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THE CHANGING ROLES OF CERAMICS IN SOCIETY: 26,000 B.P. TO THE PRESENT

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STONEWARE INDUSTRY OF THE INDUS CIVILIZATION: AN EVOLUTIONARY DEAD-END IN THE HISTORY OF CERAMIC TECHNOLOGY

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1. INTRODUCTION

The Indus Civilization (or Harappan Civilization, from the site where it was identified as a distinct cultural complex) was, together with Ancient Egypt and Mesopotamia, one of the three major civilizations of South Asia in the 3rd millennium B.C. (Wheeler 1963; 1968). Although many questions about the rise and the inner nature of the Indus Civilization remain unanswered, it is generally agreed that it developed out of a network of distinct neolithic and chalcolithic cultures, through a process of indigenous development, archaeologically traceable from as early as the 7th millennium B.C. (Fairservis 1967, 1971; Khan 1965; Halim 1970-71, 1972; Jarrige 1979, 1981; Jarrige and Lechevallier 1979; Mughal 1970, 1983; Allchin and Allchin 1982; Tosi 1979; Shaffer 1986; and many others). This evolutionary process involved the rise of a distinctive economic complex based on cultivation of wheat and barley, harvested in winter, and cattle (Bos Indicus) breeding (Costantini 1984; Costantini and Costantini Biasini 1985; Meadow 1984). More obscure is the nature of the social organizations maturing in the indo-pakistani subcontinent in the 4th and the 3rd millennium B.C., but it appears hardly questionable that, in this range of time, the settlements grew larger, were endowed of monumental architecture, and were supported by an impressive set of service and craft specialists (Shaffer 1986). By the latter phases of the 3rd millennium B.C. this process of economic and social evolution culminated in the "explosion" of the cultural traits typical of the

Indus Civilization: the growth of a few huge urban compounds with evidence of town planning and large scale hydraulic engineering, such as Moenjodaro in Sind and Harappa in Punjab; the spread of hundreds of small-sized centers in different ecological regions; the invention of a syllabic writing (which is still undeciphered); the development of specific "Indus" styles in pottery making, metalworking and semiprecious stone cutting.

While some archaeologists view this phenomenon as the archaeological expression of the rise of a unified, powerful early state (among others Jacobson 1986), others prefer to see the Indus Civilization as a complex of independent chiefdoms which never achieved the levels of cultural and political complexity which characterizes, for example, the Mesopotamian states of the second half of the 3rd millennium B.C. (e.g. Fairservis 1986).

This paper deals with a research project focussing on one of the craft industries identified in the major urban centers of the Indus Civilization: the manufacture of "stoneware" bangles. The aim of the research is to reconstruct, to the extent it is possible, the social identity of the groups of craftsmen involved in this very peculiar Bronze Age industry, thus providing more evidence to the debate on the nature of the Indus Civilization. In absence of written texts, we have to rely exclusively on material evidence, ranging from various features of the finished products to the remains left by the workshops we identified on the surface of Moenjodaro. I am, however, fully aware that this approach to the study of a small facet of the organization of production in the Indus society will be unescapably a very indirect (and perhaps even tortuous) one.

2. THE STONEWARE INDUSTRY OF THE INDUS CIVILIZATION IN THE EARLY LITERATURE

Among the hundreds of small objects mentioned in the massive report by Sir J. Marshall (1931) on the excavation of Moenjodaro, E.J.H. Mackay described the following type of "pottery bracelet", which

> ...was made of a heavily fired clay, dark brown or black on the outside and light gray inside, of a fine and uniform texture, and free from blow-holes. Indeed, these bracelets are so heavily burnt that they ring like metal when struck and in some cases break with a glass-like fracture. Owing to their brittleness, they are practically always found in pieces...In most cases, like the faience bracelets, these ornaments were made in a mould; the majority are very well finished. (Marshall 1931: 530).

At the same time, the same kind of artifacts were also found at Harappa, where a red variety of the same ornaments appeared to be rather common. M. Sana Ullah, Marshall's archaeological chemist to whom we owe much useful work, preferred

> ...to style this make of bracelet as stoneware rather than terra-cotta, for the former implies a better grade. (ibidem)

M. Sana Ullah's definition seems still to be appropriate, if with the term we mean a type of pottery distinguished by a very siliceous and partially vitrified body (Figs. 1-4)

The clayey (or silty) material used for the stoneware bangles was apparently produced exclusively for this type of artifact, an anomaly when compared, for example, with the wide range of ornaments produced with faience-related ceramics (beads, bangles, figurines, vessels, inlay and gaming pieces, and other). Furthermore, it was discovered that a high percentage of bangle fragments bore micro-inscriptions, next to invisible to the naked eye, composed of few signs in the standard Indus script (Figs. 3, 4; see Frank 1984). This set of anomalous features suggested the need of effecting a more detailed examination.

> ...A noteworthy variety...is represented by a number of fine earthenware bangles, usually black in colour, sometimes mottled white, but all distinguished by their fine vitreous texture. The chemical analysis of one of the black specimens reveals an unusual composition, containing rather large proportions of lime and magnesia. These ingredients enhance the fusibility of

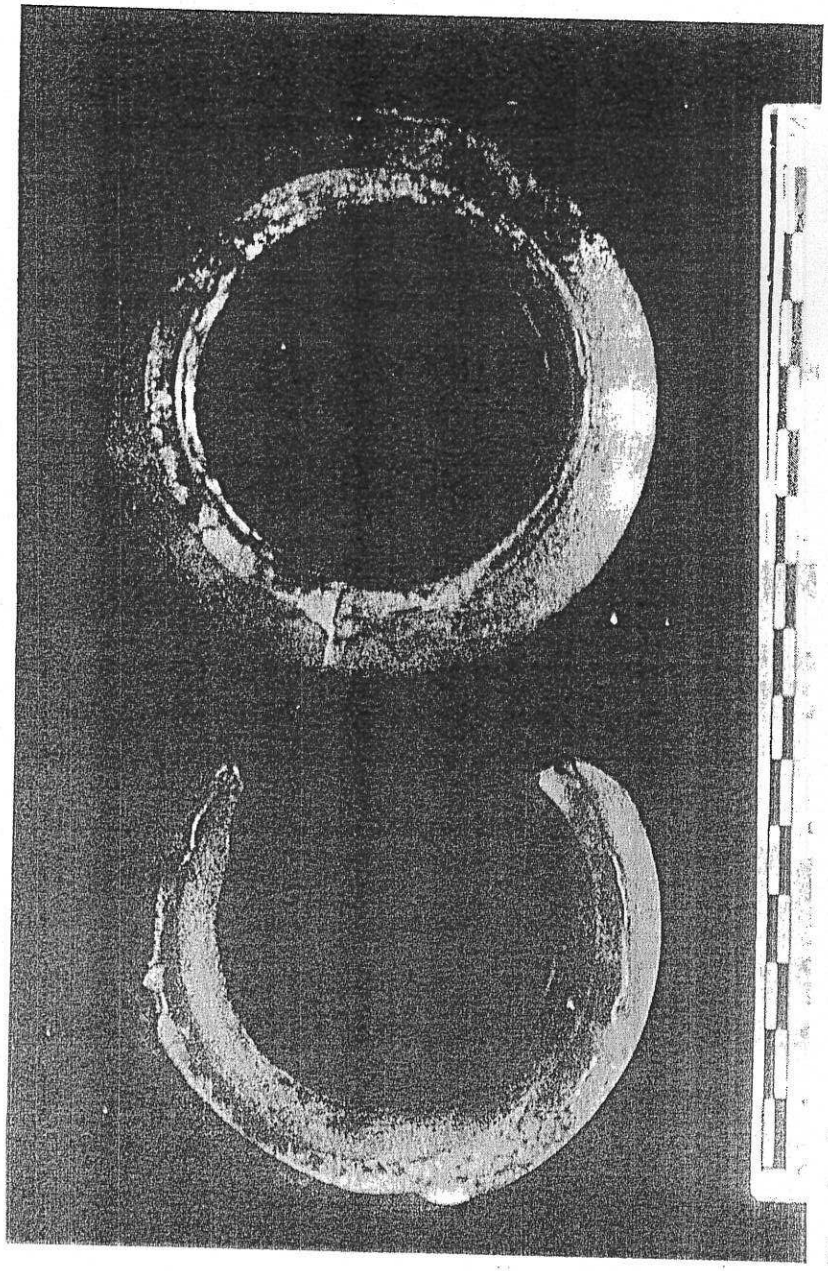

Fig. 1. Stoneware bangles found on the surface of Moenjodaro. The broken specimen at left comes from a workshop area, and was probably broken in the attempt of separating a couple of sticking pieces (see Fig. 6). Note the wide scar running all over point of maximum expansion.

Fig. 2. Fragment of stoneware bangle from the surface of Moenjodaro, showing the remnants of a scar left by the detachment of the piece from a set of piled specimens. The scar is obliterated by irregular scratches left by a post-firing abrasion (Dep.CS.Neg.14757/16).

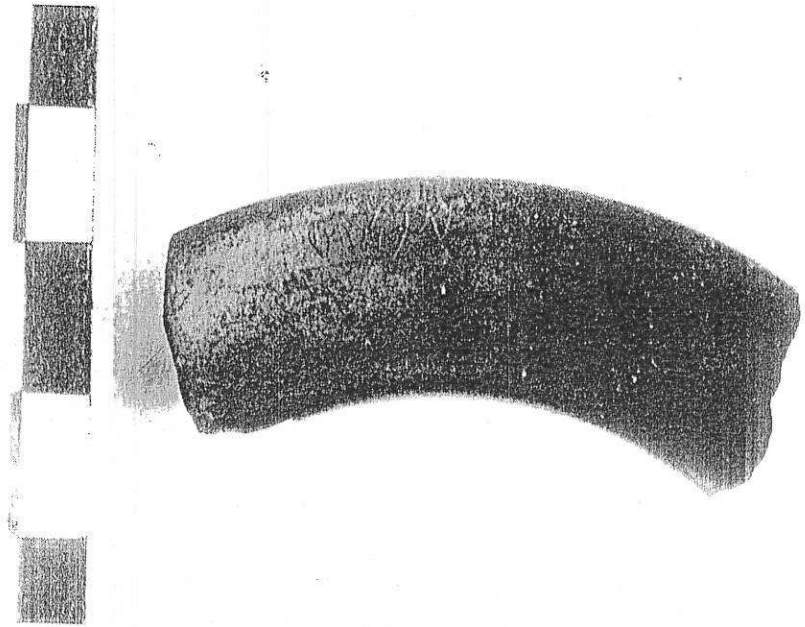

Fig. 3. Fragment of stoneware bangle bearing an exceptionally long micro-inscription of 5 signs. (Dep.CS.Neg. 14756/27).

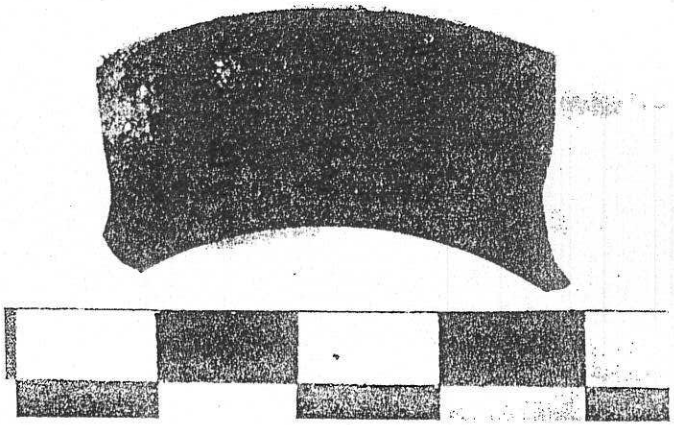

Fig. 4. Fragment of stoneware bangle from the surface of Moenjodaro with a short micro-inscription of 2 signs (Dep.CS.Neg.14575/12).

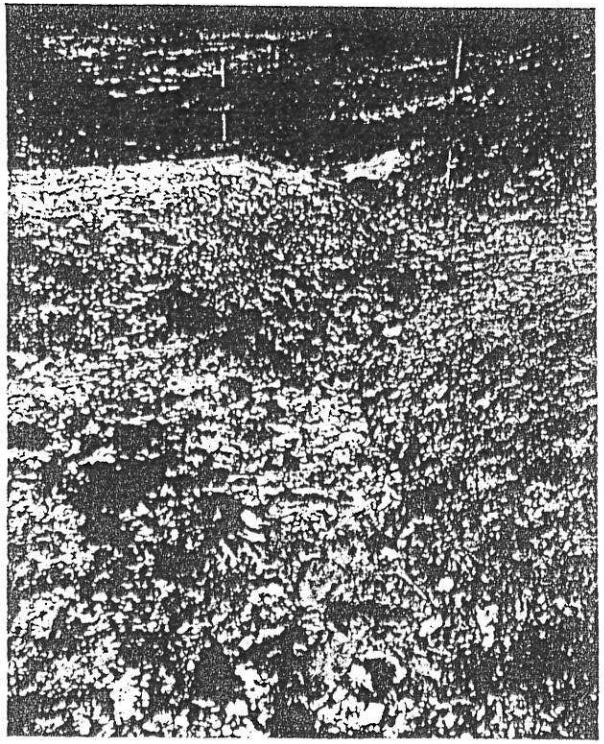

Fig. 5. Moenjodaro: wide erosion gully on the surface of a stoneware making workshop, carrying downslope huge amounts of overfired kiln remains. On the background, the poles mark the location of the store-room where a row of saggars was excavated (see text).

the clay, and therefore account for the vitreous body of the specimens. Their black colour is due to ferrous oxide, which indicates also that the firing took place in a reducing atmosphere. (Marshall 1931: 686)

The information of the Indus stoneware available at the end of the extensive excavations in the major Indus cities may be summarized in the following points:

1) In the last phases of the 3rd millennium B.C., the craftsmen of the Indus Civilization had fully developed a very sophisticated ceramic industry, exclusively aimed to the production of a single type of personal ornament.

2) The shape and the surface of the bangles appeared so perfect (and so standardized) that they suggested the use of a mold.

3) The ceramic material used in forming was so refined that no inclusions or bubbles were usually visible in the fracture; the bangles were fired at high temperatures, apparently causing a partial vitrification of the ceramic body.

4) This vitrification process, causing the glass-like look of the fragments, was enhanced by the presence in the clay mixture of lime and magnesium oxide, acting as flux.

5) The dark color of the more common variety of the bracelets was due to a high content of ferrous oxide, depending on a firing in strongly reducing conditions.

After its discovery, the Indus stoneware industry remained buried in the excavation reports and in the showcases of various museums, waiting for a new phase or active research.

3. OUTLINE OF AN ONGOING RESEARCH

With the beginning in 1981 of the German-Italian project at Moenjodaro (Jansen and Urban 1984, 1987; Leonardi 1989) we came across, and collected, dozens of fragments of stoneware bangles. Carrying out our

survey of the craft activity areas of the city (Bondioli et al. 1984; Pracchia et al. 1985; Bondioli and Vidale 1986; Vidale 1984, 1987a) we could single out at least two large workshop areas for the production of stoneware bangles, marked on the surface by heaps of overfired kiln refuse, progressively moved downslope by gravity and rain erosion (Fig. 5; see Bondioli and Vidale 1986; Balista and Leonardi 1987; Leonardi 1989). One of the workshop areas of Moenjodaro was subject for a detailed surface mapping, followed by some limited surface excavations. Moenjodaro being a protected site, we could only clear some portions of the surface of the workshops, down to a maximum depth of 30 cm, a limit which made it impossible for us to reconstruct the actual features of the kilns. While the first of these trenches was aimed at rescuing a set of ceramic containers used in stoneware production, the following were specifically monitored to study the stratigraphic position of the stoneware installations (Halim and Vidale 1984; Vidale 1987a). More specimens of stoneware bangles, furthermore, were unearthed by the American Mission excavating at Harappa, and made available for analysis by the courtesy of the Pakistani authorities and the directors G. Dales and J.M. Kenoyer.

On this documentary base, a final research project was sponsored by the Conservation Analytical Laboratory of the Smithsonian Institution, Washington D.C. This program was developed by the author under the direct supervision of M.J. Blackman and with the cooperation of P. Vandiver; it included the formalization of the available archaeological information, a series of physical and chemical investigations on a series of samples from the two sites of Harappa and Moenjodaro, and the experimental replication of the bangles' forming process, carried out together with R. Altman, a professional potter.

The following parts of the paper briefly present the general outline of this current research, describing some of the methods applied to gain information on specific aspects of the stoneware industry. As often happens, the research was triggered by finds which were, at least in part, casual, and did not strictly follow a planned path. To simplify matters, the argument will be articulated in the following points: manufacturing sequence; social context of production; circulation of the finished product.

3.1 The Manufacturing Sequence

The first stages of pottery manufacture- collecting and re-elaborating raw materials - are usually the least evident in the archaeological record, and most of the interpretation is bound to depend on the study of the finished product.

In dealing with clay mixtures used for ceramic production the definition of a given material is substantially a relational problem. In our case, we expect to gather information on the skeleton, non-plastic inclusions through the petrographic analysis of the thin sections of bangles from the two cities, as well as of a large group of ceramic items from the Moenjodaro workshops related to their firing (bricks, linings, saggars). Similarly, the study of plastic components depends upon the extensive series of samples processed through Neutron Activation Analysis by M.J. Blackman and myself at the reactor facility of the National Bureau of Standards (Gaithersburg, MD). The chemical features of the clays of the Moenjodaro bangles, when compared to the ceramic bodies used for more common purposes (in the first place the mixtures used for the construction and maintenance of the kiln) will tell us if, and to which extent, the raw material was extracted from beds of the surrounding alluvial system of the Indus river.

The clay used for stoneware is obviously highly decanted. It is not clear, however, if this operation ought to be carried out with a complex apparatus of tanks or other containers, or could simply be accomplished, as suggested by M.J. Blackman, by excavating a pit in the a silt bed, pouring water in it and collecting the finer fraction in suspension after some time. The easiest way to solve this problem would be to go back to Moenjodaro and carry out some practical experiments.

The forming process of stoneware bangles is an intricate question which used to cause long discussions and long hours at the microscope. Most of the bangles are covered with a regular pattern of parallel lines, somehow reminding, at first sight, the marks left by an extruding device; the size of the bangles appears to be very regular in diameter, width and thickness. These observations are at the base of Mackay's interpretation, which has independently been put forward by a recent publication (Schneider 1984: 74). On the other hand, this hypothesis is

contradicted by the absence, on almost all the bangles, of seam traces, and by the fact their sections are extremely variable (round oval, ogival, sub-triangular) and often definitely asymmetrical. Another factor to take into account is the extreme rarity of traces such as of moisture marks, slip traces, fingerprints, or primary warping features, usually associated with simple wheel throwing.

I decided to try to solve the problem by a threefold approach. First, the potter, R. Altman, and I classified every type of manufacturing or wear trace identifiable on the finished product. Secondly, we spent no less than 40 hours with wheel and clays, materially simulating all the different possible ways of making a pottery bangle (due to the difficulties described above, we did not try to make any complex molding device). The different types of replicas obtained this way were then studied, and their manufacturing traces classified exactly like we did with the protohistoric bangles. Third, thanks to the suggestions and the experience of P. Vandiver, we would use xero-radiographs to observe the porosity pattern of the pieces, testing part of our conclusions.

Our work is still far from being finished, and any conclusion should await a proper, quantitative analysis of the evidence gathered. At any rate, in spite of the substantial problems created by forming and finishing techniques that appears very efficient and relatively standardized, we are inclined to think that the basic forming procedure, in the majority of the cases, was trimming, carried out with a sharp blade-like tool on wheel-thrown cylinders centered on the wheel. This would explain the parallel marks, the irregular section and the standardized diameter of the pieces. This theory seems to be partially supported by the xero-radiographs of the bangles' fragments.

The firing technology invented by the Indus craftsmen for the production of stoneware bangles is distinguished by surprising sophistication. Starting from the study of the overfired ceramic residues of the workshop areas, we put forward a preliminary hypothesis of reconstruction of a complex firing apparatus; this model was later developed after the evidence of a row of firing containers <u>in situ</u> we excavated in 1983, as well as by the finding of a large block of melted ceramics embedding a couple of superimposed stoneware bangles within a saggar (Fig. 6) (Halim and Vidale 1984; Vidale 1987; Pracchia et al. 1985). More evidence, finally, was collected through the surface clearing of the kilns' remains in the center of one of the Moenjodaro workshops.

Our reconstruction (Figs. 7-9) suggests that the stoneware bangles were inserted in sets of 2-3 superimposed specimens within small cylindrical ceramic saggars (Fig. 8), which were later sealed with special lids. This first type of saggars was wheel-thrown, with a ceramic mixture closely resembling the stoneware of the bangles. The small cylindrical saggars containing the bangles were then piled one above the other, forming a small pillar-like arrangement of 5-6 containers, and coated with a thin layer of chaff-tempered coarse clay.

In turn, this set was then inserted in a second, larger saggar. This second type of firing container is distinguished by a coarser ceramic body. The lower part was evidently formed by pressing irregular sheets of clay into a reverted truncated-cone shaped chuck. Over the base thereby formed, the potters raised a cylindrical body by a ring-forming and wheel-throwing technique, and the outer wall of the saggar was grooved with a comb-like tool to grant a better adherence to an additional outer layer of chaff-tempered clay. This larger vessel containing the smaller saggars was then sealed by a hand-made or wheel-thrown lid, and the whole system was carefully closed with more chaff-tempered clay. The final closure operation involved the application of three oval sheets of highly refined clay around the mouth of the saggar, subsequently marked by the imprint of typical Indus stamp seals, preventing unauthorized access to the fired ornaments (Fig. 9).

The closed firing containers were finally inserted in the kilns for firing. Unfortunately, the information on the size and shape of these kilns is very scarce. Some evidence suggests that they were larger than the more common kilns used in pottery firing (see Pracchia et al. 1985; Pracchia 1987); they were of the vertical type, and provided with a thick grid with round flue-holes. A bed of coarse terra-cotta rings, arranged in small piles, was laid over the grid, separating the bottom of the saggars from its surface, perhaps to grant a better circulation of the hot gases around the firing containers and, as a consequence, a more uniform heating (Fig. 9).

This concentric apparatus of firing containers

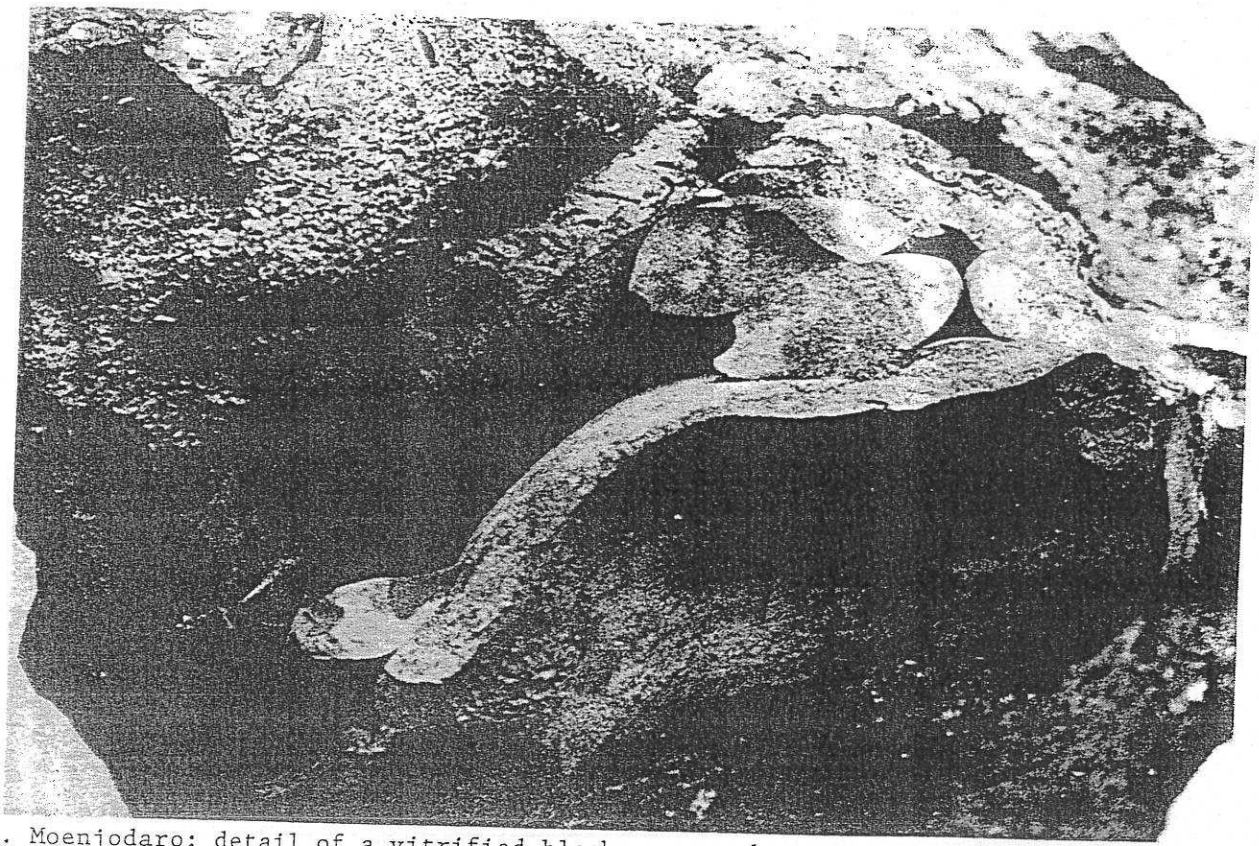

Fig. 6. Moenjodaro: detail of a vitrified block recovered on surface. The piece contains the remnants of a pile of sub-cylindrical saggars partially melted due to a firing accident. One of the saggars still contains a couple of superimposed stoneware bangles, showing the original arrangement of the products to be fired (for more information on this piece see Vidale 1987).

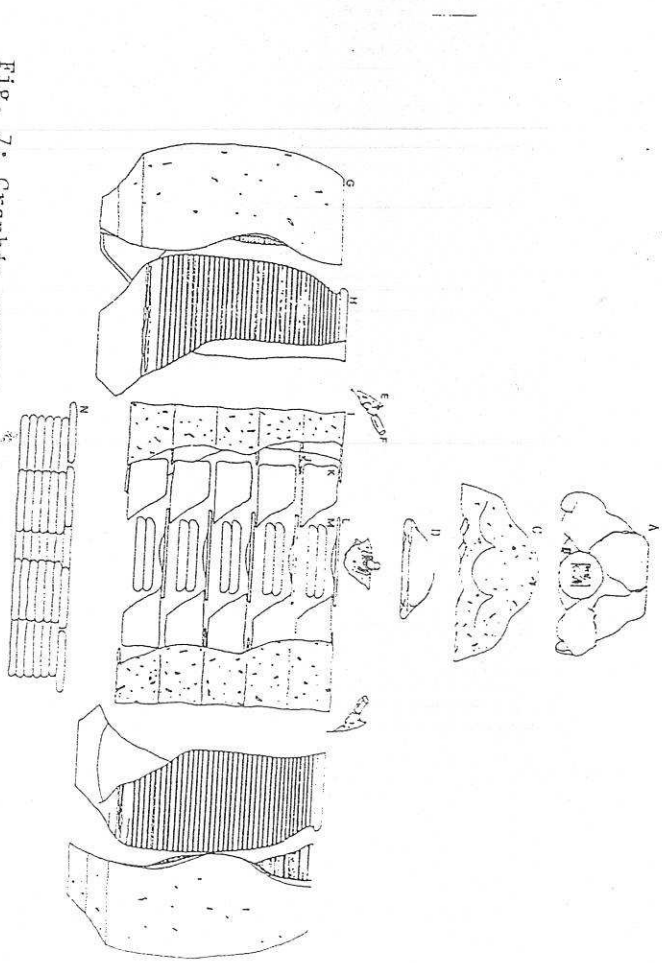

Fig. 7: Graphic reconstruction of the firing apparatus of the stoneware bangles. A: Upper capping in clay; B: Oval sealing with imprint of a Indus "unicorn" stamp seal, applied in sets of three around the mouth of the closed saggars before firing; C: Intermediate coating in chaff-tempered clay; D: Pottery emispherical lid; E,F: Broken terracotta rings used to support the lid D. The pieces of ring F were supported by the small cones of chaff-tempered clay E and applied under the interior of the mouth of the large saggar H; G: Outer coating of chaff-tempered clay, applied onto the grooved surface of the large saggar H; H: Large saggar in coarser ware; I: Further revetment in chaff-tempered material, coating the small pillar formed by the small sub-cylindrical saggars (K) contained in the large saggar H; J: Thin diaphragm in chaff-tempered clay laid between the small saggars; K: Pile formed by 5 superimposed small saggars (see Fig. 8). This type of firing container was made by throwing a ceramic mixture very close to the stoneware of the bangles; L: Ceramic lids covering each small saggar, wheel-thrown with the same stoneware-related ceramic material; M: Sets of stoneware bangles, inserted in couples within each saggar of type K (see also Fig. 6).

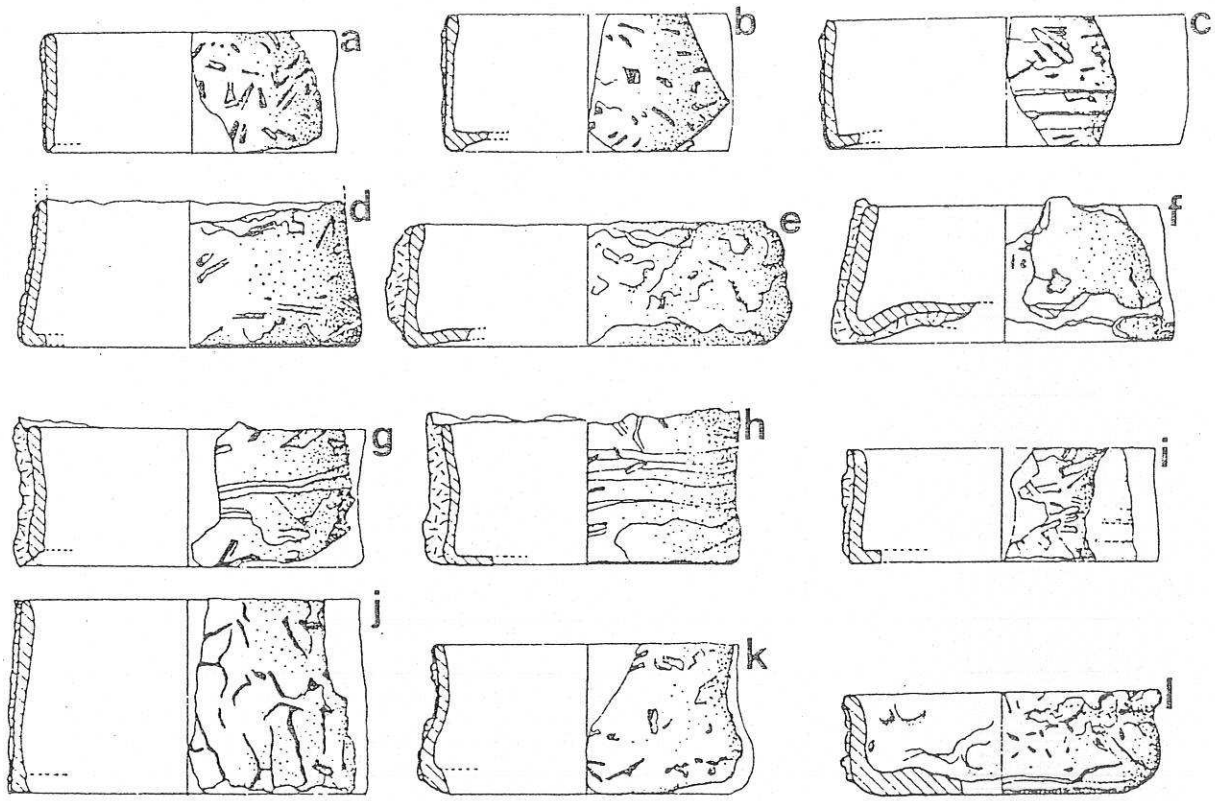

Fig. 8. Moenjodaro: Sub-cylindrical small saggars for firing stoneware bangles recovered on the surface of the workshop areas (type K in Fig. 7; see Fig. 6). The profile of these firing containers is rather variable: cylindrical (a-c) inward-inflected (d-f), slightly concave (g-i), slightly S-shaped (j-l). The size is equally variable: the specimen j, for example could have contained more than the two bangles attested by the block of Fig. 6.

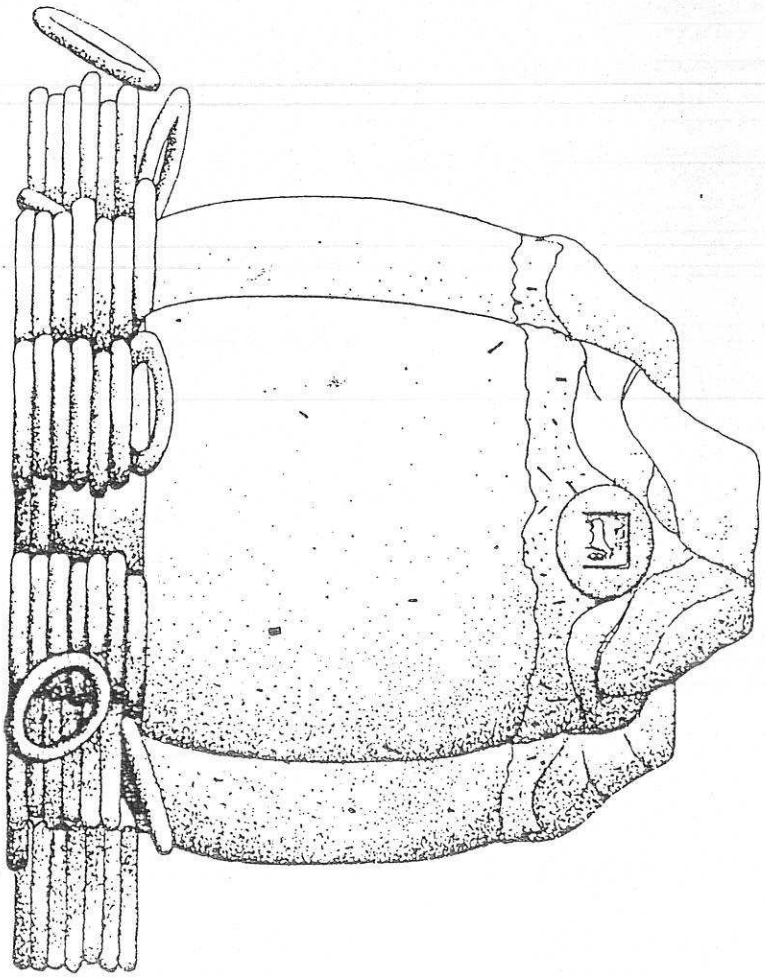

Fig. 9. Graphic reconstruction of an assembled apparatus for firing stoneware bangles inserted in the kiln.

sealed by ceramic lids and protected by coatings of chaff-tempered clay was evidently necessary to create and protect the reducing atmosphere needed to give the stoneware bangles their distinctive gray-black shining look. We have no information about the firing techniques employed for the production of the red variety of stoneware. The extreme care taken in controlling the stoneware's firing conditions was probably matched by an equally detailed control of the firing temperature reached in the kiln's chamber. The bangles' bodies had to be brought very carefully to a stage of incipient vitrification, during which any sudden heat increase would have been disastrous, as eloquently attested by the melted block of Fig. 6. According to Schneider (1987: 74) the bangles were fired at a temperature ranging from 1000° to 1100° c.

The functional meaning of this complex pyrotechnological system is currently studied, with the assistance of P. Vandiver, by preliminary re-firing experiments followed by S.E.M. examination of the bangles' specimens fired at progressively higher temperatures.

After cooling, the saggars were opened by breaking the sealings and the mouth closure. The features of the broken specimens recovered in the industrial dumps clearly show that rather often the superimposed stoneware bangles underwent a process of partial surface vitrification, causing the fusion of the surface of the pieces which had to be separated mechanically. In most cases, this separation seems to have been accomplished by strong blows, leaving an irregular scar (Fig. 1, left) all over the point of maximum expansion of the bangles (a good number of which just broke down in this operation). When this scar was particularly deep and irregular, it could be smoothed by grinding: many fragments show patterns of scratches reaching the inside of the depressions or protuberances left by the detachment of the sticking pieces (Figs. 2, 4). This was often accomplished with an apparent lack of care, contrasting with the efficiency which characterizes other stages of the manufacturing sequence.

3.2 The Social Context of Production

The distribution of archaeological remains of stoneware making at Moenjodaro shows a cluster of assemblages of overfired remains in the southeastern corner of the Lower Town, where at least two different workshops have been identified. Outside these major concentrations, the occurrence of stoneware making residues is limited to few isolated pieces of saggars, a circumstance suggesting that this industry could have occupied a well defined part of the city. It should be stressed, anyhow, that this picture could be partially affected by a greater incidence of erosion in the southeastern part of the city, and that great extensions of the original surface of Moenjodaro have been removed by old excavations.

The workshop areas in the southeast corner of the city doubtlessly represent a relatively late phase of occupation of the city quarters. If their localization is actually the expression of a pattern of segregation in a specific moment in time, we might underline that the southeast corner of the city is the mounded area farthest away from the monumental complex of the Citadel. One would also be tempted to interpret this eccentric localization as a result of a kind of compromise between the need of centralizing the manufactures and maintaining some form of marginalization.

At any rate, the study of the stratigraphic setting of the workshop east of the so-called Moneer quarter revealed that the industrial installations occupied the slopes of the city after a whole insula of dwelling units had been abandoned. This change seems to be part of a more general transformation of the city in its later phases, when different quarters or residential areas were occupied by specialized craftsmen such as potters and shell cutters (see Vidale 1987a).

The stoneware making workshop occupied an area of about 200-300 sq. m., extending over an irregular terrace-like midslope formation in front of a major gully marking an ancient street. It is possible that it was included within an irregular perimeter of walls, formed by the surrounding buildings, and partially exposed by erosion. We know that it was provided with some storerooms probably protected by roofs, one of which still contained two lines of large saggars sealed <u>in situ</u> under a collapsed wall, as well as a central open space where one or two kilns were installed, while a space at east could have been used as a dumping ground. Some evidence suggests that the architectural partitions were constructed and maintained re-cycling mud and fired bricks recovered

from older abandoned buildings (Halim and Vidale 1984: 68). The surface excavations, furthermore, showed that one of the kilns, after being abandoned, had been intentionally destroyed, and the overfired residues thereby recovered were used as a substructure for a structural filling, over which a new firing installation was constructed.

It is, therefore, probable that the stoneware markers worked in a well organized compound, which was maintained with substantial labor investments. This would match with the evidence of different forms of administrative control on the production (the storeroom, the sealings on the saggars, perhaps the microinscriptions on the stoneware bangles). The intervention of seals and writing in the manufacturing process, in particular, might indicate direct interference of the elites and administrators of the city in the production of this distinctive ornament.

3.3 The Circulation of the Finished Products

While shell bangles are rather common findings in the few known cemeteries of the Indus Civilization, no stoneware bangle has ever been reported in a burial context. Nonetheless, there are few doubts that they do represent personal ornaments. Preliminary observation of the wear traces on the surface of stoneware bangles through S.E.M. inspection of silicon imprints seems to reveal a pattern of radial scratches, possibly produced by wearing of piles of identical bracelets, as suggested by the contemporaneous iconography.

As far as I know, these ornaments have been found only at Moenjodaro and Harappa in Pakistan, and Kalibangan in India, and if they actually come from the local excavations, then this site too would be part of the list. In any case, they are all major regional centers, an evidence stressing the association between stoneware bangles and urban elites.

The study of the distribution and the circulation patterns of the stoneware products is based on the possibility of identifying the manufacturing centers. The workshops of Moenjodaro are, for the time being, the only positive archaeological identification. The observation of the micro-wear traces on the surface of the pieces, joined with the recording of other macroscopic indicators, will enable us to identify stoneware specimens, broken and discarded immediately after firing, suggesting local manufacture. This evidence will then be compared with the result of the chemical analyses, leading to the reconstruction of the ancient patterns of distribution and consumption of the products within the network of the Indus cities. The first results of the Neutron Activation Analysis are very encouraging, as the two main sites of Moenjodaro and Harappa seem to be characterized by the presence of clays well differentiated in terms of chemical composition.

4. The Dead-end

With the beginning of the 2nd millennium B.C. the Indus Civilization entered a major crisis, leading ultimately to a fast desertion of its large cities. This transformation, the causes of which are still a matter of harsh debate, involved the spreading in the indo-pakistani sub-continent of new crops such as rice and sorghum, the introduction of horse and camel, and the coagulation of social life around smaller centers somehow reminding the settlements of the pre-Indus chalcolithic communities (Costantini 1981; Possehl 1986; Meadow 1989). While the basic technological apparatuses of these centers (in terms, for example, of pottery and lithic technology) did not differ greatly from their Indus antecedents, some of the more sophisticated technologies were rapidly forgotten. This was the fate, for example, of writing; the same happened to the stoneware industry.

The highly developed techniques employed by the Indus craftsmen in forming and firing stoneware bangles turned out to be in the nature of the stoneware making profession within the Indus society.

According to the preliminary information gathered, stoneware making appears to have been a specialized occupation, distinguished by techniques which had very little in common with the procedures employed by other potters. If we are right in identifying trimming as the basic forming technique of the stoneware bangles, this would represent a major anomaly. Trimming was used by the Indus potters as a secondary refining procedure to correct morphological features of vessels in leather-state of hardness, and never as a primary forming technique. Our experimental simulations suggest that forming by trimming may represent a good solution for great part of the morphological and aesthetical requirements of the

stoneware bangles, but it demands a noticeable degree of skill, which can hardly be acquired in a short time, even by a contemporary professional specialist. Similarly, the very peculiar firing apparatus we are trying to reconstruct and understand is most probably an invention exclusively monitored to control in the most proficient way a process of incipient vitrification which was never applied to other classes of pottery of faience products.

Stoneware bangles are common only in the main political centers and, as a consequences, appear to be closely associated to the urban elites of the Indus society. Their production may be defined as a highly specialized, probably partially segregated and administratively controlled craft activity. In my opinion, all these features strongly support the idea of a highly developed statal organization, and are hardly compatible with the forms of organization of craft production usually described for chiefdom-level societies.

The highly specialized nature of the stoneware making technology may be considered as the historical result of a trajectory of invention and improvement monitored at satisfying a very specific cultural need - the production of elegant, standardized bracelets with a gray to black color and a metallic look. Although specific information is still missing, highly refined ceramic bracelets fired in reducing conditions have been noted (by me and other researchers) in archaeological contexts dated to early Indus or pre-Indus periods (see Thomas 1986). The stoneware industry of the Indus Civilization represents perhaps the extreme expression of a process of technological evolution supported, controlled and stimulated by the elites of the proto-urban centers developing in the indo-pakistani sub-continent during the 3rd millennium B.C.

A sophisticated craft like stoneware making doubtlessly required long periods of apprenticeship, which, in traditional India, are made possible by the existence of close kinship bonds within the groups of craftsmen. The close connection of these groups with the urban elites might have determined a condition of technological over-specialization. When the Indus Civilization, with its complex of formal and ritual codes, melted into the new dynamical world created by the economic transformations of the first half of the 2nd millennium B.C., the stoneware technology (exactly like writing) found itself too closely connected to the old system of social relationships to be able to survive, in this case by being adopted or "migrating" into other forms of ceramic production. After all, there are much simpler ways of making bangles.

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