The Development of Complex Society in the Volcán Barú Region of Western Panama

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Submitted to the Graduate Faculty of

Arts and Sciences in partial fulfillment

of the requirements for the degree of

Doctor of Philosophy

University of Pittsburgh

2009

UNIVERSITY OF PITTSBURGH

SCHOOL OF ARTS AND SCIENCES

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This dissertation evaluates the relative importance of craft production and ceremonial activities to the development of village communities and political hierarchy in the highland tropics of Western Panama. Previous researchers had suggested that control over the management or distribution of stone axes crucial for land clearance and woodworking activities had provided an avenue for incipient social elites to influence aspects of the broader subsistence economy. Alternatively, other researchers have stressed the importance of the role that ceremonial activities played in the development and persistence of social inequalities and political hierarchies. To evaluate these possibilities, occupational refuse was sampled from seven previously identified archaeological sites occupying different tiers of the settlement hierarchy. Artifact samples from various sites and the residential sectors within them provided the basis for an examination of approximately one millennium of social change and continuity.

This work suggests that a sparsely populated region with small agricultural villages and farmsteads provided the social context in which forms of social rank and political economy initially developed and persisted, but that these differences were expressed in variable ways over time. The sponsorship of feasting activities contributed to the expression of elevated social status and the growth of the region's largest village, while a stronger association between incipient elites and lithic craft production elsewhere in the settlement system may have resulted in distinct organizational differences. Relatively isolated farmsteads, by contrast, exhibited less diversity

and intensity in various activities than villages throughout the sequence. Combining perspectives from regional and village scales, this research concludes that the evidence for political hierarchy and occupational differentiation developed gradually over time and these differences remained relatively subtle through the sequence. The emergence and persistence of elevated social rank and regional political organization accompanied increasing specialization in serving activities and stone tool production between different villages, rather than being concentrated in one. The detailed sequence presented in this dissertation provides a comparative perspective to models of sociopolitical change in Southern Central America, and highlights one of the variable pathways by which small complex societies may have developed more broadly.

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PREFACE

Funding for this dissertation research was awarded by the National Science Foundation as a Doctoral Dissertation Improvement Grant (#0731622). Funding for the preliminary visit to Western Panama was awarded internally through the Department of Anthropology at the University of Pittsburgh. Permits for fieldwork and the export of carbon samples were issued through the Patrimonio Histórico under the direction of Licda. Linnette Montenegro, Tómas Mendizabal, and Carlos Gómez Unless otherwise noted, all maps in this study utilize the NAD27 geographic datum to agree with existing topographic maps and use the Universal Transverse Mercator (UTM) projection (zone 17 north). All site contour and density maps were based on Inverse Distance Weighted (IDW) interpolations to the 4^{th} power. Unless otherwise noted, the calculations of artifact proportions were accomplished by dividing an artifact type by total identifiable sherds. All of the non-metric multidimensional analyses were based off of Euclidean distance similarity matrices.

By definition, dissertations are authored by a single individual but they are really the sum of the all contributions of a large team of people. I thank my dissertation chair, Dr. Robert D. Drennan, for his hard work, critical attention to detail, and his professionalism. Before switching my focus to Panama late in graduate school, Dr. Marc Bermann advised me on matters of the Central Andes and taught me a great deal. Dr. Cooke, Dr. de Montmollin, and Dr. Haller have each provided me with well-timed and constructive advice. During this time, I was generously and continuously funded by the University of Pittsburgh, first as a teaching assistant, then as a Mellon fellow, and finally as a research assistant and teaching fellow. There is no question that I have been blessed with a very strong committee and the backing of a tremendously well-organized department. Without this support, chances are I would have drifted aimlessly through anthropology, becoming a cautionary tale told to incoming graduate students, and then quickly forgotten.

My research and thinking has benefited greatly from my discussions with a number of fascinating people. I would like to acknowledge my debt to a pair of warm and talented Chiriquí researchers, my co-director Dr. Luz Graciela Joly Adames of the Universidad Autónoma de Chiriquí, and Dr. Karen Holmberg, now a postdoctoral fellow at Brown University. Dr. Catherine Shelton personally introduced me to the Bugaba ceramics housed at Temple University, and has been instrumental and helping me to begin this research. Bill Locascio, Dr. Adam Menzies (whose project this work was shamelessly modeled after), and Sarah Taylor have helped me keep my sanity in Panama and in the States and have become treasured friends and colleagues. I would also like to acknowledge the help and support of Dr. Mark Abbott, Alex Bartlett, C. Adam Berrey, Dr. Robyn Cutright, Ashley DeYoung, Marcela Esqueda, Susana Flórez, Jeff Frost, Dr. Bryan Hanks, Dr. Patricia Hansell, Dr. Mauricio Herrera, Julie Hoggarth, Kenzie Jessome, Dr. Margaret Judd, Dr. John Hoopes, Eileen Kao, the Landau family, Dr. Alex Martin, Dr. Juan Martin, Nisha Patel, the Pitti family, Dr. Anthony Ranere, Dr. Gloria Rudolph, Francisco Romano, Licda. Maureen Sanchez, Nathan Stansell, and Dr. Tom Wake. Phyllis Deasy and Donna Yurko at the Department of Anthropology at Pittsburgh have saved me from more red tape than I probably know. And although I suspect I've sometimes confused everyone in my

family with my career choice from time to time, I thank them for their patience and encouraging me to pursue my dream.

I believe that most of us who pursue an academic track and university teaching do so because we had a certain instructor in our past that inspired us to think big and get involved in empirical research. For me, Mr. Daniel Cruson at Joel Barlow High School in Connecticut was such a teacher. He allowed me to enroll in his honors' anthropology class when I didn't have the grades to do so, and introduced me to the basics of archaeological fieldwork through weekend projects. He finally pointed me down a road that led through the fields, labs, and local conferences of a nascent public archaeology program in Western Connecticut managed by Dr. Stuart Reeve and Ernie Wiegand. While every guidance counselor in town advised me that I simply wasn't college material and that my best chances lay with the military, it was Cruson who was able to see something in me I couldn't, and encouraged me to test different opportunities. For that, I shall always be eternally grateful.

Above all, I would like to thank and dedicate this work to my wife Julie. The wife of an archaeologist suffers a spouse who periodically disappears for the field, is tough to get in contact with, who is always swamped with work, is usually cranky or aloof, and talks about stones and bones for an inordinate amount of time. To top it off, archaeologists tend have wildly uncertain and poorly paying job prospects even after spending more than a decade in university, dire straits exacerbated by the current bad economic conditions. Military spouses certainly have it tougher, but they may be the only ones.

Despite all this, she literally gave up nearly everything she had to come to Panama for the concluding months of the project, and sort artifacts 12 hours a day in a dark spider and scorpion filled house. Her support and belief in me has been nothing short of legendary. She has been the light of my life, my college sweetheart, and the principal reason I am inspired to work harder.

1.0 THEORETICAL INTRODUCTION

The first European explorers to encounter indigenous peoples in Southern Central America described mosaics of societies organized in different ways (Drolet 1988; Helms 1979; Lothrop 1950, 1963; Sauer 1966), yet it was their descriptions of power and social inequalities within chiefdoms which ultimately made the strongest impression upon the archaeological consciousness. Paramount among these accounts is the description of chief *Parita*'s burial in Central Panama (Espinosa 1994; Cooke and Bray 1985), his body accompanied by 400 pounds of gold, dress and ornaments (Lothrop 1937; Haller 2004, 2009), all of which pointed towards the importance accorded to wealth consumption. The association of wealth with hierarchy became codified through the excavations at Sitio Conte cemetery (A.D. 750-950) by Lothrop and Mason (Lothrop 1937, 1942), who discovered that many of the same sumptuary objects interred with the wealthiest burial matched those described in the ethnohistoric accounts (Briggs 1989; Linares 1977a). This became reason to postulate the existence of analogous chiefs further back in the past, at least in Central Panama or Gran Coclé (Drennan 1996a).

The apparent concordance between historic and archaeological data in the Sitio Conte case inspired researchers to synthesize ethnohistoric and ethnographic descriptions from other Southern Central American societies in an effort to flesh out the past. Mary Helms (1979, 1992, 1994) was especially influential in this regard, emphasizing the connection between the accumulation of esoteric knowledge and social status during the Contact Period. Although useful as a simple model to test against different archaeological sequences (Fitzgerald 1996; Haller 2004, 2009), her description of how some chiefs operated was largely substituted into an account of how chiefdoms in the area developed (Langebaek 1991). The resulting archaeological emphasis on goldwork, foreign motifs, and non-local items as materializations of the esoteric, wealth, and thus status, has steered researchers mainly towards considerations of artistic styles and their diffusion (Hoopes and Fonseca 2003; Saunders 2003), and to privilege or lament the uneven quality of mortuary data as means to reconstruct social organization (Briggs 1989; Cooke 2004; Ladd 1954; Quilter and Blanco 1995).

The archaeological record from the Gran Chiriquí culture area, encompassing both Western Panama and Southern Costa Rica, presents a different picture. Neither wealthy burials nor non-local goods were abundant during the Formative when other indications for political hierarchy appeared regionally (Drolet 1988; Fitzgerald 1996; Finch and Honetschlager 1986; Sheets 1980). Unlike elsewhere, historical analogies have been limited by the relative paucity of ethnohistoric descriptions from the region, which was one of the last areas outside of the Caribbean watershed to receive sustained European occupation (Drolet 1992; Linares 1968b). While rich graves and foreign trade items only appear after A.D. 1000 (see Cooke 1980; Lothrop 1963; Quilter 2004), they do so on a scale much more modest than would be retrodicted by Sitio Conte. The earliest underpinnings of social hierarchy, it would seem, were related to other factors than the exchange of preciosities and the overt consumption of wealth.

A simple comparison like this defies the glib assumption that political hierarchies in Southern Central America were necessarily dependent to the same degree on factors emphasized ethnohistorically, and it also raises the possibility that the foundations of political leadership or social inequalities lie elsewhere. While the identification of these as yet unknown variables is a fundamental goal for future investigation, the ultimate end point is more profound than merely being able to conclude that some things were important in certain times and places, and others less so. If we begin with a broad definition of chiefdoms (or whichever analogous term), as a level of society with some evidence for social rank differentiation, centrally organized at a regional scale, but lacking the bureaucratic infrastructure associated with states (Drennan 1991, 1995; Stanish 2004), we are immediately faced with a bewildering range of sociopolitical diversity to try and explain both in and well beyond Southern Central America (Curet 2003; Drennan and Peterson 2006). Regardless of whether or not particular researchers are satisfied with the application of evolutionary terms, many antagonistic camps advocate for the careful comparison of the similarities and differences between diachronic sequences as the most promising way to understand if and how certain factors regularly combined to produce different varieties of political and social organization (Drennan 1996a; Earle 1997; Feinman and Neitzal 1984; Hoopes 2005; Pauketat 2007; Yoffee 1993). The work presented here on the prehistoric sequence of the western slopes of Volcán Barú is ultimately envisioned as a portion of a single case to be included in this larger comparative effort.

1.1 VILLAGE-SCALE APPROACHES TO THE STUDY OF CHIEFDOMS

The 'chiefdom concept' offers a set of important anthropological questions to be pursued because they have universal relevance, as all modern human societies have aspects which are organized hierarchically or influenced by those that are (Carneiro 1981, 1998; Drennan 2000; Earle 1997). Originally based largely on the evolutionary schemes of Steward (1955), White (1959), Service (1962, 1975) and Fried (1967), the characterization of hierarchical societies emerging out of a background of relative egalitarianism has prompted many researchers to examine the factors associated with such a shift. Almost immediately, the documentation of counter-cases cast doubt on possibilities for single prime movers which explained everything, whether it was irrigation control (Netherly 1984; Spencer *et al.* 1994; Wittfogel 1957), redistribution (Earle 1977; Peebles and Kus 1977), or demographic pressure leading to warfare (Boserup 1965; Carneiro 1981; Drennan 1987; Gilman 1981; Wright 2007). Some research adjusted its focus to examine multi-linear pathways with a strong emphasis on comparative approaches (Drennan and Peterson 2006; Earle 1997; Kirch 1984; Sanders and Webster 1978), while others continued the search for nearly universal explanations, such as the presence of aggrandizing individuals or interest groups (Blake and Clark 1999; Hayden 1998; Hodder 2000). Recent calls for reconsiderations of the importance of social, economic and political heterogeneities and 'bottom-up' approaches in prehistory (see Chapman 2003; Crumley and Maruqardt 1990; Pauketat 2007), though sometimes highly critical of evolutionary and positivist frameworks, have also usefully served to introduce somewhat different units of analysis to the discussion (Brumfiel 1992). Nevertheless, the study of chiefdoms and emergent hierarchies is far from an antiquarian interest or closed case, and very few scholars today agree on the salient factors associated with social and political changes in the past (Arnold 1996; Drennan and Uribe 1987).

While many of these scenarios have been profitably tested against sequences of change at the regional scale (Drennan 2006; Kolata 2003; Kowalewski *et al.* 1989; Sanders *et al.* 1979; Steponaitis 1991), research at smaller-scales of analysis has shown the potential to offer finer-grained and different perspectives on social change, especially when they are combined with rather than substituted for other lines of evidence (Bermann 1994; Drennan 1976; Hirth 1993;

Robin 2003; Spencer 1993). A scale intermediate between the region (≥100 km²) and the individual household cluster of activity areas (roughly 50x50 m) is typically described as the community (Yaeger and Canuto 2000; Peterson and Drennan 2005), the village (Flannery 1972b, 1976, 2002), or the settlement (Parsons 1972). Communities, villages, or settlements can be viewed as an aggregation of households, though they need not always be isomorphic with what archaeologists recognize as a site (Peterson and Drennan 2005). Comparisons between dozens individual or small groups of households has provided valuable glimpses of the internal organization of chiefly centers, and contributed to our understanding of the factors that did or did not influence social change within the Intermediate Area (González 1998, 2007; Henderson and Ostler 2005; Menzies 2009).

Like households, ethnographic communities have been regarded, in part, as emic social units meaningful to the cultural participants themselves (i.e. with reference to moieties, ethnicities, etc.), but not always co-resident (see Santley and Hirth 1993; Wilk and Rathje 1982, Yanagisako and Collier 1990), which is one of the reasons why there is some disagreement between archaeologists over which perspectives to adopt and their observable correlates. As a result, each has meant different things to different researchers, such as overlapping ideational or imagined identities (Isbell 2000; Pauketat 2000), zones of daily interaction between residents (Murdock 1949; Peterson and Drennan 2005), or those of occupational practice (Sassaman and Rudolfi 2000). Following Flannery (1972b, 1976, 2002), the term 'village' is preferred here to try and avoid part of this semantic quandary, and to preserve the original emphasis on an ill-defined but intermediate unit of analysis largely analogous to how researchers ordinarily think about living village communities in many areas of the world. Regardless of the term, the theoretical and analytical foci are upon patterns of daily interaction and activities between domestic groups, and understanding how these may have contributed to wider social and political changes.

Rather than studies of regional systems or of only a few households, the settlement scale of analysis offers a better chance to examine changes and continuities in the relationships between many residential groups, which is ultimately essential to the understanding of social organization and societies in general (Fried 1967:8). Chiefdom emergence, for example, is usually thought to be associated with a reorganization of existing economies at a scale that transcends a generalized Domestic Mode of Production (see Chayanov 1977; Sahlins 1972), as well as an appropriation of important resources (i.e. staple goods, prestigious items) to finance elite activities (Carneiro 1981; D'Altroy and Earle 1985; Earle 1987a, 1987b; Gilman 1981; Sahlins 1972). The development of a chiefly political economy, in this case, has its roots in the reorganization of certain relationships between producers, traders, and consumers, and is therefore the material manifestation of an emergent set of political relationships (Welch 1991). Along these lines, researchers have often made connections between the manufacture and distribution of certain items and the processes whereby power becomes centralized (Earle 1991, 1997; Hirth 1984; Frankenstein and Rowlands 1978; Kristiansen 1991), new social identities develop (Costin 1998; Dobres 1995; Hayashida 1999), and social inequality emerges (Arnold and Munns 1994; Brumfiel and Earle 1987; Clark and Parry 1990; Costin 1991, 2001, 2004; Feinman 1995). Despite these possibilities, little attention has been given to the organization of production and exchange in chiefdom studies (Kristiansen 1991), although these organizational differences are likely to help make sense of some of the variability observable in separate chiefdom trajectories (Cobb 1996, 2000). As long as patterns in the social interactions and relationships between multiple domestic groups might tell us something about the development and persistence of political economies, then inquiry at the village-scale is critical to understanding questions about social organization.

1.2 FACTORS OF CHANGE IN THE FORMATIVE CHIEFDOMS OF GRAN CHIRIQUÍ

The Volcán Barú region (figure 1) lies in the mountains of Western Panama. The area is ecologically similar to several small, cool and rainy highland basins scattered throughout the Talamanca range, which extends well into Costa Rica. The upper reaches of the western slopes of the volcano were surveyed by Olga Linares, Payson Sheets and others (Linares *et al.* 1975; Sheets *et al.* 1980) as part of the larger Adaptive Radiations project, which was designed to investigate how prehistoric settlers adapted to the different environments they encountered. Linares and her team surveyed a 62 km² area in the highlands, encompassing several micro-environments along the uppermost sections of the Río Chiriquí Viejo.

The area is perhaps best known for the highland sites of Barriles (BU-24) and Sitio Pitti-González (BU-17), collectively thought to represent a level of social complexity broadly classified as a chiefdom by the Late Bugaba phase (originally A.D. 400 to 600) (Drennan 1991). This is based on several lines of evidence: 1) stone sculpture from the site of Barriles depicts symbols of 'rank and authority' (i.e. ornamentation, stone axes, *chicha* jars, trophy heads) that appear to be differentially associated with certain personages (Haberland 1968, 1984; Linares 1977; Linares and Sheets 1980), 2) evidence for differential mortuary treatment, ranging from a few slab-lined tombs containing fine-ware ceramics, jewelry, and stone axes, to less conspicuous internments (Bernstein 1984; Stirling 1950), 3) stone sculpture and monumental public works (i.e. a mound and large paved patio) are restricted to the site of Barriles, which possibly functioned as a central place (Hoopes 1996, 2005; Shelton 1984), and 4) the range of settlement sizes in the region suggest at least a three-tiered settlement hierarchy (figure 2), although some researchers have argued for as many as five tiers (Linares *et al.* 1975; Linares and Sheets 1980; Sheets 1980).

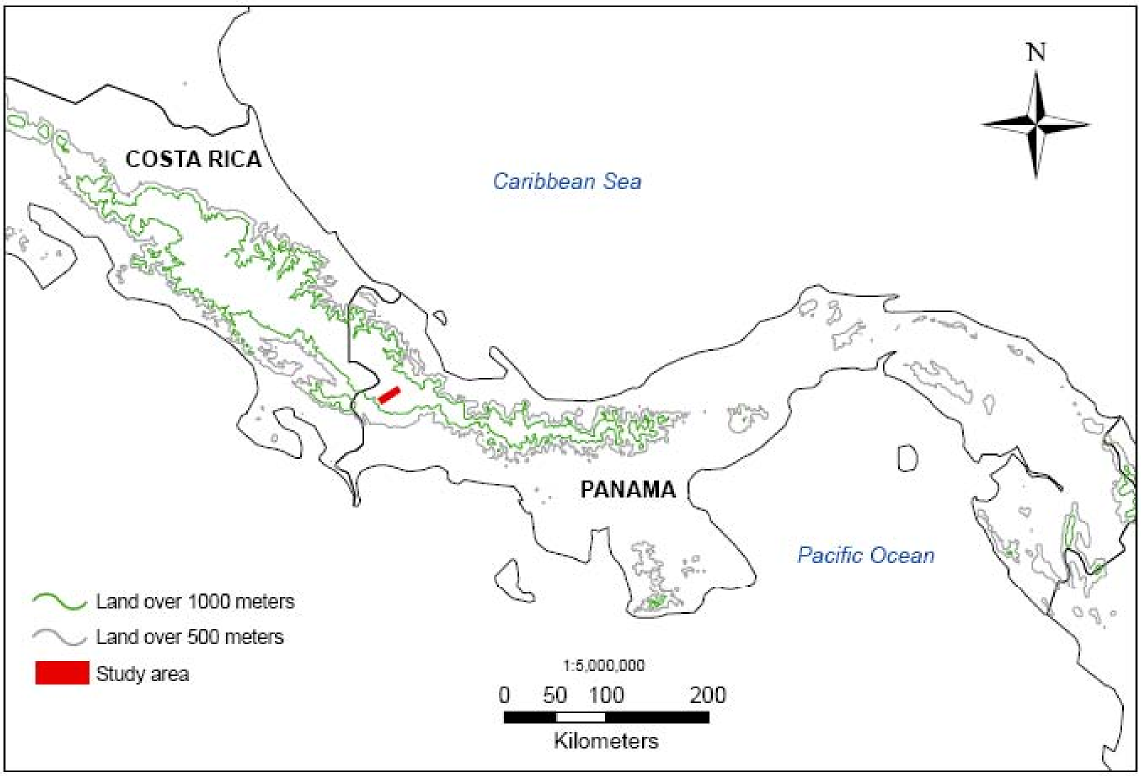

Figure 1. Location of study area within Southern Central America

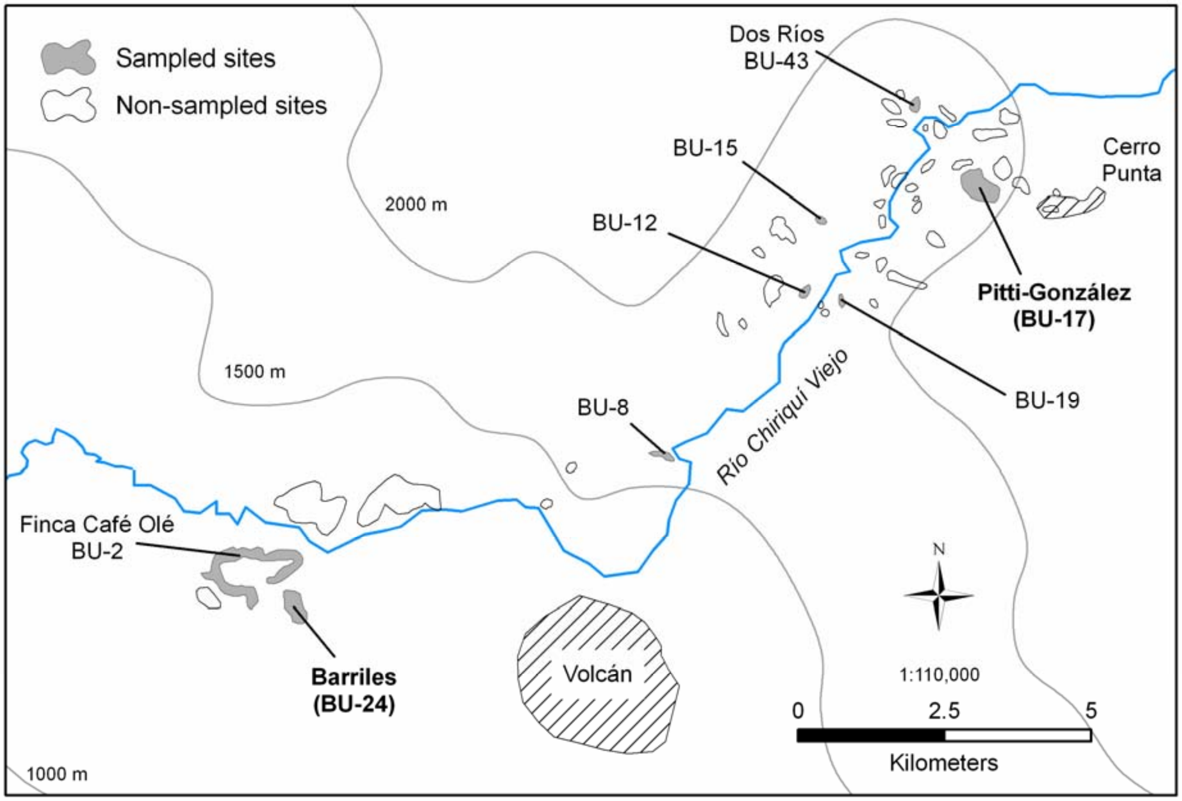

Figure 2. Archaeological sites recorded by Linares *et al.* (1975) and those sampled by this project. Map adapted from Linares and Sheeets (1980: Figure 4.0-2).

Linares and Sheets (1980) observed that only a few of the larger sites in the settlement hierarchy may have specialized in the production and repair of polished stone axes, which were then distributed as finished products to the rest of the settlements (Drolet 1983; see Haller 2004, 2009). The availability of farmland was probably not an important issue for prehistoric populations in the region, as substantial sections of flat, cultivable land were left unsettled within settlement clusters (Sheets 1980:275), but the availability of technology to clear forested land for agricultural fields may have represented a limiting factor, and stone axes would have been instrumental in this regard (Linares and Sheets 1980:52). Although the manufacture of polished stone axes and use of maize in the area has preceramic antecedents at the rockshelter sites of Casita de Piedra and Trapiche (Dickau 2005; Linares 1977; Ranere 1975, 1980a, 1980c, 1980d;

Ranere and Cooke 1996), environmental evidence from Laguna Volcán indicates that that evidence for maize pollen and deforestation increased substantially around A.D. 200 (Behling 2000). This evidence suggests the possibility that maize agriculture, land clearance, and the availability of stone axes were especially important in the centuries just prior to the emergence of the Barriles chiefdom.

The same sites where axes were presumably being produced and re-sharpened also contain higher frequencies of engraved pottery bearing Barriles iconography (Linares and Sheets 1980:52) which, if engraved pottery was associated with higher status, raises the possibility that social rank may somehow have been connected with axe production and exchange. The argument for restricted axe production was ultimately based on very small samples of lithic artifacts from different sites, generally totaling less than ten from each (Sheets *et al.* 1980:405). However, rather than just collecting more lithics, a different type of sample is required to critically test the idea that rank was connected to craft production. For example, a research strategy focused on identifying which settlements, and where in those settlements, crafts were produced and how these activities were organized in relation to 'elite' sectors, would be more likely to help clarify the relationships (if any) between social rank and the craft production of stone tools.

On the other side of Gran Chiriquí in Southern Costa Rica, Drolet (1992) has observed that small territorial polities emerged for the first time in the Terraba Valley during the late Formative (roughly. A.D. 300 to 600), which "…created the basis for structuring inter-village industries, for establishing a school of fine arts to express territorial prestige, and for initiating relationships with outside groups for trade in a diversity of luxury items" (223). These fine arts included polished stone pendants, clay portraiture, and stone sculpture (218, 222) while luxury items included negative painted wares and metates made from volcanic cinder, presumably from somewhere in or near the Chiriquí province (218). He did not regard the control over the production and acquisition of fine arts or luxury goods as particularly significant to the initial emergence of political hierarchies or social inequalities in the area, but he argued that their high quality suggested some degree of specialization and centralized control.

Alternatively, control over the circulation of prestige goods through complex societies in the Diquís, Volcán Barú and other parts of Greater Chiriquí may have provided an important ideological basis for the emergence of elites, who may have used these items to restrict access to esoteric knowledge (Helms 1979, 1992), or use in an exclusive elite culture (Ashmore 1987; Baines and Yoffee 1998; Pauketat and Emerson 1991). Hoopes (2005:32), in particular, views the production and exchange of rare and high-quality prestige goods as a fundamental part of a relatively stable and long-lasting Aguas Buenas "cultural horizon" which was composed of a lively network of interacting priesthoods or chiefdoms. Symbolically important items for use in trading networks and ritual events may have represented an important source of prestige, and the production and exchange of these items may have influenced the processes of political centralization and social differentiation in the area.

Based on this brief review of research on Gran Chiriquí during the Formative or Aguas Buenas Period (roughly A.D. 1-900 depending on the specific region), the literature suggests that two factors may have been important to the development or persistence of a chiefly political economy: 1) the controlled production or exchange of utilitarian stone axes, and 2) the production or acquisition of symbolically-charged luxury items.

1.3 CRAFT PRODUCTION

Linares *et al.* (1975) argued that, "…Barriles sculpture associates symbols of rank and warlike attributes with maize agriculture" (141), and concluded that it was ultimately the rapid introduction of maize agriculture that "…triggered sociopolitical changes that led to larger and more internally ranked groupings" (144). By the time the Adaptive Radiations book came to press, Linares and Sheets (1980) had refined this idea somewhat, arguing that the inhabitants of the Barriles, "…kept their ascendancy by offering craft and socioceremonial services, possibly extracting labor or a share of the maize crop in return" (54). Supported by more complete artifact analyses (i.e. Ranere 1980b), these later writings strongly suggested that certain types of specialized craft production may have contributed to the development of political hierarchy (Drennan 1991). As a rough hypothesis which Linares and Sheets (1980:54) felt worthy of further testing, we must first consider the range of different crafts that may have been produced and the empirical evidence associated with their manufacture.

Prior research has suggested that the manufacture of stone axes, statues, ceremonial *metates* (Linares *et al.* 1975:142), and perhaps some decorated pottery (Linares and Sheets 1980:51), occurred at some of the larger sites in the settlement hierarchy. In the largely contemporaneous Río Terraba sequence of Southern Costa Rica (500 B.C. to A.D. 600), Drolet observed that axe production and re-sharpening refuse was disproportionately restricted to the larger sites of Sitio Monge and Las Brisas. He also argues that a variety of luxury goods that "reflect expressions of prestige and rank" (1992:222) were produced by specialists there. These included statues, ceremonial *metates*, figurines, decorated pottery, ornaments of stone, and in later periods, gold and *tumbaga* pendants. In addition, village-wide specializations in textile manufacture had antecedents in the area, as the village of Boruca was known to have specialized in this activity into the historic era (Stone 1949). All, some, or none of these objects may have actually been produced by craft specialists working in the Volcán Barú area. One of the principal goals of this research was to determine which objects were most likely to have been produced by specialists.

To determine whether different items may have been produced by craft specialists, archaeologists have generally focused upon analyses of the items themselves, as well as upon the spatial patterning of different types of artifacts at the regional and settlement scales (Junker 1994). The degree of standardization is often taken to reflect specialization archaeologically because it is argued to reflect a high degree of interaction between producers, an expanded scale of production, high demand, or the use of technologies designed to streamline the manufacturing process (Blackman *et al.* 1993; Cooke and Sánchez 1998; Costin 1991; Costin and Hagstrum 1995; Longacre *et al.* 1988; Roux 2003). As a result, craft goods produced to meet similar demands in the Volcán Barú region might be expected to exhibit morphological homogeneity, measurable through the analysis of several attributes. With classes of ceramic artifacts, these include rim diameters, sherd thickness, paste color and temper, evidence for control over firing, and elements of surface decoration and finish. With classes of lithic artifacts, these include homogeneity of workshop deposits (Moholy-Nagy 1990; Schiffer 1987), homogeneity in raw material sources, and with complete objects, metric criteria like length-to-width ratios and cross-sectional forms.

Technological and morphological analyses of the artifacts themselves can be combined with data on the intra-site spatial patterning of different activity areas to make a stronger case for craft specialization. Because Linares and Sheets (1980) and Drolet (1992) observed that the evidence for craft production was spatially associated with areas of domestic refuse, the data most relevant to addressing craft production is likely to be domestic artifact inventories. Middens surround groups of domestic structures in this region and nearby areas (Drolet 1984, 1988; Linares and Ranere 1980), which reduces the likelihood that production dumps are very far removed from production areas (see Moholy-Nagy 1990). Specialized production should be recognizable by high proportions and differential distribution of production debris within a limited number of areas within a site (Costin 1991:24), ranging from concentrations in relatively few locales to dispersed patterns over wide areas. According to Sheets *et al.* (1980:404,410), the material correlates of groundstone axe manufacture include high frequencies of axe performs, broken celts, hammerstones, primary, secondary and tertiary flakes without polish, pebble burnishers, and exhausted cores. Axe repair activities are specifically recognizable by the presence of flakes with polished sides (Haller 2004:149; Sheets *et al.* 1980:422; Ranere 1980b:133).

Possibilities for other specialized production activities exist. Linares and Sheets (1980:52) suggested that ceramic production of Bugaba Engraved Wares may have been a specialized activity, and high frequencies of broken ceramics might be expected in close association with kiln wasters, firing pits, charcoal, polishing stones, scrapers, pigment, and amorphous fired clay pieces (González 1998:16). Haberland (1984a) and Lothrop (1963) both have suggested that specialists may have been involved in metal production, recognizable by the presence of ceramic or stone molds, furnace features, ingots, and slag (see Cooke *et al.* 2003:107; Costin 1991:19). Specialized shell manufacture has been observed elsewhere in Panama (Mayo 2004), and this is recognizable by high proportions of unworked shell in association with pieces in different stages of reduction, including preforms, shells with cut edges, and ornaments (Masucci 1995:73). The production of perishable, organic crafts may also have been important. Specialized textile production has been observed ethnographically in adjacent regions (Stone 1949), and this activity may be identifiable by spindle whorls and bone needles (Costin 1991; Drolet 1992). Other activities, like woodworking and hide processing, may be approachable by first comparing proportions of utilized flakes, scrapers and burins (see Aldenderfer 1990, 1991; Yerkes 1990). Activities like chipped stone tool manufacture are believed to be widespread and non-specialized ‘cottage industries’ handled by every individual residential group (Drolet 1992; Linares and Sheets 1980; Ranere 1980b), although wildly different proportions of chipped stone debitage from group to group would certainly challenge this assumption.

1.3.1 The Organization of Production

If craft production can be identified at sites in the Volcán Barú region, it is necessary to understand how production was organized, or how activities were connected to larger political, social and economic systems. There may be a continuum of many organizational states, which can be comprehended as a range between small-scale, decentralized modes of production to large-scale, centralized industrial factories (Smith 2004). Regardless of the items being produced, the organization of production can be understood as an intersection of several different continua of variability, each of which serve to distinguish it from a more generalized Domestic Mode of Production (see Sahlins 1972). Costin (1991:8) argues that these continua are the intersections of multiple axes of variability, including 1) the geographic concentration, 2) the scale and 3) the intensity of production activities.

The geographic concentration dimension refers to the spatial patterning of activity areas, which may range from nucleated to dispersed distributions. Production debris found only in a few areas suggests that production was more nucleated, perhaps in specialized precincts or wards (see Drolet 1992). Alternatively, a more dispersed type of production, in which specialists worked at multiple settlements, might leave little patterning, or perhaps a different pattern that is difficult to recognize given the body of existing middle range theory. Similarly, the scale of production refers to the number of individuals engaged in production activities, and may range from activities done by individual households to those done by many specialists working in large industries. Scale is approachable by comparing the numbers of households engaged in specialized activities to those who are not for each period or phase.

The intensity of production refers to a range between part-time and full-time activities, and is acknowledged to be the most difficult variable to study archaeologically (Costin 1991), and is thus the subject of considerable debate. At a fundamental level, the intensification of production may be identifiable as an increase in the proportions of production debris over time. If specialized craft production was organized at the domestic level, intensification may be recognizable by charting the changing proportions of production debris to artifacts related to everyday activities (Costin 1991:32), such as “cottage industry” chipped stone tools associated with food processing and household maintenance activities (see Drolet 1992; Linares and Sheets 1980; Ranere 1980b). If types of specialized production were not organized at the domestic level, areas of craft production debris should be devoid of artifacts reflective of the ordinary household toolkit. Finally, we may observe that many of these continua may vary over time with regards to the type of crafts being produced, with households producing more utilitarian goods being organized one way, and those producing status items being organized another way, or with the situation being even more complicated.

If the production or exchange of certain items was important to the exercise of a political economy, then it is likely that this situation would be reflected archaeologically by an association between these items and evidence for social differentiation through time (Muller 1997:47). Following Fried (1967:110, 186), differences in social status depend, to some degree, on the differential access to the economic resources that sustain life, or to those that influence prestige. However, as Flannery (1972a) and McGuire (1983) caution, evidence for social differentiation is not necessarily evidence for sociopolitical inequalities, a demonstrable connection to the evidence for political hierarchy is required. Studies of regional settlement hierarchies provide us with one possible connection, as certain forms of social differentiation may be concentrated within a 'central place' community, which presumably had important political functions compared to other settlements. This avoids some of circular reasoning that some critics associate with evolutionary studies because there is the possibility to recognize that ancient economies may not have been organized in such a way at all. Beginning to understand prehistoric political economies, therefore, requires investigating the organization of production and exchange with regard to social rank at each different tier within the settlement hierarchy.

1.4 RECOGNIZING SOCIAL RANK IN DOMESTIC ASSEMBLAGES

There is some mortuary and iconographic evidence from the study area, such as elaborate tombs and the famous Barriles statues thought to represent chiefs and retainers, which suggest some form of social rank may have existed in the Formative (Bernstein 1984; Haberland 1968, 1984a, 1984b; Linares 1977a; Linares and Sheets 1980; Stirling 1950). Rank and status are not clearly expressed in the domestic assemblages of some later sites (Rivas, Murcielago) in the Diquís subregion (Drolet 1992; Quilter 2004; Quilter and Blanco 1995), and one of the goals of this study was to understand if social rank was expressed at the domestic level in the Volcán Barú region. Regardless of whether they participated in craft production or distribution activities, domestic groups of higher-rank (if they existed) should be distinguishable from lower-ranking groups by qualitative and quantitative differences in their consumption of material culture (Hirth 1993:132). Since structures in the area are buried, recognizing differences in rank from structural variables such as floor size, architectural investment, or storage capacity, will not be possible. Instead, inferring rank from domestic assemblages will depend upon quantifying and comparing the relative amount, quality and diversity of artifacts recovered from each sample (Hendon 1991:895; Smith 1987:320), even if the full range of material culture has not preserved to the present day (see Cooke and Ranere 1992:244). If rank did not exist or was not clearly expressed in daily life, little variation should be evident when artifacts from different domestic assemblages are compared. If rank did exist, then more substantial variation in the quantities and proportions of different types of artifacts are expected.

Differences in relative wealth may be present between groups in domestic artifact inventories. Wealth is thought of as the possession of a great quantity or high quality of objects (Blick 1998:76), and where quality is approachable through a consideration of an object's relative scarcity, labor intensity, or decorative elaboration (Smith 1987:322). Rank may be reflected by differential consumption of preferred and high-valued goods (Costin and Earle 1989). This may include higher proportions of tools (i.e. stone axes, spindle whorls, grinding stones), high quality objects (i.e. fine ceramics), items made from non-local materials (see Cooke 1980), or more diverse artifactual assemblages than lower-ranking groups. Elevated social status may have also been associated with better diets, regardless of the degree of wealth accumulation.

This may be reflected by the presence of relatively rare genera or better cuts of meat in faunal assemblages (Haller *et al.* 2006; Jackson and Scott 2003). Similarly, higher proportions of maize, or a wider variety of plants (i.e. peppers, coca, cacao, tobacco), in botanical assemblages may also indicate differences in social status. In the absence of ecofacts, differential possession of foodstuffs may also be visible by comparing the proportions of storage vessels to other vessel forms (Smith 1987:311). Proximity of high-ranking domestic groups to important features, such as agricultural terraces or mineral outcrops, might also indicate that rank was connected to resources which produced wealth (see Spencer 1993).

Differences in relative prestige may also be present between groups. Prestige is not envisioned as completely unrelated to wealth because both are understood to be complementary in many ways (see D'Altroy and Earle 1985). But rather than the accumulation of things, prestige is the power to impress or influence others and, at its theoretical extreme, can operate exclusively on the basis of nonmaterial factors (Blick 1998:76). Many archaeologists, however, recognize that many largely nonmaterial domains (i.e. ideology and belief systems) are usually mediated by physical objects or features in various ways (DeMarrias *et al.* 1996; Hodder 1982; Holmberg 2005; Kolb 1994; Potter 2000b; Shennan 1982b), which leaves some aspects of prestige ranking approachable archaeologically.

Differential distributions of non-utilitarian goods and symbolic items, especially those that are highly visible and related to performance, might be expected to reflect relative differences in prestige. Non-local raw materials, lustrous items (Saunders 2003), rare imported goods (i.e. shell, jade, gold), and artifacts with foreign iconographic motifs, are thought to be broadly related to 'esoteric knowledge' or cosmology (see Helms 1979). Rank may be recognizable as higher proportions of jewelry and ornamentation (i.e. beads, earrings, necklaces) worn in outfits (Smith 1987:309; see Wobst 1977). Higher proportions of serving vessels (i.e. plates, dishes, *chicha* jars), or decorated ceremonial wares (Quilter 2004), may reflect differential involvement in prestigious feasting activities (Clark and Blake 1994; Smith 1987). Linares *et al.* (1975) have connected rank at Barriles to agriculture and warfare, and higher proportions of elaborate *metates* in association with celts and statues were taken by them to reflect this. Ceramics with a restricted range of iconography, perhaps related to clan affiliation (Cooke and Ranere 1992:287, Cooke 2003), may also reflect rank differences. Finally, the proximity of high-ranking domestic groups to different types of features, such as petroglyphs and mounds, may also indicate that rank was connected to resources which influenced prestige (Stark and Hall 1993).

1.4.1 Evaluating the Relationship between Production and Social Rank

If differential involvement in craft production was an important feature in the development of a chiefly political economy and social complexity in the Volcán Barú region, then one should expect to find differences in rank between domestic groups associated with craft production versus those that are not (Schortman and Urban 2004:197). As the final criterion useful in characterizing the organization of production, the degree of elite control or sponsorship is related to the amount of political influence elites, or other sociopolitical entities, are able to exert over craft producers (Costin 1991). This is the most important variable with regards to the development of a political economy involving craft production (Lewis 1996). Brumfiel and Earle (1987) have made a useful distinction between independent and attached specialists. Independent specialists are relatively free from elite influence, and produce items for an unspecified group of consumers. Attached specialists are controlled by a patron, and generally produce items for those that support them. A common third category, embedded specialists, has been either discussed as a situation intermediate between independent and attached (Janusek 1999), or one where elites handle specialized production themselves (Ames 1995; Inomata and Stiver 1998; Sinopoli 1988).

The spatial proximity of craft production areas to elite residences or compounds is typically taken as a measure of the relationship between producer and patron, which can range from a random distribution to a tight concentration of production areas in or next to elite sectors (Brumfiel and Earle 1987:5; Costin 1991:25; Earle 1987:71). For example, if the production of certain items usually took place at some distance from high-ranking domestic groups, it would suggest little connection between the two phenomena and therefore of minor importance to the development of a chiefly political economy. On the other hand, if craft production only took place in or beside elite residences or ceremonial areas (i.e. mound and platform precincts), then it would suggest a much stronger connection (i.e. Welsh 1991, 1996). This may not be universally accurate, depending on how exchange was organized (Arnold 1996), but argument for a relationship between the two is strengthened by the recognition of spatial proximity.

Understanding the degree of elite control in this manner depends upon first identifying production areas and high-ranking residential areas, and characterizing the spatial relationship between the two. Examining the relationship between production and rank has additional implications. For example, a system of social hierarchy based more on wealth accumulation might be associated with the production of utilitarian crafts rather than status goods. Likewise, a hierarchy based more on prestige, rather than wealth, might be strongly associated with the production of status goods. Each example would suggest that inequality was associated with craft production, but in variable ways. One can easily imagine more possibilities and the evidence for them; therefore the study of the organization of production outlined by Costin (1991) is not narrowly ‘deterministic’, meaning that the lack of useful middle-range models available to archaeologists limits the possibility of strict deductive hypothesis testing. In other words, modern studies of production are necessarily inductive and deductive affairs.

1.5 REGIONAL EXCHANGE

It is possible that political power was not dependent upon the control of craft production, but rather the control over the distribution of goods to different communities. Early concerns with chiefly political economies stressed the redistribution of subsistence goods (Sahlins 1958; Service 1962), but this has since been criticized as empirically inaccurate (Brumfiel and Earle 1987; Earle 1977; Peebles and Kus 1977). Chiefly involvement in the redistribution of non-subsistence goods represents an additional theoretical possibility by which control can be translated into political power, either through the exchange of alliance-building luxury goods, or the tactical allocation of certain commodities to groups within the political hierarchy. In this regard, Drolet (1983:422) notes that smaller settlements in the Volcán Barú area contained finished polished stone axes but lacked evidence for lithic manufacture, which raises the possibility that these tools were traded in after being produced elsewhere.

One way of attempting to determine which mechanisms of exchange operated prehistorically has been to measure the relative abundance of a material at multiple sites and plot it against distance from the source (Hodder 1974; Hodder and Lane 1982; Renfrew 1975). Different mechanisms of exchange produce generally distinct and quantifiable distribution patterns. Although attention to fall-off curves has been generally focused at the macro-regional scale (see Brown *et al.* 1990; Findlow and Bolognese 1982; Hodge and Minc 1990), researchers have also been able to recognize coarse distributional patterns within regions similar in size to the Volcán Barú area (see Inomata and Aoyama 1996; Junker 1994). Although Renfrew (1975) originally identified nine organizational possibilities for macro-regional exchange, Junker (1994) narrowed the possibilities down to three in her study of Philippine chiefdoms: decentralized exchange versus the central place exchange of unrestricted or restricted items.

According to Junker (1994), relatively decentralized down-the-line-exchange may be identifiable by a pattern of linear monotonic fall-off in commodity abundance as distance increases from a manufacturing center, regardless of site size or relative importance of a particular site in the settlement hierarchy. Alternatively, central place exchange involves the transport of goods to, or subsequent manufacture at, several regionally important centers where political functionaries controlled their allocation. This form of exchange is expected to yield a pattern where commodity abundance is higher at the larger regional centers and lower in intervening sites. Junker (1994:7) has argued that the central place exchange of unrestricted goods, often produced by independent specialists, tended to produce a fall-off curve that is both a function of settlement size and distance from the source. Finally, central place redistribution of restricted goods, usually produced by attached craft specialists concentrated at larger centers, tended to produce a multi-modal fall-off curve that is almost entirely a function of settlement size (Junker 1994:7).

Examining regional artifact distribution patterns in this way requires the collection of sizeable samples from a number of roughly contemporaneous sites (Hodder and Orton 1976:105). Different artifact classes can be subjected to different regression analyses where site artifact proportions are plotted against several variables, including site area, distance from hypothesized manufacturing or exchange centers (i.e. Barriles, Sitio Pitti-González), or distance from possible transport routes (i.e. Río Chiriquí Viejo). Down-the-line exchange is expected to correspond strongly with distance from the manufacturing center and perhaps distance from transport routes, while the central place redistribution of restricted goods should correspond most strongly with site area. The central redistribution of unrestricted goods should not correspond very strongly to either distance from center or site area.

1.5.1 Production and Regional Exchange within the Barriles Chiefdom

While it has become increasingly clear that ethnohistoric descriptions of Central American or Intermediate Area chiefdoms do not provide suitable analogs for the Formative chiefdoms of the Gran Chiriquí, relatively little research in the area has yet been devoted to understanding the factors and conditions associated with the emergence or persistence of either political hierarchy or social differentiation in the past. Among Central American researchers, the more traditional emphasis on mortuary studies and filling in "missing time-space systematics" (Lange 1996:307) between stylistic complexes cannot possibly lead, all by themselves, to the collection of datasets relevant to the examination and comparison of cultural sequences at different analytical scales, and are therefore unlikely to be a productive avenue to the critical study of the long-term social changes and continuities in the past.

Instead, a relatively distinct research agenda that builds off these previous contributions is required. This new agenda would not only focus on larger scale settlement systems and the relationships between sites, but would attempt to link research ideas from regional research (i.e. issues of centralization, political hierarchy, proximity to natural resources) to those typically associated with household research (i.e. social identities, craft production, feasting) by examining the internal organization of different sites in a settlement system. Studies focused on the internal organization of prehistoric villages (i.e. Boada 2003; Gallivan 2003; González 1998; Peterson 2005) have shown tremendous potential in this regard, but require the systematic and spatially extensive samples of artifacts or features in order to have confidence in interpretations essentially about degrees of unusualness (i.e. specialized activities, elevated social rank). This is a relatively different goal than arriving at normative statements (i.e. site X has lots of axes, or households here are small). Although not always so, these methodological requirements contrast with those of research projects aimed at making normative statements at a variety of spatial scales. These include the haphazard surface collections associated with the Volcán Barú regional survey (Linares and Sheets 1980), or the horizontal excavations of household-oriented research ultimately capable of examining only one or two structures (Beilke-Voigt 2004; Spang and Rosenthal 1980). These special methodological requirements will be discussed in the next chapter.

2.0 SETTING AND METHODOLOGY

The study area lies in the westernmost province of Chiriquí in Panama, clinging barely to the Pacific side of the Talamancan mountain range which marks the continental divide. This relatively high and rugged range extends from Western Panama all the way to the Central Valley in Costa Rica, occasionally peaked by a series of even larger and very active volcanoes. The Panamanian portions of this range include the highest mountains in the country, home to a handful of 3000 m peaks, including the iconic Volcán Barú. The land drops away steeply to either coast, and as a result, it is possible to view both the Caribbean Sea and Pacific Ocean during the dry season. As a result of its position a narrow part of the isthmus, Western Panama represents the tightest juxtaposition of coastal, tropical forest and alpine ecological zones in all of Southern Central America. A similar configuration is present in the Sierra Nevada de Santa Marta of Colombia, which represent an even tighter (and more extreme) vertical stacking of environments.

It is partially for this reason that the western slopes of Volcán Barú were of archaeological interest to Linares *et al.* (1975), who wished to understand the nature of pre-Columbian adaptations to highland ecological zones and contrast them with those observed in the neighboring lowlands. They originally defined the study area as a small 62 km² region straddling the upper drainage of whitewater Río Chiriquí Viejo between the 1200 and 2400 m elevation contours (130), an area which encompassed what they described as five vertically banded ecological zones. Like the other Pacific watersheds of Southern Central America, this region has a distinct wet and dry season. The rainy season, torrential every early afternoon, typically lasts from mid-May to mid-November and drops between 2500-3000 mm of rainfall (138), more than enough to qualify the area as a rainforest. The rest of the year is relatively sunny, cool, and very windy. Besides slope terraces, which were apparently never constructed, this area is not well suited to any type of agricultural intensification beyond simple rainfall cultivation.

The highest and coldest of the five zones, the small Cerro Punta basin (1800-2400 m above sea level) is a gently sloping alluvial basin containing roughly seven to eight km² of agricultural land. The average annual temperature in the basin is 15º C (Linares *et al.* 1975:138, Table 1). At its lower end, uncultivated portions of the basin are covered in jungle with evergreen stands, which grade into a perpetually misty cloud forest over the 2000 m elevation contour. The farmland presses up against steep mountain slopes, so the edges of the basin receive relatively less sunlight early and late in the day. Owing to this and its altitude, fields witness the occasional light frost in the mornings. Modern farmers claim that maize does not grow very well in these conditions, and the vast majority of their fields are devoted to the production of tubers and root vegetables like potatoes, onions, and carrots.

The Bambito area (1500-1800 m above sea level) is a deeply dissected gorge hundreds of meters deep along its 4 km length. Several tributary streams converge in the Cerro Punta basin to form the Río Chiriquí Viejo, which subsequently drops sharply through the canyon in a series of chutes and waterfalls. There is very little flat land amenable for farming within the canyon itself, which only receives direct sunlight in mid-day when the sun is highest, though there are small modern terraces and hilltops devoted to coffee and strawberry farming today. The canyon rims give way to patches of gently sloping arable land which extend up to edges of the cloud forest, though this area is frost-prone and difficult to reach from the river. The Bambito gorge abruptly gives way to a very thin (<100 m) belt of arable land bordered by the Llanos zone (1300-1500 m above sea level), the most distinctive of the region's ecological zones. The Llanos are actually the remains of an old lava flow event from Volcán Barú around 10,000 years ago, which covered the area between the Río Chiriquí Viejo and the volcano in ms of pumice, gravel and boulders (Linares *et al.* 1975:138). Today the zone is largely treeless and supports only scrub grasses or the occasional heavily-fertilized onion farm. Together, the Llanos lava flow and the surrounding high mountains almost completely circumscribe the Cerro Punta basin and Bambito canyon.

Olga Linares and her colleagues (Linares *et al.* 1975:149, Sheets 1980:270) originally defined the land north of the river and down to the 1200 m contour as belonging to two different ecological zones, one hilly (the Intermediate zone) and the other flatter and with broader river terraces (the Southwest zone), though these terraces are sometimes incorrectly described as the edges of old volcanic craters (Sheets 1980:267). Both zones can probably be collapsed together into one ecological zone. The Southwest zone is also very hilly as well, each is covered in rainforest containing some semi-deciduous vegetation, and they each have a slightly more pronounced dry season than the Cerro Punta basin. Each is also warmer than Cerro Punta, ranging from 20-25º C during the day. The river terraces are often blanketed by a meter of deep, organic-rich topsoil, which rates as productive farm and pasture land. This zone was home to maize, bean and coffee farms up until the mid-1990s, and has since been transformed into a series of large dairy plantations which produce the fattest cattle and highest-quality milk in Panama.

2.1 THE IMPLICATIONS OF PREVIOUS REGIONAL SURVEY

Prior to the regional survey conducted by Olga Linares and her colleagues, research in Gran Chiriquí was largely culture-historical in its focus (see Haberland 1955, 1962, 1969, 1984a, 1984b; Holmes 1888; Laurencich de Minelli and Minelli 1966, 1973; Linares 1968a, 1969b; Lothrop 1963; MacCurdy 1911; Osgood 1935; Šolc 1970; Stirling 1949; Stone 1943). Although these researchers described very similar assemblages of ceramics, many of their studies used a different nomenclature for similar wares and phases, and occasionally similar names for different ones, especially for those that were part of the larger Formative or Aguas Buenas Period (Corrales 2000; Hoopes 1996). The focus changed in the early 1970s and 1980s with a set of three regional studies in Gran Chiriquí which addressed issues of social organization more directly (Drolet 1984, 1988, 1992; Finch and Honetschlager 1986; Linares *et al.* 1975), along with the investigation of preceramic rockshelters in Western Panama to understand changes in subsistence patterns (Linares and Ranere 1971; Ranere 1975; Ranere 1980a, 1980b, 1992). The first regional study, the Adaptive Radiations project, is the most directly relevant to this investigation.

Though rarely cited directly, the conceptual basis for the Adaptive Radiations project mirrored anthropological themes of 'adaptive variation' found in Sahlins (1958) for Polynesia, and to lesser extent, Lathrap (1970) for Amazonia. In both cases, ancestral populations were thought to have shared common biological, linguistic, and cultural, roots prior to their movement into, or filling in, of different ecological zones in antiquity. Like Sahlins and Lathrap, the methodological aspect of the Adaptive Radiations project suffered from an inability to clarify or measure productivity, but perhaps most importantly, recent research has suggested that many of the project's conclusions may have been empirically inaccurate. These include Piperno and

Pearsall's (1998) argument that the diffusion of cultigens generally happened on a plant-by-plant basis, the presence of maize on the Panamanian side of Gran Chiriquí for millennia (Dickau 2005; Dickau *et al.* 2007), the longer time depth of Caribbean watershed sequences than previously supposed (Drolet 1980; Griggs 2005; Wake 2006; Wake *et al.* 2004), and the failure to find convincing evidence for the supposed A.D. 600 eruption of Volcán Barú (Beling 2000; Clement and Horn 2001; Holmberg 2007, 2009; Sherrod et al. 2007).

In Western Panama, the idea of ancestral populations with deep roots was largely assumed by the Guaymí ethnographer Phillip Young (1971, 1976, 1980) and carried into archaeology by Linares (1973:1012). Subsequent studies have generally supported this idea on genetic and linguistic grounds (rather than strictly art historical) for the various portions of the Intermediate Area, including the Gran Chiriquí culture area (Barrantes *et al.* 1990; Bieber *et al.* 1996). Because of these common roots, subsequent changes and continuities in varieties of social organization were largely thought to represent adaptations to different environments (i.e. social speciation), an idea largely passed over in current debates on the macro-Chibchan area. Contrasting levels of social organization in different environmental zones, a method Kirch and Green (1987:164) have compared to a phylogenic analogy, is central to this endeavor (Peoples 1993). Along these lines, Linares (1979) argued that if there was anything worth studying in Southern Central America, it was "…the development of local variations and their correlated social forms" (38), a reason which explains why she and her colleagues turned toward the environmentally diverse highlands and islands of Western Panama to attempt a controlled comparison of societies they regarded as more complex in some environments and less complex in others.

The Chiriquí highlands, largely the area west of Volcán Barú, received more archaeological attention in the Adaptive Radiations project than either the Pacific or Caribbean coasts. Stirling's (1951) prior investigation of Sitio Barriles suggested the possibility of obvious social differentiation at some point in the past: reflected partially by stone-lined versus unlined tombs (Linares *et al.* 1975:141). Additional suggestions came in the forms of four statues (with another ten depicting sole individuals) with an individual- often taller, chubbier and sometimes wearing a conical hat or ornaments- perched on the shoulders of a more diminutive naked man, though some of these porters also wore a conical hat (Vidal Friatts 1993). These indicators of social differentiation were all found at Barriles, while the circumscribed environment suspected to contribute towards population pressure, warfare, and the development of complex society (Carneiro 1970, 1981, 1998; Reichel-Dolmatoff 1973) lay to the northeast in the Cerro Punta Basin. Perhaps as a result, the 62 km² study area stretches from the Cerro Punta basin to just past Barriles. This area encompasses the widest possible range of environmental diversity, but probably leaves some unknown proportion of the settlement system south and west of Barriles unsurveyed.

Survey methods were described by Sheets (1980:268) as one where the survey area was walked "meter by meter", though surface materials were much more easily identifiable in plowed fields than in ones covered by vegetation. To identify the presence or absence of material in vegetated areas, the surveyors examined road cuts, ditches, root throws, and in a few cases, resorted to posthole soundings. Almost all of the area west of the Llanos zone is forested or heavily vegetated, and is also home to the largest sites in the study region. Given the opportunistic methods of survey here, it is very possible that these large sites might be products of grouping together widely spaced collections rather than observing relatively continuous scatters of material. This may have important implications for the identification and description of a settlement hierarchy, which Linares *et al.* (1975:141) and Sheets (1980:271) discussed as having five size classes based on site length rather than area. Their survey methodology and its interpretive implications is an idea which will be returned to in the conclusion to the final chapter.

The exact boundaries of the study area are unclear since neither the 1975, 1980, or *informe* maps illustrate the limits of the survey zone. Since we know that the total surveyed area is 62 km² (Linares *et al.* 1975:140), and assuming the Río Chiriquí Viejo was the centerline (25.4 km long), the survey zone was probably restricted to 1.2 km on either side of the river and was likely adjusted at sections to account for steep topography. Not surprisingly, 95% the sites are also within this distance from the river, a likely result of a fairly narrow survey zone, though one which Sheets (1980:274) argued reflected a linear stream and river settlement pattern. Not all sites are clustered closely to the main river, and there is a no solid correlation between site size and linear distance to the Río Chiriquí Viejo (figure 3), which suggests that further sites would be found if the study area were someday expanded north and south away from the river. For example, Barriles (BU-24), the fifth biggest site on the maps (~12.5 ha) and hypothetical central place settlement (described incorrectly as BU-3 in Linares *et al.* 1975:141), is one of the furthest from the Río Chiriquí Viejo, .84 km. The number of sites in the region changes between the 1975 and 1980 publications as well. In the Linares *et al.* (1975:140, figure 3) version, 46 sites are shown on the map. In the Linares and Sheets (1980:48-9, figure 4.02) version, only 40 sites are shown, the difference being the omission of several tiny sites in the uppermost reaches of the drainage.

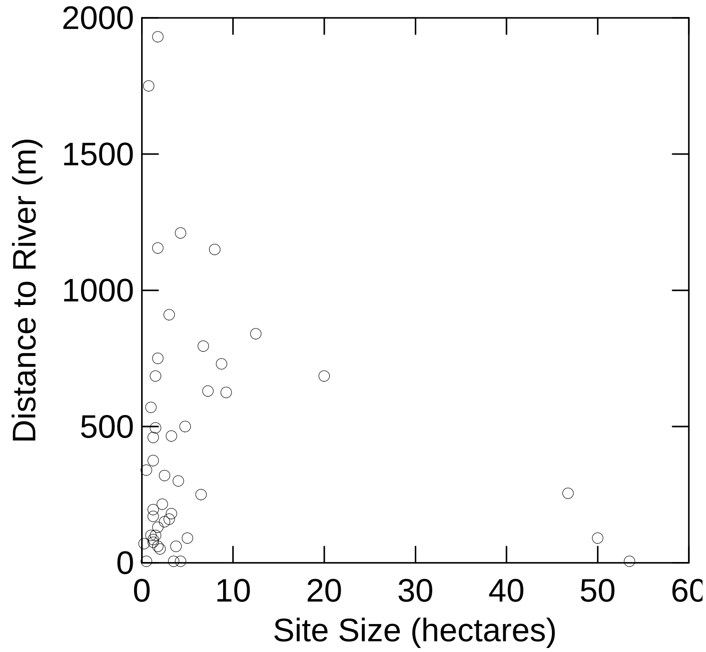

Figure 3. Scatterplot showing a poor relationship between site size and distance to the Río Chiriquí Viejo.

Though Linares *et al.* (1975) originally identified five site size classes based on length, Linares and Sheets (1980:52-3) argued that there were four types of site functions (and three population tiers), in order from smallest to largest; small hamlets (class 1, less than 30 people), nucleated farming villages (classes 2 and 3, 31-60 people), craft specialists' villages (class 4, 61-150 people), and regional centers (class 5, 61-150 people). Although the maps drawn in Linares *et al.* (1975:140), Linares and Sheets (1980:48-9), and Sheets (1980:272) show the site extents lumped together from all the chronological phases, their population estimates suggested a maximum study area population of 2,432 people at any one time, with the largest sites having no more than 150 people (Hoopes 1996:33). These estimates were based on the assumptions that houses were spaced out 50 m from their nearest neighbors (or 4 per ha), where only 25% of these houses were occupied at any one time, and where each occupied house was home to an average of 5 individuals (Linares and Sheets 1980:53). Although this would work out to only 5 people per ha of occupation, the original population estimates were based on working figure of 15 people for every 100 linear m of site length, rather than area (Linares and Sheets 1980:53). If we measure the longest axes of every site in the 1975 map (including one site was originally plotted but lacked an ID label) we arrive at almost 19 km of site or 2845 individuals, a little more than the original estimate, but with the largest site (BU-3) having 498 people, or 17.5% of the regional population. But because we know the amount of different size classes in each sub-region and the estimates attached to them, we can use Linares' estimates to also calculate a population range (assuming that class 1 sites had at least one household, or 5 people) for the study area, which was 1380 to 3150 people at any given time.

The original four households per ha estimate, only one of which was occupied at any one time, leave us with a revised estimate of 5 people per ha of occupation. Using our 5 people per ha estimate, and given the approximately 305 ha of occupation measured off the original maps, the maximum regional population would be no more than 1526 people at any one time, towards the lower end of the previous population range calculated using site lengths, and almost half of the estimate calculated from re-measuring the lengths. The largest sites on the maps reproduced in both Linares *et al.* (1975) and Linares and Sheets (1980) were BU-3 (~46.8 ha), BU-4 (~50.0 ha), and BU-5 (~53.5 ha), which work out to 234, 250, and 268 people respectively, or 56-79% more than the hypothetical maximum of 150 people for class 5 sites. More importantly, this would suggest that up to 49% of the regional population was concentrated into one of three sites (versus 19% using the site length estimate), all in the heavily vegetated southwestern zone of the study area. However these estimates are tempered by the realization that these survey maps represent occupations across a period beginning around 200 B.C. and ending sometime after

1000 A.D., and thus there is a high likelihood that regional and site estimates would vary significantly if we were able to look at them phase by phase.

This introduces questions about the accuracy of any subsequent descriptions or analyses which rely upon population estimates calculated in this manner. Catchment analyses examine the relationship between populations and (usually) locally available agricultural land. The examination of changes in these relationships is at the core of scenarios which link political hierarchy to the control of economic resources (see Cooke and Ranere 1992; Haller 2004, 2009; Isaza 2007), which are not easily tested without some reference to population estimates. Another is the identification of different tiers, or site size classes, within the settlement hierarchy as a way to talk about the relative concentration of the regional population, which may be related more broadly to different varieties of social and political organization. One way to illustrate, describe, and compare changes in population concentration and the integration of a regional settlement system is through the use of rank-size graphs (see Drennan and Peterson 2004), which examine the relationship between population and site rank on logarithmic scales (if a case can be made for the existence of interactive communities). A comparison of two rank-size graphs using the different population calculations reveals that both have similar A values (.046 versus .289) and thus both are convex to some degree, though they differ on whether that convexity is principally attributed to the larger sites or to the smaller ones.

Depending on how population estimates are done with the available regional data, different sites in different portions of the valley appear more or less important in terms of relative population concentration, but each suggests the existence of a regional settlement hierarchy. Although the original survey was done to encompass as many environmental zones as possible, there is a likelihood that many more sites and thus some portion of the area's settlement system will be found if and when the survey zone is expanded to investigate different questions. Attention now turns to questions concerning if and how different settlements and domestic groups influenced the formation or persistence of this regional settlement hierarchy through time.

2.2 DOMESTIC ARTIFACT COLLECTIONS

Spang and Rosenthal's (1980) research at Sitio Pitti-González (BU-17) suggested that higher artifacts densities, generally those more than 30 artifacts per 20 cm diameter posthole, were closely associated with buried residences. This research provides us with two working assumptions to begin with: 1) that broad artifact scatters within archaeological sites were largely scatters of domestic garbage, and 2) domestic middens, perhaps recognizable as peaks in artifact density, were closely associated with structures. Rather than trying to identify 'households' on the basis of architectural criteria such as the floor features or arrangements of postholes, a strategy aimed at collecting many small samples of artifacts over large areas has more potential to answer research questions about the relationships and interactions between many domestic groups, at least more than the relatively intensive excavation of a few structures would provide.

The focus on sampling domestic refuse is advantageous, in part, because most of it was likely initially deposited outside of domestic structures. The focus on exterior garbage scatters and middens is advantageous for three reasons. The first is that it generally allows one to examine a wider range of activities conducted outside of structures, which probably was common practice in many tropical environments (Killian 1992; Quilter 2004). The second is that sampling garbage scatters is more time and cost effective than large horizontal excavations. It is also useful because exterior garbage it is less obviously subject to a host of complicated and sometimes idiosyncratic and palimpsest factors (see Baines 2007), like sweeping or using old structures as dumps, which complicate more traditional household studies which rely largely upon piece-plotting artifact locations upon floor features (Hayden and Cannon 1982, 1983).

This is not intended to minimize the information gained from intensive excavations, slight those who do them, or advocate a wholesale replacement of that field strategy. From the idealized point of view of a multi-year and multi-scalar research program, the broad sampling of prehistoric settlements is capable of first elucidating the range of variation between domestic groups over time, especially if the argument for the spatial association between middens and areas of habitation is reasonably justified. Large and spatially extensive samples will produce statements about how typical or unusual artifact assemblages are in different sites or between portions of them. These issues may then be pursued at smaller 'household' scales of analysis which introduce additional lines of evidence to examine questions of social and occupational differentiation (i.e. architectural elaboration, structure size, sub-floor burials, etc.), an especially pertinent issue in Panama where structural foundations tend to be buried. All these lines of evidence may then contribute to the evaluation of higher-order models of social change or continuity.

Arguments about settlement or village organization cling uncomfortably to the assumption that artifact distributions do not vary wildly within even smaller units of analysis such as within an individual structure, even though such variability has archaeological precedent. Bawden (1982a, 1982b, 1990), for example, noted such variability at the Late Moche site of Galindo in Peru between the cooking zone (*cocina*), patio (*sala*), and storage areas (*depósitos*). An extensive sampling program that randomly intersected the equivalent of *cocinas*, *salas*, *depósitos*, and other various special purpose toft zones would inaccurately conclude that there was pronounced variability between domestic groups in the past. This simple hypothesis may be verified or refuted by more intensive excavations which examine variability in artifact patterning across small spaces. Such research may take the form of block excavations in deep deposits, or checkerboard exposures in shallower ones, but illustrate why a multi-scalar research program is complemented by and requires such studies. From this idealized perspective, it is not the value of intensive household oriented excavations that are question, but the order in which they occur in a scalar research project.

At the most basic level, individual collection units or excavation strata can be the smallest units of analysis to compare and contrast, but they can sometimes be combined into larger units of analysis more equivalent to a domestic group, an important goal of this research agenda. This larger unit, identifiable as a common denominator suite of artifacts which repeat again and again within settlements, has been called the 'house cluster' (Winter 1976) or the 'houselot' (Killian 1992), or the area which includes the structure or structures, nearby middens, and any surrounding gardens. This perspective is not an unreasonable import to Panama, it is analogous in many ways to the how Linares and her colleagues originally wrote about spatial organization of houses, drawn from both local ethnographic and archaeological data, as having redundant sets of artifacts indicative of a generalized 'cottage industry' (Ranere 1980b:121), and as being spaced out from one another and ringed by nearby middens and possibly 'dooryard gardens' (Linares and Sheets 1980:52).

The term houselot is preferred here over the more common usage of 'household', as was village rather than community, to try and avoid some of the potential emic-etic confusion associated with taking samples of domestic refuse to reflect a socially meaningful group, especially one which is similarly understood to have wide cross-cultural variation and not always reducible to a single structure (Yanagisako and Collier 1990). Not every houselot, for example, may have been entirely domestic in function. Young's (1980:492) ethnographic research in the Guaymí town of Marañon in the Bocas del Toro province suggested the possibility that larger community structures might be present even in very small hamlets just one or two ha in size. These structures served a part-time domestic purpose, as lodging for visitors, as well as for non-domestic ritual and church functions. Whether something like this existed in the past is an open question, but it does not correspond neatly to the co-residential group that most archaeologists refer to when they discuss 'households', although is not entirely unrelated. It is perhaps a little bit less problematic to start by approaching it as a houselot or, simply, as a sample of artifacts which were once connected to different activities which are assumed to have been at least partially domestic in nature. This assumption is not necessarily a leap of faith because comparing proportions of different 'cottage industry' or household toolkit artifacts may help to examine the degrees to which domestic activities are, or are not, represented. This perspective is intended to fall more on the etic end of the continuum, where the comparisons of collection units and houselots are simply comparisons of sets of artifacts (rather than features) and the activities they were connected to, with reference to past identities and social affiliations largely limited to those of status and occupational specialization as can be gleamed from the similarities and differences between these sets.

Linares and Sheets (1980:53) observed that individual dwellings in the region tended to be spaced 50 m apart on average, and thus that each 'household' occupied an average space 50x50 m, or 2500 square m, a spacing which subsequent population estimates using site length or area were based. Although this figure seems to roughly agree with the two 41 and 48 m distances observed ethnographically between households in Marañon in the late 1960s (Young

1980:493), it is unclear how Linares and Sheets arrived at it since only a single dwelling was excavated in the highlands. Spang and Rosenthal (1980:282-3), for example, wondered if numerous small circular patches of short grass in a fallow field at Sitio Pitti-González (BU-17) might have represented individual dwellings, though no word is given on their spacing. However, the intersection of one of these patches by Spang and Rosenthal with a test pit did not suggest that it was a house feature, although features themselves (such as floors or postholes) were notoriously ambiguous in this area. Nevertheless, a 50x50 m area represents the best available guess of a scale appropriate for examining at least one houselot.

Since the budget was finite and the research questions dealt with understanding the interactions and relationships between many domestic groups or houselots, it was worth knowing at least a little bit about multiple sectors in several sites, rather than very much about only a few. Ideally, a target sample of 70 artifacts from each 50x50 m block would allow one to estimate artifact proportions at a 90% confidence level with an attached error range of no more than ±10% (Drennan 1996b:142-144). Because a collection strategy aimed at simply collecting the first 70 artifacts would probably have been heavily biased towards higher visibility artifacts (for example, ceramics with a bright orange slip), and thus skewed calculations of artifact proportions, it was believed more prudent to adopt more systematic approach which made an effort to collect all of the artifacts within a collection unit. This was done by placing a small collection unit in the center of the block, and spacing an additional four units in the middle of each of the 25x25 m quadrants. This strategy helped to reduce the possibility that large scatters of domestic material might be leapfrogged by the sampling strategy (if they were spaced at some other distance besides 50 m), and it also provided the option to compare spatial distributions at both 25 and 50 m scales (although statistical confidence level is naturally lower at the 25 m scale). In order to conserve time and money no more than these five collection units were done within any 50x50 m block. Looking at several 50x50 m blocks together, the effect would be two alternating transects, one with collections spaced roughly every 25 m, and another with collections spaced approximately every 50 m.

The most rapid way to lay out the locations of these collection units within each 2500 m^2 block was to arbitrarily decide UTM coordinates for each center and quadrant point in advance on fieldwork, and then flag the appropriate spot immediately ahead of the field crew. In the field, this was accomplished with an older handheld Garmin GPS unit which typically had an error range between 7-10 m. A built-in error of this magnitude would probably horrify many archaeologists, but was particularly advantageous to a sampling program such as this because GPS error is random by definition. For example, when looking back at a long north-south transect of flags supposedly spaced exactly every 25 m, many would appear to be slightly out of line rather than in an orderly row. Although the UTM coordinates would suggest they are equally spaced and in a perfectly straight line, many would be 7-10 ms off in some direction in reality. This random error served to further reduce the possibility of leapfrogging most artifact scatters, but the error was not so large so as to miss any single 25x25 m quadrant altogether. Occasionally these points were adjusted or eliminated according to local topography if, for example, a steep slope or swampy area precluded doing a collection unit there. Because coordinates were decided in advance of the walkover, an effort was made to minimize the placement of collections in areas that subjectively appeared to be superficially promising or interesting.

Depending on local conditions, gathering artifact samples from potential houselots and settlements was initially accomplished by digging small shovel tests, doing small surface collections or, in a few cases, collecting material from the surfaces of larger areas.

2.2.1 Shovel Tests

When surface visibility precluded taking surface collections, shovel tests were the primary way to get information about the internal composition of different sites. From the outset, shovel testing was considered an appropriate means to collect information because soils in the project area are silty loam in composition (and thus can be dug in a timely manner), and cultural deposits rarely exceed much more than one meter in depth unless they were within a pit or shaft feature (see Künne and Beilke-Voigt n.d.; Rosenthal 1980:291; Spang and Rosenthal 1980:286; Stewart 1949). Previous subsurface sampling in the area using a 20 cm diameter posthole digger suggested that over 20 artifacts could be expected per probe within site cores almost 50% of the time, although there was no information on the depth of these tests in Dahlin (1980). A circular 40 cm diameter shovel test, twice as large as the previous postholes and dug into sterile soil or to a meter in depth (whichever came first), was expected to yield a more conservative quantity of artifacts, between 15 to 20, since they would be spread across both site cores and margins. This turned out to be a fairly reasonable expectation, as the 796 shovel tests dug in for this project (61.9% which were done at Barriles) produced a mean of 14.9 artifacts (table 1), with 95% of the shovel tests containing between 13 and 17 artifacts.

Table 1. Shovel test statistics

Number	796
Minimum Artifacts	0
Maximum Artifacts	369
Median	4.0
Mean	14.9

Shovel tests to a depth of one meter generally had straight sides until about 70 cm below the surface, where they tapered inwards until the bottom of the test terminated in a rough point. As a result, the typical shovel test was a cylinder in profile until the 70 cm mark, where the last 30 cm was conical (Figure 4). As a result, the volume for a 1 m deep shovel test was .089 m^3, but .088 m^3 of which was excavated in the top 70 cm while only .001 m^3 was taken from the bottom 30cm. How this did or not did under represent earlier phases could then be contrasted against information from deeper stratigraphic excavations. Soils were screened through 6mm (or 1/4 inch) mesh, strata quickly measured against incremental notches cut into the shovel handles and then briefly described in the field notes, and artifacts were bagged by each test pit. Each collection unit was assigned a UTM coordinate using a handheld GPS for subsequent entry into a GIS database.

Since site boundaries were generally defined by delineating surface scatters by the original surveyors (Sheets 1980:268), it was likely that some site boundaries would be redefined by subsurface testing. For example, Barriles (BU-24) was originally plotted as an approximately 12.5 ha site on published maps, but turned out to be around 32 ha (all phases together), with an additional 1 to 2 ha on the edges (bordering a ravine) left untested due to lack of landowner consent. It quickly became apparent that, through some work done at a small area where no sites were thought to exist, at least one or two artifacts could be found just about anywhere in the region and thus traditional 'sites' could, theoretically, extend almost forever. As a result, the methodology was designed so that 50x50 m sampling blocks radiated out in each of the cardinal directions from the centers of sites which were originally defined and plotted in Linares *et al.* (1975), and the process arbitrarily concluded when 20 artifacts or fewer were recovered from a 50x50 m block (an average of 4 or less artifacts per collection unit). Without this arbitrary rule, the testing of a village site like Barriles would have likely extended much further, as the site appeared to be orbited by a dispersed scatter of individual farmsteads which stretched on to an unknown distance. Therefore the site boundaries and sizes presented in this dissertation roughly approximate core occupational areas, especially of village communities.

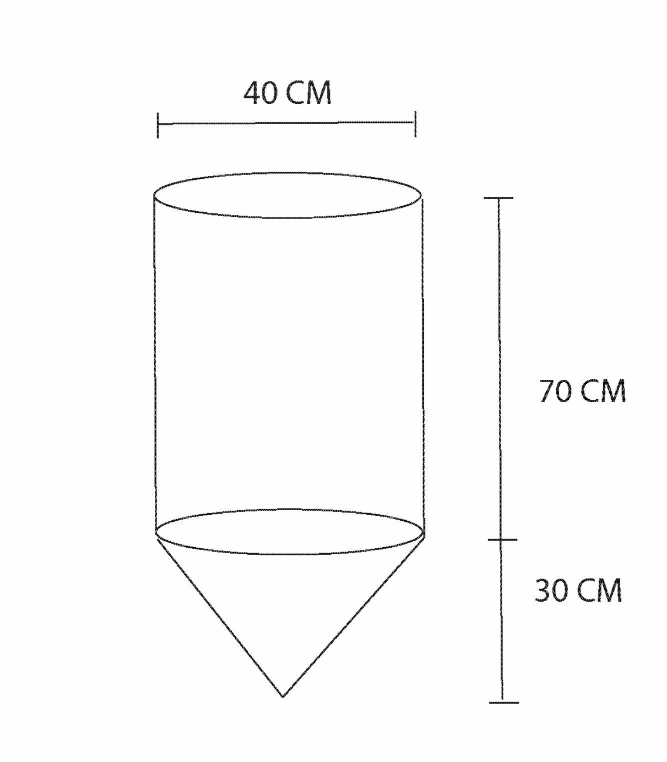

Figure 4. Typical shovel test profile.

2.2.2 Controlled Surface Collections

In areas of adequate ground visibility, the 50x50 m areas were sampled using combinations of 3 m diameter collection circles (7.1 m^2). Sites in the study area were originally not sampled by Linares *et al.* (1975) using small collection units, but by trying to collect all the ceramics and lithics within the site. Because this was impractical in sites with dense concentrations, Linares and her colleagues focused on collecting lithics and ceramic pieces they thought would prove diagnostic, like rims and decorated sherds (Sheets 1980:268). The nearest information available on artifact densities within sites comes from the Shelton's (1984) research at RN 54 in the Chiriquí foothills near the modern town of San Vicente. Though she surface collected in rectangular units, her appendices suggest that 29.4 artifacts might be expected per 7.1 m², or an expected density of 4.16 artifacts per m². Once again however, the old caveat that this previous research might have been done within particularly dense and unusual areas of artifact concentration creeps back in. Shelton's results turned out to be a fairly inflated expectation, as the 685 3 m diameter surface collection loci (each sampled with 1 to 3 circles) done in this project (90.9% of which were done at Sitio Pitti-González/BU-17) produced a mean density of 2.24 artifacts per m² (or 15.8 artifacts per circle), with 95% of the collection circles having between 2 and 2.5 artifacts per m² (or 14 to 18 artifacts per circle).

Table 2. Controlled surface collection statistics

Dogleash Collections	665
Minimum Artifact Density (m²)	0
Maximum Artifact Density (m²)	36.2
Median Density (m²)	0.6
Mean Density (m²)	2.2

These 3 m diameter circles were laid out using a 'dog leash', or a 1.5 m string tied to the ends of two sharpened stakes, one which was hammered into the center of the circular unit and the other which was used to outline out the edge of the unit in the dirt. Because these collection units could be done much more rapidly than a typical shovel test (averaging of 5 minutes per circle compared to 20 minutes for a shovel test), it was believed to be worthwhile to collect larger samples, or more than 70 artifacts, per 50x50 m block. This was desirable to try to overcome two principal worries about surface materials, 1) that there would be higher proportions of unknown ceramics because they had been exposed to more weathering, and because 2) ubiquitous but natural volcanic pumice looked very similar to weathered ceramics in the field, which would inflate on-the-spot artifact counts erroneously. Field crews were instructed, when possible, to collect at least 30 artifacts per collection spot (or at least 150 per 50x50 m block if all five collections were done). If they failed to find 30 artifacts in the first collection circle, a second circle was laid out adjacent to the first and, if needed, a third contiguous to one of the prior two. If 30 artifacts had not already been collected in three contiguous circles (or 21.2 m^2), a decision was made to conclude work in that particular spot in the interest of saving time and money. Surface collections like these were also much more popular with local landowners and administrators, who were generally suspicious of people digging in their cultivated fields or pastures for weeks at a time. In several sites, and portions of others, landowners prohibited subsurface tests altogether, making surface collections the only remaining technique available.

2.2.3 General Surface Collections

In four sites (BU-5, 8, 19, and 49), artifact densities were so low (much less than .5 artifacts per m^2) that a sampling strategy besides the relatively small collection circles was needed. After trying in vain to collect artifacts from the first several collection circles, a decision was made to have the entire team try and collect all the artifacts they could find in an entire 50x50 m block and bag them all together. This type of strategy collected more artifacts, thus increasing the statistical confidence in different artifact proportions from one block to the next, but it did so at the expense of lowering the spatial resolution. But it also almost certainly introduced more sampling bias than the collection circles, as larger and brighter artifacts had a better chance to be spotted during walkover than did smaller and inconspicuous items (see Haller 2004:28; Hansell 1988:222). One ‘site’, BU-19, only produced 6 artifacts in an entire ha of collection, and was regarded as part of the ephemeral but ubiquitous scatter of a few artifacts found nearly anywhere in the valley. It was therefore not analyzed any further.

2.2.4 Small Stratigraphic Excavations

Chronological control is notoriously difficult to achieve in shovel tests or surface collections, especially in multi-component sites. In an attempt to strengthen a diachronic perspective on domestic organization, the final phase of fieldwork involved excavating 32 1x1 m test units. Ideally, based on the results of the prior samples, units would have been placed in areas that contained evidence for stratified occupational phases and in locations where larger samples of artifacts were particularly desirable (such as possible production areas or middens). Therefore these units were not randomly placed (and cannot easily be treated as such in analyses), even if they were based on distributional maps based on randomly placed collections. In reality, landowners in working farms would only allow excavations in fallowed areas, and landowners of the smallest sites included in this study were highly suspicious of any work in general, and did not permit excavation. The strategy of placing excavations in desirable areas was largely achieved at Barriles (BU-24), where 23 (71.9%) units were excavated across the site. Another 9 (28.1%) were excavated in fallowed fields at Pitti-González (BU-17), and only one was able to be excavated elsewhere, at BU-3.

Units were excavated by 10 cm levels within natural strata and screened through 6 mm mesh. Profiles of previous excavations in Barriles (Rosenthal 1980:291; Beilke-Voigt 2002:607) and Pitti-González (Spang and Rosenthal 1980:286) indicated that cultural deposits rarely exceeded 1 m in the study area, although features such as burials and pits are known to have exceeded this depth (Beilke-Voigt *et al.* 2004; Stirling 1949). This observation proved to be largely correct, and many units at Barriles encountered sterile strata around 120 to 130 cm below the surface. Features were not the focus of this research, since units would ordinarily need to be expanded to adequately outline the edge or profile of a feature. This would have eventually made the cost of excavation prohibitive. Several features, such as possible cobblestone floors, ash stains, and a pit, were noted and photographed in the course of excavations, but were not expanded.

2.3 EVALUATING THE 'FIT' BETWEEN SURFACE AND SUBSURFACE ARTIFACT DENSITIES

One of the persistent dilemmas associated with surface collection methodologies is that they may, or may not be, representative of subsurface deposits (Greenfield 2000). It is less of a potential problem in this study since sites were either shovel tested or surface collected in their entirety by the same teams, and therefore the different patterns observed within sites cannot be directly attributable to differences in the collection units or personnel themselves. One area of purposive overlap was within Pitti-González (BU-17), and was undertaken in the expectation that understanding the relationship between surface and subsurface deposits might be informative to the future study of other sites, or be of some use in designing future regional survey programs in the Chiriquí highlands more generally.

Although it complicates stratigraphic control within excavations, the advantage of collecting the ground surfaces within working farms is that mechanical plowing may have 'randomized' artifact assemblages on and within the plow zone (Ammerman 1985), especially at a site like Pitti-González (BU-17) where the bulk of the artifacts in the 1x1 m stratigraphic excavations were found within the top 40 cm. Occasional frosts may also bring artifacts to the surface, while frequent hard rains usually harden recently plowed surfaces and increase visibility. Studies elsewhere in the world have suggested that the lateral displacement of artifacts as a result of tilling activities is minimal, usually between 1 to 8 m (Lewarch and O'Brien 1981). For a study seeking to analyze similarities and differences in the coarse distributions of artifacts between 25x25 blocks, 50x50 m blocks and so on, this degree of lateral displacement was deemed acceptable.

Surface densities of artifacts (m^2) recovered from small circular collection units were compared against volume densities of artifacts (m^3) recovered from a shovel test placed in the center of the first collection circle. This was done for 58 collection loci in a single fallowed field of 2.4 ha at Pitti-González (figure 5). Ordinarily it might be more desirable to examine the relationship from a more spatially extensive sample in the event that a given area might be unique or unusual, but subsurface tests were only permitted in fallowed areas of the farm in this particular instance. Ordinarily the 70 cm A horizon (half of it plow zone) sat atop a sterile layer of clay mixed with pumice, which graded into even thicker sterile clay with increasing depth. The depth of this stratum in the shovel tests was noted in the field notes, and it is the volume of this stratum in each test, not the underlying clay, that went into the final volume density figures. Because shovel tests narrowed with depth, volumes up to 70 cm in depth were calculated as cylinders and added to conical volumes calculated for depths below that. For the surface density figures, the total count of artifacts was simply divided by the area that was collected (each collection circle was ideally 7.1 m^2). Across this 2.4 ha portion of the site, surface densities averaged 2.8 artifacts per m^2, and volume densities averaged 140.6 artifacts per m^3, therefore qualifying as slightly denser than usual compared to other collections in the region.

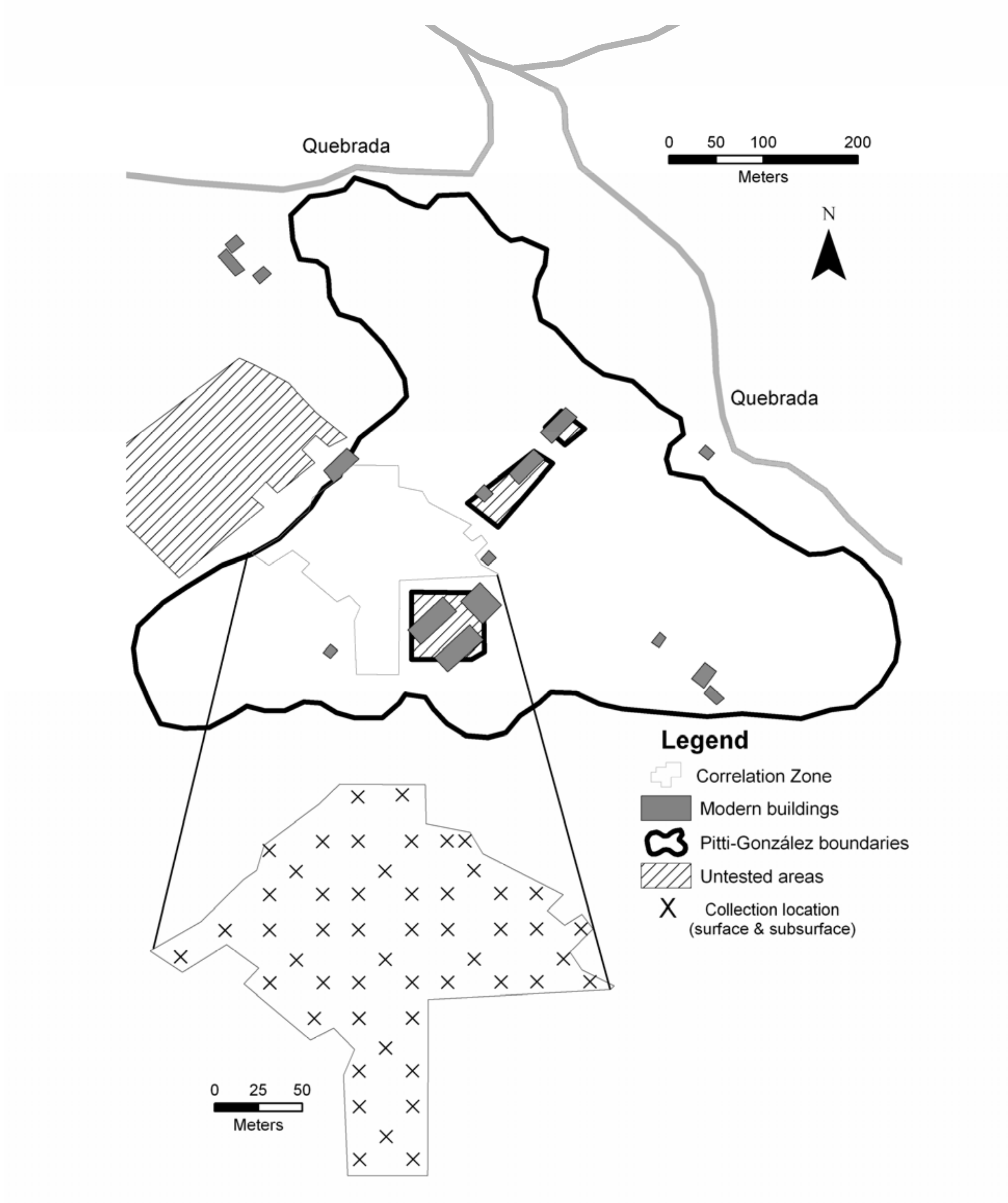

Figure 5. Map of Pitti-González (BU-24) showing location of correlation study.

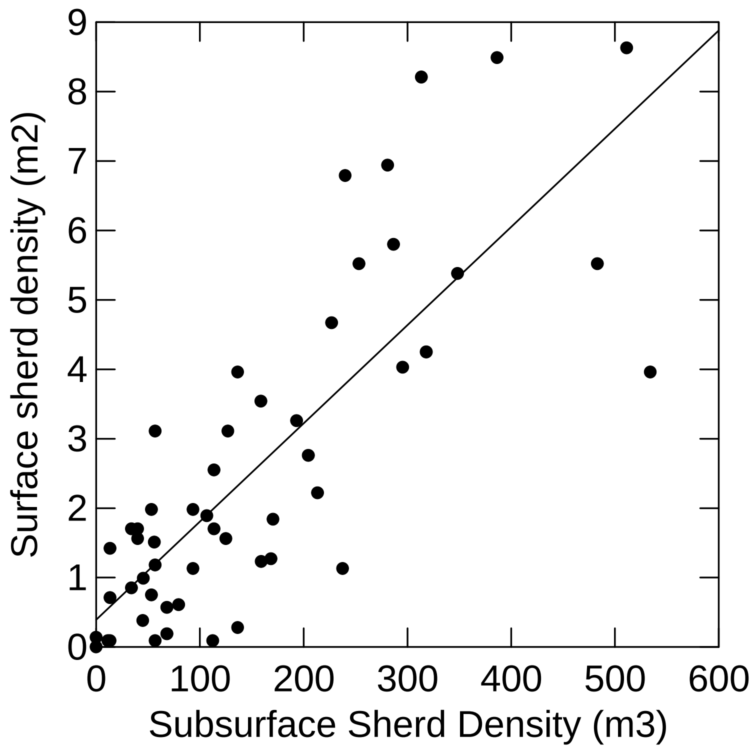

Figure 6. Scatterplot of surface and subsurface sherd densities from Pitti-González (multiple R-squared= .630, Y=.014x + 0.430, p<.001).

Figure 6 shows that there is a moderately strong linear relationship between surface and subsurface artifact densities, where approximately 63% of the variability in subsurface densities was predicted by surface densities. Quite simply, denser concentrations of artifacts on the surface of the plow zone did roughly approximate high artifact densities below ground and that, at least in a general way, surface collection data can be used to predict subsurface densities with some degree of accuracy. The moderately strong relationship between surface and subsurface densities meant that the site surface was representative of the subsurface to a degree, and can thus allay any extreme fears to the contrary.

The single greatest worry associated with the use of surface deposits are that earlier periods pr phases will be systematically underrepresented, thus biasing any discussion of change over time. This is, unfortunately, a common critique which is often expressed as a matter of faith among many archaeologists rather than an empirical issue to be evaluated. Whether or not earlier phases are underrepresented can be explored by simply comparing the proportions of early diagnostics (divided by total identifiable sherds, rather than total diagnostics) in both surface and subsurface samples. In the Pitti-González case, the earliest phases are the Concepción and Early Bugaba, descriptions of which may be found in Chapter 3 and Appendix A. The earliest ceramic phase, the Concepción, was represented by only 6 sherds total and was therefore lumped together with the subsequent Early Bugaba to create a generic Early Phase for the bullet graphs below. The Late Phase simply represents the Late Bugaba Phase (no late Chiriquí sherds were found in the zone).

In the event that the reader finds the whole revised chronology present in Chapter 3 suspect, we can also compare the proportions of rims and decorated sherds, which tend to be almost universally regarded as temporally sensitive diagnostics in many parts of the world. These comparisons are shown in Figure 7 below, and suggest that earlier periods are demonstrably not underrepresented within Pitti-González. Contrary to intuition, surface collections produced slightly higher proportions of early material and shovel probes recovered slightly higher proportions of late material. The reasonably strong manner in which surface densities approximated subsurface deposits combined with the realization that early phases are present in equivalent proportions therefore favor the use of controlled surface collection when possible.

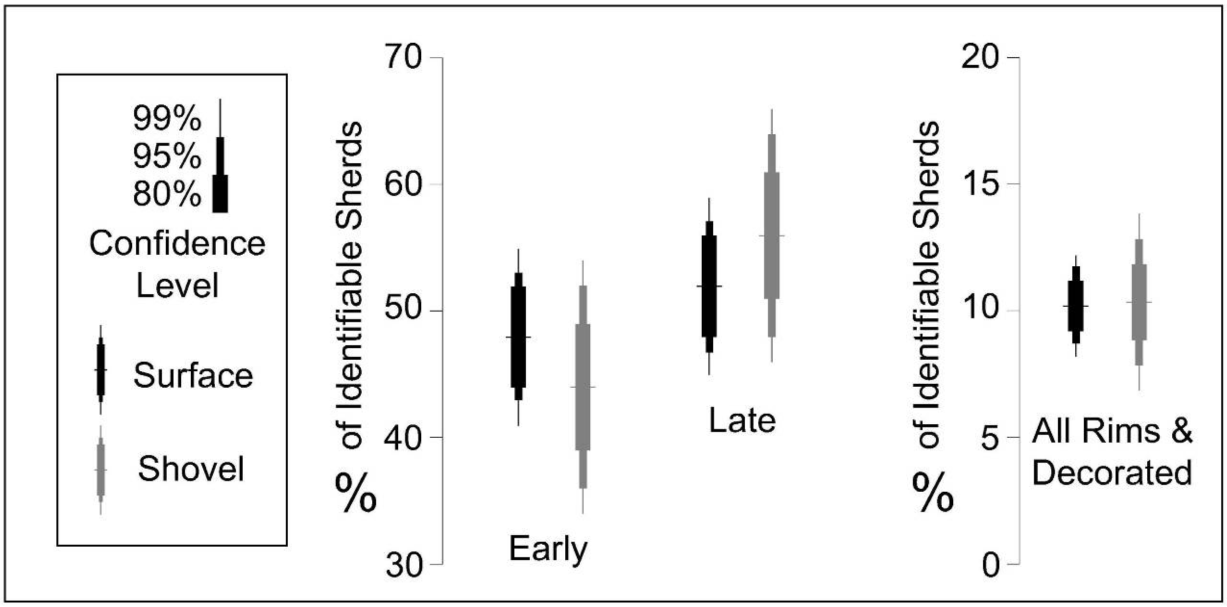

Figure 7. Statistical comparisons of diagnostic artifact proportions between surface and subsurface collections

The correlation argument basically posits that surface deposits may be analyzed if they generally agree with subsurface ones, a pattern observed here. This is a point which assumes that subsurface deposits are somehow 'correct' and that surface collections are only valuable when they approximate what lies beneath them. As Dunnell and Dancey (1983) have pointed out, to insist on such a correlation may be an unrealistic standard to regularly expect of the archaeological record. For example, few archaeologists would universally insist that one excavation stratum must mirror the one immediately below it to yield useful information. Yet this exact expectation is made by some critics who make 'surface as stratum' analogies (i.e. Hope-Simpson 1983, 1984), thereby applying a different and inconsistent logic to the use of surface deposits. What has been partially lost in the discussion is if or how the exclusive use of surface or subsurface deposits ultimately alters our ultimate interpretation of residential density.

The statistical results presented in figures 6 and 7 suggested that we may reasonably expect a fairly close agreement between the distributional patterns and interpretations from either data source. The distributional densities of surface and subsurface collections, illustrated separately as the Early and Late Phases, are shown in figure 8 below. Comparison of the two immediately alleviate another one of the most extreme worries imaginable; that surface collections might suggest a highly dispersed mode of occupation (assuming middens were close to residences) and that subsurface tests would indicate a tightly clustered one, or vice-versa. There are noticeable differences in the precise location of higher density areas, sometimes more than 50 m apart, which is reason for concern if the sole objective of using the surface collections presented here was to identify promising areas for future excavations with precision finer than 50 m. If that was the principal objective it is very likely that surface collections spaced every 20 to 25 m simply represent too coarse a resolution to plan excavations which would ordinarily open up much smaller aerial exposures.

The density maps based on surface and subsurface sherd densities both suggest that occupation in the correlation zone was remained relatively dispersed over time, with noticeable peaks in sherd density separated by 50 to 75 m of lower density sherd scatter. If we assume for the moment that these concentrations are indeed the remains of household middens, this pattern agrees generally with Linares and Sheet's (1980) description of Volcán Barú villages as being composed of highly dispersed residences separated by 40 to 50 m of space. More importantly, the maps presented in figure 8 suggest that both surface and subsurface deposits lead us to the same general interpretation of occupation within the 2.4 ha correlation area, an observation that lends crucial support to the appropriateness of using surface artifact distributions to address the research questions in this study.

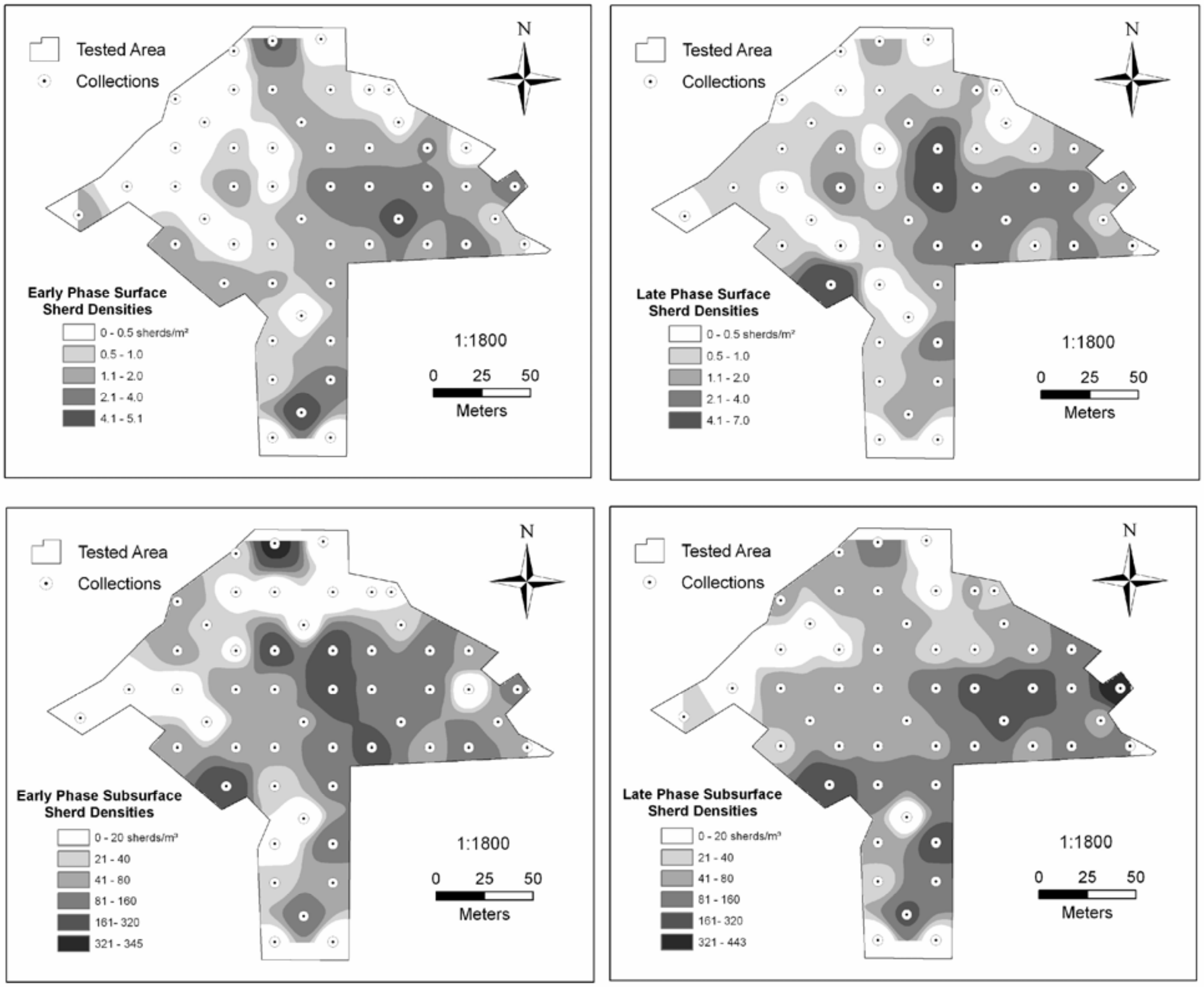

Figure 8. Sherd density maps using surface collections (top) and shovel tests (bottom).

2.3.1 The Effect of Ground Visibility on Surface Collections

The effect of surface visibility on the identification and collection of artifacts has been a persistent worry in many surveys (Drennan *et al.* 2003; Schiffer *et al.* 1978). It is an important worry in the Volcán Barú study area, as the overall surface visibility is exceedingly poor. Large portions are heavily vegetated or otherwise forested (figure 9), and areas of adequate surface visibility are limited to the Llanos (which lacks sites), or to working farms in the area (figure 10).

The majority of these farms are in the Cerro Punta and Bambito portions of the valley, where landowners would not otherwise permit subsurface testing in portions of fields that were under cultivation, but were comfortable with surface collections. Occasionally, adequate surface visibility can be found within coffee *fincas* in the Intermediate and Southwest zones. Sites in these zones, however, tend to have deeper cultural deposits that were intermittently capped by low-density or sterile surface strata, and thus favor shovel testing as a sampling strategy whenever possible.

Figure 9. Photo of Barriles, showing poor surface visibility.

Figure 10. Photo of Pitti-González, showing excellent surface visibility.

Prior to work in a surface collection loci, ground visibility was estimated as excellent (little to no ground cover), medium (~50% ground cover), or poor (very significant ground cover). Very often, areas of poor surface visibility were zones where carrots were being cultivated, whose leafy stalks could be pushed from side to side to enhance visibility. Figures 11, 12, and 13 illustrate typical examples. Two sites were systematically sampled in their entirety using small collection circles, Sitio Pitti-González (BU-17) in Cerro Punta, and BU-12 in Bambito. One site, BU-40, received five collection loci before a decision was made to collect in larger 50x50 m blocks. 623 (91.0%) of the collection loci (each requiring between 1 and 3 circles) were collected in Pitti-González, 57 (8.3%) in BU-12, and 5 (0.7%) in BU-40. Of these

685 loci in the three sites, 406 (59.3%) were done in areas of excellent surface visibility, 189 (27.6%) in medium, and 90 (13.1%) in poor.

Figure 11. Surface of Pitti-González (BU-17) showing excellent ground visibility.

Figure 12. Surface of Pitti-González (BU-17) showing medium ground visibility.

Figure 13. Surface of Pitti-González (BU-17) showing poor ground visibility.

Table 3 shows that collections made in area of poorest surface visibility had a mean density of .7 artifacts per m² (s.d.=1.4), those in medium visibility an average of 2.7 (s.d.=5.3), and those in excellent averaged 2.3 (s.d.= 3.1). These higher means and larger standard deviations in the medium and excellent visibility areas are due to several very dense outliers. Rather than isolated incidents, a few collection loci with unusually dense concentrations of artifacts were often found adjacent to each other, a pattern that repeated again and again, and which likely suggested something meaningful about the nature of prehispanic occupation. It would therefore be counterproductive to trim these as inconvenient outliers.

Table 3. Surface visibility statistics

	Poor	Medium	Excellent
Number	90	189	401
Minimum Density	0	0	0
Maximum Density	7.9	36.2	19.1
Median Density	0.3	0.5	0.8
Mean Density	0.7	2.7	2.3
Standard Deviation	1.4	5.3	3.1
95% Upper	1.0	3.4	2.6
95% Lower	0.4	1.9	2.0

The consistently low densities in areas of poor surface visibility are more of a worry, since they rarely approach the densities of the other two categories, and because an area of poor visibility defined one corner of the Pitti-González (BU-17) site. On one occasion, a few days after collections were made in a particularly poor visibility carrot patch, the crops were harvested. This effectively transformed the area from poor to excellent visibility. Superficial walkover of the area confirmed what the collection density values suggested all along, that there were simply very few artifacts to be found on the surface. Because of this, it is therefore less of a worry that areas of ordinarily high artifact density were artificially depressed by poor ground visibility, and thus variation in visibility is unlikely to have an overwhelmingly strong effect on subsequent calculations of artifact concentrations or population estimates.

2.4 LABORATORY ANALYSES

Studies of craft production have usually either examined the spatial proximity of production loci to different features (i.e. palaces, mounds) within sites (Inomata and Stiver 1998; Janusek 1999; Welch 1991), or examined the morphological homogeneity of the craft products themselves to infer something about the organization of the producers (Costin and Hagstrum 1995; Hayashida 1999; Lass 1994). In these studies, artifact homogeneity was related to the flow of information (Costin 1991), which was assumed to be higher when specialized producers were concentrated, and thus in regular communication, or through the use of similar production technologies (i.e. molds). Only a few studies, namely Sinopoli's (1988) work in India, have attempted both. The spatial distribution of production debris between different houselots is the principal focus in this study, but particular techniques within the laboratory were employed to examine at least some preliminary measures of artifact homogeneity and heterogeneity.

Temple University's collection of Chiriquí ceramic wares and decorations, many from Spang and Rosenthal's (1980) research in Cerro Punta, were shown to me by Dr. Catherine Shelton in the winter of 2007. As a result, this study's ceramic typologies and analysis follow Shelton's (1984) original study to some degree, although Corrales' (2000) dissertation was particularly useful for cross-checking these classifications and for distinguishing between different vessel forms. This investigation has kept Shelton's emphasis on the identification of different wares, based primarily on surface finish and paste, while trying to heed Corrales' suggestion to also examine the popularity of different vessel types through time. Ceramics were first divided into and counted by wares, types of decoration, and vessel types (with internal orifice diameter measurements when possible). Unknown sherds, usually very tiny or heavily eroded pieces, accounted for roughly 20% of the total assemblage. Within each of these categories, ceramics were further subdivided into those with fine paste and those with a coarser oatmeal-like paste. Although the time and cost of measuring the thickness of each and every sherd would have been prohibitive, the profile of each rim and base were sketched to exemplify different vessel forms and to provide a baseline dataset on sherd thickness and metric homogeneity, which may or may not have been clearly related to aspects of the productive organization.

The ceramic analysis presented in chapter 3 differs from Shelton's original study in a few important respects. The first is that no attempt was made to subdivide forms of appliqué decoration into finer categories like zoomorphic, anthropomorphic, etc. They were all simply lumped together as forms of appliqué decoration in the analysis. The second is that darkened ceramic cores, a feature Shelton (1984:109) felt might be characteristic of the Valbuena ware, were eliminated from the analysis. Observation of the first few lots of ceramic sherds made it apparent that the presence or absence of a darkened core in the paste was shared by every ware (although far less frequently in Bugaba Engraved), which possibly reflected varying control over the firing process. Several very large sherds (>10 cm) from both the Cerro Punta Orange and Valbuena wares had the darkened core on one side while it was absent on the other. Breaking these sherds into several smaller pieces revealed many gradations in tones between the darker and lighter sides, probably suggestive of the vessel's relative placement within a kiln rather than any straightforward attribute that could be used to identify a particular ware type.

Lithic artifacts were analyzed according to tool and debitage types, following aspects of Ranere and Cooke (1996), and Ranere (1980b). The chipped, ground, and polished stone assemblage were also classified according to raw material, usually either andesite, basalt, chert, slate, or other (i.e. greenstone, obsidian). *Mano* and *metate* fragments, as well as the Barriles statuary, were generally made out of rhyolite. Grab-bag samples were taken from the nearest stream or river to each side to compare examples of naturally occurring raw material with those in the lithic assemblages. Although measurements of axe weight, cross-sectional form, and bevel angle have proven valuable in studies of highland Papua New Guinea axe production and trade (see Burton 1989), these require complete specimens. Since only three complete stone axes (out of 36) were recovered, this type of analysis was deemed impractical.

3.0 CHRONOLOGY

The Gran Chiriquí prehistoric ‘sequence’ has been recognized as a trajectory distinct from other areas of Southern Central America (Cooke and Sánchez 2004; Fitzgerald 1996), although future research will probably illustrate the existence of many different sequences from region to region within the culture area. The first evidence for social ranking appeared in the Formative, or Aguas Buenas Period, which is associated with 16 radiocarbon dates in Western Panama or the nearby Coto Brus region. These dates span from A.D. 350-800, although the Aguas Buenas in Western Panama has been discussed as lasting from A.D. 200-600 (Linares 1980; Shelton 1984) until recently.

Besides a chalcedony biface found by Dr. Richard Cooke on the Universidad de Panamá campus in David (Cooke and Ranere 1996; Dickau 2005), the earliest portion of the preceramic sequence has not been found in Gran Chiriquí, and is known largely from the Central region of Panama. As a result, it will not be described in great detail here, although an excellent review may be found in Dickau (2005). Likely Paleoindian or early Preceramic material has been found at Carabalí (Verlario 1985), Lake Madden (Ranere and Cooke 2003), La Yeguada (Pearson and Cooke 2002), rockshelter AG-4 (Weiland 1984), La Mula-West, Aguadulce, and Cueva de los Vampiros (Ranere and Cooke 1991). Further into Colombia, very early material (and ceramics) can be found at Puerto Hormiga and Monsú (Drennan 1996a). Cueva de los Vampiros represents the only site in Southern Central America were Paleoindian material was found in stratified contexts (Dickau 2005:66). Cooke (2005) and Ranere and Cooke (1996) suggest that this period was likely one in which culturally homogeneous bands (evidenced by ephemeral but stylistically similar lithic toolkit) moved across the isthmus.

The small and highly mobile bands, supposed big game hunters from the plains of North America, encountered and adapted to a mosaic of different environments in Southern Central America (Piperno and Pearsall 1998). The evidence is scarce, but these adaptations probably involved depending more heavily on local plants and fruits in the diet. Conceivably riverine, estuarine, and maritime resources were relied upon as well, although rising sea levels during the early Holocene likely drowned much of the earliest coastline record.

The vegetational record of the Laguna La Yeguada cores show human impact on the physical landscape in the form of burning and clearing, reaching its highest intensity between 6500 and 5000 B.C. (Piperno *et al.* 1991). This increasing intensity, however, is not mirrored by increasing numbers or visibility of sites in the archaeological record until after 5000 B.C., when the archaeological evidence for redundant rockshelter use and incipient cultivation becomes clearer (Cooke and Ranere 1992; Cooke *et al.* 1996:113). Griggs (2005), for example, argues people were likely already moving into Pacific watershed around this time, and cultivating maize and manioc at rock shelter LP-8 as they did so.

3.1 TROPICAL FOREST ARCHAIC (4600 TO 2300 B.C.)

The Tropical Forest Archaic is largely known from two highland rockshelter excavations, Casita de Piedra and Trapiche, both along the Río Chiriquí downstream from the modern-day town of Boquete. A third, the nearby rockshelter of Hornito, was excavated and described by Cooke

(1977). All three are roughly contemporaneous with the site of Monagrillo in Central Panama (Linares 1977a, 1977b). This time frame in the highlands is thought to be characterized by small groups making a living by hunting, gathering, and horticulture, all well-adapted to the tropical forest environment. Although no macrobotanical maize remains were originally recovered, the research summarized by Dickau *et al.* (2007) indicates that stone tools were used to process arrowroot, maize and manioc, although no single cultivar constituted more than a minor proportion of the overall botanical assemblage.

The Tropical Forest Archaic has been divided into early and late halves- the Talamanca and Boquete- by Ranere (1980b) on the basis of changes in the lithic toolkit. Besides the host of flake and expedient tool technology in each, the earlier Talamanca phase was characterized by many heavy woodworking tools- choppers and bifacial wedges- while the subsequent Boquete was marked largely by the introduction of ground and polished stone tools (with *manos* and *metates* added in the Formative). Among these ground and polished stone tools were axes, thought to be related to woodworking and forest clearance activities associated with the growing importance of cultivation and incipient agriculture (Linares 1976, 1977a, 1977b). It is unclear whether or not differences between rockshelter assemblages were the result of year-round or seasonal occupations. The macrobotanical remains (i.e. charred seeds) suggest a short seasonal occupation from roughly late March to June (Ranere 1980a:34). The macro and microbotanical (starch) analyses summarized in Dickau (2005) and Dickau *et al.* (2007) indicate that a broad spectrum of flora were processed on site, including many types of seeds and nuts, arrowroot, manioc, wild yam, *Zamia*, and even small quantities of maize. Other rockshelter sites, presumably with Archaic components, were identified by Shelton (1984:92) in the Río Chiriquí Viejo drainage and, utilizing Dickau's (2005) techniques for recovering microbotanical remains on groundstone surfaces, their future study would almost certainly improve our understanding of trends during both phases.

3.2 THE CONCEPCIÓN PHASE (300 B.C. TO A.D. 400)

Unlike Monagrillo on the Azuero coast, pottery appears relatively late in the Chiriquí sequence with the introduction of Concepción wares around 300 B.C. The Concepción represents the adoption or introduction of ceramic technology in Western Panama. To date, Western Panama lacks clear evidence for ceramics similar to the older Sinacrá or Curré Complex in Southern Costa Rica (Corrales 2004), or the Quebradas Complex (roughly 500 B.C.) further to the west (Corrales 1988; Drolet 1988). These periods are the ones that supposedly witnessed the initial emergence of small but sedentary Formative village societies in Gran Chiriquí (Rago 1988). On the basis of stylistic similarities to older ceramics elsewhere, is thought to be an intrusive complex from Costa Rica rather than Central Panama, though examples of zoned and incised ceramics are also found in Central Panama during this Period (Willey and McGimsey 1954). Very little is known about the linkages, differences, or changes within or between Concepción societies. Shelton (1984:211) suggests the Concepción represents the first manifestations of settled village life in Western Panama, and her survey work largely agreed with Haberland's (1962, 1969) original observations that Concepción pottery is generally found in the Chiriquí foothills rather than on the coastlines or higher in the cordillera.

The hypothetical spread and settling in of early Formative farmers from the coasts and foothills of Southern Costa Rica (presumably from the Diquís Delta area) is a common idea in Gran Chiriquí (see Cooke 2005; Cooke and Sánchez 2004), though Haberland (1984) has instead suggested that colonists came from the Vereguas province to the east (Hoopes 1996). This is, in part, because macrobotanical maize remains have been found in association with the 2000 B.C. Curré ceramic complex in Costa Rica (Hoopes 1987, 1996), more than a millennium before those in Western Panama, although this now seems likely to have been a function of poor preservation in the highlands (Dickau *et al.* 2007). While some researchers have equated the spread of Concepción ceramics with the migration of a people relying on a relatively well-developed agricultural economy based primarily on maize (Linares *et al.* 1975; Hoopes 1996), Ranere (1980a) and Hoopes (1991) have argued this same time span was, like the archaic, one of a much more mixed subsistence economy based significantly on the cultivation of trees and root crops (especially manioc), with maize being present but only as a minor component of the diet. The most relevant environmental record from the area comes from Behling's (2000) single core of Laguna Volcán (2.5 km south of Barriles). This record suggests that Ranere's argument for mixed horticulture is currently the best candidate for much of the Concepción time frame, at least for a portion of the highlands, as evidence for anthropogenic landscape disturbance (i.e. some land clearance, increased charcoal) begins around 1000 B.C., but maize pollen increases only after A.D. 200 (see also Clement and Horn 2001).

Besides Haberland's (1976) excavation of a handful of cobble and *metate*-lined tombs at the type site of Concepción (located near the boundary between the coastal plain and piedmont), Shelton's (1984) research is the only in Western Panama to touch upon aspects of the Concepción settlements themselves. Shelton's work at San Vicente (roughly 500 m above sea level) documented two multi-component 'sites' (BU-69 and 73) with underlying Concepción ceramics, but which can probably be combined into one site since they were only separated by a modern road (68). Although the 'site' was fairly large by Formative standards, at least 21 ha, it seems apparent that the zone of Concepción occupation was a smaller fraction of this (91). Counts of Concepción phase ceramics toward the bottom of her two excavation trenches (247-249) suggest ceramic densities (assuming diagnostics comprised about 9% of the ceramic assemblage) of 220 ceramic sherds per m^3. Based upon this and her survey data, Shelton's research generally agrees with Drolet's (1988:172) characterization of the equivalent period in Costa Rica as one dominated by a settlement pattern of farmstead or hamlets, each consisting of a few small groups of people, scattered widely throughout the mid-elevations of the Talamanca range.

3.2.1 Concepción Artifact Styles

The Concepción as a zoned and incised ceramic phase has been thought of as a wider 'horizon' style connected to Gran Nicoya (Linares 1980d; Myers 1978), or even Mesoamerica (Snarskis 1981). The phase was first defined by Holmes (1888) and redefined by MacCurdy (1911) and Osgood (1935), all of whom described it as a ware exhibiting 'scarified' decoration, typically a form of incising applied prior to firing (Corrales 2000:299; MacCurdy 1911:96). The pottery from this phase also became the foci of Haberland's (1962, 1976) and Shelton's (1984) research, both of whom argued for the inclusion of an additional ware with zoned decoration. Shelton refers to this as Ware B, or Zoned Incised, and described it as one with alternating slipped and unslipped exteriors (usually a red or purple slip alternating with the orange body), usually with incising in the unslipped areas. This is very similar to what Spang *et al.* (1980:357-8) called Zoned Bichrome Ware in the Bugaba Period (see figures 182 and 183).

Shelton (1984:256) associated the Concepción with her wares A and B, which were associated with a variety of bowl and jar shapes, including those with relatively straight sides (such as chimney vessels) and those with outslanted rims. She considered appendages shaped like small webbed feet (see figure 181) to be particularly diagnostic of the phase (Shelton 1984:295-296). Ware C, incised restricted bowls, was considered part of the Concepción in her appendix (256), but was listed as ware intermediate between the Concepción and the Aguas Buenas in the text (171). Her wares D, E, F, and J, jars with unslipped necks, short-necked incised jars, plain vessels, and short-necked jars with s-shaped rims, were also regarded as intermediate, or perhaps even shared, vessel forms. A guided review of the Chiriquí ceramic collection at Temple University with Dr. Shelton suggested that body sherds with very course and protruding inclusions (looking like oatmeal) fit her definition of Concepción very well.

3.3 BUGABA OR AGUAS BUENAS PERIOD (A.D. 300 TO 900)

The beginning of the Aguas Buenas (a.k.a. Bugaba or Burica) in Gran Chiriquí was more than a shared set of ceramic styles and wares, it is a time period in which dispersed populations in the agriculturally fertile upper valleys and highlands (i.e. Río Chiriquí, Río Chiriquí Viejo, Coto Brus, Upper General) appeared to coalesce into larger villages than seen previously (Cooke and Sánchez 2004:21). At some point during the period, the first clear evidence for social differentiation (in tomb quality, statuary, and possibly occupational specialization), and the emergence of settlement hierarchies in the Río Chiriquí Viejo (and possibly the Río Terraba) both occurred (Drolet 1983b; Hoopes 1996; Linares 1977a). These populations are believed to have relied more heavily on maize agriculture than their predecessors (Linares *et al.* 1975), although the relationship (if any) between agriculture and political hierarchy is poorly understood (Hoopes 1996:21; see Linares 1977b:306). For the Volcán Barú region, both Linares *et al.* (1975:141) and Linares and Sheets (1980:52) interpreted an association between rank, war, and maize agriculture, and argued that these associations occurred in the absence of regional population pressure. Where regional survey work has been done, larger Aguas Buenas settlements also appear to be associated with axe production or resharpening evidence (Drolet 1992; Linares and Sheets 1980), although how this was specifically connected to social rank is similarly unclear.

Looking at Southern Central America as a whole, the Aguas Buenas Period has meant different things to different people. To Cooke (2005) and Griggs (2005), the general time span (ca. A.D. 500) marked the beginning of distinctive macroregional artistic traditions (or culture areas) in Chiriquí, Coclé, and the Darien. Hoopes (2005:32), by contrast, emphasizes similarity (or 'diffuse unity') more strongly by viewing the general period (A.D. 300-600) as a macro-Chibchan speaking "cultural horizon" of interacting priesthoods or chiefdoms, linked by a common prestige goods exchange network and shared religious iconography. The prestige goods aspect of this idea is particularly problematic Gran Chiriquí. Both the Formative Volcán Barú and Río Terraba regions almost completely lack the hypothetical trade items mentioned by Hoopes (jade, obsidian, gold, and foreign ceramics), while less durable items like shell (i.e. spiny and pearl oyster), psychotropic plants, or even exotic animal parts, would have been highly unlikely to preserve. This is despite tens of thousands of artifacts systematically collected in each region (although typically from samples of domestic refuse), and also a handful of Aguas Buenas tombs where foreign 'prestige' goods might have been more likely to be placed (Bernstein 1984; Stirling 1950). The few hypothetical 'high status' tombs, or those covered by *lajas* or lined with cobblestone, contain quantities of several nested ollas (or urns), *metates* and polished stone axes instead.[1]

Many interpretations of the Aguas Buenas have traditionally made reference to a second wave of immigrants which settled the high valleys and either displaced or incorporated existing Concepción societies (Haberland 1961, 1984; Linares 1980x:54; Shelton 1984), though this may due to the influence of Haberland's (1983) tendency to view new ceramic styles as different ethnic populations. More recent descriptions have tended to emphasize the stylistic continuity between Concepción and Aguas Buenas assemblages (or populations), while still emphasizing the colonization of the highlands and the establishment of larger villages (Cooke and Sánchez 2004; Corrales 2000; Shelton 1996). Although a rough connection between the Formative and the contemporary Guaymí was assumed by Linares (1980a:11), it was possible that ancestral Dorasque and Bribri populations, rather than Guaymí, originally inhabited the mountains and Caribbean coastal areas respectively (Joyce 1916:90). Needless to say, the general equation of linguistic or ethnic groups with ceramic styles and wares, especially in the absence of a direct historical approach, has been fraught with a host of severe methodological difficulties (Cooke 2005:163).

Linares (1980a:15) describes the Period as one in which both large villages and ceremonial centers developed, one of the earliest and most archaeologically well-known being

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[1] Exceptions include two possible jade beads recovered in an excavation at BU-17 (Linares 1980x:140), perhaps similar to jade imitation ornaments manufactured from local greenstone mentioned by Drolet for the Diquís (1992:218). Besides these, researchers have speculated that the pendants depicted on Barriles statues may have been made out of gold (Haberland 1984:243; Graham 1996:243). Decorated *metates* made from volcanic tuff and polished stone axes have both been suggested as macroregional trade items within Gran Chiriquí (Drolet 1992).

Barriles (BU-24). Barriles may have been the hypothetical seat, or central place, atop the Río Chiriquí Viejo settlement hierarchy due to its size (and potentially larger population)- although it is only the fifth largest identified by Linares *et al.* (1975)- and because of its qualitative distinctions, such as a cobblestone platform, a long low mound, slab-covered tombs and a row of statues (see Stirling 1950). Because sites with "nonresidential features" across Panama (i.e. La Pitahaya, Villalba, El Caño, El Hatillo/He-4) are few compared to the multitude of *provincias* mentioned by the Spanish (but see Creamer and Haas 1982), Cooke (2005:16) cautions against interpreting them as strictly regional phenomena. In particular, he argues that Barriles, due partially to its sculpture showing two individuals, was probably a macroregional ceremonial center that served two or more territories (and possibly paralleled by macroregional necropoli). Assuming for the moment that ceremonial centers will always have surviving features like mounds, pavements, or stone columns, the regional settlement work which included Barriles was probably designed to encompass the greatest variety of environmental zones, and thus probably only encompassed some portion of any polity (Drennan 1991:279), let alone the two or more needed to possibly identify and critically examine any macroregional role. As such, the possible macroregional role of Barriles remains an intriguing idea that awaits additional and sustained settlement survey designed to better understand varieties of ancient social and political organization.

For decades, the A.D. 600 eruption of Volcán Barú was assumed to have been catastrophic enough to have ended Aguas Buenas settlements across much of the region (Linares 1977:313, 1980e:245; Sheets 2004), to have deposited a widespread *terminus post quem* ash layer, and prompted a migration from the highlands to the uninhabited Caribbean coast and islands (Holmberg 2007, 2009). The eruption has even been suggested as an event that may have precipitated the formation of a widespread 'crisis cult' across the Intermediate Area (Hoopes 2005:5). The date has been contradicted by Behling's (2000) series of radiocarbon dates from a core in Laguna Volcán, and a recent USGS study on volcanic history of the area (Sherrod *et al.* 2007), which both suggest the only major eruption in the cultural sequence occurred closer to A.D. 1500. Coupled with earlier dates in Caribbean Costa Rica (Chávez et al. 2006) and Panama (Griggs 2005), it appears that both the A.D. 600 eruption and assumptions about the lack of early populations in the Caribbean watershed need to be rethought. Like the rest of Gran Chiriquí, the Aguas Buenas in Gran Chiriquí might have lasted until A.D. 800 or later (Corrales 2000).

3.3.1 Aguas Buenas Artifact Styles

In Western Panama, the Aguas Buenas has three different names. The most used is the Bugaba (with early and late halves), coined by Spang *et al.* (1980) to refer to ceramics in highland Chiriquí and the Caribbean coast (Kudarauskas *et al.* 1980). The second is the Burica (A.D. 400-600), used by Linares (1968) to describe Aguas Buenas materials on the Pacific coast. The least used is the Barriles phase (400 B.C. to A.D. 200), described by Haberland (1976). The earlier dates from the latter have since been rejected (Hoopes 1996:29). Corrales (2000:305) points out that, with the exception of Haberland's work, the Panamanian varieties have been classified and re-classified as wares (those based largely on surface finish and paste), while the Costa Rican equivalents are been largely discussed as stylistic types (see Baudez *et al.* 1993, 1996; Laurenich de Minelli and Minelli 1966, 1973). However, Corrales (1986) was unable to distinguish between the Early to Late Bugaba just across the Costa Rican border at the site of Cotoncito, suggesting that the Spang *et al.* (1980) chronology might be specific to the Volcán Barú region.

The most thorough study of highland wares comes from Spang *et al.* (1980) divided their Volcán Barú ceramic assemblage into five different wares (which were subsequently renamed, but essentially kept, by Shelton 1984): Cerro Punta Orange, Valbuena, Zoned Bichrome, and Bugaba Engraved. The fifth, Cotito Ware (characterized by combed decoration), occurs very infrequently and is likely to simply be a decorated variant of Cerro Punta Orange Ware (Spang *et al.* 1980:357). What could have been described as a sixth, Plain ware, also occurs infrequently and it is unclear whether or not it occasionally represents an eroded variety of some previous ware. Zoned Bichrome, characterized by alternating slip and non-slipped areas (typically with incised decorations), is very similar to Zoned Incised descriptions from the Concepción. Corrales (2000:47) argues that Gran Chiriquí was unique in Southern Central America because of this continuity in decoration[2].

3.4 SAN LORENZO PHASE (A.D. 700 TO 1100)

San Lorenzo ceramics have been described as a temporal phase by Linares (1968a, 1968b), although MacCurdy (1911) examined a 'Red Line' group of ceramics from looted Chiriquí tombs (among other decorations in other tombs) that might pass for San Lorenzo (Linares 1968:66), suggesting they may be a style. As Linares' (1968a, 1968b) research was concerned largely with fundamental chronology building, nothing is known about pre-Colombian social or political organization from this span of time. San Lorenzo ceramics were identified in the Gulf of Chiriquí, specifically around the Bahía del Muertos and Estero del Horconcitos area, the largest

[2] Shelton (1996) also argued for continuity between the Concepción and Valbuena ware (late Bugaba or Aguas Buenas) on the basis of darker cores within sherds.

sample coming from the site of El Cangrejal (SL-1) on the Pacific coast. Cooke (1980:377) has suggested that the red line painting typical of all San Lorenzo ceramics might be Chiriquí imitations of Central Panamanian painted varieties, while Haberland (1983) suggested that San Lorenzo ceramics may have reflected an intrusion of Veraguas settlers.

Generally speaking, San Lorenzo ceramics are not found in the Chiriquí highlands (only three possibilities were documented by this study), suggested either a phase of nearly complete depopulation, or that the use of San Lorenzo ceramics as a chronological phase markers may simply be inappropriate for the mountains.

3.5 CHIRIQUÍ PERIOD (A.D. 900 TO 1500)

The Chiriquí phase (also called the Boruca, Palmer, or Sierpe in parts of Costa Rica) is the best known of all the Gran Chiriquí time periods, largely because bright polychrome ceramics were adopted, and because several sites with conspicuous features (i.e. mounds, stone spheres) and large cemeteries rumored to contain gold or *tumbaga* ornaments (Holmes 1888; Quilter 2004; Quilter and Blanco 1995; Quintanilla 2007) increased in number. Partially because of the early studies (Holmes 1888; MacCurdy 1911; Osgood 1935; Šolc 1970) which classified tens of thousands of Chiriquí Period ceramics from looted cemeteries around David, the poorly understood coast and floodplains of Western Pacific Panama are still discussed as both densely populated and as a single production locale for some ceramics that enjoy a broad distribution across Gran Chiriquí (see Corrales 2000; Linares 1968). It is also for these reasons that the Chiriquí Period is usually assumed to be one where patchworks of many warring chiefdoms developed in and around the most fertile floodplains (see Linares 1977b), those in the Río

Terraba persisting until the historic era (Drolet 1992). Because of the generally wetter and more forested environments of the Gran Chiriquí, Linares (1977a:31) felt that populations were generally less centralized and whose artwork included less impressive symbols of rank and status than those in Central Panama. Nevertheless, Linares (1968b:80) argues that population pressure may have played a key role in the formation and persistence of chiefdoms on the Pacific floodplains since islands in the Gulf of Chiriquí were settled (assuming populations only settle islands when forced off the mainland), though the current evidence is equivocal.

The approximate beginning of the Chiriquí is the source of some debate. Baudez *et al.* (1993, 1996), Corrales (2000), and Haberland (1978) have suggested a beginning date around A.D. 800, while Linares' (1968b) work in the Gulf of Chiriquí suggested a later date, partially to make room for the debatable San Lorenzo phase. She did argue, however, that the Chiriquí Period may have had an earlier start in the highlands (86, 90). Besides the cultural-historical framework and a multitude of studies discussing the fine quality of various Chiriquí antiquities, what we know about social or political organization depends largely upon the regional work done in the Río Terraba (Drolet 1983b, 1984a, 1984b, 1986, 1988, 1992), on Isla Caño (Finch and Honetschlager 1986), and from the sample of artifacts recovered mostly from La Pitahaya (Cooke 1980; Linares 1968b, 1980b). These studies demonstrate that a mosaic of different societies, some regionally organized and having some evidence for social differentiation alongside others lacking these qualities, existed during the Chiriquí Period. Work on Isla Caño and La Pitahaya (compared with work in Gran Nicoya) has further enabled archaeologists to critically question the relationship between long-distance trade items as fundamental bases of social hierarchies, *contra* Helms' (1978, 1988, 1993) general expectations (see Fitzgerald 1996).

The Chiriquí Period, however, is poorly represented in the upper Río Chiriquí Viejo, recognizable only as ephemeral and diffuse artifact scatters. While the portions of the sampled sites may have been occupied by some small Chiriquí groups, many of the larger Chiriquí habitation sites and cemeteries (of which many people still collect small *haucas*), are rumored to be further downstream somewhere below 1200 ms above sea level.

Cooke and Sánchez (2004:71) argue that the year 1501 ushered in the historic era across much of the isthmus, although the degree to which indigenous societies directly interacted with the Spanish was decidedly uneven. Societies along the coastal plains and valleys and in the Central Valley of Costa Rica were the first to fight and trade with early Spanish explorers, although Spanish *entradas* became much less frequent in the century following the conquest of Peru in the 1530s (Linares 1968b:77). Societies in parts of the Talamanca mountains are believed to have had little to no sustained interaction with the Spanish until the 18th century (Ibarra 1990, 1991, 1994), although undoubtedly some European items would have still reached some remote settlements (see Quintanilla 1986). Nevertheless, the contact Period was likely one of profound cultural change and perhaps large-scale population movement across much of Southern Central America (Linares 1977a).

While the ethnohistoric descriptions of large multivillage confederacies with pronounced forms of social differentiation, particularly those from Central Panama and the Darién, have garnered the most scholarly attention (Cooke and Sánchez 2004; Haller 2004, 2009; Helms 1978; Ibarra 1990, 1994; Isaza 2007), it is also clear that these were not the only (or even the most common) forms of political organization extant at the time of Spanish contact (Creamer and Haas 1985). While chroniclers have made some mention of chiefly societies on the Burica peninsula (Linares 1968b), the Río General (Drolet 1992), and possibly coastal parts of the

Diquís (Lothrop 1963), these descriptions are interspersed with those of broadly dispersed populations, some with hereditary leaders (*caciques*) for individual settlements or islands, described by the Columbus' expedition in Almirante Bay of Bocas del Toro (Linares 1977b; Sauer 1969), the Pacific islands of Chiriquí (Linares 1968b), and parts of Veraguas (Lothrop 1950). These societies are often mentioned in passing, as the Spanish explorers were often interested in trading with or raiding (and writing about) more concentrated populations for gold.

Our picture of Chiriquí highland societies during and following Spanish contact and settlement is poor. The best source is Fray Antonio de la Rocha's observations, described in Linares (1968:79-80) of the Doraces and Zuries (rather than Guaymí) who lived around the eastern flanks of Volcán Barú. These mutually hostile and territorially defined groups lived in highly dispersed settlements, raided one another frequently, and traded a variety of goods with groups living at lower elevations. While some types of status were inherited matrilineally, multiple villages were not organized into permanent regional alliances, suggesting that ascribed forms of social differentiation can and have existed independently of regional political structures in Western Panama. Our understanding of historic era societies is non-existent other highland areas, some of which (i.e. San Vito de Java) were believed to be virtually depopulated (with sites thus largely undisturbed) up until the 1950s.

3.6 CERAMIC DESCRIPTIONS

For the most part, the ceramic chronology of Gran Chiriquí is a bewildering array of wares, styles, and varieties with different names. This is probably a reflection of both the actual stylistic diversity and many years of ceramic studies with little communication between researchers, a problem exacerbated by the fact that Gran Chiriquí is split in two by the Costa Rica-Panama border. Corrales' (2000) dissertation is the fundamental starting point for summarizing, comparing, and re-ordering all the different ceramic styles, wares, and phases into a coherent synthesis. Shelton's (1984) dissertation reviews the previous work on chronology building in the Volcán Barú area. For more in depth information or additional illustrations, the reader is referred to these two sources.

The Western Panamanian side of Gran Chiriquí represents something of an anomaly in the ceramic description literature from Southern Central America. It does so because it is less focused on describing decorative styles, though this was a concern of earlier studies (i.e. Haberland 1955, 1962; Holmes 1988, MacCurdy 1911, Osgood 1935), but been more explicitly concerned with the descriptions of ceramic wares, which may or may not have been decorated. These different attempts at ceramic seriation explicitly followed Drennan's (1976a:21) emphasis on classifying different wares by attributes of paste and surface finish (see Linares 1980:84; Shelton 1984:103; Spang *et al.* 1980:353), rather than decorative technique or vessel form. And rather than only presence-absence descriptions, there is also a tradition of comparing ware proportions by proveniences rather than using individual sherds as units of analyses (Linares 1968b; Linares 1980). Both tendencies represent an advantage in a situation where undecorated body sherds constitute roughly 90% of the ceramic assemblage but where individual sherds can be assigned to a particular 'ware' about 80% of the time.

The vast majority of the ceramics recovered in this project were Aguas Buenas varieties. For continuity's sake, the Spang *et al.* (1980) nomenclature will be used, although occasional reference is made to Shelton's (1984) terminology, which differed in a few respects. Additional references are made to Costa Rican side in Corrales (2000), Laurenich de Minelli and Minelli

(1966), and Baudez *et al.* (1993, 1996), although for an area as large as Gran Chiriquí, it seems probable that some amount of regional variation existed during the Aguas Buenas (see Corrales 1986, 2000). The description of different ceramic wares is purposefully broad and inclusive, and includes a lot of variation in vessel form and decoration. This is especially true among appliqué elements, which include a wide range of designs, and a variety of tripod leg or handles (see Skirboll 1981). Although these categories could have been more finely classified using the existing sample, they do constitute a rough baseline from which to work with.

One of Spang *et al.*'s (1980) wares, Cotito, was eliminated since it seemed to be a variant of Cerro Punta Orange. Classifying wares by the presence or absence of a darkened core within the paste was also abandoned since larger sherds of both Cerro Punta Orange and Valbuena had darkened cores on one edge and light cores on the other, probably a result of the vessel's placement in an uneven firing environment. Instead, a rough distinction between fine and coarse paste wares is included here, which had only been discussed in detail by Laurenich de Minelli and Minelli (1966) previously for the San Vito area. Four wares in particular, Cerro Punta Orange, Valbuena, Bugaba Engraved and Plain, occur frequently in the Aguas Buenas and can be reliably recognized even as undecorated body sherds, and are thus described in the most detail.

3.6.1 Vessel Form

There were a variety of Aguas Buenas vessel forms, though these almost entirely lack plates. Shelton (1984:256), for example, associated the Early Bugaba/Aguas Buenas phase with her Ware H, largely equivalent to the Cerro Punta Orange Ware previously identified by Spang and Rosenthal (1980). Associated vessel forms included tecomates, restricted bowls (including those with a lip groove), bowls with thickened rims, and short-neck jars with s-shaped rims, and broad strap handles (probably from urns). The Late Bugaba/Aguas Buenas phase was equivalent to Ware I, or the Valbuena. It was associated with restricted, incurved and open bowls (lip grooves being less frequent), bowls with s-shaped rims, jars with thin and thick rims, and ringstand bases. Wares G and K, or the Bugaba Engraved and Zoned Bichrome, were found in both Early and Late contexts, and tended to be associated with open bowls and slightly restricted bowls identified in the present study. Since Shelton's study, Corrales (2000) described many of these same vessel forms, although he questioned the utility of the Early and Late phase distinction for Southern Costa Rica on empirical grounds.

This study identified many of the same general vessel forms by using both Shelton's (1984) and Corrales' (2000) illustrations as a guide. The vessel forms described here have been assigned to broader, presumably functional categories. For example, little distinction was made between jars with slightly longer necks and those with slightly shorter necks once it was determined that these qualities were not chronologically sensitive. Instead both jars and restricted and outleaned bowls (figure 15) are believed to have been related to generalized cooking and storage activities. As Figure 14 illustrates, this is because partially because low proportions of these vessels contained any type of decoration, and also because these walls on these vessels tended to be thicker and occasionally exhibit fire-clouding or have adhered soot. Open bowls and slightly restricted bowls (figure 16), by contrast, were often decorated, had finer pastes, and rarely had associated soot. These also were shallow bowls probably no more than 5 to 10cm deep and typically had small rim diameters (less than 15 cm), possibly holding individual servings of food or drink. These vessel forms are therefore argued to be related to general serving activities. Outleaned bowls (figures 14 and 15) are associated with decoration proportions intermediate between the generalized cooking and serving categories, and may represent a vessel form associated with both types of activities.

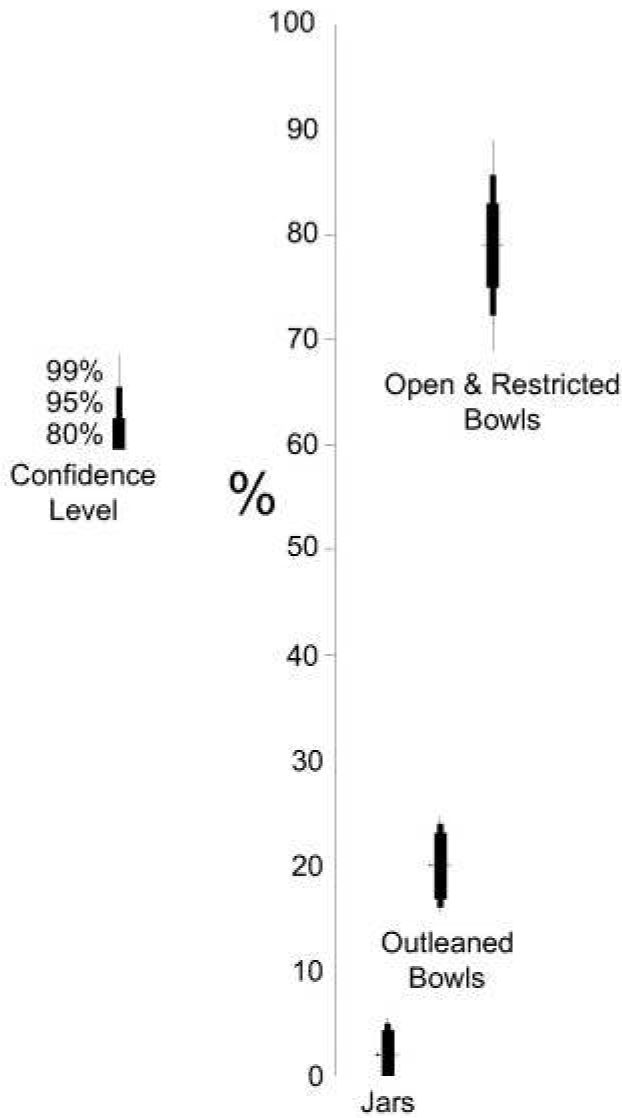

Figure 14. Decoration proportions by vessel form.

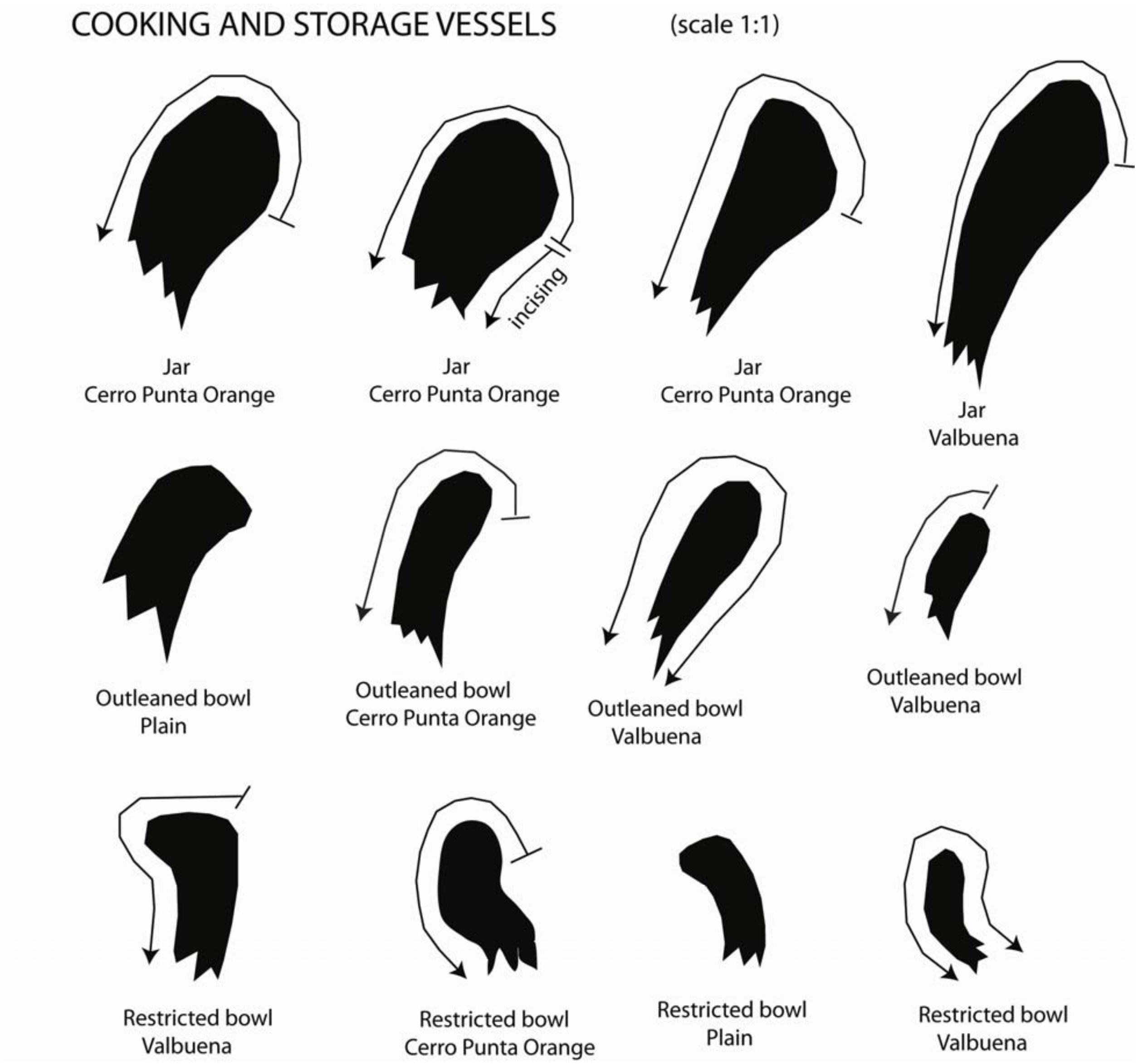

Figure 15. Cooking and storage vessel rims. Interiors oriented to left, slip and decoration zones indicated by lines.

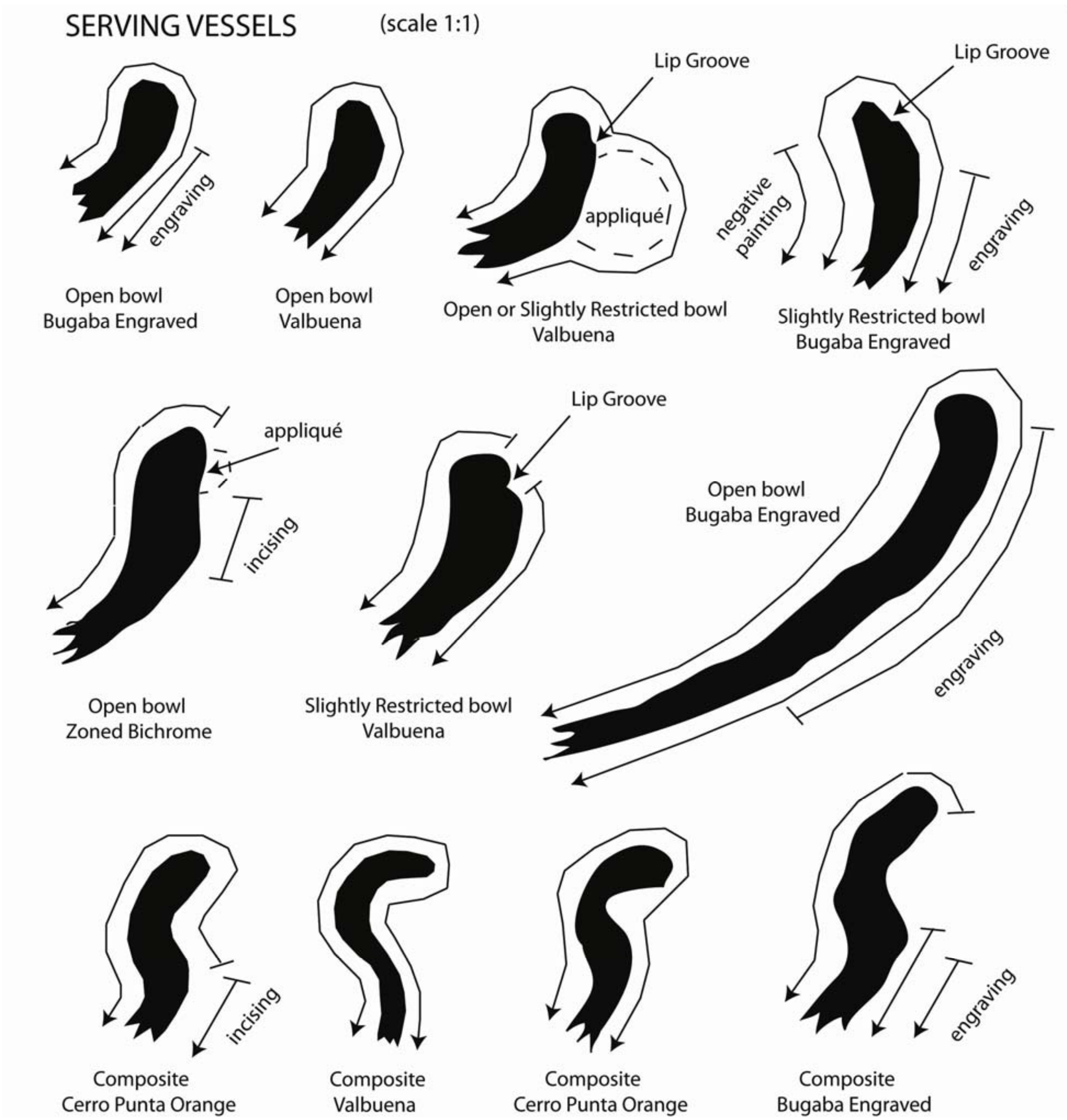

Figure 16. Serving vessel rims. Interiors oriented to the left, slip and decoration zones indicated by lines.

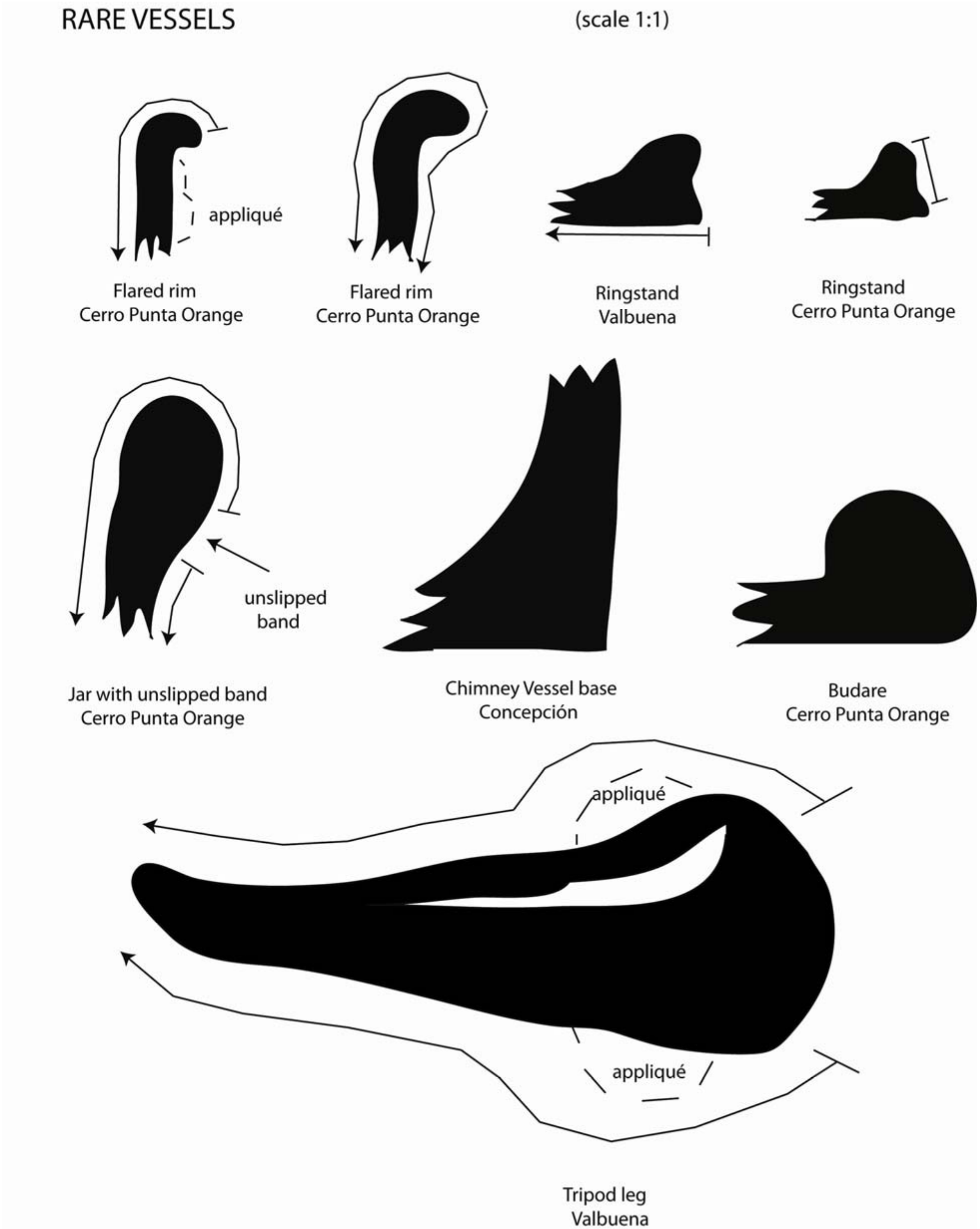

Figure 17. Rare vessels or attributes. Interiors oriented to the left (except tripod leg), slip and decoration zones indicated by lines.

3.7 PILOT SERIATION

Although the Aguas Buenas has been described as an artistic tradition that encompassed much of Gran Chiriquí during the Formative (Hoopes 1992), the likelihood that individual ceramic sequences differed from region to region has been raised by Baudez *et al.* (1993, 1996) and Corrales (1986, 2000). Therefore the term Bugaba, originally proposed by Spang *et al.* (1980) and used by Shelton (1984, 1995), is retained here to emphasize only the upper Río Chiriquí Viejo sequence. The data from this seriation comes exclusively from collections and excavations made in domestic deposits, and stands in contrasts to the early seriations which relied heavily on ceramics from tombs (see Haberland 1962, 1976; Holmes 1888; MacCurdy 1911; Osgood 1935).

For those researchers expecting the identification of diagnostics present exclusively in one phase and absent in another, the refined Bugaba sequence presented here may be disappointing. The results of the following analyses suggest that the relative proportions of different wares, the vast majority being undecorated body sherds, tended to be the most sensitive indicators of an assemblage's chronological placement. Undecorated body sherds, unfortunately, represent a class of ceramic data which have only received passing attention in most archaeological investigations in Southern Central America (excluding Linares 1968a, 1968b). In many of the regional surveys done to date, they tend to be almost completely ignored in favor of a handful of rims and decorated sherds, and those recovered from excavations are usually weighed together as a lot. At least in Western Panama, this research suggests that any type of future archaeological research aimed at understanding changes within the Aguas Buenas would greatly benefit from considering artifact proportions from fairly large and systematically collected assemblages of body sherds.

3.7.1 Choosing suitable proveniences

Following Drennan (1976a, 1976b), excavated proveniences considered appropriate for inclusion in the subsequent analyses all needed to:

1) Contain as large a sample of Aguas Buenas sherds as possible to minimize the effects of sampling vagaries. The smallest sample from a single provenience was 105 sherds, the largest 1509. These samples all needed to be relatively unmixed (for example, not containing both Concepción and Chiriquí sherds).
2) Come from an excavated provenience that was in some stratigraphic relationship to one or more proveniences from the same unit that could be included in the pilot seriation. This information could independently help support or refute the veracity of any subsequent ordering of assemblages.
3) Be from what appeared to be primary domestic middens, containing some organic material like charcoal, and thus thought to be the product of largely unintentional and accumulative activities in the past.
4) Be from relatively intact deposits, usually from units with some evidence for the A.D. 1500 volcanic stratum in the wall profile indicating that the underlying soils had not been significantly mixed by plowing or looting, at least during the historic era.

Thirty proveniences meeting these criteria were chosen for the following analyses, all from the site of Barriles. Based on the project's collections, Barriles appeared to span the entire duration of the Aguas Buenas and contained the deepest deposits encountered among any of the sites visited (see Stirling 1950:243). Except for the nine proveniences from Unit 1, which was dug into the low artificial mound at Barriles, the other proveniences all came from essentially the same meter thick stratum of fine black silty loam that sits atop sterile clay (or the water table) around the site. Barring the identification of features, these excavations levels were all dug in 10-cm arbitrary levels within 1x1 m units. In total, all these proveniences yielded 15,600 sherds for analysis. Of these, 12,493 (80.1%) were identifiable to ware or type, and 12,406 (99.3%) of these were classified as Aguas Buenas. The contribution of each individual ware or type to the pilot seriation is included as part of the ceramic descriptions, but the vast majority of the total assemblage were composed of only three wares (Cerro Punta Orange, Valbuena, and Plain). These three collectively made up 12,194 (97.6%) of the sherds included in the seriation attempt.

3.7.2 Factor Analysis

Factor analysis is a statistical technique which attempts to 'explain' variability among many observed variables according to few unobserved variables or principles (Kim and Mueller 1978a, 1978b). The technique makes no assumptions or claims about the independence or dependence of different variations, nor any causal relationships. It is typically used as way to reduce large datasets to a handful of salient variables, which is to say, as a way to identify some important trends amidst a wealth of background 'noise'. Relatively important trends are identifiable as high factor loadings in the factor output as those values close to 1 or -1. Many researchers prefer to pay closest attention to those variables whose factor loadings are greater than, or close to 0.600 (or -0.600) and up, although others also to tend to at least consider those with loadings from 0.400 (-0.400) and up (Bernard 2003).

The decision to subject the different proveniences to a factor analysis was made as a preliminary data reduction technique. Nineteen variables were included in the factor analysis: Biscuit Wares, Bugaba Engraved Wares, Cerro Punta Orange Ware, Cerro Punta Orange rims with lip grooves, Chimney vessel bases, Concepción Wares, Composite (or S-shaped) rims, Flared rims, Jars, Open bowls, Outleaned bowls, Plain Ware, Restricted bowls, Ringstands, Sherds with combed decoration, Sherds with ridged decoration, Strap handles, Unslipped band rims, Valbuena Ware, and Zoned Bichrome Wares. For all 19, the actual value was a proportion: the number of sherds in that category divided by the total number of identifiable sherds. Thus a stratum containing 5 unslipped band rims out of 50 identifiable sherds resulted in an artifact proportion of .10. The factor analysis was carried out to 10 factors, the first factors 'explaining' approximately 20% of the variance in the dataset.

Within this one factor, five variables had particularly strong factor loading values, including proportions of; Cerro Punta Orange Ware (0.900), Plain Ware (-0.877), Valbuena Ware (-0.847), rims with unslipped bands beneath the lip (0.800), sherds with ridged decoration (0.697), and sherds with combed decoration (-0.596). These and other attributes with weaker loadings are presented in table 4. Those four variables with loadings above 0.800 (or -0.800) were also associated with very large sample sizes and were included (among a few others discussed below) into the subsequent multidimensional scaling analysis.

Table 4. Factor analysis of Aguas Buenas ceramic attributes.

Ceramic Attribute	Factor 1	Factor 2	Factor 3
CP Orange Ware/ identifiable sherds	.900	-.251	-.081
Unslipped band rims/ identifiable sherds	.800	-.089	.061
Ridged decoration/ identifiable sherds	.697	.173	-.184
Concepción Ware/ identifiable sherds	.530	.291	.190
Flared rims/ identifiable sherds	.441	-.075	-.115
Chimney bases/ identifiable sherds	.313	.209	.181
Restricted bowls/ identifiable sherds	.229	.368	.541
CP Orange lip grooves/ identifiable sherds	.161	.346	.068
Composite vessel rims/ identifiable sherds	.111	-.448	-.164
Strap handles/ identifiable sherds	-.034	.102	.355
Jars/ identifiable sherds	-.041	.209	.181
Zoned Bichrome Ware/ identifiable sherds	-.063	-.416	-.056
Outleaned bowls/ identifiable sherds	-.087	-.148	-.345
Ringstands/ identifiable sherds	-.125	.056	-.396
Open bowls/ identifiable sherds	-.289	.466	-.458
Biscuit Ware/ identifiable sherds	-.452	.384	.161
Combed decoration/ identifiable sherds	-.596	-.098	.237
Plain Ware/ identifiable sherds	-.877	.168	.175
Valbuena Ware/ identifiable sherds	-.847	.363	.010

3.7.3 Multidimensional Scaling

Nonmetirc multidimensional scaling (hereafter MDS) is a technique that, in the examples used here, illustrate the relationships different proveniences to each other as a function of their similarity (rather than dissimilarity) along any number of mathematical dimensions (Kruskal and Wish 1978; Marquardt 1978). In the pilot seriation done here, the closer one provenience is to another in the resulting plot indicates that they are compositionally more similar to one another than those further away. The utility of using MDS techniques to seriate ceramic assemblages has been demonstrated by a number of archaeologists (see Cowgill 1972; Drennan 1976a, 1976b; Kendall 1971; Kruskal 1971; Peterson 2006; Spencer 1982; Wilson 2008). Unlike traditional battleship-shaped seriation efforts, which generally work off the starting assumption that styles or wares enjoy a height of popularity sandwiched between less popular phases (Ford 1962; Marquardt 1978), the principal advantage of MDS is simply that it makes no prior assumptions about temporal (or any other) trends in the dataset. It therefore has the important ability to fail in a seriation effort (Drennan 1976a, 1976b; Kendall 1971).

As an inductive exploratory technique, the disadvantage of MDS is that there are very few principles available to properly interpret, or express one's statistical confidence in, any of the resulting graphs. Like other multivariate techniques, MDS can work with small and heavily biased samples, potentially producing specious patterns. Nevertheless, when used carefully, MDS techniques are used widely and profitably across the social sciences to explore relationships between cases and variables (Bernard 2003), although there are comparatively few examples in archaeology.

The decision to use MDS as a way to seriate the Aguas Buenas was made for two reasons. The first, as mentioned previously, is that MDS attempts at seriation may fail (by simply not producing interpretable plots), a feature not necessarily true of other techniques. The second was that it appeared, based on preliminary laboratory observations of different excavation lots, that relative proportions of Cerro Punta Orange and Valbuena appeared to change fairly consistently respective to one another, i.e. the deepest levels having relatively more Cerro Punta Orange than Valbuena, and the opposite relationship generally observable in the uppermost strata (see Shelton 1984). If this hypothesized regularity in the direction of ceramic change was primarily temporal in nature, the potential to subdivide the Aguas Buenas into increasingly shorter phases might be possible- thus potentially allowing us to have some degree of confidence that any variation observed between domestic assemblages was not entirely a function of time, a likely worry if one has to treat a potentially 600-year period as a synchronic snapshot.

Using the 30 proveniences described previously, the first step was to identify which ceramic variables were likely to be the most sensitive chronologically. This was partially achieved through the factor analysis, which identified several variables with particularly high factor loadings. Three of these were ware proportions; Cerro Punta Orange (.900), Valbuena (-.847), and Plain wares (-.877). Rims with a small unslipped band immediately beneath the lips, a largely presence/absence variable, also had a high loading value (.800). Variables thought by previous researchers to be chronologically important, including Concepción ware (see Haberland 1962; Shelton 1984), Bugaba Engraved ware (see Baudez *et al.* 1993, 1996), Biscuit ware (see Linares 1968a, 1968b), Zoned Bichrome ware (see Corrales 2000)., Cerro Punta Orange carinated rims and Valbuena composite bowls (Shelton 1984, Spang *et al.* 1980), all failed to stand out very strongly in the factor analysis and were not included in the pilot seriation. In sum, information from four variables and 30 proveniences was included in the pilot MDS seriation.

The next step was to create a matrix of similarity scores between different combinations of the 30 proveniences. These were Euclidean distance similarity coefficients of standardized variables (see Cox and Cox 2000), which were then inputted into the Systat 9.0 software package to produce five separate MDS configurations from 1 to 5 dimensions. The Kruskal stress values for each of these five configurations are shown as a line graph in Figure 18, all producing values which lie well beneath the .15 value thought to be the rough uppermost limit of interpretable solutions (Drennan 1976a). As Peterson (2006:47) describes, the selection of the most interpretable configuration is often a balance between declining stress and the fewest number of dimensions. In Figure 18, the best balance looks to be the 'hinge' at two dimensional solution, beyond which stress continues to decline but not anywhere near as dramatically as it does between the one and two dimensional configurations. Not only was the Kruskal stress already very low at this point 0.02), but 99.8% of the variance was 'explained' by this configuration-beyond which only very relatively little additional information could be gained. Therefore the two-dimensional solution was chosen to organize the pilot seriation around.

The two dimensional plot produced a scatter of proveniences in a rough V-shaped pattern (figure 19). Since multiple proveniences from each individual unit were included in the analysis, the rank order in which proveniences were arranged in the plot could be examined. As figure 20 illustrates, the rough curve reproduced the stratigraphic relationships of the excavation proveniences. There was a general tendency for deeper and presumably more recent proveniences to be clustered toward the right of the plot, while shallower proveniences tended to be group towards the left side (figure 21). The arrows in figure 20 all pointed towards deeper and earlier proveniences. When all the arrows in figure 20 are summed together in figure 21, they reproduced the V-shaped curve and suggested that this curve outlined a chronological pattern.

The concordance with the original stratigraphic positioning of different strata is therefore an indication that variation in the proportions of the four different ceramic variables was most likely temporal in nature. A best fit curve was drawn, by eye, between the constellation of provenience points (figure 22), and nearby proveniences snapped by eye to their nearest location on this curve (figure 23). This resulting curve, which approximates the original V-shape in figure 19, will be referred to here as the time curve.

There were some obvious ‘mistakes’ on the time curve in figure 23, recognizable by proveniences which did not fall in their exact proper stratigraphic order. These potential problems included the Unit 1 excavation levels 80 and 70 (signifying levels ending at 80 and 70 cm below the surface respectively), which were reversed. Unit 2 levels 80, 60, 70, 130, and 120 where also out of stratigraphic order, but in the proper position compared to surrounding levels (i.e. the 80, 60, 70 grouping was ‘older’ than 50 but younger than 100).Finally, Unit 4 proveniences 90 and 100 were determined to be ‘younger’ than proveniences 70 and 80. The proveniences from Units 7 and 21 were replicated in their proper stratigraphic order. The nature of the ‘mistakes’ recognizable in figure 23 likely relate to the excavation methods themselves. These strata were shovel skimmed, a technique which is fast but results in an uncomfortable amount of wall fall and stratum mixing. Thee observation that groups of neighboring strata were mixed, and their chronological distinctions blurred, is perhaps unsurprising given the nature of these field techniques. They did, however, replicate the general stratigraphic pattern. So even if we cannot have great confidence in any single stratum, we may still have confidence in the broader trends or tendencies presented below.

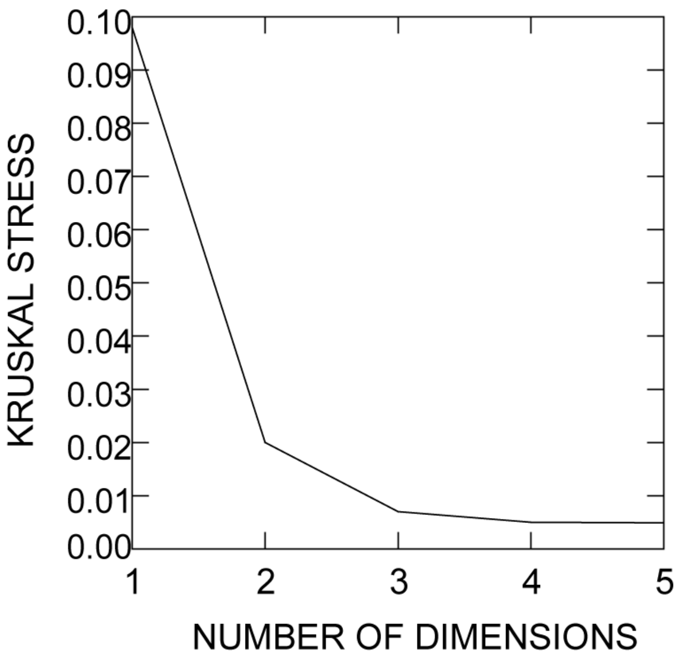

Figure 18. Line graph of declining Kruskal stress values, showing a noticeable 'elbow' at 2 dimensions

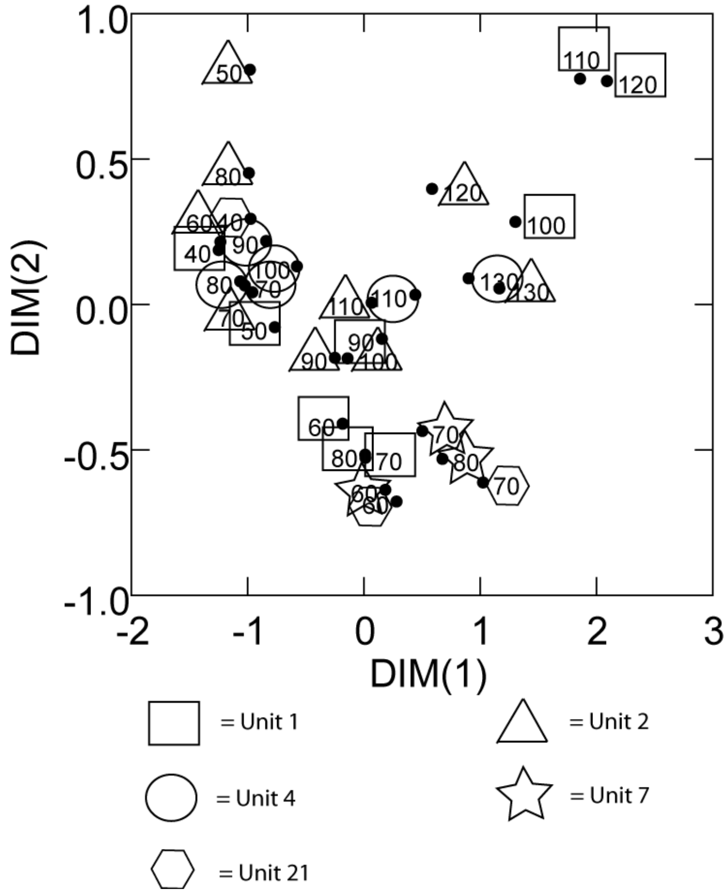

Figure 19. Two Dimensional solution of the 30 proveniences listed in table 4.

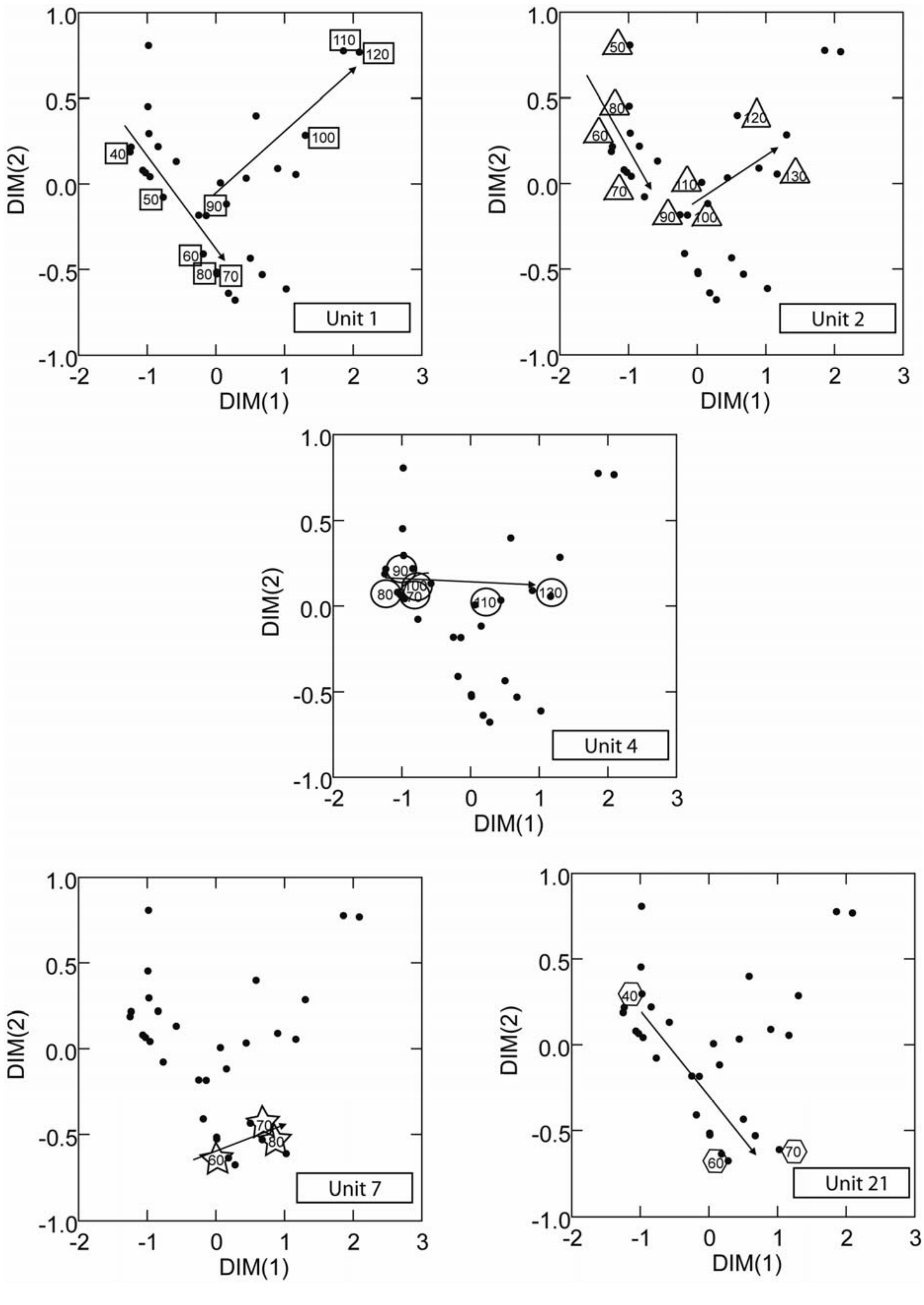

Figure 20. Two dimensional plots showing vectors for excavated proveniences.

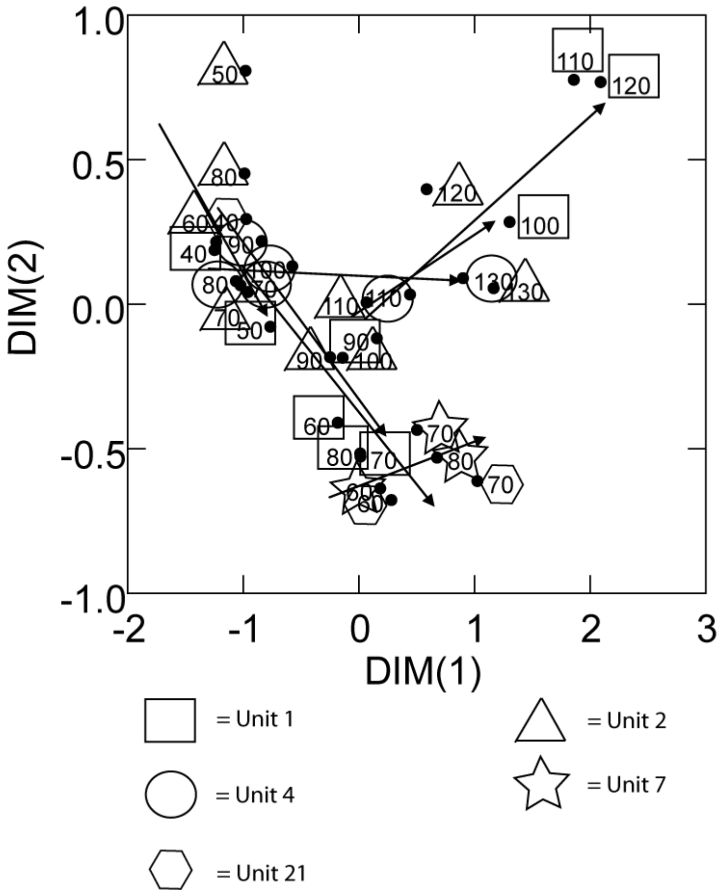

Figure 21. Two dimensional plot showing the best-fit vectors for all 30 proveniences.

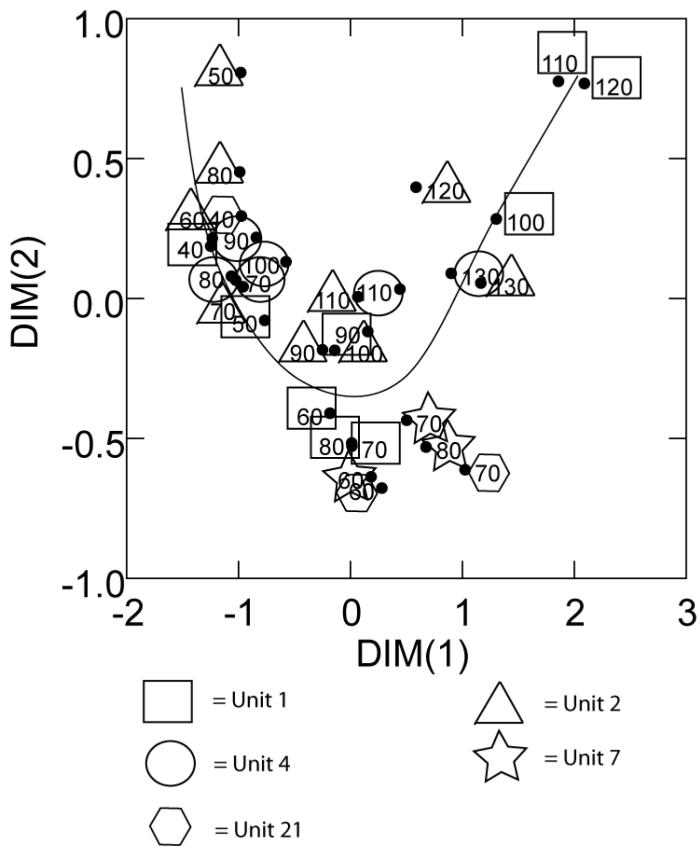

Figure 22. Two dimension solution with fitted time curve.

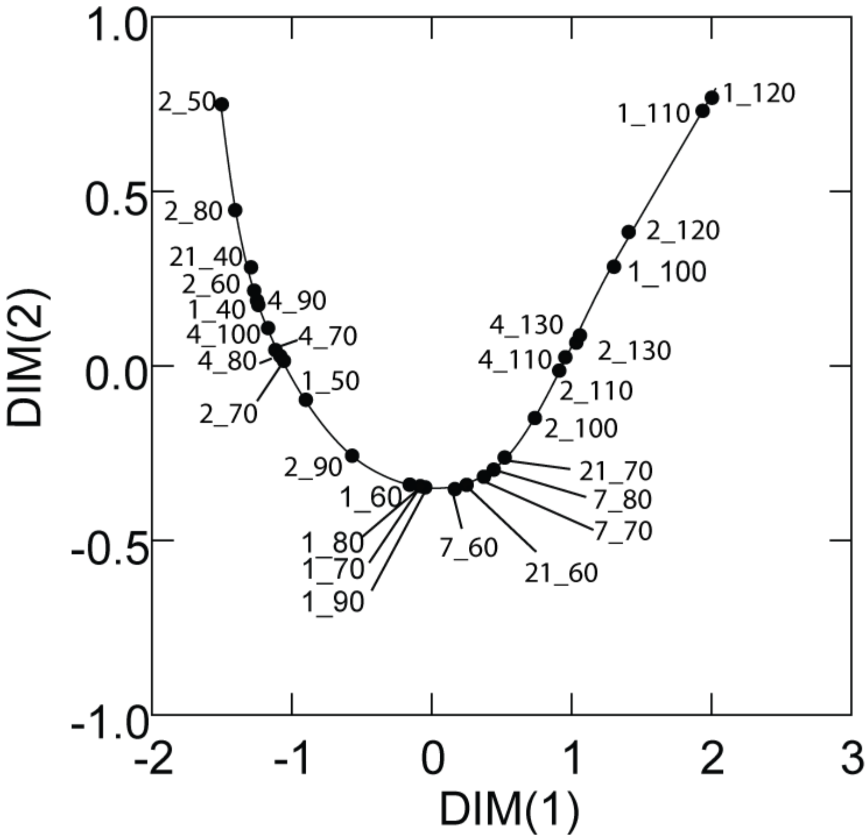

Figure 23. Two dimension solution with proveniences snapped to nearest position on fitted time curve.

3.7.4 Hierarchical Cluster Analysis

Hierarchical cluster analyses entail the division of different cases into different categories and subcategories based upon their measure of similarity (Hodson 1970), and have been used successfully in archaeological seriation efforts elsewhere (e.g. Marquardt 1978). Generally speaking, similar cases will join into the same group or cluster earlier on in the analysis than more ones with greater differences in artifact proportions. Starting from the bottom up (or from the left to right), small clusters of a few cases eventually coalesce into increasingly larger groups, ultimately creating a family tree or dendrogram chart where ultimately every case becomes included into a single cluster The hierarchical cluster analysis were calculated from the same matrix of Euclidean distance similarity scores from the same set of standardized variables as used in the previous MDS.

Two hierarchical cluster analyses were chosen in an effort to check the results of the MDS seriation. One was run according to complete linkage rules, meaning that cases could only be joined to an existing cluster if and when it was more similar to the most unalike case in that particular cluster than of any of the remaining cases still waiting to be joined. Less conservative criteria are associated with the creation of an average linkage dendrogram, in which existing clusters blend together to create a mean similarity value (rather than relying on the value of one exceptionally similar or dissimilar case), which then attracts the most like case still available to be joined. Complete and average criteria resulted in more interpretable results than other rules. Both these techniques were chosen to compare similarities and differences to those derived from the MDS, and also to help define where breakpoints between phases or subphases might profitably be placed.

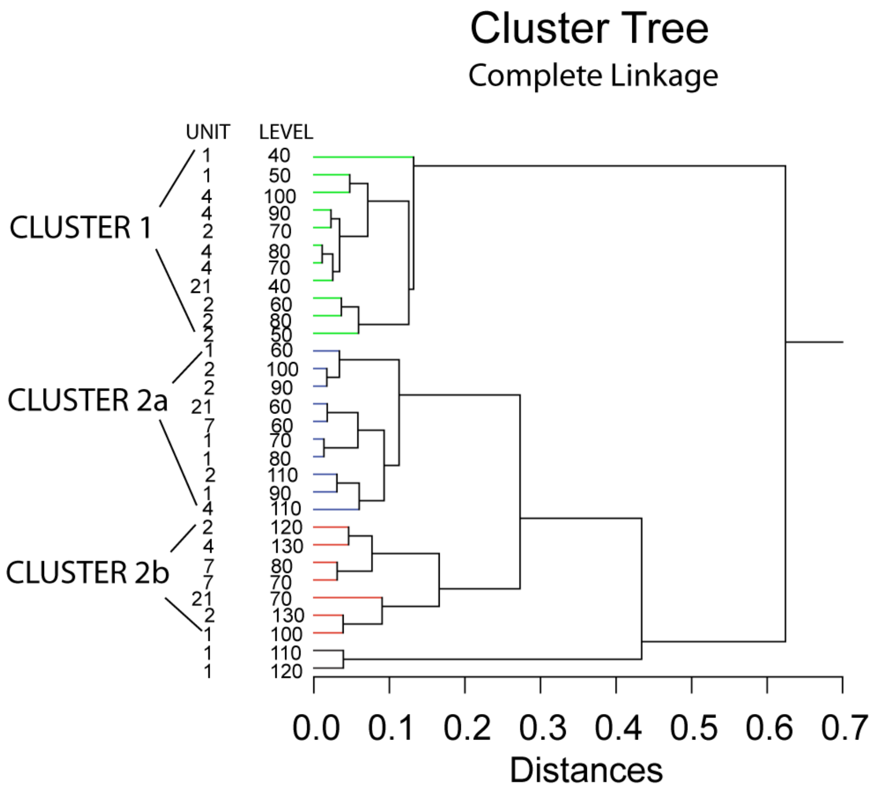

Figure 24. Hierarchical cluster analysis of 30 proveniences using complete linkage.

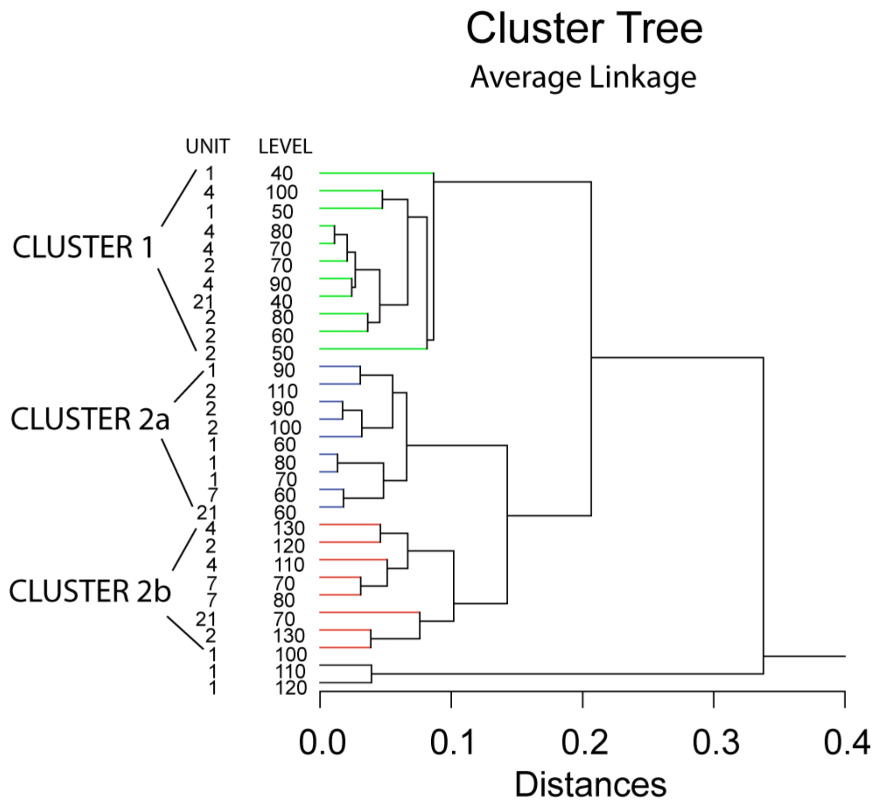

Figure 25. Hierarchical cluster analysis of 30 proveniences using average linkage.

There was remarkable similarity between the two cluster analyses, with nearly every cluster in one analysis containing the same cases as those in the other analysis. Cluster 1 was identical between the two, containing 11 (36.7%) of the cases in the analysis (Unit 1, Levels 40-50; Unit 2, Levels 50-80; Unit 4, Levels 70-100; Unit 21, Level 40). The only difference was Unit 4, Level 110, which belonged to cluster 2A in the complete linkage analysis and cluster 2B in the average linkage analysis. With the exception of this individual case, cluster 2A contained 9 (30%) cases (Unit 1, Levels 60-90; Unit 2, Levels 90-110; Unit 7, Level 60; Unit 21, Level 60), and cluster 2B included 7 (23.3%) proveniences (Unit 1, Level 100; Unit 2, Level 120-130; Unit 4, Level 130; Unit 7, Levels 70-80; Unit 21, Level 70). Levels 110 and 120 in Unit 1 were effectively outliers that did not combine into any cluster until very late in each analysis.

3.8 PHASING THE AGUAS BUENAS

When the results of the hierarchical cluster analyses are applied to the results of the idealized time curve generated from the MDS, the identification of breakpoints between possible ceramic phases appear to be straightforward (figure 26). As demonstrated by Drennan (1976a:57-65) and Peterson (2006:63-68), the appropriateness of these divisions and phases can be investigated graphically using scatterplots of proportional frequency (figures 27-43). Ten scatterplots show clear directional trends in the direction of the frequencies (or tendencies to group within one particular phases) of different ceramic wares, decorations, or vessel forms. The remaining scatterplots show only very subtle to nonexistent tendencies, including those among Cerro Punta Orange carinated rims and composite rim forms- originally once thought to be fairly reliable markers of the Early and Late Bugaba Phases by Spang *et al.* (1980), Linares (1980d), and Shelton (1984) based on smaller samples. Nevertheless, in a general way, the scatterplots also support that Linares' (1968b) and Shelton's (1984) arguments about rough early to late proportional changes in Concepción, Cerro Punta Orange, Valbuena, or Biscuit wares were essentially correct. The increase in Bugaba Engraved ware later in the Aguas Buenas sequence, a change first noted by Baudez *et al.* (1993, 1996) for the Diquís, also finds some support in this analysis.

The decision to refer to the Early portion of this particular Aguas Buenas (Bugaba) sequence as a single group, rather than identifying three distinct clusters to begin with (clusters 2a and 2b, or an Early and a Middle Phase), was made to accommodate surface collections and shovel test information into subsequent interpretations. As demonstrated in chapter 2, surface collections made in Sitio Pitti-González do roughly approximate subsurface deposits, but do not do so in a way that would allow us to be very confident that proportions of different wares on the surface are representative enough to assign a collection lot to either the Early or Middle portions of this ceramic sequence. Generally speaking, undecorated body sherds found in excavated strata appeared sensitive and common enough to allow us to recognize Late Phase lots from both Middle and Early ones, or in terms of the previous analyses, cluster 1 from cluster 2a from cluster 2b. Non-stratigraphic collections, however, did not lend themselves easily to such a differentiation between Early and Middle Phases, since this distinction is based on very subtle changes in artifact proportions. Stratigraphic excavation strata obviously would allow future researchers more confidence in estimating different ceramic attribute proportions. Thus while the classification of Middle Bugaba lots seems more likely from stratigraphic contexts, while the temporal resolution is coarser from non-stratigraphic ones. Since this project generally dealt with non-stratigraphic collections, any discussion of a possible Middle Phase must be delayed until more excavation in accomplished.

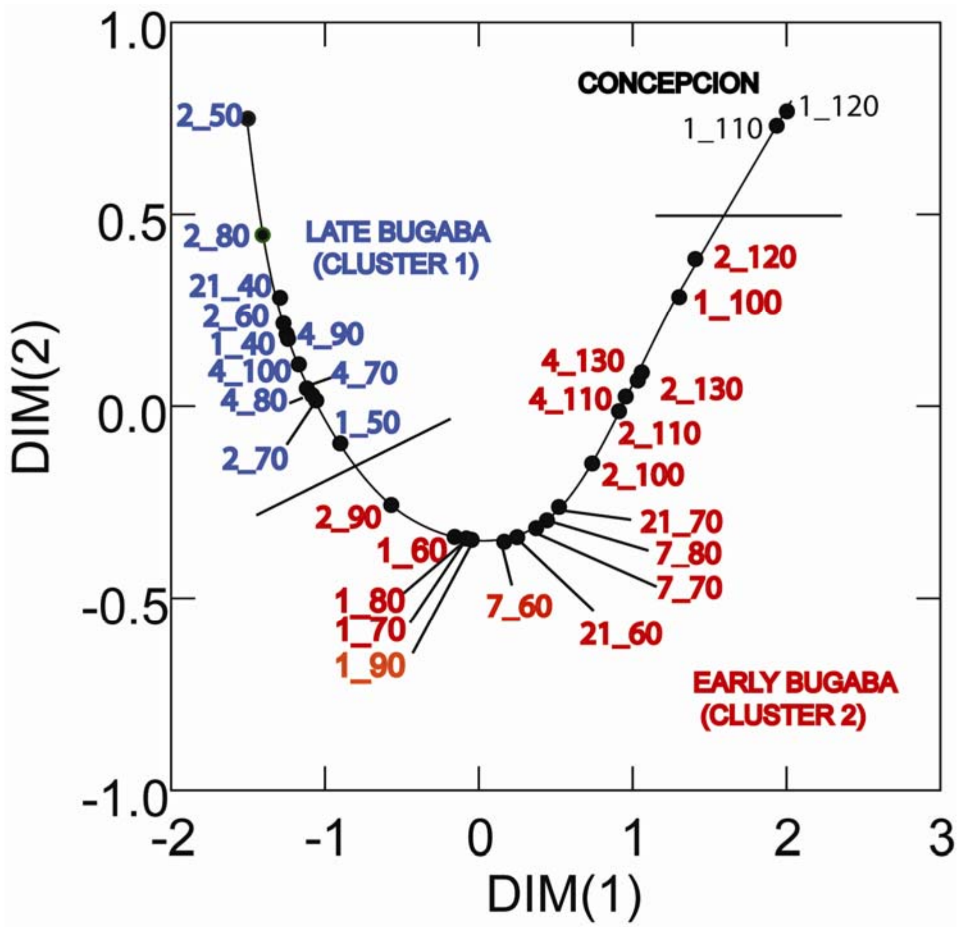

Figure 26. The fitted time curve illustrating divisions suggested by hierarchical cluster analyses.

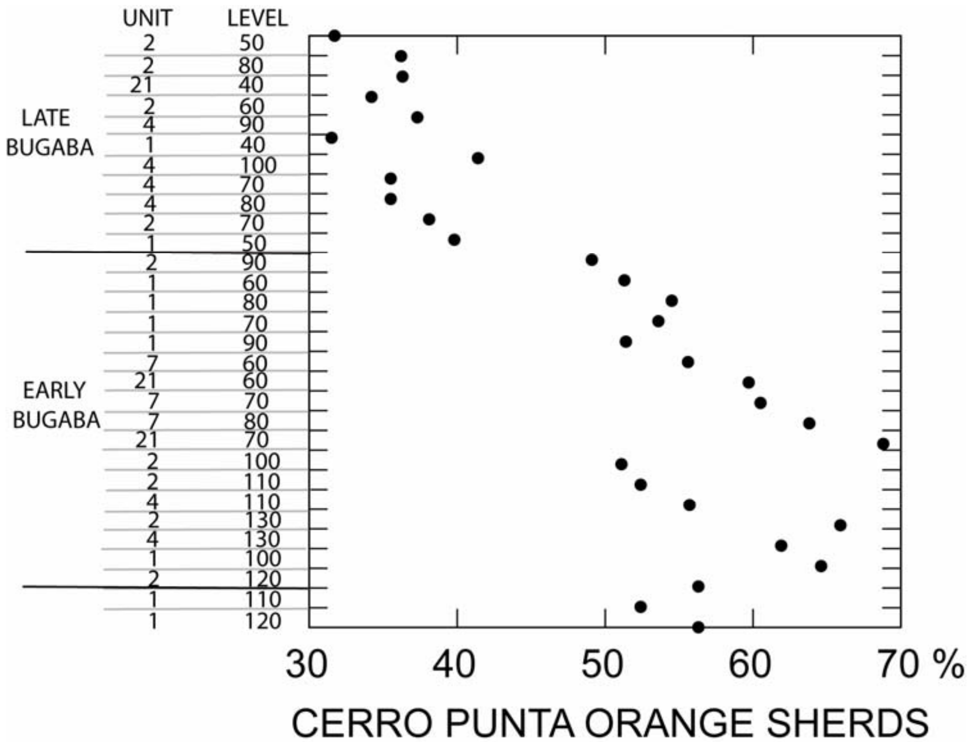

Figure 27. Scatterplot of Cerro Punta Orange ware proportions (divided by total sherds) over time.

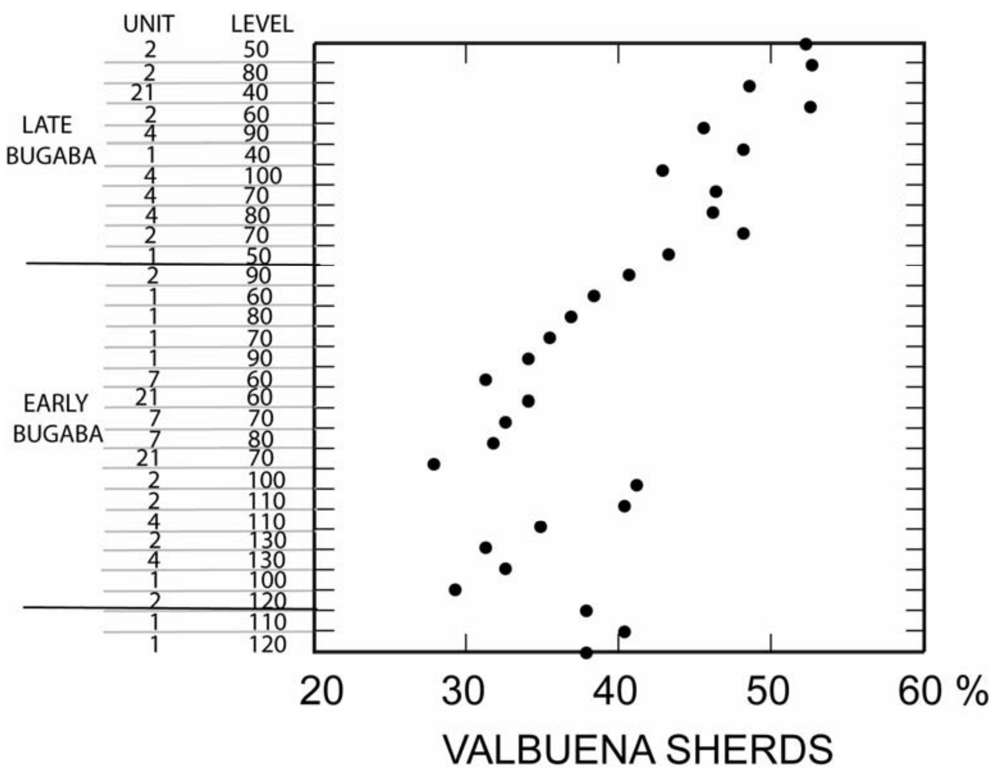

Figure 28. Scatterplot of Valbuena ware proportions (divided by total sherds) over time.

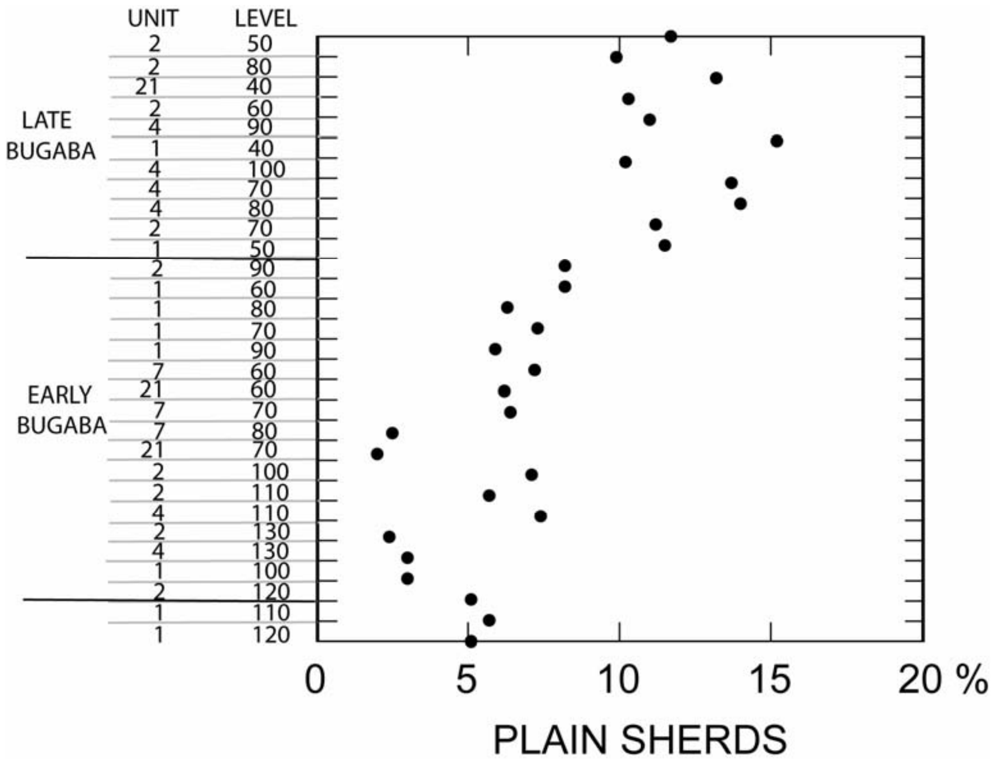

Figure 29. Scatterplot of Plain ware proportions (divided by total sherds) over time.

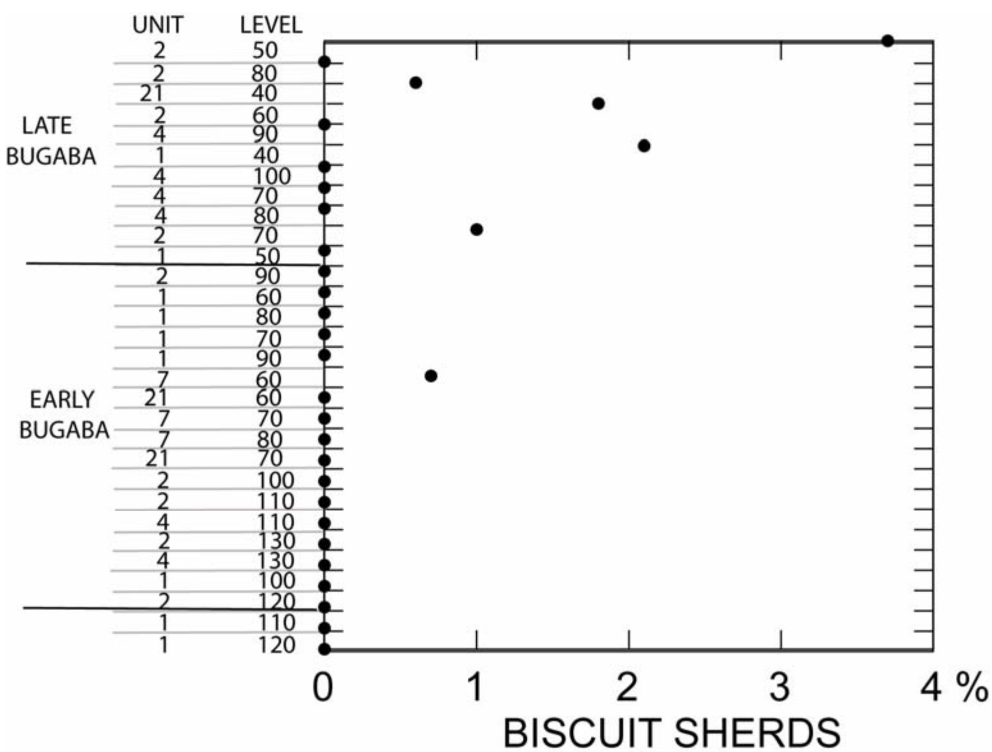

Figure 30. Scatterplot of Biscuit ware proportions (divided by total sherds) over time.

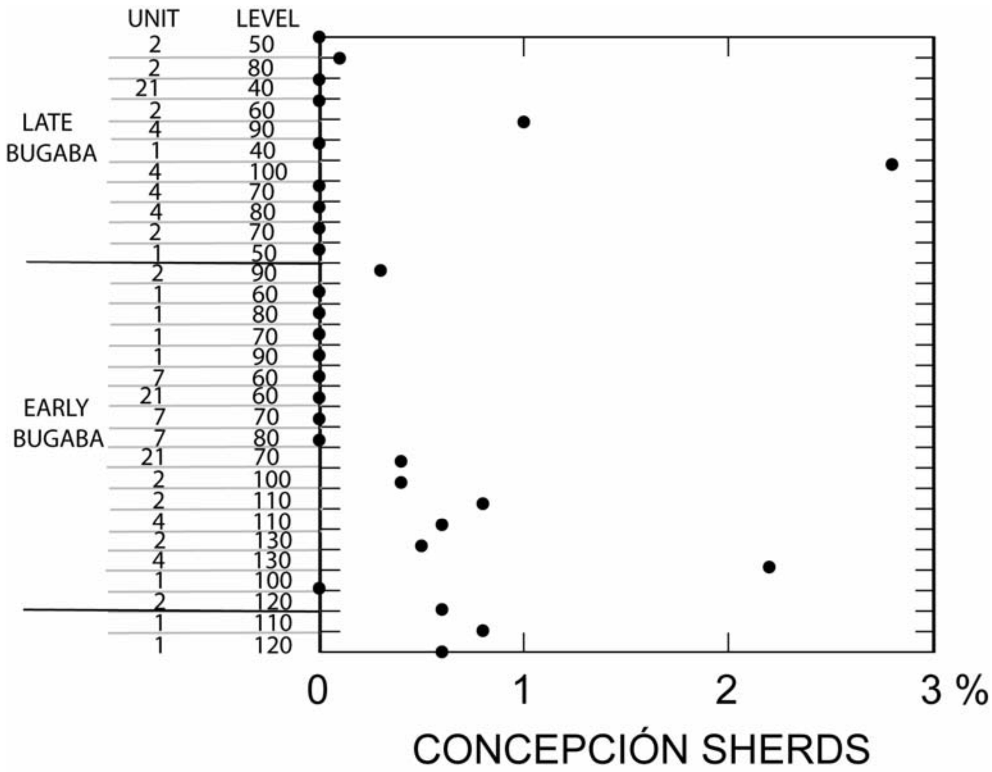

Figure 31. Scatterplot of Concepción ware proportions (divided by total sherds) over time.

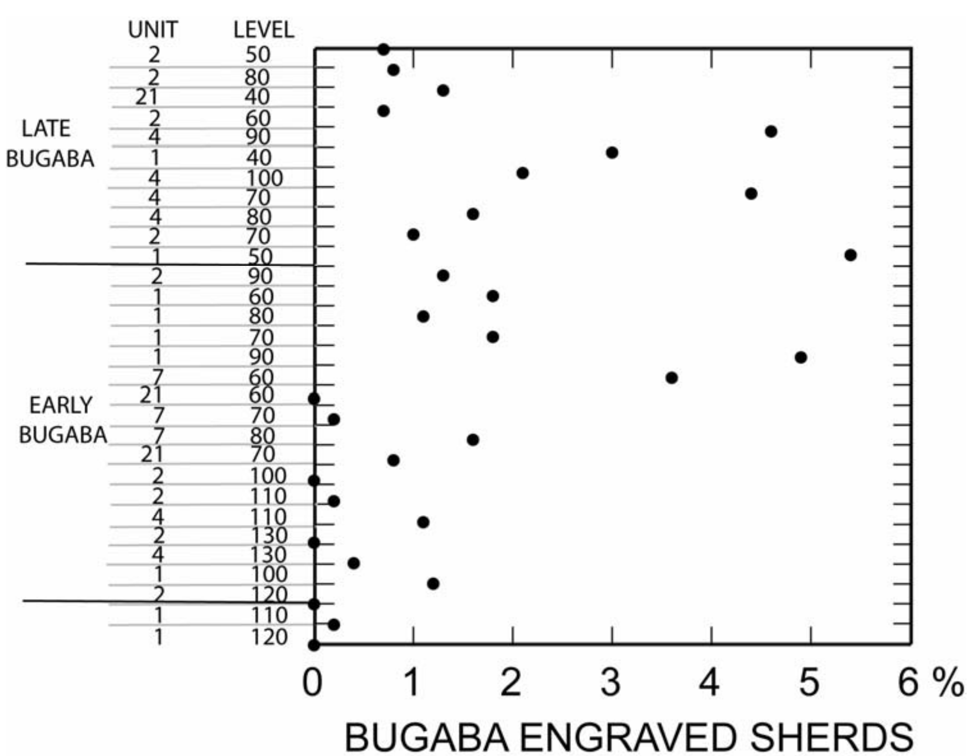

Figure 32. Scatterplot of Bugaba Engraved ware proportions (divided by total sherds) over time.

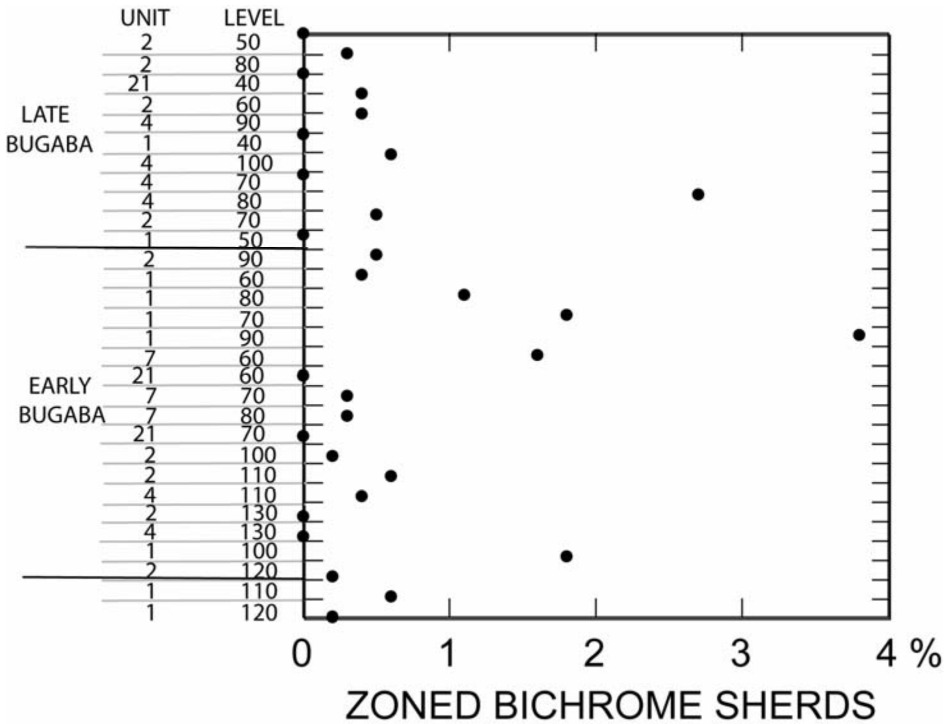

Figure 33. Scatterplot of Zoned Bichrome ware proportions (divided by total sherds) over time.

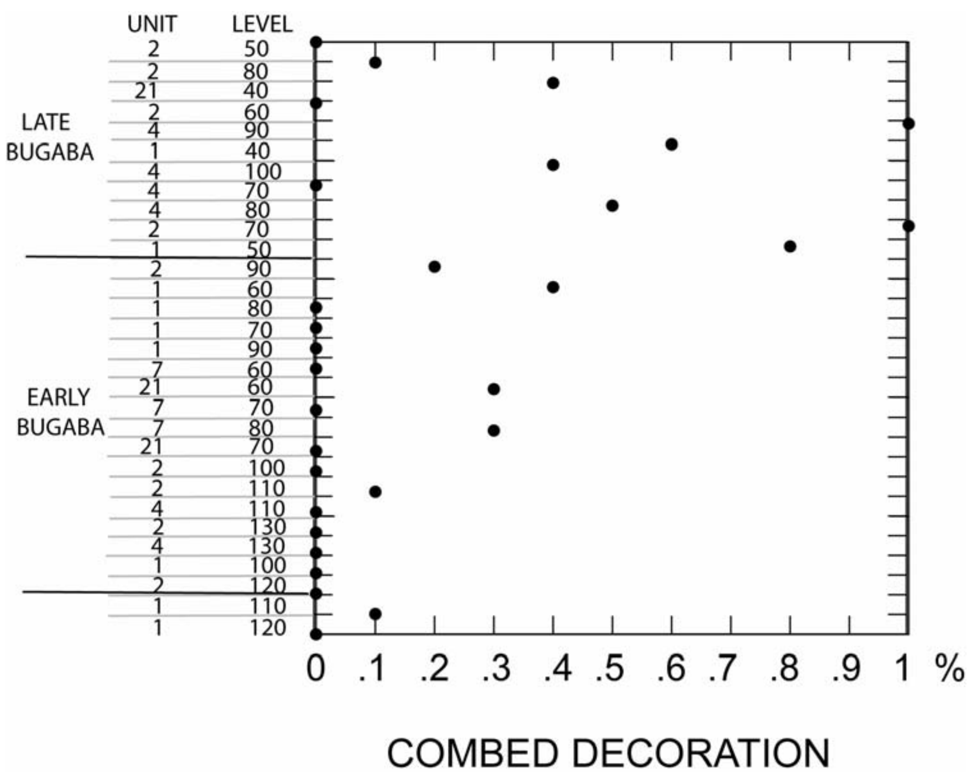

Figure 34. Scatterplot of proportions of sherds with combed decoration (divided by total sherds) over time.

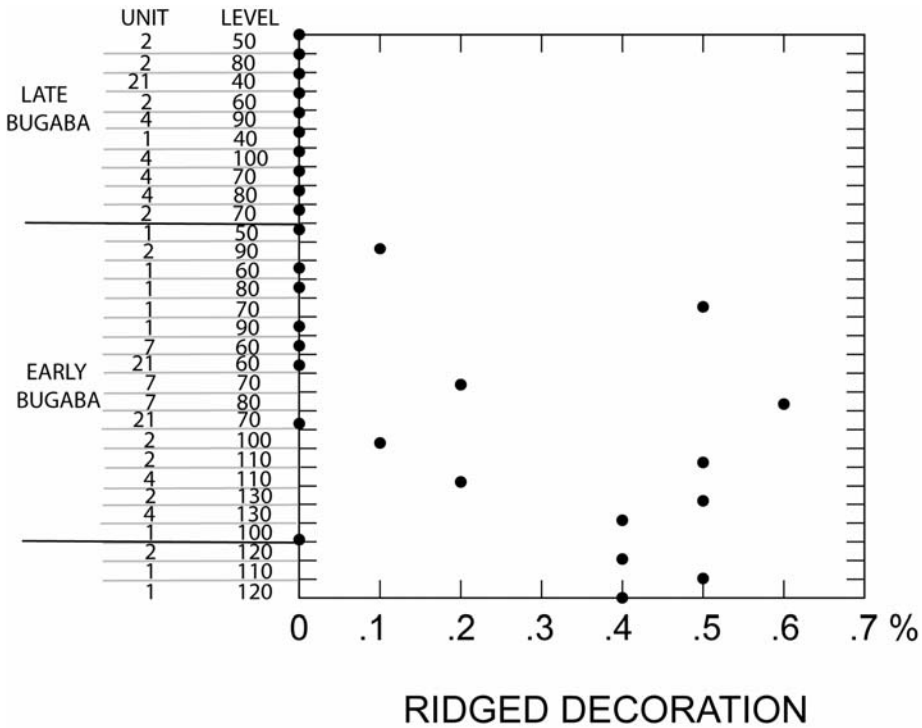

Figure 35. Scatterplot of proportions of sherds with ridged/fluted decoration (divided by total sherds) over time.

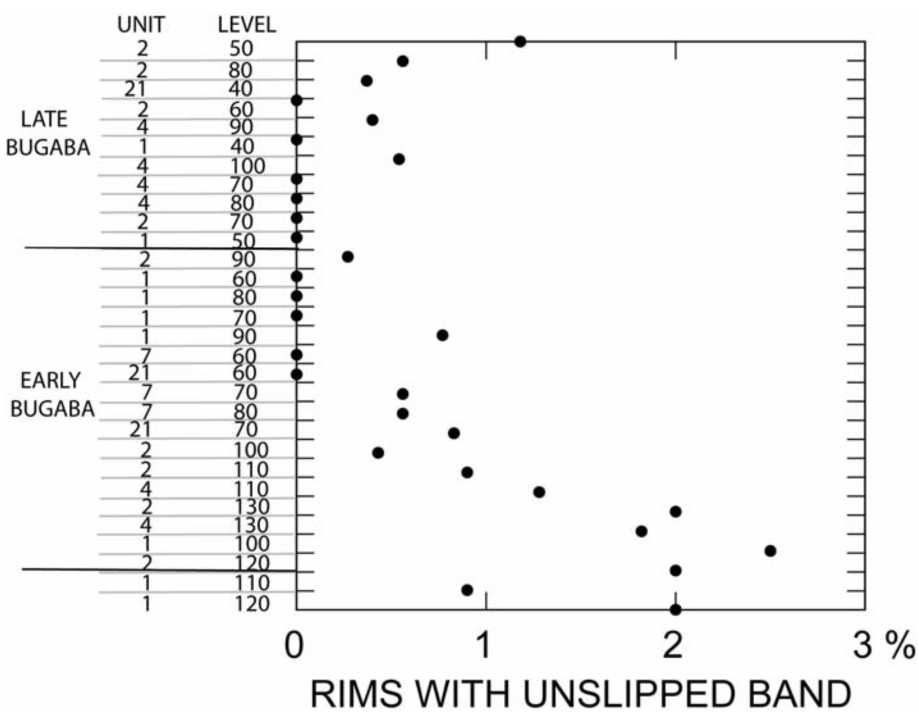

Figure 36. Scatterplot of proportions of sherds with unslipped exterior rim bands (divided by total vessels) over time.

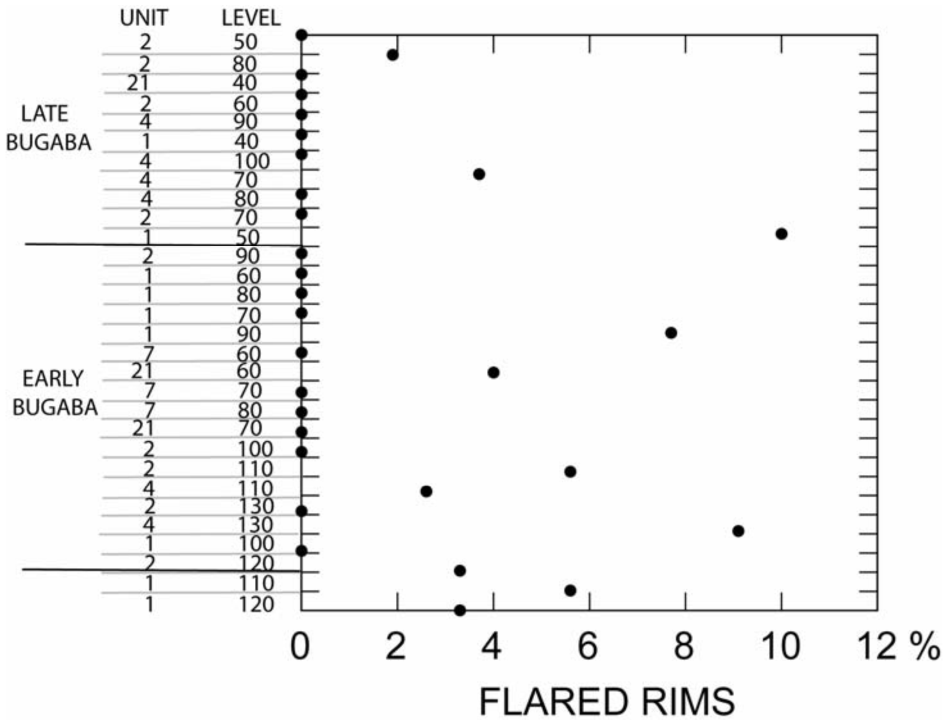

Figure 37. Scatterplot of proportions of sherds with flared rims (divided by total vessels) over time.

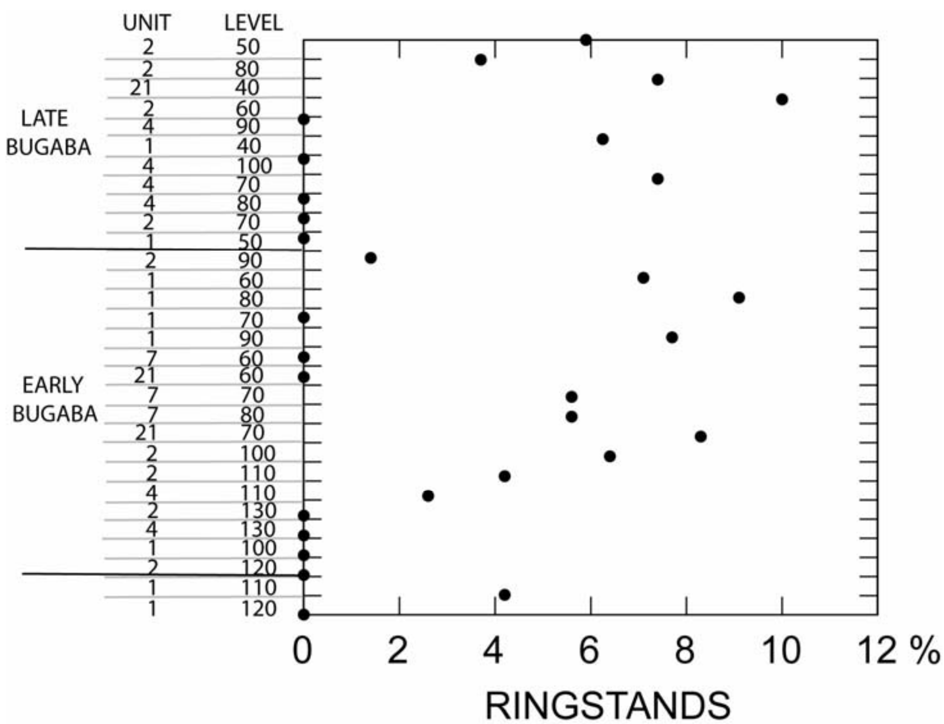

Figure 38. Scatterplot of proportions of ringstand fragments (divided by total vessels) over time.

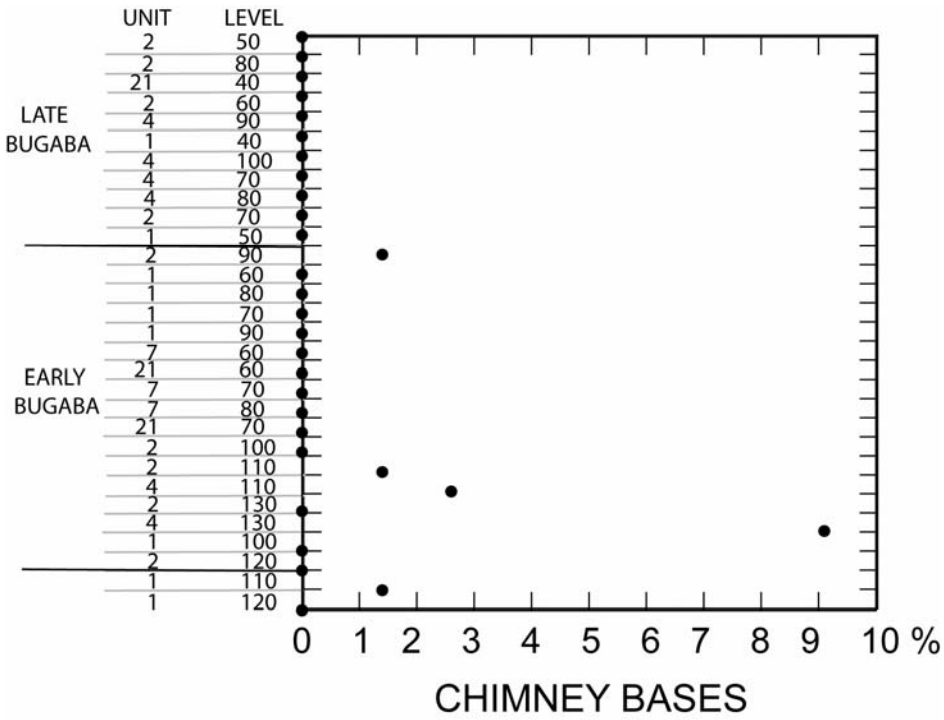

Figure 39. Scatterplot of proportions of chimney vessel fragments (divided by total vessels) over time.

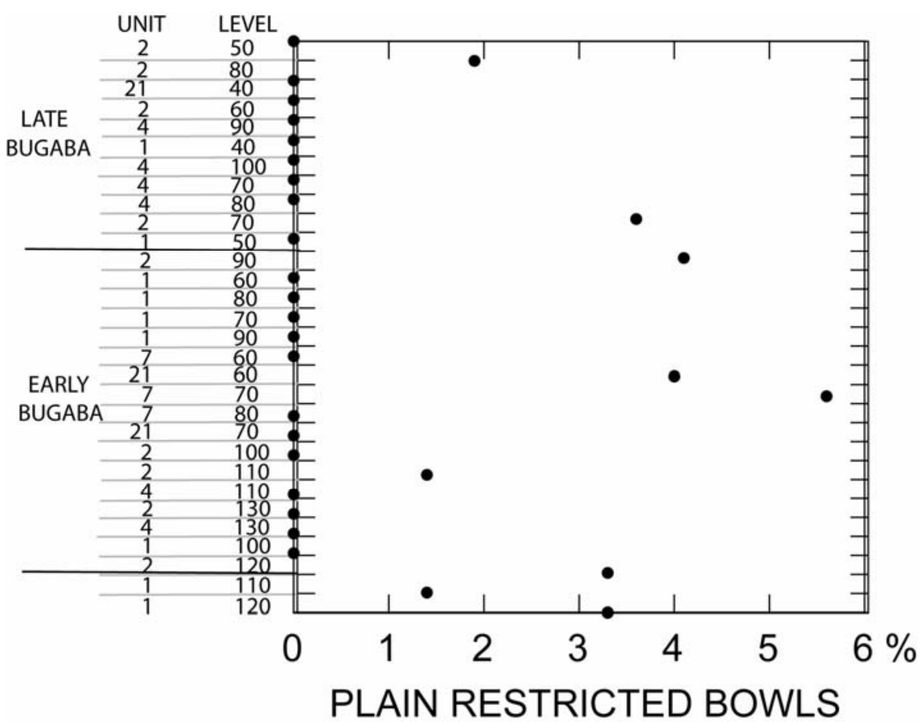

Figure 40. Scatterplot of proportions of Plain ware restricted bowl rims (divided by total vessels) over time.

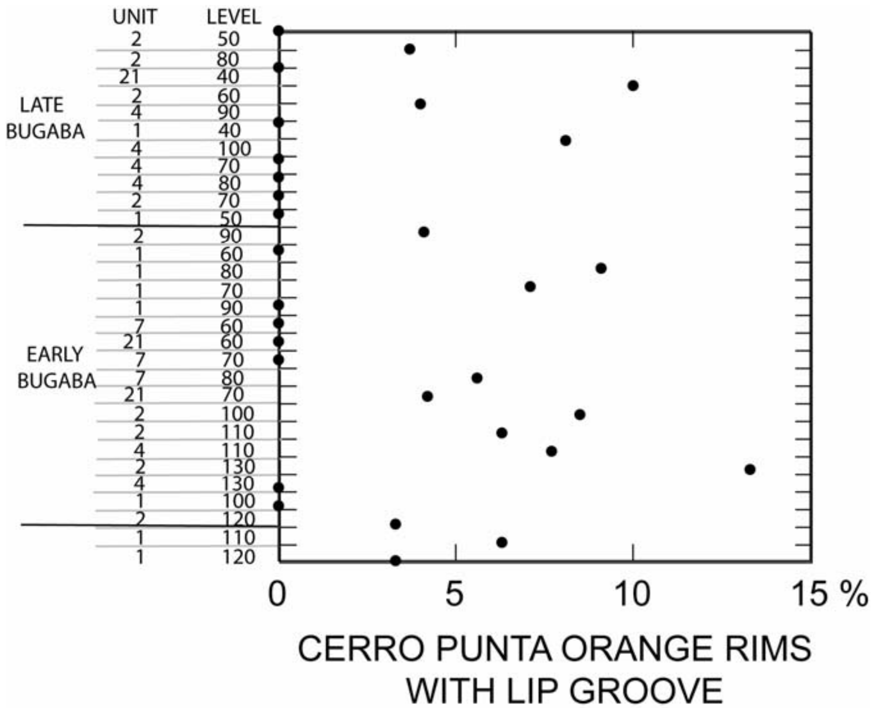

Figure 41. Scatterplot of proportions of Cerro Punta Orange ware rims with lip grooves (divided by total vessels) over time.

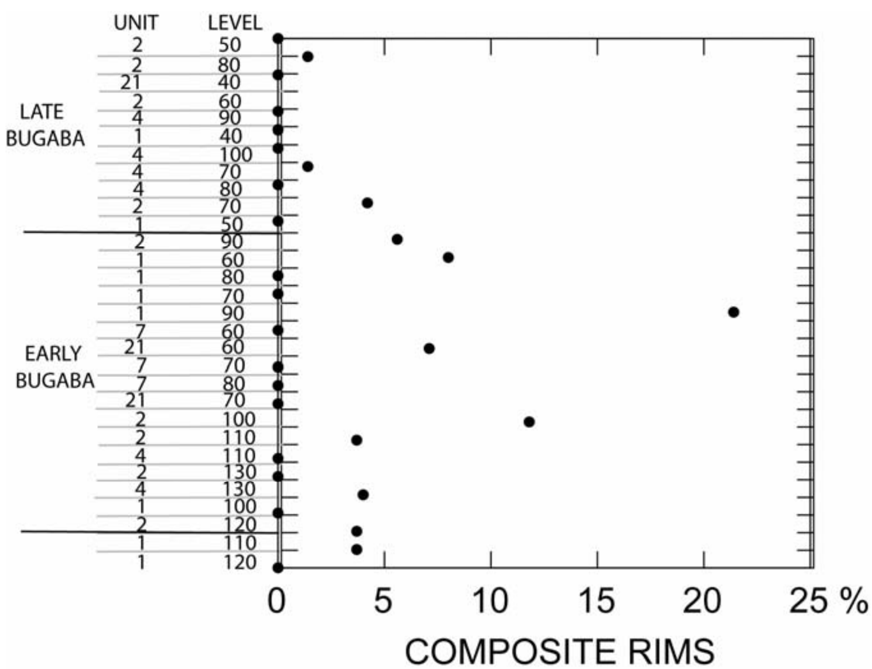

Figure 42. Scatterplot of proportions of S-shaped or composite bowl rims (divided by total vessels) over time.

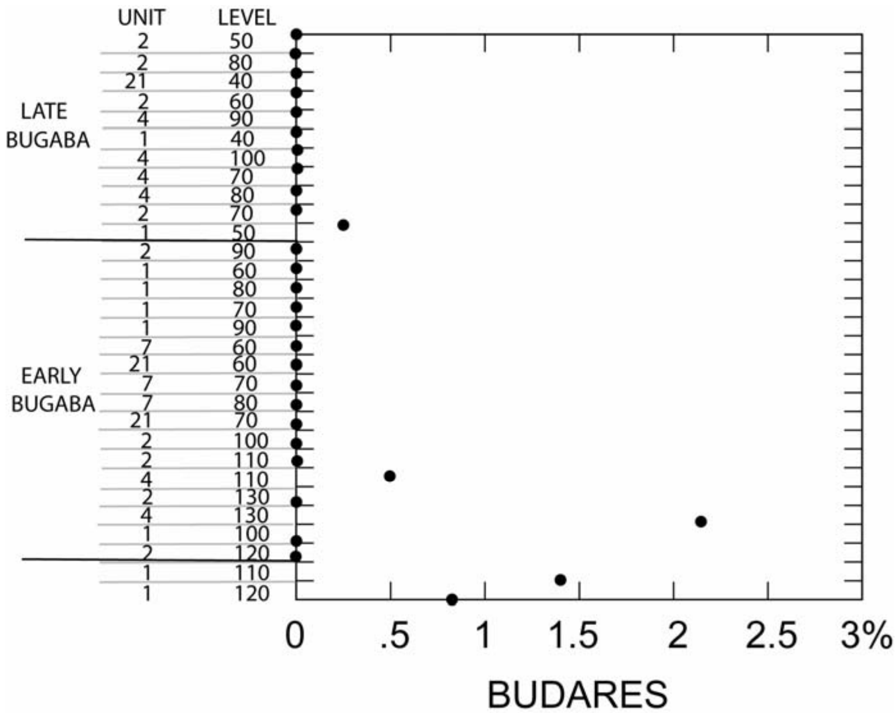

Figure 43. Scatterplot of proportions of budare rims (divided by total vessels) over time.

3.8.1 Early Bugaba Phase

The Early Bugaba phase is defined by high proportions of Cerro Punta Orange ware ($\bar{X}$=59.1%, 55.4% to 62.9% at the 95% confidence interval) relative to Valbuena ($\bar{X}$=34.8%, 31.9% to 37.8% at the 95% confidence interval). Plain wares are present in this phase, but only in small proportions, generally not exceeding 7% ($\bar{X}$=4.6%). In terms of presence/absence criteria, the Early phase has the strongest likelihood that Concepción sherds, sherds with ridged decoration, rims with an unslipped band beneath the lip, budares, flared rims, chimney vessel bases, or restricted plain bowls, will be present. Bugaba Engraved ware and ringstands are present in small proportions, and features typical of later phase, including Biscuit ware or sherds with combed decoration, are exceedingly rare.

3.8.2 Late Bugaba Phase

Late Bugaba phase deposits are defined as having an equal amount or more Valbuena ware ($\bar{X}$ =47.9%, 50.3% to 43.6% at the 95% confidence interval) than Cerro Punta Orange ware ($\bar{X}$ =39.1%, 43.2% to 36.1% at the 95% confidence interval), and typically Plain ware proportions greater than 9%. Later deposits have the strongest likelihoods for Biscuit ware, Bugaba Engraved ware, or sherds with combed decoration to be present. There appear to be slight tendencies in the Late phase for less carinated rims and more ringstands, though both are by no means uncommon in either phase. Concepción ware, Zoned Bichrome ware, sherds with ridged decoration, rims with unslipped bands beneath the lip, budares, and flared rims are all relatively rare.

3.8.3 Chiriquí Period speculations

During the Burica and Chiriquí phases, Linares' (1968a, 1968b) ordering of ceramics from excavations at El Cangrejal (SL-1) on the Pacific coast suggested that proportions of Isla Palenque Maroon Slipped ware, analogous to the Valbuena described here, declined in frequency (from nearly 50% to less than 5%) while Plain wares increased in proportion (from 15% to roughly 80%) during the same phase. No Cerro Punta Orange was observed along the Chiriquí coast, an absence also noted by Baudez *et al.* (1993, 1996) for the Diquís Delta in Costa Rica. Linares' excavations at Isla Cavada (IS-11), also on the Pacific coast, indicate that proportions of Biscuit ware also increased (less than 10% to roughly 60%) over time as Plain wares decline in proportion (from roughly 80% to 25%). To speculate for a moment, the Gulf of Chiriquí ceramic sequence might represent later manifestations of earlier chronological trends observed in this study, namely that of small but growing proportions of Plain ware continuing to increase through time as Valbuena-esque wares eventually peaked and declined in popularity. Plain wares were then perhaps subsequently eclipsed by Biscuit wares sometime during the Chiriquí Period, originally present in only trace amounts at the end of the Barriles sequence.

3.9 CONVERTING RELATIVE DISSIMILARITY TO TEMPORAL DISTANCE

The recognition of changing proportions between ceramic classes is a form of relative dating. Because the correct stratigraphic order of excavation strata was duplicated by the MDS analysis, we can be confident that directional trends in the popularity of ceramic attributes had a strong temporal component. What is left unresolved by such an analysis is a discussion of how fast or slow ceramic change occurred in calendrical terms, since it is unlikely that all excavation strata were deposited over equal intervals of time. One means of ‘anchoring’ the time curve would be to obtain and run multiple radiocarbon dates from the early, middle, and terminal ends of the ceramic sequence.

The funding to run many radiocarbon dates was well outside of the project budget, although three carbon samples were successfully submitted for AMS radiometric dating. The first two were from proveniences located toward the middle of time curve, at a point near the end of the Early Bugaba Phase defined by the hierarchical cluster analyses. Provenience 1_60 (in the mound) returned a calibrated date of A.D. 604, which produced a range between 5A.D. 60 and 650 at the 95% confidence level. Provenience 21_60 returned a calibrated date of A.D. 575, or between A.D. 540 to 620 at the 95% confidence level. Both these dates suggest that the division between the Early and Late phases dated to roughly A.D. 600. The third date came from provenience 2_50 (near the mound) and was likely corrupted since it returned a calibrated date of A.D. 1805.

Only two useful absolute dates were therefore produced by this project. The units they came from, Units 1 and 21, sampled midden deposits a few hundred meters apart, but nevertheless returned very similar dates from a similar portion of the time curve. They therefore served as a relatively independent check on the veracity of the MDS analysis in this case. There proximity in time, however, meant they could not hint at the time elapsed between the beginning of the Concepción and the end of the Late Bugaba. Since most of the published radiocarbon dates from Barriles date to A.D. 400 to 800, a liberal estimate for the sequence was made by adding a century to either end, or A.D. 300 to 900. This range will undoubtedly change in thee near future with additional research, and will probably be narrowed. The scatterplots of ceramic attributes presented early suggests that ceramic change over the 600 year period was relatively gradual, not sudden or punctuated. If this is true, the ceramic chronology presented here has the possibility to distinguish between smaller phases of 100 years or so using excavated proveniences. For research questions dealing with redundant practices or activities over time, this revised chronology makes the exploration of these issues possible.

4.0 DEMOGRAPHY

The techniques for calculating population estimates are inspired by those developed in the Basin of Mexico (Sanders *et al.* 1979), the Alto Magdalena (Drennan 2006) of Colombia, and the Chifeng region of China (Drennan *et al.* 2003). These regional settlement studies all considered sherd densities, rather than an exclusive reliance on site size (or the site concept), to estimate relative and absolute population estimates. This approach was decided upon, in part, because of the variability in artifact densities between sites and inaccuracies in previous site size estimations which became apparent during the course of fieldwork (Palumbo 2008). Some sites, like Barriles and Pitti-González, contained much denser concentrations of artifacts than any other site. For example, using only site size, Linares *et al.* (1975) and Linares and Sheets (1980) argued that BU-2 (~50 ha) would have had a much larger residential population than Barriles (~12 ha), roughly half a km to the south. However, the median sherd density for Bugaba Period shovel tests at Barriles (n=237), collected over a 32 ha area, was 1.40 sherds per m^3, and over 100x this in the center of the site. This is contrasted by the median sherd density of .08 sherds per m^3 for contemporaneous tests at BU-2 (n=91). In fact, only a single shovel test from the sampled portion of BU-2 (~15 ha, or 30%) exceeded the median Barriles density. If we use the simple assumption that more people tended to deposit more trash on the physical landscape, this example would suggest that Barriles likely contained more inhabitants, was inhabited through more of the Bugaba, or a combination of both. For this reason, it is argued that formulas which combine sherd densities and collection areas will provide superior and more defensible population estimates compared to those that use site area alone.

The Barriles and BU-2 example provides us with the beginnings of a relative population estimate. Median Barriles sherd densities during the Bugaba are 17 times as dense as the median densities at BU-2, though this difference may or may not mean there were 17 times as many individuals. Sherd densities may be higher or lower depending on a variety of phenomena, including how closely packed structures were in the past, and thus how effectively residential garbage was allowed to 'spread out' in the village. This is potentially an important issue at Barriles, since it is believed to have once been a more nucleated village (Linares 1977a), versus outlying sites interpreted as farmsteads and hamlets. One means to try and correct for this problem is to incorporate the area that a collection lot is thought to represent into a population estimate. Except for general surface collections, samples of artifacts were systematically collected every 20-25 m. Using a map of these point locations, the area that each collection effectively represents can be determined by creating thiessen polygons. Oftentimes, these areas were rarely much more than .07 ha in area, although some areas were much larger if there were modern features, swamps, or hill slopes adjacent to the sampled area. So if a surface collection (a single 3 m diameter circle, or an area of 7.1 m^2) taken in the center of a polygon measuring 0.1 ha recovered 50 Bugaba sherds, the best guess we would be able to make is that the entire 0.1 ha area contains a density of approximately 7.1 Bugaba sherds per m^2.

The step-by-step calculations of area density index values are described in detail in Drennan *et al.* (2003). They involves the multiplication the area of our theissen polygons (in ha) by the sherd density observed in collection units (in either m^2 or m^3). The moderately strong and highly significant relationship between surface and subsurface sherd densities described in

Chapter 2 allows us a means to work back and forth between densities from surface collections and shovel tests. For example, a surface density of 3.2 Bugaba sherds per m^2 was roughly equivalent to a subsurface density of 200 Bugaba sherds per m^3. However, not all sherds in a typical collection unit belonged to the Bugaba Period as in the example above. Some belonged to the Concepción, others to the Chiriquí. Those in the Bugaba Period were split into Early and Late Phases and, to make matters more complicated, roughly 20% of the sherds collected were classified as unidentifiable. Concepción and Chiriquí diagnostic sherds, described in more detail below, turned out to be only minor portions of their respective ceramic assemblage, which contained a healthy amount of otherwise Bugaba sherds. These were effectively treated as ratios in the area density calculations (i.e. one Chiriquí sherd standing for 5 additional sherds).

A complicated but common example would involve a shovel test containing 100 sherds spanning all four time periods, 20 of which were unidentifiable sherds. We would calculate the proportion of sherds that belonged to each phase, using .20, .30, .40, and .10 as respective examples here. The unidentifiable sherds would then be divided up, with 4 (or 20%) being assigned to the Concepción, 6 (or 30%) to the Early Bugaba, and so on until each sherd contributed to the density estimate. These densities would be multiplied by our thiessen polygon area, typically a tenth of a hectare or less. Finally, because many of the phases spanned a variable amount of centuries, we can correct for the influence of time by dividing each phase by the number of centuries in it. What we are left with would be an area density index value for each of the four phases from a single shovel test. When all of the area density values summed up for a particular site, these would then contribute to relative population estimates, i.e. a site with 30% higher area density values during the Late Bugaba would taken to mean that there were 30% more individuals living there during the phase. These relative population estimates are admittedly still rough approximations, but even so, they offer considerably more potential in making demographic estimates than those which make assumptions from site area alone.

4.1 ABSOLUTE POPULATION ESTIMATES

Converting relative area density values into absolute population estimates requires some sort of baseline assumptions about residential density. There are, for example, several discrete collections outside of Barriles and Pitti-González which are low density sherds scatters less than one tenth of a hectare in extent that are interpreted here as the remains of individual farmsteads. Linares and Sheets (1980:53) provided an estimate of 5 people per household or farmstead. We do not, however, know whether or not a particular farmstead would have been occupied for the full duration of a phase. More or less temporary occupations, or those on the order of a generation or two, would be expected to produce lower density estimates than those occupied relatively continuously over centuries. And since no farmstead had, for example, three or more sequential components represented which would give us some confidence that it was occupied throughout the entire middle phase, it is unlikely that relatively accurate absolute estimates can be achieved by simply scaling up the area density values we can observe among a few farmsteads. Because of this, the best population estimate we can make for a typical farmstead is somewhere between 1-10 individuals, leaving the existing estimate of 5 people unchanged.

The alternative approach would be the one used by Haller (2004, 2009), which involved estimating population sites within one of the larger villages. His estimates of residential population density at Natá combined both ethnohistoric and archaeological observations (Cooke 1972, 1979; Espinosa 1994), but is an approach that cannot be uncritically imported to Gran

Chiriquí since it lacks a similar ethnohistoric record. We can, however, review available population estimates from Gran Chiriquí and neighboring areas to arrive at ballpark figures. Of particular relevance is Drolet's (1992) estimate that Murcielago, a roughly 30 ha site in Southern Costa Rica, was home to approximately 1000 individuals. This would imply an internal population density of 33 individuals per ha of occupation. This is on the high end compared with Linares and Sheets (1980) maximum residential density estimate of 20 individuals per ha for the Guaymí, Isaza's (2007:455) estimate of 24 per ha at Cerro Juan Díaz, or Haller's (2004, 2009) figure of 15 per ha at Natá and He-4. This gives us a rough range of 15 to 30 individuals per ha for a nucleated village like Barriles.

When applied to Late Bugaba Barriles, its largest and densest phase, these low and high estimates give us an absolute population estimate for the site between approximately 500-1000 individuals. Because the densest outlier values were not trimmed from the Barriles sample, it is possible that values closer to 500 than 1000 would have much more likely in reality (or, essentially, that population densities around 20 per ha are still very reasonable). When combined with the area density values discussed above, we can calculate an absolute population estimate of .6 to 1.2 individuals for every area density value of 1.0. So in the example of the Early Bugaba hamlet of BU-12 in the Bambito gorge, whose area density values totaled 36.0, we could estimate the population as somewhere between 22 and 43 individuals (36 multiplied by 0.6, and 36 multiplied by 1.2), or 20-40 for simplicity's sake. Though it sounds like we can calculate a population estimate down to a single individual, such precision is essentially a mathematical artifact. Calculations of absolute estimates in this manner can really only distinguish between rough demographic levels; 10 people instead of 100, 100 instead of 500, 500 instead of 2000, and so on.

4.2 DEMOGRAPHIC SEQUENCE

The overall demographic sequence from the Concepción to the Chiriquí is one of dramatic population shifts and reorganization. Based on the sites sampled by this project, it appears that the earliest ceramic using populations began the sequence living in highly dispersed farmsteads. The Bugaba Formative immediately followed this, and resulted in an increasing trend of population nucleation in emergent villages such as Barriles and Pitti-González. Some proportion of the regional population was likely still organized in dispersed farmsteads and small hamlets throughout the entire Formative, and groups apparently settled in portions of the study area that had not been previously inhabited. It is possible that this process represents not only *in situ* population growth, but also the influx of highland populations to emerging centers from somewhere outside of the region. By the subsequent Chiriquí, the organization of the regional population once again returned to a highly dispersed pattern of living, one which was perhaps even more ephemeral than the Concepción. Compared to the beginning and end of the sequence, the establishment and abandonment of villages appears sudden and abrupt. However, the persistence of two separate villages over at least 3-4 centuries also suggests some degree of stability and continuity through the Formative, at least from a generational perspective.

4.2.1 Concepción Phase (300 B.C. to A.D. 400)

Following Haberland's early descriptions (1962), Shelton (1984) identified the Concepción as a distinct ceramic phase that was stratigraphically below Aguas Buenas deposits at sites 54 (BU-63) and 59 (BU-73) in San Vincente, province of Chiriquí, roughly 24 km south and 600 m lower than the site of Barriles. She excavated an area of 3x2 m (trenches 1 and 2) in Site 54, and another 1x2 m (trench 1 east) in site 59. In both trenches, the depth of Concepción deposits was roughly 50 cm deep. Shelton only analyzed diagnostics (rims, bases, and decorated sherds) in her analysis, although she did collect and count undecorated body sherds and presented these numbers by trench (rather than stratum). In total, these excavations produced 308 diagnostics and 3265 undecorated body sherds. Diagnostics therefore constituted only 9.4% of the ceramic assemblage or, to express this as a ratio, 1 diagnostic was present in every 10.6 sherds.

The Concepción strata contained only 93 Concepción sherds (identified as her Wares A through E), and 83 other diagnostics (i.e. Cerro Punta Orange, Valbuena, or Bugaba Engraved wares), for a total of 176 diagnostics. Assuming diagnostics also made up 9.4% of the ceramic assemblage in Concepción strata, this gives us an estimate of 1872 total sherds (1696 of which would be undecorated body sherds), or a density of 468.1 sherds per m^3. However, Concepción sherds made up only 52.8% of the diagnostics found by Shelton at San Vicente, which means that 1 Concepción sherd was present in every 20.1 sherds during the phase. So even though Concepción wares can be identified among ordinary body sherds on the basis of surface finish and paste, they only represent a mere 5% of the total ceramic assemblage for the entire phase. This is, of course, an entirely normative statement at present; we simply do not know how Concepción vessels were used in the past, or how any potential uses may have resulted in different proportions or ratios. Nevertheless, we can use this approximate 'Shelton correction' in our subsequent area density calculations, where each Concepción sherd is taken to stand for 20 other sherds in the collection lot.

Concepción sherds have a limited distribution among the sites sampled by this project, only being present at Barriles, Pitti-González, and BU-8. Population estimates suggest that 40-80 individuals lived at Barriles during the phase (figure 44), which was really four separate 'sites' if we use the 100 m rule to divide up areas of higher density. Much of this occupation was probably dispersed between individual farmsteads, although there is one cluster at Barriles which is slightly larger and denser than the rest, and may have been a small hamlet (or a cumulative palimpsest of multiple farmsteads). Pitti-González was similarly divided up into five small 'sites' (figure 45), all of them appearing to be small and extremely low-density farmsteads probably not totaling more than 20-40 individuals. The Concepción occupation at BU-8 is represented by only a few contiguous shovel tests (figure 46), and likely represented little more than a single farmstead of 5 individuals or so. Population levels are so low and dispersed within Barriles and Pitti-González that it stretches the imagination to refer to either as nucleated villages or as vibrant interactive communities during the Concepción.

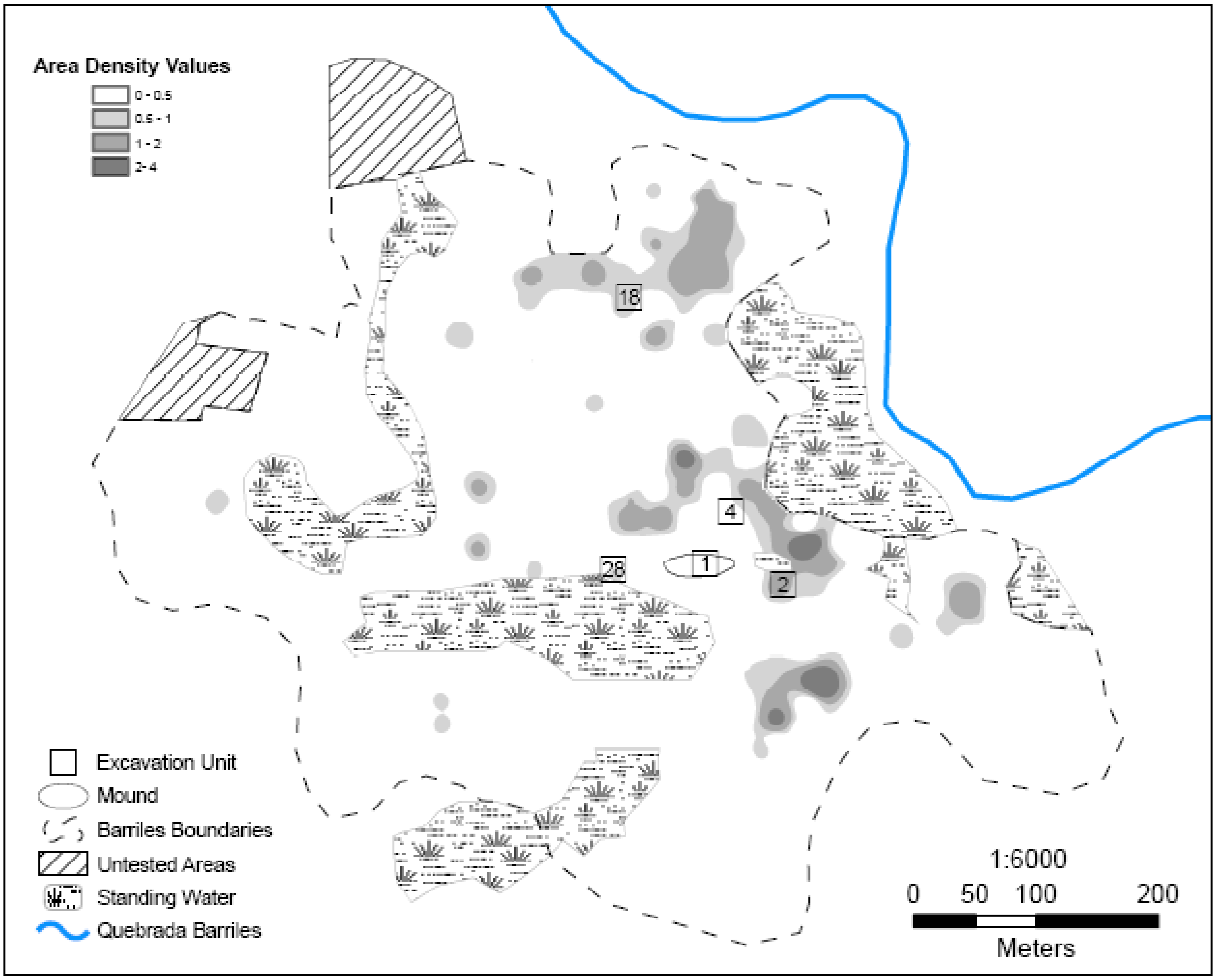

Figure 44. Concepción phase area density values within Barriles.

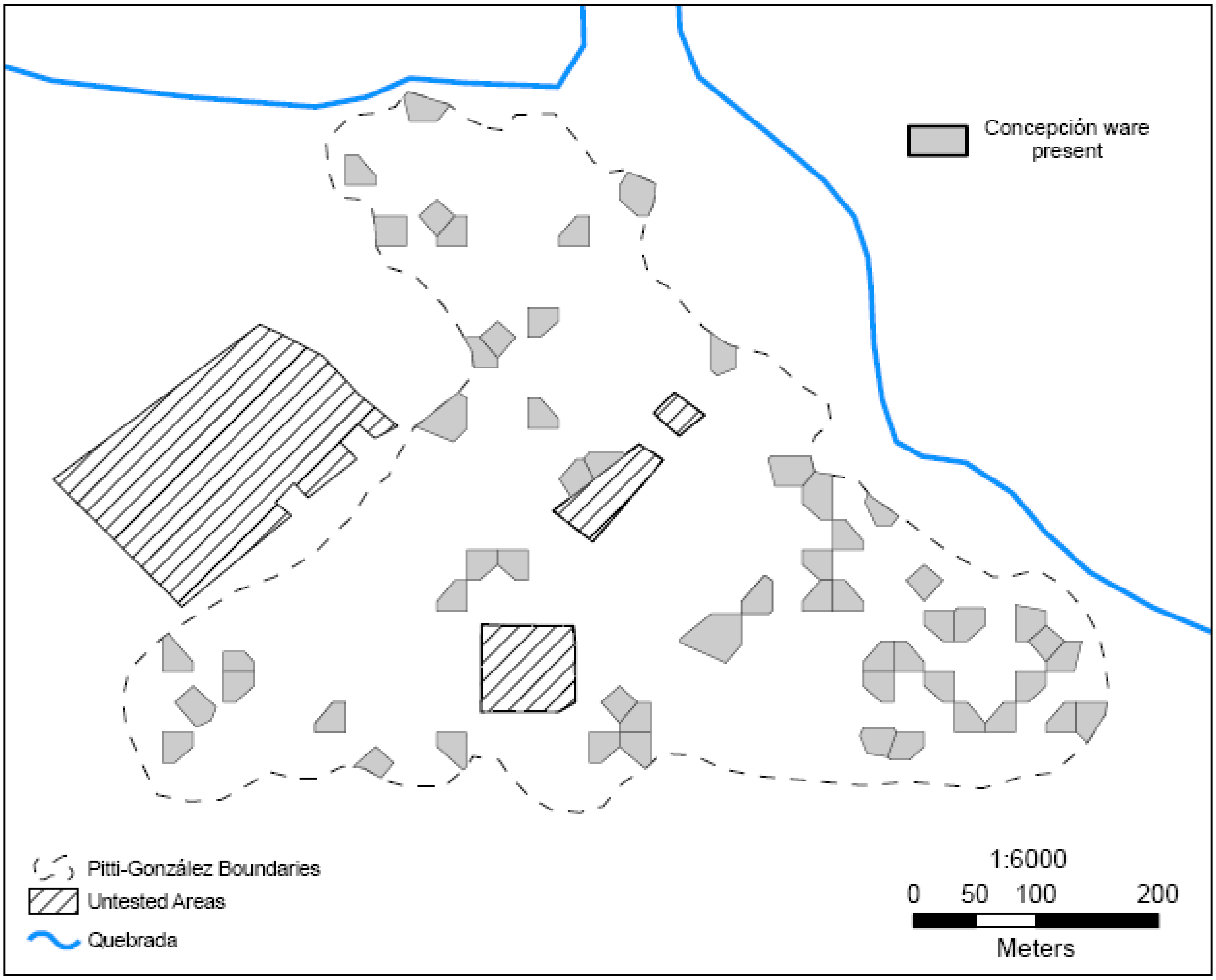

Figure 45. Thiessen polygons with Concepción phase sherds present within Pitti-González.

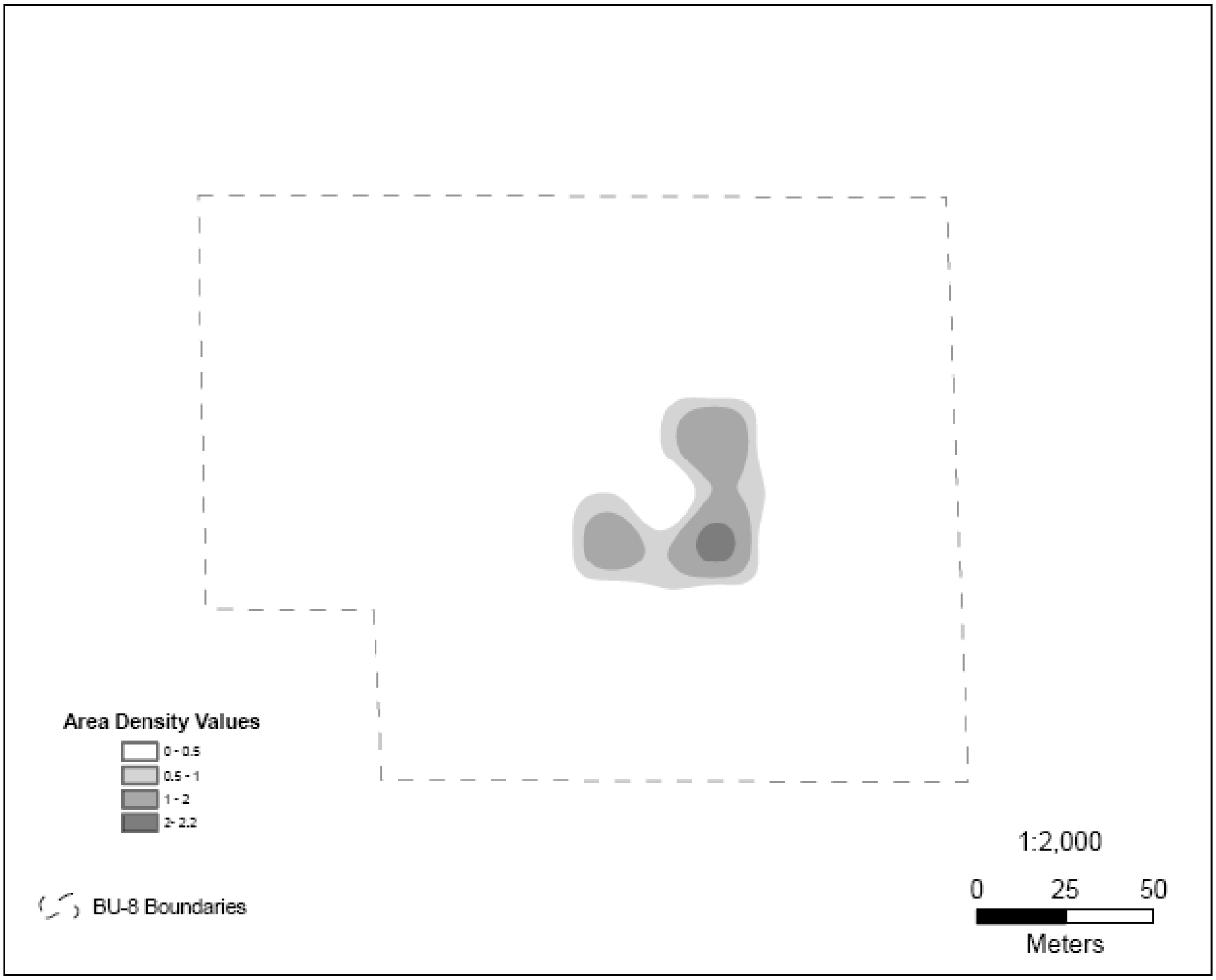

Figure 46. Concepción area density values within BU-8.

4.2.2 Early Bugaba Phase (A.D. 300 to 600)

The Early Bugaba, recognizable in non-stratigraphic samples as having an abundance of Cerro Punta Orange ware, represents a time of dramatic population growth and the likely reorganization of some of the study area's population into one of two small villages: Barriles or Pitti-González. Barriles expanded from a set of small, dispersed hamlets into a dispersed village of approximately 32 ha (figure 47). The bulk of the occupational evidence is concentrated in the center of the site (or the 'petroglyph core' described in chapter 9). This was the area with the flattest topography and deepest soils. Area-density population estimates suggest that between 250 to 500 individuals may have lived within the emerging village during the Early Bugaba.

Pitti-González is also believed to have housed approximately 250 to 500 individuals, and to have also expanded from a series of dispersed farmsteads into a small village roughly 26 ha in extent. Much of the population apparently lived in the southern half of the site, with concentrations of artifacts becoming more dispersed and ephemeral as they stretched away to the north, eventually ending at the edge of a steep *quebrada*. While both these small villages were emerging, some proportion of the regional population probably continued to live in small farmsteads and hamlets. The only hamlet encountered was BU-12 in the Bambito gorge, situated in an area with little available farmland, and estimated at 20 to 40 individuals (figure 50). Both BU-2 (figure 49) and BU-8 are estimated to have each contained an individual farmstead for the phase.

The site of Dos Ríos (figure 51) in the Cerro Punta basin was a low-density site sampled with two general collections, each approximately 1 ha in area. A great deal of lithic debitage was recovered here, principally primary flakes and cores manufactured out of andesite and basalt cobblestones which could have been collected from a nearby bend in the stream where the water slows and cobbles pile up. The general surface collections produced a total of 100 sherds, 86 of which were identifiable to ware. Of these 86, 65 (75.6%) were identified as Cerro Punta Orange ware, and 21 were either Valbuena or Plain (24.4%). No decorated sherds or sherds from any other phase were recovered. This ceramic evidence suggests that the site of Dos Ríos most likely dated to the Early Bugaba, though the site may have functioned as a lithic reduction site rather than a habitation site. If there was a residential population at Dos Ríos, such low and dispersed ceramic counts argue against it being much greater than one or two farmsteads.

A somewhat similar situation may have existed at BU-18, a small site perched atop what is arguably the most naturally defensible mesas in the valley (figure 52). Like Dos Ríos, the site was of such a low density so as to make controlled surface collections impractical, and was collected using a series of general surface collections. The site covers approximately 2 ha in extent, and of the 248 identifiable ceramics, 133 (53.6%) were identifiable as Cerro Punta Orange ware. The contains sherds of Bugaba Engraved and Zoned Bichrome wares (the so-called fancy wares), which tended to enjoy their maximum popularity in the Late Bugaba, so it is possible that BU-18 was occupied around the Early to Late Bugaba transition. This site also contained a wealth of lithics, including a great deal of fine-grained basalt cores and axe material (axes, preforms, and polish flakes). Owing to its low density and small area, it is unlikely this site was home to much more than a small hamlet, perhaps no more than 30 people or so.

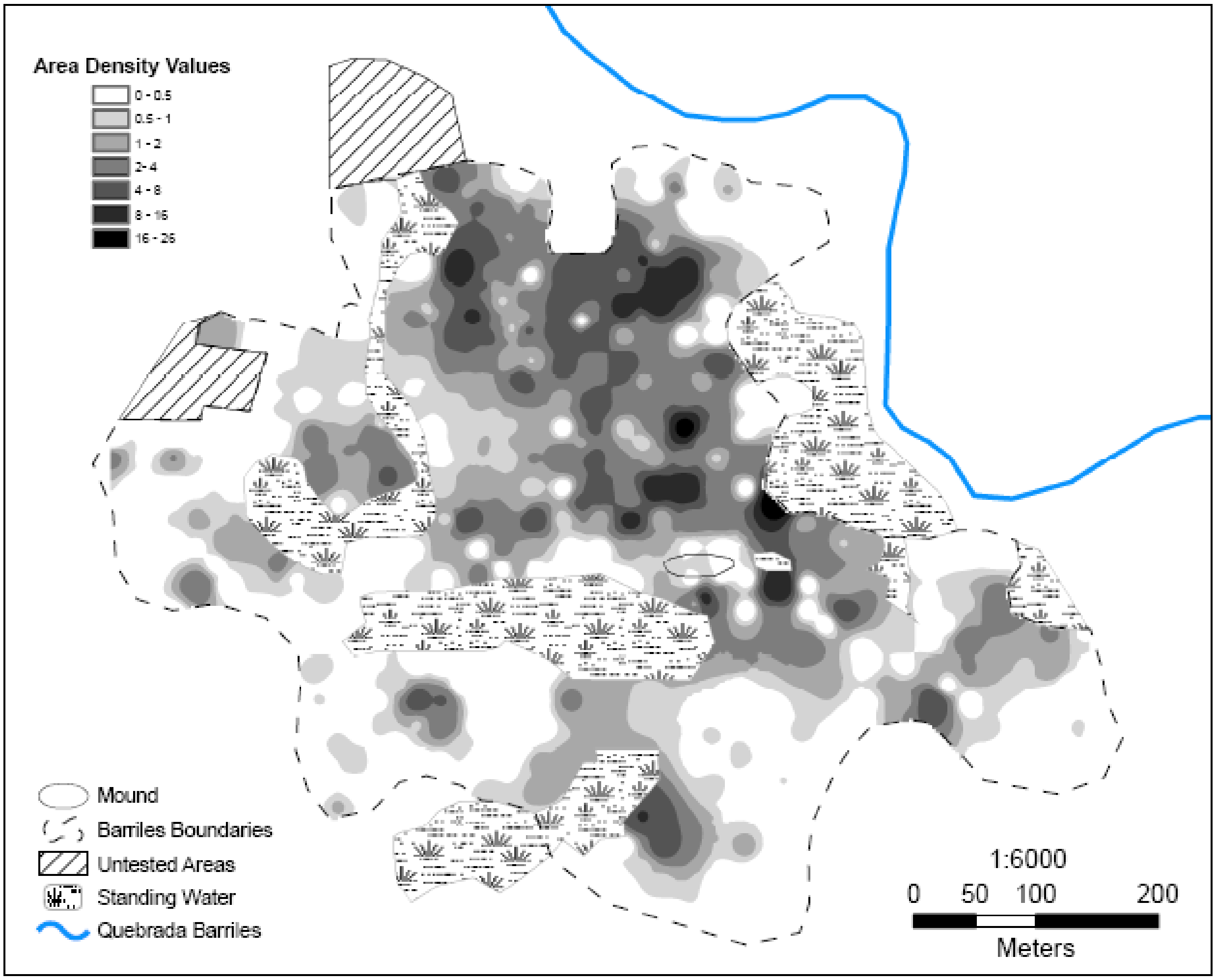

Figure 47. Early Bugaba phase area density values within Barriles.

Figure 48. Early Bugaba phase area density values for Pitti-González.

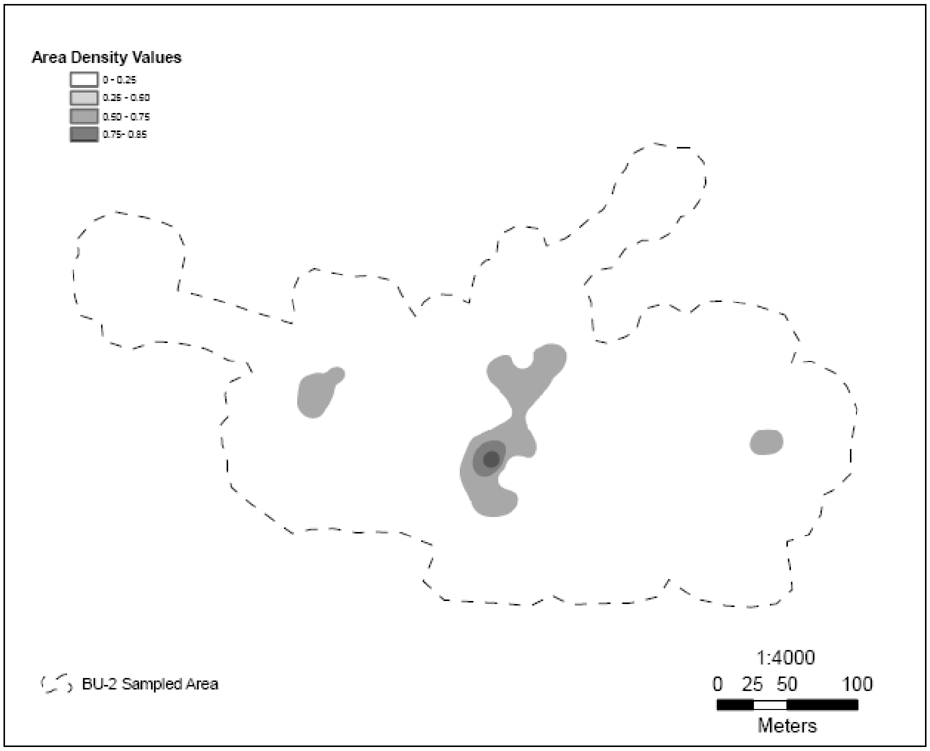

Figure 49. Early Bugaba phase area density values within sampled portion of BU-2.

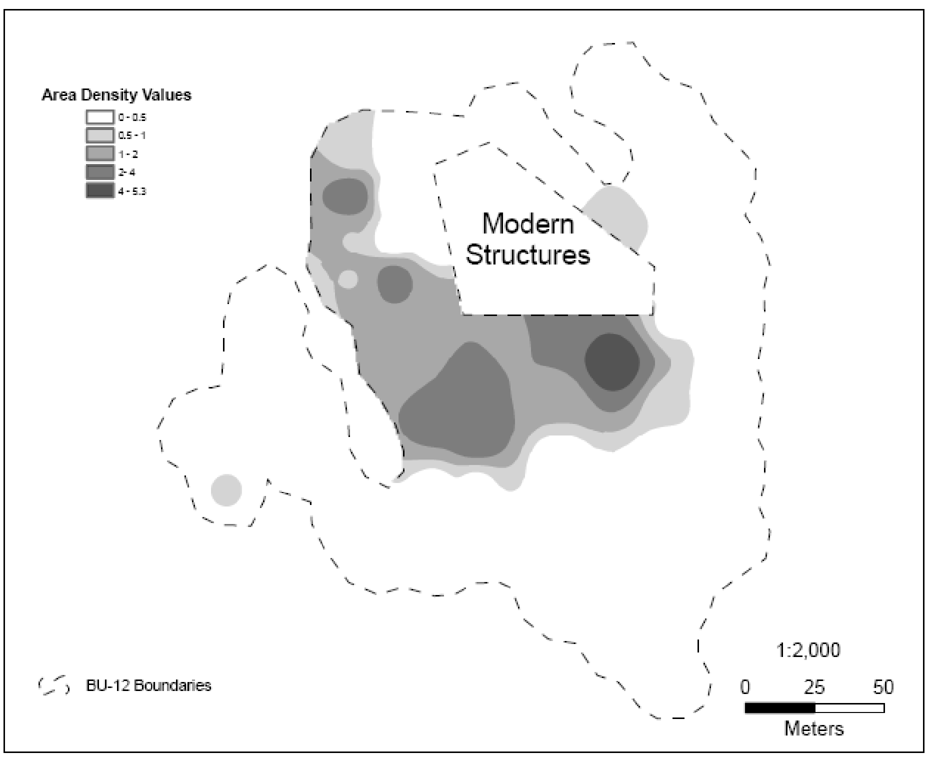

Figure 50. Early Bugaba phase area density values within BU-12.

Figure 51. Photo of Dos Ríos site.

Figure 52. Photo from site BU-12 to the mesa where site BU-18 is located.

4.2.3 Late Bugaba Phase (A.D. 600 to 900)

The Late Bugaba Phase was likely a time of maximum residential density within the villages of Barriles and Pitti-González. Barriles continued to cover the same 32 ha, but Late Bugaba Phase deposits were denser than in the Early Bugaba. Population is estimated between 500 to 1000 individuals (figure 53), but if we exclude a handful of particularly dense shovel tests, it seems a residential population closer to 600 to 700 appears to be more reasonable than 1000. Dense concentrations of artifacts tended to be found all over the site rather than in exclusively in the center.

The residential population at Pitti-González did not appear to have grown appreciably, if at all, during Late Bugaba, a may have become a 26 ha secondary center dwarfed by a denser, nucleated population at Barriles. It was however, 13 km away (and approximately 600 m higher) from Barriles, and may have served as a local center for the Cerro Punta and Bambito populations. The focus of occupation in the southern half of the site appears to have remained relatively unchanged through the phase (figure 54). As in the Early Bugaba, some small farmsteads and hamlets probably persisted outside of these villages. A small Late Bugaba phase hamlet of less than 20 individuals and a small outlying farmstead are apparent in the sampled portion of BU-2 (figure 55). Occupation failed to continue at BU-8 and BU-12, and probably did not extend well into the Late Bugaba (if at all), at Dos Ríos and BU-18. The low number of tertiary sites encountered in the sample may or may not indicate that Late Bugaba populations had become increasingly centralized in villages like Barriles, or settled around them in hamlets like BU-2. But such a possibility would be one reason to extend the sampling program at wider regional scale in the future.

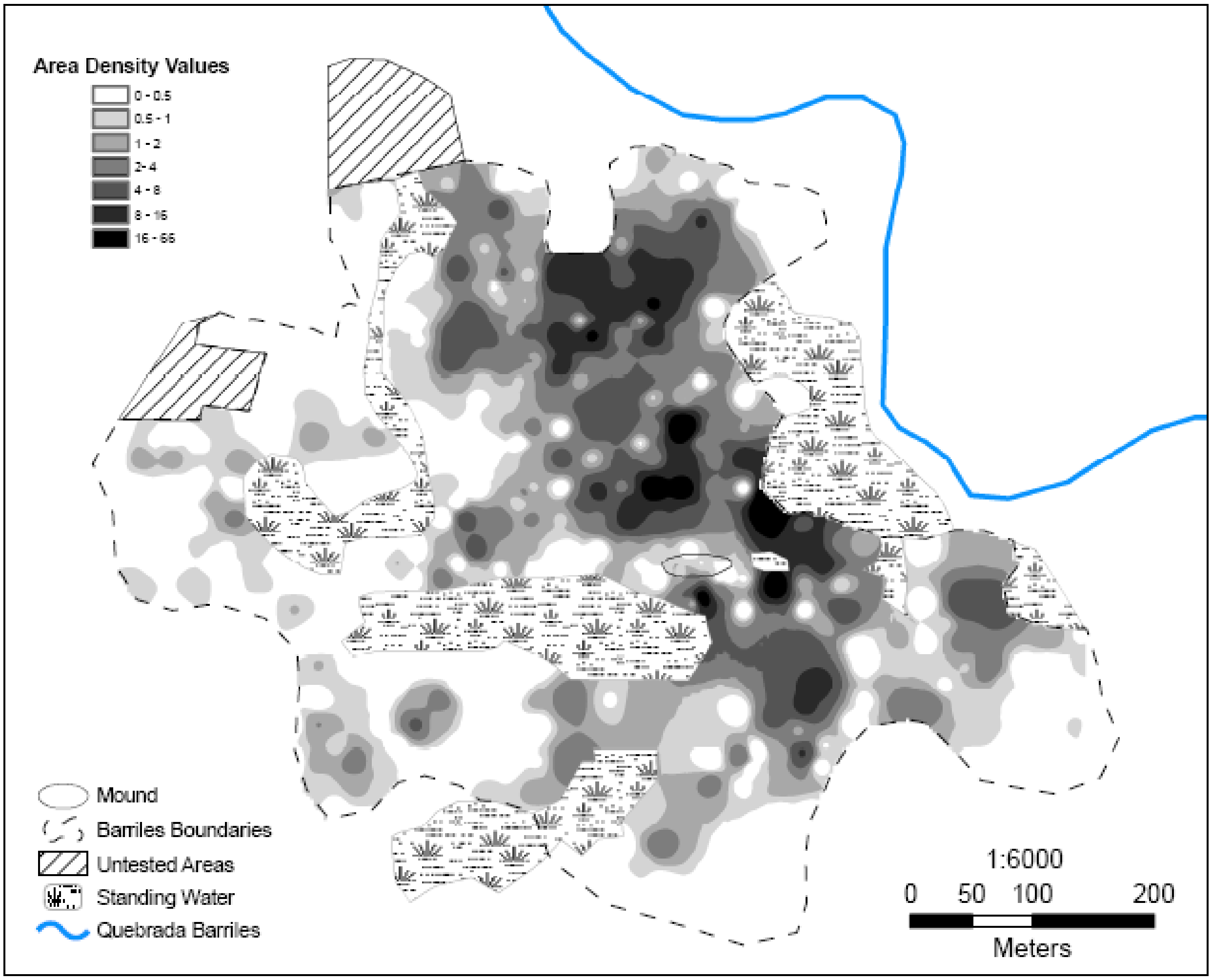

Figure 53. Late Bugaba phase area density values within Barriles.

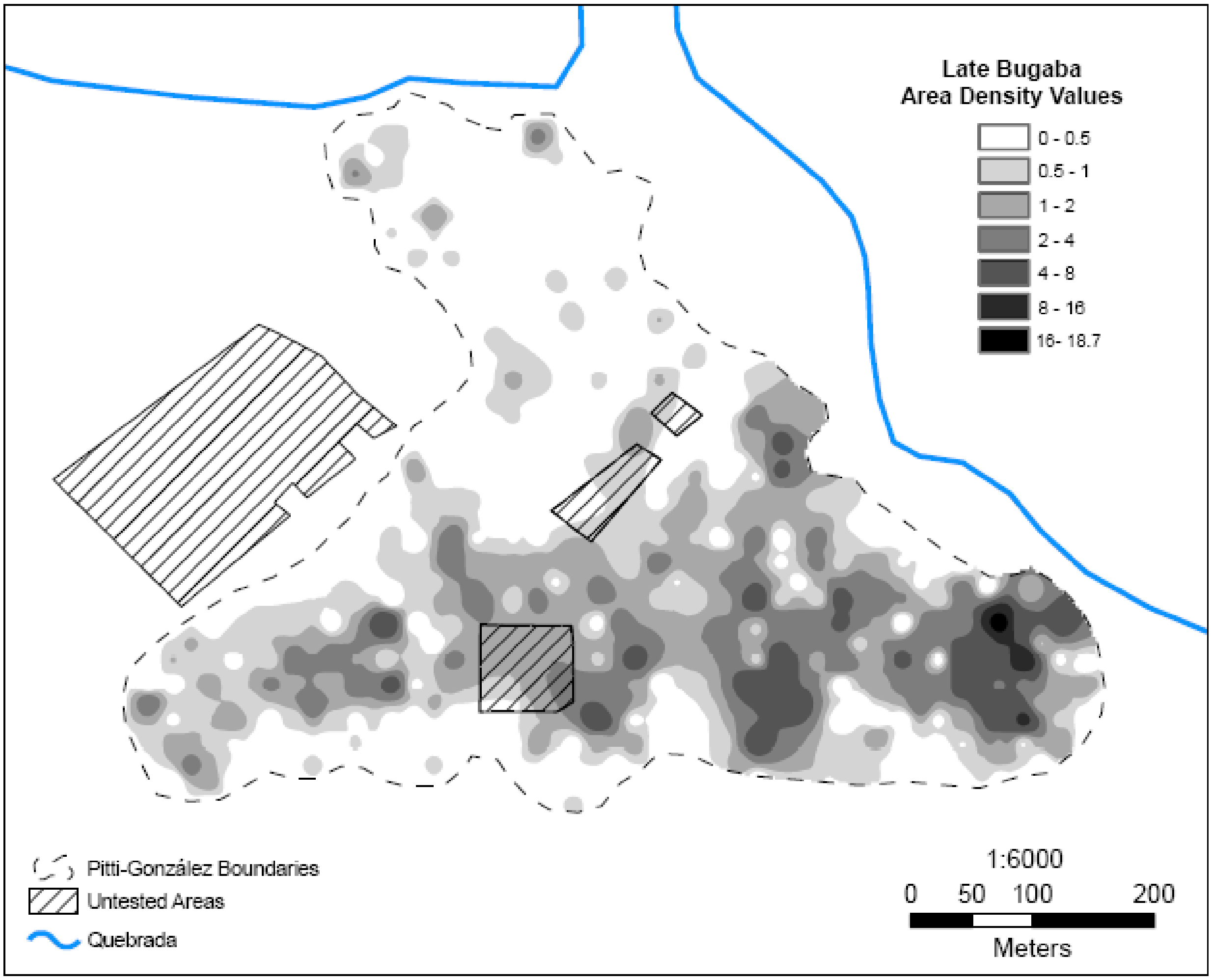

Figure 54. Late Bugaba phase area density values within Pitti-González.

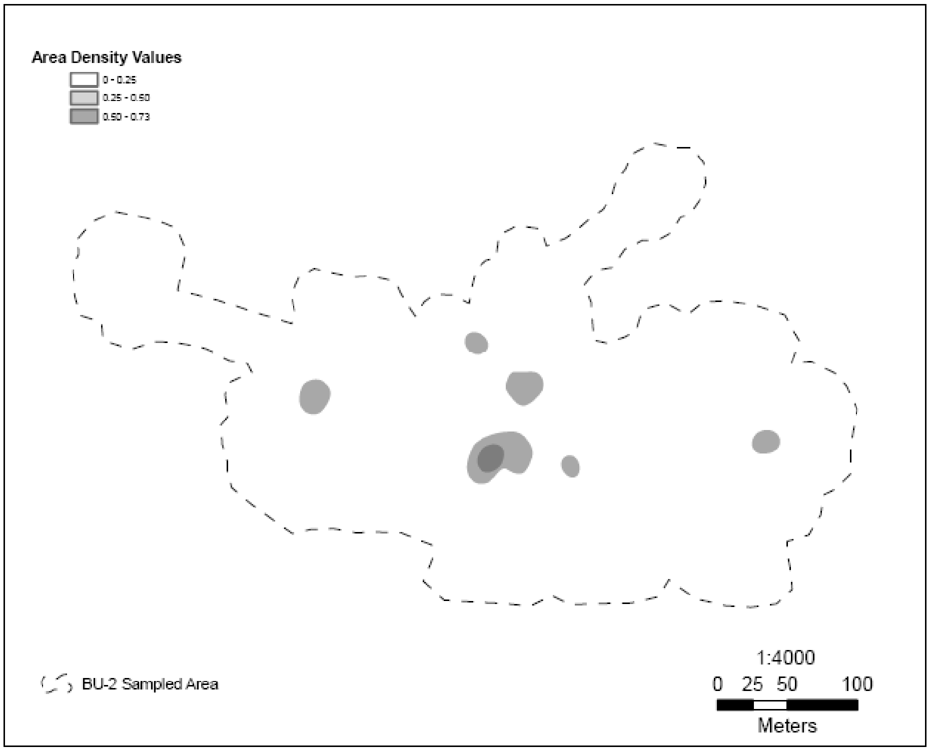

Figure 55. Late Bugaba phase area density values within sampled portion of BU-2.

4.2.4 Chiriquí Period (A.D. 900 to 1400)

As a ceramic period, the manifestations of the Chiriquí in the highlands of Western Panama are frustratingly unclear. In different portions of Río General in Southern Costa Rica, the Chiriquí seems more conspicuous, and is recognizable by Buenos Aires polychromes, Silena Winged, and Biscuit wares (Corrales 2000). Of these, Biscuit wares appear to be the most prevalent in the highlands, at least from the Río Chiriquí Viejo to the San Vito basin in Southern Costa Rica (i.e. Laurenich de Minelli 1966, 1973). Judging by Linares' (1968a, 1968b) excavations in the Gulf of Chiriquí near the modern city of David, Biscuit sherds (like earlier Concepción sherds) do not constitute 100% of a Chiriquí ceramic assemblage. The best guess we can make, though still extremely rough, is that Biscuit sherds constituted approximately 20% of the total sherd assemblage. To properly arrive at meaningful densities, we must do a 'Linares correction' to Chiriquí deposits which involves multiplying each Biscuit sherd by five to calculate reasonable area density calculations.

Even with this correction, the distribution of Biscuit wares across the sampled sites is very ephemeral compared to earlier phases. The largest Chiriquí Period occupation was probably at Barriles, which is estimated at 30-60 individuals. Slightly reminiscent of the Concepción, Barriles was 4 'sites' (using the 100 m rule) of low density scatter, probably once again several farmsteads and perhaps even a small hamlet. No other site was comparable in absolute terms, BU-2 contained a few dozen Biscuit sherds and Pitti-González just three, but the densities were so low that populations were probably organized in one or two farmsteads totaling well under 20 individuals. Of the sites sampled, no other contained Chiriquí Period ceramics.

Many questions about Chiriquí population reorganization unfortunately remain unclear. A devastating volcanic eruption at the end of the Late Bugaba Phase, previously proposed by Linares *et al.* (1975) as the cause for the majority of the study area's population abandonment, seems exceedingly unlikely considering the latest round of geological studies (Behling 2000; Holmberg 2007, 2009; Sherrod *et al.* 2007), all of which date the last major eruption to around the time of Spanish Contact. Evidence for forest clearance and landscape disturbance continue to be present in Behling's (2000) Laguna Volcán core until this eruption. One issue with our failure to recognize Chiriquí populations could relate to issues of ceramic chronology and the current inability to properly recognize Chiriquí sherds outside of painted pieces and Biscuit wares. The second issue could be that number of sampled sites or the study area are simply too small and that populations were distributed elsewhere or scattered very broadly. That the 62km² study area is potentially too small to glimpse what may be a larger regional or macro-regional dynamic is an issue that can only be addressed through additional regional survey. What seems clear, at least through comparison to the Río Terraba and through conversations with locals, is that there might be very large and internally complex Chiriquí sites further downstream. If so, the highlands of the Volcán Barú region may have been largely abandoned as a result of social factors, rather than strictly natural ones.

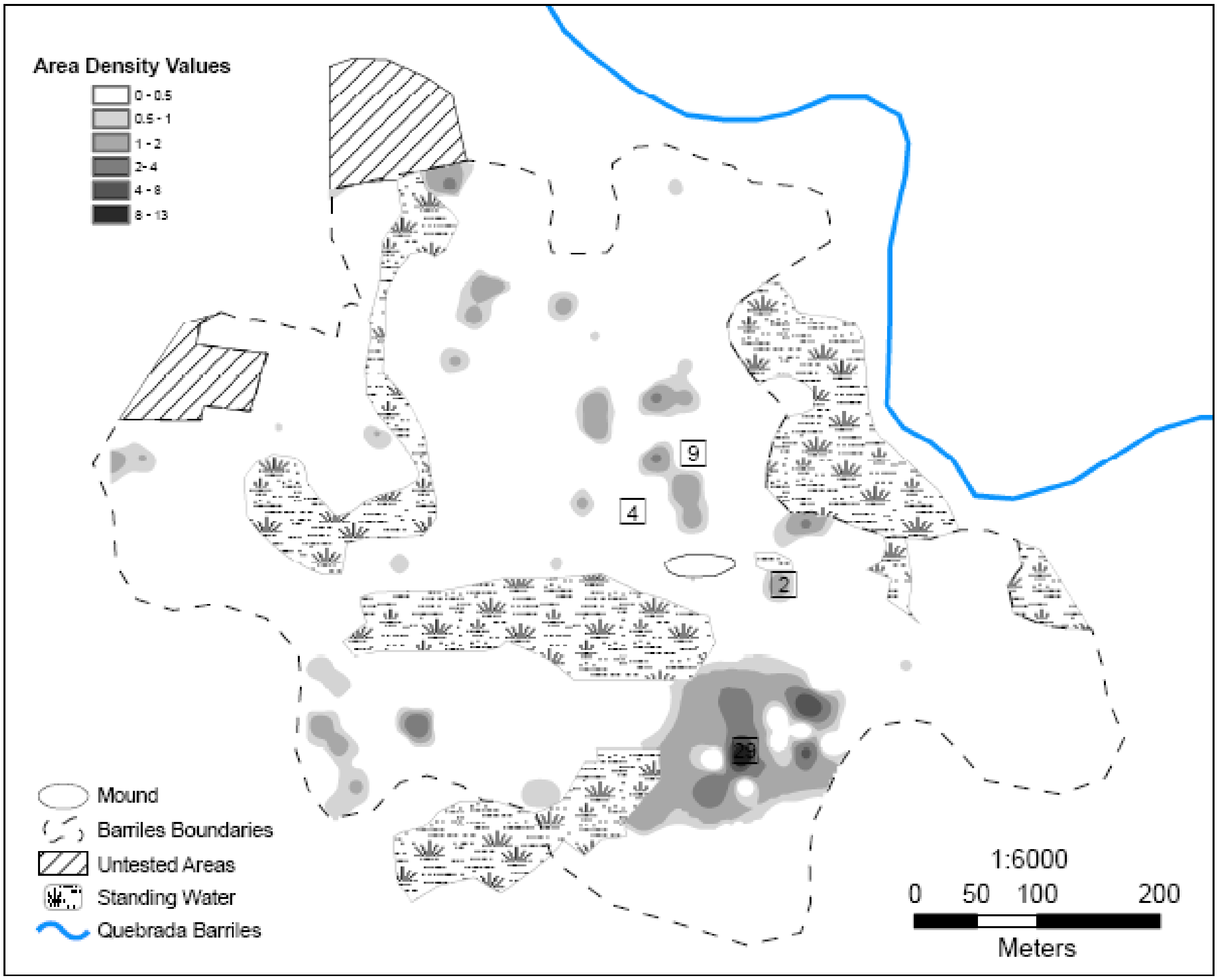

Figure 56. Chiriquí area density values within Barriles.

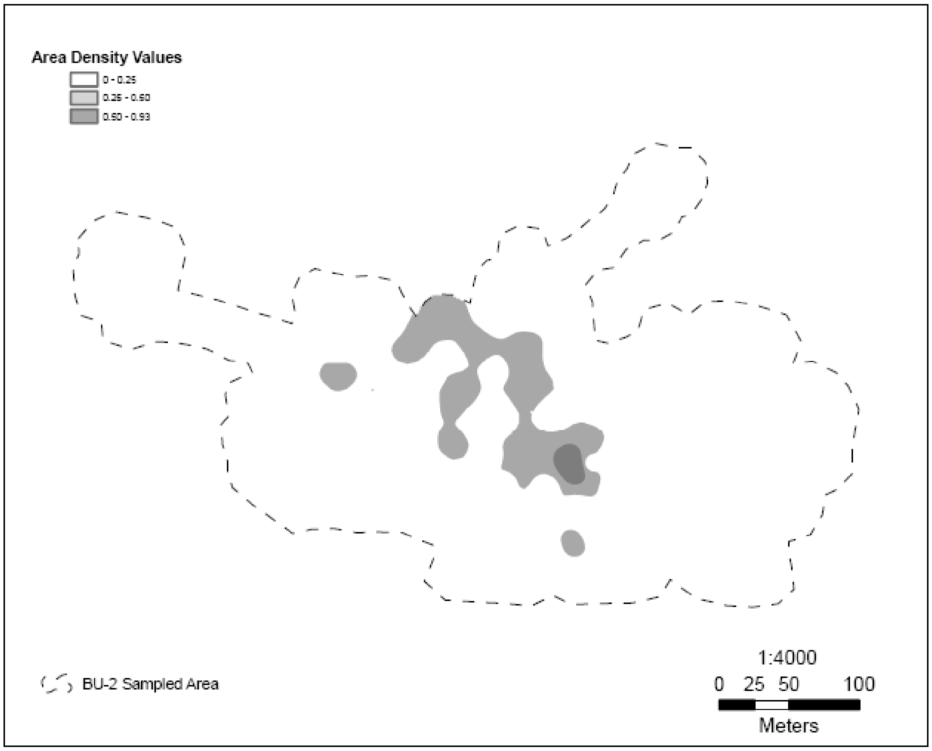

Figure 57. Chiriquí Period area density values within sampled portion of BU-2.

4.3 CATCHMENT ANALYSES

The relationship between local subsistence resources and population levels has been one of the most discussed relationships with regards to the emergence and persistence of complex societies. A whole host of scenarios, some dealing with agricultural control (i.e. Sahlins 1972; Service 1962, 1975), others with demographic pressure and warfare (i.e. Carneiro 1970, 1981, 1998; Reichel-Dolmatoff 1973), have been proposed to explain the various social changes leading to the institutionalization of social and political inequalities. While this particular project was designed with other research questions in mind, our sample of seven sites from across the study area offers us at least a preliminary opportunity to examine the some of the local environments available to prehistoric populations

Common techniques used to examine these relationships are catchment analyses which consider the available resources in the immediate vicinity of each archaeological site. To examine this, each site was arbitrarily buffered by a linear distance of 500 m, and the area of arable land (defined arbitrarily as anything under 10 degrees of slope) within this buffer zone was calculated. This calculation was based on a raster slope map with individual cells approximately 80x80 m, and the precision of the calculation is probably only to ± 10 ha. This technique is admittedly extremely simple and rudimentary since we don't have a clear idea what was grown where (see Dickau 2006; Haller 2004, 2009; Hoopes 1992), how staple products were mobilized, or how much was required for combating spoilage or reserved for provisioning ceremonial activities. It probably understates the contribution of wild fish, plants, and game to the diet and is blind to important differences in soil quality and their development across the study area.

One thing that is for certain is that the Llanos zone, which BU-8 borders, has nearly no agricultural value at all regardless of its slope. Soils in the southwestern portion of the study area where Barriles is located are deeper and darker than those in Cerro Punta, and may be partially anthropogenic, but those in Cerro Punta are believed to be slightly more productive (CATAPAN 1970). For this reason, the Cerro Punta basin may be regarded as the region's prime agricultural soils, even though some modern farmers claim it is cooler and cloudier and not ideal for maize (but see Galinat 1980). The catchment equation used here follows Haller (2004, 2009). Existing illustrations of soil zones in Western Panama (CATAPAN 1970) depict the study area as largely containing what Haller identified as high productivity soils in the Río Parita (excluding the

Llanos). Using ethnographic observations from Young (1971), Haller (2009:127) estimated that each Guaymí family of five required 4.25 ha of high productivity land (which includes fallowed land) for their own annual subsistence. This baseline estimate can be compared to the population estimates described earlier in the chapter to examine whether or not local populations could have been supported by farmland in their immediate (<500 m) vicinity. These figures are presented below in tables 5 and 6.

The results of the catchment analysis supports the general conclusion reached by Linares and Sheets (1980) that regional population pressure was probably never an important factor in the development of complex society in any period or phase. While it is uncomfortable to estimate the total regional population on the basis of just seven sites, conservative regional estimates described in the following chapters suggest that the study area's population never exceeded more than 1600 individuals at any time, an estimate well short of the original Linares and Sheets (1980:54) estimate of 2432 individuals. There are, 2570 ha of high productivity farmland (assuming the Llanos has zero productivity) in the study area which could have supported roughly 3000 individuals (or 600 Guaymí families), more than both regional estimates, and the best evidence at the moment that regional carrying capacity was probably never reached or exceeded.

As any identification of a settlement hierarchy suggests, the regional population was not distributed evenly across the physical landscape. The development of the Barriles and Pitti-González from farmsteads into small villages probably exceeded the carrying capacities of the farmland in their immediate vicinities, perhaps creating situations of local population pressure between the Early Bugaba to Late Bugaba Phases. While inhabitants of Pitti-González could find the necessary flat, arable land they needed between 500 and 1500 m from their homes, the inhabitants of Barriles inhabited a more rugged landscape that would have required farmers to visit fields up to 3 km away. This may have not been practical nor possible if the Southwest zone was filled in with existing populations as Linares *et al.*'s (1975) survey results have suggested, perhaps indicating that even though population pressure was not experienced at a regional scale, it may have been experienced at a supra-local or district level. This is not firm evidence that inhabitants of Barriles somehow offered craft or ceremonial services in return for staple foods, as Linares and Sheets (1980:54) suggested, but the analysis here agrees wholeheartedly with their conclusion that this is nascent hypothesis worth specific attention in the future.

Table 5. Available arable land within 500 m and site population subsistence requirements.

		Concepción		E. Bugaba		L. Bugaba		Chiriquí	
	Available	Pop.	Require	Pop.	Require	Pop.	Require	Pop.	Require
Barriles	107 ha	60	38 ha	375	319 ha	750	638 ha	45	38 ha
Pitti	126	30	17	375	319	375	319	0	0
BU8	37	5	4	0	0	0	0	0	0
BU2	109	0	0	5	4	20	17	20	17
BU15	12	0	0	15	13	15	13	0	0
Dos Ríos	28	0	0	5	4	0	0	0	0
BU12	15	0	0	30	26	0	0	0	0

Table 6. The net amount of arable land (total within 500 m minus population requirements) available to site populations.

	Net Concepción	Net E. Bugaba	Net L. Bugaba	Net Chiriquí
Barriles	+ 47 ha	- 212 ha	- 643 ha	+ 62
Pitti	+ 96	- 192	-249	n/a
BU8	+ 32	+ 33	n/a	n/a
BU2	n/a	+ 104	+ 89	+ 89
BU15	n/a	- 1	- 3	n/a
Dos Ríos	n/a	+ 24	n/a	n/a
BU12	n/a	- 11	n/a	n/a

5.0 THE CONCEPCIÓN PHASE (300 B.C. TO A.D. 400)

Across the region identified by Linares *et al.* (1975), Concepción sherds have a relatively restricted distribution, and were found only at Barriles, BU-8, BU-12, and Pitti-González. These sherds were completely absent at the other 4 'sites' (one of which only produced a grand total of three sherds). The majority of these were found in Barriles, which contained 284 (60.4%) out of the 470 Concepción ware sherds found in all the non-stratigraphic collections. Pitti-González contained 164 (34.9%), BU-12 returned 12 (2.6%) and BU-8 had 10 (2.1%). In none of these sites do Concepción sherds ever exceed more than 3% of the total identifiable sherds (all phases combined). This indicates that Concepción populations, regardless of how one prefers to calculate demographic estimates, were very likely dwarfed by the later Bugaba by several orders of magnitude.

As described in Chapter 4, the use of area-density calculations produced a rough estimate of 40 to 80 individuals for Barriles during the Concepción. The distribution of diagnostic sherds indicates that occupation within Barriles was widely dispersed during this phase, probably organized in several farmsteads. Using a 100 m rule between positive collection units to delineate sites indicates that Barriles was 4 separate sites during the Concepción. The largest and densest of these was 5.4 ha and surrounded what would later become the mound and statue zone. The second largest was approximately 3 ha and lay towards the northern boundary of the site, while the other two were represented by isolated shovel tests representing collection lots less than 0.1 ha. Twenty-seven shovel tests had a majority of Cerro Punta Orange ware sherds, lacked diagnostics from the later Bugaba phases or the Chiriquí Period, and contained 10 or more artifacts (figure 58). These were classified as Concepción component collections for the subsequent maps and analyses in this chapter. In addition to these, five excavation units out of 24 (20.8%) at Barriles contained components which were identifiably Concepción. Of these, all five intersected or were immediately beside (defined here as within 20 m, or twice the average GPS error) density peaks of material identified by shovel testing in figure 44.

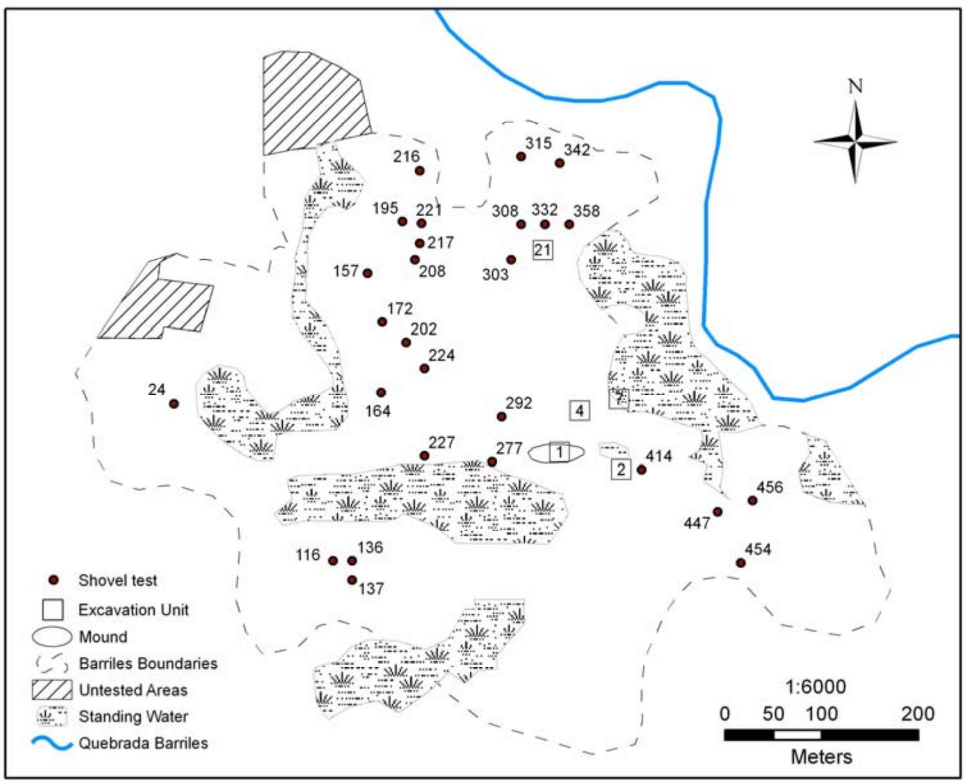

Figure 58. Locations of Concepción phase surface collections within Barriles.

Evidence for occupation is even more ephemeral at Pitti-González where only a few Concepción sherds would be found in widely spaced positive collection units (figure 45). Using the same area-density assumptions from Barriles, residential population was probably no more than 20 to 40 individuals. Such low densities (for example, the densest collection lot was represented by a .21 sherds per m² per century figure) may indicate that occupations were temporary in nature. Even if we generously assume that the presence of even a single Concepción sherd represented a prehistoric occupation, this assumption does little to change the interpretation that the Concepción population was likely organized individual farmsteads dispersed within six separate 'sites'. Thirteen surface collections met the criteria for single-component samples (figure 59) and none of the eight stratigraphic excavation units at Pitti-González contained a clear Concepción component.

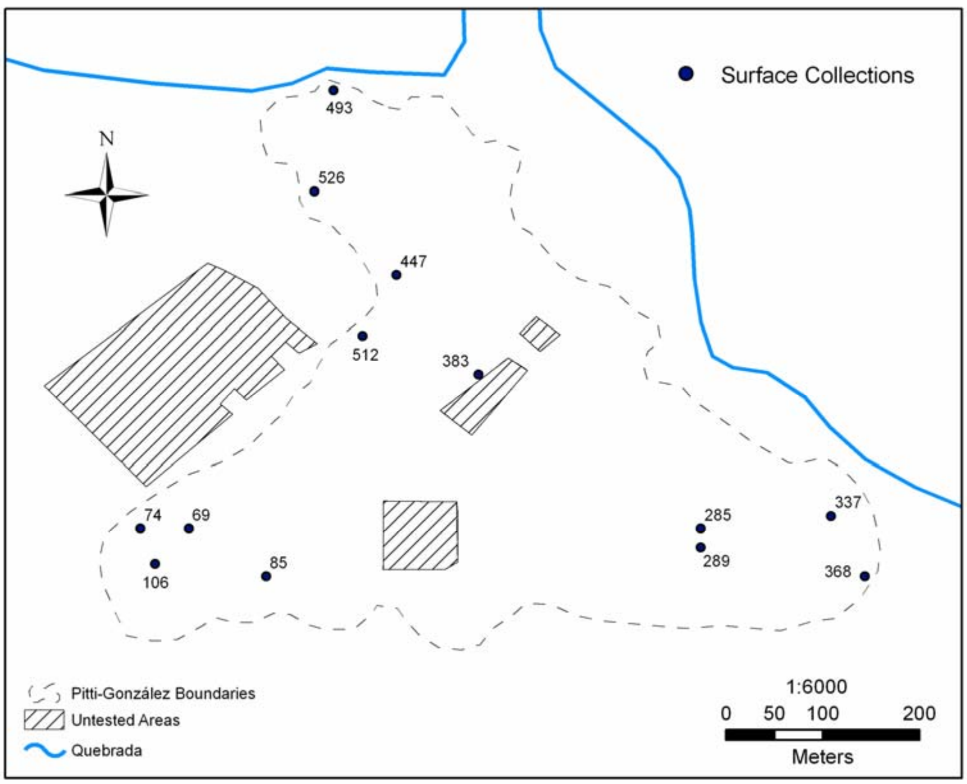

Figure 59. Locations of Concepción phase surface collections within Pitti-González.

Both BU-8 and BU-12 produced only a handful of Concepción sherds, each resulting in exceedingly low area-density estimates. These both work out to low population estimates of 1-10 individuals for both sites. Like Pitti-González, even if we abandon the area-density technique and simply assume that the small clusters of Concepción sherds in each site reflected an actual prehistoric midden, then each site was probably only home to a single farmstead , estimated at five individuals. Neither produced any single-component collections, nor were any test units excavated in either site.

Taken together, Concepción sherd densities and distributions support a general interpretation of populations living largely in scattered farmsteads, or possibly the occasional hamlet, across the sampled sites. Of the 38 or so sites left unsampled, there is obviously a high probability that a sizeable Concepción settlement would have been missed if one actually did exist. But if the remaining unsampled sites are anything like the ones sampled by this project, the best guess would be that only half contained any Concepción sherds at all. Of these, perhaps half were home to somewhere around 30 individuals and the other half were simply farmsteads of 5 individuals, both fairly conservative estimates. These would produce a very rough regional guess for the 62 km² survey zone of around 450 individuals (~100 from the sampled sites and ~350 from these estimations), or a population density of approximately 7 individuals per km².

Small artifact samples were recovered from single-component Concepción collection lots. Comparisons of artifact proportions between what would later become the villages of Barriles and Pitti-González (no single-component collections were identified for the other farmsteads) suggested that there may have been some differences in activities (figure 60). While Pitti-González contained proportionally more cooking vessel rims, the two future villages contained roughly equal amounts of serving vessels rims while the other sampled farmsteads lacked these completely. Similar proportions of chipped stone artifacts were present between all three. These patterns suggest that some quantitative and qualitative differences were evident from the beginning of the Formative sequence between loose collections of farmsteads at Barriles and Pitti-González.

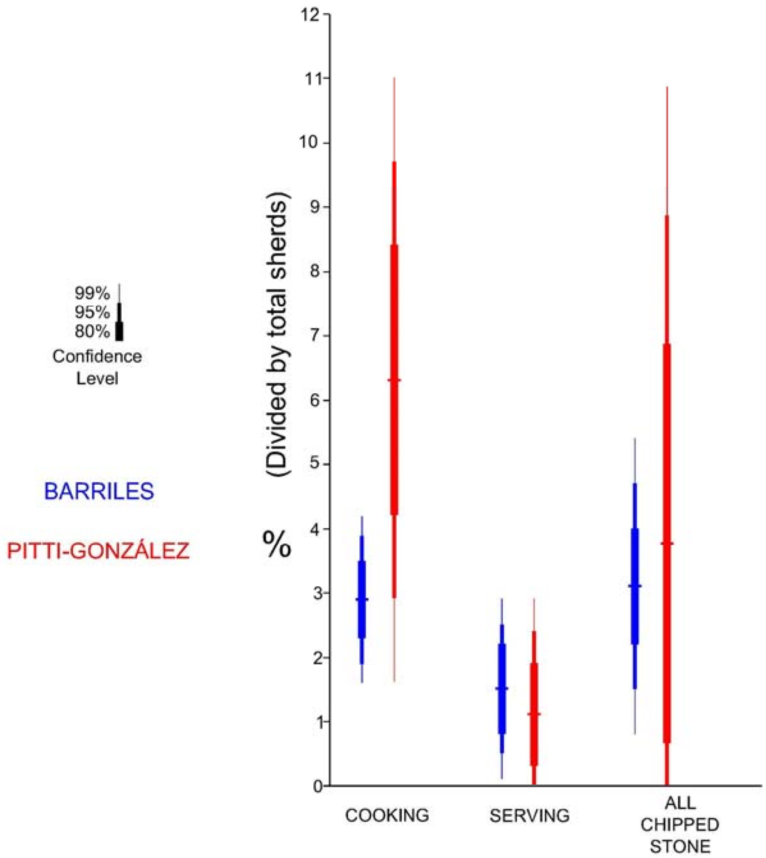

Figure 60. Statistical comparisons of Concepción artifact class proportions at between farmsteads in the eventual Barriles and Pitti-González villages.

5.1 DOMESTIC ACTIVITIES

As discussed in Chapter 3, utilitarian ceramics were generally undecorated, and cooking vessels like jars tended to have slightly coarser pastes than serving vessels. These were therefore argued to be related to the general household tasks of food preparation and storage. Proportions of sherds were calculated out of the total number of sherds found in a collection lot. For example, 19 undecorated sherds divided by 20 total sherds in a hypothetical collection lot would equal a proportion of .95. Such a proportion would obviously the inverse of the proportion of decorated sherds (.05), since every sherd was simply decorated or undecorated. A similar logic underlies the calculation other things, like fine sherd and cooking vessel proportions, with the caveat that these were not always the inverse of their opposites (i.e. coarse sherds and serving wares). They are not perfect inverses because not every sherd was identifiable to paste type, nor every rim (or base) to vessel form (or a form which could then be associated with function). Some sherds, often around 20%, were simply unidentifiable.

Figure 61 shows a contour map of undecorated sherds (green, .90) and coarse sherds (blue, .30) at Barriles based on the 27 single-component shovel tests. These contours surround noticeable depressions, which is to say, shovel tests which produced usually low proportions of these items. Collection lots outside of these contours had greater proportions, meaning that with a few exceptions, both undecorated and coarse sherds were widely distributed and quite common at Barriles. These exceptions include a single shovel test (or 3.7%) which had 18% decorated sherds, and 4 shovel tests (14.8%) which contained less than 30% coarse sherds (29, 25, 21, and 15%). Cooking wares were relatively widely distributed (figure 62). Eighteen (66.7%) of the 27 single-component collections had the rim or base of a cooking vessel present. Most collections contained at least 1-3% cooking vessels (divided by total identifiable sherds), with a few shovel tests having double or triple these proportions. The absence of cooking ware among 9 (33.3%) of the collections may be partially a result of small sample size, as 7 (77.8%) of these 9 contained less than 30 artifacts. If, for example, cooking wares typically constituted at least 1-3% of an overall assemblage, the probability of finding an jar rim in a sample of 30 would only be a fraction of a single sherd (between 0.3 and 0.9 sherds). Therefore finding no cooking wares at all in small samples is not terribly surprising.

Figure 63 shows that Concepción *mano* or *metate* fragments were relatively uncommon, limited to only 6 (22.2%) of the collections, but it remains an open question as to whether early populations either would have yet exploited seed plants regularly (see Hoopes 1996), or whether *manos* and *metates* were ultimately consumed as grave goods during the phase (see Haberland 1976). This raises palimpsest issues raised by Bailey (2007), namely that *manos* and *metates* artifacts may have been subject to a complicated life history which ultimately deposited them in tombs, rather than in middens.

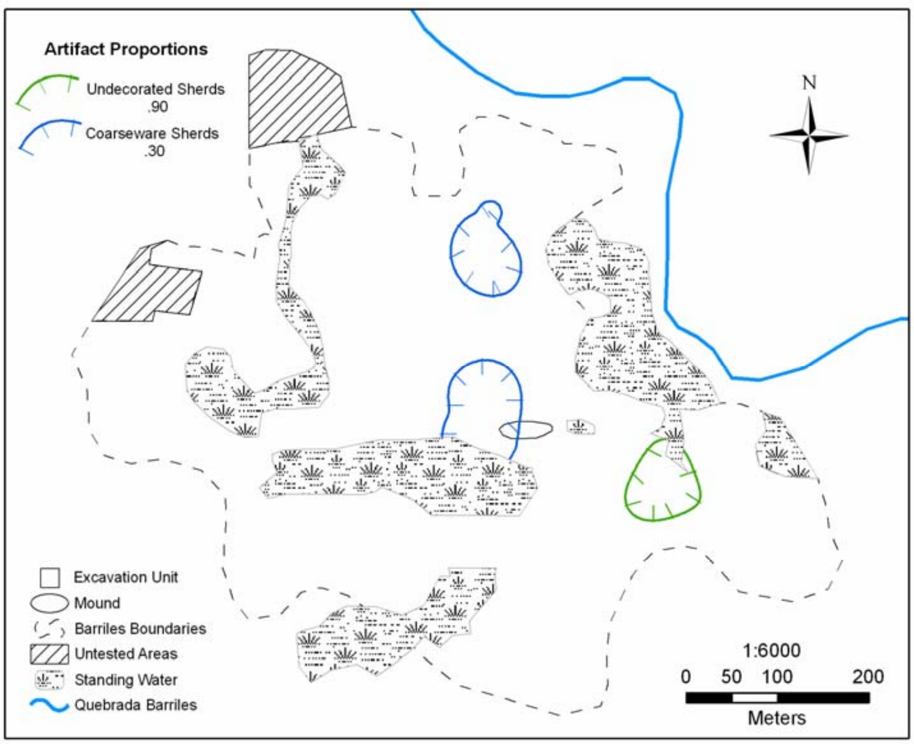

Figure 61. Proportions of Concepción phase undecorated sherds (green) and coarse sherds (blue) at Barriles.

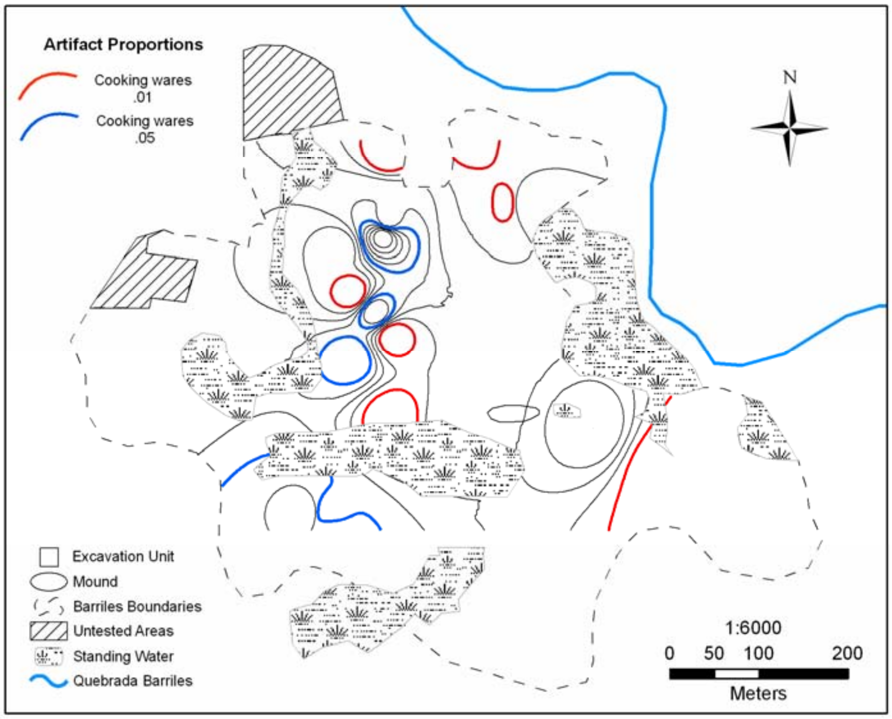

Figure 62. Proportions of Concepción phase cooking vessels at Barriles. Contour intervals are 1%.

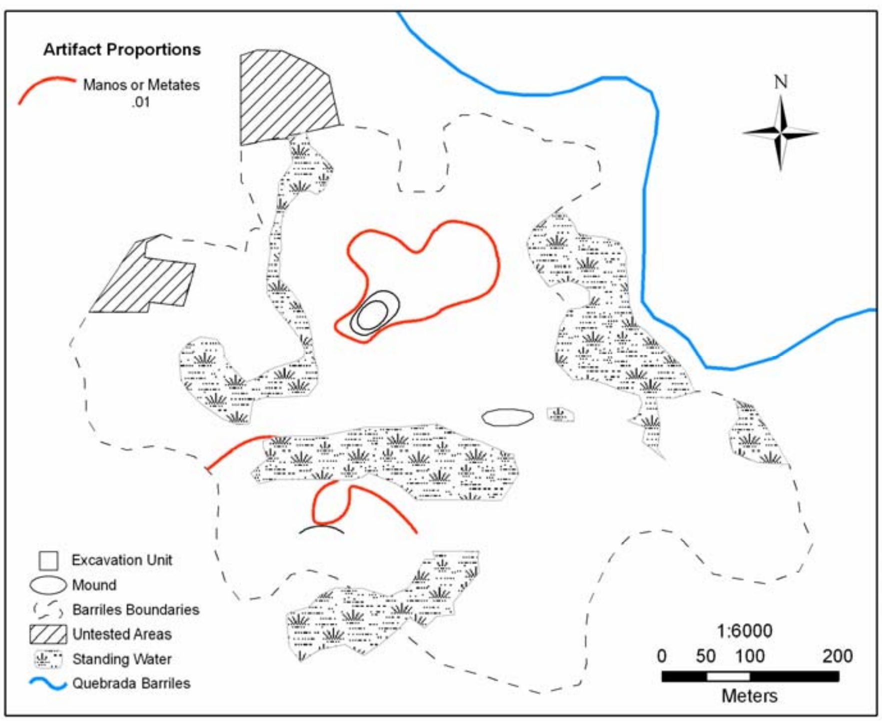

Figure 63. Proportions of Concepción phase *manos* or *metates* at Barriles. Contour intervals are 1%.

A pattern similar to Barriles was observed among the Pitti-González single-component surface collections. There undecorated sherds, coarse sherds (figure 64), and cooking wares (figure 65) were also relatively widespread with only a few noticeable depressions and peaks in the distribution maps.. One of the few spatial correlations observed was that collections with slightly more cooking ware tended to have less coarse sherds and vice-versa. Like Barriles, *mano* or *metate* fragments were very rare, limited to only two finds in the southwestern corner of the site boundary (figure 66).

The overall picture of domestic activities, essentially food preparation activities, is that they were widely shared across Barriles and Pitti-González. Each Concepción farmstead or hamlet likely managed these tasks for themselves, and most appeared to be fairly redundant units of production and consumption. There were perhaps slight variations in the intensity of cooking activities, but these differences were neither strong nor pronounced.

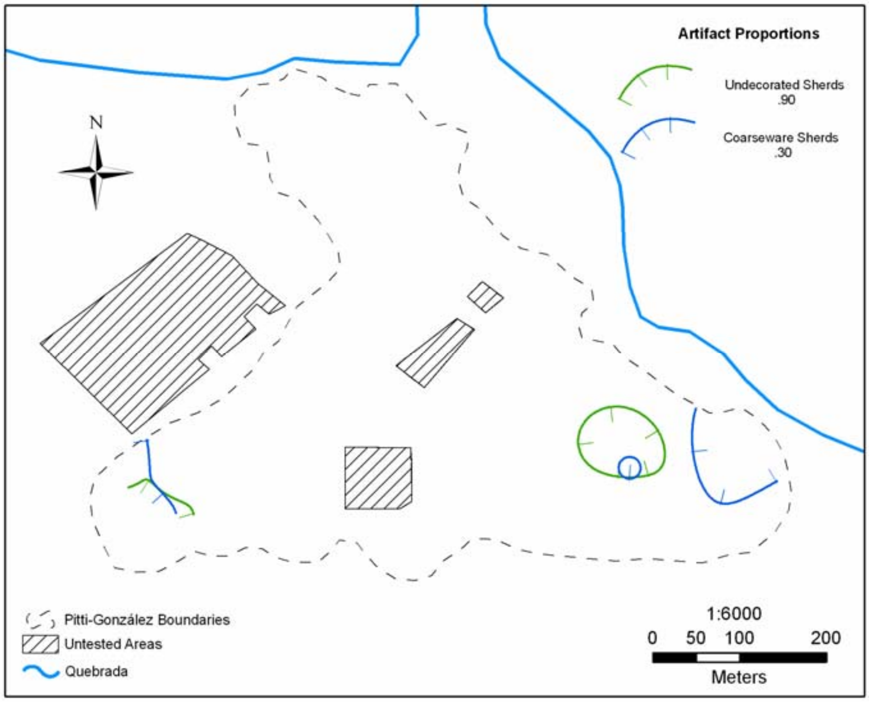

Figure 64. Proportions of Concepción phase undecorated sherds (green) and coarse sherds (blue) at Pitti-González.

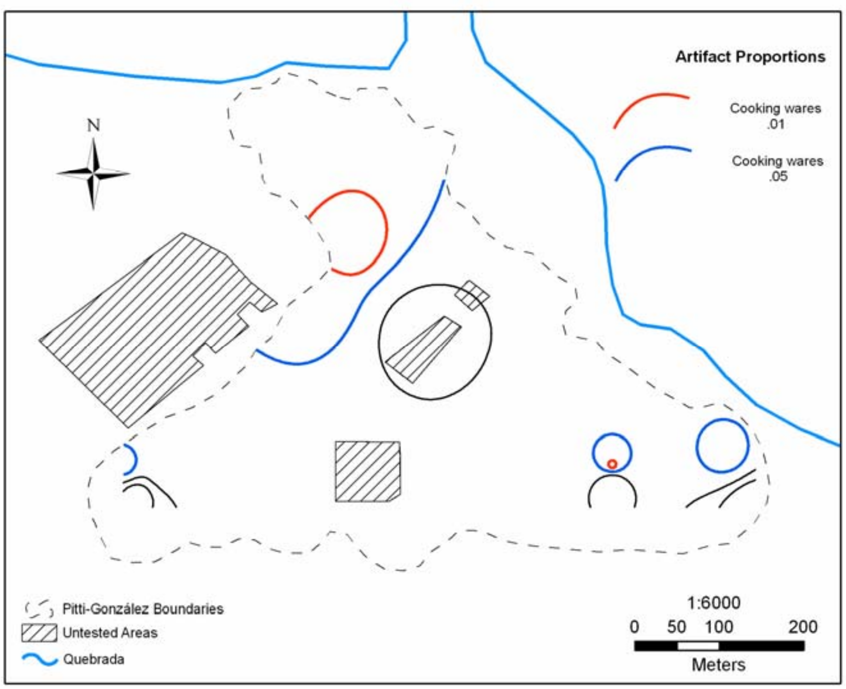

Figure 65. Proportions of Concepción phase cooking vessels at Pitti-González. Contour intervals are 5%.

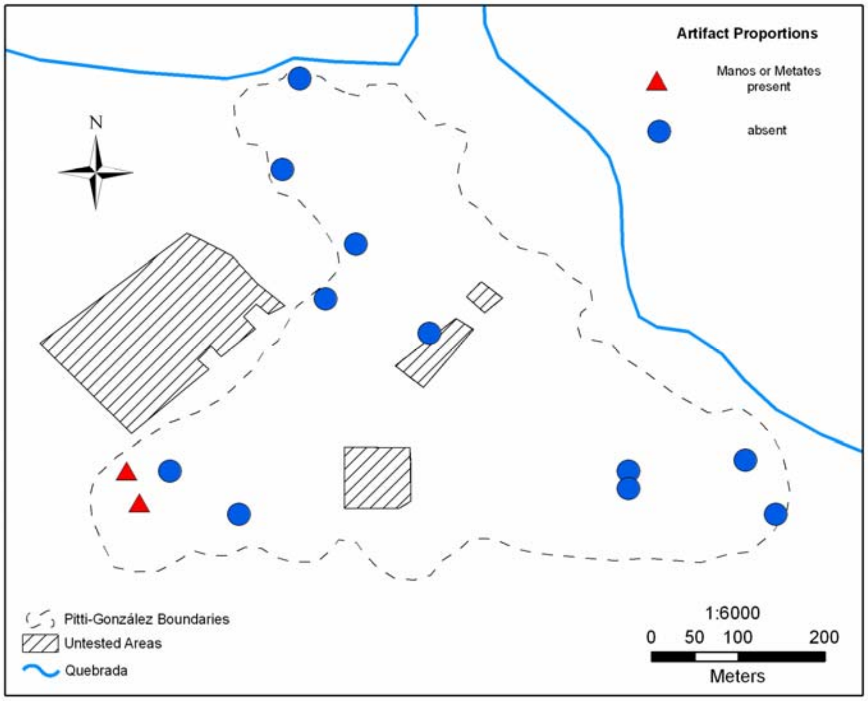

Figure 66. Presence or absence of Concepción phase *manos* or *metates* at Pitti-González.

5.2 SOCIAL DIFFERENTIATION

As discussed in Chapter 2, social differentiation and status are likely to be recognizable by qualitative and quantitative distinctions in the consumption of material culture (Hirth 1993). Typically an artifact's relative scarcity, the labor it took to produce, and the degree of decorative elaboration (usually in that order) are taken as indicators of a form of elevated social status (Blick 1998; Smith 1987). A theoretical distinction was also made in Chapter 2 between wealth and prestige. In the former, the emphasis might be the accumulation of rare of labor-intensive items, ultimately recognizable by patterns of differential consumption in certain domestic assemblages (i.e. higher proportions or perhaps more diverse assemblages). Greater social influence and social capital, at its theoretical extreme, may not result in these types of consumption patterns, but may be associated with evidence suggesting increased participation in public activities, such as hosting feasts or high-profile gift exchange events.

Generally speaking, decorated ceramics are relatively scarce throughout the entire sequence, usually averaging 3-10% of the sherds (depending on the site), with a few collections having substantially more. They also took more labor to create in the ‘production steps’ sense of Feinman *et al.* (1981). In the case of a single incised line, this extra production step was minimal and could be executed by a potter in a matter of seconds. In the cases of Bugaba Engraved and Zoned Bichrome wares (not present in the Concepción), these extra production steps could conceivably be quite complex, involving more controlled firing, incising, burnishing, careful engraving of symmetrical patterns, and occasionally the application of appliqué *adornos*. For these reasons, and observations of these sherds remaining spatially restricted over time, it is assumed that decorated ceramics were somehow related to elevated social status. A special distinction, however, is reserved for the rarest and most labor-intensive wares (the so-called ‘fancy wares’) in subsequent chapters. Among the lithics, chipped and polished stone artifacts were generally made from either andesite or fine-grained basalt (groundstone was constructed made from rhyolite), of which basalt is the relatively rarer in nearby streambeds, more predicable to chip, and much more durable (i.e. stronger under compression, greater tensile strength). Other raw material types like chert, greenstone, obsidian, siltstone and petrified wood are exceedingly rare in the study area, limited to only a few examples for each type.

Participation in likely public activities like feasting or gift-giving was most likely reflected in proportions of serving ware. As discussed in Chapter 3, serving wares are most likely open bowls or slightly restricted bowls. These vessels are open and accessible, and were generally associated with more complex decorations (i.e. alternating slip colors, appliqué) than other vessel types, probably because they were meant to be seen during events. More regular participation in public activities and ceremonies may also be reflected by more diverse vessel forms (Clark and Blake 1994). Among the ceramic assemblage, a relatively unusual vessel type possibly related to the presentation of food or drink are the composite bowls, chimney vessels and ringstands (for supporting other vessels) during the Formative, or the decorated Biscuit ware *tecomates* during the Chiriquí Period. Unusual vessels forms possibly associated with the preparation or brewing of food and drink for ceremonies might include large ollas (often with rim diameters 20cm or more), and *budares* (griddles for roasting corn or manioc).

Figure 67 shows the distribution of decorated sherds at Barriles, which were widely distributed. Almost every collection minimally had at least 1% decorated sherds, and only one single-component shovel test produced proportions in excess of 5%. Serving wares were similarly widespread across much of the site (figure 68) with a few noticeable small concentrations over 5%, but nothing that stands out terribly strongly. Andesite stone artifacts, both chipped and ground, were also distributed widely, but three peaks are evident in figure 69. These peaks do not line up with, or are located beside, any of the other artifact proportion peaks or depressions evident during the Concepción. Basalt artifacts are considerably rarer, found in only two widely spaced shovel tests toward the western and eastern site boundaries (figure 70).

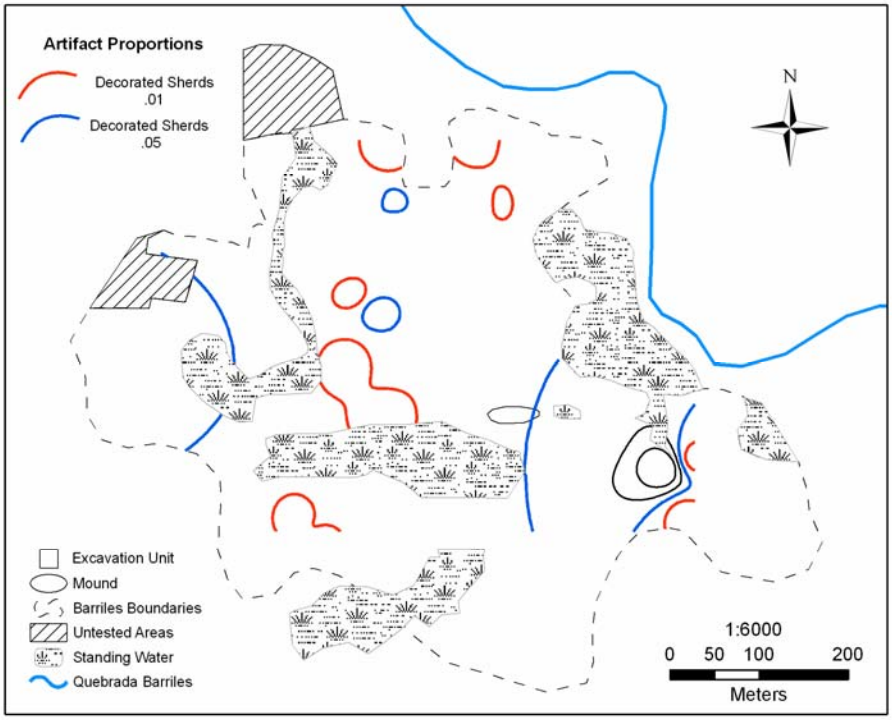

Figure 67. Proportions of Concepción phase decorated sherds at Barriles. Contour intervals are 5%.

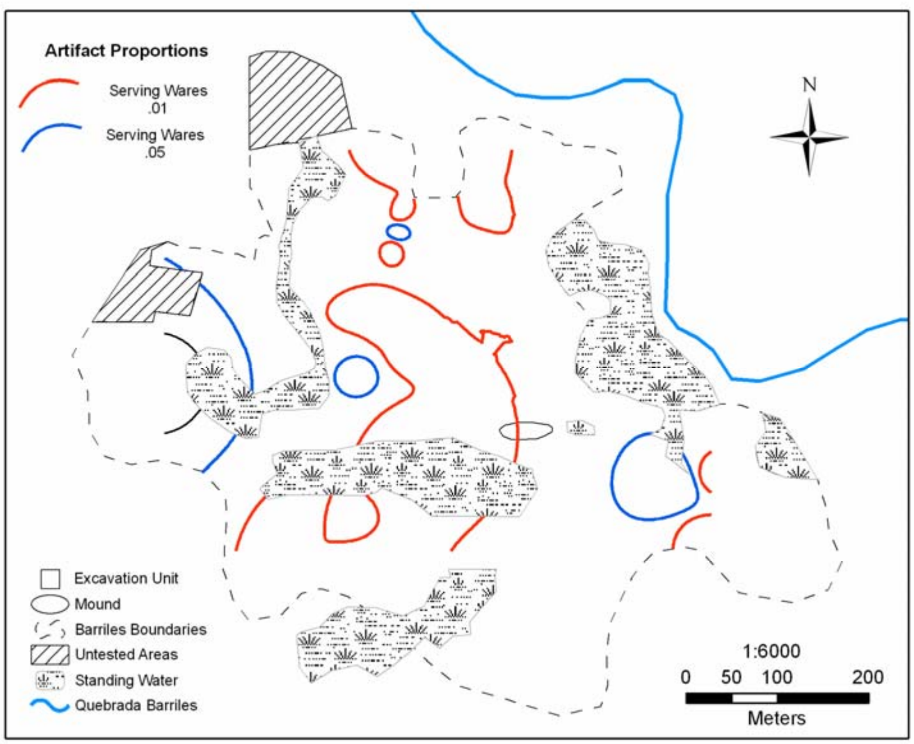

Figure 68. Proportions of Concepción phase serving vessels at Barriles. Contour intervals are 5%.

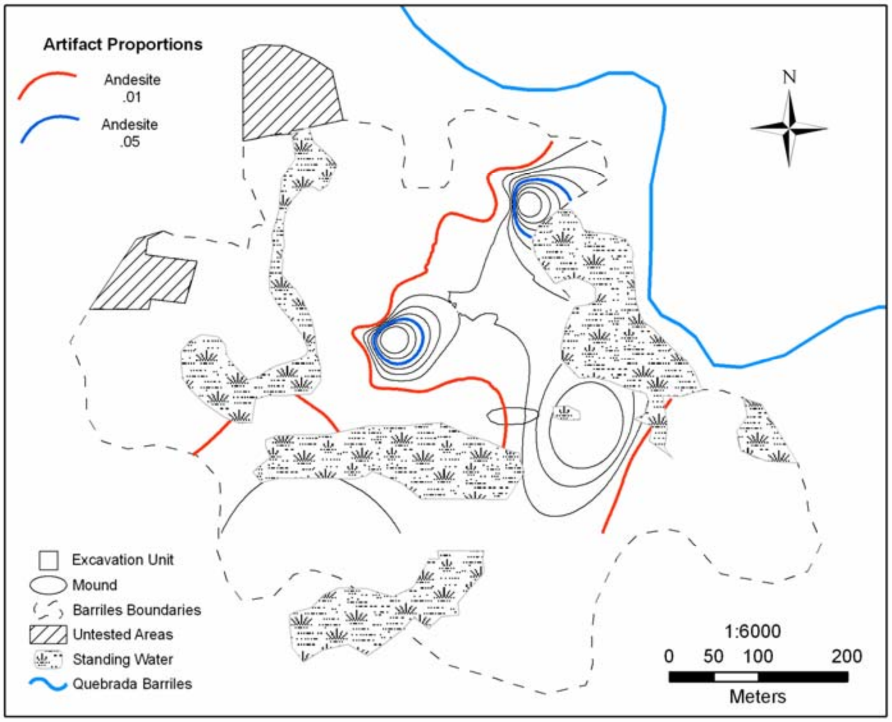

Figure 69. Proportions of Concepción phase andesite artifacts at Barriles. Contour intervals are 1%.

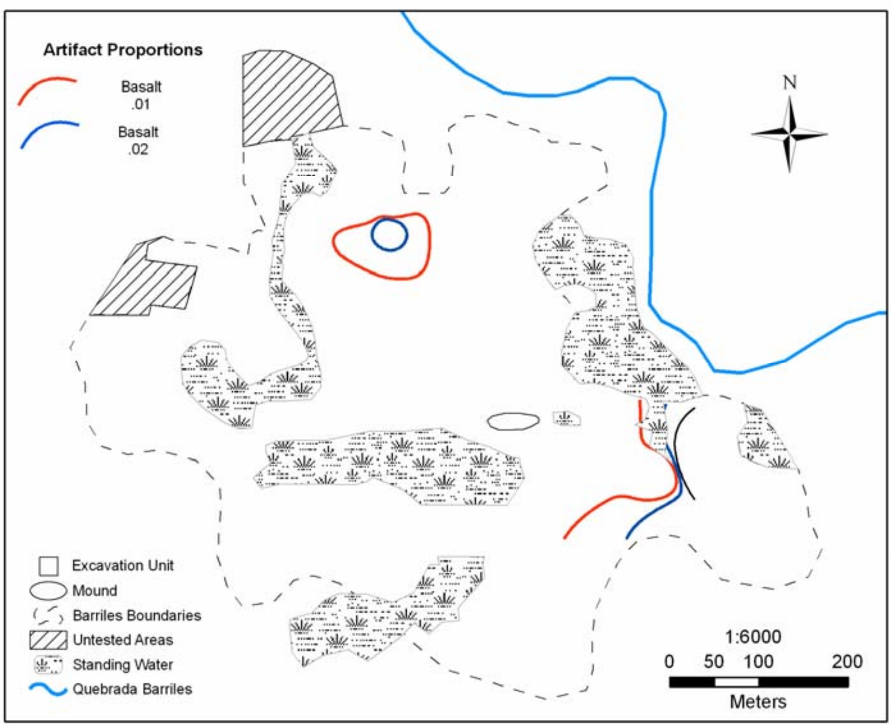

Figure 70. Proportions of Concepción phase basalt artifacts at Barriles. Contour intervals are 1%.

Decorated sherds were also widespread at Pitti-González (figure 71), with only a few surface collections containing less than 1%. This distribution appears to have been relatively even with no obvious peaks in decorated sherd proportions. Serving wares, unlike Barriles, were less common, limited to only 4 (31%) out of the 13 surface collections (figure 72). Artifacts of andesite (figure 73) and basalt (figure 74) must also be examined as presence/absence, and show little patterning. The small and ephemeral samples from Pitti-González limit what can be concluded with any confidence, but there are no strong indications that Concepción domestic groups exhibited clear or consistent differences between each other with regard to their consumption of decorated ceramics or lithic artifacts.

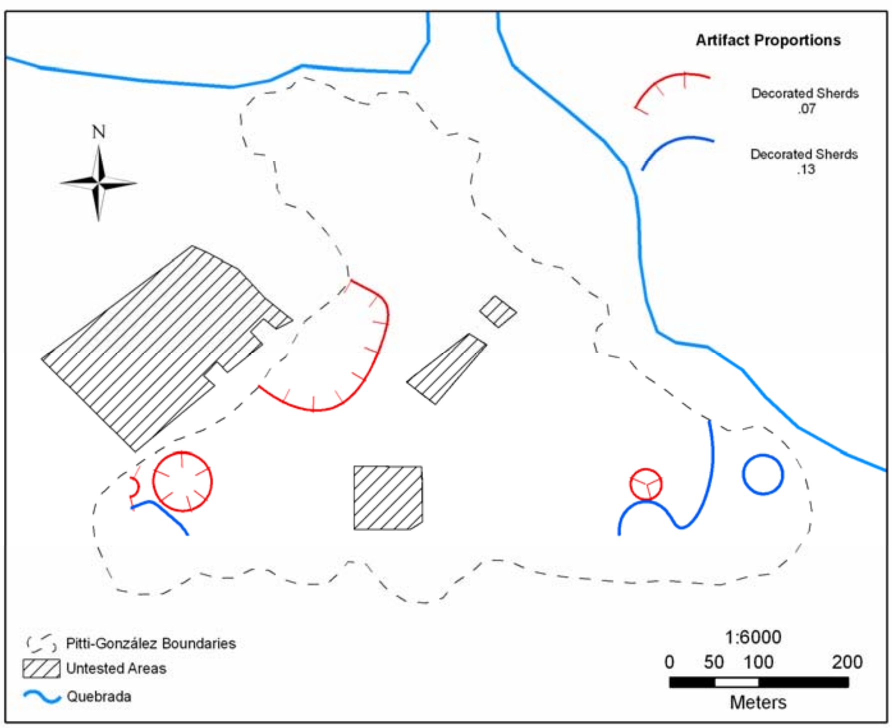

Figure 71. Proportions of Concepción phase decorated sherds at Pitti-González.

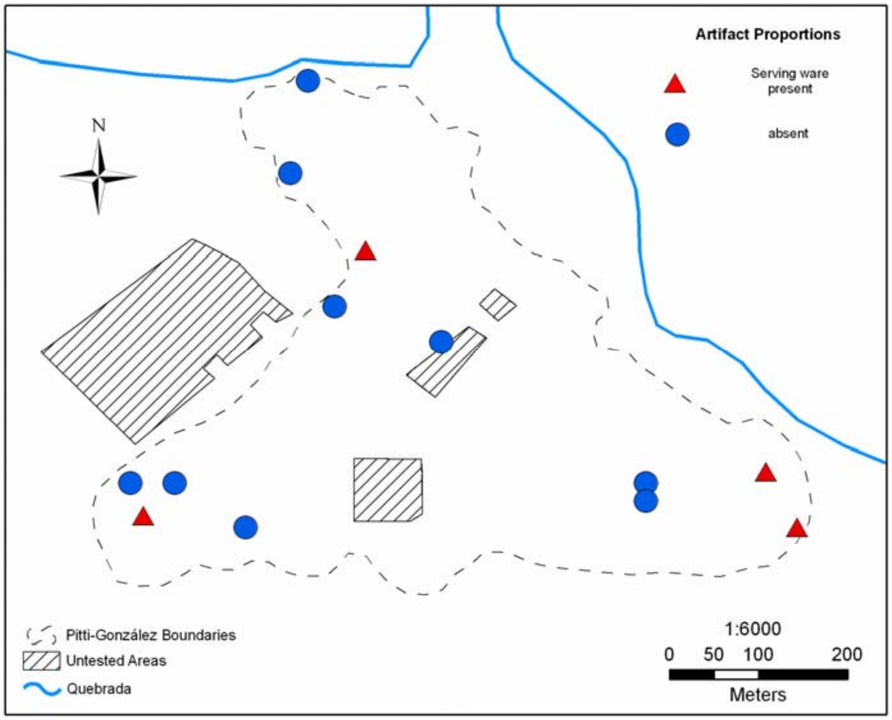

Figure 72. Presence or absence of Concepción phase serving vessels at Pitti-González.

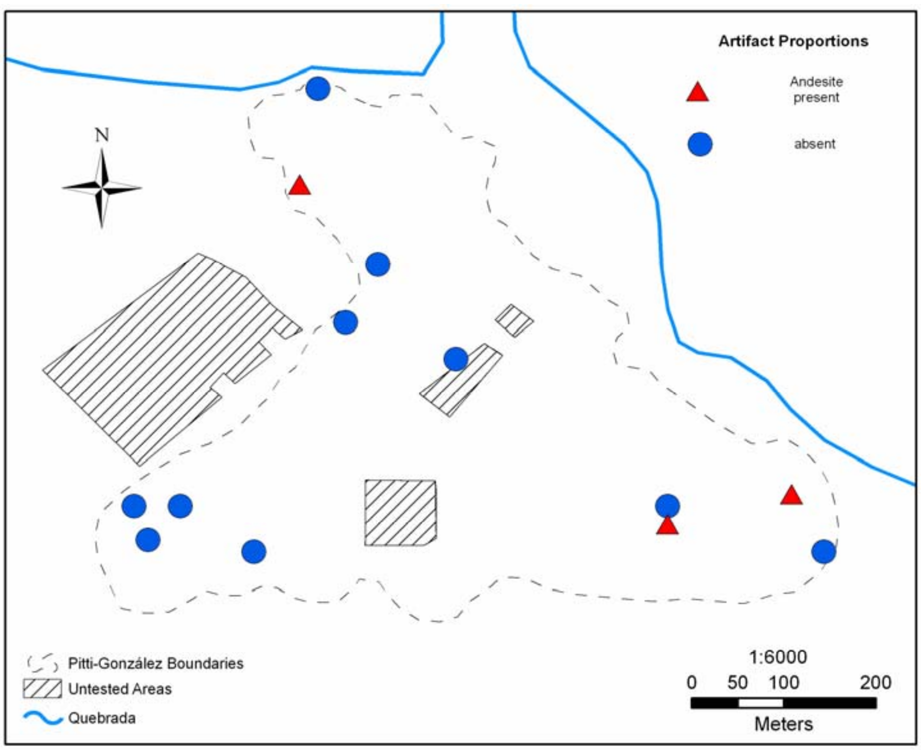

Figure 73. Presence or absence of Concepción phase andesite artifacts at Pitti-González.

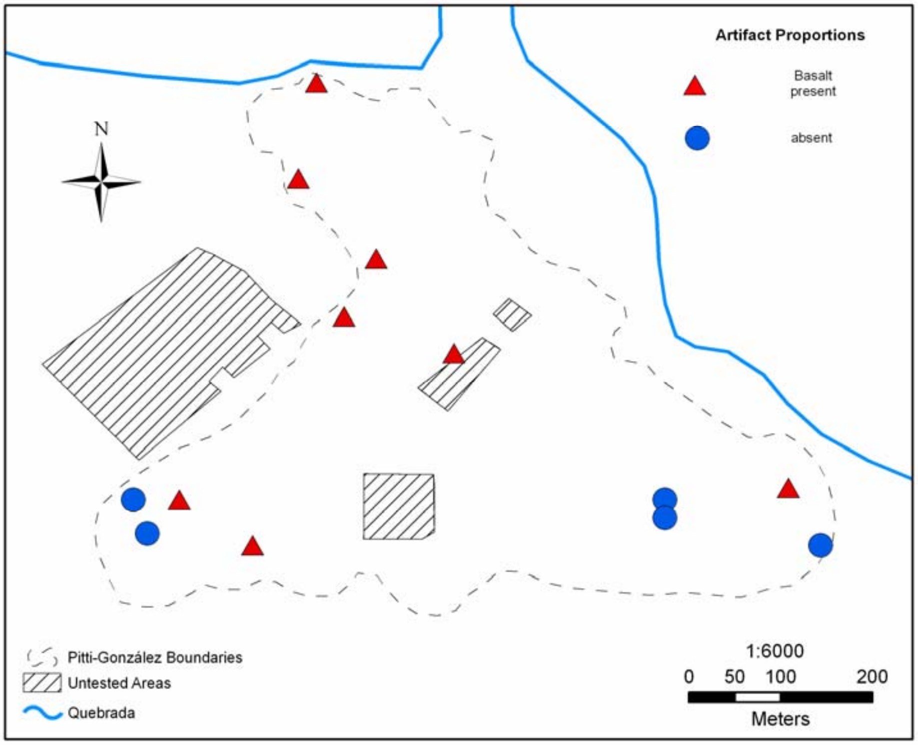

Figure 74. Presence or absence of Concepción phase basalt artifacts at Pitti-González.

5.3 OCCUPATIONAL DIFFERENTIATION

There were only a handful of lithic artifacts proveniences to single-component Concepción collection lots. The exceedingly small sample limits a meaningful discussion of occupational differentiation during the phase. Only a single production artifact, a primary flake, was recovered at Barriles (figure 75). Lithic repair or maintenance artifacts (secondary and tertiary flakes, and most pieces of shatter) were more common (figure 76), but generally limited to what would become the occupational core of the Barriles village. One noticeable peak in the distribution of repair artifacts stands out at Barriles, but the proportional difference between this collection lot and others is relatively subtle. Only one axe related artifact, a polish flake, was recovered toward the northwestern portion of the site's boundaries (figure 77), in an area just southeast of the block excavation done by Beilke-Voigt *et al.* 2004.

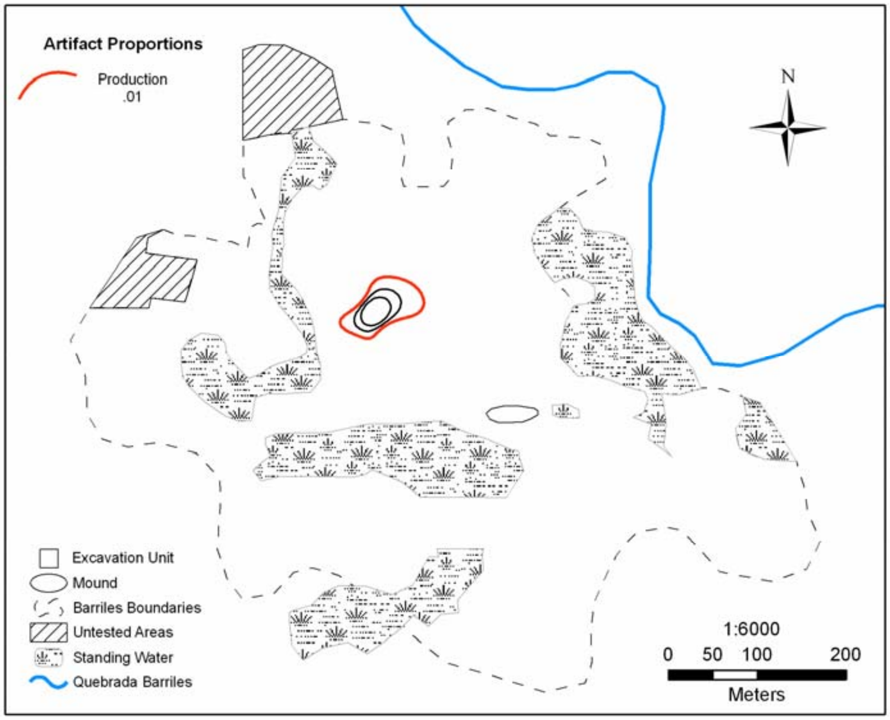

Figure 75. Proportions of Concepción phase lithic production artifacts at Barriles. Contour intervals are 1%.

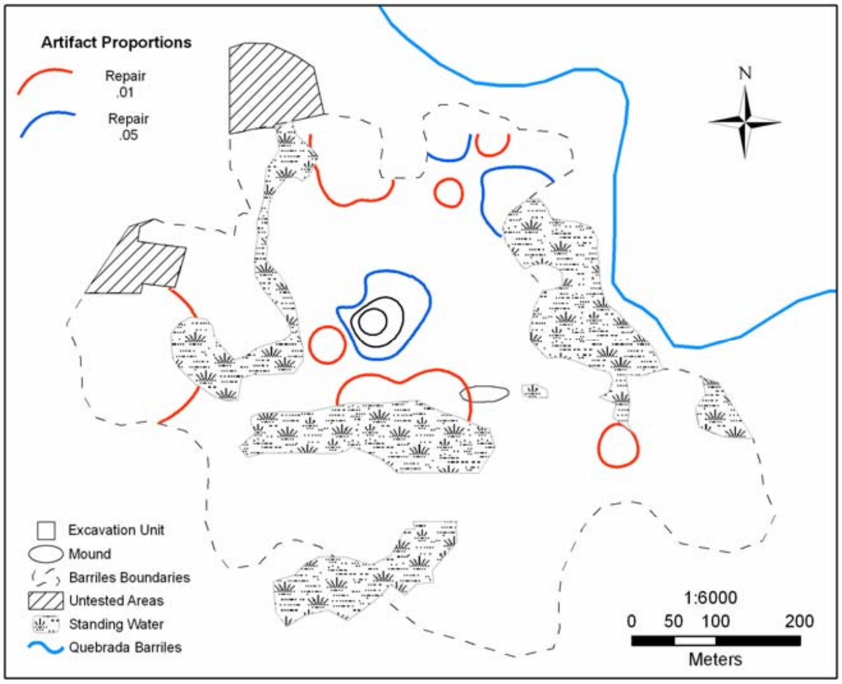

Figure 76. Proportions of Concepción phase lithic repair or maintenance flakes at Barriles. Contour intervals are 5%.

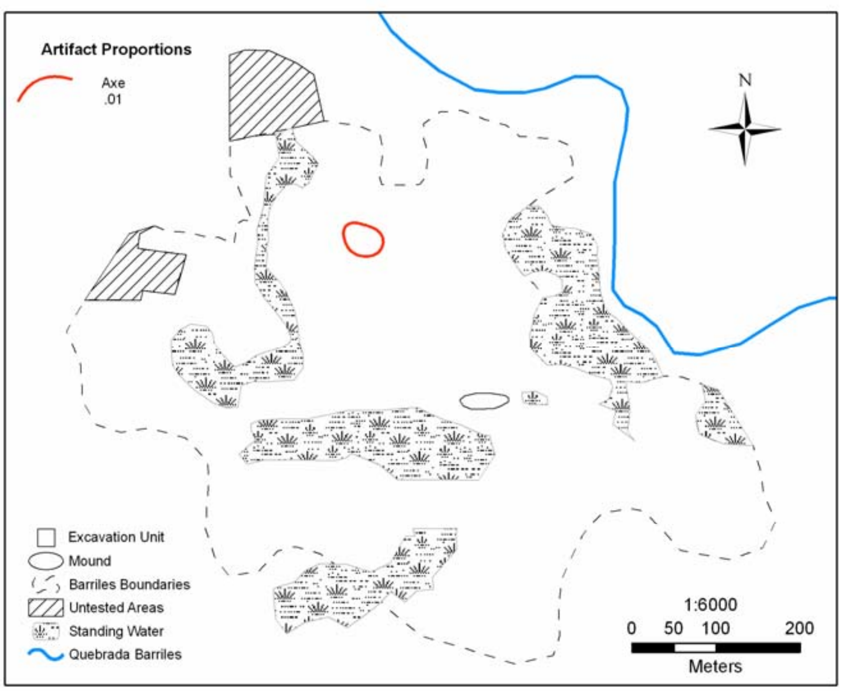

Figure 77. Proportions of Concepción phase axe material at Barriles. Contours are 1%.

A similar inability to recognize meaningful occupational patterns was associated with the small samples recovered from Pitti-González. Like Barriles, production artifacts (either primary flakes or core fragments) were rare (figure 78), though repair or maintenance artifacts were a little more common and widespread. The distribution of these flakes is shown in figure 79, but suggest that stone tool maintenance was an activity shared widely by Concepción domestic groups. Only one axe polish flake was recovered from the single-component Pitti-González collections, and was found on the northern edge of the site near the top of a steep *quebrada* (figure 80).

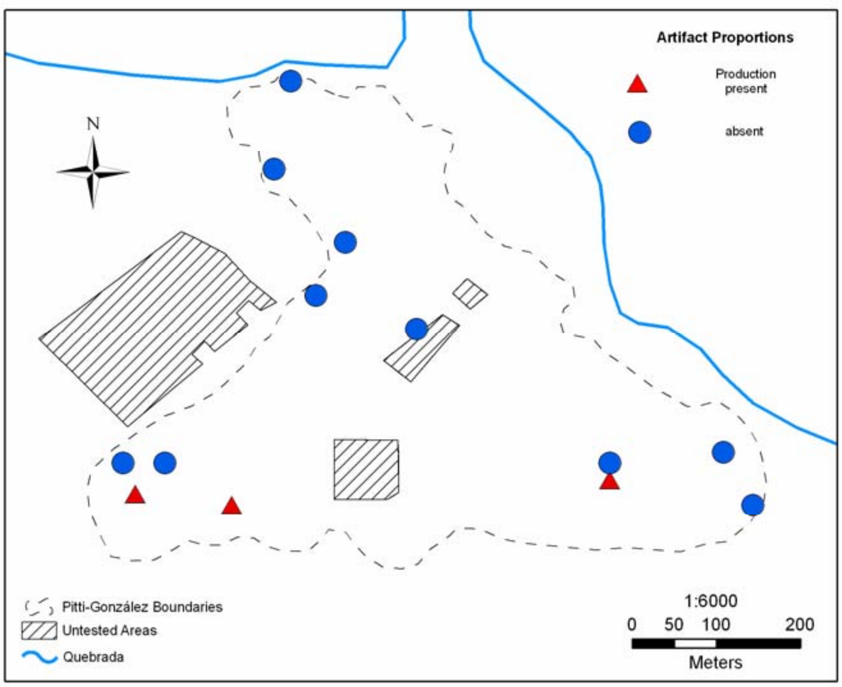

Figure 78. Presence or absence of Concepción phase lithic production artifacts at Pitti-González.

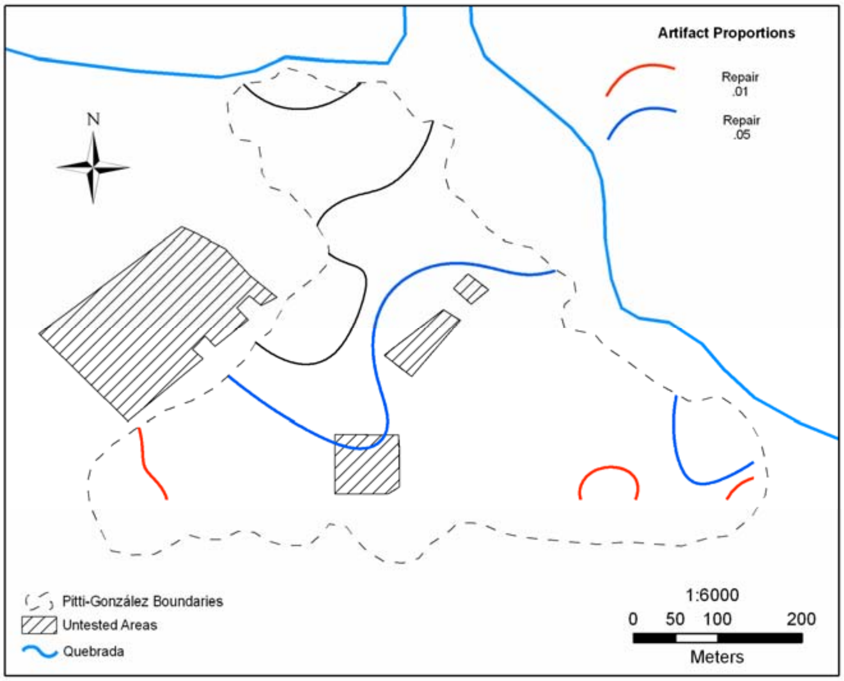

Figure 79. Proportions of Concepción phase lithic repair or maintenance flakes at Pitti-González. Contour intervals are 5%.

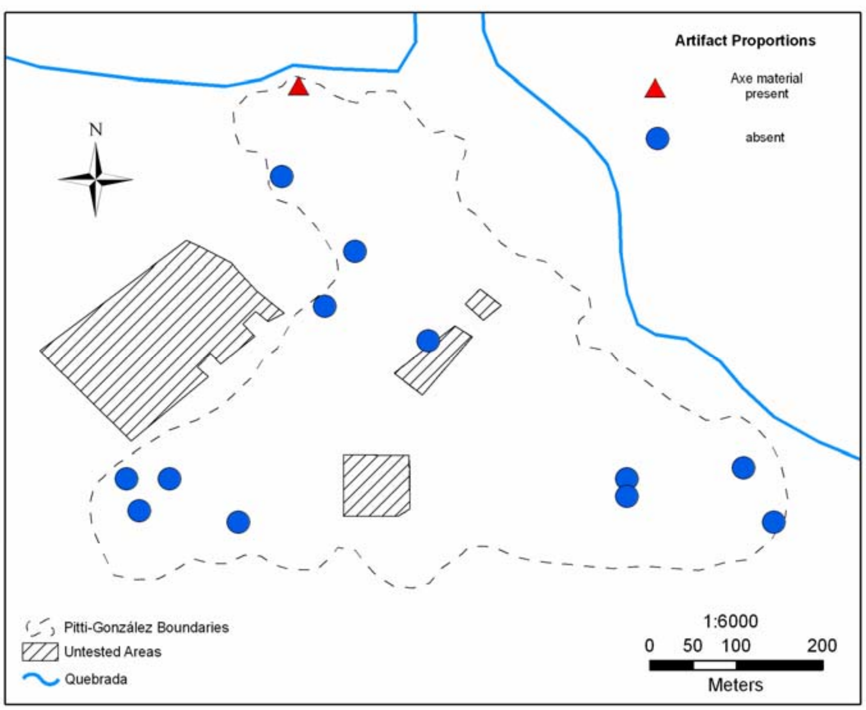

Figure 80. Presence or absence of Concepción phase axe material at Pitti-González.

5.4 MULTIDIMENSIONAL SCALING

The MDS analyses (using Euclidean distance similarity coefficients based standardized variables) included 32 proveniences from Barriles (27 shovel tests and 5 excavation strata), and 13 proveniences from Pitti-González (all surface collections), or a grand total of 45 proveniences. Sites BU-8 and BU-12 failed to produce single-component Concepción samples. Each included nine variables; decorated sherds, coarse sherds, cooking wares, serving wares, basalt artifacts, production artifacts, repair artifacts, axe-related materials, and *mano* or *metate* fragments. Each of these artifacts classes were divided by total identifiable sherds in their respective collection lots to arrive at an artifact proportion. These artifact classes were not mutually exclusive (i.e. some decorated sherds might also be rims of serving vessels), but they were not the same either. The 3 dimensional scaling of Barriles proveniences produced a Kruskal stress value of .10 (values below .15 are generally considered interpretable), and a 2 dimensional scaling of Pitti-González collections resulted in a value of .06.

As explained in Chapter 2, we do not yet understand how artifact concentrations may have varied across smaller spatial scales (i.e. across a typical houselot). We therefore cannot confidently assume that individual proveniences simply represent individual houselots. A few collections, for example, may have intersected midden areas, another few (which minimally produced 10 or more artifacts) may have intersected the relatively barren interior of structures. Just like the ceramic chronology in Chapter 3, what is being compared and contrasted in the scatterplots below are not the individual points as much as it is the spaces between them. Since these were originally based on similarity matrices, similarities in standardized artifact proportions would result in closer distances between points and differences in farther distances. The spacing is not an absolute measure but relative, based directly on the averages and standard deviations of artifact proportions within each individual site. Therefore we cannot ever say that one cm to the left on the scatterplot equates conveniently to an extra 1% of decorated sherds.

What we can say, however, is a qualitative statement about the range of domestic variation at either Barriles or Pitti-González during the Concepción. For example, if there are multiple clusters evident on the plots it might make sense to talk about multiple types of domestic groups in the past. If there are trails of several points radiating across the plot, we can consider these as different axes of variation (see Drennan and Peterson 2006). By comparing these clusters or axes to the original artifact proportions, we can examine which artifact proportions (or the activities they were connected to) seemed to vary in regular ways, and then consider how these were related to domestic organization, social status, or occupational differentiation, or usually some combination of these three. While each plot is essentially a synchronic snapshot in time, when considered with those of later phases or periods, the analyses of domestic variation in this way can be a powerful tool to consider the activities associated with social change.

Figure 81 illustrates the multidimensional scaling solution for Barriles. There is a tight cluster of proveniences toward the right of the graph which, depending on how one chooses to count, includes anywhere from 18 to 26 (56-81%) of the 32 single-component collections. These are closely spaced and indicate a high degree in uniformity in artifact proportions between each collection lot. The remaining proveniences are widely spaced and do not form obvious clusters or clear trails, and may represent idiosyncratic variations such as sampling errors. The best candidate for an axis lies somewhere between the aforementioned cluster, and the collection lots B217, U4, B456, and B208. Compared to the relatively undifferentiated lots in the cluster to the right, these four proveniences (13%) tended to have slightly higher proportions of decorated sherds, cooking and serving ware, and lithic repair flakes, but these are typically on the order of only a percent or two (and all well within the standard deviation). These were also the only to contain basalt artifacts and grinding stones, but each of these was rare in the entire Concepción assemblage from Barriles. Those in the cluster have slightly more coarse sherds, but otherwise the differences between the two are fairly unremarkable. Generally speaking, variation between Concepción collection lots at Barriles was relatively subtle, though there are some indications that food preparation and serving activities were perhaps done a little more intensively here and there. For the most part, these collection lots are widely spaced. Only B208 and B217 are located immediately beside each other in the northwestern portion of Barriles. Collection U1 represents the basal strata of the single mound feature on site, and B 456 is located on the extreme western edge of the site boundary.

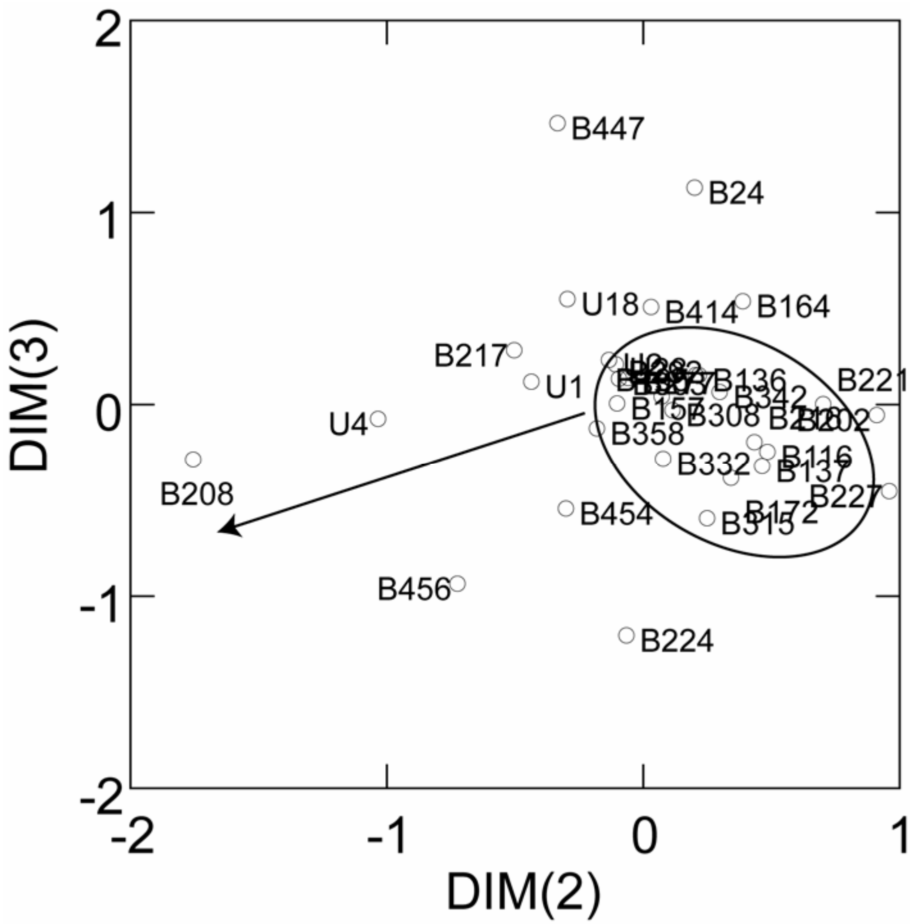

Figure 81. Multidimensional scatterplot illustrating Concepción phase proveniences from Barriles. Labels beginning with 'B' are single-component shovel tests, those starting with 'U' are excavation strata.

Figure 82. illustrates the multidimensional scaling solution for Pitti-González. Here 9 (69%) of the 13 proveniences formed a linear cluster, while the rest of the collections were spaced widely and were found toward the margins of the plot. These might represent outliers, and no obvious axes can be drawn between themselves and the cluster. Variation within the linear cluster is subtle, but those towards the top (i.e. P512, P526) tended to contain more decorated ceramics, less coarse, and had serving ware present. Those towards the bottom (i.e. P285, P337) tended to contain slightly more lithic repair debitage and basalt artifacts. Artifact collections are otherwise very similar top to bottom. Each provenience is scattered widely within

Pitti-González's boundaries, with no obvious spatial correlation between those at one end of the graph and those at the other.

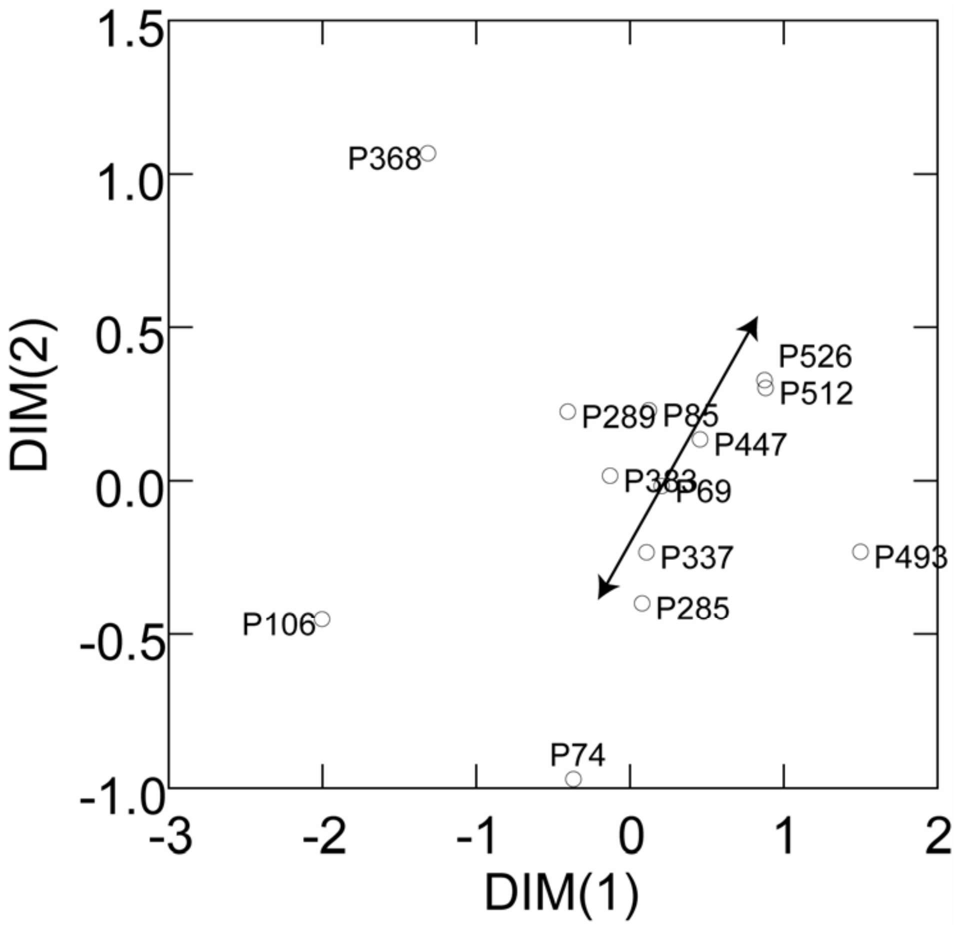

Figure 82. Multidimensional scatterplot of Concepción phase proveniences from Pitti-González. Labels beginning with 'P' are single-component surface collections.

5.5 SYNTHESIS

Residential occupation during the Concepción phase was ephemeral and highly dispersed, probably organized in individual farmsteads or in the occasional hamlet, some of which may have been inhabited on a temporary or seasonal basis. There were no identifiable villages among the sites sampled during this time, although many more Concepción sherds were found within the approximate boundaries of what would later become Barriles. Because samples were so small and spatially restricted, there are few differences in artifact proportions which may confidently point to the existence of some form of social or occupational differentiation. Nor is there any indication that these farmsteads were organized into a lasting regional settlement hierarchy.

Generally speaking, many of these farmsteads appeared to be relatively redundant units of production and consumption, each basically handling its own food preparation and stoneworking activities. Only a few possible differences are evident when all the single-component collections within Barriles' later boundaries are compared to all the single-component collections within Pitti-González's later boundaries. In particular, Pitti-González's tendency to contain higher proportions of decorated sherds and lithic debitage would evolve into stronger differences in later phases, while Barriles tendency to contain more serving vessels would do the same. It can therefore be said that at least some of the important social distinctions recognizable during the subsequent Bugaba Period were elaborations of some of the earliest patterns observable in the sequence.

6.0 EARLY BUGABA PHASE (A.D. 300 TO 600)

The population estimates presented in Chapter 4 suggested that the Early Bugaba Phase was associated with dramatic population growth across the study area. In the previous Concepción, both Barriles and Pitti-González were loose collections of dispersed farmsteads. But by the Early Bugaba Phase, both of these sites grew exponentially in small villages. Barriles expanded to a 32 ha site and likely contained 250 to 500 individuals. Estimates from Pitti-González suggest a similar demographic trend, growing from an initial population of less than 50 individuals to a site 26 ha in extent with a residential population also around 250 to 500 individuals. Both Barriles and Pitti-González contained concentrations of artifacts that were approximately 10 times larger and 5 times denser than any of the other Early Bugaba Phase sites sampled by the project, and it therefore makes sense to discuss both as emerging villages during this phase. Both could be thought of as peer settlements on a regional scale, as both had similar residential populations, and because there is little evidence that any of the features which eventually made Barriles qualitatively distinct (i.e. mound, statues, stone structure foundations) dated to this phase. The construction of the small mound at Barriles, for example, only appears to have begun in earnest towards the very end of the Early Bugaba and will be discussed in the next chapter.

Barriles provided 57 single-component shovel tests and strata from 17 different excavation units (figure 86). Pitti-González produced 120 single-component surface collections and strata from 5 different excavation units (figure 87). These were the largest sites in the project's sample, but the distribution of the population was by no means limited to Barriles or Pitti-González. Early Bugaba Phase components were found at BU-2, BU-8, BU-12, BU-18 and the Dos Ríos site (BU-43) on the edge of the Cerro Punta basin. Both BU-8 and BU-12 contained Concepción sherds and were estimated to be individual farmsteads of 1-10 individuals. By the Early Bugaba, BU-8 likely continued to be an individual farmstead, while BU-12 grew modestly into a small hamlet of 20 to 40 individuals. The section of BU-2 (or ~15% of the original site identified by Linares *et al.* 1975) which was sampled, approximately half a kilometer north of Barriles, was likely settled during the Early Bugaba as an individual farmstead.

Based on this evidence, Early Bugaba densities and distributions support a general interpretation of populations living in villages, small hamlets, or dispersed farmsteads. The best guess that can be made about the 38 unsampled sites is that approximately 75% contained Early Bugaba components. Of these, the conservative estimate is that none were comparable in residential density or population to Barriles or Pitti-González. There are, however, 4 additional large sites originally identified by Linares *et al.* (1975) in the southwestern portion of the study area which could be village candidates. One of these, BU-2, was originally estimated at roughly 50 ha, which would be larger than Barriles and Pitti-González combined, yet turned out to be a highly dispersed scatter of farmsteads during the Early Bugaba (or a hamlet and farmsteads by the Late Bugaba) with relatively small residential populations. If the pattern at BU-2 was typical for these other large sites, we might expect each of them to contain dispersed populations of 100 or less individuals. Roughly 75% of the other 33 unsampled sites may have been home to Early Bugaba populations living either in farmsteads or small hamlets, averaging somewhere around 15 individuals a piece. These estimates, plus the approximately 850 individuals estimated from the already sampled sites, total to an extremely rough guess of around 1600 individuals for the

62 km² study area (with maybe about half living in the two villages), or an overall population density of around 25 individuals per km², maybe four times denser than the Concepción.

The establishment and formation of villages at each end of the Upper Chiriquí Viejo evidently contained a wider range of activities, and generally higher proportions of evidence for social and occupational differentiation than did the farmsteads sampled by this project. One clear exception to this generalization is the site of BU-18 in the Bambito gorge, situated atop a highly defensible natural rise (figure 53) and contained a low density scatter of ceramic and stone artifacts. Although this site was probably not home to more than 20 individuals, it contained an unusually high proportion of fancy sherds, basalt artifacts, and stone axes. Because it was a low density site, it was sampled using a general surface collection, and is thus represented by a mean value (a horizontal line without confidence intervals) in the bullet graphs below.

These graphs show the two Early Bugaba villages contained 10-20 times more decorated sherds than ordinary farmsteads, though the two had a relatively equal proportion of fancy sherds (figure 83). Moderately strong differences between the two were evidently in place by some point in the Early Bugaba, with Barriles containing relatively more cooking and serving vessels (figure 84), and Pitti-González containing elevated proportions of lithics (figure 85), regardless of whether they were finished stone tools or artifacts related to lithic production or maintenance activities.

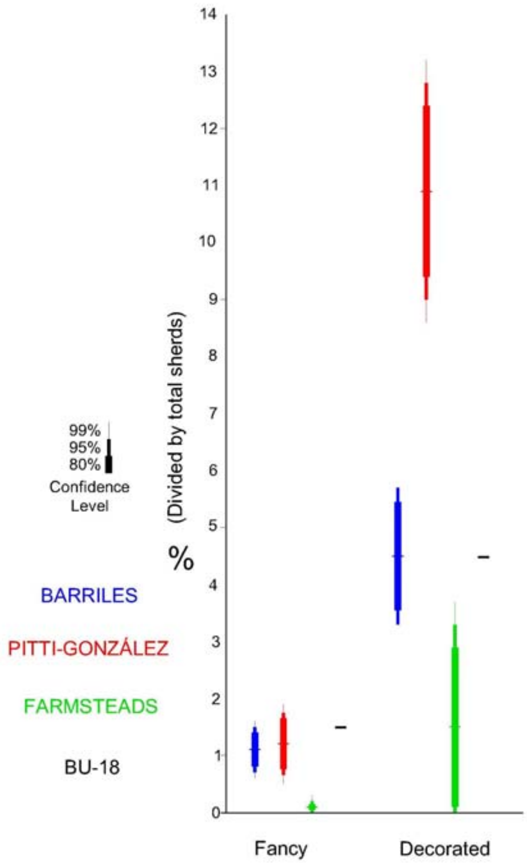

Figure 83. Statistical comparisons of fancy and decorated sherd proportions between Early Bugaba Barriles, Pitti-González, farmsteads, and BU-18.

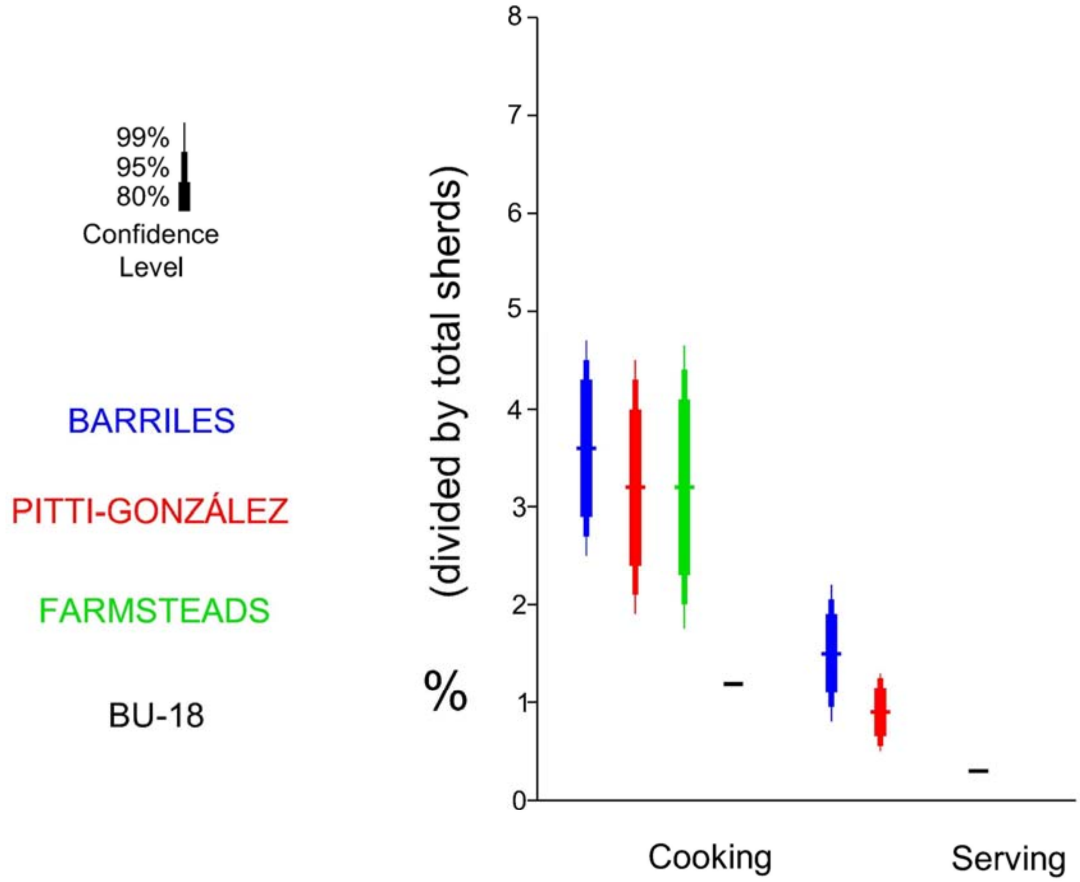

Figure 84. Statistical comparisons of vessel form proportions between Early Bugaba Barriles, Pitti-González, farmsteads, and BU-18.

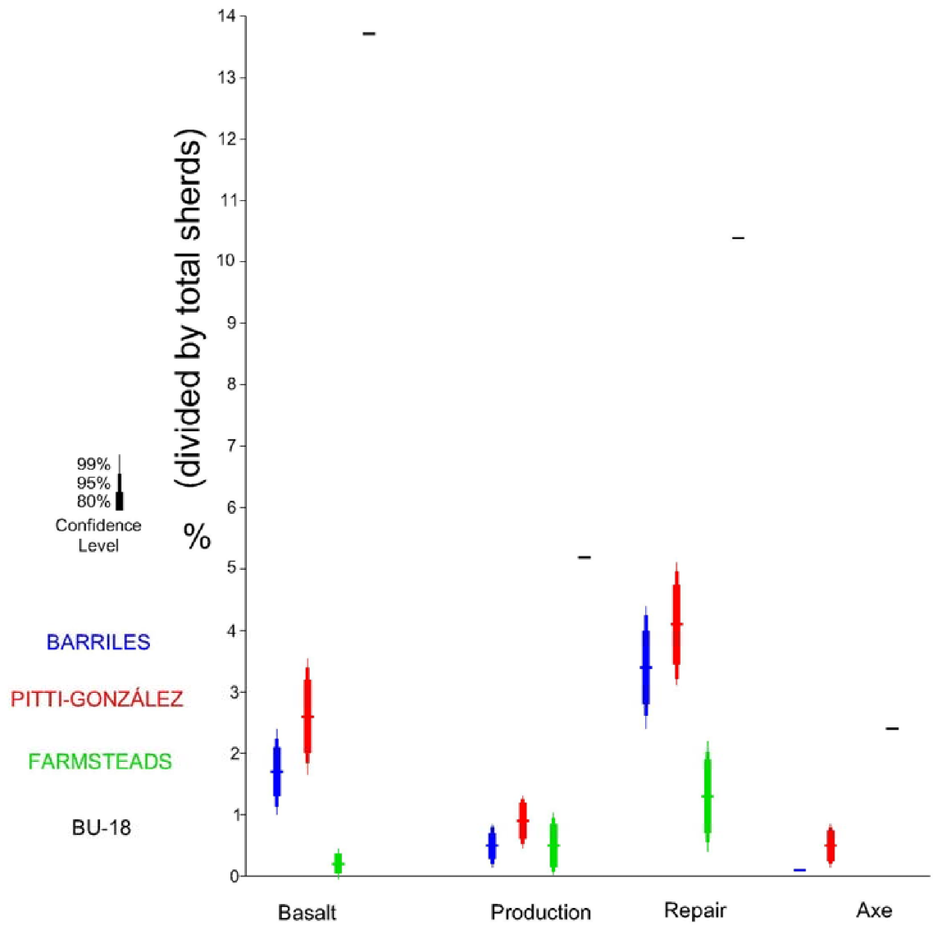

Figure 85. Statistical comparisons of lithic artifact proportions between Early Bugaba Barriles, Pitti-González, farmsteads, and BU-18.

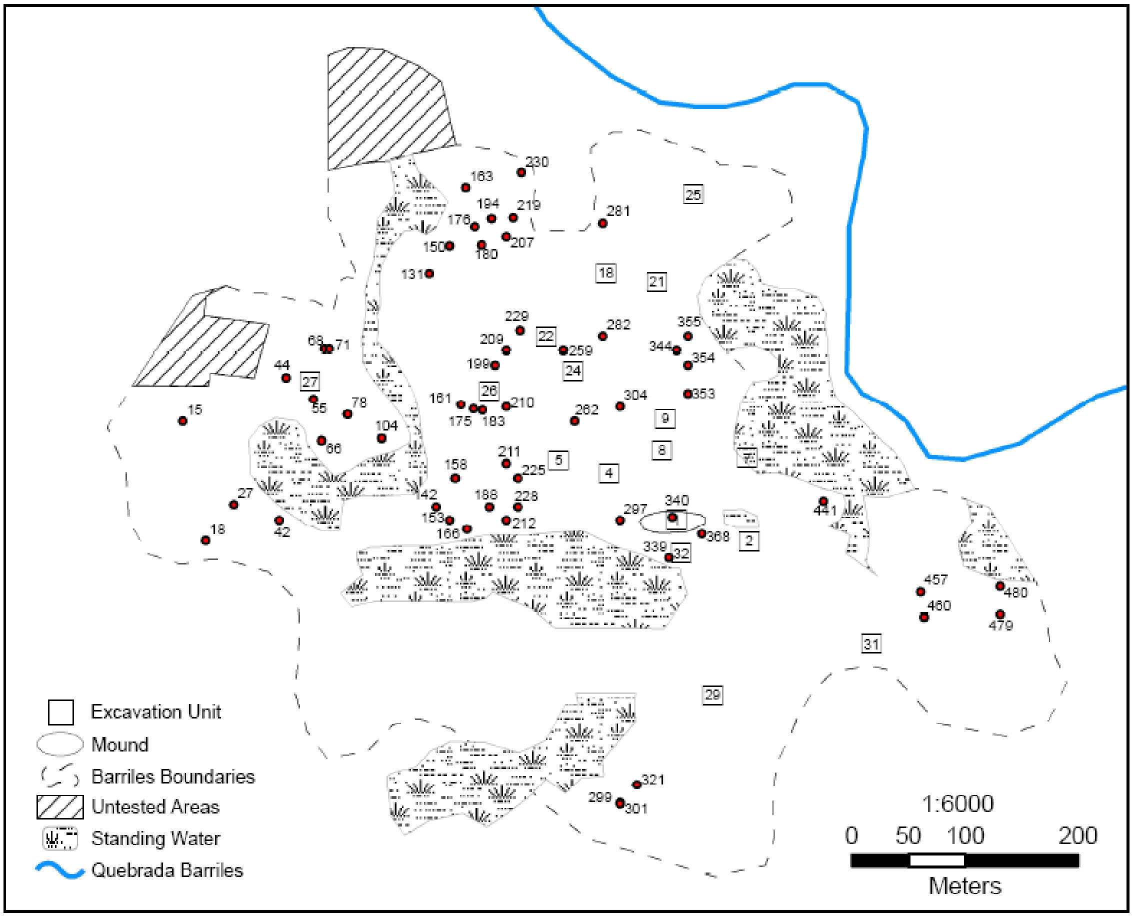

Figure 86. Locations of single-component Early Bugaba shovel tests within Barriles.

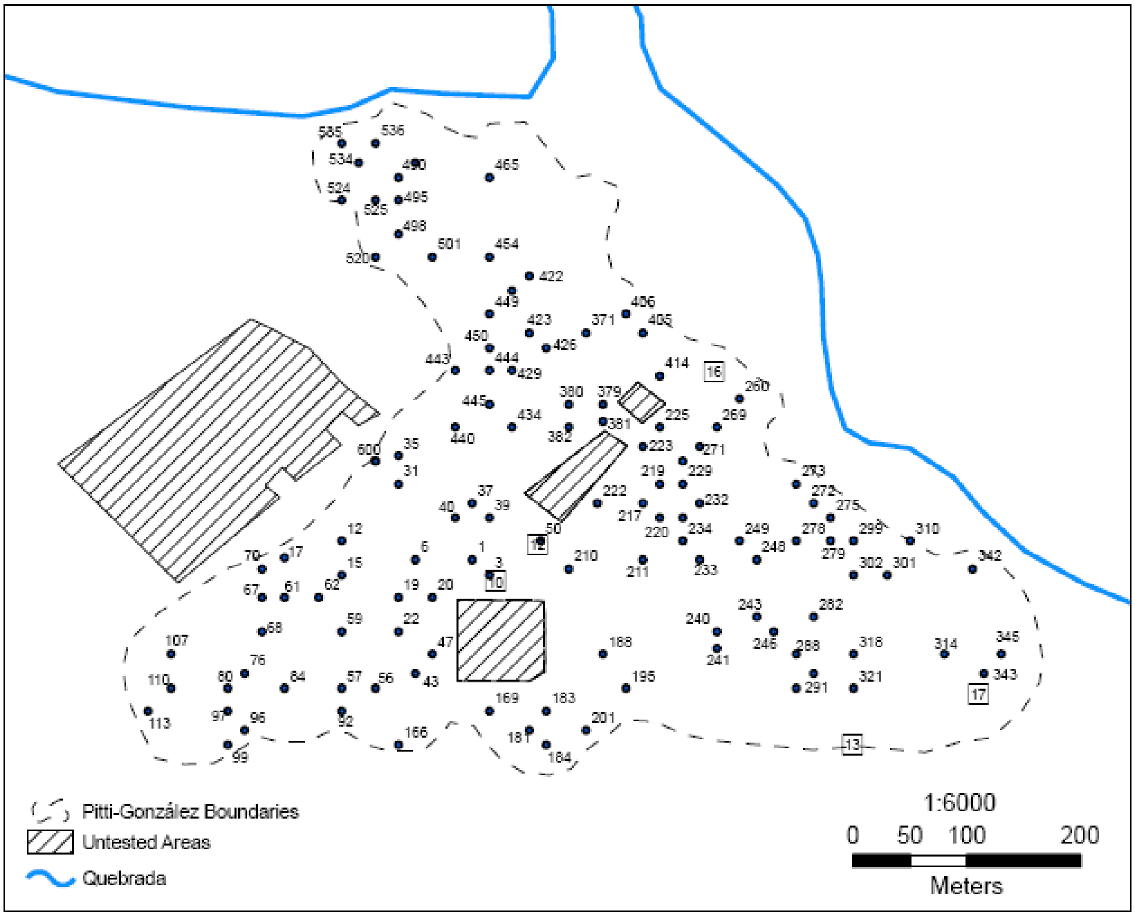

Figure 87. Locations of single-component Early Bugaba surface collections at Pitti-González.

6.1 DOMESTIC ACTIVITIES

Nearly every domestic group (or more precisely, every collection lot) at Barriles contained evidence for a common participation in domestic activities during the Early Bugaba Phase. Using the same criteria from the Concepción- undecorated sherds, coarse sherds and cooking vessels (all divided by total sherds)- all three ceramic classes were distributed widely and suggested that domestic groups across the site shared a common involvement in at least some cooking or storage activities. Figure 88 illustrates the distribution of undecorated sherds at Barriles, a map which is the inverse of the decorated sherds illustration shown in figure 96. With only a few exceptions, every collection lot in Early Bugaba Barriles contained more than 95% undecorated sherds, greater than 20% coarse sherds (figure 89), and most had one or more cooking vessels present (figure 90).

While artifacts linked to domestic activities were a common denominator in the Barriles samples, this does not necessarily mean that each domestic group performed these tasks with the same intensity. Collection lots which showed up as peaks (>.50) of coarse sherds were, for example, always associated with areas which contained more than 95% undecorated sherds (compare figures 88 and 89). The inverse relationship was not as regular, there were areas containing relatively low (<.15) proportions of coarse sherds which still had a majority of undecorated sherds. While cooking vessels (figure 90) were evenly present in low proportions across the site, there were several noticeable peaks on the distribution map indicating locations where cooking wares were found in proportions five times greater than the village average. These elevated cooking vessel proportions corresponded moderately well with low proportions of undecorated sherds (or high proportions of decorated sherds), and most were clustered within the central core of Barriles. Only four *mano* or *metate* fragments were found among the Barriles single-component shovel tests (figure 91), but all four were located in areas containing low proportions of coarse sherds and high proportions of undecorated sherds. Based on this distributional evidence, it appears that there were subtle variations in domestic activities across this Early Bugaba village, with some houselots slightly more involved in cooking or storage activities, and others slightly less.

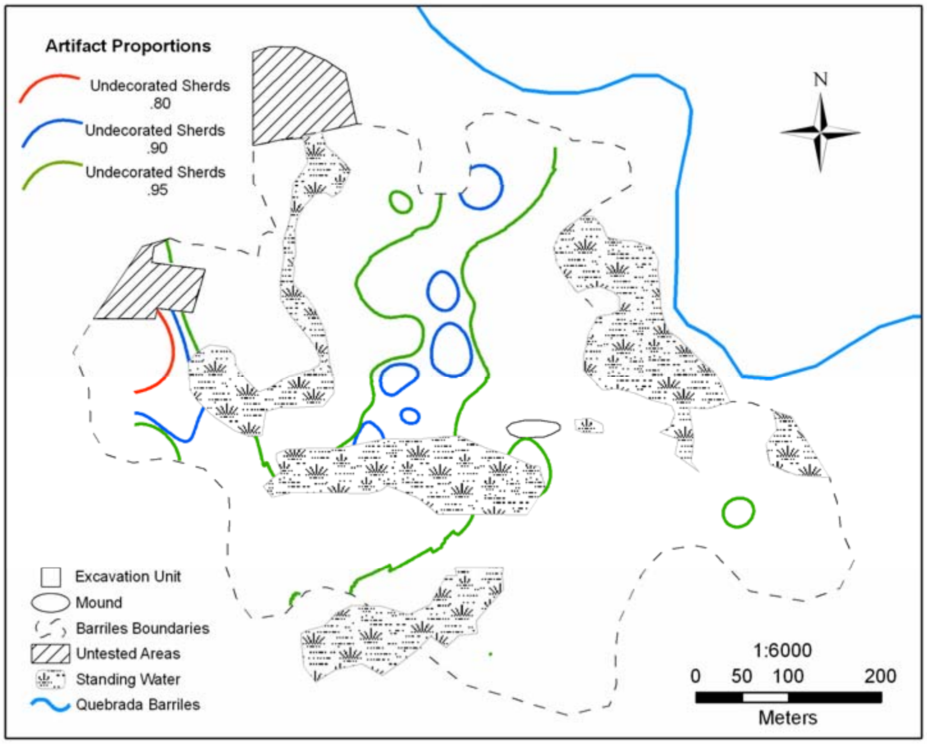

Figure 88. Proportions of undecorated sherds within Early Bugaba Barriles.

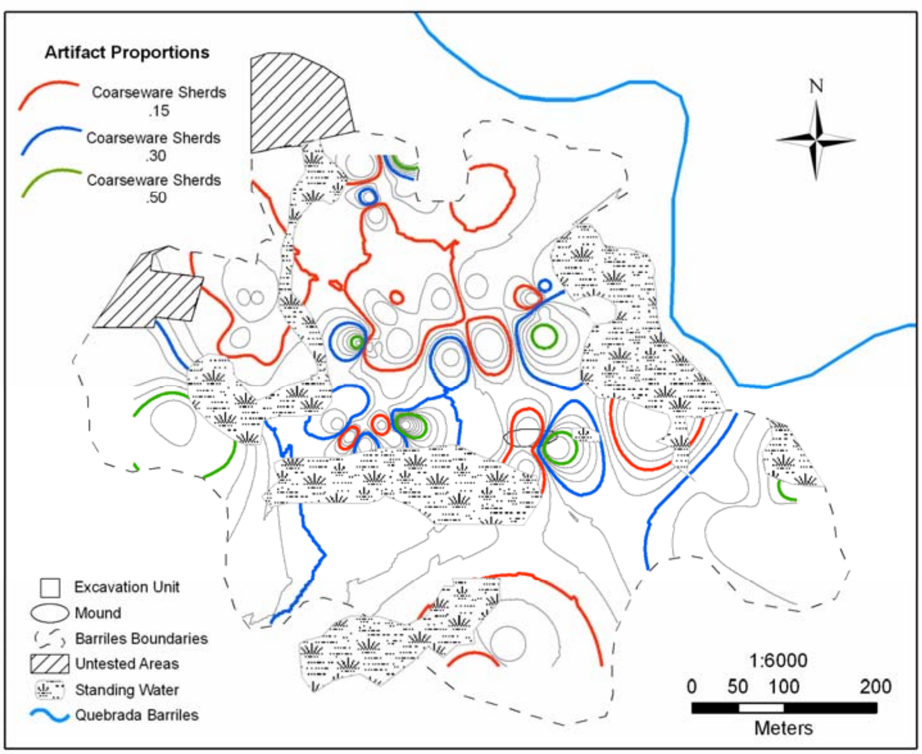

Figure 89. Proportions of coarse sherds within Early Bugaba Barriles.

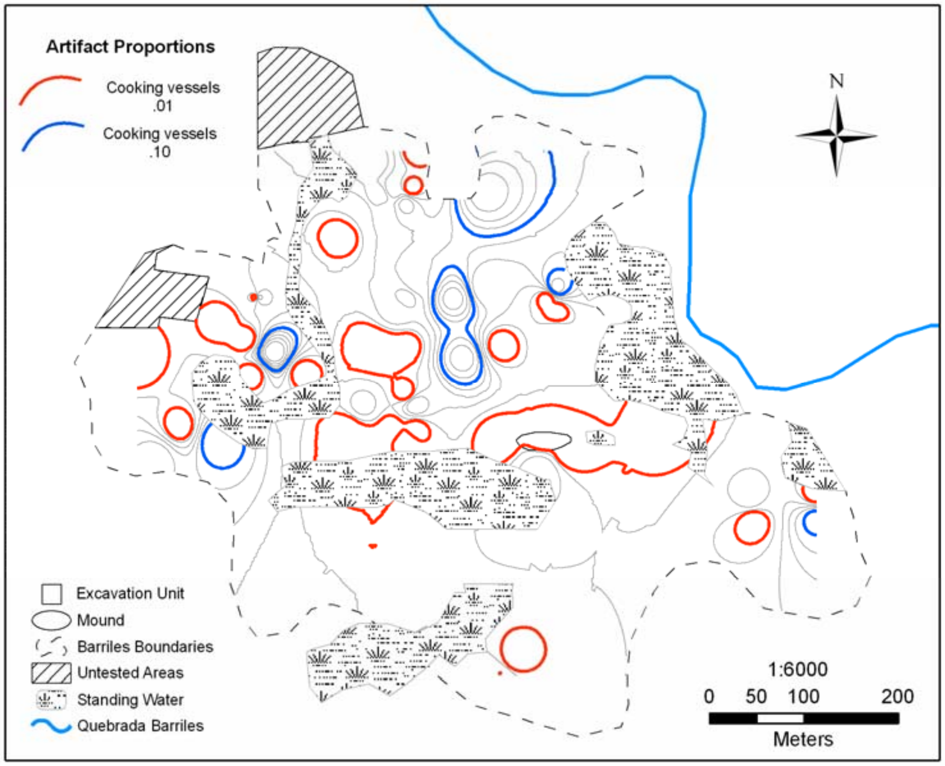

Figure 90. Proportions of cooking vessels within Early Bugaba Barriles.

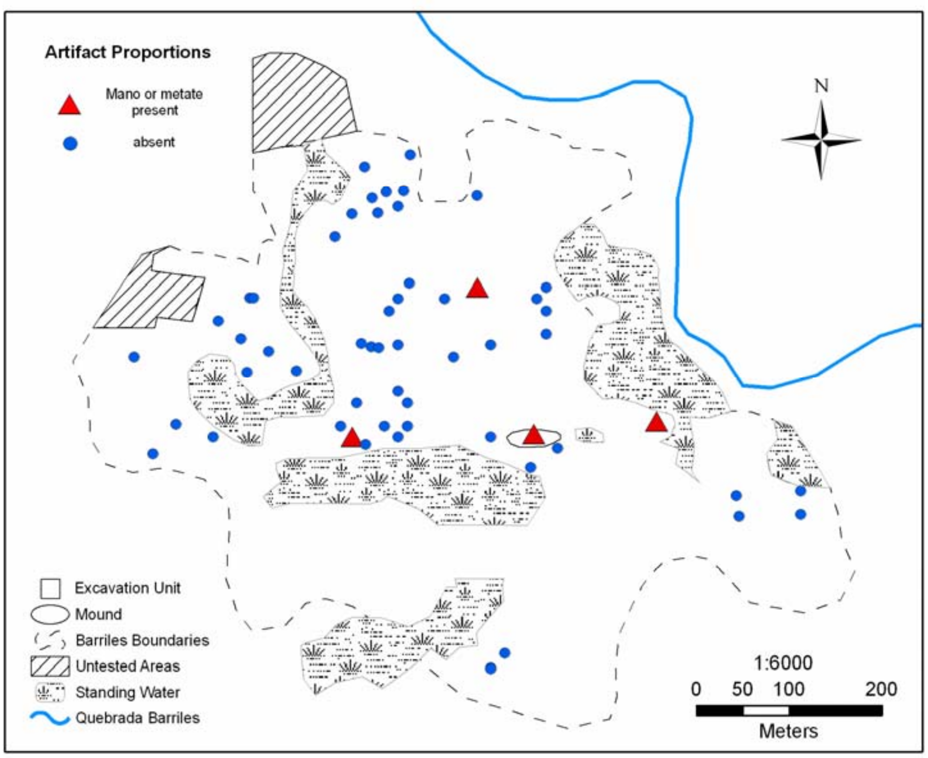

Figure 91. Presence or absence of *manos* or *metates* within Early Bugaba Barriles.

The Pitti-González evidence told a story similar to Barriles. Domestic activities appeared to have also been widespread among village residents, and with only a few exceptions. The typical collection lot contained more than 70% undecorated sherds (figure 92), greater than 10% coarse sherds (figure 93), and minimally had some cooking vessels present (figure 94). Unlike Barriles, high proportions (>.90) of undecorated sherds were not consistently located on or near lots containing elevated proportions (>.50) of coarse sherds. The distribution of cooking vessels at Pitti-González corresponded moderately well with the distributions of low undecorated sherd proportions (or, conversely, of high proportions of decorated sherds). The distribution of *mano* or *metate* fragments, on the other hands, does not regularly line up on or beside peaks or depressions of any domestic artifact type (figure 95). Like Barriles, the Early Bugaba village of Pitti-González exhibited subtle variations in domestic activities across the site, the clearest pattern being that some houselots participated in cooking or storage activities slightly more than their counterparts.

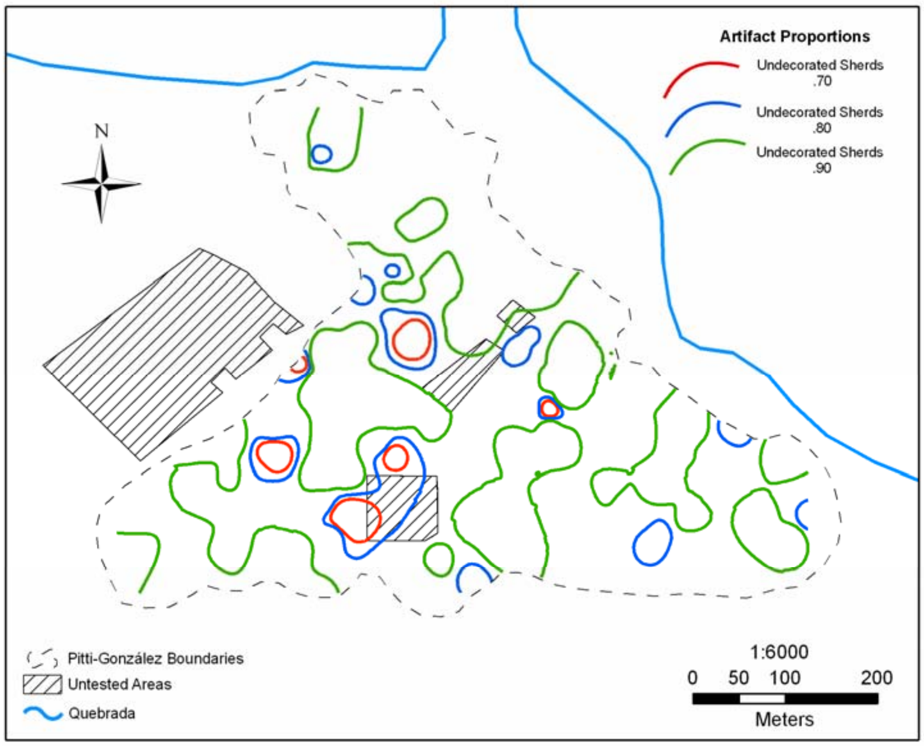

Figure 92. Proportions of undecorated sherds within Early Bugaba Pitti-González.

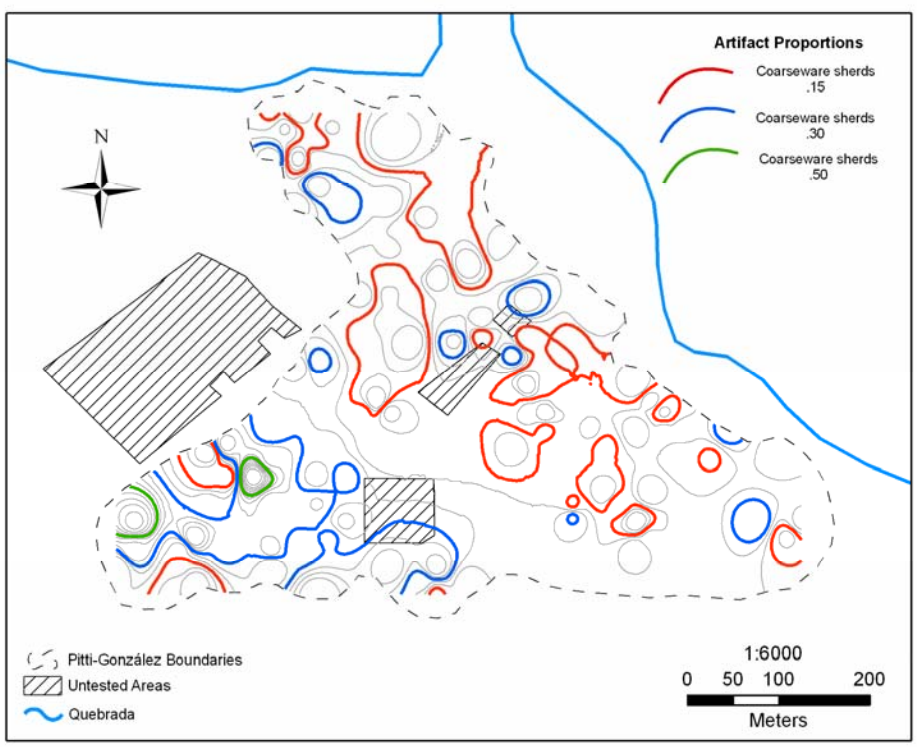

Figure 93. Proportions of coarse sherds within Early Bugaba Pitti-González.

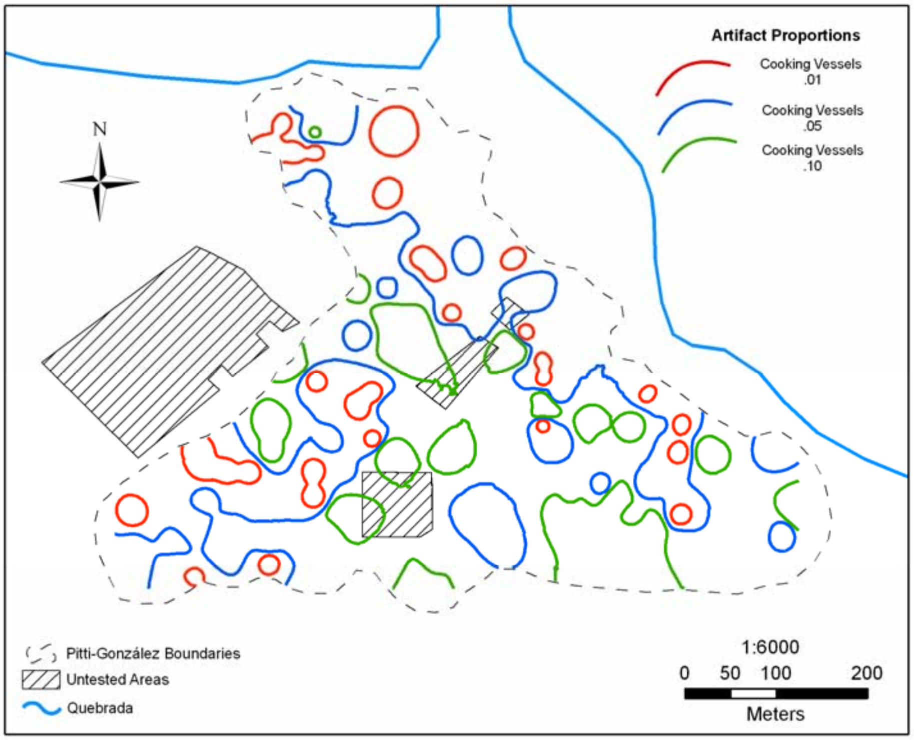

Figure 94. Proportions of cooking vessels within Early Bugaba Pitti-González.

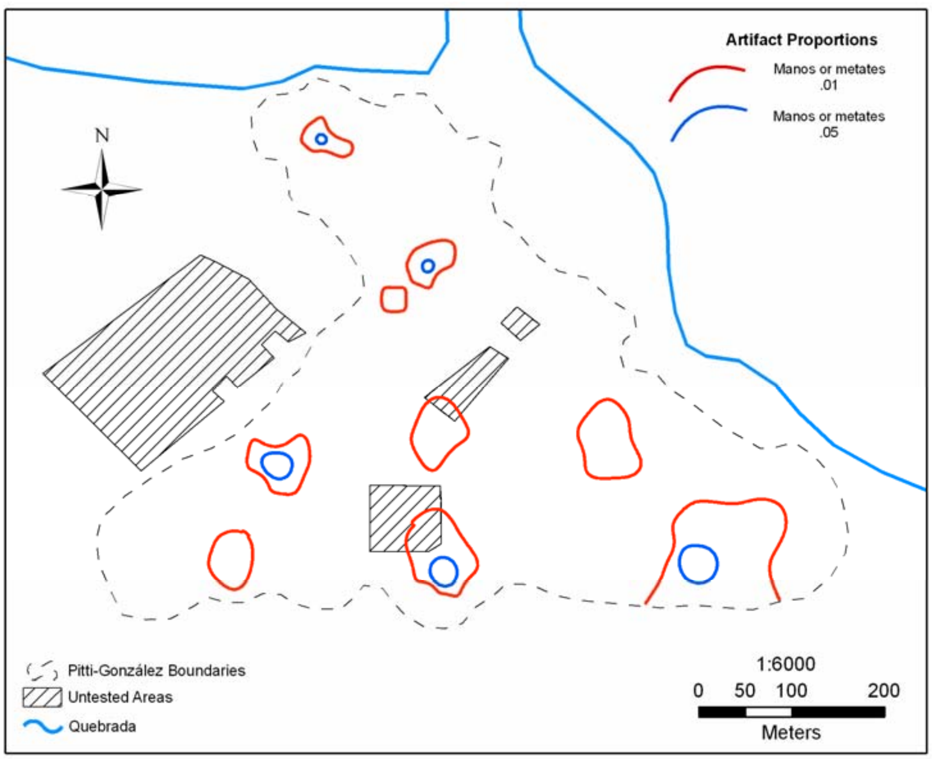

Figure 95. Proportions of *manos* or *metates* within Early Bugaba Pitti-González.

6.2 SOCIAL DIFFERENTIATION

While variations in domestic activities were relatively subtle, the evidence for social differentiation is relatively clearer during the Early Bugaba Phase at Barriles As illustrated in figures 96 and 97, typical collection lots at Barriles contained low percentages of decorated sherds, and many entirely lacked the presence of the so-called 'fancy' wares. The term fancy wares used here refers to the Bugaba Engraved and Zoned Bichrome wares described by Spang and Rosenthal (1980), and are described in chapter 3 and illustrated in Appendix A. These were the rarest and most labor-intensive ceramic wares to produce among the Formative ceramic assemblage, though it remains unclear exactly where they were produced. At Barriles, there were several collection lots that produced unusually high proportions of decorated and fancy ware sherds. These two variables strongly corresponded to each other spatially, an unsurprising pattern since all fancy wares were by definition decorated, although not all decorated sherds were pieces of fancy wares. Concentrations of both are found in largely in an approximately 100-m wide row running 200 m north (or a 2ha area) in the geographic center of the site. Elevated proportions of decorated and fancy sherds were not evenly distributed even within this small area, but rather found in discrete concentrations which may have been associated with individual houselots.

Serving wares at Barriles were more evenly distributed, with most collection lots generally outside of the center containing proportions greater than .01 (figure 98). While fancy wares are thought to have been prices of serving wares, many of the fancy ware samples during the Early Bugaba Phase were identified as body sherds which could not be confidently associated with vessel function. One moderately strong spatial association was between peaks of both fancy and decorated sherds and chipped and polished stone artifacts (figures 106, 107 and 108). For the most part, peaks of stone artifacts were found within or immediately beside peaks in decorated or fancy sherds. This was not an exclusive association, as peaks of different stone artifacts were also found closer towards the site boundaries. Many of these collections, being near the site edges, contained higher proportions which were influenced by smaller sample sizes, often between 10 and 15 sherds (and therefore containing proportions in increments between 7% and 10%). The exploration of different artifact proportions from collection lots containing variable proportions of fancy wares will be explored further in scaling solutions towards the end of the chapter.

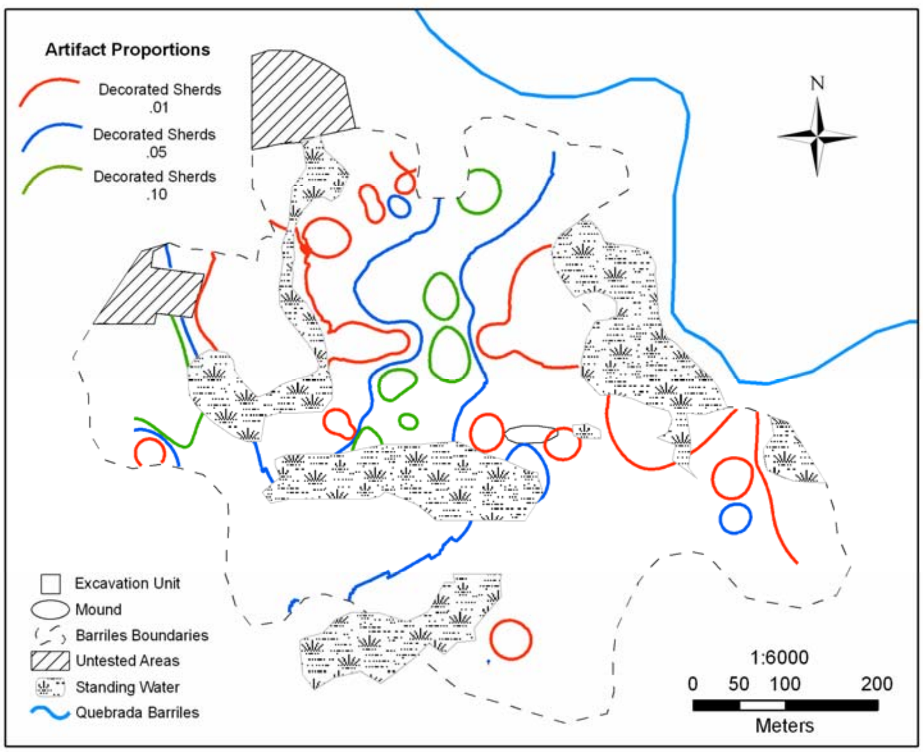

Figure 96. Proportions of decorated sherds within Early Bugaba Barriles.

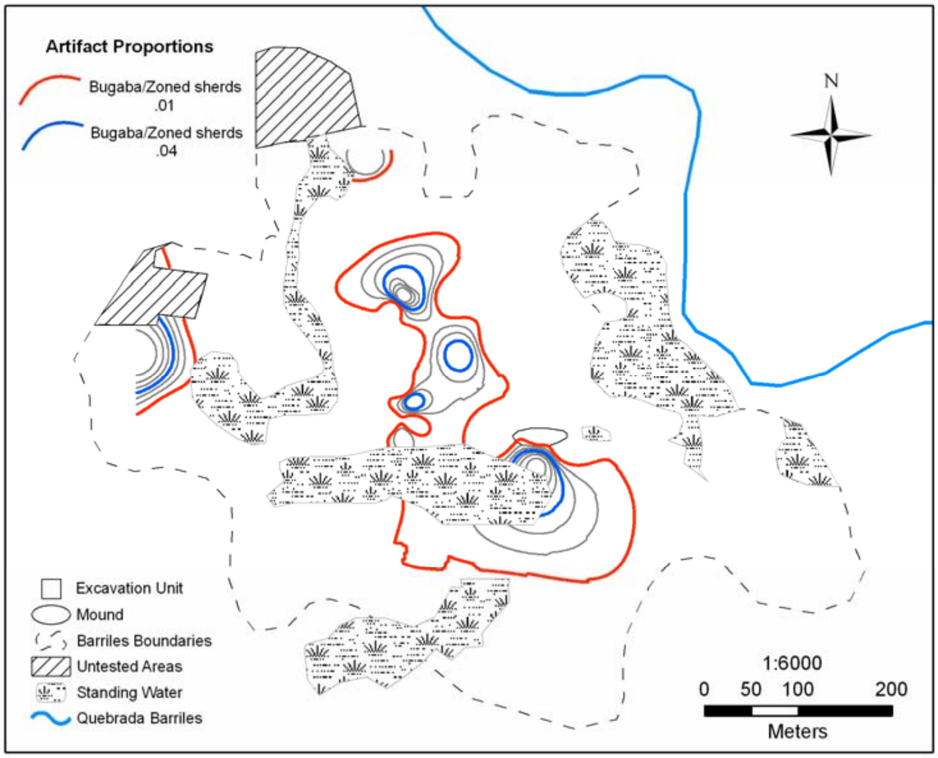

Figure 97. Proportions of fancy sherds within Early Bugaba Barriles.

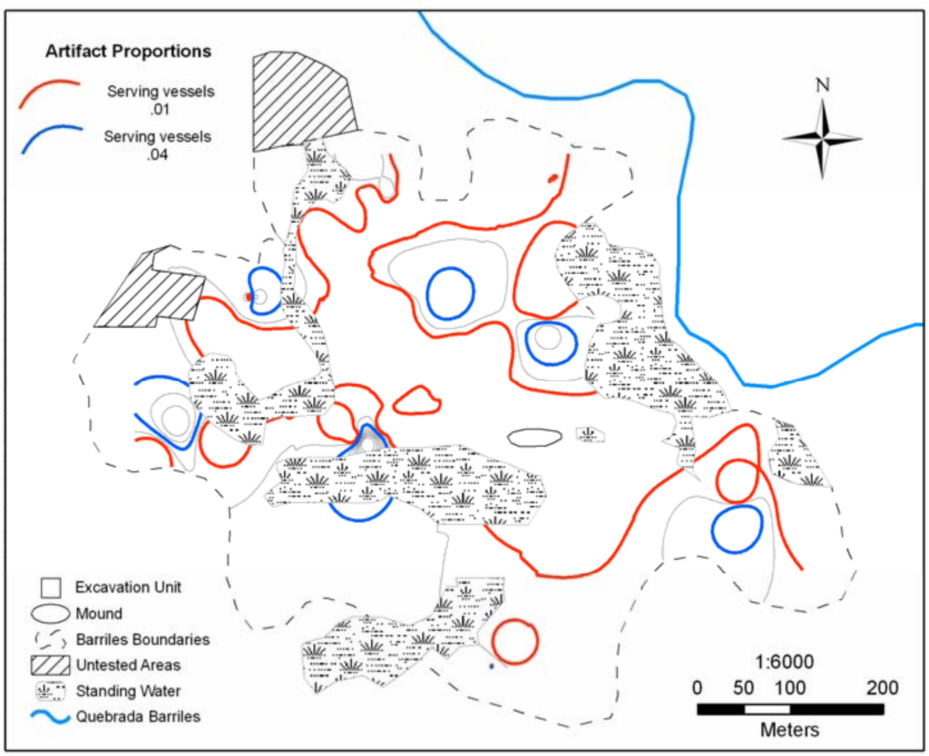

Figure 98. Proportions of serving vessels within Early Bugaba Barriles.

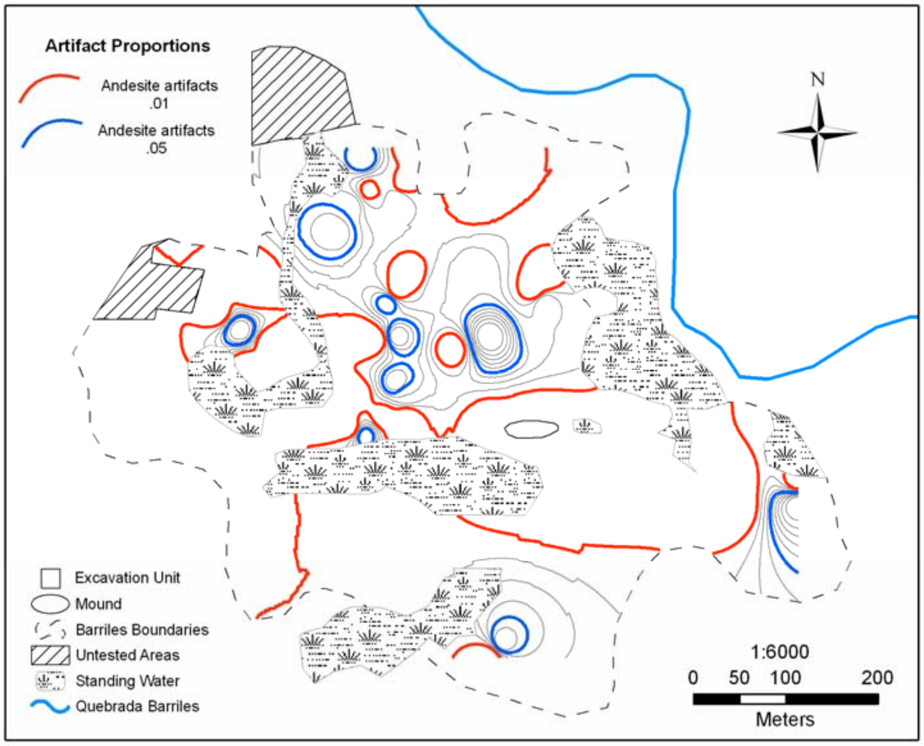

Figure 99. Proportions of andesite artifacts within Early Bugaba Barriles.

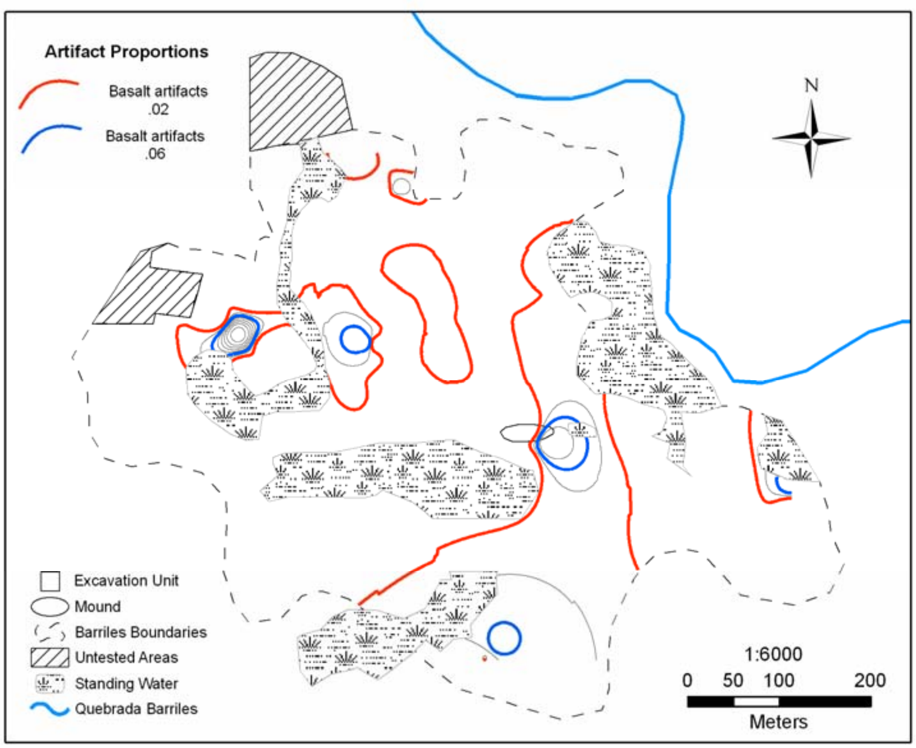

Figure 100. Proportions of basalt artifacts within Early Bugaba Barriles.

Unlike Barriles, higher proportions of fancy ware were not as strongly spatially associated with higher proportions of decorated sherds within Pitti-González. Decorated sherds, however, were much more widespread at Pitti-González than at Barriles, with the majority of collection units containing more than 10% decorated sherds (figure 101). This unexpected pattern was very unlikely to be an effect of sample size, since surface collections tended to provide larger (and perhaps more randomized) samples of artifacts than the shovel tests at Barriles. Fancy wares, however, were much more spatially restricted (figure 102), and were found in relatively discrete concentrations scattered across the southern half of the site. Unlike Barriles, which had a tighter cluster of fancy wares, higher status houselots within Pitti-González tended to be dispersed across the village and not all organized into an identifiable core area.

Collections with high proportions of serving wares (figure 103) tended to overlap slightly, or be found immediately beside, many of the more prominent peaks in decorated sherds, and to a slightly lesser degree, those of fancy wares. The majority of the stone artifacts, either of andesite and basalt (figures 104 and 105), were distributed across the southern half of Pitti-González, many generally adjacent to these aforementioned peaks in decorated sherds.

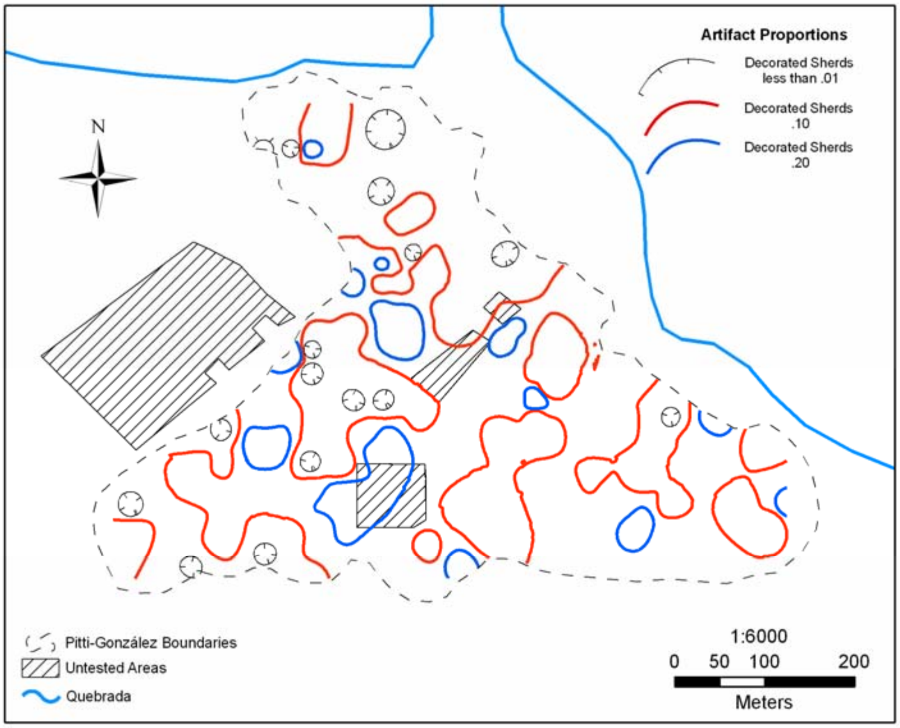

Figure 101. Proportions of decorated sherds within Early Bugaba Pitti-González.

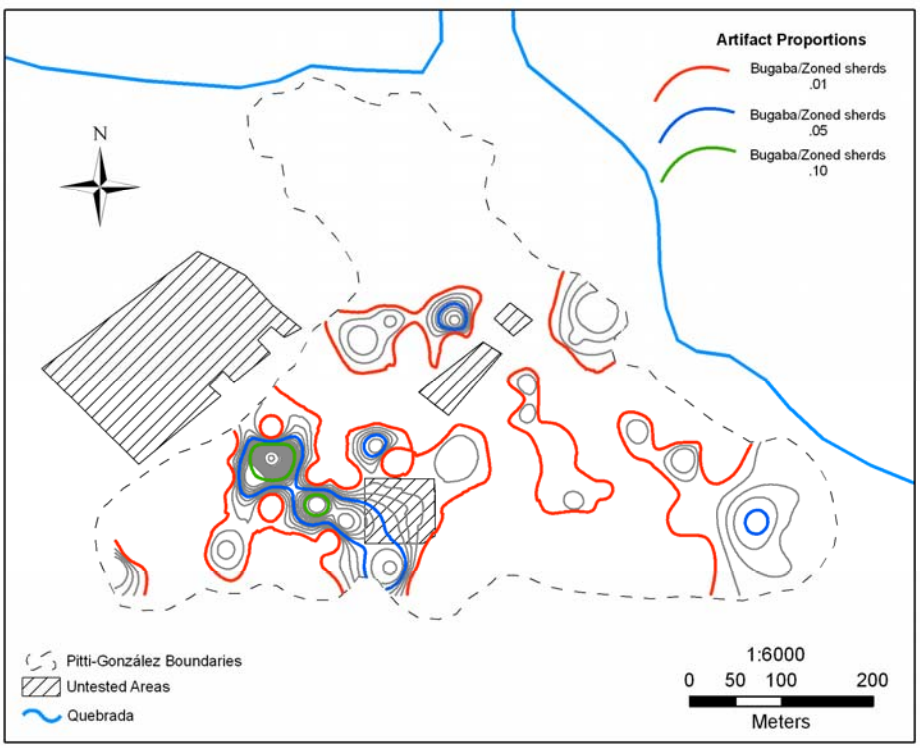

Figure 102. Proportions of fancy sherds within Early Bugaba Pitti-González.

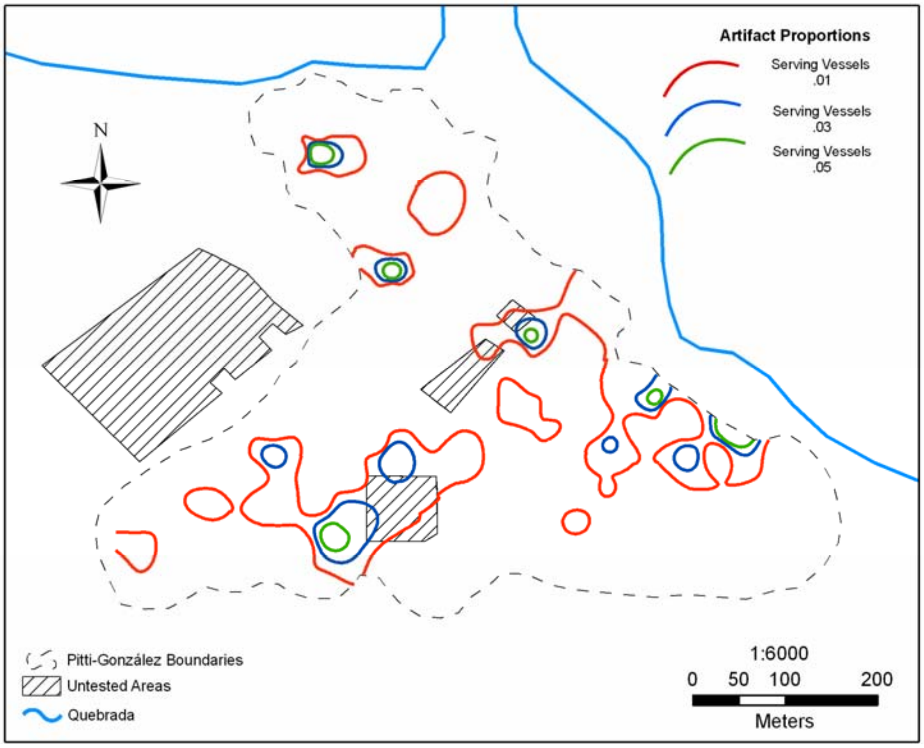

Figure 103. Proportions of serving vessels within Early Bugaba Pitti-González.

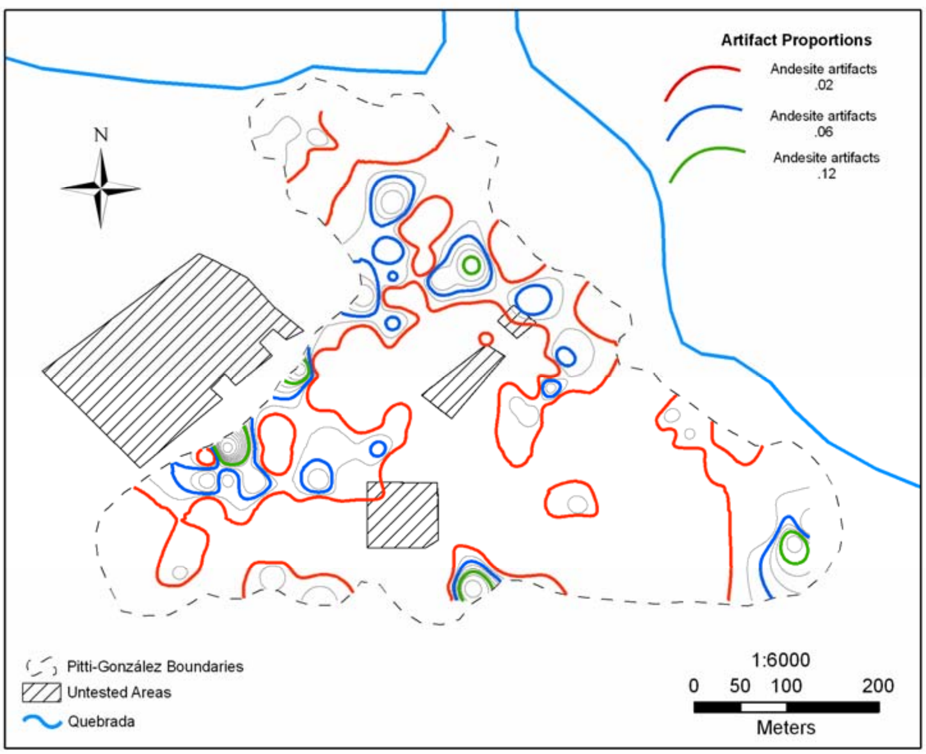

Figure 104. Proportions of andesite artifacts within Early Bugaba Pitti-González.

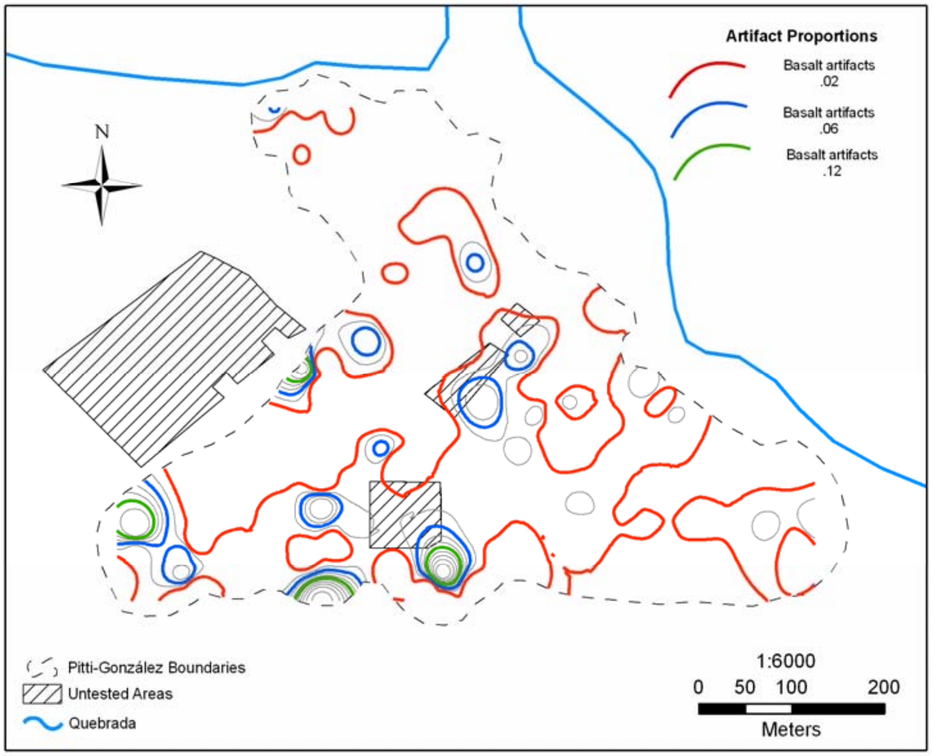

Figure 105. Proportions of basalt artifacts within Early Bugaba Pitti-González.

6.3 OCCUPATIONAL DIFFERENTIATION

In absolute terms, the Early Bugaba Barriles sample included few artifacts related to occupational activities. Of these, production artifacts (a total of 83 primary flakes or core fragments) tended to be concentrated in the central area of the site (figure 106), typically beside areas containing elevated proportions of fancy and decorated sherds. Other lithic debitage, thought to be generally related to stone tool repair and maintenance activities, was more broadly distributed throughout the village, with peaks in these proportions being found in nearly every part of the site (figure 107). Only one piece of axe-related material, a polish flake, was present in the single-component samples (figure 108) and is spatially associated with a peak in lithic repair debris.

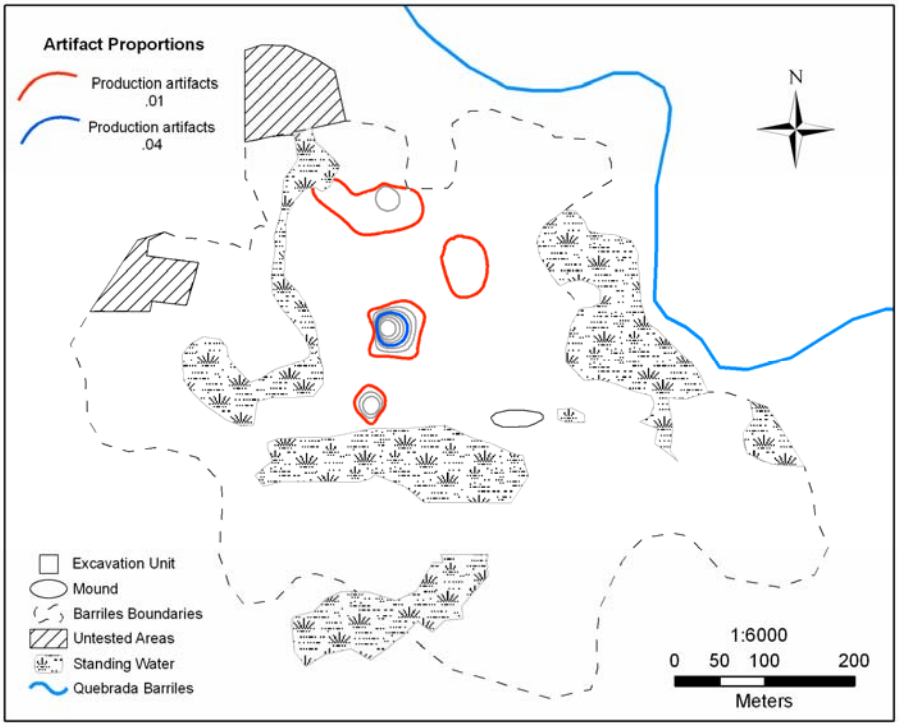

Figure 106. Proportions of lithic production artifacts within Early Bugaba Barriles.

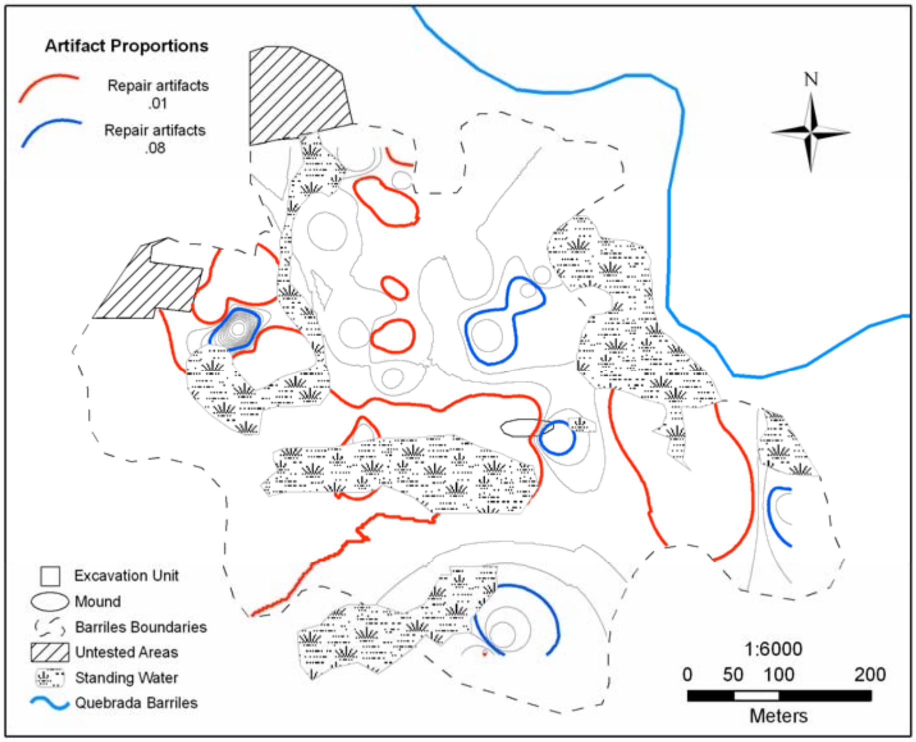

Figure 107. Proportions of lithic repair or maintenance artifacts within Early Bugaba Barriles.

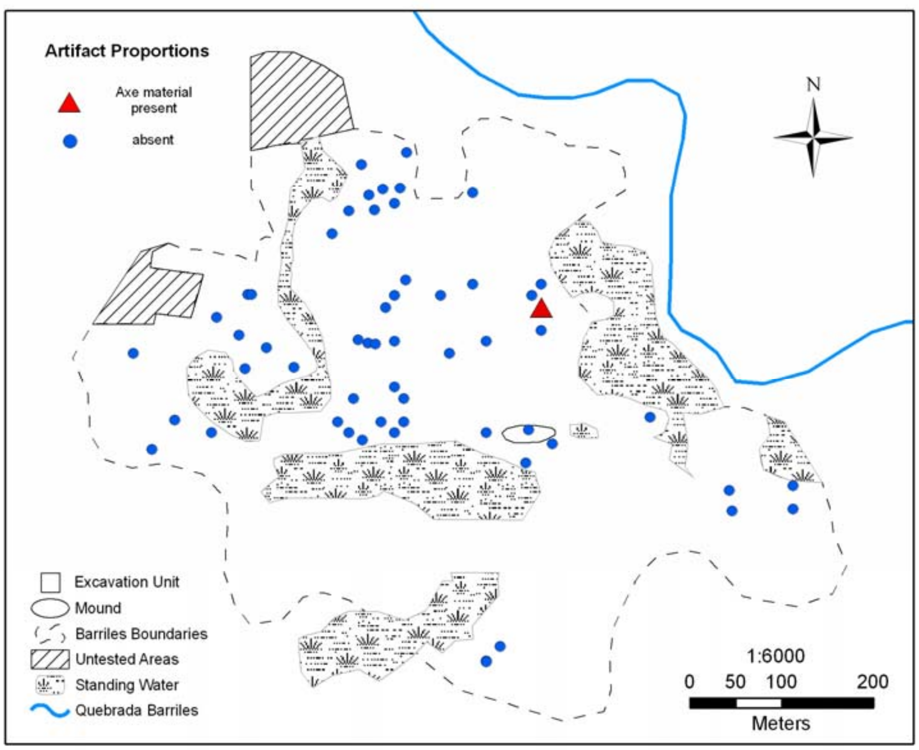

Figure 108. Presence or absence of axe material within Early Bugaba Barriles.

There was considerably more evidence for involvement of stone tool manufacture and maintenance at Pitti-González than at Barriles during the Early Bugaba Phase. Unlike Barriles, production related lithic artifacts were more widespread throughout the village (figure 109), and peaks in these distributions did not appear to have an especially strong or clear spatial association to the higher status areas defined by fancy and decorated sherd proportions. Lithic repair and maintenance activities appear to be even more widespread than production (figure 110). Virtually every collection lot at Pitti-González contained at least one secondary or tertiary flake. Peaks in the distribution of these artifacts were generally found towards the site boundaries where lots with fewer artifacts were found, so many of these peaks were likely influenced by issues of sample size. The distribution of axes, most found towards the site's eastern boundary (figure 111), may also have suffered from the same problems. However, slightly higher proportions of production evidence, repair flakes, and axe related artifacts were found at Pitti-González than at Barriles (figure 85). This occupational difference did not appear to have been clearly organized in spatial proximity with areas of elevated social status.

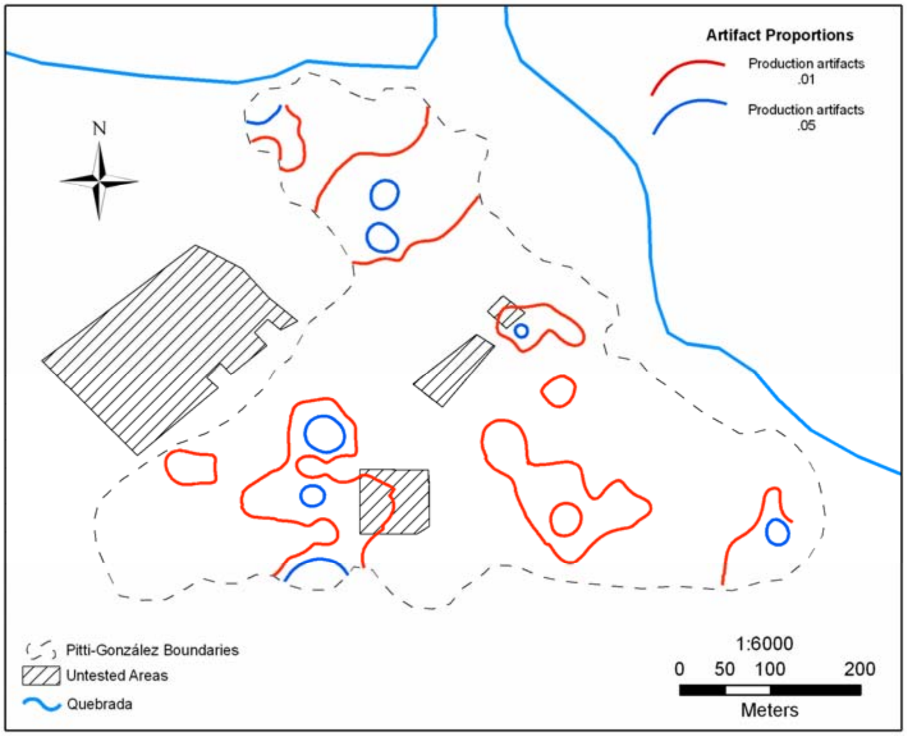

Figure 109. Proportions of lithic production artifacts within Early Bugaba Pitti-González.

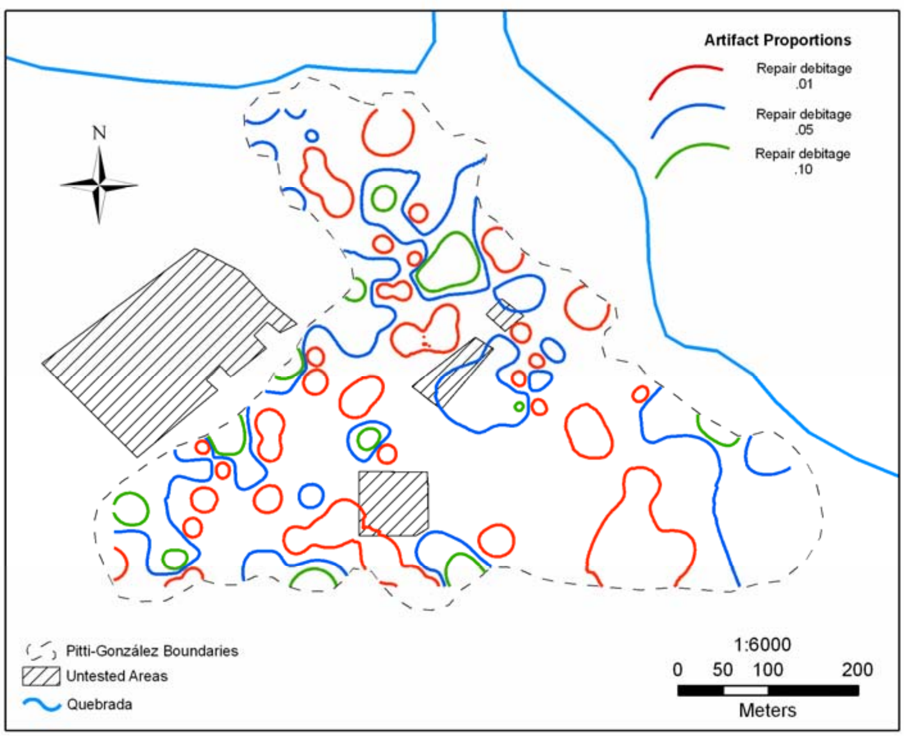

Figure 110. Proportions of lithic repair or maintenance flakes within Early Bugaba Pitti-González.

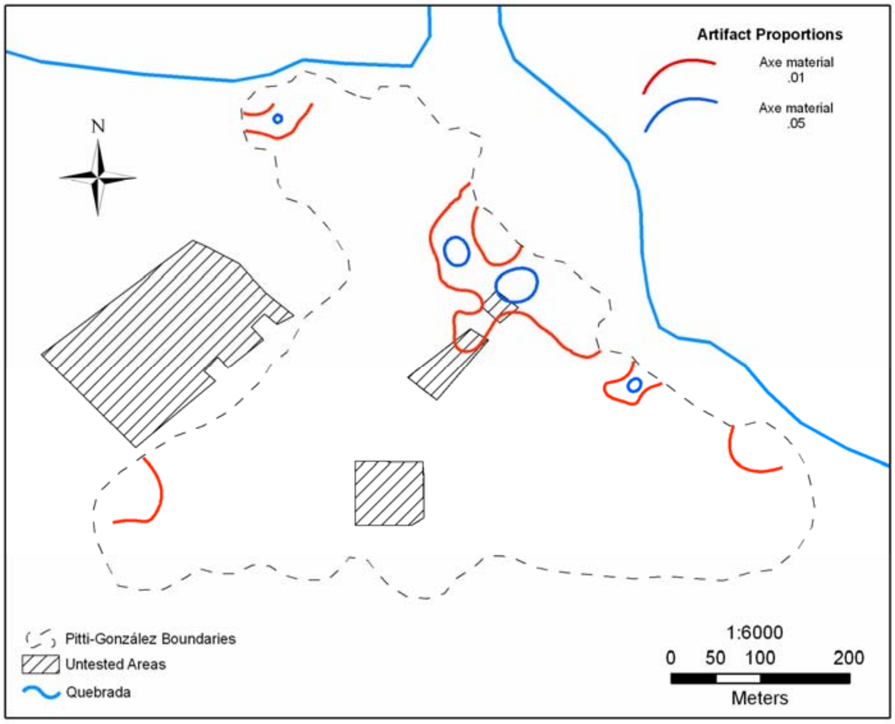

Figure 111. Proportions of axe material within Early Bugaba Pitti-González.

6.4 MULTIDIMENSIONAL SCALING

Scaling solutions are perhaps the easiest way to illustrate subtle variations along an almost infinite number of axes between domestic assemblages. Like the Concepción, the scaling figures presented below are based on Euclidean distance similarity matrices based on standardized variables, and utilized only single-component Early Bugaba Phase collection lots. With the sizeable samples of single-component lots (74 from Barriles, 85 from Pitti-González), this technique has greater potential to show general trends despite the presence of idiosyncratic variation than it did with the smaller Concepción sample. Specific artifact categories which showed the clearest patterning are presented in a series of figures for each of the two village sites. All of these figures illustrate similarities and differences in particular artifact proportions using size or color symbology. In all of these, the larger the circle or the hotter the color, the larger the proportion for a particular artifact class in the sample.

Figures 112 and 116 illustrate the scaling solutions (each using 3 dimensions with a Kruskal stress of .10) for Barriles and Pitti-González respectively. When compared to the artifact-by-artifact scaling plots for Barriles (figures 113 to 115) and Pitti-González (figures 117 to 119), a common theme emerges. In both villages, samples toward one of the scale tended to contain higher proportions of fancy and decorated sherds, a unsurprising correlation since all fancy sherds are also be decorated by definition. These lots corresponded only moderately well with elevated proportions of cooking and serving vessels, while the fit between them and any other artifact class was generally very poor. Lithic production artifacts and basalt artifacts, almost without exception, did not correlate very well at all with collections containing elevated proportions of fancy or decorated sherds. Collections with elevated proportions of basalt and production flakes either lay at the opposite end of the scale than the fancy and decorated lots, or constituted a subtle but perhaps separate axis of variation. Only in Pitti-González did high proportions of repair debitage correlate with elevated social status, a noticeable difference than observed in Barriles. In both sites, the presence of this separate axis depended very heavily on a handful of outlier values set off from the main cluster, but this pattern is suggestive that some houselots were engaged more intensively in lithic production, others in cooking and storage, but rarely both.

The resulting interpretation from these scaling plots, similar to that gained from the distributional maps, is that there was some variation in domestic activities, social status, and occupation, but as we shall see in Chapter 9, these differences remained relatively subtle, usually on the order of 1-3%. What is gained from the distributional maps, rather than the scaling plots, was the recognition of a moderately strong and regular spatial proximity relationship between areas with high proportions of fancy or decorated sherds and areas with elevated lithic production proportions. These will be revisited in further detail in the concluding chapter.

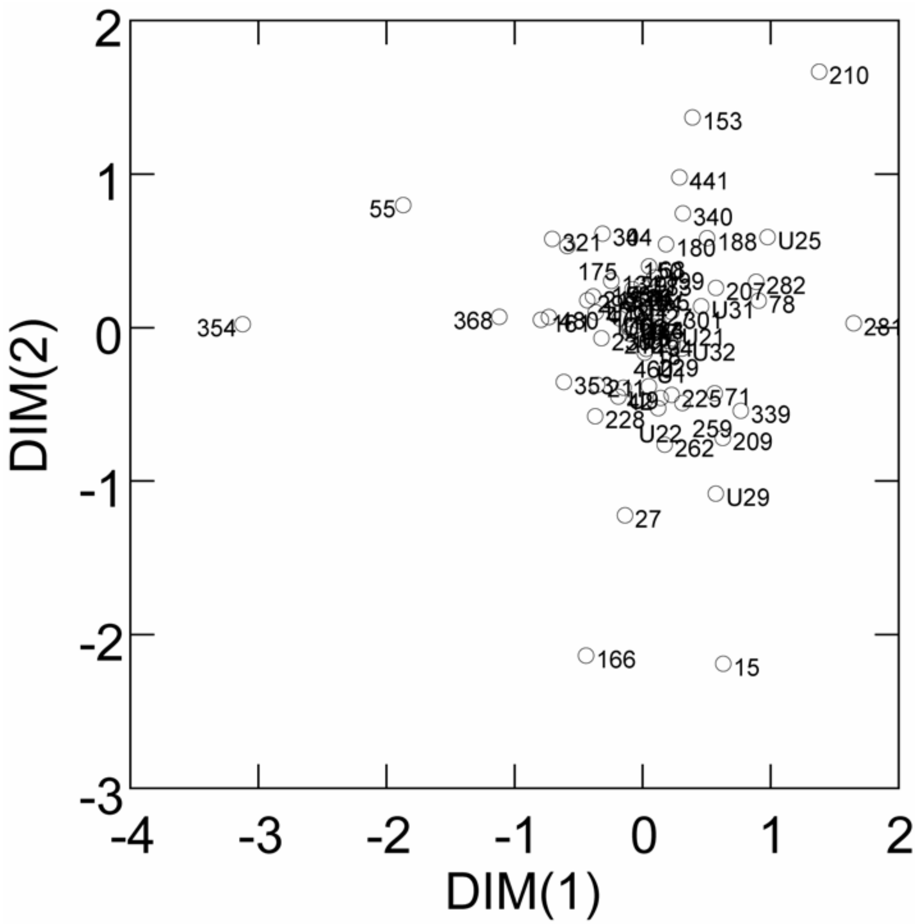

Figure 112. Early Bugaba proveniences from Barriles. Excavation strata begin with 'U', the others are single-component shovel tests.

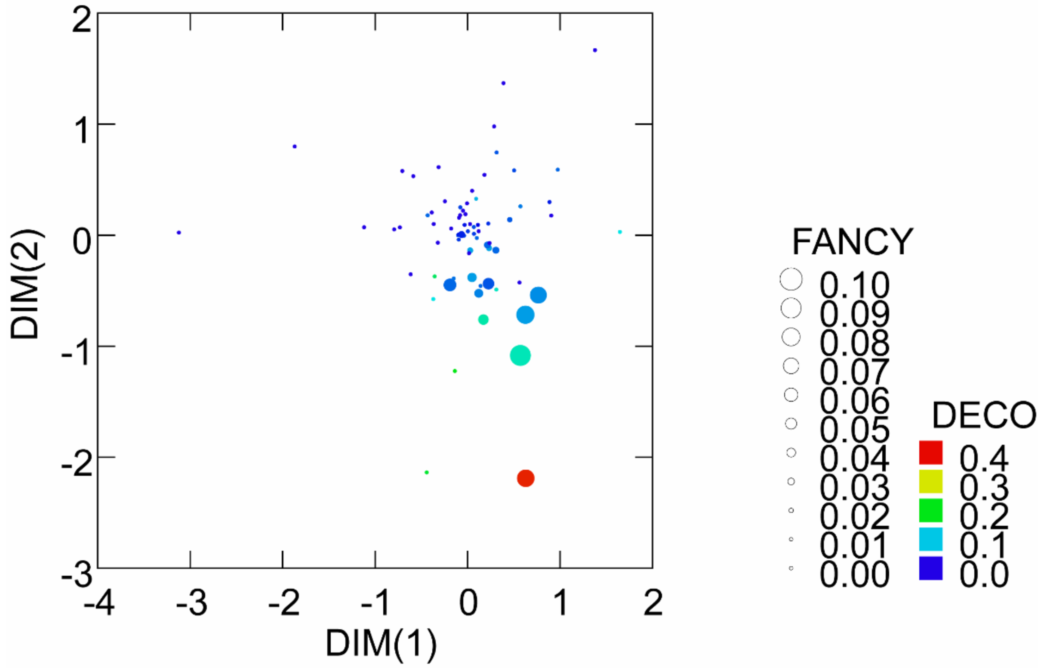

Figure 113. Scatterplot illustrating variation in fancy and decorated sherd proportions within Early Bugaba Barriles.

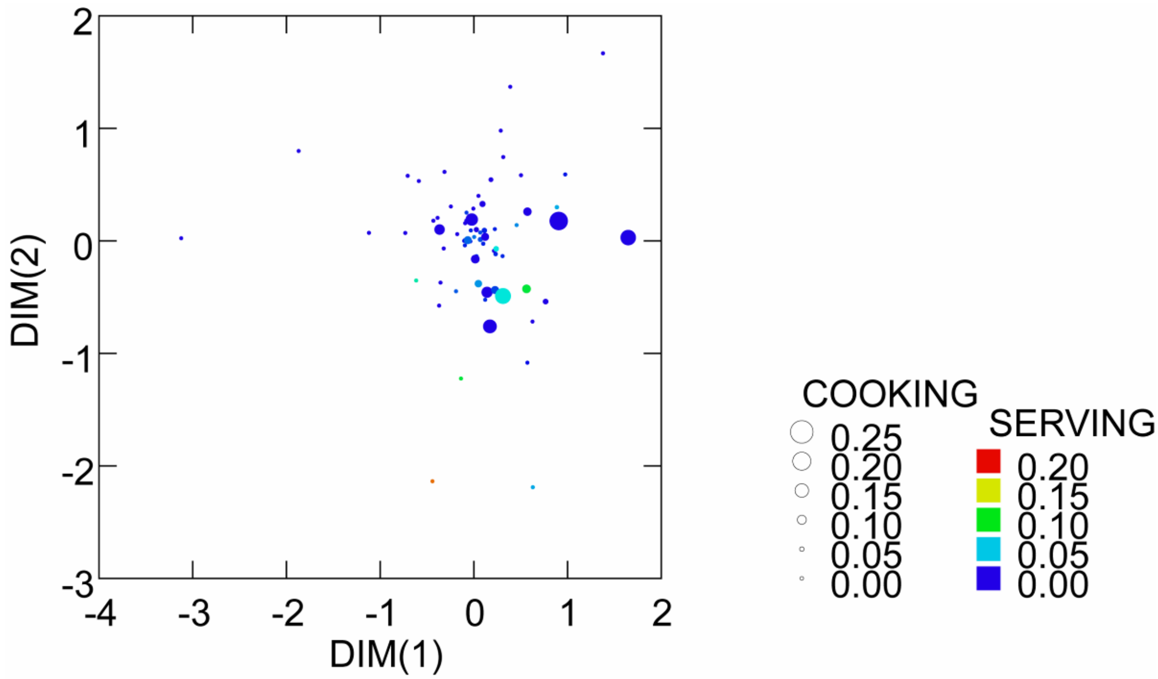

Figure 114. Scatterplot illustrating variation in cooking and serving vessel proportions within Early Bugaba Barriles.

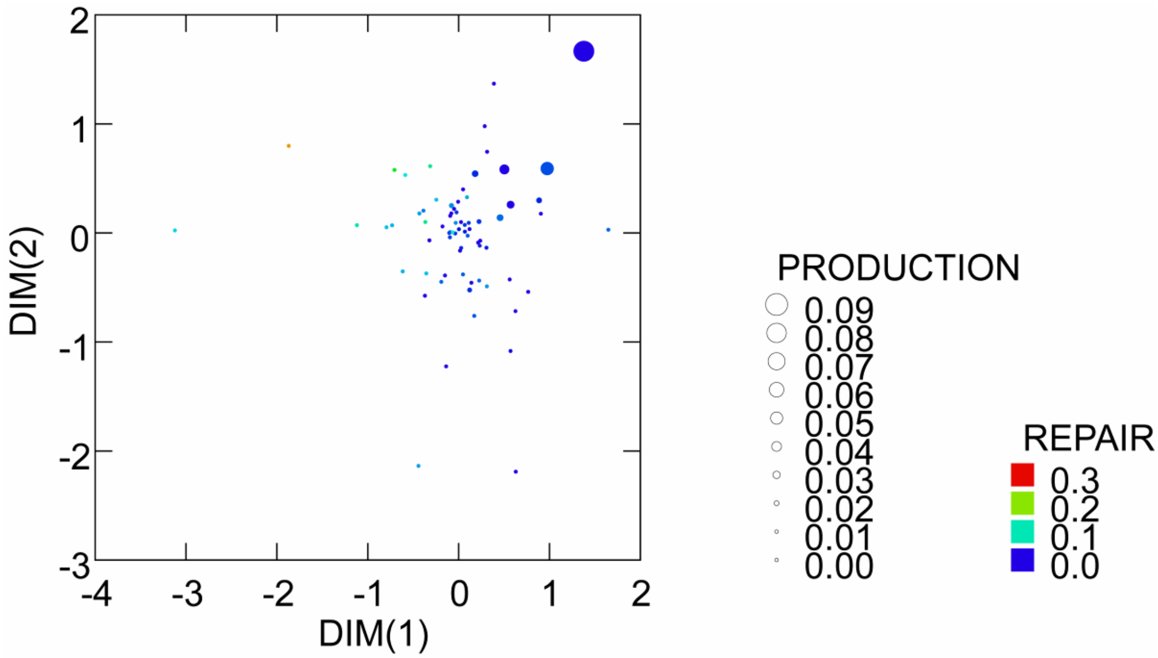

Figure 115. Scatterplot illustrating variation in lithic production and repair artifact proportions in Early Bugaba Barriles.

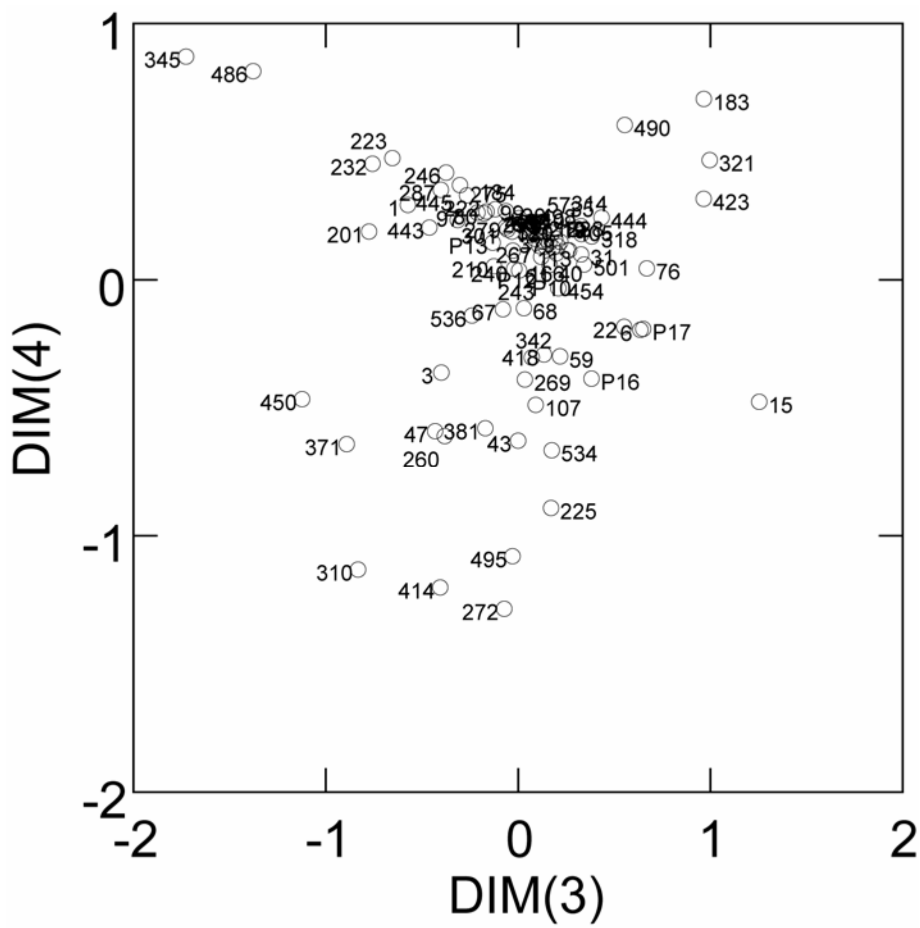

Figure 116. Early Bugaba phase proveniences from Pitti-González. Excavation strata begin with 'P', others are single-component surface collections.

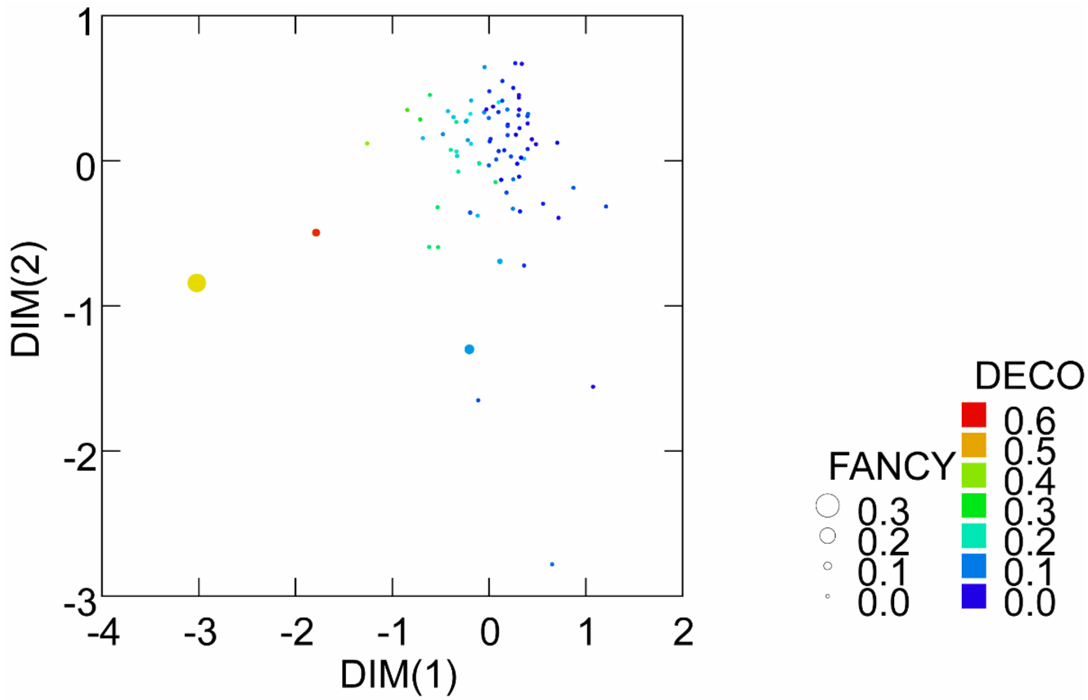

Figure 117. Scatterplot illustrating fancy and decorated sherd proportions within Early Bugaba Pitti-González.

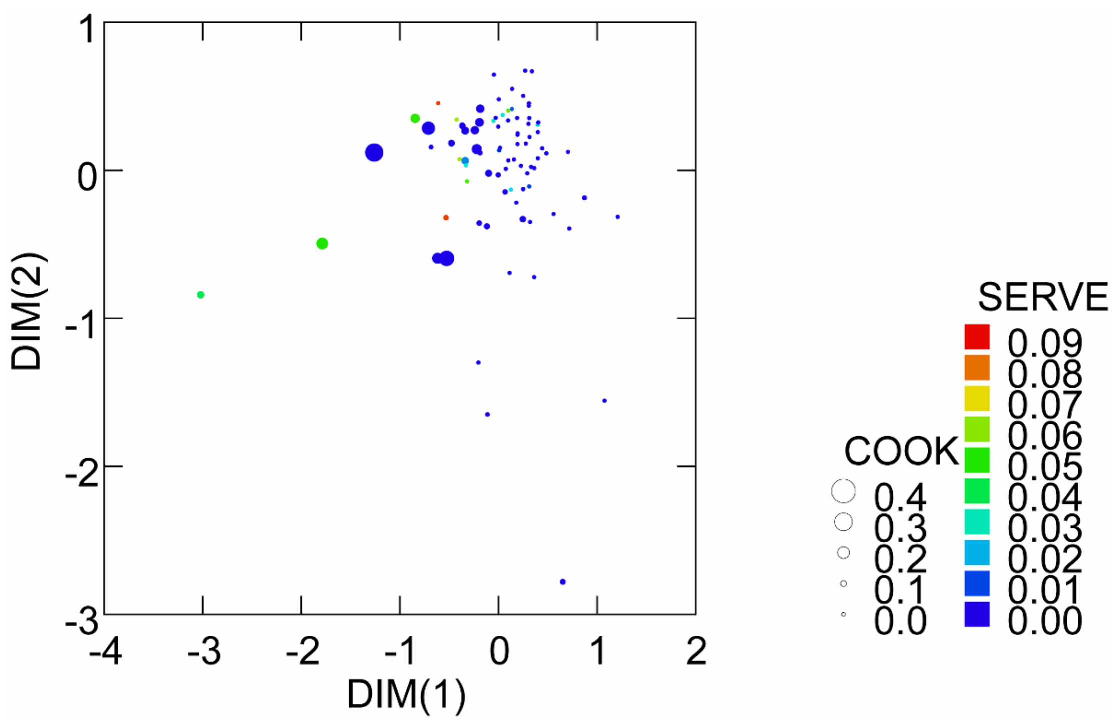

Figure 118. Scatterplot illustrating cooking and serving vessel proportions within Early Bugaba Pitti-González.

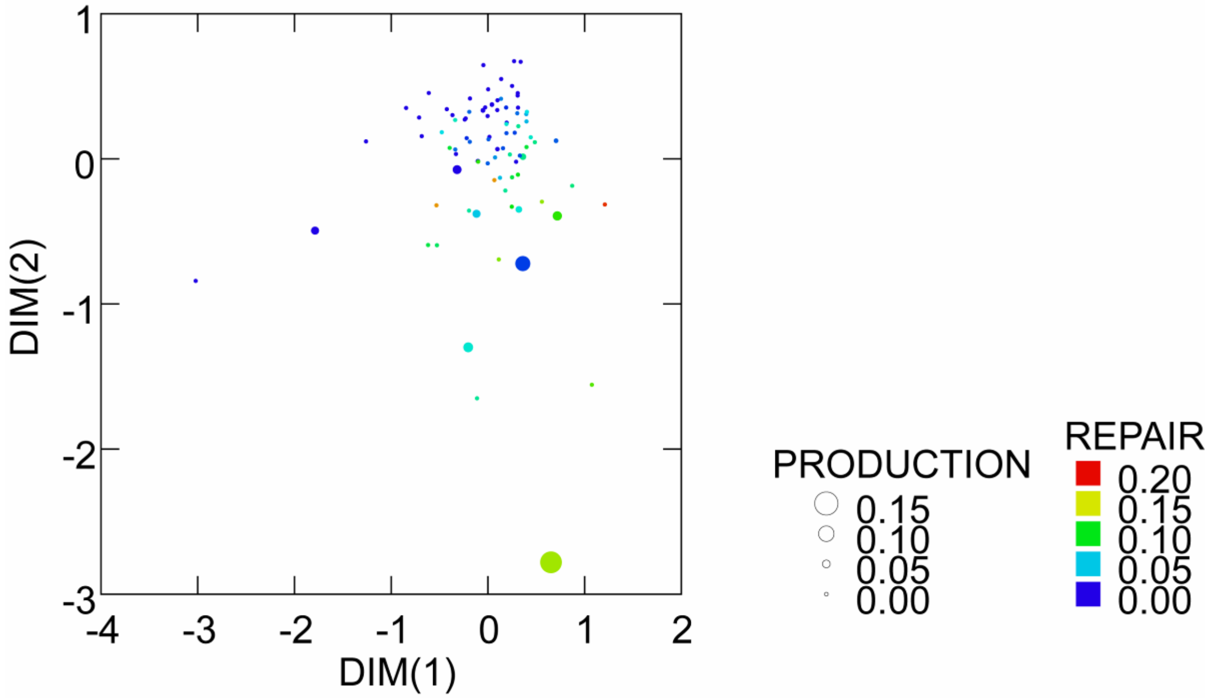

Figure 119. Scatterplot illustrating lithic production and repair artifact proportions within Early Bugaba Pitti-González.

6.5 SYNTHESIS

The Early Bugaba Phase was one associated with the growth of the emergent villages of Barriles and Pitti-González. Stronger differences in artifact proportions were recognizable if the villages and farmsteads were compared as analytical units at a regional scale (figures 83 to 85). From this perspective, the inhabitants of Pitti-González consumed higher proportions of decorated ceramics and contained more stoneworking evidence, social and occupational differences which may have persisted from the earlier Concepción. From the village scale, the evidence for forms of social or occupational differentiation within Barriles and Pitti-González remained relatively subtle. Both villages contained comparable residential populations, and there was no compelling evidence that either one assumed a more important political role during the phase. The preponderance of several Early Bugaba farmsteads (BU-8, BU-12, BU-19, and BU-43) among the sampled sites suggests that regional populations may have remained dispersed in the context of increasing regional population density. The developing villages at either end of the study area therefore probably did not have a profound gravitational pull on Formative populations, many of whom continued to live in individual farmsteads or hamlets as earlier Concepción populations had done.

The unusually high proportions of finished axe fragments, axe preforms, and lithic production or maintenance debris at the site of BU-19 argued against the idea that stone tool manufacture was organized, or redistributed though, either one of the small villages during the Early Bugaba. Individual farmsteads like BU-19 may have instead taken unique roles in the regional economy. Serving activities, however, were more conspicuous at village sites, and were associated with elevated proportions of cooking vessels. This suggests that a slightly more diverse range of activities may have occurred within the emergent villages, and these activities were most likely related to the production or presentation of food or drink. The lack of a clear correlation between these activities and the consumption of decorated ceramics or basalt lithics indicates that involvement in these activities did not result in an identifiable or lasting form of wealth accumulation.

7.0 LATE BUGABA PHASE (A.D. 600 TO 900)

The Late Bugaba Phase represented a time of maximum population density at Barriles, which had approximately twice the residential population as Pitti-González. Although very little is known about outlying farmsteads or hamlets, the differences between Barriles and Pitti-González suggest the possibility that a regional settlement hierarchy may have emerged in the Upper Chiriquí Viejo. The few features that made Barriles a qualitatively distinct village in the area, including the small mound, statues, and perhaps cobble-lined house foundations, likely dated to this phase. The sequence of mound construction appears to have begun sometime towards the terminal Early Bugaba and was completed at some point during the Late Bugaba, at which point the mound feature was surfaced with river cobbles and small boulders. Mound excavations also revealed a qualitatively different set of artifacts, including miniature metates, enormous jars, tripod vessels, and ceramic rattles, which might suggest that particular ceremonial activities which made Barriles distinct were probably unique to the site, and a special set of material paraphernalia was restricted to the mound area specifically. Because the statues found by Stirling were spatially associated with the mound precinct (Rosenthal 1980), there is a reasonable chance that they dated to Late Bugaba Phase when the mound precinct was used intensively.

The Late Bugaba Phase is recognizable in both non-stratigraphic and excavated samples as containing more Valbuena and Plain Ware sherds than the earlier Cerro Punta Orange Ware sherds, though they remained present. The phase represented the maximum popularity of Bugaba

Engraved ware, and this increase accounts for the general increase in fancy wares among the sites sampled. Barriles was home to a residential population of 500 to1000 individuals, and our sample consists of 62 single-component shovels tests and excavation strata from 13 separate excavation units (figure 120). The residential population at Pitti-González remained relatively unchanged during the Late Bugaba, and population was estimated at 250 to 500 individuals. This site provided 86 single-component surface collections and strata from 5 separate excavation units (figure 121). Of the outlying sites sampled, only BU-2 contained any evidence for Late Bugaba occupation, but was probably only home to a small hamlet of 10 to 30 individuals.

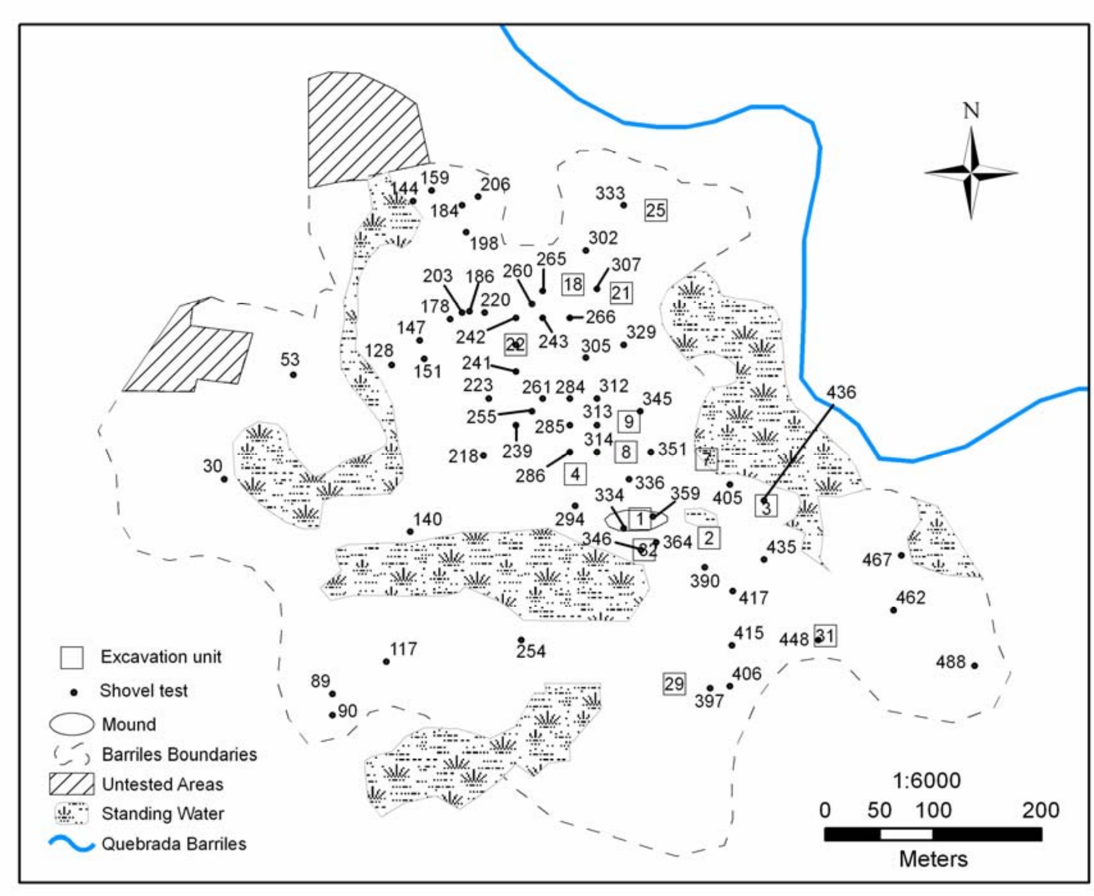

Figure 120. Map showing the location of Late Bugaba collection units within Barriles.

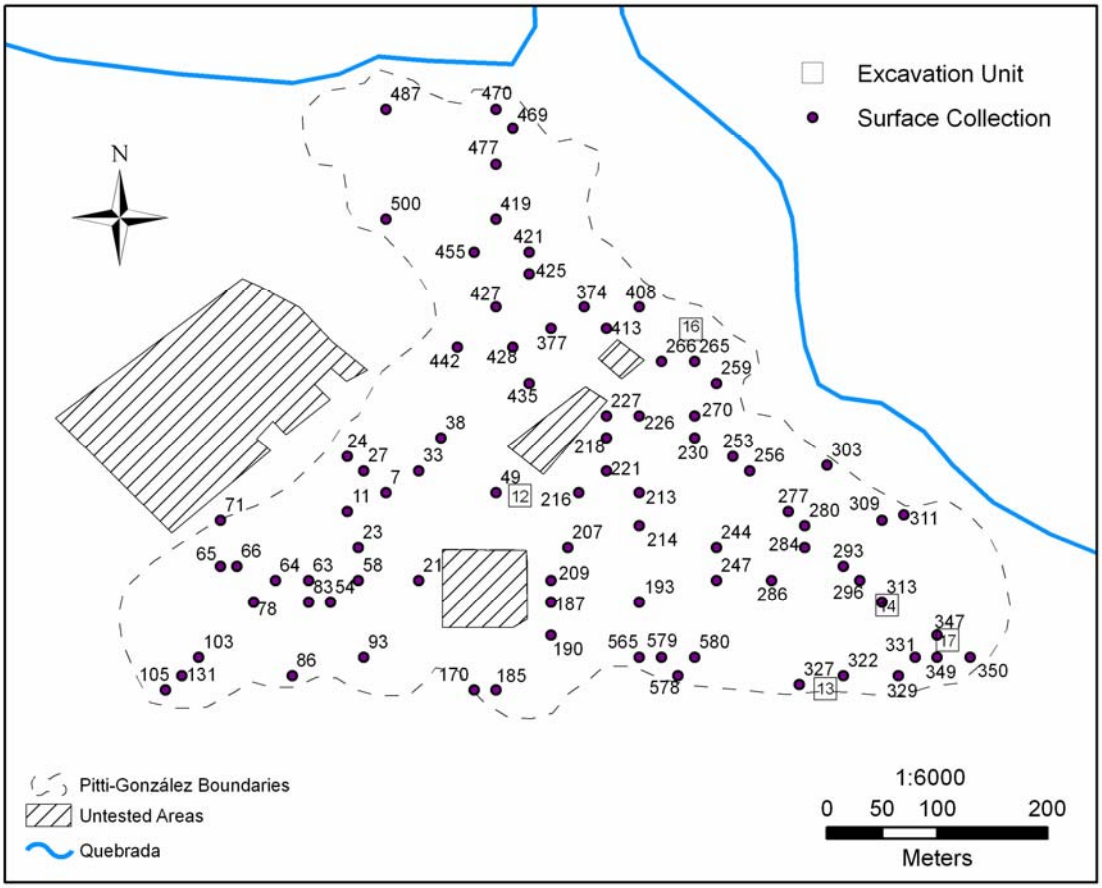

Figure 121. Map showing the location of Late Bugaba collection units within Pitti-González.

The lack of outlying sites in the sample complicates any attempt to adopt a regional perspective. Four of the smaller sites with identifiable Early Bugaba components, BU-8, BU-12, BU-18, and Dos Ríos, all failed to contain clear Late Bugaba Phase components. While BU-2 was classified as a small hamlet for the phase, it lies only 500 m north of Barriles and is probably a questionable indicator of regional trends elsewhere in the study area. The small sample of sites available to this project suggests that the Bambito gorge and perhaps the Cerro Punta Basin may have only contained low population densities during this time. Whether or not populations had become increasingly centralized around the growing village of Barriles remains an open question. Assuming only one smaller site out of every five was settled at all during the phase, averaging 20 or so individuals, we arrive at a very rough guess of a regional population of around 1400 individuals (these estimates plus those of Barriles and Pitti-González), or of a density of 23 individuals per km². This tentatively suggests that development of increasingly complex social organization during the Late Bugaba may have been associated with some degree of population centralization, but probably occurred in the absence of dramatic demographic changes across the broader region. As described in Chapter 4, population increase within both villages (and particularly at Barriles) may have resulted in localized population pressure, a potential problem which could have been exacerbated by a pattern of farmsteads and hamlets orbiting around these two villages. However, this remains little more than pure speculation at the moment.

Comparisons of artifact proportions between Barriles, Pitti-González, and BU-2 suggest many of the same similarities and differences between sites observed in the Early Bugaba Phase persisted into the Late Bugaba Phase. These differences, however, were more strongly pronounced and exaggerated by the Late Bugaba. Proportions of fancy and decorated sherds between Barriles and Pitti-González are illustrated in figure 122. While we can be confident that Barriles had slightly more fancy sherds on average, Pitti-González had approximately three times as many decorated sherds, many of which were not classified as fancy. While both sites contained more cooking and serving vessels than in the Early Bugaba (figure 123 versus figure 84), Barriles appeared to have contained slightly higher proportions of cooking vessels. Barriles also had dramatically higher proportions of serving vessels, nearly three times as many as found in Pitti-González. Pitti-González, by contrast, continued the pattern observed in the Early Bugaba of containing many more lithic artifacts, regardless of type or raw material (figure 124).

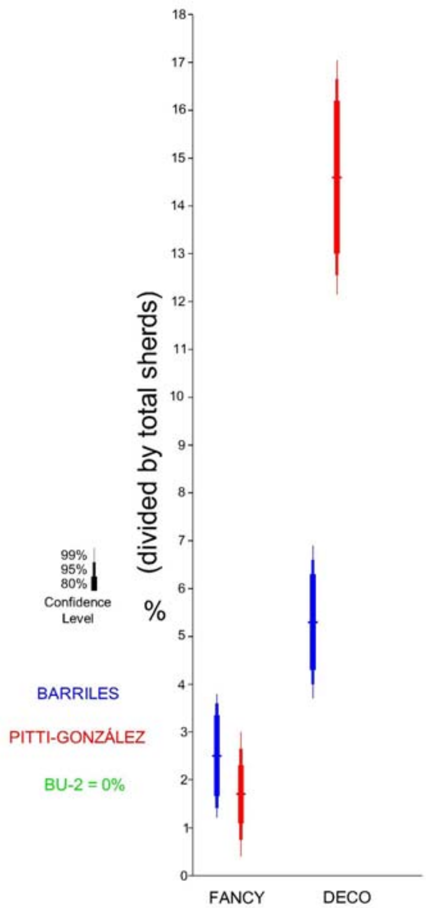

Figure 122. Statistical comparisons of fancy and decorated sherd proportions between Barriles, Pitti-González, and BU-2.

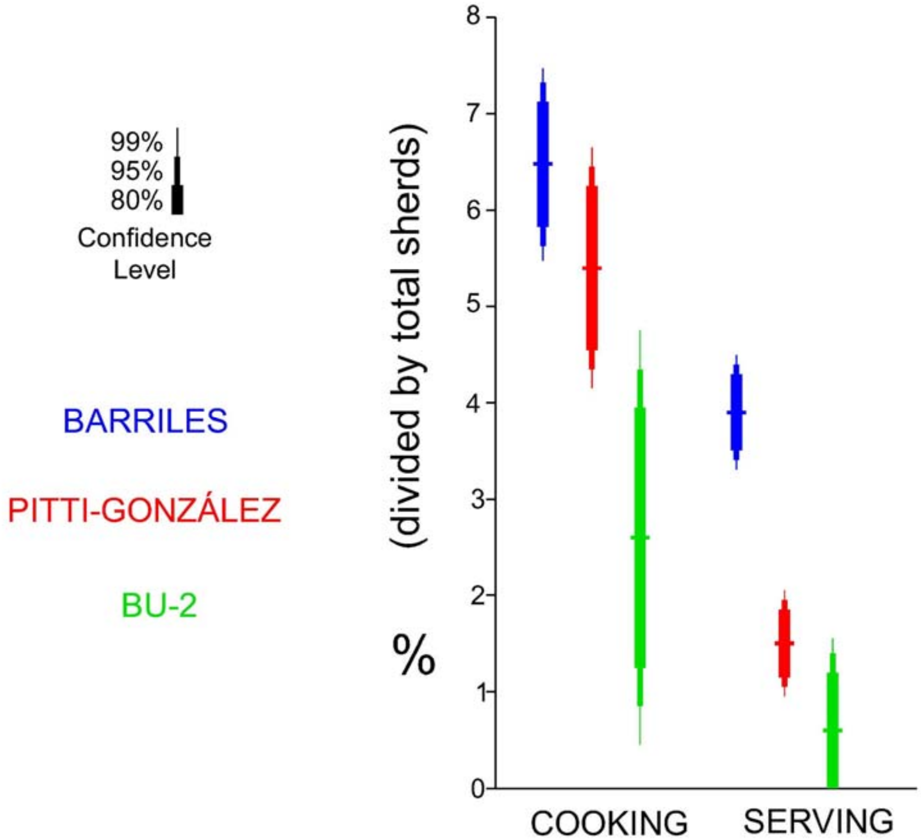

Figure 123. Statistical comparisons of vessel types between Barriles, Pitti-González, and BU-2.

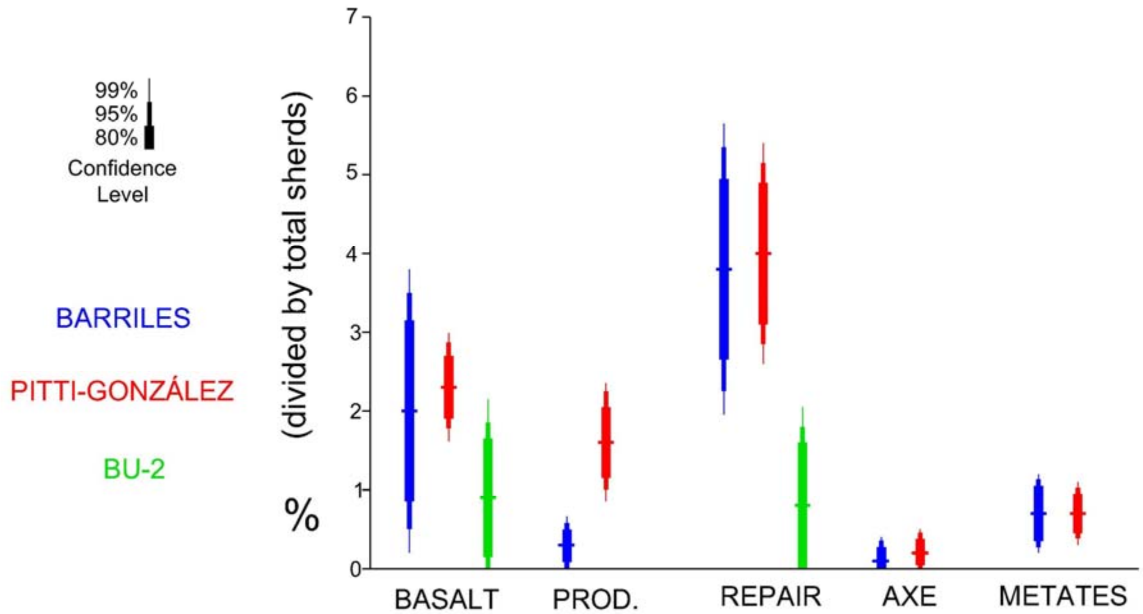

Figure 124. Statistical comparison of chipped and groundstone artifact proportions between Barriles, Pitti-González, and BU-2.

7.1 DOMESTIC ACTIVITIES

Like the previous Early Bugaba Phase, the evidence suggested that inhabitants of nearly every sector of Barriles participated in domestic activities. Figures 125 to 127 illustrate the distribution of undecorated sherds, coarse sherds, and cooking wares (all divided by total identifiable sherds) throughout the prehistoric village. Typical collection lots contained approximately 95% undecorated sherds, roughly 40% coarse sherds, and 1-3% cooking vessels. Substantial variations were observed in the frequencies of these artifacts, with some houselots containing half as many coarse sherds and two to three times the typical proportions of cooking vessels. The relatively subtle variations in domestic activities across Barriles still appear to be present in many of the same portions of the site. These variations do, however, seem slightly more exaggerated on average, with site-wide averages in proportions of coarse sherds and cooking vessels doubling from the proportions observed in the Early Bugaba.

As in the Early Bugaba, there continued to be a spatial correlation between elevated proportions of coarse sherds (>60%) and high proportions of undecorated sherds (>90%), but this association was not nearly as strong and regular as observed during the previous phase. Peaks (>10%)in the distribution of cooking vessels were the most noticeable variations present in the Late Bugaba village, with many of these weakly to negatively associated with areas containing high proportions of undecorated and coarse sherds. There was a moderately strong relationship between peaks in cooking vessels and the distribution of *mano* or *metate* fragments across the site. Many collection lots with high proportions of cooking vessels were the same as, or immediately beside, those lots containing elevated proportions of *mano* or *metate* fragments. While domestic activities continued to be performed by virtually every houselot at Barriles, cooking and storage activities appeared to intensify for the site as a whole during the Late Bugaba (along with Pitti-González), while there continued to be marked variation in the intensity of these activities internally throughout the village.

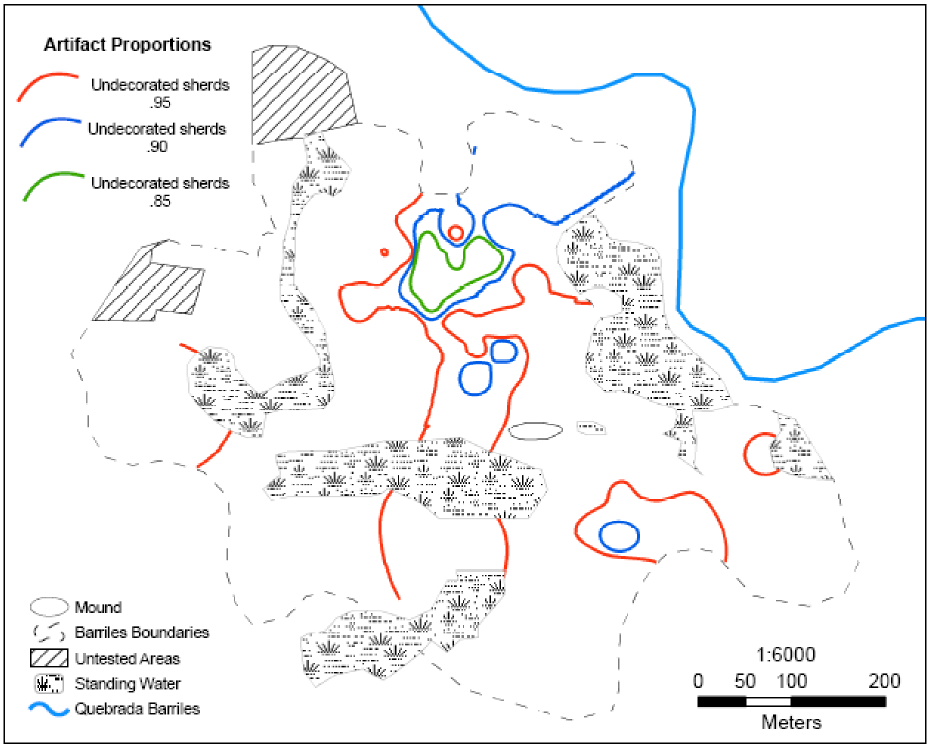

Figure 125. Proportions of undecorated sherds within Late Bugaba Barriles.

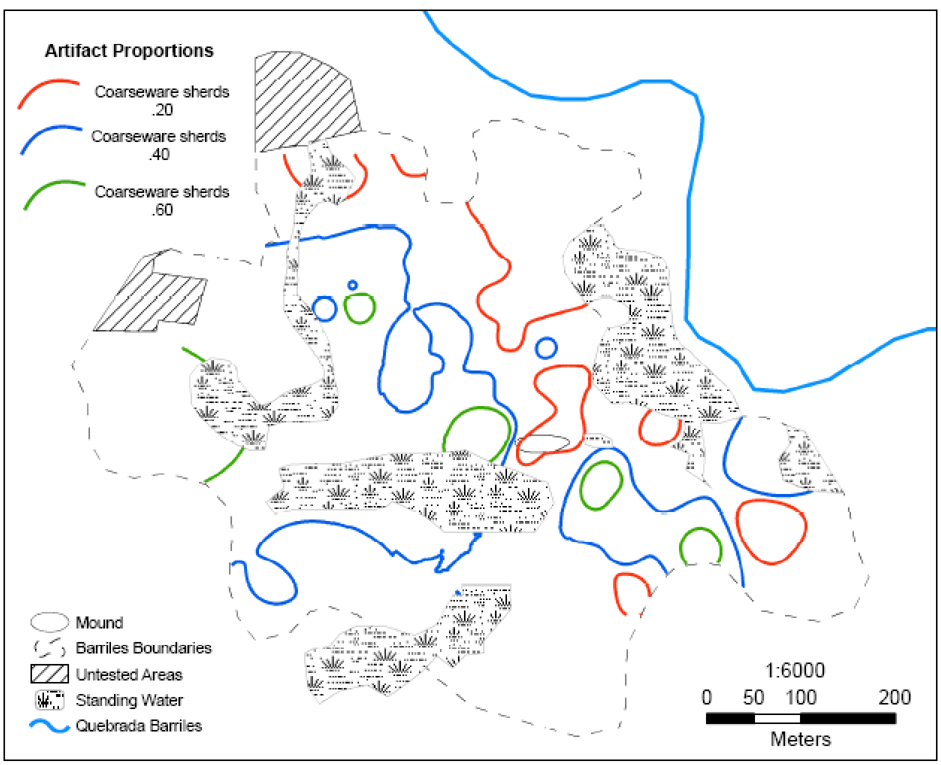

Figure 126. Proportions of coarse sherds within Late Bugaba Barriles.

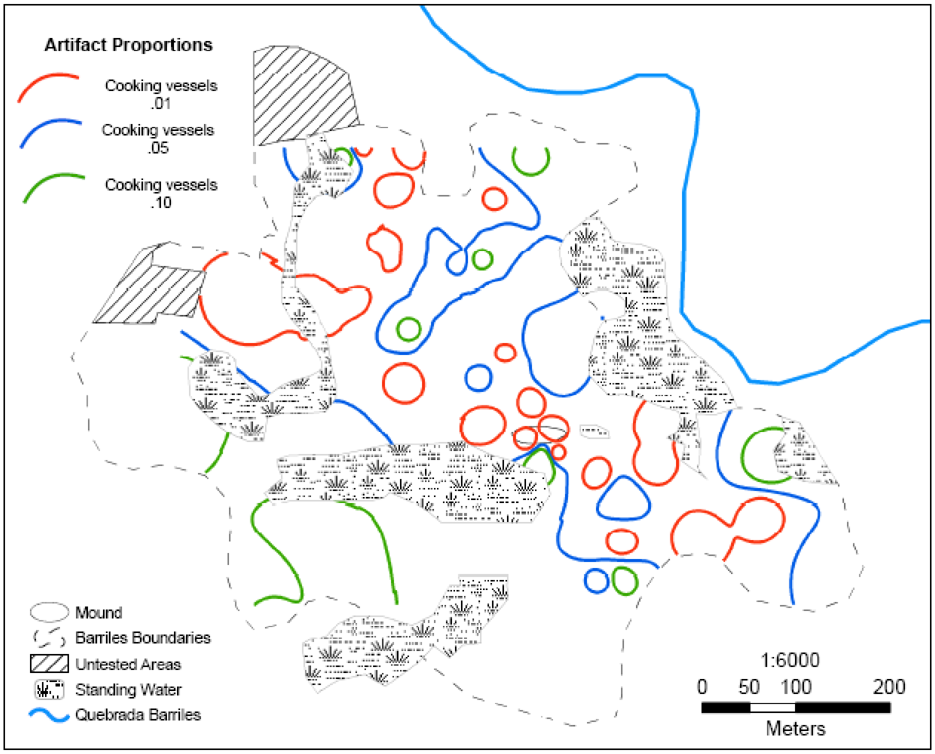

Figure 127. Proportions of cooking vessels within Late Bugaba Barriles.

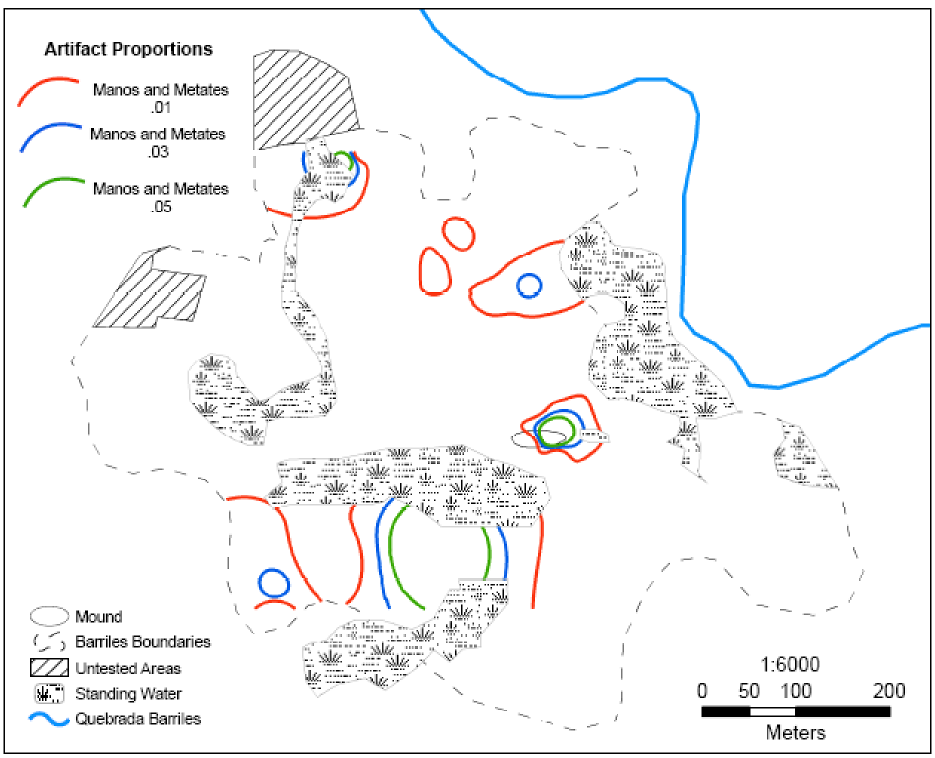

Figure 128. Proportions of *manos* or *metates* within Late Bugaba Barriles.

Pitti-González exhibited many of the same patterns observed at Barriles during the Late Bugaba Phase. Both undecorated (figure 129) and coarse sherds (figure 130) were widely distributed, though in slightly lower average proportions overall across the village. Cooking vessels were common, though they appeared to be relatively more restricted spatially than at Barriles (figure 131). The typical collection lot at Pitti-González contained roughly 90% undecorated sherds, greater than 10% coarse sherds, and 1-4% cooking wares. Like Barriles, there was a moderately strong spatial association between higher proportions (>30%) of coarse and undecorated sherds (>50%). Peaks in the distribution of cooking vessels (>10%) are perhaps most easily equated with cooking or storage activities, but failed to be spatially associated with many other supposed domestic activity artifacts, including the distribution of *manos* and *metates* (figure 132). *Manos* and *metates* appeared to much more random distributed (figure 132), but this particular distributional map probably doesn't paint a completely accurate picture. A great deal of very large *metate* fragments were found pushed into irrigation ditches and margins of fields of in the southeastern quarter of the site, a pattern was which not evident in other (similarly plowed) sections. In sum, nearly every houselot at Pitti-González performed domestic activities, but there existed subtle to strong variations in the intensities to which different domestic groups participated in these activities.

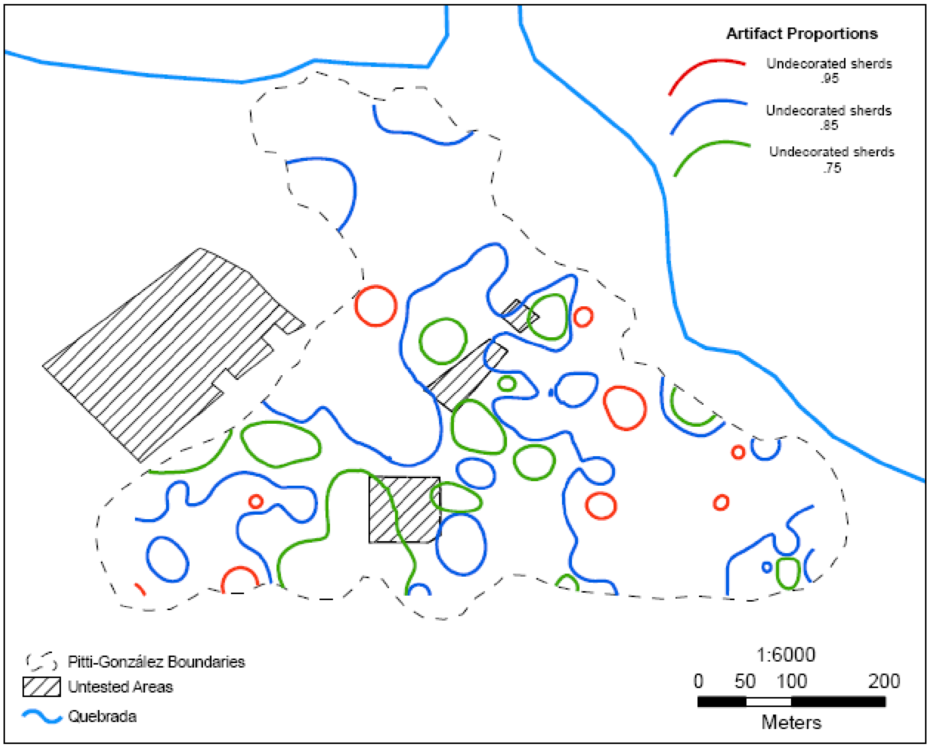

Figure 129. Proportions of undecorated sherds within Late Bugaba Pitti-González.

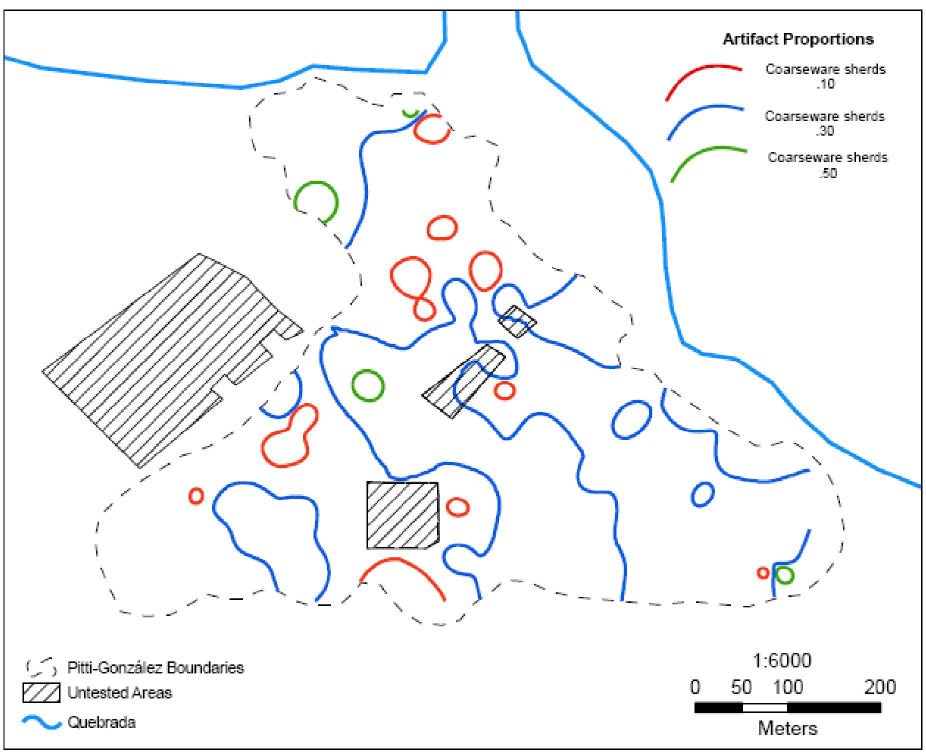

Figure 130. Proportions of coarse sherds within Late Bugaba Pitti-González.

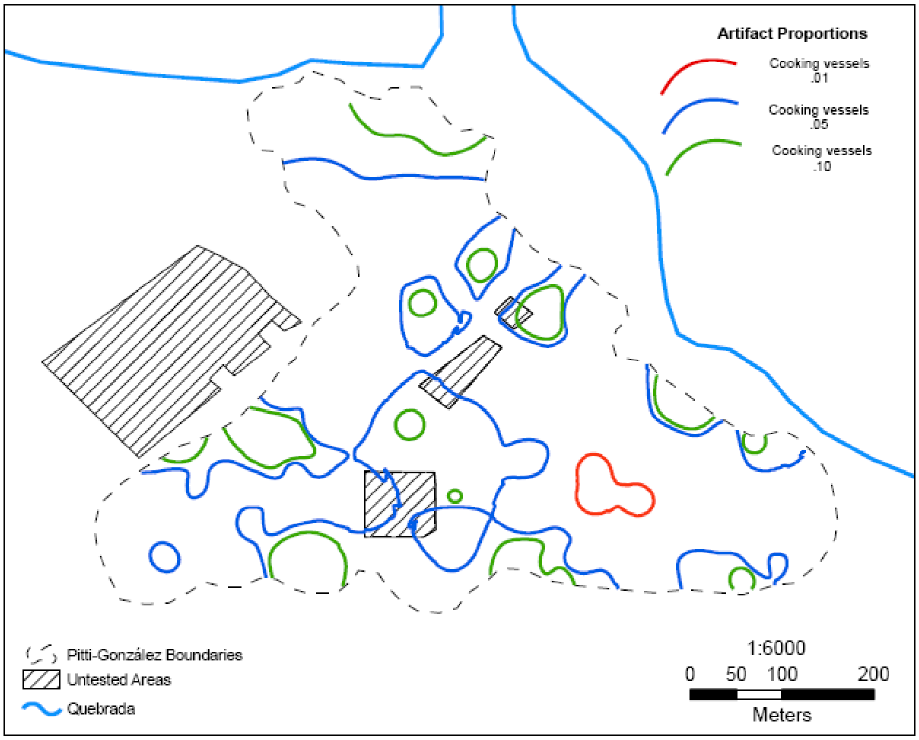

Figure 131. Proportions of cooking vessels within Late Bugaba Pitti-González.

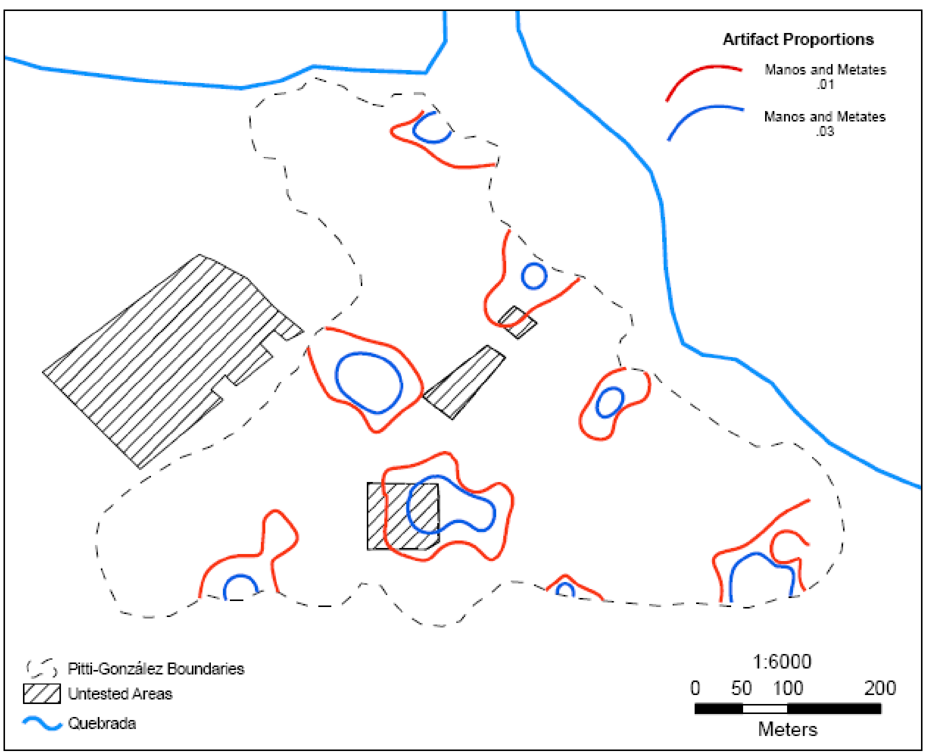

Figure 132. Proportions of *manos* or *metates* within Late Bugaba Pitti-González.

7.2 SOCIAL DIFFERENTIATION

The evidence for social differentiation appeared stronger and clearer than did variations in domestic activities. The distributions of both fancy and decorated sherds (figures 133 and 134) were spatially restricted at Barriles, confined largely to the mound area and to a 2 ha area 200 m north of the mound area. While many collections contained at least some decorated sherds (though rarely fancy sherds), there were noticeable peaks in these proportions in many of the same areas where fancy sherds predominated. Both these peaks appeared to be strongly correlated with elevated proportions of serving ware (figure 135), a point which will be returned to in the final chapter. This was not a completely circular or phantom association. As described before, many serving wares were indeed decorated or qualified as fancy, but this was also true for the Early Phase where this spatial association was much weaker. Besides serving activities, there was a weak to moderately strong association between decorated peaks and elevated proportions of cooking vessels, although the association appeared tighter between cooking vessels and the northern peak of decorated sherds than it did in the vicinity of the mound. Generally speaking, there were relatively few stone artifacts found at Barriles during the Late Bugaba, and regardless of whether they were crafted from andesite or basalt (figures 136 and 137), the majority of them were sandwiched between the aforementioned peaks in decorated sherds. This was probably not a spurious pattern influenced by small sample sizes, since collection lots in this area recovered fairly large samples, often between 50-100 artifacts per shovel test.

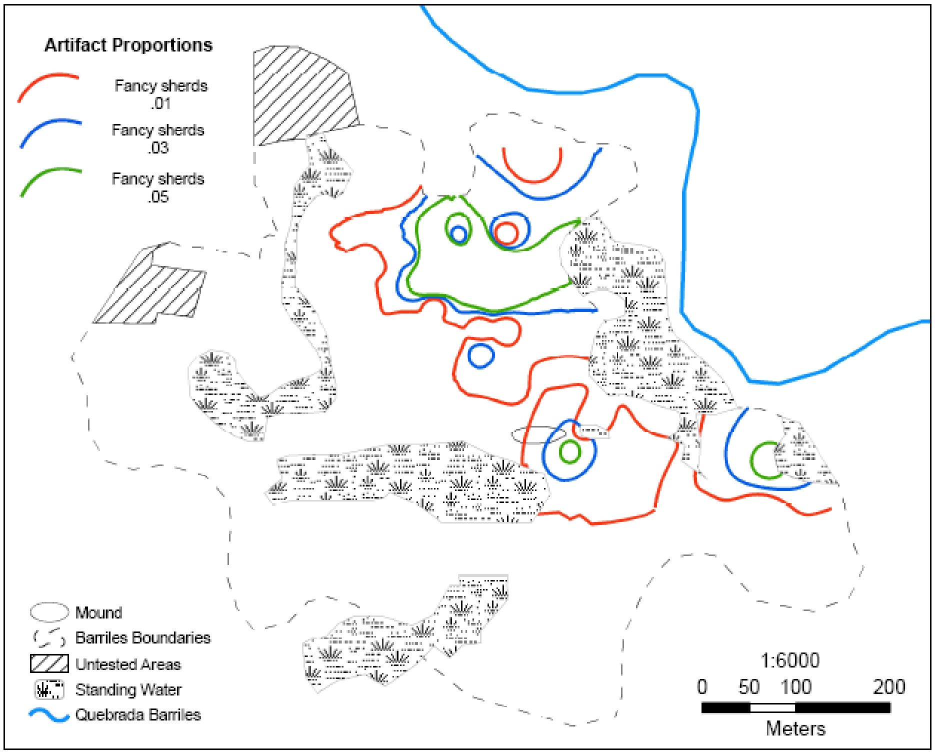

Figure 133. Proportions of fancy sherds within Late Bugaba Barriles.

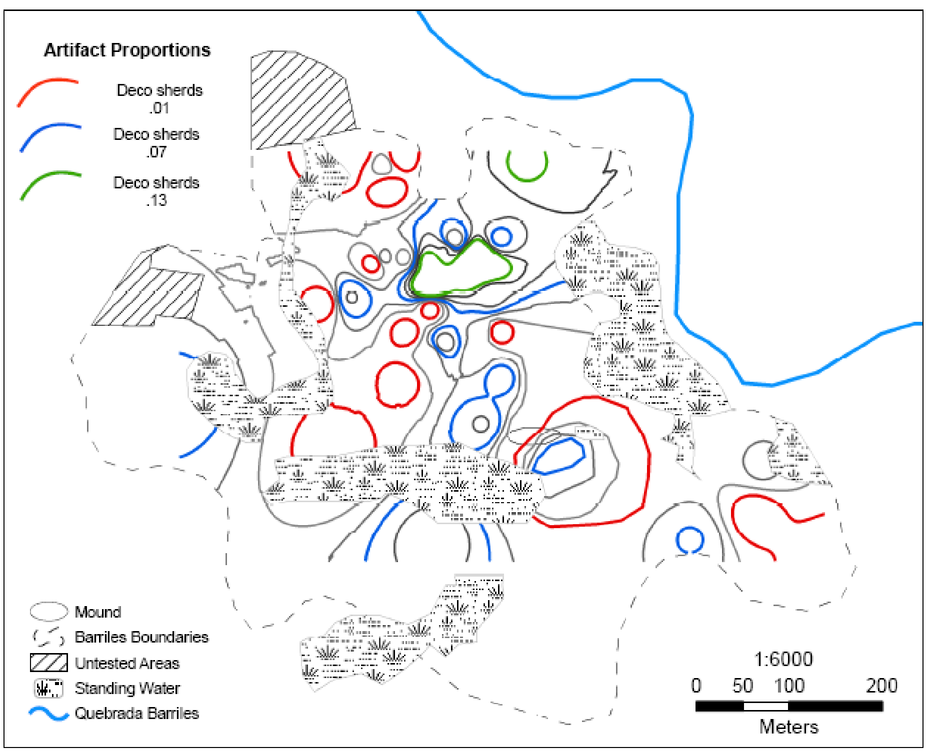

Figure 134. Proportions of decorated sherds within Late Bugaba Barriles.

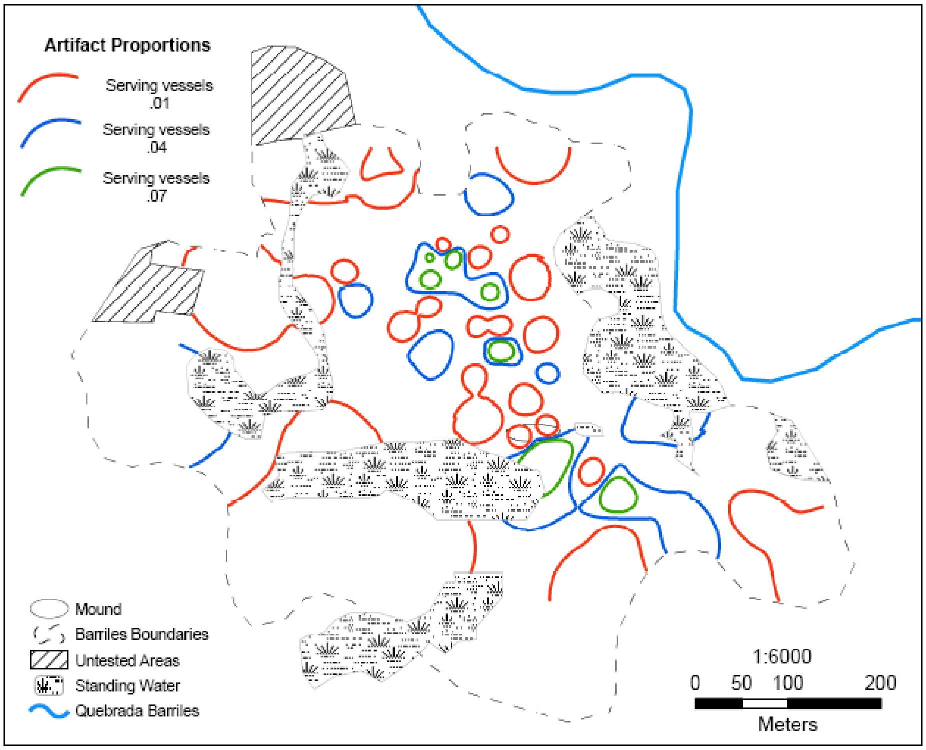

Figure 135. Proportions of serving vessels within Late Bugaba Barriles.

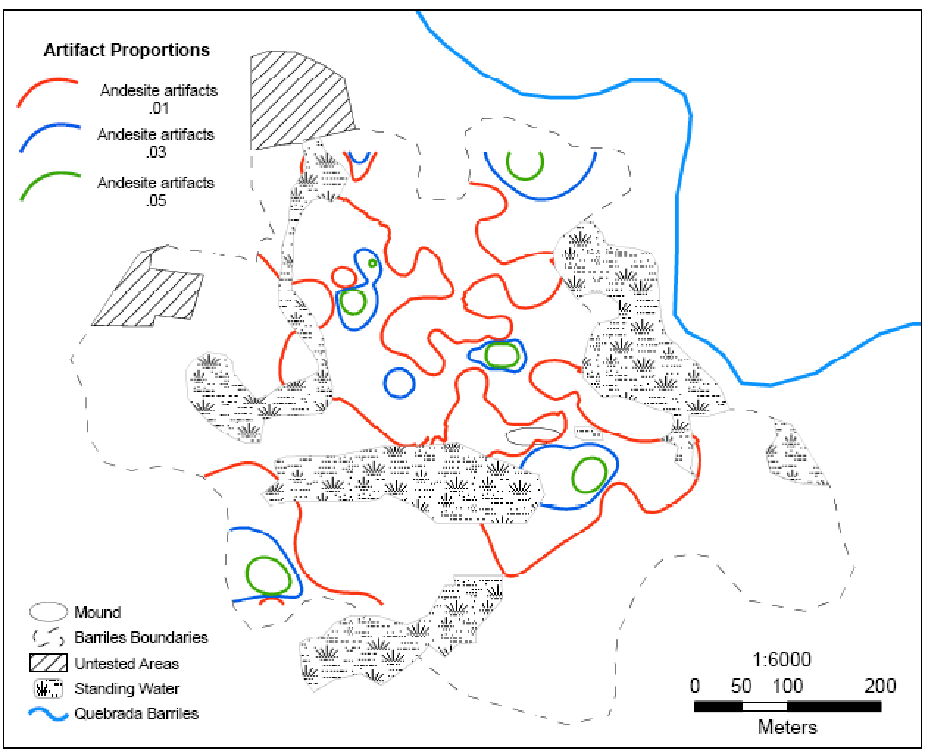

Figure 136. Proportions of andesite artifacts within Late Bugaba Barriles.

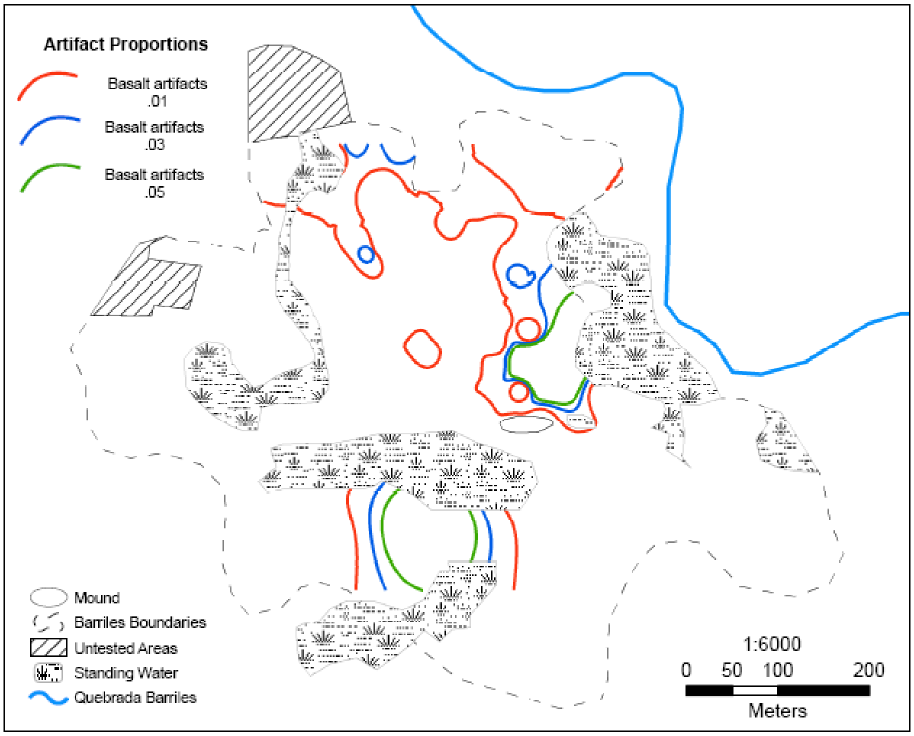

Figure 137. Proportions of basalt artifacts within Late Bugaba Barriles.

A different pattern was observed in Pitti-González for the Late Bugaba. Here the spatial association between higher proportions of serving vessels and elevated proportions of either fancy or decorated sherds was not nearly as clear or regular as observed in Barriles. The majority of the peaks in serving vessels (figure 140) were found distributed around broad areas generally removed from the contours representing concentrations of fancy sherds (figure 138). However, there was a slightly better association between serving vessels and decorated sherds (figure 139). There was a stronger association between peaks in decorated sherds with those of cooking vessels (compare figures 139 and 131), a pattern almost the opposite of that observed for Barriles. At Pitti-González, peaks in the distribution of cooking and serving vessels were rarely in regular spatial proximity, suggesting that it was probably rare that certain houselots (regardless of social status) regularly contained a greater diversity of vessel types than others.

Regardless of whether one prefers to analyze the distribution of andesite or basalt stone artifacts (figures 141 and 142), elevated proportions of each are found closely adjacent to, or occasionally within, peaks in the proportions of either fancy or decorated sherds. This was similar to the pattern observed 200 m north of the mound area at Barriles, but at Pitti-González this pattern involved significantly more stone artifacts in absolute terms. It was also a pattern that was highly unlikely to be the result of small sample size effects, since surface collections at Pitti-González enabled surveyors to collect roughly twice as many artifacts as shovel tests did in Barriles. Unlike Barriles, the distribution of artifacts connected in variable ways to domestic activities and social status suggested that domestic involvement in cooking, storage, and stone working activities were relatively more important in the Late Bugaba Phase Pitti-González than any other site in the sample.

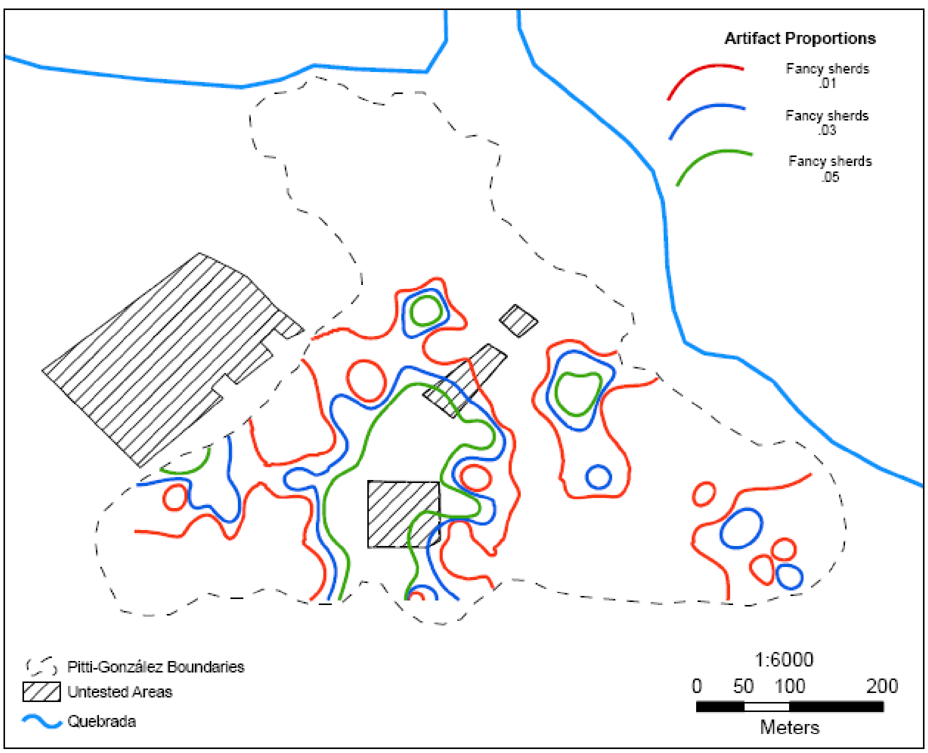

Figure 138. Proportions of fancy sherds within Late Bugaba Pitti-González.

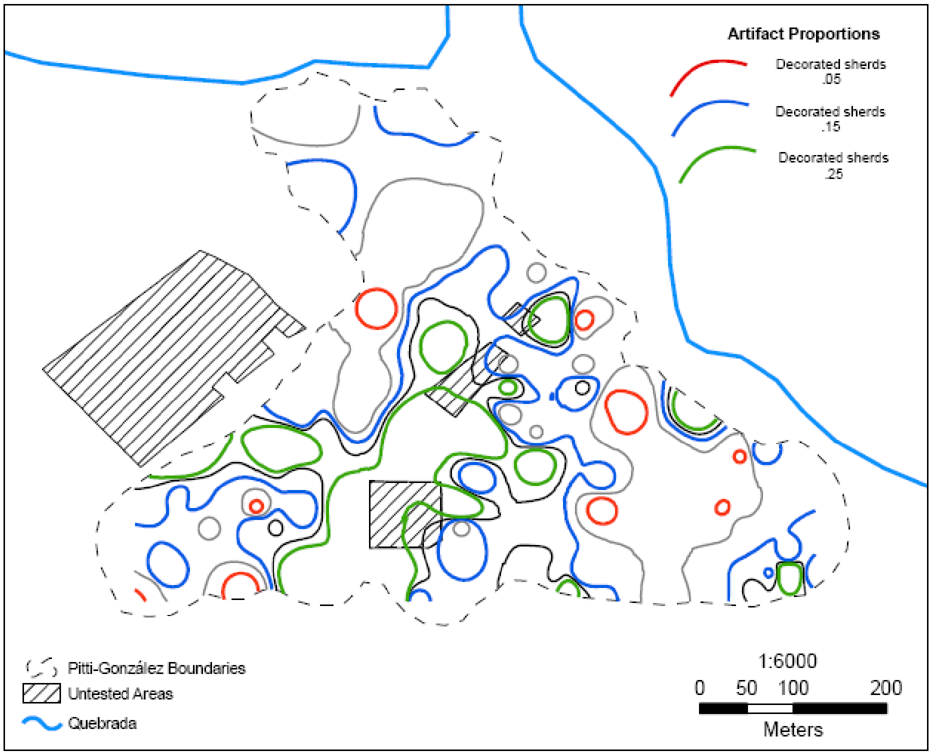

Figure 139. Proportions of decorated sherds within Late Bugaba Pitti-González.

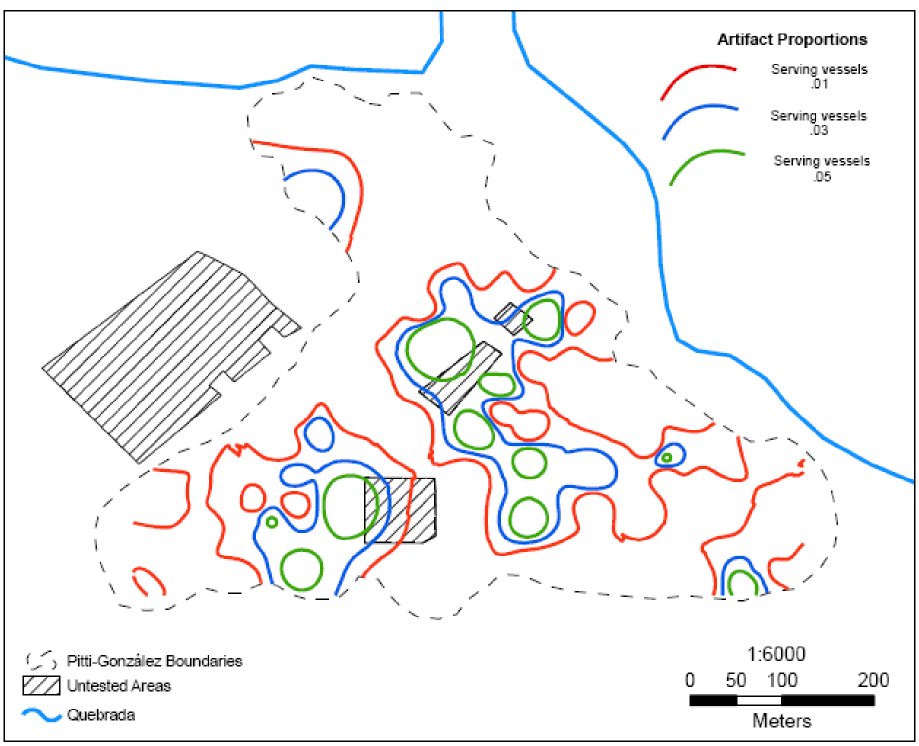

Figure 140. Proportions of serving vessels within Late Bugaba Pitti-González.

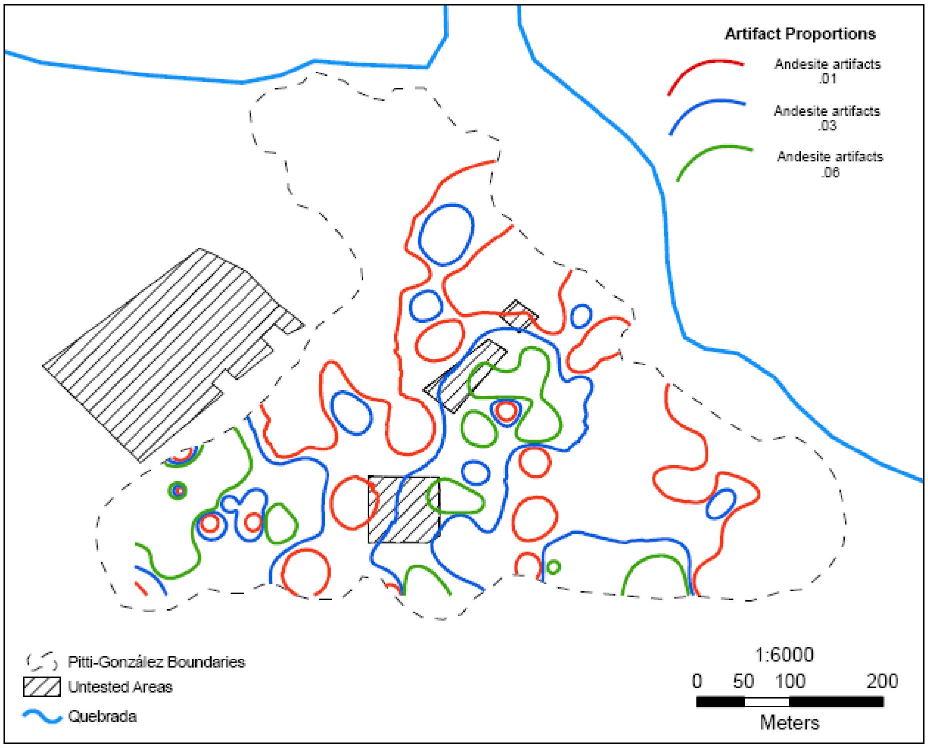

Figure 141. Proportions of andesite artifacts within Late Bugaba Pitti-González.

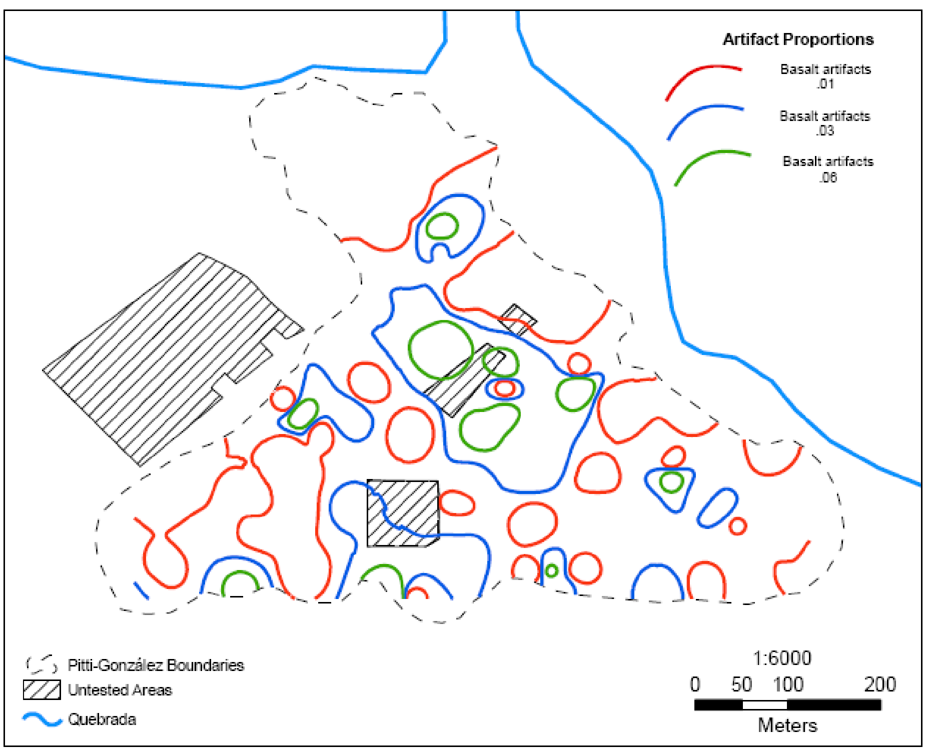

Figure 142. Proportions of basalt artifacts within Late Bugaba Pitti-González.

7.3 OCCUPATIONAL DIFFERENTIATION

Production activities were spatially restricted within Barriles. Only 6 (9.7%) out of the 62 Late Bugaba component shovel tests contained any evidence for lithic production. For those lots that contained this evidence, it still only constituted a minor component (<10%) of the overall artifact assemblage. Stone tool production was largely restricted to the geographic center of the site, near where the majority of the remainder of the chipped stone debitage was recovered. Figure 143 illustrates the few collection units with elevated proportions of production evidence were situated in, or beside, areas interpreted as those of higher social status (from figures 133 and 134). The distribution of axe material at Barriles- limited to just 2 polish flakes- were found immediately to the south of the mound feature (figure 145). Besides the mound feature itself, the area directly to the south was the only with high artifact densities, and is believed to be the area where much of the midden material from activities conducted on the mound were ultimately deposited. A small quantity of axe preforms and polish flakes were also recovered from Late Bugaba Phase excavation strata (unit 2) near this area. Stone tool repair activities formed yet another distribution, this one very broadly distributed and, as a result, interpreted as part of a common repertoire of houselot activities (figure 144).

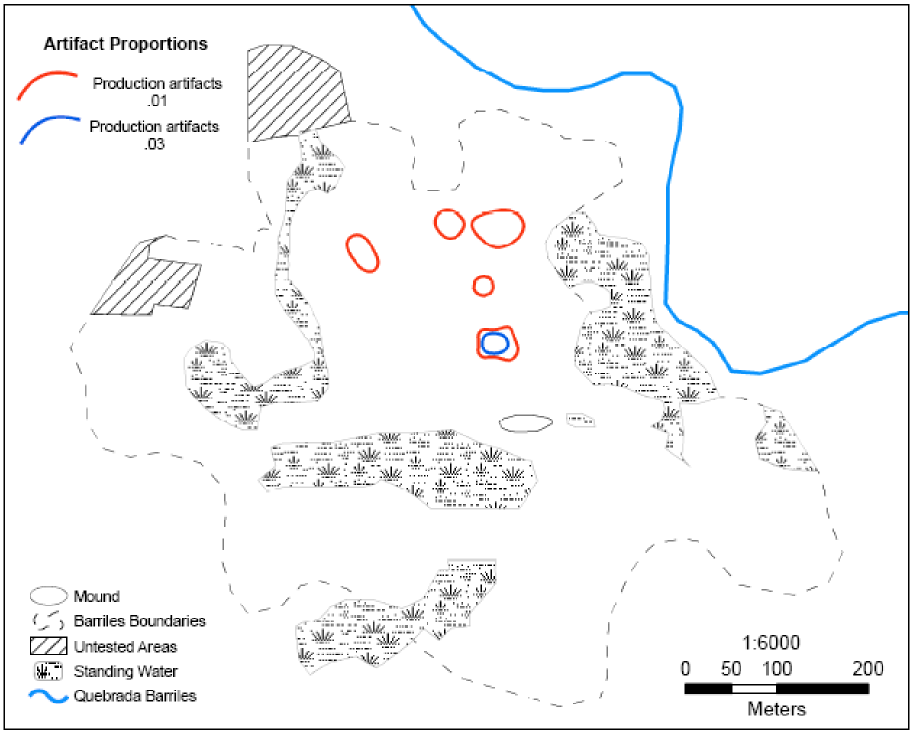

Figure 143. Proportions of lithic production artifacts within Late Bugaba Barriles.

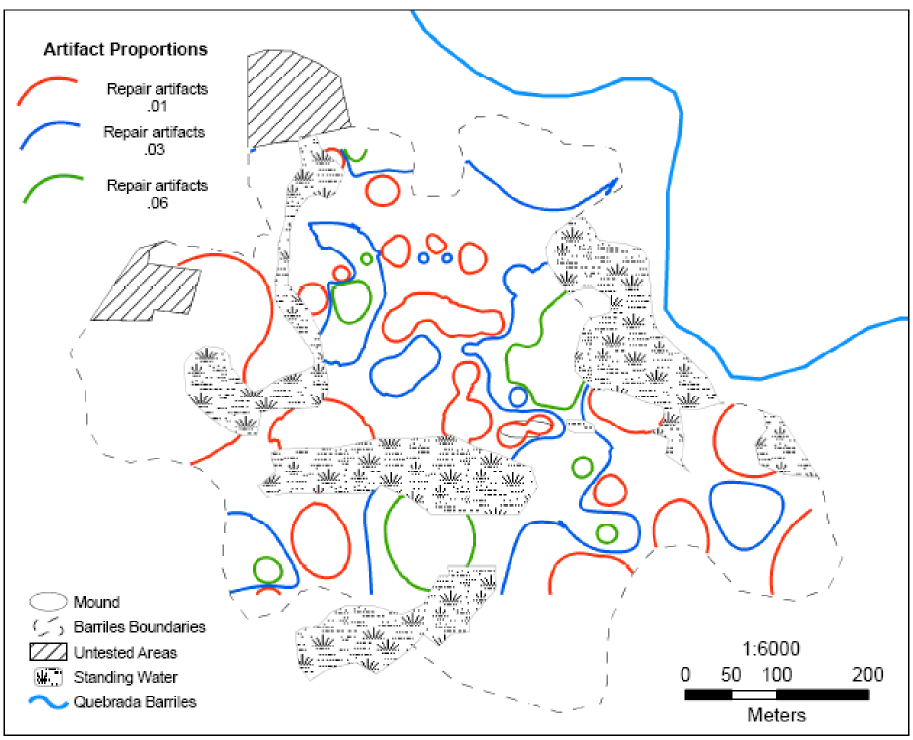

Figure 144. Proportions of lithic maintenance flakes within Late Bugaba Barriles.

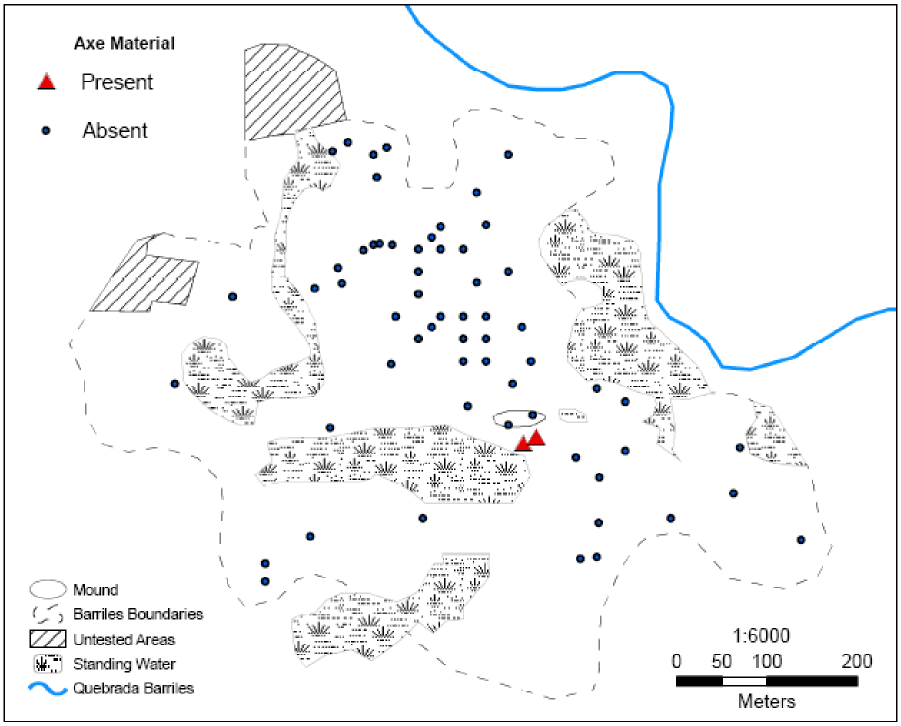

Figure 145. Presence or absence of axe material within Late Bugaba Barriles.

There was modest evidence for occupational differentiation at Pitti-González. Lithic repair artifacts like secondary and tertiary flakes were widely distributed throughout the site with only a few noticeable peaks, suggesting that (like Barriles) practically ever houselot minimally practiced stone tool maintenance (figure 147). The distribution of production artifacts was more spatially restricted, but relatively still widespread as approximately 25 (29.1%) of the 86 Late Bugaba collection lots contained either a primary flake or a core fragment (figure 146). Peaks in the distribution of both types of lithic artifacts were, as hinted at in the social differentiation section, regularly within or adjacent to areas containing elevated proportions of decorated or fancy sherds. What little axe material was recovered was no exception to this general pattern, and the majority of it was clustered near the geographic center of the site (figure 148).

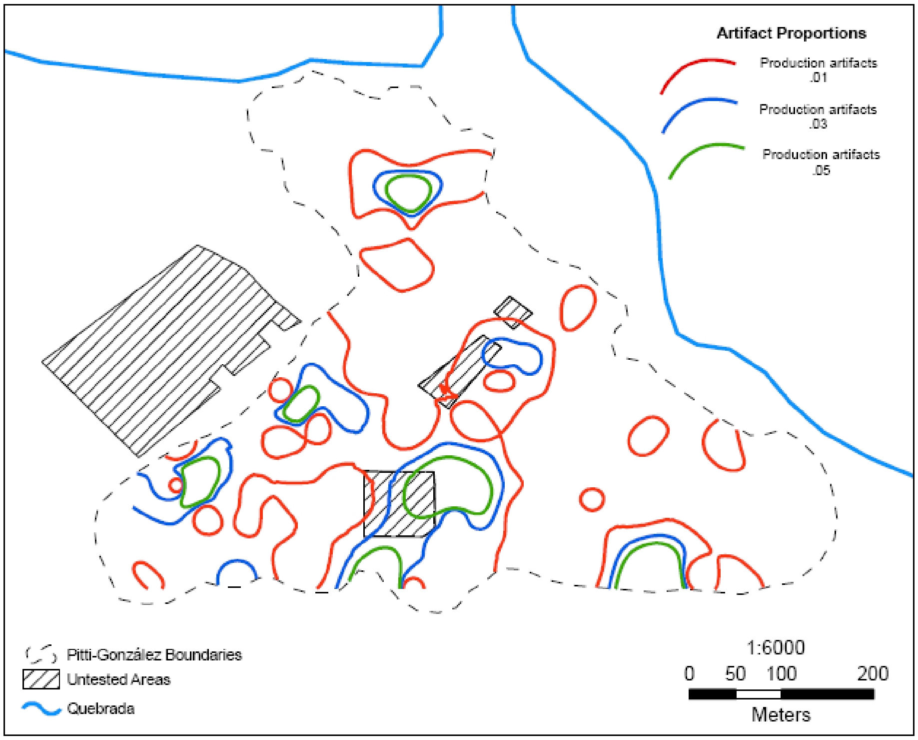

Figure 146. Proportions of lithic production artifacts within Late Bugaba Pitti-González.

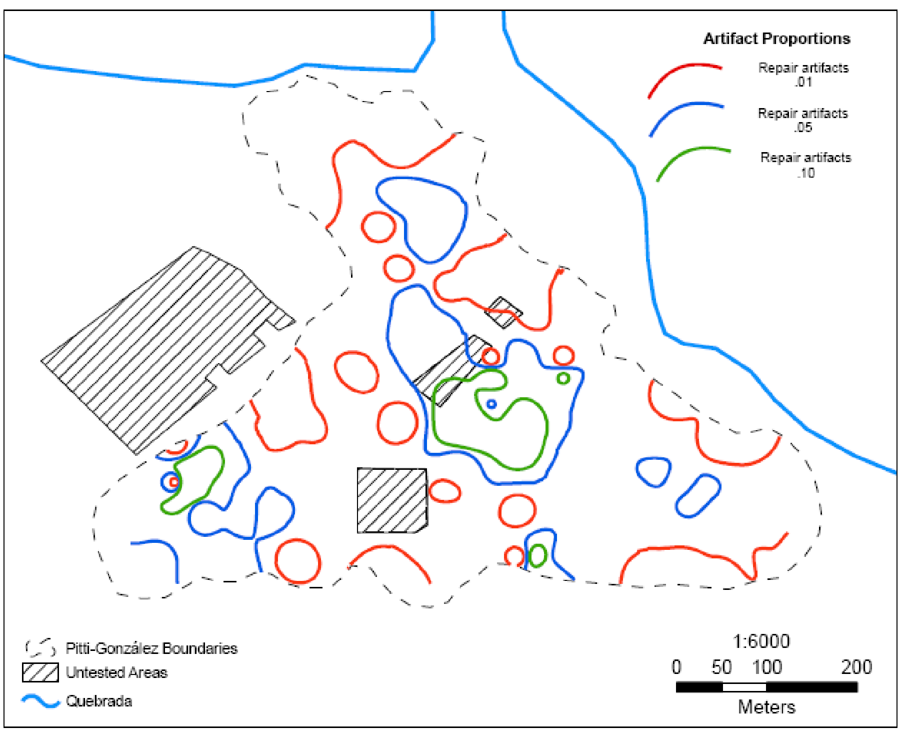

Figure 147. Proportions of lithic maintenance flakes within Late Bugaba Pitti-González.

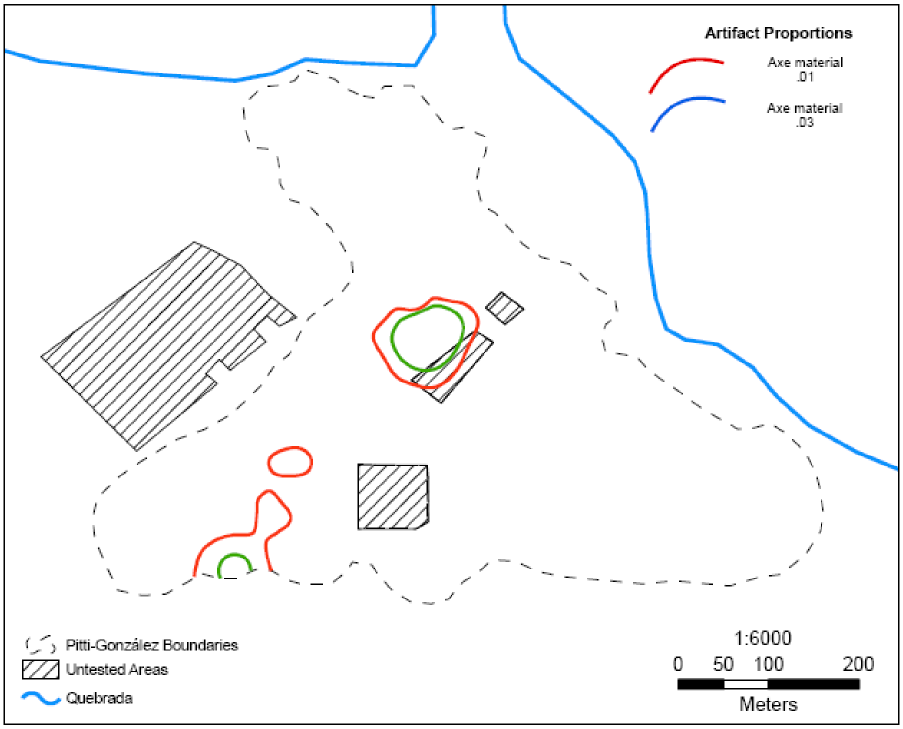

Figure 148. Proportions of axe material within Late Bugaba Pitti-González.

7.4 MULTIDIMENSIONAL SCALING

As presented in Chapters 5 and 6, the multidimensional scalings included here were also based on Euclidean distance similarity matrices based on standardized variables. Kruskal stress values declined to an acceptable level (~.10) in a 3 dimensional solution for the Barriles data, and a 4 dimensional solution for the Pitti-González data. The Barriles plots are illustrated in figures 149 to 152, and the Pitti-González plots are presented in figures 153 to 156. As presented in Chapter 6, higher proportions of particular artifact types are either illustrated by larger dots or by hotter colors in the subsequent plots.

Figure 149 illustrates all the single-component collection lots at Barriles. This plot indicates there was a large cloud of points surrounded by several outlier values. Figure 150 illustrates proportions of fancy (size) and decorated (color) sherds from the single-component collection lots. There was a pronounced tendency for elevated proportions of both fancy and decorated sherds to be found toward the bottom of the point cluster, ostensibly the collections assumed to be suggestive of higher social status. As figure 151 illustrates, many of these collections also tended to have higher proportions of both serving and cooking vessels, though the relationship between fancy or decorated sherds and serving vessels appeared to be much more regular. While high proportions of repair artifacts seemed to be distributed broadly in figure 151, elevated proportions of lithic production artifacts did not correspond well with the evidence for social status, though one outlier value strongly affects the way this plot was coded. These patterns suggest essentially the same insights from the distributional maps presented earlier, namely that social status appeared to be most strongly associated with serving activities, and that lots with high production proportions were often from different (rather than the same) collection lots.

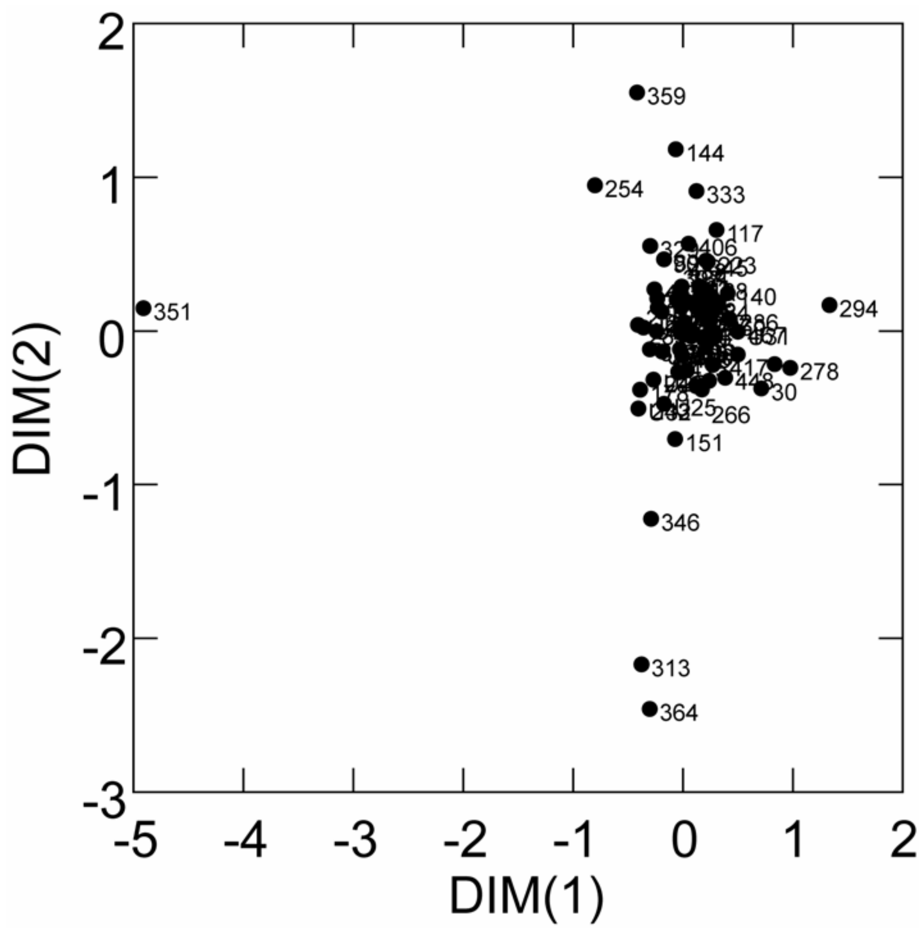

Figure 149. Scatterplot illustrating Late Bugaba proveniences from Barriles.

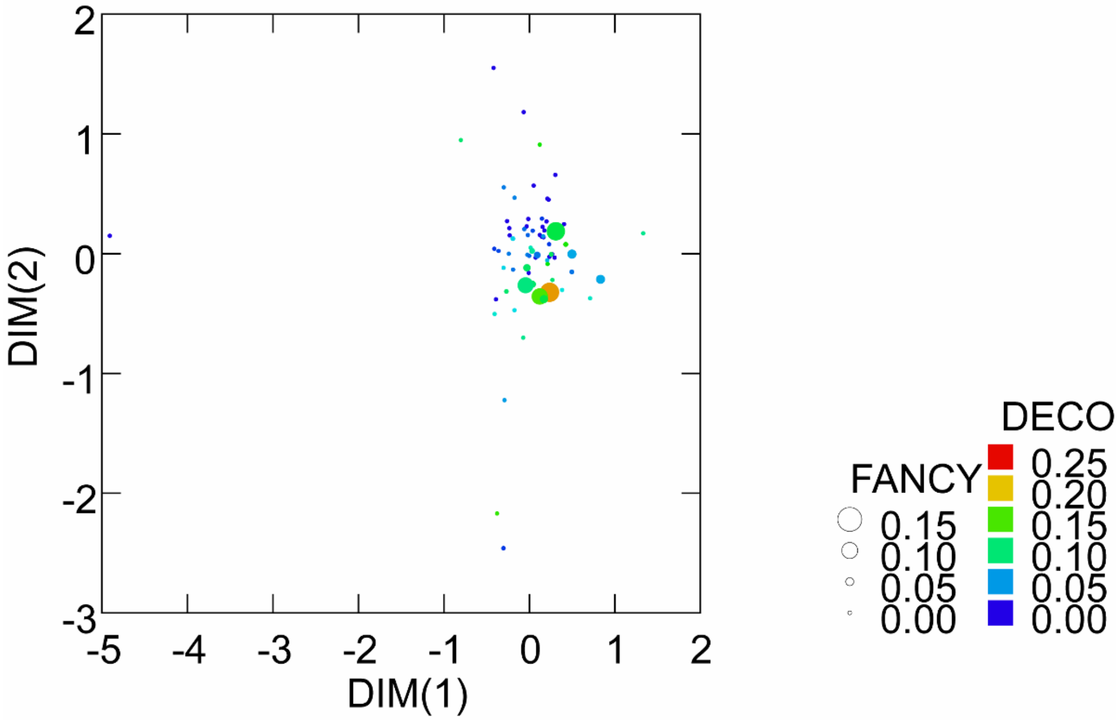

Figure 150. Scatterplot illustrating fancy and decorated sherd proportions within Late Bugaba Barriles.

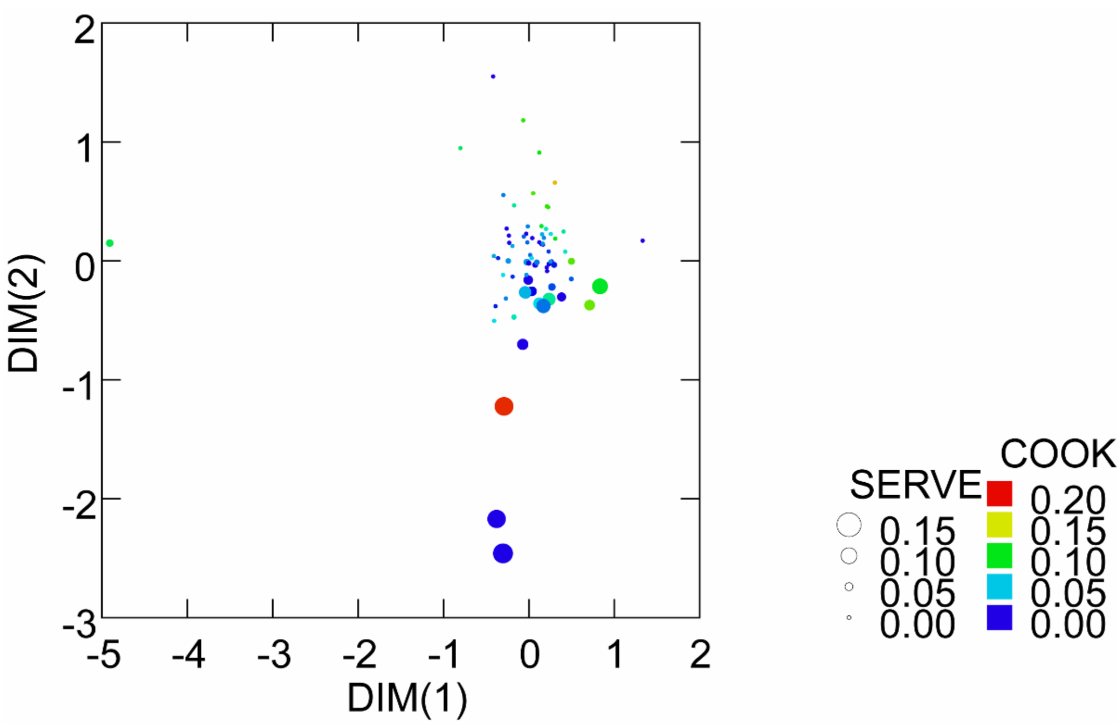

Figure 151. Scatterplot illustrating cooking and serving vessel proportions within Late Bugaba Pitti-González.

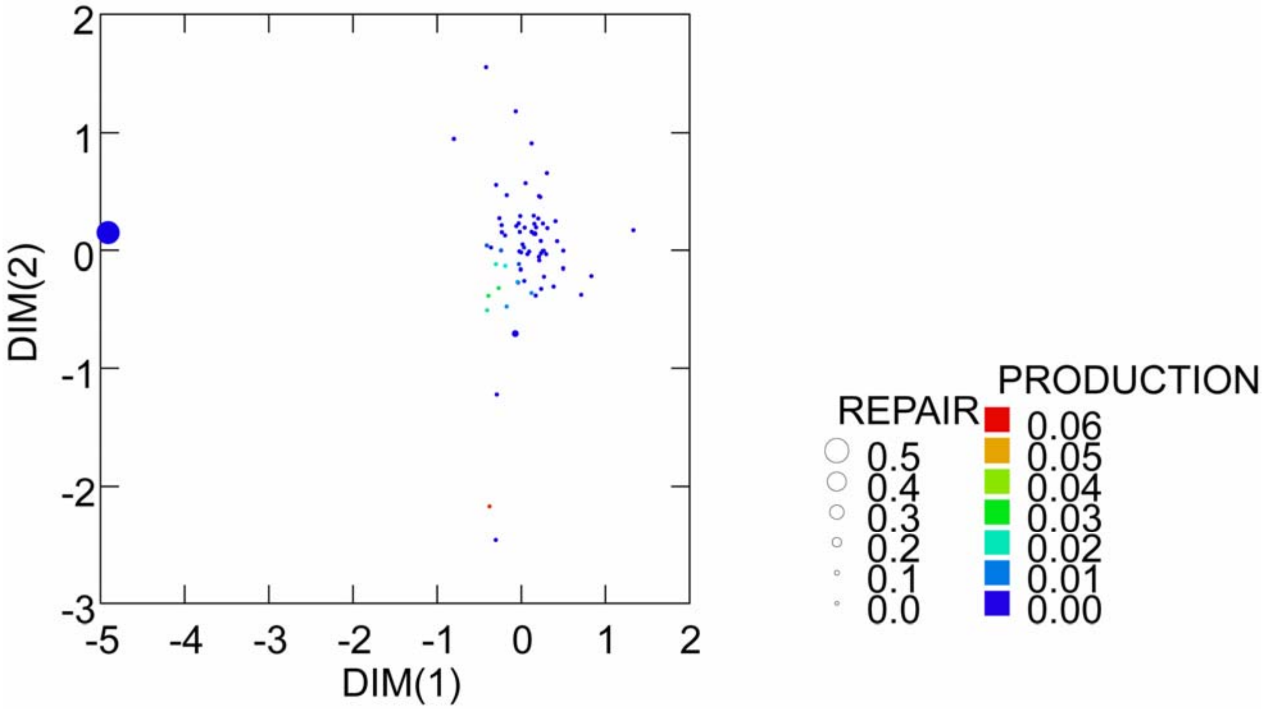

Figure 152. Scatterplot illustrating lithic production and repair artifact proportions within Late Bugaba Pitti-González.

Figure 153 illustrates the single-component collection lots at Pitti-González which formed the basis for the MDS analysis. Like Barriles, this plot illustrates a relatively dense cloud of points surrounded by trails of individual points. Points representing lots with high proportions of both fancy and decorated sherds are found to the left of the plot (figure 154). These tended to correspond moderately well with both elevated proportions of cooking and serving vessels, though slightly better with cooking than serving (figure 155). As figures 156 and 157 illustrate, collection lots which contained elevated proportions of production, repair, basalt, and axe material artifacts were not the same as those containing high proportions of fancy or decorated sherds. This is a simple observation which suggests the existence of at least two qualitatively distinct artifact assemblages (and perhaps social or occupational strata) within Pitti-González, one which consumed decorated ceramics and participated in cooking and storage activities relatively intensely, and another which performed the majority of the stone working activities.

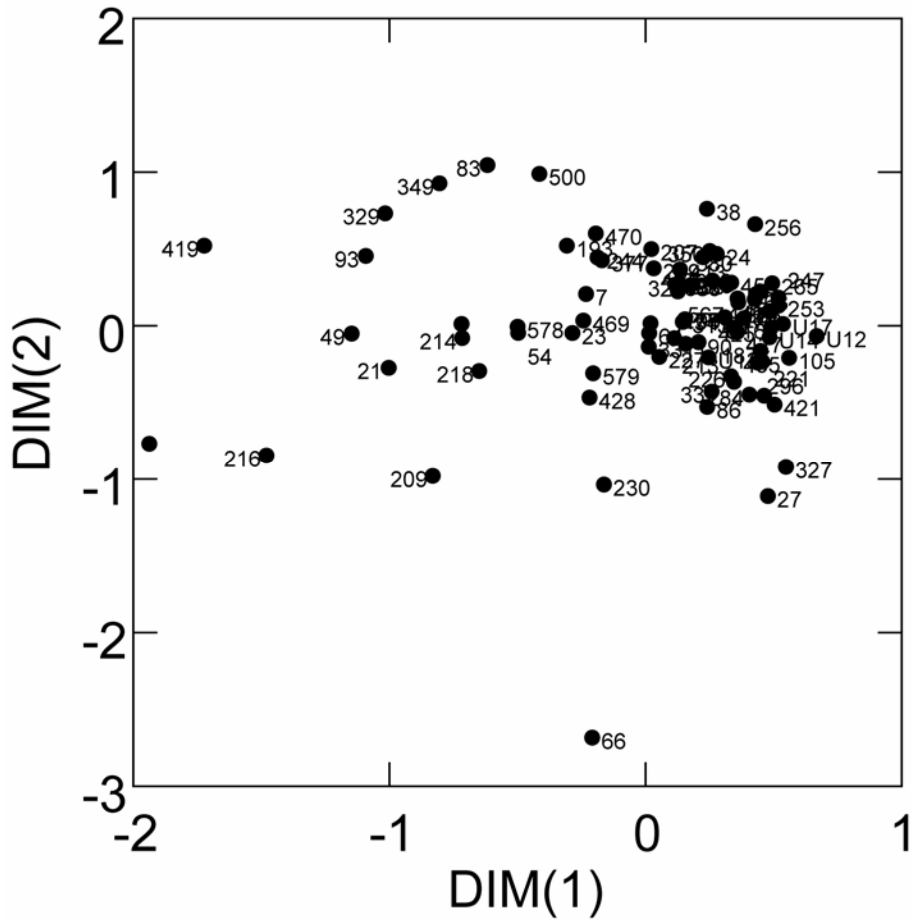

Figure 153. Scatterplot illustrating Late Bugaba proveniences from Pitti-González.

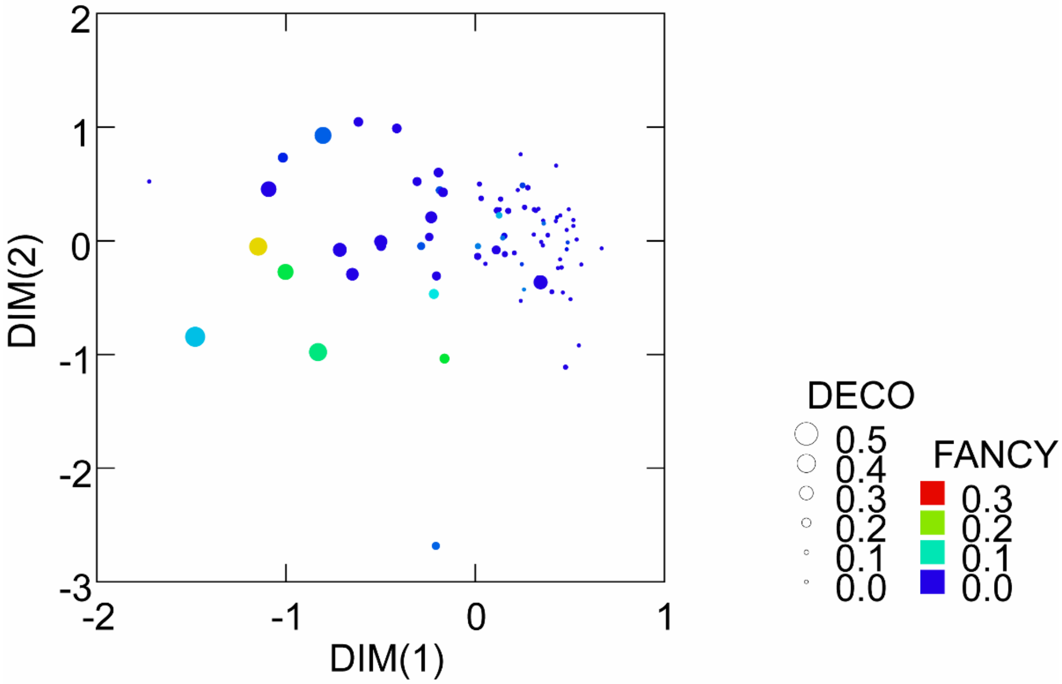

Figure 154. Scatterplot illustrating fancy and decorated sherd proportions from Late Bugaba Pitti-González.

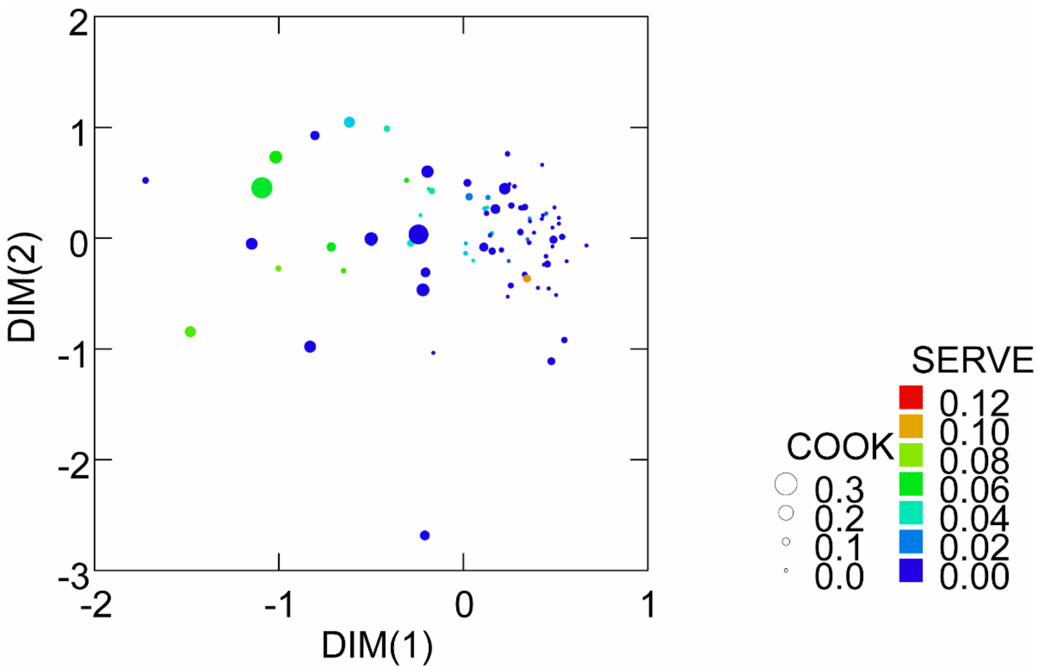

Figure 155. Scatterplot illustrating cooking and serving vessel proportions within Late Bugaba Pitti-González.

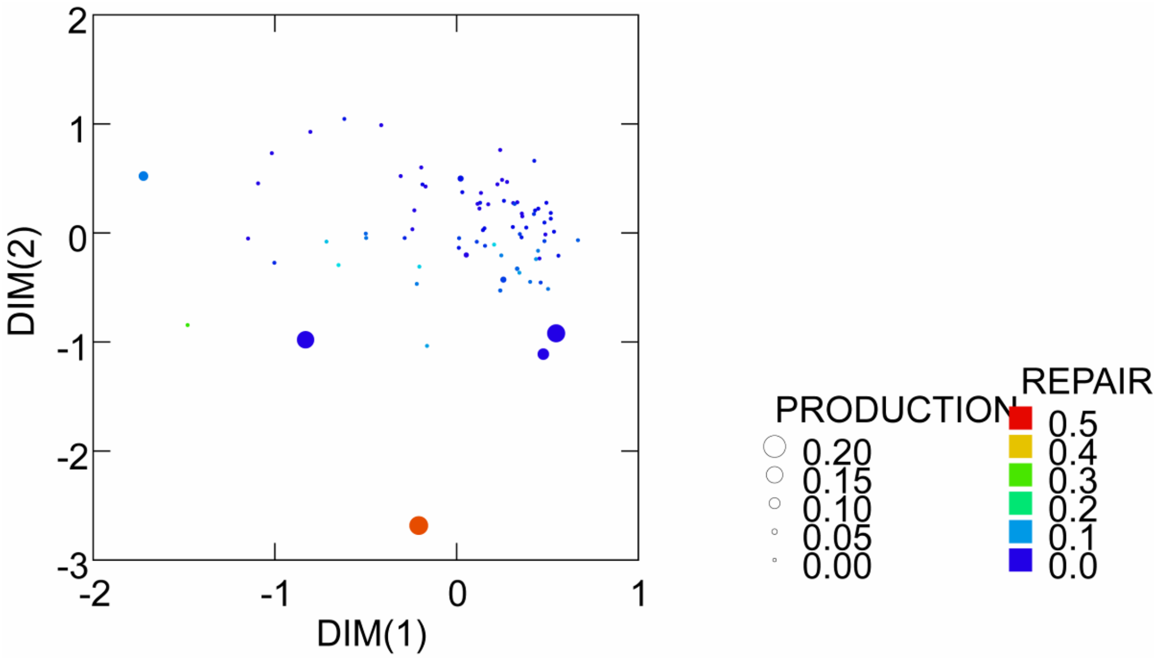

Figure 156. Scatterplot illustrating lithic production and repair artifact proportions within Late Bugaba Pitti-González.

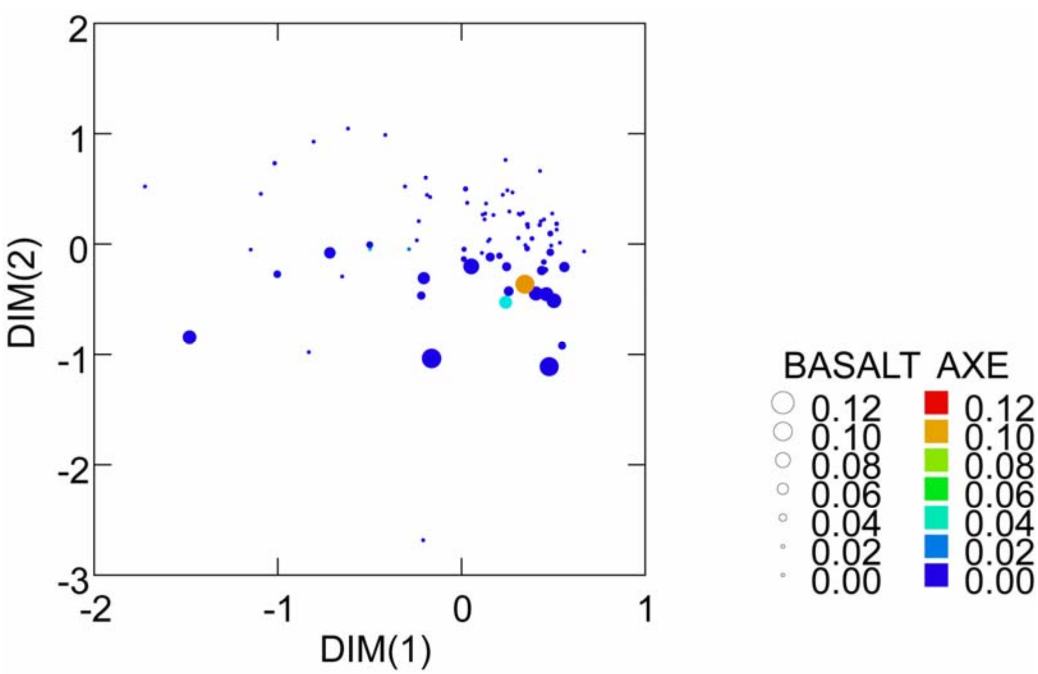

Figure 157. Scatterplot illustrating basalt and axe material proportions within Late Bugaba Pitti-González.

7.5 SYNTHESIS

The Late Bugaba Phase was associated with the largest and most internally complex villages in the sequence. It was also a time of maximum social and occupational differentiation in the study area, not only between villages but also within them. While proportions of artifacts related to cooking, storage, and serving activities all increased between nearly every houselot within Barriles and Pitti-González, Barriles seems to have taken a lead role in hosting serving activities during the Late Bugaba, while the scale and intensity of stone working activities at Pitti-González dwarfed that of Barriles and the BU-2 hamlet. Few of these activities operated completely independently of social rank and status. Serving activities appeared to have been in regular spatial proximity to other markers of social status at Barriles (figure 158). These activities may have also attracted stone tool smiths and labor pools to the margins of emerging 'elite' houselots (figure 159).

Pitti-González exhibited a different organizational pattern. While some status markers were still spatially associated with serving activities, markers of elevated social status were generally located within or adjacent to concentrations of stone tool debitage and tools (figure 160 and 161). Elevated proportions of cooking vessels were also found in spatial associated with higher proportions of decorated sherds (figure 163). One puzzling feature of Pitti-González regarded the distribution of *metate* fragments which, because of enormous fragments scattered to the edges of fields by modern plowing, escaped systematic collection. These seemed to be largely concentrated in the southwestern corner of the site, in an area suggestive of unusually dense population concentration, and may reflect an additional occupational specialization involving groundstone tools or food processing. The Barriles and Pitti-González evidence therefore suggest that relatively distinct organizational differences had emerged between the two villages during what appears to be a time of increasing sociopolitical complexity at the regional scale.

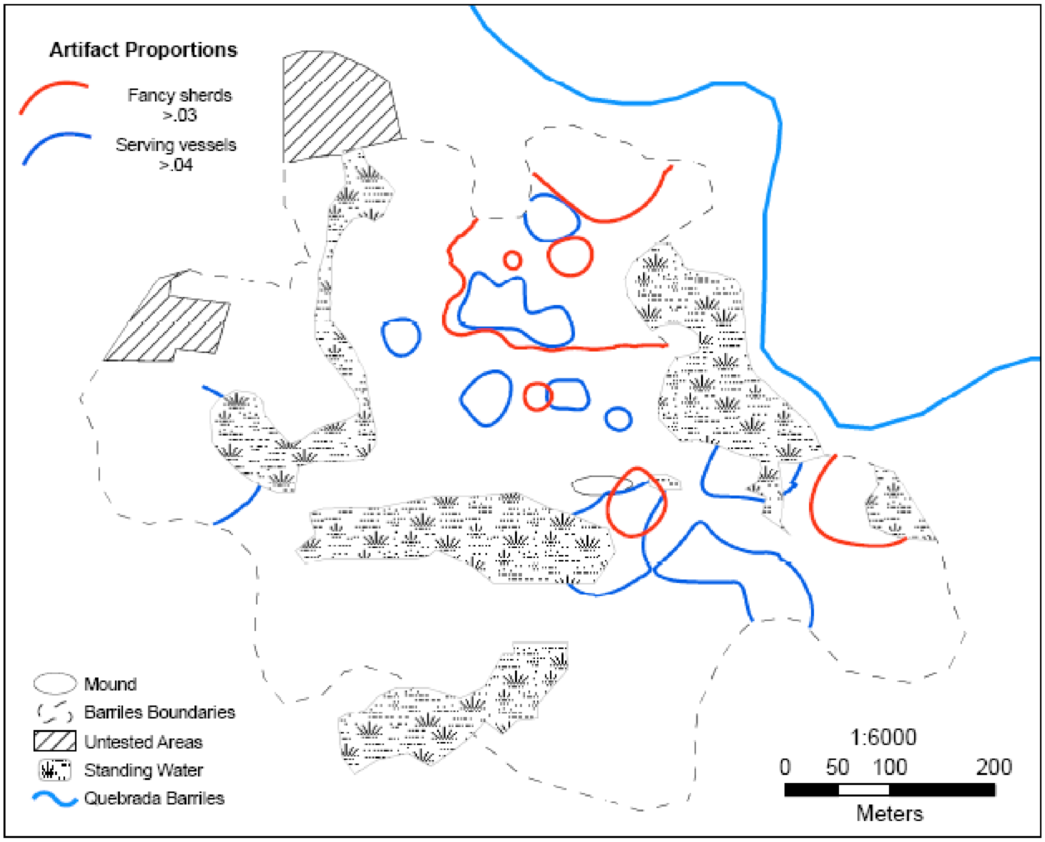

Figure 158. Combination map illustrating elevated proportions of fancy sherds and serving vessels within Late Bugaba Barriles.

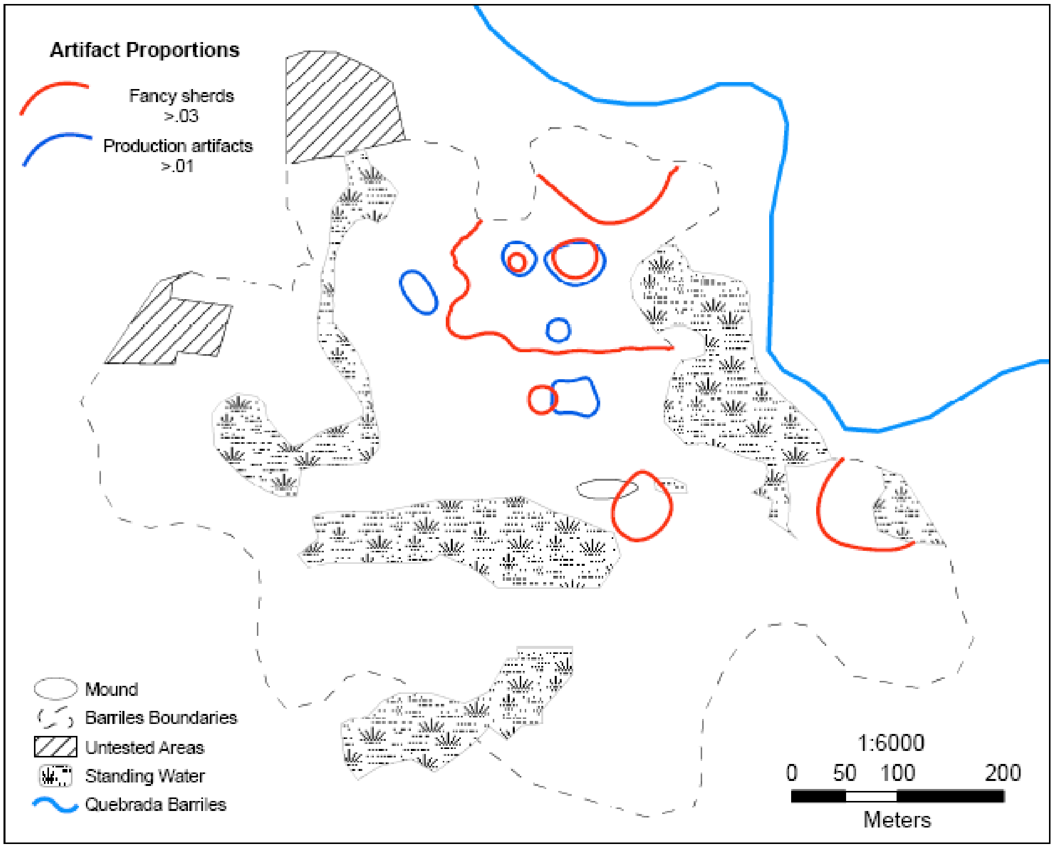

Figure 159. Combination map illustrating elevated proportions of fancy sherds and lithic production artifacts within Late Bugaba Barriles.

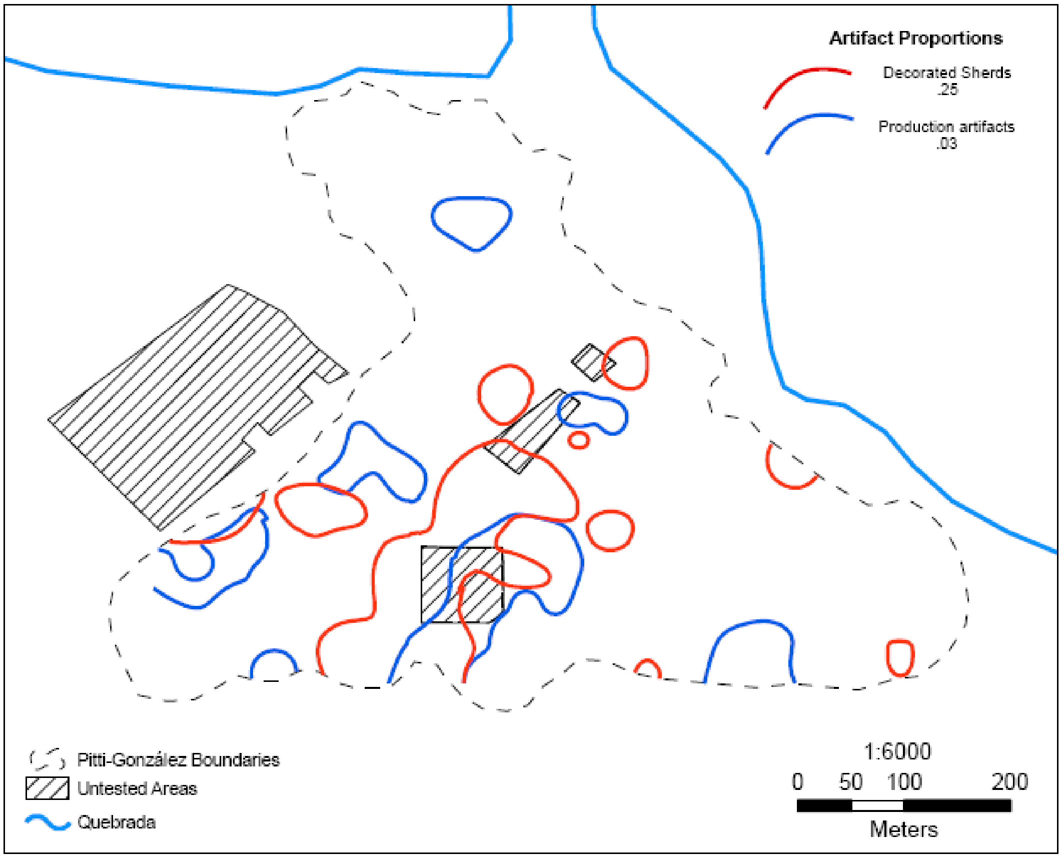

Figure 160. Combination map illustrating elevated proportions of decorated sherds and lithic production artifacts within Late Bugaba Pitti-González.

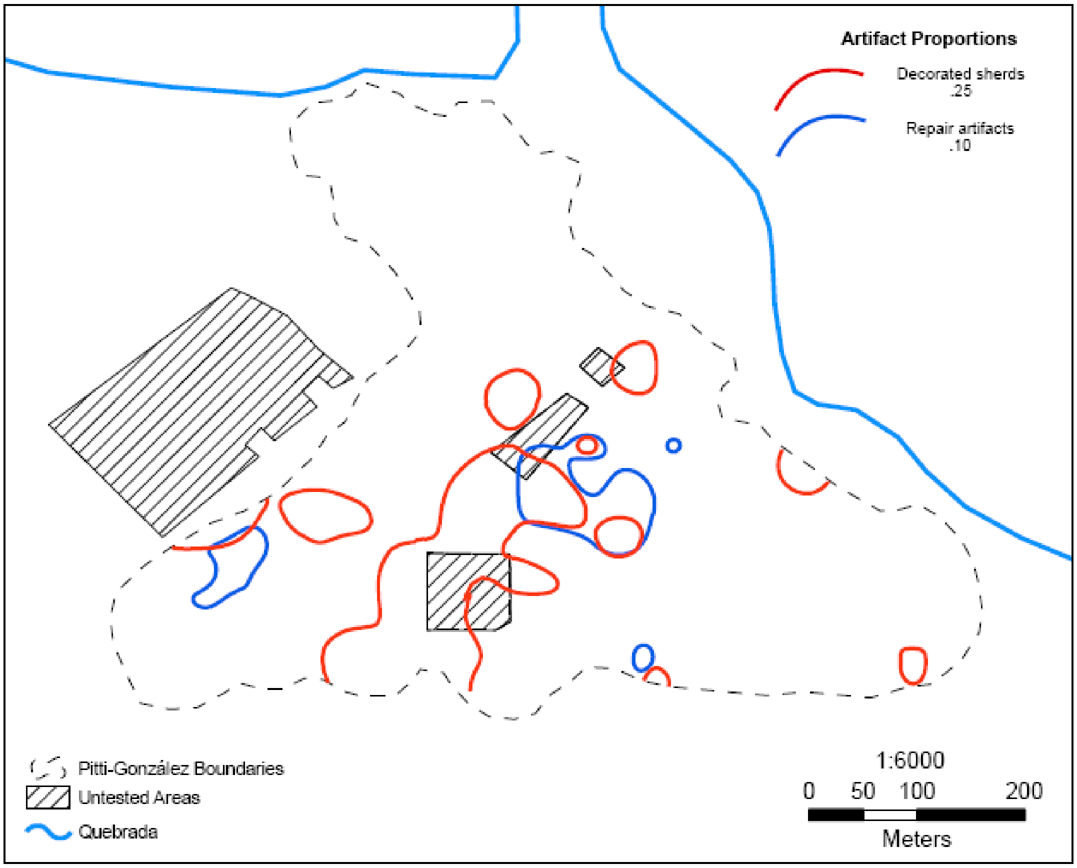

Figure 161. Combination map illustrating elevated proportions of decorated sherds and lithic repair artifacts within Late Bugaba Pitti-González.

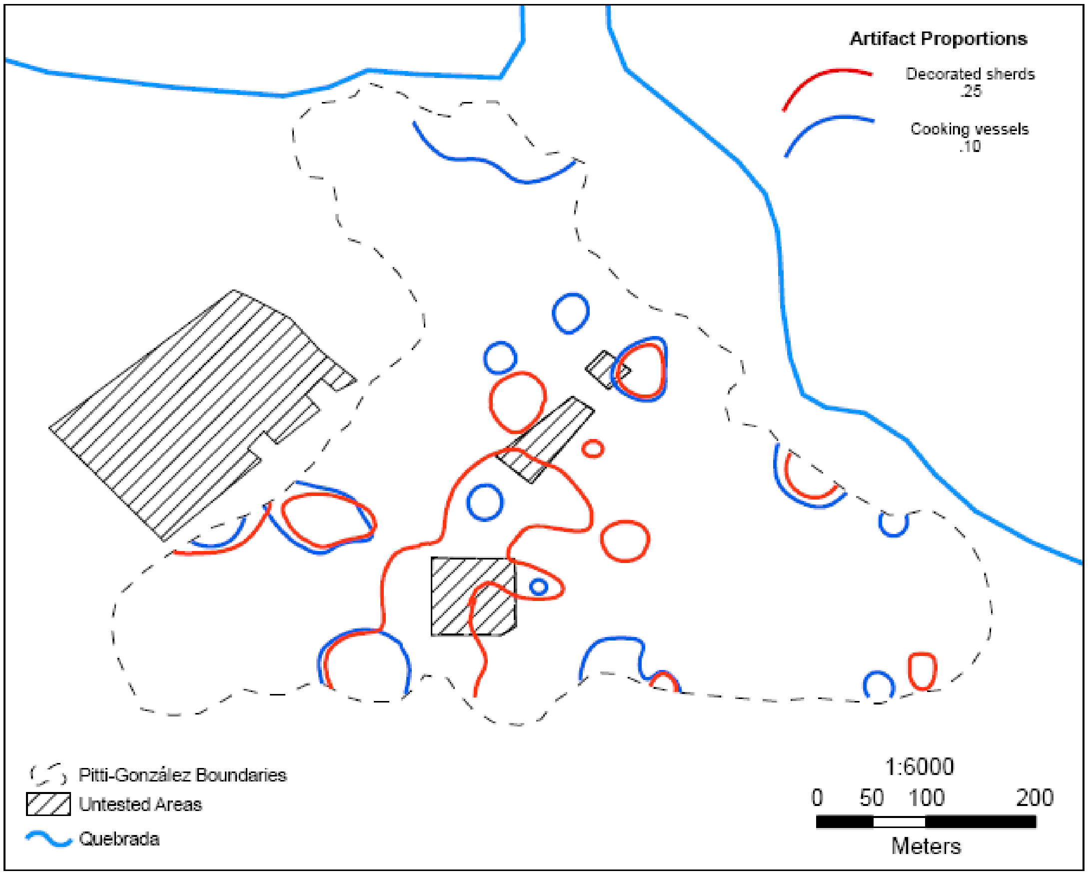

Figure 162. Combination map illustrating elevated proportions of decorated sherds and cooking vessels within Late Bugaba Pitti-González.

8.0 CHIRIQUÍ PERIOD (A.D. 900 TO 1400)

The Chiriquí Period is best known from the Pacific (Linares 1968a, 1968b) and Caribbean coasts of Panama (Wake 2006; Wake *et al.* 2004) and the Río General of Costa Rica (Corrales 2000; Drolet 1983b, 1984a, 1984b, 1986, 1988, 1992; Quilter 2004; Quilter and Frost 2007; Quintanilla 2006) as a time when monumentality, status differentiation, goldwork, and the development of large chiefdoms reached their clearest expression throughout the lower elevations of Gran Chiriquí. Many of these features persisted until Spanish Contact and their descriptions have informed current archaeological models of sociopolitical development. However, like the upper drainage of the Río Terraba (Drolet 1992) and the San Vito basin (Laurenich de Minelli and Minelli 1966) in Southern Costa Rica, the Volcán Barú highlands were virtually depopulated during this period. Our recognition of demographic collapse may be partially biased by an inability to easily import the ceramic chronology defined near the coast (Baudez *et al.* 1996; Linares 1968) wholesale into the highlands (especially the San Lorenzo phase), but the issue is unlikely to entirely be one of ceramic chronology. Many Chiriquí diagnostic ceramics are, for the most part, some of the most distinctive and noticeable in the entire sequence and have been observed in the highlands by this project, a recent project near Boquete (Holmberg 2009), and previous projects (Laurenich de Minelli and Minelli 1966, 1973; Soto and Gómez 2002). They were the most finely made ceramics (i.e. Biscuit Ware) and were often brightly painted (i.e. Buenos Aires polychrome, San Lorenzo). Although even one or two would stand out in a lot of unpainted Formative sherds, they were exceedingly rare. This situation contrasted dramatically with the Pacific plains and coast of Panama, known for thousands ceramics from large (looted) cemeteries contained almost entirely Chiriquí Period ceramics (Holmes 1888; Joyce 1916; MacCurdy 1925) that now populate the storerooms of several North American museums.

Until recent geological work aimed at refining the eruptive history of Volcán Barú (Behling 2000; Clement and Horn 2001; Sherrod *et al.* 2007), researchers only had one radiocarbon date (with a wide error range) from Cerro Punta on which to base an interpretation centered on a catastrophic eruption displacing the bulk of existing populations. We now know that the A.D. 600 eruption was highly unlikely to have occurred (Holmberg 2007, 2009) and cannot be used to adequately 'explain' the rapid depopulation of the study area, other factors must have been at work. In our sample, only Barriles and BU-2 contained any evidence at all for Chiriquí occupation. Barriles is estimated at 30 to 60 individuals, and BU-2 (a diffuse but ~1 ha scatter) was probably no more than a single hamlet. Only three widely scattered Biscuit Ware sherds were found in Pitti-González, and evidence for Chiriquí occupation was absent at every other sampled site in the Cerro Punta basin, the Bambito gorge, and the Intermediate Zone. As a result, our sample of Chiriquí material is extremely small, and any generalizations we might attempt (besides a trend toward profound depopulation) are of only minimal utility. They are, however, presented here because next to nothing is known about the highland Chiriquí Period outside of ceramic descriptions.

Of the 7 sites sampled, only 2 contained likely evidence for Chiriquí occupation, for a grand total of roughly 50 individuals. The best guess at regional population density would therefore be that only 10 sites total contained Chiriquí occupants, for a regional estimate of approximately 200-250 individuals, or 3-4 individuals per km². This estimate corresponds to that calculated for the Concepción (7 individuals per km²), the implication possibly being that post-Formative populations returned to a highly dispersed mode of living after political authority had waxed and waned at Barriles and Pitti-González. These low population density estimates also qualitatively correspond well to the ethnographic observations noted by visitors in the Veraguas province of Panama (Lothrop 1963) and the Talamanca highlands of Costa Rica (Gabb 1875). It is unclear whether these diffuse populations persisted until Spanish Contact in the Río Chiriquí Viejo, as evidence for anthropogenic landscape disturbance ceases around A.D. 1400, right around the time of the last severe volcanic eruption (Behling 2000). There is at least one ethnohistoric description of indigenous (Doraesque, rather than Guaymí) populations living on the other side of the volcano near Boquete (summarized in Linares 1968; see Miranda de Cabal 1974), which may suggest that low density occupation continued there until the historic era.

The 12 single-component shovel tests at Barriles formed the basis for the Chiriquí sample. There is little that can be meaningfully said about Barriles versus the hamlet at BU-2, since the 2 single-component BU-2 shovel tests contained only undecorated sherds without any identifiable rims (thus proportions are zero). Compared to Late Bugaba Barriles (figures 122 to 123), the Chiriquí sample represents a strong and significant decrease in proportions of fancy sherds, decorated sherds, and serving vessels, all of which had proportions zero or under .01. Proportions of cooking vessels and repair flakes, however, remained roughly the same.

There were no obvious correlations between Barriles shovel tests containing decorated ceramics and other artifacts. No lithic production artifacts, axe material, nor grinding stones were found in any of the Chiriquí samples. The pattern of cooking and serving vessels (figure 163), and repair flakes (figure 164) appeared to be randomly distributed throughout Barriles without any apparent relationship between these and decorated sherds. Acknowledging all the reservations and caveats associated with using small and spatially restricted samples, there is nothing which suggests that any of the observed Chiriquí artifact assemblages were very different from what was observed in the farmsteads or hamlet samples of the earlier Concepción Phase, most of the Early Bugaba Phase, and the Late Bugaba Phase. That is to say, the small Chiriquí sample was a less variable artifact assemblage with only very low proportions of lithic maintenance flakes, cooking, or serving vessels, and lacked clear evidence for involvement in production or axe-related activities. The overall picture of thee Upper Chiriquí Viejo during the Chiriquí is a lightly settled region containing domestic groups that were neither organized as densely nor complexly as their predecessors.

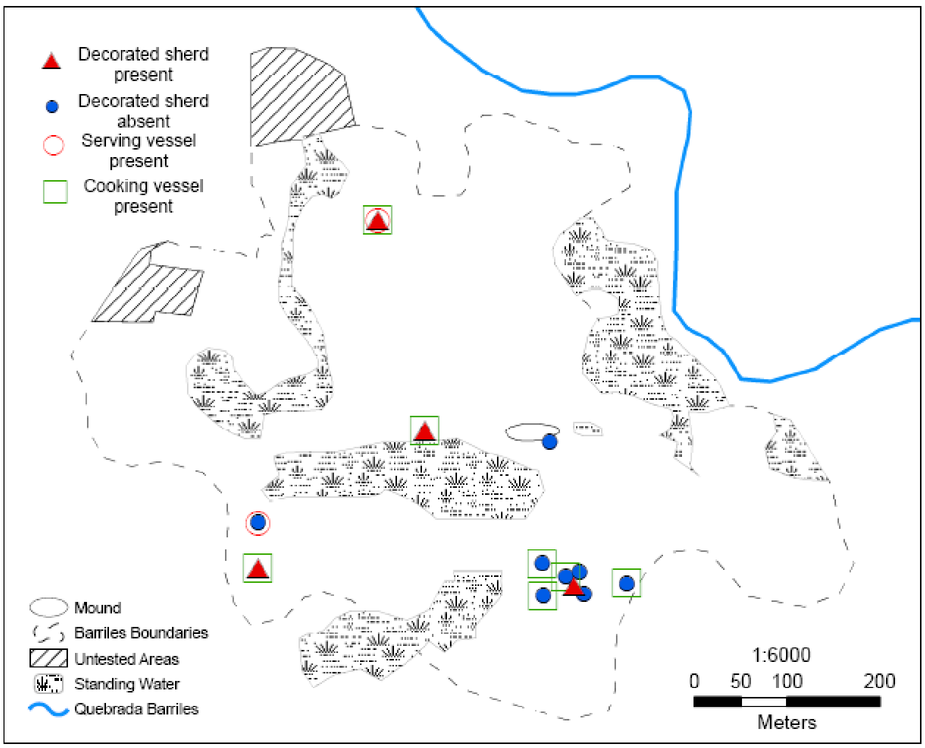

Figure 163. Presence or absence of decorated sherds, serving and cooking vessels within Chiriquí Barriles.

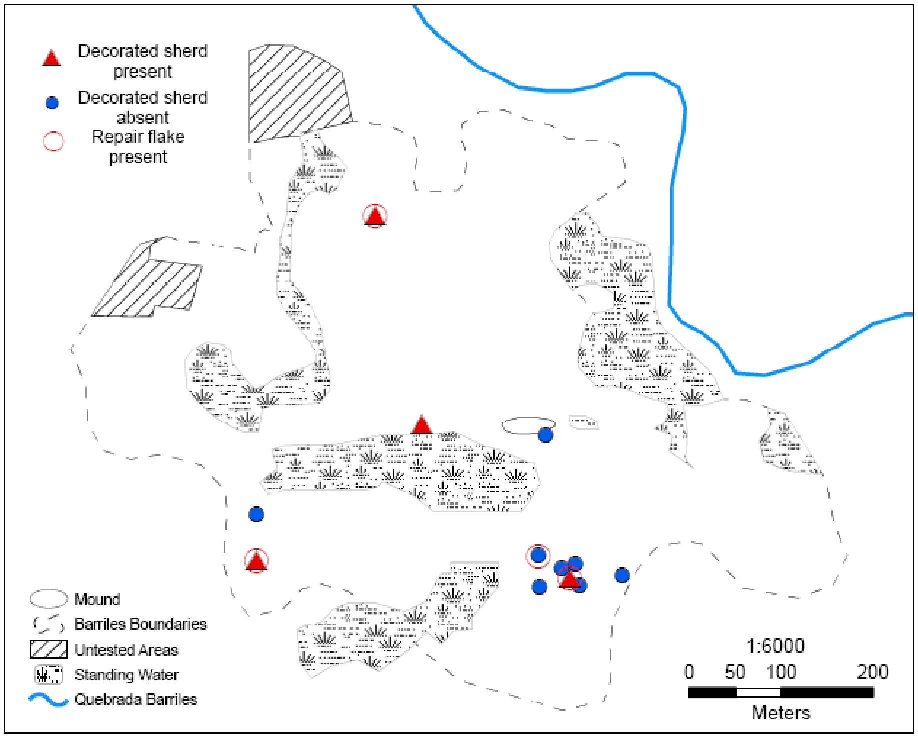

Figure 164. Presence or absence of decorated sherds, lithic production or repair artifacts within Chiriquí Barriles.

8.1 SYNTHESIS

Barring a complete misunderstanding of the Chiriquí period ceramic chronology in the highlands, this time either represented a nearly complete abandonment of the study area, or the tight centralization of the regional population in a handful sites which escaped this project's sample and the attention of all previous researchers. All of the evidence for Chiriquí occupation was restricted to the boundaries of the former Barriles village and the sampled segment of BU-2, which is only 500 m to the north. The Cerro Punta basin and Bambito gorge appear to have been entirely depopulated during this time, and the possible reasons why are currently unclear. The most likely scenario at the present moment is that Chiriquí population reverted back to the highly dispersed mode of regional occupation described for the Concepción, making the establishment, growth, and persistence of Formative villages all that more unusual for the sequence.

9.0 CONCLUSIONS

In many areas of the Americas for which we have diachronic information, a variety of Formative chiefdoms tended to develop into or interact with increasingly complex societies, or had their individual trajectories altered by European contact. The Formative sequence of the Upper Chiriquí Viejo is thus fairly rare in that it spans the full political cycle of a chiefly society: political development, persistence, and collapse. In fact, judging from Formative ceramic and lithic evidence provided by this project and summarized by Drolet (1984) and Rago (1988) for Southern Costa Rica, a combined sample of well over 150,000 artifacts, highland Chiriquí chiefdoms developed varieties of complex society without any clear evidence for intensive participation in macro-regional trade and exchange (at least of those artifacts which have preserved). This runs directly counter to expectations from prevailing models of sociopolitical development from Southern Central America which emphasize the manipulation of long-distance trade and attached knowledge systems (i.e. Helms 1979; Hoopes 2005; Snarskis 1986), a point that has only recently been explored in print (i.e. Carmack and Salgado 2005; Fitzgerald 1996).

Nascent Formative villages began to form in the Upper Chiriquí Viejo in the Early Bugaba, approximately A.D. 300 to 600. The regional population appeared to become increasingly concentrated in one of these, Barriles (BU-24), from A.D. 600 to 900. During this time, the clearest indications for a settlement hierarchy and signs of social differentiation briefly appeared. This study was designed in an effort to determine what degree, if any at all, the organization of productive activities or regional exchange were associated with these changes. Part of this effort involved the construction of a finer-grained ceramic chronology to examine the series of activities and changes in ways not previously possible within the Formative period, as well as to create a firmer foundation for demographic estimates. The 2007 fieldwork for this research involved systematically sampling seven Formative sites identified previously by Linares *et al.* (1975) using a grand total of 769 shovel tests, 665 controlled surface collections, 11 general surface collections, and 32 1x1-m excavation units. The overall sample includes 28,855 artifacts from shovel tests or surface collections, and 36,403 from excavated contexts, for a grand total of 65,258 artifacts (of which 20.2% were classified as unidentifiable). Three AMS dates (presented in chapter 3) were taken from these small excavations, two of which indicated that the middle of the sequence likely dated to around A.D. 600. Because of the humid environment and organic soils, this sample almost entirely consists of durable sherds and lithics. Even after fine-screening (2 mm mesh) bulk samples from every excavation stratum, it was determined that no faunal or macrobotanical remains (unless carbonized) preserved well enough in open-air sites to meaningfully contribute to a discussion of social or occupational differentiation.

Both single-component collections and excavation strata provided the basis for the discussion of change over time. These changes occurred over an approximately 1500 year time span, though the 98% of the evidence recovered dated to the Bugaba or Aguas Buenas Period (A.D. 300-900). While this research provided insight on the regional distribution of activities and internal organization of prehistoric villages, it was largely unable to examine the role of regional exchange and how this may have changed over time. Only the Early Bugaba Phase provided data appropriate to an analysis of regional exchange patterns, and the preponderance of preforms, finished axes, along with copious lithic production and resharpening evidence, at the small site of

BU-19 suggested that exchange of stone tools was probably not managed or redistributed through emerging villages. The sample of outlying sites dating to the Concepción Phase (n=1), Late Bugaba Phase (n=1), or Chiriquí Period (n=0) simply proved insufficient to critically analyze exchange activities across the region.

9.1 TYPES OF 'CRAFTS' PRODUCED

While evidence from the study area is almost entirely limited to durable ceramics and lithics, but production material from each was found during the course of the project. A small quantity of kiln wasters, the vast majority found at Barriles (see figure 165), suggested that some ceramic vessels were produced there, although we cannot be certain if the full range of vessel forms were manufactured. Observations of variations in the color of sherd paste, almost always grading from light to dark on larger pieces (a different observation than Shelton 1995), suggested that vessels were produced within an uneven firing environment. This is not conclusive evidence, but may suggest that vessel firing was done on a smaller scale than might be expected if larger kilns were used, since these generally results in increased control over the firing process. This observation seems to apply best to the more utilitarian cooking vessels in the sample; many of the highly decorated serving wares had much finer and more homogeneous pastes and therefore may have been produced under different conditions. Either way, while there is some evidence for ceramic production, it was ephemeral and exceedingly rare in the collections.

The same was not true for evidence of lithic production or repair. Most collection units typically contained 1-5% lithic artifacts, generally debitage. The evidence for production activities defined here- primary flakes, cores and preforms- err on the conservative side.

Certainly some secondary and tertiary flakes and stone shatter would have been part of the production process after most of the outer cortex was initially removed, and those areas where 'production' and 'repair' lithics co-occur may reflect exactly this. The production of polished stone axes was of particular interest to this study, since changes in the production or exchange of these was believed to have had indirect effects on the subsistence economy of the regional population. Axe preforms and polishing stones are the most direct evidence of axe production, and may or may not also include polish flakes and the axe fragments themselves (Ranere 1980b, 1980d). As for materials made of hide, we have only indirect evidence from the distributions of scrapers to suggest that this was possible. One particularly curious absence in the record was that of spindle whorls, especially since the weaving village of Boruca figures so prominently in an ethnographic description of Gran Chiriquí (Stone 1949). Only one possible spindle whorl was found in the entire sample. The available ceramic and lithic evidence therefore confirms that Volcán Barú settlers did occasionally manufacture items themselves. Some of the raw materials for these items may certainly have been initially quarried in the hills outside the study area (Ranere 1980d); although cursory examination of the cobbles in steambeds near sites indicated that .all the raw materials used to chip stone tools would have been locally available.

9.2 THE ORGANIZATION OF PRODUCTION

The identification different items as 'crafts' can involve very detailed studies of the artifacts themselves, such as metric measures designed to assess degrees of homogeneity and standardization (i.e. Costin and Hagstrum 1995), as a way to interpret the how production was structured. The rejoinder to this is to examine the spatial organization of production, the primary focus of the research presented here. According to Costin (1991), there are several spatial components worth considering. The first is the geographic concentration of production activities, which can range from dispersed to highly concentrated. At one extreme, the manufacture of particular items might be organized on a household by household basis (i.e. Massuci 1995), and be present in both villages and rural farmsteads. At the other, production may be found only at one or two settlements, and at the scale of these specialized settlements, these activities may be dispersed fairly evenly throughout them (i.e. Cobb 2000) or overwhelmingly concentrated in one particular area (i.e. Welch 1991, 1996).

The Volcán Barú evidence suggested that the geographic spread of production activities changed over time at both the regional and village scales. While the sample of Concepción houselots was small, each appeared to be relatively redundant units of lithic production and repair. There were appeared a slight tendency for the sample population to aggregate in Barriles, but production and repair activities were also observable at the isolated farmstead of BU-8. While population increased in the Early Bugaba, the geographic spread of lithic production activities remained dispersed. The sites of BU-18 and BU-42, for example, contained copious amounts of production debris relative to their small populations, and were located almost equidistant from either Barriles or Pitti-González. These nevertheless remained relatively specialized and unusual sites, as the two emerging Formative villages otherwise contained higher proportions of production artifacts (of both stone tools and ceramics) than the remainder of the smaller sites. The situation apparently changed by the Late Bugaba, although the sample of smaller sites is practically non-existent. By this phase, evidence for production was overwhelmingly found in Pitti-González and less so at Barriles, which may have adopted a greater ceremonial role in the settlement system. The Chiriquí Period sample is unfortunately simply too small to say much of anything meaningful at all. Overall, the broader trend in the geographic patterning of production activities from a regional perspective is from dispersed in the beginning of the sequence, to a pattern where the majority of these activities are clustered in one or two sites by the end.

Within the Early and Late Bugaba villages of Barriles and Pitti-González, the spatial distribution of production material was not evenly shared between all houselots. Production debris, while never a high proportion of any single houselot's assemblage, was always spatially restricted. To some degree, this may have been an effect of sample size. If every houselot really did engage in lithic production activities, but these didn't produce artifacts which amounted to more than ≤1% of the total artifact assemblage, then we would need larger samples (well in excess of 100+ artifacts) to have at some statistical confidence that these activities probably were indeed absent. But even if this was accurate, there still would have existed differences in production activities (with some lots in excess of 5%), and these concentrations would still have been spatially restricted. This is in contrast to lithic 'repair' activities, which were generally widespread within both villages throughout the sequence and less common (but present) at smaller sites in the region, in slight contrast to the 'cottage industry' expectations of Sheets (1980). Kiln wasters, our most direct evidence of ceramic production, were also spatially restricted (95% found at Barriles), although we cannot identify exactly what phase they all belonged to. The majority (72%) of the kiln wasters found in Barriles were located near the edges of the village site (figure x), suggesting that these productive activities may not have been strongly affiliated with social ranking. In sum, the trend in geographic concentrations at the regional scale is from dispersed to clustered over time, while the majority of production activities remained concentrated within settlements at the village scale over the Formative.

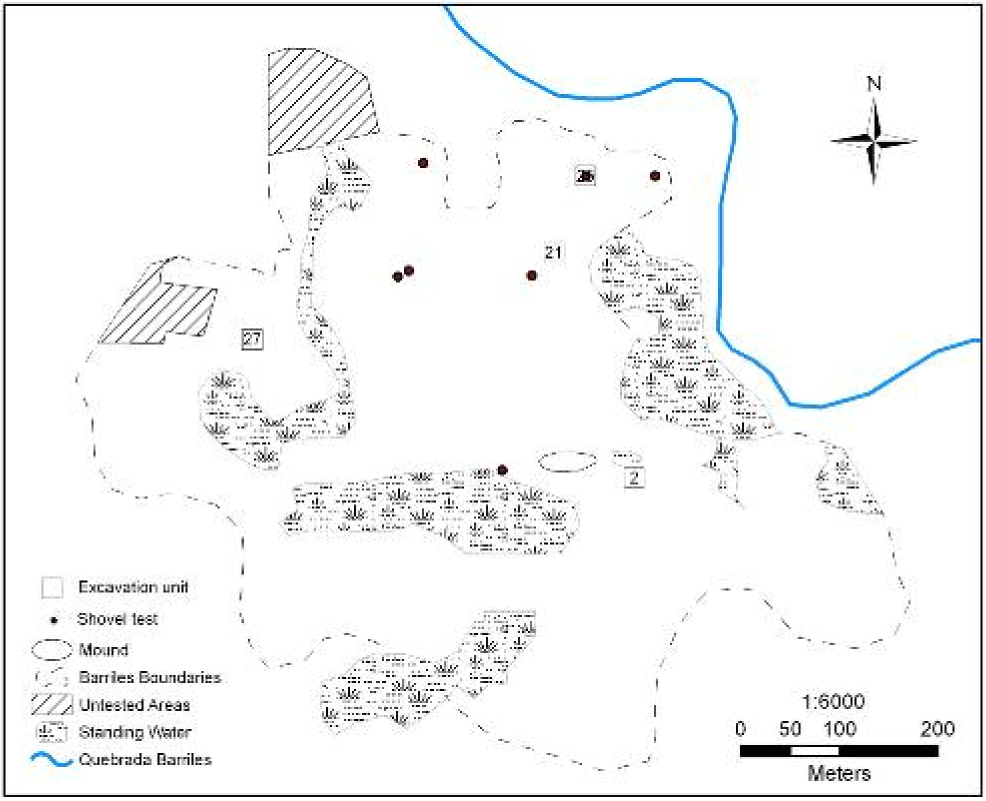

Figure 165. Location of collection units with kiln wasters in Barriles, all phase combined.

Understanding the organization of production also depends upon issues of scale, which is to say, how many people engaged in production activities over time. A crude measure of scale is to simply compare the percentages of collection units with production evidence present by site and by phase, since these collections were generally spaced in such a way to enable different houselots to be sampled. These comparisons suggest there were broad changes in scale at a level approximating the region. Since only single-component shovel tests or surface collections had both geographic spread and some random elements to their placement, only these collections (rather than excavation units) were appropriate datasets from which to examine changes in scale. The percentages of collections units with lithic production evidence (i.e. cores, hammerstones, and primary flakes) are presented in Table 4.

Table 7. Percentages of collection units with lithic production evidence (i.e. cores, hammerstones, primary flakes). This percentage multiplied by the median population estimate produced a rough estimate of the number of individuals engaged in lithic production, shown in parentheses.

	Barriles	Pitti-González	Others
Concepción Phase	3.7% (2)	23.1% (7)	0.0%
Early Bugaba	10.5% (40)	18.5% (70)	8.2% (7)
Late Bugaba	9.7% (60)	29.1% (90)	0.0%
Chiriquí	0.0%	0.0%	0.0%

Both percentages and absolute estimates point to the same trend in Table 7, where the scale of lithic production in Pitti-González was generally 33-50% larger than at Barriles, and at least double that of smaller sites. Ordinarily, the more people that become engaged in a particular activity, the less specialized it would become, since specialization is a measure of unusualness. This might mean that increased scale indicates less specialization, if not for the observation that most of the lithic production evidence was already restricted to Pitti-González at the regional scale by the Early to Late Bugaba Phases. While more and more individuals presumably became involved in these activities within the Pitti-González village, they generally did so within the context of a village, and dwarfed the output estimated for the smaller farmsteads. Considered together, both Barriles and Pitti-González had an increased scale of lithic production during the Formative compared to smaller sites, and this suggests that they were capable of supplying local populations with stone tools.

The intensity of production has been one of the most difficult and controversial axes of variation to identify archaeologically. Outside of unique and unmistakable examples like Colha in Belize (Shafer and Hester 1983, 1986), it has been near impossible to confidently calculate how much time in an average day a producer set aside for their tasks. Ranere (1980b) raised this contention with the single housefloor excavated in Pitti-González by Spang and Rosenthal (1980), which he felt simply wasn't a dense enough chipped stone midden to qualify as an axe specialist's house. While many studies of production typically wind up bordering on typological debates such as these, Costin (1991) has offered a novel solution to the intensity quandary. She argued that, rather on insisting upon dichotomies like full-time/part-time or specialization/non-specialization, analyzing the relative proportions of 'domestic debris' and 'production material' would address the degrees to which an activity was done in conjunction with domestic tasks. Doing so in the Volcán Barú case brings us to the same general conclusion regardless of phase. Production materials were always mixed with evidence for domestic activities (i.e. cooking vessels, undecorated sherds, etc.), rarely exceeding more than 5% of the total assemblage. The inescapable conclusion is that production activities were probably part-time affairs throughout the sequence, probably managed by domestic groups, and never organized like anything remotely close to commercial or industrial specializations.

The intensity of lithic production can also produce a standardized per capita estimate. Because lithic production evidence were found mixed within domestic artifact assemblages, the relative amount of evidence can be expressed as a ratio per 1000 artifacts (in this case, all artifacts rather than only lithics). These ratios are produced in Tables 8 and 9. These suggest that, at a regional level, one lithic production artifact was found for every 258 artifacts or (3.9:1000) during the Concepción (n= 1808 artifacts). The Early (n=7799) and Late Bugaba (n=7082) provide identical ratios, 10.1:1000. No production stage lithics were found in Chiriquí contexts. This evidence suggests that the per capita intensity of lithic production increased roughly 2.5 times during the Formative Period.

Table 8. Ratios of lithic production artifacts per 1000 artifacts over time.

	Ratio (X production lithics per 1000 artifacts)
Concepción Phase	3.9
Early Bugaba	10.1
Late Bugaba	10.1
Chiriquí	0

There were also changes in the scale of production between sites, and these ratios are shown in table 9.1. Although Pitti-González had a roughly equivalent residential population to Barriles during the Concepción and Early Bugaba, it produced somewhere between 6 and 1.5 times as many stone tools. It was only rivaled during the Early Bugaba by the sites of Dos Ríos and BU-18 produced even lower ratios, 58.8:1000 and 20.8:1000 respectively, or two to five times more production than Pitti-González despite having 1/20th the residential population. By the Late Bugaba, Pitti-González had roughly half the residential population of Barriles, but had nearly 5 times the production evidence. The overall trend is one of an increased intensity of production during the Formative, but one which reached its highest scale and intensity at Pitti-González while it decreased at Barriles. Whether Pitti-González was capable of provisioning all of the regional population with stone tools is unknown, but the geographic concentration, scale and intensity of production evidence there makes it reasonable to suggest that it might have at least functioned to provision the Cerro Punta basin population.

Table 9. Ratios of lithic production artifacts per 1000 artifacts by site and over time.

	Barriles	Pitti-González	Others
Concepción Phase	1.7	10.2	0.0
Early Bugaba	6.0	10.3	12.5
Late Bugaba	3.9	18.5	0.0
Chiriquí	0.0	0.0	0.0

In sum, there were changes and continuities in the organization of production throughout the sequence. Lithic production activities started out as widely distributed only to become more geographically concentrated through time, especially in the villages. Trends in the scale of production also changed, increasing in scale during the Formative, and increasing to scale (while others decreased) in Pitti-González. While lithic production activities were likely organized in concert with other domestic tasks and done by members of many different houselots, these never approached anything remotely like an industry or factory. However, the relative intensity of these activities increased at Pitti-González, particularly during the Late Bugaba Phase. The geographic concentration, scale, and intensity of these activities all suggest that Pitti-González may have been organized as a stoneworking village during the Formative. While these changes were associated with increasing sociopolitical complexity on a regional scale, they still remained relatively modest. For many of those engaged in lithic production, the consequences of increasing social complexity probably did not dramatically alter their existing domestic activities, they simply produced slightly more. Our understanding of those not engaged in production and not living in villages is muddled at the moment, but their lives could have been made more difficult by these changes in the organization of production.

9.3 RECOGNIZING SOCIAL RANK IN DOMESTIC ASSEMBLAGES

The evidence suggests that the evolution of identifiable social rank in the Formative was likely a relatively slow process that resulted in fairly subtle differences between domestic groups. The so-called ‘fancy’ wares are believed to have represented a correlate of elevated social rank because they remained spatially restricted (at both regional and village levels) throughout the sequence, and because they required the most labor to produce. These fancy wares were often pieces of serving vessels, although it is not absolutely certain that was always the case. Beyond higher proportions of these, the expression of social rank varied at different sites. On one hand, the villages of Barriles and Pitti-González both contained much higher proportions of fancy and otherwise decorated sherds than any of the smaller sites at any point in the sequence. But there were also differences in terms of the activities which elevated social rank was connected to between Barriles and Pitti-González, therefore social status did not have the exact same basis even among contemporaneous sites in the same valley.

Samples from both Barriles and Pitti-González were so small and variable that we have very little confidence in any observed differences in artifact proportions in either the Concepción phase or the Chiriquí Period. Expanding this sample to include every sizable Concepción collection (>10 artifacts) regardless of provenience suggested there no were clear social differences or strong variations in activities present during the earliest phase at Barriles (figure 166). No such possibility was available in the Chiriquí sample, which is simply too small to conclude almost anything meaningful. By the Early Bugaba Phase (figure 167) in Barriles, it is clear that elevated social rank was connected to only subtle differences in domestic activities, of which the most statistically significant was a tendency for houselots with more fancy or decorated sherds to be slightly more involved in serving activities. This subtle difference became a stronger difference in Late Bugaba Barriles (figure 168), where houselots with more fancy pottery generally contained twice as many serving vessel rims. Otherwise differences in the activities that different domestic groups performed during the Formative remained nearly equivalent.

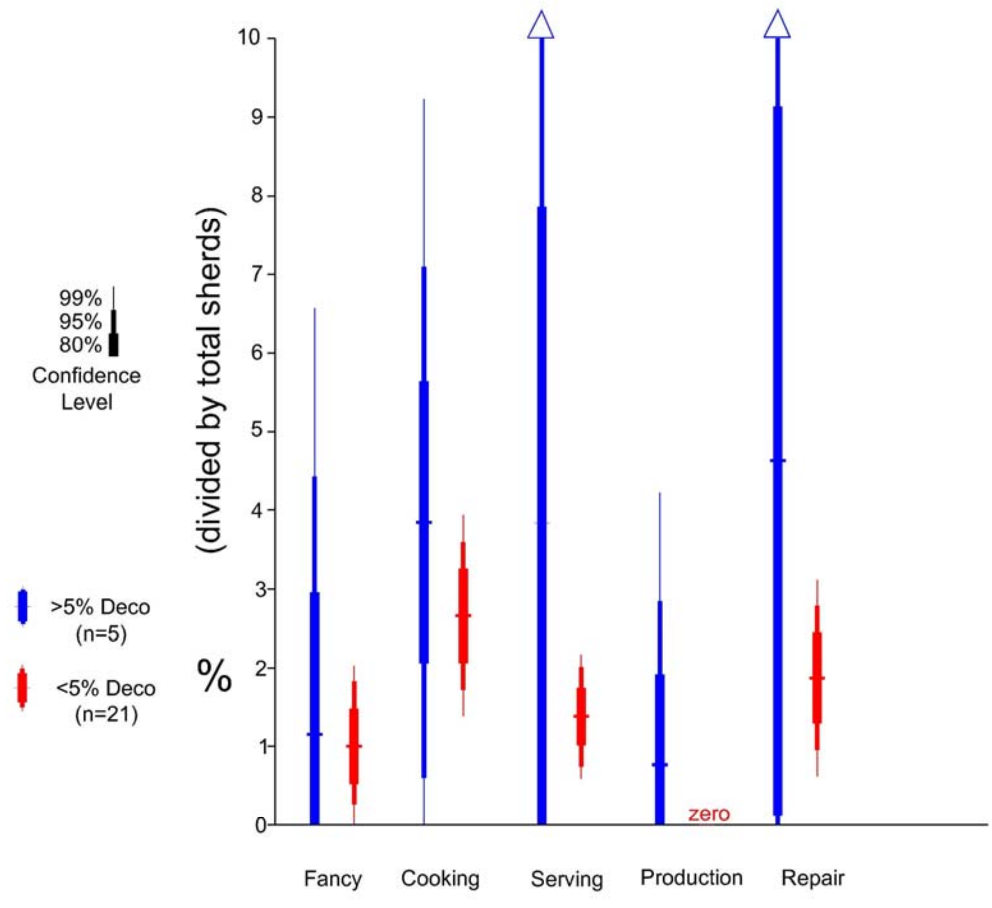

Figure 166. Statistical comparisons of artifact proportions from Concepción collection lots from Barriles containing more than 5% decorated sherds (blue) versus those with less (red). All artifacts divided by total sherds.

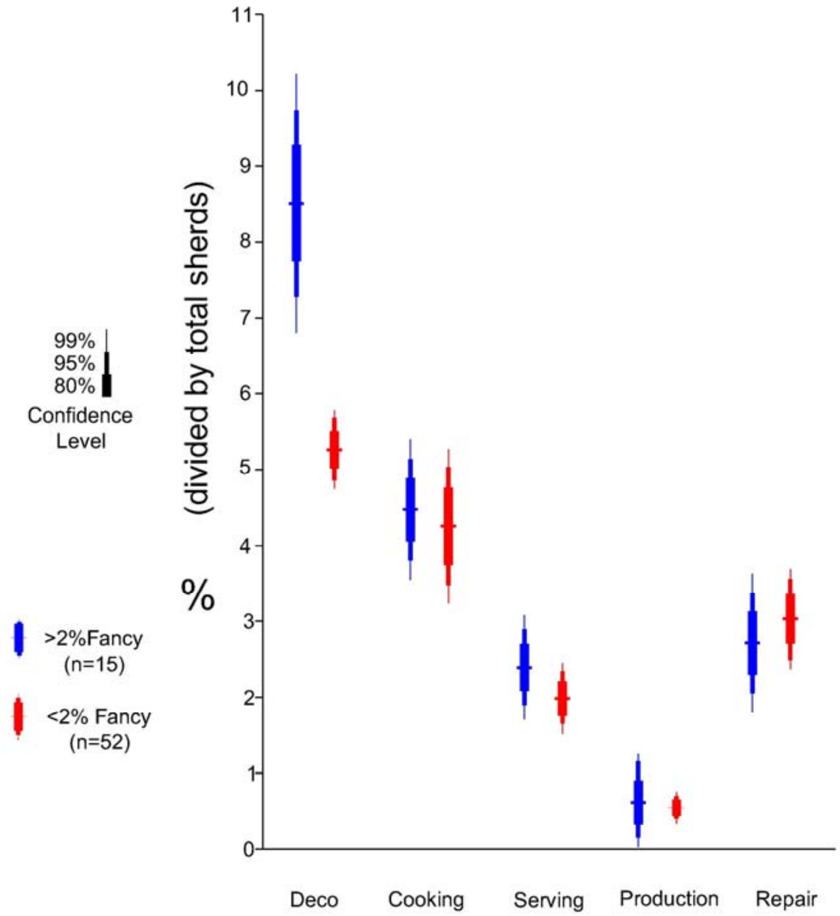

Figure 167. Statistical comparisons of artifact proportions from Early Bugaba collection lots from Barriles containing more than 2% fancy sherds (blue) versus those with less (red). All artifacts divided by total identifiable sherds.

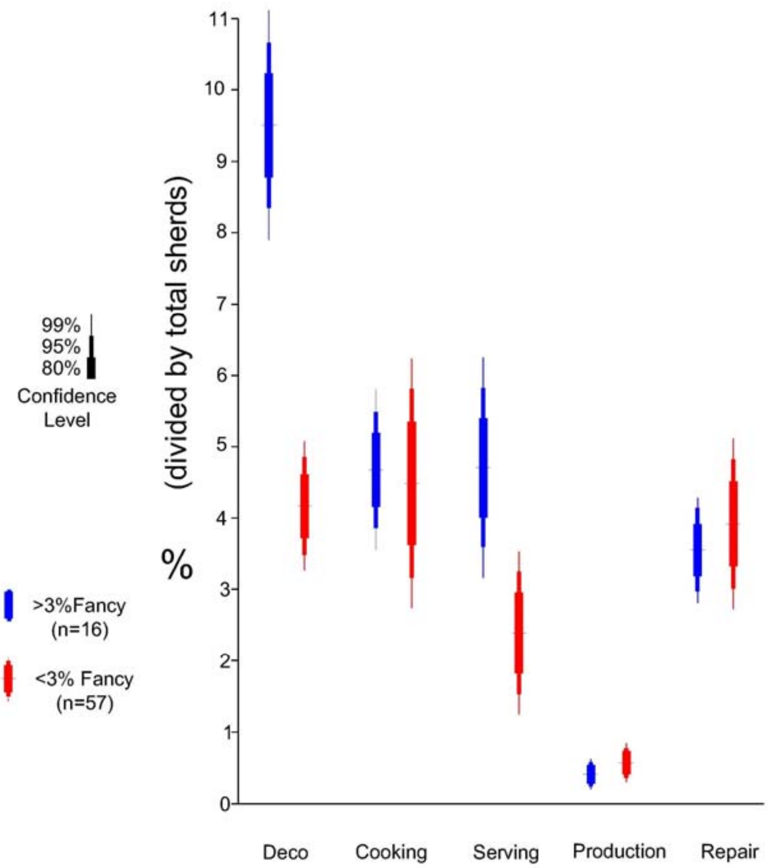

Figure 168. Statistical comparisons of artifact proportions from Late Bugaba collection lots from Barriles containing more than 3% fancy sherds (blue) versus those with less (red). All artifacts divided by total identifiable sherds.

The recognition of higher social status, defined by elevated fancy ware proportions, with serving activities borders on a circular argument because nearly 80% of serving vessels were decorated (figure 14). Collection lots containing lots of fancy ware sherds would, if rims or bases were found, typically include several serving vessel fragments. In a site like Pitti-González, there is no satisfying way around this problem other than to just be honest about it. But Barriles offered the possibility for a slightly more emic unit of analysis that could be used to 'check' the interpretations based on dividing collection lots based on more statistical terms. Unlike Pitti-González, the occupational core of Barriles was ringed by a series of petroglyphs and *laja* slabs (which presumably covered tombs), an area referred to here as the 'petroglyph core' (Figure 169). Petroglyph features appeared to outline the areas of highest residential density at Barriles during the Early to Late Bugaba, and are believed to potentially demarcate what was an important social space. Proportions of different artifacts from collection lots inside the petroglyph core could be contrasted with those outside of it. As shown in Figures 170 and 171, using these rough village core-periphery categories told essentially the same story arrived at by separating collection lots according to fancy ware proportions. That is to say, there were only subtle and modest differences in activities and various artifact proportions at Barriles during the Early Bugaba Phase, but that inhabitants within the petroglyph core intensified their serving activities (and consumed more decorated ceramics) during the Late Bugaba Phase. This general agreement in patterns arrived at by analyzing the data in two different ways offers some reassurance that the patterns observed using only fancy ware proportions likely have reflected something meaningful about actual prehistoric activities, rather than about the nature of the sherds themselves.

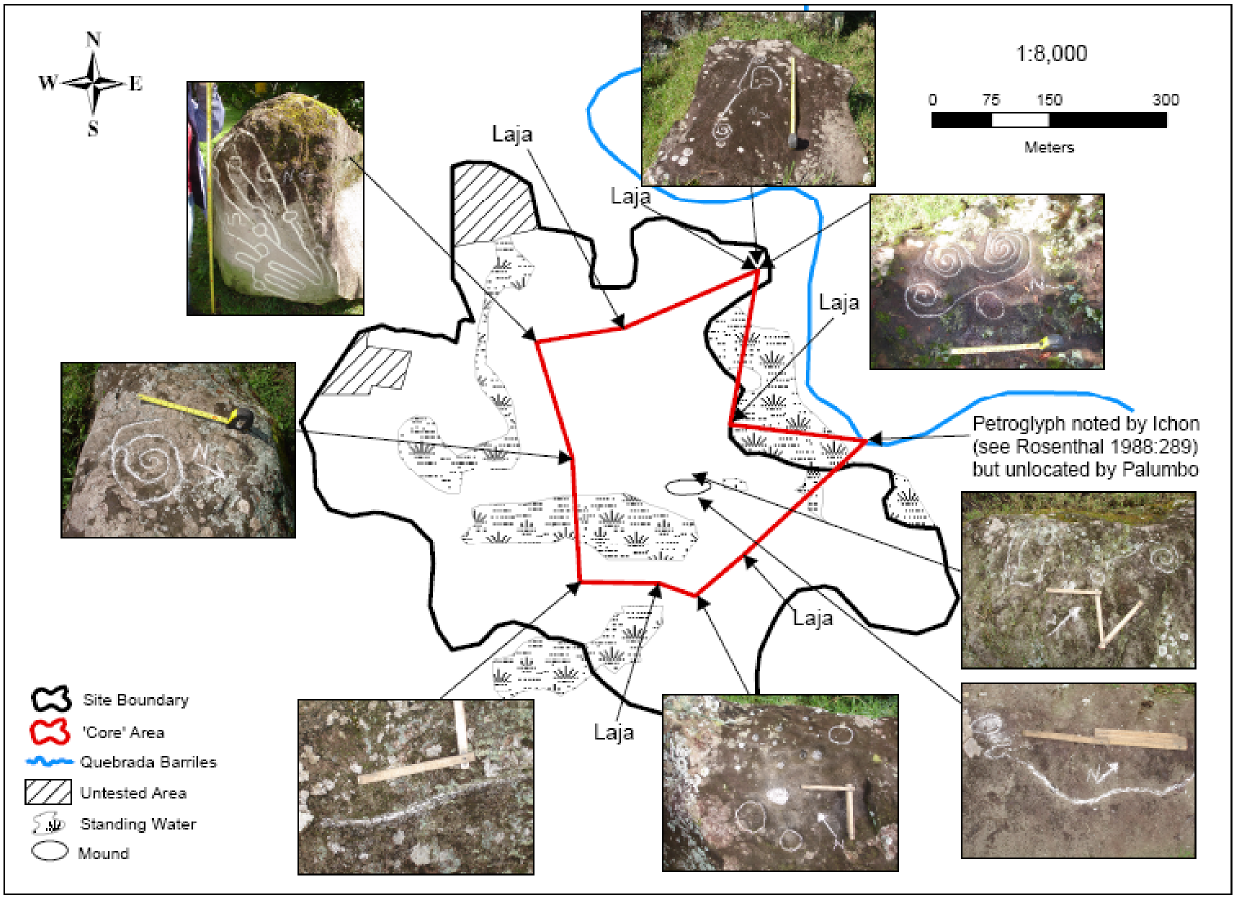

Figure 169. Barriles petroglyph core.

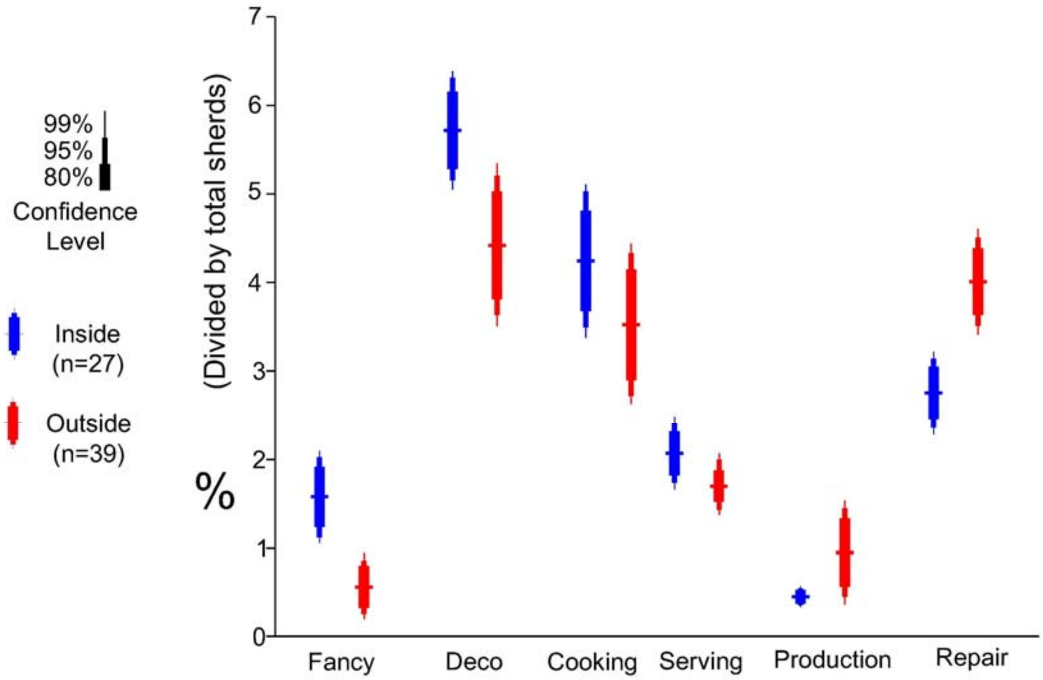

Figure 170. Statistical comparisons of artifact proportions from Early Bugaba collection lots from Barriles located inside the petroglyph core (blue) versus those outside (red). All artifacts divided by total sherds.

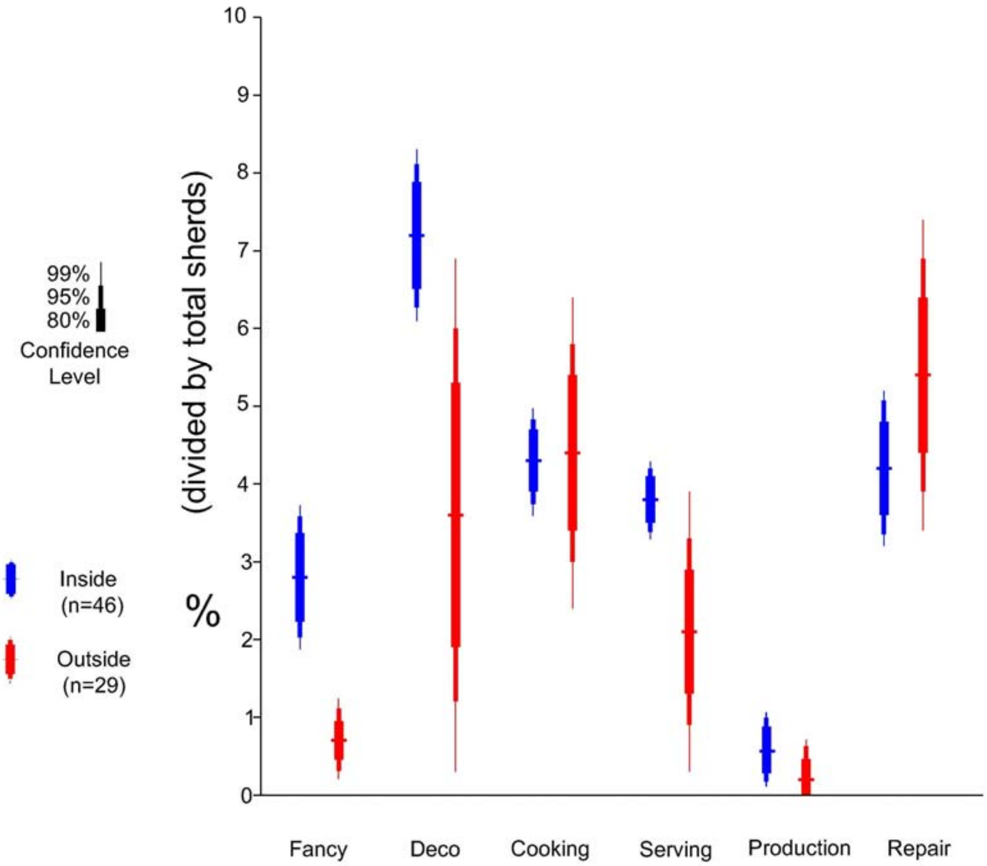

Figure 171. Statistical comparisons of artifact proportions from Late Bugaba collection lots from Barriles located inside the petroglyph core (blue) versus those outside (red). All artifacts divided by total identifiable sherds.

Pitti-González houselots containing elevated proportions of fancy wares tended to contain proportions twice as high as their Barriles counterparts, even though the two sites contained roughly the same village-wide proportions through the Early to Late Bugaba Phases. The activities to which elevated social rank was connected to at Pitti-González were subtle, and we cannot always have very much confidence that these were not the product of sampling vagaries. Higher status houselots at Pitti-González tended to have high proportions of serving ware, like in Barriles, but also contained higher proportions of chipped stone debitage. Binary bullet graph comparisons, in the examples below (figures 172 and 173), produced largely inconclusive results. However, as will be discussed in the following section, there were good reasons to believe that higher social status was more strongly related to involvement in stoneworking activities at Pitti-González rather than the serving or ceremonial activities observed at Barriles.

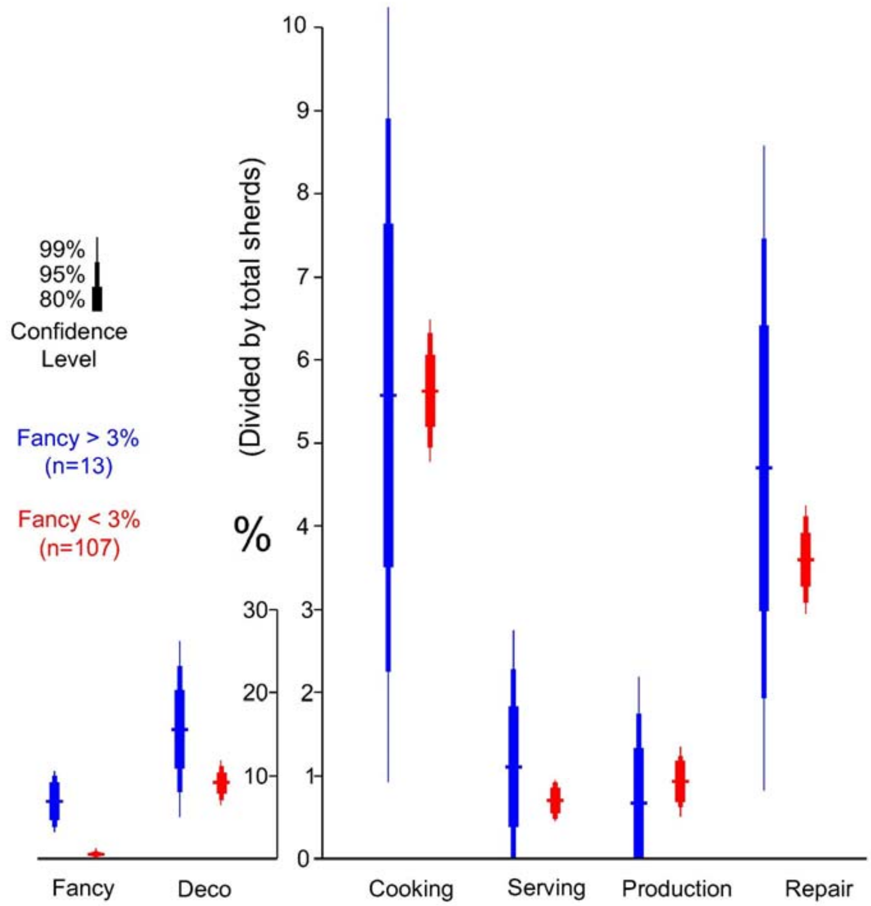

Figure 172. Statistical comparisons of artifact proportions from Early Bugaba collection lots from Pitti-González containing more than 3% fancy sherds (blue) versus those with less (red). All artifacts divided by total sherds.

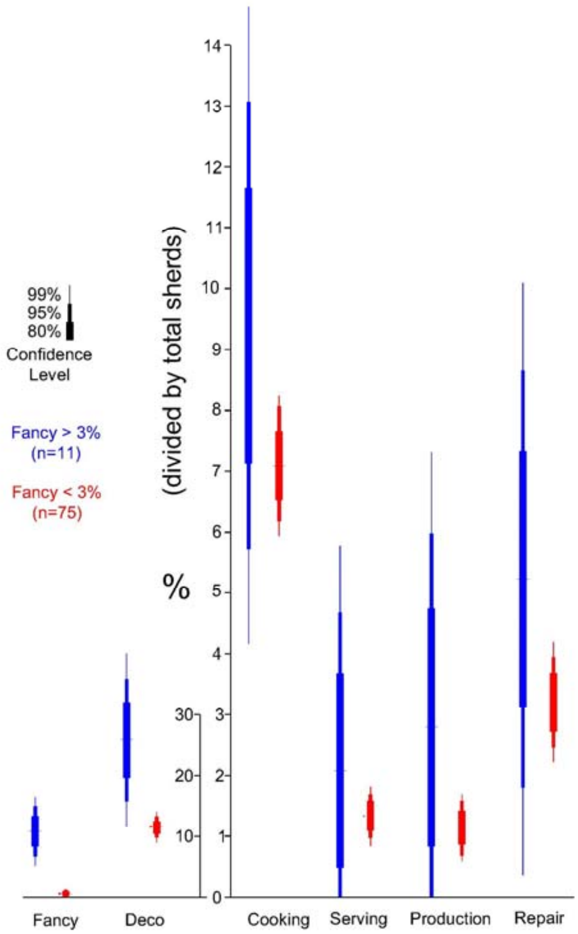

Figure 173. Statistical comparisons of artifact proportions from Late Bugaba collection lots from Pitti-González containing more than 3% fancy sherds (blue) versus those with less (red). All artifacts divided by total sherds.

9.4 THE SOCIAL AFFILIATION OF PRODUCTION

Determining the social affiliation of production meant analyzing the relationship between these activities and the evidence for social rank. The spatial proximity between production middens and houselots of otherwise higher social status has typically been taken as a measure of this relationship, which some researchers have equated with varying degrees of control over the production process (Brumfiel and Earle 1987; Costin 1991; Earle 1987). Different spatial associations between high proportions of fancy sherds and other materials were observed between Barriles and Pitti-González (figures 9.6-9.15).

In the Early Bugaba phase, there were only subtle tendencies for higher proportions of either serving or cooking vessel rims (but typically not both in the same collection lot) to cluster near areas of higher social rank (figure 174). There was a similar tendency for chipped stone debris to be found just outside of these same areas (figure 174). This suggested the higher status houselots may have been involved a relatively wider variety of activities, from cooking and storage to stoneworking activities. A similar pattern was evident in Early Bugaba Pitti-González, where the village as a whole was engaged in stoneworking activities at a higher intensity than Barriles (table 9). In both sites, lithic production evidence was generally located around zones containing higher proportions of fancy sherds. Such evidence might be taken for a variety of ‘attached specialization’, which Brumfiel and Earle (1987) described as producers working besides their patrons. They may also reflect situations where sharp debitage was intentionally moved outside of the houselot area, thereby reflecting a form of ‘embedded’ production were incipient elites handled stoneworking activates themselves, or a combination of both scenarios. Either way, social rank appears to have been a factor in the organization of lithic production, though not an exclusive one. As inferred from both bullet graphs and distributional maps, the emerging villages of Barriles and Pitti-González were highly variable, and perhaps competitive, arenas where social rank was not monolithic, but probably tied to a number of different activities and interests.

Out of this matrix of increasing interaction evolved clearer associations between different activities and elevated social rank. Heightened social status in Late Bugaba Barriles appeared most closely connected to serving activities. Here higher proportions of serving vessel rims were almost always spatially associated (and overlapping) with higher proportions of fancy and decorated sherds (figure 175). Cooking vessel rims show a similar distribution, but we cannot have very much statistical confidence in this pattern. Chipped stone debitage is still largely found in proximity to high status areas (figure 177), but the scale of production nevertheless decreased by approximately 33% village-wide during the phase (table 9). Pitti-González exhibited almost the opposite pattern. There the spatial association between chipped stone debitage and high status areas continued (figure 180), which seems meaningful since the scale of lithic production nearly doubled (table 9). Serving activities remained largely adjacent to these high status areas in the Late Bugaba, but were present in significantly lower proportions at Pitti-González than at Barriles. It therefore is reasonable to conclude that serving activities were more closely affiliated with elevated social rank at Barriles during the Formative, and that stoneworking activities (either production or repair) were tied more closely to social status at Pitti-González during the same time.

When compared to the proportions of decorated sherds (figures 170 to 175) between the two sites, the implications of these patterns suggest that the production or repair of generally utilitarian stone tools at Pitti-González was associated with stronger differences in consumption of decorated (rather than strictly fancy) ceramics. Lithic production in Barriles may have been organized in similar ways to that in Pitti-González, but there was less of it over time. Instead the hosting of serving and probably ceremonial activities was related to social rank, but this was associated with weaker differences in the consumption of decorated ceramics. It is possible that the two cases illustrate two brands of social hierarchy, one connected to increased consumption of decorated ceramics and involvement in economic activities (perhaps principles of wealth accumulation), the other to issues of feasting and ceremony (perhaps principles of prestige or social capital accumulation). The latter may be the result of qualitatively different activities at Barriles. If redistributive exchanges or gift-giving were associated with serving activities, thus spreading fancier ceramics around the village (i.e. Vaughn 2004), then we might expect to observe a situation where differences in artifact proportions are less pronounced or exaggerated than elsewhere.

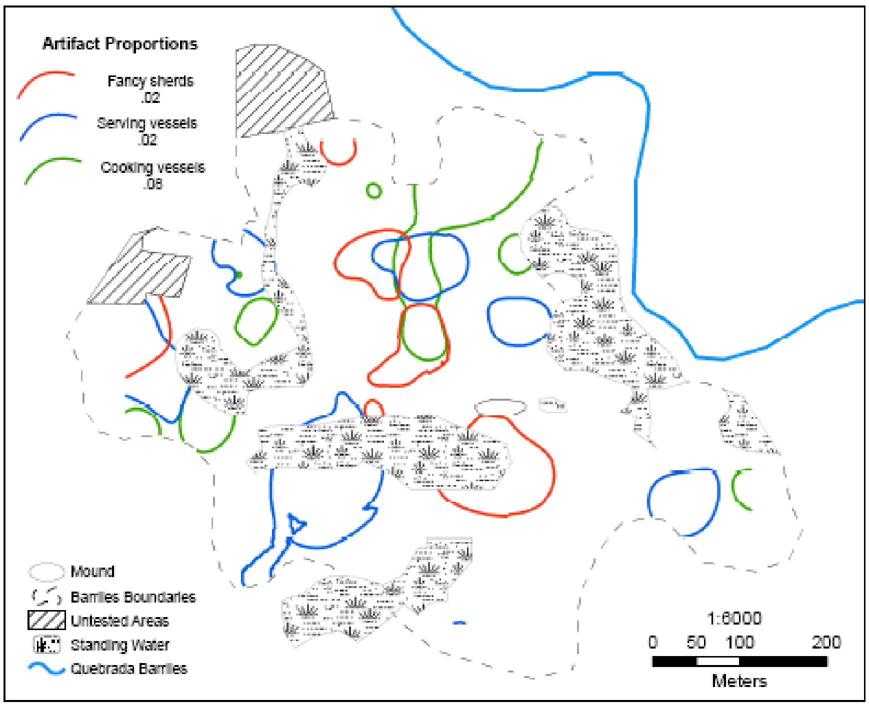

Figure 174. Associations between elevated proportions of fancy sherds, serving and cooking vessels within Early Bugaba Barriles.

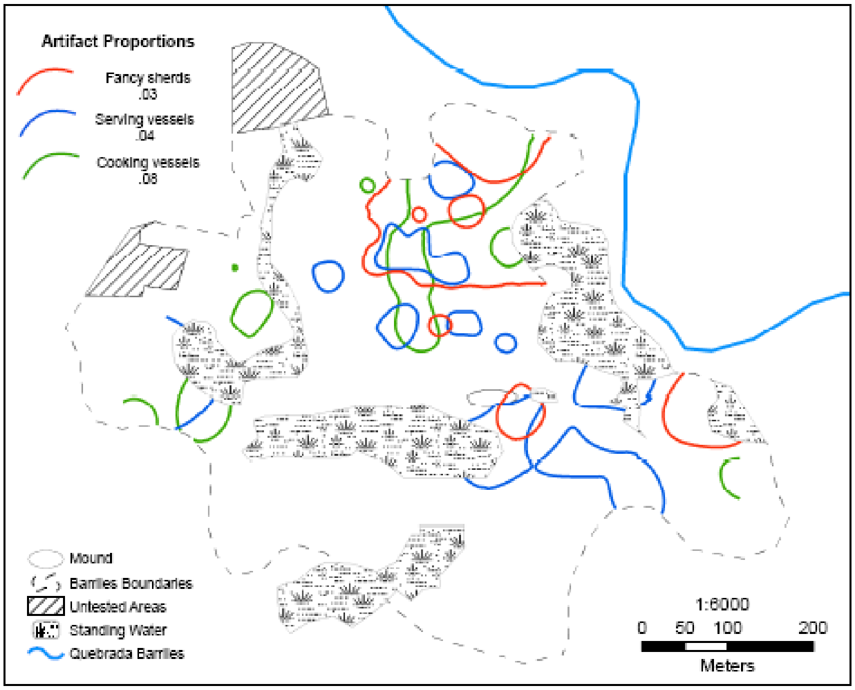

Figure 175. Associations between elevated proportions of fancy sherds, serving and cooking vessels within Late Bugaba Barriles.

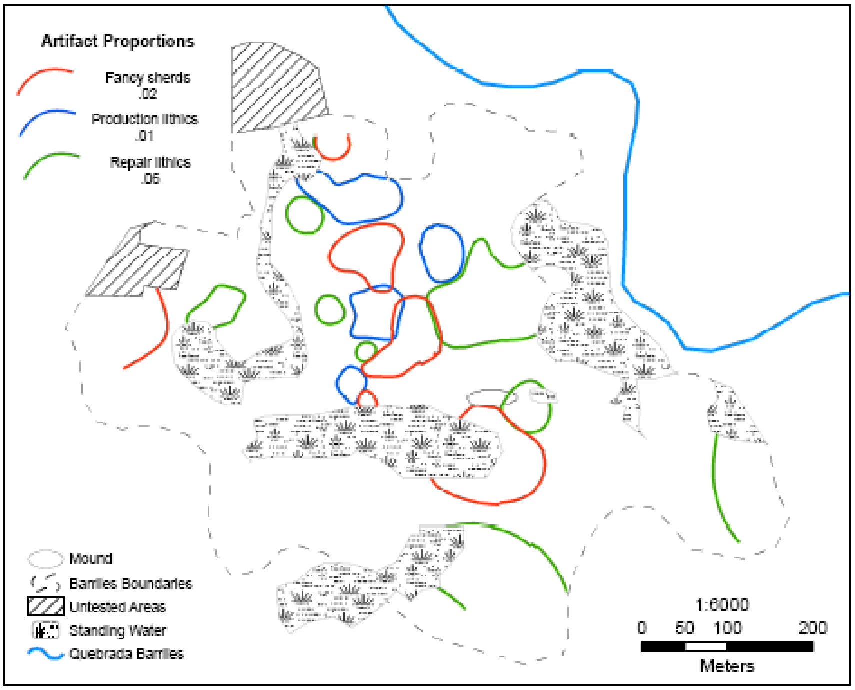

Figure 176. Associations between elevated proportions of fancy sherds, lithic production and repair artifacts within Early Bugaba Barriles.

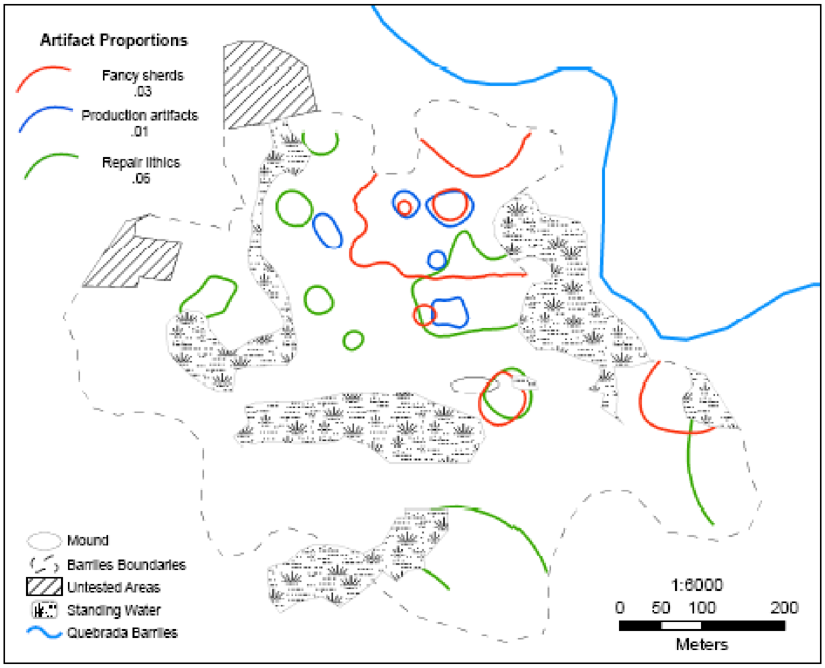

Figure 177. Associations between elevated proportions of fancy sherds, lithic production and repair artifacts within Late Bugaba Barriles.

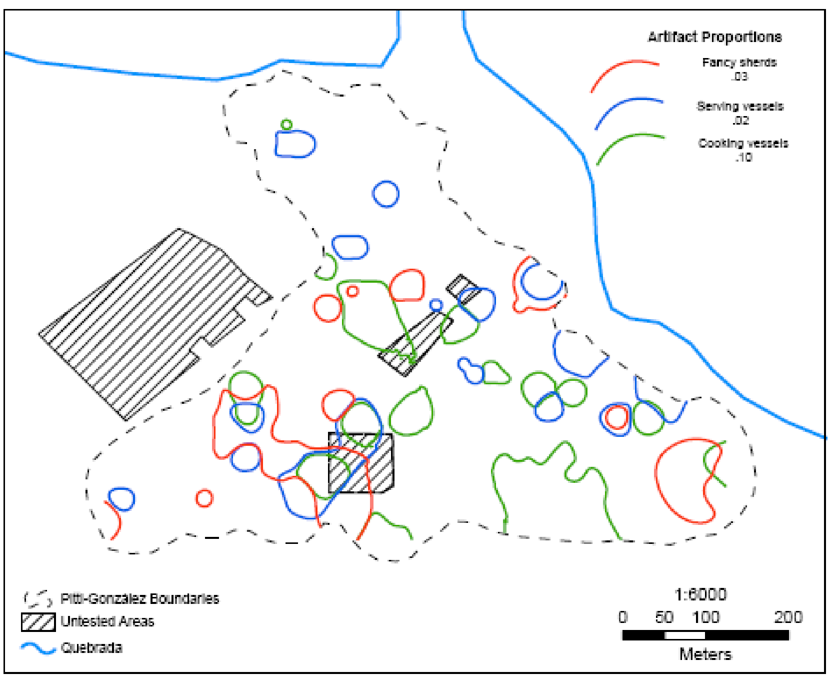

Figure 178. Associations between elevated proportions of fancy sherds, serving and cooking vessels within Early Bugaba Pitti-González.

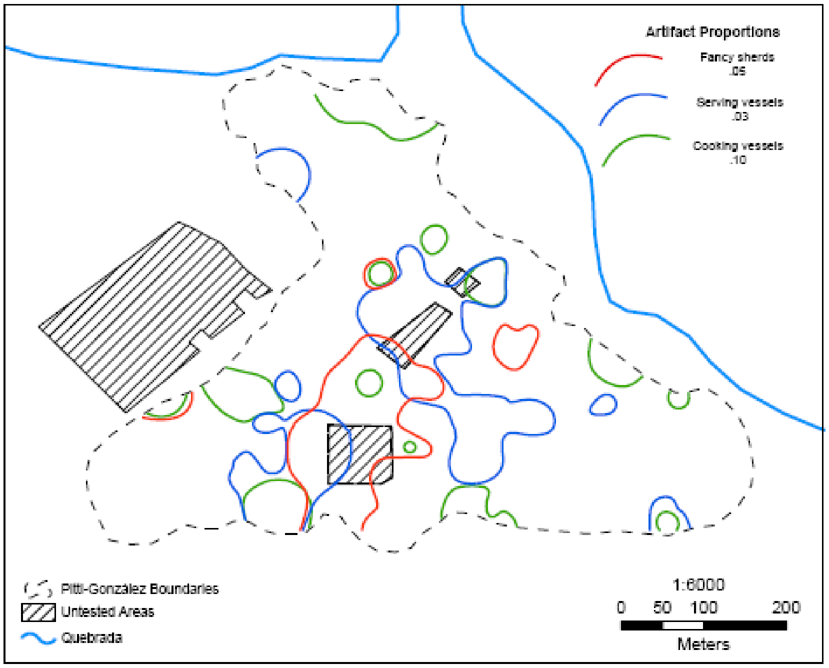

Figure 179. Associations between elevated proportions of fancy sherds, serving and cooking vessels within Late Bugaba Pitti-González.

Figure 180. Associations between elevated proportions of fancy sherds, lithic production and repair artifacts within Early Bugaba Pitti-González.

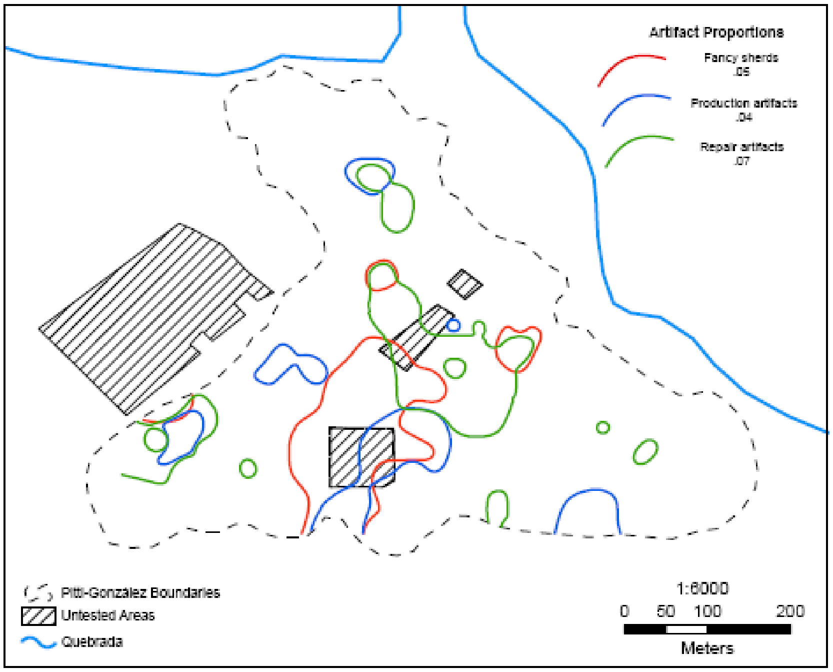

Figure 181. Associations between elevated proportions of fancy sherds, lithic production and repair artifacts within Late Bugaba Pitti-González.

9.5 THE POSSIBLE SOCIAL CONTEXTS OF SERVING ACTIVITIES AT BARRILES

While there is reason to suspect that serving activities played an important role in the development of Barriles as village and as an emergent political community, the mere recognition of these activities says little about the specific nature of the ceremonies which they were likely a part of. Feasting activities are recognized as any which involve the sharing of special foods and drinks, or the sharing of a meal for a special purpose occasion (Hayden 2001:28). This definition encompasses many highly variable food or drink sharing activities, many of which may have potentially fulfilled a number of different functions. These range from mobilizing labor to excluding particular groups to creating networks of reciprocal obligations (Hayden 2001). The distributions of serving vessels, some fancy and others not, within villages suggests that feasting activities were not exclusive affairs managed by (or contributing to the definition of) social elites. Using Hayden's (2001) terminology, these feasting activities may have ranged between competitive feasts between different portions of the village to tribute (funerary) feasts, as discussed below.

One of the more popular analogies for ceremonies past and present, especially for Western and Central Panama, has been the *balsería* ceremony previously observed in Guaymí societies (i.e. Cooke 1984; Jessome 2008; Locascio 2009; Torres de Araúz n.d.; Young 1971, 1976, 1980). While many have assumed that the inhabitants of Barriles were proto-Guaymí, it seems just as likely that they were instead ancestors of the Dorasque (see Joyce 1916; Miranda de Cabal 1974) and the Guaymí might have been more recent arrivals to the area (Linares 1977a). Nevertheless, the *balsería* was associated with ceremonial battles, ritual feasting, and the exchange of materials, and has been described as a path to leadership in Guaymí society by Young (1971, 1976, 1980). These events drew primarily male visitors and combatants in from surrounding regions, lasted for days at time, and consumed fast amounts of food and *chicha*. We might also speculate that enormous quantities of *chicha* may have taken substantial amounts of female labor to prepare (see Jennings 2005), the availability of this labor representing a bottleneck in a ceremonial mode of production. These events were often hosted by individual families, and good hosts usually exhausted many of their own supplies to provision appropriate feasts (Jessome 2008), but accumulated a great deal of prestige and social capital in the process.

There are some good reasons to be wary of *balsería* analogies, especially those which might be advanced as mechanisms through which social capital is accrued and nascent political hierarchies might form around. *Balsería* events have generally been observed among societies (i.e. Bocas Guaymí) which lacked nucleated villages or regional settlement hierarchies, though they were attended by individuals across a region or even from different valleys. This is a curious observation if *balsería* activities are regarded as possibly inequality-inducing and centralizing activities, since they had no such lasting effect in neither ethnohistoric nor ethnographic cases. The redistribution of food, the exchange of goods, and the calling in of outstanding kin obligations might actually have served to level emerging social inequalities rather than create them. Another potential worry is that *balsería* scenarios have bordered on a timeless vision of these ceremonies, as there is no firm empirical evidence (besides feasting activities) that *balserías* occurred in A.D. 500, or even A.D. 1000. Somewhat analogous to Andean *tinku* battles, *balserías* might also be thought of as reactions to historical circumstances, such as impressing or terrifying outsiders, rather than as practices with deep structural roots in Central American or even generalized macro-Chibchan society.

While the *balsería* is generally considered most often by those working in Panama, the most likely alternative analogy, funerary ceremonies, are best documented through Costa Rican sources. Ethnographers working in the Talamanca mountains (i.e. Gabb 1875; Stone 1962, 1977) described protracted funeral ceremonies, oftentimes lasting over a year, where the body of an important individual was buried with a few possessions and allowed to decay. After some time, the skeletal remains were excavated and subsequent large feasts involving copious amounts of *chicha* and funerary specialists were held in the presence of the bone bundle. Afterwards, the bone bundle was re-interred in a special cemetery. What we know about some Panamanian funerary practices might represent a twist on Talamancan funerals, as chiefly bodies were smoked and mummified on outdoor drying racks, and these mummies located in the chiefly houses and periodically consulted with by the living (Linares 1977b; Ovieda y Valdés 1950). Both examples involved extended preparation of the physical body following death and were closely associated with feasting activities. For important political and religious personages, these ceremonial activities drew in hundreds of participants from surrounding areas and impressed upon them the importance of chiefly bodies and genealogies.

One advantage to considering the role of funerary-feasting ceremonies is that aspects of these ceremonies are more recognizable archaeologically. Empty tombs containing some artifacts, but no human remains, have been described by Quilter (2004) and Stone (1977) in Costa Rica, and by Lothrop (1937, 1950), Mason (1937), and Linares (1977a) for Central Panama (see also Briggs 1993; Jessome 2008). The most famous burial site in Central Panama, Sitio Conte, was seasonally flooded and was only accessible in the dry season (Linares 1977a), perhaps creating an annual pause in the mortuary ritual calendar. The sum of our knowledge about Western Panamanian mortuary practices, unfortunately, remains practically non-existent (i.e. Bernstein 1984; Haberland 1955; Holmes 1888) until very recently (Briggs 1989, DeYoung 2008), and we might not expect skeletal material to regularly preserve in many regions anyway. However, between the Upper Chiriquí Viejo (Ichon 1968; Stirling 1950), and perhaps the Gulf of Chiriquí (Linares 1968b), urn burials are common, which suggests that bodies were likely prepped (disarticulated, cremated, etc.) in some way to be ultimately placed into the vessel. The association of feasting evidence at sites with presumably fancy burials, He-4 and Barriles (and perhaps Sitio Conte/El Caño), lends support to the idea that feasting and burial ceremonies may have been related phenomena. Like the *balsería*, these ceremonies would have drawn in participants from afar, transferred prestige to persons or corporate groups, and involved conspicuous feasts. The principal advantage to the analogy is that these activities have generally been documented in association with Central American chiefdoms both ethnohistorically and archaeologically.

9.6 VOLCÁN BARÚ IN COMPARATIVE CONTEXT

On a more general level, it doesn't matter greatly if the proper analog was organized precisely like the *balsería*, the Talamancan funeral feast, or some yet unimagined alternative. What matters more to a broader comparative perspective is that serving activities, and presumably the prestige-building ceremonies of which they were a part, were associated with elevated social rank and the emergence of Barriles as a political center between the Early to Late Bugaba Phases. While the village of Pitti-González became increasingly 'specialized' in stoneworking during the same phase, there is no convincing evidence that this village also assumed a comparable level of political or ceremonial significance as Barriles since it contained a smaller, more dispersed residential population and no (surviving) statues or monuments. While the trend has been for both villages to become increasingly 'specialized' in either ceremonial or economic terms, the unavoidable conclusion is that ideological and ceremonial factors were most salient with respect to the development of subtle social inequalities at Barriles and its growth as a village that likely headed a regional polity.

So why, of all things, were serving or feasting activities important to the development of the political center of Barriles in the Formative Period of the Upper Chiriquí Viejo? To try and answer this question requires placing the Volcán Barú region in comparative perspective. With the benefit of nearly a decade of hindsight (i.e. Behling 2000; Clement and Horn 2001; Holmberg 2005, 2007, 2009), it seems reasonable to conclude that Formative populations in the

Upper Chiriquí Viejo occupied an area abundant in natural resources and arable land, and probably experienced only the most minimal of ecological risks throughout the entire sequence. While areas of the valley are environmentally circumscribed, the regional population was highly unlikely to have experienced persistent population pressure at any point in the sequence. The population estimates calculated in this thesis have suggested that regional population densities probably remained low and spatially dispersed throughout most of the sequence, certainly in the phases preceding chiefdom emergence. As Drolet (1992) observed for the Upper Terraba of Southern Costa Rica, these highland Formative populations apparently did not participate in the wider sphere of long-distance exchange at all, at least not of materials which might ordinarily preserve such as painted ceramics or jade artifacts known from Costa Rica. Any overtures to external factors (interaction spheres, climate change, large migrations, etc.) therefore find little support in the material record reviewed here.

Situations involving low population densities, lack of population pressure, and relatively high (or high enough and risk minimal) resource productivity have been described in other Formative Period cases, notably the Soconusco region of Pacific Chiapas (Blake and Clark 1999; Hayden 1998), the Fuquene Valley of Colombia (Langebaek 1995), and the Tanjay region of the Phillipines (Junker 1999). The availability of labor, not territory, may have been a factor limiting an ability to transcend the domestic mode of production. In each of these cases, there were reasonably strong indications that feasting events were have been the principal activities associated with the emergence (not necessarily persistence) of political hierarchies and central place villages. Like Barriles, this evidence often takes the form of higher proportions of serving vessels, or more diversity in vessel forms, within or around emerging centers. As Junker (2001) and Demarest (2001) have argued, hosting feasts and ceremonies may have enhanced the ability to impress and court labor that could just as easily have stayed away, or moved elsewhere. Given particular ecological and demographic circumstances, putting on a good 'show' may have been one of the few strategies available to incipient elites to attract labor and create reciprocal obligations.

Such an idea is reminiscent of a largely forgotten aspect of Blanton *et al.* (1996:7), who argued that corporate strategies- those emphasizing group activities- might occur more often in more productive environments open to intensification. There are good reasons to steer clear of their dual processual labels entirely, essentially since the Upper Chiriquí Viejo appears to eventually celebrate individuals in their statues and tombs (a network correlate) yet entirely lack clear evidence for extralocal trade (a network strategy), an observation similar to the objection voiced in Drennan and Peterson (2006) using the Alto Magdalena of Colombia. But the general idea that productive environments might be more regularly associated with group-oriented practices such as feasts and ceremonies resonates somewhat with the idea that productive environments and low population densities offer concrete constraints and only limited opportunities to centralize populations and build multi-generational political hierarchies, a point echoed by Hoopes (1991) for Formative Costa Rica. When chiefdoms did develop under these sorts of conditions, which apparently happened only rarely, feasting ceremonies seem relatively pronounced (see Berrey 2008). However, all this remains speculation to be compared against as many detailed cases as possible, of which this thesis modestly adds a portion of a single case to the overall sample.

While much has been written about the factors associated with chiefdom development and persistence, relatively little attention has been focused on issues of political 'collapse'. In the Volcán Barú study area, the dissolution of political authority in the Chiriquí appeared sudden and complete. We lack evidence for any sort of regional political organization in the Chiriquí, and population declined dramatically. The few samples of Chiriquí material offer us no confidence in any observable differences. These changes were preceded by a process of increased specialization at Barriles and Pitti-González. As best as can be understood, Pitti-González may have represented an alternative and competing village to Barriles. It did not entirely replicate the functions of Barriles, although serving activities were still present and did increase over time, but was instead organized as more of a stoneworking center where elevated social rank was more directly tied to involvement in stone tool production. Economic activities tended to be much clearer at Pitti-González than at Barriles, and the inhabitants of Pitti-González consumed more decorated ceramics (and slightly less fancy wares) throughout the sequence. Because both villages still shared a lot of similarities, it might be an oversimplification to caricature Barriles as having a ceremonial role and Pitti-González an economic one, or perhaps contrasting prestige versus wealth accumulation emphases. But by occupying the opposite end of the study area 13 km distant, and by serving different functions just prior to a demographic collapse, we are left to wonder if Pitti-González didn't represent a brand of authority that challenged the ideological legitimacy of Barriles, leading to an eventual collapse of the political structure. Unfortunately, at the moment, this last point is almost entirely conjectural.

One lingering question would be why Pitti-González was organized the way it was, and why it didn't instead assume a more ceremonial role (instead of Barriles) during the Formative? One possible answer is that Pitti-González functioned as sort of a frontier village during the Bugaba Period. Three research projects, Linares and Sheets (1980), Shelton (1984), and this one, have all suggested that the earliest Concepción populations were probably more common at lower elevations. The Formative appeared to represent a time when populations colonized higher altitudes, including the Cerro Punta Basin where Pitti-González is located. These higher altitudes bordered on cloud forest, which is thicker and denser than the tropical montane forests below. Fresh incoming populations, which were probably small in number, might have created an increased demand for stone tools to clear land and perform woodworking tasks with, and the inhabitants of Pitti-González might have satisfied this demand through forms of embedded or attached specialization. Much of this too is also a matter of conjecture. If one accepts reasons to doubt many of the demographic interpretations from the original survey results (see Palumbo 2008), then we must candidly admit that we still know very little about demographic trends and even less about what activities the inhabitants of smaller sites were up to in different phases.

9.7 PROSPECTS FOR FUTURE RESEARCH

The social and political influences of Barriles and Pitti-González almost certainly extended beyond the 62km² study area (Drennan 1991). We only have a partial understanding of the roles of these villages within such a small study area, we certainly have a poor perspective on how these may have functioned on larger regional or macroregional scale. For example, we know nothing about other Aguas Buenas populations at lower altitudes and their influence on developments in the Upper Chiriquí Viejo. Shelton's (1984) work suggested that larger and more numerous Concepción phase or Chiriquí Period sites also lay downstream, and we require a better understanding of each to appreciate changes within the sequence. Statistical comparisons of systematically placed surface and subsurface collections in this study suggested that work at an expanded regional scale would provide an accurate picture of social and occupational differences between sites over time, which could then be complemented or challenged by work at smaller scales of analysis. A differently designed regional project that would resample and expand the project area, while incorporating highland zones that would almost certainly improve our understanding of change over time, would offer the most return for the investment in the near future and ultimately place the Volcán Barú region in stronger comparative context.

Differences in sherd densities by phase or period formed the basis of the population estimates presented here. These were ultimately based on the collection unit as the fundamental unit of analysis, rather than the site. These suggested that similar sized sites like Late Bugaba Barriles (32 ha) and Pitti-González (26 ha) might have been home to quite different residential populations, with Barriles eventually holding roughly twice as many people. Similarly, a collection unit strategy suggested that a massive 50 ha site like BU-2 may have been nothing more than a series of dispersed farmsteads, or even that the former site of BU-15 was probably not a site at all, but rather just a visible spot of the physical landscape which exposed a relatively ephemeral and continuous low density scatter of artifacts. All of these distinctions would have been obscured if site size was assumed to be equivalent to occupational area This calls into question the utility of using the site sizes provided by Linares *et al.* (1975) and used by Linares and Sheets (1980) as a meaningful means to calculate demographic estimates for the Volcán Barú area, which ultimately address the core of the comparative perspectives explored above.

Interpretations based on collection units or sites may lead to very different interpretations regarding settlement hierarchies, demographic centralization, relationships to local resources, and population pressure. The identification of five large sites around Barriles (and in an area of exceedingly poor surface visibility) became the basis for the argument that the southwestern study area may have been home to multiple warring chiefdom societies (Linares 1977b:313), or that seats of chiefly power frequently shifted from one village to another (Linares 1977a:79).

However, this research concluded that this portion of the study area likely contained at least one large village (Barriles) surrounded by constellations of dispersed farmsteads or hamlets which likely left a cumulative palimpsest of scattered artifacts across the physical landscape. This made the definition of crisp and unambiguous site boundaries impossible for Barriles, and the rough boundaries produced by this study essentially represent the point of declining returns encountered during the artifact collection program. Defining sites out of a context of relatively continuous artifact scatter (or where the landscape qualifies as a site) is likely to automatically result in large site size estimates, and where site sizes are largely a function of surface visibility. This may, in turn, lead towards a narrower range of interpretations or imprecise understandings of social processes.

Therefore any additional regional survey in the Upper Chiriquí Viejo would benefit from a reliance on collection units, rather than sites, as the unit of analysis. Such a survey would resample some portion of the existing study area to critically examine how interpretations of the settlement system change (or don't change) by adopting a different field methodology, and expand the survey universe in an attempt to include additional Archaic, Concepción and Chiriquí samples, thereby strengthening the discussion of long-term social dynamics. With regards to understanding the ways in which complex society developed more generally, the sequence of the Upper Chiriquí Viejo must then be placed in comparison with additional sequences which included different social or ecological patterns. Fortunately in Southern Central America, one does need to travel far to achieve these studies or comparisons, a point known perfectly well to the original Adaptive Radiations researchers. While any project undergoes critiques and revisions over the years, the central legacy of the Adaptive Radiations project has been to challenge researchers to chart and explain the sociopolitical evolutions of diverse prehistoric societies. Such an ambitious challenge will undoubtedly continue to inspire and animate research for many generations to come.

APPENDIX A

CERAMIC DESCRIPTIONS

A.1 CONCEPCIÓN WARE

Associated Dates: 300 B.C. to A.D. 400 (Shelton 1995:84)

500 B.C. to A.D. 500 (Haberland 1984:240)

Reference photos or drawings: Haberland (1962:384, 1976:Fig.1), Holmes (1888:87-90), MacCurdy (1911:XX), Osgood (1935:236), Shelton (1984:Figs 4-1 to 4-5), Spang *et al.* (1980:356)

Number of specimens: 322 (172 from stratigraphic excavations, 57 of these included in the multidimensional analyses)

Surface: A variety of slips, from a pale orange (10YR 5/5), red (10YR 3.6), to a light purple in color. Slipped and unslipped areas ('zoning') typically alternate on decorated pieces.

Paste & Temper: 100% classified as having coarse pastes, which are often so coarse that angular white clasts dot the surface of sherds, giving them a bumpy feel.

Vessel Forms: Open and restricted bowls, chimney or 'hourglass' jars. Multi-chambered vessels with multiple mouths (see Holmes 1988:90). Rims diameters range from 9 to 45 cm (Corrales 2000:301).

Wall Thickness: 95% of sherds (n=10) between 10.9and 15.9mm in thickness. Minimum=8mm, Maximum=18mm, Average=13.4mm, Median=14.0mm, normal distribution.

Decorations: Deeply incised ('scarified') decorations in unslipped areas alternate with red (10YR 3/6) slipped areas. The incision is done prior to firing (Shelton 1984:110). Occasionally tripod leg supports ending in a webbed foot (figure 184), considered by Shelton (1984) to be a particularly distinguishing feature of the phase. Haberland (1976) and Shelton (1984) each observed a few sherds with raised appliqué strips (or 'tabs') on the exterior.

Relationships: Ceramics with zoned and incised decorations (including some chimney vessel bases) are found widely over Southern Central America during this general time Period, and have been discussed as a possible horizon style connected to Gran Nicoya (Linares 1980; Myers 1987), or even Mesoamerica (Snarskis 1981). Examples of these include the Tronodora complex (Hoopes 1987) in the Arenal region near Nicaragua, La Montaña complex in Caribbean Costa Rica (Snarskis 1978), and the Sarigua style in Central Panama (Willey and McGimsey 1954).

Figure 182. Undecorated Concepción ware body sherds.

Figure 183. Decorated Concepción ware body sherds (courtesy of Dr. Catherine Shelton and Temple University).

Figure 184. Examples of Concepción ware 'webbed feet' (courtesy of Dr. Catherine Shelton and Temple University).

A.2 ZONED BICHROME WARE

Associated Dates: 300 B.C. to A.D. 600

Reference photos or drawings: Spang *et al.* (1980:356)

Number of specimens: 114 (94 from stratigraphic excavations, 59 of these included in the graphs following the multidimensional analyses)

Surface: Slipped surfaces similar to Valbuena ware, unslipped surfaces similar to Plain ware.

Paste & Temper: 15 (16.0%) of the 94 Zoned Bichrome sherds recovered in this project's stratigraphic excavations were classified as having coarse pastes.

Vessel Forms: S-shaped (composite) and restricted bowls.

Wall Thickness: 95% of sherds (n=34) between 10.1and 12.1mm in thickness. Minimum=7mm, Maximum=19mm, Average=11.1mm, Median=10.0mm, normal distribution.

Decorations: Alternating slipped and unslipped areas separated by deep incisions or grooves. Unslipped areas occasionally have additional parallel incisions within them. Slip color ranges from the oranges to reds typical of Cerro Punta Orange and Valbuena wares. Some rims exhibit lip grooves, and appliqué decorations are rare.

Relationships: with the zoning and incising have clear antecedents with decorated Concepción pieces

Figure 185. Zoned Bichrome ware body sherds.

Figure 186. Close-up of Zoned Bichrome ware body sherd.

A.3 CERRO PUNTA ORANGE

Associated dates: A.D. 200-600 (Spang *et al.* 1980)

A.D. 400-600 (Linares 1968)

Reference photos or drawings: Baudez *et al.* (1993:62-63), Corrales (2000:260-267), Shelton (1984:figures 4-7 to 4-9) and 1996 (figure 6), Haberland (1976:156), Spang *et al.* (1980:355)

Number of specimens: 22,139 (16,940 from stratigraphic excavations, 6,217 of these included in the multi-dimensional analyses)

Surface: Covered in a discontinuous orange slip that ranges in color from light brownish orange (10YR 5/5), a bright orange (10YR 7/8), to a dark reddish orange (10YR 4/6). This slip is shiny, but not burnished or polished (Spang *et al.* 1980:354). Slip is often applied to the interior and usually to parts of the exterior, sometimes leaving a small band of unslipped surface below the rim. Unslipped or eroded body surfaces are typically a buff (10YR 5/2) or light gray (10 YR 5/1) color.[3]

Paste & Temper: Paste is often buff in color and friable, occasionally exhibiting a dark core. Both fine and course varieties occur, coarser varieties distinguished by the presence of large (~ 2mm) and irregular white clasts (quartz sand or pumice) that look like oatmeal. 3,626 (21.4%) of the 16,940 Cerro Punta Orange sherds recovered in this project's stratigraphic excavations were classified as having coarse pastes.

Vessel Forms: Open and restricted bowls, large and small jars, s-shaped (composite) bowls, bowls with a lip groove (Corrales 2000:309), and possibly tecomates (Shelton 1984: Ware H description).

Wall Thickness: 95% of sherds (n=300) between 9.6and 10.1mm in thickness. Minimum=4mm, Maximum=18mm, Average=9.9mm, Median=10.0mm, normal distribution.

Decorations: Shallow incisions are the most common form of decoration, and like many of the decorations, occurs on the exterior of the vessel. If incised decorations occur in slipped areas, they are typically filled with slip as well. Engraving, combing, raised ridges, raised pellets ('coffee beans') and fingernail impressions occur infrequently. Some of the restricted and open bowl rims have a small groove on the exterior of the lip. A wide variety of appliqué elements are associated with Cerro Punta Orange, including a wealth on handles, vessel legs, and many figurine heads. Although the latter are very infrequent, they also do include those wearing a

[3] Baudez *et al.* (1993) did not find orange slip nor bowls with lip grooves in their sample from the Diquís. Shelton's (1984) Ware H is comparable to Spang *et al.*'s (1980) description of Cerro Punta Orange, except that it includes s-shaped bowl rims, which both Spang *et al.* and Shelton paradoxically argued were typical of the Valbuena.

pointy hat that both Linares *et al.* (1975) and Hoopes (2006) suggested might represent a depiction of a religious specialist. Hoopes (1996:41) also suggests that the iconography of the Early Bugaba (A.D. 200 to 400) includes more depictions of tropical forest animals than the later half, reflecting a concern with wildlife, mythology, and hunting.

Relationships: In Western Panama, Cerro Punta Orange ware is found in the mountains and on both coasts, though it probably has the greatest time depth in the highlands. Likely Costa Rican varieties of the ware, though oftentimes with different names, are also found in the Coto Brus (Laurenich de Minelli and Minelli 1966, 1973), the type site of Aguas Buenas (Haberland 1976), and is relatively infrequent in the Diquis (Baudez *et al.* 1993, 1996) and the Chiriquí islands (Linares 1968).

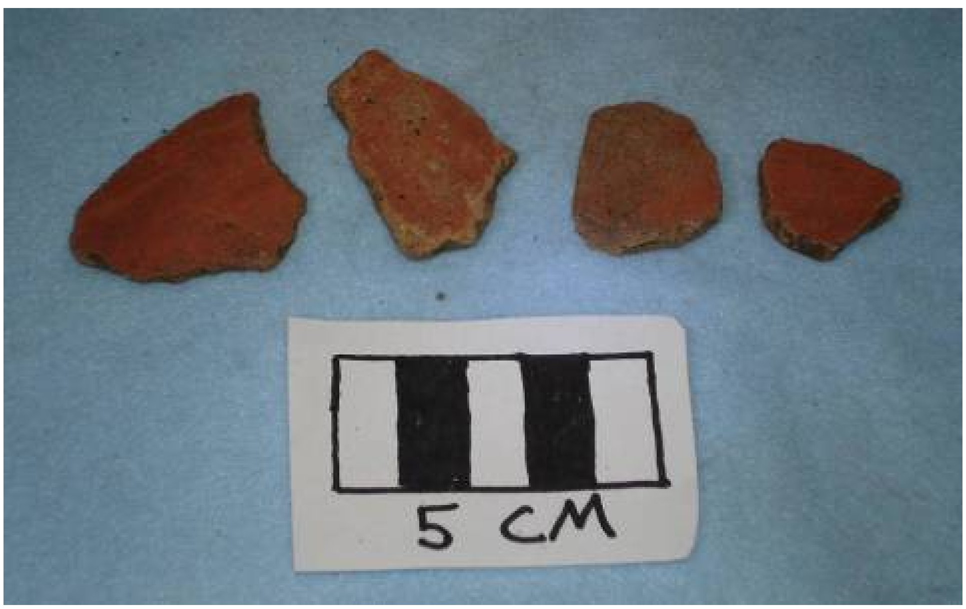

Figure 187. Undecorated Cerro Punta Orange body sherds.

Figure 188. Cerro Punta Orange ware rim and decorated sherds (courtesy of Dr. Catherine Shelton and Temple University).

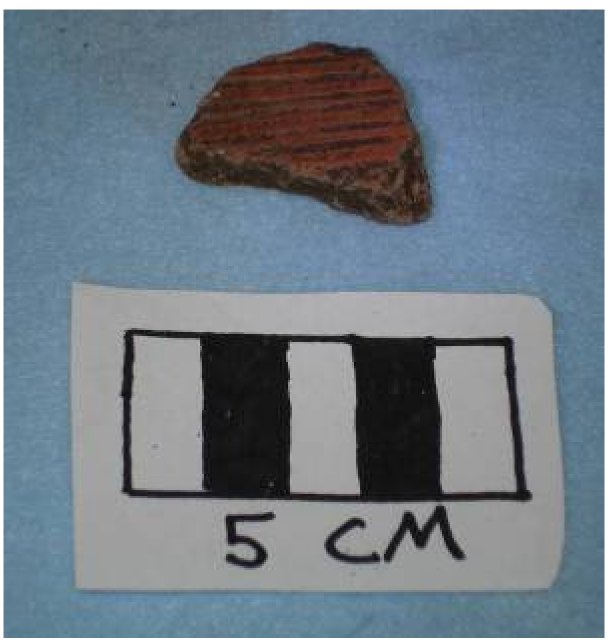

Figure 189. Cerro Punta Orange ware body sherd with combed decoration, also known as Cotito ware.

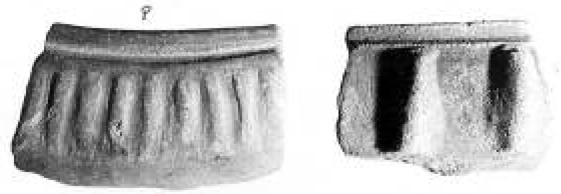

Figure 190. Cerro Punta Orange ware rim sherds with ridged decorations (archive photo by Sarah Spang, courtesy of Temple University).

A.4 VALBUENA WARE

Associated Dates: A.D. 200-600 (Spang *et al.* 1980)

A.D. 400-600 (Shelton 1984)

A.D. 300/500-800 (Linares 1968)

Reference photos or drawings: Spang *et al.* (1980:356)

Number of specimens: 19,454 (15,098 from stratigraphic excavations, 5,009 of these included in the multi-dimensional analyses)

Surface: Covered in a red (10YR 3/5) to dark purple (almost black) slip. Its lighter shades are not always clearly distinguishable from the darker varieties of Cerro Punta Orange. Described as a thin fugitive slip by Spang *et al.* (1980:356), which is also shiny but unpolished. Slip is applied to the interior, exterior, or both, though like Cerro Punta Orange, sometimes a small unslipped zone is left below the rim. Unslipped or eroded body surfaces are also a buff (10YR 5/2) or light gray (10 YR 5/1) color

Paste & Temper: Paste is also buff in color and friable, occasionally exhibiting a dark core. Both fine and course varieties occur, coarser varieties distinguished by the presence of large (~ 2mm) and irregular white clasts (quartz sand or pumice) that look like oatmeal. 3,656 (24.2%) of the 15,098 Valbuena sherds recovered in this project's stratigraphic excavations were classified as having coarse pastes.

Vessel Forms: Medium and long-necked jars, shallow open bowls, deep restricted bowls, and ringstands (Corrales 2000:313). Linares (1968:19) observed large *ollas* or urns on the Pacific coast.

Wall Thickness: 95% of sherds (n=300) between 9.2 and 9.7mm in thickness. Minimum=4mm, Maximum=22mm, Average=9.5mm, Median=9.0mm, normal distribution.

Decorations: Shallow incisions are also the most common form of decoration on the exterior of the vessel. If incised decorations occur in slipped areas, they are filled with slip as well. Raised ridges, raised pellets ('coffee beans'), and fingernail impressions occur infrequently. Some of the restricted and open bowl rims have a small groove on the exterior of the lip, which are sometimes described as the Corral Red style (Corrales 2000:311). Combed decoration on either the interior or exterior occurs infrequently. Appliqué elements are associated with Valbuena, especially those depicting small animals and small human arms bent at the elbow. Hoopes (1996:41) proposes that appliqué elements belonging to the Late Bugaba (formerly A.D. 400 to 600) may depict human individuals more often, reflecting heightened disparities in social status perhaps connected to increased competition for agricultural land.

Relationships: In Western Panama, Valbuena ware is found in the mountains and on the Pacific coast (where it is called Isla Palenque). Isla Palenque is the dominant ware of the Burica phase (A.D. 400-600) on the Chiriquí coast but was not described as mixed with any Cerro Punta Orange. Valbuena, or other varieties of Maroon ware (as originally described by MacCurdy 1911), are also found in the Diquis Delta (Baudez *et al.* 1993, 1996). Valbuena may be easily confused with Sangria Red or Silena Winged, the latter which Corrales (2000:355) describes as having an unusually shiny slip but belonging to the later Chiriquí phase.

Figure 191. Undecorated Valbuena ware body sherds.

Figure 192. Valbuena ware sherd with appliqué decoration.

Figure 193. Photo of Valbuena s-shaped (composite) bowl, interior facing right (courtesy of Dr. Catherine Shelton and Temple University).

A.5 BUGABA ENGRAVED WARE

Associated Dates: A.D. 300-500 (Haberland 1976)

A.D. 400-600 (Shelton 1984)

Reference photos or drawings: Baudez *et al.* (1993:73), Kudarauskas *et al.* (1980:387), Linares *et al.* (1975:143), Lothrop (1963:56), Spang *et al.* (1980:355)

Number of specimens: 534 (420 from stratigraphic excavations, 153 of these included in the multidimensional analyses).

Surface: Similar to some Valbuena wares, the exterior of most Bugaba Engraved sherds are covered in a red (10R 4/8) to dark red slip (10R 3/6). This slip is generally glossy or shiny and may have been lightly polished or burnished.

Paste & Temper: Paste color is also gray to buff, only 2 (0.4%) specimens total exhibited darkened cores. 52 (12.4%) of the 420 Bugaba Engraved sherds recovered in this project's stratigraphic excavations were classified as having coarse pastes.

Vessel Forms: Small (<18 cm internal diameter) restricted, open, and s-shaped (composite) bowls.

Wall Thickness: 95% of sherds (n=67) between 7 and 8mm in thickness. Minimum=5mm, Maximum=12mm, Average=7.3mm, Median=7.0mm, normal distribution.

Decorations: Engraved decorations at diagnostic of the ware and were done post-firing since they have a shallow and irregular 'scratched' look. Occasional pieces have negative resist painting on the interior, often in a stripped or honeycomb pattern (figure 195). This is what Baudez et al. (1993, 1996) identified as the Lacoste variety, which may be a later variant of Bugaba Engraved.

Relationships: Unclear. Bugaba Engraved Wares have been observed on the coasts and in the highlands of Gran Chiriquí.

Figure 194. Exterior of a Bugaba Engraved ware open bowl.

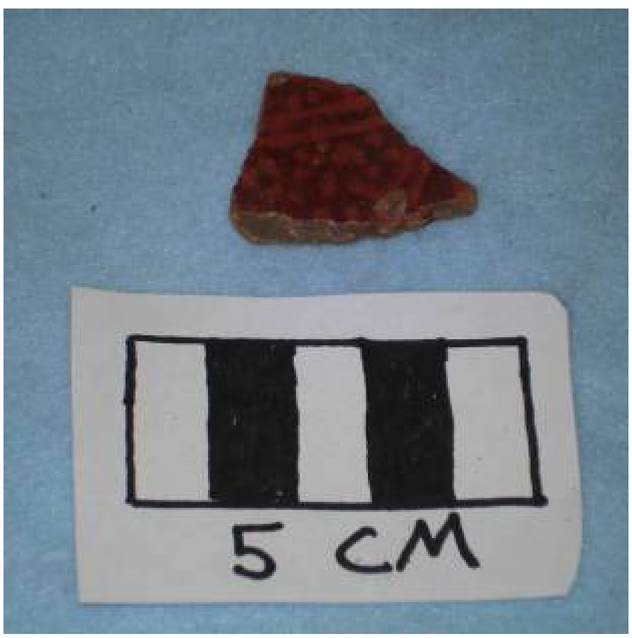

Figure 195. Interior of a Bugaba Engraved ware body sherd showing negative paint decoration.

Figure 196. Profile of a coarse Bugaba Engraved sherd.

A.6 PLAIN WARE

Associated Dates: 300 B.C.- 300 A.D. (Shelton 1984)

A.D. 200-600 (Spang *et al.* 1980)

A.D. 600-800 (Linares 1968)

Reference photos or drawings: Linares 1968; Shelton 1995:Figure 5

Number of specimens: 4,383 (3,520 from stratigraphic excavations, 968 of these included in the multi-dimensional scaling).

Surface: Although Shelton (1984) identified Plain Ware, or Ware F, as having an orange to red slip, the plain sherds defined in this study have no slip no either side. The surface is often light brown or buff in color and is occasionally smoothed.

Paste & Temper: 948 (26.9%) of the 3,520 plain ware sherds recovered in this project's stratigraphic excavations were classified as having coarse pastes.

Vessel Forms: Hemispherical bowls, restricted bowls and jars.

Wall Thickness: 95% of sherds (n=123) between 8.5 and 9.5mm in thickness. Minimum=3mm, Maximum=25mm, Average=9.0mm, Median=9.0mm, normal distribution.

Decorations: Shallow incisions are the most common form of decoration. Very few of the vessel rims exhibit a lip groove or appliqué decoration. Generally speaking, Plain ware sherds largely lack decoration.

Relationships: Unclear.

Figure 197. Fine paste Plain ware sherd on left contrasted with coarse paste Concepción sherd on right.

A.7 SAN LORENZO

Associated Dates: A.D. 800-1100 (Linares 1968:86)

A.D. 700-900 (Linares 1980a: 107-8)

A.D. 700-1000 (Linares 1980e: 76)

Reference photos or drawings: Corrales 2000: XX; Linares 1968:plates 9-12; Lothrop 1963:69a; MacCurdy 1911: Plate XXV:d

Number of specimens: 7 (3 from stratigraphic excavations, 0 included in the graphs following the multi-dimensional analyses)

Surface: Buff (10YR 5/2) to pale gray (10YR 7/1) exteriors. Corrales (2000:328) observed exterior polishing on the some jars. Ranere (1968) identified two variants- a one polished and the other brushed- in the Gulf of Chiriquí.

Paste & Temper: pale gray pastes tempered by fine inclusions of sand

Vessel Forms: Large and small jars, bowls with everted and thickened rim lips

Wall Thickness: unknown

Decorations: Sets of narrow red (≤1 cm) lines that encircle the upper half of many vessels. Parallel lines appear sloppily executed and drift into each other. Others appear to be perpendicular and intersect with each other at right angles. Corrales (2000:328) observed small red dots, triangles and appliqué elements- small faces with 'coffee bean' eyes flanked by tiny arms.

Relationships: The San Lorenzo 'complex', defined largely by Linares (1968) from four sites (three on islands) around the Gulf of Chiriquí, includes a bewildering array of type names. Nearly all emphasize the presence of red lines or bands and some form of exterior brushing or polishing. Red banded decorations may also be found in the Chiriquí phase- Villalba Red

Streaked, Cavada Applique and Red Banded- and it is entirely possible to confuse San Lorenzo for Chiriquí and vice-versa without the benefit of large comparative collections. Ranere (1968) identified two more variants in small surface collections on the Burica peninsula and mainland areas- Balsa Polished and Quebrada Baúles Brushed.

At present, it is unclear whether San Lorenzo is a style or a phase. MacCurdy (1911) found San Lorenzo ceramics (‘the Red Line group’) in Chiriquí phase tombs, while Linares (1968) found it stratigraphically beneath Chiriquí deposits on the Pacific islands. Generally speaking, San Lorenzo ceramics are not found in the mountains.

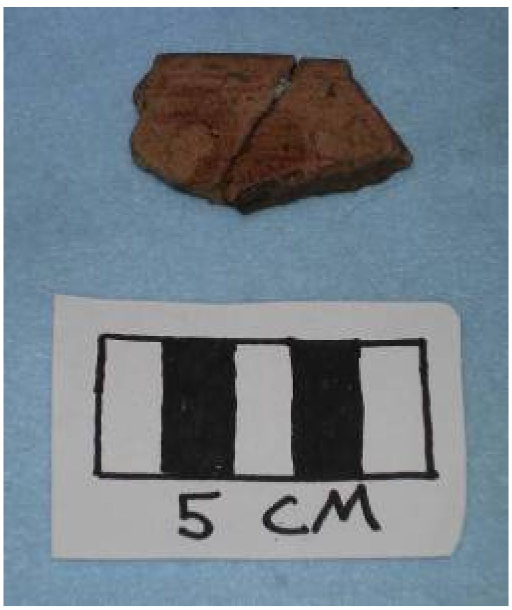

Figure 198. Possible San Lorenzo body sherd.

A.8 BISCUIT WARE

Associated Dates: A.D. 1100-1500 (Linares 1968:86)

A.D. 1200-1500 (Haberland 1976:116)

A.D. 1000-1500 (Baudez *et al.* 1993:X)

Reference photos or drawings: Many, see Corrales 2000:339 for an extensive list.

Number of specimens: 340 (237 from stratigraphic excavations, 30 of these included in the multi-dimensional analyses)

Surface: Generally a smoothed but unpolished tan or khaki (2.5Y 7/6) to light brown (7.5YR 4/6) exterior and interior, usually unslipped but Corrales (2000:339) has observed sherds with tan or buff slip. Surface often feels like very fine sandpaper.

Paste & Temper: Often a very fine and homogeneous paste with only pinpoint inclusions (Corrales 1994, 2000; Linares 1968a). Coarser versions, with larger white oatmeal-like inclusions, have been found in the highlands (Laurenich de Minelli and Minelli 1956). Thirty (12.7%) of the 237 sherds of Biscuit ware recovered in this project's stratigraphic excavations were classified as having coarse pastes.

Vessel Forms: tecomates and restricted bowls, occasionally with tripod legs. Corrales 2000:xxx reports miniature jars

Wall Thickness:. 95% of sherds (n=26) between 4.3and 5.6mm in thickness. Minimum=3mm, Maximum=9mm, Average=5.0mm, Median=5.0mm, normal distribution.

Decorations: Incising, rows of dot and fingernail punctuations, raised 'coffee-bean' dots, a wide variety of zoomorphic appliqué elements (especially armadillos, frogs, and fish) and small figurine heads wearing conical hats.

Relationships: Perhaps because it is so recognizable or recent, Biscuit Ware is found widely across the eastern half of Gran Chiriquí, from the Pacific coast (Haberland 1960; MacCurdy 1991; Osgood 1935; Stone 1958; Ranere 1968) to the Caribbean coast (Kudarauskas *et al.* 1980) and in various areas in the highlands (Corrales 1986; Haberland 1961; Laurenich de

Minelli and Minelli 1956). It was originally defined as a grave offering as thousands of complete vessels were found in cemeteries located around the modern city of David (Corrales 2000:399). This plus its relative homogeneity in paste and light weight led Haberland (1976:118) to argue that the ware was produced by specialists somewhere around David and then traded widely. The ware has also been found in domestic contexts in this project, as well as in Laurenich de Minelli and Minelli (1956) and Linares (1968).

Figure 199. Decorated and undecorated Biscuit ware body sherds.

Figure 200. Biscuit ware rim sherd with 'coffee bean' appliqué decorations (courtesy of Dr. Catherine Shelton and Temple University).

APPENDIX B

ACCESS TO DATASET

Data on artifact counts and the locations of the shovel tests, surface collections, and excavation units analyzed in this dissertation are available on-line in the Latin American Archaeology Database managed by the University of Pittsburgh. The University of Pittsburgh reserves the right to change the formatting to keep pace with evolving software programs, therefore the specific structure of the dataset will not be covered in detail here. The dataset is accessible to Internet users (browsing with Explorer, Firefox, Safari, Opera, or Chrome) via the following URL:

http://www.pitt.edu/~laad

General inquiries concerning the formatting of this database and others may be directed to the following address:

laad@pitt.edu

Specific questions concerning the database may be directed to the author at:

sdp11@pitt.edu

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