoned-incised Kalasasaya ceramics were observed by myself and my companions. This would be the center of Stanish's "southern Ccapia polity".

LF2, Tiwanaku grew to cover perhaps as much as 100 ha,[17] and some of its principal monuments, including the Kalasasaya and the Akapana, seem to have been constructed. Tiwanaku's population growth rate during the LF2 was probably in the range 1% annually. Growth this rapid obviously implies an influx of population from the countryside. Thus, although the settlement determinants on the Taraco Peninsula itself seem to have remained roughly the same as in the LF1, the peninsula was incorporated into a larger system, that of the expanding Tiwanaku polity. The Santa Rosa group no longer occupied the apex of a three-tier site size hierarchy, but rather the second tier of a four-level hierarchy. It had become a regional administrative center of a state. To the existing population growth asymmetries was added a new factor: the draw of a rapidly-expanding urban center.

The population drawn from the Taraco Peninsula actually comprised a significant percentage of the population of LF2 Tiwanaku. The precise percentage can of course never be known. However, if we apply the methods we have used in the Taraco Peninsula analysis to the Tiwanaku case, we can produce a population index value of about 1000 for LF1 Tiwanaku, and 6500 for LF2 Tiwanaku. Given an annual rate of increase (r), an initial population value (I), and a span of years (y), the final population (F) can be calculated as follows:

$$F = I * e^{(ry)}$$

If we assume that the baseline annual population growth rate was 0.10% (an average of MF, LF1 and Tiwanaku population growth rates on the Taraco Peninsula), then the LF1 Tiwanaku population index value of 1000 would have produced a population index of 1221 over the 200 year LF2 period. Thus, Tiwanaku in the LF2 period gained about 5280 population index units over and above what would have been produced by the natural increase of its initial population. That is to say that about $\frac{5280}{6500-1000}$ or 96% of Tiwanaku's LF2 population growth resulted from immigration.

Given an initial population of 5581(Table 7.2), the natural increase of the Taraco Penin-

[17]This figure was produced by John Janusek using the soundings of Bennett, Kidder and the Wila Jawira project to define the boundaries of the LF2 ceramic distribution in the Tiwanaku urban core. It is obviously tentative.

sula population would have produced a final population of 6817 over the 200 year LF2 period. Therefore, the Taraco Peninsula, through population outmigration, probably to Tiwanaku, lost approximately 2430 population index units relative to what would have been produced by the natural increase of its initial population index value. Therefore $\frac{2430}{5280}$ or about 46% of Tiwanaku's LF2 population influx can be attributed to a flow of population from the Taraco Peninsula communities.[18] Given that the Taraco Peninsula was probably the locus of highest population density in the MF and LF1 in the entire southern Titicaca Basin, this should come as no surprise.

7.6 Discussion

I argue in Chapter 6 that in the Middle Formative access to exotic goods and extra-local trading partners was incorporated into a local system of status competition on the Taraco Peninsula. The peninsula's position on a probable trade route from the western Titicaca Basin to the lowland valleys or *yungas* (see Figure 6.8) was used by local leaders and groups to obtain exotic objects which were then strategically redistributed in public ceremonial or commensal contexts. Around 250 B.C., at the beginning of the LF1, the lake rose again to nearly modern levels. This would have interrupted the existing trade route, which would then have shifted to the south through Desaguadero and the Tiwanaku Valley (see Figure 7.5).

While this relocation of the late MF trade route would certainly have had an impact on the Taraco Peninsula communities, there is some evidence which suggests a more general and profound disruption of the regional exchange system at this time. Though firm evidence is lacking, it would seem that the olivine basalt hoes - the principal archaeological marker of the late MF exchange system - does not merely become less common in the LF1, but appears to vanish entirely. The dramatic increase in the frequency of quartzite and slate hoes noted by Janusek represents nothing other than an increased use of local lithic

[18] I should emphasize that this estimate is anything but precise. However, it does underscore the tremendous importance the incorporation of the Taraco Peninsula had in the process of Tiwanaku urbanization and state formation.

materials to replace the preferred but unobtainable basalt.

Of course, Incatunahuiri - the possible source of this basalt (see Chapter 6) - was not abandoned at this time, nor did hoe production cease there. This is clearly shown by the fact that at the nearby site of Camata, hoes of this material actually become most common (almost 90% of all lithic material) in the Pucara 2 phase, around 100 B.C. - 100 A.D. (Steadman 1995: 32). What happened to Incatunahuiri is that it fell under the influence of the Titicaca Basin's first urban center: the site of Pukara, located some 60 km northwest of Lake Titicaca. Incatunahuiri in the Late Formative Period was closely affiliated with Pukara. The hill on which it is located was remodeled, an imposing sunken court was placed at its summit, and a number of large stone sculptures in the Pukara style were either produced at the site or imported from elsewhere.[19] The nature of the Pukara polity is poorly understood, though research is under way to address the many questions with which it is surrounded (Cohen 2001, Klarich and Craig 2001). What does seem clear, though, is that Pukara was deeply involved in exchange networks connecting the Titicaca Basin to the Arequipa area (the principal source of obsidian; see Burger et al. 1998, Burger et al. 2000), the southern Peruvian (Bandy 1995, Feldman 1989, Feldman 1990, Goldstein 2000) and northern Chilean (cf. Conklin 1983) coasts, and the eastern valleys (Plourde and Stanish 2001; more generally see Mujica 1978, Mujica et al. 1983, Mujica 1985). It is possible that Pukara exercised a monopoly on the obsidian trade, at least for a period of its history, and it may have possessed or aspired to similar control of other commodities. Thus it may be that Pukara actually discouraged exchange relations between its trading partners and third parties. Put plainly, it is possible that in the LF1 period exchange between the southern and western areas of the Titicaca Basin was actively suppressed by the Pukara polity. Such a situation could potentially explain the sudden disappearance of olivine basalt from the southern basin at this time. However, this scenario must remain hypothetical pending further research.

This disruption of the late MF trade route and possibly of contact with the western Titicaca Basin would have created a crisis for leaders whose power strategies had come

[19]The site and its sculpture were described by Alfred Kidder II, and more recent work has been done by Kirk Frye (Frye and Steadman 2001 ;Kidder 1943).

to depend on easy access to imported goods and non-local social contacts. If we assume that the leaders of the various communities had all adopted broadly similar competitive strategies in the late MF, then we can hypothesize a generalized crisis of political legitimacy on the Taraco Peninsula at this time. What would such a crisis look like archaeologically? First of all, we might expect artifacts associated with the older strategies to disappear. This is precisely what happens with the Late Chiripa ritual feasting artifact complex. Second, we would expect local leaders to search for other more appropriate strategies, and therefore the appearance of new artifacts associated with these new institutions. This is exactly what happens when the Kalasasaya ceramics appear in the southern basin; a new set of artifacts, associated ideas and activities almost certainly resulting from imitation of Pukara ceramics and sculpture from the northern Basin.

In addition, we would expect some leaders to emerge from the crisis more successfully than others. This would mean that each community might have fewer leaders than before, and that some sites might rise to local prominence, subjugating or extracting tribute from their neighbors. This also seems to have taken place. Sometime early in the LF1,[20] the site of Kala Uyuni began to grow very rapidly, drawing population from the remainder of the sites on the peninsula. Simultaneously, a movement of population took place away from the large villages and into smaller farmsteads and hamlets. I interpret these facts, and the resulting emergence of a three-tier site size hierarchy, as indicative of the emergence of a multi-community polity centered at Kala Uyuni.[21] This polity was quite small-scale; it's eastern border seems to have fallen between the sites of Chiripa (T-1) and Chiripa Pata (T-4). In other words, there were many surrounding villages which were not tributary to Kala Uyuni.

This political development was accompanied by a wholesale transformation of the entire ceremonial complex which had characterized MF ceremonialism on the Taraco Peninsula and in adjacent areas. The characteristic Chiripa decorated ceramics, in continuous use

[20]There was probably a period of intense competition between and within the Taraco Peninsula communities during the first decades of the LF1. Certainly, there was time for the community of Chiripa to construct a larger and more elaborate mound, sealing - and fortuitously preserving - the Upper House Level complex. This probably would not have happened had it been immediately subjugated to Kala Uyuni.

[21]These trends are discussed in detail earlier in this chapter.

for over 600 years, were abruptly abandoned, replaced by the Kalasasaya complex. The latter includes significant imitation of the northern basin Pukara style. At the same time, the sunken court complex was reinvented, incorporating for the first time the large upright pillars that come to be characteristic of later Tiwanaku architecture. The association of stone tenon heads with sunken courts also begins in this phase. The overall impression is of a complete reinvention of ceremonial practices and political strategies. I propose that this was in response to the political crisis resulting from the lake level rise and concomitant shift in the trade route.

It was apparently also at this time (early in the LF1) that the site of Tiwanaku was first substantially occupied.[22] The Tiwanaku Valley had been home to a low-density population from the Early Formative period (Albarracín-Jordan 1992, Albarracín-Jordan 1996a, Albarracín-Jordan et al. 1993, Mathews 1992). However, in the LF1 the site of Tiwanaku was founded on the valley floor[23] and grew very rapidly to cover - by the end of the LF1 - something like 20 ha. This was comparable in size to the center of the Taraco Peninsula polity. We may suppose that it was the center of a contemporaneous and competing polity, employing the same basic ceramic, architectural and sculptural styles.

It is also informative to consider what happened in the Lower Tiwanaku Valley at this time. This area lies exactly between Tiwanaku and Kala Uyuni and had been home to a small but significant population in the MF. However it was almost completely abandoned in the LFI (Albarracín-Jordan 1992, Albarracín-Jordan and Mathews 1990, McAndrews et al. 1997). This seems to be a clear case of the formation of an unoccupied buffer zone between competing polities, as has been documented in many parts of the world.

The founding and rapid success of Tiwanaku and the Tiwanaku polity probably had everything to do with the lake level rise and the shift to the south of the late MF trade route. As Figure 7.5 makes clear, Tiwanaku was located precisely on the new trade route.

[22] There do appear to be several discontinuous MF occupations within boundaries of the later city of Tiwanaku (Blom, Janusek pers. comm. 2001). Little is known of them, however, and they probably represent hamlets or small villages.

[23] Virtually all EF and MF occupation in the Tiwanaku Valley was on the slopes of the flanking hills.

Though the trade passing along this route may have been much reduced relative to its MF level, as I discussed above, whatever exchange was taking place between the southwestern Titicaca Basin and the *yungas* in the early LF1 passed through Tiwanaku. The misfortune of the Taraco Peninsula communities was a positive boon to the inhabitants of the Upper Tiwanaku Valley, and a crucial element in the founding and early growth of the Tiwanaku polity. In fact, the site of Tiwanaku was quite possibly founded in a bid to control the new trade route.

Around 100 A.D. the level of Lago Wiñaymarka dropped suddenly, and the majority of the little lake again became dry (the shoreline was roughly the same as that indicated in Figure6.8). Once again, the shortest route between the western Titicaca Basin and the *yungas* passed through the Taraco Peninsula, as it had during the late MF. Though the magnitude of this trade was possibly reduced by the influence of the Pukara polity, a strategic position on the trade route was probably still desirable to local elites.

Such a consideration was probably the reason that the center of the Taraco Peninsula polity was relocated sometime during the LF1 from Kala Uyuni to the Santa Rosa group.[24] This group of sites, including Sonaji (T-271), Kumi Kipa (T-272) and Kollin Pata (T-322), is located precisely along the low lake stand trade route (Figures 6.8 and 7.3). The Santa Rosa group eventually grew to cover 21 ha by the end of the LF1, roughly the same size as Tiwanaku.

It may be that the Taraco Peninsula experienced a period of regional preeminence with its capital at Santa Rosa. If so it was short-lived. Around 300 A.D., at the beginning of the LF2, the level of the lake rose again, this time to modern levels. At this time, the site of Tiwanaku began to grow very rapidly, averaging around 1% annually for the LF2. The reasons for the process of urbanization are beyond the scope of the present study. We may note, however, several factors which fall within the terrain covered in this chapter. First, due to the rise in lake level, the trade route between the western basin and the *yungas* again passed through Tiwanaku. Second, the collapse of the northern basin Pukara polity, which took place around this time, would have removed any barriers to exchange with the western

[24] If the principal occupations of Kala Uyuni and the Santa Rosa group are indeed sequential. The issue is addressed earlier in this chapter.

Titicaca Basin which may have existed in the LF1. Thus, activity on the trade route which now passed through Tiwanaku was probably greatly intensified relative to LF1 levels.[25]

Whatever the reasons, Tiwanaku began to urbanize rapidly in the LF2. The Taraco Peninsula was one of the regions from which population flowed into the new city. In fact, it was the principal region, with as much as 46% of the population influx into Tiwanaku in the LF2 coming from the Taraco Peninsula communities. This significant loss of population to Tiwanaku suggests that at some point in the LF2 the Taraco Peninsula was incorporated into the Tiwanaku polity.

What do we mean when we say "incorporated into the Tiwanaku polity?" The immediate image that is evoked is one of military and political domination. That is, that Tiwanaku dominated the Taraco Peninsula militarily and extracted tribute from it. The flow of population from the Taraco Peninsula would then be caused by either forced relocation at the behest of the conquering polity or a natural response to a shift in the availability of tribute redistribution, or some combination of the two. This is an easy scenario to envision.

However, the military conquest scenario is incapable of explaining the population relocation I have been discussing. This is so because at the end of the LF1, before the population relocation began, the population of the Tiwanaku polity was probably less than $\frac{1}{3}$ that of the Taraco Peninsula polity.[26] It is difficult to imagine a polity of 1500 persons overcoming one with a population of 5500 by force of arms, especially since we have no evidence of any change in military technology at this time.[27] In other words, Tiwanaku military

[25]Other factors were no doubt of equal or greater importance. Most significant, perhaps, was the rise of raised field agriculture and its integration into strategies of statecraft and surplus extraction. The Taraco Peninsula is entirely unsuited to raised field agriculture and the Tiwanaku Valley well-suited (see Bandy 1999c; Bandy 2001).

[26]The combined phase population index value of the Lower and Middle Tiwanaku Valley for the LF1 is around 1100, as opposed to 5581 for the Taraco Peninsula. The phase population index of the Upper Tiwanaku Valley for the LF1 could not have been more than another 500-600, since there are very few Formative Period sites in that part of the valley, and the largest one apparently covers only 1.5 ha (Albarracín-Jordan et al. 1993: 77). These figures were produced using data collected by Albarracín-Jordan and his colleagues (Lower Tiwanaku Valley: Albarracín-Jordan 1992, Middle Tiwanaku Valley: Mathews 1992, Upper Tiwanaku Valley: Albarracín-Jordan et al. 1993), and must be considered approximate.

[27]The only significant change in military technology in prehistory seems to have been the introduction of the bow and arrow, which Bruce Owen has shown to be both earlier and less important than had been imagined (Owen 1998).

superiority only became possible *after* the population relocation which it was supposed to have explained.

All this is to say that military superiority was an *effect* rather than a *cause* of the population movement in question. The actual cause of this population movement cannot at present be established. Any hypothesis, however, must now take into account the fact that people were moving to Tiwanaku in large numbers from surrounding areas *in the absence of military coercion*. My favored explanation is that the leaders of the Tiwanaku polity invented a new type of political economy in the LF2. This new political economy used raised field agriculture and a polycyclic *strategy of staggered production cycles* (Bandy 1999c) to allow the extraction of a greater amount of surplus labor per person without interfering with the dryland subsistence activity of the commoner population (Bandy 2000). This increased surplus extraction could then have been used to underwrite an intensification of public ceremonialism and large scale feasting at the site of Tiwanaku itself, providing further inducement to the inhabitants of adjacent areas to change their residence. This process could have produced accelerating rates of immigration throughout the LF2, and the model can account satisfactorily for the urbanization of Tiwanaku.

This scenario is a hypothesis which is in need of testing. Whatever its validity, it is clear that by the end of the LF2, around 500 A.D., Tiwanaku was a city, and had become capable of dominating the entire Titicaca Basin politically, economically and militarily. At some point during the LF2 the Taraco Peninsula ceased to be an autonomous polity and became a heartland province of the Tiwanaku state.

Chapter 8

The Middle Horizon: the mature Tiwanaku state

The focus of this study is the Formative Period, and its demographic, political and economic processes. These have been discussed in some detail in the previous three chapters. Settlement data were of course collected for the post-Formative periods, as well. These data pertaining to later time periods will be presented in Chapters 8 through 10. However, their presentation will of necessity be abbreviated relative to the treatments of the Formative Period phases. A complete review of issues relating to the Middle Horizon, Late Intermediate Period and Late Horizon lies beyond the scope of this thesis.

The last chapter concluded with the observation that at some point during the LF2 the Tiwanaku polity achieved a definitive regional preeminence, coming to dominate other polities such as the Taraco Peninsula polity. A century or two after this occurrence, the ceramic, textile architectural and sculptural styles of Tiwanaku underwent a radical transformation. The change in ceramic styles has been described by Janusek and Kolata as follows:

> Ceramic patterns changed dramatically at the beginning of the Tiwanaku Period. Most notable was the adoption of red and black-slipped vessels by inhabitants of all sites in the Katari valley ... These included a wide variety of serving and ceremonial forms ... such as *keros*, *tazones*, and *sahumadores*. In addition, large *tinaja* storage vessels appeared, most made of durable orange paste,

> and they composed significant proportions of ceramic assemblages at all sites. The widespread distribution and use of elaborate decorated wares contrasted sharply with the Late Formative. The appearance of entirely new ceramic assemblages marked the adoption of entirely new technologies of manufacture, keyed to new daily practices and ideals ... Dramatic shifts in technology and in the widespread distribution of Tiwanaku-style vessels indicate that considerable changes in regional sociopolitical and economic patterns were afoot. (Janusek and Kolata 2001)

Just what these regional sociopolitical and economic changes might have been remains, of course, a mystery. Kolata proposes that at this time “Tiwanaku’s growing economic and political power transformed it from a locally-dominant force into an aggressive, predatory state with a penchant for territorial expansion” (Kolata 1993: 243). This may be. It would at any rate appear that a dramatic reorganization of the Tiwanaku polity took place around 500 A.D., and that this reorganization, whatever its specific motivation or character, produced the changes we see in the various types of material culture at the site and within its sphere of influence.

One of the domains of material culture which was dramatically affected was that of decorated ceramics. In the Late Formative decorated ceramics were quite rare and their distribution highly restricted. They seem to have been strictly associated with local and regional elites. In the Tiwanaku Period, by contrast, certain kinds of decorated ceramics - often displaying state-associated iconographic elements - achieved a level of ubiquity rarely witnessed in prehistoric states.[1] These vessels - principally *keros* and *tazones*, two varieties of flaring cup - are found in mortuary and domestic contexts representing all strata of society; access to them seems to have been almost universal. This has the happy effect of making surface identification of Tiwanaku period occupations a straightforward affair, as explained in the following section. Also, though, this same ubiquity implies a more direct connection between the Tiwanaku state apparatus and the commoner population itself. In other words, the state may have been attempting to reduce the importance of regional elites, such as - say - those of the old Taraco Peninsula polity. This suggestion finds unexpected

[1]Some classes of ceramics, typically the more elaborate and ornate forms, continued to have a restricted distribution.

support in the settlement analysis, as I discuss later in this chapter.

8.1 Phase definition

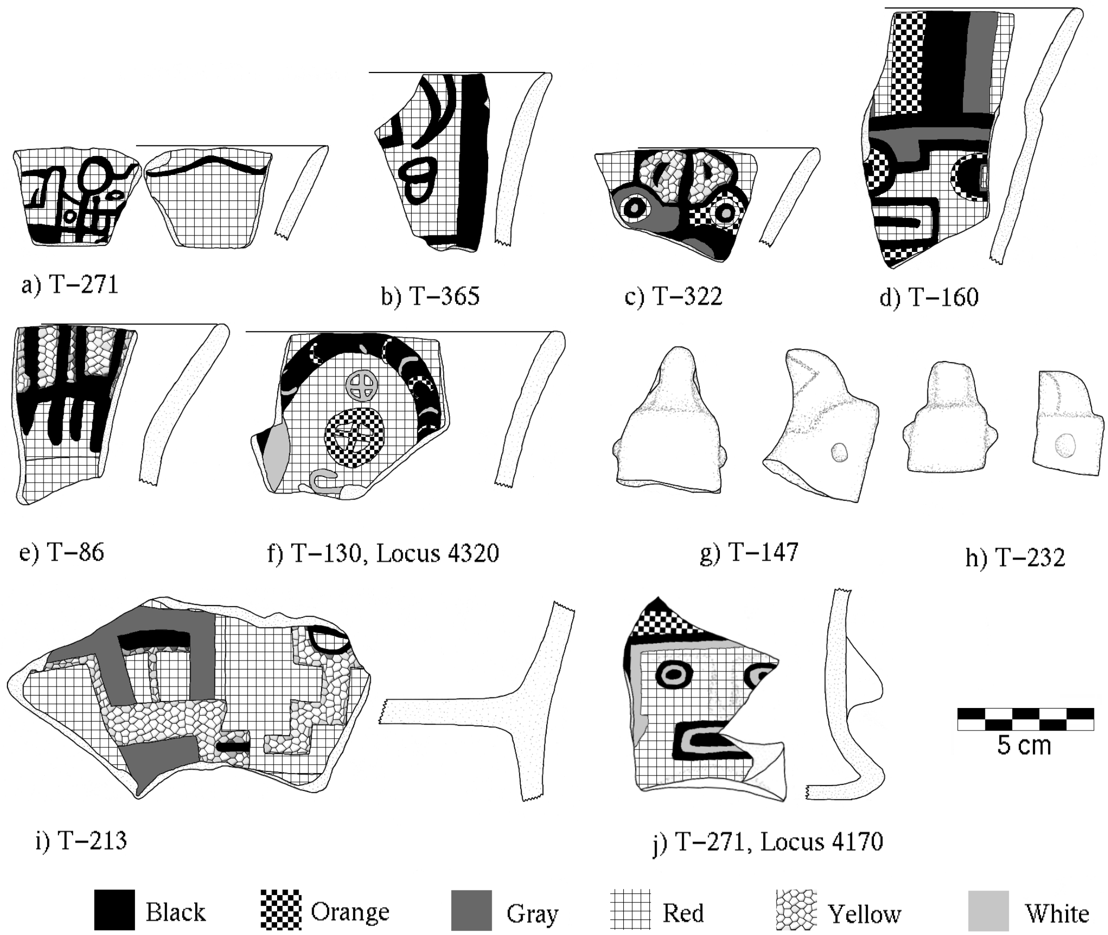
The Tiwanaku Period is easily identifiable in surface collections due to the high frequency of certain distinctive vessel forms and decorative techniques. Red-slipped *keros* and *tazones* (Figure 8.1a-d) - varieties of flat-bottomed hyperboloid cups - are absolutely diagnostic of this phase,[2] and very common. Brown and orange slips are also common, though less so than the red. Less common, though equally diagnostic, are flared-rim restricted bowls - *escudillas* (Figure 8.1e-f) - and large pedestal bowls often with evidence of burning on their interior - *sahumadores* or *incensarios* (Figure 8.1i). Both *keros* and *sahumadores* occasionally display zoomorphic modeled elements (Figure 8.1g-h). A specific variety of *kero* represents human facial features (Figure 8.1j).

Painted decoration is typically red on black. Polychromes are not uncommon however, and frequently incorporate orange, gray, yellow and white pigments in addition to black. Figurative elements include a wide variety of geometric motifs, as well as zoomorphic (felines, a variety of birds, camelids and even the occasional deer) and anthropomorphic (trophy heads, front-face and profile mythological figures, etc.) representations. Zoomorphic and anthropomorphic elements range from naturalistic to highly abstract and stylized.[3]

In his original statement of the Tiwanaku ceramic chronology Bennett distinguished between an earlier Classic and a later Decadent period (Bennett 1934). The Classic Tiwanaku ceramics were characterized by a relatively high frequency of polychromes, as well as by relatively naturalistic artwork. The Decadent Tiwanaku ceramics, by contrast, were duller - polishing being less common - with a lighter slip color. Decadent design motifs were highly abstract and stylized, with the naturalistic motifs of Classic ceramics - pumas, birds, humans - reduced to to geometric representations of metonymic elements. Basically, though,

[2] Very similar forms, though with rounded bottoms and slipped orange, yellow or a lighter red, exist in the following Early Pacajes phase. See Chapter 9.

[3] I do not pretend to offer a comprehensive review of Tiwanaku ceramics here. Many such treatments exist (e.g. Alconini Mujica 1995, Bennett 1934, Burkholder 1997, Goldstein 1985, Goldstein 1989a, Ponce Sangines 1981) and it is to these that I refer the interested reader.



a-d) *keros*, e-f) *escudillas*, g-h) modeled avian heads, i) *sahumador*, j) portrait *kero*.

Figure 8.1: Tiwanaku ceramics

the distinction between Classic and Decadent can be reduced to “a division of color treatment into a rich, varied group and drab, restricted group” (Bennett 1934: 403). Modified by Ponce (Ponce Sangines 1981), Bennett’s sequence has been generally adopted by more recent archaeological researchers.[4]

Bennett himself noted that “... the mass distinction of truly Decadent wares and truly Classic [is] an obvious one. However, detailed analysis proves embarrassing, because of the absence of sharp distinctions at any point.” (Bennett 1934: 404-405)[5] Here Bennett is saying that the distinction between the two phases is only a matter of changing frequencies of certain ceramic attributes. This presents a significant complication for settlement archaeology, as I discussed already in Chapter 3. When phases are distinguished only by attribute frequency, some mathematical technique must be employed to analytically separate the components of mixed surface assemblages. My treatment of the Chiripa ceramics is an example of such a technique. In the absence of this kind of methodology, the identification of components in complex mixed sites becomes difficult to the point of unreliability. Thus Bennett’s Classic-Decadent sequence has been troublesome to settlement archaeologists working in the Titicaca Basin.

Albarracín-Jordan, in his analysis of the settlement data from the Lower Tiwanaku Valley (Albarracín-Jordan 1992, Albarracín-Jordan 1996a), seems to have few reservations about identifying Tiwanaku IV as opposed to V components in mixed surface assemblages. James Mathews, who collaborated with Albarracín-Jordan on the Tiwanaku Valley survey, also attempted to distinguish Tiwanaku IV from V occupation sectors. However, he recognized that the procedure was questionable[6] and attempted - without success - to formulate a more reliable methodology (Mathews 1992: 131-135).

Settlement archaeologists working in the Titicaca Basin but outside the Tiwanaku

[4]The Proyecto Wila Jawira has also produced the beginnings of a new Tiwanaku Period chronology, primarily through the work of Alconini and Janusek (see Alconini Mujica 1995). This new chronology has yet to be applied successfully to mixed surface assemblages, however, or to settlement research (see Janusek 2001, Janusek and Kolata 2001).

[5]Thanks to James Mathews for pointing out the importance of this passage (Mathews 1992: 128).

[6]“... the distinction between uncontextualized Tiwanaku IV and V plainwares is a difficult (if not impossible) task at present, we are unable to ascertain the relative intensity of each phase of occupation at these sites with both types of decorated wares.” (Mathews 1992: 132)

heartland have not attempted to distinguish earlier from later Tiwanaku occupations, but have instead grouped all Tiwanaku materials under the rubric of "expansive Tiwanaku" or simply "Tiwanaku" (Hyslop 1976, Stanish and Steadman 1994, Stanish et al. 1997: 45). The same is true of more recent research in the Tiwanaku heartland (Albarracín-Jordan et al. 1993, Janusek 2001, Janusek and Kolata 2001). Thus, since there exists no accepted method of identifying Tiwanaku IV or V occupations in mixed surface assemblages, "[n]or is there a good consensus of what constitutes Tiwanaku IV versus Tiwanaku V decorated wares" (Mathews 1992: 128), I have opted in the present study to follow general practice and to combine all Tiwanaku IV and V style materials into a single long Tiwanaku Period.

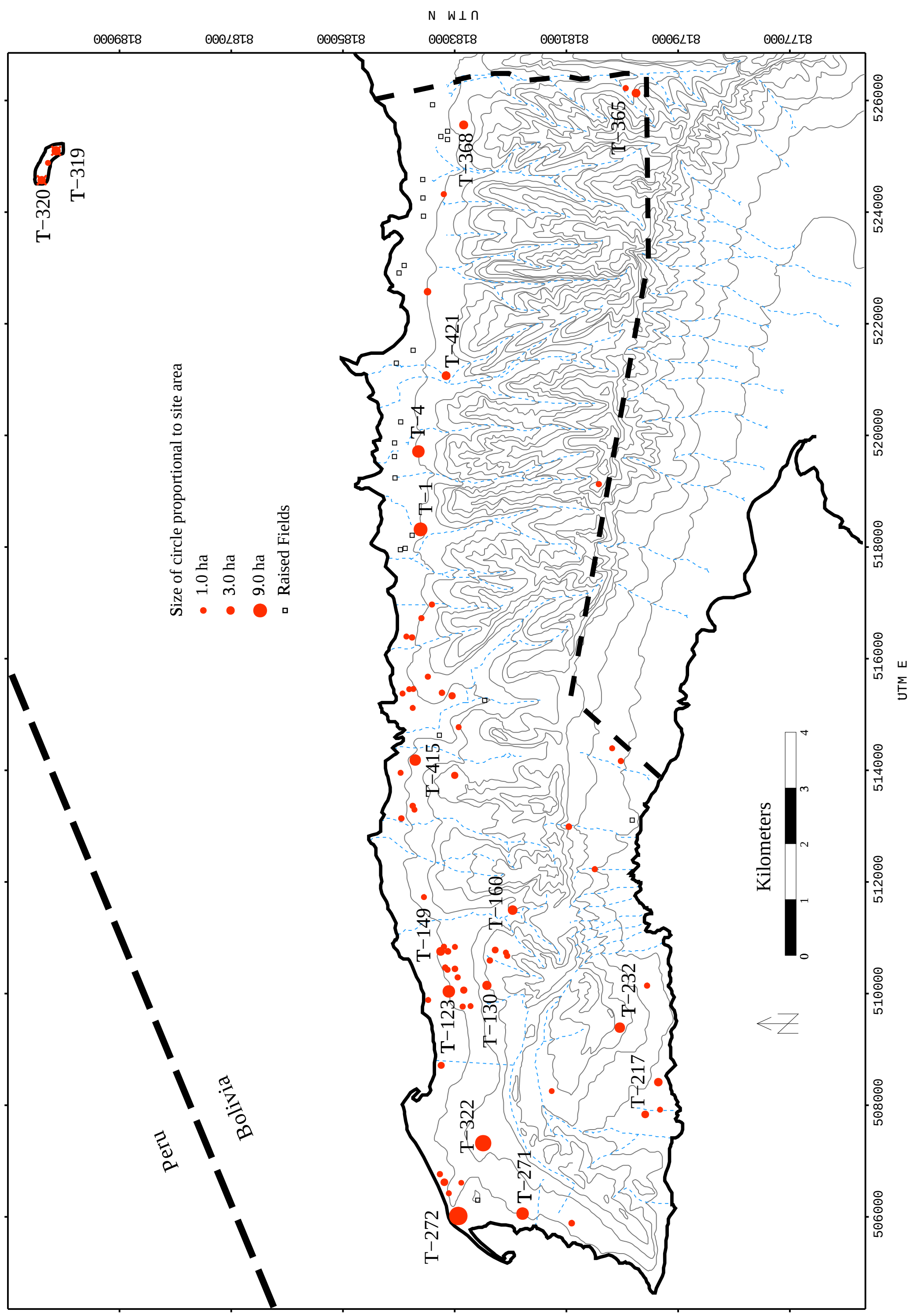
While the Tiwanaku decorated wares are highly distinctive and easily recognizable in mixed surface assemblages, Tiwanaku plainwares are another matter altogether. The latter seem to overlap significantly with both LF2 and Early Pacajes plainwares, making identification difficult. For this reason plainwares were not used for the identification of Tiwanaku occupations in the present study.

8.2 Principal sites

Seventeen sites were identified with Tiwanaku Period occupations greater than or equal to 3.0 ha. These are numbered on Figure 8.2 and are described below.

T-1G (Chiripa)

During the Tiwanaku Period Chiripa grew steadily. Sector G has a population index value of 523 (9.0 ha), as opposed to 322 for Sector F, an annual growth rate of 0.07%. This is approximately equal to the Taraco Peninsula phase average (see Table 8.1). In the settlement hierarchy of the Taraco Peninsula, Chiripa clearly occupied the second tier, with Yanapata (T-123/T-130), Titicachi (T-394/T-415) and Chiripa Pata (T-4).



Numbered sites are discussed in text.

Figure 8.2: Tiwanaku (Tiwanaku IV/V) Settlement Pattern

T-4E (Chiripa Pata)

Chiripa Pata experienced very slow growth at this time. Sector E has a population index of 429 (7.5 ha), as opposed to 353 for the LF2 sector D. This is an annual growth rate of 0.03%, considerably below the phase average. The role of Chiripa Pata in Tiwanaku Period Taraco Peninsula settlement hierarchy is uncertain. On the one hand, its large size seems to indicate that it is the smallest of the second-tier sites, with Chiripa (T-1) and Yanapata (T-123/T-130). On the other, its slow growth rate would place it with the tertiary villages.

T-123C (Yanapata Baja)

Considered as a single site, Yanapata Baja grew quite rapidly in the Tiwanaku Period. Sector C has a population index of 429 (7.5 ha), and the site seems to have been unoccupied during the preceding LF2. This growth is perhaps even more impressive when Yanapata Baja is considered as part of the larger Yanapata group, together with T-130. Considered as a whole, the estimated population of the Yanapata group grew from 17 (a hamlet) to 630 during the Middle Horizon, an annual growth rate of 0.56%. Growth this rapid clearly indicates a population influx from outside the boundaries of the local community, and suggests some form of population resettlement programme on the part of the Tiwanaku state or its local representatives. Whatever the case, the Yanapata group was clearly one of the secondary sites of the Taraco Peninsula at this time, together with Chiripa (T-1).

T-130F (Yanapata)

Yanapata grew rapidly, from an estimated population of 17 for Sector E to 201 (3.75 ha) for Sector F. Together with Yanapata Baja (T-123, see description above), the site formed part of the Yanapata group, one of the principal settlement loci of the Middle Horizon Taraco Peninsula.

T-149A

This site is a large sherd scatter located in the modern community of Nachoca. The scatter covers some 3.4 ha of fallow fields downslope of the modern road, and West of the modern church and school complex. Sherd density is generally very light to to a lack of recent agricultural activity. The Tiwanaku Period occupation (Sector A) was the first on this site, extending over the entire area. The sector has an estimated population of 180 persons, thereby falling into group of tertiary settlement on the peninsula (those with population indices below 300). No evidence of any form of corporate construction or ritual is visible.

T-160B (Pichuria K'ucha)

Pichuria K'ucha is a large sherd scatter located in the modern community of Nachoca. The scatter is continuous and very dense, covering 4.25 ha. The site appears to be deeply stratified. At the time of my visit, a large portion of the site had only recently been plowed with a tractor for the first time. Large sherds and whole vessels had been exposed, together with many features such as hearths and burials. The site clearly represents a medium-sized Tiwanaku village, with a population index of 231 (Sector B). With the exception of the tractor-plowing the site seems to be reasonably intact. Only one modern house (of two stories) is located on the site itself.

The site is very unusual in one respect at least. It is located on a low terrace at the confluence of two perennial watercourses, at the bottom of a *quebrada* and at a considerable distance (> 2 km) from the lakeshore. It is one of only two sizable Tiwanaku sites on the Taraco Peninsula (the other being T-365, below) which is not located on the lake-facing slopes of the hills, and within 1 km of the lakeshore. The significance of this topographical distinction is uncertain, but probably indicates agricultural intensification in less-desirable locales.

There seems to have been a very ephemeral LF2 occupation on the site, as well (Sector A). This was a small farmstead, with a population index of only 6.

T-217B

This site comprises a medium-sized (3.0 ha) sherd scatter located on a low rise on the lake plain in the community of Coa Kkollu. In regard to its topographical placement, the site is somewhat different from most Tiwanaku sites on the Taraco Peninsula, and is directly comparable to the slightly smaller (and nearby) T-213, and to the slightly larger site of Iwawe or Ojepuko (TMV-150), in the adjacent community of Iwawe Grande (Albarracín-Jordan 1992, Albarracín-Jordan 1996a, Burkholder 1997). Sector 217B, the Tiwanaku occupation, has a population index of 157. A smaller LF2 occupation is also present at the site (Sector A, population index 43).

A nearby Early Colonial hamlet (T-216) has a large (approximately 0.7 x 1.0 m) andesite block on the surface. This block is probably from T-217 originally. No other evidence of stone working or construction is present on the surface.

T-232E (Kala Uyuni)

As mentioned in Chapter 7, Kala Uyuni was the principal population center on the Taraco Peninsula during at least part of the LF1. During the LF2 it was virtually abandoned, an event probably associated with the incorporation of the peninsula into the Tiwanaku polity. During the Tiwanaku Period, the site again grew rapidly, from a LF2 population index of 70 (Sector D) to 291 (5.25 ha) in the Middle Horizon. This represents an annual growth rate of 0.22%, much higher than the phase average and probably indicative of an intentional repopulation of the locality. It was never again to be the principal settlement on the peninsula, however, and can be considered a tertiary site in the Tiwanaku Period settlement hierarchy.

T-271D (Sonaji)

Sonaji grew very slowly during the Tiwanaku Period. Sector D has a population index value of 429 (7.5 ha), as opposed to 368 for the LF2 Sector C. This is an annual growth rate of only 0.02%, well below the phase average. Judging by the fancy Tiwanaku ceramics present on the surface of the site, as well as from evidence of Tiwanaku Period monumental construction, it would seem that Sonaji continues to serve as the locus of public ritual and perhaps elite habitation for the Santa Rosa group (T-271/T-272/T-322; see sections 7.2.1 and 7.2.2).

The Santa Rosa group as a whole grew from a population index value of 1435 for the LF2 to 1959 for the Tiwanaku Period. This is an annual growth rate of only 0.05% again below the phase average of 0.08% (Table 8.1). Thus the Tiwanaku Period settlement system as a whole evidences a reduced importance of the largest sites on the peninsula, and higher relative growth in the lower tiers of the hierarchy. This in turn indicates a transformation of the political economy, as will be discussed at more length later in this chapter.

T-272D (Kumi Kipa)

Kumi Kipa is also a part of the Santa Rosa group, together with Sonaji (T-271) and Kollin Pata (T-322). It experienced basically zero growth in the Tiwanaku Period. The LF2 Sector C has a population index of 821, while Sector D has a value of 836 (14.0 ha). This is an annual growth rate of 0.00%. As was the case in the LF2 (see section 7.2.2), the ceramics at Kumi Kipa are on balance decidedly more utilitarian than those at the nearby Sonaji, suggesting primarily domestic habitation and productive activity, and a lack of public ritual.

T-319C (Sikuya Este)

This site seems not to have grown at all during the Tiwanaku Period. Sector C has a population index value of 204 (3.8 ha), the same as that of the Sector B. This determination is somewhat problematic, however, since the site was not systematically surface collected.

T-320C (Sikuya Oeste)

Sikuya Oeste experienced fairly rapid growth during the Tiwanaku Period. Sector C has a population index value of 157 (3.0 ha), up from 70 for the LF2 Sector B. This is an annual growth rate of 0.12%, considerably higher than the Taraco Peninsula phase average. Taking the two Sikuya sites (T-319/T-320) together, we observe an annual population growth rate of 0.04% for the entire island. This is lower than the phase average and would seem to indicate a degree of outmigration. Again, however, we must remember that population index estimates for the Sikuya Oeste are complicated by considerable modern disturbance.

T-322C (Kollin Pata)

Kollin Pata belongs to the Santa Rosa group of sites, together with Sonaji (T-271) and Kumi Kipa (T-272). Of these three sites, Kollin Pata was the only one to experience appreciable growth during the Tiwanaku Period. Sector C has a population index value of 693 (11.73 ha), as opposed to 246 for the LF2 Sector B. This is an annual growth rate of 0.16%. This is twice the Taraco Peninsula phase average (see Table 8.1). Like Kumi Kipa, the ceramics seem to indicate a predominantly domestic occupation.

T-365A (Jacha Winto)

Jacha Winto is a substantial, dense sherd scatter, located on the slopes of a large *quebrada* in the modern community of Huacullani. The scatter covers 3.23 ha, with a population index value of 170. Near the center of the site is a substantial terrace (50x50 m) which may represent some for of corporate construction.

Like Titicachi (T-415), Jacha Winto is unusual in being a single component Tiwanaku site. It is further distinguished by being only Tiwanaku Period village located more than 2 kilometers from the modern lakeshore. In fact, it lies almost 5 km from the lakeshore, more than twice as far as the next most distant Tiwanaku village in the survey area (Pichuria K'ucha, T-160). The *quebrada* in which the site is located is unusual in that it is the only place between Taraco and Tambillo (a > 40 km stretch of the Taraco hills) that is a major thoroughfare between the lakeshore and the Tiwanaku Valley. The modern road passes through the community of Rosa Pata and connects Huacullani with the Tiwanaku Valley town of Pillapi, and is passable by motor vehicles year-round. This was almost certainly an important road in prehistory as well.

Jacha Winto has a third distinction: it is the only Tiwanaku site in the Taraco Peninsula survey area on which I found non-local Middle Horizon ceramics. One fragment of a ring-footed vessel of the Mojocoya Tricolor style - possibly from the Cochabamba region - was recovered from the surface. This specimen, not illustrated here, is almost identical to one published by Janusek in his dissertation (Janusek 1994:Figure 10.26).

T-368E (Tilata)

Tilata is a small village site located in the modern community of Huacullani, not far from the eastern boundary of the survey area. The sherd scatter covers 3.56 ha, and contains ceramics from most periods in the regional sequence. It seems to have been continuously occupied from the EF2 Period through the Late Horizon.

The site is located on the lower slopes of the hills, facing to the North. The lakeshore is at present more than 1.5 km north of the site. The valley bottom adjacent to the site is occupied by a large swampy area containing the remains of numerous raised field agricultural features. Many of these were almost certainly worked during the Tiwanaku Period occupation of Tilata.

Roughly in the center of the sherd scatter the is situated a substantial mound construction, some 50x50 m. Atop this mound, which is certainly prehispanic in date, is a modern house belonging to the current owner of the site. The house itself contains numerous shaped stone blocks of both andesite and sandstone. These blocks were almost certainly recovered from the remains of prehistoric structures. The andesite, at least, probably dates to the Tiwanaku Period. This is a clear indication of at least a modest public architectural construction at the site. This was almost certainly located on the mound itself.

The mound seems to have been used as a cemetery in post-Tiwanaku times, and a number of looted stone cyst tombs are evident on the surface. The landowner showed me several complete vessels he had encountered while working the fields, including a complete Tiwanaku kero and a Late Horizon aryballoid vessel. He also informed me of a sculpted stone plaque, which from his cursory description may date to the MF or LF1 Periods. The piece was buried under a cache of dung fuel at the time of my visit, and I have been unable as yet to return to document the specimen. I should also note that both Cesar Callisaya and

John Janusek have informed me on separate occasions that they had visited the site some years beforehand and had encountered stone tenon heads on the surface. I found none of these during my own inspection, however.

The site was initially occupied during the EF2 Period. It grew slowly through the MF and LF1 and LF2 Periods. Its growth continued during the Tiwanaku Period. Sector E has a population index of 190, up from 131 for the LF2 Sector D, an annual growth rate of 0.06%. This is somewhat below the phase average, though it must be remembered that this particular site was not surface collected, and that these sector size determinations are therefore provisional.

Finally, it must be noted that this site lies in the border zone between the Taraco Peninsula and the Pampa Koani. The Tiwanaku period city of Lukurmata (cf. Bermann 1990, Bermann 1994, Janusek 1994) is in fact visible from the site. I imagine, though I cannot at present demonstrate this, that Tilata fell within the economic and administrative orbit of Lukurmata. Settlement determinants in the Pampa Koani at this time (see Janusek and Kolata 2001) were very different from those on the Taraco Peninsula. In considering the settlement history of Tilata and nearby sites this fact cannot be forgotten.

T-415A (Titicachi)

This site is a large, dense sherd scatter located on the lower slopes of the hills very near to the lakeshore in the modern community of Zapana. The scatter extends over 6.20 ha (population index value: 349), and seems, very unusually, to represent a single-component Tiwanaku Period occupation. No sherds of any other time periods were recovered after an extensive review of the surface. The slope on which the site is located faces East.

There are two probable mound constructions on the site, though both have been disturbed by plowing. One is located in the northern portion of the site, and the other in the southern. Both measure approximately 30x30 m, and a more terraces than mounds. Both stand about 2 m high on their downslope faces. The northern feature is rather uncertain, its topographical features having been effaced by agricultural activity and lacking cut stone on the surface. It could conceivable represent a more recent accumulation of stones resulting from field clearing activity, The southern feature is undoubtedly a monumental terrace, however, and several large cut stone blocks are present on the surface. One of these is of limestone, the other of andesite.

Titicachi is located approximately 750 m north of the site of Janko Kala (T-394). Janko Kala was a major center in the LF2, and earlier, but in the Tiwanaku Period was almost abandoned. The population index of that site dropped from 246 for the LF2 Sector E to a mere 84 for Sector F. At this precise time Titicachi was founded less than a kilometer away. Titicachi, therefore, almost certainly represents a relocation of the community which formerly occupied the site of Kanko Kala. Combining the population indices of the two sites we can calculate an annual population index growth rate of 0.09% for the Tiwanaku Period. This growth rate is only slightly higher than the phase average, and is directly comparable to that of Chiripa at this time. We may consider this community a secondary settlement locus, comparable to Chiripa (T-1) and Yanapata (T-123/T-130).

T-421G (Waka Kala)

Waka Kala is one of the few sites which experienced depopulation during the Tiwanaku Period. Sector G has a population index value of 186 (3.5 ha), down from 246 for Sector F. This represents an annual growth rate of -0.04%. The nearby site of Alto Pukara (T-430) experienced an even more dramatic decline in population at this time, decreasing from 127 to 84, an annual growth rate of -0.06%. These two sites, very near to one another, fall into an intermediate zone between the administrative spheres of Sonaji (the Santa Rosa group) and the much larger and more important site of Lukurmata in the Pampa Koani. As mentioned briefly above in my discussion of Tilata (T-368), the settlement processes taking place on the Pampa Koani in the Tiwanaku Period seem to have been very different from those on the Taraco Peninsula. This difference can, I believe, account for the apparently anomalous decline in the population indices of these sites when compared to general population growth on the Taraco Peninsula at this time. I will take the up the matter again shortly.

	Tiwanaku
Number of sites	69
Phase population index	6923
Annual population index growth rate	0.08
Occupation continuity index	55
Site founding index	59

Table 8.1: Middle Horizon: Metrics

8.3 Settlement and population

Several aspects of the Tiwanaku Period settlement system are worthy of note. First of all, after the radical population decline in the LF2, population growth returned to normal in the Middle Horizon. The annual rate of population growth for the Taraco Peninsula as a whole was 0.08% during the Tiwanaku period (Table 8.1), close to what is an expected growth rate for preindustrial village societies. This means that the dramatic population movement from the Taraco Peninsula into the urbanizing center of Tiwanaku had ceased. This is not to say, of course, that Tiwanaku ceased to grow. It continued to increase in size, though at a slower rate than in the LF1.[7] It is only to observe that the population moving into Tiwanaku was coming from somewhere other than the Taraco Peninsula.

Secondly, there are some indications that the settlement system was reorganized during the Tiwanaku Period, though not in an especially dramatic way. For one thing, the occupation continuity index value for the Tiwanaku Period fell to 55%, from 60% for the LF2 and 73% for the LF1. At the same time, the site founding index increased to 59% from the LF2 value of 37%. Thus, sites were being abandoned and founded - in some cases relocated - at higher rates than in the preceding period.

As far as the site size hierarchy is concerned, the Tiwanaku Period is not so different from the Late Formative. The Taraco Peninsula settlement system still displays a three-tier

[7] Tiwanaku grew at an approximate annual rate of 0.30%, as opposed to about 1% annually during the LF2. It should be remembered, though, that this is still a quite rapid growth rate and probably still implies considerable immigration from subject regions.

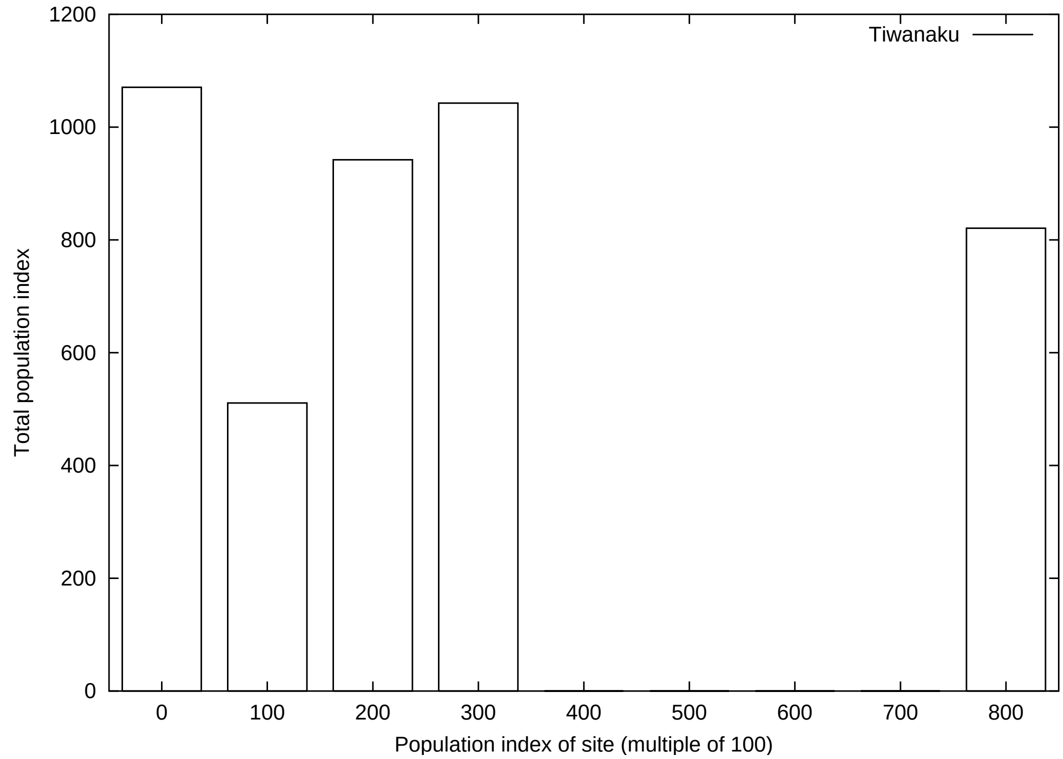


Figure 8.3: Middle Horizon site size distribution

site size hierarchy (Figure 8.3), just as it had in the LF1 and LF2. In fact, the same sites, roughly, occupy the same positions in the settlement hierarchy. The Santa Rosa group (T-271/T-272/T-322) continues to be by far the largest population concentration on the peninsula, with a total of more than 33 ha of occupation area. Chiripa (T-1), Yanapata (T-123/T-130), Titicachi (T-394/T-415)[8] and Chiripa Pata (T-4) continue to occupy the second tier. In addition, Tiwanaku itself became a primate center sometime in the LF2, alone comprising a fourth, higher-level tier in the settlement hierarchy.

However, if we look carefully at the relative population growth rates of the various levels in the Tiwanaku Period site size hierarchy (Table 8.2), it becomes clear that in fact an important change has taken place in relation to patterns observed in the Late Formative. It will be recalled that in both phases of the LF, as discussed in Chapter 7, an asymmetry was

[8] Titicachi being, of course, the new location of the major Formative Period village of Janko Kala.

Tier	Pop index LF2	Pop index Tiw	Annual pop growth rate
Tiwanaku	~6403	~39349	~0.30%
1	1435	1959	0.05%
2	938	2016	0.13%
3	2014	2948	0.06%
All Taraco Peninsula	4387	6923	0.08%

Tier 1: T-271, T-272, T-322

Tier 2: T-1, T-4, T-123, T-130, T-394, T-415

Tier 3: The remainder.

Table 8.2: Population growth rate by settlement hierarchy tier

noted in the growth rates of the various settlements on the Taraco Peninsula. Throughout the Late Formative, one group of sites, comprising the political and demographic center of the peninsula, grew relatively very rapidly. In the early LF1 this was Kala Uyuni, and in the later LF1 and the LF2 it was the Santa Rosa group. The remainder of the sites on the peninsula grew more slowly. Additionally, a trend was noted to the effect that smaller sites (hamlets and smaller villages; third-tier settlements) increased in terms of their collective size, while the middle range sites, those of the second-tier, grew slowest of all. This fact was interpreted as reflecting the political and economic dominance of the leaders of the first-tier community, and the decreasing importance and influence of the leaders of the second-tier communities. This configuration was argued to be consistent with the formation of a multicommunity polity, and the usurpation the functions of the second-tier leaders by those of the first tier.

The Tiwanaku Period settlement data present exactly the opposite picture (Table 8.2). in the Tiwanaku Period the first- and third-tier sites grew at a rate below the phase average (0.05% and 0.06% annually, respectively), while the second-tier sites grew more rapidly, at an annual rate of 0.13%. This fact is extremely interesting. I interpret it as suggestive of a change in strategies of Tiwanaku administration on the Taraco Peninsula. If in fact Tiwanaku politically dominated the peninsula during the LF2, it did so through the

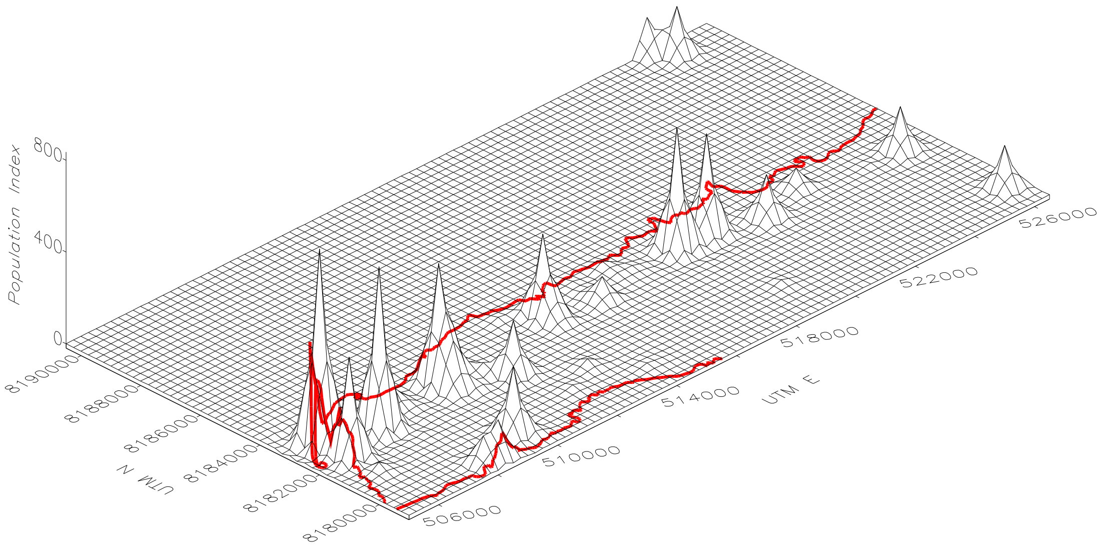


Figure 8.4: Tiwanaku: Sum of phase population index per 0.25 km^2

intermediation of the leaders of the Santa Rosa group. These leaders, by virtue of their intermediate position, retained access to resources and to labor sources which were not available to leaders of the second-tier communities. In the Tiwanaku Period, by contrast, it appears that the Tiwanaku state circumvented the Santa Rosa group to some degree. The disproportionate growth rate of the second-tier sites at this time suggests that the leaders of these communities had increased in importance and in access to resources (by this time less exotic trade goods and more special craft goods produced and distributed by the state apparatus). On the Taraco Peninsula, at least. it seems that the mature Tiwanaku state was administered on a community by community basis, and that the importance of the regional capital (the Santa Rosa group) had begun to wane. This scenario is entirely consistent with my earlier suggestions regarding the near-universal distribution of decorated pottery in the Tiwanaku period. The elites of the old Taraco Peninsula Polity were no longer capable of monopolizing decorated ceramics. I take this to be another indication of their increasing irrelevance.

Of course, there is no reason to suppose that this pattern characterized Tiwanaku administration in all of the heartland provinces. In the Katari Basin, at least, there is ev-

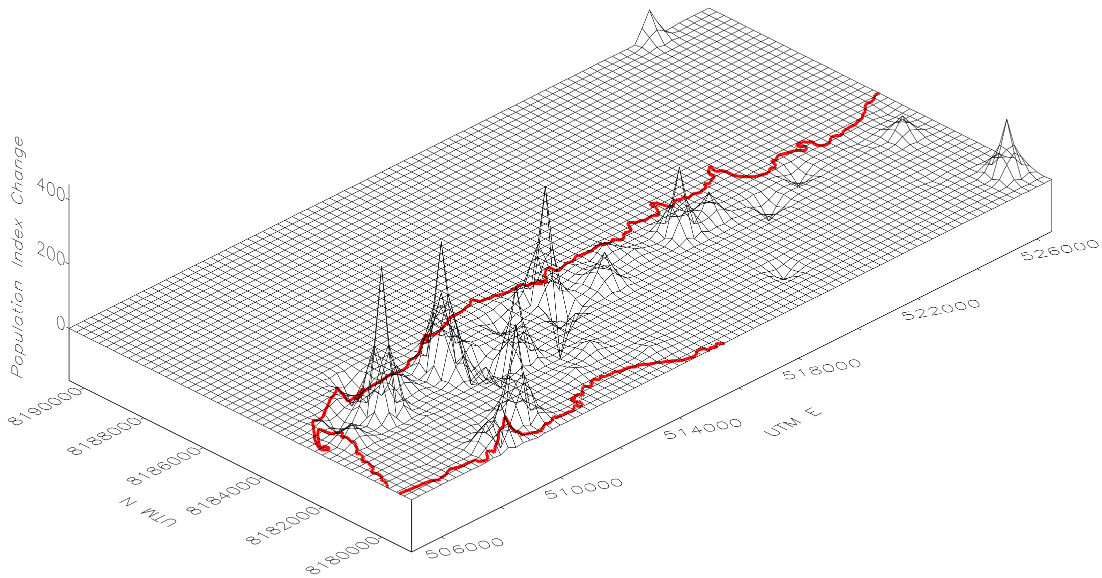


Figure 8.5: Tiwanaku: Change in phase population index per 0.25 km^2

idence that the role of the regional capital - Lukurmata - increased vastly in importance during the Tiwanaku Period. Janusek has estimated that the area of the metropolitan cluster of Lukurmata in the Tiwanaku Period was close to 200 ha, some 87% (200/229 ha) of the total Tiwanaku Period occupation area recorded in his Pampa Koani survey area (Janusek and Kolata 2001). We may suppose, therefore, that the settlement determinants of the Pampa Koani settlement system were radically different from those of the Taraco Peninsula, and that these settlement determinants were largely formed by Tiwanaku administrative strategies in the two regions. On the Taraco Peninsula, an existing primate settlement distribution was diluted by simultaneous stagnation of the old center and disproportionate growth of the second-tier sites. In the Pampa Koani, by contrast, the old center (Lukurmata) grew at a tremendous rate, while other sites were either abandoned or grew at a much slower rate.

In fact, it is of the utmost interest that the sites in the easternmost portion of the Taraco Peninsula seem to have grown at a much slower rate than those to the west (Table 8.3). This is the precise opposite of the situation noted for the LF1 (see Chapter 7). The reader will recall that I presented an argument for locating the boundary of the Taraco Peninsula polity

UTM East	Pop index LF2	Pop index Tiw	Annual pop growth rate
< 519000 (West)	3149	5454	0.09%
> 519000 (East)	1238	1469	0.03%
All Taraco Peninsula	4387	6923	0.08%

Table 8.3: Population growth rate by UTM easting

between the sites of Chiripa (T-1) and Chiripa Pata (T-4), since sites to the West of this line seem to have been impacted by the expansion of the Taraco Peninsula capital, while sites to the East seem not to have been so impacted. In fact, this line (around 519000 East) seems to function in exactly the same way in the Tiwanaku Period. That is, sites to the West of the line seem to have grown at a more or less normal rate, as a whole, while sites to the East of the line experienced very slow population growth or decline. I propose that the slower population growth East of the 519000E line reflects a loss of population to the urban center of Lukurmata, and that the normal growth of sites to the West of this line indicates that they did not participate in this process.

In other words, I believe I have located the boundary between the Taraco Peninsula and the Katari Basin administrative areas of the Tiwanaku state. It is very interesting that this administrative boundary seems to coincide exactly with a political boundary dating at least to the LF1, or no less than 700 years prior to the Tiwanaku Period. This fact serves to emphasize the extreme durability of this type of boundary. In fact, this boundary is no more than a few kilometers removed from the modern border between Canton Taraco and Canton Huacullani, and between the Provincias Ingavi and Los Andes.[9]

This border is also interesting in that it emphasizes the heterogeneity of Tiwanaku administrative practice, even within the heartland region. Janusek has emphasized that "... [t]he Tiwanaku core, considered here [as] the central three-basin network,[10] was not simply a homogeneous administrative unit of the Tiwanaku state" (Janusek 1994: 73). Specifically,

[9]It also seems to have been a politico-administrative boundary in the Early Colonial period, as I discuss in Chapter 10.

[10]The three basins to which he alludes are the Tiwanaku Valley, the Katari Basin to the north (Pampa Koani), and the Jesus de Machaca/Khonko Wankani area to the south. I would add the Taraco Peninsula as a fourth component of the Tiwanaku heartland.

UTM East	ha	ha/km^2(approx)
< 519000 (West)	1.96	0.03
> 519000 (East)	10.51	0.32
All Taraco Peninsula	12.47	0.13

Table 8.4: Total raised field area (ha) by UTM easting

"settlement organization and strategies of agricultural exploitation in the Tiwanaku Valley were entirely distinct from those in the Katari Basin" (Janusek 1994: 69). On the Taraco Peninsula, Tiwanaku administrative strategies were entirely distinct from those in either of the other two study areas. Settlement in the Tiwanaku Valley and the Katari Basin in the Tiwanaku period was oriented to the construction, maintenance and production of large-scale raised field agricultural areas (cf. Kolata 1986, Kolata 1991, Kolata and Ortloff 1996b). The Taraco Peninsula, by contrast, was and is entirely unsuited to large-scale raised field agriculture. In the Taraco Peninsula survey, only 12.47 ha of raised fields were recorded which were certainly pre-modern and probably prehistoric. Of these, 10.51 ha (84%) were located to the east of the 519000E meridian (Table 8.4), and therefore within what I have argued to be the Pampa Koani administrative area in the Tiwanaku period. Looked at another way, the density of raised fields to the east of the 519000E line - within the hypothetical administrative orbit of Lukurmata - was ten times greater than that of the area to the west of the line, within the territory of the old Taraco Peninsula polity. The administrative boundary identified above does in fact seem to correspond to the boundary of raised large-scale field agricultural production.

8.4 Discussion

In short, the stability of the Taraco Peninsula settlement system in the Tiwanaku period contrasts with the total reorganization experienced by the Tiwanaku Valley and Katari Basin settlement systems at this time. The latter systems were completely revolutionized by raised field agriculture.[11] The Taraco Peninsula system was not. It retained the basic structure that originated in the LF1, with the community boundaries and principal villages essentially unchanged from the MF. This difference would seem to suggest that the Taraco Peninsula was integrated into the Tiwanaku state and economy in very different way from the other areas of the core region. This statement is necessarily vague; I can be no more specific. Were the Taraco Peninsula communities involved in raised field production in the Tiwanaku Valley and the Pampa Koani? Or were their state labor obligations of a wholly different nature, involving dryland agriculture or non-agricultural activities? The question of the peninsula's relation to adjacent areas, and the nature of Tiwanaku state tribute extraction, clearly merits further research.

[11]Other areas of the Titicaca Basin under Tiwanaku administration were not so radically changed as the core region itself. An example is the Juli-Pomata area, where the basic Late Formative settlement configuration was unchanged in the Tiwanaku period (Stanish 1994, Stanish et al. 1997). The LF settlement system was already oriented to raised field production, and it continued to be so during the Tiwanaku period.

Chapter 9

The Late Intermediate Period: collapse and demographic decline

Sometime at or before 1050 A.D. the level of Lago Wiñaymarka dropped to 7-12 m below overflow level, or 12-18 m below its modern average of 3810 m.a.s.l. (Abbott et al. 1997a: 179) and seems to have remained low until the arrival of the Inka empire - and the Little Ice Age - in the Titicaca Basin around 1450 A.D. Kolata and his colleagues have argued that this drop coincides with a period of reduced rainfall which caused the collapse of the Tiwanaku agricultural base - principally raised field production in their view (Binford et al. 1997, Kolata and Ortloff 1996a, Ortloff and Kolata 1992).

Janusek summarizes this position as follows:

> Recent paleo-ecological research strongly suggests that changing climatic conditions triggered a profound crisis in Tiwanaku political economy. Sediment cores from Late Titicaca and paleo-environmental data from the Quelccaya ice cap of southern Peru point to a substantial decrease in yearly precipitation around A.D. 1000, possibly leading to drought conditions in the *altiplano* and the collapse of intricate raised field agricultural systems. The timing of the ecological data corresponds well with the full scale ... urban depopulation [documented by] our excavations at Tiwanaku and Lukurmata. (Janusek 1994: 384)

Janusek suggests that the late Tiwanaku period was characterized by increasing tensions between a centralizing tendency of the state and autonomous local sources of authority and power. Stress on the agricultural base only served to exacerbate existing tensions between state and local power sources, leading to a generalized crisis of the political economy and to state collapse.

Whether or not the Tiwanaku state collapsed as a result of a massive, climatically-induced agricultural failure - and this is by no means certain - collapse it did, and the event took place sometime between 1000 and 1100 A.D. The collapse was perhaps more properly a process than an event - though what is an event but a rapid process? - and seems to have taken place over the course of as much as a century. It was certainly complete by 1100 A.D., and it is this date which I use here for the Tiwanaku/Early Pacajes transition. What followed the Tiwanaku period was an entirely different social order.

> After the decline of Tiwanaku, cities and urban civilizations disappeared in the Lake Titicaca Basin for nearly 400 years. Central organization and management of intensive agriculture, craft production, long-distance trade, and other sources of wealth broke down. Across the south-central Andes, human populations dispersed across the landscape, and settled into smaller, defensible settlements. The demise of the Tiwanaku empire brought with it widespread political instability. (Kolata 1993: 299)

Kolata's catastrophic vision of Tiwanaku state collapse certainly seems to be borne out by the Taraco Peninsula settlement data. In addition, however, the Taraco data suggest that the reorganization of the settlement system was accompanied by a general demographic collapse on the peninsula. The end of the Middle Horizon brought about profound changes in virtually all aspects of Titicaca Basin life.

9.1 Phase definition

The Early Pacajes phase began with the collapse of the Tiwanaku state around 1100 A.D. and ended with the appearance of Inka-related ceramics sometime around 1450 A.D. The very distinctive ceramic assemblage was first recognized by Bennett, who referred to it as “chullpa”, and later as “Khonko Black-on-Red” (Bennett 1934). Rydén termed the material "post-Decadent Tiahuanacu" (Rydén 1947: 101), in reference to Bennett's Tiwanaku sequence.[1] However, the post-Tiwanaku phases in the southern Titicaca Basin - the Pacajes phases - remained poorly-defined until 1990. In conducting and reporting on the Tiwanaku Valley survey, Juan Albarracín -Jordan and James Mathews together documented this ceramic sequence in enough detail for it to be useful to other investigators.[2] I have used their chronology in the present study. I have found it to be completely satisfactory, though I will extend their ceramic descriptions somewhat, especially in regard to the Late Pacajes phase (see Chapter 10).

Both Albarracín -Jordan and Mathews note that Early Pacajes plainwares changed little from their late Tiwanaku precursors.[3] I found this to be the case, as well. Identification of Early Pacajes occupations was therefore accomplished solely on the basis of decorated ceramics. Only one Early Pacajes vessel form seems to have been commonly decorated. This is the open bowl form, often with a slightly everted rim (Figure 9.1). Though rim fragments are frequently very similar to Tiwanaku period *kero*/*tazon* rims, the Early Pacajes bowls are *not* hyperboloid, and are therefore formally distinct from the Tiwanaku hyperboloid forms. Mathews suggests that the disk base is also diagnostic of the Early Pacajes phase (Mathews 1992: 187). This may be true, but I was unable to confirm or deny the assertion.

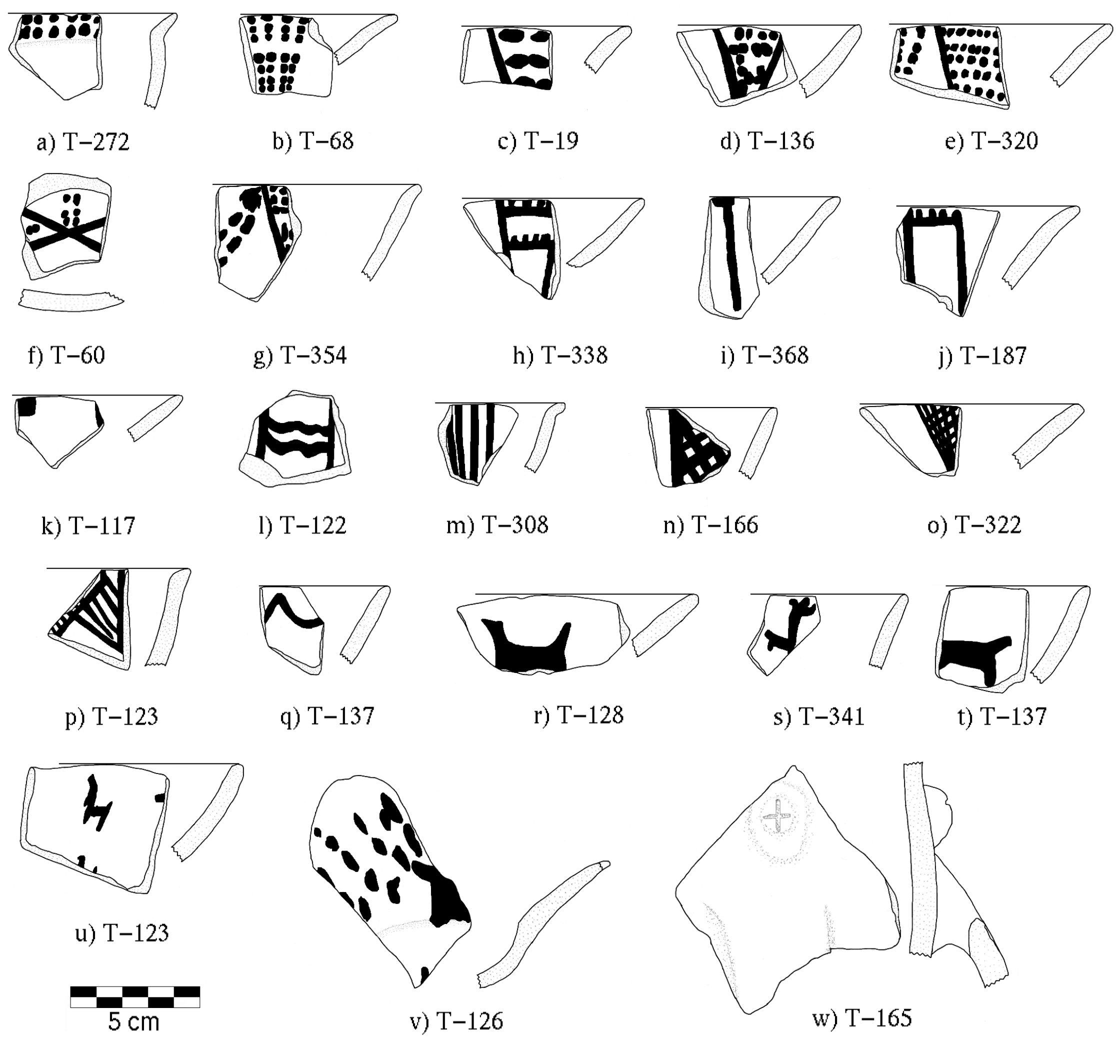
Early Pacajes bowls typically display evidence of fine manufacture. They are normally very thin, compact and well- and evenly-fired with a high exterior and interior burnish. In fact, they appear quite similar to Tiwanaku ceramics in these respects. However, two attributes clearly distinguish Early Pacajes decorated bowls. These are 1) slip color and 2) decoration.

The surface color of Early Pacajes bowls tends to the yellow and orange, though red and

[1] I should also note that Stanish, in his report on a recent reconnaissance in the Desaguadero area, has identified a Late Intermediate Period style he terms Kelluyo. Kelluyo ceramics, as he illustrates them, are identical to Early Pacajes ceramics as described here (Stanish et al. 1997: 46-47, 107-111 and Figures 22 and 82), the inclusion of a solitary Late Pacajes sherd (Stanish et al. 1997, Figure 82, leftmost) notwithstanding. The term Kelluyo will not be employed in the present study.

[2] I refer to their joint report (Albarracín-Jordan and Mathews 1990), as well as to their respective dissertations (Albarracín-Jordan 1992, Mathews 1992) and subsequent publications (Albarracín-Jordan 1996a).

[3] Rydén also made this observation (Rydén 1947: 160).



a-u) fineware bowls, v) scalloped-rim bowl, w) incised appliqué nub on jar handle

Figure 9.1: Late Intermediate Period ceramics

brown examples exist. This is in contrast to Tiwanaku period wares, whose slips were typically more red and brown. More absolutely diagnostic is the decoration of the bowls. In the Early Pacajes phase, polychrome decoration disappears completely. Bowls are decorated using a black - or occasionally dark brown - pigment over the slip. The elaborate iconography of the Tiwanaku ceramics is absent, as well, with decoration consisting only of simple geometric elements, such as dots (Figure 9.1a-g), ticked or tabbed lines (Figure 9.1h-k), cross-hatching (Figure 9.1n-o) and parallel lines (Figure 9.1m, p).[4] These elements are often arranged in zones. The only exception is the occasional very simple representation of profile camelids, rendered in a "stick figure" style (Figure 9.1r-t).

Some of the geometric elements - particularly parallel lines and zoned hachure - were part of a widespread decorative tradition which encompassed the entire Titicaca Basin in the LIP; a tradition which included the western basin Pukarani Black-on-Red (Stanish et al. 1997: 46, de la Vega M. 1990) and the northern basin Collao Black-on-Red (Tschopik 1946: 21) styles also. The Early Pacajes material is distinguished from contemporary wares most especially by its fine manufacture.

The "stick figure" camelids are clearly antecedents of the more finely-executed ones characteristic of the Late Horizon Saxamar style (see Figure 10.1p-z), and seem to occur in no other Titicaca Basin LIP ceramic style. This fact strongly suggests a direct connection between the Early Pacajes and Saxamar styles.[5] That said, however, the Early Pacajes "llamitas" are easily distinguished from Pacajes-Inka examples since the former "are depicted with thick brush strokes, contrasting with the slender llama figures of the subsequent Pacajes-Inka period" (Albarracín-Jordan 1992: 273).

[4]Undulating lines are sometimes also present below the rims of the bowls (Figure 9.1q), recalling a common feature of Tiwanaku hyperboloid bowls (for example, Figure 8.1a).

[5]Though other scholars have suggested that it indicates instead some degree of temporal overlap in the production of Early Pacajes and Saxamar ceramics (see Mathews 1992: 187, 194). I believe this argument to be invalid, and will address it at more length in my discussion of the Pacajes-Inka phase in the following chapter.

9.2 Principal sites

Two sites were identified with Late Intermediate Period occupations greater than or equal to 2.0 ha. These are numbered on Figure 9.2 and are described below.

T-153A

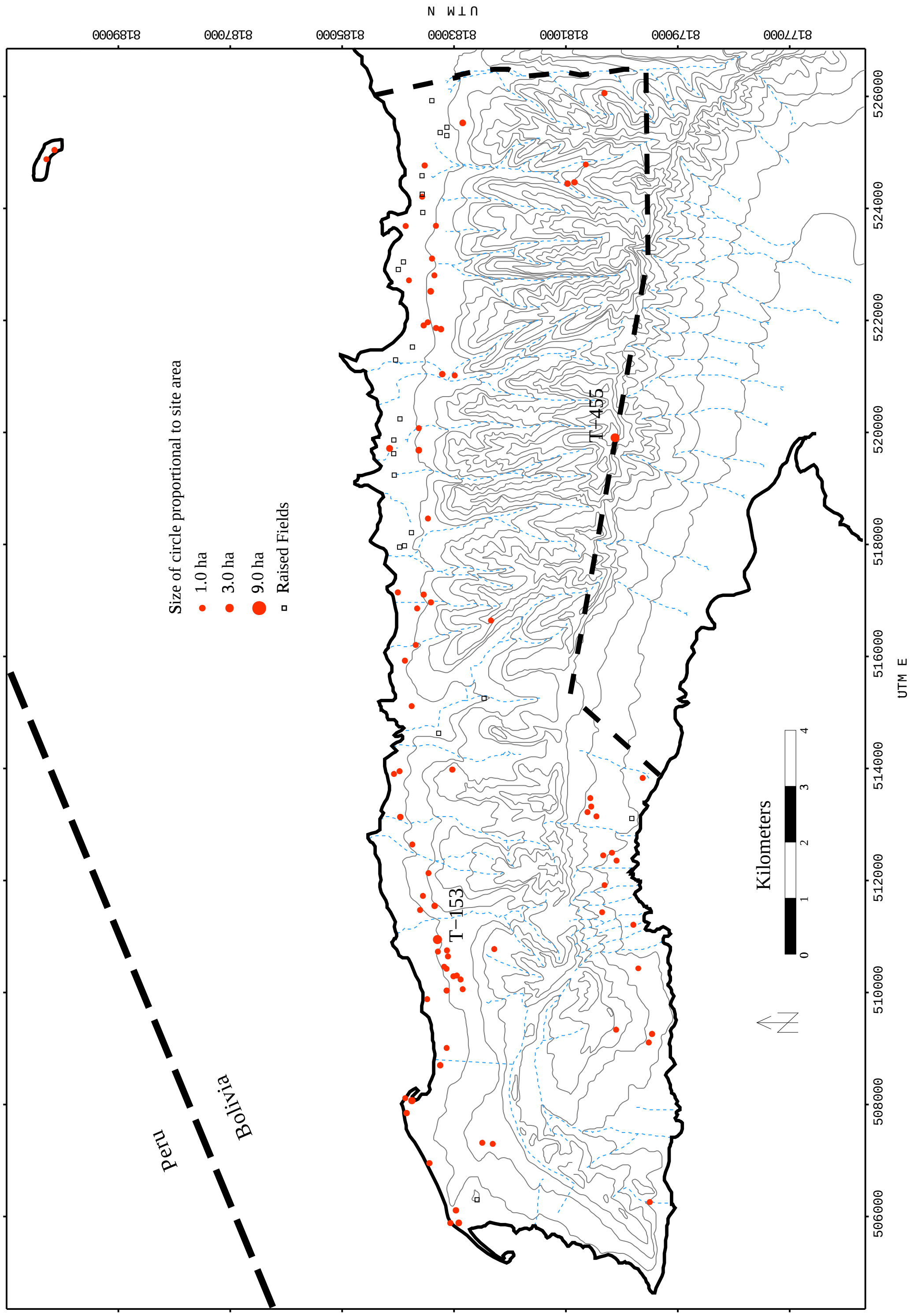
T-153 is located in the modern community of Nachoca. The site is a large continuous sherd scatter in fallow fields and low density grasslands, below the modern road between Taraco and Santa Rosa and just to the west of a *quebrada*. The only occupation at the site the the EP one, which covers the entire area of 3.6 ha. With a population index value of 192, T-153A is the largest EP site on the Taraco Peninsula. No prehistoric architectural features of any kind were recorded.

T-455A (Cerro Pulpera)

Cerro Pulpera is a single component Early Pacajes site located on the southern boundary of the modern community of Chiripa, though portions of the sherd scatter do extend into the Tiwanaku Valley community of Chivo. It should be noted that although the site was recorded in the Taraco Peninsula archaeological survey, it is in fact located on the edge of the Tiwanaku Valley. It should really be considered as part of the Lower Tiwanaku Valley settlement system (see Albarracín-Jordan 1992, Albarracín-Jordan 1996a).

The scatter covers 3.23 ha, and is located on the upper slopes of a low *cerro*, and in an adjacent saddle to the east. No ceramics seem to be located on the peak of the *cerro* itself. Whether this reflects more intense erosion on the summit, more wind exposure, or some other factor is unknown.

Cerro Pulpera is unusual in that it is the only example of a *pukara* on the Taraco Peninsula. The cobble foundations of a double-faced wall are still evident cutting across the ridge sloping down from the hilltop to the north. Some cobbles are scattered on the surface nearby, suggesting that there were a few more stone course overlying the visible foundations. The remainder of the wall was most likely of adobe, as were almost all structures on



Numbered sites are discussed in text.

Figure 9.2: Late Intermediate Period (Early Pacajes) Settlement Pattern

the Taraco Peninsula in all prehistoric and historic period. The wall delimits the northern edge of the ceramic scatter, and blocks access to the site from the northern ridge. This is most definitely the point of easiest access, and it was for this reason that it was fortified.

Though the wall described above does qualify the site as a *pukara*, there is no evidence of other fortifications. It is only a weakly-fortified settlement. The southern approaches to the site are very steep and require no further fortifications. However, approaches from the east and west are relatively easy - though not so easy as the fortified north ridge - and show no evidence of defensive features.

Certain areas of the site, especially the saddle to the east of the hilltop, have a high surface ceramic density, indicating substantial habitation. Also, the site in general has a higher than usual frequency of decorated serving bowls, suggesting that it was the residence of a local leader of some kind, and a locus of ritual hospitality. With a population index value of 170, it is the second-largest Early Pacajes site recorded on the peninsula. There is no standing architecture.

9.3 Settlement and population

By any measure, the Tiwanaku/Early Pacajes transition was the most dramatic settlement transformation in the history of human occupation on the Taraco Peninsula. Most fundamentally, it marked the end of a 2500-year tradition of nucleated habitation and village life that had persisted from the Early Chiripa phase. The ancient system of villages and communities which persisted more or less intact throughout the Formative and Tiwanaku periods disappeared completely. Every single one of the old Taraco Peninsula villages was either abandoned in the Early Pacajes phase or was reduced to occupation by a few dispersed households (for the example of Chiripa, see Bandy 1997).

All of the metrics I have been using to characterize the settlement system reflect this dramatic change. Thus, the total number of sites in the Early Pacajes phase actually increases relative to the preceding Tiwanaku period (Tables 6.3 and 9.1). However, the phase population index declines drastically from 6923 to 1408 at the same time. This decrease in

	Early Pacajes
Number of sites	83
Phase population index	1408
Annual population index growth rate	-0.46
Occupation continuity index	38
Site founding index	69

Table 9.1: Late Intermediate Period: Metrics

the average site size reflects 1) the shift from nucleated to dispersed habitation, as discussed above, and 2) a general depopulation on the Taraco Peninsula.

Averaged over the entire 350 year span of the LIP, population grew at a rate of -0.46% annually (Table 9.1). This in itself is a fairly dramatic rate of population decline. However, there are several reasons to believe that the rate of decrease was in fact quite a bit more severe than the phase population index values indicate. First of all, the LIP phase population index is most certainly inflated relative to the Tiwanaku phase population index. This is so because occupation of the Early Pacajes sites was probably more ephemeral and shorter-term than was that of the Tiwanaku period villages.[6] Second is the fact that most of the population decrease probably occurred very rapidly, possibly in the century or so immediately following the collapse of the Tiwanaku polity. In either case, it is clear that population on the Taraco peninsula decreased drastically following the Tiwanaku collapse.

Not only did the mean site size and overall population levels on the peninsula decrease precipitously, but the settlement system was completely reorganized also. The Early Pacajes phase has an occupation continuity index value of 38, meaning that only 38% of the localities occupied during the Tiwanaku period continued to have an occupation at least at some point during the Early Pacajes phase. This is the lowest rate of occupation continuity in the prehistory of the Taraco Peninsula,[7] and suggests a dramatic rupture with the by-then ancient village system. The site founding index value of 69 is also rather high, though not

[6] And the villages accounted for the great majority of the Tiwanaku period population. This issue is discussed at more length in my discussion of the phase population index in Chapter 4.

[7] The phase with the next-lowest occupation continuity index is the following Pacajes-Inka phase.

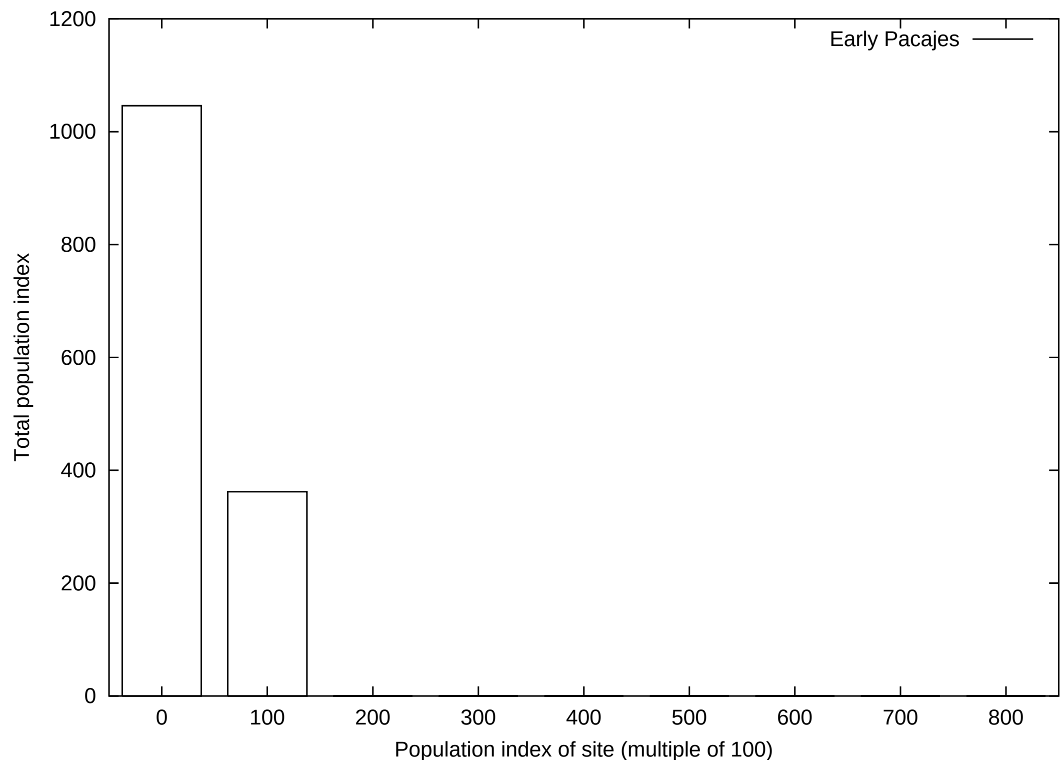


Figure 9.3: Late Intermediate Period site size distribution

truly exceptional.

The shift from nucleated to dispersed habitation is also reflected by the total collapse of the Tiwanaku period site size hierarchy. Figure 9.3 compares the two phases. The Early Pacajes data show a clear unimodal distribution, as compared to the trimodal Tiwanaku pattern. As would be expected, the Tiwanaku period settlement hierarchy failed to outlive the state.

The overall settlement system of the Early Pacajes phase is represented by the settlement density map in Figure 9.4. Since Cerro Pulpera is associated with the Lower Tiwanaku Valley settlement system, there is only small village on the Taraco Peninsula at this time (T-153). It may have been the seat of a prominent individual, family or household. Apart from this settlement, the remainder of the population was dispersed in a low-density scatter of hamlets and single-family farmsteads.

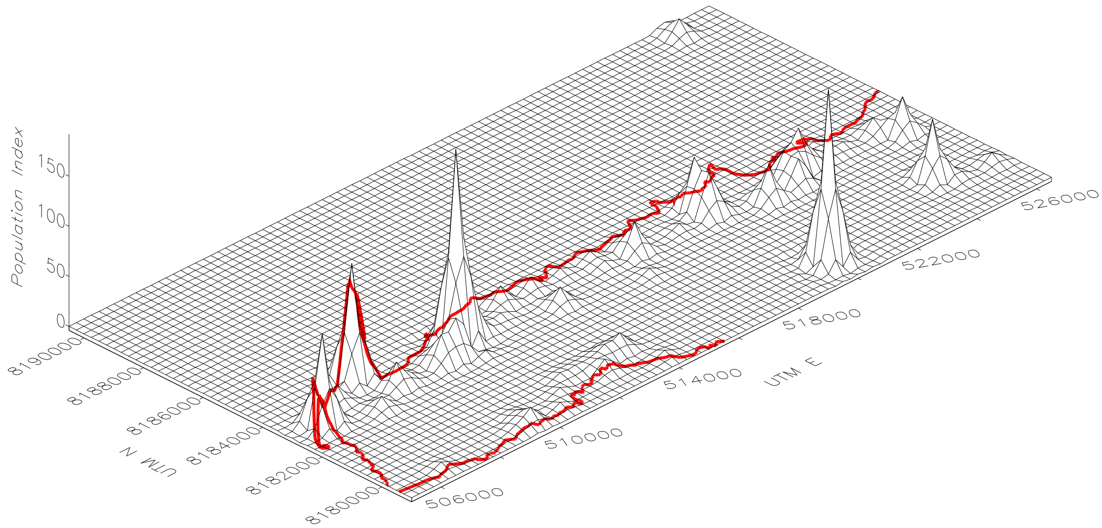


Figure 9.4: Early Pacajes: Sum of phase population index per 0.25 km^2

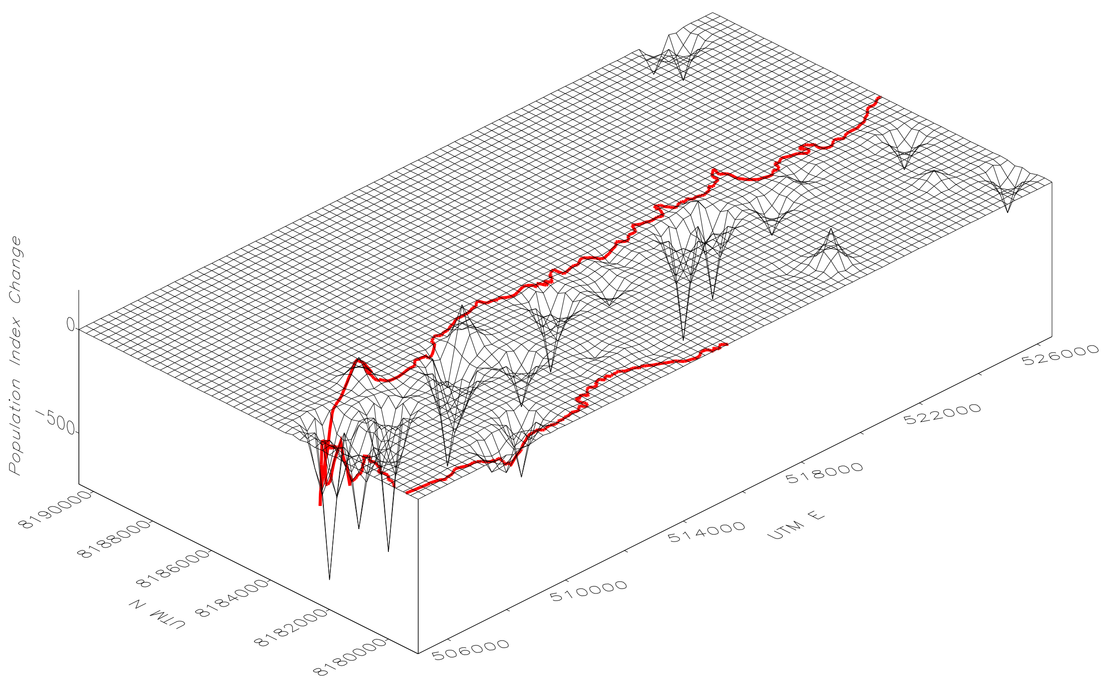


Figure 9.5: Early Pacajes: Change in phase population index per 0.25 km^2

9.4 Discussion

The catastrophic effects of the Tiwanaku collapse on the Taraco Peninsula settlement system are conveyed admirably in Figure 9.5. The map is virtually a negative impression of the Tiwanaku period settlement density map (Figure 8.4), and effectively communicates the two profound settlement shifts which took place at the end of the Middle Horizon:

1. The shift from nucleated to dispersed settlement. With the collapse of the Tiwanaku polity, the old system of nucleated village habitation which had developed over more than a two millennia was abandoned altogether. We may imagine that a whole system of territoriality - borders, usufruct rights, landscape-related ceremonialism, and so on - was simultaneously abandoned.

2. General demographic collapse. The phase population index of the Early Pacajes phase is only about $\frac{1}{5}$ that of the preceding Tiwanaku period, compared to which it is most likely relatively exaggerated.

All settlement archaeologists working in the Titicaca Basin recognize the general shift from nucleated to dispersed habitation at the end of the Middle Horizon. This fact is entirely beyond controversy. It is one of the defining features of the Early Pacajes phase, together with the changes in ceramic style discussed above. What is more controversial, of course, is the reason for these changes. Approaches to explaining the dramatic changes at the end of the Middle Horizon can be classed in two principal groups.

On the one hand, there are those scholars who explain the differences between the Tiwanaku period and Early Pacajes inhabitants of the southern Titicaca Basin in terms of a population replacement. We may term this the “discontinuity hypothesis”. These scholars, mainly linguists and ethnohistorians, posit a series of ethnic migrations - the famous “Aymara invasions” (cf. Bouysse-Cassagne 1988, Gisbert et al. 1987, Torero 1985). These invasions supposedly replaced the Tiwanaku period population of the southern Titicaca Basin - often identified as Pukina speakers - with a group of more nomadic Aymara-speaking pastoralists from the southern *altiplano*. These southern pastoralists had no tradition of village dwelling. In this way the discontinuity hypothesis is in fact able to explain the observed shift from nucleated to dispersed habitation.

Proponents of the "continuity hypothesis" - including most archaeologists (cf. Browman 1981: 417-418, Rydén 1947) - contend that the LIP inhabitants of the southern Titicaca Basin - and by extension the modern population - were in fact descendants of the builders of Tiwanaku, and that no invasion, migration or ethnic replacement took place in the LIP. They point to evidence of continuity, such as the strong similarity of domestic ceramic wares between the two phases. Most settlement archaeologists who have worked in the Titicaca Basin fall into this camp (cf. Albarracín-Jordan 1996a: 294-296, Janusek 1994: 380-383, Mathews 1992: 190-191, Stanish et al. 1997: 12-14, 118), though all admit that the evidence is not at all conclusive.[8]

As we saw, the discontinuity hypothesis can explain the shift from nucleated to dispersed settlement by positing an invading Aymara horde unacquainted with village life. One problem with the continuity hypothesis that has yet to be addressed by its proponents is how exactly to explain this shift in settlement practice which is so crucial to understanding the Tiwanaku collapse and the Early Pacajes phase. The problem in not even recognized by most researchers, who seem to see the abandonment of the village system as a natural

[8]There are many types of evidence which do indicate continuity between the Tiwanaku period and the Early Pacajes phase. One common argument, however, is absolutely invalid. Some investigators argue that the high rate of occupation continuity between Tiwanaku sites and Early Pacajes sites is evidence for the continuity hypothesis. An example from the Lower Tiwanaku Valley:

> If Tiwanaku's collapse was induced by foreign invaders with a distinct cultural background, one would expect to find substantial differences in settlement distribution and land use. On the contrary, the Early Pacajes settlement pattern suggests a continuous occupation of sites ... Approximately 82% of the Tiwanaku V settlements exhibit an Early Pacajes occupation. [Albarracín-Jordan 1992: 310]

The fallacy here is this: given that the number of sites in the Lower Tiwanaku Valley increased threefold - from 137 to 441 - in the Early Pacajes phase, and that these new sites are located in nearly every possible settlement location, a high occupation continuity index is exactly what one would expect. Put another way, the reoccupation of a village site by a small farmstead, probably only ephemerally occupied, does not constitute the kind of occupation continuity that Albarracín-Jordan perceives. It means only that " ... Pacajes people settled everywhere the Tiwanaku had been, and just about everywhere else" (Janusek and Kolata 2001).

corollary of the collapse of the Tiwanaku administrative hierarchy. It is as if the village system was in some way simply a material manifestation - a shadow or reflection - of a bureaucratic structure, which naturally ceased to be when the institutions which generated it dissipated. Of course, nothing could be further from the truth. The present study has clearly demonstrated that the village system on the Taraco Peninsula originated in the Early Formative Period and persisted with only minimal modification for at least 1500 years prior to Tiwanaku state formation. Therefore, there is no reason to suppose that Tiwanaku state collapse would necessarily produce the wholesale abandonment of village life.

In considering the related problem of compact versus dispersed residential practices in Mesoamerican settlements, Drennan has observed that it is in some ways more difficult to explain dispersed habitation than nucleated habitation (Drennan 1986). His discussion is enlightening and well worth reading for anyone interested in these issues. He ends by explaining the dispersed settlement characteristic of Classic Maya cities - and incidentally of Postclassic Basin of Mexico settlement also - with reference to intensive forms of agriculture.[9] His argument is that forms of agriculture characterized by "not just large labor requirements, but the concentration of those requirements continually in a small area ... [make] it desirable for a household to locate its residence at its agricultural plot" (Drennan 1986: 287). He contends that dispersed settlement occurs when the advantages to the household of proximity to its agricultural plot outweighs the advantages associated with proximity to other households. Nucleated settlement is produced when the balance of the advantage falls to proximity to other households. He specifically argues that ridged fields - *chinampas* - and terraces are agricultural techniques which produced dispersed settlement in Classic Maya and Late Postclassic Mexican highland contexts.

Given Drennan's argument, it is particularly interesting to observe that Graffam has constructed an argument that raised field agriculture did not end with the Tiwanaku collapse, but was in fact intensified further (Graffam 1990). He argues that in the wake of the Tiwanaku collapse individual households intensified production by incorporating raised field agriculture and expanded camelid pastoralism into their existing household subsis-

[9] In doing so he is, of course, reversing the traditional Mayanist association between dispersed settlement and swidden agriculture.

tence strategies. Increasing importance of raised field agriculture certainly could account for a shift to dispersed settlement at the end of the Middle Horizon. Though most archaeologists interested in the Titicaca Basin seem to be skeptical of the empirical basis of Graffam's model, I think that it very easily explains the observed settlement shifts. For this reason, I would suggest that we consider Graffam's claims more carefully and systematically.

Another possibility is that the critical factor was not in fact the advantage associated with proximity to an agricultural plot, but rather concrete *disadvantages* associated with proximity to one's neighbors. Drennan does not make this argument, but the scenario follows naturally from his discussion. It is fairly easy to imagine that a large increase in the size of a household's herds might make life in a nucleated settlement problematic. Pastoral communities typically are characterized by dispersed settlement worldwide. An intensification of pastoralism could also account for the settlement shift.

Either of these two scenarios could also account for the dramatic decline of population on the Taraco Peninsula, which was much more pronounced than in adjacent regions.[10] This population decline could be explained by households relocating to adjacent regions, such as the Pampa Koani and the Tiwanaku Valley, which are much better-suited for *both* raised field agriculture and pastoralism. The drop in the Taraco Peninsula population index could also be explained - but only in part - by a large number of households moving out onto the lake plain at this time. Remember that the lake level was much lower than today throughout the Early Pacajes phase. Many Early Pacajes *pampa* sites would be inundated today, and thereby excluded from the sample.[11]

I should emphasize that I am not constructing a defense of the continuity hypothesis, though I do find that it explains the archaeological record more satisfactorily than does the invasion scenario. Rather, I have presented two hypothetical explanations for the observed shift from nucleated to dispersed habitation in the LIP, both related to changes in the do-

[10] This is discounting the abandonment of the city of Tiwanaku proper, of course

[11] It is certainly the case that the Early Pacajes settlement pattern includes a much greater occupation of the *pampa* in adjacent regions such as the Katari Basin (Janusek and Kolata 2001) and the Tiwanaku Valley (Albarracín-Jordan 1992: 273, 277, Mathews 1992).

mestic economy and both consistent with the continuity hypothesis. I consider these as hypotheses to be tested by future research. I have also attempted to stress that any account of the Early Pacajes phase *must* explain the observed shift from nucleated to dispersed modes of settlement.

The issue of a catastrophic demographic collapse is not so much contentious among archaeologists as it is avoided. The substantial increase in the number of sites in the Early Pacajes phase is sometimes taken to indicate not only that there was no demographic collapse, but also that population may, in fact, have increased relative to Tiwanaku period levels.

> ... the increase in number of sites by some 150 percent over the preceding Tiwanaku V period suggests not so much an overall population decrease in the [Middle Tiwanaku] valley with the collapse of Tiwanaku, but rather a population reorganization... [Mathews 1992: 188]

In general, it seems as though many Titicaca Basin archaeologists prefer to minimize the "collapse" aspect of the Tiwanaku/Early Pacajes transition, and to emphasize instead the "reorganization" or "political fragmentation" aspects. Janusek, for example, characterizes the situation in this way:

> ... Tiwanaku "state collapse" materialized as mutually supportive processes of political fragmentation and cultural revolution among local segmentary units, involving the assertion of political autonomy by local leaders and the gradual adoption of new ideals, attitudes, social identities, and material culture. [Janusek 1994: 383]

If we accept the continuity hypothesis, this is no doubt a fair picture of at least some of the cultural processes which were under way early in the Early Pacajes phase. However, Janusek's description serves to obscure the fact that the early LIP was a period of dramatic population decline and dislocation. Put plainly, it was a chaotic and dangerous time, probably involving considerable localized conflict. population relocation and even famine.

As I discussed in Chapter 4, using raw hectares as a population measure has the effect of exaggerating the importance of small and ephemeral sites relative to large and permanent villages or towns. In the context of the Tiwanaku/Early Pacajes transition, this means that

		Taraco	Lower Tiw	Middle Tiw	Catari Basin	Juli-Pomata
uncorrected	MH	131.5	86.3	642.7	229.0	62.3
(hectares)	LIP	35.7	122.9	269.9	162.4	73.9
	annual growth	-0.37	0.14	-0.25	-0.10	0.05
corrected	MH	6923	4627	[100]	[100]	[100]
(pop index)	LIP	1408	4871	[31.25]	[52.77]	[88.27]
	annual growth	-0.46	0.01	[-0.33]	[-0.18]	[-0.04]

Sources:

Lower Tiwanaku Valley: Albarracín-Jordan 1992

Middle Tiwanaku Valley: Mathews 1992

Katari Basin: Janusek and Kolata 2001

Juli-Pomata: Stanish et al. 1997

Table 9.2: Corrected and uncorrected aggregate population measures by region: Middle Horizon and Late Intermediate Period

the Early Pacajes phase population will appear relatively larger than it was, thus reducing the apparent severity of the population decline which took place.

In the case of the Taraco Peninsula, the difference between the two measures can be calculated directly, as shown in Table 9.2. The uncorrected growth rate is -0.37% annually, while the corrected rate is a more extreme -0.46%. The two values can also be compared in the case of the Lower Tiwanaku Valley, since Albarracín-Jordan presents his data in such a way as to make this possible.[12] In this case the uncorrected growth rate appears to be higher than the 0.10% norm I have established in earlier chapters. This would suggest no population decline at all, but rather normal population growth. However, when sector sizes are corrected using the method described in Chapter 4, the corrected annual growth rate in the Early Pacajes phase is only 0.01%. This is essentially zero growth for a 350-year period.

In the case of other surveyed Titicaca Basin regions, I have not been able to correct the occupation sizes in the same way that I have my own and Albarracín-Jordan's data.

[12] Which is to say that he gives areas of occupation for each sector - or separate component - of a site.

However, if we assume that the same relation pertains between average site sizes in the Tiwanaku and Early Pacajes phases, then it is possible to calculate corrected annual growth rates by another method.

The relation between corrected and uncorrected population values can be expressed in the following equation.

$$\frac{Tiw_c}{EP_c} = k\frac{Tiw_u}{EP_u}$$

where Tiw_c = Tiwanaku period phase population index
Tiw_u = Tiwanaku period raw hectares
EP_c = Early Pacajes phase population index
EP_u = Early Pacajes raw hectares
k = a correction constant

It is a simple matter to derive the value of *k* from this equation, as follows:

$$k = \frac{Tiw_c EP_u}{Tiw_u EP_c}$$

Solving for *k* for the Taraco Peninsula and Lower Tiwanaku Valley data - the only two for which we have complete corrected settlement datasets - generates values of 1.33 (Taraco Peninsula) and 1.35 (Lower Tiwanaku Valley). These two values are very close to one another indeed, a fact which I hope inspires at least a degree of confidence in the method. I will assign a provisional value of 1.34 to *k*, obtained by averaging the two empirical values.

The corrected value for the Early Pacajes phase can therefore be obtained using the following equation:

$$EP_c = \frac{Tiw_c EP_u}{k Tiw_u}$$

Inserting the value derived for *k* above, and using an arbitrary population index value of 100 for the Tiwanaku period, a population index value for the Early Pacajes phase is derived as follows:

$$EP_c = \frac{100}{1.34}\frac{EP_u}{Tiw_u} = 74.63\frac{EP_u}{Tiw_u}$$

Note that the value obtained in this way is not an absolute one. It is only a percentage of the corrected Tiwanaku period value, whatever that may be. However, it will suffice for our present purposes, since we care only to calculate an annual percentage growth rate for the Early Pacajes phase for the various regions in question. These growth rates are presented in Table 9.2 in brackets to indicate that they have been derived by the method above. The empirical growth rates from the Taraco Peninsula and Lower Tiwanaku Valley are presented without brackets.

When the "splash zone" effects of the shift from nucleated to dispersed habitation are subtracted,[13] the population decline in the Early Pacajes phase appears much more severe than when uncorrected hectares are employed. Of the five regions sampled, not a single one has positive population growth in the LIP.[14] The Middle Tiwanaku Valley and the Katari Basin experienced the most severe depopulations, excepting the Taraco Peninsula, as would be expected given the disintegration of the cities of Tiwanaku and Lukurmata. In the Juli-Pomata area, what Stanish characterizes as "a slight leveling" (Stanish et al. 1997: 60) in the growth curve in the LIP is actually, when corrected for site size effects, a decline in population, though a less severe one than in the Tiwanaku heartland. In fact, the general basin-wide decline is probably even more severe than I have indicated, since I have failed to correct for the effects of more ephemeral and generally shorter-term occupations in the LIP.

Since all of the areas in question are low and near the lakeshore we may perhaps postulate a generalized movement of population away from the lakeshore and into higher and more mountainous regions throughout the Late Intermediate Period in the entire Titicaca Basin. It is perhaps not necessary to imagine large-scale warfare and famine as the causes of the observed basin-wide depopulation. Whatever the case, though, the collapse of the

[13] Which is only to say that the raw hectare value has been corrected by one method or the other.

[14] I consider the Lower Tiwanaku Valley to have zero population growth in this phase. This in itself is remarkable, since we can imagine that the disintegration of the urban core of Tiwanaku would have produced a large group of migrants.

Tiwanaku state was no simple rearticulation of its component segments, as has been suggested. Neither was it a matter only of a political or cultural revolution. The Tiwanaku collapse was not only a political collapse, but a demographic one as well.

Chapter 10

The Late Horizon and Early Colonial Period: conquest and colonial administration

The end of the Late Intermediate Period generally, and of the Early Pacajes phase locally, resulted from the rapid conquest of the Titicaca Basin by an upstart power from the North: the Inka Empire. The Aymara *señorios* of the Titicaca Basin were apparently brought under Inka rule during the reign of the Inka emperor Pachacuti. The Taraco Peninsula was most likely annexed along with the remainder of the southern Titicaca Basin during Pachacuti's campaign following a revolt in Ayaviri in the northern basin. That is to say that it was incorporated into the Inka empire some years after the northern basin was subjugated. Rowe places this expedition sometime between 1438 (the crowning of Pachacuti) and 1463, when Pachacuti handed over command of the armies to his son, Topa Inca (Rowe 1946: 203, 206-207). These dates are naturally inexact, and I here follow Stanish in dating the beginning of the Pacajes-Inka phase to 1450 A.D. (Stanish et al. 1997: 14; see also Bauer and Stanish 2001: 51-55, Julien 1982, Julien 1983).

The Late Horizon saw a reversal of some of the trends which had begun during the Early Pacajes phase. Population began moving back to the lakeshore, and this resulted in very rapid population growth rates on the Taraco Peninsula. Also, some villages were founded and a site size hierarchy reappeared. Both of these facts most likely reflect the organization and imposition of the Inka administrative apparatus.

Inka rule came to an end in the Titicaca Basin in 1532, when the invading Spaniards toppled the imperial dynasty and bureaucracy. However, the first decades after the Spanish arrival were very chaotic ones. The first Spanish visit to the Titicaca Basin was in 1534, when a small scouting party sent by Pizarro arrived at the lake. However, actual Spanish control was not established for some time. As late as 1538 the Lupaqa mounted armed resistance to Pizarro's army at Desaguadero (Bouysee-Cassagne 1987: 27). For this reason, I am using 1540 A.D. as the date for the beginning of the Late Pacajes phase, and the end of the Pacajes-Inka phase. I am therefore according to the Pacajes-Inka phase a span of 90 years. I follow Albarracín-Jordan in ending the Late Pacajes phase at 1600 A.D. (Albarracín-Jordan 1992: 326),[1] though in actuality we have no clear idea of when the ceramic style ceased to be produced. This is a question for future research.[2]

10.1 Phase definition

As with the Early Pacajes phase, my definition of the later Pacajes phases closely follows the chronology formulated by Albarracín-Jordan and Mathews in the Tiwanaku Valley survey (Albarracín-Jordan 1992, Mathews 1992). I have found their ceramics sequence to be correct and, almost as importantly, easy to apply to mixed surface assemblages. I will extend their phase definitions only slightly to include features and decorative motifs which they did not report. In particular, I will expand the decorative repertoire of the Late Pacajes phase, of which I appear to have a much larger sample than did the authors of the original descriptions.

[1] Though elsewhere in a figure caption he ends the phase at 1660 A.D. (Albarracín-Jordan 1996a: 310). No reason for this discrepancy has been given, to my knowledge. Mathews, perhaps wisely, mentions no terminal date at all, though a chronological diagram (Mathews 1992: 232) has the Late Pacajes phase ending at 1600 A.D.

[2] In fact, the entire question of the archaeology of the period of Spanish rule in the Titicaca Basin requires much more study. Very little has been accomplished to date in this regard, though some work has been done in neighboring regions of the Andes (e.g. Van Buren et al. 1993, Van Buren 1999).

The identification of the later Pacajes phases relies mainly on decorated wares. Decorated diagnostic ceramics are abundant on the surface of Late Horizon and Early Colonial sites in the study area, however, so this presented no practical difficulties.

10.1.1 Late Horizon

I identified four distinct Late Horizon ceramic styles on the Taraco Peninsula. These are, in order of descending frequency of occurrence,

1. Saxamar (Pacajes-Inka),
2. Chucuito Black on Red (and Chucuito Polychrome),
3. Imperial Inka,
4. and Taraco Polychrome.

I identified no Urcusuyu Polychrome (Tschopik 1946: 32-33) in my collections. This is rather surprising, given its predominantly southern distribution and possible association with the Inka sanctuaries at Copacabana and the *Isla del Sol* (Julien 1993: 192-199).

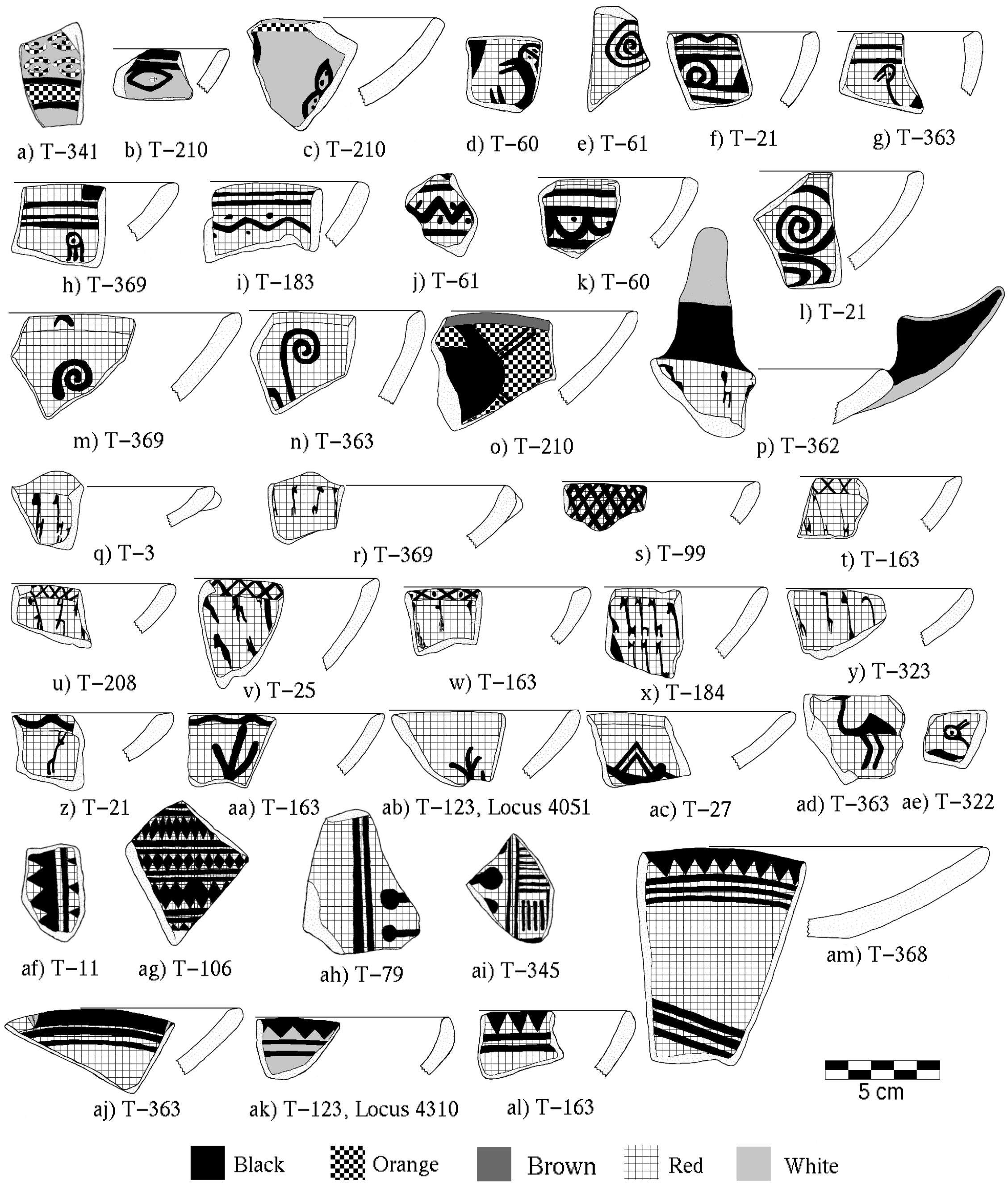
By far the most common of these was a local Late Horizon style associated with the Pacajes polity and/or ethnicity. The style has variously been termed "Pacajes-Inka" (Albarracín-Jordan 1992, Albarracín-Jordan and Mathews 1990, Mathews 1992), Saxamar (Browman 1985, Daulsberg H. 1960) and "llamita ware" (Graffam 1990). I prefer Saxamar. Examples are illustrated in Figure 10.1p-ae. Saxamar ceramics consist exclusively of shallow bowls, plates or basins. These are typically slipped a deep red and polished to a high burnish on both the interior and exterior. The paste is very fine, dense and well-fired. Bowl or plate rims are usually direct and rounded, but often have a slight interior bevel. Saxamar bowl rims are only very rarely flared, and never tapered. Therefore, slip color and rim form alone are normally enough to distinguish Saxamar from Early Pacajes open vessels.[3]

[3] Early Pacajes bowls are described in Chapter 9. Their rims are often flared and almost always tapered. Their slip color tends to the orange or yellow, as opposed to the deep Saxamar reds.

Saxamar modeled decoration occasionally includes what appears to be a duck head (Figure 10.1p) or more commonly single or double nubs (Figure 10.1q-r) protruding from the rim. Painted decoration is always applied using a black pigment. I have encountered only a single example of a Saxamar polychrome (Figure 10.1p). This example used a white pigment to color the beak and neck of a stylized duck head. Cross-hatching on an interior rim bevel is extremely diagnostic of this style (Figure 10.1s-w), and an undulating line occupying the same position is not uncommon (Figure 10.1z-aa). Also extremely diagnostic are arrays of what appear to be stylized camelids rendered with very delicate brush strikes (Figure 10.1p-r, t-z). These are clearly distinguishable from their thicker and coarser Early Pacajes precursors.

While the stylized camelid motif is the most common element in Saxamar decorative painting, other objects and animals are also represented. These include lake birds - possibly flamingos - (Figure 10.1ad-ae), what appears to be a grasshopper (Figure 10.1ac), and a branching design, possibly representing a tree or other plant (Figure 10.1aa-ab). This last motif is particularly interesting, because it becomes much more common in the subsequent Late Pacajes phase. All three of these non-camelid motifs are quite rare in the Saxamar style.

The second most common Late Horizon style on the Taraco Peninsula is related the Inka Imperial style (Figure 10.1af-am), and is related to the imperial Cuzco A and B styles (D'Altroy and Bishop 1990, D'Altroy 1993, Rowe 1944, Tschopik 1946: 36-39). Ceramics of this general style are found throughout the former territory of Inka empire and are the principal markers of the Late Horizon. These vessels are of two main types: shallow bowls or plates, clearly the inspiration for the Saxamar examples, and large restricted-neck jars generally known as aryballoid vessels, or *arybalos*. Both are normally fine, dense and well-fired, and are slipped a deep red (though exceptions exist, such as Figure 10.1ak, which has a white slip). In fact, the Saxamar style's technology and slip color are pretty clearly in imitation of the Inka Imperial style. Inka Imperial plates also frequently have modeled decoration, in the form of bird heads or nubs, on the rim. In addition, *arybalos* typically sport a highly stylized modeled animal head on their body. This head,



Styles: a-c) Taraco Polychrome, d-n) Chucuito Black on Red, o) Chucuito Polychrome, p-ae) Saxamar (Pacajes-Inka), af-am) Inka Imperial.

Figure 10.1: Late Horizon ceramics

known as an *adorno*, is usually though to have served to attach a tumpline. Inka Imperial bowls often are decorated with chains of triangles pendant from the rim (Figure 10.1aj-am). *Arybalos* are often decorated with chains of triangles or diamonds (Figure 10.1af-ag), or with a highly distinctive motif probably representing some kind of plant (Figure 10.1ah-ai). Ceramics of the Inka Imperial style seem to have been produced by state specialists, and distributed as part of the functioning of the administrative apparatus (Costin and Earle 1989, Costin and Hagstrum 1995).

The third most common Late Horizon style is the Chucuito style. The center of the distribution of the Chucuito styles seems to be the western Titicaca Basin, south of Puno and north of Yunguyu. Essentially, this was the territory of the Lupaqa "kingdom" (Hyslop 1976, Murra 1968, Murra 1970). A small number of trade pieces seem to have been transported to the southern Titicaca Basin. The Chucuito styles were originally described by Tschopik, and her analysis is still the best source on the style (Tschopik 1946).

Chucuito polychromes (Tschopik 1946: 27-29) are very rare on the Taraco Peninsula. Only one example was recovered in the survey, which seems to represent some kind of catfish (Figure 10.1o). More common is Chucuito Black on Red (Tschopik 1946: 29-31). These ceramics are very similar to the Saxamar style in terms of basic technology. They also are fine and dense, and are decorated with a glossy black pigment over a deep red slip. Diagnostic - that is, painted - examples are exclusively open bowls. Tschopik documents a wide variety of decorative motifs for this style. On the Taraco Peninsula, very few of these motifs are represented. Some figurative elements are present (Figure 10.1d, g-h), but most examples present some combination of spirals, undulating lines, and pendant loops (Figure 10.1e-f, i-l). In this, at least, my sample seems to resemble that of Stanish from the Juli area of Peru (Stanish et al. 1997: 47-48, 55).

The fourth and final Late Horizon ceramic style is Taraco Polychrome, also first defined by Tschopik (also see Julien 1993: 190-191). The distribution of this styles seems to be centered in the Peruvian town of Taraco[4] on the northern side of the lake. It is exceedingly rare in the southern Titicaca Basin. I recovered only four examples from the Taraco

[4]I like to think of this as "the other Taraco". Charles Stanish has pointed out to me a general pattern of duplicate toponyms in the northern and southern Titicaca Basin, of which this is an example.

Peninsula, three of which are illustrated in Figure 10.1a-c. Tschopik described the style as follows:

> ... a fine, compact ware with a white or cream-colored paste, containing a very fine temper and occasional reddish-brown inclusions. The surface is also cream-colored, carefully smoothed on both sides so as to be quite lustrous. There is no slip; designs are painted directly on the surface in orange, red, and a dark color which is usually black but which may appear olive green when thinly applied. With few exceptions the shapes represented are bowls. [Tschopik 1946: 31]

The black/green paint is immediately recognizable in the field, as are the cream surface color and the apparently-common "eye" motif.

10.1.2 Early Colonial Period

In contrast to the stylistic diversity of the Pacajes-Inka phase, the Late Pacajes phase seem to be much more homogeneous. Only a single style of decorated ceramics has been identified which pertains to this phase. Late Pacajes decorated ceramics are always bowls and occasionally plates (plates illustrated in Figure 10.2m-n). With a few exceptions (like Figure 10.2c) they are unslipped, with a surface color that sometimes approaches purple - normally in the 10R 3/6-4/7 Munsell range. The rare slipped bowl may be burnished, but the vast majority have a wet wiped surface finish which is very distinctive. Virtually all Late Pacajes bowls have everted rims (exceptions illustrated in Figure 10.2j, s), and a rare subtype has a very widely flared rim (Figure 10.2a-c) which sometimes approaches a shelf rim. Late Pacajes everted rims have a clearly marked point of inflection as opposed to Early Pacajes rims, which usually have very vague inflection. Thus, a combination of surface treatment, surface color and rim form is usually enough to identify a Late Pacajes bowl even in the absence of any decoration.

Two kinds of plastic decoration are known to occur on Late Pacajes decorated ceramics, both of which are derived from Late Horizon ceramics. First, some plates have cylindrical stems protruding from the rim, similar to the Late Horizon "duck plates" (Figure 10.2m-n). The only intact example I have observed has an "X" incised on the end of the cylinder

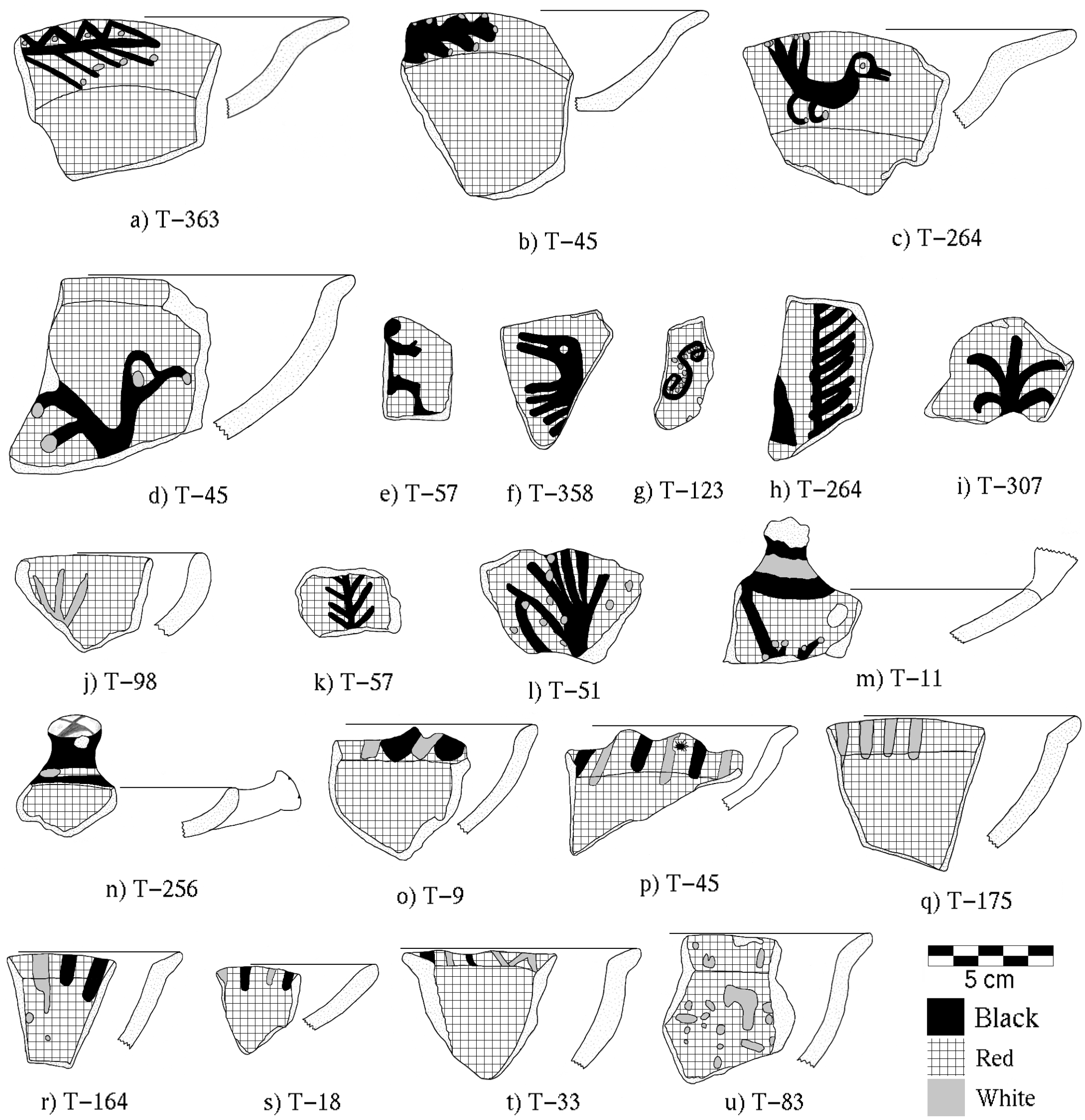


Figure 10.2: Early Colonial Period ceramics

(Figure 10.2n). More common are a series of nubs or small protrusions modeled on the rim of bowls (Figure 10.2o-p), occurring in groups of two or three spaced regularly around the circumference. These are occasionally perforated (Figure 10.2p).

Late Pacajes painted decoration is frequently polychrome, and three pigments are employed. The first appears to be an organic pigment, which produces a black or occasionally dark gray color over the red surface. The color area is normally quite diffuse, and its edges poorly defined. The principal parts of any design are usually rendered using this pigment (though see Figure 10.2j for an exception). The second type of painted decoration is a white pigment which is applied positively. It is normally used to embellish a design with the addition of white dots (Figure 10.2a-d, g, l-m).[5] The third and rarest type of painted decoration of a yellow pigment which is applied positively. It is used in exactly the same manner as the white paint just described. The yellow pigment is often somewhat runny (Figure 10.2r, u), suggesting that it is either sloppily applied or that it has melted and run during firing. It may be some kind of glaze, though I am uncertain on this point.

The white and yellow pigments never occur on the same vessel, which may suggest that the yellow is simply a result of overfiring the white paint. Whatever the case, Late Pacajes decorated ceramics are always either a monochrome Black on Red or a bichrome Black and White on Red or Black and Yellow on Red.

The most common decorative motif consists of a series of shirt parallel lines pendant from the interior rim of bowls (Figure 10.2o-t). These may be black, white, or alternating black and white. Also fairly common is a branching motif (Figure 10.2i-m), probably representing a tree or other plant and clearly derived from a similar Saxamar motif (Figure 10.1aa-ab), though the motif is also present in the Late Horizon Chucuito Black on Red style (Tschopik 1946: 31). Less common decorative motifs include avian profile figures (Figure 10.1c-d), geometric designs (Figure 10.1g-h), a possible quadruped (Figure 10.1f) and biped (Figure 10.1e), and other figures which are not immediately identifiable (Figure 10.1a-b). The Late Pacajes ceramic decorative repertoire is apparently considerably more

[5]This is similar to a common decorative technique of the Sillustani Black and White on Red style from the northern Titicaca Basin (Tschopik 1946: 27), though this is apparently the only point of similarity between the two styles.

varied than has previously been suggested.[6]

10.1.3 Are the Pacajes phases temporally discrete?

As long as I am discussing the Pacajes ceramic phases, I am compelled to address an issue that was raised by the original formulators of the Pacajes ceramic sequence. In their survey report, Albarracín-Jordan and Mathews suggested that the Pacajes-Inka phase may in fact have overlapped temporally with both the Early Pacajes and Late Pacajes phases (Albarracín-Jordan and Mathews 1990, Figure 14). In this view, Pacajes-Inka phase ceramics represented a foreign stylistic intrusion into the southern basin, which coexisted with both late Early Pacajes ceramics and early Late Pacajes ceramics. Mathews argues that certain ceramic attributes, such as disk bases and everted rims, are present in both Early and Late Pacajes ceramics, but not in Pacajes-Inka ceramics.

> In essence, this argument requires the assumption of the contemporaneous manufacture of two distinct ceramic types, emerging from two separate cultural traditions, in the Tiwanaku Valley. Specifically, we need to posit that the Inka ceramic material represented a tradition that was superimposed over over the existing cultural matrix, rather than one which replaced it completely. Inka-Pacajaes could have represented an elite or sumptuary class of ceramic which was available only to certain elements of the indigenous Pacajaes society, possibly determined by position within the Inka administrative hierarchy of indirect rule. At the same time, commoners continued to produce the diagnostic Early Pacajes wares described above, for everyday domestic consumption. [Mathews 1992: 194]

This is actually a straightforward hypothesis to test. If Mathews's suggestion is correct, then a high percentage of sites with Pacajes-Inka ceramics will also have Early Pacajes ceramics on the surface. On the other hand, if Pacajes-Inka ceramics are partially contemporary with Late Pacajes ceramics, then a high percentage of sites with Pacajes-Inka

[6] Albarracín-Jordan, for example, characterizes Late Pacajes ceramics as "essentially a debilitated extension of the previous local Pacajes-Inka style" (Albarracín-Jordan 1992: 327). Also, "[el] decorado se limita a puntos negros y blancos, y en reducidos casos a líneas paralelas" (Albarracín-Jordan and Mathews 1990: 175).

	Taraco Peninsula	Lower Tiw Valley	Middle Tiw Valley
Early Pacajes	25	88	94
Late Pacajes	40	58	36

Table 10.1: Percent of Pacajes-Inka sites also having other Pacajes occupations

ceramics will also have Late Pacajes ceramics on the surface. If neither one of these it true, then no such relationships will be observed.

Table 10.1 displays these data for the Taraco Peninsula and for the Lower and Middle Tiwanaku Valley. The Tiwanaku Valley data were derived from the dissertations of the Tiwanaku Valley researchers (Albarracín-Jordan 1992 Appendix 2, Mathews 1992 Appendix A). The Early Pacajes value for each area is equal to the complement of the site founding index for the Pacajes-Inka phase.[7] The Late Pacajes value for each area is equal to the occupation continuity index for the Pacajes-Inka phase. See Chapter 4 for a discussion of these indices.

It is easy to see how Mathews could think that Early Pacajes and Pacajes-Inka ceramics were partially contemporaneous. In his sample (the Middle Tiwanaku Valley) 94% of Pacajes-Inka sites also have Early Pacajes ceramics on the surface. However, only 36% of Pacajes-Inka sites have Late Pacajes ceramics on the surface, clearly showing that Pacajes-Inka and Late Pacajes ceramics are sequential and not contemporaneous. The Lower Tiwanaku Valley data are similar, though the relationships, both positive and negative, are weaker.

However, the Taraco Peninsula data show the opposite relation. That is, only 25% of Pacajes-Inka sites on the Taraco Peninsula have Early Pacajes ceramics on the surface. And only 40% of Pacajes-Inka sites on the Taraco Peninsula have Late Pacajes ceramics on the surface. This means that the Taraco data that Early Pacajes and Pacajes-Inka ceramics are sequential and not contemporaneous. The association between Early Pacajes and Pacajes-Inka occupations in the Tiwanaku Valley must be due to some other factor. My personal belief is that there are so many Early Pacajes sites in the Middle Tiwanaku Valley (over

[7] That is to say that it is equal to 100 minus the Pacajes-Inka phase site founding index value.

500), that there is an Early Pacajes phase occupation of the vast majority of the sites of any phase. That is, there is an Early Pacajes site in virtually every habitable location. Whatever the case, this exercise has conclusively demonstrated that the three Pacajes phases are in fact sequential and have no appreciable temporal overlap.

10.2 Principal sites

In the Pacajes-Inka and Late Pacajes phases villages reappear on the Taraco Peninsula after an absence during the Early Pacajes phase. However in both phases a dispersed habitation mode predominates, with only a few villages situated in a landscape of small farmsteads and hamlets. For this reason relatively few Pacajes-Inka and Late Pacajes sites stand out enough to merit detailed description. Those that do are the larger ones, and they are described below.

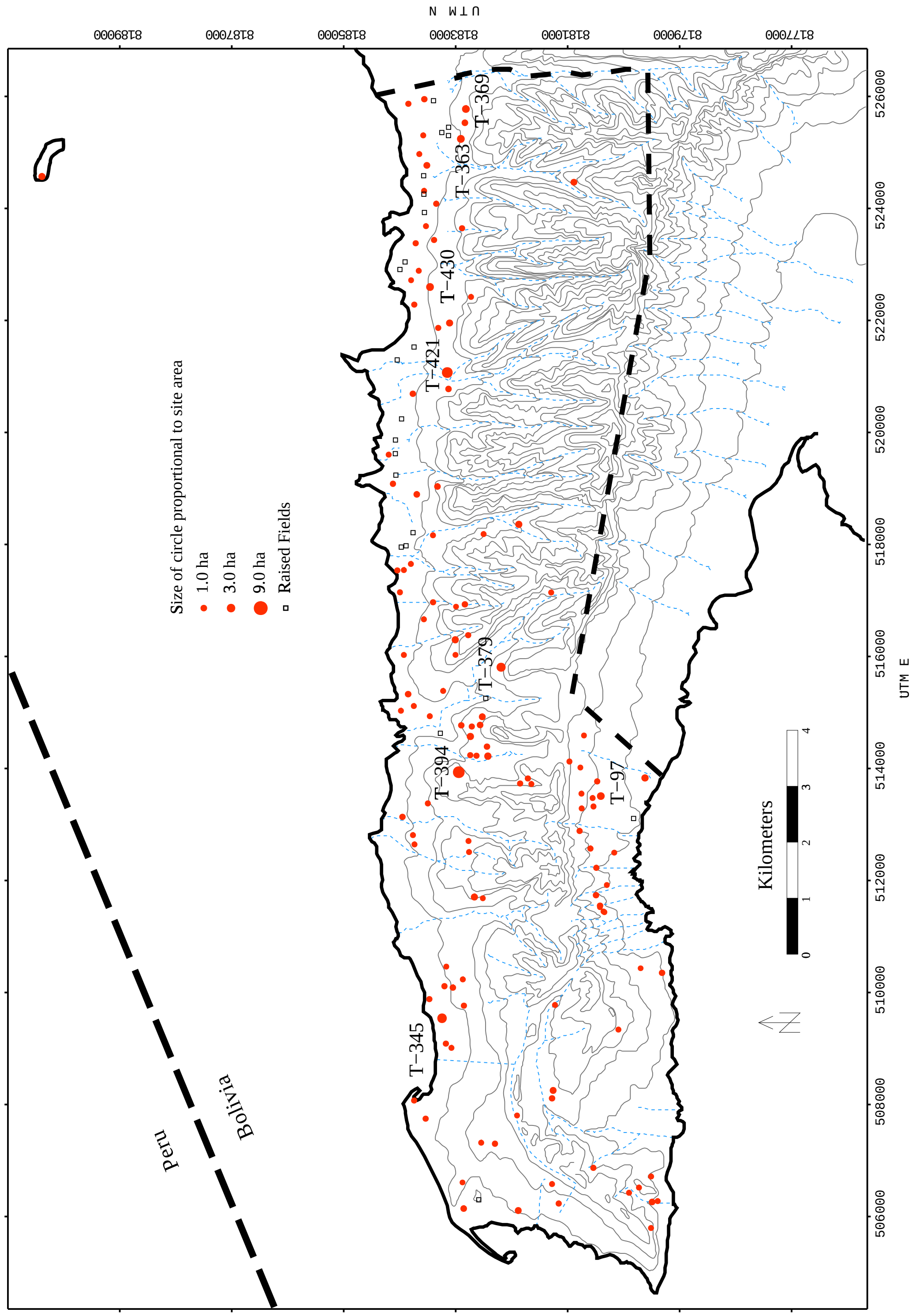
10.2.1 Late Horizon

Eight sites were identified with Late Horizon occupations greater than or equal to 2.0 ha. These are numbered on Figure 10.3 and are described below. Of these only the four largest - with population index values from 187 to 368 - could truly be considered villages. The rest are simply large hamlets or unusually dense concentrations of farmsteads, quite possibly representing palimpsests of temporally discrete occupations.

T-97A (Leque Lequeri)

This is a fairly large, low density ceramic scatter covering about 2.08 ha in the modern community of Iwawe Grande. It is located on the top and sides of a low ridge. Very few modern materials are present. A small group of trees is present on the northern end of the site. The site is now used for agriculture, and the surface consists of fallow and plowed fields. Tractors have been used on the site.

In the upper portion of the site are located two large blocks of worked andesite. Since the site is located only a little more than a kilometer from the substantial Tiwanaku site of



Numbered sites are discussed in text.

Figure 10.3: Late Horizon (Pacajes-Inka) Settlement Pattern

Iwawe - or Ojepuko - I assume the blocks were brought from there. There are no indications of any kind of surface architecture.

The entire scatter contains Pacajes-Inka materials. It seems to have been a small LH village, or a large hamlet, with a population index value of 103. The site also has a smaller Late Pacajes occupation (sector B), covering only 1 ha. There is no pre-LH occupation at the site, and very little modern material is present.

T-345A (Ollajaya Pata)

Ollajaya Pata is a large Pacajes-Inka site located in the modern community of Ñacoca. The sherd scatter is quite dense and continuous, covering some 4.2 ha (population index: 228), and the soil is dark and stained with organic material. I would imagine that there are preserved subsurface features and deposits. The site is located in the gentle slope immediately above the lakeshore. The locality is used for agriculture at present, and the modern surface consists of plowed and fallow fields. A small group of springs is located nearly, in a *quebrada* to the west of the site itself.

This site would appear to be a small village, though large by post-Middle Horizon standards. A small Late Pacajes farmstead (sector B) is also present on the site, covering only 0.36 ha.

T-363A (Kala Puju Pata)

This site is located in the modern community of Huacullani. The scatter is continuous and dense, covering 2.21 ha. Sector A, the LH occupation, has a population index value of 111. The site is located in the gentle slopes immediately above the Taraco-Tambillo road. In fact, the road has disturbed the northern extreme of the site. Numerous springs are found in the vicinity.

Sector B is a Late Pacajes farmstead, covering only 0.60 ha.

T-369A

This site is very similar to Kala Puju Pata, described above. It is located less than 500 m to the east along the Taraco-Tambillo road, also in the community of Huacullani. Its extension is almost the same, at 2.10 ha (population index value: 104). Immediately to the north of the site, across the modern road, is a large swampy area, or *pantanal*.

A series of broad, low terraces cover the surface of the site. These could have been habitation terraces, or may be more recent agricultural features. A small Late Pacajes farmstead is also present at the site, as it the case with most sites on the Taraco Peninsula.

T-379A (Wankarani)

One of the few actual villages of the Pacajes-Inka phase, Wankarani is a dense scatter located in the community of Zapana. The scatter is very dense, and the soil is quite dark in color. The village is located in a small inland valley, on the nose of a ridge to the south of the modern crossroads. It is quite near to a small river with year-round flow. Ceramic styles present include Cuzco, Saxamar, and Chucuito.

The location is strategic in the sense that it allows control of traffic through a low pass in the hills. This is the route of the modern road. In this respect Wankarani is situated identically to the modern town of Taraco, which is located nearby. Wankarani has a population index value of 187 (3.52 ha).

T-394H (Janko Kala)

Janko Kala, the reader may recall, was one of the old Formative Period villages on the Taraco Peninsula. It was one of the four principal Middle Formative villages, and remained occupied through the Late Formative. It is described in more detail in Chapters 5 and 6. The village was relocated to the site of Titicachi (T-415) in the Tiwanaku period, and was abandoned in the Early Pacajes phase, In the Pacajes-Inka phase, the original site of the village was reoccupied.

At 6.50 ha, sector H at Janko Kala is clearly the largest LH village on the Taraco Peninsula. It has a population index value of 368. The site was probably the LH administrative center of the Taraco Peninsula, and compares favorably in terms of size to other significant Inka sites such as Guaqui. There can be no doubt, however, that it was subordinate to one of the major Inka centers in the Tiwanaku Valley or the Katari Basin.

T-421J (Waka Kala)

Waka Kala is also a site with a long history. It was continuously - though not necessarily densely - occupied from the LF2 though the Early Colonial period. The LH occupation at the site, sector J, is the largest in its history. It covers 5.5 ha, and has a population index value of 307, making it the second-largest Pacajes-Inka village on the peninsula.

T-430G (Alto Pukara)

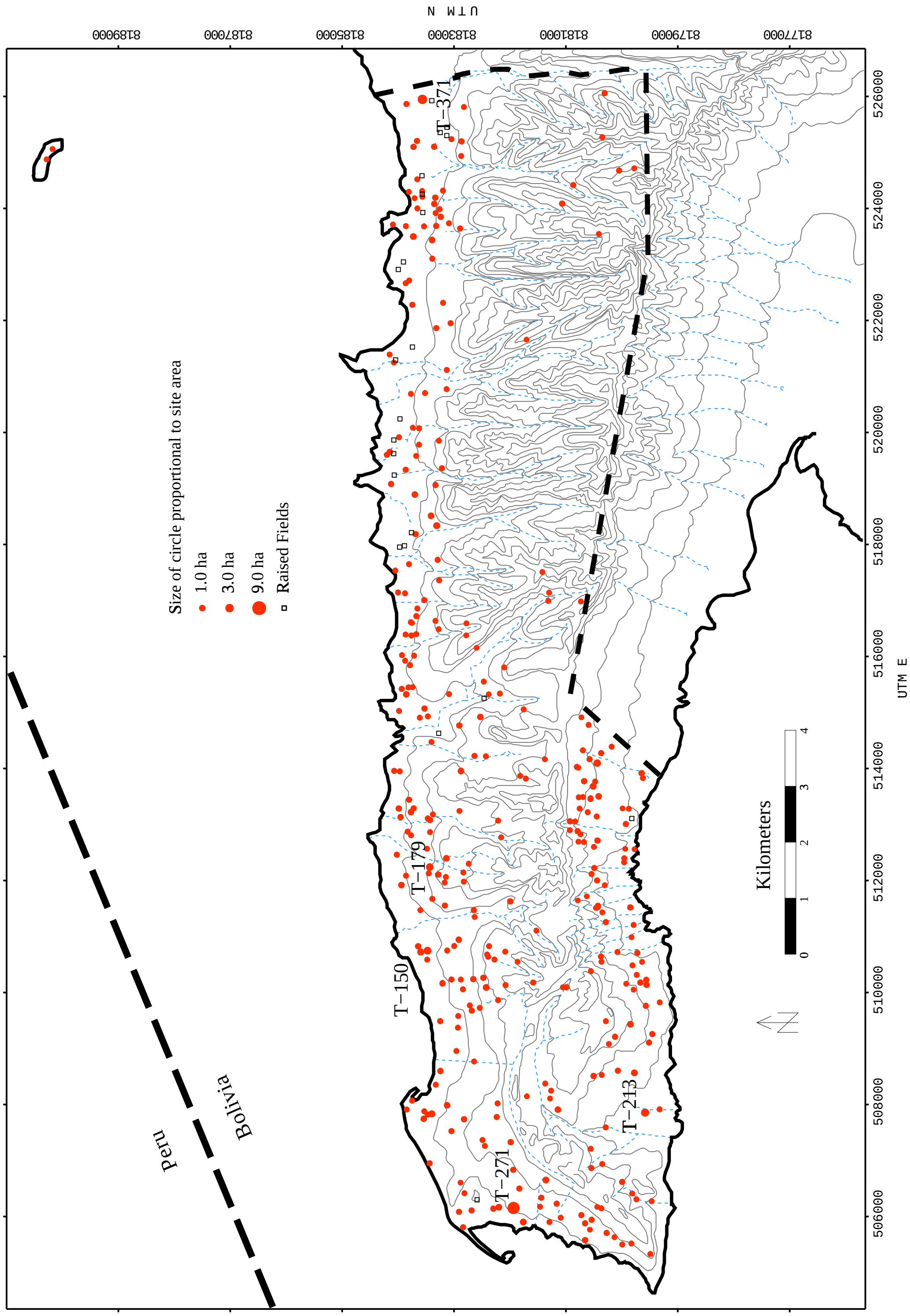
Sector G at Alto Pukara was a large hamlet, covering 2.25 ha with a population index value of 113. The LH occupation at this site is in no way remarkable.

10.2.2 Early Colonial Period

Five sites were identified with Early Colonial Period occupations greater than or equal to 2.0 ha. These are numbered on Figure 10.4 and are described below. Of these five, only two - Sonaji and K'eyuan Pampa - can be considered as true villages, the remainder representing large hamlets.

T-150A (Janko Kala)

T-150 should not be confused with the other Janko Kala (T-394). The two share a toponym but are otherwise distinct. T-150 is located in the modern community of Nachoca. The site has only one occupation component. The scatter is continuous , though low density, and covers 2.16 ha. It is located on the gentle slopes overlooking the lake plain, on a low hill well to the north of the modern road. The site has a population index value of 107, and is probably a large hamlet.



Numbered sites are discussed in text.

Figure 10.4: Early Colonial Period (Late Pacajes) Settlement Pattern

T-179A (Taypi Circa)

Taypi Circa (also called Poque Pata) is located in the modern community of Nachoca on the gentle slopes below (to the north of) the modern road. The scatter is continuous over 2.00 ha, and contains only Late Pacajes material. The site has a population index value of 98, qualifying as a large hamlet.

Andesite is present on the site, both as debitage and as ground stone. This is very unusual for a single-component Late Pacajes site and suggests that another occupation (probably Middle Horizon) is present though not evident in the surface assemblage. A few Tiwanaku sherds were encountered, but were not sufficient to indicate an occupation according to my methodology (see Chapter 3).

T-213D (Oman Jawirmunta)

This was a minor Late Formative and Tiwanaku period site in the community of Coa Kkollu. The scatter is located on a low mound in the *pampa*, probably a small tell. Sector D is the site's largest occupation, covering 2.50 ha with a population index value of 127. I consider it a large hamlet.

T-271F-G (Sonaji)

Sonaji is without a doubt the largest and most important Late Pacajes site on the Taraco Peninsula. Readers will recall that this site was first occupied in the Middle Chiripa phase, and came to be the dominant site on the peninsula in the late LF1, continuing as an administrative period in the LF2 and Tiwanaku periods.

Sectors F and G, the Late Pacajes occupations, cover 1.25 and 7.00 ha respectively, with a combined population index value of 455. These areas are somewhat approximate, since a third to a half of the site lies beneath the modern town of Santa Rosa (under the church certainly, and possibly under the plaza as well). The modern town of Santa Rosa therefore seems to have been the principal village on the peninsula in the Early Colonial period. It is also worth noting in this connection that the town of Taraco, the peninsula's modern capitol, was not occupied at all in the Late Pacajes phase. Its preeminence evidently dates to a later period.

To find this site, walk out of the plaza of Santa Rosa toward the lake. Ceramics will become apparent immediately upon passing out of town.

T-371B (K'eyuan Pampa)

This site is a moderate-density ceramic scatter in the modern community of Huacullani. It is situated on top of a low rise in the lake plain, well below the modern road, almost exactly on the boundary of my survey area. Springs are to be found nearby and the T-370 raised field group is immediately adjacent.

Prior to the Late Pacajes phase the mound was occupied by a small Pacajes-Inka farmstead, Sector B, the much larger Late Pacajes occupation, is a moderate-density scatter covering 3.99 ha with a population index value of 215. The site may be a small village, or a palimpsest of overlapping successive farmsteads and hamlets. It is impossible to say.

10.3 Settlement and population

As Table 10.2 makes clear, the Pacajes-Inka and Late Pacajes phases were times of very rapid growth on the Taraco Peninsula. During both phases the population of the peninsula grew at a rate much faster than the expected rate of natural increase. This suggests considerable immigration from other areas. If the peninsula experienced catastrophic depopulation with the collapse of the Tiwanaku state, then the arrival of the Inka state reversed the process.

10.3.1 Late Horizon

In the Pacajes-Inka phase, the population of the Taraco Peninsula grew at the very rapid rate of 1.07% annually (Table 10.2). It should be remembered that this is something like ten times the rate of natural increase, and is roughly equivalent to the rate of growth of

	Pacajes-Inka	Late Pacajes
Number of sites	125	326
Phase population index	3676	5021
Annual population index growth rate	1.07	0.52
Occupation continuity index	40	57
Site founding index	75	79

Table 10.2: Late Horizon and Early Colonial: Metrics

the city of Tiwanaku in the period of its most rapid expansion (the LF2; see Chapter 7). Such a high rate of population growth indicates that people were moving onto the Taraco Peninsula in large numbers. This is consistent with the documented population decreases that occurred at this time in the nearby Tiwanaku Valley. In the Lower Tiwanaku Valley, population decreased at an annual rate of some -0.29%. Mathews's figures from the Middle Tiwanaku Valley suggest an even higher rate, perhaps as much as -3.0% annually.[8]

This phenomenon, the relocation of population from inland areas to the lakeshore, is entirely consistent with what we know of the Inka practice of statecraft. The Inka frequently relocated subject populations in order to facilitate their governance or to shift their economic focus (cf. Rowe 1946, Rowe 1982). In the case of the Titicaca Basin a general shift from inland areas to the lakeshore zone seems to characterize the Late Horizon (see also Mathews 1992: 192, Stanish et al. 1997: 58, Stanish 1997). This pattern may indicate that the Inka state was attempting to increase agricultural production, as opposed to the more mixed agro-pastoral economy of the Late Intermediate Period, and particularly agricultural production in those areas of the Titicaca Basin which can support maize.[9] The low occupation continuity index value, and the high site founding index value, are consistent with this scenario, indicating a substantial reorganization and expansion of settlement on

[8]Mathews does not include the site of Tiwanaku itself in his site registry. Since Tiwanaku seems to have been a substantial Late Horizon town, this has the effect of underestimating the population of the Middle Tiwanaku Valley during the Pacajes-Inka phase. However, the Late Horizon population decline is a undeniably a very real phenomenon, though we may quibble about its precise magnitude.

[9]This interest in maize is characteristic of Inka rule throughout the Andean highlands (Hastorf 1990a, Hastorf and Earle 1985). In the case of the Titicaca Basin it may have been related to the provisioning of the important shrine on the Isla del Sol (Bauer and Stanish 2001).

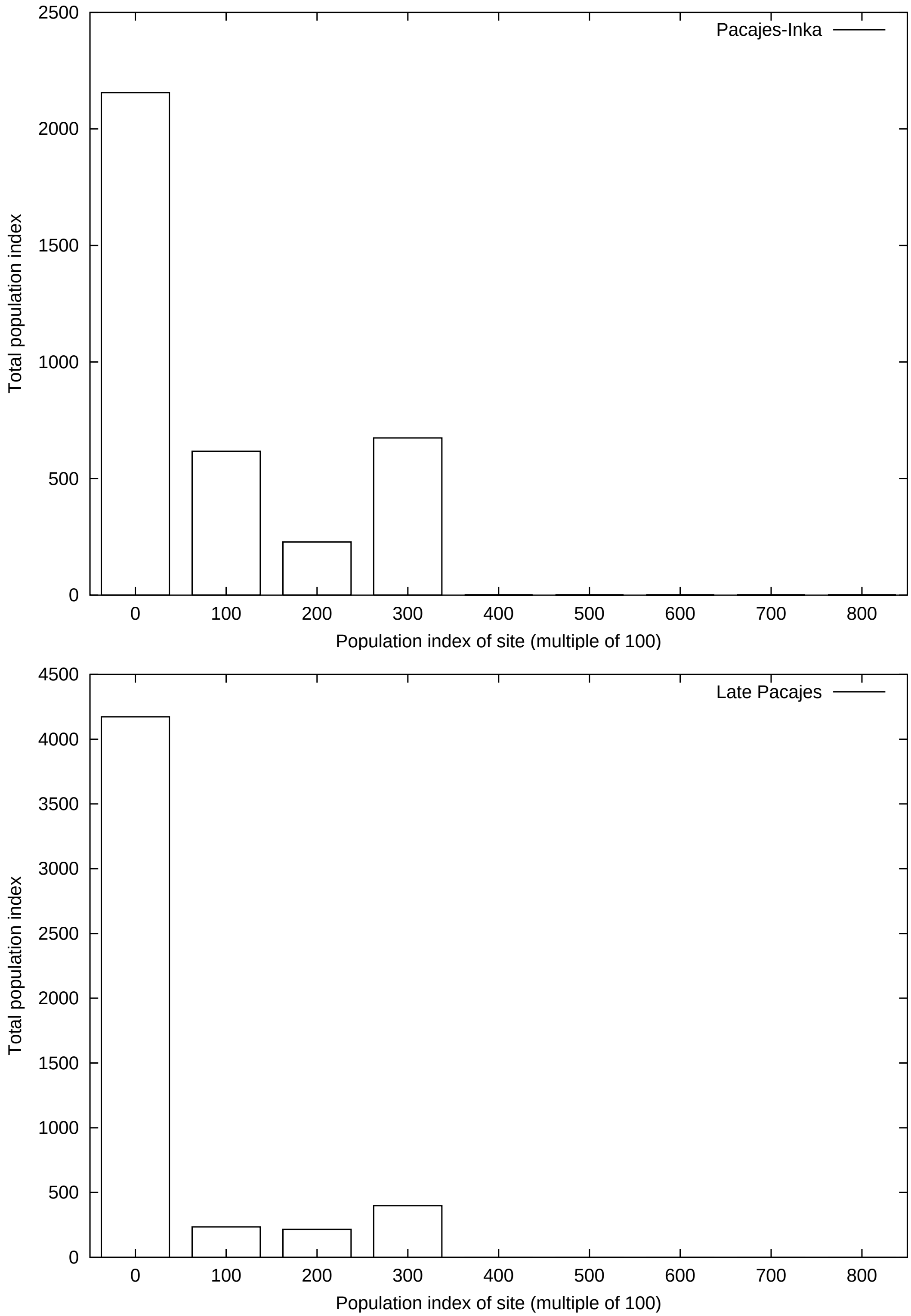


Figure 10.5: Late Horizon and Early Colonial site size distribution

the peninsula in the Late Horizon.

Whatever the case, the Pacajes-Inka settlement pattern clearly reflects reorganization into an Inka provincial administrative area. In contrast to the Early Pacajes phase, in which no site size hierarchy could be discerned (Figure 9.3), the Pacajes-Inka phase has a clear two-tier site size hierarchy. The top tier includes three sites with population index values of 300-400. These are Janko Kala (T-394), Waka Kala (T-421) and Ollajaya Pata (T-345). Of these Janko Kala is the largest. When considered together with nearby satellite villages and hamlets,[10] there is no doubt that it is the principal Late Horizon site on the peninsula. The second-tier sites include a few smaller villages, and many hamlets and farmsteads.

This settlement hierarchy shows up nicely in the population density surface plot (Figure 10.6a). Three main peaks are evident, representing the three first-tier villages. The main population concentration is clearly defined by the sites of Janko Kala and Wankarani and the smaller sites located between them.

10.3.2 Early Colonial Period

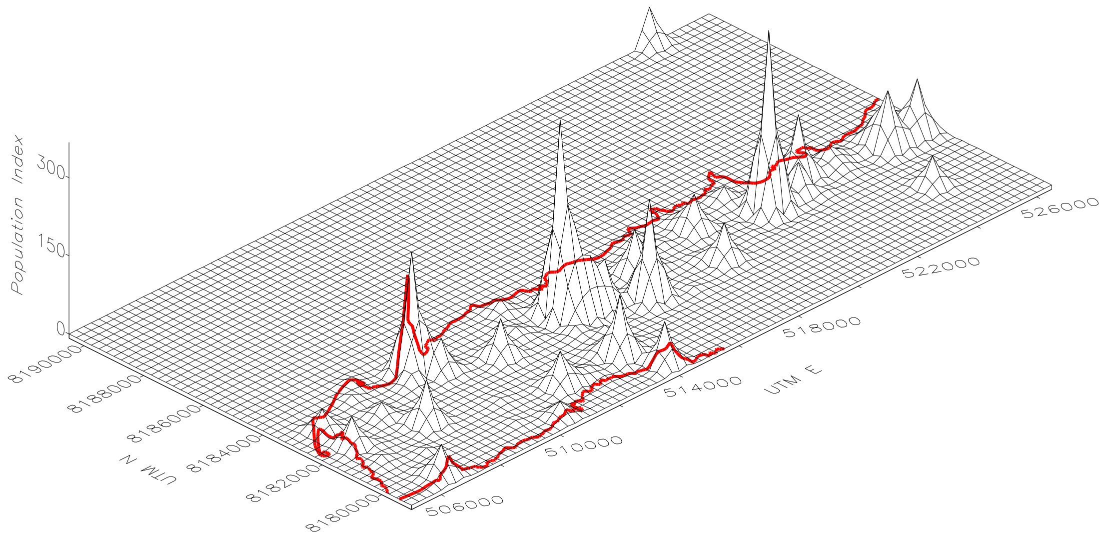
In some respects the Late Pacajes settlement pattern is essentially very similar to the Pacajes-Inka one. Population continued to grow, though at a slower rate (0.52% annually). Even this reduced rate, however, strongly implies a continued influx of population onto the peninsula, especially given simultaneous population declines in neighboring areas.[11] The site founding index continued to be high, indicating continued settlement expansion, while average site size and the occupation continuity index remained relatively low, indicating the continued predominance of dispersed and relatively short-term habitations. The Late Pacajes site size hierarchy is also nearly identical to that of the Pacajes-Inka phase, as is made clear in Figure 10.5.

On the other hand, the Late Pacajes settlement system is quite different. Figure 10.6b is a density map of Late Pacajes population on the Taraco Peninsula. The preeminence of the site of Sonaji (T-271) is clear. Figure 10.7b shows the change in population density

[10] These include Wankarani (T-379).

[11] Especially, of course, the Tiwanaku Valley (see Albarracín-Jordan 1992: 326-333, Mathews 1992: 194-195).

- a) Pacajes-Inka



- b) Late Pacajes

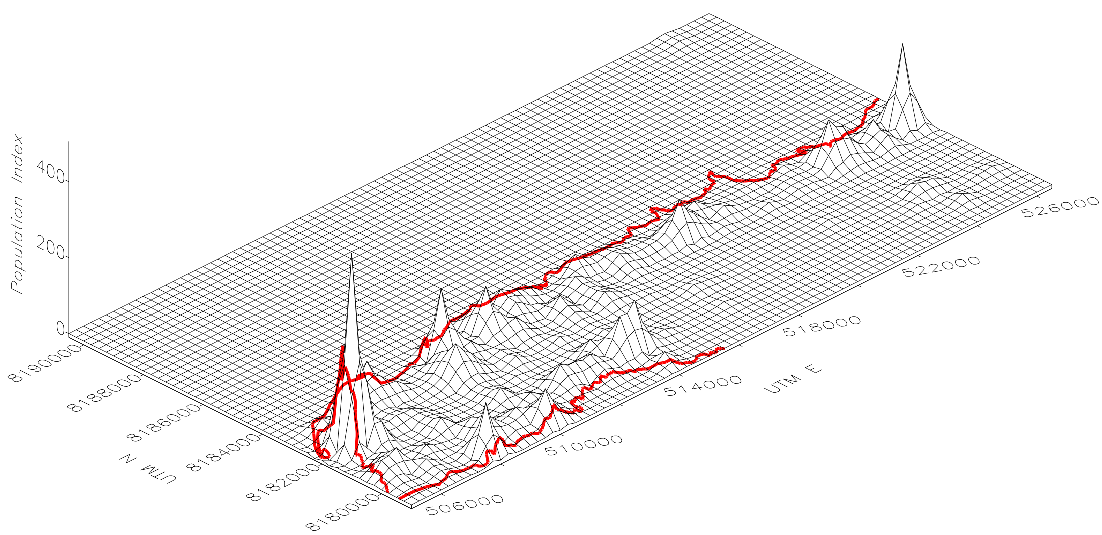
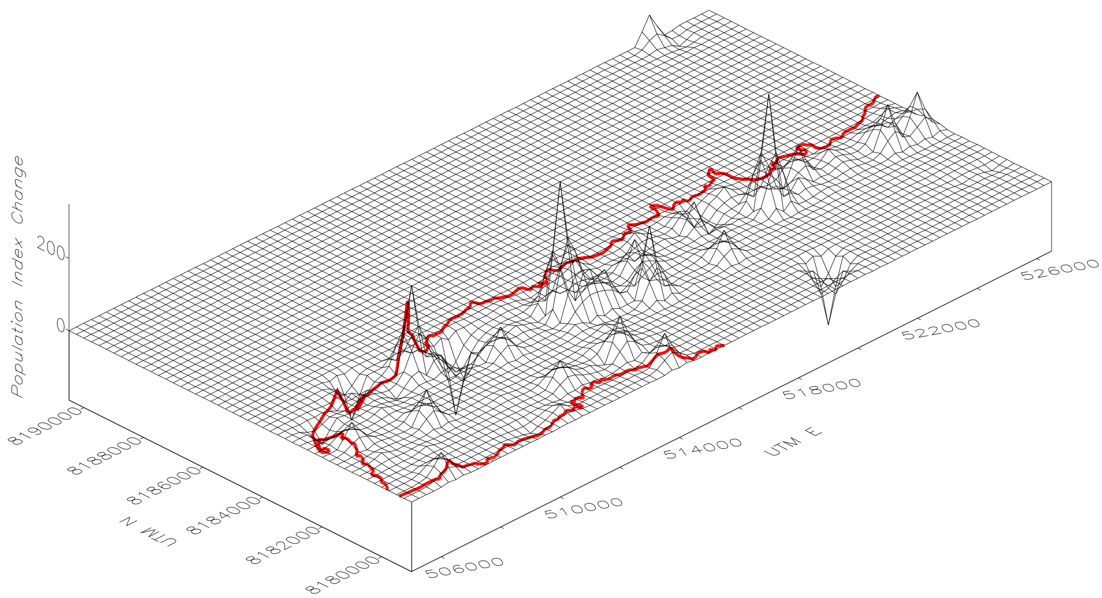


Figure 10.6: PI-LP: Sum of phase population index per 0.25 km^2

- a) Pacajes-Inka



- b) Late Pacajes

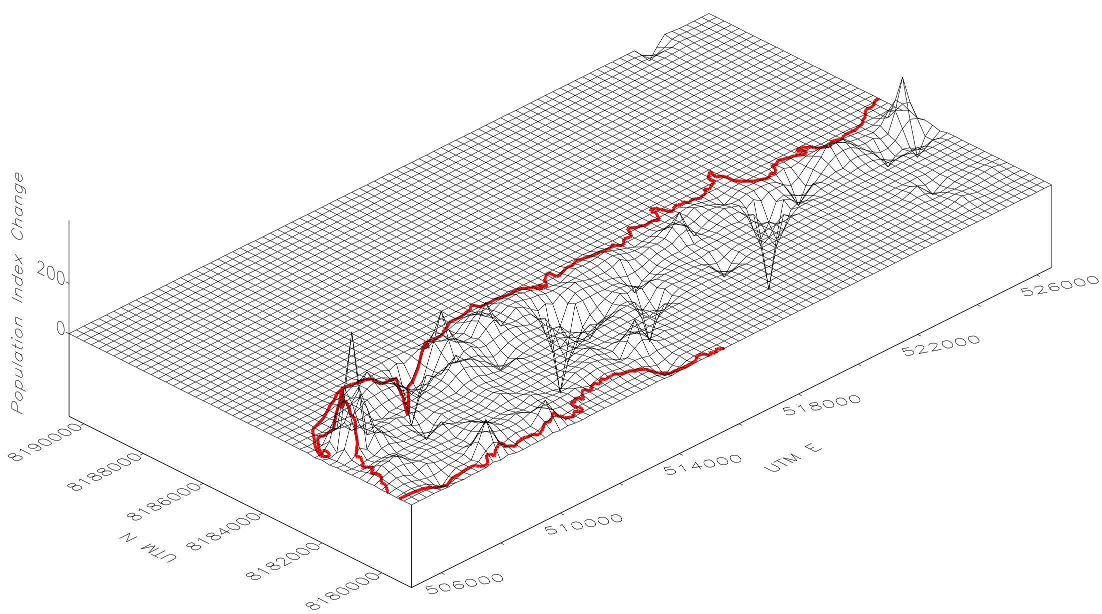


Figure 10.7: PI-LP: Change in phase population index per 0.25 km^2

on the Taraco Peninsula from the Pacajes-Inka phase through the Late Pacajes phase. The depressed areas represent the abandonment of every single one of the earlier Pacajes-Inka phase villages described above. Thus, while the Late Pacajes site size hierarchy was a two-tier one, as was that of the Late Horizon, all of the Pacajes-Inka phase villages were abandoned and a new local center was established at the present location of the town of Santa Rosa. This settlement (Sonaji [T-271]) was the sole village on the Taraco Peninsula during the Late Pacajes phase. The remainder of the population - which was actually quite substantial - lived in small hamlets and farmsteads scattered about the landscape.

10.4 Discussion

The Pacajes-Inka phase settlement data clearly suggest a policy of forced resettlement on the part of the Inka empire. Large numbers of people were relocated from more inland areas such as the Tiwanaku Valley to areas closer to the lakeshore - including the Taraco Peninsula and various islands in the lake - which are much more agriculturally productive. This reversed a very long-term trend of population movement away from the lakeshore to inland locations. This inland migration began in the LF1 and continued through the end of the LIP. This suggests a complete abandonment of raised field agriculture[12] as well as either a reduction in the importance of pastoralism or a reorganization of pastoral production. It may be that under the umbrella of a *pax incaica* groups were able to live at a distance from their herds. This would not really have been possible in the more bellicose and dangerous environment of the LIP. Pacajes-Inka phase groups and families may have had large camelid herds in inland areas which were tended by a rotating detail of herders.

This removal of the necessity for propinquity between a household and its animals also removed what I have suggested was the original reason for the shift from nucleated to dispersed habitation in the Early Pacajes phase (see discussion in Chapter 9). Indeed, in the Pacajes-Inka phase some villages were founded and a site size hierarchy appeared. I hypothesize that these small villages represent the households of local leaders who par-

[12] If it has not in fact been abandoned earlier, at the beginning of the Early Pacajes phase, as I believe it was.

ticipated in the Inka administrative hierarchy together with those of their dependants and retainers. Thus, the Inka went some way toward reestablishing the system of lakeshore agricultural villages which had existed prior to the Tiwanaku collapse. However, the local population still resided predominantly (probably more than 70%) in dispersed farmsteads.

On the whole, then, the Pacajes-Inka settlement pattern represents the reorganization of the local population in order to increase agricultural production. This increase in agricultural production may or may not have come at the expense of pastoral production, depending on whether and in what ways management of camelid herds was modified. This question goes well beyond the scope of the present discussion, however.

The Late Pacajes settlement pattern is in most ways a straightforward continuation of the Pacajes-Inka pattern. The population continued to reside in dispersed households, with a few small villages, and one substantial one (Sonaji [T-271]). All of the village locations changed however. That is, all of the Pacajes-Inka phase villages were abandoned or reduced to hamlet status, and new villages were founded. This seems to me to be further evidence that the Pacajes-Inka “villages” were not in fact true villages but rather an agglomeration of dependent households around a single wealthy or influential one. All such configurations would have depended for their stability on continued privileged access to the workings of the Inka administrative hierarchy. With the collapse of the Inka Empire these “villages” would have dissolved into their component households. Seen in this light, Sonaji was probably not a true Spanish “town” either, but rather a concentration of dependent and attached households about a representative of the crown. That is, it was the same kind of phenomenon as the Pacajes-Inka “villages”.

However, the Late Pacajes settlement pattern does display one peculiarity which was absent from the Pacajes-Inka pattern, and which indicates a somewhat more heterogeneous political landscape. This peculiarity is a radical change in site and population density evident in the settlement location (Figure 10.4) and density (Figure 10.6b) maps. These figures show an area of very low site and population density between the 520000E and 522000E meridians. The 3 km stretch has very few sites in the Late Pacajes period, and the ones which are present are very small. Figures 10.3 and 10.6a clearly show that this area was

Phase	All Pop Index	All Growth	UTM E < 521000 Pop Index	UTM E < 521000 Growth	UTM E > 521000 Pop Index	UTM E > 521000 Growth
Early Pacajes	1408	-0.46	1091	-0.48	317	-0.33
Pacajes-Inka	3676	+1.07	2625	+0.98	1051	+1.22
Late Pacajes	5021	+0.52	4259	+0.81	762	-0.54

Table 10.3: Post-Tiwanaku annual population growth rates: Taraco Peninsula

well-populated in the Pacajes-Inka phase.

Alert readers will recall that this line is quite near to one I identified as a political boundary in the Late Formative and Tiwanaku periods (see discussions in Chapters 7 and 8). The earlier boundary was in fact located at 519000E, more or less, several kilometers to the west of the line I am discussing. It is sufficiently nearby, however, to suppose that the Late Pacajes settlement discontinuity may represent a political boundary of some kind as well.

In order to investigate this possibility, I compared population index growth rates on either side of this boundary, which I fixed at 521000E. These data are presented in Table 10.3. This table clearly shows that growth rates were roughly similar on both sides of the line during the Early Pacajes and Pacajes-Inka phases. Thus it seems not to have constituted a boundary at all in these phase as far as demographic processes are concerned. However, in the Late Pacajes phase growth rates diverge drastically. Population grew by 0.81% annually on the western side of the line, a very rapid growth rate indeed, undoubtedly implying a considerable population influx. On the eastern side of the line, however, population decreased at an annual rate if -0.54%, again a rapid rate of decline.

These data almost certainly indicate that population was moving out of the Katari Basin and onto the Taraco Peninsula during the Late Pacajes phase, and at a rapid rate. What could case this kind of population displacement?

Spanish administration of the Titicaca Basin was probably regularized around the same time as the discovery of the Potosí silver deposits in southern Bolivia in 1545. At this time, the Titicaca Basin became essentially a sustaining area of the Potosí mines. Its population was reorganized in order to provide food, coca, other supplies, and, critically, manpower to the mining operations. The founding of the city of La Paz in 1548 was part of this process. Titicaca Basin groups were subjected to various administrative strategies - *encomienda, repartimiento, corregimiento* - which served to enrich their conquerors and to impoverish themselves.

Later in the colonial period - the mid-seventeenth century to be exact - Taraco was a *marka* (see Albarracín-Jordan 1996a and Albarracín-Jordan 1996b for more detailed discussion of the concept) or town with eight *ayllu* or communities under its jurisdiction. In the Lower Tiwanaku Valley it included the *ayllu* of Iwawe, Chivo, Pillapi, and Jawira Pampa (Mamani Condori 1991: 22). Pillapi and Jawira Pampa are still communities today. This allows us to locate the seventeenth century borders of Taraco as follows:

- on the South near the Tiwanaku River, or approximately 8172000 N, and
- on the East near the modern town of Pillapi, or approximately 524000 E.

It's border on the northern side of the Taraco Hills is somewhat more obscure, but we can with some reason locate it near the boundary between the modern cantons of Taraco and Huacullani. This boundary is:

- between the modern communities of Pequery and Cala Cala, or approximately 521000 E.

Naturally, it is no coincidence that this is the same meridian identified above as a boundary from population growth rates. The Late Pacajes settlement pattern clearly identified a colonial period political boundary.

Of course, there is no guarantee that these were the boundaries of sixteenth century (Late Pacajes) Taraco also. In fact, the town of Taraco did not yet exist in the sixteenth century as far as I have been able to determine. Sonaji (T-271) was the only town on the peninsula at this time. Further research will be necessary to confirm the sixteenth century borders of what we now call Taraco. However, given the settlement data already discussed it is not unreasonable to assume for the moment that it was the same as the seventeenth century borders just defined.

Phase	All		UTM E < 524000 UTM N > 8172000		UTM E > 524000 UTM N > 8172000	
	Pop Index	Growth	Pop Index	Growth	Pop Index	Growth
Early Pacajes	4871	+0.02	1635	+0.02	3235	+0.02
Pacajes-Inka	3762	-0.29	1051	-0.49	2711	-0.20
Late Pacajes	2793	-0.48	1541	+0.64	1251	-1.29

Table 10.4: Post-Tiwanaku annual population growth rates: Lower Tiwanaku Valley

Assuming that the borders were the same, the entirety of Late Pacajes Taraco has been archaeologically surveyed, together with portions of neighboring administrative units. The area of the Lower Tiwanaku Valley contained territory pertaining to both the *encomiendas* (later *repartimientos*) of Tiwanaku and Guaqui.[13] And now an interesting question emerges. If Taraco's boundary with Huacullani was characterized by such a marked difference in population growth rates, might not its boundaries with Guaqui and Tiwanaku display the same discontinuity? To answer this question, I entered the Lower Tiwanaku Valley settlement data collected by Albarracín-Jordan[14] into the same database I used for my own sites (see Appendix F). I corrected his site sizes and derived population measures in the manner described in Chapter 4. Thus, the resulting data were entirely comparable to my own from the Taraco Peninsula. I then calculated population growth rates for the area of the Lower Tiwanaku Valley which was a part of Taraco in the Late Pacajes phase, as opposed to the area which pertained to Tiwanaku or Guaqui at that time. The results are presented in Table 10.4.

Remarkably, though perhaps not surprisingly, the Lower Tiwanaku Valley data display exactly the same patterning as the Taraco Peninsula data. Both areas grew at about the same rate during the Early Pacajes phase, and the population of both declined strongly in the Pacajes-Inka phase. In other words, this boundary, like the Taraco-Huacullani boundary, was not demographically significant during the LIP or the Late Horizon. However, in the Late Pacajes phase the Taraco side of the boundary grew at the very rapid rate of 0.64%

[13]In fact, the first *encomendero* of both Tiwanaku and Guaqui (1538-1541 A.D.) was none other than Francisco Pizarro, the conqueror of Peru (Choque Canqui 1993: 60).

[14]The data are in his dissertation (Albarracín-Jordan 1992) in Appendix 2.

annually, which the population of the rest of the Lower Tiwanaku Valley declined even more rapidly, at -1.29% annually.[15]

It appears, then, that in the Late Pacajes phase people were deserting the *encomiendas* of Tiwanaku, Guaqui and Huacullani at a rapid rate, and were relocating to the territory of Taraco. Albarracín-Jordan recognized that a general population decline took place in the Late Pacajes phase in the Lower Tiwanaku Valley.

> ... no se puede ignorar la depressión demográfica que se presentó hacia comienzos del siglo XVII. La minería de plata, en Potosí, se convirtió en principal factor de desiquilibrio poblacional en la región. El Valle Bajo de Tiwanaku fue incorporado a la mit'a. Un gran número de tributarios fueron reclutados para trabajar las minas de Potosí ... La versión española de la mit'a hizo que de 868 tributarios, enlistados en el Repartimiento de Tiwanaku en 1583, solamente resten nueve, en 1658... [Albarracín-Jordan 1996a: 313]

Albarracín-Jordan attributes the population decline to mit'a obligations in the Potosí mines, and other onerous exactions of the colonial government and its representatives. These processes are well-documented (cf. Choque Canqui 1993, Sanchez-Albornoz 1979, Spalding 1984, Stern 1982) and relatively well-understood. Throughout the seventeenth century extremely onerous labor exactions, as well as very poor working conditions and a series of catastrophic epidemics, decimated indigenous populations throughout the Andes.[16]

How, though, are we to understand the meteoric population growth on the Taraco Peninsula in this context? A clue is provided by the fact that Taraco was not, in the Early Colonial period, given in *encomienda* to any private individual. Rather, the peninsula was *tierra de la corona*, crown territory (Waldemar Espinoza Soriano, pers. comm.), and was ruled directly by the viceregal government. Though documentation for this period from Taraco has never to my knowledge been published, it may be that conditions were more comfortable under crown rule in the Late Pacajes phase than in any of the neighboring *encomiendas*.

[15] This boundary is very dramatically visible on Albarracín-Jordan's own settlement maps (e.g. Albarracín-Jordan 1992 Figure 15.2, Albarracín-Jordan 1996a Figure 12.2).

[16] Though Stern has suggested that these population declines, while real, might not have actually been so drastic as presented in official records. He documents a pervasive pattern of local groups hiding births, exaggerating deaths rates, and otherwise skewing population figures in order to reduce the tribute demanded by the colonial government (Stern 1982: 121-132).

As Roberto Choque Canqui puts it, “[l]os pueblos de Waki y Tiwanaku estaban ‘tan despoblados y perdidos sin gente por la mita’ porque muchos indios tributarios se han huido ... “ (Choque Canqui 1993: 83). If they were fleeing from Tiwanaku and Guaqui, perhaps some at least were fleeing to Taraco. The anomalously high Late Pacajes population growth rates may therefore be explained by an administrative anomaly: Taraco was ruled by the crown, and surrounding areas by *encomenderos*. The possibility is certainly an intriguing one and merits further research.

Chapter 11

The southern Titicaca Basin in the long term

I began this report with an observation and with an objective. The observation was that we know very little about the processes that led up to the formation of the Tiwanaku state, and that this lack of information seriously hampers attempts to compare the Titicaca Basin trajectory to that of other, better-documented areas of primary state formation, such as Oaxaca or the Basin of Mexico. The objective, of course, was to provide an account of long-term change in the southern Titicaca Basin in the centuries preceding Tiwanaku state formation. Such an account was to be sensitive to the particularities of Titicaca Basin ecology and history and still maintain a focus on cross-cultural developmental regularities - Steward's "phenomena of limited occurrence" - which permit comparisons with other regional sequences.

That account was provided at some length in Chapters 5 through 8, with additional data on later developments provided in Chapters 9 and 10. By way of conclusion, I would like to discuss the broader outlines of the sequence as I have presented it, and reflect briefly on some of the processes and events which shaped it. In the body of the thesis, my discussion was organized by the southern Titicaca Basin ceramic chronology. The chronology, obviously, is a fundamental factor structuring our understanding of prehistory. In this final chapter, however, I would like to consider the social and evolutionary processes operating through time and to summarize the regional sequence in terms of what we might call social evolutionary stages. Each stage may be distinguished from the others in terms of general social processes.

11.1 Initial settlement, population growth

No evidence of an Archaic period or preceramic occupation was encountered in the survey. No aceramic sites nor even a single Archaic period projectile point were found. This agrees with the results of many seasons of excavations at Chiripa; though we have found Archaic period points, they seem to have been collected by the Formative period inhabitants; no preceramic levels were encountered, despite the fact that we excavated to sterile in a number of locations. This is probably due to the fact that Lago Wiñaymarka, was almost completely dry prior to 1500 B.C., and the peninsula was no doubt considerably colder and drier than it is today. It seems likely that whatever occupation there may have been of the area would have been located near the meandering streams on the vast pampas. If so, then they are all below the lake at the present time. It should also be mentioned that the entire spine of the Taraco Peninsula was an extensive lithic quarry throughout prehistory, and is thus covered by a low density lithic scatter. It is possible that the remains of short-term, ephemeral aceramic encampments have been lost in this ubiquitous background scatter.

At any rate, the Taraco Peninsula was colonized at the beginning of the Early Chiripa phase (EF1), beginning around 1500 B.C. when the lake rose suddenly to near-modern levels. What is interesting about this colonization is that people were living from the very beginning in nucleated settlements; small villages, with population index values typically between 100 and 200. Four such villages were encountered in the survey, accounting for 82%[1] of the total population in this period. In this, the Early Formative settlement of the Taraco Peninsula contrasts strikingly with that of Juli-Pomata, where people at this time seem to have lived in scattered farmsteads and small hamlets. Most of these early Taraco Peninsula villages (all except Cerro Choncaya) continued to be occupied throughout the

[1]Combined EF1 population index of four villages with population index values > 100 = 571
Phase population index for EF1 = 693

Formative and indeed until the collapse of the Tiwanaku state. Already in the Early Chiripa phase, then, we may observe a system of well-established communities that was to endure for two millennia. This is a rather startling finding, not at all expected, and it distinguishes the Taraco Peninsula from other areas of the Titicaca Basin for which we have comparable data.

Of course, the EF1 phase population index represents the population of the peninsula at the *end* of the EF1. Given the high rate of growth observed in the following LF2 phase, this does not necessarily imply a large starting population. Given the 500 year span of the LF2, and assuming that the EF1 population growth rate was the same as the EF2 rate (0.47% annually), the EF1 phase population index of 693 could have been produced by an initial population of only 66. This would represent a starting population density of only 0.77 persons/km^2. I would propose that this initial population was concentrated on the peninsula by the 1500 B.C. lake level rise. That is, prior to the lake level rise they were practicing a generalized and extensive agro-pastoralism in the vast grasslands on the Wiñaymarka Basin. The sudden inundation of the *pampa* forced this population to concentrate on what had become the Taraco Peninsula, and the territorial claims of neighboring groups prevented many of them from relocating. The Taraco Peninsula is not good grazing land, neither today nor in the past. The concentrated population was forced to adopt a sedentary lifeway probably concentrating mainly on lacustrine resources with some intensification of agricultural activity as well.

Sedentary populations normally have much higher population growth rates than do nomadic or transhumant ones (cf. Hassan 1981: 221-229, Lee 1972, Sussman 1972). The large village sizes and high regional population density of the EF1 Taraco Peninsula relative to other areas of the Titicaca Basin at this time is probably therefore a result of the earlier establishment of a sedentary lifeway. And this in turn could simply have resulted from their concentration on the Taraco Peninsula by the 1500 B.C. lake level rise. This scenario goes a long way toward explaining the cultural and developmental precocity of the Taraco Peninsula within the southern Titicaca Basin. This model would predict that other long, narrow peninsulas surrounded by shallow water - at modern lake levels - would display evidence of a similar precocity. The area that immediately suggests itself for the testing of this model is the Capachica Peninsula, in the northern Titicaca Basin. Virtually no archaeological work has been done there, however.

The Middle Chiripa phase (EF2) begins around 1000 B.C., and comprises the latter portion of the Early Formative period. No significant changes are evident in the settlement pattern. The site size data continue to display a unimodal distribution, though the mode is higher, with population index values between 200 and 300. Population grew rapidly - at 0.47% annually, close to some theoretically derived maxima for sedentary, non-industrial agriculturalists - and most of the Early Chiripa villages continued to be occupied.

If site abandonment rates were low, though, the rate of founding of new sites was quite high. This probably reflects a situation in which villages grew to a certain size and then fissioned into two or more groups, due to scale-related social stresses and conflict. All of these factors are included by Johnson in the term “scalar stress” (Johnson 1982). Three such fissioning events are documented in the settlement data from the Taraco Peninsula.

1. Near the beginning of the EF2, around 1000 B.C., the village of Chiaramaya (T-3) split into at least two groups and more likely three or four. One of these, probably the largest, remained in place, while another founded the new site of Chiripa Pata (T-4). Other smaller groups may have founded the sites of Alto Pukara (T-430) and Quiswaran (T-303) at the same time. Chiaramaya had a maximum population index value of 186 before this event.

2. Around the same time that Chiaramaya fissioned, the site of Cerro Choncaya (T-2) broke into two groups. One of these moved to the East and founded the site of Kala Uyuni (T-232) which was to become important in the LF1 period. The other segment moved to the North and apparently combined with the population of a smaller village - Sunaj Pata (T-268) - to form the new village of Sonaji (T-271). The site of the Cerro Choncaya village was abandoned. Cerro Choncaya had a maximum population index value of 157 before this event.

3. Near the end of the EF2, around 800 B.C., the site of Sonaji (T-271) - which had

itself been the result of the earlier fissioning of Cerro Choncaya in event 2, above - split into at least three groups. One of these reoccupied the site of Cerro Choncaya (T-2), another reoccupied the site of Sunaj Pata (T-268), and another seems to have moved further to the East and combined with the population of the existing village of Yanapata (T-130). Sonaji attained a maximum population index value of 277 probably immediately prior to this event.

It is certainly worth noting that these three events are particularly conspicuous because they took place very near to phase boundaries. They are therefore very visible archaeologically. It is almost certain that other events than these took place during this time. It is probable in fact that all of the new sites founded during the EF1 and EF2 resulted from similar events. In other words, I believe that village fissioning was a fundamental process structuring the development of the settlement system during the Early Formative. Since the sites are all distributed along the paleolake terraces at the base of the Taraco Hills[2] settlement growth was linear. The pattern that resulted from this process (see Figures 5.5a, b and 6.10) is not so different from those observed along river systems (Flannery 1976b, Reynolds 1976).

We have ascribed village fissioning to pressures and conflicts which increase as the size of a community increases; that is, to "scalar stress". This interpretation is supported by the fact that the three communities which have been shown to have fissioned in the Early Formative were the largest villages in each phase. Chiaramaya and Cerro Choncaya were the two largest EF1 villages, while Sonaji was the single largest EF2 village. As the process of village growth and fissioning progressed, however, the landscape began to fill up. That is, the distance it would be necessary to move in order to found a new village increased as time went on and as the landscape of the Taraco Peninsula became more and more populated. Thus, the costs of community fissioning - which is simply to say the difficulty and inconvenience associated with fissioning - increased through time. This is probably why the maximum community size increased from less than 200 to almost 300 in the course of the EF2.

As the larger communities were increasing to unprecedented sizes, scale-related

[2] See Chapter 2 for a discussion of the geology of the Taraco Peninsula.

stresses within those communities were also increasing. It was in such a context, in the EF2, that an array of new material culture associated with public ceremony made its appearance. It was at this time that the earliest known sunken court was constructed at the site of Chiripa. This structure - the Choquehuanca structure - was an open trapezoidal plaza, excavated into the ground, lined with cobbles, and plastered with colored clay. It is associated with a higher than average percentage of serving wares (Steadman and Hastorf 2001), suggesting that it was the site of public feasting activity; of what Dietler calls "commensal politics" (Dietler 1996). At the same time we observe the first appearance of decorated serving ceramics, probably implicated in the same range of activities.

The timing of the appearance of this early public ritual complex is almost certainly not a coincidence. I interpret it as representing experimentation on the part of community leaders and members attempting to discover ways to reduce scale-related stresses and conflicts. The effort seems to have been at least partially successful, since only a few of the largest sites did in fact fission in the EF2, and the "fission threshold" increased from around 190 in the EF1 to almost 280 in the EF2. This early period of experimentation was to be followed, in the Middle Formative, by the formalization of a complex of ritual ceramics, architecture, and stone sculpture known as the "Yaya-Mama Religious Tradition" (Chávez and Mohr Chávez 1975, Chávez 1988). That tradition, however, had its roots in the experimental structures and ceramics which we have observed in the EF2, in the Middle Chiripa phase.

11.2 Autonomous villages, competitive ceremonialism

Population continued to grow in the Late Chiripa phase, though at a slower rate than in the Early Formative. However several very interesting changes took place with regards to settlement organization. First, the rate at which new sites were founded decreased dramatically. The population was growing, but the old pattern of village growth and fissioning, resulting in the foundation of new villages, seems to have become untenable in the Middle Formative. This suggests that the set of social forces and processes brought together by Carneiro under the rubric of “circumscription” had intensified further in this period (Carneiro 1970, Carneiro 1988). This is only to say , as I did in the previous section, that the costs of village fissioning increased to a point where alternative mechanisms of conflict resolution and social integration were sought.

I am most decidedly *not* suggesting that the subsistence potential of the Taraco Peninsula had been exhausted, or that the communities of the peninsula had begun to feud over a scarce or strained resource base. Rather, I believe the principal factors to have been scale-related conflicts and stresses which challenged the viability of communities exceeding a population index value of a few hundred. Carneiro’s concept of circumscription accords explanatory primacy to conflict *between* groups,[3] and the rapid and competitive increase in the size of political groups as existing communities merge either through conquest or alliance. I am suggesting, on the contrary, that the important dynamic in this period of early villages was conflict *within* villages and communities which intensified as the size of the villages increased. While the landscape was largely empty, it was a simple matter for villages to fission, and to relocate to a nearby area which was similar in terms of the physical environment to that of the parent community. Several such examples were described in my discussion of the EF.

However, relocation costs increased as the landscape of the Taraco Peninsula filled up with villages. In order to found a new village it would not be necessary either to appropriate lands already claimed by another village - which would presumably involve fighting - or to move off of the peninsula itself into the adjacent Katari and Tiwanaku Valleys, which were still lightly-settled. However, the agricultural potential of these inland areas was not so great as on the peninsula, and communities in these areas would have no direct access to the lacustrine zone, which, I would argue, was always crucial to the subsistence strategies of the Taraco Peninsula communities. Thus village fissioning became an increasingly difficult and unattractive solution to scale-related stresses. This being the case, there was no doubt experimentation with various techniques and strategies for resolving conflicts and

[3]Circumscription theory put succinctly: "...the major change we see in political structure, the change from village to chiefdom to state to empire, is the direct consequence of competition between societies" (Carneiro 1978: 209).

increasing social solidarity. As I said, I believe the appearance of the first sunken courts and decorated ceramics in the EF2 to represent exactly this type of experimentation.

Early in the MF, however, some stable solution was apparently produced. From this point on village fissioning ceased on the Taraco Peninsula, and villages grew steadily to sizes many times what had been the fissioning threshold in the Early Formative. Of course, we have no clear idea what the exact nature of this solution might have been. Archaeologically, it is evident as the Yaya-Mama Religious Tradition. Its principal features include:

1. sunken courts and associated architecture,
2. decorated serving ceramics,
3. ceramic “trumpets”,
4. ceramic burning bowls, almost certainly used in ritual burning activity, and
5. a distinctive style of stone sculpture.

Of course, the Yaya-Mama Religious Tradition was actually produced and reproduced by the actions and routinized practices of the members of the communities involved. The material cultural features by which we define the Tradition are only the byproducts of the actions of these people. The material features themselves, however, allow us to hazard some guesses as to the nature of some of these practices. In particular, the presence of a complex of decorated serving ceramics, which are moreover associated almost exclusively with public architectural contexts, suggests the serving of food and drink in a public context; in a word, feasting; in two, commensal politics. The sunken courts were probably employed periodically for community-wide events involving the serving of food and drink. We may imagine that a system of competitive generosity developed which allowed competition to take place in a way which actually increased the solidarity of the community as a whole.

This process may have occurred more or less simultaneously in many parts of the Titicaca Basin. Only one other settlement dataset has adequate temporal resolution in these early phases to permit useful comparison. Carlos Lémuz, in his signal study of a portion of the Santiago de Huatta Peninsula, documents a 30% decrease in the number of sites in the Late Chiripa phase, together with a 60% increase in occupied site area (Lémuz Aguirre 2001: 196). That is, average site size increased, and population became increasingly concentrated in fewer sites, exactly the same process we have observed on the Taraco Peninsula. I have yet to inspect Lémuz's data carefully for evidence of site fissioning in the Early Formative, but I would predict its presence.

It is particularly interesting that, after an early experimental phase in the EF2, the complex of features which made up the Yaya-Mama Religious Tradition stabilized to a remarkable degree and was adopted by communities throughout the Titicaca Basin. The Yaya-Mama Religious Tradition, as a relatively stable configuration of practices, seems to have been very portable, a sort of "cultural portmanteau." It was adopted by many communities, presumably for many different reasons. In this way, it was similar to early horizon styles such as Chavín in the Central Andes and Olmec in Mesoamerica, though with a much more restricted distribution.

Around 450 B.C., after the Yaya-Mama Religious Tradition had apparently become established throughout the Titicaca Basin, the lake level dropped to about 16 meters below its modern level. Since the Lago Wiñaymarka is very shallow - almost all of it is less than 20 meters deep - it became almost completely dry at this time. The lake we see today did not exist. In its place was an immense grassy plain, crossed by small, meandering rivers and dotted with marshes. The Desaguadero River was dry; the lake had no outlet.

There can be no doubt that this event had a significant impact on the Taraco Peninsula communities. It is almost certain that the drying of the lake - and the resulting disappearance of lacustrine resources such as fish and birds - forced a reorientation of the economies of these communities, which were probably predominantly lake-oriented beforehand. Pastoralism no doubt became more common, since the former lake bed would have rapidly become a vast *pampa*, ideal for grazing animals. Agriculture also probably became more important. As important as these shifts in the subsistence economy, however, was a change in the manner in which the Taraco Peninsula communities were integrated with the remainder of the Titicaca Basin.

Since the little lake was mostly dry, it was possible to walk directly from the Taraco Peninsula to the Copacabana/Yunguyu area, and from there to the important population centers of the western Basin (Figure 6.8). At this time trade with the western basin expanded dramatically. The evidence for this is the large quantities of a particular lithic raw material which is found almost exclusively in sites of this time period. This material, a kind of olivine basalt, may come from outcroppings near Incatunahuiri, north of modern Chucuito. It is certainly exotic to the Taraco Peninsula. It was used for the manufacture of agricultural implements, principally hoes, and is much superior to the materials available locally. This material appeared for the first time in Late Chiripa sites and virtually disappeared when the lake level rose again, around 250 B.C. This stone was being imported in very substantial quantities. In Chapter 6 I calculated that perhaps as many as a quarter million hoes of this material were imported to the Taraco Peninsula during the MF. And it is virtually absent from the surface of any site from an earlier or later period.

It is clear that this rock is present on the Taraco Peninsula as a result of external exchange, possibly with the western basin. Probably, though, it was only a part of a much more elaborate trading system, other items of which have not been preserved in the Titicaca Basin environment. These could have included products of the lowland *yungas* and *selva*, including coca, *ají*, cotton, feathers, pelts, and hallucinogenic substances. Thus in the late MF the Taraco Peninsula communities may suddenly have found themselves located on a major trade route.

I would like to suggest that local leaders incorporated the acquisition and distribution of desirable exotic goods - the aforementioned hoes being only the most visible example - into the existing system of status competition and competitive generosity. That is to say that a wealth finance strategy (see D'Altroy and Earle 1985, Earle 1987b) was added to the existing commensal system. Not coincidentally, it is also in this period - from 450 to 250 B.C. - that we see the first indications of wealthy graves at Chiripa (T-1). And finally, it is precisely in this period of lowered lake levels that the well-known Upper House Level complex was constructed at Chiripa. These are the famous double-walled structures first discovered by Bennett, located on a monumental artificial terrace. This complex was clearly the most elaborate public architecture yet seen on the peninsula; the houses were constructed around 380 B.C., shortly after the drying of the little lake. Similar terraces were found at a number of contemporary sites, though these have yet to be excavated.

Also during the MF, perhaps in the latter half, a two-tiered site size hierarchy emerged on the Taraco Peninsula. At the top were four large villages or small towns, each with population index values between 350 and 450. These were the sites of Kala Uyuni (T-232/T-225), Janko Kala (T-394), Yanapata (T-130) and Chiripa (T-1). What is interesting is the fact that this site size hierarchy was produced by a difference in the growth rates of different sites.

The four sites that by the end of the MF came to make up the first tier of the settlement hierarchy grew at an average rate of 0.13% annually during the MF period. By contrast, the smaller sites grew at an average rate of only 0.09% annually. I have argued that these differential rates of population growth can be explained by small differentials in residential choices over time. These residential decisions in turn were affected by the distribution of both staple goods - through public feasts - and imported materials - through public prestations probably in ritual contexts. Essentially, I am suggesting that the inhabitants of the Taraco Peninsula took into account the relative lavishness of each village's system of competitive generosity when deciding where to locate their residences. Over time, this produced higher growth rates in communities with more lavish ceremonies. The lavishness of ceremonies in turn would be correlated with the success of each village's leaders in external exchange relations and in the negotiation of internal community politics. Assuming all of this to be true, then by this standard the most successful villages in the MF were Kala Uyuni (0.15% annual growth; see Table 6.4), Yanapata (0.14%), and Chiripa (0.13%). Janko Kala in fact grew at the very slow rate of 0.09% annually, and is in the first tier of the MF settlement hierarchy only because it was the second-largest village in the EF2 (the largest, T-271, fissioned near the EF2/MF boundary). The fact that Janko Kala is also the only one of these four large sites which lacks unambiguous evidence of MF public architecture would seem to support my interpretation. Also, Kala Uyuni's MF exceptionalism may in part explain its success in the following Late Formative 1 period.

11.3 Multi-community polities, tributary relations

In the late MF, as I have just said, the inhabitants of the Taraco Peninsula were confronted with new economic opportunities as a result of the drying of the little lake. Trade and trade goods became incorporated into the competitive strategies of local leaders. However, early in the following Late Formative 1 period two things happened which served to disrupt these strategies and thereby to provoke a generalized crisis of political legitimacy.

In the first place, around 250 B.C. the level of Lago Wiñaymarka rose again to near-modern levels. This had the effect of shifting the trade route to the *yungas* - upon which local leaders had come to depend during the two century period of low lake levels - to the south, to pass through Desaguadero and the Tiwanaku Valley (see Figure 7.5). This event would certainly have reduced the access to the trade route enjoyed by the Taraco Peninsula communities and eliminated any advantage they might have enjoyed due to to their strategic location in this regard.

At approximately this same time - the timing is somewhat uncertain - the Pukara polity came to dominate the northern portion of the Titicaca Basin. All evidence suggests that the Pukara polity was deeply involved in the regional exchange system, and it is entirely possible that its leaders attempted to suppress direct exchange relations with areas not under its control. It may be, then, that the Pukara polity attempted to eliminate the southern trade route which had been so active during the Middle Formative and to channel all exchange between the western Titicaca Basin and the *yungas* through a northern route, perhaps passing through the area of Huancané and Putina, which it controlled (Plourde and Stanish 2001). Whatever the case, it is clear that trade with the western basin was disrupted in the LF1. The evidence for this is the near-disappearance of the olivine basalt hoes which had been so ubiquitous in the MF. The hoes were still being produced in the western basin, but the southern basin communities no longer had access to them. This suggests some intentional disruption of exchange relations between the two regions.

In the early LF1, then, the Taraco Peninsula communities suddenly found themselves with reduced access to a probably greatly reduced volume of exchange. A political crisis seems to have ensued. In fact, this disruption of the political economy seems to have occasioned much more significant social upheaval than did the earlier disruption of the subsistence economy resulting from the drying of the lake. First of all, a true three-tiered settlement hierarchy emerged on the Taraco Peninsula for the first time in the early LF1. This was a result of the fact that Kala Uyuni (T-232/T-225), one of the four principal MF villages, more than doubled in size, to a population index value of 901.[4] At the same time the other MF centers actually shrank slightly. I interpret this as indicating that the entire Taraco Peninsula was unified into a single polity encompassing perhaps 100 km^2 with an overall population index value of around 5000. I have tentatively located the eastern boundary of this polity between the sites of Chiripa (T-1) and Chiripa Pata (T-4) on the northern side of the peninsula.[5] This was the first true multi-community polity in the area.

If I am to interpret the rapid LF1 growth rate of Kala Uyuni in the same manner as I did that of the large MF villages, I must understand it as resulting from a sustained residential bias toward residence in Kala Uyuni. In the MF case, I suggested that biases in residential choice resulted from an expansion of public ceremonialism in certain of the Taraco Peninsula villages. This expansion was underwritten by the increasing access of the leaders of these communities to exotic trade goods as a result of their newly-found privileged position on the *yungas* trade route. I have argued that access to the *yungas* trade decreased in the LF1. How then did the leaders of Kala Uyuni underwrite the expansion of their own ceremonial sponsorship and increase the number of their dependants? I would suggest that they did so by extracting tribute from neighboring communities. That is, the acquisition of exotic wealth items from trading partners was replaced, in the LF1, by the appropriation of staple items from neighboring communities. Obviously, not all communities in a region could succeed in such an enterprise. On the Taraco Peninsula, Kala Uyuni seems to have won out. The establishment of some kind of regular tribute flow between communities would have simultaneously increased the scale of ceremonialism sponsored by the Kala

[4]From a MF population index value of 361.
[5]The boundary is located at approximately 519500E.

Uyuni leadership, and reduced that of their tributary communities. It was this, then, that would have produced, over time, 1) a systematic bias toward residence in Kala Uyuni, resulting in 2) a higher population growth rate for Kala Uyuni than for tributary communities, which lead to the formation of 3) a three-tier site size hierarchy.

This political development was accompanied by a wholesale transformation of the entire ceremonial complex. The characteristic Chiripa decorated ceramics, in continuous use for over 500 years, were abruptly abandoned, replaced by the Kalasasaya complex. The latter includes significant imitation of the northern basin Pukara style. Given my suggestion that the Taraco Peninsula Polity's political economy was critically dependent on tribute extracted by Kala Uyuni from neighboring communities, it is probably no coincidence that martial themes, especially trophy head imagery and the figure of the "decapitator," come to be prominent in LF1 iconography (cf. Chávez 1992). At the same time, the sunken court complex was reinvented, incorporating for the first time the large upright pillars that come to be characteristic of later Tiwanaku architecture. The association of stone tenon heads with sunken courts is also characteristic of this phase (again, possibly a martial theme). The overall impression is of a complete reinvention of ceremonial practices and political strategies. I propose that this was ultimately in response to the political crisis resulting from the interruption of the Taraco Peninsula communities' access to the trade route between the western basin and the *yungas*.

The trade route to the *yungas* seems to have remained a settlement determinant, however reduced its volume may have been. At the same time that the lake level rose and the trade route shifted, the site of Tiwanaku - which is located in what would have been the new caravan route - began to grow rapidly. Prior to the LF1, the Middle Tiwanaku Valley had been only lightly populated. However, by the end of the LF1 the site of Tiwanaku had a population index value of somewhere around 1000. That is, it was as large as the center of the Taraco Peninsula polity. This very rapid rate of growth would suggest that there was some movement of population out of the Taraco Peninsula - where growth was a somewhat slow 0.08% annually - and into the site of Tiwanaku. In the course of the LF1, Tiwanaku almost certainly became the center of a multi-community polity of its own, probably competing with the Taraco Peninsula polity. The abandonment of the Lower Tiwanaku Valley in the LF1 probably indicates the formation of an unpopulated buffer zone between these two polities. Thus, while the Taraco Peninsula remained the demographic core of the southern Titicaca Basin in the LF1, a movement of peoples inland had begun which was to continue for more than 1000 years.

Late in the LF1, around 100 A.D., lake levels dropped again, and Lago Wiñaymarka once more dried up. We have yet to identify a corresponding change in ceramic style, so we are unable to say what the exact demographic, political and economic effects of this drop were. We may imagine that the Taraco Peninsula polity once again came to enjoy privileged access to the *yungas* trade, and that the flow of population to Tiwanaku was stemmed, at least for a while. One effect may have been the relocation of the center of the Taraco Peninsula polity. Though this is not certain, is seems as if Kala Uyuni was abandoned sometime in the LF1 and its population relocated to a group of three sites on the tip of the peninsula, near the modern town of Santa Rosa. These three sites are Sonaji (T-271), Kumi Kipa (T-272), and Kollin Pata (T-322); I refer to them collectively as the Santa Rosa group. By the end of the LF1 these three sites had a combined population index value of 1217, probably larger than Tiwanaku, certainly larger than the old center of Kala Uyuni. Thus, it may be that the 100 A.D. lake level drop made possible a brief rise in the fortunes of the Taraco Peninsula polity and of its new center at the Santa Rosa group. The flow of population to Tiwanaku may have slowed or even reversed during this 200 year period. The respite was to be short-lived.

11.4 Tiwanaku dominance, state formation

Around 300 A.D., the beginning of the LF2, the lake rose again to modern levels or even somewhat higher. Lake level was to remain high for the next 800 years. This lake level rise coincided approximately with the collapse of the Pukara polity in the northern Titicaca Basin. Thus, two things happened at approximately the same time: 1) the *yungas* trade route shifted so that it once more passed through Desaguadero and the Tiwanaku Valley, and 2) any suppression of trade between the southern and western regions of the Titicaca Basin on the part of the Pukara polity abruptly ceased.

These lake level shifts and the collapse of Pukara may or may not have been related, but their combined effect seems to have been dramatic. Together, they would have produced a situation in which the site of Tiwanaku controlled the route of an expanded southern exchange system. If we continue in the explanatory vein established in the preceding sections, we could suppose that this strategic position with regard to an expanded volume of traded goods gave the leaders of Tiwanaku a distinct advantage over those of neighboring polities. That is to say, they became capable of collecting and - to say the same thing - redistributing a much greater quantity of both exotic and staple products than their neighbors. The expanded volume of both staple and exotic goods under their control also would have permitted the leadership of Tiwanaku to greatly expand the scale of the public ceremonialism they sponsored. As a result, Tiwanaku began to attract immigration from adjacent areas. This process is almost certainly responsible at least in part for its greatly increased rate of population growth in the LF2. Tiwanaku grew by as much as 1% annually during this period, an order of magnitude faster than what we have established as a normal rate of increase.[6]

At the same time, the population of the Taraco Peninsula actually declined, the first time this had happened in the Formative period. Other nearby areas such as the Katari Basin and the Khonko Wankane area may have experienced depopulation as well. However, the high population density of the Taraco Peninsula in the LF1 meant that it was the largest population donor, probably accounting for almost 50% of Tiwanaku's LF2 expansion.

During the LF2, Tiwanaku grew to cover about 1 km^2, probably with a population of more than five thousand. Thus, by the end of the Formative period - ca. 500 A.D. - it was by far the largest site in the Titicaca Basin, and had probably become capable of dominating neighboring populations politically, economically and militarily. The most interesting

[6]It is interesting to note that the Santiago de Huatta Peninsula was beyond the radius of this LF2 demographic effect (Lémuz Aguirre 2001: 202), population there increasing by more than 100% during this phase. So, apparently, was the Juli-Pomata area (Stanish et al.), though the LF chronology employed there makes no clear distinction between LF1 and LF2.

fact about its early growth, however, is that it probably took place without resort to coercion. When the large-scale population movement into Tiwanaku began, the Tiwanaku Polity probably had a total population well below half that of the Taraco Peninsula Polity, and was probably not its military equal. That is, Tiwanaku regional dominance was an *effect* rather than a *cause* of the population movement we have been discussing.

I have just attempted to explain the remarkable LF2 growth of Tiwanaku as a result of two significant changes in the Titicaca Basin environment: 1) a rise in lake level which shifted the route of the southern *yungas* trade through Tiwanaku and away from the Taraco Peninsula, and 2) an expansion in the activity of this southerly route due to the collapse of the Pukara Polity which hypothetically suppressed external trade in its period of primacy (see my discussion of this possibility in Chapter 7). Can this really explain the unprecedented growth of Tiwanaku? The answer is not clear. After all, the trade route had shifted before on a number of occasions, but never with an effect this dramatic. It is certainly possible that the greater Late Formative population density in the southern basin, the western basin, and presumably in the *yungas* as well propelled the volume of exchange passing through the southern route beyond some as-yet untheorized critical threshold. However, we should also consider that some new process might have been at work, in combination with those we have just described. I would like to propose that this new process was the incorporation of raised field agriculture into the political economies of Titicaca Basin polities, and of the Tiwanaku Polity specifically.

There are various interpretations as to the manner in which raised field agriculture was integrated into the Tiwanaku political economy. The majority view is that of Alan Kolata, Clark Erickson, and their colleagues, which I have termed the *hyperproductivity hypothesis* (Erickson 1985, Erickson and Candler 1989, Kolata 1986, Kolata 1991, Kolata and Ortloff 1989). These scholars hold that certain properties of raised fields in the Titicaca Basin environment make possible very high yields and short - even zero - fallow periods relative to the dryland techniques employed in the area both ethnohistorically and historically. The most important of these properties are thought to be the use of canal sediments as fertilizer, preventing soil nutrient depletion, and thermal effects of the water in the canals, which provides some protection against frost. My own view (Bandy 1999c, Bandy 2000) is what I call the *staggered production cycle hypothesis*. As I conceive it, the importance of raised field agriculture was not its supposed hyperproductivity but rather the fact that splash irrigation using the water in the canals, perhaps combined with their frost-ameliorating thermal properties, made it possible to cultivate raised fields on an annual agricultural cycle which was offset by as much as two months from the normal dryland agricultural cycle.

This theory is derived from the work of Jürgen Golte, which I regard as absolutely fundamental for understanding ancient Andean political economies (Golte 1980). In his slim volume, Golte observes that in areas where the growing season is tightly circumscribed, as in the Andean highlands, a labor scheduling problem arises. In such areas, planting and harvest must take place at certain well-defined points in the annual cycle. There is very little room for variation, since to plant too early would mean that the crops would fail for want of rain, and to plant too late would not allow sufficient time for crops to mature before the onset of killing frosts. Since the most concentrated and intensive labor demands of agricultural production occur at the time of the harvest, a productive unit - a household, for example - may not plant more land than it is capable of harvesting within a short time period; a month, say. In such situations groups often develop mechanisms for spreading their subsistence labor more evenly throughout the year. The cultivation of winter wheat is an example of such a strategy from temperate Europe. Golte calls these 'estrategías policíclicas' - polycyclic strategies.

The most fundamental and ancient example of this sort of strategy in the Andes is tuber agropastoralism itself. In this system, the timing of labor investment in the herds is offset from the crunch periods of the agricultural cycle. In this way labor that cannot be invested in agriculture is invested in herding, and vice versa. This results in a more complete and efficient use of labor throughout the year than would be possible in either a purely agricultural economy or in a purely pastoral one.

Another class of related examples are the agricultural systems of the highland valleys, with which Golte is primarily concerned. In these environments, producers practice a form of microverticality, exploiting the agricultural properties of land at varying elevations. In these different elevations, different crops may be planted, with differing growing seasons and labor requirements. In this way a whole series of staggered agricultural cycles are exploited, together with pastoralism in the puna grasslands, to spread productive labor more evenly throughout the year. This is a technique for maximizing labor efficiency on the household level.

In this connection, it is interesting to note that Golte singles out the Titicaca Basin as an area in which the possibilities for polycyclic labor maximization are very limited. This is because the circumlacustrine plain lacks the dramatic vertical relief of the valleys and is therefore unsuitable to microverticality-oriented agricultural strategies. Herding and fishing and more recently wage labor can make up for this to some extent. But, Golte points out, opportunities for maximizing the use of agricultural labor throughout the year remain extremely limited in the Titicaca Basin.

I would like to propose, however, that raised field agriculture represents exactly such a strategy for the staggering of agricultural cycles and the maximization of labor efficiency, and one specific to the Titicaca Basin. The key to this strategy would have been the water in the canals, which, as Erickson has noted, would permit splash irrigation of the fields (Erickson and Candler 1989) . This could have allowed planting to take place after the danger of frosts had passed, but still well before the onset of the rainy season. This practice has been observed by Erickson, and he concludes that splash irrigation of planting surfaces with water from the canals can be accomplished with very little effort. Indeed, in one drought year in Huatta, Peru, his raised fields produced good yields while surrounding dryland fields failed completely, due solely to the fact that the raised fields were splash irrigated as necessary (Erickson and Candler 1989).

The addition of such a new, offset agricultural cycle would have made it possible for leaders or rulers to exact agricultural labor from the population at large while minimizing the interference of this exaction with normal subsistence activities, and at the same time to put into action a vast labor potential that could not otherwise have been applied to agricultural production. This would have simultaneously 1) reduced conflicts between elite -

and eventually state - labor demands and the subsistence interests of the populace and 2) permitted a significantly higher rate of annual agricultural labor extraction and therefore of annual surplus production.

Whatever the exact role raised field agriculture may have played in the Tiwanaku political economy, its centrality is generally accepted. The introduction of raised field agriculture would in any event have greatly increased the quantity of staple goods redistributed by leaders or rulers, and would thereby have permitted a tremendous expansion of existing systems of competitive ceremonialism. Such an expansion is exactly the kind of process which could stimulate immigration and population movement, as I have argued in reference to earlier time periods. Therefore, it is entirely possible that the LF2 growth of Tiwanaku was due not only to its increased importance in the southern Titicaca Basin exchange system, but also - and perhaps more importantly - to the integration of raised field agriculture into its political economy.

I propose that perhaps the crucial factor in Tiwanaku's early success was not its advantageous position *viz a viz* the *yungas* trade, nor, at least initially, was it the influence of its religious cult. Rather, the critical factor distinguishing Tiwanaku from other contemporaneous and competing centers was its proximity to the high density populations of the Taraco Peninsula. After the 300 A.D. lake level rise, the Taraco Peninsula communities found themselves in a landscape in which large-scale raised field agriculture was impossible. They were circumscribed by the saline waters of Lake Titicaca, and no appropriate marshy, freshwater landscapes were present within their borders. It is possible that during the second half of the LF1 raised field agriculture was practiced to some extent on the vast pampas that surrounded the Taraco Hills.[7] If such activity did exist, however, it was brought to an end by the 300 A.D. lake level rise. From the beginning of the LF2 the Taraco Peninsula Polity was unable to participate in what seems to have been a general basin-wide increase in the importance of raised field agriculture during the Late Formative (see Stanish 1994, Stanish 1999). Its leaders were therefore at a competitive disadvantage relative to those of the Tiwanaku Polity.

[7]There are rumors of inundated raised field groups in the vicinity of the Taraco Peninsula. I have been unable to confirm these, however.

Thus, as the importance of raised field agriculture in the Tiwanaku political economy increased, and as the associated social technologies of labor organization and surplus extraction were elaborated and improved, the inhabitants of Taraco Peninsula communities began to exhibit a marked preference for relocation to Tiwanaku (Bandy 2000). This, then, is a fact which distinguishes Tiwanaku from other Late Formative polities in the Titicaca Basin. The developing political economy of Tiwanaku had a unique resource: an adjacent area, densely populated whose inhabitants were unable to compete with the emerging Tiwanaku Polity on its own terms. That is, they could not build raised fields on their own land, and could therefore be incorporated into the expanding Tiwanaku political economy on a subordinate basis. No such geographical configuration existed in Juli-Pomata, and perhaps nowhere else in the Titicaca Basin.

The incorporation of the Taraco Peninsula populations into the Tiwanaku political economy seems to have taken place in two distinct stages. The earlier stage, which took place during the LF2 (300-500 A.D.), was characterized by population movement from the Taraco Peninsula into the expanding proto-urban center of Tiwanaku. During this period, the power and importance of Tiwanaku gradually waxed, while that of the Taraco Peninsula Polity waned. However, it does not seem as if the Taraco Peninsula fell under the direct political control of Tiwanaku until late in the LF2.

The later stage began with the political subjugation of the Taraco Peninsula Polity to the Tiwanaku Polity. In this stage the depopulation of the Taraco Peninsula communities ceased, and growth rates returned to normal or near-normal. However, we may assume that the large population of the Taraco Peninsula was still an important source of labor for the cultivation of the vast raised field complexes in the Tiwanaku Valley and the Pampa Koani, and ongoing monumental construction in the civic-ceremonial core of Tiwanaku. The Taraco Peninsula was at this point organized into a heartland province of the Tiwanaku state. By this time Tiwanaku had emerged as the dominant power in the Titicaca Basin and indeed in the entire South-Central Andes .

In this thesis I have identified several potential factors which contributed to Tiwanaku's emergence and eventual dominant position in South-Central Andean prehistory. In the final analysis, though, the principal factor which distinguished Tiwanaku from other Late Formative Titicaca Basin centers may not have been an attribute of Tiwanaku itself; it may simply have been that Tiwanaku was located adjacent to the Taraco Peninsula.

Thus, chance, physical geography and the *longue dureé*, human agency and especially residential decisions, and human genius and invention can all be seen to have played a role in Tiwanaku state formation. Tiwanaku state formation is here argued to have resulted from the rapid urbanization of the site of Tiwanaku during the LF2. This urbanization itself - in my view - resulted principally from the dramatic success, quite possibly unanticipated, of a political-economic strategy: the strategy of staggered production cycles.

11.5 Collapse, demographic decline, conquest

There are indications that the Tiwanaku state began to break down some time prior to its actual collapse (Janusek 1994). However, around 1100 A.D. a dramatic lake level drop took place (Abbott et al. 1997a: 179, Binford et al. 1997, Kolata and Ortloff 1996a, Ortloff and Kolata 1992). This drop may or may not reflect severe drought conditions at that time. Whatever the case, the local inhabitants reacted as they had reacted to such events before. They reoriented their subsistence economy to emphasize camelid pastoralism in order to make up for the disappearance of lacustrine resources and probably for worsening agricultural conditions as well. It is also possible that individual households came to incorporate raised field agriculture into their subsistence strategies (Graffam 1990).

The latter possibility is especially intriguing when it is considered in light of my proposal that the Tiwanaku political economy was fundamentally premised on a strategy of staggered production cycles, in which state labor took place at a different point in the agricultural cycle than did household subsistence labor. Household involvement in raised field agriculture would have introduced scheduling conflicts between household subsistence activity and state tribute demands. This would have undermined what I have suggested was the fundamental political-economic strategy of Tiwanaku statecraft. This process could quite plausibly have caused the collapse of the state itself.

Tiwanaku state collapse, for a number of possible reasons (see Chapter 9), involved some very fundamental transformations of Titicaca Basin settlement systems. The village system that originated in the Early Formative and persisted for more than two thousand years was abandoned. Nucleated habitation and stable village life was replaced by dispersed residence in extended family farmsteads. These farmsteads were occupied for perhaps one or two generations and were then abandoned. This manner of life has persisted to the present day in Titicaca Basin communities.

Political life was similarly reinvented. Camelids and their secondary products seem to have become the primary source of wealth, and so the political center of gravity shifted to areas suitable for the raising of very large herds. Thus, the principal settlements and chiefly centers in the Late Intermediate Period seem to have been located in higher elevation areas of the basin, in contrast to the lakeshore demographic focus of the Formative and Tiwanaku Periods (see Frye's Appendix 2 in Stanish et al. 1997; Kirk Frye personal communication), with significant centers established at Tanka Tanka, Cutimbo, and other sites. In addition, political entities seem to have become more fragmented and unstable. A state of more or less constant warfare seems to have prevailed, as indicated by the building of fortifications - *pukaras* - throughout the Titicaca Basin (cf. Hyslop 1976, Stanish et al. 1997). The Taraco Peninsula was not suited for large-scale camelid herding, and no fortifiable prominences exist. It was therefore a very marginal location in the LIP, and it is to this marginal status that we may attribute the dramatic decline in population on the peninsula in this phase.

Sometime probably in the 15th century the Titicaca Basin was invaded by a new northern power, the Inka empire. The divided and feuding Aymara *señorios* were played off against one another by the Inka generals. After a short campaign, the Aymara kingdoms were violently subjugated to Inka rule. Thus began a long period of central Andean hegemony in the Titicaca Basin. Its populations were ruled first from Cuzco and later from Lima. Sources of power, authority, prestige, and legitimacy were located far from the old center of Tiwanaku. Quechua and Spanish began to replace Aymara throughout the south-central Andean region. The long history of autonomous social and political evolution in the Titicaca Basin had come to an end, and its people had become enmeshed in continental and later global relations of domination and dependence.

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Appendix A

Site and sector registry

Micro-environmental Zones:

SGZ - Springs and Grass Zone
LCZ - Lower Colluvial Zone
UCZ - Upper Colluvial Zone

See Albarracín-Jordan and Mathews 1990 and section 2.3 for explanations of these terms.

Phases

0.0 - Phase unknown
0.1 - Unknown, definitely prehispanic
1.1 - Early Formative 1: Early Chiripa
1.2 - Early Formative 2: Middle Chiripa
2.0 - Middle Formative: Late Chiripa
3.1 - Late Formative 1: Tiwanaku I
3.2 - Late Formative 2: Tiwanaku III
4.0 - Tiwanaku: Tiwanaku IV-V
5.1 - Early Pacajes
5.2 - Pacajes-Inka
5.3 - Late Pacajes

Area always reported in hectares.

Site	Sector	UTM N	UTM E	Elev	Area	Phase	Zone	Type
1	A	8183639	518437	3825	0.5	1.1	LCZ	Habitation
1	B	8183539	518262	3825	2.0	1.1	LCZ	Habitation
1	C	8183514	518362	3825	4.25	1.2	LCZ	Habitation
1	D	8183539	518287	3825	7.75	2.0	LCZ	Habitation
1	E	8183614	518312	3825	6.25	3.1	LCZ	Habitation
1	F	8183614	518312	3825	5.75	3.2	LCZ	Habitation
1	G	8183614	518312	3825	9	4.0	LCZ	Habitation
1	H	8183464	518462	3825	0.25	5.1	LCZ	Habitation
1	I	8183414	518162	3825	0.25	5.2	LCZ	Habitation
1	J	8183689	518187	3825	0.75	5.3	LCZ	Habitation
1	K	8183414	518512	3825	1	5.3	LCZ	Habitation
1	L	8183313	518337	3825	1.25	5.3	LCZ	Habitation
1	M	8183764	518212	3810	0.1	0.1	SGZ	Raised Fields
2	A	8180597	506511	3870	3	1.1	UCZ	Habitation
2	B	8180597	506511	3870	4.25	2.0	UCZ	Habitation
3	A	8183675	516662	3825	3.5	1.1	LCZ	Habitation
3	B	8183700	516662	3825	2.5	1.2	LCZ	Habitation
3	C	8183650	516662	3825	4.25	2.0	LCZ	Habitation
3	D	8183650	516662	3825	3	3.1	LCZ	Habitation
3	E	8183650	516662	3825	0.25	3.2	LCZ	Habitation
3	F	8183600	516722	3825	0.5	4.0	LCZ	Habitation
3	G	8183575	516662	3825	0.25	5.2	LCZ	Habitation
3	H	8183775	516612	3825	0.25	5.3	LCZ	Habitation
3	I	8183675	516722	3825	0.5	5.3	LCZ	Habitation
4	A	8183679	519707	3825	3.25	1.2	LCZ	Habitation
4	B	8183679	519707	3825	5	2.0	LCZ	Habitation
4	C	8183654	519707	3825	7.25	3.1	LCZ	Habitation
4	D	8183654	519707	3825	6.25	3.2	LCZ	Habitation
4	E	8183654	519707	3825	7.5	4.0	LCZ	Habitation
4	F	8183629	519682	3825	1	5.1	LCZ	Habitation
4	G	8183679	519582	3825	0.25	5.3	LCZ	Habitation
4	H	8183629	519782	3825	0.25	5.3	LCZ	Habitation
5	A	8181881	518356	3865	1.52	5.2	LCZ	Habitation
6	A	8183879	517128	3810	0.32	5.3	SGZ	Habitation
7	A	8183724	515947	3820	0.09	0.0	LCZ	
8	A	8183791	515846	3820	0.36	1.2	LCZ	Habitation
8	B	8183791	515846	3820	0.25	3.1	LCZ	Habitation
8	C	8183791	515846	3820	0.36	5.3	LCZ	Habitation
9	A	8183877	515924	3815	0.31	5.1	LCZ	Habitation
9	B	8183877	515924	3815	0.31	5.3	LCZ	Habitation

10	A	8183934	515779	3820	0.04	0.0	LCZ	
11	A	8183934	516023	3815	0.15	5.2	LCZ	Habitation
11	B	8183934	516023	3815	0.15	5.3	LCZ	Habitation
12	A	8183716	516014	3820	0.2	5.3	LCZ	Habitation
13	A	8183661	516323	3820	0.14	0.0	LCZ	
14	A	8183679	516399	3820	0.12	5.3	LCZ	Habitation
15	A	8183684	516204	3820	0.17	5.1	LCZ	Habitation
16	A	8183767	516376	3820	0.74	4.0	LCZ	Habitation
16	C	8183767	516376	3820	0.36	5.3	LCZ	Habitation
17	A	8183870	516391	3815	0.15	4.0	SGZ	Habitation
17	B	8183870	516391	3815	0.15	5.3	SGZ	Habitation
18	A	8183753	516598	3820	0.04	5.3	LCZ	Habitation
19	A	8183658	516856	3815	0.17	2.0	LCZ	Habitation
19	B	8183658	516856	3815	0.17	5.1	LCZ	Habitation
19	C	8183658	516856	3815	0.17	5.3	LCZ	Habitation
20	A	8183002	516888	3850	0.01	5.2	UCZ	Habitation
21	A	8182845	516928	3850	0.6	5.2	LCZ	Habitation
22	A	8182043	516836	3900	0.01	0.0	UCZ	
23	A	8182338	516641	3900	0.11	5.1	UCZ	Habitation
24	A	8182781	516592	3890	0.04	5.3	UCZ	Habitation
25	A	8182785	516378	3880	0.5	5.2	LCZ	Habitation
25	B	8182785	516378	3880	0.09	5.3	LCZ	Habitation
26	A	8183336	516636	3840	0.16	5.3	LCZ	Habitation
27	A	8183015	516295	3850	1.5	5.2	LCZ	Habitation
28	A	8183277	516486	3840	0.15	3.1	LCZ	Habitation
28	B	8183277	516486	3840	0.15	3.2	LCZ	Habitation
28	C	8183277	516486	3840	0.15	5.3	LCZ	Habitation
29	A	8182488	516354	3890	0.04	0.0	UCZ	
30	A	8182599	516155	3880	0.04	5.3	UCZ	Habitation
31	A	8183012	516026	3870	0.04	5.2	UCZ	Habitation
32	A	8179737	510314	3835	0.21	5.3	LCZ	Habitation
33	A	8179671	510178	3835	0.65	5.3	LCZ	Habitation
34	A	8179560	510138	3835	0.5	4.0	LCZ	Habitation
34	B	8179560	510138	3835	0.78	5.3	LCZ	Habitation
35	A	8179565	510228	3830	0.48	5.3	LCZ	Habitation
36	A	8179475	510173	3830	0.09	0.0	LCZ	
37	A	8179322	510347	3820	0.6	5.2	SGZ	Habitation
38	A	8179704	510431	3830	0.04	5.2	LCZ	Habitation
38	A	8179704	510431	3830	0.04	5.1	LCZ	Habitation
39	A	8179642	510547	3830	0.08	5.3	LCZ	Habitation
40	A	8179813	510484	3835	0.09	5.3	LCZ	Habitation
41	A	8179925	510156	3845	0.09	5.3	LCZ	Habitation
42	A	8180557	510381	3900	0.16	5.3	UCZ	Habitation

43	A	8180368	510548	3855	0.17	5.3	UCZ	Habitation
44	A	8180082	510723	3825	0.16	5.3	LCZ	Habitation
45	A	8180377	510643	3845	0.35	5.3	UCZ	Habitation
46	A	8180429	510667	3845	0.14	0.0	UCZ	
47	A	8180532	510561	3860	0.5	0.0	UCZ	Terraces
48	A	8179726	510707	3820	0.36	5.3	LCZ	Habitation
49	A	8179829	510988	3815	0.04	5.3	LCZ	Habitation
50	A	8179793	511208	3815	0.25	5.1	SGZ	Habitation
50	B	8179793	511208	3815	0.25	5.3	SGZ	Habitation
51	A	8180289	511256	3830	0.34	5.3	LCZ	Habitation
52	A	8180351	511431	3830	0.09	5.1	LCZ	Habitation
52	B	8180351	511431	3830	0.09	5.2	LCZ	Habitation
52	C	8180351	511431	3830	0.09	5.3	LCZ	Habitation
53	A	8180286	511340	3830	0.09	0.0	LCZ	
54	A	8180368	511444	3840	0.1	5.2	LCZ	Habitation
55	A	8180430	511546	3830	0.6	5.2	LCZ	Habitation
55	B	8180430	511546	3830	0.6	5.3	LCZ	Habitation
56	A	8180465	511510	3840	0.18	5.3	LCZ	Habitation
57	A	8180431	511521	3830	0.15	5.2	LCZ	Habitation
57	B	8180431	511521	3830	0.15	5.3	LCZ	Habitation
58	A	8179852	511520	3815	0.56	5.3	SGZ	Habitation
59	A	8180270	511848	3820	0.04	0.0	LCZ	
60	A	8180308	511916	3820	0.09	5.1	LCZ	Habitation
60	B	8180308	511916	3820	0.09	5.2	LCZ	Habitation
60	C	8180308	511916	3820	0.09	5.3	LCZ	Habitation
61	A	8180502	511734	3825	0.7	5.2	LCZ	Habitation
62	A	8180628	511717	3845	0.04	5.3	LCZ	Habitation
63	A	8180790	511645	3840	0.08	5.3	LCZ	Habitation
64	A	8180545	512115	3840	0.16	5.3	LCZ	Habitation
65	A	8180444	512000	3835	0.48	5.3	LCZ	Habitation
66	A	8180400	512276	3820	0.08	0.0	LCZ	
67	A	8180495	512224	3825	0.49	4.0	LCZ	Habitation
67	B	8180495	512224	3825	0.49	5.2	LCZ	Habitation
67	C	8180495	512224	3825	0.49	5.3	LCZ	Habitation
68	A	8180333	512448	3825	0.12	5.1	LCZ	Habitation
69	A	8180176	512495	3820	0.09	5.1	LCZ	Habitation
69	B	8180176	512495	3820	0.09	5.2	LCZ	Habitation
70	A	8180094	512353	3815	0.09	5.1	SGZ	Habitation
71	A	8179963	512324	3815	0.08	5.3	SGZ	Habitation
72	A	8179777	512559	3810	0.04	5.3	SGZ	Habitation
73	A	8179961	512396	3815	0.12	5.3	SGZ	Habitation
74	A	8179943	512565	3820	0.09	5.3	SGZ	Habitation
75	A	8180067	512444	3815	0.11	0.0	SGZ	

76	A	8180476	512546	3830	0.09	0.0	LCZ	
77	A	8180501	512601	3835	0.24	5.3	LCZ	Habitation
78	A	8180439	512714	3835	0.8	5.3	LCZ	Habitation
79	A	8180601	512567	3840	0.4	5.2	LCZ	Habitation
80	A	8180685	512492	3840	0.16	0.0	LCZ	
81	A	8180780	512694	3850	0.09	5.3	LCZ	Habitation
82	A	8180742	512826	3845	0.2	5.3	LCZ	Habitation
83	A	8180680	512685	3840	0.08	5.3	LCZ	Habitation
84	A	8179932	513008	3820	0.33	5.3	SGZ	Habitation
85	A	8180961	512984	3825	0.8	4.0	LCZ	Habitation
86	A	8180795	512881	3845	0.41	5.2	LCZ	Habitation
86	B	8180795	512881	3845	0.41	5.3	LCZ	Habitation
87	A	8180838	513053	3840	0.14	5.3	LCZ	Habitation
88	A	8180931	513057	3855	0.54	5.3	LCZ	Habitation
89	A	8180931	512899	3860	0.2	5.3	LCZ	Habitation
90	A	8180758	513284	3845	0.16	5.2	LCZ	Habitation
90	B	8180758	513284	3845	0.16	5.3	LCZ	Habitation
91	A	8180614	513218	3835	0.09	5.1	LCZ	Habitation
91	B	8180614	513218	3835	0.09	5.3	LCZ	Habitation
92	A	8180546	513318	3835	0.33	5.1	LCZ	Habitation
92	B	8180546	513318	3835	0.33	5.2	LCZ	Habitation
93	A	8180454	513142	3830	0.16	5.1	LCZ	Habitation
93	B	8180454	513142	3830	0.16	5.3	LCZ	Habitation
94	A	8179823	513108	3820	0.13	0.1	SGZ	Raised Fields
95	A	8179880	513282	3820	0.12	5.3	SGZ	Habitation
96	A	8179990	513288	3825	0.09	5.3	SGZ	Habitation
97	A	8180417	513503	3835	2.08	5.2	LCZ	Habitation
97	B	8180417	513503	3835	1	5.3	LCZ	Habitation
98	A	8180565	513453	3835	0.04	5.3	LCZ	Habitation
99	A	8180562	513470	3835	0.26	5.1	LCZ	Habitation
99	B	8180562	513470	3835	0.26	5.2	LCZ	Habitation
99	C	8180562	513470	3835	0.26	5.3	LCZ	Habitation
100	A	8180700	513490	3845	0.16	5.3	LCZ	Habitation
101	A	8180761	513548	3850	0.27	5.2	LCZ	Habitation
102	A	8180772	513486	3855	0.24	5.3	LCZ	Habitation
103	A	8180678	513774	3845	0.56	5.3	LCZ	Habitation
104	A	8180636	513692	3845	0.09	0.0	LCZ	
105	A	8180518	513682	3840	1	5.3	LCZ	Habitation
106	A	8180480	513766	3840	0.44	5.2	LCZ	Habitation
106	B	8180480	513766	3840	0.2	5.3	LCZ	Habitation
107	A	8179626	513828	3815	0.16	5.1	SGZ	Habitation
107	B	8179626	513828	3815	1.7	5.2	SGZ	Habitation
107	C	8179626	513828	3815	0.16	5.3	SGZ	Habitation

108	A	8179650	513917	3815	0.66	5.3	SGZ	Habitation
109	A	8180781	514013	3850	0.09	5.2	LCZ	Habitation
109	B	8180781	514013	3850	0.09	5.3	LCZ	Habitation
110	A	8180807	514027	3855	0.39	5.3	LCZ	Habitation
111	A	8180976	514121	3860	0.32	5.2	UCZ	Habitation
112	A	8180770	514212	3850	0.04	0.0	UCZ	
113	A	8180700	514324	3845	0.12	5.3	LCZ	Habitation
114	A	8180580	514166	3840	0.48	5.3	LCZ	Habitation
115	A	8180373	514273	3835	0.35	5.3	LCZ	Habitation
116	A	8180444	514096	3835	1.8	5.3	LCZ	Habitation
117	A	8180030	514160	3825	0.44	4.0	SGZ	Habitation
118	A	8180184	514390	3830	0.24	4.0	LCZ	Habitation
118	B	8180184	514390	3830	0.24	5.3	LCZ	Habitation
119	A	8180716	514586	3850	0.09	5.2	LCZ	Habitation
120	A	8180597	514777	3850	0.18	5.3	LCZ	Habitation
121	A	8180726	514915	3855	0.08	5.3	LCZ	Habitation
122	A	8182843	510057	3830	0.25	2.0	LCZ	Habitation
122	B	8182843	510057	3830	1	3.1	LCZ	Habitation
122	C	8182843	510057	3830	1	3.2	LCZ	Habitation
122	D	8182843	510057	3830	1.54	4.0	LCZ	Habitation
122	E	8182843	510057	3830	0.25	5.1	LCZ	Habitation
122	F	8182843	510057	3830	0.25	5.3	LCZ	Habitation
123	A	8183034	510159	3815	0.25	2.0	LCZ	Habitation
123	B	8183034	510109	3815	1.25	3.1	LCZ	Habitation
123	C	8183109	510034	3815	7.5	4.0	LCZ	Habitation
123	D	8183209	510109	3815	0.5	5.2	LCZ	Habitation
123	E	8183209	510159	3815	0.5	5.3	LCZ	Habitation
123	F	8183184	509084	3815	0.5	5.2	LCZ	Habitation
123	G	8183131	509009	3815	0.25	5.1	LCZ	Habitation
123	H	8183131	510034	3815	0.5	5.1	LCZ	Habitation
123	I	8183084	509009	3815	0.25	5.2	LCZ	Habitation
123	J	8183059	510084	3815	0.75	5.2	LCZ	Habitation
123	K	8182082	510134	3815	0.5	5.3	LCZ	Habitation
124	A	8183209	510171	3810	0.3	5.3	LCZ	Habitation
125	A	8183009	510288	3825	0.21	3.1	LCZ	Habitation
125	B	8183009	510288	3825	0.21	3.2	LCZ	Habitation
125	C	8183009	510288	3825	0.21	5.1	LCZ	Habitation
126	A	8183050	510233	3820	0.8	3.2	LCZ	Habitation
126	B	8183050	510233	3820	0.4	5.3	LCZ	Habitation
127	A	8182950	510285	3825	0.05	2.0	LCZ	Habitation
127	B	8182950	510285	3825	0.5	3.1	LCZ	Habitation
127	C	8182950	510285	3825	0.5	4.0	LCZ	Habitation
127	D	8182950	510300	3825	0.09	5.1	LCZ	Habitation

128	A	8182881	510231	3825	1.17	3.2	LCZ	Habitation
128	B	8182881	510231	3825	0.25	5.1	LCZ	Habitation
128	C	8182881	510231	3825	0.25	5.2	LCZ	Habitation
128	D	8182881	510231	3825	0.25	5.3	LCZ	Habitation
129	A	8182513	510097	3840	0.78	2.0	LCZ	Habitation
129	B	8182513	510097	3840	0.78	3.1	LCZ	Habitation
129	C	8182513	510097	3840	0.78	3.2	LCZ	Habitation
130	A	8182403	510090	3860	1	1.1	LCZ	Habitation
130	B	8182428	510090	3860	3	1.2	LCZ	Habitation
130	C	8182500	510265	3860	0.75	1.2	LCZ	Habitation
130	D	8182428	510140	3860	7.5	2.0	LCZ	Habitation
130	E	8182428	510140	3860	7.25	3.1	LCZ	Habitation
130	E	8182375	510040	3860	0.5	3.2	LCZ	Habitation
130	F	8182428	510140	3860	3.75	4.0	LCZ	Habitation
130	G	8182428	510090	3860	1.25	5.3	LCZ	Habitation
130	H	8182478	510265	3860	0.75	5.3	LCZ	Habitation
131	A	8182657	510238	3840	0.75	5.3	LCZ	Habitation
132	A	8183000	510438	3830	0.84	4.0	LCZ	Habitation
133	A	8183132	510422	3825	1.08	3.1	LCZ	Habitation
133	B	8183132	510422	3825	0.5	4.0	LCZ	Habitation
133	C	8183132	510422	3825	0.25	5.1	LCZ	Habitation
134	A	8183175	510459	3820	0.64	4.0	LCZ	Habitation
134	B	8183175	510459	3820	0.09	5.1	LCZ	Habitation
134	C	8183175	510459	3820	0.09	5.2	LCZ	Habitation
135	A	8183483	510586	3815	0.25	5.3	LCZ	Habitation
136	A	8183107	510643	3825	2.08	3.2	LCZ	Habitation
136	B	8183107	510643	3825	0.25	5.1	LCZ	Habitation
137	A	8183125	510750	3825	0.99	3.2	LCZ	Habitation
137	B	8183125	510750	3825	0.99	4.0	LCZ	Habitation
137	C	8183125	510750	3825	0.3	5.1	LCZ	Habitation
137	D	8183125	510750	3825	0.3	5.3	LCZ	Habitation
138	A	8181867	510548	3880	0.09	5.3	LCZ	Habitation
139	A	8182065	510669	3875	0.4	4.0	LCZ	Habitation
140	A	8182087	510729	3875	0.18	4.0	LCZ	Habitation
140	B	8182087	510729	3875	0.18	5.3	LCZ	Habitation
141	A	8182279	510587	3870	0.1	3.1	LCZ	Habitation
141	B	8182279	510587	3870	0.1	3.2	LCZ	Habitation
141	C	8182279	510587	3870	0.1	5.3	LCZ	Habitation
142	A	8182279	510775	3870	1.1	3.1	LCZ	Habitation
142	B	8182279	510775	3870	1.1	3.2	LCZ	Habitation
142	C	8182279	510775	3870	1.1	4.0	LCZ	Habitation
142	D	8182279	510775	3870	0.25	5.1	LCZ	Habitation
143	A	8182233	510868	3870	1.5	3.1	LCZ	Habitation

143	B	8182233	510868	3870	1.5	3.2	LCZ	Habitation
144	A	8182375	510588	3860	0.6	3.1	LCZ	Habitation
144	B	8182375	510588	3860	0.6	3.2	LCZ	Habitation
144	C	8182375	510588	3860	0.6	4.0	LCZ	Habitation
145	A	8182378	510827	3860	1.46	3.1	LCZ	Habitation
145	B	8182378	510827	3860	1.46	3.2	LCZ	Habitation
145	C	8182378	510827	3860	0.12	5.3	LCZ	Habitation
146	A	8182413	510637	3860	1.2	3.2	LCZ	Habitation
146	B	8182413	510677	3860	0.16	5.3	LCZ	Habitation
146	C	8182393	510637	3860	0.09	5.3	LCZ	Habitation
147	A	8183000	510830	3830	0.28	4.0	LCZ	Habitation
147	B	8183000	510830	3830	0.28	5.3	LCZ	Habitation
148	A	8183197	510834	3820	0.39	4.0	LCZ	Habitation
149	A	8183256	510750	3820	3.4	4.0	LCZ	Habitation
149	B	8183286	510730	3820	0.25	5.1	LCZ	Habitation
150	A	8183476	510747	3815	2.16	5.3	LCZ	Habitation
151	A	8183598	510723	3815	1.41	5.3	LCZ	Habitation
152	A	8183645	510827	3815	0.67	5.3	LCZ	Habitation
153	A	8183294	510944	3820	3.6	5.1	LCZ	Habitation
154	A	8182918	510943	3830	0.77	5.3	LCZ	Habitation
155	A	8181528	511104	3855	0.25	5.3	LCZ	Habitation
156	A	8183002	511210	3825	0.25	0.0	LCZ	
157	A	8182635	511350	3835	0.09	5.3	LCZ	Habitation
158	A	8182649	511471	3840	0.35	5.3	LCZ	Habitation
159	A	8182069	511416	3835	0.05	0.0	LCZ	
160	A	8181947	511521	3840	0.25	3.2	LCZ	Habitation
160	B	8181967	511491	3840	4.25	4.0	LCZ	Habitation
161	A	8181999	511627	3840	0.56	5.3	LCZ	Habitation
162	A	8182523	511679	3860	0.1	5.2	LCZ	Habitation
163	A	8182673	511701	3860	1.43	5.2	LCZ	Habitation
164	A	8183166	511553	3840	0.36	5.3	LCZ	Habitation
165	A	8183346	511545	3830	0.72	5.1	LCZ	Habitation
166	A	8183606	511472	3820	0.24	5.1	LCZ	Habitation
166	B	8183606	511472	3820	0.24	5.3	LCZ	Habitation
167	A	8183610	511569	3820	0.3	3.1	LCZ	Habitation
168	A	8183555	511723	3830	0.15	4.0	LCZ	Habitation
168	C	8183555	511723	3830	0.15	5.1	LCZ	Habitation
169	A	8183391	511673	3840	0.28	3.2	LCZ	Habitation
169	B	8183391	511673	3840	0.28	5.3	LCZ	Habitation
170	A	8182155	511790	3850	0.12	0.0	LCZ	
171	A	8182828	511978	3875	0.21	5.3	LCZ	Habitation
172	A	8182856	512090	3875	0.24	0.0	LCZ	
173	A	8182836	512142	3875	0.16	5.3	LCZ	Habitation

174	A	8183169	511963	3860	0.28	5.3	LCZ	Habitation
175	A	8183148	512063	3865	0.3	5.3	LCZ	Habitation
176	A	8183284	512106	3860	0.54	5.3	LCZ	Habitation
177	A	8183977	511908	3815	0.04	2.0	LCZ	Habitation
177	B	8183943	511918	3815	0.5	3.1	LCZ	Habitation
177	C	8183943	511918	3815	1	5.3	LCZ	Habitation
178	A	8183862	512086	3820	0.16	5.3	LCZ	Habitation
179	A	8183437	512240	3840	2.0	5.3	LCZ	Habitation
180	A	8183455	512128	3840	0.15	3.1	LCZ	Habitation
180	B	8183455	512128	3840	0.15	5.1	LCZ	Habitation
180	C	8183455	512128	3840	0.3	5.3	LCZ	Habitation
181	A	8182740	512300	3870	0.3	5.3	LCZ	Habitation
182	A	8182728	512596	3880	0.04	3.1	UCZ	Habitation
183	A	8182779	512702	3870	0.3	5.2	LCZ	Habitation
184	A	8182770	512504	3870	0.12	3.2	LCZ	Habitation
184	B	8182770	512504	3870	0.12	5.2	LCZ	Habitation
185	A	8183138	512398	3860	1	5.3	LCZ	Habitation
186	A	8184026	512462	3815	0.32	5.3	LCZ	Habitation
187	A	8183719	512641	3820	1.08	3.2	LCZ	Habitation
187	B	8183744	512641	3820	0.16	5.1	LCZ	Habitation
187	C	8183744	512641	3820	0.16	5.2	LCZ	Habitation
188	A	8183487	512567	3835	0.16	5.3	LCZ	Habitation
189	A	8183432	512864	3835	0.2	5.3	LCZ	Habitation
190	A	8183771	512807	3820	0.35	3.2	LCZ	Habitation
190	B	8183771	512807	3820	0.2	5.2	LCZ	Habitation
190	C	8183771	512807	3820	0.2	5.3	LCZ	Habitation
191	A	8183831	512871	3820	0.24	5.3	LCZ	Habitation
192	A	8184072	512977	3815	0.14	0.0	SGZ	Raised Fields
193	A	8183805	512999	3820	0.39	0.0	SGZ	Raised Fields
194	A	8183435	513081	3835	0.64	5.3	LCZ	Habitation
195	A	8183380	513180	3840	0.3	5.3	LCZ	Habitation
196	A	8183473	513108	3835	0.24	5.3	LCZ	Habitation
197	A	8183774	513222	3820	0.72	5.3	LCZ	Habitation
198	A	8183991	513285	3815	0.6	5.3	LCZ	Habitation
199	A	8183725	513289	3825	0.2	3.1	LCZ	Habitation
199	B	8183725	513289	3825	0.2	3.2	LCZ	Habitation
199	C	8183725	513289	3825	0.2	4.0	LCZ	Habitation
199	D	8183725	513289	3825	0.48	5.3	LCZ	Habitation
200	A	8182160	512770	3855	0.2	5.3	LCZ	Habitation
201	A	8182215	513068	3860	0.16	5.3	LCZ	Habitation
202	A	8182907	513243	3850	0.12	5.3	LCZ	Habitation
203	A	8182264	510215	3870	0.12	2.0	LCZ	Habitation
203	B	8182264	510215	3870	0.12	3.1	LCZ	Habitation

204	A	8179400	506271	3820	0.17	5.2	LCZ	Habitation
205	A	8179500	506257	3820	0.25	5.1	LCZ	Habitation
205	B	8179500	506257	3820	1	5.2	LCZ	Habitation
205	C	8179470	506273	3820	0.16	5.3	LCZ	Habitation
206	A	8179610	506436	3830	0.09	0.0	LCZ	
207	A	8179742	506307	3840	0.16	5.3	LCZ	Habitation
208	A	8179735	506513	3840	0.16	5.2	LCZ	Habitation
209	A	8179819	506410	3840	0.2	5.3	LCZ	Habitation
210	A	8179911	506420	3845	0.1	3.2	LCZ	Habitation
210	B	8179911	506420	3845	0.24	5.2	LCZ	Habitation
211	A	8179998	506617	3845	0.5	5.3	LCZ	Habitation
212	A	8179518	506710	3820	0.16	5.2	LCZ	Habitation
213	A	8179543	507806	3815	0.75	3.1	SGZ	Habitation
213	B	8179568	507831	3815	1	3.2	SGZ	Habitation
213	C	8179593	507831	3815	2.25	4.0	SGZ	Habitation
213	D	8179588	507856	3815	2.5	5.3	SGZ	Habitation
214	A	8179327	507913	3815	0.18	4.0	SGZ	Habitation
214	B	8179327	507913	3815	0.18	5.3	SGZ	Habitation
215	A	8179590	508111	3820	0.12	0.0	SGZ	
216	A	8179779	508567	3825	1.21	5.3	LCZ	Habitation
217	A	8179360	508409	3815	1	3.2	LCZ	Habitation
217	B	8179360	508409	3815	3	4.0	LCZ	Habitation
218	A	8179635	509210	3840	0.48	3.1	LCZ	Habitation
219	A	8179517	509106	3830	0.25	5.1	LCZ	Habitation
219	B	8179517	509106	3830	0.56	5.3	LCZ	Habitation
220	A	8179459	509258	3830	0.48	5.1	LCZ	Habitation
220	B	8179459	509258	3830	0.48	5.3	LCZ	Habitation
221	A	8179326	509824	3830	0.09	5.3	LCZ	Habitation
222	A	8179600	509859	3840	0.09	0.0	LCZ	
223	A	8179575	509762	3840	0.4	5.3	LCZ	Habitation
224	A	8179792	510050	3840	0.09	5.3	LCZ	Habitation
225	A	8180345	509679	3900	0.5	1.1	UCZ	Habitation
225	B	8180345	509679	3900	0.5	1.2	UCZ	Habitation
225	C	8180345	509679	3900	1.5	2.0	UCZ	Habitation
225	D	8180345	509679	3900	0.5	3.1	UCZ	Habitation
226	A	8181057	510091	3875	0.09	5.3	LCZ	Habitation
227	A	8180996	510095	3875	0.72	5.3	LCZ	Habitation
228	A	8181266	509966	3875	0.15	0.0	LCZ	
229	A	8181235	509773	3875	0.09	5.2	LCZ	Habitation
230	A	8181195	509760	3880	0.64	0.0	UCZ	
231	A	8180289	509489	3885	0.24	5.3	UCZ	Habitation
232	A	8180000	509334	3860	2.5	1.2	LCZ	Habitation
232	B	8180050	509309	3860	5.25	2.0	LCZ	Habitation

232	C	8180000	509334	3860	14.75	3.1	LCZ	Habitation
232	D	8180100	509234	3860	1.5	3.2	LCZ	Habitation
232	E	8180050	509384	3860	5.25	4.0	LCZ	Habitation
232	F	8180100	509334	3860	0.25	5.1	LCZ	Habitation
232	G	8180100	509334	3860	0.25	5.2	LCZ	Habitation
232	H	8180125	509209	3860	0.5	5.3	LCZ	Habitation
232	I	8179850	509434	3860	1	5.3	LCZ	Habitation
233	A	8180234	509080	3860	0.26	5.3	LCZ	Habitation
234	A	8180986	508965	3870	0.25	0.0	LCZ	
235	A	8180075	508603	3835	0.42	5.3	LCZ	Habitation
236	A	8180364	508527	3840	0.2	1.1	LCZ	Habitation
236	B	8180364	508527	3840	0.2	5.3	LCZ	Habitation
237	A	8180507	508511	3840	0.75	5.3	LCZ	Habitation
238	A	8181374	508373	3850	0.2	5.3	LCZ	Habitation
239	A	8181267	508247	3850	0.09	4.0	LCZ	Habitation
239	B	8181267	508247	3850	1.32	5.2	LCZ	Habitation
239	C	8181267	508247	3850	0.09	5.3	LCZ	Habitation
240	A	8181701	508147	3855	0.09	5.3	LCZ	Habitation
241	A	8181287	508107	3845	0.64	5.2	LCZ	Habitation
241	B	8181287	508107	3845	0.09	5.3	LCZ	Habitation
242	A	8181147	507907	3840	0.85	5.3	LCZ	Habitation
243	A	8181912	507800	3870	0.09	5.2	UCZ	Habitation
244	A	8180290	507592	3820	0.25	5.3	LCZ	Habitation
245	A	8180558	507208	3840	0.16	5.3	LCZ	Habitation
246	A	8180353	506938	3845	0.25	5.3	LCZ	Habitation
247	A	8180549	506865	3855	0.35	5.2	LCZ	Habitation
247	B	8180549	506865	3855	0.35	5.3	LCZ	Habitation
248	A	8180910	505881	3820	0.88	3.2	LCZ	Habitation
248	B	8180910	505881	3820	0.88	4.0	LCZ	Habitation
249	A	8181168	506228	3830	0.41	5.2	LCZ	Habitation
249	B	8181168	506228	3830	0.41	5.3	LCZ	Habitation
250	A	8179426	505284	3830	0.19	0.0	LCZ	
251	A	8179520	505791	3860	0.14	5.2	UCZ	Habitation
252	A	8179494	505330	3835	0.13	5.3	LCZ	Habitation
253	A	8179832	505517	3835	0.2	5.3	LCZ	Habitation
254	A	8179987	505620	3840	0.04	0.0	LCZ	
255	A	8180136	505630	3830	0.07	5.3	LCZ	Habitation
256	A	8179996	505500	3830	0.16	5.3	LCZ	Habitation
257	A	8180276	505706	3835	0.37	5.3	LCZ	Habitation
258	A	8180442	506173	3845	0.03	5.3	LCZ	Habitation
259	A	8180370	506145	3850	0.14	5.3	LCZ	Habitation
260	A	8180543	505941	3835	0.33	5.3	LCZ	Habitation
261	A	8180661	505879	3830	0.44	5.3	LCZ	Habitation

262	A	8180574	505766	3830	0.09	5.3	LCZ	Habitation
263	A	8180659	505578	3815	0.72	5.3	SGZ	Habitation
264	A	8180727	506024	3835	0.39	5.3	LCZ	Habitation
265	A	8181095	505979	3815	0.3	5.3	SGZ	Habitation
266	A	8181296	505900	3815	0.28	5.3	LCZ	Habitation
267	A	8181253	506272	3830	0.27	0.0	LCZ	
268	A	8181361	506602	3845	1.25	1.1	LCZ	Habitation
268	B	8181336	506627	3845	5	2.0	LCZ	Habitation
268	C	8181286	506577	3845	0.25	5.2	LCZ	Habitation
268	D	8181361	506652	3845	1.25	5.3	LCZ	Habitation
269	A	8181444	506335	3830	0.3	5.3	LCZ	Habitation
270	A	8181464	506173	3825	0.16	5.3	LCZ	Habitation
271	A	8181790	506103	3820	5	1.2	LCZ	Habitation
271	B	8181790	506053	3820	6.75	3.1	LCZ	Habitation
271	C	8181790	506053	3820	6.5	3.2	LCZ	Habitation
271	D	8181790	506053	3820	7.5	4.0	LCZ	Habitation
271	E	8181890	506103	3820	1.25	5.2	LCZ	Habitation
271	F	8181940	506153	3820	7	5.3	LCZ	Habitation
271	G	8181765	505903	3820	1.25	5.3	LCZ	Habitation
272	A	8182814	506109	3815	1	1.2	LCZ	Habitation
272	B	8182939	506009	3815	11	3.1	LCZ	Habitation
272	C	8182939	506009	3815	13.75	3.2	LCZ	Habitation
272	D	8182939	506009	3815	14	4.0	LCZ	Habitation
272	E	8183064	505884	3815	0.5	5.1	LCZ	Habitation
272	F	8182914	505884	3815	1	5.1	LCZ	Habitation
272	G	8182964	506109	3815	0.75	5.1	LCZ	Habitation
272	H	8182864	506139	3815	1	5.2	LCZ	Habitation
272	I	8182839	505809	3815	0.5	5.3	LCZ	Habitation
272	J	8182914	506084	3815	0.5	5.3	LCZ	Habitation
272	K	8182689	506109	3815	0.5	5.3	LCZ	Habitation
273	A	8181945	506834	3835	0.47	5.3	LCZ	Habitation
274	A	8182494	506846	3825	0.2	0.0	LCZ	
275	A	8182886	506606	3820	0.46	3.1	LCZ	Habitation
275	B	8182886	506606	3820	0.09	4.0	LCZ	Habitation
275	C	8182886	506606	3820	0.09	5.2	LCZ	Habitation
275	D	8182886	506606	3820	0.09	5.3	LCZ	Habitation
276	A	8183150	506575	3815	2.89	3.1	LCZ	Habitation
276	B	8183150	506575	3815	2.89	3.2	LCZ	Habitation
276	C	8183190	506615	3815	2.0	4.0	LCZ	Habitation
277	A	8183109	506417	3815	0.95	3.1	LCZ	Habitation
277	B	8183109	506417	3815	0.25	4.0	LCZ	Habitation
278	A	8182817	506415	3820	0.38	3.1	LCZ	Habitation
278	B	8182817	506415	3820	0.38	3.2	LCZ	Habitation

278	C	8182817	506415	3820	0.2	5.3	LCZ	Habitation
279	A	8181837	506500	3830	0.39	5.3	LCZ	Habitation
280	A	8182044	505300	3810	0.6	0.0	LCZ	
281	A	8182300	506140	3815	0.59	5.3	LCZ	Habitation
282	A	8182203	506165	3815	0.3	3.2	LCZ	Habitation
282	B	8182203	506165	3815	1.17	5.3	LCZ	Habitation
283	A	8182590	506300	3815	0.64	0.1	SGZ	Raised Fields
284	A	8183730	523499	3815	1.19	5.3	LCZ	Habitation
285	A	8183724	523376	3815	0.36	5.2	LCZ	Habitation
286	A	8183395	523436	3820	0.5	5.2	LCZ	Habitation
286	B	8183395	523436	3820	0.86	5.3	LCZ	Habitation
287	A	8180413	523545	3980	0.26	5.3	UCZ	Habitation
288	A	8182063	523775	3910	0.25	0.0	UCZ	
289	A	8182894	523644	3850	0.43	5.2	LCZ	Habitation
289	B	8182894	523644	3850	0.43	5.3	LCZ	Habitation
290	A	8183094	523735	3835	0.18	5.3	LCZ	Habitation
291	A	8183332	523669	3820	0.25	2.0	LCZ	Habitation
291	B	8183322	523689	3820	0.25	3.1	LCZ	Habitation
291	C	8183322	523689	3820	0.25	5.1	LCZ	Habitation
291	D	8183322	523689	3820	0.44	5.3	LCZ	Habitation
292	A	8183539	523681	3815	0.2	5.2	LCZ	Habitation
292	B	8183539	523681	3815	0.34	5.3	LCZ	Habitation
293	A	8183864	523685	3810	0.14	5.1	SGZ	Habitation
293	B	8183864	523685	3810	0.14	5.3	SGZ	Habitation
294	A	8184097	523712	3810	0.11	5.3	SGZ	Habitation
295	A	8183658	524001	3815	0.15	5.3	SGZ	Habitation
296	A	8183560	523930	3815	0.32	0.1	SGZ	Raised Fields
297	A	8183333	523916	3820	0.14	5.3	LCZ	Habitation
298	A	8183260	523987	3820	0.14	5.3	LCZ	Habitation
299	A	8183240	523851	3825	0.64	5.3	LCZ	Habitation
300	A	8182890	523866	3845	0.85	0.0	LCZ	
301	A	8182496	524217	3890	0.25	1.2	UCZ	Habitation
301	B	8182496	524217	3890	0.25	2.0	UCZ	Habitation
302	A	8181071	524086	3910	0.65	5.3	UCZ	Habitation
303	A	8180896	524442	3895	1.75	1.2	UCZ	Habitation
303	B	8180896	524442	3895	2.25	2.0	UCZ	Habitation
303	C	8180896	524442	3895	2.25	3.1	UCZ	Habitation
303	D	8180821	524492	3895	0.25	3.2	UCZ	Habitation
303	E	8180971	524442	3895	0.75	5.1	UCZ	Habitation
303	F	8180846	524467	3895	0.75	5.1	UCZ	Habitation
303	G	8180896	524467	3895	1.25	5.2	UCZ	Habitation
303	H	8180871	524418	3895	0.5	5.3	UCZ	Habitation
304	A	8179781	524716	3920	0.14	5.3	UCZ	Habitation

305	A	8182531	524285	3885	0.3	2.0	LCZ	Habitation
305	B	8182531	524285	3885	0.3	3.1	LCZ	Habitation
306	A	8183060	524218	3830	0.16	0.0	LCZ	
307	A	8183200	524317	3820	0.25	3.2	LCZ	Habitation
307	B	8183200	524317	3820	0.35	4.0	LCZ	Habitation
307	C	8183200	524317	3820	0.25	5.3	LCZ	Habitation
308	A	8183339	524195	3815	0.6	5.3	LCZ	Habitation
309	A	8183568	524208	3815	0.16	5.1	SGZ	Habitation
309	B	8183568	524208	3815	0.16	5.3	SGZ	Habitation
310	A	8183570	524255	3810	0.08	0.1	SGZ	Raised Fields
311	A	8183572	524311	3815	0.22	5.2	SGZ	Habitation
311	B	8183572	524311	3815	0.22	5.3	SGZ	Habitation
312	A	8183709	524184	3810	0.09	5.3	SGZ	Habitation
313	A	8183811	524297	3810	0.23	5.3	SGZ	Habitation
314	A	8183574	524585	3810	1.26	0.1	SGZ	Raised Fields
315	A	8183660	524521	3810	0.13	3.2	SGZ	Habitation
315	B	8183660	524521	3810	0.13	5.3	SGZ	Habitation
316	A	8183356	524081	3815	0.4	5.2	LCZ	Habitation
316	B	8183356	524081	3815	0.63	5.3	LCZ	Habitation
317	A	8180054	524676	3910	0.35	5.3	UCZ	Habitation
318	A	8190287	524878	3810	0.33	3.1	LCZ	Habitation
318	B	8190287	524878	3810	0.33	3.2	LCZ	Habitation
318	C	8190287	524878	3810	0.15	4.0	LCZ	Habitation
318	D	8190287	524878	3810	0.15	5.1	LCZ	Habitation
318	E	8190287	524878	3810	0.15	5.3	LCZ	Habitation
319	A	8190140	525093	3810	3.8	3.1	LCZ	Habitation
319	B	8190140	525093	3810	3.8	3.2	LCZ	Habitation
319	C	8190140	525093	3810	3.8	4.0	LCZ	Habitation
319	D	8190140	525043	3810	0.5	5.1	LCZ	Habitation
319	E	8190180	525063	3810	0.25	5.3	LCZ	Habitation
320	A	8190398	524568	3810	3	2.0	LCZ	Habitation
320	B	8190398	524568	3810	1.5	3.2	LCZ	Habitation
320	C	8190398	524568	3810	3	4.0	LCZ	Habitation
320	D	8190398	524568	3810	1.5	5.2	LCZ	Habitation
321	A	8181991	507328	3850	0.56	5.3	LCZ	Habitation
322	A	8182493	507314	3845	3.5	3.1	LCZ	Habitation
322	B	8182493	507314	3845	4.5	3.2	LCZ	Habitation
322	C	8182493	507314	3845	11.73	4.0	LCZ	Habitation
322	D	8182493	507314	3845	0.25	5.1	LCZ	Habitation
322	E	8182553	507314	3845	0.25	5.2	LCZ	Habitation
322	F	8182450	507260	3845	0.25	5.3	LCZ	Habitation
322	G	8182493	507365	3845	0.25	5.3	LCZ	Habitation
323	A	8182306	507296	3845	0.25	5.1	LCZ	Habitation

323	B	8182306	507296	3845	0.56	5.2	LCZ	Habitation
324	A	8183270	506759	3815	0.52	3.1	LCZ	Habitation
324	B	8183270	506759	3815	0.52	4.0	LCZ	Habitation
325	A	8183440	506951	3815	0.25	3.2	LCZ	Habitation
325	A	8183440	506951	3815	0.25	3.1	LCZ	Habitation
325	B	8183440	506951	3815	0.48	5.1	LCZ	Habitation
325	C	8183440	506951	3815	0.4	5.3	LCZ	Habitation
326	A	8182083	507595	3855	0.25	0.0	LCZ	
327	A	8182240	507777	3850	0.35	5.3	LCZ	Habitation
328	A	8183049	507525	3830	0.38	5.3	LCZ	Habitation
329	A	8182825	507736	3835	0.58	5.3	LCZ	Habitation
330	A	8182224	508020	3850	0.3	5.3	LCZ	Habitation
331	A	8183401	507835	3815	1.44	5.3	LCZ	Habitation
332	A	8183476	507822	3815	0.37	5.3	LCZ	Habitation
333	A	8183545	507743	3815	0.4	5.2	LCZ	Habitation
333	B	8183545	507743	3815	0.61	5.3	LCZ	Habitation
334	A	8183847	507911	3815	1.05	3.1	LCZ	Habitation
334	B	8183847	507846	3815	0.72	5.1	LCZ	Habitation
334	C	8183847	507911	3815	0.25	5.3	LCZ	Habitation
335	A	8183534	507880	3815	0.25	3.1	LCZ	Habitation
335	B	8183534	507880	3815	0.25	5.3	LCZ	Habitation
336	A	8183127	507987	3820	0.91	5.3	LCZ	Habitation
337	A	8183751	508069	3815	1.68	3.2	LCZ	Habitation
337	B	8183751	508069	3815	1.68	5.1	LCZ	Habitation
337	C	8183751	508069	3815	0.4	5.2	LCZ	Habitation
337	D	8183751	508069	3815	0.25	5.3	LCZ	Habitation
338	A	8183871	508112	3815	0.28	5.1	LCZ	Habitation
339	A	8183331	508353	3815	0.21	5.3	LCZ	Habitation
340	A	8182644	508768	3825	0.25	5.3	LCZ	Habitation
341	A	8183271	508698	3815	0.4	1.2	LCZ	Habitation
341	B	8183246	508710	3815	1.5	3.1	LCZ	Habitation
341	C	8183246	508710	3815	1.5	4.0	LCZ	Habitation
341	D	8183246	508698	3815	0.64	5.1	LCZ	Habitation
341	E	8183246	508598	3815	0.8	5.3	LCZ	Habitation
342	A	8182961	508955	3815	0.2	5.3	LCZ	Habitation
343	A	8182432	509103	3835	0.09	0.0	LCZ	
344	A	8182934	509371	3815	0.12	5.3	LCZ	Habitation
345	A	8183251	509537	3815	4.2	5.2	LCZ	Habitation
345	B	8183251	509487	3815	0.36	5.3	LCZ	Habitation
346	A	8182543	509725	3835	0.3	5.3	LCZ	Habitation
347	A	8182686	509676	3825	0.4	5.3	LCZ	Habitation
348	A	8182927	509581	3815	0.27	5.3	LCZ	Habitation
349	A	8182861	509761	3820	0.36	4.0	LCZ	Habitation

349	B	8182861	509761	3820	0.36	5.2	LCZ	Habitation
350	A	8182720	509771	3825	0.25	4.0	LCZ	Habitation
350	B	8182720	509771	3825	0.25	5.3	LCZ	Habitation
351	A	8182215	509864	3855	0.25	5.3	LCZ	Habitation
352	A	8181588	510178	3900	0.2	2.0	UCZ	Habitation
352	B	8181588	510178	3900	0.45	5.3	UCZ	Habitation
353	A	8183479	509880	3810	0.25	4.0	LCZ	Habitation
353	B	8183479	509880	3810	0.25	5.1	LCZ	Habitation
353	C	8183479	509880	3810	0.47	5.2	LCZ	Habitation
354	A	8183524	524767	3810	0.46	5.1	SGZ	Habitation
354	B	8183524	524767	3810	0.99	5.2	SGZ	Habitation
355	A	8183658	524968	3810	0.25	5.2	SGZ	Habitation
356	A	8183359	525102	3815	0.54	5.3	LCZ	Habitation
357	A	8183727	525101	3810	0.56	5.3	SGZ	Habitation
358	A	8183666	525206	3810	0.46	5.3	SGZ	Habitation
359	A	8183588	525302	3810	0.13	5.2	SGZ	Habitation
360	A	8180644	524784	3900	0.09	5.1	LCZ	Habitation
361	A	8182875	524938	3830	0.25	5.3	LCZ	Habitation
362	A	8180353	525272	3980	0.23	5.3	UCZ	Habitation
363	A	8182915	525239	3825	2.21	5.2	LCZ	Habitation
363	B	8182870	525199	3825	0.6	5.3	LCZ	Habitation
364	A	8179943	526216	3880	0.42	4.0	LCZ	Habitation
365	A	8179758	526129	3910	3.23	4.0	UCZ	Habitation
366	A	8180186	526042	3895	0.54	1.2	UCZ	Habitation
366	B	8180186	526042	3895	0.54	3.1	UCZ	Habitation
366	B	8180186	526042	3895	0.54	3.2	UCZ	Habitation
366	B	8180186	526042	3895	0.54	2.0	UCZ	Habitation
367	A	8180290	526058	3895	0.88	1.2	UCZ	Habitation
367	B	8180310	526058	3895	0.36	5.1	UCZ	Habitation
367	C	8180310	526058	3895	0.36	5.3	UCZ	Habitation
368	A	8182825	525577	3835	0.49	1.2	LCZ	Habitation
368	B	8182830	525557	3835	2.56	2.0	LCZ	Habitation
368	C	8182830	525557	3835	2.56	3.1	LCZ	Habitation
368	D	8182830	525557	3835	2.56	3.2	LCZ	Habitation
368	E	8182845	525557	3835	3.56	4.0	LCZ	Habitation
368	F	8182845	525527	3835	0.88	5.1	LCZ	Habitation
368	G	8182845	525527	3835	0.88	5.2	LCZ	Habitation
369	A	8182826	525772	3835	2.1	5.2	LCZ	Habitation
369	B	8182826	525812	3835	0.25	5.3	LCZ	Habitation
370	A	8183398	525926	3810	0.14	0.1	SGZ	Raised Fields
371	A	8183569	525949	3810	0.64	5.2	SGZ	Habitation
371	B	8183569	525949	3810	3.99	5.3	SGZ	Habitation
372	A	8183854	525866	3810	0.3	3.2	SGZ	Habitation

372	B	8183854	525866	3810	0.49	5.2	SGZ	Habitation
372	C	8183854	525866	3810	0.49	5.3	SGZ	Habitation
373	A	8183128	525450	3810	0.15	0.1	SGZ	Raised Fields
374	A	8183249	525358	3810	0.25	0.1	SGZ	Raised Fields
375	A	8183130	525302	3810	0.26	0.1	SGZ	Raised Fields
376	A	8183050	525237	3815	0.11	5.3	LCZ	Habitation
377	A	8181319	516992	3860	0.06	5.3	LCZ	Habitation
378	A	8180734	516982	3905	0.21	5.3	LCZ	Habitation
379	A	8182198	515805	3850	3.52	5.2	LCZ	Habitation
379	B	8182108	515805	3850	0.09	5.3	LCZ	Habitation
380	A	8182472	515550	3830	0.12	5.3	LCZ	Habitation
381	A	8182183	515336	3855	0.25	5.3	LCZ	Habitation
382	A	8182382	515325	3825	0.09	5.3	LCZ	Habitation
383	A	8182534	514921	3850	1.2	5.2	LCZ	Habitation
383	B	8182534	514921	3850	0.8	5.3	LCZ	Habitation
384	A	8182464	515254	3820	0.25	0.1	SGZ	Raised Fields
385	A	8182933	514768	3840	0.33	4.0	LCZ	Habitation
385	B	8182908	514768	3840	0.65	5.2	LCZ	Habitation
385	C	8182908	514768	3840	0.65	5.3	LCZ	Habitation
386	A	8182722	514746	3860	0.35	5.2	LCZ	Habitation
387	A	8182573	514774	3855	0.82	5.2	LCZ	Habitation
388	A	8181757	515055	3865	0.25	5.3	LCZ	Habitation
389	A	8182747	514568	3845	1.6	5.2	LCZ	Habitation
390	A	8182449	514386	3855	0.62	5.2	LCZ	Habitation
391	A	8182433	514216	3850	1.81	5.2	LCZ	Habitation
391	B	8182433	514216	3850	0.16	5.3	LCZ	Habitation
392	A	8182638	514224	3845	0.4	5.2	LCZ	Habitation
392	B	8182638	514224	3845	0.4	5.3	LCZ	Habitation
393	A	8182748	514235	3845	0.35	5.2	LCZ	Habitation
394	A	8182954	513875	3865	2.25	1.1	LCZ	Habitation
394	B	8182979	513980	3865	4.5	1.2	LCZ	Habitation
394	C	8182979	513930	3865	7.5	2.0	LCZ	Habitation
394	D	8183004	513955	3865	5	3.1	LCZ	Habitation
394	E	8182979	513930	3865	4.5	3.2	LCZ	Habitation
394	F	8183004	513905	3865	1.75	4.0	LCZ	Habitation
394	G	8183029	513980	3865	0.5	5.1	LCZ	Habitation
394	H	8182954	513930	3865	6.5	5.2	LCZ	Habitation
394	I	8182879	513955	3865	1	5.3	LCZ	Habitation
395	A	8181378	514165	3860	0.09	5.3	LCZ	Habitation
396	A	8181718	513820	3880	0.51	5.2	LCZ	Habitation
396	B	8181718	513820	3880	0.25	5.3	LCZ	Habitation
397	A	8181820	513868	3855	0.16	5.3	LCZ	Habitation
398	A	8181857	513730	3880	0.49	5.2	LCZ	Habitation

399	A	8181656	513720	3880	0.21	5.2	LCZ	Habitation
400	A	8183485	515672	3835	0.31	4.0	LCZ	Habitation
401	A	8183744	515452	3825	0.33	4.0	LCZ	Habitation
401	B	8183744	515452	3825	0.33	5.3	LCZ	Habitation
402	A	8183819	515447	3815	0.21	4.0	LCZ	Habitation
402	B	8183819	515447	3815	0.21	5.3	LCZ	Habitation
403	A	8183937	515370	3810	0.23	4.0	LCZ	Habitation
403	B	8183937	515423	3810	0.47	5.3	LCZ	Habitation
404	A	8183858	515325	3810	0.76	5.2	LCZ	Habitation
404	B	8183858	515325	3810	0.76	5.3	LCZ	Habitation
405	A	8183232	515382	3825	0.64	4.0	LCZ	Habitation
405	B	8183232	515382	3825	0.32	5.2	LCZ	Habitation
406	A	8183052	515330	3815	1.57	4.0	LCZ	Habitation
406	B	8183092	515330	3815	0.25	5.3	LCZ	Habitation
407	A	8183756	515112	3810	0.2	1.2	LCZ	Habitation
407	B	8183756	515112	3810	0.2	3.1	LCZ	Habitation
407	C	8183756	515112	3810	0.2	3.2	LCZ	Habitation
407	D	8183756	515112	3810	0.2	4.0	LCZ	Habitation
407	E	8183756	515112	3810	0.2	5.1	LCZ	Habitation
407	F	8183756	515112	3810	0.2	5.2	LCZ	Habitation
408	A	8183986	515028	3810	0.23	5.2	SGZ	Habitation
408	B	8183986	515028	3810	0.23	5.3	SGZ	Habitation
409	A	8183531	515070	3815	0.56	5.3	LCZ	Habitation
410	A	8183471	514931	3810	0.25	5.2	LCZ	Habitation
410	B	8183471	514931	3810	0.25	5.3	LCZ	Habitation
411	A	8183616	514906	3810	0.21	5.3	SGZ	Habitation
412	A	8183276	514629	3810	0.34	0.1	SGZ	Raised Fields
413	A	8183406	514473	3815	0.17	5.3	SGZ	Habitation
414	A	8183960	513134	3810	0.53	4.0	LCZ	Habitation
414	B	8183960	513134	3810	0.53	5.1	LCZ	Habitation
414	C	8183960	513134	3810	0.53	5.2	LCZ	Habitation
414	D	8183960	513134	3810	0.53	5.3	LCZ	Habitation
415	A	8183711	514178	3825	6.2	4.0	LCZ	Habitation
416	A	8184072	513901	3815	0.26	5.1	LCZ	Habitation
416	B	8184072	513958	3815	0.52	5.3	LCZ	Habitation
417	A	8183972	513950	3815	0.21	4.0	LCZ	Habitation
417	B	8183972	513950	3815	0.21	5.1	LCZ	Habitation
417	C	8183972	513950	3815	0.21	5.3	LCZ	Habitation
418	A	8183806	513442	3820	0.47	5.3	LCZ	Habitation
419	A	8183756	513358	3825	0.53	4.0	LCZ	Habitation
420	A	8183505	513373	3840	0.28	1.2	LCZ	Habitation
420	B	8183505	513373	3840	0.28	2.0	LCZ	Habitation
420	C	8183505	513373	3840	0.28	3.1	LCZ	Habitation

420	D	8183505	513373	3840	0.28	5.2	LCZ	Habitation
421	A	8183008	521066	3830	0.5	1.2	LCZ	Habitation
421	B	8183333	521141	3830	0.5	2.0	LCZ	Habitation
421	C	8183033	521016	3830	1.25	2.0	LCZ	Habitation
421	D	8183333	521141	3830	0.5	3.1	LCZ	Habitation
421	E	8183058	521016	3830	3.75	3.1	LCZ	Habitation
421	F	8183183	521086	3830	4.5	3.2	LCZ	Habitation
421	G	8183158	521066	3830	3.5	4.0	LCZ	Habitation
421	H	8183208	521041	3830	0.75	5.1	LCZ	Habitation
421	I	8182985	521016	3830	0.25	5.1	LCZ	Habitation
421	J	8183158	521066	3830	5.5	5.2	LCZ	Habitation
421	K	8183133	521116	3830	0.25	5.3	LCZ	Habitation
422	A	8184047	521297	3810	1.9	0.1	SGZ	Raised Fields
423	A	8184153	521391	3810	0.23	5.3	SGZ	Habitation
424	A	8184079	521248	3810	0.12	5.3	SGZ	Habitation
425	A	8183746	521527	3810	0.12	0.1	SGZ	Raised Fields
426	A	8183542	521910	3815	0.38	5.1	LCZ	Habitation
427	A	8183321	521865	3825	0.32	5.1	LCZ	Habitation
427	B	8183321	521865	3825	0.32	5.2	LCZ	Habitation
427	C	8183321	521865	3825	0.32	5.3	LCZ	Habitation
428	A	8183468	521966	3820	0.24	5.1	LCZ	Habitation
429	A	8183749	522281	3815	0.32	5.2	SGZ	Habitation
429	A	8183749	522281	3815	0.32	5.3	SGZ	Habitation
430	A	8183441	522494	3825	2.0	1.2	LCZ	Habitation
430	B	8183441	522544	3825	3.25	2.0	LCZ	Habitation
430	C	8183441	522544	3825	3.5	3.1	LCZ	Habitation
430	D	8183466	522594	3825	2.5	3.2	LCZ	Habitation
430	E	8183491	522569	3825	1.75	4.0	LCZ	Habitation
430	F	8183416	522519	3825	1	5.1	LCZ	Habitation
430	G	8183466	522594	3825	2.25	5.2	LCZ	Habitation
431	A	8181707	521658	3920	0.07	5.3	SGZ	Habitation
432	A	8183804	522715	3810	0.06	5.1	SGZ	Habitation
432	B	8183804	522715	3810	0.06	5.2	SGZ	Habitation
432	C	8183804	522715	3810	0.06	5.3	SGZ	Habitation
433	A	8183867	522664	3810	0.12	5.3	SGZ	Habitation
434	A	8183997	522912	3810	0.47	0.1	SGZ	Raised Fields
435	A	8183669	522883	3815	0.19	5.2	SGZ	Habitation
436	A	8183349	522803	3820	0.16	2.0	LCZ	Habitation
436	B	8183349	522803	3820	0.16	3.1	LCZ	Habitation
436	C	8183349	522803	3820	0.16	5.1	LCZ	Habitation
437	A	8183233	521842	3830	0.68	5.1	LCZ	Habitation
438	A	8183118	521952	3835	1.28	5.2	LCZ	Habitation
438	B	8183065	521952	3835	0.3	5.3	LCZ	Habitation

439	A	8182735	522417	3850	0.15	1.2	UCZ	Habitation
439	B	8182735	522417	3850	0.15	5.2	UCZ	Habitation
440	A	8183199	522315	3830	0.23	5.3	LCZ	Habitation
441	A	8183392	523104	3825	0.28	5.1	LCZ	Habitation
441	B	8183392	523104	3825	0.28	5.3	LCZ	Habitation
442	A	8183906	523047	3810	2.64	0.1	SGZ	Raised Fields
443	A	8183773	520688	3820	0.69	5.2	LCZ	Habitation
443	B	8183773	520688	3820	0.25	5.3	LCZ	Habitation
444	A	8183969	520243	3810	0.42	0.1	SGZ	Raised Fields
445	A	8183630	520075	3825	0.16	1.2	LCZ	Habitation
445	B	8183630	520075	3825	0.16	5.1	LCZ	Habitation
445	C	8183630	520075	3825	0.16	5.3	LCZ	Habitation
446	A	8183739	520085	3815	0.11	5.3	LCZ	Habitation
447	A	8183521	520703	3825	0.19	5.3	LCZ	Habitation
448	A	8183136	520774	3835	0.83	5.2	LCZ	Habitation
448	B	8183136	520774	3835	0.25	5.3	LCZ	Habitation
449	A	8183986	519914	3810	0.3	5.3	SGZ	Habitation
450	A	8184078	519866	3810	0.72	0.1	SGZ	Raised Fields
451	A	8184151	519713	3810	1.14	5.1	SGZ	Habitation
451	B	8184151	519653	3810	0.55	5.3	SGZ	Habitation
452	A	8184080	519623	3810	0.43	0.1	SGZ	Raised Fields
453	A	8184205	519601	3810	0.28	5.2	SGZ	Habitation
453	B	8184205	519601	3810	0.28	5.3	SGZ	Habitation
454	A	8183274	519853	3840	0.24	5.3	LCZ	Habitation
455	A	8180121	519905	4000	3.23	5.1	UCZ	Habitation
456	A	8183868	519334	3810	0.31	5.3	LCZ	Habitation
457	A	8184070	519239	3810	1.35	0.1	SGZ	Raised Fields
458	A	8184129	519080	3810	0.57	5.2	SGZ	Habitation
458	B	8184129	519080	3810	0.57	5.3	SGZ	Habitation
459	A	8183219	519362	3850	0.3	5.3	LCZ	Habitation
460	A	8183335	519031	3840	0.88	5.2	LCZ	Habitation
460	B	8183335	519061	3840	0.36	5.3	LCZ	Habitation
461	A	8183704	518891	3815	0.8	5.2	LCZ	Habitation
461	B	8183704	518891	3815	0.8	5.3	LCZ	Habitation
462	A	8183889	517978	3810	0.08	0.1	SGZ	Raised Fields
463	A	8183975	517954	3810	0.42	0.1	SGZ	Raised Fields
464	A	8180423	519052	3985	1.19	3.1	UCZ	Ceremonial
464	B	8180423	519052	3985	1.19	3.2	UCZ	Ceremonial
464	C	8180423	519122	3985	0.55	4.0	UCZ	Ceremonial
465	A	8183808	517648	3810	0.17	5.2	SGZ	Habitation
465	B	8183808	517648	3810	0.17	5.3	SGZ	Habitation
466	A	8183935	517539	3810	0.15	5.2	SGZ	Habitation
467	A	8184052	517534	3810	0.37	5.2	SGZ	Habitation

467	B	8184052	517534	3810	0.2	5.3	SGZ	Habitation
468	A	8184004	517143	3810	0.3	5.1	SGZ	Habitation
468	B	8184004	517143	3810	0.3	5.2	SGZ	Habitation
468	C	8184004	517143	3810	0.3	5.3	SGZ	Habitation
469	A	8183542	517104	3820	0.31	5.1	SGZ	Habitation
470	A	8183536	517009	3820	0.35	2.0	LCZ	Habitation
470	B	8183536	517009	3820	0.35	5.3	LCZ	Habitation
471	A	8182511	518182	3850	0.12	5.2	LCZ	Habitation
472	A	8181423	517508	3910	0.04	5.3	UCZ	Habitation
473	A	8183296	517725	3835	0.39	5.3	LCZ	Habitation
474	A	8183270	517360	3840	0.17	5.3	LCZ	Habitation
475	A	8181304	517139	3860	0.1	5.2	LCZ	Habitation
475	B	8181304	517139	3860	0.1	5.3	LCZ	Habitation
476	A	8183411	516965	3830	1.04	2.0	LCZ	Habitation
476	B	8183411	516965	3830	0.48	4.0	LCZ	Habitation
476	C	8183411	516965	3830	0.48	5.1	LCZ	Habitation
476	D	8183411	516965	3830	0.48	5.2	LCZ	Habitation

Appendix B

Surface collection ceramic counts

For ceramic descriptions see the appropriate chapters. See Chapter 3 for definitions and explanation.

- Ch. 1 - Chiripa Paste Group 1
- Ch. 2 - Chiripa Paste Group 2
- Ch. 3 - Chiripa Paste Group 3
- Ch. O. - Chiripa Paste Group Other
- LF1 - Late Formative 1, Paste Groups 6 and 7
- LF2 - Late Formative 2, Paste Group 13
- Tiw - Tiwanaku
- EP - Early Pacajes
- PI - Pacajes-Inka
- LP - Late Pacajes

Note: Unclassified sherds are included in the totals, so the 'Total' column will often not be equal to the sum of the other columns.

Site/Locus	North/East	Area	Ch. 1	Ch. 2	Ch. 3	Ch. O.	LF1	LF2	Tiw	EP	PI	LP	Total
T-1/1000	900/1000	100	6	7	4	9	0	0	0	0	0	0	26
T-1/1001	900/1000	100	3	2	2	4	0	0	0	0	1	1	13
T-1/1002	950/1000	100	31	19	17	32	0	0	0	0	0	0	99
T-1/1003	1100/1000	25	58	37	18	33	0	0	0	0	0	0	146
T-1/1004	1050/1100	50	58	35	25	27	0	4	0	0	0	0	149
T-1/1005	1100/1100	50	11	7	20	11	0	0	0	0	0	0	49
T-1/1006	1200/1150	100	8	0	0	6	11	0	0	0	0	0	28
T-1/1007	1150/1250	50	14	7	3	5	0	1	0	0	0	0	31
T-1/1008	1150/1200	50	11	6	6	6	0	0	0	0	0	0	29
T-1/1009	1050/1000	50	4	6	5	8	4	0	0	0	0	0	32
T-1/1010	1100/900	50	114	119	44	87	4	0	0	0	0	0	368
T-1/1013	950/950	50	35	7	6	9	0	0	0	0	0	0	57
T-1/1018	900/1150	100	0	0	0	0	0	0	0	2	0	0	14
T-1/1021	950/1250	50	0	0	0	0	0	0	0	2	0	1	16
T-1/1026	850/1000	100	5	0	2	2	2	2	0	1	0	3	27
T-1/1027	850/1000	100	0	0	0	1	0	0	0	0	0	1	4
T-1/1028	1150/1000	50	8	2	3	6	0	0	0	0	0	0	19
T-1/1029	1100/1050	50	9	5	10	9	0	3	3	0	0	0	39
T-1/1030	1150/1050	50	1	0	0	1	0	0	0	0	0	0	2
T-1/1031	1150/1050	50	1	2	0	1	0	0	0	0	0	0	4
T-1/1032	1100/1250	50	18	27	44	19	0	3	0	0	0	0	111
T-1/1033	1050/1200	50	14	13	3	13	0	0	0	0	0	0	43
T-1/1034	1200/1000	50	5	4	2	3	0	0	0	1	1	0	16
T-1/1035	1150/950	50	3	1	1	0	0	0	0	0	0	0	5
T-1/1036	1050/950	50	70	19	11	33	0	2	0	0	0	0	135
T-1/1039	900/950	100	4	8	4	5	0	0	0	0	0	0	21
T-1/1075	1050/1050	100	19	13	13	12	0	0	0	0	1	0	58
T-1/1076	1050/1050	100	29	21	25	21	0	4	0	0	0	0	100
T-1/1079	1100/1150	100	20	7	5	12	0	0	0	0	0	0	44
T-1/1080	1150/1150	50	9	1	0	0	0	2	1	1	0	0	22
T-1/1081	1100/1200	50	47	22	12	26	0	0	0	0	0	0	107
T-1/1082	1200/1250	50	1	2	3	1	0	0	0	0	0	0	7
T-1/1085	1100/950	50	111	49	18	57	0	0	0	0	0	0	235
T-1/1108	1000/1250	100	0	0	0	0	4	3	0	0	0	0	15
T-1/1121	1050/1250	50	0	0	0	3	3	0	0	0	0	0	25
T-1/1122	1000/1000	50	16	2	5	4	0	0	0	0	0	0	27
T-1/1123	1000/1050	50	4	15	11	5	0	0	0	0	0	0	35
T-1/1124	1000/1100	50	8	2	1	5	0	1	0	0	0	0	17
T-1/1133	1000/1150	50	3	1	1	1	0	0	0	0	0	0	6
T-1/1135	950/1050	50	10	5	2	7	0	0	0	0	0	0	24

T-1/1136	950/1150	50	0	3	3	1	0	0	0	0	0	0	7
T-2/4054	1000/1000	50	51	34	64	19	0	0	0	0	0	0	171
T-2/4055	1000/1050	50	14	6	17	4	0	0	0	0	0	0	41
T-2/4056	1100/1100	50	4	2	3	0	0	0	0	0	0	0	13
T-2/4057	1150/1100	50	22	6	16	11	0	0	0	0	0	0	57
T-2/4058	1050/1050	50	63	27	41	18	0	0	0	0	0	0	159
T-2/4059	1100/1050	50	245	91	80	66	4	0	0	0	0	0	490
T-2/4060	950/1000	50	28	24	53	12	0	0	0	0	0	0	121
T-2/4061	950/1050	50	19	3	14	7	0	0	0	0	0	0	46
T-2/4062	900/1000	50	9	6	2	3	0	0	0	0	0	0	30
T-2/4140	1050/1000	50	38	18	31	14	3	0	0	0	0	0	107
T-2/4141	1100/1000	50	31	0	0	21	3	0	0	0	0	0	57
T-2/4142	1150/1050	50	0	1	4	3	0	0	0	0	0	0	8
T-2/4143	1150/1100	50	50	24	32	31	1	0	0	0	0	0	140
T-2/4144	1000/950	50	7	2	1	4	0	0	0	0	0	0	15
T-2/4145	950/950	50	17	5	9	8	0	0	0	0	0	0	41
T-2/4146	900/950	50	49	24	56	19	0	0	0	0	0	0	155
T-2/4147	900/900	50	30	13	29	6	1	0	0	0	0	0	82
T-2/4148	950/900	50	8	6	13	3	0	0	0	0	0	1	34
T-3/4000	1000/1000	50	69	24	31	30	13	0	0	0	3	0	215
T-3/4001	1050/1000	50	221	113	51	111	6	1	0	0	0	0	517
T-3/4002	1100/1000	50	38	24	24	27	7	0	0	0	0	1	140
T-3/4003	1150/1000	50	13	5	8	9	4	0	0	0	0	0	46
T-3/4004	1200/1000	50	10	10	14	5	3	0	0	0	0	0	57
T-3/4005	1200/950	50	15	11	11	6	4	0	0	0	0	5	130
T-3/4006	1200/1050	50	15	0	0	9	28	0	0	0	0	0	89
T-3/4007	1150/950	50	9	4	6	6	4	0	0	0	0	0	118
T-3/4008	1150/1050	50	19	20	22	15	7	0	0	0	0	0	159
T-3/4009	1100/950	50	25	14	13	16	7	0	0	0	0	0	98
T-3/4010	1100/1050	50	76	31	41	46	14	0	0	0	0	0	236
T-3/4011	1050/1050	50	81	37	26	35	4	0	1	0	0	0	198
T-3/4012	1050/950	50	61	40	53	72	11	0	0	0	0	0	270
T-3/4013	1000/1050	50	66	33	28	18	9	0	3	0	0	0	169
T-3/4014	1000/950	50	32	10	14	12	6	0	0	0	0	0	105
T-3/4015	950/1000	50	3	0	0	2	3	0	0	0	0	0	12
T-3/4016	900/1000	50	3	0	0	3	1	0	0	0	0	0	28
T-3/4017	950/950	50	0	0	0	2	5	0	0	0	0	0	11
T-4/4393	1000/1000	50	20	15	2	16	96	7	62	0	0	1	822
T-4/4394	1050/1000	50	12	9	1	12	45	1	59	1	0	1	523
T-4/4395	1100/1000	50	3	1	0	1	21	2	7	1	0	0	145
T-4/4396	1100/950	50	3	1	0	2	17	3	4	0	0	0	131
T-4/4397	1100/1050	50	7	3	0	5	11	0	12	1	0	0	123
T-4/4398	1050/1050	50	18	12	1	6	54	1	39	0	0	0	395

T-4/4399	1000/1050	50	38	27	3	36	137	18	75	1	0	0	1160
T-4/4400	950/1050	50	7	19	5	27	222	10	24	0	0	0	951
T-4/4401	900/1050	50	1	2	0	7	20	3	10	0	0	0	147
T-4/4402	850/1050	50	1	0	0	0	13	2	2	0	0	0	56
T-4/4403	900/1100	50	1	1	0	6	35	3	2	2	0	1	124
T-4/4404	950/1100	50	3	3	0	4	53	3	9	0	0	3	255
T-4/4405	1000/1100	50	6	8	2	11	229	0	19	2	0	0	518
T-4/4406	1050/1100	50	5	6	3	6	31	2	8	0	0	0	206
T-4/4407	1050/1150	50	2	6	1	10	4	1	1	0	0	0	85
T-4/4408	1000/1150	50	1	0	0	3	7	2	4	0	0	0	72
T-4/4409	900/1150	50	0	1	0	0	8	1	1	0	0	0	71
T-4/4410	950/1000	50	0	1	0	0	25	2	26	1	0	0	366
T-4/4411	900/1000	50	1	0	0	1	15	7	22	3	0	0	393
T-4/4412	950/950	50	9	12	1	12	62	4	60	0	0	0	821
T-4/4413	1000/950	50	14	9	3	23	169	12	103	4	0	0	1422
T-4/4414	1050/950	50	5	4	1	8	43	2	12	0	0	0	315
T-4/4415	1050/900	50	1	2	0	0	12	0	3	0	0	0	110
T-4/4416	1100/900	50	2	2	0	2	10	1	0	0	0	1	52
T-4/4417	1000/900	50	3	6	0	7	46	2	2	0	0	4	298
T-4/4418	950/900	50	1	1	0	6	16	1	10	0	0	0	105
T-4/4419	900/900	50	3	1	0	0	28	2	15	1	0	0	245
T-4/4420	900/950	50	2	3	0	2	6	8	5	0	0	1	185
T-123/4034	1000/1000	50	0	0	0	0	0	0	2	0	0	0	66
T-123/4035	1000/950	50	0	0	0	0	0	0	0	1	0	0	28
T-123/4036	1000/900	50	0	0	0	0	3	0	1	1	0	0	36
T-123/4037	1000/1050	50	0	0	0	0	0	0	2	0	0	0	39
T-123/4038	1050/1050	50	0	0	0	0	0	0	0	0	0	1	18
T-123/4039	1100/1050	50	1	0	0	0	0	0	0	0	0	1	70
T-123/4040	950/1050	50	0	0	0	1	1	0	1	1	0	0	48
T-123/4041	900/1050	50	1	0	0	6	12	0	5	0	0	0	148
T-123/4042	850/1050	50	1	0	0	0	10	0	2	0	0	1	57
T-123/4043	1050/1000	50	1	0	0	2	0	0	0	1	1	1	63
T-123/4044	1100/1000	50	0	0	0	2	2	0	0	0	2	0	104
T-123/4045	950/1000	50	1	0	0	1	3	0	0	0	0	0	45
T-123/4046	900/1000	50	0	0	0	1	2	0	0	0	0	0	28
T-123/4047	850/1000	50	1	0	0	1	0	0	2	0	0	0	68
T-123/4048	1050/900	50	0	0	0	0	2	0	1	0	0	0	26
T-123/4049	950/900	50	1	0	0	2	1	0	4	0	0	0	45
T-123/4050	1050/950	50	0	0	0	0	0	0	1	0	0	0	21
T-123/4051	950/950	50	2	0	0	0	11	0	1	1	2	0	82
T-123/4052	900/950	50	0	0	0	2	22	0	1	0	1	0	94
T-123/4053	850/950	50	2	0	0	1	4	0	5	0	1	0	118
T-123/4301	900/850	50	0	0	0	0	4	0	4	0	0	0	38

T-123/4302	900/900	50	0	0	0	0	1	0	4	0	0	0	27
T-123/4303	850/900	50	0	0	0	0	0	0	0	0	0	0	52
T-123/4304	800/900	50	0	0	0	0	0	0	1	0	0	0	27
T-123/4305	800/850	50	0	0	0	0	9	0	7	0	0	0	140
T-123/4306	900/800	50	1	0	0	0	1	0	1	0	0	0	34
T-123/4307	950/800	50	0	0	0	0	2	0	2	0	4	0	68
T-123/4308	1000/800	50	0	0	0	0	1	0	3	1	0	0	61
T-123/4309	1050/800	50	0	0	0	1	1	0	1	0	0	0	35
T-123/4310	1050/850	50	0	0	0	0	0	0	1	0	2	0	30
T-123/4311	1000/850	50	0	0	0	0	2	0	1	0	0	0	49
T-130/4018	1000/1000	50	154	87	39	59	95	2	4	0	0	3	553
T-130/4019	950/1000	50	15	0	0	10	13	0	0	1	0	0	56
T-130/4021	1050/1000	50	28	82	39	69	51	0	1	0	0	1	352
T-130/4022	1050/1050	50	34	0	0	27	16	0	0	0	0	0	89
T-130/4023	1050/950	50	25	0	0	20	8	0	0	0	0	0	66
T-130/4024	1050/900	50	26	16	9	9	57	0	0	0	0	0	145
T-130/4025	1000/1050	50	47	36	25	32	30	2	2	0	0	1	234
T-130/4026	1000/950	50	59	0	0	47	29	0	3	0	0	0	196
T-130/4027	1000/900	50	7	0	0	5	9	0	1	0	0	2	67
T-130/4028	950/1050	50	5	0	0	4	22	0	0	0	0	1	74
T-130/4029	950/950	50	8	5	5	4	15	0	0	0	0	0	76
T-130/4030	950/900	50	99	32	15	41	27	0	1	0	0	0	265
T-130/4031	900/1050	50	1	0	0	2	9	0	1	0	0	0	26
T-130/4032	900/950	50	35	18	8	10	46	0	2	0	0	0	215
T-130/4033	900/900	50	74	31	31	31	31	0	1	0	0	0	247
T-130/4312	1000/850	50	76	35	17	22	97	0	8	0	0	0	474
T-130/4313	950/850	50	174	109	68	100	216	0	27	0	0	2	1376
T-130/4314	900/850	50	77	78	38	63	105	13	30	0	1	2	1292
T-130/4315	900/800	50	49	72	22	59	27	0	13	0	0	1	420
T-130/4316	900/750	50	1	0	0	5	4	0	0	0	0	0	12
T-130/4317	800/800	50	77	46	20	39	57	0	7	0	0	0	548
T-130/4318	850/750	50	44	12	11	22	55	1	0	0	0	0	241
T-130/4319	1000/800	50	25	12	5	9	24	0	3	0	2	0	140
T-130/4320	950/800	50	16	22	11	26	40	3	9	0	0	0	423
T-130/4321	950/750	50	5	0	0	4	11	0	0	0	0	0	35
T-130/4322	1050/800	50	9	0	0	5	11	0	1	0	0	0	65
T-213/4063	1000/1000	50	0	0	0	1	1	0	2	0	0	1	112
T-213/4064	1000/950	50	0	0	0	0	2	0	1	0	0	0	49
T-213/4065	1000/1050	50	0	0	0	0	2	0	1	0	0	0	58
T-213/4066	950/1000	50	0	0	0	2	10	2	12	0	0	1	233
T-213/4067	950/950	50	0	0	0	3	14	2	13	0	0	0	299
T-213/4068	900/1000	50	0	0	0	0	5	1	3	0	0	0	61
T-213/4069	900/950	50	0	0	0	1	2	1	28	0	0	0	208

T-213/4070	850/950	50	0	0	0	1	1	0	0	0	0	0	18
T-213/4071	1050/1000	50	0	0	0	0	0	0	0	0	0	0	12
T-213/4072	1050/950	50	0	0	0	0	0	0	0	0	0	0	10
T-225/4073	1000/1000	50	107	40	33	37	6	0	0	0	0	0	227
T-225/4074	1000/1050	50	405	0	0	215	3	0	1	0	0	0	625
T-225/4075	1050/1050	50	111	0	0	90	0	0	0	0	0	0	201
T-225/4076	1050/1000	50	88	0	0	78	3	0	0	0	0	0	175
T-225/4077	1000/950	50	352	159	124	151	7	0	0	0	0	0	810
T-225/4078	1050/950	50	22	0	0	9	2	0	0	0	0	0	65
T-232/4079	1000/1000	50	1	4	2	5	224	0	0	0	0	0	285
T-232/4080	1050/1000	50	7	7	5	7	173	0	1	0	0	0	314
T-232/4081	1100/1000	50	34	22	7	12	248	5	5	0	0	0	561
T-232/4082	1150/1000	50	1	0	1	3	149	2	4	1	1	0	513
T-232/4083	1200/1000	50	0	0	0	2	194	0	24	0	0	0	919
T-232/4084	1250/1000	50	1	0	0	4	64	0	0	0	0	0	115
T-232/4085	950/1000	50	2	0	0	2	124	0	0	0	0	0	158
T-232/4086	900/1000	50	2	0	0	2	26	0	0	0	0	0	44
T-232/4087	900/950	50	0	0	0	0	42	0	0	0	0	0	58
T-232/4088	950/950	50	1	1	0	4	96	0	1	0	0	0	137
T-232/4089	1000/950	50	0	0	3	2	118	0	1	0	0	0	165
T-232/4090	1050/950	50	47	24	10	19	876	0	2	0	0	0	1455
T-232/4091	1100/950	50	129	114	68	82	148	2	2	0	0	0	743
T-232/4092	1150/950	50	40	16	10	34	174	0	8	0	0	0	414
T-232/4093	1200/950	50	10	0	0	11	84	1	0	0	0	0	173
T-232/4094	1200/900	50	0	0	0	0	13	0	0	0	0	0	46
T-232/4095	1150/900	50	5	0	0	2	105	0	9	0	0	0	329
T-232/4096	1100/900	50	289	0	0	232	173	2	6	0	0	0	975
T-232/4097	1050/900	50	30	0	0	17	484	0	2	0	0	0	735
T-232/4098	1000/900	50	5	0	0	3	81	0	1	0	0	0	135
T-232/4099	950/900	50	0	1	0	0	104	0	0	0	0	0	126
T-232/4100	900/900	50	0	0	0	1	65	0	0	0	0	0	85
T-232/4101	900/850	50	0	0	0	0	117	0	1	0	0	0	139
T-232/4102	950/850	50	1	0	0	1	40	0	1	0	0	0	55
T-232/4103	950/800	50	0	0	0	0	4	1	0	0	0	0	12
T-232/4104	1000/800	50	0	0	0	0	23	0	0	0	0	0	27
T-232/4105	1000/850	50	0	0	0	0	15	0	0	0	0	0	35
T-232/4106	1050/850	50	2	0	0	2	68	0	0	0	0	0	98
T-232/4107	1100/850	50	0	0	0	2	23	0	1	0	0	0	32
T-232/4108	1100/800	50	1	0	0	0	16	0	0	0	0	0	25
T-232/4109	1150/850	50	0	0	0	0	13	0	0	0	0	0	26
T-232/4110	900/1050	50	0	0	0	1	16	0	0	0	0	7	135
T-232/4111	850/1050	50	0	0	0	0	5	0	0	0	0	0	21
T-232/4112	950/1050	50	1	0	0	4	123	0	2	0	0	0	170

T-232/4113	1000/1050	50	0	0	0	0	44	0	33	0	0	0	295
T-232/4114	1050/1050	50	9	21	23	18	324	0	0	0	0	0	611
T-232/4115	1100/1050	50	0	0	0	0	61	0	30	0	0	0	328
T-232/4116	1150/1050	50	0	3	1	4	542	0	2	0	0	2	643
T-232/4117	1200/1050	50	0	0	0	0	40	0	27	0	0	0	198
T-232/4118	1250/1050	50	1	0	0	1	5	0	0	0	0	0	11
T-232/4119	1250/1100	50	0	0	0	0	1	0	0	0	0	0	7
T-232/4120	1200/1100	50	0	0	0	0	6	0	0	0	0	0	40
T-232/4121	1150/1100	50	1	3	0	2	172	0	13	0	0	0	720
T-232/4122	1000/1100	50	1	2	0	4	388	0	24	0	0	0	837
T-232/4123	1050/1100	50	0	0	0	0	10	0	0	0	0	0	30
T-232/4124	1000/1100	50	1	0	0	0	19	0	0	0	0	0	40
T-232/4125	950/1100	50	0	0	0	0	9	0	0	0	0	0	29
T-232/4126	900/1100	50	0	0	0	0	10	0	0	0	0	1	36
T-232/4127	850/1100	50	1	0	0	0	4	0	0	0	0	0	17
T-232/4128	950/1150	50	1	0	0	0	3	0	0	0	0	0	25
T-232/4129	1000/1150	50	0	0	0	1	12	0	1	0	0	0	40
T-232/4130	1050/1150	50	0	0	0	0	17	0	2	0	0	0	89
T-232/4131	1100/1150	50	0	0	0	0	7	0	0	0	0	0	25
T-232/4132	1150/1150	50	0	2	0	0	65	0	2	0	0	0	200
T-232/4133	1200/1150	50	0	0	0	0	3	0	1	0	0	0	24
T-232/4134	1150/1200	50	0	0	0	0	1	0	0	0	0	0	9
T-232/4135	1100/1200	50	0	0	0	0	4	0	0	0	0	0	14
T-232/4136	1050/1200	50	0	0	0	0	4	0	0	0	0	0	17
T-232/4137	1000/1200	50	0	0	0	0	10	0	0	0	0	0	44
T-232/4138	950/1200	50	0	0	0	2	9	0	0	0	0	0	26
T-232/4139	900/1200	50	0	0	0	0	6	0	0	0	2	0	27
T-268/4149	1000/1000	50	36	28	70	24	0	0	0	0	0	0	161
T-268/4150	950/1000	50	289	0	0	198	1	2	0	0	0	1	511
T-268/4151	900/1000	50	113	20	41	31	0	0	1	0	0	0	217
T-268/4152	900/1050	50	13	0	0	9	0	0	0	0	0	0	28
T-268/4153	950/950	50	199	0	0	154	4	0	1	0	3	0	387
T-268/4154	950/900	50	7	0	0	3	0	0	0	0	0	2	30
T-268/4155	950/1050	50	120	0	0	85	2	0	0	0	0	0	223
T-268/4156	1000/950	50	27	5	16	7	1	0	0	1	0	0	64
T-268/4157	1000/900	50	7	0	0	4	1	0	0	0	0	0	43
T-268/4158	1000/1050	50	197	35	54	73	2	0	0	0	0	0	390
T-268/4159	1050/1000	50	82	0	0	54	0	0	0	0	2	0	152
T-268/4160	1050/950	50	29	8	19	9	0	0	0	0	0	0	68
T-268/4161	1050/900	50	4	0	0	2	0	0	0	0	0	1	68
T-268/4162	1050/1050	50	162	0	0	98	2	0	0	0	0	0	304
T-268/4163	1050/1100	50	47	0	0	27	4	1	0	0	0	0	106
T-268/4164	1100/1000	50	60	0	0	31	2	0	0	0	0	2	163

T-268/4165	1100/950	50	5	0	0	1	0	0	0	0	0	6	104
T-268/4166	1100/1050	50	36	0	0	28	0	0	0	0	0	0	74
T-268/4167	1100/1100	50	83	0	0	69	0	0	0	0	0	0	153
T-268/4168	1150/1050	50	17	0	0	12	0	0	0	0	0	0	44
T-271/4169	1000/1000	50	3	10	3	12	219	20	36	0	0	0	1199
T-271/4170	950/1000	50	3	6	4	3	129	20	81	0	0	2	1136
T-271/4171	900/1000	50	0	9	2	4	80	7	118	0	0	0	1106
T-271/4172	850/1000	50	1	0	0	0	3	0	2	0	0	0	50
T-271/4173	850/950	50	0	0	0	1	4	0	1	0	0	0	50
T-271/4174	900/1050	50	2	2	2	2	47	5	21	0	0	1	673
T-271/4175	900/950	50	1	2	3	16	175	14	31	0	0	0	812
T-271/4176	900/900	50	0	2	1	2	18	3	2	0	0	0	166
T-271/4177	900/850	50	0	3	0	1	4	2	1	0	3	3	165
T-271/4178	900/800	50	0	0	0	0	3	0	0	0	0	2	47
T-271/4179	950/1050	50	2	2	1	7	89	24	33	0	0	0	685
T-271/4180	950/1100	50	0	10	1	5	60	3	30	0	0	0	599
T-271/4181	950/950	50	2	10	3	6	59	9	17	0	0	0	611
T-271/4182	950/900	50	0	13	1	7	39	5	3	1	0	1	225
T-271/4183	950/850	50	0	1	0	0	11	1	1	0	0	3	117
T-271/4184	950/800	50	0	0	0	0	0	0	0	0	0	1	72
T-271/4185	950/750	50	0	0	0	0	2	0	0	0	0	0	19
T-271/4186	1000/950	50	1	13	3	6	61	12	46	0	0	1	698
T-271/4187	1000/900	50	1	11	1	3	16	6	5	0	0	0	161
T-271/4188	1000/850	50	0	3	0	2	8	1	0	0	0	0	79
T-271/4189	1000/800	50	0	0	0	0	4	4	0	0	0	1	145
T-271/4190	1050/800	50	0	0	0	0	4	0	0	0	0	2	108
T-271/4191	1050/750	50	0	0	0	1	4	0	0	1	0	2	113
T-271/4192	1000/1050	50	1	1	1	4	28	15	12	0	0	0	288
T-271/4193	1050/1000	50	0	2	2	8	49	4	4	0	3	3	340
T-271/4194	1100/1000	50	0	0	0	0	30	1	1	1	6	6	345
T-271/4195	1150/1000	50	0	0	0	0	8	0	0	0	1	7	171
T-271/4196	1200/1000	50	0	0	0	0	3	1	0	0	0	4	121
T-271/4197	1250/1000	50	0	0	0	0	9	0	0	0	0	0	53
T-271/4198	1300/1000	50	0	0	0	0	1	0	0	0	0	0	50
T-271/4199	1250/1050	50	0	0	0	0	0	0	0	0	0	1	66
T-271/4200	1250/1100	50	0	0	0	0	3	0	0	0	0	1	69
T-271/4201	1250/1150	50	0	0	0	0	0	0	0	0	0	3	85
T-271/4202	1200/950	50	0	0	0	0	1	0	0	0	0	1	42
T-271/4203	1200/1050	50	0	0	0	0	0	0	0	0	0	2	61
T-271/4204	1200/1100	50	0	0	0	0	1	0	0	0	0	2	57
T-271/4205	1200/1150	50	0	0	0	0	0	0	0	0	0	1	77
T-271/4206	1200/1200	50	0	0	0	0	1	0	0	0	0	1	30
T-271/4207	1150/950	50	0	0	0	0	9	0	0	0	0	2	68

T-271/4208	1150/1050	50	0	0	0	0	3	0	0	0	0	3	55
T-271/4209	1100/950	50	0	2	1	1	10	0	2	0	0	3	110
T-271/4210	1100/900	50	0	8	1	6	38	3	1	0	0	8	307
T-271/4211	1100/850	50	0	4	3	1	15	6	2	0	0	2	131
T-271/4212	1100/1050	50	0	0	0	0	2	0	0	0	2	8	204
T-271/4213	1050/1050	50	1	17	9	29	278	19	53	0	1	0	1185
T-271/4214	1050/950	50	0	5	1	9	60	4	4	0	2	5	480
T-271/4215	1050/900	50	2	19	3	11	50	6	0	0	0	3	393
T-271/4216	1050/850	50	0	3	0	1	7	0	0	0	0	0	46
T-272/4217	1000/1000	50	0	0	0	0	6	0	0	0	0	0	35
T-272/4218	950/1000	50	0	0	0	0	3	1	0	0	0	1	67
T-272/4219	1000/1050	50	0	0	0	0	3	1	0	0	0	0	27
T-272/4220	950/1050	50	0	1	0	0	12	1	0	0	0	3	212
T-272/4221	1050/1000	50	0	3	1	3	124	10	1	0	2	0	339
T-272/4222	1050/1050	50	0	2	0	0	24	0	3	0	0	0	135
T-272/4223	1100/1000	50	0	0	0	0	226	24	4	1	0	0	464
T-272/4224	1100/1050	50	0	0	0	0	749	3	6	0	0	1	1211
T-272/4225	1100/1100	50	0	0	0	0	0	0	0	0	6	0	24
T-272/4226	1100/950	50	0	1	0	1	139	6	0	0	0	0	408
T-272/4227	1100/900	50	0	0	0	0	41	5	2	0	1	1	178
T-272/4228	1100/850	50	0	0	0	0	6	3	1	0	0	0	120
T-272/4229	1100/800	50	0	0	0	0	4	0	1	0	0	0	45
T-272/4230	1050/800	50	0	0	0	0	4	2	1	0	0	0	83
T-272/4232	1050/700	50	0	0	0	0	4	0	0	0	0	0	19
T-272/4233	1100/700	50	0	0	0	0	6	1	0	0	0	1	25
T-272/4234	1100/750	50	0	0	0	0	4	7	0	0	0	2	112
T-272/4235	1050/850	50	0	0	0	0	39	3	3	0	5	0	275
T-272/4236	1050/900	50	0	5	4	3	244	12	10	0	0	0	551
T-272/4237	1050/950	50	0	1	3	2	276	7	2	1	0	0	628
T-272/4238	1150/1000	50	0	0	0	0	268	13	0	2	2	2	540
T-272/4239	1150/1050	50	2	18	6	19	288	4	3	0	0	0	980
T-272/4240	1150/1100	50	0	2	1	1	45	5	0	0	0	2	169
T-272/4241	1150/1150	50	0	0	0	0	12	0	0	0	0	0	60
T-272/4242	1200/1000	50	0	1	1	1	164	7	2	0	0	1	506
T-272/4243	1200/1050	50	0	0	0	0	178	26	0	1	0	0	801
T-272/4244	1200/1100	50	0	0	0	0	28	1	1	0	0	0	88
T-272/4245	1200/1150	50	0	1	0	1	22	3	0	0	0	0	86
T-272/4246	1250/1000	50	0	0	0	0	43	3	1	1	0	0	180
T-272/4247	1250/1050	50	0	0	0	0	28	3	1	2	0	0	94
T-272/4248	1250/1100	50	0	0	0	0	1	0	0	0	0	0	11
T-272/4249	1250/1150	50	0	0	0	0	26	2	0	0	0	0	94
T-272/4250	1250/950	50	0	2	0	0	42	5	5	0	0	1	335
T-272/4251	1250/900	50	0	0	0	0	122	10	6	0	0	0	512

T-272/4252	1250/850	50	0	0	0	0	18	1	1	0	0	0	159
T-272/4253	1250/800	50	0	1	0	0	4	1	2	0	0	0	82
T-272/4254	1300/1000	50	0	0	0	0	5	2	1	0	0	0	76
T-272/4255	1300/950	50	0	0	0	0	15	11	4	0	0	0	214
T-272/4256	1300/900	50	0	0	0	0	3	2	5	0	0	0	82
T-272/4257	1300/850	50	0	0	0	0	4	5	2	0	0	0	150
T-272/4258	1300/800	50	0	0	0	0	52	16	4	5	0	0	529
T-272/4259	1300/1050	50	0	0	0	0	3	1	0	0	0	0	23
T-272/4260	1350/1000	50	0	1	0	0	1	3	1	0	0	0	32
T-272/4261	1350/950	50	0	0	0	0	5	2	2	0	0	0	95
T-272/4262	1350/900	50	0	0	0	0	8	4	7	1	0	0	142
T-272/4263	1350/850	50	0	2	0	0	1	5	4	0	0	0	125
T-272/4264	1350/800	50	0	0	0	0	14	6	13	5	0	0	391
T-272/4265	1350/1050	50	0	0	0	0	21	0	4	0	0	0	142
T-272/4266	1350/1100	50	0	0	0	0	8	0	2	0	0	0	34
T-272/4267	1400/1000	50	0	0	0	0	3	0	2	0	0	0	25
T-272/4268	1400/950	50	0	0	0	0	1	0	0	0	0	0	26
T-272/4269	1400/900	50	0	0	0	0	2	0	5	0	0	0	140
T-272/4270	1400/850	50	0	1	0	0	3	0	2	0	0	0	77
T-272/4271	1400/1050	50	0	0	0	0	6	1	3	0	0	0	62
T-272/4272	1400/1100	50	0	0	0	0	13	0	0	0	0	0	26
T-272/4273	1450/1100	50	0	0	0	0	7	0	0	0	0	0	24
T-272/4274	1450/1050	50	0	0	0	1	9	0	2	0	0	0	35
T-272/4275	1150/950	50	0	0	1	0	322	5	6	0	0	1	577
T-272/4276	1150/900	50	0	0	0	1	258	19	5	0	0	0	567
T-272/4277	1150/850	50	0	0	0	0	34	4	1	0	0	0	140
T-272/4278	1150/800	50	0	0	0	1	9	17	7	2	0	0	234
T-272/4279	1150/750	50	0	1	0	1	18	4	2	0	0	0	223
T-272/4280	1150/700	50	0	0	0	0	4	4	0	0	0	0	39
T-272/4281	1200/700	50	0	0	0	0	6	3	0	1	0	0	71
T-272/4282	1200/750	50	0	1	0	0	19	7	3	2	0	0	288
T-272/4283	1200/800	50	0	0	0	0	5	2	2	0	1	0	57
T-272/4284	1200/850	50	0	0	0	0	4	7	2	1	0	0	89
T-272/4285	1200/900	50	0	0	0	0	15	2	1	0	0	0	79
T-272/4286	1200/950	50	0	0	0	0	27	5	3	0	0	0	136
T-301/4299	1000/1000	50	98	114	47	76	3	0	0	0	0	0	352
T-303/4287	1000/1000	50	27	20	8	16	9	0	0	0	1	0	120
T-303/4288	1050/1000	50	0	0	0	1	1	0	0	0	0	1	29
T-303/4289	1050/1050	50	0	0	0	0	5	0	0	6	0	0	27
T-303/4290	1050/950	50	0	0	0	4	2	0	0	1	0	0	19
T-303/4291	1000/950	50	21	17	6	10	42	0	0	0	0	0	133
T-303/4292	1000/1050	50	3	0	0	2	1	0	0	0	1	0	15
T-303/4293	950/1000	50	49	61	22	44	53	0	0	3	7	3	517

T-303/4294	950/950	50	4	6	1	4	26	0	0	0	0	0	60
T-303/4295	950/1050	50	20	18	6	19	25	0	0	4	2	0	196
T-303/4296	900/1000	50	9	8	4	5	16	0	0	1	0	0	76
T-303/4297	900/950	50	15	23	9	19	15	0	0	0	0	0	118
T-303/4298	900/1050	50	15	0	0	12	39	1	0	0	1	0	109
T-305/4300	1000/1000	50	12	0	0	11	5	0	0	0	0	0	70
T-394/4324	1000/1000	50	161	103	48	67	33	8	3	1	36	0	730
T-394/4325	1000/1050	50	150	130	47	88	44	3	2	0	12	0	714
T-394/4326	1000/1100	50	19	13	7	12	20	1	0	0	2	0	111
T-394/4327	1000/950	50	97	55	28	21	23	6	2	0	66	0	370
T-394/4328	1000/900	50	110	45	27	48	11	3	1	0	2	1	316
T-394/4329	1000/850	50	26	53	25	51	62	3	0	0	1	0	316
T-394/4330	1000/800	50	0	0	0	0	0	0	0	0	1	0	12
T-394/4331	1050/800	50	1	1	0	3	0	0	0	0	0	3	15
T-394/4332	1100/850	50	1	3	0	3	0	2	0	0	0	0	13
T-394/4333	1050/850	50	0	0	0	2	1	0	0	2	0	0	39
T-394/4334	1050/900	50	27	10	6	14	11	2	0	0	4	0	124
T-394/4335	1100/900	50	18	6	1	11	16	1	0	0	0	0	78
T-394/4336	1050/950	50	56	39	37	31	37	5	2	0	6	0	303
T-394/4337	1050/1000	50	143	89	56	72	26	2	0	0	7	0	465
T-394/4338	1050/1050	50	256	123	57	75	109	9	2	1	4	0	850
T-394/4339	950/1000	50	61	37	21	31	4	5	0	0	21	0	369
T-394/4340	950/1050	50	149	99	43	66	67	9	0	0	38	0	691
T-394/4341	950/950	50	53	20	5	25	37	22	0	0	9	1	302
T-394/4342	950/900	50	63	55	6	19	8	1	0	0	3	0	204
T-394/4343	950/850	50	9	5	6	10	3	0	0	0	4	0	62
T-394/4344	900/900	50	12	4	5	11	2	0	0	0	0	0	50
T-394/4345	900/950	50	27	10	11	8	2	3	0	0	5	3	206
T-394/4346	900/1000	50	63	14	17	41	10	9	0	0	11	1	305
T-394/4347	850/1000	50	32	15	6	14	2	1	0	0	5	1	128
T-394/4348	850/950	50	8	2	1	4	0	1	0	0	2	2	49
T-394/4349	850/1050	50	46	39	11	26	4	1	0	0	1	3	174
T-394/4350	950/1100	50	91	35	24	41	63	7	0	0	5	0	379
T-394/4351	950/1150	50	25	11	7	13	16	1	0	0	2	0	110
T-394/4352	900/1150	50	3	2	1	1	4	1	0	0	0	2	24
T-394/4353	900/1100	50	18	5	2	8	10	0	0	0	2	0	68
T-421/4369	1000/1000	50	36	8	2	11	24	6	0	0	2	0	195
T-421/4370	950/1000	50	0	0	0	3	3	12	26	0	37	1	443
T-421/4371	950/1050	50	1	0	0	0	3	0	3	0	2	0	32
T-421/4372	1000/1050	50	1	4	2	6	6	2	1	0	1	0	66
T-421/4373	950/950	50	0	0	0	1	4	2	6	1	8	0	119
T-421/4374	900/950	50	0	0	0	0	2	12	33	1	25	0	264
T-421/4375	900/1000	50	0	0	0	0	1	5	5	2	21	0	139

T-421/4376	850/1000	50	0	0	0	0	5	16	7	0	53	2	394
T-421/4377	850/950	50	1	2	0	0	5	29	7	1	113	0	790
T-421/4378	850/900	50	1	0	0	1	25	9	3	0	7	0	194
T-421/4379	800/900	50	1	0	0	1	26	9	4	1	55	0	521
T-421/4380	800/850	50	0	0	0	1	5	3	1	0	18	0	56
T-421/4381	800/950	50	1	0	0	0	3	15	5	0	61	1	530
T-421/4382	800/1000	50	0	1	0	0	4	7	5	1	41	0	485
T-421/4383	750/1000	50	1	0	1	2	4	6	4	0	80	0	680
T-421/4384	750/950	50	1	2	0	1	7	32	21	0	75	0	627
T-421/4385	750/900	50	0	0	0	1	3	14	0	0	42	0	256
T-421/4386	750/850	50	0	3	0	3	96	4	1	0	6	1	167
T-421/4387	700/850	50	4	2	1	3	28	2	0	0	1	0	89
T-421/4388	700/900	50	0	0	0	0	6	0	1	0	3	0	26
T-421/4389	700/950	50	0	1	1	5	1	1	1	1	6	0	73
T-421/4390	700/1000	50	0	0	0	0	2	0	0	0	1	0	41
T-421/4391	650/950	50	8	9	6	10	0	1	0	0	5	2	58
T-421/4392	650/900	50	0	0	0	1	5	0	0	1	0	0	28
T-430/4354	1000/1000	50	47	23	9	12	17	4	0	3	1	0	136
T-430/4355	1000/950	50	92	66	31	42	16	0	7	0	2	0	287
T-430/4356	1050/950	50	80	77	15	44	12	0	0	1	0	0	258
T-430/4357	1100/950	50	19	12	4	11	15	0	0	0	0	0	69
T-430/4358	1050/900	50	1	1	0	1	3	1	0	0	0	1	18
T-430/4359	950/1000	50	29	35	13	23	13	2	0	1	2	1	135
T-430/4360	1050/1000	50	65	57	23	50	31	5	0	0	3	0	339
T-430/4361	1100/1000	50	102	64	35	80	31	2	6	0	11	1	439
T-430/4362	1100/1050	50	43	0	0	36	7	7	5	0	54	0	319
T-430/4363	1000/1050	50	6	6	3	3	8	3	6	0	8	0	88
T-430/4364	1050/1050	50	65	18	11	32	56	19	2	0	67	1	860
T-430/4365	1050/1100	50	34	11	7	15	12	6	1	0	115	0	531
T-430/4366	1100/1100	50	49	14	7	37	8	2	3	2	34	0	283
T-430/4367	1050/1150	50	1	2	1	0	4	0	2	0	8	0	47
T-430/4368	950/1050	50	0	0	0	3	6	0	0	1	0	0	25

Appendix C

Ceramic analysis program code

```
#! /usr/bin/perl
####################################
#This program, given percentages of the three Chiripa Paste
#Groups in a given surface assemblage, will then compute the
#most likely combination of the three phases that would result
#in the observed frequencies.
#####################################
#First, define the three phase profiles. These may later be edited as desired.
# Late Chiripa...
%LC = (
	’1’ => ’0.68’,
	’2’ => ’0.18’,
	’3’ => ’0.14’
);
#Middle Chiripa...
%MC = (
	’1’ => ’0.07’,
	’2’ => ’0.75’,
	’3’ => ’0.18’
);
#And Early Chiripa...
%EC = (
	’1’ => ’0.02’,
	’2’ => ’0.27’,
	’3’ => ’0.71’
);
&do_one_unit;
&warn_and_exit("\nDone...");
#The following is the master subroutine that loops as long as the user wants
#it to...
sub do_one_unit {
	&get_frequencies;
	#Now we get down to the meat and potatos...
	$permit_error = 0.01;
		#displays results with errors <= than this value
	$BEST{’error’}=10000;
		#sets initial ridiculuously high value for best matches error
	print "Matches with error less than or equal to ",$permit_error*100,":\n";
	print "LC%\tMC%\tEC%\terror\tLC\tMC\tEC\n";
	for $lc_percent (0..100) {
```

```
        for $mc_percent (0..100-$lc_percent) {
            $lc=$lc_percent/100;
            $mc=$mc_percent/100;
            $ec_percent=100-$lc_percent-$mc_percent;
            $ec=$ec_percent/100;
            $PROFILE{'1'}=$LC{'1'}*$lc+$MC{'1'}*$mc+$EC{'1'}*$ec;
            $PROFILE{'2'}=$LC{'2'}*$lc+$MC{'2'}*$mc+$EC{'2'}*$ec;
            $PROFILE{'3'}=$LC{'3'}*$lc+$MC{'3'}*$mc+$EC{'3'}*$ec;
            $error1=abs($PROFILE{'1'}-$ASSEM{'1'});
            $error2=abs($PROFILE{'2'}-$ASSEM{'2'});
            $error3=abs($PROFILE{'3'}-$ASSEM{'3'});
            $error = ($error1 + $error2 + $error3)/3;
            $error_round = round($error,0.001);
            if ($error <= $permit_error) {
                $lc_num=round($lc*$all,1);
                $mc_num=round($mc*$all,1);
                $ec_num=round($ec*$all,1);
                print "$lc_percent\t$mc_percent\t$ec_percent\t",
                    $error_round*100,
                    "\t$lc_num\t$mc_num\t$ec_num\n";
            }
            if ($error < $BEST{'error'}) {
                $BEST{'error'}=$error_round;
                $BEST{'lc_percent'}=$lc_percent;
                $BEST{'mc_percent'}=$mc_percent;
                $BEST{'ec_percent'}=$ec_percent;
                $BEST{'lc_num'}=round($lc*$all,1);
                $BEST{'mc_num'}=round($mc*$all,1);
                $BEST{'ec_num'}=round($ec*$all,1);
            }
        }
    }
    print "\nBest match:\n";
    print "LC%\tMC%\tEC%\terror\tLC\tMC\tEC\n";
    print "$BEST{'lc_percent'}\t$BEST{'mc_percent'}\t
        $BEST{'ec_percent'}\t",$BEST{'error'}*100,"\t$BEST{'lc_num'}\t
        $BEST{'mc_num'}\t$BEST{'ec_num'}\n\n";
    print "Would you like to process another surface collection unit?
         (y/n)";
    $reply=<STDIN>;
    if ($reply =~ /y/) {
        &do_one_unit;
    }
}
sub get_frequencies {
    print "\nEnter Paste Group counts in the assemblage to be analyzed:\n";
    print "\tPaste Group 1: ";
    $first = <STDIN>;
    chop $first;
    print "\tPaste Group 2: ";
    $second = <STDIN>;
    chop $second;
    print "\tPaste Group 3: ";
    $third = <STDIN>;
    chop $third;
    print "\tAll others: ";
    $fourth = <STDIN>;
    chop $fourth;
    $three = $first + $second + $third;
    $all = $three + $fourth;
    $ASSEM{'1'}=round($first/$three,0.01);
```

```
        $ASSEM{'2'}=round($second/$three,0.01);
        $ASSEM{'3'}=round($third/$three,0.01);
        print "\nSummary of data:\n";
        print "\t\tGroup 1\tGroup 2\tGroup 3\tOther\n";
        print "Count\t\t$first\t$second\t$third\t$fourth\n";
        print "% of Total\t",round($first/$all,0.01),"\t",
                round($second/$all,0.01),"\t",round($third/$all,0.01),"\t",
                round($fourth/$all,0.01),"\n";
        print "% of three\t",round($first/$three,0.01),"\t",
                round($second/$three,0.01),"\t",round($third/$three,0.01),"\n\n";
        print "Press ENTER to continue\n";
        $trash= <STDIN>;
}
sub warn_and_exit {
        print "$_[0]\n";
        print "Press Enter to Exit\n";
        $trash=<STDIN>;
        exit (0);
}
sub round {
        my $num = $_[0];
        my $nearest = $_[1];
        if (mod($num,$nearest) >= $nearest/2) {
                return $num-mod($num,$nearest)+$nearest;
        } else {
                return $num-mod($num,$nearest);
        }
}
sub mod {
        my $num = $_[0];
        my $div = $_[1];
        my $times = int $num/$div;
        return $num-$times*$div;
}
```

Appendix D

Occupation density program code

```
#! /usr/bin/perl
####################################
#This program, given grid parameters and filenames via user input,
#will parse a 3-column tab-delimited file, with the columns
#being north, east and hectares, and output the results in a similar
#3-column format. No headers in original file, please, and I'm not sure
#what'll happen if it's fed a file not of this strict format, so don't do it.
#####################################
print "Name or path of input file: ";
$infile=<STDIN>;
chop $infile;
print "Name or path of output file: ";
$outfile=<STDIN>;
chop $outfile;
$delim="\t";
print "\nSelect an area for which to calculate occupation density:\n";
print "\t1: Taraco Peninsula\n";
print "\t2: Lower Tiwanaku Valley\n";
print "\t3: Middle Tiwanaku Valley\n";
print "\t4: Taraco Peninsula and Lower Tiwanaku Valley\n";
print "\t5: Entire Tiwanaku Valley\n";
print "\t6: Taraco Peninsula and Entire Tiwanaku Valley\n";
print "Selection:  ";
$area=<STDIN>;
chop $area;
if ($area==1) {
	$emin=505000;
	$nmin=8179000;
	$emax=526500;
	$nmax=8190500;
} elsif ($area==2) {
	$emin=514500;
	$nmin=8162000;
	$emax=528500;
	$nmax=8180500;
} elsif ($area==3) {
	$emin=527500;
	$nmin=8160500;
	$emax=540000;
	$nmax=8177500;
} elsif ($area==4) {
```

```
        $emin=505000;
        $nmin=8162000;
        $emax=528500;
        $nmax=8190500;
} elsif ($area==5) {
        $emin=514500;
        $nmin=8160500;
        $emax=540000;
        $nmax=8180500;
} elsif ($area==6) {
        $emin=505000;
        $nmin=8160500;
        $emax=540000;
        $nmax=8190500;
} else {
        &warn_and_exit ("Area not defined.\n");
}
print "\nGrid dimensions (meters): ";
$grid=<STDIN>;
chop $grid;
print "\nWorking...\n\n";
open (INFILE, "< $infile") || &warn_and_exit ("File $infile could not be opened. Aborted.");
#First initialize the HoH data structure to zero for all grid points...
$e_extent=($emax-$emin)/$grid;
$n_extent=($nmax-$nmin)/$grid;
for $i (0..$n_extent) {
        for $j (0..$e_extent) {
                $DATA{$i * $grid + $nmin}{$j * $grid + $emin}=0;
        }
}
#Then read in $infile and augument the HoH appropriately...
while ($line = <INFILE>) {
        chop $line;
        @data = split /$delim/, $line;
        $data[2] =~ s/,/\./;
        $rem=mod($data[0],$grid);
        if ($rem > $grid/2) {
                $data[0]=$data[0]-$rem+$grid;
        } else {
                $data[0]=$data[0]-$rem;
        }
        $rem=mod($data[1],$grid);
        if ($rem > $grid/2) {
                $data[1]=$data[1]-$rem+$grid;
        } else {
                $data[1]=$data[1]-$rem;
        }
        if (($data[0] < $nmin)||($data[0] > $nmax)||($data[1] < $emin)||($data[1] > $emax)) {
                &warn_and_exit ("Data out of grid boundaries. Aborted.\nNorth:
                        $data[0]\tEast: $data[1]\n");
        }
        $temp=$DATA{$data[0]}{$data[1]};
        $temp=$temp+$data[2];
        $DATA{$data[0]}{$data[1]}=$temp;
}
close INFILE;
# Now all we have to do is print the output file...
open (OUTFILE, "> $outfile") || &warn_and_exit ("File $outfile could not be
        opened. Aborted.");
for $i (0..$n_extent) {
        for $j (0..$e_extent) {
```

```
            $north=$i * $grid + $nmin;
            $east=$j * $grid + $emin;
            $DATA{$north}{$east} =~ s/\./,/;
            print OUTFILE "$north\t$east\t$DATA{$north}{$east}\n";
        }
}
close OUTFILE;
&warn_and_exit ("Okay. All done.\n");
########################################
#Passed a number and a divisor, gives the remainder. Just don't pass it a
#zero divisor...
########################################
sub mod {
        my $num = $_[0];
        my $div = $_[1];
        my $times = int $num/$div;
        return $num-$times*$div;
}
sub warn_and_exit {
        print "$_[0]\n";
        print "Press Enter to Exit\n";
        $trash=<STDIN>;
        exit (0);
}
```

Appendix E

Occupation continuity program code

```
#! /usr/bin/perl
####################################
#This program will parse a 2-column tab-delimited file, with the columns
#being site and period (phase), and determine percentages of
#occupation continuity between any two given phases. No headers in
#original file, please, and I’m not sure what’ll
#happen if it’s fed a file not of this strict format, so don’t do it.
#####################################
print "Input file must be tab-delimited, and must contain 2 columns: \n";
print "\t1) Site, 2) Period\n";
print "Name or path of input file: ";
$infile=<STDIN>;
chop $infile;
$continue=1;
while ($continue) {
print "\n\t1: Early Formative 1\n";
print "\t2: Early Formative 2\n";
print "\t3: Middle Formative\n";
print "\t4: Late Formative 1\n";
print "\t5: Late Formative 2\n";
print "\t6: Tiwanaku\n";
print "\t7: Early Pacajes\n";
print "\t8: Pacajes-Inka\n";
print "\t9: Late Pacajes\n";
print "Calculate occupation continuity from:";
$phase1=<STDIN>;
chop $phase1;
print "To: ";
$phase2=<STDIN>;
chop $phase2;
if ($phase1==1) {
	$phase1=1.1; #  Early Formative 1
} elsif ($phase1==2) {
	$phase1=1.2; #  Early Formative 2
} elsif ($phase1==3) {
	$phase1=2.0; #  Middle Formative
} elsif ($phase1==4) {
	$phase1=3.1; #  Late Formative 1
} elsif ($phase1==5) {
	$phase1=3.2;#   Late Formative 2
} elsif ($phase1==6) {
```

```
        $phase1=4.0; #  Tiwanaku
} elsif ($phase1==7) {
        $phase1=5.1; #  Early Pacajes
} elsif ($phase1==8) {
        $phase1=5.2; #  Pacajes-Inka
} elsif ($phase1==9) {
        $phase1=5.3; #  Late Pacajes
} else {
        &warn_and_exit ("Phase not defined.\n");
}
if ($phase2==1) {
        $phase2=1.1;
} elsif ($phase2==2) {
        $phase2=1.2;
} elsif ($phase2==3) {
        $phase2=2.0;
} elsif ($phase2==4) {
        $phase2=3.1;
} elsif ($phase2==5) {
        $phase2=3.2;
} elsif ($phase2==6) {
        $phase2=4.0;
} elsif ($phase2==7) {
        $phase2=5.1;
} elsif ($phase2==8) {
        $phase2=5.2;
} elsif ($phase2==9) {
        $phase2=5.3;
} else {
        &warn_and_exit ("Phase not defined.\n");
}
print "\nWorking...\n\n";
undef %SITES;
#Now we take a first pass through the file to build a list of sites with
#occupations in $phase
open (INFILE, "< $infile");
        || &warn_and_exit ("File $infile could not be opened. Aborted.");
while ($line = <INFILE>) {
        chop $line;
        @data = split /\t/, $line;
        if ($data[1]==$phase1) {
                $SITES{$data[0]}=0;
        }
}
close INFILE;
#Now a second pass to see which have occupations of $phase2...
open (INFILE, "< $infile")
        || &warn_and_exit ("File $infile could not be opened. Aborted.");
$phase2_sites=0;
while ($line = <INFILE>) {
        chop $line;
        @data = split /\t/, $line;
        if ($data[1]==$phase2) {
                ++$phase2_sites;
        }
        if (($data[1]==$phase2)&&(exists($SITES{$data[0]}))) {
                $SITES{$data[0]}=1;
        }
}
close INFILE;
#Now report the results...
```

```
$sites=0;
$continuities=0;
foreach $site (keys %SITES) {
	++$sites;
	if ($SITES{$site}) {
		++$continuities;
	}
}
print "Results:\n";
print "\tTotal sites with a $phase1 occupation:\t$sites\n";
print "\tTotal sites with a $phase2 occupation:\t$phase2_sites\n";
print "\tSites with both $phase1 and $phase2 occupations:\t$continuities\n";
$percent=&round($continuities*100/$sites,1);
print "\t$percent percent continuity between $phase1 and $phase2\n";
$new_sites=&round(($phase2_sites-$continuities)/$phase2_sites*100,1);
$abandonment=&round(($sites-$continuities)*100/$sites,1);
print "\t$abandonment percent site abandonment rate\n";
print "\t$new_sites percent new site founding rate\n";
print "Would you like another?  ";
$answer=<STDIN>;
chop $answer;
if ($answer =~ /n/) {
	$continue=0;
}
}
&warn_and_exit ("Okay. All done.\n");
sub round {
	my $num = $_[0];
	my $nearest = $_[1];
	if (mod($num,$nearest) >= $nearest/2) {
		return $num-mod($num,$nearest)+$nearest;
	} else {
		return $num-mod($num,$nearest);
	}
}
sub mod {
	my $num = $_[0];
	my $div = $_[1];
	my $times = int $num/$div;
	return $num-$times*$div;
}
sub warn_and_exit {
	print "$_[0]\n";
	print "Press Enter to Exit\n";
	$trash=<STDIN>;
	exit (0);
}
```

Appendix F

Settlement database schema

Table: site					
Field	Type	Null	Key	Default	Extra
site	varchar(10)	Yes		Null	
sector	char(2)	Yes		Null	
utm_north	int(11)	Yes		Null	
utm_east	int(11)	Yes		Null	
elevation	int(11)	Yes		Null	
area	float(5,2)	Yes		Null	
phase	char(3)	Yes		Null	
zone	varchar(255)	Yes		Null	
type	varchar(255	Yes		Null	
prefix	varchar(10)	Yes		Null	
area_corrected	float(5,2)	Yes		Null	
pop_index	float(5,2)	Yes		Null	

Table: surface_ceramics					
Field	Type	Null	Key	Default	Extra
locus	int(11)	Yes		Null	
paste_group	varchar(100)	Yes		Null	
painted_sherd	int(11)	Yes		Null	
rim_shirds	int(11)	Yes		Null	
incised_sherds	int(11)	Yes		Null	
other_diag_sherds	int(11)	Yes		Null	
plain_body_sherds	int(11)	Yes		Null	
total_sherds	int(11)	Yes		Null	

Table: surface_collection					
Field	Type	Null	Key	Default	Extra
site	int(11)	Yes		Null	
locus	int(11)	Yes		Null	
area	float(5,2)	Yes		Null	
north	float(5,2)	Yes		Null	
east	float(5,2)	Yes		Null	
real_north	float(5,2)	Yes		Null	
real_east	float(5,2)	Yes		Null	
ceramic_bags	int(11)	Yes		Null	
lithic_bags	int(11)	Yes		Null	
other_bags	int(11)	Yes		Null	
ground_cover	varchar(255)	Yes		Null	
more_info	varchar(255)	Yes		Null	
prefix	varchar(10)	Yes		Null	