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Garth Bawden
University of New Mexico, gbawden@unm.edu

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SETTLEMENT SURVEY AND ECOLOGICAL DYNAMICS ON THE PERUVIAN SOUTH COAST

Garth Bawden
Maxwell Museum
University of New Mexico

Introduction

In recent years archaeologists have enthusiastically endorsed the model of Southern Andean ecological complementarity in which permanent colonies, separated from their nuclear communities but maintaining ethnic and social links with them, exploited a diverse range of environmental zones, constituting a vertically-ordered "archipelago" (Murra 1972, 1976, 1985). Acceptance of this model has been increasingly accompanied by research in the region in which verticality has been most clearly demonstrated, namely southernmost Peru, the contiguous area of northern Chile and the Titicaca Basin and its environs (Masuda *et al.* 1985). Given the fact that the Titicaca Basin is the best known archaeological zone in the region, that its monuments far surpass all others in elaboration, that expressions of its material culture appear throughout the region, and that historical documents suggest its "nuclear" status in the vertical archipelago pattern, it is natural that scholars have assumed a dominant role for the Basin throughout the prehispanic period. Conversely other regions, including the coastal zone and mountain valleys, are assumed to have been politically and economically subordinate in the vertical relationship as befits their primary role as subsistence resource donors. Little room is left in this model for the emergence of strong and autonomous local societies exercising control of their own territories and broader subsistence systems.

An alternative view that does admit the possibility of regional development is that propounded by Maria Rostworowski de Diez Canseco. Working primarily from historical information on the late prehispanic populations of the Peruvian central and north coast she sees a quite different interactive pattern (Rostworowski 1970, 1975, 1977). According to this model, coastal groups from Ica to Piura were able to obtain an abundant living for themselves from the complementary subsistence resources provided by the sea, the littoral, and irrigation agriculture in the river valleys in addition to trade with distant highland and tropical forest groups for exotic and ceremonial commodities. In this model, political power in the coastal valleys was wielded by local lords under whose control specialist fishers, farmers, and merchants produced and distributed their regional resources largely independently of highland polities. To date, however, there has been little archaeological investigation of this model for the pre-Incaic period and none on the south coast of Peru (although see Shimada 1987 for general discussion of the relative importance of lateral and vertical interaction in the far northern Peruvian coastal area). The present study presents the results of two seasons of research in Southern Peru and discusses their implications for further refining the prevailing concepts of ecological interaction in the light of the two conflicting models.

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Archaeological Setting

The southernmost coast of Peru has received only sparse archaeological coverage relative to the nearby highlands and the north coast of Chile. A number of surveys in the coastal valleys (Vescelius 1960; Flores Espinoza 1973, 1979; Trimborn, 1973a, 1973b, 1975, 1977, 1978, 1981; Kleeman 1975, 1981) have indicated that the zone generally participated in the interaction spheres of the Titicaca Basin at least from the time of Tiwanaku domination of the region. However, until very recently little was known of pre-Tiwanaku occupation of the area. Moreover, the most prominent post-Tiwanaku culture, Chiribaya, has largely been represented as an accomplished expression of polychrome ceramic decoration with little real understanding of its related settlement configuration, cultural affiliations, or stylistic development. Further south, the northern Chilean sequence has been much refined (i.e., Berenguer 1978; Berenguer et al. 1980; Rivera 1975, 1976a, 1976b, 1977, 1980; Mujica 1981, 1985; Muñoz 1983). An important aspect of the resulting archaeological picture is its indication of the intrusion of successive waves of highland influence of varied form spanning the long period from Pukara (ca. 300 BC) to Inca (ca. AD 1470) times.

Recent research (1983) in the mid-Osmore drainage by the author in collaboration with Drs. Michael Moseley and Luis Watanabe (Bawden 1988) together with more current work (Goldstein and Feldman 1985), has expanded the archaeological picture in the highland zone adjacent to the present study area. Survey and excavation in the Moquegua Valley and its tributaries produced a cultural sequence in which highland influence was prominent from pre-Pukara times on. Most impressive was the Tiwanaku presence with a number of large settlements reflecting direct domination by the Titicaca Basin polity. Following the collapse of this hegemony, other less centralized influence continued in the immediately pre-Inca period (Stanish 1985); significantly, this was accompanied by coastal presence represented by a Chiribaya occupation, centralized highland domination being re-established by the Inca in the fifteenth century.

In general the results of our work in Moquegua supported the verticality model. Perhaps its least expected feature was the strength of upward coastal intrusion into the Moquegua Valley whose lower extremity lies approximately 50 km inland. Not only did this appear in the form of exchange or diffused items such as Gentilar ceramics (known through the northern Chilean sequence) but also as large-scale settlement represented by the Chiribaya sites of Yaral (1000 meters above sea level), La Victoria (1500 meters above sea level), and smaller contemporaries. Commencing in 1986 the current phase of research on the coast was initiated with full expectation that our Moquegua results would be in large part replicated and the verticality model confirmed. As we shall see, the actual results did not fulfill these expectations, instead reflecting a very different ecological pattern.

Study Area

The 1986-1987 study area is located immediately north and east of the port of Ilo (Figure 1), incorporating a series of spring-fed "oasis" located along the coast and the Rio de Ilo, the lowest portion of the Osmore drainage. Specifically, intensive settlement survey with preliminary excavation concentrated on

the Carrizal spring complex 20.5 kilometers north of Ilo. Adjacent spring areas and the Ilo Valley were less intensively surveyed as a complementary component of this research.

The Osmore drainage is characteristic of the far south coast of Peru, comprising a deeply entrenched valley that permits significant agricultural activity only in its middle Moquegua section above 1000 meters and in the lowest coastal segment, the Rio de Ilo, below 300 meters. In this lowest course the river passes through the coastal mountain range in a narrow valley bounded by steep slopes and provides water for moderate cultivation, nowadays chiefly of olives for commercial purposes. The presence of agricultural terraces along the northern side of the valley gives clear evidence of more extensive agriculture in prehispanic times.

On the coast north of the river mouth a series of springs emerge below 300 meters, providing the only source for fresh water and agriculture in an otherwise arid environment whose only other vegetation is represented by fog-derived lomas growth. Recent work by Moseley (1988) shows that these specialized agricultural systems nowhere exceed fourteen hectares and are fed by intricate canal complexes. All springs are characterized by small volume and slow flow, necessitating the impounding of water in massive tanks whose periodic and sudden emptying generates the velocity needed to propel water through the longer canals to the more peripheral fields. These restricted water sources have supported flourishing agricultural communities for many centuries. In addition, they represent one vital link in a micro-environmental chain that encompassed a range of coastal subsistence zones and human adaptive techniques.

The Carrizal irrigation system, the focus of research, has been operating at least from the later pre-Incaic period to the present. The springs originate near the point of junction between the drainage basin and constricted *quebrada* channel, the central feature in a topographic micro-system that extends from the westernmost mountain foothills to the sea (Figures 2 and 3). The inland border of this system is represented by the slopes of the coastal range, today still dotted with the remains of *yura* trees, in earlier periods supporting more extensive stands of open woodland. From these hills the terrain slopes westward across a plain, broken by deep channels the catchment basin of the Carrizal drainage system. This plain supports substantial *lomas* growth in wet years and investigations suggest that this was thicker in antiquity. The drainage basin narrows towards the west and terminates in a deeply indented canyon that carries its accumulated catchment down to a fan shaped run-off delta that slopes down to the sea.

These various topographic zones in combination form an ecological micro-system whose components provide the basis for distinctive, complementary subsistence activities. The higher eastern elevations supported a hunting and gathering economy in the earliest periods and provided at least intermittent grazing for herds of llama, cattle and goats in later times. In the spring system itself, the permanent water supply allowed the development of widespread agriculture in the run-off delta. Finally, the sea and adjacent littoral were the setting for intensive marine subsistence exploitation in all periods.

Research Aims

In general terms the goals of this preliminary research involved gaining knowledge of the cultural associations of the Carrizal system and its neighbors through time, thus to complement Moseley's work on the technological aspects of the agricultural complexes, and to use this information to examine the nature of ecological adaptation on this segment of the coast. On a broader level this information, supplemented by more intensive research in the Ilo Valley and combined with the results of work in the Moquegua region and elsewhere will allow a better understanding of the interactive patterns operating in this important area of the South-Central Andes.

More specifically, we proposed to survey the entire Carrizal system and its environs in order to reconstruct its settlement configuration in both synchronic and diachronic dimensions. Following from this work, we intended to examine this space-time pattern in its wider environmental setting, thus to draw preliminary, testable conclusions regarding the ecological adaptive strategies employed first in this environmental micro-system and, by projection, in the wider coastal context. The second phase of research involved broader survey along the coast and the Rio de Ilo. The organization of this article reflects the varied emphasis of our work to date. The Carrizal spring system, the focus of the most intensive research and, secondarily, the nearby Pocoma system, provide the information necessary for preliminary understanding of the area immediately adjacent to the sea. I shall present the results of the spring system research first. Following this section I shall briefly present the results of preliminary survey in the Ilo Valley, the coastal section of the Osmore drainage.

Research Methodology

Initial reconnaissance utilized stereoscopic examination of air photographs of the study area. All settlements so identified were checked by on-ground survey. In addition, walk-over survey revealed other occupations possessing little surface evidence. Given the time strictures of each season, the extensive survey area and the need to optimize coverage, we formulated a complementary excavation strategy so as to maximize data recovery. Thus, where available, naturally eroded *quebrada* faces, old bulldozer cuts, and looted areas were cleared and profiled where they contained cultural refuse. Elsewhere, small exposures and shovel pit transects were used to explore settlement content, cultural affiliation, and boundaries. Surface scatters were collected and all intact architectural features as well as excavation cuts were mapped and drawn. Study of ceramic, textile, and subsistence collections allowed us to assess cultural and behavioral affinities of their associated occupations. The final Carrizal settlement pattern, as reconstructed by this strategy, was plotted on the general site map (Figure 4).

Concurrent with the focal Carrizal investigations, we initiated settlement survey in the Ilo Valley and other coastal areas. While much remains to be done in these areas, a considerable amount of information has already accumulated, permitting the formulation of broader questions regarding prehispanic human occupation in the region.

Findings from Settlement Survey

The preliminary Carrizal settlement map, incorporating the previous hydraulic and agricultural survey of Moseley as well as the 1986 and 1987 settlement survey is shown on Figure 4. While we expect that some revisions will be necessary on the basis of future work, the general culture historical configuration is becoming clear and is presented here. For descriptive purposes this material is organized into four major phases: Preceramic, Early Precolumbian Ceramic, Late Precolumbian Ceramic, and Spanish. The first two of these phases must at present be regarded as catch-all categories whose detailed cultural history and related processual character awaits further work. In the case of Preceramic occupation, ongoing work at the Ring Site south of Ilo (Sandweiss *et al.* 1988) is aiding the development of a chronological framework. The Early Ceramic Phase, although still indistinct, is now taking shape as a tangible expression of long-persisting coastal adaptation, the necessary ecological forerunner to the better known cultures of the later precolumbian period. The Late Ceramic Phase is associated with the relatively well-known Chiribaya culture and the extensive agricultural systems of the coastal springs and the Ilo Valley. In addition, I shall relate the previously unsuspected presence of specialized fishing communities of different cultural affinity to this late period. Finally, the Spanish phase, or period, is represented by a series of sites of various types that reflect the major changes in economic and demographic patterns initiated by European contact. In this study, reflecting my principal research interest, I shall concentrate on the two precolumbian ceramic phases, the material expressions of indigenous sedentary occupation on the coast.

Preceramic Phase

Preceramic occupation at Carrizal has been located in all environmental micro-zones. Extensive shell and lithic scatters whose total lack of ceramic content strongly supports this cultural affiliation crown the ridge that borders the main quebrada channel and lower drainage basin east of the canyon (Figure 4: Sites 55, 75), while continuous and deep midden deposit, now truncated by run-off erosion, covers a 420 square meter area terrace on the other side of the canyon (Site 53) and in a more scattered pattern the ridge above it (Site 74). These settlements are ideally located to exploit the faunal and floral resources of the lomas while standing near a permanent water source less than two kilometers from the sea. Midden excavation clearly demonstrates that all of these subsistence sources were being utilized with a large variety of marine and terrestrial remains appearing in the refuse.

Comparison of the various inland settlements also suggests a behavioral difference. The extensive superficial ridge-top scatter (Figure 4: Site 75) reflects long-term transient hunting and camping, while the nearby intensive midden deposits of Site 53, and to a lesser extent Site 74, better represent permanent occupation nearer to the springs.

Elsewhere, as would be expected, preceramic settlements occur immediately behind the shoreline (Figure 4: Sites 72, 73, 83, 84). These are small in size, contain generally-thin deposits of midden with an overwhelming preponderance of shell, fish, and sea mammal bone and only a minor occurrence of terrestrially-derived food. There is little doubt that these littoral sites represent a series

of small semi- or fully-sedentary villages whose location is determined by their chief activity--the gathering of marine food resources. It should be noted that no preceramic occupation has been identified on the lower run-off delta west of the area of later agricultural disturbance, even though it can be assumed that a small spring-fed stream flowed across the area. This absence is most feasibly explained on the basis of selective exploitation, a topic to which I will return later, although it must be admitted that wind-caused surface deflation is a possibility in this respect.

Early Precolumbian Ceramic Phase

The ceramic inventory of the Carrizal spring system prior to the better known Chiribaya style is represented by a complex of coarse, mineral tempered, undecorated wares whose dominant form is the neckless olla (Figure 5). Several occupation sites containing these wares have been identified in all environmental micro-zones (Figures 4 and 6: Sites 51, 55, 70, 76, 81, 82). Of these, Site 55 is a stratified, multi-component site (Figure 7). A radiocarbon sample taken from the middle stratum of this site--the Early Ceramic Phase stratum--yielded a date of 2140 ± 240 BP or 190 ± 240 BC (Beta 20905). Site 51 has been described by Bolaños (1987: 21-22) as a very disturbed domestic component whose ceramic inventory included a majority class of neckless ollas but also a strong secondary group of open bowl forms. The remaining sites (Figure 6: Sites 70, 76, 81, 82) display varying degrees of surface erosion and generally poor organic material preservation. Site 70 represents the best preserved occupation and contains approximately one meter of stratified midden from which portions of two corn cobs were recovered. Comparative examination of the rim forms from the Early Ceramic phase sites strongly suggests that their associated pottery in fact reflects a long process of formal evolution, the shapes from Site 76 exhibiting considerably more variety than those of other sites from which meaningful collections were recovered (Sites 51, 55, 70); in Site 76, small bowls, necked jars, and strap-handled vessels appear as significant secondary components even though the neckless olla remains the dominant form.

Elsewhere, the remains of an Early Ceramic Phase site has been identified in the large Pocoma spring system north of Carrizal (Figure 1). This site is located approximately three kilometers inland, directly adjacent to the chief spring source. While badly disturbed by later olive cultivation, this site exhibits the same locational and formal traits as the Carrizal sites of the early phase with abundant domestic refuse and an undecorated ceramic inventory dominated by neckless ollas and open bowls. Finally, in 1987 an undisturbed cemetery of this phase was discovered in the hills overlooking the small Wawakiki spring complex 3.5 km north of Pocoma (Houghteling and Bawden 1988). Burials contained individuals wrapped in matting and lying on their sides in a simple flexed position and accompanied by large neckless ollas (Figure 8). One of these ollas was decorated with blue hematite-based mineral paint and is the only decorated vessel of the Early Ceramic Phase yet recovered (Figure 9). A radiocarbon sample taken from burial wrapping produced a date of 1610 ± 70 BP or AD 340 ± 70 (Beta 25384).

This growing inventory of Early Ceramic Phase sites along the coast together with the formal variation of their ceramic contents and chronological placement permits us to posit the existence of a long pre-Chiribaya coastal

tradition. The ecological contexts and related adaptive strategies represented by the early phase site distribution suggest that this tradition was characterized by a pattern of differential, complementary resource exploitation. Site 76 at Carrizal, like its preceramic predecessor Site 75, is ideally located to exploit the hunting and gathering opportunities furnished by the lomas growth of the drainage basin and adjacent hillslopes and plains. Additionally, Site 55 is located on the inland fringe of the irrigable area allowing easy access to both drainage basin and delta agricultural land. These sites are smaller and more compact than the preceramic Site 75 and contain considerable domestic midden, suggesting that they were formal residential occupations rather than temporary camp and work scatters. However, while the form of these inland settlements can be seen to have changed, their location suggests continuity of basic subsistence patterns.

Elsewhere in the Carrizal system there is considerable occupation adjacent to the canyon itself (Figure 6: Site 51), a pattern which is also indicated at Pocoma by the presence of a badly disturbed Early Ceramic phase site near the main spring source. In addition, occupation of this phase flanks the course of the stream that flowed from the springs across the run-off delta (Figure 6: Sites 70, 81, 82), an area apparently devoid of settlement in the preceramic phase. Site 51 crowns a hill and adjoining ridge and contains extensive remains, chiefly domestic in nature. Site 70 is a large domestic occupation overlooking the run-off channel from the north, while Sites 81 and 82 are part of a continuous occupation that spans the channel in its lowest delta section nearer to the shore.

It is logical to assume that Sites 51 and 70 were located near the spring sources and the adjacent part of the run-off plains so as to be close to irrigable land. While the extensive later Chiribaya terraces would have obliterated their Early Ceramic predecessors, the presence of early ceramics in the fields near these sites and carbonized maize cobs in their middens mark this formative stage of agriculture. The lower delta settlement (Figure 6: Sites 81 and 82) on the other hand, while still in close proximity to agricultural land, is also well suited to utilize the nearby marine environment, continuing this specialization from earlier times. The recovery of fish hook fragments from the surface of these sites may well reflect this activity. On a broader level, we see in this period of cultural development an emerging pattern of specialized exploitation that is characteristic of this coastal region.

Late Precolumbian Ceramic Phase

The later precolumbian ceramic inventory along the coast is dominated by the Chiribaya style (Figure 10). This polychrome style is the ceramic expression of a distinctive coastal culture that appears to have been less affected by influence from neighboring areas than we had previously supposed. Specifically, the unexpected absence of Tiwanaku occupation along the coast north of Ilo, together with the lack of any evidence for the presence of pre-Tiwanaku highland cultures, contrasts markedly with the Moquegua Valley and underscores the relative strength of indigenous coastal development. Moreover, the apparent sequential relationship of Chiribaya and the Early Ceramic complexes discussed above, with no intervening cultural phase that corresponds to the highland

valley Tiwanaku periods, raises the possibility that the Chiribaya culture possessed origins in a long, local, coastal tradition.

Chiribaya settlement at the Carrizal spring system reflects a more restricted utilization of the various available micro-zones. Residential occupation with domestic architecture and deep midden deposition occurs only in the direct vicinity of the springs and their associated field complexes. Site 55 (Figures 6 and 7), occupied during the earlier periods, continued in use, its stratified deposits graphically demonstrating the sequential juxtaposition of the Carrizal precolumbian cultural phases. I have already noted that the location of this site near the springs enabled easy exploitation of the resources of the higher terrain to the east--the drainage basin and the inland hillslopes--as well as the irrigable run-off plains near the coast. However, by contrast to the Earlier Ceramic Phase there is no conclusive settlement evidence to show that the Chiribaya population was significantly utilizing the inland zone. The dominant settlement type in the drainage basin is the stone enclosure or corral. Corrals (Figure 4: Sites 54, 77, 78, 85) appear to date chiefly to the Spanish period judging from their association with majolica and wheel-turned pottery. However, the presence of camelid excrement in one corral (Site 54) which possesses no related pottery does at least raise the possibility that herding in the basin dates to the later precolumbian period. This suggestion must obviously remain extremely tentative at present, all evidence strongly indicating that the exploitation of the inland zone was only a minor component of Chiribaya subsistence strategy.

Further west, the Chiribaya period hydraulic distributive system reflects increasing technological refinement, employing catchment tanks and canals that greatly expanded the area that could be used for agriculture and leading to significant modification of the settlement pattern in the run-off delta. Thus, an extensive system of agricultural terraces spreads fan-like from the spring sources westward across the delta (Figures 2 and 3). Chiribaya domestic occupation accommodated to this pattern, shifting from the ridges that directly overlooked the springs into the agricultural area, where it comprised small clusters of dense occupation located wherever possible on natural terraces adjacent to the fields (Figures 3 and 6: Site 56). Further north along the coast neighboring spring systems display the same Late Ceramic Phase development. Thus, a succession of spring-fed irrigation complexes extend from their respective water sources down toward the shore providing the setting for widespread field terraces and associated intensive Chiribaya settlement.

It is significant that the development of intensive irrigation-based agriculture appears to have occurred concurrently with even greater micro-environmental specialization along the coast. On the northern periphery of the Carrizal system there is a small settlement standing on a low bluff beside a bay (Figures 3 and 6: Site 71), a location that would have provided relatively sheltered landing facilities for boats. Excavation at the site revealed substantial midden and, importantly, an elaborate and specialized fishing tool inventory including stone harpoon points, bone harpoons with copper tangs, floats, and composite fish hooks (Figure 11). A second site (Site 86) of identical form and content stands by the shore approximately three kilometers farther north. Ceramics associated with both of these sites are of a style that is non-Chiribaya (Figure 12). Analysis indicates that these ceramic components are of the San Miguel phase

of the northern Chilean cultural sequence (ca. AD 1000-1400). It thus seems that these small fishing sites represent the northern portion of a specialized intercultural economic system that extended far beyond the local area.

We can conclude that the development of elaborate irrigation agriculture during the later precolumbian cultural phases did not, as might be expected, lead to lower utilization of other resources. In fact, the evidence to date suggests the contrary, at least along the coast where the technology of marine exploitation was progressively refined and specialization of economic production became even more evolved. The appearance of non-local fishing communities near Ilo adds a further dimension to the regional adaptive model, one not present in the Early Ceramic Phase. Clearly, the pattern of interdependent micro-environmental complementarity on the coast and its immediate hinterland continued to develop throughout the entire precolumbian period.

Before closing this summary of the Late Ceramic Phase occupation of the coastal area, it is pertinent to mention the nature of the Inka presence. In fact, it would be more accurate to describe the Inka occupation as a virtual non-event, at least archaeologically. A single small site, partially eroded and consisting of a surface scatter of shell in which a few Inka decorated pottery sherds occur, is located just above the beach about five kilometers south of Ilo. The location and composition of this site suggests that it was associated with marine exploitation. Indeed, the site may represent a local successor to the San Miguel settlements described previously with the ceramic component merely marking the broader influence of the dominant regional political authority and not actual Inka occupation. Otherwise, there is no known Inka site west of the upper Moquegua drainage where the administrative center of Torata Alta dominated the route to the *altiplano*.

Spanish Phase

Although this study concentrates on the precolumbian period, a brief summary of the post-Conquest occupational pattern is important in order to understand on-going cultural process. Several changes characterize the shift to Spanish rule. The Chiribaya agricultural system, based on maize, was replaced by a "hacienda" economy oriented almost solely to olive production, reduced in area and tended by a small work force. Concomitantly, large-scale population ceased in the area with a minor domestic presence located on the periphery of the new plantation giving evidence of the new demographic situation (Figure 4: Site 52). The subsistence needs of this small work force shrank with the population size and no longer sustained specialized occupations along the shore or inland from the springs, although a small additional and temporary plantation facility was developed along a higher spring level roughly three kilometers inland from the Carrizal springs (Figure 3: Site 85).

By contrast to this general reduction in formal occupation, increased use of the inland drainage basin is reflected in the numerous corrals built there in the Spanish period (Figure 4: Sites 54, 77, 78). This construction may possibly have been related to mule breeding. In addition, there can be little doubt that herds of cattle and goats were brought from the highlands during wet years. It appears, then, that with the incidence of Spanish control, changes in land use, population size, and associated subsistence needs resulted in major disruption of

the precolumbian pattern, although there is still abundant indication of the persisting functioning of environmental complementarity in a less locally-specialized form under the new system.

Preliminary Survey in the Ilo Valley

As noted previously, the preliminary nature of survey in the Ilo Valley has to date permitted the formulation of only the most general cultural framework for this important area. The circumscribed topography of the valley, bounded as it is by sheer cliffs, determined that the limited but potentially fertile lands flanking the river would form the context for intensive settlement based on irrigation agriculture whose associated canal systems can still be seen. Thus, the general configuration of the Ilo Valley is one of large settlements that physically overlap each other, resulting in numerous multi-component archaeological sites, a pattern quite different from that of the spring systems. This pattern, with its inevitable destruction of earlier sites by coterminous later settlement, has made it difficult to identify early settlement through surface survey. Consequently, present knowledge of Early Ceramic Phase occupation is limited to a single site located on the northern fringe of the valley roughly six kilometers inland from the river mouth. This is a badly disturbed residential site containing the same dominant neckless olla pottery forms that characterize coastal settlements of this period. It is to be assumed that other settlements of the period were sited so as to utilize the agricultural potential and abundant water resources of the river, that is, in the disturbed valley bottom. Very little else of a meaningful nature can be stated regarding the early occupation at this stage.

Elsewhere, in the upper part of the valley, archaeological sites are more densely spaced, reflecting the smaller area available for settlement. A more complex occupational pattern characterizes this narrow inland segment of the valley. While Chiribaya ceramic presence is widespread in both residential and burial settings, it is thoroughly mixed with other styles. These non-Chiribaya styles (Figure 12) display various features that are in the most general sense similar to other late precolumbian painted wares of the South-Central Andes. However, in detail they differ greatly from both the Titicaca Basin-derived highland tradition and the coastal Chiribaya style and must be regarded as distinct from either. While their specific shared motifs may well reflect the transmission of decorative attributes throughout the broader region, it would be far outstripping the evidence to interpret such general traits as the result of direct or profound cultural impact. Certainly, there is no sign to date of the prominent ceramic and architectural intrusions that mark Tiwanaku presence in the Moquegua Valley area. Surprisingly, even survey at Loreto Viejo, the best-known example of a Tiwanaku site on this part of the coast (Kolata 1983: 264) has to date only revealed the same mix of Chiribaya and non-Chiribaya painted pottery that characterizes the entire valley.

On the basis of this preliminary work it is probably correct to regard the Chiribaya style as representing the latest indigenous precolumbian occupation of the valley. However, it is clear that in much of the area Chiribaya occupation did not exist in isolation but shared the valley with other cultural groups whose closest ceramic stylistic affinities appear to be with the later phases of the

northern Chilean sequence, especially Las Maitas and San Miguel (ca. AD 700-1400, Figure 12). While at present the precise time depth of these Ilo Valley occupations is uncertain, deep residential deposits were revealed by test excavation in the large multi-component site of La Florida in the upper valley (Figure 1). La Florida possesses a stratified sequence of Chiribaya pottery in which stylistic change appears, earlier decoration being simple and bichrome, later decoration more elaborate and polychrome. Elsewhere at the site Las Maitas-like pottery is present in the deeper levels. Obviously, it is premature to posit any elaborate conclusions regarding the relationship of these various cultural components on the basis of these preliminary excavations. Nevertheless, it can tentatively be suggested that a considerable time depth is represented by the Chiribaya component of La Florida and that for part of this period the local Chiribaya population co-existed with another cultural group originating from further south.

Summary of Results and Interpretations

This research has produced findings on two significant levels. First, we are now in a position to understand the various mechanisms that together allowed the formation of a coastal ecological system which to a large extent was separate from that of the highlands in terms of economic potential and cultural association. Second, our work has produced the beginnings of a culture historical sequence for the region, a sequence that, based on present evidence, is much more complicated than originally foreseen. These two levels of findings are summarized below.

Coastal Ecology

It is clear that the environmental and topographic configuration of the coast formed the setting for a complex subsistence system. The several components of the physical environment coastal mountain slopes, *lomas* plains, water courses, littoral and sea together offered coastal populations a varied and intensive nutritional potential that largely obviated any need for wider economic interaction. We see both at the coastal spring systems and in the Ilo Valley extensive canal-fed field systems adequate in size for providing the basic food requirements for their related populations. Abundant maize remains demonstrate that this staple was produced in large quantities in the later periods. For the Early Ceramic Phase where preservation is not nearly as good, agricultural activity is indicated both by the distribution of the related settlements and by the presence of numerous carbonized corncobs in their midden deposits.

Complementing this basic agricultural economy, specialized shoreline communities exploited the marine resources throughout the precolumbian epoch, as evidenced by the intricate tool kits seen in later period sites and the large shell middens characteristic of the earlier coastal settlements. The inland areas of *lomas* were heavily utilized for hunting and collecting in the earlier periods. Even today *lomas* stands extend to the lower hillslopes and, prior to recent industrial contamination, regularly flourished closer to the shore. The intensity of shell and lithic scatters throughout this area and the location of substantial settlement at its periphery, at times at a considerable distance from spring water, underscores the importance of this inland activity. Finally, herding

became a major factor in the Spanish period and may have possessed precolumbian roots as a coastal activity.

These varied ecological elements cumulatively represent a stable coastal subsistence sphere whose several interdependent resource zones were intensively utilized by technological and occupational specialization. Such a pattern suggests that we must revise our traditional conception of the coast as merely the lowest link in an interactive Andean economic system conforming to a simple model of verticality and accept the probability of coastal self-sufficiency and related autonomous cultural development. Certainly, the evidence to which I now turn supports this interpretation.

Cultural Patterns

The 1983 survey by Bawden and Moseley and subsequent work in the Moquegua drainage illuminated a close and long-lasting relationship between the area and the highlands which dates at least to the Pukara culture. This relationship was especially close during the period of Tiwanaku expansion in the later first millennium AD when direct political domination of the lower zone is reflected by Tiwanaku 5 ceramics and corporate Tiwanaku architecture. In the post-Tiwanaku period the picture is less clear. However, although the ethnic origins of the dominant Estuquinia culture is a matter of some disagreement, there appears to have developed a pattern of archipelago-like highland colonization, first in the Osmore Valley, later by Lupaqa colonies throughout the region. This interaction took place within an economic context in which highland polities exploited the produce of the lower Andean zones.

On the basis of this firm evidence of vertical interaction, we assumed that the coastal survey would replicate the same pattern. However, this has proven not to be the case. Contrasting dramatically with the Moquegua situation, signs of direct highland presence are, at best, ill-defined. Indeed, there is a much stronger indication of direct coastal (Chiribaya) intrusion into the Moquegua Valley than the reverse. The situation along the coast and in the lower Ilo Valley--and most visible in the Carrizal spring system--actually illustrates a relatively independent development. Following a long preceramic phase which is most visible near the coast, an early ceramic-producing culture emerged in the later first millennium BC. Most sites of this phase have been identified in the spring systems north of Ilo. However, a single settlement located on the fringe of the valley suggests that this occupation extended inland. Certainly, the association of the Early Ceramic Phase with early agriculture in the spring systems logically points to similar exploitation of the more plentiful water resources of the valley. Consequently, we can posit the presence in the wider Ilo region of a long pre-Chiribaya tradition of pottery-making agriculturalists living near the available water sources and supplementing their subsistence by foraging in the inland drainage basins and fishing along the shore. All indications suggest that this early period of micro-environmental exploitation was conducted by a local populations, there being no evidence for the presence of intrusive groups as occurred in later periods.

The later precolumbian ceramic phase sees a further development of this pattern, with different ethnic groups engaging in more specialized farming and fishing activities along the coast. Inland there is similar evidence for multi-

ethnic co-existence in a pattern of agricultural exploitation of the river valley. We should now explore the implications of this complex situation in the late period. First, there seems little doubt, given the large number and size of the associated sites, that the Chiribaya ceramic style is an expression of the dominant indigenous culture of the Ilo region. However, in addition to this local culture, there is clear evidence, both on the coast and in the Ilo Valley, of significant non-Chiribaya settlement whose ceramic affinities are with the later phases of the northern Chilean cultural sequence, specifically the Las Maitas and San Miguel phases of the late first and early second millennia AD. This intrusive cultural presence with its specialized resource procurement economy along the coast, conforms in general to the prevailing late precolumbian South-Central Andean pattern of multi-ethnic exploitation of various zones. However, the identity of the intrusive presence in the Ilo region raises important questions regarding the nature of long-range interaction in this area.

We can say with reasonable confidence that none of the late painted non-Chiribaya wares bears close resemblance to Classic Tiwanaku pottery, the stylistic expression of highland political and economic expansion in the later first millennium AD, and only the most general similarities to its *altiplano* successors. In fact, the closest Tiwanaku connection that can logically be posited is one of an indirect nature. The Las Maitas style of the Chilean sequence corresponds in time to the florescent phase of Tiwanaku culture and displays some of its decorative motifs. It follows that highland traits were adopted into the indigenous northern Chilean ceramic tradition at this time. However, the real significance of this adoption in political and economic terms has yet to be demonstrated and it would be reverting to simplistic diffusionist interpretation to use such stylistic similarity as the basis for positing profound cultural impact. In fact, the subsequent appearance of Las Maitas colonies in the Ilo region is an example of the interaction of two coastal groups within the context of a basically self-sufficient regional ecological system. Any highland involvement is remote and stylistic in origin and possesses little relevance for explaining coastal cultural dynamics. The somewhat later San Miguel settlements near the spring systems are best regarded as representatives of this coastal interactive pattern in the succeeding period. That the associated intercultural relationships were largely peaceful is indicated by the abundant presence of agricultural produce in the middens of the San Miguel fishing villages. These sites are located well beyond the fringes of Chiribaya field systems, thus must have obtained this produce through economic exchange. In summary, the available evidence suggests a long tradition of interaction along the coast, shared by the various ethnic groups of the area and maintained largely in the absence of highland involvement.

In the face of this evidence of localized coastal interaction, the significance of the Tiwanaku presence on the coast must be reassessed. As mentioned earlier in this study, there have long been reports of Tiwanaku remains in the coastal valleys. It is important in terms of understanding the impact of Tiwanaku culture on the coast to note the nature of these remains and to compare them with their counterparts in the upland valleys. In general, Tiwanaku coastal sites are fairly small, intrusive cemeteries. In the Ilo Valley Tiwanaku presence appears especially ephemeral, our survey being unable to locate any Tiwanaku 5 material at its coastal type site of Loreto Viejo! This situation is dramatically contrasted with the Moquegua Valley, where Tiwanaku presence is omnipresent,

long-lasting, and distinguished by a broad range of architectural as well as ceramic remains. Such dissimilarity in the archaeological record must reflect a major difference in the Tiwanaku presence in the two zones. While I do not presume to explain this difference in detail, it is logical to assume that the brief and limited Tiwanaku coastal expressions reflect a considerably less profound impact on the local populations. In the Moquegua Valley cultural features of Titicaca Basin origin were absorbed widely by the indigenous peoples so that the area became in actuality part of an evolving Tiwanaku culture area for several centuries. By comparison, the coastal Tiwanaku presence appears at best as a temporary intrusive contact with a strong continuing tradition.

The paucity of culturally significant highland presence in the Ilo Valley and along the coast has interesting implications regarding the nature of local cultural development. On a chronological level, two major ceramic expressions appear--coarse undecorated wares of the Early Ceramic Phase and later painted wares dominated by the Chiribaya style in the Late Ceramic Phase. Wider interregional comparison would indicate that the early category correlates, in general, with such pre-Tiwanaku complexes as Wankarani and Chiripa (from ca. 1200 BC) in the highlands and Faldas el Morro (from ca. 800 BC) on the Chilean coast. However, there are also significant differences that set the Ilo early ceramic inventory apart from these other wares and characterize it as an expression of a local cultural tradition. First, the two available dates, from Site 55 and the Wawakiki Cemetery, are 190 ± 240 BC and AD 340 ± 70, respectively. These dates suggest a time range somewhat later than the other pre-Tiwanaku ceramic traditions mentioned above. Second, the Ilo early wares are entirely mineral tempered by contrast to the other wares which are fiber tempered, an important distinguishing structural feature. Third, the Wawakiki Cemetery contained an olla painted crudely in a style quite unlike any known contemporary counterparts. Absence of any likely exotic donor culture suggests, at least for now, that it is of local origin. If this premise is correct, the Wawakiki material, in addition to indicating the local nature of coastal ceramic development, also demonstrates a pre-Chiribaya origin for painted pottery on the coast. Finally, I have already noted the differential occurrence of the early ceramic forms in the Carrizal settlements of the Early Ceramic Phase. There is little evidence to support a functionally-related explanation for such variance. Thus, this distributional pattern may well be due to chronological variation and in conjunction with the radiocarbon dates indicates a long developmental history for pre-Chiribaya ceramic culture on the coast.

A similar stylistic evolution is probable in the Chiribaya style. The deep stratigraphic profile of the Chiribaya occupation at La Florida in the Ilo Valley, with its suggestion of stylistic change through time, is repeated in the spring system inventories of Carrizal and Pocoma. In summary, it is clear that, in the absence of substantial Tiwanaku settlement in the area and in the light of the accumulated evidence for long evolving traditions of coastal farming, economic specialization, and even painted pottery, we must approach coastal research from a viewpoint that accepts its distinctive character and cultural self-sufficiency to a much greater degree than previously.

In conclusion, our work has begun to illuminate the ecological and historic frameworks that molded human occupation of southernmost coastal Peru. As we have seen, the resulting picture conforms to the pattern of environmental micro-niche adaptation seen widely in the Andes. However, the coastal version of this pattern reflects a model of interaction that more closely follows the one propounded by Rostworowski than any based in concepts of long-range vertical exploitation controlled from the highlands. What is perhaps unexpected is that this coastal ecology appears to have incorporated a sufficiently numerous and productive variety of resource components to make the area largely self-sufficient. I have pointed out that verticality as it is visible in the study area occurs *within* the local ecological system. The wider pattern of verticality that closely linked higher segments of the Osmore drainage with the highlands through much of their history appears weakly, at best, in the coastal record. Within this specialized ecological system local peoples developed stable cultural traditions, largely unaffected by the highlands, interacting chiefly with their coastal neighbors in a pattern of lateral rather than vertical economic inter-relationship.

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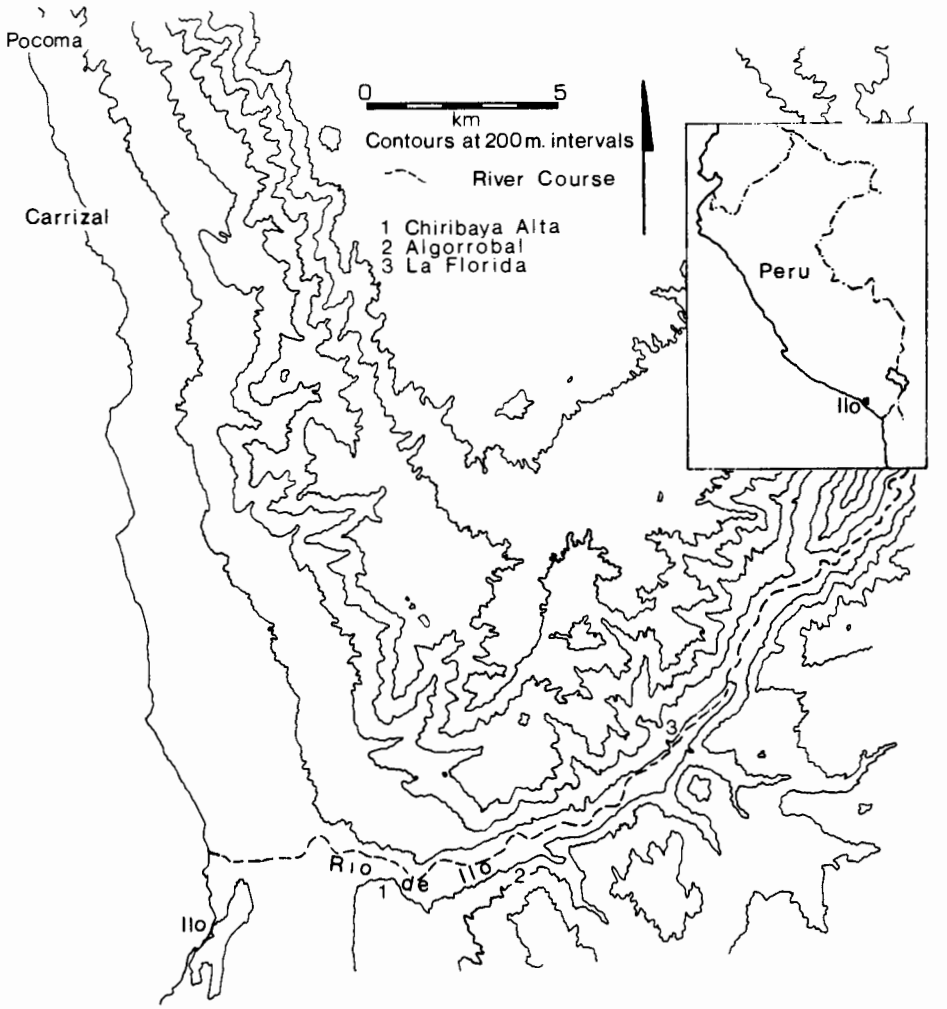

Figure 1. Map of Ilo region with major research sites.

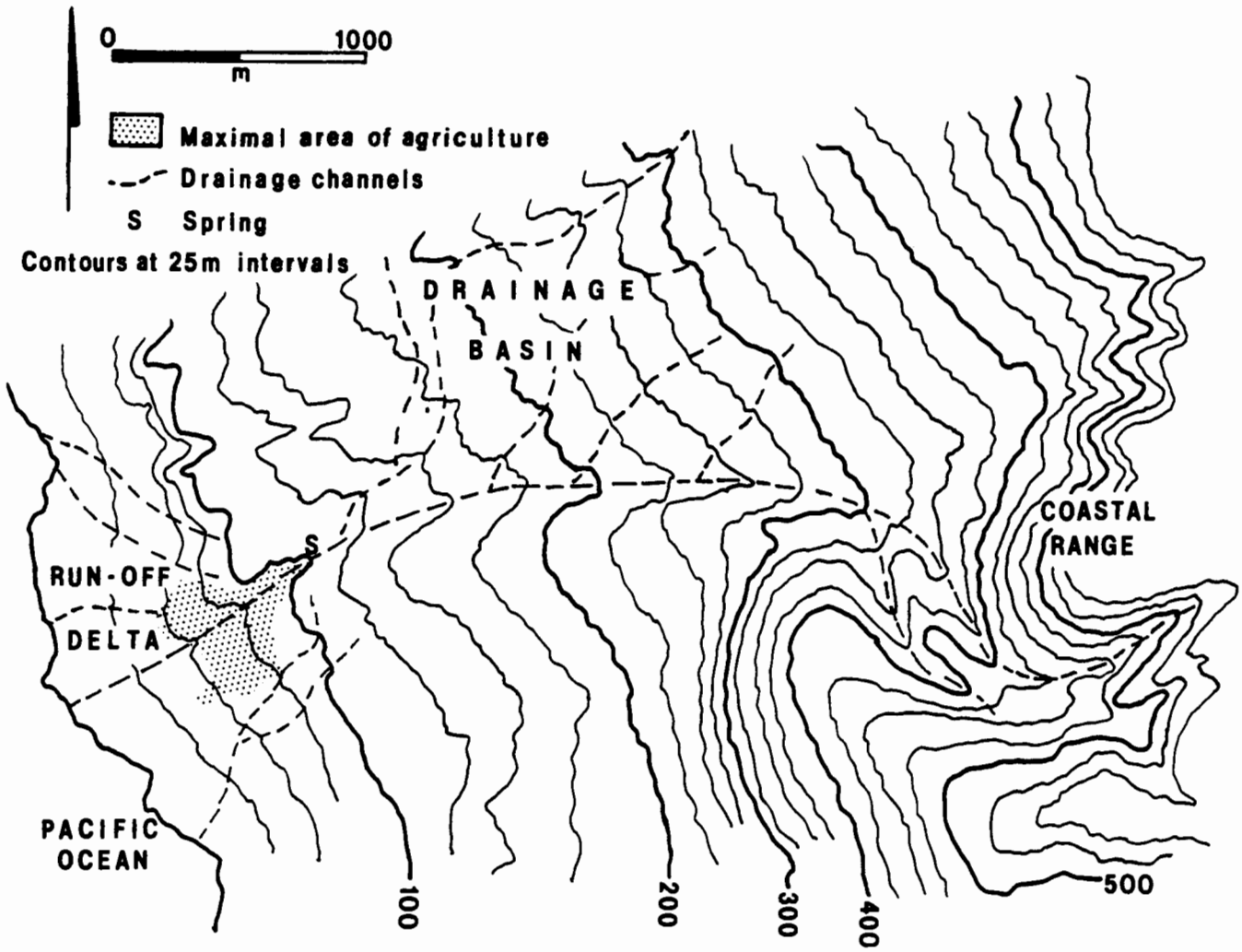

Figure 2. Carrizal microenvironmental zones.

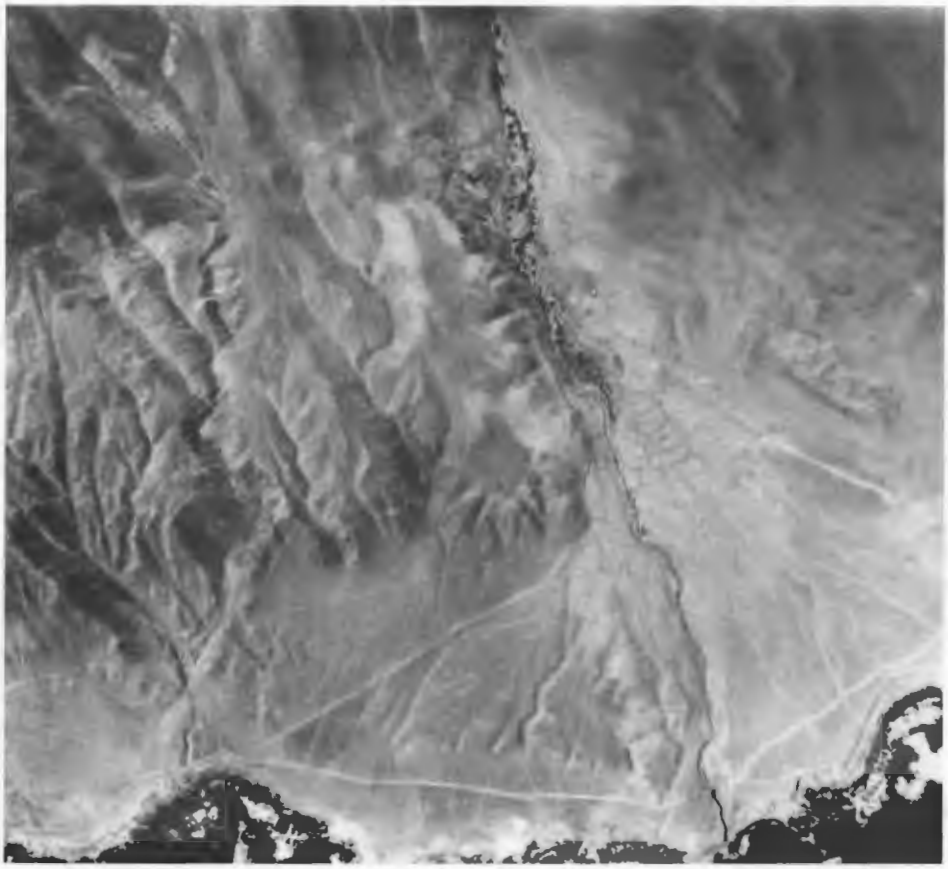

Figure 3. Airphoto of Carrizal spring system showing agricultural terraces and springs. Site 71 is the light area by the shore in the extreme bottom left hand corner of the photograph.

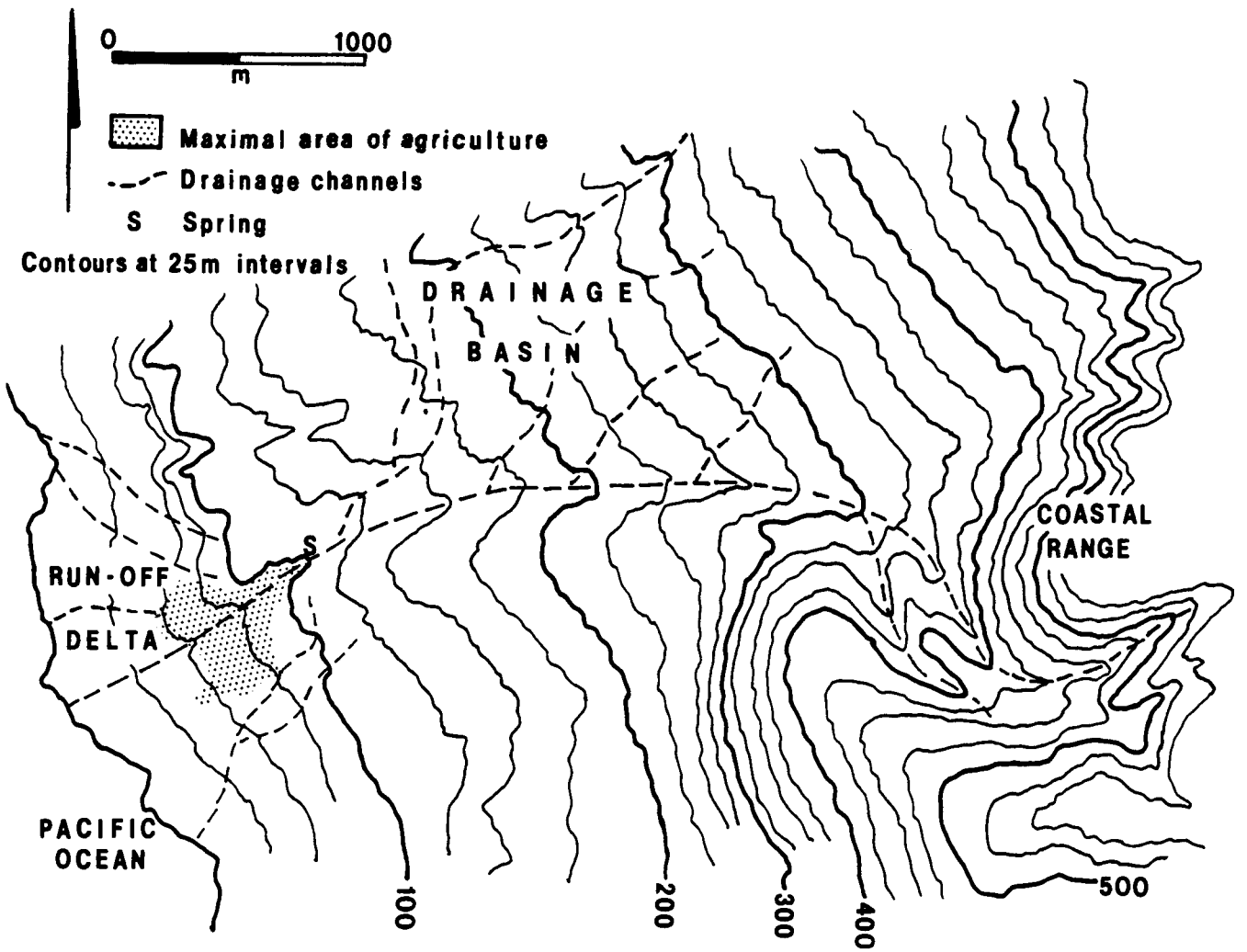

Figure 2. Carrizal microenvironmental zones.

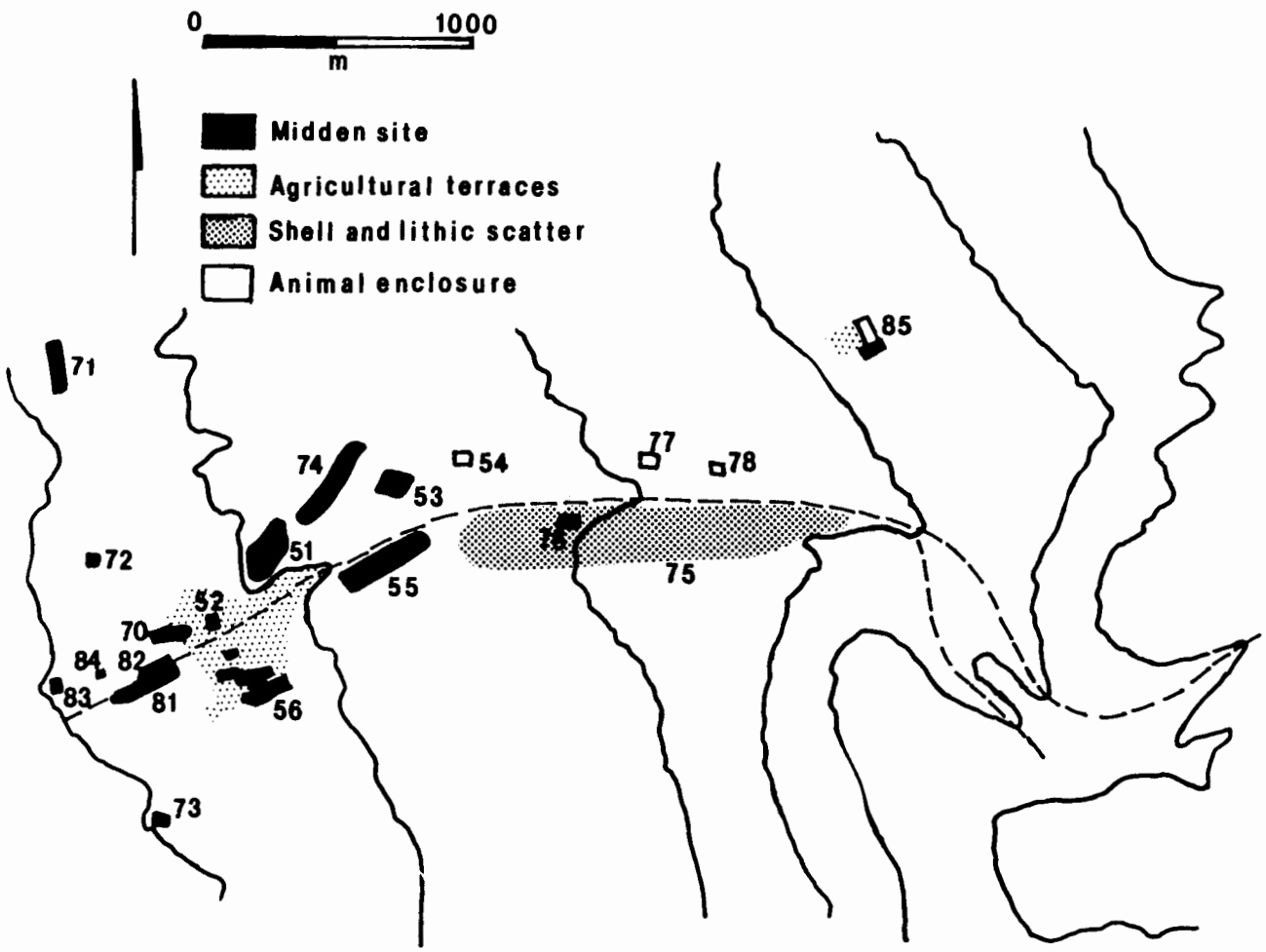

Figure 4. General settlement map of Carrizal.

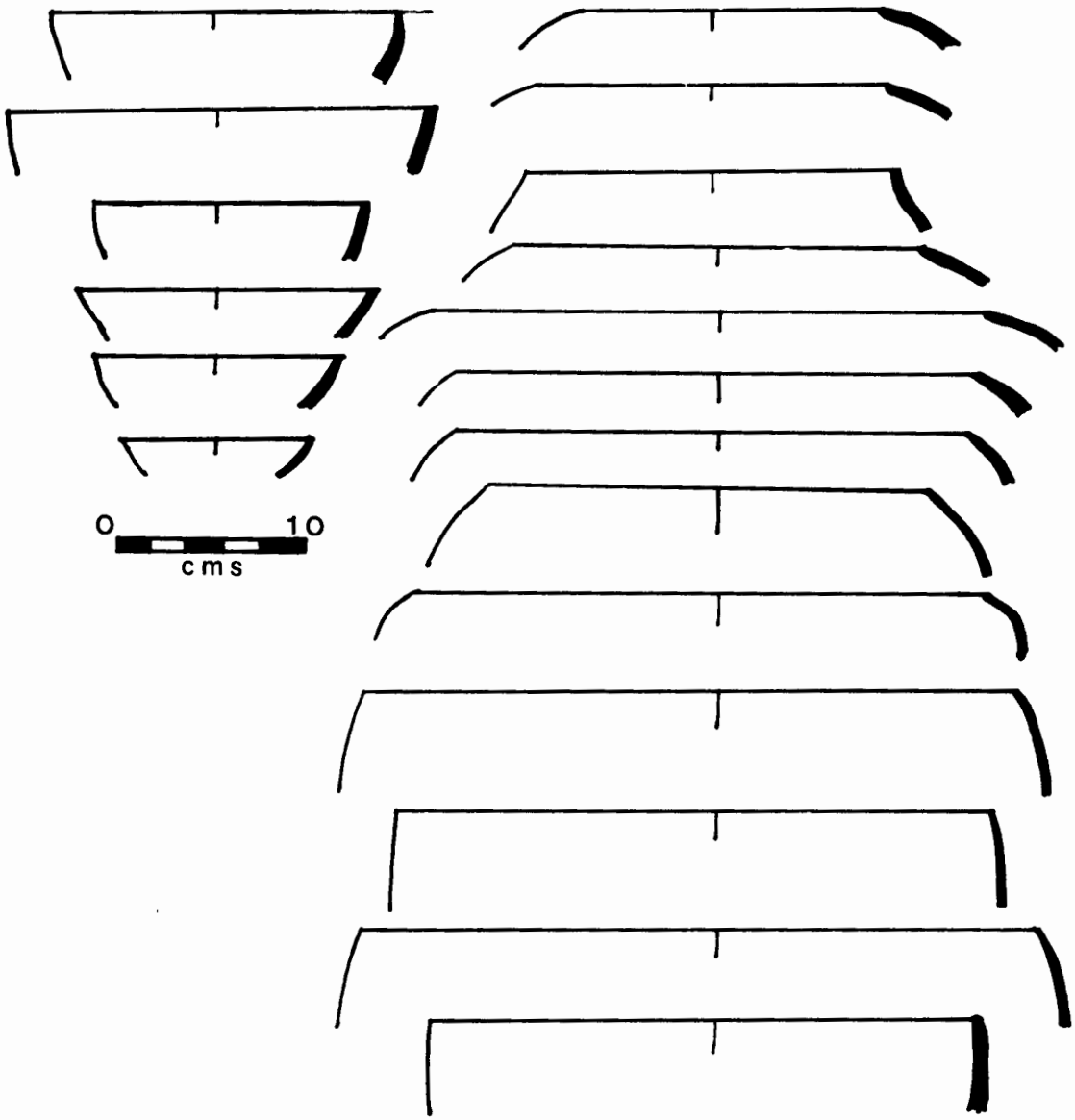

Figure 5. Early Ceramic Phase vessel profiles from Site 70 Carrizal.

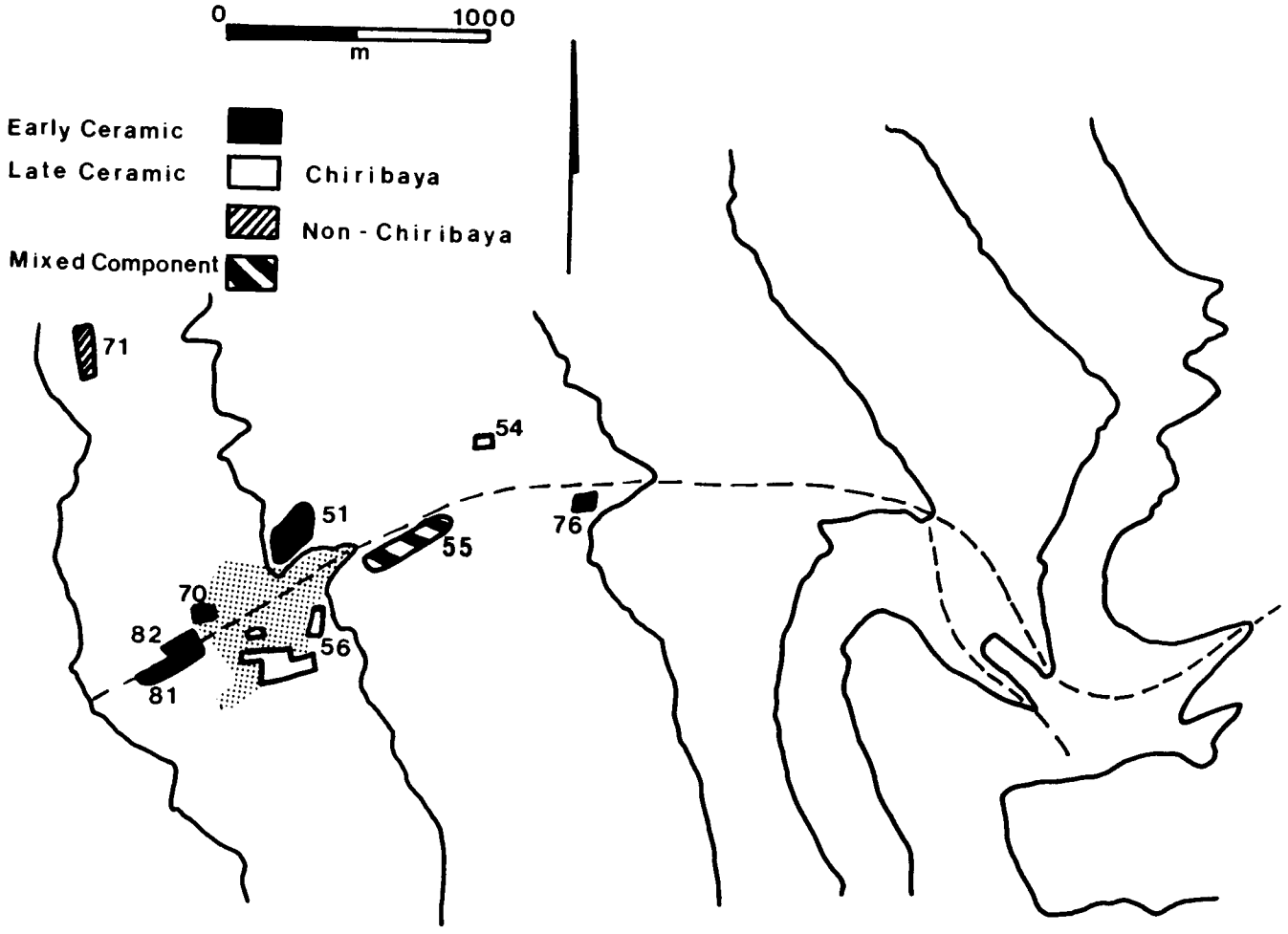

Figure 6. Early and Late Ceramic Phase settlement at Carrizal.

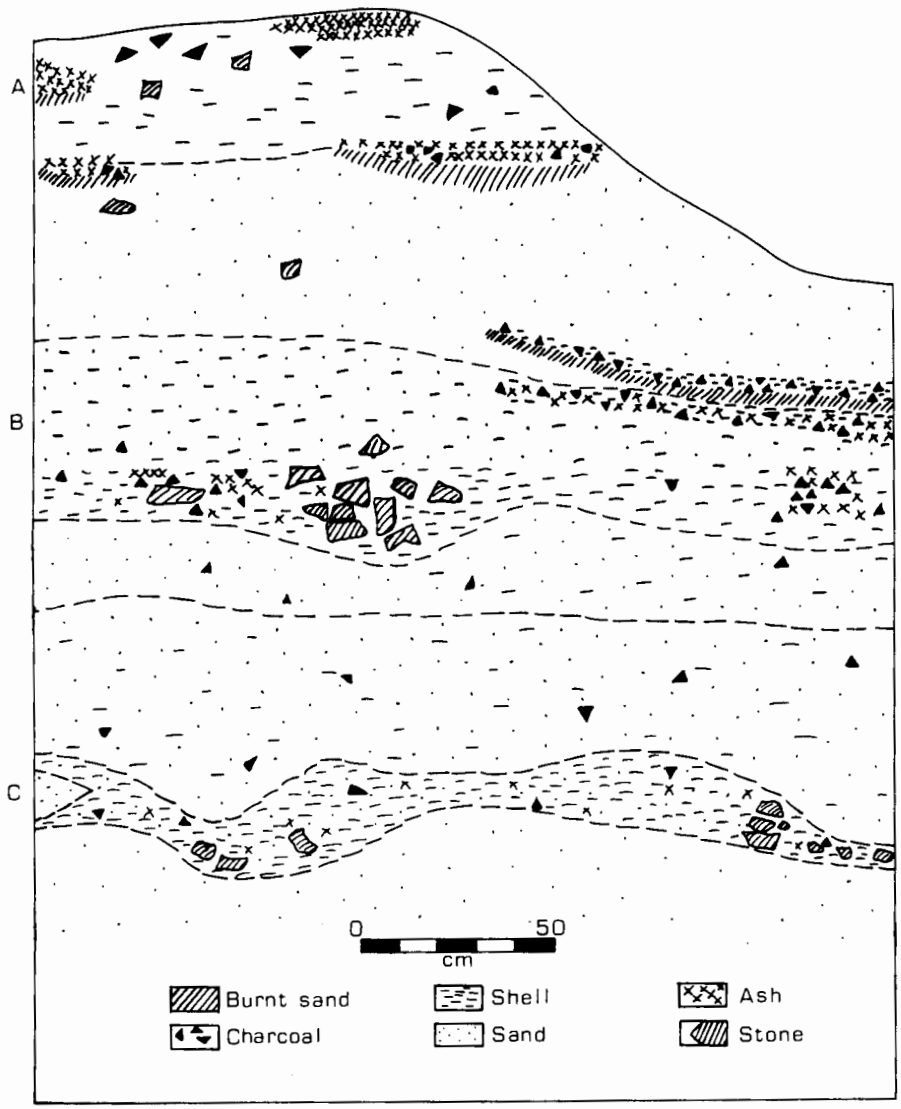

Figure 7. Site 55: Stratigraphic profile.

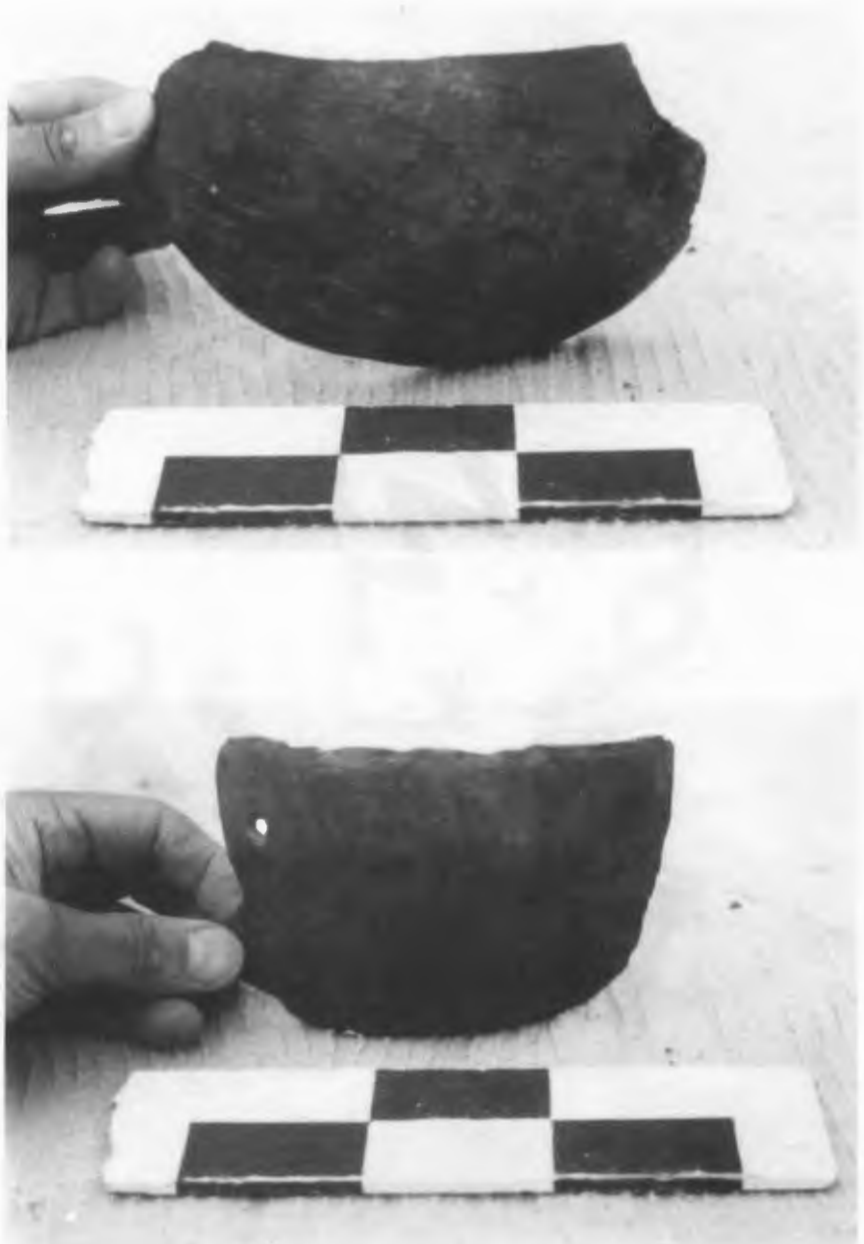

Figure 8a (*above*) **and 8b** (*below*). Vessel from Wawakiki Cemetery, Early Ceramic Phase.

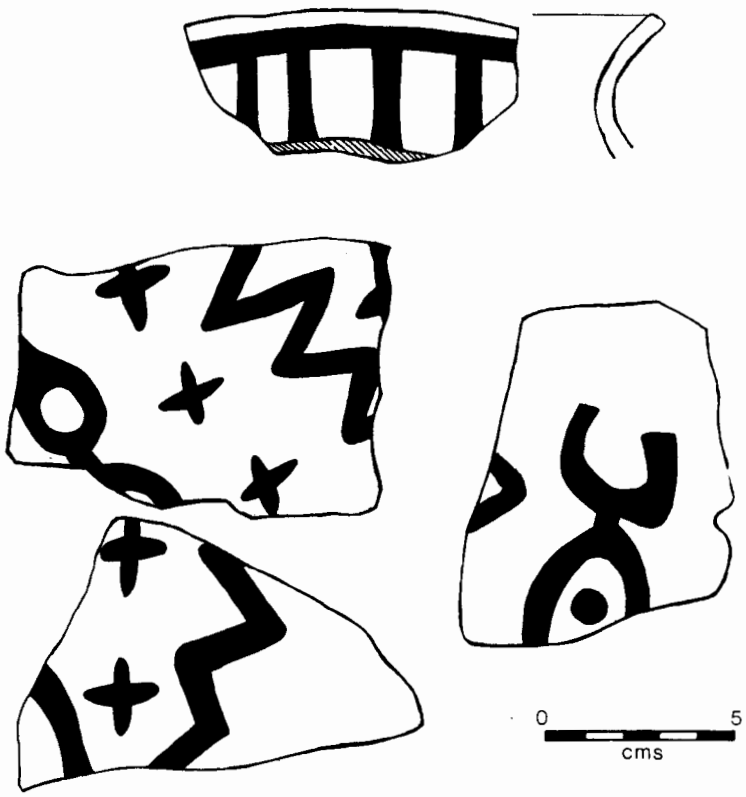

Figure 9. Drawing of painted ceramic from Wawakiki Cemetery, Early Ceramic Phase.

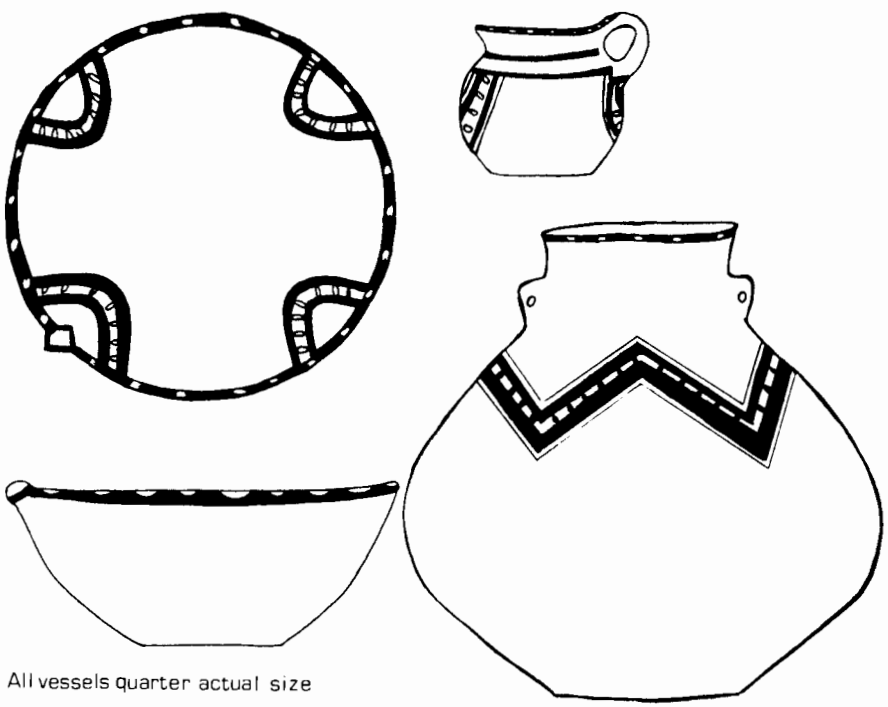

Figure 10. Chiribaya pottery from Site 56, Carrizal.

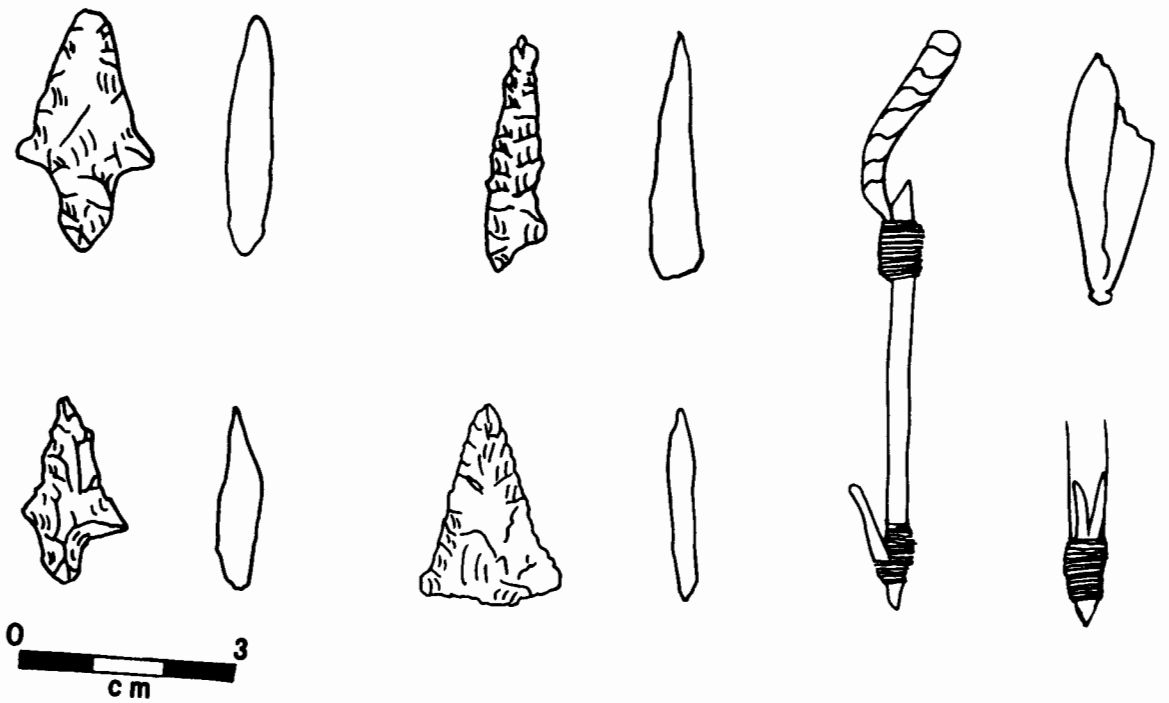

Figure 11. Fishing tool inventory, Site 71.

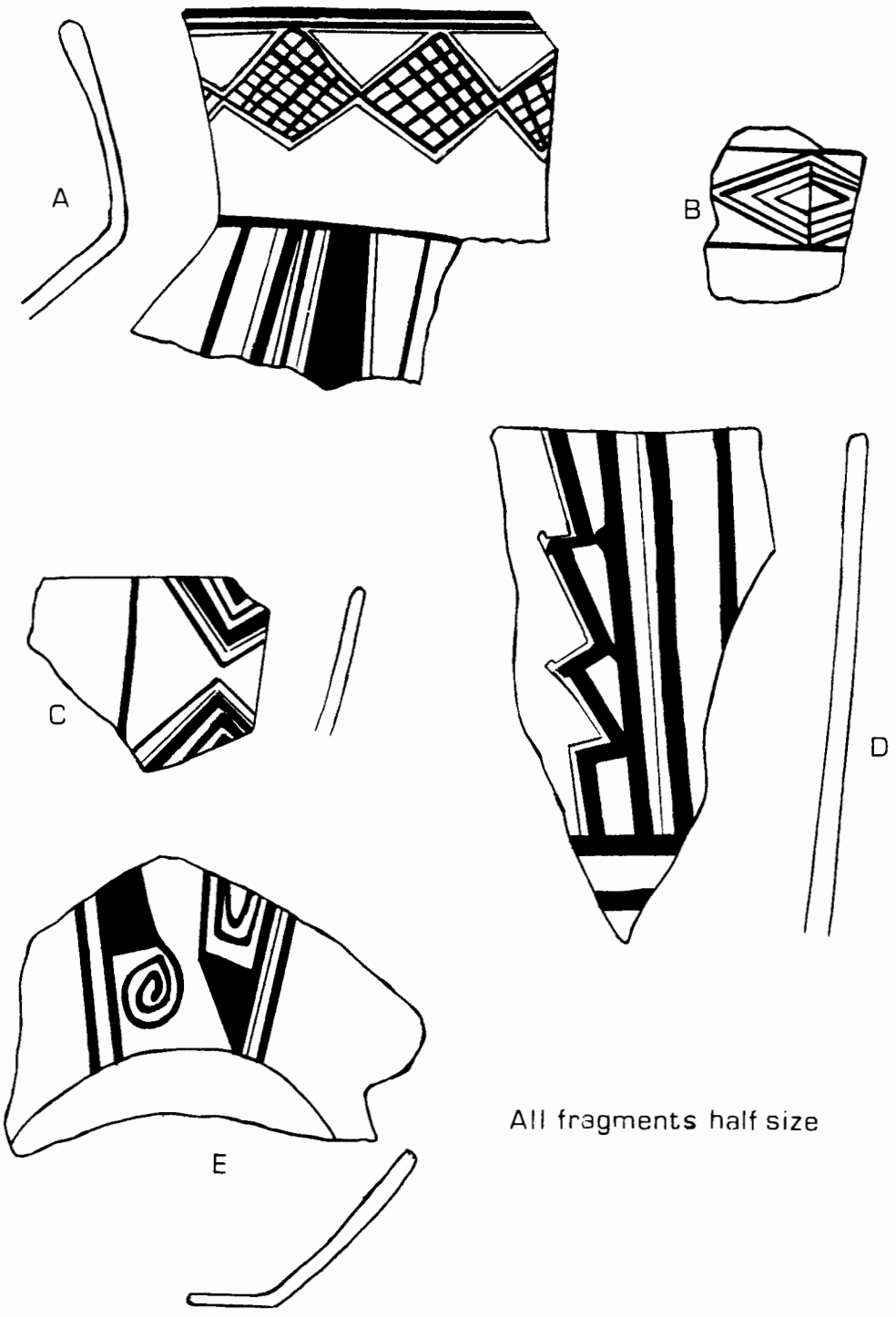

Figure 12. Non-Chiribaya Ceramics from Ilo region. A-D: Upper Ilo Valley Sites. E: Site 71.