

Chipped Stone Technology and Agricultural Households in the Moche Valley, Peru

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A thesis submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Master of Arts in the Department of Anthropology (Archaeology).

Chapel Hill
2010

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ABSTRACT

EVAN SURRIDGE: Chipped Stone Technology and Agricultural Households in the Moche Valley, Peru
(Under the direction of Brian Billman)

Stone tool technology has received little attention in the study of complex societies in the Andes, as archaeologists have focused heavily on elite crafts and architecture. Such tools, however, offer an important means of assessing the labor roles of particular social groups. This thesis examines lithic assemblages dating to the Early Intermediate Period (ca. 400 BC – AD 600) from Peru's middle Moche Valley and assesses variability in elite domestic economies. During an occupation of the valley by highland colonists, elite households were intensely involved in agricultural labor, as evidenced by high discard rates of stone hoes. These households may also have produced surplus tools for exchange. By the Middle Moche phase, middle valley elites and their retainers were only marginally involved in agricultural labor. Instead, their domestic economies focused on mobilizing the labor of other households through the redistribution of crafts and foodstuffs such as *chicha*.

Dedicated to the memory of my grandfather, Louis Szafron, who really knew what it meant
to be a farmer.

ACKNOWLEDGEMENTS

This study was only possible with the interest and assistance of many people. Special thanks go to Brian Billman for his advice and general support, and to Jesús Briceño for providing access to artifact collections. Jennifer Ringberg provided the ceramic weight data used here, as well as indispensable assistance and advice in Peru. Caitlin Smith photographed artifacts and helped maintain my sanity while organizing a large collection of artifacts. Danny Costa, Beth Plunger, Beth Koontz, and Rebecca Winker assisted with preliminary surveys of lithic surface assemblages in the middle valley. Barker Fariss graciously allowed me to use some figures from his own MA thesis. José Melendez, Eloisa Piminchumo, and their respective family members kept us all going with their dedication and hard work. They have my sincere gratitude, and I don't think any of us could do it without them. The many people involved with the UNC-Moche Field School as staff, volunteers, and students are all to be thanked as well. I wish I could name them all, but a giant 'Thanks everybody!' will have to do. Finally, thanks also go to Margie Scarry, Silvia Tomášková, and Tricia McAnany, who read and re-read this study, and provided many useful comments and advice.

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CHAPTER ONE:

INTRODUCTION

“The relics of the instruments of labor are of no less importance in the study of vanished socio-economic forms than fossil bones are in the study of extinct species...not only are the instruments of labor a standard by which we can measure the development of human labor power; but they are indicators of the social relations amid which labor was performed.”

-Karl Marx, *Capital* (1962:172)

In a sense, the development of archaeological research can be seen as a broadening of the evidence considered relevant to the discipline's practice, with the questions and artifacts that capture our attention developing in a synergistic fashion. In the Central Andes, where archaeology matured in tandem with iconographic studies and ethnohistory, early research focused heavily on elite material culture through much of the 20th century. The discipline has changed significantly and is now a heterogeneous endeavor with diverse agendas, but in many quarters there is still little active interest in the ancient Andes' less urbane artifacts. This has had a particularly negative effect on the study of non-elite culture and society.

As a counterpoint, the research presented here attempts to focus investigation on a class of materials and questions that have received less than overwhelming attention: domestic stone tools and rural labor patterns. Generally, I investigate the relationship between household labor mobilization and emerging social hierarchies in Peru's Moche Valley during the Early Intermediate Period (EIP) (~400 BC–AD 600). I focus mainly on the production, exchange, and use of chipped stone hoes, although more informal tools are considered as well. Based on these data, I suggest that surplus hoe production occurred

during the occupation of the middle valley area by highland groups, in tandem with increased agricultural production. Elite households generated this surplus as means to achieve power and participate in exchange networks with other communities and ethnic groups. The data also indicate declining hoe consumption in elite households by the Middle Moche phase (ca. AD 400–600), suggesting a shift in high-status domestic economies to ascribed positions that focused on mobilizing the labor of others. On a more theoretical level, I argue the intensity with which certain social groups produced and consumed stone tools is an important indicator of their position within networks of social and political capital.

Unlike prestige goods and monumental structures, simple tools represent a technology employed directly or indirectly by every person in a society. Furthermore, the study of contextualized ancient tools provides one of the best means for associating the performance of labor with particular social groups such as households or peasant communities. This may be especially significant given that traditional Andean societies considered the control of labor to be the foundation of social power, rather than possession of material wealth or commodities (Ramírez 1996). Understanding how labor relations varied across the social landscape and through time therefore seems at least as critical to understanding Andean political economies as the movement of exchange goods.

On the Peruvian coast during the EIP, everyone depended on agricultural labor for food, cotton clothing, and other necessary goods. In turn, this labor was based on the combined productive power of people, irrigated fields, and tools such as hoes and digging sticks. Stone hoes were therefore an important means of economic production, as well as social products themselves, with serious implications for the organization and transformation of production. Specific tools such as hoes were neither *necessary* for the practice of

agriculture nor its intensification (Netting 1993: 56; Trigger 2003: 309), but their use and discard can be seen as a gross archaeological indicator of labor investment and, by inference, social relations. For example, any prehistoric agricultural intensification would have involved increased labor investment through tasks such as fertilizing, weeding, and mulching. Many factors may have motivated such an increase, including demographic pressure or taxation, and the analysis of tools helps identify the scale of labor transformation and the roles of various social actors.

Before European colonization, metallurgy in the central Andean region was, with some exceptions, largely confined to use in symbolic communication (Lechtman 1984: 9). Although some metal utilitarian objects existed, such as fish hooks, most tools in day-to-day life were made of stone or wood. This is confirmed by the large quantities of stone tools and production debris found in archaeological deposits at residential settlements. However, study of these assemblages is hampered by the inconsistency with which they have been collected and the lack of straightforward ethnographic analogues with which to compare them (Nash 2009: 220). Stone tools are often unrecognized and frequently ignored by scholars unconvinced of their analytic importance. A major goal of this thesis, then, is to demonstrate that research questions that depend on lithic datasets can make major contributions to the study of complex Andean societies.

I begin by providing some background on the Moche Valley during the Early Intermediate Period (ca. 400 BC–AD 800), discussing both the context in which political centralization occurred and the archaeological sites from which data for this study were gathered. I then offer a theoretical background for understanding the connection between stone tools and the mobilization of surplus labor, and make a heuristic distinction between

hierarchical and heterarchical schemes of labor mobilization. The third section provides basic information on the methods of data collection used, the structure of the dataset, and the assumptions and limitations inherent to it. I then discuss the results of my analysis, arguing that households and communities potentially moved certain tools through exchange networks, and that after the formation of the Moche state, certain households reduced their consumption of agricultural tools as their domestic economies came to focus on craft production and redistribution rather than agricultural production.

CHAPTER 2:

ARCHAEOLOGY OF THE MOCHE VALLEY

The Moche Valley is a small and unremarkable drainage in terms of natural resources, but has been the site of significant political power on the Peruvian coast since at least the early part of the first millennium AD (Moseley 1982). Beginning in the Andean highlands, the Moche River falls almost 4000 meters over its short 107 km journey to the Pacific Ocean, bringing water to the narrow desert that hugs the Andean foothills. The valley can be divided into several traditional agro-ecological zones with different productive potentials based on access to moisture, diurnal temperature change, and insolation (Pulgar Vidal 1972). The highest areas, including the *puna* and *suní* zones above 3000 m.s.l, are customarily used for tuber cultivation and the herding of camelids. Below this, in highland basins, the warmer *quechua* zone permits the cultivation of maize. As the streams of the Moche drainage drop below 2000m towards the coastal plain, they flow through narrow incised valleys known as the *yunga*, where scarce but productive land allows the cultivation of crops such as peppers, coca, and fruits. Finally, the river flows out on to the coastal plain or *chala*, where agricultural potential begins to decrease as one approaches the ocean due to poor soil drainage, salinity, and persistent maritime fog.

Cultivation of land adjacent to the Moche River and exploitation of rich cold-water fisheries formed the subsistence base for sedentary sea-side villages beginning around 2500 BC in the Cotton Preceramic period (Pozorski and Pozorski 1979a). Plant cultivation and

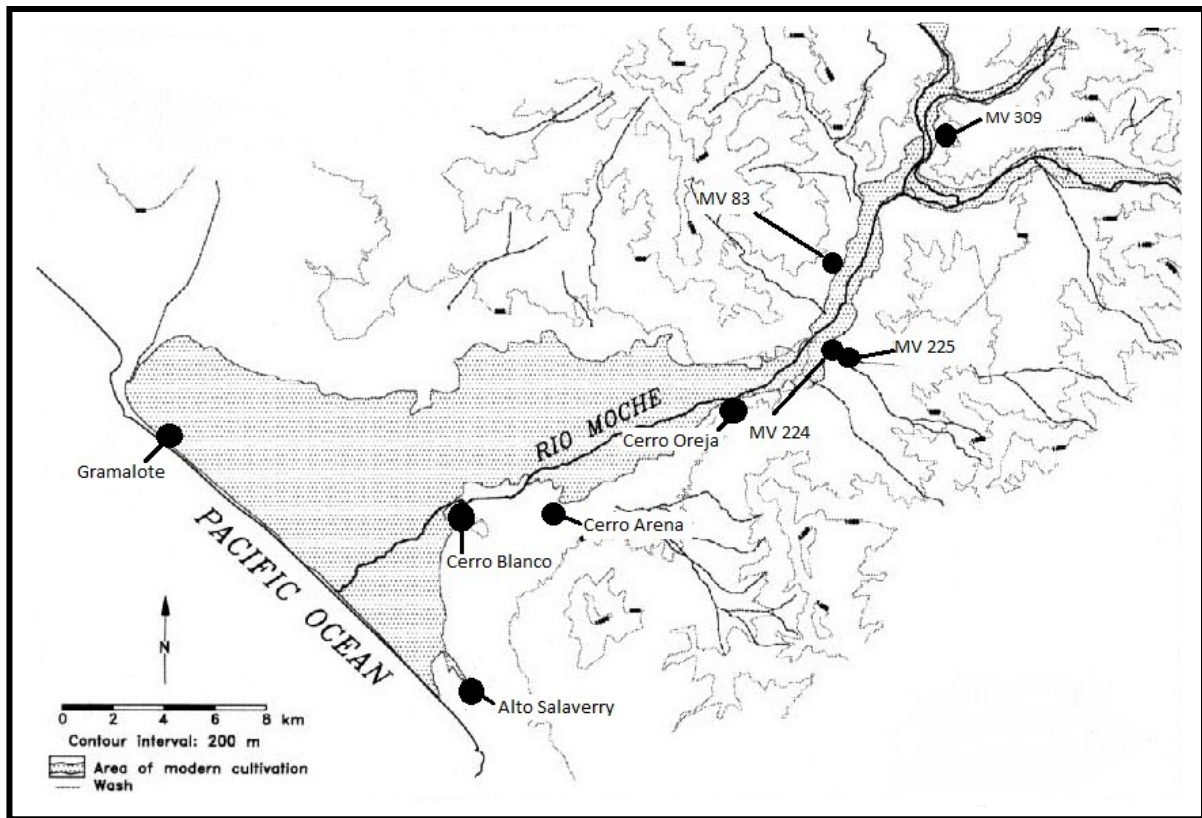


Figure 1. Map of the Moche Valley, including sites mentioned in the text. (Adapted from Billman 2002: Figure 3.)



Figure 2. Oblique View of the Middle Moche Valley. (Screen capture from Google Earth.)

resource exchange intensified during the Guañape phase (1800–400 BC), as settlement moved inland to more easily control access to irrigation canals. This new irrigation-dependent subsistence regime, along with a materialized ideology of monumental mounds and artworks, appears to have supported the first significant forms of social stratification (Billman 1996; Pozorski 1980). During the later part of this period, Guañape ideology and cultural life in the valley was influenced by the Chavín horizon, a pan-central Andean pilgrimage cult (Burger 1992; Pozorski 1980). The collapse of this ideological and economic arrangement after ~400 BC set the stage for the Early Intermediate Period (EIP), a time of social instability, change, and regionalism in the Central Andes as a whole (Topic 1982: 256).

Social Dynamics and Labor Patterns in the Early Intermediate Period

Scholars are continually refining EIP chronologies on the North Coast, but Moche Valley ceramic assemblages can generally be divided into three major phases: Salinar (~400BC–AD 0), Gallinazo (~AD 0–200), and Moche (~AD 200–800), with additional sub-phases for the Salinar and Moche phases. Some scholarship has questioned the validity of this sequence and its diagnostic ceramic styles, arguing that many Salinar and especially Gallinazo-phase vessels appear to have endured into the Moche phase (Donnan 2009; Millaire 2009; Shimada and Maguiña 1994). Since these questions await resolution through further quantitative analysis and are not directly germane to my results, this discussion will follow the traditional chronology. This framework has enabled regional settlement pattern studies in the 1970s and early 1990s, as well as excavations at several EIP centers, leading to the establishment of a basic social and historical outline for the period (Brennan 1982, Billman 1996, Chapdelaine 2001; Topic 1982, Uceda 2001).

Several critical aspects of early EIP archaeological data in the Moche Valley are the indicators of violence and the intrusion of highland ethnic groups. Both the Salinar and Gallinazo phases feature increasing levels of settlement nucleation and defensive features, culminating in the concentration of habitations at Cerro Oreja in the latter phase. Significantly, Billman (1996) recorded the presence of some 117 sites in the middle portion of the valley dominated by highland ceramic assemblages dating to the same time. In terms of paste, form, and decoration, these ceramics appear almost identical to assemblages observed in the Carabamba Plateau and Otuzco Basin areas above the Moche Valley. Globular ollas with evert rims are the most prominent utilitarian vessel type, while bichrome or polychrome ceramic bowls characterize the fineware assemblage. When found in mixed assemblages, these wares are associated with lowland/coastal Gallinazo or Moche styles, indicating an EIP date. Highland sites can also be distinguished by a masonry style that featured up-right slabs and an exterior veneer of small chinking stones, and by the presence of stone-lined cist tombs (Billman, Ringberg, and Briceno 2009). These architectural and mortuary patterns are distinct from Gallinazo and Moche-phase coastal styles.

Billman divided the highland occupation sites into three clusters, perhaps indicating small independent polities (Fig. 3). The largest of these was based at the site of Cerro León (MV 225), which is discussed in detail below. Based on the overwhelming proportions of highland ceramics, these sites were likely occupied by migrants from the Carabamba and Otuzco areas (Billman 1996: 264). This cultural tradition, designated the Highland-Early Intermediate Period (HEIP), appears to have played a major role in whatever processes led the Cerro Oreja polity to develop into the Moche phase polity, centered at the Cerro Blanco site in the lower portion of the valley.

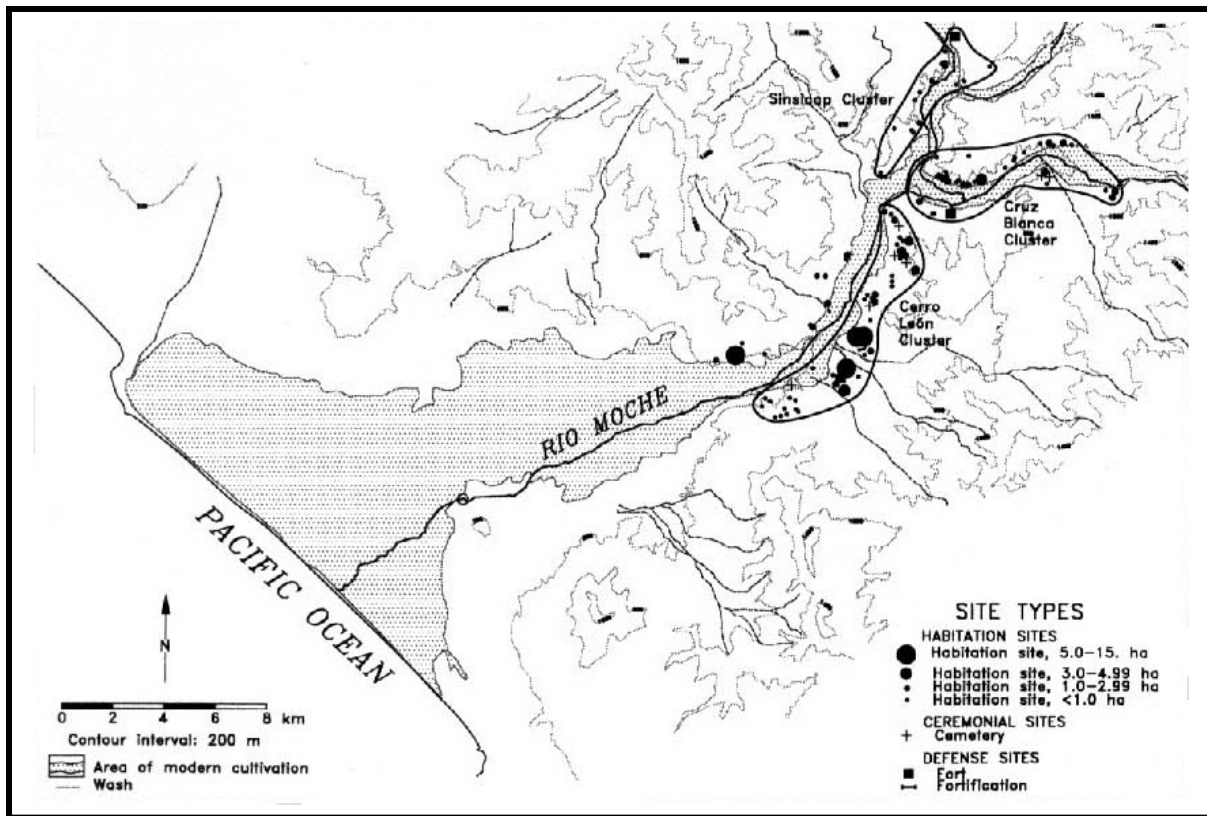


Figure 3. Highland-Early Intermediate Period settlement clusters in the middle Moche Valley. (Adapted from Billman 2002: Figure 10)

The Moche-phase societies were the most hierarchical and politically complex yet seen on the Peruvian coast, and likely had a significant impact on the domestic worlds of the general population. Through some combination of ideological diffusion and conquest, Moche material culture spread along the Peruvian North Coast, especially in the form of a distinctive elite culture that emphasized military prowess and sacrificial rites. The relationship between various Moche elites is not clear, although most researchers now believe that two or more polities existed and one of these was based at the Cerro Blanco site in the Moche Valley (Castillo and Donnan 1995). Ultimately, Moche society reorganized during the centuries between AD 700–900, leading to the Sican/Lambayeque and Chimú societies, the latter of which was conquered by Inka armies circa 1460.

A defining feature of the Moche elite was their ability to mobilize large amounts of labor for construction projects, including the creation of large monuments at sites such as Cerro Blanco, El Brujo, Pañamarca, and Pampa Grande (Franco et al. 2001; Proulx 1968; Shimada 1994; Uceda 2001). These mobilizations also included the expansion of agricultural fields and irrigation networks. In the Moche Valley, this added between 3950 and 6470 hectares of arable land, possibly allowing Moche rulers to extract resources from thousands of farming households in exchange for usufruct rights, including the resources necessary to support craft specialists and urban settlements (Billman 2002: 395).

Generally speaking, the processes that mobilized such household labor in Moche society are not well understood, although the use of a powerful political ideology by paramount Moche elites seems certain. This created a spiritual context where supporting exclusive elite roles and sacrificial rites seemed necessary and logical to the non-elites (Bawden 1995). Yet few scholars have examined the social networks and operational chains that connected these non-elite communities to their rulers. Archaeological research on Andean societies as diverse as the Mantaro Valley Wanka (D'Altroy 2001; Hastorf 2001) and the Nazca (Vaughn 2003) has emphasized the importance of intermediate elite households as links in the political economy. Such households facilitated the ideological connection between paramount elites and subject populations by hosting rituals of consumption and redistribution using goods, symbols, and practices that originated in the centers of political leadership.

It is difficult to compare these arrangements to the Moche situation because relevant household excavations have only been carried out sporadically. A growing body of research does suggest that feasts and other redistribution rituals were important political and economic

links during the Moche phase (e.g. Arsenault 1992; Swenson 2007), but it is difficult to understand how these activities may have influenced labor mobilization and daily practice at the community and household levels. Pursuing such questions requires us to trace the nature and locations of labor through the analysis of utilitarian items. As will be elaborated below, chipped-stone materials have some particular advantages in this line of research, although their study in the Moche Valley (and the North Coast in general) has been extremely limited.

Lithic Analysis in the Moche Valley

Following a traditional intellectual divide between the study of mobile foragers and sedentary food-producers (Pluciennick 2001), the only dedicated investigations of lithic assemblages on the Peruvian North Coast have pursued Paleoindian contexts (Chauchat 1988; Ossa 1978; Ossa and Moseley 1972). Generally, these assemblages feature the high quality materials, formal tools, and standardized production practices typical of mobile hunter-gatherers. As such, they bear little relation to the more informal assemblages of the later preceramic and ceramic period sedentary sites.

Various types of groundstone weights and food-processing tools are reported from the early coastal sites of Alto Salaverry and Gramolote (Pozorski and Pozorski 1979a, b), but they have received little analytic attention. Tools from the Gramolote assemblage were more than 80% fine-grained basalt, and the authors reported such categories as chopping tools, unifacial and bifacial cutting tools, denticulates, and cores (Pozorski and Pozorski 1979b: 417). At the major Salinar settlement of Cerro Arena, Brennan recorded ground and chipped stone industries, the latter mostly based on white quartzite available in the area immediately around the site. Besides two projectile points, the types of stone tools present are not mentioned, although they seem to be informal retouched flakes and cobbles. Hoes were

apparently not present (1978: 680–682). No lithics from Gallinazo phase sites have been analyzed, but very basic description are available from the Moche phase Cerro Blanco site, where excavations also yielded retouched stone and cobble artifacts (Tello et al. 2008: 126). No mention has been made of formal stemmed tools, such as chipped hoes or points, and I have not personally observed any in this site’s extensive surface scatters. Raw materials seem to have been predominantly fluvial cobbles from the nearby Moche River.

In short, ceramic period lithic assemblages from the Moche Valley are characterized by the production of expedient and non-standardized tools from locally available materials. This pattern is generally consistent with the shift to sedentary society worldwide (Andrefsky 2005: 227), and hampers the study of stylistic change or long-distance trade of materials, but the potential still exists for patterning in material sources and basic tool types. For example, Thompson (2002) documents the absence of chipped stone hoes at the major Moche center of Huaca El Brujo in the adjacent Chicama Valley and contrasts this with the presence of hoes at the Moche sites of Santa-Rose Quirihuac and Ciudad de Dios. Although her study does not present sufficient data to incorporate in my analysis, it does suggest patterns in household labor similar to those I am exploring. Her data also provide an important contrast between households at Moche ceremonial centers and those of the rural countryside.

Background on the Archaeological Sites Investigated

This section contextualizes the analysis of EIP labor patterns by providing basic information on the sites from which lithic data were obtained. I include background on their inhabitants’ status, economic practices, and social relationships. As analysis of excavation data is ongoing or incomplete in each case, my intention is to provide a preliminary and area-specific framework for understanding household exchange and labor.

All contexts used in this analysis were excavated by the Moche Origins Project, using consistent excavation procedures. In general, every attempt was made at each site to excavate in natural or culturally meaningful units (Briceño and Billman 2007: 32). Excavation units were placed so as to incorporate distinctions in architecture and deposits as visible from the surface, rather than to impose an arbitrary grid. Features such as rooms and hearths were excavated in bisects or quarter-sections to ensure the maximum recovery of material in stratigraphic context. Each deposit, such as an excavation level, surface collection, or back-dirt from a looters pit, was assigned a Provenience Designation number, with associated information such as structure number, context type (e.g. construction fill), and integrity. In

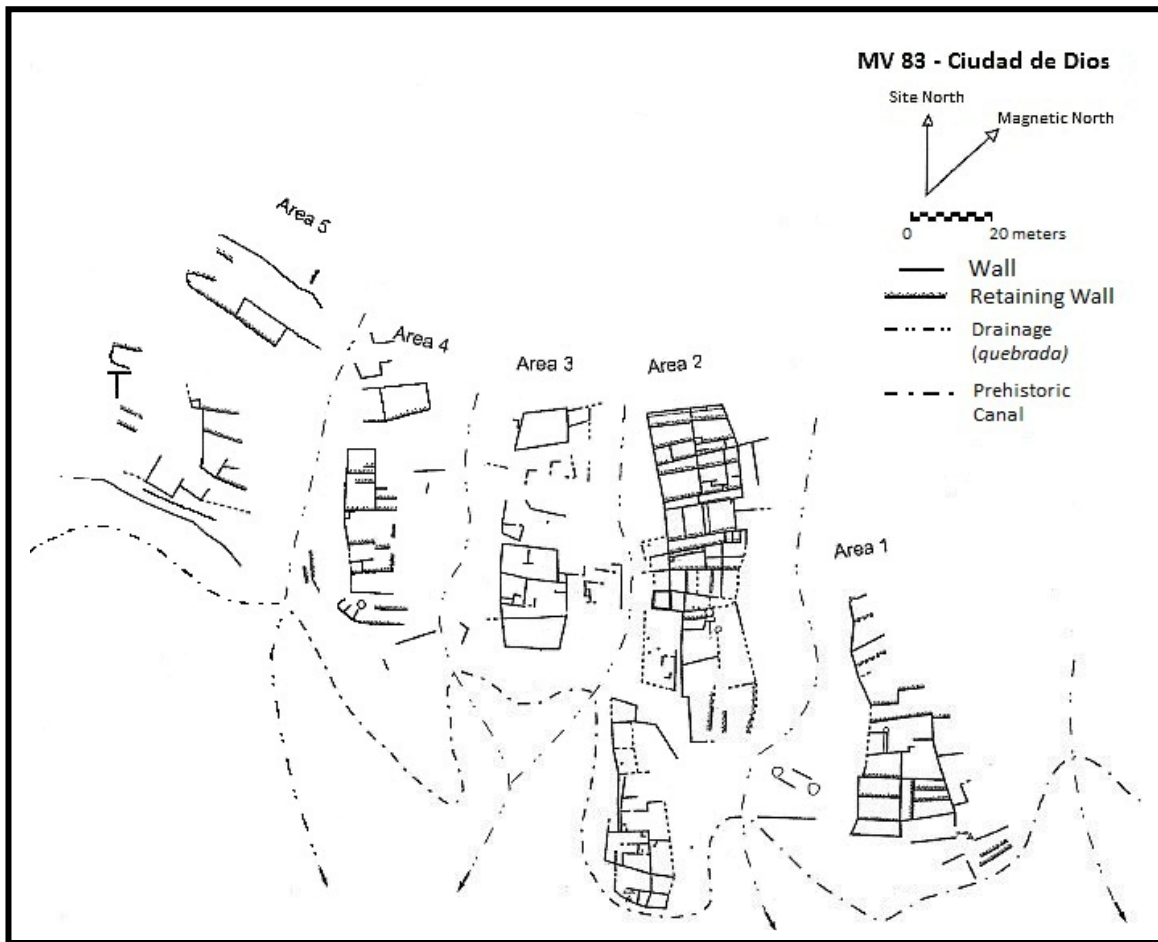


Figure 4. Planview of architecture at MV 83 – Ciudad de Dios.

almost all cases, excavated soil from each provenience was screened using 1/8-inch mesh and 100% of materials were collected

MV 83 – Ciudad de Dios

Ciudad de Dios (MV 83) is located in the Middle Moche valley, directly above the modern village of Ciudad de Dios. The site consists of five ridges designated Areas 1 – 5 and was first recorded in the late 1970s by John and Theresa Topic (Fig. 4). During his survey of the middle valley, Billman dated the site to the Middle Moche phase and mapped visible architecture. Excavations were conducted here for several seasons in the late 1990s and early 2000s (Billman et al. 2000, 2002) The data used in this study come mainly from deposits excavated in Areas 3 and 4 in 1999, with some material from the 1998 season incorporated.

Each ridge or site area at Ciudad de Dios consists of a series of residences. Those located on Area 2 are some of the largest known Moche phase habitations in the valley and may represent the homes of the paramount elites of the middle valley area (Billman 1996; Billman et al. 2000, 2002). Intermediate sized architecture was observed in Area 3, while Areas 1, 4, and 5 contained yet smaller and less elaborate structures. These areas appear to have housed retainers and craft specialists, including metal-workers and *chicha* brewers (Billman et al. 2000, 2002). Overall, there is substantial evidence that the residents of Ciudad de Dios were relatively wealthy and enjoyed a high social status. This includes the high quantities of fine-ware serving vessels and metal objects recovered here, and the comparatively low quantities recovered at the Early Moche site of Santa-Rosa Quirihuac (Gumerman and Briceño 2003: 235).

Residents of Ciudad de Dios also consumed or processed far more maize than those at Santa Rosa-Quirihuac, less beans, and utilized many more neckless jars (Mehaffy 1998;

Ryser 1998; Tate 1998). The association between this vessel form and *chicha* production has been documented elsewhere on the Peruvian coast (Moore 1989), and may indicate that Ciudad de Dios households were increasingly involved in mobilizing work parties through the redistribution of *chicha*, coca, and other consumables. Daily rituals, including those using ceramic figurines, would have been significant to this ‘home’-centered form of domestic labor (Ringberg 2008). Based on skeletal evidence from cemeteries at Cerro Oreja, Gagnon suggests males gained increasing access to such goods throughout the EIP, due to their

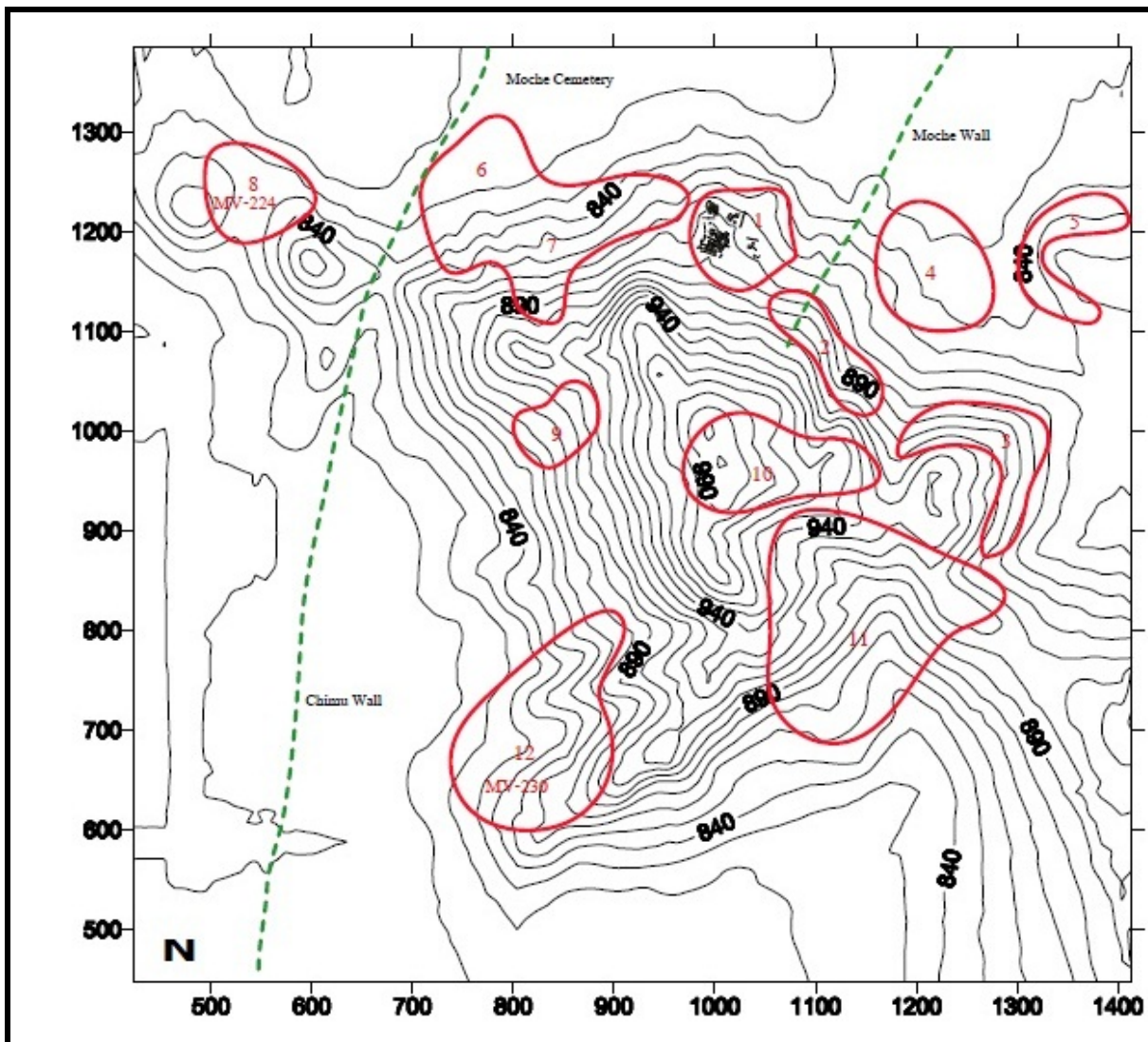


Figure 5. Cerro León Archaeological Complex. Unless other indicated, areas are part of MV 225. Drawing by Jennifer Ringberg.

participation in state or elite-sponsored work parties, suggesting a model for elite domestic economy in Moche society (Gagnon 2008: 180). By sponsoring such parties and other redistributive institutions, the residents of Ciudad de Dios could have functioned as an intermediate node in the Moche era administrative network, providing a connection between the rural populations of the middle valley and the paramount elites at Cerro Blanco (Billman 2010).

MV 224 – West Cerro León

West Cerro León (MV 224) was first recorded by Billman during a surface survey of the middle valley, and is one of two fortified settlements dating to the Gallinazo phase (1996: 244– 245). The site features some 25 to 50 residential compounds spread over a 1.1 ha along a hill slope between two large *quebradas* or dry drainages (Fig. 5). A substantial wall, ~1m thick and between 1.5 and 2 m high runs along the northern base of the hill. Based on artifact concentration in the construction and terrace fill, initial occupations may have been located at this base, and then moved farther up the slope (Billman 2009: personal communication).

Billman also recorded a Moche phase occupation, although the extent and duration of this is unknown (Billman 1996: 304). Excavations yielded relatively high quantities of Castillo Incised and Modeled sherds, diagnostic of the Gallinazo phase, while Moche painted sherds were rare or absent, indicating a principally Gallinazo occupation.

One of the major research questions at West Cerro León is whether its residents had hostile or cooperative relations with nearby highland-occupation communities. The fortifications suggest the inhabitants had a major interest in defense, although this does not directly indicate violence occurred. All interpretations of West Cerro León are very preliminary, as it is the least thoroughly studied site in the sample. Besides the initial survey,

and some subsequent mapping of visible walls (Fariss 2008), only one season of excavation has been carried out here in July 2009. The site habitations have been subject to heavy colluvial erosion and looting, resulting in many mixed deposits and some difficulty in associating deposits with particular structures and their corresponding social/domestic groups. At this time, the relative social and economic status of its inhabitants is unclear, as is the size of their dwellings.

MV 225 – Cerro León

Cerro León (MV 225) was first recorded by Billman in the early 1990s, and was the focus of six seasons of excavation and mapping from 2002–08 by UNC-MOCHE field school students and staff. Architecture at the site covers some 8.64 ha on a hill immediately east of West Cerro León, and has been divided into ten areas (Fig. 5). These site areas feature various levels of defensibility and labor investment, with the greatest levels of both present at

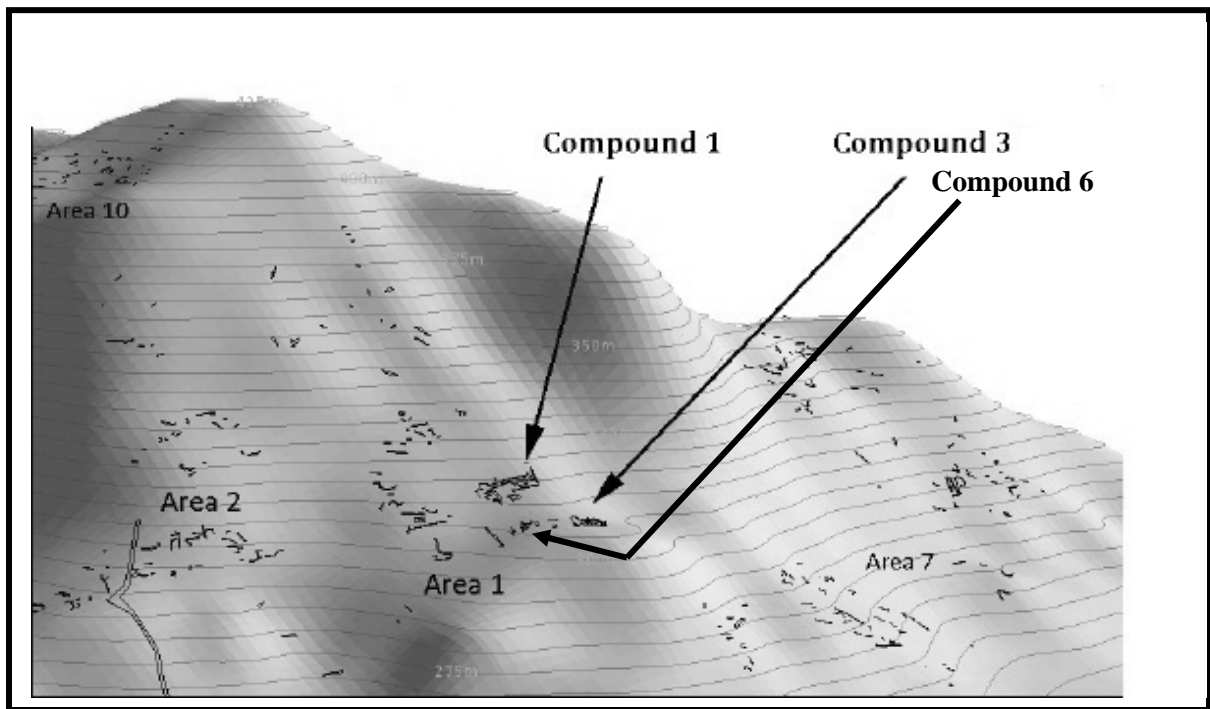


Figure 6. Area 1 at Cerro León, with excavated compounds marked. Based on Farris 2008: Figure 8.

Area 1 (Fariss 2008). The bulk of excavations on site have focused on three domestic compounds in this area, designated Compounds 1, 3, and 6 (Fig. 6). Compound 1 represents the largest known residence dating to the highland occupation of the middle valley, and may have been the home of the paramount elite of the largest polity of highland colonists. The other two compounds represent an intermediate class of residential architecture.

The residents of Cerro León seem to have established exchange networks with coastal communities, based on the presence of shell and bony fish remains. In addition, the high quantities of highland ceramics, apparently manufactured either in the highlands or using highland tempering agents, suggest networks regularly moved goods from the upper valley area (Ringberg 2009). Agricultural production and food processing were key aspects of domestic economies at Cerro León. Household members also participated in relatively small-

Table 1. Summary of Background Information for Research Sites.				
<i>Name</i>	<i>Site Number</i>	<i>Phase (approximate date)</i>	<i>Research Activity</i>	<i>Socio-economic and Political Context</i>
West Cerro León	MV 224	Gallinazo (AD 1 – 200)	Excavation and laboratory analysis in 2009	Results are preliminary, but fortifications indicate concern with defense. Relative socio-economic status of residents unclear.
Cerro León	MV 225	Highland-Early Intermediate Period (~AD 100 – 300)	Excavation and laboratory analysis from 2002–2008. Additional mapping and ceramic analysis by Fariss (2008) and Ringberg (e.g. 2009).	Large amounts of structures with concentration of elaborate residential architecture in Area 1. Artifactual data, including marine fish bones and ceramics, suggest exchange linkages with highland areas.
Ciudad de Dios	MV 83	Middle Moche (AD 400 – 600)	Excavation and laboratory analysis from 1998–2002. Previous research in 1997, including thesis work by Campbell (1998), Mehaffy (1998), Ryser (1998), Tate (1998), and Thompson (2002).	Five areas with residential architecture. Area 2 likely high-status residences, with intermediate architecture at Area 3 and still less elaborate architecture in Areas 1, 4 and 5. Various architectural, ceramic and botanical data suggest Ciudad de Dios enjoyed a relatively high status position in the middle valley.

scale production of metal fish hooks, ornaments, and stone beads. This is evidenced by the presence of metal-working tools, preforms, and pieces of ceramic crucibles (Briceño and Billman 2007: 77–78).

Summary

Overall, the investigation of Moche-period socioeconomic forms, and how they contrasted with Gallinazo and Salinar antecedents, is both promising and preliminary. Questions of how labor was mobilized in Moche society in order to generate and manage surpluses remain unresolved, although the excavation of households holds great promise in pursuing this issue. While the household assemblages analyzed in this study come from key sites in the middle Moche Valley, the social networks they were part of varied in important ways, with significant implications for their respective domestic economies.

CHAPTER 3:

CONCEPTS AND RESEARCH STRATEGIES

To address issues of labor mobilization, we need a conceptual framework that encapsulates both the social relationship involved and the ways these would affect material culture. This section provides such structure by introducing the basics of stone tool reduction, and describing how this can be understood as a strategy for dealing with the constraints and opportunities of the natural and social worlds. Any strategy of tool production and use must contend with the confines of the natural world, such as raw material distribution. However, I am interested in showing that stone tool assemblages are also the result of social relationships, such as obligations (or opportunities) to intensify production beyond the subsistence demands of households or communities.

Such intensification can be conceptualized as surplus labor, in which such groups produce in order to negotiate social relationships beyond their own membership. For example, ethnographers have frequently documented agricultural intensification by smallholders in response to market demands (Netting 1993: 288–294). Stone-tool users in the ancient Andes may not have exchanged goods in a market context, but many were certainly involved in relationships of labor mobilization. As detailed below, an important axis of variability in such social relationships is power and status and involves the difference between hierarchical and heterarchical methods of labor organization.

Understanding Stone Tool Reduction

Chipped stone tools have long been recognized by archaeologists as an important and informative line of evidence. Since chipped stone implements are formed by the removal of pieces, or flakes, from a larger core, the production and maintenance of stone tools leaves durable traces across the landscape, from the initial procurement of raw material to the final discard of a tool. In contrast to additive technologies such as ceramic or metal, every step of chipped stone formation may leave residues for the archaeologist to recover, allowing the potential reconstruction of an object's entire life history.

Such reconstructions are based on the analytical concept of the reduction sequence. In essence, this is an idealized model of stone tool production, maintenance, and discard, conceived of as a series of processes and decisions made by those who produced and used the implements. It is a temporal and technological trajectory that actors most likely followed when employing these objects. It provides a framework for classifying objects as representative of particular stages of an organized system with implications for human behavior. For example, stone flakes removed from a core during earlier stages of the trajectory tend to be larger than those produced later in the reduction sequence. If a corresponding difference in flake size tendencies is observed between two archaeological sites, it may indicate that the earlier and later stages occurred in separate contexts.

These reduction models are most meaningful when data are available for analogous experimental sets that replicate the manufacturing techniques and tools observed or inferred in archaeological contexts. Since these experimental analogues do not exist for every archaeological assemblage, many investigators reason through uniformitarian principles based on mechanics, assuming that all knappers pursue basically similar technical goals

through similar means (e.g. Ford and Olson 1989). Although a generally supportable assertion, any analyst must recognize that variations can arise, including differences in the nature of the raw materials, the form of the desired end products, and the skill of the knappers.

Technological Organization: Linking Reduction to Social Behavior

The reduction sequence model can thus act as a bridging theory, allowing an analyst to link archaeological datasets to a variety of questions about the factors that shape the sequence. For example, the quality and location of raw materials, the requirements of particular tasks, or a well-positioned actor's ability to mobilize unique forms of labor can all influence how stone is shaped, where, and by whom it is done. One body of theory geared towards understanding these issues is called technological organization (TO) studies, a framework for understanding tool production and use as a strategy (Nelson 1991:57). This perspective views lithic reduction sequences as a form of problem-solving and attempts to model the least-effort solution to constraints such as distance and the availability of time and materials (Nelson 1991:61). This approach can give equal attention to the necessities and contingencies of both natural resources and human histories, but technological organization studies have historically been dominated by scholars with an eco-functionalist interest in how tool producers adapted to their physical environments (Cobb 2000: 80).

Although these rationalist approaches are often highly illuminating, I intend to highlight the social dynamics that influence reduction sequences. My goal is to show that the examination of lithic evidence can draw attention to social dynamics. Here, I follow the work of Charles Cobb, who stresses the critical role of stone tools in many ancient economies and argues that lithic analysis has the potential “to evaluate how surplus labor may be mobilized

under different historical circumstances and under different historical constraints” (Cobb 2000:83). Therefore, the organization of lithic technology can be seen as directly related to the organization of labor, and lithic analysis can be seen as a tool for studying power dynamics by those who control both the production of stone tools and the contexts of their use. Furthermore, the ‘strategy’ of a reductive sequence is a conceptual tool with its own history, or a form of cultural habitus that structures a laborer’s decision-making process. Such issues of historical contingency and agency are emphasized in *chaîne d’opératoire* approaches to tool manufacture and use (Creswell 1983; Lemonnier 1992; Leroi-Gourhan 1945). Thus, the specific reduction sequence utilized in any one situation should be seen as the combined consequence of cultural tradition, social structure, and cost-benefit calculation.

A technological organization perspective can be applied to understanding the manufacture of stone tools in production situations, and their use, maintenance, and discard in consumption situations. A brief example from the Maya Lowlands using data from producer and consumer sites in the Colha chert interaction networks should clarify how this is possible (McAnany 1986, 1989, 1992; Shafer and Hester 1991). The Colha quarry was intensely used from the Middle Preclassic through the Late Postclassic period, providing raw material for tools and ceremonial items to a wide region of Belize, northeastern Guatemala, and parts of Yucatan Mexico. The settlement at this quarry is one of the best examples of lithic craft specialization in the Americas (Shafer and Hester 1991: 81). Analysts working with its lithic assemblage were able to identify specialized production based on various lines of evidence, including the level of standardization in artifact form, the presence of production failures, and the volume of debitage recovered. These data also speak to the changing socioeconomic circumstances of the site, as the type of artifacts and the intensity of their

production shifts with the broader demands of exchange network in the Maya world. For example, the production of hoes, adzes, and axes (oval bifaces and tranchet-bit tools in technical nomenclature) grows with rising populations during the Late Preclassic and Classic periods, apparently to meet the demands of agricultural intensification

A consumer context is provided at the communities around Pulltrouser Swamp, where McAnany documents the use of Colha chert bifaces by Maya farmers (McAnany 1986, 1989, 1992). She is able to demonstrate how strategies of tool maintenance and discard respond to the changing conditions of agricultural production, and the availability of tools through exchange networks. For example, tool maintenance, or ‘curation’ increases as Colha chert bifaces becomes less available, with greater frequencies of resharpening flakes and smaller bifaces over time. McAnany also demonstrates how agricultural intensification is correlated with increased redundancy of tasks, with a corresponding decrease in the heterogeneity of tool form and wear patterns (McAnany 1986). Finally, she correlates an increased use of near-residence agricultural land with changes in the distribution of stone hoe fragments and maintenance debris (McAnany 1992: 211).

These cases should suffice to demonstrate how strategies for tool reduction can be related to human social relationships, such as that between specialist producers and consumers. Given that stone tools are both social products and a means of production, they are well suited to speak to relationships that mobilize labor. The next section provides a conceptual background for understanding how variety in the means of labor mobilization can be understood.

Labor and Lithic Technological Organization

One of the principal arguments of this thesis is that stone tools and their production debris reflect different forms of labor mobilization. Through lithic analysis, archaeologists can study the socioeconomic organization and structure of ancient societies. In demonstrating this, I focus in particular on variability in labor mobilization due to power and control, conceptualizing this along a continuum from heterarchical to hierarchical forms. I should stress that this is intended as heuristic distinction that succinctly emphasizes the status relationships at work when people are mobilized to produce surpluses. Rather than providing essentialized categories of social forms, such a continuum highlights variability in power and control. In addition, such variability is but one of many factors that structure political economy.

In more hierarchical forms of labor mobilization, an empowered political or economic elite extracts surplus from a subordinate population with promises of reward and threats of punishment (Earle 1997; Haas 1982). Such elites are broadly perceived as having established rights over the time and labor of lower ranked social groups. In a classic example, the Inka state, embodied by royal lineages and their administrators, forced a *corvée* labor tax upon the peasant populations of their empire. The farming households subject to this tax were required, among other things, to work additional fields to provide food for state warehouses (D'Altroy 2003). The impetus to generate surplus thus comes 'from above', in the sense that an overarching elite coerces, subsidizes, or otherwise manipulates laborers to produce more. This can be contrasted with relatively heterarchical mobilization, where the producers of a surplus and its consumers are unranked, or minimally so, relative to each other (cf. Crumley 1995). In these situations, the impetus to produce a surplus is based more on shared costs and

benefits, as in balanced or negative reciprocity. This distinction can perhaps be better understood by considering how they might apply to the manufacture and use of stone tools.

Mobilizing Flintknapper Labor: Production Issues

What might spur stone tool makers, or flintknappers, to produce surplus implements for distribution? In various situations, archaeologists have offered answers that can be considered both hierarchical and heterarchical. Arguments for hierarchical structures in the Americas have come from Mesoamerican research, where extensive trade networks moved obsidian and chert over long distances, and regions such as the lowland Gulf coast where populations apparently relied on trade to obtain the implements necessary to their daily lives. Jonathan Haas (1982) has argued that control of stone sources was a critical power base for the leadership of early Olmec society, but it is unclear whether these elites were responsible for directly mobilizing flintknappers to produce excess tools, or simply controlled their distribution. Scholars have also argued that the Teotihuacán state controlled obsidian distribution networks. While specialists worked independently in workshops away from central elite observation, both raw materials and finished products are interpreted as moving through state economic channels. On the whole, the industry is seen as administered by a hierarchical political structure with the main benefits going to the state (Spence 1981: 785).

However, researchers have increasingly come to favor interpretations involving more heterarchical approaches to the production of stone tools by specialized knappers. In this respect, ethnographic research by Burton (1984, 1989) in Papua New Guinea has been influential in demonstrating how stone tool producers can supply large consumer populations without the intervening mechanism of either markets or political elites. In this case, producers are encouraged to produce surplus ground axes to use in personalized prestige and bridewealth relationships with close neighbors, placing the axes in exchange networks that

ultimately move them great distances from their sources (Burton 1989: 258). Shafer and Hester (1991: 94) suggest similar incentives prompted the Colha producers to begin surplus production in the Middle Preclassic (600–300 BC), but production and especially distribution became more hierarchically controlled as political centralization increased in the Late Preclassic to Classic Maya eras. This argument is based largely on changing patterns of Maya settlement hierarchy in north-central Belize and the emergence of other large chert producing centers.

Heterarchical arguments have also been made for Mississippian tool production in the chiefly polities of Cahokia (Cobb 2000) and Moundville (Wilson 2001). In the former case, knappers of Mill Creek chert bifaces had little or no direct relationship with the elites of Cahokia, despite the fact their products were intensely used throughout the Cahokian cultural sphere. The bifaces were instead distributed from the Mill Creek locale through ‘down-the-line’ exchange, although elites may have controlled distribution at certain key nodes (Cobb 2000: 199). Hoe producers in the Mill Creek area were driven to surplus production in order to acquire socially necessary objects through exchange networks (Cobb 2000: 205).

The Moundville case seems to offer a comparable scenario. There is little evidence at the site that producers of greenstone celts were generating surpluses at the direct behest of Moundville’s elite. Although greenstone display items may have been produced by ‘attached’ craft specialists, the utilitarian celts were widely available in the broader region around Moundville and knappers may have procured blanks for general circulation to consumer households (Wilson 2001). Similar heterarchical organizations seem to have characterized the distribution of chert blades in Peru’s Mantaro Valley (Russell 1988) and obsidian procurement and distribution in the south-central Andes (Tripcevich 2007).

This review is far from comprehensive, but it should be sufficient to demonstrate that surplus tools can be generated through heterarchical labor mobilization. Of course, the relationship between this form and hierarchical mobilization is neither simple nor likely to be static in any situation. While the political control of ancient production was often geared more to *restricting* the access of consuming populations to high-status display goods (Clark 2003: 131), controlling places of distribution such as marketplaces or roads could provide benefits as well. Cobb argues that, once outside the Mill Creek locale, chert bifaces were often stockpiled and redistributed by high-status households as part of their political economic strategies (Cobb 2000: 199). Therefore, it is important to note that both hierarchical and heterarchical elements could have been present in the networks that moved stone tools from the quarry to the archaeological midden, even if producers often mobilized and controlled their own labor.

Mobilizing Domestic and Agricultural Labor: Consumption Issues

The ‘use’ end of lithic reduction sequences has perhaps received less attention in the archaeology of complex societies. I contend, however, that this aspect of the artifacts can speak equally well to labor patterns. Stone tools are, after all, a means of production as well as products themselves, and changes in their use and maintenance may be related to changes in the socioeconomic relationships of users. Again, both hierarchical and heterarchical organizations can be the driving factor in these circumstances.

A straightforward example of hierarchical labor mobilization is provided by Glenn Russell’s work in the Mantaro Valley (Russell 1988). His lithic analysis documents a significant increase in stone hoe discard after the area was conquered by the Inka Empire in the 15th century, bridging the transitions between the Wanka II and Wanka III phases (1988:

248–250). Russell argues that this is due to Inka demands on domestic production in the valley, with increased obligations to fulfill *corveé* labor requirements and intensify maize production (1988: 263). In this particular case, a reconnaissance of cultivated fields around the sites yielded no evidence of hoes. Site elevation and issues such as violence and warfare appear not to have affected discard, meaning that people generally discarded tools in the same places through time. Russell thus concludes that changes in discard rates must have been due to real differences in tool use and not the location of their discard and maintenance (1988: 253).

Data on stone tool use and function can also be applied to the study of heterarchical labor mobilization, where tool users are incited to generate surpluses for the purposes of exchange. In doing so, they increase their consumption of certain kinds of stone tools. For example, some producers of shell and stone beads may produce surplus items for exchange, increasing their use of flaked stone drills in the process. Russell argues for a similar process when he observes increases in scraper and drill discard rates in Wanka III elite residences. He suggests this may be due to elite households' growing involvement in the production of basic items such as wooden tools, in response to demand from nearby households and communities. Therefore, the impetus for surplus production (and increased tool discard) seems to have come through local exchange networks (Russell 1988: 321).

In sum, a consideration of reduction sequences as strategies allows us to view lithic assemblages as the result of multiple factors, including the social relationships in which producers are involved. A great deal of ink has been spilled on the problems of specialization, labor, and their relationship to political economy. My hierarchical–heterarchical dichotomy both sidesteps and oversimplifies many issues. My main goal is to

offer a heuristic framework that can encompass the multiple reasons pre-industrial producers may have for generating a surplus, while highlighting that authoritative political relationships are not necessary for engendering complex labor relationships.

CHAPTER 4:

LITHIC DATASET AND ANALYSIS PROCEDURES

Having described the interpretive background for both the social environment of the EIP Moche Valley and some of the mechanisms which mobilize actors to generate surplus, we can now attempt to bring a lithic dataset to bear on questions of household labor and exchange in the middle valley area. The method used here is relatively basic in lithic analysis, but fundamental in its outline of categories and quantities. It should be seen as a stepping stone for further empirical work, including more precise typologies and studies of tool function. Before presenting key results of this analysis, I provide a basic introduction to the dataset itself, including raw materials used to manufacture tools, types of artifacts identified during analysis, and the archaeological contexts of these materials. I will also lay out some of the basic assumptions and limitations inherent in the data.

This dataset represents a sample of the chipped stone recovered from residential contexts at MV 83, West Cerro León, and Cerro León. After excavation and washing, all bags of lithic artifacts were sorted. During the 2007-2009 field seasons, I personally sorted 56% of the artifacts used in this study, although the remainder was sorted by 10 other workers over previous years (see below). The sort involved discarding non-artifacts, classifying specimens according to tool type and material type, and counting, weighing, and describing whether an artifact was broken or whole. I also subjected a small sample of debitage and tools to detailed analysis, including size and angle measurements, descriptions of flaking patterns, and descriptions of macro-usewear such as polish and striations. This

detailed analysis also sub-divided debitage into production and resharpening flakes based on the presence or absence of polish on each flake's striking platform. This sample only included specimens from West Cerro León and Compound 6 at Cerro León.

All lithic quantities are presented per unit weight of ceramic recovered from the same context. This standardization allows for some control of confounding factors such as the duration of structure occupation, the overall intensity of artifact discard, and the variable size of collection units. Ideally, this would involve standardizing by vessel types within which discard rates are most likely to remain constant, e.g., cooking vessels. However, as analysis of the ceramic assemblages is ongoing, and such functional categories are not yet available, the more coarse-grained use of total ceramic weight is used in this study. As an additional note, associated ceramic weights were not available for all the sorted lithic artifacts from Ciudad de Dios. This is notable because the smaller standardized sample does not contain the same range of artifact types as the general lithic sample. I note below the instances where this appears to have an effect on artifact counts.

Material Types

At all three sites under analysis, the materials recovered can be grouped into the same three categories for overview purposes: 1) primary tool materials; 2) secondary materials; and 3) trace materials:

Primary Tool Materials. At each site, almost all chipped stone tools were formed from a few varieties of fine-grained igneous rocks (FIG), sedimentary mudstone, and quartzite. The igneous rocks were predominantly basalts or andesite that varied in fineness but were generally very hard. In contrast, the mudstone was a relatively soft and brittle material. As microcrystalline materials, none of these rock types are of especially high quality relative to

the cryptocrystalline or amorphous rocks preferred by stone tool producers. Most tools feature many step and hinge scars, a generally undesirable result for flintknappers.

Secondary Materials. This category includes chert and crystalline quartz. Debitage from both these materials were ubiquitous in some cases, but tools were exceedingly rare.

Crystalline quartz pieces were common at both West Cerro León and Cerro León, but evidence of human modification was not always clear, and the materials appear to outcrop naturally on Cerro León. Interestingly, the only crystalline quartz ‘tool’ yet recovered is a projectile point in association with an residential burial in Compound 1. The presence and use of quartz is especially interesting to note in light of ethnohistorical references to the importance of translucent stone and crystals in traditional Andean ritual (Giesse 2000: 51–56). However, because of the difficulties in separating flaked quartz from natural occurrences, and the dearth of clear ‘non-debris’ categories for this material type, data are not yet available to assess the role of quartz in middle valley households.

Trace Materials. This includes only materials for which very small amounts were recovered, such as chalcedony.

Raw Material Sources. At least three different geological sources of material within the Moche Valley are known, including: (1) the cobble bed of the Moche River, geologically part of the Sechin Alloformation (Wells and Noller 1999); (2) an igneous rock quarry (MV 309) on the terraces of a dry tributary of the Sinsicap River, part of the Colorado Alloformation; and (3) the Chicama Formation, a bed of sedimentary rock that outcrops in various places in the middle and upper valley, including the dry *quebradas* northeast of Cerro León (Cossío and Jaén 1967: 28). In addition, nodules of crystalline quartz appear to be found throughout

the middle valley, with a major concentration located on the south side of Cerro León. Most material therefore could be procured within 10 km of all three sites, although cherts and chalcedonies do not appear to be located within this range and must have been obtained through longer-distance exchange.

Artifact Types

Artifacts in this assemblage were classified on the basis of shape or morphology rather than function, although some functional considerations are indicated in the names given to various categories. The types of artifacts recovered are broadly similar between all three sites, and include various kinds of both chipped and ground stone, although the main focus here will be on the former. From the perspective of artifact shape, the most diverse category is expedient tools, including cores, core tools, and retouched or utilized flakes (Fig. 7). This represents the simplest technology used in the middle valley, and apparently was based on the exploitation of igneous rock cobbles and mudstone nodules to form tools for cutting, scraping, pounding, and chopping tasks.

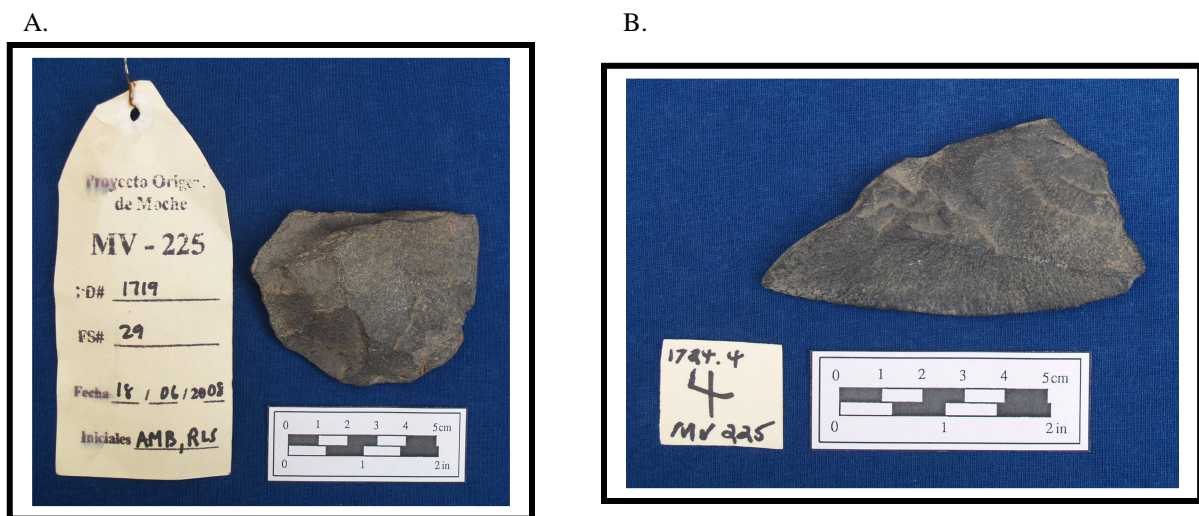


Figure 7. Expedient Igneous Rock Tools from Cerro León. (a) Core Tool; (b) Utilized Flake.

Somewhat more standardized were the bifacial tools, which including general bifaces and chipped hoes, distinguished by the presence of two clearly flaked sides on the tools. As opposed to the non-stemmed general bifaces, hoes were stemmed and apparently hafted to handles (Figs. 8–10). Although they are superficially the most formal lithic artifact in the assemblage, bifaces are still a heterogeneous group and seem to be the product of a variety of reductive strategies, rather than the formalized stages which often characterize

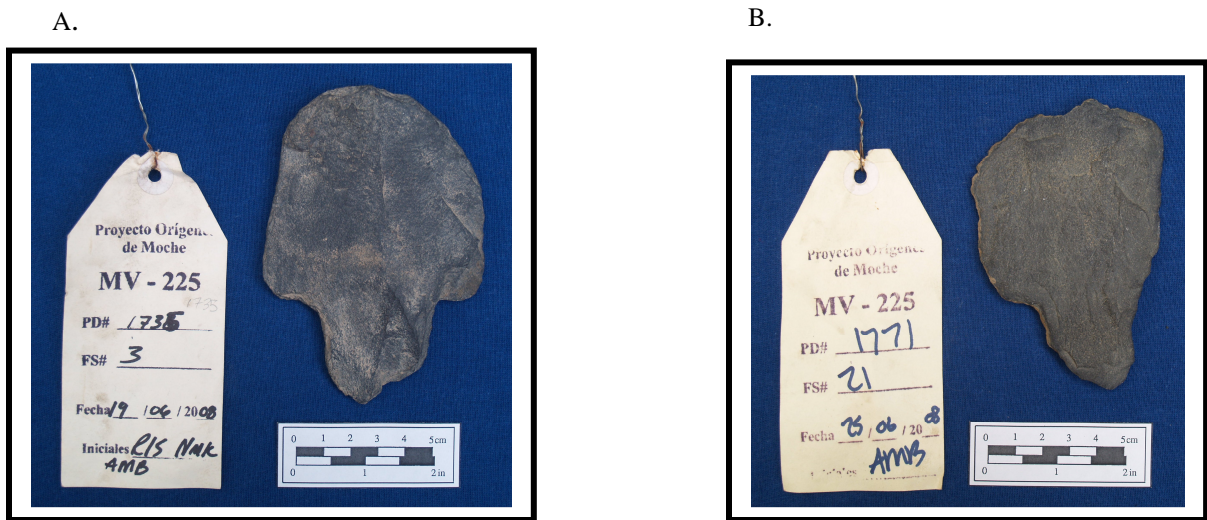


Figure 8. Fine Grained Igneous Hoes from Cerro León.

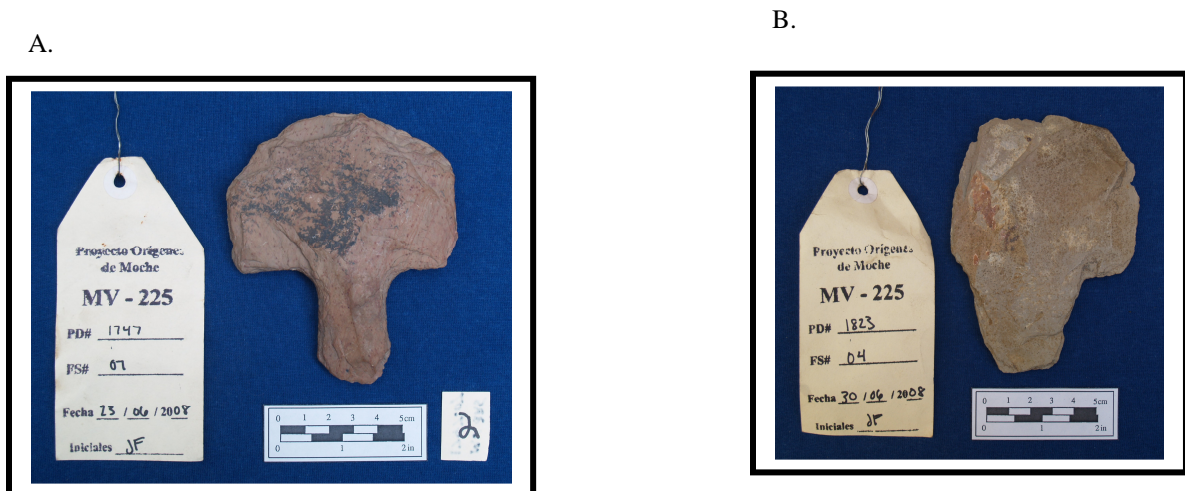


Figure 9. Mudstone Hoes from Cerro León. Note the contrast in formality between (A) and (B).

tool production in situations of curation or mass production. Therefore, they are probably best thought of as what Odell calls “non-reduction bifaces”, or artifacts that are bifacially chipped but do not pass through consistent stages. (Odell 2003: 109). It may therefore be difficult to associate particular types of debitage with hoe reduction stages, but more replication work is needed to confirm this.

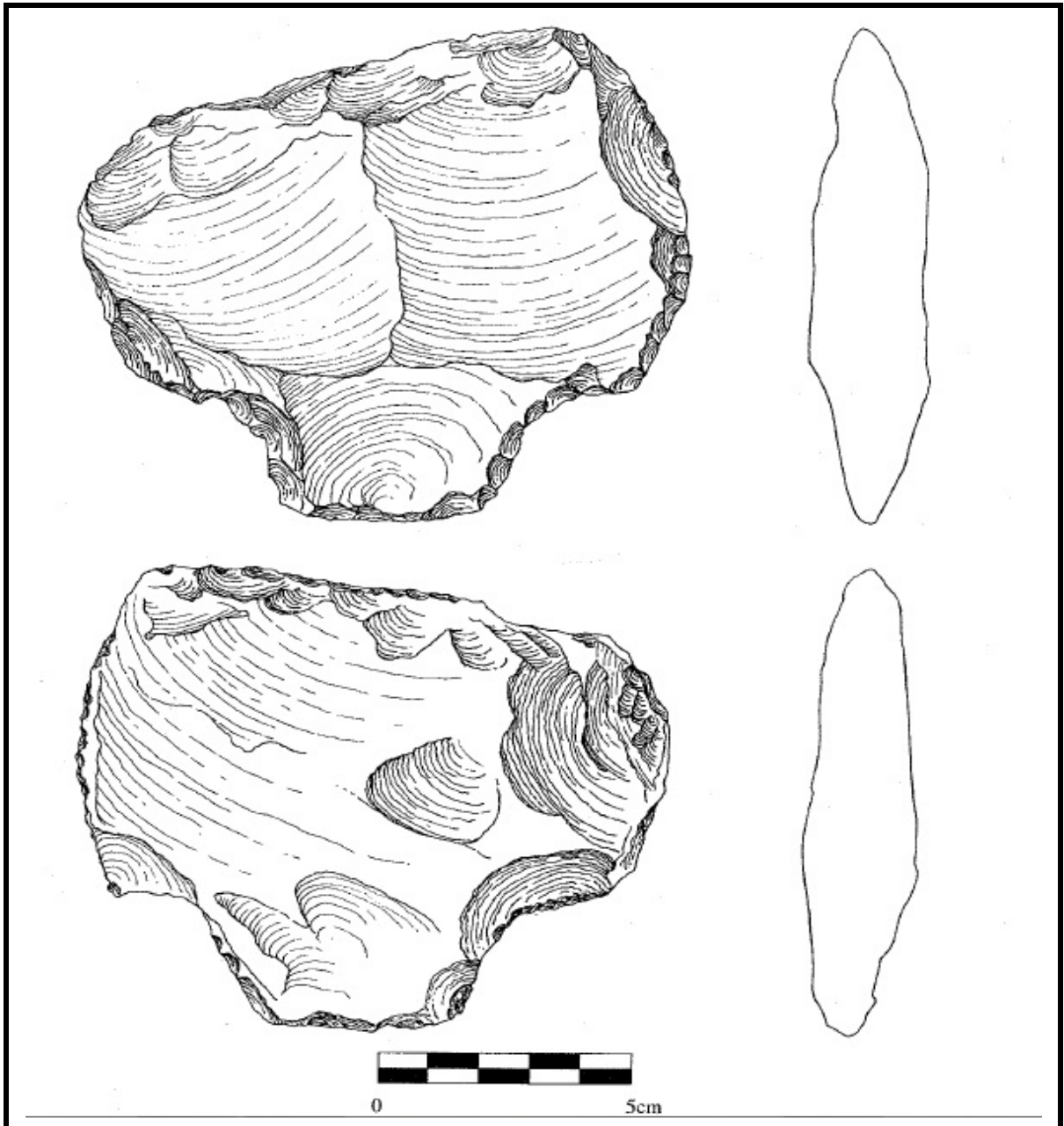


Figure 10. Fine Grained Igneous Rock Hoes, Ciudad de Dios (MV 83). From Billman et al. 2002.

Similar corner-notched bifaces have been found throughout the Andes, and have been interpreted as agricultural field tools (e.g. Berman 1997; Gumerman and Briceño 2003; Russell 1988; Vining 2005). The high level of wear on most of these tools does suggest agricultural use, although it seems likely they could have functioned as general domestic tools as well, with use ranging from terrace construction or shoveling dung to cracking mammal bones. Interestingly, hoes from the middle valley bear resemblance to the blades on agricultural tools called *tawna rumi*, reportedly used by traditional Quechua groups in south-central Peru. These tools are used for moving soil during seeding and weeding (Luque 2005: 35).

Table 2. Tool Types Recorded During Sort.		
Numeric Code	Text String	
7	BIF	biface
7.1	BIFF	Biface fragment
8	FPIG	flake with pigment
9	DEB	debitage
10	UTIL	retouched/utilized flake
11	DENT	denticulate
13	BEAD	bead
15	HOE	hoe
15.1	HOEB	hoe blade fragment
15.2	HOEH	hoe haft fragment
16	POLI	polishing stone
17	POLI/T	polishing stone/tool
18	MANO	mano
19	GROU	ground stone
20	HAMM	hammer stone
21	HAM/MAN	hammer stone/mano
22	GROU/CHIP	groundstone/tool
23	ANV	metal working anvil
24	KNIF	knife
25	CORE	core
26	COR/T	core/tool
28	DONU	donut stone
29	FCR	fire cracked rock
30	CHUN	chunga
33	DRIL	drill
	ERROR	type was not properly recorded



Figure 11. Mudstone Debitage from Cerro León



Figure 12. Fine Grained Igneous Rock Debitage from Cerro León.

Other chipped tool types include denticulates, donut stones, drills, knives, projectile points, and informal tools manufactured through a combination of flaking and grinding (Table 1). These tools represent relatively small percentages of the assemblage, and are not considered in detail in this study. Production debris, or debitage, is classified on the basis of absence of any indication of human modification or usage (Figs. 11 and 12). More specific debitage categories, such as shatter, were not consistently applied by various analysts, and all debitage in this study is considered as a single category. Also, some mudstone was used for bead production at Cerro León, although both finished beads and preforms are rare relative to the quantities of mudstone tools. As such, I believe that these beads were largely manufactured from the side-products of tool production and that the impact of this production on tool and debitage discard was minor.

Contexts of Recovery

The majority of materials were recovered within or on top of residential architectural features. For all three sites, most lithic material by weight came from room fill, or deposits which rested on top of floors and filled in enclosed masonry wall features and patios. Substantial amounts of material were also recovered from pits dug by looters or their backdirt, ubiquitous at all sites and severely hampering stratigraphic analysis. At Cerro León, less but still substantial amounts of material also came from trash mounds and surface collections, while at West Cerro León, materials from mixed deposits are relatively prominent.

These residential contexts have several implications for formation processes. The assumptions behind analyzing refuse from household contexts are discussed in somewhat more detail below, but in general, it is likely that artifact deposition varied considerably

between residential structures, rooms, and settlements. Almost all artifacts, with the possible exception of floor assemblages, appear to have been recovered from secondary or tertiary contexts, raising the question of whether or not they represent trash dumped by that structure's occupants or post-abandonment fill. Generally though, these compounds are single component structures with long occupational histories. Trash generally accumulated in tandem with replastering and raising of floors in the main rooms, and it appears that most excavated artifacts were used and discarded by residents of the compounds in which they were recovered (Billman 2009: personal communication).

Assumptions and Limitations

Unfortunately, one of the great limitations of any 'household' assemblage is the fact that it is recovered from within or around a house structure, a spatial unit that does not incorporate every activity or dumping area used by a social household (Hayden and Cannon 1983; Murray 1980). We can establish that a given feature was a residence and roughly estimate the size of the group that could have inhabited it. However, it is difficult to precisely relate the percentage of artifacts from an archaeological house to the total objects used by a social household over time. Based on different cultural logics and even idiosyncrasies, household members use and discard the objects of daily life in places other than the dwelling. Therefore, variation in household assemblages may indicate differences in what households do or just differences in where activities were conducted and refuse was discarded. It could also represent variations in household division of labor along age or gender lines.

Beyond this, a variety of potential problems may arise from the nature of the artifact typology and the manner with which it was applied. The dataset in this study is a palimpsest of analyses done by 11 workers, all in varying degrees of communication with each other. Some classification error resulting from inconsistency can therefore be expected. These

problems may affect two artifact types in particular: utilized flakes and bifaces. The former category is identified primarily on the basis of macro-wear and polish, which may be difficult to observe, particularly if the artifact was used for only a brief period of time. Furthermore, the non-stemmed bifaces can be difficult to separate from other artifact types such as flakes and hoes, particularly in the case of mudstone, which tends to fragment easily into pieces with fractures that are difficult to distinguish from intentional flaking. During my own work, I sorted 56% of the artifacts and these issues were kept to a minimum using the standards outlined above. However, my methods may differ in some ways from those used by earlier analysts.

Additionally, artifacts from different sites were not classified with an equal degree of specificity. Biface edge fragments and hoe edge and haft fragments were new categories only applied to materials from the 2008 and 2009 field seasons. Therefore, there is some ambiguity in the assemblage over the amount of material represented by these fragmentary pieces in the assemblage. A similar problem arises in reference resharpening flakes, which may account for a sizeable percentage of the debitage in certain contexts. These were not distinguished from production debitage during the sorting, and therefore the percentage of overall debitage represented by them is uncertain.

Finally, the analysis of reduction trajectories in this assemblage is hampered by problems of mixing and redeposition. A variety of tools and some beads were manufactured using very similar raw materials, such as fine-grained igneous rock, and it is therefore difficult to assign any given flake or piece of debitage to the production sequence of a tool such as a hoe. This makes examining particular reduction sequences rather difficult (Andrefsky 2005: 140). The general category of fine-grained igneous rock is also somewhat

problematic, as it encompasses a variety of igneous materials whose proportions in the debitage assemblage may or may not reflect those in the tool assemblage.

Methods for Assessing the Production and Exchange of Tools

With these categories and their limitations in mind, the study of actual human behavior can proceed in fairly straightforward fashion. As with most quantitative reasoning in archaeology, assessing labor and exchange patterns with lithic tools comes down to a consideration of differential occurrence. For studying production, this means a consideration of differences in counts of those artifacts associated with tool manufacture, such as debitage and hammerstones/percussive instruments. The study of consumption can proceed through the study of differential discard of used tools and resharpening flakes. Ideally, this occurs by assigning particular artifact categories to a particular stage in the reduction sequence model. Due to the issues of non-standardization and assemblage mixing discussed above, this must be accomplished more generally in this assemblage.

The method used here, therefore, is a simple ratio of debitage to tools, with the understanding that locations that produce more tools will most likely be associated with the highest debitage counts. Unfortunately, I was not able to sub-divide debitage into categories such as bifacial reduction flakes, meaning that I cannot trace variation in the production of particular tools such as hoes. Therefore, I do present data on the ratio of debitage to hoes, with the caveat that at least some of the debitage was clearly not generated by hoe reduction.

In a similar fashion, variation in the quantities of tools recovered from a given context can be seen as representative of changes in the quantities that were discarded in that situation, with higher recovery rates indicating increased consumption by the same social group. However, it is important to consider the relationship between tool usage and maintenance, and the possibility that increases in maintenance may increase breakage and therefore the

rates at which tools are discarded. Such changes in curation may indicate variation in the accessibility of particular materials, the type of labor being performed, and the ways that labor was organized.

CHAPTER 5:
RESULTS AND DISCUSSION:
LABOR AND SURPLUS IN THE MIDDLE MOCHE VALLEY

How does lithic technological organization at these three sites reflect the mobilization of labor and surplus products? This section marshals patterns in lithic production and consumption data to make several proposals:

- (1) During the HEIP, households in Area 1 at Cerro León may have been producing surpluses of mudstone hoes for trade to other communities and households in the middle valley, such as West Cerro León
- (2) Cerro León may have been generating agricultural surpluses through increased field labor, relative to other sites
- (3) By the Middle Moche phase, elite retainer households at Ciudad de Dios were less involved in agricultural labor than households from earlier eras, and may have instead been involved in hierarchically mobilizing labor from lower ranked groups.

I stress that these arguments are preliminary, although still significant. The nature of the dataset, as previously described, should make it apparent that alternative explanations are possible. As will be discussed below, sampling and changes in discard and curation practices may have influenced observed patterns.

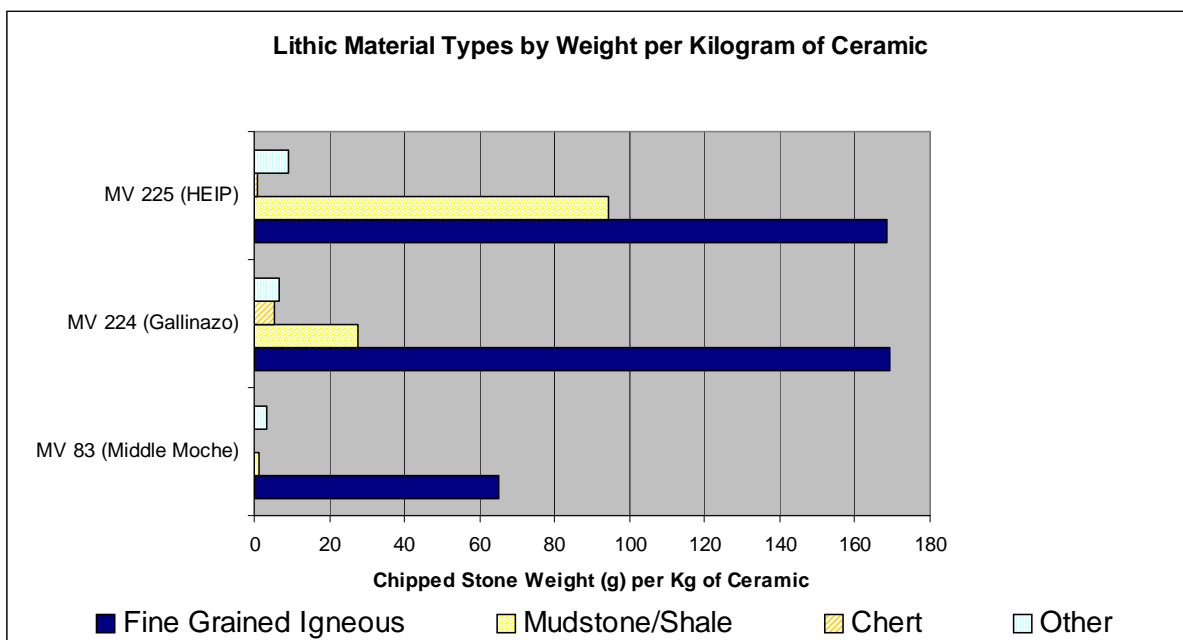


Figure 13. Lithic Discard Rates at MV 83 (Ciudad de Dios), MV 224 (West Cerro León), and MV 225 (Cerro León).

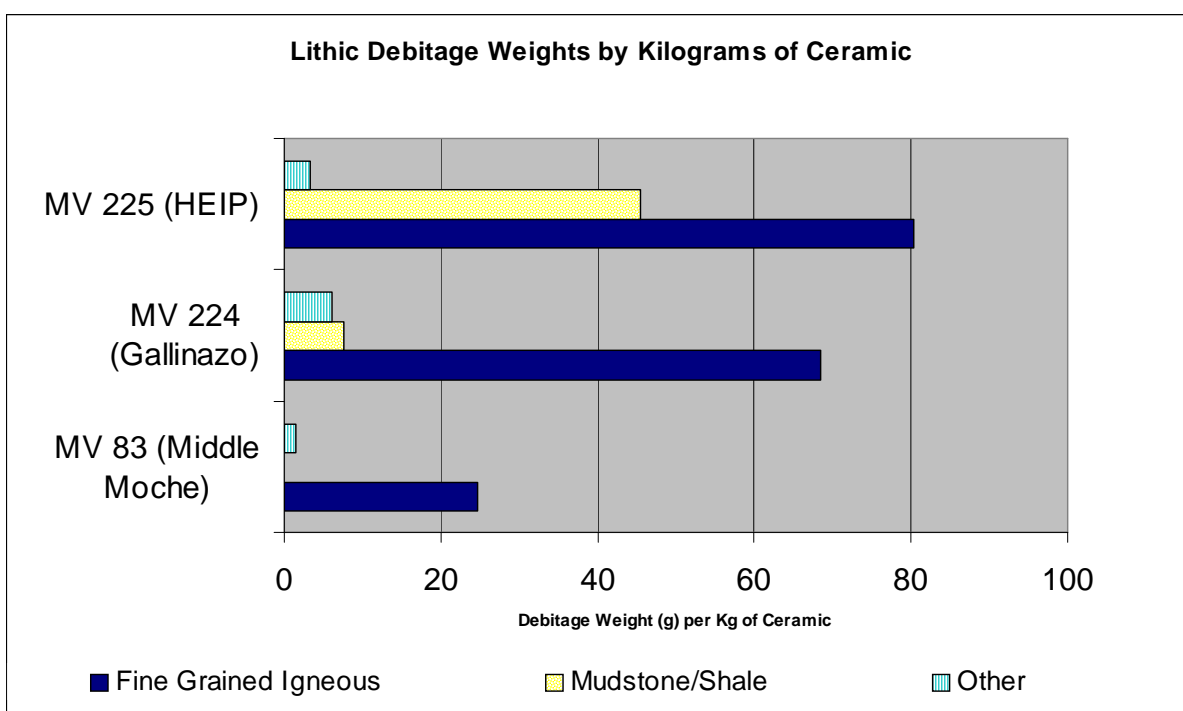


Figure 14. Lithic Debitage Discard Rates at MV 83 (Ciudad de Dios), MV 224 (West Cerro León), and MV 225 (Cerro León).

Technological Organization at Three Middle Valley Sites

Figures 13 and 14 present data on the quantity of lithics by material type recovered from each site. The heavy exploitation of local materials by each settlement is consistent with expectations for an ‘expedient’ organizational strategy (Nelson 1991), which minimizes the need for planning because raw materials and activities occur in close proximity. However, there is considerable variation in lithic discard rates relative to ceramics at each site. Given this, I will discuss reduction and discard strategies at each site in more detail.

Cerro León. Chipped stone discard in general was highest at Cerro León (MV 225), indicating stone tools were reduced and used more intensely here relative to the other two sites. Compared to West Cerro León, the bulk of this additional material is mudstone artifacts, with the discard of igneous rock approximately equal. The use of mudstone was also much higher than that observed at Ciudad de Dios. Apparently, flintknappers at Cerro León faced an additional demand for lithic material in their community or exchange sphere, likely for bifacial hoes, which they strove to meet by reducing more mudstone. Discard rates for bifaces and hoes at Cerro León are very high overall (Fig. 15), and while some of this comes from increased discard of igneous rock bifaces, discard of mudstone bifaces greatly increases. Changes in informal tool consumption may also account for rising rates of mudstone consumption, but these patterns are less clear and classification error may be partly responsible for the variation present (Fig. 16).

The proportion of mudstone debitage relative to tools and hoes is also significant at Cerro León, and is significantly higher than that at either Ciudad de Dios or West Cerro León (Fig. 17). This finding is the strongest indicator of surplus tool production at the site and is probably related to the additional production of bifacial hoes. This ratio does not hold for the

igneous rock assemblage, which shows few signs of variation in production practices between Cerro León and the other sites. At least in part, this is likely due to confounding factors from the reduction of igneous river cobbles. This reduction strategy produced significantly larger flakes, raising the ratio values for each site. While igneous biface reduction flakes are common at both Cerro León and West Cerro León, there are no quantitative data to assess their relative frequency.

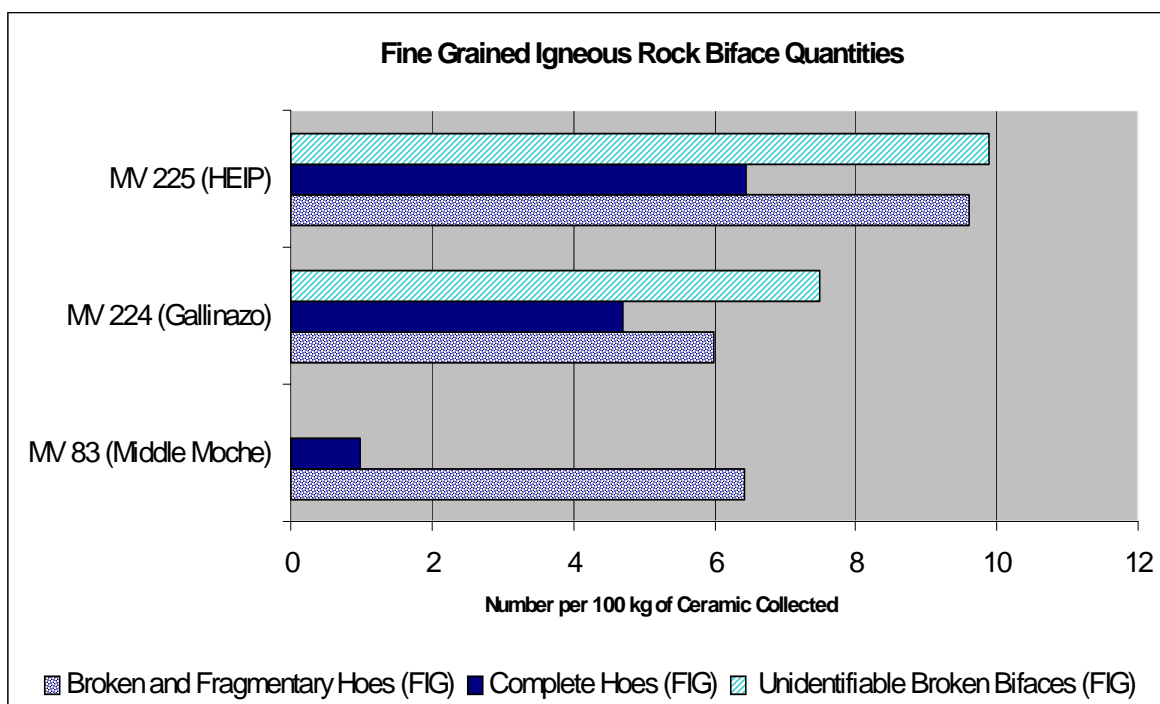
Additionally, it is unclear whether mudstone reduction represents tool production or tool maintenance. Almost all hoes recovered at Cerro León show polish and striations from use and most show significant wear. Based on the debitage sample subjected to detailed analysis, mudstone resharpening flakes compose a significantly higher fraction of the analyzed sample at Cerro León than at West Cerro León, but igneous rock resharpening flakes are relatively constant (Table 2).

Table 3. Resharpening Flakes Observed During Detailed Analysis				
	Fine-Grained Igneous Rock		Mudstone / Shale	
	Production Flakes	Resharpening Flakes	Production Flakes	Resharpening Flakes
West Cerro León	n= 241 (89.6%)	n=28 (10.4%)	n= 94 (91.3%)	n=9 (8.7%)
Cerro León*	n= 353 (88.2%)	n=47 (11.8%)	n= 686 (70.2%)	n= 292 (29.8%)
* Cerro León detailed analysis sample only includes material from Compound 6. Resharpening flakes identified by presence of polish on dorsal edge of flake's striking platform. Production flakes were identified by the absence of such polish.				

It is difficult to reconcile this increase in tool maintenance with models of Cerro León as a surplus tool producer, since lithic production locales are generally expected to be less concerned with tool maintenance due to the ready accessibility of material.

West Cerro León. In general, reduction strategies at West Cerro León (MV 224) are comparable to those of Cerro León, particularly in the high exploitation of mudstone relative to Ciudad de Dios. The low level of mudstone debitage relative to mudstone tools does

A.



B.

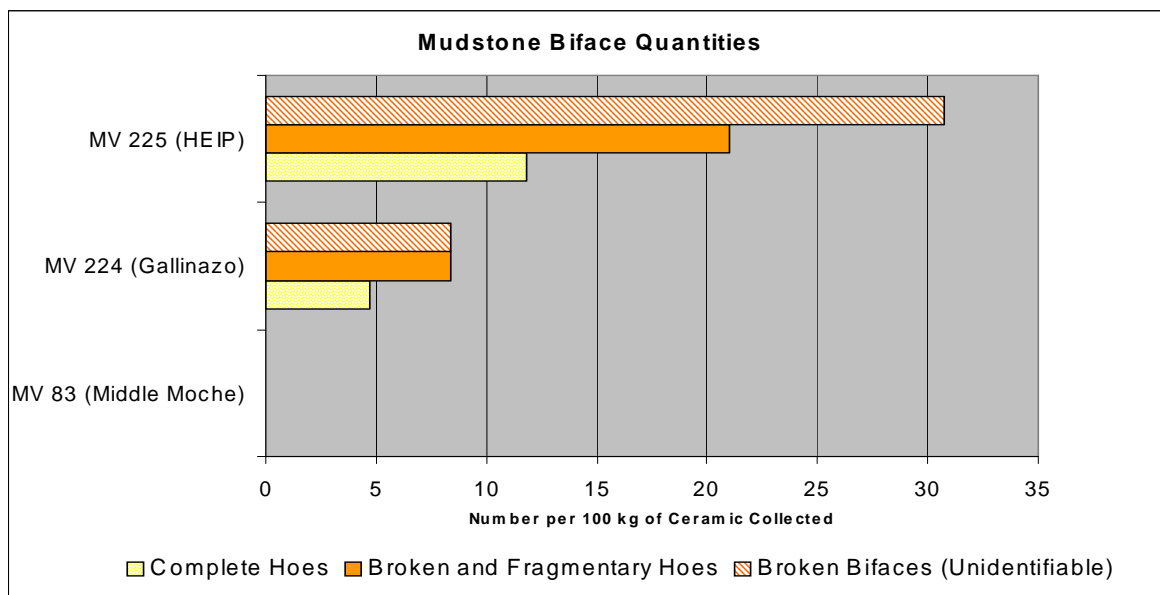


Figure 15. Biface Discard Rates at MV 83 (Ciudad de Dios), MV 224 (West Cerro León), and MV 225 (Cerro León). (A) Fine-Grained Igneous Rock; (B) Mudstone

suggest some significant differences in reduction practices between the two sites, and may indicate dependence by West Cerro León residents on materials imported from elsewhere. The relatively low fraction of resharpening flakes here is again inconsistent with expectations for a consumer site, but this may be a sampling issue (Table 2). Of equal interest at West Cerro León is the large number of freehand cobble cores brought to the site and the decline in the number of informal retouched and utilized flakes relative to the other locales (Fig.11). It is difficult to interpret this pattern in terms of human practices because these tools' functions are unknown, but the contrast does indicate some difference in domestic economy between West Cerro León and the other two sites. Large amounts of alluvial cobbles were brought to the site for construction fill, so the high freehand core count may reflect an abundant supply very close to dwellings.

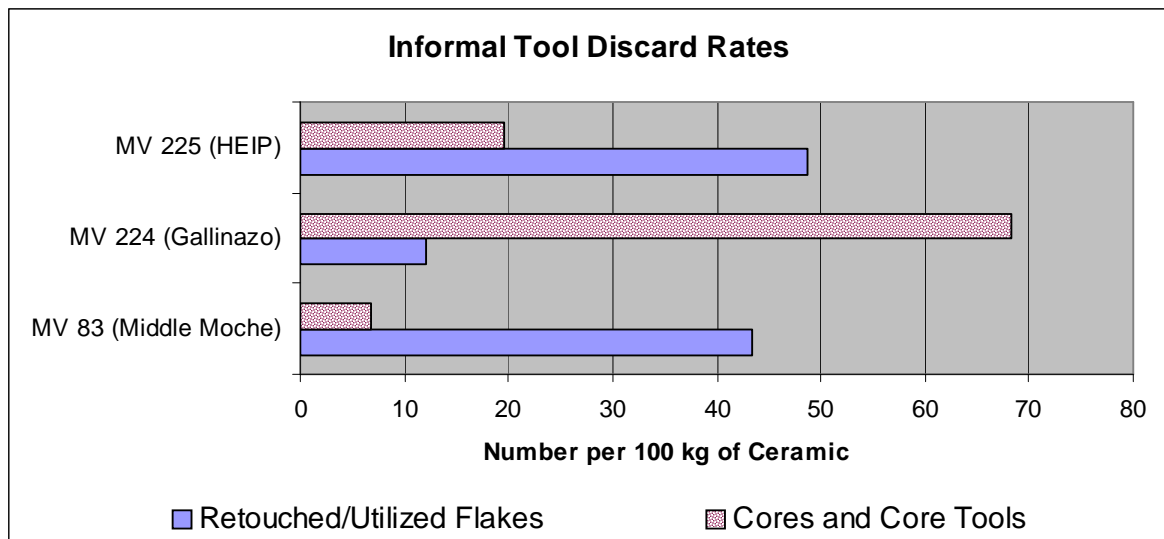
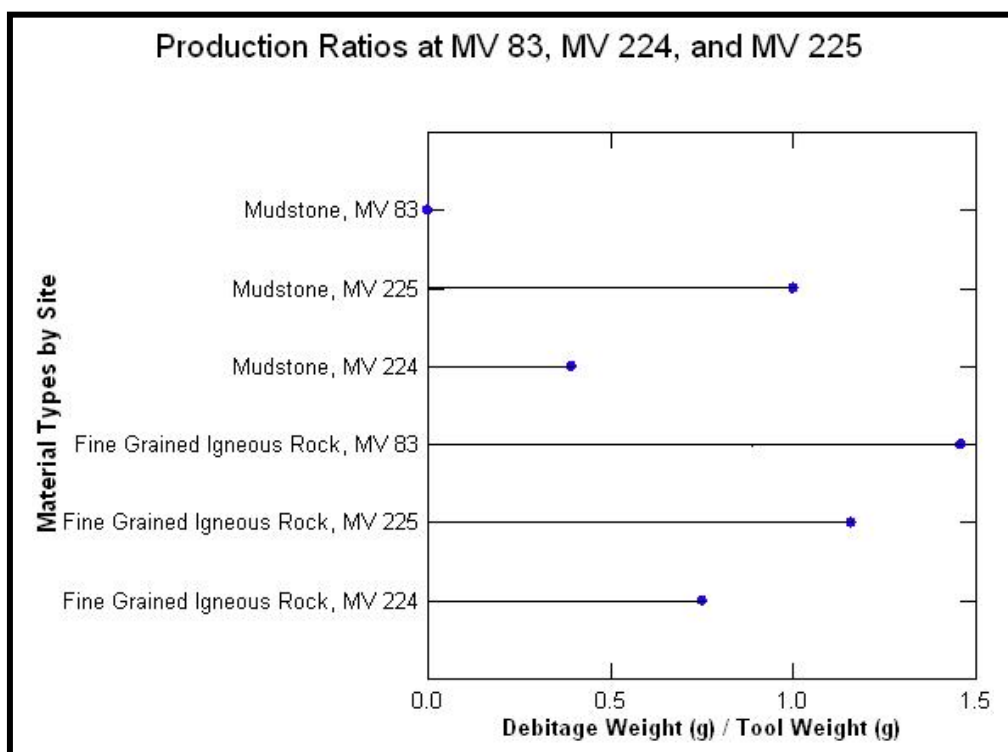


Figure 16. Informal Tool Discard Rates at MV 83 (Ciudad de Dios), MV 224 (West Cerro León), and MV 225 (Cerro León).

Ciudad de Dios. In many ways the outlier, this site yielded a far smaller lithic assemblage than either Cerro León or West Cerro León, indicating a significant drop in lithic discard rates by the Middle Moche phase (Fig. 13). Very few mudstone tools, no mudstone debitage, and no mudstone hoes are present in the sample. Some recovered tools are not included in

A



B.

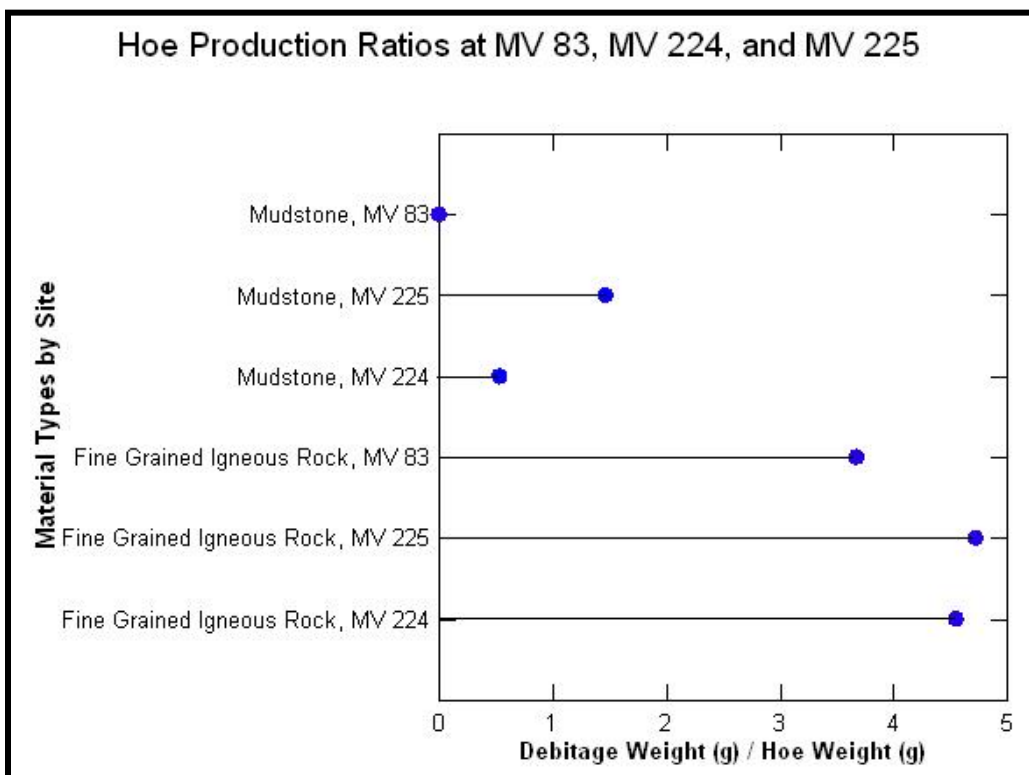


Figure 17. Debitage to Tool Ratios for a) all chipped stone tools; and b) hoes. MV 83 (Ciudad de Dios), MV 224 (West Cerro León), and MV 225 (Cerro León).

this sample because associated ceramic weights are unavailable; nevertheless, the contrast with Cerro León is striking. Apparently, the demand for bifaces had declined significantly and the procurement practices that brought mudstone to Cerro León were all but dropped. The reduction of cobbles to make informal flake tools was the basis of flintknapping at Ciudad de Dios.

The discard of hoes did continue at Ciudad de Dios at lower rates and indicates that high-status households maintained some involvement in agricultural field labor. The large amount of igneous rock debitage relative to tools suggests that some tool production was going on in these residences, but these were likely not a product of hoe reduction. The high average flake/debris weight from Ciudad de Dios suggests that this statistic is mainly a result of the larger cortical flakes generated by river cobble reduction, as opposed to the smaller bifacial trimming and resharpening flakes more common at the other two sites. The use, maintenance, and discard of tools in residential contexts seem to have declined overall at Ciudad de Dios, also contributing to the high debitage to tool ratio.

Mobilizing Surplus: Tool Production

The available data on reduction strategies are not conclusive, but suggest a scenario where the control of mudstone production and distribution was a component of elite domestic economies during the HEIP occupation. At the simplest level, the logic behind this could be explained in terms of the socioeconomic advantages that exchanging surpluses conferred. However, the fact that the middle valley sources for sedimentary rock were surrounded by highland communities during this time suggests that coastal Gallinazo/Moche groups may have relied on ‘highland’ labor to achieve access to these goods. Based on the presence of marine resources at Cerro León, exchange networks that linked the two groups are known to

have existed (Briceño and Billman 2007). In this sense, the movement of mudstone hoes would represent a collection of social and economic capital on the part of elite producers, who generated surpluses for the purposes of reciprocal exchange. While this arrangement would appear heterarchical from the perspective of labor mobilization, it could have had hierarchical elements insofar as it allowed elite households to control exchange and trade or withhold hoes at their whim.

The corollary of this would be consumer sites, receiving hoes in exchange for some other good. No definitive candidates for this role are known, but West Cerro León is a possibility. Here, the relatively low amounts of mudstone debitage suggest that these households were not producing these tools to the same degree as their ‘neighbors’ at Cerro León. Such an interpretation depends entirely upon whether or not the two sites were contemporaneous, and as discussed above, this has not been clearly established. Other highland occupation sites in the middle valley also are possible consumer sites. Based on my own preliminary surveys, there does appear to be a correlation between HEIP sites and mudstone hoes, and many of these sites seem to have relatively low mudstone debitage accumulations. Such observations could be strengthened with a quantitative assessment of discard rates.

It is important to realize that other lines of evidence do not necessarily converge on this surplus production model. The Cerro León mudstone assemblage lacks some common attributes of specialized lithic production, such as low proportions of maintenance flakes or high proportions of hammerstones and production failures. However, Cerro León was a residential settlement and not a workshop or quarry. Household members may have recycled production failures and preforms for use in making informal tools, or failure rates may have

been low. It is also entirely possible that mudstone was worked using soft hammers like mammal bone or deer antlers, which do not preserve well at the elevation of the middle valley. Such alternatives are admittedly speculative.

The evidence for surplus production of igneous rock hoes or tools is more ambiguous. There is little sign of diachronic change in igneous rock reduction and discard, and it may be the case that demands for these tools remained stable through time. While an igneous rock quarry in the middle valley has been described (MV 309), like most quarries it is difficult to tie to any particular ceramic phase or to observe changes in how it was exploited through time. It is also difficult to source artifacts specifically to this quarry based on visible attributes alone. Therefore, while the presence of this point source suggests igneous rock exchange networks existed in the middle valley at some point, the elucidation of their dynamics awaits further work.

Mobilizing Surplus: Tool Consumption

At Cerro León, various lines of evidence suggest that the site was occupied by highland immigrants who had moved to the middle valley (Billman 1996; Briceño and Billman 2007; Ringberg 2009). This has many parallels to the ‘vertical archipelago’ model first proposed by Murra (1970) for the southern highlands, whereby Andean communities in the highlands established colonies in various ecological zones in order to maximize the range of resources to which they had access. In southern Andean valleys, this migration involved agricultural intensification, particularly of maize (Goldstein 2005: 216–220), which required increased investment in field maintenance by laborers. Tasks such as mounding around plant bases, weeding, mulching, and fertilizing could increase plant production by providing access to essential nutrients. All of these labor forms could have involved manipulating the soil with hoes.

Ceramic temper evidence indicates that large quantities of goods were moving into the Cerro León settlement from the highlands (Ringberg 2009); thus, it seems reasonable to suggest that some goods were moving back to the highlands. These could have been cultigens such as coca, fruits, and peppers, which would have been unavailable in the highland areas. Elite families increased their own production in order to access the objects necessary for reproducing a highland identity, such as polychrome serving vessels, highlands foods, and clothing. Insofar as these households were mobilizing their own labor in order to participate in these exchanges, I argue this was a heterarchical form of labor mobilization. However, it is likely not all households had the resources to participate directly in these networks, and the difference in opportunity may have been a source of hierarchy and power.

The evidence at Cerro León could also be interpreted as a change in domestic work patterns or space usage. Both the increased levels of hoes and broken hoes, and the sample of increased levels of resharpening flakes suggest tool maintenance and rehafting were going on at Cerro León. The differential curation of the two main material types may be significant here, as these increases seem only to involve mudstone bifaces, with andesite specimens staying relatively constant. This may be a result of different use lives, as mudstone is a considerably softer material and might respond differently to increased use. If this is the case, mudstone hoes may have dulled more quickly (or were perceived as doing so) and were more frequently maintained, leading to higher frequencies of resharpening flakes. In short, the evidence clearly indicates increasing use and discard of hoes, but we must consider the complexities of material properties and tool function in order to accurately tie these data to agricultural production.

The decrease in hoe discard at Ciudad de Dios perhaps reflects the changing sociopolitical situation in the Moche Valley after the rise of powerful elites at the Cerro Blanco site ca. AD 350. The overall discard of chipped hoes dropped ~75% from levels at Cerro León, indicating a declining involvement of the Moche-period elites and their retainers in agricultural field labor. It is significant that this change seems mainly due to a complete decline in the use and discard of mudstone bifaces, while the recovery of igneous rock hoes and biface fragments is fairly comparable to that at West Cerro León and only somewhat lower than Cerro León. While bifacial tools consumption drops overall, the bulk of this seems to be due to a marginalization of mudstone in the lithic economy of the middle valley, indicating a dramatic change from the exchange patterns that characterized the highland occupation.

The evidence is not definitive, but it seems likely this change results from a decline in the demand for hoes at Ciudad de Dios, and by inference, a decline in agricultural field labor. Middle Moche phase elite and specialist households did not frequently work in the fields, but participated in a hierarchical labor mobilization network and took in a surplus for redistribution to lower status groups. Biological evidence in the middle valley suggests coca, *chicha*, and fish were becoming important components of male diets throughout the EIP. Gagnon (2006, 2008) has argued that these shifts resulted from increased participation in elite or state-sponsored work parties, for which males received special foods in return. Sixteenth-century documents from the Peruvian North Coast describe local level elites as sponsoring similar work groups and rituals during canal maintenance and cleaning (Netherly 1984: 244). The lithic data from intermediate architecture at Ciudad de Dios suggest declining involvement in field labor, and it may be the case that this extra time was spent

collecting, processing, and redistributing high-status consumables. Labor may also have been redirected into producing display goods such as metal ornaments, which were clearly manufactured on site at Ciudad de Dios. In any event, a significant change in domestic economies and social roles seems to have taken place by the Middle Moche phase.

Whereas the elite families of the earlier HEIP occupation at Cerro León achieved and maintained power in part through their intense involvement in agricultural labor, the residents of Ciudad de Dios relied on an ascribed position within a hierarchical network of rights and obligations.

Directions for Future Research

From this study, several questions and avenues for further investigation emerge. Tool function remains a key issue, and since the reduction strategies for the two main material types seems to respond to different factors, it is possible that igneous and mudstone hoes were involved in different agricultural tasks. The visible patterns in macro use-wear do not suggest this, but it remains an open question as to why the residents of Cerro León and West Cerro León used two very different materials to make the same tool. Microscopic comparisons of the two types could be quite helpful in addressing this, especially in conjunction with experimental work on a variety of local soil types.

More generally, further systematic investigation of lithic assemblages in the middle valley is needed to explore these patterns, and the extent to which they reflect broader social changes versus the changing nature of consumption and exchange at particular sites and sectors of sites. For example, further excavation and lithic analysis at other HEIP sites in the Moche Valley could illuminate whether increased mudstone use at Cerro León is an anomaly of elite households, or a more general pattern of the agricultural economy in the Middle Moche Valley during the HEIP occupation. Similar work is needed for the Moche phase,

especially for commoner sites such as Santa Rosa-Quirihuac, which was excavated in the late 1990s. Although lithics were recovered and partially analyzed from this site (Gumerman and Briceño 2003; Thompson 2002), a full analysis and consideration of discard rates is needed to make these data comparable. At any excavation in the Moche Valley, simply recording debitage quantities, including resharpening and cortical flakes and material types, could greatly increase our understanding of household and site economics, and therefore patterns of labor mobilization.

The greatest contributions of future lithic analyses, as in many cases of complex societies, will occur when they are used as one of several lines of evidence in the examination of economic practice (Braswell 2003). The problem of labor mobilization addressed in this thesis interfaces with ceramics, archaeobotanicals, and faunal assemblages, and the most comprehensive interpretations will use all these data. Archaeobotanical data could greatly augment the explanations offered here by documenting changes in plant consumption and could enhance inferences about the changing nature of agricultural production. For example, if the contrast in mudstone discard between West Cerro León and Cerro León is in fact due to changes in a particular aspect of the agricultural regime, then this may be reflected in the assemblages of charred and desiccated plant remains recovered from each site. As this study shows, no single line of archaeological evidence is unambiguous, but a multiplicity of datasets should allow future scholars to ‘close in’ on the best interpretation possible.

CHAPTER 6:

CONCLUSIONS

This thesis has used lithic data from three sites in the Middle Moche valley to make arguments about the nature of domestic and community economies in the later part of the Early Intermediate Period. During the Highland-Early Intermediate Period occupation of the valley, a spike occurred in the use of mudstone nodules from nearby outcrops of sedimentary rocks. At the large highland settlement of Cerro León, elite households may have been involved in a heterarchical form of labor mobilization, turning these nodules into haftable bifaces and exchanging them to other communities, including contemporary Gallinazo sites. Debris from this production was used for other domestic tasks and as blanks for lapidary work. However, many of the hoes themselves remained within the household to work the fields, orchards, and pastures of elite families and these tools were regularly rejuvenated. It may be the case that the spike in debris suggesting surplus production in fact indicates more regular use of domestic space for tasks such as tool maintenance.

This pattern can be contrasted with non-highland sites such as West Cerro León and Ciudad de Dios, where lower debitage and biface levels, particularly for mudstone, suggest both lower production and less use of agricultural field tools. The contrast between the elite compounds at Cerro León and Ciudad de Dios is particularly striking, and may indicate the growing hierarchical power of middle valley elites during the Moche period. In this case,

Moche phase households were involved in mobilizing others through the organization of work parties. The high levels of biface discard at Cerro León may suggest agricultural surpluses, but in this case the organization was likely heterarchical, insofar as the elites families of this site were still involved the basic agrarian labor of their communities. Partly through this labor, they participated in exchange networks that moved goods from the warm lowland agricultural zones into the highland areas above.

More generally, this thesis has demonstrated the importance of expedient lithic assemblages in working towards key problems in the archaeology of complex societies. These conclusions are preliminary, but it should be apparent that such data are indeed useful for examining labor mobilization and the generation of surpluses. As the archaeology of Peru's North Coast and Andean archaeology more generally continue to develop, the addition of datasets such as these will prove indispensable in building a complete picture of ancient Andean societies, providing a nuanced view of the social relationships that constituted them.

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