New Perspectives on the Harappan Culture in Light of Recent Excavations at Rakhigarhi: 2011–2017

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Volume 1
Bioarchaeological Research on the Rakhigarhi Necropolis

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Cover. Main image: Documentation of excavation at Rakhigarhi necropolis. Background image: Drone view of RGR-2, RGR-3, and RGR-4. Photos: Rakhigarhi Project Team.

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Preface

The Saraswati River basin, well-watered and fertile, was most favoured by the Harappans. With the abundant agricultural productivity that comes from this, it became the place of origin and development of the Harappan civilisation. Since the first discovery of Harappa (now in Punjab, Pakistan), countless sites have been identified in South Asia, and research on them can estimate the scale and density of the Harappan civilisation. In fact, the geographical extent of Harappan civilisation encompassed a huge area covering many South Asian states in the north-west part. The unification of indigenous farming communities eventually made a civilisation based on complex urban societies. By trade networks between the regions, the Harappan civilisation developed a common heritage characterised by sophisticated urban life in highly developed towns or cities. To date, five major urban sites can be identified by Harappan archaeology; the Rakhigarhi site, named after the present-day agricultural village, is one of such urban sites of Harappan civilisation.

The site of Rakhigarhi was excavated by the Archaeological Survey of India between 1997 and 2000. Remains excavated then included a well-arranged road, a drainage pattern, a part of the fortification, a few burials, etc. Due to a lack of scientific analysis many questions regarding the gradual transformation of the Harappan Culture, i.e. craft specialisations, the genetic history of the Harappan people, their appearance, health, diet, etc., remained unknown until this fresh excavation was conducted at the site by the present team. The excavation at Rakhigarhi was small, focused, and problem oriented.

In that sense, our research on the Rakhigarhi occupation and the necropolis is of great academic significance. Excavations at RGR-4 were aimed at understanding the cultural transformation of the Harappan civilisation. We have now a clear understanding of RGR-2 craft specialisation. For the first time, human DNA of the Harappan people has been extracted, from which new light has been shed on the generic history of the Harappans. Craniofacial research was initiated on some of the well-preserved skeletal remains excavated from RGR-7. Since 2011, under the collaboration of archaeologists and scientists of the Deccan College Post-Graduate and Research Institute (India), the Department of Archaeology & Museums, Haryana (India), and the Seoul National University College of Medicine (South Korea), interdisciplinary research has been conducted on the human remains from a Rakhigarhi cemetery which is representative of the Mature Harappan period. Several novel research techniques were successfully applied to the human remains taken from the Harappan cemetery ruins, and the results obtained were interpreted based on rigorous academic standards.

This present volume consists of nine chapters, followed by the results of the research in the form of a conclusion. Each chapter has provided information on many previously unknown facts about the Harappan culture and people. Briefly, Chapter 1 provides a concise introduction to the Harappan culture and civilisation. The author has examined advances made in Harappa civilisation research from its discovery to the present. The current report on the Rakhigarhi excavations can be recognised for its importance within the context of the study of the Harappa civilisation. Chapter 2 discusses the geographical description of the Rakhigarhi site and the application of the latest geophysical techniques to understand the extent and nature of the archaeological evidence at different parts of the site. Our objectives in terms of excavations at various areas of the Rakhigarhi site from 2013–2016 are summarised in Chapter 3 as follows: 1) To try and understand the complete cultural chronology of the site and cultural transformation from the Early to the Mature Harappan phases; 2) To try and understand the nature of evidence from the Early Harappan levels; 3) To attempt reconstructions of the physical features of the Harappan people, their health, and diet. The same chapter also details our surveys of each mound, and the very strict levels of care required when collecting samples. In Chapter 4, the authors present their archaeological data from the

Rakhigarhi cemetery, with summaries provided for each burial. It was the intention of the authors to help readers understand the nature of the research and excavations by the inclusion of as much photographic evidence as possible of each grave investigated in the Rakhigarhi necropolis. Related archaeological information is also included in Chapter 5 and Appendix 1. Chapter 5 includes reports on the anthropological research undertaken at the Rakhigarhi necropolis, i.e., data on the physical and pathological traits of the Harrapan population, such as sex, age, cranial indices, stature, dental health, traumatic injuries, periostitis, osteomyelitis, etc. The same chapter also deals with the social structures and way of life of Harappan society from anthropological perspectives, e.g., by looking at such features as brick-lined graves, prone-position burials, double burials, soil composition, ceramics, etc. In Chapter 6, the authors attempt facial reconstructions of some residents of ancient Rakhigarhi based on the finds of typical terracotta figurines, which provide conjectural, and occasionally not so conjectural, ideas of how Harappan individuals might have appeared. Chapter 7 outlines parasitism in mankind's history and the way parasitologists have developed skills to examine evidence from archaeological samples. Harappan civilisation remains have provided very little parasitological evidence to date, and thus this chapter tries to present archaeoparasitological data from the Rakhigarhi necropolis that might relate to India more generally. One such theory is that the low detection rates of parasite eggs found in ruins associated with the Harappan civilisation might be due to high levels of sanitation and city management skills at the time. Finally, Chapter 8 assesses the animal remains found at Rakhigarhi sites. The authors conducted scientific analyses of the animal bones and other remains, and the archaeozoological data is presented. The authors note that the majority of faunal material was from mammals, and that the bones of domestic animals were more commonly found than those of wild mammals. Wild fauna at the Rakhigarhi site is represented by a variety of herbivores, carnivores, birds, reptiles, and fish, that could have provided meat, horn cores, antlers, etc. The relatively small quantities of wild faunal remains, compared to domestic material, might suggest that hunting was limited at the time, and that more emphasis could have been placed on animal husbandry and stock raising in ancient Rakhigarhi society. The chapter ends with tentative conclusions.

It just remains to say how pleased we are to present this volume, containing as it does fresh data, new research methodologies, innovative scientific analyses, and the interpretation of evidence from the largest Harappan city in India, Rakhigarhi.

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Chapter 1

Introduction to the Harappan Culture: Recent Perspectives

Vasant Shinde

Introduction

The discovery of the Harappan Civilisation (also known as the Indus Valley Civilisation) was considered the greatest important archaeological find in the Indian Subcontinent in the 20th century. The 1920s saw the beginning of excavations at Harappa and Mohenjo-Daro, two of the most well-known remains of the Harappan civilisation. The age of the finds was not determined when the excavators started looking into the long-abandoned city ruins. Some Harappan seals were formerly found by Leonard Woolley and Earnest Mackey in firmly dated levels of Mesopotamian ruins. Their report gave Sir John Marshall a clue, and in a seminal essay,[1] he unambiguously announced the finding of the Harappan Civilisation. Since then, many academics and institutions, both inside and outside India, have taken great strides to reinforce the importance of this so-called 'missing link' in Indian history. Up to this point, more than 2,000 sites connected to the Harappan civilisation have been located by means of thorough and extensive surveys and excavations.

This discovery has drawn enthusiastic responses from academia and the public, considering that the Harappan civilisation is recognised as one of the oldest ancient civilisations in the world. The Harappans have drawn more recognition than any other society on the subcontinent. However, this was not the only factor in South Asia's positive reactions. The history of settled life on the Indian continent suddenly increased by *c.* 2000 years with the discovery of the Harappan civilisation. At the beginning of the 20th century, Vincent Smith (1904) visualized a gap in the history of South Asia between the Stone Age and Early Historic periods. Nevertheless, Smith's argument proved wrong when the archaeologists reported that there was an ancient civilisation in the Indian subcontinent that was comparable to those of Mesopotamia and Egypt in terms of chronology and cultural levels.

The extent of the remains makes it especially evident that the highly advanced Harappan civilisation thrived over a considerably larger area than Mesopotamia and Egypt, in fact geographically larger than the two combined. Essentially, since the start of Harrapan research, the archaeological significance of the Ghaggar Basin has become apparent. The scale and density of Harappan sites along the Ghaggar and Hakra Rivers (identified with the RigVedic Saraswati) were also documented by the early explorer Sir Aurel Stein (1942), demonstrating that the Harappan civilisation had advanced far beyond the two major towns of Mohenjo-Daro (Sindh) and Harappa (Punjab), where archaeologists had focused their efforts (Mackay 1938; Marshall 2004; Vats 1997). After Partition in 1947, Harappa and Mohenjo-Daro found themselves in Pakistan, and the scholars who remained on the Indian side of the border concentrated on identifying the full extent of the Harappan civilisation beyond Sindh and Punjab on the Pakistan side (Joshi *et al.* 1984; Shinde 2010; Thapar 1975). Hundreds of new sites were identified, and scholars recognised that there was a wide range of cultural variation in the Harappan remains found in each region, and that different regions may have played different roles in the formation of the Harappan (Possehl 1990).

Indeed, the Harappan civilisation, according to recent academic consensus, had a significant impact not only on the western and northwest regions of the Indian subcontinent, but also up to the northern Russian border, the Gulf region to the west, Bengal in the east, and Tamil Nadu in

[1] *New Dawn on a Long-Forgotten Civilization: New Discoveries of an Unknown Prehistoric Past in India*, published on 20 September 1924. *Illustrated London News*.

the south. From this vantage point, the Harappan was clearly a civilisation with an 'international' character among its ancient counterparts that coexisted at the time (Shinde 2016).

In terms of ecological prerequisites, the Indian subcontinent presents favourable conditions for the emergence of an agricultural society. The site of Kile Ghul Mohammad in the Quetta valley (Fairservis 1956) was the first to provide evidence in this respect. However, the remains of the beginning of agriculture and a settled way of life were excavated and dated at the site of Mehrgarh, near the Bolan Pass in the Kacchi Plain in the Indus Valley (Jarrige 1984). The research conducted at the Baluchistan site of Mehrgarh revealed, for the first time, the chronological position of the Harappan culture. The agricultural community in the area continued to grow steadily from the 7th millennium BCE onwards, and eventually Harappan influence developed around the middle of the 4th millennium BCE (Jarrige *et al.* 1995). To explain under what circumstances the ancient civilisation flourished, it is important to reconstruct the paleoclimatic conditions in play.

The climate variations experienced in Harappan times, from the Early to Mature periods, can be traced using paleoclimatic data gathered from lakes in Rajasthan, including Didwana, Lunkarnsar, Sambhar, and Pushkar. So far, there have been two opposing points of view presented on this issue. The mid-Holocene climatic optimum, according to Singh *et al.* (1990), corresponds with the Harappan mature stage, but this bountiful period came to an abrupt end as aridity increased.

Examples supporting the assertions of Singh *et al.* include the discovery of Cerealia-type pollen and finely ground charcoal in 7,000 BP samples from Rajasthan lakes, which have been regarded as scientific proof for forest clearances in that period and the start of agriculture. The paleoclimatic research of Enzel *et al.* (1999) provided a different perspective, i.e., claiming that rather than a favourable climate, when the Harappan civilisation reached its pinnacle (the Mature period), corresponded with a time when the climate was declining. Accordingly, following Enzel *et al.* (1999), the Harappan civilisation actually developed in highly unfavourable circumstances. Of course, more investigations are required to determine which of these two claims is true.

We should note that very often scholars use two terms: 'Harappan Culture' and 'Harappan Civilisation'. The entire span of the Harappan Culture is from 6000–1300 BCE. Based on settlement factors, architecture, and painted ceramics, three phases have been identified for Harappan Culture. The formative stage is referred to as Early (6000–2600 BCE), characterised, inter alia, by the chiefdom society and rural economy, a distinct painted ceramic tradition, use of basic technologies for the manufacture of various crafts, etc. The next stage is the most advanced and characterised by the presence of urbanisation and development of state organisation; this era is referred to as the Mature Harappan phase and the Harappan Civilisation (2600–1900 BCE). Overall for the Harappan culture, this was its most prosperous stage, in which general development in science and technology is evident. The declining or decadent phase of the culture is termed as Late (1900–1300 BCE), marked by the collapse of urbanisation and declines in lifestyle, material culture, and technologies. The emergence of a few local rural cultures becomes evident in this phase.

Early Harappan Phase

The Amri-Nal is one of five regional cultures that make up the Early Harappan phase. The other Early regional cultures include Sothi-Siswal, Kot Diji, Damb Saddat, and Anarta-Padri.

Amri-Nal Phase of Sindh and Baluchistan

This phase was defined by Majumdar at the type-site of Amri following his excavations there in 1929-1930, and subsequently confirmed by J.M. Casal between 1959–1962. The explorations of Aurel Stein and B. de Cardi in southern Baluchistan also show that assemblages sharing some features of Period-I at Amri are also found in the mountains there. Nal material appears in both southern

Baluchistan and Sindh. The two assemblages have been merged into a single regional phase; in Sindh, the Amri material tends to predominate, while in Baluchistan, the assemblage is more Nal-like (Possehl 2002).

The Amri ceramic assemblage is made up of extremely well-made fine wares, generally fired red or buff, with painted decorations in black. At the beginning of the phase, the designs are exclusively geometric, developing into more curvilinear motifs towards the end. Open bowls, jars, and tall vases with simple, featureless rims are the diagnostic types of the Amri ceramic assemblage. Nal ceramics are of much higher quality compared to the Amri finds and are said to be the most attractive wares of the Protohistoric period in South Asia (Lattanzi 1995). These are very fine and treated with buff to make a pink slip. The characteristic vessel forms are canisters and straight-sided bowls with simple, knife-edge rims. The polychrome fillings of the designs include the use of red, pink, blue, and yellow. A painting in white over a black slip is also known as one of the features shaped by Amri. In fact, the use of white paint was a hallmark of the early Harappan culture. Evidence for the early expansion of Amri and Nal into Gujarat is evident at sites such as Dholavira, Surkotada, Kanmer, Nagwada, Moti Pipali, etc.

Kot Diji Phase of Northern Sindh and elsewhere

F.A. Khan identified the Kot Diji phase following excavations in the mid-1950s at the small site along the major highway connecting Karachi, Hyderabad, and Sukkur. Despite sharing some vessel types and decorative themes with those found at Amri and Nal, the archaeological assemblages found at Kot Diji are distinct from those at other sites, and they represent one of South Asia's greatest ancient products. The red and buff pottery is extremely well fired, and large jars and vases with smooth rims are the most prevalent shapes (Possehl 2002).

Central Baluchistan's Damb Sadaat Phase

Contemporary with the Kot Diji and Amri-Nal phases is a smaller, more localised cultural phase of the Early Harappan, centred on the Quetta Valley. So far, *c.* 40 sites from the Damb Sadaat phase have been reported. The largest, Quetta Miri, has been continuously occupied from prehistoric to modern times. The next largest site, Mundigak, in the Kushk-i-Nakhud valley of the Helmand River, was already a town during the Early Harappan.

The pottery of the Damb Sadaat phase was often slipped to create a uniform surface. Paring was often done to thin the walls of the vessels and the stems of goblets. Painted Quetta Ware is the most characteristic type of pottery, but short-necked, globular jars of the Kot Dijian type also occur. A ceramic known as Faiz Mohammad Grey Ware was also manufactured – a fine product, generally a plate decorated with Quetta Ware designs. Two phases of firing were involved, first as red-buff ware in an oxidising environment, and then refined under reducing conditions to achieve the ultimate grey colour, i.e., overall technologically complex method (Write 1985). The motifs from the Quetta Ware repertory closely resemble the traditional designs in black paint (and occasionally red) (Possehl 2002).

Hakra/Ravi Phase of the Upper Indus region

No Hakra-phase site has been discovered in Pakistan's Hakra basin to date. Mughal (1997) recognised the phase based on surface data collected in Pakistan's Cholistan desert. The Hakra pottery, which the Mughals dated to 3500–3000 BCE, serves as the distinctive chronological marker for this period in Cholistan. The Ravi-phase, known as the basic levels in Harappa, and dated to 4000 BCE by the archaeologists, contained more or less comparable pottery (Kenoyer and Meadow 2000).

The pottery associated with the Hakra/Ravi Early Harappan phase was produced from clays that were fired red and treated with different colour slips, i.e., brown and white, and decorated with black pigment. The differences between them are in the shapes of the vessels and the ways in which their decorations were combined. The Ravi pot usually has a flat base, whereas the Hakra product has a round base. The surfaces of both the Ravi and Hakra materials look similar, but the compositions of the slurry (sandy materials mixed with clay) and rim shape differ (Kenoyer and Meadow 2000). The majority of the Ravi pots is handmade, whereas many pots from the Hakra are wheel-made.

The Sothi-Siswal Phase of the Eastern Region

To the east of the Greater Indus region, two Early Harappan phases were discovered in the 1950s. A. Ghosh discovered a phase, which he termed 'Sothi', and Suraj Bhan (1975) discovered a different phase, which he termed 'Siswal', both in the Saraswati basin. The true characteristic features of these cultures became clear after the excavations at Kalibangan (Lal 1979). The concentration of these two phases of the Early Harappan culture is found in the Ghaggar-Chautang (ancient Saraswati-Drishadvati) basin, but it also spread into the Ganga-Yamuna doab of western Uttar Pradesh.

So far, *c.* 200 sites from the Sothi-Siswal phase have been discovered. B.K. Thapar has classified the Early Harappan Sothi-Siswal pottery into six different fabrics (A–F). Fabric A was the most prolific and characteristic of the Sothi culture. Pots were turned differently on the wheel; hence, the striation marks are weak and irregular. It is treated with a dull red to light pink wash, over which are painted motifs in black and white. The outline of the motifs was done in black, and the white colour was used for filling purposes. The painted decorations, confined mostly to the upper half, included mostly geometric (i.e., criss-cross oblique lines) and curvilinear patterns (i.e., semi-circular arches with the upper intervening space either hatched or filled with latticed triangles, rows of loops, and fish scale patterns). The most important shapes found in this fabric include vases with an everted rim, globular bodies and disc/ring/pedestalled bases, and bowls and basins with convex or tapering sides.

Fabric B is represented by mostly large globular pots with an everted rim. The portion from the rim down to the shoulder was slipped in a red colour while the remaining lower portion was given a further coating of sandy clay that was roughened either by combing it or by impressing it with tortoise shell. While the slipped upper portion bore thick or thin bands of black pigment, the rusticated surface features a variety of designs, including faunal (i.e. stag, bull, duck, scorpion, etc.), as well as floral motifs (i.e., five-petalled flower, stylised sunflower, etc.).

Fabric C was much finer compared to those of A and B and was treated with slip, ranging in colour from red to plum red. The motifs, painted in mostly black, consist of bands, cross-hatched loops, rows of filled-in and apex-down triangles, fish scales, and dots. At Kalibangan, one of the sherds revealed a painting of a fowl beneath what appears to be a banana plant. The shapes include elongated vases, bowls, and basins; dishes on stands; cups on stands; and lids.

Fabric D is fine and well fired, but it was thick in sections when compared to the other fabrics. Occasionally it is slipped in red and appears as wide-mouthed pots, troughs, and basins. The interiors of these pots feature deep, incised designs that include wavy or horizontal lines, criss-cross hatched patterns, and vertical or oblique lines. On the outside, there are only a few cord impressions and/or horizontal bands of black pigment.

Fabrics E and F are differentiated primarily by colour, the former being reddish buff or buff, and the latter grey. Fabric E includes bases with an elliptical body, jars, with or without a flanged rim, basins, knobbed lids, and cups and dishes on stands. The painted decorations, executed in both black and white, include linear and curvilinear motifs, floral and faunal motifs, etc. Fabric F is represented by dishes on stands, globular vessels, bowls, and basins. The grey surfaces feature simple linear and curvilinear designs in black pigment, with occasional use of white. Graffiti marks appear occasionally on Early Harappan pottery, some resembling Harappan letters (Lal 1979).

Gujarat's Anarta/Padri Phase

Possehl's theory (1993) of Harappan domains acknowledges regional variations within the Mature phase, and regards Saurashtra as one of the domains termed as the 'Sorath Harappan', or south-eastern domain, with Lothal as the type-site of the Harappans in Saurashtra. Although Saurashtra is accepted as a zone of the Mature phase, the early levels have mostly been termed as local Chalcolithic or Pre-Harappan Chalcolithic communities, living in small villages with an agricultural-pastoral economy during the second part of the 3rd or 4th millennium BCE, according to the most significant early sites that have been excavated to date. In Saurashtra there are several pre-Harappan cultures, including Padri, Pre Prabhas, Micaceous Red Ware, and the Anarta culture in North Gujarat. With the rise of the Sorath Harappan theory, researchers began to view the pottery as belonging to two distinct periods: The Sorath Harappan and the local Chalcolithic. This was the main reason behind the creation of four regional, or non-Harappan, cultures in Gujarat, i.e., Anarta in North Gujarat, Micaceous Red Ware, Padri, and Pre-Prabhas in Saurashtra.

Padri Culture

Padri Culture takes its name from its eponymous pottery, first discovered at that site. The excavator describes this as coarse pottery appearing in thick and thin variants. The coarse clay used to create the thick pottery is combined with sand as a tempering agent. It is poorly burned and of medium thickness. Convex-sided bowls with short rims, deep bowls with short straight or slightly incurved sides, and bowls with gently everted rims are important types associated with this culture. Globular pots feature short, out-turned, or beaded rims, whereas basins have either flat projecting or round undercut rims. The paintings are completed in disorderly black. A chevron design, vertical or horizontal bands grouped together, etc., are some examples of the motifs.

Compared to the thick variety, the thin products are finer, being well fired and made of fine clay. The red slip is quite thick. A buff colour patch with broad horizontal lines and a black or, very infrequently, white mesh pattern embellishes the neck region. The jali pattern's tiny squares are filled in with either light brown or white, creating a polychrome look. This variation only includes small globular pots with an outwardly twisted rim.

Other ceramic types associated with this culture are Pink Slipped Painted Ware, White Lustrous Ware, Bichrome Ware, Red Painted Ware, and Plain Handmade Ware (Shinde and Kar 1992; Shinde 1998).

Anarta culture

This unique culture is found at the sites of Nagwada and Loteshwar in north Gujarat. Pottery from both Harappan and non-Harappan cultures was found during the excavation at Nagwada. While typical Mature Harappan pottery, such as decorated and plain Sturdy Red Ware and Buff Ware, was discovered outside the burials, non-Harappan pottery is connected to the extended and pot burials. The burials contain bowls, disc-based globular jars, dishes with no carving, dishes on stands, and beakers. These forms resemble those discovered in the pre-Harappan stages at sites such as Amri, Nal, and Kot-Diji. Coarse, grittier Red Ware and Black-and-Red Ware are significant non-Harappan ceramic forms. In light of recent work on the Padri/Anarta Culture, this complex is tentatively identified as Early Harappan, rather than being associated with other names, prefixes, or nomenclatures.

The above illustrates the several regional practices that developed during the early Harappan period. Due to frequent interactions and trade, all the distinct zones experienced simultaneous development and integration, and in the middle of the 3rd millennium BCE, the developed Harappan ('Harappan Civilisation' or 'Mature Harappan') phase began to form. Therefore, its significance to Harappan studies cannot be overstated, with the largest site in the most populous area of the civilisation being Rakhigarhi, the remains of which serve as cultural markers for the Mature Harappan phase. Compared to other ancient civilisations of the Old World, the Harappan civilisation is exceptional in many aspects, e.g., in its urban planning and maintenance technology. The Harappan city featured a citadel and a lower town, both of which were arranged in a checkerboard pattern. It seems there were also various infrastructures put in place to sustain and maintain the Harappan cities. These urban remains are the subject of ongoing excavations, but these works have already allowed us to more clearly understand how the people of this civilisation might have lived in their towns and cities, but we must acknowledge that there is still very much to learn.

Harappan Civilisation Phase 2600–1900 BCE (Mature Harappan Phase)

The site of Manda on the River Beas in Jammu indicates the northernmost limit of the Harappan civilisation, while Bhagtrav on the Tapti, near the border of Maharashtra and Gujarat, appears to be the southernmost frontier. Alamgirpur on the Hindon River in Western Uttar Pradesh is the easternmost limit, and Sutkagendor, along the Makran coast near the Iranian border, could be the western limit. The Harappan culture appears to be a blend of many ethnic groups, representing a variety of cultural identities (Mughal 1990; Possehl 1982; 1990; Shaffer and Lichtenstein 1989). Different categories of sites emerged during the Harappan Civilisation phase, and it is evident that there were symbiotic relations between them. No site remained in isolation.

Harappan standardisation and urbanisation (2600–1900 BCE)

During the Harappan Civilisation phase, urban and rural settlements of varying sizes and functions emerged. Some of the important attributes of the urban settlements include grid planning with defensive walls and gates around the site, two or more divisions in the city, drainage, baked and mud brick structures, brick size in the ratio of 4:2:1 and 3:2:1, generously painted pottery, script (not yet deciphered), and the development of a variety of crafts and traditions.

Town planning

The urban planning of the Harappan Civilisation was highly developed, with a grid-like pattern and facilities for an advanced drainage system. The standardisation of the bricks in a size ratio that was extremely close to 4:2:1 was the most important breakthrough. The citadel, defence walls, dams, etc., serve as examples of monumental architecture. The four urban centres that were among the most populated in the Harappan region were Rakhigarhi, Mohenjo-Daro, Dholavira and Harappa. These locations also served as significant regional, political, and administrative hubs. The Citadel, which housed officials and members of the elite class, and the Lower Town, where the general populace lived, were two or more internal divisions of the metropolises.

The private residences were built around a central area, with an entrance from the street that concealed the inside of the residence from view. In the central region of Mohenjo-Daro there are *c.* 700 private wells, each of which is connected to a group of homes (Jansen 1989). The abundance of wells and their proximity to residential areas would suggest a demand for assured largely private water sources.

Examples of significant public structures that either had open access or served as a conduit linking other parts of the site include the 'Great Bath' and the 'granaries' at Mohenjo-Daro and Harappa. The exact use of the huge, watertight tank known as the 'Great Bath' is still unknown.

Both cities and smaller towns had properly thought-out and well-conceived drainage systems. The presence of brick-lined wells and bathing platforms connected to the network of drains is evident within the cities. Rubbish pits for solid waste disposal were located on the streets, and some street drains had sump-pits. The sites were designed with an effective drainage system and a rectangular grid of main streets and side streets. Due to the grid-like layout of the streets, and the resulting appearance of homogeneity among the structures, which suggests strong state supervision, this is the first known example of town planning in history. Circular pit-dwellings from 5500 BCE were progressively replaced by this well-planned town layout (Shinde 2016). The citadel was built on tall, mud platforms, and it is possible that its architectural components served as a complex that included a stronghold for defence, a gathering place, a storage space, a ceremonial centre, and possibly a location for community dining. According to the excavations at Dholavira, the Citadel and the Lower Town were shielded by a defensive wall composed of stone masonry work (Bisht 1993; Gupta 1997).

Subsistence and economy

The economy, which depended on trade networks for the acquisition of raw materials and distribution of processed goods, both within and outside the boundaries of the civilisation, was built on the foundations of agriculture, animal husbandry, and trade. The subsistence-based nature of the economy appears to have remained substantially constant in Mehrgarh since the start of agriculture, *c.* 7000 BCE, according to all the available evidence. The Harappan civilisation, assumed to have descended from its ancestors, is renowned for its expert use of irrigated agriculture, which allowed them to benefit from the vast and fertile Indus River valley, despite regulating the fierce yearly flood that both fertilises and inundates the area (Kenoyer 1991).

Although the majority of their communities were in semi-arid areas with unpredictable winter rains, their prosperity depended on a subsistence economy of both barley and wheat cultivation. The main staples were these winter crops, field peas, chickpeas, and mustard. Rice, dates, melons, green vegetables (mainly legumes), cotton, and other crops were also raised. Some summer crops, i.e. cotton, were grown for their fibre. The Harappans produced two crops a year from a variety of grains they farmed. The food was supplemented by hunting and fishing. In the arid Kutch regions, such as at Dholavira, the excellent Harappan water collection and management systems involved dams, canals, and reservoirs to manage the scarce and vital water supplies (Bisht 1993).

Industry

During the Harappan economic boom, a wide range of material resources, including shells, ivory, a range of semi-precious stones and metals (copper, gold, silver, etc.) were mined from several different sources. Craftsmen created items for domestic (earthen pottery and tools) and public (stamp seals and weights) use, as well as jewellery for both domestic and foreign markets (bangles, beads, pendants, etc.). The crafts were thought to produce uniform objects that were used all over the Harappan region. Archaeological evidence points to the segregation of skilled crafts at some sites and areas, i.e. Shortugai, a centre for the mining and processing of lapis lazuli, and Nageshwar, a location for shell crafts. Many different groups of artisans worked at Chanhu-daro to create objects of higher status – seals, long carnelian beads, copper vessels, etc. According to Piggott (1950), Wheeler (1968) and others, centralised production controls and/or conservative ideologies resulted in the standardisation of crafts (see also Fairservis 1984; Miller 1985).

Copper/Bronze metallurgy

The Harappans were known for using copper and bronze to shape their tools, containers, and ornaments. Most of the objects discovered are common utensils and everyday tools – flat axes, adzes, knives, fishhooks, chisels, pots, pans, etc. Other objects included bangles, beads, rings, etc. Finds of arms and amour are few. Although generally the artefacts were made using sophisticated manufacturing techniques, we did not notice much in the way of ornate ornamental decorations on them. Instead, they were primarily of a simple and modest style that was probably fairly typical of the Harappan ideology.

The Khetri mines in the Aravalli are the most likely candidates as the source of this copper, although this remains unconfirmed. Some copper mines have been reported from northern and southern Baluchistan, Afghanistan, and the Baluchistan part of Iran, and it is possible that Harappan trades developed connections with these regions. A potential source of Harappan copper is the Oman peninsula, which has evidence of continuous trade contacts. According to Agrawal (2007), the Ganeshwar site complexes have yielded more than 5000 copper artefacts, including some typical Harappan kinds, i.e. thin blades, arrowheads, etc. These sources could have been used for casting, fabrication, and for supplying to Mesopotamia. Melluha, identified with the Harappan region, was one important source of copper for Mesopotamians. Correspondingly, it was more efficient to import from a local source than from an external one. Pigott (1999) and Kenoyer (1991) state that there is no conclusive data that there existed mining or smelting sites in the Aravalli belt in the Mewar region of Rajasthan, even though the region has been widely investigated by academics. As a result, there is still no general agreement regarding the source of Harappan copper.

Although the Harappans are considered a Bronze Age civilisation, the Harappans appear to have preferred working with pure copper, as can be seen by the increases in quantities of objects made of this metal.

Although the process of copper alloying was common practice in Harappan contemporaneous civilisations, only 30% of the 177 investigated copper artefacts from Harappa and Mohenjo-Daro exhibit tin, arsenic, nickel, or lead alloying, with tin being the most common. The Harappans were aware of the lost-wax process, also known as *cire-perdue*. However, most objects were made by beating with a hammer on the hot or cold metal. In addition to copper, the Harappans also worked with gold, silver, and lead.

Shell-working

Shell artefacts, particularly bangles and beads, were made using the shell variety *Turbinella Pyrum*, which was split and worked, probably, with a bronze saw. Gujarat was one of the main production hubs. The sites of Nageshwar and Bagasra have been identified as crucial for the provision of raw materials, and for producing items such bangles, beads, pendants, spoons, ladles, etc.

Stone

Different types of stone were used by the Harappans for making a range of products, including tools, hammers, pounders, saddle querns, beads, pendants, etc., for domestic use as well for trade, both within the hinterland and further afield.

It has been established that in terms of their crafts, the Harappans were a technologically forward-thinking people who had little use themselves for the valuable stones that were commonly found, such as lapis and turquoise. It is suggested that the Harappan community, could be notable for the extent not of their power or conquests, but rather their capacity for innovation (Vidale in Agrawal 2007: 323).

Trade

The primary foundation for commerce and trade was the range of various artefacts made of marine shell, semi-precious stones (agate, carnelian, lapis lazuli, turquoise, coloured cherts and jaspers, serpentine, steatite), copper, and gold. The transportation of goods within the hinterland area was possibly by bullock carts, and other means, such as animals and human labour. Riverine or sea transport using ships and boats may have been relied upon by the Harappans for connecting with the outside world (Jansen 1989; Ratnagar 1981), having developed their infrastructure in the form of docks and ports for the maritime trade.

Some of the Mesopotamian centres have revealed evidence of artefacts of shell, ivory, gold, etched and plain carnelian beads, lapis lazuli, and possibly also perishable products (wood, cotton, wool and jute textiles, oil seeds, grains, etc.), which may have been supplied by the Harappans (Meluhha). Gujarat's advantageous location in the Indus River delta meant that a significant percentage of this trade would have passed across its shores.

Based on the discovery of two clay mummies from Lothal, it is thought that trade and cultural exchange occurred between Egypt and the Harappans. Additionally, according to Zarins (1992), the blue colour utilised by the Egyptians was derived from indigo grown in India, indeed Rojdi provides proof of this. The Harappans built smaller industrial centres throughout the resource-rich and coastal regions to boost their trade, which appears to have significantly expanded westwards *c.* 2300–2200 BCE. However, there could have been a slump in overseas trade from *c.* 1900 BCE, and by 1700 BCE it appears to have disappeared (Dhavalikar 1997).

The Harappan script

The Harappan invention of writing, which may have been used to record social, political, and religious events, as well as accounting, ownership, and business transactions, enables us to easily distinguish them from their forefathers and successors (Fairservis 1983; Parpola 1986). The history of this writing system is unknown and has not yet been decoded, as no bilingual text has been found and because the inscriptions are frequently only five different symbols long (Parpola 1979).

Linguists have proposed links to Proto-Dravidian or Indo-Aryan languages, despite a lack of agreement or supporting evidence (Fairservis 1983; Parpola 1986). Right-to-left writing is now commonly acknowledged, with evidence coming from terracotta cakes and cones, intaglio seals made of carved and burned steatite, clay/faience tablets, innumerable incised tools, and from decorative features (Joshi and Parpola 1987).

Regardless of how contemporary historians interpret these texts or symbols, they undeniably show a shared ethos and belief that spread over a very large area and undoubtedly played a significant role in the blending of urban and rural populations distributed across numerous ecological contexts.

Religion

Wheeler (1968) emphasised the interdependence between religious and secular pursuits. This truth applies not only to past civilisations but also to the present, as is frequently seen in the contemporary Indian subcontinent's religious symbols. Even today, many secular items take on a 'ritual significance' in various contexts. A variety of artefacts and symbols, including seals, horned gods, Mother Goddess statues, fire altars, and others, have all been considered suggestive of Harappan 'religious' ideas and practices. However, due to the lack of a decoded text, any attempt to relate these artefacts and scenes to Indian mythology and religion, or to modern Mesopotamian religious belief, has faltered (Allchin 1985; Ashfaque 1989; Dhavalikar and Atre 1989; Fairservis 1975; 1984; Parpola 1984; 1988).

Death rites reveal religious practices and beliefs, and regional variations can be seen in Harappan funerals (Kennedy and Caldwell 1984). Because the cemeteries are small and do not seem to reflect the entire civilisation, it is possible that certain tribes practised burial while others utilised cremation or exposure. The abundance of grave goods and the variety of burial styles also suggest that social and religious rituals are diverse (Shinde *et al.* 2011a).

Similar to what he saw in the persistent practices of a number of minor cults and a larger pantheon of religious beliefs, Wheeler (1968) advocated the presence of regional cults and a state religion. According to Fairservis (1986), cities like Mohenjo-Daro were essentially centres for ceremonial activity, and 'religion' served as an integrating element by leveraging a sophisticated network of common rituals and beliefs to validate the exercise of political and economic power.

The Harappan society and polity

Despite this vast area of cultural uniformity, it is still hard to do anything other than make speculative assumptions about how society was organised or how political and administrative power might have been exercised. Evidence of extensive trade in a variety of goods, seeming uniformity in weights and measures, a shared script, and in the use of seals, all point to some degree of control over administration, with the economy most likely being manipulated by the large, regional hubs. Robust socio-economic practices and a religious belief system that required and encouraged the procurement and use of the items just listed is suggested by the broad distribution of status artefacts throughout the Harappan region.

Economic networks, the growth of specialised craftspeople, and the use of technology in strategic locations, would all have helped to guarantee sufficient supplies. Interestingly, there appear to be no signs of acquisition by force, as witnessed by the nearly complete absence of finds of weaponry.

Although some of their burial sites have been excavated, it is unclear how the Harappan population was composed. Separate graves have been found at sites in Harappa, Kalibangan, Rakhigarhi, Lothal, and Farmana (Shinde *et al.* 2011a). Substantial scientific research has been done on DNA, isotopes, trace elements, and other properties to try and understand genetic components, human health, and dietary patterns (Shinde *et al.* 2019; Shinde 2020). There are elements of a relatively clear social hierarchy in the cemeteries investigated.

Recent studies on the Harappan Culture of the Saraswati Basin

The Saraswati basin, today known as Ghaggar/Hakra, was the area the Harappans most preferred, as evidenced by the density of their villages there. Earlier researchers recorded a large number of locations, but they can no longer be visited or analysed. Essentially, the majority of the coordinates provided by the earlier scholars is either incorrect, or most of the sites have been entirely destroyed, either through the process of being turned into agricultural fields, or as a result of numerous development initiatives initiated by the state or central governments.

A suitable climate and an abundance of grain production are regarded as the two most important variables among the numerous factors that contributed to the growth of the Harappan Civilisation. Due to its extensive areas of fertile alluvium soil and perennial rivers, the Saraswati basin was particularly effective at producing grain surpluses. This area is still regarded as being a component of India's 'Agricultural Bowl' today.

It is possible to interpret a significant number of Harappan sites that are close to arable ground as agricultural villages. They feature sizable deposits and are extremely large in size. The largest of the long-occupied sites, such as Rakhigarhi and Farmana, may have had a significant impact on the socio-economic structures of the Harappans. Rakhigarhi, because of its proximity to the region's centre and the huge catchment area that surrounds it, most likely developed into what we might think of as a sizable 'regional centre' within the Saraswati basin. It might have governed the region's government and economy as a whole. The Farmana area, due to its proximity to the Rakhigarhi site, which is only *c.* 40 km away, may have become significant in its own right and developed into a town.

Excavations at Farmana, Bhirana, Rakhigarhi, Kunal, Girawad, Mitathal, Kalibangan, and other sites have revealed Early (6000–2600 BCE) and Mature Harappan (2600–1900 BCE) remains. Most sites from the Late Harappan phase (1900–1300 BCE) are located far from the Saraswati and Drishadwati Rivers. These discoveries have shed substantial light on the town planning and burial customs of the Mature Harappans in the area. The town is oriented in a slightly NW–SE direction, and its overall drainage, road plan, and building layout are quite similar to those at Harappa and Mohenjo-Daro (Shinde *et al.* 2008a; 2010; 2011a; 2011b).

Period I: Early Harappan (6000–2600 BCE)

Evidence from locations such as Farmana (Shinde *et al.* 2008b; 2010; 2011a), Bhirrana (Rao *et al.* 2005), Girawad (Shinde *et al.* 2008a; 2008b; 2011b), and Kunal (Khatri and Acharya 1995) points to the possibility that the earliest settlers lived in compact, circular or oval underground structures that built into the base level. Evidence of their use as dwellings includes charred bones, household hearths, wattle-and-daub wall remnants, cooking crockery, and some finer ware. The residents utilised relatively contemporary pottery production and firing techniques to create a range of ceramics, including Mud Appliqué, Incised, Chocolate-Slipped, Reserve Slipped, Grooved, and others. The copper and lapidary crafts were also well developed, and the locals had already established long-distance trading relationships for obtaining suitable raw materials and then distributing the finished goods. The early civilisation was agrarian in nature, according to findings at Farmana and other sites in the Saraswati basin. It took some time for this region to become urbanised, and it was not until the Mature Harappan era, *c.* the middle of the 3rd millennium BCE, that it became sufficiently developed.

Mature Harappan Period (2600–1900 BCE)

Numerous artefacts from this period, including ceramics, buildings, and features, have been uncovered at the above-named sites. From the start until the end of the Mature Harappan occupation, there seems to be some diversity in the material culture. Identification of sub-phases was made possible by this variance, in conjunction with the stratigraphy. In their tombs, these sub-phases are highly distinct. As a result, Mature/Advanced Harrapan has been separated into periods IIA, IIB, and IIC. Periods IIA and IIB may be dated to 2600–2400 BCE, while period IIC can be dated to 2200–1900 BCE on the basis of a few accelerator mass spectrometry (AMS) dates, the examination of data from the site, and comparative analysis.

According to their settlement strategy and cultural output, the Mature Harappan period marks the culmination of the cultural process that began in the early stage. The architecture and ceramics of the Mature Harappan demonstrate a distinct gradual transition from the Early Harappan. The rectangular mud-brick constructions at the site's higher levels replaced the pit-dwellings of the lower levels. Between the pit-dwelling sequence and the beginning of the Mature Harappan Phase (IIA), multiple floor levels are discernible, demonstrating continual progression. Between the Early and Mature Harappan there are simple, independent, rectangular structures with circular fire pits at the transition level.

From period IIA on, extensive ruins of finely designed and constructed mud and burned brick structure complexes, streets, drainage systems, rectangular fireplaces, and storage rooms have been discovered (Shinde *et al.* 2011a; 2016). Brick sizes appear in ratios of 1:2:3 and 1:2:4 from the

Early Harappan until the end of period IIB. An extensive horizontal section of period IIB has been unearthed at Farmana, exposing a piece of the perfectly planned Mature Harappan village (Shinde *et al.* 2011a).

The unfinished, partially handmade pottery from the Early Harappan phase evolved into a finer ceramic, with prominent Harappan pottery shapes, by the Mature Harappan phase. Pottery with the distinctive Harappan Red paint is shown. Period I revealed no seals, but they begin to appear in Period II. Growth in urbanisation is indicated by the use of seals and sealing, significant town planning, awareness of cultural heritage, cutting-edge technology, and intricate burial practices.

Harappan cemeteries have been discovered in the Saraswati basin at a few sites, including Kalibangan, Farmana, and Rakhigarhi, typically situated *c.* 1 km from the main settlements. The deceased were arranged in pits, usually with the head facing north and the legs to the south. Pots, jewellery, and weapons found in graves would indicate that the Harappans believed in the afterlife. The social and economic position of the deceased might be inferred from the nature and quantity of the burial goods.

Historical Contributions of the Harappan Civilisation

To date, archaeologists have made little in the way of systematic attempts to publish their thoughts on the philosophical outlook of Harappans, or the historical contributions they made, both technologically and economically.

The data currently available suggest that the Harappans received substantial resources through external trade with the West. They made sophisticated and practical use of their wealth by building clean, healthy towns with basic amenities for all social strata. It appears they believed that building enormous structures, or interring great wealth along with the dead, represented a waste of resources, with no advantages to the community. They preferred to use their wealth to build towns and cities across the entire Harappan territory, thereby establishing a unified culture over the widest possible area. The Harappans are credited with the creation and application of foundational sciences and technologies, which later provided a means of subsistence for numerous South Asian modern societies. Indeed, many of the customs and technologies that these people created are still in use today.

South Asia’s cultural and historical continuity, spanning at least 5000 years, places the region in a distinct position within the framework of world history. What follows, therefore, is an outline of the major contributions the Harappans are credited with:

Idea of nation: The Harappan culture is thought to have had a formative phase between *c.* 6000–2600 BCE. During this period, several local cultures, such as the Ravi, Kot Diji, Amri, Kulli, Nal, Padri/Anarta, Sothi, Hakra, etc., emerged in various areas of the region where the Harappan Civilisation flourished. They had certain similarities in their cultures, but their painted ceramic traditions set them apart primarily. All of these cultures came together *c.* 2600 BCE, and over an area of more than 2.5 million km^2, the Harappans were able to establish a huge nationhood (civilisation) in the western and north-western regions of the subcontinent. In the modern world, this is perhaps the only instance of a country founded entirely by peaceful means, without the use of force.

Scientific construction methods: The Harappans developed the scientific rectangular construction system referred to as the ‘English Bond’, with building bricks at ratios of 1:2:3 and 1:2:4, whereby one line of bricks is laid horizontally and the next vertically. The Harappans were able to develop exceptionally well-planned cities thanks to their scientific construction techniques, i.e., grid planning. This is regarded as one of the distinctive features of Harappan town layouts. This method was used to build all public and private structures discovered throughout the Harappan period. Present-day construction methods are still based on these strategies.

Civic infrastructure: One of the most notable characteristics of Harappan cities is their well-planned streets and lanes, which have drainage. The Harappan cities were exceptionally hygienic and clean, with methods for taking waste and contaminated water outside the city walls. Networks of closed and open drainage systems, connected to main drainage lines, were provided to cities and towns. The latrines of private homes were connected to the drains, which were constructed of baked bricks. The brick-paved main roadways had the open drains that entered the larger sewers. At the major entrance between mounds E and ET at Harappa, a series of four drains, constructed one after the other, have been discovered (Kenoyer 1998: 61). They were kept hygienic as the main sewer line took the unclean water beyond the city.

Water management: The site of Dholavira (Gujarat) has some of the earliest evidence for water management. Water would always have been in short supply as the area is arid. Manhar and Mansar, two intermittent streams whose catchment areas are in the hills *c.* 10–12 km away, flow beside the city. Water from the flash floods of these streams was channelled by the Harrapans into reservoirs (4 – 6 m high), and they used masonry stones and rubble to build a series of check dams across the Manhar. The Mansar stream, which supplied 150,000 m^2 of agricultural, had one check dam. The dams constructed by the Harrapans at Dholavira were designed to collect and filter the fresh back into the river, improving its quality for agricultural and residential purposes. They were also designed to divert rainwater into the city's landscaping and reservoirs.

The region's groundwater is frequently both saline and silty, and if it rained, it would eventually get worse. Each of the three sectors of the city had reservoirs. Some were discovered cut into solid rock with only a small amount of stone masonry used in the weaker portions of the building; others were discovered built of stone blocks and featured flights of steps. The reservoirs throughout the city were linked to one another by subterranean closed water pipes made of either stone slabs or fired bricks. As a result, the Harappans were able to maintain their water supply within the city. This is to date the earliest known record of large-scale water management anywhere. These systems allowed Dholavira to prosper, despite being in a desert region.

Dockyards: At the site of Lothal, a sizable hydraulic structure was constructed (215 m long, 37 m wide, 3 m deep) (Rao 1963). At high tide, vessels entered the dockyard through inlets in the northern and eastern walls, which measured 12 m and 7m, respectively. An artificial channel system for water (*nala*) links the port to the Bhogavo river, which flows into the Gulf of Cambay. A spill channel with a spillway was constructed in the eastern wall to drain away surplus water. Boats could therefore work during high tide. A similar system is employed at the modern dockyard of Gogha in Bhavnagar, Saurashtra.

In a research paper, Rear Admiral (Retd) Bindra conducted a thorough scientific analysis of the workings of the dockyard over recent decades. The two inlets (northern and eastern), and the spillway with its low walls, suggesting moorings for ships, are the distinctive constructional features that set this structure apart from other similar structures (Bindra 2002–2003: 1-18). It can be argued, therefore, that Lothal provides evidence for one of the earliest known dockyards/ports.

Silk Production: Silk threads from Chanhu Daro and Harappa have been studied, suggesting that the Harappans developed techniques for manufacturing silk. The present study provides fresh information about the extent and dates of sericulture. These findings demonstrate that indigenous wild silk-moth species were farmed in South Asia as far back as the 3rd millennium BCE. At this time, two types of silk were used by the Harappans, according to scanning electron microscopy (SEM) image analysis (*Antheraea sp.*). It is also probable that *Philosamia spp.*, a different species of South Asian moth, produced the silk from Chanhu-daro (Eri silk). Additionally, it appears that this silk has been spun. These silk variation types give us a glimpse of the Harappan Civilisation's understanding of sericulture during the Mature Harappan phase. One can identify the source of a silkworm species by carefully examining the surface appearance of archaeological silk fibres. Through research of this kind, we can also start to comprehend the earlier East Asian uses of silk. One should, therefore, perhaps re-evaluate earlier theories that solely credit the origins of silk and sericulture to China (Good *et al.* 2009).

Trade strategy: The prosperity created by trade with the hinterland and beyond is one of the factors that allowed the Harappan Culture to flourish into what we consider a 'civilisation'. The necessary raw materials for making a variety of objects were found outside of Harappan lands and were governed by the Neolithic/Chalcolithic people at the time the Harappans developed long-distance trade, which provided individuals and social groupings with opportunities to elevate their social status.

The Harappans were supplied with raw materials from their contemporary neighbours. To create a range of completed goods, including terracotta artefacts, beads, stone tools, seals, and other items made of various materials, etc., they developed both pyrotechnic and non-pyrotechnic methods. This indicates that the Harappans bought essential raw materials from and provided finished items to the same people. As the demand for raw materials grew, people developed manufacturing bases/centres to assist with 'mass production'. They created a very efficient commercial network with the means to easily conduct profitable trade with contemporary civilisations (e.g., Egypt and Mesopotamia). Such instances of trade, provided by archaeological data, have shown that trading could be a crucial factor in societal advancement.

New subsistence approach: The Indus and Saraswati (Ghaggar-Hakra basin) alluvium zones and the Gujarat and Rajasthan black cotton soil zones were the two primary agricultural areas in the Harappan region. The Harappans made a deliberate decision to establish two significant agricultural zones because they understood that they would always have access to one of the two areas in the event of natural disasters. Harappan society has been evolving constantly since 4000 BCE, with its hospitable environment allowing for significant population expansion. Sophisticated agricultural tools and the double cropping system were also introduced to the Indian subcontinent in this era, indeed little has changed from the double-planting system and other agricultural practices developed by the Harappans.

Fundamental technology: The settled life, *c.* 7000 BCE, led to the introduction of the majority of the fundamental technology required to create pottery, metal artefacts, gemstone beads, ornaments comprised of various materials, and other domestic innovations. The middle of the 3rd millennium BCE saw the development of these technologies as they continued to advance steadily. It is evident from the data at hand that the Harappans had a significant impact on the advancement of fundamental technology, serving as a source for several current South Asian societies.

In conclusion, the above brief examination of Harappan accomplishments reveals a sufficiently developed socio-economic and technological framework capable of giving rise to a complex economic infrastructure and a political system that included international ties. The fact that most of the sites are situated in significant locations, such as resource areas or trade routes, indicates that Harrapans were able to expand into a variety of ecozones with different environmental variables and economic potential as a result of their advanced economic and technological development. The Harappans excelled as traders, which in some ways served as the foundation for the development of their culture.

Decline of the Harappan Civilisation

How, therefore, to account for the abrupt and enigmatic collapse of the Harappan Civilisation? Among the many elements that have contributed to the destruction of this great society, the environment appears to be the principal factor. A reconstruction of the Indian subcontinent's Holocene climate sequence, particularly in Rajasthan's Thar Desert region, reveals a decline in annual rainfall *c.* 2000 BCE, which may have played a significant role in the fall of the subcontinent's first civilisation, which was then at its most prosperous.

The influence of climate and environment on habitation has been highlighted by many researchers. Global studies on the reconstruction of climatic patterns suggest that the entire planet may have been affected, not just the Indian subcontinent, by a major climatic change *c.* 2000 BCE. Yasuda (2001) asserts that arid weather contributed to the collapse of all of Eurasia's civilisations, not just the Harappan, *c.* 4000 BP.

The growth of *Pinus koraiensis* in the Changbai Mountain region of north-eastern China appears to be the most notable aspect of the Late Holocene Forest development *c.* 2000 BCE (Sun *et al.* 1991). According to vegetation reconstruction at the Kurugai site in northern Sichuan, China, the forests of the Qinghai-Tibetan plateau retracted and expanded *c.* 2000 BCE (Gotanda 1998). Sclerophyllous, drought-adapted plants expanded concurrently in the mild temperate forest zone of southern Sichuan, indicating a drop in East Asian rainfall (Jarvis 1993).

Oxygen isotope analysis of lake sediments in the regions of northern Xinjiang and the Qinghai-Plateau indicated the most arid conditions (Wei and Gasse 1999). *Carpinus betulus*, a tree that grows in arid climates, began to spread across Europe *c.* 4100 BP, particularly in the Great Poland Plain; it has dominated the forest since *c.* 3500 BP. At the same time, there was a decline in lake levels (Makohonineko 1998). According to pollen studies from Syria's El Rouj basin and Ghab valley, the environment began to dry up *c.* 2000 BCE, with decreases in the production of wheat, barley, and olives resulting from droughts.

Limited studies on climate reconstruction for the period *c.* 2000 BCE affecting the Indian Subcontinent point to a similar pattern of aridity. Research on a core taken from the oxygen minimum zone off Karachi, Pakistan, at a depth of 700 m, has established a unique record of monsoon climate variations over the past 5000 years (von Rad *et al.* 1999).

Although the extent to which the Saraswati, a significant river for the Harappans, dried out after these deteriorating climate conditions is unclear, it is feasible that the Saraswati (today Ghagger-Hakra) and its main tributary, the Drishdvati (represented by Chautang today), shifted their courses and converged with other significant rivers, i.e., the Yamuna, due to specific tectonic action in the higher reaches. It is possible, however, that the Saraswati simply dried up entirely following the varying environmental changes. Given that *c.* 75% of the Harappan sites were situated in the river basin, its loss may well have been the heaviest blow to the civilisation.

The region of the Indus and Saraswati river basins was where the Harappans seem to have produced their grain surpluses. With the changes in climate, they were obliged to travel further inland to grow their crops, after losing their agricultural base.

It is conceivable that the change in sea level was caused by a drop in precipitation (it remains unclear whether it was a global or local event). In any event, the number of Harappan ports along the Saurashtra and Makran coasts decreased as sea levels fell. This must have had a negative impact on their trade with contemporary civilisations. Harappan surpluses from ther foreign trade was one of the main factors contributing to its wealth.

The pace of Harappan decline accelerated after foreign trade levels dropped. The general Harappan way of life was impacted by this economic downturn, which is reflected in their material culture. They seem to have abandoned their agricultural base in the Saraswati basin and moved their settlements away from the banks of the rivers. In later times, the Harappans preferred new areas, such as the western half of Uttar Pradesh and the districts of Gujarat (Sinha-Deshpande and Shinde, 2005). Different local cultures intermingled and were slowly assimilated into the civilisation.

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