

ADOBE BRICKS AND LABOR ORGANIZATION ON THE NORTH COAST OF PERU

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INTRODUCTION

Archaeologists studying monuments often estimate the number of people and time needed for a particular project. Less often, however, do they investigate the organization of this labor, that is, how a group of workers was divided and subdivided, assigned the same or different tasks, and how their work was credited and recorded. Such studies are crucial for understanding ancient states because they reveal the relationship between laborers, administrators, and the elite. By tracking the change in labor organization through time, we can model the evolution of labor administration as early states develop into empires.

In this article I investigate labor on the north coast of Peru by presenting data on adobe bricks from two archaeological sites: the Huaca de la Luna and Farfán (Figures 1 and 2). At the Huaca de la Luna (Unit 16, Moche IV, A.D. 400-700), I confirmed observations made earlier by Hastings and Moseley (1975) that bricks of the same size, and with the same makers' mark, were placed together in the same construction segment. By contrast, bricks from Farfán (Chimú occupation, A.D. 1310-1460) lacked makers' marks and bricks of different sizes can be found in the same section of a wall. If adobe manufacture and construction can be used to infer labor organization (Cavallaro and Shimada 1988; Hastings and Moseley 1975; Kolata 1978:164; Moseley 1975; Shimada 1997), then these patterns suggest that the Moche system of

organizing and recording the work of brick laborers had disappeared by Chimú times.

CULTURAL HISTORY OF THE NORTH COAST OF PERU: A.D. 100-1470

One of the earliest states of the Andes, the Moche, emerged on the north coast of Peru (Stanish 2001:55). Some scholars hypothesize that at least two Moche states were present between the second and eighth centuries A.D., the "southern Mochica" centered in the Moche Valley and the "northern Mochica" in the Lambayeque region (Billman 2002:372-373; Castillo and Donnan 1994; Shimada 1994:78-87). At the capital of the southern Mochica state stood two large adobe pyramids, the Huaca del Sol and the Huaca de la Luna, the former measuring approximately 342 by 159 meters, reaching forty meters in height, and containing more than 143 million bricks (Hastings and Moseley 1975:196-197). The area between these two pyramids was an "urban zone" packed with residences, streets, and plazas. During the height of the southern Mochica state, between A.D. 300-700 (ceramic phases Moche III and IV), its capital achieved maximum size with at least 10,000 people living within a five kilometer radius (Chapdelaine 2003:276).

During the Middle Horizon (A.D. 600-1000) new centers emerged, including Galindo, located just eleven kilometers northeast of the Huacas of Moche, and Pampa Grande in the Lambayeque Valley, some 160 kilometers to the north. Radiocarbon dates show that the Huacas

of Moche (Chapdelaine 2000:137), Galindo (Lockhard 2008:279), and Pampa Grande (Shimada 1994:4) co-existed during the seventh century A.D. They were all abandoned, or no longer served as major population centers, by A.D. 800. The reasons for these transformations are still unclear. Some suggested causes include flood and drought (Moseley 2001:223-225), internal social unrest (Bawden 1996:271-275), and external conquest by the Wari, a highland state whose capital was some seven hundred kilometers away (Collier 1955:136-137; Willey 1953:398). The last scenario, that highlanders from Wari conquered the Moche states, is not supported by the archaeological evidence (Donnan and Mackey 1978:213; Wilson 1988:334-335).

New states and, eventually, an empire, emerged on the north coast of Peru during the Late Intermediate Period. In the La Leche Valley, the Sicán state, with its capital at Batán Grande or Sicán, thrived between A.D. 900 and 1100, a period called Middle Sicán (Shimada 2000:51-61). The site of Sicán was the paramount center of a four-tier settlement hierarchy (*ibid.*: 61), and its core area, the Sicán Precinct, boasted more than a dozen adobe huacas or pyramids. Later the temples atop the pyramids of Sicán were burned and the site was abandoned. A new center, Túcume or El Purgatorio (Sandweiss 1995), emerged during the subsequent period (Late Sicán, A.D. 1100-1360).

While Sicán flourished in the north, the Chimú or Kingdom of Chimor (A.D. 900-1470) started building a city of palaces, residences, and workshops in the Moche Valley (Topic and Moseley 1983). This city, now the archaeological site of Chan Chan, was home to 30,000-40,000 people and covered some twenty square kilometers with an urban core of six square kilometers (Moore and Mackey 2008:784). Chimor started its military campaign around A.D. 1310, conquering other coastal polities in the

valleys of Jequetepeque, Casma, and Lambayeque. Túcume fell to Chimú conquerors between A.D. 1360 and 1400.

The military nature of Chimor's expansion was remembered through oral accounts and recorded by Spanish chroniclers some two centuries later (Cabello Valboa 1951 [1586]: 329; Calancha 1977 [1638]:1227). The archaeological evidence for Chimú conquest consists of rectangular compounds that resemble the palaces or *ciudadelas* of Chan Chan, but are very different from local, non-Chimú sites. By A.D. 1460, the Chimú empire controlled an area more than six hundred kilometers from north to south along the coast of Peru. The fall of Chimor was also recorded by Spanish chroniclers, who provided histories (and conflicting accounts) of the Inca conquest, the relocation of the Chimú king to Cusco, and the break-up of the Chimú empire into smaller provinces (Hart 1983:106-116; Rowe 1948:42-46).

ADOBE BRICKS AND THE INVESTIGATION OF LABOR ORGANIZATION

Sixteenth-century Spanish accounts describe the rights of native Andean *curacas*, or lords, to demand labor and service from their subjects (Hart 1983:175-176; Rowe 1946:261). The recruitment and administration of laborers on the northern Peruvian coast, according to Moseley (1975), can be traced back to Moche times. At the Moche capital, the massive pyramids of the Huaca de la Luna and Huaca del Sol were constructed in "segments", that is, in separate columns of adobes not bound by mortar (Kroeber 1930:61). Some bricks had a makers' mark or symbol, a circle, line, dot, etc., incised into the surface of the brick when wet. More than 100 different marks have been recorded. Within each segment, the majority (eighty-five to ninety-five percent) of the bricks had only one type of makers' mark. Bricks from the same segment also tended to have the same dimen-

sions and be made from the same soil type (Hastings and Moseley 1975:197-198). Other Moche period sites with marked adobes include Pampa Grande (Shimada 1994:162-166), El Brujo (Franco *et al.* 1994:160-161), Galindo (Lockard 2008:287-289), Huaca Vichanzao (Pérez 1994:241-246), and Dos Cabezas (Donnan 2007: figures 2.3 and 2.11). Some marks were common and are found at various sites, whereas other marks are unique and observed at only one site (Lockard 2008:288; Pérez 1994: 244).

Moseley (1975:192) proposed that each makers' mark represented a distinct social group, possibly a work party or a community (Figure 3). A makers' mark could not have represented a single individual because (1) some marks persisted for more than a century and (2) one hundred individuals could not have produced the 143 million bricks that made up the Huaca del Sol (Hastings and Moseley 1975:197; Moseley 1975:192). The Moche state, therefore, must have enlisted work parties as represented by the different makers' marks to construct the two pyramids.

Some two centuries later, a different pattern of brick production characterized Chan Chan, the capital of the Chimú empire. Bricks from Chan Chan did not have makers' marks and, within any given structure, the adobes were made from the same soil and "look as if they came from the same mold(s)" (Kolata 1978: 163). Because of this contrast between Chan Chan and the two Huacas of Moche, Kolata (*ibid.*:164) suggested that "the principle of organizing the labor for construction [at Chan Chan] was different from that used at the Moche pyramids."

Shimada's (1997) study of adobe structures from the Lambayeque region also led him to suggest that labor organization had changed over time. At Sipán a Moche III (c. A.D. 300)

site in the Lambayeque Valley, the adobe mounds were built in segments similar to those at the Huacas of Moche (Meneses and Chero 1994:182-183). Adobe structures from the Moche V (A.D. 550-750) site of Pampa Grande, however, differed from earlier patterns of construction. Some construction segments at Pampa Grande included bricks with different makers' marks. Furthermore, some segments had only one makers' mark but the bricks were of different sizes (Shimada 1994:162-165).

During the Middle Horizon (A.D. 750-1000), construction principles no longer followed the earlier Moche scheme of one segment=one mark=one brick size. At the site of Sicán, one segment often contained adobes of different sizes and makers' marks (Shimada 1997:79). This pattern of brick mixing also occurred at the site of Túcume, where "adobes within a given wall segment vary in size, proportions, soil, and mark, and well over half of the adobes are marked" (Sandweiss 1995:166). Thus, unlike the Huacas of Moche, the post-Moche sites had segments built with bricks of diverse sizes, soil types, and makers' marks.

Kolata (1978) and Shimada (1997) recognized the importance of studying bricks from a diachronic perspective. If brick size and construction method reflect how states organized labor, then any change in these variables could indicate a corresponding change in labor organization. Variations in brick sizes and makers' marks are the result of certain decisions made during adobe production. To understand such variations, we need to divide the production of adobes into multiple stages, and then infer how patterns in the archaeological record reflect actions taken at each stage of production.

STAGES OF ADOBE PRODUCTION

In this section I provide a brief outline of how adobes are made. The purpose of this

discussion is to show how various stages of brick production affect the variability (size, shape, color, etc.) of adobes. The production of adobes consists of four stages: (1) procuring the soil; (2) mixing the soil with water and temper; (3) placing that mixture in brick molds; and (4) drying the bricks. In the following discussion of adobe production, I present my observations of modern-day adobe production from the town of Moche (May-June 2004) and archaeological evidence regarding prehispanic adobe production.

Modern-day *adoberías* are large rectangular depressions in the ground where the soil is excavated, mixed, and made into bricks. The soil used to make adobes is a mixture of sand, silt, and clay (Brown and Clifton 1978:139). Before the introduction of trucks or donkeys, adobe makers would obtain the soil close to the structure about to be built, generally within a kilometer. At Farfán, the type and color (brown 10YR 5/3 to red 7.5YR 5/4; Munsell Color 2000) of the soil used in the bricks most resembled the type and color of the natural soil near those bricks. Bricks from Compound I of Farfán, for example, contain many rock inclusions, and the natural soil surrounding Compound I also has many rock inclusions compared to other areas.

During soil mixing, water is added to moisten the soil. It is likely that adobe manufacture occurred between the months of November and April, when there is more water from the river. Today adobe makers follow a “recipe” that dictates the ingredients of the adobe soil. I recorded four such recipes at the town of Moche. Each recipe gives a different proportion of fine sand, coarse sand, earth, and lime. The mason then mixes the soil either by foot or by shovel. Adobe makers often use straw as a temper.

Wooden molds are used to manufacture rectangular bricks. The adobe maker pours the

mixed soil into the mold, flips the mold over, removes the mold, and leaves behind a damp adobe. Modern bricks made from a single mold are very uniform. The standard deviation is less than 0.4 centimeters ($n=61$). Therefore if one brick is larger than another by several centimeters, it is likely that it was made from a different mold.

During the Gallinazo period (200 B.C.-A.D. 200, Early Intermediate Period), rectangular bricks were made from cane molds, as indicated by cane imprints on the sides of the bricks (Hastings and Moseley 1975:198). In the following Moche period, most bricks had smooth sides, although a few bricks still retained cane imprints (Hastings and Moseley 1975:198; Moubarac 2002:59, 69). Chimú bricks from Farfán have smooth sides without any cane impressions. Instead of being flat, the top surfaces of Chimú bricks are often slightly concave, sometimes displaying finger grooves. These grooves suggest that brickmakers at Farfán used their hands to smooth the upper surfaces of their bricks.

After removing the molds, the brickmaker might incise a makers’ mark on the damp adobe (Hastings and Moseley 1975:198). The bricks are then placed on their sides, and after about a week, they will be dry and ready for use in constructions (Gillin 1947:37). Workers carry them to the construction site and the masons lay the bricks, using mud mortar to bind them. The final touch to the construction is a layer of plaster that covers the wall and obscures the brickwork.

MODELS OF ADOBE PRODUCTION AND LABOR ORGANIZATION

The production, transportation, and laying of adobe bricks could have been done by one group or different teams accomplishing separate tasks. For example, a community could have

made and transported a few hundred bricks to the construction site. Then a separate group of masons, summoned from another community, would use those adobes to build a wall. Alternatively, people from the same community could be responsible for every task, including the manufacture, transportation, and laying of the adobes. Each stage of adobe production and construction can be accomplished in different ways, and by evaluating all the possibilities, we have several permutations of the production sequence to consider.

Different models of adobe production and construction were outlined by Cavallaro and Shimada (1988), who then tested these models using brick data from the sites of Sicán and Batán Grande (Figure 3). At Sicán, they discovered that bricks of the same size often had different makers' marks, leading them to believe that the "discontinuous territoriality" or "sponsor" model best explains their data (Model C or D in Figure 3). In these models, the "sponsor" (individual or community who donated bricks to a temple) or the *curaca* commissioned the production of adobe bricks. The sponsor or *curaca* first received bricks from different workshops, marked the bricks with the lord's or sponsor's insignia, and finally donated the adobes for the construction of a temple (Figure 3, Model C or D). Cavallaro and Shimada (*ibid.*: 98) assumed that different adobe workshops produced bricks of different sizes: "The task differentiation-labor tax model would have to stipulate the use of molds of identical shape and size at numerous *adoberías*, a situation we regard as unlikely." I will later examine this assumption using data from Huaca de la Luna. Following Cavallaro and Shimada (*ibid.*), I test which model best describes brick production in the states of Moche and Chimú. If the two states can be characterized by two different models, it would indicate that adobe production and labor organization had changed through time. Using adobe brick data I collected from Huaca de la Luna and

Farfán, I argue that Moseley's labor tax model still holds for the pattern observed at Huaca de la Luna, and the task-differentiation model, as outlined by Cavallaro and Shimada (*ibid.*: 90-92), best explains the pattern of brick variability at Farfán.

BRICKS FROM THE HUACA DE LA LUNA

The Huaca de la Luna is the smaller of the two pyramids at Moche, reaching at least twenty meters high and consisting of more than fifty million adobes (Hastings and Moseley 1975: 197). Ongoing excavations at the Huaca de la Luna, directed since 1991 by Santiago Uceda and Ricardo Morales, have uncovered evidence of ritual offerings and human sacrifices, as well as friezes depicting dancers, warriors, and various supernatural figures (Morales 2003; Uceda 1997, 2001; Uceda and Tufinio 2003; Uceda *et al.* 1994). Excavation of the area between the two huacas uncovered a densely occupied urban zone filled with numerous workshops and residences (Chapdelaine 2001; Uceda and Armas 1997; Uceda and Chapdelaine 1998).

During the summer of 2004, I participated in the excavation of Unit 16 on top of the Huaca de la Luna (Figure 4). Unit 16 contained numerous burials. The ceramics associated with these burials date to Moche IV, ca. A.D. 400-700 (Zavaleta 2007:13). Bricks from Unit 16 are rectangular and sometimes incised with a makers' mark. Most of the adobes were made from wooden molds with smooth sides. A few bricks were made from cane molds, as indicated by rows of parallel grooves on their sides.

I measured the length, width, and height of 95 bricks from Unit 16. I also recorded the general location (north, northwest, and south) of the bricks within the unit (Figure 5). One makers' mark was observed (diagonal line) on 14 bricks from the north corner (Figure 6). Although the sample is very limited, especially

in contrast to the number of adobes measured at Farfán. I have decided to present these data because the pattern I found contrasts sharply with any sample from Farfán. In other words, no sample of bricks at Farfán, out of the 4,826 measured, had produced the results obtained from Huaca de la Luna. I believe this result is significant and indicates a contrast in the types of adobe production at the two sites.

In addition, an examination of Moubarac's (2002) data, collected from the Huacas of Moche, led me to revise some of the assumptions made by Cavallaro and Shimada (1988). Though widely cited in the archaeological literature, Hastings and Moseley's (1975) study was not reexamined statistically until years later by Moubarac (2002). Moubarac's thesis is exceptional in presenting the much-needed data on individual bricks, including mark, dimensions, and soil type. This is the sort of information one needs to evaluate Moseley's brick labor model. Moubarac's brick sample comes from the Huaca de la Luna, Huaca del Sol, and the urban zone between the two pyramids. His sample consists of 6,893 bricks, though he gives numerical data for only 293 bricks with makers' marks (*ibid.*: 116-122). Out of these 293 marked bricks, I have selected only the ones with an adequate number (more than 5 bricks) for each makers' mark for re-analysis (n=168).

During field-work, I noticed that bricks from different locations within Unit 16 differed in size. For example, bricks from the south side of Unit 16 tended to be smaller than bricks from the northwest corner (Figure 5). A scatterplot of the lengths and widths corroborates my observation (Figure 7). Cluster analysis of the bricks, with length and width as the variables (three cluster solution, Ward's method), and chi-square analysis of the clusters show that the size difference between bricks from different locations is statistically significant (Tables 1 and 2). This result shows that sometimes different sizes

of bricks characterized different sections of the Moche pyramids.

Cluster	n	Length (cm)		Width (cm)		Height (cm)	
		Mean	s	Mean	s	Mean	s
1	12	34.67	1.23	25.67	1.5	14.00	1.48
2	24	28.04	.91	19.75	.68	9.67	1.46
3	59	31.61	1.19	21.83	.81	11.83	1.04

Table 1. Bricks from Unit 16, Huaca de la Luna.

Location	Cluster 1	Cluster 2	Cluster 3	Total
North	0	0	47	47
North-west	11	1	4	16
South	1	23	8	32

Table 2. Bricks from Unit 16, Huaca de la Luna. Chi-square is significant ($p < .0001$).

According to Moubarac (*ibid.*: 116-122), bricks of the same size often had different makers' marks. This indicates that different workshops often produced bricks of the same size. This is expected. If size difference alone distinguished different work groups, then there would be no need to incise makers' marks. Makers' marks were utilized because workshops often produced similar-sized bricks, and hence the marks were needed to avoid confusion.

Moubarac (*ibid.*: 86-88) notes that there are two sizes of bricks—standard and large. A histogram of the lengths of the bricks shows two peaks, with the cut-off at around 33-34 centimeters (Figure 8). The standard-sized bricks are shorter than 33 centimeters and on average measure 30 by 19 by 13 centimeters (length, width, and height). The large bricks are longer than 33 centimeters and on average measure 37 by 23 by 15 centimeters (Table 3). It is possible that the larger bricks were used for the base of a wall or building, a phenomenon observed at Chan Chan (Kolata 1982:68). Indeed, a layer of

“giant” adobes, each measuring 96 by 60 by 21 centimeters and weighing some two hundred kilograms, had been found eight meters below Floor 1 (Piso 1) of Plaza 2B at Huaca de la Luna (Tufinio 2003:29).

Brick size	n	Length (cm)		Width (cm)		Height (cm)	
		Mean	s	Mean	s	Mean	s
Standard	134	30.22	1.18	19.00	1.04	13.38	1.16
Large	34	37.17	1.40	23.44	1.05	15.41	1.28

Table 3. Comparison of standard and large bricks from the Huacas of Moche (data from Moubarac 2002:16-122).

In some cases both the standard and large bricks bear the same makers' mark. For example, diagonal marks occur on both standard and large bricks, though certain marks, such as double vertical bars, appear only on standard bricks (Table 4). Adobes of different sizes that had the same makers' mark were also present at El Brujo (Franco *et al.* 1994:161). This means that some communities or workshops produced both large and standard bricks. The fact that a community made bricks of different sizes is not surprising, because, as Moseley (1975:192) pointed out, these brick marks spanned many generations, and it is also possible that, within a workshop, brickmakers with different molds were working at the same time.

	Diagonal	Double vertical bars (center)	Double vertical lines (off-center)	Point	Semi-circle	Vertical lines on the side	Finger
Standard	56	45	17	8	2	0	6
Large	13	0	0	5	8	8	0
Total	69	45	17	13	10	8	6

Table 4. Bricks from the Huacas of Moche (data from Moubarac 2002:116-122).

There are more than just two size classes of bricks. Even within the category of standard

bricks, there are smaller size classes or sub-types. Bricks from the north and south sides of Unit 16, as represented by Clusters 2 and 3, respectively, show a difference of a few centimeters that was observed in the field and confirmed through statistical analysis. Had I clumped all the bricks from Unit 16 as a single data set, this small difference would have gone undetected and all these bricks would have been classified as “standard”. It is therefore necessary to control for location and separate the bricks from different corners of the excavation unit.

It has been argued that the construction of separate segments is due to purely technical (as opposed to social or administrative) reasons. For instance, Meneses and Chero (1994:183) suggested that segmented construction made the structures more resistant to earthquakes (contra Moseley 1975:193). While the separation of building segments might be attributed to construction technology, there is no apparent technical reason for the use of different brick marks in different sections, and therefore the use of makers' marks is better explained as identifying social groups. The division of construction projects based on social groups (*ayllus* or lineages) is a common Andean practice, documented ethnohistorically (Thompson and Murra 1966:636) and observed ethnographically as recently as the 1980s by Urton (1988) in the highland town of Pacariqtambo, where the church's perimeter wall was maintained by different *ayllus*, with each *ayllu* responsible for a certain section of the wall.

This is not to say that every section of the Moche pyramids contains bricks of the same size; there is always some mixing, probably due to sharing or borrowing among labor groups. Moreover, Andean societies did not have a single, uniform system of labor organization. In fact, I will argue the opposite. The Moche pattern of brick marking and construction contrasts sharply with that of the Chimú, and in

the following section I present data from Farfán to demonstrate this difference. Because my sample of bricks from Unit 16 of Huaca de la Luna is extremely limited, future investigators should measure more bricks from Huaca de la Luna, and record their exact provenience in order to confirm or reject my observations.

FARFÁN AND THE CHIMÚ CONQUEST OF THE JEQUETEPEQUE VALLEY

Farfán, located in the Jequetepeque Valley, was first excavated by Richard Keatinge and Geoffrey Conrad (1983) in 1978 and then by Carol Mackey (2004, 2006, 2009) from 1999 to 2004. The site was occupied by three successive polities: Lambayeque, Chimor or Chimú, and Inca or Late Horizon (Table 5). Because of its strategic location at the crossroad of two major routes (Figure 9), Farfán became the administrative center for the Jequetepeque Valley under Chimú and Inca rule (Mackey 2006:328). During each occupation new structures were built, eventually creating the six compounds of Farfán that can be seen today along the Pan-American Highway (Figures 10 and 11, Table 5). The investigation of Farfán, therefore, represents an important case study on how imperial conquest can be documented using ethnohistory (Conrad 1990) and archaeology (Mackey 2006, 2009).

Occupation	Date	Compounds built	Brick forms
Lambayeque	1100-1310	III	Flat rectangular
Chimú	1310-1460	II, IV and VI	Flat rectangular, some with slightly bulging top
Inca	1460-1532	I and V	Flat rectangular, plano-convex, and oval

Table 5. Dates, compounds, and brick forms of the three occupations of Farfán (Moore and Mackey 2008: figure 39.3).

Farfán's northernmost compound (Compound VI) is more than 3 kilometers from its southernmost compound (Compound I), even

though the east-west extent of the site is no more than 0.25 kilometer. Compound II was the first compound built by the Chimú at Farfán. It is identified as Chimú because it contains architectural elements similar to those at Chan Chan, the Chimú capital (Keatinge and Conrad 1983:271). For example, like the Ciudadela Rivero of Chan Chan, the only entrance to Compound II is from the north. Visitors first encounter a plaza, followed by a series of storerooms and *audiencias*, or U-shaped niched rooms. The storerooms or bins may have contained valuables, and someone sitting in the *audiencia* would be able to control access to the bins (Andrews 1974:256), or, according to John Topic (2003:251-252), keep track of the number of goods in the storerooms. At the southern end of the compound lies the burial platform (Figure 10), which overlooks another set of plazas and storage bins. This arrangement of plazas, storerooms, *audiencias*, and burial platforms at Compound II is analogous to the architectural layout of the late-period *ciudadelas* of Chan Chan (Mackey 2009).

Keatinge and Conrad (1983) excavated Compound II of Farfán to investigate Chimú expansion into the Jequetepeque Valley. Based on an ethnohistorical account by Calancha (1977 [1638]), Keatinge (1982:206-209) proposed that Compound II was the palace of Pacatnamú, a Chimú general who conquered the Jequetepeque Valley during the first wave of Chimú expansion (Mackey 2009). Calancha (1977 [1638]:1228-1229) mentioned a chain of mountains 3 *leguas* (fifteen kilometers) long next to the palace of Pacatnamú, and the mountain range next to Farfán, Cerro Faclo, is indeed about fifteen kilometers long.

The geographic and economic importance of the Jequetepeque Valley may have been the initial motivation for conquering that region (Conlee *et al.* 2004:216); the valley was situated between Chan Chan and the metal ores of

Cajamarca (Lechtman 1976:14), the Sicán polity in the Lambayeque Valley (Heyerdahl *et al.* 1995; Tschauner 2001), and the prized *Spondylus* shell in Ecuador (Cordy-Collins 1990; Pillsbury 1996). Keatinge and Conrad (1983: 282) postulated that, after the conquest of the Jequetepeque Valley, Chimú administrators at Farfán managed the flow of information and goods from lower level sites in the valley (Talambo, for example) to Chan Chan.

From 1999 to 2004, Mackey excavated all the compounds of Farfán (Mackey and Jáuregui 2004). Mackey's work showed that Compound III was built by a local polity prior to the Chimú invasion, and the Inca empire continued to use the site after conquering the north coast around A.D. 1460 (Mackey 2003). Located at the "crossroads of empires" (Kosok 1965:118), Farfán hosted a heterogeneous mix of local, Chimú, and Inca personnel, demonstrating its importance as an administrative center in the lower Jequetepeque Valley.

ADOBE STRUCTURES AT FARFÁN

Almost all the structures at Farfán consist of adobes. Walls made from tapia are present, but rare. The compounds were made from adobes, and some perimeter walls, like those of Compound IV, still reach 4.5 meters in height (Figure 12). At its base, the width of the perimeter wall ranges from 1.7 to 3 meters, with large rocks serving as the foundation. Some perimeter walls taper as they ascend, perhaps to ensure stability. Walls within the compounds are not as high as the perimeter walls. They do not taper as they ascend, nor do they have large rocks as their foundation. Instead, a layer of gravel serves as the foundation for these internal walls.

The compound walls were made from adobes. In building the walls, Chimú masons set down layers of bricks bound by mortar. Sometimes broken bits of mortar or adobes were used

as fill, a practice observed at Chan Chan (Day 1982a: 340). After all the bricks were laid down and mortared, masons applied a layer of mud plaster (about three centimeters thick) to both sides of the wall. The bricks were arranged in the header-stretcher or header-runner configuration; *i.e.*, the adobes in each layer were placed perpendicular to the layer above and below. One layer would have bricks parallel (length-wise) to the wall, and the layer above would have bricks perpendicular to the wall, and so on. All the walls and structures at Farfán were built in the header-stretcher configuration.

Construction at Farfán reflects both local (Jequetepeque Valley) and Chimú (Moche Valley) traditions (Table 6). Like the structures at Chan Chan, the perimeter walls of Farfán compounds were made almost entirely of flat rectangular bricks. Structures from Pacatnamú, a Late Intermediate Period site in the Jequetepeque Valley, have both rectangular and plano-convex bricks. Plano-convex bricks, which have a bulging top surface, are common in Late Intermediate Period structures from the Lambayeque and La Leche Valleys. Some structures at Farfán, especially Inca period annexes and modifications, have a mixture of rectangular and plano-convex bricks.

All adobe walls and structures (*e.g.* burial platforms) at Farfán were made from solid adobes. In contrast, certain walls from Chan Chan exemplify the chamber-and-fill method (Day 1982b: 55-57). At Chan Chan, bricks at the base of the walls are larger than bricks on top (Kolata 1982:68), a phenomenon not observed at Pacatnamú (McClelland 1986:41) or Farfán. Bricks from Farfán, Chan Chan (Kolata 1978:163), and Pacatnamú (the only exception being some marked bricks from a ramp; see McClelland 1986:39) do not have makers' marks. In contrast, makers' marks are present on bricks from the Late Intermediate Period site of

Túcume in the La Leche Valley (Sandweiss 1995:164-166).

	Chan Chan	Pacatnamú	Farfán
Brick type	Mostly rectangular, few plano-convex bricks	Mixture of rectangular and plano-convex	Chimú period construction made with rectangular bricks; add-ons and later structures show mixture of rectangular and plano-convex bricks
Wall construction	Solid bricks and chamber-and-fill	Solid bricks, some chamber-and-fill	Solid bricks
Presence of segmentation	Yes	Yes	Not observed
Larger bricks found near the bottom of the wall	Yes	No	No
Makers' mark	No	No (present only in one ramp)	No

Table 6. Comparison of construction techniques at Chan Chan, Pacatnamú and Farfán.

The walls at Farfán do not exhibit segmental construction, a practice noted at Chan Chan (Day 1982b: 57) and Pacatnamú (McClelland 1986:41). Exposed wall surfaces at Compounds II and IV of Farfán, where wall plaster had been removed by rain or wind, revealed no sign of segmentation.

Bricks from Farfán are more similar to those from Pacatnamú (*ibid.*: figure 4), a local Jequetepeque Valley site, than those from Chan Chan. The later *ciudadelas* of Chan Chan were built using tall rectangular adobes, a type entirely absent at Farfán. Compound II of Farfán, therefore, imitated the layout of these later Chan Chan *ciudadelas* from the Moche Valley, even though its adobes were manufactured by local brickmakers, rather than by brickmakers (using their own their molds) from the imperial capital. This is a case, then, of local masons building structures after the style of their conquerors,

similar to how native Andeans built churches in the Spanish canon during the colonial period (Fraser 1990).

ANALYSIS OF BRICK VARIABILITY AT FARFÁN

Over the course of six field seasons (1999-2004), 4,826 bricks from Farfán were measured (Table 7). Members of the Farfán Archaeological Project recorded the length, width, height, shape, and location of the bricks. Farfán's bricks had three shapes: rectangular, plano-convex rectangular (rectangular bricks with "rounded tops" [Kroeber 1930:58]), and plano-convex oval (Figure 13). The rectangular bricks were made from molds, whereas the plano-convex oval bricks were hand-made (Shimada 1990: 352). Chimú period constructions consisted almost exclusively of rectangular bricks, whereas subsequent Late Horizon structures included all three brick shapes. My analysis will concern only rectangular bricks from Chimú contexts.

Compound	n	Length	Width	Height	L/W ratio	H/W ratio
I	152	29.8	16.7	11.8	1.80	0.71
II	775	30.7	17.2	10.9	1.82	0.64
III	1695	30.2	17.4	11.4	1.75	0.67
IV	583	29.3	17.3	10.9	1.72	0.64
V	116	28.5	19.1	13.2	1.53	0.70
VI	1505	28.7	18.1	12.4	1.61	0.70

Table 7. Average length, width, height, length-to-width ratio, and height-to-width ratio of bricks from the six compounds at Farfán.

Prior to 2003, all sampled bricks came from excavation units that exposed architectural features such as walls, floors, benches, doorways, and so on. In 2003 and 2004, I made four cuts in the perimeter walls of Compound II (Figure 10), and one in Compound I. In each cut, the exact position of the bricks was recorded by

noting the layer, row, and orientation (header vs. stretcher).

Brick Change through Time

According to Kolata (1978, 1982), flat rectangular bricks are associated with the earlier *ciudadelas* of Chan Chan, whereas tall rectangular bricks are associated with later ones (see also Cavallaro 1991:15-18). In other words, earlier *ciudadelas*, such as *Ciudadela Tello* and *Ciudadela Uhle*, have bricks with lower height-to-width ratio than bricks from later *ciudadelas*, such as *Ciudadela Gran Chimú* and *Ciudadela Laberinto*. No rectangular brick from Farfán, even those from late contexts (Inca period), approach the height-to-width ratio of the tall bricks at Chan Chan.

Three different projects sampled the bricks from Compound II at Farfán: Kolata (1978:190), Keatinge and Conrad (1983:274), and the present study. The bricks I sampled in Compound II (n=775) have an average height-to-width ratio of 0.64; Keatinge and Conrad's (1983:274) height-to-width ratio for Compound II is 0.56 for the *audiencia*/storeroom complex (n=13) and 0.57 for the burial platform (n=140); Kolata's (1978:190) brick samples from Farfán yielded an average height-to-width ratio of 0.732 (sample size unknown). Tello (2004:33) also mentioned a general dimension of bricks from Farfán (29 by 18 by 10 centimeters, or 0.55 height-to-width ratio), though he did not specify the sample size or where the bricks were measured.

These differences in the measurements of Farfán bricks show that different parts of Compound II have bricks with different dimensions (Table 8). For instance, bricks from Cut 2 (n=108) have a height-to-width ratio of 0.78, whereas bricks from Cut 4 (n=101) have a height-to-width ratio of 0.61. Hence a limited sampling of bricks would not accurately charac-

terize the variability of bricks within a compound or site.

Location	n	Length (cm)		Width (cm)		Height (cm)	
		Mean	s	Mean	s	Mean	s
Storeroom 2	48	29.79	2.72	16.98	2.02	11.42	1.46
Storeroom 3	52	30.06	1.78	17.81	1.66	10.79	1.45
Storeroom 4	83	31.28	2.39	17.52	1.91	12.16	1.26
Cut 1	110	31.73	3.25	16.63	2.40	11.15	1.45
Cut 2	108	30.06	1.81	14.14	1.99	9.57	1.06
Cut 3	131	29.47	1.57	17.70	1.22	10.31	1.01
Cut 4	101	32.51	2.47	18.15	1.79	10.95	1.49

Table 8. Bricks from Compound II, Farfán.

At Farfán, a diagnostic feature of later buildings is the plano-convex brick. Except for some slightly plano-convex bricks (n=3) found in Cut 1, all Chimú bricks at Farfán were rectangular. Plano-convex bricks appear in annexes and renovations that date to the Late Horizon or Chimú-Inca horizon. For example, one structure north of Compound II, Elite Residence C (not shown in Figure 10), was built entirely of oval plano-convex bricks.

Synchronic Differences in Brick Dimension

To test for synchronic differences in brick size, one must isolate an area in which the structures were built within the same period. Once chronological contemporaneity is established, the analysis of brick variation can be conducted at various levels—comparing different layers of adobes within a sampling cut, comparing different sampling cuts within a wall, comparing different sampling cuts within a compound, comparing different compounds within the site, and so forth.

To investigate synchronic differences in brick dimension, I placed four adobe sampling

cuts on the perimeter walls of Compound II (Figure 10, Table 8). The perimeter walls of Chan Chan prevented outsiders from looking inside the rectangular compounds (Moore 1996:117-118); thus the perimeter walls of Farfán presumably had to have been built before the compound could function properly. The perimeter walls were likely built in a relatively short time, in months or years, but not decades or centuries. It is unlikely that any administrator (perhaps General Pacatnamú) had to wait many years before a compound came into use. In addition, because no separate wall segments were found at Farfán, I sampled adobes from different storerooms to test whether each storeroom was built by a separate group of workers.

While measuring the bricks from Farfán, my first impression was that one area of the site did not have bigger or smaller bricks than any other area. A scatterplot of bricks sampled from three different storerooms seemed to confirm my observation (Figure 14). Yet the cluster analysis of these bricks (with length and width as the variables, three cluster solution, Ward's method) shows that the differences between the storerooms *are statistically significant* (Table 9). In other words, the difference is very subtle and not visually obvious. Such minor differences also exist between parts of the perimeter wall. Bricks from Cut 2, for example, are generally narrower than other bricks in Compound II (Table 8), whereas bricks from Cut 4 tend to be longer.

Storeroom	Cluster 1	Cluster 2	Cluster 3	Total
2	12	23	13	48
3	7	39	6	52
4	41	33	9	83

Table 9. Bricks from the storerooms of Compound II, Farfán. Cluster analysis of the bricks, with length and width of the variables (three cluster solution, Ward's method) and chi-square analysis of the clusters show that the size difference between bricks from different locations is statistically significant ($p < .0001$).

The difference in brick sizes between the cuts, even though small, is statistically significant. Median test (Siegel 1956:111-116) comparing the length, width, and height of bricks from different sampling cuts shows that there is less than 0.1 percent chance that the bricks came from the same population (1-way test, ChiSquare = 45.6776; $df = 2$; $p < .0001$). In other words, it is unlikely that all the bricks from Compound II came from a single maker. This suggests that multiple brickmakers were involved in the construction of Compound II, and that one area of construction (a storeroom or a section of a wall) might contain more bricks made by, say, Brickmaker A than by Brickmaker B. The difference between bricks of different sampling cuts is not visually obvious. There is too much overlap in brick dimensions to distinguish bricks from different sampling cuts (Figures 14, 15). One cannot say with confidence, from size alone, where a brick was used. Rectangular bricks sampled from Compound IV, which dates to the Chimú occupation (Mackey 2009: 330), all tend to measure (give or take a few centimeters) 30 by 17 by 11 centimeters (Figure 16). Therefore size or dimensions cannot be used to determine where a brick should be placed in the compound. Both Brickmaker A and Brickmaker B contributed bricks to the construction of Storeroom 2, though we cannot separate the two kinds of bricks after they are pooled and mixed.

One section of the north wall of Compound IV had alternating layers of bricks made from different kinds of soil (Figure 17). Some layers had greater amounts of rock inclusions than the layers above and below. Alternating layers of adobes with different makers' marks were found at Galindo, a Moche site (Lockard 2008:287-289); these patterns suggest that certain sections of a wall or building were built in horizontal stretches with adobes from different sources or workshops. At Farfán, bricks found within the same cut sometimes have different dimen-

sions (Figures 18-21, Table 10). This shows that bricks made from different molds (and by inference, different brickmakers) were placed in the same area within the wall.

Number	Layer	Length (cm)	Width (cm)	Height (cm)	Orientation
1	5	29	18	13	Stretcher
2	5	29	16	13	Stretcher
3	5	29	16	11	Stretcher
4	5	27	18	10	Stretcher
5	5	29	16	12	Stretcher
6	5	28	18	9	Stretcher
7	5	31	19	10	Stretcher
8	5	28	18	11	Stretcher
9	5	29	16	12	Stretcher
10	5	28	18	9	Stretcher
11	5	28	19	10	Stretcher
12	5	27	18	9	Stretcher
13	5	29	18	9	Stretcher
14	5	29	17	10	Stretcher
15	5	30	16	10	Header
16	5	27	18	9	Stretcher
17	5	28	18	10	Stretcher
18	6	27	18	10	Header
19	6	29	18	10	Header
20	6	27	17	9	Header
21	6	28	15	12	Header
22	6	30	18	11	Header
23	6	27	17	10	Header
24	6	32	15	10	Header
25	6	28	17	10	Header
26	6	28	18	10	Header
27	6	33	20	11	Header
28	6	31	17	10	Header
29	6	30	17	10	Header
30	6	28	17	9	Header
31	6	30	19	10	Header
32	6	32	17	9	Header
33	6	29	19	10	Header
34	6	29	18	11	Header
35	6	33	20	12	Header
36	7	30	20	10	Stretcher
37	7	30	19	9	Stretcher
38	7	29	18	11	Stretcher
39	7	27	19	10	Stretcher
40	7	30	16	10	Stretcher
41	7	29	17	8	Stretcher
42	7	30	18	10	Stretcher
43	7	29	18	10	Stretcher
44	7	29	17	11	Stretcher
45	7	29	18	10	Stretcher
46	7	29	17	10	Stretcher
47	7	30	18	10	Stretcher
48	7	30	18	10	Stretcher
49	7	29	17	10	Stretcher
50	7	30	18	9	Stretcher
51	7	29	20	10	Stretcher
52	7	29	17	11	Stretcher
53	7	35	17	12	Stretcher
54	7	29	16	11	Stretcher
55	8	30	18	10	Header
56	8	32	18	10	Header
57	8	28	18	10	Header

/Continued

Number	Layer	Length (cm)	Width (cm)	Height (cm)	Orientation
58	8	27	18	9	Header
59	8	28	19	10	Header
60	8	27	19	9	Header
61	8	26	18	9	Header
62	8	33	16	11	Header
63	8	33	15	9	Header
64	8	33	15	9	Header
65	8	29	15	11	Stretcher
66	8	26	17	8	Header
67	8	29	18	10	Header

Table 10. Measurements of adobes from Layers 5 to 8 of Cut 3, Compound II, Farfán.

DISCUSSION

My data show many important differences in brick production and construction between Huaca de la Luna and Farfán. To account for these differences, I suggest that at Huaca de la Luna, Moche brickmakers dried their adobes in separate areas (Figure 22 or Model A in Figure 3). Each group of Moche workers then built the pyramids from their respective pool of bricks. There was some exchange of bricks between work parties, but this exchange was minimal. As a result, archaeologists can still identify different groups of bricks with unique makers' marks or sizes at Huaca de la Luna. My data corroborate earlier observations made by Hastings and Moseley (1975:202-203).

By contrast, brickmakers at Farfán placed their bricks together to dry, and a group of workers, separate from the brickmakers, went to this pool of bricks to construct walls for the compounds. As a result, archaeologists find a mix of different brick sizes within a construction segment (Figure 22 or Model B in Figure 3). Because the bricks were pooled and mixed, the difference in brick size between the walls or storerooms at Farfán is not as strong as the difference in brick size at Huaca de la Luna (compare Figure 7 with Figure 14).

Why did Moche bricklayers use separate columns of adobes to distinguish one part of the monument from another, while Chimú bricklay-

ers did not? One explanation is that Chimú rectangular compounds at Farfán, unlike constructions at Huaca de la Luna or Huaca del Sol, could be divided into clear subunits. For example, one work group could be assigned to finish all the storerooms, whereas another work group could be responsible for building the perimeter wall. Indeed, Day (1982a: 340) suggested that at Chan Chan “smaller walls of structures within *ciudadelas* usually do not have joints or sections, but the volume of these walls is a great deal less than the volume of the large surrounding walls [which were segmented]. Perhaps entire small walls represent task units, equivalent to a section or sections of the larger wall.”

Monuments such as the Huaca del Sol and Huaca de la Luna, in contrast, required “dividers” to differentiate one segment from another. Because the Moche pyramids are mostly solid adobe blocks, it would be very difficult for supervisors to know where one group of workers had started building and where another group had stopped without some kind of segmentation. Separate segments, therefore, could help distinguish one task from another.

To explain why makers’ marks were used by Moche but not by Chimú brickmakers, I suggest that Moche brickmakers were not as closely monitored as Chimú brickmakers. With makers’ marks, a Moche state official, instead of having to visit the adobe workshops and supervise brick production, was able to (1) receive the bricks at the site of construction, (2) identify the maker and transporter of the bricks, and, (3) ensure that each group of laborers completed their unit of construction using bricks from their own community (and not accidentally “borrow” the bricks of others). If state officials personally supervised every stage of the production and construction, then makers’ marks would not have been needed to account for labor effort. And this is what I believe the Chimú officials did: they replaced makers’ marks as a form of

labor “receipt” or “punch card” with direct supervision and monitoring.

This difference between Moche and Chimú methods of supervision could be due to (1) the distance between the area of adobe production and the construction site or (2) the degree of state centralization. First, if Chimú brick manufacture occurred near the site of construction, then Chimú officials could directly observe which communities were making the bricks and supervise construction at the same time. In contrast, if Moche brick manufacture occurred away from the pyramids, then Moche officials could not witness the production of adobes. Instead, they waited at the construction site, received the adobes, and credited the work of each community by examining the makers’ marks.

It is also possible that under the Chimú, specialized groups of brickmakers and bricklayers were directly under the command of local lords, who were themselves subordinates of the overarching Chimú state. In this specialized system, each group of brickmakers or bricklayers became the unit of labor tribute, and because the state was no longer keeping track of different communities, the laborers’ work resulted in a diversity of adobe shapes and sizes within a section of a wall or building. This contrasts with the Moche system, in which the unit of tribute was a community or *ayllu*. Each *ayllu* had its own brickmakers and bricklayers, and Moche state officials had to separate the efforts of different *ayllus*. Specialists in construction, the *albañiles*, were recorded in sixteenth-century Spanish documents from the north coast of Peru (Ramírez 1986: table 11.1). Although it is unclear whether the term *albañiles* referred to brickmakers, bricklayers, or both, such specialists may have originated during the Late Intermediate Period. They may have worked on state projects for a few months, paying a time-based

labor tax similar to that imposed by the Inca (LeVine 1987:24).

The Sicán pattern of adobe construction, as documented by Cavallaro and Shimada (1988), may represent an intermediate stage between the Moche and Chimú states: like the Moche, Sicán adobe production occurred away from the construction site, thereby requiring makers' marks. The Sicán system of construction, however, was specialized (like the Chimú system) and entailed separate groups of brickmakers and bricklayers, and, therefore, resulted in the mixture of bricks observed at Farfán (Table 11). Thus I would argue that Shimada's task differentiation-labor tax model (Model B in Figure 3) best describes Sicán and Chimú forms of labor organization, whereas the Moche form of labor organization is best described by Moseley's labor-task model (Model A in Figure 3).

	Brick production	Drying bricks	Construction
Moche (A.D. 100-800)	Makers' marks → production not monitored.	Separate areas	Same brick mark for a seg- ment. Hence brickmakers came from the same commu- nity as the bricklayers of a single segment.
Sicán (Middle and Late, A.D. 900- 1375)	Makers' marks → production not monitored.	Pooled	Mixed brick sizes and makers' marks. Bricklayers dif- ferent from the brickmakers.
Chimú (A.D. 900- 1470)	No makers' marks → production monitored.	Pooled	Mixed brick sizes. Bricklayers dif- ferent from the brickmakers.

Table 11. Comparison of hypothetical Moche, Sicán and Chimú processes of brick production and construction.

The scenario I have proposed can be tested in various ways. First, when different communities come together to build one large monument, I would expect some kind of division to distin-

guish the construction of one segment from another. In this case, we need more data on bricks from sites dating to the time between Huaca de la Luna and Farfán to detail the relationship between monuments, construction techniques, and segmentation. I would expect that as structures become more internally heterogeneous, that is, having more and different architectural features—storerooms, platforms, benches, ramps, corridors—there would be less need to have unbounded segments, because each internal feature would serve as a unit of labor taxation.

Second, as the site of brick production moves farther from the site of construction, state officials can either visit every adobe workshop (which is time consuming) or stay on-site to make sure that enough bricks had been brought to the building area. In the case of the Moche, makers' marks were used to help officials keep track of brick production. Future investigations should test my interpretation by sourcing the soil used to make the bricks at Moche and Chimú sites. I would expect Moche bricks to have been made from soil to be found at some distance from the monument, and Chimú bricks to have been made from soil found close to the rectangular compounds.

Finally, I expect more centralized states to have a different type of labor organization than less centralized states. To test this hypothesis, we would need other lines of evidence to determine how much control the state had over its production. The archaeological evidence for centralized control of production and distribution would include pottery or metal workshops and administrative features such as *audiencias* and storerooms. Indeed, researchers working on the north coast of Peru have already proposed that the Chimú state was more centralized with more bureaucratic control over its labor and resources than the preceding Moche states (Topic 2003; Topic 1982:282-283). We could

extend this line of inquiry into coastal valleys beyond the Moche heartland, such as Nepeña, Casma, or Huarmey.

CONCLUSION

Kroeber (1930:61) suggested that, during the construction of “Chimu edifices”, “each contingent of a community” had built “its own wall or column.” He also noted the difference between northern and southern Peru: “most Chimu edifices appear to have been largely reared as units rather than by the gradual accretion which is so often indicated in central and southern Peru” (*ibid.*). The study of adobe construction and its relation to labor organization on the north coast of Peru was continued by Hastings and Moseley (1975), Kolata (1978), Cavallaro and Shimada (1988), and Moubarac (2002).

Moseley’s (1975) model is often cited in overviews of Moche society (Bawden 1996:104-105; Stone-Miller 1995:90-91; Wilson 1999:387), but many scholars who work in the Andes do not know that makers’ marks were not used at later sites like Chan Chan, or that there is a diversity of makers’ marks and brick sizes within one segment of a Sicán pyramid. Subsequent changes in adobe production and construction among polities such as the Sicán and Chimú indicate a restructuring of labor organization by second- or third-generation states on the north coast of Peru.

I suggest that, at Farfán, Chimú officials supervised the entire process of brick production and construction. Because Chimú officials could witness and count the number of bricks made by each community, makers’ marks or other types of labor record were not needed. By contrast, Moche state officials did not supervise the production of bricks. Local communities made bricks away from the site of construction and away from the supervision of officials. Moche adobe workshops therefore marked their bricks

to make sure that they would receive credit for their labor. Moche state officials then received the bricks at the site of construction and oversaw the completion of a building.

Despite the one hundred kilometer and seven hundred year gap between Huaca de la Luna and Farfán, there is no *a priori* reason to assume that construction methods at the two sites were different or the same. It is not adequate (nor accurate; see Topic 1982:280-282) to refer to the Chimú as another “ethnic” group to explain its differences with the Moche, since we still need to account for the origin of Chimú principles of adobe production and construction, or any other Chimú practices, which, like all cultural traits, did not emerge out of nowhere. To address this lacuna in our data, I recommend a continuation of the present study by investigating labor organization in the valleys from Jequetepeque to Moche, spanning the Early Intermediate Period to the Late Horizon. Such long-term investigation of adobe construction and labor organization has already been initiated in the Lambayeque region (Shimada 1997).

Future studies of adobe variability should measure an adequate sample of bricks from different parts of each site and document the exact locale of the bricks. Many more bricks need to be measured *in situ*, especially from Huaca de la Luna. Then we should collect similar data from other sites from different valleys and periods. Tschauner (2001:787-809) has measured adobes at several sites in the Lambayeque region and Reindel (1993) has surveyed the architecture of numerous sites on the north coast of Peru, though both studies lack detailed intra-site brick data. Because “various adobe forms coexist in time and space” (Shimada 1990:355), it is important to measure an adequate sample of bricks. Unless the bricks are perfectly standardized, brick dimension will vary across the site. My recommendation is to sample bricks from different parts of the site,

with at least 100 bricks from each part to assess adobe variability across space. I would also suggest investigating adobe variability through time (in other words, between different cultural periods), which would require the investigator to know when parts of a site were constructed. It would be interesting, for example, to study adobes at sites dating to the Late Horizon to see whether labor organization had changed under Inca administration.

To understand adobe variability within the site, adobe sampling cuts, like the ones made in this study, should be implemented. The investigator should open sections of architecture, observe the construction method, and record the adobe dimensions *in situ*. Documenting adobes *in situ* will allow an investigator to detect the presence (or absence) of vertical or horizontal segments of construction. Furthermore, one should try to look for differences between bricks in horizontal and vertical segments, what the nature of that difference is, and what that might tell us about labor organization.

Smith (2004:92) noted the difficulty archaeologists face when attempting to study labor organization. I suggest that the analysis of construction units, such as stone blocks and bricks, can help us understand how communities or state officials organized labor. On the north coast of Peru, the disappearance of makers' marks means that, at the most basic level of interpretation, the Chimú state recorded labor differently from the Moche. Thus Andean labor organization was not a static, monolithic entity, but was instead a dynamic phenomenon that varied across space and time.

It is possible that the Chimú or Moche state organized labor differently for different tasks like the construction of monuments, cleaning of canals, production of pottery, etc. In order to comprehend this diversity of labor organization, we must document the mobilization of labor

from different sites, in different contexts (monument construction, ceramic production, etc.), and from different regions and periods. Only then can we begin to understand the relationship between the type of labor organization and the nature of the sociopolitical system.

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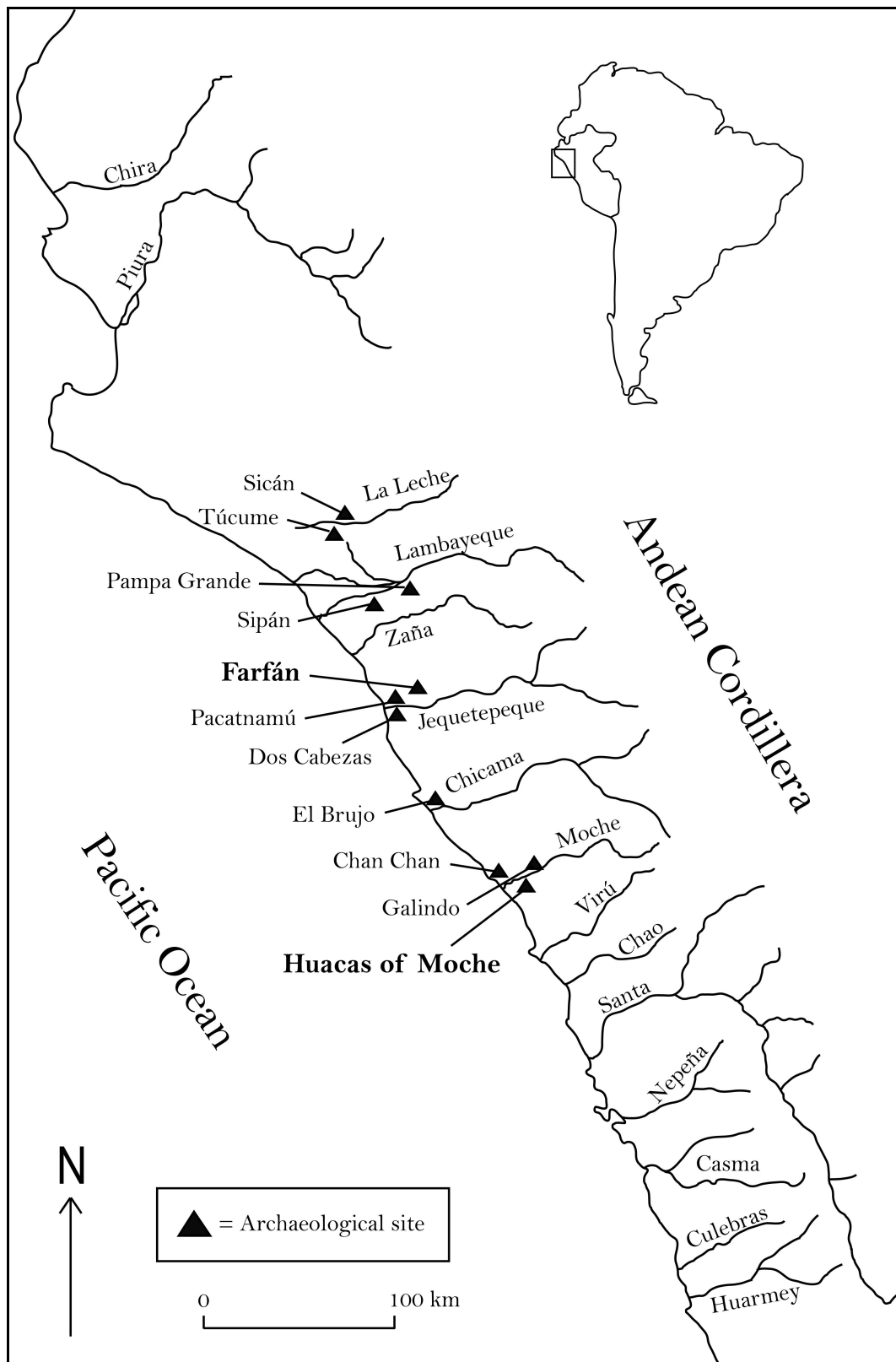


Figure 1: Map of the north coast of Peru. Archaeological sites are indicated by triangles. Solid triangles indicate the sites where bricks discussed in this study were sampled.

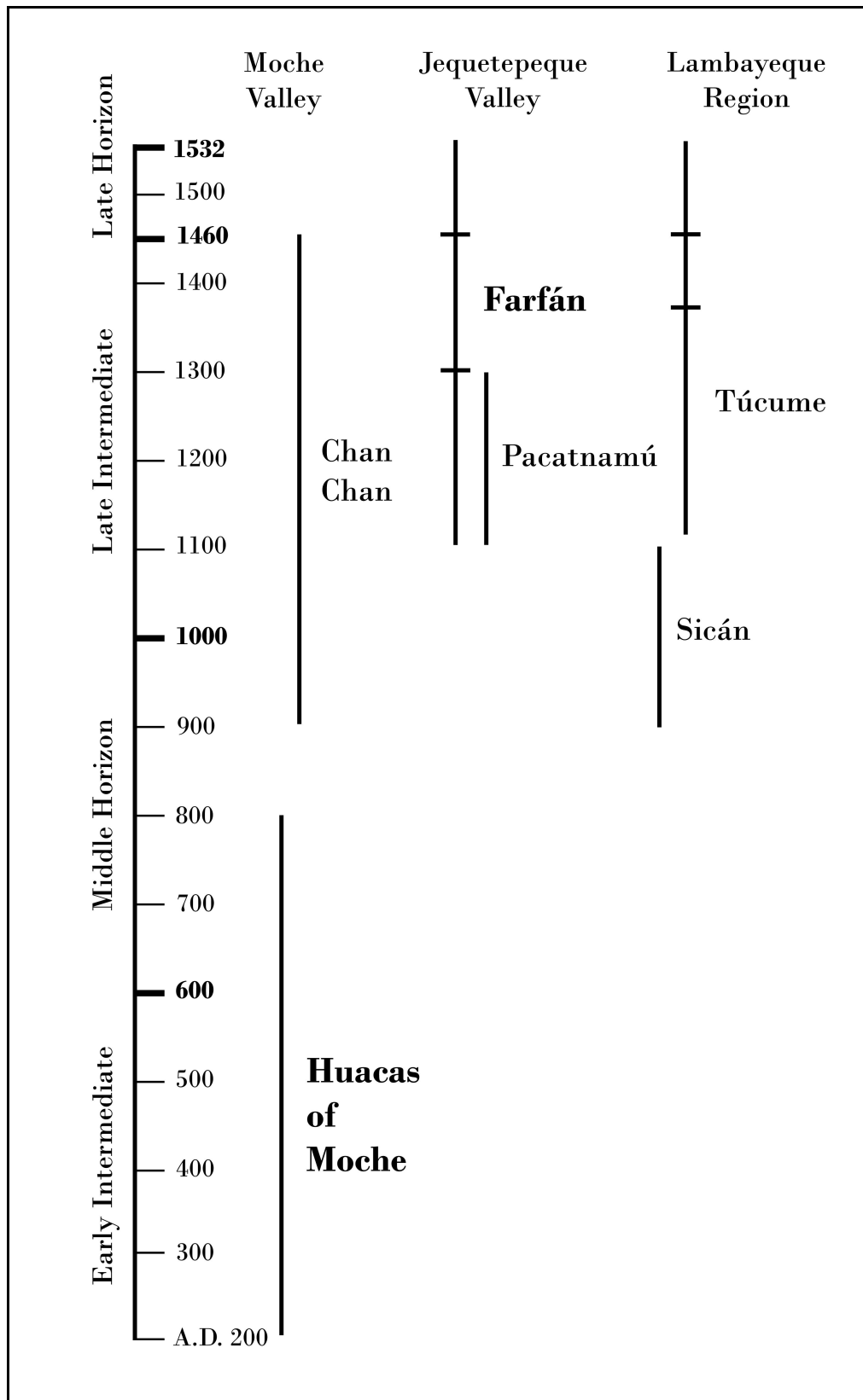


Figure 2: Chronology of some sites mentioned in the text.

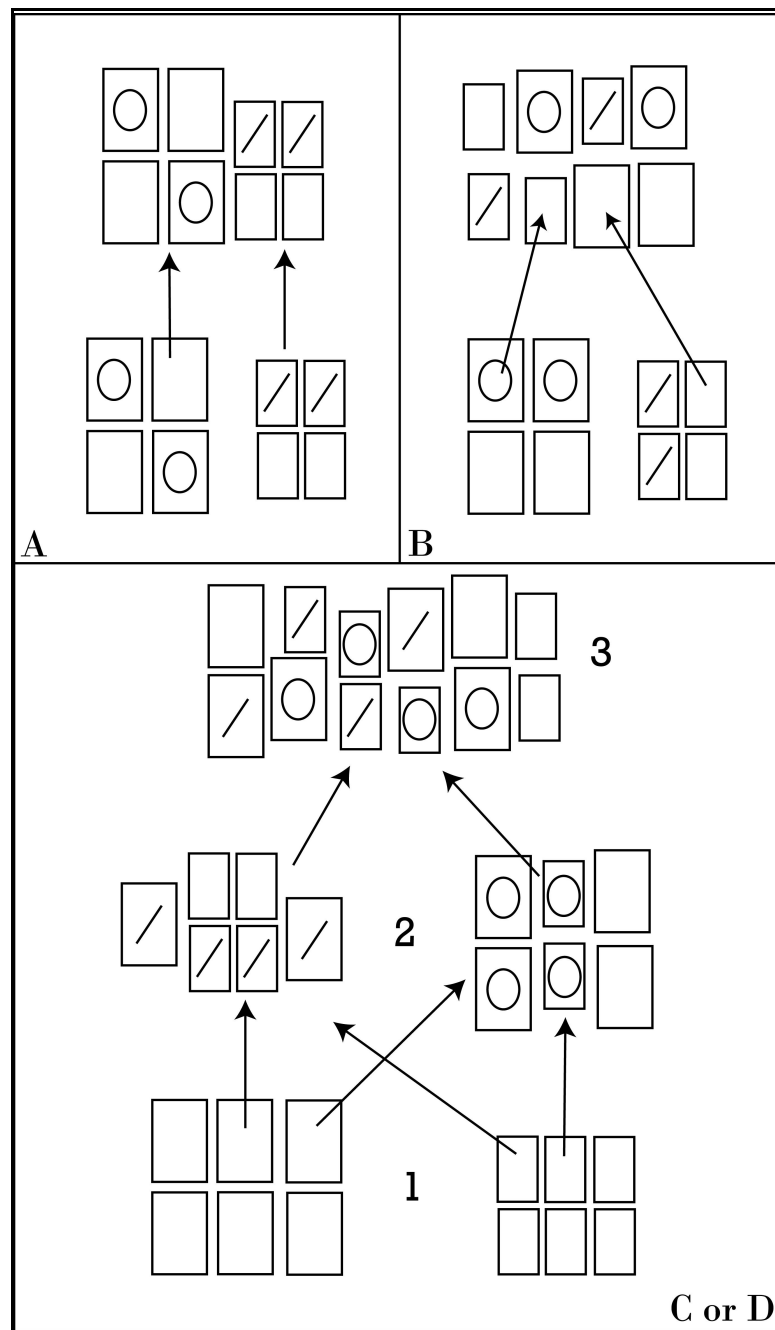


Figure 3: Models of adobe construction and labor organization after Cavallaro and Shimada (1988: figures 11-14): (A) Moseley's labor tax model, (B) task differentiation-labor tax model, (C) discontinuous territoriality model, and (D) sponsor model (Models C and D produce similar results). In Model A, the brick-makers and brick-layers come from the same community, whereas in Model B, the brick-makers and brick-layers are two separate groups of laborers. In Models C and D, (1) each workshop produces bricks of a unique size; (2) the patrons or sponsors then receive bricks from various workshops and incise the bricks with their own marks or "insignia"; (3) The bricks are then donated for the construction of a temple.

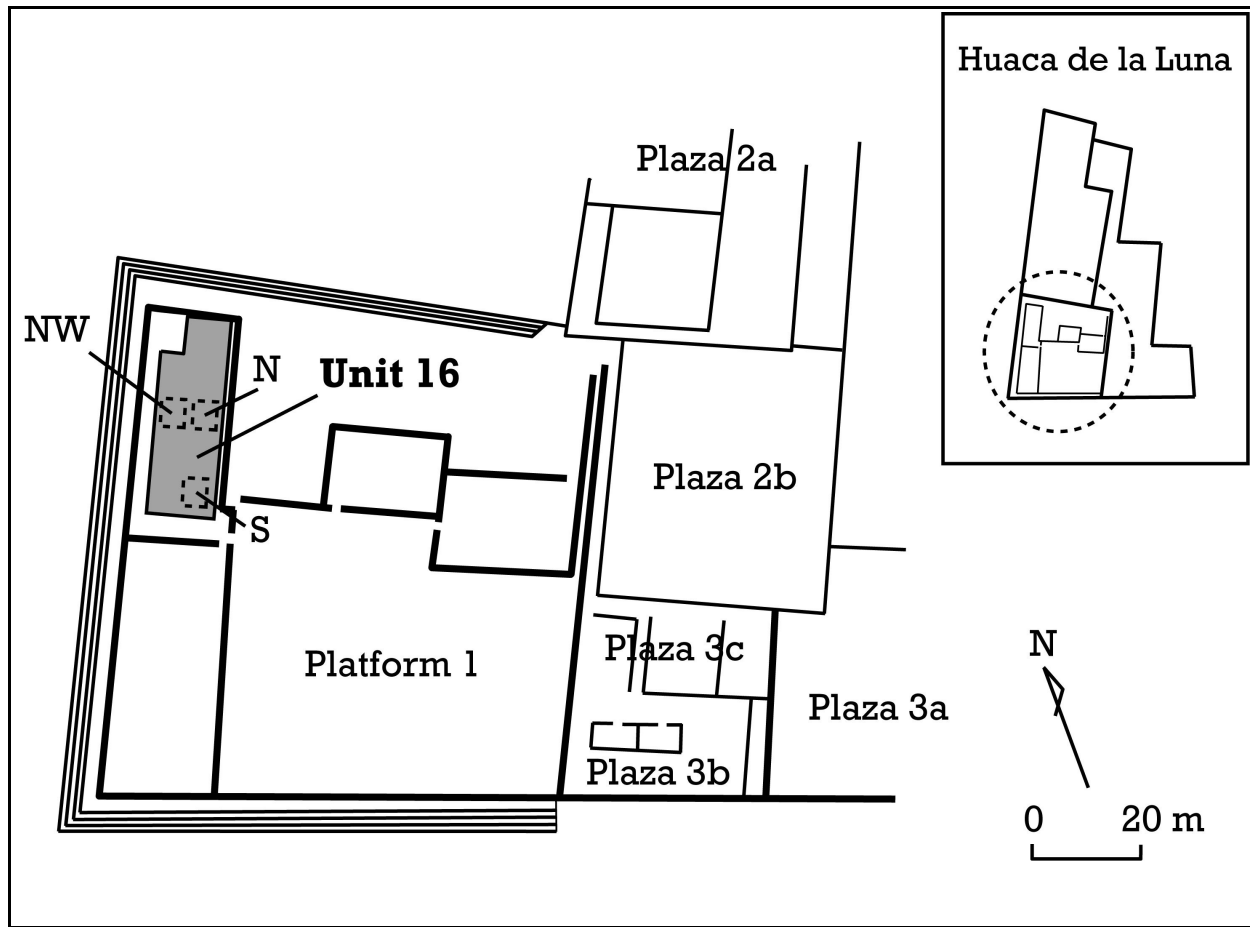


Figure 4: Map showing the location of Unit 16 at Huaca de la Luna. Small boxes with dashed borders indicate areas where adobes were measured (redrawn from Zavaleta 2007: figure 2).

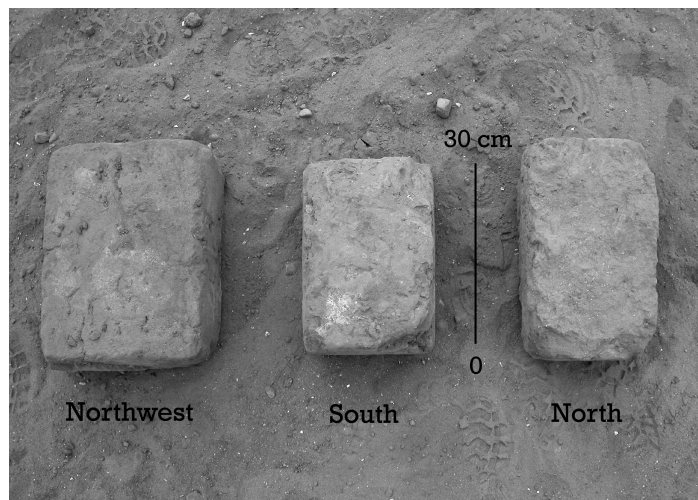


Figure 5: Bricks from three different locations, Northwest, South, and North, within Unit 16 of Huaca de la Luna.



Figure 6: Group of bricks of the same size (31 by 22 by 13 cm) and maker's mark from Unit 16, Huaca de la Luna. The scale measures 20 centimeters.

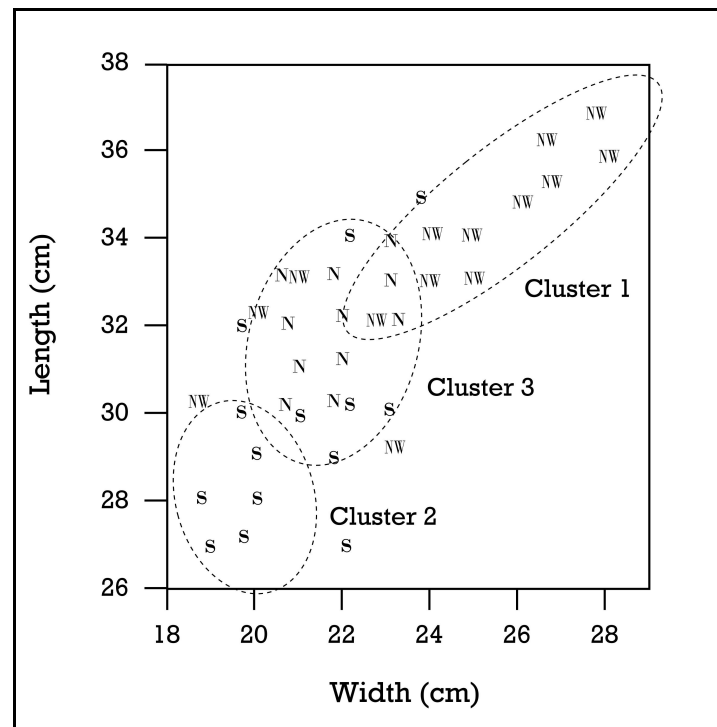


Figure 7: Scatterplot of the lengths and widths of bricks sampled from Unit 16, Huaca de la Luna.

“S” represents bricks from the south side of Unit 16; “N” denotes bricks from the north; and “NW” represents bricks from the northwest corner. The three ellipses with dashed borders represent density ellipses ($p=.95$) drawn around the clusters as indicated by cluster analysis.

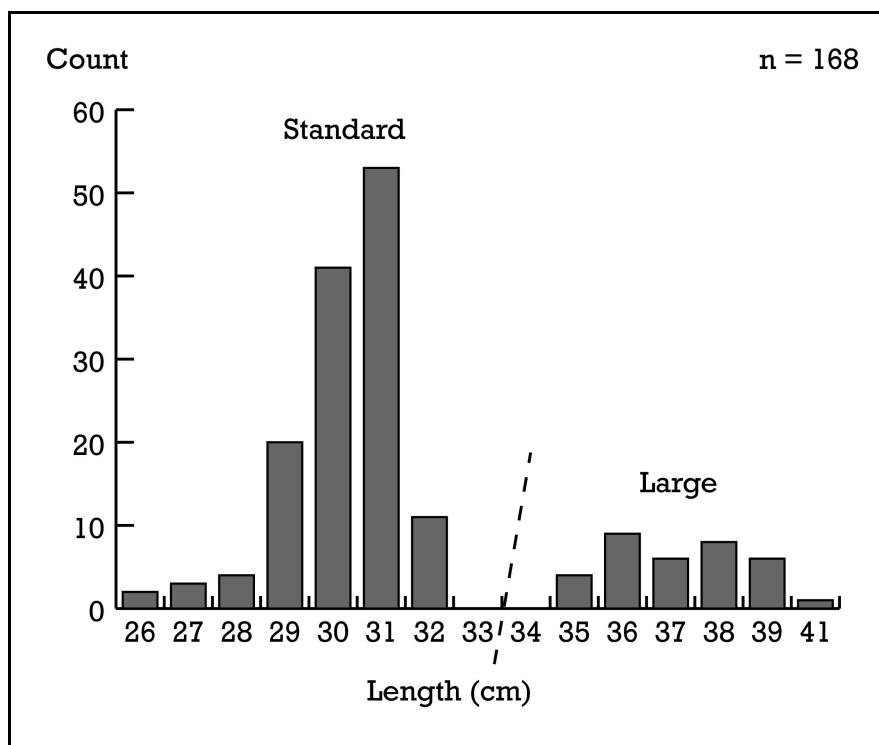


Figure 8: Histogram of lengths of bricks from the Huacas of Moche (data from Moubarac 2002:116-122).

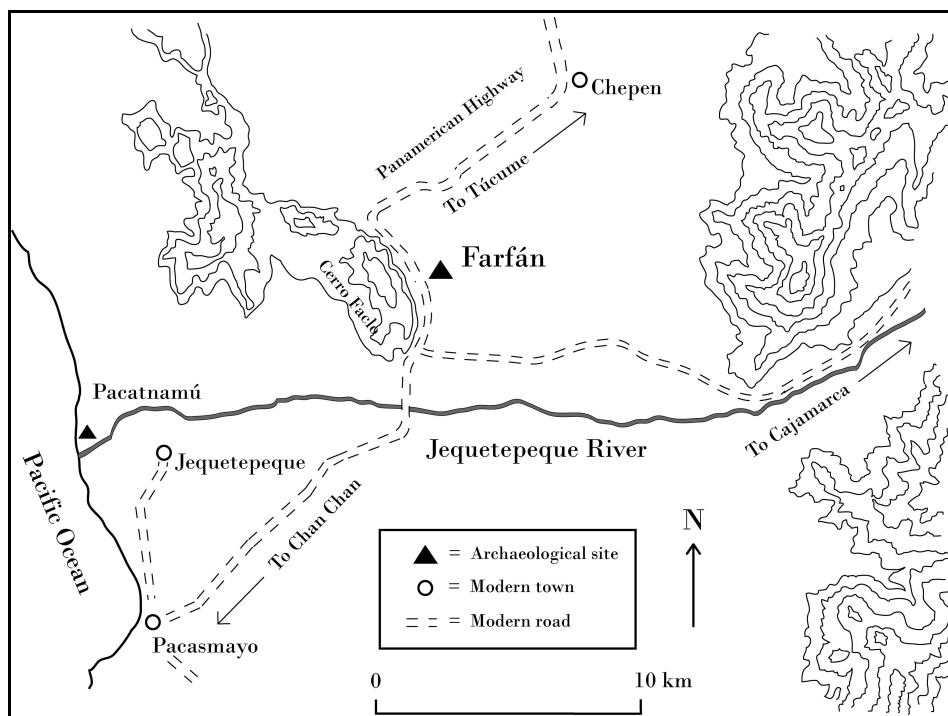


Figure 9: Map of the Jequetepeque Valley.

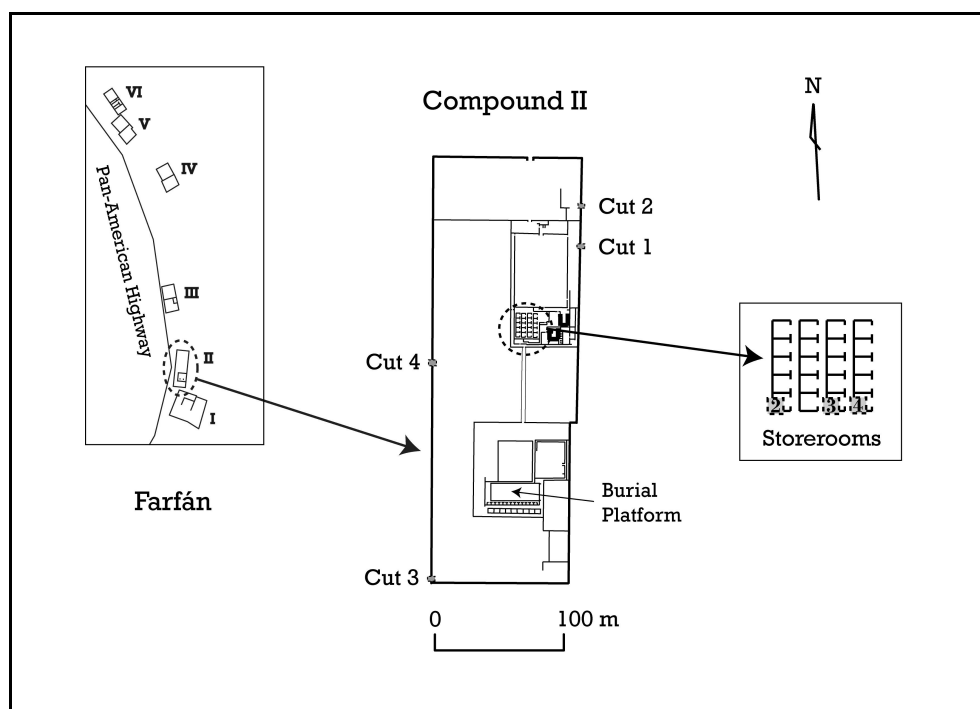


Figure 10: Compound II, Farfán.



*Figure 11: Compound II, Farfán, viewed from Cerro Faclo.
A bus on the Pan-American Highway serves as scale.*

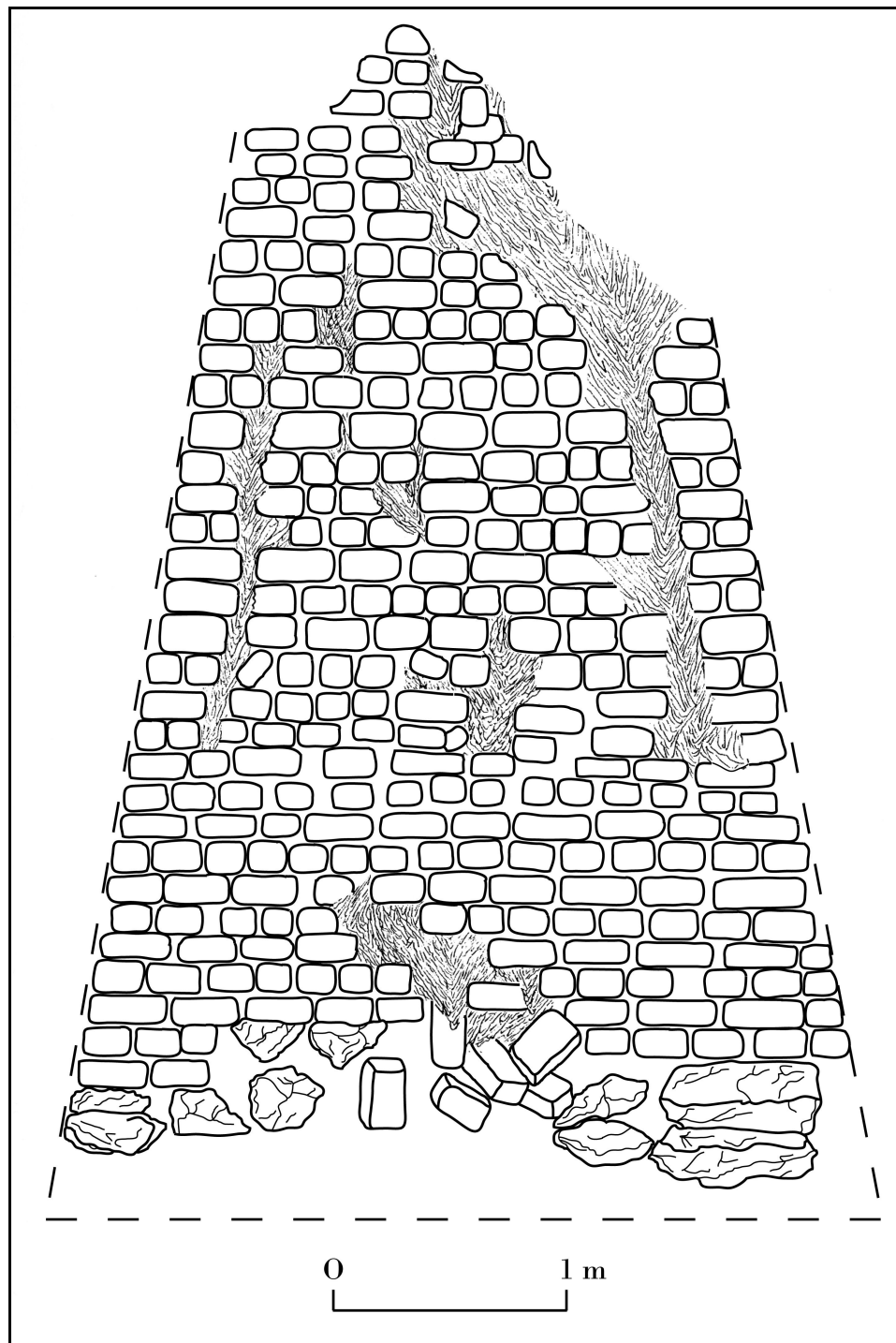


Figure 12: Cross-section of north perimeter wall, Compound IV, Farfán. Note header-stretcher configuration of construction, stone boulder foundation, and wall tapering toward the top (after Mackey and Jauregui 2001:Figure 8).



Figure 13: Three different brick types found at Farfán.
From left to right: plano-convex oval, plano-convex, and rectangular.

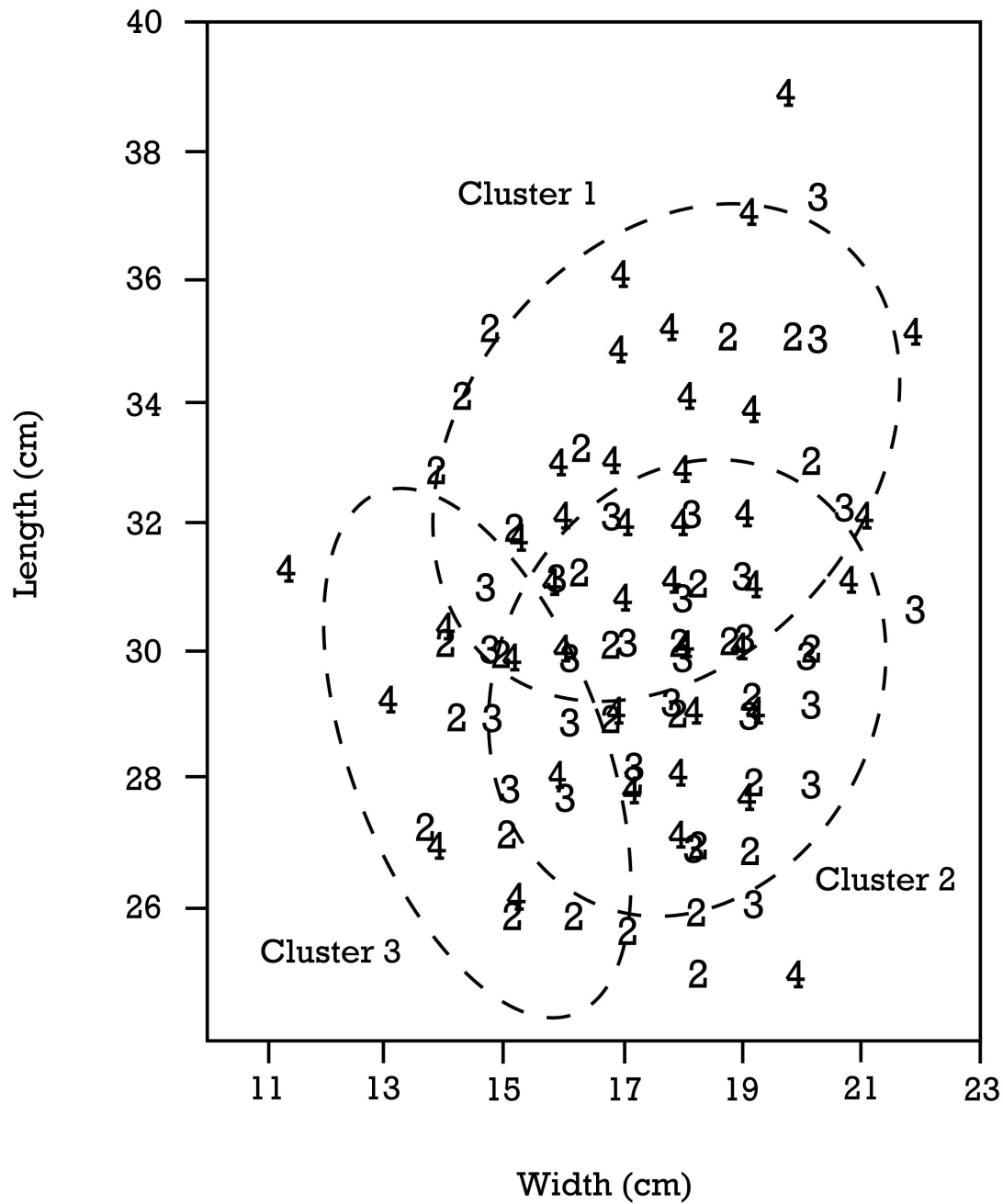


Figure 14: Scatterplot of the lengths and widths of adobes sampled from the storerooms of Compound II, Farfán. The number 2 represents bricks from Storeroom 2; 3 represents bricks from Storeroom 3; and 4 represents bricks from Storeroom 4. Ellipses with dashed borders represent density ellipses ($p=.95$) drawn around the clusters as indicated by cluster analysis. Compare with Figure 7.

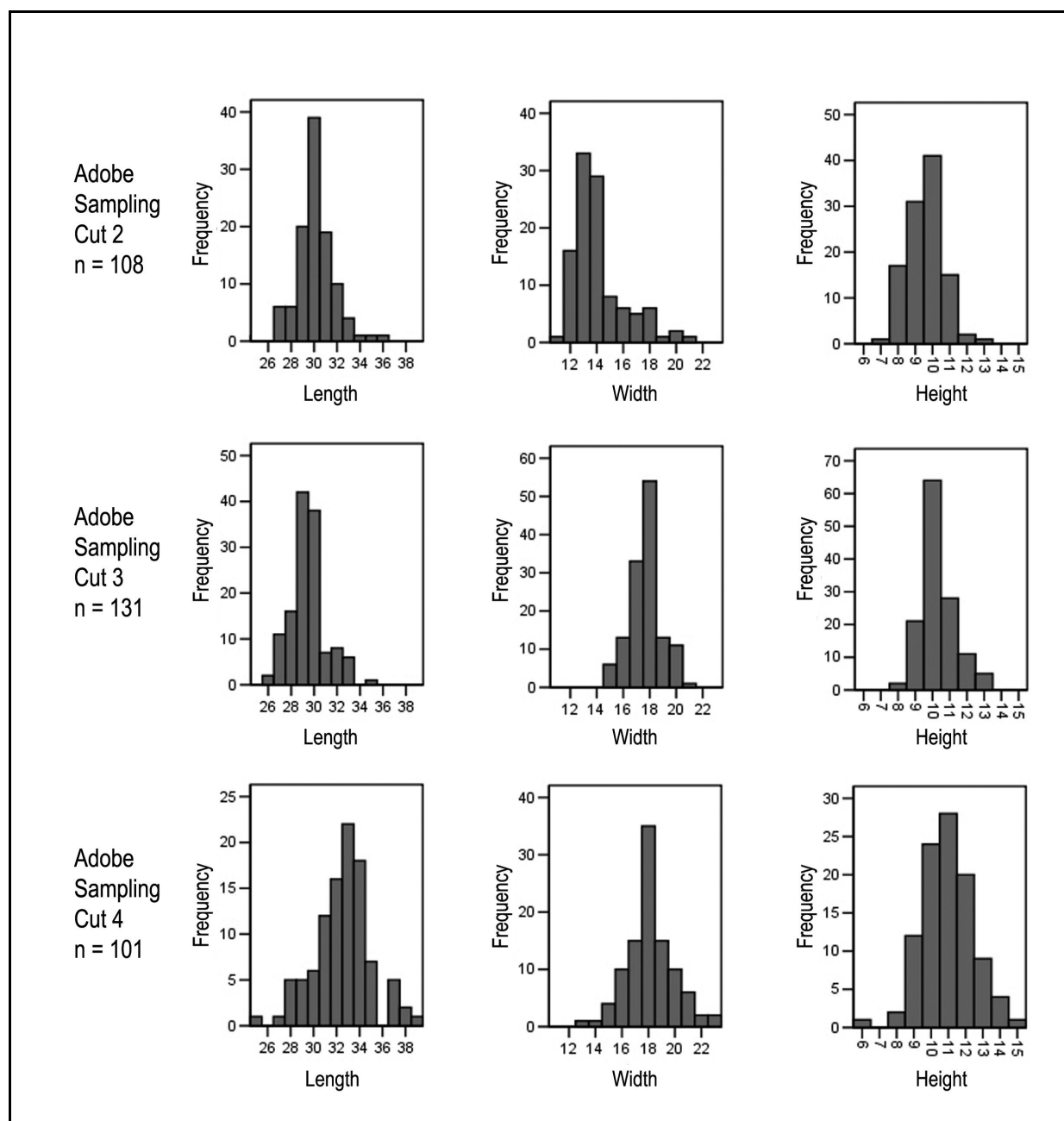


Figure 15: Histograms comparing length, width, and height (in centimeters) of bricks sampled in Compound II, Farfán.

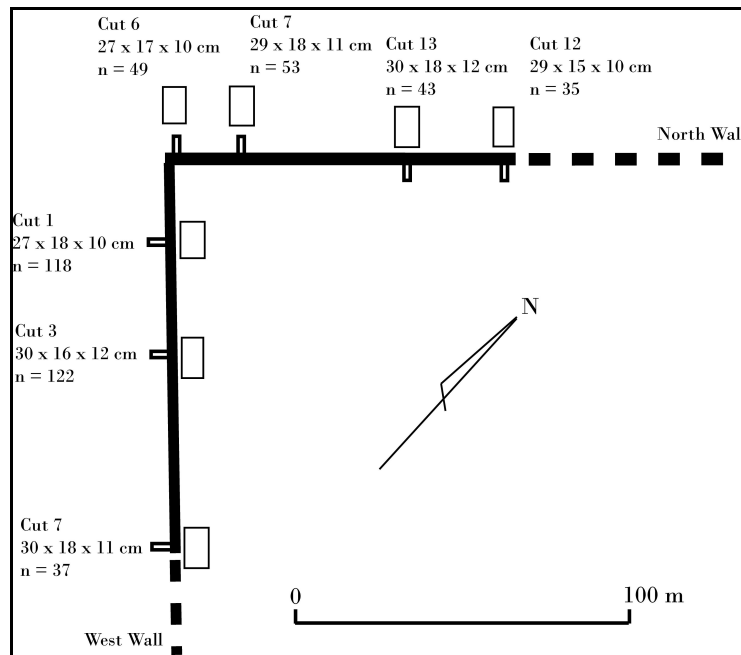


Figure 16: Northwest corner of Compound IV at Farfán, showing locations of excavation units and the average length, width, and height of bricks recovered in the excavation units.



Figure 17: A section of the north wall of Compound IV, Farfán. Note layers of bricks (indicated by arrows) with greater amounts of rock inclusions than adjacent layers.



Figure 18: Adobes from Layer 5 of Cut 3, Compound II, Farfán. Numbers on adobes correspond to Table 10. The trowel (above Brick 10) points north.



Figure 19: Adobes from Layer 6 of Cut 3, Compound II, Farfán. The trowel points north. Numbers on adobes correspond to Table 10. Note broken adobes used as fill.

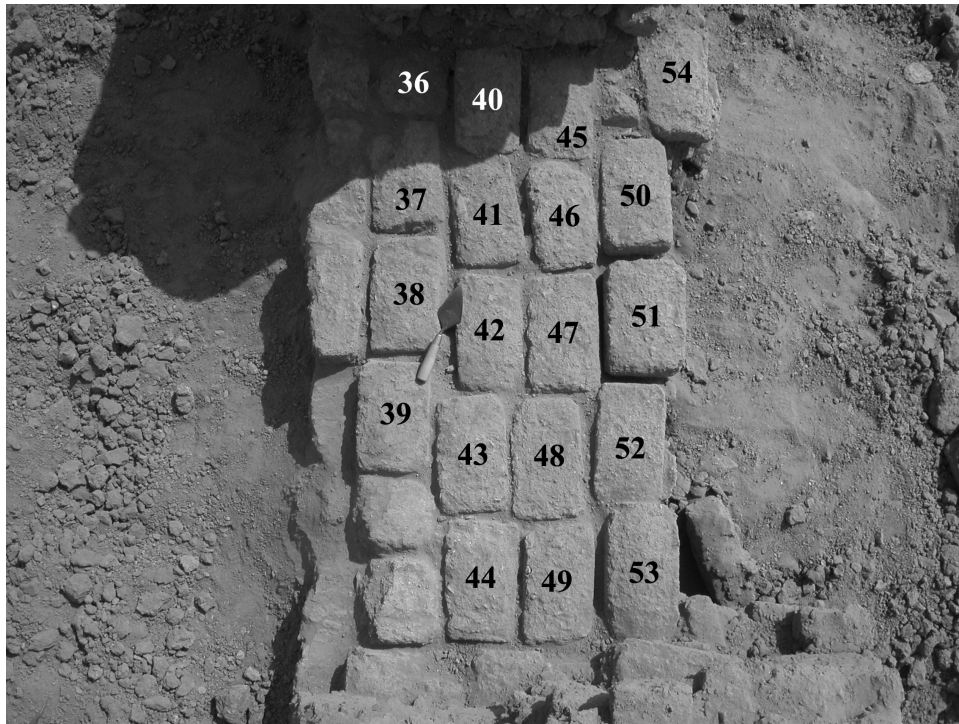


Figure 20: Adobes from Layer 7 of Cut 3, Compound II, Farfán. The trowel points north. Numbers on adobes correspond to Table 10. Note that Adobe 51 is slightly wider than adjacent bricks.



Figure 21: Adobes from Layer 8 of Cut 3, Compound II, Farfán. The trowel points north.

Numbers on adobes correspond to Table 10.

Note that Adobes 62-64 are slightly longer and narrower than other bricks.

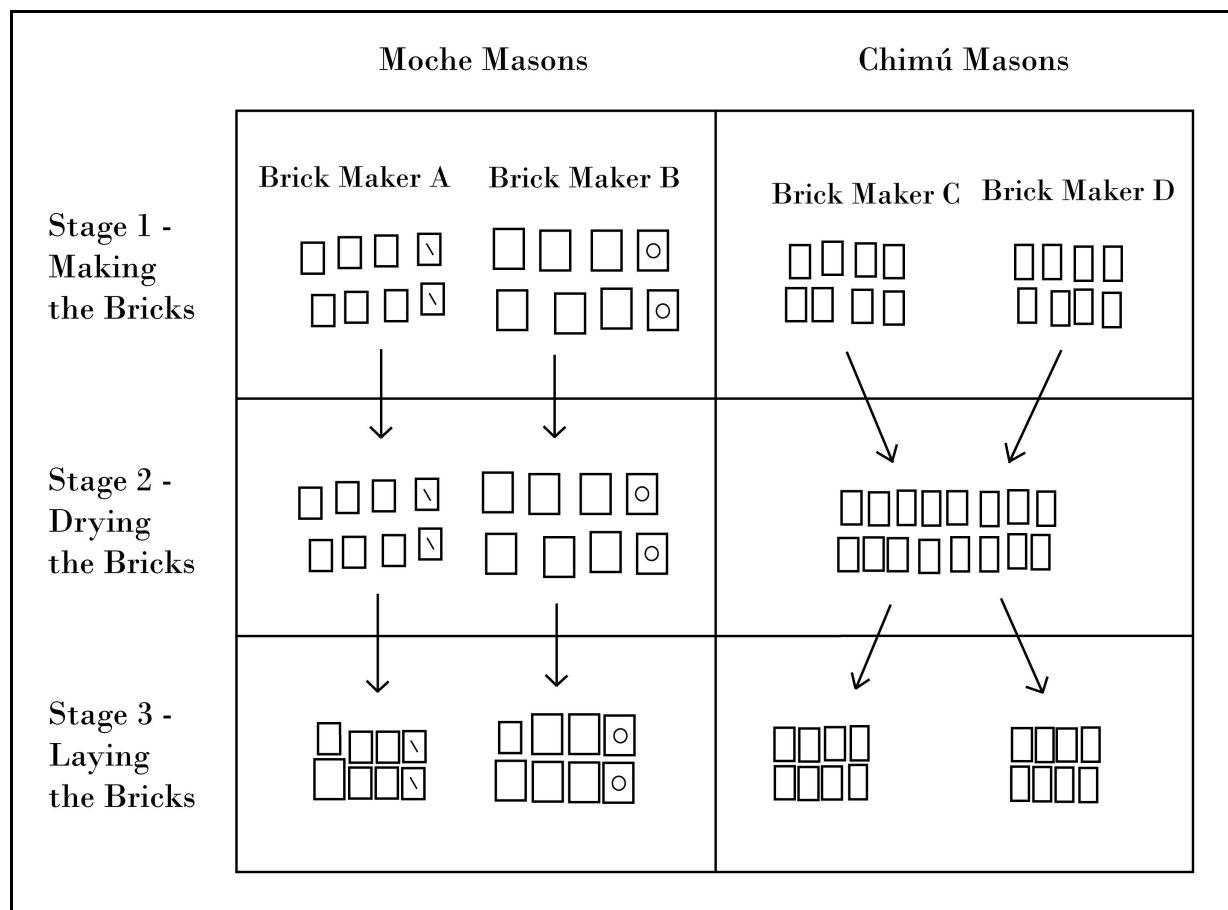


Figure 22: Hypothetical diagram comparing the three stages of making, drying, and laying adobes by Moche and Chimú masons.

