CRAFT PRODUCTION IN THE HARAPPAN CULTURE

Thesis submitted to the Jawaharlal Nehru University
in partial fulfilment of the requirements
for the award of the Degree of
DOCTOR OF PHILOSOPHY

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CERTIFICATE

This thesis entitled "Craft Production in the Harappan Culture" is submitted in fulfilment of the requirement of the degree of Doctor of Philosophy of Jawaharlal Nehru University. I certify that no portion of this has previously been submitted for the award of any degree or diploma of this or any other University.

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Acknowledgements

My deepest thanks go to my supervisor Dr. Shereen Ratnagar who has been a constant source of inspiration to me. This thesis owes much to her unstinted help throughout these years.

I am very grateful for the patience with which my parents have borne with this work and their encouragement and support during my period of study.

Much of my primary research was completed with the active help rendered by the staffs of the Libraries of Deccan College, Pune, the Archaeological Survey of India, New Delhi, the National Museum, New Delhi, and the Delhi School of Economics, New Delhi. For this help, I am immeasurably grateful.

I undertook a short field trip to Khambhat in Gujarat in Feburary 1990 to study the bead making techniques practised here. In Khambhat, I was helped by Jitendrasinh Kesarisinh Thakore and Hasimbhai Shaikh who invited me into their workshops and showed their skills and by Anil Brahmbhatt who rendered much practical help. In Nagara, the following craftsmen demonstrated their skill in drilling beads-Amrat Somabhai Chauhan, Ghanda Bhai, Shiva Bhai, Purushottam Bhai and Bhikabhai Solanki. In Sakkarpur, I observed the technique of bead grinding in Hira Lal's workshop and that of mechanized polishing in

Latifbhai Gulzar Shah's workshop.

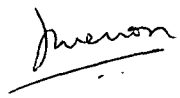
I must also thank Dr. K.K. Bhan of the M.S. University, Baroda for the invaluable discussions on bead making. Dr. A. Habib of the Centre for the Study of Regional Development, Jawaharlal Nehru University was also helpful with her suggestions regarding urbanism.

For allowing me to participate in various excavations which have enriched my understanding of the interpretation of archaeological data,I am indebted to Dr. M.S. Mate, Dr. M.K. Dhavalikar and Dr. V.N. Misra of Deccan College, Pune, Dr. K.T.M. Hegde of the M.S. University, Baroda and Mr. R.S. Bisht of the Archaeological Survey of India.

I could not have completed this thesis without the help and encouragement rendered by Sujata Gopinath, Supriya Varma, Deepika Kundaji, K. Krishnan, Rajni Menon and many other friends.

I thank the University Grants Commission and the Indian Council for Historical Research for funding me during my period of research.

I also thank Mrs. Kameswari, Kuldeep and Hema for their efforts towards finalizing this piece of work.



ABBREVIATIONS

Am. Ant.	American Antiquity
AJA	American Journal of Archaeology
IAR	Indian Archaeology: A Review
IJHS	Indian Journal of the History of Science
JOI	Journal of the Oriental Institute
MASI	Memoirs of the Archaeological Survey of India
MGSI	Memoirs of the Geological Survey of India
PA	Pakistan Archaeology
RGSI	Records of the Geological Survey of India
SAA	South Asian Archaeology
WA	World Archaeology

INTRODUCTION

Craft production in the Harappan culture is the focus of this thesis. It is perhaps craft production with the development of specialization of labour which provides one of the means for differentiating the Bronze Age from the preceding Neolithic period (Childe 1952). Therefore, more than just the exploitation of a new material - metal, the Bronze Age is distinguished by the initiation of significant changes in the organization of production and the development of social complexity.

Harappan craft production has been dealt with by various scholars often in relation to a particular site or a particular craft. The early excavations at Mohenjodaro and Harappa did reveal the interest that was taken by the excavators in craft activities. Marshall (1931) and Mackay (1938) working at Mohenjodaro made note of most craft indicators such as raw materials, tools, unfinished objects, debitage, rejects and reused objects and byproducts of manufacture. Vats (1940) working at Harappa too dealt with most unfinished materials and tools, though the poor structural preservation of the site prevented any contextual analysis of craft production indicators. Mackay's particular interest in craft production is also noted by his further articles on bead making (1937) and a study of a modern day bead etching technique practised in

Sind (1933). The relevance of craft production was further realized when excavations at Chanhudaro were undertaken (Mackay 1943). Mackay's absorption with bead making was illustrated by his outline of the technology used to produce long barrel-cylinder beads, smaller stone beads, wafer steatite beads and miniature disc beads. Mackay (1943) also hypothesized about many craft processes from his Chanhudaro data: the use of long slender paste rods for the production of segmented faience beads and the use of copper/bronze bead tools to produce steatite micro beads. Excavations and explorations at other Harappan sites have recorded all evidence for craft production, wherever available (Stein 1929; Majumdar 1934; Rao 1962-63; Lambrick 1964; Joshi 1966; Joshi 1972; Suraj Bhan 1975; Dales & Kenoyer 1977; Dales 1979; Durante 1979; Jarrige 1981; Khan 1981; Fairservis 1982; Chitalwala 1982; Bhan & Kenoyer 1984; Francfort 1984). More recently, exploration projects of unexcavated areas have given much more evidence of craft working loci at Chanhudaro (Vidale 1989) and at Mohenjodaro where an extensive bead making area was discovered (Bondioli et al 1984; Vidale 1987). Exploration and excavations at Harappa (Dales & Kenoyer 1988; 1989) too indicated the promise of a new area-Mound E-as a craft working area.

Work on Harappan metallurgy and that of later periods was undertaken by Agrawal (1970, 1971, 1982, 1990). This

study followed earlier chemical analyses of metal artifacts by Khan Bahadur Mohammad Sana Ullah, Prof. Desch and Dr. Hamid in the 1920s and 1930s (Marshall 1931; Mackay 1938). A discussion of Harappan metal objects and differences with those of post Harappan cultures was undertaken by Bhardwaj (1970).

A complete study of Harappan shell working industries was undertaken by Kenoyer (1984a). Sources of raw materials, tools utilized, the techniques adopted for various artifact categories were dealt with. Information on Harappan shell working was enhanced with the discovery of Balakot and the different techiniques used to produce bangles made out of Tivela damoides (Dales & Kenoyer 1977). Excavations at Nageshwar and Balakot assumed importance due to shell cutting, which was carried out as the primary activity at both settlements.

As mentioned earlier, Mackay (1943) proposed that steatite micro beads were manufactured using special metal bead tools. Further work on Harappan micro beads was done (Hegde, Karanth & Sychanthavong 1982; Hegde 1983) suggesting a new technique for the production of these beads.

Very little work on Harappan faience production has been undertaken. Singh (1988) has primarily dealt with faience of a later period but does briefly discuss

Harappan faience. Among other crafts, Halim & Vidale (1984) analyzed the production of stoneware bangles, a study which gave valuable insights into a craft object that had been barely noted till then.

The above is a list of studies undertaken of particular crafts. Clearly, the main focus so far as has been on the techniques utilized as deduced from various craft indicators. Very little discussion has ensued on the particular socioeconomic climate within which crafts were practised. The attempt in this thesis will be to explore just such a climate. It is surely social complexities which would permit the development and utilization of sophisticated technologies.

Craft production is here considered to be a significant aspect of an ancient society and one of the more reliable ways to study the development of social complexity. Increase in social stratification will have its repercussions primarily through the division of labour which is archaeologically best detectable in the sphere of non-subsistence production. Craft products comprise our primary archaeological data and any study which aims at understanding the organization of such production and the role that craft products played in the socioeconomic and political lives of ancient peoples must be relevant. Craft products by their nature and in their presence in particular contexts give modern observers a distinct idea

of ancient technological attainments, of the social differences in use patterns and evidence of local and extra-local contacts.

To understand socioeconomic complexities in the Harappan period, it was considered essential to study a number of crafts rather than a single one. More usually, one finds a number of crafts practised in a single settlement. Only by studying a multiplicity of crafts would we be able to weave together the different strands of the ancient economy and judge where crafts and craftsmen stood in relation to each other. Moreover, our interest in how crafts were organized and our use of the concept of specialization to measure occupational differentiation will only have some relevance to the overall economic structure if we study a number of crafts in conjunction.

It must be specified that justice cannot be done to particular crafts which may have had a significance in ancient society. Crafts such as spinning, weaving and wood working, which would leave no archaeological evidence except for inferential indicators such as tools, inlays (where wood working is concerned) and depictions in art, cannot be fruitfully included in our discussion. We must also excuse our neglect of pottery production. Pottery has been considered as too ubiquitous to enable any

correlations to be made between production and distribution. The considerable differences between different wares from separate settlements also are not helpful. That this craft was not unimportant in the ancient period is indicated by its vast output.

We have begun this thesis with an overview of the Harappan economy. Various subsistence strategies possibly employed by the Harappans have been discussed as also the role of the manufacturing sector and the mechanisms existing for distribution and exchange of the output. The aim in this thesis is not to reduce the significance of subsistence production. In fact, increased agricultural production would have been necessary in this period due to population expansion. Dense nucleated populations in particular loci would also have dramatically increased requirements of subsistence products. Moreover, the divison of labour and increased specialization will place more burdens on the capacities of the cultivators. Though agricultural and non-subsistence production are conducted in different spheres, they are directly related. It will be the economic capacities of society to support non-food producers that will have a direct impact on the development of craft activities. Thus, we can hardly begin to discuss Harappan craft production without first situating such production within the economy as a whole.

It was next considered necessary to undertake a study

of craft production in ethnographic contexts. This is one of the means by which the organization of production in simple economies could be clarified. A perusal of the ethnographic literature to obtain an idea of the various aspects of craft production in simple and market economies is necessary for us to explicate the variations in human behavioral patterns. However, we must first accept that we can make no assumptions about the correspondence between past lifeways and the ethnographic present. The aim has been to deduce aspects of craft production that are likely to leave archaeological indicators in particular contexts. The type of indicators and the contexts in which they are found can be tested in relation to the archaeological record. Ethnographic data will give us valuable insights into the way we approach our archaeological data and hence must be undertaken at an early stage of study.

In examining the Harappan evidence for craft production, we must first deal with the technological aspect. The techniques and tools required to produce Harappan artifacts, an idea of the raw materials concerned and of basic inputs in production are essential aspects within a study of craft production. We will study the production processes for metallurgy, bead making, shell cutting, faience production, seal carving and weight making. These will give us an idea of the degree of skill required for

different processes, the inventory of craft tools, the role of other inputs such as fuel as well as the variations in possible artifact categories. This study should give us an indication of the quantity and quality of labour required for Harappan craft production. Each craft would require a separate set of skills while some processes may be done with no particular skills involved.

In the context of craft technologies, it would be fruitful to also compare Harappan capacities, with those of the Early and the post Harappans. This evidence will give weightage to an already preconceived notion of the abilities of the Harappan craftsmen in view of the richness of the archaeological record. A comparison of craft activities within the different cultures will illuminate the societies behind the cultures. The structure of society which would enable such technological advances could then be understood.

In the analysis of our archaeological material, the distribution of craft activities across the entire Harappan region is significant if we are to decipher any patterns in production, consumption and distribution. It is assumed that not all Harappan settlements will reveal evidence of craft production in the absence of a market economy and a measurable "demand". The concept "demand" is here used to denote simply requirement rather than a

desire which is adjustable to prices.

We will be dealing with crafts that have resulted in objects that are particularly Harappan, such as the production of steatite seals and cubical weights, with shell cutting, production of etched carnelian beads and long barrel-cylinder beads; as also with other crafts such as metallurgy, bead making and faience production. In our analysis, we will use some of the variables we had discussed in relation to the ethnographic evidence such as the location of production and the procurement of raw material. For each craft, an analysis of raw material sources and of other inputs, the possible values embedded in certain products as reflected in their consumption, and the pattern of production for separate crafts will be undertaken. Chapter IV will hence help us to relate production centres to findspots of finished goods within particular crafts.

The distribution of craft activities and findspots of finished artifacts give us significant information on a macro-level. However, direct correlations between production centres and findspots of finished goods can obviously not be made. The scale of manufacture at craft centres is to be understood if we are to avoid making any simplistic correlations. Thus, to study craft production at a micro-level, intra-site analyses of craft centres must be necessary. Hence, after a survey of the entire

Harappan region, we will fine-tune our analysis in the fifth chapter by concentrating on three specific craft centres. Only then would we be able to explicate the role of craft production in the economy of each production centre, the particular products manufactured at these centres, the location of each centre in relation to input sources and the distribution and consumption points. This would be essential to realize why crafts were engaged in at certain centres and not at others.

Finally in Chapter VI, we will take up the phenomenon of urbanism. Production at centres catering to a large and diverse local population must take account of the urban character of the settlements. It is considered that craft production as also most other activities will differ considerably in urban situations from that in non-urban settlements, due to the social and economic stratification arising out of a dense agglomeration of people. The enlarged production of craftsmen, the focus of their activities and the means of their livelihood are invaluable from the point of view of specialization. Harappan cities as centres of consumption and distribution, as loci of increased production, as centres of political power consuming elite goods and using them for exchange purposes are essential for our understanding of Harappan craft production. It is finally urbanism that will explain the quantum change occurring in the economy.

Harappan subsistence production will be expanded to cope with the increased demands of the nucleated population, but will not differ in its nature. It is, however, the non-subsistence economy that will reveal vital differences in the urban situation, as opposed to the non-urban.

It must be emphasized that this thesis is a specific study on Harappan craft production, so no attempt will be made to go into other aspects such as chronology. Suffice it to say that the Harappans lived in the period roughly from 2600 to 1750 B.C.

Moreover, no explicit reference to the political organization of the Harappans has been made. In the context of various inferred indicators such as the size of the Harappan occupied area, the physical segregation within settlements, the presence of large, public architecture, the uniformity of the archaeological assemblage over a considerable area, the prevalence of a uniform system of mensuration, the presence of seals and a widespread control over resources, we can say that we are dealing with some form of an early state.

CHAPTER I

The Harappan Economy

Before we focus on Harappan craft production we must consider its place in the economy as a whole. Production in simple/early economies largely consists of subsistence procurement activities, such as agriculture, pastoralism, fishing and hunting, and the manufacturing sector. Archaeologically, this would translate into the raw materials utilized, tools used, the by-products of producing activities and the final products. This would imply that in a study of the economy of a particular culture, we must focus on what goods were produced and the techniques utilized. However what is much more significant is one of the factors of production, viz. labour. The forms in which labour was organized and diversified into different producing activities is generally of crucial importance. The question of the utilization and organization of labour will be addressed through this thesis. Here, in this chapter, the archaeological evidence pertaining to the Harappan economy and a preliminary discussion on organization will be delineated.

We can assume that agricultural activity was the mainstay of the economy. The basic inputs in agriculture are soil, seed, water, labour, and tools. In view of the vast area covered by the Harappan culture we may be

constrained to look into the problem region-wise. Moreover, though the entire region of the Harappan culture comprises of a semi-arid zone, there are niches where natural inputs of production and cropping patterns may have differed. Geographically the Sind area comprises of a number of subregions, such as the Western and the Eastern plains, the mountain areas with the Kirthar and the Kohistan, and the desert areas of the Thar and the Pat or the Kachhi, and the Delta (Spate & Learmonth 1984 [1967]: 504). In Gujarat, the Kutch region was separate from the Gujarat mainland and from Kathiawar. Thus the attempt will be made to study Harappan sites from the viewpoint of the local environment, rather than to take the entire northwestern portion of the subcontinent as a single undifferentiated zone.

Soils and Land Use Zones

Near the Indus in Sind is a stiff clay or rich loam called kacho resulting from recent inundations (Lambrick 1964: 16), and as the land receded from the limit of the inundations the soil became light and sandy. The inundations result in a deposit of a white, clayey surface, generally with a depth of 0.6-0.9 m succeeded by fine sand (Postans 1843: 81-83). According to Leshnik (1973: 73), land use zones in Sind and the Punjab are of four categories. First, are the cultivated areas,

parallel to and close to rivers called "bet" land; second are cultivated areas further away from rivers-called kadir, they are low lying areas; third are uplands for grazing and cultivation of rain-fed crops (barani); and fourth are depressions and marshes. Of these, only the first two zones are in the plains of the Indus river. The third category of the uplands will be discussed separately. The fourth category of depressions and marshes are largely in the delta country; as also Lake Manchhar; alkaline depressions or dhands are found along the eastern bank of the Eastern Nara which fill up with water when heavy floods on the Indus send water down the Nara. Then when the flow stops, water fills up in the dhands and is retained for some weeks even when the Nara dries up. These dhands, some occurring singly, some in clusters of thirty to forty, are rich sources of fish and fertile soil for rabi crops (Selections from the Records of the Bombay Government 1857: 39, 41, 66).

The banks of the Indus have the most fertile soil as this is the area immediately affected by the inundations. The fertility of soils nearest the river is exemplified by the dense growths of natural vegetation evident here. According to Aitken (1907: 40) forests largely followed the course of the Indus all through Sind; inland forests also exist in the northern districts of Sukkur and Upper Sind Frontier. Prior to the British conquest, forest

growth covered all the land where the flood water reached. Timber was cut and settlements were made which resulted in the separation of wooded areas into blocks, some of which were reserved by the Mirs or local potentates for hunting areas; these form the nucleus of the presently existing forests. The fertility of riverain areas is clear when a month or two after subsidence, the alluvium shows quick regeneration of tamarisk which if not washed away in the next floods will become a dense growth of low bushes in a year's time (Lambrick 1964: 17).

Obviously soil is not as extensive a resource in the Kirthar hill region as it is in the Lower Indus basin. Soils in the Kirthar are poorly homogenized, shallow in depth and are present in narrow occurrences (Flam 1981: 150). As compared to water, soils are a limiting factor here. Where springs occur, fields have to be cleared of stone for cultivation and soil fertility can be quickly lost with intensive cropping patterns. In these areas, most Harappan sites are located in broadish plains rather than in the narrow valleys of the major streams that cut across the ranges of the mountains. Such sites are Ghazi Shah, Karchat, Bachani, Shahjokotiro, Damb Buthi, and Gorandi.

Mohenjodaro was not located on the active flood plain but was situated close to the meander flood plain (Fairservis 1979: 81). Harappa was situated on an area of

high ground called the Dhaya Ridge near an old branch of the Ravi, now a depression called a Sukhrawa. The settlement was away from the reach of destructive floods and was close to fertile cultivable land. Even now, the region between the Dhaya Ridge and the second Sukhrawa near Harappa is composed of good quality soil with available sweet water and a dense forest of Tamarix orientalis in the near vicinity (Fagan 1900: 3). Suratgarh district in which Kalibangan is located has good soils composed of light loams which are highly fertile with irrigation. For the whole of the then Bikaner district (in the early 20th century [Erskine 1909: 343]) the growing of rabi crops is primarily confined to the Suratgarh tahsil. This fertility now augmented by modern canals must in ancient times have been accentuated by the waters of the Ghaggar river.

Harappan sites in Kutch and Saurashtra can next be considered. In Kutch the few `islands' in the Rann such as Khadir, did support Harappan sites such as the large settlement of Dholavira. The soil of the `bets' is the same as that of the Rann, but is free from salt (Frere 1870: 186). The softness of the sandy soil allows plant roots to penetrate deep in search of water. According to soil maps (Singh 1990: 885), the Harappan sites of Desalpur, Surkotada and Pabumath are located on or near limited stretches of alluvial sandy soils. In Saurashtra,

possibilities for agriculture are far richer. The major soil type is the black cotton soil derived from the Deccan Trap. However it does not appear that these soils were utilized in the Harappan period. Nageshwar near Dwarka probably exploited alluvial sandy soils, while the major Harappan site, Lothal, probably made use of alluvial sandy loams.

Irrigation:

The importance of water in agriculture cannot be stated enough. The best of soils can be rendered infertile with lack of water. In the case of cultivation in the Punjab and Sind, the issue of water is all important as it is the annual inundation floods which result in the deposition of rich alluvium on which crops are grown. The mode of agriculture, on inundation lands (sailaba cultivation) is simple but gives enormous benefits. The flood saturates the land and leaves a heavy deposit of rich silt. With the receding of the river the farmer sows his crops. In modern times, the river floods fulfilled two purposes:-

a) to deposit enough rich alluvium for crops to be planted; and
b) with the help of canals and channels, the flood waters were diverted for use in irrigating the crops.

Regarding the diversion of flood waters for irrigation, it should be stated that we are left with no visual evidence of canals or channels dating to such early times in the Indus region. Aerial photographs too have not shown such evidence. It would appear probable that canals if once existing were obliterated through redeposition in the following centuries, especially since canals were never dug deep enough to draw off water from the river except during inundations. A river has to rise many feet before its water can run into the canals. During the winter the river waters are not sufficiently high to enter them (Report on Administration in Punjaub Territories: 1854-56: 39), unlike the hot period when Himalayan snow melt and rain in the lower ranges increases the discharge of the Indus by as much as 20-40 times the winter flows (Lambrick 1964: 18).

However it would seem that the region of the Indus river was geographically not suited for canal construction. The British were the first to construct canals on a wide scale and their efforts were not always successful. The reason for this lies in the changeable character of the river where it keeps shifting its bed. Thus often the building of canals was rendered ineffective when the river itself moved away. According to Fairservis (1979: 81) existing remains in the Indus valley reveal none of the characteristic settlement patterns had there

been a dependence on canal irrigation (other than short irrigation canals).

We have evidence for canal irrigation from Eastern Bactria. Working with the hypothesis that artificial irrigation would have to be found given the semi arid climate in the area, Gardin (1984: 317-19) indicated that the Shortughai sites came into existence when a major canal was built to bring water to the area. The existence of the canal was confirmed in diggings and its date to the Harappan period through the find of Harappan sherds in a series of three superimposed ditches. It appears however that the water was supplied not from the Amu Darya but by the Kokcha now 25 kms away (Francfort 1984: 306). It is still unclear if the knowledge of digging extensive canals was a local phenomenon or one brought from the Indus valley, but it is clear that we have no archaeological remnants of canals in the Indus region.

Very often old natural channels are utilized for diverting flood waters kept open by annual clearance of silt. The numerous natural creeks and inlets leading off from the main river could have been used. These dry beds which lie above the level of the river are filled during floods. The water spills over the banks of these arms of the river and floods adjacent low lying land (Leshnik 1973: 75). Apart from natural channels in modern times, numerous artificial canals are taken recourse to. These

often lead off from the natural channels to adjacent or low-lying land. The problem with channels and artificial canals or chhars is that they often require lifting devices to raise water from the channels on to the fields. It would be difficult to obtain evidence of lifting devices since these were usually made of non-durable materials, so we have to rely on other evidence. Leshnik (1973: 69) mentions a scratching on a potsherd which could represent a shaduf or beam lift.

In modern times, wells are often used in a supplementary capacity to the inundations and the scarce rainfall. Sometimes in the flood plain if saturation has not been enough it may be needed to work the well if one is nearby (Fagan 1900: 123). In areas close to the river, wells are usually temporary in nature being little more than hollows and are seldom lined. In areas further from the river, the role of wells is more important and hence their construction is more permanent in nature. In tracts in the Montgomery district, wells are used as the sole means of irrigation, though wells assisted by canals are more common (Fagan 1900: 118-20). According to the Bahawalpur Gazetteer (1904: 241) wells helped neither by floods or by canals can irrigate upto 15 bighas only while wells in inundation areas with ploughing and sowing done with the help of floods can irrigate upto 40 bighas and wells in canal irrigated areas (with ploughing and sowing

done with the aid of canal water) irrigate upto 30 bighas.

In Kutch, lift irrigation by the leather bag technique was practised over a large area (Campbell 1880: 11). In Gujarat, the major means of irrigation is by wells (Dikshit 1970: 78-80).

Instead of a major river, settlements in the Kirthar and Kohistan regions relied on a number of hill streams or nais which were rain-and spring-fed and generally ran in an east-west direction from the numerous ranges of hills most of them having a steeper eastern slope than on the west.

Harappan hill sites in the uplands are situated in open plains or at entrances to narrow valleys. Water in the Kirthar and Kohistan regions comes from three sources- 1. rainfall and runoff; 2. ground water; and 3. springs. The runoff from the mountains often results in a volume of water difficult to control. Crops grown in these areas are largely dependent on rain (barani cultivation). The major stream here is the Gaj Nai. In the Sind Kohistan region streams are more ephemeral in nature but here also seasonally there is a massive discharge of water. Here also springs which are perennial feed the major nais such as Naing and Maliri. Some Harappan sites are located on such springs such as Naing and at Taung, about a hundred metres to the west of the mound is the head of a spring

called the Ratan Shah. At both places, remains of wangis or conduits from the nearby spring have been found. At one time the conduits probably carried spring water to the prehistoric sites (Lambrick 1944: 66).

The cluster of settlements in the Karachi district appear to be exploiting two main sources of water. One is the only perennial river in this region, the Hab, and the other is the vast underground reservoir of the Malir River. An interesting method of irrigation was possibly employed at Allahdino on the Malir River. Fairservis (1982: 110) has suggested that Harappan wells were deliberately kept small in diameter (one well measures c. 60-80 cm), so that water would not only rise higher but would overflow as an artesian well. The central well is located at the highest part of the site and any runoff from that well could be channelled through earth-cut ditches or stone channels wherever required, on account of the slope of the surrounding site.

Labour Requirements and Agricultural Techniques

The question can come up for discussion whether the Harappans utilized the river banks for cultivation. The advantages of river bank areas are a) the fertility of the soil-here it is at its richest; b) the organization involved in diversion of water is absent. On the other hand the major disadvantage would be the destructive

capacities of the summer inundations and the clearing of the dense forest growth which is richest on the river bank. For cultivation to be carried out in areas not immediately adjacent to the river the advantages would be that forest growth would be scantier. However more labour would be required- a) more effort needed for construction and maintenance of canals, even short ones; b) more labour needed for construction and maintenance of wells, probably more needed in these areas. However if a large number of natural spillways and inlets were utilized the labour involved would have been less concentrating on maintenance, that is periodic removal of silt from the channels.

As regards labour required for cultivation in Harappan times, we have very little information. We are on surer ground where small settlements such as those located in the Kirthar are concerned as the size of the settlements indicates an independent self-sufficient cultivation strategy. These settlements utilized local resources and were separated by the hill streams. The question of larger settlements such as Mohenjodaro and Harappa brings the issue of labour requirements into prominence. First we must note that physically we have no archaeological evidence of any Harappan villages or smaller settlements in the immediate vicinity of Mohenjodaro. Second the large population indicated by the

size of the settlement must have been economically and socially differentiated to a certain degree to bring out dichotomies between farming and non-farming segments of the population. In view of the significance of agriculture for these Bronze Age times it is likely that the ratio of the farming to the non-farming must have been very large.

Labour requirements for clearing fields of natural vegetation may not have been excessive. We do not have direct archaeological evidence for actual agricultural processes employed. Agricultural practices on low-lying lands would have been simple. It appears that on the fertile alluvium not too much effort is required for agriculture. When ploughing, only a very slight portion of the surface is disturbed and always after the soil is well saturated, and seeds are sown (Postans 1843: 86). From some accounts, it seems that practically no effort is required, that the soil almost sowed itself. Lambrick (1937: 16) indicates sailaba cultivation as an operation necessitating no labour beyond clearance of jungle, often perfunctory and sowing the moist deposit after a perfunctory ploughing. In fact where inundations are extensive, tillage is not employed. Seeds are thrown on the earth after secession of the waters, and the spring crops, especially wheat, are "luxuriant". No attention is paid to manuring or assisting the soil in any part of Sind

(Postans 1843: 83).

Modern kharif cultivation practices are described by Lambrick (1964: 76). A suitable piece of land is surrounded with an earth embankment, leaving an opening, through which water is admitted as soon as the first rise in the Indus occurs. The opening is blocked, the land ploughed and the seeds sown. While the inundation is in progress, the `bund' is kept secure and water let in only when required.

Labour requirements for irrigation must also have been required. Low-lying areas would not require many waterings after sowing but other lands would have required supplementary waterings from the well or other means. A strong case for lift irrigation has been made by Ratnagar (1986 a), and it does appear likely that Harappan agriculture must have had to make use of such means, as cultivation carried out in areas removed from the river banks would require labour for getting water onto the fields and for digging the wells themselves, many of which had to be dug afresh each season and rare ones which lasted 2-3 years.

Another point the farmers would have had to take cognizance of, was keeping cultivable land periodically fallow. Even in Sind, where there are excellent soils, land can yield a good winter harvest for only a limited

number of years after which it must be kept fallow. Fallowing is here practised one year in four, or two in five, and if ignored or delayed could have serious repercussions (Ratnagar 1986 b). Lands under lift irrigation are fallowed for longer periods than lands watered by flow while inundated lands are often worked continuously for a number of years (Aitken 1907: 241), as the inundations periodically replenish the needed minerals in the soil.

We have scarce information about tools used for agricultural purposes. Most of the tools must have been made of wood and the absence of the use of metal for agricultural implements is remarkable. Only fish hooks (comprising another subsistence strategy) were made of copper/bronze. For clearing the forests, the purely copper axes would have been inadequate and bronze perhaps not much more effective. Few stone axes have been found at Harappa (Vats 1940: 359). Perhaps fire was resorted to for clearance operations.

The Harappan people appear to have known the plough from evidence such as the ploughed field uncovered at Kalibangan of the Early Harappan period (Lal 1970-71), the ploughed field in the Harappan settlement of Shortughai (Francfort 1984: 303) and from the terracotta model of a plough discovered at Banawali (Bisht 1987: 150). Terracotta plough models have also been recovered from

Mature Harappan sites in the Cholistan region (Mughal 1982: Pl. 7.8). Other evidence is scanty, such as a hoe like tool found at Khajur in the Amrian period (Flam 1981: 338). The numerous chert blades found from almost every Harappan site were probably hafted in wood to function as sickles. Cattle were used probably as an important source of energy, particularly for ploughing. Cattle would have been used in devices to lift water from the river onto the fields.

Harappan Crops

Palaeobotanical evidence from excavations of Harappan sites has given us some information on the crops that were grown then. In modern contexts wheat (Triticum sphaerococcum, T. compactum, T. aestivum) is a favoured crop in the Indus region. On lands irrigated by wells the fields nearest the wells were planted with wheat (Leshnik 1973: 75). Wheat could be grown as a rabi or winter crop. Extensively grown on sailabi lands-inundated lands-wheat would have been sown at the end of inundation i.e. September/October and reaped in March/April. Wheat grown on well-irrigated lands during the cold and dry period requires more waterings than wheat grown on sailabi lands. Fentress (1985: 365) mentions that the area around Mohenjodaro has now two periods of crop growing-one during monsoon with water from snow-fed floods and in winter when

dhands (depressions) retain water from Kirthar nais in January and February. Wheat has been noted from Mohenjodaro (Marshall 1931: 586), Nausharo (Costantini 1991: 323), Harappa (Vats 1940: 466), Chanhudaro (Mackay 1943: 31, 250), Banawali (Vishnu-Mittre & Savithri 1982: 206), Allahdino (Fairservis 1982: 111) and Kalibangan (Lal 1979: 89).

Barley (Hordeum vulgare) is also a rabi crop and like wheat is found at a number of Harappan sites-Mohenjodaro (Marshall 1931: 586), Nausharo (Costantini 1991) Harappa (Vats 1940: 466), Chanhudaro (Mackay 1943: 250), Kalibangan (Lal 1979: 89), Allahdino (Fairservis 1982: 111), Banawali (Bisht 1978: 87), and at Balakot, where barley has also been found in the Balakotian (pre-Harappan) period (Dales 1979: 257). Being a hardier grain than wheat, barley is grown in areas too dry or too saline to carry a good wheat crop; barley is tolerant of drought and frost and has a shorter growing season (Vishnu-Mittre & Savithri 1982: 216).

On the evidence of rice (Oryza sativa) husks found in imprints on clay lumps at Lothal (Rao 1985: 678), it was debated that perhaps this crop was grown at Lothal. However, it is not clear whether the husks belonged to wild or cultivated varieties. At Rangpur too, rice impressions were reported. No evidence of cultivation of rice has come to light from the Indus and the Punjab areas

of Harappan times. Present cultivation of rice in Sind is primarily due to the modern canal irrigation system.

That cotton (Gossypium arboreum) was grown in Harappan times appears probable from actual remnants of cotton cloth found at Mohenjodaro, as mentioned in Chapter III. Charred cotton seeds were recovered from Mehrgarh (Jarrige 1981: 89), but none have yet been revealed at any Harappan site. Cotton is a kharif crop as it does not mature in the winter due to the possibility of frost. Cotton requires three or four pickings from November uptil February (Aitken 1907: 233). Traces of bast fibres have been found at Mohenjodaro (Mackay 1938: 593-94). Flax, a type of bast fibre was found at Shortughai where a ploughed field was found covered with flax seeds (Francfort 1984: 303).

Other kharif crops grown in the Harappan period were sesame (Sesamum indicum), melons and peas (Pisum arvense); peas could be a rabi crop too. Field peas have been recovered from Kalibangan (Vishnu-Mittre & Savithri 1982: 213), Harappa (Vats 1940: 467) and Chanhudaro (Mackay 1943: 250). From Nausharo (Costantini 1991), Balakot (Dales 1979: 257) and Allahdino (Fairservis 1982: 111), the fruit of a legume was revealed. Sesame was reported from Lothal (Rao 1985: 678-79) and Harappa (Vats 1940: 467). Chickpea (Cicer arietinum) was found at Kalibangan

(Vishnu-Mittre & Savithri 1982: 213) and finger millet or ragi (Eleusine coracana) from Surkotada (Vishnu-Mittre & Savithri 1982: 214). At Surkotada were also found millet grains of Setaria species (Vishnu-Mittre & Savithri 1982: 214); a very hardy crop. Seeds of a millet probably Setaria italica, were recovered at Lothal (Rao 1985: 678-79). Seeds probably belonging to Brassica juncea were found at Chanhudaro (Mackay 1943: 250).

Evidence of the cultivation or collection of fruits is not lacking. Fruits of the Zizyphus species appear to have been eaten. In areas of Sind and Montgomery district, Zizyphus is one of the commonly met species. Melon seeds were found at Harappa (Vats 1940: 467). Indirect evidence in the form of a lemon leaf shaped pendant, two polychrome earthen vases in the shape of a pomegranate and a coconut, and a representation of a lotus fruit in faience, may indicate consumption of these fruits. Carbonized date seeds were recovered from Mohenjodaro (Marshall 1931: 585) date stones from Nausharo (Costantini 1991) and from Harappa, two faience sealings in the shape of such seeds (Vats 1940: 467).

The archaeobotanical record has also revealed the presence of wild species. At Surkotada, 93% of seeds recovered belonged to wild plants (Vishnu-Mittre & Savithri 1982: 214) and recent excavations at Harappa (Dales & Kenoyer 1989: 27) also brought to light many wild

seeds.

Cropping Patterns

The question of cropping patterns comes up here for discussion. Archaeological evidence will not indicate whether the Harappans produced more than one major food crop a year or not. Wheat and barley as staples are both rabi crops. Cotton is a kharif crop but it is not a food crop. Sesame and melons are kharif crops, but must have been secondary foods. In modern times, rice is an important kharif crop, but we have no evidence of rice cultivation in Sind and the Punjab in the Harappan period. This pattern would indicate that Harappan agricultural production was markedly seasonal, depending on a winter cycle, and the Harappan farmer practically took off from agricultural work the rest of the year. However the cultivation of cotton would require a long growing cycle.

Mixed cropping is clearly revealed by the remains of a ploughed field discovered in the Early Harappan levels at Kalibangan. In modern times, mixed cropping of cereals like wheat and barley is resorted to in Punjab, Haryana and Uttar Pradesh as a precaution against weather hazards so that in any event, the hardier barley will definitely yield.

Archaeozoological Evidence

The exploitation of cultivated plants did not provide the sole source of nourishment for the Harappan people. The number of bones recovered in excavations indicate the significance of faunal species for consumption. The Harappan sites for which we have archaeozoological evidence are Mohenjodaro (Sewell & Guha 1931), Harappa (Prashad 1836), Chanhudaro (Mackay 1943: 246-50), Lothal (Bholanath & Sreenivas Rao 1985: 636-48), Balakot (Meadow 1979: 287-313), Rangpur (Rao 1962-63: 153) and Allahdino (Fairservis 1973: 101; Fairservis 1982: 111). At all these sites, a number of bones of a wide range of wild species is noted, along with domesticated faunal species. Statistical analyses of wild to domesticated species have not been done in most cases. Hence, the extent to which hunting as a subsistence strategy was resorted to is not clear. At Allahdino however Meadow (1979: 291) indicates that the bulk of meat in both Balakotian and Mature Harappan periods came from large mammals i.e, cattle. It also appears that the proportion of smaller mammals such as sheep, goat and gazelle increased in the Mature Harappan period from the Balakotian occupation.

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Fish also supplemented the Harappan diet, as noted by the recovery of fish bones from various sites. At Mohenjodaro, fish species recovered were Rita rita, Wallago and Arius species (Sewell & Guha 1931: 664). The

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species Pomadasys hasta predominated at Balakot (Meadow 1979: 297) and at Harappa, bones of Rita rita and Carp species were recovered (Prashad 1936). The Indus river is a rich source of fish resources. The Manchhar Lake too was exploited for fishing, on the banks of which even now a number of fishing communities live. That this area may have been a locus of settlement in ancient times gains credence from the finds of prehistoric sites in the vicinity of the lake, some of which are now low mounds often submerged by the waters (Majumdar 1934).

From some sites we have recovered evidence of the use of molluscs for nourishment. A list has been compiled by Durante (1979: 317-19) of such species-Terebralia palustris, Rostellaria curvirostris, various species of Arcidae and Ostreidae, Callista umbonella and Callista casta. The last mentioned was also used for craft working, but in a limited way. According to Meadow (1979: 296), Terebralia palustris appears to have only been exploited for food and has been recovered in large quantities. Complete specimens are rare and no evidence has been found of their use in craft activities. Some shell artifacts are in fresh condition and suggest the intentional collection of live molluscs-probably the gastropods were smashed to obtain the meat (Kenoyer 1984a: 156-57).

What is particularly interesting about the recovery of faunal material from Balakot is that in the earlier or Balakotian period, very little shell or molluscs were recovered [98.5% of bones were animal bone, 1.5% shell, no fish bones (Meadow 1979: 289)], whereas in the following Harappan period, fish contributed significantly to the diet and it is suggested that marine resources could have contributed upto about half of the dietary intake from faunal sources with the major portion coming from fish. In modern times too, fish is a regular item of food in villages on the Makran sea coast and in riverine tracts such as in Lower Sind (Andrus & Mohammed 1958: 29).

Pastoralism

Economic strategies must also have included pastoralism. All Harappan sites have revealed bones of cattle, sheep and goats; from some sites in large numbers. But separate from the livestock probably maintained by the Harappan farmers, it is conceivable to imagine the existence of a specialist group, that of nomadic pastoralists. According to Possehl (1979: 547) a look at the map of Harappan sites would reveal a number of interstices in the Harappan settlement pattern; an example is the dearth of Harappan settlements to the west of Harappa. It was proposed that pastoral nomads or other mobile occupational specialists filled these interstices.

Fairservis (1986: 47) argues that as cattle require good grazing land all the year round, their requirements would eventually come into competition with those of the agriculturists. Regular sources of water and availability of land would be a bone of contention. As cultivation expands into areas of natural pasture, decisions would have to be made to cultivate fodder crops for the cattle or herd them to other suitable pasture areas. Thus in the winter period herds would have to be maintained by fodder production and in the summer would be herded to the cooler highlands with more abundant grazing potential. This would appear to indicate more a pattern of transhumance than true pastoral nomadism.

The entire northwestern portion of the subcontinent reveals seasonal movements of pastoralists in search of pasture. These are evident between Baluchistan and Sind and also between Sind and Kutch. A 13-to 15-cm rainfall in Kutch "covers the desert with a carpet of deep rich grass" which attracts graziers from Sind and Rajasthan (Frere 1870: 203). Lambrick (1964: 8) mentions that the Thar grasses are far superior to those of the Sind plains and that large herds are driven into the desert specifically for fattening. The entire region of the Harappan culture was an area where pastoralism was eminently viable. Even the Bikaner district in whose northern portion Kalibangan is located, is indicated as a

vast pasture ground (Erskine 1909: 345). In the Punjab area, there is vast pasturage for the numerous numbers of sheep, goats, camels and bovine cattle (Report on the Administration of the Punjaub Territories 1854-56: 15).

Non-subsistence Economy

So far we have been looking at the subsistence economy. There is yet another facet of the economy which concentrates on the production of material not directly related to subsistence, that is, the production of craft goods. The produce of such activities forms the bulk of our archaeological evidence. Noting the number of crafts for which we have evidence in the Harappan culture (see Table I.1 below), we shall have to attempt some preliminary classification of them. If we use material as the distinguishing factor, we would have a large number of crafts. Among non-durable materials, we would have fibres like threads, reeds and skins, of which we have only cotton cloth as archaeological evidence. We know from the recovery of tools and actual cotton material that spinning and weaving must have been undertaken. That dyeing must also have been done is inferred from the evidence of facilities thought to have been dyeing vats found at Mohenjodaro and Lothal.

TABLE I.1 LIST OF HARAPPAN CRAFTS

1) Stone tool making
2) Pottery production
3) Spinning and weaving
4) Limestone working
5) Metallurgy
6) Bead making
7) Shell cutting
8) Seal making
9) Weight making
10) Faience production
11) Steatite cutting
12) Ivory working
13) Making of etched carnelian beads
14) Stoneware bangle production

Durable materials obviously form the bulk of our evidence. These mostly consist of baked clay, bone, shell, ivory, stone, minerals and metals. The utilization of varied categories of raw materials is attested from the material evidence from Harappan sites. The Sind and Punjab plains are particularly deficient in mineral sources, steatite and copper. Many crafts are found located at centres from where sources of raw materials are quite distant. Most required raw materials for Harappan crafts are located in areas outside the Harappan occupied area while sources of other materials such as shell and chert fall within the Harappan region. A number of materials such as carnelian and copper have various source areas from where they could have been obtained. In contrast, a few materials such as lapiz lazuli and shell have limited occurrences in nature and few doubts exist about their source areas. Bulky and heavy raw materials

(for example shell and metal) are also noted as having been worked in Harappan settlements. Some initial processing of bulky materials may have been done at source areas to reduce transport costs. What must be noted here is that materials brought from distant sources must have required some mechanisms for obtaining them. The attention paid to this aspect - the procurement of raw materials - by the Harappans must have been of no little significance.

Tools for Craft Production

We know far more about craft working tools than we know about tools used in agricultural production. For crafts such as spinning and weaving, we have the evidence of a number of spindle whorls made from different materials found from a number of sites. For dyeing of cloth, vats would be the only facility required of which we seem to have evidence. For pottery production we do not have absolute evidence like the presence of a wheel which in all probability was made of wood. The only tools recovered for potting would appear to be dabbers. A number of kilns have also been recovered at Harappan sites.

Tools for other crafts are made out of various materials such as stone, bone and ivory and metal. Stone was used to produce most household objects such as querns,

mortars, cutting implements, and scrapers. Apart from these products, stone was used to make tools used in further production. Stone hammers could have been used for metallurgical operations: for breaking up the ore, for cold hammering, for forming metal utensils, stone moulds along with clay examples for casting metal objects; hammerstones, drills and hones for bead making; and grinding stones for shell working.

Tools of bone and ivory comprise awls and engravers used largely for seal carving, and needles for sewing.

Tools of metal could have been used for a number of craft processes, but in various cases, stone would also have sufficed. In the Harappan culture, metal tools comprise saws which could have been used for shell cutting or for cutting stone nodules for beads or steatite for seals; bead tools probably used in the production of steatite micro-beads; awls used for drilling beads or for incising designs on steatite seals or shell objects; chisels for wood working or for seal carving.

Clay could also have been used for some tools and accessories, such as crucibles for holding molten metal; moulds for casting metal objects; for the core in the cire perdue technique of casting metal objects; and for moulding faience objects.

Heating facilities are required for various processes in separate crafts. Agate nodules and beads in various stages of completion need to be heated to achieve the red of carnelians; metallic ore has to the smelted prior to the production of metal objects; heat is needed for the casting of metal objects; steatite seals and beads need to be heated to harden the material and to cement the slip on the objects; and finally, heat is necessary for the moulding of faience objects. A number of Harappan kilns have been found, but the purpose for which they were built is not easily decipherable, due to the lack of associated material.

Studying the typology of tools used for Harappan craft activities, it becomes apparent that Harappan craftsmen used a standardized inventory of tools. Though not connected with craft production, the use of long chert blades attested at several Harappan sites is a clear example of a conformity in use patterns over the large area covered by the Harappan culture or in this particular case, an interesting example of the movement of a utilitarian artifact type several distantly located settlements.

Stone drills used to perforate beads are of two types, both of which are found at major bead making centres. One type are the flanged or unflanged variety

made of chert or flint and the other is of phtanite. Stone hones for grinding beads are typologically similar from different sites such as Mohenjodaro, Harappa and Chanhudaro. Metal tools such as chisels and awls are of a standard design. It is also interesting that the specialized metal bead tools used for steatite microbead production are identical from the two major bead making centres, Chanhudaro and Lothal, though the former site revealed a greater number of such tools. Harappan metal chisels, awls and engravers of metal, bone and ivory are all standardized artifacts.

Labour Requirements

a) Specialists

In consideration of labour requirements for craft producing activities, it is relevant whether a portion of the Harappan population spent most or all of its time in the production of non subsistence goods. In this is embodied the concept of a specialist as one who obtained the whole or the major portion of his livelihood from the pursuit of a single occupation. Archaeologically it is not easy to distinguish between a craftsman and a farmer. Even in modern times, we often find craftsmen groups who own fields which are worked by themselves or their family members. Many are seasonal labourers working their craft at suitable times and devoting their primary attention to

agriculture. Some crafts would perforce have had to be worked on a seasonal basis due to environmental factors. This aspect will be dealt with in Chapter II.

b) Technology as a Factor in Labour Utilization

In view of the labour and technological sophistication involved in the working of various crafts such as faience production, bead making, shell working, it may be difficult to imagine that knowledge as involved in such production would have been available to all. Various crafts comprise a number of intermeshing processes some of which require individual skills. In the present day, the craftsmen at Cambay who shape or flake beads are different from the bead drillers and those who grind and polish beads (Trivedi 1964). Observations of iron smelting in the beginning of the 19th century in Canara note the division of the labour force for separate tasks such as mining of ore; transport of ore to the smelting site; for working the bellows; for hammering; and for looking after the forging furnace (Buchanan 1807: 361-62). Modern reanalyses of ancient faience production (Wulff et al 1968; Lucas 1948; Noble 1969) envisage numerous complicated stages through which the production of faience passes and it is then possible to think of a number of workers each assigned to a specific task relating to collection of raw material, processing of the materials, and further manufacturing processes of forming objects,

and of firing and finishing them.

Where the technology involved in the production of various artifact categories was sophisticated and where few production centres were involved for the Harappan culture as a whole, it could be feasible to think in terms of a dichotomy between farmers and craftsmen. However for a number of other crafts, the members of the population must have combined farming with craft production. In that case we must make a note of adjustments in the scheduling of various activities, so as to optimally combine them. Crafts would probably not have been engaged in during peak periods of requirement of labour for agricultural operations, such as during the sowing and harvesting periods. Noting the probability of technological simplicity where agricultural operations were concerned, it is apparent that the preparation of fields may not have taken much time. Post-sowing waterings from the wells however, would have required much time and effort.

Scheduling of various sowing and harvesting operations would mean that a major chunk of time would be given over to agricultural operations around September-October-November, when wheat and barley would be sown and cotton would be first picked. Prior to this period, the Sind area would witness the period of inundations on the Indus roughly from May till the end of September [the

inundations commence in March but are felt effectively in lower Sind only in mid-May (Postans 1843: 119)]. In this period, the transportation of goods and raw materials up and down the Indus would be made more difficult.

Rabi crops would be harvested around March/April while kharif crops would be sown around May/June. The final calendars for the Sind, the Punjab and Kutch would be :-

Fig 1: Crop Calendar for Sind

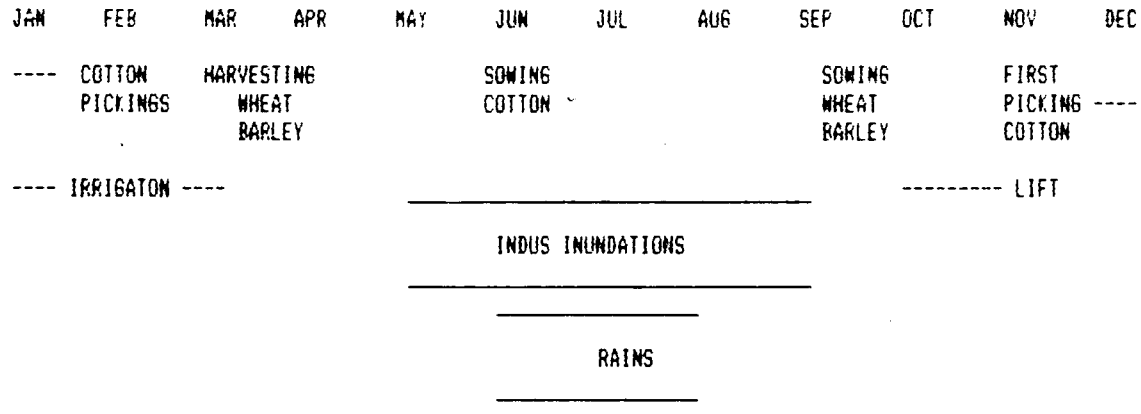


Fig 2: Crop Calendar for the Punjab

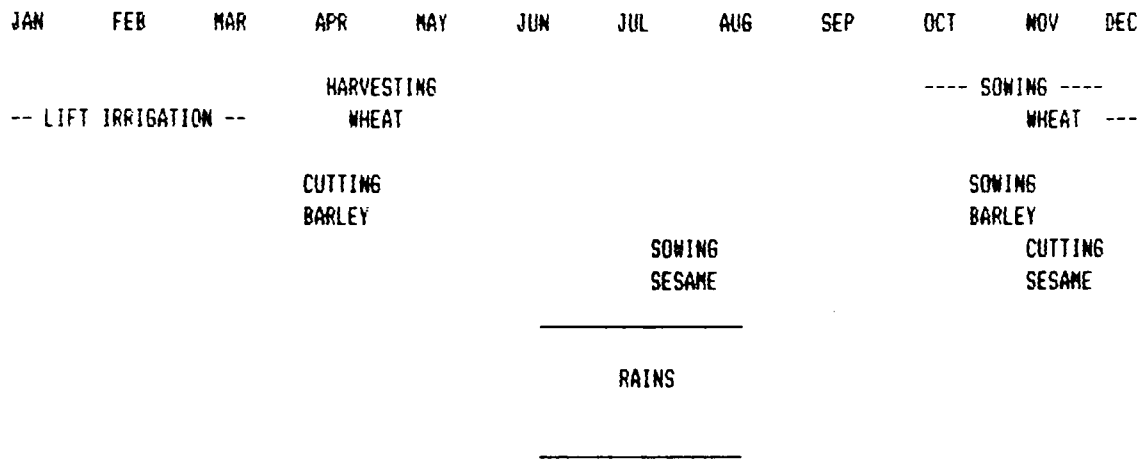
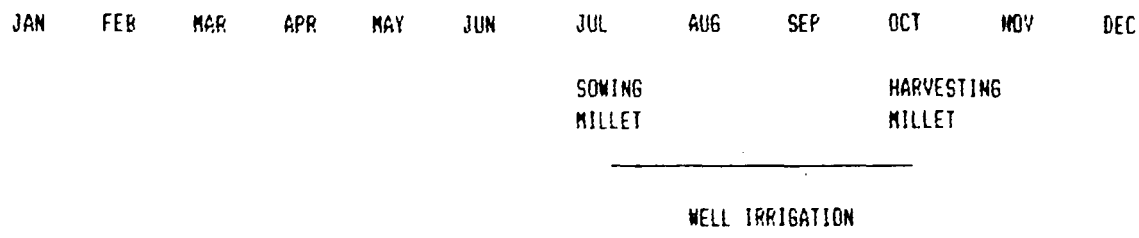


Fig 3: Crop Calendar for Kutch



The production of staple crops would obviously require most attention, due to fears of its failure. The busiest periods for agricultural operations would then be from September to November and March- April. The coming of the rains may not put too extended a halt on craft operations, in view of the scarcity of rains in the concerned areas. However operations requiring heating facilities may have been halted. If lift irrigation was employed by Harappan farmers, then most of the fair-weather period between rabi sowing and harvesting would have been occupied in watering the fields. This would leave no time for craft activities in Sind and Punjab. However, in Kutch, the limited evidence we have to date is only of the cultivation of millet which from Fig. 3 would point to the period from November to May being free for the craft procution. The issue concerning the proportions of populations engaged in separate activities in different settlements will be resolved through this thesis.

The inventory of artifacts produced by Harappan craftsmen comprise two main categories, one consisting of household goods, tools and implements and the other of

ornaments,decorative and recreational artifacts. Artifacts in the first category were further subdivided into tools used for various activities and tools used for further production, including agricultural production and craft production.

Production Processes

Actual production processes for various crafts obviously differ as we shall see in Chapter III. Some crafts indicate highly specialized production techniques. Within bead making , there are a number of stages through which the raw material must pass before its transformation and moreover, these differ according to different shapes, types and materials of beads, such as cylindrical stone beads, wafer steatite beads or segmented faience beads. Shell bangle manufacture is a complex process, differing within itself according to the raw material used and on the other hand differing from ladle manufacture not only in the species of shell used but also in production processes. In the production of faience objects, the very variety of objects, and their decoration necessitate differing and elaborate production proesses.

Distribution

In agricultural production, we do not know how the crop yields were divided among the population. Agriculture

would have been the mainstay of the economy, but it is not immediately apparent from the archaeological record whether there were a group of people who were entirely divorced from subsistence procurement activities. What is clearer is that there was probably considerable socioeconomic differentiation between the inhabitants of Harappan cities. The morphology of some settlements shows a `citadel-lower town' dichotomy which could imply some segregation by status or function. Some Harappan settlements have revealed granaries or warehouses which suggest some amount of public storage of a portion of the total produce. The distribution of manufactured products is easier to discern than that of agricultural products. Where production centres are few, the question of the distribution of manufactured products becomes even more interesting.

A considerable measure of differential consumption is perceived where distribution of manufactured products are concerned. A few settlements out of the total number of Harappan settlements reveal a greater variety of artifacts in excavations. This difference is apparent for all those crafts which produce a varied inventory of artifacts from a few raw materials. Crafts such as pottery making and stone tool production would have had a wide distribution and broad consumption pattern. Other crafts are such that they could not have been practised at each and every settlement. Crafts such as seal cutting and faience

production have in fact been noted at only a few sites. Reasons for the limited loci would be proximity to sources of raw materials, but also various other reasons. Looking at the artifactual evidence, the consumption of shell bangles appears to have been greater than that of ivory. Regarding shell itself, shell bangles are found in greater quantities than shell ladles or inlay, and may have been produced in larger quantities. Among faience objects, cylindrical beads were made and used more than the miniature jars.

We have various clues for the possibility that consumption was not uniform. It seems that not all inhabitants of Harappan sites could afford objects such as etched carnelian beads, in view of the number of examples found imitating the stone beads in clay. The same is also true for the faience spindle whorls whose rarity indicates that they were used by few while terracotta spindle whorls were for more general demand. A large number of stone bead types may have been imitated in terracotta, suggesting that some stones could not be afforded by all. For copper/bronze metallurgy, we are not able to distinguish clear contrasts in use patterns. There are few substitutes for metal tools in other materials; hence they may have had a wider distribution. Copper/bronze utensils had a smaller distribution as pottery would have been a much cheaper and a easily available alternative.

Objects of metals such as gold and silver also had a very limited distribution across Harappan sites.

Harappan manufactures were not only meant for consumption by the Harappans themselves. In archaeological contexts, finds of a particular region or culture in another have been termed as the result of trade. However, this is applicable only in certain cases. The context or the mechanisms through which objects are found in another culture will determine whether the movement of artifacts took place through trade or other means such as gift exchanges or reciprocal offerings in return for raw materials or through state-organized expeditions.

Internal Networks

Internal networks or exchanges within the Harappan culture must have existed. In the first place, we know that a number of required raw materials were available in areas peripheral to the Harappan culture and where materials were available within the Harappan region, their production areas were not necessarily contiguous, thus necessitating some means for the transportation of raw materials. Not only this, where production centres are few and loci of finished artifacts are numerous, then too, networks for the distribution of finished artifacts must be assumed. In some areas, Harappan communities were

settled at the source regions of raw materials in an effort to procure desired materials; examples are of Nageshwar and Shortughai.

At the local level, we can consider exchange possibilities between farmers and craftsmen and between pastoralists and settled populations of Harappan settlements. Distinctions between farmers and craftsmen are not easily ascertained, as noted earlier. Craftsmen utilizing locally available materials such as cotton yarn, reeds,clay, chert and bone need not have been solely craftsmen but were probably primarily agriculturists. On the other hand, craftsmen working at seemingly specialized tasks also could have maintained fields of their own to supplement their income. Contact between pastoralists and settled populations must have been one of symbiosis. The archaeological record does not explicate what the relations between the two groups of people were and what goods were exchanged. Milk products, meat and leather may have been more desired by settled populations than wool, and they must have given grain in exchange.

External Contacts

It is impossible to imagine that the Harappans did not come into contact with outsiders, in view of the area covered by the Harappan culture and the requirements of

various materials, most of which were not available within Harappan boundaries. Immediately to the West, the Harappans would have been in contact with people of the Kulli culture in view of the spatial proximity between the two cultures, similarities in material artifacts and the location of the Kulli region in between the settlements of the Harappans in Sind and the Makran. Kulli culture sites, termed as Complex A sites in the Las Bela region, revealed Harappan type artifacts, like terracotta cakes, clay cart pieces and perforated wares (Fairservis 1971: 203). Niai Buthi II also revealed perforated wares (Fairservis 1971: 193). Two typically Harappan seals with the unicorn motif were found at Nindowari (Casal 1966: 16). According to Possehl (1986) the Kulli culture was a "highland aspect of the Indus civilization" and specialized in supplying the Harappans with animals and needed raw materials found in their territories.

In the extreme northeastern limit of the Harappan region, near Manda, the Harappans must have come into contact with other cultures. Possibilities of contact with the Neolithic culture of Burzahom have been considered. The evidence consists of 950 beads of agate and carnelian found in a wheel-made red ware pot, painted with a horned figure recalling a similar design from Kot Diji (Agrawal 1971: 103). Towards the southeast, it has been considered that the Harappans may have come into

contact with people of the Kayatha culture. Fine necklaces, composed of beads of semi-precious stones recall Mohenjodaro examples; the beads are made of carnelian, agate, crystal, jasper, quartz, malachite and shell. Moreover, 40,000 steatite micro beads were found in a pot (Dhavalikar 1970: 91) suggesting they were carefully hoarded and were probably non-local in origin.

Another example of contact with outsiders is furnished by the discovery of the Ganeshwar-Jodhpura culture. This culture is speculated to have comprised a settled, local population who perfected their copper technology and supplied ingots and finished goods to a number of Harappan settlements (Agrawal & Kumar 1982: 128). The proximity of Ganeshwar to the Khetri copper mines could be significant.

Contact with people of the South Indian Neolithic culture was considered on the basis of the evidence of argentiferous gold found at Harappan sites; this area is seen as a possible source of gold for the Harappan people. At a few Southern Neolithic sites, steatite disc beads have been found, which are a type-fossil of the Harappan culture. In most cases, beads are found dispersed at Neolithic sites and not concentrated and hoarded as at Burzahom and Kayatha. At most Neolithic sites, steatite disc beads are few in number , but at Veerapuram in the Krishna Valley a large number of such beads were found in the Neolithic period with very few examples in later

periods. Out of a total of 281 steatite beads, 221 were found in Period I, the Neolithic phase at the site. Out of these 119 were disc beads of a tiny size, 60 of small size, and 40 of large size (Sastri et al 1984: 117). The occurrence of steatite paste disc beads at Southern Neolithic sites was termed as evidence of export and trade contact (Allchin 1960: 126).

Long-Distance Trade

Long-distance trade or exchange relationships are testified from different areas. In the first place, we must note the presence of Indus material from the site of Altyn Depe in Southern Turkmenia. The goods associated with the burial of a woman revealed a square-sectioned ivory stick engraved with circles (Masson 1988: 43), such as have been amply discovered at Mohenjodaro. Two etched carnelian beads were found separately associated with two burials. Etched carnelian beads and beads of agate,paste and carnelian were found in another burial (Masson 1988: 51). A seal of proto-Indian type was found at Altyn Depe (Masson 1988: Pl. XXII, Ia) and in a room, a flat white seal decorated with the swastika motif (Masson 1988:68). Ring-shaped ivory beads, flat chips of ivory and four rectangular sticks of ivory with concentric rings on three sides and an ornament on the fourth were also found (Masson 1988: 93) of which only the sticks resemble

Harappan specimens. Similarities in ceramics and metallic objects and terracotta toycart models also suggest direct or indirect contact with the Harappan culture (Masson 1988: 93, 68).

Long-distance trade with Mesopotamia is attested on evidence of a literary and archaeological nature. Identification of the Meluhha of the Mesopotamian texts with the Indus region would indicate the movement of goods such as timbers, copper, gold dust, ivory, lapis lazuli and carnelian to the Mesopotamian cities. Textual records attest the movement of such goods, but archaeologically, other materials are also found, such as etched carnelian beads, steatite containers (Ratnagar 1981: 78), shankh shell and long barrel-cylinder carnelian beads (Chakrabarti 1982). In the context of this thesis, the transfer of Harappan manufactured goods is more significant than that of raw materials. The movement of traders and goods appears to be attested by the finds of Harappan seals at Mesopotamian sites (Gadd 1932) and a Harappan weight found at Ur (Ratnagar 1981: 185-86).

Contacts with areas between the Indus region and Mesopotamia were probable on account of their situation. The names of two regions, Dilmun and Magan are mentioned in Mesopotamian literary contexts. Some material evidence points to contacts between the Indus valley and Dilmun (probably the region of Bahrain and Failaka Island) as

Dilmun probably served as an entrepot for the trade being carried out in the Persian gulf. Bibby (1958) noted similarities between seals discovered in Bahrain with those described by Gadd (1932), and hypothesized that since the seals were foreign to both Mesopotamia and the Indus region, they could have been made in a third region, that is, Dilmun. This hypothesis gained credence with the large numbers of such seals termed as `Persian Gulf seals' from Ras al Qala'a, Barbar and Failaka. A Persian Gulf seal was also found at Lothal (Rao 1963 a) suggesting contacts between the two areas. Some of the Persian Gulf seals have reverse bosses almost identical to that of Harappan stamp seals, while others have smaller bosses with three grooves and centre-pointed circles as decoration. Nagaraja Rao (1969: 219-20) found similarities between a bronze figure found in the Barbar temple in Bahrain and the handle of a mirror found at Mehi, a Kulli culture site. He suggested the Bahrain figure was also intended for a mirror handle. Weights found in Bahrain (Bibby 1966: 92; Bibby 1970: 184) though mostly of local materials are manufactured according to a standard which approximates to the Harappan standard. No conformance with Mesopotamian weights was noted. This piece of evidence is of considerable significance, concerning contacts between the Harappan culture and the land of Dilmun. Other evidence could be the presence of

carnelian at Ras al Qala'a (Bibby 1970: 184) and more clearly, the presence of identical seal motifs such as the radiating animal heads motif noted in a seal from the Barbar temple in Bahrain and one found at Mohenjodaro (Joshi & Parpola 1987: 101). The pottery recovered at Umm an-Nar suggested some Kulli influences or contacts with the Umm an-Nar culture (Thorvildsen 1962: Fig. 23).

Mechanisms for Distribution and Exchange

Boats would have been required for external trade which have been mentioned in Mesopotamian records. These boats could have sailed from the mouths of the Indus and/or from the Makran Harappan sites. We have no evidence for Harappan ports in the delta region. The sea route could have been used by Lothal and Kathiawari Harappan sites to bring raw materials and manufactured goods to Harappan and external markets.

The Indus river being the artery of Sind must have been utilized for transporting materials and goods up and downstream. The Indus is navigable all through its length, but navigation in the delta is difficult and dangerous due to the velocity and force with which the Indus discharges its contents of mud and silt (Burnes 1973 [1835]: 39). The current makes it easier to navigate down the river than up against its flow. In some sections of the Indus river, such as between Hyderabad and Sehwan, the

river can be navigated upstream only by dragging the boat against the stream hence involving extra labour. During the inundation period, the main stream of the Indus becomes dangerous to traverse and though the distance is almost double, many travellers prefer the Western Nara: this stream is used to reach Sukkur from Sehwan (Postans 1843: 130-31).

Land routes would have been significant for connecting the different parts of the Harappan area. Transport of goods would have been largely with the use of pack animals but we are unsure as to the animals used for such purposes. In modern times, camels and donkeys are so utilized. Bones of both these animals have been found in excavations, but are scarce. Possibly pack oxen could have been used for this purpose. We know the cart was a means of transportation for the Harappans in view of the ubiquity of terracotta models of carts and cart wheels from Harappan sites, but this was a means of transport for largely short or medium distances and rarely for long distances (Ratnagar 1981: 177). A number of land routes between Baluchistan and Sind are well used by modern pastoralists. From Sind, the Baran or Hab rivers could be followed or the various Kirthar passes used; the Bolan pass led to the Quetta region and the Mula pass to Kalat (Ratnagar 1981: 59). Movement between Sind and Kutch was widely undertaken by pastoralists in search of pasture.

From Kutch there are three main routes: one from Nalia to Luna at the west end of Banni and thence to Rahim-ka-Bazar near Ali Bandar on the Kori river; second from Samrasar north across the middle of Banni to Balliari in the Thar; and third, north from the island of Bela to Nagar (Campbell 1880: 14, 120).

The Significance of Weights and Seals

So far, in the preceding discussion on agricultural and non-agricultural production, requirements of labour are understood in the context of an essential input in production activities. However, to integrate various facets of the economy into a viable, working system, some kind of a directional authority is necessary. This is especially so when one remembers the area covered by the Harappan culture. Some hints of the existence of this authority have been indirectly mentioned earlier. The requirements of a large number of raw materials whose source areas lay outside the Harappan boundaries would have necessitated the organizing of exchange and trading networks and enabling the safe transportation of materials and goods. Manufactured products produced at a few centres must also have been taken to other Harappan settlements through the internal networks of the Harappans. Two categories of artifacts give evidence of an overall authority in the Harappan culture. These are the weights and the seals. The significance of Harappan

weights lies primarily in their adhering to a common standard over the entire breadth of the Harappan area. This common standard implies a uniform system of mensuration over the entire Harappan area. The production of Harappan weights signifies a supervisory authority responsible for and certifying the accuracy of these objects. It is likely that various goods were exchanged or traded using these weights. The discovery of a number of tiny weights could indicate that precious materials were weighed against them. The large number of weights found associated with beads and bead making debris in the centre of Mound II at Chanhudaro (Room 215) could indicate that manufactured artifacts such as beads would also have been weighed.

Harappan seals are another artifact category with specialized functions. The majority of Harappan seals are the square steatite stamp seals depicting an animal motif and an inscription. Seals served as identity markers for administrative and trade purposes. That the impressions of seals were used to authenticate the contents of containers is evident from the finds of numerous sealings on clay tags showing on the reverse imprints of cords, reeds and packing materials. The best example is of the Lothal warehouse where a group of 65 sealings showing impressions of packing material on the reverse were found. Pots have also been found stamped with seals near the rim.

Seals, as weights, are a measure of the provision of guarantee of authenticity and accuracy, given by an authority which had the means and the power to enforce control. The finds of Harappan seals and weight standards in a pan-Harappan context suggests significant involvement of the Harappan authorities in a trade far beyond their own boundaries.

The integrating element in the economy between the agricultural and non-agricultural activities is illustrated through the character of the major urban settlements in the Harappan culture. That agricultural produce was stored and distributed on a large scale is probable from the evidence of large structures such as granaries or warehouses at three settlements. The availability of agricultural produce to support the work of non food producers will be one of the major means of differentiating between the members of separate communities. In this chapter, we have given an overview of the Harappan economy, to illustrate the background against which a detailed study of Harappan craft production and its role in the economy will be highlighted.

CHAPTER II

Historical and Ethnographic Data on the Organization of Craft Production

According to Binford (1967) ethnographic analogies should not be used to directly interpret archaeological data, but should serve as a foundation on which a postulate could be based as to the relationship between archaeological forms and their behavioral context in the past. The successful use of analogies can be accomplished in various ways. One criterion is that if the initial resemblances are such that the inferred property would account for the resemblances, then the conclusion is more likely to be true. A smaller number of cases with a large number of common attributes is more useful than a large number of cases with a small number of common attributes (Binford 1967; Hodder 1982: 16, 18). The postulate should then be rejected or confirmed on the basis of testable hypotheses. In his specific example of smudge pits as used for hide smoking, Binford illustrates his use of ethnographic analogy. In a later article, Binford (1972: 52-58) pointed out that the presence of a valid alternative need not disprove the original postulate which could only be disproved through hypothesis testing. When faced with valid alternatives, one could evaluate the relative strength of alternatives in probabilistic terms.

The proper use of analogy in archaeology must take

care of the relevant context or the functional and ideological framework within which material items are used in everyday life.

It is significant and cautionary to realise that the portion of attention that is devoted to craft production in the ethnographic literature is very meagre when economies of individual societies are being studied. The bulk of the data comprises information on agricultural or other basic subsistence production activities. Even the discussion on established "guild" organized crafts among the Nupe occupies only a small part of the total thesis. It may also be obvious from this chapter that a great deal of attention has been given to ethnographic references to pottery production, which bias is due to the large amount of ethnographic field work done in this craft. Also a number of very early ethnographic histories are useful where organization and techniques of craft production are concerned but may not yield much information from an archaeological point of view. More recent work is undertaken from an ethnoarchaeological viewpoint, with the development of this branch of study in archaeology.

Our aim in this chapter is to approach the ethnographic data with the concept of specialization in mind, so as to gain an idea of the variations in all aspects of craft production and be able to understand the

archaeological data, realising that there can be no automatic generalisations about production, degree of specialization and location of working. The presence of specialization in an economy is a reflection of the complexity in the socioeconomic make-up of a community, though scholars have differed about the exact threshold for the emergence of specialization. But first, it is imperative to define the concept of a "specialist".

The concept of a specialist generally entails that of a person engaged in an activity not undertaken by other members of the population and from which he makes his living. In this, he is provided with goods needed for his own subsistence by the consumers of the specialized goods he produces, in one of many ways. The degree to which he is supported by the rest of the community involves a variant of specialization which will be discussed below.

The beginnings of specialization are more in the nature of a basic division of labour on the basis of age and sex. The latter dichotomy is evidenced in the most primitive societies, where men undertook tasks of hunting and butchering, and women of food gathering, and looking after the household and children. Within the fairly distinct divisions of labour between the sexes, all adults are expected to fulfil all roles (Fried 1967: 62). Differentiation in tasks on the basis of sex has survived into the present, with a number of crafts in various

contexts being worked only by men, where women are not involved in production and vice versa. For example, among the Zande (Kandert 1978), the Basuto (Ashton 1967) and the Yoruba (Bascom 1969), women are the potters. In other communities, crafts like weaving and potting are carried out only by men.

Another distinction lies in cases where within the same craft, some objects are produced by men and others by women. The most common example is of handmade pottery production done by women and sometimes also by men, while wheelmade pottery production is largely only undertaken by men, in Upper Egypt (Blackman 1968). Among potters in Uttar Pradesh and Bihar, parts of ritual terracottas which are wheelmade are manufactured only by men, on injunctions against women using the wheel, while hand moulded parts can be made by women. It should be noted that women often perform subsidiary tasks in pottery production, such as preparation of the clay, painting and decoration, but the operation of the wheel is done only by men (Jayaswal and Krishna 1986: 54, 66). Such examples are furnished by potters of Baradia village, Gujarat (Fischer and Shah 1970) and at Takouchtem, Morocco (Beckett 1958: 185).

If we were to trace the development of craft specialization, ethnographic references to incipient craft specialization in the form of limited craft production by

a few chiefship societies would be significant. In a chiefdom, superior workers can be subsidized by the elite or influential members of society, resulting in family lines of production (Service 1971: 138). Control of craft production by higher status individuals has been evidenced in the societies of Hawaii, Tonga, Mangareva and Easter Island (Sahlins 1958). The role of specialization in ranked/chiefdom societies is amply brought out by Earle (1987: 69), with examples from Hawaii and the Inca realm where he emphasizes that goods used only as prestige/wealth goods must be scarce if they are to maintain their restricted use and value. The limited availability of such goods is reflected in the rarity of raw materials utilized and amount of skilled labour required in manufacture.

Specialization as a concept involves itself with a number of different aspects. Muller (1984) has asserted that site specialization should be clearly differentiated from producer specialization, so as to make the concept clearer. He feels that regional specialization is often only site specialization, in that people may pursue ordinarily a full range of activities and still undertake only a single activity at a particular location. This in effect is true, but depends largely on the activity being carried out at a single location. The production of salt (with which Muller is concerned) may not be seen as a

specialized activity in the context of the utilized technology, as every single individual in a settlement could produce salt, but if metallurgy or ore smelting is carried out at a particular location, then we must think of this activity as a regionally specialized activity in which the technology involved ensures that this activity could not be engaged in by any and every individual. Often, we find that "site specialization" is not indicative of true specialization, in the context of activities such as butchering of animals for meat. Such activities may be done in a special quarter and may not indicate actual specialization, but just a desire to locate an unpleasant activity in a particular place. The basic idea to be confronted is the question of part-time craft production. In Muller's specific example of the Great Salt Spring, in Southern Illinois, he tends to favour the view of a part-time extraction of salt or an activity undertaken on a seasonal basis.

Part-Time Craft Production

Part-time craft production is very common where craftsmen work on their own fields and also engage in crafts for the rest of the time, a phenomenon seen often with potters (Balfet 1965: 170; Thurnwald 1969: 114; Horne 1982: 11). Among the Nupe, blacksmiths practice agriculture on farm plots close to their homes (Nadel

1942: 264). The Yoruba smith, too, cultivates land, to which he can retire after he gives up his craft (Rowlands 1971: 213). Among the Pangwe in Africa, the smith only plies his trade as a secondary occupation (Thurnwald 1969: 129). For a number of crafts, such as weaving, and basket-making, part-time working would seem to be the only method of production. Weaving in the Sultanate period in India, was carried out by weavers working in their homes on yarn purchased by themselves or given to them by customers. Where expensive materials such as silk or gold and silver wire were involved or where products were luxury garments, weaving was done in Karkhanas or royal workshops (Habib 1982: 80) the production of dyestuffs, the production of salt and saltpetre and iron smelting and charcoal production in late 18th century Bihar were also part-time peasant activities (Raychaudhuri 1982: 281). Thus, in medieval India too we find that "the line of demarcation between agricultural and manufacturing activities was not always clear." (Raychaudhuri 1982: 279). Weaving in some parts of Nigeria though, is a full-time occupation for men. Most crafts engaged in by women are necessarily undertaken on a part-time basis. It can be noted here that often crafts engaged in in cities are practised on a full-time basis, while crafts in villages are often part-time (Vansina 1978: 363).

Seasonality of Craft Production

Closely associated with the above idea of part-time craft working is that of seasonality of production. We have many examples of the seasonal exit of labour, or a seasonal mobility between farming and craft working. Much of craft production is seasonal, that is, in the period of demand for craft products, the craftsman is busiest, while in the slack season, he turns to more usual economic activities such as farming. An important point to be noted here is that usually cultivation is the major occupation and craft production a seasonal one; the Hausa farmers in the dry season only work as blacksmiths (Hill 1972: 71). Seasonality of production could be for different reasons, according to demand or environmental considerations. Production and demand for new tools is often a seasonal factor, concentrated at a time when new tools are most needed, that is, at the start of the agricultural season, for example in the dry season in West Africa (Rowlands 1971: 212). The important point is that demand for products is such that it can be satisfied at the time of actual need. The craftsman finds little advantage in building up a stock of required goods, as he can fulfil the amount of demand at the required time. Furthermore, the scale of demand is such that the craftsman cannot afford to work full-time at his craft. In Sudan, men and women grow crops for six months and

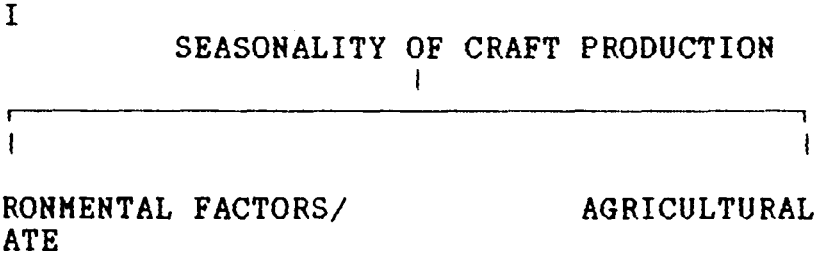
after the harvest, move from their villages to market centres and work at potting, blacksmithing and aluminium casting (Tobert 1985: 278). Farmers of seven villages neighbouring Cambay in Gujarat, undertake drilling of beads which becomes a major occupation in the period after the agricultural season in the monsoons (Trivedi 1964: 17). Potters in Pakistan, especially in the North West Frontier Province, combine farming and potting (Rye & Evans 1976: 115).

Activities such as mining, too, are engaged in on a seasonal basis, as in Northern Nigeria, where temporary settlements are set up to smelt ore and make hoes, and among the Angas, where mining begins after the harvest (Heek 1971: 149-50; Rowlands 1971: 212). Among the Hassa of Ghana, deep-shaft mining could be undertaken only in the dry season, due to climatic reasons and also coinciding with the low period of agricultural labour requirements, that is, after harvesting in December and before planting in April (Dumett 1987: 214). In Ratanpur, in Gujarat, agate and carnelian mining was done in the dry season, as such work could not be undertaken in the rainy season (Allchin 1979:100); the Yeke tribe in Zambia mine in the dry season only (Bisson 1976: 36); so also with copper ore extraction in Bambe in Angola (Birmingham 1970: 166-67).

Craft working on a seasonal basis was also sometimes

due to environmental factors. The iron working Agaria cannot work in the rainy season, as their smithies are in the open and unroofed (Elwin 1942: 185); baking of carnelian (in bead making) is also done in the dry season, making use of the hot weather (Arkell 1936: 302); floods prevent collection of clay for potting in Sokoto in the rainy months (Nicholson 1929: 46); shell diving in Kutch and South India is not undertaken in the rainy season (Kenoyer 1984 b: 102); among the Yoruba supply of products of weaving is low during July to September, as rain and lack of sunshine make dyeing difficult (Hodder 1967: 176-77). In the craft of potting, it is evident that work is slack during the rainy season.

Fig. I



In the archaeological context, part-time or seasonal craft working would be very difficult to discern. Literary evidence rarely gives us information in this regard, and in contexts for which no literary evidence is available, the task of distinguishing a part-time craft worker from a full-time specialist would be near nigh impossible. Attempts to decipher such differentiation have largely focussed on density of craft debris in a production locus,

such as that attempted by Spence (1981: 771). According to Brumfiel (1987: 107), at Huexotla, under the Aztecs, production debris was either ubiquitous, suggesting household craft working, or present in very light concentrations, suggesting part-time working. However, such inferences must remain largely conjectural. In the absence of an archaeologically detectable time-frame within which production was undertaken it would be difficult and valueless to differentiate between large and small amounts of debitage.

Seasonality of craft production, too, involves the important question of dichotomy or relations between farmers and craftsmen, which is invisible in the archaeological record. However, seasonal production can be inferred with some degree of confidence when we know that seasonality will place a halt on an activity for one season. Mining for ore or minerals, fishing for shell and pottery production, all require a dry season for such procedures. So we may then suppose that subsistence related activities were practised in periods not conducive for craft production or that craftsmen worked on stocks of raw materials. Working on raw material stocks is possible where craftsmen are separated from miners or procurers of raw material.

In the Harappan case, this variable, of the

seasonality of craft production can only be inferred and is not archaeologically detectable. For example, it can be inferred that the collection of shells for the craft of shell cutting could not be undertaken in certain months of the year when it would be dangerous to dive for shells. As for the claims of agricultural operations, in a period when agriculture would have been the mainstay of the economy, it is difficult to conceive of craft production being undertaken in agricultural peak seasons when labour would be required for operations such as sowing and harvesting.

Division of Labour

The division of labour concept is significant in a discussion of craft specialization. This can again be seen in different lights. The basic form of division of labour has been mentioned earlier, that is, between men and women. Division of labour on the basis of age is also evidenced, mostly centering on experience. In various crafts, young people are involved as apprentices, learning the craft from the specialist workers. In crafts such as potting, apprentice workers undertake subsidiary tasks for a number of years, till they are allowed to work the wheel. In a craftsman's family, it is usual to find children helping with various tasks. Many crafts, following a familial mode of production, will find apprentices who are usually relatives, as with black-

smithy, brassworking, glassworking and weaving among the Nupe (Nadel 1942: 263, 272, 277, 279) and among the Asante of West Africa (Arhin 1983: 473).

Division of labour in crafts is often first noted where procurement and processing of raw material is done by individuals or groups other than the craftsmen who work up the finished goods. Though a number of potters obtain their own clay, quite a few potters import clay, hence relying on others to quarry it. Thus the miners of agate and carnelian in the Narmada valley are distinct from the actual bead workers at Cambay: mining is done by the Bhils from surrounding villages (Allchin 1979: 88). In archaeological contexts, such a form of procurement of raw material is easily discernible, where production debris is found of a material which is not locally available. The inference underlying this assumption is that craftsmen located near a suitable raw material source will usually exploit that, rather than move out to find other sources.

Archaeological inferences have been made of cases where raw materials were probably collected and processed by groups other than the craftsmen of finished goods. An interesting example is given by Thurnwald (1969: 130) of metal working among the Kitara in Central Africa, where quarrying and smelting of ore is done by one tribe, the ore being "bought" from them by pig iron workers, who

break up the iron into various sizes, which is then obtained by the actual smith for working up into objects. Dyeing among the Yoruba reveals similar differentiation between processing of raw material and craft working, where one group of women prepare the dyestuff which is given to another group of women who do the actual dyeing (Fadipe 1970: 152).

Yerkes (1983: 500, 502) mentions such division of labour in his discussion involving stone drills and shell beads at Cahokia, where he considers that individuals who worked the shell beads were possibly different from those who manufactured the microdrills on the evidence that microdrills and related artifacts are largely found associated with shell material. Arnold (1987) also indicates that specialist producers of shell bead money were different from the producers of chert drills among the Pomo Indians though each group worked towards the same final product. The knowledge for each activity was handed down in different family lines. In these examples, we have strayed from distinctions between craftsmen and procurers of raw materials into separation of groups, some which produce tools with which other craftsmen work at their craft. With increasing complexity in techniques of production, producers of tools and procurers of raw material tend to become separate from actual craft working groups.

Subspecialization

Specialization is also indicated by division of labour on the level of differentiation between craftsman and between workshops, amounting to subspecialization. Specialization is inherent when one workshop specializes in a particular production process or production of a particular object. This can be best illustrated by examples. Among the glassworkers of Bida, we find different workshops working at different products, where one makes black bangles, another coloured bangles or black beads, yet another coloured beads (Nadel 1942: 276). Rowlands (1971: 211) gives an example from Kerma, Nubia, of a customer who takes iron to a smith for a dagger to be made, then takes the dagger to another craftsman for hafting and to a third for a sheath to be fitted. Among the wood carvers of the Kuba, some make bowls for pipes and others, stems (Vansina 1962: 191). Among the Akan-speaking peoples of the Gold Coast, too, woodcarvers sub-specialize into producers of stools, umbrella frames and drums (Manoukian 1950: 20). Smiths, leather workers and pottery manufacturers in Bida also subspecialize into separate product categories (Vernon-Jackson 1960: 53, 56, 58).

This discussion, however, largely centres around skill. Where particular craftsmen are skilled in production of an object, they concentrate in producing that

object. Thus, while we find that most smiths make and repair tools, only a few make artifacts like swords and spears (Rowlands 1971: 218). Similarly among the brass smiths of Bida, while bangles and ladles are produced by all, only a few smiths will specialize in sword hilts and daggers and others in figurines (Nadel 1942: 272); all Nupe potters make clay lamps and small pitchers, but large cooking pots, platters and tall pots are made by only some potters (Nadel 1942: 296). In the Fijian archipelago various islands specialize in the making of different kinds of mats (Sahlins 1962: 421-22). Ashton (1967: 159) mentions tanning and minor decorations in leatherwork as done by the owners of the skin, among the Basuto, but more elaborate work like matching skins, cutting, sewing and decorating is done by specialists. Differentiation among potters also arises between those who produce earthenware and those who make toys and images (Saraswati 1978: 32). Among the Dahomey, hoes and knives are made in most forges, but objects of a ceremonial nature are made by a special forge (Herskovits 1967: 44). Modern bead making at Cambay also reveals much division of labour between workshops. Looking at the map facing page 25 of Trivedi's (1964) book, we can see separate areas for 1) chiselling and shaping of beads; 2) grinding; 3) drilling and; 4) polishing. There are also areas where two or more processes are carried out in the same area, such as

chiselling, shaping and grinding; chiselling, shaping and drilling; and grinding and polishing. Incidentally, and interestingly, there is not a single workshop where every single process is undertaken from start to finish (Trivedi 1964: 25).

The significance behind this aspect of subspecialization is explicated by Chapple and Coon (1947: 255, 272), where they note that when a craftsman focuses on a single technique, he will develop more skill, as by "conditioning himself to a single motion or set of motions, he can acquire greater dexterity and greater speed." Here, the question of standardization is relevant, as the motions required to produce a particular object are used, as a matter of course, to produce a number of such objects. However, the issue of standardization becomes more relevant in later periods when mass production became a major mode of manufacture. In earlier periods uniformity would have been the result of particular requirements and the production of simplistic shapes and types. However variations in forms of artifacts reflect the skill of craftsmen.

Elaborations in standardized forms are very often a result of elite requirements. Hence, a more heavily decorated object,or a more richly embroidered garment will be produced for elite consumption. Thus, the issue of the nature of demand is relevant for our discussion on

subspecialization. As for quantum of demand, we find that if demand for products is low, then a craftsman would be forced to undertake the production of a range of products, rather than specialize in the making of a single product. This is well illustrated by Jayaswal and Krishna (1986: 60-62) where areas with sparse populations reveal centres of production on a low scale and production of ritual terracottas is undertaken along with production of pots and tiles, while religious centres and concentration of terra-cotta production in townships with high demand reveal a higher scale of production of only ritual terracottas.

Product specialization and division of labour between workshops would be clearly discernible in archaeological contexts. The latter would appear in differentiated loci for separate manufacturing stages of a single craft. Product specialization, too, would be evident from finds of a single artifact category being produced from a locus. This has possibly been evidenced at Mohenjodaro, with the find of a concentrated production area of the pointed goblet type (Bondioli et al 1984: 29).

Division of labour within a workshop is significant, as it indicates a high degree of specialization, where different tasks are allotted to different workers. A primitive form is noted with families of potters where

children collect raw materials, women prepare the clay and men shape products and fire them. In less primitive forms, there could be separate workshops, where various individuals work, not necessarily related to one another. An example of such differentiation in tasks is given by Nadel (1942: 276) of glassmaking among the Nupe. In individual workshops, tasks are divided between workers, for example, one prepares the liquid glass, another shapes bangles or beads, another adds coloured ornaments. Wulff et al (1968: 99) have given an example of similar organization of an industry at Qom, Iran, possibly related to ancient faience production, where within one observed workshop, three adults and six boys helped the master. One worker was responsible for collecting the raw material-blocks of quartz; another pounded and pulverized the stones; another mixed the gum; and others made the mixture into balls which were packed into containers and baked. Among the Cambay bead makers, division of labour on the basis of different tasks is indicated by different terms given to groups of workers. For example, those who cut the stones and remove the rough, outer layer are called "khondiya", those who smoothe the surfaces of shaped stones "ghasiya", and drillers are called "vindhar" or "sari" (Trivedi 1964: 14-17). The modern shell workers of Bengal also work accordingly. A bag of shells is given to a sawer to cut; bangle blanks are given to a grinder to shape and finally are returned to the merchant who

commissioned the work (Kenoyer 1984a: 330). As mentioned earlier for differentiation between workshops, the basic idea behind the specialization of individuals in separate processes within a single craft is to achieve greater efficiency and skill in craft production, though one should not lose sight of the fact that despite specialization, each worker within a workshop can yet be an all-round craftsman, as seen by the Nupe glassmakers (Nadel 1942: 276). The scale of demand is also a factor which will determine this level of subspecialization.

A number of crafts are, however, individual in nature. Among the Nupe in Bida, indigo dyeing was an individual craft carried out by women, each of whom had her own pot and made her own dye (Nadel 1942: 295). Woodcarvers of Dahomey, too, worked individually (Herskovits 1967: 77). Crafts individually undertaken would be those for which very simple tools would be required. Crafts utilizing locally available raw materials would hence require no elaborate mechanisms for procuring raw materials. Thus, spinning and weaving are important individual crafts as they complement other subsistence strategies such as agricultural operations. Basket making and mat making would also be individually undertaken crafts. An example of independence among craft workers is given of the jewellers of Dahomey who may work together and share the same forge, but are not controlled

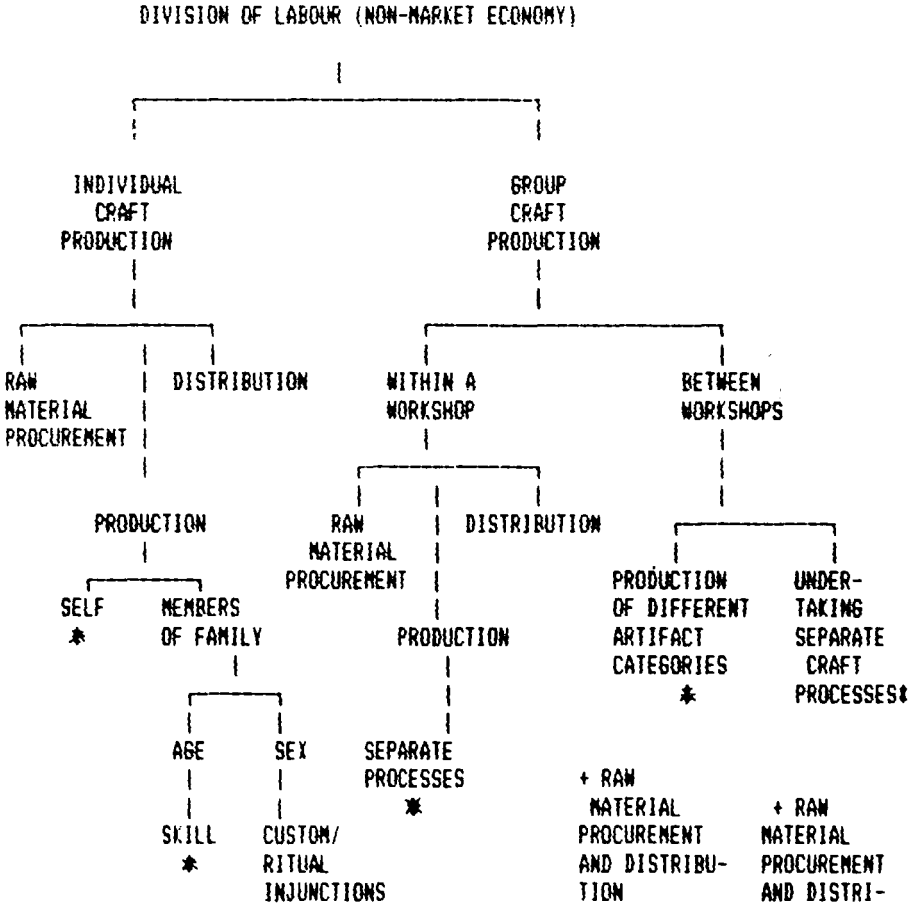
as to the time they work, what they produce, how they sell their produce, or what prices are obtained for their work (Herskovits 1967: 77).

Despite individuality, a large amount of cooperation is often found between separate workers. This is often seen among potters who fire their products on a communal basis. Perhaps the best example of cooperation is that of the ironworkers and weavers of Dahomey, among whom exists the practice for one smith/weaver to buy a quantity of raw material and keep it till such time as it is his turn to avail of the labour of his fellows for whom he has been working in the meantime. When his turn arrives, all the members convert the raw material into finished goods, which he sells and whose proceeds he keeps (Herskovits 1967: 75-76).

The degree of independence as enjoyed by the jewellers of Dahomey is rarely seen in most established crafts. A large number of craft groups are organized under a "chief". Occupations undertaken by the Kanuri of Bornu, are organized under headmen in each settlement and under an overall headman for the entire occupation who lives in the capital city (Cohen 1967: 80). Dahomey weavers were strictly controlled by a chief heading the principal group from whom permission was required even to reproduce a design (Herskovits 1967: 76). In a number of

cases crafts are organized on the basis of guilds (prevalent only in market economies), concentrated in different families. Most artisans belong to groups of families and in many examples, all male members of the family work at the same craft. In such organization, we see the survival of societies structured on lines of kinship. Apprentices are usually relatives and rarely outsiders. Examples are of the brassworkers, iron workers and weavers of Dahomey (Herskovits 1967: 45, 48, 103); blacksmiths among the Zande (Kandert 1978: 513); bead workers of Bida (Nadel 1942: 283).

Fig. II



*: Archaeologically detectable

Archaeological clues to decipher organizational complexity in craft production lie in estimates of size of activity areas and the number of manufacturing stages performed in close spatial proximity (Tosi 1984: 24). Household crafts can perhaps be discerned by finds of spindle whorls in dispersed contexts. Finds of a specific production activity at a single locus could indicate individual working of a single stage of production in a craft distinguished by different stages. Such finds would obviously differ from individual crafts such as basket making or weaving. The basic point of difference lies in crafts such as basket making, as a single process, engaged in by a single person and probably for use by that person. In more complex crafts, where different processes and skills are involved, each process may be engaged in on an individual basis, but is not independent of the final product. Examples of the latter are seen at Cambay, where different stages of production in bead making are engaged in by different groups or individuals. To fully explicate the above, we may consider the case of farmers outside Cambay town, engaged in drilling beads on an individual basis (Trivedi 1964: 17).

Most data regarding Harappan craft production appears to relate to individual craft working. Bead making indicators at Chanhudaro indicate much work done on an individual level with possibly some amount of differen-

tiation between separate processes. Thus a person may flake or shape beads or grind them and polish them or drill holes in them. Most craft production indicators that we have such as, of unfinished objects in various stages of completion, indicate a particular process being undertaken there. Thus a seal found unshaped or uninscribed indicates the shaping or carving process was underway, or a seal found unglazed suggests the seal had to be glazed next. A bead found roughly flaked suggests further grinding to be done while unbored beads suggest this stage had to be undertaken. Beads broken while boring could imply the locus of a bead driller. There are numerous such examples in the Harappan culture which will be detailed in the following chapters.

Skill on the part of craftsmen as dependent on age and experience is best delineated in the craft of seal making. Here skill and expertise and the lack of it are exemplified by technically perfect seals and those seals suggesting the work of an apprentice. Seals where outlines are drawn first could indicate the work of novices.

Separate processes within a single craft undertaken in a single workshop could be archaeologically detectable as would be separate craft processes and manufacture of separate artifact categories between different workshops.

In the Harappan culture, we have hardly any such examples. In the first place, we have few examples of workshop production and where we may have them, as in the bead workshop at Lothal, it is not clear whether different craftsmen worked at separate processes. This is inferred so, on the basis of individual craft workers at other Harappan sites working on separate craft processes. At Balakot, it is possible that separate craftsmen or workshops worked at the cutting and shaping of Turbinella pyrum bangles and these differed from the craftsmen working with Tivela damoides. The two species of shell involved different technologies in dealing with them.

What next comes up for discussion are the concepts of independent and attached specialists, which according to Brumfiel and Earle (1987) are central to a consideration of specialization and complex societies. The major difference between the two kinds of specialists is seen to lie in the consumers. Independent specialists provide goods/services for an "unspecified demand crowd that varies according to economic, social and political conditions" while attached specialists undertake production for a patron, either a social elite or a governing institution. The concepts of independent and attached specialists are important as they can provide a fulcrum on which a number of aspects depend, right from procurement of raw material to consumption of finished

producers' outputs by merchants became widespread. Cloth, yarn, wool, agricultural products, saltpetre, and indigo were bought by middlemen (Chicherov 1971: 162-64). Thus merchants and entrepreneurs were buying the labour of craftsmen rather than buying their products (Chicherov 1971: 173). Artisan-entrepreneurs are a rare group in medieval feudal societies given the difficulties for upward economic and social mobility of craftsmen. However there are examples where some craftsmen were able to get ahead of their fellow workers as noted in a sixteenth century inscription of the Vijaynagar period. The inscription mentions, in the context of the number of taxable looms, that Gurivi Setti of the weavers' caste had 65 looms and another weaver had 12 looms. This must indicate that there would have been dependent artisans (Chicherov 1971: 166).

Regional Specialization

One form of specialization-regional specialization-which was partly discussed earlier in Muller's site specialization, should not be neglected. This concept involves the idea of a locality, a unit of area, focusing on a single production process or product. In a large number of cases, reasons for such localization depend on proximity to a raw material source, as noted by Blouet (1972: 7). Examples are pottery production among the

Arikuyu of British East Africa (Thurnwald 1969: 123); the Kuba (Vansina 1978: 362); the Yoruba (Bascom 1969: 102); in the kingdom of Dahomey (Herskovits 1967: 46); in Ibadan (Callaway 1967: 158) and with charcoal production in Iran (Horne 1982: 10). However, we can neither accept that proximity to a raw material source implied craft production nor that all crafts were located near raw material sources. Differential loci for production could also depend on custom, restricting manufacture of a particular product to a certain area and of another to a different group and area (Herskovits 1974 [1940]: 150). We have the example of the inhabitants of Fergusson Island who do not manufacture pottery, despite having good local clays which are exploited by the Amphlett Islanders. We also have the example of shell diving for the discs or kaloma in the Trobriand Islands. Fishing of the shell and manufacture of the discs is forbidden to the inhabitants of nearby villages, while the inhabitants of Sinaketa alone can undertake these activities (Malinowski 1964 [1922]: 367).

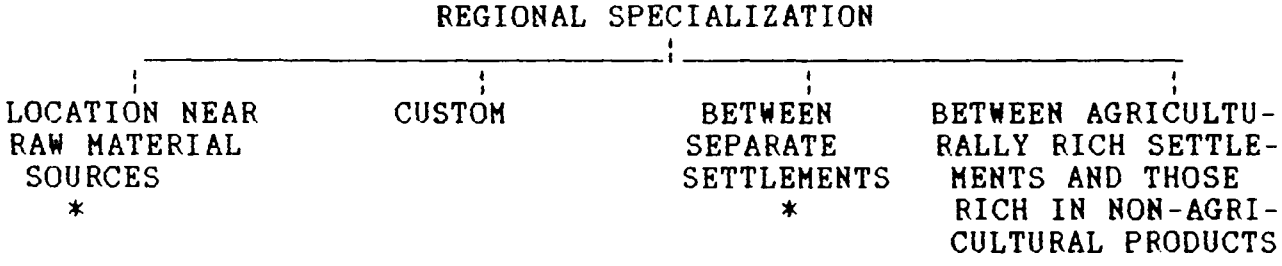
In other cases, we find different villages given over to different crafts, such as among the Ashanti, where different settlements concentrated on cloth weaving, cloth dyeing, pottery production, wood working and metal working (Arhin 1983: 473). An interesting situation comes up when a whole village is given over to a single craft. Then one

may, in all fairness, ask as to what could be the source of subsistence of the craftsmen. To answer that question, one must first locate the consumers of goods produced by that particular settlement. On the other hand, we must speculate that craftsmen had their own fields, which are worked by themselves or their family members. Ideally, such specialized settlements must be suburbs of a larger settlement which functioned as a consumer base of goods produced by the smaller satellite settlement.

Regional specialization is also indicated in situations where craft goods are exchanged against agricultural goods. People in areas that are less fertile and unable to support themselves in subsistence goods, divert their energies toward manufacture of craft goods which are exchanged with areas that are more fertile and concentrate on agricultural production. Such a situation is clearly brought out by Sahlin's (1962: 420) study of Moala and inter-island trade between the Fijian islands, where infertile islands concentrated on craft production and fertile islands such as Moala on cultivation of yams. A precautionary note in accepting this information lies, however, in the realization that Moala and other islands were largely kinship oriented societies and such cooperation seen in regional specialization and exchange was largely accomplished through various kin transactions. The significance of kinship was noted in cooperation

between islands which mitigated ecological differences between islands, resulting in a situation where fertile islands which could produce craft goods, did not do so, in fact, thus sustaining the trading potential of agriculturally poor islands (Sahlins 1962: 420-22). Such a situation may not, however, occur in more complex societies and especially in a money economy, where competition will not allow such cooperation.

Fig. III



* Archaeologically detectable

Archaeological investigations into regional specialization are possible when raw material sources can be located and when settlements are noted in proximity to the source of raw material, along with evidence of craft working in the settlement. With recent scientific advances, it has been possible to pin down sources of a number of raw materials. Source areas of materials, like lapis lazuli, can be pointed out, as their occurrence in nature is limited. Even without being located close to raw material sources, a number of settlements which show through their occupation assemblages, adherence to a single craft would

qualify for regional specialization in craft production.

Regional specialization as resulting from location of a population near a required raw material source, is exemplified in the Harappan culture in the craft of shell working. At Nageshwar and Balakot, the population appears to have primarily focused on the production of shell objects. At Shortughai too, the settlement revealed evidence of the working of lapis lazuli which is locally available. Regional specialization between separate settlements in concentration on a single craft is also exemplified by the sites of Nageshwar and Balakot, but more so at Balakot, as at Nageshwar some pottery production was also undertaken.

Itinerancy

Before we go on to various aspects of craft production and the ethnographic evidence in that regard, we can discuss one more type of craft worker, that is, an itinerant craft worker. Itinerancy in craft working is by no means rare. We have various examples of craftsmen, who are highly mobile and who generally undertake a single craft working activity. Rowlands (1971: 214) is, however, of the opinion that there is no real itinerancy and that the itinerant smith divorced from any social context is rarely found in simple societies and gives an example that though smiths are dispersed in Tonga, each, however, has a

fixed workshop in one village and travels to other villages in the vicinity. We have a few examples of itinerancy in craft working, but in a money economy: the Gadulia Lohars in India are semi-nomadic and have no regular base of working in any village (Mishra 1977); and dhokras or itinerant casters who set up foundries on the roadside, where they produce their wares (Saraf 1982: 10). Kenoyer's (1984a: 331-32) study of shell working in Bengal has revealed that some amount of itinerancy is present though mostly secondary work is done by the craftsmen. It appears that one or two members of most families go to outlying villages to sell their wares. They carry a few basic tools and sometimes bangle blanks to make a few quick bangles. The output must be very low as they undertake mainly repairs and little manufacture. Nicklin's (1979: 443-44) perusal of ethnographic literature concerning the location of pottery manufacture has revealed a number of cases of potters travelling to areas away from their village and in some cases to remote areas to produce pots. It should be noted that itinerancy would largely be noted only in complex societies with a money economy. In simpler societies, it is difficult to conceive of craftsmen travelling distances to produce and dispose of manufactured products to people not known to them. The attachment to land which is an important feature of these societies would also preclude such movement. The diffi-

culty of obtaining raw materials in the absence of money and a market situation and of customers who are not directly or socially related will prevent much movement of craftsmen. The products they manufacture may be transported, but rarely the craftsmen themselves. Travelling craftsmen sent to work under the aegis of a political authority are known of, but these would be attached specialists, not independent itinerant craftsmen.

In any case, itinerancy would be very difficult to detect archaeologically. The mobility of these craftsmen would not leave too many traces and to presume itinerancy from scale of working, that is, from scarce remains of craft working would be too conjectural. Such an archaeological pattern could be the result of other kinds of behaviour, perhaps part time craft working, perhaps a household scale of working.

What is left for discussion are the various aspects of craft production itself. These are procurement of raw materials, types of goods produced, the quantum of production, and the location of craft activities. The various forms that these aspects will take will depend on the economic structure of society, on the presence or absence of a money economy and the market, and on the nature of the consuming group. Raw material procurement for a number of crafts undertaken at an individual level will be by the craft producers themselves. Thus, raw

materials for basket and mat making, clay for potting may be procured by the craftsmen. Procurement of rare or exotic raw materials will be difficult for individual craft workers, especially when source areas of the raw materials are distantly located. In less developed societies, craftsmen requiring exotic raw materials will be dependent on the elite members of society to obtain these materials on exchange expeditions or have them brought in as tribute. An example of elite procurement of raw material is given in the context of the feathered cloaks worn only by high-ranking males in Hawaii (Earle 1987: 70-71). Initial procurement of the feathers for the cloaks indicates the control manifest in the system to preserve the special nature of such cloaks. The skins of feather bunches were valuables apparently used in exchange, but specially used as tribute payments. Feathers were an important annual tributary payment made to the paramount chief by communities where the birds were found. In more developed cases, one may find that raw materials are brought in by a separate group, engaged solely in trade, transporting raw materials and finished goods (Meek 1971: 148; Nadel 1942: 200), or through the efforts of craftsmen themselves when they are organized in guilds, such as among the Nupe (Nadel 1942; Vernon-Jackson 1960: 52). A good example of raw material procurement dependent on the structure of the economy is of the glazed

ware potters from Quetta, Multan and Hala who purchase clay from contractors, so as to spend more time on actual production (Rye & Evans 1976: 127).

Procurement of Raw Material

Potters often use clay dug in the vicinity of the work area (Nicholson 1929: 45-46; Rye & Evans 1976: 127; Shah 1985: 21; Dietler & Herbich 1989: 150). In fact, Arnold (1985: 50) found that exploitation of clay sources within a territory of 1 km accounted for 33% of his sample, and taking a larger area, exploitation within 7 km occupied 84% of his sample. It should, however, be remembered that proximity to clay sources by no means implies location of pottery production, as mentioned earlier for regional specialization. The best example is of the clay resource at Yayawana on Fergusson Island in Melanesia, which is not used by the people in the vicinity for pottery production, but instead, the Amphlett Islanders come to fetch supplies of clay from here (Nicklin 1979: 442). Rye and Evans (1976: 127) mention a potter in the Chitral valley, Pakistan, who used a distant clay source, but instead of importing it, travelled a full day for clay gathering. There are numerous other examples of import of clay from far areas, such as brought to the Yoruba towns of Abeokuta; potters from a quarter of Bida obtain clay from itinerant vendors bringing supplies from Badeggi, 10 miles away; the Kutchi Kumhar potters of Poona

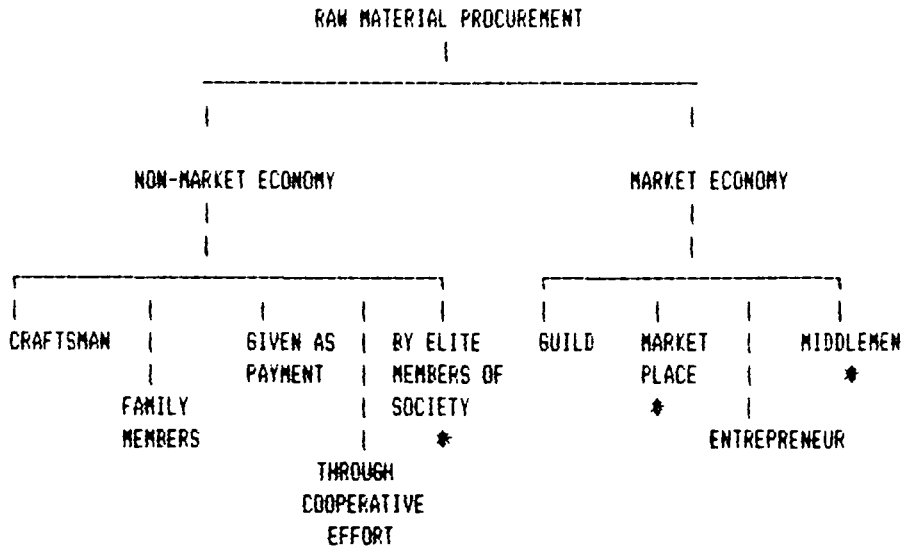
who import clay from 3 miles away; in a potter's establishment at Lahore, clay is brought from three different sources, one 80 miles away, white clay from a source 200 miles away and China clay from 300 miles away (Nicklin 1979: 445).

We find other interesting means of procurement of raw material, for example, where the customer gives a smith, raw material and often along with it, fuel and even his labour for production of the tool he requires (Rowlands 1971: 211; Thurnwald 1969: 124). We have already mentioned earlier a means of procurement of raw material in a cooperative manner, among iron workers and weavers of Dahomey where raw material is obtained in turn by each member of a group worked by the labour of the whole group. The glassworkers of Bida also have a system where raw glass can be obtained by a workshop from another workshop where glass is being made. In return, soda and sometimes firewood or money for firewood is contributed (Nadel 1942: 276).

With the introduction of money and the market, raw material procurement becomes a matter of purchasing the required materials, like the Gadulia Lohars who purchase scrap iron from the market (Mishra 1977: 63). Modern examples of cooperation between workers for the purpose of obtaining raw materials is seen in the Cambay bead making

industry, where dealers or middlemen obtain materials, store them and pass them on to craftsmen for further processing (Trivedi 1964: 25).

Fig. IV



*: Archaeologically detectable

Procurement of raw material would only be archaeologically discernible when stocks of raw material are kept in elite areas or residences unassociated with other craft production indicators. Similarly, in market economies, the presence of raw material stocks ı the actual marketplace or in residences of middlemen or traders or entrepreneurs, that is, in contexts divorced from actual craft working indicators would specify the mechanisms for the procurement of raw materials. The only form that would be archaeologically visible in non-market situations, which is procurement through the elite members

of society, has no examples from the Harappan culture.

Production and Demand

The question of what objects are produced depends on demand. Utilitarian objects of daily use are produced by craftsmen on direct demand by consumers. It is not really correct to say that independent specialists produce for an unspecified demand crowd (Brumfiel & Earle 1987: 5-6). In primitive societies, we are not dealing with a market economy, where goods are produced large scale for marketing. In such societies, manufacturing is done largely on directly expressed demand.

Thus, agricultural tools are produced only in the period of their requirement. No stocks of finished products are manufactured and stored by the smiths among the Pangwe in Africa (Thurnwald 1969: 129) and the Wabena potters of Tanganyika (Culwick 1935: 169). Among the Nupe blacksmiths, it is interesting to note that a store of hoe and axe blades will be manufactured by blacksmiths, but this is done in the busiest time of the year for blacksmithy in May and June, and not in the slack season. Products are disposed of in nearby villages (Nadel 1942: 264). In some cases, we find a different pattern as in Gujarat, where some potters produce a stock for the monsoon period, during which work cannot be done (Fischer & Shah 1970: 124).

Even in a developed society, as discussed by Jayaswal and Krishna (1986), in modern-day Uttar Pradesh and Bihar, in the context of terra-cotta figurine production, we find that such products are manufactured on direct demand, a result of transactions between craftsmen and the jajmana; similarly with the Yoruba weavers (Hodder 1967: 176). The work of what one would call "attached specialists" will also be according to a specific demand. Thus we find that the craft of bead making by the Yoruba of Southwest Nigeria, where the products such as crowns, caps and other solidly beaded pieces were used by kings and hence, much work was done under royal patronage (Bascom 1969: 102). Another example is that of the Aqllakuna - women given over by their local community to the Inca for working at textile manufacturing and maize beer production (D'Altroy & Earle 1985: 190); so also silversmiths from Chimu, working for the Inca (Murra 1980: 157, 163); and craftsmen sent to work in distant villages for high chiefs in the Fijian Islands (Sahlins 1962: 354). Manufactured products were also given as tribute, such as rough cloth woven by commoners' households and given to the state (Murra 1962: 716). Archaeological interpretation of manufactured products brought as tribute would be difficult to discern, in some cases such as cloth, but would be easier with more durable materials, found in contexts such as temples, palaces or royal mausolea.

Thus, what we do find is that production becomes divided into two categories, depending on the nature of the products manufactured. While discussing craftsmen groups in Dahomey, Herskovits (1967: 47, 48) mentions that most of them deal in luxury goods (brass, gold and silver objects, clothes for chiefs, stitched designs on ritual cloths), and only the wood carvers make both utilitarian and ritual-associated articles. Similarly, the work of the brass and silver smiths among the Nupe is located only in Bida as products manufactured are solely luxury products, and though these are also taken to outlying settlements, only in Bida is a constant demand ensured (Nadel 1942: 270).

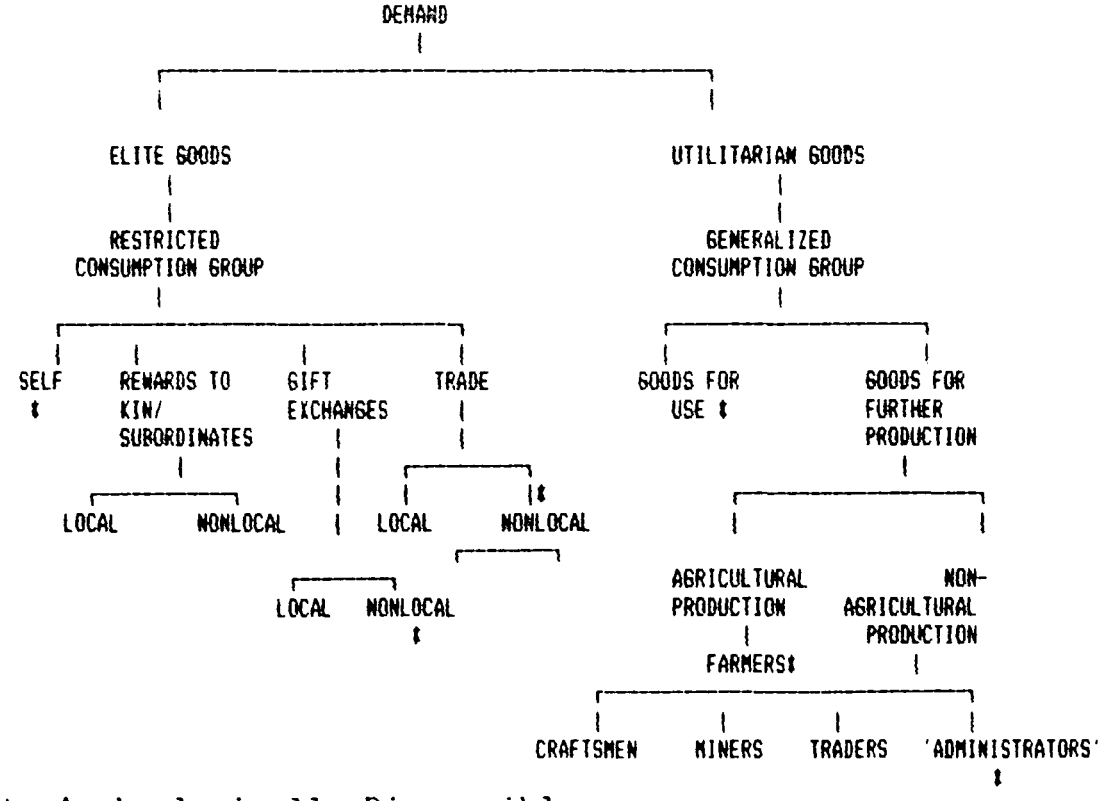
The quantum of demand that made the work of the Bida brass smiths lucrative is not something which is decipherable in an archaeological context. Archaeologically, the quantum of demand would translate into the scale of production, which in itself is not easily realized. Some indicators may, however, give a hint in a relative fashion. It could be said that the construction of permanent facilities to aid craft working could indicate that the proceeds from craft production may be substantial. This is especially so in the case of a craft like pottery production, as firing of pots could easily be done in temporary installations. (With other crafts such as metallurgy, permanent facilities would be needed, as

higher temperatures are required which would be difficult to obtain for sustained periods in open fires.) Ethnographic inferences suggest that unspecialized craftsmen and those consuming the products they manufacture are likely to use temporary facilities, such as open fires for baking pots, as contrasted with specialized potters who will use more permanent facilities (Alden 1982: 99-100; Balfet 1965: 166). We have a number of references to the use of open fires/bonfires for baking pottery (Thomas 1910: 98; Birmingham 1975: 381; Rye & Evans 1976: 165-66; Hegde 1977-78: 110; Tobert 1984: 141). Thus, the only way to detect pottery production with temporary facilities, could be through scatters of vitrified sherds. Rye and Evans (1976: 164) also mention that for open fires and bonfires, the fuel used (in the context of Pakistan) was largely dung mixed with straw, while wood was used for divided firing, where fuel and pots are kept in separate parts of a furnace. Thus, the use of dung for open fires indicates the use of a fuel commonly available in a domestic context, while wood used for fuel would have to be specifically collected or brought for the purpose. The use of dung for fuel instead of wood could also reflect a scarcity of wood due to deforestation.

It is also clear that where kilns are constructed for firing pottery, the purpose is to fire a large quantity of

pots; otherwise, the firing would be wasteful. In open fires, a much smaller number of pots could be fired. In the Kathmandu valley, most potters lit small bonfires once or twice a week as required (Birmingham 1975: 381). In updraught kilns used in Upper Egypt, 500 to 700 vessels could be baked at each firing (Nicholson & Patterson 1985: 230). Kramer (1985: 80-81) mentions that potters working on a large scale must have enough space (specially restricted in an urban context) for storage of finished vessels or must be able to dispose of pots on a regular basis. The scale of production may be more directly identified if we find a large (in a spatial context) production locus in a settlement, with the replication of a number of production processes.

Fig. V



*: Archaelogically Discernible

The use of valuables or elite goods by elite members of society could be exemplified by the find of two identical faience spindle whorls in the Great Bath area on the Citadel mound at Mohenjodaro (Marshall 1931: 469). The use of elite goods in non-local trade could be inferred from the finds of etched carnelian beads and long barrel-cylinder carnelian beads at Mesopotamian sites. The use of utilitarian goods is seen from finds of querns, mortars, pounders, and stone tools. Goods for further production are primarily tools used by farmers such as sickle blades, hoes or ploughs; by craftsmen such as engravers and awls for seal carving, drills for perforating beads and hones for grinding beads; heavy duty tools would be used by miners; weights would be used for weighing objects and materials and seals for sealing packages and for identity. All these goods are visible in the Harappan culture, except for heavy duty miners' tools and hoes and ploughs for farming.

There has been a suggestion that the work of "attached specialists" resulted in products that were higher in labour investment, as compared to the work of "independent specialists" (Earle, Costin & Russel 1986: 4). It is possible that products manufactured for consumers who could afford superior workmanship will be more carefully manufactured. High labour investment may be, but not entirely, due to the nature of the products

manufactured. Sometimes, the utilized technology may be such that even utilitarian products may require a considerable amount of labour.

Location of Craft Production

We next go on to the location of craft working. We have a number of examples of what we would call household craft working. In fact, we have overwhelming evidence of craft specialists working in domestic contexts, in workshops attached to the home, or in the home itself. Such a pattern has been termed a "household industry" by Santley and Arnold (1986: 9-12), where they consider all aspects of production activity to have taken place within a 50 m radius of a craftsman's (in their case, a potter) residence. Potters appear to have been particularly suited towards a domestic pattern of production location and activity, as is seen in the case of the Pakistani potters (Rye and Evans 1976: 168), women potters in Sudan working in their compounds (Tobert 1985: 279) and potters in Bailen, Spain (Curtis 1962: 488). Pottery firing is often also done within the potter's homestead (Saraswati 1978: 111). Of other crafts, too, we have significant similar information - among the Hausa at Batagarawa, forges are attached to the houses of blacksmiths (Hill 1972: 212); the Asur of India engage in metal working within their own compounds (Leuva 1963: 32); weaving and

cloth making are other crafts carried out in the family compound itself, in Ibadan (Callaway 1967: 158). In the Nupe kingdom of Nigeria, in the presence of a money and market economy, we find that a number of established crafts are carried out in the home itself. Bead working is carried out in the entrance hut of the craftsman's compound, brass smiths worked in their house compound, and workshops of glassmakers are in the living quarters of the craftsmen (Nadel 1942: 283, 270, 278).

In some cases, a separate shed is built for craft activity, but which is merely an adjunct to the house, as is seen in Takouchtem, Morocco, where a shed is attached to each house, equipped with the tools of the potter's trade (Beckett 1958: 185). Weavers in Dahomey, too, have separate shelters for their looms near their compounds (Herskovits 1967: 45). Buhari potters in South Gujarat have a studio directly across the road from their houses (Shah 1985: 98). Distinct workshop activity is noted among the Yoruba, where occupations of blacksmiths, potters and cloth dyers are carried out in locations separate from the home (Mabogunje 1967: 40) and among the Kafficho in Abyssinia, where smiths undertake their occupations in workshops (Thurnwald 1969: 122). Nadel (1942: 259) also notes that though in some cases a blacksmith's forge is located in the entrance hall of the residence compound usually the forge is in a separate hut

which stands at a short distance away.

Where archaeological evidence gives information of craft related activity in conjunction with domestic artifacts, inferences of a craft on the scale of a household industry are not too far fetched. However, to deduce household industry as being of small scale or catering to a local demand or being unspecialized, would be erroneous, as Nadel's example of glassmakers and bead makers would show. Such crafts as noted earlier were specialized to an extent of depicting considerable division of labour in production and yet were located in household contexts. In Cambay, various bead making processes were centred in homes (Trivedi 1964: 25). In fact, a survey found that 89% of 446 units saw bead making carried out in the front/verandah/upper portion of the craftsman's residence (Trivedi 1964: 29-30). At Tikal, Guatemala, evidence of flint and obsidian workshops were found in groups of dwellings in the central zone (Haviland 1974: 194).

Proximity of a production locus to a patron's residence has been an archaeological indicator of attached specialization, so long as elite residences can be distinguished. Where craftsmen are attached to "ceremonial centres", the evidence is even more direct. In Shang China, some craftsmen certainly worked within the precincts of sacred enclaves. In the An-yang core, two

bronze-casting and working areas, a jade and stone workshop and a bone working area were discovered at the important site of Hsiao-t'un (Chang 1980: 98-99, 233-235), though there were dispersed workshop areas surrounding the palace area (Chang 1980: 124, 126; Wheatley 1971: 74). Out of the three Shang crafts, bronze working, pottery production, and stone and jade working, only bronze working seems to have solely focused on elite consumption. In both pottery production and stone and jade working , we find the production of a variety of products such as slate harvesting knives aimed at different consumption groups. Spence (1981: 760, 771-72) noted that some obsidian workers were engaged periodically within the precincts of major structures and were probably overseen by the state. This settling of craftsmen close to their source of consumption is conceivable, though in the Shang, as in the Inca case (Rowe 1982: 103), such settling could be instituted at the instance of those in authority. The production of utilitarian items in such contexts could also indicate the interests of the elite in such activity.

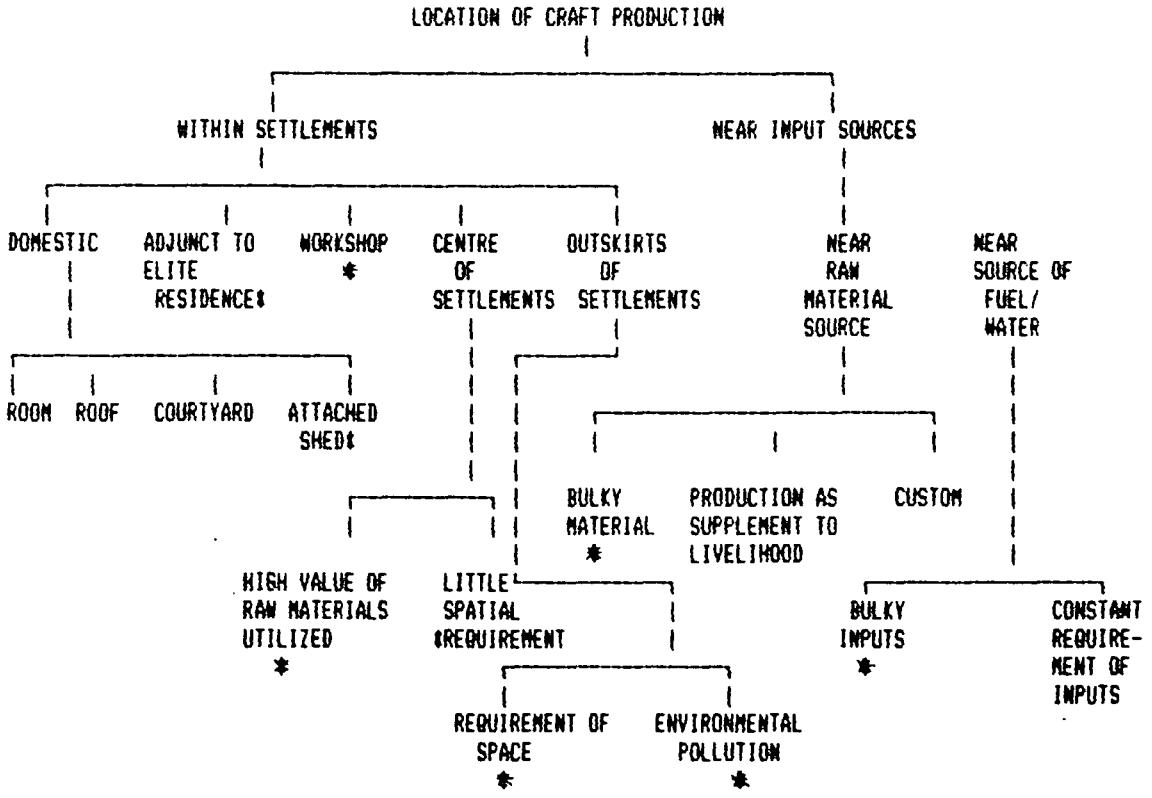
Differences in the location of craft production in the centre of settlements or in the outskirts are quite significant. Such locations could depend on diverse factors, such as security for production of a wealth good to environmental reasons. An example of the first is evidenced from five sites, Uruk, Shahdad, Shahr-i Sokhta,

Altyn Depe and Tepe Hissar, where areas for semi-precious stone working were concentrated in residential areas within urban boundaries, perhaps because the raw materials used in the craft were procured from distant sources and were valuable (Mariani 1984: 122). However, from the same sites, we find other crafts located at the periphery of the settlement, largely due to environmental reasons. Crafts such as pottery production and metal working were often relegated to such locations to prevent air pollution in residential areas. However, such locations could also be a result of the scale of production. Large residential workshops and establishments would probably not be located in central areas of habitations as such areas were generally the most densely populated.

A number of ethnographic references are, however, available on potters firing their pots in their own courtyards, which could be understood in terms of the scale of their operations, where if craftsmen baked pots in open fires and where no facilities were constructed, little discomfort to the community can be envisaged, and requirements of space would also not be large. Also, since most firings were individual in nature, not much pollution would have been produced. Where communal firing of pottery is resorted to, this is done in an open area outside the living space. Sometimes pottery production was so displaced from the centre, that a separate suburban complex

existed solely for the craft. Such seems to have been the case at Shahr-i Sokhta, where the suburban settlements of Tepe Dash and three other loci to the east and south of Shahr-i Sokhta were founded (Tosi 1984: 31, 42). Similar locations for purely environmental reasons can be adduced with tanning activities (Nicholson & Patterson 1985: 226) and with shell working, due to the stench emanating from decaying organisms in shells. Shell working in modern contexts, too, is located on the periphery of settlements for precisely this reason (Kenoyer 1984 b: 107).

Fig. VI



* : Archaeologically detectable

Data from the Harappan culture exemplifies most of

the forms delineated by the above discussion on the location of craft production. Evidence of domestic craft production are plentiful, with innumerable cases of unfinished objects, found in houses such as beads, seals, metal objects, shell objects and weights. Other examples are of waste products of craft working fragments of sawn and partially worked steatite and a bone object like a stylus in room 127 in House X, HR Area of Mohenjodaro (Marshall 1931: 184); chank shells, columellae and unfinished bangles in house 159, Block G of Lothal (Rao 1979: 122). Evidence of working in a courtyard could the kiln in House VII of HR Area at Mohenjodaro (Marshall 1931: Pl. XXXIX). Craft working in an attached shed or adjacent to the house is not so clear in Harappan settlements, but the kiln located in an enclosed area between houses XXII and XXIV in Section A of VS Area at Mohenjodaro (Marshall 1931: Pl LVII) could indicate craft production undertaken not inside, but near the home. Craft production in elite areas is also not very common, but there are a few examples. The surface survey at Mohenjodaro revealed small spreads of the working of lapis lazuli and metal working along with some shell debitge and pottery production on the Citadel mound (Bondioli et al 1984: 27).

Non-domestic workshop production would be archaeologically discernible, but is not quite common in the

Harappan culture. Room 215 with its adjacent furnace on Mound II at Chanhudaro could represent a workshop; so also the bead factory in Block G at Lothal. Evidence of craft production in the centre of settlements due to the little space required is evident from the myriad examples of indicators of craft production in the form of unfinished objects, tools and debitage that is revealed from within houses in the centre of settlements such as Mohenjodaro, Harappa and Chanhudaro. Crafts requiring little space for production purposes are mostly bead making, seal making, weight making and the production of shell objects. Craft production undertaken in the centre of settlements on account of the high value of raw materials utilized is not so clear from Harappan sites. Craft working in the outskirts of settlements due to requirements of space is probably exemplified by the large spreads of kilns and pottery wasters that are noted on the edges of the settlement of Mohenjodaro (Bondioli et al 1984: 27). Craft production undertaken in the outskirts to prevent polluting the environment is to be noted in the location of the initial processes of shell working on an isolated mound to the northeast of the main mounds of Mohenjodaro (Kenoyer 1984b: 107).

The best example of the location of craft production near a raw material source is the production of beads from lapis lazuli at Shortughai. Apart from shell working at

Nageshwar and Balakot, we have no other examples of craft production undertaken near raw material and fuel sources but it is inferred that much of the initial ore-smelting operations were probably undertaken near the source of ore and fuel. There are not many examples of the proximity of craft production to water sources save the smithy at Lothal located near the river (Rao 1979: Pl. XXXVIII).

Another point discussed earlier under regional specialization is also of relevance here: the source of the inputs. The location of craft working is sometimes dependent on the location of the required raw materials. Numerous examples of pottery being produced near the source of good clay were mentioned earlier; so also imports of clay from distant sources. Water is essential for some crafts as seen in the case of the dyers' workshops in Persia (Wulff 1966: 193). Some scholars note that proximity to fuel sources is not essential as any combustible material can be used to bake pots. This is likely as much pottery firing can be done in open fires. However, where metallurgy is concerned, a comparatively large amount of fuel would be required. Nadel (1942: 269) given an example of the work of iron workers being interrupted when they ran out of raw material; a similar situation could arise with fuel. However, much appears to hinges on the particular craft and the scale of work undertaken. With a craft such as bead making, it is

conceivable that nodules of raw material could be transported to the producers, rather than it being necessary for the producers to settle near the source of raw material. With metallurgy, large amounts of ore are required for objects, but again, ingots of refined metal can be transported to producers. As regards the scale of work, it is possible that if a metal-worker's furnace is not worked on a regular basis, then it would be possible to set in a store of fuel.

Payment for Craftsmen

Forms of payment for the work of craftsmen differ in various ways. Goods given in exchange appears to be the most common form. Among the Bantu (Nicklin 1971: 13) and the Kpelle of West Africa (Thurnwald 1969: 124), subsistence goods are given in exchange. In a money economy, we find that ritual terracottas produced for a patron (jajmana) are "paid" for by conventional items like clothing, cereals and some money. Agricultural products are given periodically for supply of utilitarian items such as earthen pots (Jayaswal & Krishna 1986: 70). In the context of "attached specialists", Brumfiel (1987: 106) considers the most basic form of patronage as the awards of agricultural lands to specialists, to sustain themselves through subsistence agriculture. In the Aztec state, specialists were given a share of tribute cloth,

received by the ruler, which freed the specialist from subsistence agriculture. Here, however, the presence of the market made possible the conversion of non-agricultural goods into subsistence goods. Other forms of "payment" for craft goods are mentioned in the literature. This need not be in subsistence goods, but could take the form of part of the raw materials obtained from a customer (Rowlands 1971: 211). There are cases where the customer worked in the fields of the craftsman as "payment", this form being found among the Nupe (Nadel 1942: 265), the Ewe (Thurnwald 1969: 133) and in Northern Nigeria (Meek 1971: 150).

Recycling and Archaeological Recoverability

The question of re-use of products of by-products of craft activity are also significant for our discussion, especially from an archaeological viewpoint. How products are used and re-used will affect our interpretation of the archaeological record. Hence, ethnographic evidence in this regard is valuable. Thus, Sheets (1975: 101-102) makes a valid point when he notes that the most common artifact found in a workshop need not be the aim of the activity, but a by-product of the craft process. In the craft of shell working, it is noted that even tiny chips and shell dust are sold to lime makers, who produce a lime plaster or whitewash (Kenoyer 1984 a: 343). Specific types of manufacturing waste like columella and body whorls of shells are taken to distant regions and

processed into small objects (Kenoyer 1984 a: 346). Debitage resulting from the chipping process of bead making is sorted and large pieces of nodules are utilized to make smaller beads or smaller debitage is sold to be ground into a powder which is used in the grinding and polishing processes. We have a number of references to the re-use of pottery wasters-old cracked pots are sometimes riveted with banana fibre and used as moulds for new ones in Uganda (O`Brien and Hastings 1933: 191); potsherds are pulverized and used as temper; a broken pot can act as a base for a new pot; cracked pots are used as tripods for cooking; a big sherd can be used as a water/ food dish for animals; a potsherd can be used as a receptacle for sacrifices (Ikechukwu 1987: 453). Potsherds could be used to cover and protect pottery in firing; to block holes in walls and window frames; and in ovens, instead of stones (Stanislawski 1955: 83). In an archaeological context, it was noted at Shahr-i Sokhta, that wasters in alabaster stone working were re-used as a raw material to produce smaller objects (Ciarla 1981: 53).

To conclude, it can be mentioned that specialization is dependent on technology of the craft in the context of the required skill. Cleland (1986: 99) gives the example of stone tool production vis-a-vis metal working, where the latter craft would require more complex supportive industries, greater inputs of time and exploitation of

distantly located raw material sources. Chapple and Coon (1947: 101) refer to the same point when they reiterate that few people know where to find deposits of copper or tin or are able to recognise these minerals when they see the ore, how to extract the metal from the ore and how to blend metals and cast tools. Thus, one should not lose sight of this aspect, as on whatever scale of operation the craftsman works, he still will be a specialist. The following chapter attempts to study the technological attainments of craftsmen in the Harappan period.

CHAPTER III

Technological Aspects of Crafts and the Harappan Evidence

Although the focus of this thesis is not the technology of craft production, we must yet have an understanding of the technological processes involved in each craft. Without delving into the technological aspects of each craft, our decisions regarding the archaeological record will remain merely conjectural. It is through an understanding of the technology involved in the production of various categories of artifacts that one can get an idea of the skill required for various craft processes. As we have seen in the previous chapter, a number of indicators give us inferences on specialization. Here, however, what will be studied, are the techniques involved, and the sophistication of tools. Not only this, the raw materials utilized will also give us an indication of the sophistication of each craft.

The Harappan evidence indicates the presence of a number of craft production activities. These range from faience objects, beads of various materials, metal objects, steatite seals, shell artifacts and a number of other objects. It should, however, be remembered that these artifacts are the durable relics of craft activities and that there were other crafts which have not left any visible products behind. Thus, it would be relevant to

begin with a survey of such crafts. The basic problem of dealing with such crafts, using non-durable materials, is that the artifacts themselves very seldom remain and we are forced to look for indirect indicators. Such indirect means could take the form of tools or illustrations of such crafts/objects through art. Crafts being studied in this context are weaving and its associated activities of spinning and dyeing, wood working and stone tool making.

Spinning Spinning must have been undertaken with wooden or metal spindles, weighted by whorls. Spinning could be done in the absence of spindles, but the spindle with its weight or whorl considerably helped the spinning process, which according to Birrell (1959: 30) assisted in the three sub-processes of stretching the fibres taut while spinning, twisting fibres to form the yarn and winding the yarn on to a bobbin to prevent its unravelling. The whorl could be of any material heavier than the rod or spindle (Geijer 1979: 15). Lighter whorls also indicate the spinning of fine delicate yarn.

In the Harappan context we are left with no concrete evidence regarding the spindles. Quite probably, these were made of wood. In some cases, holes in the spindle whorls are so small, that it was suggested that metal spindles were used of which we have no evidence. Whorls have been found in numerous quantity from sites such as Mohenjodaro and Harappa, the majority being of terra-

cotta. Pottery spindle whorls have been found with one, two or three holes and some two or three holed whorls have a deep groove around the edge (Marshall 1931: 469; Mackay 1938: 418; Vats 1940: 73). Some terra-cotta whorls are very roughly made out of broken potsherds which are rubbed down to the required shape (Marshall 1931: 468-69). Excavations at Lothal have revealed two whorls with three holes each (Rao 1985: Pl. CCXIV B5, 6). Whorls with numerous holes were used with a stick divided into two or three segments. According to Rao (1985: 498), such whorls are still used in present-day Gujarat. Rao (1985: Pl. CCXVI B) has found another type of whorl at Lothal, with numerous holes around the edge, which if joined together with thin sticks, would form a large spool on which the thread could be wound.

Spindle whorls were also made of other materials, such as faience and shell. Mackay (1938: 418) indicates that shell whorls are numerous at Mohenjodaro and seven examples have been illustrated. Metal spindles are suggested for these whorls, seeing the size of the single hole in each of them, though some whorls may have been used with wooden spindles (Mackay 1938: Pl. CVI 23).

Faience whorls appear to have been exclusive artifacts, perhaps limited to certain members of the population. Whorls of this material all have one hole and

are decorated with moulded designs and pigments. Such whorls are limited in occurrence to the SD Area and the DKG Area in Mohenjodaro. From Marshall's excavations (1931: Pl. CLVII 36, 41, 47), 3 out of 5 described whorls are found from the SD Areas, which would seem to accord well with the idea that SD Area was perhaps habited by a ruling/elite group and that faience was an exclusive and expensive material; thus objects made out of such a material were not available for use by all. 2 whorls (Marshall 1931: Pl. CLVII, 41, 47) which were probably made in the same mould, have been found in the SD Area, to the north and east of the Great Bath. However, from Mackay's excavations (1938: Pl. CV 13, 22, 34) concentrating in the DK Area, we find a number of faience whorls, all located in the eastern portion of this area.

Shell and terracotta whorls were also found in the DKG Area. We are yet doubtful what can be made of such correlations, as the picture that emerges may be distorted by the better recording of objects noted in the later excavations at Mohenjodaro.

Similarly, at Harappa, we cannot discuss the extent of spinning activities for though spindle whorls of mostly pottery and some of shell and faience have been mentioned as uncovered, no loci have been recorded (Vats 1940: 377), save that of a pottery whorl (Vats 1940: 73). At Lothal, only terra-cotta spindle whorls were found from

unspecified loci. Chanhudaro, too, revealed only clay whorls (Mackay 1943: Pl. XCII 4, 5, 7); out of 4, 3 were found in the Cutting. Thus, again we have no information of the extent of spinning activities. We get evidence of the presence of spindle whorls at a few other sites. At Rakhigarhi (Suraj Bhan 1975: 101) and at Surkotada (Joshi 1972: 126), spindle whorls have been found of unknown material. Bobbins or sheaves were found at Mohenjodaro (Mackay 1938: Pl. CV 33; Pl. CVIII 33; Pl. CX 33) - 2 of steatite and 1 of terracotta; and at Chanhudaro (Mackay 1943: Pl. XCII 6).

Weaving Evidence of weaving is considerably more difficult to obtain, as no looms can be expected to survive and the simplest loom, using no sophisticated frames, may leave no traces. Evidence of weaving then, largely depends on indirect means such as impressions of woven cloth, illustrations of woven cloth on figurines, and by direct evidence, however rare, of woven fabric itself. As an example of the latter, a fragment of cloth was found adhering to the lid of a silver vase (Marshall 1931: 585). Other evidence consists of 4 bits of cotton string adhering to the side of a broken knife (Mackay 1938: 591-92) and fabric on a copper razor, probably indicating that the razor was wrapped up in coarse fabric (Mackay 1938: 592-93). Traces of bast fibres have also been found at Mohenjodaro (Mackay 1938: 593-94).

Other clues for the presence of woven materials are the imprints on the reverse portion of sealings. Pieces of clay were probably affixed to woven materials such as bags, on which seals were pressed for an imprint. Numerous such examples have been obtained from Lothal in the warehouse structure. Most of the sealings carried impressions of packing material, such as reeds, woven fibre and matting, and of twisted cords on the reverse (Rao 1979: 113). However, this could also refer to materials coarsely woven in the finger weaving technique and need not give evidence of weaving on looms. Some miniature faience vessels show impressions of fabric on their interior walls, suggesting that woven materials were used to bind the core ingredients for moulding such objects (Vats 1940: Pl. LXXXII 15, 17, 19, 28). Imprints of woven material were found on 2 bricks at Harappa (Vats 1940: Pl. LXXII, 50, 51); also on a copper rod at Chanhudaro (Mackay 1943: 185). One indirect clue towards the existence of weaving is through art: representations of woven materials on human figurines. Some human figurines (female) are depicted as wearing short skirts with or without a girdle with medallions on it. Practically all female figurines are thus clothed (Marshall 1931: Pl. XCIV, 9, 14; Pl. XCV 11, 27; Mackay 1938: Pl. LXXII, 5, 6, Pl. LXXIII, 6, Pl. LXXV, 1, 6, 21, 22, 17; Pl. LXXVI, 21; Vats 1940: Pl. LXXVII 46, 49, 51,

52, 53, 62). Some figurines, usually male, are found with a scarf around the neck (Marshall 1931: Pl. XCIV, 11; Mackay 1938: Pl. LXXVI, 22, 24; Pl. LXXV, 13, 20; Pl. LXXIV, 24, 23; Mackay 1943: Pl. LIV 3, 5, 9, 10-12). A female figurine from Mohenjodaro wears a substantial over-garment or blanket (Mackay 1938: Pl. LXXV, 9).

The limestone statue of the 'priest-king' cannot be forgotten (Marshall 1931: Pl. XCVIII), as here we have a clear representation of a garment worn over one shoulder, leaving the other bare; a garment which is decorated over with a trefoil design, whether woven or embroidered is obviously not known.

Regarding weavers' tools, we are at quite a loss. Shuttles could have been made of wood. Objects thought to have been loom weights have been found at Lothal (Rao 1985: Pl. CCXV C); also an example, in brick, of a tapering cubical object (Rao 1985: Pl. CCXVI A). It must also be mentioned that needles of metal and bone have also been found, suggesting sewing activities (Marshall 1931: Pl. CXXXII I, 2, 3, 5; Rao 1985: 544: Fig III, 1-5).

Dyeing Detection of dyeing in the archaeological record is problematic as it may not leave any archaeological traces, except for the actual facilities used in the process. Here too there are problems, as what are basically required are large vessels for the dye which could be

earthen and therefore destructible. At Mohenjodaro, troughs thought to have been for dyeing were found embedded in the floor and secured at the top with a course of bricks around the mouth. Two in a single room, of equal size, and a third vessel of the same size in the adjoining room (between the group of two pots and the third is a later wall, so originally all the 3 troughs would have been in a single room) (Marshall 1931: 197). At Lothal 2 facilities comprise of 2 jars each, skirted by bricks on the surface, as in the Mohenjodaro example; but the difference lies in the two jars being at different levels and being connected by a drain. Hence, it would seem the lower jar received water overflowing from the higher jar and a drain led excess water from the lower jar into a public drain (Rao 1979: 81, 110). Another single large jar set in a burnt brick pavement could have been a dyeing vat. There may have been more facilities for dyeing in antiquity, located near the river or a water source.

Wood Working: Wood working may have been a significant occupation, about which we have little evidence, owing to the perishability of the material. It is conceivable, however, that hafting of tools may have been done by the users of the tools, whereas other artifacts, such as furniture or boxes, could have been made by separate producers. One indirect piece of evidence which could

pertain to the presence of wooden objects are the numerous examples of finished shell inlay that have been found at various sites and in large quantities from Mohenjodaro. Where a few finished inlay pieces are found, these could imply the presence of a wooden object which has since decayed.

Tools used by woodworkers would probably have been chisels, gouges and saws. Two saws, of copper and bronze, respectively, have been found at Mohenjodaro (Mackay 1938: Pl. CXVI 6; Pl. CXIX 10) and one at Chanhudaro (Mackay 1943: Pl. LXIII,1). As will be detailed in the conclusion, such tools need not necessarily imply the craft of wood working, as other crafts too would require similar tools. Numerous types of chisels have been found from Harappan sites, but we have no evidence to prove that they were used solely for woodworking. With gouges, too, the same problem arises of determining the craft for which these tools were utilized.

Stone Blade Production Harappan stone tool production differs from the above discussed crafts in that the final products are available to us for study. The Harappan blades, largely made of chert, suggest that despite the introduction of copper and bronze, stone tools were still used by the Harappan people. Marshall (1931: 458) suggests that the presence of blade flakes and cores in

nearly all houses of the settlement, indicates that production of blade tools was undertaken in each house and was not a specialist occupation, while Allchin (1979: 183-84) considers the tools as the remnants of a very specialized activity. Cleland's study (1986: 109) indicates that from the Early Harappan period itself, centres such as Kot Diji had emerged for the production and export of stone tools. At this site we have evidence of blade tool export, as the raw material utilized is the same as that from source areas, similarities in the typology of artifacts, and relative quantities of blades and wasters. The Sukkur-Rohri region is taken as a source area for Harappan chert. Here, Harappan working areas were delineated (Allchin 1979: 185-87). There is also a close correspondence in the average width of blade fragments between blades from Sukkur and those from Harappan sites (Allchin 1979: Table 5: 190). Mackay (1938: 395) suggests that material was imported from the Rohri region, in the form of cores. This corresponds with Allchin's study (1979: Table 1: 181) of the Mohenjodaro collection, in which 20 cores and 5 blade core fragments were found, while from the Sukkur factory, 28 cores were found. On the basis of a sample collected in recent excavations on the western portion of HR mound at Mohenjodaro, Kenoyer (1984c: 118-19, 130) found that the majority of tools were made from Rohri chert, though some darker coloured cherts were also found, for which he does

not rule out the Kirthar sources. At smaller sites, stone tools may have been produced by the inhabitants of the community, suggesting a measure of self sufficiency. This can only be possible if the raw material utilized was of local origin.

Our major problems with the crafts described above, apart from stone tool making, lies in the fact that we may not find one or two pieces of indirect evidence in conjunction. If the raw material was durable in nature, such as stone, conjunction of materials and tools could give some indication of craft working. However, when the material is non-durable, we can make very few inferences. Again, most of the tools with which we are concerned here are not of such a nature that we can unhesitatingly slot them into a particular craft. The organisation of such crafts must remain elusive to us from the archaeological record.

The crafts with which we will be dealing in the following pages are those for which we have the final products as a part of the archaeological assemblage. Most of these crafts are characterized by considerable sophistication in techniques and tools. The crafts we will be dealing with are bead making, metallurgy, faience production, seal making, weight making and shell working.

Bead Making Bead making in the Harappan culture

incorporates the use of a very varied range of raw materials, such as semi-precious stones, steatite, faience, and metals, such as copper or bronze, gold and silver (see Table III.1 at the end of the chapter). In view of the ubiquity of beads at Harappan sites, it would appear that beads were a necessary concomitant of the aesthetic life of the Harappan people.

When attempting to study the technological aspects of bead making, it becomes necessary to separate the discussion largely according to raw materials, as each raw material envisaged a different means of procurement, processing and working to achieve the final form. Hence, we may use the arbitrary division, as mentioned earlier, that of stone beads, of steatite, of faience and of metals. It would probably be more relevant to consider faience and metal beads as subsumed within the crafts of faience production and metal working, respectively. Here, we will only deal with stone and steatite beads.

For semi precious stones, mining of minerals may have been undertaken. In procuring stones for the present-day Cambay bead working industry, mine shafts are dug into the ground, to locate the good quality stones, which are quarried. Modern mines are roughly 4-4.5 m deep (Trivedi 1964: 12). It, however, appears that in the Rajpipla area, in Gujarat, agate could be picked up from the

surface and occurs in river beds too (Trivedi 1964: 8). Steatite was probably quarried in blocks.

Processing of the raw material could be done at the source area itself or at the production area of objects, or at both loci. The two loci could be one and the same. Observing present-day parallels for stone bead production, it appears that blocks of stones were chipped to expose some of the colour of the mineral, and if satisfactory, the material was sent for further working. Stones are first exposed to the sun for six to eight weeks and then given heat treatment through two possible techniques. In one, stones are placed on a layer of ash and these are covered with another ash layer over which fuel is placed. Heating is done for two days. In the second method, the stones are put in old earthenware pots, in whose bottoms holes are broken, placed with necks facing downwards. Fuel is piled all around and the whole fired for one day (Trivedi 1964: 12-14). The heat treatment does not end at this stage. Repeated baking brings out the colour of agate and is undertaken at various stages of the production process. The temperature necessary for the colour transformation is around 300 to 450^{o} C.

The production of beads is divided into different stages or processes. For disc-shaped beads, the initial stage involved the removal of roughly flaked blanks, which were then further finely flaked to shape them. These then

had holes bored in them with the help of drills of stone or perhaps pointed metal instruments. The final stage envisaged grinding of the perforated blanks to finally shape and smooth them. This could be done using bead hones, or though a process of stringing the blanks on a wire and rolling them to and fro on grit stones (Mackay 1943: 210).

In the production of barrel-cylinder beads, rods or slips were detached from the parent nodule, for which the Cambay evidence gives parallels. The nodule is held against an iron stake, set at an angle into the ground, and the flakes removed by indirect-reverse percussion technique. The nodule is constantly moved in the flaking process (Roux & Pelegrin 1988-89: 51; Kenoyer et al 1991). The shape of the bead was given a distinct form by further careful and finer flaking. At Cambay, the two processes of initial shaping and of finer flaking, are usually done by different persons in more organized workshops. Grinding of beads is now done at Cambay by mechanised means, but in antiquity, it is probable that stone hones or whetstones were utilized for this purpose. Polishing, too, could have been done by this process or by the leather bag method, by which hundreds of beads could be polished (Trivedi 1964: 16). Perforation of barrel-cylinder beads would require more expertise than the drilling of disc beads; long beads would require

perforation from both ends. The Harappan long barrel-cylinder beads would undoubtedly have required a great amount of expertise in their production. At Cambay, a bow drill is utilized for perforating stone beads. The bead is set in a wooden vice and reversed in the middle of the process to allow drilling from both ends. A small pot is set on a tripod and a wire sloping down towards the hole to be drilled allows water and agate powder mixed in it, to drip slowly on to the bead, thus providing an abrasive and a cooling agent to prevent overheating. The used water and new agate dust collects in another bowl set on the ground underneath the bead, which is recycled into the pot on the tripod (Trivedi 1964: 17; Kenoyer et al 1991). The whole apparatus is one which can be carried anywhere and we also find drillers working in the fields away from their homes. Also, little would be left of the modern drilling apparatus for an archaeologist to recover, save the metal drill, the little pots and the wire. This is significant if we keep it in mind that the Harappan sites revealing bead working also give no evidence for the drilling process, other than the drills themselves. In the archaeological context, the drilling stage is one which resulted in the most casualties, as shown by beads broken while boring found at Chanhudaro (Mackay 1943: 201, 314). In the Harappan period, drilling was done with stone drills aided with an abrasive and water for the

required friction. An abrasive was necessary for use with the drills, as the drills were made of stones of the same hardness as the beads themselves. A final polishing was resorted to after the drilling.

The making of composite beads of stone (sometimes with another material) is an indication that bead making had long passed a stage of incipience in the Harappan culture. Mackay's excavations at Mohenjodaro revealed beads made out of two or more materials. One specimen is of carnelian and bluish-white chalcedony; another of shell and pink limestone; another with black steatite and shell; another with pink and white limestone; and one of which only one segment-of dark green stone- is remaining (Mackay 1938: Pl. CXXXV, 1, 2, 5; Pl. CXXXVI, 5; Pl. CXI, 25, 36; Pl. CXXXIX, 88). An irregularly shaped turquoise bead capped with gold and an agate bead also capped with gold were found (Marshall 1931: 521, 523). At Chanhundaro, composite beads of stone and copper/bronze were found (Mackay 1943: Pl. LXXXI 17, 18, 21). Steatite beads capped with gold were also found at Mohenjodaro (Marshall 1931: 519).

Etching of carnelian beads is a Harappan example of decorating stone beads. Three varieties of etched beads are noted. In the first, designs are etched in white on the red stone; in the second, part of the stone is etched white, and on it, black patterns are imposed; and in the

third, black patterns are etched directly on the stone (Beck 1933; Dikshit 1949). It appears that an alkaline solution was painted onto the beads, and baking of the painted beads caused the alkali to cut into the surface, leaving the patterns. Etching designs on carnelian beads was a practice which was noted by Mackay (1933) in Sind. Here, the tips of young shoots of the kirar bush are ground to a paste and with it is combined washing soda (sodium carbonate) mixed with water and the paste used as a "paint" for designs on carnelian. The painted stones are heated over a charcoal fire, then cooled and polished. The kirar bush paste is used only as an adhesive for the soda which is the primary ingredient for etching. Designs are rather limited, for etched carnelian beads-circles, trefoils, concentric circles, bordered stones, and figure-of-eight designs (Marshall 1931: Pl. CXLVI, 43-45; Majumdar 1934: Pl. XVII, 25; Mackay 1938: Pl. CXI, 4, Pl. CXXV, 5, Pl. CXXXIV, 6, Pl. CXXXV, 19 (g); Vats 1940: Pl. CXXXI, 4; Mackay 1943: Pl. LXXIX, 1-16; Rao 1985: Fig 131, 5).

Steatite was used as a raw material in the production of a large number of different shapes and types of beads. It is clear that steatite was the favoured raw material in the craft of bead making. In some cases, steatite blocks were used for making beads, in others, steatite paste was utilized. Obviously, steatite paste would have been used

for moulded beads, and it is equally plausible that the carved type of beads and zoned beads were made out of steatite blocks and not from paste of the material.

Steatite beads of the disc and wafer shapes were probably produced by first shaping steatite blocks into tubes of the required diameter and then cutting the tubes into narrow discs, using a wire or a metal knife. Lines, perhaps showing the direction of the cutting motion can be seen on beads from Harappa (Vats 1940: Pl. XXXIII, 1). As for drilling these beads, Marshall (1931: 212) considers it possible that they were held by moisture on the tip of the finger and pierced by a sharp metal point, an operation requiring skill. The beads could be perforated after steatite was shaped into tubes of the required size and diameter and before cutting of the individual beads; then the problem of perforating the beads individually could have been avoided.

The miniature steatite beads almost certainly involved a different production process altogether. A class of copper/bronze tools found at Chanhudaro and Lothal could have been utilized for this purpose. These tools (Mackay 1943: Pl. LXXX, 1-8; Rao 1985: 545, Fig 112, 3, 4) are tubular in shape, with a point projecting from the lower end which is partly protected by a flange. Steatite was probably powdered and made into a paste which

was then put into the tool and the beads cut off as the paste emerged from the tool point. These beads were probably then fired, to harden them. The ensuing problem would be the perforation of such beads. This problem has been thought to have been solved by a different process envisaged by Hegde et al (1982: 242-43). This requires the use of a copper or bronze plate with a series of tiny holes in it, each of 1 mm diameter. Each hole had a wire of 0.5 mm diameter, with one end riveted near the hole and the other positioned in the centre of the hole. If cloth was fastened to the disc through tiny holes at the edges, paste put into the device, and the cloth gathered up, the paste would emerge as perforated tubes and could be cut to form microbeads. Finally, these would be baked to harden them.

Another aspect of the production process involves some amount of decoration on various types of beads. We have already discussed the etched carnelian beads. Steatite beads were also decorated in various ways, one variety being the painted beads. These possibly are an imitation of the etched carnelian beads. Painted designs are mostly trefoils and zone or spiral designs (Marshall 1931: Pl. CXLVI, 41, 42, 48, 51, 53, Pl. CXLVII, 8; Mackay 1938: Pl. CXXXVII, 94, 101; Vats 1940: Pl. CXXXIII, 2). Carved steatite beads are another variant of decorated steatite beads. Here, the bead surface has been carved

into designs, and possibly some sort of inlay was used for decoration. The range of designs from Mohenjodaro include trefoils, chevrons, longitudinal grooves, scarab beetle design, and zones perhaps inlaid (Mackay 1938: Pl. CXXXV, 35, Pl. CXXXVII, 92, 99, Pl. CXXXVI, 54). 3 similar beads were found at Harappa (Vats 1940: Pl. CXXXII, 2, a, b, c). The use of steatite paste facilitated the moulding of beads into various unusual shapes, such as a bead from Mohenjodaro, with a flat back and a fluted edge and a shallow recess in the middle of the face to take an inlay (Mackay 1938: Pl. CXXXIV, 14).

The comparative rarity of decorated stone and steatite beads is clear. Each of these types of decorated beads-the etched carnelian beads, the composite beads, the painted steatite beads, the carved steatite beads and the zoned beads would all have required considerable attention and individual production. This is at variance with beads such as the miniature steatite beads and the disc or wafer shaped steatite beads, whose production process would have resulted in the simultaneous production of a very large number of beads. This would be the reason behind the comparative rarity of decorated beads in the archaeological assemblage, as opposed to the large numbers of miniature and disc beads of steatite that have been found.

It must also be noted that most stone beads are of

geometrical shapes. This is because the material utilized, that is, stone, can be easily cut into such shapes. More unusual and decorative shapes are possible only with materials that are more plastic and can be moulded, such as faience or steatite paste. Thus these materials are utilized for beads of shapes such as segmented, gadrooned, fluted, grooved, tubular denticulate, bobbin-shaped and those fashioned like the carved shell balls (e.g. Mackay 1938: Pl. CXXXIX, 91) other than more usual geometric shapes. Moreover, all the beads of "unclassified types" that is, of unusual shapes which do not conform to a set pattern are of faience, paste and steatite.

The basic tools required for beadmaking could have been of stone or metal. It is quite possible that a large number of tools could have been of stone, despite the existence of metal in this period. Moreover, wood could also have been used for some tools and accessories, as attested by the Cambay drillers' craft.

For preliminary chipping of stone nodules and further careful flaking, stone tools could possibly have been used. In Cambay, a hammer made of goat or buffalo horn is used for chipping and flaking (Trivedi 1964: 14). For grinding and polishing of stone beads, stone hones, mostly of sandstone, would have been used. Hones, with parallel

grooves on the surface, have been found at Harappan sites (Mackay 1938: 21; Mackay 1943: Pl. LXXXIX, 21, Pl. XCI, 36-38, Pl. XCIII, 9-11, 15, 16; Rao 1985: Pl. CCLII, A). Polishing could also have been done by the leather bag technique, earlier undertaken at Cambay, or by a variant, which would not leave any archaeological trace. For perforation chert drills were used with the help of a powder acting as an abrasive with water. Harappan examples of stone drills are tools, largely cylindrical in shape with a small depression at the anterior end, probably caused by the rotating motion of the drill. Examples of drills from the surface at Mohenjodaro (Bondioli et al 1984: 24) and at Mundigak (Jarrige 1981: Fig 11) show that these drills flare outwards from the shoulder. Similar stone drills have also been found at Tepe Hissar, for drilling beads of lapis lazuli (Bulgarelli 1979: 49).

It is possible that the copper/bronze flanged tools described above, were utilized for the production of steatite microbeads. Perhaps metal was used to cut the steatite wafer beads. For decorations on steatite beads, it is possible that metal awls, or chisels or drills were used on the soft material. Awls, chisels and drills are part of the Harappan inventory of metal artifacts, but it is not entirely clear which craft or activity they were exclusively utilized for.

A heating facility was also essential. Among stone beads, carnelian needed to be heated to bring out the colour of the stone. Often this was done at various stages of the manufacturing process. Steatite, too, needed to be heated to harden the beads, probably after the beads were cut from the parent material. It is unlikely that high temperatures were required for the heat treatment of stone and steatite. Very elaborate heating facilities would not have been required. In fact, at Cambay, the heating technique known as "bhalsal" makes use of a trench dug in dry ground in which layers of ash and stones and fuel are laid and heated (Trivedi 1964: 13).

Metallurgy Metallurgy is a significant craft, considering the period we are concerned with, when metal craftsmen were gaining experience and the craft was evolving into sophistication.

If we were to study this craft from the very first stage, then we would have to begin with mining of the raw material, that is, the metallic ore. Since in the period, we are primarily concerned with copper and bronze production, the basic raw material would be the form in which copper is found. The main copper ores are chalcopyrite, chalcocite, malachite, azurite, cuprite, bornite, tetrahedrite and covellite. Analyses show that oxide ores and native metal were used by the inhabitants

of Harappa and Mohenjodaro, and in some cases, sulphide ores were also used, such as chalcopyrite (Agrawal 1990: 18). For bronze, other essential raw materials required are the minerals used in producing the alloy, either tin, or lead or arsenic. Lead largely occurs as galena and arsenic as realgar or orpiment. Tin is commonly found as cassiterite in water-concentrated deposits known as "stream tin".

Mining of these ores would require heavy duty tools, probably of bronze themselves. These would probably have been axes and chisels. If native copper was utilized, then mining would not have been resorted to, as such copper is found on the surface. In the Harappan case, the source areas for copper do not fall within the settled area, and it is probable that ore or smelted ore or ingots or a combination of these were brought into Harappan settlements. Oxide ore was found in Mohenjodaro in a trough in DKG area (Mackay 1938: 54). Numerous ingots have been found at Harappan sites (Marshall 1931: 485; Mackay 1938: 129, 160, 452; Vats 1940: 85-89; Rao 1985: 552, 652; Mackay 1943: 43).

After mining of the ore, its smelting would need to be undertaken. According to Bhowmik (1986: 39), copper ores were crushed to powder, and mixed with a fuel such as cowdung, made into rolls and sundried. These were roasted in an open fire and then transferred to a furnace.

Smelting of oxide and carbonate ores of copper was much easier than that of sulphide ores. The former was a single-stage procedure, where one product, the slag, was thrown away and the metal was kept. Smelting of sulphide ores was a complicated process involving a number of smelting and roasting operations till more refined copper was obtained.

Alloying of copper with was done to obtain a number of advantages. An alloy was harder and had more tensile strength than pure copper and removed the problems of a porous casting, as pure copper had a tendency to "gas" when cast (Agrawal 1971: 158). It is generally considered that addition of tin of more than 1% constitutes a bronze. Analyses showing less than 1% tin are considered as impurities. Generally inclusions of tin to about 8-12% were the best for optimum strength and ductility. As regards arsenic, inclusions of more than 1% were regarded as deliberate.

That the Harappans knew how to alloy copper is ascertained from the metallographic analyses that have been done (Khan Bahadur Mohd. Sana Ullah and Prof. C.H. Desch in Marshall 1931: 484-87; Khan Bahadur Mohd. Sana Ullah, Dr.Hamid and Prof. Desch in Mackay 1938: 478-482; Rao 1962-63: 152-53, Lal 1985: 651-661). But it is clear that bronzes and other alloys were far rarer than copper

artifacts. Agrawal's Table 27 (1971: 166) shows that for the upper levels of DK Area, Mohenjodaro, the percentage of copper artifacts was 77% as compared to 23% bronze objects while in the lower levels, the comparative figures were 94% for copper and 6% for bronze. According to Agrawal (1971: 168), 70% of copper artifacts are not alloyed, that is, the tin content is upto 1%; 10% of artifacts reveal inclusions of tin upto 8%; only 14% of artifacts show the optimum inclusion of tin required which is 8-12%; and 6% of artifacts are analyzed as having 12% of tin. Some Mohenjodaro bronzes show a high range of tin inclusions, from 19% going upto 26%. Bronzes from Lothal and Surkotada (only one for each site, out of 9 analyzed from Lothal and 1 from Surkotada) show a very low admixture of tin: 1.09% in the case of Lothal and 1.04% in the case of Surkotada (Nautiyal et al 1981: Table 1: 49).

Other alloys of arsenic, lead and antimony are known of in Harappan artifacts. In some cases, two or three minerals are found in percentages of more than 1 within the same artifact; such as, for example, a rod from Mohenjodaro with tin, arsenic and antimony (Agrawal 1971: Table 14: 131). Out of a total of 177 objects studied, 8% revealed arsenic alloying (1-7%); 4% showed nickel alloying (1-9%); and 6% revealed lead alloying (1-32%) (Agrawal 1971: 168).

Copper and its alloys are cast into ingots

preparatory to forming them into vessels and tools. This was done probably for convenience, for storing pending further working, and provided a differentiating stage between two distinct processes in metal working, ore smelting and manufacture of artifacts of metal. These ingots were of different shapes and in the Harappan case are simple bars or rods and bunshaped lumps. Ingots were formed by pouring the smelted metal into a hole in the ground.

A list of Harappan metal artifacts divided into three rough categories, is given in the following table.

Table III. 2: Harappan Metal Artifacts

Tools/Implements	Utensils and Accessories	Ornaments
blade-axes	vessels	bangles
razors	spatulae	earrings
awls	spouts	buttons
saws		finger rings
chisels		terminals
fish-hooks		spacers
blades		beads
sickle		cone
drill bit		hair pin
spear and lance heads		fillet
knives and daggers		
crescentic sleeved axe		Subcategory I
sword		mirror
scraper		kohl stick
gouge		surgical/toil set
plumb bob		
shovel		
stave heads		Subcategory I
bead tools		human figurin
planer bit		animal figurines
tubular drill		copper tablet
scale pans		
hooks		
bolts		
nails		

Actual techniques for manufacturing different objects depend on the objects themselves. Vessels or utensils were formed by hammering ingots and in "sinking" and "raising" them. In "sinking", the hammered ingot was placed over a shallow depression and hammered into it, and in "raising", the metal ingot or sheet was put over a domed stake and hammered from outside.

Thin-sectioned tools were perhaps made out of sheets of metal, in which shapes were chiselled out. Sheets of metal also appear to have been utilized for making ornaments like beads and bangles, and vessels. Ornaments were fashioned over cores in order to give them the required shape. Other metal working techniques comprise cold and hot working, the former where the metal objects were made much harder by hammering - no heating was done; and in the latter, where the metal was heated not above a temperature of 1050^{o} C and worked. In annealing, a cold-worked brittle metal was heated to increase its malleability for working.

Casting of metal objects was done in a variety of ways. Both open and closed moulds could be used, made of clay or stone. Stone which could not alter at high temperature, such as sandstone was used (Agrawal 1971: 180). The use of a closed mould would be apparent in an object, as ridges would be seen, where the mould covers would meet.

Cire perdue or the lost wax process was a sophisticated method for complicated shapes. In this technique, a wax model was moulded onto a clay core, and over this another clay layer was added with runners and raisers. When heated, the wax would melt, leaving a gap between the two clay layers for the metal. Chaplets were used to prevent the core from moving, which would eventually become part of the finished object. When the wax was removed through the vents, the molten metal was poured in to take its place. The outer clay covering was then broken to reveal the cast metal figure.

Techniques for joining parts of objects to each other were also known. "Running on" was one such method, where the parts to be joined had molten metal poured on the joints. Another technique was riveting where a rivet or a short piece of metal was used to join the two parts, hammered down at both ends. Soldering was another technique, where a different alloy was used to join the two metals. It appears that some gold and silver objects were soldered, though we have no evidence of this technique in copper or bronze.

To illustrate the above mentioned techniques, Table III.3 classifies copper/bronze artifacts from Marshall's excavations at Mohenjodaro (1931) into various technological categories.

Table III. 3: Technological Processes Utilized to Manufacture Objects from Mohenjodaro (Marshall 1931)

Utilization of Sheet Metal	Cold/hot Working, Annealing	Casting	Cire Perdue	Joining
Vessels Pl. CXLI,3 Pl. CXLII,4 jar-cover Pl. CXLII,7 arrow head Pp. 499) needle Pl. CXXXII,1	spear and lance-heads knives and daggers razors sickle blade chisels awls	Vessel Pl. CXLI,2 Bowl Pl. CXLI,10 dish and cover Pl. CXLII, 1 flask Pl. CXLII, 6 blade axes Jar handle Pl. CXXXIX, II bull figurine Pl. CXLIV, 2 animal Pl. CXLIV, 4 bird Pl. CXLIV, 8 beads Pl. CXLIII, 16 tablets	Bronze dancing girl animal figurines	handle secured to lid of vessel Pl.CXL, 5- both rivetting and "running on" rivet hole in saw Pl.CXXXVII, 6
wire:- finger rings earrings bracelets beads				

Tools and materials essential for metal working would comprise hammers for breaking up the ore, a furnace for smelting the ore, crucibles for holding the smelted metal and for pouring into moulds for casting. For further cold and hot working, hammers and chisels would be required. An anvil would be needed as a support for working.

In the Harappan context, very few of the required tools for metalworking have been revealed in excavations. We have no evidence as to what tools were utilized for

hammering, though probably hammer stones of pebbles were utilized. As for chisels, these are tools which are part of the Harappan metal inventory, but which cannot be conveniently slotted as tools for a particular craft. Chisels could be used in stone working, metal working, and for wood carving.

Crucibles have been found at Mohenjodaro, in rooms 31-32 in house LXI, Block 8 of HR Area, where rough crucible fragments were found along with lumps of unrefined copper and ashes (Marshall 1931: 212). Another crucible fragment was found along with slag (Marshall 1931: 485). At Lothal, two types of crucibles were found, made of coarse clay. One was a shallow bowl for melting an ingot and the other was a channel for pouring molten metal (Rao 1985: 497, 557). At Shortughai, too, a crucible with traces of copper was found (Francfort 1984: 303).

Suspected moulds for casting metal objects were found at Lothal. Two were sandstone moulds, possibly for casting pins (Rao 1985: 557) and four other terracotta moulds (Rao 1985: 497-98). A muffle was also found (Rao 1985: 497).

An anvil stone was uncovered in a smithy at Lothal (Rao 1985: 95). Stones, thought to have been anvil stones for metal working, in the shape of animals, were found at

Mohenjodaro (Marshall 1931: Pl. CXXX, 24; 465), but these resemble bead hones found at Chanhudaro.

We have no concrete proof that the several heating facilities, be they kilns or furnaces, were used by a metal worker. This is especially so in the case of Harappa, where 16 furnaces were found in Mound F (Vats 1940: 470, 473-74). At Mohenjodaro, a rectangular pit containing copper ore and a piece of lead was found in the DK Area (Mackay 1938: 54). At Chanhudaro, though a number of hoards of copper and bronze objects were recovered, no metal worker's furnace was revealed. Only Lothal revealed furnaces in conjunction with evidence of metal working (see Chapter V).

Some information may be included about the use of gold and silver which were largely utilized for making ornaments, but also as in the case of silver, some rare vessels. A list of objects made out of silver and gold is given below. Manufacturing objects out of these metals probably involved the hammering of these metals first into sheets, and moulding these sheets onto cores to form objects. Thus we have beads, conical head ornaments, bead caps and fillets. Silver was also hammered and shaped into jewellery. Gold and silver were also sometimes cast, as seen by the globular gold beads and rough silver pieces found in Hoard I at Mohenjodaro (Marshall 1931: 519).

Repoussé work was also done in gold as seen by a pendant at Harappa (Vats 1940: Pl. CXXXVII, 8). Gold was also drawn into wires and used for ornaments. It is probable that gold was rarer than silver, as the latter metal was utilized for three vases, two of which were cast (Marshall 1931: Pl. CXL, 1, 2), suggesting that the metal was not that rare, and one vase raised from a sheet of silver (Marshall 1931: 483).

Table III.4 : Objects made out of Gold and Silver in the Harappan Culture

Gold	Silver
beads	vases
bangles	bangles
conical cap	earrings
ear studs	ring
bead caps	foil - fillet?
spacers	lumps
terminals	cone
netting needles	bead
fillet	button
boss for stud	
sheet	
loops and washer for necklace	
pendants of gold and glaze	

The gold sheet and the lumps of silver are possibly raw materials kept for manufacture.

Faience Production The term "faience" or "Egyptian faience" is generally used to distinguish an object of glazed quartz. Silica, the major component for the quartz body is obtained mainly through quartz, powdered flint, rock sand, powdered rock crystal or crushed white quartz

pebbles (Lucas 1948: 181; Hodges 1964: 44). It appears that the use of flint or powdered sand or sandstone would result in a brown, grey or yellowish body material (Lucas 1948: 181).

The glaze of faience is termed an "alkaline" glaze. This glaze consists chemically of a sodium-calcium-silicate or a potassium-calcium-silicate without any lead compound. This glaze in a universal context came in a number of colours such as blue, green or greenish-blue, violet, white, yellow, black and red. The most common, however, were the first three colours. In some cases, it is difficult to make out the original colour due to prolonged burial.

The technology of Harappan faience production is as yet not wholly known. Numerous examinations and analyses have been conducted of ancient faience objects, but these have served to indicate the components of these objects, while the production process itself remains elusive. Here, we may attempt to discuss the possible methods by which faience may be produced. Before we start on the technology of faience production, it is necessary to know what objects were made out of faience in the Harappan culture. The following table lists these objects.

Table III.5 : Objects made out of faience in the Harappan culture

1) miniature jars
2) sealings
3) seals
4) animals
5) spindle whorls
6) beads
7) spacers
8) terminals
9) pendants
10) bangles
11) studs
12) buttons
13) brooch
14) "temple ornaments"
15) nose discs
16) ear buttons
17) ear studs
18) ear pendants
19) finger ring
20) amulets
21) balls
22) gamesmen
23) inlay
24) box covers
25) plaques
26) cones
27) tetrahedra
28) dice

Processing of raw materials would have involved the crushing or pulverising of the basic ingredient, that is sand or quartz pebbles. In a modern-day possible parallel of faience production in Iran, first the quartz pebbles are crushed with a sledge hammer and further pulverized to a powder by using a hand mill (Wulff et al 1968: 99).

Regarding the production of faience itself, the first question which arises is how the powdered quartz (or other source of silica) was converted to a plastic form, to enable it to be shaped. According to Lucas (1948: 201),

silicate of soda was used as the flux in the form of natron. Gum or oil, if used to bind the quartz particles, would eventually burn out in the firing, leaving a highly friable object, which could not even be handled for glazing. Experiments made by Lucas (1948: 204-5) indicated a dry powdered natron added in the proportion of 5-10% to quartz powder as a binding agent for moulded objects, while for hand shaped objects, a natron solution was effective. However, it is interesting to note that quartz powder mixed with gum traganth dissolved in water to a consistency where it would be plastic enough to produce beads and other objects was used at Qom in Iran (Wulff et al 1968: 99).

It appears likely that most objects were shaped by pressing the mixture into moulds. Carving could not have been possible, due to the angularity of the quartz grains which would not lend themselves to this technique. Most objects must have been made in moulds though some hand modelling is also possible. Even after moulding, details would have been made fine with an awl or some other sharp instrument. A faience monkey holding a young one on the knee was entirely hand modelled, though details were added later with a sharp tool (Mackay 1938: 310). According to Lucas (1948: 183), larger Egyptian jars may have been turned on the wheel. In the Harappan context, it is probable that the wheel was not utilized for the

manufacture of the miniature jars. The manufacture of these jars is quite difficult to explain. Some, it is apparent, were made in two pieces, and joined with more of the raw material (Marshall 1931: Pl. CI 4, 10). It appears that some difficulty would have been experienced in making these, as their sides and especially their bases are very thick. In some cases, they may not have held anything at all. It is possible that hollow objects were moulded on cores of sand, which was tied up in some fabric and raked out after firing. Impressions of woven material as well as remains of the sandy core have been found in some Harappan specimens (Marshall 1931: 687; Mackay 1938: 319; Vats 1940: 312).

A very large number of red pottery, one-piece open moulds have been found in Egyptian contexts, but the lack of moulds from Harappan sites is remarkable. A number of Harappan objects, such as beads, spindle whorls (Marshall 1931: Pl. CLVII, 41, 47), and little animals such as squirrels appear to have been made in moulds, though other animals may have been hand modelled. Sealings or amulets, found at Harappa, give evidence of moulding in some cases, where a number are found with the same motifs. 6 sealings are made from one mould (Vats 1940: 331), 2 are made from one mould No. 326 and 4 from No. 332 (Vats 1940: 331); two fish-shaped sealings are made from one mould (Vats 1940: Pl. C, 658); the use of a double mould is seen on some

objects (Vats 1940: Pl. XCIX, 650).

For simple shapes, such as globular beads, the Qom technique indicates simple hand moulding, or forming the small globes with pairs of pliers with semi-spherical cup-shaped ends, for which there are no prehistoric parallels. One method of manufacturing the cylindrical beads could be to roll the mixture around an organic core (a reed or straw or thread) which could be ashed out in the firing (Aspinall et al 1972: 28). Though this would appear to be a simple and obvious method, an unglazed cylindrical faience bead found at Chanhudaro (Mackay 1943: 210) has been left unbored. Boring could have been easily done later in such a soft material, though it would have been far easier to form the bead and bore it at the same time.

Objects were probably sun-dried before glazing, as is evidenced now at Qom. The glazing procedure is one which is generally debated. On the one hand, we have Lucas' experiments (1948: 199-200), which indicated that solid quartz was easy to glaze, but powdered quartz was another matter, as the glaze would just sink into the material. His experiments led him to pronounce that the ancient faience worker probably glazed solid quartz first, then chipped off the glaze, powdered it finely, applied it to the moulded quartz objects (he did not indicate how the glaze would be applied) and fired it. The glaze was made

by strongly heating either potassium carbonate (the principal constituent of wood and ordinary plant ashes) or powdered natron, mixed with the copper compound, which was to impart colour. In the Qom technique, a glazing powder is made, the basic constituent of which is a plant ash called salsola kali (the prickly saltwort) and salsola soda, containing soda and potash. The plants are cut and burnt in large pits where the ashes sinter into large blocks. The ash is ground finely, mixed with hydrated lime and quartz powder, plus ground charcoal and copper oxide in certain proportions (Wulff et al 1968: 100). The production of glazing powder leads to a different technique. Instead of resorting to two firings, Wulff's observations (1968: 100-101) indicated only one firing as necessary. The technique envisages the sun-dried moulded objects to be placed in a large, unglazed earthenware pot in layers, each layer separated from the other by glazing powder and the spaces between the objects too filled up with the glazing powder. This would also remove the difficulty of unglazed portions of objects where they have rested on a surface during firing, which could be a problem in Lucas' technique. Most objects are uniform all over, and if a liquid glaze were applied, one surface would be damaged while firing.

Noble's experiments (1969: 436-37) are interesting as they illustrate a different technique. According to him,

various ingredients are mixed with water and kneaded into a gritty paste. What is significant about the paste, is that apart from ground flint and ground white sand, sodium carbonate and sodium bicarbonate, it contains copper oxide. Thus the paste from the beginning contains the colourant. The mixture is then put into moulds, removed while still not fully dry, and dried freely. As this occurs, the carbonates and the copper compound migrate to the surface as an efflorescence and form a white powdery layer. While firing, the powdery layer of carbonates acts as a flux and the surface of the piece fuses to form a glassy layer. The copper oxide colours it and the central core of quartz fuses to form a hard, gritty mass.

It is obvious that the Qom technique could not have been used for those faience objects which have more than one colour of glaze coating. This is also asserted by Noble (1969: n. 12, 438-39) who discards this technique on the point at least of Egyptian objects where certain vases incorporate blue, white, yellow and other colours combined in a single piece. In the Harappan case, however, it should first be verified whether more than one glaze colour was used, or if a second paint was utilized which would indicate a secondary operation. Table III. 6 gives a list of objects of faience decorated in more than one colour.

Table III. 6: Faience objects decorated in more than one colour

1. Miniature jar, light blue, inlaid bands of white (Marshall 1931: Pl. CLIX, 3)

2. Miniature jar, light blue, thin bands of purplish-black paint (Marshall 1931: Pl. CLIX, 4)

3. Spindle whorl, rings of light blue and white (Marshall 1931: Pl. CLVII, 36)

4. Spindle whorl, white and blue (Marshall 1931: Pl. CLVII, 40)

5. Ball with an equator painted in manganese (Marshall 1931: 553)

6. Squirrel figurine, apple-green glaze, three violet coloured lines down back (Marshall 1931: Pl. XCVI, 7)

7. Miniature jar, blue, lines of black manganese paint on upper part (Mackay 1938: Pl. CV, 34)

8. Miniature jar, light blue, circles and lines of black paint on neck (Mackay 1938: Pl. CV, 35)

9. Spindle whorl, dark red over blue-green glaze (Mackay 1938: Pl. CVI, 14)

10. Sealing, yellow, svastika with traces of violet glaze (Mackay 1938: Pl. CXI, 1)

11. Sealing, faded cream glaze, edge painted black (Mackay 1938: Pl. XCII, 4)

12. Amulet, yellow, edge coated black (Mackay 1938: PI. CII, 12)

13. Bead, light grey, irregularly incised bands of white paste (Mackay 1938: Pl. CXI, 28)

14. Bead, apple-green, violet coloured bands inlaid (Mackay 1938: Pl. CXI, 38)

15. Bead, white, bands of chocolate coloured inlay (Mackay 1938: Pl. CXXXVII, 89)

16. Bead, white, turquoise blue bands (Mackay 1938: Pl. CXXXIX, 77)

17. Cog-wheel bead, blue, traces of red in incised ring (Mackay 1938: Pl. CXXXIX, 63)

18. Bead, yellow in middle, broader ends purplish-black (Mackay 1938: Pl. CXXXIX, 97)

19. Bead, white, inlaid black bands (Mackay 1938: Pl. CXI, 67, 68)

20. Squirrel figurine, turquoise blue, bands of purplish-brown (Mackay 1938: Pl. LXXVII, 20)

21. Ball, cream, purplish-black glaze (Mackay 1938: 566)

22. Cone, white, inlaid with paste now yellow-possibly green (Mackay 1938: 571)

23. Cone, white, inlaid band of yellow paste (Mackay 1938: 571)

24. Bobbin-shaped gamesman, apple-green, crossed lines of black (Mackay 1938: Pl. CXL, 26)

25. Three bowls, light green, purple to black bands (Vats 1940: 313)

26. Miniature vase, band of purplish-black (Vats 1940: 313)

27. Wheel-shaped pedestal for miniature jar, white, bands of purplish-black (Vats 1940: 314)

28. Cylinder, green, dots of white frit on surface (Vats 1940: Pl. LXXXII, 14)

29. Bead, outside zones dark brown, next two greyish-white, central zone red (Vats 1940: Pl. CXXXIII, 8, h)

30. Bead, white, black spots (Vats 1940: Pl. CXXXIII, 8, i)

31. Bead, brown and white wave bead (Vats 1940: Pl. CXXXIII, 8, c)

32. Bead, circular eye design (Vats 1940: Pl. CXXXIII, 9, m)

33. Bead, dark grey, three irregular white bands (Vats 1940: 435)

34. Bead, white, black bands at end, in between four horizontal rows of three dots each (Vats 1940: 435)

35. Three squirrel figurines, blue, purple-black stripes down back (Vats 1940: Pl. LXXVIII, 28-30)

36. Ball, concentric circles (Vats 1940: 456)

37. Tetrahedron, chocolate, three white parallel lines on top (Vats 1940: Pl. CXX, 57)

the basic ingredients for the cores of objects and for making the glazing mixture would have been required. Moulds for shaping faience objects are essential and could have been of pottery or stone. For the exact process of glazing the moulded objects, it is not sure if a crucible or some larger container was required. At Qom, in Iran, large containers of unglazed earthenware were used. The process employed at Qom utilized a large kiln, 2.13 m in diameter and 2.5- 3 m high, cylindrical in shape and elaborate in design. The extent of its output is realized when one notes that small workshops in Qom were able to produce 40,000 donkey beads in a single firing (Wulff et al 1968: 101). It is very likely, however, that the Harappans would not have needed such a large furnace.

Temperatures needed for faience manufacture are again different according to different techniques. According to Wulff et al (1968: 101), the best temperature for the Qom objects was 1000°C and experiments showed that a lower temperature of 900°C resulted in a coarse and pale glaze, while higher temperatures of 1100°C fused the beads and the surrounding powder into a solid mass. According to Noble (1969: 437), a temperatures of around 950°C is considered necessary. These temperatures would not be a problem for the Harappan craftsman who knew smelting and casting of copper and bronze, but a closed or permanent heating facility would have been required. Temperatures,

of 900° to 1000° C are impossible to obtain in an open fire. Moreover, a firing time of 12 hours, as required in the Qom technique, is considerable and would require a permanent structure.

Moulds for Harappan faience objects are singularly lacking in the artifactual assemblage. None of the other required tools are such that are used exclusively for faience production. As for furnaces, the 16 facilities found by Vats (1940: 470) on Mound F could have been used for glazing of faience objects or for metal working. Two of these, F (a) and F (m) (Vats 1940: 54, 470), give evidence of intense firing. This fact and the small size of the structures mitigate against their being used for pottery firing. Some Harappan furnaces show a pillar or a stump in the centre of the structure which could have been used, to support crucibles or muffles or containers for metallurgy or faience production. Two kilns at Mohenjodaro in the 'palace' in DKG Area (Mackay 1938: 49-50) revealed a 10 cm. ledge around the inside of each structure. These have been thought to support crucibles or to hold a grating on which glazed objects could be kept. Needless to say, the lack of associated evidence makes this aspect of the discussion conjectural.

Faience objects are decorated with glaze, with paints and with pigments applied over the glaze in some objects.

Sophistication in shapes of faience objects depends on the moulds in which they were made. Faience is more amenable than stone, because of its plasticity, for forming beads of different shapes. Thus we have examples of cog wheel beads; gadrooned beads; denticulate beads; collared beads; and more complicated shapes with grooves around the edges and diagonal lines on the body which speak of being formed in moulds.

Mention must be made of a variant of faience, a semi-glass faience whose body is a fused vitreous mass, called "vitreous paste". This differs from faience when seen through the magnifying glass for it shows a number of air or blow holes. The constituents are much the same as faience with the basic ingredient as silica. It appears that addition of the glaze to the siliceous powder was the method by which vitreous paste was produced, which distinguished it from faience. Analyses have been done of some vitreous materials which show that there was not much difference in the constituents.

1) A blue faience bead from Mohenjodaro HR 3352

Silica	87.11%
Ferric oxide and alumina	4.89%
Lime	2.42%
Magnesia	0.30%
Alkalies (by difference)	3.71%
Oxide of copper	0.52%
Loss on ignition	1.05%

(Marshall 1931: 514)

2) Analysis of a sample of vitreous paste

Silica	88.12%
Alumina	3.20%
Ferric oxide	1.82%
Calcium oxide	1.26%
Alkali oxides	5.04%
Cupric oxide	0.46%

Compounds fired to about 1200° C

(Marshall 1931: 574)

3) Fragment of a jar of vitreous paste (HR 3572)

Silica	85.80%
Ferric oxide and alumina	6.74%
Lime	1.73%
Magnesia	0.38%
Alkalies	3.70%
Oxide of copper	0.46%
Loss on ignition	1.49%

(Marshall 1931: 574)

4) Slab of vitreous paste VS 195

Silica	84.66%
Ferric oxide and alumina	6.31%
Lime	1.40%
Magnesia	tr
Alkalies	5.48%
Oxide of copper	0.97%
Loss on ignition	1.18%

(Marshall 1931: 574-75)

5) Fragment of vase

Silica	89.76%
Ferric oxide and alumina	4.79%
Calcium oxide	0.88%
Magnesia	tr
Alkalies	4.07%
Oxide of copper	0.50%

(Satya Prakash & Rawat 1965: Table 3.1: 21)

6) White faience ribbed bangle from Harappa

Silica	87.45%
Alumina	6.57%
Magnesia	1.09%
Lime	0.10%
Alkalies	4.56%
Water	0.73%

(Vats 1940: 468)

However, two objects (a human figurine and the base of a vessel), which on visual examination appeared to be

faience artifacts, were found on analysis to be made out of steatite, which was apparently artificially crushed. The analyses show high amounts of silica and magnesia.

	Base of vessel (%)	Figurine (%)
Silica	57.99	57.23
Oxides of iron and aluminium	4.85	3.69
Lime	4.31	6.39
Magnesia	27.20	28.99
Alkalies	3.54	1.88
Oxide of copper	1.09	0.46
Loss on ignition	2.01	1.36

(Marshall 1931: 576)

This analysis is significant, as it is possible that steatite may have been used as a source of silica for the formation of these objects. If this is so, until chemical analyses are done for more Harappan artifacts, we will not know if steatite or other silica-bearing minerals were used for production of faience. In this context it is interesting to note Vidale's discovery (1989: 178-79) on the surface at both Mohenjodaro and Chanhudaro, of an association of steatite and frothy slag thought to be a by-product of faience manufacture, along with bone chips whose use is not clear. It may be conjectured here, that the presence of bone chips is perhaps to be explained as being an ingredient in the production process. It appears that a mild volatile alkali, containing ammonium carbonate is obtained by the distillation of bones (Partington 1965: 77). As an alkali is a required ingredient for faience production, this may explain why bone chips are found in

this context. Experiments to reproduce faience by using steatite or talc by Khan Bahadur Mohd. Sana Ullah (ARASI 1928-29: 153) resulted in a friable and easily decomposed material. However, it appears possible that steatite was used along with other silica sources as an ingredient for the production of faience. Analyses of about thirty-one specimens from Lothal have not revealed any trace of objects made of a steatite-silica mixture. The Lothal specimens are highly siliceous and the colouring agent in all cases is adjudged to be a compound of iron, while copper compounds were used at Mohenjodaro and Harappa, along with ferric oxide. In the majority of cases, admixtures of lime too are noted, and in two specimens the ingredients are silica, with traces of compounds of calcium and iron (Rao 1985: 661-64).

Seal Making Steatite was used as raw material for the production of seals. Steatite was used as found or in the form of steatite powder, compressed into blocks. Some seals, probably made from compressed powdered steatite have not survived burial well (Mackay 1943: Pl. L II, 1-6, 11). Steatite is a soft stone well-suited for seal carving, but it tends to split along cleavage lines, thus requiring immense care in its cutting and shaping. It would appear, that considerable skill would be required for the initial shaping of the seal itself. Apart from the expertise required for the carving of the symbols (the

pictorial representations) on the seals, a high degree of literacy would be necessary for the delineation of the signs. The seal maker would have to be an artist to deal with the numerous representations that are found on Harappan seals: representations of the 'unicorn', short-horned bull, rhinoceros, tiger, elephant, hare, composite animals and depictions of scenes that are rarer than the animal symbols. Differences in delineation of animal symbols suggest stylistic trends or variations in skill. Inexperience in carving the symbol is seen in seal No. 3817 (Mackay 1943: Pl. L I, 25), and problems with the signs are seen in two examples from Chanhudaro (Mackay 1943: Pl. L I, 4, 25). As for the signs, it appears that roughly 417 signs belong to the Harappan script (Mahadevan 1977: 14), though this number could vary, if signs are classified into basic signs and their variants.

Steatite blocks must first be cut into the required shape and size. From marks left on unfinished seals, it seems that the seal shapes were cut with the aid of a saw (Mackay 1938: 345; Vats 1940: 71-72; Mackay 1943: Pl. LI, 1, 18). According to Marshall (1931: 377), the average thickness of this saw appears to have been 0.6 mm. In a number of examples, we find that the face of the seal (or the obverse) was prepared before the boss was cut (Rao 1985: 312, 307, 315; Mackay 1938: Pl. L 1, 2, 6, 8, 10, 12). In very few cases (Marshall 1931: 377, 378; Mackay

1938: 347; Vats 1940: 54) was the boss finished before the seal face. Three specimens (Vats 1940: 83, 121, 258) are examples of the obverse and reverse being worked together. The operation of engraving the seal face required the largest and most delicate effort on the part of the seal maker. The majority of examples show that signs or pictographs were carved first before the motifs or symbols were delineated (Mackay 1938: 346; Vats 1940: 82, 119, 124; Rao 1985: 307, 311, 312; Mackay 1943: Pl. L I, 9). Only two examples (Rao 1985: 307; Vats 1940: LXXXIX 123) show that the symbol was carved first. Two specimens (Rao 1985: 307; Mackay 1943: Pl. LI, 1) show that outlines were delineated before the detailed work was done. As mentioned, a number of examples show that the seal face was completed before the reverse was dealt with. This ensured that the most difficult operation was undertaken first, so that no wastage would result if one were to complete the back first and then discard the seal due to some flaws in dealing with the obverse. However, the back was not so easy to carve either: on several examples, the boss is either broken off or was damaged during production, hence necessitating cutting of a fresh boss, and consequently, a considerable thinning of the seal itself (Marshall 1931: 377). Work on the reverse of the seals saw the carving out of the boss with a perforation in the centre. At the back, the seal surface was cut away

with a knife, leaving the boss protruding in the centre. This was then carefully shaped and polished, before the groove running across it was made. Finally, the boss was bored from both ends (Marshall 1931: 377). Sometimes the bosses were perforated before being shaped (Mackay 1943: Pl. L I, 4, 5).

The seal coating appears to be much like a slip. Analysis of a decomposed seal from Harappa (ARASI 1930-34: 299) and of the glaze on a steatite seal from Mohenjodaro (Satya Prakash & Rawat 1965: 21) shows that the coating was made out of the same basic ingredients as the seals themselves:-

Ingredients	Seal (%)	Coating (%)
Silica	61.36	61.02
Alumina	1.08	
Lime	0.46	-
Ferric oxide	-	2.40
Magnesia	33.24	34.60
Water	4.65	2.20

The basic purpose of application of this coating appears to have been to whiten the seals. A large number of seals were made out of a steatite whose colour was other than white (grey, brown, or black), and it was perhaps desired to impart a glossy appearance to the finished seal. It would be logical to expect this coating process to have been carried out after the seal was completed in all other respects, but Marshall (1931: 379)

feels that it was done before engraving of the designs, as deeper incisions show the actual colour of the stone beneath. It is possible however that the face was engraved first and the boss cut and only then was the seal coated with the slip-like material and any further working to perhaps highlight some details may have cut through the glaze and revealed the actual colour of the steatite beneath. This is likely from unglazed specimens, which are complete in other respects (Vats 1940: 167, 184; Rao 1985: 309- 3 examples; Mackay 1943: 43). The slip-like material, no doubt, also served the purpose of hardening the parent material, hence enabling the seals to become more durable.

The above discussion does give some indication of the tools required for the craft of seal making. A saw or knife, preferably of metal would have required to carve out the seal shapes from the parent material. A similar tool would have helped to form the boss on the reverse of seals. For carving out the signs and symbols on the seal, a burin could have been used or awls or drills. From some unfinished examples, it appears that pointed instruments were used to first outline the figures and then work further (Mackay 1943: Pl. L I, 3, 5, 8). For putting in the final details pointed or hollow drills were perhaps used.

Knives form a significant proportion of the Harappan

metal inventory and are found at most sites. Saws are, however, rarer. Saws have been found at Mohenjodaro, and Chanhudaro (Marshall 1931: 500-501; Mackay 1943: 300). We have a number of specimens of instruments for engraving, almost none of which can be authoritatively specified as having been used only for the craft of seal carving. Small chisels are found at Mohenjodaro (Marshall 1931: 502-503), a copper rod with a sharp point (Marshall 1931: 218) and a number of awls (Marshall 1931: Pl. CXLIII, 31, 33, 37; Mackay 1938: Pl. CXVI, 4; Pl. CXXI, 6, 8; Pl. CXXIV, 1, 6; Pl. CXXX, 5, 7, 17; Pl. CXXXI, 3, 5, 8, 11) and gravers (Mackay 1938: 474). Objects thought to be drills could also be used for seal carving (Mackay 1938: Pl. CXXXI, 6; Pl. CXXXII, 10). Gouges were found mainly at Harappa (Vats 1940: 47-48), one along with a stylus and a chisel suggesting these were all employed for seal carving (Vats 1940: 48). At Lothal, a wedge-like chisel with a triangular section, an awl and three engravers were found (Rao 1985: 532, 628, 626). At Chanhudaro, some chisels were possibly used in seal carving (Mackay 1943: Pl. LXX, 17, 20) and a number of awls have also been found (Mackay 1943: Pl. LXII, 9, 14; Pl. LXXII, 6-10, 12-17; Pl. LXVI, 14, 21, Pp. 185). Awls of bone have also been found (Marshall 1931: 470-71; Mackay 1938: 420-21; Mackay 1943: Pl. XCII, 29, 32; Rao 1985: 626), along with three of ivory (Mackay 1938: 421).

For the slipping process, utensils would have been required. To facilitate the drying process, without damaging the slip, it may be considered that seals could have been strung on chords through their bosses and hung to dry. A small furnace or a heating facility would have served for baking the seals after they were coated with the slip-like substance.

Weight Making It may be supposed that weight making was a restricted but recognized craft, in view of the conformity of Harappan weights to a uniform system and the accuracy that was essential in the value of such objects.

Regarding raw materials, chert appears to have been preferred for the cubical weights, though other stones were also utilized for this type of weight. However, it appears that chert was used for only this type of weight (Mackay 1938: 605). The system of weights in the Harappan culture is binary in the smaller weights and then decimal. A unit is equal to 13.625 gms. The succession of weights are in the ratios of 1, 2, 1/3 x 8, 4, 8, 16, 32, 64, 160, 200, 320, 640 ... 12,800 (Marshall 1931: 596; Mackay 1938: 602). The Chanhudaro excavations extended the system by the recovery of two weights in the ration of 2/3 of 1 (Mackay 1943: 241), and one as 2/3 of 8 (Mackay 1943: 244). Thus, a new series of 15 weights focus a secondary sequence of fractional ratios: 2/3 of 1, 2/3 of 2, 2/3 of

4...2/3 of 32 (Mackay 1943: 244). According to Bisht and Asthana (1978: 230), a weight which is one-fourth of the smallest Harappan weight was found at Banawali. Some aberrant weights have been found but these are not confirmed as belonging to another system (Marshall 1931: 581; Mackay 1938: 604). Raw materials utilized for making weights are listed in Table III.7.

Table III.7 : Materials used for weights

Materials	A	B	C	D	E	F	G	H	I	J	K	L
Chert	X	X	X	X				X		X	X	
Chalcedony	X		X						X			
Agate	X	X	X	X								X
Yellow limestone	X											
Cherty limestone	X	X										
Limestone	X	X	X									
Carnelian		X		X								
Slate	X	X										
Quartzite	X									X		
Amphibole-schist	X			X								
Jasper			X	X	X							
Hornblende		X										
Flint	X											
Jade		X										
Calcite			X									
Black schist				X								
Granite		X	X							X		
Gneiss				X								
Alabaster	X											
Steatite	X	X		X								
Paste	X											
Sandstone	X	X								X		
Terracotta						X						
Grey stone?		X										
Banded grey stone?		X										
Mottled grey stone?		X										
Hard white stone?	X											
Hard black stone?	X											
Grey and black stone?	X											
Grey and white marble	X											
Dolerite												X

(Site codes: A= Mohenjodaro; B= Harappa; C= Chanhudaro; D= Lothal; E= Desalpur; F= Allahdino; G= Banawali; H= Kalibangan; I= Lohumjodaro; J= Mitathal; K= Rupar; L= Rangpur).

Despite the popularity of steatite in the Harappan culture this material was little used for making weights, probably on account of its light weight and capacity for damage; similarly with faience. Moreover, the weight of steatite can be altered on heating, which would render it ineffective for weighing. Yet, this material was still used. In Mackay's excavations at Mohenjodaro (1938: 605), 7 out of 220 weights were made of steatite.

At some sites, weights are found which were not as accurate as the manufactured weights. Here, possibly, pebbles or stones, roughly equivalent in values to manufactured weights were used as substitutes. These could have been used by the common people at various sites. At Mohenjodaro, pebble weights are made out of a hard white stone, brown sandstone, hard black stone, grey and black stone and grey and white marble (Mackay 1938: 404). At Chanhudaro, pebble weights are made of granite and limestone (Mackay 1943: 242). At Lothal, such a class of weights are the truncated spheroids of dolerite (Rao 1985: Pl. CCLVIII). At Mitathal, inferior quality weights are of sandstone, granite and quartzite and are mostly of a late period (Suraj Bhan 1975: 59).

Initial stages of weight production must have followed that of bead making. Out of stone blocks, smaller blocks were chipped off and by careful flaking,

were reduced to the required shape. None of the shapes of weights would have been difficult for the Harappan lapidary worker. The main shapes of weights are cubical, spherical with flattened top and base, cylindrical with flattened top and base, conical and barrel-shaped. Weighing of the weights, to confirm their adherence to the system, may have been done prior to and after the occasional bevelling of the corners and polishing. The techniques of shaping the blocks and polishing them would have been the same as for bead making.

Weight-making tools would have been essentially similar to those of bead making. Hafted hammer stones could have been used for chipping larger blocks and for finer flaking; grinding stones would have been used for smoothing and polishing the surfaces.

Shell Working Shell artifacts, primarily bangles, ladles, inlay, beads, rings, and other objects whose use is not immediately apparent, (see Table III.8 below) have been found at most Harappan sites. Shells and shell artifacts have been found at sites far removed from the source of raw material, such as at Harappa and Shortughai.

Table III. 8 : List of objects made of shell

Artifacts	Objects of uncertain use
Spindle whorl	Wavy ring
Ladles	Caps-jar covers?
Cups	Small cones
Dishes	Rods
Receptacle	Handle?
Knife	Temple ornament?
Engravers	Plumb-bob
Scrapers	Plectrum
Burnisher	"Bridge"
Needle	
Compass	
Linear measure	
Beads	
Composite beads	
Ear stud	
Bracelets	
Spacer	
Finger ring	
Pendants	
Amulets	
Hair-pin head	
Gamesmen	
Balls	
Inlay	

A short note on species of shells used for the manufacture of various objects will be relevant here. Bangles were made out of the conch shell or Turbinella pyrum., Chicoreus ramosus, and occasionally Pugilina bucephalla was also used (Kenoyer 1984b: 103). Bangles were also made from a bivalve species, Tivela damoides. Ladles or spoons were made solely out of Chicoreus ramosus, and another receptacle, the "libation vessel" (Kenoyer 1984b: 105) out of the gastropod Turbinella pyrum. Inlays were made out of a number of species, such as Turbinella pyrum, Chicoreus ramosus and Fasciolaria trapezium.

The sources of shell used by the Harappan craftsmen are limited. The collection of shells would not have been difficult for the inhabitants of coastal villages who must have farmed the shallow waters along the coast and perhaps ventured into slightly deeper waters too. Shell fishing was probably undertaken most of the year round, except for the hazardous period during the monsoon.

After the shells were collected, they were heaped up and left to enable the organisms inside to rot and decay. Probably this activity would have been undertaken in areas away from the main habitation, so as to reduce pollution. This may explain the find of a shellworking area in the surface survey at Mohenjodaro, on a small mound several hundred metres northeast of the Moneer Area (Kenoyer 1984b: 107). After these organisms decayed and were removed, the actual process of making artifacts was started.

It would appear from a glance at the inventory of Harappan shell objects, that shell was primarily used to make bangles and that most other objects were made from smaller waste pieces and bits of discarded bangles, or those broken during the process of manufacture. However, from Chicoreus ramosus, only ladles were made.

Shell species were treated in different ways

according to the objects that were to be manufactured from them. For the manufacture of bangles out of Turbinella pyrum, the large shell had to be first hollowed out. According to the techniques used by modern shell workers of Bengal, a slice of the lip was sawn off and through the aperture, the internal septa were chipped off and removed. Then the apex was smashed in and the columella removed; the whole operation resulting in a hollow shell (Hornell 1910-1914: 436).

The next stage, that of actually dividing the shell body into segments or bangles, required a firm hand and considerable skill. For this operation, a metal saw was required. Striations on shell pieces indicate the use of a bi-directionally denticulate saw with an extremely thin edge, roughly 0.4 to 0.6 mm in width (Kenoyer 1984b: 103). One of the Harapan saws, of bronze, measures 45.7 x 15.7 x 2.5 cm (Marshall 1931: 500). The other, also of bronze, of which only a fragment was found, had a width of 6.2 cm (Marshall 1931: 501). A saw from Chanhudaro measured 26.7 x 8.7 x 0.35 cm (Mackay 1943: 300). However, none of these saws correspond with the saw marks visible on Harappan shell pieces (Kenoyer 1984b: 103). The final task after sawing the circlets, remained only that of smoothing the inner surfaces of the bangles and polishing the outer surfaces. Some bangles were decorated with a simple chevron design, utilizing the natural suture of the shell

to facilitate the design. Other designs include bangles with single, double, triple and multiple grooves.

Large gastropods would have required a complicated technique, as described above. Only in this fashion, could a number of bangles be removed from a single shell. Simpler techniques could be possible only with other species of shell, such as the bivalve shells (one example are Tivela damoides), where each half of the shell was ground on a stone so as to perforate the centre of the shell and eventual formation of the bracelet needed further grinding and polishing of the inner and outer surfaces of the bangles. Shell bangles of the Papuans of New Guinea show that simple techniques could be employed to make bangles. A bamboo pole, with a stone lashed across it as a handle, is used as a borer to bore holes in firm shells which are placed in a wooden block with a hole to prevent the shells from moving. A circular downward motion of the borer on both sides of the shells results in the formation of bracelets (Frobenius 1909: 432-35).

For the shell ladle, the external spires or varices were first chipped off. The shell was then diagonally cut from the top of the main whorl covering both sides of the shell and eventually reaching the anterior portion of the shell. To form the handle, two parallel cuts were made, from the anterior end to the main body of the shell, and a rough ladle form could be detached. A smaller ladle could

be similarly made from the other side of the shell (Kenoyer 1984b: 103-104). Eventually, the whole shell was used to make two ladles, along with a quantity of re-utilizable waste. The final stage of ladle production involved smoothing down the rough ladle into a more presentable form. These ladles could have had a ritual association, such as for pouring oblations. Cups and dishes were also made out of gastropods (Mackay 1938: Pl. CV, 8; Pl. CVI, 44; Vats 1940: 373); so also, a receptacle made out of a gastropod with the inner whorls and outer excrescences removed (Mackay 1938: Pl. CVI, 36).

A quantity of minor objects were manufactured out of either whole shells or more usually, out of waste material resulting from the production of larger objects such as bangles or ladles. Objects such as inlays were made from the lip portion of shells, discarded pieces of shell walls, or out of thin shell sheets. That whole shells were utilized for the manufacture of inlays is concluded from the fact that two species of shells, Lambis truncata sebae and Fasciolaria trapezium were used only for inlay production and no other object appears to have been made from them (Kenoyer 1984b: 104). Circular inlays must have been cut from the columellae of gastropods. The production of inlay involved sawing out of shapes, chiselling, drilling and grinding. Simple inlay pieces were slightly bevelled for keying (Marshall 1931: 565).

Spindle whorls were probably made out of the walls of shells, as these objects appear to follow the natural curvature of shell (Marshall 1931: Pl. CLVI, 13, 16-18; Mackay 1938: Pl. CV, 41, 48; Pl. CVI, 23; Pl. CVII, 10; Pl. CIX, 48, 55-57). So also with objects termed as "shell caps" which are thought of as jar-covers (Mackay 1938: Pl. LXXI, 5, 6; Pl. CV 42; Pl. CVI 27; Pl. CIX 34; Vats 1940: Pl. LXXXII 11; Pl. LXXXIII 13). Spindle whorls and shell caps, unlike inlay pieces, were obviously not by-products, but must have utilized a considerable portion of a shell.

Solid objects or artifacts apparently made from thicker pieces of shells were probably made from the columellae of large gastropods, such as Turbinella pyrum, whose walls were utilized for bangles. Thus we have objects such as cones, wavy rings, spherical balls, beads and amulets.

Decorations on shell objects were limited, perhaps due to the material. Bangles usually had a chevron design incised or incisions of diagonal lines, and grooves. Spindle whorls were sometimes, and shell caps were mostly decorated with simple designs of parallel cuts on the face meeting in the centre from the four corners. Shell balls were also decorated with a standardized design of concentric circles at regular intervals all over the

surface of the ball. Some incised designs could have been filled up with pigments (Mackay 1938: Pl. LIII 61; Pl. CXLII 57).

Tools required for shell working must have included a repertoire of crude and sophisticated forms. For the early stages of bangle production, stone hammers were probably hafted and used to chip off external protruberances from shells. In cutting the apical septa and removing the columella, a similar hafted stone hammer was probably used, perhaps with the aid of a chisel. For grinding the finished bracelets, for smoothing outer surfaces of ladles, for rubbing down inlays to make them uniform in thickness, whetstones or grinding stones were probably used. Whetstones, with small circular depressions for polishing shell bangles and stone cylinders for polishing internal edges of bangles, were found at Nageshwar (Hegde et al 1984-85: 18). For cutting out bracelets from bivalve shells, grinding stones were probably the only stones used. A basalt anvil stone was found along with unworked shells at Balakot (Dales & Kenoyer 1977: 15).

More sophisticated tools, probably of metal, were also undoubtedly used. The best example is the requirement of a metal saw for the cutting of bracelets from large gastropods. A flint knife or saw with a

serrated edge would have been insufficient. A metal file or sharp instrument would also be required to shape the ladle made from Chicoreus ramosus. Fretting out of inlay pieces too may have required some instrument such as a file or a saw or a drill. According to Marshall (1931: 565) the drill would have been the easiest to use, but studies of the edges of some inlays appear to suggest the work of a file or a saw. To carve out circular pieces, a tubular drill may have been used. To carve out the simple designs on spherical shell balls, fine chisels or awls were perhaps used. Designs on shell bangles were probably incised with chert blades or specialized copper or bronze files (Kenoyer 1984b: 103).

Where small whole shells (for instance Dentalium Spp.) were utilized as beads or pendants, the only work required was perforation. This could have been done with any pointed instrument, a metal awl, a stone drill or even with a pointed bone tool, and due to the fragility of the material, could have been undertaken with great ease. It may be mentioned here that among the Chumash, Olivella shells were drilled with sharp flint splinters fixed into a slender stick, which was twirled between the palms (Arnold 1987: 25).

Difficulties in the Archaeological Interpretation of Craft Working Tools:

There are various aspects that need to be considered,

as we conclude. One aspect that should be emphasized in this chapter on Harappan technology is the question of craft tools. A number of crafts depend on tools which do not essentially differ from tools used by other crafts, which makes archaeological detection of craft working difficult. Chisels could be used for metal working, in steatite seal carving and for woodworking. Awls could be used for sewing garments, for carving seals, for leatherworking and for boring stone beads. Saws could be used to cut shell bangles, and cut blocks of stones for beads and seals. Hammers could be used for breaking up metallic ore, for metal working and for use with chisels. Grinding stones could be used for the polishing of beads, weights, shell bangles, and for boring bangles made from bivalve shells. Thus the presence of such tools, unassociated with other craft working indicators, will not clarify the specific activity undertaken. Some tools would have a specific use- moulds for faience or steatite paste objects, if such were found. Apart from moulds, for which we have no evidence, other tools which are relatively non-ambiguous, are stone and metal drills for boring beads, bead hones, and crucibles found with traces of metal in them.

Use of Harappan Kilns

Another issue involves the requirements of permanent

heating facilities for separate crafts. From some ethnographic clues, discussed in the preceding chapter, it would seem that a fair amount of pottery baking can be done in open fires. This also gets credence from a third-millennium pottery firing structure unearthed at Mehrgarh (Audouze & Jarrige 1979) which has been delineated as an open firing structure. That large quantities of pottery could be fired in such a fashion, seems to be indicated by the capacity of this structure for about 200 vessels (Audouze & Jarrige 1979: 17). But not one of the kilns recovered at Mature Harappan sites has been unequivocally associated with pottery, suggesting their being used for firing earthenware. Some furnaces at Harappa have been thought of as having fired objects requiring much higher heat than pottery (Vats 1940: 473).

Mohenjodaro furnaces or kilns are circular or oval on plan. Two kilns measure roughly 1 m x 1.3 m (Mackay 1938: 49); another one, slightly elliptical measures 1.8 m x 1.4 m with an extant height of 20.3 cms (Mackay 1938: 62). An unfinished kiln is of a very large size, c. 4.5 m, with a part of the wall standing 1.5 m above the foundation (Mackay 1938: 85). Another two kilns measure 2.1 m x extant height 0.4 m, and 1.4 m x extant height 0.4 m (Mackay 1938: 154). Mohenjodaro kilns are of the double - chambered variety, with the upper chamber as the baking chamber where objects to be fired are kept, while fuel is

burned in the lower chamber. The two chambers are connected with flues in the floor of the upper chamber. Furnaces at Harappa are of three types: one, a jar-furnace (Vats 1940: 470), a cylindrical furnace (Vats 1940: 470), and pyriform or pear-shaped furnaces, whose major axes vary between 1.8 m and 2.5 m and minor axes from 1.06 m and 1.7m (Vats 1940: 472). Two furnaces at Harappa revealed a pillar positioned at the back of the furnace perhaps for supporting a crucible or objects to be baked (Vats 1940: 472). At Mohenjodaro, also, two kilns revealed similar rough brick columns (Mackay 1938: 102-103). So also a furnace at Lothal had a brick column set at the back at a short distance from the back wall. The shape of this kiln was more like an oval (Rao 1979: 84: Fig. 12, 2). Two kilns at Mohenjodaro revealed instead of a column, a 10 cm ledge round the inside of the kilns (Mackay 1938: 49), perhaps to support vessels or crucibles or a more likely a grating on which objects were kept.

The bead kiln at Lothal, measuring 2.6 m x 1.2 m, resembles pyriform examples of furnaces from Harappa. At Lothal, the heating facility was unambiguously associated with the heating of agate nodules and unfinished beads (Rao 1979: 83). Jars associated with brick pavements at Lothal are thought to have been jar-furnaces (Rao 1979: 98-100), of which one example, unassociated with pavements, was found at Harappa. Another type of furnace

which was unique was found at Lothal. This consisted of a rectangular furnace, measuring 0.79 m x 0.6 m, built of bricks laid vertically on end (Rao 1979: 95). Harappan kilns or furnaces ensured that the fuel introduced was used efficiently and thus there was less wastage. Rather than being used for pottery firing, it could be more likely that such facilities were used for operations requiring higher temperatures, such as metal working or faience production. One other type of furnace, again of unique design, was probably not used for pottery firing or metal working. This facility, found at Chanhudaro, is the only one of its kind and will be discussed in detail in Chapter V.

Fuel Requirements For Harappan Kilns

We do have some information in connection with the fuel that was used in Harappan kilns. Most of the facilities from Harappa are said to have utilized charcoal, from the evidence of the light weight of the ashes and intense vitrification of the furnace walls (Vats 1940: 473). Two furnaces, F(b) and F(i) were fired with cowdung cakes (Vats 1940: 470-73). From Mohenjodaro, two kilns in Block 1 of DkG appear to have used wood or charcoal as fuel, while another two kilns in Block 9 of DKG clearly used wood fuel (Mackay 1938: 49, 102). It is not clear whether the bead kiln at Lothal used cowdung cakes or wood of Acacia species or both (Rao 1979: 120;

1985: 669).

Wood and charcoal (depending on particular tree species) are efficient fuels, giving high heat for a longer duration. Cowdung cakes are not likely to give a high heat for long, and thus, the utilization of cowdung cakes as fuel for a bead kiln would be understandable, as a very high heat is not required for this operation. High temperatures are essentially required for two crafts, metallurgy or metal-working and the production of faience. The smelting of carbonate ores would not require a great heat, only about 500-600^{o} C (Shepherd 1980: 162). Oxide and carbonate ores can be smelted in a wood or charcoal fire over a clay-lined pit with air, but the copper obtained is a spongy mass, which is not easy to work (Agrawal 1971: 156-57). The smelting of sulphide ores would require considerable amounts of fuel, as the technique involves a number of refining processes.

According to Raghu Nandan (1988: 181), the roasted ore is introduced gradually into the furnace along with flux (silicate slag- a refuse from old iron ore furnaces) and charcoal. The ratio of charcoal to ore and flux is 1:1.23 (ore and flux are in equal quantities). This figure is for smelting in the Khetri copper ore region. For smelting in Shiraz in Iran, Horne (1982: 12) gives different figures: charcoal to copper ratios (for oxide

ores) is at least 20:1 and perhaps as much as much as 40: 1. A 5 kg smelt would thus require 100 kg of charcoal. There is no mention of flux. Hodges (1970: 62-63) mentions that ore is mixed ideally with charcoal, but dry wood could also be used and the whole fired for almost a day. Raghu Nandan (1988: 181) mentions a firing time of 12-14 hours. Horne's calculations (1982: 12) for the production of charcoal envisages 700 kgs of wood and 3.3 mandays of labour to produce 100 kgs of charcoal.

These calculations, show that large quantities of charcoal and therefore wood were required for smelting operations. The melting of copper ores for casting would also require a high temperature of 1083^{o} C. Hence, what should be noted is the high requirements of fuel for such operations. In this context, it may be relevant to discuss the Harappan evidence. It should be noted that in excavations, practically no smelting operations have been revealed at Harappan sites. Only one trough containing copper ore and a piece of lead was found at Mohenjodaro. Thus, this could point to preliminary ore smelting operations being carried out at mining areas for copper. This would involve not only saving of fuel for the costly smelting operations, but also a saving in transportation costs, as cast copper pieces or ingots would be cheaper to transport than the more bulky ore. A number of Harappan metal objects as noted in Table III.3 are made by cold

/hot working or by annealing copper/bronze ingots. But it should not be forgotten that the melting of copper, too, requires considerable fuel inputs, but obviously not for the duration of time needed for ore smelting. That copper and bronze were melted at Harappan sites is noted by the presence of cast objects and those produced by the cire perdue method (again see Table III.3). Thus we can conclude that in the case of metallurgy at least, the most fuel-expensive processes were probably carried out nearer the mining areas.

As for faience production, it is true that high temperatures are required for these objects and if the Qom technique is applicable, then the duration of firing [12 hours (Wulff et al 1968: 101)] would require very considerable inputs of fuel, although a number of small faience objects could be fired in one operation.

The use of permanent heating facilities also envisages larger spatial requirements, unlike most crafts which can be undertaken in domestic contexts or in very little space. Thus flaking and shaping of stone beads, drilling of beads, carving of steatite seals, making of stone weights and cutting of shell objects all need little space. This is apart from the crafts of spinning, stone tool making, basket and mat making which would require little space.

The uses to which various materials were put could be multiple. Metal was utilized, as seen in Table III.2, for tools and implements and utensils and for ornaments; steatite for ornaments, seals, and utensils; shell for tools, accessories such as ladles and cups, and ornaments; faience for ornaments, tiny utensils, sealings; silver for ornaments and vases. Some raw materials which are rare, such as gold, lapis lazuli, turquoise, were used only for ornaments.

Recoverability: Issue of the Reuse of Materials and Products

Various artifacts give evidence of reuse, suggesting a consciousness of the value of materials and objects. The clearest example is the reuse of metal objects, some of which were folded over and kept in hoards, obviously to be remelted and used again to form other objects. From Mohenjodaro, a casting kept for reuse and discarded tools, broken and bent, kept for remelting were found (Marshal 1931: 506, 490), a copper blade with its point doubled over; two castings of blade-axes- faulty and full of blow-holes; and an irregular copper casting, were all found in the DKG Area (Mackay 1938: 459, 452, 452). At Chanhudaro were found a chisel folded over, a small knife reused without a tang (Mackay 1943: 43, 181). A flat corroded piece of copper was found at Harappa, in association with a number of metal objects and possibly kept for reuse

(Vats 1940: 277).

In the context of steatite seals, too, some reuse is noted which is expected considering the function of such objects. From Chanhudaro, a seal showed on its reverse the making of a second handle after the first broke away, and another seal whose inscribed portion was cut and reused (Mackay 1943: 146). A seal at Lothal showed its surface rubbed for reuse (Rao 1985: 316). Rejected pieces and waste pieces from steatite seal carving could be powdered to make ornaments and seals of compressed powdered steatite (Rao 1985: 612).

Broken pieces of ladles could be used to make backing for a bow drill; waste fragments from gastropod species could be used to make inlay pieces; shell fragments could be burned to make lime (Kenoyer 1984b: 108, 104, 109); and the manufacturing process for bangles out of gastropods would leave shell parts which could be utilized for making a number of objects. The outer lip of the species Lambis truncata sebae could be used for making toy cart frames and animal figurines (Kenoyer 1984b: 104). At Lothal, broken pieces of shell bangles were chiselled and sharpened to make engravers and scrapers (Rao 1985: 615).

Thus it must be realized that unless we keep in mind the potential of by-products of manufacture or waste pieces or broken objects for reuse we may not get a

correct conception of the craft. When the basic data regarding craft production comprises only archaeological evidence, then this aspect of reuse must be kept in mind. Not only this, materials that we may ascribe as rare in a culture, in that few objects are recovered in the material assemblage of a particular material, may not actually in antiquity have been so rare; even if damaged or broken, these objects may have been retained by the inhabitants of a settlement when they moved away.

Mature Harappan Craft Working As Contrasted With The Early And Late Harappans

A list of raw materials utilized for craft products that have so far been revealed from explorations of Early Harappan sites illustrates clearly the difference between the Early Harappan and the Mature Harappan periods (see Table III.9).

In the context of craft production, the sites of Amri, Mehrgarh, Rahman Dheri and Sarai Khola give some evidence of stone bead making. At Amri 3 micro-drills of phtanite were found (Jarrige 1981: 110) which could belong to the Mature Harappan period. At Rahman Dheri, unfinished beads were found and also a micro-drill still embedded in a partially bored bead (Khan 1979: 397). Two unfinished beads from Sarai Khola indicate stone bead making carried out here (Halim 1972: 16-18). At Jalilpur, beads and unworked pieces of lapis lazuli were found

(Mughal 1972: 124). Stone bead making is attested at Mehrgarh where unfinished beads and fragments of lapis lazuli, turquoise, carnelian and other semi-precious stones were found with stone drills and micro drills of phtanite (Jarrige 1981: 108-109).

Stone tool production is noted at Jalilpur (Mughal (1972: 124), Sarai Khola (Halim 1972: 29), Kot Diji (Khan 1965: 82) and Mehrgarh (Jarrige 1981: 104).

Mehrgarh has also revealed the working of steatite, shell cutting and the production of bone tools. About a 100 bone awls and a stone awl sharpener with another 50 awls were found (Jarrige 1981: 99). It is not clear what the awls were used for. It must also be mentioned that charred cotton seeds, whether cultivated or wild, were also found (Jarrige 1981: 99). Metallurgical activities are noted in the form of 13 crucible fragments with metal deposits on them (Jarrige 1981: 108). (See Table III. 10).

A number of Early Harappan sites in the Sind such as Tando Rahim Khan (Majumdar 1934: 86), Bandhni (Majumdar 1934: 121), Chauro (Majumdar 1934: 123), Maliri (Majumdar 1934: 127), Pokhran Landi (Majumdar 1934: 129) and Khajur Landi (Majumdar 1934: 135) have revealed only chert tools as artifacts apart from pottery. As for other finished artifacts, faience and paste are rare in the Early Harappan period. Some paste beads were recovered at Rahman

Dheri and paste beads and fragments of faience bangles at Sarai Khola (Halim 1972: 16, 24). Shell bangles and beads are also rare and are found at Kalibangan, Sarai Khola (Halim 1972: 23), Kot Diji (Khan 1965: 83), Gumla (Dani 1970-71: 44), Damb Buthi (Majumdar 1934: 120) and Mehrgarh (Jarrige 1981: 98, 109). Metal objects too are rare and are found sparsely at individual sites: a copper bangle at Mitathal (Suraj Bhan 1975: 6), 3 antimony rods and 1 nail parer at Gumla (Dani 1970-71: 42, 44), a copper awl fragment at Kohtras Buthi (Majumdar 1934: 134), a copper chisel at Othmanjo Buthi (Majumdar 1934: 141), a fragment and a pin at Mehrgarh (Jarrige 1981: 108) while 13 metal objects were found at Sarai Khola (Halim 1972: 18). 1 gold bead was found at Jalilpur (Mughal 1972: 119). Thus the quantification of objects reveals the difference between the Early Harappan and the Mature Harappan periods. The limited varieties of raw materials utilized also illustrates the difference between the two periods.

The late Harappan period too reveals vast differences in craft products as contrasted with the Mature Harappan period. At Jhukar in Sind, steatite beads, a lapis lazuli bead, a green felspar bead, a jasper bead, an ivory pin, a copper spearhead and chert cores and flakes were found (Majumdar 1934: 15). The Jhukar occupation at Chanhudaro reveals seal amulets which with only a few exceptions are coarsely and roughly made. They reveal no characters or

pictographs and are mostly of terracotta (Mackay 1943: 141-43). Very few metal objects were found at Chanhudaro in the late occupation (Mackay 1943: 188-89) while beads were mostly of terracotta and faience. At Harappa the post-Harappan culture termed as Cemetery H, revealed primarily pottery. Cemetery H culture sites were also noted in the Bahawalpur regions where disappearance of the characteristic Mature Harappan artifacts is evident (Mughal 1982: 92).

Further to the east, the late Harappan period is known at Mitathal as the Mitathal II B period. In the surrounding area, this period is associated at a number of sites with the Degenerate Siswal Ware (Suraj Bhan 1975: 117). At Mitathal, in the II B period, inferior pottery, household objects and ornaments are noted, Cubical stone weights are replaced by discoid weights. A celt, a "parasu" and a ring comprise the metal objects (Suraj Bhan 1975: 17). 34 beads were found in this phase, including 3 of agate, 2 of carnelian, none of faience, 3 of paste and 17 of terracotta (Suraj Bhan 1975: 70). A large number of faience bangles were found (Suraj Bhan 1975: 76). This reliance on faience was noted by Dikshit (1984: 265) who stated this to be the main material used in the late phase of the Harappan culture. Most other materials such as semi-precious stones, shell, metal and especially steatite became rare.

In Gujarat the late Harappan sites reveal the paucity of material artifacts recovered in excavations and the degeneration in the material culture. At Jokha 2 beads were found; 1 bone objects; a copper bar forming a ring; and 2 flakes, 11 cores and 6 tools among the stone tools (Mehta et al 1971: 7, 50-55). At Dhatva 1 terracotta whorl; terracotta handmade wheel; 2 cicular terracotta disc; 2 terracotta beads and 1 shell bead were found (Mehta et al 1975: 16, 22-23). At Kanewal a large number of stone tools; terracotta spindle whorls, balls and cakes; clay toy wheel, bull figurine, lamps and handles were found (Mehta et al 1980: 63-65). Among the beads recovered were 3 of carnelian, 2 of chert, 1 of agate, 3 of shell, 32 of faience and 1 of terracotta (Mehta et.al 1980: 67-68). At Somnath shell bangles, microliths, one copper celt, a stone muller and a ball were recovered. Beads unearthed comprised one each of terracotta, crystal, shell, carnelian, dentalium shell, and burnt agate (Nanavati et al 1971: 71-73, 77). Only at Lothal do we find a number of metal artifacts in the post Harappan period. However it must be remembered that metal is a material highly amenable to recycling and it is likely that some Harappan artifacts were reused by the late Harappans.

Stone tool production is widely attested in the Early

Harappan sites. Bead making too is found at a few sites, but we find scarce indicators of other crafts. The indicators of stone tool production illustrate clearly the presence of a craft which made use of easily procurable raw materials whose processing did not require sophisticated technologies. On the other hand in the Mature Harappan period we find the indicators for crafts utilizing raw materials that were definitely non-local in origin and which would have required effort in procuring them. The difference between fishing for shell and collecting chert for stone tool production can be appreciated.

Technological advancement in the Mature Harappan period is clear from finds of numerous craft objects which would have required sophisticated tools and techniques for their manufacture. This is exemplified by faience production, production of etched carnelian beads, seal carving and shell cutting. Sophisticated metal working techniques such as cire perdue, soldering, casting, and alloying are noted in the Mature Harappan period while the few metal objects from the Early Harappan period probably were produced by basic metal working techniques. Technological sophistication should also be noted from the requirement of heating facilities in which high temperatures could be obtained for faience production and casting of metal objects.

Sophisticated technologies utilized for Mature Harappan crafts imply a greater labour input. Major crafts in the Early Harappan period such as stone tool production and bead making would not have required much time or effort for production of artifacts. However, crafts such as faience production, seal carving, shell cutting, and metal working would all have required significant inputs of time and energy. Thus depending on the scale of output, less time would have been available to craft producers for other activities. This issue would be significant for the economy as a whole.

In the Early Harappan period we do find the production of few seal-like objects. These objects however, reveal mainly geometric motifs. The seals produced in the Mature Harappan period required the carving of symbols and signs. The necessity to acquire expertise over the carving of signs and the use of such objects have direct implications for the literacy levels of Mature Harappan populations. The functions of stone weights found in the Mature Harappan period signify the prevalence of a uniform system of weighing for the entire Harappan area. The weights recovered from late Harappan levels at various sites reveal the existence of separate diverse weighing systems prevalent in different regions.

It is clear that there is a significant change in

the form and quantity of manufactured products in the Mature Harappan period as contrasted with the earlier and later periods. This increase in the variety and technological attainments of the Mature Harappan craftsmen in a reflection of the expansion of consumption. The production of seals and weights reflects the growth of specialized functionaries using these objects while a number of other craft products appear to have used by a restricted proportion of the population. According to Vidale (1989: 180) Mature Harappan craft products reflect the desire of the consumers for crafted objects produced with much expenditure of labour.

It must be remembered that such production will be possible only in certain social environments. Such environments, facilitating the procurement of exotic materials and the encouragement of technological skill for production, and paving the way for increased consumption, will be dealt with in Chapter VI.

Table : III.1

Materials used for Beads at Harappan Sites

S.No.	Sites	Agate	Carnelian	Jasper	Chalcedony	Quartz	Lapis Lazuli	Lime Stone	Chert	Faience/ Paste	Steatite	Copper	Gold	Silver	Terracotta	Shell	Other Materials
1.	Allahdino	✓	✓	✓			✓					✓		✓		✓	bone
2.	Banawali		✓				✓			✓	✓		✓		✓	✓	
3.	Chanhudaro	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	✓	crystal, amazon stone, onyx, plasma, fuchsite, hornblende, breccia, haematite
4.	Dabarkot									✓							coral, glass(?), stone(?)
5.	Desalpur									✓					✓		
6.	Harappa	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	jadeite, felspar, serpentine, lydian stone, marble, hornblende, breccia, calcite, diorite, stalagmite, jaisalmer stone, ivory
7.	Lohumjodaro		✓							✓	✓	✓					felspar, grey stone(?)
8.	Lothal	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	chrysoprase, bloodstone, opal, sard, crystal, amazon stone, onyx, cairngorm, ivory, bone, plasma, granite

contd

ontd.

S.No.	Sites	Agate	Carne-lian	Jasper	Chal-cedony	Quartz	Lapis Lazuli	Lime Stone	Chert	Faience/ Paste	Stea-tite	Copper	Gold	Silver	Terra-cotta	Shell	Other Materials
9.	Mitathal	✓								✓	✓				✓		
10.	Mohenjodaro	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	turquoise, felspar, serpentine, onyx, hornblende, jade, haematite, breccia
11.	Nagoshwar	✓								✓	✓				✓	✓	
12.	Rakhigarhi									✓	✓				✓		semi-precious stones(?)
13.	Rangpur	✓	✓	✓						✓	✓		✓			✓	ivory
14.	Rupar	✓	✓		✓						✓				✓	✓	flint
15.	Shortughai		✓				✓										
16.	Surkotada	✓	✓				✓			✓	✓				✓		

Table III. 9

Raw Materials Utilized at Early Harappan Sites

S.No.	Sites	Agate	Carne-lian	Jasper	Lapis Lazuli	Chert	Stea-tite	Faience/ Paste	Copper	Shell	Ivory	Terra-cotta	Others
1.	Arabjo Thana					✓			✓			✓	grey stone(?), slate
2.	Bandhni					✓							
3.	Chauro					✓						✓	
4.	Gumla			✓		✓			✓	✓		✓	bone, white stone(?)
5.	Jalilpur					✓						✓	gold, bone
6.	Kalibangan	✓	✓						✓	✓		✓	
7.	Khajur Landi					✓							
8.	Kohtras Buthi					✓			✓			✓	
9.	Kot Diji					✓				✓			mother-of-pearl
10.	Maliri					✓						✓	
11.	Mehrgarh		✓		✓		✓		✓	✓		✓	flint, bone, turquoise, phtanite
12.	Mitathal								✓		✓		stone(?)
13.	Nausharo						✓						
14.	Othmanjo Buthi					✓			✓				
15.	Pokhran Landi					✓							
16.	Rahman Dheri	✓	✓		✓			✓			✓	✓	bone
17.	Sarai Khola	✓	✓		✓		✓	✓	✓	✓		✓	flint, bone, lime, slate
18.	Siswal											✓	stone(?)
19.	Tando Rahim Khan					✓							

Table : III.10

Evidence for Early Harappan Craft Activities

S.No.	Site	Stone Bead Making	Metallurgy	Shell Cutting	Steatite Working	Faience Production	Stone Tool Making	Spinning	Reference
1.	Aari	X ✓	✓	X(?) ✓	✓		✓		Casal 1964
2.	Arabjo Thana		✓				✓		Majumdar 1934
3.	Balakot		✓			✓	✓		Dales 1979
4.	Banawali	✓	✓	✓	✓	✓	✓		Bisht 1982
5.	Bandhni						✓		Majumdar 1934
6.	Chauro						✓		Majumdar 1934
7.	Damb Buthi	✓		✓			X ✓		Majumdar 1934
8.	Gorandi	✓		✓					Majumdar 1934
9.	Gumla	✓	✓	✓			✓		Dani 1970-'71
10.	Jalilpur	✓	✓	✓		✓	X ✓		Mughal 1972
11.	Kalibangan	✓	✓	✓			✓		Lal 1979
12.	Khajur Landi						✓		Majumdar 1934
13.	Kohtras Buthi		✓				✓		Majumdar 1934
14.	Kot Diji		✓	✓			X ✓		Khan 1965
15.	Lewan	✓	✓	✓			X ✓		Allchin & Knox 1979
16.	Maliri						X ✓		Majumdar 1934
17.	Mitathal	✓	✓	✓	✓	✓	X ✓		Suraj Bhan 1975
18.	Mehrgarh	X ✓	X ✓	X ✓	X ✓		X ✓		Jarrige 1981
19.	Othmanjo Buthi		✓				✓		Majumdar 1934
20.	Pokhran Landi						X ✓		Majumdar 1934
21.	Rahman Dheri	X ✓					✓		Khan 1979
22.	Sarai Khola	X ✓	✓	✓	✓	✓	X ✓		Halim 1972
23.	Siswal		X(?)						Suraj Bhan 1975
24.	Tando Rahim Khan						✓		Majumdar 1934

CHAPTER IV

The Distribution of Harappan Craft Activities: A Survey Through Maps

An attempt is made in this chapter to survey the location of Harappan craft production through a series of maps, each focusing on a separate craft. Each craft is viewed from two angles, one of production areas for the craft and the other of findspots of objects produced by that craft. It is hoped that in delineating production and findspot sites for each craft, one would be able to discern linkages between two important threads of economic activity, which are production and distribution.

Production is studied in the contexts of the sites themselves where production is ascertained, the links between production sites and their environment, the linkages between production sites and their raw material sources and the pattern between production sites and findspots of finished articles with which the particular production process is concerned. Findspots of finished artifacts are looked at primarily from the angle of production areas, to discern any formations of dependency between the two. Both types of sites are studied from the angle of their social and economic structure and from the viewpoint of their self-sufficiency.

It is very easy, however, to fall into the trap of

seeing superficial links between production areas and findspots of final products and in delineating areas of dependency of the latter on the former, at least in this context. This problem becomes more significant where production sites are few and findspots of finished artifacts far removed. For such cases, caution must be taken in discerning linkages, and the actual mechanisms possible for such distribution of objects should be studied taking in view the structure of society and the purpose and value of such artifacts.

Metallurgy

If we were to study Map 1 [1] we would note that metallurgical activities appear to be well spread over the areas of the Harappan culture. Looking at the distribution of production sites of metal objects, we cannot postulate that a very few, that is two or three, sites were producing metal objects and transporting finished goods to all other sites in the Harappan region. On the other hand, some degree of clustering of production sites and findspots of metal objects can be discerned. In the Kutch and Kathiawar, out of the published material, Lothal is the only known metal working site. Sites in this area where metal objects are noted, with no evidence of metallurgy, are Bhagatrav (Rao 1962-63: 190), Nageshwar (Hegde et al 1984-85), Rangpur (Rao 1962-63), Desalpur (IAR 1963-64: 10, 12) and Surkotada (Joshi 1972: 126). At

Pabumath (Joshi 1966), no metal has been reported.

As we move towards the Indus river and the southern areas of Sind, interesting details are noted - small sites such as Garho Bhiro (Lambrick 1964: 88), Allahdino (Fairservis 1982: 112) and Balakot (Dales 1986: 129) reveal some evidence of metal working. Further west, no metal was reported from the Makran sites of Sutkagendor and Sotka Koh. In the plains of the Indus, sites revealing evidence of metallurgy are Chanhudaro and Mohenjodaro. In this area, metal findspots are Amri, Badah, Chanhudaro, Kot Diji, Lohri, Lohumjodaro, Mohenjodaro and Naru Waro Dharo. In the Kirthar and Sind Kohistan region, a few copper/bronze objects were found at individual sites, none of which reveal any evidence of metal working. At all these sites, only limited soundings were taken. Sites revealing copper/bronze artifacts are Gorandi, Ghazi Shah, Karchat, Bedi Kotiro, Rajo Dero and Dhal. No copper/bronze objects were found from Damb Buthi, Pai jo Kotiro and Pandi Wahi. Further north at Gumla, metal objects were reported (Dani 1970-71: 47). At the Harappan site of Shortughai, some amount of metal working was noted.

In the Punjab, no metal working is evidenced from sites in present-day India, such as Kalibangan, Banawali, Mitathal, Rupar and Manda, but each of these sites have revealed metal objects. At Banawali, fragments of a clay

crucible were found (Bisht 1987: 139); as to which craft utilized this object is unclear. Only Rakhigarhi (Suraj Bhan 1975) and Kotla Nihang Khan (Vats 1940) give no evidence of metal artifacts. Further west, evidence of metal working is revealed at Harappa and at some of the Cholistan sites on the now dry Ghaggar or Hakra river (Mughal 1980; 1982). Chak Purbane Syal shows no metal (See Table IV.1).

The above information does go to show that the number of production sites were few for the Harappan culture as a whole. The question of specialized technology limiting the number of production sites could be relevant in the context of metallurgy. Various manufacturing techniques were known by the Harappans from the smelting of ore to the casting of objects along with comparatively difficult techniques such as cire perdue. The picture then on our map is either to be explained by this theory or we have an incomplete picture of metal working areas in the Harappan culture.

If we focus our attention first solely on production sites the situation appears to bring forth no pattern. In the Sind area, this lack of pattern is more pronounced with small and large sites engaging in metal working. In view of limited quantification having been done, inferences on the scale of working are not easily made. A small site such as Garho Bhiro reveals some amount of

metal working. Small lumps of smelted but unworked copper were found at this site (Lambrick 1964: 89). Similarly, Allahdino gives evidence of small scale metal working in the form of a little copper slag (Fairservis 1982: 112), which is belied by the large number of metal artifacts found here. If we look at the Indus map as a totality, these anomalies also are seen. Large sites such as Mohenjodaro and Harappa reveal metal working, but a site such as Kalibangan does not.

Sites which give no evidence of metallurgical activities, however, do not appear to suffer from any paucity of objects produced by that craft. We can take one example, that of Kalibangan. A list of artifacts given by Agrawal (1984: 160) need only be reproduced to satisfy this point. The Mature Harappan inventory includes antimony rods, pins, bangles, beads, arrowheads, hooks, rings, chisels, spearheads, celts, knives, awls, fishhooks, spouts, mirrors, axes, nails, blades, earrings, drills, daggers, needles, razors and bull figurines. Clearly, almost every category of Harappan metal artifacts is represented here.

The major part of Harappan metal working involved copper and bronze, with some amount of gold and silver. Since here we are focusing on the metallurgy of copper and bronze, then the source of copper ores becomes relevant to

our discussion. We are not however postulating a one-to-one relationship between source of raw materials and proximity of production centres. Even so, a knowledge of the sources of raw materials can give some clues towards an understanding of raw material procurement networks. Various viable sources of copper ores find mention in the records. There are sources in northern Baluchistan, that is, in the Ras Koh range (Pithawala 1948: 49A). Further south, in the Kanrach Valley, copper was found in considerable quantities, though the area has been indicated as of somewhat difficult access being surrounded by hills (Lambrick 1964: 65). Griesbach (1881: 57) mentions a source near Shah Bellawl, southeast of Bela in the province of Luz. There are some references to copper found in the Chitral region (Pithawala 1948: 49A). In Rajasthan, a large-scale survey (Roy 1959) gives us detailed information on copper sources where ancient mining pits were found and areas where smelting operations were undertaken. Copper sources in Rajasthan lie primarily in the Aravalli range near Ajmer, Jaipur; further north are extensive sources along with remains of mines and smelting activities in Jhunjhunu and Sikar districts (Roy 1959: 126-30); ores extend further south to the Udaipur-Sirohi region (Roy 1959: 138-40).

It is tempting to regard as logical the location of production sites comparatively near the raw material

source areas. The Rajasthan area has been postulated as being a likely area for the source of copper but was probably not the only source. The extensive nature of the resources from the Rajasthan area and from analyses conducted on correlating impurity patterns of ores from this area and objects from Harappan sites, which have shown some success, are part of the reasons for this assertion.

The copper sources at Rajasthan may explain metal working at sites like Lothal, Harappa and those in the Cholistan desert. The northernmost of the Aravalli sources, in Sikar and Jhunjhunu districts, are nearer to the northeastern Harappan sites such as Kalibangan and those in the Cholistan than to those in the southern reaches of the Indus. These sources are also the richest of those in the Aravallis and the ones which have revealed extensive evidence of ancient mining and smelting activities. However, proximity of sites to resources need not automatically mean that production was done at such sites. This is shown by the lack of any evidence pointing to metallurgical operations at Kalibangan, Mitathal and Banawali, which lie close to the Rajasthan sources of copper. Similarly, in the Gujarat area, to date, only one metal working centre is known - Lothal. Here too, proximity of raw material sources does not seem to have been taken advantage of. On the contrary, sites remote

from the Aravalli sources, such as Mohenjodaro and Chanhudaro, have revealed evidence of metallurgy.

The Aravalli sources cannot be postulated as the only source of copper for the Harappan people. It is very likely also that people may have made use of native copper, wherever available, for which we would have little evidence left to discern its exploitation. Analyses of metal objects may indicate that native copper was utilized where the copper content of objects was very high. Objects made out of native copper show a high purity level of copper, sometimes even attaining 99.9% copper. However, copper smelted from an ore such as malachite could also approach the purity of native copper. Where native copper has been annealed a number of times the metal will not retain its original structure, so it may not be easy to detect the use of native copper (Coghlan 1951; with Willows 1962). Hence, on the whole detection of the exact source of copper may be difficult. Also, other minor sources of copper may have satisfied small scale needs. Such seems to have been the case with Balakot and perhaps with Allahdino. Balakot, where slags and prills of copper were found (Dales 1986: 129) lies in the vicinity of some copper sources in the hills to the east of the Las Bela plain.

On the basis of a lack of proper quantification, it is difficult to point out the metal working sites which

were producing objects for inhabitants only within that site, and those for inhabitants of other sites in the vicinity or further. In some cases, it may be logical to assume one or the other, such as in the case of Garho Bhiro. This site appears to enjoy an isolated position in the Thar Parkar area of Sind. Its proximity to Harappan sites in Kutch is greater than to Harappan sites on the Indus. Here, unworked metal lumps were found, along with some finished objects including pins (Lambrick 1946: 60). Though the site was not excavated extensively, the copper material at this site appears quite limited. It is conceivable that unworked raw material was being transported to sites further west via this site, where some limited quantity of the material was worked into objects. We can assume that metal working at this site, limited as it was, was only for local inhabitants. The same would appear to be the case with Shortughai, where clay crucibles were discovered with traces of copper inside (Francfort 1984: 303). Some small scale metallurgy appears to have been undertaken at this site and was probably meant for the production of objects for local inhabitants, an assumption based on the scale of working and on the lack of Harappan sites in the vicinity, for whom also production may have been geared. Details of metal working activities are given in Table IV.2.

If we leave out sites such as the above, which show

evidence of working for local needs, then other sites where we have more evidence of metal working could imply production for larger areas. However, this need not be the case. The scale of working inferred from the evidence of metal working from Mohenjodaro does not appear to explain the vast quantities of metal artifacts found at this site. Moreover, it should be admitted that we have no clear idea of the exact scale of production at these sites. A site such as Chanhudaro gives much evidence of hoards of metal objects, along with unworked metal in the form of two ingots. These were taken to indicate hoards of metal workers (for details of hoards, see Table IV.3). However, no furnaces of these metal workers or their workshops have been found which would give us direct evidence of their craft. In the case of Mohenjodaro, we have evidence of a pit containing ore, but not of furnaces with metal in association. At Harappa, we have the evidence of 16 furnaces found together (Vats 1940: 470) but none were associated with metal working evidence. At Lothal alone, do we have possible workshops of metal workers. It is also possible that there may have been separate metal working centres, an idea which accords well with the environmental constraints of this craft. It should be noted that in the Cholistan region, the Mature Harappan period showed areas devoted to crafts, including metal working, as separate from residential areas (Mughal

1982: 92).

One other point needs to be discussed. Actual smelting of metal ore has been noted at Lothal, Garho Bhiro, Mohenjodaro, Allahdino, Balakot and in the Cholistan region. In most cases, local ores or ores available in the vicinity were being utilized. At Lothal, ores were perhaps brought from the Aravalli region southwards. At Allahdino and Balakot, locally available ores in the Las Bela region were probably being utilized. In the Cholistan region, the melting and probable smelting of copper is inferred and the likely sources exploited were in the Rajasthan region. Mohenjodaro is the only site which is not utilizing locally available ore. The evidence, however, for ore smelting is very meagre at this site and consists of crude lumps of unrefined copper found along with crucibles (Marshall 1931: 212), of a pit containing ore and a piece of lead (Mackay 1938: 54) and some possible smelting undertaken on a mound east of the lower town (Vidale 1989: 172), which indicates that very little conversion of ores to smelted metal was undertaken here. Metal was probably brought to Mohenjodaro in the form of ingots of which there are excavated examples (Mackay 1938: 41, 129, 160, 452). Chanhudaro also revealed two ingots from two separate hoards in a single area (Mackay 1943: 43) and the complete absence of unrefined metal. Surface explorations conducted recently

(Vidale 1989: 178; Fig 18.3) also indicated the absence of ore smelting activities.

For some Harappan metal working centres it seems that the metal was brought in refined form. This was probably done to reduce transportation costs in that ingots would have been cheaper to transport than metal ore of which large quantities would be required to obtain pure metal. Metallurgy is a heavily weight-reducing industry and hence it would have been considered more economic to transport refined metal.

Linkages between production centres and the environment come largely into focus when we consider the fuel requirements for metallurgical operations. This aspect will be discussed in detail towards the end of this chapter taking all crafts into consideration.

To conclude, we are reverting to the earlier discussion of the most plausible copper ores exploited by the Harappans, that is, the Aravalli sources and the question of contact with an area outside the Harappan culture. Agrawal's (1982: 125-34 - with Vijay Kumar; 1984: 157-62) work on the Ganeshwar-Jodhpura culture would appear to be pointing to the exchange of copper artifacts from these sites near the copper sources in Rajasthan, to Harappan sites on the basis of alleged typological similarities. Bhardwaj (1985: 139-48), however, does not

find much similarity in chemical analyses between Ganeshwar and Indus objects. Moreover, it should be noted that Harappan artifacts are not typologically very unusual or distinct unlike some artifacts of the Copper Hoard complex. If it is the assertion of Agrawal that finished artifacts were brought to the Harappan culture sites, how does this accord with the fact that the Harappan sites have shown some evidence of metal working? Yet the issue of obtaining copper from the Aravallis does raise important questions. First, noting the absence of Harappan sites here, it does raise the question of how copper resources were tapped. Metal axes and bangles matching the Harappan technology were found at Kayatha, but all in a single house along with Harappan - style ornaments (Dhavalikar 1970). The source of Kayatha metal is not yet known. Were copper ores (or artifacts) brought to Harappan sites by intermediaries between the Harappan people and the inhabitants of the Rajasthan area? Were Harappan people sent here on sporadic mining expeditions? The whole issue involves the important question of possible territorial rights over raw materials in that period.

Bead Making

For the craft of bead making, we have a number of production sites (Map 2). On the other hand, beads are ubiquitous at Harappan sites, so a list of findspots would

include practically every Harappan site. It would probably be far easier to pinpoint sites where beads were not reported (which need not be a conclusive list, as these sites were either only explored or dug in a limited way). Such sites are Damb Buthi, Desalpur, Dhal, Garho Bhiro, Kot Kori, Lakhiyo, Lohri, Manda, Naru Waro Dharo, Pai jo Kotiro, Pabumath, Rajo Dero, Sotka Koh, Sutkagendor and Balakot.

Bead making sites also appear to be well dispersed over the area of the Harappan culture. No area has been left unrepresented in this craft. In Gujarat, we have evidence of bead making at Lothal. In Sind, Chanhudaro and Mohenjodaro have given evidence of bead making; also we have possible evidence of bead making at Amri. In the Kirthar and Sind Kohistan region, two sites, Pandi Wahi and Gorandi give limited evidence of bead making. To the northeast, we have Harappa and Mitathal as bead making sites. The site of Shortughai is significant largely on account of the evidence of production of beads of lapis lazuli, the site being near the lapis mines and also due to the evidence of lapis lazuli debitage, some unfinished beads of carnelian and one drill-head (Francfort 1984: 303). (See Table IV.1).

The above assertion of a fairly uniform dispersal of bead making sites should, however, take account of the

scale of working at each production centre. There would be little use in proclaiming that a particular production centre engaged in the production of objects for that site as well as for others in the vicinity, if the scale of production at that site was meagre and seemingly insignificant. Such definitely appears to have been the case with Mitathal. Noting in the immediate vicinity of Mitathal only bead findspot sites such as Rakhigarhi, Banawali, Kalibangan, it would be tempting to say that Mitathal supplied such sites with beads in the absence of other bead making centres. However, at Mitathal, we have limited evidence of bead production - only one unfinished bead and one lump of agate (Suraj Bhan 1975: 7-8). It would not be logical to assume this site as a bead making centre for other sites in the vicinity on the basis of such evidence. At Garho Bhiro, chippings of semi-precious stones were found (Lambrick 1964: 89), but it is not clear if this is an indication of bead making. At Amri, the evidence of bead making is confined to the recovery of a few microdrills of phtanite (Jarrige 1981: 110; Jarrige 1984: 297-98). At Gorandi, one unfinished carnelian bead (Majumdar 1934: 106) and at Pandi Wahi, two unfinished beads of white stone (Majumdar 1934: 113) were found. From the excavated evidence from Harappa, it appears that 4 out of 5 unfinished stone beads were found from Mound F. Surface explorations conducted in 1988 revealed that a new area, Mound E, was emerging as a craft producing area in

the settlement of Harappa (Dales & Kenoyer 1988: 37).

On the other hand, sites such as Chanhudaro and Mohenjodaro have given considerable evidence for bead making (see Table IV.4). At Chanhudaro, a number of unfinished beads have been found, along with stone drills, sandstone hones and nodules of raw material. Moreover, a bead making workshop has been located, as well as a possible facility for heat treatment of stone and steatite beads. At Mohenjodaro too, we have evidence of unfinished beads and tools for the manufacture of beads, but here no facility or workshop for bead production can be discerned in the excavations. Surface explorations of unexcavated areas of Mohenjodaro have revealed the production of stone beads in the form of bead blanks, raw materials and debitage (Bondioli et al 1984: Table IV.4). Figure 9 in the cited article (Bondioli et al 1984) shows no one area for bead making - chalcedony debitage and bead blanks are found in various areas of the lower town, though lapis lazuli debitage is found in two areas, one on the citadel mound between L and SD areas, and the other southeast of the Moneer area.

Following from the above discussion, one could speculate on the proximity of the two apparently major bead making centres, Mohenjodaro and Chanhudaro. Mohenjodaro is a much larger site than Chanhudaro, the

107) and on Mardak Beyt in the Little Rann of Kutch (Trivedi 1964: 10). According to Wynne (1872: 69-70), a hardened lateritic crust is often found thickly covered with a coating of agates in eastern Kutch. Chalcedony and quartz are found in an area about 27 km south of Sehwan in Sind (Blanford 1879: 36). Carnelian, jasper and agate are also mentioned as available in the Lyari Hills, Porali Basin, the Kohistan and the Hab River valley in Sind (Fairservis 1982: 111).

The primary lapis lazuli source area, the Badakshan mines in the valley of the Kokcha, a tributary of the Oxus, have been worked from antiquity. Lapis lazuli mines are also located at Bi-Bi-Dick, north of Dalbandin in the Chagai Hills (Usman Hasan 1986: 5). Crystal was perhaps obtained from the isolated outcrop in the district of Nagar Parkar in Sind which is associated with the neighbouring Aravallis (Pithawala 1936: 311). Quartz and chalcedony are also found in nodules from the Lakhi Hills, where there is an ancient Cretaceous formation (Flam 1986: 71). Jasper is available from northeastern Kathiawar, in Morvi (Bombay Gazetteer 1880: 201) and limestone from sources in Sind - the Kirthar range and the Sukkur Rohri Hills. Amethyst is common in Bashahi and other parts of the Sutlej valley (Pithawala 1948: 42).

The presence of Harappan sites in Kutch and Kathiawar and the evidence of bead making recovered from Lothal

would possibly point to the sources of semi-precious stones abundant in Gujarat being exploited in Harappan times. This region would also appear to have been the source of raw materials for bead making sites in Sind. Lothal appears to have been well situated from the point of view of the craft of bead making, being close to the sources of agate and carnelian at Ratanpur and Ranpur. Another site appears to have been situated for the express purpose of exploiting raw materials in the vicinity, which is Shortughai, located near sources of lapis lazuli. However, except for these two sites, it does not appear that loci of bead making sites were chosen with proximity to raw material sources as a factor. The other major bead making centres, Chanhudaro and Mohenjodaro, are removed from the Gujarat sources to a degree that raw materials would have been needed to be transported to them. It may tentatively be said here, that possibly very large quantities of the raw material would not have been needed for bead making in this period, in which case, transportation of raw material may not have been too onerous a problem, the only point remaining unclear being the means of transportation.

It is conceivable that raw materials could have been transported to Sind via Gujarat coastal Harappan sites which could have been Navinal on the Gulf of Kutch or Hajnali (Kuntasi) on the Saurashtrian coast (Chitalwala

1982: 198, 200). Land routes could also have been used, entailing travel through Kutch to southern Sind (Joshi 1966) which may explain the presence of semi-precious stones at Garho Bhiro.

It is still not clear how sites in the northern area obtained their raw materials for bead making. Notwithstanding the possibility that scale of working at production sites in this area may have been small, the question should yet be studied. It is not possible for these communities to have obtained semi-precious stones directly from Gujarat. At this stage, it may be reasonable to consider that raw materials at these sites were brought here through the regional networks of procurement or exchange from sites in lower Sind.

As in the case of metallurgy, proximity to raw material sources does not necessarily determine the location of production. We may dwell for a moment on the paucity of bead making centres in Gujarat, the region where raw materials for this craft are extensively found. From the discussion in Chapter III, it would appear that this craft involved quite a complicated procedure, with a number of different operations. It is inconceivable for an inexperienced person to manufacture beads. Some processes, drilling especially, required experience in the craft. To explain the paucity of sites in this region,

Desalpur, Garho Bhiro, Ghazi Shah, Kotla Nihang Khan, Lakhiyo, Lohri, Manda, Pandi Wahi, Rajo Dero, Rakhigarhi, and Bhagatrav.

At once a distinct picture arises when one studies Map 3. Most production centres are located in proximity to the coast, which is the source of raw material for this craft, and in near inland sites in Sind and in Gujarat. Two sites near the coast, Sotka Koh and Sutkagendor, have not however given evidence of shell working.

The source of Turbinella pyrum or the conch shell, the species used for the majority of Harappan shell objects is limited to protected bays along the western and southern coasts of the Indian subcontinent. The shell is found upto Karachi (Kenoyer 1984b: 108) and near Balakot, is not found in Sonmiani Bay itself, but further out (Kenoyer 1984a: 73). According to the same author (Kenoyer 1984b: 108), the Gulf of Kutch could supply Turbinella pyrum and other species such as Chicoreus ramosus, Lambis Truncata sebae and Fasciolaria trapezium; such species are also found on the Oman coast with the exclusion of Turbinella pyrum. The species Tivela damoides, is noted in coastal waters west of Karachi extending upto the Persian Gulf (Kenoyer 1984b: 97).

We may be able to say for this craft at least, that proximity of raw material sources was a factor for

production at sites. The anomaly to this pattern is production noted at the settlements of Chanhudaro, Mohenjodaro, Amri, Kot Diji and Harappa. The picture at Chanhudaro appears to be that of a pattern of a varied number of crafts being practised in this settlement. The production at Amri and Kot Diji may not have been extensive and was probably making use of some amount of the raw material passing through these settlements from source areas to Chanhudaro and Mohenjodaro. It is significant, however, to note production at Mohenjodaro and Harappa. For this, the reason probably lay in the character of these settlements. Both settlements are large urban sites with access to raw materials from far afield attested to in excavations. In view of the fact than other crafts are also practised at both settlements, the evidence pertaining to shell cutting is not entirely surprising. The two urban centres must have attracted shell cutters to settle there, to produce directly for the consumers. The picture that emerges of craft working at settlements such as Mohenjodaro and Harappa will be explored more fully in Chapter VI.

If we were to look at individual production centres then we can discern no pattern in size or structure. Some sites such as Lothal, Nageshwar and Balakot are right on the coast, while sites such as Mohenjodaro and Chanhudaro are some distance inland. Sites such as Nageshwar and

Balakot are small, while Chanhudaro and Lothal fall into separate size brackets from Mohenjodaro and Harappa. Some of the sites seem to have focused solely on shell working, while others are also engaged in other crafts. Examples of the first are Nageshwar and Balakot and in the second category come Chanhudaro, Mohenjodaro, Harappa and Lothal. If we study the scale of working, then with our limited quantification, we can discern differences between sites like Nageshwar, Balakot and Mohenjodaro, where extensive evidence of shell working is found, with sites like Allahdino, Surkotada and Kot Diji where we have limited evidence (see Table IV.5: some duplication of details may exist between Table 5 and Table 6 pertaining to production of shell ladles, inlay and other objects, in view of unspecified published details). The above observation also holds true for the structure of production centres, where sites such as Nageshwar and Balakot appear to engage in shell working to the seeming exclusion of other activities, a point to be discussed further in Chapter VI. Shell bangles with double, triple and multiple deep grooves found at Surkotada are considered a regional style of Kutch and perhaps Kathiawar (Kenoyer 1984a: 243-44).

Earlier, we had discussed proximity of raw material sources as, to some extent, a motivating factor for production at settlements. This is clearly seen in the case of Nageshwar and Balakot. Noting also that these two

sites appear to focus their economic activities on shell working, their location close to raw material sources is logical. Other shell working sites like Chanhudaro and Mohenjodaro have other economic considerations so are not located on the coast, but are able to obtain their raw materials easily. Their location is determined by other factors. In the case of Balakot, the exploitation of local raw materials is especially illustrated by the extensive manufacture of bangles made out of a locally available bivalve species - Tivela damoides. It should not, however, be forgotten that two sites on the Makran coast, Sutkagendor and Sotka Koh, show no production of shell objects from Tivela damoides, despite the bivalve being available in waters along this coast. At Balakot, limited manufacture of bangles made out of the chank shell is noted, but bangles made out of the bivalve shells far outnumber chank bangles. That the production of such bangles was not for the settlement of Balakot alone is noted by the presence of such bangles at Sotka Koh, Sutkagendor, Allahdino (Dales & Kenoyer 1977: 19; Kenoyer 1984a: 227) and perhaps at Shahi Tump. However, the absence of Tivela bangles at Mohenjodaro is a curious feature. It would seem that Tivela bangles were not being produced for the purpose of an urban site such as Mohenjodaro, but for Balakot itself and for sites in its vicinity and along the Makran coast. Production of Tivela

bangles at Balakot was probably a reaction to and exploitation of locally available resources which could be worked into objects with no real sophisticated techniques.

What could have been the role of sites such as Nageshwar and Kot Kori? Detailed quantification for Kot Kori is not available, but large marine gastropods have been recovered, sawn to make shell bangles (Khan 1981: 44). Whether Kot Kori was producing bangles for its own inhabitants or for sites in Sind to its west is a question to consider and will largely be determined by the scale of working at this settlement. The evidence of large scale shell working and comparatively limited recovery of finished artifacts suggest production at Nageshwar to have been geared for requirements far afield (Bhan & Kenoyer 1984: 73; Hegde et al 1984-85: 13). There are hardly any Harappan settlements in the vicinity of Nageshwar to justify such large scale production here, hence giving credence to the idea of shell objects being required in Sind and beyond.

Turning to other shell objects, one kind is the ladle or spoon, made from the species Chicoreus ramosus only. Various species of large gastropods, Turbinella pyrum, Chicoreus ramosus and Fasciolaria trapezium were used to produce inlays, possibly for the decoration of wooden objects. Gastropods were again used for other sundry objects for gaming or ritual purposes or for toys (Kenoyer

1984b: 104). As such, only inlays and ladles have been marked out on map 4 (Table IV.6 gives information on all kinds of unfinished objects). Production centres for ladles were Nageshwar, Balakot, Chanhudaro and Mohenjodaro, with findspots being also Allahdino, Harappa and Lothal. These objects are far from ubiquitous in Harappan sites. There is not much that can be read from the map of production and distribution of shell ladles, save for the presence of finished ladles from the site of Nageshwar. Numerous unfinished ladle fragments were found, but no finished specimens (Bhan & Kenoyer 1984: 73). The assumption would then be that finished objects were transported to other sites rather than used at this site. The number of unfinished ladles found at Nageshwar could imply that ladles were far more common at Harappan sites than would appear from the published evidence.

Production of shell inlays has been noted at Mohenjodaro, Lothal and Nageshwar. Findspots of shell inlay apart from Mohenjodaro and Lothal are Chanhudaro and Harappa. At Chanhudaro and Harappa, no inlay manufacturing waste has been recovered. But this does not mean that no such production took place, as inlay production results in very minute waste, often not recoverable. On the other hand, it is possible to explain findspots of inlay at sites where no production has been noted as findspots of wooden articles from which only the

inlay would have remained, the wood itself not recoverable to archaeologists.

One could hypothesize that inlay production would not be noted in sites where other shell objects such as bangles or ladles were not produced. The reasoning behind such a statement is that largely inlay production utilized those parts of the raw material that were left unused in the production of bangles and ladles. After the production of bangles, unutilized pieces of the body wall of shells were used for inlays. However, examples from Mohenjodaro of fragments of Fasciolaria trapezium show that this shell was solely used for inlay production, where the shell walls were used for inlays and the columellae left as production discards (Kenoyer 1984b: 104). This could indicate larger requirements for inlay at Mohenjodaro and/or elite use patterns where it was not necessary to use only waste pieces for inlay production.

Similarly, the discarded columellae of large gastropods were used to make a number of objects such as cones, gaming objects and cylinders. The limited numbers of such artifacts point to their production where other shell object production was taking place.

Faience Production

The faience objects found at Harappan sites have been

depicted in two maps, one pertaining to faience miniature jars (Map 5), and the other to all other objects (Map 6). Findspots of finished faience objects (other than miniature jars) are Bhagatrav, Lothal, Rangpur, Desalpur, Nageshwar, Surkotada, Balakot, Kot Diji, Chanhudaro, Mohenjodaro, Lohri, Lohumjodaro, Gumla, Dabarkot, Shortughai, Chak Purbane Syal, Rupar, Kotla Nihang Khan, Harappa, Mitathal, Banawali, Kalibangan and Rakhigarhi. Faience has not been reported from a large number of sites, as is evident from Table IV. 1.

Production sites are few and widely separated. In the southern area, we have only Lothal; in Sind, both Chanhudaro and Mohenjodaro; and in the northern area of the culture, we have evidence of production of unspecified quantification in the Cholistan area where according to Mughal (1982: 92), the glazing of faience objects was practised in separate production centres. The complex technology of faience production would seem to accord well with the scarcity of production sites on the map of the Harappan culture. This technology would also appear to be of the type to produce a large number of objects in a single firing or glazing process. We would assume that a number of production centres were not necessary, so long as the internal transportation and communication avenues between settlements were efficient. The anomaly in the pattern of production centres, as seen with so many other

crafts, is the proximity of Chanhudaro and Mohenjodaro. The importance of this fact is such that it needs separate discussion (see Chapter V).

Some interesting questions arise when looking at this map in the light of what we know of Harappan faience objects. In the northern area of the Harappan culture, except for some sites in the Cholistan desert (again, we do not know exactly how many faience producing centres there are), we do not know the scale of working. Yet it is in this region that practically every site has revealed faience objects, which is not the case in Kutch and Saurashtra, where sites like Pabumath, Pirwada Khetar; in Sind, such as Garho Bhiro, Allahdino, Balakot, Sutkagendor, Sotka Koh and numerous sites in the Kirthar and Kohistan regions have not revealed faience objects. Not only is it a fact that practically every site in the northern area has revealed faience objects, but the types of objects too are interesting. It is from this region that we have plenty of evidence for faience of a range of colours, apart from the more usual blue and green. At Harappa, blue, yellow, black and red faience are found apart from the variegated faience. At Mohenjodaro, a few beads of this variegated variety have been recovered (Mackay 1938: 507), but none from Chanhudaro.

The evidence from the north would seem to point to the importance of the Cholistan area in faience

production, so that in this sense the scale of production in this area may apparently be quite large. The above hypothesis does not however, reduce the importance of the Sind production centres, such as Chanhudaro and Mohenjodaro, not is it to be made out that the Cholistan area supplied faience objects to Sind. We have evidence of faience production from these centres to justify their self-sufficiency and capability to supply settlements in their vicinity. A certain type of bead, some with collars, all with carved designs on their body - diagonal lines or herringbone patterns (Mackay 1943: Pl. LXXXV 1 - 10, 19-21, 28) have been mentioned as found only in Chanhudaro (Mackay 1943: 207), with one specimen at Lohumjodaro (Majumdar 1934: 55). However, 3 examples of such a bead type have been illustrated from Harappa (Vats 1940: Pl. XXXIII 9 d, e; Dales & Kenoyer 1988: Fig 31: 15), but in view of the faience producing activities at Chanhudaro one may presume that the beads at Harappa were brought from the Sind area. Similarly, another category of faience objects are the small model animals. At Chanhudaro, only 2 specimens were found and both were unfinished (Mackay 1943: 160). A limited inference could perhaps be made of the production of such artifacts at Chanhudaro and possibly their being taken to other places (for details of faience producing activities, see Table IV.7).

Raw materials required in bulk for faience production, as discussed in Chapter III, would primarily be quartz, or some form of silica such as sands, as well as fuel. Large quantities of the quartz or source of silica would be required as this was to be pulverized and made into a form amenable for moulding. Analyses undertaken by Basu suggest that quartz and not river sand was used as a source of silica as the main ingredient for faience (Singh 1989: 146). Alkalies for the production of faience objects were mainly obtained from soda. Crude natural soda was obtained from early times from reh soil containing a mixture of sodium carbonate, sodium bicarbonate and sodium chloride. Evaporation of water from such soils could give mixed crude natron (Singh 1989: 150-51). The waters of some of the salt lakes or dhands in eastern Sind have carbonate of soda mixed with or instead of common salt. When the water dries up, this powder can be dug out and used (Aitken 1907: 78). It is not known if in Harappan times naturally occurring natron was used as a source for alkalies or plant ash/potash. According to Singh (1989: 151), plant ash was used as a source for alkalies from the early first millennium A.D. If plant ash were used then it is pertinent to note that Sind and other areas reveal considerable growths of the species of Salsola. Sind is rich in these plants, locally called lani (Aitken 1907: 34. 78). It is also interesting

that the Salsola plant occurs in abundance at Anupgarh on the Ghaggar river (Erskine 1908: 577). If plant ashes were used for alkalies in the Harappan period, then these plants could have been utilized by the faience workers in the Cholistan sites.

As regards fuel requirements, the necessary temperatures of around 1000° C would require a large quantity of fuel. On the other hand, this would assume significance only if these quantities of fuel were required on a daily basis, or to put it in general terms, if the scale of working was very high for sustained periods. If, however, faience production was not a regular craft but was irregularly practised on requirement, then fuel requirements on the whole would not be too large. This would hold true even if workshops were small, as a large number of objects could still be produced in view of its technology. The quality of the wood used is also important. To tabulate the above arguments, we would have:

Small amounts of fuel required	Large amounts of fuel required
1. Small furnaces	1. High temperatures
2. Not a regular craft	2. Firing on daily basis
3. Large number of objects produced in one operation	3. No stock produced and stored
4. Good quality wood used	4. Firing of long duration

On the whole, however, it may have been that fuel requirements were high, on account of high temperatures needed and long duration of firing. Also rarely was stock manufactured and stored. Production of large quantities of objects in one operation would have indicated optimum use of fuel and facilities, would envisage a form of mass production which was not done in Harappan times.

The production of faience miniature jars is quite different. No site has given direct evidence of such production, which is not surprising as for these particular objects, direct evidence is probably not possible. Moulds were not used to produce these miniature jars. Some miniature jars have revealed traces of a sandy core being used (Vats 1940: 311-12), so it has been assumed that jars were made on cores of sand bound up and on which the faience mixture was applied. According to Mackay (1943: 139), these pots were made on a wheel. Whatever the techniques used, we have no archaeological evidence of the tools utilized.

Thus, we have really no means of discerning production centres of such objects, but Harappa could possibly be demarcated as a production site on the basis of a piece of undeniably doubtful evidence. One miniature jar recovered from Harappa shows traces of an overfired glaze (Vats 1940: 313). The assumption behind taking this object to be manufactured at Harappa itself, lies in the possibility that an overfired object would not be

exchanged out of its production area, but may be discarded. If, however, one were to look at the function of such objects, then it could be said that if such objects were rare or had some special value, then even an overfired one would have had some value, and hence the Harappa specimen could have been brought to the site from elsewhere.

Findspots of faience miniature jars are Lothal, Chanhudaro, Mohenjodaro, Jhukar,[2] Harappa and Banawali. Mohenjodaro and Harappa are urban settlements and the find of such rare objects at these sites comes as no surprise. Chanhudaro and Lothal are primarily craft centres as will be outlined in Chapter V. It is likely that these two settlements were closely supervised by an elite in view of the functions of the sites. Evidence that a jar was actually used at Chanhudaro is seen from the brown stains inside a little jar (Mackay 1943: 139). Perhaps it was used by a local member of the elite. The find of faience jars from Banawali is not entirely surprising in view of the rich material excavated from this site - a number of seals have been found, a number of finds of gold, lapis lazuli were made and evidence of all categories of Mature Harappan crafts is noted (Bisht 1982: 119). Yet, the absence of such artifacts from sites such as Kalibangan becomes more glaring, though it must be admitted that the entire inventory of artifacts from this site is not yet

published.

It can be hypothesized that if there was some special value attached to these objects or their contents, then they were not likely to be produced at a large number of sites, the idea being to limit their distribution. Their rarity value could also arise from a difficult production technique. In any case, it is logical to see a paucity of production centres for such objects.

Seal Making

Evidence of the production of seals is recovered from Lothal, Chanhudaro, Mohenjodaro, Harappa and from Manda. Findspots of seals are Lothal, Surkotada, Desalpur, Allahdino, Chanhudaro, Kot Diji, Mohenjodaro, Lohumjodaro, Jhukar, Dabarkot, Harappa, Rupar, Kalibangan, Banawali, Rakhigarhi and Shortughai (see Table IV.1 and Map 7).

The primary seal cutting centres were the first four production sites mentioned.[3] (See Table IV.8 for information on seal cutting activities.) Comparative quantification from these four sites gives interesting information:

Table IV.8: Seal Manufacturing

Site	Unfinished Seals	Finished Seals	Percentage of Unfinished Specimens
Chanhudaro	13	65	20
Harappa	30	974	3.08
Mohenjodaro	10	1262	0.7
Lothal	14	87	16
Manda	1	-	-

The paucity of production centres of seals is partly a result of the complicated process involved in the production of such objects. Though steatite is easy to cut and shape, great skill is required for the delineation of the signs and symbols. Apart from this, it is very likely that literacy or the knowledge itself of the Harappan written signs was limited and hence it is difficult to conceive of the fashioning of these seals at a number of centres. Moreover, seals would not be used by the majority of the Harappan population and their use was definitely restricted. Thus, unlike beads which would be desired by a large number of people and require large-scale production at several manufacturing centres, the more restricted specialized consumption of seals would necessarily involve fewer production centres.

There appear to be various sources of steatite, out of which seals were made. A number of references point to

Rajasthan as a rich source, extending from the southern area near Sabarkantha in Gujarat to Jaipur in northeastern Rajasthan (Hackett 1880: 245; Middlemiss 1912: 52-53; Heron 1917: 125; Heron 1953: 372; Brown & Dey 1955: 525-26; Hegde 1983: 70). Another source is in the Peshawar district and the North West Frontier Provinces, namely Kund in the former (Pithawala 1948: 48A) and Katti Miana in the latter, which appears to be of a low grade (Coulson 1940: 47). According to Coulson (1940: 46), deposits at Kund in Peshawar district have been mined for a long period. Harappa could have obtained its steatite supplies from the Peshawar district, but it may be more likely that the Rajasthan sources were exploited as it is probably from the latter region that copper was obtained and the same avenues could have been used to obtain steatite supplies. [Incidentally, Rao (1973: 103) mentions that known sources in Gujarat do not appear to have been worked in Harappan times.]

Whatever be the source exploited, it is clear that seal cutting centres were not located close to raw material sources. Lothal, of all the manufacturing centres, is the closest to the sources. The function of such artifacts and the value embodied in them seem to have made it necessary for their manufacture where political authorities were centred. Transportation of raw materials for the manufacture of such artifacts would have been a

simple matter, the value of this category of artifacts far outweighing costs of transportation of the raw material.

Weight Production

So far, production of weights has been noted only at Chanhudaro, Mohenjodaro and Harappa. Weights have been reported from Lothal,Rangpur, Nageshwar, Pabumath, Desalpur, Allahdino, Chanhudaro, Mohenjodaro, Lakhiyo, Bedi Kotiro, Lohumjodaro, Gumla, Harappa, Kalibangan, Banawali, Rupar and Kotla Nihang Khan (see Table IV.1 and Map 8).

Production of weights does not appear to have been done on a very large or sustained rate (see Table IV.10). This would appear so from the number of unfinished weights from each production site. To tabulate we would have:

Table IV.11: Scale of Weight Manufacture from Production Centres

Site	Unfinished Weights	Finished Weights	Percentage of Unfinished Specimens
Chanhudaro	6	118	5
Mohenjodaro	5	340	1.4
Harappa	5	199	2.5

At Chanhudaro, production could have been on a scale larger than that implied by the small number of unfinished weights found, as Mackay (1943: 236) refers to a "large number of misshapen weights" being found, pointing to

their having been rejects perhaps due to some fault.

The following table gives the number of weights found at each findspot.

Table IV.12 : Number of Weights found at Harappan Sites

Site	Number of Specimens
Lothal	27 ?
Rangpur	2 ?
Pabumath	?
Desalpur	?
Nageshwar	1
Allahdino	?
Chanhudaro	118
Mohenjodaro	340
Lakhiyo	1
Lohumjodaro	1
Gumla	1
Harappa	199
Rupar	?
Banawali	23 ?
Kalibangan	?
Kotla Nihang Khan	1

As seen from the table, exact quantification is not available and the figures indicate number of specimens mentioned in the reports.

The comparative figures of weights found (from the available data) is significant. The majority of sites in Sind have not revealed any weights. At a number of settlements, such as Nageshwar, Lakhiyo, Lohumjodaro and Gumla, very few weights occur. In contrast, at a very few settlements, a large number of weights are found. The numbers of weights recovered from Mohenjodaro, Harappa and Chanhudaro are particularly significant in the light of currently available evidence. It is likely that there is a relation between the use of weights and craft production

as evidenced by the number of weights found at Chanhudaro. Unlike Mohenjodaro and Harappa, which are large urban centres, Chanhudaro was primarily an urbanized craft working centre. As noted by Mackay (1943: 243), 22 small weights were found in room 215 and its vicinity on Mound II, and may have been used to weigh precious materials and microbeads. Apart from this use, weights were also manufactured at Chanhudaro. Since there are few production centres on the whole in the Harappan culture, the large number of weights found at Chanhudaro could also be explained by this factor. The reason for the scarce of weights found at Lothal is not clear. It may have been that there were fewer precious materials to be weighed at this site. It may well be that the manufactured cubical chert weights were used mainly at the primary urban centres.

The scarcity of production sites as seen from the map accords well with the function of such objects. The largest number of weights found are from Mohenjodaro, Harappa and Chanhudaro, which are to date the only weight production centres. It appears then that weights were produced close to their point of use. Weights must have been manufactured at Chanhudaro also for the use of the inhabitants of Mohenjodaro. Obviously, great accuracy would have been required for such objects and if they were made at any site which is technically possible as their

mention of any unfinished etched carnelian bead, while 6 at Chanhudaro have been broken while being bored (Mackay 1943: 201), clearly indicating then their manufacture at this site.

Findspots of etched carnelian beads within the Harappan area are Lothal, Surkotada, Chanhudaro, Mohenjodaro, Gumla, Shortughai, Harappa, Banawali and Kalibangan.

If we study the total number of etched carnelian beads from every findspot we have an interesting picture, as two sites reveal a larger number than those found from any other site.

Table IV.13 : Number of Etched Carnelian Beads found from Harappan Sites

Site	Number of Specimens
Lothal	12
Surkotada	2
Chanhudaro	16
Mohenjodaro	8
Gumla	1
Shortughai	?
Harappa	4 (illustrated)
Banawali	?
Kalibangan	?

The number of beads found from Chanhudaro and Lothal would accord well with their status as production centres for these beads. The rarity of such beads at Mohenjodaro and Harappa, which are otherwise exceptionally rich sites, would indicate that they were not the primary consuming centres for these beads. The finds of numerous beads of

etched carnelian outside the Harappan boundaries, in Mesopotamian sites and at Altyn Depe, would indicate that at least some were manufactured for export. The beads found from Harappan sites may have been rare specimens used by the elite. The fact that the etched carnelian beads were imitated in steatite by the Harappans (Marshall 1931: Pl. CXLVI 41, 42, 48, 51, 53, Pl. CXLVII 8; Mackay 1938: Pl. CXXXVII 84, 101; Vats 1940: Pl. CXXXIII 2) emphasizes the rarity value of the stone beads.

Ivory Working

The raw material for this craft has been found at a few sites: 2 tusks at Mohenjodaro (Mackay 1938: 116-18); 1 tusk at Chanhudaro (Mackay 1943: 14); fragments of a tusk and 2 pieces with saw marks at Lothal (Rao 1979: 108-10); and a tusk at Surkotada (Joshi 1973) (Map 10).

At no site was ivory debitage found, save the 2 pieces found at Lothal. At Mohenjodaro, an unfinished plaque was found suggesting some production was undertaken here.

Despite the evidence of working at Lothal, it does not appear that this site manufactured objects for the needs of other settlements. A comparison of the typology of ivory objects from Mohenjodaro, Harappa and Lothal is enough to confirm this hypothesis. The majority of Mohen-

jodaro ivory objects are what are called "casting bones/ sticks." Also found are rods for unspecified purposes, dice, tabular dice, handles, combs, cylinders, awls, hair-pins, hooks, batons, roundels, fish-shaped objects, gamesmen, part of a cosmetic jar, a vessel, a peg and a jar stopper. Some of these categories such as gamesmen, awls, rods and beads were also found at Lothal which also revealed a scale, ear-studs, ear ornaments, "ceremonial knives" and "knitting needles". At Harappa, objects are found with designs and decoration similar to Mohenjodaro specimens. No such objects with similar designs are reported from Chanhudaro, except for a comb with 3 incised concentric circles (Mackay 1943: Pl. XCI, 4).

The limited indicators of ivory working from Mohenjodaro however, must indicate that the unusual artifacts found here were manufactured at this settlement.

Apart from production centres ivory has so far been recovered from Badah, Jhukar, Harappa and Rangpur. Ivory has been reported in large numbers from Mohenjodaro where Mackay (1938: 117) notes that bone plays a subordinate role to ivory. Thus, ivory could have been a raw material utilized in a more widespread manner than present data indicate.

Conclusion

In conclusion, we may go over some general aspects.

First, on the whole, Harappan production centres do not show a predilection for location near raw material sources. One exception to this is shell working. This aspect is interesting as in most cases, raw materials are heavy and sometimes bulky as for example, copper ores, blocks of quartz and steatite and agate. It is doubly significant that shell working, a craft generally located near raw material sources, depended on a raw material that was definitely not heavy though could become bulky. It may be that the raw material was too fragile to be transported on a large scale to be worked near the consumption centres.

The importance of the fact that production centres are not located near raw material sources is amplified by the evidence that in a number of cases the raw materials for crafts are located in areas that show no Harappan sites, hence probably being outside the Harappan culture. The problem then becomes two-fold: one, the question of transporting raw materials to production centres and two, the question of dealing with other peoples, when raw materials outside the Harappan culture area are exploited. For the first, there appear to have been efficient mechanisms for not only bringing raw materials into areas where they are not available, but also for finished goods being found in areas where they are not produced. An example of the former are unworked shells found at

Harappa, and of the latter, finished shell bangles found in Shortughai, a site remote from raw material sources and the working areas of such bangles. Not only this, it would also seem that the transportation of raw materials for a number of crafts engaged in at Mohenjodaro, Harappa and Chanhudaro was considered essential and costs of transportation may not have considered a major constraint. If the internal networks of distribution were efficient, then goods could very well have been produced at raw material and other input sources. The value and exclusive character of the objects manufactured and the importance of the consumption groups involved is indicated by the fact that raw materials and other inputs were carried large distances to be worked.

In other cases, production could not be carried out at raw material source areas as these lay outside the Harappan region and possibly within the purview of other cultures. In Chapter I, we have already dealt with the possibilities of contact with the Ganeshwar-Jodhpura culture, with the Kulli people, with Burzahom and the Deccan Neolithic cultures. Possibilities of contact with Kayatha have been mentioned earlier. It is conjectured that requirements of particular materials - such as gold from the south, steatite and copper from Rajasthan and timber from the north could have been the motivating factor for such contacts. Yet, little is known or

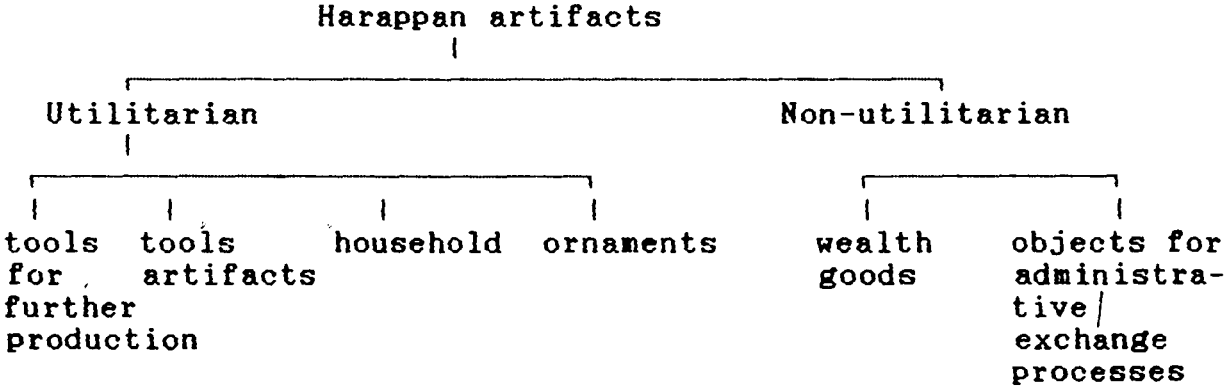
conjectured over the nature or duration of such contacts. Apart from local rights existing over raw materials, we have to take into account some administrative mechanisms to either arrange for these raw materials to be exploited or to organise long-distance exchange networks.

The issue of fuel requirements also needs some attention. A number of crafts require some amount of heat treatment in their production process, as indicated in Chapter III. As required temperatures of heat varied between crafts, requirements of fuel would also differ. The issue also depends on the scale of working. For bead making, though firing of agate is resorted to at several stages of the bead making process, still in a single firing a number of bead blanks or finished beads can be subjected to heat treatment. So also for steatite working. Only for metallurgy would fuel requirements be high as a number of individual production processes within metallurgy required high temperatures. Faience production would also require high temperatures. It is doubtful if wood would have sufficed to produce the required temperatures. If charcoal was used, then large amounts of suitable woods would again be required. Carbonization of wood carried out in heaps, which would have been the practice then to produce charcoal, would have low yields rarely exceeding 15% (Brame & King 1955: 41). Thus, it is clear that requirements of wood and charcoal would have

been high. This may be a reason for the scarcity of indicators for metallic ore smelting in/near Harappan production centres. Since in metallurgy, smelting is the major fuel-consuming process, it may have been considered more economical to bring refined metal into the production centres to be worked into required objects.

Another aspect to be touched upon is the question of technology. In general, it could be said that if a craft involved a complex and difficult production process, then the number of sites devoted to that craft would be few. This appears to be the case with faience production and seal cutting. It is not our aim to advocate technological determinism, but it should be admitted that if it were not for technology and the question of gaining experience in the craft, then practically every site in Kutch and Kathiawar would have engaged in making beads. However, the fact is that technology is not the only factor limiting the number of production centres. Requirement of objects and the ability to offer goods in exchange must have important for production. If requirements for objects were not high, then it would be illogical for every site to be producing these objects. Weight production shows also that technology was not a motivating factor for limiting production centres, as this craft involved no sophisticated techniques; yet production centres were few, due to the operation of other factors.

The nature of artifacts and the uses to which they were put will determine to an extent the findspots of such artifacts and the production centres involved in their manufacture. Harappan products can largely be categorized into utilitarian and special-purpose objects. Utilitarian objects are again divided into tools such as knives and axes used for various activities and tools used for further production. Artifacts having a special non-utilitarian function are wealth objects along with artifacts used to facilitate administrative and exchange processes such as seals and weights. Thus we have -



It appears that raw materials such as metal, shell or semi-precious stone were not used exclusively for the production of utilitarian objects or alternatively for non-utilitarian artifacts. Metal was used for tools, for ornaments and for decorative items (see table IV.14). Semi-precious stones were used for beads, which would classify in the utilitarian category, but particular types of beads, such as the etched carnelian beads would not

fall within this group, being wealth objects or traded items. Shell could be used to make ornaments which are found all over the Harappan region, yet artifacts such as ladles could have had a restricted sacred function. Faience was used primarily for ornaments and decorative items, some of which were probably wealth goods (see Table IV. 15).

It is essential to discuss each category shown in the diagram above, in the context of this chapter, that is of the findspots of artifacts and production centres for each artifact category. Utilitarian objects such as household artifacts and ornaments will be found at practically every site. Household artifacts such as pottery, querns and stone tools are necessary for basic food-processing activities and hence will be found at the majority of sites. It is also probable that production of such artifact categories will be undertaken at a large number of sites. This can perhaps be noted in the case of stone tool production.

In Table IV.16 we have listed the sites from where evidence of stone tool production is recovered. It must be clarified that here we are not only talking about the Harappan long chert blades. Kot Diji was an important centre for the production and distribution of Harappan long chert blades, as also the workshop sites in the Rohri

Hills (Allchin 1979). At Kalibangan too, some prepared cores were found suggesting that blades were detached at the site (Inizan & Lechevallier 1990). At a number of other sites mentioned in Table IV.16, production of blades from local materials was undertaken. Examples of such sites are Maliri where thousands of worked and unworked cherts were found (Majumdar 1934: 101), Rupar (Dutta 1984: 21) and a number of sites in Gujarat utilizing local materials such as Pirwada Khetar (Joshi 1966: 67), Kotara (Joshi 1972: 111), Lakhapar (Joshi 1966: 65-66), Khari-ka-khanda (Joshi 1966: 68), Kotada Bhadli (Joshi 1966: 67) and Surkotada (Joshi 1972: 133, 135). At other sites such as Banawali, Lohri, Mashak, Mitathal, Lohumjodaro, Naru Waro Dharo and Jhukar, we are not sure as to the source of the chert. It is very likely that the production of the Harappan long chert blades was undertaken in very few centres due to the material used and the technology involving a complex preparation of the core (Inizan & Lechevallier 1990: 56) while other settlements produced smaller blades from local materials.

If we quantify the sites from where we have evidence of stone tools and those which give some evidence of stone tool production, it becomes apparent that roughly every one in 2.4 sites reveals stone tool making. This figure can be contrasted with the available figures for other crafts, gleaned from Table IV.1. Thus, we get the following table, relating to currently available data.

ornaments rather than the primary utilitarian artifact category of tools. This pattern, however, is due to the likelihood of small ornaments being lost in antiquity, while tools being larger were less likely to be misplaced.

In view of limited consumption, the findspots of wealth goods will be few in relation to the area of the Harappan culture. This can be seen from the rarity of faience miniature jars, an artifact category which cannot be termed as utilitarian in view of the material used and the fact that containers could easily have been made of more common materials. To maintain the exclusiveness of wealth objects, their production will understandably be undertaken in few centres. This is exemplified by the scarcity of centres for the production of faience.

Objects used for administration and exchange will also be made at few centres and very probably under central supervision. The evidence of 4 centres for seal cutting is a clear cut example of the production of this category of artifacts being undertaken under an authority. Three centres for the production of weights indicates clearly the measure of importance given to the establishment of accuracy in manufacture. The production centres of seals and weights gives evidence of the location of the power structure within the Harappan culture. The rarity of production centres for artifacts

such as seals and weights and of wealth goods can be contrasted with the larger number of centres engaging in metallurgy, bead making and the cutting of shell bangles, as noted in Table IV.17.

Another point which should be noted and is discussed more fully later (see Chapter VI) is the variety of artifacts within each category that are found at larger sites as opposed to the fewer, more standardized types found at smaller sites. This is exemplified by Table IV.15 which shows the variety of faience objects found at Mohenjodaro and Harappa, as compared to most other settlements which primarily reveal faience beads and bangles.

As set out in the preceding pages, the picture drawn of Harappan craft production according to the maps does not provide any simple explanation for the location of production. Proximity to raw material sources is only rarely a reason for craft location. The number of craft centres and their dispersal over the Harappan region cannot be ascribed solely to the availability of technological expertise, nor to localization coinciding with politically significant centres. It becomes necessary then to set the discussion within the correct perspective of the particular politico-socio-economic context with which we are concerned, so as to better understand the place of craft production in the Harappan

cultural environment.

The period with which we are dealing involves an economy that was not controlled by market forces or the use of coinage. We know from the development of theory in economic anthropology (Belshaw 1965; Meillassoux 1971; Leclair and Schneider 1968; Polanyi et al 1958; Mauss 1967) that production was not controlled by the forces of demand and supply and was not geared towards the market. There may be categories of objects that are used as measures of value [4] but these forms of primitive money could not be used for all kinds of transactions. There was no universal system of equivalencies between different categories of objects. Most clearly there was a distinct lack of exchangeability between subsistence and wealth goods. Equivalencies may have existed between subsistence goods, but significant resources in society such as land and labour could not be bought and sold. Commoditization of these resources and wealth goods had not taken place.

The Harappan period also preceded by a number of centuries the commencement of the guild system as an organizing entity in the subcontinent. A non-market economy is unlikely to have a system of guilds with their myriad functions of raw material procurement and distribution of goods, allocation of duties and work, fixing of prices and laying down of rules. The various facets of

craft production could only operate in different ways.

The procurement of materials and the distribution of goods especially in the Harappan context, imply movement over considerable distances. In the absence of regular guild procurement and marketing other mechanisms must have existed to perform these functions. It is possible that independent craftsmen may have moved some distances in their agriculturally slack seasons to dispose of produced goods and obtain needed materials. As contrasted with this, may have been groups of itinerant craftsmen who relied on mobility to dispose of their produce, hence being able to travel to areas where requirement for their goods were larger. The major difficulty with such a situation would be the lack of social relationships between the producer and the consumer. In this early period, it may not have been feasible for producers to overcome the social ties and cultural limits set by their physical boundaries to travel considerable distances to dispose of goods. Despite the fact that transactions approaching the status of `commerce' require interactions between strangers or aliens, it is necessarily difficult to conceive of craft producers <u>regularly</u> interacting with strangers to dispose of their goods.

Some amount of small scale distribution through peddlars who carried meagre stocks for exchanges could have been possible. Their activities of trading and of

moving over distances for this purpose would primarily be due to their status as strangers, not part of a local society. Meillassoux (1971: 72, 74) emphasizes that once a peddlar or trader becomes part of a local group or society, he would lose his status of stranger which essentially allows him to trade. It should also be mentioned that the middleman trader has an area of operation outside of which he does not travel. Thus, the movement of goods over long distances may not be explained by such a mode. Professional merchants operating on the lines of personal profit and loss are equally difficult to conceive of in this early period. Regular transactions between strangers would be difficult in the absence of a money economy and a fixed system of equivalencies.

Another means of disposal of goods could be via periodic markets which in the present day less developed economies serve an important function. Skinner (1964) in his study of periodic markets in China, has outlined various reasons for the prevalence of such markets. In rural areas, the total amount of demand is insufficient to sustain a permanent trader; an individual who is both producer and trader can combine both functions efficiently. Prior to the 18th century, the rural population was sparse and villagers would have had to move greater distances for a permanent market and the level of demand was such that villagers did not need to market

can be used to reward allies and subordinates and are also brought as tributes to the elite. Such exchanges gradually acquire a more political, rather than social, complexion.

From the data in this chapter, we have to account for the bringing into Harappan settlements of required raw materials and the distribution of finished products to the consumers. Intermittent trading expeditions to obtain raw materials may have occurred, especially where areas peripheral to the Harappan region are concerned. Refined metal and steatite may have been brought from Rajasthan in this fashion. In other cases, procurement was more organized and regular. We know that settlements such as Nageshwar and Balakot were probably established solely to exploit particular raw materials. It is hence inconceivable that these settlements would have been specifically set up and the transportation of materials left entirely to chance.

Periodic markets where individual producers may gather to dispose of their produce could have been effective for the distribution of utilitarian goods between people. It is unlikely that elite goods would find a place in transactions undertaken in such contexts.

In the case of elite goods, we need to explain on the one hand how manufactured goods were transported from production centres such as Chanhudaro and Lothal, and on

the other how elite goods were transported from centres such as Mohenjodaro. Chanhudaro and Lothal (which will be discussed further in the next chapter) were primarily craft centres, their produce intended for non-local consumers. Manufactured goods may have been taken to Mohenjodaro or other large Harappan cities and thence distributed onwards. This would imply a centralized distribution system. It appears though that there was not a unilineal mode of distribution. Some goods (probably not elite goods) appear to have bypassed Mohenjodaro and are found in other settlements. Distribution of elite goods would require some authority responsible for production and ensuring the restricted nature of the output. Distribution of elite goods from craft centres then must have been rigidly controlled.

The distribution of elite goods to and from Mohenjodaro must have followed various forms. Elite goods must have been used to reward subordinates, used as offerings in shrines and as ceremonial prestations to and from ruling elites. Elites in regional settlements may have been given such goods as a mark of favour or to obtain political loyalty. The presence of these goods in settlements such as etched carnelian beads at Shortughai, Surkotada, Gumla, and Banawali will indicate the presence of elites. Gift exchange may also explain the presence of etched carnelian beads and long barrel-cylinder carnelian

beads in non-Harappan contexts.

Manufactured products such as shell bangles may not have been elite goods, as they are quite ubiquitous and were made at a number of production centres. Bangles from a shell cutting centre such as Nageshwar must have been transported to a regionally larger settlement (perhaps Dholavira) and then to other Harappan settlements. Separate transportation networks from every craft centre to the Harappan nuclear area would have involved high inputs of labour and expenditure.

There may have been other mechanisms for the distribution of manufactured goods, such as kin transactions, marriage alliances and so forth which may not be easily decipherable. However, it is abundantly clear that there were multilineal distribution networks within the Harappan region.

FOOTNOTES

1. The maps referred to in this chapter will be found at the end of the thesis.

2. A small faience jar of blue-green colour, 1.8 cm. tall is exhibited in the National Museum, New Delhi. Registered as No. JK 69/ - 1749, it is described as a cylindrical tapering faience bead, on account of the hole

Table IV.1
Distribution of Artifacts and Production Centres in the Harappan Culture
X : Production
✓ : Findspot

No.	Sites	Metal-lurgy	Bead Making	Shell Working (Bangles)	Shell Working (Ladles etc.)	Seal Cutting	Steatite Working	Faience Production	Ivory Working	Weight Making	Production of Etched Carnelian Beads
1.	Ali Murad	✓	✓	✓			✓				
2.	Allahdino	X ✓	✓	✓		✓				✓	
3.	Amri	✓	X ✓					✓			
4.	Badah	✓	✓	✓	X ✓				✓		
5.	Balakot	X ✓		X ✓	X ✓			✓			
6.	Banawali	X? ✓	✓	✓	✓	✓	✓	✓		✓	✓
7.	Bedi Kotiro	✓	✓	✓						✓	
8.	Bhagatrav	✓	✓				✓	✓			
9.	Chak Purbane Syal		✓				✓	✓			
10.	Chanhudaro	X ✓	X ✓	X ✓	X ✓	X ✓	X ✓	X ✓	X ✓	X ✓	X ✓
11.	Dabarkot	X? ✓	✓			✓		✓			
12.	Damb Buthi			✓	✓						
13.	Desalpur	✓				✓		✓		✓	
14.	Dhal	✓		✓							
15.	Gharo Bhiro	X ✓									
16.	Ghazi Shah	✓	✓				✓				
17.	Gorandi	✓	X ✓	✓							
18.	Gumla	✓	✓	✓				✓		✓	✓
19.	Harappa	X ✓	X ✓	X ✓	X ✓	X ✓	X ✓	✓	✓	X ✓	✓
20.	Jhukar	✓	✓			✓	✓		✓		
21.	Kalibangan	✓	✓	✓		✓	✓	✓		✓	✓
22.	Karchat	✓	✓	✓	✓		✓				
23.	Kot Diji	✓		X ✓	X? ✓	✓		✓			
24.	Kot Kori			X ✓							

contd.

Contd.

No.	Sites	Metal-lurgy	Bead Making	Shell Working (Bangles)	Shell Working (Ladles etc.)	Seal Cutting	Steatite Working	Faience Production	Ivory Working	Weight Making	Production of Etched Carnelian Beads
25.	Kotla Nihang Khan	✓	✓		✓		✓	✓		✓	
26.	Lakhiyo						✓			✓	
27.	Lohri	✓						✓			
30.	Manda	✓				✓					
31.	Mashak		✓	✓							
32.	Mitathal	✓	✗ ✓	✓			✓	✓			
33.	Mohenjodaro	✗ ✓	✗ ✓	✗ ✓	✗ ✓	✗ ✓	✗ ✓	✗ ✓	✗ ✓	✗ ✓	✓
34.	Nageshwar	✓	✓	✗ ✓	✗ ✓		✓	✓		✓	
35.	Naru Waro Dharo	✓		✓							
36.	Pai Jo Kotiro			✓							
37.	Pabumath			✓						✓	
38.	Pandi Wahi		✗ ✓				✓				
39.	Rajo Dero										
40.	Rakhigarhi		✓	✓			✓	✓			
41.	Rangpur	✓	✓	✗ ✓	✓		✓	✓	✓	✓	
42.	Rupar	✓	✓	✓	✓	✓	✓	✓		✓	
43.	Shortughai	✗ ✓	✗ ✓	✓		✓	✓	✓			✓
44.	Sotka Koh			✓							
45.	Surkotada	✓	✓	✗ ✓		✓	✓	✓	✗ ✓		✓
46.	Sutkagendor			✓							
47.	Lohumjodaro	✓	✓	✓		✓	✓	✓		✓	
48.	Lothal	✗ ✓	✗ ✓	✗ ✓	✗ ✓	✗ ✓	✓	✗ ✓	✗ ✓	✓	✗ ✓

Table IV.2
Details of Metallurgical Activities At Harappan Sites

S.No.	Site	Nature of Evidence	Location	Reference
I	Mohenjodaro	1) Lumps of unrefined copper, ashes, crucible fragments	HR, Section B, Block 8 House LXI Room 31-32	Marshall 1931: 212
		2) Rectangular paved pit, containing copper ore + a small piece of lead	DKG, Block 4, House VI, Room 51	Mackay 1938 : 54
		3) Crucible fragment		Marshall 1931: 485
		4) 2 kilns, found near 3 faulty castings	DKG, Block I, Room 33	Mackay 1938 : 452
		5) Plano- convex lumps of crude copper		Marshall 1931: 485
		6) 4 copper melts	DKG, Block 2, House IV, Room 15	Mackay 1938 : 129
		7) Bronze ingot	DKG, Block 25, House I, Room 9	Mackay 1938 : 160
		8) Ingot ?	DKG, Block 7, House III, Room 52	Mackay 1938 : 452
		9) Copper blade kept for reuse	DKG, Block 12A, House I Room 15	Mackay 1938 : 459
		10) 2 castings kept for reuse	DKG, Block I , House VI, Room 52	Mackay 1938 : 452
		11) Copper casting kept for reuse ?	DKG, Block 12, House V, Room 96	Mackay 1938 : 141
		12) Casting kept for reuse	DK, Block 8, Section C, Room 14	Marshall 1931: 506
		13) Broken ingot	DKG, Block 12A, House I, Room 15	Mackay 1938 : 451-52
		14) Metal board	DKG, Block 12A, House I, Room 15	Mackay 1938 : 141
		15) Unfinished chisel	HR, Section B, Block 3, House XVI, Room 30	Marshall 1931 : 200
		16) Unfinished chisel	DKG, Block 4, Room 15	Mackay 1938 : 475
		17) Unfinished sword	DKG, Block 12A, HouseI, Room 11	Mackay 1938 : 467
		18) Unfinished bronze jar	DKG, Block 9, House VIII, Room 16	Mackay 1938 : 450
		19) Coppersaith's blow pipe	HR, Section B, Block 2, House XII, Room 105	Marshall 1931:198
		20) Copper slags, prills and crucibles	AA. 19A, East of HR Area	Bondioli et al 1984 : 30
		21) Slags and prills	AA.11. Between VS and Moneer	Bondioli et al 1984 : 30
II	Allahdino	1) Copper slag, scattered and sparse		Fairservis 1982 : 112

Table IV. 2 Contd.

Table IV. 3

Details of Hoards of Metal Artifacts Recovered from Chanhudaro

S.No	Registration Number	Locus of Hoard	Details of Artifacts	Reference (in Mackay 1943)
1	2593	Mound II, Northeast of locus 212	13 Knives	LXIV, 1-6 LXV, 2-8
			1 Portion of knife	LXIV, 7
			1 spearhead	LXV, 1
			1 casting	LXV, 9
			1 bangle	LXVI, 2
			3 axes	LXVI, 3-5
			1 shovel	LXXIV, 13
			1 dish	LXIV, 9
			1 handled dish	LXVI, 1
			3 adzes	LXIV, 8-11
2	2360	Mound II, locus 213	2 pins	LXVII,13,17
			3 knives	LXVII,14-16
			2 chisels	LXVII,18-19
3	2596	Mound II, North-eastern corner of Courtyard 297	2 razors	LXVII, 1,7
			1 scale pan	LXVII, 2
			1 spatula ?	XVII, 8
			1 knife	LXVII, 12
			3 bangles	LXVII, 4-5
			4 chisels	LXVII,3,9-11
			1 portion of axe	LXXIV, 1
4	2529	Mound II, courtyard 297	1 ingot	LXXIV, 2
			1 jar	LXII, 1
			5 scale pans	LXII, 2-4, 8,10
			2 bangles	LXII, 5-6
			1 tube-drill	LXII, 7
			2 awls	LXII, 9,14
			5 chisels	LXII,12-15, 18-19
			2 axe pieces	LXII, 20,22
			2 adzes	LXII, 21
			1 saw	LXIII, 1
			3 spearheads	LXIII,2,4-5
			1 axe	LXIII, 3
			8 unillustrated objects	

Table IV. 3 Contd.

Table IV. 3 Contd.

S.No	Registration Number	Locus of Hoard	Details of Artifacts	Reference (in Mackay 1943)
5	2199	Mound II, Southeastern side of courtyard 297, locus 227	1 jar cover	LXVI, 6
			1 dish	LXVI. 7
			4 bangles	LXVI, 8-11
			1 scale pan	LXVI, 12
			5 chisels	LXVI, 13,17-20
			2 awls	LXVI, 14,21
			1 axe	LXVI, 15
			1 knife	LXVI, 16
6	2525	Mound II, locus 227	3 chisels	LXIII, 6-8
			1 scale pan	LXIII, 9
			1 scale beam	LXIII, 11
			1 knife	LXIII, 10
7	2594	Mound II, locus 228	2 knives	LXXVI,29,31
			1 dagger ?	LXXVI, 30
8	3324	Mound II, locus 302; in storage jar	1 bangle	LXIX, 11
			1 chisel	LXIX, 12
			1 axe fragment	LXIX, 13
			2 axes	LXIX, 14-15
9	2365	Mound II, locus 284	1 platter	LXXV, 10
			2 jars	LXVIII, 1,3
			1 handled pan	LXVIII, 2
			3 staff heads	LXVIII, 4,5,7
			1 arrowhead	LXVIII, 6
			3 knives	LXVIII, 8, 10, 16
			1 pin	LXVIII, 9
			2 adzes	LXVIII, 11-12
			2 daggers?	LXVIII, 13, 15
			1 fragment of fillet	LXVIII, 14

Table IV. 4 Contd.

S.No.	Site	Nature of Evidence	Location	Reference
		26) Unfinished limestone bead	Mound II, locus 136	Mackay 1943: 204
		27) Unfinished agate bead-reject	Mound II, locus 215	Mackay 1943: 206
		28) Rejected carnelian bead-while boring	Mound II, locus 394	Mackay 1943: 314
		29) 6 etched carnelian beads-broken while boring	Mound II, 215, 278, 125, 226 B(5) 43, Trench F(1) 46	Mackay 1943: 201, 308
		30) Chalcedony/carnelian bead-making wasters	Mound II, Squares 9/E, 9/F, 10/E, 10/F 10/C, 10/D	Vidale 1989: 175
		31) Chalcedony/carnelian geode deposits	Mound II, Square 8/F	Vidale 1989: 175
		32) 2 flake drills	Mound II, locus 215	Mackay 1943: 43, 213
III	Gharo Bhiro	1) Chippings of semi precious stones		Lambrick 1964: 89
IV	Gorandi	1) 1 unfinished carnelian bead		Majumdar 1934: 106
V	Harappa	1) 2 unfinished agate beads	Mound F, Trench III, Square M 10/21	Vats 1940: 114, 412
		2) 1 unfinished bead, carnelian, unperforated	Area G, Trench I, Square AM 36/25	Vats 1940: 192
		3) 1 unfinished bead, jadeite, unperforated	Mound F, Square I 13/17	Vats 1940: 413
		4) 1 unfinished bead, agate, unpolished	Mound F, Trench I, Square M 12/12	Vats 1940: 438
		5) 20 unfinished beads	1 - Cemetery; 1 - Mound AB; 18 - Mound E	Dales & Kenoyer 1988: 37
VI	Lothal	1) Bead factory, kiln, finished and unfinished beads, cores and flakes, flanged drill	Block F, 164	Rao 1979 : 118
		2) 1 unfinished bead, agate, partly polished		Rao 1985 : 600
		3) 1 unfinished bead, jasper unpolished and unbored		Rao 1985 : 603

Table IV. 4 Contd.

Table IV. 4 Contd.

S.No.	Site	Nature of Evidence	Location	Reference
		4) 1 unfinished bead, jasper, partly perforated		Rao 1985 : 603
		5) 3 unfinished beads, onyx, unbored		Rao 1985 : 603
		6) 2 unfinished beads, bloodstone, unbored		Rao 1985 : 603,605
		7) 2 unfinished beads, opal, unbored		Rao 1985 : 603,605
		8) 1 unfinished bead, chert, bored but unpolished		Rao 1985 : 603
		9) Copper drill, 3 types	One found in bead factory	Rao 1985 : 532
VII	Mitathal	1) 1 unfinished bead, agate unbored	Unstratified	Suraj Bhan 1975 : 7,73
		2) 1 unworked nodule of agate	?	Suraj Bhan 1975 : 7-8
VIII	Mohenjodaro	1) Amethyst nodules	?	Marshall 1931: 526
		2) 3 unfinished beads, agate, unbored	2 from DK Area, 1 from SD	Marshall 1931: 526
		3) 1 unfinished bead, agate, unbored	DKG, Block 7, House I, Room 15	Mackay 1938 : 501
		4) 1 unfinished bead, jasper, unbored	DKG, Block 3, House I, Room 5	Mackay 1938 : 547
		5) 1 unfinished bead, agate, unbored	DKG, Block 1, House IV, Room 63	Mackay 1938 : 501
		6) 1 unfinished bead, unbored	Surface	Mackay 1938 : 501
		7) 1 unfinished bead, agate, unbored	DKG, Block 6A, Room 38	Mackay 1938 :549
		8) 1 unfinished bead, agate, unbored	DKG, Block 6A, Room 41	Mackay 1938 : 502
		9) 1 unfinished bead, agate, unbored	DKG, Block 9A, House VIII, Room 56	Mackay 1938 : 549
		10) 1 unfinished bead, agate, partly bored	Central Street	Mackay 1938 : 549
		11) 1 unfinished bead, agate, unbored	DKG, Block 23, House II, Room 13	Mackay 1938 : 549
		12) 1 unfinished bead, agate, partly bored	DKG, Block 8A, Room 38	Mackay 1938 : 553
		13) 1 composite unfinished bead, unpolished	DKG, Block 18, Room 17	Mackay 1938 : 504
		14) 1 unfinished bead, agate, unbored	Surface	Mackay 1938 : 513
		15) Sandstone hone	SD, Block 6, Room 23	Mackay 1938 : 21

Table Contd.

Table IV. 4 Contd.

S.No.	Site	Nature of Evidence	Location	Reference
		16) Several hundred chert microdrills, hammer stones, bead making debitage	Moneer South-East, AA. 40	Bondioli et al 1984 : 24
		17) Chalcedony debitage and bead blanks	Between 19A and 19B, East of HR	Bondioli et al 1984 : 27
		18) Chalcedony debitage and bead blanks	East of Southern portion of VS	Bondioli et al 1984 : 27
		19) Chalcedony debitage and bead blanks	West of Southern portion of VS	Bondioli et al 1984 : 27
		20) Chalcedony debitage and bead blanks	Between VS and Moneer	Bondioli et al 1984 : 27
		21) Chalcedony debitage and bead blanks	Between M and E, East of DKG	Bondioli et al 1984 : 27
		22) Chalcedony debitage and bead blanks	Locus 18, Northeast of DKG	Bondioli et al 1984 : 27
		23) Chalcedony debitage and bead blanks	Locus 16, North-north east of DKG	Bondioli et al 1984 : 27
		24) Lapis lazuli debitage	Locus 33, between L and SD	Bondioli et al 1984 : 27
		25) Lapis lazuli debitage	Moneer South East, AA. 40	Bondioli et al 1984 : 27
		26) 1 copper drill	DKG, Block 10, House I, Room 4	Mackay 1938 : 139
		27) 1 bronze drill ?	DKG, Small lane between Block 5and 6	Mackay 1938 : 40
		28) 1 quartzite hone	Old excavations' dump northeast of HR	Vidale 1987 : 127
		29) 1 quartzite hone	DKB and C dumps	Vidale 1987 : 127
		30) 1 sandstone hone	Surface of Moneer Southeast	Vidale 1987 : 127-28
IX	Pandi Wahi	1) 1 unfinished bead		Majumdar 1934 : 113
		2) 1 unfinished bead		Majumdar 1934 : 113
X	Shortughai	1) Unfinished carnelian beads		Francfort 1984 : 303
		2) Chunks and chips of lapis lazuli		Francfort 1984 : 303
		3) Flint micro-blades in association with lapis lazuli		Francfort 1984 : 303
		4) 1 drill-head in association with lapis lazuli		Francfort 1984 : 303

Table IV.5

Details of Shell Bangle Manufacturing Activities from Harappan Sites

S.No.	Site	Nature of Evidence	Location	Reference
I	Balatot	1) 3 non-utilized shells 2) Fragments of finished bangles 3) Roughouts 4) Non-utilizable wasters 5) Wasters utilized as smoothing and punching implements		Durante 1977 : 328
II	Chanhudaro	1) 4 unfinished bangles	Mound II, locus 181	Mackay 1943 : 48
		2) Shell manufacturing waster concentrations	Mound II, Squares 4/D, 5/D, 10/C	Vidale 1989 : 175
		3) 2 large shells, a shell feeding cup and a shell cone	Mound II, locus 215	Mackay 1943 : 43
		4) Numerous cut pieces of conch shells	Mound III, Trenches I and II	Majumdar 1934 : 38
III	Kot Diji	1) 1 unfinished <u>Turbinella pyrum</u> bangle		Kenoyer 1984a : 249
IV	Kot Kori	1) Large marine gastropods seem to make bangles		Khan 1981 : 44
V	Lothal	1) Hundreds of columellae of chank shell, rejected flakes, unfinished bangles and finished objects		Rao 1985 : 614
		2) 2 stone grinders and 1 large chank shell	Block A, E 13-E14	Rao 1979 : 93-94
		3) Dump of gastropods, unfinished bangles and rejected cores	Block A, 157, B18-B19	Rao 1979 : 96
		4) Chank, shells, columellae and unfinished bangles	Block G, 159	Rao 1979 : 122
		5) Unfinished bangle		Rao 1985 : 619
VI	Mohenjodaro	1) 4 chank shells	L, Section B, Block 10, 89	Marshall 1931: 159
		2) 15 chank shells	L, Section B, Block 3, Room 69	Marshall 1931: 173

Table Contd.

Table IV. 5 Contd.

S.No.	Site	Nature of Evidence	Location	Reference
		3) 35 chank shells; some whole, some partly sawn	L, Section D, Block 1, Room 44	Marshall 1931: 170
		4) 24 chank shells	L, Section D, Block 3, area 70	Marshall 1931: 174
		5) 1 complete shell	DKG, Block 7, House I, Room 19	Mackay 1938 :580
		6) A hoard of 41 shell cores, useful parts for bangle making removed	VS, Block 2, House XIII	Marshall 1931: 219
		7) 15 unfinished bangles found in a pot	HR, Block 2, House III, Room 29	Marshall 1931: 181
		8) Unfinished bangle	DKG, First Street (24)	Mackay 1938 : 537
		9) Unfinished bangle	DKG, Block 1, Court 1 (81)	Mackay 1938 : 537
		10) Unfinished bangle	DKG, Long lane, between Blocks 10 A & 11	Mackay 1938 : 537
		11) Wasters from bangle, ladle and inlay production	HR East	Kenoyer 1984b : 107
		12) Large quantities of tiny chipped fragments from apex portion of Turbinella pyrum	On a low mound, several hundred metres northeast of Moneer Area	Kenoyer 1984b : 107
		13) Shell debitage	West of southern portion of VS, locus 23	Bondioli et al 1984 : 27
		14) Shell debitage	North-north-east of DKG, locus 16	Bondioli et al 1984 : 27
		15) Shell debitage	North east of DKG, locus 18	Bondioli et al 1984 : 27
VII	Nageshwar	1) A heap consisting of 413 Turbinella pyrum columellae, fragments of shell bangles, broken ladles, pendants, beads, inlays		IAR 1983-84 : 19
		2) Spread of thousands of fragments of gastropods, bangles and ladles		IAR 1983-84 : 19
		3) Debitage from preliminary chipping of I. pyrum	South West portion of site	Bhan 1986 : 6-7
		4) A dump consisting of 714 columellae, 430 lip fragments, 11 apex portions of I. pyrum	a3, b3 Squares	Hegde et al 1984-85 : 6

Table Contd.

Table IV. 5 Contd.

S.No.	Site	Nature of Evidence	Location	Reference
		5) Special querns with small circular depressions for polishing bangles		IAR 1983-84 : 19
		6) Masters of Chicoreus ramosus-production of bangles and ladles	Squares 1c-c3 and and 1d-d3	Hegde et al 1984-85 :7
VIII	Surkotada	1) Fragments of sawn manufacturing waste		Kenoyer 1984a: 242-43
IX	Rangpur	1) Rejected cores and columellae		Rao 1962-63 : 149

Table IV. 6

Details of the Production of Ladles, Inlay and other Objects of Shell from Harappan Sites

S.No	Site		Nature of Evidence	Location	Reference
I	Balakot	1)	1 unfinished ladle fragment		Kenoyer 1984a : 219
		2)	Finished objects - 2 ladles (0.3%); ornaments other than bangles 25 (3.6%); special objects 8 (1.1%); no inlay		Kenoyer 1984a : 218
II	Chanhudaro	1)	2 unfinished ladles	Mound II, loci 211, 171	Mackay 1943 : 316, 317
		2)	3 unfinished dishes	Mound II, loci 228, 197, 153	Mackay 1943 : 40, 43, 45
		3)	1 unfinished ball	Mound II, locus 297	Mackay 1943 : 43
		4)	Numerous cut pieces of conch shells	Mound III, Trenches I and II	Majumdar 1934 : 38
III	Harappa	1)	5 broken chank shells, 5 cores and numerous fragments	Mound F, Trench V, Square J 12/23	Vats 1940 : 71-72
		2)	Large cache of shell wasters and about 1.8 Kg of finished inlay pieces	Trench V (probably same as above)	Kenoyer 1984a : 211
		3)	6 unfinished ladles (30% of total sample)		Kenoyer 1984a : 208
		4)	40 unfinished pieces and waste fragments of other ornaments (other than bangles), inlay and special objects		Kenoyer 1984a : 208
		5)	1 unfinished bead, unbored		Vats 1940 : 416
IV	Kot Diji	1)	1 sawn fragment each of Chicoreus ramosus and Lambis truncata sebae		Kenoyer 1984a : 249
V	Lothal	1)	Dump of shell cores possibly for bead making. Unfinished bangles found	Block A, B18-B19, 157	Rao 1979 : 96
		2)	Unfinished gamesmen - cylinderical and rectangular pieces		Rao 1985 : 617
		3)	Unfinished inlay pieces		Rao 1985 : 620
		4)	Large number of columellae and rejected pieces from ladle manufacture		Rao 1985 : 615
		5)	Production of Dentalium beads		Rao 1985 : 584

Table IV. 6 Contd.

S.No	Site		Nature of Evidence	Location	Reference
VI	Mohenjodaro	1)	2 whole chank shells + 2 inlay pieces	L, Section D, Block 1, Room 51-52	Marshall 1931: 171
		2)	11 chank shells + 1 inlay piece	L, Section D, Block 2, Room 53	Marshall 1931 : 173
		3)	23 chank shells + 2 inlay pieces	L, Section C, Block 4, Room 27	Marshall 1931 : 162
		4)	5 chank shells + numerous unfinished inlay pieces	L, Section D, Block 1, Room 45	Marshall 1931 : 170
		5)	1 unfinished inlay piece	DK, Section C, Block 6, Room 2	Marshall 1931 : 569
		6)	1 unfinished object	HR, Section A, Block 2, House III	Marshall 1931 : 569-70
		7)	1 unfinished inlay piece	VS, Block 4, House XXII	Marshall 1931 : 569
		8)	1 unfinished inlay piece + 3 finished pieces	L, Section D, Block 1, Room 50	Marshall 1931 : 567
		9)	Unfinished beads		Marshall 1931 : 565
		10)	1 unfinished ladle	DKG, Block 18, Room 7	Mackay 1938 : 159
		11)	1 unfinished cone	DKG, Block 9, House VI, Room 34	Mackay 1938 : 410
		12)	1 unfinished object	DKG, Block 4, Room 12	Mackay 1938 : 582
		13)	1 unfinished ladle - reject ?	DKG, Block 7, House III, Room 44	Mackay 1938 : 422
		14)	A mass of shell inlay, debitage of shells	HR, Section B, Block 2, House IX, Room 85	Marshall 1931 : 195
		15)	53 wasters of Fasciolaria trapezium, resulting from inlay production	L area dump	Kenoyer 1984a : 191
		16)	Wasters from bangle, ladle and inlay production	HR East	Kenoyer 1984b : 107
		17)	8 inlay waste fragments+2 unfinished inlay pieces	North of L Area	Kenoyer 1984b : 107
		18)	Hoard of 41 shell cores	VS, Block 2, House XIII	Marshall 1931 : 219
		19)	Bead reject-partly drilled	DKG, Block 9, House I, Room 34	Mackay 1938 : 509
VII	Nageshwar	1)	Broken ladles, pendants, beads and pieces for inlay along with columellae and bangles		IAR 1983-84 : 19

Table IV. 6 Contd.

Table IV. 6 Contd.

S.No	Site	Nature of Evidence	Location	Reference
		2) Spread of thousands of fragments of shells, bangles and ladles		IAR 1983 - 84 : 19
		3) Numerous unfinished ladle fragments		Bhan & Kenoyer 1984 : 73
		4) Shell wasters of Chicoreus ramosus and a number of broken ladles- production of bangles and ladles	Squares 1c-c3 1d-d3	Hegde et al 1984-85 : 7

Table IV.7
Details of the Production of Faience from Harappan Sites

S.No.	Site	Nature of Evidence	Location	Reference
I	Chanhudaro	1) Paste plaques and cylinders	Mound II, locus 171	Mackay 1943 : 48
		2) 1 paste cylinder	Mound II, Trench C, Section (2)	Mackay 1943 : 10
		3) 1 paste plaque	Mound II, Trench D, Section (1)	Mackay 1943 : 10
		4) 1 unglazed bead	Mound II, locus 244	Mackay 1943 : 210
		5) 2 unfinished model animals	Mound II, locus 204, Trench J (1) 79	Mackay 1943 : 160
		6) Faience-smelting assemblage	Mound II, Squares B/E and B/F	Vidale 1989 : 175
II	Harappa	1) 1 miniature jar with traces of an overfired glaze		Vats 1940 : 313
III	Mohenjodaro	1) 2 slabs of vitreous paste	VS Area	Marshall 1931: 574-75
		2) Lump of vitreous paste	DKG, Block 1, House VI, Room 64	Mackay 1938 : 128
		3) Faience smelting slags and wasters	Locus AA. 38, South of DKB	Bondioli et al 1984 : 27
IV	Lothal	1) 1 unfinished pendant, partially perforated		Rao 1985 : 610
		2) Reject piece of vitreous paste		Rao 1985 : 663

Table IV.9
Details of Seal Cutting Activities from Harappan Sites

S.No	Site	Nature Of Evidence	Location	Reference
1	Chanhudaro	1) Small blocks of steatite with saw marks	Mound II	Mackay 1943 : 209
		2) 3 unfinished seals	Mound II, Locus 121	Mackay 1943 : 50
		3) 1 unfinished seal	Mound II, passage 286	Mackay 1938 : 43
		4) 1 unfinished seal	Mound II, Trench E (1) Locus 34	Mackay 1943 : 145
		5) 1 unfinished seal	Mound II, Trench F (2) Locus 65	Mackay 1943 : 145
		6) 2 unfinished seals	Mound II, Locus 56	Mackay 1943 : 145
		7) 1 unfinished seal	Mound II, Locus 410	Mackay 1943 : 145
		8) 1 unfinished seal	Mound II, Locus 459	Mackay 1943 : 145
		9) 1 unfinished seal	Mound II, Locus 344	Mackay 1943 : 145
		10) 1 unfinished seal	Mound II, Locus 223	Mackay 1943 : 145
		11) 1 unfinished seal	Mound II, Locus 240	Mackay 1943 : 145
II	Harappa	1) Bronze gouge	Mound F, strata over Great Granary	Vats 1940 : 47-48
		2) Copper objects-stylus, chisel and gouge	Mound F, Strata over Great Granary, Square J9/2	Vats 1940 : 48
		3) 2 gouges	Mound AB, Trench at Southern edge, Square Q 27/14	Vats 1940 : 389
		4) 1 unfinished seal	Western Extension (West of Great Granary), Square I 9/2, Mound F	Vats 1940 : 25
		5) 1 unfinished seal	Mound F, Trench IV, Square I 14/11	Vats 1940 : 54
		6) 4 unfinished seals	Mound F, Trench V, Square J 12/23	Vats 1940 : 71-72
		7) 1 unfinished seal	Mound F, Trench V, Square K 12/13	Vats 1940 : 72
		8) 1 unfinished seal	Mound F, Trench I, Square M 12/7	Vats 1940 : 82
		9) 1 unfinished seal	Mound F, Trench I, Square M 11/6	Vats 1940 : 83
		10) 1 unfinished seal	Mound F, Trench III, Square N 9/13	Vats 1940 : 118
		11) 1 unfinished seal	Mound F, Trench III, Square N 9/8	Vats 1940 : 119
		12) 1 unfinished seal	Mound F, Trench I, Square N 9/3	Vats 1940 : 121
		13) 1 unfinished seal	Mound F, Trench VI, Square O 11/23	Vats 1940 : 122
		14) 1 unfinished seal	Mound F, Trench VI, Square P 9/5	Vats 1940 : 124

Table Contd.

Table IV. 9 Contd.

S.No	Site	Nature Of Evidence	Location	Reference
		15) 1 unfinished seal	Mound F, Trench VI Square O 10/23	Vats 1940 : 125
		16) 1 unfinished seal	Mound F, Trench VI, Square O 10/25	Vats 1940 : 125
		17) 1 unfinished seal	Mound F, Trench VI Square O 8/20	Vats 1940 : 128
		18) 1 unfinished seal	Mound F, Trench VI Square O 11/21	Vats 1940 : 128
		19) 1 unfinished seal	Mound F, Trench VI, Square P 11/1	Vats 1940 : 134
		20) 1 unfinished seal	Mound F, Trench VI, Extension I	Vats 1940 : 135
		21) 1 unfinished seal	Mound AB, Extension Pits I & II, Square P 24/16	Vats 1940 : 151
		22) 1 unfinished seal	Mound AB. Extension Pits 1 & II, Square R 24/12	Vats 1940 : 153
		23) 1 unfinished seal	Mound AB, Extension Pits I & II, Square Q 24/5	Vats 1940 : 156
		24) 1 unfinished seal	Mound AB, Extension Pits 1 & II, Square R 24/17	Vats 1940 : 167
		25) 1 unfinished seal	Mound AB, Extension Pits I & II , Square Q 28/16	Vats 1940 : 173
		26) 1 unfinished seal	Mound AB, Trench at Southern edge,Squares Q 29/11,12,16 and 17	Vats 1940 : 178-79
		27) 1 unglazed seal	Mound D, Area J, Trench I, Square Q 31/18	Vats 1940 : 184
		28) 1 unfinished seal	Mound AB	Vats 1940 : 320
		29) 1 unfinished seal/reject	Mound F. Eastern Extension (area east of Great Granary), Square J 9/24	Vats 1940 : 38
		30) 1 reject seal	Mound F. Trench III, Square N 10/1	Vats 1940 : 113
III	Lothal	1) Lumps of steatite and partially cut blocks		Rao 1985 : 306
		2) Chisel for engraving ?		Rao 1985 : 532
		3) Seal making tool ?		Rao 1985 : 307
		4) Metal awls - two types		Rao 1985 : 532
		5) Ivory engraver		Rao 1985 : 628
		6) 2 bone engravers		Rao 1985 : 626
		7) 1 unfinished seal	SRG 2, C5	Rao 1985 : 307

Table Contd.

Table IV. 9 Contd.

S.No	Site	Nature Of Evidence	Location	Reference
	Lothal	8) 1 unfinished seal	SR6 2, Unstratified	Rao 1985 : 307
		9) 1 unfinished seal		Rao 1985 : 307
		10) 1 unfinished seal		Rao 1985 : 307
		11) 1 unfinished seal	SR6 3, B - C 5	Rao 1985 : 307,314
		12) 1 unfinished seal	SR6 2, C 25	Rao 1985 : 307,316
		13) 1 unfinished seal		Rao 1985 : 307
		14) 1 unfinished seal	SR6 1, XII-XVII	Rao 1985 : 309,317
		15) 1 unfinished seal	SR6 3, E 4	Rao 1985 : 309,317
		16) 1 unfinished seal	SR6 1, AX 1	Rao 1985 : 309,317
		17) 1 unfinished seal		Rao 1985 : 311
		18) 1 unfinished seal/reject	SR6 1, IX-XI	Rao 1985 : 312,318
		19) 1 unfinished seal	SR6 2, Unstratified	Rao 1985 : 312,314
		20) Unfinished seals		Rao 1985 : 307
		21) Unperforated seal	SR6 2, E 1	Rao 1985 : 315
		22) Seal kept for reuse	SR6 3, C 6	Rao 1985 : 316
		23) Reject seal ?	SR6 2, M 28	Rao 1985 : 317
IV	Manda	1) 1 unfinished seal		Joshi & Madhu Bala 1982 : 187
V	Mohenjodaro	1) Chisel used for engraving ?	VS, House XIII	Marshall 1931: 502-3
		2) Tool for engraving	VS, Block 2, House VIII, Room 3	Marshall 1931: 218
		3) Graver	DK6, Block I, House I Room 18	Mackay 1938 : 474
		4) Graver	DK6, South of Block 10 (IV)	Mackay 1938 : 474
		5) 1 unfinished seal		Marshall 1931: 378
		6) 1 unfinished seal	VS	Marshall 1931: 377
		7) 1 unfinished seal	Northern end of street 1	Marshall 1931: 184
		8) 1 unfinished seal	VS, Block 2, House X	Marshall 1931: 221
		9) 1 unfinished seal	HR, Section B, Block 5 House XXIII, Room 1	Marshall 1931: 203
		10) 1 unfinished seal	DK6, Block 3, House V Room 8	Mackay 1938 : 345
		11) 1 unfinished seal	DK6, Block 9, House VIII, Room 15	Mackay 1938 : 346
		12) 1 unfinished seal	DK6, Between Blocks 1 (1) and 2	Mackay 1938 : 346
		13) 1 unfinished seal	DK6, Block 7, House II Room 89	Mackay 1938 : 347
		14) 1 unfinished seal	DK6, First Street (13)	Mackay 1938 : 347
		15) Fragments of sawn and partially worked steatite + a bone stylus	HR, Section B, House X, Room 127	Marshall 1931: 184
		16) Concentration of tiny steatite wasters, small lumps, small perforated stone blocks, flakes : seal making/ bead making?	Westernmost limit of DK6	Bondioli et al 1984 : 30

Table IV. 10

Details of Weight Manufacturing from Harappan Sites

S.No.	Site	Nature of Evidence	Location	Reference
I	Chanhudaro	1) 4 unfinished weights		Mackay 1943: 238-39
		2) 1 unfinished weight	Mound II, locus 423	Mackay 1943: 226
		3) 1 unfinished weight	Mound II, locus 187	Mackay 1943: 238
		4) 3 weights - rejects?		Mackay 1943: 238
		5) Large proportion of misshapen weights - rejects?		Mackay 1943: 236
		6) Find of 22 weights	Mound II, Room 215	Mackay 1943: 243
II	Harappa	1) 1 unfinished weight	Eastern Extension (area east of Great Granary), Mound F, Square J 9/23	Vats 1940: 36
		2) 1 unfinished weight	Mound AB, Extension Pits I & II, Square Q 23/25	Vats 1940: 159
		3) 1 unfinished weight		Vats 1940: 362
		4) 1 unfinished weight	Mound AB, Trench at Southern edge, Square Q 28/21	Vats 1940: 362
		5) 1 unfinished weight	Mound F, Great Granary Area	Vats 1940: 362
III	Mohenjodaro	1) 1 unfinished weight	DK, Section B, Block 4, Room 22	Marshall 1931: 462
		2) 1 unfinished weight	VS, between Houses XVII and XXIII	Marshall 1931: 462
		3) 1 unfinished weight	VS, Block 2, House XVII, Room 113	Marshall 1931: 221
		4) 1 unfinished weight	DKG, Block 9, House IX, Room 66	Mackay 1938: 408
		5) 1 unfinished weight	DKG, Block 7, House IV, Room 49	Mackay 1938: 134

Table IV.14

Categories of Metal Artifacts found from Harappan Sites

		Tools, Utensils and Accessories																Tools for Further Production						Ornaments and Decorative Objects										
S.No.	Site	Knives	Axes	Celts	Arrowheads	Spearheads	Razors	Daggers	Rods	Vessels	Fishhooks	Nails	Hooks	Bolts	Sickle	Scale Pan & Beams	Spatulae	Indeterminate	Chisels	Awls	Saws	Drills	Gouge	Bead Tools	Bangles	Beads	Rings	Earrings	Pins	Cone	Mirrors	Antimony Rod	Seals, Tablets	Figurines	Fillet
1.	Ali Murad			✓																✓						✓									
2.	Allahdino		✓			✓							✓													✓	✓		✓						
3.	Amri																																		
4.	Badah																												✓						
5.	Balakot				✓	✓	✓				✓				✓				✓																
6.	Banawali				✓	✓	✓	✓		✓	✓					✓	✓		✓	✓	✓	✓		✓	✓	✓									
7.	Bedi Kotiro																																		
8.	Chanhudaro	✓	✓		✓	✓	✓	✓		✓	✓					✓	✓		✓	✓	✓	✓		✓	✓										
9.	Dabarkot									✓																									
10.	Desalpur	✓							✓										✓								✓								
11.	Dhal																																✓		
12.	Gharo Bhiro																										✓								
13.	Ghazi Shah				✓																								✓						
14.	Gorandi																		✓	✓					✓	✓	✓								
15.	Gumla								✓																		✓								
16.	Harappa	✓	✓		✓	✓	✓		✓	✓	✓				✓				✓	✓			✓						✓			✓			
17.	Jhukar				✓	✓																									✓				
18.	Kalibangan	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓						✓	✓		✓			✓	✓	✓	✓	✓		✓	✓			
19.	Kander Bhit																	✓																	
20.	Karchat																												✓						
21.	Khosa Daro																												✓						
22.	Kot Diji		✓		✓														✓						✓	✓									
23.	Kotla Nihang Khan																	✓																	

Table IV. 14 Contd

	Tools, Utensils and Accessories																	Tools for Further Production						Ornaments and Decorative Objects										
	Knives	Axes	Celts	Arrowheads	Spearheads	Razors	Daggers	Rods	Vessels	Fishhooks	Nails	Hooks	Bolts	Sickle	Scale Pan & Beams	Spatulae	Indeterminate	Chisels	Awls	Saws	Drills	Gouge	Bead Tools	Bangles	Beads	Rings	Earrings	Pins	Cone	Mirrors	Antimony Rod	Seals, Tablets	Figurines	Fillet
24. Lohri																	✓																	
25. Lohumjodaro	✓				✓	✓	✓	✓											✓						✓									
26. Lothal		✓		✓	✓	✓	✓	✓	✓	✓	✓					✓		✓	✓	✓	✓		✓	✓	✓	✓	✓			✓			✓	
27. Manda																								✓	✓	✓	✓							
28. Mitathal			✓			?																		✓		✓		✓						
29. Mohenjodaro	✓	✓		✓	✓	✓		✓	✓	✓			✓	✓	✓	✓		✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
30. Nageshwar																	✓																	
31. Naru Waro Dharo					✓																													
32. Rajo Dero																																		
33. Rangpur	✓		✓																					✓	✓	✓		✓				✓		
34. Rupar			✓																															
35. Shortughai																	✓											✓		✓				
36. Surkotada			✓		✓													✓						✓	✓	✓								

Table IV. 15

Categories of Faience Objects found from Harappan Sites

S.No	Site	Miniature Jars	Seals	Sealings	Model Animals	Spindle Whorls	Gamesmen	Balls	Inlay	Box Covers	Plaques	Cones	Tetrahedra	Dice	Beads	Spacers	Terminals	Pendants	Bangles	Buttons	Brooches	'Temple Ornaments'	Nose Discs	Ear Buttons	Ear Pendants	Finger Rings	Amulets
1.	Balakot														✓												
2.	Banawali	✓													✓				✓					?	?		
3.	Chak Purbane Syal																		✓								
4.	Chanhudaro	✓			✓		✓	✓					✓		✓		✓		✓	✓							✓
5.	Dabarkot														✓												
6.	Desalpur														✓												
7.	Gumla																										
8.	Harappa	✓	✓	✓		✓		✓					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9.	Kalibangan														✓				✓								
10.	Kot Diji														✓												
11.	Kotla Nihang Khan																		✓							✓	
12.	Lohri																		✓								
13.	Lohumjodaro						✓								✓				✓								
14.	Lothal	✓																✓	✓	✓				✓		✓	
15.	Mitathal	✓						✓							✓				✓								
16.	Mohenjodaro	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓				✓	✓			✓
17.	Nageshwar														✓												
18.	Rakhigarhi														✓				✓								
19.	Rangpur														✓												
20.	Rupar														✓				✓								
21.	Surkotada														✓												

Table IV.16
Stone Tool Production from Harappan Sites

S.No.	Site	Flakes and Blades	Cores
1.	Ali Murad	✓	
2.	Allahdino	✓	
3.	Badah	✓	
4.	Balakot	✓	
5.	Banawali	✓	✓
6.	Bedi Kotiro	✓	
7.	Bhagatrav	✓	
8.	Chanhudaro	✓	✓
9.	Dabarkot	✓	
10.	Damb Buthi	✓	
11.	Desalpur	✓	
12.	Dhal	✓	
13.	Gharo Bhiro	✓	
14.	Ghazi Shah	✓	
15.	Gorandi	✓	
16.	Gumla	✓	
17.	Harappa	✓	
18.	Jhukar	✓	✓
19.	Kalibangan	✓	✓
20.	Kander Bhit	✓	
21.	Karchat	✓	
22.	Kerasi	✓	
23.	Khari-Ka-Khanda	✓	✓
24.	Khosa Daro	✓	
25.	Kot Diji	✓	✓
26.	Kotara (Juni Karan)	✓	✓
27.	Lakhapar	✓	✓
28.	Lakhiyo	✓	
29.	Lohri	✓	✓
30.	Lohumjodaro	✓	✓
31.	Lothal	✓	✓
32.	Manda	✓	
33.	Mashak	✓	✓
34.	Mitathal	✓	✓
35.	Mohenjodaro	✓	✓
36.	Nageshwar	✓	
37.	Naru Naro Dharo	✓	✓
38.	Kotada (Bhadli)	✓	✓
39.	Pabumath	✓	
40.	Pai Jo Kotiro	✓	
41.	Pandi Wahi	✓	
42.	Pirwada Khetar	✓	✓
43.	Rajo Dero	✓	
44.	Rakhigarhi	✓	
45.	Rangpur	✓	✓
46.	Rupar	✓	✓
47.	Shortughai	✓	
48.	Surkotada	✓	✓

CHAPTER V

Chanhudaro, Mohenjodaro and Lothal as Craft Centres

In the previous chapter, we attempted to study the production and distribution of manufactured objects through the Harappan map. It is clear that not all settlements engaged in craft production and that some settlements focused on a single craft. In contrast, some sites reveal that a number of crafts had been practised by their inhabitants. Sites belonging to this latter category are Mohenjodaro, Chanhudaro, Lothal and Harappa. In this chapter, we will focus on three craft centres, Mohenjodaro, Chanhudaro and Lothal. An intra-site survey may reveal the role and function of craft production within the three centres. In a larger context, the role of these centres within the Harappan region as a whole will be considered. The functions of the three centres will also help to explicate the place of craft production in the Harappan economy. First we will briefly go into details for craft activities for the three centres. This data has already been presented in the form of tables in the preceding chapter.

Before we begin with the Chanhudaro evidence for craft production, it may be noted that the preservation of structures at the site was particularly poor. Very few

house walls are left standing and it is primarily the paved bathrooms and privies that give an indication of the location of the former structures. Also, the settlement of Chanhudaro did not die out with the Harappan occupation but was subsequently reoccupied by the Jhukar people followed by people of the Jhangar culture.

At Chanhudaro the various processes incorporated in bead making appear to have been practised all over Mound II (See map I at the end of the chapter). Nodules of raw material are noted at loci 215, 125, 443 and 306 (Mackay 1943: 320, 49, 50, 209). Chalcedony and carnelian geode deposits were also found in Square 8/F in the surface survey (Vidale 1989: 175).

- Ample evidence of unfinished beads are available. In room 215, a number of unfinished disc-shaped carnelian beads were found in various stages of manufacture (at 215, no stone cylinder beads were found and presumably this variety of bead was produced elsewhere). Other loci for unfinished beads are 208, 259, 184, 160, 150, 136, 394, 31 in Trench D (I), 46 in Trench F (I) and 43 in Trench B (5) (Mackay 1943: 320, 314, 320, 320, 320, 320, 204, 314, 201, 201). One unfinished bead was also found on Mound III (Majumdar 1934: 40, 44).

- Stone drills for the drilling of beads are noted at numerous loci - 215, 292, 293, 393, 450, 103, 108, 105,

141, 125, 428, 253, 255 and 85 (Mackay 1943: 43, 213, 41, 314, 40, 314, 314, 314, 314, 314, 49, 314, 48, 58, 57).

- Hones probably used for grinding were picked up from 214, 393, 439, 145, 130 (Mackay 1943: 44, 40, 320, 318, 45) and from unspecified loci in Squares 8/F, 9/F and IO/G. 2 hones were found on Mound III (Majumdar 1934: Pl. XIX, 33, 34).

- The rejected bead found at 394 (Mackay 1943: 314) broken during drilling was near locus 450 where two stone drills were found.

- Apart from structure 215, some other loci give evidence of the practice of more than one process; these are 393 where stone drills were found along with sandstone hones for grinding; nearby, a rejected etched carnelian bead was found at 226. At 125, some raw material was found along with stone drills. A rejected etched carnelian bead was also found here. Thus, apart from these few loci, bead making processes appear to have been dispersed all over Mound II.

- Chalcedony and carnelian bead making wasters were found in Squares 10/D, 9/E, 8/F and 10/E (Vidale 1989: 175).

Steatite beads of various kinds were also produced at Chanhudaro. The production of micro beads and wafer beads

are definitely attested to. In Room 215, apart from stone beads, steatite beads too were produced. A concreted mass of micro beads found in an unglazed state has raised the issue of the heat facility leading from room 215 being used to glaze the beads (Mackay 1943: 42). It is conjectured that the copper/bronze bead tools found were used to produce the beads by forcing a steatite paste through the tools and cutting beads off as the paste emerged. Findspots of such bead tools could point to the locus of a steatite bead manufacturer. 10 specimens of such tools were found in room 215 (Mackay 1943: 187, 308) and two from 468 (Mackay 1943: 308). The production of wafer shaped beads is noted in room 215, where several were found in an unfinished state. Unfinished disc beads were also noted in courtyard 190, immediately southeast of 215 (Mackay 1943: 41). Steatite blocks were found from various unspecified loci on Mound II, bearing traces of cut marks and still in their original colours of yellow, grey and black (Mackay 1943: 209), but these could have been used for seal making too.

Copper/bronze working is noted largely in the eastern part of the mound II at Chanhudaro and that too in the vicinity of room 215 (Map II). To the northeast of 215 is courtyard 297, where two collections of copper/bronze tools and utensils were found which were not just hoards of metal objects but specifically hoards belonging to a

metal worker as an ingot was found with one collection in 297 (Mackay 1943: 43), an unfinished chisel at 228 (Mackay 1943: 43) and a chisel folded over to be re-used at 227 (Mackay 1943: 43). About 7.5 m away, at two loci, one near 213 and the other northeast of 212 revealed two collections of metal objects. The collection northeast of 212 (Mackay 1943: 41) included a casting. The two collections could belong to a metal worker whose house, but for the privy at 212, had disappeared, or they could have a connection with the metal working undertaken at and in the vicinity of 297. Southwest of 212 was found an unfinished bronze casting at 208 (Mackay 1943: 177). Apart from this seeming localization, other pieces of evidence point to a dispersed craft. At 284 may have been a metal worker's house for here metal objects and unfinished castings were found (Mackay 1943: 44). Apart from this, in the western portion of Mound II, an unfinished jar was found at locus 201 (Mackay 1943: 177).

In view of the concentration of metal at and near 297, it appears probable that metal working was practised in the courtyard 297. As for where the craftsmen may have lived, it is possible that room 183 which opened on to the courtyard could have been a dwelling of a metal worker. Mackay (1943: 44) feels that this room was the living area of the craftsman making beads and seals, but on account of the metal finds from 297, it seems more probable for the

metal worker to have lived here.

No facilities such as furnaces have been uncovered at Chanhudaro. Nor do we have any evidence of ore smelting activities being undertaken at this site. The surface survey too revealed the absence of even a piece of slag or crucible (Vidale 1989: 178). On the available evidence, one could postulate that the Chanhudaro metal craftsmen worked on refined metal or in the absence of a heating facility, that the areas for metal working have not yet been uncovered at the site. In the latter case, the evidence from 297 could point to the dwelling area of a metal worker who hoarded the various collections of copper/bronze objects found here.

Seal making appears to have been dispersed over the periphery of Mound II (Map III). Except for locus 286 (Mackay 1943: 43) and 223 (Mackay 1943: 145), all other loci of unfinished seals are at places which skirt the periphery of the buildings at the centre of Mound II. Unfinished seals were found at unspecified loci in Squares 7/F and 9/F. Finds of unfinished seals at loci 459 and 240 (Mackay 1943: 145) probably belonged to the same craftsman, as 240 was the privy of 459. At another locus, 121, as many as three unfinished seals were found indicating the work of a seal cutter (Mackay 1943: 50), though we have no architectural correlations for the find

to reconstruct this working area. Three other finds of unfinished seals are from Trenches E (1), F (2) and B (5) in the northern part of the mound (Mackay 1943: 145).

As with seal making, shell working debris was also dispersed over the mound (Map IV). Evidence of unfinished objects are available from loci 211, 297, 153, 226, 197, 171 and 181 (Mackay 1943: 316, 43, 40, 43, 45, 319, 48). Of these, four loci were near the centre of the mound. Evidence from each locus was limited to a single unfinished object, except for locus 181, where four bangles were recovered in an unfinished state. However it is likely that the major locus of shell working was in a different part of Chanhudaro. Earlier exploratory efforts by Majumdar (1934: 38) recovered numerous pieces of conch shells, namely columellae and cores, from his trenches I and II on Mound III. These could point to an area for bangle manufacture or to a hoard of columellae kept for further use. Shell manufacturing wasters were also found on the surface in squares 4/D, 5/D, 6/B and 10/C (Vidale 1989: 175).

For other crafts practised at Chanhudaro we have sparse evidence. Faience production was presumed to have been undertaken here on the basis of the finds of paste plaques and cylinders found at three or four loci - at 171, a number of these objects were found along with ash and dark coloured soil (Mackay 1943: 48). Apart from the

presence of ash, no actual facility for the glazing process was found. A number of long and slender rods were found in unspecified loci and are considered to have been the first step in the production of segmented faience beads (Mackay 1943: 205). An unbored faience bead was found at 244 (Mackay 1943: 210), quite separate from other loci where paste cylinders were found. At locus 174, a number of unfinished beads were found. Despite the report being unclear about the material of these beads, it is possible that they were of paste as the catalogue refers to a paste bead found at the same level. According to Mackay (1943: 63) some faience production was also undertaken on Mound I, for which no details are available. In the surface survey, faience smelting wasters were found in Squares 8/B and 8/E (Vidale 1989: 175).

As for the production of weights, about 6 unfinished examples were retrieved at Chanhudaro, though the loci of all are not known. There is a reference by Mackay (1943: 236) to a number of misshapen weights being found, which could point to a greater scale of weight manufacture than would appear from the catalogue.

Chanhudaro thus gives evidence of a localization as regards craft production. Craft activities are concentrated largely on what is termed Mound II, the easternmost of the three mounds all of which were part of

one mound originally. In this part of the site were noted evidence for all the major crafts of metallurgy, bead making (including etched carnelian and long barrel-cylinder carnelian beads), seal carving, weight making, faience production and some shell cutting.

Such a pattern of production could be due to various reasons. First it does appear, from the information in Chapter III, that separate processes within the craft of bead making required separate distinct skills. Some skills are specialized while some are not so technically exacting and can be undertaken as household work. Within the craft of bead making, very possibly flaking and shaping of the beads would have been done by one individual, while drilling would have been done by another, or by the first if he acquired the skill. The task of polishing the stone beads into their final form could be done anywhere and by anyone with no specialized skills involved. Also, since large facilities are not required for bead making, this craft could well be organized familially, with skilled household members coordinating with those performing tasks requiring little skill. Another reason, though difficult to establish archaeologically, could be that different production processes within a single craft could get embedded within separate social groups. This brings up the question of hereditary skills in particular crafts, even if we were to

rule out an organization on the lines of a guild which would not have existed in a non-market economy.

On the other hand, we can also have craft working largely within a compact area. This could indicate sponsorship of craft production by an interested authority. A number of production processes were practised in room 215, such as preliminary chipping and shaping of the raw material to form bead blanks, and drilling of beads as evidenced by a stone drill. A hone found just outside the northeastern doorway of the structure indicates that grinding too was undertaken inside room 215. As regards polishing, the possibilities of finding evidence for such a process are remote as non-durable materials such as leather or wood would have been used. The evidence of a number of activities concerning bead making found in this structure could indicate that this was a workshop.

Moreover structure 215 does not appear to have been of a residential nature. It seems to have a separate existence from the rooms and walls comprising loci 178, 180, 207 and 208, immediately to the southeast. Even room 183 which Mackay (1943: 44) thought belonged to the man in charge of the production of beads and seals, is not directly connected by a doorway with 215 but only through courtyard 297. In view of the large and varied contents of room 215, Vidale (1989: 177) conceived of this

structure and its environs as comprising "warehouses for stockpiling and regulating the flow of materials and commodities." Whatever be the use, this structure with its contents and suggested functions and location in a predominant place on a main street in the eastern part of the town (Mound II) clearly appears to have been non-residential in antiquity. In contrast, craft working in other parts of Mound II was probably practised in the dwelling areas and not in separate workshops. This is assumed in the face of evidence of craft activities being undertaken in residential structures with bathrooms and privies and the association of toys and domestic artifacts.

Continuing on the theme of architecture, we have little evidence of the facilities required for some crafts, primarily the heat facility. There is one exception. Leading northwestwards from room 215, were a series of flues and cross-flues which formed part of a heating facility, totally dissimilar to heating facilities from other Harappan sites. Over the flues, a layer of a single course of bricks was laid and over this were built three compartments of varying sizes probably originally having their doorways on the southwestern side. On the other side was a passage (286) leading by two steps to a pavement (287) at the opposite end of the building from 215. The absence of associated material in the facility

gives no clue as to its probable use. It should be noted that a number of crafts need a heat facility at some stage in their manufacturing process. As for stone bead making, agate has to be heated at various stages of the production process to obtain the clear red of carnelian; steatite beads and seals require heat for the glazing process; metallurgy requires heat for annealing and for melting the metal for casting; and faience production requires heat for fusing of the raw materials. Now in the immediate vicinity of the heat facility are unfinished stone and steatite beads, an unfinished seal, and evidence for metal working. Metallurgy can be deleted from the list as this craft would require an open fire whose heat could be directed onto ingots or crucibles filled with metal. Heat treatment of agate too may require more direct heat than could be obtained through the flues. It appears more likely that the facility could have been used for the glazing of steatite.

Factors Involved in the Location of Chanhudaro

Having considered the evidence for various crafts obtained from Chanhudaro, the question of the location of Chanhudaro comes into focus. Why was Chanhudaro located where it is? By what factors was the location of Chanhudaro governed? Does the list of raw materials utilized at Chanhudaro give any clues towards its location?

Materials used in bead making were mainly agate and carnelian followed by faience/paste (primarily using silica) and steatite. Lapis lazuli, hornblende, crystal and Amazon stone are rare and found in restricted numbers. At Chanhudaro, two unfinished specimens of beads from lapis lazuli point to working of the material here. Actual source areas for lapis lazuli are far removed from Chanhudaro. Two lumps of amethyst were found, but no beads in the material. Other required raw materials were copper and shell. Possible source areas for copper, agate, carnelian, shell and steatite have been outlined in Chapter IV.

It appears that a number of raw materials were available at places in the Kirthar Range and from sources in Gujarat and Rajasthan to the east. The question would then arise as to which of the sources was exploited for production at Chanhudaro. The location of Chanhudaro to the east of the river Indus would seem to point to the exploitation of the eastern sources. If raw material sources in the Kirthars were being exploited, it would have been far more convenient for the craftsmen of Chanhudaro to have lived on the opposite bank of the river so as to avoid the issue of transporting raw materials across the Indus. In the event, it would have been more cost-efficient to transport finished goods, with less bulk

and weight, to settlements across the river. Moreover, it must not be forgotten that opposite Chanhudaro on the right bank of the Indus lies Amri, a site with 'neolithic', Early Harappan, and Mature Harappan remains. This settlement would have been conveniently situated for exploitation of raw materials from the Kirthar hills. As it is, there is no evidence for raw materials passing through this site. Amri in fact reveals a reduction in size of the settlement in the Mature Harappan period probably as a result of the founding of Chanhudaro on the opposite bank. The foundation of Chanhudaro must have attracted a significant proportion of Amri's population (Casal 1979: 108).

Chanhudaro could also have made use of the gallery forests along the Indus or a left bank overspill channel for its fuel requirements, heat being needed for a number of crafts. In its present situation, Chanhudaro's link with other Harappan sites could be maintained. In view of the hypothesis that the majority of products of craft working carried out at Chanhudaro were for outside consumption, then the location of Chanhudaro near Mohenjodaro is quite significant. It is very likely that from Chanhudaro, goods may have been carried over to the larger city. However, it is clear that Mohenjodaro was not the sole consumer of goods produced at Chanhudaro. One example is a particular variety of bead that has not

been found at Mohenjodaro (Mackay 1943: Pl. LXXXII 14-22).

It is likely that much of the production undertaken at Chanhudaro was meant for nonlocal consumers. The number of metal hoards found and the plentiful evidence for bead making indicate that finished artifacts may have been taken out of the settlement. The production of etched carnelian beads meant for export is a good example of this. Moreover, Chanhudaro also reveals the production of long barrel-cylinder carnelian beads which in all likelihood had considerable value attached to them. The high proportion of unfinished seals to finished pieces established in the previous chapter also indicate that these artifacts were transported out to be used elsewhere.

Besides the evidence at Chanhudaro of production for outside consumption, it is also clear that a number of artifacts were used at Chanhudaro itself. One of the faience miniature jars gives evidence of having been used as it contained some substance in antiquity (Mackay 1943: Pl. XXIX 55). The large number of weights found at Chanhudaro - roughly 118 - may not be easily explained only by weight production here. The number of unfinished weights found at Chanhudaro are very few as seen in Chapter IV. It is also apparent that a number of weights were actually being used at Chanhudaro. In and around structure 215, a total of 22 weights (not one of which was unfinished) were found, which indicates that weighing was

definitely being undertaken at Chanhudaro. Moreover, a concreted mass of steatite beads were found here (Mackay 1937: 10) adhering to a scale pan, suggesting that these tiny beads were weighed at Chanhudaro.

These consumption patterns indicate that the settlement of Chanhudaro was not entirely composed of craftsmen. Moreover, the plan of Chanhudaro and the evidence of craft working indicators also gives this impression. Craft working appears to have been focused primarily on what is now designated as Mound II, with some amount of shell working and a little bead making also located on Mound III. Mound I reveals very little evidence of craft production. The absence at Chanhudaro, from the excavated evidence, of large public architecture does give credence to a hypothesis that the number of elite individuals residing at the settlement was very small. That some members of the elite were present is probable from the evidence of consumption as indicated earlier and the need for an overall organization of craft production at this centre.

The location of Chanhudaro seems to reveal a different principle from that of sites like Nageshwar and Balakot. The latter settlements were situated close to the source of raw materials, so as to exploit the sources and engage in production at the spot, thus avoiding the

problem of transport of raw material stocks. Hence, such small settlements must have had a dependent status on others in the Harappan culture for the distribution of the finished artifacts. Chanhudaro is not located close to any particular raw material source and the fact that raw materials are obviously being transported to this site along a variety of routes indicates the importance of Chanhudaro. Apart from being primarily engaged in production, it is possible that people here could also have handled the transfer of raw materials, such as copper or shell, from source areas to other craft centres such as Mohenjodaro. This appears so on the basis of the location of Chanhudaro within the Harappan area.

Mohenjodaro as a Craft Centre

More than a hundred km northwards from Chanhudaro, lies Mohenjodaro, in the western valley of the Indus. The latter site is very much larger than Chanhudaro, the comparative areas being some 125 ha and 6.5 ha respectively. Excavations revealed craft working in various parts of the site. At Mohenjodaro, various crafts are seen to have been practised in the Citadel and in the lower town area, though admittedly very much less in the Citadel (and often in the later periods). There is little localization of craft production at Mohenjodaro, either in the site as a whole or concentration in separate parts of the site as for example, in HR or DK/G areas. This can be

seen when one studies different crafts. Take for example, weight making.

For weight making, we have two separate loci indicating this craft in VS area, two in DK/G and one in DK/B section (Map V). As for seal making, unfinished seals are largely found from the southern portion of DK/G, along with two specimens from HR and one from VS (Map VI). As for tools possibly used for engraving seals, one was found in VS area and two in DK/G. None of the tools was found in association with any of the unfinished seals mentioned. One piece of evidence gives the probable location of a seal maker's working area. In Section B of HR, house X, room 127, was found debitage of sawn and partially worked steatite, along with a pointed bone tool. Among the other objects in association in the room was found a large dish containing a seal and a terra-cotta sealing (Marshall 1931: 184). Also of significance may be the kiln found in the next room, 135. This facility could have been used for glazing steatite seals. Thus, again we have seal making evidence from different parts of the site, though all the evidence is from the lower town area.

Evidence for bead making is somewhat scarce from the earlier excavations at Mohenjodaro. Exact details for raw materials for beads found are not given. Marshall (1931: 526) does mention that amethyst is found in the form of

rough beads and in nodules, but it is not clear exactly where. 4 beads are mentioned by Marshall as incomplete, largely being left unbored, and though we know from the registration numbers that 2 are from the DK area and 2 from SD, we do not know the exact findspots of these beads. 2 probable hones in the shape of animals are illustrated (Marshall 1931: Pl. CXXX 24; Pl. CLVII 54) similar to Chanhudaro specimens. Unfinished beads were found in Mackay's excavations. Out of 12 specimens, only 2 were found in the northern portion of DK/G, while all the rest were from the southern portion. Other evidence included a hone from the southern portion of DK/G (Map VII).

Evidence of steatite bead making from the excavations is rare. Marshall (1931: 526) mentions an unfinished steatite bead (drilled but unpolished). One unfinished steatite bead was found in Mackay's excavations (1938: 508), in the southern portion of DK/G between Blocks 4 and 5. The scarce nature of the Mohenjodaro evidence for bead making stands out in contrast with the variety of finished beads. Apart from some amethyst nodules, raw materials are not mentioned in the reports. Nowhere do we find evidence to indicate preliminary chipping of roughouts but this could be due to the excavation techniques where small pieces of debitage resulting from chipping and flaking were not collected. All unfinished beads found are in the

stage after roughouts were chipped into shape, and before they were ground to a finer shape and drilled. Hones for grinding beads into finer shapes are very few and it is significant that not a single drill has come to light in the excavations.

As for metallurgy, quite unlike Chanhudaro, at Mohenjodaro we do find evidence of smelting of unrefined ore apart from further metal working activities (Map VIII). In the HR area, we have one locus for the refining of copper ore, as lumps of ore, ashes and fragments of rough crucibles were found (Marshall 1931: 212). At another spot, whose exact location is unknown, a crucible fragment was found with metallic slag still sticking to the edges (Marshall 1931: 486). In the DK/G area, Mackay (1938: 54) found a rectangular pit containing an amount of copper ore in small pieces along with a little piece of lead. Though there is no kiln of the same `level' nearby, this find could indicate some metal working activity. Marshall (1931: 485) mentions finding plano-convex lumps of crude copper but we do not know their exact location. Copper melts, possibly stored for working, were found in the southern portion of DK/G (Mackay 1938: 41, 129), and there are ingots in both northern and southern portions of DK/G. One locus in the southern portion of DK/G revealed two ingots. However, in all cases, no other associated material is available to prove they were loci of metal

workers. There is still the possibility that the ingots could have been kept by customers who would get their requirements made by the metal craftsmen. Apart from the crucible fragments mentioned earlier, one other tool of a metal worker to be found is a possible blow-pipe used by a smith, located in HR area (Marshall 1931: 198). At another unspecified locus, discarded tools of copper and bronze in an unusable state were found in association with a group of three vessels, two of copper and one of bronze (Marshall 1931: 490). They could possibly represent the tools of a metal worker or could have been kept for recasting. Among unfinished objects were found a chisel in HR area (Marshall 1931: 200), a bronze jar, a sword and a chisel, all in DK/G south (Mackay 1938: 450, 467, 475). Other indicators are objects obviously kept for reuse such as a casting of copper, bent and rough in appearance (Marshall 1931: 506). Three castings and a copper blade were found in the southern portion of DK/G probably kept for reuse (Mackay 1938: 141, 452, 459). Thus, while looking for any localization within the excavated areas of Mohenjodaro as a whole, largely this craft appears to have been limited to the southern portion of DK/G, though one locus from the northern portion is known, along with one from DK/C and three from HR area. Apart from the general localization in the southern portion of DK/G, one particularly notes house I in Block 12 A, as a probable metal worker's craft area. Here, in room 15, a hoard of

metal objects was found, consisting of two copper axes, a copper mass, a copper ingot piece, two copper spearheads, two bronze axes, a copper casting, a bronze ingot, a bronze chisel, and a broken copper ingot (some of these objects were mentioned earlier) (Mackay 1938: 141). In room 11 of the same structure was found the unfinished sword mentioned earlier (Mackay 1938: 467).

As with the evidence for metallurgy and quite unlike that for seal making and weight production, one finds some amount of localization in the craft of shell working (Map IX). A number of loci for raw materials, that is shell, have been found. Marshall's report (1931: 159, 162, 170, 171, 173, 174, 580) indicates many findspots of groups of chank shells, all in the L area of the site, some with as many as 23 and 35 shells. In yet another locus in VS area, a hoard of 41 shell cores was found, from which all usable parts for bangles were removed (Marshall 1931: 219). This could represent the locus of a bangle maker or a dump near a bangle maker's workshop or could indicate cores kept for storage before being sent on to a craftsman for further processing of the columellae. In any case, it must indicate that a craftsman worked here unless we are to presume a state of economy where the shell cores were in the possession of an organiser of the craft who got different objects, such as bangles, ladles and inlay made by different craftsmen. Unfinished objects have been

found in various parts of the site with a number of isolated specimens from DK/G area and others from HR, VS and DK/C. One locus in the HR area reveals a find of 15 unfinished bangles in a pot (Marshall 1931: 181). This could have been the locus of a shell bangle maker. One locus for the production of inlay was found in HR area where along with a mass of inlay were found waste pieces of shells (Marshall 1931: 195). If one takes each findspot of an indicator of craft production as the actual locus of a craftsman, then each find of groups of shells as raw material would qualify as a place of shell cutting. Apart from the finds of raw materials in L area, some groups of chank shells have been found along with debitage. Thus, Marshall (1931: 162) mentions a find of 23 shells of which 16 were in perfect condition, implying that 7 had probably been cut up or worked; in another part of L area, 35 shells were found, some whole, some partly sawn up (Marshall 1931: 170); and a find of 5 whole shells and pieces of unfinished inlay (Marshall 1931: 170). Definite localization of the shell industry on L area of the Citadel mound would seem to be the case, with isolated working in other parts of the site.

The evidence as per the reports on the excavations at Mohenjodaro reveals no localization of seal making and weight production. From the point of view of all crafts, we get numerous pieces of evidence from the DK/G area

excavated by Mackay but that could be the result of a later and more methodical excavation. The evidence from the excavated areas of Mohenjodaro gives us much the same sort of information of the spread of craft production in a site, as does the record from a site like Harappa. However, craft working evidence from Mohenjodaro is amplified by the Surface Evaluation Project undertaken by an Italian team which gives us a different picture of craft production from Mohenjodaro. The project (Bondioli et al 1984) undertook a detailed survey of the unexcavated areas of Mohenjodaro, keeping in mind various indicators of craft activities, such as raw materials, unfinished objects, tools, debitage of craft working and rejects. Tt does appear that the primary craft activity areas of Mohenjodaro lie in the still unexcavated areas. It also seems that though the entire eastern and southeastern portions of Mohenjodaro recorded significant evidence of craft activity areas, we still do not have evidence of separate areas for separate crafts. Thus, in this sense, Mohenjodaro follows Chanhudaro in displaying a pattern of juxtaposed craft working. The map comprising Figure 9 of Bondioli et al's report (1984) confirms this assertion.

The evidence for ore refining activities in the context of metallurgy are dispersed. We have one locus immediately south of the ridge extending eastwards from HR; two loci, 20 m apart, both about 50 m west of the

Moneer site; one locus about 100 m northwest of these two; another locus about 15 m to the east of Moneer; one about 50 m south of DK/C; and a solitary locus about 30 m north of L area. Shell debitage is found in about four loci to the east of HR; one locus immediately west of the southern portion of VS; one locus about 30 m north of L (right next to a findspot of copper slags and crucibles); two loci about 75 m northeast of DK/G; and a solitary locus about 50 m southeast of the last two mentioned. Some crafts such as lapis lazuli working, faience production and steatite working are so rare that their working areas really stand out. Thus, we find working of lapis lazuli at a solitary locus in Moneer southeast and yet another isolated locus between SD and L areas. Faience wasters, largely drops of glassy material attached to straw-tempered sherds, have been noted at only one area, about 20 m south of DK/C. Steatite debitage is also noted rarely with one locus about 50 m south of DK/A and two loci 15 m apart on the extreme western edge of the excavated area of DK/G. Other crafts such as chalcedony bead making are noted in many more loci. We find chalcedony debitage and bead blanks among evidence for other crafts east of HR south of the ridge; both to the west and east of VS Area; to the west of the Moneer site; and to the northeast and east of DK/G. But by far the largest concentration of chalcedony bead making is noted

in the Moneer southeast area, where flakes, drills, anvil stones and finished beads practically sprout all over (Bondioli et al 1984: Figure 8). In this area, chalcedony bead making is also spatially associated with the manufacture of chert drills, though whether the drills were manufactured by the bead makers is not definitely known (See Maps V-X). Chert tools and debitage are also found in numerous loci to the east of HR area; about 25 m to the west of VS; and to the north and west of Moneer.

The emerging picture shows that at Mohenjodaro we find no one area where a separate craft was practised. A study of the accompanying maps will make this clear. For bead making, there are a number of craft indicators dispersed all over the site, but no indicators from HR, DK/A, B and C areas and from the excavated portions of VS. Metallurgy is more dispersed, with only the VS revealing not a single metal working indicator. As for shell, we find no indicators in DK/A, B and C areas. Seal making indicators were not found on the Citadel mound and in DK/A, B and C areas; weight making indicators were not found from the Citadel mound or from DK/A and C areas.

The evidence from the surface survey for lapis lazuli working is as expected. Considering the rarity of artifacts in this raw material in the Harappan culture, we cannot expect to find a large area or a number of areas devoted to this craft. But the picture for steatite

working and metallurgy is surprising. Keeping in mind the number of steatite and metal objects unearthed at Mohenjodaro, the scarcity of their production areas is difficult to explain. The only inference that can be offered is that the craft working areas may have been outside the present limits of Mohenjodaro or that the inhabitants of this settlement depended on other craft production centres.

Some details on the production processes within each craft can be gleaned from the report. It is also to be noted that there is limited localization of different processes within a single craft. The surface survey report emphasizes that the weight and shape of metallurgical wasters do not attest to primary smelting operations, but that mostly secondary refining work was undertaken (Bondioli et al 1984: 30). Vidale (1989: 172) indicates that some copper ore smelting may have taken place on a mound well to the east of the excavated area. However, we know that ore smelting was not undertaken only at this locus, due to the evidence from the excavations. As for stone bead making, the debitage from the Moneer southeast area points mainly to the preliminary chipping and flaking of roughouts being done here. Though this area is associated with the manufacture of chert drills, very few beads broken during perforation are found here, perhaps suggesting that this work was done elsewhere.

Marshall's finds of shaped, but unbored, beads is mainly revealed from the SD and DK areas. Mackay's finds of unfinished beads all fall into the stage of stone bead making between the preliminary flaking and before the perforating process. Out of 11 beads, 8 were in this stage, 3 were partly bored and left incomplete. It is possible that in the DK/G area, beads were brought in a roughly flaked shape to be drilled. Since some beads are found in a smooth (but unpolished) state, it is possible that grinding of bead roughouts was also undertaken here, prior to drilling. This could indicate that separate processes within the craft of bead making may have been undertaken in different areas of Mohenjodaro. Similarly we have the evidence of shell working. We note the preliminary stage of perforation and chipping of the apex portion of Turbinella pyrum on an isolated mound northeast of the Moneer site (Kenoyer 1984b: 107) indicating localization of a separate process within this craft, probably for environmental reasons. We have no evidence of this stage having been done in other parts of Mohenjodaro, but this could also be due to inadequate collection of material in excavations. Thus, only the Moneer southeast area shows the concentration of a single production process, which is the preliminary shaping of beads.

As regards architectural units, we gather that most

crafts were practised in houses and living areas and that no separate workshops or an industrial area for craftsmen were available. Even kilns are seen in regular residential units such as the one in HR area, Block 2, House VII (Marshall 1931: Pl. XXXIX). The kiln is located in a courtyard, which is bounded by Lane I to the north, hence preventing smoke going into the neighbours' houses. This pattern is similar to that found in villages in the present, where heat producing industrial activities are carried out in the courtyard. Other craft activities are seen carried out in rooms of residential structures. South of House VII in HR is house X, where in one room probable evidence for steatite seal making is noted. To the west in House XII, were found in one room, two pieces of a copper blow-pipe. Lumps of unrefined copper were found along with ash and crucible fragments in a house in the southwestern sector of HR. A mass of shell inlay and waste products occurred in a house just southwest of House VII mentioned earlier. The attempt being made here is to bring out the fact that several crafts were practised in what were essentially residential areas. We have no means to determine what was the position of craft location in the Moneer southeast area, declared during the survey as a "craftsmen`s quarter" (Bondioli et al 1984: 31). Since the project involved only a surface survey, we have no idea with what architecture were the different crafts here

correlated.

The evidence from the surface survey confirms the picture revealed from the excavations. Examples of faience smelting, steatite working, metallurgy and lapis lazuli working all indicate small working areas. 25 out of 49 clusters of craft indicators extend over less that 30 m (Bondioli et al 1984: 28). For example, AA 11, representing steatite bead making, extends over 25 to 30m, while AA 19A, where copper slags, prills and crucibles were found, is spread over 10 to 12 m (Bondioli et al 1984: 30). Only in the Moneer southeast area do we find an extensive area, with a spread of almost 1200 m^2 (Bondioli et al 1984: 30) covered with evidence of stone bead making and the production of stone drills. This area just may represent a large workshop, geared primarily towards bead manufacture. If this hypothesis is proved correct in the future, it will imply that at Mohenjodaro, workshop craft production functioned alongside that of domestic craft working. Similarly, we must note the isolated mound northeast of the Moneer site where a single process within the craft of shell cutting was noted. It is not clear if this mound, roughly 4 ha in area (Vidale 1989: 172), was entirely or mostly given over to shell processing. Vidale (1989: 172) did note a little metallic ore smelting also undertaken here. However, rather than this area being a workshop, this localization is seemingly more a reflection

of an unpleasant and polluting activity being undertaken outside the residential limits of the ancient settlement.

It would be worthwhile to sift the evidence of craft production in the SD and L areas of the Citadel to figure out if facilities or working areas for craftsmen differed here from those in the lower town. Largely we find evidence for shell working and that too, in the late period. In the SD area, a few unfinished beads, a hone, some spindle whorls were revealed. The Surface Evaluation Project indicates limited spreads for metal working, shell cutting, lapis lazuli working and some vitrified nodules in the area between SD and L. The surface survey gives no architectural correlations for this area. As for the published information on the excavations, shell working indicators were found in large structures in the northern portion of L area, that is, in the C and D sections. However, since most shell cutting here took place in late periods, the buildings may not have been fulfilling their original functions, at the same time as the shell workers were practising their craft. Hence it is difficult to delineate the role of craft working in this part of the site.

The Focus of Craft Producing Activities at Mohenjodaro

The question then arises as to who were the consumers of the craft products manufactured at Mohenjodaro. Each

craft must be studied separately to understand this aspect. First we will note what impressions are obtained about quantity of products produced by a particular craft and the scale of production if available. Finally, we will give our estimate of the consumption groups involved.

If we were to study steatite working, we would observe that a number of artifacts at Mohenjodaro were made out of steatite, as noted below:

boxes	terminals
vessels	amulets
roundel	ring
beads	pectoral
spacers	model animals
hairpins	human figurines
gamesmen	spindle whorl
buttons	

It further appears that steatite was the most favoured material for beads [Mackay (1938: 495) emphasizes that three-fourths of the beads found at Mohenjodaro were made out of steatite]. In this context we must note the steatite bead making area found in the surface survey, about 25 to 30 m in extent. Some unfinished objects such as beads are found in other areas of the site (Mackay 1938: 506, 508).

In the case of lapis lazuli working, we have both limited number of objects found made of this material and limited indicators for lapis lazuli working. Apart from 6 beads found in the earlier excavations (Marshall 1931: 542-43) and 2 beads found in the later excavations at

Mohenjodaro (Mackay 1938: 499), other objects found were a gamesman (Mackay 1938: Pl. CXXXIX 18) and part of a toilet vase (Mackay 1938: 500). The evidence for lapis lazuli working, albeit very rare, is only attested in the surface survey. According to Vidale (1987) a couple of flakes and a small roughout were found in the Moneer southeast area.

The variety of metal objects found has already been indicated in Table III.2, where most of the artifacts are represented at Mohenjodaro. The quantity of metal artifacts found is equally impressive. In the light of this, we must re-emphasize the scarce evidence for smelting.

The previous chapter brought out that 1.4% of weights unearthed at Mohenjodaro were unfinished while the corresponding percentage for seals was as low as 0.7% (out of the total number available for discussion). The evidence for the surface survey and the excavated areas highlights the difference between the evidence for craft production and the evidence of the quantity of respective artifacts found. Only in the case of bead making is it possible that we may get relatively proportional figures for bead making and for quantities of finished artifacts. We must, however, note that little evidence of carnelian working is obtained - agate in other varieties is reported. The surface survey also shows very limited

working of carnelian - sardonyx and chalcedony are more commonly worked (Bondioli et al 1984: 24).

From the available evidence outlined above, it does appear that the scale of craft production as inferred from craft activity indicators was either small or just enough to fulfil the requirements of the settlement of Mohenjodaro itself. In the case of metallurgy the evidence is definitely too little to justify the quantities of metal objects found. In the case of bead making the evidence of working may just satisfy the picture of quantities unearthed, except for carnelian which may have fallen to the responsibility and expertise of the Chanhudaro craftsmen. In the same connection, one can question the role of the manufacture of drills in the Moneer southeast area. According to Bondioli et al (1984: 24), this area revealed "several hundred chert microdrills". It is difficult to credit that these stone drills were made only for the use of the craftsmen of Mohenjodaro. It is possible that the chert outcrops in the Sukkur-Rohri region may have been exploited for the making of these drills which could have been sent to other bead making centres, much as the long chert blades were sent to a number of Harappan sites from their production centres. No stone drills however are mentioned as having been found at Lothal.

It appears likely that Mohenjodaro was primarily a

consuming centre. Production was for the needs of its own inhabitants. In some cases, the craftsmen were probably not able to satisfy the needs of the inhabitants. Thus in the case of seal and weight making, it is probable that the artifacts were brought into the settlement to make up the requirements. Some crafts were probably not practised at all, such as the production of etched carnelian beads and of steatite microbeads. Here, the requirements were fulfilled by other production centres. In other cases, some rare crafts, such as stoneware bangle production, may have been undertaken to fulfil local needs.

Finished goods as well as raw materials were coming into Mohenjodaro. We have already mentioned etched carnelian beads and steatite microbeads. Shell ladles must have been procured from Nageshwar. Apart from finished goods, raw materials such as shell, semi-precious stones and refined metal were being brought into Mohenjodaro. Most of the materials were being brought from considerable distances, as emphasized a number of times. These consumption patterns indicate that the inhabitants of Mohenjodaro were not obtaining their requirements from within their immediate hinterland but were able to make use of mechanisms for long-distance procurement and distribution.

The Evidence for Craft Production from Lothal

We shift our focus now from the Sind plain to Gujarat, to a discussion of the site of Lothal. Lothal like Chanhudaro, is a single-mound settlement but the physical resemblance ends there. The first structural feature of difference is the "dock", a large burnt brick enclosure on the eastern part of the mound. Lothal covers an area of about 6.4 ha. and is now more than 16 km away from the sea. Originally the settlement was on the left bank of a river as seen by a depression marking the bed of an ancient river to the west of the settlement.

Our discussion on Lothal in this chapter focuses on its role in craft working in the Harappan culture (Map XI). One difference noted at Lothal from Chanhudaro is that most of the walls of structures here are still standing and we can obtain a good idea of the architectural context in which craft activity indicators are found. We get ample evidence for metal working at Lothal, in loci, some of which are termed "factories" or "workshops". These workshops or smithies differ among themselves.

- House 154, in Block A, was judged to be a coppersmiths' workshop on the basis of a furnace, a stone anvil and fragments of two terracotta crucibles found here. Other finds were copper fragments, a muffle, a few other

copper objects (Rao 1979: 57-58), stone moulds for casting pins and awls and a hammerstone (Rao 1985: 522).

- Another smithy located near the nullah was of a different plan, where four separate burnt brick pavements interconnected with drains and associated with pot furnaces were revealed. The walls of the structure have not completely survived and we are left with two burnt brick walls and a burnt brick pavement (Rao 1979: 98-100). Associated material consisted of two terracotta crucibles, small copper lumps and a crescentic sleeved axe bearing hammer marks (Rao 1985: 522).

- In Block C another probable smithy is indicated by the finds of pot furnaces, crucibles and slag dumps, but the walls of the structure have not survived (Rao 1979: 122).

- Another metal working area was noted in the southernmost structure in the lower town where a furnace was found along with copper slag (Rao 1979: 55). Since the area has not been illustrated in the detailed plans, we are not able to delineate the plan of the workshop.

- Yet another metal working area lay at the extreme northern edge of Block A near the nullah, which is identifiable largely on the basis of a furnace with associated metallic remains. In the furnace were found a bowl of thick grey ware with traces of copper and

fragments of a copper chisel, slag and cinders. Large copper sheets were found near the furnace (Rao 1979:83, 90-91; Rao 1985: 522). According to the archaeological chemist, however, the terracotta crucible revealed no trace of copper but a substance representing clay rich in iron (Lal 1985: 661). But on the basis of a copper sheet found nearby, it is possible that metal working was practised here.

The moulds were suggested to have been used for pressing metal foil over their depressions rather than for pouring molten metal in and casting objects. One stone object has been asserted to have been used to cast pins (Rao 1985: 557) but it is possible that this object may have been a bead hone; at least quite probably the object illustrated in the top portion of Pl. CCLII B (Rao 1985). A single ingot was found at Lothal, bun-shaped and of pure copper (Rao 1985:552, 652).

The evidence for metal working from Lothal consists primarily of furnaces with associated crucibles, slag and copper metal. We have no record of unfinished objects which are some of our primary evidence from Mohenjodaro and Chanhudaro. Again, differing from the other two sites, are the structural facilities for metal working, in other words, the furnace. At Chanhudaro we have no such heat facilities save the one found in room 215, which could have been associated with steatite bead manufacture or

faience production. At Mohenjodaro, various kilns have been found mostly without associated material to suggest their function. At Lothal, the furnaces found largely give an idea of their use. The heat facilities differ considerably. In one metal working area, a rectangular brick furnace is found (Rao 1979: 95; Rao 1985: 522). In another workshop, an oval furnace with a rectangular projection for fuel is noted (Rao 1979: 83), much like furnaces at other Harappan sites. In yet another area, one comes across pot furnaces of jars cut in half, containing ash (Rao 1979: 98-100). What is also significant and differing from Chanhudaro and Mohenjodaro are the definite contexts in which these furnaces are found. In some cases, such as the smithy near the nullah, they are entirely separate from other structures and hence are identifiable as an independent unit for craft working. This is unlike the slightly ambiguous situation at Chanhudaro where metal hoards are found but no exact locus for the metal craftsman's working and living area.

Bead making at Lothal appears to have been mainly concentrated in a single structure in Block F, to the west of the Acropolis in Block B. The justification for judging this structure to have comprised a bead making unit rested on the following pieces of evidence:

- a central courtyard to the structure which had a mud

brick platform in which were found two jars one containing 600 finished beads (Rao 1979: 118). Other beads in various stages of manufacture were embedded in the platform;

- agate pebbles, unfinished beads in various stages of manufacture, rejected cores and flakes were found in the courtyard and the rest of the structure;
- a flanged drill was found in one of the rooms;
- a kiln was noted to the northeast of the structure, suspected to be a bead kiln (Rao 1979: 118);
- a mud brick platform between the structure and the kiln could perhaps have been used to dry agate pebbles or to sort out stones and beads after removal from the kiln.

It is not immediately clear whether the bead factory in Block F was the sole bead making area in Lothal. Unfinished beads, drills, and other tools are described and illustrated in the report, but we have no clue as to their precise findspots. Hundreds of carnelian beads were found in an unfinished state (Rao 1979: 118), but not one is described. The unfinished beads described comprise 2 of jasper, 3 of onyx, 2 of opal, 1 each of bloodstone, agate and chert and 3 of copper. Thus, if we find that at Lothal, apart from the bead factory, there were other individual and separate craft loci then we may get a picture akin to that from both Chanhudaro and Mohenjodaro. At the latter site, for example, the Moneer southeast area

may have been the principal bead making area, though individual operations were also undertaken in the rest of the site. We shall go into this aspect again later.

It is interesting that not a single stone drill is mentioned as recovered from the site. If this site is a significant bead making centre, it is indeed surprising that no drills of stone, which would be easily replaceable, are found. As for other requirements, one can discuss the bead kiln found in the vicinity of the bead making establishment. This construction is quite unlike the structure found in room 215 at Chanhudaro. The kiln at Lothal consists of a circular structure with an elongated stoking hole, the heat from the fuel moving round a lower chamber which was connected to the upper chamber by a series of four interconnecting flues. It was in the upper chamber that the objects or materials which required heat treatment were placed. The Chanhudaro facility, as described earlier, is entirely different from kilns found at Mohenjodaro and the Lothal furnace in the general plan of its outer appearance.

Seal making appears to have been extensively practised at Lothal judging from the number of unfinished seals found here. However, we are handicapped by not knowing the exact findspots of unfinished specimens. Out of 14 unfinished seals mentioned, 3 were found in SRG 1; 4 in SRG 2; 3 in SRG 3; and the location of 4 specimens is

unknown. This does not clarify matters as trenches such as SRG 2 and 3 are very large and we do not know in which part of them the seals were found. We are faced with the same inadequacy when we study possible tools for seal making such as engravers, for we are not told where they were found or even if they were associated with unfinished seals or raw materials. Uncut and partially cut blocks of steatite have also been found (Rao 1985: 306) from unspecified loci.

We are slightly better off where shell cutting is concerned. Three separate areas can be delineated for shell working activities. One locus is doubtful and has been conjectured to be a place of worship (Rao 1979: 93-94). Here, in a house, a mud brick enclosure was found to contain a broken pot, 2 stone grinders and a large chank shell. Roughly between 10-15 m to the north of this structure is house 157 which can definitely be attributed to a shell worker, on the basis of a shell dump found in one of the rooms. Unfinished bangles and used cores of Turbinella pyrum were found here (Rao 1979: 96). It is quite possible that the platform next to the shell dump and one found in the adjoining room could have been used in the activity. A large house (159) roughly 15 m to the north-west of the last mentioned structure was revealed in Block G. In the structure were found chank shells, columellae and unfinished bangles, suggesting definite

shell cutting activities being undertaken here. Other pieces of evidence indicate shell working being practised at Lothal, such as unfinished gamesmen, inlay and pendants (Rao 1985: 617), an unfinished bangle (Rao 1985: 619), an unfinished inlay piece (Rao 1985: 620), production of dentalium beads (Rao 1985: 584) and production of ladles, indicated by the presence of more wasters and reject pieces than finished objects (Rao 1985: 615). The findspots of none of these objects is known.

There do not appear to be any finds of unfinished steatite beads at Lothal. Rao (1985: 582) mentions the find of a dump of dehydrated lime near the kiln used for baking agate and suggests that limestone was used for dehydrating steatite. He further suggests that steatite beads along with those of other stones were baked in the kiln. Manufacture of steatite microbeads is suggested by the recovery of 3 copper tools (Rao 1985: Figure 12, 2, 3 4), similar to the specimens found at Chanhudaro. The report terms these tools as flanged drills (Rao 1985: 532, 543) and one of these, as mentioned earlier, was found in the bead factory. However, it may just be that these tools were used to produce steatite microbeads.

Some amount of faience production was undertaken at Lothal on the basis of an unfinished, partly perforated faience pendant (Rao 1985: 610) and from a piece of

vitreous paste probably improperly fired (Rao 1985: 663). Bone working is suggested by a find of 26 pins and awls found with a stone anvil in the Acropolis in a late occupation (Rao 1985: 624). Ivory working is suggested after a find of 2 pieces of an elephant's tusk along with 2 other fragments with saw marks on them (Rao 1979: 108-110). One other craft activity is thought to have been practised at Lothal - that of dyeing. Facilities consisting of 2 interconnecting jars at different levels and connecting with a drain are thought to have functioned as dye vats (Rao 1979: 81).

Apart from bead making, it is not really clear if different production processes within a single craft were concentrated in separate areas. The report gives no specific details on the location of different indicators of craft activities, such as whether shell was initially chipped in one area and bangles cut in another. It is known that the bead factory revealed nodules of raw material, finished and unfinished beads in various stages of manufacture and a metal drill. Despite the fact that the report mentions other drills and unfinished beads at unspecified loci, the picture at Lothal does indicate that at this site there was at least one major concentration of bead production indicators. Metal working evidence from Lothal is in the form of furnaces with associated crucibles. Another clue is the ingot find. From the

available data, one can speak of some casting being undertaken here and an anvil stone in a workshop indicates its use for hammering objects into shape. No information on ore refining is available to us suggesting that only refined metal was brought to the site and worked. The heat facilities must primarily have been used for annealing and casting activities. Where seal making is concerned, we know at what stages the seals were left incomplete giving us an idea of the different stages of the craft. Largely, unfinished seals are of the type where the inscription is carved but the motif not started; where the motif is carved but the inscription is left; seals which have unperforated bosses; and seals which have not been coated with the slip. However, in the absence of data on loci, we do not know whether particular production processes were localized within the site. As regards shell working, we have no idea where preliminary cleaning and chipping of shells were done; the data we have indicate loci for the cutting of artifacts.

As mentioned earlier, Lothal can give us much information on architectural provisions for craft activities. A number of working areas or "workshops" have been uncovered which allow us to study the context in which craft activities were undertaken. The coppersmith's workshop, 154 in Block A, has been reported to have two rooms, one with a furnace in it. According to the plan on

Pl. XLIX (Rao 1979), there seems no reason why house 153, consisting of two partially exposed rooms, should not be considered part of 154. The whole seems to form a unit, if quite large, though corresponding in size to a shell worker's workshop to the southwest. Houses 154 and 153 consist of a unit bounded on the south by Lane 3, on the west by Street I, on the north by Lane 2 and the east by Lane 4. Thus the unit with a furnace is well isolated, even within the habitation area. Another furnace is found near the nullah which again is a location distinct from the habitation area. The structure designated as a bead factory is also in a locus separate from the structures oriented north-south along Street I. It is very likely that more structures will come to light in the still unexcavated areas to the north and south of the bead factory and end its present arbitrarily isolated appearance and situation.

In the lower town at Lothal, house units are well-delineated and streets and lanes are many. Separate structures are unearthed in one room of which metal working or shell cutting activities are noted. If these are workshops, they probably also are residential structures. It is very likely that there is no clear demarcating line between workshops and living spaces, but rather what we have are crafts being practised in the house of the craftsmen. This is a pattern which survives

very much into the present, as we saw in Chapter II. A number of crafts do not require heavy facilities or tools which cannot be shifted and hence the crafts can be undertaken anywhere. Such seems to be the case with the flaking, drilling, grinding and polishing of beads, shell bangle cutting, seal carving and weight making which can be undertaken anywhere. Only metal working requires facilities which cannot be easily moved. But here too a residential pattern of working can be easily established.

The archaeological evidence from Lothal of bead making brings to light a very large structure of about 11 rooms, including a courtyard. This structure could not have been the home of a single bead craftsman. Moreover, if this structure was the principal bead making area at Lothal, implying some amount of concentration of the craft, it becomes more difficult to conceive of this structure as a living area-cum-workshop. Rao (1979: 118) has delineated some rooms as workers' quarters. What is significant and has not been discussed is the absence of any household artifacts such as querns or hearths in the structure. Also to be noted is the absence of any baths in the structure and of any drains or soakpits in the vicinity of the structure. No domestic facilities are noted from what have been termed the workers' quarters either. The whole structure appears to have been surrounded by a mud brick wall, implying considerable

protection given to this structure.

Differences between the Acropolis and the lower town can be studied to note distinctions in architecture, in view of the fact that very little craft working is noted in the Acropolis. Only some late period dyeing activities are revealed in one house in Block B. A structure with two small chambers having corbelled roofs in the Acropolis is said to have been used to make paste beads (Rao 1979: 108).

The plan of the lower town where most crafts are concentrated seems well suited for craft working activities. Working areas using heat facilities are situated away from the habitation area or in house units which are segregated from others by lanes and streets. Such is, however, not the case with all crafts. If the facilities delineated as dyeing units are really so, then the location of one unit in the Acropolis is surprising. Dyeing activities would surely have been better located near ample sources of water.

Consumers of Products Manufactured at Lothal

In the face of the data that we have in relation to craft working at Lothal the question comes up as towards whom was production geared. It is doubtful that the population of Lothal would have been large. Houses in the lower town are large and widely spaced apart revealing

little trace of congestion. A large portion of the site is taken up by non-residential structures such as the Acropolis, the warehouse and the dock. The population definitely does not seem so large as to justify the production of hundreds of carnelian beads. 1200 carnelian beads were found in Period A (Rao 1985: 587). In the bead factory, 2 jars were found embedded in the platform in the courtyard one containing 600 finished carnelian beads and the other, beads in various stages of manufacture (Rao 1979: 118). It is probable that finished beads were kept carefully in pots to be sent out of Lothal to other sites. Beads of onyx and opal are much rarer in the Indus valley sites than at Lothal and at the latter site we have evidence of the production of beads in these materials. Onyx, jasper and carnelian were probably obtained from sources in Gujarat and taken to other Harappan sites. The number of metal working loci also appears to be in excess of what the inhabitants of Lothal would have required. The high proportion of unfinished seals (16% of the whole as established in the last chapter), second only to Chanhudaro, also does appear excessive for the needs of Lothal. The number of etched carnelian beads found at Lothal (12) again second only to Chanhudaro, highlights the number of objects found at the site which must have been meant for outside consumption.

What could have been the factors responsible for the

location of Lothal within the Harappan region? What was the importance of the site in relation to other Harappan sites? One fact that strikes us is the comparative proximity of raw material sources, such as carnelian and agate for bead making from the Rajpipla hills, of steatite and copper from extreme north Gujarat and Rajasthan. Roughly 40 km to the southeast is the modern town of Cambay or Khambhat where bead making is still carried on as an industry which obtains its raw materials from the Rajpipla hills near Ratanpur. The situation of Lothal then would be understandable for the purpose of obtaining raw materials, processing some part of the raw materials and sending them on to other Harappan settlements. Lothal would have taken advantage of its location in a frontier area and its proximity to the coast. No Harappan sites have been located in the central part of Rajasthan. While there are a number of small sites in central Gujarat, Lothal is closer to the carnelian sources in Jhagadia taluka. There are very few Harappan settlements in the Gujarat plain, while the majority of them are in Kutch and Saurashtra. The construction of a dock at the site assumes significance in view of the proximity of Lothal to the sea. It is thought that ships and boats could enter the Lothal dock through an arm of the sea. Lothal's participation in the Harappan economic networks can be seen in the presence of certain materials here which are

not locally available. Such seems to have been the case with lapis lazuli. 3 such beads were found in the Harappan period (Rao 1985: 587). Apart from this, long chert blades found at Lothal must have been brought from the production centres in the Indus valley.

Craft working was probably not the primary reason for the existence of Lothal. The site in all likelihood functioned as a centre for the receipt of raw materials which were sent on to other sites. What craft working was carried on here was probably undertaken because considerable stocks of raw materials were transported from this centre. It was convenient to have craftsmen here at Lothal working on raw materials so that some costs of raw material transportation would have been eliminated from goods produced here. It is also possible that Lothal originally functioned solely to transport raw materials to other settlements and at a later stage craft working was added to the functions of the site. Such an hypothesis could gain credence from the fact that most craft production workshops and facilities were established in Phase IV or a later phase of the Harappan culture. Thus the coppersmith's workshop 154 in Block A is found constructed in Phase IV; so also the smithy on a different plan, consisting of pot furnaces and pavements for cooling the metal. Similarly the smithy in H 26 of Block G was worked in the same phase. The bead making factory in

Block F was established in phase IV and in the same phase, the shell worker's house with associated shell craft and shell working indicators undertaken in 159 in Block G, was uncovered. Despite the late appearance of craft working at Lothal, the importance attached to these activities is clear from the number of craft loci and the establishment of a walled, separately constituted workshop for bead making.

The settlement of Lothal appears to have been laid out on a predetermined pattern and the impression received from the excavation report is of a planned settlement. The lower town is clearly occupied by the general mass of population while the Acropolis probably housed the elite, and was separated from the lower town both socially and functionally. Workshops of craftsmen were located in the lower town and there were some attempts to localize certain crafts such as bead making. The general appearance of the "bead making workshop" does seem to point to the particular nature of the complex in its separate identity as a large unifunctional structure and in the protection afforded to it in the form of an enclosing wall. It is very probable that the products - beads of carnelian and other stones were of special value, possibly to the elite of the settlement but more probably transported by them to other Harappan settlements or exported outside the Harappan region. In the case of

metallurgy too the number of workshops appears to be too many for a settlement such as Lothal. Metal objects too may have been transported outside Lothal to other consuming centres. Thus the laying out of the settlement of Lothal according to a preconceived plan does indicate the interest and the involvement of the Harappans in safeguarding the transportation routes for raw materials and the supervision of production at this craft centre.

Conclusion

From the evidence outlined above it is clear that there was more than one mode of organizing craft production. One mode envisages craft production as an activity undertaken in domestic contexts while the other visualizes craft production undertaken in a special locus and concentrated within a certain area. In the latter context, all or nearly all the processes within a single craft can be practised: this could imply workshop organization. From Mohenjodaro the information brought to light from the excavations gave no indication of a workshop for any of the crafts. However the Moneer southeast revealed in the surface survey two related activities of stone bead and drill making. As mentioned earlier, and discussed also in Chapter II, a workshop need not reveal that all processes within a craft were practised. Similarly, in AA 40, in Moneer southeast, only the preliminary flaking and shaping of beads into

roughouts and some drilling is noted apart from the production of stone drills. All other stages of bead making - grinding and drilling -were undertaken in domestic contexts as seen from individual finds of unfinished beads in various stages of manufacture. It is also the size of AA 40 that suggests a workshop rather than a residential mode of manufacture; separate loci for working of steatite and lapis lazuli are also found in the surface survey but their size indicates domestic production. It should also be realized that we have no idea of the architectural correlations of the Moneer southeast area. If later excavations reveal a number of houses rather than a single structure, then the hypothesis of a workshop would have to be discarded in favour of a number of residences in close proximity practising a single craft.

At Lothal we have the evidence of a bead factory suggesting a workshop organization, as also individual craft loci suggesting domestic craft production. At Chanhudaro the evidence is not so simple. On one hand we know that structure 215 on Mound II revealed in excavation the evidence of carnelian disc-bead manufacture as well as steatite microbead and wafer bead production. Thus at this site as distinct from the other two, we have the evidence of the working of two different materials within a single locus. The Chanhudaro workshop, if structure 215

was such, was then definitely more complex. Apart from structure 215 we also have evidence of bead making all over Mound II which gives the impression of separate processes being undertaken in domestic contexts. In some cases, such as at locus 125 and 393, more than one process was undertaken in domestic contexts.

It is also significant that the only common craft in the context of workshops from all three centres is the craft of bead making. At Mohenjodaro and Chanhudaro, metallurgy, shell cutting and seal making are not thus organized. At Lothal "workshops" for metallurgy and shell working have been uncovered but they are all in domestic contexts. In effect, the shell cutting "workshops" at Lothal are no different from, for example, the locus of shell inlay production (shell inlay found along with waste products) uncovered in the HR area of Mohenjodaro.

Data regarding the location of craft activities within each craft centre indicated that in most cases craft production was spatially separated from elite residential areas. At Mohenjodaro craft production activities are concentrated in the lower town and primarily in the eastern portion. A few sparse indicators for craft working, such as lapis lazuli working, some copper working and shell cutting were noted in the surface survey of the Citadel mound. The excavation report

indicates a considerable amount of shell working to have been practised in the L area of the Citadel mound but these indicators belong to the late period of occupation at the site. At Chanhudaro, we are not quite sure where the elite members of the population lived; if the elite or supervisory personnel lived in the now-demarcated Mound I, then it is clear that they were separated from the craft working area. Most craft activities were undertaken on Mound II with some shell cutting undertaken on Mound III. At Lothal, the probable seat of power, the Acropolis, revealed no craft working indicators apart from some dyeing vats.

Yet the picture that is obtained shows differences between Mohenjodaro and the other two craft centres. At Lothal and Chanhudaro, supervision had to be present as a number of crafted objects were probably leaving the centres for consumption outside. At Lothal the situation of the Acropolis and its elevation ensured the necessary supervision not only over craft production but also over operations concerning the warehouse and the dock. Despite superficial similarities, the data for Mohenjodaro does differentiate this settlement from the other two craft centres. Craft working at Mohenjodaro concentrated in the eastern portion of the lower town could not be directly supervised from the Citadel mound. Production may not have been for very limited consumption. This picture may

explain why Mohenjodaro reveals finds of elite goods from all over the site. The only anomaly to this pattern is the evidence for seal cutting and weight manufacture. As noted earlier we find not one craft indicator for seal and weight production on the Citadel mound. One would expect these crafts at least to have been undertaken under close supervision at Mohenjodaro. But again it must be realized that these craft objects were found and probably used all over the site of Mohenjodaro.

At Mohenjodaro craft working is just one of the many activities undertaken as part of city life and the evidence of the location of such activities within the site points to the overall lack of direct supervision and of the probability of a number of consumers for various craft products. At Chanhudaro, in the entire portion of Mound II we find extensive evidence of different indicators of craft production. It appears very likely that Chanhudaro functioned almost solely as a craft centre and that too for the purpose of manufacturing craft products and sending them on to other areas of the Harappan culture. At Lothal, craft production was one of the major functions, but probably not the reason for establishing the site. Craft working was probably engaged in to complement the function of obtaining raw materials.

Mohenjodaro was then primarily a consuming centre. In view of the location of Chanhudaro and Lothal and the

nature of the activities performed there, it appears that the two craft centres were instituted to perform these particular activities. This appears clearer in the case of Lothal where we have the evidence of an earlier settlement which performed few of these activities and functioned purely as a village settlement. We have no knowledge of the nature of the earliest settlement at Chanhudaro but it does seem that the settlement became prominent with its specialized functions in the Harappan period. This appears so from the changes in the size of the settlement of Amri on the opposite bank of the Indus. Dating from the Early Harappan period, Amri reveals a reduction in its size in the Mature Harappan period when probably its inhabitants were attracted to the settlement of Chanhudaro. It is this evidence which gives a clue to the probable Mature Harappan origins of Chanhudaro. This aspect concerning the three craft centres will be highlighted in the following chapter.

Key for Maps I - IX

Raw material

Unfinished object

Copper/bronze bead tool

Stone drill

Hone

Reject

Objects kept for reuse

Hoard of metal objects

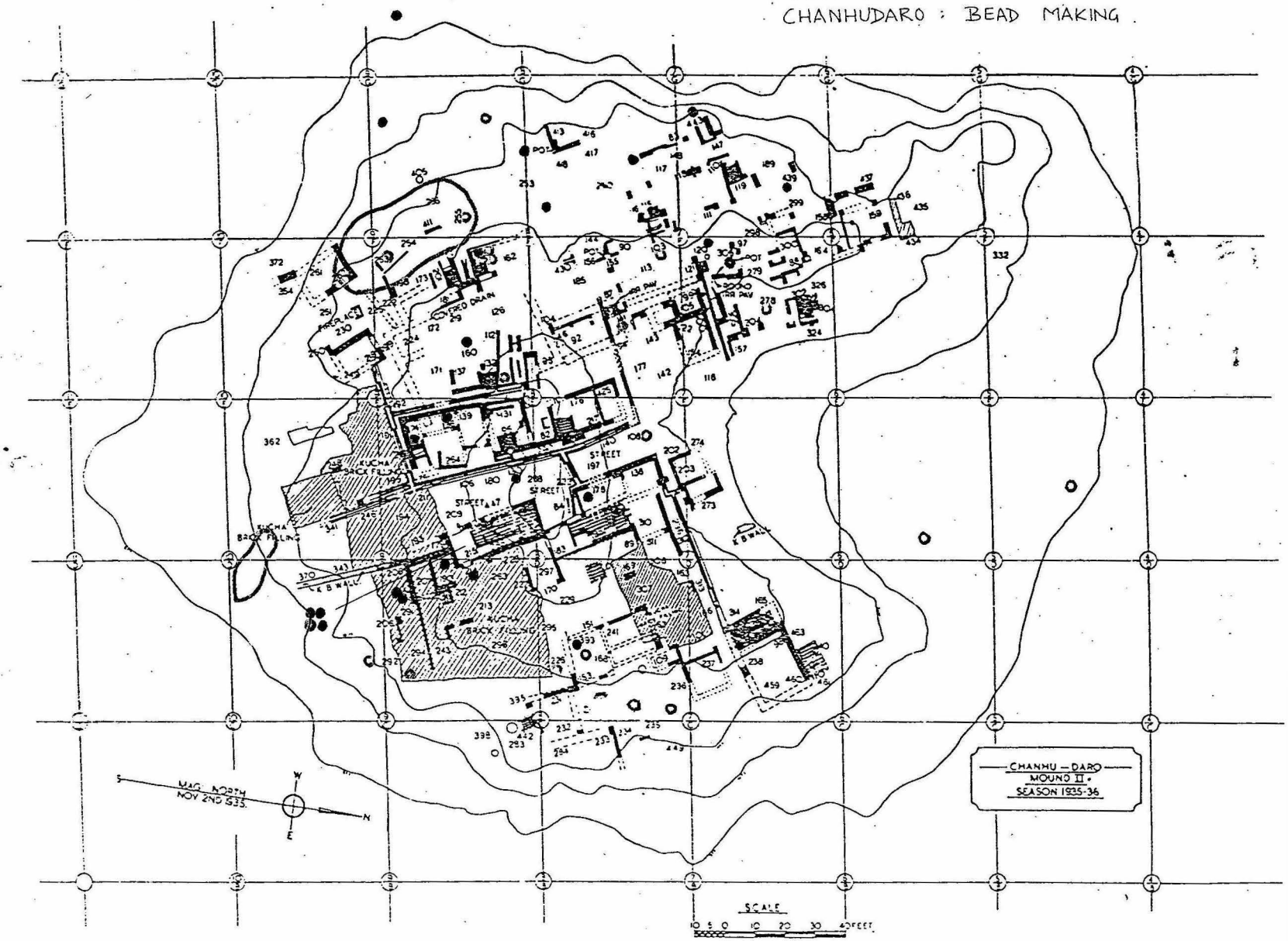
Craft debitage

Chert tools and debitage

Furnace

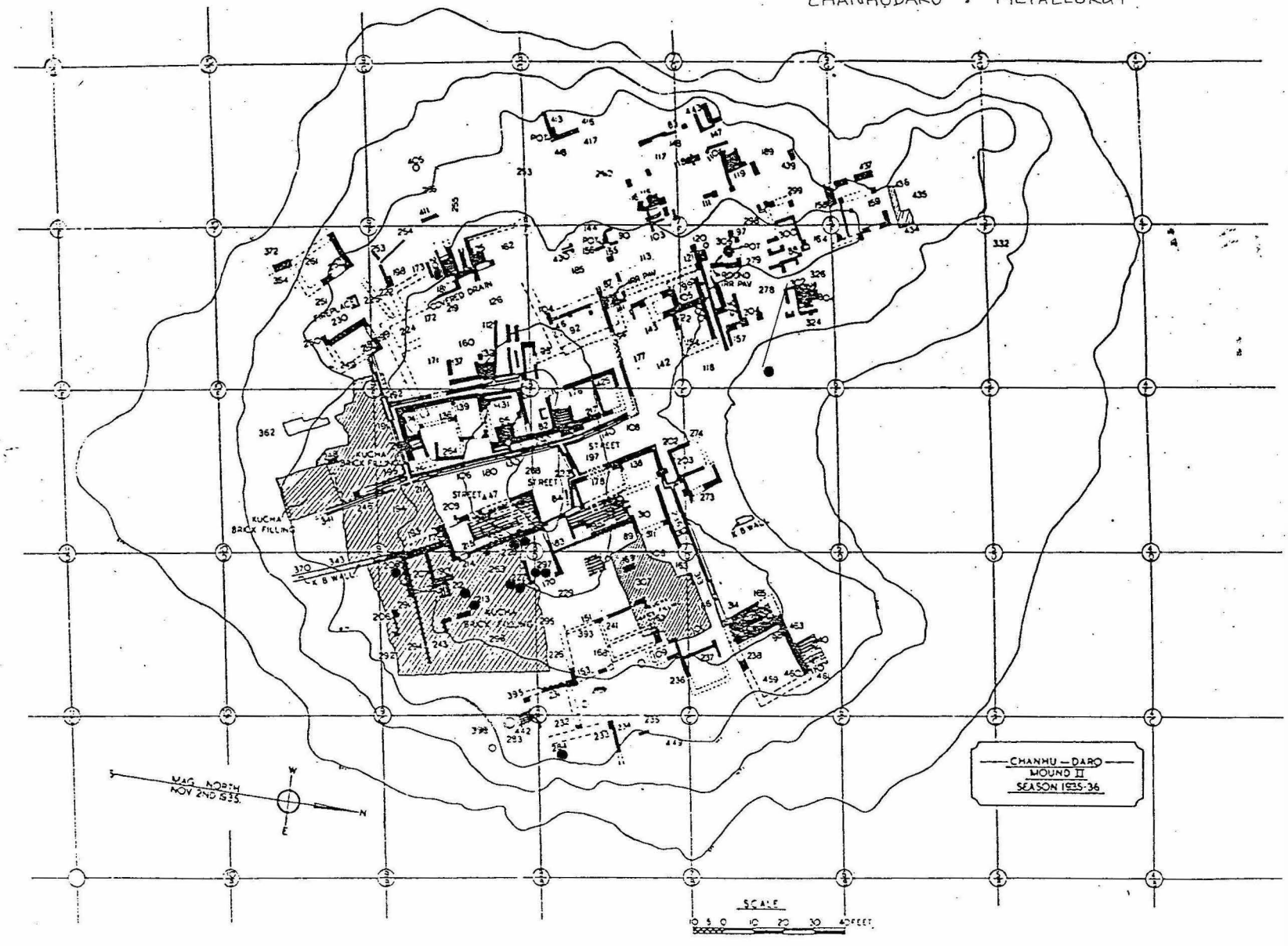
MAP I

CHANHUDARO : BEAD MAKING



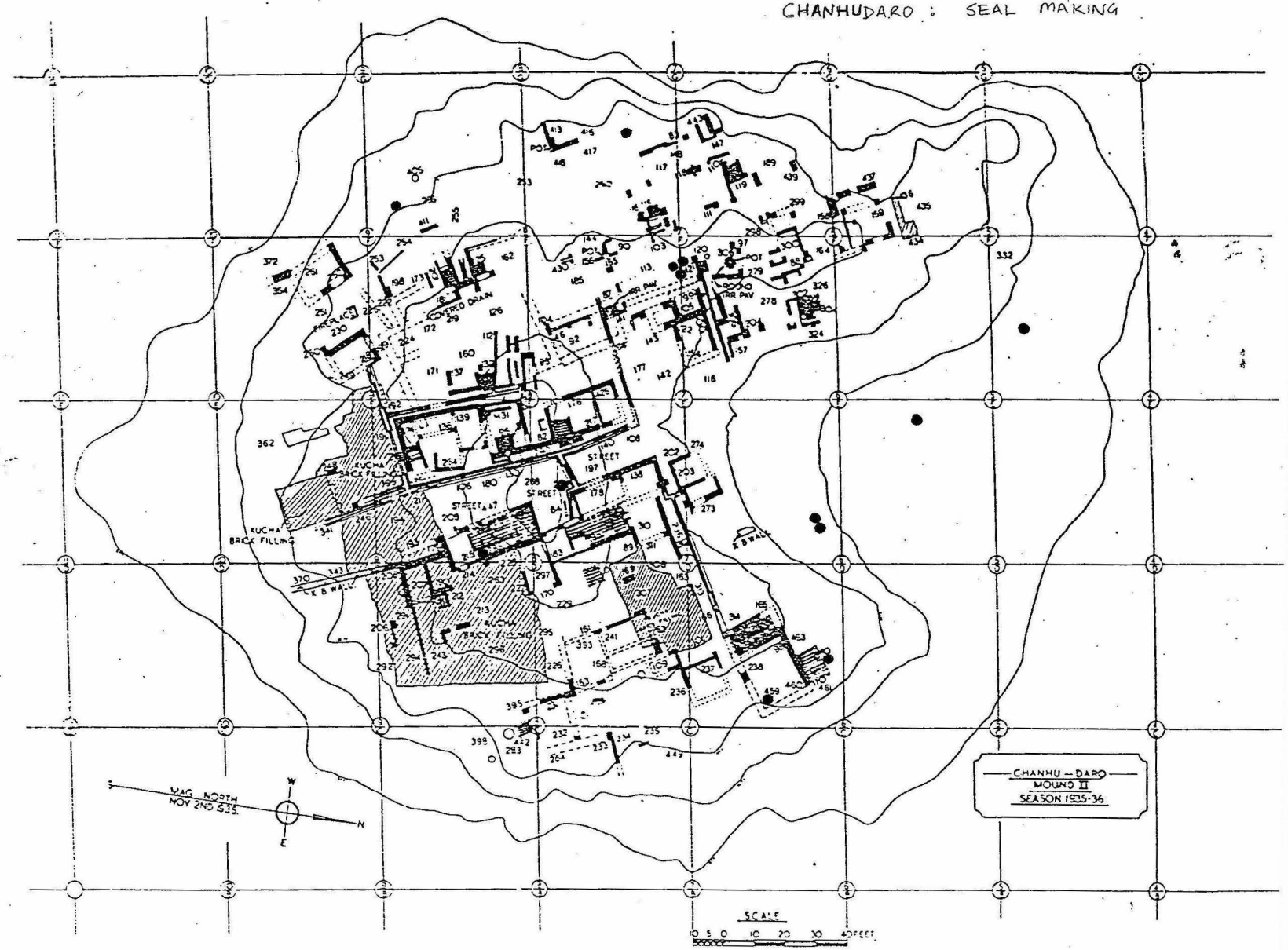
MAP II

CHANHUDARO : METALLURGY



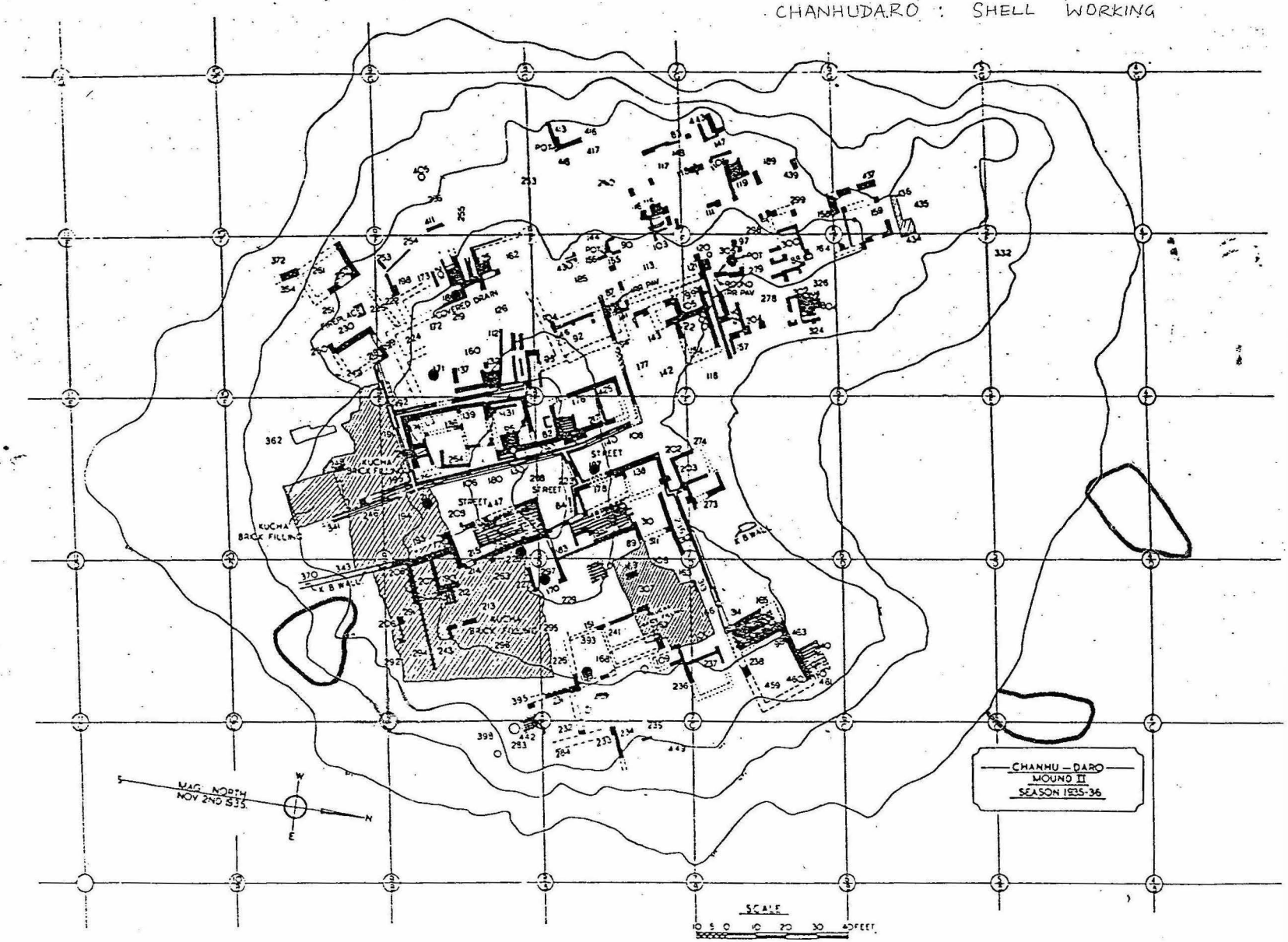
MAP III

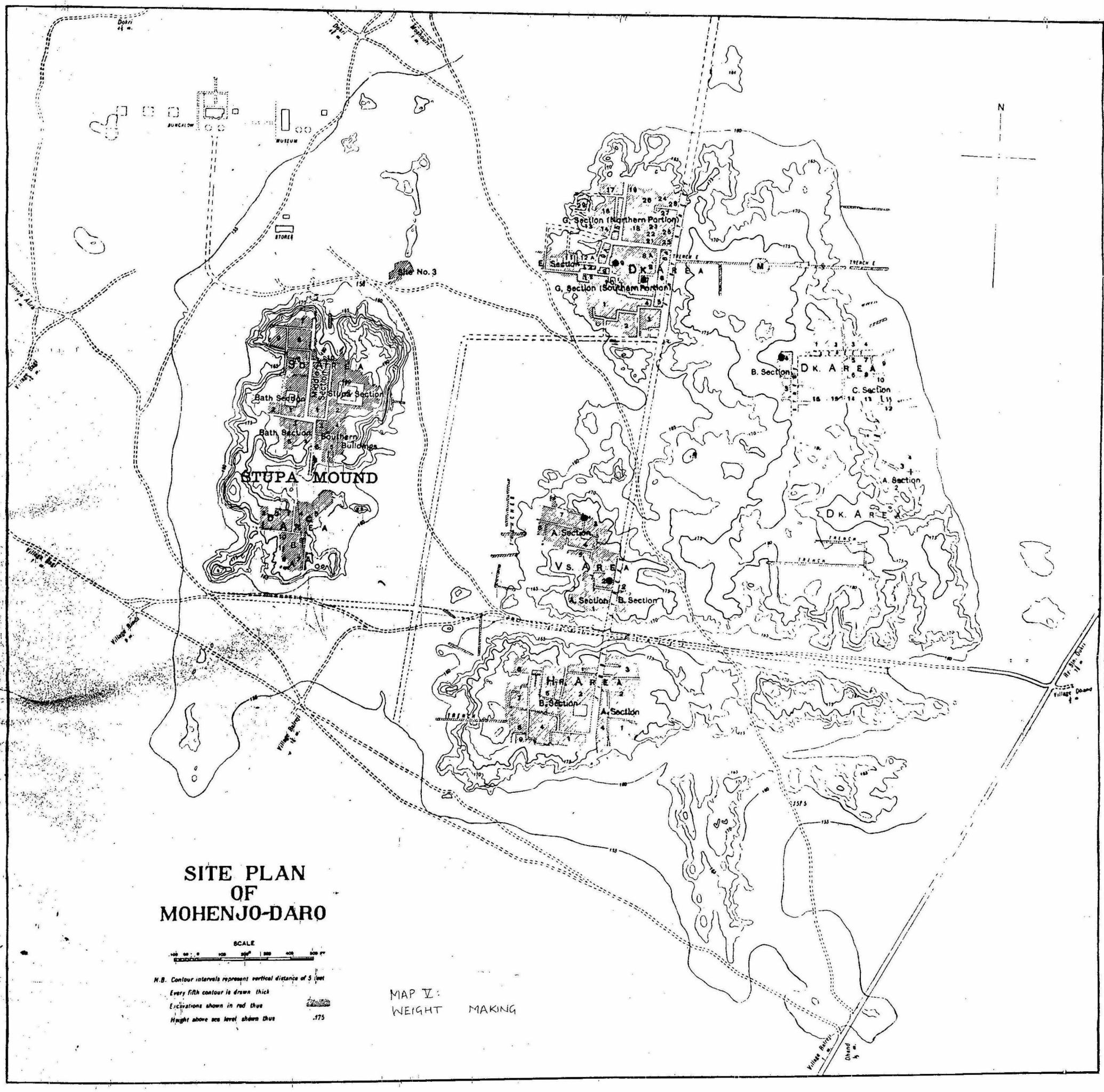
CHANHUDARO : SEAL MAKING



MAP IV

CHANHUDARO : SHELL WORKING





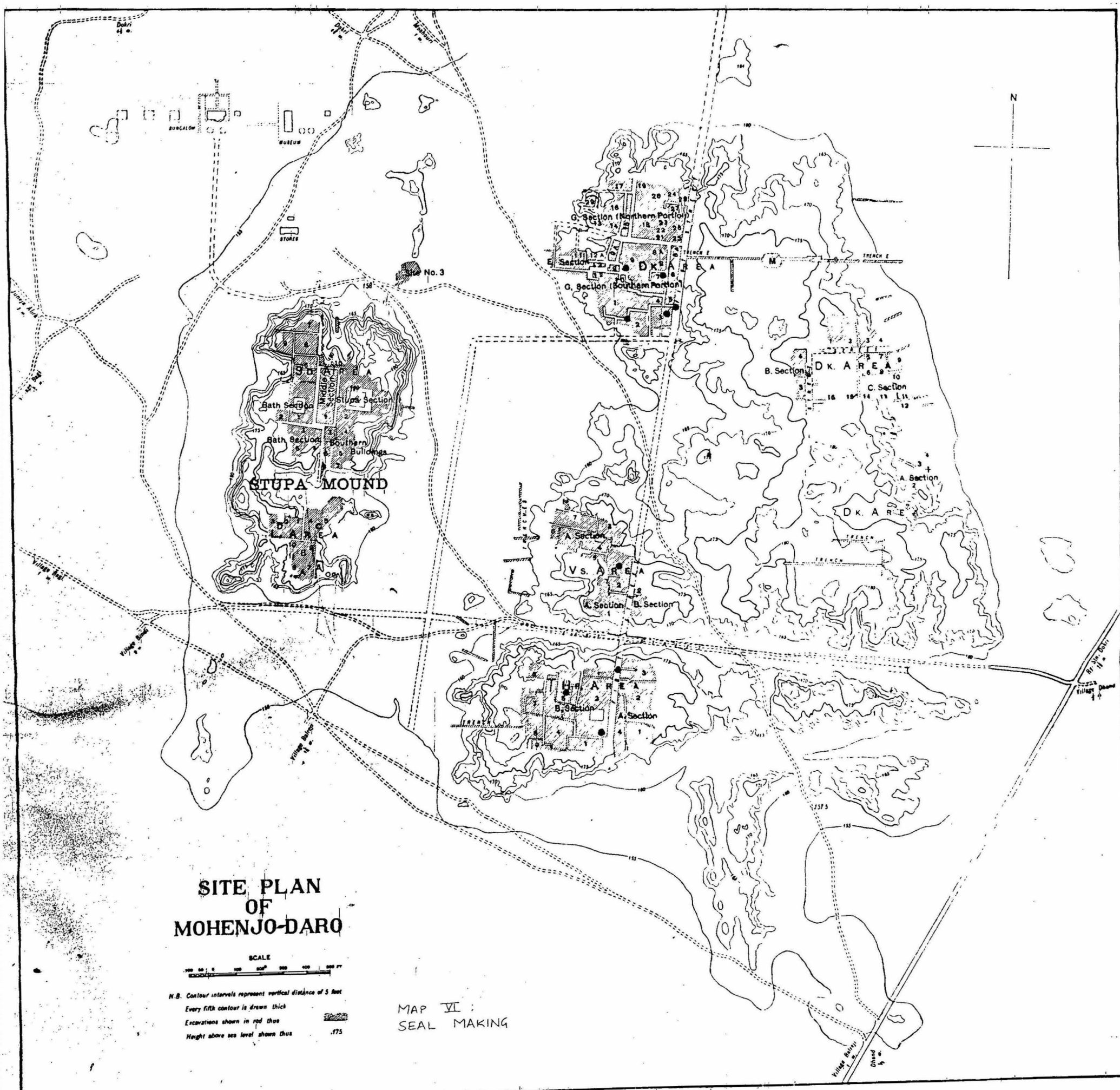
SITE PLAN OF MOHENJO-DARO

SCALE

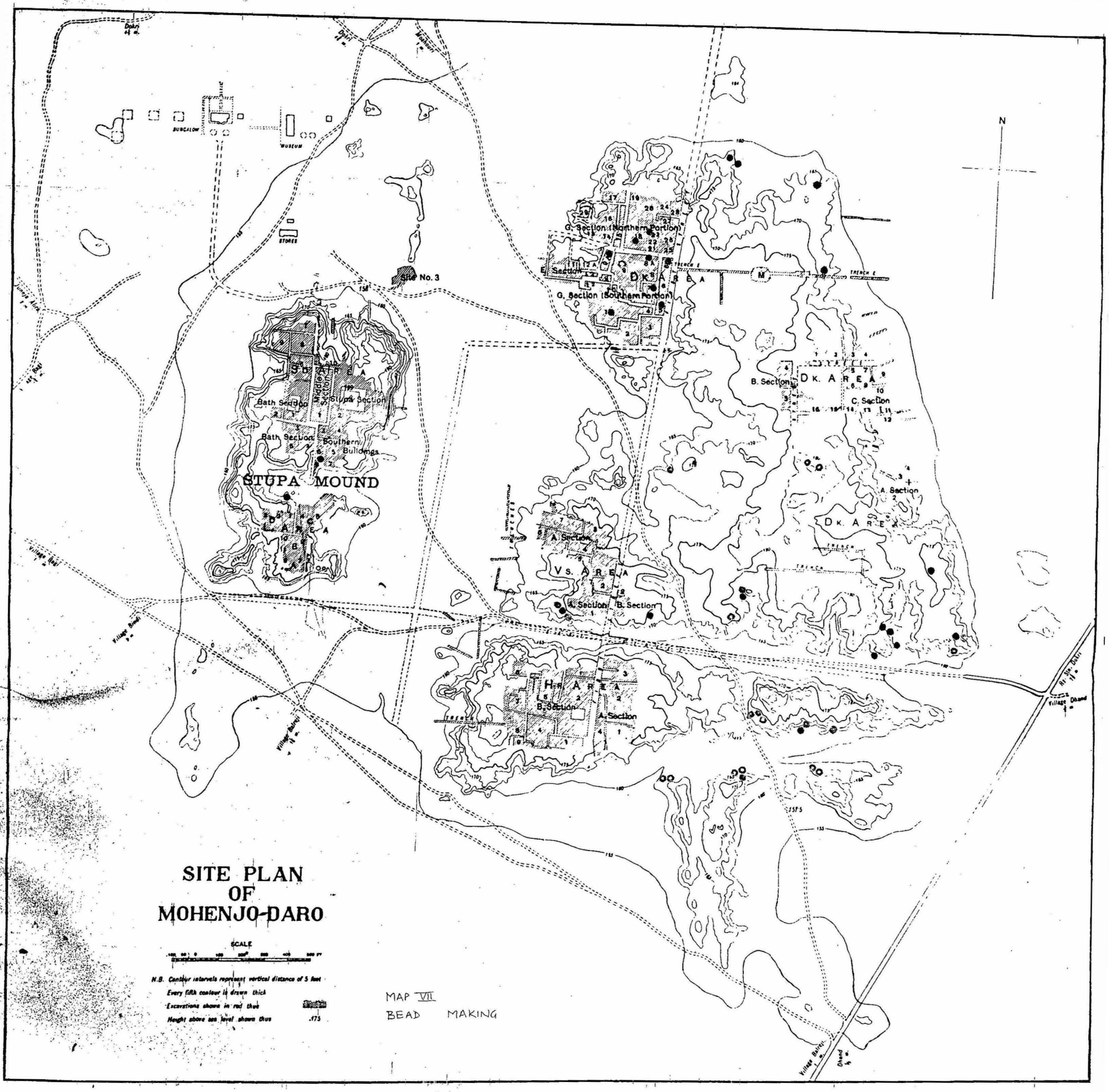
N.B. Contour intervals represent vertical distance of 5 feet
Every fifth contour is drawn thick
Excavations shown in red thus
Height above sea level shown thus .175

MAP V:
WEIGHT MAKING

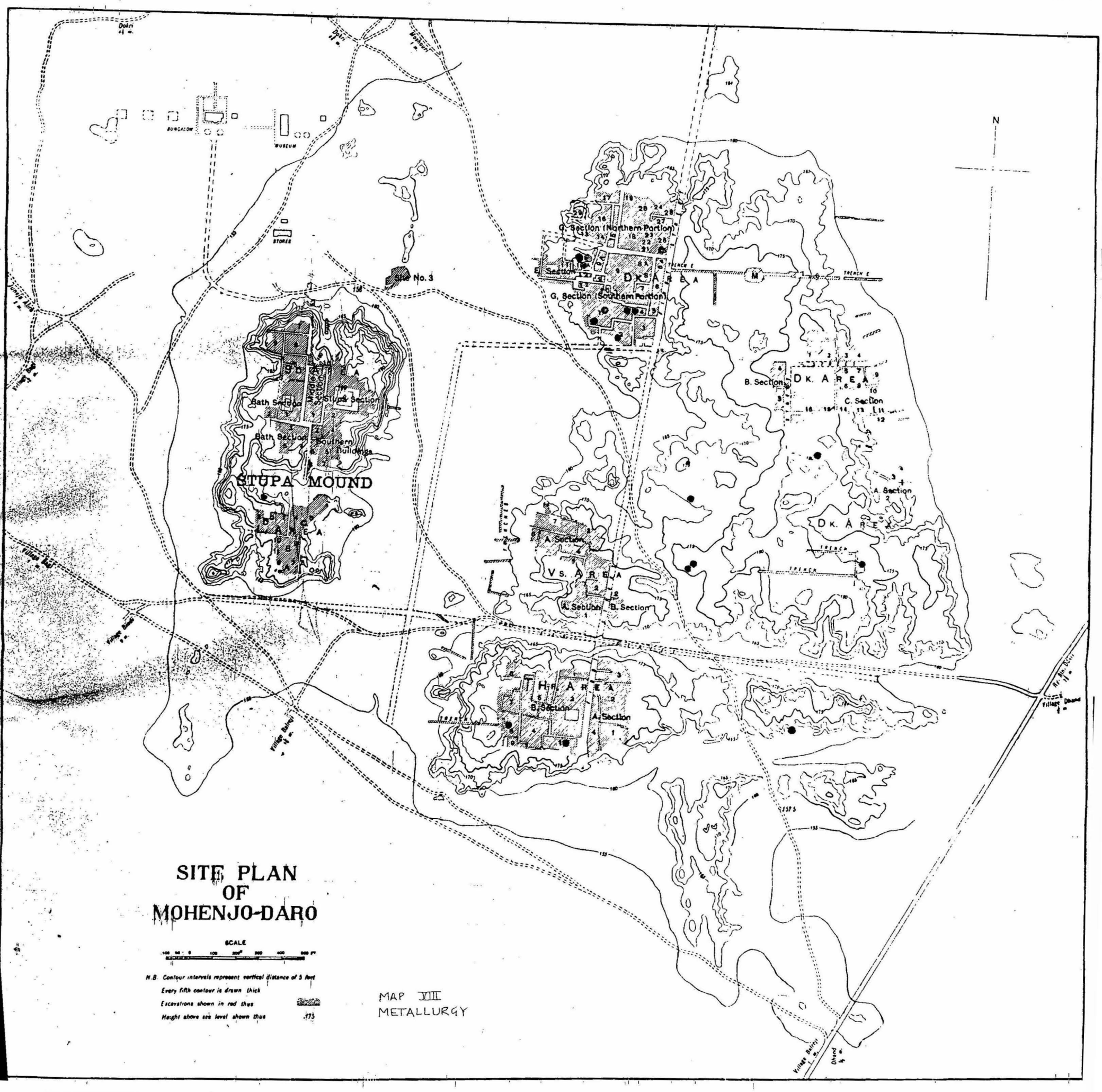
Frontispiece.



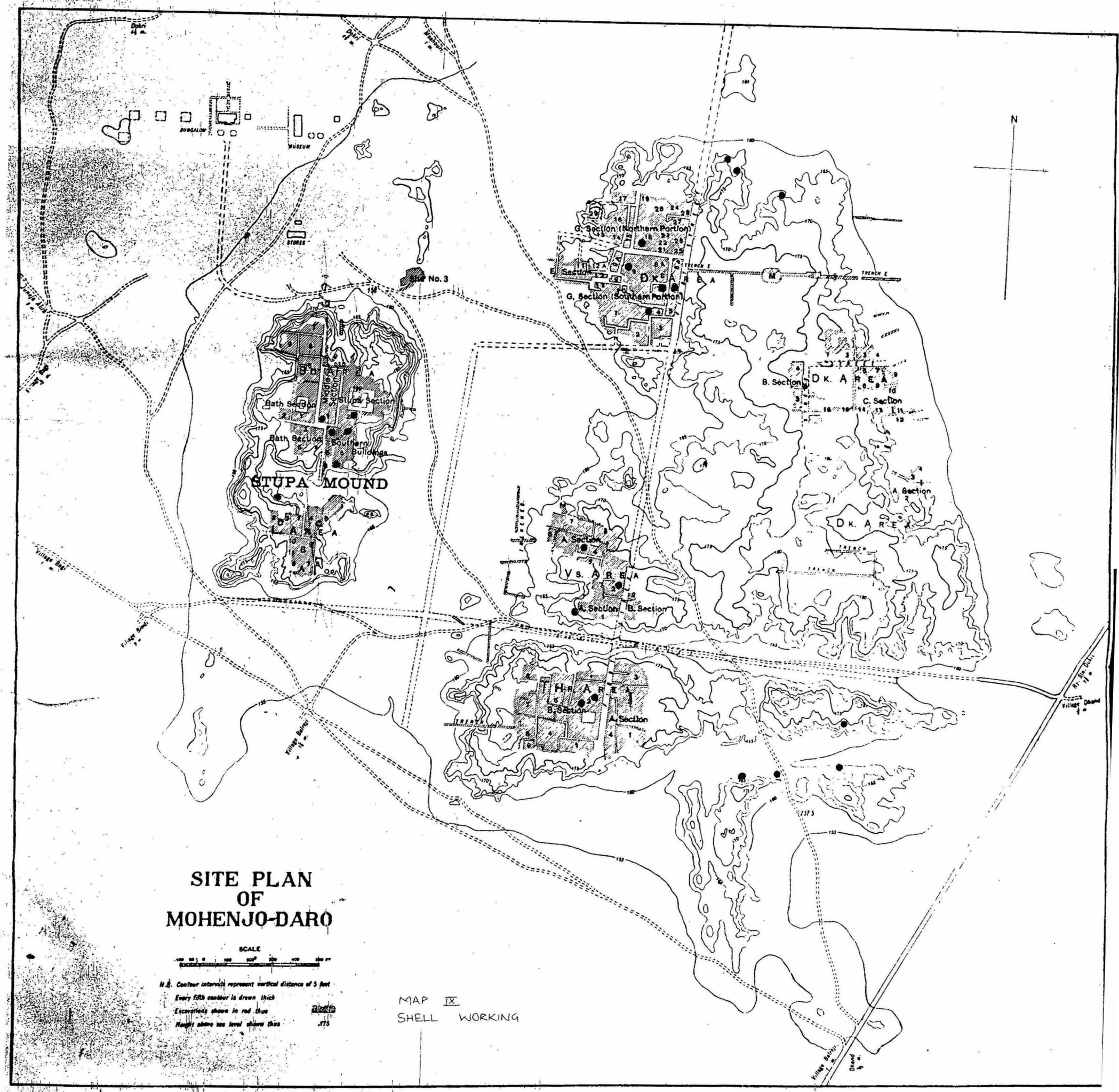
Frontispiece.



Frontispiece.

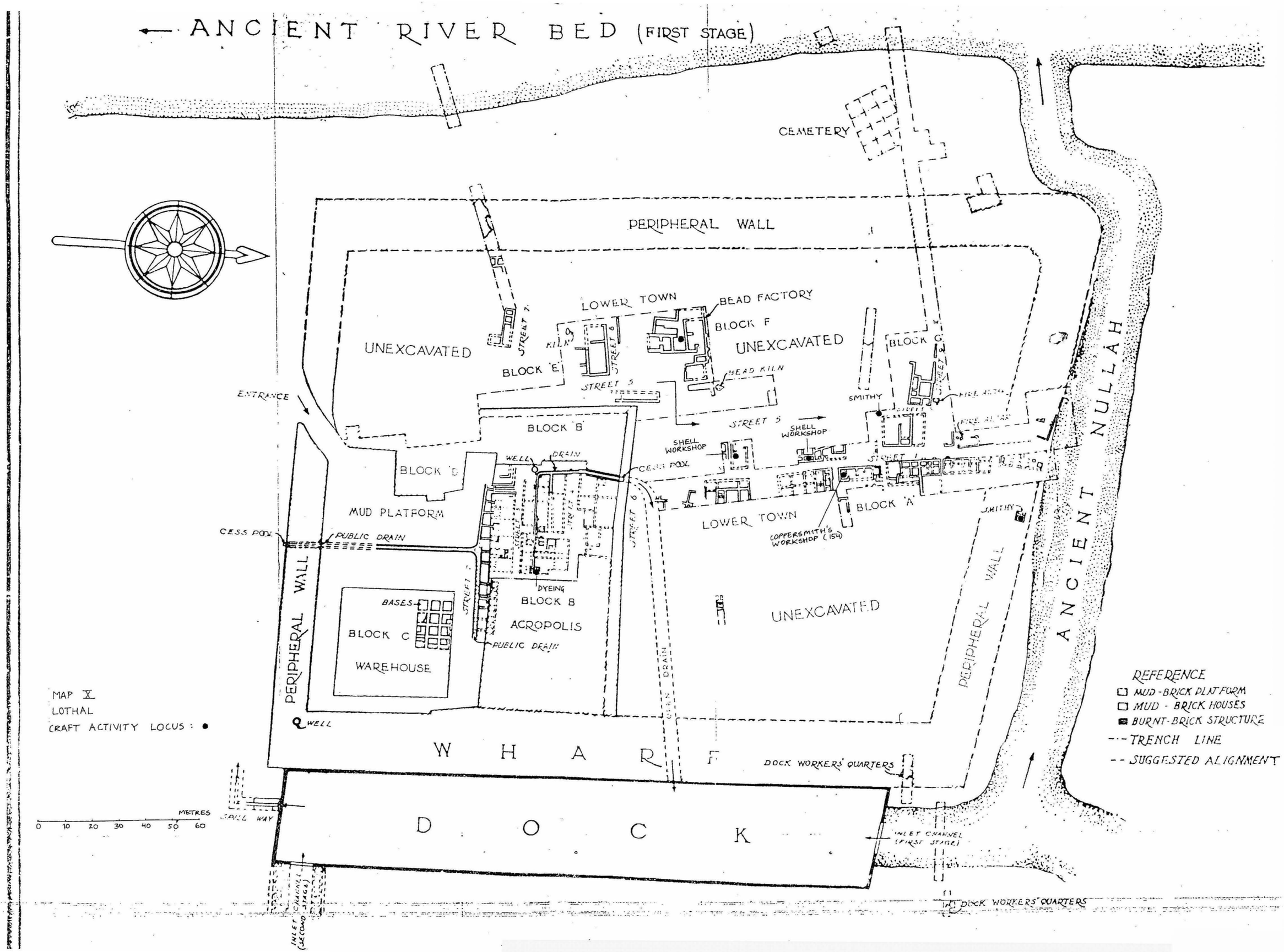


Frontispiece.



MAP IX
SHELL WORKING

Frontispiece.


ANCIENT RIVER BED (FIRST STAGE)
CEMETERY
PERIPHERAL WALL
UNEXCAVATED
LOWER TOWN
BEAD FACTORY
BLOCK F
UNEXCAVATED
BLOCK G
BLOCK E
KILN
STREET 6
STREET 5
STREET 7
BEAD KILN
ENTRANCE
BLOCK B
BLOCK D
WELL
DRAIN
CESS POOL
SHELL WORKSHOP
SMITHY
FIRE ALTAR
NULLAH
MUD PLATFORM
PUBLIC DRAIN
BASES
BLOCK C
WAREHOUSE
DYEING
BLOCK B
ACROPOLIS
BLOCK A
COPPERSMITH'S WORKSHOP (154)
UNEXCAVATED
OPEN DRAIN
DOCK WORKERS' QUARTERS
WHARF
DOCK
SPILL WAY
INLET CHANNEL (FIRST STAGE)
INLET (SECOND STAGE)
METRES
0 10 20 30 40 50 60
MAP X
LOTHAL
CRAFT ACTIVITY LOCUS : •
REFERENCE
MUD-BRICK PLATFORM
MUD - BRICK HOUSES
BURNT-BRICK STRUCTURE
TRENCH LINE
SUGGESTED ALIGNMENT

CHAPTER VI

Craft Production and Urbanism

Craft production in a bronze age context must involve the phenomenon of urbanism. Cities with their marked social and economic differentiation and division of labour are particularly relevant to the central focus of this thesis. In this chapter, we will try to illustrate the nature of the earliest cities, and the changes that come about in production activities in an urban situation, keeping in mind that economic functions were one out of several in a city.

It is the city and all concomitants of city life that are embodied in a study of urbanism. In 1950, V Gordon Childe laid out a list of ten attributes for the city. Though they encompass most of the characteristics of urban life, it can by no means be said that in every urban context the city reflected all the ten criteria of Childe. It has to be understood that the city arose in a particular social, economic and political milieu and that levels of society in which urban life are entirely absent are instantly recognizable from levels of a more complex nature. One means of initiating the discussion on urbanism could be through a better understanding of the type of society in which elements of urban life are absent. The primitive hunting and gathering level of

society is automatically deleted from the discussion and here we primarily focus on the simple egalitarian and chiefdom levels of socioeconomic achievement. Many of the elements that typify a tribal society do not make urbanism viable.

Urban societies are characterized by a significant density of population within a given spatial area. The fusion of dispersed settlements makes this possible. However it should also be clarified that fissioning in no way is obliterated from the urban pattern of settlement. Before we go on to the reasons for population nucleation, it should be emphasized that size is not a criterion of urbanization. Given raw population statistics it is difficult to draw an arbitrary line between what should be termed as urban and what is rural, solely on the basis of population. What should distinguish an urban centre then, is not its size, but the structure of the population.

Factors for Population Nucleation

One of the primary reasons for dense population growth is the defence factor. Living in dispersed settlements, communities find it hard to protect themselves and their means of livelihood. It is only when they are spatially compact, with a large number of individuals living in close proximity, that it would be possible to put up a united and formidable front to

external attacks. Moreover it would be easier to mobilize an attacking force from a compact settlement than from dispersed holdings. The element of leadership too would find it advantageous to live in a settlement with a large, dense population so as to enforce control by military power. Population nucleation also occurs when an area is environmentally particularly suitable: as, for example, when there is a limited source of water; or when a settlement is near a navigation point on a water course or body of water; or near a valued raw material source. In New Guinea, nucleation of individuals has been noted among the Tsembaga who periodically come together for ritual purposes, that is, during the kaiko which lasts for a year or more (Rappaport 1984 [1968]: 21). However this residence pattern is not a permanent one.

This coming together of population spatially makes possible relationships of exploitation and dependence which can result in differential degrees of control over the factors of production. Population nucleation facilitates a greater degree of exchange than that possible in a settlement pattern of dispersed holdings. This facilitation is primarily due to the elimination of difficulties of movement and transportation for the purpose of exchange. Individual production units would find it advantageous to live in a larger settlement so as to exchange their extra produce or obtain goods they need.

However exchange transactions are also controlled and facilitated by other factors which will be discussed later. A dense, compact population provides a large amount of labour and its increased availability due to the increased pressure on land in an urban society. Unlike in dispersed settlements where the more the number of hands available the more that can be cultivated, in an urban society with increasing pressure on limited land resources, the amount of labour that can be put into the same portion of land is limited and ultimately leads to decreased productivity. This available labour can be used to set up temporary settlements near distant fields during agricultural peak seasons but more important can be diverted to other tasks which hitherto had been undertaken on a part-time basis.

The Relation of Transportation Costs to Population Nucleation

What should be highlighted from the above paragraphs is the cost of transportation and its relation with the location of particular activities. One of the prime advantages of a dense population is that it provides an economy of transport costs. Transport costs are reduced when a number of activities required by the inhabitants of a number of sites are located at a 'central place'. A simple example is given of two sites, X and Y, situated some distance from each other. In the absence of a

central place, the inhabitants of both X and Y will have to be entirely self-sufficient or travel to the other to obtain needed goods and services. It would be far more convenient and time- and effort- saving to have a 'central place', Z, where goods and services needed by both X and Y would be concentrated resulting in a halving of travel time and energy for the peripheral communities involved.

Clark and Haswell (1966) have given extensive data (Table XXXIV: Pg 160-63) to show the relative costs of different means of transportation, expressed in a uniform relatable fashion, in terms of kilogram grain equivalent per ton kilometre. The highest transport costs are for movement of goods by human porterage and by pack animals and costs begin decreasing with mechanisation or where another source of power, such as wind for boats or fuel for power vehicles is used: for porterage, the median in Kg grain equivalent per ton Km was 9.0; by wheelbarrow 3.2; by pack animals 4.1; by wagons 3.4; by boats 1.0; by steam boats 0.5; by railways 0.7; and by motor vehicles 1.0 (Clark & Haswell 1966: 164). Thus as Drennan (1984) has also explained, where humans and animals are the transporters of goods without any mechanistic aids, the caloric costs of their sustenance will be viable only for a short distance and movement over a particular distance will result in increasing costs. This maximum distance

will be calculable on the basis of per diem caloric needs of the transporters and the cost of the goods transported.

Economy of transport costs will also occur when activities requiring heavy expenditures of time, labour and bulky inputs are located close to the inputs. In agriculture, for example, crops requiring heavy inputs of manure or water or needing particular care and attention will be grown near the settlement while crops requiring less care will be grown further away. In any case, in areas nearest the habitations, fields will be greatly benefited by periodic deposits of refuse and night soil; the keeping of small livestock near the habitations will also result in a zone of high fertility as seen in Africa (Morgan 1969: 303). Crops cannot be grown too far away from the settlement as daily travelling to the fields and transporting crops back to the settlement will result in increased costs in labour and time. Hence, in dense settlements, fields are usually near the settlement while more distant soils, even if agriculturally viable, are allowed to lie unused or are used for other activities such as grazing or as forest lands reserved for procurement of forest resources. Chisholm (1984 [1962]: 45-59) illustrates this pattern of land use as the infield-outfield system where the infield was the land nearest the settlement and most intensively cultivated while the further land was the outfield which was less

cultivated and given periodic respite. An instance given by Murra (1984: 121) of distantly located land being utilized in Mesoamerica to meet ecological threats such as unusually severe frosts does not in fact reduce the force of the argument above.

Non-agricultural activities are also best located at the source of bulky inputs such as fuel or water. Costs of transporting the finished goods may be lower than those involved in transporting the raw materials or fuel and so, it would be more viable for production to be carried out at a location where transportation costs of various factors are weighed and judged less.

Moreover the nature of goods transported is also important. It will be less easy to carry fragile objects where the risk of breakage is greater than durable goods with no likelihood of losses due to breakage. Thus manufacture of highly fragile objects will perhaps be located near the centres of consumption, so as to minimize losses. This could be the case with pottery production though there are instances where transport of pottery products are undertaken over considerable distances.

Physical barriers to movement such as rivers, mountains and deserts can result in increased expenditures in transport costs. In all these cases the longer time needed to surmount these barriers will have repercussions

in other increased inputs, such as fuel, food for humans and animals and effort, especially where river crossings are concerned.

But there are cases where economy of transport costs do not fit. This happens when bulky raw materials and fuels are carried to distant places for the manufacture of artifacts. In the Harappan case, we find the transporting in to urban sites, of non-local materials such as copper, semi-precious stones and shell. In this case the role of the objects to be manufactured is such that the disadvantages in the transportation costs of their raw materials will be outweighed.

Central Place Studies

The reduction in transport costs embodied in the location of a central place gained momentum with Christaller's Central Place Theory which assumes that to some extent every town acts as a focus for the surrounding countryside. Christaller worked under certain assumptions, some of which envisaged a uniform plain with no differentiating resources, population and purchasing power, incomes and transportation networks and a marketing system of perfect competition. The idea was that the central place exists to focus activities/services and production and enabled movement of goods to and from itself through its accessibility to a larger area which is

its hinterland. In Christaller's theory, at each central place, the range of a good/service was noted which denoted the maximum distance that people were willing to travel to obtain a good/service. Each good/service had a threshold level which denoted the minimum population required to make the offering of the good/service viable. Thus, each central place was found to have a circular complementary region, the hinterland, within which it provided some goods and services. To make the model more efficient, and to prevent any overlapping, hexagonal complementary areas were devised. For other goods and services, the range and threshold levels will be different requiring other central places. Thus, one can see an urban hierarchy where higher order centres will provide those goods and services available in lower order centres in addition to more goods and services commensurate with the increased size of the hinterland; those in the same level of the hierarchy will be equidistant from each other. However, it is not possible to arbitrarily delineate the area occupied by the hinterland for a city. Some large cities, such as Rome in the Classical period, had an extensive hinterland comprising Gaul, Spain, Northern Africa and Egypt.

In modern contexts, the relations between a city and its hinterland assume considerable significance due to the market economy. By selling excess agricultural goods, cultivators can purchase other required manufactured

goods. The advantage in marketing surplus agricultural goods in a town is that the cultivator, by purchasing other needed objects, frees himself solely for agricultural production and by concentrating on food production can increase productivity.

However in ancient periods, and in modern less complex societies, the absence of a market economy in many instances prevents the bringing of agricultural goods from villages to the city to be sold. In ancient periods what goods are brought to the city are not brought so as to increase profits but primarily through the political mechanism of tribute.

Social Aspects of City Life

One of the key differences between a tribal society and an urban society hinges on the social makeup of the respective types of communities. In a tribal society, settlements were small and dispersed, many occupied by closely related kin groups. Among the Tiv of Central Nigeria figures indicate that in a compound 15% were sister's sons and only 2% were distant kinsmen and strangers (L & P Bohannan 1953: 17).

In a tribal society all relations on social, economic and political levels revolve around kinship and kin relations. With growing complexity in society the significance of kinship does not diminish but becomes more

formalized. The determination of most relations on the basis of kinship is best brought out in the economic sphere, where exchanges are undertaken in the spirit of equal reciprocation, each party being fully aware of the close social links between them. Very often commodities are given to individuals in acts approaching the pure gift. One example is the matrilineal custom of an annual payment given to a man at harvest time by his wife's brother, in the Trobriand Islands (Malinowski 1964: 180).

To take another context, whatever proportion of output of production is given to a chief is done so on the basis of perceived kinship and the social value of such gifts. Never is this movement of goods termed as compulsory giving or collected through coercion. What is also significant is that goods which come to the chief are distributed back through society and never finally appropriated. This carrying out of large-scale distributions made Fried (1967: 118) note that such persons (chiefs) were rich for what they dispersed and not for what they hoarded. Sahlins (1972: 147) in emphasizing the kinship aspect wrote-"the chiefly toll on the household economy had a moral limit consistent with the kinship configuration of the society. Upto a point, it was the chief's due, but beyond that, high-handedness."

In contrast in an urban society in a spatially limited area, day-to-day relations are not exclusively

ordered by kinship but engaged in by a number of groups that can be specified as nonkin, perhaps even individuals coming from great distances to live in a city. Thus "residence, not kinship, became the qualification of citizenship" in a city (Carter 1983: 2).

In an urban society various activities become concentrated along kin lines. Adams (1966: 85-90) has carefully delineated the role of lineage groupings in Mesopotamian and Mesoamerican urban societies, showing landholding, craft production and other occupations grouped into lineage and clan modes of organization. However what also happened was that lineage groups lost much of their autonomy and were no longer liable to themselves but to a higher authority.

Social Stratification and the Division of Labour

A major difference between tribal and urban societies is the degree of stratification. Fried mentions stratification in society as one of the major reasons for growing complexity or as he sees it, with increasing complexity, there are fewer and fewer positions of rank than those individuals able to fill them. It is this horizontal restructuring of society which serves to increasingly differentiate the upper strata from the general mass of the population. Relations of power are not based on kinship, but on exactions. It is this extra-

kin basis of authority which gives the real permanence to such an office. Access to power results in many levels of stratification; access to resources in its turn is no longer assured to all. Thus by exercising control over significant resources in society, such as land and labour, dominant sections in society can extend hierarchical groupings by supporting and sponsoring other groups of people. One finds legitimization of political dominance through tangible material goods serving as status markers. This is, in effect, the result of restricting access to valuable resources as apart from basic resources such as land and labour, and in the display of these resources emphasizing superiority. In the urban context, the production of valuables will be largely directed towards demands or requirements of the elite. Barter of valuables would find a conducive climate in an urban society but for the fact that possession of valuables will become restricted and many valuables will go out of circulation.

From social stratification stems the division of labour. In an egalitarian society any perceivable distinctions are largely on the basis of skill. Besides that individuals do what others do. Every household is responsible for its own food procurement and its provision of other necessities such as clothing, shelter and tools. When some amount of differentiation comes in, occupational differences are not large. Chiefs may themselves engage

in subsistence pursuits. Their additional activities are concentrated in the sphere of redistribution or pooling which "stipulates a social centre where goods meet and thence flow outwards and a social boundary, too within which persons (or subgroups) are cooperatively related." (Sahlins 1972: 189). It is not really difficult to conceive of the situation where the community contributes a portion of its output on individual basis, all such contributions moving towards a social centre in the person of the chief. Chiefs in less stratified societies hold their positions more on the basis of their personal qualities than on any show of force. Any hint of force being employed would lead to the downfall of the chief, there being little permanency in such an office. Through his ability to gather to his side a number of supporters and dependents, a chief could build his status in which the prestige of the community was expressed. Despite the chief's added duties, he still has to engage in his own primary producing activities and can never coerce others to undertake such activities for him.

As society becomes more stratified, however, more and more people are removed from basic subsistence activities and are in turn provided their means of subsistence in exchange for the powers of governance, for maintaining the community as a political entity, for religious services and due to increasing coercion. No longer do social norms

or kin relations bind or restrict the growth of the elite into predominance. No longer is redistribution a system where the chief received tribute which is filtered back to the people. The paramount chieftaincy of Hawaii is an example where extreme social stratification, though never relinquishing the kinship relation, yet went beyond to coercion of tribute to the chief and the complete separation of the chief and direct subsistence production. "The Hawaiian makahiki, with its elaborate associated cult of Lono, and the Tongan inasi represent peaks within Polynesia of the transformation of first fruits to regularized taxation." (Kirch 1984: 167).

Thus with increasing social stratification some groups of people extricate themselves from subsistence production, but have access to subsistence goods from those sections of society engaged in agricultural production. This separation serves to reinforce the differences between rulers and ruled. So long as justification of the process through supernatural or other means can be given, or coercive control can be maintained in society, such a system is possible.

The Concept of Surplus and the Support of Non-Agriculturists

But for such a state of division of labour to arise, the society must be able economically to support non-food

producers; people must be willing to devote some measure of their agricultural output to support individuals engaged in specialized non-agricultural activities. This support of specialized individuals is viable only when a surplus of agricultural production is possible. The term surplus is often understood in the sense of output over and above the minimum required for subsistence. However, the doubt frequently arises that even where capacities for producing a surplus are present, there has to be some motivation for food producers to produce more and be willing to give up a portion of the fruits of their labours to support a group of non-food producers. In an early discussion on the concept of surplus, Pearson (1957: 323) wrote that the term "surplus" should be used in a relative sense in that "a given quantity of goods and services would be surplus only if the society in some manner set these quantities aside and declared them to be available for a specific purpose." Other writers have focused on this and instead of speaking in terms of "society" talk more specifically of an authority as responsible for mobilizing a surplus. Thus Orans (1966: 31) wrote that "it is... not unthinkable that the very first extra production per food producer which went to a full-time non-food producing specialist went via an hierarchical authority." Larger populations become more stratified due to the necessity to administer a more populous society requiring more layers of administrative

control. Also it would be "easier to establish and maintain wide differences in prestige and privilege in a large society than in a small one where all relationships tend to be based on kinship and/or face to face." (Orans 1966: 30). On the whole then it is through stratification that the mobilization of surplus can take place.

Apart from political authorities other specialists were the religious ones. Carter (1983: 7-8) has discussed the role of religion as a theory for the origin of cities but while acknowledging its significance has discarded it as resulting in the city as religious entities preceded the first cities. He is probably right in saying that the priests "became the first group to be detached, the first specialized sector of the population." (Carter 1983: 8). The significance of the temple in the Mesopotamian context must be acknowledged.

Support for other categories of non-agriculturists such as craftsmen is forthcoming when the produce of their labours is of such value that the demand for such production fulfils their subsistence requirements. Such non-food producers can be supported full-time for craft production by the potential elite of a society in which case they are engaged in the production of objects which are highly valued in the society and are used by a limited group of people. Such objects can form the bridge whereby

the elite of a community can communicate with a similar section in another community. In societies which are relatively less stratified there is no clear demarcating line between groups in which valuables are found and those in which they are not. There are ways and means for most members of the community to attain some portion of wealth in the form of valuables. It is only when valuables become highly restricted and form the basis of differentiation between groups that control over the means of acquiring such objects through controlling their source areas or means of production, attains significance. It is then that craftsmen producing such categories of objects which are valuables in that few individuals can exchange objects against them, largely become full-time workers and are supported in their endeavours by being provided for their subsistence requirements.

Another means whereby a society can support non-food producers is in politically complex societies with a distinct figure of authority backed by the use of force, who through exaction and conquest can have agricultural goods brought into their region through the appropriation of cultivable lands.

There is yet another alternative. When an area is agriculturally poor, or when a community is located close to a zone rich in a particular resource, this can induce the population of that region to marginalize agriculture

and concentrate on other kinds of production activities. As Rice (1984: 49) puts it, "environmental zoning or microzoning or agriculturally poor land may stimulate a search for economic alternatives." For this to happen, however, the products manufactured should be such that goods from other areas can be exchanged for them and avenues exist for the movement of such goods. One finds in the ethnographic literature, however, that such transactions between agriculturally poor and rich areas are not always "economic" in content and purpose. For this, one can take the example of Moala where social norms permit monopolistic specialization to sustain an island's trading potential (Sahlins 1962: 421-22). Similarly, Kirch (1986: 35) notes Firth's identification of exchange relationships between Anuta and Tikopia as one of symbiosis, where products offered by each island are not such that cannot be produced in the other island and "retention of specialization" enables such exchanges to take place.

Specialization and Occupational Differentiation

Division of labour on a community level implies occupational differentiation. Occupational differentiation and the ensuing specialization become marked in urban societies. Particular individuals and groups receive tribute and are increasingly divorced from basic food-

producing activities. One of the means through which occupational differentiation is emphasized is through labour services carried out by the ruled for those sections of society which are dominant. Examples of such labour obligations are the cultivation of fields, non-subsistence production and so forth.

Another form of occupational differentiation occurs where different professions and activities are held or performed by separate individuals or groups. Thus one finds in a compact society, some individuals in whose hands religious activities are concentrated, others who comprise a decision-making authority; yet other individuals undertake separate pottery production, metal working, weaving and such crafts.

Increasing division of labour and the maintenance of distinctions between professions makes for specialization. When the labour potential of a community is divided into separate groups engaged in different tasks, this makes for specialization of these groups in their respective activities. Specialization whether part-time or full-time implies that certain individuals are undertaking certain tasks or activities which are not undertaken by other individuals.

Specialized personnel and craft producers attached to the elite strata or to a political authority are more

likely to be full-time specialists entirely removed from basic subsistence activities. This is largely because individuals in power are more able to insure the supply of subsistence goods and raw materials to attached specialists (Brumfiel & Earle 1987: 5) and provide the need for specialized articles. Whereas in the case of independent specialists, we find that even in the presence of a large demand, they may be less able to function if for their craft goods, they are unable to get goods in exchange. In early urban communities, production must have been in the hands of specialists who alone could undertake these activities, but whether they had any other source of livelihood is less clear.

The essential element underlying the organization of urban centres will be the utilization and control of labour. It is the excess labour resulting from spatial aggregation that will be utilized for non-agricultural activities and will be directed and sponsored by the figures of authority. Less significantly, restructuring of the control and use of land will result in people organized to work on lands other than their own.

Politically dominant groups base their power on differentiating themselves from others in society. This results in increasing differentiation between groups in society and with concomitant increase in amount of labour available in a limited area, different groups will

concentrate on separate activities. Hence the relevance here of craft production. Craft producers will find themselves in the urban situation, as primarily occupied in craft production. Depending on the value of the goods produced by them, their production may be sponsored by elite groups. Crafts may even be differentiated on the basis of some individuals being supported by the elite while others work for any orders among the rest of the population. Hence, weaving in certain Mesoamerican cities was, in some cases, sponsored by the political elite while the rest of the population would also have woven cloth. Certain craft objects would become restricted in use-only by the elite- and their sponsored production would lead to restriction in use. Distribution of these goods by the elite will be used to a large extent to sustain and retain the power base. Brumfiel and Earle (1987) have deliberated on the role of craft production in complex societies, the role played by craft production in the manufacture of wealth objects, the differences between independent and attached specialists and differences in the value of the products manufactured by them and the significance in the economy of subsistence goods and wealth goods.

Craft production in an urban context has the potential for considerable expansion through a growing demand group. For demand to be translated into real

exchanges, craft producers need consumers who can offer goods or services in exchange. In an urban centre, the potential for exchange is extensive with the differentiated groupings in society, the considerable demands by the upper levels of society and the constant striving for upward social mobility. But it should be noted that the elite stratum in any society is a small proportion of the total population. For the rest of the population, the reality still exists of the ability to provide goods or services in exchange for other required goods.

An understanding of urbanism through archaeological evidence needs to take into account a variety of indicators. The absence of textual evidence makes the explication of socioeconomic institutions and processes difficult. The best that can be done will be to study the archaeological data for the Harappan culture to glean some clues which will still remain conjectural.

A significant aspect in the earlier discussion on urbanism was the political factor in the makeup of urban societies. Delineating the presence of a political entity could be through residential structures or through large specialized non-residential structures associated with these elements. In the archaeological study of early urban communities, it is easier to distinguish the

presence of the elite strata of society and comparatively much more difficult to demarcate the overall political authority. A number of physical aspects of archaeological sites can help towards delineating a political power. These could be evidence of fortification, presence of public architecture and public storage facilities, provision of wells and civic and drainage facilities, variations in size and plans of individual residential structures. The presence of these features has implications going beyond the mere provisioning of facilities for the urban population. A number of these facilities require political or administrative control for their conception and direction, especially where uniformity is associated with the designing and construction of these facilities (see Table VI.1). But first, we will study the evidence for public architecture.

Public architecture generally comprises those large, specialized, possibly non-residential structures, though residential elements for the elite section of society are also included here. At Mohenjodaro such structures are largely located in the SD Area (or the Stupa mound). These are the Great Bath and a number of related structures to the south (Marshall 1931: 143) and southeast (Marshall 1931: Pl. XXVII) of the Great Bath; and to the east of the Buddhist stupa, Building MM, well-built, with a number of small paved bathrooms and well made drains

(Marshall 1931: 125). In Mackay's excavation (1938: Pl.I) the Middle Section of the SD Area appears to be a single large structure, about 69.8 x 23.7 m. Two other structures adjoining this Block were numbered Blocks 6 and 10. In Block 6, a number of bathing compartments were found and has been called a bathing establishment for priests in view of its proximity to the Great Bath (Marshall 1931: 18-20). Block 10 has not been fully excavated, but seeing its massive southern and western walls, it does appear to have formerly been a structure of significance. In the northern part of L Area, were found two pillared halls, one in Section C and a smaller one in Section D. However, not all public structures were found only on the Citadel mound. In the HR Area, Marshall terms House XXX in Block 5, Section B as possibly having had some sacred character. Associated with this structure are 16 small dwellings, said to have housed retainers for the large structure. A large structure in Section E of the DK Area prompted Marshall (1931: 251-53) to consider it as a possible temple Mackay's excavation brought to light a large structure (60.8 x 36.4 m) which has been termed a 'palace'. In the northern portion of the DK Area, Section G, Blocks 18 and 19, was another huge structure, measuring 67.5 x 33.7 m, raised on a mud brick platform. Its use is still unknown, and a smaller structure to its east was said to be occupied by the person in charge of the larger building on the west (Mackay 1938: 154). Though a number

of copper-bronze objects were found in Block 18, only one seal was found at a high level. In the VS Area, Block 1 in Section A too seems to have housed some large structures. House I was very large, its east-west measurement being some 43.7 m while the southern portion is destroyed. To the north of this structure, is another block divided into 4 structures, Houses II-V (Marshall 1931: Pl. LIII), but it is possible that the houses were all part of a single structure.

Apart from the granary at Harappa, the only other structures possibly serving some specialized purpose are those called "workmen's quarters" and the circular platforms and furnaces found in Mound F. The major part of construction of these structures was undertaken in the same period as the granary. The workmen's quarters consist of 14 small houses, measuring roughly 16.5 x 8.5 m and with two exceptions, Houses 5 and 9, are all on the same plan. Little was found associated with these structures, apart from a jewellery hoard in House 2. The circular platforms 12 in number, in two rows are laid almost equidistant from each other (about 20ft). These consist of bricks laid in a circular fashion, sloping towards the centre which was hollow in which possibly mortars were used. In the hollow of one, a small amount of burnt wheat, husked barley and animal bones were found. 16 furnaces were found in the same area as the circular

platforms and the workmen's quarters. The number of circular platforms suggests a considerable amount of grain being husked here. However, it does appear that the occupants of the workmen's quarters did not belong economically to the weakest sections of society, as is apparent from the poorer constructions recovered at Harappa.

There is no evidence from Chanhudaro of any public architecture. Remains of complete structures are rare at Chanhudaro. It is very likely that the structure comprising rooms 215 and 286 may have been of a functionally special character. This is deduced not only from the heat facility that formed the major portion of the structure, but from the contents of the two rooms and the location of the structure in the context of Mound II as a whole. This structure is located on a main street of the site running in a northwest-southeasterly direction. The structure may have served a public purpose, providing a heat facility for a particular process of craft manufacture. It may also have served as a storehouse for partly processed artifacts, complete objects and tools, to be worked in and utilized by craft workers living all around the structure.

At Kalibangan, the southern portion of the Citadel area most probably served some special function, possibly

ritual in character. Though rooms with fire altars have been found in houses in the lower town, the provision here for fire altars, located in rows on mud brick platforms along with, in some cases, baths with pavements, suggests some sort of public functional character of the area (Lal 1984: 56-58). To the east of the two large mounds at Kalibangan, is a smaller one, KLB 3, on which four or five altars were found in a single room, each located individually, the whole within a thick enclosure wall (Lal 1984: 61).

The major evidence at Balakot for an "elaborate, perhaps monumental building" (Dales 1979: 260) is the extant floor of baked square tiles impressed with intersecting circle designs. No associated walls survive, but another well paved floor was found adjoining, plastered with white lime in which there was a circular depression with charred remains of a wooden column. Adjoining are small rooms with very large storage jars. This eastern sector of the High Mound appears to have anciently housed formal architecture; to the north of the above mentioned paving was found in a higher level, another paved floor enclosing a round ceramic tub 95 cm in diameter (Dales 1979: 260-62).

The 'Acropolis' at Lothal most likely served a specialized function. Block A comprising the Acropolis consisted of an artificially elevated rectangle of mud

brick platforms, the centre of which was further raised by additional courses of bricks. The platforms on all four sides of the interior raised area, along with the latter, were all built upon by structures which are however no longer extant. However, what does remain is a complicated system of drainage constructed of burnt bricks which does suggest the presence here of structures of significance. What is specially interesting is the probable presence of 12 baths indicated by the drains. It is conjectured that there were 12 houses in this area, as these would be too many for a single structure (Rao 1979: 102). It may be mentioned that at Mohenjodaro, in SD Area, a structure with 8 baths was found in Mackay's excavation. It does appear that the importance attached to water and ablutions attested at Mohenjodaro was noted at Lothal too. On the whole, the particular care taken to protect the Acropolis, its vantage point in overseeing operations at the warehouse and the dockyard and hints of rather exceptional structures within the Acropolis, all point towards special functions being undertaken here. At Lothal, other special structure were the dock and the warehouse. In the excavation of the dock itself, a considerable amount of labour must have been utilized and it is probable that the dock formed part of a preconceived plan for the construction of the town as a whole, in Phase IIa at Lothal. The earth excavated from the dockyard was

utilized for constructing the massive mud brick platforms and for filling in the interior of the base of the Acropolis with rammed mud. Otherwise, it is difficult to conceive what the Lothal inhabitants would have done with the huge amount of mud that would have been unearthed.

The presence of structures which do not appear to be fulfilling ordinary purposes such as residence are significant from the point of urbanism and suggest they were constructed for specific purposes, for the use by a possibly specialized task force. It can be accepted that if specialized personnel are working in special structures, then there is likely to be division of labour and specialization among the population. Similarly, the dockyard at Lothal not only is significant from the point of view of regular movement of goods being carried out here, but also from the probability of a labour force employed here, at least in the shipping season, for loading and other activities.

The association of religion in fairly specialized structures is probably attested to at Kalibangan, in the southern portion of the citadel. At Mohenjodaro, a number of structures are mentioned as probably having served a religious or ritual purpose in antiquity, such as the Great Bath, the priests' bathing establishments, but these remain at best conjectural. The poor quality of the remains at Harappa prevent any kind of analysis of this

aspect, while at Lothal, the absence of architecture apart from the drains on the Acropolis, also makes any conjecture impossible.

The presence of fortifications appears to be one means by which a plural, multifunctional society can spatially segregate itself from the rest of the population, both within the individual settlement and from other settlements. Masson (1988: 107) has mentioned the presence of fortifications as one of the traits of early cities, related to the role and place of the military function within social processes. One must also consider the labour involved in the construction and maintenance of fortifications, and the organization of this labour. Some amount of administrative authority would be required for the direction of this labour force. In the Harappan context, not only are massive enclosure walls involved, but in some sites also, huge mud brick platforms for certain areas of individual sites. One must also note the preparations required for the construction of walls and platforms- the immense quantities of sun dried bricks and stones required for walls and foundations.

Excavations in 1946 at Harappa revealed massive fortifications for Mound AB. The defensive wall overlay a rampart or bund, perhaps to raise the defences above flood level. A platform of mud brick helped to retain the

rampart and the lower part of the defensive wall (Wheeler 1947: 65). Lothal was surrounded by a mud brick peripheral wall which may have been an anti-flood measure rather than protection against external attack. This is because a number of structures on the Acropolis would have been unprotected, as they were built high on mud brick platforms and would have been prone to attack over the peripheral wall (Rao 1979: 87). This feature at Lothal is significant in view of the location and the nature of the settlement. Noting the extensive fortifica-tions constructed at a site like Dholavira in Kutch, it is surprising that Lothal, located so far to the east in an area with few other Harappan sites, almost in what could be a frontier area, was not better protected. Moreover seeing the function of the site, as a base for collection of raw materials, manufacture of products and a dockyard arranging transportation of goods in and out of the settlement, the lack of defence against a non-Harappan population is inexplicable.

At Kalibangan, two of the three mounds were provided with fortification walls. Of the two larger mounds, the western and smaller was internally divided into two units, of which the southern probably was the original and the northern a structural addition. The `Lower Town', was also fortified and right from the inception of the site (Lal 1984: 56-59). At Banawali, the settlement had an

internally differentiated citadel in the single mound, both sections with enormous defensive walls (Bisht 1984: 91). The settlement of Surkotada is fortified as a whole. Internally, a wall divided the settlement into two units, east and west, of which the western and slightly larger is the citadel, while the eastern is the residential area (Joshi 1979). Desalpur in Kutch also had massive stone fortifications, comprising a wall with corner towers and salients (IAR 1963-64: 11). Stone was also used for fortifying the Makran site Sutkagendor (Dales 1962: 4-5). At the other Makran site of Sotka Koh, Dales (1962: 10) found traces of one stone wall which was followed for over 486 m. At Ali Murad in Sind, a rampart wall of irregularly dressed stone blocks was traced (Majumdar 1934: 89-90). At Balakot, the presence of an encircling wall is conjectured on the basis of a stratigraphic study of the edges of the mound where the strata do not slope away but abruptly end, suggesting ancient enclosure within some sort of architecture. What is new at Balakot is that a line of structures facing inwards may have served as an encompassing "wall" (Dales 1979: 262-63). At the site of Dholavira, presently being excavated in Kutch, not only is there a fortification wall for the entire settlement, but it appears that the `Castle' and the `Middle Town' too were individually walled. The `Lower Town' had no individual enclosure wall, but was enclosed within the general outer fortification wall (Bisht 1989: 398). It

should be kept in mind that smaller Harappan sites may have had mud walls surrounding the settlements which may not always be extant.

The interest which emerges from the above details is the degree of segregation within individual settlements. We find that some settlements were anciently divided into two units, in many instances the two being functionally very different. This has led to the general terminology adopted for the two units as the `Citadel' and the `Lower Town'. At Mohenjodaro, most (but not all) of the large, public architectural elements are located on the citadel mound. At Kalibangan, the citadel was divided into two segments, the southern one containing only fire altars and baths with pavements while the northern unit contained only residential buildings. The lower town contained only residential elements again. This delineation of settlements into two mounds has been noted in the case of Mohenjodaro, Harappa, Rakhigarhi, Surkotada, Amri, Balakot, Ganweriwala and Mitathal. Among settlements being composed of single mounds we have the sites of Allahdino, Banawali, Chanhudaro, Dabarkot, Kot Kori, Kot Diji, Lohumjodaro, Nageshwar, Desalpur, and Sutkagendor. As rare cases, we have three mounds in the case of Kalibangan and at Dholavira, where the intervening spaces were paved; this evidence is the first so far obtained in a Harappan site. The site of Surkotada has been indicated

as having two mounds, on the basis of Joshi's (1978: 64) exploration where a low mound, now mostly washed away, was noted beyond the present-day nullah about 500 m to the southeast of the site. This could be the city area or the lower town. The evidence seems to be similar to Kalibangan, except that at the latter site, the orientation of the two units was north-south, while at Surkotada, the two units lie east-west.

This spatial or physical segregation, so obvious in double-mound settlements, is apparent in settlements anciently composed of single mounds too. In single-mound settlements, walls were used to divide the areas of the settlement. Moreover the special nature of the citadel area is often reinforced by a physical elevation of this area of the settlement either naturally (by the citadel being situated on a naturally elevated area) or by building mud brick platforms on which structures were raised. Generally speaking, in double-mound settlements, the citadel area is smaller but higher, while the lower town is larger but not as elevated in height. This is also a reflection of the comparative populations of the elite and the non-elite, occupying the different parts of the settlement. In Lothal, the ancient settlement was a single unit and not internally divided by walls, but the Acropolis, the probable seat of political and administrative authority, was higher than the rest of the

settlement.

An indicator for the existence of a centralized authority can be the plan of each individual settlement as a single unit. Haphazard construction may to some extent indicate a lack of centralized control over planning. However it cannot be said that all haphazard or unplanned cities reflect a lack of centralized control as exemplified by Ur. "Colonies" on the other hand show preconceived planning on account of the nature of their origin. One of the features of the plan of Miletus is relevant here - "It is evident that the whole city was constructed in relation to a coherent and controlling plan. It was not the result of gradual and unorganized extension, but was conceived as one complete whole." (Carter 1983: 21).

Different patterns for modern urban growth based on land use are mentioned in the literature. Thus we find that cities could be organized on the pattern of concentric zoning or in sectors or in functionally multiple nuclei (Carter 1981: Figure 9-1: 173). Town plans are of three types-irregular plans, radial-concentric plans and the rectangular or grid plans (Carter 1981: 144-45). The third type has been studied by Stanislawski who put forward five conditions for the emergence of the grid pattern-1) a new town or a new part of town is considered; 2) there should be centralized

control; 3) when a town has colonial status; 4) should be a measured disposition of available land; 5) there should be knowledge of the grid. Basically then the question of centralized political control is of paramount importance in the context of a grid pattern of settlement (Carter 1981: 154). The right-angled crisscrossing of streets at Mohenjodaro is an example of the grid layout. The pattern is, however, not universal in Harappan sites. At Banawali, except for streets 5, 6 and 7, the others do not cross each other at right angles (Bisht 1984: Figure 9: 92). In ancient settlements, functional demarcation into areas is rarely attested and hence we cannot speak of concentric zoning or sectored planning in cities. The only Harappan example giving some evidence of strict demarcation of space according to functions is noted at Lothal where different activities of city life are separated into different parts of the settlement.

It needs to be discussed whether settlements reveal a gradual growth towards urban proportions and functions. At Lothal the earliest settlement (pre-Harappan and pre-urban) was a village settlement occupied by a Micaceous Red Ware-using people who surrounded their settlement with a mud wall (Rao 1979: 28, 53). The Harappans came along and lived with the original inhabitants until the destruction of the settlement at the end of Phase I which was followed by a completely planned settlement, its

various sections divided into different functions and provided with roads and civic amentities. The site is bordered on the west by the ancient nullah and on the east by the dock and the wharf. The warehouse is located close to the wharf to facilitate loading and unloading of cargo. The Acropolis occupies a central position on the mound and overlooks both the warehouse and the wharf on one side and the lower town on the other. The majority of craft activities are located in the lower town. Thus it appears from the available evidence that there was no gradual evolution towards urbanism at Lothal.

A similar picture is available for Chanhudaro, though less clear than at Lothal. This is primarily because the lowest levels have still not been reached at Chanhudaro due to the high water table. The evidence from Amri, as outlined in the previous chapter, indicates the probable Mature Harappan beginnings of Chanhudaro. Here too we find a completely planned settlement for the Harappan culture.

To return to other architectural elements, the existence of public storage facilities is a good indicator of urbanism. The presence of such structures is significant regardless of the commodities that would have been stored there. If these structures housed foodstuffs such as grain, this signifies that apart from individual storage facilities, there was a public structure for the

same purpose, undoubtedly being able to contain larger quantities and for a number of varied purposes. the presence of such a structure implies some kind of authority in charge of its contents, collection and disbursement. Collection of vast quantities of grain and other foodstuffs could not be solely for a hierarchical authority but must have been used to support other specialized sections of the population. The existence of such structures must also take into account the machinery involved in the collection and distribution of the contents. Even where objects and materials other than food are stored, the above implications arise, along with those of the producers of such goods and the possible uses of such goods in exchanges with more remotely located settlements.

It surely must be significant that out of the presently available evidence, only three sites have given evidence of storage facilities, namely, Mohenjodaro, Harappa and Lothal. At Mohenjodaro, the granary revealed by Wheeler (1968: 43-44; Figure 9: 45) consisted of 27 blocks of brick work with externally battered walls.

The granary at Harappa is divided into two blocks, each covering an area of 45.6 m north-south and 17 m east-west and divided by a corridor 6.8 m wide between them. Each block is composed of six halls (Vats 1940: 15, 18).

The warehouse at Lothal consists of a platform of mud bricks covering an area of about 48.6 x 41 m, on which in the north-western corner, 12 blocks as bases for wooden superstructures are still extant. Originally, 64 solid blocks would have been provided covering the entire platform (Rao 1979: 111-13). The location of the warehouse adjoining the Acropolis and near the wharf and dock gives evidence of a preconceived vision of the layout of the town by the settlement's authorities. Not only this, the size of the Lothal warehouse in comparison to the other two warehouses, in view of the much smaller size of the settlement of Lothal, surely is significant.

It is not quite clear what commodities were stored in the warehouses revealed at Mohenjodaro, Harappa and Lothal. In the Lothal structure, 65 terracotta sealings bearing impressions of packing material such as reeds, woven fibres, matting and cords twisted into knots on the reverse, were found in the extreme southeastern part of the extant structure (Rao 1979: 113). In view of the fact that all the sealings found in the warehouse were impressions of nonlocal seals (Rao 1979: 114), it appears that nonlocal goods were stored in this structure.

The provision of wells, drainage system and other civic amenities also gives information for an authority overseeing and responsible for aspects concerning

municipal details. We know for certain that the sites of Allahdino, Banawali, Chanhudaro, Harappa, Kalibangan, Mohenjodaro and Dholavira were provided with wells. At Allahdino, an artesian well may have been built as mentioned in Chapter I. According to Jansen (1989: 252, 253 f.n.), more than 700 wells probably existed in the settlement of Mohenjodaro, a figure calculated according to the existing density pattern of excavated wells. In interesting contrast, only 6 wells were found in the excavated portions of Harappa of which all were public wells (Vats 1940: 14) which was not the case at Mohenjodaro.

Considerable sophistication is noted in the case of the drainage system especially where the larger sites were concerned. At Mohenjodaro drains were constructed of burnt brick and were covered, provided with manholes and sullage pits which could be regularly cleaned. Drains led from most houses in the lower town to street drains. At Lothal, burnt brick drains are noted only in the Acropolis though the lower town had its own drainage system of soakage jars. At some sites, materials such as stone were utilized for constructing drains, as has been seen at the site of Allahdino. Harappan sites which have so far revealed some sort of drainage system are Allahdino, Banawali, Chanhudaro, Harappa, Kalibangan, Lothal and Mohenjodaro. At Banawali it appears that street drains

are absent but the presence of soakage jars points to a consciousness of hygiene (Bisht 1984: 96). At Mohenjodaro we find the evidence of the consciousness to provide other civic amenities such as garbage dumps, one revealed to the north of the DK area, H Section (Mackay 1938: 1).

Differences in plans and sizes of architectural elements such as residential structures gives us an idea of the existence or not of social stratification which is necessary for an urban makeup of society. Settlements where residential structures are largely undifferentiated give evidence of a relatively homogenous society and where there is considerable differentiation, the overall picture is suggestive of a large degree of social stratification. At Mohenjodaro, excavations have revealed significant differentiation in sizes and plans of houses. However, there is no spatial concentration of large as opposed to small houses and no one area was given over to a particular strata of society (apart from the citadel) if one looks only at house sizes. Examples of differentiation in house sizes can be noted from the following:

Table VI.2: Variations in Sizes of Houses at Mohenjodaro

Small Houses	Large Houses
1. House III, Block 3, DKG- 9.7 x 4.5 m	1. House X, Block 2, Section B, HR- 36.9 x 30.6 m
2. House IV, Block 3, DKG- 9.7 x 8.5 m	2. House XVI, Block 2, Section A, VS- 27.7 x 14.3 m

Contd.

Table Contd.

3. House I, Block 5, DKG- 12 x 11.5 m

4. House IX, Block 4, DKB- 9.7 x 6.6 m

5. House XI, Block 2, Section A, VS- 14.8 x 5.7 m

6. House LXII, Block 8, Section B, HR- 9 x 5.6 m

7. House LXI, Block 8, Section B, HR- 8 x 14.7 m

8. House XXI, Block 4, Section B, HR- 12 x 12 m

9. House LIV, Block 7, Section B, HR- 11.4 x 9.9 m

3. House V, Block 2, HR- 42 x 26.6 m

House plans indicate some amount of differentiation. A large number of houses at Mohenjodaro are built using the courtyard as an open space generally surrounded by various other rooms. Interestingly, courtyards or open spaces are also used to separate individual structures or houses units as seen clearly in the Moneer site of Mohenjodaro in Block B (Jansen 1984: 81; Fig. 8.4: 80). Such open spaces can also be seen in other parts of Mohenjodaro, as for example, north of House XXII in Block 4, VS, Section A and north of House XXIV, Block 5, Section B of HR (the measurements of the two open spaces are about 12.6 x 6.2 m and 12.3 x 7.8 m respectively). These can be compared to two courtyards in the Moneer area, ZV or BI which measures about 17.6 x 9.6 m and the courtyard between B III, B IV and B VI which measures about 11.5 x

7.5 m (Jansen 1984: Fig. 8.6).

Wells are often located so that they can also be used by those other than the inhabitants of the structure itself. The inner rooms were probably used for private purposes, while the rooms nearer the entrance were for more public purposes. A large number of activities were probably conducted in the courtyard. Remnants of staircases give evidence in a number of cases of the construction of upper storeys or the use of the roof. Generally each house had a bath with a carefully paved floor with drains connecting with those in the street outside. Some analysis of plans of private houses at Mohenjodaro has been undertaken by Sarcina (1979) where she has attempted to distinguish artisans' houses from those belonging to an extended family or elite members of society.

At Harappa there is really very little scope for a comparison of house plans and sizes on the basis of the widespread destruction of the site by the removal of bricks. However we do have some evidence of differentiation. House 1 in Trench VI of Mound F was a large domestic structure with a frontage of more than 30.4 m on the east, with more than 10 rooms in it and with a well (with public access) and two circular grain bins in one of the rooms (Vats 1940: 131). Possibly, House 2, adjacent to the above was also a large structure. In

contrast we have houses of mud and mud brick in Trench I, Mound D, Area J. Though the houses are average in size (House 1-14.7 x 8.4 m; House 4-11.4 x 8.4 m), the fact that they are made of mud brick and not of burnt brick should be significant. Besides these we have the evidence of reed and bamboo huts from Pit II in Mound AB (Vats 1940: 163) and of other mud huts in Trench I of Mound F (Vats 1940: 84). The workmen's quarters have been called so on the basis of their architecture which is identical; however despite their uniformity, their occupants were probably not the poorest inhabitants of Harappa as seen from the evidence given above.

Not much differentiation in plans and sizes of houses is noticed at Lothal though this is largely true of the lower town only. The constructions on the Acropolis were probably very differently conceived and executed. However, within the lower town the excavator notes differences for some structures as seen in the 'Merchant's house'. Here the size of the house - 14.2 x 7.1 m, along with its contents- sherds of Reserved Slip Ware, 2 steatite seals, 3 carnelian beads, 8 gold pendants with axial tubes, a copper bangle and 4 chert blades (Rao 1979: 91)- have contributed to such an identification. But the house immediately to the north of the merchant's house (Rao 1979: Pl. XL) too, is almost of the same size. However the merchant's house may have had a westward

extension, which is not entirely extant, and if so, the house would have been much larger. Some large structures are noted in Block G also, such as House 158 which would be about 12 x 9.5 m, but these belong to a late period of occupation at the site. The bead factory in Block F is also a large structure but has different implications which will be discussed shortly. All structures at Lothal are constructed of sundried brick and only drains in the Acropolis and wells were constructed of burnt bricks.

At Chanhudaro, any discussion of variation in plans and sizes of houses must be undertaken with a note of caution on account of the poor recoverability in the excavations of complete structures. On the available evidence, one of the largest houses at Chanhudaro of the Harappan period was in a later phase of culture at the site, termed as Harappa I. This structure filling almost the whole of Square 9/E was about 16.5 x 10. 5 m. Another complete structure, rooms 176, 425 was roughly 7.2 x 3.9 m. In the Harappa II occupation, a house on Mound I in Square 12/K was one of the largest. Apart from this, structure 174, 139, 264 in Square 9/D on Mound II was also large. The measurements of the respective structures are instructive, as they are sizes comparable to the smallest at Mohenjodaro. The house in Square 12/K was about 11.5 x 8.8 m and the one occupying Square 9/D was about 8.5 x 6.2 m. The largest houses from Chanhudaro compare favourably

with those at Lothal, a site which equates roughly in its overall measurements too with Chanhudaro. Other house reconstructions are conjectural. A number of bathing places are noticed in the plan of Mound II (Mackay 1943: Pl. IV) but are devoid of walls indicating adjoining rooms. Hence the task for discussing variations in sizes and plans of houses is difficult.

At Kalibangan it is interesting to note that structures in the northern annexe in the citadel are not very different from those in the lower town area. However some differences are noted in structures in the unfortified area to the south of the citadel (where it is thought the poorest inhabitants lived) from those in other residential areas of Kalibangan (Lal 1984: 59-61). Published evidence is scarce from Desalpur but some indications exist to show a certain amount of differentiation in houses. In a report in IAR of 1963-64 (page 11), it is mentioned that towards the central portion of the site, a structural complex with massive walls and spacious rooms was partially exposed. If this indicates some sort of public architecture, the pattern in different from other Harappan sites where such architecture is generally towards the western portion of settlements. The report on Mitathal does not indicate much differentiation between individual houses, as no complete house plans have been recovered. The excavator

notes the difference between the Late Siswal and the Harappan occupations where the latter period reveals more massive structures of mud brick with metre-wide walls (Suraj Bhan 1975: 12).

An analysis of house plans and differences in sizes of residential structures should give some information relating to the existence of social stratification in individual settlements which is a key variable in the discussion on urbanism. Delineation of the urban character of a settlement necessitates finding evidence of a socially stratified society reflected in differential patterns of living, in consumption and in relation to other members of the society. We have already studied differential patterns of housing. It is not easy to make simplistic assumptions that larger residential structures belonged to wealthier sections of society. Members of large extended families could be occupying larger structures, testifying to the prevalence of strong kin relations. However, we do undoubtedly have small, in some cases, tiny houses which could not possibly be occupied by extended families (yet, sometimes we have doubts even about this assertion as seen in Mohenjodaro. In HR area, House LVIII in Block 8 of Section B, having a frontage of only 6.6 m has been seen to have two baths). It does appear then that differential living patterns are probably practised. The evidence of the working platforms on Mound

F at Harappa and the thatched huts nearby do suggest strongly that a particular social stratum occupied such structures and they probably had a functional and social status different from and lower than, for example, the occupants of House 1 in Trench VI of Mound F, the largest extant domestic structure at Harappa.

Construction patterns may be important. Structures with more massive walls could be thought of as belonging to those sections of society who are able to afford such constructions, especially when we have evidence of close juxtaposition of the two types of structures. Such can be seen from the differences between House XVIII as opposed to House XIX and XX in HR area, Section B and House XXII from House XXV and XXVI immediately to the north in HR area (Marshall 1931: Pl. XXXIX). However Jansen (1979: 446-47) suggests that thickness of the walls could also be due to the need to carry further storeys or to combat heat by constructing thick walls. The environmental factor can be discounted here as then most structures would be thick-walked. But on the whole we can say that thick-walled structures may have belonged to more affluent members of society on the basis that such structures would have required greater quantities of construction material and also because poorer members of society would make do with smaller, thinner walled structures. House XVIII in Block 4 Section B of HR appears to have belonged to members of a

higher social strata as seen in the large size of the structure, its being surrounded on three sides by lanes and its principal entrance being a raised causeway reached by a flight of steps from Street 3 (Marshall 1931: 201-2).

An analysis of the artifactual assemblage needs a foray first into the question of elite goods. From ethnographic evidence, we know that wealth/elite goods had a social, not a utilitarian or exchange value. These goods move in distinct spheres and are not directly exchangeable with utilitarian goods. Thus we find that when wealth goods come into an individual's hands, they cannot be exchanged for consumable subsistence goods. Conversion of elite into utilitarian goods will only occur in a market situation (Brumfiel 1987: 106). We also know the forms of production and use of these goods. Wealth goods can be produced by specialists attached to the elite strata of society working under their sponsorship and direction. Hence they may be given subsistence goods for their maintenance in return for production of these goods. Or else, these goods could be produced by other craft specialists not necessarily attached to the elite. In this case social norms and restrictions will prevent generalized consumption of these goods. Another means of obtaining these goods is when they are brought by separate and/or subordinate polities to a city and its rulers as tribute.

What is also fairly clear are the uses to which such goods are put. Such goods are used by the elite as status markers, in exchanges with other elites and to reward loyal subordinates and personnel working for the elite. They could be used to reward clients, attract allies and to solicit favours from one's superiors (Brumfiel 1987: 112). They may also be given as offerings to religious institutions.

But the archaeological identification of such goods, in the absence of textual evidence, is not easy. We could discern the role of wealth goods in Aztec or Inca contexts in view of the textual material available. But in the Harappan context, we are dependent on the artifactual assemblages and their archaeological contexts. Firth (1965: 342) on the basis of valuables among the Tikopia, cautions that factors for delineating such objects may not be very obvious. Thus he gave the example of bonito hooks, saying that these objects are valuables, they had an utilitarian value, are made out of locally available materials and are made by a simple technology. However, we are constrained to accept some of these factors. Elite goods would probably be made out of exotic raw materials, would be generally produced by superior or difficult techniques, would have very few production centres and their findspots too would be restricted. They may have imitations in cheaper, locally available raw materials.

Apart from already prevalent difficulties, there are others, in that we cannot even begin to discuss objects made out of non-durable materials. The implications of leaving these out are obvious as is seen by the role of the fine cumbi cloth in the Inca state (Murra 1962). Peregrine (1991) on the basis of data from the North American chiefdoms has found a direct correlation between prestige goods requiring more labour input and more sophisticated production techniques and societies of greater political centralization. This is particularly relevant in the Harappan context too.

Elite goods and urban centres have a direct relation. These goods will be found in a much greater degree in these sites than in rural sites. These goods will be used for purposes including that of cementing already existing social relationships. In a dense clustering of individuals at an urban centre these goods will be used as expressions of dominance over other sections of society. Also in urban centres the production of these goods will be undertaken. These goods will be found at rural sites too as noted in Mesopotamia with copper, stone bowls and obsidian, stone maceheads and clay cones. Adams (1981: 78) has explained these finds as the work of part-time craft specialists in individual communities of different sizes, by the presence of elite consumers in small settlements and as ritual offerings being made in shrines.

It is very possible that production at rural sites will be for the purpose of exploiting a locally available raw material. This could be the case in the Harappan context. In the Harappan case, moreover, it should be realized that the sheer quantity and variety of craft goods will immediately give a pointer towards the urban character of sites as opposed to rural sites (see Table VI.3).

Differential patterns of consumption give some information in respect of differing social statuses. A variety of artifacts, the use of precious materials, substitutes of cheaper raw materials for more precious varieties of artifacts are all clues that can help to discern social stratification. At Mohenjodaro the variety of artifacts in the archaeological record, both quantitatively and qualitatively, is a significant feature. In a number of cases, we find imitations of objects in cheaper raw materials, as exemplified by terra-cotta imitations of long barrel-cylinder carnelian beads, of terracotta spindle whorls as cheaper substitutes of faience whorls. Gold and silver are rare in the Harappan culture and are used solely for ornamental purposes and for rare objects such as the silver vases (Marshall 1931: Pl. CXL 1, 2, 3).

The attempt to study objects in relation to their findspots within a settlement in the context of

architectural elements, is easier in smaller sites where the variety and quantity of artifacts is less. Such has been seen in the case of Lothal where Rao (1979: 91) tried to identify a structure in the lower town as a merchant's house. In the case of Banawali also a merchant's house and the house of a jewellery dealer were tentatively identified on the basis of artifacts found within the structures (Bisht 1982: 117). At Chanhudaro too, the number and variety of artifacts found in room 215 on Mound II suggests some specialized non-residential function for the structure. The largest extant structure of the Harappa II occupation at Chanhudaro (in Square 12/K, Mound I), was studied in the context of the associated material assemblage and a list of the finds could be instructive :- 2 pottery stands; 1 large round stone; fragment of faience bangle; pottery grating; model cart wheel; gamesman; black steatite seal; white steatite seal; steatite button; etched carnelian bead; white steatite spacer; hornblende pendant; light blue faience bead; light green faience bead; grey faience bead. Among these there is no evidence of any artifacts such as terro-cotta beads suggesting occupation by a poorer section of society.

In larger sites such as Mohenjodaro and Harappa, distinctions as were made for the Chanhudaro structure are not easy to make. Spatially small structures which may suggest the residence of an ordinary occupant of the city

One indicator to discern economic and occupational differentiation is the presence of large, public architecture (such as granaries, the Lothal dock, large residences) requiring specialized personnel for manning them. The spatial demarcation of certain areas within a site such as the Citadel from the lower town brings a suggestion of specialized personnel and retainers coming from the lower town to work in the Citadel. The number of civic amenities such as drains, soakage pits, garbage dumps, streets and lanes would all have required a body of personnel responsible for cleaning and maintenance.

Within craft production, a study of the material assemblage should give an indication of differences between occupations, which is a hallmark of urbanism. In an urban context, not all members of a community undertake the same activities. Occupational differentiation leading to specialization in different economic lines is a significant feature of urbanism. On the basis of difficult technologies and rarity of raw materials utilized, it is possible to differentiate between separate craft traditions. The production of stoneware bangles or faience miniature jars or steatite seals require specialized producers and a considerable period of training and apprenticeship before engaging in production. The objects produced too are not those that are essential requirements for an ordinary domestic household. Thus

differentiating between technology, the use of artifacts, and the raw materials required for separate artifacts in the material assemblage, one can infer that there would be occupational differentiation between producers of different craft objects.

In this context it is necessary to note the presence of actual craft work indicators to reveal production. Simply finding artifacts requiring considerable expertise in their manufacture or of a valuable nature, does not mean that the society was divided on the basis of occupational differentiation. Thus, we do find differences between sites of the Harappan culture on the basis of the presence or absence of different craft working indicators. The information concerning the presence or absence of craft working indicators as also of the artifacts themselves is set out in Table IV.1. From the table it appears that, on the basis of presently available information, Harappa, Chanhudaro, Mohenjodaro and Lothal have shown evidence for working of the majority of crafts that have been studied, as discussed in Chapter IV. Other sites have revealed evidence of the working of one or two crafts such as Allahdino and Balakot for metallurgy and shell working and Shortughai; for bead making and metallurgy, Kot Kori and Kot Diji, Surkotada and Nageshwar for shell working.

The demarcation of particular areas within individual sites for craft working is a strong, positive indicator for the presence of a separate group of craft producers. The logic behind this statement is that an activity undertaken in every domestic unit will leave archaeological debris that will reflect a uniform pattern for the whole settlement. Thus activities undertaken at only specific loci, even if associated with evidence of domestic occupation, would indicate that only certain individuals engaged in those particular activities. Some sites give evidence of a craft undertaken in a particular area of the settlement. Such is the case with stone tool working seen at Surkotada and the separate pottery making area at Kalibangan to the south of the citadel in an unfortified part of the mound (Lal 1979: 86). [It should be clarified, however, that pottery making in a separate part of a settlement need not necessarily indicate a separate pottery making group as this activity could be purposely located in a distant part of the settlement to limit pollution; similarly we note the presence of kiln wasters, muffles and pottery debris lying all over the peripheral areas of Mohenjodaro (Bondioli et al 1984:27) and the initial processing of shell undertaken on a mound northeast of the Moneer site at Mohenjodaro (Kenoyer 1984b: 107)].

At Surkotada stone tool making debris was noted in a concentration in an area about 200 m away from the main

habitation mound (Joshi 1972: 132, 135). This is significant as stone tool working can be easily carried out in domestic contexts. A site like Nageshwar has given evidence of working of shell from almost all parts of the mound. At Chanhudaro, Mohenjodaro and Harappa, though we get evidence of the working of different crafts from all over each site, the data does not point to craft working undertaken in every residential structural unit, which could possibly be the case with the eastern part of Chanhudaro which is similar to the Moneer southeast area at Mohenjodaro. At Lothal, craft activities are concentrated in the lower town, with some dyeing done in the Acropolis.

At Mohenjodaro there is archaeological evidence to suggest that facilities were shared by various craftsmen. This is seen from the location of kilns. Kilns are generally located in areas which have access to the public and are not confined architecturally, suggesting their use only by certain individuals or groups. This is clear by the kiln located in an open area north of lane 2 between houses XXII and XXIV in VS, SectIon A, Block 4; and by the kiln in HR area, Section B, Block 2, in a courtyard between Houses VII and VIII. 2 kilns in DKG, Block 1 also were probably used by a number of people, as suggested by the size of the entire Block.

It is, therefore, interesting to see the contrary evidence from Lothal. Here, the bead factory is evidently segregated and restricted from general use by a surrounding wall. This pattern would fit in with the idea that urban features were introduced into Lothal with the Harappans. With the pattern of how an ideal city should be constructed, the inhabitants also reveal a mixture of occupations suggesting specialization.

Probably the clearest picture of craft producers working in separate areas may be revealed in the Cholistan area. The survey of the area has revealed that in the Mature Harappan period, 45.4% of 174 sites are purely industrial sites though sites giving evidence of residential and industrial functions also occur (Mughal 1982:92). The significance of pure industrial sites is unmistakable. They imply that craft workers are going out to a separate area to work at a particular craft which must entail workshop production. The crafts which were practised in separate industrial sites were the firing of pottery, bricks, small terra-cotta objects, the glazing of faience objects, and the melting and possible smelting of copper. The common feature in all these crafts is the use of heat facilities at some stage of the production process; the separate location of these crafts could have been primarily to avoid the effects of pollution in residential areas. The picture from the Cholistan could

give us some clues to explicate the scarce evidence for metal working at Mohenjodaro.

As outlined in the earlier part of this chapter, the presence of non-food producers is an important indicator of the urban character of a settlement. Archaeologically, the scale of individual production is not easy to decipher especially where craft working indicators largely comprise tools for manufacture or unfinished objects. In early excavations, rarely was debris from craft production retained during excavations. The surface survey at Mohenjodaro does give us a more complete picture of craft working in particular loci, but we have spatial rather than chronological information. The requirements for the products manufactured would largely determine the scale of working and requirement for products are governed by the value of the products. Another significant factor is also the concerned technology but not necessarily the raw materials involved in production. Rare materials such as lapis lazuli could be worked by any lapidary worker but materials such as gold combine rarity along with a difficult technological process.

The presence of non-food producers is also discernible by the degree of standardization, not only in the products manufactured, but also by tools utilized. Variety in artifacts in the form of sophistication of

basic types is possibly a result of requirement of these artifacts by social groups who are able to sponsor such production or able to afford such products. There is a considerable degree of standardization in Harappan artifacts clearly illustrated by the cubical chert weights and the steatite stamp seals. The functions performed by these two classes of artifacts requires a high level of standardization, accuracy and precision.

Among objects falling into other categories such as ornaments, utilitarian goods, tools also there is some standardization. Steatite microbeads are a Harappan marker while the variety of other shapes in steatite such as the inlaid beads, decorated steatite beads, zoned beads are indications of the advanced nature of the steatite bead maker`s craft. Faience tubular beads are almost ubiquitous, while other types such as segmented, gadrooned varieties are also found. Faience is the material used for a large number of unusually shaped beads. Agate and carnelian short barrel cylinders are again ubiquitous, with the long barrel-cylinder beads being a distinctive Harappan artifact though not found at all Harappan sites. Thus, here we find that variety going beyond the basic could be a reflection of elite wants and requirements. Elite demands for artifacts out of the ordinary would spur craft production into innovation. This is amply reflected in the variety of craft goods revealed at Mohenjodaro (see

table VI.3).

Craftsmen brought from other areas and made to work at their craft under centralized supervision would probably be full-time non-food producers. Archaeologically, they would be distinguished by their working and living areas situated close to the loci of a settlement's elite population. In Harappan sites, as noted in Chapter V, we have no clear-out evidence of a close relation between certain craft producing activities and elite supervision. Also we have no evidence of craftsmen coming from outside individual Harappan settlements due to the lack of literary data and the absence of information regarding the presence of different ethnic communities in a single settlement. Neither can we accept that craftsmen living near loci of raw materials would be the only experts in that material and would be brought to urban centres, as it is plausible for craftsmen living far from the source of a particular raw material to acquire expertise in the working of that material.

It remains to collate the preceding information to fit in the known evidence from Harappan sites into a framework elucidating the urban character of the Harappan civilization. Table VI.1 shows clearly that in the Harappan context, at least, size cannot be taken as a primary indicator for urbanism.

We can have no doubt of the true urban character of

sites like Mohenjodaro and Harappa. This is clearer in the case of Mohenjodaro on the basis of the better preservation of its remains. On the basis of size, planned layout, provision of civic amenities, roads and wells, differentiation not only between public and residential structures but also between different residential structures, the variety and quantity of the artifactual assemblage, the presence of luxury goods and exotic raw materials, the evidence for occupational differentiation all lead to the conclusion of Mohenjodaro as a significant urban centre. If we study the Harappan culture as a whole, Mohenjodaro appears to stand out in various aspects pointing to a predominant position for the centre in antiquity. We find the city's structures built entirely of burnt bricks of uniform sizes, revealing an immense effort in production and supervision. The ubiquity of seals points to a widespread literacy in this city. The evidence of the working of all the major crafts pointing to the immense requirements of this city and the significant working of elite objects in close proximity to their consumers. The transporting in of exotic raw materials into Mohenjodaro implied that the value of the goods manufactured far outweighed the costs of transportation of the raw materials. It is very probable that Harappa would give much the same information if its structures were still extant.

It is likely that Chanhudaro was anciently a small city or a town. Chanhudaro has a number of urban features such as the functions that were carried out at the site and the provision of a number of civic amenities for its inhabitants. Though archaeologically it appears as if Chanhudaro primarily functioned as a craft working centre one cannot negate the role of agriculture as one of the means of subsistence for the inhabitants. For Chanhudaro it is more a case of introduced or instituted urbanism. Urban growth at Chanhudaro was probably not an evolutionary process, an organic growth from within; this assertion being primarily on the evidence from Amri. The role of Chanhudaro appears to have been enforced on it. Very likely, Chanhudaro was in the nature of a town, supervised by officials or an elite group sent from the cultural centre, perhaps Mohenjodaro. Hence we find not much evidence of craft working from the Mound I area of the site. Though the largest structure of the Mature Harappan period is on Mound I, there is no great difference between this structure and another on Mound II. Thus there may have been supervisory personnel located in the heart of the craft working area. The artifactual assemblage testifies to the significance of the functions undertaken in this settlement. The bringing in of non-local raw materials signifies the importance of the crafts being produced here. One cannot negate the links between

a village: and a city in an urban network, but the role of Chanhudaro appears to far exceed the envisaged role of village in an urban framework. A village in the territory of an urban centre would to a large extent retain its economic autonomy. Rather than materially provisioning the urban centre, it may provide the labour to work at certain activities in the urban centre. At Chanhudaro we find definite evidence for craft working, whose products must have had a final destination, some point of consumption. Hence the functional nature of Chanhudaro, with its implications of an extra-local link, must elevate the position of the settlement above that of a village.

Lothal is distinctly urban, but as with Chanhudaro, a case of instituted urbanism. The urban character of Lothal is clearly brought out by the evidence of planning in the layout of the settlement and the provision of various amenities, pointing to supervision and maintenance; the elevation of the Acropolis to denote occupation by special groups; by the construction of a warehouse; by the evidence of occupational differentiation in the spatial segregation of various crafts; by the indirect evidence for social stratification (administrative personnel or elites, craft workers and other inhabitants of the lower town, dock workers and warehouse personnel to name a few).

It is not at all easy to delineate rural Harappan sites and no single variable can be adopted to differen-

tiate between urban and rural. If we take size as a criterion, Allahdino one of the smallest Harappan sites with a size of 90 x 90 m would seem to be a good choice for a rural site. However this is belied by the presence of exotic raw materials such as silver and gold, by the evidence of craft working (metallurgy and shell working) and by the provision of amenities such as drainage channels and wells. If we take factors of social stratification and occupational specialization, then we would have to negate the character of Mitathal as an urban site-this site has only revealed very negligable traces of craft working [one unfinished bead and an agate nodule (Suraj Bhan 1975:7-8)], and very few raw materials brought from distant areas (a good example in the scarcity of shell at the site and the very few indeterminate metal pieces). Even a material as common as steatite is rare at Mitathal [only 5 beads in stratified Harappan levels and 11 from unstratified levels (Suraj Bhan 1975:75)]. Only faience bangles are attested in large numbers and in considerable variety (Suraj Bhan 1975:76). Thus the material assemblage appears to be particularly poor at Mitathal and houses are of mud brick, though no complete house plans are available. However what is interesting about the site is its division into two mounds, the higher and more prominent to the east and the lower and more extensive to the west. The two mounds are separated by a

gap of nearly 20m (Suraj Bhan 1975:3-4). Thus the layout of the settlement follows that of much larger, distinctly urban centres such as Mohenjodaro, with the perhaps significant distinction of the "citadel" area being in the east.

Though the site of Nageshwar is too disturbed for us to discern information of the layout and planning of the ancient settlement, the material assemblage according to Table VI.1 and VI.3 reveals a largely socially undifferentiated settlement. In the concentration of its inhabitants on shell working lies the role of the site. No attempt was made to transform Nageshwar into an urban centre; it remained physically a village settlement exploiting a locally available raw material. However we must note that if we take a lack of self sufficiency as a major characteristic of urbanism, then we really cannot consider sites such as Nageshwar as rural. The function of the site as a shell working centre made it dependent on others for consuming the products it manufactured. The probable Mature Harappan origins of Nageshwar may also indicate the deliberate settling of people here to exploit a particular raw material. The role of settlements such as Nageshwar in producing artifacts for the urban consuming centres will explain the incorporation of such settlements within the Harappan economic structure. It is very probable then that true rural villages will be those

that will be within the hinterland of a Harappan town or city, but will show no or very few Harappan markers. They may reveal other wares signifying the presence of other ethnic groups. It is very probable that these village sites if occupied for short periods compared to large urban centres will leave few archaeological traces and hence will not be recovered. But it must be realised that the finds of even a few Harappan artifacts will show the articulation of these settlements within the Harappan culture.

The relevance of urban centres in the context of craft production is valid from various viewpoints. The density of population makes for increased consumption. The variety of manufactured products is a reflection of the role of political powers in urban centres and of the presence of a number of diverse social groups in the community. The presence of elite goods requiring much labour in their production is a result of the excess labour that must be diverted to non-subsistence related activities and as mentioned earlier, of the political power and elite strata which utilize this labour for the production of goods which will be largely used by themselves. Economy of transport costs will also make it worthwhile to locate production in the proximity of consumers.

All craft production centres which focus on crafts whose products will be used by nonlocal consumers will not

be rural in character. The role of the inhabitants as producers will negate any self-sufficiency which must be a characteristic of rural settlements. Thus the weaving of craft centres with large cities and rural settlements into one economic structure will be fulfilled through the role of distribution where the large cities will display a greater consuming potential than small rural settlements in view of their internal structure.

From the viewpoint of this thesis, we may reiterate the relevance of craft production to urban centres. Social differentiation in urban centres is brought out by different consumption patterns of non subsistence goods as seen by variations in craft products and the use of cheaper materials to substitute for the more exotic. In large urban centres as mentioned earlier, valuables may be found in smaller structures suggesting their use as rewards to subordinates. It is clear then that manufactured elite goods were exchanged to fulfil particular purposes. The smaller number of valuables found in smaller settlements in particular. concentrated loci could indicate the presence of limited elite personnel such as at Banawali. It is in large urban centres where sophisticated craft products are found in more diverse contexts that the potential of such settlements for consumption is realized.

The presence of valuables in a settlement is an indica-

tor of social stratification while evidence of production implies economic differentiation. Sophisticated crafts would have required trained craftsmen with skill that could only have been acquired over a long period. Skilled workers would not have comprised a very large sec-tion of the population as their activity could not have been sponsored at each settlement. The production of valuables must have been of primary interest to the elite who would ensure that such goods were produced in limited centres.

The bringing in of heavy inputs such as raw materials and fuel into urban centres overcoming transport costs would indicate the importance of craft activities. This pattern of engaging in production close to the consumers is particularly relevant for Harappan craft production. The value of the goods produced and the uses to which they were put would have dictated this pattern of production. Large Harappan cities as centres of political power must have been the main consumers of manufactured valuables. Ceremonial prestations by the elite, tribute offerings to the elite, ritual offerings in shrines would all have been more relevant in urban centres and must have had direct repercussions on the expansion of craft production. This expanded activity would have been centred in urban settlements to enable political elites to acquire control over the output.

We must consider craft production as significant,

even crucial, to the society and economy of the Bronze Age. In the absence of a market economy and the commoditization of resources, craft goods would have functioned as symbols of power, furthering political interests and cementing social alliances. The support of production specialists by political elites for the above purposes would have been one of the primary functions of the earliest cities.

Table VI.1

List of Urban Features

S.No.	Site	Fortification	Number of Mounds	Public Architecture	Public Storage Facilities	Provision of Wells	Variations in Plans and Sizes of Houses	Drainage and Civic Amenities	Size
1.	Allahdino	-	1	(?)	(?)	✓	(1) ✓	✓	0.8 ha
2.	Amri	-	2						8 ha
3.	Balakot	✓	2	✓	‡	‡	‡	✓	2.6 ha
4.	Banawali	✓	1	‡	‡	✓	(1) ‡ (2) ✓	✓	4.5 ha
5.	Chanhudaro	-	1	‡	?	✓	‡	✓	7 ha
6.	Dabarkot		1						18.6 ha
7.	Desalpur	✓	1	?					1.3 ha
8.	Dholavira	✓	3	‡	‡	✓	‡	✓	48 ha
9.	Harappa	✓	2	✓	✓	✓	(1) ✓ (2) ‡	✓	150 ha (?)
10.	Kalibangan	✓	3	✓	-	✓	(1) - (2) ‡	✓	12 ha
11.	Kot Diji	-	1						2.1 ha
12.	Kot Kori		1						6 ha
13.	Lohumjodaro		1						
14.	Lothal	✓ (Mud brick)	1	✓	✓	✓	(1) - (2) ✓	✓	7.5 ha
15.	Manda								
16.	Mitathal	-	2	‡	-		‡	-	Mound I: 1.9 ha Mound II: 5.2 ha
17.	Mohenjodaro	✓	2	✓	✓	✓	(1) ✓ (2) ✓	✓	125 ha (?)
18.	Nageshwar	-	1	‡	‡	‡	‡	‡	1.2 ha
19.	Pabumath								3.5 ha
20.	Rangpur								
21.	Rupar								
22.	Shortughai		2						2.5 ha
23.	Sotta Koh	✓	1	‡	‡	‡	‡	‡	
24.	Surkotada	✓	2 (?)						2.6 ha
25.	Suttagendor	✓	1	‡	‡	‡	‡	‡	1.5 ha

‡ : Information Not Available

Table VI.3

List of Exotic Materials and Elite Goods found from Harappan Sites.

S.No	Site	Miniature Faience Vessels	Faience Objects	Silver	Gold	Lapis Lazuli	Minute Steatite Disc Beads	Long Barrel Cylinder Carnelian Beads	Ivory	Stoneware Bangles	Decorated Steatite Beads	Metal Statuettes	Metal Vessels	Seals	Etched Carnelian Beads
1.	Allahdino			✓	✓									✓	
2.	Ali Murad														
3.	Badah								✓						
4.	Balakot														
5.	Banawali	✓	✓		✓	✓								✓	✓
6.	Bedi Kotiro														
7.	Chanhudaro	✓	✓			✓	✓	✓	✓		✓	✓	✓	✓	✓
8.	Dabarkot		✓	✓	✓								✓	✓	
9.	Damb Buthi														
10.	Desalpur			✓										✓	
11.	Ghazi Shah			✓			?								
12.	Harappa	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
13.	Kalibangan		✓				✓		✓	✓				✓	✓
14.	Karchat					✓									
15.	Kot Diji														
16.	Lakhiyo														
17.	Lohri		✓												
18.	Lohumjodaro		✓		✓									✓	
19.	Lothal		✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
20.	Mitathal	✓	✓						✓						
21.	Mohenjodaro	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
22.	Nageshwar		✓												
23.	Rakhigarhi		✓				✓								
24.	Rangpur		✓		✓		✓		✓						
25.	Rupar		✓										✓	✓	
26.	Shortugha				✓	✓								✓	✓
27.	Surkotada		✓			✓			✓						✓

CONCLUSION

In this thesis, we have attempted to study the role of craft production within the Harappan economy. Rather than concentrating on technology, the aim has been to explore the socioeconomic structure within which Harappan craft production matured. We have seen in Chapter I that Harappan agriculture is still little understood, as agricultural activities are largely archaeologically undetectable. Tools which would be an indicator of production have rarely survived in Harappan contexts. Non-subsistence production on the other hand provides us with most of our archaeological data.

In the Introduction, we noted that Harappan craft production has been dealt with in varying detail by different scholars. The references to craft production made by the early excavators of Harappan sites form some of our primary data in this thesis. Further work on various crafts have enhanced our knowledge of Harappan productive capacities. However, the majority of such work has been done within limited parameters.

Most ethnographic information on production focuses on agricultural production. Craft activities on the other hand are often summarily dealt with and it is largely the techniques utilized that are considered more important than the organization of such production and the aim of

manufacture of non-utilitarian objects. Moreover aspects such as division of labour, location of production and scale of production which may give us important clues to understand our archaeological data are often lacking. We have been able to collect ethnographic data for various aspects such as part-time or full-time craft working, division of labour and subspecialization, regional specialization, itinerancy, procurement of raw material, location of production, the scale and nature of product requirement and the payment of craftsmen. The aim was to deduce aspects of craft production that were likely to leave archaeological indicators. These indicators in turn were tested in relation to the Harappan data. Only in a few cases do we find that archaeological indicators are applicable to the Harappan context. We find evidence of subspecialization (separate processes of bead making found from different loci within settlements such as Chanhudaro and Mohenjodaro, for example); regional specialization in the case of shell working and lapis lazuli bead making ; the location of production within architectural contexts, within settlements and between different settlements. Yet the ethnographic data informs us about aspects which would leave no archaeological indicators. The division of labour between skilled and unskilled members of a household working at a craft, the seasonality of production, all can be inferred taking ethnographic data into consideration.

Harappan craft technology was studied in Chapter III. The entire data regarding processes and tools utilized, amount of labour and time and space required for various crafts were collected. This body of data provided us with particular evidence. First we were able to understand better the configuration of archaeological material and make inferences about the contexts of craft activities in terms of space and organization. However, in a number of cases, the exact activity being performed was not clear, as craft tools were found unassociated with production debris. Few craft tools are unambiguous in their functions, while a number like chisels and saws can be used for multiple purposes.

A detailed study of Harappan technology also, illustrated the sophistication of Harappan crafts and the `considerable` investment of labour that must have been involved. Examples of crafts requiring extensive time and skilled labour are the production of etched carnelian beads, carved steatite beads, faience miniature jars and objects produced by cire perdue and the carving of seal designs.

Spatial requirements for Harappan crafts are also noted to vary : shell cutting, seal carving, weight and bead making can be easily undertaken in a room, while metallurgy, pottery and faience production would require

more space due to the installation of furnaces and working areas for other processes. Some craft processes such as pottery firing and the initial processing of shell need to be undertaken at a distance from habitation areas to prevent pollution.

Harappan craft production also makes clear the multiple uses of raw materials for a varied range of objects. Ornaments and utensils were made out of faience, steatite and silver; and ornaments, tools and utensils out of shell and copper/bronze.

A comparative study of craft production in the Mature Harappan, as well as in the Early and the Late Harappan periods highlighted the differences between the cultures. Both the Early and Late Harappans utilized a far smaller range of raw materials than that exploited by the Mature Harappans; rarely were non-local materials utilized. The expansion of craft production in the Mature Harappan period embraced a far greater range of craft technologies. The result was an extensive range of products, for diverse purposes and the use of exotic materials for many crafts.

The Early Harappans appear to have been satisfied with simple crafts, changing a raw material into a required object with none too complex technologies involved. The Mature Harappan period however revealed the

practice of a number of crafts which totally transformed the raw material into a different object. This is clearly illustrated by the use of silica and alkali ingredients to produce faience, the etching of carnelian beads and the production of decorated steatite beads.

One other issue arising out of the use of non-local materials by the Mature Harappans is significant here. The Mature Harappans appear to have ensured the regular availability of certain raw materials by the settling of Harappan communities at source areas. Examples of these are Shortughai, Nageshwar and Balakot. We know that shell was little used by the Early Harappans, but the widespread use of shell in the Mature Harappan period is explained by the establishment of communities at Nageshwar and Balakot. In Bactria, colonies were probably set up to exploit the locally available lapis lazuli. It appears that access to lapis lazuli was not left to chance (Ratnagar 1981).

A survey of craft products within the Harappan region as a whole was undertaken in Chapter IV. The aim was to understand the relation of production centres to sites where products were finally consumed. Apart from this, sources of various inputs such as raw materials and fuel were also outlined to enable us to relate between these and production centres.

Production centres have largely not been located near

raw material sources. Only where shell working is concerned do we note that a number of shell cutting centres were located in proximity to the coast. Craft centres have also not been located near fuel sources. The picture that emerges from our survey hints rather at the location of production near consumption points. The transporting of raw materials and other inputs was preferred to locating craftsmen near input sources.

In some cases such as seal carving, weight making, production of etched carnelian beads and faience miniature jars, the nature of the finished goods must have dictated that production be undertaken near the consumers who may have been a small proportion of the entire population. Restrictions on the use of particular goods would also have been maintained by fewer production centres for these goods. Thus, seal carving was noted at only four centres while weights were produced at only three centres and etched carnelian beads at two centres. The value embedded in certain objects would have negated costs of transportation of raw materials and other inputs.

We have delineated objects that were rare or complex to make and those which had imitations in cheaper materials as luxuries or wealth goods. That certain goods must have been valuables or used only by specialized individuals also appears so from the number and location of findspots of such goods. Weights, etched carnelian

beads, faience miniature jars, long barrel-cylinder beads are found at very few settlements.

On the other hand, the extensive requirements for other goods such as regular stone beads and shell bangles is inferred from the number of production centres for such goods and their ubiquity over the Harappan region. A far larger proportion of the Harappan population appears to have been able to afford stone beads and shell bangles unlike etched carnelian and long barrel-cylinder beads and faience miniature jars.

Technology is not such a reliable factor for ascertaining the value embedded in certain objects. It is the function of objects which is more important. For example, weights which were not difficult to make were in fact produced at very few centres, so as to assure the uniformity and accuracy that must have been functionally necessary for such objects. The high level of literacy required for the production of steatite seals must also have limited the number of production centres. The number of skilled literate craftsmen in the Harappan culture as a whole must not have been so many as to be dispersed over a number of settlements.

To cohere our data on production and findspots of finished goods, we have gone into the means of distribution of craft objects. We have noted that market

forces and the use of money would not have governed production and distribution of Harappan craft goods. Production and distribution in organised guild fashion would also not apply for the Harappan period.

Exchanges could have taken place through itinerant craftsmen or full- time traders but these means are again difficult to accept for our period as regular interactions with outsiders purely for the purpose of profit may not have been viable in the Harappan culture. Periodic `markets` may have existed but these would have mainly dealt with utilitarian goods. The movement of elite artifacts relied on other means.

Gift exchange may have been a significant means of product distribution. Exchanges between kin may still have been prevalent in this period, but more formalized gift exchange in the form of ceremonial prestations between elites probably accounted for much of the transfer of Harappan `luxuries`. Valuables may also have been given by rulers to subordinates which may explain the widespread finds of luxuries in Mohenjodaro. Such exchanges,as also those between high-ranking kin groups may account for the presences of valuables in smaller Harappan settlements. Finds of Harappan craft objects such as long barrel-cylinder and etched carnelian beads outside the Harappan region may also have reached their

destinations through gift exchanges between ruling elites of different cultures.

Organized transportation networks bringing raw materials to craft centers and distributing finished goods to consumption points must have existed. The organization of these must have been in the hands of the Harappan ruling elite. It is difficult to imagine that settlements such as Lothal and Chanhudaro would have been established without any networks to transport finished goods to other settlements. The transfer of objects used in administration and exchange, such as weights and seals, also must have been in the hands of the ruling elite, to prevent unauthorized use of such objects.

Our survey of craft activities across the Harappan region resulted from an analysis of the archaeological data from each excavated Harappan site. The presence of indicators such as raw materials, unfinished objects, tools, debitage, and objects kept for reuse indicated that production activities were undertaken at particular settlements. The discussion in Chapter V focused on three settlements which from our initial study were noted to be craft centres. Our aim was to study primarily the reasons for craft production at these centres. All the three settlements revealed the production of a number of crafts, which was the primary reason for studying them. Settlements such as Nageshwar would have given data

regarding only one craft. The organization and economy of centres undertaking multiple production activities were bound to differ from settlements practising a single craft.

A contextual analysis of craft indicators within the settlements of Mohenjodaro, Chanhudaro and Lothal was undertaken. This analysis revealed the following points. Crafts in most cases appear to have been practised in domestic contexts : rooms or courtyards of residential structures reveal craft indicators. In very few cases do we note workshop production. One example is the Lothal bead workshop. The identification of non-residential workshops from the other two settlements was not evident. At Chanhudaro, room 215 could have been a workshop but could also have been a storage area for craftsmen working with different materials. At Mohenjodaro we have speculated that the Moneer southeast area could have functioned on the lines of a workshop. This is conjectural as the area has not yet been excavated. Craft production in all other cases was undertaken in domestic contexts. Thus it appears that the Mature Harappan craftsmen worked primarily in their homes, with only rare instances of workshop production. It should be significant that so far only bead making has given evidence of being practised in workshops. This fact, allied with the number of bead making centres for the

entire Harappan region must indicate the large requirements for stone beads among the Harappans.

The study of craft indicators from their findspots within Harappan craft centres also indicates a measure of subspecialization. Different craftsmen specialized at separate processes within each craft as indicated by the distribution of craft indicators for each craft. This is especially clear from the evidence of bead making. The craftsmen flaking or shaping the initial roughouts were different from the drillers and from those who ground and polished beads. The distribution of indicators for different processes of other crafts is not as clear. For most other crafts, we find mainly unfinished objects as craft indicators and finds of raw material in other cases. But the lack of association of production debris and facilities wherever required makes the identification of different processes difficult.

Chanhudaro and Lothal were primarily craft centres, established for specific purposes. At Lothal, the impetus for the location of Harappans here must originally have been to arrange for the transportation of local raw materials. Craft production was added to the functions of the settlement. Production of various goods, such as seals and metal objects, beads and shell objects appears to have been in excess of local requirements. Chanhudaro

seems to have entirely focused on craft production. Its location near Mohenjodaro must have been intentional and strategic. Raw materials were brought to this settlement, worked here and sent to other settlements across the Indus and further. This centre also must have sent on raw materials to other craft centres such as Mohenjodaro. Production at both Lothal and Chanhudaro have been speculated as probably having been in excess of local requirements. This must indicate that production was primarily for non-local consumers.

We also have evidence that some manufactured goods were used at Chanhudaro. Thus production at Chanhudaro was also aimed towards the needs of local inhabitants, but a far larger quantity of manufactured goods were transported out of the settlement.

Chanhudaro by itself was not located close to raw material sources. It is only in comparison to Mohenjodaro that it is closer to raw material sources. Production at this centre must have been significant if raw materials and fuel were being transported considerable distances. Thus, the role of Chanhudaro as a centre manufacturing a number of Harappan `luxuries` such as etched carnelian beads and long barrel-cylinder beads becomes significant. Chanhudaro is also one of the very few centres producing seals and weights.

Mohenjodaro in contrast is not primarily a craft centre. A number of diverse crafts were practised here but all these craft activities appear to have been part of the myriad functions of the ancient city. Production seems to have been geared to the needs of local inhabitants and in some cases (such as metallurgy) may not even have satisfied local needs. Bead making undertaken in the Moneer southeast area may have accounted for the requirements of the local inhabitants. However, we know that special beads such as etched carnelian beads and long barrel-cylinder beads were not made at Mohenjodaro. These were probably brought from Chanhudaro. The few artifacts found made of lapis lazuli could be accounted for by the limited indicators for this craft. The evidence for steatite working is however difficult to explain in view of the vast quantities of steatite objects found in the excavations. Stoneware bangles were made at Mohenjodaro which have so far been found at few Harappan settlements. Thus in most cases production appears to have been just enough or less for the needs of the Mohenjodaro populace. However, chert drill making attested to in the Moneer southeast area must have been in excess of the needs of local craftsmen and may have been sent to other bead making centres. Thus Mohenjodaro in contrast to Chanhudaro and Lothal was a consuming settlement, an urban centre where craft production was only one out of various economic functions.

Thus, on the whole it would seem that the status of separate Harappan settlements must have differed considerably. Settlements where no crafts were pratised must have been in a dependent position as all manufactured products would have to be transported to them. Such settlements may have been composed of a population which was economically and socially homegenous unlike settlements where specialized craftsmen were based. Settlements without craftsmen may have revealed a lack of division of labour among the populace unless there was a specific function or purpose for the location of the settlement. This may have been so in the case of Kalibangan. Here we have no evidence of craft production, apart from some pottery production. Kalibangan in spite of not revealing any craft activities, has reported a vast quantity of crafted objects. Kalibangan may have served as a regional centre for the Harappan culture. The vast quantities of metal artifacts found at the site could indicate its proximity to a metal working centre as is also apparent its relative proximity to metal ore sources in Rajasthan.

The status of craft centres must also have differed as noted from the evidence in Chapter V. Centres such as Chanhudaro and Lothal which manufactured for outside consumers must have been in a more dependent position than

a craft centre such as Mohenjodaro which produced mainly for its own consumption and moreover availed of products from other craft centres. On the other hand, craft centres such as Chanhudaro and Lothal may have occupied a more prominent place in the Harappan economy than Nageshwar or Balakot. The latter two settlements were specifically established for exploitation of a local raw material while transportation costs of most inputs were outweighed for production at Chanhudaro.

Yet another aspect arises from the above points. Here we note the context of craft production in a settlement such as Mohenjodaro. Mohenjodaro as noted earlier was primarily a consuming settlement. Craft production was probably one among many other activities in this ancient city. Here we enter into a discussion on the phenomenon of urbanism. We have considered the structure of the population of a settlement as more important than the size of the population (though size cannot be entirely negated). In the case of the Harappan culture, we have also studied various architectural elements and provision of civic amenities to assess the role of a governing or ruling elite in Harappan settlements. The disassociation of a certain proportion of the population from primary food-producing activities is of particular significance in an urban society. The multiplicity of economic functions will make for socioeconomic differentiation of the

population.

We assume that in rural settlements too there will be some amount of division of labour and occupational differentiation. However, in urban contexts, the proportion of a non-food producing population will be far greater, more formally organized and will have a widespread rather than local impact. The role of a ruling group in urban settlements will have more far-reaching power and influence than the element of leadership in rural centres. Urban settlements comprising a dense, concentrated population will provide political elites with `considerable` control over labour. The attraction of occupation specialists to urban settlements and perhaps the bringing in of other production specialists will increase the stature of the urban centres. The degree to which these diverse strands of the population will be controlled and woven together will depend on the political stability of the rulers.

With this background of the role of political elites in urban centres, craft production acquires new dimensions. In an urban context, craft production must expand with the requirements of a dense, nucleated population. Moreover, the existence of different social groups will necessitate the production of a wide variety of crafted objects. Political interest in craft production is of primary value in the context of this

thesis. In the period with which we are concerned, commoditization of land has not yet occurred. In such a situation, craft objects occupy a primary position in the society and economy as valuables or luxuries. It is these objects which stratify individuals and groups into separate hierarchical levels. The position of individuals at the apex of the hierarchy will depend on their ability to restrict consumption of valuables. Maintaining control over sources of raw materials and distribution, and primarily over production, will ensure the restriction of these goods.

We have been careful also to delineate between wealth goods and other goods which may have had a restricted use due to other reasons. Distribution of objects such as the Surkotada bangles and the Tivela bangles from Balakot signify regional styles and preferences rather than socially instituted restrictions.

The significance of urban centres for craft production arises as urban settlements will be the loci of the political elites. The production of valuables and the working of complex technologies requiring skilled craftsmen will be necessary in urban centres; production will hence be in close proximity to the elite consumers. The access of the urban centre to a large area (the hinterland) will enable the procurement of a wide range of

raw materials. The transportation of raw materials and other inputs would have been organized by the ruling elite. The resulting expenditures would be outweighed by the uses to which finished goods would be put.

It is not easy to distinguish between what is urban and what is rural in the Harappan case. Typical Harappan artifacts are found in settlements which identify these sites as Harappan. Settlements like Nageshwar and Balakot did not evolve as rural settlements. These were settlements of craftsmen or procurers of raw material. Nageshwar was not urban from what can be made out of the remains of this settlement. However its role in the Harappan economy as a producer of a category of goods with extensive requirements would raise its status above that of a village. True villages would perhaps only be those within the hinterland of a city, depicting more or less unilineal means of subsistence strategies. Finds of Harappan objects in such settlements (which would identify them as Harappan) could have reached there through kin exchanges or movement of peoples. However, local production of pottery according to Harappan specifications in small settlements will indicate specific preferences for products by the Harappans.

Conclusion

One of the primary requirements for Harappan craft

production is skill. With the question of skill is associated the concept of specialization. Various criteria have been laid down to identify a craft specialist : a person having a skill not available to other (Evans 1978 :115), of at least part-time dedication to a task (Arnold 1987 : 20 ; Muller 1984 : 491), of a craftsman producing well is excess of local needs (Arnold 1987 : 20), of the existence of a subsistence surplus necessary to support a specialist, of specialists attached to the elite or to a patron (Earle 1982 : 8; Santley & Arnold 1986; Earle & Brumfiel 1987) and an association with standardization and homogeneity, suggesting proficiency (Rice 1981 : 220; Earle, Costin & Russel 1986: 4; Arnold 1987 : 59; Santley & Arnold 1986: 5).

We have considered a specialist as one who obtains the major portion of his livelihood from one particular activity. This can be inferred taking various aspects into consideration. Archaeological evidence such as the amount of debitage resulting from a particular craft process may not be very useful in the absence of a sound chronological sequence. It is not likely that one will get a continuous sequence of debitage suggesting full-time craft production. An artisans' workshop or work area like any other activity locus will be regularly cleaned and swept out (Vidale 1990) and hence such debitage will not

remain in situ. Evidence of full-time craft production can be inferred in other ways.

The time required for the practice of various crafts may not have allowed subsistence procurement activities. Seasonal scheduling of different activities may have been possible, but for the operation of other factors. Certain crafts may have been performed on a full-time basis. The carving of seals, requiring a high degree of literacy could not have been performed by part-time craftsmen. This is because the number of such craftsmen, combining literacy with artistic ability, could not have been large for the Harappan culture as a whole. Certain other crafts on the basis of their technology may have been performed on a part-time basis, but the contexts in which they were pratised and the requirements they were fulfilling may have necessitated a full-time craft. Activities engaged in in cities will largely be performed by full-time specialists, due to the division of labour and the social support of specialists. Crafts practised in a workshop are also more likely to have been undertaken by full-time specialists, unlike crafts pratised in residences.

Harappan evidence for subspecialization and the location of craft production in urban centres must have entailed strict division of labour. In smaller settlements, this degree of division of labour may be less apparent. Specialists must have been at work in small

settlements such as Nageshwar and Balakot. Craftsmen may have had families involved in food production, but the scale of work undertaken at Nageshwar, evidently for outside consumption, would have largely precluded part-time craft working.

Uniformity and standardization have also been considered as a result of the work of specialists. In the Harappan case, it cannot be denied that there is a high degree of uniformity in crafted objects. It is Harappan craft products and their uniform nature that have helped to delineate the Harappan nature of settlements. Specific pottery types, seal forms, weights, long chert blades, long barrel-cylinder beads are the artefactual indicators of the Mature Harappan. However, despite this uniformity there are variations within the Harappan culture, local preferences over material, designs and types of products which cannot be ignored.

Harappan craft production does not appear to have been geared towards mass production. Production was not engaged in with the aim of producing the maximum number of objects. Mass production is relevant only to a money economy where goods are produced for sale and profit; in the Harappan case, craft products were manufactured largely for specific requirements and little stock was maintained.

Uniformity in Harappan products was probably not a result of the number of production centres involved. Rather, uniformity in particular craft products such as seals and weights was a result of specific consumer requirements.

The political interest in craft production must be reiterated as this seems to have been the fulcrum for Harappan craft activities. We have noted the role of Harappan authorities in the establishment of settlements in resource zones to ensure regular access to raw materials. In the case of metallurgy, sporadic mining expeditions may have been organized. Where shell and lapis lazuli were concerned, we note the founding of Harappan settlements. Here, not only was the raw material procured and collected, but also worked. This must have been done to reduce transportation costs.

In other cases, transportation costs may have been outweighed by the values of goods manufactured-thus craft objects were produced in areas distant from raw material sources. Weights, seals, faience and metal objects were manufactured near consumption points.

Typical Harappan objects are noted at a number of settlements but production is noted at few centres. The scope of craft activities too differed between separate settlements. However, settlements where valuables and

objects needed for administration were produced must have been of considerable significance within a region. The picture drawn of Harappan craft production gives a good indication of the power centres within the Harappan culture.

The distribution of valuables as mentioned earlier must have been in the hands of the political elite. The distribution of utilitarian goods is however not easy to explain. On one hand, we know that the Harappans established settlements such as Nageshwar near the coast to exploit shell resources; however shell bangles do not appear to have functioned as valuables. As another example, we find that Harappan long chert blades were distributed from limited production centres in the Sukkur-Rohri region to widely dispersed Harappan settlements. Both these examples indicate that the Harappan internal networks of product distribution extended over a large area even in the case of utilitarian objects. These goods probably were distributed in spheres different from that of elite goods. There thus appears to have been a close relation between craft production and the political structure of Harappan society. It is the finds of craft objects (whether valuables or utilitarian goods) that indicate the control of the Harappan centre over the entire Harappan region.

The production and distribution of craft objects provide us with invaluable evidence for the organization and functioning of Harappan society and economy. Through craft production, we are able to discern the relationships between Harappan settlements and the hierarchisation of settlements within the Harappan region. Craft production and the utilization of craft products had their precise role in and impact on increasing societal complexities, economic differentiation and political development and centralization.

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