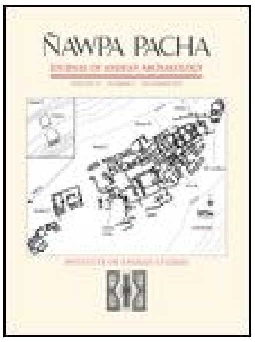

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Naipes: Functions and Significance of Middle Sicán Standardized Sheetmetal Artifacts

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NAIPES: FUNCTIONS AND SIGNIFICANCE OF MIDDLE SICÁN STANDARDIZED SHEETMETAL ARTIFACTS

Izumi Shimada and John F. Merkel

The enigmatic naipes, *the I-shaped, standardized, arsenical copper sheet artifacts occur in a few to thousands of bundles in elite Sicán tombs on the northern north coast of Peru. Examination of their production process, use contexts, spatio-temporal parameters, and levels of standardization show them to be Middle Sicán (900-1100 CE) in time and cultural origin and locally produced.* Naipes *seemed to have served two context-dependent purposes as the key standardized medium of exchange in the Middle Sicán-early Manteño interregional trade (*naipes *in exchange for whole* mullu *and their beads) and as a prestige items for Middle Sicán elite rituals and tombs. Their economic role and significance in one context coexisted with those of social and symbolic character in another. Product standardization is neither restricted to a particular mode of production or type of product nor is it dictated by a technical-technological or economic factor.*

Los enigmáticos naipes, los estandarizados artefactos elaborados a partir de láminas de cobre arsenical con forma de "I" aparecen desde unos pocos a miles de paquetes en tumbas de élite sicán en la costa norte del Perú. Nuestro estudio muestra que corresponden al periodo Sicán Medio (900-1100 d.C.) en el tiempo y origen cultural y que fueron producidos localmente. Al parecer, los naipes sirvieron para dos propósitos: como medio estándar de intercambio en el comercio interregional entre las entidades políticas Sicán Medio y Manteño Temprano, y como artículos de prestigio para los rituales y tumbas de la élite de Sicán Medio. Su papel e importancia económicos en un contexto coexistían con los de carácter social y simbólico en otro. Nuestro estudio demuestra que la estandarización de productos no estaba restringida a un modo de producción o tipo de producto en particular ni estaba dictada por un factor técnico-tecnológico o económico.

Keywords: naipes, Sicán, arsenical copper, standardization, interregional trade, medium of exchange, Manteño, mullu

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Standardization implies a high degree of conformity to an established or accepted attribute that could be in regard to the size, shape, or value of a given type of product, or material, style or technique used in accomplishing a given task. In the sphere of pre-Hispanic handicrafts, the degree of conformity is rarely ever as precise as what we find among modern products or practices, but the Inca state architecture and artifacts such as what is known today as *kallanka* (Nair and Protzen 2015) and flaring cups (*aquillas* [gold or silver] and *queros* [wooden]) possessed a high degree of similarity in appearance to serve a readily recognizable symbol of the Inca state and its power. The Moche "portrait vessels" that are often considered an epitome of life-like naturalistic art, on the other hand, were mold-made, enabling the artisan to replicate the important images of the elites. Larco (1939) thus considered the multiple occurrences of the same portrait vessels in dispersed locations as a visual territorial marker of the represented elite. At the same time, shallow open ceramic bowls (*tecomates* in Mesoamerica) that are highly similar in size and shape—to the point that one might wonder if they were standardized—may reflect a concern for the ease of stacking-packaging and safe transport.

In essence, product standardization is neither restricted to a particular mode of production or type of product nor is it dictated by a technical-technological or economic factor; depending on context and item under consideration, standardization serves diverse purposes. If so, what were the function(s) and significance of the millennial-old (i.e., Middle Sicán; 900–1100 CE), I-shaped, standardized artifacts fashioned out of patiently hammered arsenical copper alloy sheets locally known as *naipes* (Figure 1) that were widely distributed in the area spanning the Jequetepeque Valley and the central Ecuadorian coast. This is the guiding question of this paper. In addition, we ask whether *naipes* were merely grave offerings? Why were the *naipes* so standardized and made nearly exclusively of arsenical copper alloy sheets investing many hours of labor by skilled metalworkers? On what basis were some *naipes* originally selected and then bundled together into groups? Lastly, but by no means the least, what additional insights can the *naipes* provide us into the Sicán sociopolitical structure, metal production and wider economy?

This paper attempts to answer these questions based on data and insights garnered from over four decades of continuous research by the Sicán Archaeological Project. We argue that the standardized *napies* were used as (1) well-recognized tokens or mediums of exchange (see below for our usage of the term) in the restricted context of trade between the Middle Sicán polity on one hand, and the contemporaneous early Manteño populations on the central coast of Ecuador, on the other, (2) symbols of wealth, social prestige and power (over material and human resources) in the Middle Sicán heartland of the Lambayeque Complex and the adjacent far north coast of Peru, and (3) represent a convertible supply of standardized copper-arsenic alloys. Their function and significance, we believe, are fundamentally based on both intrinsic material qualities as well as symbolic value attached to arsenical copper alloys as a superior raw material created with investment of much skilled labor and material resources. A "silver-like" color of relatively high arsenic concentrations in the copper alloys may also have been an important factor in establishing their value. At the same time, their use and significance were firmly embedded in the context of the rather unique situation of (a) the Middle Sicán virtual monopoly of arsenical copper alloys production in northern Peru, (b) the extensive and intensive interregional trade in ritual and sumptuary items, especially the *mullu,* Quechua term for large tropical marine shells (*Spondylus sp., Strombus sp.,* and *Conus sp.*) that have had persistent and pervasive ritual and symbolic importance in the prehispanic world, particularly in the Andean area south of Ecuador, and (c) the rapid expansion of the Middle Sicán political power and religious prestige along the northern half of the Peruvian coast. These factors mutually reinforced each other and preconditioned the use and significance of *naipes*.

Figure 1. Five different size *naipes* recovered from Huaca El Menor (upper row; size Group IV—see text for explanation) and Huaca La Merced Mound I (lower row, left to right; size Group Vb, III-I) at the site of Sicán. Photo by I. Shimada.

Naipes, a Spanish word for playing cards, is a vernacular description by local grave looters who often found them in large numbers, sometime in thousands (an estimated 20,000 in the case of Huaca Loro East Tomb; Shimada 1995; also see Pedersen 1976), usually in bundles of ten or eleven, deposited in Middle Sicán (900–1100 CE) tombs in the Batán Grande area in the mid-La Leche valley (particularly the 60 km^2 Pomac Forest National Historical Reserve) and the adjacent coastal valleys on the north and far north coast of Peru (Figures 2 and 3). The designation is understandable in describing their physical features; both modern playing cards and the prehispanic *naipes* are in a *general sense* standardized in shape, size, weight, raw materials, and manufacturing methods.

Naipes usually occur bundled with a thin cotton string or a narrow sliver of fibrous elongated plant leafs or sheaths (e.g., cane [*Gynerium sp.*], bulrush [*Cyperus sp.*], and totora reed [*Scirpus sp.*]). Clusters of these bundles are often wrapped with a coarse, plain-weave, white cotton cloth. It is important to emphasize that the bundles of *naipes* represent groups originally selected individually, and then deliberately tied together, probably at the metal workshops where they were produced (see below).

Naipes are not the only standardized arsenical copper alloy sheet-metal objects that the Sicán produced. There are what may be considered variants or "relatives" that have a slight flaring at four corners or a simpler rectangular form without any flanges or a triangular shape resembling an elongated funnel in plane-view also called "feathers," "sheaths," or "leaves" (Figures 4 and 5; Bezúr 2003, 2014; Hosler et al. 1990:20–21).

As a whole, these relatives share many of the basic features of the *naipes*, e.g., standardized sizes, shapes, manufacturing techniques (uniformly thin sheets), raw materials, manner of disposition, and contexts of occurrence. As the names given to them suggest, they are cut and shaped out of uniformly hammered and very thin (ca. 0.1–0.3 mm in thickness) arsenical copper sheets. "Feathers" (typically 15–22 cm long and 13–20 mm wide at one end and tapering down to 3–4 mm at the other end) areinvariably found

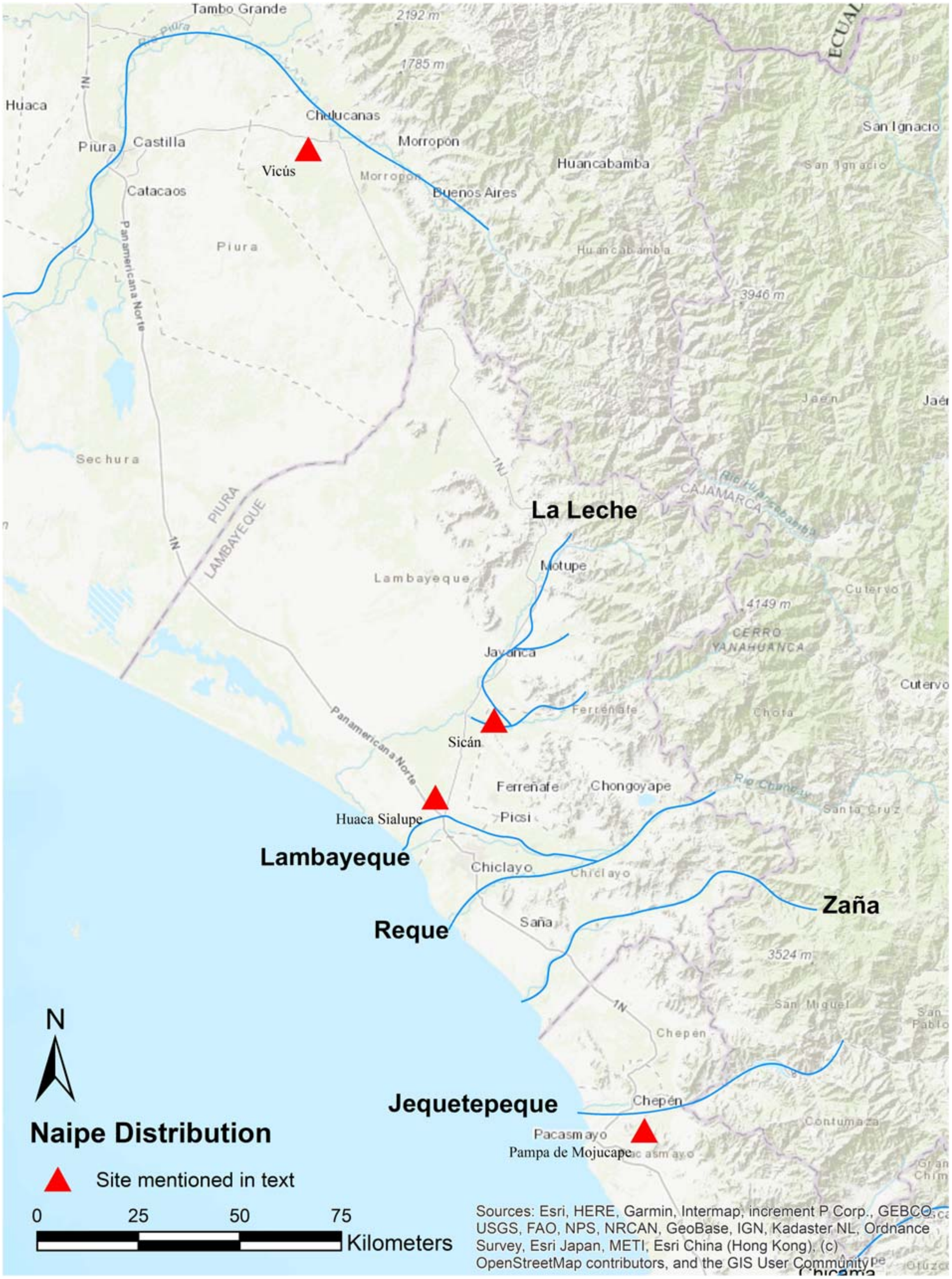

Figure 2. North and far north coast of Peru and the key sites mentioned in the text in the Lambayeque Complex. Drawing by K. Sharp and I. Shimada.

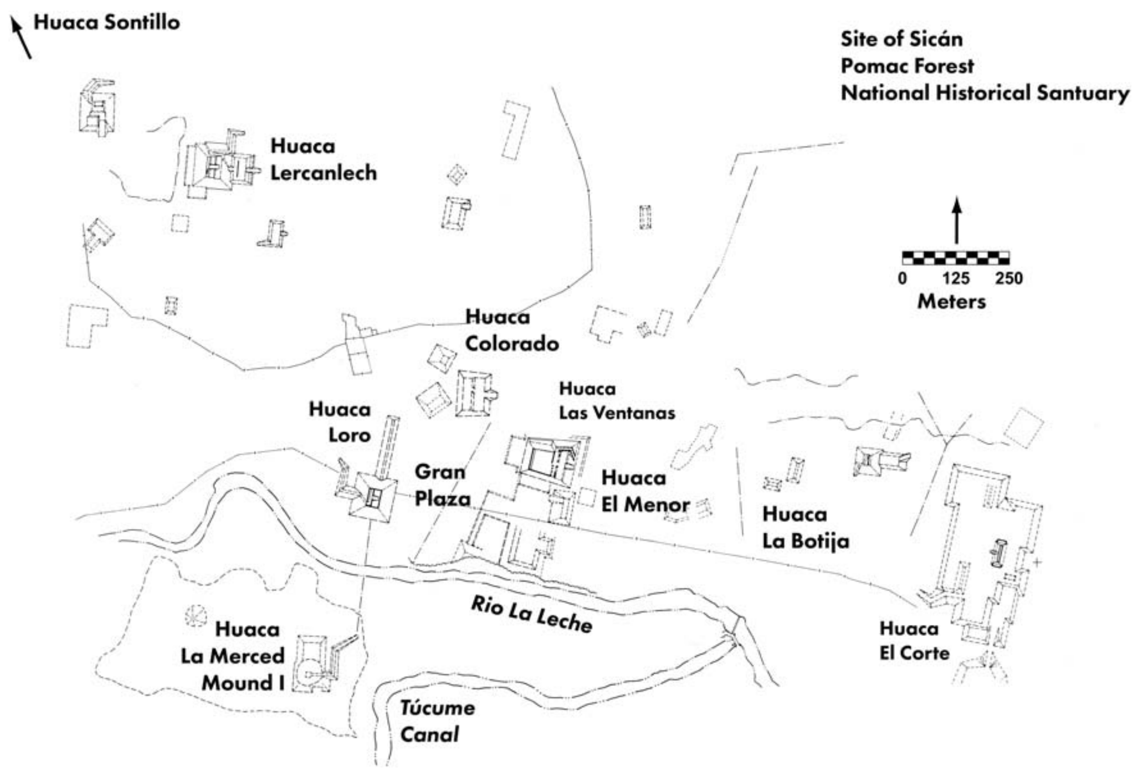

Figure 3. Major Middle Sicán temple complexes and their auxilliary constructions at the site of Sicán in the Pomac Forest National Historical Reserve, mid-La Leche Valley as they were documented by I. Shimada in 1978. Since then much of Huaca La Merced and Huaca El Corte had been washed away. Map prepared by K. Sharp.

Figure 4. Two large clusters of slender and tapered sheaths or "feathers" deposited in the Middle Sicán elite tomb at the southwest corner of the Gran Plaza of Sicán. Photo by I. Shimada.

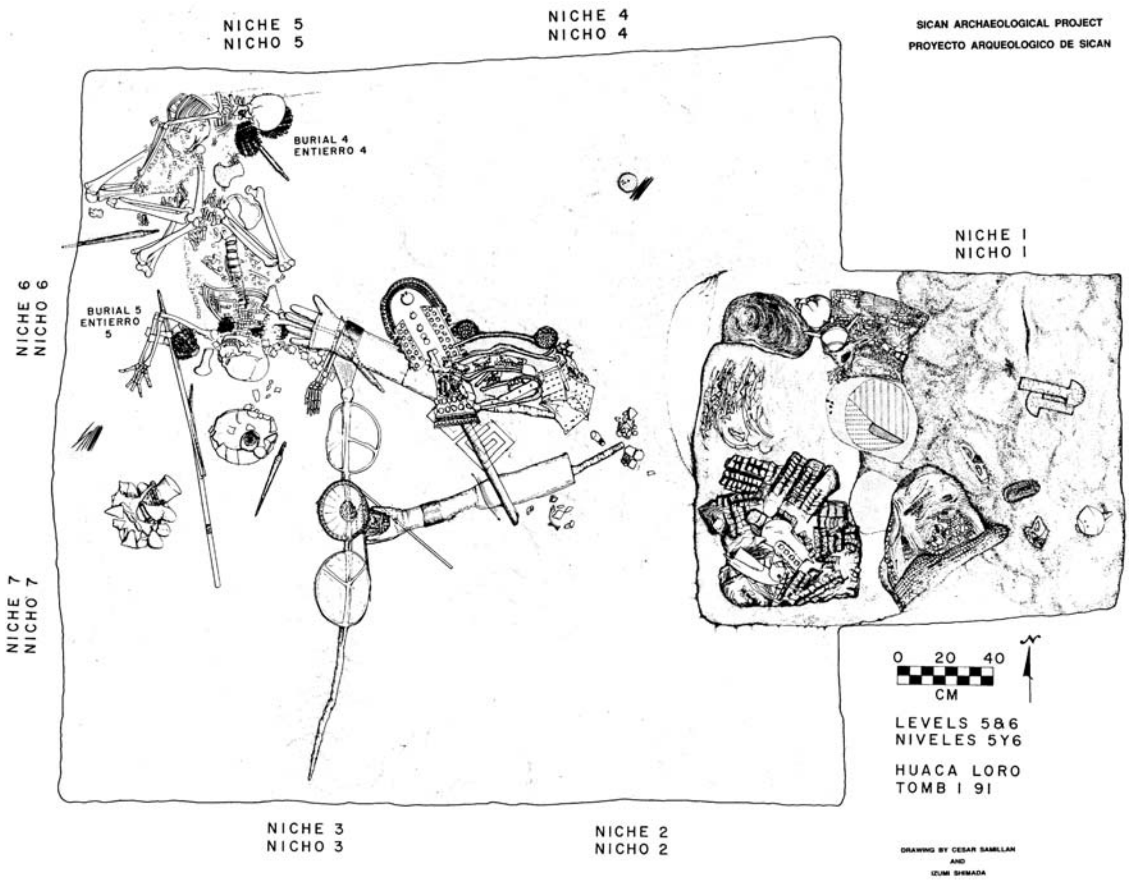

Figure 5. *Naipe* bundle cluster deposited in the high elite shaft-tomb (lower left corner of Niche 1, East Tomb) at Huaca Loro, Sicán. Drawing by I. Shimada and C. Samillán.

stacked and bundled or wrapped in simple-weave cotton cloth and badly corroded and fuzed together, making their recovery and study difficult (Bezur 2003). The rectangular "leaves" or sheets (typically 85–95 mm long, 22–25 mm wide) are plain and flat without any longitudinal trough/ridge or superficial marking seen on *naipes.* As much as with *naipes* (see below), these "relatives" could well have served dual (utilitarian and ritual) functions. Their elongated shape and thinness make them well suited for making small items such as sewing needles and fishing hooks by rolling or folding. At the same time, elite funerary contexts in which they are found also suggest, as with *naipes* (see below), they also served as prestigious offerings.

In this paper, we focus our attention to the *naipes* that are generally better preserved, better documented and analyzed. The investigative cleaning and technical studies contribute to our interpretations. As clean, uncorroded alloyed metal, the *naipes* originally looked very different than they do today (Figure 1). In addition, the temporal–spatial parameters of the Sicán *naipes* are well defined. In regard to a few specific issues, for this review, we consider both the Sicán *naipes* and their relatives (described below).

Cultural and Historical Contexts of Naipes: A Summary Characterization

The term Sicán that signifies the house or temple of the moon (*si*) in the extinct Muchik language designates a prominent and influential pre-Hispanic culture that flourished on the northern north coast of Peru from sometime in the ninth century to late-fourteenth century. It is also known as Lambayeque. It began forging its distinctive character (corresponding to the Early Sicán period, 800/850–900 CE) by fuzing selected autogenous features of the persistent Moche cultural tradition and those of exogenous character introduced there at the time of the Wari and, to a lesser extent, Pachacamac influences from the south (ca. 700–850 CE?). The exact timing and nature and dynamics of their influences are still debated (Castillo, 2001; Chapdelaine 2010; Mackey 2000; Menzel 1977; Segura and Shimada 2014; Schaedel 1993; Shimada 1985b, 1990, 2014a). The fusion of both local and external systems of belief and general cultural hybridization prompted by the inferred revitalization movement (Shimada 1983; see also Wallace 1956), together with the waning of the Wari influence starting around 900 CE and the impressive productive capacity of the Lambayeque Complex, formed the basis of the rapid formalization of its religion and associated art style as well as notable growth in Sicán economic, political and religious power. The Complex (Figure 2) consists of the four contiguous, hydrologically interlinked (via four intervalley canals) river valleys of Motupe, La Leche, Lambayeque, and Zaña from the north to the south. During the florescent Middle Sicán period, Kosok (1959, 1965) estimated that the Complex encompassed a third of the total cultivated land and inhabitants on the Peruvian coast, while Schaedel (1972) calculated its resident population size to have been ca. 1.0–1.5 millions. At the same time, the Sicán had established a stratified, multi-ethnic society with an inferred multi-lineage, collective polity similar to a segmentary state (see Gose 1993; Southall 1988, 1991). Its religion centered around the omnipotent and polymorphous Sicán Deity (e.g., with the body of the Sun, a *Spondylus* or a bird of prey) and his earthly alter ego, Sicán Lord. The polity established an ideological and political dominance over at least 350 km-stretch of the northern north coast, and far- reaching interaction sphere (including extensive trade network) that included Colombia to the north and south-central coastal Peru to the south (Segura and Shimada 2014; Shimada 2000, 2009, 2014a).

Among the most distinguishing and important legacies of the Middle Sicán culture were innovative and advanced pyrotechnologies. Their metallurgists distinguished themselves in successfully producing arsenical copper alloys and gold alloys on an unprecedented scale and employing them similarly in a range of use wider than ever before (e.g., Bezúr 2014; Carcedo 2014; Shimada 1994a, 1994c, 2014a; Shimada and Griffin 1994; Shimada and Merkel 1991; Shimada et al. 1999, 2000). The arsenical copper alloys replaced pure copper as the utilitarian metal of northern Peru until the Spanish conquest (Cleland and Shimada 1992; Shimada and Merkel 1991). Arsenical copper alloys with arsenic concentration greater than 0.5% in weight are sometimes called arsenical bronze (Hosler et al. 1990; Lechtman 1981). Such a low arsenic concentration is quite remarkable as a *deliberate* copper alloy threshold, but technical studies of Sicán *naipes* originally selected and grouped together into tied bundles, for example, also supports this interpretation. Metals permeated all facets of this culture and differentiated access to different metals served as a visible marker of social status (Shimada 1994c; Table 1). The Middle Sicán society as a whole seems to have been obsessed with metals. Practically every Middle Sicán settlement in the region manifests some copper-arsenic production debris (and even that of gold alloys at a few sites) as if the whole region became a metallurgical production center. Quantity of metal objects found in pre-Middle Sicán funerary and non-funerary contexts, including residences, pales in comparison with what is found in Middle Sicán. Middle Sicán, succeeded in producing these alloys in a peri-industrial scale due to a large measure because the Middle Sicán heartland of the Lambayeque region was blessed with necessary copper and arsenosulfide ores, dense and extensive, autogenous hardwood (primarily *algarrobo* [*Prosopis pallida*]) forest (source of charcoal fuel), and labor force.

Table 1. Inferred Middle Sicán social hierarchy based primarily on differential access to metals produced by the Middle Sicán and secondarily on other funerary goods. Large quantities of *naipes* are often associated with other elite grave goods.

	First Tier: High Elite Males	*First Tier: High Elite Females*	*Second Tier: Low Elite Males*	*Second Tier: Low Elite Females*	*Third Tier: Commoners*	*Fourth Tier: low status commoners; captives?*
GRAVE GOODS						
High-karat gold alloy objects	◆	◆				
High-silver-copper alloy objects	◆	◆				
Low-karat gold (*tumbaga*) and/or gilt and copper objects	◆	◆	◆	◆		
Silver-gilt copper objects		◆		◆		
Cinnabar paint	◆	◆	◆	◆		
Semi-precious stone beads	◆	◆				
Amber	◆			◆		
Shell beads	◆	◆	◆	◆		
Spondylus crassisquama	◆	◆	◆	◆		
Conus fergusoni	◆	◆				
Double-spout bottles	◆	◆	◆	◆		
Single-spout bottles	◆	◆	◆	◆	◆	
Copper-arsenic objects including *naipes*	◆	◆	◆	◆	◆	
Utilitarian plain and *paleteada* pottery			◆	◆	◆	◆
Ochre paint					◆	
BURIAL POSITION						
Seated	◆	◆	◆	◆	◆	
Extended			◆	◆	◆	◆

Note: Prepared by I. Shimada.

Middle Sicán potters succeeded in large-scale production of well-fired, true blackware, often with a metallic sheen (Shimada 2016; Shimada and Wagner 2001, 2007, 2019) and forms that clearly emulated more prestigious metallic vessels (Cleland and Shimada 1992; Rondón 1965/66). The pottery became widely valued, engendering an unparalleled popularity of black ceramics that rapidly spread throughout much of the Peruvian coast and persisted until Spanish conquest.

Perhaps due to the impacts of an El Niño-ENSO event (ca. 1050 CE) of a historic proportion that compounded the adverse effects of the preceding multi-decadal drought (ca. 1020–1050 CE; Craig and Shimada 1986; Shimada et al. 1991, 2018) and perhaps deforestation from charcoal making for the metallurgical production, Sicán society underwent an unprecedented reorganization (corresponding to the Late Sicán period, 1100–1375 CE) with the establishment of a new capital, the cessation of the Sicán Deity veneration, and the truncation of the trade network (Jennings 2008; Shimada 2000, 2009). Arsenical copper alloys production, however, returned early in the Late Sicán period (Epstein and Shimada 1983).

Around 1375 CE, the expanding Chimú Empire intruding from the south conquered the Late Sicán polity, ending its political autonomy (Shimada 1990, 2000, 2014a). The Chimú and the Inka, who conquered the Chimú ca. 1460–70 CE, both recognized the superiority and importance of Sicán metallurgy and intensified its production and appeared to have relocated many of their workers to their respective capitals of Chan Chan and Cuzco (Shimada 2000, 2009; Topic 1990). Thus, Sicán metallurgy lived on long after its political demise. Overall, it is clear that Middle Sicán was a culture with complex and dynamic internal institutions and ethnic relationships, a well-developed social inequality, and diverse resource bases, and extensive domain and sphere of interaction.

Naipe Characteristics and Manufacture

Naipes that were archaeologically recovered, regardless of their size classes (see below), have the same basic rectangular form with a small triangular flange protruding out of its four corners. In addition, they commonly have a recognizable, shallow, elongated central trough (conversely, central raised ridge) and striations along its longitudinal axis of the rectangle. The trough would have not only stabilized *naipes* when they were stacked together and bundled, but also have added to the overall strength as with modern corrugated sheet-metal (Hosler et al. 1990:29).

Why they have this I-shape is not understood. These symmetrical flanges may have symbolized the wings or distinctive "winged" or "comma-shaped" eyes or, conversely, stylized, triangular ears of the Sicán Deity, but the explanation remains as a pure speculation. Although they resemble each other in various respects (e.g., standardized size and shape, arsenical copper composition, general thinness, durability and portability), the so-called "axe monies" of coastal Ecuador have an inverted T- shape (e.g., Holm 1966/67, 1975, 1978, 1980; Hosler et al. 1990). They are not considered here. The intriguing question whether *naipes* similarly functioned as primitive currencies will be fully addressed later in a separate section of the paper.

Regardless of their proveniences (see below) and dates (within the span of perhaps to 200 years between ca. 900 and 1100 CE), *naipes* that have been documented to date conform well to the five distinct sizes shown in Table 2, although there is only one specimen representing the two slightly divergent forms of the largest and rarest size (Group Va,b). Some degree of variation in each of their basic dimensions, width, length, thickness, weight, and form is expected, given that they were *entirely hand-made*. Given the intrinsic value and the high labor-material cost in manufacture of arsenical copper alloy sheet-metals, however, the weight of each size seems to a degree to have been controlled. At the same time, all excavated *naipes* had been affected to a varying degree by corrosion, making it difficult today to precisely ascertain their original weights. These variables that seem beyond our control should be kept in mind in the later discussion of the possible significance of standardization.

As noted earlier, *naipes* occur either bundled and tied together or loosely. To date, only small *naipes* of Group I and II have been found tied together into bundles of 10 or 11 *naipes.* In a few cases, however, some bundles contain only five *naipes*. We have also found a few cases where as many as 30 Group I *naipes* were tied together or as multiple bundles re-tied together to form larger groups. Often these bundles were carefully stacked together as seen in Figure 5. Group IV *naipes* from the looted Huaca El Menor shaft-tomb, however, were carefully stacked with their flanges overlapping (see Figure 8).

Naipes of various sizes were recovered from different temple complexes within the site of Sicán. All those that we have analyzed to date were fashioned out of hand-hammered and -cut sheet metal, most of which have a bulk composition of 95.0–98.5.0%

Table 2. N*a*ipe size variation (average maximum length and width). Group Va and Vb have similar measurements but differ somewhat in shape.

Group I:	*ca. 4.2 cm long, 2.1 cm wide*
Group II:	*ca. 4.9–5.0 cm long, 3.0–3.2 cm wide*
Group III:	*ca. 6.0 cm long, 3.6 cm wide*
Group IV:	*ca. 6.6–7.0 cm long, 4.8–5.1 cm wide*
Group Va,b:	*ca. 10.0 cm long, 8.5 cm wide*

Note: Weight and thickness measurements are variable to some degree due to corrosion, but better estimated in metallographic section or after conservation.

copper, 0.8–5.63% arsenic, and trace amounts of a few other elements (concentration by weight; Tables 3 and 4). The values Hosler et al. (1990:95) reported for two *naipes* also from the site of Sicán fall well within this range. On the other hand, the arsenic concentration range of 0.8–2.0% defined for the uncorroded metallic portions of ten small-sized (Group I) *naipes* that together composed one of the estimated 1500 *naipe* bundles (together weighing ca. 25 kg) deposited in the Huaca Loro East Tomb (Figure 5; Merkel et al. 1995: 12; Shimada 1995, 2006; Shimada et al. 2000) represent the low end of a rather wide range of arsenic concentration defined thus far for Middle Sicán *naipes.* The low range of compositions observed for *naipes* in this bundle represents original selection from perhaps a set of readily observable properties, such as color, hardness and other working characteristics. It is significant that the observable metallurgical properties of these *naipes* in this bundle were similar, but still quite different from *naipes* containing higher or very low (rare; >05%) arsenic concentrations. The relatively high arsenic concentration that Hosler et al. (1990) focused on was based on a limited sample that was analyzed until then. Although compositional data in Table 3 and 4 were derived using different analytical methods and calibration protocols, improved procedures and inter-laboratory use of the same certified standard reference materials have made comparisons of these data generally reliable and worthwhile for determining original alloy compositions under surface corrosion. Compositional data for *naipes* provide essential evidence for original alloy color as well as other related metallurgical properties. As discussed below, variability in alloy production was recognized and probably exploited.

In comparison with copper that long served as the utilitarian metal of northern Peru in pre-Middle Sicán era (Lechtman 1976, 1979, 1980), arsenical copper alloys have a number of distinctive and superior features (Bezúr 2003; Budd 1991a; Budd and Ottaway 1991; Lechtman 1996) that seem to largely account for its rapid spread throughout the north and far north coast of Peru with its successful, large-scale production by the Sicán starting around 900–950 CE (e.g., Shimada 1985, 1990, 2014a; Shimada and Merkel 1991). For one, there are also some indications that these alloy compositions were more resistant to corrosion than pure copper (Charles 1967). This would seem relevant for *naipes*.

Table 3. Electron probe microanalysis of a single Group I bundled stack of ten *naipes* from the Huaca Loro East Tomb.

		Au	Ag	Cu	As	Position
M99	*naipe* (one of bundle)	0.0	0.1	97	1.5	metal
		0.0	0.1	86	1.7	(corrosion)
		0.0	0.1	92	2.3	(corrosion)
		0.1	0.1	83	2.2	(corrosion)
M99	*naipe* (two of bundle)	0.0	0.1	98	1.7	metal
		0.0	0.1	82	1.1	(corrosion)
		0.0	0.1	81	2.0	(corrosion)
		0.0	0.0	92	1.6	(corrosion)
M99	*naipe* (three of bundle)	0.0	0.1	98	1.6	metal
		0.0	0.1	92	2.3	(corrosion)
		0.0	0.2	93	3.4	(corrosion)
M99	*naipe* (four of bundle)	0.0	0.1	98	1.6	metal
		0.0	0.1	98	1.7	metal
		0.0	0.1	98	1.9	metal
		0.0	0.1	98	1.8	metal
		0.0	0.1	92	2.1	(corrosion)
		0.0	0.2	93	2.8	(corrosion)
M99	*naipe* (five of bundle)	0.0	0.1	98	1.2	metal
		0.0	0.1	99	0.8	metal
		0.0	0.1	94	2.3	(corrosion)
		0.0	0.3	91	5.1	(corrosion)
M99	*naipe* (six of bundle)	0.0	0.1	94	1.3	(corrosion)
		0.0	0.2	93	3.4	(corrosion)
		0.0	0.1	93	2.1	(corrosion)
M99	*naipe* (seven of bundle)	0.0	0.1	99	0.9	metal
		0.0	0.1	95	2.0	metal
		0.0	0.1	95	1.6	metal
M99	*naipe* (eight of bundle)	0.0	0.1	98	1.5	metal
		0.0	0.2	93	2.8	(corrosion)
		0.1	0.1	93	1.9	(corrosion)
M99	*naipe* (nine of bundle)	0.0	0.1	93	1.3	(corrosion)
		0.0	0.1	93	2.1	(corrosion)
		0.0	0.1	93	2.1	(corrosion)
M99	*naipe* (ten of bundle)	0.0	0.1	98	1.5	metal
		0.0	0.2	93	3.0	(corrosion)
		0.0	0.1	88	2.6	(corrosion)

Note: Multiple analyses were made on each of the *naipes*. Analyses with less than 95% copper are attributed to corrosion; principally oxygen which was not measured. The data are not normalized to 100%. The elements chlorine and sulphur were also detected in other point analyses of corroded *naipes*.

Table 4. Compositional data from the PIXE (proton-induced x-ray emission spectrometry; University of Delaware) analyses of Middle Sicán *naipes* from the site of Sicán.

MASCA No. Provenience	*Cu*	*As*	*Sn*	*Pb*	*Fe*	*S*	*Si*	*Ag*	*Sb*	*Ni*	*Cr*	*Bi*	*Mn*	*Ca*	*Cl*	P	*Zn*
BG83-52A Huaca La Merced; Middle Sican, Burial Lot 2, Group I (HLM-M-1)	95.2	4.47	<0.013	0.025	0.014	0.003	0.026	0.058	0.026	<0.013	0.009	<0.022	nd	nd	nd	nd	nd
BG83-52B Huaca La Merced; Middle Sican, Burial Lot 2, Group II (HLM-M-2)	95.3	4.32	<0.014	0.040	0.033	0.006	0.034	0.123	0.020	<0.013	0.010	<0.022	nd	nd	nd	nd	nd
BG83-52I Huaca La Merced; Middle Sican, Lot 2, Group Va (HLM-M-7)	95.1	4.50	<0.016	0.156	0.016	0.031	0.032	0.090	0.019	<0.013	nd	<0.016	0.006	0.016	0.016	0.003	nd
BG83-52J Huaca La Merced; Middle Sican, Lot 2, Group IV (HLM-M-8)	95.8	3.99	0.019	<0.011	0.028	0.012	0.029	0.026	0.015	<0.012	nd	0.033	0.007	0.006	0.015	<0.002	nd
BG83-52 K Huaca La Merced; Middle Sican, Lot 3, Group III (HLM-M-9)	94.5	5.06	<0.015	0.124	0.042	0.026	0.045	0.077	0.020	0.012	nd	<0.015	<0.007	0.006	0.010	<0.003	nd
BG83-52H Huaca La Merced; surface collected, Group IV (HLM-M-5)	96.5	3.33	0.021	<0.010	0.022	0.005	0.023	0.036	<0.015	0.039	nd	<0.016	<0.004	0.016	0.016	nd	nd
BG83-52C Huaca Las Ventanas; Middle Sican, Burial Lot 2, Group III (HLV-M-1)	96.7	2.45	<0.014	0.183	<0.011	0.026	0.065	0.0373	<0.020	<0.013	0.010	0.100	nd	nd	nd	nd	nd
BG83-52D Huaca Las Ventanas; Middle Sican, Burial Lot 3, Group III (HLV-M-2)	95.9	3.66	<0.012	0.024	0.023	0.005	0.093	0.067	0.016	0.064	0.013	0.100	nd	nd	nd	nd	nd
BG85-1B Huaca El Menor; Also BG85-M-2-85 surface, Group IV (HEM-M2)	96.0	3.53	<0.011	0.019	<0.014	0.006	0.062	0.072	0.024	0.12	nd	0.073	0.008	0.006	0.022	0.004	<0.088

Continued

Table 4. ***Continued***

MASCA No. Provenience	*Cu*	*As*	*Sn*	*Pb*	*Fe*	*S*	*Si*	*Ag*	*Sb*	*Ni*	*Cr*	*Bi*	*Mn*	*Ca*	*Cl*	P	*Zn*
BG85-1E Huaca El Menor Also BG85-M-2-85 surface, Group II (HEM-M-11)	97.0	2.72	<0.013	<0.014	0.032	0.012	0.021	0.054	<0.017	0.027	nd	0.028	0.010	0.096	0.018	0.004	<0.084
BG85-1Aa Huaca El Menor; Looted site, (one of two naipes, stacked) Group IV (HEM-M1a)	96.4	2.30	0.025	0.79	<0.014	0.039	0.016	0.22	0.094	0.034	nd	<0.016	0.009	0.017	0.026	0.004	<0.088
BG85-1Ab Huaca El Menor; Looted site, (two of two naipes, stacked) Group IV (HEM-M1a)	96.5	2.95	<0.014	0.022	<0.014	0.012	0.034	0.13	0.12	0.059	nd	0.13	0.006	0.019	0.012	0.003	<0.082
BG85-1D Huaca El Corte, Looted burial, Group I (HEC-M-10)	96.5	3.11	0.025	0.023	<0.014	0.006	0.016	0.073	0.034	0.030	nd	0.053	0.007	0.011	0.028	0.004	<0.087
BG85-1Ca Huaca Lercanlech, Burial 1 (one of two naipes, tied together), Group II (HLe-M-3)	97.6	1.90	0.031	0.035	0.039	0.018	0.049	0.039	0.069	0.026	nd	0.039	0.009	0.012	0.011	0.003	<0.055
BG85-1Cb Huaca Lercanlech, Burial 1 (two of two naipes, tied together) Group II (HLe-M-3)	97.9	1.82	0.018	0.027	0.014	0.016	0.016	0.044	0.035	<0.013	nd	0.042	0.007	0.008	0.015	0.004	<0.090
BG85-1Fa Huaca Lercanlech, Burial 2 (one of two naipes, tied together) Group II (HLe-M-12)	95.9	3.58	<0.014	0.057	<0.013	0.015	0.019	0.046	0.032	0.120	nd	0.047	0.008	0.010	0.016	0.003	<0.084
BG85-1Fb Huaca Lercanlech, Burial 2 (two of two naipes, tied together) Group II (HLe-M-12)	96.3	3.34	<0.014	0.036	<0.013	0.018	0.016	0.041	0.024	<0.013	nd	0.031	0.009	0.011	0.012	0.004	<0.085
Not listed by site																	

MASCA No. Provenience	*Cu*	*As*	*Sn*	*Pb*	*Fe*	*S*	*Si*	*Ag*	*Sb*	*Ni*	*Cr*	*Bi*	*Mn*	*Ca*	*Cl*	P	*Zn*
MASCA No.	Cu	As	Sn	Pb	Fe	S	Si	Ag	Sb	Ni	Cr	Bi	Mn	Ca	Cl	*P*	Zn
Provenience																	
BG83-52E	96.3	3.17	<0.014	0.022	0.031	0.012	0.133	0.106	0.041	0.022	nd	0.029	0.005	0.166	0.084	nd	nd
naipe Type not noted (HL# M-M-3)																	
BG83-52F	97.6	1.79	0.020	<0.015	0.058	0.010	0.030	0.095	0.027	<0.012	nd	0.066	0.009	0.021	0.020	nd	nd
naipe Type not noted (HLV-M-3)																	
BG83-52G	97.6	2.10	0.019	<0.014	<0.015	0.005	0.016	0.100	0.029	0.027	nd	0.057	0.005	0.010	0.019	nd	nd
Naipe Type not noted (HLV-M-4)																	
BG83-52La	96.5	3.22	<0.015	0.019	<0.016	0.009	0.019	0.045	0.019	0.020	nd	<0.012	<0.006	0.058	0.033	nd	nd
naipe Type not noted (HLM-M-10)																	
BG83-52Lb	92.4	5.63	<0.013	0.020	0.037	0.008	0.018	0.050	0.037	<0.008	nd	0.037	0.011	0.009	0.019	nd	nd
naipe Type not noted (HLM-M-11)																	
BG83-52Lc	98.0	1.72	<0.014	0.012	0.035	0.007	0.014	0.036	0.016	0.016	nd	0.025	<0.006	0.018	0.086	nd	nd
naipe Type not noted (HLM-M-12)																	

Note: All data are presented as weight percent. Due to the observed thickness and overlying corrosion, microanalysis represents the best approach to ascertaining original compositions and colours. In contrast to the PIXE data which include a wider range of element concentrations above detection limits, the EPMA was calibrated for only four selected elements (Au, Ag. Cu, As) to provide accurate and more precise data. All of the PIXE compositional data in this table are for single *naipes*; not bundles. The PIXE data confirm none of the naipes are alloyed with Sn. The very low concentrations of Cl, Si and Ca indicate analysis of uncorroded metal. Not detected is reported as nd. Analyses are grouped by provenience and assigned size group: Huaca La Merced, Huaca Las Ventanas, Huaca El Menor. Types are listed as Group I (small), Group II (small), Group III (medium), Group IV (medium), Group Va (large).

Secondly, as Bezúr (2003:152, 155) observed, an increasing arsenic concentration begins to lower noticeably the melting temperature from that of pure copper at 1084°C. The changes occur slowly at first, but at an arsenic concentration level of 4%, it is lowered to 1038°C and at 10% level, it nears 970°C (Budd 1991b). As discussed later, lowering of melting temperature would have been quite important because of the difficulty and high labor "costs" along with further fuel utilization for the melting, casting and annealing (see Goldstein and Shimada 2007).

Perhaps more important to Sicán metalworkers was the superior ductility (in metalworking, ductility refers to the ability of a metal to withstand tensile stress or being stretched) and workability of metal alloys. As Bezúr (2003:154) summed up, a number of experimental studies (Budd and Ottaway 1991; Lechtman 1996; Northover 1989) indicate that an arsenic concentration of 2–8% increases the "work hardening and tensile strength of copper without compromising the ductility of the alloy"—that is to say, the Sicán metalworkers were able to produce thin sheets that were harder and stronger (while retaining some elasticity) than those of pure copper, that would not develop stress cracks. Metalworkers could have evaluated hardness and strength of the sheet-metal by simple bending or scratching tests for quality. Microhardness (testing of material's hardness) values of analyzed *naipes* range from 100 to 170 (Vickers microhardness measurements using 100 g loads), which, along with the microstructure, document that the *naipes* were left in a final cold worked state. The amount of cold working and annealing necessary to produce each *naipe* represents the application of highly refined and consistent metalworking skills and acute perception for recognizing when desired dimensions and qualities are attained. Similarly, the selection of sheets for *naipes* bundles appears to have been based on metalworkers' systematic and precise evaluation of their visual and tactile attributes which in turn reflect their mechanical or performance properties. Above-mentioned superior qualities and alloy selection may well explain why objects made of these alloys rapidly replaced pure copper ones, and became standardized. Much of the standardization of *naipes* may be attributed to recognizable alloy properties within specific compositional ranges produced by comparisons and sorting.

Additionally, these alloys produced a distinctly silver-pink to silvery appearance (that over time tarnishes into a golden color; Charles 1980; Northover 1989) clearly present at around 4% arsenic concentration (Budd 1991b: 66; Hosler 1988; Lechtman 1988). For the Andean mind that clearly valued gold, silver and their colors (Lechtman 1984, 1988), the last attribute may have been quite important (Shimada et al. 1999). The range of arsenic concentration in all of the *naipes* we have analyzed to date (from rare cases of >05% to high of 5.63%) indicates that color and composition in addition to the approximate size and weight were important criteria in not only sorting/bundling, but also determining their use and value (see below).

Comparing the effects of varied arsenic concentrations described above and the documented arsenic concentration in *naipes*, it is highly likely that a superior ductility and workability of the alloys were fundamental considerations. Let us not forget, however, that Sicán metallurgy had not developed to the point of being an exact science; rather it still had a character of a manual art that were shaped by numerous factors including insights from trial and errors and specific performance-related expectations. We cannot thus expect highly precise and uniform product qualities (that we expect in modern products) in discussing *naipes;* nevertheless, the documented property ranges seem remarkable with only visual and tactile means of control. The *naipe* color and perhaps markings and subsequent secondary hammer marks on the edges, represent some attempt at quality control of selected attributes for the recognized *naipe* sizes.

Their manufacture was highly labor and fuel intensive. To start with, mining of appropriate ores and the preparation and acquisition of hardwood charcoal fuel necessary for smelting and subsequent metalworking were very arduous in time and effort (Shimada and Craig 2013; Shimada and Merkel

Figure 6. The deformation at the edge attributed to cutting documented on *naipe* M9 from Huaca Loro East Tomb. The dark edges are mostly corrosion on the edge penetrating into the remaining metal. The remaining metal indicates deformation (from top to bottom in this image) interpreted as cutting along the edge to obtain the characteristic shape after extensive working. Note scale in lower right of the image. Etched photomicrograph courtesy of Stuart Laidlaw.

1991; also Goldstein and Shimada 2007). In addition, our replicative smelting experiments (Merkel and Shimada 1988; Shimada and Merkel 1991) amply demonstrated the challenge of attaining and sustaining high smelting temperature without benefit of bellows that did not exist in the pre-Hispanic Americas. Smelting relied on an inefficient and physically taxing lung-powered draft supply consisting of three to four blowtubes, each tipped with a ceramic *tuyere* with 8 mm bore hole, assisted by strong natural winds (cf. Hayashida et al. 2014). At the same time, small quantities of copper and copper alloys can be melted with a single tuyere and charcoal.

Just as labor and fuel intensive was the preparation of *uniformly thin* sheet-metals from cast ingots or preforms. Metallographic examination of cross-sections samples revealed telltale structural deformation of numerous, alternating cycles of hammering and annealing (Merkel et al. 1995; their Figure 5), presumably using efficient updraft furnaces described elsewhere (Shimada et al. 2007; Shimada and Wagner 2007) and heavy, dense and polished hammer-stones with appropriate facets for stretching and planishing. It is difficult to fully grasp the intense and skilled work required to produce the desired uniform thickness down to 0.1–0.3 mm for the smallest Group I *naipes*. Low magnification microscopy showed evidence of some *naipe*-shape having been cut out of larger sheet-metals with small chisels (Figure 6).

As seen in Figure 6, cut edges of Group I *naipes* are blunt, not sharp. Although no evidence of further finishing or abrading of the edge was observed among small *naipes*, mid-size (Group III and IV) specimens had the edges often thickened by upsetting (i.e., hammering the edge or end to make it thicker and/or shorter), resulting in a slight ridge along them. Mid-sized *naipes* appear to have been individually hammered out of preforms that were cast in an

Figure 7. Ceramic mold fragments excavated at Huaca Las Ventanas, Sicán. The left fragment may well be a part of mold for mid-sized *naipe*. Photo by I. Shimada.

approximate "I" shape (Figure 7). Hosler et al. (1990: 66–67; their Figure 45 on p. 69) found the five mid-sized (Group III and IV) *naipes* (one from a looted burial in Vicús in the upper Piura valley and four from the looted shaft-tomb at Huaca El Menor, Sicán) they analyzed were left in an annealed state after the shaping was done. In contrast, the smaller and thinner bundled *naipes* (Group I) from the East Tomb at Huaca Loro were cold-worked to their final state with resulting higher hardness values. The difference between annealed and cold worked copper and copper alloys is readily apparent just from bending the sheet by hand. The central trough appears to have been made near the end of the series of production steps and to have perhaps been shaped using a wooden chasing or forming block.

X-radiographic examination and removal of surface corrosion from ten Group I *naipes* from the Huaca Loro East Tomb that were bundled together revealed intentionally made but puzzling short, straight parallel marks on the surface of the trough and flanges (Figures 8 and 9; Merkel and Velarde 2000). There is an appreciable degree of similarity in marking documented among the *naipes* constituting this bundle. When the *naipes* were made, these markings would have been readily visible. This observation raises the possibility that such markings identify a specific metalworker or workshop or conversely a sponsor responsible for the *naipe* manufacture, much like the cases of marked Middle Sicán adobe bricks and ceramic mold marking (e.g., Cavallaro and Shimada 1988; Shimada 1997b; Shimada and Wagner 2007).

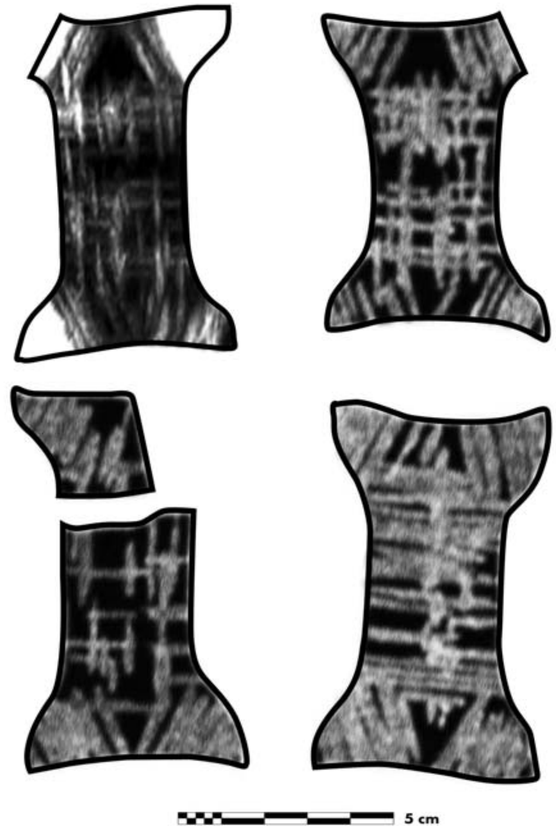

Figure 8. An x-radiograph and drawings of marking found on *naipes*from Huaca Loro East Tomb. Photo and drawing processed by S. Laidlaw and redrawn by K. Sharp.

These marks seem too complex to have served as readily recognizable and replicable identifiers. The rectilinear and patterned character of these marks and their distribution, however, support instead the view that they were produced in this corrugated structure that strengthened the thin sheet and made it easy to handle as proposed by Hosler et al. (1990:29, their Figure 15 caption). As in the case of burnishing "leather-hard" clay prior to firing in pottery production, these markings could well reflect the action of systematically rubbing the metal's surface with polished stone tools with rounded tips to flatten, smooth, or polish, and simultaneously strengthen it as noted above.

Figure 9. The x-radiograph on the left of the *naipe* specimen M9 from Huaca Loro East Tomb shows its pattern of surface markings. The photograph on the right of the same specimen taken after cleaning reveals these striations. Photos processed by S. Laidlaw.

Similar rectilinear marking is also recognizable on uncleaned but well-preserved, mid-sized (Group III and IV) *naipes* from Huaca El Menor, Huaca La Merced and other elite tombs at the site of Sicán. Clearly, additional East Tomb *naipe* bundles and larger-sized specimens from other contexts should be X-radiographed and investigated to ascertain the nature of marking variability and its possible non-structural function(s).

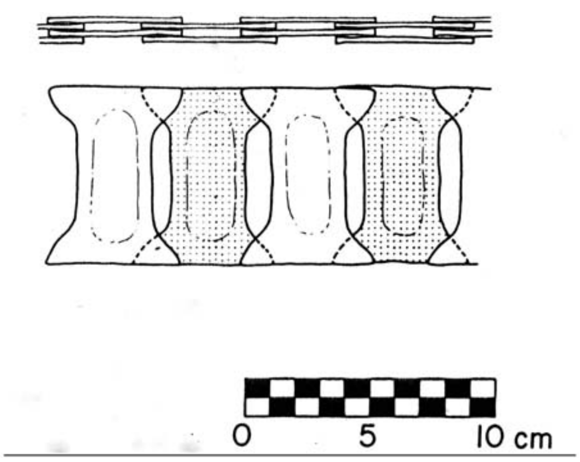

Figure 10. A small block of orderly stacked mid-size *naipes* (Group IV; cross-sectional view on top) discarded by looters at the gigantic shaft-tomb at Huaca El Menor just east of the Huaca Las Ventanas temple, Sicán. Drawing by I. Shimada.

As seen above, there seems to have been some variation in manufacturing and marking techniques. We concur with Bezúr (2003: 95; also Hosler et al. 1990: 53) that, "Manufacturing methods may have correlated with the size of individual specimens, with craftsmen fabricating larger *naipes* from individually cast blanks and cutting small *naipes* from a hammered sheet … " At the same time, this variability may have affected the use and value of the final products.

Contexts of Occurrence and Spatio-temporal Distribution

To date, nearly all cases of documented primary context *naipes* formed parts of Middle Sicán funerary offerings in the Lambayeque region of the north coast and the adjacent far north coast of Peru (Alva 1986; Bennett 1939:105; Guffroy et al. 1989; Pedersen 1976; Shimada 1985a, 1985b, 1990, 1995, 2014a, 2014b). Not all Middle Sicán funerary contexts, however, contain *naipes;* rather, they are found in the relatively elaborate tombs of "low" and "high elite" individuals (see Table 1). The same holds for *naipes'* relatives, the bundled sheaths or feathers; in fact, these relatives seem just as common as *naipes* in Middle Sicán low and high elite funerary contexts. These tombs may contain anywhere from a few dozens (e.g., West Tomb of Huaca Loro and Tomb 2 of the Huaca Loro West Cemetery) to hundreds of bundles of a small-size *naipes* (e.g., East Tomb of Huaca Loro; see Figure 5, above). A large looted tomb (14 m × 14 m by an estimated 20 m depth) at Huaca El Menor at Sicán contained an unknown number of blocks of orderly stacked two mid-sized (Group IV) *naipes* (not tied into bundles; Figure 10) with some blocks consisting of an upward of 500 *naipes* (Pedersen 1976). A partially looted high elite tomb salvaged from below the west base of the Huaca La Merced Mound 1, also at Sicán, preserved one or a few specimens of four sizes in addition to four packages of small *naipes* each wrapped in coarse cotton cloth and tied with a plant fiber cord (Elera 1984; Figure 1).

In addition to the above, a few bundles of small *naipes* (Group II) have been found associated with a human burial atop the Huaca Las Ventanas temple (Figure 11) and a sacrificial burial placed on the North Platform of Huaca Loro.

At a general level, the total number of *naipes* or their bundles found in a funerary context positively correlates with the inferred social status of the principal individual interred. The number and approximate (or estimated) weight of *naipes* deposited also correlate with the total variety and weight of all metal objects found in a given funerary context. With the exception of two cases described above, all primary contexts of *naipe* occurrence have just one size represented.

While the deceased in all of the above funerary contexts are believed to have been ethnically Sicán, *naipes* are rarely found associated with inferred ethnic Moche individuals, who were socially subordinate to the Sicáns. Their status and ethnicity have been defined on the basis of iconographic and figurine representations, settlement locations, variation in mortuary and sacrificial treatments (including associated goods) and mtDNA and stable isotope data, among other lines of evidence (Cervantes et al. 2011; Klaus 2014; Klaus et al. 2014, 2017; Shimada et al. 2004).

Figure 11. Bundles of small *naipes* (Group II), along with three early Middle Sicán pedestaled single-spout bottles and a tricolor jar that accompanied an adult male burial placed atop the Huaca Las Ventanas temple. Photo by I. Shimada.

One exceptional context of *naipe* occurrence is an elaborate ritual offering documented at the Huaca Loro West Cemetery (Figures 12 and 13). A cluster of over 60 corroded bundles of Group I (small size) *naipe*-perhaps originally wrapped together with a cotton cloth that long since perished—formed a part of what would have been a low elite funerary context had it had a deceased interred together. Use of *naipes* and their relatives as a part of ritual cache offerings may be in reality more common given that the sample size of such intact offerings is still quite small (n = 7).

One curious case of *naipe* occurrence is reported by Wassen (1973, 29), who describes a "problematic" object (35.5 × 54.0cm) looted from a burial at Sipán on the south bank of the mid-Lambayeque valley that consists of 49 *naipes* ("about 7 cm long"

Figure 12. A cluster of bundled *naipes* that formed part of an elaborate ritual offering documented at the Huaca Loro West Cemetery. Note the gilded mask was carefully positioned at the center of the niche surrounded by ceramic vessels and figurines, shell beads, clusters of cast arsenical-copper implements. The *naipe* cluster was placed near the mouth of the niche. Drawing by César Samillán.

Figure 13. Offerings consisting of bundles of rectangular *naipe* relatives (center bottom) and a *Spondylus crassisquama* (right) placed inside a columnar box atop the Huaca Lercanlech (a.k.a. Huaca Rodillona) temple mound, Sicán. The dark object on the left side of the photo is what remains of wooden post (*Prosopis sp.*). Photo by I. Shimada.

and 0.6–0.8 mm thick) stapled together. Tentatively interpreted as "ceremonial plate armor," it constitutes the only known case of stapled *naipes.* Because of the unusual presence of zinc (0.79% by weight) in these *naipes,* Hosler et al. (1990:66) raise a possibility that the object "could well be modern forgeries." To this date, we have not found any evidence of *naipes* of any size from secure contexts having being used as architectural or personal decorations or utilitarian tools (e.g., cutting/scraping—consider their blunt edges and thinness described earlier).

The emerging picture of the considerable social and economic importance of the *naipe* (and its relatives) in the Middle Sicán world is reinforced by the fact that its readily recognizable capital "I" shape is carefully reproduced as a press-molded as well as paddled between decoration on pottery, an identification mark on adobe bricks, and even as miniature carved bone (Figures 14 and 15). It is likely that the significance of the *naipes* was well known throughout the Middle Sicán world whether or not one had access to them.

A broader picture of *naipe* distribution in northern Peru and adjacent coastal Ecuador is derived mostly from specimens surface-collected at looted cemeteries within the Lambayeque valley and farther north and south commonly in association with the diagnostic Middle Sicán ceramic fragments (e.g., Ravines 2008:67, 84—for the Bayóbar Peninsula of the Sechura desert; Shimada 1988 for the Buenos Aires, Chulcanas, Vicús and Morropón areas in the upper Piura valley; Shimada 1981 for the Batán Grande area).

Our long-standing expectation of finding *naipes* in north coastal valleys south of Lambayeque where Middle Sicán presence has been well documented was recently confirmed with the discovery of a Group IV *naipe* in the Pampa de Mojucape, north of the Huaca Colorada site on the south bank of the Jequetepeque River (Branden Rizzuto, personal communication 2020; Figure 16). We would not be surprised if there were additional specimens at other sites in the Jequetepeque and the Chicama valleys.

In areas farther north, Richard P. Schaedel (personal communication 1987) reported that a burial found beneath the main Colonial church in the city of Tumbes contained *naipes* as well as inverted-T-shaped Ecuadorian axe monies. A few axe money

Figure 14. Sherd bearing a press-molded *naipe* design from Huaca Las Ventanas, Sicán. Photo by I. Shimada.

specimens have been surface-collected at the site of Garbanzal in Tumbes (Minato 1960) and a looted cemetery near Máncora some 87 km southwest of the city of Tumbes (Easby et al. 1967). The southward distribution of the "axe money" and the northward dispersion of the *naipes* overlap in the far north coast of Peru, the zone just where the "frontier" of the Ecuadorian and Peruvian cultural spheres oscillated over time (e.g., Burger 1984; Hocquenghem 1991).

Farther away from the Sicán territory, *naipes* are rare but have been reported from the Manabí province on the central coast of Ecuador near the modern city of Manta, the area where the Manteño culture (that largely overlaps in time with the Sicán) flourished (Stothert 2001; also Mayer 1992). Holm (1966/7:139, lower left piece in his Figure 3; see also comments in Hosler et al. 1990:19) illustrates a broken half of a medium-sized *naipe* that he describes as one of the "aberrant types of money axes" that occur typically as funerary offerings in the Manteño area. Given that these rare *naipe* specimens "are all broken into halves," he suggests their use as primitive monies with "fractional values."

What appear to be ceramic representations of two different-sized *naipes* (Figures 17 and 18) were excavated by J-F. Bouchard at Japotó, a well-preserved, large coastal Manteño village with numerous earthen mounds (estimated date of 900–1000 CE) close to the modern city of Manta in the Manabí province (K. Stothert, personal communication 2006; also see Bouchard et al. 2006). Although their specific contexts or reliable dates have not been published yet, they clearly resemble Middle Sicán copper-arsenic *naipes* in size and shape including their central troughs and triangular flanges. Their estimated original length of 7.2 and 6.5 cm and width of 6.2 and 5.5 cm are within the range of a common mid-size *naipes* found in large numbers in tombs at Huaca Las Ventanas and Menor, Sicán. Careful manner with which *naipes* were modeled in ceramics attests to the importance it held in the Manteño culture.

As "direct evidence" of the "Sicán-Milagro/ Manteño [Milagro is a contemporary of the Manteño in the south-east coast of Ecuador]" contact, Hosler et al. (1990:33, 71; also their Figure 19 on p. 33) discuss and illustrate "socket-end feathers" that were recovered from the "Cacique Guayas urn burial excavated by Meggers, Evans, and Estrada [unpublished] at the site of La

Figure 15. Small carved bone representing a *naipe* excavated at Mound I, Huaca Sialupe.1.7 cm long and 1.3 cm wide. This is the only known example of a *naipe* produced in bone. Photo by I. Shimada.

Figure 16. A badly corroded, partial *naipe* pertaining to Group IV (see Table 2) that was recovered at a looted cemetery on the northern end of the Pampa de Mojucape, Jequetepeque. One can see the basal part of the "wings" at the four corners of the specimen. Photo courtesy of B. Rizzuto.

Campañia, Los Rios Province" on the south-central coast of Ecuador. They are "virtually identical" to many of the feathers found in the Middle Sicán elite tombs and Hosler et al. (1990:71) suggest that they "may even be imports from Lambayeque." We concur with their assessment. Importantly, they also report that the same burial contained a number of ceramic *tuyeres* (Hosler et al. 1990:71; see also their Figure 46 on p. 84). While Hosler et al. (1990:71) feel that these *tuyeres* "are likely of local manufacture," they are virtually identical in size and shape to those found at various Middle Sicán metallurgical sites (e.g., Shimada 1985a, 378, his Figure 16.5; also Shimada and Merkel 1991). The small bore diameter (5.3 mm) of these *tuyeres* from the burial suggest that they were used in metal-working rather than smelting. Middle Sicán smelting involved the use of *tuyeres* with the highly consistent bore diameter of 8 mm. Hosler et al. (1990:71) discuss other metal objects from the site of La Campañia and other locations on the central and south-central coast of Ecuador that closely resemble Middle Sicán examples. One wonders if some Middle Sicán metalworkers were present in this area of the coastal Ecuador.

Seen from the broader perspective of the inferred interregional trade between the contemporaneous

Figure 17. Face 1 of the ceramic models of the *naipes* excavated at Japotó. Photo courtesy of K. Stothert with permission of J-F. Bouchard.

Figure 18. Face 2 of the ceramic models of the *naipes* excavated at Japotó. Photo courtesy of K. Stothert with permission of J-F. Bouchard).

Manteño (and perhaps the Milagro) and Middle Sicán cultures, various metal and ceramic items from coastal Ecuador described above do not come as a surprise. In fact, given the limited attention that late pre-Hispanic sites in coastal Ecuador have received until relatively recently, we suspect the *naipe* and other Middle Sicán products there has been under-reported.

Function and Significance

Data and observations presented above indicate that *naipes* and their relatives held a considerable significance in the Middle Sicán heartland and its northern domain and interaction sphere including the central and south-central coast of Ecuador. Within the Middle Sicán domain, they appear to have been differentially distributed and accumulated primarily among Sicán elites. More specifically, *naipes* made with the heavy investment of valuable alloys and skilled labor appear to have symbolized not only wealth, but, perhaps more importantly, social prestige and political power of the deceased and the associated living who were able to accumulate and take them out of circulation.

The social and symbolic importance of *naipes*, however, does not account for their exclusively northerly distribution. *Why was this the case?*

We argue that the *naipe* presence on the Ecuadorian coast is a tip of the iceberg of the persistent and largely economic interaction between the Manteño population (ca. 800–1532 CE) and the Middle Sicán and other pre-Hispanic populations on the northern Peruvian coast. Over the past

Figure 19. Large clusters of exceptionally large and complete *Spondylus crassisquama* and *Conus fergusoni* deposited in the East Tomb of Huaca Loro, Sicán. Altogether the tomb contained 179 and 141 of these two shells, respectively. Photo by I. Shimada.

several decades, based on archaeological and ethnohistorical data, various scholars (e.g., Carter 2008, 2011; Cordy-Collins 1990; Davidson 1981; Hocquenghem 1995, 2010; Lathrap et al. 1975; Marcos 1980; Marcos and Norton 1981; Norton 1986; Paulsen 1974; Pillsbury 1996; Rostworowski 1970, 1975; Salomon 1986, 1987; Shimada 1985a, 1990, 1994, 1995, 2010; *inter alia*) have argued that at the core of this interaction is a trade of the unprocessed and processed *mullu* (i.e., *chaquiras* or beads), large, tropical, marine shells such as *Spondylus*, *Conus,* and *Strombus.* It is widely known that singly or in different combinations, these shells have had enduring ritual and symbolic importance in western South America, particularly Peru and surrounding regions (e.g., Blower 2001; Carter 2008, 2011; Davidson 1981; Glowacki 2005; Mester 1990; Paulsen 1974; Rowe 1967).

Perhaps most insightful in regard to the inferred interregional trade is data from the comprehensive *chaîne opératoire* analysis of the Manteño *Spondylus* bead (*chaquira*) production and its antecedent and subsequent developments by Carter (2008). It revealed a close match between the size range, shape (small disc and tubular), coloration and the four-step "*heishi*" variant manufacturing technique (Carter 2008: 286; Foreman 1978) of beads that were valued and imported in quantity by the Middle Sicán elites, on one hand, and those produced at contemporaneous early Manteño bead production centers, particularly the site of Loma de los Cangrejitos. In addition, the close timing of the notable intensification and decline in the production of these specific types of beads and attendant adoption/development of the corresponding manufacturing methods matches the ebb and flow of Middle Sicán power and wealth (Carter 2008: 515). It is noteworthy that, to date, no *Spondylus* bead production center of the period under consideration has been found along the Peruvian coast and that bead production was fundamentally restricted to the Ecuadorian coast (e.g., Carter 2011; Martín and Carter 2010; Shimada 2010).

Elsewhere, Shimada (1985a,b, 1994, 1995, 2000, 2014a), has argued that the Middle Sicán polity intensified the aforementioned age-old trade for *mullu* by offering arsenical copper alloy products and products of large-scale irrigation agriculture to the Ecuadorian coastal populations to the point of monopolizing *mullu* acquisition and subsequent distribution on the Peruvian coast south of the Sicán heartland of the Lambayeque region. Hocquenghem (2010) presented much the same argument. The unprecedented accumulation of both *Spondylus* and *Conus* (both whole shells and beads) in Middle Sicán elite tombs in Lambayeque (Figure 19) is understandable given the explicit depictions of *Spondylus* harvest by means of divers with as simple tool presumably used to clean and dislodge such shells, and rope tied around their waist connected to boats (balsa rafts or reed boats, Figure 20; also see Figures 2 and 11(C) of Carcedo 2017, p. 40, 47, and Figures 2–4, of Cordy-Collins 1990, pp. 398–399). Carcedo (2017: 71; cf. Mackey and Pillsbury 2013) considers the significance of the representations of fishing and *Spondylus* harvesting as propitious symbols of abundance, fertility and continuity of the species, and as a symbol of gift offering to the divinities for these wishes to be fulfilled.

Well-shaped and preserved *Spondylus crassisquama* (the taxonomic designation *Spondylus princeps* that was previously used widely is not accepted today and has been replaced by *Spondylus crassisquama*), by itself or together with *Conus fergusoni,* that were highly restricted in its distribution in the earlier Moche funerary and ritual contexts seem to have become more common during the Moche V period (ca. 600–750 C.E.) and notably more common in Middle Sicán elite tombs and ritual offerings (Shimada 1994, 2010, 2014a, 2014b). Sicán art in various media of expression (ceramics, textiles, metals and wood; Figures 21 and 22) became replete with representations of *Spondylus* whether they occurred in the heartland or outside. A Late Sicán ceramic offering was documented at the well-known *Spondylus* harvesting site of Isla de la Plata off the Manabí coast (Marcos and Norton 1981). It is quite certain that *mullu* in both natural and bead forms were imported in large quantities probably via overland routes from Tumbes to the

Figure 20. A shallow Sicán ceramic bowl thoroughly covered with sheet-metal (corroded silver alloy?) with repoussé representations of divers, each with a rope tied to their waist harvesting *Spondylus*. Note the two men aboard a raft-like vessel holding the ropes connected to the divers. Rafts carry harvested Spondylus. Diameter = 19.8 cm; height = 4.8 cm. Brüning Archaeological Museum, Lambayeque. Photo courtesy of Yutaka Yoshii.

Middle Sicán domain on the north coast of Peru (Hocquenghem 1993).

The significant increase in *mullu* acquisition, use and distribution, particularly in the Lambayeque region and coastal area farther south is a phenomenon that we hypothesize to have been closely intertwined with the function and significance of *naipes* as well as their northerly distribution. *Mullu* and *naipes* should be considered together. We argue that the Middle Sicán polity promoted and disseminated its religious and political dogma that were encapsulated in the concept of the Sicán Deity and its earthly alter ego, Sicán Lord, by assuring local elites of secure access to *Spondylus crassisquama* and *Conus fergusoni,* as well as other enticements such as prestige goods including shell and mineral beads, arsenical copper alloy products, and lustrous black pottery (Segura and Shimada 2014; Shimada 2014a). The Middle Sicán polity effectively transduced their strategic geographical location between the coastal Ecuador and Peru and pyrotechnological superiority (particularly large-scale arsenical copper alloy production) to establish itself as the principal purveyor of the *mullu* for much of coastal Peru and concurrently to promote and disseminate its religious and political dogma. In essence, its regional and interregional economy formed a mutually reinforcing whole that allowed the Sicán to pursue their religious and political agenda.

Figure 21. Carved Sicán Deity and *Sponylus princeps* atop the wooden staff found associated with a provincial Sicán elite funerary bundle excavated at the Huaca Cao Viejo mound, site of El Brujo at the mouth of the Chicama valley. Photo by I. Shimada.

Our proposition that the *naipes* served as a medium of exchange in the Manteño-Middle Sicán trade is largely based upon the broader contextual understanding that was described above. We use the term medium of exchange in reference to a material item broadly accepted by all parties involved as representing a standard of value (has a known intrinsic value). In our uses of the term, such items would have been exchanged for desired or necessary goods or service from others. Its usage facilitated transactions between two parties as it circumvented difficulties that affect barters because it involved an individual and subjective valuation process. It was

Figure 22. Middle Sicán ceremonial gold cup with *Spondylus crassisquama* representations. Banco Central de Reserva del Perú collection. Photo courtesy of Yutaka Yoshii.

this advantage that *naipes* offered, that we suggest transformed them from being merely "good for exchange" to becoming a medium of exchange. At the same time, we see the utility of *naipes* to be restricted to the specific context of inferred Sicán-Manteño economic transactions in which their specific valuation was believed to have been shared by those who partook in the transaction. More specifically, we hypothesize that *naipes* as mediums of exchange were used by the Middle Sicán agents in their transactions with the contemporaneous Early Manteño counterparts to acquire desired prestige and ritual items, in particular, *Spondylus* and *Conus* shells and their beads. We do not envision *naipes* to have been broadly used as primitive monies to acquire any goods or services in an open market economy as is done with modern paper money and coins. Salomon (1987:66) describes how commoners as well as nobles and specialists in the early colonial Pasto country (the Ecuador–Colombia border region) used presumably standardized marine shell beads (*chaquiras*) as currency and "to buy in the native marketplace." It is not clear *chaquiras* or other mediums of exchange were used there as currency during and prior to the Inca period. Various standardized attributes of *naipes*, including their multiple sizes, however, suggest that some were exchanged by size and weight, and perhaps even color (that reflects their arsenic concentrations). Given that the shell beads that Manteño artisans produced for the Sicán were also well standardized in their shapes and dimensions as well as material and manufacturing techniques employed, the exchange process may have been relatively simple.

It is worth noting that the *naipes* share the list of intrinsic qualities of broadly conceived "primitive monies" that Holm's (1975:2–3) presented. He lists:

> (a) utility or intrinsic value of raw material used (i.e., metal); (b) increased value of metal for being a nonlocal product to the area where monies are used and requiring considerable manpower investment; (c) portability of being relatively small in size and weight; (d) durability derived from general strength of the metal; (e) uniformity or standardization (within a certain range of error being hand-made) of size, weight and form; (f) divisibility (cut or broken into different portions) /multiplicability to cope with different values; (g) stability of value resulting from the high cost of production mentioned in (b) and portions taken out of circulation in form of ritual and funerary offerings; and (h) cognoscibility of its value and function for having the features described above.

For the metal and metallic ore-poor Manteño (and perhaps Milagro as well) populations on coastal Ecuador, the first two attributes would have been particularly important in accepting the value of the *naipes*. They could have served to readily produce or, alternatively, melted and alloyed to produce what were locally deemed necessary or desirable. At present, however, the scarcity and contextual uncertainty of the *naipes* on the Ecuadorian coast does not allow us to specify their functions and distributional processes among Manteño (and Milagro) populations other than to infer that they served as context-specific media of exchange that brought *mullu* in various forms to the Middle Sicán territory. Use of valued and standardized metal objects as a medium of exchange should not surprise us as they are found elsewhere, for example, the iron objects of southern Cameroon (Guyer 1985; cf. Dalton 1965; Melitz 1974; Quiggin 2017).

Although Holm (1975) may have subsumed the sparsely occurring *naipes* in his discussion of primitive monies, he was primarily concerned with the T-shaped "axe monies." As noted above, advance in our understanding of *naipes* as well as axe monies on coastal Ecuador has been seriously restricted by the paucity of reliable information concerning their usage and contexts of occurrence.

We cannot, however, disregard the possibility that the *naipes* also served as ritual and funerary offerings there as in the Sicán heartland (see below). Indeed, the *naipes* (and their relatives) within the Middle Sicán domain functioned as visible, durable symbols of personal wealth, power and prestige among Sicán elites and their offerings to supernaturals, often together with *mullu* and/or human sacrifices (see Figure 12). As much as in the case of their functions in the Manteño (/Milagro)-Middle Sicán trade, the same two attributes (a, b—see above) underlie this interpretation. The critical role *naipes* played in acquiring exotic/prestige valuables from distant land, particularly *mullu* and their products, surely augmented their value and prestige of the associated elites (e.g., Helms 1993; Trubitt 2003). Other sumptuary items of amber and emerald found in the Middle Sicán elite tombs appear to originate in Colombia (Shimada and Griffin 2005; Shimada et al. 1997) and likely to have been obtained by the Sicán through an Ecuadorian intermediary such as the Manteño.

The standardization in size, form, material and manufacture that characterize *naipes* and their relatives, we suggest, had another important function in the Middle Sicán context; that it assured the comparability of the *naipes* and their relatives being produced by multiple workshops dispersed within the heartland, facilitating their use in inferred trade with coastal Ecuador.

Details of the Middle Sicán arsenical-copper alloy production organization are described elsewhere (Goldstein and Shimada 2007; Shimada et al. 2007; Shimada and Craig 2013; Shimada and Merkel 1991; Shimada and Wagner 2007). Instead of the entire metallurgical production process *lineally* organized with a set of specialized workshops, each dedicated to a specific phase or stage of the process, the Middle Sicán approach was based on a *modular organization* of the basic productive groups and "task redundancy on a regional level" (Bezúr 2003:130). Dispersed multiple workshops of similar sizes that were similarly (but by no mean identically) equipped and organized were engaged in the *same tasks of either smelting or metalworking*. There were few indications of high-level, external supervision; each workshop appears to have been entrusted with daily operation and maintenance, giving rise to a wide range of variation in anything from the number of smelting furnaces (3–5) to decoration and shape of *tuyeres*.

A similar modular, task-redundant organization was recognized for craft production at the earlier Moche V (ca. 600–750 C.E.) urban capital of Pampa Grande (Shimada 1994c, 2001) and the Middle Sicán workshops at Huaca La Pava (Fernández and Saavedra 2014), Huaca Sialupe (Shimada and Wagner 2007), Pampa de Chaparrí (Hayashida et al. 2014), among other sites. This organization may well be the precursor to what was called *parcialidades* (subdivisions) in historical documents that describe late pre-Hispanic and early colonial economic organization on the north coast of Peru (ca. 15th to 16th centuries; Netherly 1977, 1990; Ramirez 1981, 1986; Rostworowski 1981, 1989). These documents describe how craft and other specialists were organized into a series of *parcialidades* based on their specialties, each with its own hierarchy of local leaders, who in turn served the

Chimú and later Inka overlords. This meant that, for late prehispanic times, the Lambayeque Complex as a whole, had multiple, similarly organized and relatively small and autonomous metal-producing groups.

While this approach would offer various attractive features such as a greater sense of local/workers' autonomy and identity and minimizing of the administrative cost of the Middle Sicán polity, it would also result a greater variability in product quality. Some degree of variability was inevitable given that different smelting workshops relied on ores from different mines and visual cues in smelting (e.g., color and viscosity of slag being formed in the furnace; Shimada and Craig 2013). It is also unclear whether there were rigorous protocols and precise recipes for consistently achieving specific alloy composition, colors and/or ductility in products. Thus, the standardization in broad sense in size, form, material and manufacture of the *naipes* and their relatives, we argue is a solution that assured product comparability (and thus their values in the economic transactions) at the regional level, while allowing a certain degree of local autonomy and minimizing potential conflicts between the local producers and their supervisors.

Archaeometallurgical Assessment of the Role of the *Naipe*

Hosler et al. (1990) questioned an earlier version of our hypothesis (Shimada 1985a) based heavily on results of technical analyses of a handful of mostly surface-collected Middle Sicán *naipes* and their relatives as well as similarly derived Ecuadorian axe-monies and their relatives. Their study does not weaken our proposition; on the contrary, various observations they made strengthen our case.

Clearly, they did not have benefit of specific and general contextual and archaeometric data that we have compiled and presented above. Further, they recognize paucity of archaeometallurgical studies on coastal Ecuador that would allow them to appropriately evaluate their archaeometric data (Hosler et al. 1990:72–73) or be certain of the geographical origins of metals used there. To this day, we are not aware of definitive smelting workshops of the time period under study reported on the coastal Ecuador or in the adjacent cis-Andean region. In fact, Hosler et al. (1990:75) acknowledge the "absence of any ore mineralization on the Ecuadorian coast" that would have provided necessary ores for copper-arsenic alloy smelting. They describe four clean plano-convex, low-arsenic copper arsenic alloy ingots (0.3–0.5% by weight; their Table 2; Hosler et al. 1990:92–96) from the central and south-central coast of Ecuador that are "likely to be crucible products" rather than primary smelting products (Hosler et al. 1990:73). The low arsenic concentrations of these ingots as well as a much wider arsenic concentration range documented for the Ecuadorian corpus of objects they analyzed (Hosler et al. 1990: 73–74; see their Table 2) is not a surprise given a wide range of arsenic concentrations (up to 30% by weight) we have documented among Middle Sicán ingots, prill clusters, *naipes* and their relatives, and other products (Bezúr 2003; Merkel et al. 1995; Shimada and Craig 2013; Shimada et al. 2018; also Tables 3 and 4). Modern experimentation has shown that under oxidizing conditions arsenic concentrations decrease in copper alloys with melting, casting and working (McKerrell and Tylecote 1972; Merkel 1990; Pernicka 2004). Thus, if imported Middle Sicán arsenical copper alloy products were melted and/or reworked by coastal Ecuadorian metalworkers to produce what were locally desired, we would expect corresponding lowering of arsenic concentrations.

Hosler et al. (1990:74) suggest the possibility of co-smelting of copper oxide ores and arsenosulfide ores to explain the arsenic concentration variability, which we have independently concluded based on the locally mined ores and smelting byproducts (e.g., the presence of small sulphide and matte inclusions documented with SEM/EDS in metallographic sections of metal and slag samples) that we excavated at Middle Sicán smelting sites (Bezúr 2003; Merkel et al. 1995; Shimada and Craig 2013). For the Middle and Late

Sicán periods, the autogenous character of the mining of necessary ores and associated arsenical copper alloy production in a considerable scale and intensity has been documented (e.g., Epstein and Shimada 1983; Merkel et al. 1995; Shimada and Craig 2013; Shimada et al. 1982; Shimada and Merkel 1991). To date, within the Lambayeque Complex, there are six excavated Middle Sicán copper-arsenic smelting sites and at least five (probably as many as nine) additional sites identified in the region (Shimada and Craig 2013). As described below, there appears to have been a good deal of autonomy allowed for daily operation within these workshops suggesting that their products (including arsenic concentration) could also have varied to some degree in various respects.

In general, much of the extensive discussion of arsenic concentration variability that Hosler et al. (1990:73–75) present in assessing Shimada's earlier hypothesis is no longer applicable in light of what we presented above. At the same time, it is equally evident that general archaeological knowledge (including archaeometallurgy and chronology) of the coastal Ecuador and adjacent cis-Andean region need to be improved for us to gain a better understanding of the Middle Sicán-Manteño (/Milagro) relationship.

Discussion and Conclusion

Our paper has synthesized currently available archaeological, archaeometallurgical and archaeometric information regarding the arsenical-copper alloy sheet-metal objects known as *naipes* and to a lesser degree, their relatives, focusing on samples derived from secure primary contexts. Within broad regional cultural and historical contexts for *naipes*, our data and insights have been achieved through over four decades by the Sicán Archaeological Project.

In this concluding section, we summarize and offer additional observations on the major questions posed at the beginning of this paper. First, their function(s) and significance, we submit, are intimately linked to the choice of arsenical copper alloys as their material. Its superior intrinsic (performance) qualities, particularly their ductility and workability, made these alloys well suited for the long-standing north coast metallurgical tradition of emphasizing sheet-metals (Lechtman 1980, 1981). They could be hardened without developing stress cracks better than copper. Their durability and superior resistance against corrosion are additional beneficial properties for the sheet-metal products that were stacked and transported to varied distance.

Another key factor for the choice may well have been color. Although the extent to which a distinctly silver-pink to silvery appearance (that over time tarnishes into a golden color) of relatively high arsenic copper alloys had played in the choice remains to be ascertained, we believe subtle alloy color variation was recognized and exploited for sorting products as well as in the alloying process (Shimada and Merkel in press). For the culture that greatly valued metals to the point of using them as social status markers and many other purposes (Shimada 1994b, 2015) as shown in Table 1, the perceptible color similarity to that of valued silver and gold may have been an important consideration. It is significant to note that the ratio of copper and arsenic in precious metal alloys has some correlation with the *naipes* alloy compositions. Quite predictably, Sicán gold and silver were alloyed with arsenical copper (Merkel et al. 1995; Shimada et al. 2018). Additionally, if *naipes* had served as readily transportable raw materials to be melted to fashion different objects on the central coast of Ecuador, then the color differences would have been a most practical manner for identifying arsenic concentration within ranges.

Although the Middle Sicán was not the first to produce these alloys (see Donnan et al. 2008; Kroeber 1954 for a limited number of Moche antecedents), their metallurgists refined and expanded its production to what can be called epi-industrial scale (Shimada and Craig 2013). Undoubtedly the recognition of these metallurgical qualities and the drive to exploit and expand their production went hand in hand.

The highly exact qualitative and dimensional standardization that is common in contemporary manufactured goods cannot be expected in the context of pre-Hispanic manual production (cf., Costin and Hagstrum 1995; Longacre 1999; Longacre et al. 1988; Rice 1991). As described in this paper, *naipes* and their relatives, however, exhibit a relatively narrow variation in regard to many key formal, technical-technological, and stylistic attributes that together suggest the presence of established standards that dispersed Middle Sicán metal workshops complied.

The standardization of *naipes,* as well as their contexts of occurrence (Middle Sicán sites in the northern north coast of Peru and farther north and the early Manteño sites on the central and south Ecuadorian coast) and the consistent choice of uniformly thin, hammered arsenical copper alloy sheet-metal as the raw material as a whole illuminate their functions and significance; that they served dual functions as (1) a medium of exchange in the interregional trade between the Middle Sicán and the contemporary early Manteño, and (2) prestige goods used in ritual and funerary offerings.

The former entailed the Middle Sicán polity that monopolized the arsenical copper alloy production on the north coast offering *naipes* that could be used as versatile and/or valued stock (or "store of value") for preparing a variety of utilitarian, ornamental, prestige and/or ritual items by the metal-poor Manteño population. For example, *naipes* could have been alloyed with gold and silver to make other precious metal objects (Merkel et al. 1995; Shimada et al. 2018). The consistent low arsenic concentrations correlate with the proportion of copper added to the Middle Sicán precious gold alloy compositions. All forms of exchange are possible only with the acceptance of the notion of comparable value of what are being exchanged, whether material, non-material (economic, prestige, or some other) in nature, by both parties involved. Product standardization would have facilitated such transactions, particularly when *naipes* were produced by modularly organized, dispersed workshops. In fact, we suspect that the extensive *naipe* production played a key role in the overall production and appreciation of metallurgical properties of arsenical copper alloys. *Naipes* are at the end of the *chaîne opératoire* for arsenical copper alloys within Middle Sicán metallurgy. Recognition of changing alloy properties is significant at every step in production and use. The production of arsenical copper through co-smelting copper ores with arsenic-rich ores (Lechtmann and Klein 1999; Merkel et al. 1994; Shimada and Craig 2013), was "standardized" further through the final step of sorting the high arsenic alloy compositions as naipes, and then making their bundles. At the same time, standardization was a practical solution to assure the inter-workshop comparability of *naipes,* while allowing a sense of autonomy and identity of workshops and artisan communities involved. In other words, standardization was not based on concern for productive efficiency but was rather a *practical economic and social strategy* for the specific and unique Middle Sicán world.

In exchange for *naipes,* the Manteño offered, in turn, whole and/or processed (beads) *mullu* (*Spondylus sp., Conus sp., Strombus sp.*) that were highly valued ritual and prestige items in the Sicán domain on the north coast and sphere of influence farther south at least to the south-central coast of Peru (Segura and Shimada 2014). Just as the imported, superior arsenical-copper alloy products would have had an elevated value in the metal-poor Manteño (/Milagro) territory, these *mullu* and their beads outside of their provenience commanded a considerable ritual and symbolic value on coastal Peru and beyond. Use and distribution of *naipes* in the Middle Sicán world is unprecedented with their explicit artistic representations, including scenes of *Spondylus* harvesting.

The *mullu* did not possess similar value in the early Manteño society (Carter 2008). Offering of whole *Spondylus crassisquama* in any Middle Sicán context (as well as the preceding and subsequent Moche and Chimú contexts), for example, signaled its social and/or religious significance, but such practice or importance apparently did not exist in the Manteño world. The Manteño could also have served as an intermediary in long-distance trade that brought amber and emerald to the Sicán heartland from as far north as Colombia (Shimada et al. 1997).

As seen above, the extent of the Middle Sicán sphere of trade and influence was unprecedented for north coast-based polity. Southward, it extended beyond sites in metropolitan Lima and Pachacamac (Segura and Shimada 2014; Shimada 1991, 2014a; Uhle 1903). The very fact that the distribution of *naipes* was restricted to the northern north coast of Peru including Sicán heartland and farther north constitutes yet another key line of evidence in support of our view that *naipes* served as a medium of exchange in the trade with the contemporary early Manteño.

We infer that the ritual and funerary usage of *naipes*, on the other hand, was underlain by the widespread recognition that *naipes* were a materialization of power over valued material (superior arsenical copper alloys) and human resources. Not only smelting of arsenical copper alloy was highly costly, but preparation of uniformly thin sheet-metals with faceted stone hammers would have represented a considerable investment of skilled manpower and fuels. Not surprisingly, the quantity of *naipes* deposited in Sicán funerary contexts correlate with the inferred social status of the deceased (see Table 1). *Naipes* in essence served as durable, readily storable and visible symbols of wealth, power and prestige of Sicán elites. It is likely that *naipes* as imported products of skilled labor would have enhanced their value on coastal Ecuador.

In conclusion, this paper represents our updated vision of *naipes* and relatives that Shimada (1985a, 1985b) first discussed 36 years ago. It presented their intrinsic qualities including their alloy compositions and performance properties, manufacturing techniques and process, as well as their temporal and spatial distribution, usage and contexts of occurrence. Assessment of their functions and significance was based on the holistic approach that characterized our multi-decadal project. Thus, pertinent archaeometallurgical and archaeological information was evaluated within nested contexts—from specific and local production and use to the regional (Lambayeque Complex and its vicinities) and interregional (including the Manteño territory and beyond in the north Andes) contexts. It is from such a holistic perspective that we argue that *naipes* served two context-dependent purposes as a standardized medium of exchange in Middle Sicán-early Manteño interregional trade and as prestige items for Middle Sicán elite rituals and tombs; that their economic role and significance in one context coexisted with those of social and symbolic character in another. Similarly, our holistic perspective amply demonstrated that product standardization is neither restricted to a particular mode of production or type of product nor is it dictated by a technical-technological or economic factor; it serves diverse ends depending on context and item under consideration from facilitating economic transactions to guiding production among dispersed and disparate workshops while permitting maintenance of social identity and autonomy.

Finally, it is hoped that this paper stimulates further studies of the pre-Inka Andean media of exchange and other standardized tokens.

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