

Project Summary

In the fifth century A. D., a new state arose in the Ayacucho Basin of highland Peru. With an urban capital at the city of Wari, this expansive state would soon become the largest polity to cover Peru before the development of the Inca Empire. In fact, it has been argued that Inca politics and economics were based in the traditions of this earlier complex society.

The Wari polity rapidly became an empire, establishing large administrative centers in ethnically distinct, far-flung reaches of the Peruvian highlands. One of the first centers to be established outside the Ayacucho heartland was the colony of Cerro Baul, located at the southernmost point of Wari expansion and on the frontier with the Tiwanaku, a rival expansive state centered in the Titicaca Basin of Bolivia. The Moquegua Valley, where Cerro Baul is located, is the only valley to house both early Wari and Tiwanaku colonies that may have been contemporaneous and within visual range of each other.

Many scholars have noted the influences of Tiwanaku art and iconography on the state art styles of Wari. Cerro Baul provides the opportunity to investigate the influence Tiwanaku had on its Peruvian neighbor, not only artistically, but politically and economically as well. Baul also represents a site at which the evolution of Wari as an expansive state can be examined. This investigation will contribute to our knowledge of how empires come into existence and develop by examining a seminal site in the early development of what might be the earliest Peruvian empire.

The proposed research will address these issues by conducting two field seasons of excavation on and around Cerro Baul. Analysis of excavated materials will proceed under the direction of faunal, botanical, and ceramic specialists, and will be augmented by comparison with Tiwanaku remains excavated in neighboring Tiwanaku settlements. Materials analysis will focus on subsistence production systems, domestic activity pattern sets, craft production systems, elite exchange, and iconographic relationships with Tiwanaku material culture.

Other analytical methods that will complement specialists' work will include instrumental neutron activation analysis of Wari and Tiwanaku ceramic remains, a radiocarbon-based ceramic chronology for Middle Horizon Moquegua, and soil chemical analysis of agricultural and occupation contexts. The project will characterize the economic interactions between Wari and Tiwanaku populations in the Moquegua valley and the manner in which those interactions changed over the four centuries of Wari-Tiwanaku occupation of the valley. It will assess the potential ideological exchanges between Wari and Tiwanaku based on iconographic analysis of materials that carried manifestations of Middle Horizon belief systems.

The case of Wari-Tiwanaku interaction provides one of the few examples in prehistory in which the influence of peer empires on each other can be examined. Documenting the development of political economy and ideological exchange at Cerro Baul will make a significant contribution to the anthropological study of complex societies and evolution of Andean statecraft.

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IMPERIAL INTERACTION IN THE ANDES: WARI AND TIWANAKU AT CERRO BAÚL

The Inka dominion stretched more than 6,000 km along the Andes Mountains to form the largest native state ever to arise in the Americas. This achievement had political antecedents in earlier Middle Horizon times (ca. AD 550-1000) when two great empires held sway over the Cordillera, with Wari ruling in the north and Tiwanaku in the south. Wari, characterized as secular and militant, governed most all of highland and coastal Peru from its upland capital in the sierra of Ayacucho (Feldman 1989; Isbell and McEwan 1991; Lumbreras 1974; Schreiber 1992). Tiwanaku, portrayed as ecclesiastical and mercantile, held hegemony over Bolivia, southern Peru, and northern Chile from a higher altiplano capital near the shores of Lake Titicaca (Browman 1985; Goldstein 1993b; Kolata 1989; Janusek 1994; Lumbreras and Amat 1968; Mujica 1985; Ponce 1969; Wallace 1980).

Although contemporary, the continent's penultimate empires have been interpreted very differently. Economically, Wari increased agricultural revenues by constructing irrigated terraces on steep mountain slopes where maize and other crops could grow (Browman and Bird 1978; Isbell 1977; McEwan 1989; Schreiber 1992). Occupying the towering altiplano plains, Tiwanaku reclaimed flat terrain for farming potatoes and other high-altitude crops, while also herding camelids and using llama caravans to secure distant resources (Albarracian-Jordan and Mathews 1990; Browman 1980; Kolata 1986; 1993; Lynch 1983; Mujica et al. 1983). Imperial architecture was equally distinct. Tiwanaku emphasized sunken courts and massive mounds with masonry adornment, megalithic gateways, and imposing stelae (Bennett 1936; Manzanilla 1992; Ponce 1972; Posnansky 1945). Rarely ornamented with carved stone, Wari building focused upon grand compounds with high walls and multi-story interior galleries, courts, corridors and rooms (Benavides 1991; Bragayrac 1991; Conklin 1991; Czwarno 1989; Schreiber 1978). Although provincial centers served different functions, their monumental architecture provided graphic statements of the political power of their respective capitals (Goldstein 1993b; Isbell and McEwan 1991; Kolata 1989; McEwan 1991; Schreiber 1991).

In this proposal we seek NSF support to excavate and analyze data in order to model Wari imperial development in the Moquegua sierra of Southern Peru. A significant aspect of this study will examine the role imperial interaction between Wari and Tiwanaku played in the evolution of political institutions in the Wari empire. The Moquegua sierra is the only known setting where Wari and Tiwanaku provincial centers were erected within sight of one another and where residential settlements of the two polities occur in close proximity. The proposed study focuses upon the imperial Wari complex of Cerro Baúl and upon adjacent Wari and Tiwanaku settlements. This project integrates information on the fine arts and monumental architecture of ancient states with data on vernacular quarters and fields where common folk lived and toiled. The model will characterize: A) the agricultural, architectural, and artifactual components of the Wari colony; B) the evidences of Wari-Tiwanaku contact and interaction at Wari settlements; and C) the long term agrarian consequences of imperial colonization.

POLITICAL ECONOMY AND IMPERIAL DEVELOPMENT

The evolution of political complexity has been an important focus of archaeological research over the past several decades. Most of the models that address the rise of social complexity acknowledge the importance of an economic support base for social hierarchies, although they differ in their interpretation of the mechanisms by which social stratification arose. Conflict generated over control of critical resources has been cited as the impetus for rise of stratified societies (Adams 1965; Carneiro 1970; Fried 1967). Trade and exchange have been explicitly implicated as an important stimulus to state formation (Service 1971; Wright and Johnson 1975).

Significant contributions to the political economy of empire have been made in the past decades (e.g. Brumfiel and Earle 1987; Conrad and Demarest 1984; D'Altroy and Earle 1985). Nevertheless, much more work has been conducted pertaining to the rise of the state than on the development of empire. The political dynamics of imperialism are also distinct from those of the pristine state, as the empire is an expansive state that incorporates a diverse group of sociopolitical entities and employs a variety of methods of control (Schreiber 1992; Sinopoli 1994). Imperial economies are distinct from

those of other states because of the heterogeneity of their populace and the varied territory they control. It is imperative that we study the wide diversity of imperial integration mechanisms if we are to understand the political economy of empire.

One of the rarest forms of imperial relations in the realm of archaic empires (i.e. pre-modern world system) is the direct interaction between expansive states of similar magnitudes. Imperial peer polities in antiquity do not often overlap in time and space, and when they do, relationships are often hostile and exchange infrequent. Yet in some cases, peer empires do share close quarters, and it is in these situations that we stand to learn the most. This type of research is rather significant since imperial interaction at this scale is much more common in the modern world system, and the knowledge we gain from these researches is directly applicable to current world politics.

Imperial interaction can take place in a variety of ways. The proposed research will investigate: 1) the economic interactions between Wari and Tiwanaku populations in the Moquegua valley and the manner in which those interactions changed over the four hundred years that Wari and Tiwanaku shared valley resources; 2) changes in the use of public space and architectural organization in the Wari administrative center and in subsidiary settlements in Moquegua, and 3) the potential ideological exchanges between Wari and Tiwanaku based on iconographic analysis of materials recovered from Wari ceremonial contexts which carried manifestations of Middle Horizon belief systems (i.e. decorated ceramic wares).

We hypothesize that the original occupation of Cerro Baúl was one of militaristic intrusion, designed to define the frontiers of Wari imperial expansion. As part of this intrusion, Wari usurped the local huaca or sacred mountain of Cerro Baúl, effectively taking it hostage. Interactions between Wari and Tiwanaku would have been severely limited in this hostile climate. In order to preserve its self sufficiency, Wari constructed a large agricultural system to support the subsistence needs of the local colony. This project would have created a water shortage in times of drought in the lower reaches of the Tiwanaku irrigation system, and there may have been severe competition for water in the eighth century A. D. (Williams, 1997). During the latter half of the Middle Horizon, significant changes began to take place in the Wari-Tiwanaku interaction sphere. By the ninth century A. D., Tiwanaku had established settlements on the slopes of Cerro Baúl. Owen's (1998) excavations at La Cantera and Cancha de Yacango, confirm the presence of a rustic Tiwanaku temple with Omo (Tiwanaku IV) style ceramics and a mortuary and domestic component associated with Chen Chen (Tiwanaku V) style ceramics on the slopes of Baúl by 900 A. D. It is at precisely this time that the major architectural reorganization that restructures the summit of Cerro Baúl takes place, an event that mirrors changes taking place in other parts of the Wari realm (Williams 1999; Isbell 1997). Tiwanaku and Tiwanaku-influenced ceramics have been recovered from tenth century A. D. contexts on Baúl (Williams 1999), and late Tiwanaku affiliated Tumilaca ceramics have been recovered in association with Wari domestic terraces on the slopes of Cerro Baúl. We hypothesize that major Wari-Tiwanaku interactions were forged at the household level, and that those relationships formed the basis for more formal interactions between higher level state institutions that were realized on the summit of Cerro Baúl.

PREVIOUS RESEARCH

Cerro Baúl was first identified as a Wari settlement in the early 1980's (Lumbreras et al. 1982; Watanabe 1984). Systematic explorations on Cerro Baúl began with the 1989 excavation season conducted by Dr. Robert Feldman under a grant from the Wenner-Gren Foundation. Excavations focused on two archaeological units on the summit of Cerro Baúl. Unit 1 is a trapezoidal shaped plaza surrounded by galleries located in the central part of the site (Sector B). Unit 2 is located in Sector A, the area of non-monumental architecture on the eastern edge of the site. Feldman suggests that Unit 1 was the setting for ritual feasting and drinking. Later, the abandonment of this structure was marked by a burning event accompanied by the breaking of fine ceramic serving and storage vessels. Unit 2 facilities revealed evidence for residential and craft production activities, especially the working of lapis, onyx, and obsidian (Moseley et al. 1991).

A complete, detailed digital map of the Cerro Baúl-Cerro Mejia archaeological complex was completed in 1993 under the direction of Feldman with a Kaplan Foundation grant to Michael Moseley. This mapping project documented monumental architecture including a D-shaped structure and U-shaped building arrangements that are similar to Wari architectural canons at the imperial capital. A

1994-95 survey of the upper Moquegua valley by Bruce Owen (1994) revealed the full extent of the Wari settlement pattern and places Baúl in a regional context.

The 1997 Cerro Baúl Excavation Project, directed by Williams and Johny Isla C. was funded by a G. A. Bruno Foundation grant. The project focused on excavations in four additional summit structures on Cerro Baúl, labeled units 3 through 6. These excavations were designed to sample the range of activities taking place within the monumental architecture at the site. Preliminary results suggest that there were different types of administrative activity occurring in different sectors of the monumental architectural core of the site. The range of activity may have included storage functions, ritual drinking, and more solemn ceremonial activity involving limited numbers of high status individuals (Williams 1999a).

The 1998 Cerro Baúl Excavation Project directed by Williams was funded by the Heinz Charitable Trust. This research focused on evidence for craft specialist production and domestic activities on the eastern edge of the architectural core. Two test units were also located on the domestic terraces of the northeastern slope of Cerro Baúl in areas that contained late Tiwanaku ceramic remains. Results confirmed Feldman's findings that lapidary production facilities were in place in households on the eastern summit, but attempts to locate a pottery production center did not materialize. In 1999, Donna Nash began an NSF Dissertation Improvement Grant funded excavation project on the adjacent Wari site of Cerro Mejia. Nash's excavations are drastically increasing our database on Wari vernacular architecture in the Moquegua valley and will provide an excellent comparative database to the proposed research, and Nash herself will participate in the proposed research.

HISTORICAL AND ECOLOGICAL SETTING

The Moquegua sierra is extremely arid, and sedentary life has depended upon irrigation agriculture for 3000 years. The largest, most extensive archaeological remains in the study area are abandoned canals and planting surfaces that were used at different times. Survey of these works and their associated settlements allows ancient imperial interactions to be investigated within the context of a long-term evolutionary scenario pertaining to agrarian development (Moseley 1992:221; Owen 1993; Williams 1997).

During the first millennium B.C., local Huaracane populations established irrigated agriculture along the Rio Moquegua at elevations between 1000 and 1600 masl. Here the floodplain and valley are wide, and relatively level. The river is flanked by flat land that could be reclaimed by relatively short canals that need not negotiate broken topography and rugged terrain. Around A.D. 500 this section of the valley was occupied by Tiwanaku colonists who gradually assimilated the indigenous population (Goldstein 1989). Farming was expanded laterally to flat lands beyond the confines of contemporary irrigation. However, reclamation was not extended up-stream. Therefore, the higher, rugged sierra remained undeveloped.

Opening the high sierra habitat to agricultural exploitation required labor-intensive construction of both long, sinuous, contour canals to negotiate broken terrain, and terracing to reclaim steep mountain slopes. Around A.D. 600 this technology was introduced and used by Wari people to colonize the previously unoccupied rugged highlands above 1600 masl. This placed the Tiwanaku and Wari occupations in adjacent but different agricultural and topographic habitats. Although Wari colonization lasted some three hundred years, its agrarian innovations proved even more enduring. The technologies were locally adopted for more expansive prehispanic reclamation of the rugged mountains. Today sinuous contour canals and irrigated terraces continue to support the high sierra.

The Tiwanaku Component

The Moquegua sierra houses the largest, most diversified set of Tiwanaku remains found outside the Titicaca Basin. There is a published inventory of 25 sites (Goldstein 1993a) and more than a dozen recently surveyed settlements. In addition to numerous cemeteries and the vast Chen Chen necropolis, remains range from farmsteads and villages to fortified hills and state-built civic-ceremonial facilities. The cultural chronology for the imperial capital of Tiwanaku is more poorly understood than that of Wari.

Therefore, a separate stylistic and cultural sequence has been independently developed for the Moquegua area (Goldstein 1989).

The Tiwanaku occupation opens with the Omo Phase which begins around 500 A. D. with small scale colonization by altiplano folk who establish farmsteads and villages in the lower sierra. The largest settlement, Omo M12, was the most important. It exhibits moderate internal differentiation in residential and communal facilities, and yields Tiwanaku ceramic imports and local productions in imperial style. A stylistic disjuncture or brief hiatus appears to separate this phase from the succeeding Chen Chen Phase that is characterized by a different order of organization and a well defined settlement hierarchy. A state-planned administrative center was erected at Omo M10, and lower order administrative facilities were built at two fortified hills, Cerros Trapiche and Echenique. Undefined agrarian settlements doubled in numbers and irrigation was extended far beyond the modern limits of cultivation in the confluence section of the valley. All settlements were systematically razed at the end of the phase (Moseley et al. 1991).

The ensuing Tumulaca style has been characterized as a very simplified perpetuation of earlier artistic traditions at farmsteads and fortified villages that reflect a loss of centralized state organization that persisted until the Inca conquest (Goldstein 1989). Investigations of Tumulaca style contexts on the Moquegua coast suggest that these Tumulaca settlers may have been contemporary with late Chen Chen Phase and Wari occupations (Owen 1993; Williams 1999). Tumulaca material remains have also been found on domestic terraces on the slopes of Cerro Baúl. A 2 by 2 meter test unit excavated in one of these terraces in 1998 yielded Tumulaca pottery in association with small quantities of Wari sherds. This data, in conjunction with the dates from the coast, raises the possibility that Tumulaca may have been co-habiting the Cerro Baúl region with Wari. In fact, given the close temporal and geographic proximity of these occupations, it is possible that Tumulaca represent the Tiwanaku clients of late Wari, perhaps a faction of the main Chen Chen Tiwanaku state occupation.

The Wari Component

Known as "the Masada of the Andes," Cerro Baúl is a prominent geological mesa that towers 600 m. over the flanking Torata and Tumulaca valleys. This soaring sierra landmark is an Apu-- home of a sacred mountain spirit--visited annually by scores of Aymara-speaking pilgrims. They brave an arduous climb to the mesa top where votive offerings are made in the form of miniature stone architecture symbolizing homesteads replete with houses, corrals with pebble live stock, and fields with drawn model furrows. On the eastern summit monumental architecture commemorates ancient recognition of Baúl's unique qualities as a natural bastion and impregnable citadel. Ruins of one and two story masonry buildings, galleries, halls, and courts, form a majestic civic-ceremonial core of administrative facilities. Further east there is an expansive area of less audacious ruins where people lived and worked.

Mapping and pilot excavations on Cerro Baúl indicate that the summit areas can be grouped into 5 distinct sectors. Sector A is located on the eastern tip of the summit. Based on excavations in units 2 and 7, this sector housed craft lapidary specialists who lived and worked in this area. The recovery of large amounts of lithic debris such as chrysacolla and lapis lazuli, as well as domestic refuse such as bones, seeds, and grinding stones support this hypothesis. Three radiocarbon dates indicate that this sector was occupied at the early end of Wari settlement, between 550 and 690 A. D.

Sector B is located in the central part of the summit architectural core. Excavations in Units 1, 5, and 8 indicate that this part of the site was the monumental and ceremonial core. Unit 5 is a D-shaped structure, analogous to several structures at the Wari capital and other important settlements and argued recently by Cook (1999) to represent a ritual center of Wari culture, an area of sacrifice and propitiation of the gods. Unit 1 is a trapezoidal plaza surrounded by galleries that contained a burnt offering deposit composed of classic, probably imported, Wari fineware vessels and the hybrid Wari-Tiwanaku decorated keros. Unit 1 also contained evidence for an earlier construction phase, and further excavations in Units 1 and 5 and the area between them will be crucial to understanding the evolution of Wari ritual as the empire developed.

Sector C is composed of several large plazas flanked by long galleries that typify the orthogonal cellular architecture identified by Isbell (Isbell et al. 1991) as characteristic of Wari administrative structure. Excavations in units 3 and 6 reveal that the surface architectural pattern dates to the later part of Wari imperial presence (800-1000 A. D.) based on two radiocarbon dates. However, excavations in unit 3 during the 1998 season revealed an earlier construction phase in one part of the unit that may date to Epoch I. Material remains are rare, as the buildings in this sector seem to have been cleaned out

upon abandonment. However, a 1998 pilot soil chemical analysis project, including total phosphate content and soil acid levels, reveals the intensive use and variation in past activities that occurred within these contexts (Figure 2).

Sectors D and E are not attached to the rest of the architectural core on the summit, and have not yet been the subject of systematic study. Sector D is an architectural compound built around a large boulder at the center of the summit. Sector E is a raised platform facing a sunken plaza 500 meters west of the main architectural core. Reported surface finds near the platform structure in sector E include a large number of aryballoid fragments; the platform may represent a small temple and the ceramic associations argue that it is Inka in origin. Limited excavations are planned in these areas in order to define their nature.

The monumental architecture atop the sheer-sided mesa crowned an extensive colony implanted by Wari deep within Tiwanaku territory (Figure 4). The sole route up Baúl is a narrow path of switchback terraces crossed by two monumental walls that served to limit access to the sacred summit. The adjacent mountaintop settlement of Cerro Mejia was also transformed into a circumscribed sanctuary encircled by massive boundary walls. Construction of outlying defensive walls restricted access to the critical El Paso divide between the two major hills. As the point where the Wari canal diverges to irrigate the slopes of Cerro Mejia and Cerro Baúl, El Paso represents an important control point in the flow of traffic and the flow of water in the Wari settlement system in the region. In order to house a substantial population, domestic terraces were erected in the El Paso area, along the routes up both Cerros, and over much of Cerro Petroglifo, a naturally defensible hill east of Mejia. Several residential sites were also established on the upper flanks of the eastern and western sides of Cerro Baúl. The Wari enclave was strategically positioned high above the Torata and Tumulaca Rivers, more than two hours walk from either valley. Therefore, potable water was delivered to the El Paso area by construction of a sophisticated, high-elevation contour canal. More than 10 km in length, the now-abandoned El Paso canal irrigated extensive terrace flights and numerous planting surfaces along its winding mountain course. It is also likely that canals were built at lower elevations to reclaim Torata and Tumulaca lands that are farmed today.

Dating And Development

Colonization apparently transpired during an early era of Wari expansion in Middle Horizon Epoch 1, and endured for at least three centuries, well into Epoch 2. Excavated remains include 8 units totaling more than 400 square meters area in Baúl's monumental ruins of Sectors B and C, and 150 square meters in the non-monumental eastern architecture of Sector A. Based on 12 radiocarbon dates that fall between A. D. 550 and 1020, the summit excavations indicate: 1) Ceramic assemblages include fine decorated wares that were either imported from the imperial heartland of Ayacucho, or produced locally by skilled Wari artisans. These ceramics are predominantly of Chakipampa and Okros style, with occasional, more tentatively identified, examples of Wari Polychrome Cursive, Huarpa, Robles Moqo, and late Nazca styles. 2) The Unit 1 assemblage included one Tiwanaku kero and sherds from six different vessels that are "hybrids". They consist of Wari kero forms with Wari colors that depict designs affiliated with two local Tiwanaku Phases (Omo and Chen Chen) which have Front Facing Deity iconography. 3) Monumental construction employed masonry walls one and two stories high for civic-ceremonial facilities that resemble Wari architecture at the imperial capital and, to a lesser degree, at state-built provincial centers. 4) General architecture employed masonry foundations and field stone walls that housed residential and craft production activities. 5) Both classes of excavated architecture were erected over pre-existing refuse and both classes were products of two phases of construction, with the final use terminating in systematic ritual burnings in some of the buildings (Williams 1999).

We concur with expectations that Cerro Baúl "...may turn out to be our chronological Rosetta stone for finally working out the precise temporal relationships between [Wari] Middle Horizon epochs in Peru and the Tiwanaku phases in Bolivia" (Browman 1985). Agricultural and architectural investments at Cerro Baúl were substantial, suggesting a sizable population of over one thousand individuals (Williams 1998). The El Paso canal and its extensive terraces and planting surfaces reflect basic concerns with economic autonomy and large-scale investment in agrarian self-sufficiency. The large bulwarks of Cerro Mejia, the fortification walls of ancillary settlements, and the strategic character of Baúl, reflect concerns with potential hostilities and substantial investment in self-protection. The imperial architecture atop Baúl

reflects concerns with and investments in maintaining Wari self-identity. Thus, the largest of labor commitments were designed for economic and political independence and provided for controlled interaction with Tiwanaku populations.

Wari colonized a previously undeveloped agrarian habitat. However, agricultural reclamation may not have been the sole motivation for colonization. Exploitation of local mineral resources may have been a concern that excavation can clarify. Beyond economics, there were likely political and military considerations in colonization, but manifestations of conquest are not evident.

PROPOSED PROJECT

The proposed project will contain both field and analytical investigations. Fieldwork will focus on excavation of occupation contexts, but will include one team dedicated to the study of ancient agrarian resources in the vicinity of Cerro Baúl. We will test the hypothesis that early Wari colonization was that of an isolationist polity, with very little or highly controlled and limited interactions with Tiwanaku populations. Later developments lead to increased interaction, perhaps first on a household by household basis, that was later institutionalized in ceremonial rituals in the public architecture on the summit of Baúl. As part of the early isolationist standpoint, we contend that the Wari erected an agricultural system to provide the primary subsistence support for the colony.

Agrarian Resources

Survey of the study area indicates that agrarian reclamation was a significant component, if not motivation, of ancient imperial colonization. Focusing upon flat terrain in the lower (1000-1600 m.a.s.l.) Moquegua sierra, Tiwanaku expanded traditional canal irrigation well beyond its modern limits on the south side of the valley confluence region. With the end of state administration, lower sierra irrigation contracted back to within its modern confines.

Wari colonized the previously uncultivated high (2000-3000 m.a.s.l.) sierra with a more labor-intensive technology based upon long sinuous canals and terraced planting surfaces. Although terraces around Cerros Baúl and Mejia were abandoned when the colony withdrew, the technology was adopted by Tumilaca populations and then applied to higher elevations during late prehistoric Estuquiña times. During the Inca occupation, irrigated terracing was centralized around the Torata tributary and greatly expanded upon in this central region of the valley, while in the peripheral tributaries like Otorá, cultivation shifted down slope as populations were likely reshuffled by imperial administration (Williams 1997). Terraced agriculture persists as the modern mainstay of farming in the upper sierra.

We propose that: A) differences in Tiwanaku, Wari, and even later high sierra populations' reclamation technology extended beyond water and land management to include differences in crop frequencies and types, such as races of maize, if not roles of camelid herding. It also likely included efforts to maintain a continuous supply of fuel wood to cook, produce specialized craft goods (ceramics, metallurgy, etc...). B) centrally directed reclamation works of Tiwanaku and Wari will correlate with lands relatively far from water sources and with large and uniform planting surfaces (fields and terraces) and C) changing patterns in the amount, distribution, and internal organizational structure of cultivated land will correlate with changes in social conditions and with fluctuating hydrological conditions.

Constructed and abandoned at different times, ancient planting surfaces and their water delivery systems cover large regions of the study area. They represent the preserved, distal ends of irrigation systems. Closer to their water sources these systems are not preserved due to surface modifications by later farming. Therefore, the location, slope, and channel configuration of preserved canal sections must be used to calculate and approximate the original canal intake, contour course, and potential areas of irrigation. These procedures are particularly important for reconstructing Wari reclamation. Due to the deflation and erosion of arid mountain slopes, good preservation of the El Paso system is confined to the region of the Baúl-Mejia divide and Cerro Petroglifo, where stone was extensively employed in both canal and planting surface construction. Beyond this region there is widely scattered, but rare tracery of poorly preserved earth-banked canal sections and more numerous isolated masonry structures that may be eroded remnants of small aqueducts. This suggests that the El Paso system was potentially very extensive and that many surfaces were farmed without benefit of masonry terracing.

Dating of abandoned agricultural works relies upon: A) compatible associations of canals, as potable water sources, with settlements of known age, and incompatible associations of settlements atop former planting surfaces; B) recurrent differences in morphology and configuration of planting surfaces and terrace construction; C) relative preservation (Stanish 1992; Clement and Moseley 1989; Williams 1997); and D) radiocarbon assays performed on silts from the last active moments of canal use or organic materials from canal construction contexts. The typology and dating constraints developed through detailed investigation will be used to characterize and analyze the full sample of abandoned agricultural works within the study area. These works cover tens of square kilometers, but all relied upon irrigation. Therefore dating maximum elevation primary canals, such as the El Paso canal, brings entire systems into chronological focus. However, all of the systems were slope sensitive. Therefore, regional characterization of variability must control for the rugged sierra topography.

We will also collect soil samples from the agricultural terrain for soil chemical analysis and archaeobotanical studies. Previous research in the Andes and in other regions of the world has established a strong correlation between total and extractable phosphate values, soil organic content, and human activity (Sandor 1995; Manzanilla and Barba 1990). Pilot work conducted in 1998 indicates that extractable phosphate content of soils in irrigated areas is elevated in comparison to soils above the canal system. A total of 67 samples from 10 transects taken throughout the abandoned irrigation area on the slopes of Baúl revealed that 90% of the samples had extractable P levels in excess of 10 parts per million, with an average value of 71 parts per million. Eighty percent of P levels from the 10 control samples outside of irrigable were below 10 parts per million, and all the control samples were under 30 parts per million. The variation within the agricultural samples was also pronounced, and we believe that further testing and mapping will permit the association of certain field typologies with elevated P levels (and thus intensified cultivation practices).

Settlement Excavations

Cerro Baúl represents a complete administrative center set on top of the most imposing natural feature in the region. Two phases of monumental architecture have been identified on the summit; the surface architecture represents the latest phase, constructed between 800 and 1000 A. D. (Williams 1999). These archaeological remains include administrative architecture, religious temples, elite domestic contexts, and craft production and artisan habitation facilities. On the slopes of the mountain mesa, domestic terraces pertaining to lower status people lined the access path to the summit. Surface reconnaissance and one excavation probe have revealed that some of these terraces have ceramic remains which pertain to the Tiwanaku related Tumilaca style. New radiocarbon dates from the Baúl summit indicate probable temporal overlap of these occupations (Williams 1999), and the excavations by Owen (1998) on the lower slopes of the mesa confirm a classic Tiwanaku presence at the same time. These two areas of settlement are joined to the rest of the agricultural and settlement system at the site of El Paso, where Wari-associated monumental architecture outside of the mountain summits exists.

We propose that Wari-Tiwanaku interaction was limited and perhaps hostile in early Middle Horizon times (600 - 800 A. D.) However, it is likely that significant interactions began to take place between some social units early in the ninth century A. D., and by the tenth century A. D. institutional relationships were affirmed through ritual feasting and drinking in Sector B on Cerro Baúl. Furthermore, we hypothesize that the nature of interaction changed over time and was influential in the course of development that each state followed, and is reflected in the architectural reorganization characteristic of the second construction phase. We contend that this reorganization may stem from imperial growth and interaction with Tiwanaku counterparts in Moquegua and Tiwanaku emissaries elsewhere. It is interesting to note the preliminary correlation of Baúl radiocarbon dates from the second phase of construction, imperial architectural reorganization in Epoch 1B at the capital (Isbell 1991; Isbell 1997), and changes in ceramic iconography in the Wari heartland.

The preliminary evidence on which this model is based includes: Owen's confirmation of Omo and Chen Chen style ceramics on the slopes of Cerro Baúl, radio carbon dated to the latter half of the Middle Horizon (ca. 800 - 1000 A. D.); the Tumilaca phase contexts on the access path of Cerro Baúl; the two architectural phases on Cerro Baúl, the first of which is still poorly understood, but the latter of which dates to A. D. 800 - 1000; and the Tiwanaku influences on a ritual ceramic cache in an area of probable ritual feasting in the second phase architecture in Cerro Baúl's unit 1. We will test the model by

conducting further excavations at Cerro Baúl in the monumental and habitation architecture at the site. The proposed excavations have three principal purposes. One is to recover sufficient artifact and ecofact remains to assess Wari staple and wealth finance strategies in Moquegua through time. The objective is to understand variations both among Baúl households and between Wari and Tiwanaku households on a temporal scale. A second objective is to document Wari-Tiwanaku interaction in ceremonial/monumental areas and to evaluate the iconographic and ideological influences each state had on the other in the Moquegua region. A key element of this second objective will be to understand how activities and the construction of space in early Wari occupations was distinct from that of the later phase of monumental occupation of the summit. The third objective is to model imperial production and exchange networks from the Baúl provincial perspective.

We propose to excavate in all areas of the Cerro Baúl site over the next two years in order to define the nature of sectors D and E and augment the artifact and ecofact samples from sectors A through C. However, the majority of the excavations will focus in the elite residential compounds and in the vernacular architecture on the slopes of Baúl rather than the monumental public architecture of sectors B and C. Previous excavations have concentrated on monumental and ceremonial architecture that provide stunning architectural details and fineware ceramic offerings, but contain little information about staple economies or prestige good exchange networks. The most recent excavations on Cerro Baúl proposed to investigate the craft production system on Baúl. While additional evidence for lapidary work was found in a household context in unit 7, other excavations in unit 8, a possible ceramic manufacturing workshop based on the presence of potter's plates on the surface, did not reveal any further evidence for craft production. The proposed excavations will continue investigations in the monumental areas of the site with a focus on identifying architectural forms and the activities that took place within them during the first phase of occupation, but will focus more on elite and commoner households where evidence for economic activities such as lapidary work and food processing took place.

Previous work in sector A indicates that additional excavations in these types of domestic contexts will provide significant samples for an analysis of inter-household variation and regional exchange networks based on faunal and botanical remains of the Baúl summit occupants. Additional units in the other four sectors of the summit will augment our knowledge of Wari administrative and ceremonial contexts. Excavations on the domestic terraces on the slopes of Baúl will provide similar household economic data to the occupants of sector A. These excavations, however, will focus on people of lower status and of different ethnic affiliations (Tiwanaku Tumulaca) that shared the same settlement resources (e.g. water, agricultural land, traffic paths) as the Baúl occupants.

ARTIFACTUAL ANALYSES

The laboratory component of the project will focus on (1) subsistence production system and domestic activity pattern sets (2) craft production system and elite exchange, and (3) iconographic relationships with Tiwanaku material culture. Analytical methods will couple traditional archaeological analyses of paleoethnobotanical, zooarchaeological, lithic, and ceramic remains with trace element composition analysis and soil geochemistry from both agricultural and habitation contexts to assess these social systems. We will also emphasize the analysis of iconography, recovered thus far only on ceramic artifacts, in order to understand the process of local developments in interaction spheres and the relationship to the larger Middle Horizon picture. Radiocarbon assays will be combined with archaeological stratigraphy to provide a temporal framework for interpreting the process of imperial interaction in the Moquegua region in the Middle Horizon.

Soil Chemical Residues

Soil chemical analysis of occupied surfaces will augment the artifactual context data in order to interpret activity sets and activity set groups within the architectural unit. In some units where artifact density is low, such as in sector C, soil chemical analysis will provide the best means of recovering data on activity patterns. In sector B, where artifact densities are not necessarily low, but represent ritual offering and not primary use contexts, soil chemical analysis will be instrumental in determining how

these ceremonial buildings were utilized during the period of operation.

From each occupation surface encountered during excavation, a 10 gram sample will be extracted from each cell of a 1 by 1 meter grid. This sample will be processed in the University of Florida's Environmental Pedology Lab under the direction of Dr. Mary Collins, who has published on the use of soil chemical analysis in archaeological contexts (Collins 1989). The EPL processed 180 samples from all previous excavation contexts at Baúl this year, and they were analyzed for total and extractable phosphate and Ph levels. The results of this pilot work demonstrate that large variations in these chemical elements of soil exist within the architectural unit. In cases where primary use contexts were intact (e.g. unit 1), these soil chemical concentrations and depressions can be correlated with artifact sets which imply certain types of human activity: food processing, food consumption, lithic production, traffic areas, etc... The soil chemical correlations of these activity sets will also be confirmed through ethnographic analogy and through comparisons with other archaeological sites where this technique has been used successfully (Manzanilla and Barba 1990).

Zooarchaeological Remains

In order to understand the nature of Wari-Tiwanaku interaction, we will need to understand how spatial activity patterns within the Wari household were organized, how they changed over time, and how they are related to Tiwanaku organizational patterns (Goldstein 1989; Bermann 1993). This will be accomplished through the analysis of artifact patterning and soil chemical analysis. More importantly, however, we will need to understand direct exchange relationships between Wari and Tiwanaku, and how they developed or failed to develop. We will examine the subsistence base of the Baúl residents, both in elite households on the summit and in commoner households on the slopes, through an analysis of the faunal and botanical remains they left behind.

Bones recovered in excavation will be thoroughly brushed clean and sorted into taxon identifiable and size identifiable classes. Using the Florida Museum of Natural History's comparative collection, Dr. Susan DeFrance will supervise the analysis of faunal remains from the site. Identifiable bones will be assigned to lowest taxon and most detailed element description possible. Analyses will include count and weight by type and age, estimates of MNI, and diagnostic element measurements where appropriate.

Previous excavations on Baúl have recovered fish, shellfish, and marine bird remains in limited quantity. Some rare elements such as a shark's tooth, modified condor bone, and human phalanges also represent a minor portion of the pilot excavation's collection. Cuy (guinea pig) and terrestrial bird were also recovered, but camelid remains are the predominant source of animal protein represented. One aspect of faunal analysis will involve identification of all animal resource types and their contributions to the diet or to the tool set. We will examine the degree of variation between households in both the use of different animal resources and the access to rare or high status elements, such as spondylus shell and shark teeth. Contributions to the diet for the various faunal species will be assessed via recovered zooarchaeological remains and will be compared to evidence from Tiwanaku contexts excavated by Goldstein (1989).

As the most common species in the assemblage, investigation of the camelid herding economy will be extremely important. Construction of camelid mortality curves will reflect herd management strategies or access to age and/or sex specific animals by the Baúl summit dwellers. An emphasis on the use of camelids for meat versus wool or pack animals, for example, will be reflected by the age at death distributions (Wing 1972). Evidence for animal mortality ages may be derived from size and fusion of bones and tooth wear and eruption (Wheeler n.d.).

Butchery pattern studies and animal part indices will indicate if animals were being processed in the dwellings, or if they were being processed off-site, perhaps by non-residents. Large scale subsistence support of the summit populace, for example, might be reflected in higher proportions of non-meat segments and foot bones in butchery areas and high proportions of meaty segments in elite domestic or ceremonial feasting contexts (Miller 1979).

Paleoethnobotanical Remains

Lee Newsom of the Center for Archaeological Investigations at Southern Illinois University-Carbondale will coordinate analysis of the botanical remains to determine as many aspects of the paleoethnobotany as possible. We anticipate these data will be instrumental in examining Wari subsistence strategies and staple exchange relationships with Tiwanaku settlements. Sample recovery and analysis will include both terrace and site/habitation areas. Regarding the terraces, 1-2 liter sediment samples will be retrieved from each stratum (natural or in 10-cm increments), from as many spatially contiguous members of individual terrace series as possible. Sampling will focus on those distal terraces that are more intact and better preserved, with the deposits exposed for sampling either by small trenches or by auger coring in conjunction with the soil sampling. The terrace samples will be passed dry through nested geological sieves with mesh openings sized, respectively, 4 mm, 2 mm, 1 mm, and 0.42 mm, and capturing in a bottom pan all material finer than 0.42 mm. The four sieve fractions will be used for macroremain analysis, with the <0.42 mm component reserved for potential phytolith analysis (these will be forwarded to a phytolith analyst). In addition, bulk soil samples ranging between 10-20 liters will be collected from each provenience and depositional unit of the primary site excavations for the analysis of plant macroremains (wood, stems, seeds, tubers). These samples likewise will be processed in the field using the dry sieving procedures described above and retaining the finest fraction for possible phytolith analysis of selected samples. In terms of both terraces and the primary block excavations, any large visible plant remains such as wood charcoal, large seeds, and tuber fragments, will be extracted in situ to minimize destructive handling. These specimens will be placed in appropriate containers and sent directly to Carbondale for analysis, along with the sieved fractions as described above, without further processing in the field.

Seed remains will be identified primarily by morphology with the appropriate magnification, including in some cases, scanning electron microscopy. Wood identifications will be pursued based on the three-dimensional anatomical structure using in combination incident-light and compound microscopes, employing keys to South American taxa and seconded by direct comparison with modern reference material from the xylarium of the Florida Museum of Natural History Herbarium. Growth ring measurements will be made under a dissecting microscope with digital calipers. Tubers and other non-lignified tissues will be classified first according to their anatomical structure and supported by chemical taxonomy, when possible, by pyrolysis-gas chromatography-mass spectrometry (Py-GC/MS) using equipment at Southern Illinois University (Fankhauser 1994; Galletti 1991; Kuder & Kruge 1998; van Bergen, et al 1997). Maize remains will be identified and classified following Bird 1990, Goette et al 1994, and King 1987. All plant identifications will be conducted to the lowest possible taxon. All plant materials will be quantified initially according to standard archaeobotanical practice, employing variously raw counts, weights, density, and ubiquity data.

The archaeobotanical data will be further analyzed using ecological diversity and community similarity analyses to highlight variation in community composition (thus, individual households, strata, etc.), using relative presence and abundance to examine, for example, stability, trends in use, resource partitioning, and other aspects of the paleoethnobotany and culture process. Ultimately, we will examine which crops and combinations of crops were being consumed by the Wari elite on Baul and hope to clarify the provenance of those crops: Baul's own agricultural fields or from outside the Baul system, perhaps from Tiwanaku resources. Studies in other regions have indicated that Wari colonization resettled populations to take advantage of maize growing regions (Schreiber 1992), and we hope to emulate other excellent ethnobotanical analyses in the Andes (Hastorf 1993; Johannsen and Hastorf 1989; Persall 1994; Pearsall 1996). We will look for evidence of the introduction of new crop types like maize morocho (Anders 1991; Nicholson 1960) and their consumption by Baul summit occupants. Comparisons will be made with plant macroremain collections made by Goldstein in Tiwanaku sites. Hopefully, our planned macroremain and phytolith extractions from Wari agricultural soils will further elucidate the nature of Wari elite food production and consumption systems and their relationship to Tiwanaku in the valley.

One aspect of the archaeobotanical analysis will focus on interactions with the natural landscape and sustainable land use in this resource-limited environment. We will use the fuel resources to examine this question, this being also a situation of high fuel demand (given that these deposits represent extensive, long-term human occupation, and in an arid landscape characterized by a naturally

sparse woodland. The fuelwood supply was necessarily limited and constrained; we can anticipate the addition or application of alternative fuel sources (e.g., Hastorf 1988). We will quantify and compare the presence of non-subsistence remains among samples (e.g., wood, camelid dung, maize cobs) for the relative presence of alternative fuels. Moreover we will collect growth-increment data from wood specimens to examine changes in the ring width series, which can help to pinpoint differences in wood demand by revealing evidence of stress and thinning of local forests (extraction pressure). Dendroecological research has been demonstrated effective with woods from tropical dry forest areas (Borchert 1999), including with South American *Prosopis* spp. (algaroba, algarrobo) (Villalba and Boninsegna 1989), which are very common to this region of Peru and have long been used for fuel and charcoal production. Minimally, the growth increment data will be analyzed and compared according to variation in average ring width. Should the data prove adequate, that is, with enough details and adequate ring series for more in-depth analysis, then more sophisticated statistical analyses will be conducted employing deterministic and stochastic methods according to established dendroclimatological and dendroecological practice (Schweingruber 1996).

Soil samples from each archaeological context will be processed in the field using a set of geological sieves. In order to effectively analyze the sample in the time allotted, all samples will be briefly examined to identify taxon present. A subset of the samples will be sorted in detail based on archaeological context and observed variations in the initial sort to identify percent of taxa present (Dennell 1976). These detailed analyses will be conducted at the Center for Archaeological Investigations of the Southern Illinois University under the supervision of Dr. Lee Newsom. Scanning Electron Microscopy will aid in the identification to the species level of samples chosen for detailed analysis. These analyses will be instrumental in examining Wari subsistence strategies and staple exchange relationships with Tiwanaku settlements.

Ceramic Remains

P. I. Williams will be responsible for the technological and iconographic ceramic analysis in consultation with Middle Horizon ceramic specialist Dr. Anita Cook. Food storage, preparation, and serving vessels will identify areas of domestic activity. In addition to examining the organization of space and architectural elaboration, we will assess differences in status and ethnicity among households via the ceramic forms, design, and finishing treatments. Commoner and elite Wari households should have forms distinct from Tumulaca households. Goldstein's (1989) analyses of Tiwanaku household and ceramics will provide excellent comparative data. Interaction between Tiwanaku and Wari households may be exemplified through the existence of Tiwanaku forms in Wari domestic contexts and vice versa. Public and ceremonial activities should be distinguished by assemblages with high proportions of serving and storage vessels and vessels of unusual form or exhibiting state iconography. Incorporation of Tiwanaku vessels in these contexts and not in domestic contexts would reflect Wari-Tiwanaku interaction on a state scale that was not present between individuals. If our hypothesis regarding the early confrontational nature between the states is correct, we expect to find only classic Wari ceramics without Tiwanaku influenced designs and no Tiwanaku vessels in any early contexts. The alternative hypothesis, that Wari and Tiwanaku were trading and interacting during the early Middle Horizon, would be reflected by the presence of Tiwanaku forms or Tiwanaku influenced designs in household and/or institutional contexts of early Wari architecture.

Ideological exchange between Wari and Tiwanaku in Moquegua will be examined through iconography on fineware ceramic vessels, the only medium on Baúl for which we have preserved iconographic details. The Unit 1 assemblage included one Tiwanaku kero and sherds from six vessels that are "hybrids". They consist of Wari kero forms with Wari colors that depict designs affiliated with two local Tiwanaku Phases (Omo and Chen Chen) which have Front Facing Deity iconography that are dated to the late phase (800 - 1000 A. D.) of Cerro Baúl occupations by four radiocarbon dates. Since previous work has indicated that Tiwanaku influence is seen on some Wari forms, and that at least one Tiwanaku kero with Tiwanaku design patterns has been recovered from Cerro Baúl, we are confident that iconographic interaction can be documented at the site. The study will focus on the definition of Tiwanaku and Wari icons in the assemblage and the chronological sequence of vessel attributes based on the dating of vessel contexts. Analysis will be undertaken in conjunction with a study of the production and distribution systems of these vessels, so that we will be able to assess the location from

which the potter obtained the clays to produce these hybrid vessels.

Since we propose that exchange will be reflected in iconography, it will be necessary to model the various scales of production and exchange of ceramic wares in this Wari settlement. We will be able to link iconography on vessels with the trace element signatures of known Wari and Tiwanaku produced ceramic wares (Glowacki 1997). We will conduct trace compositional analyses of ceramic and clay sources via instrumental neutron activation analysis under a NSF-subsidized project already approved for the Baúl study. Dr. Michael Glascock of the Missouri University Research Reactor processed a pilot sample of 40 specimens this year, and these preliminary results indicate that the majority of ceramics from the Baúl summit do not pertain to the 5 valley clay sources that were sampled as part of the pilot study. Mary Glowacki has completed INAA from significant samples of material from the Wari administrative site of Pikillacta in the Cusco Basin and from the Wari capital itself. She has also documented INAA signatures from smaller samples of material from Tiwanaku and Moquegua-Tiwanaku materials, as well as six samples from Baúl. Glowacki and Williams are currently conducting a principal components analysis of the 153 samples from the Pikillacta study and the 40 Baúl samples that will make significant strides in understanding the relationship between ceramic production and distribution and will define areas for which additional Moquegua samples are required.

In order to augment the Moquegua sample we will analyze an additional 150 specimens from both Tiwanaku and Wari contexts in collaboration with Dr. Glascock. Samples will be processed from both ceremonial and domestic contexts, and we will examine both plainware domestic vessels and decorated finewares. In every case possible, we will sample fragments from which the vessel form and style can be determined in order to tell if certain classes of vessels were being exchanged at different scales. We will be able to isolate different source signatures in the valley from additional samples of valley clay sources, source signatures from Wari and Pikillacta, and source signatures from Tiwanaku related remains. Paul Goldstein has agreed to work in collaboration on this portion of the project in order to obtain further samples of the Moquegua-Tiwanaku repertoire as part of this project.

Other material remains

One of the most compelling reasons for the settlement of Cerro Baúl was the extraction of mineral resources. Until recently, obsidian extraction was considered to have been an important aspect of the Baúl settlement due to the vast quantities of obsidian artifacts recovered thus far (well over 200 tools). According to a recent study of Baúl obsidian recovered from surface collections, the vast majority came from sources far from the Moquegua valley in the department of Ayacucho (Burger et al. 1998). Extraction of materials used in lapidary work, such as crisacola and other blue-green minerals, may still have been a possible incentive in the settlement of Baúl.

Donna Nash, a doctoral candidate at the University of Florida, will conduct functional classifications of all stone tools and implements, including ground stone, flaked stone, and lapidary materials identify activity patterns involving lithic use. Subsistence use of lithics will be evaluated through an analysis of agricultural and plant processing tools, such as hoes and ground stone implements. Food processing use will also include identification of plant residues? GC/MS, as identified in the paleoethnobotanical analysis section, will be conducted by Lee Newsom to classify minute organics trapped in stone tool surfaces on both chipped stone and ground stone artifacts. Specialized production of semi-precious stones for ceremonial or elite use will be examined through the distribution of tool kits and waste materials.

Other remains seen in coastal Wari sites such as textiles have not been recovered on Cerro Baúl, presumably because they were not preserved. We do not expect to find any textile remains as the pilot sample revealed no evidence that they were present. Human remains have been found in archaeological sites in the Wari heartland, although very few have been published. To date, no human mortuary remains have been recovered from Cerro Baúl nor any of the Wari sites in Moquegua. Should human remains be recovered during the proposed project, they could be an excellent source of comparative information between Wari and Tiwanaku in Moquegua. The presence of an established bioanthropological research program in Moquegua under Dr. Jane Buikstra has documented hundreds of human remains from Tiwanaku tombs. However, based on the previous three excavation seasons, it appears unlikely that this source of evidence will be available. Should human remains be encountered,

we will collaborate with the bioanthropologists working in the valley to fully study and publish the results of any mortuary contexts.

IMPACT

The proposed project will advance our understanding of how neighboring expansive states influence each others' development. It will provide significant new data on the Andean Middle Horizon and contribute to the growing literature on Andean political and economic institutions in prehistory. It will provide opportunities to U. S. and Peruvian students at both the graduate and undergraduate levels and will promote collaborative efforts between scholars in both countries.

The department of Moquegua will also benefit from this project. Cerro Baúl is an emblem of Moquegua's identity. Our previous work at the site has generated a great deal of interest, and our dissemination of the results to the public through museum exhibitions and popular publication will enrich the culture history of the area and promote protection of this and other archaeological sites. The project will operate under the auspices of the Contisuyo Museum, a regional institution funded by the Southern Peru Copper Corporation. The institution grew out of a research program started by U. S. scholars, Peruvian archaeologists, and concerned residents and functions as a public resource and advocate for archaeology in the area. The museum will serve as the focal point for the project's interaction with the community and as the curation facility for the project collections. Thus, the excavated materials are assured quality conservation and storage and will be accessible to researchers well after the project is concluded.

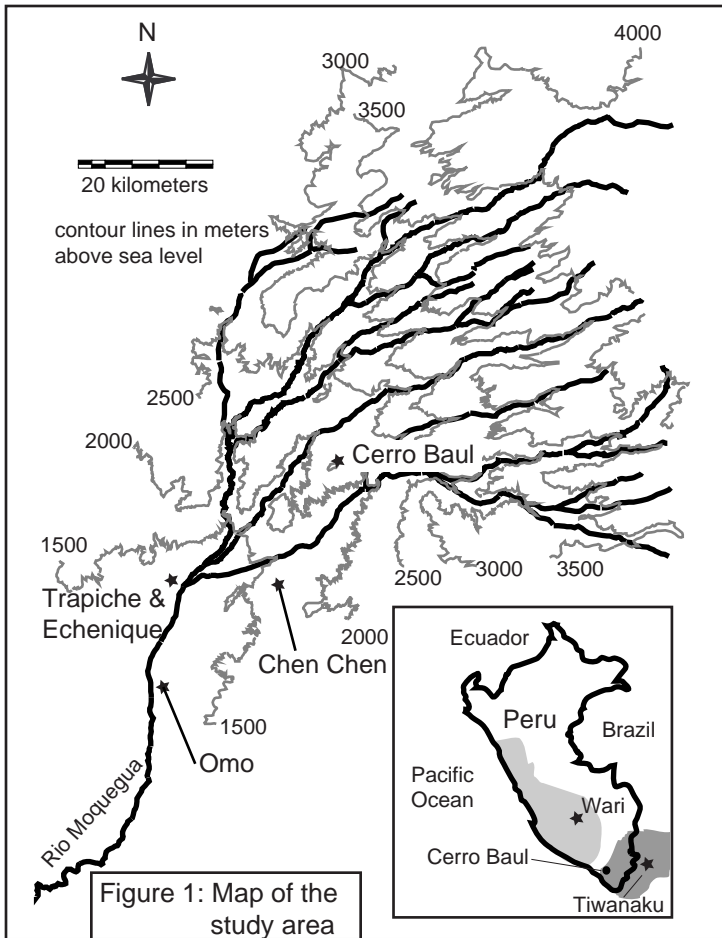


Figure 1: Map of the study area



Figure 2: The front faced deity as portrayed on a Wari kero from Cerro Baul excavated by Feldman.

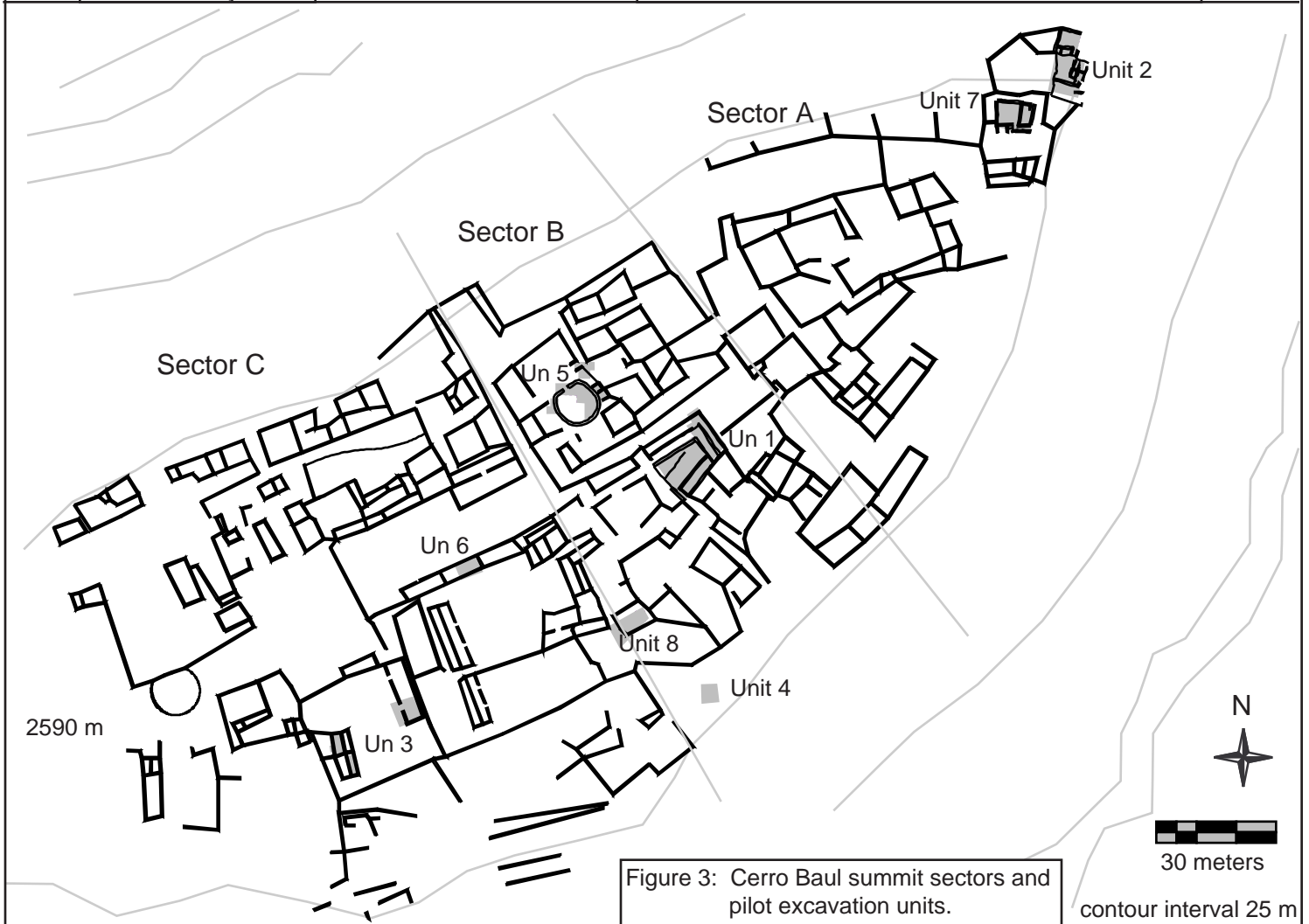


Figure 3: Cerro Baul summit sectors and pilot excavation units.

contour interval 25 m

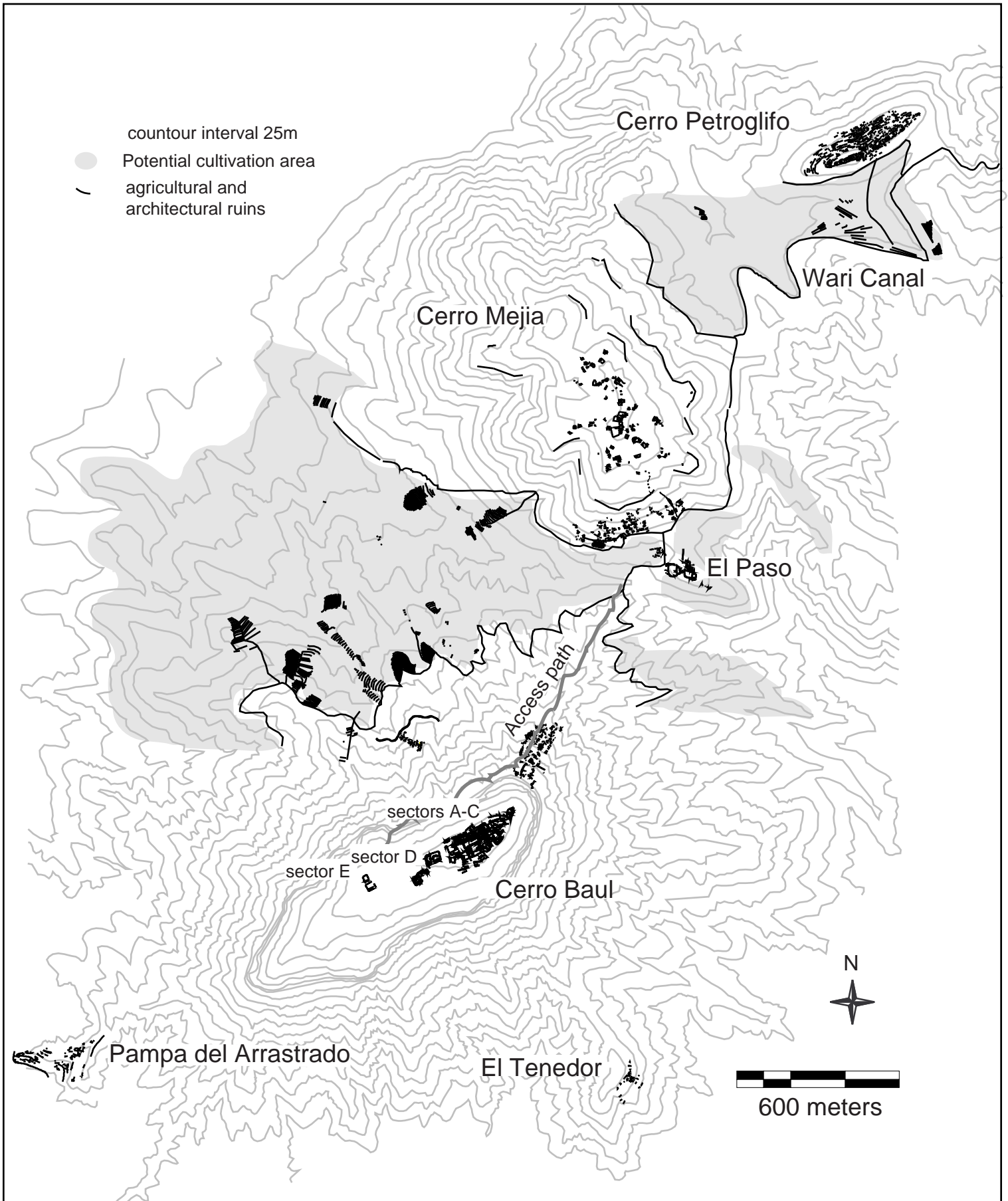


Figure 4: The Wari colony centered around Cerro Baul

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Mujica, Elias

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1998 *A Tiwanaku IV Temple at Cerro Baúl: Evidence and Implications*. Paper presented at the 38th Annual Meeting of the Institute for Andean Studies, Berkeley.

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1996 *Reconstructing subsistence in the lowland tropics: a case study from the Jama River Valley, Manabí, Ecuador*. Pp. 233-254 in *Case Studies in Environmental Archaeology* edited by E.J. Reitz, L.A. Newsom, and S.J. Scudder. Plenum Press, New York.

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1997 The Role of Disaster in the Development of Agriculture and the Evolution of Social Complexity in the South-Central Andean Sierra. Ann Arbor: University Microfilms.

1998 Archaeological Population Estimates and Agrarian Productivity. Poster presented at the 97th Annual Meeting of the American Anthropological Association, Philadelphia.

1999 Construction, Chronology, and Reorganization at the Wari Administrative Center of Cerro Baúl. Manuscript submitted to *Latin American Antiquity*.

Williams, P. R. and D. J. Nash

1997 Burning Down the House: Differential Patterns of Construction and Abandonment on Cerro Baúl. Paper presented at the 16th Annual Northeast Conference on Andean Archaeology and Ethnohistory, Orono, Maine.

Williams, P. R., D. J. Nash, J. Isla C., and R. Feldman

1998 A Wari Offering Context at Cerro Baúl. Paper presented at the 17th Annual Northeast Conference on Andean and Amazonian Archaeology and Ethnohistory, Binghamton, New York.

Wheeler, J. C.

1982 Progression of bone fusion in the New World Camelidae – Preliminary Results. Manuscript on file at the Environmental Archeology Laboratory, Florida Museum of Natural History, Gainesville.

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1972 Utilization of animal remains in the Peruvian Andes. In *Andes 4: Excavations at Kotosh, Peru, 1963 and 1966*. Edited by S. Izumi and K. Terada. Tokyo: University of Tokyo Press.

Wright, H. and G. Johnson

1975 Population, exchange, and early state formation in southwestern Iran. *American Anthropologist* 77: 267-289.

Biographical Sketch

A. Vitae

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December 8, 1970, Rutland, Vermont

Education: Ph. D. (Anthropology), University of Florida, 1997
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B. A. (Anthropology & Geography), Northwestern University, 1993

Languages: Spanish; reading, writing, and speaking competence.

Current Position: Visiting Assistant Professor, University of Florida, Department of Anthropology, 1112 Turlington Hall, Gainesville, FL 32611

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Research: Evolution of complex societies, development of agriculture, disaster research, ecological archaeology, Geographic Information Systems and remote sensing techniques, Andean South America, Eastern U. S.

Grants:

1. Heinz Family Foundation Grant, 1998 (\$8000)
1998 Cerro Baul Excavation Project
2. G. A. Bruno Foundation Grant, 1997 (\$5000)
1997 Cerro Baul Excavation Project
3. J. W. Fulbright Scholarship, 1995 (\$7250)
The Evolution of Agriculture in the Peruvian Sierra
4. NSF Graduate Research Fellowship, 1993 (\$65500)
The archaeology of complex societies in the Andes
5. Northwestern University College of Arts and Sciences Student Achievement Award, 1993 (\$500)
6. Charles D. Hurd Scholarship, 1993 (\$500)
Resource use among populations along the Peruvian south coast
7. Northwestern University Undergraduate Research Grant, 1992 (\$500)
Resource use among populations along the Peruvian south coast
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Faunal analysis on the Peruvian south coast
9. Robert C. Byrd Scholarship, 1989 (\$1500)

B. Publications and conference papers

1999 Construction, Chronology, and Reorganization at the Wari Administrative Center of Cerro Baul. *Latin American Antiquity* (under review).

1999 Cerro Baul: Masada of the Andes. *Discovering Archaeology* (under review with M. Moseley & D. Nash)

1998 Excavations in the Ceremonial District at Cerro Baul. Paper presented at the 63rd Annual Meeting of the Society for American Archaeology, Seattle. (with J. Isla C. and R. Feldman)

1998 A Wari Offering Context at Cerro Baul. Paper presented at the 17th Annual Northeast Conference on Andean Archaeology and Ethnohistory, Binghamton, NY, October 17-18. (with Donna J. Nash, J. Isla C., & R. Feldman).

1997 The Role of Disaster in the Development of Agriculture and the Evolution of Social Complexity in the South-Central Andean Sierra. Ph. D. dissertation, Department of Anthropology, University of Florida.

1997 Burning Down the House: Differential Patterns of Construction and Abandonment on Cerro Baul. Paper presented at the 16th Annual Northeast Conference on Andean Archaeology and Ethnohistory, Orono, Maine, October 4-5. (with Donna J. Nash).

1995 Agricultural Hydraulics and the State in the Torata Valley, Peru. M. A. Thesis, Department of Anthropology, University of Florida .

1993 Settlement Patterns of Southern Peruvian Coastal People from the Archaic to the Early Historic. B. A. Thesis, Department of Anthropology, Northwestern University.

1993 A Reexamination of Agrarian Collapse on the Coast of Moquegua, Peru. B. A. Thesis, Geography Program, Northwestern University.

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Current Position: Professor, University of Florida, Department of Anthropology, 1350 Turlington Hall, Gainesville, FL 32611

Previous Positions: 1976-1984 Associate Curator through Curator, Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Illinois.
1968-1976 Instructor through Associate Professor, Harvard University.

Research: Settlement and subsistence patterns, early agricultural economies, preindustrial urbanism, prehispanic architecture, prehispanic irrigation and water management technology, Quarternary geomorphology and tectonics, South America and the Caribbean, Florida and the Southeast Gulf coast.

Professional Honors:

Fellow, American Association for the Advancement of Science 1995-
Carnegie Museum Research Associate 1989-
J. S. Guggenheim Fellow 1988-89
Dumbarton Oaks Senior Fellow for Pre-Columbian Studies 1983-85.

B. Selected Publications

1994 New Light on the Horizon. Review of Archaeology 15(2): 26-41.

1992 The Inca and their Ancestors. London: Thames and Hudson.

1991 Colonies and Conquest: Tiahuanco and Huari in Moquegua. In Huari Administrative Structure: Prehistoric Monumental Architecture and State Government. W. Isbell and G. McEwan, Eds. pp. 21-40. Washington: Dumbarton Oaks. (with R. Feldman, L. Watanbe, & P. Goldstein).

1983 Principles of Agrarian Collapse in the Cordillera Negra, Peru. Annals of the Carnegie Museum 52(13): 299-327. (with R. Feldman, C. Ortloff, & A. Narvaez)

1974 Organizational Preadaptation to Irrigation: The Evolution of Early Water Management Systems in Coastal Peru," in Irrigation's Impact on Society 77-82, (T. Downing and M. Gibson, eds.) The University of Arizona Press.

1998 Early Maritime Economy and El Nino Events at Quebrada Tacahuay. Keefer, D., S. DeFrance, M. Moseley, J. Richardson, D. Satterlee, and A. Day-Lewis. Science 281:1833-1835.

1993 The Northern Dynasties: Kingship and Statecraft in Chimor. Washington, D. C.: Dumbarton Oaks. (editor, with A. Cordy-Collins)

1987 Punctuated Equilibrium: Searching the Ancient Record for El Nino. Quarterly Review of Archaeology 8: 7-10.

1982 Chan Chan: Andean Desert City. 440pp, School of American Research, University of New Mexico Press, Albuquerque. (editor, with Kent Day).

1975 The Maritime Foundations of Andean Civilization. Menlo Park, CA: Cummings.

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Research: Environmental Archaeology, Historical Archaeology, Coastal Adaptations, Zooarchaeology, Central Andes, Caribbean, Southeastern United States

Grants:

1. Heinz Family Foundation Grant, 1998 (\$7685)
Quebrada Tacahuay: the Archaeology of an Early Maritime Site on the South Coast of Peru.
2. University of Montana, University Grant, 1996 (\$2200.00)
Yaya-Mama Subsistence Adaptations on the Copacabana Peninsula
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Zooarchaeological Investigations of Spanish Colonial Settlement in Moquegua, Peru

B. Publications:

1998 Early Maritime Economy and El Niño Events at Quebrada Tacahuay. Keefer, David K., S. D. deFrance, M. E. Moseley, J. B. Richardson, D. R. Satterlee, and A. Day-Lewis
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1996 Integrated Taphonomy of an Avian Death Assemblage in Marine Sediments from the Late Pliocene of Florida. S. Emslie, W. D. Allmon, F. J. Rich, J. H. Wren, and Susan D. deFrance,
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Latin American Antiquity 7(4):355-372.

1996 Iberian Foodways in the Moquegua and Torata Valleys of Southern Peru.
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1996 The Archaeobotanical, Bone Isotope, and Zooarchaeological Records from Caribbean Sites in Comparative Perspective, with L. A. Newsom and W. F. Keegan in *Case Studies in Environmental Archaeology*, pp. 289-304. Edited by E. J. Reitz, L. A. Newsom, and S. J. Scudder, Plenum Press, N.Y.

1989 Saladoid and Ostionoid Subsistence Adaptations: Zooarchaeological Data from a Coastal Occupation on Puerto Rico. British Archaeological Reports #506, Early Ceramic Population Lifeways and Adaptive Strategies in the Caribbean, edited by P. E. Siegel.

1988 Perspectives on the Development of Political Structure in Affluent Maritime Social Groups: Ethnographic and Archaeological Examples. Combined Volume of The Florida Journal of Anthropology 13(1-2) and The Florida Anthropologist 41(2).

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