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Naipes (axe moneys): a pre-Hispanic currency in Peru

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Between AD 900 and 1100 in northern Peru, high-status members of the Middle Sicán culture were buried in large tombs accompanied by elaborate grave goods that included gold, silver and copper objects, and also pieces of sheet metal known as naipes. Metallurgical study of naipes at the Institute supports the view that they were a form of "primitive money".

Naipes (the Spanish word means "playing cards") are pre-Hispanic I-shaped objects made of sheet metal. They have central ridges that are raised and elongated, and the metal usually consists of a distinctive alloy of copper with arsenic. At the archaeological site of Sicán, in northern coastal Peru (Fig. 1),[1] over 20.000 naipes have been discovered in excavations of a single elite tomb, where a person of high status was buried (Fig. 2). Large numbers of naipes discarded by looters (huaqueros) next to their pits are sometimes the only surface remains from once-intact pre-Hispanic tombs. The naipes are left by the looters because there is no commercial market for these common objects – in contrast to any precious-metal objects found in tombs. However, these discarded naipes provide archaeologists with a fascinating insight into the organizational structure, multiple uses of metals, and trade connections of the Sicán culture. They represent an important class of objects for archaometallurgical investigation in the pre-Inca Middle Sicán period (AD 900–1100).[2]

"Primitive money"

Axe money is the general term used to designate and classify standardized sheet-metal objects that to a degree resemble an axe shape and are thought to have functioned as a form of primitive money. Many different types of axe money have been recognized in pre-Hispanic South and Central America.[3] Each type, such as the naipes, has a distinct geographical distribution. However, more archaeological research is needed to discover the extent of each regional distribution and to identify areas of overlap between types.

A formal definition of primitive money simply as a medium of exchange is very general, but it does allow a wide range of objects (which may function as money only in part) to be better understood within a variety of ancient and present-day non-industrial cultures.[4] Money can also have other functions, such as units of account, status markers and storage of value, which seem relevant for interpreting the role of naipes within the Sicán culture.

The word "primitive" is used to differentiate the exchange use of certain objects from modern functions and concepts of money. Modern coinage (with its devaluations and alloy substitutions) is much more complex in its functions. Paper money, credit cards and electronic money used for transactions are based upon trust and accepted modern conventions. Understanding and exploiting money is a distinguishing feature of modern global economic activities, and our complex uses of money today help to characterize our modern culture. Primitive money fulfils some of the fundamental aspects of a modern currency. However, the term should not imply that primitive money of various materials (metal, feathers, textiles or shells, for example) is somehow too simple to be interesting. Naipes represent a distinctive and fascinating form of pre-Hispanic, South American primitive money.

Figure 2 *Excavation by Izumi Shimada of an elite tomb at Huaca las Ventanas, Sicán, northern Peru; many bundles of naipes were found in the tomb and elsewhere at the site.*

Archaeological evidence

Within the Middle Sicán cultural region, naipes are often discovered stacked and tied together with cotton cord in bundles of five and ten. Other stacks have been found with as many as 30 naipes tied together, or as multiple bundles retied to form larger groups. The central ridge facilitated stacking. Some bundles were stacked in opposing directions, so that the raised surfaces face outwards when tied together. The naipes are most prevalent at the site of Sicán and at other Middle Sicán sites in the Lambayeque region, where they occur as grave goods in both simple and elaborate burials of the Middle Sicán period.

There is no obvious function for naipes as tools or weapons. The sheet metal is not appropriate for making axes. The edges of naipes are blunt, so they were not used for cutting or scraping. Nor is there evidence for their use as architectural or personal decorations. Copper–arsenic "digging tools", weighing up to about 1kg each, are also found tied together in some elite tombs, and they may represent lots intended for distribution to work gangs.[5] But the naipes, which occur in great numbers, deliberately sorted, stacked and tied into bundles, have no obvious functions as tools. For example, some 1,500 bundles of naipes were buried in the largest niche in

Figure 1 *The eroded mudbrick temple platform of Huaca Loro, part of the Middle Sicán capital (c. AD 900–1100), northern Peru.*

the East Tomb at Huaca Loro at Sicán. Large numbers of naipes found in elite tombs, together with more elaborate objects, some of precious metal, are interpreted as indicators of social status. Naipes may also have served as units of account. So far, five sizes have been identified – ranging in length from about 4.5 cm to about 8.5 cm – but their original thickness and weight are not easily measured because of corrosion covering the whole surface.

The use of naipes to pay for exotic materials may be inferred from the geographical distribution of different types. A few examples of Sicán naipes have been found farther north in the Piura Valley in association with Middle Sicán black pottery. There are also several examples of bundles of Sicán naipes that have been found in burials of the Manteno–Huancavilca culture in Ecuador, and other finds of Sicán naipes have been reported from Ecuador.[3,6] Long-distance trade for exotic materials, such as emeralds and cinnabar (a red ore of mercury), developed during the Sicán period with the use of naipes in "payment" or exchange as objects of a recognizable and durable copper–arsenic alloy composition. More research is under way to define better the geographical distribution of each distinct type of axe money; furthermore, on the basis of the available archaeological evidence, naipes appear to have fulfilled several important functions as primitive money.

Technical studies

Technical studies at the Institute of Archaeology have extended the interpretation of naipes as a store of value for the Middle Sicán culture. A collection of bundles from the East Tomb at Huaca Loro was exported from Peru and included in the programme of technical study and conservation. MSc students being trained in the conservation of metallic artefacts have studied bundles of naipes as part of their coursework. One bundle of ten was sectioned for metallographic investigation and analyzed using the electron-probe microanalytical facility at the Institute.[7]

The compositional study of naipes has revealed apparent trends for the percentage weight of arsenic in the copper alloy. A range of 3.5–4.5 per cent arsenic is usually reported for the Sicán naipes. However, the bundle analyzed at the Institute has a range of 0.8–2.0 per cent arsenic. Calibrations have been checked extensively to ensure the accuracy of the measured range of values. The corroded metal has higher arsenic concentrations than the uncorroded metal. Apparently there were several recognized ranges of alloy composition. The naipes were stacked and tied together in bundles, with discrete compositional ranges, suggesting that copper–arsenic alloys were recognized at levels over about 0.5 per cent arsenic.

That naipes can represent a store of value is suggested by technical studies of gold-alloy artefacts from the East Tomb at Huaca Loro.[8] These show that the copper–arsenic alloy naipes were probably alloyed with gold and silver to make other precious-metal objects. The consistently low arsenic concentrations correlate with the proportion of copper added to the precious gold-alloy compositions. The ratio of copper and arsenic in the naipes is approximately the same as the equivalent ratio in the gold alloys. The possibility of changing one type of metal object into other useful objects is an important aspect of their "store of value" function.[9]

Naipes were apparently made from specifically selected alloys of copper and arsenic. The alloy was produced deliberately by smelting together combinations of copper ore and arsenic-containing ore.[10] Copper–arsenic alloy metal made during smelting was collected from the crushed slag and remelted to form ingots. The resulting ingots could be alloyed with gold or silver, cast into other objects such as the "digging tools" already mentioned, or hammered into sheet of a desired thickness for making various other objects, including naipes. There would have been multiple cycles of hammering and annealing before the desired thickness was achieved. Selection and classification of the copper–arsenic alloys may have taken place during hammering, depending upon how each metal composition responded. The raised and elongated ridges down the centre of the naipes would have added to their overall strength, as do the ridges of modern corrugated sheet metal. Metallographic evidence indicates that the final I-shape was cut using chisels. No evidence of further finishing or abrading of the edge was observed. Microhardness values range from 100 to 170 (Vickers microhardness measurements using 100g loads) which, together with the microstructural evidence, indicate that the naipes were finished to a relatively hard cold-worked state. The fact that aipes were counted and tied together in bundles suggests that various other selection criteria, such as colour or composition, may also have applied.

While buried, bundles of naipes corroded together. Often traces of the string used to tie them together are preserved on their corroded surfaces. Sometimes the organic fibres (preserved by the copper) can be identified, by means of the scanning electron microscope, as cotton. Some bundles are rather fragile and may come apart when handled, but others are solidly corroded together.

Conservation cleaning

For investigative cleaning of corroded bundles of naipes, there is an ethical reluctance to separate each naipe for technical analysis. However, once photographed and documented as a bundle the investigation of each individual naipe, and how it was stacked, becomes more acceptable and meaningful. For example, X-radiography and investigative cleaning of individual naipes have revealed a wide variety of surface markings (Fig. 3). The superficial markings have been interpreted as a "legitimating device" which would make the object immediately recognizable. The complexity of these markings was unexpected because very few striations are readily visible through the corroded surface. However, when the naipes were made, these surface markings would have been readily visible. Perhaps they were indicators of the naipes' alloy composition and quality for further working. They may also relate to stacking criteria, or serve as identifiers of production groups (like the markings observed on adobe mudbricks in the temple platforms at Sicán).[11]

The rigidity of the I-shape and the cold-worked final state of the naipes would have allowed these sheet-metal shapes to be evaluated for quality by simple bending tests. Occasionally, during investigative cleaning, evidence has been noted of additional hammering localized in one area of the surface at the edge. Because this overmarking is not common and covers other systematic elaborate patterning, as well as distorting the edge and producing cracking, it is interpreted as the result of secondary hammering during "testing". The edge

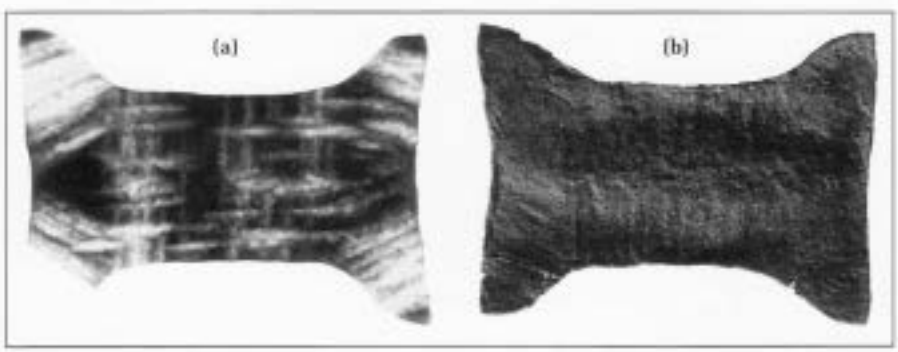

Figure 3 *One naipe from Huaca Loro, Sicán: (a) X-radiograph showing a complex pattern of markings (such markings become more visible when naipes are cleaned or X-rayed); (b) the markings revealed by investigative conservation cleaning.*

was hammered in one spot until the metal deformed and started to crack. This is a very effective means of testing the quality of sheet metal.

Some of the individual naipes are unmarked and their compositions need to be investigated. The I-shape is also found to vary slightly, depending on the curvature or angularity of the outer corners. These variations in shape may correlate with compositional differences or similarities. Unexpectedly, the low range of 0.8–2.0 per cent arsenic, which was reported for a Sicán I-shaped naipe bundle, coincides with a bundle of very differently shaped axe money found in Ecuador.

Conclusion

The copper–arsenic alloys used in antiquity are of little practical use today, so modern metallurgical research has generally neglected technical characterizations of them. Arsenic and most other impurities are detrimental to the electrical conductivity of copper. However, what specific properties may have been recognized and exploited in the past? Certainly, work-hardening, annealing, melting temperature and colour changes were observed with alloying, but to what extent were these properties manipulated and appreciated? Technical evaluations of the copper–arsenic alloys are required for a modern appreciation of ancient capabilities. Recent work by Heather Lechtman at the Massachusetts Institute of Technology has emphasized the tensile mechanical properties of copper–arsenic alloys.[12] High-tensile strength is a crucial property for successfully working the copper–arsenic alloy into sheet-metal objects. The technical studies of naipes represent an excellent means by which to investigate ancient capabilities. Tight control of arsenic concentrations in copper may not have been achieved, or sought, in the production of sheet metal, but the counting and stacking of naipes into bundles indicates that there was an appreciation, classification and selection of concentration ranges for arsenic in copper. The copper–arsenic alloy metallurgical tradition in the Americas represents one of the major achievements in the use of materials before Spanish contact.

The technical investigation of naipes and other axe moneys from adjoining regions and countries remains a fascinating topic for multidisciplinary and interdisciplinary archaeological study. The markings on the naipes can be interpreted as having both a practical meaning, in terms of the recognition and selection of materials, and a more symbolic meaning. There are several hypotheses concerning the symbolism of the markings, one of the most plausible of which is that they represent group production units. Naipes may have been made in designated metallurgical workshops, separate from the production of gold-alloy objects. Other evidence of industrial organization during the Sicán period indicates duplication and repetition – for example, the large numbers, alignment and re-use of smelting furnaces, and the bundles of metal digging tools used in building or agriculture, or both, found in some elite tombs. The standardization of and markings on the naipes, as well as their other primitive monetary functions inferred from their archaeological contexts, seems to suggest that the organization of metal production and use was under elite control during the Middle Sicán period in northern Peru. Accepting that naipes are primitive money opens a new and wider range of numismatic investigations.

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Notes

1. The Sicán Archaeological Project is directed by Izumi Shimada of Southern Illinois University. Analytical work by John Merkel on the Sicán metals has been undertaken at the UCL Institute of Archaeology since 1988. Further information on copper–arsenic and gold-alloy metallurgy at Sicán can be found in the following books and journals: I. Shimada, "Pre-Hispanic metallurgy and mining in the Andes: recent advances and future tasks", in *In quest of mineral wealth: Aboriginal and Colonial mining and metallurgy in Spanish America*, A. K. Craig & R. C. West (eds), Geoscience and Man **33**, 37–73, 1994; I. Shimada, *Cultura Sicán* (Lima: Fundación del Banco Continental para el Fomento de la Educación y la Cultura, Edubanco, 1995); I. Shimada (ed.), *Sicán – ein Fürstengrab in Alt-Peru* (Zurich: Museum Rietberg, 1997); I. Shimada & J. A. Griffin, "Precious metal objects of the Middle Sicán", *Scientific American* **270**(4), 82–9, 1994; I. Shimada & J. Merkel, "Copper-alloy metallurgy in ancient Peru, *Scientific American* **265**(1), 80–86, 1991.
2. The term "Sicán" is preferred to "Lambayeque" or "Chimú", which have also been used to denote this pre-Inca culture of northern coastal Peru.
3. D. Hosler, H. Lechtman, O. Holm, *Axe-monies and their relatives*. Washington DC: Dumbarton Oaks Research Library and Collection, 1990; I. Shimada, "La cultura Sicán caracterizacion arquelogica", in *Presencia historica de Lambayeque*, E. Mendoza Samillán (ed.), 76–133 (Lima: Falconi, 1985); I. Shimada, "Die Geschichte der Naipes", in *Sicán – ein Fürstengrab in Alt-Peru*, I. Shimada (ed.), 89–90 (Zurich: Museum Rietberg, 1997).
4. The concept of primitive money includes aspects of durability, portability, divisibility, intrinsic value and distinction. The following are standard references for the subject: A. Hingston, *A survey of primitive money: the beginning of currency* (London: Methuen, 1979); J. Melitz, *Primitive and modern money* (Reading, Massachusetts: Addison–Wesley, 1974).
5. "Digging tools" is perhaps too interpretive a term for these multipurpose tools. Technical studies of them have been undertaken by L. Vetter in *Análisis de las puntas de aleación de cobre de la tumba de un señor de la elite Sicán, Batán Grande, Lambayeque, Peru* (BA thesis, Archaeology Program, Department of Humanities, Catholic University, Lima, 1993).
6. E. Friedrich Mayer, *Armas y herramientas de metal prehispanicas en Ecuador* (Mainz: Philipp von Zabern, 1992).
7. Also, several bundles of axe money from Ecuador have been sectioned, analyzed and reported by D. Hosler, H. Lechtman and O. Holm in *Axe-monies and their relatives* (Washington DC: Dumbarton Oaks Research Library and Collection, 1990).
8. For details of the analytical technique used see J. Merkel, I. Shimada, A. I. Seruya, D. Griffiths, "Metallography and microanalysis of precious metal objects from the Sicán Period at Batán Grande, Peru", *Materials Issues in Art and Archaeology* IV **352**, 105–26, 1995.
9. The conversion of a currency into usable objects is an indication of the storage-of-value function of a primitive money. Metallurgical studies help to document possible conversions from one form to another; see J. I. Guyer, "The iron currencies of southern Cameroon", *Symbols* (Peabody Museum, Harvard University), 2–5, 15–16, December 1985.
10. J. Merkel, I. Shimada, C. P. Swann, R. Doonan, "Investigation of prehistoric copper production at Batán Grande, Peru: interpretation of the analytical data for ore samples", in *Archaeometry of pre-Columbian sites and artefacts*, D. Scott & P. Meyers (eds), 199–227 (Los Angeles: Getty Conservation Institute, 1994).
11. R. Cavallaro & I. Shimada, "Some thoughts on Sicán marked adobes and labor organization", *American Antiquity* **53**, 75–101, 1988.
12. H. Lechtman, "Arsenic bronze: dirty copper or chosen alloy? A view from the Americas", *Journal of Field Archaeology* **23**, 477–514, 1996.