1992 The Production and Distribution of Stoneware Bangles at Mohenjo-Daro and Harappa as Monitored by Chemical Characterization Studies. in South Asian Archaeology 1989, Prehistory Press, Madison, WI., 37-43. (M.J. Blackman and M. Vidale).

5

1992

# The Production and Distribution of Stoneware Bangles at Mohenjo-Daro and Harappa as Monitored by Chemical Characterization Studies

M. James Blackman and Massimo Vidale

Over the past 20 years there has been considerable and sometimes lively debate on the inner nature of the cultural complex traditionally labelled "the Indus Civilization" (Marshall 1931), or, in Schaffer's (in press) terms, the Harappan Phase of the Indus Cultural Tradition. Still today, while some scholars prefer to see the Harappan phenomenon as the expression of a powerful unified early state (Jacobson 1986), others are inclined to view it as a collage of independent chiefdoms doomed to a fast disappearance by endemic economic and political instability (Fairservis 1986).

To date, M. Fentress (1976) has presented the most rigorous attempt to break the "uniformity paradigm" that has dominated interpretation of Harappan material culture. Using the data available in the excavation reports from Harappa and Mohenjo-Daro, she developed a systematic comparison of these two major excavated cities. Her research sought to provide answers to a series of important questions: 1) were the two cities as similar in terms of ecological setting, resource exploitation, and material culture as assumed by some of the "classic" textbooks on the Harappan civilization; 2) was the view that both sites were huge, early cities with comparable town planning and management features archaeologically justified and historically sound; and 3) what types of economic and political relationships existed between the two sites?

Fentress's careful re-evaluation of the published information had an important, although negative, result. It demonstrated how partial, incoherent, and, to some extent, how scarcely reliable the data base was—the foundation upon which so much historical speculation had been based. These results played a very influential role in subsequent research. Over the last decade, the German Research Project "Mohenjo-Daro" has carried out the painstaking work of documentation and re-organization of all the archaeological data available for this city (Jansen and Urban 1984, 1987). This effort has been complemented by the ongoing collection of the corpus of the available Harappan inscriptions by A. Parpola and his collaborators. Although building these types of data bases is a necessary prerequisite for any future development, the lack of well-controlled contextual associations between architecture and archaeological finds in the early reports, and even the excavation records, severely hinders this endeavor. Much of the pre-existing data is not suitable for testing some of the most basic, large-scale hypotheses concerning: 1) the nature and historical evolution of the Harappan civilization; 2) the much debated question of its type and degree of social stratification; and 3) the nature of Harappan economic and social organization.

Intensive field activity in Pakistan, India, Central Asia, and on the coasts of the Arabian Peninsula have enormously widened the archaeological picture of the Harappan civilization. The German-Italian surface survey of Mohenjo-Daro, followed by intensive geo-physical prospection and geo-archaeological testing, produced new

ideas on Harappan urbanism and its evolution through time (Tosi *et al.* 1984; Vidale 1990b; Leonardi 1989). In the last few years, the American excavations at Harappa directed by G. Dales and J.M. Kenoyer (1989 and in this volume) have been allaying some of the doubts advanced by Fentress on the urban character of that site. The trenches opened on Mound E (topographically analogous to the HR insula in Mohenjo-Daro) have lent support to the idea of a basic similarity (in spite of substantial contextual differences) in the urban lay-out of the two protohistoric cities. New evidence on the absolute chronology of Harappa is also being gathered. But perhaps most important, this project has shown that the archaeological deposits of a Harappan urban site, even if deeply disturbed by ancient and modern post-depositional dynamics, are suitable for investigating many problems when excavation proceeds according to contemporary standards of recording.

A recurrent feature of this new phase of study is an emphasis on the acquisition of new and higher quality data from the field. This fieldwork is increasingly accompanied by the systematic application of archaeometric research to the understanding of many aspects of Harappan technology and economy. The study of the patterns of production and distribution of specific classes of raw materials and finished commodities among different geographical areas is one of the most firmly established and rewarding branches of archaeometric research. This approach shows great promise for the reconstruction of the economic structure of the Harappan civilization, given the diffusion of settlements across very different ecological zones and the wide range of resources exploited.

In this paper we will examine analytical evidence for some specific aspects of production and distribution within the context of the Harappan core area. First, however, a summary of some relevant points on what is known of the organization of production and distribution is in order. 1) The archaeological survey of the Bahawalpur area by Mughal has shown the existence, in Mature Harappan times, of a settlement structure formed by a cloud of minor sites focused around the major urban center of Ganweriwala. Many of the peripheral settlements appear to be specialized industrial sites (Mughal 1982, 1990b). 2) The surface survey of Mohenjo-Daro has shown that most of the heavy, polluting industries (e.g., ceramic and brick firing and metallurgical activities) are not represented in the urban compound. It must be presumed that these activities were carried out in a series of peripheral settlements (now invisible due to alluviation) that supplied the major center. Conversely, the city hosted scatters of small "workshops" manufacturing luxury ornaments and prestige items, most probably intended primarily for internal consumption (Tosi *et al.* 1984; Pracchia *et al.* 1985; Vidale 1989). 3) The so-called "long barrel" carnelian beads, found in several hoards at Harappa and Mohenjo-Daro, possibly made also for external trade and shipped as far as Mesopotamia (Chakrabarti 1982), were apparently produced by specialized bead makers in the relatively remote site of Chanhu-Daro (Mackay 1937, 1943). Not a single rough-out or bead blank of this type has been so far reported from the two larger cities. 4) The paleo-technological analysis of the shell industries of Mohenjo-Daro by Kenoyer (1983, 1984) shows that the manufacture of ladles from Murex (*Chicoreus ramosus*) shells is definitely under-represented in that site, while this activity represents one of the most important industries at the coastal site of Nageswar in Saurashtra (Bhan and Kenoyer 1984) and in the "workshops" of Chanhu-daro (Mackay 1943). Chanhu-Daro being one of the few extensively excavated Harappan sites in the whole Indus River basin, the possibility that the all major centers were supported, to varying degrees, by regional networks of minor settlements specializing in the manufacture, storage, and trade of restricted ranges of commodities is very strong.

This paper presents some results of the archaeometric study of production and distribution of stoneware bangles, a distinctive Harappan artifact type. Stoneware bangles had previously attracted the attention of archaeologists because of their unique technological features and the presence of micro-inscriptions, often incised before firing (Marshall 1931:530, 686; Vidale 1990a; Schneider 1984; Franke 1984). The term "stoneware" was used by the early excavators to designate artifacts with a highly siliceous, partially sintered, homogeneous ceramic body, usually free from inclusions or voids visible to the naked eye, and characterized by a very low porosity. Stoneware bangles were produced in two basic varieties—one fired in a strongly reducing atmosphere, assuming colors ranging from pinkish-grey to black, and the other with reddish shadows resulting from partial re-oxidation. Judging from the available collections, this latter variety was more common at Harappa than at Mohenjo-Daro. This sophisticated ceramic material was used exclusively for the production of bangles, presently reported only from Mohenjo-Daro and Harappa. No confirmed find of these bangles has ever been reported from minor Harappan settlements, and their possible occurrence in some sites in India needs proper confirmation.

During the surface survey of the craft activity areas at Mohenjo-Daro, a series of dumps and eroded kiln areas were identified that were related to one or more "workshops" exclusively associated with the production of stoneware bangles (Vidale 1987a, 1990b). The paleo-technological study of stoneware bangle manufacture started with these surface assemblages of slag and kiln wasters and led to the reconstruction of an extremely sophisticated firing technology within a double system of closed saggers (Halim and Vidale 1984; Vidale 1987a). The reconstruction of the firing technology was extended to the forming and finishing process through a specific program of experimental simulations carried out by one of the authors (M.V.) in collaboration with R. Altman, a professional potter. This research showed that some type of previously thrown cylindrical pre-form—in the leather hard state—was trimmed on

a wheel to form the bangles. This research was constantly integrated with information provided by J.M. Kenoyer, who independently carried out a similar set of experimental observations. The data on the forming and finishing simulations will be discussed in separate publications.

Part of the overall study of Harappan stoneware production was to determine if this sophisticated technology was restricted to the "workshops" at Mohenjo-Daro or if the same or similar technology was employed by craftsmen at Harappa as well. If the technology was restricted to Mohenjo-Daro, then mechanisms for some type of exchange, with bangles moving unidirectionally (against some other specific luxury good or archaeologically intangible commodity) would need to be posited. On the other hand, if both sites mastered the stoneware manufacturing technology, then two other distinct distribution patterns are thought possible: 1) each site produced its own stoneware bangles for internal consumption at the site of manufacture; or 2), some form of reciprocal exchange would redistribute some of the production from each site to the other site. This matter was further complicated by the realization, during the course of examination of the bangles from both Harappa and Mohenjo-Daro, that examples of a coarser terracotta bangle apparently "imitated" some technological feature of the stoneware bangles, thus blurring the technological boundary between these two bangle categories. We could also be dealing with chronological variables. In fact, evidence from surface finds at Juderjo-Daro, from Early Harappan contexts in the Bannu Basin (Thomas 1986) and at Harappa (Kenoyer, personal communication) suggests that stoneware making gradually developed from earlier terracotta bangles technology. Could Harappa simply be a center of terracotta bangle production and Mohenjo-Daro the center of stoneware production? We felt that chemical characterization of the bangles would provide specific answers to these possible scenarios and new data to add to the discussion on the autonomy or the interdependency of Harappa and Mohenjo-Daro in terms of production and consumption of craft products.

The chemical analysis of the bangles was carried out by instrumental neutron activation analysis (INAA) at the National Institute of Standards and Technology Research Reactor in Gaithersburg, Maryland. The experimental parameters used in the INAA analysis have been described elsewhere (Blackman 1984; Blackman *et al.* 1989). Twenty-nine elements were sought and 22 were used in this study. The analyzed sample reported in this paper consisted of 27 stoneware bangles, 1 terracotta bangle, and 23 sagger fragments from surface collections at Mohenjo-Daro and 14 stoneware bangles and 18 terracotta bangles from surface surveys and excavations at Harappa, kindly made available by G. Dales and J.M. Kenoyer. In addition, a single modern bangle replica made by J.M. Kenoyer, using clay from the Ravi beds near Harappa, was also analyzed. This clay is used nowadays by a village of potters about one mile north of the mounds of Harappa and provides a reliable reference for the chemical composition of the locally available raw material.

The chemical data for all 60 bangle samples, excluding the saggers, were initially subjected to cluster analysis using a "nearest neighbor" clustering algorithm on a mean euclidian distance matrix for 16 elements. The results of the cluster analysis yielded two distinct chemical compositional groups, labelled Chemical Group 1 and 2 in Figure 1. Only a single bangle from Harappa did not fall within one or the other of these two groups. The validity of the two chemical groups was then tested using Mahalanobis distance and Hotelling's $T^2$ statistic. All samples assigned to Chemical Group 1 by the cluster analysis were retained in this group at the 99% probability level. In Chemical Group 2, a single terracotta bangle (marked with an asterisk in Figure 1) was excluded from this group at the 99% level of probability. All other samples assigned to Chemical Group 2 were retained in the group. The two chemical compositional groups were then compared to each other using the same statistical test. No sample in either group showed a greater than 0.01% probability of membership in the other group. Therefore, the two chemical groups, as defined, are chemically internally consistent and readily distinguishable from each other.

The summary statistics for 22 elements in each of the two chemical compositional groups are presented in Table 1. Examination of Table 1 shows that the elements potassium, calcium, chromium, and hafnium have no overlap between the two chemical groups at the 95% confidence level, and that Chemical Groups 1 and 2 can be readily separated from each other based on these elements alone. When the ratios for the alkaline elements potassium/cesium and the transition metals iron/chromium are compared (Figure 2), separation between the groups can be graphically demonstrated at the 99% confidence level.

As can be seen in Figure 2, Chemical Group 2 contains 19 bangles from Harappa (4 stoneware and 15 terracotta) and the modern bangle made with clay from the Ravi River beds. No bangles from Mohenjo-Daro were included in this group. The association of the modern Ravi clay bangle with a chemical composition group containing only Harappa bangles strongly indicates that Harappa was the place of manufacture of these bangles; this group will now be referred to as the Harappa Chemical Group.

Chemical Group 1 contains all 28 Mohenjo-Daro bangles, including the single terracotta bangle, and 10 bangles recovered in surveys and excavations at Harappa, including 9 of the 14 stoneware bangles and a single terracotta bangle. Since we know that stoneware bangles were being produced at Mohenjo-Daro, Chemical Group 1 is strongly indicated as the Mohenjo-Daro Chemical Group. This contention is supported by the data from the saggers, as we may assume that saggers were manufactured with local clays and discarded after being damaged. Their fragments, therefore, represent reliable indicators of the chemical composition of the clayey-silty beds of the Indus River surrounding Mohenjo-Daro. Figure 3 shows the K/Cs

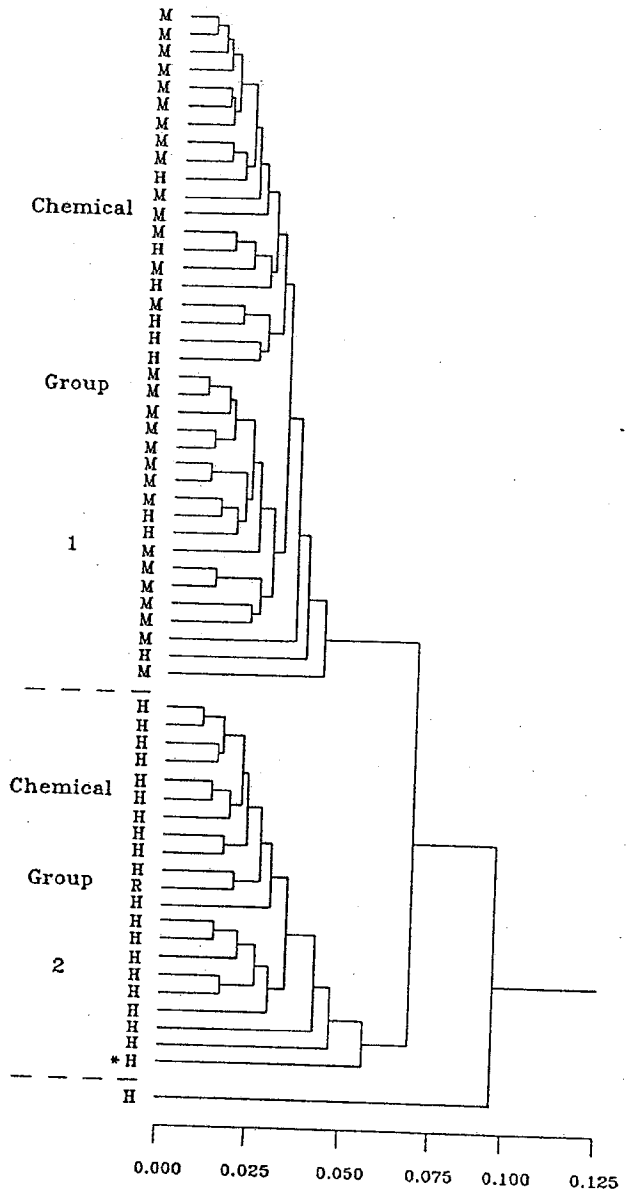


Figure 5.1. Hierarchical Aggregative Clustering Analysis Dendrogram for the Bangles Analyzed in this Investigation. The cluster analysis used the following elements: K, Sc, Cr, Fe, Co, Rb, Cs, La, Ce, Sm, Eu, Yb, Lu, Hf, Ta, and Th. Bangle samples from Mohenjo-Daro are designated M and bangles from Harappa are designated H. The modern bangle replicate of Ravi clay is marked R.

versus Fe/Cr ratio plot from Figure 2 with only the 99% confidence intervals shown for the Harappa and Mohenjo-Daro Chemical Groups. The open triangles represent the ratios from the 23 Mohenjo-Daro saggers. All of the saggers fall well within the 99% confidence ellipse of the Mohenjo-Daro Chemical Group, confirming that both the bangles and the saggers were manufactured from the same clay at Mohenjo-Daro.

Only two bangles, 1 stoneware and 1 terracotta, both from Harappa, could not be classified with either the Mohenjo-Daro or the Harappa group. These two bangles are represented in Figure 3 by the solid triangles. While both bangles show closer affinities to the Mohenjo-Daro Chemical Group, both are outside the 99% confidence ellipse for that group and must remain unclassified.

The chemical compositional data for the bangles clearly indicates that both stoneware and terracotta bangles were being produced at Mohenjo-Daro and at Harappa. The discovery that about 70% of the classifiable stoneware bangles in the sample from Harappa had been manufactured at Mohenjo-Daro is the first material proof of economic interaction between the two cities. That no Harappa composition stoneware bangles were found at Mohenjo-Daro presents an intriguing picture. Even given the rather small number of Mohenjo-Daro stoneware bangles analyzed in this study (27), it is unlikely that a significant contribution from Harappa would have been missed. For example, if 10% of the stoneware bangles at Mohenjo-Daro were of the Harappan Chemical Group, the probability is $p = 0.058$ that none would have been encountered in a random sample of 27. A 25% Harappa component has a probability of only $p = 0.0004$ of having gone undetected. We are therefore, left with a production/distribution picture that indicates production at both sites, but with a unidirectional distribution system from Mohenjo-Daro to Harappa.

## Conclusions

The present evidence supports the hypothesis of the existence, within and around the main Harappan centers, of various orders of specialized craft groups over which varying degrees of direct or indirect control were exerted. Large scale industries of substantial economic importance for Harappan cities, but by nature dangerous or polluting (such as the mass production of pottery or brick), appear to have been organized on or relegated to the periphery of the main centers (Mughal 1982, 1990b). Direct evidence for this arrangement is lacking at Mohenjo-Daro, possibly because of the intensive alluviation of the Indus River from protohistoric to recent times (Leonardi 1989); however, the absence of the debris from pottery and brick manufacture and the other bulk pyro-technological industries provides indirect evidence for production elsewhere. Other industries of smaller scale, some dedicated to the production of "luxury goods" possibly solely for internal consumption, seem to have been located mainly within the centers themselves (Tosi *et al.* 1984; Pracchia *et al.* 1985; Vidale 1986, 1987b, 1987c, 1989). The emerging picture is one of a few large centers, regularly spaced across an enormous area (Mughal 1990a) with groups of smaller, dependent, specialized settlements clustered about each. The presence or absence of economic or political interdependence of the centers is, however, not addressed by this model.

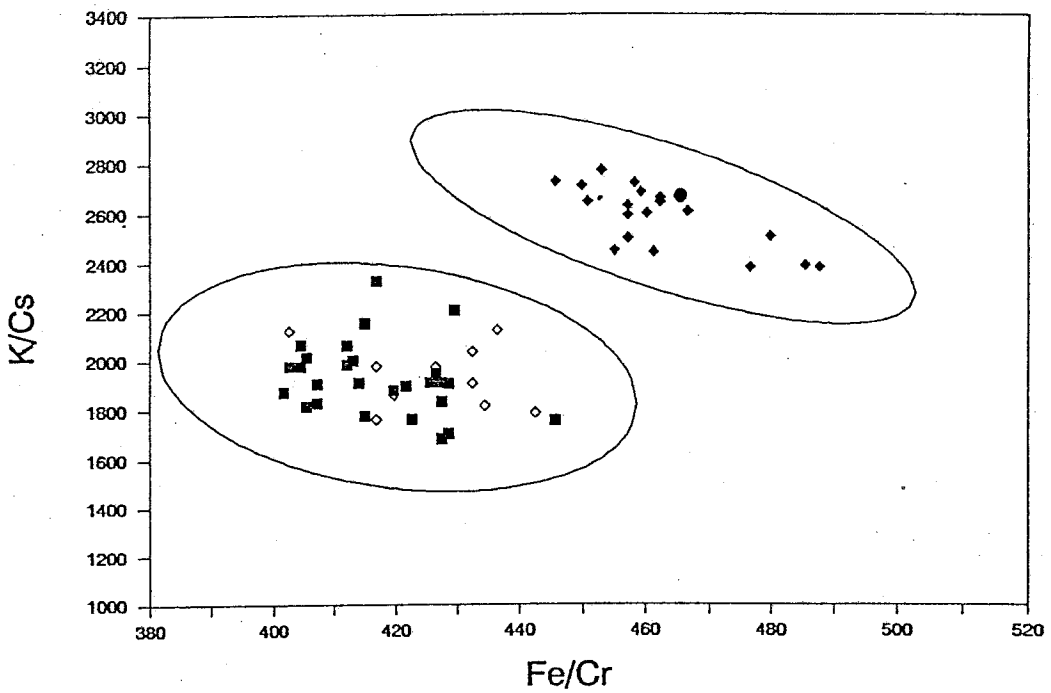


Figure 5.2. Plot of the Ratios K/Cs to Fe/Cr for Chemical Groups 1 and 2. The ellipses are the 99% confidence intervals about each group. Solid squares are the Mohenjo-Daro bangles, open and solid diamonds are the Harappa bangles and the solid circle is the modern bangle of Ravi clay.

Table 5.1. Mean Concentrations for the Stoneware and Terracotta Bangles.

| Element | | | Chemical Group 1 (n=38) Mean | 1 s.d. % | Upper 95% Limit | Lower 95% Limit | Chemical Group 2 (n=20) Mean | 1 s.d. % | Upper 95% Limit | Lower 95% Limit |
|---|---|---|---|---|---|---|---|---|---|---|
| Na | % | | 0.781 | 10.3 | 0.944 | 0.619 | 0.815 | 18.7 | 1.135 | 0.496 |
| K | % | * | 2.65 | 6.0 | 2.97 | 2.33 | 3.21 | 3.5 | 3.45 | 2.97 |
| Ca | % | * | 6.43 | 17.3 | 8.68 | 4.18 | >1.00 | - | - | - |
| Sc | ppm | | 19.3 | 2.4 | 20.2 | 18.3 | 18.5 | 4.9 | 20.4 | 16.6 |
| Cr | ppm | * | 137 | 3.1 | 145. | 128 | 112 | 4.6 | 123 | 101 |
| Fe | % | | 5.74 | 2.5 | 6.03 | 5.45 | 5.19 | 5.7 | 5.81 | 4.58 |
| Co | ppm | | 22.8 | 2.8 | 24.0 | 21.5 | 20.4 | 5.8 | 22.9 | 17.9 |
| Rb | ppm | | 206 | 7.6 | 237 | 174 | 213 | 6.9 | 244 | 183 |
| Sb | ppm | | 1.21 | 17.0 | 1.62 | 0.79 | 1.42 | 12.2 | 1.79 | 1.06 |
| Cs | ppm | | 13.8 | 8.6 | 16.2 | 11.4 | 12.5 | 7.0 | 14.3 | 10.7 |
| Ba | ppm | | 595 | 15.9 | 786 | 403 | 792 | 12.5 | 999 | 585 |
| La | ppm | | 46.1 | 2.1 | 48.1 | 44.1 | 46.8 | 5.0 | 51.7 | 41.8 |
| Ce | ppm | | 82.8 | 2.6 | 85.2 | 78.3 | 83.8 | 5.0 | 92.5 | 75.0 |
| Sm | ppm | | 6.75 | 3.5 | 7.23 | 6.28 | 6.99 | 4.7 | 7.68 | 6.31 |
| Eu | ppm | | 1.26 | 3.3 | 1.35 | 1.18 | 1.26 | 3.8 | 1.36 | 1.16 |
| Tb | ppm | | 0.877 | 11.6 | 1.08 | 0.67 | 0.936 | 8.8 | 1.11 | 0.76 |
| Yb | ppm | | 3.00 | 6.6 | 3.40 | 2.60 | 3.67 | 6.1 | 4.14 | 3.20 |
| Lu | ppm | | 0.429 | 8.9 | 0.506 | 0.352 | 0.522 | 7.7 | 0.606 | 0.438 |
| Hf | ppm | * | 4.39 | 4.3 | 4.77 | 4.01 | 5.80 | 6.9 | 6.64 | 4.96 |
| Ta | ppm | | 1.47 | 4.8 | 1.62 | 1.33 | 1.24 | 6.0 | 1.40 | 1.08 |
| Th | ppm | | 18.8 | 2.6 | 19.8 | 17.8 | 20.2 | 3.2 | 21.5 | 18.8 |
| U | ppm | | 2.26 | 0.3 | 3.65 | 0.87 | 2.31 | 33.5 | 3.94 | 0.69 |

* = elements with no overlap at the 95% confidence level.

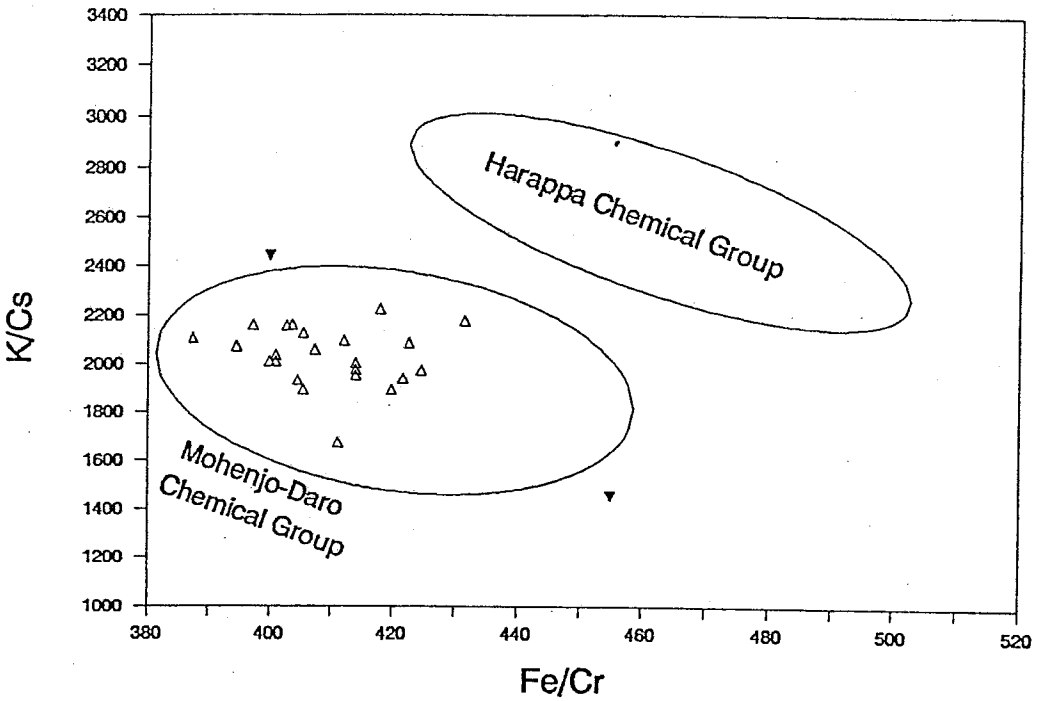


Figure 5.3. Plot of the Ratios K/Cs to Fe/Cr for the Mohenjo-Daro Saggers and Ungrouped Bangles from Harappa. The ellipses are the 99% confidence intervals for the Harappa chemical group and the Mohenjo-Daro chemical group. The open triangles are Mohenjo-Daro saggers, the solid triangles are ungrouped Harappa bangles.

Questions of interaction appear to be most profitably approached by examining the production and distribution of items requiring either extremely specialized technologies and/or made of rare raw materials. Examples, such as the carnelian 'long-barrel' beads, presumed to be made in the regional center of Chanhu-Daro and which appear to be involved in long-distance and even foreign exchange (Chakrabarti 1982), and steatite stamp seals from Mohenjo-Daro and Harappa, which, in some cases, are so similar as to suggest a common context of manufacture (Rissman 1989:168), provide only indirect evidence of interaction. Our chemical characterization of stoneware bangles provides the first direct material evidence for interaction between major centers.

The manufacture of stoneware bangles, as reconstructed from archaeological remains at Mohenjo-Daro, was carried out in a restricted, well-defined sector of the city (Halim and Vidale 1984). This production was accompanied by intensive and specialized procedures of information processing, archaeologically evident in the form of sealings and inscriptions on saggers and inscriptions on the bangles. The technology involved may be considered as narrowly specialized, because stoneware was refined and fired only in the context of production of a single standardized type of bangle. Moreover, the basic technological procedure of the forming process, i.e., trimming, although applied to the forming of complex ring-foots on some categories of vessels (e.g., Dales and Kenoyer 1986: Fig. 37, 1, 3-6), was never used by Harappan potters as a primary forming technique for any other type of ceramic. The process of exploiting a controlled reducing atmosphere by the use of closed firing containers, although part of a broader technology spread within the sub-continent (e.g., Saraswati 1978:12), was brought to extreme levels by the stoneware craftsmen and never matched in later times. The documentation, provided by the chemical characterization, of two distinct chemical groups firmly identified with Mohenjo-Daro and Harappa, points to the existence of two specialized groups of bangle makers engaged in fulfilling a specific demand by a segment of the population (possibly elite groups, Vidale 1989) living at Mohenjo-Daro and Harappa. We may assume that this complex technology was exclusively dependent upon the social *milieu* of the Harappan elitarian groups (Vidale 1990a), as it completely disappeared after the abandonment of the great Harappan urban centers. The relative rarity of stoneware bangles, the complex and singular nature of the manufacturing technology, the control of production (as exemplified by the use of sealings and inscriptions on saggers), the inscriptions on the bangles themselves, and the apparent restriction of both production and use to only two major Harappan centers, all point to a unique social function for these artifacts. The nature of the social processes involved in the distribution, exchange, or trade of these objects is, as yet, unknown; however, since both the cities were producing bangles, the unidirectional movement of these culturally unique items

over a distance of 570 km suggests a special exchange system and indeed a special relationship for Mohenjo-Daro *vis-à-vis* Harappa.

By the chemical characterization of a sample of stoneware bangles from Harappa and Mohenjo-Daro, we have been able to document a small but significant aspect of the network of production and distribution of manufactured commodities at highest level of the Harappan settlement system, center to center. The evidence from the stoneware bangles shows the existence of interaction between these two sites, but not interdependency in an economic sense. Both centers possessed the technological capacity to produce stoneware bangles, and with no evidence to the contrary, both would seem able to meet a purely local demand. Mohenjo-Daro is supplying the greater part of the stoneware bangles so far analyzed from Harappa. What then makes Mohenjo-Daro bangles "popular" in the other city? Are there religious, political, or social status implications to this distribution? To trade bangles to Harappa should have been like "carrying coals to Newcastle"; it would be more reasonable to hypothesize that stoneware bangles were distributed in the context of some specific social relationship or transaction among related status or kin groups in the two centers. The asymmetrical nature of this relationship, however, for the moment remains unexplained.

The pattern of economic and political interdependency among the Harappan centers will doubtless turn out to be more and more complex with the extension of field and archaeometric research. We should also be aware of the fact that, with a progressive focusing on the picture of the major urban centers, the problem of the archaeological invisibility of the peripheral, suburban or rural centers will become more compelling, requiring the development of new, *ad hoc* approaches to prospection and excavation.

## References Cited


Bhan, K.K., and J.M. Kenoyer
1981 Nageswar, an Industrial Centre of Chalcolithic period. *Puratattva* 12:115-120.

Blackman, M.J.
1984 Provenance Studies of Middle Eastern Obsidian from Sites in Highland Iran. In *Archaeological Chemistry III*, edited by J. Lambert, pp. 19-50. The American Chemical Society, Washington, D.C.

Blackman M.J., S. Mery, and R.P. Wright
1989 Production and Exchange of Ceramics on the Oman Peninsula from the Perspective of Hili. *Journal of Field Archaeology* 16(1):61-77.

Chakrabarti, D.K.
1982 "Long Barrel-Cylinder" Beads and the Issue of Pre-Sargonic Contact between the Harappan Civilization and Mesopotamia. In *Harappan Civilization*, edited by G.L. Possehl, pp. 265-270. Oxford and IBH, New Delhi.

Dales, G.F., and J.M. Kenoyer
1986 *Excavations at Mohenjo-Daro, Pakistan: the Pottery*. University Museum Monograph 53. The University Museum, Philadelphia.
1989 Excavations at Harappa –1988. *Pakistan Archaeology* 24:68-176.

Fairservis, W.A., Jr.
1986 Cattle and the Harappan Chiefdoms of the Indus Valley. *Expedition* 28(2):43-50.

Fentress, M.
1976 *Resource Access, Exchange Systems, and Regional Interaction in the Indus Valley*. Unpublished Ph.D. Dissertation, University of Pennsylvania, Philadelphia.

Franke, U.
1984 A Selection of Inscribed Objects Recovered From Mohenjo-Daro. In *Interim Reports Vol. 1*, edited by M. Jansen and G. Urban, pp. 117-138. RWTH, Aachen.

Halim, M.A., and M. Vidale
1984 Kilns, Bangles and Coated Vessels, Ceramic Production in Closed Containers at Mohenjo-Daro. In *Interim Reports Vol. 2*, edited by M. Jansen and G. Urban, pp. 63-97. RWTH, Aachen.

Jacobson, J.
1986 The Harappan Civilization: An Early State. In *Studies in Archaeology of India and Pakistan*, edited by J. Jacobson, pp. 137-173. Oxford and IBH, New Delhi.

Jansen, M., and G. Urban (editors)
1984 *Interim Reports Vol. 1*. RWTH, Aachen.
1987 *Interim Reports Vol. 2*. RWTH, Aachen.

Kenoyer, J.M.
1983 *Shell Working Industries of the Indus Civilization: An Archaeological and Ethnographic Perspective.* Unpublished Ph.D. dissertation, University of California, Berkeley, CA.
1984 Shell Industries at Mohenjo-Daro, Pakistan. In *Interim Reports Vol. 2*, edited by M. Jansen and G. Urban, pp. 99-116. RWTH, Aachen.
Leonardi, G. (editor)
1989 *Mohenjo-Daro: From Surface Evaluation to Ground Testing*. Interim Reports Vol. 3. Padova.
Mackay, E.J.H.
1937 Bead Making in Ancient Sindh. *Journal of the American Oriental Society* 57:1-13.
1943 *Chanhu-Daro Excavations 1935-36*. American Oriental Series 20. American Oriental Society, New Haven.
Marshall, Sir J.
1931 *Mohenjo-Daro and the Indus Civilization.* A. Probsthain, London.
Mughal, M.R.
1982 Recent Archaeological Research in the Cholistan Desert. In *Harappan Civilization*, edited by G.L. Possehl, pp. 85-96. Oxford and IBH, New Delhi.
1990a The Harappan "Twin Capitals" and Reality. *Journal of Central Asia* 13(1):155-162.
1990b The Protohistoric Settlement Pattern in the Cholistan Desert. In *South Asian Archaeology 1987*, edited by M. Taddei, pp. 143-156. IsMEO, Rome.
Pracchia S., M. Tosi, and M. Vidale
1985 On the Type, Distribution and Extent of Craft Industries at Mohenjo-Daro. In *South Asian Archaeology 1983*, edited by M. Taddei, pp. 207-247. Istituto Universitario Orientale, Naples.
Rissman, P.
1989 The Organization of Seal Production in the Harappan Civilization. In *Old Problems and New Perspectives in the Archaeology of South Asia*, edited by J.M. Kenoyer, pp. 159-170. Wisconsin Archaeological Reports, vol. 2. Madison, Wisconsin.
Saraswati, B.
1978 *Pottery-making Cultures and Indian Civilization*. New Delhi.
Schneider, G.
1984 Chemical Analysis of Stoneware Bangles and Related Materials from Mohenjo-Daro. In *Interim Reports Vol. 2*, edited by M. Jansen and G. Urban, pp. 73-78. RWTH, Aachen.
Shaffer, J.G.
in press The Indus Valley, Baluchistan and Helmand Traditions: Neolithic through Bronze Age. In *Chronologies in Old World Archaeology*, 2nd ed., edited by R.W. Ehrich. University of Chicago Press, Chicago, Illinois.
Thomas, K.D.
1986 The Bangles. In *Lewan and the Bannu Basin*, edited by F.R. Allchin, B. Allchin, F.A. Durrani and M. Farid Khan, pp. 145-156. BAR International Series 310. Oxford.
Tosi M., L. Bondioli, and M. Vidale
1984 Craft Activity Areas and Surface Surveys at Moenjodaro. In *Interim Reports Vol. 1*, edited by M. Jansen and G. Urban, pp. 9-37. RWTH, Aachen.
Vidale, M.
1986 Steatite Working on Glazing: Relational Aspects of Two Technological Environments in Harappan Urban Contexts. *East and West* 36(4):520-525.
1987a More Information on a Protohistoric Ceramic Puzzle. In *Interim Reports Vol. 2*, edited by M. Jansen and G. Urban, pp. 105-111. RWTH, Aachen.
1987b Some Aspects of Lapidary Craft at Mohenjo-Daro in the Light of the Surface Record of the Moneer South East Area. In *Interim Reports Vol. 2*, edited by M. Jansen and G. Urban, pp. 113-150. RWTH, Aachen.
1987c Some Observations and Conjectures on a Group of Steatite-debitage Concentrations on the Surface of Mohenjo-Daro. *Annali dell'Istituto Universitario Orientale* 47(1):113-129. Naples.
1989 Specialized Producers and Urban Elites: On the Role of Craft Production in Mature Harappan Urban Contexts. In *Old Problems and New Perspectives in the Archaeology of South Asia*, edited by J.M. Kenoyer, pp. 171-181. Wisconsin Archaeological Reports, vol. 2. Madison WI.
1990a Stoneware Industries of the Indus Civilization. In *Ceramics and Civilization*, vol. 5, edited by D. Kingery, pp. 231-256. American Ceramics Society, Westerwille, Ohio.
1990b On the Structure and the Relative Chronology of an Harappan Industrial Site. In *South Asian Archaeology 1987*, edited by M. Taddei, pp. 203-244. IsMEO, Rome.