

## **Chapter 6**

### **The gold rush effect**

The "effects" of the equilibrium group number model discussed so far have all assumed that the behavior of the psycho-rational forces and the force of competition remained effectively constant, while only the size of the social sphere varied. This simplifying assumption is reasonable under some circumstances, especially those in which the social sphere is extremely small (the minimum viable group size effect) or in which changing organization, communication, mobility, or other factors bring about dramatic changes in the size of the social sphere (the social sphere size effect and the cascading divisions effect). When factors such as these are known to have attained extreme values or to have changed markedly, it is fair to hypothesize that they played a central role in the events that accompanied them, while other factors that are not known to have reached extreme states or to have changed drastically may legitimately be neglected for a first approximation of the process. Such was the justification for the parsimonious assumption that "all other things remain equal" in the previous chapters.

Now let us consider a case in which these other factors do play a central role, specifically by taking extreme values. For a given type of environment, prevailing technology, social organization, and so on, there is presumably some typical or expectable range of variability for the shapes and locations of the psycho-rational and competitive exclusion curves, giving rise to some typical range in which the equilibrium group number can be expected to fall. These typical values assume that the social spheres involved are not so extremely small that the minimum viable group size effect sets the group number, nor so high that the competitive exclusion effect

(Chapter 7) overwhelms the other forces. Some circumstances may influence the psycho-rational or competitive exclusion forces so strongly that one or more of the "forces" curves moves beyond the typical range of variability, and takes the equilibrium group number with it.

Such a circumstance is the opening of a new social and ecological niche, or the drastic expansion of an existing one (see Amir 1981). The opening of a new niche means the appearance of a new opportunity for subsistence that previously was not exploited, including both primary production, as in the case of agricultural production of staple foods, and subsistence at some remove from primary production, as in the case of a craft specialist who exchanges manufactured goods for subsistence products. The expansion of a niche means an increase in the number of people that an existing strategy can support.

New niches can open in a variety of ways. When people first arrive in a previously unpopulated area, any habitable area will present one or more new niches to be occupied. A new niche may be created by rapid ecological changes caused when climatic shifts cross the temperature or humidity thresholds that are required for certain plant or animal communities to flourish. A new niche may be opened by drastic changes in hydrological regimes due to geological events such as the formation or failure of natural dams, the opening or closing of subterranean channels, or the release or exhaustion of "fossil" water supplies. When the advent of a new technology such as canal irrigation, mining, or equestrian hunting makes a region or resource potentially more productive, it opens a new niche. It is even conceivable that a new niche could be opened by changes purely in the social realm, such as the development of new practices concerning land or other resource tenure, plot size, ownership, rents

and taxes, regional peace or war, cooperative group labor, slave or other coerced labor, and so on. Many of these same mechanisms might also expand existing niches.

All of these examples refer to very specific niche types that might pertain to individuals or small groups. These niches might be called "individual niches" or "microniches". The niche occupied by a social group may be more complex, comprising a system of interacting individuals and groups each of whom occupies a more specific microniche. For example, an individual might occupy the microniche of a potato farmer who interacts with neighboring corn farmers and herders, while that individual's social group would occupy the niche of an agro-pastoralist society exploiting potatoes, corn, and camelids. The complex niches occupied by entire social groups might be called "societal niches" or "compound niches" (see Chapter 2).

When a new niche opens, or an existing niche is greatly expanded, the potential productivity of the niche far exceeds the production actually being realized in it. A new or greatly expanded niche represents untapped opportunities. I suggest that such untapped opportunities tend to shift the rational-actor forces curve far to the right, that is, that individuals' calculations of the optimal number of groups tend to take on unusually high values. Individuals under these circumstances may think that there is more to be gained by striking out alone or in one of many like-minded small groups to exploit the new opportunity than by doing so in a large group. The advantages to each member of a small group are numerous. It is bound to be easier to put together a small group of people to split off from their existing group and take substantial risks than a large one. Small group members may select their companions such that most or all are cooperative and productive, and few or none are burdens to the group. Small group members are subordinate to few or no leaders, and so receive a higher proportion of

their own production. There is an incentive to found new, small groups because if a small group is successful and grows, then the founding members will tend to be in a privileged position within it. This tendency to split off into numerous small groups and to avoid fusing into fewer, larger groups is represented by rational-actor forces curves with minima at relatively high group numbers. When the rational-actor forces are added into the total psycho-rational forces curve, the result is shifted to the right, as well.

The opening or expansion of a new niche also reduces the effect of competition. When a niche opens or expands, plenty of resources are available, but there are few individuals and groups to exploit them. Initially, multiple groups can establish themselves and expand without significantly impinging on the others. Until the carrying capacity of the niche is approached and one groups' gain increasingly becomes another group's loss, competition in the form of raids, conquest, defections, and so on will do little to reduce the number of groups in the social sphere. This relaxed force of competition is represented on a TGN graph as a competitive exclusion curve with a relatively low or flat slope.

The effect of opening or greatly expanding a niche, then, is to shift the psycho-rational curve to the right, depress the competitive exclusion curve, and produce an unusually high equilibrium group number, in what I call the "gold rush" effect. Figure 6-1 illustrates an arbitrary "typical" TGN graph and one resulting from the gold rush effect. No systematic effort has been made to determine "typical" values, slopes, or curve shapes in these graphs; what is significant is the general difference between them.

Especially since this presentation adapts many ideas and terms from ecology and

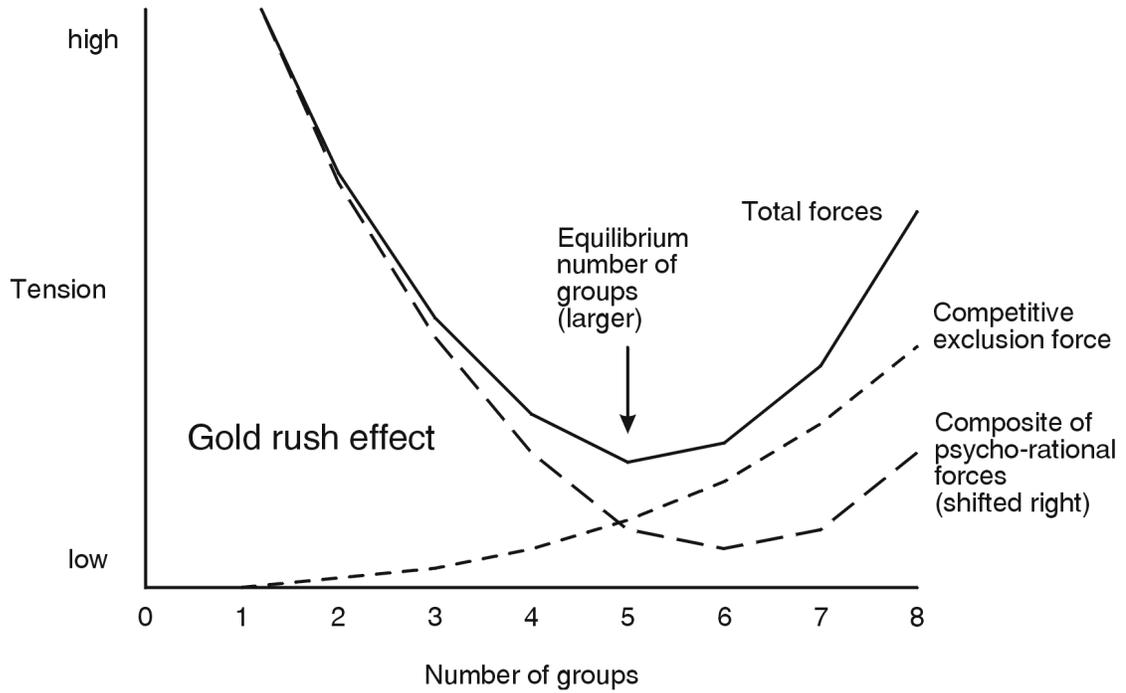
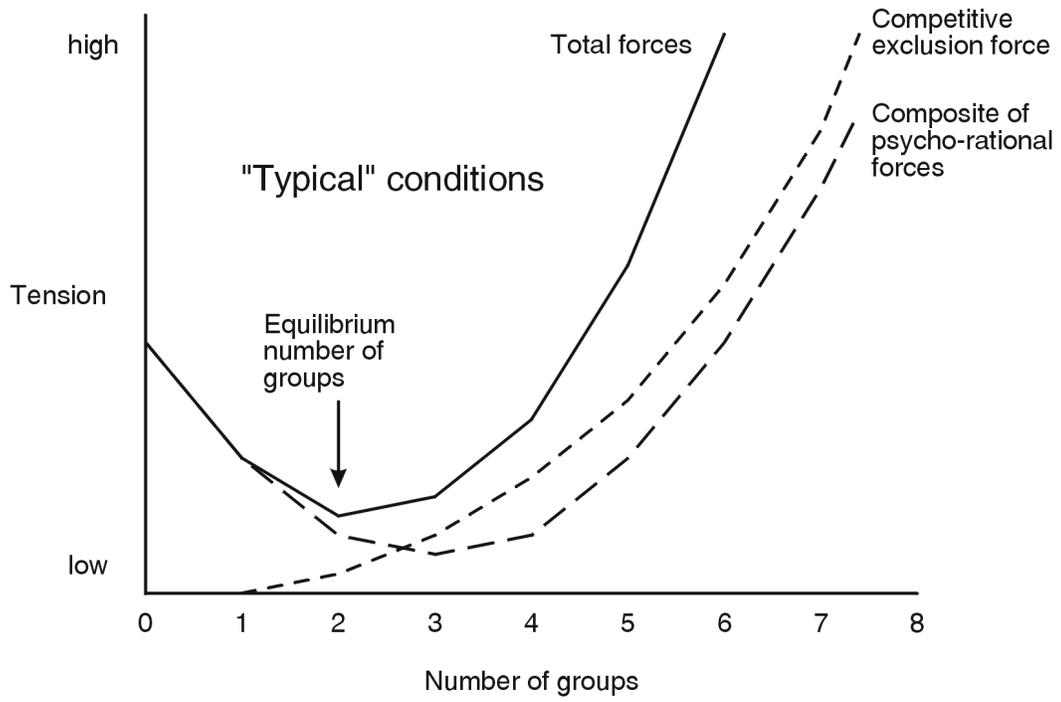


Figure 6-1. The gold rush effect.

evolutionary theory, the reader might be tempted to make an analogy between the gold rush effect and the process of adaptive radiation, which is superficially similar. The analogy is not very close, however, in that adaptive radiation refers to a rapid differentiation, or better speciation, of new and distinct forms into a territory containing a multitude of underexploited niches. The gold rush effect deals with individuals or groups that are effectively similar and exploiting a single niche, broadly defined. Moreover, species do not split except under special enabling circumstances, and they never fuse, while social groups may separate and rejoin at any time. A better analogy might be to the colonization of a new island or similar empty niche by individuals of a single species, but the gold rush effect should probably best be left as a social construct, without the unnecessary baggage of a biological analogy at all.

The gold rush effect is only temporary. As the niche is more fully exploited, there are increasingly few opportunities for new groups to form, and the psycho-rational curve migrates back towards the left. As time passes, the growing groups are in increasing competition, and considerations of conquest and defense, relative status and wealth, and strategic alliances encourage the fusion of some groups and the extinction or dissolution of others. The competitive exclusion curve becomes steeper and has a greater impact on the equilibrium group number, and the situation returns to a more "typical" condition with a lower equilibrium group number. This process will be considered further in Chapter 7.

In order to show that the gold rush effect describes the events in any specific case, several facts must be established. First, there must have been an "unusually high" number of distinct social groups in the region. The presence of distinct social groups is most convincingly indicated by distinct artifact and feature assemblages that are

found alone, in single-component residential sites. An artifact and feature assemblage is distinct if it constitutes a set of unrelated material traits that are consistently found together and contrast with the multiple, unrelated traits consistently found in other material cultures.

Second, this high group number must have arisen suddenly. One way to argue for a sudden change in group number is to show that the material cultures present do not appear to have developed *in situ* from established local traditions, which would presumably be a relatively gradual process, but rather appeared abruptly as the result of physical immigration (intrusion) of people with distinct material cultures from other regions. A material culture can be considered intrusive if multiple aspects of the new material culture are so different from the analogous features of the local material cultures of preceding periods that the new material culture seems unlikely to have developed from any local antecedents. The case is stronger if the new material culture is very similar to one known to have developed gradually in a nearby region, which would have been the source of the presumed immigrants.

Third, the multiple, distinct groups must have been contemporary. Neither a sequence of rapid material cultural changes nor successive, short-lived intrusions would fit the gold rush effect, so these possibilities must be discounted.

Finally, the sudden increase in group number must be associated with the opening of a new social and ecological niche. Evidence of the opening of a new niche might include evidence of climatological or hydrological changes that reasonably could have influenced subsistence practices, or direct archaeological evidence of new subsistence technology, food mixes, resource zones exploited, and so on.

The evidence pertaining to all these conditions may often be inconclusive, and in some cases, other lines of argument may also suggest that the conditions were met. The following sections illustrate how the applicability of the gold rush effect can be argued using the archaeological evidence from the coastal Osmore valley, and lay out some of the secondary arguments that can be used when the evidence is incomplete or the circumstances more complex than the idealized case above.

### **Post-Tiwanaku settlement in the coastal Osmore valley**

In Chapter 4 we saw how the coastal Osmore valley in Tiwanaku times was populated sparsely at best, probably by people making BR Early Ceramic pottery and concentrating more on marine and *lomas* resources (fog vegetation outside the valley) than had their more numerous agricultural predecessors. I suggested that the minuscule population of the coastal valley at this time may have reflected a lack of surface water in the coastal Osmore river caused by extensive Tiwanaku irrigation works in the middle valley.

This situation changed drastically when Tiwanaku collapsed in the middle valley. In the following pages, I present evidence that at least one, and probably two, formerly Tiwanaku groups relocated or expanded from the middle Osmore to the coastal Osmore valley, and that at least one, and probably three, other distinct groups of unknown origin appeared in the coastal Osmore at about the same time. In a period that may well have been one generation or less in duration, the meager, probably indigenous population of the coastal Osmore was augmented or replaced by five distinct, contemporaneous groups. Along with a big jump in population, the group number increased suddenly from one to five or even six, if the BR Early Ceramic style

persisted into this period.

As I show below, the subsistence base of the new settlers appears to have differed dramatically from that of the BR Early Ceramic people who preceded them, and from the even earlier Algodonal Early Ceramic people, about whom we know a great deal more. The new settlers exploited fish, shellfish, and camelids, but in the coastal valley itself, they were clearly primarily settled farmers who depended at least in part on an impressive canal that watered formally constructed terraced fields reclaimed from river terraces elevated well above the floodplain. The remains of this intensive farming activity indicate that a great deal of water was available on at least a protracted seasonal basis, while the large, presumably permanent population implies that there was at least some surface water year-round.

If my admittedly speculative reconstruction of extreme aridity in the Middle Horizon coastal Osmore is correct, then something must have occurred around the time that Tiwanaku collapsed that greatly increased the flow of water in the coastal Osmore river. I suggest that the abandonment or downsizing of large-scale Tiwanaku state irrigation works in the middle Osmore valley (Moseley et al. 1991) could have had exactly such an effect. If so, then the repopulation of the coastal Osmore would have been a direct result of the collapse of the Tiwanaku state and the resulting political fragmentation and competition that would have made both physical and organizational large-scale water allocation systems impossible to maintain or too costly to defend.

Even if the abandonment of middle valley irrigation works was not the cause of the change in the hydrological regime, and for that matter even if the coastal Osmore river had been flowing at a high rate throughout the Middle Horizon, the new settlers of the coastal Osmore valley clearly employed an intensive agricultural technology that

the BR Early Ceramic people either did not use or did not begin to fully exploit. (There is some evidence that their predecessors, the Algodonal Early Ceramic people, had also been intensive agriculturalists, but this interesting issue will not be further addressed here.) So regardless of whether the "coastal Osmore intensive agriculture and pastoralism compound niche" was opened by hydrological changes caused by the abandonment of Tiwanaku irrigation works, hydrological changes caused by geological or climatological events, the introduction of intensive agricultural technology and the necessary associated social structural features, or some combination of these events or others, the coastal Osmore valley shows every sign of having been opened up as a new, extremely underexploited niche right around the time that Tiwanaku collapsed in the middle valley. The gold rush effect seems to describe the process of rapid settlement, and makes the resulting plethora of discrete groups not only intelligible but expected.

In the particular case of the Osmore drainage, the gold rush effect may have been somewhat exaggerated, since the psycho-rational curve was probably shifted to the right not only by factors related to the opportunities in the new coastal Osmore niche, but also by factors concerning the growing disadvantages of remaining in the middle Osmore valley. With the breakdown of the Tiwanaku state superstructure and possibly of the irrigation systems that had helped to ensure the subsistence of a sizable, organized population, the middle valley probably became a more competitive, riskier place to live than it had been before. The defensible site locations, walls, and population shifts towards previously less utilized areas in the upper drainages described in Chapter 5 all support the impression of increased tension in the middle valley. The costs associated with this increased tension would have made the coastal Osmore valley look relatively more attractive as a place to settle even in the absence of

hydrological or technological changes. In addition, people living in the middle valley would have experienced a rapid change in group number from one (the Tiwanaku state) to several or even many (the Tumilaca phase "foci"), which might have shifted either their rational calculations or their psychological tendencies, or both, concerning acceptable group numbers towards the higher values that prevailed temporarily in the coastal valley.

### **The Ilo-Tumilaca/Cabuza group**

The Ilo-Tumilaca/Cabuza ceramic tradition includes the Ilo-Tumilaca style and the Ilo-Cabuza style, which appear to represent earlier and later phases, respectively, in the development of a single, possibly internally diverse, ceramic tradition. The Ilo-Tumilaca style is named for its strong similarity to Goldstein's (1989a,b; Bermann et al. 1989) Tumilaca phase in the middle Osmore valley. The Ilo-Cabuza style is named for its strong similarity to the Cabuza style of the Azapa valley (Dauelsberg 1985; Santoro 1980), which I believe has been seriously misplaced in the published chronologies for the Azapa area (Dauelsberg 1985; Santoro and Ulloa 1985; Cartmell et al. 1991). The two coastal Osmore styles represent distinguishable extremes of a continuum of variation, which means that some whole vessels and many sherds are difficult to place in one style as opposed to the other, yet clearly pertain to the tradition as a whole (see below and Appendix C). The present discussion relating to the gold rush effect focusses on the early portion of the Ilo-Tumilaca/Cabuza tradition, but because much of the archaeological data cannot be definitely subdivided within the tradition, generalizations based on the entire duration of the Ilo-Tumilaca/Cabuza tradition will have to serve in many cases. Wherever it is possible to effectively limit the data to just the early portion of the tradition, the text specifically refers to the Ilo-

Tumilaca style.

Pots made in the Ilo-Tumilaca/Cabuza ceramic tradition were probably used primarily by members of one specific ethnic or political group or set of groups in the coastal Osmore valley, and can serve as an archaeological marker for them as a social group or category. There are several reasons for accepting this common but often disputed type of archaeological inference in this case. First, the Ilo-Tumilaca/Cabuza ceramic tradition comprises a category of pottery the technological, formal, and decorative characteristics of which are distinct from all other ceramics found in the valley (see Appendix C). The only similar ceramics are some examples of the Algarrobal phase (early) Chiribaya style, which share some of the same pastes, forms, slips, paints, and finishing techniques, but are easily distinguished when any but the simplest painted design elements are present. This distinctness among the ceramic styles in the valley suggests some sort of gulf between them, such as may be created by their use as symbols for boundary marking between social groups (Barth 1969; Hodder 1982).

Second, Ilo-Tumilaca/Cabuza pottery is often found in single-component habitation or burial sites that contain ceramics only of this tradition. The existence of such single-component sites suggests that the Ilo-Tumilaca/Cabuza tradition was not simply a part of a continuous range of, for example, functional variation that included other styles in the valley, since the people living and buried at the single-component sites clearly satisfied all their ceramic needs without the other styles of pottery.

Third, at least among the earlier, Ilo-Tumilaca examples, the Ilo-Tumilaca/Cabuza style includes a full range of quality and elaboration from crude, plain utilitarian pots to highly decorated, well-made polychrome serving vessels or display pieces. The

utilitarian wares are known only from sherds and are not obviously distinguishable from those of other styles except perhaps by detailed study of some of the rarer paste variants. For this reason, the present study joins a legion of previous works in neglecting utilitarian wares for most purposes. Nevertheless, the presence of both poor and highly elaborated examples even among the diagnostic, decorated vessels suggests that the single-component sites were not simply the upper or lower ends of a single valley-wide status continuum or hierarchy, either.

Finally, a variety of other material cultural traits associated with ceramics of the Ilo-Tumilaca/Cabuza tradition consistently contrast with traits associated with ceramics of the Chiribaya tradition, which is both the predominant tradition in the valley, and the only one of the other contemporary ceramic traditions that is sufficiently well known at this point to make such comparisons with. Wooden spoons with the handles cut in the form of profile camelid silhouettes are found in some Ilo-Tumilaca/Cabuza tombs (see Appendix D), but never in Chiribaya tombs of any phase (Patricia Valdivia, Yamilex Tejada, David Jessup, pers. com.). Mummy bundles found with Ilo-Tumilaca/Cabuza ceramics are always tied with ropes made from junco stalks or a similar plant material, while mummy bundles with Chiribaya ceramics are often tied with wool ropes. Tombs containing Chiribaya ceramics are often rectangular, while tombs containing Ilo-Tumilaca/Cabuza ceramics never are. Textiles decorated with broad areas of many parallel stripes of numerous colors and variable widths are found in some tombs with Ilo-Tumilaca/Cabuza ceramics, but are rare or non-existent in tombs with Chiribaya ceramics. Similarly, bands of loop-stitched decoration are a relatively common form of decoration on shirts associated with Ilo-Tumilaca/Cabuza ceramics, but are rare on shirts associated with Chiribaya ceramics. Textiles found with Chiribaya ceramics, on the other hand, are often decorated with

complex, sometimes figural designs of white floating warps over bands of other colors; this type of decoration is unknown on textiles found with Ilo-Tumilaca/Cabuza ceramics. A variety of textile forms that are common in Chiribaya burials, such as "faja bolsas" (wide belts with front and back layers sealed at the bottom and open at the top to serve as a long pocket or bag), round knotted hats, and thick wool ropes in bright dyed colors, have never been found with Ilo-Tumilaca/Cabuza ceramics. Other common Chiribaya forms such as "panuelos" (medium-sized rectangular cloths, often with sturdy ties attached, probably for light carrying and storage) and decorative knotted belts were present at the Ilo-Tumilaca/Cabuza cemetery of El Algodonal, but extremely rare (see Boytner 1992a,b). Finally, Boytner and Wallert (1993) have shown that the red colors of Ilo-Tumilaca/Cabuza textiles from El Algodonal and Chiribaya textiles from Chiribaya Alta, although visually indistinguishable, were achieved with completely different dyes.

Although the number of examples is small, the available data suggest that Ilo-Tumilaca/Cabuza and Chiribaya domestic architecture also differed consistently. Chiribaya domestic areas excavated at Chiribaya Baja by David Jessup, La Yaral (Garcia 1988), El Algodonal (PCCT, units 513-515, 517, 523, 524, and 527), and Loreto Viejo (PCCT, unit 2504), in addition to surface evidence at Chiribaya Alta and Chiribaya Baja, all indicate that Chiribaya residences tended to have thick cane walls running along the back, front, and side edges of a leveled terrace enclosing virtually all of the terrace surface in a large, rectangular compound that was subdivided by less substantial cane walls into rooms and corridors. None of the five cane-walled domestic structures tested at the single-component Ilo-Tumilaca/Cabuza site of Loreto Alto, nor the one Ilo-Tumilaca structure tested at El Algodonal, had a substantial compound wall. Because some of the test excavations were small, in several cases the

possibility of a thin compound wall comparable to the other domestic walls cannot be ruled out, but two of the terraces at Loreto Alto and the one at El Algodonal clearly were not enclosed by a compound wall at all, but instead bore single structures that did not occupy the entire terrace surface.

Chiribaya domestic structures often include one or more cylindrical cane-walled structures one to two m in diameter, sometimes identified as storage structures (Yaral: Garcia 1988:Fig. 7A; Chiribaya Baja: David Jessup, pers. com.; El Algodonal: PCCT unit 517). No examples of these structures were found in any of the Ilo-Tumilaca/Cabuza habitations tested. The techniques used to build the cane room walls themselves appear to differ, as well. Chiribaya cane walls commonly have posts aligned with them, the bases of which are found directly in the wall trench and are often quite large in size, 25 cm or more in diameter (Yaral: Garcia 1988:Fig 7C; Chiribaya Baja: David Jessup, pers. com.; El Algodonal: PCCT unit 527; Loreto Viejo: PCCT unit 2504). The posts in the Ilo-Tumilaca/Cabuza structure at El Algodonal had small posts set on either side of the wall trench, rather than in line with it. No posts or postholes were found near any of the cane walls at the Ilo-Tumilaca/Cabuza site of Loreto Alto, although a hole that probably contained a large post located in the center of a rectangular room was sectioned in unit 1501.

For all these reasons, it seems fair to consider the Ilo-Tumilaca/Cabuza ceramic tradition to be a marker of some sort of social group that was distinct from other groups in the coastal valley. But why not subdivide the pottery and people even further, that is, discard the concept of the Ilo-Tumilaca/Cabuza tradition and separate the Ilo-Tumilaca and Ilo-Cabuza styles into two separate groups? There are numerous reasons to lump these two styles as representing a single, if temporally variable, social

group.

Although prototypical examples of Ilo-Tumilaca and Ilo-Cabuza styles look very different, there is a large area of overlap, in which designs of one style are found in the colors, finish, or vessel form of the other, or the designs or other features are too intermediate to place in one style or the other. Such a continuum of variation does not suggest an ethnic or political boundary, but rather either random variation within a single tradition or a smooth cline in space or time from one style to the other, also within a single tradition. Moreover, the entire stylistic range from the most elaborate Ilo-Tumilaca to the most drab Ilo-Cabuza was excavated from the single, small cemetery at El Algodonal. The tombs in this cemetery were all cylindrical to egg-shaped, regardless of the ceramic style they contained, and all appeared to be at about the same stratigraphic level. The position, wrapping, and tying of the corpses were consistent for all ceramic styles. There was no significant difference in the quantity or the nature of grave goods buried with one style or the other, except that the wooden spoons with camelid profiles were only found with Ilo-Tumilaca ceramics, while the wooden spoons found with Ilo-Cabuza ceramics were decorated with various geometric designs more similar to spoons found with Chiribaya pottery. Five of the seven sites known to have specifically Ilo-Cabuza ceramics on the surface also have Ilo-Tumilaca ceramics, which suggests that this co-occurrence of the two styles is not limited to El Algodonal, but is a general pattern. So despite the differences between the two styles, it seems reasonable to treat the Ilo-Tumilaca/Cabuza tradition as a single entity, representing one social group in contrast to others in the valley.

The entire Ilo-Tumilaca/Cabuza material culture tradition appears to have been imported into the coastal Osmore valley more or less intact from the middle valley,

probably by settlers who moved to the coastal valley from one or more sites in the fragmented territory of the collapsed Tiwanaku state. Archaeologists today tend to shy away from migration theories, largely because they have been overused by prehistorians in the past, but in some cases they are justified (Rouse 1985). In this case, there are no likely antecedents for the Ilo-Tumilaca/Cabuza tradition in the coastal valley, while there is a long tradition that culminated in a virtually identical material culture in the middle valley, just 25 km away along the dry section of the valley.

Both the Algodonal Early Ceramic and the BR Early Ceramic pottery styles are completely different from the Ilo-Tumilaca/Cabuza styles, and do not prefigure them in any way (Appendix C). There appear to be no forms at all in common between the two traditions. Not a single Early Ceramic sherd is red slipped, while red slip is very common on Ilo-Tumilaca/Cabuza sherds and vessels. I know of only one Early Ceramic sherd from the coastal valley with painted decoration, and that is just a few broad, washy red stripes on an unslipped ground, completely unlike the complex black line and polychrome designs on many Ilo-Tumilaca/Cabuza ceramics.

Unfortunately, none of the BR Early Ceramic sites, which are presumably the immediate precursors to the Ilo-Tumilaca/Cabuza tradition in the coastal valley, have been excavated. The earlier Algodonal Early Ceramic habitation areas at El Algodonal and Loreto Viejo that were excavated, however, were quite different from sites of the Ilo-Tumilaca/Cabuza tradition. Most notable was the complete absence of wall trenches and postholes in the Early Ceramic sites, suggesting a very different tradition of domestic architecture. While Ilo-Tumilaca/Cabuza stone walls are typically either dry laid or set in clay mortar, the one excavated example of an Algodonal Early

Ceramic wall was chinked with masses of rootlets or some similar plant fiber. The two projectile points recovered from Algodonal Early Ceramic contexts were both comparatively broad and concave-based, while with the exception of one example collected from the surface of Loreto Alto, the points from Ilo-Tumilaca/Cabuza contexts are all narrow with a small tang base.

The Early Ceramic burial traditions are not likely to have developed into the Ilo-Tumilaca/Cabuza burial practices, either. At least some individuals apparently contemporary with the Algodonal Early Ceramic style were dismembered and buried in cane-roofed pits covered by substantial mounds constructed of alternating layers of dirt and plant material (Owen 1993). This style of "tumulus" burial is well known from the Azapa valley (Muñoz 1987), and variants have been reported from as far south as San Pedro de Atacama (Muñoz 1987), and as far north as the Nazca valley (Patrick Carmichael, pers. com.). BR Early Ceramic burial practices may be represented by site 112, which could be a cemetery. If so, BR Early Ceramic burials were marked on the surface with a few rocks and a single broken vessel, a tradition that might conceivably be related to the earlier burial mounds. Neither of the Early Ceramic traditions seem likely antecedents for Ilo-Tumilaca/Cabuza burials, which stress stone-lined cylindrical to egg-shaped tombs that contain carefully wrapped, intact corpses and have no surface markers.

Of course, there could be plausible antecedents for the Ilo-Tumilaca/Cabuza tradition in the coastal Osmore valley that simply have not yet been recognized. Negative evidence is always inconclusive. Moreover, Chapter 4 listed a few artifacts that might represent a local analog to the Chen Chen phase, a perfect predecessor to the Ilo-Tumilaca/Cabuza tradition, but wrote them off as too few to indicate more than

token exchange, heirlooms brought in by later immigrants, or accoutrements of an insignificant number of individuals. Nevertheless, after PCCT's systematic 100% surface survey of the valley margins and adjoining areas, numerous PCCT test excavations scattered across various sectors of three sites, David Jessup's excavations at San Geronimo and Chiribaya Baja, Jane Buikstra's Chiribaya Project cemetery excavations at Chiribaya Alta and Baja, Ghersi's (1956) and Santos' (1983) early excavations, the extensive preliminary explorations of Programa Contisuyu members including Mike Moseley, Don Rice, and Luis Watanabe, the quantities of looted material assembled into the Museo de Algarrobal collection by Manuel Pacheco and the Municipalidad de Ilo collection, not to mention years of accumulated looted vessels in private collections and fragments left on the surface, it seems reasonable to argue that we are probably aware of all the major ceramic stylistic traditions present in the coastal valley. Any exceptions would have to have been very small occupations with virtually no impact on, nor exchange with, their neighbors. Not only does that seem unlikely for bearers of the tradition of a state living among locals who are much less organized and materially relatively impoverished, but also for the present purposes it is reasonably equivalent to no occupation at all.

While the material culture associated with Ilo-Tumilaca/Cabuza ceramic tradition has no evident roots in the earlier coastal valley traditions, it is almost identical to that of the Tumilaca phase in the middle valley, which has a long, clear developmental history there. Ilo-Tumilaca ceramics are extremely similar to Tumilaca phase ceramics in forms, slips, paints, and decoration, so much so that some of the excavated vessels from El Algodonal would go unnoticed if they were mixed into Tumilaca phase collections from the middle valley cemeteries at Omo or Chen Chen (compare illustrations in Appendix C with Goldstein 1989a,b and Bermann et al. 1989). There

are subtle differences in the frequencies of some motifs and forms, the presence or absence of others, and details of manufacture and finishing that might eventually let us assign the Ilo-Tumilaca ceramics to one of the several Tumilaca "foci" in the middle valley, but none of the material has been sufficiently well characterized to draw such conclusions yet. In addition to ceramics, the wooden spoons with camelid profile handles in Ilo-Tumilaca tombs are almost the same as examples from Tumilaca phase tombs (Goldstein 1989a:Fig. 84), as are the narrow, tang-based projectile points (Goldstein 1989a:Fig. 86). Tumilaca phase tombs in the middle valley were constructed in the same way and the same shape as Ilo-Tumilaca/Cabuza tombs, and the corpse was bundled in the same manner and seated in the same position among its grave goods (Pari 1980; Goldstein 1989a; Maria Lozada, pers. com. on excavations at La Yaral).

Finally, Tumilaca phase domestic architecture is very similar to that of the Ilo-Tumilaca/Cabuza tradition. Both are based on light walls of vertical canes that were set in trenches and were either self-supporting or associated with relatively thin poles placed on one or the other side of the trench rather than directly in line with it. Although the sample of excavated domestic structures is minuscule, the available examples suggest that neither used heavier compound walls or fences as did the Chiribaya, nor very large posts (see Goldstein 1989a). Finally, some people of both the middle valley Tumilaca phase and the coastal valley Ilo-Tumilaca/Cabuza tradition lived on sites composed of many small terraces in folds of terrain high above the valley floor, specifically the high sector of La Yaral in the middle valley, and Loreto Alto in the coastal valley. Both of these sites were definitely inhabited, as indicated by excavations at Loreto Alto and profuse surface scatters of utilitarian ceramics and groundstone on the high sector of La Yaral. This type of site, which would have

required prodigious effort to provision with water and other supplies, appears to be associated uniquely with the Tumilaca and Ilo-Tumilaca/Cabuza traditions.

The Ilo-Tumilaca/Cabuza material culture tradition not only greatly resembles its Tumilaca phase counterpart, but the radiocarbon dates for the Ilo-Tumilaca style place it around AD 1000, at exactly the same time as the Tumilaca phase, and right at the time when the Tiwanaku state seems to have been breaking up (Appendix C). The collapse of Tiwanaku and the probable resulting competition and conflicts in the middle valley provide a likely reason for settlers to move to the coastal valley, just as we already know they moved to previously unpopulated parts of the upper drainage (Stanish 1985, 1992a; Bermann et al. 1989).

The age and sex profile of the human remains from the Ilo-Tumilaca/Cabuza cemetery at El Algodonal indicate that the cemetery was used by a complete, probably stable population, not a specialized work group (Appendix D), which is what might be expected of an immigrating group of permanent settlers. If the Ilo-Tumilaca/Cabuza people were literally immigrants from the middle valley, their physical remains should show evidence of genetic similarity to middle valley Tumilaca phase populations, and comparatively more differences from remains of the Chiribaya and Early Ceramic populations that appear to have had different origins. A comparative study of cranial non-metric traits of remains from various archaeological projects in the region that is currently being conducted by Maria Lozada will assess this hypothesis, and results of DNA amplification work by Sloan Williams on many of the same individuals may also help show that the Ilo-Tumilaca/Cabuza people immigrated into the coastal Osmore from the middle valley. Unfortunately, neither of these projects is finished as of this writing.

## **The Chiribaya group**

The Chiribaya ceramic tradition includes the Algarrobal phase and the Post-Algarrobal phase, which appear to represent earlier and later phases, respectively, of the development of a single rather homogeneous ceramic tradition that changed gradually over time. This stylistic and chronological division is adapted from a stylistic and stratigraphic seriation by David Jessup (1991), based on excavated grave lots from his own excavations at San Geronimo and the excavations of the Chiribaya Project, directed by Jane Buikstra, at Chiribaya Alta and Yaral. Jessup's seriation improves on the sequence that Garcia (1988) described for the middle Osmore valley by being more rigorously developed and supported, and the resulting phases are more explicitly and systematically presented. Both Jessup and Garcia built on earlier work on the Chiribaya (Gherzi 1956; Belan 1981; Santos 1983) that did not recognize any subdivisions in the tradition at all.

Jessup identified three clusters of stylistic variation within the larger Chiribaya tradition and placed them in chronological order, starting with the Algarrobal phase, passing through the Yaral phase, and concluding with the San Geronimo phase. Jessup appears to use the term "phase" in exactly the sense that I use "style," and I retain his usage here in respect for the priority of his scholarship. In my review of some of the material on which Jessup based his seriation, as well as other Chiribaya ceramics and associations that he was unable to include, I concluded that his general results were probably correct, but found the Yaral phase to be less well defined than the other two phases, either because it was truly a transitional category, or because it served as a catch-all for vessels that were not of the Algarrobal phase, yet not clearly diagnostic of the San Geronimo phase, which it more closely resembles. In addition,

the Algarrobal phase is relatively distinct from the other two phases in terms of paste, slip, paint colors, forms, and so on, such that Algarrobal phase sherds can often be separated from other Chiribaya sherds, while the other two phases are even more difficult to separate when reduced to small fragments. Because of these classification problems, in the present work I separate the Algarrobal phase as the early portion of the Chiribaya ceramic tradition, and lump the rest together as the later Post-Algarrobal phase, acknowledging that there was probably a transition or overlap period in which vessels of both phases were produced or in use.

Pots made in the Chiribaya ceramic tradition were probably used primarily by members of one specific ethnic or political group or set of groups in the coastal Osmore valley. Chiribaya ceramics are found in a wider area, reaching from the Azapa valley in the south to the Tambo valley in the north, and well into the upper tributary drainages of the Osmore system (Belan 1981; Dauelsberg 1985; Stanish 1990a,b). While the examples from the Azapa area are stylistically distinguishable, and in fact are often referred to as "Las Maitas" style, examples from the middle Osmore and Tacna areas are very close to the coastal Osmore variant. Whether these close stylistic affinities indicate equally close social or political ties simply cannot be determined at this point, but at least within the coastal Osmore valley, Chiribaya ceramics can serve as an archaeological marker for a group or category of people who may or may not have participated in a larger community.

There are several reasons for accepting Chiribaya pottery as a marker of a distinct social group or category. First, just as I argued that the Ilo-Tumilaca/Cabuza ceramic tradition is distinct from all others in the coastal valley, so the Chiribaya ceramic tradition comprises a category of pottery that is distinct in technological, formal, and

decorative characteristics from all other styles found in the valley (Appendix C). As noted above, the one partial exception is the substantial similarity in pastes, forms, slips, paints, and finishing techniques between Algarrobal phase Chiribaya ceramics and some Ilo-Tumilaca/Cabuza ceramics. The two are easily distinguished, however, when more than the most fragmentary or simple painted design element is present. Though technologically very similar, they are quite different in decorative motifs, cannons of symmetry, delineation of design registers, and so on. This iconographic distinctness on technologically near-identical vessels is an important point that will be further explored in Chapter 7, but for the moment its significance is that the people producing and using the different ceramic styles seem to have been sharply separated, possibly explicitly and intentionally so as part of the process of social boundary maintenance (Barth 1969; Hodder 1982).

Second, Chiribaya pottery is often found in single-component habitation or burial sites that contain ceramics only of this tradition. As I argued for the Ilo-Tumilaca/Cabuza tradition, the existence of such single-component sites suggests that the Chiribaya tradition provided a complete and self-sufficient ceramic inventory, rather than comprising part of a larger assemblage that included other styles in the valley.

Third, like the Ilo-Tumilaca/Cabuza tradition, the Chiribaya tradition includes a full range of quality and elaboration from utilitarian wares to highly decorated serving vessels or display pieces. Again, the utilitarian ceramics are not highly diagnostic and are included in the present study only as counts and weights used in the midden analysis. The presence of a wide range of quality even among the diagnostic, decorated vessels suggests that the single-component Chiribaya sites were not simply

the upper or lower ends of a single valley-wide status continuum or hierarchy, either.

Finally, as I showed in the previous section, a variety of non-ceramic material cultural traits associated with ceramics of the Chiribaya and Ilo-Tumilaca/Cabuza traditions consistently contrast. Unfortunately, the Ilo-Tumilaca/Cabuza tradition is the only one of the other contemporary ceramic traditions that is sufficiently well known at this point to make such comparisons with. The contrasting non-ceramic traits discussed above include designs on the handles of wooden spoons, tomb construction, the type of ropes used to tie up mummy bundles, various textile forms and types of textile decoration, and domestic architecture characteristics including the presence or absence of heavy compound walls or fences, the presence or absence of cylindrical cane structures that might be storage features, and the size and placement of structural posts. Since each ceramic tradition corresponds to a complete and distinguishable material cultural assemblage, it seems reasonable to consider the ceramics to be markers of distinct social groups.

Like the Ilo-Tumilaca/Cabuza tradition, the entire Chiribaya material culture tradition appears to be intrusive into the coastal Osmore valley, since the known earlier coastal valley traditions are no more plausible as sources for the Chiribaya tradition than they are for the Ilo-Tumilaca/Cabuza tradition. In contrast to the Ilo-Tumilaca/Cabuza tradition, however, it is less clear specifically where the posited Chiribaya settlers might have come from, since very similar ceramics and other associated materials are known not only from the middle Osmore valley, but also from other coastal valleys to the south.

Neither the Algodonal Early Ceramic nor the BR Early Ceramic traditions are likely cultural ancestors of the Chiribaya tradition. The material cultural traits that

differ are much the same as those that made the coastal Early Ceramic traditions unlikely antecedents for the Ilo-Tumilaca/Cabuza tradition. The ceramic forms are completely different (although neckless globular ollas do rarely occur in Chiribaya utilitarian assemblages). The red slip that is totally absent in the Early Ceramic traditions is a defining feature of Chiribaya decorated wares. Sherds with painted decoration are ubiquitous on Chiribaya sites, and virtually all decorated Chiribaya vessels have two or more colors in addition to the red slip ground; only one decorated Early Ceramic sherd is known, and it has a completely different monochrome design (Appendix C).

The domestic architecture differences cited above also apply to the Chiribaya. Chiribaya sites are criss-crossed by wall trenches, often with the bases of vertical canes still standing in the fill, and posts and postholes are common. None of these features are known from excavations on Algodonal Early Ceramic style habitation terraces at both El Algodonal and Loreto Viejo, suggesting an entirely different tradition of domestic architecture. Chiribaya stone walls are dry laid or mortared, while the one excavated Algodonal Early Ceramic example was chinked with plant material. Chiribaya projectile points are indistinguishable from Ilo-Tumilaca/Cabuza points, and quite unlike the Early Ceramic concave-base style. Neither the Algodonal Early Ceramic burial mound tradition nor the presumed BR Early Ceramic graves marked with stones and smashed pots seems a likely origin for the elaborate mummy wrapping and stone tomb construction of the Chiribaya, except that some Chiribaya tombs may have had low stone rings or rectangular structures (locally called "collars") that visibly marked them on the surface.

If the Chiribaya tradition has no evident roots in the earlier coastal valley

traditions, where did it come from? The most obvious source is the same as the Ilo-Tumilaca/Cabuza tradition: the middle Osmore valley. Recent excavations by Maria Lozada (pers. com.) for Jane Buikstra's Chiribaya Project in two cemeteries at the site of La Yaral in the middle Osmore valley uncovered burials of the Tumilaca phase, Algarrobal phase Chiribaya, and Post-Algarrobal phase Chiribaya. If the coastal valley was a convenient and attractive place for Tumilaca phase people to move to, it presumably would have been just as convenient and attractive to the Algarrobal phase Chiribaya people at La Yaral or possibly elsewhere in the middle valley.

The middle valley was a likely source for the Ilo-Tumilaca/Cabuza tradition in part because the Tumilaca phase was clearly derived from the long Tiwanaku tradition in the middle valley. Arguing that Tumilaca phase people moved from the middle valley to the coastal valley did not beg the question of how they happened to be in the middle valley to begin with, because the Tumilaca phase had a long and obvious history there. The origins of the Algarrobal phase Chiribaya ceramic style in the middle valley are not so clear. In the absence of a refined absolute chronology that shows Algarrobal phase Chiribaya to have been present in the middle valley at an earlier date than in the coastal valley, or a better understanding of the initial development of the Chiribaya tradition that identifies the geographic region in which it originated, there is no obvious reason to argue that Algarrobal phase people moved to the coast from the middle valley rather than that they moved to the middle valley from the coast, or that they moved into both parts of the Osmore drainage from somewhere else entirely.

All of these geographic scenarios are possible. Chiribaya ceramics extremely similar to those found in the coastal Osmore are found in the Caplina valley (the Tacna

region), and will probably be found in the intervening Sama and Locumba valleys when more archaeological work begins to be done there (Trimborn 1975), so the valleys to the south could reasonably have been the source of immigrants who brought the Chiribaya material culture tradition to both sections of the coastal Osmore. Alternatively, the coastal Osmore valley itself could be where the Algarrobal phase Chiribaya began. The only known Chiribaya site that was evidently a center of prestige, and probably political and economic power as well, is the walled residential and mortuary center of Chiribaya Alta, perched on a prominent point on the lip of the coastal Osmore valley. Perhaps the presence of this important site suggests that the Chiribaya tradition originated in the coastal Osmore valley and spread from there.

Several arguments might be advanced to show that the Algarrobal phase Chiribaya tradition did in fact develop in the middle Osmore valley. First, despite what seem to me to be dramatic stylistic differences with extremely few transitional examples, some archaeologists have suggested that the Chiribaya style is a direct descendent of Tiwanaku models (Stanish 1989; Jessup pers. com.). If so, then the Algarrobal phase Chiribaya would have just as long a developmental history in the middle valley as the Tumulaca phase, and the middle valley would be a plausible source of Chiribaya immigrants to the coastal Osmore. Second, as noted above, the technology of the Algarrobal phase Chiribaya ceramics, including pastes, slips, paints, and forms, is very similar to that of some Tumulaca phase and Ilo-Tumulaca/Cabuza vessels; it is primarily the iconography that differs. This technological similarity to a known indigenous tradition reinforces the possibility that Algarrobal phase Chiribaya developed *in situ* in the middle valley from the same Tiwanaku antecedents as did the Tumulaca phase. Finally, much of the non-ceramic material culture found with Algarrobal phase Chiribaya pottery and Tumulaca phase pottery is the similar,

including the basic structure and assemblage of wool textiles; the use of wood spoons and *keros* (large cups); disposal of the dead as flexed, tied mummy bundles seated in stone-lined tombs with a small array of grave goods; construction of cane-walled houses, albeit of differing somewhat in details; use of small, narrow, tanged projectile points; and so on. These similarities concord with the ceramic technology to suggest that the Tumilaca tradition and the Algarrobal phase Chiribaya tradition might have developed from the same roots.

Although these arguments do tend to derive both the Ilo-Tumilaca/Cabuza tradition and the Chiribaya tradition from a common heritage, they do not actually tie the geographic location of the birth of the Chiribaya tradition to the middle Osmore valley. All would hold equally well if Algarrobal phase Chiribaya developed as a variant of the Ilo-Tumilaca/Cabuza tradition in the coastal Osmore valley, or if the Chiribaya tradition developed from Tiwanaku antecedents in one of the valleys to the south and was intrusive to the Osmore drainage.

Unfortunately, the absolute dating of the Algarrobal phase is not secure. The timing of the Algarrobal phase is based on four radiocarbon dates that were reported before the Chiribaya tradition was subdivided, and the publications do not allow the dates to be definitively associated with ceramics of the Algarrobal phase (Appendix C). Even if these dates are associated with Algarrobal phase ceramics, all four fall right around AD 1000, far too close to the estimated dates of the Tumilaca phase and the Ilo-Tumilaca style to allow any judgement of which came first. Moreover, at the moment there are no dates at all for Algarrobal phase Chiribaya material in the coastal Osmore valley, so it is impossible to say where the tradition first appeared.

This lengthy discussion of the "source" of the Chiribaya tradition has a distinctly

nineteenth-century, non-anthropological ring to it, but the purpose is theoretically sound. I made a strong case for the Ilo-Tumilaca/Cabuza tradition being introduced to the coastal Osmore valley by immigrants from the middle valley. The preceding pages should make it clear that the same process may have taken place with other immigrants who introduced the Chiribaya tradition to the coastal valley, but that they may or may not have come from the same region. If they came from somewhere other than the middle Osmore valley, then the circumstances that motivated them may have been different, although the collapse of Tiwanaku probably lead to grossly similar conditions in all the Pacific drainages. Alternatively, the Chiribaya tradition could have appeared in the coastal Osmore valley by an entirely different mechanism, the splitting off of a group from the recently immigrated Ilo-Tumilaca community there.

All of these scenarios are compatible with the gold rush effect, but some make for tidier instantiations of the model than others. Specifically, the most straightforward rendition of the gold rush effect envisions the coastal Osmore suddenly being populated by multiple groups of immigrants. The circumstances leading to the immigrants' decisions to move can most neatly be argued and treated as a unitary phenomenon if they all came from the same place, that is, the middle Osmore valley. If they came from multiple geographic sources, then a further layer of argument is required to claim that similar circumstances prevailed in all the source regions, or that the overwhelming factor was the situation in the coastal Osmore valley itself, which would have been the same for all immigrants regardless of their point of departure.

Finally, if one of the multiple groups in the valley arose not through immigration but through fission of an immigrant group, then a different extenuating argument is needed to justify fission as a process that also conforms to the model. In fact, the gold

rush effect specifies only that the psycho-rational curve is positioned unusually far to the right and that the competitive exclusion curve is relaxed, not how the resulting unusually high equilibrium group number might be attained or approached.

Immigration of multiple small groups is one obvious mechanism, but the same arguments that explained the formation of small immigrant groups also explain the tendency of immigrant groups to divide into smaller groups once they have enough members to do so.

### **Three other groups**

Three other ceramic styles that appear to be contemporary with the Ilo-Tumilaca/Cabuza and Chiribaya traditions have been recognized in the coastal Osmore. These styles may represent social groups living in the valley or on the adjacent coastline. Unfortunately, all are known only from limited numbers of examples from cemetery contexts and surface material identified at a few sites in the survey, so the inferences that can be made about them are limited. Nevertheless, the additional social groups that may be inferred from these poorly understood styles yield the highest group number recognized in the prehistory of the coastal valley, and so fit well with the predictions of the gold rush effect. These styles are similar to the Chiribaya and Ilo-Tumilaca/Cabuza traditions discussed above, and similarly have no evident antecedents in the coastal Osmore valley.

The Osmore Multicolor style and the Ilo Multicolor style were both identified by Jessup (1991) among his sample of ceramics from the cemeteries at Chiribaya Alta. Both styles are similar to Algarrobal phase Chiribaya in pastes, slips, paints, and finishing techniques, but there seem to be differences in the frequencies of some forms and plastic decorations. The diagnostic differences are in the painted decorative

motifs, which share many aspects with the Chiribaya styles, particularly Algarrobal phase Chiribaya, but also include motifs and variations that do not appear in the Chiribaya material. Both are sufficiently consistent to suggest discrete stylistic variants, rather than extremes of variation or rare types within the Chiribaya styles. Both are in the same range of elaboration, general design layout, and overall appearance as Algarrobal phase Chiribaya ceramics, and they are not particularly associated with rich or poor grave lots, so it is not likely that they represent specialized mortuary wares or valued exotic pieces acquired through long distance exchange. Jessup (1991) suggested that they might represent distinct ethnic groups living in the region, and I take the same somewhat tentative position here.

Only one example of Ilo Multicolor is known from outside Chiribaya Alta, a small, intact jar found *in situ* in an upright position in the steep slope of site 231 (Appendix F, Appendix B). It was apparently placed as an offering in a confusing area that appears too steep and rocky for habitation, yet is full of pockets of domestic midden, and is riddled with burials apparently mostly or all contemporary with the Algarrobal phase Chiribaya.

Since Ilo Multicolor has not yet been detected outside of mortuary or related ritual settings in the coastal valley, and is quite rare, the argument for inferring a local social group marked by Ilo Multicolor pottery is circumstantial and weak. Ilo Multicolor might, for example, be an exotic ware acquired from a currently unknown source outside the coastal valley. If the style does represent a local group, they must have been small in number or located outside the valley proper, for example in one or more of the small spring systems found along the coastline north and south of the mouth of the river.

Osmore Multicolor, on the other hand, was found in five separate areas in the coastal valley in addition to Chiribaya Alta. One of these areas (sites 222, 231, and 232) is located at the mouth of a major quebrada (Quebrada Ozorine) and includes numerous stone-walled habitation terraces, great amounts of domestic midden, and several areas with burials, including the one where the Ilo Multicolor vessel was found. Osmore Multicolor sherds were a small but definite component of the surface ceramics, which also included Algarrobal phase Chiribaya, Post-Algarrobal phase Chiribaya, and Ilo-Tumilaca/Cabuza material. Because of the mixed ceramics on the site, it is impossible to say whether the Osmore Multicolor ceramics were used by residents of the site, or all come from mortuary offerings mixed with domestic refuse of other groups.

A much larger Osmore Multicolor component was found at site 131, which is an extensive surface scatter of large, decorated sherds on a moderately steep slope with an extremely small amount of shell and flaked chert and no other material of any kind. There is no evidence of looted tombs, and in the absence of domestic refuse or terracing, the function of this site is a puzzle. The scatter also included Algarrobal phase Chiribaya sherds.

Site 246, a large site with numerous stone-faced habitation terraces and dividing walls, dense scatters of domestic refuse, isolated burials, and several associated agricultural terraces fed by a short canal, also has a small Osmore Multicolor ceramic component. As at sites 222, 231, and 232, however, the bulk of the ceramics are Algarrobal and Post-Algarrobal phase Chiribaya plus a little Ilo-Tumilaca/Cabuza, so the Osmore Multicolor sherds do not necessarily represent a group of people living at the site. At the remaining two sites, only one or two sherds that might be Osmore

Multicolor were found, so interpretation is difficult.

The distribution of Osmore Multicolor sherds is consistent with a discrete Osmore Multicolor social group, but not compellingly so. The lack of a single-component Osmore Multicolor site makes it difficult to rule out the possibility that Osmore Multicolor is part of the Algarrobal phase Chiribaya style. However, the fact that it only occurs at certain Algarrobal phase sites, but there in distinct quantities, suggests that Osmore Multicolor is not just part of the normal variability of Algarrobal phase Chiribaya. Instead, it appears to act as a discrete parcel, present in minor but definite force, or absent altogether. Such a pattern is consistent with a small Osmore Multicolor social group that might have shared a few sites in the valley with other groups, or occupied them before or after the other groups.

The sites with Osmore Multicolor components are scattered along virtually the entire length of the valley. At first glance, this scattered settlement pattern seems to mitigate against the idea of an Osmore Multicolor social group, since one tends to expect a discrete social group to occupy a specific territory rather than to be completely intermixed with other groups, even within individual sites. However, Ilo-Tumilaca/Cabuza and Chiribaya remains are equally intermixed both along the valley and within sites, and the arguments for their being separate, contemporary social groups are very strong (contemporaneity will be addressed below), so in this case the distribution of Osmore Multicolor ceramics is not inconsistent with the settlement pattern of a separate coastal Osmore group.

Although the Osmore Multicolor style has strong similarities to the local Chiribaya tradition, some of the motifs that distinguish it have parallels in some pieces of the Churajón style from the Arequipa region to the north (Jessup 1991; Linares

1989). Churajón is a broad stylistic term that includes a wide range of ceramics, time periods, and geographic locales, but the makers of Osmore Multicolor might have had some contact with some aspect of it, suggesting that they might have immigrated to the coastal Osmore from somewhere to the north, rather than the middle Osmore valley or the valleys to the south, which are more likely sources for the Chiribaya tradition.

One additional ceramic style was noted at site 214, located in the mouth of Quebrada de las Viboras, a large quebrada that opens into the valley roughly opposite the mouth of Quebrada Ozorine and sites 222, 231, and 232. The examples of this "Viboras" style come from tombs exposed by erosion and looted, but patches of dense domestic midden and a close examination of the geomorphology suggest that a larger alluvial fan once spread out from the mouth of the quebrada and supported a domestic occupation of unknown size, almost all of which was eroded away by a river meander and the subsequent downcutting of the quebrada. One Chiribaya sherd of indeterminate phase was noted, but the rest of the ceramics at the site seemed to be odd variants of the Ilo-Tumilaca/Cabuza style. The survey was not authorized to remove ceramics for detailed study, and only a modest number of sherds and looted vessels with diagnostic features could be examined on the site. For this reason, the Viboras style is described only in general terms. On some sherds, the red slip is unusually dark in color, some of the tazon forms (flaring straight-sided bowls) are unusually steeply everted and crudely finished, and the black line designs ranged from unusual to completely unknown. Many of the forms, colors, and motifs, though different, most resemble the more poorly made variants of the Ilo-Tumilaca style and the red slipped variants of the Ilo-Cabuza style, which is generally less elaborated and well finished than the Ilo-Tumilaca style. These similarities suggest that the Viboras style might represent a low status variant of the Ilo-Tumilaca style, or that it might fall

in the period of transition between the Ilo-Tumilaca and Ilo-Cabuza styles.

It is unclear whether the people who used these Viboras style ceramics lived at site 214, because the tombs from which the diagnostic ceramics appear to come might or might not be associated with the domestic midden. On the other hand, except for a single sherd, site 214 is a single-component site. The cemetery, if not the habitations, was used exclusively by people with Viboras style pottery. Moreover, not a single sherd identifiable as the Viboras style was noted anywhere else in the valley. This absence might be due in part to the lack of a proper description of the style, and to the style's similarity in some aspects to Ilo-Tumilaca/Cabuza and even Algarrobal phase Chiribaya ceramics. Nevertheless, if the Viboras style is present elsewhere in the valley, it must be in relatively small quantities or it would have been detected.

The presence of the Viboras style at this unique, single-component site suggests that the style was not part of the general range of variation of the Ilo-Tumilaca/Cabuza style or any other style in the valley, but rather comprised a complete and separate ceramic assemblage. A reasonable interpretation is that a distinct group of people who used Viboras style pottery lived at this single site and buried their dead there. Site 214 fits the concept of a "site-unit intrusion," with the only caveat being that there is no source region from which the presumed intrusion must have come. The style could reasonably have derived from the Chen Chen or Tumilaca phases in the middle Osmore valley, the terminal Tiwanaku or post-Tiwanaku phases of the Churajón tradition to the north, or the hypothetical Tiwanaku or post-Tiwanaku styles that presumably existed in the Sama or Locumba valleys to the south. Alternatively, the Viboras style and social group could have split off from the Ilo-Tumilaca/Cabuza tradition itself, right in the coastal Osmore valley.

None of these three minor styles are well enough known, but a reasonable case can be made that both the Osmore Multicolor style and the Viboras style mark social groups distinct from the other groups in the coastal Osmore valley. The Ilo Multicolor style might also represent such a group, but essentially the only evidence is the existence of the style itself. The Osmore Multicolor style, and to a much lesser extent the Viboras style, show some affinities with Churajón ceramics from the Arequipa area, but none of the three minor styles can clearly be shown to be intrusions from elsewhere. The important point for the gold rush effect, however, is that multiple distinct groups existed in the coastal valley, not that they did or did not literally immigrate from one or more other regions.

### **Dating and contemporaneity**

Showing that multiple, distinct groups appeared suddenly in the coastal valley is not sufficient to demonstrate that the gold rush effect could apply. The groups must have been contemporaneous, as well. Establishing the temporal relationship between the Chiribaya and Ilo-Tumilaca/Cabuza traditions was one of the major short-range goals of PCCT, and the excavation strategy emphasized numerous, widely dispersed test pits in part to maximize the chances of finding clear examples of stratigraphic superposition. That not a single pit encountered clear stratigraphic separation in any order of any of the post-Early Ceramic traditions in itself suggests that the period of multiple ceramic styles may have been relatively short, and so that the various ceramic traditions may have been contemporary.

The most solid evidence of contemporaneity are the radiocarbon dates, both published and collected by PCCT, that indicate a roughly 250 year period of

contemporaneity between the Ilo-Tumilaca/Cabuza tradition and the Chiribaya tradition (Appendix C). For the purposes of evaluating the gold rush effect, the important issue is the relationship between the early portions of each tradition. The initial portion of the Ilo-Tumilaca/Cabuza tradition, that is, the Ilo-Tumilaca style, is relatively well dated by both mortuary and domestic material collected by PCCT. Absolute dates for the initial portion of the Chiribaya tradition are a bit more inferential, but nevertheless are probably roughly correct. The two initial, intrusive styles do indeed appear to have been contemporaneous.

Other lines of less specific evidence are consistent with the radiocarbon results. Single-component sites of both styles are in a similar state of preservation, which contrasts markedly with the more buried and eroded condition of most Early Ceramic sites. The two styles are found together at some sites that are rather shallow and do not imply long or repeated occupations, which suggests exchange, coresidence, or other relations that might obtain between contemporary groups. Finally, the stylistic trends over time noted within each of the two ceramic traditions tend to diverge, that is, there is no way to arrange the styles into a single linear development. Instead, they appear to follow separate trajectories that start from relatively greater similarity and proceed to greater dissimilarity, which might be expected of contemporaneous, rather than sequential, traditions.

No radiocarbon dates are available for any of the three minor styles, but both stylistic arguments and archaeological associations suggest that they are contemporary with the Algarrobal phase Chiribaya and the Ilo-Tumilaca style. Beyond the obvious stylistic relatedness of the Osmore Multicolor and Ilo Multicolor styles to the Chiribaya tradition, and specifically to the Algarrobal phase Chiribaya, Jessup (1991)

also notes more subtle stylistic similarities between Osmore Multicolor, Ilo Multicolor, and the Ilo-Tumilaca style, suggesting that all four may have been contemporary. In contrast, Osmore Multicolor and Ilo Multicolor are distinctly less similar to the later Post-Algarrobal phase Chiribaya.

Jessup reports that whenever Osmore Multicolor vessels were found with another ceramic style in a tomb, the accompanying pieces were always Algarrobal phase Chiribaya. The various cemeteries at Chiribaya Alta vary in the ceramic styles represented, and both Osmore Multicolor and Ilo Multicolor were found only in cemeteries that also contained Algarrobal phase ceramics. The same association holds in the survey data, as well. Osmore Multicolor was found in significant quantities only at sites that also had Algarrobal phase Chiribaya, and generally Ilo-Tumilaca/Cabuza style pottery as well. The one example of Ilo Multicolor identified on the survey was also at a site with a large Algarrobal phase Chiribaya component. This consistent association concords with the stylistic evidence to suggest that the Osmore Multicolor and Ilo Multicolor styles were both contemporary with the Algarrobal phase Chiribaya, and by extension with the Ilo-Tumilaca style.

The Viboras style is the most difficult to date. There are no radiocarbon dates for it, nor are there any associations with other styles. The only clues are in the style itself, which is clearly a variant of the Ilo-Tumilaca/Cabuza style. The tazon form (everted straight-sided bowl) seems to be a generally early form in both the Ilo-Tumilaca/Cabuza and Chiribaya traditions, because it is characteristic of the Ilo-Tumilaca style but rare in the Ilo-Cabuza style, and is occasionally found in Algarrobal phase Chiribaya material but never in Post-Algarrobal phase Chiribaya. Tazones are common among the Viboras style vessels, which suggests that the Viboras style might

be contemporary with Algarrobal phase Chiribaya and the early part of the Ilo-Tumilaca/Cabuza tradition. As noted earlier, the colors, finishes, and black line designs of the Viboras style seem to have affinities with both the more poorly made Ilo-Tumilaca pieces and the red slipped Ilo-Cabuza style, which might place the Viboras style as contemporary with the transitional period between Ilo-Tumilaca and Ilo-Cabuza. If so, the Viboras style could be fully contemporary with the other styles, or it could have originated slightly later than the others. In the absence of more conclusive evidence, the best hypothesis is that the Viboras style was probably contemporary with the other four styles for at least part of their duration.

### **The new niche**

If my reconstruction of the period prior to the collapse of Tiwanaku is correct in the claim that the coastal Osmore was nearly empty, then showing that a new social and ecological niche was exploited by the various new groups in the valley is almost trivial. The post-Tiwanaku Osmore valley supported a much larger number of people than it had perhaps only a generation or two before. Either some change dramatically increased the carrying capacity of the valley, or the potential of the valley had been grossly underexploited before. In either case, the simple fact of significant immigration into a virtually empty region implies that an unoccupied social and ecological niche was being filled, and the gold rush effect can reasonably be invoked to describe the process.

Ideally, this argument would be bolstered by a comparison of the subsistence strategies of the immigrant groups and the people of the immediately preceding period. Unfortunately, the BR Early Ceramic is known only from surface collections, so the comparison can only be made at a general level. The settlement pattern alone,

however, does suggest a difference in emphasis, if not kind, between the subsistence strategies of the BR Early Ceramic and the various immigrant groups. The known BR Early Ceramic sites are all found within about five km of the coast, and all but one of the sites are located up on the rim of the valley, while only one is located on the margin of the floodplain. This choice of site locations is dramatically different from that of all the other social groups recognized in the valley, which all concentrate along the margin of the floodplain and are dispersed along the entire length of the coastal valley. As I argued earlier, this difference may correspond to a relatively greater reliance on resources of the *lomas* (fog vegetation) zones found on the coastal strip of pampas and hillsides to the north and south of the valley proper. The *lomas* supported small populations of game, various edible plants, and land snails that may have been eaten, and would have provided good forage for any camelids that the BR Early Ceramic people may have kept. The accessibility of marine resources may also have been a more important consideration for choosing BR Early Ceramic sites, although only insignificant amounts of shell are visible on the surface of these sites.

Every other group known in the coastal valley clearly located sites to have access to the valley bottom and adjacent irrigable river terraces, and excavation shows that they all consumed considerable quantities of corn, beans, and tubers, which indicates at least a partial reliance on farming (Appendix E). Except for sites within a km or two of the coast, which predictably have large quantities of shell and fishbone among the domestic debris, unsystematic examination of exposed middens located during the survey suggests that all the post-Early Ceramic floodplain margin sites had broadly the same subsistence patterns. Valley bottom farming and camelid herding is what all these sites had in common, while marine and *lomas* resources evidently were less important, since sites too far away to exploit them directly are not different in any

obvious respect.

Finally, the Ilo-Tumilaca/Cabuza and Chiribaya groups depended in part on a long canal that irrigated terraced fields on several slopes and river terraces elevated above the valley floor. Both Ilo-Tumilaca/Cabuza and Chiribaya sites are directly associated with the canal, in several cases bounded by it but not crossing over into the irrigated area, which suggests that the canal, fields, and sites were in use at the same time and immediately adjacent to each other. The irrigated fields are all located from about four to nine km upriver of the most inland BR Early Ceramic sites, which suggests that the BR Early Ceramic people did not place their sites in order to be near the canal, and probably that the canal did not yet exist. If so, the canal constitutes a new subsistence technology that probably opened up a new irrigated agriculture niche or greatly expanded the existing one in the coastal valley.

All the conditions for applying the gold rush effect seem to have been met in the post-Tiwanaku coastal Osmore drainage. Perhaps five distinct social groups appeared suddenly and at about the same time in the nearly empty valley, apparently exploiting a new social and ecological niche different from that of the scanty existing population. This proliferation of groups is exactly the expected gold rush effect that results when a niche opens or greatly expands. All that remains to explain is how and why a new social and ecological niche opened in the coastal Osmore valley. I suggested above that the trigger may have been the reduction in irrigated area in the middle valley that accompanied the collapse of local Tiwanaku control. Ortloff (1993) has documented significant precipitation changes in the altiplano at around the same time, to which he attributes the failure of Tiwanaku's agrarian heartland and, in turn, its urban capitol. These changes might have affected the hydrology of the Osmore basin in complex

ways, as well. Alternatively, there may have been social or political barriers to exploiting the coastal valley that were removed when the Tiwanaku state collapsed, opening a new niche by purely social means. In any case, both the particular events and the general process in the coastal valley at the collapse of Tiwanaku have been well demonstrated. It remains for future research to determine their ultimate causes.