

# INTERIM REPORTS VOL.3

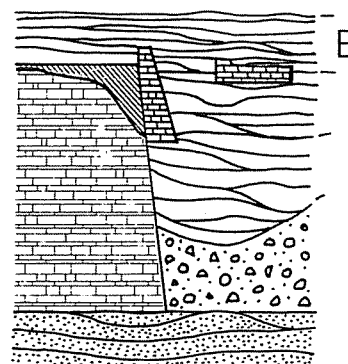
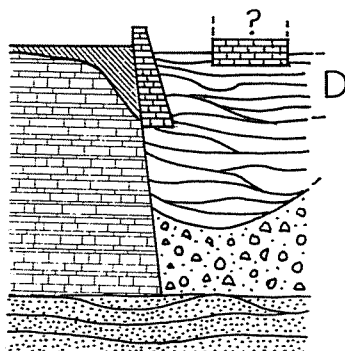
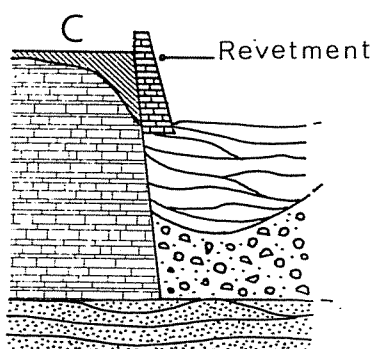
Reports on Field Work  
Carried out at Mohenjo-Daro  
Pakistan 1983-86

IsMEO-Aachen-University  
Mission

## MOENJODARO: FROM SURFACE EVALUATION TO GROUND TESTING

Giovanni Leonardi

(with integrative texts of Claudio Balista and Massimo Vidale)



# Towards a Geo-Archaeology of Craft at Moenjodaro

by M.Vidale

Istituto Centrale del Restauro, Roma

and C.Balista

Consultant Geologist, Fondazione Lerici, Roma

## 1. On the study of craft production in the Harappan civilization ( fig. 1)

Since the early identification of Harappan Civilization as the protohistorical background of the cultural evolution of the Subcontinent, a great deal of research has been carried out by Eastern and Western scholars. Hundreds of new localizations have been added to the list of known sites of the Harappan Civilization; the extension of the research beyond the core of the Indus Valley, Haryana and Saurashtra progressively enlarged the image of Harappan sphere of influence (if not straight political control) over South West Asia. Recently, the discovery of the Harappan settlement of Shortugai on the banks of the Amu-Darya (Francfort 1984) and of the trading outpost of Ras al'Junayz in Oman (Tosi 1987) further demonstrated the real extent of Harappan "expansion" at the beginning of II millennium BC.

As sharply questioned by W.A.Fairservis, is the Harappan Civilization a civilization comparable to the traditional Near Eastern models, or does it represent something different? Whatever might be the meaning of the Harappan "way of life" described by its material culture, the control of such an enormous complex of quite different geographical, ecological, cultural areas may only be conceived as the political expression of an extremely diversified economical system. Such a system exploited a wide range of resources and regulated the flow of commodities production and exchange on a scale probably unknown to the Mesopotamian states of III millennium BC.

In the sphere of the archaeological record craft production, or, with a more abstract term, industrial production, is the sector of protohistorical economies more directly accessible. It may be approached from the narrow, fragile bridge represented by remains of ceramic firing and metal

smelting installations, by the debitage left by workshops and factories cutting shells and semiprecious stones. In the last ten years, such remains were systematically recorded and studied on the surface of a series of protohistorical sites in Eastern Iran (by Italian scholars) and in the Indus Valley (by the German-Italian research team), with the aim to move the first steps towards the reconstruction of organization of industrial production in the early states of South-West Asia.

In the Indus Valley, this study was centered, in its initial stages, on the major urban center of Moenjodaro. Residues of industrial installations or heavy concentrations of dumped debitage were often encountered by the early excavators of the Harappan cities. But how were the great centers connected with the surrounding settlement network? Recently, new light on the nature of Harappan organization of industrial production has been spread by R.Mughal with his surface survey of the Bahawalpur area (1980), where hundreds of hectares of sites, bearing traces of industrial occupations -mainly represented by remains of pyrotechnological installations- were identified among simple camp sites or settlements. Out of the 174 sites dated to Mature Harappan period by the author, 79 are considered as purely industrial in nature (Mughal 1980: 51). Although more research is needed before attempting any interpretation, the size of Ganweriwala, the political center of the Hakra-Ghaggar region in Mature Harappan times, strongly suggests that this network of specialized sites was strictly oriented towards the regional center. Although any direct evidence is nowadays missing, it is probable that future research will demonstrate the existence of a similar model for Harappa and Moenjodaro as well.

Leaving aside the evidence from Moenjodaro, to be described in detail in the following sections, we may briefly review the information we have on the "sister" city of Harappa. It should be stressed that

here a major project of surface analysis and excavation is currently run by an American team directed by Prof. G. Dales; our experience at Moenjodaro showed the enormous amount of information available on surface, and, given the interest shared by the American colleagues on Harappan craft production, we expect a vertical growth of our knowledge on this subject.

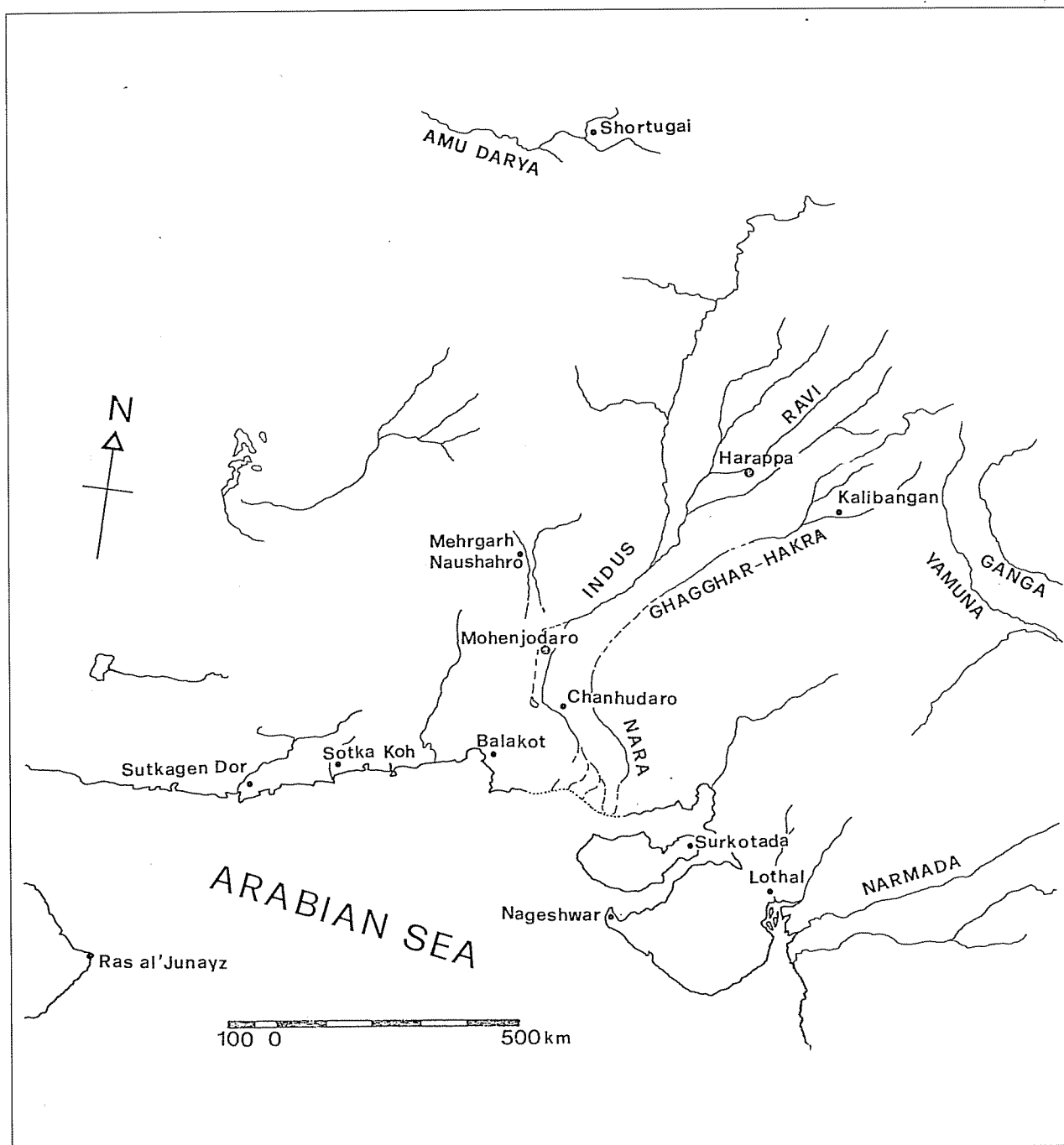
The image of craft production at Harappa is somehow confused. Great amounts of valuable objects, among which many unfinished items, were recovered in deposits occurring in different sectors of the site. This is the case, for example, of Find 8650, including, besides seals, metal items, semiprecious stone beads, a series of chert cores and blades as well as shell pieces (Vats 1940: 60); or, again, of our groups of antiquities (*ibidem*: 71, 72) containing unfinished seals, unprocessed pieces of Shank shell, alabaster fragments and many other finished products, suggesting to the author the possible existence of a "workshop". Shell manufacturing indicators appear frequently in these "mixed" contexts (see also Vats 1940: 85, 175). These deposits, not very different from some assemblages recovered at Moenjodaro or Chanhudaro, show the existence of a diffuse circulation of semifinished products within the cities' quarters, involving the existence of close economic bonds between the residential areas and craft production sphere.

Within the excavated structures reliable identifications of "workshops" (as manufacturing areas contained within buildings) are missing. Steatite stamp seals making, judging from the published data, seems to have left unfinished products all over the site (Vats 1940: 25, 71, 72, 82, 118, 119, 120-122, 125, 151, 153, 156, 173, 179; cf. also 320). Equally scattered are the mentions of metal working indicators such as crucibles (*ibidem*: 150) or hammered bars (*ibidem*: 182), of bead making indicators (*ibidem*: 114, 192, 399) or stone weight manufacture (*ibidem*: 159, 231, 361). To this scanty list of artefacts and assemblages might be opposed the monumental complex composed by the so-called "Workmen's Quarters", the famous circular platforms and the 16 kilns recovered in Mound F (Vats 1940: 17-135). The presence of precisely planned houses for "workmen" close to the rows of platforms interpreted as infrastructures for the preparation of cereals has been one of the supporting elements, together with the theory of the granaries, of the "regimented" character of Harappan management of primary production. According to Vats, nonetheless, "the find of several furnaces belonging to Strata

III and IV in this part would suggest that some workmen or artisans were living here" (1940: 62). "Ten (furnaces) lie in or over the Workmen's Quarters (Blocks I and II)...while six occur to the North of Lane I scattered among bits of walls which may have supported thatched huts" (*ibidem*: 470). The kilns appear to be distributed in 4 different layers, suggesting the persistence in time of an industrial quarter; but the exact relationship between the "quarter", the furnaces, the damaged architecture of Mound F is obscure. Equally obscure remains the function of the 16 kilns on record (Vats 1940: 470-474). In both the cases (the possible presence of a scattered network of small workshops and of an enlarged industrial quarter), the lack of attention for the formation processes of the archaeological record prevents us from understanding the nature and the evolution of the craft production organization at Harappa.

A second site holding a primary position for the study of Harappan craft is Chanhudaro. The site, excavated by Mackay (1943) in the late 30s, has been recently revisited by our team (Shar and Vidale 1985; Vidale 1986a), partially complementing and refreshing the information provided in the excavation report. According to the available data, the central mound of the site (Mound II), in the levels relative to a phase defined "second Harappan occupation" (Mackay 1943: 37-64), was inhabited by artisans. The inference was supported by a long inventory of finds related to industrial activities and activity areas identified across the excavated architecture; the apparent heavy concentration of such finds within the center of the town stands as an unicum situation in the archaeology of the Harappan Civilization. Steatite working, semiprecious stone working, glazing, shell cutting are substantially represented in the archaeological record; steatite seals manufactures, according to the author, was probably concentrated in the northern sector of the excavated area. The presence of coppersmiths would be proved by the find, within the excavated structures, of rich hoards containing semifinished bronze castings (*ibidem*: 52).

A careful re-consideration of the excavation data (cf. Vidale S.D.) pointed out a series of possible drawbacks and limits of Mackay's interpretations, particularly regarding the interrelationships between the assemblages of industrial indicators and the architecture. Are the concentrations of industrial artefacts dumps over decayed architecture, as often observed in our survey at Moenjodaro, or do they represent "primary" deposits left by working



**Fig. 1 :** Sites of the Harappan Civilization discussed in text.

floors and storing facilities? These quite different models may be tested only through careful stratigraphic readings which were beyond the scope of the large-scale excavations of the town. What is the exact nature of the large, well constructed buildings rising in the center of the city, evidently connected to industrial activities but also to the storing of

valuable amounts of metal? " One should take into account the possibility that the blocks in the center of the city, rather than houses of craftsmen, might represent warehouses leading and regulating the flow of materials and commodities through a direct, physical control of a wide range of craft industries, eventually expressed by recurrent temporary hous-

ing of manufactures and stores in their premises" (Vidale S.D.).

Generally speaking, the range of craft industries identified at Chanhudaro closely reminds Moenjodaro: pottery firing and metal working are absent or under-represented (the castings in the hoards do not indicate production *in situ*), and the city seems to be crowded by small workshops intensively producing luxury ornaments, playthings, and steatite stamp seals. An interesting field of enquiry is the nature of the economic interaction between the contemporary communities of Moenjodaro and Chanhudaro. In this latter town were produced commodities such as "long barrel-shaped carnelian beads" and bangles and ladles made out of *Chicoreus Ramosus*, which, apparently, do not range among the inventory of the articles manufactured in the capital (for shell cf. Kenoyer 1984). This preliminary evidence could represent a segment of the pattern of economic relationships linking the major urban centers with the settlement network spreading from the fertile alluvial plains to the faraway peripheries, where biological and mineral resources were extracted.

The site of Lothal, at the mouth of the Gulf of Cambay in Indian Gujarat, is a meaningful example of a district capital concentrating a set of manufactures only partially similar. Metalworking, in this case, seems to have been a primary occupation of the craftsmen of Lothal. Not less than three metalworking installations have been identified by the excavators: one on the edge of the mud-brick wall of the town in Block A, dated to Phase IIIa and later reconstructed (Rao 1979: 90, 98), a second one in the same Block, facing one of the main streets (ibidem: 95), dated to Phase IV, and a third one in the nearby Block G, Phase IV (ibidem: 122). The exact nature of these installations (including furnaces, pot-furnaces, tanks, drains) and of the recovered indicators mentioned in the report (crucibles, slags, tools) would be a rewarding subject of further investigation.

Such industrial units would appear to have settled around or within a kind of "bazaar" complex of shops/workshops in the northern part of the so-called "Lower Town" of Lothal. The same quarter contained a "shell worker's shop", identified after a find of a dump of shell debitage, and a second house with similar remains (ibidem: 49).

Another remarkable complex of industrial remains was recovered in Block B, Phase III, in correspondence with the "Acropolis" of the town. Poorly preserved remains of structures, to the south of the

supposed elites residences, yielded evidence of elephant's tusk ivory working, of specialized pyrotechnological infrastructures and, always according to the excavator, of dyeing infrastructures (ibidem: 108).

Lastly, mention should be made of the so-called "Bead Factory" of Lothal (ibidem: 118-119). It is my impression (and of other colleagues) that the meaning of the find has been somehow overemphasized, as no evidence of semiprecious stone debitage is nowadays available around the excavated structure. Nonetheless, the recovery of two jars full of beads, many of which unfinished, doubtless show the involvement of the town in the production and trade of semiprecious stone ornaments.

On the whole, the image we have of Lothal is the one of a "frontier" district capital, controlling the exploitation and the transformation of a wide spectrum of local resources to be conveyed to the inland markets and, perhaps, partially, to coastal trade.

A last aspect of Harappan industrial organization to be briefly mentioned is the economic and technological specialization of a series of sites strategically located in close proximity with the extraction areas of rare resources. This may be the case of coastal towns such as Balakot (Dales and Kenoyer 1977), where activity areas involved in the production of *Meretrix Casta* shell bangles were excavated, or of Nageswar (Bhan and Kenoyer 1981), where architectural remains contained dumps of thousands of *Turbinella Pyrum* and *Chicoreus Ramosus* waste pieces were excavated; but also of inland outposts such as Shortugai in Bactria, apparently involved in the production of ornaments in lapislazuli (Francfort 1984).

It may appear obvious, if not dull, to state that the economical system underlying this phenomenology is a very complex one. The problem is that a hoard of stored semifinished products is quite different, from this viewpoint, from a dump of industrial debitage or an "activity area"; and that a "factory" organized within an architectural complex is hardly comparable with a spread of debitage over a decayed, abandoned residential area. One of the purposes of the following contribution is to show in which way the reconstruction of site formation processes in the very particular depositional contexts of the activity areas of Moenjodaro may be directly relevant to their historical understanding.

## 2. Introduction

One of the most important lines of research in the project of "indirect archaeology" carried out by Germans and Italians at Moenjodaro since 1981, has been the surface evaluation of the craft activity areas of the archaeological complex. In the course of 3 main campaigns (1982-84) we were able to single out not less than 50 different sites, across the undisturbed areas of the site, ranging from very small localizations to major complexes up to 6000 sq. m. (in the isolated case of the DK-G North spreading of kiln vitrified wasters).

The general distribution and quantitative evaluation of the detected industrial sites seem to point to a scattered system of small activity areas, generally involved in the intensive production of luxury ornaments or status signs, administrative media and leisure commodities, while the heavy transformational industries definitely appear under-represented or absent from the main compound (Pracchia et al. 1985).

As summarized on previous occasions (Bondioli et al. 1984; Pracchia et al. 1985; Vidale 1984; 1986) the general distribution map of industrial areas should be considered as a preliminary working hypothesis. In the plateau-like sections of the site, our field of observation is strictly limited to the upper archaeological levels, which, according to the existing literature, should be regarded as the residual evidence of a "late urban" if not "post-urban" settlement phase. All along the slopes of the Lower Town, strongly dissected by rain erosion, the outcropping of assemblages of industrial indicators, often in the form of overlapping surface concentrations, provides us with a cumulative representation of the archaeological outputs of functionally different and chronologically displaced occupations (Balista and Leonardi 1987; Vidale 1987a). The present alluvial floodplain, furthermore, represents a severe obstacle to the surface analysis. The survey of the peripheral mounds to the north-west, south-east and south of the town showed the absence of large industrial complexes like those concentrated around Shahr-i Sokhta, for example, at the end of the 3rd millennium BC. (Tosi 1984). A single, small shell-working atelier was identified in 1983 on the border of a mound to the south-east of the Lower Town (Kenoyer 1984). Here, more recently, extensive earthworks along the south-eastern side of Moenjodaro have brought to light an archaeological

compound extending about 8-10 hectares, lying under 1 m. of alluvium. On the disturbed surface one could observe other substantial amounts of industrial debitage from shell-working, and, possibly, copper smelting, suggesting the presence of sub-urban manufacturing units hardly detectable from the present surface.

These three points clearly show the biasing effects of erosion and sedimentation on the archaeological representation of craft at Moenjodaro. Generalized erosive dynamics are systematically (but differentially) at work on the elevated sections of the compound, while alluvial sedimentation hides large sectors of the low-lying areas from archaeological observation. While the role of alluvial activity within and around the complex has been the subject of a good deal of discussion and debate, the nature of saline evolution and weathering on the deposits has been preliminarily described by Balista and Leonardi (1987). In both cases we are dealing with macro-variables affecting the interpretation of the general distribution maps that have been published on a large scale (Bondioli et al. 1984; Pracchia et al. 1985).

The present contribution is keyed to the discussion of the contextual variability of the activity areas identified. Given a set of surface concentrations of industrial indicators, it appears clear that the degrees of co-occurrence and functional interconnection among the indicators as well as their degrees of concentration, may provide useful information only if a) the transformational sequences from which the indicators originate are identical or analogous and b) the archaeological record's formation processes are at least largely similar.

While the first point may be ascertained simply by ordering and analyzing the indicators on record, the second point involves the need to take a much wider range of evidence into account, largely consisting in sub-surface observations. For this purpose, it is necessary to expand the concept of surface from a purely bi-dimensional euclidean acceptance to an elastic, three-dimensional one. The highly dynamical, "dismantling" geo-archaeological system operating on the deposits of Moenjodaro is characterized by maximum levels of entropy in the mud-flow formation progressively channeled into the gullies, and in the upper salinized formations affected by areal sheet-erosion. In both cases, by extending observation down to the underlying archaeological context, we may immediately reach significant levels of order: "regoliths" of washed architecture, often prevailing in the first case, and,

in the second case, traces of the sedimentary units generating the surface scatters of artefacts (the point of departure of the processes). The sub-surface observation tests so far carried out in HR East which is the subject of this volume, Moneer (Vidale 1987a) and in the contexts explored by Pracchia (1987), had the common aim of enabling a reconstruction of the site's genetic dynamics, through a minimal removal of archaeological deposits (generally limited to strips with a maximum depth of 30 cm.).

### 3. Dimensions of variability in craft activity areas formation processes

As in any other "normal" archaeological context, the Moenjodaro mounds are composed of three orders of components: artefacts, structures and sediments (what is peculiar about the depositional environment of Moenjodaro is the action of salt, whose disaggregating action cyclically turns, at an accelerated rate, the two former components into the third one). When we say that the formation processes of an activity area may be reconstructed after the sub-surface inspection of its archaeological context, we assume that such processes may be inferred by the nature and patterning of the three components. In this paragraph we attempt a preliminary discussion of the main dimensions of variability of each component.

#### 3.1. The nature of craft indicators

Within the archaeological record left by an industrial activity we may list three different *classes* of artefactual inclusions: *archaeological indicators of craft activities* (as defined in Tosi 1984), *"indirect" indicators of transformational / subsistence activities* such as charcoal and fired clay particles, and *residues of structures or infrastructures*. The second class, besides being massively represented in the archaeological record left by fire-using industries, is also associated to the performance of domestic and subsistence tasks probably accompanying a wide range of craft activities. The third class, finally, is presently relevant in the specific case of firing infrastructures.

The archaeological indicators of craft activities surviving the post-depositional filters of biological aggression, chemical alteration and saline attack (Bondioli et al. 1984: tab. 3) may be subdivided into four categories: lithic residues, organic residues such as shell, bone and ivory items, ceramic residues (including under the heading "ceramics" all the products of thermal transformation of mixtures with mineral non-metallic bodies) and metals.

From the view-point of the transformational sequences of the production cycles, the first two groups may be referred to *Extractive-Reductive Industries* (ER industries), while the others may be associated to *Pyrotechnological Industries* (P industries). This distinction is highly artificial: ER industries are often intersected by pyrotechnological processes (for example, the application of thermal treatments to stone-working: cf. Purdy 1982) and, generally, all the preliminary stages of P industries have an extractive-reductive character. Nonetheless, this gross distinction may be useful for a preliminary discussion of the different behaviour of the indicators of the two groups in the formation of Moenjodaro activity areas.

ER industries are best known in the prehistoric and protohistoric literature since the beginning of European palethnology, as they include flint-working. Various types of stone-working, bone, ivory, shell, wood, horn, leather-working may fall into this group. They generally need some preliminary reduction stages (such as the detachment of flint cortical flakes or bark peeling), some preparatory shaping, and a final shaping by progressive reduction, plus some specific finishing treatment.

Interest in the formation processes of palaeolithic industrial and "occupation" floors provided us with some ethnographic and experimental record (among others Binford 1978; Newcomer and Sieveking 1980; Cleghorn 1986) as well as with theoretical deductive contributions (Stevenson 1985). (The experimental approach to flint-working is greatly enhanced by the fact that the material is cheap and almost no infrastructure is needed).

In dealing with the industrial units of a III millennium BC urban compound we have to hypothesize the possibility of a (partially) "curated" attitude towards the working spaces (cf. Binford 1983). One of the authors (M.V.) could briefly observe the removal of lithic reduction debitage in the manufactures of Cambay (Gujarat, India). Here each craftsman collects his own output of chalcedony flakes into the sack over which he had been sitting, working therefore both like a micro-activity area and as

an individual disposal unit. Similar expedients would allow the accumulation of large amounts of debitage without any sedimentary addition. As an alternative model, the simple brushing away of the debitage floors would determine the formation of secondary, horizontally spread concentrations of debitage enriched in a fine-grained matrix. As a preliminary generalization, in spite of the scanty available information, we may assume the following points: a) the reduction processes may take place, without particular constraints in terms of facilities or environmental pollution, within or around living spaces; b) in the case of a "curated" exploitation of the spaces, the disposal of the refuse consequent to the cleaning of the working areas should follow the gravimetric-dimensional dynamics described by Binford (1978), South (1979), Kroll and Isaac (1984) and, generally speaking, the movement of debitage within and around the working areas should be characterized by horizontal dynamics; c) always in the case of the cleaning of the working areas, debitage could be removed "via air", within containers or by simple tossing, "via floor", by brushing, or, naturally, by a combination of the two ways. The more the debitage moved on the floor, the richer the dump was in soil matrix; d) the debitage left by ER industries, particularly some lithic classes such as chalcedony or steatite may be subjected to systematic forms of recycling and lateral cycling (in the Schiffer's acceptance of 1972) (for the cases see Shar and Vidale 1985; 1986). The debitage from ER industries, generally, although characterized by an increase in absolute occupied space, in the passage from the semifinished pieces to the shaped elements, is not comparable from the viewpoint of the quantitative output with the massive production of refuse from P industries. Leaving aside, for the moment, the possible intervention of purely ideological constraints <sup>(1)</sup>, this renders the intentional employment of ER debitage in structural fillings rather unlikely, when in any case, the matrix of these may include substantial assemblages of indicators (for an example see Bondioli et al. 1984: 30).

The behaviour of the indicators of P industries is almost totally different. With rare exceptions, the archaeological representation of P industries at Moenjodaro is limited to residues of the firing processes: unutilizable misproducts, kiln fragments, ashes and fuel remains (Pracchia et al. 1985). The following discussion is mainly centered on large-scale ceramic processes such as pottery-firing, as the features of the firing processes relative to other

more luxury Harappan industries like faience or stoneware-making are still poorly known (Vidale 1986a; Halim and Vidale 1984).

The pottery kilns recovered in the upper levels of the lower town (for the references see 3.2.) are presumed to have been installed in open public or semi-public spaces. In the excavation reports we find mention of substantial amounts of overfired misproducts dumped in the immediate surroundings of the kilns (Mackay 1938: 102-103), as well as, within the DK-G North pottery-firing area, of brick-robbing pits filled with ceramic refuse (Mackay 1938: 6, footnote; see also 57). Our knowledge of III millennium pottery-firing infrastructures in South Asia is generally limited to their residual structural components, and attention is rarely paid to their activation/disactivation cycles as well as to the inter-relationships between outer habitational floors and inner fillings (Adouze and Jarrige 1979; Pracchia 1987; 1986). We may anyhow assume that, after firing, the kiln had to be cleared not only from defective overfired or broken products, but also from layers of ashes and charcoal, and, probably, from fragments of the inner linings or of the vault to be replaced or restored; these refuse products had to be dumped without major transport activities (cf. the case of the Sasanian kiln excavated at Malyan in Alden 1978). In the case of the Lal Shah factory site near Mehrgarh (Pracchia 1986) it was possible to observe a synchronic growth of the outer floors, pottery misproducts dumping layers, and inner restorations of the chambers. The 7 kilns excavated at Lal Shah were installed in two different phases, the upper ones cutting the heaps of deposits previously formed.

Observations carried out in different sites suggest that in a final phase the kilns were filled or simply abandoned; contemporary evidence shows that they are used as disposal pits for all kind of refuse (J.M. Kenoyer, personal communication), and often as latrines. A preliminary sub-surface testing of the stoneware-firing installations in the Moneer South-East Area (Pracchia and Vidale S.D.) would indicate the existence of thick deposits of slag and kiln fragments below the actual primary floors of the infrastructures. If this interpretation is correct, the kilns of a first phase would have been destroyed and their remains employed as an enlarged sub-structure for the new ones.

Thus we may summarize the following points: a) the polluting character of P industries conveyed the firing installations into open, often peripheric spaces, with a relatively wider available space for the dis-

posal of refuse; b) the pottery-firing areas were substantially "non-curved" areas, the maximum curation being the excavation and filling of pits instead of areal dumping; c) in both the cases (heap-dumping and pit-filling) vertical dynamics of sedimentation might be directly observed in the manufacturing contexts; d) the nature of the refuse largely excluded the possibility of recycling it (one can't do that much with a vitrified splashed vessel); in the late levels of Moenjodaro impressive amounts of overfired wasters were systematically "laterally cycled" (always following the terms proposed in Schiffer 1972) in form of structural filling beneath paved floors with purpose of insulation (for example, see Marshall 229, 246; Mackay 81-82, 85, 89).

### 3.2. The interaction with the urban architecture

For our present purposes, the urban architecture of Moenjodaro may be deemed as a system of containers with walls in fired and mud brick and fillings retaining and supporting residues of the material outputs of the transformational sequences (cf. Balista in this volume, § 3.1). Fillings are a key variable in the sphere of the archaeological representation of craft at Moenjodaro. They may range (see *infra*) from almost sterile deposits of silt and sand to thick substructures composed almost entirely of refuse from pyrotechnological processes. The relationships between craft indicators and elements of the structural "containers" and "supporters" are substantially expressed by forms of stratigraphic patterning. In spite of the unsatisfactory information provided on the nature and the features of the discussed contexts, the excavation reports may provide a useful starting point for a preliminary classification of the architectural contexts of craft production at Moenjodaro.

(The following 6 models are adapted from the discussion presented in Bondioli and Vidale 1986; see also Vidale 1987a).

1. The widespread presence of flint cores, blades and flakes in a large number of houses and other architectural contexts (Marshall 1931; Mackay 1938: *passim*) may be due to the detachment and employment of cutting, scraping and polishing tools in connection with domestic activities. As a rule, no information is provided on the stratigraphic context of the finds. A similar situation may be hypothe-

sized for spinning (Marshall 1931: 31). For two possible vertical looms see Mackay 1938: 65, 113.

2. A small number of houses contained concentrations of industrial residues suggesting the performance of specialized activities, reminding the pattern of a "...combined shop and dwelling house arrangement". This may be the case with two possible lapidaries workshops (Vidale 1987), of a room containing a dump of copper-smelting slags, fragments of crucibles and ashes in HR Area (Marshall 1931: 212), as well as of a house containing large amounts of steatite-cutting debitage (*ibidem*: 184) (for the possible evidence of precious metal-working see Marshall 1931: 205). Within dwelling units hoards were also found containing unexhausted or semi-finished pieces of shell (Marshall 1931: 181, 219; Mackay 1938: 219, 226), and other material, such as metal or stag horns. These deposits could indicate the existence of economic ties between residential houses and manufacturing units.

3. Along the town's main streets, rows of small raised benches or platforms were interpreted by the excavators as an arrangement similar to the structure of the present day oriental bazaar (Marshall 1931: 240; Mackay 1938: 27-29, 30, 32, 74, 76, 82). Some small-scale manufacturing activity could have taken place together with retail sale on the small platform (for an ethnographic example see Shar and Vidale 1986). At Chanhudaro rows of brick understructures have been interpreted as bases for wooden posts holding roofings under which craft activities could have taken place (Mackay 1943: 49). The "bazaar" model, partially overlapping with the former one, has been independently taken into account to explain some features of the distribution of craft indicators in the HR-East insula (Pracchia et al. 1984).

4. The two large architectural complexes traditionally considered "elite" or "public" buildings (the so-called "Chief's House" in DK-G North and the "Palace" in HR Area) included spaces apparently designated to highly specialized, infrastructures-demanding craft industries. The first complex was endowed with a metal-working workshop provided with kilns and storage pits (Mackay 1938: 41, 49-50, 54, 172), while the HR "Palace" included a complex arrangement of facilities interpreted as a dyeing or a plaster-making atelier (Marshall 1931: 196-197) and a probable glazing infrastructure (Marshall 1931: 478-479; cf. Vidale 1986a). In other rooms of the HR complex amounts of debitage were found, left by a shell inlay manufacturing unit and by a steatite working atelier (Marshall 1931: 189-198).

On the whole, this evidence of concentration of craft activities within elite residential units recalls similar situations encountered in mid III millennium BC Mesopotamia (Henrickson 1982: 24-33).

5. In at least one case, the excavators found a series of structures occupied, in the later levels, by a group of craftsmen. The buildings correspond to Section D of L Area, on the citadel mound, and to the southern rooms of the so-called Pillared Hall (C Section) (Marshall 1931: 159, 162, 165, 167, 170-174, 195, 564-565; cf. Kenoyer 1984). For the rooms in C Section, we are informed that the industrial debitage, consisting of whole and partially cut *Turbinella Pyrum* shells, inlay pieces and beads, was found associated to different floor levels (a circumstance perhaps suggesting the presence of superimposed filling deposits). In Section D, some shell deposits were found at the base of walls (Marshall 1931: 173) (in a sub-primary context?), while some large open spaces were filled with massive deposits of pottery misproducts also containing some shells.

6. In the upper levels of the Lower Town, excavators encountered substantial but localized evidence of groups of potters extensively re-occupying public or semi-public open spaces. Here the craftsmen installed their kilns, erecting temporary installations and expedient cooking facilities, often dumping the misproducts in situ (cf. 3.1) (Marshall 1931: 167, 193, 226; Mackay 1938: 6, 33, 57, 62-63, 81-82, 84, 85, 102-103, 154, 172).

The first 4 models, in a very ideal acceptance, may be considered as fully "urban", i.e. fully responding to the system of rules socially shared within the city's context. The 5th model, although representing, in the excavators' view, a form of "improper" exploitation of the urban architectures, still reveals the existence of highly organized forms of control on the disposal of industrial wasters (the lateral cycling of potters' kilns misproducts into structural fillings). The 6th model, finally, seems to conform to our ideas of "post-urban" behaviour. The relationships between urban architecture, the underlying urban policy and craft production, therefore, might have generated two broad environments of archaeological formation processes. In the first case, the artefactual flow from the transformational sequences to the archaeological record would follow a constrained path, strictly determined by the urban maintenance rules (as in the case of the Egyptian Predynastic context described in Hoffman 1974). In the second case, the same flow might have

been relatively "free", characterized by more immediate functional criteria.

#### 4. Primary sedimentation processes in the craft activity areas of Moenjodaro : an ideal path

Leaving aside the mythical presence of "water-logging" silty layers in the *elevated* part of the compound, sedimentation processes at Moenjodaro coincide, to a fair extent, with the processes of installation, maintenance, decay and re-structuring of the urban architecture. Such dynamics, due to the employment of fired bricks, to the widespread occurrence of massive mud-brick understructures, as well as to the maintenance of a capillary system of regulation of the urban waters, cannot be compared with the Tell formation processes normally occurring in other regions of South-West Asia (see Kirby and Kirby 1976; Miller Rosen 1986); our state of knowledge on this subject is unsatisfactory, and specific field research would be necessary for defining sets of rules governing the growth of the mounds.

With the term "Primary Sedimentation Processes" of craft activity areas we mean here the complex of factors determining the formation of the sediments containing the archaeological craft indicators in primary, sub-primary or secondary context, before the intervention of post-depositional alteration (mainly saline evolution and downslope wash-out). Some aspects of these processes have been previously mentioned discussing the dynamics involving the artefacts or the architecture (§ 3.1 and § 3.2). The following discussion is specifically centered on the genesis of the matrix *component* of the sediments, in the trajectory starting from the actual site of manufacture and leading to the final place of deposition.

In § 3.1. the artefactual inclusions were subdivided into three classes. A parallel distinction may be proposed for the variability of the matrix component of an industrial deposit.

As far as ER industries are concerned, a first class is represented by the sediments produced by the wear of the tools and, above all, by the abrasion of the processed materials. Meaningful examples are provided by the layers of lapis lazuli powder encountered in the workshops of Tepe Hissar (Tosi 1986; Bulgarelli and Tosi 1986), by the floors of shell

powder excavated at Balakot (Dales and Kenoyer 1977: 18) or, turning to contemporary evidence, by the steatite dust-producing manufacture described in Shar and Vidale 1986. It should be stressed that the presence of clean, unmixed sedimentary horizons of the described types may be reliable markers of "de facto refuse" contexts or of secondary refuse transported "via air". For P industries, this component may be represented by the silty-sandy deposit with baked clay particles and vitrified residues usually encountered around the kilns, and sands and micro-grained rocky fractions introduced for preparing ceramic mixtures.

The second class includes fine-sized fractions produced by "indirect" transformers such as fire and water. In the first case the deposit will include ashes and heat-altered fine materials, forming a fair percentage of the layers commonly associated to P industries; in the second case, evidence like water-laid lenses could be expected.

The third class includes all the components extracted by abrasion, decay and weathering of horizontal or vertical structures. The nature and extent of this flow of sedimentary material are a function of the general relationships between working spaces and structural containers described in § 3.2.; the amount of sedimentary addition in situ will be minimum in the case of a highly curated attitude towards the working environments (generally expected in dwelling contexts such as model 1., 2., 4.) and sharply increasing in any squatting-like occupation. In a context similar to the ones described for models 5. and 6. one would expect thick layers of re-deposited silt from weathered mud bricks as well as crumbled fired bricks in primary setting. In a curated floor exploited by a ER manufacture, the intervention of this type of component will be limited to thin lenses laid down from mud-brick walls and plasters and to the uncoherent brushing products mentioned in § 3.1.

As a preliminary proposal, the graphic model of fig. 2 presents a three-stage sequence of transformations of an assemblage produced by an ER industry. The cycles 1a-1b are determined by a curated behaviour towards a working floor connected to mud brick structures. In situation 1a, the floor is covered by heaps of dusty material left by the reductive activities, in which fragments of unprocessed debitage are visible. Together with this type of industrial debitage, some domestic activities leave ashes, charcoal, bone fragments and some sherds on the ground. In situation 1b, the cyclical abrasions of the surface leave few small-sized fragments of the

processed material embedded in the silty material produced by the weathering and decay of mud bricks combined with trampling and brushing. On the present floor thin residual lenses of the powder-like matrix deposited in 1a are visible.

Situation 2 describes a stratified dump produced by "via floor" and/or "via-air" dynamics. The inner layers of the dump formed by continuous discharge are characterized by different percentages of powder of the processed material within the matrix, corresponding to the various possible alternative ways of recollection of the debitage. The hatched lens represents a horizon of ash, associated with some bone and ceramic fragments, produced by the mentioned cooking-heating activities. The dump extends over an abandoned decayed structural context.

Situation 3 represents a structural filling within a parallelepiped-like three-dimensional space enclosed by walls. The industrial assemblage has been removed, re-elaborated and mixed with other "disordered" deposits, to a fair extent formed by bricks, sherds and their related fine-grained components. Few fragments of the processed material, together with a very weak percentage of powder, represent the residual evidence of the industrial activity, scattered among one or more inner layers of the filling.

Once this model of processual evolution of the industrial assemblages at Moenjodaro has been defined, we may hypothesize that in the sequence 1-3, the relative amount of sedimentation is proportional to the disorder progressively affecting the assemblage; that the possibility of exploiting the debitage for recycling or lateral cycling is inversely proportional to the same sequence, being maximum in situation 1a and minimum in 3; that the social context of the removal-disposal operations progressively expands from 1a (where the disposal may be effected by the single craftsman) to 3, where the dislocation may be ascribed, in some cases, to forms of collective work.

Leaving aside the synchronic sphere, finally, it is interesting to observe that the sequence 3-2-1, expressing a sequence of cycles that involve decreasing levels of curation and environmental control of the industrial spatial resources (see § 5.3.), may be reflective of the evolutionary trends from urban to post-urban models of behaviour (cf. the sequence of industrial occupations encountered in Moneer South-East Area and described in Vidale 1987a).

Applying the model to P industries, the 1a-1b

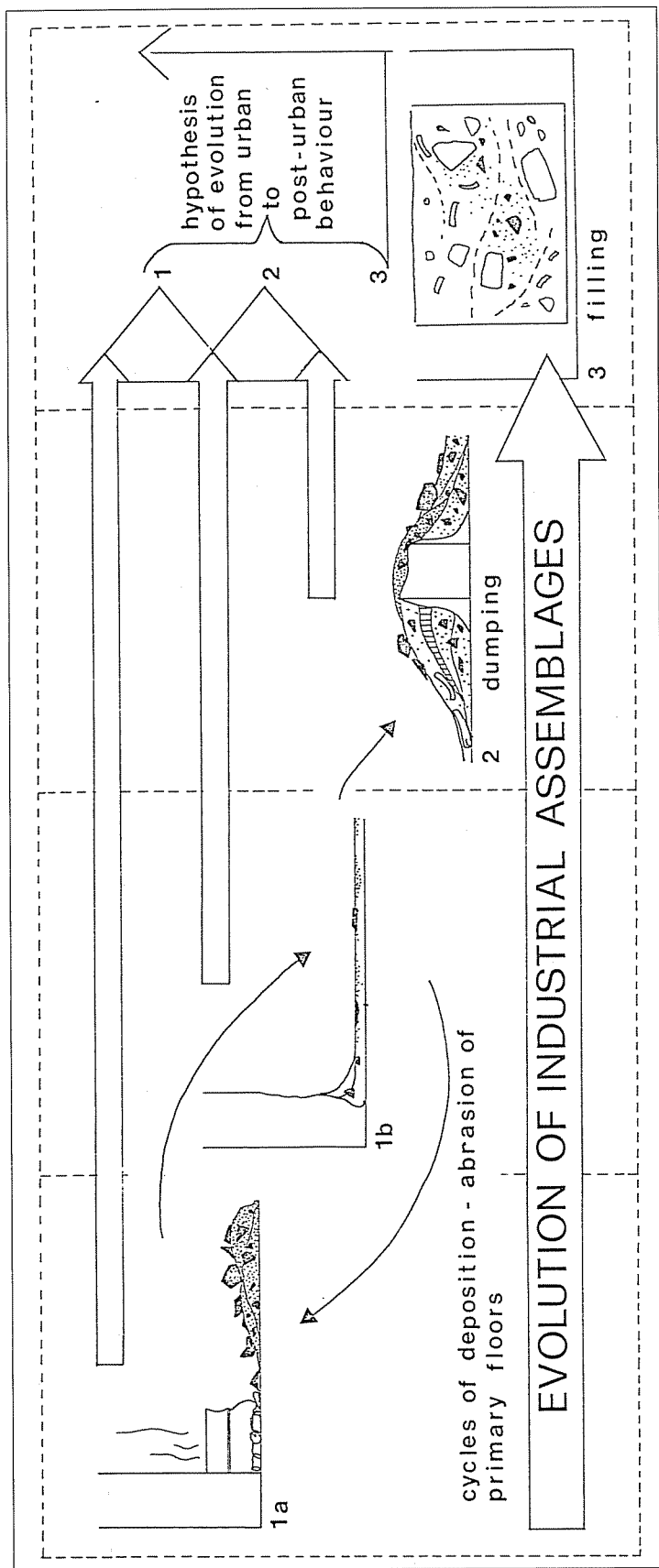


Fig. 2: Processual ideal model of the evolution of an industrial "activity floor" at Moenjodaro. For the explanation see text.

cycles become the firing-cleaning cycles of the kiln's chambers (1b representing the floors of the infrastructures); situation 2 may be imagined immediately surrounding the firing context. The archaeological outputs of sequences 1-2 are therefore much closer in space for P industries than ER ones. Situation 3, as expressed in § 2.1., is a very common find in the upper levels of the town, representing a systematic, functional trait of architectural growth. Limiting the observation to the inner space of the firing infrastructures, the available information would suggest that, in a final stage, the sequence of disactivation would follow the centripet path 1b (floor), 1a (residues of the last load), 2 and/or 3 (dumping of related or non related cultural material, structural filling for levelling).

If we compare the proposed processual sequence with Schiffer's (1972) flow models, some interesting points are raised. In Schiffer's terms, our situation 1a – imagining that the craftsman had worked over the heap of debitage without removing it – would fall under the semantic sphere of “*de facto refuse*”, being determined by “elements which reach the archaeological context without the performance of discard activities” (1972: 160). Situation 1b, in spite of the strict spatial coincidence between the residual evidence and the actual place of manufacture, should be classified as “*primary refuse*”, (elements discarded in the same location of use); but a more proper definition should include situations 2 and 3, characterized by a location of discard different from the location of use, would be classified as “*secondary refuse*”. It is anyhow evident that situation 2, dumping, whether in close proximity with the location of cycles 1 or not (cf. Vidale 1986d) retains high levels of order, while in 3 the massive ingression of products belonging to different subsystems causes high levels of noise. These observations would suggest, therefore, the opportunity, in our case, of calibrating the discussed categories more on the base of processual than locational parameters.

Situations 1a and 1b seem to have been rather rarely encountered (or described) in the old excavations; as a rule, with the possible exception of P industries, they are excluded from the observation range of surface analysis. The study of Moenjodaro craft activity areas, therefore, will be carried out substantially on *dumping* and *filling* contexts.

## 5. Filling and dumping as expressions of urban policy

Filling and Dumping are two phenomenological categories pertaining to the wider sphere of the urban sedimentogenesis. The ideal model described in § 3 should come to terms with the material expressions of the historical development of Moenjodaro as a city. As a preliminary, ideal model, we propose the gross outline of a three-stage trajectory taking the interplay among these dynamics of addition and the evolution of the urban complex into account.

### 5.1. Urban installation phase

This phase is here conceived as an ideal moment (or better, as a series of discontinuous events in time) in which large sectors of the city are constructed or re-built according to a planned design. Preliminary observation indicates that this phase should involve large bunding works along the edges of pre-existing mounds, inner fillings and/or levelling earthworks, together with minor additions of sterile or sub-sterile cubature deposits (cf. Balista, this volume). This latter type of deposit, being more solid, is to be expected mainly along the edges of new or re-adapted urban blocks. Such constructions are presumably the fruit of collective work, affecting enlarged social contexts and directed by well-defined institutions appointed to the urban management.

This phase is expected to produce large-scale, massive filling deposits, generally unrelated to structural micro-perimeters, which could be preliminarily labelled as “*extended fillings*”. These formations could incorporate fractions of assemblages pertaining to pre-existing fillings and dumps, including occasional associations of indicators of craft activities. Given the scale of the related earthworks, these associations would be scanty, rarefied and, as a rule, strongly disordered. Craft activities are therefore largely non-represented in the sedimentary additions of this ideal phase; the scanty residual evidence embedded in the “*extended fillings*” should be referred to the industries performed in previous settlement phases.

## 5.2. Urban activity and maintenance phase

In this second ideal phase, blocks, insulae and fractions of insulae are taken over by different social (ranked?) groups. The architectural lay-out is re-articulated according to different needs and models, the large substructures being adapted with secondary additions and partitions. Small-scale cycles of maintenance, decay and restoration take place all over the city's sectors. Part of the new, secondary substructures are obtained from selected anthropogenic materials such as potsherds or crumbled mud bricks. Dumping deposits related to pyrotechnological processes, both through direct disposal or after a period of intermediate storing, appear to have been laterally cycled for small-scale specialized substructures.

In houses and courtyards, subsistence and specialized activities, together with the decay of the structures, cause the formation of deposits the removal and disposal of which is regulated by the constraining filter of the urban policy. Dumps are temporarily kept in the proximity of the dwelling and working areas, to be progressively conveyed into mixed fillings, sometimes containing small homogeneous patches of industrial debitage.

In this phase, not all the industrial sectors have free access to the city's spatial resources. These latter seem to be mainly reserved to luxury manufactures of personal ornaments, status indicators, administrative media and leisure items (Pracchia et al. 1985); steatite processing, in particular, seems to be an organic trait of the city's economy (Vidale 1986c). This phase attests to the models of industrial units labelled as 1-5 in § 3.2.

## 5.3. Late urban evolution phase

This much discussed and still poorly understood "phase" appears to be characterized by decreasing investments in the organization of the urban spaces as well as by decreasing levels of control onto the city's environment. The architecture of the later levels shows widespread evidence of re-utilization of structures, as a rule accompanied by makeshift, fading constructions. The city's substrata have suffered from diffuse small-scale brick-robbing, as well as the excavation of pits. These activities often interfere with vital elements of the city's lay-out

such as the street network.

Besides the overall evidence of "crowding" claimed by the old excavators, the central role played by Moenjodaro in its later stages is demonstrated by the progressive concentration of craft installations and working areas on the slopes of the mounds and on the plateaus. The research carried out on the surface of the so-called Moneer site (Vidale 1987a) led to the reconstruction of a sequence of industrial occupations culminating in the "conquest" of the plateau of this sector of the city by groups of potters (Model 6, in § 3.2.). It has been suggested, furthermore, that the sequence of industrial occupations progressively allowed within the city might be reflective of the system of rank of the various crafts in the Harappan society (Vidale 1986a).

At this stage, sediments produced by industrial and domestic activities flowed onto the urban architecture largely, free from the pre-existing constraints. One may expect the absolute prevalence of dumping deposits, perhaps occasionally cumulated into fillings, over the sub-sterile or mixed cubatures of the previous stages; the associations of industrial indicators, scarcely affected by post-depositional anthropic dynamics, now present the maximum degree of ordered coherence, the work of the natural agents allows.

## 6. A preliminary definition of filling and dumping features

The last paragraph, which hardly could be followed by the consoling voice "conclusions", takes into account the need to lay down a set of features to be used as archaeological indicators to define the nature of a given depositional context. In discussing § 2, the depositional environments of the craft activity areas of Moenjodaro have been discussed in terms of artefacts and sediments; both the artefactual inclusions and the matrix fraction were described as produced by the alteration of industrial materials, by the performance of less specialized subsistence activities and by the abrasion and decay of the related structures and infrastructures. This scheme of reference may be summarized as follows:

#### ARTEFACTUAL INCLUSIONS:

**a:** industrial materials (fragments of tools and debitage of the processed materials).

**b:** domestic and subsistence indicators (domestic pottery, charcoal, bones, etc.).

**c:** residues from structures and infra-structures (bricks, fragments of plaster, fragments of ovens or kilns, etc.).

#### MATRIX COMPONENTS:

**a':** powder produced from abrasion of tools and processed materials; deposits altered from industrial activities.

**b':** ashes, organic matters and other fine-grained deposits from subsistence activities.

**c':** fine components produced by decay and weathering of walls, roofs, swept floors, etc.

On the basis of this hypothesis of resolution, and given the ideal sequence briefly exposed in § 5, centered on the processual evolution of the urban substrata from "extended fillings" to "fillings" and "dumps", we have attempted to formalize a preliminary model of the inner compositional features of each depositional context (fig. 3).

In our hypothesis, each context would be composed of a distinctive distributional pattern of the six classes of components in play. Extended fillings and fillings would be characterized by an absolute prevalence of **c-c'** components (produced by the demolition of structures), but fillings are represented as much more selective.

The composition proposed in fig. 2 for this latter context is far from representative of the wide range of variability these show at Moenjodaro. In the case of a potsherds filling, the proposed distribution could remain a meaningful approximation only considering the selected construction material (the sherds) as belonging to the **c** components. Future testing will doubtless provide substantial articulations and alterations of this type of models. Dumping formations are defined by an absolute prevalence of **a** terms in the artefactual sphere, with a good percentage of **a'** components in spite of the still substantial incidence of **c'** terms.

A further dimension of differentiation among the three depositional contexts may be identified in the relationships they have with structures. These relationships may be expressed in the following list:

#### EXTENDED FILLINGS:

**COVER:** alluvial deposits, levelled structures.

**ARE COVERED BY:** all types of fillings and structures.

**ARE FLANKED BY:** gaps among blocks or insulae, other macro-structures.

#### FILLINGS:

**COVER:** extended fillings, fillings, intentionally abraded structures, levelled collapse deposits.

**ARE COVERED BY:** activity floors, "nodules" floors, structures.

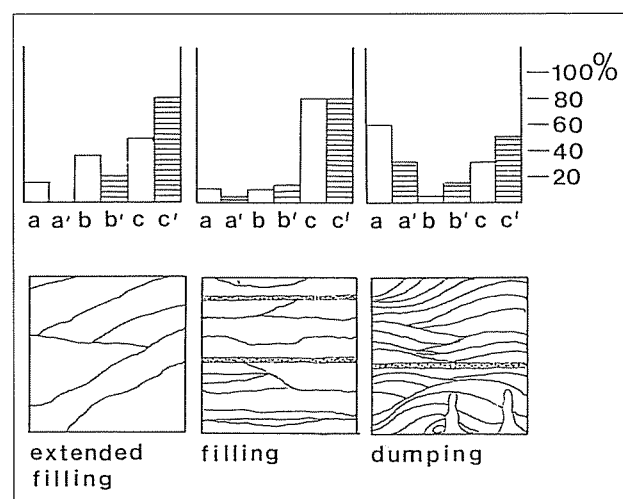
**ARE FLANKED BY:** primary entrenched walls.

#### DUMPS:

**COVER:** abandoned activity floors or erosion surfaces, decaying collapse deposits, negative interfaces (pits, etc.).

**ARE COVERED BY:** other dumps, small infrastructures, erosive surfaces, anthropic negative interfaces.

**ARE FLANKED BY:** residual segments of walls or re-adapted architectures, temporary erections, non-artefactual delimitations (paths, etc.), other dumps.



**Fig. 3 :** Preliminary model of the compositional variability of extended fillings, fillings and dumps at Moenjodaro. For details see text.

## Acknowledgments

Many of the ideas contained in this paper are the result of the collective work of the RWTH-IsMEO team at Moenjodaro. Many thanks are due to M.Jansen and M.Tosi for their precious suggestions. We would like particularly to thank G.Leonardi for his invaluable and continuous help, and the many ideas and doubts raised in working together.

## Footnotes

- 1 On the basis of the strong ideological characterization contemporarily attached to soapstones in Baluchistan and Sindh, one might wonder if the presence of steatite debitage within structural fillings is due to casual inclusions or rather may obey to given ideas on the stone's properties and possible super-structural meanings.