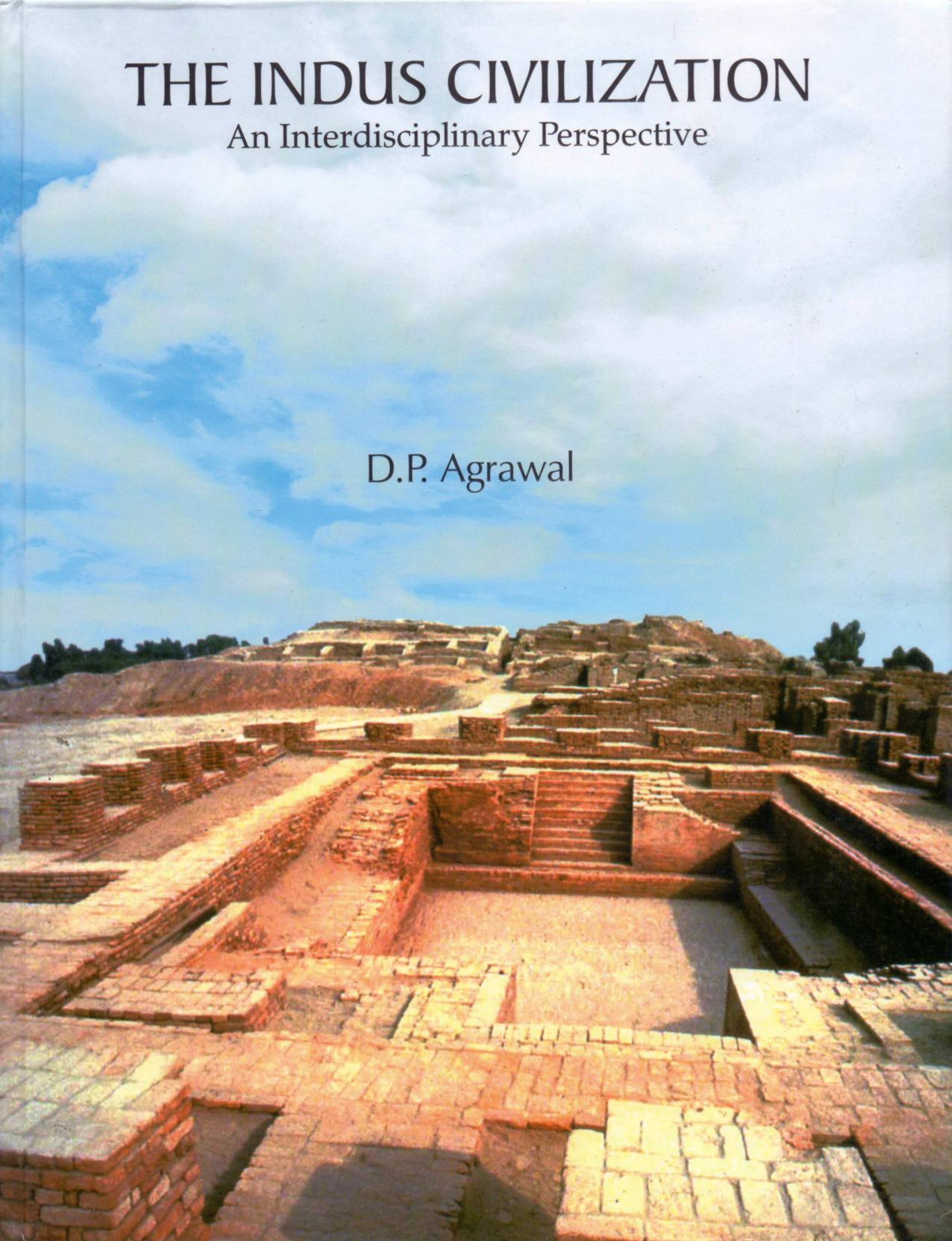
THE INDUS CIVILIZATION

An Interdisciplinary Perspective

D.P. Agrawal



The Indus Civilization is as old as the ancient civilizations of Egypt, Mesopotamia and China. It spreads over an area of more than a million sq km, an area much bigger than the Mesopotamian and the Egyptian Civilizations which are famous for their sepulchral splendour. Though technologically innovative, the Indus Civilization is marked by a modesty and the functionality of its architecture and artefacts. After the classical reports of the excavators of the 30s and 40s of the last century, in recent years quite a few synthetic accounts of the Civilization have also come out. As the author of the present book has worked not only on archaeology but also on palaeoenvironment and archaeo-metallurgy, the book gives a holistic account with an interdisciplinary perspective. The data on climate, environment, metals, hydraulics, animals, plants and agriculture, have been given adequate coverage. The book discusses both the elite and folk traditions and the author suggests that the Rama legend carries the echo of the Indus Civilization.

The author has covered the latest discoveries from the recent excavations, including most of the major and minor Harappan sites. The Indus Civilization in its mature phase flourished between 2600-1900 BCE, though its beginnings can be traced further back. The civilization is marked by a uniformity and standardization over its large territory but now the regional variations appear equally important. It shows considerable variation in town planning, yet a baffling uniformity in weights and measures as well as motifs. The book fully captures the uniformity in diversity of the Indus Civilization and covers its different dimensions. The Indus Civilization did not exhibit the macabre splendour of the Mesopotamian or the Egyptian graves but the book does capture its water splendour as described by Jansen's German term *wasserluxus*. The author does not avoid technical data but presents it in an interesting style so that it retains the attention of the laymen.

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For

Dilip Chakrabarti

Preface

There are quite a few books on different aspects of the Indus Civilization written by well known scholars like Kenoyer, Possehl and Wheeler, besides the edited specialized volumes. In fact, Possehl's book is just four years old, so what was the need of a new book on the Indus Civilization? I have excavated Kalibangan, in Rajasthan for a few seasons under the supervision of B.B. Lal and the late B.K. Thapar but did no independent excavations. Of course, I have done some work on environmental problems as also on Harappan technology. Though I have first hand knowledge of metallurgical and environmental data, I would still call myself a generalist. I felt that a book on the Indus Civilization written by a generalist integrating the multidimensional studies related to the Indus Civilization was worth the effort. This is the justification for attempting this book – whether I have succeeded in my attempt or not has to be decided by the readers. I must confess that though I have seen archaeological sites all over the world, as also most of the Harappan sites in India, I could never get into Pakistan to see the great sites of Harappa and Mohenjodaro. It is a great pity but this is my unfulfilled ambition. Though HARP reports have been regular, other publications from Pakistan are not easily accessible, it is only my personal contacts with both Western and Pakistani archaeologists that have allowed me to keep abreast.

In a book on archaeology, illustrations matter a lot. In this respect I have been very lucky with Greg Possehl giving me a CD of his Harappan illustrations and Mark Kenoyer and Richard Meadow a few of their beautiful slides. R.S. Bisht of ASI has been equally kind to supply a lot of illustrations from his famous sites of Banawali and Dholavira. Jeewan Kharakwal, my younger colleague, has proved a great asset not only in collecting data for the book but also in offering his critical comments on my draft chapters. Heather Miller has always been a source of latest data on Pakistan archaeology. All these friends deserve hearty thanks. There are so many other colleagues who helped me, some of them I have acknowledged separately. To the colleagues who helped me, especially Manikant Shah, Pankaj Goyal, Shalini Gupta, Sunita Arya, Parveen Bano, Kailash Rautela and Dipika Tripathi, I would like to extend my hearty thanks.

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1

Introduction

I have been working on Indian archaeology and related disciplines for a long time, yet the fascination for the Indus civilization never abated. In the 3rd Millennium BCE context it ranks amongst one of the greatest civilizations of the world. But when we compare it with the Mesopotamian, Egyptian or Chinese civilizations, it loses its sheen. The macabre splendour of the Mesopotamian graves, the Egyptian pyramids or the massive bronze images and cauldrons of the Chinese, in contrast, make the Indus civilization appear so modest and humble. There are no great palaces, the graves are full of clay pots and nothing much else, and the statuary is on a minuscule scale. Copper and bronze have been used mostly for tools rather than for imagery; even temples, if at all present, must have been very modest affairs. In contrast to the megalomania of the great Mesopotamian, Egyptian and Chinese emperors, the Indus rulers or priests appear pretty modest. The Harappans believed in circulating the wealth through generations rather than keeping it locked in graves and providing perpetual temptation to robbers!

Yet it was one of the most magnificent civilizations, larger than any other contemporary empires. The Indus civilization had several big towns of more than 80 hectare area. Their technological innovations in architecture, hydraulics and metallurgy remain unparalleled. The massive dockyard of Lothal, the elaborate water harvesting system of Dholavira, the intricate waterproofing technology of the Great Bath at Mohenjodaro – all attest to the technological virtuosity of the Harappans (Chapter 6).

The architectural remains have to be understood in terms of the Indus socio-polity. Kenoyer thinks that numerous large buildings and public spaces in the Lower Town at Mohenjodaro and on Mound F at Harappa probably indicate that several distinct elite groups lived in the cities. The separate walled mounds with associated suburbs may represent the houses and workshops of competing merchant communities who were united in a single settlement by common language, culture and religion. An exception to this pattern is seen at smaller fortified sites on the periphery of the Indus Valley. For example, at Dholavira, in Kachchha, the nested walled habitation area of the Citadel does dominate the entire settlement and may represent the residences of a ruling family. However, the presence of unicorn seals and pottery identical to those found at Mohenjodaro and Harappa indicate that this site, and many other walled towns, were probably colonies or regional capitals with governors appointed from one of the larger cities.

While Wheeler and Piggott thought that Harappa and Mohenjodaro were the twin capitals of the Indus empire, Kenoyer suggests that due to the long distances between the four major cities, it is highly unlikely that a single ruler ever dominated the entire Indus Valley. Each of the large cities may have been organized as an independent city-state. At times a single charismatic

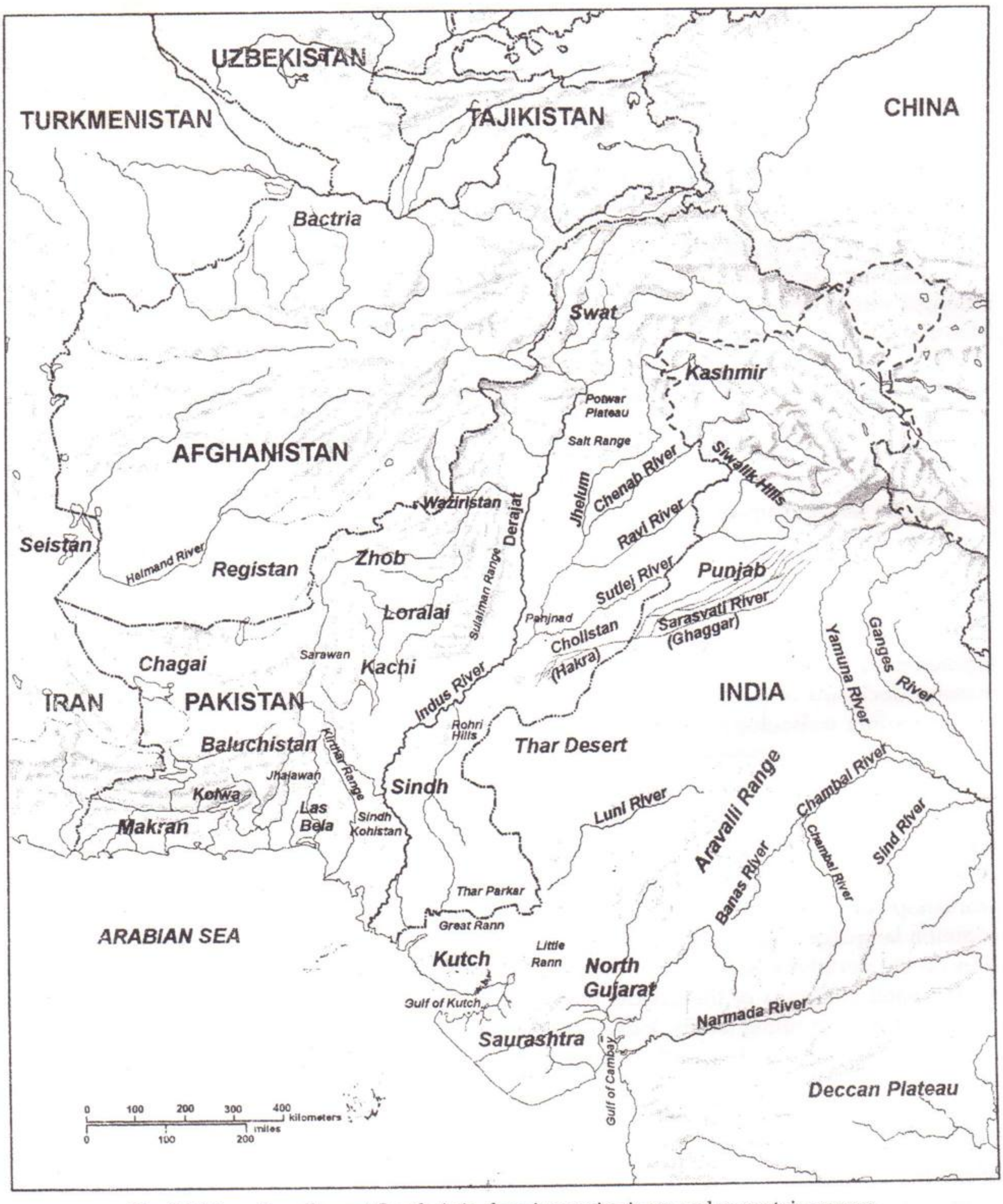


Fig. 1.1 Map of north-west South Asia showing main rivers and mountain ranges.

leader may have ruled the city, but most of the time it was probably controlled by a small group of elites. Comprised of merchants, landowners and ritual specialists, alliances between the ruling elites at two or more of the largest sites would have stimulated extensive colonization of resource areas. On the other hand, competition between the cities may have resulted in the temporary breakdown of trade and the collapse of political power.

In its sheer magnitude, in a 3rd Millennium BCE context, the Indus civilization or Harappan culture (named after the first discovered site, Harappa) was a unique phenomenon in the history of the world. Not only in its wide distribution, but it is unique also in its well-planned towns. Town-planning seems to be an Indus concept. It was distributed over an area more than a million sq km, far larger than the Egyptian or the Mesopotamian civilizations; even larger than the present-day Pakistan. Mohenjodaro, the most famous Harappan site, was comparable in area to Uruk in Mesopotamia, but far larger than contemporary settlements in Egypt. The Harappan culture was spread over a large area of the sub-continent (Fig. 1.1). Its far-flung outposts were in the west Sutkagendor (Makran), in the east Alamgirpur (UP), Manda (near Jammu) in the north and Bhagatrav in south Gujarat (Figs. 1.1, 2, 3). The uplands of Baluchistan, most of Uttar Pradesh and the south were however out of its purview. Even the Indo-Gangetic divide does not have the Mature Harappan sites. The culture is mainly confined to the Indus Valley and Saurashtra, including Kachchha. There are a number of Harappan sites on the dry Ghaggar-Hakra system, which probably joined the Indus or the Nara in the past. The spatial extent of the Indus civilization is discussed in Chapter 4.

The integration of this vast geographical area into a single cultural system was probably the result of economic strategies defined by ideology and social relations rather than overt military coercion. Competition between elites living in two or more of the Harappan Phase cities might have resulted in periods of greater or lesser integration, as one community or another came into power. Alliances between ruling elites living at two or more of the largest sites would have stimulated extensive colonization of resource areas by other communities to compete for power (Kenoyer 1997: 51-70).

The Indus civilization exploited a far wider range of ecological resources: riverine, intermontane, and coastal. From the border of Iran, its geographical distribution extends along the Arabian Sea coast, to Gujarat and further south, northward even beyond Lahore and up to the Oxus River, and eastwards even beyond Delhi. Rainfall for the western domains came from the winter westerlies, which brought snow to the mountains of Baluchistan and the Northwest Frontier and rain to Punjab and north-western India. The summer rain of the south-west monsoon brought moisture to Saurashtra, North Gujarat, Punjab, and north-western India, and sometimes even to the western domains. (The environmental backdrop is discussed in Chapter 2)

The most remarkable thing is that the major Harappan cities represent the epicentres of distinctive cultural-linguistic states which grew out of them through history. The latter-day linguistic-cultural states of Gujarat, Panjab, Sindh, and Rajasthan grew out of Dholavira, Harappa, Mohenjodaro, Rakhigarhi and so on (Fig. 1.3). The idea of India is a changing concept – both in space and time. Perhaps these units were city-states, like the *janapadas* of the early historical times. In the 3rd Millennium BCE context, India was represented by the extent of the Indus civilization. The 'Indias' of the Mauryan times, Gupta period, Mughals or of the British empire were quite distinct and different spatial entities.

Archaeologically there is very little known about the Vedic civilization. In fact, the culture, religion, science and technology and even metrology of modern India can be traced back to the Indus substratum. This rich legacy is discussed in detail in Chapter 10. The Indus civilization was unique in its vast extent, planned towns, elaborate baths and hydraulic structures, toilets and a highly evolved system of weights and measures. In fact, the binary system of weights and measures (and Indian coinage with 16 annas to a rupee or 16 *chhatacks* = 1 seer) can be traced

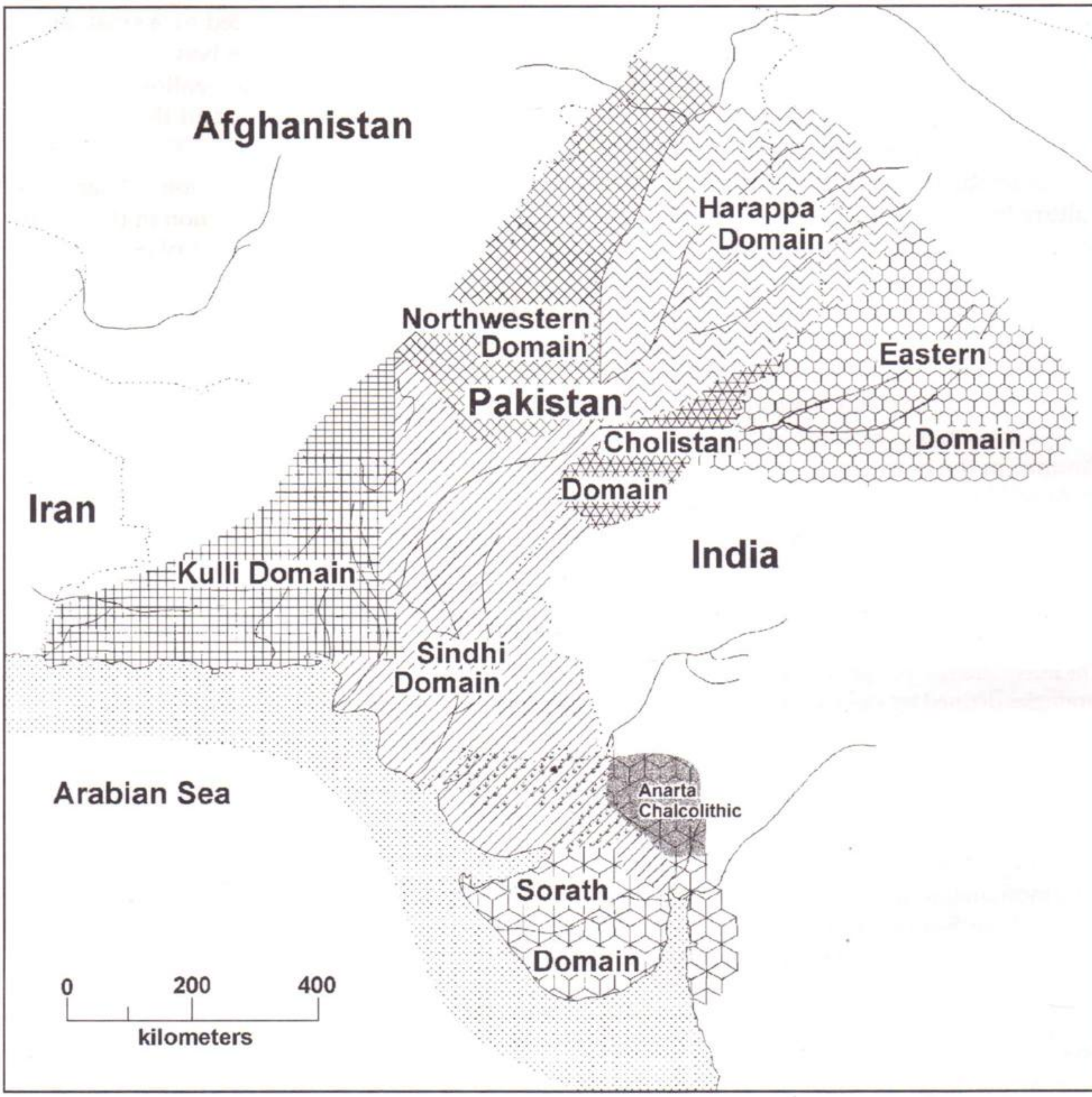


Fig. 1.2 The main domains of the Harappan distribution zone which in due course developed into linguistic-cum-cultural states during historical time (After Possehl, 2002).

back to the Harappan times. The obsession of the Harappans with cleanliness and water is perhaps at the root of the water ablutions that continue till today.

Both its roots and the end are topics of endless debate. The beginning of the Indus civilization are discussed in Chapter 3. The roots of the Mature Harappan undoubtedly lay in the Early Harappan stage, and the latter grew out of the agricultural revolution that preceded them. In the early agricultural societies full-time specialists, including the elite, could be supported only when it could produce agricultural surplus. At the Early Harappan stage there is evidence for long distance trade. In Possehl's words,

The ability of people in the subcontinent to reach out and capture such goods, apparently on such a scale that it stands out in the archaeological record, starts at the very beginning of the Indus Age and persists through the Mature Harappan stage. Long distance trade begins with the development of villages and pastoral camps and persists right into the Mature Harappan. The Baluchistan-Central Asia interaction sphere emerges in the

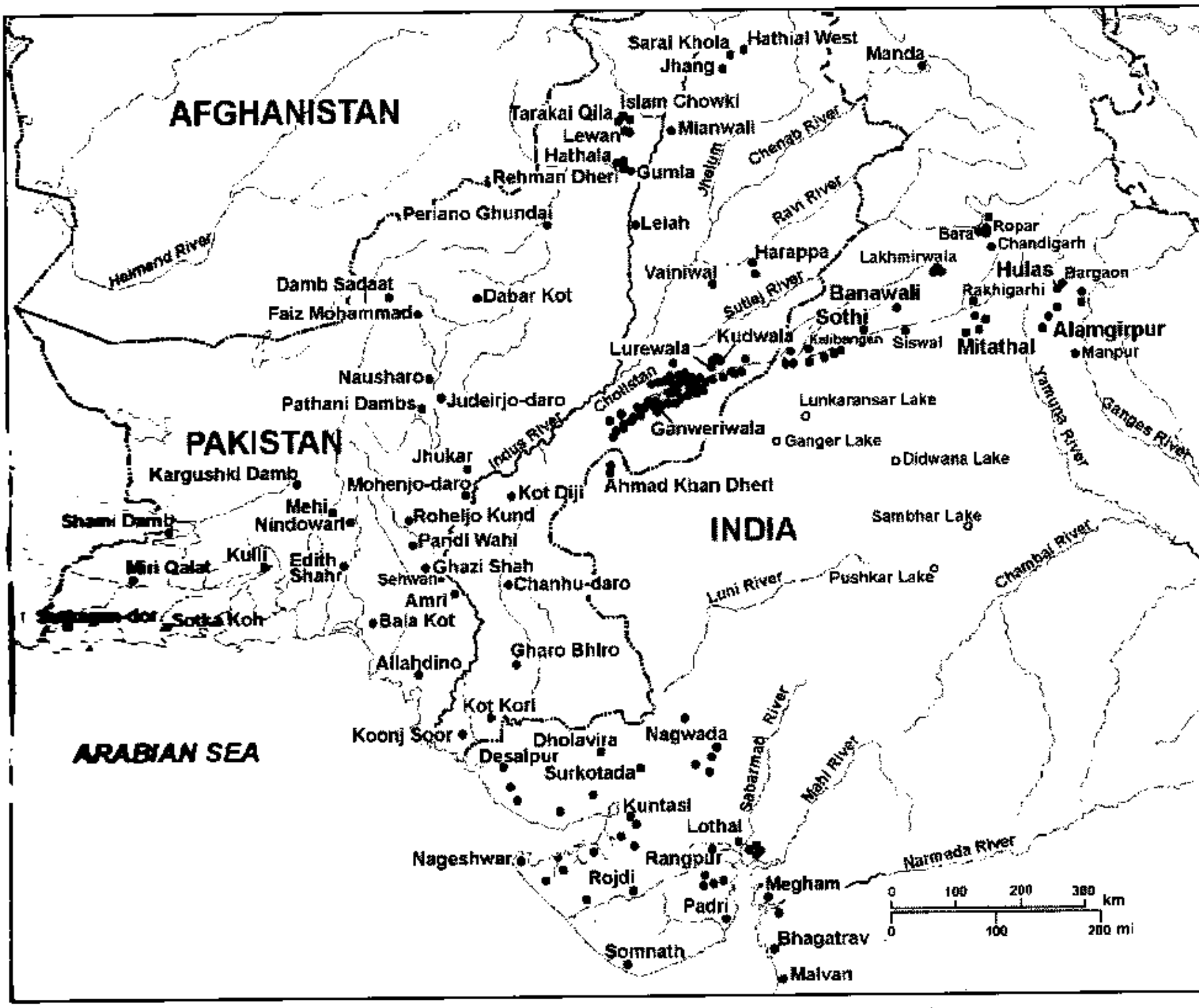


Fig. 1.3 Distribution of Harappan sites (After Possehl, 2002).

archaeological record as one based on durable goods, mostly stone and metal. With the exception of turquoise there are few durable products from Central Asia that might have been desired by the inhabitants of the Greater Indus Region. This kind of interaction is generally based on perishables, especially grain and textiles. The Early Harappan, Damb Sadaat Phase seems to mark a growth in interregional connections on the western side of the Indus area. This seems to have been on a large scale, involved long distance travel and was enduring. It was also an important harbinger of developments that took place during the Mature Harappan, which built on the foundation laid in Damb Sadaat and earlier interaction.

Some of the sites like Quetta Miri, Mundigak, Early Harappa, Early Lathawala, Early Dholavira, Las Bela, etc. do have a settlement area ranging from 20-50 hectares. At several sites like Kalibangan period I, Banawali, Kot Diji, etc. there is clear evidence of fortification or massive platforms indicating the beginning of the monumental architecture. In Kunal period IC, there is evidence of proto-seals. From stage one (of Possehl) the settlement area jumps from 140 hectares to more than 2100 hectares. Even if the Early Harappan was a weakly-developed threshold, we know for sure that the Mature Harappan was a fully urbanized phase. Such a development was possible only within the socio-economic constraints of the contemporary cultures. The contributory components of the Mature Harappan have to be found in the Early Harappan stage and obviously they are there (see Chapter 3).

The enigma is that after attaining the peak of urbanization during the Harappan times, the beginning of the 2nd Millennium witnesses a regression to the rural mode of living with no trace of cities, wells, elaborate hydraulics or even the script. The second urbanization was witnessed far away from the epicentres of Indus civilization. This time the theatre of the second urbanization was the Ganga Valley and not the Indus. Its technological base was no more bronze but iron. Iron was far more abundant than copper and became the tool of the masses. The irony is that this glorious Indus chapter of Indian history was totally forgotten, both in written tradition as well as in the folklore. No texts ever referred to it, yet the majority of the Indian cultural traits, its religion, its yoga, its obsession with water ablution, animal sacrifices, fire worship, binary system of weights and measures can all be traced back to their Indus origins (We have discussed the details of legacy in Chapter 10). How do we explain this paradox? I have however tried to suggest that the folklore probably did retain the memory of this great tradition in Chapter 7.

Probably most of the religious practices of India can be traced back to the Harappans. Be it the deities like Shiva, *Linga* worship, *Mahisamardini*, or tree worship (pipal, banyan), water ablutions – they can all be traced back to the Harappan times. In fact, Jansen calls the Indus civilization *wasserluxus* (water splendour). The ubiquitous wells, bathing platforms and the Great Bath at Mohenjodaro itself bear testimony to it. The sacred motifs of swastika, pipal, intersecting circles – all go back to the Harappan substratum. The mother goddess terracotta figurines, yoga, fire altars, animal sacrifice go back to the 3rd Millennium BCE. All such manifestations of religion of the Harappans have been discussed in Chapter 7.

Possehl (2002) has tried to elaborate the modes of communication between different regions during the Indus Age.

> The symbiosis of the highlands of Baluchistan and the North-west Frontier with the Indus lowlands is one of the timeless facts of life within the Greater Indus Region. Migration of pastoralists from the mountains in the winter, and back again in the summer, is one of those constant, enduring patterns of movement and interaction that were present during the Indus Age and beyond, into modern times. These nomads are frequently also craftspeople, traders, tinkers, transporters, bards, and messengers. They bring news from afar and bring along their children – potential marriage partners for the people with whom they stay in the course of their yearly round.

There could be many routes for such communication: the constant search for pasture land may well have been one. Contributing to this process were the mobile craftspeople, traders, tinkers, transporters, bards, and messengers. The uniformity of the bricks, pottery, seals, etc. may be due to the mobility of the craftsmen. The Indus people depended heavily on animals, especially cattle, and to a lesser extent sheep and goats. In this sense they were pastoralists, whether settled or nomadic. Seasonal nomadism must have been common. Some individuals may have been settled for a part of their lives and nomadic at other times. Possehl calls it very human stuff and in the range of human attitudes and activities that shapes the distribution of artefacts across a landscape such as the Greater Indus Region. It implies the movement of people and their possessions as well as their skills. Another related activity has to do with bards and people who carry news. These are "professional" wanderers who tell tales, keep an oral folk literature alive, and carry to new localities information of happenings in the places they have visited. They tell of famines and plagues; war and peace; marriages and deaths; the comings and goings of the great, near-great, and even those who only presume such status.

Despite the communication and uniformity, the diversity was also preserved. The interaction has not now, or ever, led to cultural and biological homogenization. Geography, distance, the forces of human parochialism, strong sense of group identity, and the need for protection and solidarity have combined to yield a diversity of people and cultures. The forces of intercommunication, diffusion, homogenization, and regional unity are in constant, dynamic tension with local forces of parochialism and the need for group identity and solidarity. All of these forces are real and in some ways contradictory. Over the long duration of the Indus Age, they led to a kind of "unity of diversity" from the Mediterranean to the Indus (Possehl 2002).

Although the Harappan culture appears in a fully developed form, a closer look at it reveals that it had in fact derived a great deal from the antecedent cultures, so much so that Mughal terms the so-called pre-Harappan cultures, "Early Harappan".

The Indus civilization is remarkable for its uniformity and standardization in weights, measures, ceramics, architecture, town-planning and other arts and crafts. Despite formidable difficulties of transport and communication, this uniformity appears all the more imposing when one considers that the culture extended over more than 1.25 million sq km. The "State" seems to have imposed uniformity in weights, measures, items of mass consumption like pottery, etc. but the religious differences were not interfered with. For example, the mother-goddess figurines and phalli of the Sindh are absent in Rajasthan and Gujarat (Chapter 7). At Lothal there are fire altars, but they are different from those of Kalibangan. At Kalibangan the tower platforms with fire altars, approachable only through a staircase, are unique in the whole of the Harappan "empire". The script and the language too may have showed regional variations, but nobody has looked into it so far. These local differences will come to the fore in the course of our discussion of individual sites (Chapter 4, 7).

The rulers who controlled the Indus cities appear to have maintained the standardized system of weights and kept the trade networks open for over 700 years without developing a standing army. While there may have been periods of conflict between competing settlements or feuding clans, there is a general lack of evidence for militarism.

It is also worth emphasizing that the Indus elite did not suffer from the megalomania of the kings of that period of Egypt and Mesopotamia. The Harappan cities do not show any manifest marks of exhibition of wealth of the elite; in contrast, the Egyptian and Mespotamian kingdoms were marked by monumental stone architecture, sculptures made of stone or precious metals, elaborate grave goods, and royal tombs filled with gold and exotic treasures. The absence of comparable categories of wealth items and centralized architectural structures in the Indus cities has led most scholars to conclude that the people ruling the Indus cities had different values and possibly a different form of political organization from that seen in other early states (Kenoyer 1989). Kenoyer contrasts the kingdoms of Mesopotamia and Egypt, where large stone sculptures and relief of kings were made, with South Asia. Ashoka built more than 115 stone columns but none of them had the portrait of the king.

Renfrew also echoes the same views about the character of the Harappan culture. He says:

> I have often thought how singular the Indus Valley civilization is in this respect. For it possesses very large urban centres with a rectangular layout more impressive than any in Early Dynastic Mesopotamia, and worthy of comparison with Teotihuacan. The centres have Citadels with large granaries, which were clearly the hub of a complex re-distributive exchange system. A range of traded materials is seen. Yet nowhere, on the basis of archaeological record at present available, is the superabundant personal wealth so characteristic of the early civilizations of Egypt, Mesopotamia and China. Nor has there been found the exceedingly complex and monumental religious symbolism characteristic of the Mesoamerican early state modules. Nor yet, despite the existence of a script, is there the vainglorious assertion of personal power, expressed in colossal monuments and inscriptions that we see in Egypt and Mesopotamia. The Harappan civilization does not reveal to the world any Ramses, any Hammurabi, nor yet any Gudea of Lagash. Indus exchange evidently functioned without such emphatically assertive statements about the prestige and power of the central person (Renfrew 1984: 106).

This innate modesty of the Indus civilization makes it look something like a faceless socio-cultural system to Possehl. Individuals, even prominent ones, do not readily emerge from the archaeological record, as they do in Mesopotamia and Dynastic Egypt, for example. There are no clear signs of kingship in the form of sculpture or palaces. There is no evidence for a state bureaucracy or the other trappings of "stateness". Nor is there evidence for a state religion in the form of large temples or other monumental public works. It is clear that the Indus civilization is an example of an archaic socio-cultural complexity, just as complex in its own way as the archaic civilizations of Mesopotamia and Dynastic Egypt or the Maya and Inca of the New World. Therefore Possehl thinks that the Indus civilization was not organized as a state. And that makes the Indus civilization so fascinating, and also challenging (Possehl 2002). The Harappans did spend resources on such public works which were of direct public concern like the platforms and Great Bath of Mohenjodaro, dockyard of Lothal, potable water reservoirs of Dholavira etc.

Did the Indus people have an ideology? Possehl tries to grapple with this difficult question. He says:

Assuming that the ideology of the Indus people would be reflected (approximated) in the archaeological record, I decided to use as my proxies those traits of the Indus civilization that come to mind as the most distinctive Harappan-features-the important things I think of when I think of them. These are features of the Indus civilization that define the civilization for me, give it character and substance, and set it apart from other complex sociocultural systems of antiquity.

This led me to four aspects of the Indus ideology:

1. The Indus people were nihilists who sought to bring a new sociocultural order to the Greater Indus Region.
2. Urbanization and city life were a part of this new ideology.
3. The physical and symbolic aspects of water formed a part of the Indus ideology. M. Jansen calls it *wasserluxus*, a term I have integrated into my position on Indus ideology.
4. The Indus ideology promoted technological prowess and innovation.

I have found that these aspects of ideology are expressed in visual and symbolic form in the Indus cities, towns, villages, and camps. They are found in the distinctive Indus artefacts–stamp seals, painted pottery, figurines, architecture, baked brick buildings, brick-lined wells, bathing facilities, new or expanded technologies, and the like. The Early Harappan people were not seafarers; the Indus people were. Thus, the Indus maritime technology was also a part of, or resulted from, the Indus ideology.... In thinking about this ideology that I have "found", it became clear that it would be an excess to believe that it is "the" ideology of these people. Those things that I have used to define the "ideology of the Indus civilization" may well be close to what the Indus peoples believed. Some of it might even be "spot on", but to think of this collection of observations as the genuine, complete ideology of the Indus civilization would be wrong. It is an approximation of the deeper values of the Indus people that have been expressed to us archaeologically (Possehl 2002).

The innovations, crafts and metallurgy of the Indus civilization have been dealt with in Chapter 6. Crafts create wealth as also help differentiate the elite from the masses. Kenoyer says, generally speaking, a wealth item can be defined as an archaeologically preserved object that reflects relatively high levels of indirect or direct economic control of resources, labour or technological knowledge. Archaeologically-preserved objects, such as ornaments, architecture, or tools reflect other forms of wealth that are not preserved, for example, grain, foodstuffs, livestock, or even agricultural land.

The metal tool repertoire of the Harappans shows a lack of war-like weapons. The types are simple. Neither the complicated mouldings of Mesopotamia nor the ornate designs of Chinese metalware were ever attained by the Harappan smiths. Most of the artefacts appear utilitarian. Except for two specimens of dancing girls, no human images are available in metal. The main tool types are: razors; leaf-shaped knives with incurved end; sickle blades with externally sharpened edge; chisels; spearheads; thin barbed arrow-heads; straight and circular saws; blade axes; mid-ribbed daggers; drills; and eyed needles. It may be pointed out that needles with eyes on the pointed ends, true saws, circular saws, and drills are Harappan contribution to the world of instruments. Shaft-holed axes are rather a rarity and must depict imports (see Chapter 6).

The Indus script surprisingly vanished with the Harappans. Despite several claims, the script does not seem to have been deciphered. Now Farmer has argued that it was not a script at all! We shall discuss the script in Chapter 8.

International trade of the Harappans is again a controversial subject. Trade, agriculture, animal husbandry have been dealt with in Chapter 9. We also summarize in this chapter the exhaustive archaeobotanic studies carried out recently by Steven Weber.

Towards the last quarter of the 3rd Millennium BCE, a drastic change is writ large all over the Harappan zone. Was it the end of the Indus civilization, a transformation, or merely a change? What caused it: new immigrants, climatic change, disorganization of the Indus trade, or something else? Thus with recent research, it is becoming clearer that new elements were making their appearance in the Harappan region and they were not localized. The Cemetery H and Jhukar were no more localized aberrations but occupied large areas. So if one is looking for elements in the archaeological record of new people, the Jhukar and Cemetery H cultures with their larger distribution are now eligible to be claimants for that title. The problems related to the decline, end and the legacy of the Indus civilization are discussed in Chapter 10.

The geomorphological, palynological and archaeological evidence from Rajasthan indicates fluctuations of wet and dry periods. In the present state of knowledge, climatic change for the worse cannot be ruled out. An increasing desiccation may have given the last blow to a people already exhausted by their incessant fight against floods. Progressive degeneration is writ large over the successive levels of Mohenjodaro.

It is necessary to discuss in greater detail the recently discovered evidence of drastic changes in palaeo-channel configurations, especially in Rajasthan. They did affect the Harappans as also the subsequent cultures in the area.

Singh (Singh 1971; Singh et al. 1974) on the basis of his palynological studies on the lakes of Sambhar, Didwana, and Lunkaransar proposed that the increase in salinity was due to increased aridity and that this climatic change could have been the root cause for the eclipse of the Indus civilization. But Possehl doubts these inferences:

> The changing salinity of these lakes, which appears to be well documented, need not be due to changes in rainfall. The geology and environment of Rajasthan are coupled. The three lakes investigated are hypersaline today, but there are also freshwater lakes in this same region (Lakes Pushkar and Ganger). This observation leads to the conclusion that, under one climatic regime in Rajasthan, there can be both freshwater and hypersaline lakes, calling into question Singh's hypothesiz. Site counts go up from 218 during the Mature Harappan to 853 in post-urban times. Although there was a dramatic drop in average site size, down from 13.54 to 3.55 hectare area., the estimated total settled area remained remarkably stable for both periods. These data do not look like those that one would expect if there had been a severe reduction in rainfall as Singh proposed, especially given the fact that it is a dry cropping region (Possehl 1999b: 18).

These problems would be debated in Chapters 2 and 10.

The Indus civilization thus is a fascinating chapter of the march of humanity towards exploitation of riverine ecology to usher in the most extensive urbanization of the 3rd Millennium BCE world.

2

Ecological Backdrop: Environmental Changes and Civilization Process

INTRODUCTION

During the last two million years climate has been changing with 100 Kyr long cold periods alternating with 10-12 Kyr long warm ones. The earth has already enjoyed this sunshine period. So if this trend is right, the planet should be slipping into another glacial period. But the global warming due to higher emissions of greenhouse gases (CO_2, CH_4, CFCs) may have reached a point where it could reverse the natural trends. It has therefore become all the more important to know accurately the past trends and periodicity of climatic change so that we have a better understanding of the climate machine. It may enable us to predict the effects of anthropogenic factors on global climatic change. On the other hand, climate determines environment and the latter affects human settlements and habitat.

The records of climatic change are found in a variety of natural archives like ocean sediments, lake deposits, wind-borne loess, ice sheets and glaciers, tree-rings, etc. Compared to the sea and ice cores, the land records are often disturbed and have gaps due to various geomorphic processes. The continental records, however, provide higher spatial and temporal resolution. The more definitive type of proxy climatic data in India, however, is available only from the transact, which runs from south-west to north-east, from the Arabian Sea to the Kashmir Himalayas. We have been associated with major interdisciplinary palaeoclimatic research projects in Rajasthan (Agrawal et al. 1990; Singh et al. 1990; Agrawal 1992) and Kashmir, besides our initial work on the sea-level changes on the western coasts (Agrawal 1989).

The effect of environment on humans is a much-debated subject as many scholars resent any claims that smack of environmental determinism. Diamond tells us that mention of environmental differences invites among historians the label "geographic determinism", which raises hackles. The label seems to have unpleasant connotations, such as that human creativity counts for nothing, or that we humans are passive robots helplessly programmed by climate, fauna, and flora. Of course these fears are misplaced. Without human inventiveness, all of us today would still be cutting our meat with stone tools and eating it raw, like our ancestors of a million years ago. All human societies contain inventive people. It is just that some environments provide more starting materials, and more favourable conditions for utilizing inventions, than do other environments (Diamond 1997: 410-424). Yet, in sensitive zones, it assumes special importance. When, for example, it became too cold in Kashmir, or too arid in Rajasthan, humans had to migrate elsewhere.

To explain the effect of environment on humans, we would like to quote a very appropriate extract from Diamond.

Jared Diamond (1997: 400-424) in his famous book *Guns, Germs & Steel*, tries to reply to Yali, an aborigine of New Guinea, in an apocryphal dialogue:

The striking differences between the long-term histories of people of the different continents have been due not to innate differences in the people themselves but due to differences in their environments. I expect that if the populations of Aboriginal Australia and Eurasia could have been interchanged during the Late Pleistocene, the original Aboriginal Australians would now be the ones occupying most of the Americas and Australia, as well as Eurasia, while the original Aboriginal Eurasians would be the ones now reduced to downtrodden population fragments in Australia. One might at first be inclined to dismiss this assertion as meaningless, because the experiment is imaginary and my claim about its outcome cannot be verified. But historians are nevertheless able to evaluate related hypotheses by retrospective tests. For instance, one can examine what did happen when European farmers were transplanted to Greenland or the U.S. Great Plains, and when farmers stemming ultimately from China emigrated to the Chatham Islands, the rain forests of Borneo, or the volcanic soils of Java or Hawaii. These tests confirm that the same ancestral people either ended up extinct, or returned to living as hunter-gatherers, or went on to build complex states, depending on their environments. Similarly, Aboriginal Australian hunter-gatherers, variously transplanted to Flinders Island, Tasmania, or south-eastern Australia, ended up extinct, or as hunter-gatherers with the modern world's simplest technology, or as canal builders intensively managing a productive fishery, depending on their environments .... Of course, the continents differ in innumerable environmental features affecting trajectories of human societies. But a mere laundry list of every possible difference does not constitute an answer to Yali's question. Just four sets of differences appear to me to be the most important ones. ... The first set consists of continental differences in the wild plant and animal species available as starting materials for domestication. That is because food production was critical for the accumulation of food surpluses that could feed non-food-producing specialists, and for the build-up of large populations enjoying a military advantage through mere numbers even before they had developed any technological or political advantage .... For both these reasons, all developments of economically complex, socially stratified, politically centralized societies beyond the level of small nascent chiefdoms were based on food production .... But most wild animal and plant species have proved unsuitable for domestication: food production has been based on relatively few species of livestock and crops. It turns out that the number of wild candidate species for domestication varied greatly among the continents, because of differences in continental areas and also (in the case of big mammals) in Late Pleistocene extinction. These extinction were much more severe in Australia and the Americas than in Eurasia or Africa. As a result, Africa ended up biologically somewhat less well endowed than the much larger Eurasia, the Americas still less so, and Australia even less so, as did Yali's New Guinea (with one-seventieth of Eurasia's area and with all of its original big mammals extinct in the Late Pleistocene) ... On each continent, animal and plant domestication was concentrated in a few especially favourable homelands accounting for only a small fraction of the continent's total area. In the case of technological innovations and political institutions as well, most societies acquired much more from other societies than they invented themselves. Thus, diffusion and migration within a continent contribute importantly to the development of its societies, which tend in the long run to share each other's developments (in so far as environments permit) because of the processes illustrated in such simple form by Maori New Zealand's Musket Wars. That is, societies initially lacking an advantage either acquire it from societies possessing it or (if they fail to do so) are replaced by those other societies .... Hence a second set of factors consists of those affecting rates of diffusion and migration, which differed greatly among continents. They were most rapid in Eurasia, because of its east-west major axis and its relatively modest ecological and geographical barriers. The reasoning is straightforward for movements of crops and livestock, which depend strongly on climate and hence on latitude. But similar reasoning also applies to the diffusion of technological innovations, in so far as they are best suited without modification to specific environments. Diffusion was slower in Africa and especially in the Americas, because of those continents' north-south major axes and geographic and ecological barriers. It was also difficult in traditional New Guinea, where rugged terrain and the long backbone of high mountains prevented any significant progress toward political and linguistic unification ... Related to these factors affecting diffusion within continents is a third set of factors influencing diffusion between continents, which may also help build up a local pool of domesticates and technology. Ease of intercontinental diffusion has varied, because some continents are more isolated than others. Within the last 6,000 years it has been easiest from Eurasia to Sub-Saharan Africa, supplying most of Africa's species of livestock. But inter-hemispheric diffusion made no contribution to Native America's complex societies, isolated from Eurasia at low latitudes by broad oceans, and at high latitudes by geography and by a climate suitable just for hunting-gathering. To Aboriginal Australia, isolated from Eurasia by the water barriers of the Indonesian Archipelago, Eurasia's sole proven contribution was the dingo .... The fourth and last set of factors consists of continental differences in area or total population size. A larger area or population means more potential inventors, more competing societies, more innovations available to adopt and more pressure to adopt and retain innovations, because societies failing to do so will tend to be eliminated by competing societies.

We think that Diamond's profound observations provide a fitting prelude to our discussion of climatic and environmental changes in South Asia.

Early humans during different periods in the past too had to face environmental crisis, as humankind is facing today. When in the Indus region water tables rose up, or salinity of the lakes increased, or the rivers became dry, early humans had to move towards more congenial environments. Iron technology allowed them to colonize even monsoon forests. Even in the early Stone Age, humans had faced other environmental crisis for which they had found a technological solution. In the early Stone Age humans could match neither the strength nor the speed of the animals and had to resort to wasteful mass killing of large herds of animals by stampeding them across cliffs and precipices. This resulted in large-scale extinction of mammals. The Middle Palaeolithic humans, therefore, invented the first missiles in the form of spearheads and arrowheads. With this new technology they not only could pick and choose the animal they wanted to kill but it was ecologically less wasteful too.

With our concern for the future of this planet we may perhaps draw some lessons from the past. Early humans resolved the economic crisis either by moving into more congenial environments or by developing new technologies to face new environmental challenges. Today the American prosperity is based on the exploitation of 45 per cent mineral wealth of the world. If the whole world, including the largely populated developing countries, want to attain that sort of prosperity, there are no more worlds left to exploit. With a better understanding of the globe now we also know that large-scale denudation of the tropical forests or melting of snow-covered polar areas in the north and south will lead to devastating damage to the overall ecology of the planet. By developing new technologies humans could live under the sea or colonize other planets. But is this the answer to the environmental crisis that we are facing today mainly because of the exorbitantly rich standard of living and impossible levels of consumption of the people of the north. The north now wants to put a moratorium on the developmental activities of the south on the plea that the south would further pollute the earth by burning its coal, by growing paddy and with its large cattle population. Today the north seems to have forgotten that they have polluted the earth so much during the last 200 years to raise their level of consumption to impossible heights. If we want to maintain ecological balance today and leave a healthy environment for posterity the only way to do it is by reducing our wants by following Gandhian ideals of modest living and symbiosis with nature.

Coming back to the area colonized by the Harappans, we will discuss the states Rajasthan and Gujarat. In marginal areas the environmental changes have played almost a deterministic role in affecting human settlement. As a relevant case to the Harappan studies, let us examine the evidence of Rajasthan.

In Rajasthan large settlements appear only during periods of higher rainfall. The Upper Palaeolithic, the Mesolithic and the Harappan cultures are associated with relatively wetter

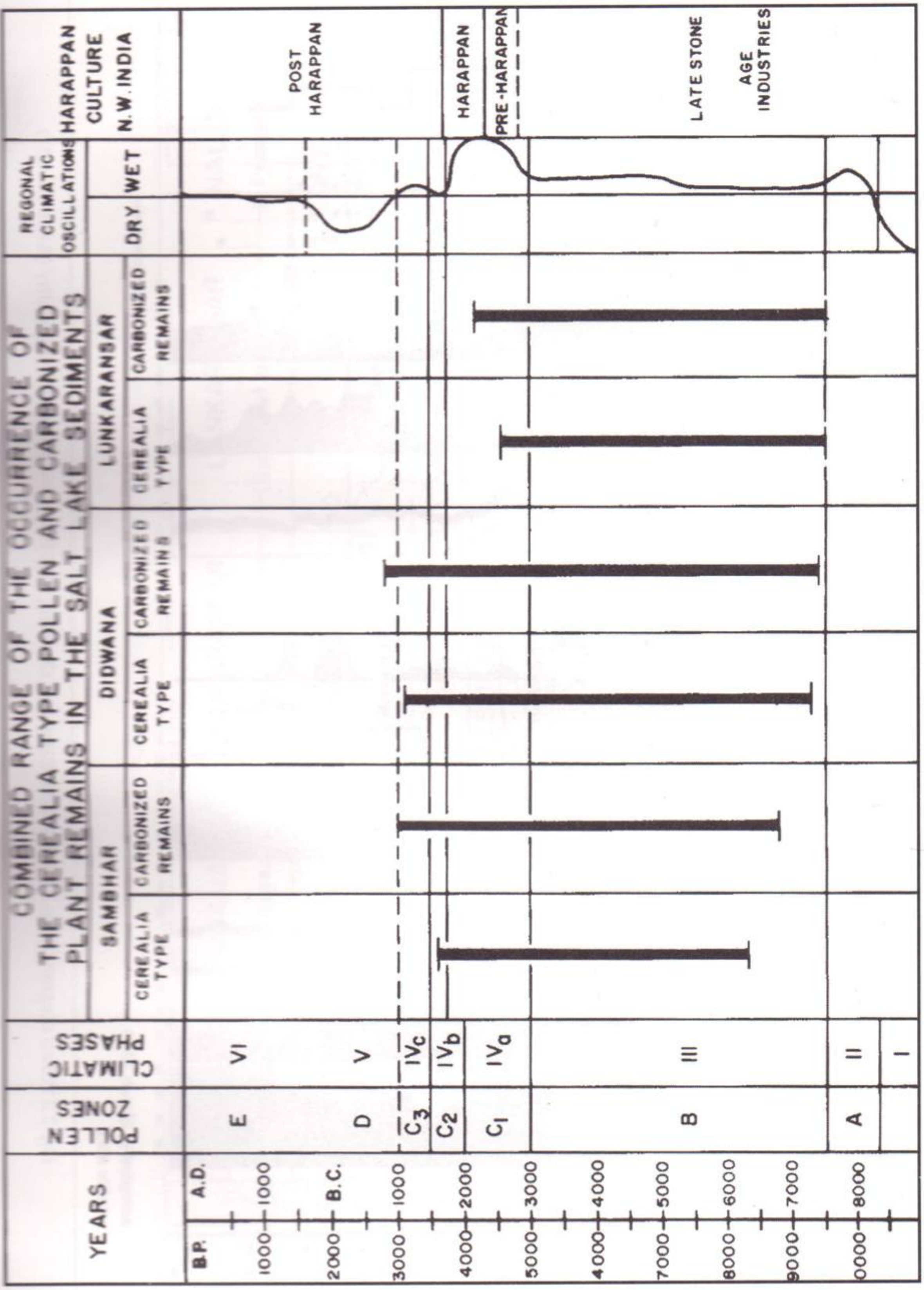


Fig. 2.1 Pollen and charcoal plot of Sambhar and other lakes of Rajasthan showing higher rainfall and low salinity during Harappan times (After Singh, 1971).

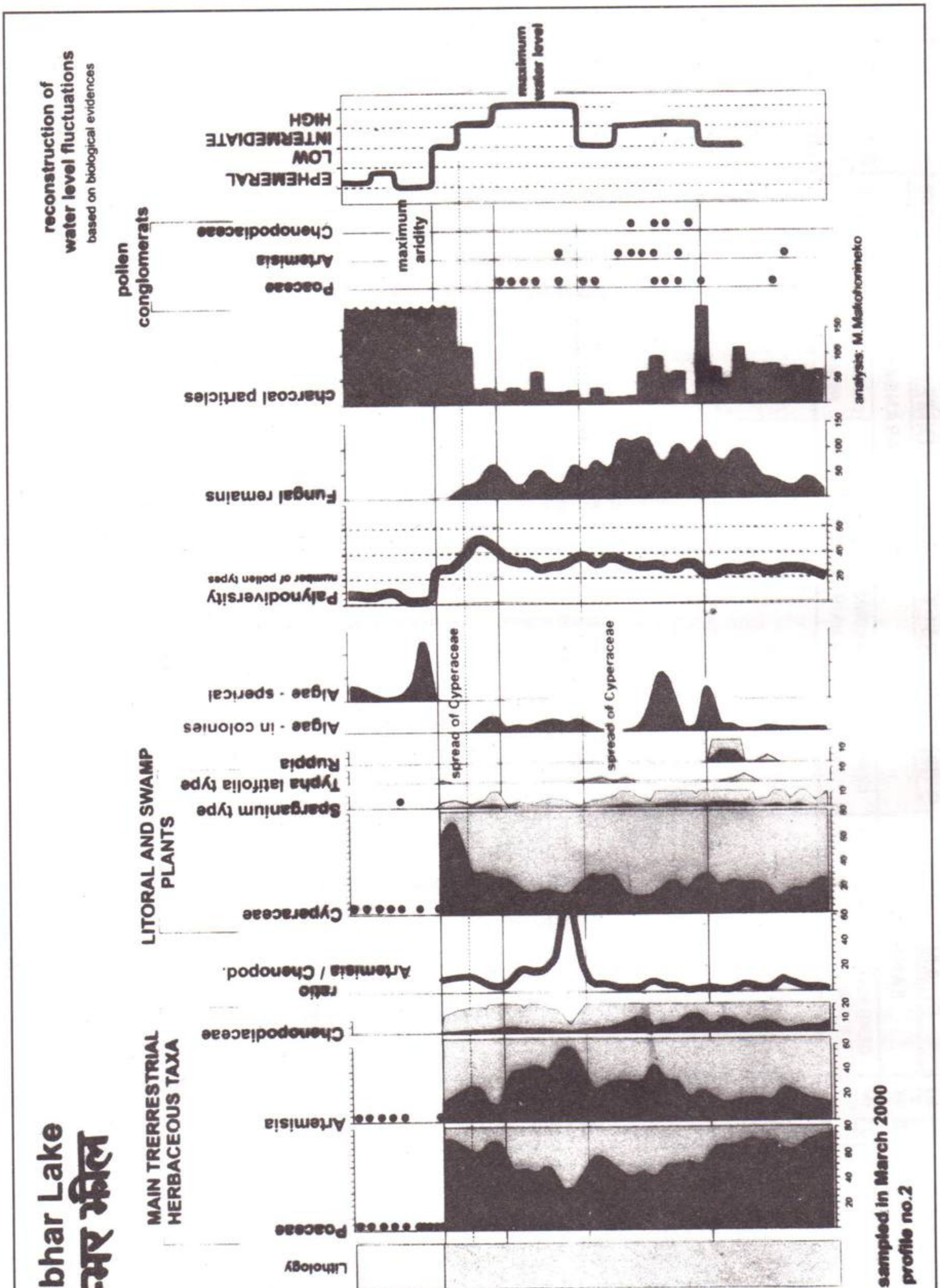


Fig. 2.2 Pollen diagram from Sambhar lake Rajasthan showing mid-Holocene increase in humidity (After Yasuda).

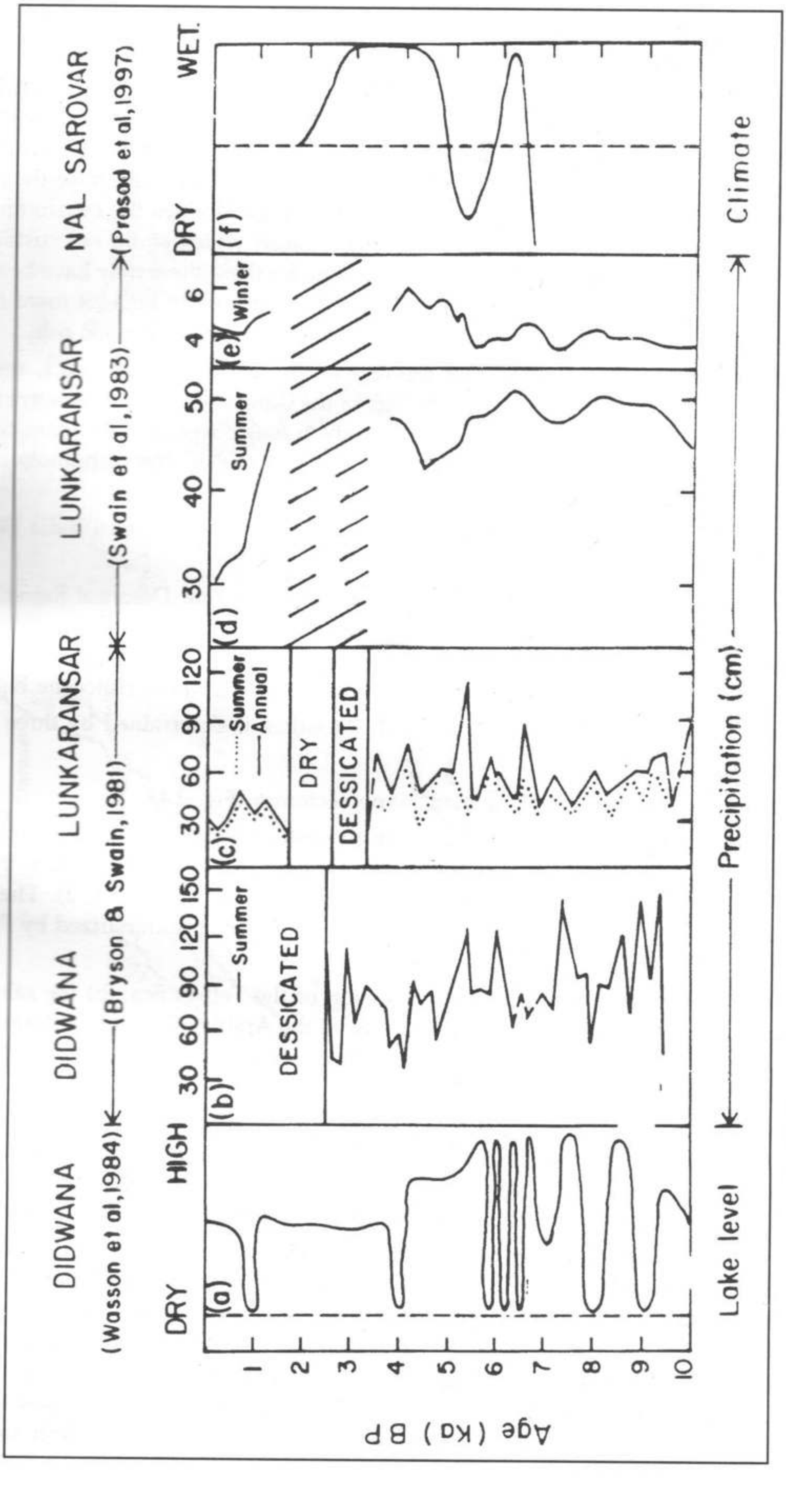


Fig. 2.3 Comparative Holocene climatic changes in Rajasthan and Gujarat (Prasad et al., 1997).

periods. During the Harappan Period the rainfall was much higher than even today, though there was considerable variation with time.

Superimposed on a gradual trend towards aridity were other factors, which made life difficult for early humans. Neotectonic movements led to changes in the loyalties of older tributaries of the Saraswati. The Palaeo-Satluj joined the Indus and the Palaeo-Yamuna, the Ganga. The Saraswati River became an ephemeral river. In fact, one can trace the movement of cultures as Palaeo-Yamuna was shifting towards the Ganga. Besides the environmental causes, there was the intrinsic constraint of the semi-arid ecology, which could not sustain very large sedentary populations of towns and urban centres. Besides these there may have been invasions/ migrations from the west. Though the case of Rajasthan appears to be a bit more complex, it is obvious that here too environmental changes were playing a deterministic role.

We also note that due to aridity, at the turn of the 2nd Millennium BCE, the Harappans started migrating towards the monsoonal ecology of the Ganga Doab. But they were not equipped to cope up with a higher rainfall environment, which was covered with dense forest and big swamps. The Doab could be colonized only with the advent of iron technology, which could provide an abundance of cheap iron tools.

We will now examine the palaeoenvironmental evidence of Western India (Rajasthan and Gujarat) in greater detail.

There have been various theories about the origin of the Thar Desert of Rajasthan. We have worked out an outline of the quaternary climatic history of Rajasthan and we know that the Thar Desert came into existence only about 200 Kyr ago. The loessic deposit of Kashmir also dates to the same period. Here we will confine our discussion to the Holocene Period.

The human-environment relationship in Rajasthan is determined by three main factors:

1. Change in rainfall
2. Change in palaeochannels caused by neotectonics (Fig. 2.4)
3. Limited capacity of semi-arid ecology to sustain large sedentary populations. Singh et al. (1973, 1990) had carried out pollen studies on the cores raised from the saline lakes of Didwana, Lunkaransar and Sambhar in Rajasthan (Figs. 2.1, 2). There have been mainly four theories about the origin of their salinity, as summarized by Possehl (1999c: 263-265):

(a) It is marine and results from the regression of the Tethys Sea; (b) the salt derives from brine springs in the region; (c) it is wind-borne, from the Arabian Sea and the Rann of Kachchha; and (d) G. Singh's hypothesiz that it results from the concentration of salt through the evaporation of lake water with dissolved salt in it.

For periods younger than 20,000 BP, the palaeoecological data derived from pollen and the physical and geochemical evidence of Wasson et al. (1984) from the Didwana lake (Rajasthan) profile show independent, but converging, trends that clearly reflect the history of past changes in climate and the vegetation response in the semi-arid region of the Thar Desert (Figs. 2.1-5).

The evidence for treeless steppe environments, the extremely low values of wetland taxa, and the simultaneous deposition of halites together with low sedimentation of clastics in the lake basin, from about the time of the Last Glacial Maximum to *ca.* 13,000 BP, indicate hyper-arid conditions. As *Artemisia* (a winter rain taxon) values are much higher in pollen zone Dl than those at present, it appears that hyper-aridity was probably caused by a decline in summer monsoon precipitation and that winter precipitation was probably higher than that at present. For this rainfall pattern to exist the westerly circulation must be farther south and the summer

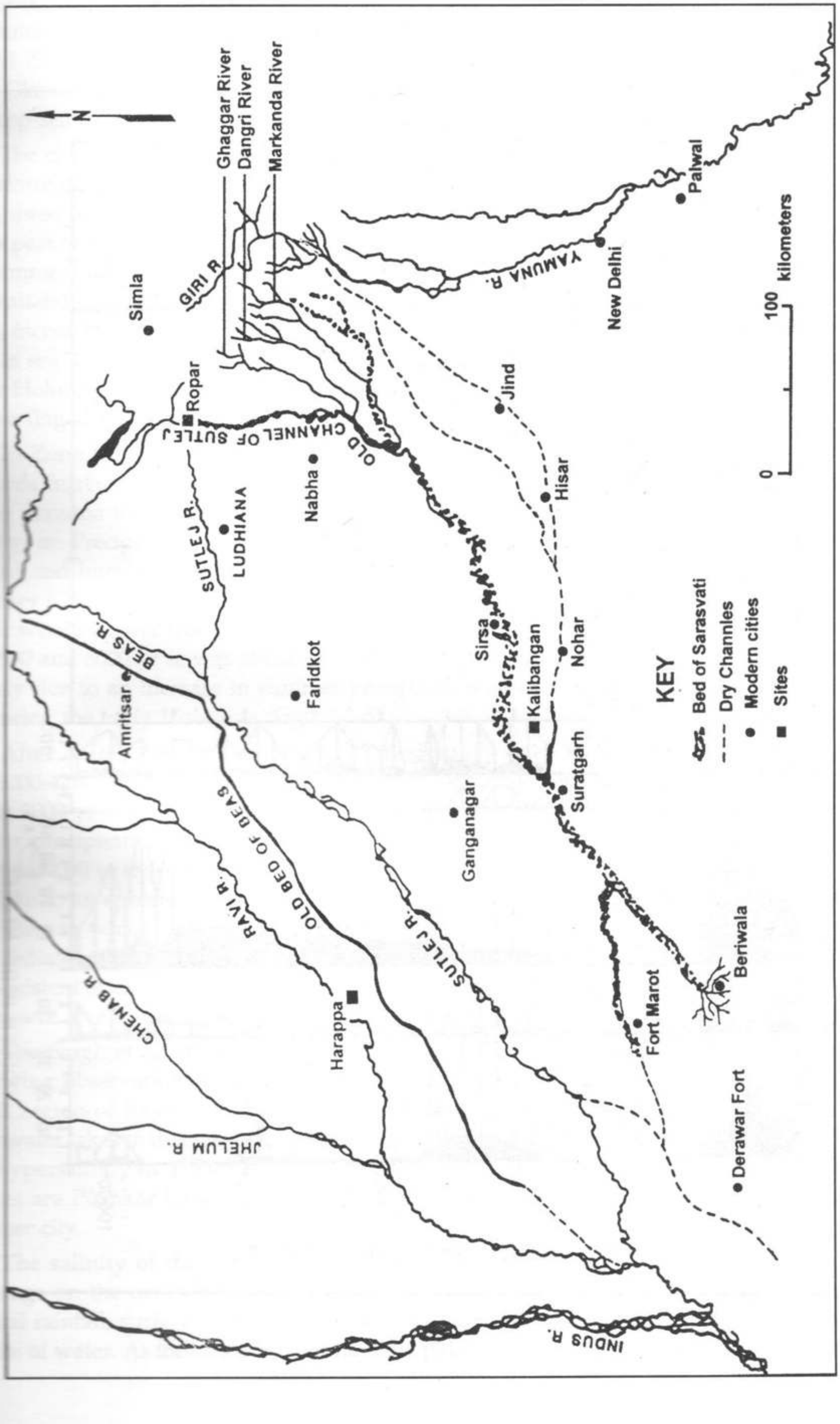


Fig. 2.4 Palaeochannels of Rajasthan including old Ghaggar.

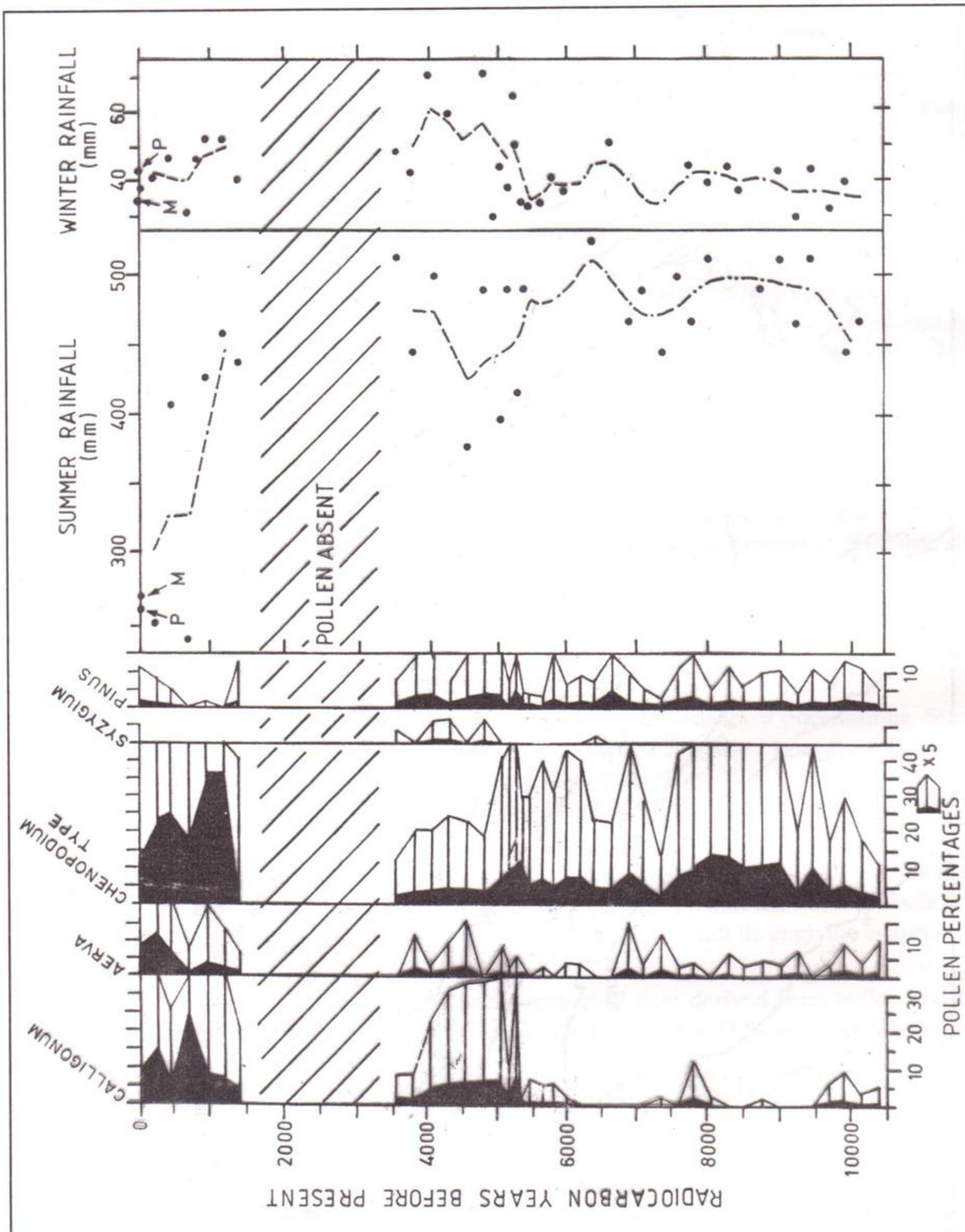


Fig. 2.5 Resolving summer and winter rainfall in Rajasthan on the basis of some sensitive floral species (After Kutzbach et al.).

monsoon circulation must be weaker. The evidence of increased aridity during the Last Glacial Maximum and the Late Pleistocene in the Thar Desert has many parallels in other parts of the world (Sarnthein 1978; Singh 1988). That the monsoon circulation had weakened during the Last Glacial Maximum is also amply supported by pollen, oxygen isotope and faunal analyses of deep sea cores from the Arabian Sea (Van Campo et al. 1982).

The change in a shrub savanna grassland, about 13,000 yr BP, corresponds closely with the transformation of the lake basin to a fluctuating, saline to deep freshwater regime, in Zone D2. Both these developments, together with the rise in the values of freshwater wetland taxa in the latter part of the zone, are indicative of a rise in precipitation, presumably through reinvigoration of summer monsoon circulation, about 13,000 yr BP (cf. Van Campo 1986). That the winter precipitation was not adversely affected was shown by the fact that *Artemisia* values remained high, increasing towards the top of the zone, dating about 9400 yr BP. It is possible that with the rise in sea level, and increasing sea surface temperatures, during the terminal Pleistocene and early Holocene, both summer and winter atmospheric circulation carried greater moisture than before (Fig. 2.5).

In Zone D3 (*ca.* 9300-7500 yr BP) and Zone D4 (*ca.* 7500-6000 yr BP) the trend continued towards increasing precipitation (cf. Singh et al. 1990, Swain et al. 1983). The establishment of a tree savanna in Zone D4 correlates with a sustained deep, freshwater lake condition around 6000 yr BP. Precipitation levels were considerably higher than at present. As taxa from the sub-humid and humid zones (with almost twice the present rainfall at Didwana), comprising both summer (*Oldenlandia*) and winter (*Artemisia*) precipitation, reached their highest values in Zone D4, it would appear that the total mean annual precipitation during the mid-Holocene between ca. 7500 and 6000 yr BP was about twice the modern value. It seems likely that the doubling was largely due to an increase in summer precipitation and that winter precipitation had remained as during the early Holocene (Figs. 2.3-5).

After *ca.* 6000 yr BP, the change to moderately deep freshwater conditions, in Zone D5 (*ca.* 6000-4200 BP), corresponds with the return of *Calligonum* shrubs on dunes in the region. By about 5000 yr BP, both *Oldenlandia* and *Artemisia* show decline indicating that both summer and winter precipitation had started to decline–a trend which appears to have intensified further from ca. 4000 yr BP to the present day. The evidence for intensification comes from the change in the lake to an ephemeral regime, from *ca.* 4200 yr BP, and from the quality of the surface pollen spectrum in which *Aerva*, *Calligonum* and *Gramineae* pollen is shown to dominate the present day sedimentary record. As *Artemisia* values are at their lowest level and *Oldenlandia* practically non-existent at either end of Zone D6, it is likely that both summer and winter precipitation fell to present levels at or soon after *ca.* 4200 yr. BP.

The Singh et al. (1973) hypothesiz has been recently questioned, most seriously from the following observations (Possehl 1999c): The salt lakes are all grouped together within a very small region of Rajasthan. They are under one climatic regime. On the other hand, there are freshwater lakes in this same region, flourishing under the same climatic conditions that produced the hypersalinity in the lakes that have been studied by the geoclimatologists. The freshwater bodies are Pushkar Lake at Ajmer, and the lesser-known Lake Gajner, 30 kilometres south of Bikaner city.

The salinity of the lake water is a function of the balance between rainfall and surface drainage on the one hand, and subsurface conditions on the other. A change in total average annual rainfall, surface drainage or subsurface drainage will change the halite content of these bodies of water. As indicated by the changing palaeochannels of the Satluj, Yamuna, Drishadvati, etc., the area is riddled with lineaments and fault lines caused by neotectonics. These changing lineaments could change both surface run-off and also subsurface drainage, affecting the salinity of the lakes. There is no doubt that Pushkar and some other lakes have access to subsurface water which more than neutralizes evaporation. But that does not mean that the lakes of Sambhar, Lunkaransar and Didwana, separated from each other by a few hundred kilometres, could have remained unaffected by severe changes in precipitation. Swain et al. (1983: 1-17) used precipitation-sensitive species to calculate quantitative changes in precipitation in Rajasthan. They estimated greatly increased summer precipitation of about 480 mm/yr, from 10.5 to 3.5 Kyr. The interval from 5-3.5 Kyr had the highest winter rainfall. Bryson (1988: 233) also remarks:

In northern India, summers during the mid-Holocene were much wetter. Now the summer monsoon is essentially the only rain in northern India, but in mid-Holocene time there was also considerable winter rainfall.

One has therefore to note that not only the summer monsoon but also the winter rainfall was significantly higher during the mid-Holocene, which brought down the salinity of the lakes in question. These climatic inferences were based on rain-sensitive pollen spectra. Wasson et al. (1984) carried out extensive geochemical and sedimentological studies at Didwana. They inferred that the deepest water conditions in the entire sequence were indicated soon after 6 Kyr, thus confirming the climatic pattern indicated by pollen studies. A Japanese team in collaboration with the Deccan College, Poona, has again raised cores from Didwana for high-resolution work. Their detailed results are awaited. Singhvi et al. (2004: 371-402) have been busy with extensive studies of the Thar Desert for several years now. They have brought out a comprehensive report with five papers in a special issue of *Proceedings of Indian Academy of Sciences,* 2004, 113(3).

Bryson (1988: 233) emphasizes the importance of the fact that there was "the long dry period from 3500 to 2000 BP". Recent work on the cores taken from the oxygen minimum zone off Karachi at water depth of 700 m contains continuously laminated sediments with a sedimentation rate of 1.2 mm/yr and a unique record of monsoon climatic variability covering the last 5000 years (Rad et al. 1999: 39-53). They further notice that the period from 3900 BP is marked by varve thickness minima and low turbite activity, which they interpret as indicators of low precipitation and decreased river run-off.

Prasad et al. (1997) carried out multi-disciplinary studies in the Nal Sarovar in Gujarat employing sedimentological, faunal, $\delta^{13}C$, C/N in organic matter, magnetic susceptibility, and measurement of crystalline index of clay minerals techniques. Their study concludes that this period (6-4.8 Kyr)

showed the highest value of C/N indicative of higher proportion of terrestrial plants in association with enriched $\delta^{13}C$, shallow water loving *Bittium* and land snails.

The overall climate was dry but evenly spaced with wet spells. During 4.8-3 Kyr the climate was wet. Thus we see that the Rajasthan climatic data, though admittedly not of high-resolution quality, do show convergence not only between different indicators but also agree with the multi-disciplinary studies carried out by Gupta and Prasad in nearby Gujarat. We have also to note that the whole of Northern Hemisphere shows mid-Holocene warming and wetter conditions (Bryson 1988, Figs. 10 & 11).

A recent study by Thomas et al. (1999: 192) also supports the findings of Singh et al. This study concludes:

(1) The present study provides evidence that during the Holocene, the Thar Desert experienced multiple episodes of aeolian accumulation of short duration. These are spaced by periods of ~1.5-2.0 ka of low

accumulation/quiescence. These results also pose new questions that would require further work to consider: i) the role of winter precipitation changes in regulating aeolian dynamism; and ii) the implication of monsoonal teleconnections and phase lag in dune accretion. (2) The study also indicates that the earlier phase of desertification in the Thar ended at ~ 0.6-0.8 ka ago. This may be an important input for land use planning of the region. (3) Evidence of increased sand mobilization/accretion is seen during the past 0.3 ka, suggesting anthropogenic effects.

Bryson (1988: 234-235), Singh (1971: 177-189), Singh et al. (1990: 351-358) and Agrawal (1992) all have emphasized the role of climate and environment in affecting habitations, especially the Harappan culture. But one has to admit that in Rajasthan the situation is more complex.

The changing river channels, mainly in response to neotectonic movement of lineaments in Rajasthan, have resulted in changes in the course of the Satluj, Ghaggar and Drishadvati rivers as indicated by both the distribution of archaeological sites and satellite imageries (Agrawal & Sood 1982; for a detailed historical summary of such studies see Possehl 1999c). As a result of these tectonic changes, the Satluj joined the Indus System and the Drishadvati, the Yamuna drainage. The ancient Harappan settlements of Kalibangan and other smaller sites were on the banks of the Ghaggar, which eventually dried as its main tributary joined the Indus system (Fig. 2.4).

The third factor one has to take into account is the limited sustainability of semi-arid ecology for large sedentary populations. Despite the mid-Holocene climatic amelioration, Rajasthan remained a semi-arid ecology. It could not sustain large towns for any length of time. The ecology had to give way once a threshold was crossed, till it regenerated again. We see this phenomenon in Rajasthan. The Harappans appeared around 2600 BCE and withered away around 1800 BCE. The Painted Grey Ware culture again appeared around 800 BCE and disappeared a few centuries later. So also the Rangmahal culture, which appeared around 2nd-3rd centuries AD and withered away in a couple of centuries.

We thus see that in Rajasthan, it's not only the changing precipitation that affects habitation but also the changing loyalties of the rivers and the sustainability thresholds of semi-arid ecology to allow large sedentary populations for long periods of time. All these trends are superimposed on each other in Rajasthan.

More recent work of Singhvi et al. (1998) has shown that the main dune building activity is dateable to *ca.* 14 Kyr, just before the onset of the strengthening of the monsoon. Our studies also have brought out the vital role of the Tibetan Plateau in forcing climatic change (Agrawal & Yadava 1998: 55-58).

EVIDENCE FROM THE ARABIAN SEA

Van Campo et al.'s (1982) work on the Arabian Sea cores has already shown that between *ca.* 18 Kyr and now there were three cold and arid periods, approximately at 18, 7 and 2 Kyr (stages 6-4). The pattern of heavier oxygen isotopes of the forams, and the dry winds indicated by the pollen diagram show that on the land also there must have been cold and dry periods. Interglacial substage 5e is marked by high relative frequencies of the Sudanese savanna and humid tropical pollen taxa which include the long distance transported tropical African Montane Podocarpus and Olea signalling a strong south-west monsoonal air-flow, while Chenopodiacae, Sahelian steppe and Mediterranean steppe Artemisia pollen decrease. They interpret this period as both warm and humid. According to them, stage 1, early Holocene, around 8 Kyr is also characterized by highly increased amounts of humid tropical and Sudano-Sahelian savanna taxa, increasing with a stronger south-west monsoonal flow (stage 5).

Glacial isotope stages 6, 4 and 2 (including end of 3) denoting the Last Glacial Maximum are marked by low relative frequencies of humid tropical taxa from the Mediterranean steppe. These latter taxa originate from the north and north-east, indicating stronger north-east trade winds and increased aridity. They thus conclude that:

This marine pollen diagram from the arid tropical zone depicts the fluctuations of the intensity of the seasonally reversing low latitude wind systems, and of the local moisture, and correlates littoral aridity with sea-level variations. These fluctuations correlate with the global climatic changes as indicated by isotope stratigraphy. The intensity of the monsoonal winds seems to respond mainly to the variations of the insolation, controlled by earth's orbital parameters, being maximum when the insolation is strongest. In south-western Asia and at low latitudes and the north-east, trade winds were intensified against a decreased monsoon. In the tropics, as evidenced by the most detailed Holocene record, incipient interglacial stages were the most humid periods over the Atlantic, Africa and over the Arabian Sea and India. ... (Van Campo et al. 1982).

As discussed above, there is considerable concordance between the evidence of the Arabian Sea and the pollen and palaeosalinity data from the Rajasthan salt lakes. In Rajasthan, up to 13 Kyr there is a very dry period (Agrawal 1983, Agrawal et al. 1980, Wasson et al. 1984). In this period sand-dunes became active, lakes turned hypersaline, giving rise to evaporation and halites. Between 13 and 6 Kyr, to repeat, there is considerable fluctuation, but aridity lessens. But between 6 and 4 Kyr, the lakes become sweet and deep; dunes get stabilized and around 1800 BCE there are again dry oscillations as mentioned above.

Balakot

The first of these reconstructions comes from Balakot near Sonmiani Bay in Pakistan. Here Margaret McKean (1983) undertook some palynological research aimed at reconstructing *the* ancient environment. Her conclusion from a comparison of ancient and modern pollen samples covering the Early Harappan and the Mature Harappan is:

... occupation during both cultural periods existed under essentially modern climatic conditions (McKean 1983: v)

Malvan

The second study was undertaken as part of the archaeological excavations at Malvan, in South Gujarat, by J.P. Joshi and F.R. Allchin (F.R. Allchin and J.P. Joshi 1970, 1995; J.P. Joshi and F.R. Allchin 1972). The palynological research conducted by Vishnu-Mittre and Chayya Sharma at an oxbow lake in the vicinity of the Bronze Age archaeological site has shown considerable environmental stability. The entire pollen sample revealed that an open grassland of Cheno-Amaranths, along with several other herbaceous elements, surrounded the lake. Distant arboreal forests were also suggested.

There was good evidence for the occasional drying up of the lake, for reasons that are not fully understood. Overall, the pollen sequence suggests little environmental change. However, this is undated and there is no sense of the time depth covered by this sample (Vishnu-Mittre and Sharma 1973).

In Rajasthan monsoon plays a major role in human settlements. Mid-Holocene, like everywhere else in the Northern hemisphere, witnessed higher temperature and rainfall. The flourishing sites of Harappan culture in Rajasthan mark this period. Neotectonic changes of lineaments have played their role in changing the loyalties of the rivers there. Highly populated settlements of the Harappan culture could not be sustained by the semi-arid ecology of Rajasthan for any length of time. For the Ganga Valley, on the other hand, there is very little climatic data, though this monsoonal region with 100-150 cm rainfall/yr did not allow the second urbanization of India to take place till abundant iron became available to clear the forests and the swamps.

Any climatic shifts which might have led to a more even distribution of rainfall throughout the year, or to an increase in the amount of winter rain, would have had a distinctly beneficial effect on past arable agriculture. All this is speculation: it must be stressed that we have no unambiguous evidence that late Holocene climates were markedly different from the climate of the Bannu Basin today. This is not, of course, to say that climates have remained the same through much of the later Holocene time in this area; we just do not know (Thomas 1986a: 22-3).

EVIDENCE FROM OTHER REGIONS

There are data from four other sources of palaeoenvironmental reconstruction, with three of them based on pollen. These are not entirely consistent among themselves but do tend to indicate that the environment of the 3rd millennium was not so different from the present. There is also an implication that the science of reconstructing the ancient environment of the Greater Indus Region is very young and a great deal of work needs to be done before consistent patterns of climatic variability begin to emerge over this vast area.

NAL LAKE, GUJARAT

Vishnu-Mittre and Sharma (1978) tested Nal Lake *ca.* 60 km south-west of Ahmedabad. Their reconstruction there indicates lake level stability between 3000 and 1500 BCE, with a disappearance of pollen between 1500 BCE and AD 1819 when the lake was revived. More detailed and multidisciplinary works of Prasad and Gupta has been discussed above.

MEHRGARH

Stephanie Thiebault undertook the examination of wood charcoal from Mehrgarh (Periods VI and VII) and Lal Shah, the Period V kiln site (Thiebault 1989, 1992). The species she identified are still endemic to the region, although *Juniper,* for example, would only be found at higher elevations in the Quetta Valley. There is little, rather, nothing to suggest higher rainfall in the past from this data set. The macrobotanical analysis at Mehrgarh leads to the same tentative conclusion (Costantini and Biasini 1985).

ROJDI

The joint team from the Gujarat State Department of Archaeology and the University of Pennsylvania Museum undertook an intensive program of palaeobotanical research (Weber 1991). While palaeoenvironmental reconstruction was not the principal aim of this research it was a topic that received much attention. From an analysis of thousands of seeds from about 100 different plants there is nothing at Rojdi to suggest that the environment during the 3rd and early 2nd millennia was significantly different from today.

BANNU BASIN

There is another view on the climate of the Indus Age that deserves notice. Some attention has been paid to the ancient environment of the Bannu Basin in Pakistan as part of archaeological work being undertaken there by the University of Peshawar. Although it is clear that the drainage of this valley has undergone significant changes, they seem to be late glacial or early Holocene in age (Thomas 1986a: 22, see also Thomas 1986b). Helen Rendell suggests that:

> Several lines of evidence point to the existence of moist conditions within the basin 3000 to 5000 years ago. In addition to an increase in aridity since that time, there is evidence that the major phase of incision within the basin occurred within the last 300 years ...

(H Rendell in Allchin, Allchin, Durrani and Khan 1985: 12). Rendell's colleague on the Bannu Basin Project has put this in a good context by noting:

3

The Beginnings

Probably the march of humanity towards civilization was inevitable, though there are still tribes in a Stone Age economy. There is no way of telling whether the Stone Age tribes are happier than the so called "civilized" people. The people in the hunting-gathering stage were definitely healthier. As we will see below, the agricultural revolution has not been an unmitigated bliss for the humanity, as it brought in its wake disease and decay.

Humanity could afford urban societies only because it could generate agricultural surplus. Agriculture allowed us to sustain very large populations. About 100 Kyr ago the population was only about 10,000 and now very soon we are crossing the 10 billion mark – a million-fold increase in just a few millennia! Though we generally regard hunting-gathering as a primitive stage and attribute civilization to agricultural surplus, yet agriculture brought several problems in its wake. The easily digestible food of *Homo sapiens* gradually led to shrinking of the jaw. Our jaw now can accommodate only 28 teeth. The wisdom teeth create a variety of problems when they erupt. About 15 per cent Europeans and 30 percent East Asians do not grow more than 30 teeth. During the last 10 Kyr *Homo sapien* size is shrinking. From Cro-Magnon man's 6 feet average height, it has come down to 5 feet 8 inches today. Molleson (1994: 60-65), who studied skeletons from Abu Hureyra (Syria) dating back to 11.5-7.5 Kyr, found that daily grinding of grain for several hours resulted in damaged discs and crushed vertebrae. Maize cultivation, which started 8000 years by the American Indians, resulted in several fold increase in tooth cavities, anaemia, TB, yaws, arthritis and syphilis. Almost 1/5th population died in infancy. Dense populations led to a variety of epidemics.

If agriculture brought such disasters then why did we opt for it? The answer is simple. Farming allowed a larger number of people to sustain themselves over a piece of land than would hunting-gathering. However, hunting-gathering life style had its own advantages. The physical exertion of hunting kept us in good health (Stringer & McKie 1996). Agriculture and ceramic technology had a dramatic effect as porridge could now substitute breast milk. Regular breast-feeding suppresses ovulation and weaning of infants from breast milk led to more frequent pregnancies and an increase in population.

About 10 Kyr back, domestication of plant and animals started in several areas of the world. Wheat was cultivated in West Asia, rice in China, millets, yam and sorghum in West Africa, and maize in South America.

It may be worth noting the warnings about dependence on agriculture that Possehl would like us to heed. He warns:

There is a correlation between food producing subsistence systems and the use of domesticated plants and animals. With the full advent of the primary village farming community, and the evolution of pastoralism, human dependence on domesticated species was very great, almost total in some "mature" cases. As the system of farming and animal-keeping developed into today's world, that dependence could be dangerous. Looking at the production of food on a worldwide scale there were six animals, or groups of animals that each produced over a million tons of meat per year: pigs, cattle, poultry, sheep, goats and buffalo (in that order), but of the 113.1 total metric tons just about 75 per cent of the productivity came from two animals, pigs and cattle. Plants are a bit different. The thirty or so principal plants yielded about 2360 million metric tons of produce. But the top seven producers (wheat, rice, corn, potato, barley, sweet potato, and cassava in that order) accounted for about 71 per cent of the total yield. Thus, nine plants and animals constitute three-fourth of the world's food supply – this vulnerability is part of the legacy of the "Neolithic Revolution" ... There are, however, two sides to the issue. The legacy is good because these plants and animals have been brought to a point where they can provide food for the billions of people now living. It is bad because out of the millions of plants and animals species, we are dependent on so few. If something catastrophic should happen to just one or two of them, our extreme dependence could be turned into disaster for those same billions of people. There may be little resiliency in this subsistence regime (Possehl 1999b: 404).

He also differentiates the two processes of civilization in the Old and the New Worlds. He further writes:

The economic foundation for civilization in the Old and New Worlds differed. The parallel and independent processes for development of civilization in both hemispheres are distinctive in their subsistence pattern. Old World and New World civilizations developed essentially independently of each other and thus they provide opportunity for the comparative study of the rise of civilizations. The economic foundations on which Near Eastern civilizations were built depended upon wheat, barley, certain legumes (especially peas and lentils) and domesticates. These subsistence resources are remarkably different from those that established the economic foundation for the New World and in their difference might be found a partial explanation for the distinctive paths that both hemispheres followed toward civilization. In the New World the vegetable domesticates were principally beans and squash; the animal domesticates, the Lama of Peru and guinea pig of Mesoamerica were far more limited geographically than those of the Old World.

The geographical area in which the manipulation of plants and animals began extends from the Anatolian plateau to the deserts of Central Asia and from the uplands of Palestine to the Caucasian range. In this large area several primary centres can be isolated where domestication of plants and animals was first accomplished. This occurred in the millennia following the stabilization of our modern climate (after the last Ice Age) by 9000-8000 BCE in the Syrian-Palestinian Levant, the hilly flanks of the Zagros in Iraq and Iran, the south Anatolian plateau and eastern Elburz; in short, in the highland zones of the Near East. The presence at Nahal Oren, Israel, around 18,000 BCE, of seeds of precisely those plants later domesticated indicates that already at such an early date particular plants were selected for exploitation.

Braidwood (1960: 130-148) discerned two levels in the evolution of food production: an era of incipient cultivation and animal domestication and a later era of primary village farming. It is important to realize that these "levels" of socioeconomic evolution did not develop contemporaneously, nor did they inevitably succeed each other. Perhaps the mosaic of interdependence between village agriculturalists and nomads was never uniform over large geographical expanses.

It is interesting to note here that Meadow finds two early farming transformations in South Asia: One after the Indus civilization declined and the other in the Neolithic times. Meadow (1989) says:

One of the major unanswered questions of South Asian archaeology is the reason(s) for an apparent "de-urbanization" of the Greater Indus Valley beginning at about 1900 BCE. This phenomenon took place together with the development of distinctly local manifestations of material culture that are particularly striking when

> compared to the extent of integration evident during the Harappan Period. It is possible, even likely, that the degree of diminution in site size and amount of "localization" that actually occurred is overestimated because of gaps in our knowledge and mistakes in our understanding of the archaeological record (e.g. Shaffer 1981, 1986). Yet one cannot escape the impression that significant shifts in settlement did take place if only in the abandonment of certain very large sites, including Mohenjodaro, and the establishment of many small sites throughout the region but particularly in East Punjab (Shaffer 1981, in press; Joshi, Bala & Ram 1984). Some abandonment and realignments can reasonably be attributed to changes in hydrological regimes in Punjab (e.g. Wilhelmy 1969; Mughal 1982; Agrawal and Sood 1984) and in Sindh (e.g. Flam 1981) .... Yet there is increasing evidence that it was precisely at this time, in the beginning of the 2nd millennium BCE, that a new complex of cereal crops and domestic animals was becoming known in the region ... When viewed on a broad basis, two distinct agricultural revolutions can be identified for the north-western region of South Asia during the pre- and proto-historic period. The first involved the establishment by the 6th millennium BCE of a farming complex based principally on the rabi (winter sown, spring harvested) crops of wheat and barley and on certain domestic bovids including zebu cattle, sheep, and goats. The second saw the addition during the early 2nd millennium BCE of kharif (summer sown, fall harvested) cereals including sorghum, various millets, and rice along with new domestic animals including the camel, horse, and donkey.... The proposal explored in this essay is that new agricultural opportunities resulting from the introduction of the summer-sown cereal crops, when combined with the new means of animal-based traction, transport, and communication, facilitated widespread settlement in areas previously marginal to food production as well as realignment of settlement in already occupied areas of north-western South Asia. This is by no means a new idea, having been proposed in part by Shaffer (1981:97) for East Punjab and Possehl (1986) for peninsular South Asia. What Shaffer did not emphasize was the importance of the differences in growing seasons (see Hutchinson 1977 and Costantini 1979, 1981), while Possehl did not stress the role that such a change could have played in the Greater Indus Valley itself. Costantini (1979, 1981), Tosi (1983, but with a broader geographical scope), and Jarrige (1985a), have all underlined the significance of the new food production systems, and this essay can be seen as a distillation of ideas which we have explored together over a number of years.

In his concluding remarks Meadow observes:

> The new crops and animals that came to be widely used in South Asia during the early 2nd millennium BCE did not supplant but were exploited together with those that had formed the basis of agriculture for millennia in the Greater Indus Valley. In terms of its subsistence base, the Harappan was very much a Middle-Eastern civilization, depending principally on wheat, barley, sheep, goats, and cattle although with significant distinguishing features including the overwhelming importance of cattle, which has continued to characterize South Asia to modern times. The claims of Fentress (1985: 367) that the risks and uncertainties of one-season agriculture led to double-cropping in Sindh during the Harappan Period in order to "ensure a stable and regular food supply are unconvincing, as present evidence indicates that the fruit of the date palm is the only significant food source used at that time in the Indus Valley that matures in the summer or fall. Summer grown crops such as cotton and grapes were never vital to subsistence, although their cultivation may have developed expertise valuable to farmers who would later plant summer cereals (Meadow 1989: 1-16).

Summer (*kharif*) cultivation of the "millets" and rice appears to have begun in areas with significant monsoon rainfall east and south of the Indus Valley where wild forms of some "millets" and rice are likely to have occurred. When and how this took place, however, is still obscure, although there is hope that palaeoethnobotanical investigations will clarify the matter in the not too distant a future. The presence of Harappan settlements in these areas may have provided the impetus necessary for local populations to begin to systematically plant seeds of grasses, which had previously been gathered to feed themselves or their animals (if the keeping of animals is truly earlier than crop-growing east and south of the Indus). The importation of sorghum probably from Arabia into Saurashtra at this time may also have played a role in developing the cultivation of similar grasses.

To date, the emphasis in discussing pre- and proto-historic South Asian subsistence has been placed on the major food crops and animals. As palaeoethnobotanical and archaeozoological studies have begun to show, however, other plants and animals played significant, if perhaps less critical, roles in the lives of the people of the region. Vishnu-Mittre (1985) has pointed to some directions worthy of investigation for plant materials, including consideration of those forms important for cultural and technological reasons and as animal fodder. The actual evidence for such practices will come from careful consideration of data gathered through flotation, wet sieving, and pollen analysis. As far as the animals are concerned, the processes of integration into the domestic economy of the water buffalo, dog, cat, and chicken still require classification, as does also the spread of pastoralism into areas south and east of the Indus Valley. The role of hunting, gathering, and foraging must also be evaluated in their relation to agricultural and pastoral practices and as the principal source of supply for particular resources. Finally, investigation of the climatic and environmental conditions prevailing on the local level during pre- and proto-historic times is essential to a better understanding of ancient settlement generally and of agriculture and animal husbandry in particular. To date, it has been extremely difficult to do more than to generally characterize the situation in the Greater Indus Valley as a whole and to use analogy with modern conditions as a guide to the past.

With this preamble, we now trace the origins and spread of agriculture and animal husbandry in South Asia in a Pan-Asian perspective.

Here we may note that in India we have one more stage between Upper Palaeolithic and Neolithic, named Mesolithic, which is marked by the use of microliths. The Neolithic is marked by the use of ground stone tools. This is mainly because we have traditionally placed more importance on artefacts than on evidence of the domestication of animals and plants. Even in Rajasthan we have evidence of clearance of vegetation and *Cerealia* type pollen from the lakes of Didwana, etc. which may mark the beginning of agriculture in early Holocene but without any ground tool appendage. In the Vindhyas too use of pottery and domestication of plants and animals and permanent settlements mark the so-called Mesolithic.

It appears that in South Asia, there were four early centres of domestication of plants and animals: 1. North-west and West (includes Kachhi plains of Pakistan; Indian states of Kashmir, Rajasthan and Gujarat); 2. The Ganga Valley and the Vindhyas; 3. East (the Indian states of Bihar, Assam, North-eastern states, Bengal, Orissa); and 4. Peninsular India. Out of these early centres, the North-west and Western centre is very well documented and is more relevant to the development of the Indus civilization.

Of these four nuclei, we have good documentation of the developmental stages in north-west as evidenced in Mehrgarh area. It should, however, be noted that an antecedent stage of hunting and gathering, preceding the appearance of the village farming community, has not been defined well in either India or Pakistan. Though there is a good chance that Afghanistan may provide the evidence for the origins of agriculture in this region. Possehl points out:

> The dates for the "Aceramic Neolithic" material from both Snake and Horse Caves compare well with dates from the Near East. At present, these dates and the archaeological materials themselves can be seen as good indications that northern Afghanistan, probably the entire western Hindu Kush, should be taken seriously as a place where early, independent experiments with agriculture and animal husbandry may have taken place. There is more Aceramic Neolithic material in Pakistan which is clearly much nearer to the foundations on which the Indus Age rests (1999: 434).

No detailed work has been done in Rajasthan though the pollen evidence is suggestive. The lakes of Sambhar, Didwana and Lunkaransar are situated about 300 Km apart from each other in Rajasthan, yet they show the presence of *Cerealia* type pollen accompanied by comminuted pieces of charcoal probably indicating clearance of vegetation for agricultural purposes. These levels are dated to *ca.* 7500 BCE (8300 cal BCE) (G. Singh 1971: 185-86). There are no Neolithic sites though microliths are found from many sites. Baghor has given some evidence of early domestication of animals. Unfortunately, this palaeobotanical evidence has not been followed up archaeologically. Pollen profiles also indicate that from *ca.* 13000 BCE the monsoon had started strengthening though there were major fluctuations till the mid-Holocene when it was finally stabilized. The rainfall during this mid-Holocene Period was probably twice than today. It is interesting to note that this climatic amelioration is co-incident with the flourishing of pre-Harappan and Harappan cultures.

Weber's extensive archaeobotanical study of the floral remains found at Harappa (2003) will be discussed in Chapter 9 (Trade & Agriculture). Weber (1998) has also brought out the significance and origins of some important millets found in South Asia. Table 3.1 shows the name of the millet and the country of origin, as also the date.

Recently, there have been some chauvinistic claims that the Indus civilization was born in the Saraswati Valley, though, as we will see below, its foundations were laid in Baluchistan – at Mehrgarh and Nausharo. Identities of countries and nations are not static entities but changing spatio-temporal concepts. The different "Indias" of the Indus civilization, of the Mauryan times, of the British Period and of today—all represent different spatial configurations. In studying history of cultures and archaeology, one cannot be conditioned by narrow, present-day chauvinistic considerations.

With this backdrop, we can now go into more details of the north-western region which is of direct relevance to the beginnings of the Indus civilization.

DEVELOPMENTS IN THE NORTH-WEST

There is considerable controversy regarding the locales of the origins of wheat and barley. Possehl (1999:405) thinks that the Indo-Iranian borderlands may have played a significant role in the beginnings of agriculture. He remarks:

> The modern distribution of wild wheat and barley does not inform us of the distribution of these plants at the beginning of the Holocene. Thus, it is premature to insist that the Indo-Iranian borderlands were outside the distribution of wild wheat 10,000 years ago ... Even if wild wheat was not present on the Indo-Iranian borderlands this region could still have played a key role in the domestication process. The genetic history of free threshing wheat, which was most useful to humans, involves genetic crosses with the genus *Triticum* and with a related plant, goat-face grass (*Aegilops squarrosa*), found all across the Iranian plateau. Richard H. Meadow has made the point that: The necessary conditions for an emmer X (and) *Aegilops* cross .... could have been met anywhere the latter appeared as a weed in fields where emmer was cultivated. Therefore, *T. aestivum* could have originated as easily in the Pakistan area as in north-west Iran and, in fact, it seems quite likely that free threshing wheat of the west was *T. turgidum* cf. conv. *durum* and that of the east *T. aestivum* (Meadow 1993a: 301).

In his encyclopaedic work, *The Indus Age: the Beginnings*, Possehl (1999) has exhaustively discussed the socioeconomic antecedents of the Indus civilization. We have followed Possehl's chronological framework and detailed discussion in delineating the early farming cultures of the north-west.

Table 3.1 Origin of millets in South Asia with dates and countries of origin (Weber 1998).

Latin and Common Names	Country (Area) of Origin	Earliest Finds in South Asia
Setaria italica Foxtail millet	East Asia	2400 BCE
Panicum miliaceum Broomcorn or common millet	East Asia	1900 BCE
Echinochloa colona Sawa or barnyard millet	East Asia	1900 BCE
Panicum sumatrense Little millet	South Asia	1000 BCE
Paspalum scrobuculatum Kodo millet	South Asia	1700 BCE
Eleusine coracana Ragi or finger millet	Africa	2500 BCE
Sorghum bicolor Jowar or large millet	Africa	2000 BCE
Pennisetum typhoides Bajra or pearl millet, bullrush millet, spiked millet	Africa	1900 BCE

Table 3.2
Cultivated Plants from South Asian Sites of the 3rd and 2nd Millennia BCE (Weber 1998).

Plant Taxon	Cropping Season	Date BCE		
Cereals		**4000-2600**	**2520-2000**	**2000-1700**
Wheat (*Triticum*)	W	R	R	R/K
Barley (*Hordeum*)	W	R	R/K	R/K
Rice (*Oryza*)	S		K	R/K
Millets	S	K	R/K	R/K
Pulses and vegetables				
Pea (*Pisum*)	W	R	R/K	R/K
Chickpea (*Cicer*)	W		R	R/K
Grass pea (*Lathyrus*)	W	R	R/K	R/K
Lentil (*Lens*)	W	R	R/K	R/K
Horse gram (*Dolichos*)	S		K	R/K
Bean (*Phaseolus*)	S		K	R/K
Vigna	S		R/K	R/K
Medicago	S		K	R/K

Oilseed and Fiber				
Lin (*Linum*)	W		R/K	R/K
Mustard (*Brassica*)	W		R/K	R/K
Sesame (*Sesamum*)	S		R/K	R/K
Cotton (*Gossypium*)	S	R (?)	R	R/K
Fruits				
Melon (*Cucumis*)	S		K	R/K
Date (*Phoenix*)	S	R	R	R
Jujube (*Zizyphus*)	W	R/K	R/K	R/K
Grape (*Vitis*)	W	R	R	R/K

Note: W = winter/spring-harvested; S = summer/fall-harvested; R = rabi areas,with winter rain; K = kharif areas, with summer rain.

Table 3.3 Pre-Harappan Cultures (After Possehl, 2002).

Stage One:	
Kile Ghul Mohammad (KGM) Phase	7000-5000 BCE
Burj Basket-marked Phase	5000-4300 BCE
Stage Two:	
Togau Phase	4300-3800 BCE
Kechi Beg Phase	3800-3200 BCE
Hakra Wares Phase	3800-3200 BCE

We will now individually discuss the growth of cultures at the main sites.

Mehrgarh

As a result of the French and the American teams that have been working for several years in the region of Mehrgarh, (Fig. 3.1) we have quite a good documentation of early farming stages there. The following summary is based on the various reports (Jarrige, Meadow and Quivron 1995: 316; Costantini 1984; Meadow 1993a: 301) of the French-Pakistani (French-Pakistan) team that have come out from time to time, as also on Possehl's (1999) encyclopaedic work, *The Indus Age*.

Lal (1997: 32-91) describes the geophysical position of Mehrgarh.

> Mehrgarh is situated at a distance of about a hundred kilometres from KGM (Kile Ghul Mohammad). Cutting through the Kirthar Ranges is the Bolan River, after which the pass is also named. Just where the river debauches on the slopes there begin the Kachhi plains and it is here that Mehrgarh is located. The overall area covered by the ancient settlement measure a little over a kilometre along the river initially, the habitation was hugging the river but as time passed, it kept on expanding away from it, some parts of the settlement lying as far away as 2 km. Lal emphasizes that not all the parts were occupied simultaneously—there was shift in the habitation from time to time. The excavators have named the southern area as MR-1&2; the north-eastern areas, hugging the Bolan River, as MR-3 and MR-4, and the north-western areas as MR-5 and MR-6 (Lal 1997: 32-91).

Mehrgarh and the Kachhi plains are a difficult terrain to work in with no spectacular remains like those of the Harappan cities. Thanks to the extensive work in this inhospitable

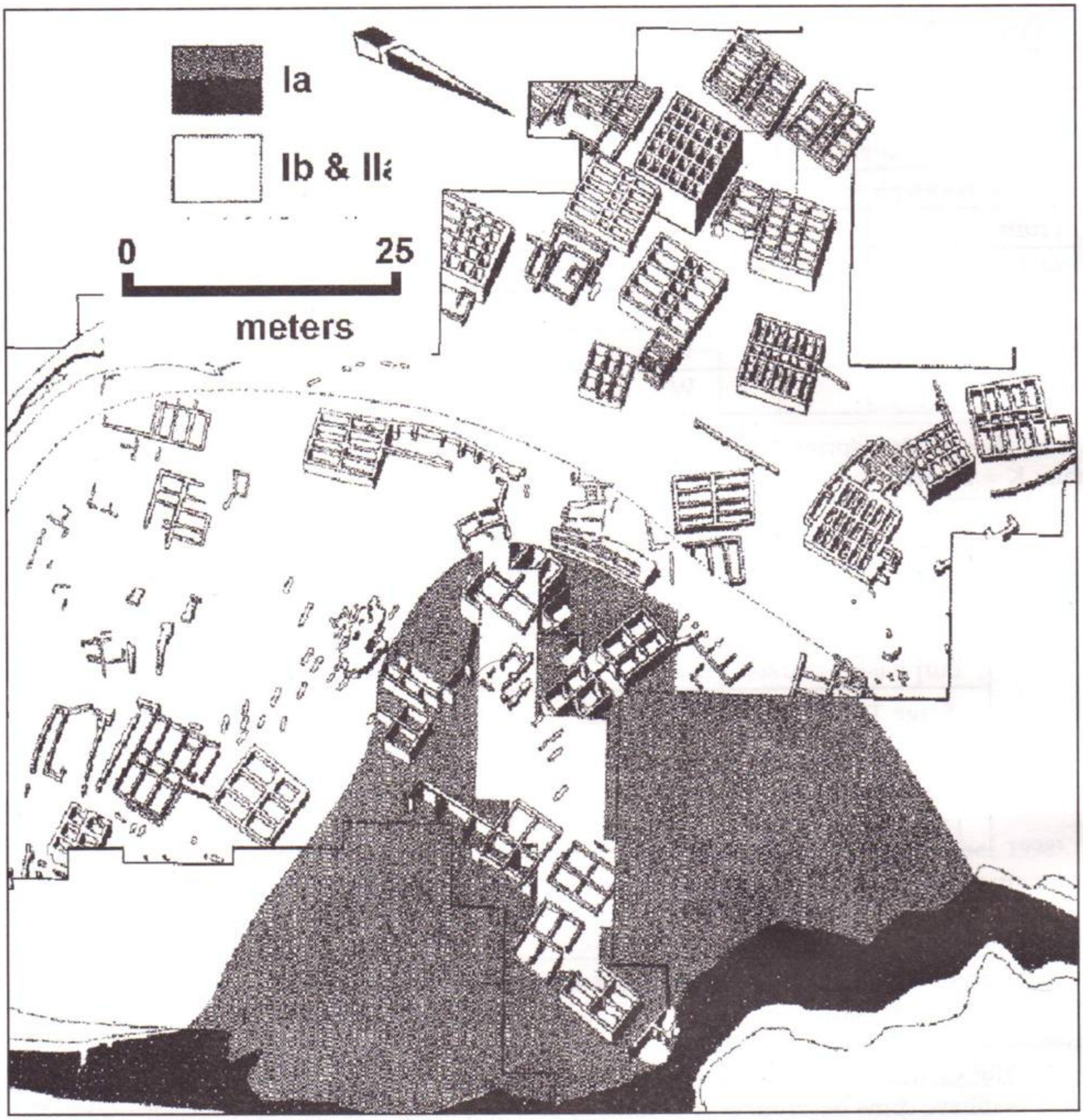


Fig. 3.1 Mehrgarh: Layout of site (After Possehl, 2002).

region of the French-Pakistani team for a dozen seasons, the area has yielded valuable information about early agriculture and animal husbandry. This work has also delineated the steps towards urbanization, which eventually led to the efflorescence of the Harappan civilization. If we survey the north-west, it presents a bewildering variety of cultures and wares. Some of the excavations go back to the early excavators like Hargreaves and Aurel Stein. Hills and valleys added to the variety of cultures. After Piggott (1950), in recent years Lal (1998: 32-91) and Possehl (1999c) have re-analysed this vast material and given very exhaustive summaries of the earlier discoveries in the north-west of the subcontinent. Both these works have provided the main base for the following summary of the north-western cultures. Mehrgarh has yielded a rich repertoire of painted pottery motifs (Pls. 3.1-5).

Mehrgarh I

The technology in this period was relatively simple. The baskets were lined with bitumen to make them waterproof. Some fragments of native copper were found. Flint sickle blades occasionally carried some sheen. A large number of ground stone tools like querns and grinding stones, two small limestone chisels, a small bowl, and a small mortar were also found (Jarrige, Meadow and Quivron 1995: 316). Some unbaked clay figurines were also found (Fig. 3.2). The rich bone industry comprised awls, spatulas, a needle with an eye and two highly polished bone pendants with round perforation (Plate 3.6). Most of the bone tools were perhaps used in basket and cloth-making. Some of the burials showed faint traces of textiles.

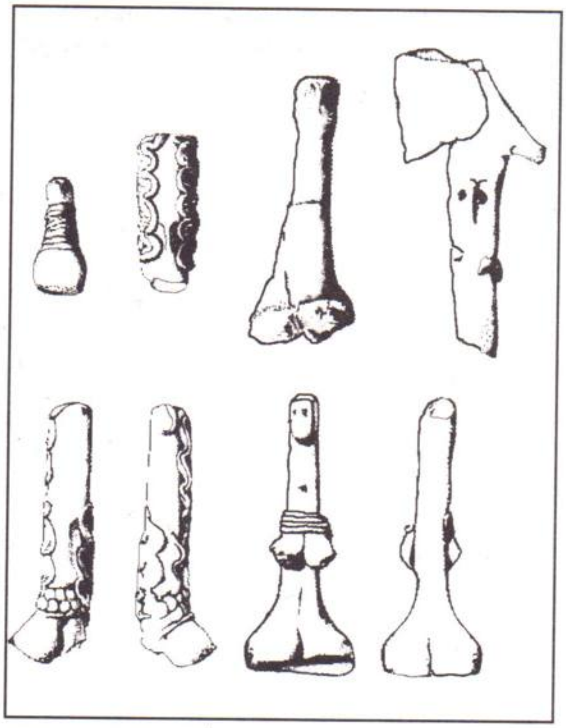


Fig. 3.2 Mehrgarh: Terracotta female figurine, period-IV (After Possehl, 2002).

It seems that the foundations of the Harappan bead industry were laid here. Jarrige et al. report:

... Ornaments associated with the burial of the child show the quality of bead working at this early period. Tiny disc-shaped beads in black steatite, long barrel-shaped beads in calcite, and well-polished bangles of conch shell reveal the existence at the beginning of the Neolithic occupation of craft traditions that lasted for a long time in the region. The quality of the belt with its two flower-shaped pendants in shell is especially worth notice (Jarrige, Meadow and Quivron 1995: 277).

Fig. 3.3 Mehrgarh: Terracotta phallus figures (After Possehl, 2002).

Agriculture: The naked six-row barley (*Hordeum vulgare* subsp. *vulgare* var. *nudum*) was the main plant of Period I, comprising about 90 per cent of the seeds and plant imprints. Also present were hulled six-row barley (*H. vulgare* subsp. *vulgare*), two-row barley (*H. vulgare* – both subsp. *spontaneum* and *distichum*), einkorn (*Triticum monococcum*), emmer (*T. turgidum*, subsp. *dicoccum*), and hard wheat (*T. turgidum* cf. conv. *durum*) though they were poorly represented. Other plants remains of the Period IB and IIB included the Indian jamun or jujube (*Zizyphus* sp.) and dates (*Phoenix dactylifera*) (Costantini 1984). Though the einkorn and emmer disappeared from the region, the bread wheat and shot wheat continued as the eastern species of *Triticum*. The free thrashing wheat in the Near East was *Triticum turgidum* cf. conv. *durum* (hard wheat) and that of the east *Triticum aestivum*, bread or club wheat (Meadow 1993a: 301).

Animal Husbandry: Period IA is dominated by:

... 12 species of "big game": gazelle (*Gazella dorcas*), swamp deer (*Cervus duvaucelii*), nilgai (*Boselaphus tragocamelus*), blackbuck (*Antelope cervicapra*), onager (*Equus hemionus*), chital or spotted deer (*Axis axis*), water buffalo (*Bubalus bubalis*), wild sheep (*Ovis* (?) *orientalis*), wild goat (*Capra* (?) *aegagrus*), wild cattle (*Bos* (?) *namadicus*), wild pig (*Sus scrofa*) and elephant (*Elephas* *maximus*). This composition of the game indicates that the firsi inhabitants of aceramic Mehrgarh I exploited the Kachhi Plain as also the nearby hills (Meadow 1984a: 35).

Fish and bird remains are poorly represented which may be the artefact of lack screening of the deposits.

Regarding the subsistence economy of early Mehrgarh, Meadow observes:

1. Goats were kept from the time of the first occupation of the site.
2. Cattle and sheep are likely to have been domesticated from local wild stock during the course of the aceramic Neolithic.
3. Size diminution in goats was largely complete by Period II A, and in sheep perhaps not until Period III.
4. The contribution of domestic stock to the faunal assemblages came to surpass that of other animals early in the aceramic, but not in the earliest levels.
5. The development of animal-keeping by the ancient inhabitants of Mehrgarh took place in the context of cereal crop cultivation, the building of substantial mud-brick structures, and the existence of social differentiation and long distance trade networks as attested by the presence of marine shells, lapis lazuli, and turquoise in even the earliest graves (Meadow 1933a: 311).

To begin with, the sheep, goats and cattle were wild. Over time the potential domesticates came to look like domesticated animals showing a smaller size and other typical osteological features of domestication. They also came to dominate the animal resources used by the early inhabitants of Mehrgarh; something we would expect in the early-mature stage of food production. As stressed by Meadow the local domestication of animals took place within the context of a fairly advanced cereal agriculture. Further east, it may be noted that the *Cerealia* pollen and early burning was noted by G. Singh in the lakes of Rajasthan, as early as 7500 BCE (G. Singh 1971:185-86).

The long distance interaction called for by the notion of an "expanded nuclear zone" in Middle Asia is documented by the trade network implied by the presence of marine shells, lapis lazuli (found in Afghanistan and Baluchistan) and turquoise (Iran and Central Asia), as noted by Meadow. The people of Mehrgarh IA were not isolated from the world, to the north, south and west.

Possehl has suggested that there was a single "expanded nuclear zone" in Middle Asia within which food production and domestication took place within a single period of time: from about 11,000 to 5500 BCE. In the Near East this would encompass the period beginning with the Natufians through Pre-Pottery Neolithic B (PPNB). There is evidence people that of Mehrgarh were participating in the early stages of the food producing/domestication revolution. Possehl thinks that there is evidence for local involvement in the shift of the animal economy from "hunting to herding". Their participation in interregional communication give us good reason to believe that further work in the region around Mehrgarh will tend to support the hypothesiz put forth here.

He also holds the view that over this period of time the people within the "expanded nuclear zone" were experimenting with their subsistence economy, seeking ways to better control the vagaries of production through husbandry of animals and management of plants. The communication within the "expanded nuclear zone" was generally rich. This was driven in many ways. Some of these would have been: 1) Trade in material goods, raw materials and finished products; 2) The presence of marriage and other social network such as systems of exchange founded upon reciprocity and ecological mechanism for spreading risk and forming alliances; and 3) The maturation implied by the emergence of food production and domestication.

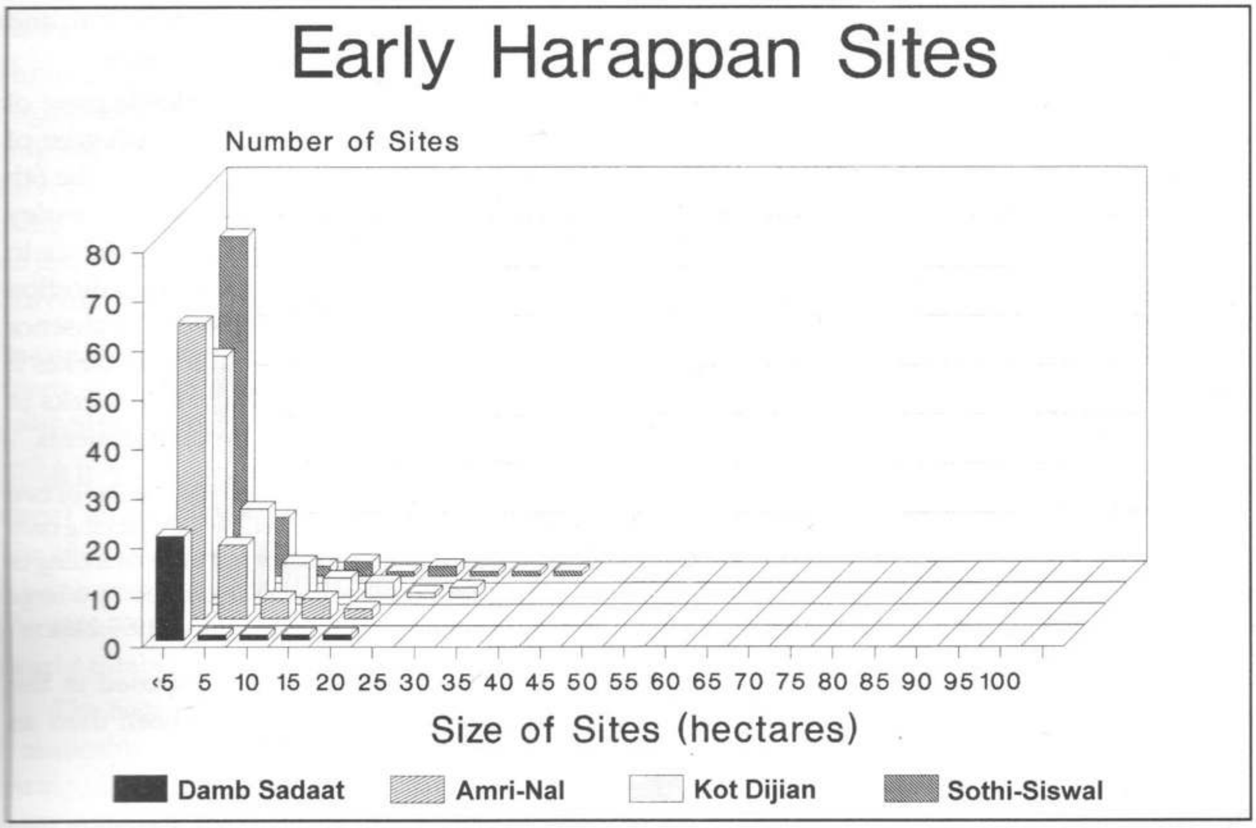


Fig. 3.4 Histogram of distribution of early Harappan sites according to the size of the sites (After Possehl, 2002).

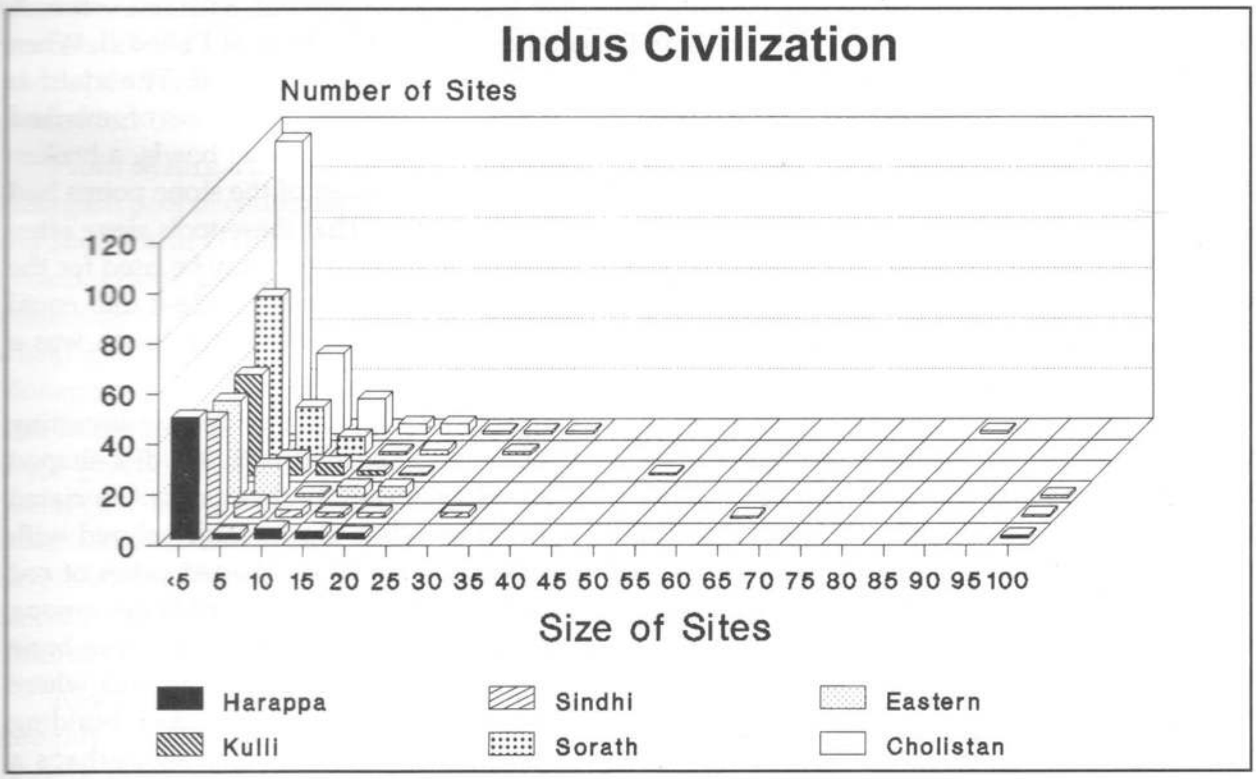


Fig. 3.5 Histogram of Indus civilization sites according to the size of the sites (After Possehl, 2002).

Possehl has emphasized the need for further work as the richness of this communication, and the diversity of these mechanisms of antiquity are, of course, poorly documented today.

The French team has suggested that the association of the massive and remarkable piece of architecture with the impressive complex of compartmented buildings reveals a degree of planning probably related to well developed social and community organization during the 6th millennium BCE (Jarrige, Meadow and Quivron 1996:422). A significant amount of charred barley was found at the bottom of the completely excavated rooms in structure L 2. This tends to confirm that these were storage facilities. The fill in the rooms of this building had no indication of domestic debris. The cells or compartments were too small to have been inhabited. The absence of any fireplace or remains related to domestic activities on the floors of these buildings makes it difficult to believe that they could have been used as shelters even during the few cold weeks of the year. Moreover, there was an absence of doors between the small cellular compartments.

A connection with agricultural activities is shown by the discovery made in one of the compartments of two sickles composed of three bladelets shafted slantwise in bitumen. These almost-complete sickles, lacking only the now disintegrated wooden parts of their handles, are finds of exceptional interest for our understanding of the tools used for farming activities. The function of the building as a granary is also suggested by a large number of impressions of grains in the fill of the compartments (Jarrige, Meadow and Quivron 1995:248).

Possehl also says that there is good evidence that most of the buildings exposed in the context of Period IIA, mostly compartmented or cell-unit buildings, must have been used as storage units and not as proper dwellings.

Mehrgarh II

Two copper artefacts (one bead and a ring) were found along with some slag. For shell working in Period II, conch shells (*Fascolaria trapezium* and *Turbinella pyrum*) imported from the Arabian Sea were used. A rectangular and a circular stone slab were found covered with red ochre. A cylinder bead in terracotta was found in one of the compartmented buildings of Period II. When rolled out this bead produces an impression much like that of a cylinder seal. The motif is regular and portrays vegetation. Other finds include violin-shaped human figurines of unbaked clay colored with red ochre, animal figurines, grinding stones, mortars, stone bowls, a broken mace head of alabaster, hundreds of chipped stone tools and drills. Most of the stone points had a lustrous polish that may suggest use in basketry or leather work. That these tools were often found in association with red ochre is an interesting observation since ochre may be used for the tanning of hides. A well-preserved elephant tusk with three grooves cut to divide it into equal parts from Period II and a leg bone was found from Period I, which suggest that Sindh was a natural habitat for elephants (Jarrige, Meadow and Quivron 1995:422).

In another area the remains of a steatite workshop were found, with evidence for cutting the raw material and making beads. Flint drill and flakes were associated with 334 disc-shaped beads with diameters ranging between 3 and 4 mm, including several broken ones. Associated with the steatite beads were a few cut *dentalia*, a few beads in white chalk (some colored with red ochre), and wasters in black steatite. Near this workshop, six oblong-shaped cakes of red ochre were found. East of the building, an open space was covered with heaps of bones among which were about a hundred bone tools including awls and needles. About fifty more bone tools were found close by. This concentration would indicate that we have here an area where bone tools were used in connection with leather working. Associated with the same building were collected several hundred charred seeds of cotton (*Gossypium* sp), indicating perhaps a ginning area.

Mehrgarh III

Three compartmented copper seals were found in Mehrgarh III along with unidentifiable fragments of metal; one tubular gold bead is also associated with this period. Mehrgarh is the only site where direct evidence for smelting, refining or melting copper has been found. A surface survey of the Mehrgarh III settlement area (about 70 hectares), revealed evidence for craft activity using lapis lazuli, carnelian, calcite, garnet, turquoise, shell and bitumen. The materials on the surface were clearly waste products from workshops in the area (Jarrige, Jarrige, Meadow and Quivron 1995: 213). One of areas had:

> One micro-drill in phtanite, waster, and fragments of rattle-like objects, and a few bone awls. Several stone objects such as grinding stones, pestles and flint tools also were recorded. One more exceptional find is a polished stone axe … (Jarrige, Jarrige, Meadow and Quivron 1995: 320)

B.B. Lal points out that the presence of a large number of drill-bits of phtanite (a greenish stone) in association with the beads clearly indicates the existence of a lapidary's workshop. The ends of these drills are slightly hollow suggesting that these were manipulated with a bow. It is interesting to note that such drills have also been found in the pre-Harappan levels of Amri (Periods I and II; Jarrige 1984: 297). Their occurrence at Chanhudaro in the Harappan context clearly establishes a case for the continuity of the technique (Lal 1998: 39-01).

The beginning of steatite "paste" beads was made at Mehrgarh. It was first heated to make it malleable. The craftsmen then squeezed it through a metal tube, slicing off a thin wafer bead (Samzun 1992: 68). A similar process for the manufacture of micro-beads was reconstructed from materials found at Zekhada, a site in North Gujarat (Hegde, Karanth and Sychanthavong 1982), although here the craftsmen used a true steatite paste made of powder and water.

Agriculture and herding were well established by the beginning of Stage Two and some subsistence surpluses were possible. The excavators think that this does not imply that we can reconstruct the social stratigraphy that would be associated with an archaic state, but some internal differentiation of the Stage Two society is possible, in view of the sophistication of craft production documented at Mehrgarh.

From Mehrgarh III there is strong evidence for an expansion of farming activities. The Mehrgarh people continued to use four different varieties of wheat: einkorn, emmer, club wheat and shot wheat (*Triticum monococcum*, *T. dicoccum*, *T.* cf. *aestivum compactum*, and *T.* cf. *aestivum sphaerococcum*), goat face grass (*Aegilops* sp.), oats (*Avena* sp.), and two-rowed barley (*Hordeum spontaneum*) (Jarrige, Jarrige, Meadow and Quivron 1995: 250). The use of multiple varieties of wheat and barley is a reflection of the subsistence pattern that began during the Kile Ghul Mohammad and Burj Basket-marked phases at Mehrgarh, and doubtless other early village sites in the region. By the Mature Harappan Phase this pattern changed and barley became the single predominant food grain. Earlier peoples used varieties of wheat that can be thought of as "eastern": bread/club wheat (*Triticum aestivum/compactum*) and shot wheat (*Triticum sphaerococcum*). The durum wheat of the "west" was no longer used. This changeover seems to have adaptive value according to Van Zeist and Bakker-Heeres: *T. durum* is well adapted to the Mediterranean climate, whereas *T. aestivum* is a crop plant from more humid, temperate climatic conditions.

Amongst the structural remains of this period there are two which call for special attention. Roughly square and oriented approximately along the cardinal directions, these are planned more or less on the same pattern. In the western half of these structures there is a north-south corridor running all the way from one end to the other. On its west there are eight rectangular

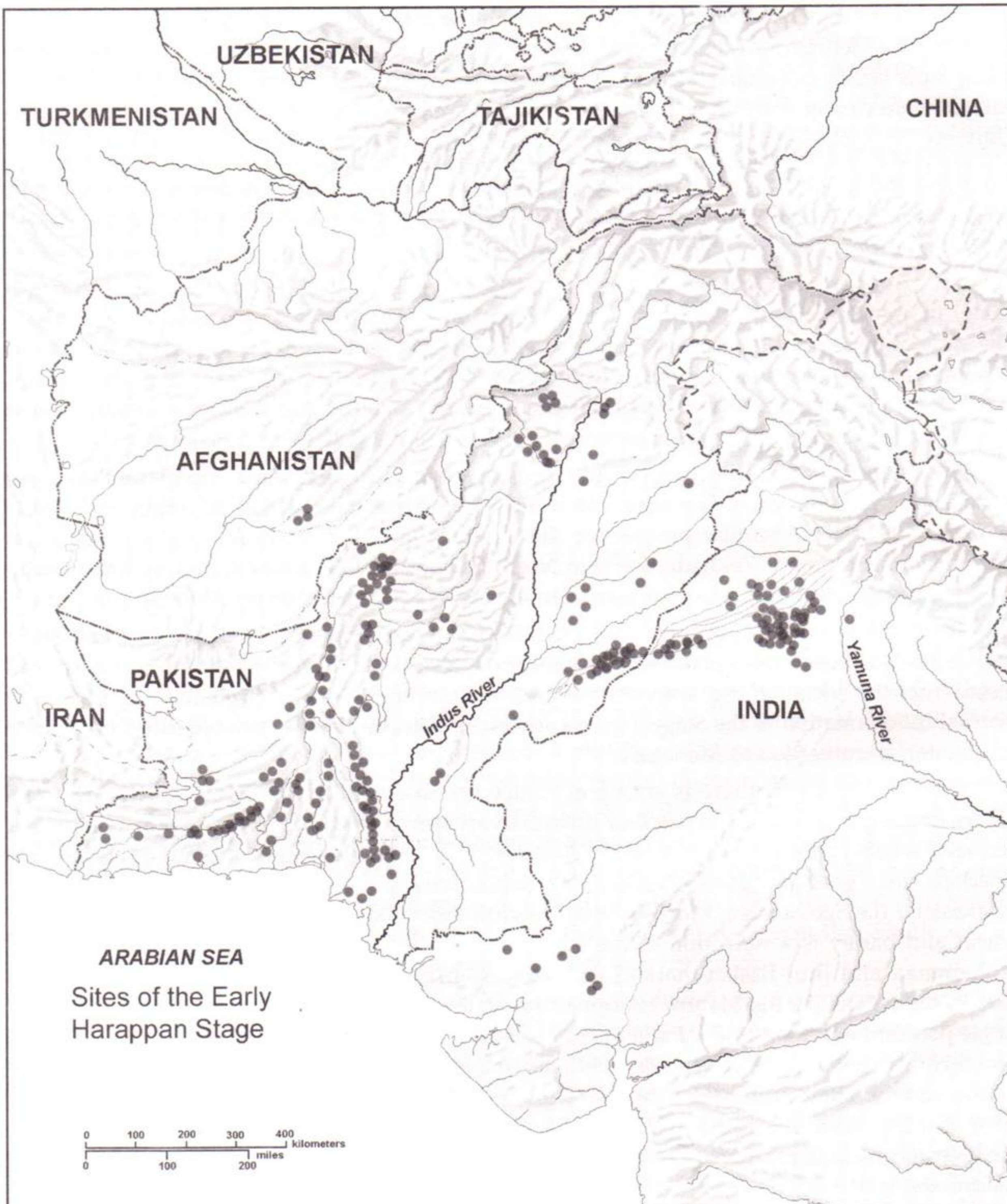


Fig. 3.6 Map showing sites of early Harappan stage marked by solid circles (After Possehl, 2002).

cells with the longer axis east-west, to the east of the rows of cells. There is, however, some minor difference in their size. While in one case each row has a rectangular and a square cell, in the other, there are two rectangular cells (smaller in size than in the previous case) and a square one. In this latter case, at the northern and southern ends the break-up is in four squares. These were evidently not living houses: small sizes of the cells and absence of doors nullify that possibility. For all one can guess, these could have been granaries – perhaps anticipating the granaries at Harappa and Mohenjodaro. We have noted the presence of celled structures as early as Period I. But in their case the size was smaller and those may have been granaries for the family. The granaries of Period III, being much larger, may well have had other socio-political ramifications. If these indeed were granaries, it would appear that they were controlled by some authority which may have been that of the chief who got the cereals in the form of taxes or tributes and redistributed them as payments for civic works or similar purposes. In the alternative he would collect and redistribute the produce. All this would be in keeping with the fast growing size of the population as indicated by the extensive area covered by the settlement.

Radiocarbon dating does not help us in fixing the chronological horizon of this period. There is only one date, viz, 5474/5435/5426 BCE (Possehl 1990: 35), which, to say the least, is quite out of context, since it would place Period III right in the middle of Period I – a position *prima facie* untenable! Thus, in view of the aforementioned dating of Period II and the continuity between Period II and III, the latter may be placed in the first half of the 4th millennium BCE.

Mehrgarh Period III indicates the beginning of stabilization in the animal exploitation pattern at the site that lasts to the threshold of civilization. Thus this period was a phase of consolidation in the subsistence regime, and the maturation of the earlier food production into a more stable, less experimental subsistence system.

Togau Phase (human remains): The only Togau Phase site with human remains is Mehrgarh III where 125 human interments were found in an area reserved as a cemetery (Samzun and Sellier 1985: 96); of these ninety-nine were excavated. This burial ground is toward the centre of MR2. During this phase the density of human remains was high in some parts of the cemetery as two burial customs are noticed at Mehrgarh. In this phase the practice of using red ochre in a lavish way was discontinued. There are also burials arranged in a way that suggests collective graves. These were aligned in an east-west orientation, with the head always towards the east, lying on their side in a flexed position. Disarticulated, secondary inhumations were also found, some with the skull set on a brick.

The skeletal remains, according to Possehl, do not support Renfrew's Neolithic Aryan Hypothesiz. Rather than demonstrating biological continuity within the Indus Valley from Neolithic time to the dawn of the Christian Era, two discontinuities exist. The first occurs between 6000 and 4500 BCE and is reflected by the strong separation between the two samples of Mehrgarh.

BEGINNING OF REGIONALISM

During the Togau Phase, a settlement was established at Mundigak in southern Afghanistan within the drainage system of the Helmand River, but the most dramatic shift was eastwards into the drainage of the ancient, now dry, Saraswati Valley by the peoples of the Hakra Wares. The old Saraswati River is called the "Hakra" in Pakistan and the "Ghaggar" in India. The former princely state of Bahawalpur was a centre on the Hakra drainage, in the larger region also known as "Cholistan" or "Desert Country" in the local dialect.

Kechi Beg is the largest site with an area about 21 hectares, although it is not as large as Dabar Kot, which is the largest site of the stage. Mehrgarh III, according to the excavators, covered 100 hectares (Jarrige, Jarrige, Meadow and Quivron 1995: 69). The ascendancy of barley over wheat also seems to take place during this period; barley continues to dominate throughout the Mature Harappan.

An illustration of some of this pottery is given in *Indus Age: the Beginnings* (Possehl 1999c: 534, Fig. 4.68). Kenoyer has referred to this material as the "Ravi/Hakra Assemblage". This terminology expresses the sense that there is a general resemblance of the pottery to Mughal's Hakra Ware, while recognizing the fact that there are also fabrics, shapes and decorations unique to the Harappan assemblage.

Of the 103 Hakra Ware (Fig. 3.7) sites, 54 can be classified as camps used by pastoralists, leaving 49 village farming communities (Mughal 1994, 1997). Camp sites are represented by a light scatter of pottery without the build-up of an archaeological midden. Such pastoralists could have played a role as traders, bringing products not indigenous to the people living in the Saraswati drainage.

Mehrgarh Period IV is marked by the emergence of a polychrome pottery, with black, white and red. The designs comprise concentric rectangles, diagonally crossed squares, placed in a series of horizontal registers. A new and noteworthy shape was that of a tall goblet with wide mouth, tapering down to a small pedestal base. The repertoire of motifs is comparable to the other sites of Baluchistan, like Kechi Beg, Togau B, and even in Afghanistan, Mundigak I. The painted pottery accounted for only about 15 per cent of the total. The plain wares had two extremely divergent types of fabric: one very thin eggshell like, used for goblets, and the other sturdy, for storage jars.

A very low wooden lintel of only 1.10 m height was found over a door. Such low doors continued even later and in fact were to be found until recently in rural areas of the Indo-Pakistan Sub-continent and the Central Himalayan houses. Roofs were made of wooden rafters placed parallel to one another and supported from underneath by a crossbeam. The rafter may have overlain by mud, etc. to provide a certain amount of thickness, as was noticed at Kalibangan.

Terracottas are the more noteworthy antiquities of this period – armless terracotta female figurines with somewhat cylindrical head, pinched nose and pendulous breasts, seated with outstretched joint legs. Stamped seals of terracotta and bone also make their appearance perhaps indicating trade.

Lal (1998) suggests a date between 3500 BCE and 3000 BCE for the period.

Mehrgarh Period V can only empirically be placed around 3000 BCE and is marked by a decrease in polychrome wares. The designs included chevron, squares and hatched diamond, and remind one of the Togau D motifs. However, more noteworthy was the appearance of a grey (sometimes reddish grey) ware painted with geometric, floral and faunal designs. We may note here that the beginning of the common Harappan motifs of pipal leaf and fish was made in this period.

Mehrgarh Period VI, assignable to the first quarter of the 3rd millennium BCE [radiocarbon date is 2470 BCE (Possehl 1990:36)], is marked by a plethora of pottery styles, signifying not only local growth but also interaction with regions in Baluchistan, Afghanistan and even Iran, up to the Indus plains on the east. Also found were large circular pottery kilns, with burnt pebbles at their bottom and full of ash and a vast quantity of potsherds. The pebbles were evidently used for maintaining heat for a longer period.

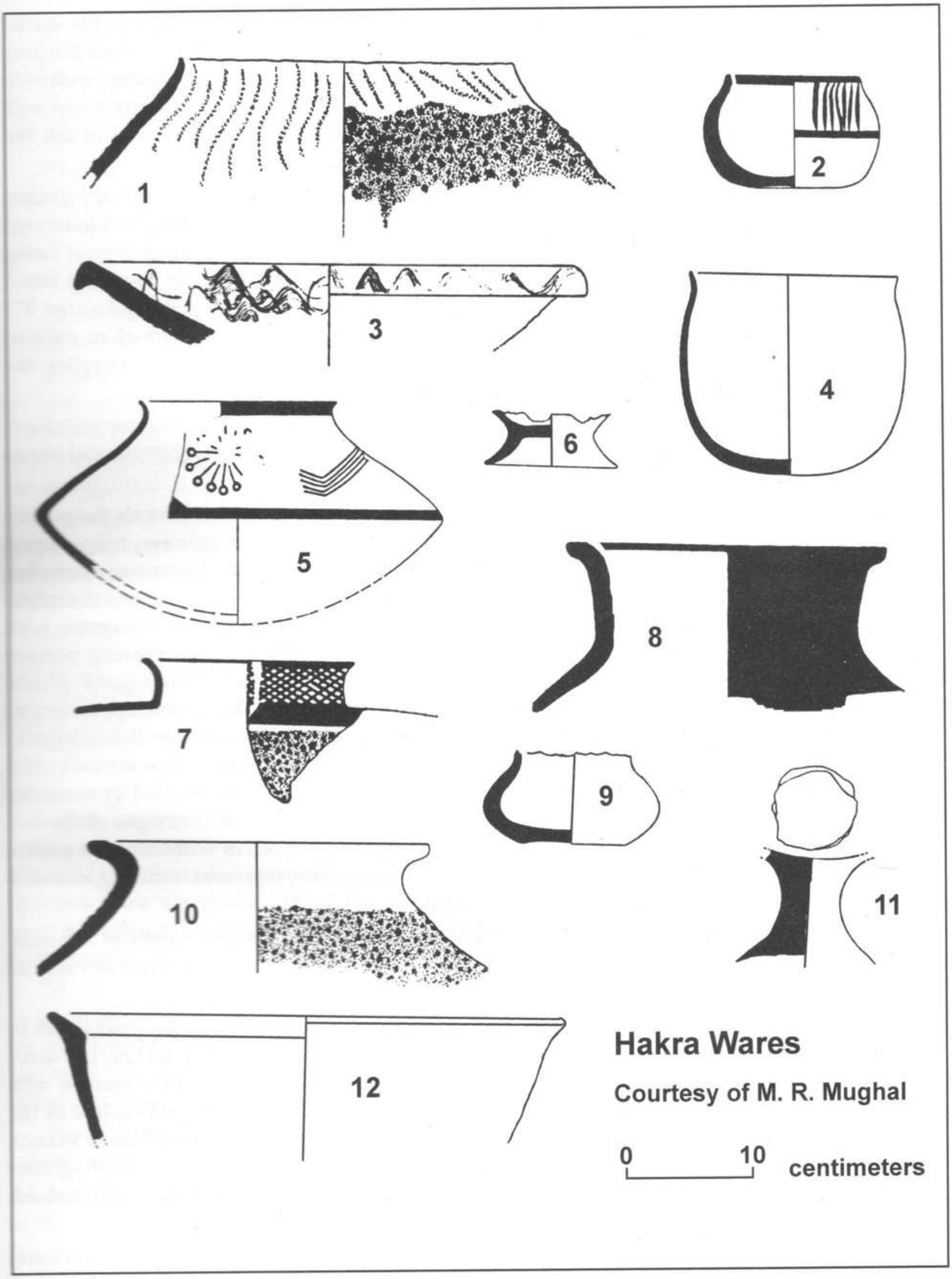


Fig. 3.7 Hakra ware types (After Possehl, 2002).

The black-on-red and white-on-red pottery of the previous period continued in the earlier parts of this period, but gradually disappeared. More common ware of this period was the grey ware with black-painted designs. Prominent designs were the pipal leaf and humped bull with large dot-centered eyes and long horns in the Kulli style. The black-on-buff Quetta Ware with geometric designs too made its appearance. Some of the potsherds are reminiscent of the Nal polychrome pottery, signifying contact with southern Baluchistan.

In this period both pottery and terracotta figurines proliferate. Except for the appearance of the arms, the terracotta continue to be in the seated posture with outstretched joint legs thinning down almost to a point as those of Period IV and V. The prominent breasts being covered with necklaces. But the most distinctive feature is the hairdo with the hair done into a large bun shape, much above the head. Similar figurines occur in Central Asia (Namazga III), though in the Namazga examples the female genitals are indicated by an incised or painted triangle, the Mehrgarh ones do not have the same. Unlike the Central Asian examples, the Mehrgarh terracotta legs are sometimes tied with a coil of clay.

Amongst the artefacts microliths with leaf-shaped arrow-heads of flint, and copper chisel, a flat axe and a double spiral-headed pin, compartmented seals, both in terracotta and stone, are the main finds.

The excavators assign Period VII to the 3rd Millennium BCE. As in earlier periods the pottery is both plain and painted. In the plain ware the main types are "brandy" glasses, tulip-shaped goblets, plates and sturdy storage jars. The storage jars are similar to the Harappan examples. The "Wet Ware" continued from Period IV, was now decorated with rows of stamped circlets. The painted pottery is marked by the black-painted grey goblets with friezes of caprids with dotted eyes, long horns, elongated snouts and outstretched bodies, as if in a running posture (Pl. 3.1), and dishes or shallow bowls with elongated fishes amidst seemingly aquatic plants, often called the "Faiz Mohammad Grey Ware", after the type-site of that name. Specimens of this ware have been found from Sindh in the east through central and northern Baluchistan to Afghanistan (Mundigak IV) and even Iran (Shahr-i-Sokhta II and III) in the north-west indicating intercommunication. The other variety was that of a pinkish buff ware, represented by carinated bowls, tulip-shaped goblets and globular vessels painted with geometrical designs of the late Quetta style in plum or brown colour. The occurrence of two chalices with concave profile ending up at the lower end in a carination and long pedestalled base, represent intruding elements from northern Iran, for example in Hissar IIA and B.

Fragments of shallow dishes bearing on the interior finger-nail designs, motifs of fish-scale and intersecting circles, which became the hallmark of the Harappans, appeared as early as Period VII at Mehrgarh.

Mehrgarh sub-Periods A, B, and C of Period VII were most prolific in the production of terracotta figurines. The goggle-eyed, beak-nosed figurines were no longer seated, but were now in a standing posture (Pls. 3.7-10). In the female figurines the hair was often painted with black pigment. A streak of red paint was also put in the medially located partition-line of the hair. B.B. Lal suggests that this may mark the beginning of the age-old practice of Hindu women applying *Sindura* (vermilion) to their *manga* (medial line in the partitioned hair), denoting their marital status? Necklaces were sometimes painted in yellow colour (representing gold?). Indeed, the painting of terracotta figurines may be regarded a novelty of the period.

The male figurines often bore a solid headgear, sometimes widening towards the upper end (Pl. 3.10), perhaps anticipating the more expanded "fan-shaped" head gear of the Harappan terracottas, such examples have often been referred to as of "Zhob style".

These terracotta figurines produced in thousands have been found in rubbish dumps full of ash, pottery, etc.. The depiction of a child in the arms of a few examples, may perhaps justify the use of the term, "Mother Goddess". Amongst terracotta animal figurines one notes the naturalistic depiction of the humped bull with prominent dewlap and the face reminiscent of the vigour of the Harappan counterparts. Also noteworthy is the figure of a ram in alabaster.

The designs on terracotta seals included the swastika, cruciform motifs and running animals. One of the seals was made in bitumen which is available not far from the site, in the Bolan Pass. Metal was not plentiful: only a few specimens comprising spiral-headed pins, axes, chisels and blades were found. Microliths were still in use with blades, lunates, triangles and trapeze.

Of the structural remains of this period a very large mud-brick platform and a long wall with a series of square pilasters are noteworthy.

A burial of a flexed skeleton with the head towards the east was found lying inside a clay box measuring 1.10 x 0.80 m. The person wore a necklace of kaolin, carnelian and lapis lazuli beads and wristlets of tiny white beads. A couple of plates constitute the pottery component. A large number of burials of children ranging in age up to five years were found in clay boxes with the average size of 60 × 50 cm.

Mehrgarh Period VIII, the last occupation at the site, is represented by some structures and graves associated with a red ceramic industry, beads of semi-precious stone and bronze objects including a shaft-hole axe. It has also yielded pedestalled bowls and truncated bowls or tumblers which are similar to those found in the uppermost level of Nausharo, making this complex contemporary with the Late Harappan.

NAUSHARO

About 6 km south of Mehrgarh, Nausharo excavations have revealed that the site was occupied for the first time around the end of the Mehrgarh Period VI, in the first quarter of the 3rd millennium BCE. The earliest occupation at Nausharo has been designated as Period I, with four sub-Periods, viz., IA, IB, IC and ID. Of these, sub-Periods IA, IB and IC can be equated with Mehrgarh sub-Periods VIIA, VIIB, VIIC. Of unusual interest was a grave in which a small child was buried below the floor of a house. It belonged to sub-Period IB. Terracotta figurines (Pls. 3.7-11) of this sub-Period are painted variously with red, yellow and black colour. The male figurines show the genitals (Pl. 3.10). The pottery included, besides other types, (Pls. 3.12-13) what is known as the Faiz Mohammad Grey Ware which, it may be recalled, was also met with in Mehrgarh VIIB.

In sub-Period IC, the houses consisted of courtyards, living and storerooms. Two mud-brick pillars in one of the rooms probably supported the roof. The provision of a staircase may suggest the existence of a second storey. Remnants of mud plaster were found on some of the walls. Important finds of this sub-Period were a 21 cm long bronze spearhead and a bull-shaped seal, and an unfinished button-shaped seal.

B.B. Lal thinks that the pre-Mature Harappan strata antedated the middle of the 3rd millennium BCE.

Nausharo sub-Period ID is a transitional stage towards the Mature Harappan, like Amri IV or the transitional levels of Kot Diji, and has contributed many pottery shapes and painted designs which contributed to the ceramic repertoire of the Mature Harappan civilization. Some of the examples of such motifs are a fish motif on a dish-on-stand, a jar bearing the fish-scale design and a comb-like pattern in the Kot Dijian style, humped bulls, pipal trees, (Pls. 3.12-13) etc.

Mud-brick platforms became quite a characteristic feature of the monumental buildings of the Mature Harappan culture. Their beginnings can be traced to this sub-Period where many large-sized mud-brick structures were found including a platform and a 7.75 m wide wall. The wall could be just a retaining wall or a part of fortification.

Nausharo Period II has yielded typically Mature Harappan shapes and painted designs on pottery; some even bear characteristic Indus script signs. We must also note here that practically all the structures of Period ID had been 'heavily burnt and the walls turned red due to heat' (Jarrige 1989: 64). The evidence of burning encountered at Kot Diji between the Kot Dijian and the Harappan levels has been interpreted by scholars as suggesting that the Harappans invaded and burnt down Kot Diji, before settling there.

Let us also have a look at some smaller sites of Baluchistan.

Rana Ghundai

Some of the Northern Baluchistan sites were explored and partly excavated by Aurel Stein and later by Fairservis. Lal suggests that at least two of these sites, viz., Rana Ghundai (excavated by Brigadier E.J. Ross, another untrained excavator) and Dabarkot, should be re-excavated. Stuart Piggott (1950) classified his findings into five Periods, named I-V from bottom upwards. It may, however, be noted that the natural soil was not reached and thus the possibility of there having been some earlier stuff below Period I. There were four teeth which Ross thought were of the true *horse (Equus* caballus), but Zeuner did not agree with this identification. The distinguishing feature of Period II was the appearance of a wheel-turned red ware, often slipped and painted in black pigment with characteristic motifs like humped bull and black bucks. Mud walls with stone-foundation were also noted. Period III is further sub-divisible into a, b and c. In sub-Period IIIa there was the use of an additional red colour and to the design were added panelled squares and rectangles. In sub-Period IIIb, however, the brush-work of the painting becomes somewhat coarser but a new pottery-type, a carafe-like vessel, is seen for the first time. In contrast to the foregoing sub-Periods, IIIc is marked by the appearance of quite a few new wares, e.g. Quetta Wet Ware, Faiz Mohammad Grey Ware, etc. signifying contact with regions to the south. This sub-Period came to an end perhaps because of fire. The site has not, however, yielded any clearly identifiable remains of the Mature Harappa culture. It is clear that Rana Ghundai was occupied long before the Mature Harappan civilization.

Dabar Kot

Dabar Kot is certainly one of the most impressive sites in Baluchistan. It has yielded a lot of typically Mature Harappan material from the middle levels. In these levels were also found structures and drains of kiln-fired bricks and compartmented seals, besides goggle-eyed clay figurines, signifying an amalgamation of local cultures with the Harappan. A unique discovery was that of a male head in stone which may have Mesopotamian similarities.

Damb Sadaat

At Damb Sadaat, about 15 km west of Kile Ghul Mohammad, the earliest levels (Period I) yielded a variety of painted pottery (Fig. 3.8) e.g. black and brown designs on buff surface, white designs on black surface, and polychrome designs on black surface, and polychrome designs involving simultaneous use of black, white and red – all going under the generic name of Kechi Beg Ware. The houses were made of mud bricks on stone foundations (Fairservis 1956).

In Period DS II was witnessed another kind of pottery, with plain or slipped buff surface painted over in black colour with floral, faunal and geometric motifs – known as the Quetta

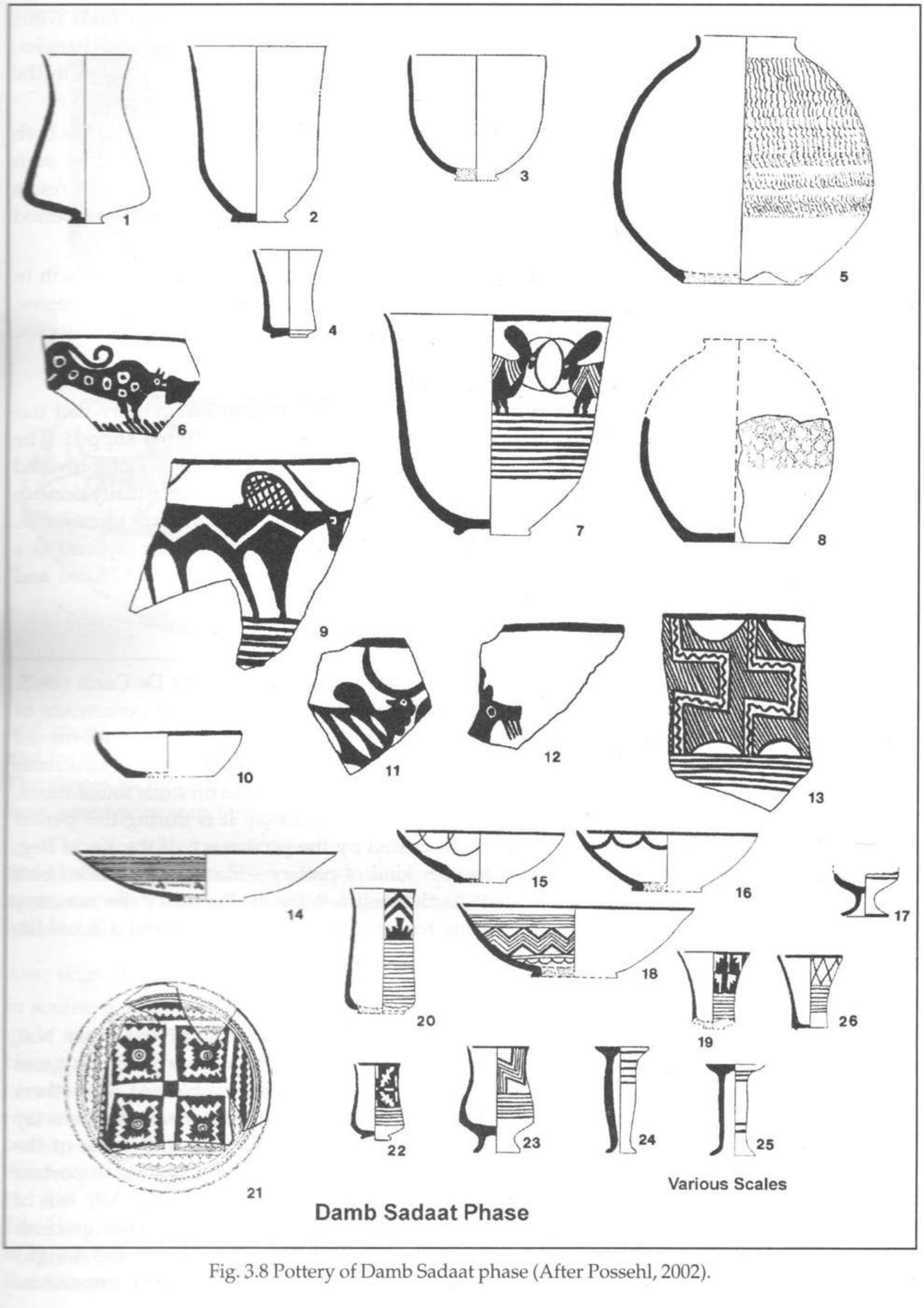


Fig. 3.8 Pottery of Damb Sadaat phase (After Possehl, 2002).

Ware. The houses continue to be made of mud bricks on stone foundations. Other finds were: copper objects including a dagger, alabaster vessels, a compartmented seal, clay and shell bangles, bone and ivory beads, human and animal figurines and house-models of clay painted in the Quetta Ware style.

Period DS III was marked by another kind of pottery, called the Sadaat Ware, which is both plain and painted. Many of the antiquities found in Period II also continued, including such specialized ones as alabaster cups and compartmented seals. Amongst the structures, a monumental mud-brick platform associated with drains is a noteworthy find. This last period may be contemporary with the Mature Harappan civilization.

One of the distinguishing accomplishments of the Damb Sadaat Phase was the growth in connections between the Greater Indus Region and surrounding tracts. Long distance trade begins, with the development of villages and pastoral camps and persists right into the Mature Harappan.

Togau

From a village called Togau, north-west of Kalat, was found a characteristic pottery that has been named after the site as the Togau Ware. It is a well-fired red ware, often slipped. The important types in this ware are: carinated bowls and globular jars. These were often provided with foot-rings. In Togau A there is a fairly naturalistic frieze of animals or birds usually done in solid black. In Stage B, the body gets eliminated, but the neck, head and horns are identifiable. By Stage C only the hooks of the horns remain while in D the designs get further stylized as a sort of question mark. The motifs, being quite distinctive, have been recognized at Hissar and Sialk in Iran, Mundigak in Afghanistan and Amri (Fig. 3.7) on the Indus plains.

Anjira

The small mound called Anjira is located south of Surab. It was excavated by De Cardi (1965: 94-103) who brought to light four periods. Period I was characterized by the occurrence of microlithic and bone tools, cattle and sheep bones, an occasionally burnished, fine, wheel-turned buff ware (sometimes with a red slip), and a few sherds of dark tan burnished ware. No structures were met with. Period II, however, was marked by structures of mud bricks on stone foundations. In Period III roughly-dressed stones were used for house construction. It is during this period that contacts with other areas are noticeable, as indicated by the occurrence of the Kechi Beg, Nal and Togau Wares. Also noteworthy was another kind of pottery – black-colour-coated buff ware, often cordoned, christened after this site as the Anjira Ware. In Period IV the masonry was better dressed, and a few rectangular narrow rooms, a stone-paved floor and a door-slab were recorded.

Nal

Proceeding southward, we come across the famous sites of Nal, Kulli and Nindowari. Nal, located in Jhalawan District, was excavated systematically by Hargreaves in 1925. Six areas were opened up by Hargreaves, but only in some house structures were obtained. The others yielded burials, mostly in pots but a few separately in graves as well. In the graves skeletons lay flexed in a mud-brick chamber. The pot-burials were fractional. The pots and some of the antiquities recovered from these burials as well as from the habitation area are the important finds. The pottery is so distinctive that it has been christened as the Nal Ware (Fig. 3.9). It is of fine fabric, wheel-turned and well-fired. The body colour is either buff or red or even greenish grey. The designs were executed in black, blue, yellow and green; the outline of the designs being usually in a kind of sepia. Motifs included: geometrical motifs such as stepped, trapezoidal

Fig. 3.9 Polychrome Nal pottery (After Possehl, 2002).

and zigzag panels; faunal motifs included ibex, gazelle, scorpion, fish, birds and humped bull; and there were also some floral motifs. The total effect of these colors and designs is spectacular. The shapes included tapering, wide-mouthed bowls or straight-sided bowls, mostly with a ring-base, squat pots with bulging sides, canister-like vessels with a constricted mouth, etc.

The site yielded a rich repertoire of antiquities including long, narrow, crescent-edged axes and seals of copper; a finger-ring of silver; querns, mullers, pounders, celts of stone; beads of agate, carnelian and lapis lazuli; bangles of shell; and terracotta figurines mostly of the humped bull but also of the ram.

AMRI (Figs. 3.10)

In southern Sindh, however, the large pre-Harappan villages maintained their individuality for quite sometime, despite the appearance of the Harappan culture. This alone explains the Harappan pottery (Pl. 3.14) at the Kulli sites and in Amri Period ID, and the pre-Harappan ceramics in the early Mohenjodaro levels. At Kalibangan, the coexistence of the two is unmistakably documented. Finally, the nearby pre-Harappans did succumb to the urban fashions, perhaps like the present-day satellite villages of the cities. The Harappan Phases at Kot Diji, Amri correlation and Kalibangan should not be understood as one culture supplanting another, but like a city corporation taking over a suburban village to urbanize it, as mentioned above. The Harappan culture, though essentially derived from the pre-Harappan cultures, continued to be coeval with the latter. The cities as trading centres had vital economic relationship with the numerous villages, which produced the agricultural surplus. The Harappa culture and the

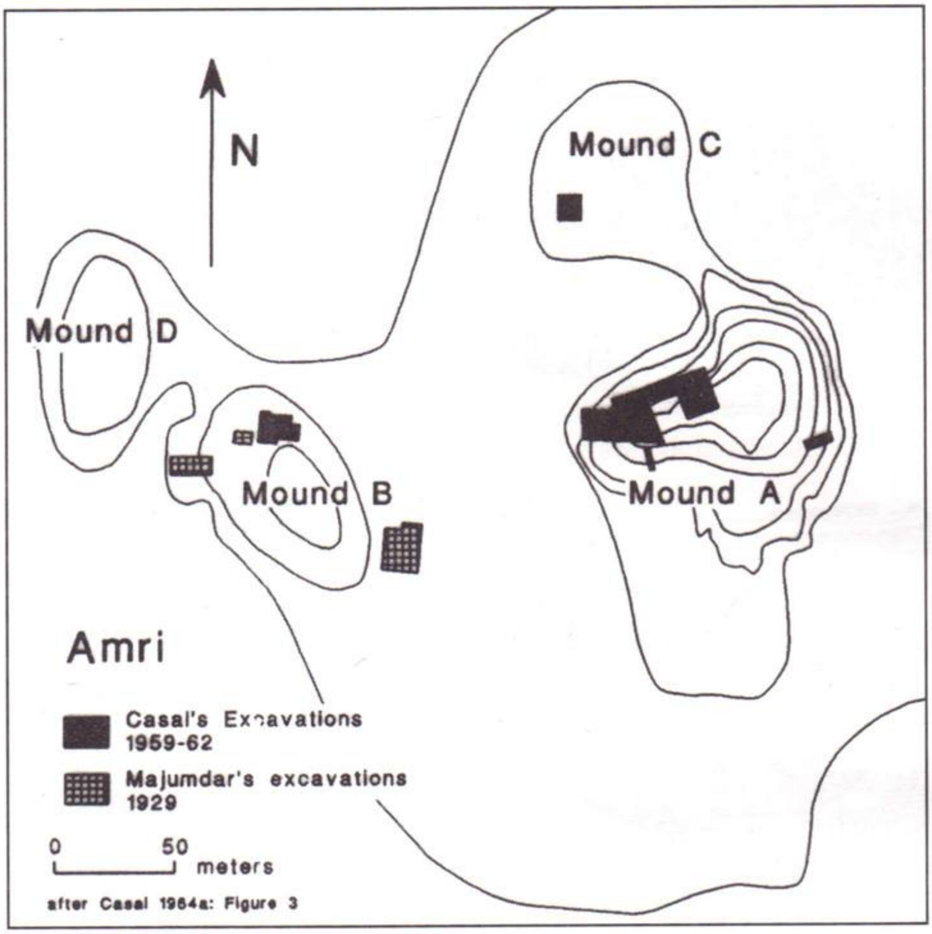


Fig. 3.10 Amri: Site plan (After Possehl, 2002).

so-called pre-Harappan cultures (obviously a misnomer in the context) are in fact urban and folk (rural) faces respectively of the same cultural phenomenon.

It should, however, be emphasized that the presence of the pre-Harappan elements in the composition of the Harappan culture does not underestimate – much less deny – the large number of innovations that were part of the Harappan urbanization.

The Mature Harappan culture seems to appear on the scene with a deceptive abruptness, and is thought to have succeeded the so-called pre-Harappan cultures. The monumentality of its city architecture and the regimented and standardized (and also commercialized) cultural traits aggravate its uniqueness, and hence the problems of its genesis. Dales (1965), Wheeler (1968), Fairservis (1967), Ghosh (1965) and the author (Agrawal 1971), have put up theories to explain the Harappan origins. Fairservis has given a very comprehensive and a stimulating discussion on this subject (1967). The evidence is re-evaluated here in a new perspective and an unorthodox hypothesiz is suggested to explain the data.

As most of the excavations were confined to the Harappan cities (Fig. 3.6), which were planned to a large extent and thus had an in-built abruptness. The recent evidence of Kalibangan excavations and a large number of ^{14}C dates that are available help us understand this genesis in a proper perspective now. If we take into account the total matrix of the pre-Harappan cultures on which the Harappan culture was implanted, and take a dynamic view of the cultural processes, the problem of the Harappan origins becomes easier to understand.

Kulli

The site of Kulli lies in the Kolwa region and was excavated by Stein (1931). In one of the rooms, steps were met with suggesting that there may have been an upper storey as well. This may have been a temple complex. Characteristic of the site were terracotta figurines: painted humped bull and female figurines with beaked nose, appliqué eyes, arms placed akimbo, and cut off below the hip. The pottery was plain as well as black-on-red. A bull with large rounded eyes and long horns is typical of the "Kulli style".

Mehi

Stein (1931: 154-63) had excavated Mehi also, another site in the region. The site was marked by cremation burials, the bones lying generally in urns. The funerary assemblage included, besides pottery, bangles, hairpins and mirrors of copper, beads of semi-precious stones, Terracotta female figurines, etc. were also found. In an adjacent area of the site residential structures were found. The more important finds were of the compartmented vases of steatite bearing incised motifs on the exterior.

Nindowari

South of Kulli, Nindowari is yet another noteworthy site of this region. It was excavated by Casal (1966: 10-21). He reported a large number of stone structures. Some of these were very massive and monumental in character. It has been surmised that these might have had a ritualistic significance. The site belongs essentially to the Kulli culture, as signified by the occurrence of typical Kulli style pottery and terracotta figurines. The most important finds were the two seals with typical characters in the Harappan script and the unicorn motif, which indicates trade contacts with it.

To sum up, we find that certain parts of Baluchistan had come under human habitation as early as the pre-pottery Neolithic times (for example at Kile Ghul Mohammad). Gradually pottery began to be used, first handmade and plain and later wheel-turned and painted. About this time, copper also came to be used. Following the natural barriers created by the hills a plethora of cultures thrived, without any single culture dominating the entire area. The regional manifestations were characterized by individualistic pottery and terracotta figurines at sites like Zhob, Nal, Kulli etc. It is obvious that the foundations of the urbanization process were laid in this region, which became the hallmark of the Harappan culture later in the Indus Valley.

Gumla

A.H. Dani (1970-71) excavated Gumla, located about 10 km from Dera Ismail Khan. Gumla yielded the remains of six occupational periods. Period I yielded a variety of microliths such as parallel-sided blades, burins, scrapers, awls, etc., besides heavier stone artefacts like saddle querns, mullers and pestles. No polished stone axes, pottery, metal or even structural remains were found. The presence of large pits with ash and charcoal might indicate community ovens. The absence of pottery but the presence of saddle querns and mullers suggest that Gumla I people were still in a sort of aceramic Neolithic stage. Period II brought newcomers to the site who not only used pottery but also copper/bronze of which an antimony rod was found. Pottery was wheel-turned. The plain ware included cooking pots and storage jars, while the painted ware comprised bowls with ring-base, flat dishes, dishes-on-stand, troughs, etc. The painted designs in deep chocolate colour over a buff or whitish background comprised faunal and geometric motifs. Both stone and bone artefacts and terracotta figurines of humans and animals were found. Amongst the animals, both humped and humpless bulls were represented. The other terracotta objects were hubless wheels, triangle-sectioned bangles and gamesmen.

There is a sterile layer between the end of Period II and Period III. The new settlers arrived with cultural equipment which was substantially different from that of the preceding period. For the first time mud-brick structures were encountered; and interestingly the size of the bricks was 28 × 13 × 7 cm, showing an approximate ratio of 4:2:1, which became distinctive of the subsequent Harappan culture. Because of the vertical nature of the trench, no detailed house-plans were obtained but in many cases it was noted that they were showing a sense of orientation along the cardinal directions. A characteristic feature of the pottery of this period was the thick bands along the rim and neck. Another noteworthy motif was a horned deity. The terracotta female figurines had broad hips merging into an undifferentiated short and flat leg-block, extending at right angles to the former. The upper part was reasonably modelled, having curved-in arms resting at the hips, a pinched up face and long hair coming down to the shoulders. Also found were two antimony rods and a nail-cutter of copper/bronze, a variety of terracotta bangles decorated with incised zigzag designs. Conch bangles indicate contact with coastal sites.

A layer of ash, charcoal, potsherds, etc., running all along the excavated trench, intervened between Period III and IV. Period IV has duly identifiable Harappan elements, such as perforated vessels, triangular terracotta cakes, toy-carts, solid wheels, cubical weights, etched beads of carnelian and disc-shaped beads of paste. There was a large podium of mud-bricks reminding us of the podia encountered at many of the Mature Harappan sites. If the intervening ash layer signifies fire, it reminds one of similar evidence of burning at Nausharo, Rana Ghundai and Kot Diji.

Gumla Period V was represented by graves containing cremated human and animal bones (including those of the horse). A layer of burnt earth, ash, etc. marks Period IV and the excavator thinks that it is the grave-people who destroyed the Harappan settlement. The graves were in the form of a circular pit in which first the sacrificed animals and then above them the human body was placed. Dani states,

> The whole (interment) was sealed by clay. It seems that fire was lighted later after the sealing of the grave and it was never opened. As such, we may take the grave as a burial as well as a funeral pyre (Dani 1970-71 : 52).

Amongst the antiquities recovered from the graves mention must be made of a model of a saddled horse. Period VI, according to the excavator, is represented by graves with flexed burials associated with iron.

Rehman Dheri

About 23 kilometer north of Dera Ismail Khan, Rehman Dheri covers an area of about 540 × 390 m and rose to a height of about 6 m above the surrounding plains. Though now the Indus is far away from the site, it seems to have been much nearer, around 5 km, in ancient times, as indicated by an abandoned ancient bank of the river. Excavations carried out by F.A. Durrani (1981a, 1981b, 1988; and Durrani et al. 1991) revealed three periods of occupation, named I, II and III from bottom upwards.

Though some of the pottery of Rehman Dheri I matched with that of Kot Diji, it represented predominantly a local tradition which included ring-based bowls and cups of fine red ware (Fig. 3.11). The designs painted in black or chocolate colour included lozenges, stepped motifs, triangles, fish, etc. What is more interesting is that body was first filled with white paint. Likewise both black and white colour were used in depicting a horned deity, also seen at Gumla. The other designs included mountain goats, bulls and scorpions. On the basis of the pots in certain cases there occurs graffiti which may have been potters' marks, but, interestingly are akin to the signs in the Harappan script.

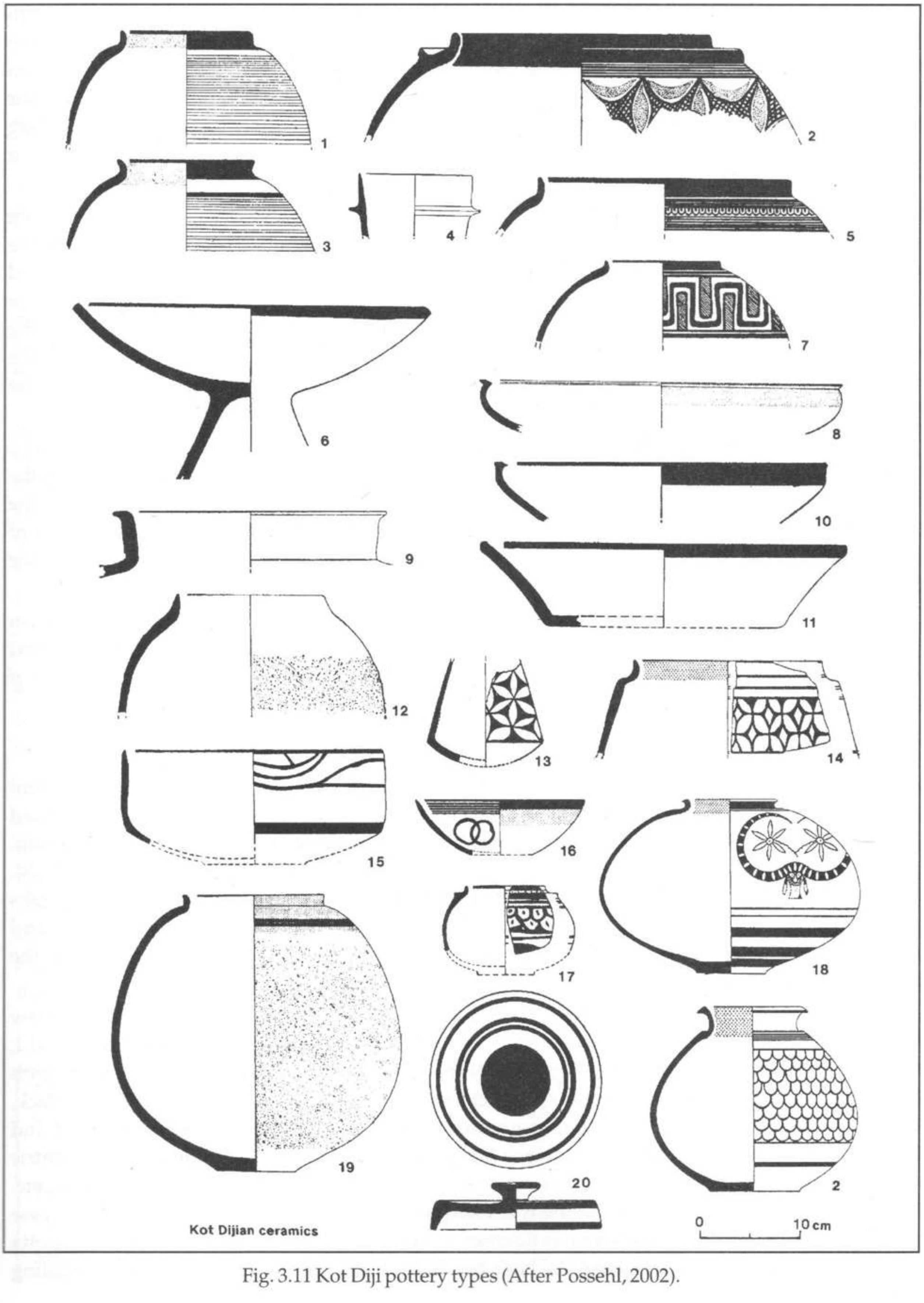


Fig. 3.11 Kot Diji pottery types (After Possehl, 2002).

A very noteworthy find from Period I was a roughly squarish (3 × 2.7 cm) ivory seal, with two holes along one edge evidently for suspension. On one of its sides have been engraved two mountain goats, along with three symbols, one T-like, another I-like and the third resembling an arrow. The other side shows two scorpions, a frog and again a T-like symbol. There are four radiocarbon dates for Period I, which indicate that the use of seals (evidently for sealing commodities) may have started, around 3000 BCE, if not earlier; similar evidence is there for Mehrgarh Period IV.

From Period II of Rehman Dheri came typical Kot Dijian pottery. The painted designs on it included the peacock, pipal leaf, intersecting circles, fish-scales — all of which are amongst the characteristic motifs of the Indus pottery. On a typically Kot Dijian grooved pot there also occurred knob on the exterior (Fig. 3.11), a feature which continue in Period III and is available on some of the pots at Harappa as well as Mohenjodaro. The material from Period III gets closer to the typical Harappan. There were beads of carnelian, lapis lazuli, turquoise, etc., along with the raw material and waste flakes, indicating local manufacturing beads. Interesting was the discovery of a microlithic drill still inside a long tubular bead of carnelian.

In the south-western part of the mound, a wall made of mud blocks was traced up to a length of 19 m. Maybe it was a fortification wall. Likewise, a wide street was found dividing the site into a northern and southern block. However, the excavator does not clearly bring out the exact period of these features. In any case, it is interesting to note that there was a system of town-planning and fortification (if it is finally proved to be so) in an area far removed from the main hub of the Mature Harappan civilization and in a period preceding it.

The uppermost levels of Rehman Dheri (Period III) have yielded more evolved Kot Dijian pottery showing further elements of the would-be Mature Harappan complex. In this context one may refer to the nearby site of Hissam Dheri from the surface of which a good amount of Mature Harappan material has been picked up.

Sarai khola

Sir John Marshall carried out extensive excavations at Taxila. His earliest site, Bhir mound, went back to *ca.* 600 BCE. Just 2.5 km from Taxila lay the site of Sarai khola, with an impressive mound approximately 600 × 300 m on plan with about 6 m of occupational debris. Mohammed Abdul Halim (1970-71 and 1972), the excavator, has identified four cultural periods, numbered I-IV. The tool-assemblage of Period I is marked by polished stone axes, chert and flint blades, microliths and bone points. The pottery had a burnished brown surface. The types included pans and bowls, the latter having mat-impression at the base, very much like the pottery found at the Neolithic culture of Burzahom which was by and large contemporary.

It seems that Sarai khola Period II is marked by the appearance of a generation of new people, characterized by the Kot Dijian Ware. The brown burnished pottery, typical of Period I, begins to diminish after Period IA. The Period II shapes were represented by globular vases with short rims, having horizontal grooves on the exterior as well as bands along the neck in black, red and sepia colors; ellipsoid jars with prominent flange on the exterior, dishes-on-stand and flat dishes. The main painted designs were the thick or thin bands along the neck, concentric semicircles on the upper part of the pots, loops in rows, dot-ended radial lines, pipal leaves, etc. Often the space within a painted outline was filled in with white colour, for example in the case of four-petalled flowers etc. The other antiquities of this period are human and animal terracotta figurines, toy-carts and wheels, beads of lapis lazuli, agate and carnelian, and bangles including those of faience. The terracotta seated female figurines, had conjoined legs thrown forward, broad hips but thin waist, and prominent breasts. These terracotta are quite similar to those found at Gumla and Rehman Dheri. Period II yielded over a dozen copper/bronze objects comprising spearheads, needles, nail-cutters, antimony rods with rolled ends, pins, rings and bangles. However, there is no evidence of the Mature Harappan Phase at the site.

Period III marks the advent of iron at the site. There was a break between Periods II and III. The dead were buried in an east-west orientation. A typical Kot Dijian pot bearing the "horned deity" motif has been found at Burzahom, but otherwise there is no evidence of the Kot Diji culture in the Kashmir Valley.

SUMMARY

After this brief survey of the north-west and its bewildering variety of cultures and wares of the early agriculture and Early Harappan sites, we will now try to trace the foundations of urbanization as also of the Mature Harappan culture itself.

The Mature Harappan stage can be called a full fledged civilization answering to Childe's famous criteria, but it was not an abrupt phenomenon, despite its superficial suddenness. Its foundations were already laid during the Early Harappan stage, though Possehl finds the case of the Early Harappan sites a bit weak. He has identified four cultures belonging to the Early Harappan stage: Amri-Nal Phase; Kot Diji Phase; Damb Sadaat Phase; and Sothi-Siswal Phase (Fig. 3.12) (Possehl 1999c: 730-724) and has tried to define the Early Harappan stage at different sites using a variety of parameters. He takes into consideration:

1. Settlement patterns and growth of urban centres;
2. Development of public architecture;
3. Evidence for social stratification;
4. Evolution of writing and weight and measure systems;
5. Ethnic diversity; and
6. Emergence of political units

As shown in Table 3.4 the Early Harappan sites are about 10 hectare in size (Figs. 3.4, 6). The average size is 4.54 hectares. One notices major changes at the Mature Harappan stage (Fig. 3.5) where the number of sites increases to about 1000. In Cholistan the number jumped to 174 Mature Harappan sites, while Mohenjodaro, Harappa and Ganweriwala are around 100 hectare (Fig. 3.5). The Kulli site of Nindowari is only 50 hectare. Though Mughal had given a four-tiered settlement hierarchy in Early Harappan times in Cholistan, the statistical analysis done by Possehl does not support any clustering within a tiered hierarchy of settlement patterns. Possehl therefore concludes that Early Harappan sites are small and not organized in an emerging tiered settlement hierarchy.

Table 3.4 Size distribution of early Harappan sites (Possehl, 1999 c).

Smaller than 10 hectares	257
Smaller than 5 hectares	209
Smaller than 3 hectares	171
Smaller than 2 hectares	133
Smaller than 1 hectare	78
Smaller than 0.5 hectare	36

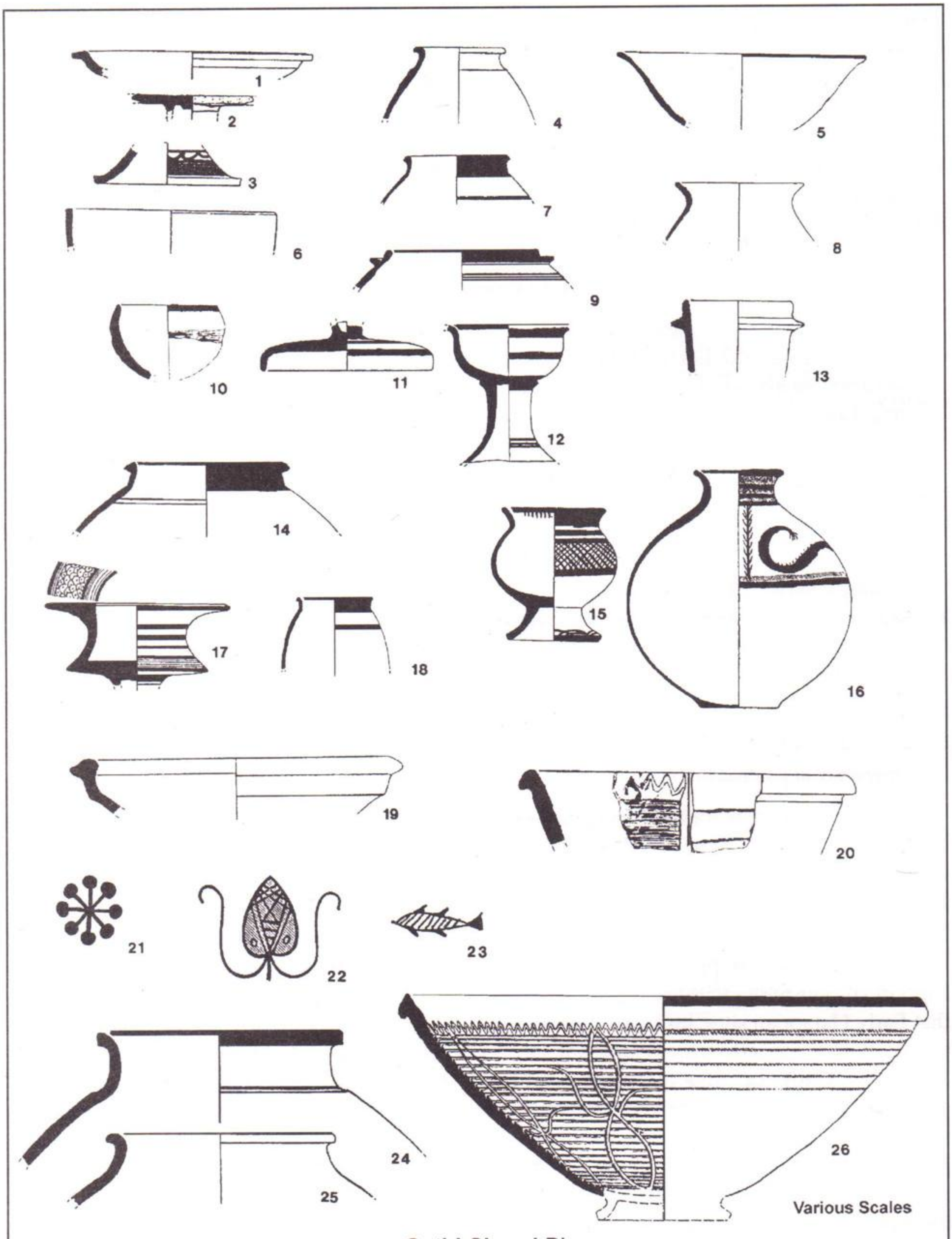


Fig. 3.12 Sothi-Siswal phase pottery (After Possehl, 2002).

Table 3.5 Summary of estimates of settled area by stage and phase (Possehl, 1999 c).

Stage	Phase	Total Area (in ha)
Stage Three		2114.03
	Amri-Nal Phase	610.56
	Kot Diji Phase	700.06
	Damb Sadaat Phase	97.54
	Sothi-Siswal Phase	705.87
Stage Two		1524.95
	Kechi Beg & Hakra Wares Phases	1230.32
	Togau Phase	294.63
Stage One		138.07
	Burj Basket-market Phase	85.07
	Kili Ghul Mohammad Phase	53.00

Public Architecture

Some Early Harappan stage sites have given evidence of public architecture. There is a circumvallation around Kot Diji though as a feature of defence it may not have been of much use. At Kalibangan a surrounding wall in the shape of a parallelogram of about 250 × 170 m is more impressive. In the first phase it was about 2 m thick. At Banawali, in Haryana, also there is a wall surrounding the occupation in the Sothi Phase, which is assigned to Period I by Bisht. Possehl however thinks that Banawali wall also was not a fortification but only a device for flood protection. At Kohtras Buthi the stone masonry appears to be quite substantial. There seems to be a clear fortification wall of Early Harappan Period at this site. Rehman Dheri, excavated by Durrani, had a massive wall surrounding the site. From Mehrgarh VII, a large platform and a large wall have been called monumental by the excavators. Thus these are some of the only known Early Harappan sites with evidence of monumental architecture. It may be noted here that though the excavators of these sites called such structures fortification walls and massive structures, Possehl seems to belittle their monumentality.

Social Stratification

There is a lot of stylistic variation and a variety of developed crafts which to my mind show division of labour and a class of people who are not part of agricultural production, who could be supported by the society only when there was enough agricultural surplus. Of course, the scale of monumental architecture may show a quantitative jump during the Mature Harappan in such features as the Great Bath, the Warehouse, the size of the houses, etc., but a qualitative beginning had been made in the Early Harappan stage. One of the Mature Harappan houses illustrated by Jansen (In Habib 2002) covers 300 sq m area and has 20 rooms! The rich jewellery also marks social stratification; writing and scripts are also an index of socio-cultural complexity. From Kunal Period Ic some proto-seals have been reported, which could be taken as an Early Harappan beginning of seals and script. Though the main corpus belongs to the Mature Phase: from Mohenjodaro alone 377 examples of weights have been recorded.

Ethnic Diversity

The Early Harappan stage is marked by a diversity of artefacts. Material culture is a marker of self identity. Quoting Barth (in Possehl 1999c), Possehl says that only a few articles from the wide spectrum of available artefacts can serve as ethnic markers. On the other hand, the Early Harappan stages have ceramics that are historically deep and stylistically identifiable. Possehl agrees with Shaffer and Lichtenstein (1989) that the four phases of the Early Harappan stage reflect ethnic diversity.

The criteria given by Possehl are sound indeed. But we have also to take into account that such a variation in art forms and crafts requires specialization and full-time activity. In the early agricultural societies full-time specialists, including the elite, could be supported only when it could produce agricultural surplus. At the Early Harappan stage there is evidence for long distance trade, some of the sites like Quetta Miri, Mundigak, Early Harappa, Early Lathawala, Early Dholavira, Las Bela, etc., do have a settlement area ranging from 20-50 hectare area. At several sites like Kalibangan Period I, Banawali, Kot Diji, etc., there is clear evidence of fortification or massive platforms indicating the beginning of the monumental architecture. In Kunal Period Ic, there is an evidence of proto-seals. From stage one (of Possehl) the settlement area jumps from 140 hectare area to more than 2100 hectare. Even if the Early Harappan was a weakly developed threshold, we know for sure that the Mature Harappan was a fully urbanized phase. Such a development was possible only within the socio-economic constraints of the contemporary cultures. The contributory components of the Mature Harappan have to be found in the Early Harappan stage and obviously they are there.

Role of Trade

Possehl (1999c: 680) remarks:

> One of the distinguishing accomplishments of the Damb Sadaat Phase was the growth in connections between the Greater Indus Region and surrounding tracts. Even in Mehrgarh I, in the Aceramic Period, there were abundant signs of long distance trade in luxury items such as lapis lazuli, turquoise and sea shells. The ability of peoples in the subcontinent to reach out and capture such goods, apparently on such a scale that it stands out in the archaeological record, starts at the very beginning of the Indus Age and persists through the Mature Harappan stage. Long distance trade begins with the development of villages and pastoral camps and persists right into the Mature Harappan .... The Baluchistan-Central Asia interaction sphere emerges in the archaeological record as one based on durable goods, mostly stone and metal. With the exception of turquoise there are few durable products from Central Asia that might have been desired by the inhabitants of the Greater Indus Region. ... When we have written sources we learn that this kind of interaction is generally based on perishables, especially grain and textiles. These important commodities should not be neglected in our thought, in spite of the fact that there is virtually no archaeological record for these in the Indus Age .... The Early Harappan, Damb Sadaat Phase seems to mark a growth in interregional connections on the western side of the Indus area. This seems to have been on a large scale, involved long distance travel and was enduring. It was also an important harbinger of developments that took place during the Mature Harappan, which build on the foundation laid in Damb Sadaat and earlier interaction.

Could even such trade be called itinerant peddling? Ratnagar (2004:. 272-338) mentions that within the category of market trade we may distinguish itinerant peddling, where buying and selling takes place at only those places and times where prices are favourable, from trade expeditions involving the predetermined flow of merchandise between two or more specific centres. Itinerant peddling is distinguishable from unscheduled exchanges in that it is (a) motivated by profit, (b) repetitive rather than sporadic, and (c) can involve "specialists".

Mederos and Lamberg-Karlovsky (2004) introduce a psychological angle to the organization of trade. Trade leads to the emergence of the theoretic stage.

> The most important attribute in the emergence of the theoretic stage is the invention of 'external symbolic storage' systems, i.e., writing and symbols of meaning, as with weights and measures. Thus, a weight bears no relationship to what is weighed and a number has no perceptual relationship to what is represented. Within an evolutionary context, the increasing recognition that goods (property) could be, or were allowed to be, systematically exchanged led to an increasing significance of commodity and value. This, in turn, demanded units of measure and a permanence of memory, namely, the development of writing.

Donald's second evolutionary cognitive transformation, the emergence of a "theoretic culture", privileges the development of writing as a powerful tool for "external symbolic storage".

> Donald argues that writing played a major role in transforming the cognitive processes of the mind by introducing new systems of symbolic storage. If, however, one looks upon the function and nature of the earliest writing, as well as standard weights and measures, one finds them to be new and powerful technologies of social control. Thus, the transforming of cognitive processes in conjunction with a new technology of social control were co-evolutionary processes that transformed both brain and culture.

Thus such long distance trade eventually led to the transformation of cognitive processes which was an ongoing process from the Early Harappan stage and culminated in the script, weights and measures of the Mature Harappans.

Table 3.6 Early Agriculture dates from sites from Pakistan-Calibrated ages are given in BCE (After Possehl, 1999 c).

SITE	*SAMPLE NO.*	*5568 YRS. BP*	*CALIB. DATES*	*CULTURE*	*MATERIAL*
MEHRGARH	BETA-2690	3590±60 BP	1997 cal.bce	Period IV	Unknown
MEHRGARH	BETA-1719	13340±125 BP	14,191-13, 789 cal.bce, 2e 14,381-13, 567 cal.bce centre 13990 cal.bce	Period IB	Unknown
MEHRGARH	BETA-1721	9385±120 BP	1 8827-8818, 8591-8542, 8539-8335, 8305-8261 cal.bce (2) 8949-8090 cal.bce; Centre 8420 cal.bce	Period IA	Unknown
MEHRGARH	LV-993	6110±90 BP	5190,5058 cal.bce	Period IB	Unknown

SITE	*SAMPLE NO.*	*5568 YRS.* BP	*CALIB. DATES*	*CULTURE*	*MATERIAL*
MEHRGARH	BETA-2686	5860±70 BP	4777 cal.bce	Period IA	Unknown
MEHRGARH	BETA-2688	5490±70 BP	4350 cal.bce	Period IIA	Unknown
MEHRGARH	LY-1945	5360±310 BP	4235 cal.bce	Period IIB	Unknown
MEHRGARH	BETA-7315	5620100 BP	4465 cal.bce	Period IIA	Unknown
MEHRGARH	BETA-2689	6500±78 BP	5474,5435, 5426 cal.bce	Period III	Unknown
MEHRGARH	LV-994	6290±70 BP	5238 cal.bce	Period IB	Unknown
MEHRGARH	LY-1946	33000±3000 BP	None	Period IB	Charcoal
MEHRGARH	BETA-1408	6925±80 BP	5749 cal.bce	Period IA	Unknown
MEHRGARH	BETA-1407	7115±290 BP	5980 cal.bce	Period IA	Unknown
MEHRGARH	BETA-1720	7115±120 BP	5980 cal.bce	Period IIB	Unknown
MEHRGARH	LY-1950	8440±250 BP	(1) 7694-7665, 7648-7239, 7223-7200, 7180-7141, 7119-7096 cal.bce; (2) 8008-6758, 6739-6719, cal.bce; Centre 7490 cal.bce	Period IB	Unknown
MEHRGARH	LV-906	5950±65 BP	4894,4883, 4845 cal.bce	Period IB	Unknown
MEHRGARH	LV-907	6020±80 BP	4937,4917, 4907 cal.bce	Period IB	Unknown
MEHRGARH	LV-909	5940±55 BP	4892,4887, 4841 cal.bce	Period IB	Unknown
MEHRGARH	LY-1948	5720±730 BP	4653,4648, 4581 cal.bce	Period IA	Charcoal

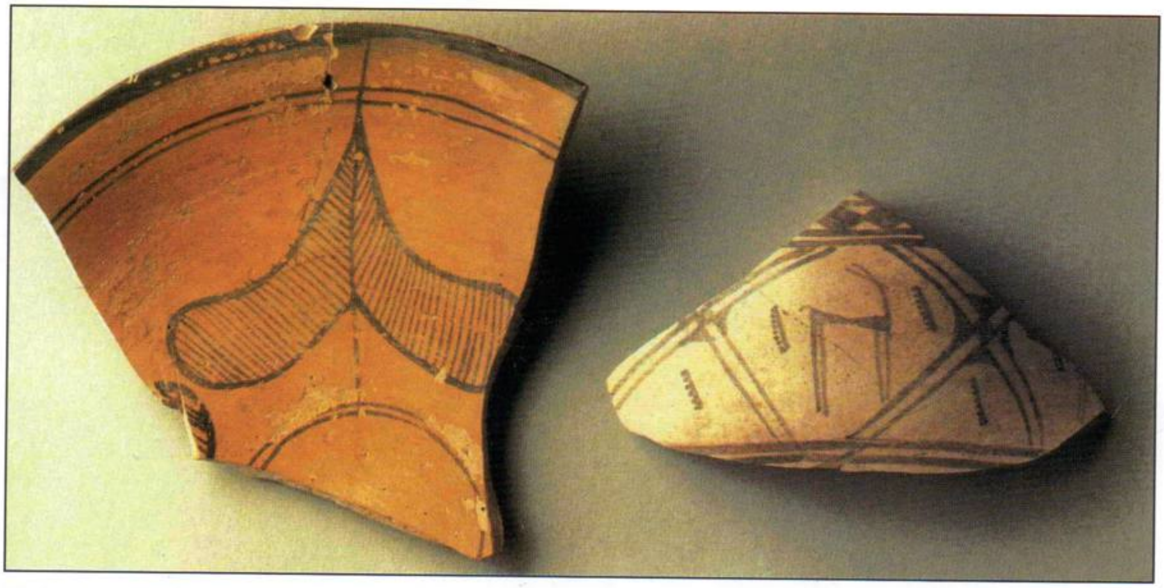
SITE	*SAMPLE NO.*	*5568 YRS. BP*	*CALIB. DATES*	*CULTURE*	*MATERIAL*
MEHRGARH	LV-908	6090±70 BP	5046,5019, 5004 cal.bce	Period IB	Unknown
MEHRGARH	LY-1949	5530±180 BP	4360 cal.bce	Period IA	Charcoal
MEHRGARH	BETA-7314	5400±90 BP	4318,4285, 4246 cal.bce	Period IIA	Unknown
MEHRGARH	LY-1947	5830±190 BP	4725 cal.bce	Period IA	Charcoal
MEHRGARH	LY-1528	4190±140 BP	2877,2800, 2780,2712, 2708 cal.bce	Period IV	Charcoal
MEHRGARH	LY-1529	3960±140 BP	2470 cal.bce	Period VI	Charcoal
MEHRGARH	LV-910	5880±100 BP	4782 cal.bce	Period IB	Unknown
MEHRGARH	LY-1527	3570±150 BP	1923 cal.bce	Period VII	Charcoal
MEHRGARH	BETA-7316	5990±120 BP	4931,4928, 4901 cal.bce	Period IA	Unknown
REHMAN DHERI	PRL-675	4400±110 BP	3034 cal.bce	Period I, Kechi beg	Charcoal
REHMAN DHERI	PRL-676	4520±110 BP	3331,3226, 3185,3155, 3143 cal.bce	Period I, Kechi beg	Charcoal
REHMAN DHERI	WIS-1698	4190±70 BP	2877,2800, 2780,2712, 2708 cal.bce	Period I, Kechi beg	Unknown
REHMAN DHERI	WIS-1697	4300±70 BP	2915 cal.bce	Period I Kechi beg	Unknown
SAID QALA	DIC-22	3620±220 BP	2018,2002, 1980 cal.bce	Occupation No.1 (Damb Sadaat III)	Charcoal
SAID QALA	DIC-20	3710±90 BP	2135,2052, 2050 cal.bce	Occupation No.1 (Damb Sadaat II)	Charcoal

SITE	*SAMPLE NO.*	*5568 YRS. BP*	*CALIB. DATES*	*CULTURE*	*MATERIAL*
SAID QALA	DIC-18	3800±220 BP	2278,2234, 2209 cal.bce	Occupation No.3 (Damb Sadaat II)	Charcoal
SARAIKHOLA	BM-1934R	4470±150 BP	3263,3246, 3102 cal.bce	Period I, Neolithic	Charcoal
SARAIKHOLA	BM-1939R	4530±160 BP	3334,3219, 3189,3152, 3148 cal.bce	Period I, Neolithic	Charcoal
SARAIKHOLA	BM-1940R	4600±200 BP	3360 cal.bce	Period I, Neolithic	Charcoal
SARAIKHOLA	BM-1935R	4370±250 BP	3023,2994, 2928 cal.bce	Period I, Neolithic	Charcoal
SHAHR-I SOKHTA	P-2077	3950±60 BP	2468 cal.bce	Shahr-I Sokhta II, Phase 5, proto-Urban	Charcoal
SHAHR-I SOKHTA	R-627	4020±50 BP	2573,2535, 2506 cal.bce	Shahr-I Sokhta II, Phase 5-6, proto-Urban	Charcoal
SHAHR-I SOKHTA	R-634	4050±50 BP	2584 cal.bce	Shahr-I Sokhta II, Phase 6, proto-Urban	Charcoal
SHAHR-I SOKHTA	P-2542	3990±60 BP	2559,2544, 2495 cal.bce	Shahr-I Sokhta II, Phase 5-6, proto-Urban	Charcoal
SHAHR-I SOKHTA	P-2543	4200±60 BP	2880,2798, 2782 cal.bce	Shahr-I, Sokhta I, Phase 9-10, proto-Urban	Charcoal
SHAHR-I SOKHTA	TUNC-24	3943±70 BP	2466 cal.bce	Shahr-I Sokhta III, Phase 3-4	Charcoal

SITE	*SAMPLE NO.*	*5568 YRS. BP*	*CALIB. DATES*	*CULTURE*	*MATERIAL*
SHAHR-I SOKHTA	R-623	4050±50 BP	2584 cal.bce	Shahr-I Sokhta II, Phase 5-6, proto-Urban	Charcoal
SHAHR-I SOKHTA	TUNC-27	3890±90 BP	2455,2416, 2405 cal.bce	Shahr-I Sokhta III, Phase 3-4 proto-State	Charcoal
SHAHR-I SOKHTA	R-405A	3960±50 BP	2470 cal.bce	Shahr-I Sokhta II, Phase 5-6 proto-Urban	Charcoal
SHAHR-I SOKHTA	TUNC-22	3829±61 BP	2298 cal.bce	Shahr-I Sokhta III, Phase 3-4, proto-Urban	Charcoal
SHAHR-I SOKHTA	R-629	4200±50 BP	2880,2798, 2782 cal.bce	Shahr-I Sokhta I, Phase 8-9, Archaic	Charcoal
SHAHR-I SOKHTA	P-2081B	4150±70 BP	2867,2808, 2772,2723, 2699 cal.bce	Shahr-I Sokhta II, Phase 6, proto-Urban	Charcoal
SHAHR-I SOKHTA	TUNC-26	4115±72 BP	2859,2819, 2692,2686, 2661,2635, 2625 cal.bce	Shahr-I, Sokhta III, Phase 3-4, proto-State	Charcoal
SHAHR-I SOKHTA	P-2084	4110±60 BP	2587,2821, 2691,2689, 2660,2637, 2623 cal.bce	Shahr-I Sokhta II, Phase 6, proto-Urban	Charcoal
SHAHR-I SOKHTA	R-632	4100±50 BP	2855,2824, 2657,2640, 2619 cal.bce	Shahr-I Sokhta II, Phase 6, proto-Urban	Charcoal

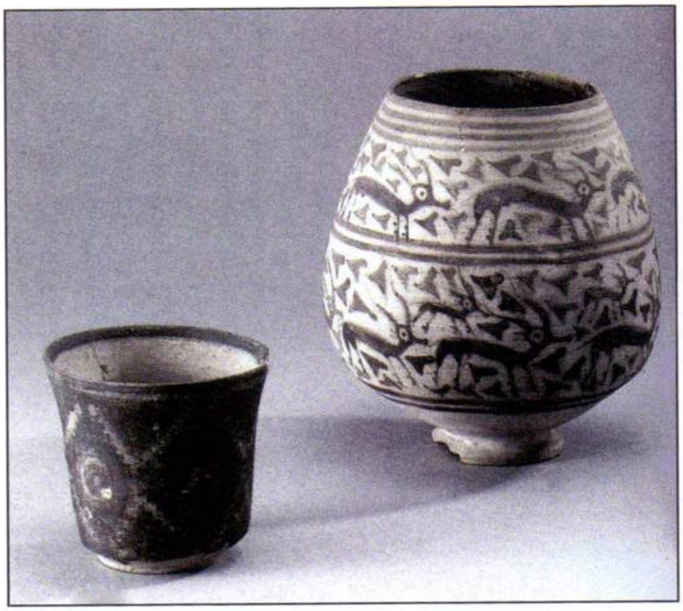
SITE	*SAMPLE NO.*	*5568 YRS. BP*	*CALIB. DATES*	*CULTURE*	*MATERIAL*
SHAHR-I SOKHTA	P-2071	3970±60 BP	2483 cal.bce	Shahr-I Sokhta IV, Phase 0, post-Urban	Charcoal
SHAHR-I SOKHTA	TUNC-21	4065±65 BP	2598 cal.bce	Shahr-I Sokhta III, Phase 3-4, proto-State	Charcoal

Pl. 3.1 Mehrgarh, pottery with bird motifs.



Pl. 3.3 Mehrgarh, potsherd with pipal and gazelle motif.

Pl. 3.4 Mehrgarh, pottery.



Pl. 3.2 Mehrgarh, pottery with animal and geometric motifs.

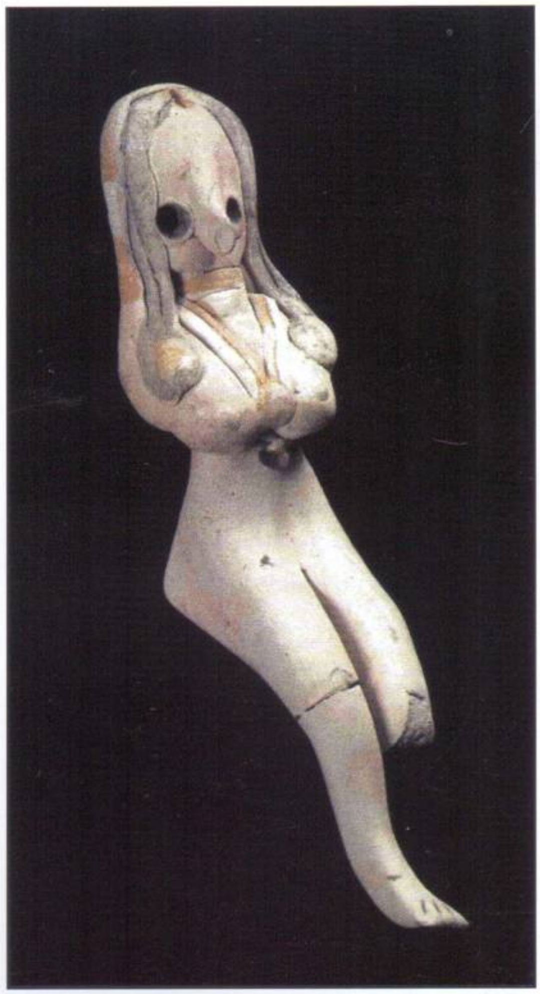
Pl. 3.6 Mehrgarh, bone needles.

Pl. 3.5 Mehrgarh, pottery with sun and bull motifs.

Pl. 3.7 Nausharo, female with child terracotta.

Pl. 3.9 Nausharo female-male couple (?) terracotta.

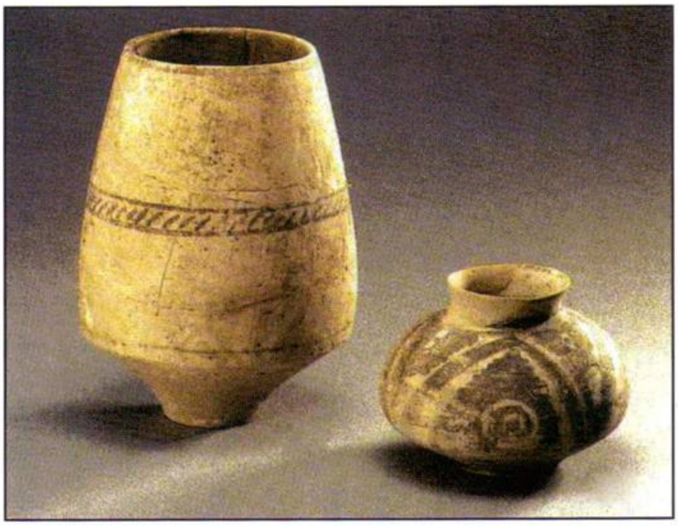
Pl. 3.10 Nausharo, male and female terracotta.

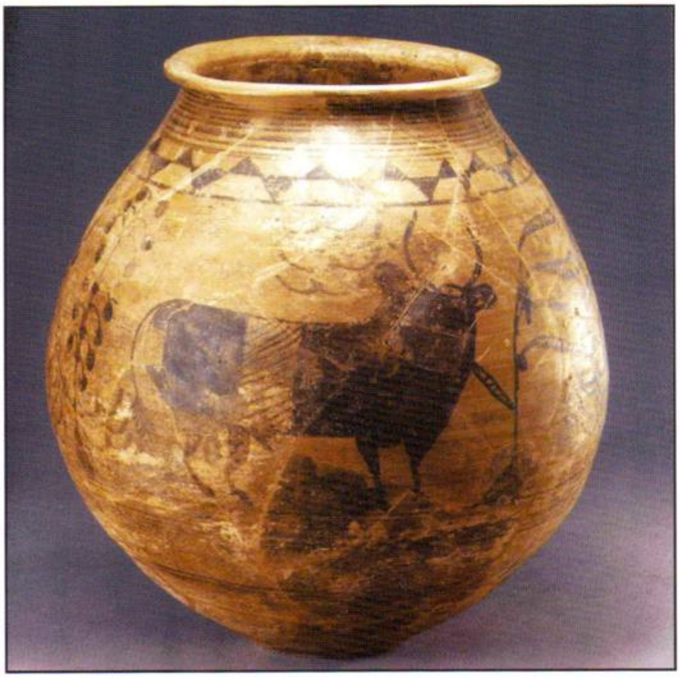


Pl. 3.8 Nausharo, female terracotta.

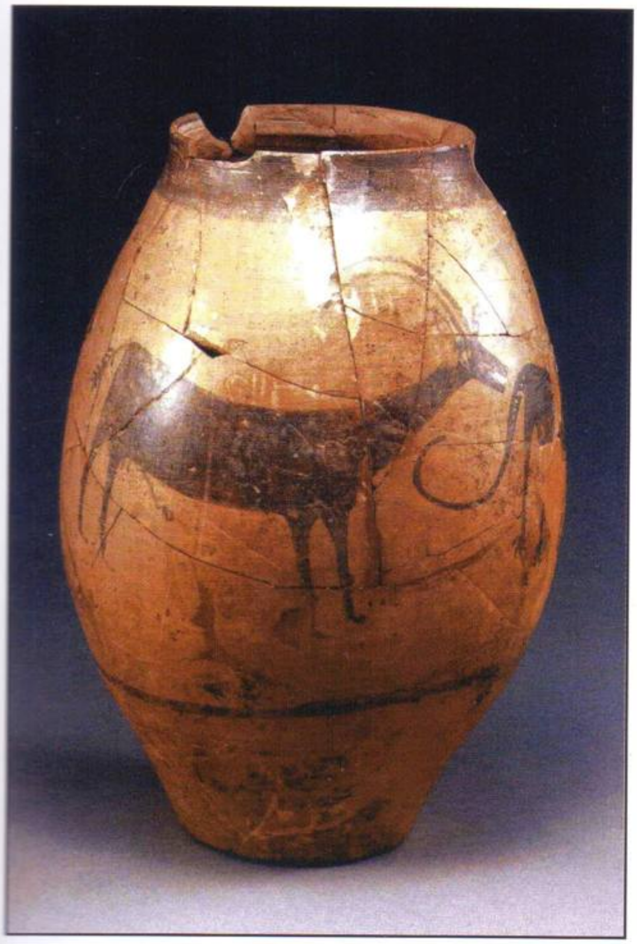
Pl. 3.11 Nausharo, terracotta bull.

Pl. 3.12 Nausharo painted buff ware.





Pl. 3.13 Nausharo pot with bull motif.

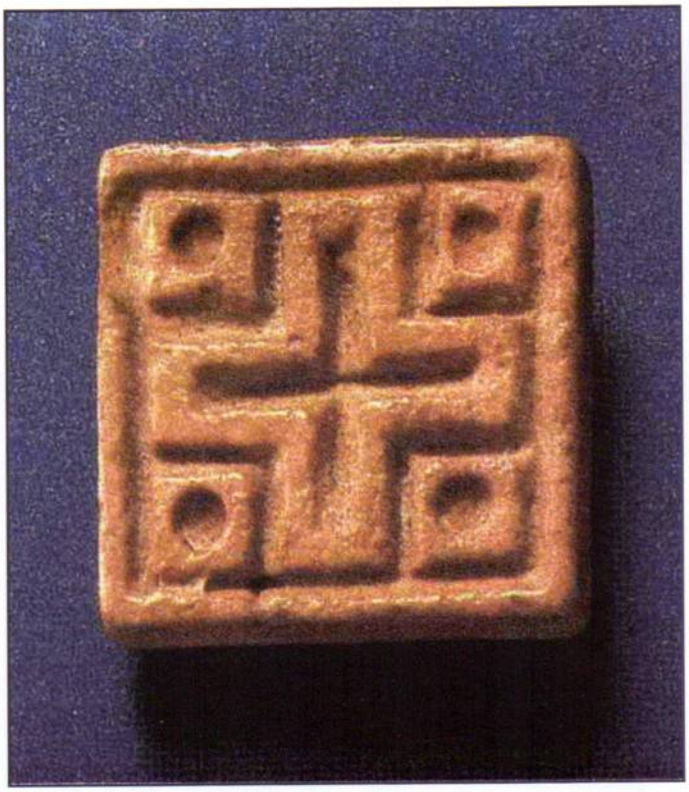


Pl. 3.14 Amri, pot with antelope motif.

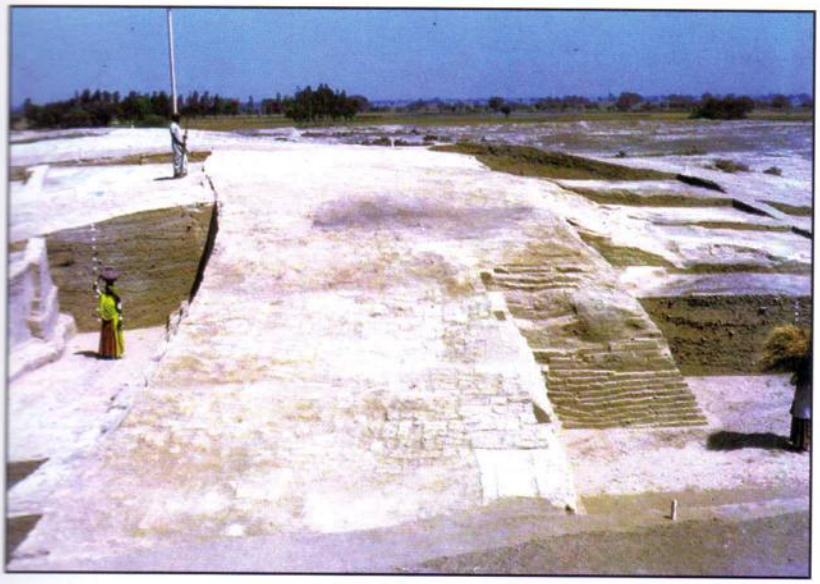
Pl. 3.15 Terracotta beads, Amri.

Pl. 3.16 Rehman Dheri, female terracotta.

Pl. 4.1 Bichrome painted pottery, Harappa.

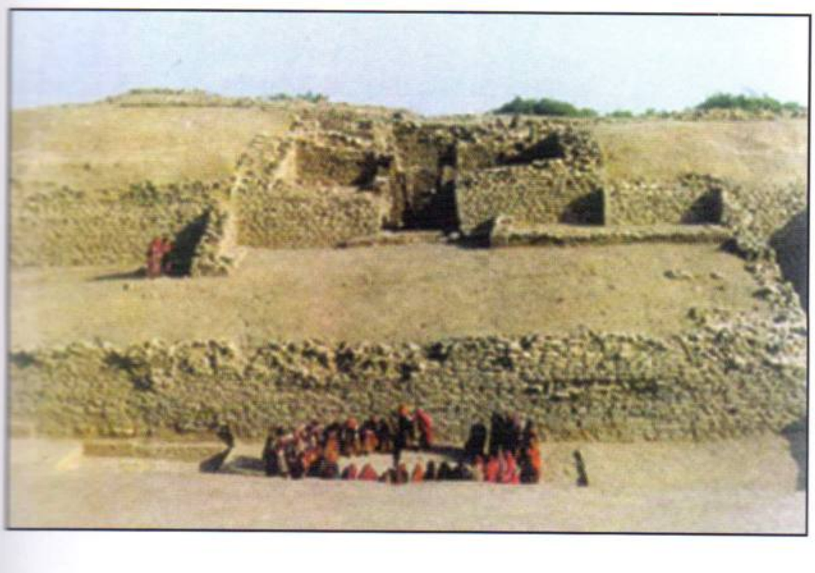


Pl. 4.2 Tablet with cross, Harappa.

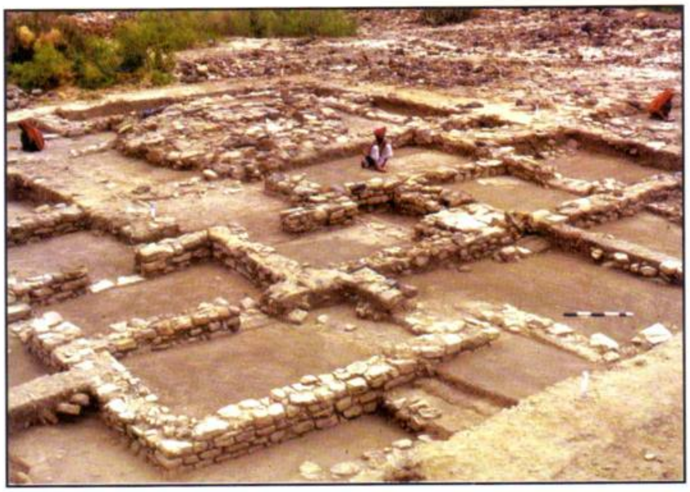


Pl. 4.3 Banawali fortification.

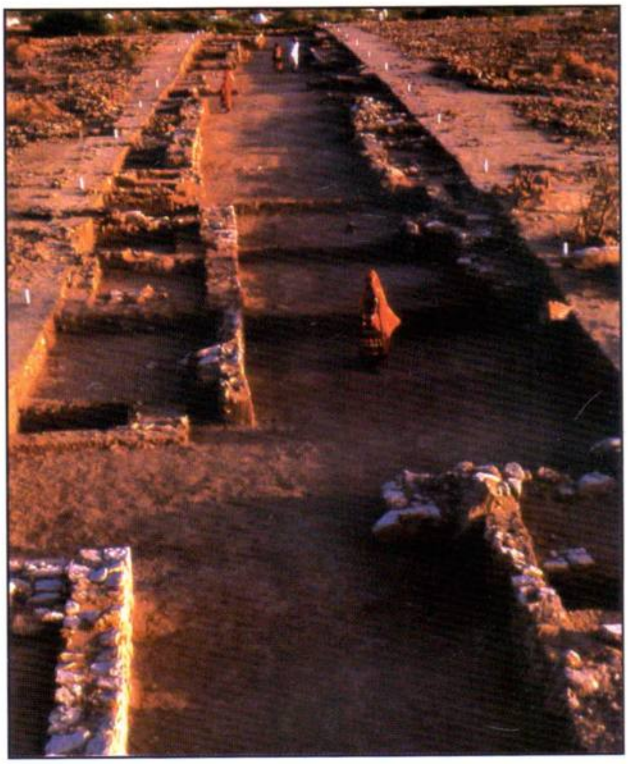
Pl. 4.4 Banawali, sealing on clay (ASI).



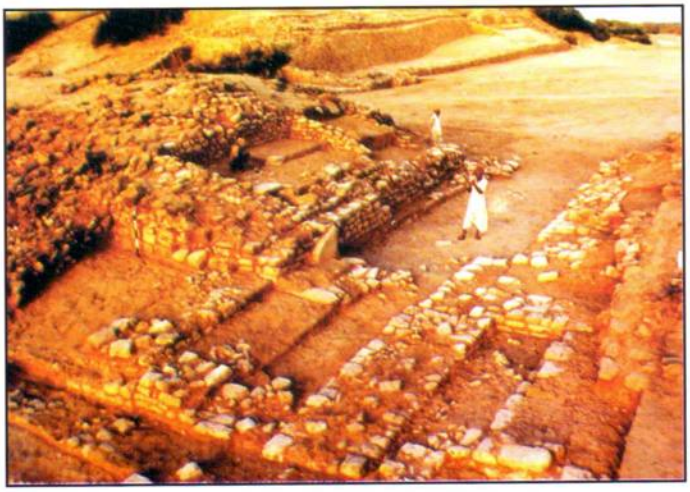
Pl. 4.5 Northern gate, Dholavira.



Pl. 4.6 Middle town, Dholavira.



Pl. 4.7 Lower town, Dholavira.



Pl. 4.8 Ceremonial ground (stadium), Dholavira.

4

Spatial Spread and Main Towns

INTRODUCTION

For a culture of the 3rd Millennium BCE, it was a vast extent: the Harappan culture spread over 1.25 million sq km. In the west Sutkagendor (Makran), in the east Alamgirpur (UP), Manda in the north, and Bhagatrav in south Gujarat represent the outer limits of the culture (Fig. 1.3). The uplands of Baluchistan, most of Uttar Pradesh and the south were out of its purview. Even the Indo-Ganga divide does not have the Mature Harappan culture as such but only an amalgam of pre-Harappan, the Harappan and local elements. The culture is mainly confined to the Indus Valley and Saurashtra, including Kachchha. There are a large number of Harappan sites on the dry Ghaggar-Hakra system, which probably joined the Indus or the Nara in the past.

The Indus civilization or Harappa culture (named after the first discovered site, Harappa) is remarkable for its uniformity and standardization in weights, measures, ceramics, architecture, and in other arts and crafts, though there is considerable variation in ceramics and town-plans. This uniformity appears all the more imposing when one considers that the culture extended over more than a million sq km, an area more than that of Pakistan today. What this uniformity reflects, can only be a speculation. But such uniformity, in a 3rd Millennium BCE context is indeed unique. Recent studies, however, are bringing out a good deal of regional variation, as discussed in the section on Indian sites. Thus we find that the Harappan culture exhibits both the traits: a uniformity which characterizes it as a uniform culture, and the regional diversity which allows for expression of local religious beliefs and traditions. This unity in diversity has always been a hallmark of the Indian civilization.

Lal (1998:19-47) also points out that it has been held for long that the Harappan civilization was sadly monotonous, both in time and space, i.e. from the middle of the 3rd millennium BCE to the first quarter of the second and from Baluchistan (Pakistan) in the west to Alamgirpur in Uttar Pradesh (India) in the east. Lal asserts that this was hardly the case. He makes his point, which has become increasingly obvious, by showing the variations in the town-planning of the main Indian sites: Kalibangan, Banawali, Lothal, Surkotada and Dholavira.

In their humility, the Harappan towns present a contrast to the Mesopotamian and Egyptian ones. Mark Kenoyer (1998) thinks that the Indus rulers governed their cities through the control of trade and religion rather than armies. No monuments were erected to glorify the power of the elite. In Mesopotamia and Egypt stone sculptures and relief of kings were made, unlike in South Asia where Asoka built more than 115 stone columns but none of them had the portrait of the king.

Renfrew also echoes the same views about the character of the Harappan culture. As quoted before, he says:

I have often thought how singular the Indus Valley civilization is in this respect. For it possesses very large urban centres with a rectangular layout more impressive than any in Early Dynastic Mesopotamia, and worthy of comparison with Teotihuacan. The centres have Citadels with large granaries, which were clearly the hub of a complex re-distributive exchange system. A range of traded materials is seen. Yet nowhere, on the basis of archaeological record at present available, is the superabundant personal wealth so characteristic of the early civilizations of Egypt, Mesopotamia and China. Nor has there been found the exceedingly complex and monumental religious symbolism characteristic of the Mesoamerican early state modules. Nor yet, despite the existence of a script, is there the vainglorious assertion of personal power, expressed in colossal monuments and inscriptions that we see in Egypt and Mesopotamia. The Harappan civilization does not reveal to the world any Ramses, any Hammurabi, nor yet any Gudea of Lagash. Indus exchange evidently functioned without such emphatically assertive statements about the prestige and power of the central person. (Renfrew 1984: 106).

It was the stamp seals of the elite with symbols of wealth and power that separated them from common people. Large buildings of the elite were not located in a single area of the town, but were spread all over the different mounds, unlike the layout of the Mesopotamian cities. Kenoyer suggests that the seal has a name or title represented by the totemic animal which may have represented a clan or political office. These seals appear from the very beginning of the Indus civilization and linger on even in the Late Harappan Phase. He notes that at Harappa mound E the walls were rebuilt at least three times between 2600 and 1900 BCE. Such phases of rebuilding and growth may denote the rise of new rulers who had gained support of powerful communities living in the cities and suburbs. It is also intriguing that in Harappa several localities (mounds) had independent fortifications, suggesting some sort of oligarchy. It may be worthwhile to correlate the animal motifs and legends on seals with each such locality of a town as also town-specific motifs.

It has been suggested that stamp seals with animal motifs carried messages understandable to all different communities. As totemic symbols, the animals represented a specific clan or an official. Kenoyer suggests that the totemic animals represent at least ten clans: unicorn, humped bull, elephant, rhino, buffalo, humpless bull, goat, antelope, crocodile and hare. The unicorn is most numerous. It is to be noted that zebu bull is found only at Mohenjodaro and Harappa. The unicorn motif is most popular (Pl. 4.9). At Mohenjodaro 60 per cent seals have this motif. Unicorn probably represents the aristocracy and merchants directly involved in governing the different settlements. Of course, seals were also used to verify the contents of the parcel to be sent. From Lothal more than 100 impressed clay lumps have been found. Many other common animals like cobra, the peacock, the monkey and the mongoose are seen in the narratives but never on stamps seals (Kenoyer 1998).

The importance of symbols and motifs would be discussed in the chapter on Religion. Next we give a brief description of the main sites – both in Pakistan and India.

SITES IN PAKISTAN

BALAKOT

Balakot on the Makran coast yielded a large corpus of stratified pottery, the faunal and floral data, and the radiocarbon dates from Period I. Dales, the excavator, thought that extensive excavation would be required to reveal the quantity and types of information on architecture and settlement planning that is desired from an ancient site (Dales 1979). The Period II excavations provided abundant information on this Harappan frontier settlement. The faunal remains provided important new information on the ecological situation of four millennia ago and on the exploitative and dietary practices of the Harappan inhabitants. The pottery and figurines promise to clarify some of the questions concerning the relationships between the Mature Harappan culture and the various ill-defined cultural groups in Baluchistan. Some evidence for maritime or coastal contacts with the Persian Gulf region has also been found. The Balakot evidence is being studied in relationship to the other two large coastal sites in Pakistani Makran (Dales 1962a; 1962b) and to Lothal in India.

MOHENJODARO

Recently, Jansen has suggested interesting ideas about the beginnings of Mohenjodaro. He doesn't think that it evolved slowly. Perhaps it was constructed as a planned town (Fig. 4.1) in a short time. He says:

> Many indications point towards a founding and building of the first urban 'Mohenjodaro' in a rather short time. If this assumption is true then the builders of this monumental project would have been already fully in control of the entire spectrum of building technology [prefabrication of standard-size bricks, walls in block-bond (so-called English bond), the levelling of the water canals, the sinking of wells down to over 20 m in depth, etc]. Moreover, they would have been able to plan and organize the construction of a city of more than 200 hectare area in a short time on top of a protective earthen substructure, up to 7 m high, in the middle of the alluvial Indus Valley plain despite the danger of annual floods! The foundation structures alone which finally protected the buildings on top of it against the annual floods could have occupied, for example 5,000 workers for several years. These extraordinary efforts would have been possible only by a highly developed spirit of planning, the necessary population potential, and a corresponding economy. Above all, there must have existed the necessity for such an extraordinary effort. (Jansen 2002: 111)

He makes it clear that:

> Mohenjodaro would not be the place of transition from the Early to the Mature Harappan Period, but it would be, shortly after the first great building achievement of an already fully matured civilization—the result of an extraordinary need of an already potent culture.

Jansen's hypothesiz seems to make sense as it is here that we get the well planned Great Bath, the hieratic figures and such other forms of "official" importance. The Indus religion emerges best at Mohenjodaro, where there seems to be some evidence for an Indus Great Tradition (*Margi*) as well as religious beliefs that are more folk or Little Tradition (*Desi*) in nature. Mohenjodaro has both types of evidence: the hieratic figures, temple buildings, mother goddess figurines, the Great Bath. Both these traditions have continued to this day In India. Impressed by the Great Bath and other water structures at Mohenjodaro, M. Jansen used the word *wasserluxus*, which literally means "water splendor", but as Possehl has pointed out, it does not quite catch the significance of the German word. The bathing facilities in each house indicate that washing and cleanliness were important to the Harappans. The many wells throughout the city were sources of new, pure water, essential for effective cleanliness. The drainage system served to move the effluent away from the houses, below ground, safely out of the way and safely out of sight, in brick-lined channels that prevented contamination of the earth and the city (Possehl 2003: 56).

Amongst the modern archaeologists, George Dales has done extensive work in Pakistan. The HARP project started by him at Harappa is being continued by Kenoyer and Meadow. Mohenjodaro, situated on the Indus, in Sindh, is one of the oldest excavated Harappan sites (Figs. 1.3, 4.1). In 1979 Dales published a fairly comprehensive update on the archaeology of

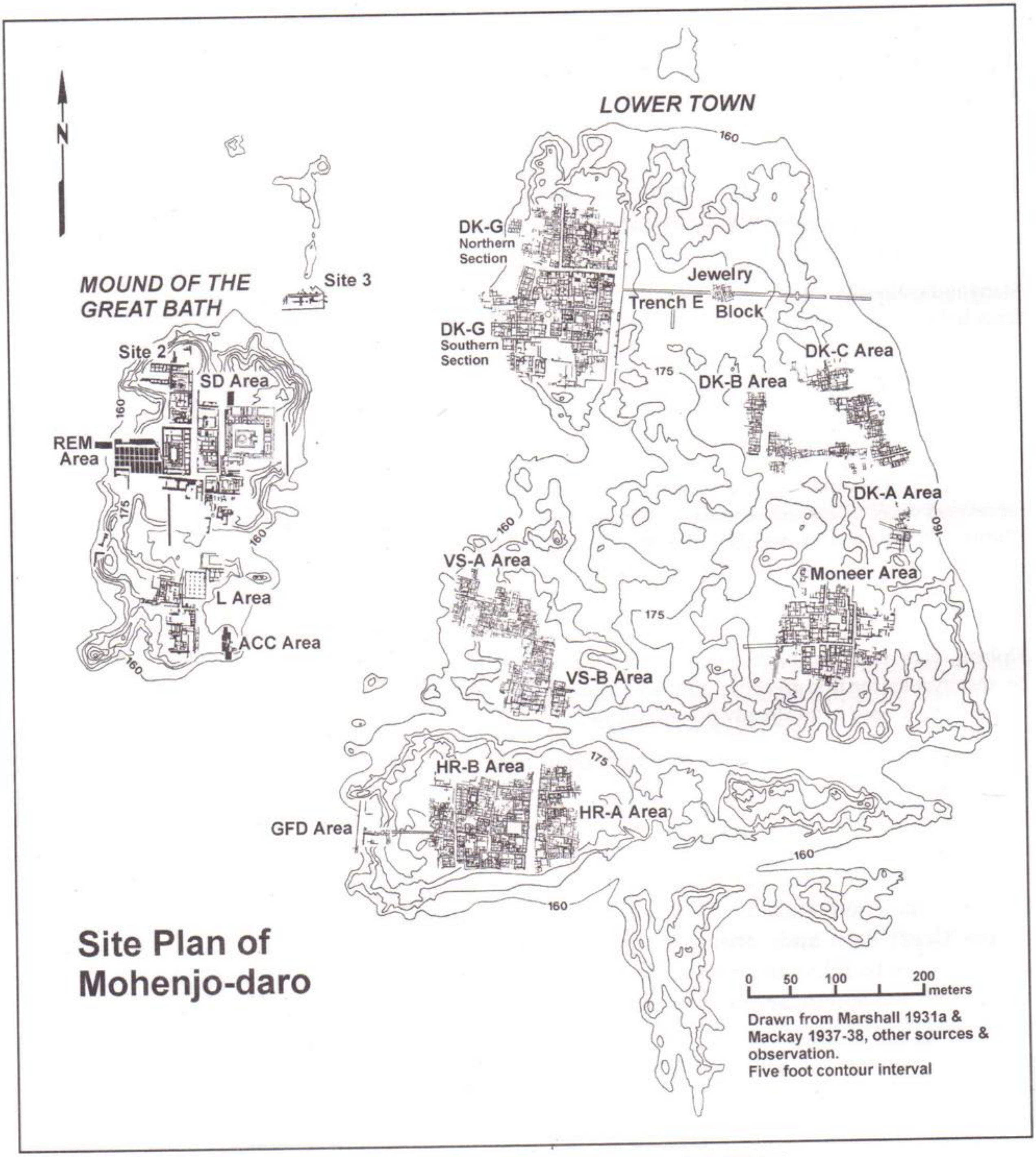


Fig. 4.1 Site plan of Mohenjodaro (After Marshal, 1931 a).

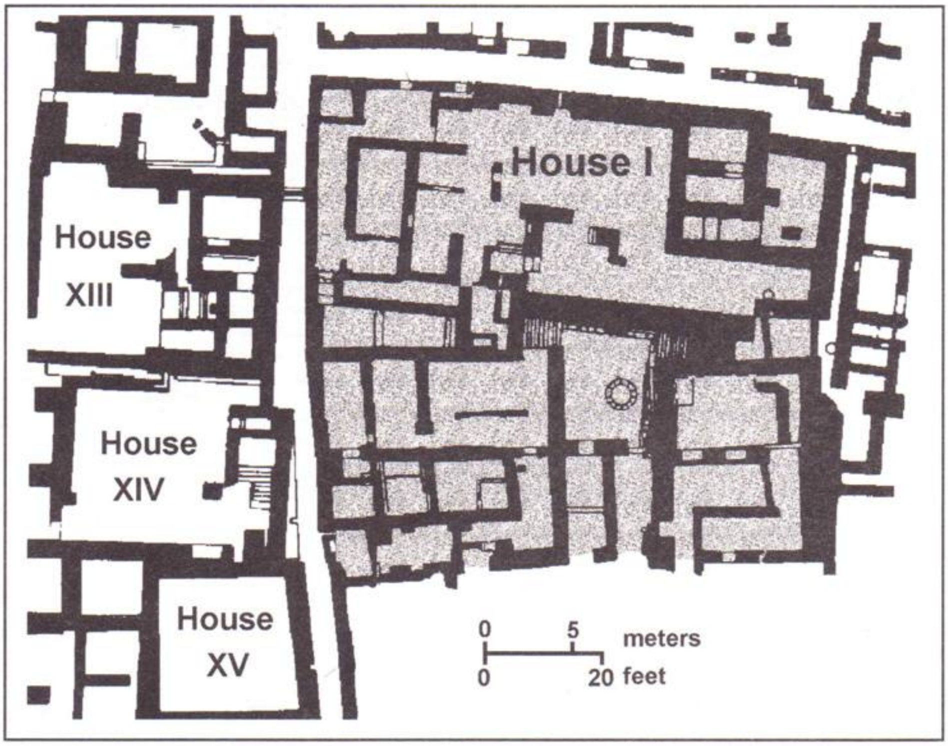


Fig. 4.2 Mohenjodaro: House plans including the big house no. 1
(After Possehl, 2002).

Mohenjodaro. The site was extensively excavated during the 1920s and early 1930s. Almost one-third of the area of this huge city was exposed, revealing for the first time the remains of the oldest civilization of South Asia. But little reliable information was gathered concerning the origin, life history and decline of the city and the civilization as the earliest levels are many feet below the present ground water level of the area. And the highest recognizable flood deposits at Mohenjodaro are 31 feet above the present level of the plain!

Sir John Marshall was the first to carry out excavations at Mohenjodaro and published his results under the title *Mohenjodaro and the Indus Civilization* (1931). E.J.H. Mackay continued the excavations through 1927-1931. He published, *Further Excavations at Mohenjodaro* (1938 b). Sir Mortimer Wheeler also did some digs there in 1950 but did not publish any formal report.

About their excavations, Dales informs us the first phase of the initial season's work involved the drilling of exploratory holes to determine the maximum depth of occupation. Three drillings were made near the maximum depth of occupation. Three drillings were made near the area of the proposed new excavations by the Indus Valley Construction Company of Lahore. Samples of soil and artefacts were collected from levels at about 60 cm intervals down to virgin soil. The results of two borings at the base of HR mound were identical, showing that occupation in this particular area of the site starts 12 m below the present level of the plain. The mound itself in this area is about 10 m high, and thus the total depth of occupation is about 22 m. As the present ground-water level is only some 4.5 m below plain level, it will thus be necessary to penetrate at least 7 m below the water-table in order to reach the earliest level of occupation.

They opened an area approximately 20 × 20 m on top of the HR mound. No traces of post-Harappan occupation were found; but they found abundant evidence for the final phase of the Harappan occupation. On this level were found jerry-built houses made with used, often broken, bricks and other indications of a squatter type of occupation rather than just a late phase of the

Harappan civilization. The few artefacts associated with these latest structures were basically of Harappan type but of a simple and degenerated nature. Dales calls it the Squatter Period, to distinguish it from the Late Period described by the previous excavators. The Late Period remains were directly beneath the thin squatter level and in places were even exposed on the mound surface. There were suggestions that some of the rooms had been hastily abandoned. A thick layer of straw and chaff had smouldered on the floor after the roof collapsed. Most important was the discovery of burned wooden door jambs, still in place in a doorway leading from this room.

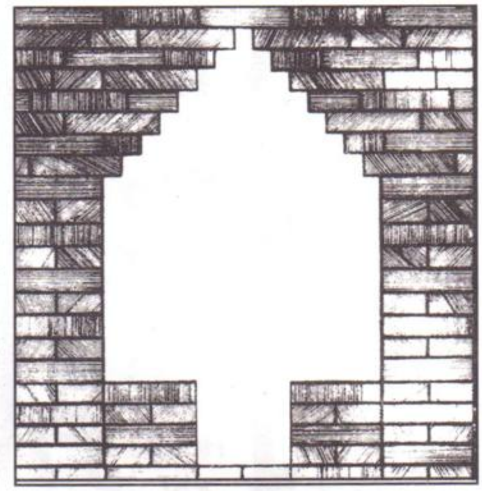


Fig. 4.3 Corbelled Arch, Mohenjodaro (After Possehl, 2002).

Between the walls bordering a narrow alleyway was found a very thick debris in which were enmeshed five skeletons. They resembled some thirty others found earlier at this site– not buried deliberately but perhaps the victims of some disaster.

They found typical Indus seals of steatite, depicting animals with Indus script, from these Late Period levels. Small square seals of faience with geometric designs – including the swastika– were found only in the Late Period levels of their excavations. Certain ceramic forms and styles of painted decoration can be assigned to this period. The animal figurines from the late levels are of a simple toy-like variety with little or no plastic modelling. Facial details are depicted by deep holes and carelessly incised lines. The unnaturally large eyes are usually represented by pierced clay discs applied to the head. These figurines contrast sharply with the beautifully modelled animal figurines from the base of the HR mound. The bull figurines, probably belonging to the most flourishing period of the city's life, had the bodies and legs carefully modelled by hand while the heads appear to have been made in moulds. Horns and ears were attached separately and tiny clay pellets were inserted as eye balls.

At the edge of the mound they found a massive construction composed mainly of huge solid mud-brick embankments with baked brick retaining walls. At one point an exploratory pit was dug into an embankment, but digging was stopped at a depth of 7 m without reaching the bottom.

A series of solid baked brick walls at least 6 m high was found running north and south. These seem to provide the facing for the mud-brick embankments which form the edge of the mound. Dales says that it is tempting to consider the walls and embankments as part of a city wall surrounding at least the eastern part of the city. Wheeler reported the discovery in 1950 of a wall associated with the Citadel or stupa mound in the western part of the city. Probably the Citadel and the habitation area of the city each had its enclosure wall and there was no single wall surrounding the entire city. This would fit in with the possibility that the north-south depression separating the eastern and western parts of the city was originally a canal or a branch of the river. The massiveness of the walls and embankments suggests a function beyond that of a simple defence wall. Considerable evidence was found at the base of the mound for the combined use of baked brick and wooden architecture. Wooden beam sockets, recesses in brick wall faces for wooden beams, and a series of regularly spaced vertical slots on the outer wall surface of one building point to the use of wooden architectural components on a scale much more extensive than had hitherto been realized.

According to the detailed study of Raikes and Dales, the evidence suggests that Mohenjodaro and much of the lower Indus Valley suffered from a series of severe and extensive floods which eventually forced most of the population to abandon the area. Dales describes their theory of the grand dam on the Indus caused by tectonics. These theories will be examined in chapter 10 on the end of Indus civilization.

Kenoyer (1998) has recently put in considerable effort in giving additional information on the Harappan archaeological data. Confirming Dales' inference, Kenoyer says that at Mohenjodaro the presence of city walls and gateways has been doubted, but recent studies seem to confirm that like Harappa, each major mound was surrounded by an enormous mud-brick wall, with gateways at key locations. From the western Citadel mound, the highest habitation area at Mohenjodaro rising up to 12 m above the plains in the north was found a Buddhist stupa and monastery of the historical period. Wheeler identified a gateway at the south-east corner of the Citadel mound, though he never fully published his report. This mound is encircled by a massive mud-brick wall or platform, which is now eroded down to the modern plain level.

Large Buildings

The important buildings were prominent enough to be visible from all parts of the city. Many of the largest and best-known buildings of the Harappan Phase are located on the Citadel mound at Mohenjodaro. Three prominent large buildings, on the northern part of the mound, are generally known as Granary, the Great Bath, and the College (Figs. 4.4-7). At many places protruding fragments of walls indicate that other important buildings may be lying buried beneath the Buddhist stupa, which covers the eastern quarter of the mound. The southern part of this mound has a large building called the assembly hall, which has a double row of square columns and lines of bricks set into the floor like in the modern Buddhist monasteries and Brahmanical ashrams. Perhaps this tradition can be traced to the Harappan times. Other important public buildings have been found in different neighborhoods of the lower mounds. A large courtyard in the DKG area may have been a large market or public assembly area.

Chief's House or Temple

Located nearby is a large complex of houses, which the early excavators called the house of a chief. To the south at the other end of the lower mound in the HR area another important building (Fig. 4.2), called House A1, may have been a temple or the house of an important person. Two doorways led to a narrow courtyard at a lower level. A circle of bricks in the courtyard might have been the site of a sacred tree. A double staircase led to an upper courtyard surrounded by several rooms. This house had numerous seals and fragments of a stone sculpture depicting a seated man wearing a cloak over the left shoulder. Other pieces of this bearded figure were found scattered in nearby houses. This sculpture closely resembles the so-called priest-king image, which was found far to the north in the DK area (Pl. 6.1). Kenoyer thinks that there are indications that it may have been a religious area, or a temple.

Great Bath

The "Great Bath" of Mohenjodaro (Figs. 4.4, 5) without doubt is the earliest public water tank in the ancient world. The tank's measurements are 12 m north-south and 7 m wide, with a maximum depth of 2.4 m. Two wide staircases, one from the north and one from the south, lead down into the tank. Small sockets at the edges of the stairs could have held wooden planks or treads. There is a small ledge at the foot of the stairs running the entire width of the pool (Fig. 4.5).

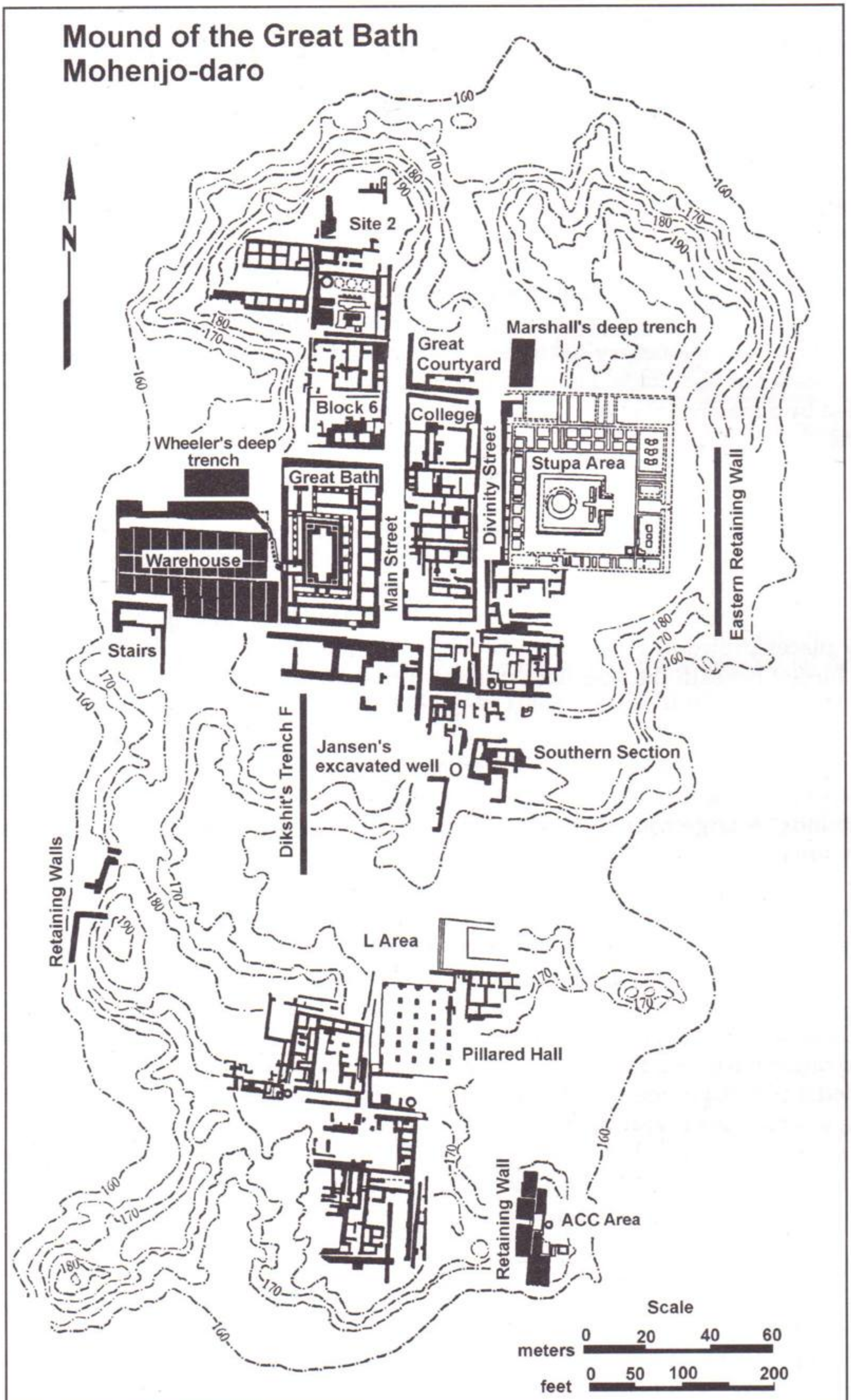


Fig. 4.4 Mound of Great Bath, Mohenjodaro (After Possehl, 2002).

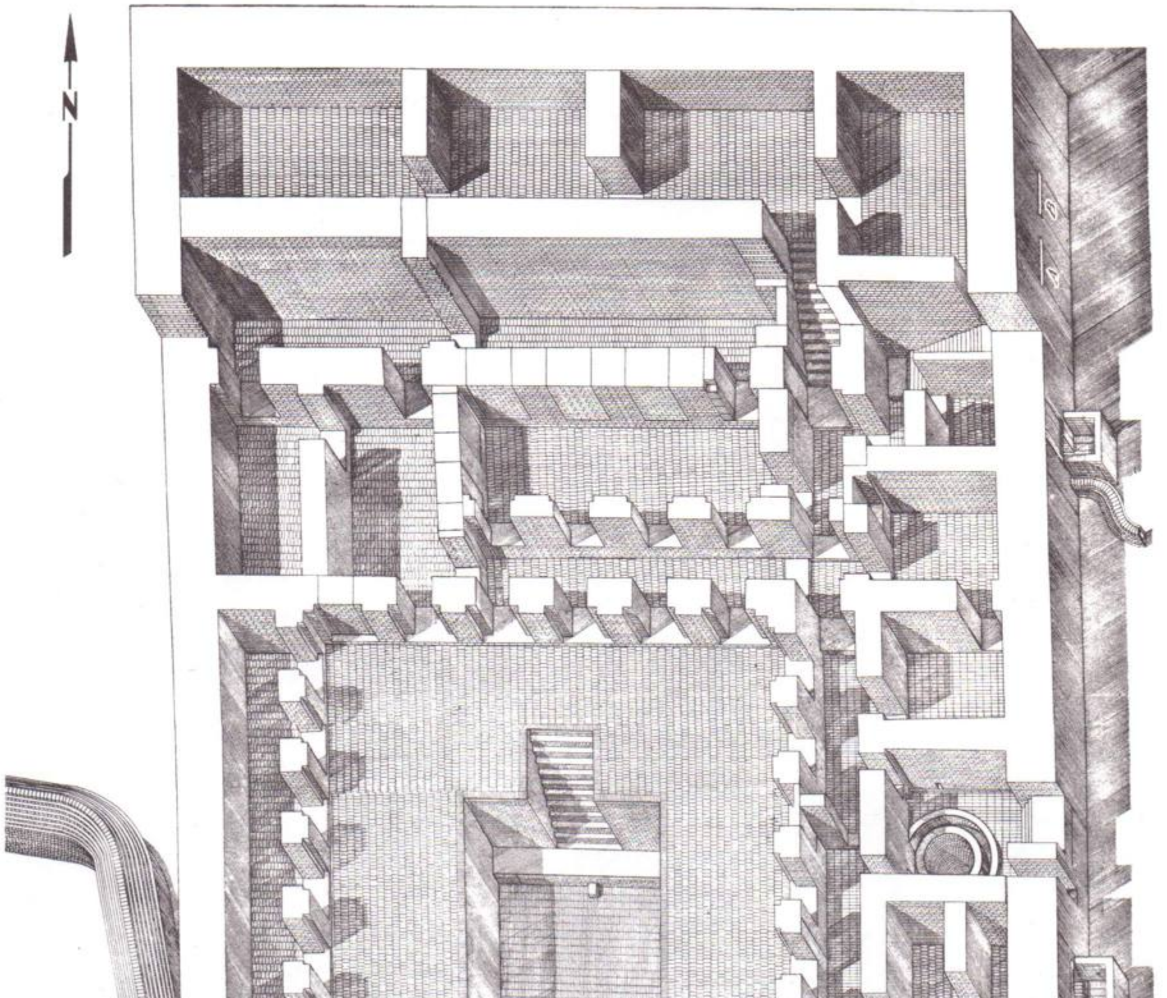
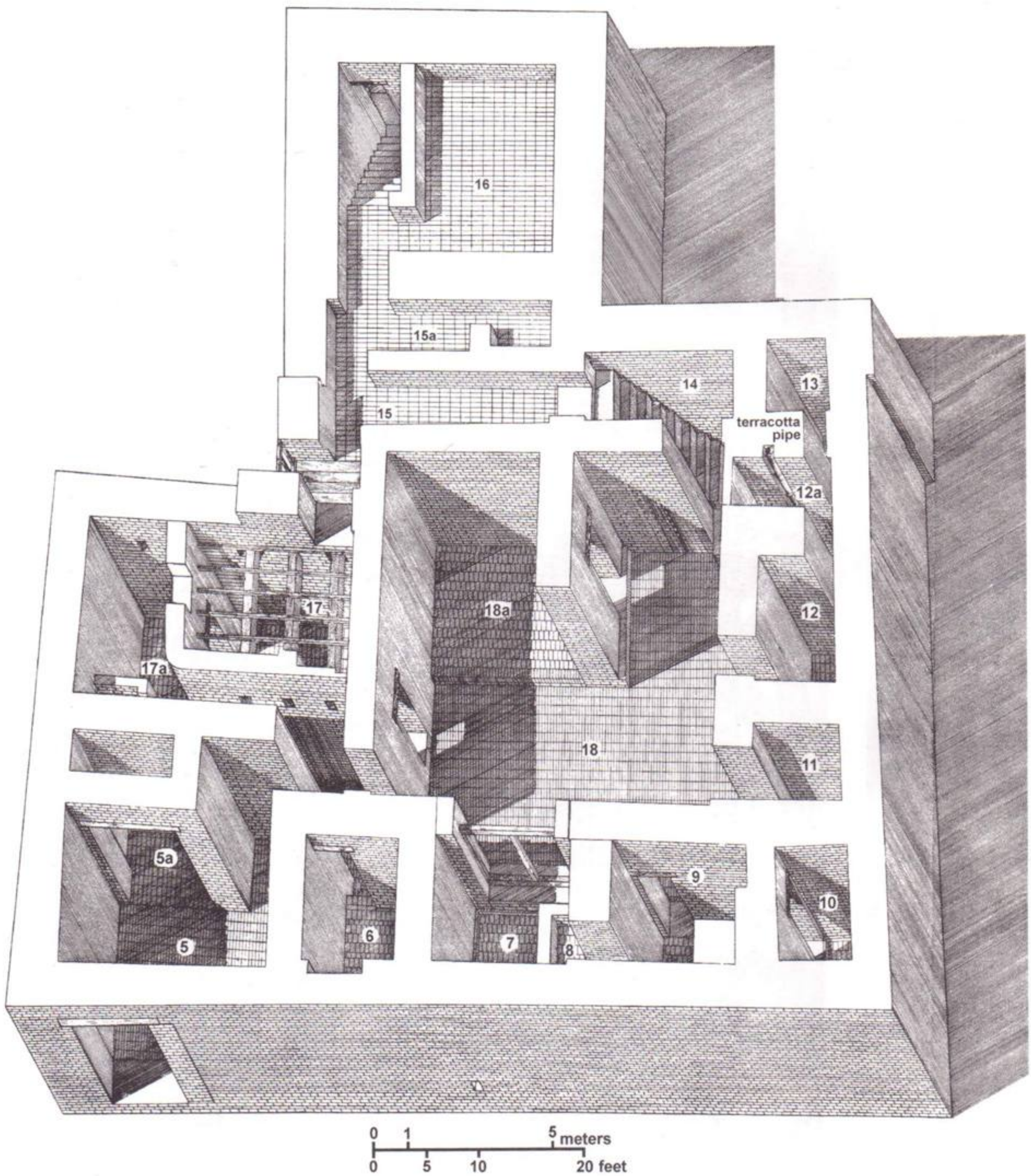


Fig. 4.5 Great Bath Mohenjodaro, isometric view (After Possehl, 2002).



Oblique projection of House VIII
After Marshall 1931c : Plate IV

Fig. 4.6 Oblique projection of house no. VIII, Mohenjodaro, isometric view (After Marshal, 1931c).

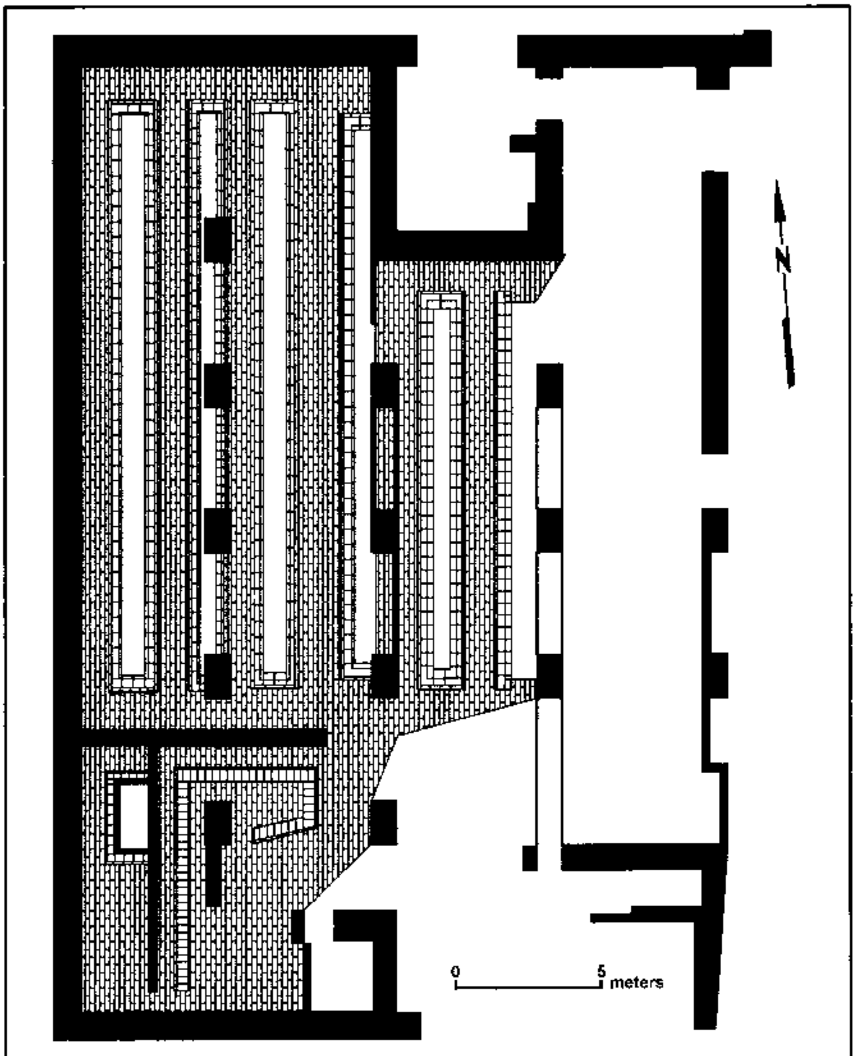


Fig. 4.7 Pillared Hall, Mohenjodaro (After Marshall, 1931).

The Great Bath is remarkable for the waterproofing engineering skills of the Harappans. Both the floor of the tank and the side walls are made water-tight with finely fitted bricks laid on edge with gypsum plaster. A thick layer of bitumen (natural tar) along the sides of the tank and perhaps also beneath the floor makes the Bath even more watertight. The floor slopes down to the south-west corner where a small outlet leads to a brick drain, which takes the water to the edge of the mound. On the basis of a detailed analysis of symmetry of the building and comparison with other buildings, Michael Jansen suggests that the architects who designed and constructed this building and water tank had severe constraints of space, as there was a very limited area available between the main north-south street and the granary. Except for the eroded western side, brick colonnades were discovered around all the edges. Marshall had also assumed that there would have been a colonnade running along the western edge. The preserved columns have stepped edges that may have held wooden screens or window frames. Two large doors led into the complex from the south, with additional access from the north and east.

Rooms were located along the eastern edge of the building. There was a well in one of the rooms that may have supplied some of the water needed to fill the tank; rainwater also may have been collected for this purpose.

Probably Kenoyer is correct when he suggests that it is unlikely that this elaborate building was used simply for public bathing, because just to the north was a substantial building containing eight small rooms with the more common bathing platforms. Most scholars agree that this tank was used for special religious functions where water was used to purify and renew the well-being of the bathers.

The Great Bath at Mohenjodaro is a bathing platform, raised to the civic level. It is larger and more complex than household facilities, but conforms to the proposition that cleanliness of both the body and mind were an important element in the Indus ideology. Possehl observes that it is interesting, too, that the builders of the Great Bath used elevation and distance to symbolically set it apart from the rest of Mohenjodaro. This was an important ritual space, one that seems to have been reserved for the elites of the city, possibly the elites of the entire Indus world (Possehl 2003: 58).

Granary

A large building at Mohenjodaro was first identified as a *hammam* or hot-air bath, and later as the state granary (Fig. 4.8). Initially excavated in the 1920s, the complete structure ("Granaries" or "Great Halls") was reinvestigated by Wheeler (in 1950) whose imaginative reconstruction of this structure as a state granary was based on comparisons with Minoan Crete and Rome.

The foundation of this building appears to have been laid before the Great Bath, as its exit drain cuts across the north-east corner of the foundation. Built on top of a tapered brick platform, this building had a solid brick foundation that extended 50 m east-west and 27 m north-south. The foundation was divided into 27 square and rectangular blocks by narrow passageways, two running east-west and eight running north-south (one additional north-south passageway was added at a later stage). Some of these blocks had square sockets for holding wooden beams or pillars. Kenoyer suggests that the entire superstructure may have been made of timber.

A brick-lined well was located at the foot of the stairs, and a small bathing platform was found at the top of the stairs. Wheeler identified a brick-paved 4.5 m wide staircase, which led from the south-western edge of the structure to the plain level. There was also a terraced platform with numerous sockets for wooden beams and an alcove as a loading dock. To the north of the terrace was a low courtyard or open area and two additional wells. It is difficult to reconstruct the function of this structure as the entire structure was excavated without detailed recording of the types of pillars found in the passageways or nearby rooms. However, the earlier excavators did note the lack of charred grains and storage containers. The absence of sealings from bundles of goods and the unique nature of the structure all raise doubts about the identification of this building as a state granary or storehouse. Kenoyer has suggested that a more general name like "the great hall" may be more appropriate for this building with large and spacious wooden columns and many rooms.

On the other hand, a granary at Harappa was identified by M.S. Vats with a different type of building located on mound F. This structure is built on a massive mud-brick foundation that is over 50 m north-south and 40 m east-west. Two rows of six rooms that appear to be foundations are arranged along a central passageway that is about 7 m wide and partly paved with baked bricks. Each room measures 15.2 × 6.1 m and has three sleeper walls with air space between them. Small triangular openings may have served as air ducts to allow the flow of fresh air

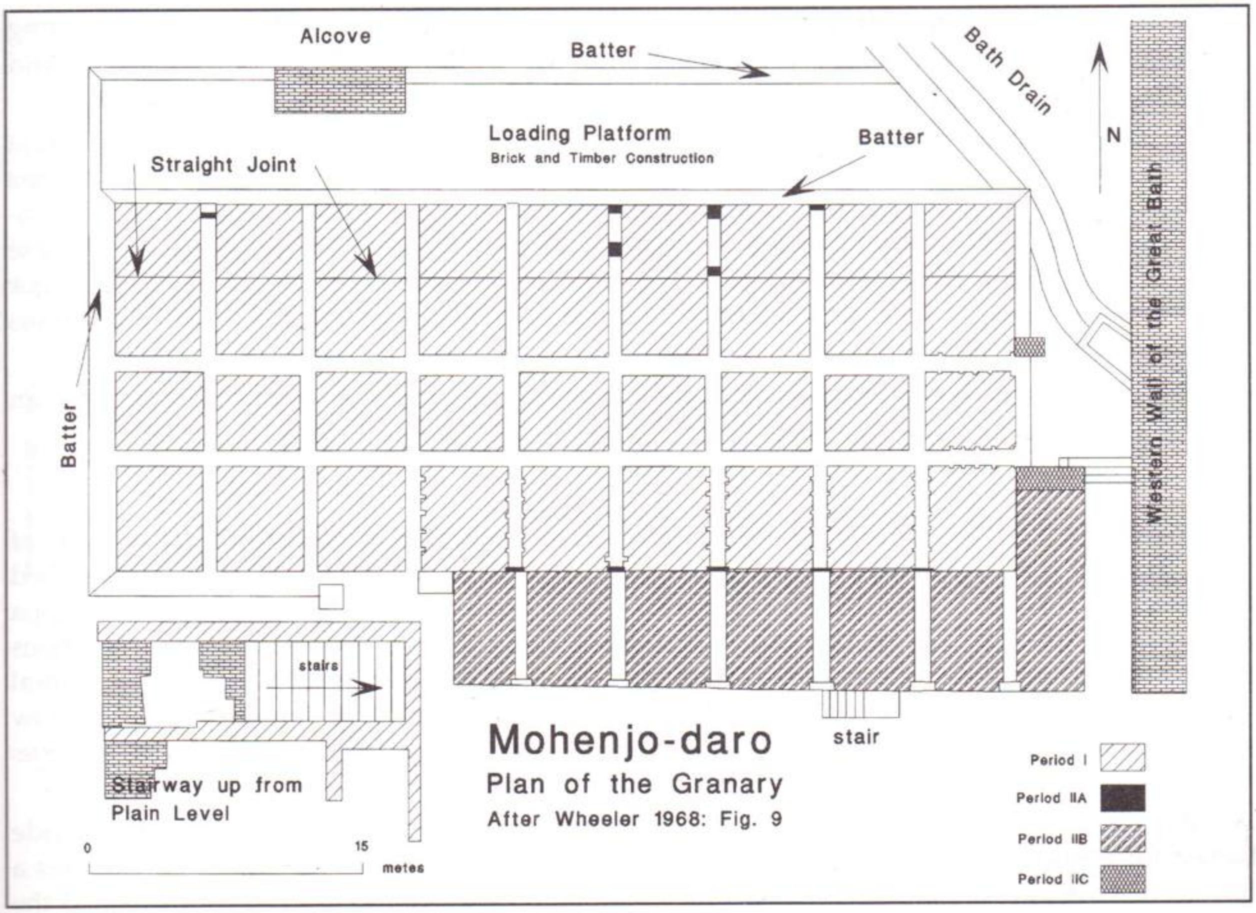


Fig. 4.8 Plan of Granary, Mohenjodaro (Wheeler, 1968).

beneath the hollow floors. A wooden superstructure supported in some places by large columns would have been built on top of the brick foundations, with stairs leading up from the central passage area.

Earlier excavators had suggested that the nearby circular brick platforms were used for husking grain. They did not find any special concentrations of burned grain or storage containers. In 1946, Wheeler reported a large wooden mortar placed in the centre of one of these circular brick platforms. Such wooden mortars are still popular in India and are used in many parts of the world to remove the husks or crushed grain. Even though these circular platforms were found near the granary, Kenoyer cautions that it is important to note that they were constructed inside smaller buildings and that they belonged to many different building phases. One has to admit that there is little to suggest a connection between the circular platforms and the so-called granary. In fact, the main argument for suggesting that this structure was a granary is again based on comparisons with Roman buildings and not because of parallels with any building tradition in South Asia. One has to note that traditionally grain in the north-western subcontinent is stored in large mud plastered bins raised above the ground on bricks or wooden platforms.

Advising caution, Kenoyer says that most scholars agree that there is little evidence for the construction of massive granaries at either Mohenjodaro or Harappa and that these structures should only be seen as evidence for large public buildings. Powerful rulers who were supported by generations of artisans, traders and farmers lived continuously in these cities for over 700 years. Many such large buildings may have been used for specific religious functions; rulers and state officials probably did meet in such public buildings. Nevertheless, the size and complexity of these buildings demonstrate the ability of the Indus architects to construct imposing architecture. With the gleaming red-brick gateways and grey mud-brick walls, the city would have been a towering landmark (Kenoyer 1998).

Recent corings along the eroded perimeter of HR area have revealed the presence of great mud-brick walls or platforms. Kenoyer says that if these structures indeed are the foundations for city walls, they would be even more impressive than those recovered at Harappa. The so-called Lower Town to the east consists of low mounds covering over 80 hectares of area. These mounds (comprising DK-G area, VS area, HR area and Moneer area) are divided into major blocks by four major north-south streets and four equally wide east-west streets, with numerous smaller streets and alleyways.

With its burnt brick buildings, Mohenjodaro presents an awesome vision of a 3rd Millennium BCE city.

Harappa

Located on the left bank of the Ravi, Harappa is a large site (Fig. 4.9) extending over a circuit of 6 km. The site was excavated extensively from 1920 to 1950 and has been adequately published (Marshall 1923-24, 1924; Vats 1940; Wheeler 1947, 1968). From the early nineties, HARP (Harappa Archaeological Research Project) began its systematic excavations, conservation and explorations at Harappa. The following account of Harappa is mainly based on the HARP team's several years' work at Harappa (For details see Meadow 1991; Meadow and Kenoyer 1993; Meadow and Kenoyer 1995; Kenoyer 1998; HARP Annual Reports. Kenoyer's 1998 book, *Ancient Cities of the Indus Valley Civilization,* is a laudable attempt to provide flesh to the Harappan data).

It is sad to note that from 1856 to 1919 burnt bricks from the site were removed to provide ballast for a railway line, resulting in considerable devastation of the site. The site encloses a Lower Town and a Citadel in the form of a parallelogram. From mound F were excavated the "coolie-lines", the so-called granary etc. In a pit, in area G was found a tightly-packed mass of human skulls and bones. The Harappan cemetery (R-37) and the post-Harappan cemetery H were located south of the Citadel, though the red ware associates of the cemetery H have no affinity with the Harappan Wares (Pl. 4.1) and show signs of being an intrusive culture.

At Harappa different walled areas were spread around a central depression that may have been a large reservoir. HARP's remarkable discovery lies in finding that each major mound was surrounded by a massive mud-brick wall, with brick gateways and bastions located at intervals along each face. Mound E, oriented along an east-west axis, is one of the oldest parts of the ancient city that grew up on top of the early village settlement. This mound is surrounded by a large mud-brick wall, which was partly faced with baked brick. A major gateway was constructed along the south wall. At the gateway itself, the massive mud-brick city wall is over 9 m wide and may have had additional bastions making it up to 11 m wide. The gate itself is made of baked brick with one m thick walls firmly bonded to the mud-brick city wall. A small projection on the inner eastern edge of the brick gate (2.8 m wide and perhaps 4 m high) may indicate stairs leading to the top of the wall.

It has been suggested that the large open area inside the gateway may have been used as a market or checkpoint for taxing goods being brought into the city. To the east of the gateway there is evidence for shell and agate workshops and on to the west for copper works. Outside the city wall and only some 30 m due south of the gateway is a small mound dating to the Harappan Phase, with houses, drains, bathing platforms and possibly a well. This cluster of houses may represent a temporary rest stop or caravanserai.

Kenoyer thinks that the modern road, which runs along the southern edge of the mound past this gateway, probably belongs to the Harappan Period. The small mound outside the

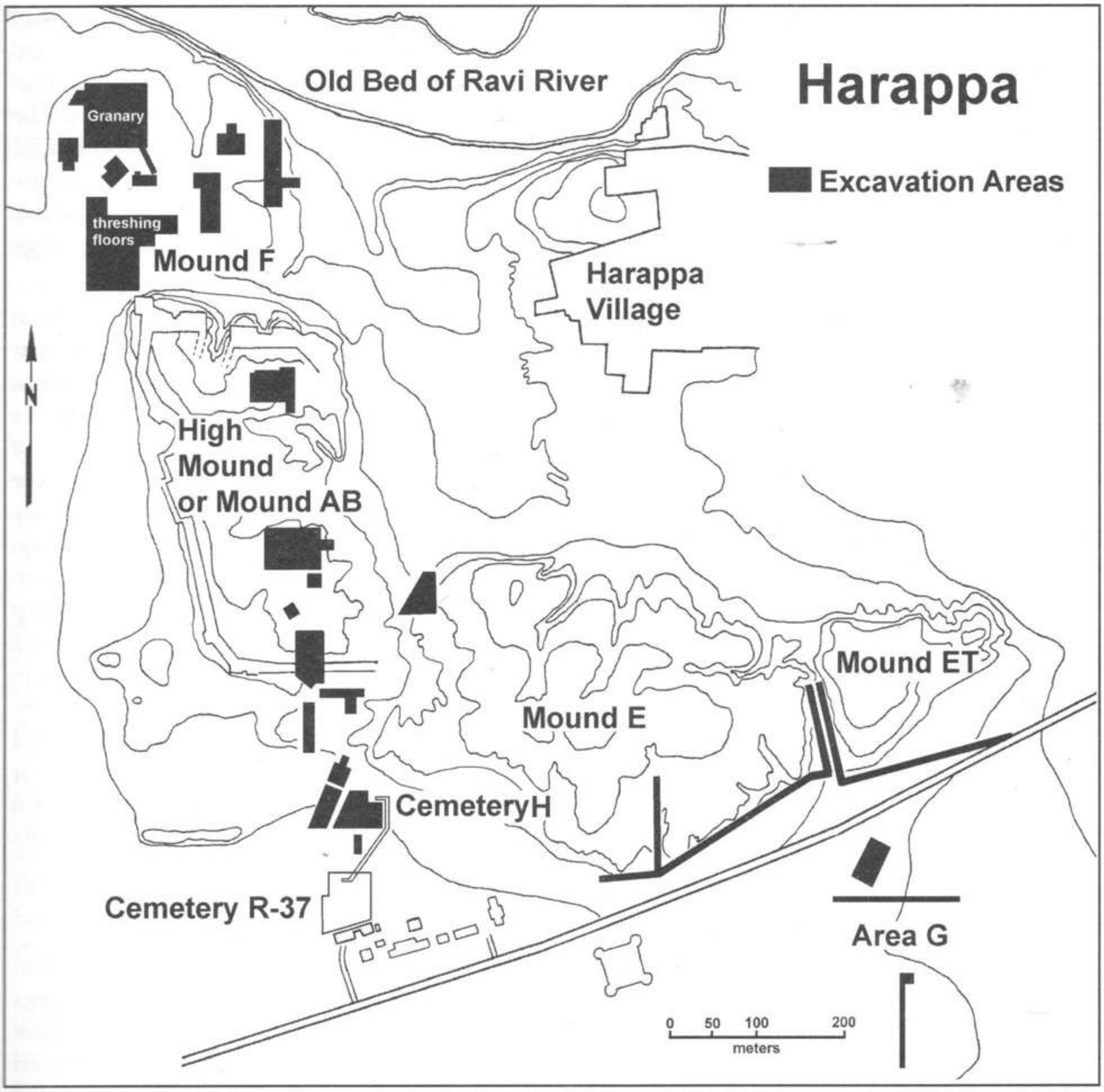


Fig. 4.9 Site plan Harappa showing excavated areas (After Possehl, 2002).

ancient gateway of mound E was used during historical times as a caravanserai and a stable for horses used in postal relays between Lahore and Multan. The historical well in the centre of the caravanserai was probably a reused Harappan well.

Much more complex is the second gate which is the major gateway of mound E. Its actual opening is only about 2.6 m wide, but the gate pylons and side rooms cover an area over 25 m across and some 15 m deep. It is located some 200 m to the east, at the juncture between the corner of the old city wall of mound E and a new wall that encircled the suburb on mound ET. The main function of this gateway seems to be to control access into the new suburb of the city, where numerous workshops produced ornaments and trade goods. There was perhaps another caravanserai for merchants outside this gateway, about 50 m to the south.

Kenoyer suggests that the other mounds at Harappa probably had their own walls and separate gates, but only the wall around mound AB has been excavated. This wall, much larger and higher than the wall around mound E, was up to 14 m wide at the base with a veneer of baked bricks, gently tapering to the top, more than 11 m above the plain level. Wheeler had found three small gateways built at different periods along the western face of the wall, and in the north was a larger gate with a ramp leading down to a lower suburb (mound F) in the north. A mud-brick wall enclosed the area of mound F, which was like the suburb of mound ET in the east. This northern suburb was probably craftsmen's quarters as it had numerous house structures associated with craft manufacturing debris and a series of circular working platforms. To the north of this area was probably a palace or storehouse, which was an extremely large building with twelve sections.

Along with the growth of the city grew the different mounds or walled neighborhoods at Harappa, but they all belonged to the same culture. The excavators admit that it is still not clear why the different mounds continued to be walled or how they were politically united into a single city. Characteristic styles of painted ceramics, clay figurines, inscribed seals and ornaments have been recovered from all the excavated mounds, and there is evidence for the movement of goods from one sector to the other. Though most scholars have assumed that the walls were constructed for military defence, Kenoyer thinks that it is not practical to have so many separate walled areas next to each other, nor did the HARP team find any evidence of damage from battles. It seems that none of the gateways found at Harappa was constructed for defence from frontal military attack. Generally in the later historical cities, major city gateways had a sharp turn just inside the gate to expose attackers to the defenders on the top of the gate. A fortified city also had a moat and double or triple walls like those of Dholavira. Kenoyer therefore infers that the lack of such defensive planning suggests that the gates and walls of Harappa were never intended to withstand battle, but were more symbolic in nature and intended to control the trade and commerce, which was the life blood of the city. Whatever the precise function of the walls and gateways, they demonstrate the high level of architectural skills and civic control in the Indus cities. And their presence made the city stand out from other smaller settlements (Kenoyer 1998).

Buildings and Houses

In contrast to the considerable variation in the raw materials used and the style of construction of the houses built during historical periods by people of different communities, the Indus buildings exhibit a remarkable uniformity in both raw materials used and style of construction. Because most Indus settlements were located in the alluvial plains, the most common building materials were mud-bricks and baked bricks, wood and reeds. However, in the rocky foothills and on the islands of Kachchha and in Saurashtra where stone is commonly available, dressed stone replaced baked brick.

Standard-sized mud-bricks and baked bricks (7 x 14 x 28 cm; Ratio 1:2:4) were used in house construction, but for the city walls a different size (10 x 20 x 40 cm; Ratio 1:2:4) was used. Both sizes of brick have identical proportions: thickness (=1), width (=2 x 1) and length (= 4 x 1). This ratio is commonly expressed as 1:2:4. Both sizes of bricks appeared during the Early Harappan Kot Diji Phase and became standard at all the Harappan sites. Kenoyer makes an interesting suggestion that the uniformity is probably not the result of a state decree or federal building codes, but rather the rise of a class of brickmakers whose craft tradition spread to all of the different settlements.

As a guild of craftsmen, on the pattern of early historic period, the brickmakers may have also branched out as masons and architects, filling an important niche in the rapidly growing urban centres. The result is a fairly uniform building tradition with variations depending on the availability of materials and the plot of land on which a house was being built. Mud-bricks and baked bricks or stones were used for the foundations and walls of the houses; the doors and windows were made with wood and mats. Very few actual roof fragments have been recovered, but they were probably made of wooden beams covered with reeds and packed clay. The house floors were generally made of hard-packed earth often covered with clean sand. Some rooms were paved with bricks or fired terracotta cakes. Bathing areas and drains were made with baked brick or stone. As we had noted in the description of Kalibangan, for making a floor they first put a soling of terracotta nodules intermixed with pieces of charcoal. Over it was laid the clay floor. This process was repeated when renewing the floor. The purpose of intermixed charcoal pieces is twofold: one, it prevents moisture from travelling upwards along the mud walls; second, it is an anti-termite device. This proves the ingenuity of the Harappans (Lal 1998). The rooms were often paved with mud-bricks and sometimes even with decorated tiles.

Kenoyer thinks that the wooden components in the Indus houses were probably made by a different guild of artisans (carpenters) who used totally different techniques and tools. The Harappan pottery replicas of houses with carved and painted windows and doorways attest to the beginnings of the embellishments of the protective designs and decorative carvings on door-frames, which designated status and wealth in the later historical cities.

In the fashion of the historical guilds, perhaps another Harappan guild specialized in woodwork. Tropical hard woods and aromatic cedar were used for buildings and furniture. One locally available hard wood that became a popular export item to Mesopotamia was shisham (*Dalbergia sisoo*). Its dark hard wood is termite-proof and is used extensively even today for making doors, windows and furnitures. A type of cedar, deodar (*Cedrus deodara)*, was also used by the Indus artisans, but it is a Himalayan timber. The Himalayan traders may have intentionally floated down some cedar from the hilly hinterland, but landslides and storms in the mountains could have tumbled many trees into the river naturally. To fashion wood, copper and bronze axes, adzes, chisels, drills and saws were used. Stone tools were used for drilling, scraping and finishing. Some of the largest public buildings at Mohenjodaro and Harappa appear to have been made entirely of wood, and specialized tools would have been designed to shape and fit the huge timbers for gateways and columns.

Stonework perhaps required another guild. Hammer stones and chisels were used to shape the large discs and square blocks. Abrasive drills were used for hollowing out the centre of the ring-stones and for making the dowel holes. Fine-grained quartzite and sandstone were used for grinding and polishing the carefully-finished surfaces. Large ring-stones and square column bases reflect a much more refined stone-working tradition. So much effort was put by the utilitarian Harappans on such fine polishing of ring-stones because they needed accurate fitting in the observatory room for observing summer/winter solstice, examples of which one can see in the Mayan architecture. At Dholavira they even have an alcove (slit) on the wall. All these techniques were used on a much finer scale to produce polished alabaster grillwork that would have been set into windows or dividing walls. Dressed stone blocks and architectural components represent a third major craft associated with the architecture of cities.

Most buildings in the cities were constructed either entirely or partially with baked brick. It appears that many different social and economic classes were able to live in close proximity yet in harmony, and still maintained their status and identity. In villages and small towns houses were made almost entirely of mud-bricks with occasional burnt bricks or stones used in the foundations or drains.

Kenoyer groups most of the architecture into three categories:

Category 1

Private houses with rooms were arranged around a central courtyard that offered privacy from the public passing along the city streets. Doorways and windows rarely opened out onto the main street, but faced sidelanes. I would like to mention here that both the plans of an open shaft in the centre of the house and the street opening into the narrow lanes had an air-conditioning effect. The former arrangement set up an air-circulation which allowed cooler air to sink and warmer air to escape. The narrow lanes kept temperatures cooler, as the sun could hardly beat down for any length of time. The view into the house was blocked by a wall or a hallway, a custom still practiced in traditional homes throughout the northern subcontinent. Several rooms were situated around the courtyard; stairs led up to the roof or second storey from one room or the courtyard. Many houses were at least two storeys high, and based on the thickness of some house walls at Mohenjodaro, there may have been three-storied buildings as well. On the average, walls were 70 cm thick, and most ceilings were probably over 3 m high.

Though one gets a general impression from the Harappan houses that they were drab and monotonous, it is mainly because of the wooden components have decayed and vanished. They must have carried most of the decoration, both sculpted and painted, on woodwork. Clay models of houses show that some of the door frames were painted and possibly carved with simple ornamentation. The doors were made with wooden frames, and a brick socket set in the threshold served as a door pivot. A hole at the base of the doorframe may have allowed a rope to secure or lock the door. Two holes at the top of the doorframe may have been used to hang a curtain. The lock at the base of the door and a curtain to cover the doorway is still a common practice in cities and villages throughout the subcontinent.

The roots of the elegant marble screens of the Mughal Period and the wooden screens on high-rise apartment buildings of modern Karachi perhaps lay in these Harappan houses. Windows situated on both the first and second storeys had shutters with lattice-work grills above and below the shutters. This allowed air and light into the room when the shutters were closed and yet maintained the privacy of the room. The shutters and grillwork were probably made of wood, but some may have been made of reeds or matting. A few examples of carved alabaster and marble lattice-work have been found at Mohenjodaro and Harappa. Set into the red-fired brick walls these lattice may have adorned the houses of wealthy merchants or rulers.

Category 2

Buildings in this category include large houses surrounded by smaller units. Complex passageways gave access to interior rooms, and numerous rebuilding phases indicate repeated reorganization of space. Outer units may have been the houses of relatives or service groups attached to the original house.

Category 3

This category of structures includes large public structures that have many access routes or provide a thoroughfare from one area of the site to another. Markets or public meetings may have been held in large open courtyards, while other buildings may have had specific administrative or religious functions. In Dholavira, Bisht has reported a stadium for public events. Groups of houses or public buildings were built close together with shared walls and formed larger blocks that were bordered by wide streets. Most houses or groups of houses had private bathing areas and latrines as well as private wells.

Hydraulics

We have discussed Hydraulics in detail in the chapter 5 on Architecture and Hydraulics. Here we would only have a cursory look at it.

The bathing facilities in each house indicate that washing and cleanliness were important to the Harappans. The many wells throughout the city were sources of pure water, essential for effective cleanliness. The drainage system (Fig. 4.3) served to move the effluents away from the houses, below ground, safely out of the way and safely out of sight, in brick-lined channels that prevented contamination of the earth and the city (Possehl 2003: 56). At Mohenjodaro numerous wells were dug throughout the city and maintained for hundreds of years. At Mohenjodaro and Harappa tapered terracotta drainpipes were used to direct the water out to the street. Bathing platforms with drains were often situated in rooms adjacent to the well. HARP excavations at Harappa reveal latrines in almost every house, though this regular feature seems to have escaped the notice of the early excavators at both Mohenjodaro and Harappa. The fact that even smaller towns and villages have impressive drainage systems indicates that removing polluted water and sewage was an important part of the daily concerns of the Indus people.

Chanhudaro

Though only about 5 hectare area in size, Chanhudaro is one of the best-known settlements of the Indus civilization. It was excavated by Majumdar in March, 1930 and again during 1935-1936 by Mackay, who reported four periods from the site.

Chanhudaro is also interesting from the point of view of its association with some stalwarts of Indian archaeology. Mackay arrived at Chanhudaro on October 23, 1935 to begin his excavations. The post-urban Harappa was also investigated, with the exposure of the Jhukar Phase and also the later phases of the so-called Jhangar and Trinhi cultures. Chanhudaro is still an important site for understanding Harappan technology and the emergence of the post-urban Harappa in Sindh. Mackay published a final report on Chanhudaro (Mackay 1943) and several papers (Mackay 1935-36, 1936a, 1936b, 1937b, 1937c; see also Ghosh 1937; Brown 1938, 1939). Chanhudaro produced evidence for the stratigraphic relationship between the Mature Harappan and post-urban Harappa, as well as more information on the still enigmatic Jhangar and Trinhi "cultures". But most important has been the insight into Harappan crafts that emerged from the discovery of bead- and seal-making facilities at the site (Possehl 2002:74).

Possehl's *Indus Age* is encyclopaedic in its coverage – both anecdotal and scientific. Possehl informs us that H.D. Sankalia, who became famous for his contributions to Indian archaeology, was also at Chanhudaro for almost a month during the excavation. From Mortimer Wheeler, Sankalia had learnt three-dimensional recording and stratigraphic excavation in England. Since Mackay understood none of this, Sankalia was put off by the field methods he saw being employed at Chanhudaro (Possehl 1999: 99-101). Possehl also informs us that during the Great Depression, the Chanhudaro Project was discontinued by the Museum of Fine Arts. Despite the World War, lack of funds, as also Mackay's not so cordial relations with John Marshall, the Director General of Archaeology at that time, Chanhudaro excavations were fully published. Mackay died on October 2, 1943, an archaeologist who published everything he dug, a rare thing and something for which he can be admired.

Mackay had reported four Periods at the site:

Period IV	Jhangar Culture
Period III	Trihni Culture
Period II	Jhukar Culture
Period IA	Mature Harappan

Period IA had buildings of baked brick, paved bathrooms, and a civic drainage system that was as well thought out and doubtlessly quite as effective as that of the larger city (Mohenjodaro).

Some buildings were grouped along a wide street that ran north-west to south-east but was cut by at least one thoroughfare coming in at a right angle. This attention to town-planning was not seen in the uppermost Indus levels. A bead factory and furnace are the most interesting features of this occupation. The central piece of the installation was a furnace that was used in several ways, including the glazing of steatite, providing heat to bring out the red colour of carnelian, and preparing stone for better chipping– also a part of the bead-making process.

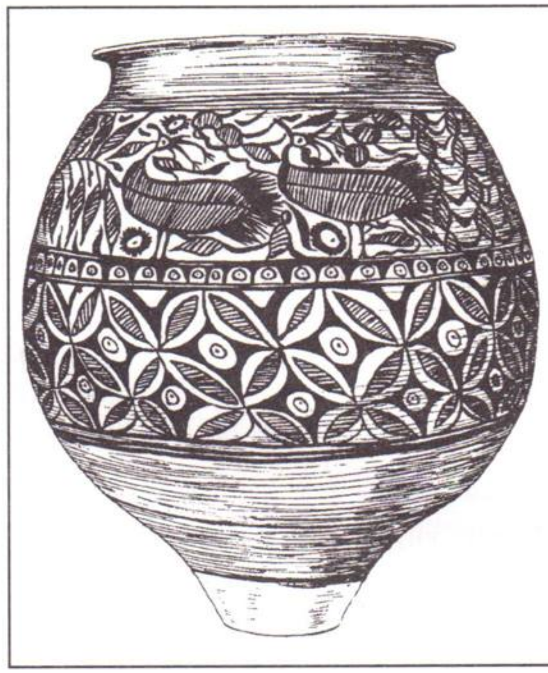


Fig. 4.10 Big jar showing peacock and intersecting circles, Chanhudaro (After Possehl, 2002).

Amongst other interesting finds were the two copper-bronze toy vehicles from Chanhudaro. The human figurines are very much like those at Mohenjodaro; however, the very elaborate females are not present. One interesting male figurine has a very close parallel from Nippur. Chanhudaro seems to have a larger number of bird figurines than other Mature Harappan sites. Perhaps the most interesting figurines are the bulls with single horns, true unicorns.

Chanhudaro seems to have been a regional craft centre for the Sindhi Harappans. This is seen in the bead- and seal-making area and was also confirmed by intensive surface exploration that found concentrations of pottery wasters, debris from the making of chalcedony/carnelian beads, faience work, and shell working. These are much the same kinds of materials and craft activities that are found at Lothal 250 km to the south-east, and one would suspect that there was an intimate connection between these two sites during the period of the Indus civilization (Possehl 2002:74).

Recently, Miller (1998) has done interesting research on the artefact morphologies in Harappan metal assemblages, with special reference to the finds from Chanhudaro. The typology begins with a preliminary division into general functional categories which are then further divided into specific types. This early division helps to organize the objects into functionally consistent and mutually exclusive groups. Each category has its own set of functional attributes which are not the same for the other categories. These categories are:

Vessels – (Fig. 4.10) Containers of all Types;

Ornaments – objects which adorned the body;

Tools – objects with a working edge or point used to modify other materials; and

Miscellaneous – unique objects such as figurines, carts, and staff-heads.

Tools

The tool category defined by Miller contains the largest number of objects as well as the greater number of types. Labels such as adze, axe, spear or lance-head have not been used because these terms carry a functional interpretation based on a genetic shape shared with more modern examples, and as descriptive terms, are not well-defined. Instead, a systematic classification for tools has been devised by her that groups tools with similar working edges with each other. The purpose of this is to move beyond the automatic assumption of function to explore the varied ways in which different tool shapes and sizes (i.e. types and subtypes) could have been used. Miller has used four attributes to define tool types: overall shape and size of the object, shape of the working edge, and whether part of the tool may have been hafted. To begin with, the shape of a tool is classified as either a blade or a rod. A blade is flat and rectilinear in section, and the size difference between the width and the thickness of the body of the tool is greater than 1 cm; i.e. the object is much wider than it is thick. The width and thickness of rods are similar and the difference between the two measurements is less than or equal to 1 cm. Rods may be round or rectilinear in section. The distinction between blades and rods reflects the different size of the working edge. Consequently, the two shapes may have been used for different types of tasks.

Along with the overall shape and size of the tool, the shape of the working edge is the third attribute considered in determining tool types. The two main edge forms are: wedge, also referred to as a chisel edge, and can be both straight and flared; and points which can be either dull and round, or sharp and pointed. The fourth new attribute considered is whether the tools could have been hafted or not, and if so, how. These four attributes, the overall shape of the objects, overall size, the size and shape of the working end, and how it may have been hafted, are what determine tool type. Types 1 through 8 are blade tools, where working edges are wide areas, and types 9 through 13 are rod tools with smaller, shorter and more concentrated functioning ends. Types 14 and 15 are unique tool types. All sizes listed below refer to objects in the Chanhudaro collection only.

Characteristics of the Chanhudaro Metal Assemblage

As discussed in Chapter 6, Miller's (1998) typology can be used in a number of ways to characterize an assemblage. One way to do so is to examine the distribution of function categories. Out of the 521 objects from Chanhudaro considered in her study, 64 per cent are tools, 26 per cent are ornaments, 7 per cent are vessels, and 3 per cent are miscellaneous objects. In the future it will be interesting to see if this same broad functional pattern is represented in the assemblages of metal objects from other sites in the Indus Valley, and how this pattern may vary through time and space.

Within each category, certain patterns are clear. For example, out of 37 copper vessels found at Chanhudaro, 27 (or almost 73 per cent) were dishes. In the tool category, rod shaped tools make up 52.1 per cent of the sample while blade tools are 47.9 per cent, showing a relatively even distribution between the two shapes. There are 334 metal artefacts classified into 15 tool types and none makes up singly more than 17.2 per cent of the category. There appears to be a range of tool types with no dominating specific type, suggesting that copper alloy tools were used for a variety of purposes. Only three copper objects from Chanhudaro are inscribed: type 14, described by Yule as a "snarling iron", and two examples of tool type 3A blades.

Miller suggests that this typological tool will allow for comparative studies between sites as well as an examination of spatial patterning of types within a site, and will facilitate comparative studies between the ongoing research into the technological aspects of metal-craft production, and together, the typological and the technological, will provide a clearer picture of how metal objects were made and used in the Indus Valley.

Of the Upper Periods, little is known at Chanhudaro, and the exact relationship between the important Jhukar levels and the Mature Harappan has not yet been settled. Of Trihni and Jhangar Periods almost nothing is known, and further exploration of these periods is a pressing problem in the regional archaeology of Sindh.

CHOLISTAN

On the other side of the border, in Pakistan, is Cholistan. Here the river Ghaggar (now dry) goes by the name of Hakra. Mughal has done an intensive survey of the area with all the experience and expertise he commands. In this area, Mughal has discovered 377 sites, of which 99 are ascribable to what has been called the Hakra Ware Period (after the name of the river), 40 to the Early Harappan times, 174 to the Mature Harappan stage, 50 to the Late Harappan times and 14 to the Painted Grey Ware Period. No excavation has been carried out at any of these sites, though Mughal's systematic exploration does give us a reasonable insight into the cultural contents of these sites.

The "Hakra Ware", in fact, is a rich complex of ceramic varieties. A very distinctive category, designated "Hakra Applique", consists of pots whose exterior surface is coated with clay, intermixed with tiny bits of pottery. While the larger pots in this category are usually handmade, the medium-sized ones are wheel-turned. Some of the latter also have a painted band along the rim. In another category, called "Hakra Incised", there are pots whose exterior is characterized by groups of incised lines, drawn either horizontally or obliquely or in a wavy fashion. The pots are usually wheel-made and well-fired. There also occur a few examples which bear deeply incised designs on the interior. Painted pots also constitute a part of the Hakra Complex, though their percentage is lesser than what it is in the later, i.e. "Early Harappan", period. Made of fine fabric and wheel-turned, some of the pots have a red or cream slip and are usually painted on the exterior with simple designs in black pigment. In a few cases an additional colour, viz., white, has also been used. Then there are some examples of even a buff-slipped ware with designs painted in black. Mention must also be made of what Mughal terms as "Hakra Black Burnished" Ware in which the red body is covered with a glossy black slip or just black colour. An interesting shape in this ware is that of handi-like vessels having sharp carination at the middle of the body.

Amongst the other cultural equipments of the Hakra Ware sites mention may be made of terracotta animal figurines of humped or humpless bulls with short joint legs. An exception is that of a cow, as indicated by the four udders. The other terracotta objects comprise balls, beads, flesh-rubbers and bangles. In the lithic industry microliths comprise leaf-shaped arrowheads, scrapers, borers and parallel-side blades with or without retouch. Other stone tools include pestles and mace-heads. Copper, though present, is rare, represented by only a few bits. It would thus appear that the Hakra Ware people had not yet reached full-fledged Copper Bronze Age. In this context, it may not be out of place to add that more than half of the Hakra Ware sites have a very shallow deposit and in all likelihood represent shifting camps.

As no excavations have been carried out in Cholistan, one cannot define the interrelationship between the Hakra Ware sites and the Early Harappan ones in the region itself. But not very far, in the Ravi Valley, is the site of Jalilpur where excavation has demonstrated their stratigraphic sequence. Within the limited dig in Jalilpur Period I (Hakra Complex), no structures were met with, but clay-and-lime floors were duly noted. However, Jalilpur Period II (Early Harappan) was marked by regular houses made of mud or mud-bricks. Again, while Period I yielded only bone points, chert blades and a few beads including one of gold, from Period II came a variety of terracotta objects, including toy-carts and "cakes", saddle querns and mullers of stone, beads of carnelian and lapis lazuli and bangles of faience.

The hallmark ceramics of Jalilpur Period I was an under-fired, handmade thick ware which had on the exterior a coating of clay, intermixed with small bits of pottery. It is this ware that characterizes the Hakra sites in Cholistan. In the upper levels of this period, however, there began to appear a well-fired, wheel-made red ware, painted with designs in black, brown or chocolate colour. By Jalilpur Period II, this latter ware began to dominate while the handmade coated ware gradually petered out. The Period II pottery is marked by many of the shapes and painted designs (including those in black outline and white in-filling) which characterize what is now called the Early Harappan Culture Complex, already reported from so many sites in the Saraswati-Ghaggar-Hakra system.

Though it appears that the Hakra Ware complex immediately preceded the Early Harappan culture, excavation at selected sites in Cholistan area is necessary to establish the sequence firmly. From the recent excavation in the northern part of Mound AB at Harappa itself Kenoyer has brought to light a culture-complex which is distinguished by its handmade plain as well as painted pottery with some characteristic shapes, in levels that preceded the Early Harappan-complex. Mughal emphasizes the need of a comparative study of this recently discovered pre-Early Harappan complex at Harappa with that from the Hakra Ware sites in Cholistan to determine their interrelationship. The question is whether or not this "pre-Early Harappan complex" is genetically related to the Early Harappan itself (Mughal 1997).

SITES IN INDIA

HARYANA

Rakhigarhi

Rakhigarhi (29°16' N and 76°10' E), located in Hissar district, Haryana, is one of the major Harappan centres in India. Rakhigarhi (also known as Rakhishahpur) is a huge mound in Hissar district of Haryana, associated with the right, or northern bank of the Drishadvati River. The site is large enough to have two villages named after it: Rakhishahpur and Rakhikhas. The site is about 17m in height. It was excavated by Suraj Bhan in 1963-64 and reopened in 1997-98 by Archaeological Survey but no detailed reports are available yet. There is both a Sothi-Siswal and a Mature Harappan occupation at the site. Fire altars of the Banawali type have also been reported from this site. A cylindrical seal of faience with an alligator, two circular terracotta amulets with an elephant figure, gold fillet and beads, silver, copper and shell bangles constitute important finds. The remains of a pillared corridor, a granary, ritual places, a "shopping arcade" have also been reported.

Banawali

The site of Banawali (29° 37' N and 75° 23'6" E) lies essentially in the Ghaggar Valley, about 120 km north-east of Kalibangan and 220 km north-west of Delhi, in district Hissar, Haryana. This site was excavated by R.S. Bisht. He discovered interesting architectural features: the Citadel and the Lower Town had a common fortification wall. As we will see below, Banawali shows some unique features. The site has a diameter of about 400 m. The 8 m thick occupational debris is divided into three cultural periods: Period I is similar to Kalibangan Period I; Period II represents the Mature Harappan culture; and Period III is essentially the post-Mature Phase (Bisht 1984, 1994).

Special Features of Banawali

Lal points out that the Mature Harappan town-plan at Banawali is quite different from that of Kalibangan. At Banawali the settlement was not divided into separate units. Instead, the entire complex lay within a single fortified area. The Lower Town had its own fortification walls, forming a rough quadrangle on plan (Lal 1998: 19-47).

Period I

Period I has been divided by Bisht into sub-Periods A, B and C. There was no fortification around the settlement in Period IA; it came up in IB. By IC, the settlement was divided into a Citadel and a Lower Town. All through the houses were oriented along the cardinal directions. While in sub-Periods IA and IB the bricks were made in the ratio of 3:2:1, in IC these were also made in the typical Mature Harappan ratio of 4:2:1. Thus by IC the stage had been set for the emergence of the Mature Harappan civilization.

Period II

Bisht points out some characteristic features of the Banawali town-plan. Unlike Kalibangan, here the Citadel or acropolis was not detached from the Lower Town. It lay within the overall fortified area (Pl. 4.3) within which the Lower Town was also located. In addition, the Citadel had its own fortifications, with a common wall on the southern side. Unlike Harappa and Kalibangan, here at Banawali, the acropolis, with the common wall as the base, the surrounding wall formed a semi-ellipse. Having been built over the remains of Period I, the acropolis occupied a level higher than that of the Lower Town. The thickness of the Citadel walls varied from 5.4 m to 7 m. Inside the Citadel, a few streets with flanking houses have been identified. These houses, with a roughly north-south and east-west orientation, formed a grid-pattern. One street also ran along the inner side of the Citadel wall, a counterpart of which existed on the outside, falling within the Lower Town. No major gateway to the Citadel has yet come to light since only a small part of the fortification wall has been exposed. The fortification wall was provided with a squarish bastion on the exterior. A similar bastion was also exposed along the southern part of the wall. A 1.5 m wide ramp was found near the apex of the ellipse, laid with burnt bricks, leading from the Lower Town into the Citadel.

The Lower Town was quadrangular, in contrast to the Citadel. The Lower Town has been exposed in fair length on the eastern side, where squarish bastions on the exterior have been identified. Along a part of the exterior of the fortification wall, a moat has also been identified.

There was an entrance in the northern half of the above-mentioned eastern wall. On the inner side of this entrance there was a wide open space at the western end of which three streets, one going southwards, another going westwards, and the third to the north-west, formed a tri-junction. The western street met a south-north street emanating from the Citadel ramp referred to above. Along the interior of the eastern fortification wall of the Lower Town there was a north-south street, which passed through the eastern end of this open space. Thus, one could go in five different directions from this open space, which was like the latter-day *chauk*. The bigger streets measured 5.4 m in width, similar to the Kalibangan streets.

Bisht thinks that Banawali was inhabited by rich people, as indicated by the size and contents of their houses. With a central courtyard, the houses had a large number of rooms around it; sometimes the rooms were paved with mud-bricks. In the case of one house, the toilet was provided with a washbasin placed high in a corner near the drain which carried off the waste water into a sullage jar placed outside the street. This particular house seems to have belonged to a rich merchant as it yielded seals and weights. Another big house may have been owned by a jeweller, as a large number of beads of gold, lapis lazuli and etched carnelian were found from it. Tiny weights found in the same house may have been used for weighing these precious commodities. The discovery of a touchstone bearing gold streaks of different shades is of great interest since it indicates that gold was tested for its purity, as is done even today.

As in Kalibangan, many of the houses had fire altars but here they are associated with an apsidal structure. An interesting feature at Banawali was the presence of alcoves, varying from 1 × 1 m to 1 × 2 m, set within the walls. The use of kiln fired bricks was limited to wells, bath-pavements and drains. The residential houses as well as fortifications were all made of mud-bricks, the difference, however, was that in the former case the size of the bricks were relatively small, viz., 24 × 12 × 6 cm or 32 × 16 × 8 cm. The construction of platforms adjacent to the houses was a common feature. There were no encroachments on the roads throughout the occupation of the site, indicative of an efficient and well-organized civic administration. An interesting find is the stone ware vase with the horned deity done in appliqué design.

A habitation deposit of about 4.5 m represents the Mature Harappan (Period II) occupation at the site. The pottery from Period II was typically Mature Harappan, in spite of the continuity of some traits of Period I. The bara-type pottery, which constitutes a noteworthy feature of the Harappan sites in the upper Ghaggar-Saraswati and Sutlej basins, was also found in Period II at Banawali.

Unlike the general grid pattern of the Harappan towns, the layout of the Lower Town did not follow it. Instead, its streets ran in all directions. Thus, while a street, emanating from the above-mentioned ramp did run south-north, a street forking from it ran in an east-south-east direction. This street joined three other streets, running in various directions, at a plaza close to an entrance through the eastern fortification wall of the Lower Town. This wall too was provided on the exterior with square bastions at intervals. Bisht points out that the most noteworthy feature of the Banawali fortifications was the provision of a moat, which was identified on the exterior of the eastern wall. It got its supply of water from the river, hardly 200 m to the south. The water would have easily been inducted from the upper reaches of the river, carried through the moat and finally discharged back into the river. The moat could not be traced around the entire periphery. Bisht notes that the provision of a moat does really add another new dimension to the fortification system of the Harappans.

Bisht makes an interesting observation that at Banawali the seals (Pl. 4.4) have only come from the Lower Town and not the Citadel. This goes against the suggestion of Kenoyer who identifies seals with the elite. Banawali site is rich in antiquities: seals, sealings, weights, beads, bangles, etc. This evidence requires to be examined further to determine the role of the inhabitants of the Citadel, if they at all participated in trade or similar activities. The site has also yielded a large number of weights in small denominations, two of these weigh around 0.216 grams and 0.072 grams. Amongst the terracotta objects, a complete model of a plough is a remarkable find.

Banawali shows a sort of composite culture: it has both fire altars like Kalibangan and goddess figurines like Mohenjodaro. The presence of female figurines at Banawali relates the site to Harappa and Mohenjodaro, where such mother goddess figurines have been reported too. In this context, it needs to be stressed that at Kalibangan no female figurines were found. It has to be noted that the faience ornaments – beads, rings, papal-shaped earrings, bangles, and anklets – still occur in large numbers, indicating that this industry was still going strong. Attention may also be drawn to a terracotta object which has a square base and whose sides taper as they go upwards, finally to culminate in a two-pronged horn-like top. Examples of this peculiar object have been found at many other sites in the upper Ghaggar-Sutlej basins, in a chronological horizon similar to that of Banawali.

Period III

There is an obvious cultural discontinuity between Periods II and III; the next occupation (Period III) came up after a time gap. The reasons for this termination of the Mature Harappan Period are not known. In Period III all that characterized the Mature Harappan had disappeared: there was no town-planning, no fortification, no seals, no weights and no use of script. The new settlement came up initially against the eastern wall of the Mature Harappan defences, but later on it encroached to some extent on the eastern part of the mound itself. The houses in Period III were now made not out of bricks but of mere rammed clay, though still oriented along the cardinal directions. Within the houses were noted corn bins made of clay and lime, *tandûrs* and underground cylindrical silos, the last two items recalling their counterparts of the pre-Mature Harappan times. This re-emergence of some of the earlier features is also indicated by the pottery. However, a distinctive aspect of the ceramics was their oily touch and glossy appearance. The colour of the slip in most of the cases ranged from subdued plum-red to purple or from glowing buff to bright orange. There was also a marked change in the features or forms of the pottery. For example, in the case of the dish-on-stand, the rim curved out pronouncedly and showed even a distinctive droop. The presence of incised patterns on the exterior was another distinctive feature. It links up the Banawali pottery with that of Bara, a site on the upper Sutlej and not far off from the well-known Harappan site of Rupar. A kind of burnished grey ware was also included in the pottery repertory. Bisht also reports the presence of Cemetery H type pottery and designs in Period III. This evidence connects it to the desertion of the main Harappan towns in Pakistan where also cemetery H type of pottery marks the end of Mature Harappan occupation.

Period III thus shows a curious amalgam of Early Harappan and post-Harappan traits.

Kunal

The recently excavated site of Kunal (Lat. 29°30' N and 75°41' E Long.) is also in district Hissar, Haryana. Khatri and Acharya (1994-95) have made some exciting discoveries from Kunal. It is located on the banks of now dried-up course of the Saraswati. The total occupational deposit is only around 3.10 m. Dwellings were semi-subterranean, usually 2 m in diameter and 1.10 m in depth.

In Period IA, the pottery repertoire is dominated by the so-called Hakra Ware. It also has a handmade black-and-red ware. A dull red ware of the Early Harappan vintage with wavy incised decorations on the outer surface was also found. The faunal and floral painted motifs are also noteworthy, which include bull head and pipal leaf. The cultural assemblage includes a large number of bone tools, micro beads of chalcedony and copper arrowheads (of Ganeshwar type) and fishhooks.

Period IB Phase represents the expansion of the settlement and elaboration of the semi-subterranean houses of round pits. The pits were now lined with finely moulded mud-bricks of very special sizes 11 × 24 × 39 cm. The pottery repertoire of Period ID mainly consists of the bichrome red ware with black and white paintings of faunal and floral designs, including the bull head, with highly curved horns marked with three parallel lines. The pipal leaf which is sometimes beautifully hatched, or solidly filled, presents the most popular, and perhaps the most sacred motif. In Period ID they report practically all the six Kalibangan I fabrics, including the grey ware, and internally incised red ware pots. The black and red ware continues to occur in small quantities and so also the plain dull chocolate-colored burnished ware.

The excavators claim that the Early Harappans at Kunal, did have round silos or pits plastered with *chunam* and clay mixture for storage of grains.

Period IC represents the Transitional Phase between the Early Harappan and Mature Harappan culture. The dwellings changed from the semi-subterranean huts to regular square rectangular houses built of standardized mud-bricks on the ground level which was further raised at various points to provide height and stability. The brick sizes are in two ratios 1:2:3 and 1:2:4 (9 × 18 × 36; 13 × 6 × 39; 11 × 22 × 33 cm), both used simultaneously. It is common knowledge that 1:2:3 ratio bricks cannot always produce the so-called "English Bond". The houses, though modest in size compared to those of the Mature Harappan Period, had developed drainage systems also.

Period IC has been divided into three structural phases: IC (i, ii, iii). The houses, the drainage systems, the street, etc., did not change much except that they were slightly larger and better built. The site remained throughout its existence only as a village.

Phase IC (i) is the most significant phase. In one of the rectangular brick houses, the excavators found a virtual treasure of gold and silver ornaments placed on a silver sheet and buried in a plain simple dull red globular pot of Early Harappan fabric. The silver objects include two tiaras, one small and one large, each with a large fully-opened flower with petals, topped with a decoration like the Greek letter alpha. Never before such magnificent objects were found at any Harappan site. Along with these two silver objects one large silver armlet with horizontal mouldings was also found. This too is a unique object. The excavators claim:

The three together, it seems quite likely, belonged to some *raja* or king, else a socially distinguished elite because not only the forms of the objects but also because the metal silver is foreign to the region.

The availability of silver does not appear to be a big issue but these finds do upset the concept of egalitarian nature of the Harappan society.

The following ^{14}C dates have been given for the Kunal samples:

Table 4.1 Calibrated dates of Kunal (After Possehl, 2002).

BETA No.	5568 half life	5730 half life	Calibration by CALIB-3
BETA-77726	4040±70 bp	2210±75 bce	2837 (2504) 2466 cal. BCE
BETA-77727	4250±130 bp	2430±135 bce	3016(2884) 2621 cal. BCE
BETA-77728	3990±70 bp	2160±75 bce	2577(2473) 2409 cal. BCE

From a different cache, found in another house of the same period, a large number of gold ornaments with disc beads, cup-shaped tubular beads, with facets all over the surface, etc., have also been found. Beads in terracotta but of shapes identical with the metal ones are also found from several houses. Similarly, large hoards of lapis lazuli micro-beads and 92 beads of agate make the whole gamut of luxury items as the "richest" when seen in the context of the rural nature of the settlement. Most of the shapes were similar to those found at Harappa and Mohenjodaro. The excavators claim that the Mature Harappan types of stone and metal beads were manufactured centuries before the emergence of Harappan cities at sites like Kunal. And this includes classical faience and carnelian beads too. Small chert blades were also found.

Significantly, copper objects included the so-called Mature Harappan types, e.g. coiled finger rings, coiled cones, a number of arrowheads identical to Ganeshwar type (two sides with marked curvature at the base) and inverted 'v'-shaped ones with sides absolutely straight, flat axe and fish-hooks, spearheads, etc. It seems that copper melting was done at the site as a terracotta crucible with molten metal still sticking to the inner surface has also come to light. Undoubtedly, therefore, the copper ingots came from some other site but the objects were manufactured locally. One pottery kiln has also been reported.

And above all, the discovery of as many as six steatite and one shell seals makes it absolutely clear that typical Mature Harappan square seals with knobbed back along with a hole were made centuries before the emergence of the urban centres in the Saraswati and the Indus basins, claim the excavators. The seals, however, bear only geometric designs, all of which were found in the Mature Harappan context. Thus, one has to note that neither writing, nor human and animal motifs of the Mature Harappan type have been found here.

Panjab

Ropar

Ropar (also spelt as Rupar and now known as Rupnagar) is located on the left bank of the Sutlej in Indian Panjab. It was the first Harappan site excavated in India after Independence, the credit for which goes to Y.D. Sharma. At present the site is divided into three mounds, but whether this was the case in antiquity also is difficult to say. Of these, the southern part is covered by the modern town and hence not much excavation could be carried out there. It is the northern mound, rising to a height of about 21 m, which has given the maximum information on the sequence of cultures. Underneath the western mound lay a cemetery of the Harappan times.

The site revealed a sequence of six cultural periods: the Harappan (Period I); the Painted Grey Ware Culture, (Period II); continuing up to the Medieval Period (*ca.* AD 1700). From the lower levels of Period I was discovered, besides the typical Mature Harappan material, pottery of the pre-Mature Harappan (or Early Harappan) vintage as found at Kalibangan, Banawali, etc. In Period I, the houses were usually made of mud-bricks with occasional use of kiln-fired bricks. Sometimes locally available kankar stones were also used. The bricks were irregular in size – a rather unusual feature for the Mature Harappan stage, but the thickness was uniformly 10 cm. The Harappan levels also yielded Bara type pottery, which is characterized by a variety of incised designs. Moreover, the site yielded the typical Mature Harappan antiquities, for example, a steatite seal, a terracotta sealing with impressions of three different seals, chert weights, a razor, arrowheads and spearheads of copper, beads of steatite paste and carnelian triangular cakes and toy-cart frames of terracotta.

Burials: The cemetery contained complete inhumation burials. The body was laid supine in an extended position but the head was towards the north-west instead of true north. The grave furniture included pottery, besides personal ornaments. One skeleton had a faience bangle on the left wrist; another had a copper ring on the middle finger of the right hand. There was also a burial of a dog, perhaps a pet, with a human skeleton.

Rajasthan

Kalibangan

The site is located on the dry river-bed of the Ghaggar, in Ganga Nagar district, Rajasthan. From its wide bed, one can imagine that it must have been a massive river in ancient times (perhaps known as the Saraswati, as indicated by literary sources). It was excavated by B.B. Lal and B.K. Thapar for a number of years.

No full report has seen the light of the day so far, though brief articles and chapters have appeared from time to time (Lal 1997, 1998, 2002, Lal et al. 2003; Thapar 1975, 1979, 1985). Lal has brought out the fact that the Harappan sites are not totally monotonous but show a great deal of variation from site to site, especially the Indian ones (Lal 1998: 19-47).

Enclosed by a perimeter of about 2 km, the site of Kalibangan has three parts (Fig. 4.11). The westernmost part is called the "Citadel"; the central the "Lower Town"; the easternmost contains a few ritualistic structures but has not been given any specific name. The "Lower Town" was fortified. The fortifications formed a rough parallelogram on plan, the eastern and western walls running due north-south, but the northern one was slightly deviating from east-west. As the mound is eroded at the southern end, it is therefore difficult to delineate the southern wall. The east-west extent of the Lower Town was 240 m; the north-south length was about 360 m. The fortification walls were made of mud-bricks, though at a few places kiln-fired bricks were also employed. To begin with large-sized bricks (40 × 20 × 10 cm) were used but in subsequent repairs only smaller ones (30 × 15 × 7.5 cm) were used.

The settlement within was laid out more or less in a grid-pattern. While the longer streets did not quite follow the alignment of the north-south fortification walls, the east-west streets,

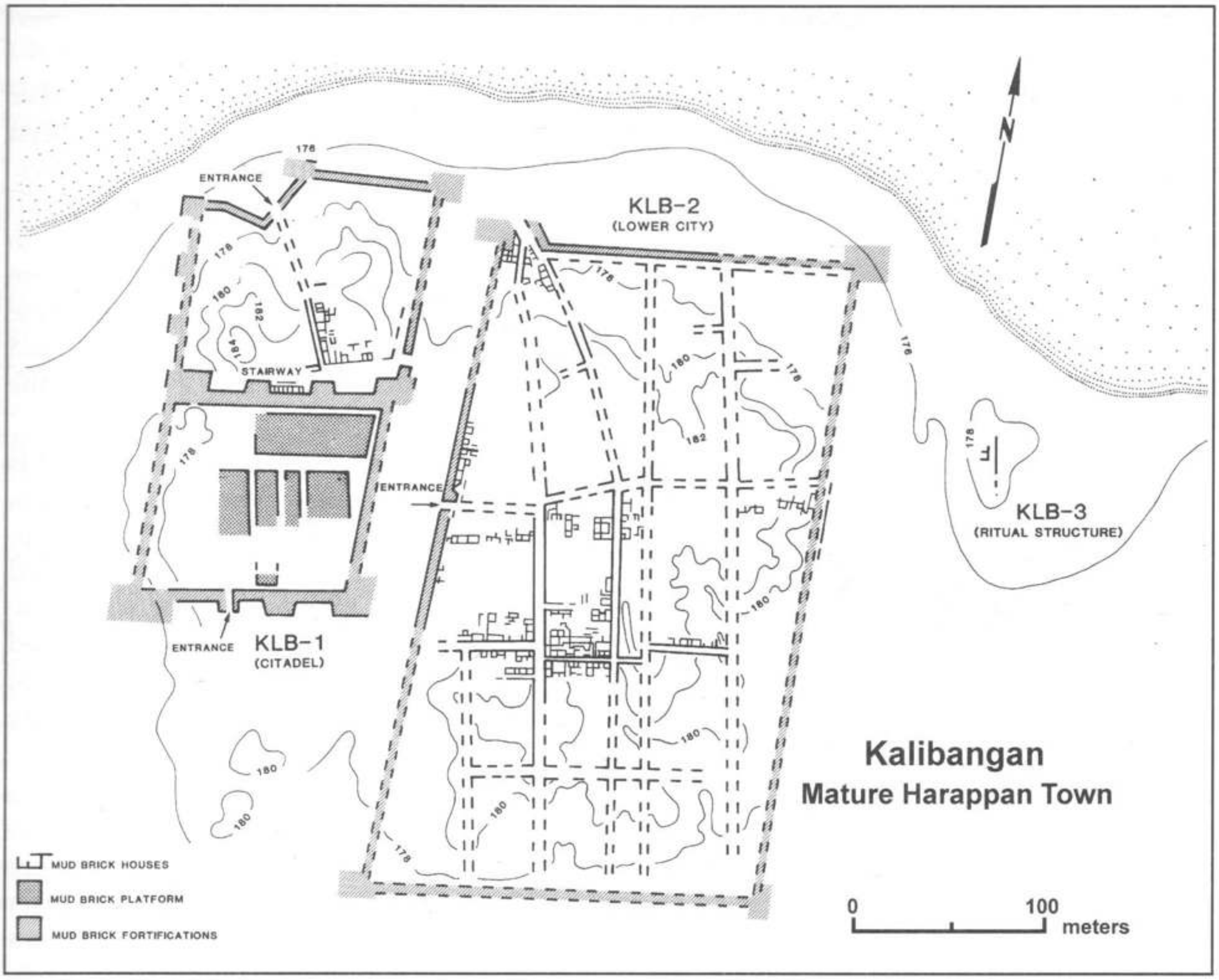


Fig. 4.11 Site plan of mature Harappan phase, Kalibangan (ASI).

though often staggered, did follow the alignment of the northern wall. The Harappans did believe in standardization, be it weights, measures or size of bricks. Lal points out that even the lanes and streets of Kalibangan followed a ratio of 1:2:3:4. Thus, while the narrowest, evidently a lane, was 1.8 m in width, the others were 3.6 m, 5.4 m and 7.2 m respectively.

Houses

The houses had a courtyard with rooms along its three sides and an entrance on the fourth; the *havelis* in rural and urban India still follow this plan. The entrance was sufficiently wide, so as to let a bullock-cart in. In the courtyard there were rectangular troughs, probably to keep fodder for the cattle. Also, the lower parts of large jars were embedded in the ground for providing water. It is interesting to note that cooking was usually done in the open courtyard, to allow free escape to smoke. A well was also sometimes located here.

Lal points out that they first put a soling of terracotta nodules intermixed with pieces of charcoal. Over it was laid the clay floor. This process was repeated when renewing the floor. The local engineers explained that this practice of laying a soling of nodules intermixed with charcoal was followed even now in many villages. The purpose of intermixed charcoal pieces is twofold: One, it prevents moisture from travelling upwards along the walls – a problem often faced in mud houses. Second, it is an anti-termite device. This proves the ingenuity of the

Kalibangan Harappans. The rooms were often paved with mud-bricks and sometimes even with decorated tiles.

In an average house, there was always a *puja* room, as is the practice even today; the other rooms were used for different purposes. In the *puja* room have been found what have been called "fire altars". Or simply they could be domestic hearths! Lal emphasizes that the civic authorities were very particular about not allowing any encroachment on the streets. Throughout the nine or so structural reconstructions that Kalibangan witnessed, from about 2600 BCE to about 1900 BCE, not a single structure intruded on to the streets. The only structures that were noted on the sides of the streets were small platforms adjacent to the entrances to houses. These were a part of the approved plan, and in no way encroachments. Even now the villages and small towns in this area have such platforms immediately outside the entrance, where the occupants of the house and neighbors sit and chat.

The Citadel at Kalibangan has a unique configuration and has its own fortification. It is located about 40 m to the west of the Lower Town, forming a parallelogram on plan, 240 m north-south and 120 m east-west; the complex was divided into two equal rhombs by a partition-wall in the middle (Fig. 4.11). While in the northern rhomb there were residential houses located on each side of a street running up to a gateway in the north-west the southern rhomb had no such houses. Instead, it had a number of mud-brick platforms, on cardinal directions, separated from each other, as also from the fortification walls. The ravages of time have obliterated most of the superstructures on these platforms, barring two exceptions. On one there was a "fire altar" complex, while on the other a sacrificial pit.

Two entrances were provided for both the rhombs. For the northern rhomb there was one on the north-western end, and another in the south-eastern part which provided access to the occupants of the Lower Town which had its own gate a little to the south of this one. There were two entrances also to the southern rhomb: one from the northern rhomb and the other from the area south of the southern rhomb itself. Whereas the two entrances to the northern rhomb, being on a level ground, allowed vehicular traffic to get in, those to the southern rhomb, because of their stepped nature, did not. It makes sense too. Carts had to reach the northern rhomb as it was a residential area. But the southern rhomb was a religious area and the devotees were required to reach it on foot, and not on vehicles!

Antiquities

Amongst the more interesting antiquities from the Harappan levels of Kalibangan is a cylindrical seal (Plate ?), which points to Mesopotamian influence, since such seals were common there. There are some sealings which throw valuable light on the function of seals. It is obvious that some seals were used to stamp the outgoing cargo. Another interesting object is a *kernos* with seven lamps affixed to it. It may have been used on some ceremonial occasions. Two bulls, one each in terracotta and bronze, are remarkable for their naturalistic powerful modelling.

We will now go into some details about the finds of each period at the site. The following account of the site is based mainly on Thapar (1979) and Lal et al. (2003).

Period I: On the basis of the comparison of the material equipment of Kalibangan Period I with that of corresponding cultures at Harappa, Amri and Kot Diji, Thapar thinks that while these village and town cultures share a common level of economic subsistence, they are marked by regionalization with an uneven development and essentially differing ceramic traditions. However, one of the characteristic types of Fabric D of Kalibangan I is found to be closely paralleled in Amri IIB (Casal 1964a), thus providing a datable marker ceramics between the two cultures on a common time-scale. On the basis of a radiocarbon date, Amri IC is dated to *ca.* 2600 BCE (calib. *ca.* 3000 BCE). Amri IIB, therefore, would fall around 2450 BCE (calib. *ca.* 2800 BCE), which Thapar thinks agrees with the date for the beginning of Kalibangan I. Confirmatory evidence is also forthcoming from layer 5 at Kot Diji, representing the Late Phase of the Kot Diji Culture. Another noteworthy analogue in both form and fabric is provided by the globular vase with short neck and externally grooved body, found at Kalibangan I (Fabric C), Sarai khola II, Pre-Defence Harappa and Kot Diji.

Lal compares the cultural complex of Period I at Kalibangan with the other Early Harappan/pre-Mature Harappan sites. Besides Kalibangan, three other noteworthy sites of pre-Mature Harappan vintage, i.e. Banawali, Rakhigarhi and Kunal have been excavated in the Ghaggar-Saraswati valley. In the adjoining region of Pakistan, where the same river is known as the Hakra, no excavation has been carried out, but large-scale exploration (Mughal 1997) have brought to light a culture complex which seems to antedate even Kalibangan Period I.

Period I settlement at Kalibangan is marked by well-planned houses and streets, oriented roughly along the cardinal directions. They used mud-bricks in house construction, though kiln-fired bricks are also attested to in the case of drains. The dimension of the bricks were 3:2:1 and not 4:2:1 as in the case of the Mature Harappan stage. There was a fortification following roughly the cardinal directions. There was a limited use of microliths and bone tools. Relatively more copper artefacts were found. Pottery was predominantly wheel-turned, though handmade examples are also there. Six fabrics have been identified. There are painted designs, some of which show the use of a second colour, viz., white, in addition to the usual black. Main ceramics were marked by a red ware with multiple incised parallel lines on the exterior; application of clay intermixed with sand on the exterior of some of the pots; occurrence of graffiti on pottery, some of the symbols resembling those used in the Mature Harappan script. For cooking hearths as well as tandoors were there. There was provision of lime-plastered circular pits, most probably for storage of grains. There were agricultural fields with typical criss-cross furrows. On the basis of radiocarbon dates, Lal assigns the Period I between the 3000 and 2700 BCE. There was a break of occupation between Periods I and II, the latter being Mature Harappan and commencing around 2600 BCE (Lal 2003: 25-26).

To compare the evidence of Kalibangan with Banawali and Kunal, we will briefly recall the sequences at the last two sites (detailed site descriptions are given elsewhere).

There are three periods at Banawali: Period I is Early Harappan; Period II, Mature Harappan, and Period III, Late Harappan. While there was no break of occupation between I and II, there was a gap between II and III. In Period I, right from the beginning, the houses were oriented along the cardinal directions. These were made of mud-bricks, though use of kiln-fired bricks is also attested to. As at Kalibangan, the bricks had a length, breadth and thickness ratio of 3:2:1. Inside the houses were located plastered circular pits, evidently for storage of grains. The pottery also showed the six fabrics encountered at Kalibangan, as also the colour-scheme of the painted designs. That the Banawali I people used copper is duly established by the occurrence of an arrowhead and a fish-hook of that metal. At Banawali, the settlement was not fortified right from the beginning, but only a bit later, namely in sub-Period IB. In sub-Period IC the concept of a Citadel and a Lower Town, so typical of the Mature Harappan stage, is also evidenced. Bisht observes that sub-Period IC was marked by:

> drastic and diagnostic changes in architecture, planning and antiquities in an otherwise continuing cultural *milieu* of the preceding sub-Periods. The entire settlement was planned and constructed *de novo.* The dichotomous layout which the Harappans adopted was introduced during this sub-period. The fortification of the previous (sub-) Period was externally chiselled or partially sliced away and doubled in width for

housing the Citadel, and the Lower Town was laid out continuously towards the east as well as the north, while the position in the west remained unresolved (IAR-1986-87:31).

It may further be recalled that there was a continuity of occupation between Periods I and II. Thus Banawali bridges the gap that was in evidence between Periods I and II at Kalibangan.

Just 20 km north-east of Banawali, is Kunal. At this site no Mature Harappan remains have been encountered above the Early Harappan settlement. Hence the latter can be studied without any chance of a mix-up. Within the Early Harappan Period itself three sub-Periods, named IA, IB and IC from bottom upwards, have been identified (Khatri and Acharya 1994-95:84-86). In sub-Period IA people dwelt in pit-huts, as indicated by the occurrence of circular pits, about 1 m in depth and 2 m in diameter. Along the periphery of these pits post holes have been identified, indicating that the pits were provided with some kind of wattle-and-daub superstructure. By sub-Period IB the size of the pits increased up to 3 m in diameter and now were lined with mud-bricks. The presence of mud-brick hearths in them indicates that cooking was done inside. In sub-Period IC the use of pit-huts was given up. Instead, square or rectangular houses were constructed. These were made of mud-bricks, the size of which was in typical Mature Harappan ratio, viz., 4:2:1, and not 1:2:3 as at Kalibangan. Within the houses, circular silos plastered with a combination of lime and clay have been recorded, which are similar to those noted at Kalibangan.

Kunal has yielded all the varieties of pottery found at Kalibangan. Some of the painted designs in black outline and white in filling are of special interest, for example, pipal leaves and peacocks, since these were to be the hallmark of the subsequent Mature Harappan times. Likewise, some of the pot-forms also point the same way. Particular attention may also be drawn to the occurrence in the lower levels (in IA and to some extent in IB) of the Hakra Ware reported by Mughal from the now-dry bed of the Hakra (by which name the Ghaggar-Saraswati is known on the Pakistan side of the border).

An intriguing feature of Kunal finds is that it is mainly an Early Harappan culture, but it does yield artefacts of Mature Harappan style too, e.g. pottery motifs, copper/bronze artefacts of Mature Harappan vintage, as also pottery with Mature Harappan graffiti.

Most remarkable is the rich haul of ornaments from Kunal. In one of the houses, a jar of red ware was found to hold silver ornaments wrapped in a sliver sheet. These included 'two tiaras, one small and one large, each with a large fully opened flower having petals, topped with a decoration like the "Greek letter alpha". Along with these tiaras there lay a multi-spiralled armlet, also of silver. The shape is interesting since it reminds one of the spiralled bangles worn by the famous Mohenjodaro "dancing girl". In another house were found a large number of silver beads, discular in shape with perforation along the diameter, which are similar to those in gold found in the Mature Harappan levels at Lothal. From different parts of the site also came beads variously of chalcedony, carnelian, lapis lazuli and faience. In this context it needs to be pointed out that neither silver nor lapis lazuli was available anywhere nearby, which indicates long distance trade.

As noted above, three radiocarbon dates place Kunal broadly between *ca.* 3016 and 2577 BCE.

From a comparative analysis of the settlement-patterns as well as the material contents of the three sites, viz. Kalibangan, Banawali and Kunal, Lal infers that the beginning of Kunal was earlier than that of either of the other two sites. This is also upheld by the radiocarbon dates. Further, Kunal never saw the Mature Harappan days, whereas the other two sites did. Between Kalibangan and Banawali, the Early Harappan settlement at the former came to an end earlier, whereas Banawali continued its journey well into the Mature Harappan times.

Some sites in the upper Ghaggar-Saraswati valley have yielded some of the varieties going under the general banner of the "Hakra Ware", intermixed with the Early Harappan culture complex. It is, therefore, necessary to explore more thoroughly the area from the west of Kalibangan to well north-east of Kunal to find out if in this region too there exist settlements with a culture complex similar to that of the Hakra Ware complex and/or pre-Early Harappan complex of Harappa.

In Period II the structural pattern of the settlement changed. There were now two distinct parts: the Citadel on the west, represented by a smaller mound (KLB-1); and the lower city towards the east, represented by a fairly extensive mound (KLB-2). The former was situated atop the remains of the preceding occupation (Period I) to gain an eminence over the lower city which was laid out on the natural plain towards the east, leaving a gap of over 40 m.

The fortifications were built throughout of mud-bricks; two sizes of bricks, 40 × 20 × 10 cm and 30 × 15 × 7.5 cm (ratio: 4:2:1), representing two principal structural phases, were used in the construction, the larger bricks in the earlier phase and the smaller ones in the latter.

The Citadel was well fortified. Its southern half was more heavily fortified not only with corner bastions but also with rectangular salients along the northern and southern sides. The salients projected 8 to 9 m from the main face, and were 13 to 17 m broad. The enclosed area contained some five to six massive platforms of mud-bricks (40 × 20 × 10 cm for the earlier phase and 30 × 15 × 7.5 cm for the latter), each separate from the other and intended to be used perhaps for a specific purpose by the community as a whole.

All these platforms were found to be oriented along cardinal directions. In the case of the fully exposed platform, the longer axis was east-west, for the remaining three it was north-south. The size of the platforms, no less than the width of the passages separating them, varied. At no point, however, were these platforms joined to or were integral with the fortifications. Access to the working floor of the platforms was by means of steps, which rose from the passage. Through the passages also ran baked brick drains. Of the buildings, which stood upon these platforms, no intelligible plans are available because of the depredations of brick robbers.

The available remains do indicate that some of these might have been used for religious or ritual purposes. One had the complete outline, besides a well and a fire altar, a rectangular pit (1.24 × 1 m), lined with baked bricks containing bovine bones and antlers, representing perhaps a sacrifice. On the top was noticed a row of seven rectangular "fire altars" aligned beside a well. The entrances to this part of the Citadel were located both on the south and the north.

The passage was 2.65 m in width, which could have been stepped, in front of the main fortification wall. In this entrance complex again, two structural phases were recognized. The small-sized bricks, viz., 30 × 15 × 7.5 cm were used right from the beginning of the occupation for domestic structures. It was only in the fortifications and massive platforms that the large-sized bricks were employed in the earlier phases and smaller ones later. It is significant, however, that the ratio of both sets remains 4:2:1.

Perhaps the elite lived in the northern half of the Citadel, which was also fortified. Although full details of the house plans could not be recovered, it was noticed that the houses were built away from the fortification walls of the Citadel, perhaps to give some privacy to these structures. The passage between the partition wall and the houses was paved with brick-on-edge, extending from the north-western corner bastion (of the partition fortification wall) to the easterly of the two central salients and perhaps reaching the entrance stairway. There was evidence to show that this pavement was renewed at least three times during the lifetime of the Citadel. The size of the bricks used in all these floorings was 30 x 15 x 7.5 cm.

Running north-south was a thoroughfare, starting from the easterly of the two salients of the partition fortification wall. There were three (one each on the eastern, northern and western sides) entrances to this part of the Citadel. The lower city was also a parallelogram, some 240 m from east to west and 360 m from north to south, and lay to the east of the Citadel beyond a broad space of some 40 m. The lower city was enclosed by a fortification wall ranging in width from 3.5 to 9 m, made of mud-bricks of similar sizes to those used for the fortifications of the Citadel, viz. 40 × 20 × 10 cm for the lower phase and 30 × 15 × 7.5 cm for the upper. Within the walled city was a grid of streets running north to south and east to west, dividing the area into blocks.

The excavations established the existence of four arterial thoroughfares, running north to south and three running east to west (Fig. 4.11). While the former were not equally spaced, the latter were situated on an average of 7 m from each other. Besides, there were quite a few other streets, which served only one or two blocks and were not thoroughfares. The width ranged from 1.8 to 7.2 m. To avoid damage from the vehicular traffic, fender posts were provided at some street corners. The width of the thoroughfares seems to have been maintained throughout the occupation; the only structural encroachments into the streets were the rectangular platforms (mentioned above) immediately outside some houses. The streets, except in the Late Phase, were unmetalled. House drains, which were either of wood or of baked brick, discharged into soakage jars buried under the street floor. The alignment of the streets is at variance with that of the fortification walls. Perhaps the alignment of the fortifications was conditioned by the Period I (Pre-Harappan) layout of the adjacent Citadel and by later modification by the Harappans as occupation advanced. Excavation has revealed that the fortification and the streets had been planned from the very beginning of Harappan occupation of the site. From the very beginning, the houses were built of mud-bricks (30 × 15 × 7.5 cm), the use of baked brick (of the same size and also the wedge-shaped type) being confined mostly to drains, wells, sills and bathing platforms. In the typical chessboard plan of the city, each house faced two, if not three, streets and consisted of a courtyard with six to seven rooms. Entrance to the house, located usually on the lane side, was either through a courtyard or through a corridor running between sets of rooms.

The artefacts found from the occupation of Period II were all characteristic of the Indus civilization. The important finds were: a cylinder seal; a terracotta cake, incised on the obverse with a horned human figure and on the reverse with a human figure pulling a sacrificial animal (?); a terracotta human head; a copper bull showing the dynamic mood of the animal and other copper objects, including a pin; a terracotta feeding-cup with a cow's head on the rim; a fragment of terracotta graduated scale and an ivory comb. Both wheat and barley were found in the deposits of this period. No evidence of rice was obtained.

There was also a third part of the town – a modest structure situated about 80 m east of the lower city. The structure, of which the complete outline could not be recovered, was built of mud-bricks of the usual Harappan size, 30 × 15 × 7.5 cm, and consisted of an impressive wall enclosing a room containing four to five "fire altars". No other building, residential or otherwise, existed on this small mound. The absence of normal occupation debris suggests that the lonely structure with the altars was used only for ritual purposes.

Subsistence Pattern

About the subsistence pattern, Joshi (2003: 19-24) states,

> the subsistence pattern consisted of raising of livestock coupled with agriculture, evidenced by the furrowed field surface having two rows of furrow marks in two directions, cutting at right angles to each other, closely-spaced furrows in one direction crossing widely-spaced furrows which indicates "mixed crop cultivation" and it has great similarity to such growing of double crops even in modern times, during the winter season in Rajasthan. The terracotta model of ploughshares of the Harappan Period could give the idea of the ploughshare in the antecedent Early Harappan culture.

Large number of bones of *Bos indicus* found during the excavations suggest the use of bullocks for agricultural activities, as also for eating. The occasional flooding of the Saraswati which brought rich alluvial soil added to the productivity and fertility of the soil. From Early Harappan levels at Kalibangan, both mono and dicotyledonous grains have been recovered. Wheat *(Triticum spharococcum)* and barley *(Hordeum vulgare)* were used for staple diet; pea was also used. The use of barley, a more popular grain, indicates their awareness of its high nutritious value in the diet. They also grew wheat and barley, *Pisum* (matar, pea) and *Cicer artieum (chana,* black gram). Joshi suggests that apart from wheat flour being exclusively used for making *roti,* the mixture of flour of barley, wheat and gram was also possibly used as it is even today in wide use as *sattu,* a fast food in many parts of northern India for a most nourishing and a balanced diet. Besides, these cereals were used individually also.

> Since cultivation during that period seems to have depended on flood-irrigation, supplemented by seasonal precipitation, it is reasonable to infer that only the winter crop, viz. the *rabi*, was grown, the sowing being done in the autumn after the river flood resulting from tropical monsoon had subsided.

The presence of gypsum on a potsherd from Early Harappan levels may indicate that the Early Harappans perhaps used gypsum as a fertilizer to reclaim saline lands and render them productive. It is perhaps during the Early Harappan times that artificial system of irrigation was evolved which was further advanced during the Mature Harappan times. Saddle querns, mullers and pestles were used for grinding and making paste and powdering these cereals. Interesting evidence regarding cooking practices was revealed by the presence of ovens inside the houses, both of the underground and above-ground variety, closely resembling the present-day tandoors (a barrel-shaped furnace with an open end) in the region. The former has mud-plastered walls with a slight overhang near the mouth and the latter, also made of mud-walls with bridged side-opening for feeding fuel, seem to have been periodically plastered. The credit for innovation of this advance technology to bake thick *roti* in almost a closed tandoor goes to the Early Harappans. It should be noted that this technology suddenly disappeared in Mature Harappan levels and reappeared in the early historical period. Does it indicate that culturally the Early Harappans and the Mature Harappans were different people? The husking troughs of fabric 'D', though heavy, were perhaps used for cleaning the grains of different husk-bearing cereals. Besides, meat of fowl, pig, cattle and goat was also possibly part of the diet. Equally noteworthy was the existence of cylindrical pits lined with lime plaster, possibly for storing grains.

Human Remains from Kalibangan

Possehl has given an interesting and informative summary of the burials at Kalibangan (Possehl 2002: 170-74). There is a cemetery at Kalibangan approximately 300 west-south-west of the western high mound. A.K. Sharma observed that the Kalibangan cemetery is located downwind from the habitation mound and that it is also

> situated on the downstream floodplain. Water first passes by the side of the habitation mound and then touches the fringes of the cemetery. The chance that flood waters from the cemetery could ever reach the habitation was thus remote.

While Kalibangan has two periods of occupation, all of the interments are of Period II. The survey and excavation of the cemetery area show that this area contains only 102 inhumations, too small to represent the entire population of the site.

Burial Types at Kalibangan

There are three types of burials at Kalibangan, only the first (Type 1) of which contains human skeletal remains. This is a typical Harappan-extended inhumation in an oval pit, generally containing pottery as grave goods. There are eighty-eight Type 1 interments reported from the Kalibangan cemetery. According to Possehl, the other two types of interment are technically cenotaphs, in that neither of them contains human remains. Type 2 consists of pots buried in circular pits; and Type 3 consists of pottery deposits in rectangular or oval pits, much like the extended burials, but without the skeletal remains.

Burial types 1 and 2 are the most common grave forms. The pot burials in circular pits (Type 2) were found in an area in the north, separate from the area with the Type 1 and Type 3 inhumations. It is further apparent that the Type 1 interments were found in groups, suggesting perhaps they were family burial areas.

Social Implications of the Kalibangan

Possehl observes that the extended inhumations in rectangular pits are associated with a ritual interment. These seem to cluster spatially in the cemetery, suggesting that there is a sociological unit behind the arrangement; the family is the most obvious unit. The Type 2 interments (cenotaphs in pots) are quite different and are spatially separated from the other burials. This suggests a second pattern of burial, possibly associated with another social group, or stratum, within the Indus population at Kalibangan. It is also possible that the Kalibangan Type 2 interments represent individuals who died or were lost while away from their homes at Kalibangan and that their relatives chose to remember them in this particular way. There are certainly other possibilities, but the preceding are the most obvious, if not certain. Possehl suggests that there may be a relationship between the pot burial cenotaphs at Kalibangan and the post-cremation urns at Mohenjodaro and Harappa.

Possehl (222: 170-174) has done some statistics on the burials. If the entire population of Kalibangan lived in the Lower Town, an area of about 8.6 hectares, and that this entire area was generally inhabited, the population of the town would have been between approximately 860 and 1,160 individuals. The chronology for the Mature Harappan at the site indicates that it had a duration of about 600 years, but there is no age profile for those interred in this cemetery. If we estimate that only five individuals died each year, from the thousand or so people living there, that amounts to 2,500 graves over the life of the settlement. There are, however, only eighty-eight interments with skeletons in them – far short of the estimated number. Since the survey and excavation of the Kalibangan cemetery were done in such a thorough and competent way, we can reasonably depend on its findings. Perhaps some graves were missed in the excavation, but even if we double the number of graves found, it still falls far short of the estimated number of deaths. This suggests that the cemetery at Kalibangan may contain only the remains of some small portion of the population for whom burial was seen as the appropriate method of disposal after death. The more obvious of the two major axes for such differentiation are, of course, ethnicity and class, perhaps working together in some complex way. A distinctive grave was lined with mud-bricks (40 × 20 × 10 cm) covered with approximately 2 cm-thick plaster.

The striking feature about these pits was the filling, which showed two stages: after the funerary deposit, the pit seems to have been left unfilled resulting in the accumulation of bands of fine sand and clay; at a later stage the remaining part of the pit was filled in by human agency with cloddy clay.

The Kalibangan cemetery has evidence for (1) trepanation of a child, (2) a serious, unhealed axe wound to the knee, (3) the remains of an individual with serious bodily deformation, (4) some differentiation in the grave goods with skeletons, mostly expressed in the amount of pottery included.

Summary of the Kalibangan Cemetery

The available reports suggest evidence of ethnic differentiation based on burial type. While the evidence for cremation is equivocal at Kalibangan, it is not at Tarkhanwala, just downstream on the Saraswati River.

Thapar recognizes that the occurrence of these three varieties of burial has posed problems of a sociological kind. Meanwhile, it may be affirmed that the grave goods obtained from each of these types are typically Indus. Graves of the first and second variety occur in separate defined areas, the latter lying to the north of the former, while the graves of the third variety are found largely in the area of the first but occasionally also in that of the second.

The End of the Site

It would be interesting to find out what brought about the end of the Early Harappan settlement at Kalibangan. Lal has analyzed the behaviour of layers: they do not run continuously. Instead, these are "broken" at a number of places. For example, if one observes the first black layer from the top one finds that (i) it does not run horizontally, as an occupational layer should do, and (ii) it is cleft at least at three places, being thus divided into four parts. These parts not only are of uneven length, but also occur in a stepped fashion, each one of the left being at somewhat lower level than the one on its right. In fact, one may even see the slightly oblique cleavage lines between these broken and stepped parts of this layer. Lal assigns these cleavages of layers and walls to a violent earth-movement. It would mean that an earthquake brought about the end of the Early Harappan occupation at Kalibangan. The available evidence indicates that the site was abandoned for some time, may be a century or so, after which it was re-occupied by the Mature Harappans. The end of the Early Harappan settlement may be placed around 2700 BCE (Lal 2003: 99-100). Bisht also records that in Stage IIIB a natural catastrophe, most plausibly a severe earthquake caused extensive devastation at the site at Dholavira.

Uttar Pradesh

Alamgirpur, a small Harappan site, was discovered in Meerut district (UP) in 1959. It was the first Harappan site to have been found in the Ganga-Yamuna Doab. It is a 60 × 50 m mound located on the bank of River Hindon. Period I here belongs to a late stage of Harappan culture, the other periods belong to PGW and later cultures. The brick sizes in Period I were either

30 × 15 × 7 or 35 × 20 × 10 cm. The main finds are: a cubical dice, cart frames, terracotta animal figurines, miniature bowls of faience; etc. and a small terracotta bead fragment which seems to have been coated with gold.

Hulas

Hulas, also located in the upper Ganga-Yamuna Doab, was excavated by Dikshit (1982). Like Alamgirpur, it is also a Late Harappan site. It did yield a sealing with some Harappan characters but no animals. A large mud platform was perhaps put up to guard against floods. Unlike Bhagwanpura, Hulas does not show any overlapping with the subsequent PGW culture.

Most spectacular has been the recent discovery of a fabulous jewellery hoard from Mandi (29° 26'10" N, 77° 34'35" E), in district Muzaffarnagar (UP). It was a chance find from a farm where local people were looting the precious Harappan hoard for several days, till somebody reported it to the police. Police was able to recover about 10 kg of jewellery. One can only imagine what has been lost to the local robbers.

The pottery from Mandi is of the same Late Harappan vintage as found at Hulas and Alamgirpur. The Archaeological Survey did a salvage digging at the site. Bricks found measure 8 × 22 × 31, 9 × 23 × 33 and 9 × 20 × 3 0 cm. The hoard, it is alleged, comprised a large number of beads made of etched carnelian, gold, onyx, and copper. The gold bead types are: spacer beads, circular beads, hollow terminal beads, bell-shaped beads, and disc beads. Broken silver ornaments were also found. It is estimated that the Mandi hoard 'is the most important and the largest amongst all' of the Harappan hoards so far. The circular wafer gold beads are generally found in small numbers in the Harappan sites, but at Mandi, the hoard has these as the main constituent. In fact, they are thousands in number and weigh a good 7 kg! The excavators estimate that the Mandi Hoard might have contained at least 3 to 4 times the quantity recovered! (Sharma et al. 1999-2000: 36-41).

GUJARAT

Gujarat constitutes three distinct zones: Kachchha, Saurashtra and mainland Gujarat. The narrow corridor, which connects the mainland of Gujarat with Kachchha bordered in the north-west by the Rann of Kachchha and in the south-east by the Sabarmati River, is known as north Gujarat; traditionally, the region was known as Anarta. It is a semi-arid sandy plain, dotted with fossil sand-dunes. The region extends in the north up to the southern Rajasthan and gradually merges into the alluvial plains of Saurashtra and central Gujarat. The region is drained by the rivers Banas, Saraswati, Rupen and their tributaries, which flow into the little Rann of Kachchha. Though none of these rivers are perennial, during monsoon they drain large volumes of water into the Rann. At present, these rivers contain brackish water for the major part of the year. The Banas and Saraswati, which flow in the northern part of the region, are heavily silted and have developed broad and shallow channels. But silting is not so evident in the Rupen, which forms a deep channel by cutting the alluvial plains (Sonawane in press).

The entire landscape is marked by a thick deposit of sandy loam and appears dead flat except for a few sand-dunes and attendant blowouts. Such inter-dunal depressions accumulate rainwater and often retain water throughout the year. Since water in these village ponds remains potable they are an important source of water for people as well as livestock.

The climate is characterized by hot summers and cold winters; a dry weather prevails in the region during most part of the year. Being situated in a climatic zone of 600 mm isohyte, rainfall in this region is sparse and irregular, gradually grading down from 80 cm to 40 cm from east to west. Because of the unpredictability and the uneven distribution of rainfall, drought in this region is a recurrent phenomenon. A major portion of the soil is sandy; however, the black cotton soil is also not uncommon in some parts. In many areas the soil is poor and saline and subsoil water is brackish. As a result, most of the western part is marked by saline treeless grassland, which is gradually transforming into a desert. The vegetation is characterized by tropical thorn forest. However, all along the eastern margin of the little Rann of Kachchha, the river banks and large area of wastelands, locally known as Padthar, favor excellent growth of grasses, including bokana (*Cressa cretica*), kharidhar (*Aeluropus flariddum*), lapdi (*Aristida redaets*), soma (*Enimochloe colonum*), jinko soma (*Panicum flaridum*), mancho (*Dhetyloclemium egyptium*), mano (*Chlarismonm*), dhaman (*Cenchrus ciliaris*), zinzvo (*Andropogan pumlis*), etc. These grasses are available immediately after the first monsoon showers and are exploited by the present-day pastoral communities for feeding their cattle (Bhan 1994: 73). This area also supports a large population of the Asiatic wild ass or onager and is an important source for the famous konkrej breed of cattle. Bajra (pearl millet) is the most predominant kharif crop of this region. It is drought-resistant and also provides much-needed fodder for the cattle (Patel 1977: 62). Cotton also forms an important cash crop of the region. Likewise, a major food grain produced in the *rabi* season is wheat. However, its cultivation is restricted due to its dependence upon irrigation. It can, however, be grown without irrigation in the low-lying saline strips or in the filled-up ancient inter-dunal depressions. These major crops have considerable influence on the subsistence activities of the people living in this area. Animal husbandry is another mode of subsistence, of which cattle, sheep, goat, camel and buffalo form the major component species. Nomadic or semi-nomadic pastoral communities such as Rabari and Bharvad make their living primarily out of breeding and/or herding of these animals. In fact, agriculture and pastoralism are the two important components of the economy of this region (Sonawane in press).

The archaeological research in Gujarat was somewhat overshadowed by the glamour of big Harappan sites like Mohenjodaro. The Harappan studies also dominated the archaeological research, as the local and independent development of chalcolithic cultures was largely ignored. Now it is being recognized both in Rajasthan (e.g. at Balathal, Ahar, etc.) and Gujarat (Prabhas Patan, Rojdi, etc.) that there was an indigenous/local development from the Mesolithic cultures to Neolithic-Chalcolithic cultures on which the Harappan culture impinged at places. It is therefore not surprising that such sites, such as Rojdi, which had local roots did not get crippled at the eclipse of the Harappan culture in the major Harappan towns.

Sonawane (2000: 137-146) points out that between the 4th and 2nd millennia BCE in Gujarat there existed a mosaic of different adaptations such as hunting and gathering, pastoralism, agriculture and various specialized craft production strategies. Hence we see not only regional diversity in the manifestations of the Harappan culture in Gujarat, but also the capacity of the Harappans to mobilize different subsistence systems by integrating them into their economic structure. In addition, the integration of the Harappan culture with indigenous counterparts offers an interesting situation in terms of the processes of cultural transformation. Regional diversity is now an accepted phenomenon of the Harappans, for which the role of the regional Chalcolithic traditions can be held responsible. Moreover, fresh data brought to light from recent studies have revealed that some of the non-Harappan indigenous settled communities emerged on the scene more than half a millennium prior to the beginning of Mature/Urban Harappan Phase in Gujarat. However, in spite of the considerable overall advancement in Harappan studies, the information pertaining to the exploitation of plants for sustenance in this region is still inadequately addressed.

Herman (1997: 107-108) has made a very perceptive study of the Gujarat Harappan sites. He points out that the size estimates of settlements in Gujarat are built on very weak arguments, especially since the regional cultural differences within Gujarat (Sorath Harappan, Indus Harappan, Anarta tradition, Microlithic complex, etc.) have not been taken into account. Herman thinks that refined settlement sequences can indeed be produced, if based on, amongst others, reliable and (above all) independent pottery sequences. In this respect, Rojdi has a great potential thanks to the detailed stratigraphic control over the pottery. The establishment of sound and detailed evolution in the many distinct pottery productions – Herman recorded over 35 different names of wares in Bronze Age Gujarat – is an absolute must for a better chronological control. Herman suggests that if the excellent pottery sequence at Nageshwar could be complemented by one from, for example, Prabhas Patan, one from the northern Gujarat plains, one from Padri, one from the Sorath Harappan and Lustrous Red Ware (LRW) occupations at Dhevalio, and also from Dholavira, the intra- and extra-regional variation may well show up to be less ephemeral. Such approach will prove more reliable than arguments based on isolated, and often problematic ^{14}C dates (Herman 1997: 107-108).

Herman thinks that the relationship between Kachchha and Saurashtra during Early Harappan and Late Harappan times is in need of further exploration. Dholavira in Kachchha and the excavation of a site with a long history down to post-Harappan times in Saurashtra and in the northern Gujarat plain will be useful.

Strongly pleading for a re-excavation of Rangpur, Herman points out that Rangpur, the first ever discovered "Harappan" settlement in Gujarat territory, still remains one of the best sites to return to. The de-urbanization process in the area is not only different in nature, but is also of a greater complexity. The apparent, quite distinctive cultural and trade networks as well as subsistence systems of Kachchha (including the Ranns), of the northern Gujarat plains and of Saurashtra, shed a different light on Rangpur as a settlement. Herman suggests that it should now be examined to what extent and at what stage Rangpur belonged to the Core/Periphery Interaction Zone, to the Sorath Harappan realm, and/or to urbanized Harappa. The impact of the pastorals of the north Gujarat plains communities (Microlithic, Loteswar Anarta complexes) and Saurashtra should also be properly established. It should not be forgotten that Rangpur remains the largest settlement (between 50 and 100 hectare area) in Saurashtra, in the Mature, Late and Post-Harappan Periods. With its more than 6 m of deposits, its period of occupation may well be much more extensive than is nowadays assumed. Sorath Harappan deposits (RGP IIA-B-C) have been found on the whole mound, showing more Harappan architecture in the north-western part. But the pre-structural levels with Micaceous Red Ware below the RGP IIA-architecture deposits may indeed belong to Early Harappan times and date to the first half of the 3rd Millennium BCE cal. At the upper end, the Lustrous Red Ware (LRW) occupation may also have lasted much longer than presumed. The extensive deposits may well illustrate an internal evolution throughout the LRW occupation. However, to achieve this, the nature and shifts of lateral occupations need to be established. The excavations at Oriyo Timbo, Kanewal, Ratanpura, Nesadi, Jokha and elsewhere would receive new meaning for the relative chronology if a close re-analysis of the LRW layers at Rangpur and Prabhas Patan is executed. The precise chronological relationship between the Late Sorath Harappan and LRW is crucial in this matter. Herman points to the puzzling stratigraphic interpretations of the LRW deposits at Rangpur, which show great disturbances in the RGP IIC layers, may lead to the question whether LRW does really belong to IIC or to III only? The fact that Rangpur, together with Prabhas Patan, is one of the few sites where LRW is associated with rectangular structures, instead of with round ones, is indeed of interest. We do also need the much-awaited first radiocarbon dates for this key-site which, for instance, could illustrate the first occupation, the contact-phase or the crucial date of the introduction of LRW in Gujarat. In view of its overriding importance, Herman concludes that Rangpur would be a good candidate to receive on Indian territory full attention for further investigations as the other great cities of the Indus/Ghaggar-Hakra-Nara Valley (Herman 1997: 107-108).

Lothal

Lothal, located on the head of Gulf of Cambay in Gujarat, is a small (4.8 hectare area) Mature Harappan site, excavated by S.R. Rao (1979, 1985) for seven consecutive seasons. Stratigraphically the site (Fig. 4.12) has been divided into five building levels, each separated from the others by flood deposits. In the first four levels, numbered I-IV from bottom to top and designated Lothal A, were found ceramics and small finds of Mature Harappan character, while the fifth and final level (Lothal B) can be termed Late Harappan. Comparative typology and radiocarbon dates suggest that Lothal A can be dated between 2100 and 1850 BCE (2550 to 2160 BCE, cal) and that Lothal B ends 100 to 150 years later. The following description of the site is mainly based on the comprehensive summary by Possehl (1979).

The first building level, with its limited architecture and no signs of settlement-planning, suggests that Lothal was at that time a small "pioneer" settlement. Then in the succeeding three levels the settlement expanded in size, with definite indications of community-planning. In the fifth level Lothal is once again reduced to a small settlement and the architecture suggests a "squatters" occupation just before the final abandonment of the site. The following discussion will be limited to the "Mature" Phase levels II, III and IV:

Lothal is basically a small town, approximately one-fourth the size of Mohenjodaro or Harappa, with a population of about one to two thousand. Lothal has been divided into three architectural areas or "districts": the Citadel, the Lower Town and the dockyard. The Citadel is an imposing area artificially raised above the remainder of the settlement on a mud-brick platform. This area occupies the south-east quadrant of the site and is 48.5 × 42.5 m in size. On the Citadel are streets at right angles to one another, which separate blocks of mud and baked brick structures. One of these blocks, with very thick mud-brick foundations, has been interpreted as a warehouse.

The Lower Town is also divided into blocks separated by streets at right angles oriented to the cardinal directions. Only six of these blocks were excavated. The Lower Town was used both for residential and manufacturing purposes.

The so-called "dockyard" is probably the most controversial feature at Lothal. This structure is located on the eastern side of the site. Constructed of baked bricks, the "dockyard" is nearly rectangular in shape, 219 × 37 m in size. The brick walls of the sunken enclosure are 4.5 m high. A platform borders the town side and permits easy access to the warehouse area on the Citadel. Possehl thinks that the precise function of this brick-lined enclosure is still open to question. Some scholars believe that it was a tank. In fact, neither of these alternatives, the tank versus the dockyard, is fully convincing. One has to seriously question the necessity of a tank for irrigation water storage in the Lothal area. Seasonal inundation is sufficient for one crop and ground water is extremely close to the surface at other times of the year. The means of lifting water from the tank has yet to be explained. Leshnik suggests a shaduf system, positing that the "anchor" stones found in the enclosure were counterweights. Possehl however disagrees, as the holes in the anchors are too small. There are no stairs or other means of access to the interior of the enclosure. This means that it could not have been used for bathing and laundry.

Possehl queries whether a large dockyard would have been necessary, even if Lothal had been a port. Today ships come into riverine ports on and adjacent to the Gulf of Cambay and

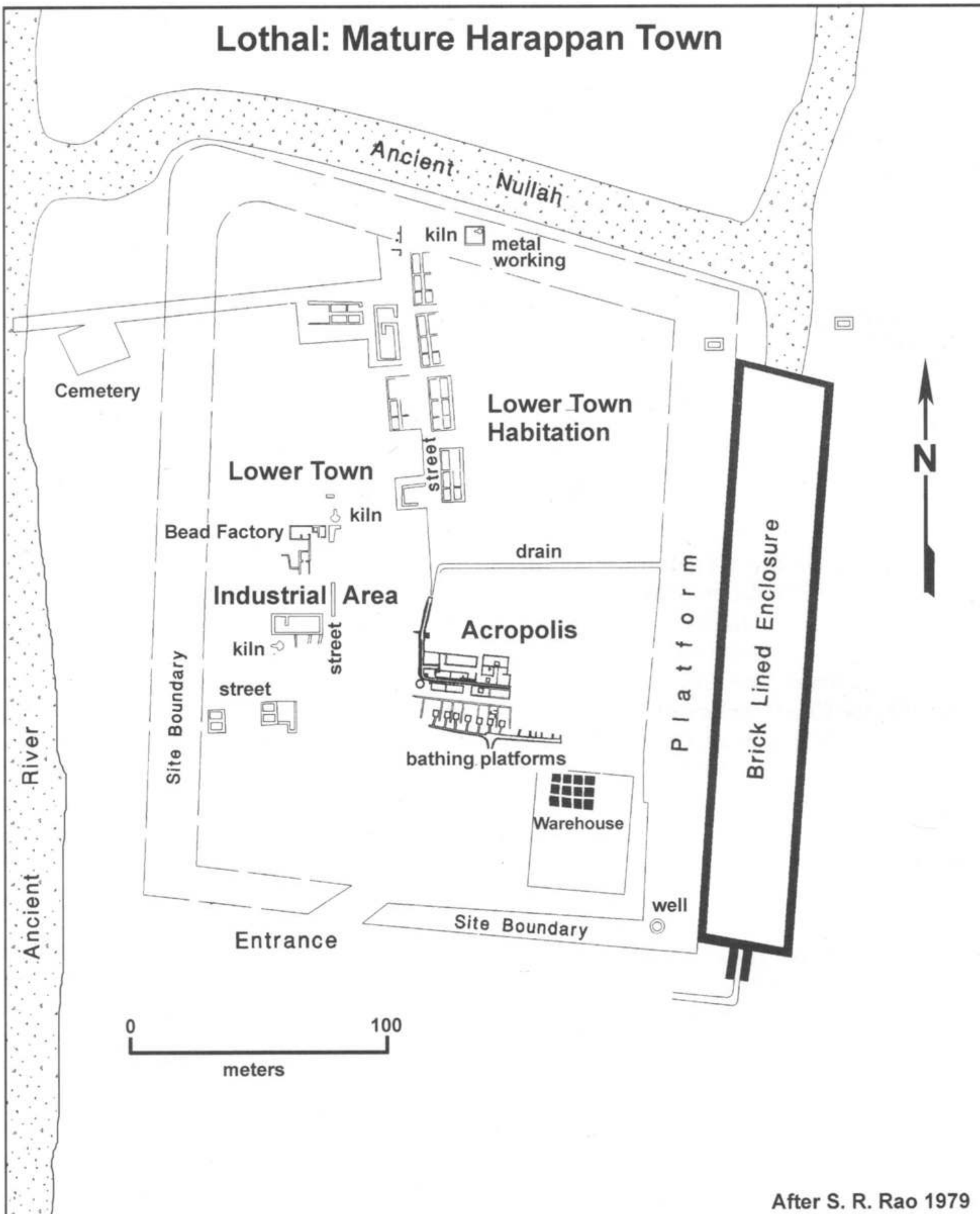


Fig. 4.12 Site plan, Lothal, Gujarat (ASI).

anchor at high tide on mud flats where they are loaded and unloaded without other facilities. How much more logical it would have been if the dockyard had been built on the riverside of the town where an uncomplicated entrance system would have sufficed. Finally, access over the peripheral enclosing wall to the interior of the facility is extremely shallow. Excavation has shown it to be of the order of seven brick courses. This would admit watercraft with less than a meter draft, probably excluding sailing craft appropriate for ocean-going maritime trade.

The interpretation of the Lothal "dockyard" is far from resolved. But whether it is or is not a dockyard or a tank makes little difference in terms of this settlement's place in the cultural geography of prehistoric Gujarat. The differentiated nature of the architecture and the presence of identifiable districts suggest a complexity for Lothal. This is revealed in the type and variety of the artefactual assemblage as well.

Present at the site was a wide variety of raw materials, objects in various stages of manufacture, finished products as well as waste and residual materials. Stone anvils, bronze drills, crucibles, slag, remnants of conch shell, copper ingots, whole tusks from elephants (and others partly sawn) are but a partial list of the items relating to specialized crafts. Most noteworthy is the presence of a bead factory in the Lower Town. In this structure several rooms of small size surround a central courtyard. Within the latter there is a raised working platform with an anvil. The archaeological deposits associated with the factory contained many unfinished beads, drills, and other tools as well as bead materials and hundreds of finished ornaments. A special furnace for heating carnelian to enhance its colour is also a part of the complex. Beads of many forms made from carnelian, crystal, jasper, opal, steatite, paste and the like were manufactured on a very large scale at Lothal, suggesting that this manufacturing process must have been one of the most important activities at the site.

Lothal was a carefully planned settlement, ordered into districts in a way which led to an economy of space. There were areas, such as the bead factory, a smelter, a place within which shell bangles were made, that suggest craft specialization and an overall order to the layout of the town. It can be reasonably inferred that this diverse and evidently voluminous, specialized craft activity produced much more in the way of finished products than the settlement itself could have consumed. Lothal was not situated in a location particularly suited to resource extraction. Its immediate environs in fact produce almost none of the raw materials (copper and other ores, stones, shell, ivory, etc.), which played such a key role in the life of this settlement. The nearest copper comes from Rajasthan, as does steatite. Agate is found on the Narmada and in Saurashtra and Kachchha. Shell is found along the coast of the Arabian Sea. Ivory was undoubtedly available locally. Possehl emphasizes that Lothal should therefore be seen as a hub of a complex and continuous exchange network. The nature of this exchange is not fully understood; however, it appears to have involved not only the inhabitants of this settlement but the other non-Harappan folk around them. Nevertheless, Possehl denies Lothal's role in external trade.

Seasonal hunting and gathering people inhabited the large north Gujarat plains, to the north and east of Lothal, at the same time as Lothal was occupied. This has been demonstrated by excavations at Langhnaj, a "microlithic" site 20 km north of Ahmedabad.

Of considerable importance is the occurrence of what appear to be trade items at Langhnaj. There is a 98.12 per cent pure copper knife, black-and-red ware, which is typologically akin to a ware found at Lothal, and disk beads of Harappan type. These items all suggest contact between the inhabitants of Langhnaj and the Harappan civilization. Langhnaj is probably not a unique site in north Gujarat since there were several hundred such hunting and gathering settlements. Possehl suggests that Lothal appears to have been a kind of "point interface" between the hunting and gathering people in North Gujarat and its parent Harappan hinterland.

Possehl argues that Lothal was an entrepot, a settlement of entrepreneurs interested in the procurement of raw materials demanded by the inhabitants of the cities and towns of Sindh and the Panjab. To facilitate this process of acquisition they formed an alliance, an exchange relationship, with the hunting and gathering people on the south-eastern borderland of their civilization. Seasonal mobility plus an intimate knowledge of the resources available within the regional environment made these hunter-gatherers efficient partners in the overall acquisition process. But there is more than merely culture historical importance to this relationship. What it suggests is that within the late 3rd and early 2nd millennia BCE a complex interlocking cultural mosaic was developing in South Asia. This mosaic is not one which only portrays cultural diversity within simple geographic bounds and for which border phenomena and territoriality are particularly useful in terms of complete analysis. The mosaic is rather one which suggests a growth of interdependence between socio-cultural groups with fundamentally different systems of settlement and subsistence, material culture and presumably diverse cultural traditions. This is a form of cultural integration still found in India as revealed by the ethnographic analogy employed for the hunter-gatherers. This interlocking relationship is also generally applicable to one of the essential aspects of caste organization if viewed as a total system. That is general economic integration of what are in deep historical terms ethnically diverse populations. Possehl makes an interesting observation:

Without making the undue claim that the discussion of the relationship between the Harappan civilization and hunter-gatherer groups in Gujarat charts the beginning of the caste system' it can nonetheless be suggested that the development of a complex and integrated cultural mosaic has its roots in prehistory and that such conditions are wholly congruent as a precondition to the growth of caste institutions in later historical contexts. This is, in fact, the larger significance of the discussion in hand, and one, which deserves a greater attention in archaeological research (Possehl 1979).

Dholavira

Dholavira, one of the five largest (60 hectare area) cities of the Harappans, is situated on the isolated island of Khadir in the Great Rann of Kachchha in Gujarat (India), which has been excavated for several seasons by Archaeological Survey of India (Bisht 1989a, b, 1991, 1994, 1999). Bisht (1999:393-442) rightly claims that Dholavira has supplemented and complemented profusely to the data base of the Harappan culture. For the first time, a full configuration, together with hitherto unknown elements of Harappan city planning, was laid bare here (Figs. 4.13, 14). New evidence was added in respect of monumental and aesthetic architecture. An altogether new system of water harvesting and storage was brought to light. A congregation ground or stadium with seating arrangements for spectators was uncovered (Pl. 4.5 shows the eastern gate). Dholavira had its Citadel, as also Middle and Lower towns (Pls. 4.6, 7) Plate 4.8 shows the ceremonial grounds. In addition, fresh information relating to funerary practices and structures is being gathered. A unique inscription made up of ten large-sized Harappan signs was discovered. Metal use, though not too abundant, was significant nevertheless. Furthermore, an enormous accumulation of successive settlements of over a millennium has revealed seven significant cultural stages documenting the rise and fall of the first Indian urbanization known as the Harappan civilization. Local art and craft show the typical Harappan virtuosity.

All the seven cultural stages through which the settlement at Dholavira passed are encountered only in the castle of the Citadel. The successive settlements containing residential structures and the habitation debris account for 11.30m of deposit. Bisht summarizes the features of the seven stages as follows:

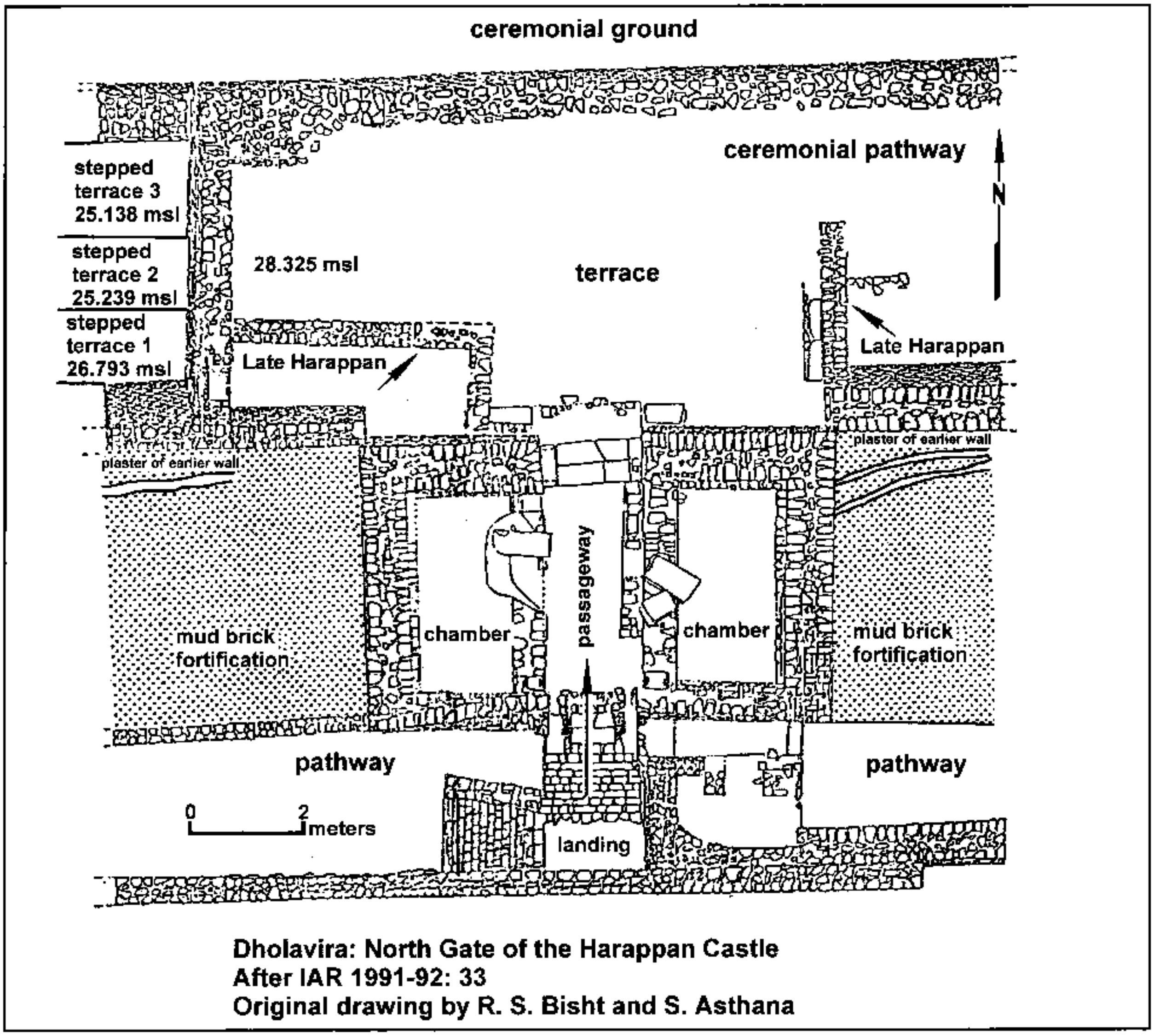


Fig. 4.13 North gate of the Harappan Castle, Dholavira (ASI).

Stage I

Right from the beginning, the first settlement was fortified by a massive wall. The occupational deposit, measuring 65-70 cm in thickness, has revealed a fairly developed state of culture. The first occupants at the site were familiar with diverse pottery traditions, copper metallurgy, stone-dressing, lithic tool technology, shell-working, use of steatite and the knowledge of definitive principles of planning and architecture, (Bisht claims) all datable to the beginning of the 3rd Millennium BCE. The fortification wall was made up of rubble-stones set in mud mortar. A strong cultural marker was the use of moulded mud-bricks measuring about 36 × 18 × 9 cm (providing a ratio of 4:2:1). The presence of moulded bricks, monumental architecture, indication of formal planning, perforated jars, carinated dishes, basins, triangular terracotta cakes, long chert blades, steatite wafer beads, etc., from Stage I point to the beginning of the process which later blossomed into the Harappan civilization.

Stage II

The first visible evidence of the beginning of Stage II was found in the form of widening of the pre-existing fortification wall. Resting on the antecedent deposit of Stage I, a 2.80 m thick mud-

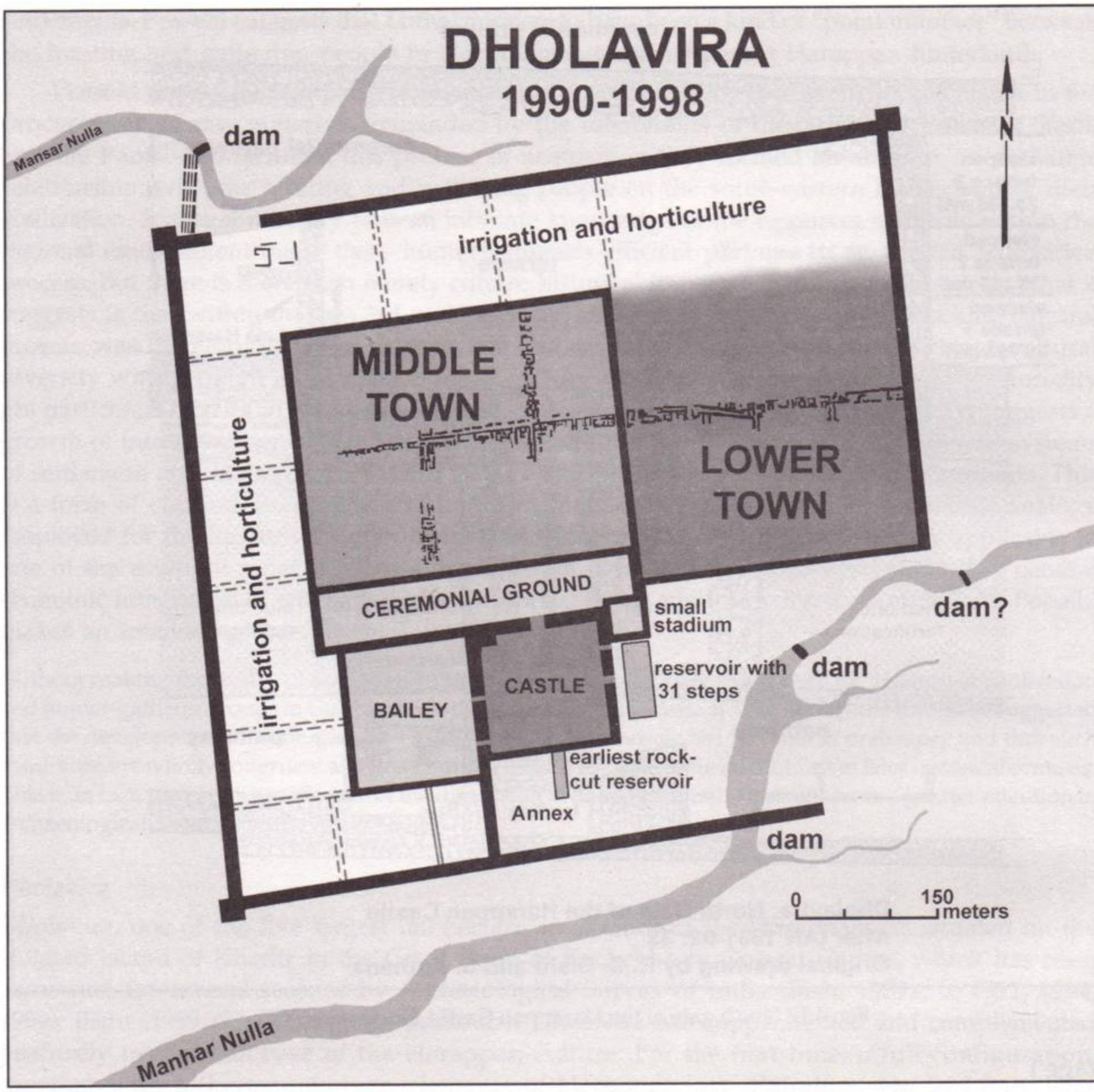


Fig. 4.14 Site plan of Dholavira showing Castle, lower and middle town (ASI).

brick masonry was added against the inner face of the southern arm of the fortification. Most significantly, on the inner face of the defensive wall, there were at least 13 coats of plaster, each made of a white, off-white, grey, or one of the shades of pink clay which are available locally. Not only the fortification but also the house walls and floors were found respectively treated with and made of similar clays. It is the same trait, a part of the Harappan legacy, that shows the aesthetic sense of the contemporary society. During this stage, the settlement was extended towards the north and possibly to the east as well. This perhaps points to the introduction of a dichotomy in the settlement and thereby indicating an emerging stratification in the society or elevation of the political status of the establishment. Among antiquities, copper items, beads of chalcedony and steatite, bladelets of chalcedony and chert, bangles of shell and clay, industrial waste of stone and shell workings and triangular terracotta cakes increased in number. The shell bangles continued to be thin and elegant.

Stage III

This was a very creative period at Dholavira. As in the case of Stage II, its beginning too was first recognized in the final widening of the southern wall by adding 4.40-4.50 m broad brick masonry, once again from the inside. This stage is also denoted by six building phases contained in an occupational debris of 3.30-3.60 m, which may be subdivided broadly into two sub-stages, viz. IIIA and IIIB.

Stage IIIA

In this stage, the pre-existing fortress was not only substantially reinforced as indicated above, but enlarged into a bipartite Citadel having a castle and a bailey. The northern extension of the residential area that came into existence during Stage II was cleared of its structures and made into an extensive esplanade for a stadium, which was enclosed by stepped terraces meant for seating spectators. To the stadium's north, the general town was located, and both of them were brought within one fortification with bastions, corner towers and gateways. A smaller stadium with massive walls on three sides was also laid out at the south-eastern corner of the larger one. An annexe was also in existence during this stage, although its origins, whether going back into the earlier stage remains to be ascertained. Reservoirs, along with partition bunds, inlet channels and dams had also been provided although provision of some of them, especially in the east, south and west of the antecedent settlements, might have come into existence right from the beginning. All these reservoirs of Stage IIIA were, however, provided within a circumvallation, furnished with bastions, towers and gateways, which in fact enclosed the entire city.

Stage IIIB

This stage followed a natural catastrophe, most plausibly a severe earthquake that caused extensive devastation at the site. In its aftermath, some drastic changes were brought about in the inner layout of all the prevailing divisions, besides adding a third principal division, i.e. the Lower Town with well-defined streets and sectors. The newly added division was located to the east of the earlier town and, consequently, the city walls were also extended eastwards in order to bring it within the outer fortification. In addition, the monumental gates of the castle, together with their front terraces as well as a ceremonial pathway leading to the north gate had been built up by this sub-stage, which is represented by a deposit approximating 1.10 m.

Amongst others, one of the most distinguishing traits of Stages II and III, and, to some extent of Stage I, is the almost universal use of colorful clays particularly of white and pink hues for making floorings as well as plastering of both public and private structures. So much so, the broad way in the castle and the larger and smaller stadiums too were furnished successively with floors made up of such clays. The diagnostic Harappan elements, such as stamp seals (Pl. 4.9) (Fig. 3.25 from Mohenjodaro), the script, weights (Pl. 9.10) and many typical pottery forms as well as decorative motifs, made their debut all along during Stage III.

Stage IV

The relics of Stage IV are represented by 4.40-4.60 m of habitational accumulation revealing the Mature Urban Phase of the culture which is well-known from a large number of excavated Harappan sites. The general planning and architecture of the preceeding stage was maintained but with a few minor alterations. During Stage IV, an overall phenomenal progress in the material culture is witnessed. Its manifestation may be seen in pottery, in the seals, in the writing, in the weights, and in a variety of ornamental and utilitarian artefacts made of metals, semi-precious stones, other stones, faience, steatite, shell, ivory, bone and clay, all found in abundance. Local mass production in each craft demonstrates that the city of Dholavira had become a great manufacturing centre to which raw materials were being brought from different sources for catering to the needs of the local manufactories as well as for supply to other centres.

The fortification network was, as a rule, entirely made of mud-bricks, but for the limited use of stones for facing the outer sides of the walls. Stone was also used for the gates, drains, steps, tanks and special architectural features. In the houses, it was used in foundations, but the superstructure was made of mud-bricks. Quite surprisingly, with the very beginning of Stage IV, the use of colorful clays for flooring and plastering went out of vogue altogether and never recurred thereafter at the site. Instead, ordinary clays were used for the purpose as everywhere else during the Harappan Period.

Stage V

It is characterized by a general decline, particularly in the maintenance of the city, as is most vividly reflected in the Citadel. The deterioration in other items of the culture is not easily recognizable. The classical pottery, seals, script, weights and others continued as before. Two fragments of vessels made out of soft stone, perhaps chlorite schist, are important as they may be imports. They appear to belong to the "intercultural style" of the later phase. In point of time, they go well with the Stage V.

Stage VI

The desertion of the site that followed Stage V was broken by the advent of Stage VI which presents a state of transformed Harappan culture, found as widely distributed in Gujarat. Vertically, its debris is only 70 cm thick, with two phases of structural activity, which could have spanned a period of a century or so. The size of the settlement became substantially smaller and the layout was different. The newcomers confined themselves to the Citadel and the southern margin of the middle town while the greater part of the latter and the entire Lower Town was not reoccupied at all. They, however, maintained the necessary vital parts of the outer walls as well as some of the reservoirs. Only in the north, the new occupants built a wall to defend as well as to delimit their settlement. Like the wall, the houses were also built with the stones robbed from the older structures. Bricks were no longer in use. The layout also differed drastically. A new system of streets, alley ways and housing sectors was introduced. Structures were largely rickety and jerry-built. The stone masonry shows poor workmanship. Though most of the classical pottery forms, fabrics and decorations are present in the assemblage, some exotic ceramics, possibly coming from diverse sources, made their appearance. There is Jhukar-style pottery, perhaps from Sindh. The burnished black, grey and black-and-red wares, occasionally embellished with dots and lines in a fugitive white colour, might have come from Gujarat or Rajasthan where they were widely distributed. Among antiquities, the seals, weights, the script, beads, bangles, copper ornaments and tools, long chert blades, triangular terracotta cakes, miscellaneous terracotta objects, animal figurines and many other items of the Mature Harappan traditions continued to be in use.

But, in many cases, there are remarkable changes. For example, the seals now had only inscriptions but no figures. This was just the opposite of what had been obtained in Stage III when there were no inscriptions but only figures. However, the overall picture that emerges is that of progressive degeneration. This stage is identical with IC at Surkotada, IB at Desalpur and upper levels at Pabumath and also comparable to the several sites in Saurashtra and Gujarat. This was followed by another desertion.

Stage VII

The second desertion was certainly of a longer duration as was reflected in the stratigraphy, particularly at such places where there were favourable locations for the accumulation of the eroded and collapsed debris. This last habitation at the site lasted only for a solitary building phase. The people of this stage were living in circular stone-lined huts laid out neither in conformity to any plan nor showing any preference for a particular area.

Summarizing the evidence, Bisht says that these seven stages in fact make four distinct cultural horizons. The first comprises Stages I to III, the second Stages IV and V and the third and the fourth are represented by Stages VI and VII, respectively. All these are abundantly reflected in the stratigraphy, settlement planning, pottery technology and other material contents, within a broad framework of one long cultural process, which culminated into the Harappan culture. As stated earlier, one of the most distinguishing features of the Stages II-III and, to some extent, of Stage I too, is the almost universal use of the colorful clays of white and pink hues for flooring as well as plastering for both public and private structures. No sooner did Stage IV commence, the use of such clays came to a sudden stop, as if under a social taboo or a royal decree. Likewise, there seems to have been a drastic change in lifestyle, as is reflected in explicit distinctions in colour, composition and behaviour of the occupational layers. A similar situation is seen to prevail between the second and third horizons as well. The omnipresent mud-bricks, planning and monumental architecture which were the hallmark of the Mature Harappan Phase are no longer seen in the third horizon, although some amount of cultural continuity is visible. In sum, despite continuity, significant changes are manifest from one cultural horizon to another.

Dholavira in a Wider Perspective

Placing the Dholavira evidence in a wider perspective, Bisht says that the foregoing account makes it amply evident that the miscellaneous antecedent cultures flourishing in the Indus Valley, Baluchistan and Kachchha were constantly evolving in all aspects and developing their distinctive repertoire. Many elements of the earlier societies were adopted, refined in some cases, elaborated and widely distributed by the succeeding Harappans. All these early cultures had strong, comparable socio-economic infrastructures and there was regular interaction and exchange among them. Secondly, many of the sites of preceding cultures have evidenced fortification systems and inner planning. At many places, their fortified settlements were superimposed by the Harappan cities and towns, which usually were of larger extent. In addition, the arrival of Harappans was quite sudden and emphatic. At many places, the earlier settlements were set on fire before the Harappan occupation started. At some sites, the Harappans seem to have levelled the previous settlements before a wholesale reconstruction in a more planned way was brought about. Evidence at Dholavira is somewhat different because the Harappans of Stage IV almost scrupulously maintained the planning which they inherited from their immediate predecessors. While Stage III demonstrates the Early Phase of Harappan culture in several ways, yet there are abundant indications that the transfer of power might not have been smooth and peaceful.

In the post-urban or post-Harappan Period, the cultural scenario undergoes a sea change. The uniform character of the Harappan culture is not evident. There are a number of regional cultures into which the urban components rapidly devolve and disappear. Barring the Kachchha and Saurashtra area, fortification, formal planning, use of seals and bricks, whether sun-dried or fired, went out of vogue. The Jhukar seals are different from Harappan ones and are devoid of writing. The classical Harappan pottery forms and painted motifs disappear along with weights, triangular terracotta cakes and many other sophisticated items of art and utility. Only those pottery forms and items, which were present in the Pre/Early Harappan Phase remained in use (Bisht 1998-99:14-37; 1999: 393-442).

Animal Husbandry at Dholavira: Ajita Patel says that the animal economy of Dholavira was principally pastoral in nature involving the use of four principle domestic animals. Although sheep, goat, and cattle can be tended extensively and moved to new grazing areas as needed, water buffaloes are dependent on better quality forage and water for soaking their hides. Thus, they are likely to have been kept in the city itself where the reservoirs of Dholavira would have provided a reliable source of water for daily bathing. It is possible that some of the sheep, goat, and cattle needed for provisioning the city, could have been obtained from more mobile pastoral populations in exchange for agricultural products or other goods. Ideas such as these need to be systematically investigated by integrating faunal data with the results of architectural and artefactual studies. Individual kin groups or even households may have included both pastoral and agricultural elements, thus ensuring access to both animal and plant products. In addition, a particularly interesting study would be an investigation of the relationship of Dholavira with its hinterland. Patel says that a large city like Dholavira would not have existed in isolation from surrounding communities, be they agricultural, pastoral, or even hunter-gatherers (Patel 1997).

Surkotada

Surkotada is located in Rapar Taluka of Kachchha district, Gujarat. J.P. Joshi excavated Surkotada (Fig. 4.15) for a number of years in his usual meticulous way for which he is well known (Joshi 1990). Describing the evidence, Joshi says Surkotada unfolded a sequence of three cultural periods dated to *ca.* 2100 to 1700 BCE (uncalibrated). The Harappans had a fortified Citadel and a residential annexe in Period IA and the same pattern of settlement had been maintained through the successive IB and IC Periods. In the later two periods, coarse red ware and white painted black-and-red ware using folks respectively come to the site, yet the Harappan influence continues through the periods in a substantial way as evidenced by the pottery, chert blades, terracotta cakes, weights and measures, beads, terracotta cart frames and seals. Joshi points out that a remarkable feature is the coexistence of a non-Harappan element represented by cream slipped ware, a red ware akin to pre-Harappan traditions of Kot-Diji and Kalibangan and a reserve slipped ware showing extra-territorial affinities with Ur, Mohenjodaro and Lothal.

The Citadel with bastions, elaborate gateway complex having guard rooms, lanes and by-lanes and well-planned fortified residential area with a separate entrance and an intercommunicating passage between the Citadel and the residential area and a substantial quantity of the Harappan cultural equipment shows full-fledged Mature Harappan influence even up to ca.1700 BCE (uncalibrated), which Joshi thinks is itself a remarkable feature.

There is evidence of the Harappan script on potsherds. The copper objects found at Surkotada show that in Period IC copper technology was popular and more copper objects are available in this period than in earlier periods. Joshi suggests that possibly the increase in the number of copper objects in later periods can be ascribed to the possible contact of the Harappans of Surkotada with white painted black-and-red ware using Banas culture people. Though Joshi claims that the Harappans knew *Equus* right from the time of their arrival at Surkotada, it's more likely that the bones are of onager. Joshi however admits that the reserve slip ware and the cream slipped ware with its west Asian links and the find of *Equus* bones needs further comparative study. The Harappans at Surkotada were probably worshipping *linga* type clay objects, which have been found from the mid-levels of Period IA. Neither mother goddess figures nor fire alters of Lothal and Kalibangan type have been found. However, terracotta triangular cakes are available all through.

It is rather strange that at Surkotada, there is a compact Citadel and a residential annexe but no city complex has been unearthed. Joshi thinks that most probably Surkotada was a

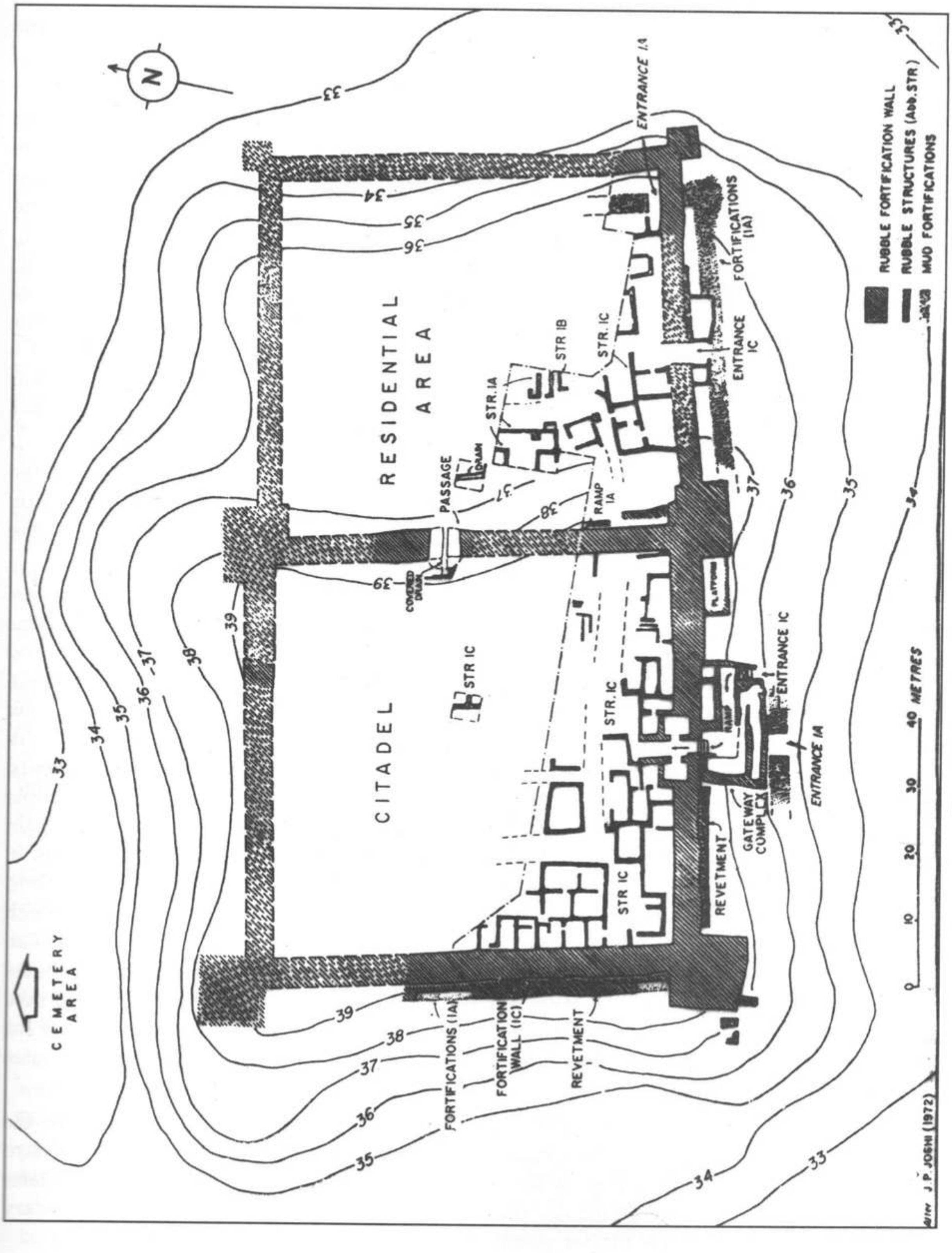


Fig. 4.15 Site plan, Surkotada (ASI).

garrison complex to control the eastward movement of Harappans. Possibility of the existence of a large settlement in the immediate vicinity is rather remote. The increased frequency of Harappan pottery from certain layers of the upper levels in Period IC shows a fresh lease of life, possibly indicating a fresh wave of Harappan immigrants.

It is significant to note that while the white painted black-and-red ware is available at Lothal from the earliest levels of the Harappan culture (and also at Rangpur) and continues throughout, this ware is available only in Period IC at Surkotada. At Desalpur too this ware occurs only in Period IB. Joshi suggests a possible explanation that at Lothal along with the Harappans the white painted black-and-red ware remained in a subservient form right from the beginning, but by *ca.* 1700 BCE (uncalibrated) with the decay of Harappan culture in Saurashtra it got a fresh lease of life and rejuvenated and started moving to Kachchha where in Period IC at Surkotada it is available with the Harappan Wares. It is also possible that with its remote connections with Banas Valley the white painted black-and-red Ware culture got fresh impetus in its movement and expansion. Joshi thinks that it may indicate the coming to power of a people represented by the white painted black-and-red ware who remained in a subjugated state during the heydays of the Harappans and started a mass expansion by *ca.* 1700 BCE (uncalibrated) in western India (Joshi 1972).

Regarding the burial practices at Surkotada, the Harappans were sometimes burying the bones in pots and sometimes only pots in pits and covering them with a stone slab or a cairn. This is a most unusual form of burial tradition amongst the Harappans. The availability of the stone nearby might have tempted them to do so.

Migrations: The following is the summary of Joshi's views on migration of the Harappans. Joshi thinks that the Harappan expansion took place not as a sequel to a catastrophe but it was natural and waves after waves of Harappans from their epicentres from Mohenjodaro and Harappa came in search of new lands and trade well within 2300 BCE to 1750 BCE (uncalibrated), possibly after that also. Economic pressure and man's natural urge for expansion into new areas were the prime factors. However, fleeing after a flood or invasion cannot be ruled out. One can doubt that flood and enemy attacks cannot solely be responsible for mass movements. From time immemorial floods have been a constant feature in so many parts of India but people have hardly migrated en masse to safer regions forever. Temporarily they might move but again they come back and establish their own home at the original place or slightly removed from it. Hence on the basis of dates available it is possible that during the life-time of Mohenjodaro and Harappa, the Harappans with their best traditions moved towards south-east and north, which is attested to by the ^{14}C dates of Kalibangan, Lothal and Surkotada. In Rajasthan and Punjab land route and riverine routes of Indus, Sutlej and Ghaggar might have been used. Land routes were easy for migration when quite a large number of people moved, maybe in search of new lands or establishment of trade. After trading stations are fixed, riverine route is quicker for carrying merchandise and also keeping contact with the parent site with known land routes assuring greater security and certainty.

It was Rao who first proclaimed that Harappans came to Saurashtra by sea route. He envisaged coming of Harappans in two main streams–one during the lifetime of Mohenjodaro and Harappa by sea and establishing the first settlement at Lothal for overseas trade and later on Desalpur in Kachchha and Bhagatrav on the Kim estuary and made several temporary settlements on the coast line. He further points out that

> the conspicuous absence of sites of Mature Harappan culture connecting the peninsula of Kachchha and Kathiawad with the main land supports the view that the Harappans did not follow a land route.

So Rao dismissed the theory of land route of the Harappan migrations. The suspicion of Raikes in 1964 that this part including Kachchha was under water during the Harappan times does not stand in the light of the discovery of so many sites of Mature Harappan culture by J.P. Joshi.

Joshi however suggests that the following factors postulate a case for migration of Harappans to Kachchha by land routes and then to Saurashtra:

1. The geographical position of Kachchha is in between Sindh and Saurashtra. Kachchha could be easily accessible from Allahdino, Kot Diji or Mohenjodaro and is only about 400 kms from Kotada, a Harappan site in Kachchha. Coming regularly by boat following the coastline will involve a coverage of nearly about 1300 km. Human instinct to follow the shorter route is a prime factor, which cannot be denied or overlooked.

2. At present anybody can cross the Great or Little Rann of Kachchha from January to June on foot. Bombay Gazetteer clearly mentions even when there is slight depth of water it does not make the Rann impassable, on the contrary camels move safer through water than over slippery mud. It is possible to think that the land routes were in vogue even in the 2nd and 3rd millennia BCE. Luna, a Harappan site discovered by Rao himself, does lie in the Banni area at a height of 3.6 m above sea-level. Though the area around this site is flooded now during the rainy season, in ancient days this was not the condition, otherwise this habitation would not have been there or if at all it was there, the conditions could not be different from what we find at present. Today also the Rann between the mainland of Sindh and Khavada, Khadir and Kachchha as such is crossable at quite a few points except during the monsoon when the area in-between is flooded to a depth of 1 into 2 m. Even if the present position is taken into account then also the area is crossable at least for six months.

3. The Harappans being also agriculturists it is but natural that they would move to explore fertile tracts available along the stream basins. In this pursuit they could move along the available land routes, rather than taking journey by sea. Even in the present day's geographical environment of Kachchha there is abundant cultivable land and as such during the Harappan times the condition could not have been vastly different when the population was also of smaller size.

4. The Harappans made the first fortified establishment at Kotara, near Kuran in Khavada. Here they could easily reach from Sindh crossing through Biar Bet, Gainda Bet, Kuvar Bet and then through the narrow valley between Kala Dungar and Gora Dungar. They could cross a strip of Rann at Amarapur (about 6 km) and reach Kotadi again, a big Harappan fortified establishment, and from here cross the Rann and reach the present Rapar Taluka where a cluster of Harappan sites is now available, besides Surkotada which is another fortified Harappan settlement.

The route from Sujwal, Jati, Musafir Khana in Sindh and Lakhpat led to Desalpur and the route from Rahim-ki-Bazar to Luna and then to Desalpur, were also in vogue besides many other land routes crossing through the Rann could have also been in use. The most popular land route preferred by the Harappans seems to be one from Allahdino to Kotara and then to Kotadi and to the various sites in Surkotada in Rapar Taluka of Kachchha. Kotadi had a very strong Citadel to control and protect the eastward movements of the Harappans in Kachchha region. Thus it will be plausible to say that the Harappans used a land route and came to Kachchha and then also reached north Gujarat and Saurashtra from Surkotada after crossing the Little Rann (Joshi 1972).

Kuntasi

The ancient site at Kuntasi (Lat. 22° 45' N, Long. 70° 76' E), located about 2.5 km south-east of the present village in Rajkot district, was excavated jointly by Deccan College and State Department of Archaeology of Gujarat (Dhavalikar 1993, 1993a: 555-570 and 1996). The site is spread over an area of about 2 hectare on the right bank of River Phulki. The maximum cultural deposit at the site is about 7 m of which the lower 5.50 m represents Period I (the Mature Harappan Phase) and is dated to *ca.* 2200-1900 BCE (uncalibrated), the remaining belonging to Period II, Late Harappan, is assigned to *ca.* 1900-1700 BCE (uncalibrated). The excavators believe that this small Mature Harappan village was deeply engaged in inter-regional trade rather than agricultural activities.

Period I

A noteworthy discovery is that of a copper hoard in a small pot from one of the structures in the north (St 50). There were a few copper bangles, over a thousand micro-beads of steatite and two finger rings, which are unique as they have no parallel at any other Harappan site. Of the two rings, one is broken, but the other is intact. It has a large double spiral. The structure complex on the west consisted of several small and large rooms, some of them containing kilns and furnaces, storage areas and so on, clearly indicating that it was meant for manufacturing pottery, a variety of beads and possibly also copper artefacts.

Dhavalikar thinks that when the Harappans realized that there was a growing market in Mesopotamia for Indian luxury goods, such as carnelian and lapis beads, shell, ivory, etc. they soon started coming to Gujarat around 2200 BCE for acquiring these raw materials, processing them into finished goods and exporting them to West Asia by sea. The calibrated dates for this phase are in the range of *ca.* 2500-2300 BCE (Possehl and Raval 1989: 10-11). There is evidence to suggest that Early Harappans had some trading contact with West Asia in the first half of the 3rd millennium, which was probably mainly confined to agricultural products (Asthana 1985). But sometime about 2300 BCE, the enterprising Harappans found that there was also a sizable demand for other luxury items such as carnelian beads, ivory, copper, lapis lazuli, shell, and so on. Most of this raw material was abundant in western India. The obvious course for the Harappan entrepreneurs was to travel to Saurashtra to procure the raw material and process it into finished products for export. The west coast also offered harbouring facilities, which encouraged sea trade.

Padri

The village Padri Gohilni (Lat. 22°22' N, Long. 72°95' E) lies hardly 2 km from the Gulf of Cambay. It is roughly 8 km to the west of Talaja, and 50 km to the south of Bhavnagar town. The site of Padri is spread over an area of 7.15 hectares. This area falls in the semi-arid zone.

Explaining the rationale of excavating Padri, Shinde says:

> The reconstruction of the lifestyle of the Harappan civilization is based on excavations at sites like Harappa, Mohenjodaro, Kalibangan and Lothal. All these sites are large in extent and may be classified as urban or regional centres. However, there were many sites belonging to other categories such as agricultural settlements, processing centres, farmsteads, etc. that are poorly understood, leading to a biased reconstruction of the nature of the Harappan lifestyle. It has been recognized for a long time that a number of small sites of different categories need to be excavated systematically in order to produce a more realistic picture of all aspects of the Harappan civilization (Shinde 1992: 56-66).

Excavations at the ancient site revealed a two-fold cultural sequence: Early Historic (1st century AD) and Harappan (*ca.* 2200-1900 BCE uncalibrated). The total habitational deposit is 3.2 m of which the upper 1.2 m belongs to the early historic period.

Shinde thinks that there is a strong possibility that the main intention of occupying this site was the production of salt and its supply to other inland settlements. This hypothesiz is based on two factors. First, a large section of the present population of Padri and the nearby villages are engaged in full-time manufacture of salt. The second factor that can be considered to support this theory is the presence of a large number of storage jars. These jars could have been made exclusively to store and transport salt to different places as indicated by their superior quality and sturdiness.

Shinde assigned Padri to an Intermediate Phase, akin to Rojdi and Kuntasi in Saurashtra. The Intermediate Phase that precedes the post-Urban seems to be economically as prosperous as the earlier Urban Harappan Phase. The frequency of the perforated pots, leaf-shaped copper arrow-heads with two perforations and the examples of Harappan script are on the decline, and long parallel-sided chert blades which characterize the Urban Harappan Phase are almost absent in this Phase. The sturdy red ware, which characterizes Padri, has also been referred to as the Sorath Harappan Fine Ware by Possehl (1989) in terms of the ceramic assemblage from Rojdi. The sturdy red ware differentiates the Saurashtra Harappan ceramic tradition from that of Sindh and Panjab. From the mid levels of the Harappan Period, a considerable number of sherds of a new painted ceramic have been collected and named "Padri Ware" after the site. This ware is made of coarse clay and treated with a thick coating of red slip, which shows a tendency to develop cracks. It should be noted that there is a great deal of similarity between the Savalda Ware reported from such sites like Savalda (Sali 1964) and Kaothe (Dhavalikar et al. 1990) in the central Tapi basin and this ware from Padri. On the basis of a ceramic assemblage which is similar to that of Rojdi B and Kuntasi, Shinde dates Padri to 2200-1900 BCE (uncalibrated).

Of the three intact painted storage jars recovered from Padri, two were found to be decorated with the motif of a horned deity. The largest jar in the sturdy red ware is decorated with a linear human figure wearing a horned head-dress. The other jar in buff ware bears three motifs of a horned head-dress. Horned human figures and head-dresses were earlier reported from other Harappan sites like Kalibangan (Rajasthan, India), Mohenjodaro and Kot Diji (Sindh, Pakistan), but for the first time Gujarat has produced some significant evidence in this respect. The discovery of the motif of the horned deity suggests an early date for the Harappan culture at Padri, but the ceramic assemblage resembles that of Rojdi B, which has been dated to 2200-2000 BCE (uncalibrated). Perhaps the horned deity motif may be associated with the potter's religious beliefs.

Shinde reports two rectangular mud structures with low mud walls, possibly to prevent the rainwater from entering them. This is perhaps the first time that a rectangular mud structure has been uncovered in the Harappan levels anywhere in Gujarat. A number of other rural Harappan settlements like Kanewal, Zekda, Valabhi and Vagad in Saurashtra, subjected to small scale excavations by the M S University of Baroda, have produced evidence of circular mud huts. Two rectangular structures unearthed at Padri are similar to those found in the Chalcolithic levels in the Deccan, particularly in Inamgaon, in Poona district and Daimabad in Ahmednagar district, both in Maharashtra. Structure No. 1 was first noticed at a depth of 2.9 m in trench J2 beneath layer (7). It is rectangular on plan with low mud walls and post holes on the periphery, obviously to support the superstructure.

Shinde concludes that Padri has produced very interesting evidence in the form of rectangular mud structures, three unusually large painted storage jars and a new ceramic. On the basis of ethnographic parallels and other factors, Shinde thinks that the main function of this site was the manufacture of salt. Rectangular mud houses, painted pottery and the restricted use of copper were some of the characteristic features of the Deccan Chalcolithic culture. The discovery of rectangular mud houses and a circular domestic hearth with a pillar in the centre in one of them at Padri is yet another piece of evidence supporting close contact between the two cultures. The discovery of a small globular jar with a beaded rim and decorated with a panel of hatched diamonds at Padri assumes great significance in the light of the predominance of the same type and design in the ceramic assemblage of the Deccan Chalcolithic culture. The ceramic assemblage from the excavations at Kaothe in Dhule district, Maharashtra has revealed a high percentage (nearly 50 per cent) of material of Harappan tradition. The sturdy red ware of fine fabric found at Kaothe bears a strong resemblance to the Harappan black-on-red pottery from the adjoining Gujarat region. Shinde notes that the convex-sided bowls and globular jars with either beaded or clubbed rims were predominant types at Padri and most of the vessels were provided with either flat or disc bases. Shinde points out that the same features also characterize the sturdy red ware at Kaothe (Dhavalikar and Shinde 1989; Dhavalikar et al. 1990: 31-47). Kaothe being close to the border of Gujarat and almost falling in the peripheral zone of the Harappan empire, a considerable cultural influence is expected (Shinde 1991). Shinde therefore surmises that the Harappans, after the decline of their prosperous period, began to migrate to the Deccan around the beginning of the 2nd Millennium BCE. The discovery of a new ware at Padri and its close similarity with the Savalda Ware from the Deccan further indicates to close contact between the cultures of these two regions.

GUJARAT: OTHER RELATED SITES

The map (Fig. 4.16) shows the distribution of Harappan and other Chalcolithic sites in Gujarat. Like Central India and Deccan, the Chalcolithic cultures also flourished in various regions of Gujarat, though their contribution to the development of the Harappan civilization is poorly understood. Thanks to the studies undertaken by M.S. University, Baroda, Archaeological Survey, State Department of Archaeology, Deccan College and Pennsylvania University Museum in the last few decades, a number of Chalcolithic sites/cultures have been identified in different regions of Gujarat.

It is interesting to note that like Rajasthan, north Gujarat is dotted with Mesolithic sites and at a number of places, e.g. Loteshwar, Datrana, Santhli, Moti Pipli and others the non-Harappan or Chalcolithic people settled (Fig. 4.16). Chalcolithic sites in Gujarat are right over the Mesolithic deposit. These Chalcolithic sites are named "Anarta tradition sites", after the name of the region. They perhaps lived on rammed mud floors and used a variety of pottery, which includes black-and-red, reserved slip, fine red ware, buff ware, grey ware, gritty red ware, burnished red ware and burnished grey/black ware. Large and medium pots, small pots with constricted neck and bulbous body, bowls, basins, dishes and dish-on-stand are some of the common vessel forms of north Gujarat Chalcolithic. Sometimes painted decorations are executed in chocolate or black colour on the pottery. At some sites like Santhli, child as well as adult burials have also been found (Sonawane and Ajithprasad 1994). Recent studies have shown that the Anart Chalcolithic had independent existence in north Gujarat prior to the Harappan culture, as some of the sites have been dated around middle of 4th Millennium BCE. The evidence also indicates that even after the penetration of the Harappans in Gujarat, the Chalcolithic people continued flourishing at several sites during the mature and post-Harappan times. Ratanpura is an important site in north Gujarat, which has yielded pottery similar to Rangpur Period III and some pottery like Ahar.

Similarly Kachchha and Saurashtra have also yielded evidence of pre- or early non-Harappan sites and post-Harappan sites, which represent indigenous regional Chalcolithic traditions, for example Padri Ware, pre-Prabhas Ware, micaceous red ware, black-and-red ware and lustrous

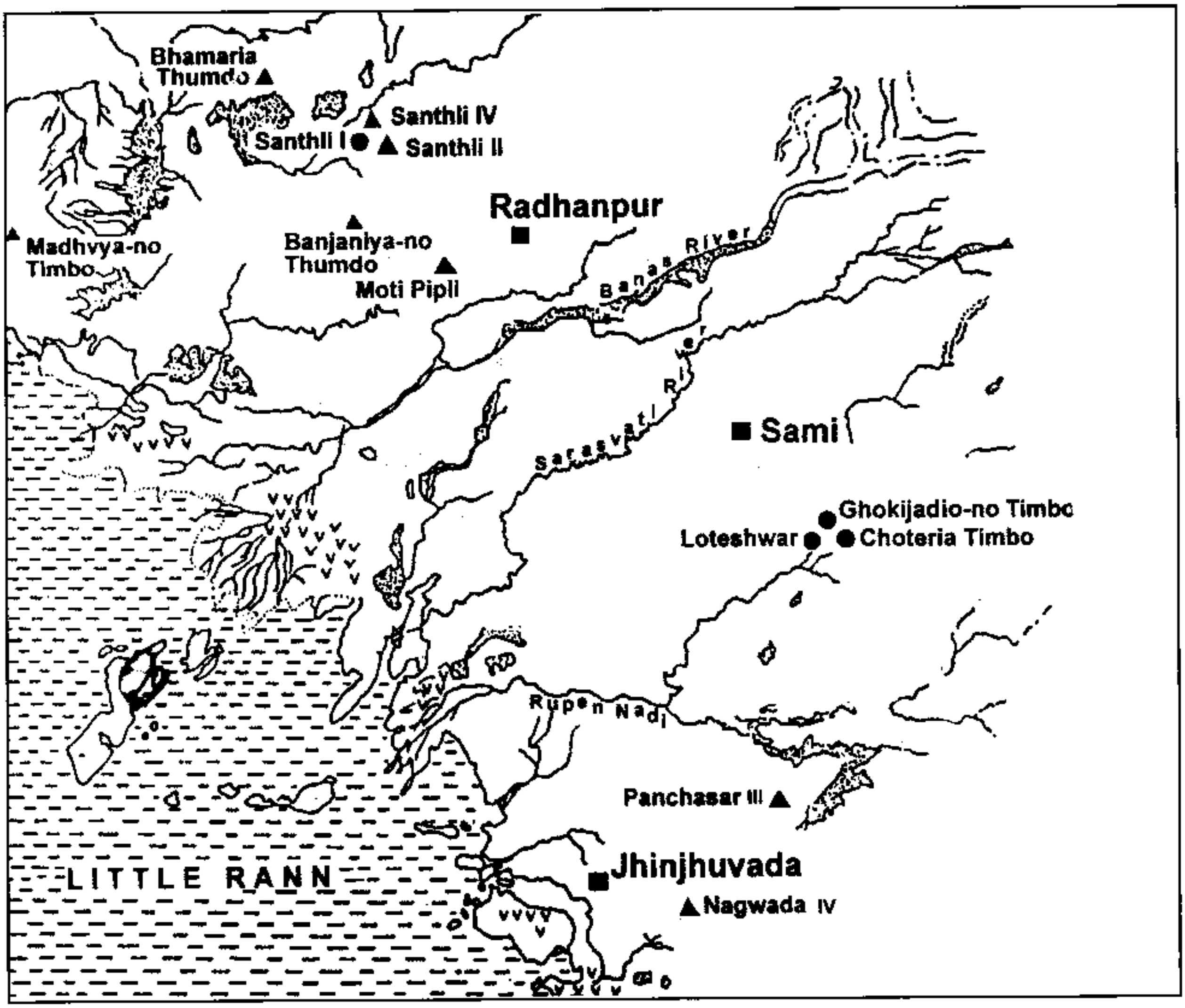


Fig. 4.16 Map of Gujarat showing late Harappan sites (courtesy Sonawane).

red ware. The lustrous red ware, however, found at a number of Harappan sites in Saurashtra has been assigned to the Late Harappan Phase. On the other hand, Shinde finds a lot of similarity between the Padri Ware of Gujarat and the Savalda Ware of Deccan. The role of these different Chalcolithic traditions should be studied to unravel the regional manifestations of the Harappan culture and also to determine the beginning of agriculture and domestication of animals in Gujarat.

Bagasra

Bagasra is being excavated by the Department of Archaeology, M. S. University of Baroda. The Department has been excavating this ancient site situated on the south-eastern shore of the Gulf of Kachchha in Maliya Taluka, Rajkot district, Gujarat, for the last three years with spectacular results. The excavations, so far, have revealed a fortified settlement spreading over an area covering approximately two hectares and believed to be an important trading centre of the Indus Valley civilization, contemporary to Dholavira in Kachchha and Lothal in Saurashtra. The massive 5 m thick fortification wall of the settlement was built of mud-bricks on a stone foundation and it was occasionally braced with large blocks of stone. The height of the wall, now completely concealed under the debris, varies from 3 to 5 m.

This well-protected settlement of the Indus civilization came up near the Gulf of Kachchha with a view to exploiting the easily available natural resources like marine gastropod shells (shank) and semi-precious stones of this area. Significantly, the economic set-up of this settlement was based on industrial production and trade of utilitarian and lapidary items like beads, bangles, pendants and inlays of shell, semi-precious stones and faience (a synthetic vitreous/glaze-like material formed by heating a mixture of powdered quartz with soda and some coloring agent). The excavation has revealed a large quantity of different varieties of semi-precious stones and large shells (shank) stored at different places within the walled area, indicating the importance of the above industrial products and their trade in the economy of the site.

The inscribed seal unearthed from the site could have played a role in authenticating commercial consignments. The seal is a small, 1.8 × 1.8 cm square steatite tablet bearing a two-letter inscription and the figure of a one-horned bull, popularly known as the mythical unicorn, engraved on it. In front of this animal, there is also engraving of a small standard-like device. The projected boss at the backside of this seal has a small hole for passing a thread. Several samples of clay lumps bearing stamped impressions of similar seals have also been recovered from the site.

Another important set of items possibly connected with trade recovered from the excavation were a few large, pear-shaped, black slipped jars which are believed to have been used by the Harappans for overseas transportation of goods. Some of these vessels bear graffiti in the Harappan script. Similar vessels have been reported from a number of 3rd millennium Bronze Age sites in the Oman peninsula. Clay matching analysis of the black slipped jars found in Oman by French archaeologists has indicated that these jars have their origin in the Indian sub-continent. Hence, the black slipped jar sherds discovered from Bagasra are a sure indicator of the trade contact of the Harappans with overseas Bronze Age settlements of the 3rd Millennium BCE, especially that of the Oman peninsula. Tapping the rich copper deposits of Oman might have been the major attraction for the Harappan interest in that region. A number of household copper implements and tools including heavy chisels, punch points, knives, and a hoard of copper bangles and a small axe in a copper pot were recovered from the site during excavation. Apart from the trade of industrial products, the economy of the settlement was also dependent upon agriculture, stock-raising and fishing. A good collection of fish remains including otoliths (the stone-like calcium carbonate concretions formed in the internal ear of bony fish) indicate that fish was one of the important food items of the Harappans at Bagasra.

Bagasra is located mid-way between Kachchha, Saurashtra and north Gujarat regions. This advantageous geographical position has helped the site to act as a conduit for the transportation of materials and movement of communities from one region to the other during the 3rd Millennium BCE. Therefore, the site was a meeting point for diverse cultural traits from all the three major cultural regions. The excavation in this year has also revealed late survival of the settlement up to about the first half of the 2nd Millennium BCE (1700 BCE) even after the decline of the urban Harappan centres by the end of 3rd Millennium (2000 BCE).

The descriptions of the following Harappan and Harappan related Chalcolithic sites of Gujarat is based on Sonawane (in press).

North Gujarat was extensively inhabited by the hunters-gatherers of Mesolithic Period. At sites like Loteshwar, Datrana, Santhli and Moti Pipli cultural remains of Chalcolithic Period representing non-Harappan and Harappan traits have been found in a well-defined strata above the Mesolithic occupation. Even after the emergence of Chalcolithic cultures, Mesolithic people continued to live in this area along with the Chalcolithic communities. Sonawane points out that until recently it was assumed that the earliest settled Chalcolithic communities were associated with the Mature/Urban Phase of the Harappan culture (*ca.* 2550-2000 BCE). However, recent excavations at Loteshwar in north Gujarat suggest that prior to the coming of the Harappans, this part of Gujarat was already inhabited by the regional non-Harappan Chalcolithic communities. Calibrated radiocarbon dates for this cultural phase from well-defined stratified levels at Loteshwar go back up to the second half of the 4th Millennium BCE making them earlier than the Harappans. The region of Kachchha and Saurashtra also revealed sites of a pre-Urban Phase of an indigenous regional Chalcolithic tradition with non-Harappan pottery types such as Padri Ware, pre-Prabhas Ware, micaceous red ware and black-and-red ware. A critical review of this pre/early non-Harappan Phase of Gujarat is available in Sonawane and Ajithprasad (1994: 132-36), and Bhan (1994: 77-78). Very little is known about its cultural interaction with the neighboring regions like Kachchha and Saurashtra and also about the origin and development of its early village farming communities. However, it played a vital role in the regional manifestation of the Harappan culture and refuted earlier claims of the mass migration of Harappans into this region during the Mature/Urban Phase (Sonawane in press).

Nagwada and Santhli excavations reveal an early penetration of Harappans in north Gujarat. The burial pottery does not show any similarities with the classical Harappan pottery, rather it resembles the ceramic forms from the pre-Harappan levels at Kot Diji (Khan 1965), Amri (Casal 1964) and Balakot (Dales 1974). Analogous pottery types have been reported from the cemetery at Surkotada. These too are comparable with pre-Harappan pottery of Sindh and Baluchistan (Joshi 1990; Possehl 1997). Stratigraphically the burials at Nagwada are found buried below the Mature/Urban Harappan levels. However, no distinct habitation deposit of the community who buried their dead is reported from these sites. Moti Pipli, another site in the same region, however, showed a substantial habitation deposit containing similar burial pottery but without burials. Similar pottery is reported from six more sites from the same region during the recent explorations. According to Sonawane, this similarity may signify that the elements of pre-Harappan culture of Sindh and Baluchistan extended southwards as far as north Gujarat when this region was already inhabited by the indigenous Chalcolithic communities.

The settlements of Mature/Urban Harappan Phase are few in north Gujarat, Nagwada I being the most important site of this phase showing most of the classic Harappan traits. Other sites like Nagwada IV, Zekhda and Datrana IV can also be included in this category although they incorporate only few type-fossils of the Mature Phase. At all these sites, non-Harappan elements dominate compared to the Harappan traits. It appears that the Mature Harappans penetrated north Gujarat basically to exploit the natural resources of the region. This resulted in an amalgamation of the cultural traits. The excavations at Nagwada I, Zekhda and Datrana IV demonstrated that they were also engaged in specialized craft production centres, like Nageshwar, Kuntasi, Bagasra and other coastal settlements of Saurashtra. Their location demonstrates that these sites were developed mainly for trade and access to raw material of specific commodities. Apart from these, a large number of sites belong to the post-Urban Phase comparable to Rangpur Period IIC and III category. Ratanpura and Datrana II are the only excavated sites representing this phase.

Sonawane thinks that, unlike the Indus Valley in Sindh, none of the rivers in north Gujarat allowed irrigation. Agriculture here is entirely dependent on dry farming techniques. As a result, a complicated picture emerges which shows the inter-related aspects of sedentism, pastoralism, hunting, craft production and many other diversified resource exploitation strategies. Sites in north Gujarat indicate a dispersed type of settlement pattern, in contrast to the linear-dendritic pattern of Saurashtra. While majority of the territorial Saurashtra sites are based on agrarian economy, western part of north Gujarat favored pastoral activities. The availability of excellent grassland, water, patchy appearance of thin cultural deposits and large frequency of animal bones suggest that the north Gujarat sites may have been seasonal camps involved in pastoral activities (Bhan 1992: 175-79). Thus, the settlement pattern shows a lack of standardization and homogeneity in its material culture during the post-Urban Harappan Phase. There was a decline in the material prosperity transforming the urban way of life into a rural one. As a result, the post-Urban Phase witnessed a process of decentralization and localization, giving rise to regional cultural expressions (Sonawane in press).

With this background, we can now describe the recent excavations of north Gujarat, mainly based upon Sonawane's reports.

Loteshwar

Loteshwar (23°36'N and 71°50'E), 17 km north-east of Shankheshwar in Mehsana district, lying half a kilometer east of Loteshwar village on the left bank of the Khari, a tributary of the Rupen, was excavated by the M. S. University of Baroda in 1991. The site, measuring 120 x 50 m revealed a habitational deposit of 1.65 m belonging to two cultural periods. Period I representing 1 m thick deposit lying directly on the stabilized sand-dune yielded a large number of microliths together with sandstone palettes, hammers and grinding stones. The microlithic tools include both geometric and non-geometric types made of chert, chalcedony, jasper, agate and quartz. Besides, small shouldered bone points and few prismatic red and yellow ochre crayons and two human burials constitute important material remains of this period. One of these burials was found placed in an extended inhumation position while the other was placed in a crouching position. A preliminary assessment of the rich collection of faunal remains indicates an abundance of a few wild species. Stratigraphically, the Chalcolithic deposit directly overlies the Mesolithic deposit without any break in the central (highest) part of the mound.

A solitary radiocarbon date on a charred bone sample from Layer 4 of the Mesolithic deposit suggests the beginning of microlithic tradition at the site to around 6th Millennium BCE.

The cultural deposit of Period II spread over a small area of 50 × 30 m is hardly 30 cm thick. These pits have varying dimensions from 0.50 m to 2 m in diameter and 0.50 m to 2 m in depth, filled with ashy soil, containing habitation debris including pottery, animal bones, terracotta lumps, etc. The significance of these pits has not yet been fully understood. The ceramic assemblage shows similarity with the non-Harappan pottery types reported from Nagwada and Surkotada. It represents the regional ceramic types of north Gujarat, termed as "Anarta Tradition" after the traditional name of this region, which is distinct from the Mature and Sorath Harappan pottery. In addition, black-and-red ware was also found at the site. Unlike Nagwada and Surkotada, Harappan pottery, terracotta triangular cakes and other typical Harappan antiquities are significantly absent here. Only a few sherds of reserved slip ware were found. Also found were steatite micro-beads, carnelian beads and crudely made bangles and beads of shell. The settlement appears to be very ephemeral. The faunal analysis has indicated heavy emphasis on the domestication of cattle, indicating a pastoral economy.

Two ^{14}C dates of charcoal obtained from Period II levels date back to around 3500 BCE. Evidently, it suggests that the Anarta Chalcolithic had its independent existence in north Gujarat prior to the Harappan culture.

Santhli

Santhli (23°54'N and 71°29'E) is situated about 20 km north-west of Radhanpur in Banaskantha district on a large stabilized sand-dune. It was excavated by the M. S. University of Baroda in 1994. The excavation revealed a total habitation deposit of 40 cm belonging to two distinct cultural periods. Period I belonged to the Mesolithic Period. The assemblage includes typical Mesolithic artefacts of both geometric and non-geometric microliths, made of fine siliceous materials, besides, a number of small pieces of flat sandstone slabs or palette-stones, which are generally associated with the Mesolithic assemblage in Gujarat. The meagre collection of finished artefacts and lithic debitage may be due to only seasonal occupation by the Mesolithic hunter-gatherers. The habitation debris, however, yielded a large quantity of skeletal remains of the animals, mainly bovines, hunted by the microlith using community. These bones are found as discrete clusters; the largest of such clusters had four such skulls piled together along with other bones. Therefore, the available evidence suggests that the site might have been used as a butchery and food-processing place by the Mesolithic folk. Apart from these, the other faunal remains included sheep/goat, gazelle, pig and equuid species (*Equus hemiones*?).

Period II has only a patchy Chalcolithic deposit directly overlying the Mesolithic debris. The deposit included a few sherds of pottery and bangles and beads of shell besides some stone objects. The most interesting finds are two extended inhumation burials placed in an east-west orientation with the head towards east. The first one is an extended joint/double burial of two adult individuals interred in the same pit. With the burials were found five pots, similar to the burial pottery at Nagwada. The second is a child burial associated with a few pottery vessels, similar to the first burial. Except pottery vessels, no other burial goods were found in these graves (Sonawane and Ajithprasad 1994:136).

Moti Pipli

Moti Pipli (23°49'N and 71°32'E) is situated about 10 km west of Radhanpur town of the Banaskantha district on a large stabilized sand-dune. Adjacent to the site there is a large inter-dunal depression known as Shakatari Talav. The excavation revealed a regular habitation deposit of 90 cm belonging to the Mesolithic, Harappan-affiliated Chalcolithic and historic periods.

Period I had a Mesolithic deposit of about 20 cm which yielded a number of microlithic blade and flake cores along with industrial debitage, besides a few typical Mesolithic tools like lunates, backed blades, points and scrapers. The tools were made of locally available chert, chalcedony, agate and jasper. No pottery was associated with the Mesolithic industry. Faunal remains were fragmentary..

Period II representing Harappan-affiliated Chalcolithic culture had a deposit of about 50 cm. There was no evidence of structural remains. A variety of different pottery types like fine red ware, buff ware, grey ware, gritty red ware, burnished red ware, burnished grey/black ware, burnished red ware, black-and-red ware and reserved slip ware comprised the major ceramic assemblage. Fine red ware and buff ware form the most important group. Important shapes in this group are large pots, dishes, dish-on-stand, beaker, large beaker-like vases with narrow mouth and bulbous body. A few of the fine red ware pots were treated with a cream or chocolate slip and painted with thick bands of chocolate or black pigments at rim and shoulder. In addition, some of the pots are treated with red pigment generally on a cream background, imparting a polychrome effect. Similar vessels are reported from the pre-Harappan levels at Kot Diji, Balakot and Amri. It is interesting to note that here they are associated with the habitation levels and not found as part of burials, unlike Nagwada and Santhli.

A few typical Harappan red ware and buff ware types were also recovered from these strata. There is a prominent presence of reserved slip ware. However, the Anarta tradition is more predominant at the site, in the form of gritty red ware and red ware. Large and medium pots, small pots with constricted neck and bulbous body, bowls, basins, dishes and dish-on-stand are some of the common vessel forms of these wares. Very often, these are decorated with thick bands and lines of dark chocolate or black colour at the rim, neck and shoulder. Invariably such decorations are executed on a cream background to get a bichrome effect. Similar pots are met with in the burnished grey/black ware and burnished red ware of the same ceramic tradition. The black-and-red ware is another indigenous ceramic tradition of Gujarat. Very few sherds of bowls of this ware were noticed here. All the above types are common at many of the Chalcolithic sites in north Gujarat.

Other important antiquities of this period are a copper/bronze nail, a fish hook and a folded tip of copper, a number of long parallel-sided chert blades of Rohri origin and ornamental beads of agate, lapis lazuli, steatite and faience. The collection also included shell bangles and beads, biconical and spherical terracotta beads decorated with delicately incised lines or dots, terracotta pellets, two or four pinched clay lumps, *mushtikas*, moulded terracotta triangular cakes, spindle whorls and scrapers. Faunal remains include cattle, sheep/goat, deer and pig.

Datrana

Datrana (23°46'N and 71°07'E) is a small village situated about 8 km north-west of Santhalpur town of Banaskantha district. There are ten distinct clusters of the Harappan-affiliated Chalcolithic settlements around Datrana. Datrana was excavated by the M. S. University of Baroda.

Datrana IV

Datrana IV is located about 1.5 km on a large crescent-shaped fossil sand-dune. The excavated area revealed a total habitational deposit of about 90 cm belonging to two distinct cultural periods.

Period I – Mesolithic : The lithic assemblage includes crudely worked micro-blade cores, sandstone palettes and small backed tools like lunates, triangles, trapeziums, blades, scrapers and points, mainly made on chert. Overlying the Mesolithic deposit is the Chalcolithic (Period II) stone blade industry, though there is no stratigraphic break between the two. The Period II is characterized by long blades, made on fine chalcedony. The assemblage incorporates hundreds of crested ridge blades and cores including different types of backed blades, points, truncated blades, large size crescents, burins and simple long blades. Some of the blades show a very heavy inverse retouch. In addition to chalcedony, agate, jasper and chert was also used. A few characteristic long parallel-sided chert blades of Rohri origin also make their presence.

A bronze punch-point was also found, which might have been used for detaching blade flakes from the prepared core. It is a small squarish prism-like tool measuring 2.8 cm in length, having a thickness of 0.5 cm. The broad blunt end might have been used as a working end after hafting it into a socketed wooden handle, like a punch, for removal of blades by indirect pressure-flaking method.

A few cylindrical and small disc-like bead rough-outs in carnelian with perforation, and a few with tell-tale marks of attempted perforation, small tanged chert drill-bits and sub-cylindrical drill-points in banded agate were also found.

Besides a few sherds of the typical north Gujarat regional pottery types, like gritty red ware, the ceramic assemblage includes a few unique wares like the burnished grey ware and the burnished coarse grey ware with a thick grey/black slip. These vessels are handmade and show panels of thick, obliquely impressed lines all over the body, set in between two lines of similar character. These incised/impressed lines are drawn on the burnished surface of the pot by using a smooth rod with a blunt, flat end. A few black-and-red ware sherds showing a similar decorative feature at the rim with distinct shapes are also part of this assemblage. There is also a type of red ware with a corrugated/ribbed surface. Occasionally, sherds of the burial types recovered from Nagwada and Santhli have also been found associated with them.

These artefacts are found in discrete clusters within the excavated trenches in association with heaps of animal bones. Many of these clusters include unworked nodules, hammer stones, fragments of copper tools and other artefacts. A large number of animal bones, antlers, teeth and fish vertebrae were collected from this deposit. Cattle, sheep/goat, antelope and pig are the important animals identified in the faunal collection.

Datrana V

The Mound V at Datrana is located about 300 m north-east of Mound IV. Here, the total cultural deposit varies from 70 to 90 cm belonging to two Periods: Mesolithic and Chalcolithic.

The Mesolithic assemblage of Period II includes a large number of geometric and non-geometric tools along with lithic debitage apart from hammer stones, flat sandstone palettes, red ochre crayons with facets, and a few fragmentary bones, horn-cores and teeth. The Mesolithic artefacts including the raw material are comparable with the Mesolithic assemblage unearthed from Datrana IV.

The Chalcolithic Period II lies over the Mesolithic deposits. It has revealed two large pots, intact up to their body part from the base, and also a number of sherds of similar to the burial pots from Nagwada and Santhli. Besides these, except long chalcedony blades, no worthwhile artefacts of the Chalcolithic Period were unearthed during the excavation.

Datrana II is located about 1 km east of Datrana Mound IV and about half a kilometer south-west of the village. It is a stabilized sand-dune flanked by two inter-dunal depressions covering an area of about 50 × 40 m. However, the evidence of the Chalcolithic occupation at the site is patchy and probably confined to the southern slope of the mound. Interestingly, habitation deposit in all the three clusters is confined to pits of different dimensions. A few of them measure a maximum of 2 m diameter and also depth, while the smaller ones measure hardly ½ m both in diameter and depth. Some of these pits were in fact served as pottery kilns. These pits have yielded a rich collection of pottery, most of which belonged to Sorath Harappan pottery of Rojdi A and B type, made of finely elutriated clay and uniformly well baked, painted with typical bull figures and other usual designs. One of these pits has yielded a number of lustrous red ware bowls, dishes and a neck of a corrugated vessel, typical of the post-Urban Harappan sites of Saurashtra; while most of the pottery recovered from other pits are of gritty red ware and fine red ware representing the regional Chalcolithic ceramic tradition of north Gujarat.

However, the most interesting find is the discovery of a pottery kiln, stocked with Sorath Harappan pottery types, especially pots/jars, basins, bowls and dishes. These features, therefore, suggest that the site might have been a pottery manufacturing centre, although, no evidence of habitation structures was unearthed within the excavated trenches. The pottery types reported from Datrana IV are not found in any of the trenches dug at Datrana II. Therefore, it seems these two mounds are chronologically well separated and the occupation at Datrana IV seems to be much earlier than Datrana II.

Nagwada

Nagwada (23°20'N and 71°41'E) is an important Mature Harappan settlement situated in Dasada Taluka of Surendranagar district, close to the eastern margin of the Little Rann of Kachchha. A shallow stream, the Vonkali, drains the area. To its north-east is a large inter-dunal depression that accumulates monsoon run-off, which could have served as a source of potable water. The M. S. University of Baroda excavated the site from 1986 to 1990. The site measuring 140 x 110 m has a 1 m deposit with four structural levels. The single period occupation is divided into two distinctive phases.

Period IA has hardly any substantial deposit. Structural remains are indicated by a few post holes and rammed mud floors. Four symbolic pot burials and two extended inhumation burials with pots, lying in the east-west direction, belong to this phase. Of these, five burials show a close affinity with the pottery found from pre-Harappan levels at Kot Diji and Nal, while one urn burial reflects the local style. The pottery types of first category are not met within any of the later habitational deposits at the site. One of the symbolic pot burials contained ten intact pots. The burial ceramics include dish-on-stand, dish, beaker, bowl, disc-based globular jars and short-necked globular medium-sized vessels. It appears that the Pre/Early Harappan settlements of Sind and Baluchistan extended further south into the north-western part of Gujarat, prior to the beginning of the Mature Harappan Phase.

Period IB comprises the upper four layers with artefacts of the Mature Harappa culture. The mud-brick sizes show the standard Harappan ratio of 1:2:4 (8 × 16 × 32 cm and 7 × 14 × 28 cm). The brick masonry consisted of alternate layers of headers and stretchers (English bond), using mud mortar. The exposed structures are rectangular, except for a semi-circular one, with a uniform thickness of 65 cm. One of the independent rubble structures measured roughly 6.6 × 4.4 m, while other brick structures measured 6.6 × 5.1 m.

The ceramic repertoire at Nagwada has both the Harappan and non-Harappan types. Though the classical Mature Harappan types in fine red ware, buff ware and chocolate-slipped ware were few, they are represented by the typical painted natural and abstract decorations and standardized vessel-forms like the 'S' profile jars, perforated jars, beakers, dish-on-stand, large storage jars, medium-sized disc-based vases, bowls, basins and even typical miniature vessels. Gritty red ware, dominating the ceramic assemblage, and white painted black-and-red ware represent the indigenous non-Harappan Wares. Gritty red ware is distinctly different from the Harappan Wares, in its form and the use of pigments for decorative design. The ceramic assemblage recovered from the lower levels show more ornate and intricate patterns. Other pottery types found at the site include Reserved Slip Ware, Coarse Red Ware and Incised Grey Ware.

The most significant contribution of the Nagwada excavation is that it clearly demonstrates the manufacture of a variety of stone beads and shell objects here. Although no industrial workshop was found, a variety of evidence indicates that beads were manufactured here. The occurrence of raw materials such as chert, agate and amazonite; fine-grained stone nodules and their bladelets and blades; mostly unretouched variety of bead rough-outs and blanks; stone hammers and polishers; disposed defective beads and broken beads; a large number of well-polished, finished semi-precious stone beads are definitive indicators of the local lapidary industry. The other indicators of stone bead industry are a large number of micro drill-bits of chert and a few tubular drills of ernestite. Among the semi-precious stone beads of carnelian, agate, amazonite and lapis lazuli obtained from Nagwada, etched carnelian beads (eye beads of typical Indus origin) are most striking. It seems steatite micro-beads, faience and shell beads were also produced here. The islands of the Little Rann are known for their rich semi-precious stone deposits, especially the Mardak Bet.

Nagwada has also yielded small hemi-spherical gold caps for covering the ends of the semi-precious stones for use as pendants. The Nagwada jewellers made necklaces using colorful stone beads and gold caps; perhaps to cater to the needs of the urban elite of the Harappan towns.

Nagwada was also engaged in the production of shell objects, though it appears that only cutting and polishing of shell objects was carried out at the site. Primary dressing of gastropods was not done here. The most common shell products were the bangles produced from *T. pyrum* gastropods. Finished shell bangle pieces were invariably decorated with the typical chevron motif. Beads and pendants form other shell ornaments. Waste fragments of shell were recycled to produce a variety of tiny, flat, geometric forms as inlay pieces. The most fascinating was the discovery of a spherical object decorated with six sets of concentric circles. *T. pyrum* and *C. ramosus* might have been easily procured from the shallow bays of the Gulf of Kachchha by the Nagwada shell workers.

Other important antiquities recovered from Nagwada include a variety of gold and silver ornaments; copper implements and ornaments like celts, chisel, saw blade, knives, bangles, beads and pendants; cubical weights of agate; inscribed clay sealing; long parallel-sided chert blades of Rohri origin; terracotta female figurine with embedded steatite beads; triangular cakes; toy cart frames and wheels and bone points, along with several other household objects. Most of these artefacts show the typical Mature Harappan style.

The domestic animals at the site included cattle, sheep and goat, forming more than 60 per cent of the total faunal assemblage at the site. Wild animals exploited here are represented by 12 different taxa. Among these, sambar, chital, black buck, gazelle and pig are more common while nilgai is rare. The bones of wild ass are also suspected in the faunal collection. Bones of hare, hyena, camel and fowl are also recovered in small quantity.

Radiocarbon assay of a single charcoal sample collected from the site has given a date of *ca.* 2100 BCE (calibrated).

Zekhda

Zekhda (23°40'N and 70°20'E) is another important Harappan-affiliated Chalcolithic settlement situated about 7 km north of Varahi town of Banaskantha district, spread over an area of about 600 x 200 m with four distinct artefact concentrations. The excavation carried out here by the M. S. University of Baroda in 1978 revealed a habitational deposit varying from 0.5 m to 1.5 m in depth, though the actual mound is 3 to 4 m high from the surrounding ground level. At Zekhda also Harappan and non-Harappan pottery types were found mixed throughout the habitation strata with Harappan ceramics in a minority. The excavated assemblage compares well with the Nagwada material obtained from Period IB deposit. Though Zekhda revealed most of the diagnostic artefacts of the Mature Harappan Phase, unlike Nagwada, it had only simple circular mud hut floors with post holes. It seems that some portion of the settlement was occupied during the post-Urban Harappan Phase. Zekhda also perhaps was involved in craft production using marine gastropods and semi-precious stones. The most interesting is the discovery of two small clay pots containing approximately 34,000 steatite micro-beads and two gold beads found carefully buried underneath in one of the circular hut floors.

Ratanpura

Ratanpura (23°28'N and 71°48'E), one of the post-Urban Harappan settlements on the Rupen estuary, is situated about 5 km south of Shankheshwar in Sami Taluka of Mehsana district. A large depression seen on the eastern side of the mound might have served as the main water source for the settlement. The site was excavated by the M. S. University of Baroda in 1985. The entire mound measuring 500 x 250 m (12.5 hectare) has revealed four distinct localities with two cultural periods.

Locality III with an area of about 90 x 90 m is strewn with exploited faunal remains and lithic materials. The excavation had revealed a thin cultural deposit of 5 cm with a lot of chipped blades, lunates and points together with debitage of the microlithic industry, made of chert, chalcedony, agate and jasper. The faunal remains revealed nearly 60 per cent of domestic species, with a high frequency of sheep/goat followed by cattle and buffalo. Among the wild animals were chital, sambar, black buck, chinkara, nilgai, Indian boar, camel and wild ass. It seems that before the Harappans came here, this portion of the mound was occupied by the Mesolithic hunting and gathering community.

The other three localities were subsequently inhabited during the post-Urban Harappan Period. The lower two strata yielded circular huts marked by post holes, while the upper one was devoid of such well-laid structures. Mostly circular pits characterized Locality IV. These pits appear non-religious in their use and were filled with ash, terracotta lumps, charred and uncharred bones, besides the ceramic types of the post-Urban Harappan Phase. The most distinctive types at the site are lustrous red ware, fine, medium and coarse black-and-red ware, red ware, buff ware and cream slipped ware. The shapes and decorations of the lustrous red ware and fine black-and-red ware show affinity with the pottery reported from Rangpur Period III. Besides pottery, a number of pestle stones, saddle querns, variety of terracotta objects and ornamental beads of carnelian, steatite, shell and terracotta were recovered. Of these, the most noteworthy finds are stamped clay lumps bearing the intricate circular geometric designs. These enigmatic objects formed a special feature of Ratanpura since none of the Harappan-affiliated Chalcolithic culture sites recorded such decorated clay lumps. The occurrence of chocolate colored tan slipped ware, buff ware and cream slipped ware at Ratanpura indicates that the post-Urban Harappan Phase of Gujarat had developed contacts with cultures related to Period IC of Ahar.

The small size of the settlement with thin and patchy cultural deposits and high frequency of animal bones suggest that Ratanpura was a temporary or seasonal camp site involved in pastoral activities.

Maharashtra

Kaothe

Spread over an area of 30 hectare, the site is situated (Lat. 21° N, Long. 74° 18′ E) on the left bank of River Kan, a tributary of the Tapi, about 50 km west of Dhule city in Maharashtra. The land surrounding the site is in moderate relief which consists of a valley, flat, pediment surface and residual isolated hills in the form of inselbergs. The region around Kaothe lies within the Kan-Panjhara Doab. The site was excavated by the Deccan College, Pune, under the direction of M.K. Dhavalikar.

Dhavalikar et al. (1990) report that the principle objective in undertaking large-scale excavations at Kaothe was to learn about the material remains of the people of the Savalda culture. The culture thus far could be distinguished only by its distinctive painted pottery. A couple of houses of the Savalda culture were also exposed in the course of excavation at Daimabad (Sali 1986), where its chronological position could be determined. Underlying the Late Harappan at Daimabad, the Savalda culture has been assigned to *ca.* 2200-2000 BCE (uncalibrated) indicating that the Savalda people were the first farmers of Maharashtra. On the basis of a single radiocarbon determination for Kaothe (3870 BP, i.e. 1920 ± 90 BCE, uncalibrated) they assign a time bracket of *ca.* 2000-1800 BCE, but they feel that it could go back further. Shinde reports that the ceramic assemblage from the excavations at Kaothe in Dhule district, Maharashtra, has revealed a high percentage (nearly 50 per cent) of Harappan vintage artefacts.

As Kaothe was spread over an area of 30 hectares, they inferred that perhaps it was the most flourishing phase of the Chalcolithic Period in Maharashtra. But the occupational debris was very flimsy with an average thickness of about 50 cm. However, they discovered many new significant features of the Savalda culture.

They found a number of pits, some used as dwellings and others for ancillary purposes. The pits formed clusters and each cluster consisted of a dwelling pit, kitchen pit, storage pit, poultry pit and so on. All these pits were quite shallow, their depth ranging between 15 to 30 cm and a majority of them were quite small in size. There were no post holes along the periphery, save in one house, and there was no evidence of a well made floor in any pit. The occupation was evidently very flimsy and this is also corroborated by the hearths which appeared to have been used only for a brief period. The evidence points to the site being occupied only seasonally. Perhaps periodically the people shifted the location of their dwelling pits. This explains the large area of the settlement and it is only because of this shifting habitation that the entire site shows traces of settlement. It is almost impossible to think of the entire site occupied by the people at a given point of time. In that case Kaothe would have been the most extensive early farming settlement in Maharashtra.

The excavators' inference that the site was inhabited only seasonally is based on the flimsy nature of occupation and the make-shift pit-dwellings, without floors and post holes, and also on modern ethnographic parallels. The pastoral nomads of Maharashtra such as the Dhangars who keep large herds of sheep and goats and the Gopals who are cattle breeders locate their settlements in open areas near villages. Their dwelling huts have a sloping roof of thatch resting over a network of sticks which are secured in a bunch at the top. The area covered by this roof is the floor of the hut which is never well made. Similarly there are no post holes around the floors. These huts are occupied during the four months of the rainy season from June to September. The Kaothe pit-dwellings would not have looked much different from the temporary huts of the present-day pastoral nomads.

The dwelling pits at Kaothe probably were occupied during the rainy season. This inference is based on the evidence of charred seeds of *bajra* (*Pannisetum typhoides*) which has been found in the course of excavation. Bajra is sown at the beginning of rainy season and is harvested after 120 days, in the month of October. The Savalda people therefore must have lived at the site only during the monsoons when they cultivated bajra. Incidentally, it may be noted that the earliest evidence of bajra so far comes from Rangpur (Surendranagar district, Gujarat) where it occurs in Period III, dated to ca.1200-800 BCE, uncalibrated (Possehl 1989:175). The evidence from Kaothe takes back the antiquity of bajra to the beginning of 2nd Millennium BCE.

Kaothe has also yielded evidence of five human burials. Two of them are of adults whereas three belong to infants. They were buried in a dug pit in a supine posture, oriented north-south.

The Savalda people at Kaothe do not appear to be a sedentary community, but perhaps were semi-nomadic. They seem to have practiced incipient agriculture. Their economy was based more on stock-raising, subsistence agriculture and hunting-fishing. Hunting seems to have played a very important role in their life. This is evident from the variety of wild animals represented in the animal bone repertoire from the site. In fact, they claim that no other Chalcolithic site in Maharashtra has yielded such a range of wild animals as Kaothe. Among the animals hunted, mention should be made of black buck, four-humped antelope, sambar, chital, hog deer, barking deer, wild boar, hare, etc. All these animals are found today also in the nearby forests. It is interesting to note that a majority of bones of wild animals occur in the eastern part of the habitation, whereas there is a preponderance of bones of domestic animals, more particularly cattle, in the central part. This may indicate a heterogeneous composition of the occupants of the site. The evidence of fishing is available in the form of bones, as also from the painted motifs on the pottery. The occurrence of bone tools in great profusion is also indicative of the preponderance of animal foods in the diet of the Savalda people. Among the bone tools, the most numerous are points and punches followed by scrapers and chisels. The depictions of arrows on painted pottery suggest that they may be fish harpoons. Bone points occur in good number.

The Savalda culture at Kaothe is marked by a profuse occurrence of bone tools and a conspicuous absence of stone tools. It is a bit intriguing that the blade-flake industry of siliceous material (like chalcedony) which is so characteristic of the Chalcolithic cultures of Maharashtra should be totally absent at Kaothe in spite of the abundance of raw material at the site.

Compared to the succeeding Malwa and the Jorwe cultures, the material equipment recovered from Kaothe suggests that the people were comparatively much poorer. For example, there are only a few paste beads and fewer still are the shell bangles. They could not afford the use of copper or perhaps they found bone tools more effective. The overall economic poverty is also reflected in their burials which were devoid of burial goods. Though the Savalda Ware is beautifully painted, most of the pottery is handmade and is coarse in fabric. The forms too are limited to bowls and *lotas*. Anthropometrically the people betray combined characteristics of the Mediterranean and Proto-Australoid populations (Dhavalikar et al. 1990).

Daimabad

South-east of Gujarat, Daimabad is located in the Godavari Valley, Maharashtra. In this valley more than twenty Late Harappan settlements have so far been found in clusters; only Daimabad is an isolated site. Daimabad has become famous for many controversies. Earlier it was identified as a Chalcolithic site; later on it was branded a Late Harappan site, hence its inclusion here. Near the site were discovered a hoard of massive bronze images, which some scholars have assigned to the Late Harappan Phase, an identification I have contested. A hoard of massive copper animal figures of a rhinoceros, an elephant, a buffalo and an ox-driven chariot ridden by a man, all mounted on wheeled platforms, was accidentally discovered at Daimabad, but not from the systematic excavations. Some scholars assign these bronze findings to the Chalcolithic or Harappan Phase. Each object however weighs several kilograms (up to 29 kg!) and to use such a quantity of metal for non-utilitarian artefacts seems unaffordable for a poor Chalcolithic culture. Moreover, unlike the ornate and massive Chinese examples the metal objects of the Harappans are tiny and entirely utilitarian; such massive quantity of bronze is therefore totally out of character of the Harappan assemblage, more so of the Late Harappan as it was a poorer and degenerated phase. Therefore it is quite doubtful whether they belong to any Chalcolithic or the Late Harappan culture of Daimabad, and may be only of historical age.

The wheel-turned Late Harappan ceramic assemblage from Daimabad excavations is characterized by the red and grey wares. The red ware is treated with dull or bright red slip, though the classical Harappan fabric and levigated clay are absent. The common shapes include a variety of dish-on-stands, vases and storage jars. At Daimabad three main wares have been identified: sturdy red ware, burnished grey ware and thick coarse ware (Sali 1986:221-47).

Their houses were made of mud and mud-bricks and were rectangular on plan. A circular hearth from the house no. 16 at Daimabad was 50 cm in diameter and 10 cm in depth. The discovery of terracotta seals from these levels is quite significant. Many houses were found interconnected and hence the excavator believes that this complex belongs to a merchant (Sali 1986:25). The largest house was 6.3 × 6 m in area. An adult grave was found within the habitation area, which is quite unlike the Harappan tradition. However, this kind of disposal of dead was practiced by the Deccan Chalcolithic cultures. The grave pit was prepared by ramming brickbats and gravels. The entire pit was plastered with lime and clay and lined with bricks ranging from 32 × 16 × 8 to 28 × 14 × 7 cm (in the typical Harappan ratio of 4:2:1). The male skeleton is oriented north-south, with head towards north.

The Late Harappans of Gujarat were forced to live a pastoral life due to sharp deterioration in climatic conditions around the beginning of the 2nd Millennium BCE. But the pastureland of the Tapi and the Godavari valleys were perhaps ecologically more congenial than Gujarat and attracted them to settle down there. Possibly from Bhagatrav, a Harappan settlement on the Maharashtra border, they started moving towards the Tapi through Songarh Pass (Dhavalikar 1979: 248), in Maharashtra. Two of their settlements, Shetgaon and Chikhali, are found on the banks of Nesu, a tributary of the Tapi. It appears that they were migratory camps. Shinde (1998:20) writes, 'from the Kan Valley some people moved towards the north Dhule district and established large settlements at Prakashe, Khaparkheda, etc.' Most of the Late Harappan settlements in the Tapi basin have been identified on the basis of surface examination. The pottery generally resembles Rangpur IIC of Gujarat (Shinde 1998: 21). However, we do not know whether the Late Harappans actually migrated to the valleys of the Tapi and the Godavari or the pottery at these sites is a result of cultural contacts. The picture will remain obscure till most of the reported sites are re-examined.

From the actual excavations, the copper artefact repertory includes a fragmentary copper celt, a pinhead, and a fragmentary knife. This poor copper assemblage is quite pale in comparison to the massive Daimabad bronzes. Also reported are terracotta animal figurines of dog and bull.

5

Architecture and Hydraulics

ARCHITECTURE

Gordon Childe had identified monumental architecture as one of the criteria of urban status of a culture. Except for some buildings like the granaries, the Great Bath, or the dockyard of Lothal there is not much in the Harappan cities which could be called monumental in proportions. With the culture spread over a million sq km, dealing with the architecture of the Indus civilization is a daunting task. We can only discuss it briefly here.

In the initial years of discovery, what impressed scholars were its uniformity, standardization, similar town-planning, burials, etc. But more work on more sites brought out tremendous variations, though within the same basic theme. For example, we found that baked brick is not really the hallmark of the Harappan cities, except for Mohenjodaro. Each city seemed to have its distinguishing town-plan. There was so much of funerary variation. There were unique structures like the so-called dockyard of Lothal and the Great Bath of Mohenjodaro. The great variety of female terracotta found in Sindh disappears in other areas. Similarly, the basic town-plan seemed to be based on a grid pattern but one finds many local improvizations on this plan. Before we proceed further, we may like to examine some of these variations in the Harappan architecture.

Was it Always the Grid Town-Plan ?

The best examples of Mature Harappan grid town-planning are Mohenjodaro (in Sindh), Kalibangan (in Rajasthan) and Nausharo (in Baluchistan). While there is an overall sense of planning at Mohenjodaro, the settlement does not seem to be perfectly organized. First Street (7.6 m wide) and Second Street (9.1 m wide) run north-south through the Lower Town. The east-west streets are a bit more problematic. Central Street (5.5 m wide) is the northern east-west thoroughfare in DK-G area. It is certainly a wide, straight street, but it terminates at the First Street, where it runs into a building wall. Eleven m to the south of the Central street, another wide street joins the First. This is Dikshit's Trench E. It is 3.8 m wide, on par with the Central. Piggott and Wheeler in their reconstruction of the grid town-plan ignore Mackay's Central Street and place the principal east-west axis in the northern part of the site at the bottom of DK-G.5. It was excavated only on the northern side, so we are not even certain that it is a street. There is a rough alignment between this feature and a street (9.1 m wide) in DK-C Area, 245 m to the east. But the street in DK-C is only exposed for 55 m and seems to dip to the south, and not head straight across the mound toward DK-G. In fact, the DK-C Street might be a byway internal to the local neighborhood. Possehl points out that there is very good evidence for First Street, a main north-south thoroughfare in the Lower Town at Mohenjodaro. The evidence for Second Street is thin, a possibility but not quite proved. The southern east-west street is unexcavated, but it is a possibility. The northern east-west street, Central and Trench E, or the street at the southern edge of DK-G south, can be debated but not proved. Inside the major blocks the streets are not well aligned (Possehl 2002: 99-109).

The regularity in the layout of Mohenjodaro is manifest, though far from perfect. The regularity itself suggests that the founders of this city started with a clean slate, virgin soil, on which they began the construction of their metropolis.

How Extensive Was the Use of Baked Brick ?

There is a general impression that all ancient Harappan cities were built of baked brick, though only at Mohenjodaro baked bricks were used far most extensively. At Harappa though there is good evidence for baked brick, even in some houses, there is a great deal of mud and mud-brick construction. Sometimes both baked and unbaked bricks were used in the same building, as in the granary at Harappa. In most of the Harappan towns baked brick was generally used for drains, wells, bathing platforms, husking floors, etc. as evident at Harappa, Chanhudaro, Kot Diji, and Kalibangan. Basically baked bricks were used where there was fear of erosion through water or wear and tear due to hard use. There is no baked brick at Rojdi or the other Sorath Harappan, or the Kulli sites; nor has the westernmost Indus site of Sutkagendor any baked brick. At Dholavira and Surkotada, instead of baked brick they have used stone which was abundantly available there. The houses, walls, and drains were constructed of stone.

The Harappan Layout of the Cities

Generally Mohenjodaro was considered the model of town-planning, with an acropolis to the west, separated from the Lower Town meant for the common people. But most Mature Harappan town-plans were different from Mohenjodaro. For example, Allahdino, Amri, Banawali, Dholavira, Lothal, Rojdi, Surkotada, Ropar and Hulas, had their own distinctive plans. We know that Harappa had pre-Harappan beginnings by the time the Indus civilization began, and this would have probably constrained the would-be civic planners there. At Harappa there is an acropolis to the west, but there is also an important part of the city to the north of the acropolis, called Mound F, with the granary and husking floors. The other mounded parts of the city (mounds E and ET) were built out from the southern end of the A-B Mound, like the lower extension of letter 'L'. The pattern is not evident at Chanhudaro, which is simply a set of three mounds separated from each other. Dholavira has the acropolis near the middle of the enclosed settlement, and has both Lower and a middle towns. Only Kalibangan resembles Mohenjodaro in its layout. As pointed out by Possehl, out of some 1,050 Mature Harappan sites there are only two – Mohenjodaro and Kalibangan – that resemble each other.

Platforms

Though we know that the Harappans built Mohenjodaro on virgin soil, the choice of the site is a bit enigmatic, as they located it on the floodplain of a tremendously powerful, violent river. Serious flooding of the Indus River in historical times has been recorded every five to seven years. The selection may have been partly influenced by the convergence of riverine and land trade routes, as discussed in the chapter 9. Perhaps they had some economic or religious compulsions in the selection of the site. So they had to find some solution to the problem of floods. Mohenjodaro was therefore built on platforms to raise the buildings and streets above the floods.

Jansen asks,

Why was Mohenjodaro built exactly there, in the active alluvial Indus plain with such enormous efforts? If it was not primarily the fertility of the inundation which made the Indus people to settle so close to the river itself what else could have been the reason for such an extraordinary (and very expensive!) effort?

Jansen thinks that

the urban layout of Mohenjodaro does not point towards an agricultural settlement, it seems much more to have been a centre of coordinative administration. The round-the-year availability of the Indus as a water transportation way by boat enabled permanent access, especially during the inundation period, to the entire river system with its tributaries and to the entire coastal zone of the Arabian Sea. The extraordinary desire for expansion of the Mature Harappan Phase, especially in the direction of Saurashtra and along the Makran coast, are characteristic of this period. For the selection of the locus of Mohenjodaro the crossing of two transport systems must have been responsible: the water system of the Indus itself and the west-east land route from the Quetta Valley (Mundigak and further on to Mesopotamia) along the Bolan River to Kot Diji and the western Nara. At Kot Diji, for example, the richest flint mines of the Rohri Hills were long exploited. Jansen says that if this hypothesiz is true, then the Indus civilization was controlled from Mohenjodaro primarily by means of water transport (Jansen 2002: 105-128).

Coming back to the specific question of the platforms, Jansen (1993, 1994) sees four principal functions for platforms in the Harappan context.

1. Foundations, or substructures, for building areas, as in the case of the mound of the Great Bath.
2. Foundations, or substructures, for single buildings.
3. Substructures for elevating single buildings, in whole or part, as in House 1 in HR-A area.
4. The often complete infilling of older, abandoned structures to form a new occupational level and surface. This was found in virtually all the older houses at Mohenjodaro.

Possehl suggests that we are dealing with a rather small time gap of not more than 80 years around 2400 BCE where all these elements must have been developed, most probably not in Mohenjodaro, but in a place close enough to the alluvial plain to study the river carefully. It seems that the first urban settlement of Mohenjodaro was constructed as a whole in a very short period of only a few years, equipped from the beginning with vertical water-supply systems such as wells, which could hardly have been constructed later when the city was already flourishing.

Platforms of the Lower Town

In 1964 Dales found a massive structure of mud-brick with a solid, burnt brick wall. It provided a facing and support to the mud-brick structure for a length exceeding 183 m along the western face of HR mound. There is evidence for a clay or mud-brick platform at the very southern end of Mohenjodaro, below HR area, which was gained from a geophysical survey carried out in 1981-1982. Finally, the deep digging at Mohenjodaro has consistently encountered masses of mud-brick, often recognized as platforms, at the lowest level of the site.

The early platforms were foundation structures that substantially raised the city above the Indus plain, much above *the flood levels*. Possehl calculates that it was a massive amount of work, and a *huge* investment. One can assume that a laborer can move about a cubic meter of earth a day, so it must have taken approximately 4 million days of labour. This means 10,000 laborers working 400 days, or just over a year. That is a very large labour force. If it were 2,500 laborers, it would have taken 1,600 days, or about 4 years and 4 months, and that was just to put the "foundations" in place.

Possehl has given special importance to Mohenjodaro amongst the Harappan towns. He remarks that interesting implications flow from the theory of platforms at Mohenjodaro. They make it clear that someone or some group of people had a plan for the entire city before they built it. This is seen most clearly in the layout of the Lower Town, with the alignment of the main avenues, First and Second Streets running north-south with it and Central running east-west, if they can be fully confirmed. Planning on this scale, especially planning that was accompanied by the will and means to bring it into reality is something special for the 3rd Millennium BCE because the Harappan civilization is nowhere better defined than at this city; we may be justified in thinking that, in some ways, it represents what it meant to be Harappan. This takes us further in the direction of contemporary thought, that ideology was the defining quality of the Harappan civilization and that it was a definition that developed in the 3rd millennium as a new way for people to organize themselves in terms of their social configuration and their system of beliefs and practices (Possehl 2002: 99-109).

Wheeler- Piggott Paradigm

Now we have vastly more archaeological data, than Wheeler or Piggott had in their day. Wheeler-Piggott paradigm assumed that the cities incorporated Citadels, from which a ruling elite ruled a vast empire. The mound of the Great Bath at Mohenjodaro is thought to have been one of these Citadels. Possehl has refuted this paradigm. He argues that if the mound of the Great Bath had been effectively fortified, it would have to have been fortified all the way around. This does not appear to have been the case. For example, the warehouse, a large storage facility of some importance, was placed on the western side of the mound. It is open to the Indus plains, vulnerable, and not a place that could be observed from the Lower Town. Thus, the notion that the "great granary" was on a "Citadel", argues Possehl, makes no sense from a defensive, protectionist point of view (Possehl 2002: 99-109).

Possehl says that since the warehouse was built just after the mound of the Great Bath had been raised, the placement of the facility would have been part of the planning and could have been set anywhere on the mound. But it was put at the centre of the western side, in perhaps the most vulnerable location from a military point of view. The mound of the Great Bath is man-made and built of Indus alluvium. To contain the earthen fill and inhibit erosion, the builders of the mound of the Great Bath put a retaining wall around its "hill". This helped to keep everything in place; it also defined the mound of the Great Bath architecturally and provided defence against floods. The retaining wall would have been a useful feature for the defence of the mound of the Great Bath, as well. Solidly built walls like this retaining wall generally emerge as multipurpose features. But this one is an imperfect fortification, and the placement of the warehouse suggests that this acropolis was not a Citadel at all, but a place that the people of Mohenjodaro built as a platform to symbolically elevate important public edifices (Possehl 2002: 99-109).

Domestic Architecture

The Lower Town is the part of Mohenjodaro where the common people lived and worked. The buildings there were the prime setting for these activities. Marshall has illustrated pictures of two residential houses. Possehl has observed that along with the burnt brick middle-class houses of the Intermediate Period dwellings of the poor were made of mud and mud-brick, e.g. Houses 1-4 in Trench I, Mound D. Sometimes even in the better class houses mud-bricks were used in alternate courses along with burnt brick masonry. Mud-brick was also used for raising solid terraces to guard against the danger of floods. The use of sun-dried brick at Mohenjodaro was different. There are no complete structures made of this material. Sun-dried brick was also extensively used as fill there (Possehl 2002: 99-109).

The walls with a thickness of a meter or two are common. As a result the buildings of the Lower Town are generally substantial and solidly built. The very latest levels of the site have shabby squatters' quarters.

Vats also says that during the Late Period, most of the foundations of numerous fragmentary walls seem to have been laid on any kind of slipshod debris, possibly as a majority of them had nothing more than a thatched roof to support. Indeed, this is exemplified by the Late III dwellings in the extension of Pits I and II in Mound AB where a considerable quantity of charcoal of pinewood rafters, bamboos and reeds was brought to light (Vats 1940: 12).

The architectural remains have to be explained in terms of the Indus socio-polity. Kenoyer thinks that numerous large buildings and public spaces in the Lower Town at Mohenjodaro and on Mound F at Harappa probably indicate that several distinct elite groups were living in the cities. The separate walled mounds with associated suburbs may represent the houses and workshops of competing merchant communities who were united in a single settlement by common language, culture and religion. An exception to this pattern is seen at smaller fortified sites on the periphery of the Indus Valley. For example, at Dholavira, in Kachchha, the nested walled habitation area of the Citadel does dominate the entire settlement and may represent the residences of a ruling family. However, the presence of unicorn seals and pottery identical to those found at Mohenjodaro and Harappa indicate that this site, and many other walled towns, were probably colonies or regional capitals with governors appointed from one of the larger cities.

While Wheeler and Piggott thought that Harappa and Mohenjodaro were the twin capitals of the Indus empire, Kenoyer suggests that due to the long distances between the four major cities, it is highly unlikely that a single ruler ever dominated the entire Indus Valley. Each of the largest cities may have been organized as an independent city-state. At times a single charismatic leader may have ruled the city, but most of the time it was probably controlled by a small group of elites. Comprised of merchants, landowners and ritual specialists, alliances between the ruling elites at two or more of the largest sites would have stimulated extensive colonization of resource areas. On the other hand, competition between the cities may have resulted in the temporary breakdown of trade and the collapse of political power.

Double Storied Houses

From the thickness of the walls of the houses at Mohenjodaro and the presence of stairways leading up (to open sky today), one can infer that perhaps most of these buildings had an upper story. The stairs could have led to the roof, but the thickness of the walls argues against this, at least as the general pattern. The number of floors cannot be determined in an accurate way, but one story above the ground floor can be hypothesized securely. It is entirely possible that the general pattern was a ground floor, another with living space, and then a roof. Possehl thinks that some of the larger buildings could have had two, even three, additional floors below the roof.

Possehl briefly refers to the study of the residential architecture at Mohenjodaro undertaken by Sarcina. She found that there were five recurring house plans in the city, which she identifies with colour names.

Hearths

About the evidence of fires in the town, there are conflicting accounts. Possehl finds that there is much evidence for burning at Mohenjodaro and fires consumed many of the buildings.

Additional information on fire at Mohenjodaro comes from Dikshit's report on his excavation near the "jewellery block". He reports,

The destruction of the latest city in this quarter seems to have been caused by fire. This was evident from the existence of stratified layers of ashes, alternating with debris of fallen structures.

In contrast Mackay says,

Evidence for houses having been burnt out is extremely rare and accidental fires were carefully guarded against.

Marshall has noted only three doubtful hearths at Mohenjodaro. Mackay informs us that these fireplaces were simple platforms of brick, slightly raised, and usually placed along one side of a room.

In one house in HR area there was an arrangement for boiling water; the vessels were set on a high brick stand with an ample space beneath for fuel.

According to Possehl the situation is reasonably clear. The frequent house fires and almost no hearths suggest that the hearths and therefore cooking seem to have been done upstairs.

There are some windows in Mature Harappan buildings. Terracotta fragments that look like grills could be window filling. Mackay observes that the trick at Mohenjodaro was to keep the heat out, just as we do with cold, and windows work counter to this. There are a few door sockets, but not as many as one would expect if every door had one. Lack of door sockets may indicate wooden doors and frames with sockets in the frame. Dales found a portion of a door frame in his 1964 excavations at Mohenjodaro but made no mention of a socket. Regarding the construction of roofs, Marshall suggests flat roofs set on timbers for all of his buildings at Mohenjodaro, as does Mackay.

There is no direct evidence for furniture although a number of individuals depicted on the stamp seals seem to be sitting on a kind of dais. Not much definitive evidence of furniture is there on the seals either. The use of dish-on-stands suggest to Possehl that the people who used them sat on the ground, probably cross-legged with this utensil in front of them.

THE HARAPPAN CITIES IN INDIA

The above discussion was dominated by the architecture of the two major cities of Mohenjodaro and Harappa, both in Pakistan now. The details of the sites are discussed in Chapter 4 on Spatial Extent. Here we will briefly mention the significant variations among the Harappan towns excavated in India, though it has been held for long that the Harappan civilization was sadly monotonous, both in time and space. B.B. Lal (1998: 19-47) has dramatically brought out the significant differences among the Indian Harappan sites of Kalibangan, Banawali, Lothal, Surkotada and Dholavira.

KALIBANGAN

Unlike Mohenjodaro, the "Lower Town" at Kalibangan has yielded clear evidence of having been duly fortified. The fortifications formed a rough parallelogram on plan, the eastern and western walls running due north-south. The settlement within was laid out more or less in a grid-pattern. While the longer streets did not quite follow the alignment of the north-south fortification-walls, the east-west streets, though often staggered, did follow the alignment of the northern wall. Lal notes that the lanes and streets followed the ratio of 1:2:3:4. Thus, while the narrowest, evidently a lane, was 1.8 m in width, the others were 3.6 m, 5.4 m and 7.2 m respectively. The Harappan house plan is still followed in Indian towns of the north. An average house had a courtyard with rooms along its three sides and an entrance on the fourth. The entrance was sufficiently wide, so as to let a bullock-cart in. The rooms were often paved with mud-bricks and sometimes even with decorated tiles. They first put a soling of terracotta nodules intermixed with pieces of charcoal which prevents moisture from travelling upwards along the walls and also acts as an anti-termite device. It is remarkable to note that throughout the nine or so structural reconstructions that Kalibangan witnessed, from about 2600 BCE to about 1900 BCE, not a single structure intruded on the streets.

The Citadel had its own fortification system. Forming a parallelogram on plan, 240 m north-south and 120 m east-west, the complex was divided into two equal rhombs by a partition-wall in the middle. While in the northern rhomb there were residential houses, the southern rhomb had a series of cardinally oriented mud-brick platforms, separated one from the other as also from the fortification walls. On one of the platforms, there was a "fire-altar" complex, while on the other a sacrificial pit.

Banawali

The site of Banawali, in Hissar district, Haryana, was excavated by R.S. Bisht. The Mature Harappan town-plan at Banawali is quite different from what we saw at Kalibangan. Here, the entire complex lay within a single fortified area. However, within this area the Citadel too had its own fortification. Thus, while the Citadel partook of a common wall with the Lower Town on the southern side, it had its own fortification walls on the other sides, forming roughly a semi-ellipse on plan. Beyond these walls, on the northern, eastern and to some extent on the western side as well, there was the Lower Town, having its own fortification walls and forming a rough quadrangle on plan. The layout of the Lower Town did not follow the classic grid-pattern. Instead, its streets ran in all directions. The most noteworthy feature of the Banawali fortifications was the provision of a moat.

The Lower Town followed the usual pattern of having a courtyard with rooms on sides. Some of the houses, however, were large and may have belonged to the elite. One of the houses yielded many seals and weights and may have belonged to a merchant. Further, its toilet was provided with a wash basin placed on a high place in a corner near the drain which carried off the waste water into a sullage jar placed outside on the street (Bisht 1982: 117). Another big house yielded weights and a large number of beads variously of carnelian, lapis lazuli and gold.

Lothal

Located at a distance of about 80 km south-east of Ahmedabad in Gujarat, Lothal has given to the world the earliest dockyard, though there are doubts about its functions. Oriented along the cardinal directions and forming a rough rectangle on plan, the fortified settlement measures about 225 m east-west and 280 m north-south. Though lying within the overall fortified area, the Citadel or the acropolis did not have a fortification wall of its own, as did the Citadel at Banawali. Nevertheless, it had its own identity and separateness, having been built on a raised platform in an exclusive area in the south-east. There was also a complex comprising twelve bath-pavements with accompanying drains. To the south of the aforesaid structures there was a major complex which has been identified as a warehouse. The houses had a courtyard surrounded by living rooms. In many houses "fire altars" have also been identified.

Surkotada

It seems that each urban Harappan settlement had its individualistic plan. Thus, Surkotada, located 160 km north-east of Bhuj in Kachchha, was no exception (Joshi 1990). It had both the components, viz. a Citadel and a Lower Town, but with a difference: the two parts were juxtaposed, with a common wall in between, an opening through which provided access from one to the other. The entrance to the Citadel was provided with a ramp, barbican steps and guard rooms. The provision of steps would mean that no vehicular traffic could get into the Citadel, a situation similar to that in the southern part of the Citadel at Kalibangan. The fortification wall had a 7 m thick core of mud and mud-bricks, provided with a veneer of stone rubble. There is also evidence of mud plaster having been applied to it.

Dholavira

Dholavira has not only yielded a unique town-plan, but it has also brought to light a remarkable system of water-supply. The site also has yielded the only stadium (Pl. 4.8) known to the Harappans. The various units of the settlement were not arranged in a concentric manner, i.e., the Citadel did not form the centre around which the middle town and then the Lower Town (Pls. 4.6, 7) were located. As might be expected, the Citadel commanded the entire scenario, with a height of 15-18 m above the surrounding ground-level. Within the Citadel (Pl. 5.1) itself, the castle was higher than the bailey. The castle had gates on the northern and southern sides as well. Equally noteworthy is the drainage system met with in the castle. A large-sized covered drain, (Pl. 5.2) starting at the northern end, with cesspools and cascades, passed through the broadway and moved on to the western gateway to enter the Bailey from where it finally discharged into the open space on the west. The middle town, located to the north of the Citadel complex and separated from it by an open space, most probably used as a stadium, had its own fortifications. The fortification walls as well as the streets and houses inside were all oriented along the cardinal directions. The houses in the middle town were fairly large (Pl. 5.3), with provision for many rooms, bathrooms, etc.

The Lower Town did not have a system of fortification of its own. However, it did lie within a fortified area, provided by the outermost fortifications of the settlement as a whole. The layout of the streets in the Lower Town was also on the grid pattern. Thus, more or less in alignment with the major east-west street of the middle town there was a street in the Lower Town as well. Crossing it at right angles there were two major north-south streets, besides other north-south and east-west streets and lanes.

HYDRAULIC STRUCTURES

The distribution zone of the Harappan sites falls mainly in a semi-arid region, even though there is evidence that the mid-Holocene was a bit wetter than today. It is obvious that the Harappans paid due attention to water harvesting, use of underground water, drainage and sanitation.

While discussing the evidence of Mohenjodaro, in Chapter 4 on Spatial Extent, we had noted that impressed by the Great Bath (Pl. 5.4) and other water structures at Mohenjodaro, M. Jansen used the word *wasserluxus*, which literally means "water splendor", but Possehl has pointed out it does not quite catch the significance of the German word. The bathing facilities in each house indicate that washing and cleanliness were important to the Harappans. The many wells throughout the city were sources of pure water, essential for effective cleanliness. The drainage system served to move the effluents away from the houses, below ground, safely out of the way and safely out of sight, in brick-lined channels that prevented contamination of the earth and the city (Possehl 2002: 56). At Mohenjodaro numerous wells were dug throughout the city and maintained for hundreds of years. When the early excavators had cleared some of these wells, they once again began to fill with water, although much of the groundwater around the site today is quite brackish. These 10 to 15 m deep wells were lined with specially made wedge-shaped bricks to form a structurally round cylinder that would not cave in under pressure from the surrounding soil. On the top edge of the well there are grooves on the bricks indicating that ropes were used to lift the water out, probably with leather or wooden buckets. Possehl guesses that the wells in private houses at Mohenjodaro and Harappa were probably built by people living in these houses and not by the state government. Kenoyer suggests that the abundance of private, as opposed to public wells, indicates that water purity and pollution had become an important issue in the increasingly congested urban setting of the town. There is no evidence for a highly stratified caste society in the Indus cities, but such perceptions about water do become an important feature of the caste divisions in the later Brahmanical Hinduism. The members of the higher castes even today do not drink water that has been touched or carried by individuals of a lower caste.

The drains for collecting rainwater and those for taking away dirty sewage water were quite separate. Many neighborhoods had public wells along the main streets for animals and the general public. At Mohenjodaro, most houses had at least one private well. On the basis of the number of wells found in the excavated areas, Jansen et al. (1996) have calculated that the city may have had over 700 wells. In contrast, Harappa may have had only 30, since only 8 wells have been discovered in the areas excavated so far. Kenoyer suggests that the difference between these two cities may be that Mohenjodaro had less winter rain and may have been situated far away from the Indus River. At Harappa a large depression in the centre of the city may represent a large tank or reservoir accessible to the inhabitants from all the different neighborhoods. Dholavira, in Kachchha, has only a few wells and most water for the city was collected during the rainy season in large stone-lined cisterns (Pls. 5.8-5,11).

At Mohenjodaro and Harappa bathing platforms with drains were often situated in rooms adjacent to the well using tapered terracotta drainpipes to direct the water out to the street. The floor of the bath was usually made of tightly-fitted bricks, often set on edge, making a water-tight floor. In the Harappan cities, the top of the well would have stood above the ground level with a small drain nearby to keep dirty water from running back into the well itself. There was a small drain cut through the house wall into the street, which carried the dirty water to a larger sewage drain. They made sure that water from the bathing area and latrines did not flow into the rest of the house. Drains and water chutes from the second story were often built inside the wall with an exit opening just above the street drain. HARP excavations at Harappa reveal latrines in almost every house, though this regular feature seems to have escaped the notice of the early excavators at both Mohenjodaro and Harappa. The commodes were made of large jars sunk into the floor. Many of the latrines contained a small jar similar to the modern water jar or *lota* used throughout South Asia for washing after using the toilet. Sometimes these sump pots were connected to a drain to let sewage flow out, and most had a tiny hole at the bottom to let water seep into the ground. Clean sand was scattered on the floor of the latrine and periodically an entire new floor was installed. These latrines must have been cleaned out quite regularly by a special class of laborers, like the present-day sweepers in small towns. The baked brick drains connected the bathing platforms and latrines of private houses to medium-sized open drains in the side streets, which flowed into larger sewers in the main streets. The sewers were covered with bricks or dressed stone blocks. The well laid-out streets and side lanes equipped with drains are one of the most outstanding features of the Indus cities. As noticed by the excavators, even smaller towns and villages had impressive drainage systems indicating that removing polluted water and sewage was an important part of the daily concerns of the Harappans.

The HARP team noticed that some drains had wooden sluice gates or grills, perhaps to keep people from secretly entering into the walled city. At Harappa a sequence of four drains, built one after the other, leave the city at the main gateway between Mound E and Mound ET. A well-preserved magnificent corbelled drain is 1.6 m high, 60 cm wide and extends for 6.5 m beneath a major city street. The device of the corbelled arches allowed larger drains to cut beneath streets or buildings until they finally came out under the city wall, draining out sewage and rainwater onto the outlying plain. At intervals along the main sewage drains were rectangular sump pits for collecting solid waste. These sump pits must have been cleaned out on a regular basis; otherwise the entire drainage system would be choked. It is worth noting that there were garbage bins along the major streets, a civic concept which seems very modern but had originated in the Harappan times. Probably fluctuations in the streets and drain maintenance resulted in the rapid build-up of street levels. Many doorways and walls had to be raised above the level of the street to keep sewage from flowing into the house. Gradually, entire rooms would be filled with dirt and a new house had to be built well above the street level.

The Great Bath (Pl. 5.4) at Mohenjodaro, is a bathing platform, raised to the civic level. It is larger and more complex than household facilities, but conforms to the proposition that cleanliness was an important element in the Indus ideology. Marshall excavated a deep trench north of the Buddhist stupa on the mound of the famous Great Bath. This trench and the exposure of retaining walls around the mound of the Great Bath allowed Marshall to reconstruct the rough history of the place. It is an artificial hill, probably begun in the Early Harappan-Mature Harappan Transition or the early Mature Harappan. The mound of the Great Bath functioned as a massive platform to elevate the buildings on its top above the surrounding floodplain and the Lower Town. Elevating them, especially the Great Bath, above the Lower Town can be presumed to have been an important symbolic act.

The Great Bath is a marvel of waterproofing engineering skill.

> To ensure that the Bath was watertight, the floor was of bricks set on edge in gypsum mortar; the sides were similarly mortared, and behind the facing-bricks was an inch thick damp-proof course of bitumen held by a further wall of brick which was in turn retained by mud-bricks packed between it and on outer backed brick wall (Wheeler, 1968).

It is interesting, notes Possehl, that the builders of the Great Bath used elevation and distance to symbolically set it apart from the rest of Mohenjodaro. Possehl (2002: 99-110) lays a lot of emphasis on the Harappan water management technique. In fact, he thinks that water and the management of water have been central to the ideology of the Indus people. This is most fully expressed at Mohenjodaro, but is also found at many other Indus sites, most notably Dholavira. Great Bath was an important ritual space, one that seems to have been reserved for the elites of the city, possibly the elites of the entire Indus world. Wheeler too found *wasserluxus* an interesting and important feature of the Indus civilization. He felt that the Great Bath and the "extravagant provision for bathing" in private homes were both testimonies to the importance of water in the life of the Indus people.

Bathing Platforms

Most houses at Mohenjodaro had a special platform for bathing. These are usually about 1.5 m on a side, always rectilinear on plan. The bricks of the floor were very carefully prepared, sawn and ground to shape, with right angles where faces met and smoothed upper surfaces. This was specialized, careful work, expensive in terms of time, but then the jobs were relatively small in scale. Not only were the floors of these platforms sloped, they were very smooth, probably ground down after all of the bricks had been fitted to give a seamless surface. Then they were coated with a plaster of lime and brick dust that was polished by the plasterer and the feet of the users (Possehl 2002). Similar bathing facilities have been found in Harappa and also at Lothal.

For the supply of water there were wells within the courtyard of the house. These had a lining of wedge-shaped bricks. But Dholavira, in Gujarat, has yielded evidence which suggests that where the water-table was very low, the water was drawn up through leather bags with the help of bullocks. At Dholavira, in a stone-lined well with a stone trough, the basal slab bears abrasion marks left by the rope that constantly rubbed against it (Lal 2002).

B.B. Lal suggests that despite the claims of some scholars, much more evidence is needed to fully establish the canal-irrigation system during the Harappan times. The people of Dholavira dammed streamlets to take out channels from the dams and use the water. Whether this water was also used for field-irrigation is not yet clear.

Wells

The ruins of Mohenjodaro today exhibit prominent chimney-like brick structures which are actually wells of different levels of the town's life. Jansen has estimated that there were about 700 brick-lined wells at Mohenjodaro. Wells were also found at Harappa, Chanhudaro, and Lothal. Lining wells with burnt bricks guards against erosion, and also delivers clean, sweet water with a minimum of other large-particle contaminants. Possehl notes that the well locations at Mohenjodaro seem to have been decided when the original platforms were built and were maintained over the history of the city. He suggests that in the early days of the city it is probable that the wells were private, as there seem to be no means of reaching them from the street, but later on, as the population grew, they were thrown open to public use. The rooms in which wells were situated were, as a rule, carefully paved.

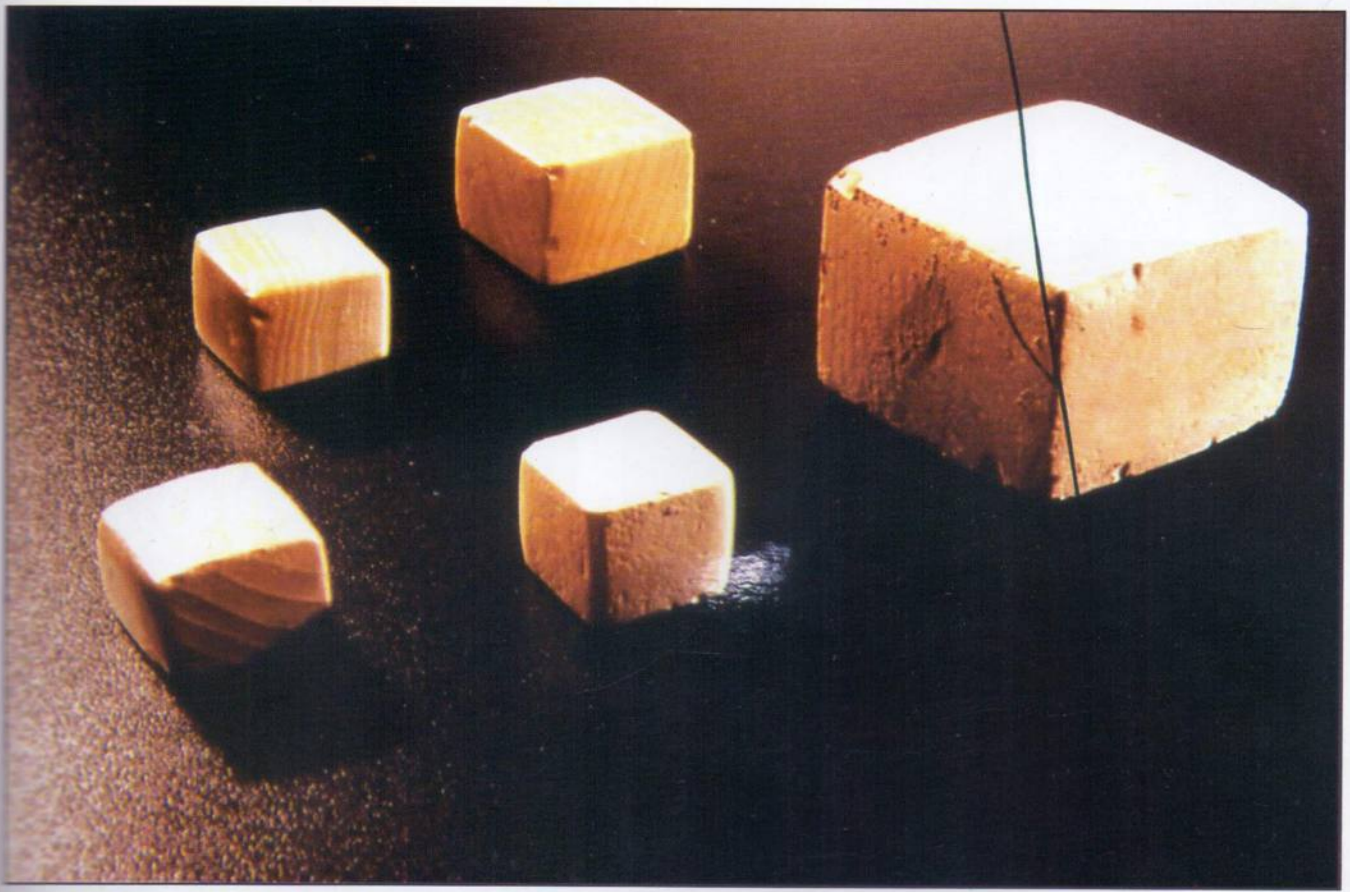
Hydraulic Structures

The most remarkable feature of Mohenjodaro and several other Mature Harappan settlements (e.g. Harappa, Kalibangan, Nausharo, Chanhudaro, Allahdino, Dholavira, Lothal, etc.) is the drainage system. At Dholavira an elaborate drainage system made of store slabs was used (Pls. 5.2, 5, 6). At Mohenjodaro the lanes in the neighborhoods were provided with drains. There was also provision for the management of wastewater inside the houses, with intramural dams, vertical drain pipes in the walls, chutes through walls to the streets, and drains from bathing floors into street drains. Possehl points out that Mohenjodaro receives less than 13 cm of rain per year, which would not seem to be enough to justify such an elaborate drainage system.

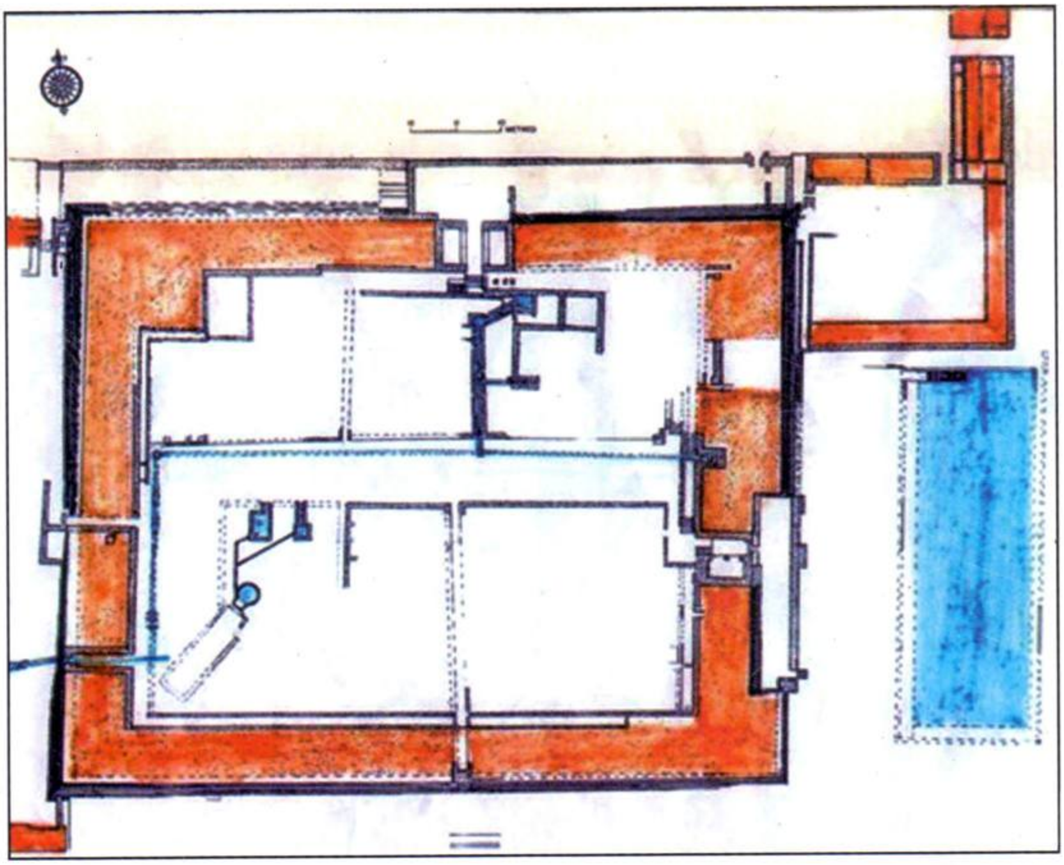
At Mohenjodaro drains were found at all levels of the site. In SD area of Mohenjodaro there are some drains with the bottoms made of gypsum and lime plaster but the sides of baked brick. In most instances ordinary baked brick was used, but specially dressed brick was noted in some drains of SD and DK areas. Specially-shaped bricks were used to form the gently rounded corners of drains. The integrity of the drains was achieved by closely fitting the bricks with a bit of mud mortar. Dressed bricks made the fit even better.

Drains were often reused between different building periods at Mohenjodaro. This was done by simply raising the walls with more bricks. At the southern end of First Street in DK-G the walls of a drain were repaired and raised at least twice. Most of the drains had brick or stone covers because they were under the street or ground surface. Open drains have been found along the sides of streets. Mackay estimates that the average depth was in the range of 46

Pl. 4.9 Steatite seals, Dholavira.



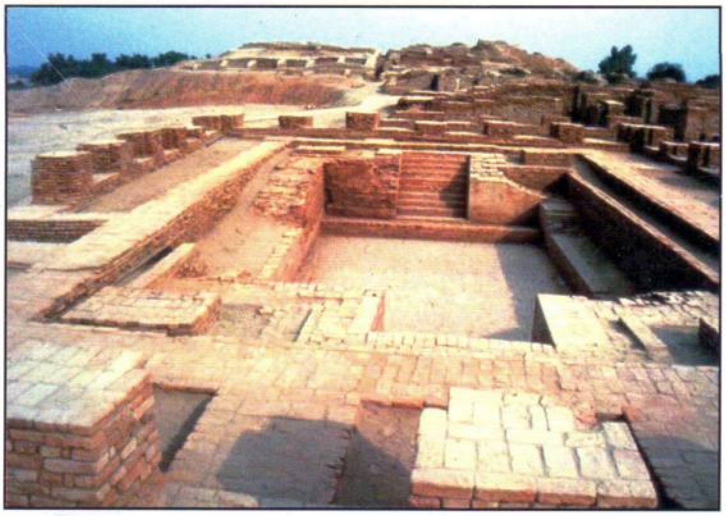
Pl. 4.10 Chert weights, Dholavira.



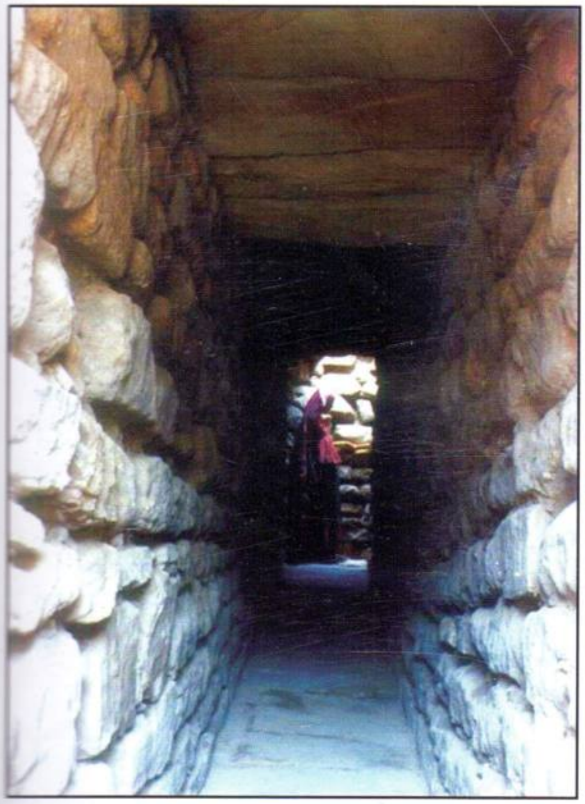
Pl. 5.1 Plan of the Castle, Dholavira.

Pl. 5.2 A typical covered drain, Dholavira.

Pl. 5.3 A typical big house, Dholavaira.

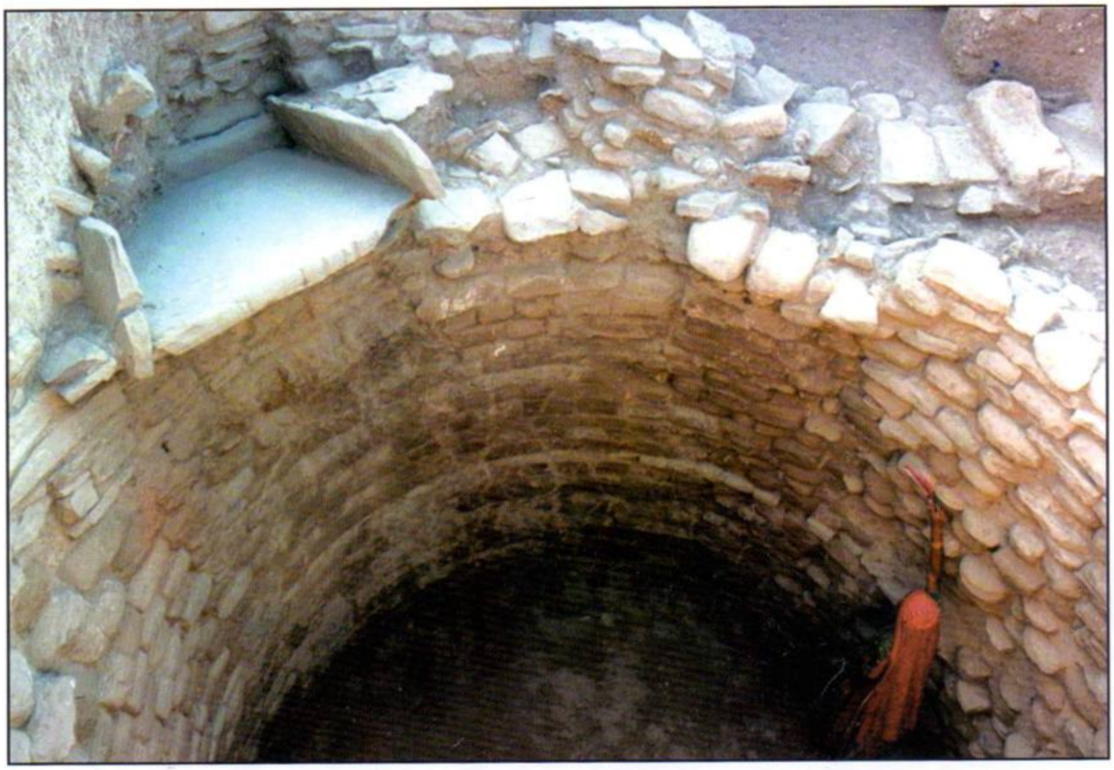


Pl. 5.4 Great Bath, Mohenjodaro.

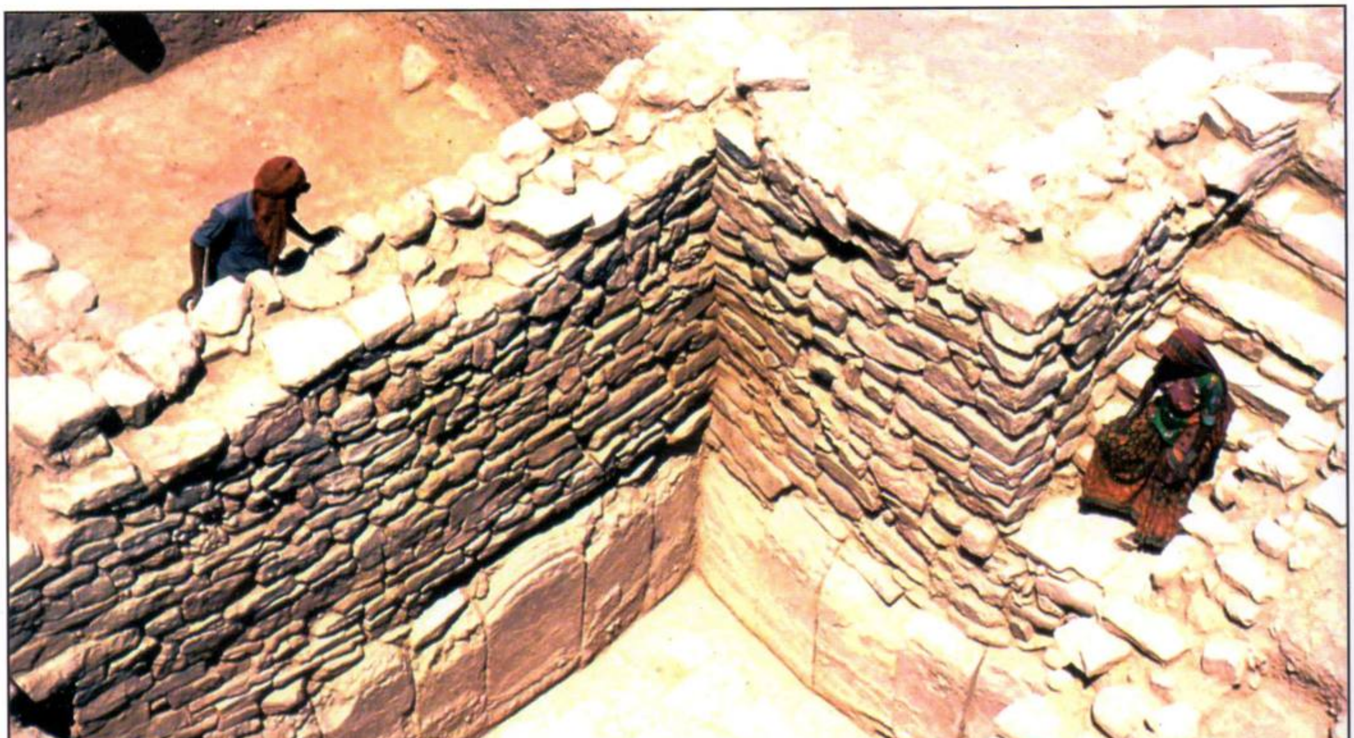


Pl. 5.5 Dholavira, a huge storm water drain.

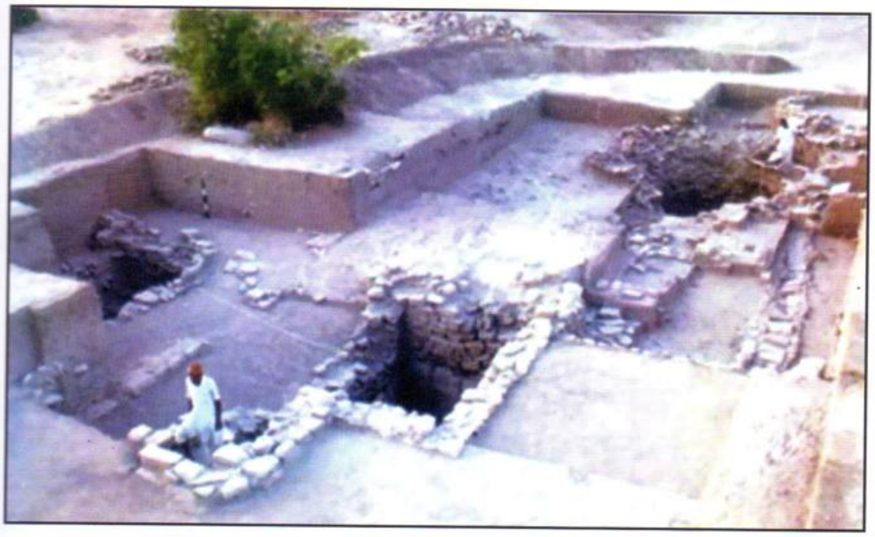
Pl. 5.6 A sanitary tank, Dholavira.



Pl. 5.7 The Dholavira largest well showing rope abrasion marks.

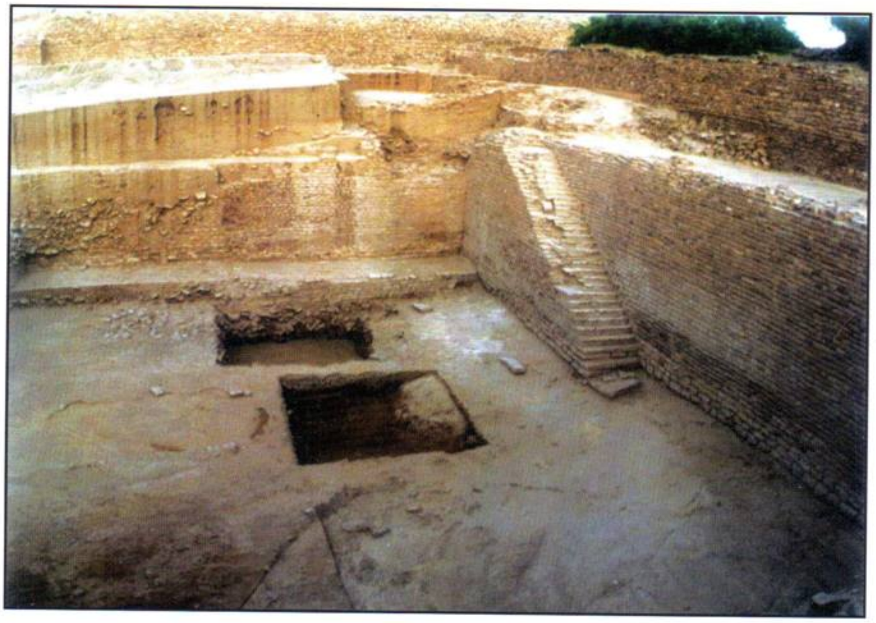


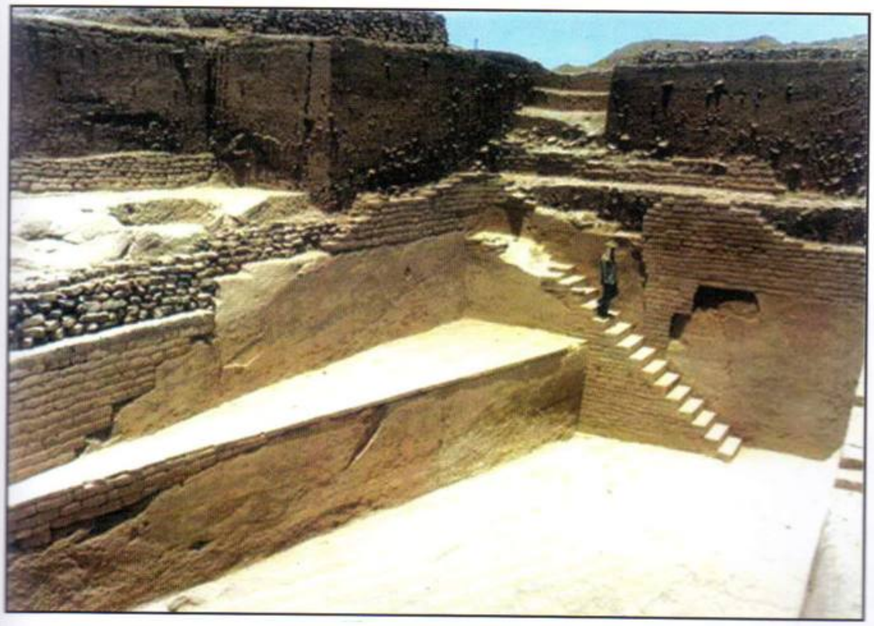
Pl. 5.8 Hydraulic reservoirs and troughs, Dholavira.



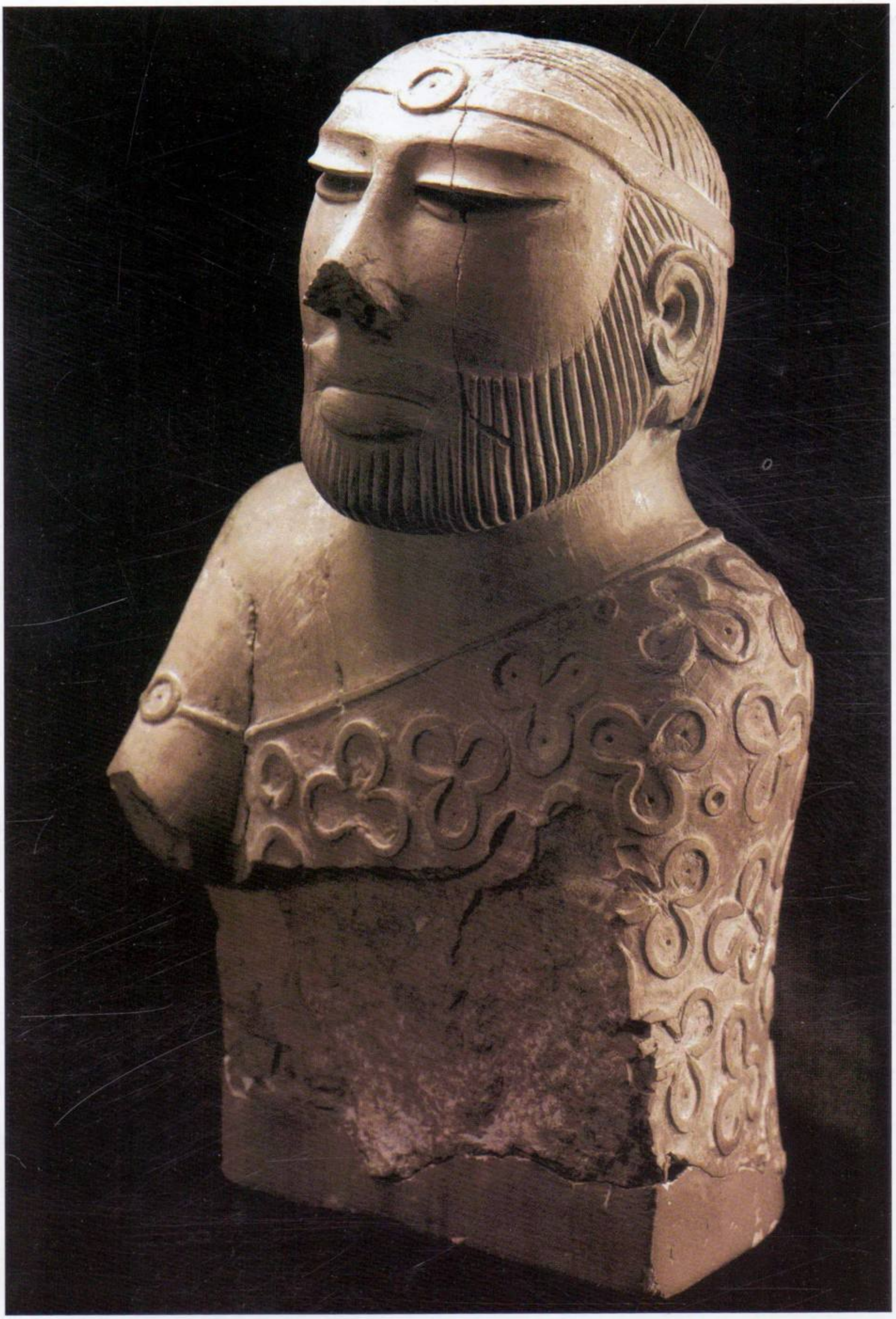
Pl. 5.9 Reservoirs in the Castle, Dholavira.

Pl. 5.10 Eastern Reservoir, Dholavira.

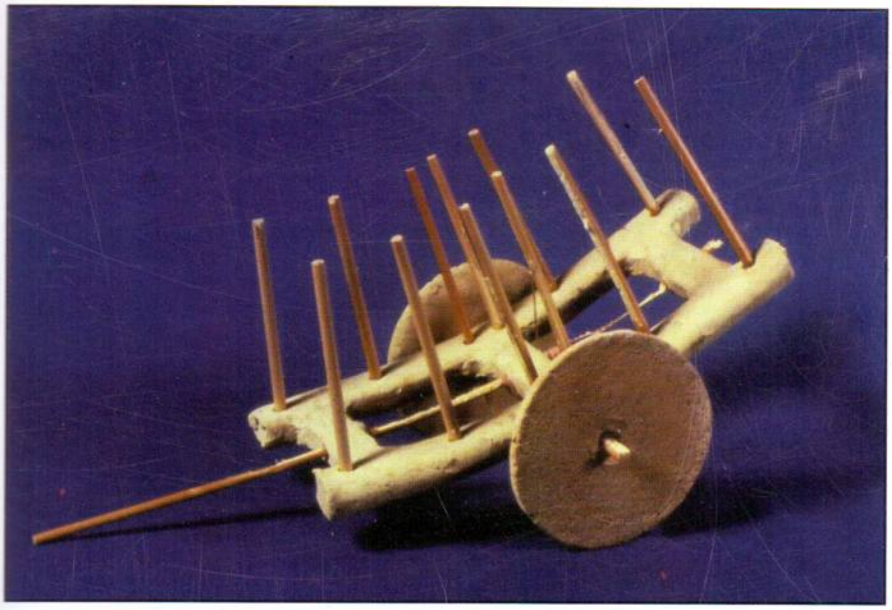




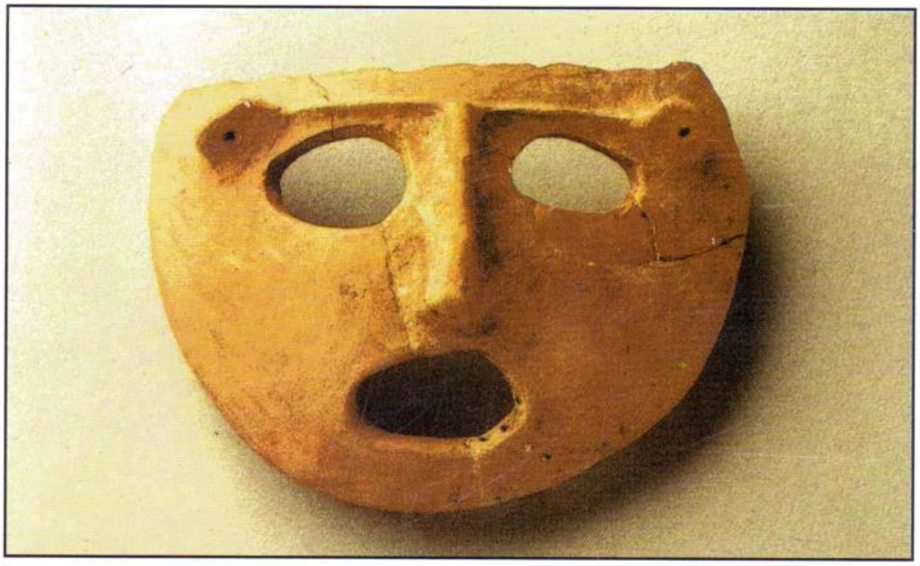
Pl. 5.11 A large rock cut reservoir, Dholavira.



Pl. 6.1 The priest king in stone, Mohenjodaro.



Pl. 6.2 Terracotta cart model, Nausharo.

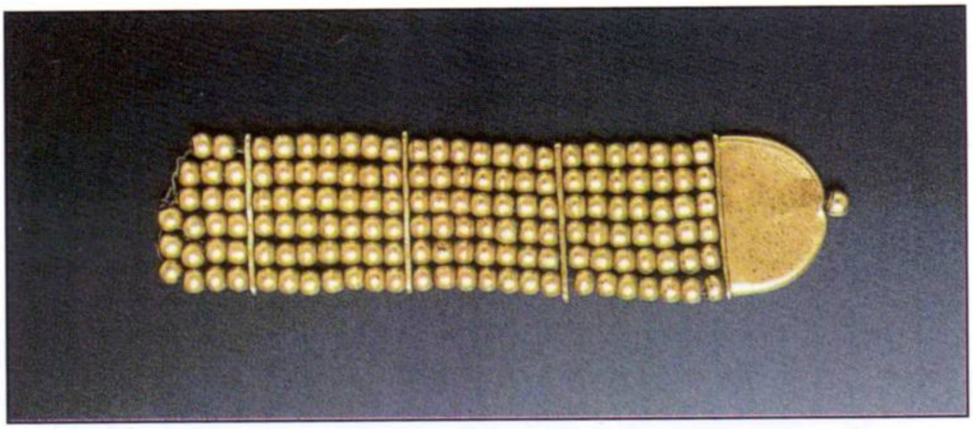


Pl. 6.3 Terracotta mask.

Pl. 6.4 Terracotta tablet showing boat, Mohenjodaro.

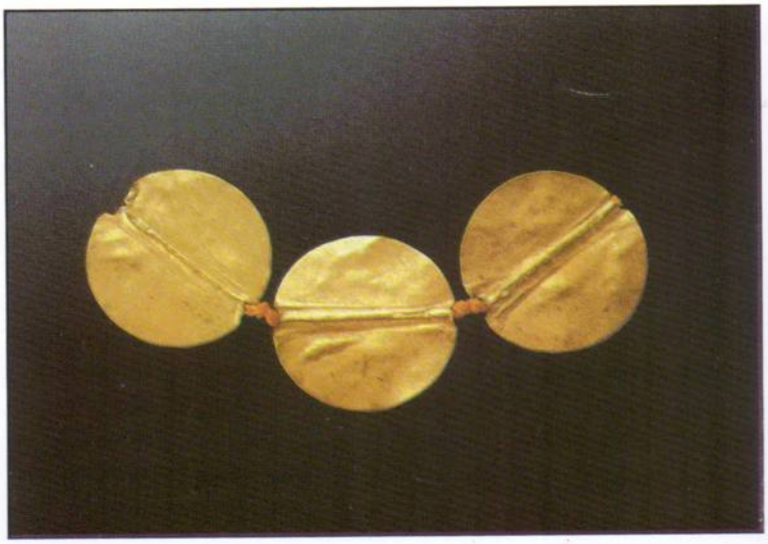
Pl. 6.5 Gold disc beads, Mohenjodaro.

Pl. 6.6 Gold necklace, Mohenjodaro.



Pl. 6.7 Gold necklace, Mohenjodaro.

Pl. 6.8 Gold beads, Dholavira.



Pl. 6.9 Gold disc beads, Lothal.

to 60 cm, but some drains were very close to the surface. The drains were mostly hidden underground, out of the way of the traffic. The wider drains were covered with large limestone blocks quarried from the nearby Rohri hills. Such blocks were especially common on the mound of the Great Bath. The corbelled arch was used for the culverts. The Great Bath was provided with the largest of all the Mature Harappan culverts. Small settling pools and traps were built into the system of drainage. This allowed coarse sediment and other materials to drop out of the flow in places were it could be periodically collected. Heaps of greenish-grey sand were frequently found alongside the drains, which shows that they were cleaned out periodically.

Privies

Most houses or groups of houses had private bathing areas and latrines as well as private wells. The early excavators at both Mohenjodaro and Harappa did not pay much attention to this essential feature of the Indus cities, but the HARP excavations at Harappa are finding what appear to be latrines in almost every house. The commodes were made of large jars or sump pots sunk into the floor, and many of them contained a small jar similar to the modern water jar or *lota* used throughout Pakistan and India for washing after using the toilet. Sometimes these sump pots were connected to a drain to let sewage flow out, and most had a tiny hole at the bottom to let water seep into the ground. Clean sand was scattered on the floor of the latrine and periodically an entire new floor was installed. These sump pot latrines were probably cleaned out quite regularly by a special class of laborers who also would have periodically cleaned out the large garbage bins and sewage drains in the city streets (Kenoyer 1998: 55-65).

Water Reservoirs

Bisht, the excavator at Dholavira, says that the Harappans were extremely conscientious to store the maximum water that used to flow in the flanking streams after the rains. For that, they created 16 or more water reservoirs (Pls. 5.8-11) almost all around within the city walls. A casual rough estimate works out that approximately 17 hectares, i.e., 36 per cent of the total enwalled area was appropriated for the storage of the water harnessed from the streams by raising several dams across the Manhar in the south and two or three across the Mansar in the north. In addition, there might have been quite a few inlet channels piercing through the city walls for bringing in the surface run-off. There are some rocky outcrops which were efficiently used for damming the streams. In fact, the builders had started to reduce the velocity of the water-flow further upstream by way of raising a series of dams across them so that the downstream dams could successfully hold back the pressure of water. Bisht informs that the gradient between the higher east and the lower west side of the city is 13 m, an ideal situation for having reservoirs. In the whole scheme, the city walls played the most crucial role. Firstly, they served the purpose of providing a formidable protection to the city. They also provided the most effective bunds made of millions of moulded sun-dried bricks, carefully laid in mud mortar. To save them from the water stored in the tanks, a broad road lined with stone-masonry walls was provided all along. This road served the purpose of the first bund as well as provided easy movement of men and material. Further, since the area reserved for the tanks was immense, approximately 750 m along southern as well as northern margins, the width varied from 70 to 80 m. On the west, it was about 590 × 80 to 170 m, much broader at places. For example, the south-eastern area measuring roughly 250 × 200 m was entirely converted into a huge reservoir. In such a situation, also keeping in mind the general gradient of 13 m, it was necessary to construct a number of cross bunds across the width at necessary intervals for the following reasons:

1. For reducing the gravitational thrust of the stored water-body and save the city walls from being washed away under the pressure of the waterfront;
2. Those bunds served the purpose of causeways for easier movement of the inhabitants, animals and vehicles alike; and
3. In case of poor inflow under erratic rainfall, the water could be stored in selected tanks instead of letting it spread out over a larger area as a thin sheet which would have disappeared quickly due to evaporation and seepage.

Deeper troughs or depressions were cut into the bedrock (Pls. 5.8-11) so that some water could be made available during a lean time. At least, one such came to the view in course of making test-probes. The largest water-reservoir was located in the south-eastern corner which alone accounts for about an area of 5 hectares, close to the 1/10 of the total enwalled area of the city! In one of the bunds, near the most conspicuous dam site on the Manhar, there was found a spill-water channel for passing off the surplus water into the tanks provided along the south side of the "Citadel".

The satellite imagery suggests that there should be a large buried reservoir, most likely an artificial one, to the south-west of the city. It is a contiguous area now affording one of the best cultivated fields in the locality. If so, it must be receiving the surplus water escaping from those within the walls. Interestingly, the area surrounding the suspected reservoir is found dotted with several Harappan funerary structures including those circular elevations which appear to be sepulchral mounds entombing the mortal remains of privileged persons or families. It may be recalled that in Indian tradition the funerary rites or the disposal of the dead are performed close to a river, a lake, or a tank. This location was therefore ideally suited for special funerary structures.

In the prime of its youth, the entire city might have looked like a lake-city or a *jala-durga* (water fort). Reservoirs seem to have been kept regularly desilted and the removed matter was piled up on the nearby bunds which, in turn, were being protected by masonry walls. In close proximity to important bunds there were some built-up areas having multi-roomed, multi-block structures, probably meant for the personnel posted there for the proper maintenance and security of the bunds as well as reservoirs. On a most conservative estimate, Bisht assesses that the reservoirs within the city walls covered an area of at least 17 hectares which could store a massive volume of not less than 250,000 metric m of water! This excludes what might have been stored outside the city (Bisht 2000: 11-23).

6

Arts, Crafts and Metallurgy

The Indus civilization achieved an unprecedented uniformity and standardization over an area of more than a million square km, though detailed excavations in recent years have also thrown up evidence of regional variations. How they achieved it in the 3rd millennium BCE amazes everybody. A functional and utilitarian concept underlines all their works; their products have neither the splendour of Mesopotamians nor the over-ornamentation of the Chinese. But this simplicity and uniformity should not mask their revolutionary innovations and their sophisticated technologies.

ARTS & CRAFTS

Crafts create wealth as also help differentiate elite from masses. As a preamble to discussion of crafts, it may be useful to quote Kenoyer's interesting observations in this regard. He says,

Generally speaking, a wealth item can be defined as an archaeologically preserved object that reflects relatively high levels of indirect or direct economic control of resources, labour, or technological knowledge. Archaeologically preserved objects, such as ornaments, architecture, or tools reflect other forms of wealth that are not preserved, for example, grain, foodstuffs, livestock, or even agricultural land. The relative value of preserved objects can be calculated on the basis of four major assumptions:

i) Rare or exotic raw materials have relatively more value than locally available raw materials;

ii) The overall wealth value of an object increases with amount of labour required for production, where labour refers to time and/or number of artisans involved in production;

iii) Technological processes involving numerous stages, high degrees of skill and/or specialized technical knowledge increase value of an object; and

iv) Once an item has been accepted as a symbol of wealth within a society, the elite will attempt to control the access to raw materials or knowledge in order to limit the production of specific wealth items and control their use.

Within this framework, it is possible to rank various craft products used in a society and estimate the relative value of specific types of objects. This ranking can then be compared with the actual distribution of objects throughout the site or their frequency over time. These four assumptions can be further correlated with major groups of specialized crafts that are defined by two sets of variables: accessibility of raw materials and complexity of technology required to process raw material into specific objects. In geographical context of Indus Valley craft technologies used to create objects can be divided into four major groups:

i) Crafts processing from locally available materials using relatively simple technologies include woodworking, basket making, simple weaving, terracotta pottery production, and house-building;

ii) Crafts using imported materials with relatively simple technologies include stone-shaping for domestic purposes and chipped stone tool-making;

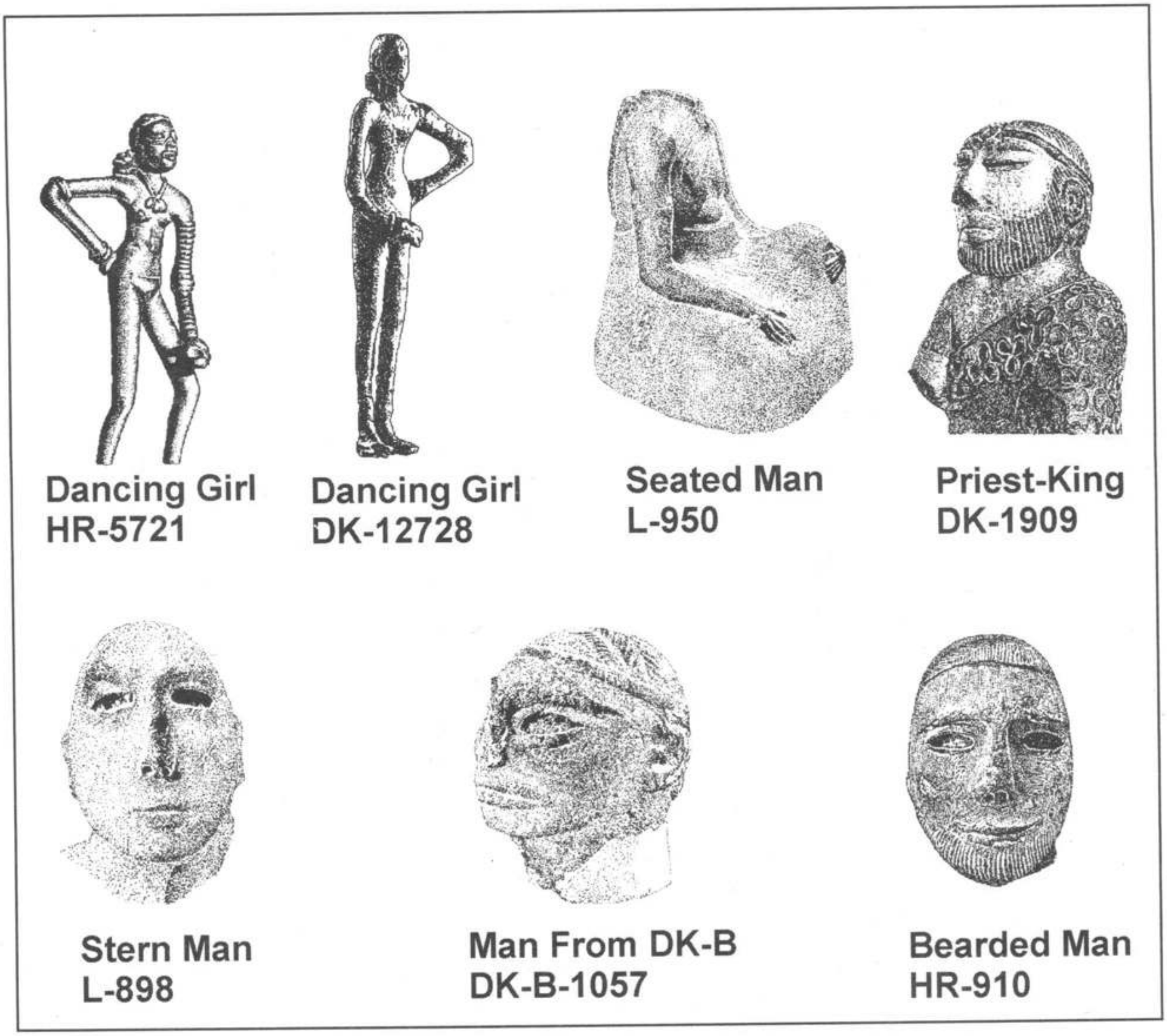


Fig. 6.1 Seven Harappan stone and bronze statues (After Possehl, 2002).

iii) Crafts using local materials and complex technologies and production processes include stoneware bangle manufacture, elaborate painted and specialized pottery production, complex weaving and carpet making, inlaid woodwork production and construction of decorative architecture; and

iv) Crafts using imported materials and highly complex technologies include agate bead manufacture, seal production, copper/bronze metalworking, stone carving, precious metalworking, shell working, and faience manufacture.

The production and distribution of objects made by crafts in the last two categories are the most easily controlled. Consequently, these are the crafts that tend to be used in the creation of wealth items, a process that began with the earliest Neolithic communities and became modified with each subsequent phase of development (Kenoyer 1999: 90-112).

With this backdrop, lets have a look at the Harappan arts and crafts now.

We discuss below Harappan technology under following categories: (1) Sculpture; (2) Transport; (3) Stone Technology; (4) Bead Technology; (5) Ceramic Technology; (6) Shell Technology; (7) Standardization; and (8) Innovations. Metal and pyrotechnology will be dealt with in section II.

1. Sculpture

Though the non-perishable art-remains of the Harappans appear poorer in comparison to the contemporary Egyptian or the Mesopotamian artefacts, few surviving examples do show their mastery of plastic art. Perhaps wood-carving (an ancient Indian tradition) was a developed art though no remains have survived. Quite often the stereotyped nature of stone statuary and terracotta figurines is emphasized but the naturalistic rendering of animals in terracotta and on seals, bronze-dancing female, stone male torsos indicate their sculptural virtuosity.

Fig. 6.2 Female terracotta from Mehrgarh period V: note the slender waist but heavy breast and hips and elaborate coiffure (After Possehl).

Quite a few stone statues (Pl. 6.1) represent perhaps the same person. Narrow eyes, stylized ears and hair, shaven upper lip, inlaid eyes, and a hieratic rendering mark these statues. Two such pieces were discovered from a building, which Wheeler suspected to be a temple at Mohenjodaro. The plastic rendering of Kalibangan terracotta head is livelier than that of Mohenjodaro statues.

But the plastic modelling of the two male torsos in stone from Harappa is very naturalistic, almost sensuous. Perhaps one of the images was ithyphallic (with erect penis) probably connected with *Siva*, the latter day Hindu god. The bronze dancing girl from Mohenjodaro is a very delicate representation in the round of a female nude (Fig. 6.1). The ease of its stance, graceful way of resting one hand on the hip, and a slight tilt of the head enhance its voluptuous appeal.

Very naturalistic too is the rendering of animals, especially the bulls and rhino, and even of the mythical unicorn on the steatite seals. Excellence in plastic art is reached in the rendering of terracotta bulls in the round. The examples from Mohenjodaro, though naturalistic, appear somewhat stiff. The best example of a charging bull comes from Kalibangan. The massiveness of the bull, the fury of charge and movement are eloquently expressed in terracotta.

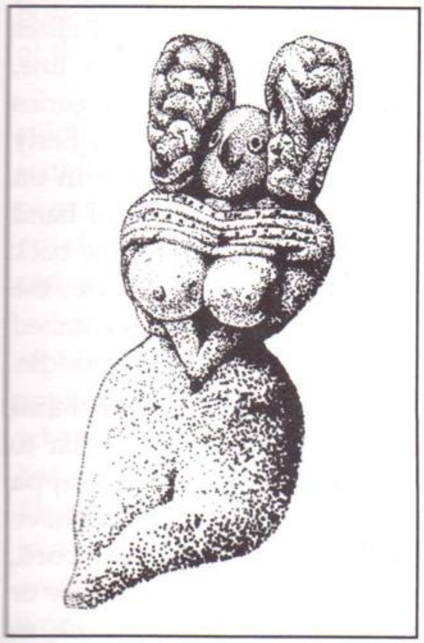


Fig. 6.3 Mehrgarh female terracotta, periods VI, note the elaborate coiffure, full breast and heavy hips (After Possehl, 2001).

The female figurines in terracotta are very common in the Harappan sites of Sindh, but absent from Rajasthan and Gujarat, except for a late Harappan context from Nagwada. The more common type has an elaborate headdress, waist girdle, necklace and a lower garment. Breasts are big and hips broad (Fig. 6.2). The tradition of making such terracotta for worship still continues in Indian villages and therefore these figurines could as well have a religious function. Toy carts (Pl. 6.2) with solid wheels, whistles, rattles, birds and animals, gamesmen and discs were also rendered in terracotta. The female terracotta tradition of Mehrgarh (Figs. 6.2, 3) is very graceful and sensuous. From Harappa there is an interesting terracotta of a woman grinding corn (Fig. 6.4). Masks were perhaps common for puppetry and plays (Fig. 6.5; Pl. 6.3).

Ardeleanu-Jansen (1988) has made some interesting observations about the Harappan terracotta. She says that at present, we cannot draw a final picture of the significance the terracotta figurines had in the Harappa Culture. These issues will be discussed in Chapter 7, Religion and Burials.

Fig. 6.4 From Harappa an interesting terracotta of a woman grinding corn (After Vats).

Stone sculptures

Kenoyer (1998) suggests that the famous stone sculptures found at Mohenjodaro may represent the rise and fall of a community of the ruling elite. These stone sculptures were found on the surface of the site or in the topmost levels, buried under the fallen walls of the latest Indus structures. Because all of these sculptures are broken, many scholars feel that they were intentionally vandalized. However, they are made from relatively soft stone, and some may have been damaged in the collapse of a building or through natural wear. Some sculptures appear to be unfinished, whereas others are carved with extreme detail and careful modelling. Overall they appear to represent a formal style of sculpture depicting a seated, bearded male with a cloak thrown over one shoulder and hands resting on the knees (Pl. 6.1). One broken sculpture from the Citadel mound may possibly represent a female because it has long unbound hair and no beard is discernible, but the nose and mouth have been badly eroded and any traces of the beard may have been obliterated.

Kenoyer (1998: 99-102) suggests that the almond-shaped eyes would have been filled with shell or white stone inlay which are portrayed in varying styles. Some eyelids are half-lowered, but usually they are rendered wide open and staring, much like the formal sculptures of elites found in Mesopotamia and Iran. The wide mouth with heavy lips is usually set in a firm line, contributing to overall expression of calm authority and power. Kenoyer identifies four categories of hair styles, which many scholars have compared to similar hair styles on sculptures of Early Dynastic Mesopotamia and nearby Baluchistan. Most figures have long hair tied in a bun on back of head and secured with a head band that is tied in a bow or hangs down the back of the neck in two strands. In some cases the hair is braided or wavy; in others it is combed back in straight lines or parted in the middle.

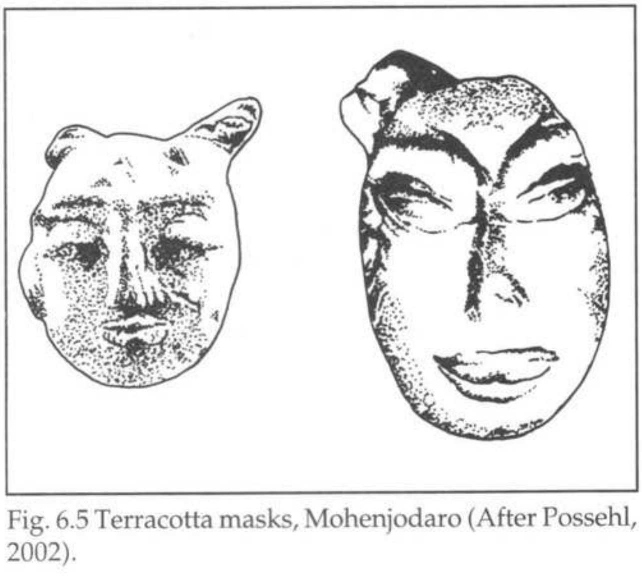


Fig. 6.5 Terracotta masks, Mohenjodaro (After Possehl, 2002).

Kenoyer suggests that the head band probably represents a golden fillet similar to those recovered at Mohenjodaro, Harappa and Allahdino. These golden fillets all have tiny holes at the ends for tying with a cord, which would have been secured as a bow or left free to hang down the back of neck, as seen on these sculptures. The most famous "priest-king" sculpture has a disc-shaped ornament carved onto the fillet at the centre of the forehead (Pl. 6.1). This disc may have been inlaid with red carnelian to create a spectacular eye-bead like those found in the excavations of Mohenjodaro and Harappa. A matching arm ornament is carved on the upper right arm. Similar golden fillets with central gold disc ornaments have been found in burials of both men and women at the royal cemetery of Ur of the late Akkadian period, which would correspond to the general date for Mohenjodaro sculptures. There may be no direct connection between these styles, but this period saw the introduction of many Indus elements into the artistic and economic spheres of southern Mesopotamia. The presence of Indus immigrants is clearly attested in the literature, and the use of the water buffalo motif on cylinder seals becomes quite common. Kenoyer points out that the lack of definitive Mesopotamian styles or influences in the Indus cities at this time may indicate that the movement of styles was primarily from the Indus to Mesopotamia, undoubtedly carried by traders.

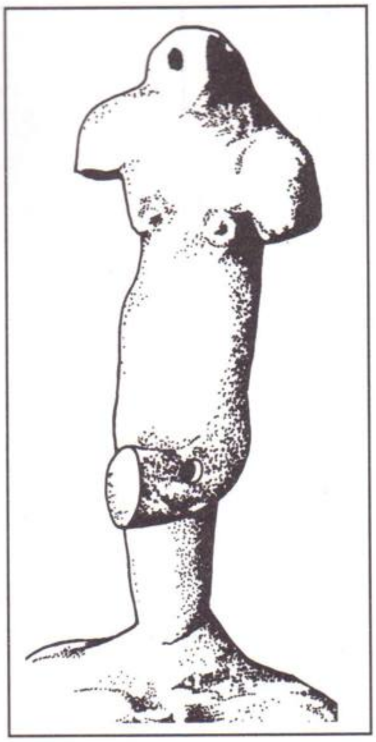


Fig. 6.6 Grey stone female dancing figure, Harappa (After Possehl, 2002).

Most figures have short, combed beards, and some show the upper lip clearly shaved. The ears are usually depicted in a highly stylized kidney shape with double lines. This shape is much like that seen on the body of unicorn pendant and is repeated in the design of some faience bangles and shell inlay. The hole in the centre of ear may have had iconographic significance, but it also may have had a simple utilitarian function to secure some form of ear ornament or to support a horned headdress. Some of the sculptures have holes beneath the ears that may have been used to attach massive necklaces. Two of the sculptures definitely had some form of headdress attached to the top or back of the head. A small, shallow hole was drilled on the top of the head of one figure, and the back of the "priest-king's" head is cut at an angle, possibly to support a large horned headdress or the branch of the pipal tree as is seen on some of the seals.

With such elaborate ornamentation, it is likely that the sculptures were painted with bright colours. In two cases the garments were carved with special designs. On one fragmentary sculpture (HR 5785), garment is covered with tiny drill holes that may have been filled with pigment to create a spotted cloak. In the cloak of "priest-king," carefully drilled and hollowed out designs of circles, double circles and trefoils were originally filled with a red pigment. The rest of the garment may have been coloured with other pigments, but no traces remain.

Kenoyer does not agree that these designs represent block printing, as the design is not repeated identically over the entire garment. The cloth may have been made with embroidery, applique or the decorated animal skin. In modern Pakistan, on festive occasions and particularly when cattle are marked for sacrifice the white hide is often decorated with red spots made with henna. This practice has its roots in earlier, traditions that may reach back to the Harappan Phase. The cloak of priest-king was obviously a ceremonial garment and may have been decorated in a similar manner. In addition to the cloak, many figures show a lower garment that was tied, around the waist and drawn through the legs to be tucked in the back like the traditional dhoti worn in many parts of the subcontinent. Some sculptures also show the belly button.

Kenoyer identifies two seated positions in these sculptures, which can be compared to the seated positions of terracotta figurines as well as to the anthropomorphic figures carved on seals. The basic posture has one knee bent to the ground and other raised, so that one foot is

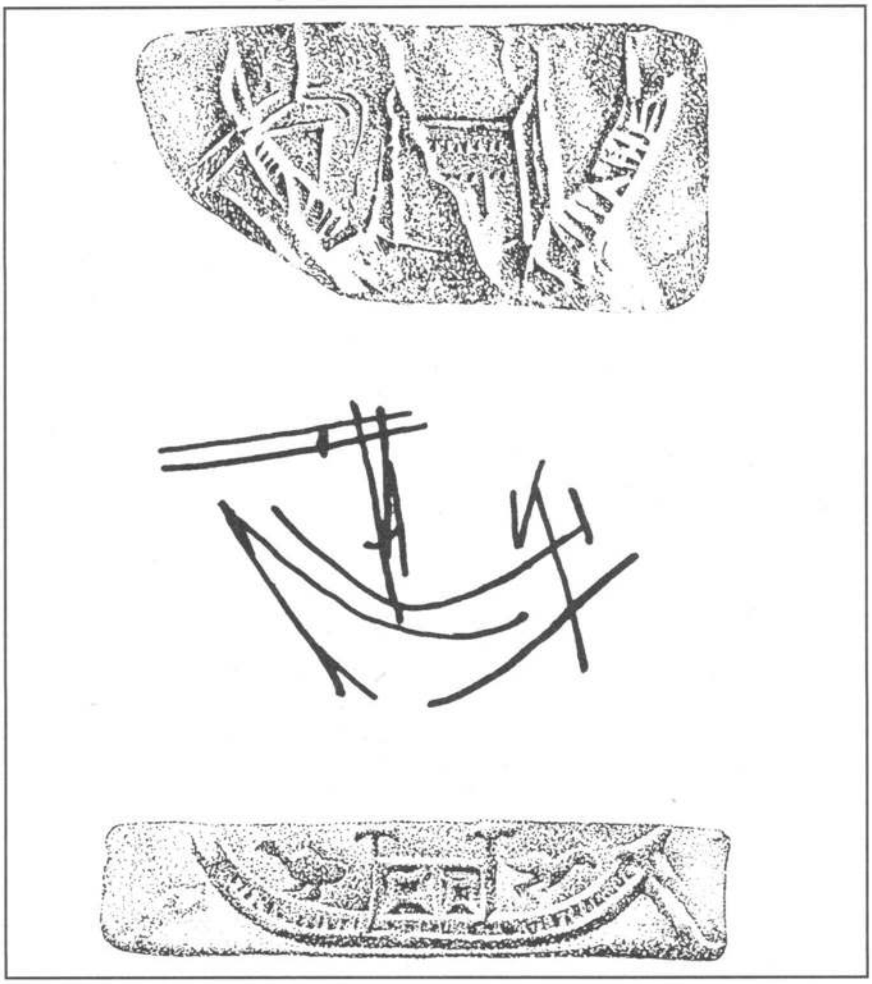


Fig. 6.7 Depictions of Harappan boats on tablets etc. (After Possehl, 2002).

forward, while other is tucked beneath the buttocks. In some sculptures the right foot is forward and the right knee is raised, while in others position is reversed. The raised knee is usually clasped by the corresponding arm while other arm rests on the opposite knee or thigh. In all of the sculptures where hands are visible, they rest directly on the knee or thigh and do not carry any form of symbolic object or weapon.

The grey stone dancing figure (Fig. 6.6) from Harappa has been reconstructed by Possehl (2002, Fig. 6.4). Kenoyer interprets partly kneeling position as supplication or subservience, but this is also a standard position for sitting in readiness for action. With one swift movement a person can stand up and move in any direction. In contrast, yogic pose depicted on many of the seals, heel to heel with widespread knees, is clearly a ritual posture that would require considerable effort to stand up.

The stone sculptures from Mohenjodaro are generally thought to represent clan leaders or ancestral figures. Comparisons have also been made with eight seated figures depicted on a silver vessel attributed to Bactria and generally contemporaneous with the late phase of the Indus cities. Although these figures are seated in a broadly similar manner, their hair styles and the presence of hand-held objects represent an iconographic tradition different from that of the Indus style.

Kenoyer thinks that a more appropriate comparison could be with three stone heads found in the Helmand basin in Baluchistan. These heads have been broken off from a larger figure,

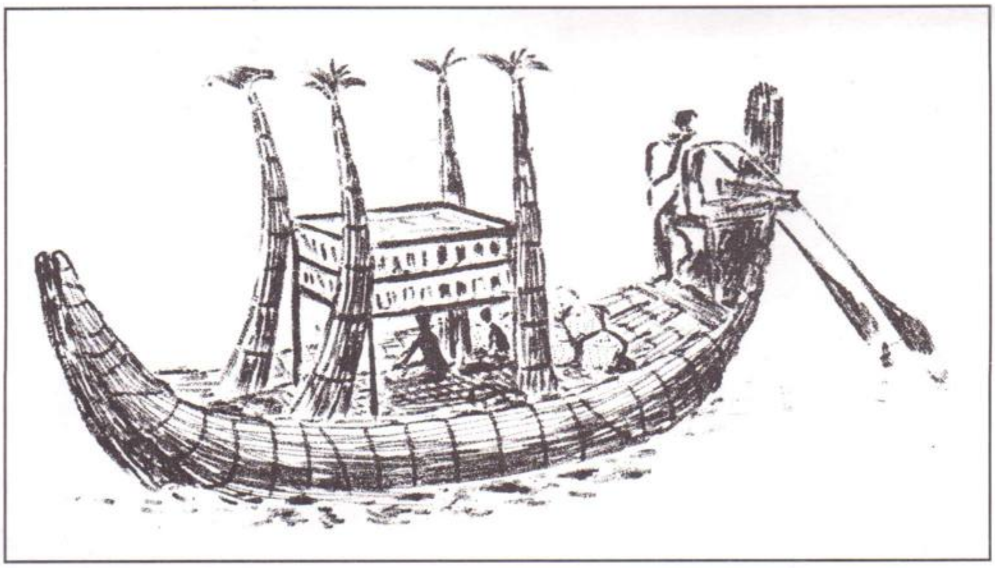


Fig. 6.8 Reconstruction of Harappan boat (After Possehl, 2002).

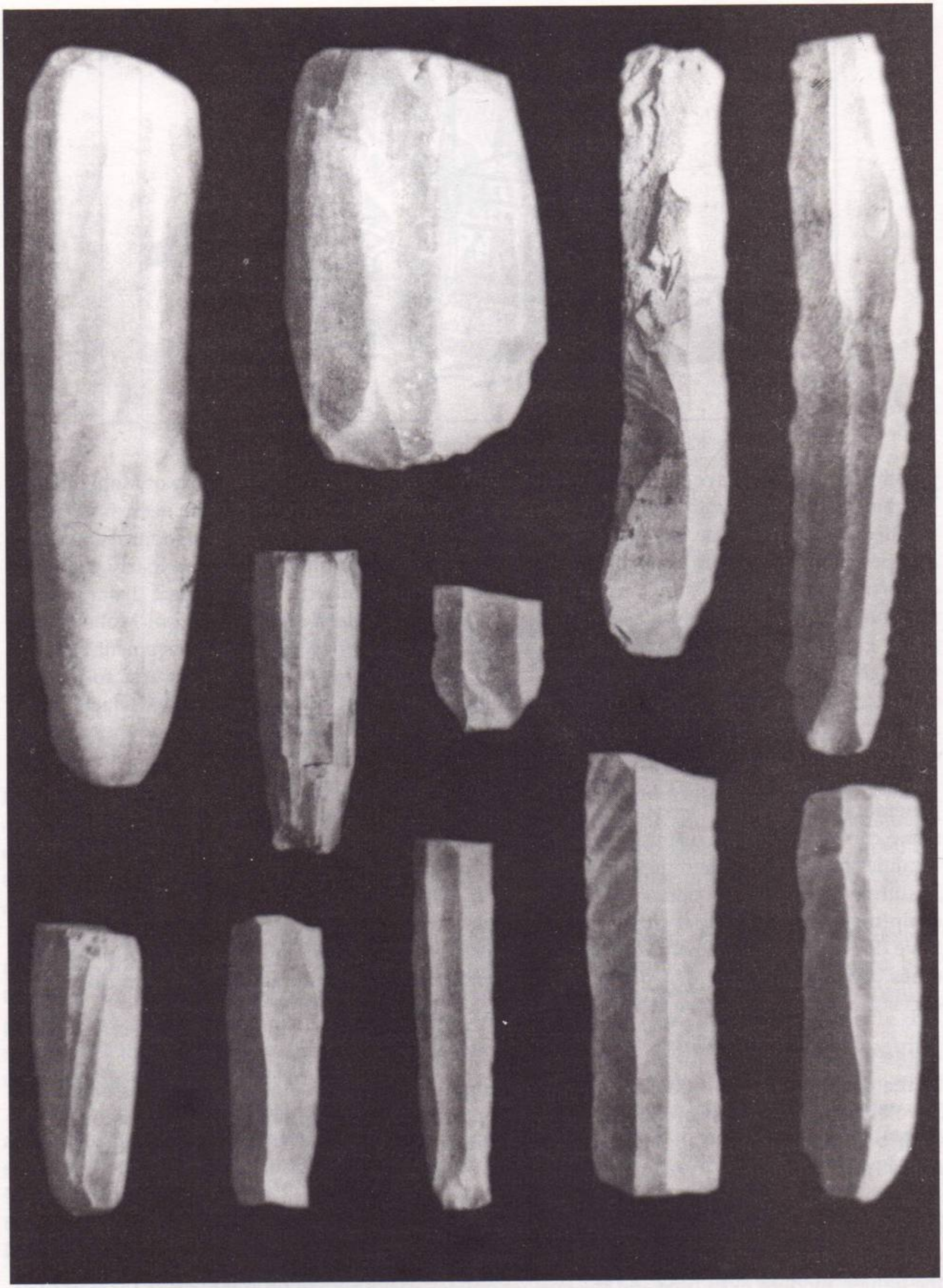
possibly seated, and have carved facial features and stylized ears similar to those of Mohenjodaro. The hair is tied back with a fillet that hangs in two strands down back of the neck, but hair is not tied in a bun. These heads appear to be contemporaneous with Mohenjodaro sculptures and possibly derive from a very similar sculptural tradition, but they were clearly made by different artisans in distinct workshops. The general similarities may reflect distant ethnic relations between a community of powerful merchants or landowners living at Mohenjodaro and a group living in Helmand basin. However, due to the long history of movement between the highlands and the Indus plains, Kenoyer does not try to use these sculptures to identify specific movements of elites in either direction. The general absence of Indus artefacts in the Helmand sites and rarity of sherds from Baluchistan at Mohenjodaro preclude any strong cultural interactions between these possibly related communities.

Differences in hair style, garment decoration and seated posture may signify several generations of elders, whereas variations in carving style probably reflect several generations of stone carvers. Kenoyer surmises that if the distribution of sculptures can be taken to indicate localities of residence, then these communities were possibly living on Citadel mound as well as in different neighbourhoods of the lower city. It is likely that the individuals depicted in these sculptures were influential citizens or even rulers at Mohenjodaro, but they probably did not have direct political control over other cities such as Harappa or Dholavira. Each of these large cities probably had its own powerful clans and rulers, but only at Mohenjodaro do we see carving of commemorative stone sculptures (Kenoyer 1998: 00-103).

2. Transport

In the development of a civilization, harnessing and efficient use of energy are essential. We have evidence that the Harappans used cattle power for transport and wind power for sailing their boats (Figs. 6.7, 8; Pl. 6.4). The invention of wheel helped both transport and ceramic industry.

No carts have survived, but their tracks have been discovered in the Harappan sites and indicate roughly the same spans as used today. Terracotta models of carts (Pl. 6.2) are quite ubiquitous, though bronze models have been found only at Harappa and Chanhudaro. Both the lighter, modern ekka type and the heavier bullock-cart type can be identified in these models and hardly seem to have changed through all these millennia. Rao (1973) has reconstructed



Pl. 6.I Harappan chert blades.

three main types of cart from Lothal: (i) concave or flat with a solid chassis; (ii) with a perforated chassis; and (iii) with a perforated chassis and a detachable crossbar. On such a chassis wooden posts could be fixed to make a box-like structure to carry light merchandise, as it is done even today. There is no evidence of fast transport like chariots.

The Harappans also used boats. One of the Mohenjodaro stone seals and a terracotta amulet depict boats. Rao discovered five clay models of boats from Lothal. He describes "a sharp keel, pointed prow and high flat stern. It has three blind holes probably for stern, mast and ropes for sail". Boats - with sails and without - were in use. The pots from Lothal have paintings of multi-ored boats, compared by Rao with Late Gerzean examples from Egypt. The size of the boats is more difficult to judge. If the small stones 'anchors' (less, than 50 cm diameter) found in so-called dockyard at Lothal are any indication, the boats must be very small indeed. As pointed out by Pandya (1977), even a 50 tonnes barge requires an anchor of one-quintal weight.

3. Stone Technology

Taking out long blades of stone is an old technique, which started from the Upper Palaeolithic times. A stone is selected and by alternate flaking across its shorter axis a crested guided ridge is made and blow is struck along the longer axis of the core, at the end of this ridge. The impact results in a long blade which leaves two ridges on their side, and which again can be used in a similar manner to detach further blades. The most crucial factor in this technique was manipulation of mass over the core surface, which pre-determines the shape of flake to be detached. Blades up to a length of 20 cm have been recorded. Rohri-Sukkur in Sind provided the source material for the blades (Pl. 6.I) for the whole Harappan 'empire'. This, incidentally, indicates a developed internal trade.

About rock material, Kenoyer (1998) thinks that most stones came into Indus workshops as raw material, but there are rare examples of finished objects that were produced in highlands to west and brought to cities by traders or visiting elite. Carved chlorite and green schist containers with distinctive woven mat designs were produced at sites such as Tepe Yahya in southern Iran and possibly at workshops in Baluchistan. These vessels were traded throughout Near East and Persian Gulf, and a few examples have been found at Mohenjodaro. Indus traders living in southern Baluchistan may have brought such exotic containers to city along with copper and/ or highland raw materials.

One famous stone vessel found at Mohenjodaro is a tall glass with concave sides that is similar in shape to ritual columns found in Baluchistan and Afghanistan. This green stone, called fuchsite, is rare, but it can occur with quartzite, which is common throughout Baluchistan and Afghanistan. When this fuchsite vessel was first examined by a geologist in 1930s, the only known source was in Mysore State, over 1600 km south of Indus Valley. Early scholars suggested that stone was brought to Indus cities from south along with gold and ivory, but both of these important raw materials were actually available from nearby sources. Herds of elephants lived in the thick forests of Gujarat or eastern Punjab, so ivory could have been obtained by Indus hunters themselves or traded from tribal communities living at the edge of Indus plain. Gold was easily obtained from sands of the upper Indus river where it is still panned by itinerant miners. Another source of gold was along the Oxus river valley in northern Afghanistan where a trading colony of Indus cities has been discovered at Shortughai. Situated far from the Indus Valley itself, this settlement may have been established to obtain gold, copper, tin and lapis lazuli, as well as or exotic goods from Central Asia. Recently, Garhia et al (2001a, 2001b) have reported gold mineralization from Rajasthan area also.

4. BEAD TECHNOLOGY

Vidale, who has done extensive studies on sociology of the Harappan crafts, reports that during the 7th millennium BCE beads made from talcose rocks become progressively smaller in size; this is a trend, which continues until 3rd millennium BCE (Vidale uses terms "talc" or "talcose" and "steatite" interchangeably). Pyrotechnological treatment of talcose rocks begins during the 6th millennium BCE, then becomes more and more common, culminating in the beginning of 4th millennium BCE when more than 90 per cent of steatite beads from Mehrgarh are fired white. The amount of talc working debris at the Indus sites becomes massive, and data from the activity area of Mehrgarh 2 (5th millennium BCE) is sufficient to suggest the possible presence of apprentices (Vanzetti & Vidale 1994). The application of blue-green glazes to steatite beads also begins in the 4th millennium BCE. At the beginning of the 3rd millennium BCE, artificial materials such as talc paste, steatite-faience, and siliceous faience are introduced in the Indus bead repertory. The talc powder resulting from bead cutting is recycled as talc paste beads, and this new technology culminates in second half of the 3rd millennium BCE with the invention of famous Harappan microbeads (Vidale in press).

Heather (in press) has come out with a very perceptive paper on the Harappan technology. It may be worth quoting some excerpts. She says, 'I found throughout my studies of Indus pyrotechnologies that Indus craftspeople were extremely technologically innovative in the creation of new materials. This was particularly true for sintered talcose and siliceous materials, where we see a virtual explosion of new materials during the 3rd millennium, at the same time as development of Indus civilization.... I think there are a number of desired attributes, in some cases overlapping, which relate to this development of new materials. One attribute is indeed imitation of rare natural materials, as discussed above. A separate attribute is valuation of transformed materials, with a special valuation of transformation by fire — although *not* necessarily a valuation of fire itself. Another set of attributes are the desire for materials of particular colours and high reflectivity, and perhaps sound. A further possible attribute desired by the Indus people, not discussed here but important to overall question of material culture style, is appreciation or even veneration of 'traditional' styles; that is, a deliberate archaism. .. the most valued objects were those artificially created and transformed in colour and state.' Heather suggests that importance of talc in Indus bead assemblage may in part be related to its startling transformation from various colours to a bright white after firing. This colour change may have served as a material illustration or symbol of religious beliefs.

Heather makes an important point that while only talc is used to make white disc bead burial ornaments at Harappa, shell is still the primary material used for bangles for Indus period burials, and there is never any attempt to make bangles from talc. Thus, shell continues to hold ritual value, but talc disc beads, rather than imitating 'more valuable' shell beads, replace them altogether. Again, the high value of talc may have to do with its transformative quality, something not possible with shell. She further stresses that the Indus valuation seems to have been of transformation, not of fire itself. There are no clear symbols or scenes of veneration of fire in Indus cultural material. The so-called 'fire-altars' of Kalibangan are identical to a well-documented cooking hearths and pottery-production kilns found at sites. As a pyro-technologist, Heather emphasizes that the Indus people valued fire and its uses, but certainly there is no archaeological evidence to show that they held it in religious veneration.

Heather explains the relative indifference of Indus people to lapis and even turquoise by a combination of a desire for materials transformed by heat and for materials with high reflectivity. Jarrige is reported to have said about Indus attitudes toward turquoise and lapis lazuli, "they didn't like them because they couldn't play with them". That is, these materials did not change in colour, reflectivity, or hardness with technological treatment, primarily heat treatment. She also points out that the selection of very hard, dense materials for bangles and beads by Indus people indicates that sound is worth considering in future studies of Indus ornament assemblages.

Heather further explains that to deal with extensive difficulties involved, she used as many lines of evidence as possible to determine *relative* worth of objects within Indus civilization. These relative value hierarchies, rough as they are, yielded some surprising results, with many cases where artificial materials were more highly valued than expected, and some rare natural materials apparently not desired at all. She finds that culturally-specific desires and values seem more important, including the value of transformed materials, particularly those transformed by heat, and the desire for specific colours and high reflectivity. Quoting Vidale, she sums up her thoughtful essay, the Indus people are noteworthy for their cultural expression of "[n]ot power of conquering, but rather power of creating; from abstract universes created in their urban organization to artificial stones of their microbeads" (Vidale 1989: 180).

In another interesting paper, Heather (in press), explains the location of craft centres in the Harappan towns. She says,

> Looking at craft production location with respect to civic organization provides insights into possible associations between crafts, as well as general Indus attitudes towards the placement of manufacturing within city centres. There are several possible interpretations for these locational patterns, but all interpretations illustrate that craft production distribution sheds light on more than just control of production. Craft production location informs on the technical development of and links between various crafts, structure of Harappan Phase cities in general, and social relations of people within. Considerably more work needs to be done to verify the patterns I have identified, particularly continued systematic survey of other city and town sites.

Beads are by far the most popular indicators of ornamentation found in the archaeological record of Harappan sites. If one includes the masses of steatite microbeads, there are hundreds of thousands of beads, in a wide array of types and materials, each requiring its own manufacturing technology. This is a huge subject, we can only briefly cover here.

India and Pakistan have been famous for their native lapidary industries for millennia, right from the Harappan times, in fact. Possehl informs us that Nero paid the round figure of a million sesterces for an Indian cup.

There is evidence for the manufacture of hard-stone beads at many Harappan sites. The early sites are Mehrgarh III, Ghazi Shah I, Amri Ic and Id, as well as Shahr-i Sokhta II. During Mature Harappan, we have a bead shop at both Chanhudaro (See etched beads from Chanhudaro in (Fig. 6.9) and Lothal. Mackay notes that "proof that some beads made from hard stones were actually manufactured at Mohenjodaro is afforded by unfinished specimens that we have found, though no actual bead factory has yet come to light (Mackay 1937-38: 50). More evidence in this regard comes from the intensive surface exploration of Mohenjodaro. In Moneer Area there was found co-occurrence of several classes of artefacts indicating craft activity, but "thousands of flakes of agate, chalcedony chert drills and/or specialized tools form largest assemblage of indicators of semi-precious stone working so far identified at Mohenjodaro" (Halim and Vidale in Possehl 2002).

It is interesting to note that the lapidaries also used stone flaking techniques. Bead making is a living craft in the Gulf of Cambay (Khambat) even today. When we visited them, craftsmen reproduced beautiful long chert blades for our benefit with an effortless ease. Bead making also required techniques of sawing, flaking, grinding and boring. The material used for beads was agate, carnelian, lapis lazuli, shell, terracotta, gold, silver and copper. Probably pressing paste through thin bronze tubes made fine steatite beads. Harappans etched the beads by making

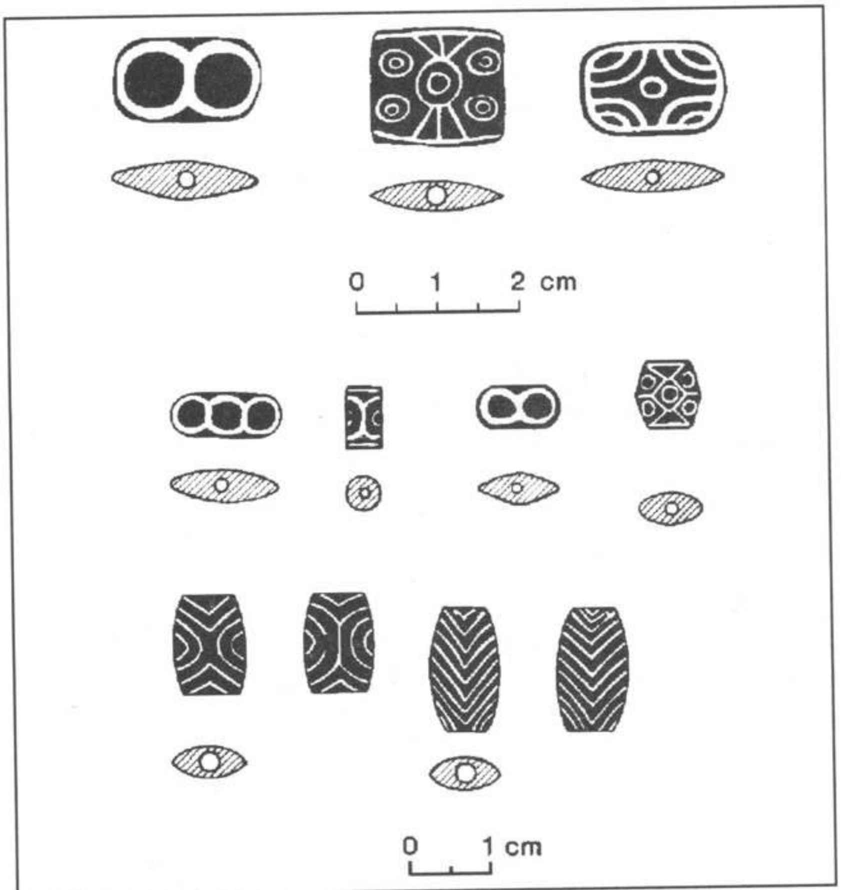


Fig. 6.9 Etched carnelian beads, Chanhudaro (After Possehl).

patterns in alkali paste and then heating the bead till the alkali was absorbed. In other type, the whole bead was made white with alkali heating and then a black design was painted, perhaps with copper nitrate solution.

The most spectacular Harappan beads were made of hard stones, generally of agate, both banded and clear, or chalcedony. The stones of this general class that the Harappans employed in bead making are described by Possehl as follows:

Table 6.1 Stones used for mature Harappan bead-making.

Alabaster	Amazonite	Amethyst
Azurite	Bloodstone	Breccia
Caringom	Chalcedony	Chert (brown and black)
Chrysoprase	Hematite	Hornblende
Jade	Jasper	Lapis lazuli
Limestone	Moonstone	Onyx
Opal	Plasma	Quartz (milky and rose)
Rock crystal	Serpentine	Turquoise

Technology of Bead Making

Based on hundreds of archaeological specimens, especially those from Chanhudaro and Lothal, Possehl has reconstructed the outline of sequence of hard-stone bead manufacturing. This begins with chipping out a rough blank, then refining the shape with a second, more delicate round of knapping. There is also evidence for sawing during early stages of shaping at Chanhudaro (Fig. 6.9). Mackay felt that this implied use of an abrasive. The chipping marks were then ground away on a hone. This was time-consuming handwork, at the end of which bead had its final shape and size, but with an unpolished surface. The bead was then drilled. The beads often show little cup marks, pecked into both ends, which served the function of small starter holes. A drill with a hard-stone bit was used. The stone we have from archaeological sites is chert or a hard green stone we believe to be phtanite. This was used with rotary motion implying the use of a bow or possibly a pump drill. Drilling proceeded first from one end of the bead to the centre and was finished with a second hole penetrating from the opposite side, two holes meeting in the middle. Even very small beads were drilled in this two step manner. There is also evidence that not all beads were drilled. Sometimes perforation was carefully pecked through using a delicate chipping technique. We can only guess at the polishing process. Perhaps it included moving the beads and a slurry of light abrasives inside a sealed bag of probably leather.

Carnelian Beads

According to Kenoyer, technological studies of the manufacturing processes confirm that many long biconical carnelian beads as well as the decorated carnelian and green amazonite beads were actually made in distant Indus workshops. However, the long faceted carnelian beads may have been made by the Indus artisans in Mesopotamia. These beads are drilled with the unique technique of the Indus Valley, yet, faceted shape is a style that was never produced in the Indus workshops. The pear-shaped decorated carnelian bead is also a shape that was never produced in the Indus, but it is made using a technology that has only been documented in the Indus cities. These clues suggest that merchants or entrepreneurs from the Indus Valley may have set up shops in cities such as Ur, to market their goods and also produce, objects in local designs. If this can be confirmed through further studies, it would be the earliest evidence for a pattern that came to be the norm in later historical times, when craftsmen and merchants from the subcontinent extended their trade networks throughout West Asia as well as Southeast Asia (Kenoyer 1998).

Carnelian, or sard, is a form of chalcedony that has been turned red by heating. Heating the stone causes oxides of iron to become yellow, orange, and red. Some stones turn a uniform deep cherry red. One of the distinctive bead types of the Mature Harappans is etched carnelian. These are red with white designs (rarely black) that were traded far and wide as a part of the Middle Asian Interaction Sphere. They were also prized by the Harappans themselves, who found them worthy enough to fake. The art of etching stone is known in modern Sindh, and Mackay found one practicing craftsman in Sehwan near Lake Manchar who gave him a demonstration. The process began with the juice extracted from the tips or young shoots of a bush called *kirar* in Sindhi (*Capparis aphylla*). The informant then ground washing soda to a fine powder and mixed it with water in a cup. He poured a small quantity of this on *kirar* and rubbed the whole carefully together to a semi-fluid mass. Then the craftsman strained this mixture through a piece of linen into a large empty mussel shell, and "paint" was ready. This paint was applied to a carnelian stone using a reed pen. The painted stone was then allowed to dry, first in hand, then by placing it on a metal plate over a charcoal fire. When fully dry, the carnelian was covered with live coals and the fire fanned for about five minutes. The piece was then removed from the heat and allowed to cool slowly for about 10 minutes under an inverted cup, at which point the craftsman rubbed his piece of carnelian briskly with a rag and it was ready.

Possehl informs us that etched carnelian was so prized during the Mature Harappan that it generated a market for a cheap imitation product. These have been found at Mohenjodaro, and they are all of steatite or steatite paste (Possehl 2002: 95-97).

Lapis lazuli is comparatively rare, though unfinished examples from Chanhudaro indicate a local manufacture. Badakshan was the nearest source of lapis. It may, however, be noted that many a so-called lapis objects have turned out to be azurite on analysis. Precious stones of all varieties were highly valued in the Indus cities, and special designs and colours were sought after for making ornaments and utensils. Hard stones like agate and jasper that would hold a high lustre polish appear to have been more popular than the softer varieties, such as lapis lazuli and turquoise that would quickly wear away to a dull lustre. Banded agate, variegated jasper and red-orange carnelian were among most commonly used materials, obtained from distant sources in Kachchha and Gujarat, as well as widely distributed sources, one in Chagai hills of southern Baluchistan and/or in Badakhshan, northern Afghanistan. Turquoise also may have been obtained from southern Baluchistan or from more distant regions of northern Iran, but neither of these stones was very popular with the Indus city consumers. When worn as beads, these relatively soft stones become dull or change colour. This may have stimulated production of glazed faience beads that could be coloured to look like turquoise or lapis lazuli. They also made beautiful gold ornaments and ivory objects (Pls. 6.5-6.16).

Vidale (in press) makes a very significant observation,

> The imitation of various semi-precious raw materials such as turquoise, lapis lazuli, carnelian, and shell by artificial replicas (mainly terracotta, talc, and faience-related materials) allowed provision of differently ranked categories of people with different ranks of ornaments (Kenoyer 1991). The addition of new artificially-created materials to the array of semi-precious raw materials allowed an increased number of layers of hierarchy to be represented, and it is clear that technology became an important tool for categorization of people arranging themselves in new orders. A fascinating aspect of this evolution is that while the forms of some important ornament types remained basically simple and stable across time, and particularly during the Harappan phase, the materials employed multiplied. If stability of form promoted an (deceptive) image of cultural homogeneity, social integration, and social stability through time, then an extended hierarchy of base materials might have been the most efficient key for categorizing a diversifying social pyramid. The two aspects (stability of form vs. hierarchy of materials) are completely integrated and intimately support each other. These various processes might have concurred in developing, within Indus societies, a complex hierarchy of social personae and functions. This hierarchy might have been the social background on which, in 2nd millennium BCE, were built and formalized much simpler social categories of *Varna* system (Vidale in press).

Seals

Generally the seals were made of steatite. This is the softest of the minerals and is rated only 1 on the Mohs' scale of hardness - so soft that it can be scratched by a fingernail. The stone was probably sawed and finished with the help of a knife and abrasive.

Marshall has noted that it has been found by experiment that the even sharp chert flakes cut steatite very well. The carving of animals and script was done with fine chisels and drills. To obtain a white lustrous surface seal was coated with an alkali and heated which slightly hardens to about 4 on Mohs' scale. This was often done since it makes the seals wear better. The seals were also often glazed white, apparently to make their outer surfaces a uniform colour, improving their lustre and beauty. Sana Ullah found that this covering was a fused powder of steatite. Thus furnaces are one of the pieces of physical evidence for a seal-cutting establishment.

Possehl (2002: 95) has made some interesting observations on seal-cutting. The steatite was first sawn into blanks of the approximate size and shape of the seal, including thickness needed to accommodate the boss. Mackay gives a table of seal sizes that range from 1.25 by 1.25 cm to 6.85 by 6.85 cm. A rough boss was then cut. This was done with four saw cuts parallel to the face of the seal, thinning it. These "flats" were then removed by taking four additional saw cuts at right angles, at the edge of the reserved hump of boss. We know from examples from Chanhudaro that boss was left in an unfinished state while seal itself was smoothed of saw marks and prepared for cutting. We also know from Chanhudaro examples that the design was roughed out on the surface with a sharp point. Some unfinished seals were covered with a thick coating of red ochre, the utility of which is not yet known. Various devices were completely carved and finished as a single operation, before even roughing out the inscription was undertaken. Mackay suggests that "seal-cutters probably kept a stock of seals by them and added inscriptions as required," something that has not yet been confirmed.

Finally, the back of the seal and the boss were finished. The boss was carved to a rounded shape and a deep V was carved along the length at right angles to the perforation, which was done next. This was most often a two-step drilling operation, which was usually angled slightly down into the body of the seal from opposite sides of the boss. We presume that this hole took a cord used to suspend, or hold, seal. There are many broken bosses but few of the holes show wear along the edges, as would occur if the seal were moving back and fourth along a cord. This suggests that the seal was tied onto the cord so that it did not move. In fact, given the fragile nature of the steatite, the seal might well have been wrapped in cloth to protect it from being banged around and moving on the suspension cord. To finish the operation, seal was coated with a mixture of steatite dust mixed with water and then baked, fusing the coating and hardening the steatite body of the seal itself. The finished product was a seal with a beautiful, white and lustrous surface.

5. Ceramic Technology

The Harappan pottery is mostly wheel-thrown, red-slipped and painted with motifs in black. After the pot was made, it was dipped in a red-slip and painted and then fired. Some people suspect the use of slow wheel, which is still in use in Sindh and Punjab. Foot wheel is put in a pit and is connected to a smaller turntable with an axle. The foot regulates the movement of the wheel. But in the post-Harappan times, for example at Rangpur, pots with rounded bellies come in vogue and probably indicate the use of spun-wheel. This wheel is an ordinary cartwheel and is spun with the hand. It can be given adequate momentum to run for more than a minute during which pot should be given the shape. This type of spun-wheel is now common in most parts of the subcontinent.

Variations in Pottery (Pl. 6.17)

From some of the earliest levels of Mohenjodaro, a burnished grey ware with a dark purplish slip and a vitreous glaze has been reported (Marshall 1931). A glazed ware from the earliest levels of Mohenjodaro is unique and anticipates a technique, which became popular only in the medieval times. Faience was used to make bangles, rings, miniature animals and pots. It appears to have been a short-lived innovation, but probably is the earliest record of glazing in the world. In fact, glazed pottery became popular in India only during the Muslim period. From the Saurashtra Harappan sites, a black-and-red pottery was also found. How exactly bicolour was achieved is still a matter of debate but it is obvious that supply of oxygen (air) was restricted to only those portions of pot which were oxidized red; or portions, deprived of air, were reduced black. The pots were generally fired in round kilns with round tops, pierced floors with underlying fire-pits (Mackay 1938).

6. Shell Technology

In contrast, the large gastropods *Turbinella pyrum* and *Chicoreus ramosus* were cut with a specialized bronze saw that would have been available only in the largest workshops. By studying the depth of each saw stroke on fragments of shell from the ancient workshops, we can reconstruct the basic shape of the saw. It had a very thin serrated edge that was long and curved, similar to the saws still used in shell bangle making in modern Bengal. Even more astounding is fact that Indus bronze saw was able to cut shell as efficiently as modern steel saws, which suggests that Indus bronze workers were able to produce a bronze that was as hard as steel (Kenoyer 1998). Ivory was also used extensively by the Harappans (Pl. 6.10).

In a recent excellent review of the shell industry Bhan and Gowda (2003: 51-80) give a regional perspective of the industry. We have quoted their report extensively below, including some of their conclusions:

Lothal (22° 33′ N; 72° 15′ E)

The site of Lothal is situated on the flat alluvial plain between the Sabarmati and Bhogava Rivers. Kenoyer (1983) informs us that bangles are highest in frequency in the assemblage (65.8%), of which 21 were of *C. ramosus* and one of *Tivela damoides*. The *C. ramosus* and *T. damoides* bangles are thought to have been brought to the site from elsewhere owing to the absence of manufacturing waste of these two species.

Rao (1973: 136) interpreted the presence of shell manufacturing at Lothal as being indicative of a major shell industry aimed at export to the hinterlands and to sites in Mesopotamia. Kenoyer (1983) is however, of the opinion that the site was not producing massive quantities of such artefacts and does not represent a major production centre for export purposes. The workshops perhaps catered primarily to local demand for other Indus cultural groups.

Ladles were also manufactured at this site and the frequency of the manufacturing waste is (48%) more than Mohenjodaro (15%) or Harappa (30%) (Kenoyer 1983: 234). This is not surprising as the site is closer to the resource area in the Gulf of Kachchha (around 200 to 250 km) while *T. Pyrum* must have been brought from the Gulf of Khambat.

Besides ornaments and utensils, shell-cutters of Lothal were producing various categories of special objects. At Lothal, as at Nagwada, these were produced by recycling the columella of *T. pyrum*. These include button/studs, figurines, toy cart, a frame 'bridge' for string musical instrument (?), 'wavy' multiple ridged rings (Rao 1979: 105), and incised button seals. The multiple grooved rings and button seals are very similar to the Nagwada specimens. These button seals may actually be ornaments, although their similarity to rectangular shell and steal seals from Baluchistan and Afghanistan and southeastern Iran (Tosi et al. 1981) suggests that they might have as seals.

Rangpur (22° 20′ N; 71° 55′ E)

About 40 km southwest of Lothal, is the site of Rangpur (Rao 1963). Here, a long sequence of occupation provides an important reference for cultural development throughout the region; although this has recently been challenged by the Possehl and Rawal (1985) on the basis of radiocarbon determinations at Rojdi. During the Mature Harappan phase (IIA) there is evidence for the use of shell bangles with an incised chevron motif (Rao 1963, Pl. XXXVII, A), shell beads (Figure 145), spoons, inlay and special objects such as games men and incised shell caps (Rao 1963, Figure 149). Most of the objects were made from *T. pyrum*, but the spoons and possibly some bangles were made from *C. ramosus* (Kenoyer 1983: 239). The presence of sawn columellas of *T. pyrum* indicate that some manufacturing was being carried out at the site, but the absence of *C. ramosus* wasters suggest that artefacts made from this species were being produced elsewhere. The illustration (Rao 1963, Figure 140 B) of terracotta cakes, perhaps used for sharpening tubular drills and the presence of manufacturing waste of ring manufacture in the form of circular shell discs (Rao 1963, Figure 149A) also suggest that some manufacture of shell rings was being carried out.

Surkotada (23° 37′ N; 70° 30′ E)

Another important shell working site that deserves mention here is the Mature Harappan site of Surkotada in the eastern Kachchha. The Harappan occupation is represented by three phases; IA, IE and IC (Joshi 1972: 129). In Phase IA, bangles are of thinner variety with characteristic chevron motifs. In Phases IE and IC the thinner bangles continue, along with wider bangles with shallow or deep grooves. Similar bangles have been reported from Lothal and Bagasra in Saurashtra and perhaps are characteristic of the late phase of the Harappan culture and are a regional style confined to Kachchha and Saurashtra (Kenoyer 1983: 244). The presence of ground columella and finished rings indicates reuse of columella pieces.

Kuntasi (20° 45′ N; 70° 30′ E)

Kuntasi situated on the southeastern part of the Gulf of Kachchha is represented by three phases, A, B, and C (Dhavalikar 1996). Here *T. pyrum* and *P. bucephala* seem to have been used for bangles (Deshpande 1996: 344). The overall frequency of finished bangles to manufacturing waste (Deshpande 1996, Figure 11.14) indicates that the site was geared to fulfill local demand rather than for trade in shell items. However, while Deshpande (1996, Figure 11.15) provides illustrations of wasters perhaps associated with bangle manufacture from *C. ramosus*; but no positive statement can be made on the basis of the illustration alone.

Nageshwar (22° 20′ N; 69° 6′ E)

Nageshwar situated on the southwestern tip of the Gulf of Kachchha provides an important perspective of the shell industry in Gujarat (Bhan and Kenoyer 1984; Bhan 1992). The site is located on the southern shore of the Gulf of Kachchha and is about 17 km northeast of Dwarka. Systematic surface survey and limited excavations at the site revealed that Nageshwar was a major manufacturing centre for the production of shell bangles and ladles.

Shell bangles appear to have been made primarily from *T. Pyrum* and less commonly from *C. ramosus*. Relatively, few finished bangles were recovered from the site (n = 135). Vast quantities of wasters found from pits dug out by earthwork contractors, who were building the northwestern embankment on Bhimgaja Talav (lake). In one such pit there were 714 sawn columellae, 430 outer margin of lips and 11 apex portions of *T. pyrum* spread over I m^2. The cache of wasters from this single pile was more than what was reported from the entire excavation at Mohenjodaro (n= 110) (Kenoyer 1984: 241). These wasters may have been intended for reprocessing into other shell objects like rings and beads, but save in the case of bangles and ladles, no other evidence for recycling was noted. However, recent analysis of the shell material from this site by the second author has revealed only one tubular drill waste produced during the manufacture of grooved rings, which had remained unrecognized during the earlier analysis. The presence of such wasters from the site indicates that some amount of recycling of the columellae might have been carried out at the site though undoubtedly not on a very large-scale. Another neatly kept pile of 413 columellae from *T. pyrum* was recovered from a rammed floor level during the excavations. The presence of these neatly kept sawn columellas, suggest that this material was carefully saved for transportation elsewhere and for reworking into rings and other shell items.

A significant feature of the site was the production of shell ladles from *C. ramosus*. In the course of surface surveys, a shell working location for the manufacture of ladles and bangles was located in D5-D9 and E5-E9 squares. In this area, a large number (n= 89) of *C. ramosus* wasters discarded during ladle manufacture and two sawn shell sections forming the blanks of ladles were recovered (Table 6.3). This area also revealed *C. ramosus* wasters discarded during bangle manufacture, and which could be easily identified from the unformatted sawn apexes (n = 93) and from about 54 columella portions. Not a single finished ladle or bangle of this species was either recovered from surface surveys or during excavations. The absence of finished ladles and the low frequency of bangles of this species at the site imply that bangles and ladles were not being made for use at the site itself. These objects were evidently being manufactured exclusively for trade to the major urban centres in the eastern and the nuclear region (Bhan 1992).

Table 6.3 Nageshwar shell objects compiled from Hegde et al. (1991: Figs. B1 and B2).

		No.	per cent
C. ramosus	Sawn spires	143	40.05
	Sawn columella	54	15.96
	Ladle manufacturing waste	89	24.92
	Unfinished ladles	02	0.56
	Sawn spines	54	15.12
	Sub-total	**342**	**96.97**
T. pyrum	Sawn apexes	06	1.68
	Sawn columella	06	1.68
	Grand Total	**354**	**99.97**

Except from Nageshwar and Lothal typical ladle manufacturing wasters have not been reported from any of the Harappan sites of Gujarat. In the nuclear region, ladle manufacturing wasters were recovered from Mohenjodaro (15%), and Harappa (30%) (Kenoyer 1984: 234). Sher and Massimo (1985, PI. VIII) recovered two concentrations of ladle and bangle manufacturing wasters of *C. ramosus* from residual patches in the northeastern area of Chanhudaro, clearly indicating that it was an important production centre, although this was overlooked by Mackay (1943). It is interesting to note that as at Nageshwar, the *C. ramosus* was almost exclusively used for the manufacture of ladles and bangles; in contrast to Mohenjodaro; where *T. pyrum* seems to have been used in the manufacture of bangles and where ladle manufacturing wasters are rare. The Chanhudaro industry resembles that of Nageshwar and also displays similarities in pottery types.

On the basis of the proximity of Nageshwar to sources of *T. pyrum* and *C. ramosus*, and based on the recovery of enormous quantities of waste, higher than that at any other Indus valley site; it may be assumed that this site was an important centre, geared towards supply of raw shell and finished goods in the form of bangles and ladles for regional and interregional markets. On the basis of near absence of bore holes and undersized shells of *T. pyrum*, Bhan (1992: 127) suggested that shell cutters of Nageshwar were perhaps involved in the seasonal collection of shell. He also suggested that the *T. pyrum* species was collected using boats for diving into deep waters. As 60% of *C. ramosus* showed worm- holes indicating that it was collected from rocky areas of the coral reefs during low tide or from shallow shores.

Bagasra (23° 3′ 30″ N; 70° 37′ 10″ E)

Bagasra is a small village on the southeastern shore of the Gulf of Kachchha in Maliya taluka of Rajkot district. Excavations revealed three architectural development stages, represented as three phases. Phase I is the preperipheral wall phase and is represented by Harappan pottery, 'Anarta' pottery, lithic tools, shell objects and plastered floors. During Phase II, the site seems to have been enclosed within a peripheral wall and we also see the development of various industrial sectors like faience, stone bead and shell manufacturing industries. Phase III is represented by 'Sorath' Harappa pottery and the function of the peripheral wall seems to have come to an end. However, the production of shell items seems to have continued, though perhaps on smaller scale (Excavation at Bagasra: A Preliminary Report: 1995-96).

Phase II witnessed the development of a flourishing shell cutting industry at the site, reflected in the discovery of a large shell-cutting workshop (Figs. 31, 33) on the western periphery of the settlement. The excavations at the workshop revealed a shell-cutting area between the two huge piles of unused *T. pyrum* shell. The working area is represented by sawn circlets, columellas and the apex portions of the *T. pyrum* shell. Preliminary observations of these two shell piles revealed that one of them had hundreds of the shells that were either undersized or worm-eaten. This indicates that the shell-cutters of Bagasra, separated shells based on quality. However, unlike Nageshwar it appears that the shell-cutters were perhaps not personally involved in the seasonal collection of shell. Kenoyer's ethnographic work on shell workers of Bengal provides an excellent parallel to this situation (1983: 328). He reports that since large quantities of shell are shipped from South

India, merchants mix defective worm-eaten and undersized shells with good quality ones, thus leaving distributors in Kolkata with a sample of defective shells. These are passed on to smaller producers. Tidal mud flats in the vicinity of Bagasra, may have been the source of edible shells and smaller gastropods; but larger gastropods must have been sourced from the coral reefs of the Jamnagar coast, which is nearly 150 km away, Thus, it appears that shell-cutters of Bagasra depended on other coastal sites, for the procurement of raw shell, which also contained a large quantity of defective shells.

Besides, *T. pyrum*, the shell-cutters of the settlement also occasionally used *P. buchephala* for making bangles. Though this species of shell was used from the initial days onwards, it appears to have been more common during the last phase of the settlement. Besides, a small heap of unused *F. trapezium* was recovered and was perhaps intended for shipping to the nuclear region, as this species appears to have been exclusively used for manufacture of inlays. As this species is absent at coastal sites of Gujarat, Kenoyer assumes that the Harappans must have obtained this species from the Oman Coast. This hypothesiz needs to be revised in the light of this new discovery. Although, coastal Oman might have been an important source for this species, some amount might have been exported from Gujarat.

The recovery of ground and exhausted pieces of columella along with one tubular drill waste and a few ring blanks (Excavation At Bagasra: A Preliminary Report: 1995-96; Fig. 31: 3, 5, 6), clearly suggests that some amount of reprocessing of *T. pyrum* columella was being carried out at the settlement, although perhaps, not on a large scale. A preliminary report on the shell remains from Bagasra is available (Deshpande-Mukherjee 1999). The second author studied the shell assemblage at this site to determine whether the typical manufacturing waste associated with ladle production was found at the site. However, there are no indications of ladle manufacture from *C. ramosus*, although a few finished ladles and a few broken ladle pieces were recovered (Excavation at Bagasra: A Preliminary Report: 1995-96; Fig. 31: I and 2).

From the presence of an enormous quantity of manufacturing waste and complete shells as compared to finished products, it appears that Bagasra, besides Nageshwar, was also an important centre of bangle manufacture on the southern shore of the Gulf of Kachchha, geared to regional and inter-regional trade. However, it should be noted that no quantitative analysis of the shell material has been undertaken as yet and most of the inferences presented here are provisional in nature.

Besides Bagasra, seven sites in north Gujarat reveal occurrence of shell bangles, beads and manufacturing waste from *T. Pyrum*. Each such occurrence was taken to be a 'huge' manufacturing centre (Hegde and Sonawane 1986), playing a decisive role in the economy of the site (Majumdar 1999: 164). However, as rightly pointed out by Kenoyer, on the basis of his ethnoarchaeological studies in eastern India, no manufacturing is carried out in distant regions, owing to the difficulty in procuring raw material and tools. At present, middlemen collect the whole range of shell objects from workshops in Kolkata and Dhaka. Finished goods that cannot be produced in distant workshops are purchased along with bangle blanks that will be processed with designs in local demand. He further adds that whole shells and manufacturing wasters such as columella fragments and rough discs are also purchased. These rough discs are usually sold to Naga tribes who grind them to make beads and pendants. In this system of distribution, specific types of waste, such as columella and sawn body whorls are carried to regions where no primary manufacture is carried out. Waste fragments originating from workshops in Kolkata go through one or more intermediary exchanges (1983: 346). A few sawn columellae, unfinished bangle and some manufacturing waste in an isolated village does not indicate the presence of a cottage industry, but is more likely the activity of itinerant shell traders or craftsmen. Therefore, it appears that the small shell occurrences from north Gujarat settlements may represent a similar distribution system. It thus becomes apparent that three levels of distribution systems existed in the Gujarat shell industry.

The settlements of Nageshwar and Bagasra appear to be geared towards the supply of raw shell and finished goods to Harappan sites through regional and interregional networks. Settlements at Lothal, Rangpur, Nagwada, Kuntasi and Surkotada appear to have produced shell artefacts primarily for local demand, or at the most, for other Harappan culture groups. The small shell occurrences from distant North Gujarat settlements appear likely to represent activities of itinerant traders and craftsmen.

Conclusion

Concluding their review, Bhan and Gowda say,

The present study arose from discussions relating Harappan economic systems, trade, social stratification and religious systems, and the perception that these questions are treated in a rudimentary fashion based on data from the archaeological record. In this study, some of the questions are addressed through a detailed analysis of shell material primarily from the excavated site of Nagwada in conjunction with data obtained from other major excavated and explored sites of Gujarat.

Shell collection and distribution

Through a careful study of shell species used as raw material and their distribution in coastal Gujarat, it has been possible to identify the source areas and major species used in workshops. Two major source areas the Gulf of Kachchha and the Gulf of Khambhat and perhaps the Great Rann of Kachchha, an ancient bay might have been potential marine raw material resource areas for the Harappans. No conclusive evidence exists as to whether the Greater Rann of Kachchha was an important resource area, and this awaits further information from the publication of the excavation report on Dholavira, one of the major excavated Harappan sites of Gujarat.

Through careful comparisons of modern habitats and shell collecting techniques, it appears that *T. pyrum* was probably collected at low tides by wading in shallow bays and making shallow dives from boats. Occasionally, this species is found on coral reefs and has holes bored by worms. Based on the paucity of shells with wormholes and the high degree of production at Nageshwar, it is possible that divers/collectors may have been engaged at least part-time in supplying workshops with material. The recovery of a large pile of undersized and worm- eaten shells, along with the paucity of these species near Bagasra, indicates that the shell-cutters of Bagasra had no direct access to raw material. On the basis of the model presented by Kenoyer of modem Bengal (1983: 328), it can be suggested that the shell collectors of Bagasra and Nageshwar were perhaps not closely related socially.

Looking at the distribution of shell in coastal Gujarat it appears that shell cutters of Nagwada also had no direct access to the raw material, although the site is just 6 km inland from the Little Rann of Kachchha, which appears to have been a bay during Harappan times. In addition to *T. pyrum*, *P. bucephala* and *C. ramosus* were occasionally used for the manufacture of bangles. *T. pyrum* appears to have reached the site in a semi-finished stage. Manufacturing wasters produced during preliminary chipping and the wasters associated with subsequent hollowing of the shell are more or less negligible (refer Table 1), thereby suggesting that these stages of manufacture were not carried out at the site. At Mohenjodaro (Kenoyer 1983: 192-93) and Nageshwar (Bhan 1992) manufacture was outside the habitation area. However, no such area was located at Nagwada, thus suggesting that the shell must have been shaped somewhere near the source of the raw material, and transported over a long distance. Sources include either the northern coastal line of Jamnagar district or from the area now known as the Greater Rann of Kachchha. It was not obtained from the Little Rann of Kachchha, which is just 6 km from the site, as proposed earlier (Hegde 1988, 1990 et a1.; Sonawane 1992: 168; Majumdar 1999: 56), though this may also have formed an arm of the sea.

Kenoyer reports an inland distinct rural shell-manufacturing centre at Hatgram, a small rural village in Indupur subdivision of West Bengal. Here, the production of bangles is on a smaller scale than other centres, and the primary raw material comprises recycled manufacturing waste (Kenoyer 1983: 347), purchased from larger shell working centres. At Nagwada, the ratio of finished artefacts to waste, and the type of artefacts produced, suggests that the workshop catered to local demand for bangles rather than for export purposes. However, rings might have been produced here for local as well as regional markets, owing to the high percentage of ring manufacturing waste at this site. It is also possible that some amount of columella portions of *T. pyrum* were brought to Nagwada via itinerant traders/craftsmen from the main Harappan shell working centres such as Nageshwar for transforming them into rings. Nageshwar was primarily a bangle and ladle producing centre. Here, hundreds of *T. pyrum* columellae found separated from other manufacturing waste and kept stacked in heaps on house floors, perhaps to be sent to sites like Nagwada and others for recycling. Only two pieces of manufacturing wasters associated with ring manufacture were identified in the Nageshwar shell material. *Chicoreus ramosus* is found primarily in reef areas in the Jamnagar coast and is collected by wading or through shallow dives. The distribution of this species at the Harappan sites of Gujarat suggests that Nageshwar was the only site where this species was exclusively used for the manufacture of ladles. However, some ladle manufacturing wasters and small amounts of bangle-manufacturing waste has been reported from Lothal and Nagwada, respectively. No ladle-manufacturing waster was found in the Bagasra assemblage. The presence of a few worked spines of this species indicates that it was very occasionally used here for bangle manufacture. Undoubtedly, the raw material must have reached to these sites from the settlements like Nageshwar, since this species is not found in the Gulf of Khambat.

The recovery of small amounts of bangle manufacturing wasters of *Puilina bucephala* from Nagwada and Bagasra, suggests that this species was occasionally used for bangle manufacture and at times for inlay manufacture (for example at Kuntasi). However, at Nagwada the columella of this species was also used for the production of small shell items, perhaps beads. This species is also found in the Gulf of Kachchha and it appears that they must have been collected by wading and shallow dives.

The recovery of a pile of unused *Fasciolaria trapezium* shell from the coastal site of Bagasra, suggests that at least some raw material of this species must have been exported from this region contrary to Kenoyer's (1983: 357) hypothesiz that the raw shell of this species was brought from the Oman coast to the Indus Valley sites.

Levels of production

The Gujarat shell industry reflects three levels of distribution/production systems. Nageshwar and Bagasra produced a limited range of artefacts. At Bagasra, we see intensive production of bangles from *T. pyrum* and occasionally the use of *P. bucephala*; and Nageshwar seems to have specialized in the production of bangles (from both *T. pyrum* and *C. ramosus* species) and ladles from *C. ramosus*. Both settlements appear to have been geared for trade in raw material and finished goods to regional and extra regional markets.

On the other hand, at major Mature Harappan sites such as Surkotada, Rangpur, Lothal, Nagwada and to some extent Kuntasi, we see a wide variety of objects being produced. At times there are indications of reprocessing of shell wasters perhaps brought from other shell manufacturing centres like Nageshwar, where we have evidence of separation of material for recycling. Most sites of this category appear to have produced shell items for local markets at and near the site.

The distant North Gujarat settlements, where some small occurrences of shell working have been reported represents the third level of production. This appears to be the activity of traveling shell cutters and/or traders, who visited these settlements along with their wares and for production of shell items on the basis of specific local demand.

Socio-religious Aspects

In contrast to specialization between settlements, manufacturing technology was quite standardized. A specific technology of chipping and cutting shell was used at all workshops, to the extent that the width of the copper/ bronze saw blade appears to be identical. Although there are some variations in the width of bangles, they were all incised with the same chevron motifs, and this tradition continued throughout the Mature Harappan period. The only change in style is seen during the Later Harappan sites of Kachchha and Saurashtra. Other artefacts such as ladles, rings, 'gaming' pieces and even inlay designs show remarkable uniformity between the distant regions. These similarities in artefact types and style of decoration undoubtedly reflect specific uses related to the common cultural and socio-ritual role of shell objects.

Distribution of raw material and finished goods from coastal sites to inland manufacturing centres was probably defined by social ties between the major shell working comminutes. The existence of such social connections would explain the uniform technology used in shell production and the standardization of designs. In the larger urban centres, the distribution between shell-collectors and shell workers would have been even more pronounced and possibly certain individuals or families were involved in trade rather than production.

Ladles made from the spine-covered *C. ramosus* required a disproportionate amount of labour for use as domestic utensils. Despite this, their occurrence at almost every Harappan site indicates that they were in demand. It is unclear as to whether they were used by affluent individuals as symbols of status and wealth or were a part of specific rituals. Imitations made in clay suggest that they were of considerable value and in high demand.

C. ramosus shell ladles at Balakot, Amri, Chanhudaro, and other sites could have been brought directly from the Gulf of Kachchha, or through intermediate central places such as Mohenjodaro, Lothal or even Dholavira. The presence of a *Tivela damoides* bangle at Lothal suggests that direct or indirect contact between sites existed along the coastal seaboard. Evidence of strong contacts between Chanhudaro and the Gulf of Kachchha, and probably Nageshwar, along with production at Mohenjodaro could mean that many of the shell ladles in the central region were being distributed or manufactured at these important sites.

The ethnographic study carried out on stone ring manufacture at Khambat and the detailed study of the Nagwada shell material, has made it possible to understand and reconstruct various sequential stages of ring manufacture using tubular metal drills. It has been possible to present concrete data relating to important technological developments in the shell industry. The study also high lighted the importance of diverse craft indicators that may be useful to archaeologists in discerning activities related to shell manufacture in the archaeological record. Differential access to marine resources and distribution of shell demonstrated the complexity of the trade and exchange networks. This study indicates that it is no longer necessary to refer to each shell occurrence as a 'factory site', 'playing a role in the economy of that particular site', or loosely attribute the source of shells to the 'the Gulf of Kachchha or Little Rann of Kachchh'. It is only through a detailed study of such 'lesser' or 'minor' craft industries that we will begin to understand the development of socio-economic system in the Harappan civilization (Bhan and Gowda 2003: 51-85)

7. Standardization

The uniformity and standardization of the Harappan artefacts has baffled many an archaeologist. It assumes both an amazing administrative control over a territory of over a million square km and also over production and distribution. The shapes and designs of pottery, the types of copper tools, the weights and measures, the standard size of bricks (ratio 1:2:4), uniform layouts of the cities, etc. clearly indicate that they had realized the advantages of standardization.

The Harappans had evolved a highly standardized system of weights and measures. For linear measures, two systems were in vogue: cubits and a long foot. A cubit was about 52 cm (52.5 to 52.8 cm) and the long foot 33.5 cm. Rao reports a shell object (now also reported from other sites in Saurashtra) with four slits, which was probably used to measure angles. A shell scale from Mohenjodaro and of ivory from Lothal indicate the Harappan measures of length. Lothal scale has a length of 128 mm. The smallest divisions are 1.7 mm and the next unit is 33.46 mm (1.7 × 20). Lothal scale is divided decimally. On the Mohenjodaro and Lothal scales a bigger unit of 67.056 mm can also be discerned. Both foot (13.2" or 33.5 cm) and cubit (20.5" or 52.5 cm) seem to be in vogue, as indicated by the measures of buildings and roads. For example, the main walls of the Harappan granaries measured 30 cubits and their widths 10 cubits; some houses of Lothal measured 40 × 20 units of the Harappan foot (Rao 1973). Rao (1973) has pointed out that 17.7 mm Harappan division is very near traditional *angula* measure of 17.86 mm of the *Arthasastra*.

Similarly the Harappan cubical weights show remarkable accuracy of the standardization (Wheeler, 1968). In the lower denominations the system is binary: 1, 2, 1/3 × 8, 4, 8, 16, 32, etc., up to 12,800 which is comparable with traditional Indian ratio of 1:16 (Rupee=16 annas). The unit is equivalent to 13.625 gm. In the higher weights they have followed a decimal system, with fractional weights in one-thirds. Weights are discussed in greater detail in the Chapter 9 on Trade.

8. INNOVATIONS

The technological skills of the Harappans are not only reflected in their accurate and scientific system of weights and measures, but also in their innovations. They made circular saws, true saws (with teeth and body set alternating from side to side for maximum efficiency of cutting), and fine tubular drills. Probably the Harappans were the first to make these instruments.

For survey and measuring angles, they had a device, which was identified for the first time by Rao at Lothal. It is made of shell.

It is a hollow cylinder with four slits on each of the two edges. When placed on a horizontal board it can be used almost as a compass in plane table survey for fixing the position of a distant object by viewing it through slits in margins. The lines so produced pass through the central point. If the opposite slits on one side are joined by cords they cut at right angles, and if all the cords passing through the slits on both the margins are drawn on the same plane as shown.... they intersect one another at centre and angles so formed by eight lines measure exactly 45° each. Obviously this instrument must have been used for inland survey and for fixing alignments of streets and houses (Rao 1973).

This object is not unique at Lothal but was found at Mohenjodaro also and was mistakenly listed as an ornament. Recent explorations have produced this instrument from Pabhumath and other sites of Saurashtra (Atri pers, comm.).

A unique find of a stone rotary mill from Lothal seems to attribute this revolutionary innovation to the Harappans. The only problem is that such an efficient use of manual energy should have found more common use elsewhere too. But so far this is the only such find reported from any Harappan site. Sankalia (1974), however, attributes such rotary querns to historical times. He says that the rotary querns of the heavy type with transverse holes for a two-way handle have turned up from numerous sites from the 1st-2nd century AD/BCE deposits. And this is exactly the type of rotary quern found at Lothal. Nowhere the lighter rotary quern with a hole on the top for a vertical handle (hopper type) has been found. He further emphasizes that nowhere in the several Chalcolithic and Harappan sites dug so far, such rotary querns have been found (Sankalia 1974).

The concept of town planning was too an innovation of the Harappans (and the Early Harappans). They laid out their town on a gridiron with streets running at right angles to each other. There was an extensive drainage system, which collected sewage from each house. The drains were laid underground, below the streets. The lower city was always located in the eastern part and the Citadel on the west. There is a remarkable uniformity in the layout of the cities - from Harappa to Kalibangan, despite several variations.

Another remarkable innovation was the technology of waterproofing. The Great Bath is a marvel of waterproofing engineering skill.

To ensure that bath was watertight, the floor was of bricks set on edge in gypsum mortar; sides were similarly mortared, and behind facing-bricks was an inch thick damp-proof course of bitumen held by a further wall of brick which was in turn retained by mud-bricks packed between it and on outer backed brick wall (Wheeler 1968).

We thus see that the Harappans had developed sophisticated technologies of casting and forging copper, of lapidary art, of ceramics and of agriculture. They invented new tools and instruments. They were perhaps the first to realize the importance of standardization not only in systems of weights and measures but also in the products of mass consumption. They gave the world the concept of town planning.

II. Metallurgy

We discuss below the metallurgy of the Harappans under the following categories:

1. Sources of metal
2. Making of artefacts
3. Harappan pyrotechnology
4. Typology of artefacts

1. Sources of metal

Silver & Lead

There is a bit of controversy regarding the sources of silver. Chakrabarti (1990), while emphasing the significance of Afghanistan as a possible source of Indus copper, lead and silver, says that each of these metals is easily procurable in Baluchistan, Rajasthan and Gujarat. Ratnagar however thinks that there was no indigenous production of silver in India until a fairly late period, and that the Harappan silver came from Mesopotamia. Chakrabarti argues that this statement does not appreciate the extent to which we have argentiferous galena in the lead-zinc deposits of Zawar and Agucha in Rajasthan, besides, silver objects are found as early as Nal.

Ratnagar, replying to Chakrabarti's criticism about silver, says that this point about two urbanized termini of the trade comes across vividly when we consider the trade in silver. Little silver has been found in the intermediate areas of southeast Iran, Seistan, or the Gulf except for two silver artefacts at Shahr-i-Sokhta in Seistan and two silver beads in an Oman grave. She had earlier argued (Ratnagar 1981: 144-46) that the Harappans, who were the only people of proto-historic South Asia to have used silver on a substantial scale, imported this metal, most likely from Mesopotamia. A regular movement of silver from the Assyrian merchant colonies of Cappadocia to Mesopotamia is well documented for the period between 1920 and 1750 BCE and texts from Ur which refer to silver being taken overseas by merchants to buy copper in Dilmun (clearly an entrepot) date to the time of Rimsin of Larsa of 1822 to 1763 BCE. It had also been pointed out that silver occurs in the two large Harappan settlements, Mohenjodaro and Harappa, but is almost totally absent at other sites. Another argument for Mesopotamia as the source is that, even earlier, around 3500-3000 BCE and also later, silver and lead were used on a substantial scale in Mesopotamia and Elam. One example is provided by the Early Dynastic III Royal Cemetery at Ur, with a truly exceptional amount of silver (Moorey 1985: 114 ff, 122 ff). Second, we now have a run of radiocarbon dates from the silver-lead bearing localities of Dariba, Agucha, and Zawar, near Ajmer in Rajasthan, which testify to mining in the later first millennium BCE rather than earlier (Craddock *et al.* 1989). The only earlier mining is attested to at Dariba, but these dates are post-Harappan, viz. later 2nd millennium BCE. Finally, it needs to be mentioned that Kosambi noticed on a rectangular piece of silver from Mohenjodaro, traces of cuneiform writing. He expressed his surprise that neither Marshall nor Mackay had paid attention to it. But as copied by Kosambi, the cuneiform signs are not complete.

The late Shashi Asthana (1993), who did some very important studies on Indus trade, has made some interesting observations about silver in the Harappan context. Asthana thought that silver was apparently quite popular with the Harappans living at Mohenjodaro and Harappa, but those at Lothal and Kalibangan rarely used it. Silver was used for making vases and ornaments, such as bracelets, bangles and beads. Asthana also held the view that possibly the most promising source for silver at Mohenjodaro and Harappa is in Afghanistan and Iran (Marshall 1931: 675-77). Lead mines, which could have been a source for silver as well, are situated in Ghorband valley of Afghanistan and are common in southern Afghanistan, especially at Hazara Jat. Well-known silver mines are also known to have existed near the head of the Panjsher valley in the southeastern Hindu Kush and in the vicinity of Herat. It was rarely used for making utensils and ornaments. Large finds of lead at Harappa (Vats 1940: 58) and Mohenjodaro include only a lead vase and a lead dish (Mackay 1938: 472), a round lead ball with a copper or bronze staple attached to it (Mackay 1938: 476) and a lump which may be a net sinker (Marshall 1931: 30). Balakot had produced a flat, semicircular piece of native lead (Dales 1979). Looking at these resource areas in terms of locational proximity to Harappan culture area, it can be suggested that Harappans living in Sindh were exploiting sources on the southwestern frontiers (Baluchistan and southern Afghanistan). Northern Iran and Soviet Central Asia were exploited mainly by the Harappans of Punjab. Those in Gujarat and Saurashtra were apparently getting their raw materials from more than adequate sources in their own area, as well as from the South, including Mysore. Northern Rajasthan and Haryana must have taken most of their raw materials from central and southern Rajasthan.

The Harappan settlements at Shortugai on the confluence of the Oxus and Kokcha in the Hindu Kush area indicate that the Harappans of the northern region established trading posts to monopolize trade in raw materials from north-east Iran and Soviet Central Asia (Asthana 1993: 271-85).

Copper

The question of supply of copper minerals to the Indus civilization is quite controversial. Right from the early thirties, a variety of sources have been suggested.

Chakrabarti & Lahiri (1996) have recently provided a comprehensive survey of the copper mines and mining areas in the subcontinent. The following account is based mainly on their work, my book and papers (Agrawal 1971, 1982b) and the more recent work of Kenoyer and Miller. Kenoyer and Miller (in Pigott 1999) in a recent review indicate three possible sources for the Indus copper. The first is the combined area of Baluchistan and Afghanistan, to the west of the Indus valley, which extends from Badakshan to coastal Makran. This extensive region contains numerous copper deposits and appears to have the earliest evidence for copper processing. A second potential source of copper is the inland mountain range of modern Oman on other side of the Arabian Sea, though Chakrabarti does not seem to agree with this view. A third region, to the east of the Indus and Ghaggar-Hakra valley, comprises the north-south oriented Aravalli mountain range of Rajasthan. Numerous concentrations of copper ores are found in these ranges along with zinc, lead, and silver ores.

Baluchistan-Afghanistan: This area is full of old workings. Herat, Kabul and Loghar provinces have the major deposits but there are smaller occurrences in the areas of Farah, Ghar, Badghin, Fariah, Jozjan, Bamiyan, Uruzghan, Ghazni, Kandahar, Parwan, Bagwan, Kapisa and Badakshan. There are substantial old workings at Simkoh in Herat, Balkhab in Jozjan and Bazaraka in Kapisa. The old workings near Kabul (22 km to the north-east) showed vast quantities of slag and small rectangular (0.9 by 1.2 m) mining entrances to follow the sloping ore vein which was possibly bornite (Reedy 1992: 243 in Chakrabarti & Lahiri 1996).

In the highland plateau west of the Indus valley flood plains, numerous copper working areas have been reported over the years, but the most impressive is the region of southern Afghan Seistan, often referred to as Gardan-i-Reg (Dales and Flam 1969; Fairservis 1952, 1961). Here in the windswept wastes of the Helmand basin there are vast areas of exposed copper slag mixed with pottery and/or cultural debris. Dales (1992) mentions that some of this slag was analysed and contained 14% copper, and that the gold assay was also quite high, but most of samples have yet to be studied. The copper ores processed at Gardan-i-Reg are assumed to be from nearby deposits, but no detailed report has been published on the mining areas.

The ceramics and/or cultural material associated with the copper smelting debris of Gardan-i-Reg correspond to the Helmand tradition (Shaffer 1992) at the sites of Mundigak, Shahr-i Sokhta (Period III) and Tepe Rud-e-Biyaban (Periods II and III). The dating of the ceramics is disputed and while some scholars feel that they fall between approximately 2500-2400 BCE (M. Vidale: personal communication), others suggest that they date to the period prior to 2600 BCE (Jarrige: personal communication). The copper smelting activity would be basically contemporaneous with their late Regionalization Era ("Early Harappan") or the Integration Era, the Harappan Phase of the Indus valley tradition. Occasional discovery of Indus valley tradition artefacts at sites in Baluchistan and Afghanistan indicates that there was movement of people and goods between this important mineral resource area and the greater Indus region (Kenoyer and Miller 1999).

Copper occurs widely in Baluchistan. In the Quetta district it occurs at Ziarat, in Kjojak Amran range and in the hills west of Sohrab and Ghiddar, as also between Sohrab and Rodinjo. Malachite occurs in large quantities in Jhalawan to the south of Kalat. Chalcopyrite and malachite both occur in the Saruna and Khidrani areas of this territory. Copper is apparently plentiful in Las Bela, in the hills between Liari and Bela where, according to an account of 1840, somebody procured half a mound (1 mound = about 40 kg) of excellent refined copper by smelting three mounds of copper ore. The ore was smelted in a mud furnace with wood as fuel. The Chagai region has three areas of occurrence: Ras Koh in Kharan and Lar Koh, both with chrysocolla as the ore-type and the areas of Robat Koh, Malik-i-Siah Koh and Saindak Koh where there is carbonate of copper in some veins. The extensive presence of slag can be inferred from the fact that at Robat a small fort was built with copper slag as the principal building material. According to Buller, pre-industrial copper smelting was practised in Chagai till the last quarter of the 19th century. On other hand, some slag specimens from the Sandak mines of the area are dated around 3500-3000 BCE.

Copper and iron ores that are rich in arsenic are found in limited distribution in Baluchistan (Agrawal 1971; SanaUllah 1940) and the Iranian plateau, but it is not clear if these ores were being exploited continuously or only at specific chronological periods. For example, Pigott et al. note that the arsenic and lead components in copper objects increase in the later periods at Tepe Hissar in Iran (Periods II and III: *ca.* 3600 to 1700 BCE; Dyson and Remsen 1989:1089) and suggest that this increase is due to selection by the metalsmiths (Pigott et al. 1982). On the other hand this pattern could be the result of changing access to copper ores due to political or trade alliances, and not an intentional act on the part of metalsmiths.

In the Northwest Frontier, chalcopyrite and malachite occur in small pockets in Gilgit, Dainyor Nala, Dikut and Pasu, while chalcopyrite, bornite and malachite are present in Dir. From the Potwar plateau small nodules of copper sulphate were reported by Valentine Ball (1881: 226) in the local shale beds. Chalcopyrite and pyrite pockets have been noted in Swat. Coggin Brown and Dey (1955: 153) also reported some copper ore in Chitral and Waziristan.

Oman

Major connections between Oman and the greater Indus region may be inferred from the presence of Harappan Phase artefacts and possible short term Harappan Phase settlements in Oman (Cleuziou 1989, 1992; Cleuziou and Tosi 1989; Tosi 1982; Potts 1990), combined with the presence of shells from Oman at Indus valley tradition sites (Kenoyer 1983). By taking advantage of the monsoon winds, Indus or other maritime traders may have been marketing Arabian copper in the Indus valley, Baluchistan, and Gujarat.

The Omani copper ores are similar to those of the Aravalli region of Rajasthan (below) in that they have little or no arsenic and have relatively high quantities of nickel, cobalt, and vanadium (Agrawal 1971: 152, Table 20). They are different from Iranian ores in that they have higher quantities of nickel, cobalt, vanadium, and chromium (Berthoud and Cleuziou 1983). However, in light of the use of arsenic impurities as a sourcing marker by Indus researchers (see below), it is important to note that copper slag and objects containing arsenic have been reported from copper processing sites in Oman (Hauptmann and Weisgerber 1980b: 135,137). The sites in the Indus valley flood plains may have imported Omani copper, but probably drew on at least one other source as well.

Mainly because of the cultural contacts between the Indus and Oman, it has been surmised that Oman was a major source of copper for the Harappa culture. But in my opinion the circumstantial evidence goes against this assumption. Heather Miller has pointed out that several copper prills were found to have been discarded without retrieving copper from them. This shows that there was abundance of copper and it was not treated as a precious imported commodity.

On the other hand, the Ganeshwar complex sites have yielded more than 5,000 copper objects with a number of Harappan types like thin blades, arrow-heads etc. Kharakwal has found old furnaces associated with these sites (pers. comm.). Rakhigarhi was a major Harappan city with rich copper resources of Rajasthan in its hinterland. Besides, the Mesopotamians imported copper from Meluhha, which has been traditionally identified with the Indus region. In view of this evidence, it does not make much sense to import copper from Oman on any major scale.

West Asian Sources

Wertime (Wertime 1964) says that Ergani Maaden in Central Anatolia and Anarak-Nacwak, about 120 km from Sialk, are the two ancient copper mining centres that stand in reasonable propinquity to the copper yielding old sites of this region (Agrawal 1971: 144-50).

Kenoyer & Miller (in Pigott 1999) state that in the early 3rd millennium BCE, there was brisk trade between Dilmun (island on Persian Gulf) and Ur, a port of Sumer.

Copper was supplied in ingots and in the form of manufactured goods too. A lexical list notes three types of copper: 'Copper from Dilmun', 'Copper from Magan' and 'Copper from Meluhha'. The primary purpose in noting the point of origin of the copper probably was an indication of its purity and quality. It is also possible that Mesopotamia imported copper from Anatolia. Probably it was shipped to Tishmurna and Durhumit as 'Black copper' for final refining. Assyrian traders who had their agencies in Asia Minor in early 2nd millennium BCE bought 'bad' (black) and 'good' (refined) copper; the ingots were in the shape of ox-hides. The peaks of production are confined to the periods between *ca.* 2400-2000 BCE and ca.1500-1200 BCE. Assyrians also got copper from Urartu (Ararat). Sargon II lists 126 tons of crude copper and hundreds of daggers, lance heads and vessels amongst the spoils of wars. Edon near Khirbet-en-Nehas and Umm el' Amad as copper mining area for Palestine and Syria dated back to ca.1800 BCE. It is estimated that about 1,000 tons of copper were produced in about 1,500 years in ancient Egypt. The main source of Egyptian supply was Sinai, though a few eastern desert mines are also known. The presence of crucibles, slag and copper objects prove that the smelting of ore was already practised in Pre-Dynastic times. Production of the oldest mines in the Wadi Magarah continued (with a break between Dynasties V & XI) to *ca.* 1750 BCE. From 1600 BCE onwards mining was concentrated in the region of Sarabit el- Khadim, until it ceased about 1200 BCE by which time Egypt had come to depend upon imports from Cyprus and Armenia. Remains of mines, habitations and copper workings mark these early mining sites. Smelting was carried out at the spot but refining took place in Egypt. Sinai mines were most important sources till XXI Dynasty. Kubban mines may have been used from XII Dynasty and Abu Seyal not before XIX Dynasty. Arabah, between Gulf of Aquaba and Dead Sea, too was an early copper mining centre. This was in use from Early Bronze age to the period of Edomites (*ca.* 1100 BCE). Cyprus was another important centre. Egypt received supplies from there during Dynasty XIII (*ca.* 1580-1350 BCE). These mines also supplied Troy, Crete and Greece and were famous in Homeric times (Kenoyer and Miller in Pigott 1999).

Moorey (1994) reports that a group of five circular bun-shaped ingots of copper were included in the mid-third-millennium BCE 'Vase a La Cachette' excavated at Susa. They have been associated with ingots of this shape found in the Gulf and in Indus valley settlements. Two bun-shaped ingots were found in a contemporary context at Tell Chuera in Syria (Moorey 1994).

Indian Copper Ores

About the Harappan sites, Kenoyer & Miller (in Pigott 1999) say that actual copper minerals (e.g. chrysocolla, chalcopyrite, malachite, etc.) are rare at Harappan Phase sites in the core areas of the greater Indus valley as are other metal minerals such as haematite, lollingite (iron and arsenic), antimony, cinnabar (sulphide of mercury), cerussite (carbonate of lead), galena, and an unidentified type of lead ore recently recovered from excavations at Harappa. Some of these metallic ores may have been used in copper melting and alloying processes, such as the colorants, cosmetics, medicines or even poisons. Given the low occurrence of raw materials, it is assumed that most of the initial stages of smelting and preparing ingots were undertaken in remote resource areas near metal ores and forests that would have been necessary for preparation of charcoal. Major regions for copper ores are northern and southern Baluchistan, northern Aravalli range, and more distant Oman. It is not unlikely that the Harappans, stimulating an important market dynamic because of the different types of metals available from each region, exploited all of these sources and the different distances involved.

Copper is widely distributed in nature. Native copper is found on the surface of copper and iron ore bodies.

The main Indian copper minerals are:

1. Chalcopyrite	$Cu_2SFe_2S_3$	34.6% copper
2. Chalcocite	Cu_2S	79.8% copper
3. Bornite	Cu_2FeS0_4	55.5% copper
4. Tetrahedrite	$4Cu_2S.Sb_2S_3$	52.1% copper
5. Covellite	CuS	66.5% copper
6. Malachite	$CuCO_3.Cu(OH)_2$	57.3% copper
7. Azurite	$2CuCO_3.Cu(OH)_2$	55.1% copper

Present mining areas in India for copper are mainly located in Rajasthan, Bihar, Andhra and Kumaun, though there are several other minor deposits reported from Kashmir, Tibet, Jammu etc.

Bihar: Singbhum belt extends over a region 130 km long and up to 8 km wide. In 1959 reserves of copper ore were estimated to be 3.8 million tonnes with an average 2.47% copper content. New explorations have brought to light copper ore resources of Patharghora, Surdha, Kendadih, Roam-Sidheshar area.

Andhra Pradesh (AP): Chakrabarti & Lahiri (1996) have noted the following main copper bearing sites in AP. The major copper bearing districts of Andhra Pradesh are Cuddapah, Guntur, Khammam, Kurnool, Nellore, Prakasam, Mahbubnagar and Nalgonda, with Guntur and

Khammam being the most important. Guntur belt is 4.8 km long. The district-wise distribution of the localities is following:

Cuddapah: Velidendla, Chinnakudala, Bestavaripalle, Brahmanapalle, Venkatapuram, Vemula and Midipenta; Native copper is found in the lead mines of Jungamrazpilly (Ball 1881: 240).

Guntur: Agnigundala belt (Karunakaran 1975:22), the most significant copper-bearing area of Guntur contains the localities of Bandalamottu and Peddagavalakonda hills (chiefly chalcopyrite), Nalakonda (bornite and chalcopyrite) and Dhukonda (chalcopyrite and some bornite (Sivadas et al. 1985:6). Pyrite and stray specks of native copper are found in all these areas.

Khammam: (Chalcopyrite with some pyrite and pyrrhotite) Mailaram, Venkatapuram, Banjar, Mainkawaram, Rabingudem, Sarkal and Yellambailu.

Kurnool: (chalcopyrite) Gani-Pallava (for the old workings, Satyanarayana Rao 1972: 26-27), Kommamarri, Somyazullapalle and Jonnagiri; Nellor (malachite, pyrite and chalcopyrite) Chandraredipalem, Gotigundla, Garimanipenta, Gogupalle, Kottapetta, Rajupalem, Somalregada, Tirumalapuram and Vinjamoor (Karunakanm 1975:23). Prakasam : Gajjalakonda (Karunakaran 1975:23).

Mahbubnagar: Kanrikalwal (Rajagopal 1976:9). Nalgonda: Chintriyal (Rajagopal 1978:13). Satyanarayana Rao (1972:26 ff) describes in some detail the old workings in the Kurnool district. Old workings here are easily identifiable from the dumps of fragments of shale, trap and vein quartz surrounding them and found distributed in the Tadpatri shales formation, the longest stretch being 2.8 km. The size of the workings varies from being mere trial pits to about 200 m long and 16m wide (Saryanarayana Rao 1972:29).

Rajasthan: In Rajasthan, copper ore mines are located in practically all the divisions. The most important of them are at Khetri-Singhana in Jhunjhuna district. This belt continues from Singhana to Raghunathpura, about 80 km. In this belt, in the Mardan- Kudan section, there is a reserve of 28 million tonnes of ore with 0.8% copper and in the Dariba area 0.5 million tonnes ore deposit of 2.5% copper. The mineral found in these places is chalcopyrite ($CuSFe_2S_3$) which is usually disseminated in schists and phyllites. Below we will note some of the main occurrences and details of copper ores in Rajasthan, as this area has a greater importance for the protohistoric sources. The description is based on Sethi (1956), Dunn (1965), Mujumdar and Rajguru (1962-63), and Srinivasan (pers. comm.), Kenoyer & Miller (in Pigott 1999), Chakrabarti & Lahiri (1996) and (Agrawal 1971). For details of references to mining areas, the last two references may be consulted.

(i) *Khetri Singhana* (Jaipur dist.)

Outside Singhana several million tonnes of slag heaps are lying. The ore used was chalcopyrite (old name, *dha*), which occurs with pyrrhotite disseminated in shales, phyllites, schists and quartzites. At places copper content of ore is 0.75 to 4%.

(ii) *Kho-Dariba* (Alwar dist.)

Ore occurs as veins and lodes in most phyllites along the contact plane separating them from quartzites. The mineralization of chalcopyrites and chalcocites occur here under gossan area. Incrustations of chalcanthite were also seen. Old slag heaps are reported.

(iii) *Delwara Kirovli* (Udaipur dist.)

Old workings are reported from Delwara, Kotri, Vilota, and Kiroli. Extensive slag heaps were found at Delwara and Kirovli (IAR 61-62). Chalcopyrite and malachite are associated with quartzites and biotite-actinolite schists. Malachite has 6.8% copper.

(iv) *Debari* (Udaipur dist.)

Ores are malachite, chalcopyrite, cuprite, azurite and bornite. Rajguru and Mujumdar (IAR 61-62) reported many such sites from this area. Some of the openings, e.g. Kotri and Delwara, appear to be very crude and small in dimensions. There are no ^{14}C dates for these workings.

The slag pieces showed great variation in size, shape, composition, density etc. From froth-like glassy to heavy iron-rich varieties were reported. Portions of clay retorts, crucibles and other pots, as also malachite stained quartz pieces were collected from these heaps.They grouped slag pieces in following categories:

(a) Heavy and massive type containing more iron and possibly copper and other silicates.

(b) Lighter types with lesser iron and more of silica and other silicates.

(c) Glassy froth.

(d) Slag pieces fused with clay and fine sand.

Glassy froth found at Ahar from purely Chalcolithic horizons was analysed by Hegde (unpublished thesis). Srinivasan (pers. comm.) has traced the history of Khetri belt workings up to Mauryan times. Abul Fazl (AD 1590) mentions these mines and in recent times Captain Baileau (AD 1830) reported it first. Hegde & Ericson (1985) have done some interesting work on the Aravalli mines. Though a few minor deposits of copper are known from southern and central part of the Aravallis it is mainly found in the northern Rajasthan.

Kenoyer & Miller (in Pigott 1999) also refer to the previous reports on Rajasthan. The copper deposits in Rajasthan and Aravalli mountain ranges have been discussed by SanaUllah (1940), Hegde (1965, 1969), Agrawal (1971, 1984), Asthana (1982), Agrawala (1984a), Hegde and Ericson (1985), Rao (1985), and Hooja (1988: 38), but only a few analyses of ore samples have actually been published. Hegde and Ericson also present results from lead isotope analyses of copper ores from eight sites in the Aravallis (1985:61).

Kenoyer & Miller (in Pigott 1999) further discuss the evidence of the composition of ores. They say:

> From mines in Rajasthan (Khetri and Alwar), Bihar (Singhbhum), and Afghanistan they were examined by SanaUllah, and all contained both nickel and arsenic. SanaUllah proposed that Rajasthan (Aravalli) mines were the source for most of the metal used in the greater Indus region, because of their relative proximity to Mohenjodaro and Harappa.

Kenoyer & Miller (in Pigott 1999) also discuss the problem of arsenic in Rajasthan ores. SanaUllah (1940: 379) did not publish his analyses of Aravalli ores, but Hegde (1969: 227) mentions that his "sample of Chalcopyrite obtained from Khetri showed 4.28% of arsenic". It is interesting to note that Kenoyer & Miller (in Pigott 1999) find that in contrast, copper ore impurities from the region of Khetri reported by the Director, Indian Bureau of Mines (Rao 1985) are:

Lead : Generally occurs as traces, highest percentage noted is 0.18%

Zinc : Generally occurs in second decimal, highest percentage noted is 0.18%

Arsenic: Generally occurs in the fourth decimal, highest percentage noted is 0.06%

Cobalt: Around 0.01%

Nickel: Around 0.05%

Iron: 15 to 20%

My own analyses of chalcopyrite ores from Khetri (Rajasthan) and Singhbhum (Bihar) yielded less than 0.5% arsenic (1971: Table 20, facing p. 152). My studies (Agrawal 1971) based on trace impurity analyses, though the data were limited, showed the possibility of Khetri ores being used by both Harappans and Chalcolithic people.

Of course, Kenoyer & Miller (in Pigott 1999) are right when they say, "At this point there is no direct evidence for Harappan Phase mines or smelting sites in the Aravalli copper resource areas, even though these areas have been explored by numerous scholars".

They further report that the earliest well-dated copper smelting slags are from levels of Ahar dated to the early 2nd millennium BCE (Sankalia et al. 1969:10; Allchin and Allchin 1982:262; Hegde and Ericson 1985:60). Although Hegde and Ericson (1985) assumed that the smelting furnaces they found in surface surveys in the Aravallis are from the 3rd millennium BCE, these furnaces have not been dated, either by radiocarbon or by associated artefacts. If these sources were actually being exploited as early as the 3rd millennium BCE, it is possible that the Indus peoples themselves were not involved in the mining and smelting. These activities may have been undertaken by local communities of Aravalli region. Ganeshwar-Jodhpura Culture in northern Rajasthan or Ahar Culture in southeastern Rajasthan may in fact be some of these groups (Agrawala 1984b; Hooja and Kumar 1995).

Kenoyer & Miller (in Pigott 1999) further note that, "Many Harappan Phase sites have been reported in the nearby desert region of modern Cholistan, Pakistan, along now dry bed of Ghaggar-Hakra River (Mughal 1980)".

This region is close to the copper sources of Rajasthan, and Sir Aurel Stein recovered a copper ingot from Siddhuwala, near Derawar. Many of the sites discovered by Mughal have kilns that were apparently used for "firing pottery, clay objects, bricks and perhaps smelting of copper" (Mughal 1980: 96). However, there is no report of ores, slag heaps, or smelting furnaces, which would be required before classifying any of these as copper smelting sites. With the availability of at least three different major source areas in easy reach, it is not unlikely that the larger urban centres used copper from more than one source over 700 years of the Harappan Phase. Only future systematic studies will provide the necessary data to elucidate these sources, and the analyses of copper ores, ingots, slag, and metal prills on crucibles are particularly needed. However, the regional patterns of arsenic presence/absence already provide some evidence for the exploitation of more than one source of copper metal.

It is not only in the Cholistan region that we have Harappan sites. Rajasthan is full of Harappan sites - big and small. Kalibangan is a major site, so is Rakhigarhi. I think justification of Rakhigarhi could only be the control of mineral-rich hinterlands. I have mentioned elsewhere that the Harappan planning of their towns had some economic basis. Harappa itself commanded the western passes and also the supplies of timber etc. from hilly region behind. One has also to consider the fact that Neolithic Burzahom in Kashmir has Harappan pottery and beads from Neolithic levels. In return, the Neolithic people must be bartering some commodities. Himalayan foothills have orpiment brought by the glaciers. Could it be that arsenic (orpiment) and copper was being supplied by Neolithic people of Kashmir (see below)?

Uttaranchal: The Ganga valley covers most of UP. As it is an alluvial fill of the foredeep caused by the Miocene Himalayan orogeny, it has no exposed mineral outcrops. Uttaranchal in Central Himalayas seems to be the only source in the vicinity both for copper and iron.

Kumaun-Garhwal: North of Pithoragarh near Chandak and east of Kanalichhina minor veins of pyrite-chalcopyrite are seen within the Gangolihat dolomite. In the Dewalthal area near Almora, magnesite and dolomite show disseminations of chalcopyrite. All the places having suffix 'agar' were ancient mining/metallurgical centres. At Rai Agar an 18 m long and 0.5 m wide lode of chalcopyrite and pyrite, with an average copper content of 0.04 to 1.5% has been located. Bora Agar mineralized zone is about 1.5 km long extending between Tusrani and Dol, and 5.30 m in width with an average copper content of 1.29% (Krishnamurthy and Krishnaswamy 1986; Pant 1988).

Raghunandan et al. (1981:195 ff.) refer to some more copper workings in the area: Khanayun-Galpakot-Kimkhet areas in Nainital and Pithoragarh districts over an area of 20 sq. km, Kanalichinna, Charandeo, Dungri and Tamakhani mines in Pithoragarh and old adits in Bageshwar area of Almora. A polymetallic copper deposit has been located near Askot. This is the only occurrence of significance. The mineralization is mainly represented by sphalerite, galena, chalcopyrite and arsenopyrite, with minor amounts of marcasite, bornite, chalcocite, pyrite, pyrrhotite, cubanite and stinnite (occurrence of arsenopyrite is to be noted). The thickness of the ore zone is variable, average being 4.47 m. The weighted average composition is copper 2.32%, lead 2.64% and zinc 3.95% (Krishnamurthy and Krishnaswamy 1986). A total reserve of 0.77 million tonnes of copper-lead-zinc ore, with an average grade of 9% metal, has been estimated for this polymetallic deposit by the Geological Survey of India.

Kharahi *patti* is located close to the north of Almora town and extends between Binsar and Bageshwar. The area is known as a traditional centre of metallurgy from times immemorial. Atkinson (1980-81:282) writes that the Gaul mine of Kharahi *patti* and Sor Gurang mines produced grey copper in small quantity. Tamtyura, Danochhina, Chaugochhina, Ghingarkhola, Binsar, Bhatkhola, Simsyari, Bihargaon, Uderkhani, Bilona, Agar, Gair-Sikera, Lob and Borgaon (all in the districts of Almora, Bageshwar and Pithoragarh) were some of the places where metallurgy was practised in ancient times, according to the villagers, who now inhabit these places. The coppersmiths are known as Tamtas, who are thought to be responsible for introducing coppersmithy in Kumaun (for details of the old metal sites, see Agrawal & Kharakwal 1998, chapter 4). The Agri people, who are considered expert miners, have been living in Kharahi *patti*. It is told that Chanauli, Joshi Palari, Uderkhani, Chaugaonchhina, Bihar-gaon, Naial and Kharak Tamta are the locations of the first settlement of Tamta people in Kharahi. The following places are believed to be ancient mining sites, where still traditional metallurgy is occasionally practised:

Khan-garh (Khano-ki-garh), Chaugaonchhina, Dewaldhar: Stephens has given a detailed description of the old workings and cruel and inhuman pre-industrial mining methods of copper extraction and ore processing in different parts of Kumaun. He reports two types of ore in the region: irregular deposits worked extensively at Dhanpur, Dobri and Al-Agur, and regular nodes distributed from near Pithoragarh to the area south of Badrinath and beyond Pokri. He reports: "This 50 mile long band is the major copper bearing zone of the region, with localities like Rai, Bellar and Barabesi in Kumaun and Gwaldum and Pokri in Garhwal being located here".

At Dhobri, Stephens noticed many old workings, which ramified to an extraordinary extent.

Dhanpur hillside where the formations dipped with the slope of the hill and thus provided easier facilities for mining was burrowed with holes. Situated on the western bank of Ramganga, Al-Agur deposit where some old workings went down to great depths contained carbonate of copper and grey copper ore with a little pyrite. The other deposits included Tarag-ke-tal (16 km north of Dwarahat) and Goron (5 km west of Pithagora) where the lodes were not rich but the old miners honeycombed m with holes like a rabbit warren, and taking out every particle of copper (Stephens 1901-02:405).

At Rai, Stephens noticed that the ancient miners must have gone down to a 'considerable depth, as every drive has more or less encountered unsuspected and masked old workings.

Jammu, Kashmir and Tibet: In view of the archaeological contacts between Neolithic Burzahom and Harappans, mineral deposits of this region assume more importance.

Chakrabarti and Lahiri (1996) summarize the evidence for this region. A number of sites have been reported from this region (Vardan 1976a: 44-46; Raghunandan et al. 1981:186-87): malachite stains on the slopes of the Mammal and Dunpathri and sporadic mineralization in the Shumahal area, all in Anantnag; pyrite and arsenopyrite on the Lashteal hill spur in Baramulla; report of copper near Purnihal, Padri and in Bazan Nar area of Ganderbal tehsil in Srinagar; occurrences at Rollu, Duligam and Dedni in Doda district of Banihal; copper mineralization in several localities of Doda district of Banihal; copper mineralization in several localities of Doda and Luneak valleys of Zanskar range in Ladakh; chalcopyrite with malachite and azurite in Kunzmala formation and malachite at Akche in same region. Perhaps more importantly, native copper is found disseminated in the geological formation of 'Volcanics' at Tamze, Kamal Tokpo, Tungri, and Sirtung Nala. Large irregular masses of native copper were found in the Zanskar river as early as 1878 (Ball 1881:267). It is not without reason that in the Ladakhi language 'Zanskar' means 'copper fort' (Raghunandan et al. 1981: 186). Dudura near Katra in Udhampur district in Jammu has shown stains of malachite.

The areas, which have major clusters of old workings, are in the Banihal, Anantnag and Baramulla districts. In the Shomal area of Anantnag, the shafts are about 2m wide and 10m deep while at Mamal, also in Anantnag, the hillside showed pits, generally 10m deep and 5m across. The old workings at Lashteal in Baramulla showed more complexity: main shaft (1m wide) goes down for 3 m, levelling off for about 5m to terminate in a room of about l0 cubic m. The shaft leading to it is about 2m high. From the room like space itself, a shaft (1m high) goes down steeply to come out of the side of the hill where the terrain is flatter and more accessible.

Himachal Pradesh: Chalcopyrite and pyrite with some secondary chalcocite, malachite and azurite are spread over 13 km in the Shallu valley from Atoll to Batera in Shimla district. Chisani, Maol, Malanna, Kot Kandi, Chitrani, Shatgurh near Jerri and Kanor khad localities in Kullu showed copper, in addition to Narnaul and Danala where the mineralized vane extends for about 10 km in the Garsah valley, Uchich in the Parvati valley where pyrite and arsenopyrite occur at silver workings and Kullu Bijnar area where there are about 20 occurrences. In Sirmur, malachite stains were noted at Banal. Old workings with slag heaps have been noted in the Garsah valley, near Chisnai and in Sirmur (for details, Raghunandan et al. 1981; Ball 1881).

Haryana: In Haryana there are several areas of copper occurrence: the region between Khetri and Khodana in Narnaul; Golwa-Gangutanna area of Mahendragarh where 4-40 m wide mineralization vane extends for over 4.5 km; and the locality of Tosham. Old workings occur at Khodana but more extensively in the Narnaul area, between Dhani-Umrabad and Khalra hills and in Teejanwali and the Luni hills (Raghunandan et al. 1981:188). Near Tosham, tin minerals have also been reported (Kochhar et al. 1999).

Gujarat: The following areas are noteworthy (Raghunandan et al. 1981:58): Deri-Ambamata, extending for 8-10 km from Sirohi to Banaskantha; Kui-Chitrasani, extending over 45 km in the same Sirohi-Banaskantha stretch; and Champaner where mineralization occurs in the Panchmahals and Baroda districts. Native copper occurs in vesicular basalts of the Deccan trap in a number of localities: Beh, Sherdi, Buri and Athmanabara in Jamnagar, and Moj Dam, Tetpur, Virpur and Bhayvadar in Rajkot. The extent of pre-industrial workings in the region can be gauged from the fact that in an area of less than one-fourth of a km between Ambamata and

Kumbaria, slag heaps weighing as much as 0.6 million tons and containing an average metal content of 6.2% have been found. An old copper working has also been noted at Jhari in the Panchmahals (Chakrabarti & Lahiri 1996).

Maharashtra: Copper ores are disseminated in Nagpur, Chandrapur, Bandara and Ratnagiri districts (Raghunandan et al. 1981: 49-56). At Pular-Parsori in Nagpur the mineralized zone is about 3 km long. At Dangarmunda in the same district chalcopyrite and malachite encrustations have been noted. At Thaneswasra-Chandrapur the strike length comprising chalcopyrite, arsenopyrite and pyrite extends to about 30 km and includes the localities of Bhajgaon, Lalhetri, Dhanur, Dubharpeth, Ghot and Govindpur. Chalcopyrite and pyrite have been noticed at Mendki in Bhandara whereas chalcopyrite associated with a small amount of bornite and pyrite has been found at Kolapur, Jalakwadi, Rasin and Sirsondia. Furthermore, according to M.K. Dhavalikar (1975-76:72), native copper occurs at Rashin in Ahmednagar and chalcopyrite around Sirur in the same district (Chakrabarti & Lahiri 1996).

Madhya Pradesh: Several areas (Dinara, Burua Nallah, Narowa, Nadawan and Bijrawan, Shivpuri) show traces of copper mineralization and the same is true of the areas of Tamakhan, Jinwani, Kothkhera, Kanjikhera and Mirzapur in Dewas (Roy Chowdhury 1955: 32). But the more important copper belt in this region is the Sidhi-Shahdol-Jabalpur belt where there are major occurrences of copper, lead and zinc ores near Sukwari, Bagwari, Byriah, Cherke, Kira, Kawakup, Sleemanabad, Imalia, Newalia and Bhulla (Raghunandan et al. 1981: 39). In addition to the Malanjikhand deposit where open cast mining is practised by the Hindustan Copper Ltd. and which contains chalcopyrite, pyrite and molybdenite (strike length 2.6 km), Balaghat possesses copper-bearing localities at Bhauna-Pahar, Taregaon and Khandapar (Raghunandan et al. 1981: 39-42). The copper bearing localities in Bastar are Netanar (malachite, azurite), Mudenar (malachite and chalcopyrite), and Mundatikara (chalcopyrite, pyrite and bornite). In Chhatarpur, traces of chalcopyrite, pyrite and arsenopyrite have been reported in the Salaiya-Jamtoli area. Chalcopyrite occurs at Kurnol, Bhagesh, Girjora and Lakhnauti in Gwalior. Cerussite and chalcopyrite are noted at Bhelai and Dhorpur for a strike length of 15 km in Surguja. Old workings have been noted all over the region: a number of places in Gwalior, Shivpuri, Bhilsa and Dewas (Roychowdhury 1955:32), Netanar and Mudenar (vertical shafts and galleries) in Bastar and around Bahera-Baheria in Sidhi (Raghunandan et al. 1981: 42 ff). Ore deposits of Jabalpur area are very poor. The veins of copper minerals are only 7 to 15 cm in width. The minerals are chalcopyrite and tetrahedrite. These ores are in dolomite limestone regions (Hegde, therefore, expected calcium to be present in the Chalcolithic artefacts, in case these ores were used) (Chakrabarti & Lahiri 1996).

2. Making the Artefacts

Now we will talk about the basic techniques of metal technology and related evidence from archaeological sites. We will first trace the history of pyrotechnology in a global perspective and then discuss the evidence related to South Asian sites.

Darling (in McNeil 1990) has claimed that the earliest crucible furnace remains so far identified were found at Abu Matar, near the old city of Beersheba in Israel at a site dated between 3300 and 3000 BCE. These furnaces appear to have had a vertical cylindrical clay shaft, supported in such a way that air could enter freely at the lower end, providing the necessary draught. The earliest furnaces reported from Ahar, Rajasthan, however have provision for bellows.

The earliest copper slag was found at Catal Huyuk, in Anatolia, in a 7000-6000 BCE context and the earliest cast native copper from Sialk in Iran (4500 BCE). The earliest Egyptian artefacts date from 5000-4000 BCE. Darling (1990) therefore suggests that the technique of melting and casting native copper originated in Anatolia between 5000 and 4000 BCE. By the end of the 4th millennium BCE, the extant supplies of native copper could not meet the rapidly increasing demand. This is obvious from the fact that most of the copper artefacts produced after 3500 BCE contain substantial quantities of nickel, arsenic, iron, or other base metal impurities indicating that ores were now being processed to extract copper. Systematic copper mining had begun as early as the first half of the 6th millennium.

In the beginning, copper was extracted from oxide or carbonate ores that could generally be smelted successfully in the primitive furnaces then available. For example, at Rudna Glava in Yugoslavia, a copper working site of 6th millennium BCE, the main chalcopyrite ore body was not exploited, but used instead a thin, rich carbonate vein. But by about 1000 BCE, smelting techniques reached their zenith at Timna. The rings and other small artefacts of iron found at Timna are now thought to have been the by-products of the main copper refining operations. Lead isotope 'finger-printing' has shown that the source of the iron was hematite used to flux the copper ore during refining (Darling 1990).

As we will discuss later in the Indian context too, the presence of arsenic and other elements did not always indicate a deliberate alloying but only the fact that now they were using ores to extract copper and not native copper or other oxide minerals. Darling also (1990) states,

From the presence of arsenic and/or impurities in many of the early Copper Age artefacts it must be concluded that much of the copper used was extracted from sulphide rather than oxide or carbonate ores. In prehistory, as in modern times, the bulk of the world's supply of copper appears to have been obtained from ores based on chalcopyrite, a mixed sulphide containing equi-atomic proportions of iron and copper.

The sulphide copper ores exploited at the beginning of the Copper Age appear to have been located some distance below the surface of a weathered and oxidized primary outcrop. The iron-oxide regions above the rich copper deposits are known as gossans. From these gossans, when copper content is completely leached away, it is precipitated in sulphide form in the surrounding strata. This is how secondary enrichment of copper minerals is effected.

Darling (1990: 71) has described in detail the extraction of ores at Laurion in the 4th and 5th centuries BCE. The ore

was crushed with iron mallets and then ground to a sandy consistency in rotating stone hourglass mills or in hopper querns. The crushed ore emerged as a fine powder from which lighter; earthy material was removed by water washing in some very ingenious helicoidal washers. A continuous current of water during its passage around the spiral carried the suspended particles of ore from cup to cup and classified them. The rich ore was the first to be deposited, then the poorer ore and finally the sand and silts. When the water reached the lower tank all suspended solids had been deposited and it could be returned to standing tank, so completing the circulation process.

Darling (1990) has traced the history of global metallurgy as follows: By the early 3rd millennium, foundry processes in the Land of Sumer appear to have developed rapidly. Before 3000 BCE most of the copper artefacts from Ur were simply fabricated from sheet metal. By 2700 BCE, however, very refined cast copper artefacts were being produced, probably by a version of shell moulding, using a prefired mould of thin clay. Long thin sections, such as the blades of swords and daggers, were also cast into thin shell moulds, which appear to have been heated to redness before the molten metal was introduced. By 2500 BCE, the Egyptians had developed considerable expertise in the production of hollow copper and bronze statuary. Many large Egyptians statues were cast with an internal sand core, which is still present in some of the figures, which have been found. Smaller components, such as the spouts of copper water vessels, were undoubtedly made by the *cire perdue* ('lost wax') technique, which had obviously been mastered by Egyptian craftsmen before 2200 BCE.

The characteristic metal artefact of Crete was the double axe, an object of great ritual significance; the compositions of some of which range from pure copper to ductile 4 per cent tin bronzes, and finally to hard, brittle bronzes containing 18 per cent tin. By early 2nd millennium BCE, Crete was beginning to obtain tin from Eritrea and southern Spain, and their designs for spearheads and daggers were widely copied throughout the ancient world.

The Dorians had primitive metal working skill of their own. It was a combination of Dorian vigour and Minoan sophistication, which eventually emerged as the metallurgical virtuosity of classical Greece. Bronze statuary soon began to demonstrate a mastery of foundry the techniques, which remained unsurpassed until the European Renaissance. Such casting probably represents the high peak of Bronze Age technology, preceding the later domination by Rome of the classical world.

Before 500 BCE, bronze technology had developed in an irregular manner, which does not relate in any metallurgical sense with the Early, Middle and Late Bronze Age classifications of the archaeologists. The major metallurgical discontinuity occurred around 1600 BCE, in late Minoan times, when large copper ingots weighing more than 30 kg first appeared, and usage of bronze throughout Europe and the Mediterranean region began to increase very rapidly.

The full Bronze Age emerged in the middle of the 2nd millennium BCE. After about 1600 BCE, the majority of the bronzes produced contained lead, which, in most cast objects of any intricacy, was present in concentrations between 5 and 10 per cent by weight, and which was added to improve casting fluidity.

The Shang bronzes, produced at Anyang between 1400 and 1027 BCE, are now world famous for their artistic merit and technical virtuosity. These ritual objects, which were produced entirely by casting, were notable for the richness of their relief patterns and also for their mass and solidity, although some smaller wine vessels were also produced. One vessel weighed over 1.6 tonnes and had obviously been cast in a multipart mould made from prefired clay segments. Most of these Shang artefacts had lead contents less than 1 per cent by weight, and some contain negligible quantities of lead. It would appear lead was an accidental impurity. The tin content of the alloys varies considerably, however, in what appears to be a random manner from about 1.8 per cent to more than 20 per cent.

To produce large, intricate and decorative castings which would not be subjected to mechanical shocks, the Chinese preferred to add lead to obtain casting fluidity required. To avoid brittleness in weapons, the tin content was very considerably reduced and a minimal quantity of lead added to improve castability of alloy. The melting point of a binary 20 per cent tin bronze is approximately 880°C; a similar quantity of lead only reduces the melting point of copper to 1000°C. The high tin, lead-free alloys would therefore be easier to melt and cast in large quantities and this must have been a factor which encouraged their use in a situation where tin was plentiful and intricate castings weighing perhaps a tonne were being produced.

Bronzes containing 20 per cent tin are invariably associated with the manufacture of bells. It is interesting to note that the Greeks attempted to standardize the compositions and mechanical properties of bronzes around 360 BCE. They specified that the contractor would use for the copper blocks from Marion, the alloy being made of twelve parts, eleven of copper to one of tin. This Eleusinian inscription apparently provides the earliest evidence for the use of a metal turning lathe in the Greek mainland.

The main Roman metallurgical innovation was the introduction of the brass, which was first used for coinage when tin became expensive. The Romans worked the Tartessian mines continuously from about 200 BCE until AD 400. The mines appear to have reached their maximum output between the 2nd and 3rd centuries AD. The ancient Roman workings at Rio Tinto were not reopened until the middle of the 16th century, during the reign of Philip II. The Romans exploited the copper mines of Tima in the Negev only in the 3rd century AD, although workings continued until the middle of the 7th century when the Arabs invaded. Most of the statuary of the Graeco-Roman world was cast in bronze. Leaded tin bronzes were generally used in the 4th century Greece, although zinc was also added to the later Roman bronzes, which by the middle of the 2nd century AD tended to contain comparable quantities of zinc and tin.

The arsenical content of Middle Eastern copper artefacts begins to decline after about 3000 BCE rapidly throughout the Middle Eastern world.

Early Bronze Age developments have also been recorded in southern China, Thailand and Indonesia, where alluvial tin and copper ores are sometimes found in close association. It probably arrived with the peaceful integration of a group of skilled foreign workers, perhaps displaced by military disturbances in China. Chinese bronzes containing 8 per cent of tin were being produced in Gansu province as early as 2800 BCE, apparently independently of the emergence of high tin bronzes in Sumer.

The earliest tin bronzes so far identified appear to date from the 4th millennium BCE and were found in 1930 at the site of Tepe Giyan, near Nahavand in Western Iran. The sudden appearance of true bronzes at Ur around 2800 BCE, and in Amuq near Antioch in Turkey, about 3000 BCE would be consistent with the view that the concept of bronze manufacture originated in a community such as Tepe Giyan, in the Persian highlands, during the 4th millennium, which subsequently moved southwards to Sumerian and the Persian Gulf, and westwards to the Mediterranean seaboards, during the 3rd millennium. Bronze was first made in Italy between 1900 and 1800 BCE, using tin from deposits at Campiglia Marittima in Tuscany, although copper extraction started in Spain in Neolithic times and during the 3rd millennium its copper and precious metal deposits were extensively worked. Many crucibles used in the Mediterranean region between 3000 and 2500 BCE had a socketed boss moulded on one side to facilitate handling.

Although lead was also known at a very early date, the first metal to be practically utilized was copper. Small beads and pins of hammered copper found at Ali Kosh in Western Iran and Cayonu Tepesi in Anatolia date from the period between the 9th and 7th millennia BCE and were made from native, unmelted copper.

Fabrication and Casting

The production of metal objects can be divided into two categories, casting and fabrication, depending on the state of metal during the actual working.

Casting:

Casting is done when the metal is molten and fabrication is undertaken when the metal is not molten. These two categories divide the methodologies of metal-working artisans as well as the states of the metal itself. Fabrication involves the direct shaping of metal, while casting begins with the shaping of or materials into which the molten metal is poured (Kenoyer & Miller 1999).

The tools and techniques of two categories overlap to some degree, and ancient metalworking ateliers may have been involved in both fabrication and casting. Some objects, however, may have been cast by one group of artisans and finished or fabricated by another group in a separate workshop. The possible division of manufacturing stages into discrete and often exclusive activities practised by different artisans is an important part of metal working that has not been investigated for the Indus Valley Tradition, primarily because metal production areas have not yet been conclusively identified.

The following discussion of the Harappan techniques of making artefacts is mainly based on Kenoyer and Miller (1999) and Miller (1993).

Casting: By defining casting as shaping of molten metal they include a wide range of metal working activities, including the production of secondary ingots as well as the casting of semi-finished or finished objects.

Evidence for casting thus includes all of the indicators discussed under melting, as well as several types of indicators directly related to casting such as moulds, semi-finished objects, and finished objects. Lahiri (1993) also notes the importance of recognizing the presence of secondary ingot casting in South Asian metalworking.

The best evidence for casting activities at a site is the presence of moulds. Ancient mould types include open stone, terracotta, or sand moulds; bivalve stone, terracotta, or sand moulds; and terracotta-based "lost model" moulds. Horne (1990) suggests the term "lost model" rather than "lost wax" since the technique employs or materials besides wax, such as tallow, resin and tar. At present, no convincing examples of any type of mould for casting metal have been reported from Harappan Phase sites.

The only published stone "moulds" from a Harappan Phase site are from Lothal, where Rao identifies two grooved stones as open moulds for casting pins/rods (Rao 1979: 557, 568; Fig. 121, nos. 3 and 4; Pl. CCLIIb). The first problem with Rao's identification is that the grooves are much larger than the metal pins found at Harappan Phase sites. Second, the grooves are not straight along their length or sides and taper off in depth at each end, which seems highly impractical and unlike known casting moulds from other regions and periods. Third, there is no report of discolouring or spalling, which would occur if molten metal were repeatedly poured onto a stone surface. Similar stones (made of sandstone and quartzite) with long parallel grooves have been found at Harappa and Mohenjodaro, and at Chanhudaro they are clearly associated with agate bead manufacturing areas (Mackay 1943: 213-14, Pl. XCIII). The grooved stones from Lothal probably do not represent open stone moulds for metal casting.

The only published terracotta moulds are also from Lothal, and might be fragments of open moulds, although Rao calls them "crucibles" (Rao 1979: Pl. CCXIIIa, b, c). Scrapings collected from the interiors of these "crucibles" gave negative tests for tin, lead, nickel, arsenic, and copper, even upon repetition of the copper test (Lal 1985: 661). Future test results showing the presence of some metallic traces would be necessary to define these objects as moulds for casting metal (but see Bayley 1989: 298-99). Finally, there are no reports of sand moulds neither of any kind nor of fragments of lost wax moulds.

Paradoxically, the few metallographic analyses that have been done on Harappan Phase copper/ bronze objects indicate that some tools were definitely made by open or bivalve casting (Agrawal 1971; Pigott et al. 1989; SanaUllah 1940; Wraight 1940). In addition, the modelled forms of the famous metal figurines of animals and humans can be attributed to lost model casting. For example, two exquisite objects reported from Chanhudaro that may have been made by lost model casting have often been overlooked, a covered cart with the wheels missing, and a complete cart with a driver holding a goad (Mackay 1943: 39, 41, Pl. LVII, 1 and 2). A similar model cart was also recovered in excavations at Harappa (Vats 1940: 27). Some of the small vessels may also have been made by lost wax casting (Mackay 1938: 446; 1943: 176).

Due to the low percentages of lead found in his analyses, SanaUllah did not think that the Indus peoples used lost model casting techniques (1940). While unalloyed copper is difficult to cast, it should be pointed out that lead is not a prerequisite for lost model casting. Or alloys may be used (e.g. copper-tin), as most alloys are usually fluid enough to cast well. Furthermore, the types of objects tested by SanaUllah were unlikely to have been made by lost model casting in any case; no figurines or vessels were tested.

Many of the cast Harappan Phase metal objects, particularly the figurines, are definitely Harappan in style, corresponding to the morphology and subject matter of objects in other materials such as faience, stone, and ceramic. There is no evidence for Harappan-style metal objects or moulds from sites outside of greater Indus region; indeed, Yule (1985 b) notes that Harappan Phase metal ware is very different in style from contemporaneous products in other regions.

It is more likely that this paradox is due to the lack of identified metal processing areas at Indus Valley Tradition sites and also perhaps a problem of the archaeological identification of moulds. Egyptians and Mesopotamians obligingly left moulds of stone, clay, and even metal (Moorey 1985; Scheel 1989); the Indus people were not so helpful. Given the scarcity of stone in the Indus valley plains, it is possible that stone moulds were reused for other purposes. However, this seems extremely unlikely, as the detailed examination of every fragment of stone and fired ceramic recovered from five seasons of excavations at Harappa, as well as examination of the Mohenjodaro reserve collections, have not revealed any fragments of stone or ceramic moulds. Another explanation is that the Indus people used mould materials, such as sand or sandy clays, which leave little trace in the archaeological record. Two techniques using sand or sandy clay moulds are sand casting and lost model casting, both of which leave almost no archaeological traces.

Sand-based moulds are used for casting in modern South Asia and many other areas of the world (Untracht 1975), and employ finely powdered sand, sometimes mixed with water and organics such as dissolved sugars. This mixture can be used to make an open mould or packed into a hinged wooden box to make a bivalve mould. A form made of wood or some other material is impressed into the sand mixture, which is cohesive enough to create a mould into which the molten metal is poured. It is well suited for objects such as celts, axes, adzes, knives or spears. It may even leave characteristic bivalve lines on objects, often taken to be indicative of the use of stone or terracotta bivalve moulds.

Since forms are used to impress sand and create mould, some degree of duplication of objects is possible, and creation of sand moulds is obviously quite rapid. Although these moulds have a great resistance to heat, making them an excellent casting material, they break down quickly into sandy deposits when exposed to weathering from water and wind. In addition, modern sand moulds are usually ground and reused, and ancient moulds would probably have been similarly recycled.

The materials used to make lost model moulds are also quite ephemeral. These materials form a continuum with fine sticky sand used for sand casting, but employs more cohesive sandy clay so as to retain better complex three-dimensional features of object to be cast.

Lost model casting often employs several grades of material. First, model of wax, resin, tar, etc. is coated with fine sandy clay. This inner coat will form details of object to be cast, so the finer the detail desired, the finer texture of coat. Increasingly coarser sandy clay is used to form the bulk of mould. The crucible containing metal can be built into mould, as is done in India and Africa, or metal can be poured into mould from a separate crucible, as was done in Americas and Egypt, (See Emmerich 1965; Fox 1988; Frohlich 1979; Horne 1990; Reeves 1962; Scheel 1989 for ethnographic and historic descriptions of lost model casting).

An essential component of the lost model process is use of sandy clay that will not sinter under high temperatures. Thus, in addition to the fact that the moulds are broken to remove the cast object, such moulds also break down very quickly when exposed to wearing. As with sand casting, broken pieces of the mould are also often recycled, increasing their archaeological invisibility.

The ability to rapidly produce moulds and to recycle the mould materials is one of the great advantages of sand and lost model casting over stone-mould casting. Miller notes that while this is beneficial for the artisan, it is a nightmare for the archaeologist. Perhaps with increasing awareness of these methods and their ephemeral remains, archaeologists will begin to look more closely at patches of sand for the tiny fragments that may still retain the contours of cast objects.

Fabrication:

Fabrication of metal objects includes all of the various types of modification of non-molten metal: shaping, via forging, turning and drawing; cutting; cold and hot joining; and finishing, via planishing, filing, polishing, colouring, engraving, and so forth. The metal can be worked while cold or hot, but at a heat below the molten state. Ingots (either secondary or smelting ingots) can be worked either into sheet form or directly into a finished object. Cast semi-finished objects, such as those found by Mackay at Chanhudaro (1943: 175), also would be subsequently worked to form the finished object.

Shaping: In its broad sense, shaping is the controlled mechanical stretching of metal. This includes stretching by forging, including sinking and raising; by spinning or turning; and by drawing.

Forging: The most common form of shaping is forging, "controlled shaping of metal by force of a hammer", usually on an anvil or stake. Whereas the term "hammering" is sometimes used for non-ferrous metals, and "forging" reserved for ferrous metals, forging is the term most often used by coppersmiths themselves, and will be used here.

Hammer and anvil or stake can be made of a variety of materials, such as metal, stone, wood, bone or horn, or even leather. Finds of such tools, or of the marks left on objects by such tools, comprise one type of archaeological evidence for forging. Other main source of evidence for forging comes from metallographic examination of artefacts.

Forging can be done while the metal is hot or cold. Forging not only shapes the object, it also hardens it, and so forging is an important step in the manufacture of edged tools. Annealing is re-heating of an object after working, and most metalworking involves cycles of annealing and hot or cold "hammering" (forging). Metallographic studies help to establish the use of such methods.

There is some evidence for forging during the Harappan Phase, both from finds of tool marks and from metallography (Agrawal 1971; Mackay 1938; Pigott et al. 1989; SanaUllah 1940; Wraight 1940). Indus peoples forged objects both from castings, including bar or block ingots and semi-finished shapes, and from sheet metal. For example, chisels, which are one of the most numerous tool types, appear to have been forged from cast bars (e.g. Vats 1940: 87-88). Metallographic analyses of other edged tools confirm that at least some of these tools were cast and then forged (Agrawal 1971; Pigott et al. 1989; SanaUllah 1940; Wraight 1940). Thin razors are thought to have been cut from copper sheets, and then forged to a sharp edge (Mackay 1938, 1943).

Sheet manufacture is a type of forging, and fragments of copper, silver, and/or gold sheets have been found at Chanhudaro (Mackay 1943), Harappa (Vats 1940), Lothal (Rao 1979, 1985), and Mohenjodaro (Mackay 1931, 1938; Marshall 1931). The Indus method of sheet manufacture is unknown, and there are no published anvils or hammers. However, many of the non-cubical "weights" from Harappan Phase sites are very smooth cylindrical or semi-hemispherical stones with highly polished surfaces. These types of objects might well have been used for metalworking, and the highly polished surface would be necessary to avoid marring the metal. The reports of hematite and magnetite "hammerstones" from Afghanistan (Dupree 1963; Shaffer 1984) are particularly interesting, given the use of these materials in copper metal sheet manufacture in western Iran.

Use-wear studies of these stone objects may help to clarify their function. It is also possible that wood or other perishable materials were used. At this time, the most hopeful method for elucidating the methods and materials used by the Indus peoples for forging is through the analysis of objects for tool marks, particularly on the better-preserved gold objects. Experimental studies aimed at discriminating marks left by various tool materials (e.g. stone, wood, metal) will also be useful.

Sinking and raising to form vessels from metal are also types of forging. As the names imply, sinking is the forming of metal by hammering from the interior of an object into a depression in an anvil, while raising employs hammering from the exterior of the object over a shaped stake or form. There are a number of ways to raise objects: both from sheets and directly from ingots, while the metal is cold and while it is hot, by an individual artisan or by a group working together. Indus people are known to have raised vessels (Mackay 1938: chap. XIII; Vats 1940), and appear to have made some jewellery by similar forming techniques, particularly the gold "cones". Unfortunately, no studies have been done to show what techniques of raising or sinking were employed.

Hollow metal tubes of copper or copper alloys were also made. The method of production is not exactly known, but the tubes are seamed and were produced from sheets, and so were forged in some fashion (Mackay 1943). The edges do not overlap, but rather abut, and there is no mention of the use of solder in the published accounts. Handled pans (Mackay 1931, 1938, 1943) also show production of tubes by rising, in that their handles are tubes made by lapping over opposite sides of metal. Two pieces of a long, 2.5 cm diameter copper tube were also found at Mohenjodaro, but no details of its construction are given. Marshall refers to this tube as a "coppersmith's blow pipe", but gives absolutely no support for such a conjecture (Marshall 1931: 198).

Decorative uses of forging include the use of stamps or punches, hammering of thin metal sheet (often gold) into or over patterns, and chasing. Hammering into or over patterns is not noted so far, but simple circular punch marks were used in the decoration of gold objects and fillets (e.g. Mackay 1938: 526, no. 4; Marshall 1931: 527, Pl. CXVIII,14), and sheet metal was beaten out from one side to make designs in at least one piece (Vats 1940: 64,no. S). There are no published reports of true chasing (working of metal from both sides).

Spinning and turning: Spinning and turning are methods of mechanical stretching with results similar to sinking and raising but using a lathe rather than a hammer. While Mackay originally suggested that some of the vessels from Mohenjodaro may have been made by turning (1931), no lathe marks or evidence for a lathe have yet been discovered to support this conjecture, and Mackay seems to discard it in later writings.

Drawing: Wire production has not been studied at all, although there are abundant examples of copper "wire" and silver "wire". This is probably due to the poor preservation of the metal, so that details of manufacture are not discernible. There is no evidence at present to indicate whether Harappan Phase wire was drawn or forged, although the latter is far more likely for the 3rd millennium BCE. Wire was used to make rings, possibly for adorning the fingers, toes and ears, as well as for other purposes. Some stone beads have pieces of copper wire inserted through the hole, possibly in imitation of the method seen with gold wire so that the bead could be hung as a pendant from a larger composite necklace.

When corroded wire remains inside a bead, it will often split the bead into two fragments, making the bead look as if it was broken in manufacture. Occasional reports of copper "drill bits" found stuck in beads may be such fragments of corroded wire. For example, Jarrige mentions that a long barrel-shaped lapis lazuli bead from Mehrgarh, Period VII with a "copper bit" still inserted in the hole, was broken in two during the drilling process (Jarrige 1985b). This may instead be a fragment of the copper wire used for stringing the bead. However, further investigation of these reports is needed, as possible use of copper for drill bits is an important unanswered question for the Indus Valley Tradition (Kenoyer and Vidale 1992). Jarrige's discussion (1985a: 290) of the helicoidal bronze rods from Lothal, Mundigak, and perhaps Mehrgarh is of great interest for this topic. These rods are exactly like modern auger drills, and the rods from Lothal and Mundigak still retain their pointed tip. Jarrige (1985a: 290) also notes that the helicoidal rod from Mundigak corresponds in diameter to the hafting holes in wooden handles found at Shahr-i-Sokhta.

Cutting: Indus peoples are thought to have cut many of their thin objects out of sheet metal. Cutting was probably done for the most part with chisels (Mackay 1938: chap. XIII, and many other cases); the V-shaped or double-edged chisels, which are the most common type, can be used to cut metal. Most of the chisels analysed to date are of tin bronze or arsenical copper, and therefore relatively hard. In addition, there are some saw marks in metal objects (Mackay 1938: 368, 452, 475, 583), although Mackay was unable to distinguish if these were from an ordinary blade saw or a wire saw. From the evidence of both chisel and saw marks, the usual procedure seems to have been to cut a groove in the metal mass on one or more sides, then snap the piece in two. Similar methods are seen in Indus Valley Tradition stone working.

Joining: The number of identified Harappan Phase methods of joining metal is limited. There are very few examples of cold joining, comprising primarily the use of rivets to attach metal handles to metal vessels (Marshall 1931).

Hot joining is represented by the evidence for soldering of gold and silver (SanaUllah 1940; Rao 1979), and by one example of pouring molten copper metal over a joint to attach a copper handle securely to a copper vessel (Mackay 1931: 489). (Hot joining is considered a fabrication technique even though the joining material is molten, because the body of the metal is not molten.). There are as yet no published examples of soldering of copper materials, but this is probably due to the generally poor state of preservation of the copper metal and the lack of analysis. For example, a large cooking vessel found at Chanhudaro appears to have been joined at the carination. However, it is not yet clear if this joint was cold or hot joined, due to the poor preservation of the object (Kenoyer, on-going research at the Museum of Fine Arts, Boston).

One possible example of hot joining without solder is seen in a gold tubular bead from Harappa, measuring 33.95 mm in length and between 2.14 and 2.41 mm in diameter. The thickness of the gold wall of the tube is between 0.34 and 0.39 mm and there is no visible longitudinal seam. Further studies of the bead are needed to confirm the precise techniques, but one possible method of manufacture was reproduced in silver by a skilled jeweller in Karachi (Kenoyer, on-going research). A long silver wire was wrapped around a solid rod, and the wire was fused into a tube by vigorous burnishing and annealing. If this were the manufacturing method of the ancient tubular bead, casts of the interior of the gold tube should reveal whorls along the circumference.

Another find from Harappa perhaps related to joining is the discovery of a tiny snippet of gold that is a swollen pillow shape (4.35 mm length, 1.39 mm width, 1.58 mm thickness). This type of object is often seen in the process of manufacturing granules of gold for use in granulated decoration. However, such granules are also a standard by-product of soldering, for the intentional or unintentional heating of a tiny gold, silver, or copper fragment often results in such a shape. The essential step defining granulation is not the making of granules, but the attachment of the granules. At present no ornaments with gold granulation have been found from Indus Valley Tradition sites.

Finishing: There have been few discussions of Harappan Phase metal finishing techniques (Mackay 1938). While this is understandable for the copper-based objects, which are generally heavily corroded, silver and especially the gold objects should provide evidence for Indus methods of finishing. Finishing techniques, which need to be investigated, include the planishing of forged (especially raised) objects; filing and polishing to smooth surfaces; engraving; inlay and stone-setting; and surface coloration via plating or enrichment.

Mackay notes the presence of hammer marks on many of the vessels, but does not indicate if this represents planishing. (Planishing refers to fine, even hammering with a highly polished hammer, used particularly to create a smooth surface on forged objects). Evidence for polishing comes from the gold objects from recent excavations at Harappa, such as the copper and gold beads, which show minute striae oriented in groups.

Polishing materials could have included ground and polished stone objects, perhaps even magnetite nodules, sand or silt-sized powders, plants, or even leather. Engraving to produce designs or accentuate details is known from the figurines and the numerous inscriptions on copper tablets and/or metal objects (Yule 1985a, 1985b). Stone burins or metal engravers may have been used for this technique, and could probably be identified through use-wear studies. Finally, a number of inlaid pieces are found amongst the Indus jewellery, although the techniques of setting have not yet been studied.At present there is no evidence for surface coloration via plating or chemical enrichment. However, the mechanical wrapping of gold sheet over copper and paste beads is known from Mohenjodaro (Mackay 1938) and Harappa (Dales and Kenoyer 1990), as well as from Allahdino (Fairservis: personal communication). At Harappa, gold sheet used for wrapping the core ranges in thickness from 0.07 to 0.1 mm in thickness; it appears to only have been wrapped and hammered around the core without having been actually fused to it.

Miller pleads that more precise information on finishing, and manufacturing techniques in general, would benefit greatly from re-study of all objects in a standardized fashion, using xeroradiography of the objects and selected metallography. Methods of manufacture would give us more information on diffusion and independent invention of metal processing techniques in Indus Valley Tradition. It would also allow investigation of possible regional styles of production both within the Indus Valley Tradition (e.g. Indus Valley vs. Gujarat sites), and in contrast with other Traditions (e.g. Indus Valley vs. Rajasthani cultures, or even Mesopotamian groups) (Kenoyer and Miller 1999; Miller 1993).

Alloying

The most common metal objects were made of copper or copper alloys. SanaUllah (1931:485) defined four categories of copper metal objects at the site of Mohenjodaro: (1) "lumps" of crude copper directly derived from smelting and rich in sulphur (these are ingots, based on the size and shape description); (2) "refined" copper (i.e., specimens containing few non-copper elements—note that one such specimen is also a "lump" or ingot, however); (3) arsenical copper (SanaUllah's "copper-arsenic alloy"); and (4) tin bronze. At present no object made from native copper has been reported from an Indus Valley Tradition site.

Out of the 177 artefacts analysed earlier from Mohenjodaro and Harappa, only 30% were alloyed. Tin alloying ranged from 1-12%; arsenic alloying 1-7%; nickel alloying 1-9%; and lead 1-32%. Tin bronzes were more common than any other alloys. The Harappans knew the techniques of sinking, 'rising', 'running-on', cold work, annealing, riveting, lapping, closed casting, *cire perdue* etc. (Agrawal 1971).

Other processed metals that have been reported include lead, gold, silver, and electrum. Although there are copper objects with iron components from contemporaneous sites in Baluchistan (Shaffer 1984), no confirmed iron objects have been reported from Harappan Phase sites in greater Indus region. Finally, no true brass objects (copper-zinc alloy) have been identified from any Harappan sites, though at Lothal there is a copper artefact with 6% zinc.

A serious problem is that most of the published analytical studies of Indus Valley Tradition metals do not outline specific methods of analysis, so we do not know if results are really comparable. For example, very large differences in per cent oxygen and acid insoluble materials between metal objects from Harappa and Mohenjodaro (tested by SanaUllah or Hamid) and from Lothal (tested by Lal) may be due to analytical techniques. Also, we can seldom tell if an element was truly absent from a collection of artefacts, or if no tests were done to determine its presence, such as zinc at Mohenjodaro. An additional discrepancy factor is introduced by the great disparity in the preservation of metal in different objects, and at different sites. For example, many objects analyzed from Lothal were less well preserved than those from Harappa and Mohenjodaro.

3. Harappan pyrotechnology

In connection with her dissertation, Heather Miller has specialized in pyrotechnology. As this is the only exhaustive and specialized study of Harappan pyrotechnology, we have made liberal use of her work here. The following discussion on pyrotechnology is mainly based on Miller (1993) and Kenoyer & Miller (1999), and also on Agrawal (1971), Chakrabarti and Lahiri (1996), Hegde and Ericson (1985) (see also Jarrige 1985b; Kenoyer 1997a, 1998; Miller 1994a, b, 1997a, 1998).

Earlier workers often did not distinguish between melting and smelting (reduction of ores to metal) evidence, another between kilns and furnaces. Recent work by Miller, under HARP (Harappa Archaeology Research Project), has done a great deal in sorting out such confusions, which are not merely semantic but signify important metallurgical processes. As HARP is well equipped, both equipment-wise and human resources-wise, we will mainly base our account on their work at Harappa. In recent years, the most focussed study on the Harappan pyrotechnological remains has been carried out by Miller (1993). As she critically reviews the previous work too, we will first discuss her publications, then go to other sources of information.

At the outset, Kenoyer & Miller (1999) caution about the use of terms: "...we prefer the more general term 'kiln' rather than using 'furnace', a term specific to metal processing".

The major indicators for metal processing at a site are defined by Kenoyer & Miller (1999) to include: (1) fragments of ores; (2) kilns, or fragments of kilns, attributed to metal processing; (3) metallurgical slag, from the reduction of ore to metal; (4) tools used for metal processing, such as crucible fragments with metal prills, moulds, anvils, stakes, hammers, chisels, etc.; and (5) metal objects, including smelting and melting ingots, semi-finished and finished objects. Significant amounts of ores and/or metallurgical slag fragments are the most convincing evidence for smelting at a site. A variety of day-based non-metallurgical slag, including fragments of kilns and crucibles, can represent either the smelting of ores or the melting of metal, depending on the exact nature of these indicators (Bayley 1989; Craddock 1989; Miller 1994b). Metal-working tools (or than crucibles with prills or moulds) are usually difficult to attribute directly to metal processing, except when found in well-documented contexts in association with a number of other metal-working indicators. Metal objects, including metal ingots, must also be from such contexts to show their production at a site, as these objects may have been imported from other sites.

Kenoyer & Miller (1999) say,

... by the 4th and 3rd millennia it is clear that mining and smelting of ores was being carried out in many localities throughout Baluchistan and Afghanistan (Dales and Flam 1969, Fairservis 1952, 1961, Jarrige and Tosi 1981, Stech and Pigott 1986). Smelting of metal ore usually results in fairly conspicuous accumulations of manufacturing debris and broken furnaces. In particular, the smelting of most ores results in the production of weather resistant metallurgical slag, vitrified masses of silica and other fused minerals, which generally accumulate in conspicuous mounds near the smelting furnaces. On the basis of quantity and type of slag, the small amounts of copper metal slag found at Indus Valley Tradition sites seem to be more representative of melting rather than smelting (Miller 1994b). Often cited copper smelting slag from Ahar is from levels dated to 2nd millennium BCE, after the end of Harappan Phase. The absence of slag heaps and smelting debris may be due to the fact that most excavated sites, particularly of the Harappan Phase, are located some distance from the primary sources of metal ores. Further collections and analyses are needed in the Aravallis, as well as in the regions of Gardan-i-Reg and Cholistan, to determine if there is Indus Valley Tradition or contemporaneous smelting sites in these regions. Archaeologists working in Rajasthan have made a laudable effort to look for copper slag, but specialist surveys are needed.

Discussing the available evidence, Kenoyer & Miller concur with SanaUllah's (1931: 485) and Mackay's (1938: 451) earlier interpretations that most of the copper used at the Harappan Phase sites was imported in ingot form, and little or no smelting was done at the major sites of the Indus Valley Tradition. Plano-convex disc-shaped ingots (almost all of copper) have been recovered from Chanhudaro (Mackay 1943: 188), Lothal (Rao 1979), Harappa (not reported but found in the reserve collections), and Mohenjodaro (SanaUllah 1931: 485; Mackay 1938: 451). Although relatively few ingots were reported in these publications, recent examination by Kenoyer of the reserve collections from Harappa, Mohenjodaro, and Chanhudaro (Museum of Fine Arts, Boston) have revealed the presence of additional examples.

Kenoyer & Miller (1999) argue that melting of metal is a necessary stage in the production of cast objects, both semi-finished and finished.

The remelting of original smelting ingots to produce secondary or refilled ingots is also a common intermediary stage between the production of the original smelting ingot and the final fabricated or cast object. This secondary ingot production is undertaken for one or more reasons: to remove slaggy impurities left in the original smelted ingots; to break up large smelting ingots into more workable or transportable ingots; to form metal alloys; and/or to melt down metal scrap, which is usually varied in composition.... For example, SanaUllah remarked in the very first published analysis of Harappan Phase ingots (his 'copper lumps'), that three of the four ingots were the 'crude product of the smelting furnace, which were too rich in sulphur to be forged. He suggested that such ingots would be remelted for refining; otherwise this metal could only be used for casting 'heavy or plain objects' (SanaUllah 1931: 484-85).

Kenoyer & Miller (1999) warn that...

Much of archaeological evidence for melting (and casting) resembles evidence for smelting, i.e. presence of crucibles, kilns, slag, and metal ingots. However, careful analysis of such objects, particularly identification of types of slag present, usually allows differentiation of these processes.

I think Rakhigarhi and Ganeshwar complex sites need to be explored for such copper ingots, which have been reported at Harappan sites.

Crucibles

Kenoyer & Miller note that the evidence for melting of copper in crucibles is first found during Period III at Mehrgarh, dated to 4000-3500 BCE. Crucibles with traces of melted copper have been found in rubble associated with a Period III firing structure made of brick (Jarrige 1983, 1985a). Jarrige notes that crucibles are comparable in interior size and shape to ingot recovered from Lothal (1985a: 289). Only a few crucible fragments with copper prills have been reported from Harappan Phase sites, although they could represent small-scale smelting of high-quality copper. A crucible rim fragment was found during excavations at Mohenjodaro; SanaUllah thinks that it represents the re-melting of crude metal for refining (1931: 485 and Plate CXLII, 9). No analyses were ever published, but the photograph of this rim shows slagging, and looks quite similar to fragments found by the Aachen IsMEO surveys at Mohenjodaro. A single crucible is also reported from the excavations at Harappa; Vats mentions in a footnote that "a fragmentary earthenware crucible whose contents show that it was used for melting bronze" was found near furnace "Fa" on Mound F at Harappa (1940: 471). Again, no analyses were ever published. Finally, the so-called "crucibles" reported from Lothal must be some kind of a container, as they had no traces of slagging and upon analysis contained no trace of copper (Lal 1985: 661). At Harappa, half a dozen crucible rim fragments with slagging and copper prills have been found in surface surveys of the southern slope of E Mound, and a number of both rim and base fragments of similarly slagged crucibles have been found in nearby excavations (Miller 1994a, 1994b). At least two crucible fragments with slagging and copper prills were also found in surface surveys at Mohenjodaro, as well as an entire small ceramic cup (Pracchia et al. 1985; Tosi et al. 1984). This cup is similar to the crucibles used by modern goldsmiths in South Asia, but there are no visible traces of metal or slagging, and microprobe analyses found no traces of metal (Vidale: personal communication). All of the crucible fragments from Harappa, and one of the two from Mohenjodaro, show a quite small diameter; the second fragment from Mohenjodaro is much larger. Based on the associated types of slags, these seem to represent melting crucibles, not smelting crucibles, but archaeometric research still has to be done.

Of the five crucibles/muffles, three were found together, and are also of the same shape and size, with a smooth interior and rough exterior, and heavily fired apparently more than once (Mackay 1938: 178, Pls. XLI, 72; LXVI, 14). Another piece is thickly coated with a mixture of sand and clay, and seems to have been expressly constructed to withstand heat. However, it is only in the case of the last specimen that one can be sure of its being used for copper-smelting/ melting since there was slag on its edges.

Unfurnished and unworked objects:

Two lumps of sulphur-rich crude copper and two lumps of very pure copper (Marshall 1931: 485), rough castings including those of jar-handle, two indeterminate objects and four ingots were all found in the area of room 15, house IV, block 12A; house 1, room 15 (DK Area). Room 52, house VI, block 1 of the same area yielded two castings of blade-axes. A few miscellaneous fragments including two small rods were found in the same context.

Furnaces and metalworking areas:

Three ingots were found in

> room 15 of house IV, block 2, evidently the quarters or workshop of a metalworker, at levels ranging from 14.5 to 11.1 ft. The rounded lower surface of each is comparatively smooth as though the hole into which the flows were run had been shaped about the curved base of a jar.

Two kilns were noted close by. Measuring 3 ft 3 inches in diameter at the top and 4 ft and 3 inches in depth, the inside surface of the mud-lined pits was vitrified. Each had a 4 inch wide ledge inside, possible intended for a grate. There was no draught or vent in their lower portions, and according to Mackay this could act against the premise of there being copper-smelting places. Two other kilns were noted in a different locality, the larger one belonging to the Late Ia period. A rectangular brick-lined pit (5 ft 6 inches × 4 ft 3 inches × 4 ft 6 inches deep) could have been used by a metalsmith since copper ore and lead were found there (Mackay 1938: 54). It is also possible that the assorted objects (copper and bronze axes, ingots, castings, etc.) found in House I in Block 12A suggest the presence of metalworkers.

Kilns: Kenoyer & Miller (1999) have critically examined the reported evidence of kilns and report that not all were really kilns for copper smelting/melting. Kenoyer & Miller (1999) report four kilns at the Harappan Phase sites which have been attributed to copper-processing: one at Harappa (Vats 1940: 470-73, Fig. d, Pl. XVIa and b); one at Lothal (Rao 1979: 522); and two at Mohenjodaro (Mackay 1938: 49-50, 452). In all of these kilns, the interior is heavily vitrified, and the blackened melted surface indicates a reducing atmosphere. This evidence of high temperatures seems to have been the primary reason for attributing these kilns to metal processing. They point out that evidence of high heat alone is not sufficient to show that a kiln was used for metal processing. Many of the excavated Indus Valley Tradition pottery kilns show similar vitrification (e.g. Dales and Kenoyer 1989), as did experimental mud-brick pottery kilns fired at Harappa during the past seven seasons. The temperature data obtained during the experimental firings show that the vitrification of the ceramics and walls of the kiln occurred somewhere in the range of 1000° to 1100°C, generally in a heavily reducing atmosphere (Meadow and Kenoyer 1992; Kenoyer 1994). Kiln "Fa" at Harappa was one of 16 pyrotechnological structures excavated by Vats in a relatively small area of Mound E. Kenoyer & Miller (1999) emphasize that this kiln was the only one of the 16, Vats ever suggested might be related to metal processing. When first excavated, half of the original structure was present (split vertically), and the interior was well-preserved due to heavy vitrification. The kiln is described by Vats as a pit 3 ft 4 in (1m) in diameter and 3 ft 8 in (1.1m) to 5 ft 3 in (1.6m) deep. A circular kiln on the surface of Mohenjodaro between VS and Moneer Areas was also reported (personal communication). This kiln was approximately 0.8 to 1 m in diameter and was surrounded by hundreds of copper prills and over-fired pieces of clay with copper traces.

About Mohenjodaro, Chakrabarti and Lahiri (1996) also concur,

> evidence of smelting and manufacturing... seems to have been primarily related to secondary manufacture. Admittedly, a quantity of copper ore in pieces, along with a small piece of lead, has been found near a rectangular pit, which could have been used for smelting (Mackay 1938: 54). The analysis by CH Desch of a copper ore sample (Marshall 1931: 600) suggested 'copper oxide, no doubt a surface ore at the outcrop of pyrites, as it

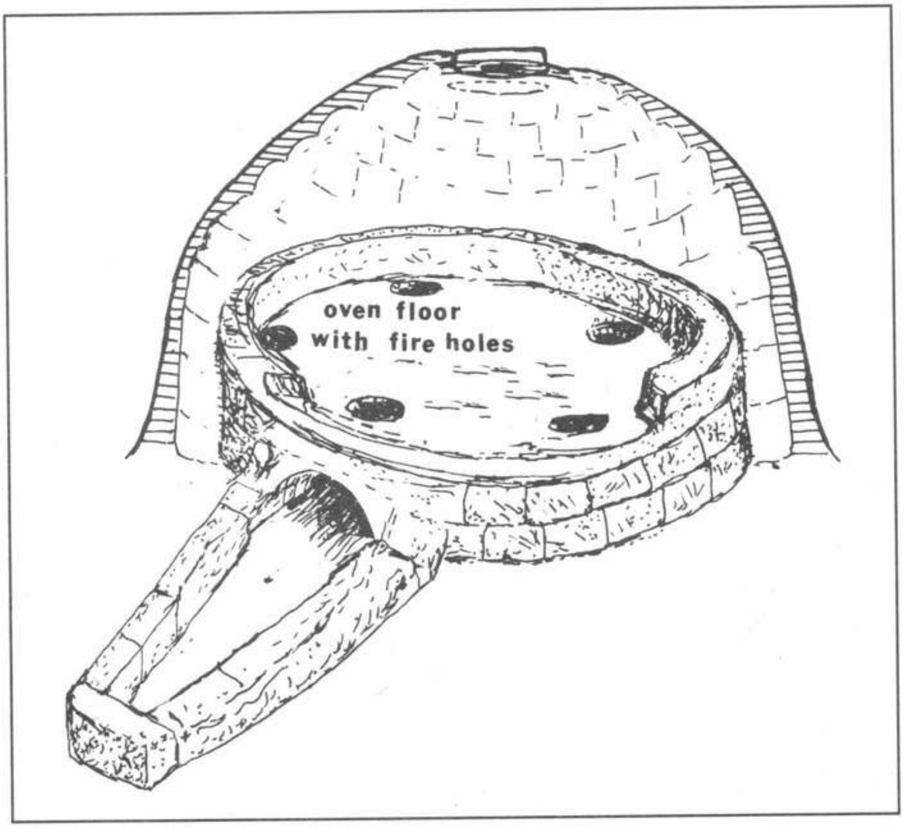


Fig. 6.10 Updraft kiln model (After Possehl, 2002).

contains some sulphide'. However, this evidence does not amount to much and, in fact, original excavation reports do not mention artefactual remains which can be interpreted as evidence of primary smelting. Subsequently, despite a careful search, only small surface clusters of metalworking have been documented at the site.

Furnaces:

There are several kinds of furnaces and ovens, which can be divided into two broad types:

1. Intermittent
2. Continuous

They occur in different forms, such as oval, oblong, and circular and pear-shaped. Some are raised with mud bricks and the base is cut into the natural soil. A fine paste of clay is applied for smoothness along the walls of pit. Generally, these types of furnace will be jutting out nearly 7 to 9 cm above the ground level. Oval shaped furnaces are more common (Fig. 6.10). From Mohenjodaro Mackay (Mackay 1976) found a quantity of copper ore in small pieces together with a little piece of lead and it is quite possible that a metalsmith worked here with a furnace in close vicinity (Kenoyer & Miller 1999).

From Harappa, sixteen furnaces, all situated in trench IV, mound F were discovered (Vats 1940). They are of three kinds:

(a) Part of round pottery jar.

(b) Cylindrical pits dug in the ground with or without brick lining.

(c) Pear-shaped pits dug in the ground with or without brick lining.

There was only one jar furnace and it consists of three-fourths of a round pottery jar with its lower parts embedded in earth. It contained ashes. This kind of furnace, with charcoal as fuel, is still used by goldsmiths in India.

There are two examples of cylindrical shaped furnaces. The walls of this furnace are mud-plastered and along with ashes a lot of highly vitrified slag was found in it. This indicates evidence of intense firing. The remaining thirteen furnaces are all pear-shaped on plan.

At Tarkhan-wala-Dera mud bricks having four courses were used for construction. An oval shaped structure, possibly a furnace, which was partly jutting out and partly underground yielded Harappan pottery. The top of the wall was covered with mud. One complete dish was obtained from this structure.

At Kotla-Nihang Khan in the eastern Sector, several such kilns were noticed in a row, partly underground and partly jutting out of the surface. From one of these kilns were recovered fragments of three terracotta bangles. A similar kiln was also noticed at Bara and it yielded a small painted vase (Sharma 1976: 12).

At Sanghol furnaces or small kilns were found at several places in structural phases 2, 3 and 4. Near some of these kilns were found pieces of faience bangles. Although not many objects were found from inside or in the vicinity of these firing enclosures, it is evident that Bara people were engaged in considerable industrial activities. It may be assumed that beads, bangles and/ or small objects were being fired in these kilns. In this connection the discovery of 92 micro-gold-beads and agate beads, some of which unfinished, a chert weight and a few copper chisels, which were found inside near large corner enclosure of room 2 of phase 4 is significant (Sharma et al. 1982: 72-82). A series of furnaces were noticed from Moharana.

From Daulatpur (Singh 1977) existence of walled constructions, round to oval in shape and. burnt inside, most probably designed as ovens or *bhattis* were noticed. Along with ash and pottery, animal bones were also found in these enclosures, which may have been used as refuse-pits, once they fell into disuse as kilns.

J.P. Joshi (1978) has also reported oval structures of burnt earth from Bhagwanpura, Dadheri, Nagar and Katpalon.

Similar small kilns or furnaces were also found at Hulas, a Late Harappan site in western Uttar Pradesh (Dikshit 1981). Two small furnaces, one circular and/or oval shaped, were unearthed from the Harappan levels. These were plastered with a fine clay paste. No evidence of burnt or mud-brick was noticed in their construction. The oval furnace (IAR-78-79: Pl. XXXIVA) yielded a complete dish-on-stand along with the Harappan potsherds and two more broken dishes. Perhaps this was used for baking the pottery under careful supervision of the potter. In the vicinity of the circular furnace, a good percentage of cylindrical faience beads were found. At Hulas bricks either burnt or of mud were never used for construction of furnaces like Tarkhan-wala-Dera. Further, these kilns were cut into ground level and plastered with fine clay occasionally. Minor objects of specific nature were baked in these furnaces under high temperature.

Two kilns were noticed at Lothal (Rao 1980). One of them was circular on plan and had two chambers one above the other brick wall and floors of both chambers were plastered with mud; these were possibly used for baking pebbles and beads of semiprecious stones. Beads in different stages of manufacture, partly baked pebbles, fragments of earthen bowl used as containers for baking the pebble and finished beads were found from this furnace. Due to intense heat, the mud-plaster on the wall turned red and bricks were vitrified.

Coppersmith's furnace from phase III is more or less a circle on plan with a rectangular projection for the supply of fuel. Pots containing the metal were introduced through enclosure wall. A bowl with copper traces and a rod were found here. Near the second furnace also one copper pin was encountered which goes to prove that coppersmith used the structure. In both cases crucibles were placed directly on burning coal as it is done even today.

This survey revealed that the small furnaces were used for firing of specialized items including pottery. These can be also termed as ancient industrial kilns. In late Harappan stage small furnaces are less in number in comparison to its availability on mature sites. Large furnaces (Oval-shaped) noticed at Bhagwanpura and Daulatpur were possibly used for some other purpose for firing of certain objects on large scale such as pottery etc. This inference is drawn from the massiveness of Daulatpur structure. The absence of small furnaces at Daulatpur and Bhagwanpura indicate that at this stage of Indus civilization specialized craftsmanship was more or less on decline.

Slag:

Kenoyer & Miller emphasize that there is no mention of metal processing slag from any of the early excavations at Harappa or Mohenjodaro. They clarify that from Lothal, several objects originally identified as copper slag have been analyzed and were found to be lumps of corroded copper metal (Lal 1985: 659-61). It is interesting to note that Lal (1985: 658) reports two unshaped objects from Lothal (no information is given about the archaeological contexts or phases of these objects, however, so it is not clear if they are even from the Harappan Phase) composed primarily of iron and copper:

15211 (Lump)	15212 (Cu frag.)
per cent Cu 43.1	9.3
per cent Fe 39.1	66.1
per cent Sn -	—
per cent Pb -	—
% Ni 1.5	tr
per cent Zn -	—
% Ag -	—
per cent Acid Insol. 11.5	17.2
per cent O by diff. 4.8	7.04
Total per cent 100	**100**

Bisht mentions "a few contiguous rooms" with reddened floors, "several hearths, ovens and fire-pits," and "pieces of copper and copper slag" (Bisht 1984: 90-91), and concludes that this area was probably used by metalsmiths. If subsequent analyses show that this is indeed copper slag, Kenoyer & Miller caution, this information from Banawali will make a welcome addition to the scanty information on metal processing, especially as these rooms are attributed to the Sothi or pre-Harappan (Kalibangan I) levels of Banawali (Bisht 1984: 90).

Miller says that with crucible fragments, several discrete scatters of metal processing slags have been found during surveys at Harappa (Miller 1994a, 1994b) and Mohenjodaro (Pracchia et al. 1985; Tosi et al. 1984). Pracchia et al. (1985: 229) report that in Mohenjodaro, the site was identified on an isolated hillock about 10 m long on the E-W axis and 1.5 m high, aligned with the row of possible workshops detected on the southern flank of HR East, perhaps along the edge of a single mudbrick structure. Here scattered on an area of 4-5 sq m, was detected a small cluster of bronze-smelting wasters including some fragments of the furnace's walls, a bronze slag, some prills and a single perforated cylinder of copper (Pracchia et al. 1985: 229). These slags are primarily vitrified clay-based materials with copper prills; metallurgical slags are quite limited in number and do not appear to constitute the type or quantity of slag associated with smelting (Miller 1994a, 1994b). Based on both the characteristics of these slags, as well as the relatively small amount of copper slag found at the excavated Harappan Phase sites, they are more likely to be by-products from the re-processing of copper ingots or scraps than from the original smelting of ores.

4. *Typology of Artefacts (Pls. 6.18-21)*

Ornaments and Mirrors:

The following description of the Harappan ornaments is mainly based on Kenoyer & Miller (1999) and Possehl (2002). The use of copper as a form of ornament has a long history in greater Indus region and can be traced back to early levels of Mehrgarh, where there is evidence for a single copper bead from Neolithic levels (Period IB) at *ca.* 6000 BCE (Jarrige 1983, 1985b). Several copper ornaments have been reported from subsequent layers (Jarrige 1983), but these objects have not yet been analysed, so details of composition and manufacture are still unknown.

Deposits of Period III at Mehrgarh (4000-3500 BCE) also contained corroded fragments of rods and pins. Two double spiral headed pins show that discovery of such pins in later Harappan phase sites no longer indicate connection with much later Namazga III sites in western and northern highlands. A fragmentary copper object from one grave of Mehrgarh Period III may be a compartmented seal, again indicating presence of these objects in a context that predates Quetta-Namazga III complexes (Jarrige 1985b).

The excavations at Mehrgarh and other sites of Regionalization Era provide clear evidence for gradual increase in importance of metal between Early Food Producing and the Regionalization Eras. During the Harappan phase of Integration Era, it is evident that metals supplement rather than replace earlier materials used to manufacture ornaments (Table 6.1). In fact, many metal ornaments are copies of beads, pendants, or bangles made in non-metal materials. There are some unique new types of metal ornaments, however, specifically those that incorporate gold, silver, and electrum. Metal also comes to be used in composite ornaments with other valued or symbolic materials, such as faience, various coloured stones, and shell.

It has to be noted that, unlike contemporaneous sites in Mesopotamia, almost all of the complete ornaments (e.g. necklaces and belts) found at Harappan phase sites have been recovered from hoards rather than from burials. Copper/bronze ornaments as well as copper/bronze tools have been recovered primarily from non-hoard contexts. In contrast, gold and silver ornaments and silver vessels have been found almost exclusively in hoards. It is interesting that copper/bronze vessels have been found almost equally in hoard and non-hoard contexts.

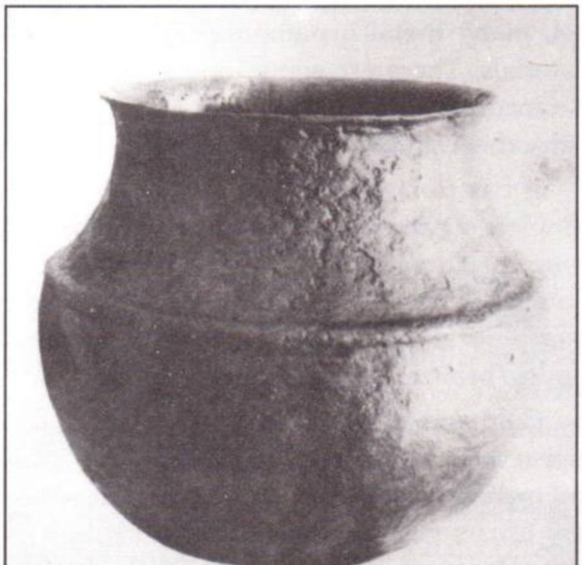
Gold and silver ornaments have been found stored in ceramic, copper, or silver vessels that appear to have been deliberately hidden away. Some of these hoards include broken ornaments and melted lumps of gold or silver that would undoubtedly have been re-melted and made into new ornaments. The hoards often contain numerous stone beads made from agate, carnelian, jasper, turquoise, and other varieties of coloured stones.

Copper beads and spacers are also included with some of the hoards (e.g. Allahdino), but copper ornaments have primarily been recovered in non-hoard contexts, such as in debris accumulating in streets or habitation areas, or in some of the burials. Out of 168 total copper/ bronze ornaments reported, 130 were found in non-hoard contexts and only 38 were found in hoards, generally in association with gold and silver ornaments. The gold and silver ornaments found in non-hoard contexts are usually tiny beads or gold foil fragments that were probably lost in muddy streets or courtyards.

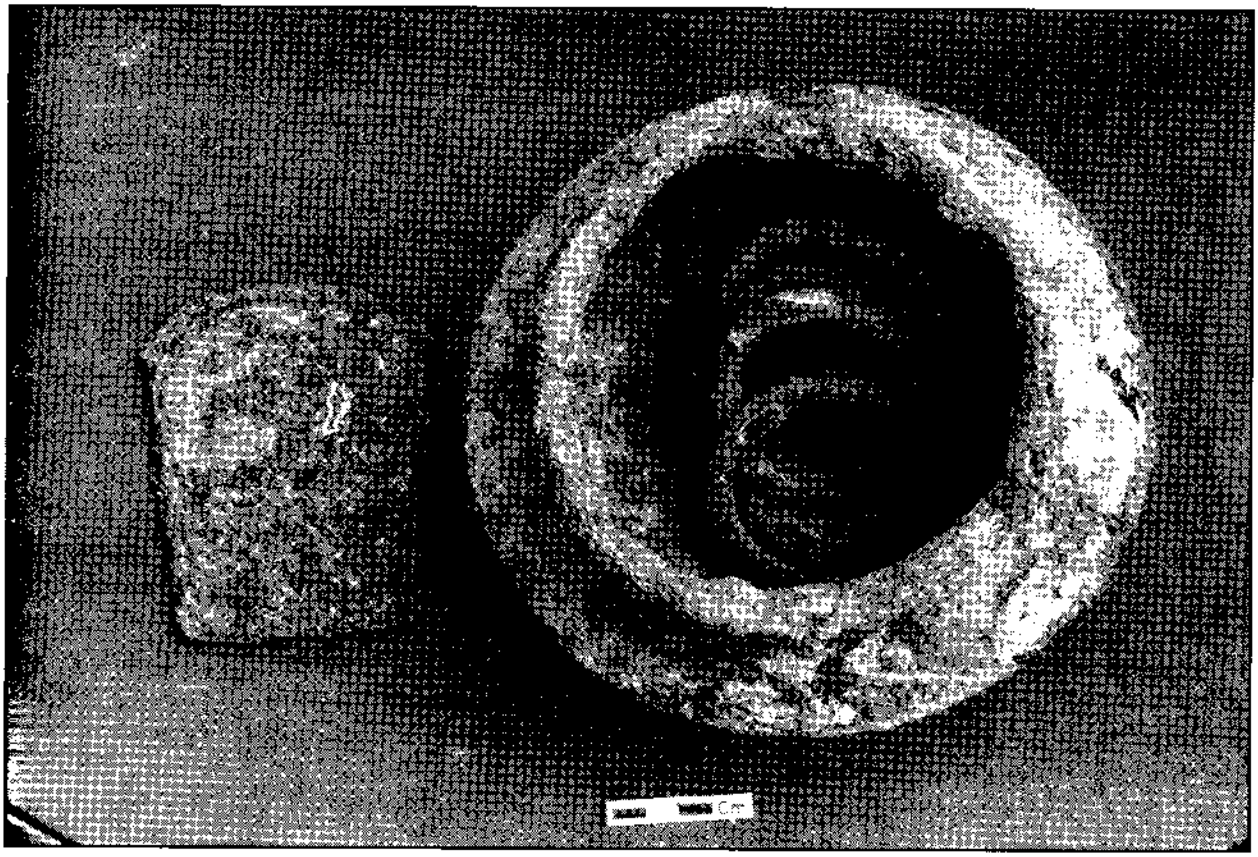
Sepulchral metal objects are almost all of copper/bronze, and include mirrors, finger rings, bangles, and occasional beads. In one instance three gold beads were found, strung together with three stone beads. While mirrors are invariably placed with female burials, other metal ornaments have been found with both male and female individuals (Dales and Kenoyer 1989). It should be noted that no utilitarian copper/bronze tools have been found in burials.

The occasional pilfering of burials cannot explain low incidence of metal in undisturbed burials, especially absence of elaborate gold and silver ornaments. Ornaments that are noticeably absent are those made from exotic materials or involving complex production techniques, e.g. carnelian, faience, or stoneware. This pattern suggests that ornaments which represented wealth or status were passed on from generation to generation and recycled, much as is done today in the subcontinent (Kenoyer 1992b). But presence of mirrors in burials is intriguing, as they were made of a considerable amount of metal that could have been recycled. Metal mirrors are a new object during the Harappan phase, as mirrors were not previously made in any material, either polished stone or metal (Table 6.1). Perhaps mirrors were needed by women in afterlife, or personal use of a mirror made it an object that could not be passed on to another individual at death. However, mirrors are not found in all female burials. One possibility is that such beliefs may have been important to certain groups within Harappan phase communities, while others held different beliefs. However, another possibility is that this difference may reflect looting by grave diggers. Many of burials recently excavated at Harappa were disturbed by Harappan grave diggers in course of digging pits for later burials, and shell bangles and copper mirrors were generally missing from disturbed female burials (Dales and Kenoyer 1989). It is interesting to note that, in contrast to the Harappan graves, the Chinese and Japanese graves were far richer in grave goods especially in bronze objects. From one Yayoi grave alone 25 bronze mirrors were discovered. Unlike in the Indus Civilization, metal objects were symbols of power in China and Japan.

The fact that precious metal vessels (Pls. 6.II-III) and ornaments have been found primarily in hoards suggests that, unlike copper/bronze metal objects, they were used more overtly to define wealth, status, and power. The types of ornaments depicted on figurines may represent gold, silver, and stone ornaments that had symbolic as well as ornamental value. However, it is curious that unlike Mesopotamia or Egypt, Indus terracotta or stone figures are never depicted holding metal tools or weapons as symbols of status or power. The only pictorial or glyptic representation of use of weapons or tools is seen in pictographic signs of undeciphered Indus script, or in narrative scenes on seals or moulded tablets (Kenoyer & Miller 1999).



Pl. 6.II Copper vase – DK area G section/ Mohenjodaro.



Pl. 6.III Copper vessel with copper bangles and celt, Mohenjodaro.

About the Harappan ornaments (Pls. 6.6-16), Lal (1997:167-68) notes,

Of gold, no vessels, even tiny ones, were made, evidently because of its rarity and cost, however, ornaments were frequent. These included a variety of beads - micro-beads, barrel shaped ones, some flat and discular with axial holes, amulets, pendants, rings, broaches etc. One of the spacers found at Lothal has ten holes, indicating same number of strings in necklace concerned. Thin, elongated, conical pieces with a hole near thinner end may have been ear-pendant of type used even now in India. However, no less interesting is a hollow conical ornament which is even today worn by rural womenfolk in Rajasthan and Haryana, in the middle of upper part of forehead where hair parts sideways. It is known as *chauk*. Attention may also be drawn to circumstantial evidence regarding occurrence of a small, thin, discular plate with two perforations on a margin. It was found at Lothal on an altar where an animal had been sacrificed and may thus have had some ritualistic significance. In this context, the excavator (Rao 1985:634) reminds us of ornament worn on the forehead by the famous 'priest' from Mohenjodaro.

After this general discussion of the Harappa culture and its material assemblage, we would mainly confine ourselves to copper-bronze artefacts discovered at the main sites and will not go into details of cultural milieu of individual sites.

Chanhudaro (All plates refer to Mackay 1943)

As most of the copper and bronze artefacts found at Chanhudaro came from Squares 8B, 8C and 9C, Mackay thought that this was the quarter of the city inhabited by metal workers.

Utensils: A copper canister (Pl. LXXIII, 37 – all plate nos. in this description refer to as given in Mackay 1943) fitted with wire loop handles. It may be noted that handled vessels are a rarity in the Indus corpus, except for handled pans, of which some examples have been found at Chanhudaro. Another remarkable find is that of a fluted cosmetic jar (Pl. LXXIII, 39), with a very narrow (0.22 inch diameter) mouth and a long neck, like those used for keeping kohl. The fluting ornamentation is unique among the Harappan vessels.

Other finds: Jar covers, scale-pans and beams, blade-axes, adzes, saws, spearheads, daggers, large and small knives, razors, arrow-heads, chisels, fish-hooks, awls, rods, tubular drills, ingots and plumb-bobs are similar to those found at Mohenjodaro and Harappa. The scale-beams have slightly thickened ends to prevent strings holding pans from slipping off. The blade axes are both long and short, and inscribed in some cases. The adzes are longer and slender than axes. Only one specimen of a saw was reported. Some agate nodules for making beads have saw-marks. There are two new types in razors: U-shaped and crescent-shaped. Two examples of tanged arrow-heads (Pl. LXXIII, 1 and 13) have been found at Chanhudaro, but otherwise arrow-heads belong to an usual type. Mackay (1943: 183) mentions that they have all been cut from thin pieces of sheet copper, varying from 0.02 to 0.05 inches in thickness, and must have been set in tapered and slit ends of their shafts, so that the latter formed a stiff wooden mid-rib. A cement of some kind must have been used to fix these heads in place, for no tie holes in them occur. Both fish-hooks and chisels (5 varieties: uniformly thick tang, flattened tang, round in section, short and round/rectangular/square in section, and short and pointed) conform to Mohenjodaro specimens as do awls, rods, plumb bobs, tubular drills and ingots. 'Bead tools' of Chanhudaro (Pl. LXXX, 1-8) constitute a new type (cf. one specimen: bronze casting 1.9 inches long, with a point protruding from its lower end—this point is shielded by a flange partly encircling it). These were used in production of minute steatite beads. The shovel (Pl. LXXIV, 13) is a new type. Stave heads (Pl. LXVIII, 4, 5, 7) might have served to surmount ceremonial staffs. There is also a specimen of spatula (Pl. LXVII, 8).

The evidence of local manufacture: Unfinished castings were noted in three of hoards discovered at Chanhudaro (Mackay 1943: 40-41). One hoard of 16 objects was found buried at locus 284, in remnants of a room of a house in Square 8/B; although the excavator noted "several unfinished castings", these castings are not mentioned in the catalogue of illustrated objects (Mackay 1943: 300). Another such hoard which contained a casting (for production of a knife?) was found north-east of pavement at locus 212, Square W. In the largest deposit consisting of 37 pieces at Square 8/C, locus 297, unfinished casting was presumably intended for the manufacture of an implement. In this hoard, a bronze rod, round in section and about 13.75 inches in length has been characterized as an ingot (Mackay 1943: 187). Mackay (1938: 188) also noted the concentration of artefacts in a particular sector as denoting metalworkers' area. However, no furnaces or kilns that could have been used in the production process were discovered, and consequently it has generally been argued that the rough work was carried on outside the city and artefacts were brought in only for finishing.

Heidi Miller (J.H. Miller 1998: 3-12) has done a very promising systematic study of metal artefacts from Chanhudaro. In her analysis, she explains:

Labels such as adze, axe, spear or lance head have not been used because these terms carry a functional interpretation based on a genetic shape shared with more modern examples, and as descriptive terms, are not well defined. Instead, a systematic classification for tools has been devised that groups tools with similar working edges with each other. The purpose of this is to move beyond automatic assumption of function to explore the varied ways different tool shapes and sizes (i.e. types and subtypes) could have been used.

Heidi Miller (1998) explains her typological criteria:

Four attributes are used to define tool types: overall shape and size of object, shape of working edge, and whether part of tool may have been hafted. To begin with, shape of a tool is classified as either a blade or a rod.

A blade is flat and rectilinear in section, and size difference between width and thickness of body of tool is greater than 1 cm; that is, object is much wider than it is thick. The width and thickness of rods are similar and difference between two measurements is less than or equal to 1 cm. Rods may be round or rectilinear in section. The distinction between blades and rods reflects different size of working edge than rods. Consequently, two shapes may have been used for different types of tasks.

Along with overall shape and size of tool, shape of working edge is the third attribute considered in determining tool types. The two main edge forms are: edge, also referred to as a chisel edge, and is found both straight and flared; and points which can be either dull and round, or sharp and pointed. The fourth new attribute considered is whether tools could have been hafted or not, and if so, how. These four attributes, overall shape of objects, its overall size, size and shape of working end, and how it may have been hafted, are what determine a tool type. Types 1 through 8 are blade tools, where working edges are wide areas, and types 9 through 13 are rod tools with smaller, shorter and more concentrated functioning ends. Types 14 and 15 are unique tool types. All sizes listed below refer to objects in Chanhudaro collection only (Heidi Miller 1998 - I have used her full name to distinguish her from Heather Miller).

Characteristics of Chanhudaro metal assemblage

Heidi Miller has studied 521 objects from Chanhudaro, out of which 64 per cent are tools, 26 per cent are ornaments, 7 per cent are vessels, and 3 per cent are miscellaneous objects. She hopes that in future it will be interesting to see if this same broad functional pattern is represented in assemblages of metal objects from other sites in Indus valley, and how this pattern may vary through time and space.

Within each category, she distinguishes certain patterns. For example, out of 37 copper vessels found at Chanhudaro, 27 (or almost 73 per cent) were dishes. In tool category, rod shaped tools make up 52.1 per cent of the sample while blade tools are 47.9 per cent, showing a relatively even distribution between two shapes. There are 334 metal artefacts classified into 15 tool types and no single type makes up more than 17.2 per cent of category. There appears to be a range of tool types with no dominating specific type, suggesting that copper alloy tools were used for a variety of purposes. Only three copper objects from Chanhudaro are inscribed: type 14, described by Yule as a 'snarling iron', and two examples of tool type 3A blades.

She explains that this is a functional typology for metal objects. It begins with four categories which reflect general patterns of use: vessels, ornaments, tools and miscellaneous objects. Each category consists of specific types defined by shape, size, and if a tool, by working edge and hafted area. She says, "Definitions have been made as clear as possible and it is hoped that future research will further clarify and expand upon types presented here". She hopes that this typological tool will allow for comparative studies between sites as well as an examination of spatial patterning of types within a site, and will facilitate comparative studies between the ongoing research into technological aspects of metal craft production, and together, typological and technological, will provide a clearer picture of how metal objects were made and used in the Indus valley (Heidi Miller 1998).

Mohenjodaro

It was E. Mackay who had described the metal artefacts in John Marshall's report on Mohenjodaro, as also in his own report on Mohenjodaro. The scientific analyses were done by Muhammad SanaUllah (for illustrations and detailed descriptions see Marshall 1931: 481-508; Mackay 1937-38: 441 ff. Plate nos. refer to these original reports). Earlier I had given a general summary of the Harappan tool repertoire (Agrawal 1971). Recently Chakrabarti & Lahiri (1996) have come out with a more detailed description of the earlier finds at Mohenjodaro and Harappa, Chanhudaro and Lothal which we have followed below. Recent data follow the reports based on earlier excavations. Following original older descriptions, we have retained measurements in inches (for conversion: 1 inch = 2.5 cm).

Vessels (Pls. 6.II-III): Many copper vessels were raised from single sheets of metal by hammering. In some cases, they were made in two parts and joined with a "rib being caused by projecting of jar". In addition, bases were frequently "lapped on" to the upper parts. There are cases in which vertical knob handles of lids were secured to cover both by a rivet and. "by pouring molten metal around base of rivet for additional security". The heavy bronze vessels were probably cast, although some bronze vessels could also be raised from sheet metal by hammering aided by frequent annealing. In some cases final finish could be given by carefully rubbing down objects or by turning them up on a lathe. In such cases, the marks "could have mostly removed by subsequent honing and polishing". The vessels have mostly flat or semi-flat bases, those with rounded bottoms being kept on separate ring-stands. No effort was generally done to strengthen rims "by turning metal down a little all the way round" but common process of flaring rim partly added to its stiffness. Plate CXL (in Marshall 1931) illustrates outlines of a few representative vessel-shapes.

1. Pl. CXL, 4: bronze—cast-dish and cover-heavy and well finished with a smooth surface-cover fitted with a slight projection on inside, made by thinning edge, to prevent its sliding off- cover handle a separate piece riveted to top-dish diameter 6.55 inches; height 0.9 inch-cover with a slightly larger diameter- two together 2.6 inches high-4 ft below surface-room 1, house I, trench E(M), DK Area.
2. Pl. CXL, 7: copper-hammer—'—marks-plain bent-over rim- ht. 4 inches-4 ft below surface-room 9, block 12, section C, DK Area.
3. Pl. CXL, 8: bronze-wide-mounted, plain rim- base heavy compared with sides-a sunken band (0.8 inch wide and 0.2 inch deep) at base-ht. 4 inches-2 ft 6 inches below surface-trench E, DK Area.
4. Pl. CXL, 9 and 18: copper-vessel and cover- vessel made from one metal sheet ribbing formed from inside by beating metal or a round-edged anvil- ht. including that of cover 12 inches- 4 ft below surface-house I, trench E(M), DK Area.
5. Pl. CXL, 12: bronze-plain flared rim- lapped on-8 inches high-4 ft below surface-room 1, house I, trench E (M), DK Area.
6. Pl. CXL, 13: bronze-cast-very thick metal- diameter 12.75 inches, ht 4.4 inches rounded base-5 ft below surface-room 12, section C, DK Area.
7. Pl. CXL, 14 copper-plain rim 4.6 inches across-9 inches high-2 ft below surface-room 14, block 8, Section C, DK Area.
8. Pl. CXL, 16: bronze-3.05 inches high flask-cast-very thick, solid metal-2 ft 6 inches below surface-chamber 6, house II, trench E(M) DK Area.
9. Pl. CXL, 20: bronze-small, flat base lapped on-0.18 inch thick plain edge-ht 10.5 inches-5 ft below surface-room 9, block 12, section C, DK Area.
10. Pl. CXL, 5: stem and base of a censer - pan missing - copper axe decorated with a fluted pattern, flutings being hollow on inside-slightly bent over rim with a raw edge carrying three rows of indented markings- stem horizontally and regularly fluted by hammer work and made from a single piece of metal with base-knob at top of stem of bronze-in solid casting and very heavy—a final finish on a lathe-estimated height 6.65 inches-diameter of base 6.75 inches-room 1, house I, trench E, DK Area.

Blade-axe:

The general slope of cutting edge is on both sides, except in one case where there is a 'true chisel-edge', slope being only on one side. Mackay takes care to point out that there is 'no skimping of metal' in manufacture of this tool-type which was first cast in open moulds and then hammered for requisite hardness. The greatest thickness of these implements is about 'two-thirds down hem, which gave weight at that part of blade where it was most needed'. The specimens were carefully rubbed down after they were hammered because hammer marks survive only in one. The hammering was light in centre, getting more pronounced at edges.

Long and narrow sub-type

11. Pl. CXXXVIII, 1: copper-8.9 inches, 0.24 inch thick-cutting edge 2.3 inches wide and rounded-5 ft below surface-room 11, house XXX, block 5, VS Area.
12. Pl. CXXXVIII, 7: copper-4.82 inches long, 0.2 inch thick-sides and butt cut square-unusual in the sense that 1.32 inches wide butt end is wider than cutting edge, 6 ft below surface-room 87, house IX, block 2, HR Area.

Short and broad sub-type

13. Pl. CXXXVIII, 2: copper- 8.25 inches long, 0.35 inch thick-rounded cutting edge sharply sloped on both sides- butt end with a blunt edge-5 ft below surface-room 11, house XXX, block 5, VS Area.
14. Pl. CXXXVIII, 6: copper-6.25 inches long, 0.3 inch thick-rounded cutting edge sharply sloped on both sides- butt end with a blunt edge- 5 ft below surface- room 11, house XXX, block 5, VS Area.

    Spear/lance-bead: width and thinness of these blades drew comments from Mackay (Marshall 1931) who pointed out that unless strengthened along their edges, they would have been totally ineffective as weapons. He also discounted possibility of their being knives of some sort because of total absence of rivet-holes by which they could be tied. However, he suggested that specimens of this type could be shafted to bamboo shafts and cemented by a resinous substance like shellac. The objects were made from rods of metals, which were thicker than tangs. There was never any attempt to turn out a mid-rib, and their edges were possibly sharpened by hones.

15. Pl. CXXV, 2: copper-9.1 inches long, breadth 4.1 inches, thickness 0.15 inch near the tang-2 ft below surface-room 14, block 8, Section C, DK Area.
16. Pl. CXXXV, 8: copper-a very fine specimen-length 11.3 inches, breadth 3.5 inches, thickness 0.15 inch-most of it 0.11 inch thick, "very thin, and likely on this account to have been easily bent" -10ft below surface in Great Bath area in a street. Arrow-head: the most interesting aspect of these arrow-heads is that their lithic prototypes are not available.
17. Pl. CXLIII, 12: 1.33 inches long, 0.5 inch thick-evidently cut from a piece of sheet proper-5 ft below surface-Stupa section. Knife/dagger: Mackay (Marshall 1931: 500) commented on "smallness of the number of knives and daggers found at Mohenjodaro".
18. Pl. CXXXV, 3: copper knife-6.7 inches long by 1.23 inches wide- back thick near the tang (9.17 inch thick) and fine down towards tip to blade-edge sharp and graduated 7 ft 6 inches below surface-Structure V, block 2, Section B, HR Area.
19. Pl. CXXXV, 6: copper-possibly a lethear-cutter, since its tip is curved-restored from a perfect example from Harappa -present length 6.2 inches, estimated width 2.1 inches- 0.1 inch

thick-flat tang-edged only on convex side-3 ft 5 inches below surface-First Street, HR Area.

Razor:

The type is not very clearly determined but Mackay suggests prevalence of two types.

Razors were classified into double-blade, L-shaped, hook-shaped and simple-bladed sub-types. The double-blade type was most common.

Blades are always very thin and paper-like, and tangs which are oval in section are not very much thicker. It will be noticed that the two blades of a razor are not the same shapes; probably each side had its own purpose. They were roughly cut out of sheet metal and blades subsequently spread by means of a hammer before being finally trimmed into shape. None of these razors is very large, biggest that we have found being only 2 inches across blade. It seems unlikely that they were set in handles, for in better preserved specimens metal tang, thin as it is, would suffice for holding blades as light as these (Mackay 1937-38: 468).

20. Pl. CXXXVIII, 11: bronze (?)-2.2 inches long, 1.05 inches wide-fine curved edge-2 holes at back for riveting it to a handle-5 ft below surface-house 17, VS Area.
21. Pl. CXXXVII, 12: bronze-badly broken-measuring at present 2.28 inches across sharp curved edge-average thickness of blade 0.9 inch- rectangular tang-6 ft below surface- Room 104, Block 8, L Area.

Saw: In 1931, Mackay (Marshall 1931: 500-501) illustrated only two examples:

22. Pl. CXXXVIII, 8: bronze-"is of much the same shape as iron saws used in the present day to cut up shell"-18.3 inches long. 6.3 inches wide-thickness corroded-2 holes in tang for riveting- teeth well preserved at its tip-5 ft below surface-Room 9, Block 12, Section C, DK Area.

The second example by Mackay in this context is more or less guesswork.

Sickle-shaped blade: Only one example has been cited by Mackey (Marshall 1931:501).

23. Pl. CXLIII, 25: bronze-19.5 inches long, maximum diameter of shank 0.12 inch- end of shank bent over to form an eye-3 ft below surface-house 9, block 2, Section 8, HR Area.

Fish-hook: Fish-hooks are said to be common at Mohenjodaro.

24. Pl. CXLIII, 25: bronze-1.95 inches long, maximum diameter of shank 0.12 inch- end of shank bent over to form an eye-3 ft below surface-house 9, block 2, Section B, HR Area.

Chisel: There are 3 types of chisel: rectangular/square in section with uniform dimensions along the entire length; rectangular/square in section with flattened tang; and round in section. The third type is said to be very rare. All chisels are double-sloped. The flattened shanks are expressly meant to be fixed in handles. The pointed chisels with round sections were meant for cutting stone. None of these chisels are suitable for deep mortise cutting, for their splayed edges would prevent easy withdrawal from the hole. Certainly none of them show evidence of having been used on hard materials. They were probably employed for simple woodwork, and it may be for soft stones, such as steatite, which was very commonly used at Mohenjodaro. The smaller tools were perhaps employed for engraving. (Marshall 1931: 502).

25. Pl. CXXXV, 11: copper- 9 inches long, splayed edge 0.64 inch wide abruptly sloped on both sides-made from a rectangular rod measuring 0.5 inch wide by 0.38 inch thick-tapers slightly towards butt and edge 11 ft below surface-Block 4, Southern Buildings Section.
26. Pl. CXXXV, 12: copper-8.2 inches long, made from a square rod (0.4 inch square)- shank measures 0.7 inch by 0.16 inch and is cut square at butt- 6 ft below surface- room 8, house 8, block 2, HR Area.

Awl and Reamer: One example has been cited.

27. Pl. CXXXV, 7: copper- 7.7 inches long, made from a rod 0.28 inch square in section- towards the end it fines down to a point- the shank hammered flat and measures 0.37 inch by 0.1 inch at butt- point bent-'from sharpness of its angles it seems likely that this tool was used as a reamer'- 4 ft below surface-First Street, HR Area.

Among the other tool-types, Mackay first mentions needles of which three examples have been illustrated by him (Marshall 1931: Pls. CXXXII and CXLIII). He then covers kohl-stick ("their blunt ends preclude their being awls, and the fact that the ends are usually carefully rounded and polished proves that they are not pieces of unused metal"), finger-ring (a typical example: internal diameter 0.72 inch, made of wire, 0.13 inch in diameter, with the ends closely touching), earring and bracelet/bangle (a typical example): 2.55 inches outside diameter, 0.3 inch diameter of the round section-tapering points coming close).

In the category of miscellaneous objects is included jar-handle, piping (Pl. CXLIV, 1- cast, 22.5 inches long. 0.78 inch diameter, 0.11 inch thick), shield-boss (Pl. CXLIX, 3- irregular circular piece, 3.3 inches in diameter- marks of 10 rivets around the bevelled edge- certainly patch of some kind), bull (Pl. CXLIV, 2), bird, tube, terminals, spacer, bead, casting, chain and the famous dancing figure of a girl.

In 1938 more data were published on the copper-bronze objects from Mohenjodaro (Mackay 1937-38: chapters 13 and 14). Mackay begins by saying that no distinction can be established between types and shapes on the basis of stratigraphy. He (Mackay 1937-38: 441) also emphasizes that

Bronze was known too and used by the people of the earlier occupations as well as later. For instance, bronze containing no less than 22.2 per cent of tin was found at level 30.4 ft below datum and another piece with 8.3 per cent of tin at 33.4 ft below datum.

He further points out that in some cases copper objects were wrapped in cotton cloth. A good number of objects in the upper levels of the site came from three hoards. Hoard 1 (room 19, house II, block 14, DK Area), found 4.8 ft below surface (Late I date, according to Mackay), comprised no less than 40 objects including bronze figure of a goat. Hoard 2 (room 28, house VI, block 15, DK Area) occurred 5.7 ft below surface and belonged to Late Ib period. Hoard 3 was found in the same room as Hoard 2 but at a lower depth 7.1 ft below surface. These three hoards were found in 1930-31 but in 1929 another hoard of metal objects had been found. This hoard (room 15 of block 12A of DK Area) occurred 24.4 ft below surface and thus belonged to a much earlier level. As far as the metal utensils are concerned Mackay (1938: 445) tries to establish some parallels between pottery vessels and metal vessels. Both pans and dishes were found earlier, but frying pan with a simple tubular handle seems to be a new type of utensil.

28. Pl. CXXII, 10: copper- 5.7 inches long with a handle which is a broad strip of metal bent round to form a hollow tube which tapers to an end- possibly inserted into a wooden handle - sides of the pan 0.45 inch high- hammer-marks visible.

Mackay (1938: 450-53) refers to the occurrence of "quite a number of ingots and castings which throw considerable light on the methods adopted by the metallurgists of Mohenjodaro". Plano-convex shape of ingots (cf. 3.62 inches in diameter, 1 inch thick; base rounded and fairly smooth, top uneven with characteristic puckering due to contraction of metal when cooling; p.451) suggests that "ore was smelted in an open hearth with charcoal over a cavity in ground into which metal ran". As an example of casting Mackay (1938:452) refers to an irregular piece which "seems from its appearance definitely to have been broken from a larger mass of metal, for its longer edge shows a preliminary saw-cut, 0.13 inch deep, after which the piece was snapped off". He also illustrates castings of blade-axes which "were so faulty and full of blow holes as to be unusable except for re-melting". These blade-axes were cast in closed moulds set on edge or on one end. However, in this context Mackay (1938: 457-58) draws attention to an axe-adze (Pl. CXXII, 12), found in the Stupa section (open space between Blocks 7 and 10 where there was substantial brick-robbing), 6 ft below surface. He is disinclined to accept it as being a product of the Indus valley Culture as we know it. In fact, he "would prefer to regard it as of later date, perhaps even as late as Kushan Period, despite its being found 6 ft below datum". Axe-adze is 10.15 inches long and made of cast bronze. Although Mackay doubts authenticity of this particular find, he points out that " Indus valley people knew of socketed tools, even if they themselves did not use them".

Spear lance-heads and arrow-heads (from Dholavira: Pls. 6.18-19) conformed to the earlier types. One of these specimens was found to have two holes through which the wooden mid-rib could be tied by a wire. Distinction between knives and daggers is made by Mackay in following fashion: whereas knives were meant primarily for cutting or severing something, daggers were intended basically in shape of blade: (1) broad, leaf-shaped; (2) leaf-shaped with curved tips; (3) narrow and straight; (4) triangular with upturned points; (5) broad, curved; (6) narrow curved-edged; (7) hollow-backed; and (8) double-curved. There is a type which is called 'both knife and dagger'. Finally there is an exclusive class of daggers, with two of them having a definite mid-rib. Sword or dirk: This type was obtained for the first time in the 1930-31 excavations and is double-edged, heavy for their size and well-made and shaped.

29. Pl. CXIII, 3: copper- blade and tang 15.75 inches long and greatest thickness 0.4 inch-two rivet holes at junction of tang and blade-in section blade diamond shaped- rectangular tang 0.65 inch wide by 0.28 inch at its thickest part- room 19, house III, block 14, DK Area-Late Ib period.

Saw and Bolts and/or objects: A good specimen of saw has been illustrated (Pl. CXVL, 5). It has irregular teeth 'in much same way as teeth of modern saw' (It may be note here that true saw was an innovation of Harappans). Specimen was riveted to a handle. Among other types are mentioned sickle, fish-hook, plain hook, chisel, awl and reamer, drill, kohl-stick, needle, bolt, plumb-bob, scale-pan and beam, mirror and spatula, besides some miscellaneous objects. The new types here are plain hook, drill, plumb, scale-pan and beam, mirror and spatula. Interestingly, a bronze hook (Pl. CXXRV, 32) was initially thought to be elephant-goad, although Mackay (1938: 472) writes: "I am now assured that it is much too small to have been used for that purpose, though when perfect it may have been very similar in shape to the goads in use in India at the present day".

Drill (Pl. CXXXI, 6) represents a type of small pointed implement. A bolt has been illustrated in Pl. CXXVII, 14:

> It is 25.15 inches long, and tapers slightly to a point 0.59 inches wide by 0.37 inches thick. The head is slightly bent and measures 0.98 × 0.92 inches. This bolt appears to have been smoothed in some way (Mackay 1937-38: 476).

Plumb-bob (Pl. CXXV, 50) is a round lead ball, 1.2 inches in diameter, with a copper or bronze staple attached. According to Mackay (1938: 476) this is 'undoubtedly a plumb-bob'. Scale-pan and beam (Pl. CXIV, 10 and Pl. CXXXII, 7) are basically a flat-edged dish 'turned into a scale-pan by boring three small holes at regular distances in its rim' (diameter in one case 3.26 inches). The beam is identified by its association with two scale-pans (6.2 inches long beam in one case).

Mirror (Pl. CXIV, 1)

is bronze, slightly oval, and the face raised 0.17 inch. back which is quite plain is somewhat irregular. The polish has completely disappeared from the recessed face of the mirror. The handle is rectangular in section with a hole at the end, and it looks as if there had been another hole close to the mirror itself, but, if so, it has been filled up by corrosion. The recessing of the faces of all these mirrors was perhaps intended to protect them and to preserve their polish. It is almost certain that the handles were at one time encased with wood and therefore longer than they now are, for these mirrors (Pl. 6.21 this book) are very heavy and difficult to hold in their present condition. The slightly pear-shaped form of all three is in noticeable contrast with the round or elliptical mirrors of early Egypt, Sumer and Elam. Metal mirrors are still in use in India today; certain orthodox Hindus prefer them to glass mirrors for their religious ceremonies (Mackay 1937-38: 478).

Spatula (Pl. CXXXIII, 18) has a very thin blade (0.04 inch thick) and was perhaps used to remove paint or cosmetics from a palette. On the use of copper or bronze in personal ornaments, Mackay (1938:501) writes,

Copper and bronze were frequently used in the manufacture of beads, spacers and terminals. The two latter were always made of thin metal, but beads which are generally short-barrel shaped or globular are solid castings, holes through them, it would seem, being drilled later, though it is possible that they were cast with holes which had to be improved. Traces of gold survive on one copper, or perhaps bronze, bead, and it is possible many of these beads were so finished to imitate gold.

Among the terminals the most common shapes is the triangular one.

Harappa

The following summary of the copper artefacts in the earlier excavations at Harappa is based on Chakrabarti & Lahiri (1996) and Vats (1940). All references to plates belong to Vats (1940).

The most important find was jar no. 277 (III Stratum, Square M 11/15, Mound F) which contained following artefacts (Vats 1940): 13 blade-axes, 8 narrow and long axes, 2 double-axes, 11 daggers with tapering sides and with or without curved tips, 1 mace-head, 13 spearheads and flaying knives, 1 lance-head, 1 arrow-head, 1 chopper, 2 saws, 10 chisels with or without shanks, 2 cast-bars for making chisels, 1 flat strip of metal, 1 stylus, 1 beam of a weighing scale, 1 semi-oval, hollow terminal, solid bangles, 1 rod for making a bangle, 3 hollow bangles, 4 flattened leaves for making hollow bangle, 4 thick rectangular copper-pieces, 1 thin bowl with tapering sides, 2 large folded sheets of copper, 2 thick broken pieces bearing prominent hammer marks, several more thick pieces and 1 small lump of lollingite.

The broad types of objects found at the site are following: Vessels, adze (one socketed), dagger-knife, spearhead, chisel, sickle, scraper, razor, gouge, nail-cutter, surgical or toilet set, cobbler's awl (?), needle, pin, antimony rod, mirror, fish-hook, arrow-head, hasp or a typical Indian *kundi* made of a round copper bar, hook, and latch (?). Among the vessels, Vats illustrates a carinated jar from Mound AB, Pit II, Stratum II, Pl. CXXII, 24- height without cover 7.8 inches, diameter at the mouth 7.7 inches and across the body 11.5 inches which is made in two parts, the upper part being lapped on to lower one by hammering two together. Owing to lathing, the joint is imperceptible. There is nothing special about adzes from site except lower part of a socketed specimen (Pl. CXXII, 18). Among what Vats calls 'dagger knives' there is a specimen with a long, narrow and curved tip with double edge and incipient, vertical mid-rib down the centre. This has two rivet holes and the shape is considered 'unique at Harappa and Mohenjodaro'. Similarly, among spearheads which are relatively common and of various shapes, 'often with long tangs which are sometimes holed for rivets', there is a specimen (Pl. CXXIV, 49) which is unique in having a strengthening mid-rib, with two holes at base of head and a third one at base of tang. Three chisel-types are noticed: a long and narrow type with flattened shank and splayed edge; a short, thick and strong type with splayed edge and burred butt, and tanged chisels, the last type being rare and reported for first time from Harappa. A number of straight edged and curved knives and curved sickle blades have been documented, along with 'scrapers' (flattened, with rounded edge, length 3-4 inches). Razors are Mohenjodaro-type. The cutting edge of gouges are circular or approximately so. The nailparer illustrated in Pl. CXXII, 14 is said to be 'exactly similar to those now used in Punjab.' What has been called a 'surgical or toilet set' (Pl. CXXV, 1) is a bunch of three bronze instruments (roughly 4-5.3 inches long) held together by their looped and interlaced ends. One is a double edged knife; the second is a pair of pincers, and the third one is a piercing rod. Among the other varieties of artefacts (cobbler's awl, needle, antimony rod, mirror, fish-hook, arrow-head, hasp and latch) the interesting ones include a hasp or Indian *kundi* made of a round bar (0.35 inch in diameter) and latch (CXXII, 28 and 33). There are strong objects of cast bronze, 3.75 inches long and 1.37 inches broad in one case, and 2.37 inches long and 1 inch broad in another.

Lothal

According to S.R. Rao, the excavator of Lothal, personal ornaments form the bulk of copper and bronze objects from Lothal. The total number of artefacts recovered is about 1,500, out of which shape and use of about 1,000 could be recovered (Rao 1985: 520). Among the axe-types at Lothal, the first type consists of a flat axe with a long narrow blade or a broad one ('blade-axe' of two types in the earlier site reports). Second type has a thick triangular section and can be grouped with socketed axe specimens from elsewhere. In fact, one of the three specimens of this type found at Lothal appears to have had a shaft-hole. A new type is a single specimen of what is called a 'crescentic sleeved axe' (Rao 1985: figure 107 phase IV, Period A, axe with 2 asymmetrical sleeves on margin, one edge blunt and crescentic- opposite edge and sleeves damaged -deep hammer marks all over surface). Spearheads conform to usual type from other sites: leaf shaped blades with a tang and ending in a point; some have one or two holes in centre of tang or blade for fastening it to a shaft. Specimens of dagger range in length from 1-2 inches to 3-4 inches. One of them has a folded socket while another has a rivet-hole near tang. Arrow-heads are 0.75 to 1 inch long. Razors have curved, triangular and L-shaped blades. Chisels are common and have 3 categories: square/rectangular section and with parallel margins; blade square/rectangular in section with flat tangs; and blade with round section. A small wedge-like chisel with a triangular section is a unique find at Lothal. A drill-bit at Lothal "has twisted grooves with a chisel end and works exactly like a modern auger. It could have been fitted into a T-shaped frame to bore holes by rotary movement with downward pressure" (Rao 1985: 532). Awls and needles are of three types: first has a pierced eyelet at sharpened end and was possibly used for stitching tougher material like leather and flax; second type has a thicker end and no eyelet hole, third type has a sharp tip. A partly damaged saw with a curved blade and three teeth intact has been reported from Lothal and it is distinctive in sense that it has a straight serrated edge and "must have been used for cutting grooves in ivory and shell objects of circular shape, e.g. gamesmen, rings, etc. or for trephining" (Rao 1985: 533). In view of large size of some of fish-hooks (barbed and non-barbed) it has been presumed that 'sea-fishing was well known to Lothal fisherman'. Nails occurred with or without a head and some rods have been found to have longitudinal grooves at regular intervals. A completely new type at Lothal is a single specimen of 'plainer-bit' (figure 112.5 in Rao 1985): rectangular with a small concavity on either margin-thick butt and working edge sloped from both sides. Among the personal ornaments were bangles (one type cast in a mould and with a corrugated edge average internal diameter 2 inches), rings (both coiled and plain), ear-ornaments (rings and pendants) and beads

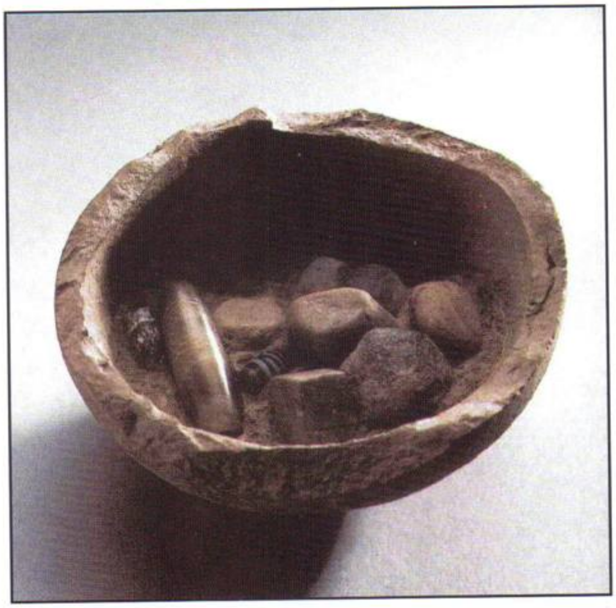
Pl. 6.10 Ivory ornaments, Mohenjodaro.

Pl. 6.11 Gold ornaments from Harappa (Upper) & Mohenjodaro.

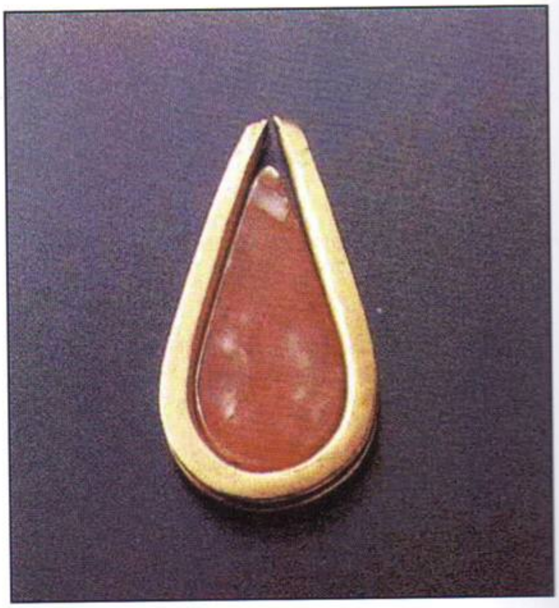
Pl. 6.12 Gold and silver ornaments from Allahdino.

Pl. 6.13 Gold ornaments from Banawali.

Pl. 6.14 Agate beads, Banawali.



Pl. 6.15 Pot with beads, Banawali.



Pl. 6.16 Gold pendant, Harappa.

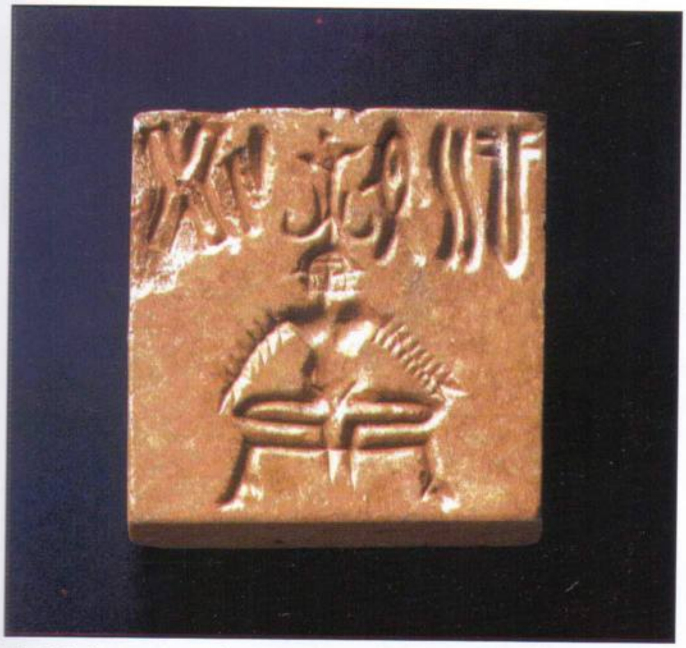
Pl. 6.17 Typical Harappan ware, Kalibangan.

Pl. 6.18 Arrowheads and Chisels, Dholavira.

Pl. 6.19 Bronze artifacts, Dholavira.

Pl. 6.20 Copper spearhead and arrowhead, Nausharo.

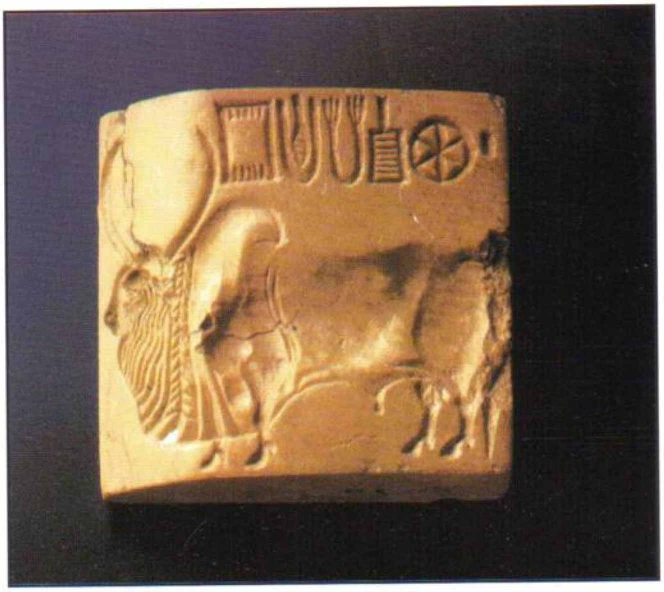
Pl. 6.21 Copper mirror, Dholavira.



Pl. 7.1 A version of proto-Siva terracotta seal.

Pl. 7.2 A human lifting two tigers, recalling the Gilagamesh legend, Harappa.

Pl. 7.3 A deity killing a water buffalo, recalling the legend of *mahishmardini*.



Pl. 7.4 Seal depicting a sacred bull, Mohenjodaro.

Pl. 7.5 Seal depicting unicorn, Mohenjodaro.

Pl. 7.6 Seal depicting tiger, Mohenjodaro.

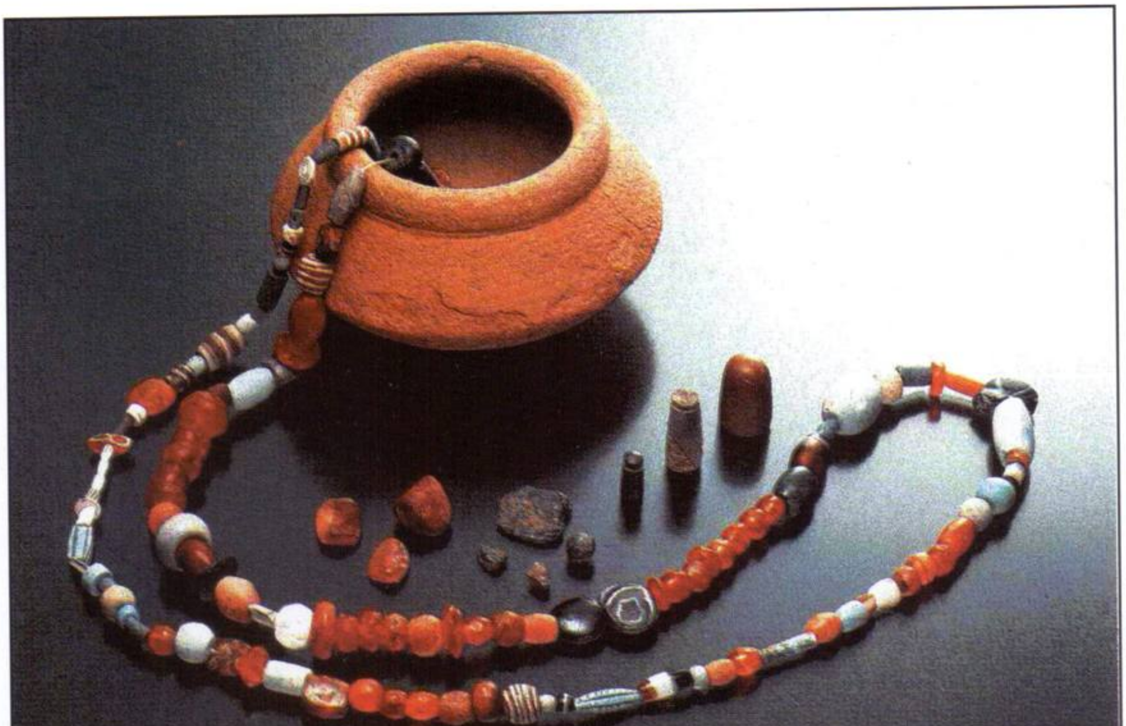
Pl. 7.7 Horned deity from Dholavira.

Pl. 7.8 Adult male burial, Harappa.

Pl. 7.9 Adult female burial, Harappa.

Pl. 7.10 A unique type of funerary structure, Dholavira.

Pl. 8.1 The largest Harappan inscription, Dholavaira.



Pl. 10.1 Cemetery H stone beads, Harappa.

(including spacer beads and facetted beads). Animal figurines comprised a couchant bull, hare, dog, bird, fowl, etc. Chain-links, spoons, a mirror and a carinated jar have also been reported from Lothal.

For evidence of local melting among crucible and moulds from this site, Rao (1985: 557) mentions a small sandstone bowl-shaped crucible used presumably for melting metals and two rectangular slabs of sandstone with groove-like depressions used for casting pins and needles. Three areas seem to be connected with copper crafting/smelting (Rao 1985: 522). Five rectangular sink-like brick pavements have been interpreted as a coppersmith's workshop. That they were used by metal crafts persons is suggested by presence of a pot furnace containing ash near each sink as also bits of muffles. Other relevant finds in this area are two terracotta crucibles, small lumps of copper and the crescentic sleeved axe mentioned earlier. A circular kiln of mud bricks (6 ft in diameter and 2 ft 3 inches deep) is located near the workshop and was possibly used, according to Rao for remelting of ingots. The relevant finds here are an earthenware bowl and large copper sheets, recovered in form of flattish chunks. A rectangular furnace of burnt bricks was found in a room of a mud-brick structure (151 in street 1 of Lower Town). The contents of the kiln were ash and fragments of terracotta crucible while a cubical stone anvil with signs of use was *in situ* near the kiln. The presence here of a stone mould for casting pins and awls, a copper pin, a broken copper chisel and a hammer stone with a socket for hafting also suggests copper/bronze manufacture.

Banawali

To the excavator (Bisht 1993: 113-24), the advent of Mature Harappan (Period II) at the site appears a bit abrupt. He says,

> With proverbial dramatic precocity full-bloomed Indus culture makes its appearance at Banawali. This includes its essential culture appurtenances: town-planning and architecture, ceramics, seals, script, weights, clay figurines, terracotta 'cakes', items of ornament (Pls. 6.13-15) and miscellaneous knick-knacks and tools. The older ceramic tradition continues throughout Period II as a culture-companion of new pottery corpus but in reduced frequency. Among tools, are objects of copper: arrow-head, spearheads, a fragmentary sickle blade, typical razor, chisels, rings, double spiralled and simple pins, ear/nose rings and fish hooks. There are points, a knife and scrapers of bone. Chert blades and fluted cores and flakes are also present. Other objects include clay net-sinkers, balls, pallets, sling balls, longish cones and solid wheels made of clay, besides numerous other household implements.

Rojdi

From Rojdi, a Harappan site from Gujarat, Chitalwala (1989: 157-97) reports that no analysis has yet been done on the rich inventory of copper-based metal implements from renewed excavation at Rojdi. These artefacts are important since they document abundant presence of metal tools within post-urban, Rojdi C context within Saurashtra. The axe, bar, celt, *parasu* and bangles are especially important in this regard. He gives the following inventory of artefacts.

Copper Axe. 14.8 × 9.5 × 0.6 cm. Found in the Large Building, Main Mound. Trench 46L. Rojdi C.

Copper Bar Celt. 32.1 × 4.8 × 0.7 cm. Found in Large Building on Main Mound. This object was broken in artiquity when it was bent as it was placed in a shallow pit. Trench 46 L. Rojdi C.

Copper *parasu* or *knife*. 17.5 × 5 × 0.3 cm. This cutting tool has parallels in Sorath Harappan context at Mitathal (Suraj Bhan 1975: 65) and Kurada in Rajasthan (Agrawal 1980: Pl. II, p. 90). Found in trench 75L on South Extension. There are no building associations. One side of *parasu* has an "endless knot" design on it (see also Marshall 1931, Pl. CXVIII, 5). The upper, non-cutting edge, has transverse marks which appear to indicate that blows were struck there in antiquity, Rojdi C.

Copper Ornaments. 10.4 × 4.6 × 0.1 cm. This ribbed object was fashioned on a sheet of copper. There are no perforations. The object has no parallels that we know of and it has been called an "ornament" simply to give it a name. Found in trench 76L Rojdi C.

Copper Bangle. Approximately 17.5 cm diameter, overlapping ends. Trench 771, South Extension, Rojdi C.

Copper Toe Ring. Approximately 3 cm diameter. From trench 751, South Extension, Rojdi C. Copper Ring. Approximately 2.5 cm diameter. From trench 75L, South Extension, Rojdi C. Copper Bangle. Approximately 4.5 cm diameter. From trench 27S, North Slope. Rojdi C(?). Copper Ring. Approximately 2.1 cm diameter. From trench 20P Rojdi B.(?). Copper Pin. 9.6 cm long, approximately 0.3 cm diameter wire. From trench 76J, Rojdi C.

Padri

From this Harappan site in Gujarat, Shinde and Elizabeth (1993: 145-247; Fig. l) report a unique type of fish-hook.

> From the surface of the floor of Structure-12 was recovered a unique copper fish-hook, which is 14 cm long, with a barbed point and a loop on the other end. It weighs 45 gm and is in a very good state of preservation. It is round in section. The loop on the other end of the fish-hook does not touch the shaft. Such a large fish-hook would probably be used to catch large marine fish, weighing more than 50 kg, which leads us to believe that the Harappans of Padri had mastered the technique of deep sea fishing. The Indus valley fish hooks are similar to the modern ones and this feature is suggestive of a continuity of this culture trait. The best metallic fish-hooks were probably developed by the Harappans, and were certainly superior to those from contemporary sites in Egypt and Mesopotamia.

Dholavira

This Harappan site is probably the most impressive in the Indian part of subcontinent. It is a massive site with a stone fortification. It has been excavated by Bisht for about a decade. It is quite rich in copper tool repertoire. Pls. 6.18-19) shows a few spacers, rings and bangles. Pl. 6.18 shows some blades, arrow-heads and chisels. No detailed report on the metal artefacts is available as yet (Bisht, R.S. 2001).

Surkotada

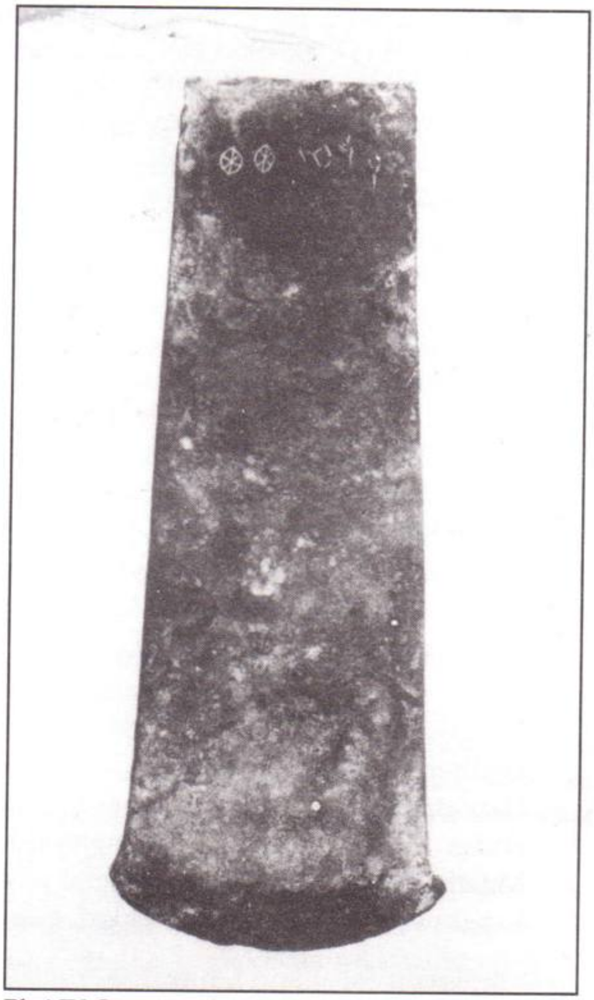
This site in Kachchha yielded 129 objects, besides a hoard containing an unspecified number of beads and bangles (J.P. Joshi 1990: 266-74). The main types are: simple blade and crescent-shaped blade, long or short chisel with rectangular-section long and narrow blade, arrow-head, knife with thin leaf-shaped blade, drill, spearhead with a tang, lid with raised edge, socketed axe, fishhook, antimony rod, bangle, ring, ear-ornament, hook and chain. In addition, fragments of a crucible have been found.

1. Fig. 68 (Figure numbers as given in Joshi 1990), 1- flat axe, rectangular cross-section-sharp crescentic edge- 24.3 cm length, 9.3 cm broad and 0.7 cm thick-mid-level of Period IC.
2. Fig. 68, 2-chisel-sharp, double-sloped edge - squarish cross-section-rectangular tang 30.5 cm length, 1.7 cm broad in lower end and 2.7 cm in upper-mid-level of IC.
3. Fig. 68, 3-axe fragment, probably socketed-edge, 4 cm wide-mid-Ievel of IC. (Fig. 68 in Joshi 1990).

Inscribed Metal Objects

Kenoyer & Miller (1999) have studied the inscribed metal objects too. This section is based on their study.

Although it has not been possible to make an exhaustive study of the types of metal objects on which inscriptions occur, the recent publications of inscribed objects from the Indus Valley Tradition sites (Shah and Parpola 1991; Joshi and Parpola 1987; Parpola 1994a and 1994b; Yule 1985a and 1985b) reveal some interesting patterns. Large axes, adzes, spears, chisels and sheets of copper often have one or more signs chiselled into one or both sides. The inscriptions are usually in a vertical line down the centre but in case of some celts (Pl. 6.IV), they are located at butt edge. In most instances, the script would be obscured by hafting or damaged during use, and this suggests that these metal tools may have had some specific ritual or symbolic function.



Pl. 6.IV Copper celt – Mohenjodaro with script.

One category of metal objects that was used almost exclusively for inscriptions is flat, square to rectangular copper tablets. At Mohenjodaro hundreds of such inscribed tablets have been recovered (Marshall 1931; Mackay 1937-38; Yule 1985a). The inscriptions consist of Indus script and animal motifs, usually on both faces of the tablet. The engraving may have been done with a stone burin or a bronze graver. So far this type of engraved tablet is unique to Mohenjodaro, but copper tablets with raised script were found at Harappa by Vats (Vats 1940) and also by the Harappa Archaeological Research Project (HARP) (Meadow and Kenoyer 1994). Due to heavy corrosion, the techniques of manufacture have not yet been determined. The script on both types of tablets was not written in reverse and therefore these tablets were not intended to be used as seals; but represent some sort of ritual or economic token (Parpola 1992).

Usually, the Harappan phase seals are made from fired steatite, but there are two examples from Mohenjodaro of silver seals made in the standard square shape with a boss (Mackay 1937-38:348, Pl. XC, 1, XCVI, 520). Mackay suggests that they were first cast with the animal motif, script and boss, and later touched up using a graver. The edges have been scrapped and pared, but the rest of surfaces are too corroded to determine the exact nature of manufacture.

Careful examination of some gold ornaments from a jewellery hoard in DK-E area at Mohenjodaro by Kenoyer has revealed the almost invisible traces of inscriptions that have been overlooked by previous scholars. Of particular interest are gold pendants that have often been referred to as "needles" (Marshall 1931:251-53, 521, Pl. CLI, B 3, 4, 5). Two of three pendants are inscribed. The third pendant was on display at the National Museum in Delhi and it has not been examined, but it too may be inscribed. On one pendant five signs encircle entire object, while on second example a sequence of five different signs is inscribed along the length of pendant. From this same hoard came two pairs of gold caps or terminals that would have been affixed to the ends of beads. One of each pair of gold caps has an identical inscription consisting of a single sign.

All the inscriptions appear to have been made by some sharp and very pointed tool, and give the impression of being written in the same "handwriting". These inscriptions are extremely important because they are clearly different from the types of inscriptions found on the large copper celts and chisels. These inscribed gold objects were found inside a copper cooking pot that had been covered by a copper-plate. Other items in the hoard include a massive belt made of carnelian and bronze beads, gold ear studs, stone beads and some copper vessels. It is possible that before this wealth was hidden away, the names of specific owners were incised on some of the gold jewellery (Kenoyer Pers. comm.).

Late Harappan Repertoire

We have included here sites in Pakistan, Haryana, Punjab, and Maharashtra.

The late Harappan levels are stratigraphically established at many excavated Mature Harappan or Indus civilization sites. The quantity of metal used is now limited and no new tool-type seems to appear.

From Haryana and Punjab sites

Bara	:	bead, fish-hook
Bhagwanpura	:	rod
Dadheri	:	chisel, hook
Daulatpur	:	bangle, fish-hook
Hulas	:	bangle, chisel, ring and wire
Mitathal II B	:	several pieces of bangle, flat
Sanghol	:	chisel, celts, 1 *parasu* (a type of "double axe")

Area between Swat and Chitral

Period IV at the site of Ghaligai in the Swat valley has been placed early in the 2nd millennium BCE. Metal occurs first in this period, and in addition to Ghaligai, the sites of Loebanr III and Bir-kot-Ghundai deserve some consideration in this context. The bulk of the evidence, however, comes from succeeding 'Gandhara Grave Culture' complex, the evidence of which occurs widely in the region (Stacul 1987).

From Swat-Chitral Area

Ghaligai	:	spearhead, hook
Loebanr III	:	pin, fish-hook, chisel, wire
Bir-Kot-Ghundai	:	pin, fish-hook, point, wire
Loebanr	:	pin, earring, knife, pendant, buckle, spearhead, bead
Katedai	:	pin, earring, bead, pendant, knife, Bodkin/needle, fish-hook, horse figurine
Butkara II	:	pin, knife, buckle, earring, hook
Timargarha	:	pin, toilet object, needle, hairpin, pendant, earring, bangle ring

The major evidence of coppersmithy is indicated by a container with ashes and charcoal and a chisel at Loebanr.

From Protohistoric Kashmir

Burzahom	:	arrow-head
Gufkral	:	hairpin with coiled head

Daimabad Bronzes

We include below a discussion of the Daimabad copper finds, only because the excavators have now changed its affiliation from Chalcolithic to Late Harappan. We will also discuss the big statuary bronzes discovered from the site. About these latter bronzes, we have to be careful. We have to note that: 1. They do not have lead in any significant quantity compared or the Harappan artefacts. 2. They show significant presence of arsenic, in contrast to the Chalcolithic artefacts. 3. In typology they are totally different than any objects found in proto-historic India. 4. They are very heavy - some weighing 29 kg- and so much of precious metal was never used in statuary in the whole of Harappan or Chalcolithic repertoire. Such large scale use of metal on statuary is known in India from historical period only. Spending so much of metal on non-utilitarian artefacts goes totally against the grain of the Harappa culture. We know of tiny animal figures and the dancing girl which weigh only a few grams. If we take into account all these facts and also the fact that the discovery is not at all from a controlled excavation but an accidental find, I do not think one could include these finds among the Harappan artefacts. If we compare the Harappan metal repertoire with the Chinese, there is a stark contrast between the monumentality and elitist nature of the Chinese vessels and statuary and the functional and frugal Harappan assemblage. We will discuss these bronzes below with these clear constraints.

Dhavalikar (1993: 421-26) has described the large Daimabad bronze objects as follows:

the chariot and bull are the most remarkable pieces in the hoard. Its total length is 45 centimetre and width is 16 centimetre. The complete bronze consists of an elaborate chariot yoked to two bulls and driven by a man standing on it. Two solid wheels rest over the light body of the chariot. The wheels have a projecting hub on the inner side in which the axle is fixed so that it moves along with the wheels. This is an extremely interesting feature.

The elephant is the largest of the three animals in the hoard. The beast stands on a platform 27 centimetres long and 14 centimetres broad. There are four ring loops which once held the wheels, all of which are unfortunately missing. The total height, including platform, is 25 centimetres. The large trunk is curved at the lower tip but the tusks appear to be broken or not completely indicated. A short tail is almost hidden in the rump. This animal recalls another bronze elephant from Southeast Deccan (Barret 1958) which is dated to about the 3rd century AD. Barret's specimen is a female, standing, or rather running, on a platform with raised edges and ring loops for wheels (all of which are missing). There is a small bell tied around its body.

The rhino stands not on a platform as is the case with the elephant, but on two horizontal bars over two sets of wheels; the bars are bent at both the ends with the axle passing through them. The wheels, which are solid with a projecting hub on inside, are fixed to axle and move along with it. The rhino is 25 centimetres between the two sets of wheels. Skin folds on the animal's body are rather stylistically duplicated with those on back and belly forming a sort of rectangle.

The buffalo also is modelled in a naturalistic manner. Its height, including that of the wheels, is 31 centimetres and the length is 25 centimetres. It resembles a bison somewhat, but on close observation it is clearly a water-buffalo with characteristic transverse ribbing on its horns. The animal stands on a platform similar to that of the elephant, but the corner near the right foreleg is broken. The axles attach to the platform through vertical bars which are provided with holes. The front wheels are smaller (eight centimeters) than those on rear (10 centimetres).

Dhavlikar finds it tempting to identify the person in the chariot as '*Pasupati*, lord of beasts', for the simple reason that all animals, save tiger, which appear on the famous *Pasupati* seal from Mohenjodaro, are present in the Daimabad hoard. Marshall's identification of *Pasupati* on the seal was based on comparisons with medieval representations of *Siva* (Marshall 1931: I, 52-56; Pl. VII, 4). Presently, however, one is not concerned with the identification and the iconography of the figure. One can only conclude that the evidence discussed in the foregoing pages amply demonstrates that in all probability the bronzes in the hoard belong to the late Harappan period at Daimabad, and that they were probably imported from Harappan, or some smith from Harappa made them locally.

Table 6.2 Copper objects from Daimabad.

Phase	I	II	III	Overlap III/IV	IV IV/V	Overlap	V	TOTAL
Objects								
Bangles	2	x	x	x	2	3	8	15
Chisel	x	x	x	x	1	x	x	1
Celt(frg.)	x	1	x	x	x	x	x	1
Spearhead	x	x	x	x	1	x	x	1
M. goddess	x	x	x	x	x	x	2	2
Rect.piece	x	x	x	x	x	x	1	1
Trap.piece	x	x	1	x	1	x	x	2
Razor	x	x	x	x	1	x	x	1
Wire	x	x	x	1	x	x	1	2
Lump	x	1	x	x	x	x	1	2
Slag	x	1	1	x	x	x	x	2
Total	**2**	**3**	**2**	**1**	**6**	**3**	**13**	**30**

Sali excavated Daimabad in Maharashtra. It yielded an assemblage which has been variously named as Chalcolithic and Late Harappa. It has become more famous because of the massive bronze objects that have been accidentally discovered near the site, though they are in no way stratigraphically related to Sali's excavations (Sali 1986; Dhavalikar 1993: 421-26). We will first discuss the excavated remains.

Sali reports,

Most of the specimens were found in a highly corroded state. Specially two bangles from Phase I were in so advanced a stage that encrustation in one of them crumbled very fast so much so that within a short period of a couple of years only a thin wire of one of them has survived. The extant wire also, being beyond the scope of chemical treatment, is likely to be completely corroded leaving behind only powder of encrustation. The other or bangle was also heavily encrusted and was broken into pieces as a result of further corrosion. Only those specimens which could withstand chemical treatment were subjected to it and the rest had to be left without cleaning.

7

Indus Religion and Afterlife

INTRODUCTION

To reconstruct spiritual beliefs of people from the surviving material artefacts does involve a lot of subjective interpretations. It is further compounded by a number of other factors: spatial diversity, and the presence, if any, of the Indo-Aryan religious elements; the dichotomy between the two religio-cultural traditions [the Greater (*Margi*) and the Lesser (*Desi*) Traditions]. The female terracotta and the *lingas* (phalli) and *yonis* (vulvas) could be part of the Lesser Tradition. Water rituals, Great Bath, the religious imagery on the seals could be the beginning of the Greater (elite) Tradition. It is difficult to differentiate a domestic hearth from the so-called fire altar; but the homely hearth could as well have been used for some daily fire rituals before actual cooking. There is evidence of Mesopotamian legends (e.g. Gilgamesh) in the Harappan seals, so there could as well be some West Asian elements, but to assume that the Indus civilization is an Indo-Aryan creation is not supported by any evidence. The beginning of the latter-day *yatras* seems to have been made by the processions depicted on the seals. The depiction on seals of females with plants coming out from vagina, may go back to Neolithic fertility cults, and continue to this day in the form of *Navratra* festivals in Gujarat and *Harela* in Kumaun. So also the ithyphallic seated male on the seals does have the components of the latter-day Shiva.

We discuss below the main artefacts/symbols, which seem to have religious significance such as trees (pipal, banyan), horned deities, clay female figurines, phalli and vulvas, bathing platforms and structures such as the Great Bath (Pl. 5.4), and fire altars (?), narrative scenes on the seals, (Figs. 7.1-4) etc. Symbols of tree worship and horned deities will also be dealt with in detail below, emphasizing the cultural continuity of the tradition.

But not all seals were of ritual significance. The Indus seals seem to have served a variety of functions. Their discovery at the Lothal warehouses clearly suggests that they were used to seal grain parcels or merchandise, but a majority depict scenes which could be interpreted only as religious. A well-known seal depicting a seated, three-faced, horned and ithyphallic (erect penis) figure (Pl. 7.1) surrounded by a number of animals recalls the *pasupata* nature (preserver of animals) of *Siva*. There is a terracotta cake from Kalibangan, which shows (Fig. 7.3) a standing figure (deity) with a horned headdress and on the reverse a man carrying a goat/bovine tied with a rope, perhaps for sacrifice (horned deities are discussed in detail below). In a lined pit, from the religious sector of the Citadel at Kalibangan, were discovered bovine and antler bones and ash, probably indicating a sacrifice. Several naturalistic phallic stones and terracotta and perforated stones (perhaps depicting the female organ) may take the present *Sivalinga* and *Yoni* worship back to the Harappan times. One of the nude male stone torsos from Harappa also appears to be ithyphallic, recalling the *yogisvara* aspect (in control of all senses) of *Siva*, who in later sculptures is quite often depicted as ithyphallic. Another male statue from Harappa shows a nude male in a dancing pose, reminiscent of Siva's cosmic dance. All these features indicate that the elements of the latter-day Hindu god *Siva* were already there in the Harappan culture. The conical stone objects found in the early excavations at both Mohenjodaro and Harappa have often been referred to as phallic symbols. In the past these objects were associated with the ring-stones, which were thought to symbolize female reproductive organs. Yet many conical objects appear to have been used as pestles, and most ring-stones can be associated with architectural features. Nevertheless, some conical stone pieces, both large and small, may in fact have been used as phallic symbols. While some may have been gaming pieces, others have a tiny hole in the base, as if they were to be attached or anchored to a base.

Kalibangam, impression of the cylinder seal K-65
After Joshi and Parpola 1987: 311, K-65

Fig. 7.1 Showing impression of cylinder seal with human-animal figure and two males' fighting over a female, Kalibangan (After Joshi and Parpola, 1987).

It is interesting to note, as B.B. Lal has pointed out, that some of the Indian folk tales go back to the Harappan times. For example, the tale of the crow who manages to bring the water level up to his beak by throwing pebbles into the pitcher. And of the fox who praises the bird so that she opens her mouth and drops the fish from her beak and he grabs it. The legends of the killing of the buffalo also can be traced back to the Harappan times. But the recurrent theme of the lifting of two tigers by a human, though has Mesopotamian echoes, is not supported by any legends/folk tales current today, though Jaykar has pointed out some parallels in the tribal art, as discussed below.

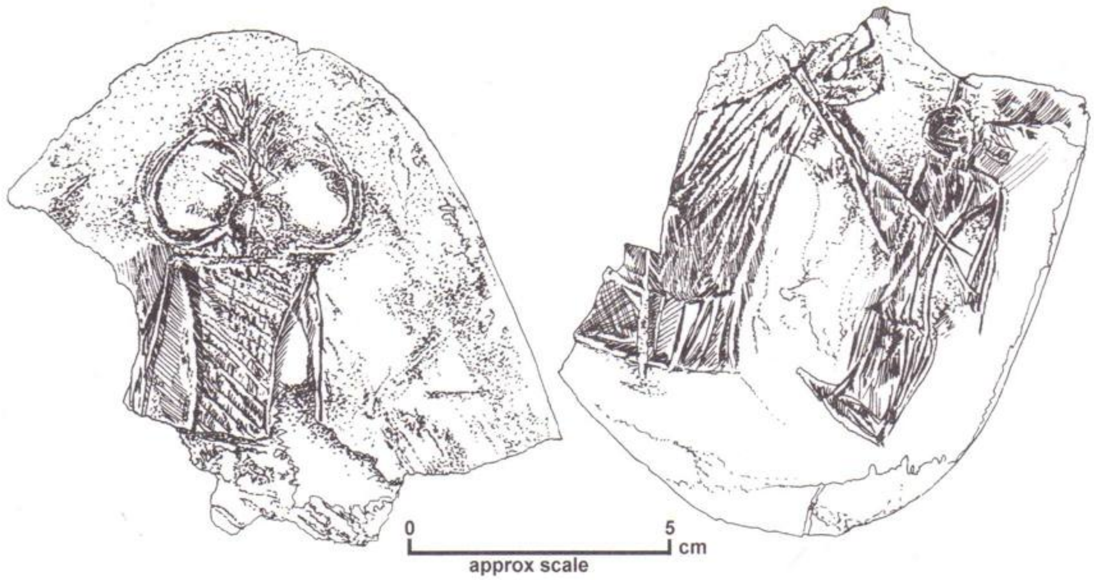
DEITIES

In one of the seals, a deity (?) is shown with a supplicating figure and a sacrificial (?) goat (Fig. 7.4). Possehl calls it the seal of divine adoration. In the lower row are seven standing figurines, perhaps devotees. Another seal shows an upside-down woman with legs spread apart and a plant coming out of her vagina. On the other side of the seal are a man holding a scimitar and a seated figure with dishevelled hair. It has been interpreted as a human sacrifice to a tree-spirit. On a seal a bull-headed human is attacking a tiger (Fig. 7.5), yet on another, a horned person, recalling the Sumerian mythology of Enkidu and Gilgamesh, has lifted two tigers up (Fig. 7.6; Pl. 7.2). The struggle between wild animals and humans is graphically illustrated in a magnificent terracotta tablet discovered in 1995 from Mound ET at Harappa. On one side the tablet has a narrative motif showing a figure grasping two felines, probably tigers, and standing above an elephant; on the opposite side is a scene depicting the killing of a water buffalo (Pl. 7.3) (Kenoyer 1998).

Mohenjo-daro copper tablet stamp seal with a two headed animal
After Mackay 1937-38: Plate XCIII, No. 8

Fig. 7.2 Double headed animal on copper tablet stamp seal, Mohenjodaro (After Possehl, 2002).

The figure strangling the two tigers with bare hands could represent a female, as a pronounced breast (or is it a pectoral muscle?) can be seen in profile (Pl. 7.2). Earlier discoveries of this motif on seals from Mohenjodaro definitely show a male



Kalibangan terracotta cake with incised drawings
Drawn from Thapar 1975: 29, No. 5

Fig. 7.3 Terracotta cake (Obverse and Reverse) showing a horned deity and sacrificial goat (?), Kalibangan (Courtesy ASI).

figure, which are reminiscent of the carved seals from Mesopotamia that illustrate episodes from the famous Gilgamesh epic. The Mesopotamian motifs show lions being strangled by a hero, whereas the Indus narratives substitute tigers as being strangled by a figure. On the reverse of the same tablet is a narrative scene depicting the killing of a water buffalo. A person, possibly a man, with hair tied in a bun on the back of the head, impales a water buffalo with a barbed spear. The hunter's foot presses down the water buffalo's head as he thrusts the spear into its shoulder. In later Hindu rituals, the water buffalo sacrifice is associated with the worship of the goddess Durga, but on this seal the sacrifice takes place in the presence of a priest or deity seated in yogic position. The seated figure wears bangles and a horned and plumed headdress. Above the head of the hunter is a *gharial* (crocodile) that was once common in the Ravi and Indus rivers. Similar scenes of an individual spearing a water buffalo have been found on other terracotta tablets from both Harappa and Mohenjodaro, but none is associated with the figure strangling two tigers.

There is an iconic continuity of such traditions. Pupul Jayakar reports that at Jambudvipa in Panchmarhi (in Madhya Pradesh) there is a cave-painting depicting a similar subject. Here the hero stands erect, taut with power and majesty, out of his body emerge on either side, two leaping tigers. The rampant tails of the tigers are held tautly by the magician-priest. Are these also representatives of ancient magicians, who have special intimacy and control over tigers, who have the power to summon their secrets, and the capacity to transform themselves into tigers at will? (Pupul Jayakar 1989: 71).

Rama and Gilgamesh

I have been quite intrigued as to why the Indus civilization, the most glorious chapter of India's past, has been blanked out from the later historical writings, though the historical kings boasted of their lineage from mythical beings like sun and moon. Even the folk tradition seems to have erased it from its memory, or has it? One can understand the omission of the Indus civilization in our poor historical tradition but the folk tradition has powerful epics of the *Ramayana* and the *Mahabharat* but unrelated to the Indus civilization. Or is there a possibility of the Ramayana retaining the memory of this great chapter of India's past? Hiltebeitel (1980) has drawn parallels between the legends of Rama and Gilgamesh (Fig. 7.6; Pl. 7.2) of Mesopotamia. The figure holding two tigers in the Indus seals does remind one of the Gilgamesh story. Does the *Ramayana* depict the story of a battle between two Harappan states 5000 years ago? The sea at that time was 5-7 m higher than today and was therefore much closer to Mohenjodaro and Dholavira. Was Mohenjodaro/Dholavira the Lanka of Ravan? As far as archaeological evidence is concerned we are on a very flimsy ground. One straw in the wind is that unlike Harappa, both at Mohenjodaro and Dholavira there are no regular supine burials of the R-37 type of Harappa. Does it mean that the people of these two Harappan states had different religions?

Fig. 7.4 Seal of divine adoration with seven female figures and a big ram with a deity in a papal tree, Mohenjodaro (After Possehl, 2002).

It may be interesting to discuss here some interesting parallels Hiltebeitel (1980) has brought out between the two epics. He says that the numerous correspondences between traditional sacrificial rituals and epic narratives invite a final comparative look at the two epics themselves. He makes it clear that he is not arguing for a direct influence of one epic on another, but rather highlighting certain structural and thematic similarities that would themselves seem to rely on an evocation of archaic themes and rites which in both cultures are drawn from common (or at least similar) ancient cults of the great goddess.

The similarities between the two epics are:

- Rama and Gilgamesh are on dangerous missions in the forest.
- Rama must find and defeat Ravana. Gilgamesh has been elected to kill Huwawa.
- In each case a new ally is required: Sugriva and Enkidu.
- In both cases the ally's story concerns a sacrificial scenario. In one case the sequential sacrifices of Huwawa and the Bull of Heaven involve Enkidu himself, who dies as a result of the second. In the other, the killings of Dundubhi and Mayavin are by Sugriva's brother Valin, whom Rama must kill himself to cement his friendship with Sugriva. Two of Enkidu's roles are divided between these two brothers: Valin, the sacrificer who suffers death, and Sugriva, the permanent friend, guide, and ally. In both epics the ally and "sacrificer" are wild creatures, affiliated or identified with wild animals, who contrast sharply with their highly cultured counterparts, Gilgamesh and Rama.
- The sacrificial themes and accoutrements of office that mark them are wild hair, women's garb, drums, connections with cult women, drunkenness, possession – all indicate that they represent "tribal" or "barbaric" forms of sacred power.

- Hiltebeitel clarifies that this is not to suggest that these figures are leaders of actual forest tribes. Rather, they are figures whom the authors of these highly stylized literary epics have chosen so as to represent *symbolically* certain values and themes associated with tribals, outsiders, and aborigines.
- The important point in each epic is that the connection between the king and the "wild man" of the forest is made to the advantage of the king. The sacred power which the forest figure makes accessible is in some manner necessary to the king's welfare and thus to the welfare of his domain.
- In Gilgamesh's case Enkidu's services bring him fame and eventually reconciliation to a responsible rule in Uruk. In Rama's case, Valin's killing of Dundubhi and Mayavin stands behind Rama's friendship with Sugriva, which in turn makes possible his recovery of Sita and his return to rule at Ayodhya.

Fig. 7.5 Female horned deity attacking a tiger, Mohenjodaro (After Possehl, 2002).

- Finally both stories concern a restoration of a proper relationship with the goddess after that relationship has been disrupted. Gilgamesh, recipient of Ishtar/Inanna's *mikku* and *pukku*, insults the goddess by refusing to be her lover. Sita, the goddess incarnate, is of course abducted. In each epic the initiation of the restoration of relations between the king and goddess involves a sacrifice performed by an inhabitant of the forest. And in each case, the "sacrificer" dies: Enkidu as a direct result of his role; Valin indirectly, but with the slaying of Dundubhi as the root of his problems with Mayavin, Sugriva, and finally Rama. One need only recall that the restoration of proper relations with the goddess is the very purpose of the buffalo sacrifice.

If indeed the Rama's story depicts the story of the Indus civilization, it would be easy to understand that this great phase of our past was retained by the folk tradition and to me it makes more sense. I am giving this suggestion so that further research is undertaken to correlate archaeological and literary data of the earliest versions of *Ramayana*.

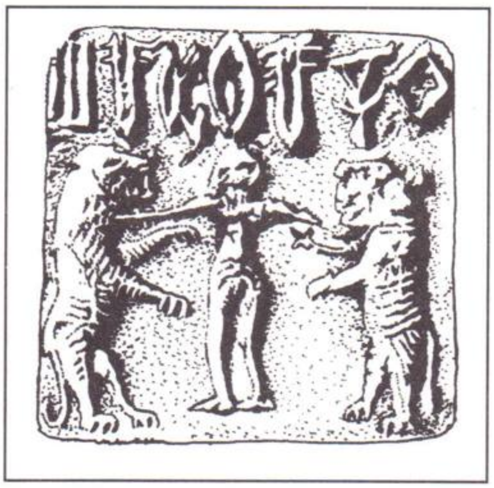


Fig. 7.6 A human deity lifting two tigers reminding one of the Gilgamesh legends (After Possehl, 2002).

Bhattacharya thinks that the Sumerian Mother Goddess whose attributes were later absorbed by Nana of Uruk, Nina of Nineveh, Inanna of Erech, Bau of Lagash, Ninlil of Nippur, Annuit of Akkad, Zarpaint of Babylon, etc. belonged to the same category of the Harappan Magna Mater whose attributes were also specialized by various goddesses of the historic age. Some of the aforesaid deities had evidently an eastward migration in subsequent ages. The goddess Inanna, also known as Nana, Nanai, etc. who was supposed to be the mother of Anaitis and Aphrodite, was able to extend her cult into India through the Scythians and Kusanas in later times. Examples are the Naina Devi of the Kulu Valley, Sirmur and Bilaspur, Bibi Nani of Baluchistan, Naini Devi of Nainital and Almora, etc. Goddesses of the Ishtar group (Ishtar, Astarte, Astaroth, Atargatis, etc.)

might also have contributed something to the later tantric conception of Tara, as is indicated by the similarity of their names (Bhattacharya 1977: 149-150). It is interesting to note that the most powerful and popular deity of the Himalayas is Nanda, who is offered water buffaloes and goats in sacrifice (Agrawal and Kharakwal 1998).

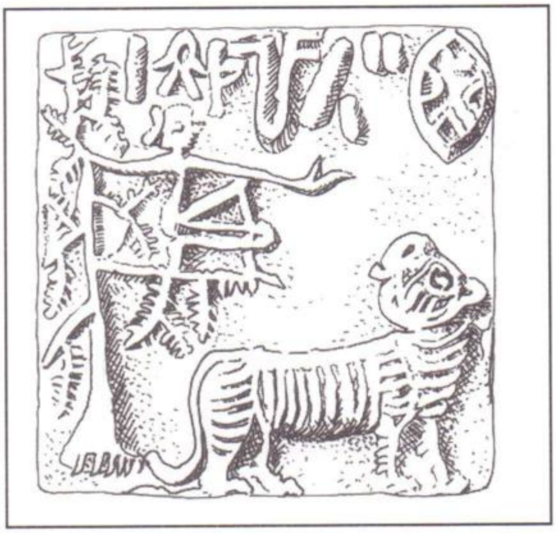


Fig. 7.7 Deity on a pipal tree with tiger looking back, seal impression, Mohenjodaro (After Possehl, 2002).

The double tiger motif seems to be quite popular among the Harappans. HARP team has found two other broken tablets at Harappa that appear to have been made from the same mould that was used to create the scene of a deity battling two tigers and standing above an elephant. One was found in a room located on the southern slope of Mound ET in 1996 and another example comes from excavations on Mound F of the 1930s. However, the flat obverse of both of these broken tablets does not show the spearing of a buffalo; rather it depicts the more well-known scene showing a tiger looking back over its shoulder at a person sitting on the branch of a tree (Fig. 7.7). Several other flat or twisted rectangular terracotta tablets found at Harappa combine these two narrative scenes of a figure strangling two tigers on one side of a tablet, and the tiger looking back over its shoulder at a figure in a tree on the other side.

It is thus obvious that both tiger and pipal are popular motifs of the Harappan seals, imbued with religious significance. Jayakar brings out the importance of these symbols in Indian tradition. She relates a Tamil legend in which Subramaniam, the son of *Siva* and the forest mothers, loved an aboriginal virgin, Valli. To win her love he turned himself into a *vengai*. *Vengai* is the Tamil word for tiger; it is also the name of the neem (*azadirachta indica*) tree in its male aspect before its flowers. The association of both the male neem tree as well as the tiger with Subramaniam is of great interest. Are the Indus Valley virgin, the tiger and the neem tree an illustration of an ancient legend, memories of which survive in the Subramaniam story? In ancient magic, the tiger is the guru of initiation. In the great birth seal, he guards the mysteries. In the Indus pictographs the tiger is never visualized as violent, he never kills. His role is protective. He is in communion with the energy sources of nature. The horned tiger is also familiar in the Baiga myth. When the Baiga Gunia calls on all the tigers of the world by name, the horned *bagh* (tiger) is one of them. The tiger is a phallic symbol of wildness and grandeur of the virile, heroic male. The *Atharva Veda* refers to the tiger as the first of all creatures. In Nepal, Bhairava is worshipped in the image of a tiger and in the painting of the Maithili *women* of Bihar, the tiger mask covers *Siva's* loins (Jayakar 1989: 76).

In a seal from Mohenjodaro illustrated by Jayakar (1989: Fig. 7), the woman and the tiger become united, or it is a way of depicting the goddess riding the tiger. Jayakar informs that separated by five thousand years, an amulet worn by primitive people who dwell on the Narmada River depicts a woman riding a tiger. The body of the tiger and the skirt that covers the body of the goddess are leaf-formed. Plants sprout around the luminous, uprising presence. The arms of the lady are outstretched in the all-including sacred gesture of the goddess. The arms are tendrils, sprouting and extending from the trunk of the body. The fragile nature of the tiger-lady, the interchanging of plant, animal and human, the outstretched arms embracing the cosmos, affirm the mighty roots of the visual tradition. In Indian myth it is always the lady who rides the tiger (Jayakar 1989: 74).

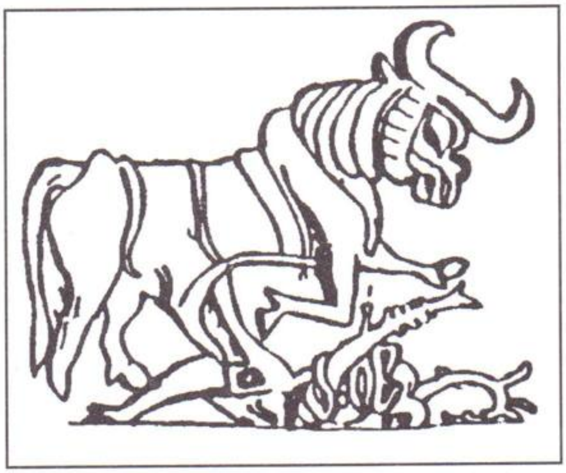


Fig. 7.8 Bull deity ravishing a female from Chanhudaro (After Possehl, 2002).

The semi-nude female terracotta figurines with their elaborate headdresses have been associated with a mother-goddess cult, and may be part of the Lesser (*Desi*) Tradition. In fact, the so-called mother-goddess figures are known from Turkey to Iran starting from the Neolithic times and in India they continue to this day. These figurines could have been associated with the earth goddess or fertility cults. Mother-goddess cults have been discussed in great detail in an historical perspective by Kosambi (1956, 1962) and Bhattacharya (1977). The act of procreation is a major theme in all ancient religions. Male virility is represented in the nude male figurines, the male animal symbols on seals and stone phallic objects. Kenoyer also thinks that female figurines with accentuated breasts and hips represent mother goddesses, and some objects may represent female reproductive organs. Terracotta tablets and inscribed objects show humans engaged in sexual intercourse, and others depict animals mating. One of the most controversial seals from Chanhudaro perhaps shows a bull engaged in intercourse with a supine female (Fig. 7.8).

Ardeleanu-Jansen (1988) has made a detailed study of the contextual occurrence of the Harappan terracotta figurines. Her field inventories and photographic documentation of the artefacts indicate that most of the figurines in Mohenjodaro were found smashed in secondary locations, and that none was found in a context which could be interpreted as a shrine, altar or temple. At Mehrgarh also broken terracotta figurines were common throughout all periods of settlement (Jarrige 1984: 133). Her study strengthens the folk association of the female terracotta.

Quoting modern ethnographic examples, Ardeleanu-Jansen says that the production and use of terracotta figurines is often 'governed by a strict seasonality' indicating a yearly 'ritual cycle' in which terracotta figurines are used on special occasions. Some of the household rituals of Bihar and Uttar Pradesh, for example, require women devotees to prepare simple clay figurines for domestic worship. The Bhils in Gujarat buy their votive terracotta idols from the potters. In order to drive out evil spirits and disease from a patient, a tribal priest or shaman called *bhagat* performs a ceremony during which he models clay figurines. They are meant to be substitutes for the spirits and after food has been offered to them in order to placate the spirits the figurines are deposited in a field far away from the village. She says that besides their function as toys, terracotta figurines are traditionally used in India as votive offerings and images representing deities.

Explaining the use of such female terracottas, Jayakar says:

> Fired or left unbaked, depending on the rituals for which they were intended, these icons of the Mothers, the holders of the secret of the earth, epitomized magical rites of agriculture, fertility, life and death. At the time of sowing of seed and harvesting and in rituals to dead, icons of the virgin Mothers were made of clay, installed, worshipped and then cast into the waters, or offered to ancient sites of the goddess – to caves, clearings in forests, or to trees- or abandoned at village boundaries. By their very nature impermanent, the Earth Mothers could not be kept under a householder's roof except for short ritual purposes (Jayakar 1989: 168).

It is interesting to note that the festival of *Harela* is celebrated, in the beginning of the rainy season, the wedding day of Shiva and Parvati. On the eve of *Harela* unbaked small images of Shiva and Parvati are made. They are locally called *Dikare*. On *Harela* they are worshipped. After a few days these clay icons are left near an old tree (Bhatt 1999: 71).

Referring to the Harappan terracotta female figurines and the continuity of the tradition, Jayakar says:

At the cities of the Indus civilization (2500-1700 BCE), the mothers appear with the sacral face of divinity, moulded with deep concern, with the ancient brooding shamanistic face of the seer, elaborate ritual head-dress, serpentine form, long slim legs and slender hips. The ornamentation on ears and neck, the virgin breasts and the girdle that holds the cloth that covers the waist are formed of clay withes, appliquéd on to the body of the divinity. As the timeless nude Earth Woman, she appears through the centuries headless, sightless, with outstretched arms – the universal gesture of the sacral female in all archaic civilizations. Free of all in essential detail, the awesome lines of her body are tightened and her form abstracted in sacred austerity, as in the early images from the Chalcolithic finds of 1200 BCE from Nevasa and Bilwali Dhar on the Deccan plateau. She appears with bird, animal or human faces, pinched into shape by hand; with clay pellets applied to eyes, mouth and breasts; with outstretched arms and a hole for the genitals. In later forms the thighs and breasts of the sacred lady grow rounded and heavy; she becomes synonymous with the vessel of plenty; her heavy girdle accentuates her pubic triangle .... In her manifestation as the Great Mother, creator and destroyer, she is conceived in the northern river valleys as a woman with virgin breasts and massive thighs, holding a baby in one hand, and a cup of blood to fecundate the earth in the other. These fired clay images of the Mother date from around 2nd century AD. The conception is monumental. The body is moulded by hand; the texture of the clay is uneven. The massive arms have withes of clay coiled around them. The body and ornaments are pitted with holes. The face of the Mother is a grim mask; the eyes are elongated; the nose is a bird's beak; the breasts are immature; the feet point backwards, indicating links with rituals of death, magic and fertility. In one of the icons from the Farakka barrage, the face of the Mother, with her timeless, passionless mask gazing into eternity, has given place to a terror-devoured face with eyes poignant with the knowledge and agony of death. The arms and legs of this image are broken. A strange horseshoe-shaped clay-strip rests over her breast (Jayakar 1989: 168).

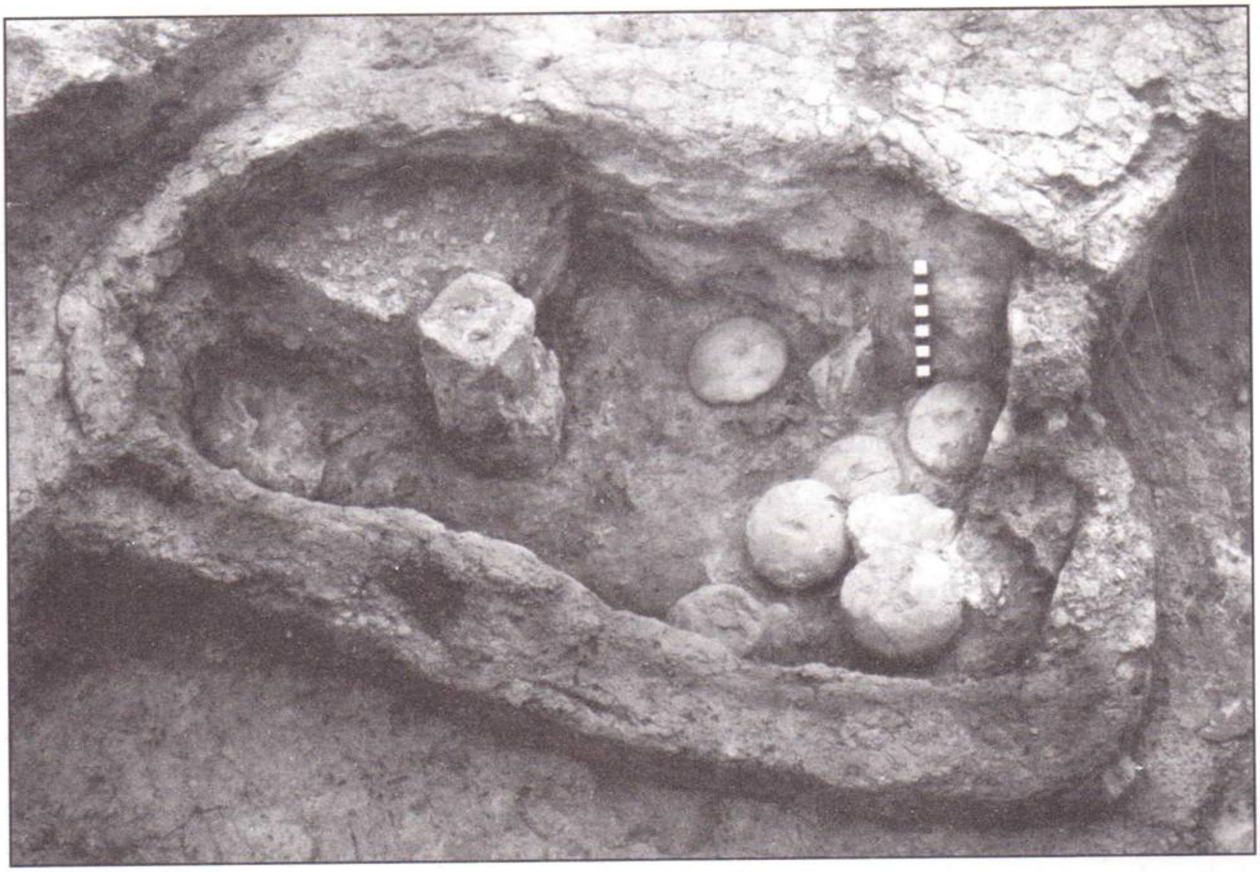
Ardeleanu-Jansen believes that evidence from Mohenjodaro suggests that the majority of the terracotta figurines were not isolated finds but were usually associated with other terracotta images. Thus the female figurines were found together with animal representations such as bulls, birds and dogs, but also with monkeys, rams and other female or male figurines. Hence the interpretation according to which they are merely to be regarded as idols of the "Great Mother Goddess" symbolizing the procreative aspects appears to be too simplified.

From the results gathered so far, it is apparent that we have to base our interpretation on a combination of two main factors, namely the iconographical diversity of the female figurines themselves and the range of other human and animal terracotta figurines associated with them. Taken together, these factors indicate an ideological sophistication, which goes far beyond the familiar fertility/maternity complex (Ardeleanu-Jansen 1988).

Ardeleanu-Jansen explains that another factor to be considered is that the range of representational subjects and iconographical diversity is complemented by the contemporaneous use of different figurine types. The figurines may have been regarded as substitute symbols for conception in a complex pantheon. We should not forget that a whole cosmos of conceptions regarding divine beings emerged from the subcontinent. Finally, it should also be remembered that apart from the diversity in the terracotta art from Mohenjodaro, it is still an interesting and perhaps significant point of evidence that no temples or other monumental effigies of a monumentalized ideology have been found so far (Ardeleanu-Jansen 1988).

Quite a few stone statues have been found from Mohenjodaro, which depict a seated male, modelled in a hieratic style. A terracotta head from Kalibangan is also stylistically similar to it. It has been suggested that he represents the priest-king.

At Kalibangan (Rajasthan) and Lothal (Gujarat), however, figurines are conspicuous by their absence despite very extensive excavations at these sites. Seven fire altars in a row were found on the "Citadel" at Kalibangan (Pl. 7.I), associated with a sacrificial pit containing animal



Pl. 7.I Kalibangan fire altars.

bones. It has to be noted that these "sacrificed" and *cut* bones are bovine, an evidence that does not allow tracing the sanctity of the cow to the Indus times. A small structure outside the settlement housed five such altars. Each house also seems to have had such an altar. At Lothal too several fire altars are reported, though a little different from those at Kalibangan. No such structures were reported from the main Indus sites. It may be that some sort of fire-worship was in vogue in Rajasthan and Gujarat but no iconic worship seems to be prevalent. Though, personally I have not been able to differentiate the fire altars from the run of the mill domestic hearths!

Human-animal deities

Many of the latter-day syncretistic gods like Narsingh Avtar and Varah Avtar may have roots in the Indus religion, where human and animal figures occur in various combinations (Fig. 7.1). Some figures have human heads and animal bodies; others have animal heads and human bodies. A tiger with a man's bearded head contrasts with a seated cat-like animal with a woman's head.

Kenoyer mentions another category of human-animal figurines probably used in puppet shows to amuse and teach the public. One of the most famous figures has a dog-like head and a pot-bellied human body with holes for attaching moveable arms. A long penis was once attached under the bulging belly, and a broken tail can be seen at the back of the figure. A hole in the base indicates that it was attached to a stick, probably to allow a puppeteer to manipulate the figure while sitting behind a screen. Ithyphallic caricatures, common in most societies, usually attract and keep the crowd's attention in-between more serious presentations. More serious figurines that also may have been used as puppets or for special rituals combine several different forms of animals. The two examples of such figurines so far discovered come from the site of Nausharo,

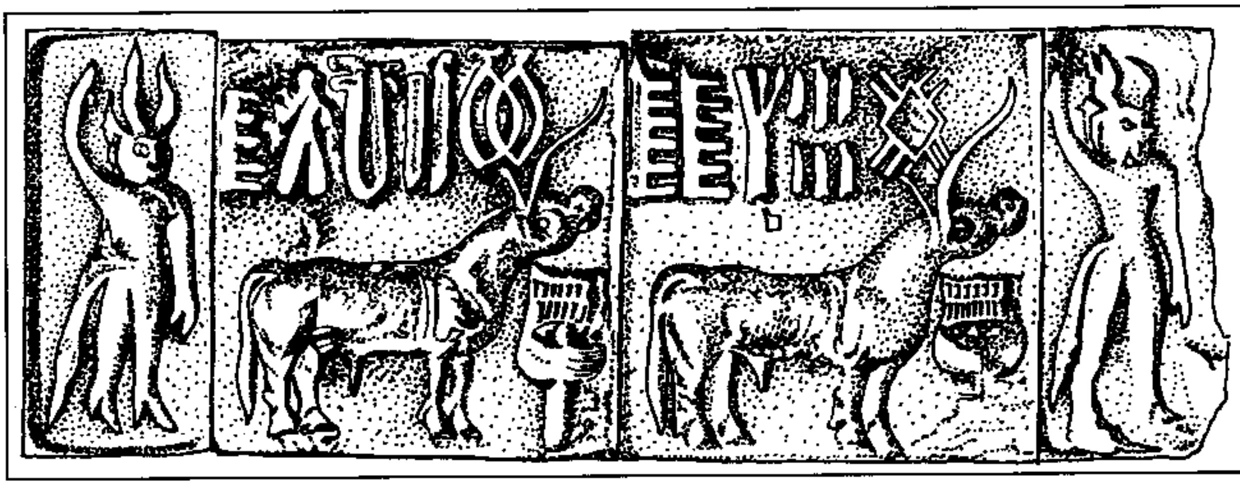


Fig. 7.9 Seal with a unicorn and a horned devil with a tail from Mohenjodaro (After Possehl, 2002).

Pakistan. Although Nausharo has the only terracotta figurines of multiple animals, multiple-headed animals are found on seals from most of the larger sites. One square seal from Mohenjodaro shows a triple-headed combination of important totemic animals: the bull and the antelope. A double-sided seal from Mohenjodaro shows a unicorn with a "devil" with horns and a tail (Fig. 7.9). A cylinder seal from the site of Kalibangan, depicts two men fighting (?) over a woman, with long braided hair and bangles on each hand, with a long skirt (Fig. 7.1). While trying to spear each other, the men grab the woman's hands, and their spears form an arch over her head. In the background what may be a female deity, with the body of a tiger and the horns of a Markhor goat, watches the scene. Kenoyer suggests that since the Indus deities combine the most important totemic and plant motifs, they must be important symbols of Indus religious integration.

Here I would like to suggest that many of such deities must have been part of the folk religion [the Lesser (*Desi*) Tradition] of various tribal groups, which were probably deliberately integrated into the elite (*margi*) religious imagery.

Miniature glazed faience figurines of seated rams have a perforation through the body so they could be worn as amulets. The white glazed surface is generally quite thick and well preserved, but it conceals the delicate modelling of the face. These figurines have been found at Mohenjodaro, Harappa, and Nausharo. Bull and water buffalo figurines made from terracotta are quite common.

Domestic and wild animals were probably sacrificed for specific Indus rituals, as indicated by narrative scenes on tablets, such as the killing of a water buffalo or the scene of a man grappling with a short-horned and humpless bull. Annually at the end of the rainy season, in central Himalayas, buffaloes are sacrificed even today to appease Nanda goddess, which Bhattacharya traces from Mesopotamia, as noted above.

Horned deities

Male terracotta figurines are usually depicted nude, but wearing turbans or headdresses, neck ornaments and occasionally bangles. Similar postures are represented on seals and moulded tablets, where male figures stand on the ground or on a tree. The standing figure is usually interpreted as a deity, the kneeling figure as a worshiper or priest. A unique posture found only on seals and moulded tablets shows a male with horned headdress seated in a yogic position, with legs spread wide and heels pressed to the groin. The images of the Buddha and various Hindu deities, including Shiva, are often shown in the famous yogic posture called *padmasana.*

The posture we see on the Indus seals can be correlated with a difficult position of highly advanced yoga called *mulabandhasana* (Kenoyer 1998).

One of the most common motifs in Indus ritual art is the image of a bearded man wearing a headdress of horns (an example is from a jar from Padri, Fig. 7.10), which has a triple-leafed branch sprouting from the centre. It is associated with both animals and pipal.

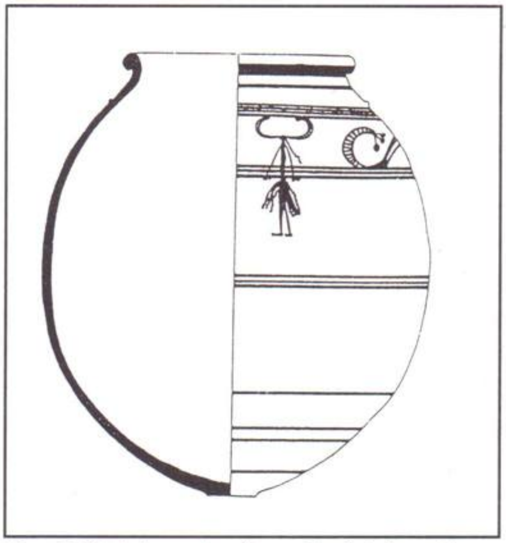


Fig. 7.10 A large jar from Padri showing a horned deity (After Shinde).

There are two distinct horned deities in terracotta carved onto seals. Some seated figures with horned headdresses appear to have additional faces carved at the side of the head, suggesting that this deity had three or even four heads if there was a face at the back of the head. This multi-faced deity has been generally identified with the later images of Shiva, a Hindu god. The human image with bull's horns is generally depicted with bull's tail and hoofed hind legs, but arms with human hands or tiger's claws. On copper tablets from Mohenjodaro this figure also has a tail and runs with a bow in one hand and arrows in the other. This archer or hunter may represent a deity or simply the common practice of wearing camouflage while stalking game. However, such costumes may also have been worn in ritual dances or processions to represent natural or supernatural powers. The second important horned deity wears a central branch as a headdress in addition to the wide, spreading horns of the water buffalo. The most famous representation of this image is on a seal from Mohenjodaro that shows a male deity seated in yogic position with erect phallus. The deity is heavily adorned with bangles on both the arms and a series of graduated necklaces reaching to his waist. In the various narratives animals surround the deity: a rhinoceros, a water buffalo, an elephant and a tiger. This may indicate that this deity or different deities depicted in similar manner were the focus of considerable worship and sacrifice. A single line of the Indus script (in reverse) is carved along the top of the seal. This seated figure has been referred to as "proto-Shiva" because of its similarity to later iconography of the deity Shiva from the Hindu pantheon. Kenoyer thinks that whereas many later Hindu deities may have had their roots in earlier beliefs of the Indus Valley or other indigenous communities living in the subcontinent, we cannot confirm specific connections between the horned figure on the Indus seals and the later Hindu deities. There are similarities in the iconography, but the meaning relayed may have been significantly different (Kenoyer 1998).

Two other similar seals with horned deities wearing bangles and seated in yogic position were found in the DK-G area of Mohenjodaro. One is a relatively simple figure seated on a throne with legs carved in the shape of bovine hooves. The front view is not clear, but there appear to be additional faces on each side, making it a second example of the three-faced deity. The carving of the body shows well-defined pectoral muscles and the penis. The headdress has three pipal leaves branching out of the centre, and two curving horns on either side.

But this motif does not always have three faces. On one example from Mohenjodaro the face is shown in profile with a massive braid of hair projecting to the back. A star is carved in the centre of each curving horn, and the stylized branch with five leaves curls up from the centre of the headdress. Both arms are covered with bangles; the deity is nude, seated with legs positioned in the standard yogic pose. Almost identical figures are found on other moulded terracotta tablets from Mohenjodaro as well as from Harappa. Kenoyer informs that two recently discovered tablets from Harappa show this deity on a throne with a reed house or temple at one side. On the other seals the seated deity is witness to the killing or sacrifice of a water buffalo. The various contexts and narrative motifs indicate that this deity or different deities depicted in similar manner were the focus of considerable worship and sacrifice, though today sacrifices are associated with the female deity and never with the male.

The fragile wide spreading horns of the deity (terracotta figurines) are mostly broken, but even these fragmentary pieces give a sense of the powerful beauty of the deity. Many examples of terracotta buffalo horns have been found with holes for attaching them to headdress. Generally these horns are broken, but complete horns may have been from 10 to 20 cm in length. Kenoyer suggests that such terracotta horns may have been attached to actual headdresses worn by puppets or child performers. Full-sized headdresses may have used actual horns, as is still the practice among the Muria Gond communities in central India. A unique aspect of this figurine is the goat-like beard that replaces the normal wide, spreading tiger beard. The goat-like beard may indicate a specific aspect of the deity that is correlated to a myth or cult associated with the wild goat, often depicted on the seals.

We have to however note that although most horned deities are bearded and therefore male, others are beardless and have a prominent breast that could represent either male pectoral muscles or female breasts. One seal from Mohenjodaro shows a bull-horned deity with claw-like hands attacking a horned tiger. The deity has the hindquarters and tail of a bull, but the torso is human, with a prominent pectoral muscle or breast in profile. If this does represent a female deity, it indicates that the horned deity had both male and female aspects.

The Brahmani bull is associated with *Siva* as his *vahana* (mount) and is worshipped even today. Emphasis on the depiction of bulls on seals (Figs. 7.8, 11; Pl. 7.4) and terracotta, and a scene on a seal where it is carried on shoulders in a procession, can only be explained as being of religious significance. Quite a few small terracotta human figures from Harappa show various postures, identified by some as *yogic* exercises.

WATER ABLUTION

Water is such an important substance at Mohenjodaro that M. Jansen has published a book titled *Mohenjodaro: City of Wells and Drains, Water Splendor 4000 Years Ago*. The translation of *wasserluxus* as "water splendour" from the original does not quite catch the word's meaning, so Possehl uses the German word in his new book (2002: 58). The bathing facilities in each house inform us that washing and cleanliness were important to the Harappans. We have to anticipate, Possehl suggests, that this involved both physical cleanliness, as well as something of a more symbolic nature. The many wells throughout the city were sources of new, pure water, essential for effective cleanliness. The drainage system served to move the effluent away from the houses, below the ground, safely out of the way and safely out of sight, in brick-lined channels that prevented contamination of the earth and the city. Concern for cleanliness, bath and ablution is traditional in India. Pious people take bath daily with ice-cold water even

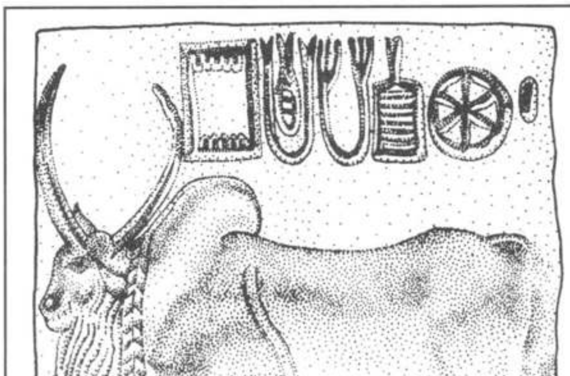


Fig. 7.11 One of the best seals of humped horned bull from Mohenjodaro (After Possehl, 2002).

in winter and then offer prayers. Elaborate provisions of drains on the Kalibangan platforms and the Great Bath of Mohenjodaro (Pl. 5.4) may be the beginning of these ablutionary rituals. Water is essential for life, and all societies have a special reverence for the rains. Pure drinking water and the proper disposal of polluted water were important concerns for the Indus cities. At most sites, wells were dug to provide water for the inhabitants. The number of wells at Mohenjodaro appears to exceed the normal needs of a large urban centre. At Harappa, there are fewer wells, suggesting that there were other sources for water, but at both sites, bathing platforms were found in every block of houses. When considered along with the massive construction known as the Great Bath at Mohenjodaro, we assume that bathing and the purity of water may have had specific ritual significance in the Indus cities. This high regard for water and bathing is complemented by concern for the removal of polluted water and sewage. The Indus Valley civilization is not the only culture with concerns for the purity of water sources, but it is the first urban culture to develop specialized drainage technology throughout the entire urban settlement. In Kumaun even today the spring wells are constructed as temples and treated with the same reverence.

Ardeleanu-Jansen says:

The sheer dimensions of the Great Bath (Pl. 5.4) in Mohenjodaro can be taken as proportional to the importance of ritual cleanings in the life of the town. The frequency of bathing platforms in the dwelling-houses of the "lower town" would suggest that such ritual cleansings were so inherent to Harappan society that they were likewise primarily the private domestic concern of the inhabitants, the Great Bath being reserved either for more formal, ceremonial occasions or for a particular population group (Ardeleanu-Jansen 1988).

SACRED TREES

Of all the religious symbols, pipal seems to be the most popular and potent (Figs. 7.4, 7, 12). It continues to be of special significance at religious places like temples. No temple can afford to be without a pipal tree even today. Cutting a pipal tree or its branches is still a taboo.

Both pipal and *bata* (*Ficus indica*/banyan) trees have a rich tradition of myths and legends in India. Kosambi says:

The pipal (*Ficus religiosa*) has been worshipped throughout India with unbroken continuity from pre-history, long before the Buddha found enlightenment beneath its boughs. The local name for the god of the pipal tree is *Munjaba*, specially a god of small children before investiture. The vada (*Ficus bangalensis*) is associated with the devoted Savitri who reclaimed her husband from the god of Death, hence becomes the patron deity of all good wives. These two wild fig trees were edible totems, like the tastier and more digestible *Udumbara* (*Ficus clomerata*) of the same class. We know this from names like *Paippalada* (pipal eater). *Audumbara* (descendants of Udumbara) marks a well-known historical tribe whose coins bear the mark of that sacred tree (Kosambi 1956: 38).

Trees are also associated with the apsaras:

In the later *Samhitas* the sphere of the apsarases extends to the earth and in particular to trees. They are spoken of as inhabiting banyans (*nyagrodha*) and sacred fig-tree (*asvatha*), in which their cymbals and lutes resound. Elsewhere the same trees as well as other varieties of the fig-tree (*udumbara and plaksa*) are said to be the house of Gandharvas and apsarases. The Gandharvas and Apsarases in such trees are entreated to be propitious to a passing wedding procession (Macdonell 1995: 134).

Fig. 7.12 Double unicorn seal with a papal tree, Mohenjodaro (After Possehl, 2002).

Regarding tree worship, G.C. Pande writes:

Yaksha worship represents, on the popular level, a continuation of pre-Aryan religion. The Yakshas were spirits, often connected with trees and granted worldly desire, especially progeny and wealth (Pande 1995: 318).

Kosambi also points to the evil aspects of the tree gods:

Traders setting out on their travels made animal sacrifices to some deity, and vowed to make more if the journey was profitable; the vows were regularly fulfilled. Apparently, such deities were associated with some tree outside the village, sometimes in a grove or the dense jungle. In a *Jataka* story, men make the sacrifices to the *yakkhas* (Sanskrit=*Yaksha*) at crossways (*caccara-raccha*) with fish, flesh, and wine in bowls or sherds; this resembles the sacrifice to Rudra and the goblins .... King Pasenadi of Kosala is terrified by sixteen ominous dreams in a single night; the Brahmins advise him to make extensive blood sacrifices at every crossway .... In fact, the *yakkhas* often ate human beings (among them unwary traders) who entered certain localities, which Vessavana as the chief of the demons had assigned, to a particular *yakkha* or demoness. Many *Jatakas* narrate how the Bodhisattva converted such goblins to a simpler diet and kindlier way of life, which has to be interpreted to mean that human sacrifice went out of general fashion (except among forest tribes) before the time of the Buddha. The especially cruel warrior-king makes sacrifice of *ksatriya* prisoners to a nigrodha (*Ficus indica*) tree's deity in another *Jataka* story in order to take the besieged city of Taxila (Kosambi 1956: 103-104).

Kenoyer (1998) in his interesting book, *Ancient Cities of the Indus Valley Civilization*, gives a detailed description of ritualistic objects. He becomes poetic in describing the virtues of pipal:

Deep in the jungle, the pipal tree still provides a natural sanctuary for animals. The red figs sprouting profusely from the trunk and branches attract deers and monkeys. Birds and honeybees live in the protective foliage, while snakes, rodents and a host of insects live in the hollows of its roots and trunk. Two related trees, the pipal *(Ficus religiosa)* with a heart-shaped pipal leaf and the banyan *(Ficus indica)* with a long oval leaf, are found throughout the Indus Valley.

Even in the Early Harappan period, heart-shaped pipal leaves, often arranged in groups of three, were commonly painted on small jars, and continued into the Harappan phase as elaborate paintings of the pipal tree and its wide, spreading branches on both large storage jars and smaller vessels. In narrative terracotta tablets, human figures with water jars bow before the tree. On other tablets and seals, deities emerge from the centre of a pipal tree or stand under an arch of pipal leaves. In a seal from Mohenjodaro, two unicorns emerge from a pipal tree (Fig. 7.12). Many horned deities wear a distinctive headdress comprising three heart-shaped pipal leaves. As we have not been able to decipher the script so far, the specific meaning of this symbol during the Indus period can only be inferred by examining its meaning in later cultures (Kenoyer 1998).

Kenoyer remarks that two thousand years after the foundation of the Indus cities, the Buddha attained enlightenment under a banyan or bodhi tree. In Pakistan, even the tombs of Muslim saints are found under the protective branches of pipal tree.

In a famous seal from Mohenjodaro, the pipal tree is divided into two main branches, each with three leaves, and the deity wears a horned headdress with a curved branch emerging from the centre (Fig. 7.4). In front of the deity is a kneeling worshipper also wearing a horned headdress offering perhaps a human head placed on a stool (?). Behind the figure is a giant ram and along the top is a series of script signs that may identify the ritual or the deity. In the lower register is a procession of seven robed figures. If animal figurines were used as votive offerings substituting for actual animal sacrifice, some human figurines may have served a similar function. Human sacrifice is also indicated by the fragmentary male figurine found in recent excavations at Harappa that appears to have his arms pressed to the back as if they had been bound. A more common type of figurine shows a seated male with legs together and hands clasped at the

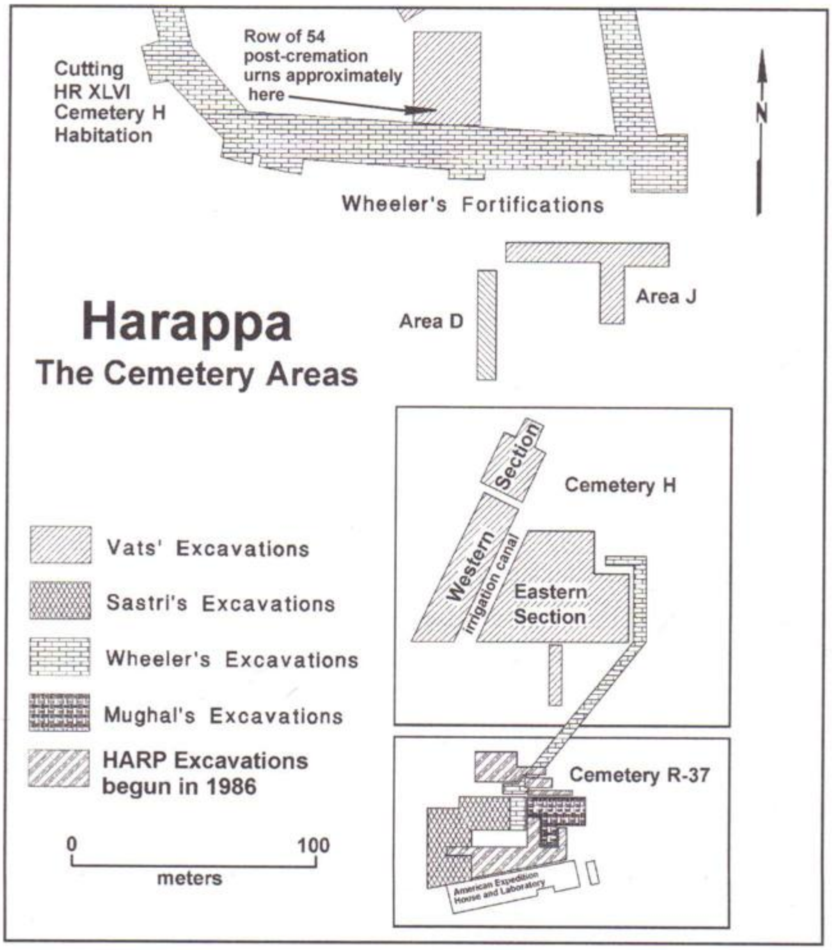


Fig. 7.13 Harappa cemetery areas (After Possehl, 2002).

knees. This type of figurine has been interpreted as a worshipper, but perhaps it represents a sacrificial victim with hands and feet tied together (Kenoyer 1998).

Such practices, with roots in the Indus religion, continued even in historical times. Bhattacharya (1977: 164) reports:

> Self-mutilation was probably a feature of the worship of the goddess during the Pallava and early Cola period, as is evident from several Pallava panels where the devotee is shown to offer his own head. This custom might have some bearing on the later conception of *Chinnamasta*. A late Pallava inscription upon a slab refers to a warrior who had offered his own head to the goddess, and the slab itself contains a relief of that act.

Bhattacharya (1977: 65) also refers to such practices in Assam:

> When the new temple of Kamakhya was opened, the occasion was celebrated by the immolation of no less than a hundred and forty men, whose heads were offered to the goddess on salvers made of copper.

Kenoyer reports a recently discovered terracotta tablet from Mound ET at Harappa portraying a deity standing beneath a curved arch of thirteen pipal leaves. One other example from Harappa has an arch of thirteen leaves; three smaller tablets have seven- and eight-leafed arches. The number of leaves must be significant, especially the number thirteen, which is generally associated with exceptional power in the subcontinent (though in the West it is an unlucky number!). There are thirteen full moons in a year, and in the Vedic literature the thirteenth sacrifice is considered especially beneficial.

Kenoyer suggests that although the rituals depicted on the seals and tablets may have been practiced by only the higher classes or priests, they appear to have been carried out in the open under a pipal tree. The purpose of public rituals is often to teach people the power of the deities and to legitimize the power of the rulers who worship the deities. People coming to the larger urban centres to trade and participate in seasonal festivals and rituals returned to their villages and towns carrying stories about the gods and rulers of the city along with trade goods. The narrative amulets (Fig. 7.1) and terracotta figurines may have been commemorative mementos of these events. (Fig. 7.5 shows a female deity attacking a tiger, for example). An interesting example is from Dholavira where a horned deity is standing between two trees and seems merging with the landscape (Pl. 7.7).

SACRED MOTIFS AND SYMBOLS

In India bangles and even thread is tied round the wrists of brothers during *Rakshabandhan* festival, which symbolize sister's control or right for protection and brotherly love. Bangles often serve as a symbol of protection or control. A warrior wears bangles to protect the wrist and arm in battle, while a woman wears bangles to protect her family and assure the long life of her husband. Simple circlets of clay were probably worn by the common people, while the more affluent used shell, bronze and gold bangles. No other early civilization used bangles to the extent the Indus people did.

The endless-knot motif [Parpola (1994: 56) calls it "Brahma's knot"] found on copper tablets at Mohenjodaro may have been an important symbol of a specific cult or community. Related designs are found on tablets and seals. Traditional Hindu women continue to paint similar ritual designs to protect and purify the home. In the *rangoli* paintings this motif is still popular in Central Himalayas. Swastika is a more common symbol. The intersecting circle, fish-scale design, hatched triangle, checkerboard design and the circle-and-dot motif are among the more common geometric motifs on pottery. Many of these designs are repeated on seals, in shell inlay or carved on ivory gaming pieces and even on bathtubs or tiles.

Rings, sometimes wavy, that were not used as body ornaments were made of stone, shell and clay. Circles and wavy lines are commonly painted around pottery as part of the design, but they also may have had ritual significance as a protective bond. Many earlier scholars identified these objects as female fertility symbols, but they could have had varied uses and meanings. The shell wavy rings probably decorated the handle of a staff or baton. Larger stone rings were used as column bases at the site of Dholavira, and numerous large ring-stones have been found at Mohenjodaro and Harappa. At Harappa, excavators recently found wavy ring-stone fragments near the main gateway at the south-eastern corner of Mound E, possibly parts of massive pillars in the gateway area. The use of rings as a pillar component, Kenoyer suggests, does not diminish the symbolic significance of these objects, for in prominent contexts such as gateways, they would have been seen by everyone entering or leaving the city.

But at Dholavira, the ring-stones have been lavished with a lot of effort to make them smooth (and accurate?). There is a slit-like depression on the wall. I would suggest that they made a carefully designed structure so that the sun's rays on the change of the equinox could be accurately recorded, as in the Maya structures.

RITUAL OBJECTS

The most common object is the ritual-offering stand that has been interpreted variously as a sacred filter for making an intoxicating drink called *soma* or an incense burner. Shallow basins or feeding troughs also may have had some ritual significance as a container for food offerings to totemic animals.

A variety of shell objects, perhaps used for some rituals, have been reported from the Harappan sites. Similar objects are used today for rituals and give us a clue to their identification. Elaborately crafted objects such as shell ladles and libation vessels, and even perforated pots, may have been used for pouring sacred offerings of water, milk, oil or butter. Another ritual utensil is the libation vessel made from the conch shell *Turbinella pyrum*. Several examples of these distinctive vessels have been found at Mohenjodaro and one example made from another shell species, *Fasciolaria trapezium*, was found at the nearby site of Chanhudaro. Even today, this type of libation vessel is used throughout the subcontinent for ritual libations and for dispensing medicinal preparations. Another ritual object made from the conch shell *Turbinella pyrum* is a trumpet that has a mouthpiece chipped at the apex of the shell. This unique example of a conch shell trumpet was found at Harappa. Trumpets made from horn or shell are used even today for a variety of religious purposes, and even the daily worship at home starts with blowing of the conch trumpet. An important category of ritual paraphernalia is pottery vessels for holding sacred water or offerings.

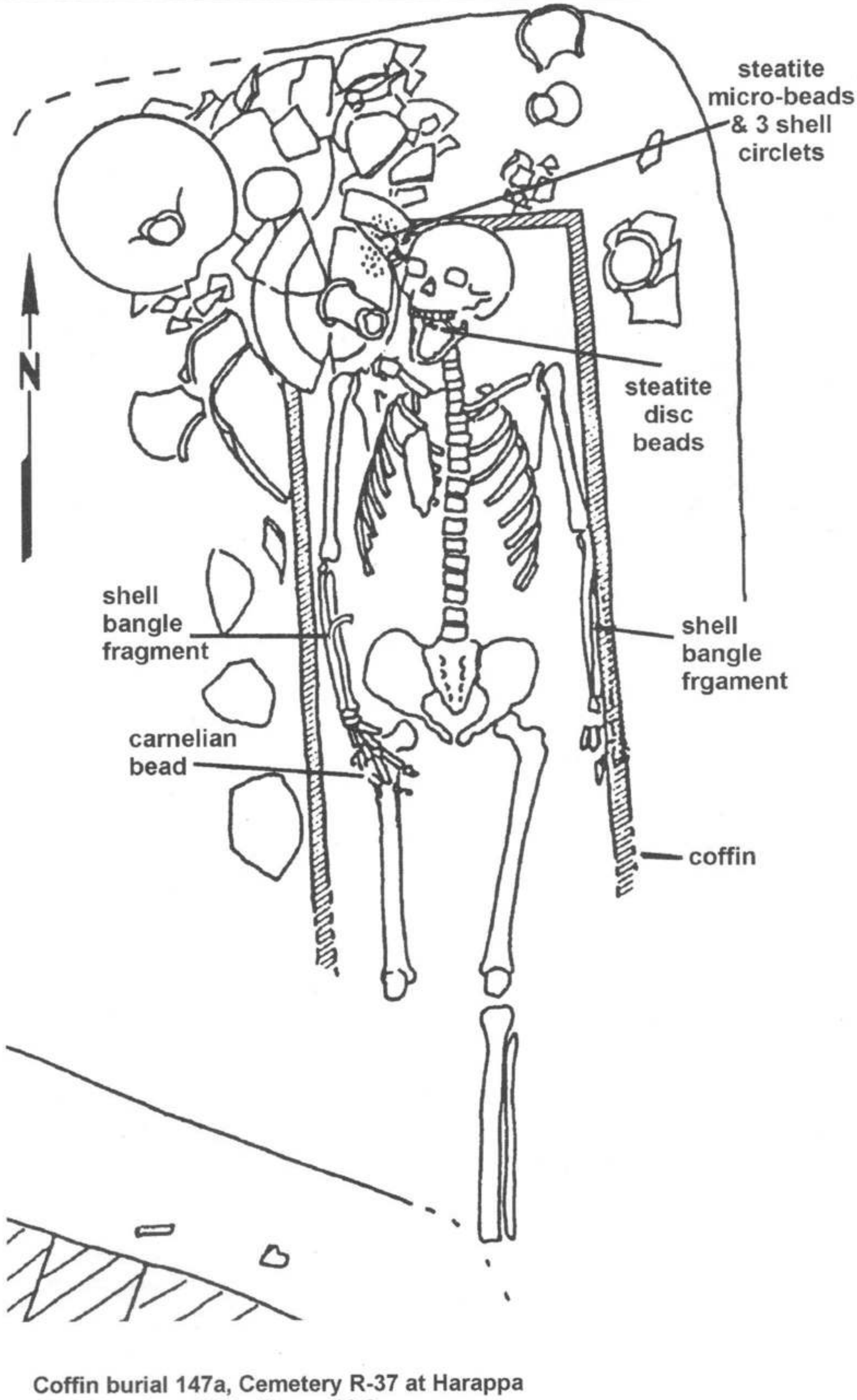
Thus we notice again and again that a large number of religious practices and rituals of the present day can be found to have roots in the Indus civilization.

BURIALS AND AFTERLIFE

The care one bestows on the disposal of the dead reflects the religious beliefs of the people. The Christians, Muslims, Parsis and Hindus, etc. have their own religious beliefs that underlie the methods of disposal of their dead. Though one would have expected uniformity, surprisingly there is quite a bit of variation in the Harappan burial customs. Normally the Harappans buried their dead in unlined pits, head pointing north, though there are exceptions like Ropar (Indian Panjab) burials where the direction is north-west. About twenty pots (sometimes even up to forty) were buried as the funerary appendage. The dead were provided with food and drink for the afterlife too as the remains on the pots indicate. At Harappa (Figs. 7.13, 14; Pls. 7.8, 9) most graves show that the pottery was covered with a layer of soil and then the coffin was placed on top of this partially-filled grave shaft. Personal ornaments like rings, earrings, necklaces, anklets, bangles and at times copper mirrors were also found with the burials. Of course in their furnishings the Harappan graves stand no comparison to the macabre splendour of the Ur graves, or the lavish paraphernalia of the Chinese.

Seldom were the graves lined with bricks; only one such example of each is known from Harappa, Lothal and Kalibangan. This also reminds one of the Nal graves of South Baluchistan. A unique example from the Harappan R-37 cemetery has a coffin (Fig. 7.14) of rosewood with a lid of deodar *(Cedrus deodara)*. Deodar must have been imported from the Himalayas, a few hundred kilometres away. The lady was provided with thirty-seven pots, but nothing else was lavish about it. This type of wooden shroud is Mesopotamian in style. She could be the Mesopotamian wife of a local elite! Kenoyer has however recently reported stains of decayed wood from a number of burials indicating use of coffins, which would also mean that this was not a unique coffin.

Besides the inhumation type, Kalibangan, in Rajasthan, provided other varieties of burial. In one case, urns were placed inside circular or oval pits. In another, there was a rectangular-ovalish pit, with the longer axis directed north-south, containing only pots. No skeletal remains were found in either type of burial. The grave-goods in all the three types are characteristically Harappan. But the urn burials are confined to an area north of the



Coffin burial 147a, Cemetery R-37 at Harappa
After Meadow 1991: Figure 13.8

Fig. 7.14 Coffin burials, cemetery R 37 at Harappa (After Possehl, 2002).

inhumation graves. Probably these differences in burial customs have some important sociological basis.

The Harappan cemeteries were away from the settlement, unlike the Chalcolithic cultures of Central India and the Deccan where burials were right below the house floors.

The burials of the Indus people provide the most direct evidence for specific rituals and religious beliefs. No seals or inscribed objects have been found with burials. Simple grave offerings of pottery suggest a belief in life after death, and the inclusion of modest personal ornaments may have served to identify the social and ritual status of the individual in the other world. Some individuals were buried with great care and preparation, wrapped in a shroud and placed in a wooden coffin. But there are also instances where a corpse was thrown into an open pit filled with previously disturbed bones and broken pottery. The coffin burials may be the standard among elite communities, whereas interpretation of the casual disposal depends on the specific details of preservation and stratigraphy.

Scattered burials, as well as discrete cemeteries, have been found at sites in each of the major regions, but most cemeteries are small and would not be sufficient for all of local inhabitants, if everybody practiced burial custom. It is possible that only certain groups practiced burial while others were disposed off by other means. The lack of evidence for differential dietary stress among the individuals buried at Harappa may indicate that the people were healthy and well-fed, probably from among the upper classes. However, there are variations in the number of funerary offerings and ornaments with each burial, possibly indicating minor differences in social or ritual status. Thus the indication seems to be that burials may have been confined to only the elite; others may have cremated their dead.

Kenoyer (1998) has tried to analyse the burial goods and drawn some important conclusions. He suggests that the inclusion of modest personal ornaments may have served to identify the social and ritual status of the individual in the other world. There are variations in the number of funerary offerings and ornaments with each burial, possibly indicating minor differences in social or ritual status. No seals or inscribed objects have been found with burials, and presumably high-value objects such as copper tools and ornaments of gold and long carnelian beads are conspicuously absent. But if seals identified individual owners, their absence from the burials is difficult to understand (Habib 2002). Precious metals, gold and valuable stone beads were generally kept in circulation among the living, while only the most essential personal objects were buried with the dead.

With this backdrop we can now discuss the details of burials from the major sites.

Harappa

Harappa, the type site in Pakistan, which has lent its name to the Harappan culture, has yielded the richest evidence as far as burials are concerned. This includes remains from the two famous cemeteries named Cemetery H (after the name of the mound) and Cemetery R-37 (after the name of the trench) (Figs. 7.13, 14; Pls. 7.8-9). Stray human bones and two clusters of what may be fractional interments have also been found at Harappa. A significant number of post-cremation urns have also been reported.

Cemetery R-37

It was K.N. Sastri who should get the credit for discovery of this cemetery. Because of the typical Harappan associated artefacts it can be safely assigned to the Harappans. It was excavated in 1987 and 1988 over an area larger than 50 × 50 m. Possehl (2002) thinks that the internal chronology of Cemetery R-37 covers the time from Period 3B to early 3C, or from about 2450 to 2150 BCE.

Sex distribution of Cemetery R-37 (after Possehl, 2002).

Sample	Males	Females	Unknown	Total
R-37A	38	55	13	106
R-37C	19	29	42	90
Total	57	84	55	196

Age distribution of the sample from Cemetery R-37C (after Possehl, 2002).

Category	Age range	Number
Subadult	<16 years	15
Young adult	17-34 years	35
Middle aged adult	35-55 years	27
Older adult	>55 years	13
Total		90

The alignment of the graves in the Cemetery R-37 was generally in a north-south direction. Some graves were lined with bricks, while others had wooden coffins (Fig. 7.14). Most burials were extended, with supine bodies. Some graves had offerings of a large numbers of pots. Some of the dead were wearing jewellery when they were buried as is indicated by the presence of beads, bangles, copper artefacts, and the like. Only women wore shell bangles in the Cemetery R-37 interments, though not much wealth was buried with the dead, unlike the elaborate sepulchres of China, Mesopotamia or Egypt (Possehl 2002: 169-170).

A total of 67 well-preserved skeletons from excavations in R-37C were studied. The general health and robustness of the population of Harappans identified in Cemetery R-37 was quite good. No cases of nutritional inadequacy, such as rickets, scurvy, or anaemia were reported. There was a low incidence of traumatic injury, chronic infectious disease, and no malignant neoplastic disease. Arthritis mostly associated with the spinal column was the most common health problem. There were several cases of severe arthritis in the neck, including fusion of adjacent elements. This could be associated with unusual stress on the neck vertebrae, such as would result from carrying heavy loads on the head. Examination of the teeth reveals that the incidence of dental caries was found in 46 per cent of the individuals. Cluster analysis of cranial data suggests that the R-37C series is most closely related to other individuals interred in this cemetery as well as to those of the two phases of Cemetery H and Timargarha, an Iron Age site in northern Pakistan (Hemphill et al. 1991: 137-182; Possehl 2002: 257).

Compared to the size of the town and the expected population, the disproportionately small number of the burials indicates that possibly only certain groups practiced burial while others were disposed off by other means. As noted above, the lack of evidence for differential dietary stress among the individuals buried at Harappa may indicate that the people were healthy and well-fed, probably from among the upper classes. Wheeler's excavations in 1946 recovered some fragments of wood from a coffin and shroud that were identified as rosewood *(Dalbergia latifolia)* and cedar *(Cedrus deodara)* respectively. In more recent excavations, Kenoyer informs, coffins were visible as dark stains that could be measured, but no traces of wood remained. Most coffins were approximately 0.50 m wide, 1.7 to 1.9 m long and were made of boards that were 2 to 3 cm thick. Traces of a carbonized lid or shroud were found on one individual, and another corpse appeared to have been tightly wrapped in cloth, but no traces of the cloth or matting could be recovered. After the coffin had been interred, the entire pit was filled with earth, covering the burial and pottery offerings. HARP found no traces of cenotaphs or grave markers, but the cemetery area may have been marked by wooden markers or low mounds of earth. Two mud-brick buildings in the cemetery at Harappa may have been used for rituals or bathing the body.

Recent burial evidence from Harappa has led the HARP team to make many far-reaching inferences. Kenoyer suggests that the cemetery at Harappa appears to have been used by a limited group, possibly all belonging to a single kinship group or clan. They were buried one on top of the other, and the later burials often cut through the graves of earlier individuals. This pattern suggests that the burial ground itself was possibly a sacred place and that all members of a single group wanted to be buried close together. The fact that many earlier burials were disturbed by later grave digging suggests that the grave diggers were of a different social class who were unconcerned about disturbing the earlier burials. In some instances, relatively fresh burials were disinterred and partly decomposed corpses were thrown into adjacent pits to make room for new burials. In several of the disturbed female burials, the shell bangles traditionally worn on the left arm of adult women were missing. People of the same kinship group would hardly rob or disturb the burials of their relatives or ancestors, but labourers of a different community might pilfer the disturbed tombs as they dug new ones. Unlike the grave robbers of ancient Egypt, who systematically rifled the gold-filled tombs of the wealthy, the meagre grave goods in the Harappan burials hardly tempted the robbers. Shell bangles worn on the left arm and anklets made of steatite disc beads were commonly buried with adult women. A few beads of lapis lazuli, carnelian or copper have been found with both male and female burials, probably tied around the wrist or on a cord around the waist. Copper rings are found in many burial pits, and in one instance a ring was found in place on the left "ring" finger of what was probably a female burial. In South Asia today, ornaments and objects that pertain to marriage, initiations, or protection against magic or illness are seldom passed on to another person, but are broken, burned or buried with the dead. Based on modern analogies one can assume that the ornaments included with Harappan burials were symbolic objects that could not be passed on to the next generation (Kenoyer 1998). A practice that continues today, an ornament found almost exclusively with adult females is a truncated cylindrical amulet that was worn on the neck. Usually these amulets were made of black stone, but other examples have been found in green serpentine, steatite or faience. The association with adult women suggests that this ornament identified married women or adult women who belonged to a specific cult. A flattened conical ornament with a groove running along the perimeter may have been a variant of this type of amulet, and one example from Mohenjodaro was set in a copper frame or pendant (Kenoyer 1998).

Most of the buried ornaments were simple stone beads. The exception seems to be of several adult female burials at Harappa which were accompanied by a copper/bronze mirror. Because metal mirrors can be recycled and have intrinsic market value, their inclusion with pottery and personal amulets must have some specific ritual significance. The elaborate headdresses and hair ornaments depicted on the terracotta figurines probably needed repeated inspections, and mirrors would have been an essential toiletry item during a woman's life. Like the food offerings, the mirrors would have been necessary for everyday grooming in the next life, though the use of mirrors in magical rituals could not be ruled out. It is obvious that though these copper/bronze mirrors had some value, they were not passed on to the next generation and were not recycled.

Though the male burials at Harappa have only modest funerary offerings, two adult men were buried with valuable personal ornaments. One older man was wrapped in a shroud and entombed in a coffin surrounded by pottery offerings. He was wearing a long necklace of 340 graduated steatite beads and three separate pendant beads made of natural stone and three gold beads. A single copper bead was found on his waist. The fact that the stone beads were polished and rounded from long use suggests that they may have been worn for a very long time, possibly as amulets. The most prominent pendant bead is made of a rare variety of onyx with natural eye designs in alternating shades of red, white, tan and green. Gold beads framed this important ornament. The other two stone beads were made of banded jasper and turquoise, with a single gold bead at one end of the turquoise bead. Like the mirrors in female graves, even though these ornaments may have had some commercial value, they were buried with the owner and not passed on to the inheritors.

Kenoyer reports another important adult male burial where the person was entombed in a coffin with more than a dozen vessels arranged at the head of the pit and additional vessels along the side. A broken shell bangle was found on his left wrist and near the right hand was a single carnelian bead. An unusual hair ornament was found along the right side at the back of his head, where we would expect to find long hair tied into a double bun like those on the stone sculptures and seals. This ornament was made out of numerous strands of tiny steatite microbeads twisted together in circlets or bunches, with two or three shell rings and a jasper bead. The value of such an ornament can only be appreciated when the techniques of manufacture are considered. Each of the thousands of tiny steatite beads is approximately 1 mm in diameter and 1 mm in length. Some scholars suggest that the beads were made individually by delicate drilling and grinding, while others propose that they were made from a steatite paste that was extruded like a hollow noodle and then cut into short segments. Kenoyer informs us that even today, it is difficult to make glass beads of this size, and no one has been able to replicate convincingly the techniques used by the ancient Harappans.

Although this microbead hair ornament may have been worn as a crown or ritual headdress during life, it evidently could not be passed on to a surviving relative or clan leader. In contrast to the terracotta figurines and seals, which depict heavily ornamented men and women, Kenoyer infers that the Harappan burials reflect a very practical attitude towards material wealth and symbols. Precious metals, gold and valuable stone beads were generally kept in circulation among the living, while only the most essential personal objects were buried with the dead: shell bangles, beads with eye designs, steatite disc beads and mirrors. As a whole, the Harappan burial customs further reinforce the importance of ornaments and public symbols to define social and ritual status among the living (Kenoyer 1998: 122-125, 133).

Mohenjodaro

It is really strange that no cemetery has so far been reported at Mohenjodaro. The interments at this city all seem to be of a rather hasty character. There are a total of forty-two individuals represented in the Mohenjodaro skeletal series, most of which can be examined and measured. There are 17 more fractional interments and post-cremation urns at the site.

Wheeler had dramatized the scattered skeletons (Figs. 7.15, 16) as due to massacre by the invading Aryans, but Dales and Kennedy have thoroughly debunked his inference. Whatever their cause of death, its association with war and then abandonment of Mohenjodaro or the eclipse of the Indus civilization cannot be proved, asserts Possehl (2002: 164-165). Neither Indra nor his Aryan believers stand accused of these deaths!

Fractional burials and post-cremation urns

Several possible fractional burials at Mohenjodaro were noted by Marshall (e.g. VS Area, House XXVII), but they are not associated with human bones. Most of the occurrences are from late occupation of the city. Possehl reports that there are also post-cremation urns, said to be funerary relics, but most often they, too, contain no human bones. These urns occur at both Mohenjodaro and Harappa. To Possehl it seems strange to seriously entertain the notion that the Indus people had a funerary custom that involved interring cremated human remains in urns with other objects if there is hardly a shred of human bone to back up the proposition.

The evidence of the two urns buried at the entrance of the Great Bath is quite important. Whether or not these urns actually resulted from some funerary rite, these deposits are of special significance because of their location at the entrance of this important building. Possehl suggests that they should be considered a "foundation deposit" or a "commemorative offering" marking something of consequence to those who used the Great Bath (Possehl 2002:161).

Possehl thinks that the so called "massacres" are represented by groups of skeletons of men, women and children, some bearing axes or sword-cuts which have been found lying on the top-most level in the sprawled or contorted positions in which they fell. They had been left there by the raider who had no further use for the city which they had stormed. In that moment Mohenjodaro was dead.

The HR Area skeletons (Fig. 7.15) were found very close to the surface. Possehl points out that these skeletons were assumed to be in Room 74 of House V; however, they were found above the wall levels of this room as with skeleton number 2. All of the skeletons were on approximately the same level, but skeleton number 2 was 15 cm higher than the legs of skeleton number 8. Variation of this kind can be an indication that we are not dealing with a single event here. There were no signs of actual graves. These skeletons intrigued the earlier excavators also. Hargreaves (1931: 186) believed that the remains of the fourteen bodies found in Room 74 appear to indicate some tragedy, for the manner in which the skeletons are intermingled points rather to simultaneous death than synchronous burial, for the positions of the individual bodies are rather those likely to be assumed in the agony of death than those of a number of corpses thrown into a room. Marshall however thought that

> beneath a room or court of one of these vanished structures a pit was dug and the bodies thrown into it, or it may be that the living were put to death in it; for it is possible, though I do not think likely, that these groups of skeletons represent sacrifices to the dead (Marshall 1931:81).

The Harappan artefacts associated with the burials included a variety of personal ornaments, some of which still encircled the bones and a unicorn seal (though seals have never been found with burials). One of the individuals was found with 75 faience beads, which seem to have been part of a girdle, two copper rings, and two copper beads along with a fragment of another copper ornament.

Though Sewell and Guha (1931: 649-73) had noted some traumatic injuries to some of the individuals in the HR Area tragedy, Kennedy believes that they have overstated the case. Kennedy agrees that there are signs of trauma on skeleton 10; however, the "cut" is not fresh and its margins are characterized by considerable bone resorption. His assessment of this wound is that it may have contributed to the death of this individual, but the degree of resorption indicates that it was received thirty to seventy days prior to death. Kennedy also noted an old, healed lesion on skeleton 1 but he thinks that it is likely to be a skeleton of more recent date than others in the series and its relevance to the massacre is nil (Kennedy 1984: 429).

Possehl (2002: 162), summarizing the evidence says:

> we have skeletons without mortal wounds found in a context in which they all may not be associated or even in the same "room". We lack definitive evidence for the context of this macabre scene, and it could have taken place any time after the abandonment of House V at the close of the Intermediate I Period. In the end, no one knows how or why these people died, but the disposition of the bodies suggests a very hasty interment.

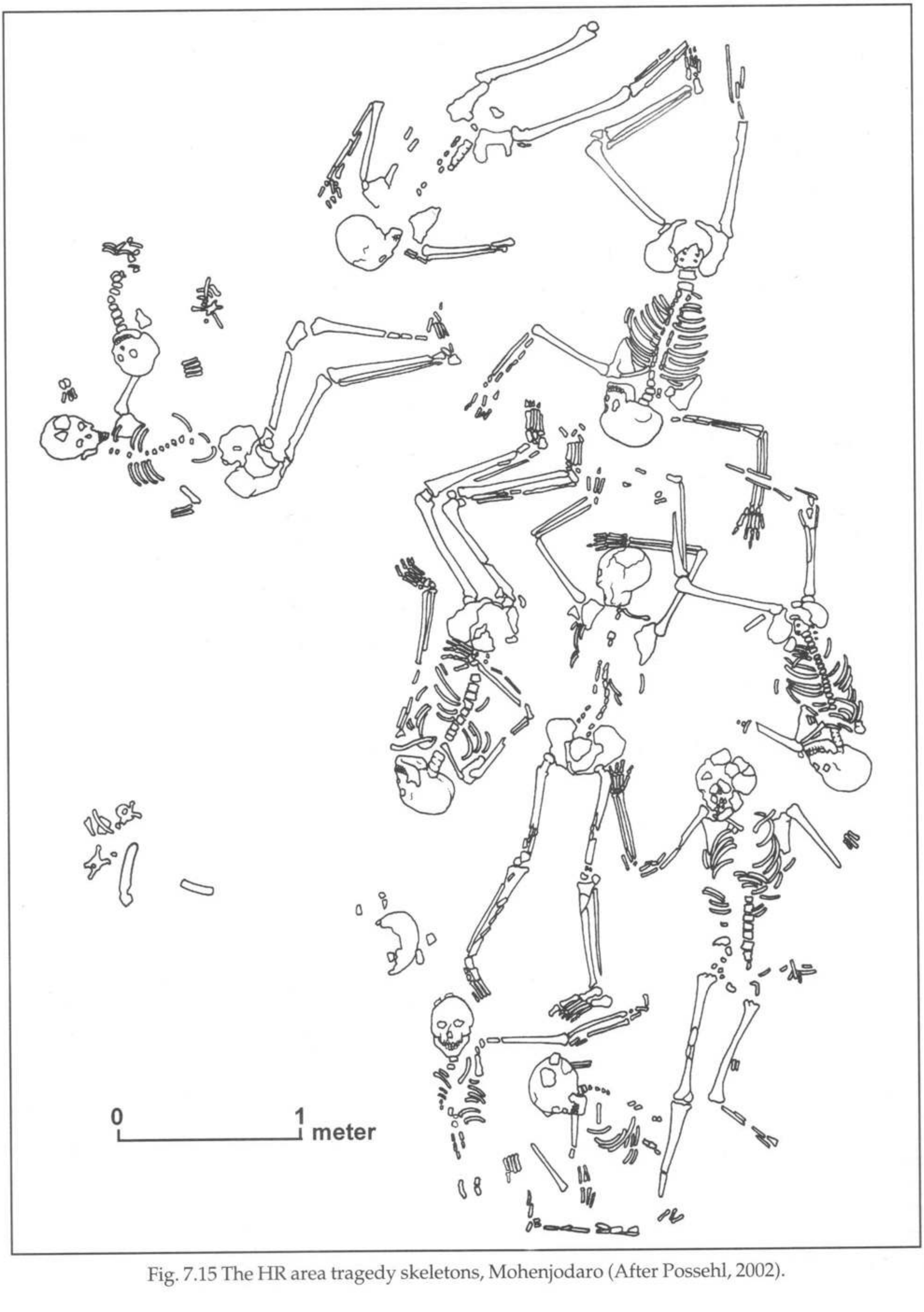


Fig. 7.15 The HR area tragedy skeletons, Mohenjodaro (After Possehl, 2002).

HR-A, VS and DK areas

The skeleton was found rather deep, at 1.25 m. About the HR-A area, Marshall says, '"Deadman's Lane", where one of the skeletons lay, was completely built over in the Late Period, and it was apparently during that period (either Late I or Late II) that the body was interred there under the floor of the then existing houses.

In the VS area, (Lane 4, between Houses XVIII and XXXIII), the evidence consists of six skeletons, including one, possibly two, children (Sewell and Guha 1931: 605-606). Four of the bodies lay on their backs, two of them facing one another. But the other two (numbers 23 and 20) were found lying face down, seemingly preserved where they fell at death. Number 20 fell fully stretched, legs slightly bent, with arms thrown forward and bent at the elbows. No artefacts were found on or near the skeletons, and they had been covered with loose earth, free of bricks. Marshall says that they must have been buried during the Late I or Late II Period, but there is no certainty that the area was a street at the time. These corpses, and the others at Mohenjodaro, must have been covered soon after death. This "burial" could have been done as an act of respect by relatives or friends, or simply to control the stench of putrefaction. These skeletons are unremarkable, except for number 23, which was an individual who was slightly over 1.8 m – rather tall for the Indus population.

In the DK-G area, Block 8A, the "Long Lane Group" consists of nine skeletons (Fig. 7.16). They were found, along with two complete elephant tusks, in DK-G, Block 10A, associated with Long Lane. The presence of an Indus-style comb and beads of faience associates this group with the living city of Mohenjodaro. Possehl thinks that Mackay's suggestion of a Late Period date, possibly Late lA, is reasonable. The contorted disposition of the skeletons suggests violence; but the elephant tusks and the other artefacts seem to preclude theft as the motive in these deaths, though Mackay blames the raiders for this act. This is the *single* case where trauma is evident and in all probability was the cause of immediate death. The large depressed area extending from the left frontal-parietal region to the left mastoid process is of a completely different form from a fracture formed by erosional processes.

The tragedy

The skeletons at DK-G area, Block 8A, Well Room 42 at Mohenjodaro, indicate that the deaths seem to have taken place during the last occupation of Mohenjodaro, in a well room close to the intersection of central and first streets. The skeletons of two people were found on the stairs leading down to the well. They seem to lay where they died in an unsuccessful attempt to claw their way out of the well room up to low lane.

> Of one of them, the badly crushed cranium lay on the partly missing top step facing north, the pelvis was on the step below and the vertebrae in position between the two. The left leg which had been flexed and drawn up rested on the same step as the pelvis, and the right leg was still extended (Mackay: 1937-38: 95).

The second skeleton was so badly preserved that the position of the body could not be determined, but it appears that he or she fell over backward just prior to death.

Fractional burials

There are only two reasonable occurrences of fractional burials at Mohenjodaro: a 'basket of human bone' from House XXVII in VS area, and the cranium from House III in HR-A area. The rest have to be considered doubtful because of the absence of human remains associated with the artefacts inside urns and the like.

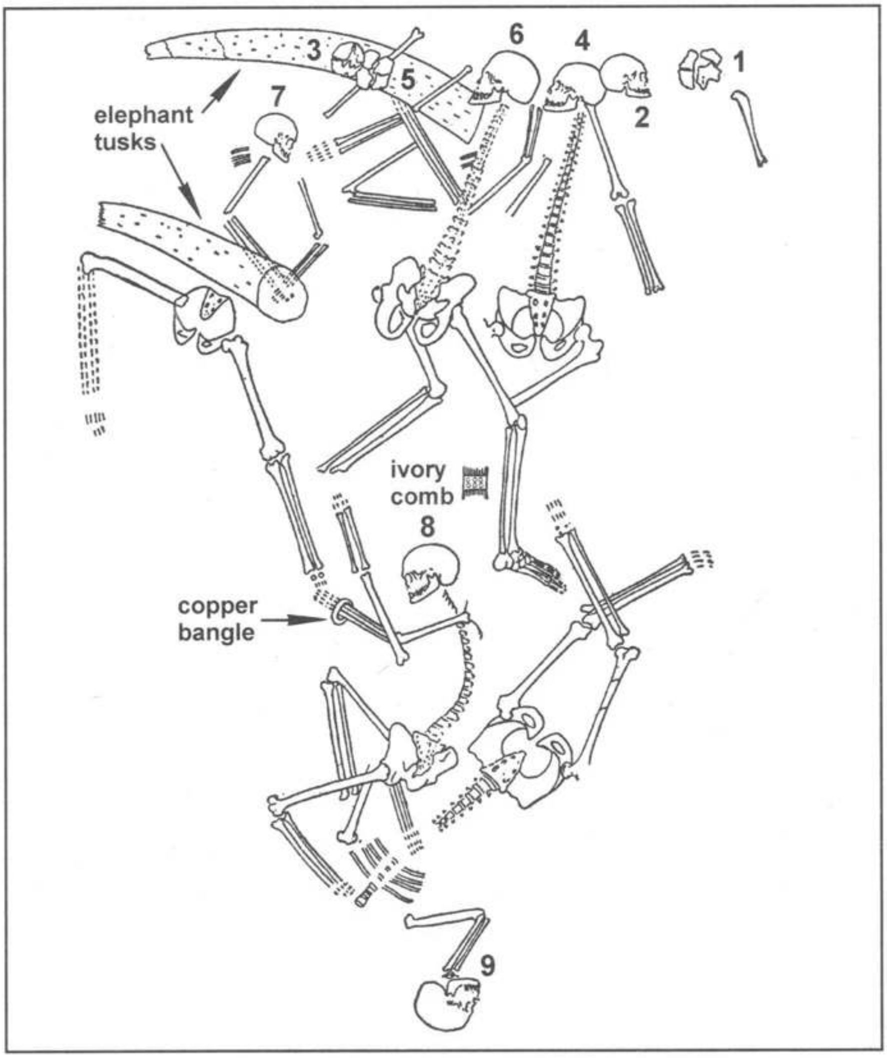


Fig. 7.16 Long Lane tragedy skeletons, Mohenjodaro (After Possehl, 2002).

Summary

If at all there is a possibility of a deliberate burial at Mohenjodaro, it could be the lone skeleton on Deadman's Lane in HR-A area. Possehl (2002: 164-165) observes that the four tragedies and the Long Lane Group are all associated with the upper levels of the site and can be dated to the Late Period, possibly even Late I, as in the Well Room tragedy. Sometimes such deaths have been supposed to be caused by the invading Aryans. Possehl points out that there are many problems with this theory, not the least of which is chronological. While there may have been speakers of one or more Indo-European languages in the Greater Indus region earlier, there is a gap of centuries between the abandonment of Mohenjodaro at about 1900 BCE and the documentation found in the *Rigveda*, which probably dates to *ca.* 1000 BCE. The *Rigveda* is not a text documenting the invasion and conquest of the subcontinent, but speaks of the feuding among the Aryans as well as with the indigenous peoples. Sindh is a peripheral area in the Vedic literature: the centre of this world was the Panjab. Possehl asserts that there is no evidence for a massacre at Harappa or any of the other Indus settlements in the geographical area described most prominently in the Vedas.

Who then were the murderers? Mackay thinks that the culprits were hill people and those of the Indus frontier. This is one possibility, but the cause of death of many of these people is not at all apparent. If violence was involved, we can imagine that as the civic order of Mohenjodaro failed, the place would have become an increasingly unpleasant environment, perhaps eventually becoming a huge slum. The law-abiding citizenry would have largely departed to be replaced by those not having much respect for the property and lives of others. Summarizing, Possehl says that the victims we see in these tragedies, if they did indeed die violent deaths, may have been victims of decaying city life, not invading Aryans (Possehl 2002:165).

DHOLAVIRA (GUJARAT)

At Dholavira, out of the many graves excavated, only one is of the standard Harappan type. Bisht informs that at Dholavira there is an extensive cemetery where were encountered a great variety of graves – rectangular, circular, oval-cists, cairns, circles with one or more grave-like structures as well as tumuli made of mud-bricks. Several graves were opened. Grave goods in the form of full pots were found though there were no skeletons in the graves. It has to be noted that the only skeleton along with a copper mirror was found during subsurface clearance. Perhaps the pile of earth or stones or both over the skeleton seem to have been removed by a bulldozer used for collecting earth for raising a bund in recent years.

Excavations at Dholavira have also brought to light existence of *stupa*-like architecture employed in construction of graves. Made of mud-bricks, it has a diameter of about 35 m and the extant height is approximately 2.5 m above the surrounding ground-level. It shows a circular construction in the centre whence radiate several walls like the spokes of a wheel, finally terminating into an outer circle (Pl. 7.10). In historical times this method of bonding a circular structure with spokes-like walls was employed in the construction of *stupas*. Therefore, it may be suggested that these graves represent proto-type of *stupas* (R.S. Bisht, unpublished thesis, Kumaun University, Nainital).

The Dholavira excavations have shed fresh light on the sepulchral architecture of the Harappans. The cemetery is situated to the west of the city, where flows the Manhar stream. Besides, there lies an extensive field which perhaps overlies a buried reservoir according to a study of satellite imagery by a hydrogeologist. In all, six grave structures were probed. Two of them were almost rectangular pits lined with large slabs of yellow limestone. In one case, one of the capstones was found broken and sunk into the fill of the dugout while the others were found missing. Inside the 2 m deep pit, which was oriented in north-south direction, there was deposited a thick water-borne silt. The grave was certainly disturbed by robbers or miscreants. However, in lower levels, there were found many dishes of coarse red ware. The other, an identical one, also 2 m deep pit lined with large slabs of yellow limestone, the capstones being missing, was otherwise found intact. Strangely it yielded a 5 cm thick walled structure made of fine-grained grey-coloured clay, showing a thin smearing of red clay. On the north, there was a marked convexity and, on the south, a slight concavity. At a first look, Bisht reports, it appeared like a coffin but there was no skeleton inside. At some height, above the level of the coffin-like structure, there was placed on the north a dish-on-stand on one side and a water-vessel on the other. Along the side of and underneath the coffin, there were placed a variety of pottery forms and stones as props to the coffin. The northern slab of the structure bore two gaps, perhaps intentionally made portholes for making subsequent offerings to the dead. In the following seasons, no further probe on the north side could be made. One oval-shaped grave, with its broader side on the east and narrower on the west, was made of random rubble piled in a pit. Another similarly oriented grave was made of random rubble, heaped in a thick pile inside an oval pit as well as above the ground. In the eastern side was found a collection of pottery containing a dish-on-stand, a vase with a perforated bowl-lid, etc. while nothing else was seen in the western part. One structure, laid out in NE-SW orientation with two large stone slabs marking the boundary of the pit, yielded pottery as grave goods. Interestingly, a single pot was placed in a circle marked by small stones (Bisht 2001: unpublished thesis: pp. 129-131).

It is quite intriguing that no skeletons or bodily remains were found in the fill of the "grave". However, it might suggest a symbolic burial. The soil collected from the pottery for analysis may provide some information with regard to the mode of disposal. The entire evidence was contrary to the general funerary architecture as well as practices of the Harappans. All those architectural forms might be cenotaphs. Graves without skeletal remains but with grave goods have also been found at Kalibangan and Surkotada. Lal (1997: 218) is of the opinion that it might represent 'post-cremation type of disposal'.

At Dholavira, both within and outside the city, a variety of grave-like structures have been spotted. Some graves are there on a low rocky outcrop lying at a distance of about 1.5 km south-west of the settlement. These suspected graves are circular, oval, somewhat polygonal, rectangular, or squarish. Most of them are circular cairns or lined with stones. Some of them show provision of cists as well (R.S. Bisht 1997: 107-120).

At Dholavira, out of the many graves excavated, only one is of the standard Harappan type, having a full skeleton, laid supine in an extended position, with the head on the north. Out of six graves, BR-l to BR-4 are roughly circular pit burials, in east-west as well as north-south orientations with burial pottery but without skeletal remains, whereas burial Nos. BR-5 and BR-6 are quite different: they are rectangular pit chambers lined with large-sized limestone slabs and almost covered. Some of the coping stones were found within or outside the pit. These graves are oriented with only pottery as grave goods.

The remaining graves show two separate characteristics: "megalithism" and *stupa*-like superstructure.

Lothal (Gujarat)

Located near the head of the Gulf of Cambay in the delta of the Sabarmati River, Lothal is the south-eastern most Harappan site. A small cemetery was located within the bounds of the site. Kennedy examined the Lothal skeletal series. In addition to these interments, two other "stray" skeletons were found in the cemetery area.

Joint burials

The most remarkable feature of the Lothal cemetery was the occurrence of four joint burials. Rao notes, 'In grave 13, bones of another individual besides skeleton no. 16 were found. Two bodies in one grave brings the ancient Indian custom of *sati* to mind.

Kennedy makes the following observations:

1. Compared to the mortuary series from Mohenjodaro and Harappa, there is a high degree of phenotypic heterogeneity in the skeletal biology of the Lothal population.
2. The ancient people of Lothal are similar enough in phenotypic pattern to their contemporaries in the Indus Valley, which indicates that the local people of Lothal were not reproductively isolated from the macro populations of the region.
3. There is a biological continuum of ancient and present-day populations in this part of the subcontinent.
4. A number of physical variables present in the Lothal skeletal series suggest that their closest biological affinities are with some of the hunting-gathering communities whose descendants survive as tribal enclaves in modern India.

A principal components analysis of the Lothal specimens, along with those from fourteen other South Asian sites, demonstrates the close affinity of this population with that from the hunter-gatherer site of Langhnaj, on the north Gujarat plain to the north of Lothal. This serves to reinforce their notion that there was a regular gene flow between Harappan and hunting-gathering populations in pre-historic Gujarat (Kennedy 2000).

Out of the twenty graves excavated at Lothal, all of which were of the extended-burial type, four produced two skeletons each. This naturally gave rise to a debate, namely whether these were examples of what is known in later-day India as the practice of *sati*, i.e. the wife immolating herself at the pyre of her husband. While this may be a tempting premise, the evidence of physical anthropology, though controversial, does not seem to uphold this view. The case is weak at Lothal since we are dealing with burial, not cremation, and some of the Lothal double interments are of the same sex.

KALIBANGAN (RAJASTHAN)

The cemetery of the Harappan period was located 300 m to the west-south-west of the Citadel (Fig. 7.17). Three types of burials were attested: extended inhumation (Pl. 7.II) in rectangular or oval grave pot-burial in a circular pit; and rectangular or oval grave-pit (Pl. 7.III) containing only pottery and other funerary objects. The latter two methods were not associated with any skeletal remains. Of the first variety, the main features were: on the floor of the oblong pit, the body was laid in an extended position with the head towards the north; around the head area, the funerary furnishings comprising pots and such objects of personal jewellery as bronze mirrors, etc. were deposited. The pit was thereafter filled with the same soil.

Three graves were quite unique. In one of them the body was lying face down with its head towards the south, quite contrary to normal Harappan interment, in a crouching position with folded legs. The other grave was lined with mud-bricks (40x20x10 cm) covered with approximately 2 cm-thick plaster. The third grave showed evidence of two types of burial, one superimposed upon the other. The lower interment, consisting of pottery, was without any skeletal remains, while the upper contained the normal extended human body with pottery and one bead each of gold and carnelian around the neck. The grave in this case was quite large and had steps on the eastern side leading down to the grave floor.

Of the second variety, the grave pit was oval or circular and contained an urn and other pots including platters and dishes-on-stands clustered round the former. Besides pottery, some of the pits also contained such other objects as shell bangles and steatite beads.

Of the third variety, the grave pit was rectangular or oval in plan, with the longer axis oriented north-south as in the case of the first variety, but it was marked by the absence of skeletal remains. The grave goods consisted of pottery and occasionally of personal ornaments like beads and bangles. The filling showed two stages: after the funerary deposit, the pit seems to have been left unfilled resulting in the accumulation of bands of fine sand and clay; at a later stage the remaining part of the pit was filled in by human agency with cloddy clay.

Thapar recognized that the occurrence of these three varieties of burial has posed problems of a sociological kind. Meanwhile, it may be affirmed that the grave goods obtained from each of these types are typically Indus. Graves of the first and second variety occur in separate defined areas, the latter lying to the north of the former, while the graves of the third variety are found largely in the area of the first but occasionally also in that of the second.

Lal reports that from Kalibangan a child had an unusually large head. It was evidently a case of excessive accumulation of fluid in the brain-cells which caused swelling and consequent enlargement of the head. To deal with the malady, the Kalibangan "surgeons" trephined the head so that the fluid could be drained out. This is indicated by three small holes in the right

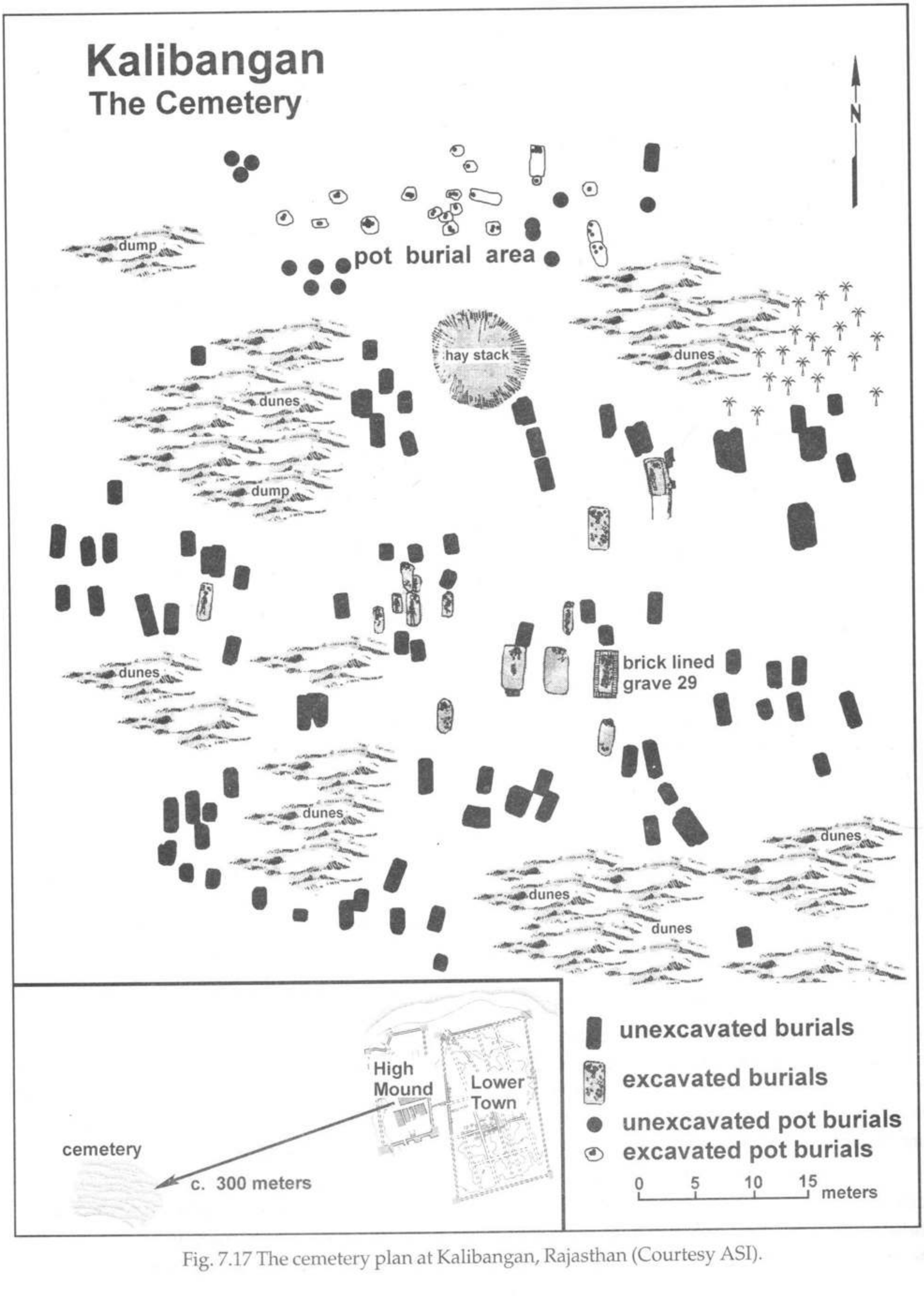
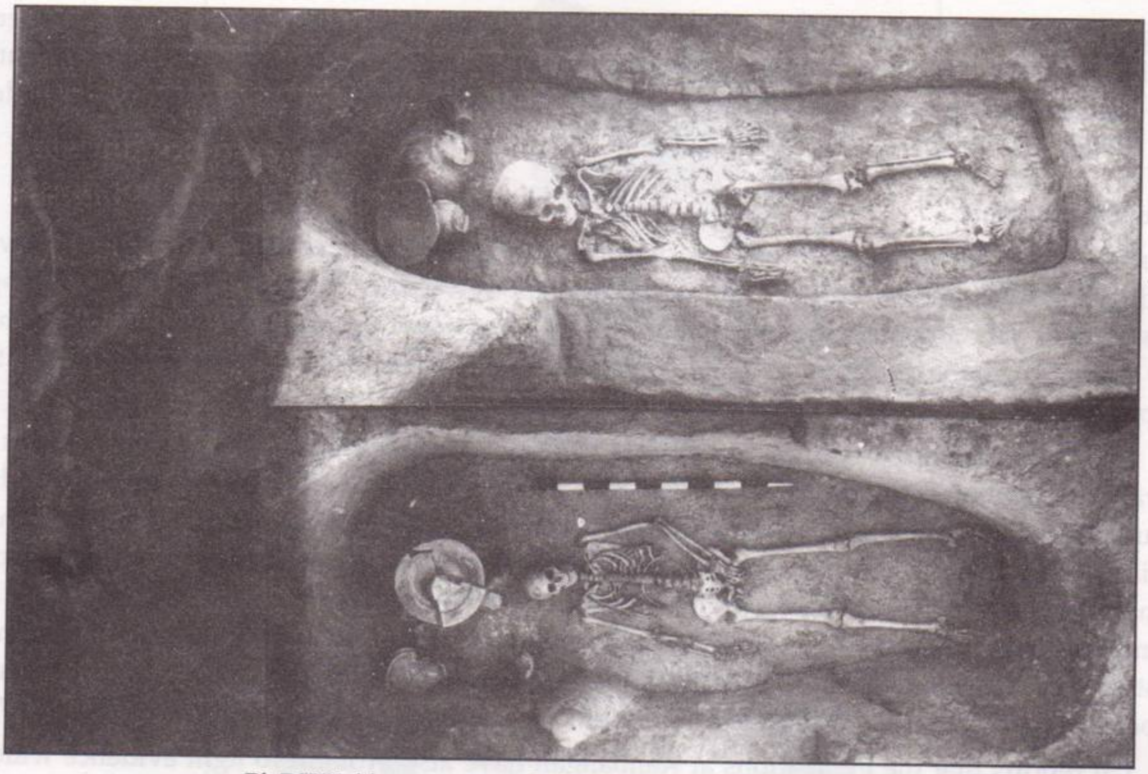


Fig. 7.17 The cemetery plan at Kalibangan, Rajasthan (Courtesy ASI).



Pl. 7.II Kalibangan extended inhumation (Courtesy ASI).

Pl. 7.III Kalibangan burial without bones (Courtesy ASI).

temporal region. A case of trephination has also been reported from Lothal. Once discovered, this kind of treatment was continued through the ages. There is literary evidence that trephination was practised by the renowned medical expert Jivaka who was a contemporary of the Buddha (Lal 1998: 102-107).

Funerary variations

After the Independence, several Harappan sites have been excavated in India: Dholavira, Rakhigarhi, Kalibangan, Lothal, Surkotada, etc. Though earlier impressions of the Harappan sites were of a monotonous sameness, recent work has thrown up evidence of local variations in city plans, burials, religious artefacts, etc. B.B. Lal in his popular book, *India 1947-1997*, emphasizes the evidence of variations in burial customs (Lal 1998: 102-108).

As in the earlier excavations no burials were detected, Mackay thought that perhaps the Harappans cremated their dead. But soon K.N. Shastri, followed by Wheeler, brought to light regular burials of the Harappans at the type-site itself. Emphasizing the differences among burials, Lal points out that sometimes the dead continued to wear their jewellery. Also placed alongside were objects of toiletry, such as mirrors, antimony rods, etc. In one case the body was found encased in a wooden coffin; in another the grave was lined with mud-bricks; and in yet another case there was a mud-brick tumulus over the grave, signifying that here lay someone important (Lal 1998: 102-108). Bisht has reported a unique type of funerary structure (Pl. 7.10).

Lal reports that the excavations at Kalibangan have also brought to light evidence which is new and at the same time intriguing. A rectangular grave-pit was lined with mud-bricks which were given a coating of mud plaster. The body lay supine in an extended position, with the head towards the north. The pottery assemblage was very rich: while thirty-five pots lay below the body, as many as thirty-seven had been placed on the northern side of the head (Fig. 7.18).

In some of the Kalibangan graves there were pots and even beads, bangles, etc. but no body, complete or even fractional. Probably these graves were of a symbolic nature, associated with persons who may have died elsewhere and only the ritual was performed in these graves.

There was yet another variety at Kalibangan. The graves of this type were also located in the same general area, but a little away from the two groups just discussed, but the pit was circular or ovoid and not rectangular. No skeletal remains were found except for a fragmentary bone-piece in only one of the sixteen graves excavated of this type. While these graves too must have a funerary association, their exact nature remains a bit enigmatic (Lal 1998: 102-108).

SURKOTADA

Strangely enough, of the four graves excavated from Surkotada, none was of the usual extended burial type. On the contrary, these yielded only fragments of skeletal remains or even no bones at all. In one case, 'the pit yielded a red ware sherd of an urn and very small charred human bone splinters or remains'. Joshi (1990: 369) emphasizes :

> The *post*-cremation human remains found in a burial bear a great significance. The relatives of the dead in all probability out of regard for the deceased used to take care of the burnt or charred bones after submission of the corpse to fire.

The Surkotada burials are also marked by the use of stones for lining the graves. Often these were also covered with capstones and even had a scattering of stone-rubble over them. The use of stones in the aforesaid manner reminds one of the megalithic graves of South India.

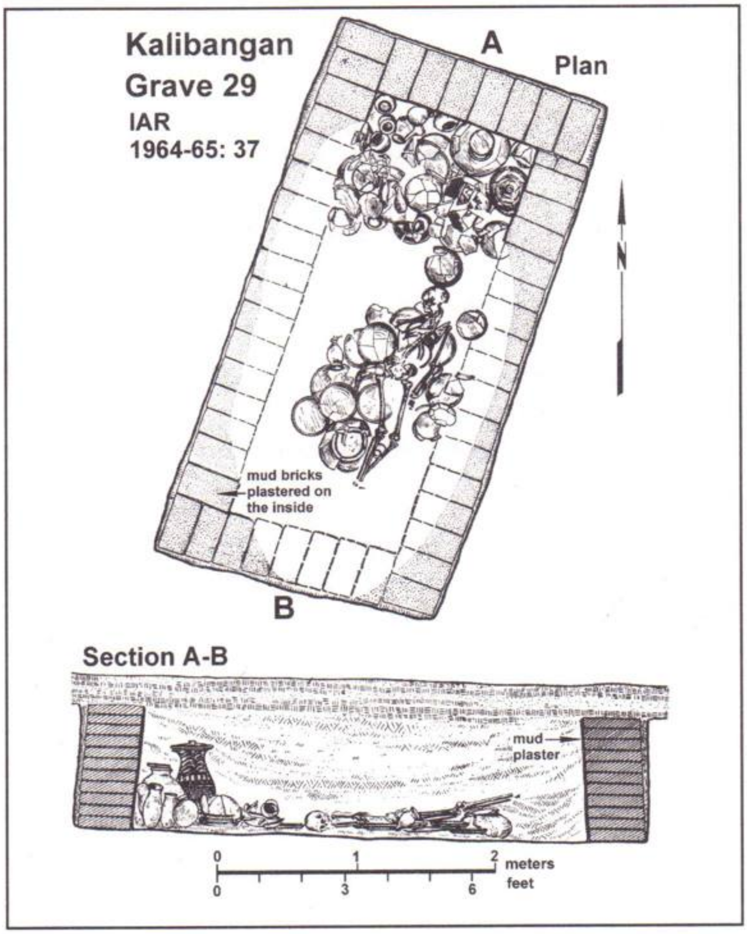


Fig. 7.18 A rich grave at Kalibangan on plan and section (Courtesy ASI).

The Harappans at Surkotada were sometimes burying the bones in pots and sometimes only pots in pits and covering them with a stone slab or a cairn. This is a most unusual form of burial tradition amongst the Harappans. The use of stones reminds one of the South Indian megalithic traditions. The difference, however, is that whereas in the South Indian graves the usual practice was first to expose the body to the elements and then collect some bones and the skull and inter them in megalithic chambers; in the case of the Surkotada graves no such method seems to have been adopted. In Subperiod IC at this site, a white-painted black-and-red ware appears, connecting it to the South Indian megalithic black-and-red ware. Dholavira also strikes a discordant note. Here, out of the many graves excavated, only one is of the standard Harappan type, i.e. having a full skeleton, laid supine in an extended position, with the head on the north. The remaining graves show two separate characteristics, viz. (i) "megalithism"; and (ii) *stupa*-like superstructure.

The type site of Mohenjodaro, interestingly enough, has not yielded any evidence of regular burials so far. In fact, all the burials seem to suggest an unseemly haste in disposing the dead. Nor has the evidence of burials been found at Banawali (Haryana) as the area around the site has been extensively ploughed again and again.

PHYSICAL AFFINITIES OF THE SKELETONS

Possehl (2003: 174), on the basis of the significant human remains from all Indus sites, makes the following interesting observations on the biological affinities of the Mature Harappans and their predecessors:

1. All Indus sites, except Mohenjodaro and Lothal, were inhabited by people with relatively strong affinities to one another. Individuals from Mohenjodaro are somewhat different in their biology than individuals from other Indus sites.
2. There is an affinity between the individuals in Mature Harappan Cemetery R-37 and those in the lower interments of Post-Urban-Stage Cemetery H; however, both of these samples are different from those in the upper stratum of Cemetery H.
3. The individuals from Cemetery R-37 have their closest affinities with the individuals from Periods III through VII at Mehrgarh.
4. There may be some kind of biological discontinuity between the individuals from Periods I and II of Mehrgarh as compared to Periods III through VII.
5. The population of Periods I and II at Mehrgarh has rather close affinities with the Deccan Chalcolithic, as seen from data on skeletons from Inamgaon.
6. The skeletal series from Sarai Khola is closely affiliated to that from Iron Age Timargarha.

8

The Indus Script

INTRODUCTION

Script, standard weights and measures have been the classical criteria for designating a culture as civilization. Writing marks the advent of urban civic society. All ancient urban systems had large volumes of information to record, process, retain, and transmit economic records, dynastic histories, genealogies, religious and ideological documents, literature, and personal identifiers. Equally important perhaps was, as pointed out by Possehl (2003), the manipulation of information, like accounts, history, especially dynastic history, and genealogy.

Though in 1977 Mahadevan included 2,906 written texts, Possehl estimates not more 3100 inscriptions, despite new discoveries from Harappa, Dholavira, and Rakhigarhi. About 87 per cent of all Indus inscribed materials come from Mohenjodaro and Harappa.

The problem is that most of the written documents that have survived are in the form of small stamp seals (personal identifiers?), or in the form of graffiti on pottery. Potters scratched some "words" on wet pots. Such messages must have had meaning to the people who used the pots. Possehl puts it nicely when he says, "There are many things yet to be learned about the Indus script, not the least of which is how to read it (Possehl 2003)."

Before we go into the technical details of various interpretations, it may be worthwhile to understand some basic facts and commonly used terms about scripts. Irfan Habib is a medieval historian and a Marxist academic. Recently he has brought out a popular book, *The Indus Civilization* (2002). He has made some interesting comments on the origins of scripts as also on the Indus script, which are worth quoting to set the stage for further discussion on the Indus script.

Habib explains:

We may imagine that, first of all, messages hitherto transmitted only by word of mouth, began to be conveyed also by scrawled marks. A summons to tribesmen by their chief for participation in a mass-hunt might be sent with the messenger carrying a potsherd with the rough figure of a bow and arrow scrawled on it. To those who saw it, the message would mean not just a bow and arrow, but: 'The chief summons you to come to the mass-hunt tomorrow.' If a mark was added of a half-sun with rays coming out of it, it might give the further meaning: 'Come early in the morning.' Such pictorial marks or symbols are called *pictographs* (or *pictograms). In the two imaginary examples we have given, context or convention gave to the pictographs in question a much more extended sense than just the things they pictorially represented. In time, non-pictorial marks could be used to convey a message which could not be easily represented by a picture. Thus, for example, a cross (X) might be used to convey the sense: 'Come immediately.' A sign of this kind is called an *ideograph* (or *ideogram).* The term *logogram* covers both pictographs and ideographs.

Since the sentences or words represented by logograms were actually pronounced in speech, it was a matter of time before the logograms, besides carrying a particular sense, would also bear a particular sound, that is, have a *phonetic value*. Suppose the language was English, and a roughly drawn eye was the pictograph for "eye". Once pronounced, the pictograph for eye could also transmit to the hearer the sound of "I" (first person singular), the English words "eye" and "I" being *homophones* (words having the same sound). The eye pictograph could, therefore, also bear the sense of "I". (A logogram used for an additional sense called for by its sound is called a *rebus*). Many logograms could begin to represent sounds of both single syllables and groups of syllables. Logograms representing different syllabic sounds could now combine to form totally different words. Take the English word "idol": it has two syllables "i-dol", the second pronounced like "dull". Suppose the word "dull" was represented by an ideograph like an exclamation mark (!). The word "idol" can now be represented by drawing an eye sign followed by an exclamation mark. Such combined signs are called *ligatures*. When a script reaches this stage, it is called *logo-syllabic*.

Sumerian, the world's earliest script (besides the Egyptian), originating *ca.* 3300 BCE, was already a logo-syllabic script, and had 1,200 distinct signs, a number much smaller than the more than 40,000 characters required by the Chinese script, which is purely ideographic. This reduction was achieved in Sumerian by increasing the number of rebuses and ligatures. When this process is completed and the language becomes purely *syllabic*, where each sign essentially represents a syllabic sound, "eye", "sun", "shore", etc., the number of signs can be reduced still further. The Old Akkadian script (used from 2375 BCE onwards) was syllabic and had just 120 signs (*'graphemes'*). ('Alphabets' would develop much later, when the consonants and vowels were separated, reducing the characters or "letters" to a further smaller number. The English alphabet, for instance, makes do with just twenty-six letters).

The nature of the Indus script is indicated by the number of its signs or characters. Because some characters might have had variants or might be ligatures, their precise number is hard to determine. But the characters probably number in all about 400 and do not exceed 450. This number shows that the script was not yet purely syllabic; nevertheless, it had been able to reduce the number of its characters by extensive use of rebuses and ligatures. In other words, it was an advanced "logosyllabic" script .... Such an inference means that even when a character appears to us to be a pictograph, it may well bear many meanings in addition to what it pictures. In our table (Habib 2002, Table 2.2), sign numbers 1, 2, 3, 4 and 5 can be seen to represent, respectively, fish, man, load-carrier (or labourer), jar and three jars. That the fish sign really represents fish is borne out by the picture of a fish-eating alligator in Indus art, where the fish is represented by precisely this sign. Also, the fish sign is found inscribed on a tablet shaped like a fish (to the extent of showing its eyes). But not only are there quite a few variants of the fish sign (nos. 6, 7 and 8 in Table 2.2), but the fish sign itself occurs so often that it must certainly have carried other senses as well. We will presently see that this may have a significant bearing on identifying the language of the Indus script.

Further effort at understanding the Indus script has been concerned with studying the direction of the script and the arrangement of the signs or characters in the different inscriptions, in order to identify groups of characters repeatedly arranged in the same sequence and to establish the positions that various characters occupy in the texts .... The direction of the Indus script is, in fact, decisively established by the positions that certain characters have been found to occupy. Thus, sign numbers 9 or 10 in Table 2.2 are often found at the right end, and numbers 11 and 12 at the left end in single line inscriptions. No. 11 is never found in the right-end position. Yet we find that no. 11 is often relegated to the second line, which is only possible if it is the terminal and not the initial sign. Also, it is on the left side in the seal impressions that the characters usually appear to be crowded, as if the engraver while coming to the end of his text found too little space remaining for him. In both cases, a right to left writing is to be inferred. (On the seals themselves, the text, being in the negative, runs from left to right; but the real intended text is that of the seal impression, which is right to left.) An overlap between signs on a Kalibangan jar also establishes that the text on it had run from right to left. There were very few known exceptions: out of 3,463 lines of Indus inscriptions recorded by Mahadevan (omitting 190 single signs), he found 2,974 lines running right to left and only 235 running left to right. In most cases where there is a second line it also runs from right to left; only in ten known cases does a left to right second line follow a right to left first line – a practice known as *boustrophedon*. The Indus direction of writing practically excludes any connection with the Brahmi script, originating more than 1,500 years later, not only because Brahmi was purely alphabetical but also because it was written left to right.

Certain signs can be explained in their relation to other signs. We have seen that sign no. 5 in Table 2.2 can be interpreted as "three jars" because the sign is written three times; when, as in no. 13, three vertical strokes precede the jar sign, one can say that this is an alternative way of writing "three jars". Such vertical strokes, then, might not mean rain in a pictorial representation, but stand for numerical units. The strokes, usually short, can reach up to twelve, so that larger numbers must have been written differently. Since the Indus weight system is largely decimal (though also binary), it has been proposed that sign no. 14 should read as fifteen, the lower semi-circular line standing for ten.

Contexts may also help identify certain characters. Sign no. 15 in Table 2.2 occurs eleven times (in ten of them in the initial or final positions) in seals found at Chanhudaro, but is found nowhere else. Parpola suggests that it represents the unknown Indus place-name of Chanhudaro. Sign no. 9, in addition to its initial position elsewhere, occurs near the end in "ownership" inscriptions on two Mohenjodaro axes, so as to suggest that, standing pictorially for a parasol, it signified a title of eminence (or, when doubled, as in these inscriptions, for one of great eminence).

Habib warns:

Beyond some very provisional explorations, however, it would be dangerous to go. We would wish the script to tell us about the Indus civilization, not impose meanings on its characters on the basis of what we think its social features, beliefs and rituals were. Diverse efforts to impose a Vedic or Aryan garb on the Indus civilization through claimed "decipherments" (for example, by S.R. Rao, Subhash C. Kak, and N. Jha and N.S. Rajaram) are not only mutually inconsistent but are ruled out by the arbitrary nature of their assumptions. This is also partly true of the attempts to read the script by giving Proto-Dravidian phonetic values wholesale to various Indus signs (as by Fr. H. Heras and Walter A Fairservis). But, perhaps, the case for Proto-Dravidian is not without some merit.

Here we may return to our fish sign (no. 1 in Habib 2002, Table 2.2). As we have noted, it occurs so frequently in Indus inscriptions that it cannot all the time just mean fish. It has been noticed that the best explanation comes if the sign is given the phonetic value of *min*, which, in the Dravidian languages (and so in the reconstructed Proto-Dravidian), represents homophones standing for "fish", "shining" and "star". The last meaning makes good sense, given the position the fish sign occupies in representations of deities on seals; and no. 16 in Table 2.2, the sole text of a seal, is actually explained by Parpola as "Seven Stars", or the Great Bear constellation. No such corresponding range for the word for fish is available in Proto-Indo-Iranian (the reconstructed early "Aryan" language). The evidence, therefore, tilts in favour of Proto-Dravidian as the more likely source for the phonetic values of Indus signs.

One hopes that a bilingual inscription with an Indus inscription set by the side of a Sumerian or Old Akkadian text might one day be discovered in Iraq, or south-western Iran. We may then obtain the meanings and phonetic values of a few Indus characters, which could help us in finally determining the language family to which the Indus speech belonged. Once this link is established, a more extensive decipherment may, in turn, become possible. At this stage, the immense material collected and classified by Mahadevan and by A Parpola and his team would be indispensable for both testing and guiding such decipherment. All this may seem to be no more than castles in the air; but such things have happened in the past with other scripts (Habib 2002: 67-71).

With this introduction, we now discuss the previous attempts at decipherment of the Indus script.

PREVIOUS ATTEMPTS AT DECIPHERMENT

The Harappan seals, sealings and pots have legends in a pictographic script comprising some 400 signs. No evolution in the script throughout the centuries has been noticed. Such a large number of signs precludes the possibility of it being an alphabetic script. But Rao (1973) finds only 52 basic signs in the total of the 400. He thinks that it is a syllabic-cum-alphabetic script which was disciplined into an alphabetic one in *ca.*1500 BCE. The script does not seem to bear any resemblance either with its contemporary foreign scripts or with the historical scripts of India. In fact, it is quite intriguing to learn that neither the script nor the great Harappan civilization left any trace in the historical records, later scripts or even in the folklore (We have discussed this enigma in Chapter 7 on Religion). In the absence of long inscriptions, where recurrent formations could be studied, and of bilingual inscriptions, a plethora of claims of decipherment have cropped up and it is not easy to choose one claim from another. The Indus script thus continues to be an enigma even today. Now new claims have been made which deny it the status of a script at all!

The most comprehensive and systematic study of the Indus script today is Asko Parpola's *Deciphering the Indus Script* (Parpola 1994), though agreement among scholars still eludes us. Tracing the history of the attempts at deciphering the Indus script, Parpola (1994) says that all kinds of answers have been offered to the questions posed by unsolved scripts ever since Graeco-Roman times. Thus in 1580, Goropius Beccanus of Amsterdam tried to prove that the language of the ancient Egyptian was Dutch! In the case of the Indus script, connections have been sought with the manuscripts of the Lolos living in southern China and in South-east Asia, dating back to the sixteenth century AD; with Proto-Elamite accounting tablets; with ideograms carved some two centuries ago on Easter Island in the south-eastern Pacific Ocean; with Etruscan pot-marks; with the numeral system of Primitive Indonesian; with Egyptian, Minoan and Hittite hieroglyphs; with the auspicious symbols carved on a 'footprint of the Buddha' in the Maldivian archipelago; and with the glyphs of ancient Central America.

But Parpola does not dismiss them as totally useless and finds some useful ideas in them too! To point out clearly how those schemes are mistaken may help to eliminate them from future work on the subject. For example, Sir Alexander Cunningham (1875), considered the first published Indus seal to be a foreign import because the bull carved on it lacked a hump, and later (1877) supposed that it might bear 'archaic Indian letters of as early an age as Buddha himself.' Another example is the "Indo-Sumerian" hypothesiz prevalent shortly after the discovery of the Indus civilization. In 1925 it provided a natural starting point for L.A. Waddell, a Tibetologist, who "read" all the published inscriptions in his book, *The Indo-Sumerian Seals Deciphered.* Waddell read the resulting sequences as "revised forms" of the names of Sumerian kings, and of Aryan kings mentioned in the Vedas and in Sanskrit epics. Waddell's method is among those most often used in attempts at decipherment. Transferring the phonetic values of signs in a known script to similar-looking signs in an unknown one is likely to work only if the two scripts are genetically closely related, and even then similar signs may have quite different phonetic values.

Another frequently used approach is to interpret an Indus sign pictorially and then assign it a syllabic value taken from the corresponding word of a chosen language by the principle of acrophony. This has been the favourite approach of many Indian scholars. Nationalistic ideas make it difficult for some North Indians to admit even the possibility of the Indus civilization being pre-Aryan; they deny the very concept of Aryan immigration and insist that the Harappan and Vedic cultures are one and the same. So the language chosen has usually been Sanskrit (Parpola 1994).

Hrozny derived the Indus script from the Hittite hieroglyphs (which actually are a thousand years younger) on the basis of superficial similarities. Sir John Marshall (1924) was the first to suggest that the Indus civilization was non-Aryan and that its language most probably belonged to the Dravidian family. Dravidian languages are nowadays spoken mainly in South India, where Tamil has a two millennia old literary history.

Father Heras in his book, *Studies in Proto-Indo-Mediterranean Culture* (1953), tried to reconstruct it as a Proto-Dravidian language, though there is no independent means of checking his meanings. Father Heras correctly thought that it would be possible to reconstruct Proto-

Dravidian by comparing its surviving daughter languages, though his own efforts to do so are amateurish. Heras characterizes the Indus script as a "pictophonographic" writing system, whose signs 'do not stand for syllables and much less for consonant sounds only, but express full words'. In practice, however, he entertains quasi-phonological assumptions about the nature of the Indus script, which are in conflict with the established history of writing. His analysis of the signs and his method of determining their phonetic value (from their pictorial shape, or from similar-looking signs in other scripts) have their own logic, but cannot be accepted, because they are not supported by the principles on which known scripts are based.

Thus the Indus script has been deciphered as Indo-Sumerian, Hittite, Indo-Aryan, Dravidian, etc. Meriggi tried to use the Dravidian language of Brahui, spoken in Baluchistan, to decipher the Indus script but gave up later on.

RECENT ATTEMPTS

In 1964, the Russian scholar Knorozov and his team launched a more scientific attempt at decipherment. They supposed the Indus script to be logo-syllabic type rather than syllabic or alphabetic. They did a computer analysis of the Indus signs and considered the high frequency signs as grammatical markers and signs with low frequency as root morphemes, like in the Egyptian. With the help of interval statistics they divided the scripts into blocks of one to five signs corresponding to words of the Indus language. By the structural analysis the Russian scholars identified the Indus language as belonging to the Dravidian family, though their approach has been criticised for insufficient differentiation between script and language.

Kamil Zwelebil (1976: 138) has reviewed the Russian approach in the following words:

> Proof that the readings and translations are correct may be offered only in the following way: (a) either a bilingual inscription or inscriptions will confirm the correctness of the "Dravidian hypothesiz"; (b) or, in the absence of a bilingual text, a much greater amount of material must be read, translated and interpreted, and this large sum of translated data must form a meaningful, logical and internally consistent corpus of data. Until then, the Dravidian affinity of the Proto-Indian language remains only a very attractive and quite plausible hypothesiz (Zvelebil in Zide and Zvelebil 1976: 138).

Mahadevan has also interpreted the Indus script as Dravidian. His readings are based on parallels offered by old Tamil descriptions. Parpola thinks that there is nothing inherently improbable in Mahadevan's approach, but his proposed concrete interpretations have failed to produce convincing internal proofs. The attempts by Fairservis have also been called 'far-fetched analysis of the pictograms.'

While the scholarly world was waiting for a bilingual inscription to be discovered to solve these controversies, a well-publicized claim came to the fore, almost to substantiate the fears of Possehl. We briefly report this recent attempt at decipherment (N. Jha and N.S. Rajaram, *The Deciphered Indus Script: Methodology, Readings, Interpretations*) which was exposed by Witzel and Farmer (*Frontline:* Volume 17 - Issue 20, Sep. 30 - Oct. 13, 2000). As such unscientific claims are inspired by chauvinistic considerations rather than by a scientific approach, a longish summary of Witzel and Farmer's (2000) observations seems to be appropriate to dispel the confusions.

A press report said, 'noted historian, N.S. Rajaram, who along with palaeographist Dr. Natwar Jha, has read and deciphered the messages on more than 2,000 Harappan seals.' The internet was abuzz with reports that Rajaram and Jha had decoded the full corpus of Indus Valley texts. Witzel and Farmer, in fact, called it a hoax. We summarize below the arguments given by Witzel and Farmer against the claims made by Jha and Rajaram.

Though Gregory Possehl had reviewed thirty-five attempted decipherments, the claims of Rajaram and Jha went far beyond those of any recent historians. Not only had the principles of decipherment been discovered, but the entire corpus of texts could now be read. Even more remarkable were the historical conclusions that Rajaram and his collaborator said were backed by the decoded messages.

Rajaram said the earliest text could be translated as 'Ila surrounds the blessed land' – an oblique but unmistakable reference to the Rigveda's Saraswati River. The suggestion was that man's earliest message was linked to India's oldest religious text. The claim was hardly trivial, since this was over 2,000 years before Indologists date the Rigveda – and more than 1,000 years before Harappan culture itself reached maturity.

Rajaram and Jha's *The Deciphered Indus Script* made it to print in New Delhi in the year 2000. Jha is a provincial religious scholar, previously unknown, from Farakka, in West Bengal. Rajaram took credit for writing most of the book. Boasts like this do not surprise battle-scarred Indologists familiar with Rajaram's work. Rajaram was a U.S. engineering professor in the 1980s, but in the 90s became a historian. Rajaram claims that the Rigvedic *rishis* packed their hymns with occult allusions to high-energy physics, anti-matter, the inflationary theory of the universe, calculations of the speed of light, and gamma-ray bursts striking the earth three times a day. *The Deciphered Indus Script* makes similar claims with different weapons. The Indus-Saraswati Valley again becomes the home of the Rigveda and a font of higher civilization: Babylonian and Greek mathematics, all alphabetical scripts, and even Roman numerals flow out to the world from the Indus Valley's infinitely fertile cultural womb. Witzel and Farmer point out that the character shapes in Mature Harappa appear to be strangely "frozen", unlike anything seen in ancient Mesopotamia, Egypt or China. This suggests that expected "scribal pressures" for simplifying the script, arising out of the repeated copying of long texts, was lacking. And if this is true, the Indus script may have never evolved beyond a simple proto-writing system. The methods of Jha and Rajaram were so flexible that virtually any desired message could be read into the texts. The Indus language was declared to be "Late Vedic" Sanskrit, some 2,000 years before the language itself existed. Through the decoded messages, the horseless Indus Valley çivilization – distinguishing it sharply from the culture of the Rigveda – was awash with horses, horse-keepers, and even horse rustlers. To support his claims, Rajaram pointed to a blurry image of a "horse seal" – the first pictorial evidence ever claimed of Harappan horses.

Within weeks, Witzel and Farmer demonstrated that Rajaram's "horse seal" was a fraud, created from a computer distortion of a broken "unicorn bull" seal. This led Indologist wags to dub it the Indus Valley "piltdown horse" – a comic allusion to the "piltdown man" hoax of the early twentieth century. Witzel and Farmer point out that horses were critical to Vedic civilization, as Vedic texts describe horse sacrifices, horse raids, and warfare using horse-drawn chariots. If Rigvedic culture (normally dated to the last half of the 2nd Millennium BCE) is identified with Harappa, it is critical to find evidence of extensive use of domesticated horses in India in the 3rd Millennium BCE. Evidence suggests that the horse (*Equus caballus*) was absent from India before around 2000 BCE, or even as late as 1700 BCE, when archaeology first attests its presence in the Indus plains below the Bolan Pass. The horse, a steppe animal from the semi-temperate zone, was not referred to in the Middle East until the end of the 3rd millennium. In India, the hemione or *khor (Equus hemionus khur)* was the only equid known before the horse; a few specimens still survive in the Rann of Kachchha. We also discuss the problem of horse under animal husbandry in Chapter 9 on Trade, Agriculture and Animal Husbandry.

The appearance of domesticated horses in the Old World was closely linked to the development of lightweight chariots, which play a central role in the Rigveda. The oldest archaeological remains of chariots are from east and west of the Ural Mountains, where they appear *ca.* 2000 BCE. Chariots like these were high-tech creations. Rajaram dates the Rigveda to early 4th or even 5th Millennium BCE, which is long before *any* wheeled transport – let alone chariots – existed. The late Hungarian palaeontologist S. Bokonyi, wrote that: "horses reached the Indian subcontinent in an already domesticated form coming from the Inner Asiatic horse domestication centres". Ajita K. Patel and Meadow (a well-known archaeozoologist) argue that not *one* clear example of horse bones exists in Indus excavations or elsewhere in North India before *ca.* 2000 BCE (comment by Meadow and Patel on Bokonyi's work in *South Asian Studies* 13, 1997, pp. 308-315). Contrast this opinion of experts with Rajaram's claims:

> The "horse seal" goes to show that the oft repeated claim of 'No horse at Harappa' is entirely baseless. Horse bones have been found at all levels at Harappan sites. Also ... the word "as'va" (horse) is a commonly occurring word on the seals. The supposed "horselessness" of the Harappans is a dogma that has been exploded by evidence.

Witzel and Farmer assert that once you see Mackay's original photo, it is clear that Rajaram's "horse seal" is simply a broken "unicorn bull" seal, the most common seal type found in Mohenjodaro. What in Rajaram's "computer enhancement" looks like the "neck" and "head" of a deer is an illusion created by distortion of the crack and top-right part of the inscription. Any suggestion that the seal represents a whole animal evaporates as soon as you see the original. The fact that the seal is broken is not mentioned in Rajaram's book. You certainly cannot tell it is broken from the "computer enhancement".

While Rajaram's bogus "horse seal" is crude, because of the relative rarity of the volume containing the original, which is not properly referenced in Rajaram's book, only a handful of researchers lucky enough to have the right sources at hand could track it down. Rajaram's evidence could *not* be checked by his typical reader in Ahmedabad, say – or even by Indologists using most university libraries. Like everyone else looking at the original, Parpola notes that Rajaram's "horse seal" is simply a broken "unicorn bull" seal, one of numerous examples found at Mohenjodaro. Checking Rajaram's claims about the "genital area", we find no genitals at all in M-772A or Mackay 453 for the simple reason that genitals on unicorn bulls are typically located right where the seal is cracked!

The introduction of chariots and horses is one marker for the earliest possible dates of the Rigveda. The ancient Iranian and Vedic word for chariot was coined sometime around 2000 BCE – about when chariots first appeared – but before those languages split into two. A good guess is that this occurred in the steppe belt of Russia and Kazakhstan, which is where we find the first remains of chariots. Vedic Sanskrit was not native to South Asia but an import, like closely related old Iranian. This view is supported by recent linguistic discoveries. One is that approximately 4 per cent of the words in the Rigveda do not fit Indo-Aryan (Sanskrit) word patterns but appear to be loans from a local language in the Greater Panjab. That language is close to, but not identical with, the Munda languages of Central and East India and to Khasi in Meghalaya. A second finding pertains to shared loan words in the Rigveda and Zoroastrian texts referring to agricultural products, animals, and domestic goods that we know from archaeology first appeared in Bactria-Margiana *ca.* 2100-1700 BCE. Rajaram's assertion that the Harappans spoke "Late Vedic" Sanskrit – the language of the Vedic sutras (dating to the second half of the first millennium) – is off by at least two thousand years!

According to Rajaram and Jha, the Indus writing system was a proto-alphabetical system, supposedly derived from a complex (now lost) system of pre-Indus "pictorial" signs. Faced with a multitude of Harappan characters, variously numbered between 400 and 800, they select a much smaller subset of characters and read them as alphabetical signs. Their adoption of these signs follows from the alleged resemblances of these signs to characters in Brahmi, the ancestor of later Indian scripts. (This was the script adopted *ca.* 250 BCE by Asoka, whom Jha's 1996 book assigns to *ca.* 1500 BCE!) Unlike Brahmi, which lets you write Indian words phonetically, the alphabet imagined by Jha and Rajaram is highly defective, made up only of consonants, a few numbers, and some special-purpose signs. Vowels were lacking in some early Semitic scripts, but far fewer vowels are required in Semitic languages than in vowel-rich Indian languages like Sanskrit or Munda. Witzel and Farmer then go on to show how Rajaram and Jha can invent free interpretations to suit their hypothesiz. They also read the script from left to right, to make it look like Sanskrit, but B.B. Lal (1997: 79-87) has proved beyond doubt that it reads from right to left.

Witzel and Farmer explain how the method of Rajaram and Jha is so flexible that you can squeeze some pseudo-Vedic reading out of any inscription.

Concluding their article, Witzel and Farmer say that it might be tempting to laugh off the Indus script hoax as the harmless fantasy of an ex-engineer who pretends to be a world expert on everything from artificial intelligence to Christianity to Harappan culture. What seems to worry Witzel and Farmer is that what belies this reading is the ugly subtext of Rajaram's message, which is aimed at millions of Indian readers. That message is anti-Muslim, anti-Christian, anti-Indological, and (despite claims to the opposite) intensely anti-scientific. Those views present twisted images of India's past capable of inflicting severe damage in the present.

Witzel and Farmer conclude that *The Deciphered Indus Script* is based on blatantly fake data (the "horse seal", the free-form "decipherments"); disregards numerous well-known facts (the dates of horses and chariots, the uses of Harappan seals, etc.); rejects evidence from whole scientific fields, including linguistics (a strange exclusion for a would-be decipherer!); and is driven by obvious religious and political motives in claiming impossible links between Harappan and Vedic cultures.

Farmer's Radical Hypothesiz was that the Harappans were Illiterate!

It seemed that the Indus script studies had reached a dull plateau, with scholars reading in it both Indo-Aryan languages and the Proto-Dravidian, without any new evidence forthcoming. Now Steve Farmer has thrown a "bomb" into the script studies. He does not consider the Indus script a script at all! The arguments have become a bit technical to discuss them in general terms. I therefore give below the main arguments in the words of the protagonists themselves. I am giving details of their arguments so that it encourages debate, though I have my own reservations. At the end I raise a few questions and also give the comments by Lamberg-Karlovsky and Possehl.

Farmer and Witzel's (Farmer et al. 2002; in press; and his presentations at the Harvard Round Table meetings) main arguments are:

1. In all ancient societies that had true scripts and produced manuscript traditions, scribal pressures to simplify and economize the copying process normally led to profound and rapid transformations in those scripts. Such evidence of "scribal pressures" shows up in cuneiform writing systems and in Egyptian, Chinese, and Mesoamerican scripts. No radical changes of this type show up in the 700 or so years in which the Indus symbols existed.
2. Every pre-modern civilization we know that had manuscript traditions on perishable materials also left extensive texts behind on pots and pottery. This is not the case in Indus inscriptions, where pottery and pot inscriptions are even shorter on the average than those found on seals and other durable materials, which average only 4-5 symbols long.

3. Every pre-modern civilization which had manuscript traditions also left long texts behind on durable goods besides pots and pottery (Obvious examples: rock inscriptions, knives, copper and bronze artefacts, architectural inscriptions, stelae, and so on). Again, all such evidence is entirely lacking in the Indus Valley.
4. Every pre-modern civilization that had extended written traditions on perishable materials (including the Maya, Egyptians, Chinese, Assyrians, and Babylonians, etc.) also left behind copious pictographic suggestions within the script of texts, scribes, or writing materials. No suggestions of this sort are found in the Indus Valley.
5. Every pre-modern civilization that had extended written traditions also left iconographical evidence behind of texts, scribes, or writing materials outside their scripts (e.g. in paintings, objects like Egyptian figures, etc.). Many examples of this can be given from pre-modern civilizations outside South Asia. No such evidence like this exists in Harappan artefacts. This is again incompatible with a literate society.
6. Every pre-modern civilization that had extended manuscript traditions also left behind archaeological evidence of writing instruments. No credible evidence like this exists in Harappa.

Farmer further argues that the closest apparent parallel to the Indus system can be found in a wide range of formal symbol or emblem systems from the Near East whose development can be traced from the 4th millennium to the Hellenistic era. Emblem inscriptions ranged from one to over several dozen signs in length, making some longer than any Indus inscriptions; examples show up on seals, stelae, plaques, boundary stones (*kudurrus*), cliff walls, friezes, amulets, and other media from Egypt to Eastern Iran. As in the Indus case, a few high-frequency signs tend to dominate in these inscriptions, supplemented by hundreds of rare signs.

The base sense of most of these signs is typically represented as signs of gods, although a few could represent abstract concepts; even apparent numerals in the inscriptions. But just as important as their basic sense were complex associations that linked these signs to the celestial, terrestrial, and human realms. Parallels with Near Eastern symbols suggest that it will never be possible to reconstruct the sense of Indus signs with the same precision expected of phonetic symbols: their function was not to record information, like true scripts or even mnemonic systems, like the *khipu* systems of the Inca, but to identify persons, groups, or events with particular divinities, and in a subsidiary way, to draw on those divinities' power through their amuletic powers.

Farmer then asks, why the Harappans did not adopt literate technology. He suggests that one possibility consistent with the evidence is that the shamanic-looking elites depicted on Indus ritual inscriptions opposed the introduction of writing due to the threats it posed to the control they exerted using the symbols over urban populations. He thinks that this explains the fact that many Indus seals and seal impressions have shown up in the Gulf region and in Mesopotamia.

Social cohesion may also have factored in the Harappans' preference for their sign system. Studies of loan words in the oldest levels of Vedic traditions suggest that Indus territories may have been just as diverse linguistically as they are today, negating old debates over "the" language of the Harappans. In a giant multi-linguistic civilization, a simple system of political-religious signs that could be interpreted in any language may have provided greater cultural cohesion than any script; the use of such a system helps explain why the society managed to expand over a wider area than any literate civilization of the 3rd millennium. The fact that Indus symbols were tied to a pan-Indus ideology is suggested by the suddenness with which the symbols vanished early in the 2nd millennium, which is not typical of the ways that ancient writing systems normally disappeared. The fact giant urban civilizations like those of the Indus Valley flourished without literate technology suggests that ancient 3rd millennium civilizations were considerably more varied than assumed in the past.

DISCUSSION

In a personal communication, Lamberg-Karlovsky comments:

As for the hypothesiz of Farmer that the Indus seals have no writing, I have little regard for this approach. Clearly, both the iconography and the signs have distinct meaning. I recall the notions prior to the decipherment of cuneiform; namely that they were a random style of decoration, and then there were those that held that Egyptian hieroglyphs were ritual symbols for the worship of animals. Prior to decipherment there have always been those that deny the past literacy. The image bears one message and the signs bear another message. I think the Proto-Elamite analogy is a helpful one. On the seals are animals, bulls, sheep, lions, etc. These are believed to refer to regional polities. There is a sensational seal published by Amiet that shows a human offering a bull a tablet. Now there are NEVER humans depicted on Proto-Elamite seals, contrary to those in Mesopotamia where humans are frequently depicted. Amiet offers the interpretation that the human, a Sumerian, offers writing to Susa, depicted by the bull. This hypothesiz is beyond proof but does confirm to the fact that writing is earlier in Sumer and the Proto-Elamites do adopt almost 50 per cent of Sumerian signs for their very different language. Thus, the animals, the motifs on the Indus seals, could refer to specific polities. As the unicorn is the most frequent glyph it could be the largest polity. The signs refer to specific items, people, titles, goods, or all of the above. Farmer's hypothesiz suggests that over a large area people were involved in the scribbling of nonsense ..... The Indus appears to have on the seals a glyph, numbers, and signs. The message being conveyed is short and very concise ... they should be directly compared to what they are finding in Predynastic Egypt at Abydos ... a single glyph, numbers and a sign or three.

My comments

Farmer seems to suggest that the Indus symbols identify the elite, important individuals. If it were true the Harappan graves should yield seals associated with the elite buried. None of the graves yields any seals. Use of seals to stamp goods' parcels is well attested at Lothal and clearly they are stamped over clay with marks of rope still there. If they did not carry any commercial information (owner/quantity, to whom sent, etc.), what did they convey? At Dholavira the early seals did not have any inscriptions at all. They appear later. This could also indicate inclusion of Dholavira in the trade circuit, or higher urban status. Habib (2002: 45-50) thinks that it is certain that the extensive Indus trading system could not have worked merely through barter (exchange of one set of goods for another). There is also the possibility that some seals served as "tokens" for goods, and their undeciphered texts might indicate their "value" in terms of particular goods.

SUMMARY

There are two main groups: one proposing that the Indus script is proto-Dravidian, and the other Indo-Aryan; and then of course there is Steve Farmer who does not give it even the status of a script. Asko Parpola (1994), Konorozov, and others favour a Dravidian affinity whereas Rao and some others claim it to be an Indo-Aryan language. The arguments and counter-arguments are quite technical and can best be seen in Parpola (1994). To be able to do a systematic decipherment, a comprehensive corpus of concordance has been computer-generated by Mahadevan (1977) and the Finnish team (Koskenniemi and Parpola 1979-82). With the publication of *Corpus of Indus Seals and Inscriptions* (Joshi and Parpola 1987), the attempts at deciphering will become easier. In 1992 Franke-Bogte also produced a thorough documentation of the glyptics of Mohenjodaro. M.N. Gupta (pers. comm.) was, however, very critical of these works and has reported many contradictions between the two. He finds about 70 symbols missing from both the works. He severely criticised Mahadevan's 'tempered normalized signary' as it has corrupted hundreds of texts beyond recognition. He finds it a wasteful repetition of identical texts; at times a single text has been repeated 40 times. Despite such reported shortcomings, one feels that such compendia will prove invaluable for research workers on the script.

Parpola (1994) describes the problems of the Indus script as a crossword puzzle. As long as there is no bilingual inscription, we can never be sure. But the probability of correctness increases with the number of interlocking solutions. Though several scholars have been working on the Indus script with similar methodology and basic assumptions, there is little consensus on the interpretations. But there are some agreements too between different interpretations and Parpola pleads that they be taken seriously. The debate continues till we have a bilingual or some more compelling evidence to accept a particular reading of the Indus Age scripts.

The direction of the script has now been accepted to be mostly from right to left and not boustrophedon (right to left and then left to right), which is rare.

At this stage it may be relevant to recall Possehl's observations. He thinks that there seems to be a certain amount of impatience on the part of some researchers working on the Indus script. So many scholars who have ventured into this area of Indus scholarship have been captured by their own work and have moved quickly from an initial hypothesiz to a series of conclusions and readings. This has meant that the patient, somewhat dreary work that would increase our understanding of the internal workings of the script and its cultural environment, has been neglected. A more methodical, deliberate approach to the decipherment program, with a kind of team spirit (as with the Finns and Soviets), would almost certainly increase the chance for progress on this important subject. As it is now, researchers barrel ahead in their own directions, showing little evidence that they can, or even care to, draw on the work of their colleagues. There is some congenial give and take, and occasional critical asides noting disagreement with the conclusions of others, but entire books can appear with the author paying almost no attention to anyone else's research. It is sad, but true, with the exception of the concordances of the Indus script, that we are no nearer a decipherment than G.R. Hunter was with his groundbreaking work in 1929 (Possehl 2003).

9

Trade, Agriculture and Animal Husbandary

TRADE

This chapter is devoted to the Indus trade and agriculture, though one has to keep in mind that trade in a 3rd Millennium BCE context and of today have very different connotations. Most of it was confined to an exchange between elites for luxury goods, though grain for the boatmen and pastoral nomads was also part of this ancient trade. It also seems to be part of cultural and diplomatic exchange in Middle Asia. It was dependent upon the natural trade routes as there were no highways, and when the marine technology became available the marine route was preferred as it was cheaper and safer. All these features characterize the Harappan trade as well.

In the beginning Marshall called the Indus civilization the "Indo-Sumerian civilization". Now it is recognized that it had its own independent status though it was never isolated from the other neighbours areas. Recent studies have amply demonstrated that in the period 2600-2000 BCE the people of the Indus civilization were engaged in trade, exchange, and what appears to have been quite intense, regular intercourse with people in the Arabian Gulf, Mesopotamia, Central Asia, and the Iranian plateau. This interaction resulted in exchange of ideas and artefacts which is writ large on the archaeological evidence. While we are discussing ancient trade, it may be pertinent to keep in mind Owen Lattimore's profound observations:

> There is a danger in assuming that trade in the times in which the archaeologist deals can be defined in the same way as trade after the rise of machine industry, capitalism and modern banking. It was often a form of tribute, in part an exchange of luxuries rather than necessities, among ruling princes and great nobles and in part, in the transport and sale of grain from agricultural regions to pastoral nomads, it contributed to symbiosis, in times of peace, between two kinds of society.

Before we talk about the trade proper, we need to discuss the trade routes.

TRADE ROUTES

In Chapter 3 (Spatial Extent) we referred to Jansen's original hypothesiz that Mohenjodaro was built de novo on the alluvial plains of the Indus. Was the choice because of agricultural use of the soil? At least, the urban lay-out of Mohenjodaro does not point towards an agricultural settlement. Jansen thinks that it is more likely to have been a centre of "coordinative administration". He asks, 'If it was not primarily the fertility of the inundation which made the Indus people to settle so close to the river itself what else could have been the reason for such an extraordinary (and very expensive!) effort?" Even in relation to the potential land route systems of the Indus Valley, the locus of the city in the middle of the alluvial Indus plain would have been absolutely unfavourable as Mohenjodaro would have been cut off from land routes for more than four months in a year by the inundating river. The round-the-year availability of the Indus as a water transportation route by boat enabled permanent access, especially during the inundation period to the entire river system with its tributaries and to the entire coastal zone of the Arabian Sea. For the selection of the locus of Mohenjodaro the crossing of two transport systems must have been responsible: the water system of the Indus itself and the west-east land route from the Quetta Valley (Mundigak and further on to Mesopotamia) along the Bolan River to Kot Diji and the western Nara. At Kot Diji, for example, the richest flint mines of the Rohri hills were long exploited. Thus, according to Jansen, the Indus civilization was controlled from Mohenjodaro primarily by means of water transport. Taking into account all the evidence, Jansen suggests that Mohenjodaro was not a centre of production but rather of administration. It was the new centre on the main line of the Indus communication.

With the other cultures also Mohenjodaro had contacts. The Bolan river system rises in the uplands of Quetta, flows through the Bolan Pass, and picks up one of the main west-east axis which points directly towards Mohenjodaro. Traversing the Indus at Kot Diji, a centre for flint mined in the adjacent Rohri hills, this axis ends here, and if not at nearby Mohenjodaro. The Quetta Valley is linked further to the west to the important settlement at Mundigak. The latter in turn is integrally linked with the Helmand and Namazga cultures as well as with the area of Elam and thus with Mesopotamia.

Jansen says that this transportation corridor was especially important in the first half of the 3rd Millennium BCE. In the second half of the 3rd millennium this overland connection collapses. In its place evidently a sea route develops along the Makran coast leading to the Umm an Nar culture of south-eastern Arabia and onto Dilmun. Following the decline of the Mature Harappa culture around 2000 BCE, new and intensive influences came from the West and from Central Asia (for example in Mehrgarh VIII) and afterwards from 1400 BCE with the coming of the Aryans.

Emphasizing the importance of Shortughai, in the highlands of Baluchistan, Jansen says that it was a trading station for lapis lazuli from Badakshan. Evidently in control of the lapis mines, this settlement from 2500 BCE is Mature Harappan. The presence of a population from the Indus Valley correlates with the shift from a land to sea trade. Thus, lapis must have been transported first to the Indus Valley, then by sea route to the Arabian Peninsula, before perhaps reaching its final destination in Egypt. Jansen himself admits that this is a challenging statement. The *Periplus Maris Erythraei* informs us that lapis belonged to the most important trade goods from the Indus during the Roman Empire, a tradition which reached back to the 3rd Millennium BCE. The replacement of land with sea trade made the Indus system more dependent on the outside world (Jansen 2002: 121).

While we are discussing the importance of Shortughai, it may be relevant to recall Possehl's observations which put Shortughai in a broad set of relationships that were part of the Harappan civilization's external relations. While the desire to participate in the lapis trade by moving closer to the source, or the attractiveness of Bactrian camels may have played a role in the day-to-day going on at this place, we have to look to a broader context to understand the *raison d'être* of the settlement.

Possehl looks at Shortughai as a symbol of the Harappans on the borders of their "allies", or "friends" to the north. It was a positive gesture; it contributed to the general atmosphere of goodwill; it brought different kinds of people into peaceful daily contact. It was a communications node for elites, or in Lattimore's words for the 'ruling princes and great nobles' of these regions.

It might even be thought of as a prototype of an embassy. Other things were probably involved as well, including the crass forms of commerce and trade that have already been suggested. Shortughai was undoubtedly a settlement enmeshed in social, economic and political complexities all of which contributed to its vitality. Possehl warns that to think of Shortughai as either a simple trading post, or a manufacturing centre for products of lapis lazuli, would seriously distort its reality and the reality of the vitality of the Middle Asian interaction sphere (Possehl 1997-98: 57-70).

Lamberg-Karlovsky complements the picture by emphasizing the role of the sites like Tepe Yahya in Iran in the Indus-Mesopotamian indirect land-route trade. He says:

> ... there was an established dialectic between these (Iranian) resource-rich areas with resource-poor Mesopotamia on the one hand and the Indus on the other which brought about a mutually dependent parallel and contemporary process toward urbanization.

From the point of view of trade routes, Shahr-i-Sokhta in Seistan is also a very interesting site. It is close to the "lake" into which the Helmand empties itself which provides some naturally irrigated tracts near its margins. It has given good evidence of growing wheat, barley, linseed, grape and melon. The bones include cattle, sheep, goat and the Bactrian camel. It needs to be noted that in the early 3rd Millennium BCE Shahr-i-Sokhta was already a brick-built town of about 150 hectare, larger than any Harappan town. Shahr-i-Sokhta was like a hub from where natural highways radiated to Kandahar, Tedzen delta and Turkmenia in the North. Shahr-i-Sokhta and Mundigak had links with Mehrgarh and Quetta sites in the Pre-Harappan period but none with the Mature Harappan sites and similarly the Mature Harappan elements are marked by their absence from the Kandahar and Seistan regions. This perhaps indicates that the Harappans were guarding their borders from the north-western neighbours.

The two-humped Bactrian camel was domesticated right from the beginning of the Bronze Age and probably came from Turkmenia to Shahr-i-Sokhta. This raises the possibilities of finding camel remains from the Harappan levels though there is some controversy about its actual date. There are ample examples of Harappan artefacts in Turkmenia and, conversely, Central Asian artefacts at the Harappan sites.

Ratnagar cautions us that the spread of the Harappan artefacts may not all be due to trade. The establishments of the state boundaries, implanted colonies and search for minerals could all have required movement, migration and dislocation of people. Information about people and places would have spread through uprooted people and peripatetic animal herders, also through inter-marriage. No wonder that Mohenjodaro human figurines shows a variety of facial features, jewellery and hair styles which shows that Mohenjodaro, even in the 3rd Millennium BCE was a very cosmopolitan town (Ratnagar 2001: 50-54).

We will now discuss different categories of the material "traded".

METALS & MINERALS

It has often been claimed that copper came from Oman, because of the presence of nickel as a trace element in the ore of the region and the high nickel content of the Indus copper bronze objects. But as pointed out by David Muhly nickel is so common that it cannot possibly be used to identify an ore from a specific source.

In 1986 S.R. Rao even suggested that copper was purified in the Lothal workshops and exported in the form of bun-ingots. One of the ingots found at Lothal is of 99.8 per cent purity and it is arsenic-free unlike the Mohenjodaro ingot. Rao assumed that Oman copper is not arsenic-free but when he found all the 300 copper objects analyzed at Lothal not one containing arsenic he assumed that this copper must have been purified at Lothal. Tosi speculates that the Indus people made a kind of base in Oman for further voyage up to the Egyptian coast. About the location of Ras-al-Junayaz where an inscription with four Indus characters was found incised on the shoulder of a painted jar, he writes: 'This locality occupies an even more strategic position on the coastal route from Karachi to the Horn of Africa'. He goes on to add 'it seems increasingly likely that the Indus civilization contributed more to oceanic sea-craft than any of the other proto-urban civilizations of the Middle East'.

Chakrabarti emphasizes the significance of Afghanistan as a positive source of Indus copper, lead and silver, although each of these metals is easily procurable in Baluchistan, Rajasthan and Gujarat. Ratnagar disagrees and says that there was no indigenous production of silver in India until a fairly late period, and that the Harappan silver came from Mesopotamia. This statement does not appreciate the extent to which we have argentiferous galena in the lead-zinc deposits of Zawar and Agucha in Rajasthan. Besides, silver objects are found as early as Nal. The idea of Harappan tin coming from the relevant mines in the southern part of Central Asia seemed to be an acceptable one, and we doubt very much if the Harappans could get all the tin they needed from any fluvial deposit. The nearest major source of tin in India is Bastar in the southernmost part of Madhya Pradesh, and although tin is now commercially exploited in that region it is very doubtful if the Harappans were getting their tin from Bastar. On the other hand, Shortughai is conveniently located to receive Central Asian tin ores. The only snag in this hypothesiz is that tin does not seem to be at all significant at Shortughai which does not even posses a significant amount of lapis, although its location is quite close to the lapis-bearing area. Tin was also in Iran. Whatever the source of Harappan tin, Central Asia or/and Iran, it must have come, partly at least, from such an external source. A long distance trade in raw materials, even bulky materials like ore, should no longer be considered a theoretical impossibility. A recent piece of pertinent research relates to the understanding of such trade in copper ore in the pre-historic Iranian plateau. It seems that from the Anarak mines, near Sialk, copper ore, in this case a natural arsenic alloy, was exported to Sialk I-III, Hissar I-II and Tepe Yahya VI (end)-IVC. This distribution virtually covers a very large section of the Iranian plateau. There was local smelting of ore in each case, each site having its own technological process and distinctive artefacts. The trade was only in ore (Chakrabarti 1990: 143).

But now the situation has changed. With the discovery of rich cassiterite bearing (upto 1.5 per cent tin) quartz-porphyry in the Tusham hills, near Bhiwani, Haryana (Kochhar et al. 1999), the possibility of bronze ingots being also supplied from Ganeshwar become more plausible.

It is not easy to suggest what the Harappans received from Mesopotamia in the Indus-Mesopotamia trade. Mesopotamia's general exports have been called invisible exports consisting of items such as fish and grain. These could not have been her exports to the Indus. David Muhly writes that judging from Ur texts the Mesopotamians offered chiefly raw wool and garments made from this wool, as well as silver, in exchange for the products of the East. On the basis of the Mesopotamian literary references Muhly also makes a detailed list of the items imported by Mesopotamia from Meluhha, which has been generally associated with the Indus civilization: lapis lazuli, carnelian, gold, silver, copper, ebony, ivory, tortoise shell, a bird thought to be some sort of chicken, peacock, dog, cat and monkey (Dilip Chakrabarti 1990: 143-148).

Gold was easily obtained from the sands of the upper Indus River where it is still panned by itinerant miners. Another source of gold was along the Oxus river valley in northern Afghanistan where a trading colony of the Indus cities has been discovered at Shortughai. Situated far from the Indus Valley itself, this settlement may have been established to obtain gold, copper, tin and lapis lazuli, as well as other exotic goods from Central Asia.

Kharakwal however informs:

GSI has now found gold both in southern and northern Rajasthan. I have carried out survey of ancient iron smelting sites in Ghatol tehsil in southern Rajasthan where gold project of GSI is going on for several years now. I have seen large number of old mines as deep as 35 m. Though I have not seen any Chalcolithic settlements in Ghatol area, a buffer zone between North Gujarat Harappans and the Ahar people, it would have been the nearest source of gold, if exploited, for the Gujarat Harappans. From Akawali in North Rajasthan GSI has found gold recently. Therefore it is possible that Rajasthan also supplied gold to the Harappans in Rajasthan, Gujarat and Haryana (Kharakwal pers. comm.; Garhia et al. 2001: 375-384).

Chlorite boxes

These are a unique class of objects. There is considerable debate about their chronology, trade and cultural significance. We will discuss the views of Lamberg-Karlovsky and Kohl and evaluate their significance in the Harappan context. A little digression about these interesting objects may be in order.

Lamberg-Karlovsky says that when the wide distribution of chlorite vessels was partially realized, about 1950, discussions immediately turned to mechanisms of its trade. The following points Lamberg-Karlovsky believes are of significance and enrich the biography of this class of artefact.

First, there can be little doubt that the intercultural style carved chlorite vessels were in use in the ancient Near East from at least 2600 BCE to 2200 BCE. Earlier theories that attempted to restrict their occurrence to a narrower time frame are simply not supported by the archaeological record. The intercultural style vessels are found over a wide geographical area throughout this time-period. Further research, however, is necessary to determine whether there was a chronological sequencing of its popularity within different geographical or culture areas.

Second, physical-chemical analyses provide a coherent story regarding their production; the intercultural style vessels were produced in numerous geographically and culturally distinctive areas. Within south-eastern Iran the site of Tepe Yahya is clearly involved with their production, while the manufacture of intercultural style vessels in the Persian Gulf differs from the resource used for their production at Tepe Yahya. Equally significant is the fact that the geological resources used for the production of this type of vessel in Mesopotamia, though still of the soapstone variety, differ from both Tepe Yahya and the Persian Gulf. It can be said with considerable conviction that numerous production centres were involved with the manufacture of this distinctive artefact.

Third, the intercultural style vessels have long been regarded as an artefact of special functional significance. The specific nature of that functional significance, however, has been elusive. Typically it has been referred to as a ceremonial or ritual object. Our complication of a comprehensive catalogue of objects in the intercultural style vessel had a direct participatory involvement with rituals and beliefs pertaining to death and burial.

Fourth, the challenge to the "new archaeology", with its emphasis on materialist explanations, led to a new concern for the meaning of art styles and symbolism. In this respect Kohl's work (1979, 1989), which focused on resource procurement and production centres, emphasized the materialist approach. Little attention was given to archaeological context; thus, the results elucidated in my third point were entirely overlooked. Similarly, no attention was given to the importance of the meaning of the iconography. My own research has indicated that there is a degree of standardization and formalism in the reliefs carved on the vessels (Lamberg-Karlovsky 1989). Such standardization and formalism indicate that in the numerous centres of production, geographically separated by thousands of kilometres, a shared ideology of meaning was manifest in the identical production of complex design motifs. A study of their identical design motifs occurring within distinctive archaeological cultures spread over thousands of kilometres suggests to me the existence of a shared belief system involving rituals and beliefs pertaining to death and burial.

Fifth, there is the question involving the social context for the distribution of these vessels. Were these vessels distributed through the mechanisms of formal markets involving supply, demand, prices, and so on or through exchange systems involving redistribution, reciprocity, or the exchange of luxury goods as gifts among elites? All earlier arguments emphasized materialist concepts and polarized formalist and substantivist models for the working of an ancient economy (Polanyi et al. 1957; Possehl 1986). Within this materialist context virtually all authors ignored the specificity of this object's archaeological context and function, namely, its dominant presence in burials and temples and its role in rituals of death and burials. Given the specific symbolic significance of this artefact, its distribution need not conform either to formal models of economics or to mechanisms of exchange theory. Behaviour dealing with one of the great *rites de passage* of human existence – specially, death – suspends the rationality on which theories of market and exchange systems operate (van Gennep 1909; Hodder 1982).

These five points add to our appreciation of both a materialist conception and a symbolic appreciation of one of the most widely disseminated objects of the late 3rd millennium in the ancient Near East. Most significant, perhaps, we learn that in deriving a history from things we can come to the appreciation that the messages encoded in things are multiple and complex and that an emphasis on a single attribute of the thing is but part of its biography. In this context the research that emphasized the materialist aspects, detailing resource procurement and the mechanisms of trade and exchange, unfolded an important element in the biography of this object. My own emphasis on the symbolic significance of the design motifs and their archaeological context and function has focused on a different side of its personality. The two distinctive approaches are not mutually exclusive nor in fact contradictory but entirely complementary. The results derived from both perspectives contour a richer biography and a deeper understanding of this class of object. Doubtless this is not an epitaph pertaining to the biography of the intercultural style, for much remains to be understood. This paper represents my own confrontation with a single class of object over the course of twenty years. We have come to appreciate and comprehend its biography in a far more complex manner. Still, important questions continue to elude us. Perhaps someday an archaeologist will recover one of these objects and answer one of the most elusive questions of all: What did these vessels contain? (Lamberg-Karlovsky 1993b: 286-289).

Phil Kohl has done a great deal of research on chlorite vessels, especially at Tepe Yahya. As these chlorite boxes are of great relevance to trade in general and the intercultural style of Middle Asia, and as their exchange and trade raises some important theoretical questions, we summarize below Kohl's views:

Kohl (2001: 209-230) concedes that the new radiocarbon dates indicate that Period IVB at Tepe Yahya dates principally to the post-Akkadian period and possibly to the immediate post-Akkadian period. This dating confirms that the chlorite produced at Yahya, specifically the carved and uncarved vessels that are so similar to those found in Mesopotamia, were actually produced later than their Mesopotamian counterparts. The argument for an extremely short period of carved chlorite produced at Yahya was based not only on their profuse occurrence in the later Period IVB levels and their apparent contemporaneity with nearly all of the securely stratified examples from Mesopotamia to late Early Dynastic or mid 3rd millennium times, but also on the theoretical argument that a long distance trade in such specific, finished commodities would have been inherently unstable. The first reconstruction that the Yahya workshop may have functioned only for a *relatively* short time (a few hundred years?) may still be correct. Kohl admits that the intercultural style as a short-lived phenomenon or a horizon style was overstated at the time and now appears glaringly incorrect.

Kohl thinks that the "low" dating of Period IVB at Tepe Yahya has two immediate implications. First, the fact that this period with its six sub-phases is *relatively* short and continuous along with the stratigraphic evidence for chlorite commodity production, suggests an initial period of development (Period IVB, Phases 6-5), followed by the take-off or period of peak chlorite production (Phases 4-1). Second, the argument for direct continuity between Periods

IVB and IVA period is enhanced. Since we know that the intercultural style was not a horizon style, exclusively produced during the mid-3rd millennium, it is possible that some of the designs and forms continued to be produced during the Tepe Yahya Period IVA. The whorl-design vessel from Yahya was found resting on the floor of a Period IVA room, while other fragments depicting this motif are found in Period IVB contexts. The imbricate design vessel from Shahdad closely resembles the intercultural style vessel found at Shahr-i-Sokhta and both of these vessels with their design covering their entire surfaces are much the same as the vessel fragments from Uruk. Kohl thinks that it is important to emphasize the secondary contexts and/or reuse of some of the most elaborately carved (and most frequently published) chlorite artefacts from Tepe Yahya. The apparently related carved chlorite vessels found at Failaka may suggest that the maritime-directed trade in these vessels continued still later, possibly even into the early 2nd millennium.

Kohl believes that the Tepe Yahya chlorite corpus can be readily distinguished from that at Shahdad, which in turn can be distinguished from that at Shahr-i-Sokhta, and both of these corpora differ from the characteristic chlorite and soft-stone artefacts found on sites throughout Bactria and Margiana. Kohl asks, 'are these latter distinctions chronological or spatial/cultural?' And answers, 'they are probably a bit of both.'

Kohl explains that the chlorite sources were impossible to precisely "fingerprint", and the statistical divisions into these groupings were not as tight and certain as is commonly achieved in provenience studies of obsidian artefacts, for example. Nevertheless, the distinction between Sumer (southern Mesopotamia and the Diyala Valley) on the one hand, and Tepe Yahya, Susa, and Mari on the other, was clear. An important and, at the time, unobserved demonstration is the central role of Susa in receiving chlorites, including apparently finished carved examples, from several different source areas; some of these materials seem to have reached Susa via a maritime route. Susa may have played a particularly significant role importing these vessels over a considerable period of time, including when the chlorite workshop at Tepe Yahya was operative.

More strikingly, the soft-stone artefacts analyzed from the small island of Tarut just off the Arabian coast and north of Dhahran and Bahrain also proved to be highly distinctive, suggesting that Tarut was an emporium or transhipment centre for these vessels and/or for the semi-processed and un-worked raw materials.

More relevant is the question: did these vessels represent part of an extensive commercial network largely directed by profit-seeking Mesopotamian merchants? How does the re-dating of the Tepe Yahya intercultural style vessels affect this model? Despite various uncertainties discussed by Kohl, the commercial trading model still appears to be plausible, though it is not necessarily the only means by which these materials were distributed; other mechanisms, such as gift exchanges, marriage alliances, tribute, booty brought back from conquest, and the like, undoubtedly were also at work.

The network(s) or other means responsible for the exchange of these finished prestige goods must be more, not less, complicated than previously imagined, if these vessels indeed were produced and exchanged over a period of several hundred years. The fact that the elaborately carved vessels appear so suddenly and the evidence for chlorite production increases so dramatically in the Period IVB levels at Yahya suggests that they were produced to answer a demand; someone wanted them. This pattern of sudden appearance likely characterized other workshops producing these vessels as well. Different workshops – functioning simultaneously, sequentially, or both – fulfilled the needs of different urban centres or markets (for example, as supported by the analytically distinctive and diverse soft-stone vessels found at Bismaya). The evidence readily lends itself to a commercial exchange model, though one that is qualified by the necessary caveats against anachronisms. These luxury goods are commodities only in the sense of being produced for exchange and consumption by elites. There must have been other mechanisms, besides commercial exchange, responsible for the distribution of these vessels. Some of the vessels certainly were brought back to Mesopotamia as royal booty. The "elites" in eastern Iran or in Amiet's trans-Elamite world are hardly the peers of their urban contemporaries to the west; rather, there is little evidence for social differentiation at Shahdad and elsewhere in eastern Iran, the Indus borderlands, and Central Asia. Of course, when it is advantageous to do so, royal elites can overlook status distinctions and treat their inferiors as equals; hence, all those Mesopotamian references to the "kings" of Magan and of other areas east of Sumer.

Whether the communities producing such prestige goods exchanged them as gifts or traded them as commodities, they must have received something in return, but the imports or gifts from Mesopotamia and other urban centres to the west remain as recalcitrantly invisible as ever. If Sarianidi (1998: 50) is correct in seeing the later composite soft-stone statuettes from Bactria and Margiana as portraying 'seated grand dames in rich Sumerian dresses,' then there possibly may be a little more evidence today for the trade of wool and woollen textiles or at least for the diffusion of styles of clothing.

Kohl emphasizes that regardless of the date of the Yahya workshop and whether Mesopotamian *tamkar* or merchants were directly involved, the evidence still overwhelmingly documents that the Yahya artisans were laboriously carving extremely distinctive objects, at least some of which had highly specific meanings or were symbolically charged, that were meant to be exchanged to satisfy an external or non-indigenous demand. Tepe Yahya was not the sole production centre for these vessels but only one of several, some of which functioned simultaneously and some sequentially. It is likely that some materials were exchanged as unworked or semi-processed objects. Other objects clearly moved as finished goods having been quarried, hollowed out, smoothed, carved, and occasionally painted and inlaid – all of these activities were performed in a small four hectare area village such as Tepe Yahya.

Kohl still believes that the intercultural style vessels are not unique. If one carefully examines ornaments and jewellery or metal tools and weapons from western Asia during the Early Bronze period, one will find numerous examples of remarkably similar objects found in disparate areas, suggesting most plausibly in many cases that these items were exchanged as finished commodities. The Tepe Yahya corpus, I strongly believe, represents just the highly visible tip of a much more substantial iceberg. The fact that these vessels had a specific symbolic content shared by different cultures is also highly significant and suggests that ideas and possibly belief systems, as well as materials, were exchanged over large parts of western Asia over a several-hundred-year period during the Bronze Age. The degree of highly specific communication over diverse areas and the sharing of ideas and materials evident in the Yahya chlorite corpus constitute the most significant features of this corpus.

Kohl asks a theoretical question, does such communication and the production, distribution, and consumption of finished commodities constitute evidence for a Bronze Age "world system"? In the Bronze Age, peripheries are not so ruthlessly exploited, nor typically made dependent on urban cores as Wallerstein proposes; if anything, they may benefit from such externally stimulated interaction. All models carry their own imperfect conceptual luggage. Certainly, the "world" of western Asia, linking together Mesopotamia, Elam, and trans-Elam and stretching across the Iranian plateau to the Indus Valley, was much more complex and systemically or structurally integrated than eastern North America during the first few centuries BCE.

Can one still conceptualize a functioning "world system" without dominant cores and submissive peripheries? Are the asymmetries and dependencies fundamental to the model or can they can be replaced by more balanced systems of long distance exchange and structured interdependencies? Or are we forever doomed to employ amorphous concepts for an archaeological discussion of extensive interregional connections? Such questions are useful to ask, I believe, even if they cannot be satisfactorily answered. The debate will continue. Castle-building in the sand fulfils at least one useful purpose: it stimulates additional research. If there is one conclusion to be drawn, it is that there is certainly more work to be done – both empirically and conceptually. For me, what is unmistakably clear is how intellectually stimulating it was to study the Tepe Yahya chlorites twenty-five years ago and to return to reconsider them again. I am most grateful for these opportunities (Kohl 2001: 209-230).

The Indus evidence

About rock material, Kenoyer (1998) thinks that most stones came into the Indus workshops as raw materials, but there are rare examples of finished objects that were produced in the highlands in the west and brought to the cities by traders or visiting elite. As discussed above, carved chlorite and green schist containers with distinctive woven mat designs were produced at sites such as Tepe Yahya in southern Iran and possibly other workshops in Baluchistan. These vessels were traded throughout the Near East and the Persian Gulf, and a few examples have been found at Mohenjodaro. These exotic containers may have been brought to the city by Indus traders living in southern Baluchistan along with copper and other highland raw materials. Possehl (2002) terms such items as belonging to the Middle Asian intercultural style.

In Middle Asia there was intense communication and intercultural exchange, which cannot be attributed to trade alone. Possehl (2002) goes to the extent of suggesting that this Middle Asian intercultural style reflects a shared set of symbols, possibly an ideology. This was a syncretic form of belief system. There were several factors coming into play: the establishment of state boundaries, implanted colonies, warfare and prospecting for minerals would all have amounted to movement, migration and dislocation of peoples. Information about people and places would have spread through uprooted people and peripatetic animal-herders, and so would knowledge about new techniques or newly-discovered goods. Intermarriages could have been common. Wheeler identified the young woman buried in the cemetery at Harappa, with a wooden coffin and reed shroud, as a Mesopotamian citizen. Such cultural interaction would have led to the spread of popular cults, fables, legends and also information about the mineral resources all over Middle Asia (Ratnagar 2001: 54). In one study of the Mohenjodaro human figurines it has been concluded that the population was of diverse stock, judging from the variety of facial features, jewellery and hairstyles. Mohenjodaro was a truly cosmopolitan city.

Ratnagar (1995) notes that Mesopotamia and South Asia represent literate and urbanized societies, the 'Bronze Age' in every sense of Gordon Childe's usage, but not so the Kulli, or groups at Yahya or in Oman. She finds it of interest that the various culture areas did not always exhibit the closest ties with those nearest them.

> It has long been appreciated that Mesopotamia, the agriculturally richest and the most populous area, had huge quantities of grain, oil, and woollen textiles to offer. It was also perhaps the home of the most skilled metallurgists. But it was the largest importer of metals, stones and shells (having none of these locally), most of which came from South Asia, the eastern terminus of the trading circuit. Besides being procurers and suppliers of so many trade items, the Harappans may well have been the most accomplished seafarers, given their privileged access to the best boat-building timbers (these have up to recent times been imported by seafarers of the Gulf from India). It hardly bears repetition that the movement of heavy and bulk items like stone, metal, and timber is immensely cheaper by water than by land ....

Ratnagar does not agree with Chakrabarti and says:

This point about the two urbanized termini of the trade comes across vividly when we consider the trade in silver. Little silver has been found in the intermediate areas of South-east Iran, Seistan, or the Gulf, except for two silver artefacts at Shahr-i-Sokhta in Seistan and two silver beads in an Oman grave. It had earlier been argued (Ratnagar 1981: 144-146) that the Harappans, the only people of proto-historic South Asia to have used silver on a substantial scale, imported this metal, most likely from Mesopotamia. A regular movement of silver from the Assyrian merchant colonies of Cappadocia to Mesopotamia is well-documented for the period between 1920 and 1750 BCE and texts from Ur which refer to silver being taken overseas by merchants to buy copper in Dilmun (clearly an entrepot) date to the time of Rim Sin of Larsa or 1822 to 1763 BCE. It had also been pointed out that silver occurs in the two large Harappan settlements of Mohenjodaro and Harappa, but is almost totally absent at the other sites .... Another argument for Mesopotamia as the source is that, even earlier, around 3500-3000 BCE and also later, silver and lead were used on a substantial scale in Mesopotamia and Elam. One example is provided by the Early Dynastic III Royal Cemetery at Ur, with a truly exceptional amount of silver (Moorey 1985: 114 ff, 122 ff). Second, we now have a run of radiocarbon dates from the silver-lead-bearing localities of Dariba, Agucha, and Zawar, near Ajmer in Rajasthan, which testify to mining in the later 1st Millennium BCE rather than earlier (Craddock et al. 1989). The only earlier mining is attested to at Dariba, but these dates are post-Harappan, viz. later 2nd Millennium BCE.

I would suggest that there is a distinct possibility that the beginning of mining and production of silver in Dariba, Agucha or Zawar may have begun during the Harappan times as there were Ahar settlements around.

Ratnagar thinks that because in Dilmun (in the Bahrain archipelago) the Ubaid pottery was found in this region that was actually made in southern Mesopotamia (Oates et al. 1977), Mesopotamia sea voyages had began by 4000 BCE ....

All this evidence together prompts the adoption of a long chronology for the Barbar/Dilmun culture. The major argument for a short chronology has been the absence in the temples and settlements of Bahrain of carved chlorite containers of the early series (see Kohl 1986: 368), which date to Early Dynastic II-III. Such vessels do, however, occur on Tarut Island not far away, and as grave goods. Carved as they are with intricate "mythological" elements, these containers in some cultures may well have been exclusively of funerary use.

Referring to the scale of the trade, Ratnagar (1995: 123) says:

We have two glimpses of its scale from the cuneiform texts. The first concerns a trade transaction (see Roaf 1982) in which some 18,000 kg of copper was involved. In the second consignment of 2,380 "gur" (a capacity measure) of barley goes to Magan (see Ratnagar 1981: 80). It is commonly accepted, a "gur" was 240 litres or 180 kg of grain, then 2,380 "gur" was a gigantic amount, and its import requires careful thinking out.

She further says:

Knowledge about metal ores and techniques and about pyro-technology appropriate for faience production may have spread wide, as Childe had often said. Yet the socketed spearhead of Oman does not appear to have influenced Harappan tools which lacked sockets and strengthening central mid-ribs. Most intriguing is the use in Turkmenia of several kinds of alloys. Copper-lead, copper-silver, silver-copper, copper-lead-arsenic/tin, and copper-tin-arsenic were in use (Masson 1988: 99) but in spite of "contacts" there appears to be no such experimentation with alloying in the Harappan civilization (where tin bronze was the alloy in general use, an alloy which apparently was scarce in Turkmenia!). Do we interpret this as a function of availability of metals, or as resistance to the spread of certain techniques?

Ratnagar's statement is however not justified in view of the use of lead, tin and arsenic in Harappan coppers.

One famous stone vessel found at Mohenjodaro is a tall glass with concave sides that is similar in shape to ritual columns found in Baluchistan and Afghanistan. This green stone, called fuchsite, is rare, but it can occur with quartzite which is common throughout Baluchistan and Afghanistan. When this fuchsite vessel was first examined by a geologist in the 1930s, the only known source was in Mysore State, over 1600 km south of the Indus Valley. Early scholars suggested that the stone was brought to the Indus cities from the south along with gold and ivory, but both of these important raw materials were actually available from nearby sources. Herds of elephants lived in the thick forests of Gujarat or the eastern Panjab, so ivory could have been obtained by Indus hunters themselves or traded from tribal communities living at the edge of the Indus plain.

Kenoyer states that as most of the basic raw materials needed by the Indus cities were available in the regions adjacent to the Indus Valley, there was no reason for Indus traders to travel to far-off lands. But, lured by untapped markets and the rewards for bringing back exotic items, some adventurous Indus traders traveled across the sea to Oman and far up the Persian Gulf to the cities of Mesopotamia. Scholars have argued that the long distance trade was carried out by intermediary communities or middlemen, but Kenoyer suggests that there is increasing evidence to suggest that at least a few Indus entrepreneurs travelled to these distant lands. Most trade was probably carried on by sea, although we have some evidence for limited overland trade through southern Iran.

The trade with Oman was probably most heavy, although it was not critical to the Indus economy. Numerous Indus artefacts have been found in Oman and along the southern coast of Arabian Gulf, and characteristic circular seals from the Gulf sites have been found in the Indus Valley. Though Kenoyer thinks that the major imports from Oman were copper, shell and possibly mother-of-pearl, I doubt if the Oman copper had any market in the Indus in view of nearby abundant supplies in Rajasthan and Baluchistan. In historical times the Arabian trade supplied the Indus Valley primarily with dates, pearls, incense, dried fruits and slaves.

Exports to Oman would have included many perishable goods transported in large black-slipped storage jars. Numerous jar fragments, often with Indus script on the shoulder, have been found at many different Gulf sites. These vessels may have conveyed indigo or liquid foods such as clarified butter, pickled vegetables or fruits, honey or wine. The narrow base may have been designed to allow the jars to be placed along the bottom of the ships hold. At the site of Ras' al-Junayz in Oman, one of these large, black-slipped vessels with graffiti was found along with a bronze Indus stamp seal. Other exports may have included wood for boats, livestock, grain and fresh fruit, but the only preserved objects are Indus beads, cubical chert weights and ivory objects such as a comb. These items may have been left in Oman by Indus traders or brought to the region by intermediaries. Current evidence suggests that most trade with Oman took place during the height of the Indus cities between 2200 and 2100 BCE (Kenoyer 1998).

Further to the west, in Mesopotamia, trade contacts with the Indus Valley are reflected in artefacts such as terracotta sealings from bundles of goods that were being traded. The earliest contacts, dating to between 2600 and 2500 BCE, are centred in southern Mesopotamia in the city of Ur. In the royal cemetery of Ur, kings and queens were buried with servants and livestock along with elaborate ornaments and personal objects. Lapis lazuli, shell and carnelian were combined with gold, silver and bronze to create exquisite ornaments, utensils and weapons. Among the beads found with the kings, queens and serving ladies, are distinctive long biconical carnelian beads and decorated carnelian beads that were produced by artisans from the Indus Valley.

Beads

According to Kenoyer, technological studies of the manufacturing processes confirm that many long biconical carnelian beads as well as the decorated carnelian and green amazonite beads were actually made in distant Indus workshops. However, the long-faceted carnelian beads may have been made by Indus artisans in Mesopotamia. These beads are drilled with the unique technique of the Indus Valley; yet, the faceted shape is a style that was never produced in the Indus workshops. The pear-shaped decorated carnelian bead is also a shape that was never produced in the Indus, but it is made using a technology that has only been documented in the Indus cities. These clues suggest that merchants or entrepreneurs from the Indus Valley may have set up shops in cities such as Ur, to market their goods and also produce objects in local designs. If this can be confirmed through further studies, it would be the earliest evidence for a pattern that came to be the norm in later historical times, when craftsmen and merchants from the subcontinent extended their trade networks throughout West Asia as well as South-east Asia (Kenoyer 1998).

The Indus trade continued during the Akkadian period too. Textual references for Indus trade date to the period between 2300 and 1300 BCE, beginning with the reign of Sargon of Akkad (2334-2279 BCE). This famous ruler boasts of ships from Dilmun, Magan and Meluhha that are docked at his capital city, Akkad. Most scholars agree that in these texts, Dilmun refers to the modern island of Bahrain, Magan refers to modern Makran and Oman, while Meluhha refers to the general region of the Indus Valley. Numerous texts describe the types of goods coming from Meluhha: hard woods, tin or lead, copper, gold, silver, carnelian, shell, pearls and ivory. Animals such as a red dog, a cat, peacocks or black partriuges and monkeys are also mentioned. Many of these items would not be preserved in the archaeological record, but Indus weights, seals and seal impressions attest to the presence of merchants and bundles of trade goods. The discovery of carnelian beads, shell bangles, ivory and shell inlay in temples or burials indicates that most of the trade objects from the Indus Valley were destined for the gods and rulers of the Mesopotamian cities (Kenoyer 1998; Chakrabarti 1990).

It is strange that no items produced in Mesopotamia proper have been found in the Indus region. Mesopotamian texts list such exports as wool, incense and gold, which are perishable or would have been transformed into new objects in the Indus cities. The absence of Mesopotamian cylinder seals and sealings would indicate Mesopotamian traders were not directly involved with the Indus trade and that no bundles of goods sealed by Mesopotamian merchants were being sent to the Indus cities. There is not enough evidence at this time to argue for the exclusion of Mesopotamian traders from the Indus market, but the Indus cities were clearly involved in the import of raw materials and the export of finished goods. Thus, perhaps the Indus people were trading both in exports and imports which may have been one of the factors that led to the rapid growth and spread of the Indus settlements throughout the north-western subcontinent.

This however required the Indus traders control the movement of goods and be able to profit from the commercial transactions. Most trade was probably conducted through a common barter system and reciprocal exchange of goods for services. Both systems are well-documented in traditional economics throughout the subcontinent and in the absence of a monetary standard would have been essential for supporting the Indus urban centres. A third system of exchange is seen in the highly standardized system of cubical stone weights that is common at all Indus settlements. Most scholars have assumed that this standardized weight system was used primarily for market exchange, but Kenoyer surmises that these weights could have been also used for taxation.

Weights and Measures

Alfredo and Lamberg-Karlovsky (2004) have given a theoretical explanation of the importance of writing and weights and measures. They say:

Alexander Marshack (1972) was among the first to discuss the importance of cognitive evolution in his treatment of the first decorated and "notational" objects recovered from the Paleolithic period of tens of thousands of years ago. Twenty years ago Colin Renfrew (1982: 17) asked whether one could examine the operation of the mind from archaeological evidence. He offered an affirmative answer and one of his examples was in the unraveling of the Indus weight system (0.836 grs) multiplied by integers such as 1, 4 or 8 up to 64 then 320 and 1,600. The development of a unit of measure is taken as an important step in the procedure of mapping the world – a cognitive mapping. More recently Jacques Cauvin (2000) and David Lewis-Williams (2002) attempted to probe the cognitive structures of the mind evident in the first farming communities and of those that produced some of the earliest rock art. Donald (1991) considers the transformations of our cognitive abilities within a long evolutionary perspective, taking us from the Paleolithic to the computer age. The appearance of written texts, as well as weights and measures, attest to the emergence of what he terms "theoretic culture". Donald (1991: 340) states, 'Until writing could be combined with other visual symbolic media, the *theoretic attitude*, that is, the deliberate analytic use of symbolic thought had little chance to develop' (emphasis in original). The most important attribute in the emergence of the theoretic stage is the invention of "external symbolic storage" systems, i.e. writing and symbols of meaning, as with weights and measures. Thus, a weight bears no relationship to what is weighed and a number has no perceptual relationship to what is represented. Within an evolutionary context, the increasing recognition that goods (property) could be, or were allowed to be, systematically exchanged led to an increasing significance of commodity and value. This, in turn, demanded units of measure and a permanence of memory, namely, the development of writing. Donald's second evolutionary cognitive transformation, the emergence of a "theoretic culture", privileges the development of writing as a powerful tool for "external symbolic storage".

Donald argues that writing played a major role in transforming the cognitive processes of the mind by introducing new systems of symbolic storage. If, however, one looks upon the function and nature of the earliest writing, as well as standard weights and measures, one finds them to be new and powerful technologies of social control. Thus, the transforming of cognitive processes in conjunction with a new technology of social control were co-evolutionary processes that transformed both brain and culture (Alfredo and Lamberg-Karlovsky 2004).

Thus weights and measures represent powerful technologies of social control. Though the standardized Indus weights were quite different from the weights used in Mesopotamia or Egypt, yet they were identical to those used by the first historical kingdoms of the Ganga Valley (*ca.* 300 BCE), and are still in use in traditional markets throughout Pakistan and India. Till the introduction of the decimal weights (CGS system), a binary system of 1 seer (about 1 kg) = 16 *chhatacks* was used.

The Harappans had evolved a highly standardized system of weights and measures. For linear measures, two systems were in vogue: cubits and a long foot. A cubit was about 52 cm (52.5 to 52.8 cm) and the long foot 33.5 cm. Graduated scales have been reported from Mohenjodaro, Lothal and Kalibangan. The Lothal scale has divisions of 1.7 mm with decimal graduations. It may be pointed out that the *Arthasastra's angula* was 17.86 mm compared to 17.7mm divisions on the Harappan scale. Rao reports a shell object (now also reported from other sites in Saurashtra) with four slits, which was probably used to measure angles.

The weights were made out of chalcedony, black stone, etc. and took cubical and at times other forms. They followed a binary system (1, 2, 4, 8, 16, 32 up to 12,800) in the lower denominations. The first seven Indus weights double in size from 1: 2: 4: 8: 16: 32: 64, and the most common weight is the 16th ratio, which is approximately 13.7 gm. The traditional Indian ratio of 1:16 (1 seer =16 *chhatacks*) seems to derive from this. At this point the weight increments change to a decimal system where the next largest weights have a ratio of 160, 200, 320, and 640. The next jump goes to 1600, 3200, 6400, 8000, and 12,800. The largest weight found at the site of Mohenjodaro weighs 10,865 gm which is almost 100,000 times the weight of the *gunja* seed. The cubical stone weights are thus based on a complex system of measurement that is calculated by both binary and decimal increments. The unit weighs 13.625 gm. Higher weights follow a decimal system with fractions in one-third. The accuracy of these weights all over the Harappan territory is remarkable indeed.

The base weight may have been a tiny black and red seed known as *gunja* (*Abrus precatorius*), which is still used by modern jewellers in Pakistan and India. However, it is possible that other grains such as barley or lentil seeds may have been used in the original calculation, because the gunja is equal to two *mung* bean seeds or two grains of barley. Scientific studies of the gunja seed show that the average weight is 0.109 gm, and eight gunja equals the smallest known Indus weight of 0.871 gm. Lamberg-Karlovsky (Lamberg-Karlovsky 2001; Alfredo Mederos and Lamberg-Karlovsky 2004) has presented interesting details on metrology in the Old World civilizations and conversion of weights in terms of shekels. He says that the ability to integrate different weight systems was crucial in developing both the scale and the nature of commercial exchange in the Near East and would have facilitated the emergence of the ancient world system.

Most of the excavated sites of the Indus Valley have yielded such cubical chert weights, and all of the weights conform to the standard system established by the Indus rulers. Heavier weights have only been found at major trading centres such as Chanhudaro, or at the largest cities of Mohenjodaro and Harappa, but complete sets of the smaller weights are found at most of the rural settlements. In addition to the common cubical weights many sites have truncated spherical weights that conform to the same weight system. Usually made from agate or coloured jaspers, these weights may reflect a regional style of weight manufacture or perhaps a competing class of merchants.

The larger weights could have been used for grain or large quantities of goods. This interpretation, however, does not fit well with the traditional trading practices of the subcontinent; there are not enough weights from the Indus sites for everyone to have been using them in commercial transactions. In market exchange, the smaller weights may have been used for precious stones and metals, perfumes and valuable medicines. A more plausible interpretation associates weights with taxation. In the recent excavations at Harappa, the highest concentration of weights has been found inside the city gateway, which is where goods coming into the city would have been weighed and taxed. Tax collectors or village elders in the smaller settlements would have needed only one or two sets of weights to collect tribute in precious commodities or produce. Finally, the large weights, which are found only at the urban centres, would have been well suited for weighing tribute coming from all of the surrounding villages and towns (Kenoyer 1998).

Let us now try to locate the oft-mentioned sites/areas of Dilmun, Magan and Meluhha.

DILMUN, MAGAN, MELLUHA

The Mesopotamian texts refer to trading and supply centres like Dilmun, Magan and Meluhha. Where are these places to be located? There is still quite a bit of controversy about these. In this connection we would discuss the different views expressed by Chakrabarti, Thapar, Ratnagar, Shaffer and others.

Dilip Chakrabarti reviewing the literature on this problem says that the literature on this theme has grown steadily in recent years. The identification of Dilmun with Bahrain is perhaps universally accepted. In 1944, S.N. Kramer identified it 'in all probability' with south-western Iran. Later on he located it in the Indus valley. In 1946, P.B. Cornwall critically reviewed Kramer's opinion:

.... It is essential to recognize at once that the cuneiform references to Dilmun fall into two distinct categories: 1. Historical, commercial, epistolary, dedicatory, and astrological inscriptions; 2. Sumerian literary compositions.

In the former, Dilmun is a definite geographical locality – of that we may be certain. In the latter it is a fabulous land, a strange antechamber to the spirit world. That the two Dilmuns were thought of as being somehow identical is very likely; but I suggest that Dr. Kramer should not have decided the location of Dilmun merely on the basis of Sumerian literary compositions, especially since the evidence gleaned from the other class of source material points decidedly to the equation Dilmun = Bahrain

.... In 1952 Cornwall re-formulated his earlier opinion:

the identification with Bahrain island and part of the Saudi Arabian province of Hasa may be accepted without reservations .... The Danish researchers in Bahrain and the adjacent areas in the Persian Gulf have clinched the issue in favour of Bahrain.

About Magan and Meluhha, Dilip Chakrabarti (1990: 148) says:

Gelb's own inference is that Makan is the southern shore of the Persian Gulf and of the Arabian Sea; it denotes Arabia, extending east of ancient Sumer up to and including Oman. Meluhha, according to him, is the northern shore of the Persian Gulf and of the Arabian Sea; it denotes Iran and India, extending east of ancient Elam and Ansan up to and including the Indus Valley. In other words, Meluhha was a generic name standing for certain regions east of Mesopotamia, which also included the Indus Valley.

Chakrabarti (1990: 148) emphatically says:

Regarding Meluhha this is a general conclusion to which we would like to adhere in the present stage of knowledge. Kinnier-Wilson suggests the following identification of Makkan, which has a bearing on the identification of Meluhha as well. He points out that the stone used in the Gudea statuary is not diorite but a substance which occurs in the Tul-i-Marmar area in the general region of the Iranian oil-fields in the south-west corner of Iran. He does not seem to have any doubt about this identification, but the point is that if south-west Iran, or a part of it, stands for Makkan of the Mesopotamian literary sources, Meluhha will stand for regions further to the east, up to and including the Indus Valley. This is very unlikely to stand for the Indus Valley alone.

International trade of the Harappans is a controversial subject. On the one hand, Fairservis and Lamberg-Karlovsky deny its existence; Rao, on the other lays great emphasis on it. During Caspers and Ratnagar have done a critical survey of the Harappan-Mesopotamian trade. There are frequent and consistent references in the Mesopotamian texts to Dilmun, Magan (Makkan) and Meluhha with which there was frequent commercial intercourse. And all these places could be approached by boat. Dilmun was located on the "Lower Sea", viz. the Arab-Persian Sea. The early references to these places mainly come from the early Dynastic to Isin-Larsa periods. Dilmun used to export copper, carnelian, semi-precious stones, ivory and its artefacts, timber, silver, lapis lazuli, pearls, red gold, white corals, eye paint and dates. There is now a consensus to identify Dilmun with the Turant, Bahrain and Kuwait region. There are many evidences of contacts of Dilmun with Mesopotamia and the Indus. The weight system followed here is exactly the same as that of the Harappans. Dilmun, however, produced only pearls and dates; for other commodities it served as an entrepot. It is likely that the Harappans (and also the Pre-Harappans) traded with the Mesopotamians at the neutral sites of Dilmun. Ratnagar says:

However, Dilmun or Late Gulf seals occur, albeit in unstratified context, at Lothal and at Bet Dwarka in Saurashtra. Thus on archaeological grounds the terminal date for the Harappan overseas trade is about 1900-1800 BCE.

Ratnagar however emphasizes that Mesopotamian trade with South Asia is in fact indicated by the occurrence of several diorite/haematite barrel-shaped weights which date from the reign of Shu-Sin of Ur (*ca.* 2037-2029 BCE) at Harappa, Mohenjodaro, Dholavira, and Lothal. Thus we may be certain that Indian products continued to come into Mesopotamia in the Larsa period. (Ratnagar 2004: 272-338).

Magan has been identified variously with Umm-an-Nar near Abu Dhabi; with the area around Minab or Tiz (Chah Bahar); and even with the inland region comprising Shahr-i-Sokhta and Tepe Yahya in Iran. Gelb, however, identifies Magan as the southern shore of the Persian Gulf and of the Arabian Sea. Textual references mention reeds, onions, diorite, carnelian, red ochre, copper and ivory as the products received from Magan. Steatite vessels, probably produced at Tepe Yahya, and exported to both west and east may support identification of Magan with Tepe Yahya region, but evidence for overland trade is lacking at the moment. Shahr-i-Sokhta was a large manufacturing and export centre for lapis lazuli objects.

Meluhha's identification is also controversial. Of course in the later part of the 2nd Millennium BCE, Magan and Meluhha denoted Egypt and Nubia respectively, but before that perhaps they represented regions on the south-east. Chakrabarti, in his balanced review of the evidence, defines Meluhha as the northern shore of the Persian Gulf and of the Arabian Sea, thus denoting Iran and India. Meluhha was thus a generic name standing for certain regions east of Mesopotamia, which also included the Indus Valley. Meluhha, according to the texts, exported a variety of timbers, copper, gold dust, silver, ebony, lapis lazuli, carnelian and other stones and ivory figurines of birds and monkeys, etc.

Ratnagar (2004: 272-338) tries to explain the absence of lapis lazuli in the Harappan sites though they may have been major exporters of the stone.

> All that we have are a few cached treasures in houses of the late strata at Harappa and Mohenjodaro. In the Harappan culture either there was no burial as such of the elite with ritual interment of their prestigious possessions, or else such burials were made, but not at the habitations (mounds), and we have not found them. We do not therefore have a balanced picture of the degree of participation of different cultures in the world trade .... It would not be illogical to proceed a step further and suggest that there indeed was a consumption of articles like lapis lazuli, silver, and gold at the Harappan centres on a scale as large as at Ur, but that such items were not utilized/interred/discarded in such ways as to constitute the archaeological record for future times. On the other hand, at Ur, lapis lazuli was used for beads and pendants, inlay on musical instruments and gaming boards, inlay on statues, small statues, cylinder seals, the handle of a dagger, and a beautiful cup, whereas at Harappan sites lapis lazuli was utilized for only pendants, beads, "buttons", and a few inlay pieces. No stray finds or broken artefacts occur to indicate the use of this blue stone for a range of artistic and ornamental purposes, and no find is noticeably large. Thus it is not quantity but the range of artefact types that shows Mesopotamia to be by far the greatest user of lapis lazuli. If quantities of particular sorts of artefacts do not, by themselves, count for much in a database that is a contingent one, neither do frequencies. For instance, we may think that Harappan pottery at Asimah (Oman) constituting almost 32 per cent of the total is significant, but as Vogt (1996: 123-4) points out, this constitutes only ten actual pots.
>
> Let us persevere with "absences" of evidence. In earlier chapters we have "mapped" the occurrence of seals, weights, or exchanged objects. We have found that Harappan seals have an especially wide distribution between the Indus and the Euphrates, Central Asia, and Oman, in total contrast to Mesopotamian cylinder seals, found only in Bahrain. Late Gulf seals also have a fairly wide distribution. Does this mean active Harappan and Dilmunite roles in the trade, in venturing abroad and taking initiative, but no such role for the prosperous Mesopotamians? Finds of Mesopotamian weights at Lothal, Dholavira, Harappa, and Mohenjodaro (Chapter III) could correct that impression. The mapping of turquoise and lapis confirms Moorey's (1993) suggestion that they moved in different ways, the one overland across Iran, and the other from South Asia by sea (Ratnagar 2004: 272-338).

Most of these items are available in India, except perhaps lapis lazuli though at Chanhudaro there is evidence of manufacture of lapis beads. The nearest lapis source could be Badakshan. Timber has been traditionally exported from the western ports. Teak grows in Panch Mahal hills in Gujarat and has also been reported from Lothal. Placer gold is found in the streams of Punjab and Kashmir and may have provided the dust gold. Gold caps for stone beads, discoid beads with axial tubes and spherical beads joined together are exactly similar in both the Sumerian and the Harappan ornaments. Carnelian is known from Rajpipla mines and its beads were manufactured at Lothal and Chunhudaro. In fact, the stone bead industry in Saurashtra is still alive and exporting. Etched beads of carnelian have been reported from most of the Harappan sites and in Mesopotamia at Ur, Kish, al-Hiba and Tell Asmar.

Ivory objects mentioned in the texts include combs, figurines, boxes, inlay pieces etc. Unworked and worked pieces of ivory have been reported from Surkotada, Lothal, Mohenjodaro and Chanhudaro. It is therefore likely that Meluhha may represent the north-west part of the Indian subcontinent.

Internal trade

When I came across Irfan Habib's recent book *The Indus Civilization (2002)*, I was wondering what a medieval historian could add to the already huge corpus of the Indus archaeology. But reading it sobered me. With his Marxist and economic history background and an incisive mind, he brings out many insights in this little book.

Habib gives due importance to all levels of the Indus trade: local village-town trade; long distance trade within the territory of the civilization; and commerce with other regions. We discuss below some of his pertinent remarks.

If the two large structures at Harappa and Mohenjodaro are correctly identified by Vats and Wheeler as granaries, the grain stored here, then, was probably meant for distribution within the Citadels. For the ordinary inhabitants, the grain they needed must have been brought by merchants or grain-carriers, on pack-oxen, carts and river-craft and also possibly on human backs.

No less important was the supply of raw materials to urban craft centres. This may be illustrated by the evidence of sea-shell workings at Balakot, Dholavira, Nageshwar and Lothal. The marine shells must have come from places on the sea-shore in the vicinity of these townships. Similarly, agate and carnelian cut into beads at Lothal came from the famous Ratanpur mines just south of the Narmada River near Bharuch. The large stone workings near Sukkur on both sides of the Indus can be explained only by the large demand for chert blades from Mohenjodaro down the Indus River, though in this case the major part of the "manufacturing" was probably done at the quarries themselves.

The uniformity in the style of many artefacts found at various places within the Indus territory gives the impression of considerable long distance trade which kept up similar tastes and fashions in manufactured goods in all of the territory's several parts. Habib gives an alternative explanation for the Harappan uniformity: Habib however thinks that this might also have been achieved by the migration of artisans from the core areas than by the transport of goods. For example, fired bricks at Kalibangan or Lothal could not have been exported from Harappa and Mohenjodaro; men skilled in baking bricks in kilns must have gone there. So also, the Indus potters must have travelled far and wide, rather than managing large-scale transport of pottery. The same may be said of seals, but for another reason: it is likely that the seals were made for individual owners, and so made according to individual preferences. They were thus presumably made only locally; and yet they all bear strong marks of uniformity in the pictures and characters they contain. At Dholavira, the seals first lacked any inscriptions and had only pictures: the writing on seals appeared only later. Apparently, as Irfan Habib explains, the craftsmen who first went there could not cut the Indus characters; those who could, came much afterwards. It could also indicate that the seals were the insignia of commercial families and it was a short-scale phenomenon.

In the 3rd Millennium BCE context, even inland trade could cover long distances. For instance, agate and carnelian pieces from the Ratanpur mines south of the Narmada were conveyed not only to Lothal, but also to Kuntasi (on the Saurashtra coast facing Kachchha) and to Chanhudaro in the middle of Sindh, as raw material for bead manufacturers there. Gold used by Indus metalsmiths came almost certainly from the banks of the Indus and its tributaries in and near the Himalayas, where gold dust could be collected. (It seems unlikely that the very small quantity of gold found in the Indus sites came from the far-off Karnataka mines.) Specialized products, like faience, which were relatively rare, and articles made of shells, mainly worked in centres near the coast, were also clearly items of long distance trade. Kharakwal however reports significant occurrences of gold from Rajasthan.

The Indus River system made for easier transportation, though the downstream (southward) movement by boat was naturally easier than the upstream (northward). There could be some traffic also on the Ghaggar-Hakra River, now dry, but then flowing down to about the middle of Bahawalpur district. In the south it is possible that a riverine connection existed, at least seasonally, between the eastern Nara, a branch of the Indus, and the mud flats near Lothal, by which small boats could carry cargo: this might explain the importance of Dholavira, a notable town, placed in what is today an isolated island in the Rann. Carts and pack-oxen could cover some land sections of long distance routes, for example, between Harappa and Kalibangan, but such transport must have been more expensive than that by boats. It is likely that most long distance commerce was undertaken by individual merchants. In the warehouse at Lothal, 65 seal impressions (sealings) on terracotta pieces have been found, which often bear on the other side impressions of mats, cloth or twisted fibre, showing that each of these seals was put on reed-mat or cloth tied to the mouth of a jar containing merchandise. None of the warehouse sealings matches any seals found at Lothal; so it has been inferred that the items on which these were affixed (and which were apparently burnt in a fire) had been brought to Lothal from other places in the Indus territory.

Such a scale of local and long distance trade raises the question of how the goods were bought and sold. We have seen above that great care was taken to maintain uniformity in weights throughout the Indus territory. Many goods must then have been priced according to their weight. But there were no coins in terms of which prices could be stated; and we are still uncertain as to what the materials were that could have served as money. For certain transactions, particular measures of grain or numbers of agate and carnelian beads or sea-shells might have been used as mediums of payment. It is, in any case, certain that the extensive Indus trading system could not have worked merely through barter (exchange of one set of goods for another). Habib suggests that there is also the possibility that some seals served as "tokens" for goods, and their undeciphered texts might indicate their "value" in terms of particular goods.

There is no firm evidence of any Indus trade with Neolithic South India, though the late Indus settlement at Daimabad, in Ahmednagar district of Maharashtra, *ca.* 1900-1700 BCE, suggests that there might have been earlier commercial links with at least the upper Godavari basin. Further north at Kayatha, near Ujjain in Madhya Pradesh, the type-site of a culture which could go back to 2400 BCE, three caches were found, two of carnelian and agate beads and one of steatite micro-beads, which could all have come from workshops in the Indus territories.

Rajasthan probably played a much more important role in the external trade of the Indus civilization, owing to its copper resources in Mewar and in north-east Rajasthan. Mines in Mewar were obviously the sources of copper used in the Banas culture (3000-1300 BCE). In north-eastern Rajasthan, the Ochre-Coloured Pottery (OCP) culture sites of Ganeshwar and Jodhpura (2800-1500 BCE) lie close to the old Bairat-Singhana copper mines (and the modern Khetri mines), and this area too could have provided part of the copper that the Indus civilization needed. It is significant that there are signs of Indus influences on the pottery of Ganeshwar and Jodhpura. We discuss the importance of the Jodhpura complex below.

In the north, the Neolithic culture of Kashmir in its ceramic phase (2500-2000 BCE) was practically contemporaneous with the Indus civilization. It is possible that the Indus lapidaries obtained their jade from Kashmir (where jade rings have been found), which in turn must have imported it from the Khotan area of Xinjiang (China) across the Karakoram Range. On the other hand, Kashmir itself received carnelian and agate beads (some 900 of which were found in a Kot-Diji-style pot at Burzahom, the main site of Kashmir's Neolithic culture) from the Indus territories.

Habib says that the Mesopotamian fashion displayed in the beard and robe-decoration in the stone statue of the "Priest King", however, strongly suggests familiarity with Mesopotamian culture at Mohenjodaro; and a young woman buried in Harappa in the Sumerian fashion, wrapped in reed-matting within a wooden-lidded coffin, even offers evidence of the presence of a Mesopotamian community in that city (Irfan Habib 2002: 45-50)

Habib's emphasis on internal trade brings us to the Jodhpura complex and its importance.

Can the Jodhpura complex be identified with Meluhha?

The discovery of rich cassiterite bearing (up to 1.5 per cent tin) quartz-porphyry in the Tosham hills, near Bhiwani, Haryana (Kochhar et al. 1999) makes it plausible that bronze ingots were also being supplied from Ganeshwar. This new evidence requires a bit of a digression to evaluate the role of the Jodhpura complex cultures (Rajasthan) in the Harappan copper industry. I think that the Jodhpura complex is a more probable candidate for its identification with Meluhha.

The following are the salient features of the Jodhpura Complex:

1. Jodhpura-Ganeshwar complex has a distinct identity though surrounded by the Harappans.
2. Jodhpura-Ganeshwar complex sites are spread over an area of about 200,000 sq.km.
3. Jodhpura site is a big settlement of 5-10 hectare size.
4. From this complex a large quantity and variety of copper artefacts have been found and a majority of them are of Harappan vintage though indicating a wide clientele.
5. The copper melting locations are on the periphery of the Harappan towns.
6. There are no smelting furnaces in any of the Harappan towns as pointed out by Chakrabarti & Lahiri (1996) and Miller.
7. Some burials have slag buried in them.
8. The tradition of itinerant smiths is still alive today.
9. The Mesopotamian texts mention Meluhha in the east from where copper was supplied.
10. The Jodhpura-Ganeshwar complex sites are close to the 80 km long Khetri copper-belt of Rajasthan and also to the Tusham hill (Haryana) tin resources.
11. The evidence from all over Asia of both copper and iron being produced by village based non-urban societies.

Hooza and Kumar (1997) also emphasize,

Subsequent explorations and excavations at Ganeshwar brought to light over 5000 copper objects .... The copper artefacts included arrow-heads, beads, rings, bangles, fish hooks, pins, spearheads, celts and balls .... such a rich find of pre-historic copper objects from a single small site is very significant.

How do we explain the fact that the main metallurgical activity was not being done by the Harappan urban people but by non-urban communities like the Ganeshwar complex people. Here the Thai model may be more relevant to the Jodhpura-Ganeshwar complex. To understand the Ganeshwar complex culture industries, Pigott's (1999) observations are very relevant:

Early in the 2nd Millennium BCE the production of copper and bronze began in South-east Asia. The Thailand Archaeometallurgy Project (TAP) had revealed the presence of major copper mining complexes and associated production settlements, the latter among the largest such sites known in Asia. The combined evidence from these sites comprises much of the primary production data by which the so-called "South-east Asian Metallurgical Tradition" can be characterized. Broadly speaking this "Tradition", defined in terms of the evidence from Thailand arose under somewhat unusual conditions. In contrast to most of the major culture areas of the Old World where large-scale production of metal, in particular bronze, is associated with complex societies and urban settings, in South-east Asia current evidence suggests that such metallurgy developed in village contexts. These villages were active in extensive network of inter-regional exchange, but exhibit only modest degrees of social ranking, at least during the early stages of metallurgy and development in the pre-historic period .... It is argued that production which will be reviewed for the sites of Non Pa Wai, Nil Kham Haeng, and Non Mak La, was accomplished by a low investment "low-tech", very labour-intensive method, which was specialized only at the household-family level and which may have been only dry season industrial activity. Despite this level of production organization, the evidence suggests that prior to the appearance of chiefdom levels of social complexity, and under conditions of economic decentralization, these village-based communities mined significant volumes of ores and produced large amounts of copper.

Ganeshwar complex sites too are village-based but may have specialized in copper production.

The main copper source for the Harappans could be Rajasthan or Baluchisthan. In this connection Oman mines have also been mentioned. Heather Miller has pointed out that even copper-rich prills were discarded at Harappa, which goes to show that there was an abundance of metal and that it was not a precious import. Even in the Mesopotamian texts, Meluhha is identified with the Indus and eastern region. We suggest that the Jodhpura-Ganeshwar complex fits the bill better for being identified with Meluhha, with its rich 80-km-long Khetri copper belt. It is estimated that in the Mardan–Kudan section there is a reserve of 28 million tons and in Dariba region 0.5 million tonnes. The main mineral is chalcopyrite ($CuFeS_2$). Therefore, import of copper from Oman does not make much sense unless marine transport was far cheaper than overland transport. There is therefore every possibility of the Ganeshwar complex itself being the much talked about Meluhha of the Mesopotamian texts!

They may also be producing copper ingots and exporting to the Harappan towns and further beyond into West Asia, though the evidence is not explicit on this point. But as smelting operations have spatial constraints of nearness to the old mines, these sites are naturally located close to the Rajasthan copper mineral occurrences. There is some evidence of sharp edged tools being made of bronze in the Harappan towns (Agrawal 1971; Miller 1999). Keeping in view the highly regulated nature of the Mature Harappan towns with their rules of town-planning, civic sanitation, standardization of weights and measures we should not be surprised if some control was also exercised on the tin/arsenic content of the bronze ingots exported to the Harappan towns. With the discovery of Tusham tin mines nearby (Kochhar et al. 1999), it now becomes more probable.

Miller has emphatically said that none of the Harappan sites has any copper smelting evidence, though there is melting evidence. Heather Miller (1999) recognizes that there is some indication of crafts segregation related to semi-precious objects and metallurgy and ceramics. She says:

At Harappa, copper melting debris, the various bone-associated slags, and to some extent pottery firing assemblages, tend to be isolated and not intermixed with debris from other crafts .... There are thus hints of differences in the organization of the pyrotechnological crafts vs. the extractive-reductive crafts. This pattern seems to be somewhat true for Mohenjodaro, although it is perhaps not quite as clear.

It may be relevant to recall here that the locality for the metalsmiths (Tamtyura, after *tamra* = copper) was kept outside the periphery of the main town of Almora (in Central Himalayas), the historical capital of Kumaun. King Kalyanchand shifted the capital to Almora in the 16th century from Champavat. So it was a deliberate act on the part of the king to keep the artisans away from the urban elite. Of course metal was being smelted at the old mining sites only (Agrawal 2000).

On the other hand, we also need to keep in mind the recent thinking about the inappropriateness of modern concepts of production and technological management in ancient technological organization. Budd and Taylor make the following observation:

Today, there is an ongoing discussion highlighting the inappropriateness of modern concept of production and technological development in conceptualizing ancient metallurgical organization (Budd and Taylor 1995, Sherratt 1994). Sherratt (1994: 337-8) has attacked Childe's basic premise that metallurgy played the same role in urban and non-urban contexts in the European and Meditterranean Bronze Age. He highlights the diversity of patterns of use and consumption of even closely similar metal artefacts and draws attention to the high, "chiefly" status of "smiths" burials suggesting that '... metallurgy was itself a prestige practice. And "prestige" itself is perhaps a modernist/ethnocentric term to convey the mystique that was involved' (Sherratt 1994: 338). The earliest metal making might thus have been associated with a politico-religious power and have a ritual or symbolic rather than purely economic component .... At present we understand far too little about the social context of Bronze Age metal making or the role of metal objects in the societies that produced them. As a consequence we know little about how metals enter the archaeological record (Budd and Taylor 1995).

Moorey (1994) has also emphasized the contrast between Mesopotamia and highland neighbours.

The contrast between Mesopotamia and its highland neighbours was not just one of unequal access to raw material, but also of unequal degrees of socio-economic organization and complexity. The urban crafts and industries of Mesopotamia were as dependent on the highly organized labour of those who produced but did not participate in the consumption of what was traded as they were on sustained access to foreign materials .... This is not the place to enter into the notoriously complex question of the relationship between centralized administrative system and individual entrepreneurship in the procurement of raw materials, their manufacture, and the distribution of goods in historic Mesopotamia. But it is necessary to draw attention to it, if only to emphasize that they were not homogeneous at any time. The three modes of exchange conventionally distinguished as reciprocal, redistributive, and commercial coexisted. They were not mutually exclusive, as is too often assumed.

We need to take into account the above examples to understand the metal trade of the Ganeshwar complex. In the context of Jodhpura-Ganeshwar complex, for production and export of metal artefacts and ingots to the Harappan towns and perhaps further beyond into Mesopotamia, what were they getting in exchange? Was it silver? Was it grain? Or something else? How do we explain the location of Kunal, a small village and Rakhigarhi, a large city, in close vicinity of Jodhpura-Ganeshwar complex sites and their apparent prosperity? Was it a very unequal relationship where the economic benefits were largely appropriated by the Harappans? Kunal has yielded one of the richest hauls of silver and gold ornaments amongst the Harappan towns.

Here we may take note of a refreshing ethnographic viewpoint. Lahiri (1993: 130) says:

.... This (Harappa) 3rd Millennium BCE city, situated in the Sahawal region of Pakistan, was an important copper/bronze craft centre of its area although its immediate hinterland is minerally barren .... In the process of secondary manufacture, however, some slag and miscellaneous waste was generated and, as Vats's *Excavations at Harappa* (1940: 254ff) underlines, these are primarily found in the post-cremation urns of its various mounds .... Slag was being produced at Harappa in the course of artisanal crafting and manufacture. However, its contextual association suggests that it was considered more than just a by-product of smelting and manufacture. When appropriated in funerary rites and rituals, it was divested of its technological meaning and reconstituted as a cultural signifier of beliefs which cannot be as clearly spelled out as at Sihi but are related to death and possible afterlife.

She forcefully concludes:

Generally, works on metallurgy in antiquity tend towards monolithic model made up of an evolutionary development of metal-craft with a unifunctional use of artefacts and raw materials, within which cognitive archaeology has no place. All those components that cannot be subsumed within this paradigm are dismissed as anomalous/discrepant products of technological/resource constraints/determinants and, hence, unworthy of interest in themselves. My purpose has been to show that some such elements of metal technology in India can, through the microcosm of ethnography and early literature, both rich sources of cognitive information, be located within historically documented cultural choices, an artisanal ecosystem that is based on resource-conserving principles as well as folk traditions and historical events (Lahiri 1993: 130).

We have thus tried to make a case for identification of Meluhha of the Mesopotamian texts with the Jodhpura complex area. With its rich copper and tin mineral hinterland and evidence of a large number of Harappan vintage artefacts, Jodhpura complex has a clear claim to such identification.

I have however to keep in mind the complexities involved. Both the role of metal technology in urbanization and the concomitant unilinear models of evolution, and the relationship of metal producing village-based societies need a fresh evaluation of the evidence. The old axioms will not serve the purpose. Towards this end we have quoted both ethnographic evidence as also the Pan-Asian evidence of both copper and iron being produced by non-urban village communities. This means that we have to re-evaluate our assumptions of role of metal technology in the ancient societies.

SUMMARY

Following Ratnagar (2004), we can now take an overview of the evidence on trade.

On the whole, the majority of materials and artefacts appear to have moved from India to Sumer, the exceptions being food, textiles, silver, and steatite vessels. Probably wood, like lapis lazuli or gold, could have been transported to Sumer for specific purposes like the building of a temple chariot, statue, or temple facade/roof, in contrast to copper/bronze, textiles, and food that would have been consumed on a regular basis. Thus copper/bronze, under-represented in archaeological sites because of its re-melting and reuse value, may be the main export. The cuneiform texts give a glimpse of the large quantities of copper that were traded by Mesopotamia.

Bitumen was also an "industrial material" and one that was in use, if not traded, on the Gulf littoral at a very early date. In the 3rd millennium it appears to have been in common use in the upper Gulf and in Oman, but not so in South Asia, where it never seems to have developed into an essential boat-building material.

Ratnagar makes an important observation that etched carnelian beads that occur in a surprising number of 3rd-millennium sites west of the Indus, are absent in the hinterland/ periphery/margin sites of the Kulli culture, Kayatha, Burzahom, and Kunal.

The extent of trade and travel and long period residence of people in foreign lands is indicated by the Sumerian official interpreter for the Meluhhans, and a Sumerian buried in a characteristic wooden coffin and reed shroud at Harappa.

Ratnagar identifies three major factors which affect the "trading capacity" of a culture:

1. Favourable environmental conditions in some regions showed immensely higher subsistence wealth than others, and were therefore more densely populated. These cultures were obviously in stronger positions for inter-regional trade than others. Unlike south-east Iran and Baluchistan, lower Mesopotamia, Susiana, Seistan, and Sind were more populated in the 3rd millennium. For example, Uruk in the early 3rd millennium was a 400-hectare city, compared to the Indus cities which were not larger than 125-50 hectares. Towards the end of the 3rd millennium, two 200-hectare cities in Sumer, Larsa, and Umma, were less than 50 km apart. Whereas the distance between Mohenjodaro and Ganweriwala on the Indus plain was over 300 km. Ur and perhaps Lothal were both ports, but whereas Ur had reached 50 hectares by the end of ED, Lothal was 10 hectares or less. The largest settlement on Bahrain, the port city of Qala' at al Bahrain, was about 28 hectares.
2. Physical location in relation to major trade routes: For example, Dilmun's proximity to Mesopotamia and its adoption of cuneiform and some elements of Mesopotamian iconography and temple forms was probably a factor.
3. Level of social organization helps a great deal. It would be urban societies with their characteristic division of labour (a range of expertise ranging from cart building to seal cutting to writing and metallurgy) that would have the wherewithal to engage in foreign trade on a regular basis. Literacy, which often accompanies the urban development of a society, also had its uses in the development of foreign trade. With the use of writing, transactions would be permanently recorded, and therefore staggered over time – it would now be possible to accumulate stores and make disbursements over time.

The bulk of the trade flowed between Mesopotamia, Elam, and India. It was an inter-regional trade between unequals, and transactions were unbalanced, the movement of goods being heavily weighted in certain directions, with metals, stone, timber, pearls, ivory, and other items moving preferentially to the Mesopotamian cities.

Around 2000 BCE, there is a drastic change. After 2000 BCE, it appears, not only did the movement of the various metals, stones, and shells dwindled, there was also a disruption of habitation at many of the settlements. The desertion of Mohenjodaro, Dholavira, Harappa, and other Harappan cities represents a dissolution of the state, the system of literacy, and urban forms and institutions like the use of seals and tokens, street planning, street drains, etc. The Jhukar culture and the Cemetery H were both intrusive at the site. Shortughai, in the last Harappan occupation, ceased to have a lapis industry and began to have links with Bactria. It is obvious that wherever late Harappan cultures are known, these did not utilize marine shell, lapis lazuli, silver, or tin-bronze, to any appreciable extent. That is to say, the end of the state and the end of the long distance trade appear to have occurred simultaneously. With the abandonment of settlements and economic decline, links between the major centres of civilization dissolved in the early 2nd millennium.

The collapse of the Harappan state was a major event which changed the pattern of trade and the alignment of routes into South Asia. Jarrige (1974-86: 119) has pointed out the absence of eastern Iranian and Afghanistan materials, including lapis, at Nausharo in the Harappan period. In particular, he stressed the scarcity of lapis at the site. In contrast, Chalcolithic Mehrgarh and Nausharo did have interactions up the Bolan route. Thus a reversal had occurred, and there was activity and exchange again between the Baluchistan highlands and the Kacchi plain.

Ratnagar points out that the desertion of several sites, and colonization of fresh areas, from north-eastern Iran and Turkmenia to the Murghab delta, and from north-eastern Iran southward and south-eastward to Seistan and Baluchistan, and even into the Kacchi, appear (1) to have occurred toward the end of the 3rd millennium or the early 2nd millennium, (2) to some extent to have been connected with the wide dispersal of a cult or cults in which polished marble objects of three sorts were used, (3) to have had some connection with a search for, or utilization of, copper in Baluchistan, and (4) in the face of dwindling state power in South Asia to have involved the reopening of passage (pastoralist movements?) from the highlands into the Indus plains. Could it mean the migration of the so-called Indo-Aryans? Ratnagar does not specify.

It is interesting that Moorey (1994: 245-6) finds it significant that cuneiform references to the copper of Magan cease at the time when the tablets of Mari and Babylon begin to mention Alashiya or Cyprus as a source of copper.

Ratnagar, Possehl and others have recognized the role of nomads in trade. The lapis of Chagai may have first been brought into the north-western plains of the Indian subcontinent by sheep and goat pastoralists who wintered in the Indus lowlands, their having acquired it from other mobile groups. However, regions as greatly distant from each other as the Tigris-Euphrates Valley and the Indus Valley could hardly have been brought into a trading circuit by the movements of animal herders.

Ratnagar suggests that it is also possible that it was Mesopotamian requirements of lapis lazuli that brought the Harappans into a trading network. The Harappan elite could have taken control of the procurement and circulation of lapis, thereafter exporting it westward by sea. For such a major change in suppliers to have occurred, however, a prerequisite would be for the Mesopotamians to know that lapis lazuli could be acquired from north-western India, or that the Harappans were aware of the great demand for lapis in Sumer. It is possible that when the Sumerian lapis "crisis" occurred, north-west India gradually became inducted into a wide-reaching network of exchange. Gradually a marked complexity and increase in trading relations would have developed when it was found that ivory, gold, carnelian, timber and other materials could also be exported from India. With the emergence of the Harappan state the acquisition of lapis lazuli was left neither to chance nor to middlemen: Harappan colonies were established in the vicinity of the mines.

Irfan Habib suggests that the Indus civilization probably drew its silver, or much of it, from the mines, famous in early medieval times, situated in the Panjshir Valley in northern Afghanistan. This becomes likelier when we consider that the valley lay astride the best route connecting the Indus basin with Shortughai, on the Oxus River in north-eastern Afghanistan. Within a period carbon-dated 2865-1975 BCE, the pottery, mud-bricks, houses and artefacts at Shortughai, all followed Mature Indus models. Its people partly sustained themselves by cultivation. But its real industry seems to have been the making of lapis lazuli beads. This semi-precious stone almost certainly came from the celebrated mines at Sar-i-Sang on the upper reaches of the Kokcha River, near whose junction with the Oxus Shortughai is itself situated. At Shortughai, craftsmen also cut agate and carnelian beads, obviously receiving their raw material from the Indus basin. Thus, agate and carnelian exchanged with lapis lazuli, with Shortughai serving as the entrepot. The lapis lazuli on which the Chanhudaro artisan worked must have been imported via Shortughai (Habib 2002: 45-50).

Elucidating the modalities of trade, Ratnagar concludes that the goods exchanged were both utilitarian (bitumen, wood, copper) and items loaded with meaning *(serie ancienne* bowls) and elite or high-status objects like etched carnelian beads, or ivory. There was no one major mode of exchange, but that ceremonial gifts, state expeditions for particular purposes, tribute; seizure, trade between contractual partners, and a minor amount of peddling by boatmen, were only some of the processes that coexisted.

Ratnagar emphasizes that it would have been the centres of state formation and urbanization that played the key roles in the trade across the world. She also gives due importance to the political factor reflected by destructions of several of the settlements involved in the trade. These two sets of phenomena may not be necessarily related as cause (political considerations, even upheavals) and effect (modes of transaction, and also termination of exchange relationships across the regions), but it is possible that they reinforced each other and that some resources (for example, tin) were contested. She concludes, 'We cannot escape the overall conclusion that the history of world trade in the Bronze Age was a history of ruptures'.

AGRICULTURE

To support the artisans and the elite of urbanized societies a prerequisite was surplus agricultural production which Gordon Childe had defined as one of the basic criteria for urbanization. The granaries at Harappa and Mohenjodaro, the stack of storage jars at Kalibangan – all suggest that the Harappans were producing surplus grains. Such storage may also suggest some sort of tax or tribute levied by the state.

There is now a sizable corpus of evidence on the agricultural crops produced by the Harappans. After the classic study by Chaudhury and Ghosh (1951) of the plant remains from Harappa, the most exhaustive and systematic recent archaeobotanic study has now been carried out by Weber at Harappa (Weber 2003).

In reconstructing the Harappan agricultural technology, modern practices give us a clue. Today wheat and barley are sown immediately after the monsoon floods in the Indus plains (Sindh) and reaped in March/April as *rabi* crops. This fertile alluvium does not need ploughing, irrigation or manuring today and one can extrapolate the same for the Harappans too. Sesamum and cotton must have been *kharif* crops, sown at the beginning of floods and reaped by autumn. No clear evidence of agricultural tools is available, though Kosambi identified a toothed harrow in one of the Harappan seals.

The principal Harappan cereals seem to have been wheat and barley. The wheat cultivated had three varieties, viz. Indian dwarf wheat (*Triticum sphaerococcum*), the club wheat (*Triticum compactum*) and *Triticum aestivum.* The dominant barley was the six-rowed variety (*Hordeum vulgare*), though *Hordeum vulgare nudum* and *Hordeum sphaerococcum* have also been met with (Costantini 1990). Rice seems to have been unknown to the Mature Harappans at least in the Indus Valley. At the same time it must be noted that husk and spikelets of rice (*Oryza* sp.) have been found mixed up with clay-lumps at Lothal and Rangpur, both in Gujarat. Clear evidence of rice, however, comes from Hulas, but that is in a Late Harappan context. Lothal has also yielded some evidence of millets, particularly Kangni (*Setaria italica*) (K. Ramesh Rao and Krishna Lal in S.R. Rao 1985: 667-83). Six varieties of millets, including ragi (*Eleusine* sp.), kodon (*Paspalum scrobiculatum*), sawa (*Enchinochloa colonum*) and jowar (Sorghum) have been identified at Rojdi, in the same region of Gujarat (Weber 1990). Thus there are regional as well as chronological variations in the Harappan food economy. Sesame and mustard, used as cooking media and for lighting lamps, were also cultivated by the Harappans. But what is most intriguing is that while Egypt, so famous for its cotton, did not produce that crop in the 3rd Millennium BCE, India did. Evidence of cotton cloth comes from Mohenjodaro, where its decomposed remains were duly identified. It seems to have been made from the fibre of *Gossypium arboreum*. Besides, terracotta sealings found at many Harappan sites bear clear impressions of cloth that may have been used in the packages which were sealed with such sealings. From Baluchistan, Mehrgarh has yielded the evidence for cotton during the 5th Millennium BCE. The Indus and many of its tributaries, originating in the Himalayas, start getting snow-melt at the beginning of the summer and the same is followed by rainfall a few months later. All this brings a lot of fresh alluvial silt which is highly productive and for which no major furrowing and irrigation seem to be necessary. Thus, it is this rich silt, spread over vast riverine tracts that must have produced a major share of the crops.

At Kalibangan there is evidence for a ploughed field. Though it belonged to the Early Harappan phase, there is no reason to doubt that the pattern continued during the Mature Harappan times. Indeed, it has survived all these millennia and is followed even today in parts of Rajasthan, Haryana, Punjab and western Uttar Pradesh. The Kalibangan field had two sets of furrows, crossing each other at right angles, along the cardinal directions, i.e. one east-west and the other north-south. The distance in between the east-west furrows was only 30 cm, whereas that in between the north-south one was 1.90 m. In the modern fields, mustard is grown in the wider north-south furrows and horse gram in the other. Probably a similar arrangement existed during the pre-Mature and Mature Harappan times. In any case, what is noteworthy is the technique of raising two crops in one and the same field.

Wooden ploughs, with perhaps a sharp-ended copper bar attached to its end, seem to have been used for tilling fields. Although a terracotta model of a plough had been found long back at Mohenjodaro, it was not duly recognized. However, Banawali has now yielded a complete terracotta model. These ploughs were drawn by bullocks that constituted a sizable part of the cattle wealth of the Harappans. It has also been suggested that the Harappans practised canal-irrigation, but the evidence is rather meagre. At the same time, the channelling of overflowing rainwater can be easily visualized. Although metal (copper) sickles were known to the Harappans, the same do not seem to have been produced in large numbers, perhaps because the metal was costly. However, the presence of a large number of chert blades, retaining the gloss on the cutting edge, indicates that these were used for harvesting. Indeed, in much earlier levels at Mehrgarh have been found stone blades set with the help of bitumen in wooden handles. These also bear the sheen. Thus, the practice of using composite stone blades as sickles was continued by the Harappans, saving copper for more useful purposes. Grinding seems to have been done on saddle querns. (Rotary querns did not come into being until about the beginning of the Christian era.) The bread was evidently prepared on a flat, circular, large platter provided with short legs (called *chakala* in Hindi), examples of which have been found at Alamgirpur . Cooking, of course, was done in ovens of which there are a number of examples.

Carbonized grains of probably field peas (*Pisum arvense* L.) and seeds of melon attest to their cultivation. The occurrence of stones of date at Mohenjodaro testify to its cultivation, though it could as well may have been imported from the Persian Gulf areas where these grow in abundance and with which region the Mature Harappans had regular trade contacts. However, it is not unlikely that these may have been grown locally. The evidence in regard to coconut and pomegranate is rather weak. Banana, of which material remains could not have survived the hot and humid climate of the region, is, however, attested to by the paintings of that plant on the pottery.

Saraswat presented some very interesting evidence regarding the horticultural practices of the Harappans (at the Annual Conference of the Indian Archaeological Society, held at Bhopal in December 1991). He stated that grape seeds and vine charcoals from Rohira and Mahorana in Sangrur district (India) have documented that the Harappans attained the know-how of grapevine cultivation. Hyacinth-bean (*Lablab purpureus*) from Mahorana is an unequivocal vegetable cultivation. One may presume that the ladies might be using henna for embellishment. The evidence of parijata (*Nyctanthes arbortristris*) in the charcoal remains at the same site is an ornamental plant with fragrant flowers. Cultivation of ornamental plants for fragrant flowers is further evidenced by the jasmine (*Jasminum* sp.) charcoal from a recently excavated site at Sanghol in Ludhiana district.

Recently, there has been a very welcome addition to the archaeobotanic literature, *Indus Ethnobiology*. Weber and Belcher (2003) have brought out this very exhaustive study of the agriculture and animal husbandry of the Indus civilization. In this volume, Weber has contributed a very exhaustive study of the Harappan plant remains. We summarize his important findings below:

Harappa was a fully developed city complex, with a population in excess of 35,000 people. Based on city layout, styles of painted ceramics, and inscribed seals and weights, we can conclude that the inhabitants of this site shared the same culture with other Indus civilization sites (Kenoyer 1998). Harappa is not only the "type" site of this civilization but it is one of the most important; any trends identified here have significance for the culture as a whole. Weber says:

> Harappa is one of only a few sites excavated in South Asia with not only an interest in extracting and interpreting archaeobotanical remains but also with an intensive and systematic strategy in place for macrobotanical analysis of material that is both chronologically and contextually well documented. Where most existing reconstructions of Indus civilization agricultural strategies draw upon data from a number of overlapping sites to produce a sequence (see: Saraswat 1992; Kajale 1991; Meadow 1996; Jarrige 1985; Fuller 2000), Harappa offers a unique opportunity to develop an agricultural sequence from a single site that incorporates all phases of this civilization, avoiding some of the inherent biases in data collected from different types of sites, excavated at different times, using different collection and analysis strategies. This in turn will help us understand the factors that bias archaeobotanical data.

Describing his massive operation, Weber says that over the last fifteen years at Harappa, over 10,000 litres of soil have been systematically collected and floated from a variety of locations and features. The strategy was to sample as wide a variety of contexts as possible and to sample these contexts multiple times. In order to maximize the value of the archaeobotanical material while minimizing the inherent biases in this kind of database, samples were collected and analyzed from each phase and within each context. The majority of samples used were from the interior of hearths or on occupational surfaces. Samples from such contexts have a quantitative value and represent discrete depositional patterns that reflect human behaviour.

Weber reports, regardless of the period, the most common plants recovered at Harappa were cereals, followed by pulses and vegetables, and finally oil-seed, fibre, and fruit plants. This pattern may be due to the fact that plants that are crushed for juice or oil, dried for later use, or species consumed in a fresh state as roots, greens, fruits, and nuts are less likely to be preserved than seed plants that are parched, cooked, or processed in close proximity to fires. As expected, the cereals wheat (*Triticum*) and barley (*Hordeum*) make up the majority of the recovered plant remains. Grains of these cereals are found in nearly every sample and together make up over 90 per cent of all seeds recovered from the Early Harappan Period, though barley is the dominant grain.

About the other winter/spring harvested crops represented in samples from these early levels of Harappa, Weber informs that they were lentils *(Lens)*, pea *(Pisum)*, grass pea *(Lathyrus)*, and jujube *(Ziziphus)*. They are present in fewer than half the samples and together account for less than 3 per cent of the recovered seeds. This period also had low counts of the summer/fall harvested crops of date *(Phoenix)*, grape *(Vitis)*, and millets *(Panicum)*, which accounted for less than 2 per cent of the seeds and had a ubiquity rating of less than 10 per cent. Weber infers that the basis of the agricultural strategy at Harappa during the Early Harappan period was the winter cultivation of wheat and barley. The people who settled in this site brought with them cereal grains, and a proven agricultural strategy for this region of South Asia involving wild plant collecting and some cultivation of vegetables and fruits. They focused, however, on wheat and barley.

The beginning of the Harappan period (*ca.* 2600 BCE) is marked by a more extensive agricultural system involving a greater variety of plants. Although wheat and barley still appear to have been the mainstays of the agricultural system, they now account for only 81 per cent of the seeds with ubiquity dropping to 90 per cent. A combination of summer millets, rice, vegetables, fruits, oilseed, and fibre-oriented crops make up an increasing proportion of the cultivated plants. While the agricultural strategy is still based on winter/spring-harvested crops, wheat now accounts for 45 per cent of the recovered seeds compared to barley with only 36 per cent of the total. Wheat is up 3 per cent from the early period while barley is down 15 per cent from that same period. More seeds were being preserved in the archaeological record during the Harappan period than at any other time. Besides a rise in seed density to nearly 60 seeds per litre of soil, a combination of summer-oriented crops make up increasing proportion of the assemblage. Still, the agricultural strategy is base on winter crops.

The Late Period at Harappa had the fewest soil samples and the lowest seed density with an average of only 11 seeds per litre of floated soil. For this reason, Weber cautions, the patterns identified in the archaeobotanical record need to be explored cautiously with the view that until more samples are added the results may be skewed. Nonetheless, the patterns identified with these samples do fit data sets from other Harappan sites with Late Harappan occupations (Weber 1999). The decline in seed density among the winter crops was 86 per cent. In contrast the ubiquity of winter crops remains similar to the previous period. Wheat and barley show a slight decline in sample percentage but still remain the foundation of the agricultural strategy. But barley once again becomes the dominant grain in this strategy.

In general the picture that emerges, taking into account the evidence from all periods of occupation at Harappa, is that the strategy remains focused on sowing crops in the fall, relying on winter rains to feed them, and then harvesting them in the spring. The crops include some summer-sown cereals and a variety of pulses, vegetables, and fruits. A complex multicropping strategy is evident in all periods of occupation, although it appears to increase in importance over the occupation of the site.

From his archaeobotanic analysis, Weber draws some important conclusions:

1. There is a growing importance of summer crops. As time went on, seeds from summer-crops were being preserved at more locations throughout Harappa implying increased use. With more efforts at multicropping, agricultural intensification was occurring. There appears to have been a constant and gradual process of increasing use of summer cropped plants, with the biggest jump seen in the Late Harappan samples. It is in this Late Period where we see the summer-cropped seed density and ubiquity at its highest and most significant levels relative to the winter-cropped plants.

   While seed density declines significantly in the Late Period, there is an increase in the density and proportions of the type of by-products generally associated with crop processing. An increase in spikelet forks, glume bases, and straw nodes, the kind of debris associated with threshing, winnowing, grinding, and cleaning of grains, is good evidence for a shift in crop-processing activities occurring over the occupation of Harappa.

2. There is also a constant increase in the number of different species being cultivated at Harappa. With few crops ever disappearing from the diet, each period sees a significant increase in crop diversity from the previous period. There are almost three times as many edible taxa per total number of edible fragments recovered per flotation sample during the Late Period than during the earlier periods (Weber 1999). This increasing diversity of food plants implies that people at Harappa were broadening their use of crops without abandoning existing plants. The new crops were not used as replacements, nor was their initial use extensive. These plants, whether local varieties or species being introduced from great distances away, appeared as part of a gradual process of supplementing existing crops.

3. The broadening of the agricultural strategy at Harappa was neither rapid nor sudden. Each subsequent period contains a greater variety of plants and represents an increasing effort at cropping throughout the year. Associated with this pattern is an increase in the proportion of weed seeds. While they make up no more than 2 per cent of the material in the Early Period, they increase to over 10 per cent in the Harappan period and nearly 15 per cent in the Late Period. Their presence in the samples is useful for reconstructing crop husbandry practices since they commonly grow in agricultural fields and are removed prior to consumption.

4. At the earliest occupation, barley is the dominant grain. During the Harappan period, wheat increases in ubiquity, density, and percentage until it becomes the most common species at Harappa. Finally, in the Late Period, wheat declines and barley once again becomes the dominant cereal.

To sum up, Weber thinks that his conclusions about the seed record are not likely to be affected by post-depositional factors or methodological procedures. In contrast, the environment did constrain what types of plants were grown locally, although the types of shifts seen in the archaeobotanical record are not typically influenced by climatic change. While the habitat around Harappa may not have been constant, and the use of fuels may also have shifted as a result of this, most of the crops are consistently associated with a winter cultivation strategy.

Weber observes an increasing use of summer-sown plants; the introduction of a number of new crops; significant changes in the density and ubiquity of seed crops in general; an increased occurrence of weeds and the by-products of cereals; and a declining percentage of cereal grains as a whole. These shifts seem to be interconnected and seem to reflect changes in specific activities, and are probably a result of changing needs of the society. If these patterns are closely related to the evolving relationship between Harappa and the surrounding settlements, and to issues dealing with storage, trade, and the centralization and control of the food supply, then a shift in the status of Harappa as an agricultural producer, consumer, and importer of crops may be the kind of explanation that integrates these changes. In the end, they should be seen as an indicator of, rather than as an instigator for, culture change.

ANIMAL HUSBANDRY

Meadow and Patel (2003: 65-94) in their detailed review, 'Prehistoric Pastoralism in North-western South Asia from the Neolithic through the Harappan Period,' discuss the archaeozoological data in a wider perspective. P.K. Thomas has been the most active archaeozoologist of India and has made very significant contributions in this field. We summarize below his recent review (Thomas 2002: 409-420; Table 1) of the Harappan archaeozoology, with focus on Western India.

Presence/absence of horse remains has acquired a bit of political overtones. We will briefly discuss the views of Meadow, Thomas, Habib and Witzel in this connection. Some overenthusiastic scholars, like Rajaram, even found a horse on the Indus seals. Witzel informs:

Once Rajaram's book could actually be read, the initial scepticism of Indologists turned to howls of disbelief – followed by charges of fraud. It was quickly shown that the methods of Jha and Rajaram were so flexible that virtually any desired message could be read into the texts. One Indologist claimed that using methods like these he could show that the inscriptions were written in Old Norse or Old English. Others pointed to the fact that the decoded messages repeatedly turned up "missing links" between Harappan and Vedic cultures – supporting Rajaram's Hindutva revisions of history. The language of Harappa was declared to be "Late Vedic" Sanskrit, some 2,000 years before the language itself existed. Through the decoded messages, the horseless Indus Valley civilization – distinguishing it sharply from the culture of the Rigveda – was awash with horses, horse-keepers, and even horse rustlers. To support his claims, Rajaram pointed to a blurry image of a "horse seal the first pictorial evidence ever claimed of Harappan horses (Witzel, *Frontline:* Volume 17 – Issue 20, Sep. 30-Oct. 13, 2000).

Chaos followed. Within weeks, the two of us demonstrated that Rajaram's "horse seal" was a fraud, created from a computer distortion of a broken "unicorn bull" seal. This led Indologist wags to dub it the Indus Valley "piltdown horse" – a comic allusion to the "piltdown man" hoax of the early twentieth century. The comparison was, in fact, apt, since the "piltdown man" was created to fill the missing link between ape and man – just as Rajaram's "horse seal" was intended to fill a gap between Harappa and Vedic cultures.

We will discuss the horse evidence in greater detail below:

Some of the recent excavations in western India, especially in Gujarat, have brought out significant account of the faunal assemblage of the Harappan period. The excavations have revealed a wide spectrum of animal species associated with the Harappan culture. Some of the earliest archaeofaunal reports from the subcontinent belong to the Harappan sites of Mohenjodaro (Sewell and Guha 1931) and Harappa (Prashad 1936). Faunal assemblage from some of the recently excavated sites such as Kuntasi, Shikarpur, Orio Timbo, Surkotada, Nageshwar, etc. has brought to light interesting perspective on ancient subsistence based on animals during the Harappan period. In spite of the limited nature of some of the excavations, an astounding number of animal species are reported from Harappan sites. A majority of these animals, both domestic and wild, contributed to the food economy and wealth of the Harappans of western India (Thomas and Joglekar 1994, 1996; Thomas et al. 1997). Animals from different habitats such as the terrestrial, avian and aquatic were exploited for various purposes. The evidence also suggests the significance of animal by-products as well as animal power in the Harappan economy.

Domestic animals

About 80 per cent of the faunal assemblage from any of the Harappan sites belongs to domestic animals. A significant amount of animal protein was obtained from domestic animals such as cattle, buffalo, sheep, goats and pig. In addition to the regular supply of meat to the inhabitants, cattle also helped in agricultural operations, and as draught animals. One of the earliest evidence of their use as draught animals is depicted at Mohenjodaro in the form of a toy cart pulled by bullocks (Mackay 1931). For much of the animal protein young and sub-adult males were used. The recent faunal studies at Kuntasi (Thomas and Joglekar 1990; Thomas et al. 1997) and Shikarpur (Thomas et al. 1995) have revealed two peaks in the culling of these animals; a first peak of young and sub-adult animals in the age group of 1.5 to 3 years and the second peak of adult and senile animals in the age group of 4-8 years. Maintaining these animals for a longer period of time suggests that other than breeding, the by-products of cattle and animal power were also significant in the Harappan economy. The socio-economic importance of this animal can be further deduced from the clay figurines of humped cattle and their depictions on seals/ sealings from a vast majority of Harappan and later cultural periods all over India. The very docile nature of the animal and the multiple utility of the cattle may have been the reason for their preponderance at many of the proto-historic sites. Cattle pastoralism was one of the main economic pursuits of the Harappans.

After the cattle, the second important animals were the sheep and goats which have been identified from all the Harappan sites. From the faunal assemblage it is rather difficult to distinguish between the bones of sheep and goats because of their close morphological similarities. Therefore, the bones of sheep and goat have often been referred to as belonging to sheep/goats. However, at sites like Shikarpur and Kuntasi (Thomas et al. 1997), compared to sheep more goat remains were found. Sheep is a grazer, and goat a browser, therefore the latter is more adapted to different environmental conditions. Unlike the cattle, sheep and goat were killed at a young age (1-2 years) suggesting that these animals were primarily kept for meat rather than for their by-products like wool and milk. Generally the bones of sheep/goats accounted for about 10 per cent of the total faunal assemblage.

Buffalo bones are sparse in the Harappan faunal collection. From the fragmentary faunal remains, it is difficult to distinguish between the bones of cattle and buffalo unless specific skeletal parts are available for identification. If the evidence from Kuntasi and Shikarpur is any indication, the buffalo bones represent 5-10 per cent of the total faunal assemblage. Unlike cattle, the elaborate habitat of buffalo has also to be considered. This could be the reason for the scant representation of the buffalo at the Harappan sites. However there is no evidence of buffalo being used for agricultural operations and traction.

Domestic pigs represent 2-3 per cent of the faunal assemblage at Harappan sites. At sites such as Kuntasi and Shikarpur there was hardly any representation of pigs in the lower strata of the Harappan deposit. Both at Kuntasi and Shikarpur, piglets were killed in large numbers. However, the real domestic status of this animal in Harappan stock-raising is yet to be ascertained. The Harappans also kept pet animals like dog and cat. Dog bones were found in almost all the sites. However, domestic cats are identified only at a few sites. Camel bones are reported from six of the Harappan sites. However, their convincing association with the Mature Harappan culture is a matter of controversy. Also whether it was the Dromedary *(Camelus dromedarius)* or the Bactrian *(Camelus bactrianus)* species is another issue which has been debated. A calcaneum of a camel was reported from the slope of the eastern side of the main mound at Kuntasi. The identification of camel at Rojdi is also enigmatic.

Horse bones

The presence of the equid bones from Harappan sites is more controversial, especially the horse (*Equus caballus*) remains, because of its bearing on the Aryan problem. Horse bones have been reported from eight of the nineteen Harappan sites mentioned in Table 1 of Thomas (2002).

The identification of true horse bones from the Mature Harappan Period has been questioned especially, the horse remains from Surkotada (Bokonyi 1997; Meadow and Patel 2003; Anthony 1997). There were no wild horses reported from the Pleistocene or post-Pleistocene deposits in India. According to some scholars the arrival of the horse in India is linked with the so-called "Aryan invasion" (Parpola 1988). The subject has been complicated by the politicized history of the study of the Aryans and their migration.

Thomas explains that the close osteological similarities between the equid species like *Equus caballus* (horse), *Equus asinus* (donkey) and *Equus hemionus* (onager or *khur*), and the hybrid animals (mule/henny) make the precise species identification rather difficult from fragmentary and scarce remains of these animals from archaeological sites. Horse remains identified in the Harappan context are often the lower limb extremities and dentition. Since the animal was not utilized in the regular diet of the Harappans the scarcity of the bones is understandable. However, the absence of other post-cranial bones is also intriguing. From Kuntasi and Shikarpur bones of wild ass (*Equus hemionus*) with cut marks and charring have been found, suggesting hunting of these animals for food. Wild ass bones were also found at sites such as Surkotada, Rojdi and Dholavira.

Discussing the hoax of the Indus seal with a hoarse, Witzel says the following about the horse, 'Evidence suggests that the horse (*Equus caballus*) was absent from India before around 2000 BCE, or even as late as 1700 BCE, when archaeology first attests its presence in the Indus plains below the Bolan pass. The horse, a steppe animal from the semi-temperate zone, was not referred to in the Middle East until the end of the 3rd millennium, when it first shows up in Sumerian as *anshe.kur* (mountain ass) or *anshe.zi.zi* (speedy ass). Before horses, the only equids in the Near East were the donkey and the half-ass (*hemione*, onager). The nearly untrainable hemiones look a bit like horses and can interbreed with them, as can donkeys. In India, the hemione or khor (*Equus hemionus khur*) was the only equid known before the horse; a few specimens still survive in the Rann of Kachchha. (As shown by their identical archaeological field numbers (DK-6664), M-772A (published in Vol. II of *Corpus of Indus Seals and Inscriptions*, 1991) is the original seal that seven decades ago created the seal impression (Mackay 453) that Rajaram claims is a 'horse seal' M-772A flipped horizontally, Mackay 453).

Witzel informs:

> The appearance of domesticated horses in the Old World was closely linked to the development of lightweight chariots, which play a central role in the Rigveda. The oldest archaeological remains of chariots are from east and west of the Ural Mountains, where they appear *ca.* 2000 BCE. In the Near East, their use is attested in pictures and writing a little later. A superb 15th-century Egyptian example survives intact (in Florence, Italy); others show up in 12th-century Chinese tombs. Chariots like these were high-tech creations: the poles of the Egyptian example were made of elm, the wheels' felloes (outer rim) of ash, its axles and spokes of evergreen oak, and its spoke lashings of birch bark. None of these trees are found in the Near East south of Armenia, implying that these materials were imported from the north. The Egyptian example weighs only 30 kg or so, a tiny fraction of slow and heavy oxen-drawn wagons, weighing 500 kg or more, which earlier served as the main wheeled transport. These wagons, known since around 3000 BCE, are similar to those still seen in parts of the Indian countryside.
>
> The result of all this is that the claim that horses or chariots were found in the Indus Valley of the 3rd Millennium BCE is quite a stretch. The problem is impossible for writers like Rajaram who imagine the Rigveda early in the

4th or even 5th millennium, which is long before any wheeled transport – let alone chariots – existed. Even the late Hungarian palaeontologist S. Bokonyi, who thought that he recognized horses' bones at one Indus site, Surkotada, denied that these were indigenous to South Asia. He writes that 'horses reached the Indian subcontinent in an already domesticated form coming from the Inner Asiatic horse domestication centres.' Harvard's Richard Meadow, who discovered the earliest known Harappan text (which Rajaram claims to have deciphered), disputes even the Surkotada evidence. In a paper written with the young Indian scholar, Ajita K. Patel, Meadow argues that not one clear example of horse bones exists in Indus excavations or elsewhere in North India before *ca.* 2000 BCE. All contrary claims arise from evidence from ditches, erosional deposits, pits or horse graves originating hundreds or even thousands of years later than Harappan civilization. Remains of "horses" claimed by early Harappan archaeologists in the 1930s were not documented well enough to let us distinguish between horses, hemiones, or asses. (*Frontline:* Volume 17 - Issue 20, Sep. 30 - Oct. 13, 2000.)

Wild animals

It appears that a wide spectrum of mammalian species was exploited in the food economy of the Harappans (Table 1). A variety of deer, antelopes, hare *(Lepus nigricollis)* and porcupine *(Hystrix indica)* are common at almost all the sites and much of the animal protein from the wild animals may have been obtained from these animals. Among the deer species, *Cervus unicolor* (sambar), *Cervus duvauceli* (barasingha), *Axis axis* (chital/spotted deer), *Axis porcinus* (hog deer) and *Muntiacus muntjak* (barking deer) are important. Likewise, antelopes such as *Antilope cervicapra* (blackbuck/Indian antelope), *Gazella bennetti* (chinkara/Indian gazelle), *Tetracerus quadricornis* (four-horned antelope/chowsingha) and *Boselaphus tragocamelus* (nilgai/blue bull) are the commonly represented species at the Harappan sites. Another important wild animal found in the Harappan context is the wild pig *(Sus scrofa)*. It is interesting to note that both domestic *(Sus domesticus)* and wild forms of pigs are reported from a few sites. Compared to deer and antelope species, wild pigs are scarcely represented.

Accidentally killed carnivores may have been utilized for food. Of the cat family the jungle cat *(Felis chaus)* is identified from Kuntasi and Padri while the desert cat *(Felis libyca)* is found only at Rojdi, where species identification of this animal is not certain. However, the jungle cat is reported from a majority of the Chalcolithic sites of the Deccan. Among the dog family three species are reported from Harappan sites such as *Cuon alpinus* (Indian wild dog/dhole), *Canis aureus* (jackal) and *Canis lupus* (wolf). However, the Indian wild dog bones are found only at Rojdi. The wolf and jackal are reported from a few of the Harappan sites. *Hyaena* (striped hyena) has been identified only at Kuntasi. These are not the animals regularly hunted by the inhabitants of the ancient settlements. The bones of these carnivores are meagre in the collection.

Amongst the large wild animals represented at the Harappan sites are *Elephas maximus* (elephant), *Rhinoceros unicornis* (rhinoceros), *Bos* sp. (cattle like) and *Bubalus arnee* (wild buffalo). The bones of these large mammals are also scarce in the collection. Often the elephant is identified at a site from the ivory pieces utilized for making different objects. Elephant remains were identified from sites such as Mohenjodaro, Harappa, Kalibangan, Rupar, Bara, Lothal, Surkotada and Rojdi. The rhinoceros is identified from a large number of Harappan and Chalcolithic sites of Gujarat. The lower extremities of limb bones like the carpals, tarsals, metapodia and phalanges are found at Kuntasi and Shikarpur. A shoulder bone of rhinoceros was identified at Langhnaj, a Mesolithic occupation contemporary with the Harappans of Gujarat. This animal inhabited a major part of the Gujarat plains in the proto-historic period and in the medieval period it had become restricted to certain ecological niches. Wild buffalo is represented at Kuntasi and Shikarpur by cranial and post-cranial bones bearing cut and butchering marks. Both at Kuntasi and Shikarpur, a few bones of cattle such as humerus, astragalus and metapodials revealed characters which were uncommon in domestic cattle. Apparently some of these bones were also larger in size suggesting the possibility of some affinity with their wild counterparts or these animals were in the early stage of domestication.

NON-MAMMALIAN SPECIES

The Harappans exploited a variety of animals belonging to the family of birds, reptiles, fish, crustacea and molluscs. Unfortunately, species identification of this large group was not attempted at many sites mainly because of the lack of expertise and the non-availability of modem reference skeletons of these animals. The domestic fowl (*Gallus domesticus*) is reported from quite a few Harappan sites. Other species of birds such as jungle fowl (*Gallus gallus*) and pea fowl *(Pavo cristatus)* are common. Reptiles like monitor lizard *(Varanus monitor)*, crocodile (*Crocodilus* sp.), gharial (*Gavialis* sp.), turtle/tortoise species such as *Trionyx gangeticus, Batagur baska, Chitra indica, Kachuga* sp. and *Lissemys punctata* are also ubiquitous.

The Harappan sites have yielded large quantities of fish, crab and molluscs remains. General terms like catfish and carp are mentioned at a few places. However, recent studies on fish remains from Balakot and Harappa in Pakistan have revealed extensive use of both riverine and marine fish in the Harappan economy. And also long distance trade of some species of marine fish has been suggested. The fish species at the coastal Balakot site include shark, sting rays and bony fish. Dominance of grunters *(Pomadays* sp.) and the presence of other species like *Acanthopagrus* sp., *Argyrops* sp., *Protonibea* sp. and a variety of *Arius* sp. has been noticed. Harappa has yielded many species of riverine catfish, carps, snakeheads and spiny eels. In addition, the identification of the remains of marine jacks and catfish at Harappa suggests long distance trade of these items (Belcher 2003).

In recent years many people have tried to evaluate the role of molluscs in the economy of the Harappans. Both marine and freshwater species of molluscs belonging to three major classes of phylum molluscs such as *Bivalvia, Gastropoda* and *Schaphopoda* are reported from a large number of Harappan sites. From the studies carried out it has been inferred that molluscs were collected mainly for shell working (it has been discussed in Chapter 6 on Crafts) and also for food. At Kuntasi more than 50 species of shells were identified. Bivalves such as *Anadara* sp., *Paphia gallus, Meretrix* sp., *Marcia recens, Crassostrea* sp., *Acanthocardia* sp., *Trachicardium enode, Lamellidens marginalis,* etc. and Gastropods such as *Agaronia nebulosa, Thais* sp., *Telescopium telescopium, Terebralia palustris, Fila globosa,* etc. were the edible species found at some of the Harappan sites mentioned above. Species like *Turbinella pyrum, Pugilina buchephala, Chicoreus ramosus, Placuna placenta, Anadara* sp., *Dentalium* sp., *Polinices didyma, Agaronia nebulosa, Nerita* sp., etc. were associated with shell industry, especially in the manufacture of bangles, ladles, inlays, beads, pendants, gamesmen, chisels, etc. The vast amount of complete shells, finished and unfinished shell objects, and waste products of shell manufacture at many of these sites indicate a technologically advanced shell industry during the Harappan period. This tradition continued till historical times in Gujarat.

Thus we see that a wide spectrum of animal species was utilized by the Harappans. The absence and presence of certain species of animals from sites which were excavated earlier may be observed with caution. Nevertheless, domestic animals such as cattle, buffalo, sheep, goat, pig and certain deer species and antelopes are common at almost all the sites. Cattle were the predominant animals in the Harappan culture. In the subsistence system of the Harappans the domestic animals contributed more than 80 per cent of the animal protein. The remaining 20 per cent was obtained from the wild animals consisting of the terrestrial, avian and aquatic fauna. Wild mammals, birds, reptiles, fish, molluscs and crustaceans were part of the Harappan diet. The role of molluscs in the shell industry and as source of food has been attested at various Harappan settlements.

Thomas notes that the representation of wild animals in the northern group of Harappan sites shows a slight variation from the sites in the Saurashtra-Kachchha group. The typical semi-arid animals like the blackbuck, gazelle, nilgai, etc. are not identified from the northern group of sites like Harappa, Kalibangan, Rupar, Alamgirpur, etc. Probably this can be attributed to the different ecological settings of these sites. The maximum exploitation of wild fauna was noticed in the post-Urban Period at Rangpur, Surkotada, Nageshwar, Mohenjodaro, Kuntasi, Shikarpur, etc. Culturally the post-Urban Period marks the decline of the Harappan culture at these places. Probably in adverse conditions people had to depend more on animal food for sustenance (Thomas 2002: 409-420).

10

Decline, Transformation and Legacy

The Harappan cultural tradition, with its diversity and uniformity, continued for almost a millennium and probably laid the basic substratum of the present-day Indian civilization. Towards the last quarter of the 3rd Millennium BCE, a drastic change is writ large all over the Harappan zone. Was it the end of the Indus civilization, a transformation, or merely a change? What caused it: new immigrants, climatic change, disorganization of the Indus trade, or something else? In the following pages we shall address these questions.

We would like to begin with Mughal's observations as he has spent a lifetime chasing the Harappans. His observations do provide a wider perspective to look at the phenomenon of decline and end of the Harappans. He says:

Rangpur IIA to IIB-C and later Period III, or Lothal A to B (both the sites are in Gujarat) are to be seen in the context of land and water, and in the basic shift from wheat to millet. In that region, the hypotheses for cultural change as suggested for the main Indus River Valley are not applicable at all. The settlement pattern during the later (than Rangpur IIA) period, having small size and considerable increase in their numbers, illustrates the effect of diversification of economy as compared to the settlements associated with the preceding Rangpur IIA Period.

The above review of the new data demonstrates the need to change our understanding of the geographical extent of the Indus civilization and to correct an erroneous impression created by lumping together all the sites of different phases of the Harappan civilization and thus showing a vast geographical area covered by it. During the Early Harappan Period (3400-2600/2500 BCE), the populations had no access to the sea but remained confined to the Indus-Hakra River plains, having inter-settlement and inter-regional contacts including the accessible valleys of Baluchistan on the west. In the Mature Harappan Period, beginning around 2500 BCE, a very significant shift towards the sea coast took place stretching at least from Sonmiani Bay near Bala Kot to the Rann of Kachchha. It is in this part of the coastline and its hinterland that Mature Harappan sites are located. The Core Area in the Mature Harappan Period consisted most of the Early Harappan Core Area and the sea coast and extended further to cover the Pakistani Makran coast and parts of Saurashtra. The Late Harappan Period in the Greater Indus Valley on the other hand, was marked by three regional areas, each springing from the Mature Harappan but having distinct assemblages localized in their own areas. The Harappan tradition was retained in each of the three areas for some time until lost completely by about the 1st Millennium BCE. The limits of these areas are defined by occurrence of similar ceramic types: Cemetery H in the Panjab, Jhukar in Sindh which overlapped with Kulli in southern Baluchistan, and Rangpur IIB-C and Lothal B in Saurashtra. Interactions between Saurashtra and Sindh are indicated but none of these two regions has yet shown contacts with the Late Harappan (Fig. 10.1) in the Panjab. The causes of emergence of Late Harappan phenomena in Gujarat were different but for the Punjab and Sindh, frequent river changes may have been the principal reason for change. The end or disappearance of the Late Harappan is not clear and the subject deserves serious research. On the present evidence, at least three geographical areas of the Late Harappan can be distinguished in the Greater Indus Valley, which will certainly be modified further as the chronology of this

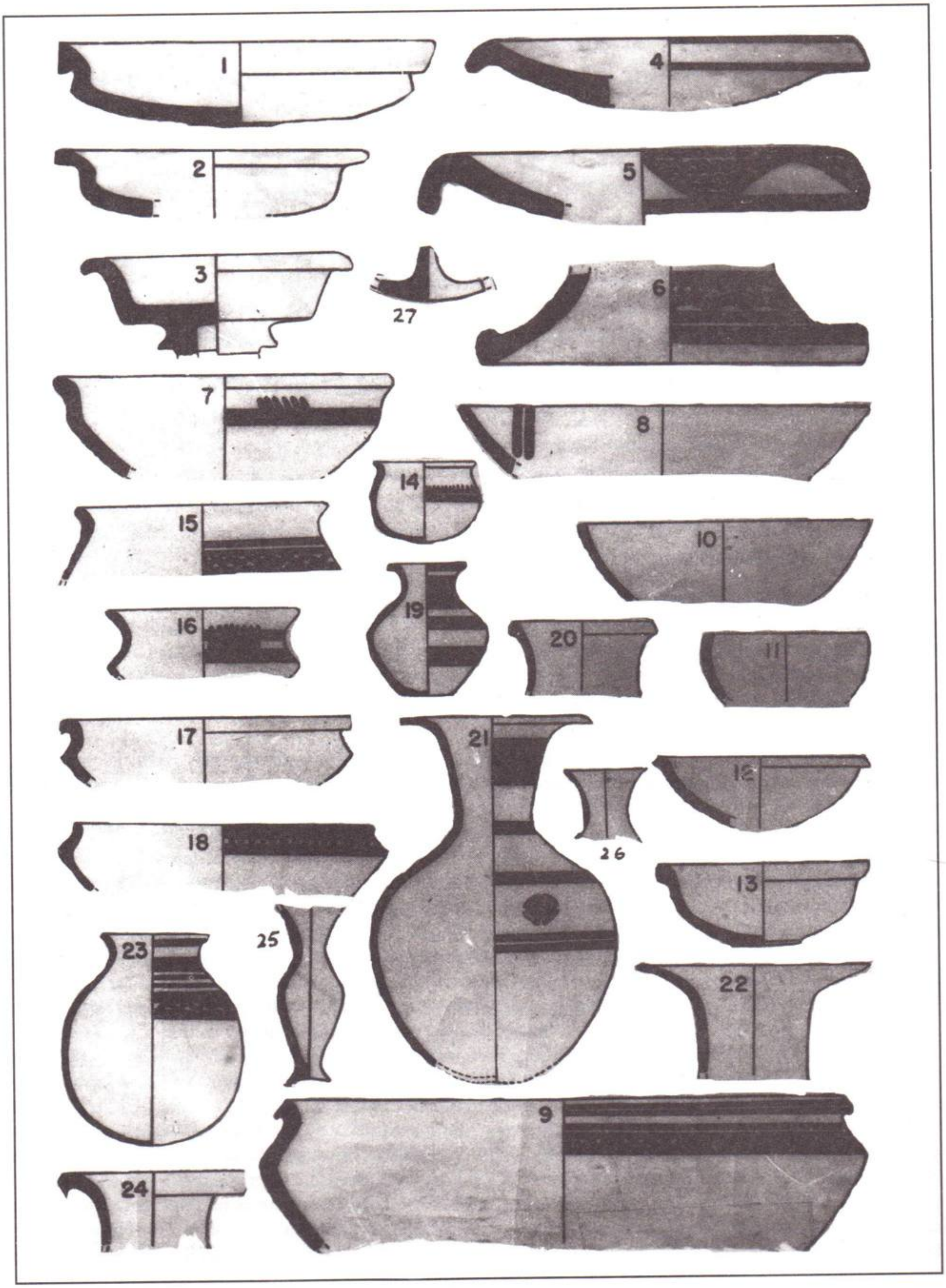


Fig. 10.1 Late Harappan pottery (Courtesy ASI).

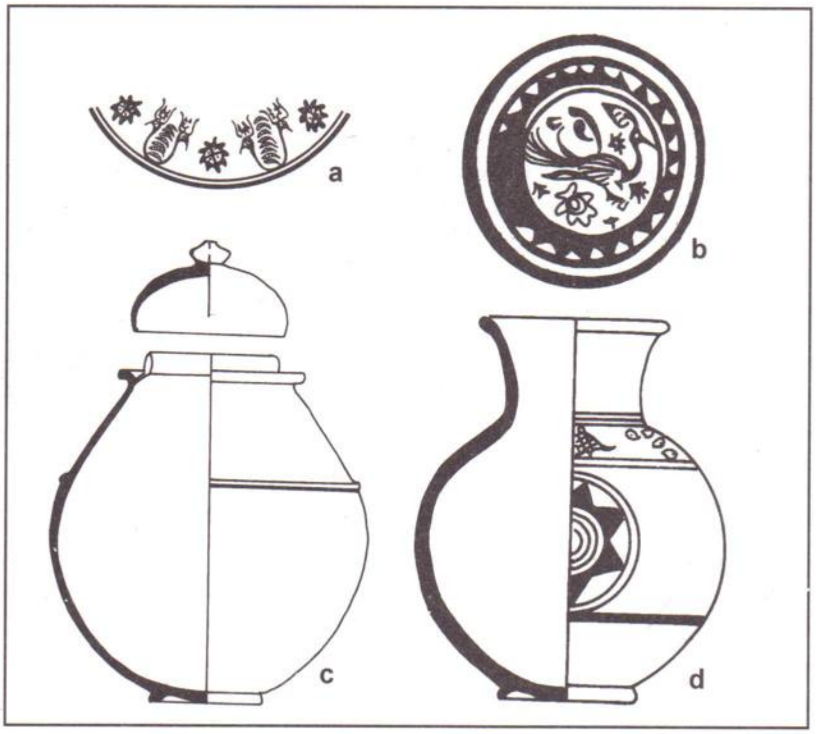


Fig. 10.2 Cemetery H painted pottery (After Possehl, 2002).

period is reconstructed with precision. Meanwhile, it is proposed to call the Cemetery H related materials as (Fig. 10.2, Pl. 10.1) Punjab Late Harappan, Jhukar related as Sindh Late Harappan, and Rangpur and Lothal related materials as Gujarat Late Harappan. These are neither intended to be mutually exclusive geographical divisions, nor it is possible to suggest a simultaneous emergence, development and eventual disappearance of the cultural features that characterized the Late Harappan Period in the Greater Indus Valley. The present review of the available evidence from the vast Harappan territory gives a different perspective of the issues being discussed currently for understanding the nature, causes and consequences of cultural change in the Indus Valley starting about the beginning of 2nd Millennium BCE. The cultural mosaic during the Late Harappan Period as suggested at present by the distribution of certain categories of materials mainly in three regions, presents a contrast to an integrated picture of the preceding Mature Harappan Period. Admittedly, each region presents a diversity of non-Harappan materials and settlement patterns lasting for more than a millennium. An attempt to reconstruct the sequence of events in the late proto-historic period is equally important. On the present evidence, the Gandhara grave culture of northern Pakistan, Pirak and Complex B assemblages of Baluchistan, painted grey wares of the Punjab and Doab, for example, demonstrate a different and unrelated mosaic which spans over another millennium beginning about the last quarter of 2nd Millennium BCE, suggesting partial contemporaneity with some of the Late Harappan assemblages of western India and the Panjab. These phenomena call for serious attention to examine socio-cultural consequences of environmental changes and adoption of various strategies for human survival in the Greater Indus Valley (Mughal 1990: 13-14).

Thus with recent research, it is becoming clearer that new elements were making their appearance in the Harappan region and they are not localized. The Cemetery H and Jhukar are no mere localized aberrations but occupy large areas. In the north, the Phase IV is characterized by Cemetery H and in the south-west by Jhukar. At Jhukar, which was excavated by Mughal in 1974, there is a clear cultural overlap and co-mingling of cultures; and in the artefacts new tastes, but perhaps the old artisans, seem evident. At Jhukar now the Harappan goblet is painted with Jhukar motifs. So if one is looking for elements in the archaeological record of new people, the Jhukar and Cemetery H cultures with their larger distribution are now eligible to be claimants for that title.

In the last quarter of the 3rd Millennium BCE, in the valleys of Saraswati, the population thins down drastically. A bit later, iron starts appearing; so do the grey wares. Rice, pig and buffalo become prominent in the subsistence record. In the Chalcolithic cultures, lentils and leguminous plants appear and assume importance in the diet; they were conspicuous by their absence in the Harappan record. The literate tradition breaks; there are no scripts anymore. Use of ground water and wells is given up, besides the use of burnt bricks. No more planned towns; in fact, no more towns. The ones that were there lost their character and population gradually. It does not mean that populations were decimated, but with lack of control from the metropolitan centres, the provincial towns degenerated and changed. Pande (1987) points out that cultural items of everyday life of the Mature Harappans disappear in later cultures: antimony rods, terracotta masks, weights and measures, metal pots and pans, even some motifs like the knot design. For the first time, the *lota* and *thali* are introduced in the Indian crockery by the Kayatha culture and continue to this day. Now burials come right into the houses: the dead of the Chalcolithic cultures are buried below the house floors, unlike the Harappan cemeteries located outside settlements.

Meadow has made important observations about early agricultural trends (for details of the agricultural evidence, especially the results of the exhaustive study made by Weber (2003), see Chapter 9), which are certainly germane to our discussion of the break. He has identified two farming transformations in South Asia: One after the Indus civilization declined and the other in the Neolithic times. Meadow (1989: 1-16) says:

> One of the major unanswered questions of South Asian archaeology is the reason(s) for an apparent "deurbanization" of the Greater Indus Valley beginning at about 1900 BCE. This phenomenon took place together with the development of distinctly local manifestations of material culture that are particularly striking when compared to the extent of integration evident during the Harappan period. It is possible, even likely, that the degree of diminution in site size and amount of "localization" that actually occurred is overestimated because of gaps in our knowledge and mistakes in our understanding of the archaeological record (e.g. Shaffer 1981, 1986). Yet one cannot escape the impression that significant shifts in settlement did take place if only in the abandonment of certain very large sites, including Mohenjodaro, and the establishment of many small sites throughout the region but particularly in East Punjab (Shaffer 1981; Joshi, Bala, and Ram 1984). Some abandonment and realignments can reasonably be attributed to changes in hydrological regimes in Punjab (e.g. Wilhelmy 1969; Mughal 1982; Pal, Sahai, Agrawal 1982; Agrawal and Sood 1982) and in Sindh (Flam 1981). Yet there is increasing evidence that it was precisely at this time, in the beginning of the 2nd Millennium BCE, that a new complex of cereal crops and domestic animals was becoming known in the region .... When viewed on a broad basis, two distinct agricultural revolutions can be identified for the north-western region of South Asia during the pre- and proto-historic period. The first involved the establishment by the 6th Millennium BCE of a farming complex based principally on the rabi (winter-sown, spring-harvested) crops of wheat and barley and on certain domestic bovids, including zebu cattle, sheep, and goats. The second saw the addition during the early 2nd Millennium BCE of kharif (summer-sown, fall-harvested) cereals including sorghum, various millets, and rice along with new domestic animals including the camel, horse, and donkey .... The proposal explored in this essay is that new agricultural opportunities resulting from the introduction of the summer sown cereal crops, when combined with the new means of animal-based traction, transport, and communication, facilitated widespread settlement in areas previously marginal to food production as well as realignment of settlement in already occupied areas of north-western South Asia. This is by no means a new idea, having been proposed in part by Shaffer (1981: 97) for East Punjab and Possehl (1986) for peninsular South Asia. What Shaffer did not emphasize was the importance of the differences in growing seasons (see Hutchinson 1977 and Costantini 1979, 1981), while Possehl did not stress the role that such a change could have played in the Greater Indus Valley itself. Costantini (1979, 1981), Tosi (1983, but with a broader geographical scope), and Jarrige (1985a), have all underlined the significance of the new food production systems, and this essay can be seen only as a distillation of ideas which we have explored together over a number of years.

In his concluding remarks Meadow observes:

> The new crops and animals that came to be widely used in South Asia during the early 2nd Millennium BCE did not supplant but were exploited together with those that had formed the basis of agriculture for millennia in the Greater Indus Valley. In terms of its subsistence base, the Harappan was very much a Middle Eastern civilization, depending principally on wheat, barley, sheep, goats, and cattle although with significant distinguishing features including the overwhelming importance of cattle, which has continued to characterize South Asia to modern times. The claims of Fentress (1985: 367) that the risks and uncertainties of one-season agriculture led to double-cropping in Sindh during the Harappan period in order to "ensure a stable and regular food supply" are unconvincing, as present evidence indicates that the fruit of the date palm is the only significant food source used at that time in the Indus Valley that matures in the summer or fall. Summer-grown crops such as cotton and grapes were never vital to subsistence, although their cultivation may have developed expertise valuable to farmers who would later plant summer cereals (Meadow 1989: 1-16).

Summer (kharif) cultivation of the "millets" and rice appears to have begun in areas with significant monsoon rainfall east and south of the Indus Valley where wild forms of some "millets" and rice are likely to have existed. When and how this took place, however, is still obscure, although there is hope that palaeoethnobotanical investigations will clarify the matter in the not too distant a future. The presence of Harappan settlements in these areas may have provided the impetus necessary for local populations to begin to systematically plant the seeds of grasses, which had previously been gathered to feed themselves or their animals (if the keeping of animals is truly earlier than crop-growing east and south of the Indus). The importation of sorghum probably from Arabia into Saurashtra at this time may also have played a role in developing the cultivation of similar grasses.

We also have to note that many of the Harappan items [e.g. burnt bricks, wells, masks, antimony rods, even the knot design, script (of course a new one)] reappear with the second urbanization in the northern polished ware times (*ca.* 600-500 BCE) in North India. (Did these artefacts in some way symbolize the state?) There are markers, in diet, in subsistence, in script and literate tradition, in daily items of use, which had suddenly disappeared after the Harappans, obviously conveying the message that the cultural tradition broke down. Perhaps it signifies the advent of some new people as well. The break of tradition is writ large on the evidence.

There were many causes of the Harappan decline: aridification (for which there is now impeccable data from Rajasthan (Agrawal 1982b; Wasson et al. 1983. 1984; Cohmap 1988; Singh 1971; Singh et al. 1990) and elsewhere from India and globally too (see Chapter 2); tectonic disorganization of perennial rivers like the Saraswati and their eventual drying up (Agrawal and Sood 1982); the inability of the Harappan culture to cope up with a monsoonal ecology of the Doab; and finally, any culture has a finite life and at some stage has to transform or die out. The process of birth, growth, decay and death governs organisms as well as cultures.

Gordon Childe (1979) in his classical definition of the state and civilization had prescribed many criteria: class stratification; monumental architecture; cities; kingship; full-time craftsmen and smiths; stylized art and architecture; writing; international trade; science and technology, etc. All these criteria show that the subcontinent did not have a civilized state after the collapse of the Indus civilization till the rise of the Ganga civilization in the 1st Millennium BCE. And therefore many of the traits, which were lost with the Harappans, are revived with the rise of the Ganga civilization. And this explanation may help us understand some traits that vanished but reappeared again in the middle of the 1st Millennium BCE. This again shows that the period between *ca.* 1700 and 600 BCE may not have been dark, but was certainly a regression. From the state the society went back to chiefdoms. Between the distinctly organized societies of the Harappans and of the Ganga civilization, the interregnum was perhaps a bit of a chaos and disorganization.

ARYANS

Sir Mortimer Wheeler (1947b: 78-83), put forward the first coherent "theory" concerning the eclipse of the Harappans; he accused the Aryans for the demise of the Indus civilization. He asked:

What destroyed this firmly-settled civilization? Climatic, economic, political deterioration may have weakened it, but its ultimate extinction is more likely to have been completed by deliberate and large-scale destruction. It may be no mere change that at a late period of Mohenjodaro men, women and children appear to have been massacred there (Mackey 1937-38, Vol. 1: 94-95; 116-117, 172). On circumstantial evidence, Indra stands accused.

Possehl (1999b: 13) picks up many holes in Wheeler's dramatic theory and says that no one should assume that the Vedic Aryans were on the scene to be active participants in the transformation process examined here. Also, George Dales (1964) and Kenneth A.R. Kennedy (1994) convincingly argue that the skeletons found in the upper layers of Mohenjodaro are actually hasty interments, not the remains of victims of a massacre (for details of the burials and skeletons see Chapter 7).

There are very few takers for the invasion theory now; but migrations of new people cannot be ruled out. We have also to note here that Bisht in a recent article has revived the Aryan invasion theory, though in a totally new form (Bisht 1999).

Recently, Ratnagar has marshalled an array of data, new and old; to understand the end of the Harappan culture. She has given a new life to the Aryan migration theory. Basing her hypothesiz on historical linguistics, Ratnagar argues:

Scholars inevitably link any discussion of the termination of Bronze Age occupation of north-eastern Iran to the migration of speakers of Indo-Iranian languages. That such a migration occurred has been asserted by historical linguists. Historical linguistics is a discipline, which investigates the histories of languages and their relationships and movements, and reconstructs the "proto" or original forms from which similar words of related languages could have been derived. It is also a science of language usage and change, and their social context in contemporary life. This discipline, in fact, emerged in the 19th century around the common past and interrelated features of a very large group of languages, known as Indo-European: Greek, Sanskrit, Latin, German, Persian, and many others.

These languages are so similar in structure and vocabulary, historical linguists say, that they are all derived from a common parent language, a language they dub "Proto-Indo-European" (PIE). On the basis of common words, reconstruction of the cultural context of PIE, and Indo-European relationships with other language groups, the ancestral homeland of this parent language is said to have been the vast grasslands or steppes of southern Europe and Central Asia.

Two factors, in particular, are involved in the identification of this homeland. First, there is ample evidence for give and take between Indo-European languages on the one hand and Finno-Ugric or Uralic languages (Hungarian, Finnish, Volgaic, Estonian, etc.) on the other. This means that in their very early history these two language families shared an extensive common border, which provided opportunities for repeated interactions. The Finno-Ugric homeland comprised the fertile forest belt of Europe, which lies north of the drier steppe land. The Finno-Ugric ancestors must have derived their knowledge of agriculture from the Indo-Europeans, as several words like those for grain, grass, and goat are derived from Indo-European. There are grammatical affinities as well (Mallory 1989: 147-9).

Second, there is evidence that the ancestral homeland culture involved agriculture and animal herding, and simple metallurgy, with great importance being given to the horse. The horse was 'embedded in the culture of the early Indo-Europeans' (Mallory 1989:119), and all the related languages used a term derived from PIE *ekwos*, for "horse". The horse is important in the Rigveda, with two entire hymns devoted to its praise; it is associated with the Iranian deity Mithra; horse sacrifice was important in ancient India and Rome. This animal, *Equus caballus*, it is certain, was a native of the Eurasian steppes and nowhere else: the wild ancestor from which it was domesticated belongs to these steppes.

For our purposes the relevant question is that of the Indo-Iranian languages (Avestan-Old Persian, Vedic Sanskrit, and the language of a few texts from the Mitannian kingdom of northern Syria). They did not each derive singly from the ancestral Indo-European. Instead they are all derived from one branch, an undivided parent, which linguists call Indo-lranian. This branch had split off from Indo-European somewhere in the eastern part of the homeland (probably the north-east Iran-Turkmenia-Bactria steppes), and this split was a separate process from the branching off of Hittite, a language very close to PIE that gained currency in Anatolia between 1600 and 1200 BCE. (Between the Vedic, Avestan, and Mitannian languages of the Indo-Iranian branch there is little chronological distance.) The horse is evidenced at Tepe Hissar, in Turkmenia in the Namazga VI Period, in Bactria and Margiana, and in the Kachchhi, generally after 2000 or 1800 BCE.

The migration of people is the mechanism by which languages move from one place to another, but archaeological evidence for migrations is rarely self-evident. Moreover, there will always be serious doubt whether language groupings can be inferred from archaeological patterns. Rarely do we find a clear chronological sequence of related archaeological assemblages over the map; the evidence itself usually comprises a few characteristic items but a large number of humdrum artefacts remain unobserved and out of purview. Not all the identified characteristic items occur at all the sites marking a reconstructed "route" and similarities in artefacts can themselves be questioned (Ratnagar 1999). Second, the evidence for material culture similarity, which is exceptionally strong over a large region west of the Harappan zone and touching its western and northern frontiers, does not necessarily give us the movements/migrations of specific speech communities. Linguistic groupings are not necessarily co-extensive with material culture groupings. In fact, an archaeological "culture" cannot be assumed to represent one people, or "a tribe". It has often been found that an area with two broad material culture divisions is actually inhabited by 30 recognized-as-separate tribes. Nor does every archaeologically-attested movement out of Central Asia necessarily have to be a migration of Indo-Iranian speaking groups. In the 13th and 14th centuries of our era, for example, it was Turko-Mongolic groups that advanced from the north into eastern and south-eastern Iran.

Third, it is extremely important that the movement of a language into a new homeland certainly requires the movement of native speakers, but this is not tantamount to mass movements of hordes of tribes, much less a sequence of destruction and trails of settlement desertions along the way. Aramaic did not become the *lingua franca* of western Asia due to mass migrations. Even in the case of the Sea Peoples of 1200 BCE, it has been stressed that they were groups of marauders and adventurers but if not an army. There was no 'movement of population' as such (Tritsch 1973). In fact, decades ago Father Heras (1953: 12-17) had asserted that Indo-Aryans came into South Asia in small numbers and intermarried with the natives, and that consequently Dravidian speakers became bilingual. Thus, even though Indo-Aryan languages did not originate in South Asia, we cannot suggest that 'the Aryans' are 'a cause of the end of the Indus Valley civilization'.

What matters to us, instead, is that the Gurgan Valley, as the excavator of Tureng Tepe said in 1932 (quoted by Cleuziou 1986), lies at the junction of the Iranian plateau, the oases of Turkmenia, and the Eurasian steppe land across the Caspian. Tureng Tepe, Yarim Tepe and Hissar occupied a frontier between agriculture and mobile animal rearing, a frontier which, of course, has shifted back and forth through history. Thus, earlier explanations for the desertions of these sites in terms of climatic change and epidemics and cultural decline were soon given up for the "invasion by nomads" theory, especially with Deshayes' discovery of the burned ruins of a monumental structure at Tureng Tepe IIIC and the subsequent abandonment of that site until about 800 BCE. Yet, we should bear in mind the observation of Arne, the excavator of Shah Tepe, that the invaders could as well have been Turks as well as Indo-Europeans!

It is often asked why and how Indo-European languages could have spilled out in so many directions from a single homeland. Mallory (1989: 147) points out that a similar "spill" was to occur later also. Speakers of Turkic languages, from a 6th century homeland somewhat east of the PIE zone, virtually exploded over an area in excess of 2,500,000 square kilometres by the 9th century AD.

It has been suggested (Ratnagar 1999), that it was in the nature of pastoralism, as it had developed on the steppe by 2000 BCE, which gave rise to repeated out-migrations. The herding of several animals, cattle, sheep, goat, and also horses was done from horse back. Once the horse could be controlled by a rider the mounted herder could cover long distances in a day, and scout for good pastures and stray animals; this would ensure that flocks moved fast when necessary. This, in turn, would make the tending of large herds possible and large herds would necessitate more labour and hence a schism between herding and agriculture. In a positive feedback mechanism would arise yet more geographically extensive pastoral circuits and larger flocks. This, coupled with certain geographic factors – such as rainfall variability, scarcity of ground water, and the choking of surface run-off channels by large herds if carelessly moved – would mean a precarious balance between people, animals, and the land, necessitating periodic out-migration.

We would, thus, agree with Cleuziou (1986: 246-8) when he argues that the desertions of the Gurgan Valley sites reflect less an Indo-Iranian event than the historical pattern of a frontier region: '... gaps in the archaeological record are due to the fluctuations between settled agriculture and steppe pastoralism,' he says. We would add that such fluctuations could have been caused by the spilling out of horse-mounted pastoralists from their homeland, as much as by political events or economic factors (Ratnagar 2000: 106-110).

It may be emphasized here that no single cause but several contributed towards the decline and the disappearance of the mighty Harappan civilization.

In a recent detailed study, Possehl (1999c: 19-33) has delved deeper into the problem of post-Mature Harappan transformations that took place in the north-west of the subcontinent. It places the drastic changes that took place in the beginning of the 2nd millennium in a wider perspective and is therefore worth quoting in detail. He says that there was an abandonment, or severe depopulation of the cities and a number of important settlements including Kot Diji, Balakot, Allahdino, Kalibangan, Ropar, Surkotada, Dholavira, Desalpur, and Lothal. Long distance trade was reduced and the production of a wide range of special materials, many of which seem to have been luxury items, was curtailed (e.g. long barrel cylinder beads, etched beads, inscribed stamp seals). Sindh and Cholistan were largely abandoned by settled farmers and there was an increase in the number of settlements in the Panjab, Haryana, western Uttar Pradesh, and northern Rajasthan, though Gujarat seems to have remained relatively stable. There were shifts in the subsistence regime, with a growth in the population's ability to sustain double cropping with the use of millets.

The Mature Harappan style in architecture and material culture disappeared, along with the stamp seals and a coherent system of writing. Post-urban times witness a return to a cultural mosaic not unlike the one found during the pre-urban phase. Yet, in spite of these changes, there is a strong line of culture historical continuity throughout the Harappan region.

Ratnagar has also tried to marshal the archaeological evidence of the break of the Harappan tradition and the emergence of new elements. She says:

The bronze cosmetic flagon known at Hissar, Altyn-depe and in Bactria, also occurs at Chanhudaro as a beautifully fluted piece (Mackay 1943: Pl. LXXIII.39), in a probable Jhukar context. Round bronze mirrors with tangs for fitting into wooden handles, as at Hissar, Altyn-depe, Gonur I, Sapalli, Dashly, Shahdad and Khinaman, and Mehi – some of them with a handle shaped as a human body – also occur at Harappa (Vats 1940: Plate 29) and Mohenjodaro (Mackay 1938: 477-8). Twelve such mirrors occurred in graves at Harappa (Wheeler 1947-8: 85 ff.) and one in a Kalibangan grave (Rissman 1988: 211-14). Rissman has remarked that in Harappan graves it was mirrors rather than any other bronze item that tended to be deposited (ibid.: 214), and that only one such mirror occurs in a Harappan hoarded treasure (ibid.: 217).

The beautifully cast socketed adze-axe of Gonur I has counterparts at Hissar, Shahdad, Khinaman and also Mohenjodaro (Mackay 1938: 457-8). Harappa and Chanhudaro each have a single-bladed socketed axe (Vats 1940: Plate CXXII.18; Mackay 193: Plate LXXII. 25). Exquisite bronze animal-headed pins or "wands" at Dashly and Hissar (Schmidt 1937: 194-7) have a counterpart in the latest stratum of Harappa (Vats 1940: Plate CXXV. 36, p. 390) in an "antimony stopper rod" surmounted by the figure of a dog biting the ear of a goat; and at Mohenjodaro where a rod is surmounted by an antelope (Piggott 1947-8). There are also compartmented seals whose faces bear raised geometric designs from Mohenjodaro, and the white steatite stepped seal with a stylized eagle from Harappa has Bactrian connections (During Caspers 1997).

The purpose here is not to elaborate on a list of similarities between the regions, for such an exercise often tends to neglect context and co-occurrence, and simplistic conclusions are drawn about "trade" or "migrations". The point is, instead, to highlight the relevance of the happenings in this region to the Harappan centres, and suggest that there may be some inter-connection between the series of Harappan settlement desertions and colonizations, and events in the western region.

The Kachchhi plain, on the frontier between the Indus Valley and Baluchistan, was also affected by group movements. Western contacts re-appear at Nausharo after the Harappan period. The famous Neolithic site of Mehrgarh near Dadhar has a South Cemetery with ordinary graves: "cenotaphs" devoid of human remains but with offerings, and grave goods interred in pits. At this cemetery grave goods of international currency include steatite kidney-shaped containers (as in Bactria), a stone sceptre (as in sites of the BMAC and eastern Iran), a bronze cosmetic flagon, mirror, and pins with double volutes or bird-shaped heads (Santoni 1984: 52-4) .... Also in the Kachchhi, near Nausharo, was a small (1 hectare area) and short-lived settlement, Sibri (ibid.). This could have been the settlement of a small group of migrants who came down the Bolan Pass from Central Asia. Among the finds occur a polished stone column, two flat, violin-shaped figurines, compartmented seals, a bronze ornamental pin, and a bronze shaft-hole axe-adze. There is also evidence of copper/bronze industry at the site, which is comparatively rich in metal .... Critically important is the fact that Sibri offers not only Central Asian elements but also Harappan ceramic traits and Indus characters on an amulet (Jarrige and Usman Khan 1989: 150), so that the chronological coincidence between the later phase of the Harappan civilization and the momentous happenings to its west are established .... At Pirak, 11 km south of Sibri on a tributary of the Bolan, a 9 hectare area settlement was founded around 1700 BCE (Jarrige and Santoni 1979). The material culture – house forms, hearths, pottery, bone and stone tools and grain storage methods – presents a contrast to the Harappan material culture. Moreover, at Pirak the horse and the two-humped Bactrian camel (probably domesticated, centuries earlier in Turkmenia) are represented by their bones. Among artefacts there are Murghab-type stone seals.

Where movements of groups from eastern Iran-Central Asia are concerned, northernmost Pakistan also becomes relevant. From about 1700 BCE, cemeteries and villages in Swat (period IV) had a material culture which seems to have been a curious amalgam of elements from South Asia (painted pottery), north-east Iran (grey burnished pottery, violin-shaped figurines, the horse) and China (jade pendants, stone harvesters, and ornate bone pins); (Tusa 1979, Stacul 1970, 1979, 1984). Swat, too, would be receiving steppe elements from Tadjikistan, via north Bactria, according to Kuzmina (1976). As regards connections with China, it needs to be said that these are visible in Bactria too: in four graves at Sapalli-tepe (2000-1700 BCE) there is evidence that the dead were wrapped in silk (Kohl 1984: 155). Was this Chinese silk (see Good 1995)? It is evident that connections with north-eastern Iran-Turkmenia and the BMAC are manifest both at major Harappan centres and on the fringes of the Harappan heartland. While during the Mature Harappan Period contacts between the plains of the Indus and the hills of Baluchistan were meagre and there were few villages in the western mountains, pottery of the type found at Pirak and Nausharo now occurs at Ispelanji, north of Kalat, at Dabarkot in Loralai and at Sulaimanzai on the Quetta plateau (Jarrige and Santoni 1979: 389-90; Jarrige 1985: 43-5).

Not only were there movements of groups of people, social transformation was also involved. While centres like Altyn-depe with their social stratification, elaborate cult centres, and varied metal alloys were clearly urban, the settlement forms in Margiana and Bactria, according to the early excavators (see Lamberg-Karlovsky 1994), are totally different, with each arm of the Murghab settled by an individual tribe or tribal section, and, as stated already, separate families occupying each settlement. According to Hiebert and Lamberg-Karlovsky (1992), in fact, the BMAC was a short-lived (say two century) phenomenon, collapsing between 1900 and 1700 BCE, and followed by migration to eastern Iran and the Kachchhi (Ratnagar 2000: 113-123).

THE DECLINE

The Indus River in Sindh is a mature stream which frequently changes it's course. Much river training has been done on the Indus in modern times, so these course shifts are not as apparent today as they were through the nineteenth and early twentieth centuries. But they are a powerful part of the history of Sindh. Two other archaeologists have followed Mackay's lead, suggesting that a dramatic shift in the course of the Indus led to the abandonment of Mohenjodaro (Lambrick 1967, Mughal 1990).

Mackay and others (Lambrick 1967; Mughal 1990) have ascribed the abandonment of Mohenjodaro to an avulsion of the Indus River. But the abandonment of Mohenjodaro alone cannot explain the eclipse of the Indus civilization. A variety of causes played their role (Possehl 1999: 19-33).

It was M.R. Sahni who in 1956 first invoked the impounding of the Indus to explain the end of Mohenjodaro. Later on, Raikes and Dales revived the theory with greater force. In brief, they proposed that a tectonically-caused large mud-extrusion impounded the Indus causing colossal silting which gradually engulfed Mohenjodaro. Since it was a water permeable barrier, only the silt level kept on rising.

But Lambrick pointed out that such a barrier would result in the shedding-off of the silt-load by the river considerably upstream and not on the inner side of the dam. He further asks how such a permeable barrier could stand, at least in the first years, the enormous impact on a narrow front of water arriving at the rate of 2,270,000 litres per second. The Allahbund – a similar mud-extrusion caused by the 1819 earthquake – was washed away by the first flood coming down the Nara in 1826. Possehl pointed out that it will require a dam of 250 km length to engulf Mohenjodaro and asked where were the traces of such a bund? He also argued that such a lake would fill vast areas including the Lake Manchar region where the discovery of several Harappan sites precludes such a possibility.

Though Raikes and Dales seem to have realized the strength of some of the criticism mentioned above, yet they have tried to bring in some new arguments in favour of their theory. Realizing the tremendous force of water coming at 2,270,000 litres per second on a narrow front, they now try to divert part of this discharge through the Nara. They have also raised some objections to the theories of climatic change. We have raised some basic questions. If there was such a vast lake around, how could any crops grow and therefore provide any surplus to sustain a city. The gallery forests would have perished driving the game away. How could one expect any fish in the shallow waters of a mud lake? How could carts ply on muddy roads, if they were living in a quagmire? How did the drains function at all? What happened to the sanitary arrangements? Will not such extreme conditions kill the people *en masse* before any mud lake engulfed them? Even in their subsequent article, Raikes has not been able to answer these questions. Such a developed civilization needed some optimal ecological conditions for its flowering. How could a people fighting for sheer survival usher in such a grand urbanization? All these, and many other objections make one feel that Raikes' dam does not hold any water.

Having said that, we would hasten to add that the Indus did affect the fortunes of the Harappans in more than one way. Frequent floods were sapping their energy. Their raised platforms and massive bunds indicate the severity of the problem. The Indus has been raising its flood level continuously necessitating safeguard measures. The water-table could itself rise, thus destabilizing buildings, causing salinity increase and rendering vast tracts useless for agriculture. The Indus could also leave Mohenjodaro and other cities high and dry by changing its courses drastically.

On the other hand, geomorphological, palynological and archaeological evidence from Rajasthan indicates fluctuations of wet and dry periods. In the present state of knowledge, climatic change for the worse cannot be ruled out. An increasing desiccation may have given the last blow to a people already exhausted by their incessant fight against floods. Progressive degeneration is writ large over the successive levels of Mohenjodaro.

It is necessary to discuss in greater detail the recently discovered evidence of drastic changes in palaeo-channel configurations, especially in Rajasthan. They did affect the Harappans as also the subsequent cultures in the area.

When Ghosh discovered a large number of Chalcolithic settlements on the now dried-up Ghaggar and the Chautang in Rajasthan, it led to speculations about climatic changes in the area which caused these rivers to dry up. Our recent work, however, has emphasized the significance of the tectonically-caused environmental changes in north and west Rajasthan.

The fluctuations in the palaeo-channel patterns in this area have been noticed since Oldham's times in the 19th century. Dikshit has chronicled the various hypotheses in an historical sequence and several others have discussed the evidence of archaeological remains on these dried-up beds. Raikes, without adducing any tangible evidence, even talked of six well-dated diversions of the Yamuna. His promised article in which he was to give the technical data has not yet appeared, though more than a decade has passed since he first reported his findings. We will not discuss his or other theories here but summarize our new findings based on Landsat imageries and field data of other workers. A detailed paper is appearing elsewhere. So we report only our conclusions here.

The Satluj once flowed into the Ghaggar following a path east of Ropar, Sirhind, Patiala and Shatrana. The Ghaggar was a mighty river in the past and had on an average 8 km wide bed. The Satluj, before assuming its present course, braided into a multitude of channels. This event is also recorded in the *Mahabharata* in the form of a legend: when Vashista threw himself into the Satudri (Satluj) it broke into a hundred streams. As the enechlon faults controlled the river course of the Ghaggar, it was prone to drastic changes due to even minor tectonic movements. Both our Landsat imagery derived palaeo-channels and the field data given by Singh support the flowing of the Satluj into the Ghaggar in the past.

Some major easterly (from the Ghaggar) river of the past was changing its courses more frequently. We have been able to trace three such courses termed Y1, Y2 and Y3. The Y1 channel connected it to the Ghaggar. Later on it followed the Y2, merging into the Chautang, the latter meeting the Ghaggar near Suratgarh. The third time it flowed further east and south-eastwards, following the Y3 course, finally joining the Ganga probably through the Chambal. When this Y3 river shifted its course further east, it left the various lakes in its course which now lie north of Bharatpur. It is probable that this was the channel which has now assumed the course of the Yamuna.

Whereas these changes in the courses of the various palaeo-channels are fairly clear, and also find support from the published field-data, the terminal course of the Ghaggar is far from clear. Near Anupgarh, the ancient Ghaggar bed bifurcates and both the palaeo-channels come to an abrupt end. The upper one terminates near Marot and the lower one near Beriwala, in Pakistan, into a shallow depression. From the Landsat imagery it looks as if it debauched into the sea here, but obviously to bring the sea so far inland in mid-Holocene is not probable. It is, however, possible that the chain of tectonic events which diverted the Satluj and the easterly rivers away from the Ghaggar, caused a depression near Marot into which the Ghaggar, deprived of its major source of water, died into a lake-like depression.

But when the Ghaggar was a perennial river, it is possible that it could have met the Nara and flowed directly into the Rann of Kachchha, without meeting the Indus. The palaeo-channels beyond Marot do indicate such a possibility. The legend also says that the Saraswati flowed directly into the sea.

As human settlements were thriving on their banks, when they were alive, it would be easy to date these palaeo-channels. Archaeological explorations have thrown welcome light on these problems. Though a more intensive study of the archaeological remains needs to be carried out, yet broad features can now be recognized. The Ghaggar was alive during the pre-Harappan and the Harappan times. The Painted Grey Ware (PGW) (c. 800-400 BCE) mounds are located in the river-bed itself, probably indicating a much reduced discharge of the Ghaggar. The Chautang has a large number of Late Harappan sites. The channel Y3 seems to have been a living river during the PGW times. The data on channels Y1 and Y2 are not adequate yet.

Considerable geomorphological and archaeological fieldwork is required to document the vagrancy of these rivers. It has to be supported by chemical/mineralogical analyses of the core profiles from these river-beds to detect the signatures of the different relict rivers. Yet it is obvious that in north and west Rajasthan tectonically-changed palaeo-channel configurations were a major factor which affected the human settlements, perhaps from the pre-Harappan times onwards. Major diversions cut off the vital tributaries and growing desiccation, and on the other hand, dried up the once mighty Saraswati and Drishadvati rivers. (For detailed discussions also see Possehl 1999a and Baroda Conference Proceeds).

Possehl asks, Is it necessary to believe that just because the Indus River was impounded, the Harappan civilization came to an end? If the Mature Harappan succumbed to new and unpredicted riverine forces, the explanation sought by historians and social scientists lies not directly with geomorphological matters but, rather, with the internal structure of the Harappan way of life. The "flaw" that would have led to such catastrophic socio-cultural change is not to be found within the natural world of geomorphology but within the human context of the Harappan civilization, its society and culture, as discussed by Possehl (1967: 37-39).

The interface between the Cemetery H assemblage (Fig. 10.2; Plate 10.1) and the Painted Grey Ware has not yet been defined in Pakistan. In India, Painted Grey Ware begins at *ca.* 1100 BCE. The interface between this assemblage and the "Late Harappan" in the Punjab has been documented at places such as Dadheri and Bhagwanpura (see Joshi 1976, 1978, 1993).

Possehl thinks that the relatively high density of the Hakra Wares sites may well inform us of a rather strong flow in the river, which diminished in the next period, with the Early Harappan (Kot Diji) sites being relatively few in number in this area. The very high number of Mature Harappan settlements suggests a resurgence of the river and a rich well-watered inland delta. Then in the Cemetery H and Painted Grey Ware periods we see the two-step retreat of the river to the east, eventually with insufficient flow to even reach the old Fort Derawar delta. Possehl agrees that the fluvial sequence apparently has little, if anything, to do with broad trends in climatic change but can be explained by tectonics as outlined in Agrawal and Sood (1982). Over what seems to have been the course of the 2nd Millennium BCE, waters that drained out of the Himalayan watershed were gradually captured by streams that flowed to the east, into the Bay of Bengal, at the expense of the greater Indus system. This process apparently led to the creation of the Yamuna River, a very young stream, and the drying up of the Saraswati and Drishadvati rivers.

Possehl (1999b: 17) however clarifies his stand:

> This is not to propose that stream capture was the direct cause of the eclipse of the ancient cities of the Indus. A socio-cultural cause is sought here, just as with the Raikes-Dales theory of an Indus dam. But over the course of the 3rd and 2nd millennia, the Saraswati cannot be ignored in a broad consideration of the transformation of the Indus civilization.

Francfort (1986: 98) says of the stream capture:

> This shift would have occurred either in the still badly defined Late Harappan Period or in the PGW(Painted Grey Ware) Period, or gradually during both since Late Harappan (Cemetery H) and PGW sites in the state of Cholistan in Pakistan are found on one of the palaeo-channels known locally as Hakra. However, the adoption of this "hypothesiz" poses an interesting methodological problem. If we accept this hypothesiz, we *must* logically accept as well that another tectonic upheaval would have made the river revert to the Kushan (Rang Mahal) Period since sites from the latter are again found in the region (original italics).

Singh (Singh 1971; Singh et al. 1974), on the basis of his palynological studies on the lakes of Sambhar, Didwana, and Lunkaransar, proposed that this increase in salinity was due to increased aridity and that this climatic change could have been the root cause for the eclipse of the Indus civilization. But Possehl doubts these inferences:

> The changing salinity of these lakes, which appears to be well-documented, need not be due to changes in rainfall. The geology and environment of Rajasthan are coupled. The three lakes investigated are hypersaline today, but there are also freshwater lakes in this same region (Lakes Pushkar and Ganer). This observation leads to the conclusion that, under one climatic regime in Rajasthan, there can be both freshwater and hypersaline lakes, calling into question the Singh hypothesiz .... Site counts go up from 218 during the Mature Harappan to 853 in Post-urban times. Although there was a dramatic drop in average site size, down from 13.54 to 3.55 hectare area, the estimated total settled area remained remarkably stable for both periods. These data do not look like those that one would expect if there had been a severe reduction in rainfall as Singh proposed, especially given the fact that it is a dry cropping region (Possehl 1999b: 18).

Possehl doubts the entire notion of an eclipse of the Harappan civilization. He asks, Where is the collapse or eclipse in the East? Average site size goes down, but based on the data in hand, there is little change in the total settled area. These two observations may indicate a significant reshuffling of the population over the landscape and significant and interesting shifts in subsistence, trade and the economy generally; but it does not look like "collapse".

He admits that the urban paradigm on which the Mature Harappan was founded, with its large, multifunctional settlements, system of writing, weights and measures, long distance trade and contacts with the Gulf, Africa, Mesopotamia and Central Asia was no more a part of the Post-urban Harappan. There is no system of writing in the Post-urban Harappan anywhere, although graffiti from the corpus of Indus signs are found. The cities are no longer functional urban entities. There is an important transformation of Indus life, but there was hardly any collapse.

Discussing the Gujarat Harappan data, Possehl makes an important point that the number of sites drops by one-third and there is a significant drop in the average size of sites. Total settled area, as determined from the settlement surveys, is cut in half. These are robust indicators of deep change in the system of settlement and, probably, substance and the socio-cultural system generally. But there is another theme in the transformation process in Saurashtra. At Rojdi the site was expanded and rebuilt just at the time Mohenjodaro was being abandoned, and Harappa came to an end as an urban centre. Thus, while we have evidence for fewer and smaller villages, at least some of those that survived have signs of a sound economic base and a population that was able and willing to make significant investments in their community.

Gujarat

Around Lothal, the aerial survey indicated an annular pattern of drainage which points to tectonic disturbances. Either a tectonic uplift or an eustatic fall in sea-level was probably responsible for cutting-off of the Lothal dockyard from the water channels and eventually from the access to the sea.

Sea-level changes also need to be considered. Recent work has shown that the sea-level on the west coast did fluctuate between +5 and -1.00 m in the late Quaternary Period compared to the present sea-level. At about 5000 BP it was higher by about +5 m and then went down. The coastal port sites of Sutkagendor, Lothal, etc. are far inland now but may have been connected with the sea in their heyday and perhaps fell out of use due to fall in sea-level. How actually did the sea-level changes affect the Harappan culture and its prosperity will require a more exhaustive study. There is interesting evidence from Amri. In the Pre-Harappan Period 90 per cent snails/molluscs were of marine variety but with the advent of the Harappans riverine species tended to increase, attaining parity with the marine species by the end of the Harappan Period. This surely must reflect transgression and regression of the sea.

Gujarat presents a variety of Harappa-related cultures. There are interesting and important contrasts among Rojdi, Lothal, Kuntasi, and Dholavira sites.

Lothal, on the head of the Gulf of Cambay, is a small, 4.8 hectare area site that was a centre of trade and manufacturing during Mature Harappan times (Rao 1979, 1985). Possehl thinks that this site was a gateway settlement of the Sindhi Harappans to gain access to the raw materials of Gujarat. At about 1900 BCE, the signs of manufacturing and trade disappeared, and Lothal shrank to a squatter's settlement. Possehl thinks that the cause of this was not a flood but the collapse of the infrastructure of Sindh.

Kuntasi, located in Rajkot district, was excavated by a joint team from Deccan College and the Gujarat State Department of Archaeology. The excavators believe that this small, 3.3 hectare area, site was not an agricultural village but was a settlement deeply embedded in Mature Harappan interregional trade (Dhavalikar 1993, 1996).

The Harappan trade with West Asia received a tremendous boost in *ca.* 2350 BCE under Sargon of Agade, as there arose a great demand for luxury articles like carnelian beads, ivory, shell, lapis lazuli and so on. Merchant-traders began to migrate in large numbers to Saurashtra in the 23rd century BCE. When Mohenjodaro was threatened by the Indus floods, the number of Harappan migrants swelled. This would explain why most of the Late Mature Phase (*ca.* 2200-2000 BCE) settlements were located in the fertile river basins of Saurashtra. It was during the Late Mature Phase that the Harappan settlement at Kuntasi was developed into an industrial centre and a port. The structure complex unearthed at Kuntasi is unique and the evidence allows us to identify the Harappan settlement as an industrial centre for manufacturing pottery and a variety of beads as also probably copper artefacts (Possehl 1999b:22).

At about 1900 BCE Kuntasi settlement shrank in size and signs of craft activity and trade were reduced. The Late Harappan occupation at Kuntasi betrays a marked degeneration in the economic activity. People lived in flimsy structures with rubble foundation, mud walls and thatched roofs. Only a few artisans were working. The quality of life had certainly changed for worse, but not the quality of pottery. As already noted, there is not much difference in the pottery from Period I and from Period II. But they do not seem to have had enough clientele and after surviving for a couple of centuries the site was abandoned in *ca.* 1700 BCE (Dhavalikar 1996; 374-375).

According to Dhavalikar, when the decline began in West Asia, the Indus civilization also received a setback. Everywhere devastating change was taking place; one of the causes was a shift in climate which was becoming more and more arid, leading gradually to desiccation and consequent desertification of the once fertile regions of West Asia. This affected the agricultural production adversely as also trade. It is no sheer coincidence that almost simultaneously with West Asia, in India too, the great Indus civilization should be on the decline. The prosperity of the Harappans was now a thing of the past and the Post-urban Phase is marked by rural settlements which are far too few in number as compared to the Late Mature Phase settlements. Many people seem to have resorted to a nomadic existence and subsisted on hunting-gathering as the evidence from sites like Kanewal and Ratanpura would show (Dhavalikar 1996: 374). But Possehl does not seem to subscribe to this view, as he thinks that the Mature Harappan trade with Mesopotamia was never on a scale that could have compromised the integrity of the entire Mature Harappan economic system.

Dholavira, the large (60 hectare area) site in Kachchha (Bisht 1989a, b, 1991, 1994) began as a modest settlement in the later Early Harappan. Periods II and III document a full, Mature Harappan town with the full inventory of Mature Harappan finds. At about 1900 BCE, here also the site shrank drastically, with habitation confined to its highest points. There is a good deal of evidence for people destroying earlier architecture and disrupting the old metropolis, and also the presence of Jhukar ceramics at the site.

Possehl considers Lothal, Kuntasi, and Dholavira as essentially "colonies" of the Sindhi Harappans, which made them vulnerable to severe change at the beginning of the Post-urban Harappa. Rojdi and other places that were farming communities, not deeply involved in the acquisition and processing of materials or in the transport that was part of the commerce, were buffered, protected and insulated from the catastrophic changes in Sindh. But places such as Dholavira, Kuntasi and Lothal succumbed. Possehl therefore suggests that the tighter the integration the Gujarat or Sorath site had with respect to the Sindhi economy, the greater the impact of the processes of devolution that engulfed Mohenjodaro and other sites in Sindh.

We have already discussed above the views of Mughal about the Gujarat Harappans.

Punjab and Sindh

At Mohenjodaro, both the Warehouse and the Great Bath were abandoned even before the eventual abandonment of the city. In the desertion of these two facilities can be seen the initial outward signs that the Harappan civilization was deeply troubled. Data on settlement that are comparable to those from other regions already presented are given in Table 10.1 (Possehl 1999b: 23).

Table 10.1 Estimate of settled area for sites in Sindh.

	Mature Harappan	Jhukar (Post-urban)
Total sites	86	6
Average site size in hectare area	8.0	5.6
Estimated total settled area in hectares	688	34

The documentation of settlement in Sindh during the Jhukar Period, the Post-urban there, seems to record significant change. The drop from 86 to 6 sites is important, but so too, is the abandonment, or virtual abandonment, of Mohenjodaro, the premier urban centre.

In Pirak (Jarrige and Santoni 1979; Enault 1979) in Kachi plains the settlement probably began sometime in the early 2nd millennium.There is cultural continuity at Pirak through to Period III, which is associated with iron. The Pirak assemblage seems to be foreign to the Kachi region and lies outside the cultural traditions of the Indus Age. There are four or five other Pirak type sites in Kachi.

Settlement data from Baluchistan are also revealing, as shown in Table 10.2 (Possehl 1999b: 24).

Table 10.2 Estimate of settled area for sites in Baluchistan.

	Kulli/Quetta Phase 2500-1900 BCE	Post-urban
Total sites	129	0
Average site size in hectare area	5.8	0
Estimated total settled area in hectares	748	0

For the moment it appears that Baluchistan in Post-urban times was the most severely affected of all the regions that once made up the Harappan civilization. There is no documentation for a Post-urban Harappa in Baluchistan. There are three places there with signs of human activity: Mehi (Stein 1931: 153-163), Kulli (Stein 1931: 118-127), and the "Elite Burial" in Quetta City (Jarrige and Hassan 1989). These are places where the so-called "Bactria-Margiana Archaeological Complex" (BMAC) has been found (Hiebert 1994). The signs of human activity that are present are not settlements in the conventional sense. One is an interment: a cenotaph. The others are stray artefacts and signs of cremation within an uncertain, probably much disturbed, context. The BMAC extends onto the plains in Kachi at the Sibri Cemetery (Santoni 1984) and Dauda Damb (Jarrige 1994: 295-296). Together, these archaeological signatures seem to reflect the presence of mobile, nomadic peoples of the early 2nd millennium whose home might well have been Bactria and Margiana far to the north (Possehl 199b: 23).

The settlement patterns around Harappa are not well enough known, but we know that Harappa shrank in size at the beginning of the 2nd millennium. The archaeological assemblage that succeeds the Mature Harappan is the so-called Cemetery H material (Pl. 10.1), now dated to 1730 cal. BCE. The distinctive Indus stamp seals, both square and oblong, are no longer made after *ca.* 1900 BCE. There is a general reduction in artefacts that were primarily intended to carry texts. Writing virtually disappears in Sindh and is at least very much reduced in the Harappan (Cemetery H) region.

Table 10.3 A summary of the substantive data comparing mature Harappan and Post-urban archaeological assemblages by region (Possehl, 1999b).

	Site count	Average site size in hectare area	
Sindh			**Settled area in hectare**
Mature Harappan	86	8.0	688
Jhukar	6	5.6	34
Cholistan			
Mature Harappan	174	5.6	974
Cemetery H	41	5.1	209
Baluchistan			
Kulli-Quetta/Harappan	129	5.8	748
Post-urban	0	0	0
Saurashtra			
Sorath Harappan	310	5.4	1674
Late Sorath Harappan	198	4.3	815
East			
Mature Harappan	218	13.5	2943
Post-urban	853	3.5	2985

Possehl's survey thus indicates that the "eclipse of the Harappan civilization" might hold for Sindh and Baluchistan, but in the East and to a lesser degree in Gujarat, the course of culture change was different. In these areas there were strong lines of continuity through the early centuries of the 2nd millennium, with little, if any, of the "trauma" that affected Sindh.

Possehl warns that "eclipse" might not be the best concept with which to work. He finds some internal inconsistencies in the data-sets that seem to apply to this reconstruction. Though Possehl doubts the climatic reconstruction derived from the palynological research done on the lakes of Rajasthan, he admits that the tectonic movement in this region could have been a powerful force in shaping the drainage patterns of rivers, streams and lakes there during the Holocene.

Here we would like to comment that mid-Holocene climatic amelioration and onset of deterioration from *ca.* 2000 BCE is well documented globally. It is also clear that habitation is shifting towards wetter areas, as rainfall increases as one moves from Sindh eastwards. One has to concede that in Rajasthan some lakes like Pushkar and Ganger did not show signs of aridity or increase in salinity. But as he himself admits it could be due to groundwater changes and not due to entirely climatic change.

It is clear that the Panjab, Haryana, northern Rajasthan, and western Uttar Pradesh has produced good evidence for a dramatic increase in human habitation during the opening centuries of the 2nd Millennium BCE, precisely during the period of the so-called "eclipse" of the Harappan civilization. He finds the evidence going against the climatic deterioration theory on two counts: there is a period of "eclipse" with a growth of human habitation and a proposed "aridity" at a time when archaeological data indicate widespread dry cropping. Possehl does not find any evidence of climatic change in Gujarat either. There are few signs of "collapse" or "eclipse" there and at some places, such as Rojdi, they were busy with the expansion and rebuilding of their settlements as Mohenjodaro was being abandoned.

Possehl objects to the very concept of an "eclipse" or "end" of a civilization. Although the socio-cultural processes we would associate with urbanization seem to have changed drastically, life outside the urban realm is well documented as the descendants of the peoples of the Mature Harappa pursued their lives as farmers, herders, and many types of craftsmen.

Possehl also points out that by Post-urban times the centre of settlement had shifted to the Panjab, Haryana, northern Rajasthan, and western Uttar Pradesh, as well as Gujarat. He admits that it is not clear as to what this pattern for the location of the centre of settlement means. We think that it simply indicates that the Post-Harappans were seeking greener pastures and were moving to eastern region of higher rainfall, compared to Sindh.

The Jhukar assemblage in Sindh and the Cemetery H assemblage in the Punjab and Cholistan are both poorly understood. The successors to the Kullis in southern Baluchistan have also not yet been identified.

Rulers come and go and the elite changes with new regimes; but the people continue. And so do the local cultural traditions. Despite the break, the Harappan legacy continues.

THE LEGACY

In 1993, I had published an essay, *The Harappan Legacy: Break and Continuity* (Agrawal 1993). There I had tried to delineate the curious phenomenon of the drastic break after the Mature Harappan culture, and also the continuity of the cultural traditions. It is clear that the basic substratum of the Indian civilization is provided by the Harappan culture. But it is strange that this great chapter of Indian civilization has been forgotten totally by literate tradition, history and even by folklore. Though, I have pleaded the case for the folklore taking on this tradition in the story of Rama (see Chapter 7). In a traditional society like ours, hoary traditions continue along with newly-acquired fashions and technologies. A closer look clearly shows an old, Harappan substratum, on which the edifice of the present Indian culture stands. Let us recapitulate and re-emphasize some of these cultural traits.

The (Hindu) religion is basically iconic and not animistic as that of the Aryans. The *pasupata, yogisvara, trimukha* aspects of the famous seals have been identified as proto-*Siva*, or even proto-*Mahisa* (Hiltebeitel, 1978) and to us it appears to be a strong evidence. The nandi-bull worship has to be traced to the Harappans and perhaps the sacredness of the cow too. Some of the seals suggest animal sacrifice, so does the terracotta cake from Kalibangan. The *linga* worship can only be traced to the Harappans, even if the phallus-like objects are only few and some scholars do not believe that the proto-*Siva* seal shows an ithyphallic god. The importance of pipal *(Ficus religiosa),* swastika, and water ablutions in today's religion can be traced back to the Harappan preoccupation with water rituals (the Great Bath, the associated water structures, with the Kalibangan fire altars, the row of bathing platforms at Lothal, etc.) and the emphasis on the pipal motif do suggest a continuity of the religious beliefs. The enigmatic terracotta figures do suggest yoga-like postures.

In a 3rd millennium context, when communication and transport must have been difficult, the credit for unifying the north and west of the subcontinent goes to the Harappans. They were the first to achieve this unification of a society with so much of diversity. The location of their main metropolitan towns in a peculiar network of intersecting circles may have provided impetus for travel to these far-flung areas of the state. In later times, it was achieved by locating the main pilgrimage centres at the farthest points of the country, from Amarnath and Badrinath in the north, Dwarka in the west, Puri in the east, to Rameshwaram in the south.

Even secular objects like the typical Harappan house-plan of a central courtyard surrounded by rooms (it has been found by air-conditioning experts to be best suited for Indian climate) seems to have continued from the Harappan times. The binary system of weights of the Harappans followed 1, 2, 4, 8, 16, 32, 64 ... 128(X), with fractions in one-thirds. Till recently, the Indian 1 seer = 16 *chattacks* and 1 rupee = 16 *annas* basically followed the same system. Even the *Arthasastra (angula* 17.86 mm) seems to have been derived from the Harappan measuring unit of 17.7 mm. What the present Indian culture owes to the Indus civilization will perhaps never be known fully as the intangible heritage that we got from the Harappans can never be fully traced to their Harappan origins, unless one day one finds long decipherable texts of the Harappans (Agrawal 1993: 450-45).

In a recent book, *The Sarasvati Flows on: The Continuity of Indian Culture*, Lal (2002) gives a variety of examples showing how pervasive has been the legacy of the Harappans. We will briefly give some examples from his book under different categories of artefacts.

Ornaments and toiletry

The practice of applying *sindura* [vermillion to the *manga* (line of partition of the hair on the head)] by married Hindu women goes back to the Early Harappan times. In some terracotta female figurines, found in levels dating back to 2800-2600 BCE at Nausharo and at Mehrgarh, the hair is painted black which is its usual colour, and red colour has been applied to the medial parting line of the hair.

Just like the hollow cone of gold from Mohenjodaro, an ornament is used even now on the head by women in Rajasthan and Haryana and is called *chauk* in Hindi. Necklaces comprising discular beads of the Harappan type are worn even now in certain parts of northern India. The "dancing girl" from Mohenjodaro wears a set of spiralled bangles on the upper left arm, exactly the same type worn by Rajasthani women even today. The wearing of a girdle (called *karadhani* or *peti* in Hindi) around the waist, as in so many Harappan terracotta female figurines, may be seen even today amongst the womenfolk in rural areas. Worn around the ankle by the Harappan women was the *payala* which too is a common ornament today.

At Banawali was found a "touchstone bearing gold streaks of different hues" (Bisht 1987: 150). This was evidently used to test the purity of gold. The same method is applied by the goldsmiths even to this day.

The Harappans used a special kind of comb, squarish in shape with "teeth" on two opposite sides. The teeth are somewhat thick on one side but finer on the other. Exactly the same kind of comb has been in use in rural India. The use of collyrium is in vogue even today and can also be seen on the terracotta figurine from Nausharo (*ca.* 2600 BCE). The medieval metallic mirror with a handle also goes back to the Harappan times. The toiletry gadget consisting of a tweezer, a small pointed rod and a somewhat flattish object used today has exact Harappan counterparts.

Objects of recreation

As they do today, the Harappan children also played with rattles, whistles, tops *(phirkinis)*, hop-scotch discs, all of terracotta, and enjoyed wearing masks. Kenoyer has published a photograph of children at Harappa playing the game called *pittu*, with discs made from broken pottery, alongside similar specimens found in the excavations at the ancient site (Kenoyer 1998). In the Rakhigarhi excavations, such discs have been found in a stack. Like the present children in the countryside, the Harappan children also enjoyed playing with such toys as bulls with mobile heads and monkeys that could be moved up and down along a rope. Rao (1985: 503) suggested that chess also originated in the Harappan times, though the evidence is not so definitive. But the cubical dice having 1, 2, 3, 4, 5 and 6 blind holes on the respective faces are similar to the ones in use even today.

The Harappans too put a collar around the neck of their dogs and kept their birds in a cage, just as we do now.

Town-planning

The medium-sized Harappan houses consisted of a courtyard, on three sides of which there were rooms and the wall on the fourth side had a gate, opening on the street. On either side of the entrance, on the exterior, there was a small platform on which the house-members and neighbours could just sit and chat. Lal informs us that he noticed in the 1960s at Kalibangan that almost every house in the neighbouring village followed the aforementioned courtyard pattern inclusive of the wide entrance, outside platforms (called *chautaras*) and cattle-troughs. The roofs of the Harappan houses were flat and made by laying horizontal beams and thatching material like canes, consolidated with mud, as indicated by a fallen roof in a room in the southern part of the Lower Town at Kalibangan, the same technique is followed by the villagers there today. For making a floor, broken but hard-baked terracotta nodules, interspersed with charcoal, were first placed as the soling material, overlain by a layer of clay; the same practise is followed by the villagers there today. The floor was, of course, renovated as and when necessary. When we encountered this kind of flooring in the excavation we just could not understand the reason behind such a composition. The local engineers explained the charcoal prevents the moisture from travelling up and thus saves the walls from the saline effects; it also acts against termites.

The Harappan streets were laid along cardinal directions. In the 4th-3rd Century BCE, Sisupalgarh in Orissa followed the same pattern.

Ovens

The *tandur*, a typical cooking oven, used in the north-western part of the Indian subcontinent, dates back to *ca.* 2800 BCE, as found in the Early Harappan levels of Kalibangan. From the Late Harappan levels at Alamgirpur has been found a three-legged, circular *pata* (also called *chakala*) in terracotta. Similar *patas,* made of either wood or stone, are in use today for preparing bread. The Harappan adze-axe, used for digging, is again similar to the present ones. Many of the Harappan utensils have their modern counterparts in northern India, like the handled frying pan, carinated *handi,* high-edged *thali* and *lota,* all made of copper. A *kamandalu*-shaped vessel is part of the Harappan repertoire.

Farming and Hydraulics

While discussing the site of Kalibangan (Chapter 4), we mentioned the remains of a ploughed field, ascribable to the Early Harappan times and datable to *ca.* 2800 BCE. This field had two sets of furrows, one running north-south and the other east-west. This very pattern of ploughing the fields is still prevalent not only in northern Rajasthan, but also in Haryana, Punjab and western Uttar Pradesh.

Although broken terracotta models of ploughshares were reported from Mohenjodaro and Harappa, Banawali has now yielded an intact specimen.

To the north of the Citadel, at Harappa, between the workmen's quarters and the granaries, have been discovered a series of circular pavements formed by four to five rings of baked bricks, set on edge. In the centre was a pit of about 70 cm depth. The presence of fragments of straw and husk, their location near the granaries suggest that the pavements were used for thrashing grains. Similar pounding devices are used in the Kumaun hills called *ukhals.*

Like the village wells today, there were plenty of wells in the Harappan towns.

Transport

The evidence of the use of bullock carts at the Harappan sites is provided by the terracotta models. Similar bullock carts are used in the villages even today. More interesting is the discovery of cart-tracks at Harappa (Wheeler 1947: Pl. XXXVB). The gauge of the ancient carts, as deduced from these ruts, is similar to that of the modern Sindhi carts. Similar ruts have also been found at Banawali. The modern *ekka* type of vehicle was also used by the Harappans as indicated by a model in copper found at Harappa (Vats 1940: Vol. II, Pl. CXXV, 35).

A seal from Mohenjodaro depicts a boat with a central cabin. Commenting on it, Mackay (1938: Vol. I, p.341) states: 'The absence of a mast suggests that this boat was used only for river work, as are some of the wooden boats on the Indus at the present day.' Kenoyer (1998) has published a photograph of a boat which is almost similar to that from Mohenjodaro. Lothal in Gujarat has yielded some terracotta models of boats. Of these, one has holes indicating the positions where poles for the mast and sail were fixed.

Crafts

All sorts of metal techniques appear to have been known to the Harappans, such as "sinking", "raising", "cold-working", "annealing", "lapping", "closed casting" and last but not least *cire perdu.* It is interesting to note that all these techniques are in use even today.

Lothal in Gujarat was one of the centres where beads of semi-precious stones, including carnelian, were produced during the Harappan times. The industry is still flourishing in that part of the country. What a Harappan cot (*charapai* in Hindi) looked like can be easily made out from its copy in terracotta. Most of the Harappan sites have yielded its examples. The Kalibangan specimen bears a design painted in black and white colours probably depicting the design on the bedspread. Bedspreads *(daris)* with similar designs are common in Rajasthan, Haryana and Panjab.

FOLK TALES

A small red ware vase from Lothal depicts a deer and a crow with a pitcher. The scene seems to narrate the story of 'The Thirsty Crow'. According to this story, there was water in a pitcher and a thirsty deer wanted to drink it. As the water was at a low level the deer could not reach the water-level. But the crow was intelligent and dropped some pebbles into the pitcher, to raise the water-level, thus he quenched his thirst.

There is another scene on a painted jar from the Harappan levels of Lothal. In it each bird holds a fish in its beak. The birds as well as the fish are cross-hatched. At the bottom left there is a fox like animal, portrayed in solid colour. From the way the tail is depicted it seems that a fox-like animal was meant. Probably the scene narrates the tale of a fox that saw some birds sitting on a tree with some food in their mouth. The fox wanted to snatch away the food from the birds. So the fox told the birds that they were very good singers and requested them to sing a song. As the birds opened their mouths, the fish dropped down and the cunning fox ran away with it. In the scene depicted on the pot, the food in the mouths of the birds is shown in the form of fish. This tale is still part of the folklore.

RELIGION

The continuity of many religious practices and beliefs have been discussed in detail in Chapter 7 and we may not repeat it here.

RATNAGAR ON LEGACY

Before we conclude the discussions on the legacy of the Harappans, Ratnagar's perceptive conclusions are worth noting.

Ratnagar finds Wallerstein's (1991: 64-79,135-48) approach useful. According to Wallerstein, it is not "societies" that have been developing over the centuries, but world systems, long-term structures of core and peripheral relationships. Ratnagar says:

> We could thus move conceptually from the Great Tradition we had defined in archaeological terms at the outset, to a more challenging "structural space". Perhaps Harappan urbanization and state development originated and functioned as a dominant centre in South Asia, conducting unequal exchanges with peripheral tribal or hunting-gathering societies like the metal producers of Rajasthan and Malwa. Perhaps it also developed as a trading partner that carried overseas bulk goods like wood as well as objects of desire like decorated carnelian beads to richer lands abroad. Simultaneously, we have suggested, its economy of production was always dependent on supplies of metal from outside its heartland.
>
> The attempt has been to avoid confusing the evidence (which we can examine again and again), and actual events (which do not recur). There must have been several occurrences, which have left behind no evidence for us to examine. We construct happenings by reasoning about the evidence. The evidence, such as we can gather, gives us a specific kind of decline to explain: it includes the subdivision of houses, scored goblets, secreted treasures, vandalized statues, unconventional burials, destruction levels at sites, one-room huts at some sites, raider/squatter traces at others, reduction in the level of communication on seals and in their artistic qualities, the eclipse of several crafts, together with the important evidence of the end of sea trade and the abandonment of certain sites. These, together, point to breaks in tradition, migrations, and a general disintegration or breakdown, not to organic expansion or transformation to a new level, nor a situation in which elite remained in control.
>
> These specifics enable us to distinguish the symptoms of the collapse from the cause(s). Vegetational change at Lothal is a symptom, probably, of an overextended local ecology. The political strife evidenced by skeletons and the defacement of statuary could have been a symptom of the weakness of the state structure. The depopulation of the Hakra was probably a sign of hydrological change.
>
> We have not constructed a theory out of thirty-six skeletons and three hoarded treasures, so much as realized that in the uppermost levels and debris of sites, very few of the actually secreted treasures and abandoned dead

will ever survive for us to find. In other words, it is not the number of skeletons and caches that count, but the fact of their existence.

Having felt dissatisfied with arguments about natural holocausts that brought the Harappan tradition to an end, we shifted attention to political and economic factors. Natural calamities would certainly have occurred: some could have been weathered, others, occurring late in Harappan history, could have hastened the transformation. If recurrent, calamities can provide the background to a collapse.

It has been argued that what declined was a political economy with its institutions of dominance, its economic networks, its interrelationships and dependencies, and intellectual norms – in other words, a state system and the cultural circumstances in which it had flowered. What is more, this was a phenomenon of the Bronze Age, which is a unique sort of social formation. It saw technological development dependent on the acquisition of scarce metals like copper, tin, and arsenic or the natural copper-arsenic alloy. This was never the pattern in the Iron Age that was to follow. Iron is much more abundantly available than copper and tin ….

We can now recapitulate the actual causes. Triggers or immediate causes could have been raids, migrations in the west, or internal dissensions that affected the centres of control and residential stability. In contrast, background conditions or enabling factors could be the shamanistic nature of the religion, the absence of institutionalized temples, tensions in the little communities, an undeveloped division of labour within the villages, absence of village self-sufficiency in a Bronze Age economy, as also the inroads by metal, faience, and brick industries into the vegetation cover of the surrounding localities. Ultimate and deep-rooted causes would mainly be the stresses and contradictions of a system which could sustain itself only in its geographic expansion, and in which the polity, trade and craft production, all centred on the elite. And elite dominance depended on a paradoxical combination of coercion and the forging of personal ties (this being too early a form of the state to have developed a full-fledged bureaucracy). As Liverani puts it (1987: 69), when there was such great concentration of 'all the elements of organization, transformation, exchange,' ... the physical collapse of the palace was 'transformed ... into a general disaster for the entire kingdom.'

Perhaps the structural strains became too great to override when they were juxtaposed with other independent variables, coincidental occurrences in adjoining regions: the expanding pastoralist mobility in the Eurasian steppe, the emergence of Elam as a dominant power and its possible appropriation of tin supplies after 2000 BCE, which in turn could have been connected with group movements and migrations along the western margins of the Harappan world, and the possible extension of regional cults.

There were, therefore, internal as well as external factors. No Bronze Age civilization appears to have been able to flourish within its own geographic frontiers. There were systemic stresses but, we would suppose, individual ambition, greed and lack of foresight were also responsible. We do not think any period of transition, violence, or decline can be ascribed to pure abstractions; human beings, surely, have also to bear the blame (Ratnagar 2000: 128-132).

Rulers come and go and the elite changes with new regimes; but the people continue. And so do the local cultural traditions. Despite the break, the Harappan legacy continues.

CONCLUSION

We think we will have to distinguish two types of legacies that the Harappans bequeathed: technological and cultural. There is certainly a change in technology at the end of the Mature Harappan culture, as Ratnagar recounts:

The Harappan civilization was succeeded by cultures we call "chalcolithic": small-scale, usually with small, one- or two-room cottages, very few crafts, a simple stone tool technology supplemented by a few forms of bone tools, and not many types of copper/bronze artefacts, often ornaments rather than tools. There were no great storage structures, or distinctive sculptural styles, no fortifications in the true sense, not even wells. There is no evidence of cosmopolitan interaction with other societies. All that we can suggest, following Allchin and Joshi (1970), is that any coastal sailing tradition that continued would have been located in mainland south Gujarat, where Rangpur II B-C and III sites tend to lie near the coast.

> At the same time the Chalcolithic cultures exhibited tremendous subsistence diversity in terms of eco-niches utilized, kinds of crops grown, wild foods eaten, animals domesticated, and so on. Crafts with large turnovers and steady output (pottery, for example) saw continuous development. But not seal carving or inlaid ivory work or gold ornaments: such crafts would have been dependent on elite demand and state organization of imports of stones and metals. Besides, such crafts required the conscious cultivation of specific skills. Bronze Age economies and technologies, it appears, carried in-built structural weaknesses in their dependence on the inflow of materials like copper, tin, gold, lapis lazuli, or carnelian from relatively few regions, often at appreciable distances from the heartlands of agricultural prosperity and population density. (It was only in the subsequent Iron Age that everyday tools came to be made of a mineral resource that is generously distributed over the world, as in most districts of South Asia.) Trade organized by the state and elite demand meant that crafts like the etched carnelian bead would not survive, let alone thrive (Nissen 1988: 43-4), in non-elite contexts. We may take just one example of Bronze Age technology: the gold granulation technique. Minute spheres of gold were soldered on to the surfaces of ornaments or ceremonial objects. This is said to have been a Mesopotamian invention, though also known in Mycenae, Egypt, and the Indus Valley. In our century, European jewellers tried to revive this technique but found it particularly difficult to make spheres as small as those on the Bronze Age artefacts, and to solder the spheres without spoiling the surface. It took years of trial and error to develop a glue of metallic and organic ingredients that worked on a metal surface (James and Thorpe 1995: 287-9).
>
> Thus the Harappan legacy is not its city life, but rural technologies or peasant science, knowledge that was within the control and experience of the ordinary household or village – elements of culture that had been internalized and passed down generations within the family and the community (Ratnagar 2000: 126-128).

We think that Ratnagar is also referring to the collapse of the Harappan state, hence its cities. The people and the technologies that cater to non-elite populations continued. In a traditional society like ours, hoary traditions continue along with newly, acquired fashions and technologies. A closer look clearly shows an old Harappan substratum, on which the edifice of the present Indian culture stands. Let us recapitulate and re-emphasize some of these cultural traits.

As we had noted earlier, the (Hindu) religion is basically iconic and not animistic as that of the Aryans. The *pasupata, yogisvara, trimukha* aspects of the famous seals have been identified as proto-*Siva*, or even proto-*Mahisa*, and to us it appears to be a strong evidence, though Ratnagar thinks that the Harappan religion was shamanistic. The nandi-bull worship has to be traced to the Harappans and perhaps the sacredness of the cow too. Some of the seals suggest animal sacrifice, so does the terracotta cake from Kalibangan. The linga worship can only be traced to the Harappans, even if the phallus-like objects are only few and some scholars do not believe that the proto-*Siva* seal shows an ithyphallic god. The importance of pipal (*Ficus religiosa*), swastika, and water ablutions in today's religion can be traced back to the Harappan preoccupation with water rituals (the Great Bath, the associated water structures, with the Kalibangan fire altars, the row of bathing platforms at Lothal, etc.) do suggest a continuity of the religious beliefs. The enigmatic terracotta figures suggest yoga-like postures.

In a 3rd millennium context, when communication and transport must have been difficult, the credit for unifying the north and west of the subcontinent goes to the Harappans. They were the first to achieve this unification of a society with so much of diversity. The location of their main metropolitan towns in a peculiar network of intersecting circles may have provided impetus for travel to these far-flung areas of the state. In later times, it was achieved by locating the main pilgrimage centres at the farthest points of the country, from Amarnath and Badrinath in the north, Dwarka in the west, Puri in the east, to Rameshwaram in the south.

Even secular objects like the typical Harappan house-plan of a central courtyard surrounded by rooms (it has been found by air-conditioning experts to be best suited for Indian climate) seems to have continued from the Harappan times. The binary system of weights of the Harappans followed 1, 2, 4, 8. 16, 32, 64 ... 128(X), with fractions in one-thirds. Till recently, the Indian 1 seer = 16 *chattacks* and 1 rupee = 16 *annas* basically followed the same system. Even the *Arthasastras* (*angula* 17. 86 mm) seems to have been derived from the Harappan measuring unit of 17. 7 mm.

What the present Indian culture owes to the Indus civilization will perhaps never be known fully as the intangible heritage that we got from the Harappans can never be traced to their Harappan origins, unless one day one finds long decipherable texts of the Harappans, and if they really had a script!

11

Conclusion

Now we have reachead the end of our survey of the evidence. Let us look back and summarize our main conclusions.

PALAEOENVIRONMENTAL CHANGES

In Chapter 2 we had noted that new and substantive data for reconstructing climate and environment in the subcontinent is mostly confined to the north-western part, in fact, on a transect passing through the Arabian Sea in the west to Kashmir in the north. Kashmir has been the main focus as a lot of new interdisciplinary data has been brought to light by us recently. In this chapter, we dealt with the archaeological evidence and its co-relation with climatic changes as far as Kashmir was concerned. Except for a Kot Diji-type pot and some Harappan beads found at Burzahom, Kashmir is peripheral to the Harappan distribution zone. In Rajasthan, however, we have evidence of human settlements responding to climatic and environmental changes during mid-Holocene and Middle Palaeolithic, as a result, large areas of the Thar Desert were occupied by early man. During these periods climate had definitely been better than in any other periods in this area, at least during the last 2 Myr. Mid-Holocene was also the period of the efflorescence of the Indus civilization in this region.

We had pointed out that in Rajasthan monsoon plays a major role in human settlements. Mid-Holocene, like everywhere else in the Northern Hemisphere, witnessed higher temperature and rainfall. The flourishing sites of Harappan culture in Rajasthan mark this period. Neotectonic changes of lineaments have played their role in changing the loyalties of the rivers there. In Rajasthan large settlements appear only during periods of higher rainfall. The Upper Palaeolithic, the Mesolithic and the Harappan cultures are associated with relatively wetter periods. During the Harappan Period the rainfall was much higher than even today, though there was considerable variation with time.

We also noticed a gradual trend towards aridity, which made life difficult for early humans. Neotectonic movements led to changes in the loyalties of older tributaries of the Saraswati. The Palaeo-Satluj joined the Indus and the Palaeo-Yamuna, the Ganga. The Saraswati River became an ephemeral river. In fact, one can trace the movement of cultures as Palaeo-Yamuna was shifting towards the Ganga. Besides the environmental causes, there was the intrinsic constraint of the semi-arid ecology, which could not sustain very large sedentary populations of towns and urban centres. We also noted that due to aridity, at the turn of the 2nd Millennium BCE, the Harappans started migrating towards the monsoonal ecology of the Ganga Doab. But they were not equipped to cope up with a higher rainfall environment, which was covered with dense forest and big swamps. The Doab could be colonized only with the advent of iron technology, which could provide an abundance of cheap iron tools.

Recently, Singh et al.'s assertion that there has been drastic climatic change in Rajasthan has been challenged by Possehl as he cites the examples of freshwater lakes in Rajasthan like Pushkar. We had however explained that the salinity of the lake water is a function of the balance between rainfall and surface drainage on the one hand, and subsurface conditions on the other. A change in total average annual rainfall, surface drainage or subsurface drainage will change the halite content of these water bodies. As indicated by the changing palaeochannels of the Satluj, Yamuna, Drishadvati, etc. the area is riddled with lineaments and fault lines caused by neotectonics. These changing lineaments could change both surface run-off and also subsurface drainage, affecting the salinity of the lakes. There is no doubt that Pushkar and some other lakes have access to subsurface water which more than neutralizes evaporation. But that does not mean that the lakes of Sambhar, Lunkaransar and Didwana, separated from each other by a few hundred kilometres, could have remained unaffected by severe changes in precipitation. We had pointed out that Swain et al. (1983: 1-17) had used precipitation-sensitive species to calculate quantitative changes in precipitation in Rajasthan. They estimated greatly increased summer precipitation of about 480 mm/yr, from 10.5 to 3.5 Kyr. The interval from 5-3.5 Kyr had the highest winter rainfall. Bryson (1988: 233) also remarks:

In northern India, summers during the mid-Holocene were much wetter. Now the summer monsoon is essentially the only rain in northern India, but in mid-Holocene time there was also considerable winter rainfall.

One has therefore to note that not only the summer monsoon but also the winter rainfall was significantly higher during the mid-Holocene, which brought down the salinity of the lakes in question. Wasson et al. (1984) carried out extensive geochemical and sedimentological studies at Didwana. They inferred that the deepest water conditions in the entire sequence were indicated soon after 6 Kyr, thus confirming the climatic pattern indicated by pollen studies. Recently, a Japanese team in collaboration with the Deccan College, Poona, has again raised cores from Didwana for high-resolution work. Their detailed results are awaited.

We had also discussed the work of Prasad et al. (1997) who have carried out multi-disciplinary studies in the Nal Sarovar in Gujarat employing sedimentological, faunal, ^{13}C, C/N in organic matter, magnetic susceptibility, and measurement of crystalline index of clay minerals techniques. Their study concludes that this period (6-4.8 Kyr) 'showed the highest value of C/N indicative of higher proportion of terrestrial plants in association with enriched ^{13}C, shallow water-loving *Bittium* and land snails.' The overall climate was dry but evenly spaced with wet spells. During 4.8-3 Kyr the climate was wet. Thus we see that the Rajasthan climatic data, though admittedly not of high-resolution quality, do show convergence not only between different indicators but also agree with the multi-disciplinary studies carried out by Gupta and Prasad in nearby Gujarat. We have also to note that the whole of Northern Hemisphere shows mid-Holocene warming and wetter conditions (Bryson 1988, Figs. 10 & 11).

As discussed by us in Chapter 2 in detail, Bryson (1988: 234-235), Singh (1971: 177-189), Singh et al. (1990: 351-358) and Agrawal (1992) all have emphasized the role of climate and environment in affecting habitations, especially the Harappan culture. But one has to admit that in Rajasthan the situation is more complex.

The changing river channels, mainly in response to neotectonic movement of lineaments in Rajasthan, has resulted in changes in the courses of the Satluj, Ghaggar and Drishadvati rivers, as indicated by both the distribution of archaeological sites and satellite imageries (Agrawal and Sood 1982; for a detailed historical summary of such studies see Possehl 1999c). As a result of these tectonic changes, the Satluj joined the Indus system and the Drishadvati, the Yamuna drainage. The ancient Harappan settlements of Kalibangan and other smaller sites were on the banks of the Ghaggar, which eventually dried as its main tributary joined the Indus system.

The third factor one has to take into account is the limited sustainability of semi-arid ecology for large sedentary populations. Despite the mid-Holocene climatic amelioration, Rajasthan remained a semi-arid ecology. It could not sustain large towns for any length of time. The ecology had to give way once a threshold was crossed, till it regenerated again. We see this phenomenon in Rajasthan. The Harappans appear around 2600 BCE and wither away around 1800 BCE. The Painted Grey Ware culture again appears around 800 BCE and disappears a few centuries later. So also the Rangmahal culture, which appears around 2nd-3rd centuries AD and withers away in a couple of centuries.

We thus see that in Rajasthan, it's not only the changing precipitation that affects habitation but also the changing loyalties of the rivers and the sustainability thresholds of semi-arid ecology to allow large sedentary populations for long periods of time. All these trends are superimposed on each other in Rajasthan.

THE BEGINNINGS

In Chapter 3 we emphasized that in the early agricultural societies full-time specialists, including the elite, could be supported only when they could produce agricultural surplus. The foundations of urbanization were already laid in the early Harappan times. At the Early Harappan stage there is evidence for long distance trade. Some of the sites like Quetta Miri, Mundigak, Early Harappa, Early Lathawala, Early Dholavira, Las Bela, etc. do have a settlement area ranging from 20-50 hectares. At several sites like Kalibangan Period I, Banawali, Kot Diji, etc. there is clear evidence of fortification or massive platforms indicating the beginning of the monumental architecture. In Kunal Period IC, there is evidence of proto-seals. From stage one (of Possehl) the settlement area jumps from 140 hectare area to more than 2100 hectare area. Even if the Early Harappan was a weakly developed threshold, we know for sure that the Mature Harappan was a fully urbanized phase. Such a development was possible only within the socio-economic constraints of the contemporary cultures. The contributory components of the Mature Harappan have to be found in the Early Harappan stage and obviously they are there.

We fully agreed with Possehl about the role of trade in the urbanization processes.

We had quoted Possehl's perceptive remark:

> One of the distinguishing accomplishments of the Damb Sadaat Phase was the growth in connections between the Greater Indus Region and surrounding tracts. Even in Mehrgarh I, the Aceramic Period, there were abundant signs of long distance trade in luxury items such as lapis lazuli, turquoise and sea shells. The ability of people in the subcontinent to reach out and capture such goods, apparently on such a scale that it stands out in the archaeological record, starts at the very beginning of the Indus Age and persists through the Mature Harappan stage. Long distance trade begins, with the development of villages and pastoral camps and persists right into the Mature Harappan .... The Baluchistan-Central Asia interaction sphere emerges in the archaeological record as one based on durable goods, mostly stone and metal. With the exception of turquoise there are few durable products from Central Asia that might have been desired by the inhabitants of the Greater Indus Region .... When we have written sources we learn that this kind of interaction is generally based on perishables, especially grain and textiles. These important commodities should not be neglected in our thought, in spite of the fact that there is virtually no archaeological record for these in the Indus Age .... The Early Harappan, Damb Sadaat Phase seems to mark a growth in interregional connections on the western side of the Indus area. This seems to have been on a large scale, involved long distance travel and was enduring. It was also an important harbinger of developments that took place during the Mature Harappan, which build on the foundation laid in Damb Sadaat and earlier interaction.

THE HARAPPAN SPREAD

In Chapter 4, we noticed that the Harappan culture spread over 1.25 million sq. km. In the west Sutkagendor (Makran), in the east Alamgirpur (UP), Manda in the north, and Bhagatrav in south Gujarat represent the outer limits of the culture. The culture was mainly confined to the Indus Valley and Saurashtra, including Kachchha. There are a large number of Harappan sites on the dry Ghaggar-Hakra system, which probably joined the Indus or the Nara in the past.

We noticed that the Indus civilization or Harappan culture (named after the first discovered site, Harappa) is remarkable for its uniformity and standardization in weights, measures, ceramics, architecture, and in other arts and crafts, though there is considerable variation in ceramics and town-plans. This uniformity appears all the more imposing when one considers that the culture extended over more than a million sq. km, an area more than that of Pakistan today. Recent studies, however, are bringing out a good deal of regional variation. Thus we find that the Harappan culture exhibits both the traits: a uniformity which characterizes it as a uniform culture, and the regional diversity which allows for expression of local religious beliefs and traditions. We noted the variations in the town-planning of the main Indian sites: Kalibangan, Banawali, Lothal, Surkotada and Dholavira. This unity in diversity has always been a hallmark of the Indian civilization.

One of the hallmarks of the Indus civilization is its humility and modesty. In their humility, the Harappan towns present a contrast to the Mesopotamian and Egyptian ones. Mark Kenoyer thinks that the Indus rulers governed their cities through the control of trade and religion rather than armies. No monuments were erected to glorify the power of the elite. In Mesopotamia and Egypt stone sculptures and relief of kings were made, unlike in South Asia where Asoka built more than 115 stone columns but none of them had the portrait of the king. Renfrew also echoes the same views about the character of the Harappan culture. To repeat:

> I have often thought how singular the Indus Valley civilization is in this respect, for it possesses very large urban centres with a rectangular layout more impressive than any in Early Dynastic Mesopotamia, and worthy of comparison with Teotihuacan. The centres have Citadels with large granaries, which were clearly the hub of a complex re-distributive exchange system. A range of traded materials is seen. Yet nowhere, on the basis of archaeological record at present available, is the superabundant personal wealth so characteristic of the early civilizations of Egypt, Mesopotamia and China. Nor has there been found the exceedingly complex and monumental religious symbolism characteristic of the Mesoamerican early state modules. Nor yet, despite the existence of a script, is there the vainglorious assertion of personal power, expressed in colossal monuments and inscriptions that we see in Egypt and Mesopotamia. The Harappan civilization does not reveal to the world any Ramses, any Hammurabi, nor yet any Gudea of Lagash. Indus exchange evidently functioned without such emphatically assertive statements about the prestige and power of the central person (Renfrew 1984: 106).

HYDRAULICS

In Chapter 5 we tried to bring out the technical virtuosity of the Harappans in hydraulics. For the Indus civilization M. Jansen used the word *wasserluxus*, which literally means "water splendour", but Possehl has pointed out that it does not quite catch the significance of the German word. The bathing facilities in each house indicate that washing and cleanliness were important to the Harappans. The many wells throughout the city were sources of pure water, essential for effective cleanliness. The drainage system served to move the effluents away from the houses, below ground, safely out of the way and safely out of sight, in brick-lined channels that prevented contamination of the earth and the city. At Mohenjodaro numerous wells were dug throughout the city and maintained for hundreds of years.

At Mohenjodaro and Harappa bathing platforms with drains were often situated in rooms adjacent to the well using tapered terracotta drainpipes to direct the water out to the street. The floor of the bath was usually made of tightly-fitted bricks, often set on edge, making a watertight floor. In the Harappan cities, the top of the well would have stood above the ground level with a small drain nearby to keep dirty water from running back into the well itself. There was a small drain cut through the house wall into the street, which carried the dirty water to a larger sewage drain. They made sure that water from the bathing area and latrines did not flow into the rest of the house. Drains and water chutes from the second storey were often built inside the wall with an exit opening just above the street drain. HARP excavations at Harappa reveal latrines in almost every house, though this regular feature seems to have escaped the notice of the early excavators at both Mohenjodaro and Harappa. The commodes were made of large jars sunk into the floor. Many of the latrines contained a small jar similar to the modern water jar or *lota* used throughout South Asia for washing after using the toilet. Sometimes these sump pots were connected to a drain to let sewage flow out, and most had a tiny hole at the bottom to let water seep into the ground. Clean sand was scattered on the floor of the latrine and periodically an entire new floor was installed. These latrines must have been cleaned out quite regularly by a special class of labourers, like the present-day sweepers in small towns. The baked brick drains connected the bathing platforms and latrines of private houses to medium-sized open drains in the side streets, which flowed into larger sewers in the main streets. The sewers were covered with bricks or dressed stone blocks. The well laid-out streets and side lanes equipped with drains are one of the most outstanding features of the Indus cities. As noticed by the excavators, even smaller towns and villages had impressive drainage systems indicating that removing polluted water and sewage was an important part of the daily concerns of the Harappans.

The HARP team noticed that some drains had wooden sluice gates or grills perhaps to keep people from secretly entering into the walled city. At Harappa a sequence of four drains, built one after the other, leave the city at the main gateway between Mound E and Mound ET. A well-preserved magnificent corbelled drain is 1.6 m high, 60 cm wide and extends for 6.5 m beneath a major city street. The device of the corbelled arches allowed larger drains to cut beneath streets or buildings until they finally came out under the city wall, draining out sewage and rainwater onto the outlying plain. At intervals along the main sewage drains were rectangular sump pits for collecting solid waste. These sump pits must have been cleaned out on a regular basis; otherwise the entire drainage system would be choked. It is worth noting that there were garbage bins along the major streets, a civic concept which seems very modern but had originated in the Harappan times. Probably fluctuations in the streets and drain maintenance resulted in the rapid build-up of street levels. Many doorways and walls had to be raised above the level of the street to keep sewage from flowing back into the house. Gradually, entire rooms would be filled with dirt and a new house had to be built well above the street level.

The Great Bath at Mohenjodaro is a bathing platform, raised to the civic level. It is larger and more complex than household facilities, but conforms to the proposition that cleanliness was an important element in the Indus ideology. The Great Bath is a marvel of waterproofing engineering skill.

Possehl rightly thinks that water and the management of water have been central to the ideology of the Indus people. This is best expressed at Mohenjodaro, but is also found at many other Indus sites, most notably Dholavira with its extensive reservoirs and water harvesting.

It is interesting, notes Possehl, that the builders of the Great Bath used elevation and distance to symbolically set it apart from the rest of Mohenjodaro. Great Bath was an important ritual space, one that seems to have been reserved for the elites of the city, possibly the elites of the entire Indus world. Wheeler too found *wasserluxus* an interesting and important feature of the Indus civilization. He felt that the Great Bath and the "extravagant provision for bathing" in private homes were both testimonies to the importance of water in the life of the Indus people.

ARCHITECTURE

In Chapter 5 we also noted the Harappan contribution of town-planning to the world. Generally Mohenjodaro was considered the model of town-planning, with an acropolis to the west, separated from the Lower Town meant for the common people. But most Mature Harappan town-plans were different from Mohenjodaro. For example, Allahdino, Amri, Banawali, Dholavira, Lothal, Rojdi, Surkotada, Ropar, Hulas, had their own distinctive plans. We know that Harappa had pre-Harappan beginnings by the time the Indus civilization began, and this would have probably constrained the would-be civic planners there. At Harappa there is an acropolis to the west, but there is also an important part of the city to the north of the acropolis, called Mound F, with the granary and husking floors. Dholavira has the acropolis near the middle of the enclosed settlement, and has both Lower and a Middle Town. Only Kalibangan resembles Mohenjodaro in its layout. Out of some 1,050 Mature Harappan sites there are only two – Mohenjodaro and Kalibangan – that resemble each other. But the contrast in the social stratification is only subdued. We don't have palaces and huge monuments contrasted with slums. In the Harappan towns we have the acropolis but the Middle and Lower Towns are not shanty towns.

TECHNOLOGY

In Chapter 6 on Crafts and Metallurgy, we noted that four categories of crafts can be recognized:

i) Crafts processing from locally-available materials using relatively simple technologies include wood-working, basket-making, simple weaving, terracotta pottery production, and house-building;

ii) Crafts using imported materials with relatively simple technologies include stone-shaping for domestic purposes and chipped stone tool-making;

iii) Crafts using local materials and complex technologies and production processes include stoneware bangle manufacture, elaborate painted and specialized pottery production, complex weaving and carpet-making, inlaid wood-work production and construction of decorative architecture; and

iv) Crafts using imported materials and highly complex technologies include agate bead manufacture, seal production, copper/bronze metal-working, stone-carving, precious metal-working, shell-working, and faience manufacture.

We have evidence that the Harappans used cattle power for transport and wind power for sailing their boats. The invention of wheel helped both transport and ceramic industry. No carts have survived, but their tracks have been discovered in the Harappan sites and indicate roughly the same spans as used today. Terracotta models of carts are quite ubiquitous, though bronze models have been found only at Harappa and Chanhudaro. Both the lighter, modern *ekka* type and the heavier bullock-cart type can be identified in these models and hardly seem to have changed through all these millennia. There is, however, no evidence of fast transport like chariots.

The Harappans also used boats. One of the Mohenjodaro stone seals and a terracotta amulet depict boats. Rao discovered five clay models of boats from Lothal. He describes 'a sharp keel, pointed prow and high flat stern. It has three blind holes probably for stern, mast and ropes for sail.' Boats – with sails and without – were in use.

Chert blades up to a length of 20 cm have been recorded. Rohri-Sukkur in Sindh provided the source material for the blades for the whole Harappan "empire". This, incidentally, indicates a developed internal trade.

Though pyrotechnological treatment of talcose rocks begins during the 6th Millennium BCE, it becomes more and more common, culminating in the 4th Millennium BCE when more than 90 per cent of steatite beads from Mehrgarh are fired white. The amount of talc working debris at the Indus sites becomes massive. The application of blue-green glazes to steatite beads also begins in the 4th Millennium BCE. At the beginning of the 3rd Millennium BCE, artificial materials such as talc paste, steatite-faience, and siliceous faience are introduced in the Indus bead repertory.

We also noted that the Indus craftspeople were extremely technologically innovative in the creation of new materials. This was particularly true for sintered talcose and siliceous materials, where we see a virtual explosion of new materials during the 3rd millennium, at the same time as the development of Indus civilization.

We noted the relative indifference of Indus people to lapis and even turquoise by a combination of a desire for materials transformed by heat and for materials with high reflectivity. Jarrige is reported to have said about Indus attitudes toward turquoise and lapis lazuli: 'they didn't like them because they couldn't play with them.' That is, these materials did not change in colour, reflectivity, or hardness with technological treatment, primarily heat treatment.

We need to recall what Heather had pointed out about the culturally-specific desires and values of the Harappans, including the value of transformed materials, particularly those transformed by heat, and the desire for specific colours and high reflectivity. Quoting Vidale, she sums up her thoughtful essay: 'the Indus people are noteworthy for their cultural expression of not power of conquering, but rather power of creating; from abstract universes created in their urban organization to artificial stones of their microbeads.'

India and Pakistan have been famous for their native lapidary industries for millennia, right from the Harappan times. We noticed the evidence for the manufacture of hard-stone beads at many Harappan sites. The early sites are Mehrgarh III, Ghazi Shah I, Amri Ic and Id, as well as Shahr-i-Sokhta II. During Mature Harappan, we have a bead shop at both Chanhu-daro and Lothal.

We noted Vidale's significant observation that imitation of various semi-precious raw materials such as turquoise, lapis lazuli, carnelian, and shell by artificial replicas (mainly terracotta, talc, and faience-related materials) allowed provision of differently ranked categories of people with different ranks of ornaments. The addition of new artificially-created materials to the array of semi-precious raw materials allowed an increased number of layers of hierarchy to be represented, and it is clear that technology became an important tool for categorization of people arranging themselves in new social and economic orders.

The Harappans had evolved a highly standardized system of weights and measures. For linear measures, two systems were in vogue: cubits and a long foot. A cubit was about 52 cm (52.5 to 52.8 cm) and the long foot 33.5 cm. Rao reports a shell object (now also reported from other sites in Saurashtra) with four slits, which was probably used to measure angles. Shell scales from Mohenjodaro and Lothal indicate the Harappan measures of length. Lothal scale has a length of 128 mm. The smallest divisions are 1.7 mm and the next unit is 33.46 mm (1.7 x 20). Lothal scale is divided decimally. On the Mohenjodaro and Lothal scales a bigger unit of 67.056 mm can also be discerned. Both foot (13.2" or 33.5 cm) and cubit (20.5"or 52.5 cm) seem to be in vogue, as indicated by the measures of buildings and roads. For example, the main walls of the Harappan granaries measured 30 cubits and their widths 10 cubits; some houses of

Lothal measured 40 x 20 units of the Harappan foot. Rao has pointed out that 17.7 mm Harappan division is very near to the traditional *angula* measure of 17.86 mm of *Arthasastra*.

Similarly the Harappan cubical weights show remarkable accuracy of the standardization. In the lower denominations the system is binary: 1, 2, 1/3 X 8,4, 8, 16, 32, etc. up to 12,800 which is comparable with traditional Indian ratio of 1:16 (1 rupee = 16 *annas*). The unit is equivalent to 13.625 gm. In the higher weights they have followed a decimal system, with fractional weights in one-thirds.

RELIGION

In Chapter 7 we discussed the religion and the afterlife represented by burials. The archaeological evidence for reconstructing the Indus civilization is based on the depictions of deities, water ablution, sacred trees, sacred motifs and symbols, ritual objects, and burials. The dichotomy between the two religio-cultural traditions [the Greater (*Margi*) and the Lesser (*Desi*) Traditions] is also manifest. The female terracotta and the *lingas* (phalli) and *yonis* (vulvas) could be part of the Lesser Tradition. Water rituals, Great Bath, the religious imagery on the seals could be the beginning of the Greater (elite) Tradition. I find it difficult to differentiate a domestic hearth from the so-called fire altar; but the homely hearth could as well have been used for some daily fire rituals before actual cooking. There is evidence of Mesopotamian legends (e.g. Gilgamesh) in the Harappan seals, so there could as well be some West Asian elements, but to assume that the Indus civilization is an Indo-Aryan creation is not supported by any evidence. The beginning of the latter-day *yatras* seems to have been made by the processions depicted on the seals. The depiction on seals of females with plants coming out from the vagina, may go back to the Neolithic fertility cults, and continue to this day in the form of *Navratra* festivals in Gujarat and *Harela* in Kumaun. So also the ithyphallic seated male on the seals does have the components of the latter-day Shiva.

The seals depict a lot of religious motifs, but not all seals were of ritual significance. The Indus seals seem to have served a variety of functions. Their discovery at the Lothal warehouses clearly suggests that they were used to seal grain parcels or merchandise, but a majority depict scenes which could be interpreted only as religious. A well-known seal depicting a seated, three-faced, horned and ithyphallic (erect penis) figure surrounded by a number of animals recalls the *pasupata* nature (preserver of animals) of *Siva*. There is a terracotta cake from Kalibangan, which shows a standing figure (deity) with a horned headdress and on the reverse a man carrying a goat/bovine tied with a rope, perhaps for sacrifice (horned deities are discussed in detail below). In a lined pit, from the religious sector of the Citadel at Kalibangan, were discovered bovine and antler bones and ash, probably indicating a sacrifice. Several naturalistic phallic stones and terracotta and perforated stones (perhaps depicting the female organ) may take the present *Sivalinga* and *Yoni* worship back to the Harappan times. One of the nude male stone torsos from Harappa also appears to be ithyphallic, recalling the *yogisvara* aspect (in control of all senses) of *Siva*, who in later sculptures is quite often depicted as ithyphallic. Another male statue from Harappa shows a nude male in a dancing pose, reminiscent of *Siva's* cosmic dance. All these features indicate that the elements of the latter-day Hindu god Shiva were already there in the Harappa culture. In one of the seals, a deity (?) is shown with a supplicating figure and a sacrificial (?) goat. In the lower row are seven standing figurines, perhaps devotees. Another seal shows an upside-down woman with legs spread apart and a plant coming out of her vagina. On the other side of the seal is a man holding a scimitar and a seated figure with dishevelled hair. It has been interpreted as a human sacrifice to a tree-spirit. On a seal a bull-headed man is attacking a tiger, yet on another, a horned person, recalling the Sumerian mythology of Enkidu and Gilgamesh, is shown lifting two tigers up.

It seems that even some of the Indian folk tales go back to the Harappan times. For example, the tale of the crow who manages to bring the water level up to his beak by throwing pebbles into the pitcher. And of the fox who praises the bird so that she opens her mouth and drops the fish from her beak and he grabs it.

Ramayana

I had also drawn attention to the remarkable similarity between the Gilgamesh and Ramayana legends:

- Rama and Gilgamesh are on dangerous missions in the forest.
- Rama must find and defeat Ravana. Gilgamesh has elected to kill Huwawa.
- In each case a new ally is required: Sugriva and Enkidu.
- In both cases the ally's story concerns a sacrificial scenario. In one case the sequential sacrifices of Huwawa and the Bull of Heaven involve Enkidu himself, who dies as a result of the second. In the other, the killings of Dundubhi and Mayavin are by Sugriva's brother Valin, whom Rama must kill himself to cement his friendship with Sugriva. Two of Enkidu's roles are divided between these two brothers: Valin, the sacrificer who suffers death, and Sugriva, the permanent friend, guide, and ally. In both epics the ally and "sacrificer" are wild creatures, affiliated or identified with wild animals, who contrast sharply with their highly cultured counterparts, Gilgamesh and Rama.
- The sacrificial themes and accoutrements of office that mark them are wild hair, women's garb, drums, connections with cult women, drunkenness, possession – all indicate that they represent "tribal" or "barbaric" forms of sacred power.
- Hiltebeitel clarifies that this is not to suggest that these figures are leaders of actual forest tribes. Rather, they are figures whom the authors of these highly stylized literary epics have chosen so as to represent *symbolically* certain values and themes associated with tribals, outsiders, and aborigines.
- The important point in each epic is that the connection between the king and the "wild man" of the forest is made to the advantage of the king. The sacred power which the forest figure makes accessible is in some manner necessary to the king's welfare and thus to the welfare of his domain.
- In Gilgamesh's case Enkidu's services bring him fame and eventually reconciliation to a responsible rule in Uruk. In Rama's case, Valin's killing of Dundubhi and Mayavin stands behind Rama's friendship with Sugriva, which in turn makes possible his recovery of Sita and his return to rule at Ayodhya.
- Finally both stories concern a restoration of a proper relationship with the goddess after that relationship has been disrupted. Gilgamesh, recipient of Ishtar/Inanna's *mikku* and *pukku,* insults the goddess by refusing to be her lover. Sita, the goddess incarnate, is of course abducted. In each epic the initiation of the restoration of relations between king and goddess involves a sacrifice performed by an inhabitant of the forest. And in each case, the "sacrificer" dies: Enkidu as a direct result of his role; Valin indirectly, but with the slaying of Dundubhi as the root of his problems with Mayavin, Sugriva, and finally Rama. One need only recall that the restoration of proper relations with the goddess is the very purpose of the buffalo sacrifice.

If indeed Rama's story depicts the story of the Indus civilization, it would be easy to understand that this great phase of our past was retained by the folk tradition and to me it makes more sense. I am giving this suggestion so that further research is undertaken to correlate archaeological and literary data of the earliest versions of Ramayana.

The semi-nude female terracotta figurines with their elaborate headdresses have been associated with a mother-goddess cult, and may be part of the Lesser (*Desi*) Tradition. These figurines could have been associated with the earth goddess or fertility cults. Mother-goddess cults have been discussed in great detail in an historical perspective by Kosambi and Bhattacharya. The act of procreation is a major theme in all ancient religions. Male virility is represented in the nude male figurines, the male animal symbols on seals and stone phallic objects.

We noted the religious diversity of the Harappans too. At Kalibangan (Rajasthan) and Lothal (Gujarat) the figurines are conspicuous by their absence despite very extensive excavations at these sites. Seven fire altars in a row were found on the "Citadel" at Kalibangan, associated with a sacrificial pit containing animal bones. It has to be noted that these "sacrificed" and *cut* bones are bovine, an evidence that does not allow tracing the sanctity of the cow to the Indus times.

One of the most common motifs in Indus ritual art is the image of a bearded man wearing a headdress of horns, which has a triple-leafed branch sprouting from the centre. It is associated with both animals and pipal. There are two distinct horned deities in terracotta or carved onto seals. Some seated figures with horned headdresses appear to have additional faces carved at the side of the head, suggesting that this deity had three or even four heads if there was a face at the back of the head. This multi-faced deity has been generally identified with the later images of Shiva, a Hindu god.

Of all the religious symbols, pipal seems to be the most popular and potent. It continues to be of special significance at religious places like temples. No temple can afford to be without a pipal tree even today. Cutting a pipal tree or its branches is still a taboo. Both pipal and *bata* (*Ficus indica*/banyan) trees have a rich tradition of myths and legends in India. Kosambi says, 'The Pipal (*Ficus religiosa*) has been worshipped throughout India with unbroken continuity from pre-history, long before the Buddha found enlightenment, beneath its boughs. The local name for the god of the pipal tree is *Munjaba*, specially a god of small children before investiture. The *vada* (*Ficus bangalensis*) is associated with the devoted Savitri who reclaimed her husband from the god of Death, hence becomes the patron deity of all good wives.

AFTERLIFE

In Chapter 7 we also discussed the burial practices as they depict the beliefs related to afterlife. The care one bestows on the disposal of the dead reflects the religious beliefs of the people. The Christians, Muslims, Parsis and Hindus, etc. have their own religious beliefs that underlie the methods of disposal of their dead. Though one would have expected uniformity, surprisingly there is quite a bit of variation in the Harappan burial customs. Normally the Harappans buried their dead in unlined pits, head pointing north, though there are exceptions like Ropar (Indian Panjab) burials where the direction is north-west. About twenty pots (sometimes even up to forty) were buried as the funerary appendage. The dead were provided with food and drink for the afterlife too as the remains on the pots indicate. At Harappa most graves show that the pottery was covered with a layer of soil and then the coffin was placed on top of this partially-filled grave shaft. Personal ornaments like rings, earrings, necklaces, anklets, bangles and, at times copper mirrors were also found with the burials. Of course in their furnishings the Harappan graves stand nowhere in comparison to the macabre splendour of the Ur graves, or the lavish paraphernalia of the Chinese.

After the Independence, several Harappan sites have been excavated in India: Dholavira, Rakhigarhi, Kalibangan, Lothal, Surkotada, etc. Though earlier impressions of the Harappan sites were of a monotonous sameness, recent work has thrown up evidence of local variations in city plans, burials, religious artefacts, etc. In some of the Kalibangan graves there were pots and even beads, bangles, etc. but no body, complete or even fractional. Probably these graves were of a symbolic nature, associated with persons who may have died elsewhere and only the ritual was performed in these graves.

There was yet another variety at Kalibangan. The graves of this type were also located in the same general area, but a little away from the two groups just discussed, but the pit was circular or ovoid and not rectangular. No skeletal remains were found except for a fragmentary bone-piece in only one of the sixteen graves excavated of this type. While these graves too must have a funerary association, their exact nature remains a bit enigmatic.

INDUS SCRIPT

In Chapter 8 we conceded that despite several claims of decipherment, the Indus script remains undeciphered so far. We also mentioned some new hypotheses which deny that the Harappans had any script at all. There are two main groups: one proposing that the Indus script is proto-Dravidian, and the other Indo-Aryan; and then of course there is Steve Farmer who does not give it even the status of a script. Asko Parpola, Konorozov, and others favour a Dravidian affinity whereas Rao and some others claim it to be an Indo-Aryan language. The arguments and counter-arguments are quite technical and can best be seen in Parpola. To be able to do a systematic decipherment, a comprehensive corpus of concordance has been computer-generated by Mahadevan and the Finnish team. With the publication of *Corpus of Indus Seals and Inscriptions*, the attempts at deciphering will become easier. Franke-Bogte also produced a thorough documentation of the glyptics of Mohenjodaro. M.N. Gupta was, however, very critical of these works and has reported many contradictions. He finds about 70 symbols missing from both the works. He severely criticised Mahadevan's "tempered normalized signary" as it has corrupted hundreds of texts beyond recognition. He finds it a wasteful repetition of identical texts, at times a single text has been repeated forty times. Despite such reported shortcomings, one feels that such compendia will prove invaluable for research workers on the script.

Parpola describes the problems of the Indus script as a crossword puzzle. As long as there is no bilingual inscription, we can never be sure. But the probability of correctness increases with the number of interlocking solutions. Though several scholars have been working on the Indus scripts with similar methodology and basic assumptions, there is little consensus on the interpretations. But there are some agreements too between different interpretations and Parpola pleads that they should be taken seriously. The debate continues till we have a bilingual or some more compelling evidence to accept a particular reading of the Indus Age scripts.

The direction of the script has now been accepted to be mostly from right to left and not boustrophedon (right to left and then left to right), which is rare.

TRADE

In Chapter 9 we discussed the evidence of trade, agriculture and animal husbandry.

Most of trade was confined to an exchange between elites for luxury goods, though grain for the boatmen and pastoral nomads was also part of this ancient trade. It also seems to be part of cultural and diplomatic exchange in Middle Asia. It was dependent upon the natural trade routes as there were no highways, and when the marine technology became available the marine route was preferred as it was cheaper and safer. Recent studies have amply demonstrated that in the Period 2500-2000 BCE the people of the Indus civilization were engaged in trade, exchange, and what appears to have been quite intense, regular intercourse with people in the Arabian Gulf, Mesopotamia, Central Asia, and the Iranian plateau. This interaction resulted in exchange of ideas and artefacts which is writ large on the archaeological evidence.

About the trade routes, we noted that in the second half of the 3rd millennium this overland connection collapses. In its place evidently a sea route develops along the Makran coast leading to the Umm an Nar culture of south-eastern Arabia and onto Dilmun. Following the decline of the Mature Harappan culture around 2000 BCE new and intensive influences came from the West and from Central Asia and afterwards from 1400 BCE.

Shortughai, in the highlands of Baluchistan, was a trading station for lapis lazuli from Badakhshan. Evidently in control of the lapis mines, this settlement from 2500 BCE is Mature Harappan. The presence of a population from the Indus Valley correlates with the shift from a land to sea trade. Thus, lapis must have been transported first to the Indus Valley, then by sea route to the Arabian peninsula, before perhaps reaching a final destination in Egypt.

However, in Middle Asia there was intense communication and intercultural exchange, which cannot be attributed to trade alone. Possehl suggests that this Middle Asian intercultural style reflects a shared set of symbols, possibly an ideology. This was a syncretic form of belief system. There were several factors coming into play: the establishment of state boundaries, implanted colonies, warfare and prospecting for minerals would all have amounted to movement, migration and dislocation of people. Information about people and places would have spread through uprooted people and peripatetic animal-herders, and so would knowledge about new techniques or newly-discovered goods. Intermarriages could have been common.

Ratnagar gives us two glimpses of the scale of the trade from the cuneiform texts. The first concerns a trade transaction (see Roaf 1982) in which some 18,000 kg of copper was involved. In the second, consignment of 2,380 "gur" (a capacity measure) of barley goes to Magan (see Ratnagar 1981: 80). As is commonly accepted, a "gur" was 240 litres or 180 kg of grain, then 2,380 "gur" was a gigantic amount, and its import requires careful thinking out.

The trade with Oman was probably most heavy, although it was not critical to the Indus economy. Numerous Indus artefacts have been found in Oman and along southern coast of the Arabian Gulf, and characteristic circular seals from the Gulf sites have been found in the Indus Valley. Though Kenoyer thinks that the major imports from Oman were copper, shell and possibly mother-of-pearl, I doubt if the Oman copper had any market in the Indus in view of nearby abundant supplies in Rajasthan and Baluchistan. In historical times the Arabian trade supplied the Indus Valley primarily with dates, pearls, incense, dried fruits and slaves.

On the whole, the majority of materials and artefacts appear to have moved from India to Sumer, the exceptions being food, textiles, silver, and steatite vessels. Probably wood, like lapis lazuli or gold, could have been transported to Sumer for specific purposes like the building of a temple chariot, statue, or temple facade/roof, in contrast to copper/bronze, textiles, and food that would have been consumed on a regular basis. Thus copper/bronze, under-represented in archaeological sites because of its re-melting and reuse value, may be the main export. The cuneiform texts give a glimpse of the large quantities of copper that were traded by Mesopotamia.

The extent of trade and travel and long-period residence of people in foreign lands is indicated by the Sumerian official interpreter for the Meluhhans, and a Sumerian buried in a characteristic wooden coffin and reed shroud at Harappa.

Around 2000 BCE, there is a drastic change. After 2000 BCE, it appears, not only did the movement of the various metals, stones, and shells dwindled, there was also a disruption of habitation at many of the settlements. The desertion of Mohenjodaro, Dholavira, Harappa, and other Harappan cities represents a dissolution of the state, the system of literacy, and urban forms and institutions like the use of seals and tokens, street-planning, street drains, etc. The Jhukar culture and the Cemetery H were both intrusive at the site. Shortughai, in the last Harappan occupation, ceased to have a lapis industry and began to have links with Bactria. It is obvious that wherever late Harappan cultures are known, these did not utilize marine shell, lapis lazuli, silver, or tin-bronze, to any appreciable extent. That is to say, the end of the state and the end of the long distance trade appear to have occurred simultaneously. With the abandonment of settlements and economic decline, links between the major centres of civilization dissolved in the early 2nd millennium.

The collapse of the Harappan state was a major event which changed the pattern of trade and the alignment of routes into South Asia. Jarrige (1974-86: 119) has pointed out the absence of eastern Iranian and Afghanistan materials, including lapis, at Nausharo in the Harappan Period. In particular, he stressed the scarcity of lapis at the site. In contrast, chalcolithic Mehrgarh and Nausharo did have interactions up the Bolan route. Thus a reversal had occurred, and there was activity and exchange again between the Baluchistan highlands and the Kacchi plain.

Ratnagar points out that the desertion of several sites, and colonization of fresh areas, from north-eastern Iran and Turkmenia to the Murghab delta, and from north-eastern Iran southward and south-eastward to Seistan and Baluchistan, and even into the Kacchi, appear (1) to have occurred toward the end of the 3rd millennium or the early 2nd millennium, (2) to some extent to have been connected with the wide dispersal of a cult or cults in which polished marble objects of three sorts were used, (3) to have had some connection with a search for, or utilization of, copper in Baluchistan, and (4) in the face of dwindling state power in South Asia to have involved the reopening of passage (pastoralist movements?) from the highlands into the Indus plains. Could it mean the migration of the so-called Indo-Aryans? Ratnagar does not specify.

Most scholars have now recognized the role of nomads in trade. The lapis of Chagai may have first been brought into the north-western plains of the Indian subcontinent by sheep and goat pastoralists who wintered in the Indus lowlands, their having acquired it from other mobile groups. However, regions as greatly distant from each other as the Tigris-Euphrates Valley and the Indus Valley could hardly have been brought into a trading circuit by the movements of animal herders.

Irfan Habib suggests that the Indus civilization probably drew its silver, or much of it, from the mines, famous in early medieval times, situated in the Panjshir Valley in northern Afghanistan. This becomes likelier when we consider that the valley lay astride the best route connecting the Indus basin with Shortughai, on the Oxus River in north-eastern Afghanistan. Within a period carbon-dated 2865-1975 BCE, the pottery, mud-bricks, houses and artefacts at Shortughai, all followed Mature Indus models. Its people partly sustained themselves by cultivation. But its real industry seems to have been the making of lapis lazuli beads. This semi-precious stone almost certainly came from the celebrated mines at Sar-i-Sang on the upper reaches of the Kokcha River, near whose junction with the Oxus Shortughai is itself situated. At Shortughai, craftsmen also cut agate and carnelian beads, obviously receiving their raw material from the Indus basin. Thus, agate and carnelian exchanged with lapis lazuli, with Shortughai serving as the entrepot. The lapis lazuli on which the Chanhudaro artisan worked, must have been imported via Shortughai.

AGRICULTURE

The principal Harappan cereals seem to have been wheat and barley. The wheat cultivated had three varieties, viz. Indian dwarf wheat (*Triticum sphaerococcum*), the club wheat (*Triticum compactum*) and *Triticum aestivum*. The dominant barley was the six-rowed variety (*Hordeum vulgare*), though *Hordeum vulgare nudum* and *Hordeum sphaerococcum* have also been met with (Costantini 1990). Rice seems to have been unknown to the Mature Harappans at least in the Indus valley. At the same time it must be noted that husk and spikelets of rice (*Oryza* sp.) have been found mixed up with clay-lumps at Lothal and Rangpur, both in Gujarat. Clear evidence of rice, however, comes from Hulas, but that is in a Late Harappan context. Lothal has also yielded some evidence of millets, particularly Kangni (*Setaria italica*) (K. Ramesh Rao and Krishna Lal in S.R. Rao 1985: 667-83). Six varieties of millets, including ragi (*Eleusine* Sp.), kodon (*Paspalum scrobiculatum*), sawa (*Enchinochloa colonum*) and jowar (Sorghum) have been identified at Rojdi, in the same region of Gujarat (Weber 1990). Thus there are regional as well as chronological variations in the Harappan food economy. Sesame and mustard, used as cooking media and for lighting lamps, were also cultivated by the Harappans. But what is most intriguing is that while Egypt, so famous for its cotton, did not produce that crop in the 3rd Millennium BCE, India did. Evidence of cotton cloth comes from Mohenjodaro, where its decomposed remains were duly identified.

The beginning of the Harappan Period (*ca.* 2600 BCE) is marked by a more extensive agricultural system involving a greater variety of plants. Although wheat and barley still appear to have been the mainstays of the agricultural system, they now account for only 81 per cent of the seeds with ubiquity dropping to 90 per cent. A combination of summer millets, rice, vegetables, fruits, oil seed, and fibre-oriented crops make up an increasing proportion of the cultivated plants.

ANIMAL HUSBANDRY

About 80 per cent of the faunal assemblage from any of the Harappan sites belongs to domestic animals. A significant amount of the animal protein was obtained from domestic animals such as cattle, buffalo, sheep, goats and pig. In addition to the regular supply of meat to the inhabitants, cattle also helped in agricultural operations, and as draught animals. One of the earliest evidence of their use as draught animals is depicted at Mohenjodaro in the form of a toy cart pulled by bullocks (Mackay 1931). For much of the animal protein young and sub-adult males were used. The recent faunal studies at Kuntasi (Thomas and Joglekar 1990; Thomas et al. 1997) and Shikarpur (Thomas et al. 1995) have revealed two peaks in the culling of these animals – a first peak of young and sub-adult animals in the age group of 1.5-3 years and the second peak of adult and senile animals in the age group of 4-8 years. Maintaining these animals for a longer period of time suggests that other than breeding, the by-products of cattle and animal power were also significant in the Harappan economy.

Horse bones

The identification of true horse bones from the Mature Harappan Period has been questioned especially, the horse remains from Surkotada (Bokonyi 1997; Meadow and Patel 2003; Anthony 1997). There were no wild horses reported from the Pleistocene or post-Pleistocene deposits in India. According to some scholars the arrival of the horse in India is linked with the so-called "Aryan invasion" (Parpola 1988). The subject has been complicated by the politicized history of the study of the Aryans and their migrations.

Thomas explains that the close osteological similarities between the equid species like *Equus caballus* (horse), *Equus asinus* (donkey) and *Equus hemionus* (onager or *khur*), and the hybrid animals (mule/henny) make the precise species identification rather difficult from fragmentary and scarce remains of these animals from archaeological sites. Horse remains identified in the Harappan context are often the lower limb extremities and dentition. Since the animal was not utilized in the regular diet of the Harappans the scarcity of the bones is understandable. However, the absence of other post-cranial bones is also intriguing. From Kuntasi and Shikarpur bones of wild ass *(Equus hemionus)* with cut marks and charring have been found, suggesting hunting of these animals for food. Wild ass bones were also found at sites such as Surkotada, Rojdi and Dholavira.

CONCLUSION

The cultural phenomenon of the Indus civilization, in the 3rd Millennium BCE, spread over more than a million sq. km and is remarkable for its unique attributes. Above all, when in Mesopotamia, Egypt and China, the kings and the elite were showing off their megalomania, the Harappan elite comes out as modest people. There is no great social divide either. There are no palaces, no monumental buildings, nor any shanty towns. The Indus civilization shows a great uniformity in weights, measures, motifs and script but there is considerable cultural diversity as well. We also note that the cultural substratum of the present-day Indian civilization is firmly founded on the Indus civilization. The unique character of the Indian culture has always been its unity in diversity and will always remain so.

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