

Harappa Excavations 1986-1990

A Multidisciplinary Approach to
Third Millennium Urbanism

Edited by Richard H. Meadow

Monographs in World Archaeology No. 3



PREHISTORY PRESS

Madison Wisconsin

Copyright © 1991 by the Individual Authors.

Prehistory Press
7530 Westward Way
Madison, Wisconsin 53717-2009

James A. Knight, Publisher
Carol J. Bracewell, Managing Editor

All Rights Reserved
Manufactured in the U.S.A.

ISBN 0-9629110-1-1
ISSN 1055-2316

Library of Congress Cataloging-in-Publication Data

Harappa excavations 1986-1990 : a multidisciplinary approach to third millennium urbanism /
edited by Richard H. Meadow.

p. cm. -- (Monographs in world archaeology, ISSN 1055-2316 : no. 3)

Includes bibliographical references.

ISBN 0-9629110-1-1 : \$33.00

1. Harappa Site (Pakistan) 2. Excavations (Archaeology) --
-- Pakistan. I. Meadow, Richard H. II. Series.

DS392.2 H3H37 1991

934 -- dc20

91-39504
CIP

Cover art: Bowl on Stand H88-1002/192-17 associated with Burial 194a
in Harappan Phase Cemetery (see Figure 13.18).

Patterns of Technology and the Organization of Production at Harappa

Rita P. Wright
New York University

Following a brief discussion of the regional and inter-regional contexts in which Harappan pottery production took place, focus is placed on recent excavations at Harappa for the purpose of providing an introduction to the project with respect to patterns of technology and the organization of production. Evidence for specialization, standardization, and control in pottery manufacture at Harappa is evaluated. Specialization can be inferred from the restricted range of types produced in the context of a single activity area, from repetition of patterns of technology in the production process, and from the high degree of efficiency in production and in the multiple sequences employed. The high level of skill of the potters is revealed in the quality of the final product, in the patterned sequences, and in the tools they employed, while standardization is evident in the restricted range of forms produced in uniformly applied production sequences. Evidence for central organizational control over pottery production, however, is largely lacking. These features taken together with evidence from other crafts and other sites show that different kinds of production were absorbed into the Harappan urban environment in different ways. The evidence reviewed also suggests that kinship groups in the Harappan civilization continued to exist as viable political and economic entities, a situation that confirms what we know from other urban contexts.

Integral to the study of ceramics at Harappa (Dales, Chapter 5 in this volume) is research designed to reconstruct the technical features of pottery production. In doing this, we have in mind several objectives relating to chronology, production, and exchange.

First, we are identifying technological attributes for each of the defined pottery types. This aspect of the study follows the model previously developed by Dales and Kenoyer (1986) for Mohenjo-daro but expands it to include more detailed laboratory analyses. The approach used is to define structural properties and elemental components in order to reconstruct the production sequences for each type, i.e., refinement and handling of clays, forming processes, secondary treatments, components of decorative paints, firing temperatures and atmospheres. Such an integrated approach promises to permit us to refine our relative chronology.

Second, the typological/technological sequence promises to facilitate comparison between sites within the Harappan civilization and with non-Harappan

groups with which it came into contact. The major questions here are exchange related, i.e., to determine whether specialized technologies were widely shared—suggesting communication among crafts people, whether the objects themselves were exchanged, or whether both occurred. The results of a refined typological/technological analysis will form the basis on which to make determinations of which settlements may have been involved in such inter-regional networks.

Third, we are correlating the results of the technological study with different activity areas within the site. This approach permits us to determine whether specific technologies are associated with particular activity areas and provides a basis on which to make inferences on how production was organized. In urban environments such as Harappa, where the areal extent of the site is estimated at 150 ha. (Dales and Kenoyer 1990) and where the population in some phases of the city's development may have been as high as 50,000, one might expect, based on more general conceptions about urbanism, that the

organization of craft production shifted from small-scale to larger-scale units, from residential to separate workshops, and from domestically controlled to administratively controlled production. Thus Vats (1940:58) identified as "Workmen's Quarters" the remains of 14 houses and manufacturing installations that he excavated in Mound F of Harappa. He based his interpretation upon the uniformity of the structures and their association with a metal working area and suggested that at least some crafts were linked to administrative control. Whether or not Vats possessed sufficient evidence on which to base his identifications may be contested; nonetheless, they remain a legacy upon which syntheses of the evidence for the Harappan civilization have been based. Wheeler (1972:31-32), for example, described the same structures as "ranges of barrack-like quarters" and "a piece of government planning," and others have compared them to "artisans' or slaves' quarters in such sites as Tel-el-Amarna" in New Kingdom Egypt (Allchin and Allchin 1982:183). Thus the nature of the organization of production and its relationship to urbanism and state formation remains an issue of major importance in Harappan studies.

Finally, these results will be combined with studies of other crafts being carried out by members of the Harappa team, such as metallurgy, other forms of pyrotechnology, bead making, and weaving. Conceived of as a whole, comparisons of the technical properties of crafts, the organization of individual crafts, and the extent of their distribution will provide information on how different crafts were absorbed into the administrative system at Harappa.

Obviously these goals can only be realized in the long-term, and in this paper, I can approach just some aspects of them. In what follows, I provide a brief background to issues of relevance to Harappan pottery production and then focus on recent excavations at Harappa. Its purpose is to provide an introduction to the project with respect to patterns of technology and the organization of production and to discuss some preliminary findings.

The Harappan Pottery Assemblage

As is well known, by the mid-third millennium BC and extending at least to its end (Shaffer 1991:448), the Harappan civilization coexisted with several other major civilizations. A map of the Middle East during this period shows a succession of cultural groups that extended on the west from the Old Kingdom through the First Intermediate Period in Egypt (Kemp 1989:14); late Early Dynastic, Akkadian, Ur III, and possibly Isin-Larsa in Greater Mesopotamia; and the Namazga IV–V periods in Central Asia (Amiet 1986:12). In addition to

these major civilizations, other smaller, less well-known groups in the Arabian Gulf region were contemporary with the Harappans. Recent excavations there, in the United Arab Emirates (Cleuziou 1982; Frifelt 1975; Potts 1990) and the Sultanate of Oman (Cleuziou and Tosi 1989; Weisgerber 1980, 1981), have revealed a uniform material culture during the third millennium BC.

The Harappan civilization had developed wide-ranging trade relations, the scale of which was sufficient to suggest that it participated in a "world economy" (Lamberg-Karlovsky and Tosi 1973; Kohl 1979; Lamberg-Karlovsky 1989). Contact, for example, had clearly been established with Mesopotamia and possibly with Central Asia, although probably not with ancient Egypt. In addition, a growing body of archaeological evidence of typical Harappan materials such as standardized weights, etched carnelian beads, and selected pottery types, (Cleuziou and Tosi 1989:40; deCardi 1988:Figure 14:22; Potts 1990:43) attests to contacts between the Harappans and the inhabitants of the Gulf region.

In many earlier publications it had been noted that the pottery assemblage for the Harappan civilization was relatively homogeneous and standardized. This original conception has generally held up in spite of the excavations at a number of new sites. In the most recent synthesis of the chronology and material culture for the Harappan civilization, Shaffer (1991:448) characterizes Harappan pottery as possessing "a basic homogeneity throughout its distribution." Although present principally in the alluvial plain of the Indus valley, it also occurs at sites more broadly distributed and less well known in the literature. This distribution includes a territory that extends far to the north in Afghanistan and south to the Arabian Sea, including most of Pakistan and parts of India. Among the more recent excavations are those at Shortugai, (Francfort 1989), Rehman Dheri (Durrani 1988), Nausharo (Jarrige 1986, 1988), Ghazi Shah (Flam 1992), Allahdino (Fairservis 1982) and Balakot (Dales 1974, 1979).

The evidence for Harappan-related pottery at sites in the Gulf region is more limited in the range of types present. They include decorated wares (deCardi 1989: Figure 2; Cleuziou and Tosi 1989: Figure 10; dish-on-stand: Figure 11.3-5; large storage jars: Figure 11.1,2; and possibly Potts 1990:Figure 28.5). These Harappan-related types are different from locally produced pottery at Gulf sites, suggesting that Harappan pottery may have been imported, either for the objects themselves or for their contents.

This introduction provides some of the background to the regional and inter-regional contexts in which pottery production took place. However, these

systems of distribution operated within the context of locally organized production systems. In the remainder of the paper, I focus on the context of production at Harappa.

Foundations for the Study of Production

The excavations at Harappa provide an opportunity to examine the relationship among the transformative processes of urbanism, state formation, and the organization of production. There is the expectation that, with the increased availability of resources and technologies to utilize them as societies become more technically sophisticated and establish exchange relations, the division of labor within a society will become more complex. In prehistoric urban environments, for example, it is widely believed that specialist producers dominate particular technologies. A major characteristic of urbanism itself, according to V. Gordon Childe (1950), is the aggregation of specialists, both subsistence and craft-related, within the context of densely populated settlements. Social differentiation occurs as sectors of specialization develop. However, major structural differentiation and advances in social complexity are the result of the implementation of power by elites and interest groups as they attempt to control production and distribution systems. The implementation of power, whether socially, politically or economically motivated, thus plays an important role in the form that the organization of production takes.

There are a number of assumptions that underlie the expectations outlined above. Most are rooted in one or a combination of Marxist and neo-classical economic theory and in the evolutionary formulations elaborated upon by Fried (1967), Service (1971), Steward (1955), and White (1959) in the anthropological literature. Basic to each is the importance accorded to the acquisition of specialized knowledge and the limitations of accessibility to that knowledge or the products generated by it. Indeed, production systems are interesting because they represent potential arenas or opportunities for control by a variety of interest groups. In state level societies, it is assumed that one of the ways in which elites acquire and maintain their status is through the appropriation of products and the labor of producers who possess specialized knowledge. Evolutionists such as Service assume an integrative advantage to dominance by elites who sponsor crafts and organize redistribution systems, while others, such as Fried assume an adaptive role for the society in the control of heterogeneous groups that are potentially disruptive to that society. Steward's ecological model also is dependent upon evolutionary

theory, but accounts for variation by noting ecological constraints that affect choices in the allocation of resources and labor. Although elements of efficiency are at issue in the cultural ecological model, least-cost concerns are most pronounced in systems analysis. White, for example, borrowing a thermodynamic model, emphasizes the relationship between increasing efficiency, harnessing energy, and the development of complex systems.

As general concepts, each of the above provides a useful framework but is limited because of a strong adaptive bias and a failure to account for the different ways in which control and power are implemented. Power is relevant because its implementation involves a multiplicity of countervailing forces that are social, political, and economic in nature and affect how the control of production systems manifests itself. In other words, the organization of production systems and the development of complex social structures are dependent upon a variety of strategies and interest groups that attempt to maintain or control them, since attempts to mobilize resources by elites or interest groups are subject to challenges and factional interests. As Wolf (1990:590) has put it, "organization is always at risk. Since power balances always shift and change, its work is never done." In implementing power, tactical solutions are critical because they play an instrumental role in shaping organizations, maintaining them, and establishing them. Indeed, organization structures the field of action so that some behaviors are possible, while others are less possible (Wolf 1990:586ff.).

Power, therefore, and the nature of its implementation differ in different cultural contexts. This is the case because power and its implementation are socially defined actions played out within the constraints of culturally-defined acts of rationality. It follows, therefore, that advances in technology and knowledge are not in and of themselves the causes of craft specialization, greater complexity in labor organization, and urbanism as Childe believed (Trigger 1980:145), but they are made so (shaped) by elites and other interest groups in projects initiated by them (McGaw 1989; Rueschemeyer 1986). Understanding the specific processes through which the division of labor and its elaboration into complex forms of organization take place, therefore, requires "processual detailing" (Rueschemeyer 1986:193) to reveal how power takes hold in particular social and cultural settings. While we can reasonably assume that advancements in technology and increasing specialization provide opportunities for the take-over of its organization, we also must assume that competition among interest groups will affect the particular type of organization of production that occurs. Its

outcome is not pre-determined by technological advance or increased specialization.

This kind of processual detailing has already begun on the organization of production in the Harappan civilization, and the evidence shows considerable variability. As noted above, the interpretation of evidence from previous excavations suggests that at Harappa the organization of production, at least of some crafts, is based on administrative control. If this assertion is correct, it suggests that the organization of production changed between the Early Harappan and "mature" Harappan phases. At the site of Mehrgarh, for example, production during the Early Harappan phase is found within the context of domestic courtyards, suggesting that production was organized by autonomous, independent groups, perhaps on a kinship basis (Wright 1984). The picture is less clear when it is compared to results from the site of Mohenjo-daro. At Mohenjo-daro early excavations had revealed pottery production in large industrial compounds (Mackay 1938:6) and in small isolated units (Marshall 1931). A recent re-evaluation of this evidence based on surface surveys (Pracchia et al. 1985), in which distributional maps of production areas have been outlined and associated archaeological indicators tabulated, confirms the presence of both types of installations. The industrial compounds appear to be part of a post-urban occupation, however, and confined to the production of a single type, the so-called "Indus goblet" (Vidale 1989:178). They are also substantially smaller than Mackay had believed; the area has been subjected to extensive post-depositional processes, and a current estimate of its size is "below the 1200 sq m of the surface spread" (Pracchia et al. 1985:242). The small, isolated units are found both within dwelling units (Vidale 1989:178) and apparently not in dwelling units but in disaggregated ones associated with production of other crafts (Pracchia et al. 1985:224 and Figure 1). The latter have been interpreted as "small manufactures and distribution units in shop-like arrangements" akin to an "oriental bazaar" in which the city's authorities "monitored allocation of space of craft activity" (Pracchia et al. 1985:242). If all types of crafts are taken into account, the size of the production units is on "average" 25-30 sq m, while "60% of the detected units are smaller than 100 sq m" (Pracchia et al. 1985:241).

Although subject to re-evaluation, we now have documented three types of craft producing units. One type consists of larger units. At Harappa, such units are associated with an area in which administrative activities are present; at Mohenjo-daro, they are associated with post-urban encroachment in formerly residential areas the control of which is undetermined. A second type at Mohenjo-daro is small in scale and

associated with dwellings, suggestive of household production units. A third type at Mohenjo-daro also is small in scale, but is located on the periphery of the city in areas apparently allocated to craft activities. In spite of the interpretation that this production was in some way monitored by the city's authorities, there is little direct evidence of administrative control, except in the highly specialized manufacture of stoneware bangles, where seal impressions were found on saggars (Vidale 1989:178). Thus the available evidence indicates that a variety of groups may have been involved in the control of production.

In view of this variability, we have defined our terminology as broadly as possible to account for the implementation of a variety of organizational strategies. At the same time, we have attempted to build on the database established from the Mohenjo-daro surface surveys, modifying them to accommodate the finer chronological control possible in excavations and the possibility of monitoring changes through time. Therefore, we have viewed the evidence from Mohenjo-daro and earlier reports from Harappa as propositions to be tested against the results of the renewed excavations. The following discussion outlines the types of factors considered and the archaeological indicators we have selected.

Patterns of Technology and Organization of Production

A number of factors are integrally related to assessing the types of production units present and changes in the organization of production, but three form the center of our research—specialization, standardization, and control.

Specialization, Standardization, and Control

Specialization and standardization are routinely applied criteria in studies of the organization of production (for example, see discussions by Feinman et al. 1984; Rice 1981; Sinopoli 1989). They may be measured and assessed against the archaeological evidence through a variety of means (for example, Arnold 1985; Feinman et al. 1984; Rice 1981; Tosi 1984). Occupational specialization, as it is used here, is manifested in the archaeological record by evidence for patterned sequences of technology carried out by a restricted number of producers in the context of concentrated and sustained production. In addition, these patterned sequences imply a level of complexity related to skill. Specialists can be part-time or full-time (Wright 1983; Kaiser 1984), be present in small-scale or complex societies, and be independent-producing for an "unspecified demand crowd" as Brumfiel and Earle

(1987:5) have suggested—or attached—producing for a patron, i.e., an individual or government. Thus occupational specialization is a necessary but not a sufficient requisite to control by a centralized bureaucracy, since if we assume competing groups will attempt to take over or retain control of specialists and their products, the outcome may vary. Control by elites is one solution to a much broader range of possibilities as systems of specialization develop. Thus they may include a range of organizational types from household or family and kinship based to centralized or state controlled.

A corollary to specialization is standardization. It follows from the above definition that the application of specifically patterned sequences of production (whether consciously or unconsciously applied) may result in standardization of final products. Standardization is relevant because it involves repetitive behaviors which may be designed to maximize output and minimize production and labor costs (Sinopoli 1989:263). In technical studies, these factors are assessed through production step measures (Feinman et al. 1984) and other measures of labor investment (Costin et al. 1989:119). However, while there clearly is a link between standardization, patterning of sequences and least-cost strategies, it is doubtful that these factors are the concern of large-scale bureaucracies alone but equally affect independent, small-scale producers. Moreover, given that the implementation of power does not necessarily operate within the context of universally determined measures of adaptive behavior, it is doubtful that efficiency or factors of least-cost, also socially-defined phenomena, necessarily imply centralized or bureaucratic control. Thus in studies of production systems, they can only represent an “ideal,” since ideas about efficiency are not homogeneous across social groups.

The third factor, control, is the single most decisive factor because it most directly reflects the organization of production. It also is the most difficult factor to assess, since it relates to complex social relationships not easily identifiable in the archaeological record. In civilizations such as the Harappan in which a writing system, seals, and other record-keeping devices have been found, we should expect to see them in evidence where production is administratively controlled. Record-keeping devices are a universally applied criterion as a direct manifestation of the control of production. As with any measures, they may require re-evaluation in the future, but here I have included them as a primary indicator of control. A second measure, developed by Tosi at Mohenjo-daro and elsewhere (Tosi 1984) is designed to combine evidence for numbers of production sequences performed on objects with the size and output of activity areas. He

designates his four types as follows: 1. Atelier—small with limited production sequences and low *per capita* output, not to exceed 2% of small sites; 2. Workshop—small with broad spectrum of production sequences and a “significant portion of a small site” (Tosi 1984:24); 3. Factory—large with limited production sequences of a single product, and extensive facilities; 4. Craft quarter—large, several different crafts in close proximity, high per capita production, occupying “a significant percentage of large sites (10-25%)” (Tosi 1984:24).

Using the above discussion as a foundation for the study, I have outlined below two sets of archaeological indicators for the Harappan data. The first outlines general archaeological indicators of craft production and the second lists factors specific to patterns of technology and the organization of production of pottery.

Archaeological Craft Indicators

- Raw materials
- Tools
- Fixed installations
- Debris (discard/recycle)
- Finished/unfinished products

Organization of Production

Context	–	Residential workshop Separate workshop
Scale	–	Production sequences Producer indicators Single product Multiple products Output %Occupied space
Record keeping	–	Seals Tokens Standardized graffiti Sealings Weights/measures

Organization of Production

The three factors—context, scale, and record-keeping devices—are identified as follows. Context is a physical or spatial factor and refers to architectural or other features with which production is found in association. There is a range of possibilities that reflect on social relations among producers, and although many typologies have been developed (for example, van der Leeuw 1977, 1984; Peacock 1982; Rice 1987:184), here I have followed Stark (1985) in defining two types, namely, residential workshop versus separate workshop. I have chosen this simplified typology since it is

not encumbered by social equivalents and have used it to create preliminary categories for later assessment against those developed by Tosi and others at Mohenjo-daro (Pracchia et al. 1985). A residential workshop simply refers to a physical location in a domestic area; a separated workshop is not integrated into a domestic area (Stark 1985:160).

Scale refers to output in the production process, i.e., numbers of producers and products, and is based on the analysis of artifacts associated with the production process itself. It includes the number of production sequences or manufacturing operations performed on a single product. Production sequences are reconstructed through analyses of the products themselves and are suggestive of patterns of technology and their transmission, relative amounts of labor expenditure, and participation by an individual or several crafts people in a particular craft activity. Producer indicators refer to more direct indicators of relationships among producers. This aspect of the study combines the results of production sequence data with a program of finger and palm print analysis. Because of the nature of the pottery production process, many finger and palm prints have been preserved on pottery (as well as other terracotta objects such as figurines and bangles) and on potter's tools. Recent studies suggest that given a sufficiently large sample, it may be possible to identify gender and genetically-based similarities (Babler 1979; Chai 1971; Okajima 1978). Through this combined process it may be possible to identify individual potters groups, their gender, and genetic relationships. Single vs. multiple producers simply refers to whether one type of product is being produced in a given location or several to determine whether craftsmen specialized in one type of material and/or whether they produced specific types of products in a given craft. Output is a measurement based upon the amount of debris, unfinished products, secondary materials such as fuels, and the percentage of occupied space relative to other activities.

Record-keeping devices refer to tokens, seals, sealings, script, and weights or measures (for examples, see Jarrige 1988:158ff.). These items represent a series of standardized objects present throughout the Harappan civilization, but most prominently at urban sites. In view of their standardization and their association with a well-developed script, they have been closely linked with administrative control. In previous research, record-keeping devices have been associated with pottery production in three ways. At Mohenjo-daro, Indus goblets were found with seal impressions on their exterior surfaces (Jarrige 1988:163), the saggars used to fire the stoneware bangles produced at

Mohenjo-daro also are seal-impressed (Halim and Vidale 1984), and occasional sherds and whole vessels on a restricted range of forms have Harappan script inscribed on the fired vessel. Examples have been found both at Mohenjo-daro (Dales and Kenoyer 1986) and at Harappa.

Excavations at Harappa

The excavations of the University of California, Berkeley, team must be understood within the context of previous work conducted at Harappa. This context is outlined by Possehl (Chapter 2 in this volume), described by Kenoyer (Chapter 4 in this volume) and shown on Figure 6.1. Here, I review some specific aspects of previous excavations on Mounds AB and F relevant to the organization of craft production and its control.

The major mound at Harappa, Mound AB, partially excavated by Sahni (1920-21), Vats (1940), and Wheeler (1947) in the first half of this century is an area consisting principally of large public structures. In addition, Wheeler (1947) identified a massive brick structure that appears to have defined the outer limits of the mound. Although it is unclear whether this structure was subjected to one or a series of rebuilding phases and although its initial construction phase is in doubt (see Kenoyer, Chapter 4 in this volume), there does appear to have been an effort to isolate the mound, at least visually, from others contiguous to it during some periods of habitation.

On Mound F, Vats (1940:17ff.) reported a series of structures that he associated with administrative functions. They include a large building that Vats identified as a "granary," several other large buildings that he referred to as "residential," twelve circular platform structures, the 14 "workmen's quarters" referred to earlier, a metal working kiln, and associated debris.

Mound E, unexplored previously, has been the focus of excavations during the past several seasons. It lies directly east of Mound AB and was occupied from the Early Harappan (Period 1) through the Late Harappan (Period 5). Two sections of Mound E have been excavated and have yielded different types of activities. In the southern portion, dwellings, streets, and a major circumvallation have been uncovered. Numerous record-keeping devices were found in the street and dwellings. Thus far we have not found any *in situ* evidence for craft production in this part of the mound. In the northwest section of the mound, we have located a sizable area in which pottery production was carried out during Periods 2 and 3. The remainder of this paper is devoted to a discussion of this production area.

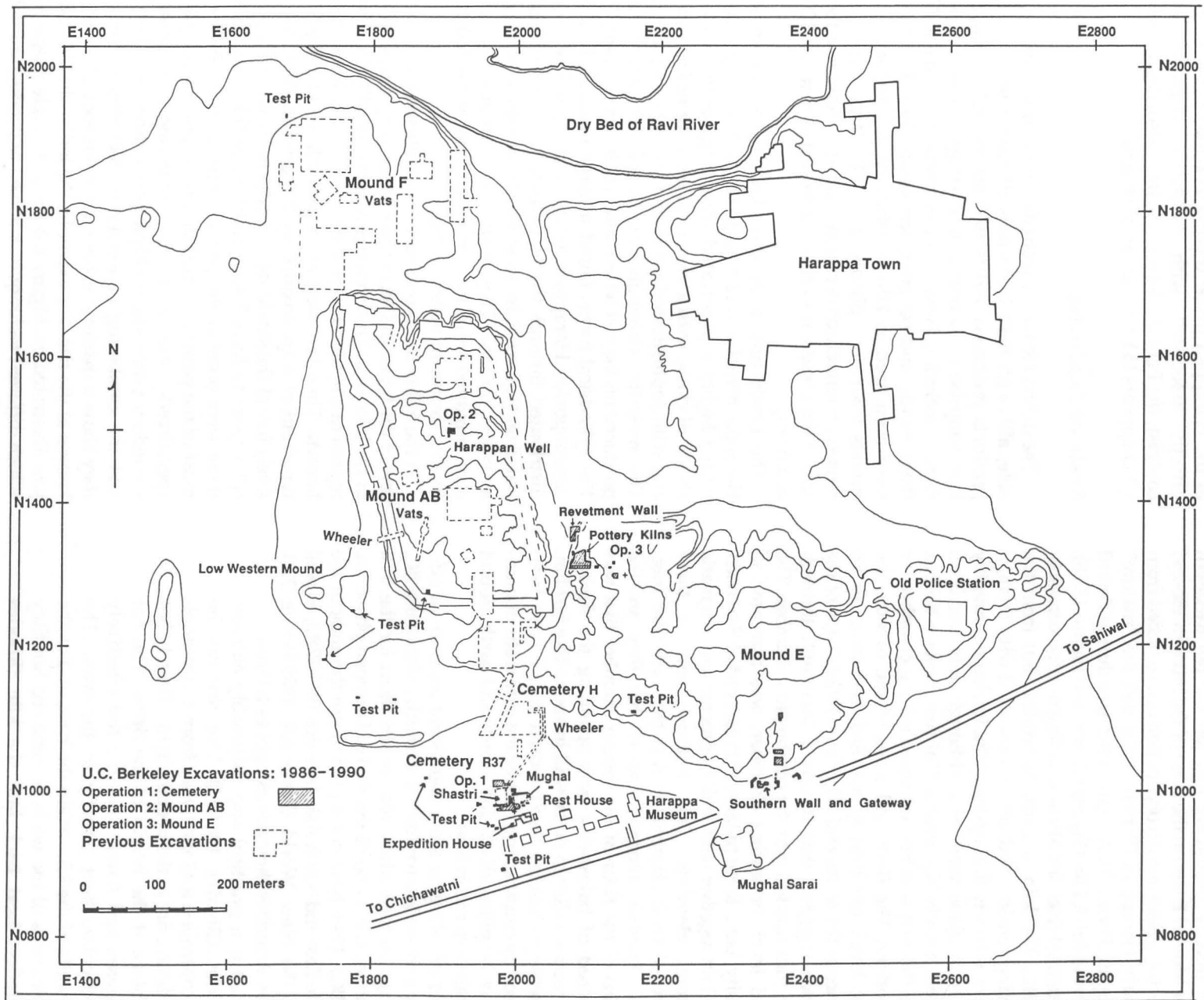


Figure 6.1: Map of Harappa showing extent of previous and current excavations.

Context of Production

The pottery producing area on the northwestern side of Mound E sits on the edge of the modern mound in a sector where human occupation can be traced from the Early Harappan (Period 1) through the “mature” Harappan (Period 3). A focus of the area during Period 3 is a mud-brick kiln (Figure 6.2; see also Figure 13.28), a substantial fixed installation, dating to approximately 2300 BC. The kiln is partially eroded, but from the surviving remains and debris associated with them, it appears to be a typical updraft kiln. Its shape is roughly circular in plane view and, although only one level remains, it probably consisted of two levels—a firebox where the fuel was burned and a setting chamber for the pottery. The floor and sides of the firebox, the lowest level, are heavily vitrified and taper to an entrance at the south end. The funnel-like shape of the entrance suggests that it was a firemouth through which fuel was fed into the combustion chamber. The second level, or setting chamber, was truncated in antiquity, but a large pillar was preserved at the center of the kiln together with wall fragments and enigmatic structural elements. One interpretation of these concave-shaped elements is that they are flue fragments. Another interpretation is that they are the remains of the floor of the setting chamber that was composed of baked-clay bars spanning the firebox from central pillar to outer wall in spoke-like fashion. The setting chamber itself would either have been enclosed by constructing permanent side walls of mud-brick or by piling discarded sherds and earth around the pottery to retain heat.

Kilns of this type are a significant advance in efficiency and are known from the fourth millennium BC, although in the Indus area we see them for the first time toward the end of the Early Harappan phase (ca. 2500 BC). They have continued in use throughout the Middle East and South Asia (Rhodes 1981:17ff.), as well as in the New World (Papousek 1989:Figure 7.1). Rhodes describes their advantages as follows:

...it is a practical and reasonably efficient kiln...(Rhodes 1981:16). The fire can be controlled and may vary from a low smoldering fire at the beginning to a fiercely hot blaze at the height of the firing. The hot gases and flame from the fire effectively circulate heat directly to the ware. The walls of the kiln retain the heat, and as the surfaces of the walls become red hot they reflect heat back into the kiln (Rhodes 1981:22).

Two other kilns are present in this area of Mound E (Figure 6.2). A smaller pit kiln to the southwest is contemporary with or slightly earlier than the updraft kiln and is less well preserved, and another pit kiln is

present in the immediately preceding Period 2. Neither of the Harappan phase (Period 3) kilns appear to be directly associated with habitation deposits. In contrast, the Period 2 kiln is in direct association with what appears to be a residential structure.

Scale of Production

The debris recovered from the kiln area is considerable, although here I can only discuss a few of the products produced. Artifacts from around the large kiln comprise numerous objects suggestive of manufacture, including bone spatulae, chert blades, a chuck (base mold), and irregular terracotta slabs that may have been used as kiln furniture or as supports for vessels when in a pliable state. The large kiln was reused on numerous occasions and, depending on the size of the vessels, may have contained as many as 200 at a firing.

The production techniques known by potters at Harappa reveal a technology suggestive of potters with a highly sophisticated knowledge of the workability of clays, with a variety of forming techniques, and with sophisticated methods for combining them. The majority, although not all, of the pottery is produced on the fast wheel, much of it “on the hump.” The cylindrical forms found in large numbers in the contemporary Harappan cemetery (R37) and widely distributed through the Harappan civilization illustrated on Figure 6.3, for example, are readily identified as wheel thrown. They were raised from lumps of clay, removed from the wheel, and not subjected to further treatment before firing.

In the following discussion I have illustrated only a few of the types and techniques utilized by the potters in the kiln area. The ceramics associated with the kiln represent a limited range of the types and technologies known. Thus far, we have been able to identify 12 types out of a approximately 200 overall. First, relatively few of the single stage products shown in Figure 6.3 appear to have been produced in this area, and there were none of the pointed base goblets. Rather, most of the pottery in the kiln area represents highly specialized manufactures, requiring elaborate secondary processes, multiple production sequences, and the combining of numerous techniques. Thus, they show a mastery of the most complex techniques known at the site. For example, the ledge-shouldered jars illustrated on Figure 6.4 show a single shape in which different techniques are used to produce a final product. These vessels first were drawn on the wheel (Figure 6.4a), subsequently trimmed to their maximum body diameter, covered with a cream colored slip (Figure 6.4b), and scraped in horizontal and diagonal striations in a final step before firing

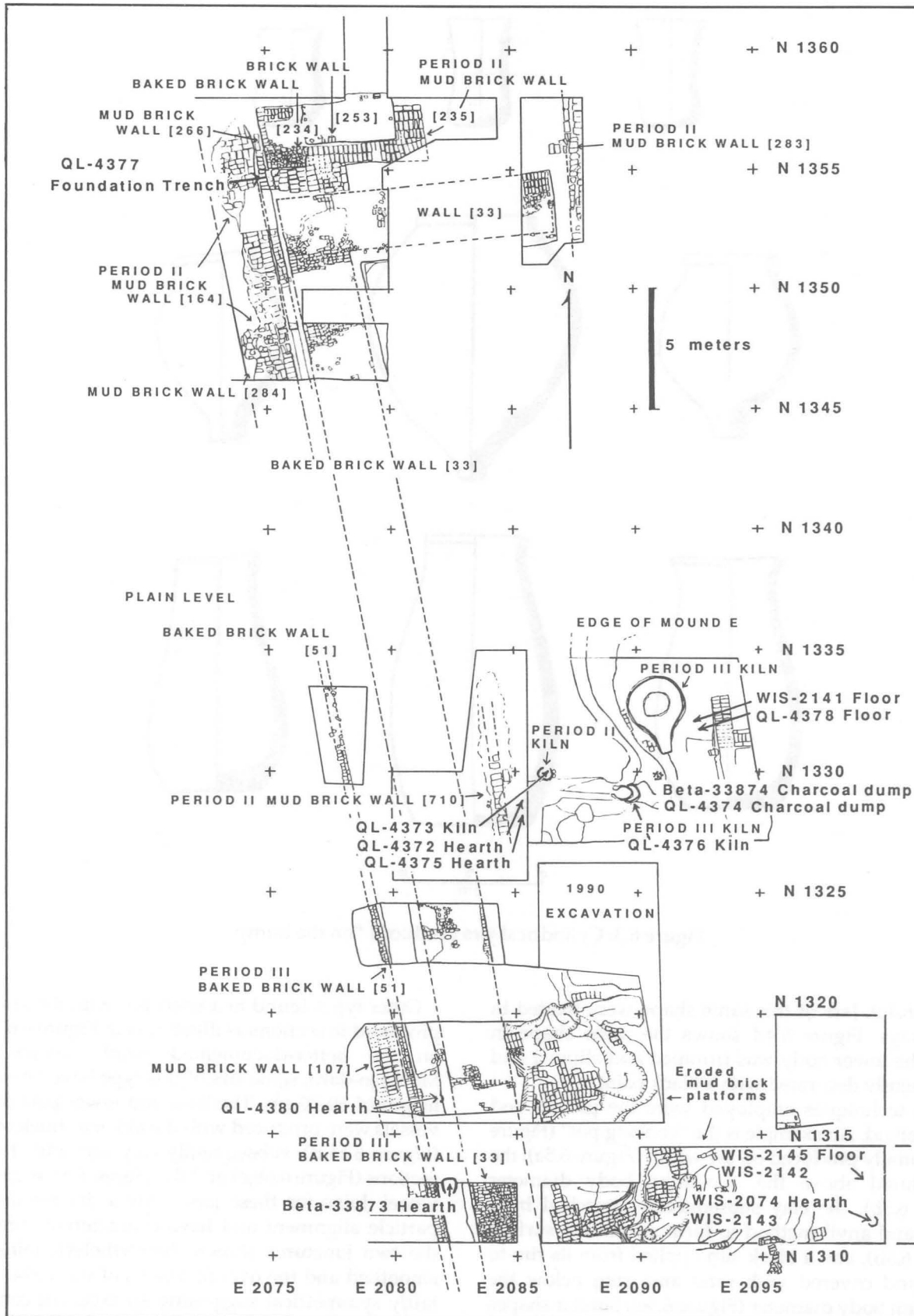


Figure 6.2: Map of northwest corner of Mound E showing location of Period 2 and 3 kilns.

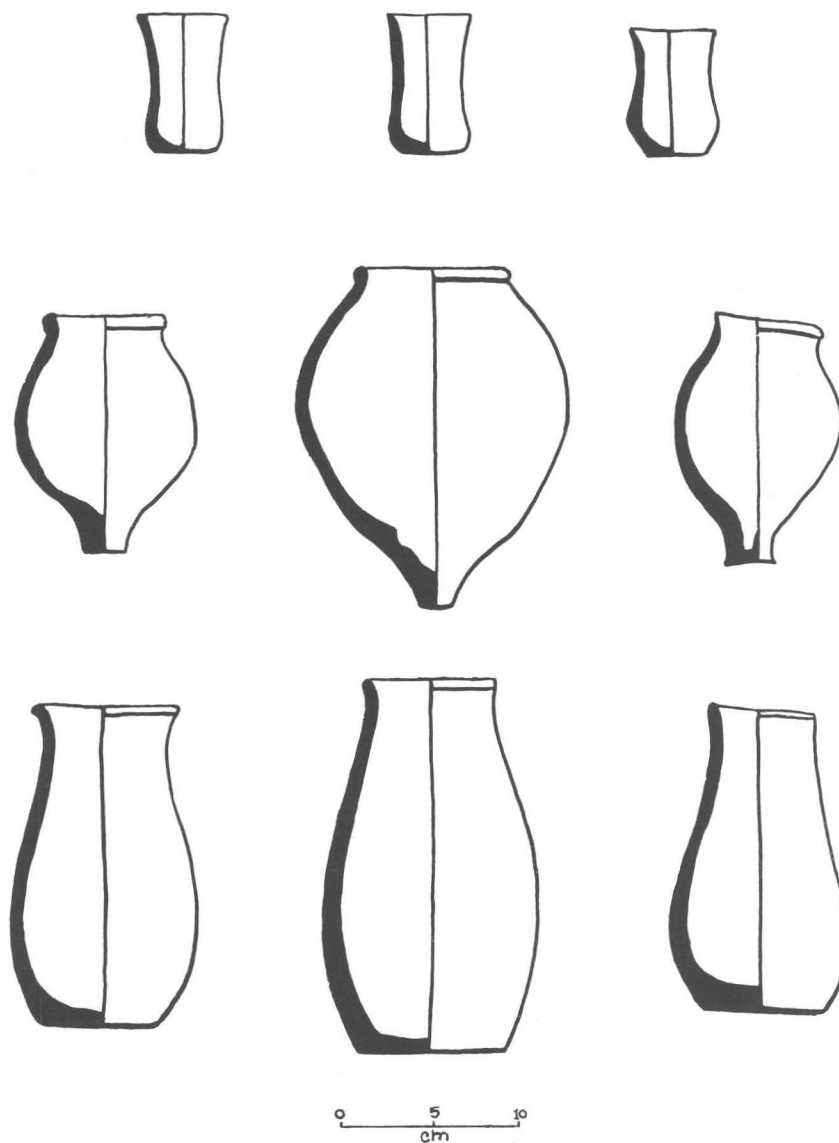


Figure 6.3: Cylindrical jars produced "on the hump."

(Figure 6.4c). Jars of this same shape were treated in other ways. Figure 6.4d shows the same shape in which the lower body was trimmed and slipped and subsequently decorated with a black paint.

Other techniques employed were the paddle and anvil method. An example is the "cooking pot" (Figure 6.5c), initially produced on the wheel (Figure 6.5a), the sides fluted above the maximum body diameter (Figure 6.5b), the clay subsequently stretched by a paddle and anvil method to form a rounded surface (Figure 6.5b), and a black slip applied from its rim to flange and covered with sand and grog below the maximum body diameter (Figure 6.5c). Similar shapes simply were fluted, leaving the base unmodified (Figure 6.5d).

Other types found in association with the kiln were produced in sections as illustrated in Figure 6.6. Based on the better-documented whole vessels from Mohenjo-daro, some jars of this type have an external height of 60-70 cm. The base and lower part of these vessels were produced with the aid of a chuck or mold (Figure 6.6a,d); subsequently clay was added in two sections (Figure 6.6b,e) and the pieces drawn up on the wheel. Joins for these jars show a disorientation of particle alignment and have characteristic breaks at the two junctures shown. Nevertheless, joins were smoothed and the overall shapes of the vessels were fairly symmetrical suggesting an excellent control of the shrinking properties of clay. In a final step the jars were coated on their interior with a thick red or

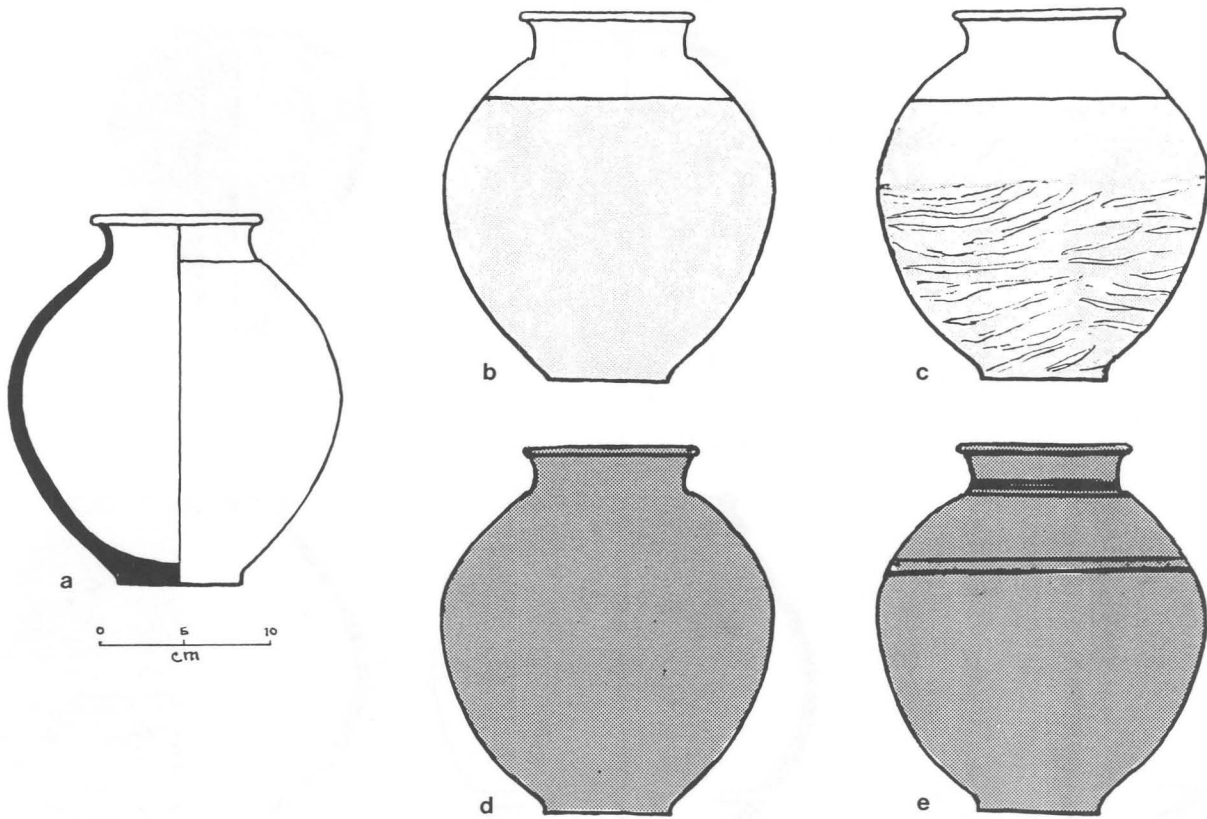


Figure 6.4: Ledge-shouldered jars and the production process.

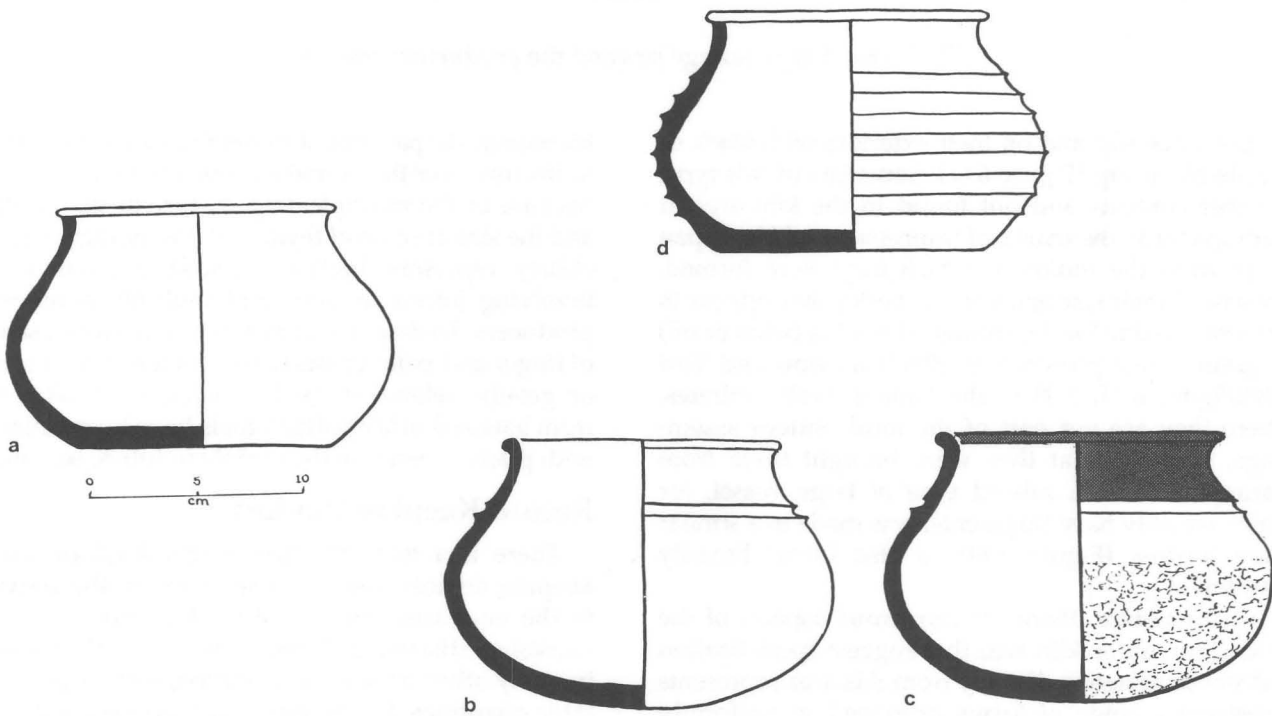


Figure 6.5: Cooking and fluted pots and the production process.

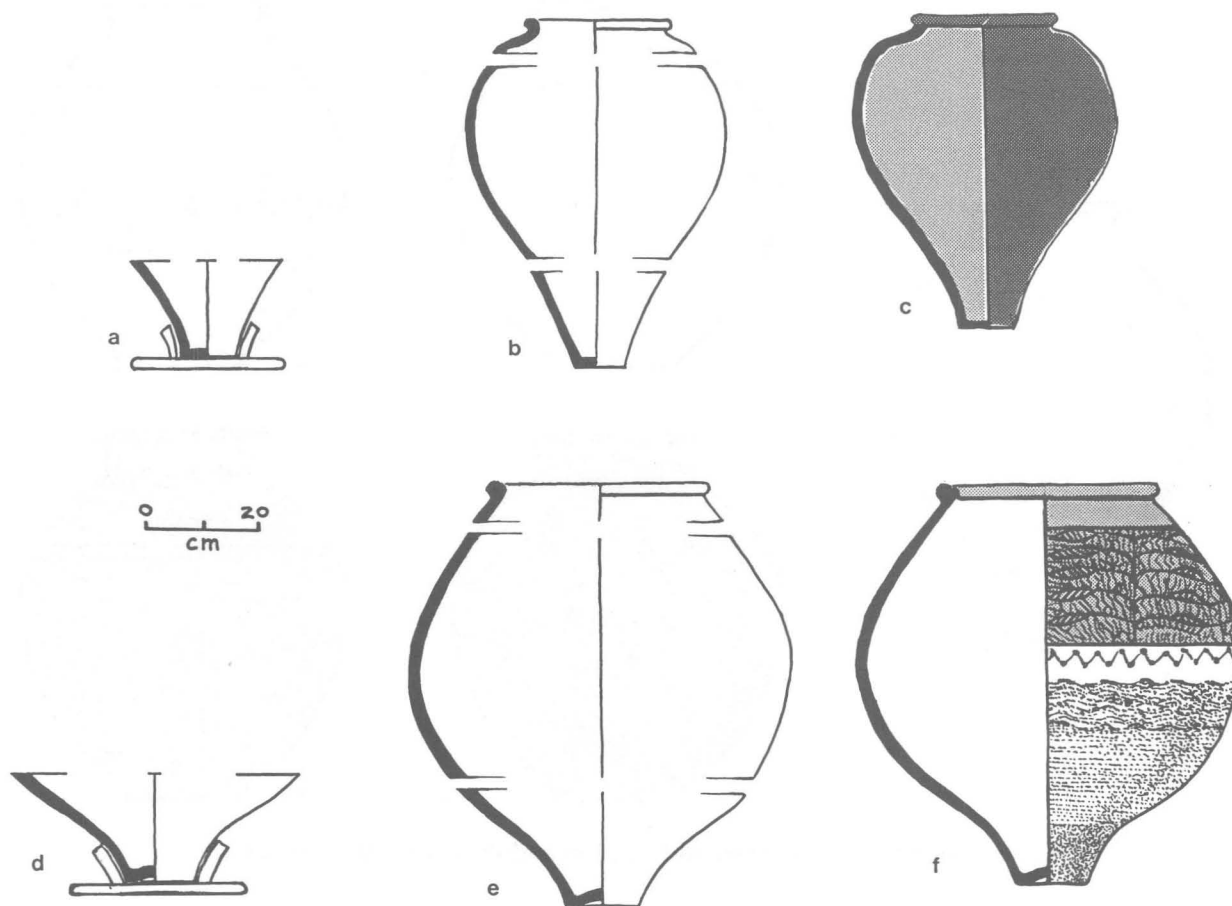


Figure 6.6: Large storage jars and the production process.

purple-black slip and on their exteriors with black or purple-black slip (Figure 6.6c). Some jars of this type, in other contexts and not found in the kiln area at Harappa, bear the marks of impressions of Harappan script from the molds in which they were formed. Because of their size and narrow necks, they appear to be most suitable for the storage of liquids (wine or oil) or grain. Their presence at Hili (Cleuziou and Tosi 1989:Figure 6.11, 1-2) in the United Arab Emirates, where they are not part of the local pottery assemblage, suggests that they were brought there from Harappan sites. A related type of large vessel, for which we only have fragments, was made in a similar stage process (Figure 6.6f), is also found broadly distributed.

To summarize, there are numerous aspects of the production in the kiln area that suggest specialization and standardization. Pottery from this area represents a restricted range of forms produced in uniformly applied production sequences. From a technical point of view, they indicate that the potters had mastered the most complex techniques known at the site.

Moreover, the patterns of technology were transmitted uniformly over the period in which the kiln was used. Because of the multiple-stage nature of the products and the size of some of them, e.g., the storage jars, they clearly represent highly specialized manufactures involving intensive labor and multiple numbers of producers. To date, we do not have a sufficient sample of finger and palm prints with which to assess gender or genetic relationships. However, over 200 prints from bats and other potter's tools have been collected, with plans to increase the sample in future seasons.

Record-Keeping Devices

There is a total absence of any kind of record-keeping devices associated with any of the activities in the northwest area of Mound E and the pottery workshop discussed above. This is remarkable since, in many other contexts at Harappa, they are found in large quantities. For example, in previous excavations by Vats (1940) over 971 seals and sealings were discovered in excavations on other mounds. Approximately 70% of the seals were found on

Mound F. Although it is impossible, based on the recording system used by Vats, to determine precisely where individual seals were found, the major installations on Mound F identified by Vats are the "granary," metal working areas, and "workmen's quarters" discussed above.

Conclusion

The evidence discussed in this paper provides some new insights, although, as stated at the beginning, they must be regarded as preliminary, especially since they are based only on macroscopic observations of the pottery and our excavations in this sector are ongoing. In the future, more detailed descriptions and tabulations of the entire corpus of pottery and the production sequences will be completed and published.

This study of pottery from a single production area, in which archaeological evidence and laboratory studies have been combined, provides new evidence for the specialization of production. Specialization can be inferred from the restricted range of types produced in the context of a single activity area and repetition of patterns of technology in the production process. Most of the pottery types present and the technologies employed to produce them show a high degree of efficiency in production and in the multiple sequences employed. Although we have not found stockpiles of raw clay or potters' wheels associated with the kiln, other tools—a chuck, bone spatulae, kiln furniture, pigments, and drying bats—argue for performance of the entire process within the vicinity of the kiln. The large size and fragility of the storage jars also argues for production near the kiln, in which they would eventually be fired. Moreover, these vessels were clearly produced by several potters working together.

The high level of skill of the potters is evident in the final product, in the patterned sequences, and in the tools they employed. The potters at the kiln workshop had developed a range of skills that they recombined, taking a single shape and modifying its form and surface textures through a variety of secondary processes. Moreover, their ability to rework surfaces and join whole sections demonstrate an exceptional working knowledge of clays. The use of several different slip and paint colors shows an advanced understanding of pigments. The potters' wheel, although known in previous periods, was utilized to its maximum efficiency by producing vessels on the hump. The kiln itself represents a complex structure that involved efficiency but also risks in that larger quantities of vessels could be destroyed in a single firing. Although some misfired pottery and kiln wasters have been found, they are not present in large quantities, suggesting a well-developed knowledge of

the construction, maintenance, and use of the updraft kiln. The presence of pit kilns in both the previous and same period suggests that different types of kilns were used to produce different wares. Work in the future will be directed toward developing better chronological control and investigating the different wares associated with the different types of kilns. The obvious greater efficiency of the updraft kiln and its ability to accommodate larger vessels makes it ideally suited for the large and technically complex wares that were produced in the kiln area. Kilns of this type also provide greater flexibility with respect to weather and climate, making it possible to fire objects on a year around basis (Arnold 1985:217). For example, contemporary potters in Pakistan who fire their pottery in updraft kilns and who operate under similar weather conditions, produce their pottery throughout the year; most potters in the same region who utilize pit kilns produce on a seasonal basis only (Rye and Evans 1976; tabulated in Arnold 1985:217).

We have not carried out extensive measurements of the hundreds of sherds and small number of whole vessels from the kiln area to assess the degree of standardization. However, they do conform to a restricted range of sizes that is wholly consistent with types found in other contexts at the site. For example, the shape and general morphology of the ledge-shouldered jars (Figure 6.4) found in the recent excavations in the Harappan cemetery (R37) and other published examples from previous excavations is consistent with those produced in the kiln area. Technologically, there also is consistency in the production sequences employed, suggesting sustained and continuous transmission of prescribed patterns of manufacture for these vessels over a substantial period. Although functional studies have not been carried out on any of the pottery at Harappa, the types present in the kiln area are suggestive of food and beverage related use. The care taken in each to achieve an impermeable surface (e.g., thick application of cream slip to the ledge-shouldered jars and red and black slip on the exterior and interior of the large storage jars) are at least as suggestive of the storage of liquids as the shape and textured lower exterior of the pots in Figure 6.5b are of cooking. However, each of these types, if indeed they are food related, were not necessarily produced solely for domestic use, as they are found distributed outside of household contexts. Although very few of the larger jars (Figure 6.6) have been found at Harappa outside of the kiln workshop (Vats did not provide counts, and thus far we have found very few sherds and no whole vessels), the smaller, ledge-shouldered jars and cooking pots have been found in a variety of contexts during the current as well as previous excavations; this indicates their widespread use throughout the city.

The control of production, as indicated earlier, is the most difficult factor to assess, given the lack of deciphered written documentation. When the production studies were originally conceived, I anticipated direct evidence of control in the form of record-keeping devices would be found in production areas. Again, this was based on expectations related to urban processes in general and inferences made by Vats for the finds on Mound F in particular. My expectation was that there would be a classic transition between a kinship type of organization (perhaps represented by the Early Harappan kiln structure associated with a residential structure) and one taken over by the city's authorities.

If we consider the two measures of control, record-keeping devices and the size of the workshop, however, there is no evidence to suggest this transition occurred. The results are, at the least, mixed. The absence of any record-keeping devices or of associated architectural features such as large administrative buildings argues against production controlled by a centralized administrative authority. Production in the kiln area at Harappa is best described as a separate workshop, with relatively high output of standardized manufactures by specialist producers who operated independently. In Brumfiel and Earle's (1987) terms, this is independent production for an unspecified demand group rather than the attached specialists anticipated.

The second measure of control, based on the correlations of size and output developed by Tosi (1984), also does not fit readily with our findings. The workshop described here falls outside of any of his types. While the area is small (his type 2) relative to the size of the site, its *per capita* production was reasonably high (type 4); and, as with his type 3, production was confined to a single craft in which a limited number of products were produced. Our evidence also does not readily conform to recent interpretations of the evidence from Mohenjo-daro. While a relatively small, isolated unit, it is not found in association with other crafts such as the "shop-like arrangements" described for Mohenjo-daro (Pracchia et al. 1985:242), nor does its size warrant the designation of "industrial compound." The third type at Mohenjo-daro, isolated kilns within dwelling areas (Vidale 1989:178), also differs from the Harappa kiln workshop in that it is not directly associated with habitation deposits.

If we view the kiln workshop area in the long-term, we can observe some shifts in associated activities. The earliest kiln in Period 2 is associated with a possible residential structure, indicating a possible change in the organization of production in Period 3, when the area appears to have been given over entirely to the pottery workshop. However, we cannot necessarily

assume that production had shifted from household or kinship based production to one more centrally and non-kinship based. Kenoyer (1989), for example, has argued that the use of the same area for pottery production may be more suggestive of a kinship-related craft, where land was occupied over generations by the same kinship group. My study of finger and palm prints is directed specifically to this question.

The principal point, however, is that there is clear evidence that different crafts—if we compare the metal working area at Harappa with the kiln workshop or contrast the pottery workshops at Mohenjo-daro with the ones at Harappa—were absorbed into the urban environment in different ways. Thus there are conditions under which the uniformity and standardization of products do not, in and of themselves, reflect control by a bureaucratic system. Differential control of crafts may be related to the function of different products, or, as Carla Sinopoli (1989:271) has proposed for medieval Vijayanagara, their utility to local administrators. In the kiln workshop, it is reasonable to assume that some of the pottery types there, such as cooking pots and ledge-shouldered jars may not have been of interest to administrators. On the other hand, the large storage jars (Figure 6.6), with their linkage to broad-ranging distribution systems, clearly would have been.

Additional factors are the long-term historical processes involved in the organization of pottery production and the implementation of power. The craft of pottery manufacture began during the Sixth millennium BC in the Indus region (Jarrige and Lechevallier 1979), and almost from its inception, pottery objects appear to have been highly valued, to judge from the large number of fine wares produced, the standardization of morphology and design, and the extensive exchange networks that developed (Wright 1985). The context of production during these early (pre- and Early Harappan) periods was within independent household units. Over a long period, the efficient organization of production based on kinship may have constrained its takeover by a more hierarchically-ordered system. As I have suggested elsewhere (Wright 1983), we should at least consider the possibility that family and kinship units that controlled production resisted their takeover and successfully maintained a non-centralized social structure (Wright 1987:75). Viewed in the long-term, the continued control of production by some segments of the society in the Harappan urban environment simply follows a well-established historical pattern that developed early and was sustained throughout the history of the region.

Finally, if these findings are supported by future research, they challenge our assumptions about the organization of production in early states and urbanism. The Harappan evidence does not indicate a tightly controlled administrative network, but rather one with flexibility in which different types of production organized in different ways were absorbed into the urban system. It also suggests that kinship groups in the Harappan civilization continued to exist as viable political and economic entities, a factor that wholly conforms to the Mesopotamian evidence and to that from other urban contexts. Adams (1966), for example, has referred to documentation in the Early Dynastic period that attests to lineages or clans composed of craftsmen or agriculturalists who apparently were not controlled by the state. Yoffee (1979) has documented the similar viability of kinship in the later Old Babylonian period. The point to be made is that states probably did not monopolize or control the organization of production, nor did their power go uncontested. What seems most likely is that in these early attempts to monopolize and establish uncontested power, the same "disgruntlement, foot-dragging, escapism, sabotage, protest or outright resistance" (Wolf 1990:590) exhibited by interest groups with their own agendas of power would have emerged as viable entities in the past, just as they do today.

Acknowledgments

Fieldwork and analysis were conducted as part of the University of California, Berkeley, project at Harappa, that has been funded in part by the Smithsonian Institution Foreign Currency Program and the National Geographic Society. Two leaves of

absence, one supported by The College of William and Mary and the other by a fellowship granted by the John D. and Catherine T. MacArthur Foundation, made it possible to conduct fieldwork at Harappa and subsequent laboratory analyses at New York University and the Smithsonian Institution's Conservation Analytical Laboratory. I am indebted to these institutions for making this research possible. I owe special thanks to George Dales, director, and J. Mark Kenoyer, co-director, of the Harappa project for inviting me to participate at Harappa and for facilitating my work there. Both have provided a stimulating and intellectually challenging environment in which to work. Richard Meadow read an earlier draft of the paper, and I thank him for his numerous suggestions. Finally, I thank Dr. Ahmad Nabi Khan, Director General and the Department of Archaeology, Government of Pakistan, for the privilege of working on this very important site.

References Cited

- Adams, R. McC.
1966 *The Evolution of Urban Society*. Aldine, Chicago.
- Allchin, B., and R. Allchin
1982 *The Rise of Civilization in India and Pakistan*. Cambridge University Press, Cambridge.
- Amiet, P.
1986 *L'âge des échanges inter-iraniens, 3500-1700 avant J.-C.* Ministère de la Culture et de la Communication, Éditions de la Réunion des Musées nationaux, Paris.
- Arnold, D.E.
1985 *Ceramic Theory and Cultural Process*. Cambridge University Press, Cambridge.
- Babler, W.J.
1979 Quantitative Differences in Morphogenesis of Human Epidermal Ridges. In *Dermatoglyphics-Fifty Years Later*, edited by W. Wertelecki and C.C. Plato, pp. 199-208. Alan R. Liss, New York.
- Brumfiel, E.M., and T.K. Earle
1987 *Specialization, Exchange and Complex Societies*. Cambridge University Press, Cambridge.

- Chai, C.K.
1971 Analysis of Palm Dermatoglyphics in Taiwan Indigenous Populations. *American Journal of Physical Anthropology* 34:369-376.
- Childe, V.G.
1950 The Urban Revolution. *The Town Planning Review* 21:3-17.
- Cleuziou, S.
1982 Hili and the Beginning of Oasis Life in Eastern Arabia. *Proceedings of the Seminar for Arabian Studies* 12:15-22.
- Cleuziou, S., and M. Tosi
1989 The Southeastern Frontier of the Ancient Near East. In *South Asian Archaeology 1985*, edited by K. Frifelt and P. Sørensen, pp.15-48. Curzon Press, London.
- Costin, C., T.K. Earle, B. Owen, and G. Russell
1989 The Impact of Inca Conquest on Local Technology in the Upper Mantaro Valley, Peru. In *What's New? A Closer Look at the Process of Innovation*. Edited by S.E. van der Leeuw and R. Torrence, pp.107-139. Unwin Hyman, London.
- Dales, G.F.
1974 Excavations at Balakot, Pakistan, 1973. *Journal of Field Archaeology* 1:3-22.
1979 The Balakot Project: Summary of Four Years Excavations in Pakistan. *South Asian Archaeology 1977*, edited by M. Taddei, pp. 241-274. Istituto Unversitario Orientale, Naples.
- Dales, G.F., and J.M. Kenoyer
1986 *Excavations at Mohenjo Daro, Pakistan: The Pottery*. University Museum Monograph 53. The University Museum, Philadelphia.
1989 Excavations at Harappa–1988. *Pakistan Archaeology* 24:68-176.
- deCardi, B.
1989 Harappan Finds from Tomb 6 at Shimal, Ras al-Khaimah, United Arab Emirates. In *South Asian Archaeology 1985*, edited by K. Frifelt and P. Sørensen, pp. 9-14. Curzon Press, London.
- Durrani, F.A.
1988 Excavations in the Gomal Valley, Rehman Dheri Excavation Report No. 1. *Ancient Pakistan* 6:1-232.
- Fairservis, W.A.
1982 Allahdino: An Excavation of a Small Harappan Site. *Harappan Civilization: A Contemporary Perspective*, edited by G. Possehl, pp. 107-112. Oxford and IBH Publishing, New Delhi.
- Feinman, G.M., S. Kowalewski, and R. Blanton
1984 Market System Development in the Prehispanic Valley of Oaxaca, Mexico. In *Trade and Exchange in Early Mesoamerica*, edited by K.G. Hirth, pp. 157-178. University of New Mexico Press, Albuquerque.
- Flam, L.
1992 Excavations at Ghazi Shah, Sindh, Pakistan. In *Harappan Civilization: A Contemporary Perspective*. 2nd edition, edited by G. Possehl. Oxford and IBH Publishing, New Delhi, in press.
- Francfort, H.-P.
1989 *Fouilles de Shortughai: Recherches sur l'Asie centrale protohistorique*. 2 vols. Diffusion de Boccard, Paris.
- Fried, M.H.
1967 *The Evolution of Political Society*. Random House, New York.
- Frifelt, K.
1975 On Prehistoric Settlements and Chronology of the Oman Peninsula. *East and West* 25:329-424.
- Halim, M.A., and M. Vidale
1984 Kilns, Bangles and Coated Vessels: Ceramic Production in Closed Containers at Mohenjodaro. *Interim Reports Volume 1*, edited by M. Jansen and G. Urban, pp. 63-97. RWTH, Aachen, and IsMEO, Rome.
- Jarrige, J.-F.
1986 Excavations at Mehrgarh-Nausharo. *Pakistan Archaeology* 10-22:62-131.
1988 *Les Cités Oubliées de L'Indus*. Musée National des Arts Asiatiques Guimet, Paris.
- Jarrige, J.-F., and M. Lechevallier
1979 Excavations at Mehrgarh, Baluchistan: Their Significance in the Prehistorical Context of the Indo-Pakistani Borderlands. In *South Asian Archaeology 1977*, edited by M. Taddei, pp. 463-535. Istituto Universitario Orientale, Naples.

- Kaiser, T.M.
1984 *Vinca Ceramics: Economic and Technological Aspects of Late Neolithic Pottery Production in Southeast Europe*. Ph.D. Dissertation, University of California, Berkeley. University Microfilms, Ann Arbor.
- Kemp, B.
1989 *Ancient Egypt. Anatomy of a Civilization*. Routledge, London and New York.
- Kenoyer, J.M.
1989 Harappan Craft Specialization and the Question of Urban Segregation and Stratification. Paper presented at the Annual Meeting, Society for American Archaeology, Atlanta, April 1989.
- Kohl, P.L.
1979 The 'World Economy' of West Asia in the Third Millennium BC. In *South Asian Archaeology 1977*, edited by M. Taddei, pp. 55-85. Istituto Universitario Orientale, Naples.
- Lamberg-Karlovsky, C.C.
1989 *Archaeological Thought in America*. Cambridge University Press, Cambridge.
- Lamberg-Karlovsky, C.C., and M. Tosi
1973 Shahr-i Sokhta and Tepe Yahya, Tracks on the Earliest History of the Iranian Plateau. *East and West* 23:21-57.
- Mackay, E.J.H.
1938 *Further Excavations at Mohenjo-daro*. 2 volumes. Government of India Press, New Delhi.
- Marshall, J.
1931 *Mohenjo-daro and the Indus Civilization*. A. Probsthain, London.
- McGaw, J.
1989 No Passive Victims, No Separate Spheres: A Feminist Perspective on Technology's History. In *History and the History of Technology. Essays in Honor of Melvin Kranzberg*, edited by S.H. Cutcliffe and R.C. Post, pp. 72-191. Lehigh University Press, Bethlehem PA.
- Okajima, M.
1978 A New Technique for Examining Primate Dermatoglyphics. In *Dermatoglyphics: an International Perspective*, edited by J. Mavalwala, pp. 57-63. Mouton, The Hague.
- Papousek, D.A.
1989 Technological Change as Social Rebellion. *What's New? A Closer Look at the Process of Innovation*, edited by S.E. van der Leeuw and R. Torrence, pp.140-166. Unwin Hyman, London.
- Peacock, D.P.S.
1982 *Pottery in the Roman World*. Longmans, London.
- Potts, D.T.
1990 *A Prehistoric Mound in the Emirate of Umm al-Qaiwain, U.A.E.: Excavations at Tell Abraq in 1989*. Munksgaard International Publishers, Copenhagen.
- Pracchia, S., M. Tosi, and M. Vidale
1985 On the Type, Distribution and Extent of Craft Industries at Mohenjo-daro. In *South Asian Archaeology 1983*, edited by J. Schotsmans and M. Taddei, pp. 207-247. Istituto Universitario Orientale, Naples.
- Rice, P.M.
1981 Evolution of Specialized Pottery Production: a Trial Model. *Current Anthropology* 22:219-240.
1987 *Pottery Analysis. A Sourcebook*. University of Chicago Press, Chicago.
- Rhodes, D.
1981 *Kilns. Design, Construction and Operation*, 2nd ed. Chilton Book Company, Radnor PA.
- Rueschemeyer, D.
1986 *Power and the Division of Labour*. Stanford University Press, Stanford CA.
- Sahni, Rai Bahadur Daya Ram
1920-21 Excavations at Harappa. *Annual Progress Report of the Superintendent, Hindu and Buddhist Monuments, Northern Circle, for the Year Ending 31st March 1921*:8-26, Lahore, Pakistan.
- Service, E.R.
1971 *Primitive Social Organization*. Random House, New York.
- Shaffer, J.G.
1991 The Indus Valley, Baluchistan and Helmand Traditions: Neolithic through Bronze Age. In *Chronologies in Old World Archaeology*, 3rd edition, edited by R. Ehrich, vol. 1, pp. 441-464. University of Chicago Press, Chicago.

- Sinopoli, C.M.
1989 Standardization and Specialization: Ceramic Production at Vijayanagara, South India. In *Old Problems and New Perspectives in the Archaeology of South Asia*, edited by J.M. Kenoyer, pp.263-272. Wisconsin Archaeological Reports 2, Madison WI.
- Stark, B.L.
1985 Archaeological Identification of Pottery Production Locations: Ethnoarchaeological and Archaeological Data in Mesoamerica. In *Decoding Prehistoric Ceramics*, edited by B.A.Nelson, pp. 158-194. Southern Illinois University Press, Carbondale, Illinois.
- Steward, J.H.
1955 *Theory of Cultural Change*. University of Illinois, Urbana, Illinois.
- Tosi, M.
1984 The Notion of Craft Specialization and its Representation in the Archaeological Record of Early States in the Turanian Basin. In *Marxist Perspectives in Archaeology*, edited by M. Spriggs, pp. 22-52. Cambridge University Press, Cambridge.
- Trigger, B.
1980 *Gordon Childe. Revolutions in Archaeology*. Thames and Hudson, London.
- van der Leeuw, S.E.
1977 Towards a Study of the Economics of Pottery Making. *Ex Horreo* 4:68-76.
1984 Pottery Manufacture: Some Complications for the Study of Trade. In *Pots and Potters: Current Approaches in Ceramic Archaeology*, edited by P.M. Rice, pp. 55-69. Institute of Archaeology Monograph 24, University of California, Los Angeles.
- Vats, M.S.
1940 *Excavations at Harappa*. Government of India Press, Delhi.
- Vidale, M.
1989 Specialized Producers and Urban Elites: on the Role of Craft Industries in Mature Harappan Urban Contexts. In *Old Problems and New Perspectives in the Archaeology of South Asia*, edited by J.M. Kenoyer, pp. 171-182. Wisconsin Archaeological Reports 2, Madison, Wisconsin.
- Weisgerber, G.
1980 "...und Kupfer in Oman": Das Oman-Projekt des Deutschen Bergbau-Museums. *Der Anschnitt* 32:62-110.
1981 Mehr als Kupfer in Oman, Ergebnisse der Expedition 1981. *Der Anschnitt* 33:174-263.
- Wheeler, R.E.M.
1947 Harappa 1946: The Defenses and Cemetery R-37. *Ancient India* 3:58-130.
1968 *The Indus Civilization*, 3rd ed. Cambridge University Press, Cambridge.
- White, L.A.
1959 *The Evolution of Culture*. McGraw-Hill, New York.
- Wolf, E.R.
1990 Distinguished Lecture: Facing Power—Old Insights, New Questions. *American Anthropologist* 91(3):586-596.
- Wright, R.P.
1983 Standardization As Evidence for Craft Specialization: a Case Study. Paper presented at the 82d Annual Meeting of the American Anthropological Association, November 16-20, Chicago.
1984 *Technology, Style and Craft Specialization; Patterns of Interaction and Exchange on the Indo-Iranian Borderlands, Third Millennium B.C.* Ph.D. Dissertation, Harvard University, Cambridge, Massachusetts; University Microfilms, Ann Arbor.
1985 Technology and Style in Ancient Ceramics. In *Ceramics and Civilization*, vol. 1, edited by W.D. Kingery, pp. 5-25. American Ceramic Society, Columbus, Ohio.
1987 The Frontier of Prehistoric Baluchistan and the Development of the Indus Civilization. In *Politics and Partitions. Human boundaries and the Growth of Complex Societies*, edited by K.M. Trinkaus, pp. 61-82. Arizona State University Anthropological Research Papers No. 37, Tempe, Arizona.
- Yoffee, N.
1979 The Decline and Rise of Mesopotamian Civilization: an Ethnoarchaeological Perspective on the Evolution of Social Complexity. *American Antiquity* 45(1):5-35.