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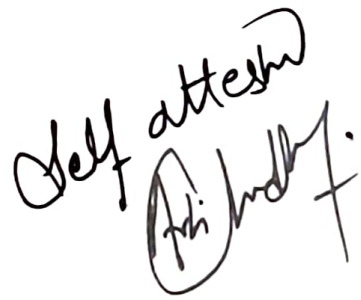

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Index

त्रिपथगा
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An International Refereed Research Journal

IIJ Impact Factor 2.013
Year-III, No-VI, Part-II
July-December, 2017
Page No. 1-7

Vedic and Modern Soil Science in Archaeological Perspective

Arti Chowdhary*

Though the findings of material culture of Vedic period might be the topic of controversy among the scholars but no one can deny about the fact that our Vedic text is full with the knowledge of science and scientific elements as well. The Vedic text produces abundance of knowledge regarding different scientific approaches such as description about earth, air, sun, water, medicine, treatment, metallurgy and soil etc. Significantly DayanandSaraswati, PanditMadhusudanOjha, Shreepad Damodar Satavlekar, Vasudev Sharan Agrawal, K.D. Dwivedi, Dr. VasudevPoddar are the notable name who have highlighted the scientific faces of different Vedic Texts. On the basis of Text the knowledge of soil science is associated with the agricultural and vegetation practices of the Vedic people, which are related with the two basic need of human habitation such as food and residence. At present, main striking point is, to find out the continuity of knowledge from Vedic to modern era, in this process Archaeology is one of the important key because Archaeology is not only the study of cataloguing or documentation of material culture it has moved much ahead from the collection of artefact to deep and focused cultural studies. At present Archaeology reflects itself complete intra disciplinary subject and in this process integration of soil science with archaeology gives a new insight to understand the human ecology, including settlement patterns, land use practices and evidence of human impact on soils and landscape. In this paper I will discuss about soil formation, soil conservation and soil fertility techniques followed by the Vedic people as well as its flourished forms following in archaeological fields in modern era because these new scientific

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facilities provide equipment by which interpretation of facts is more reliable and this micro elements of the study might fulfill the gap between the available information regarding the settlement process and human habitation.

Objective :

- Through light on the scientific aspects of the Vedic text.
- To discuss about the types of Soil, Conservation and it's fertility techniques followed by the Vedic people and their continuity in the modern era.
- To understand the settlement pattern and land use practices of archaeological fields by using Soil Science techniques.
- The importance of Soil Science in Archaeology.

Challenges :

- To understand Vedic texts exactly as they want to tell.
- The availability of the primary sources.
- Proper understanding of the source language.
- The archaeologist's cultural, religious or political bias may create problem in scientific research.

Why Study Soil???

Soil is the source of life on this earth because plants get nutrients from Soil and plant provides glucose and Oxygen to us.

1. Provides nutrients.
2. Recycles/filters water.
3. Producer and absorber of gases, waste decomposer.
4. Home to organisms.
5. Medium for plant growth.
6. Source material for construction, art, medicine, etc.
7. Snapshot of geological, climatic, biological image of Human History.

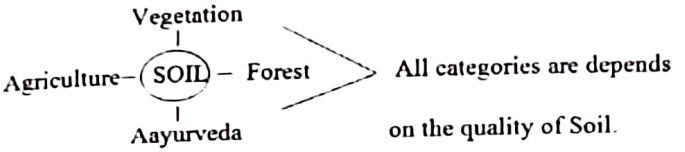
Introduction :

Vedic Soil Science :

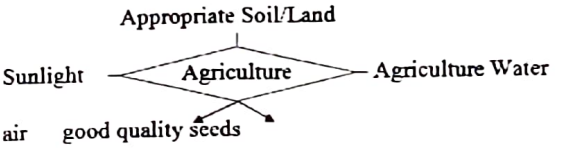
According to Manu "सर्वज्ञानमयोहि सः" (मनु0 2.9), means. Vedas are the source of all kind of knowledges. It consist not only Religion, Social teaching, moral teaching, Political Science, Economics Ayurveda even all sciences such as Physics, Chemistry, Botany, Zoology, Technology, Agriculture, Math, Astrology, Environment, Geology and Meteorology involve in it. According to Regveda Soil, Sun, Vegetation, river, place of river origin, Forest are the only source of natural resources.

पुरु वसूनिपृथ्वीबिभर्ति। **(Rigveda 3.51.5)**

Note : All the Knowledge of the Vedic People was based on a deep observation and by continuous interaction with nature.



The knowledge of Soil Science of Vedic people only revolves around the Agricultural practices and Aayurveda.



Agricultural Soil :

किंवावपनंमहत्। भिमिरावपनंमहत्। **YV. 23.45.46**

सुसस्याः कृषीस्कृधि। **YV. 4.10**

The Basic requirement for agriculture is the soil. It was questioned in Yajurveda- which is the best place to sow the seeds? The answer was - soil is the best place to sow the seeds. It is also mentioned that always do the best farming.

इन्द्रः सीतांनि गृह्णातु, तांपूषाऽभि रक्षतु।

सा नः पयस्वतीदुहाम्, उत्तरामुत्तरांसमाम्।। AV-3.17.4, RV-4.57.7

Indra gives his blessing to the plough field by rain and sun protect that field by sunlight. This kind of soil will surely give us the best production.

शुनासीरेह स्य मेजुषेथाम्। यद् दिविचक्रथुः पयस्तेनेमामुपसिञ्चतम्।।

AV-3.17.7, RV-4.57.5

Oh! wind and Sun, accept our Yagya and gives that water which is present in the sky, irrigate the Soil in the form of rain.

Property of Soil in the Vedic Text :

उपजीकाउद्भरन्तिसमुद्रादधि भेषजम्।,

तदास्त्रावस्य भेषणं, तदुरोगमशीशमत्।। Arthvaveda-2.3.5

Soil of the sea is useful for bleeding problem (Hemorrhage) and fever

अरुस्त्राणमिदंमहत् पृथिका अध्युद्भृतम्। Arthvaveda-2.3.5

Other property of Soil is related with wound treatment mentioned in Atharva Veda.

दिवः पृथिव्याः पर्योजउद्भृतम। Yajurvaveda-29.53

Earth, Universe and Aayurvedic medicine are the source of Power and Humidity of the soil.

वसुमन्तंविपर्वतम् ।गुहानिधिं–परिवीतम् अश्मनि–अनन्ते। RV-1.130.3

They knew the fact that the presence of Termite mound is indicating humidity in soil. It is also beneficial for treatment.

Soil Conservation in the Vedic text :

पृथिवींदृंह, पृथिवींमाहिंसीः। YV-13.18

Don't exploit the Earth

यत्तेभूमेविखनामि, क्षिप्रंतदपिरोहतु।
मातेमर्मविमृग्वरि, मातेहृदयमर्पिपम्।।AV-12.1.3

If we are digging anywhere in earth it is the Prime responsibility for us to fill the pit properly otherwise the pit will factor for soil erosion.

वनस्पतिंवनआस्थापयध्वं नि षू दधिध्वम् अखनन्तउत्सम्। RV-10.101.11

Save plant and trees because they protect the source of water. Trees are our friend. Don't ignore them. If plant grow then we grow.

माकाकम्वीरम् उद्वृहोवनस्पतिम् अशस्तीर्विहिनीनशः। RV-6.48.17

According to RV cutting trees is a Penal offence, Trees Protect us from the Pollution so save trees.

ओषध्यास्तेमूलंमाहिंसिषम्। YV-1.25

Do not cut or damage the trees.

Soil Treatment :

घृतेनसीता मधुनासमक्ता, विश्वैदैरनुमता मरूद्भिः।
सा नः सीतेपयसाऽभ्याववृत्स्व, उर्जस्वती घृतवत् पिन्वमाना।।
AV-3.17.9, YV-12.70

Sprinkle ghee and milk along with water which is a natural fertilizer and suitable for good farming.

करीषिणींफलवतीं स्वधाम् – AV-19.31.3

Use cow dung in farms for growth of cultivation.

पृथ्विीमस्मना–आपृण YV-12.70, AV 3.17.9

Make the soil healthy with mixing the ash of yagya.

Types of Soil in Vedic Texts :

मृत्तिका। यजु0 18.13, तैत्ति0 सं0 4.7.5.1
भूमिः, अ0 12.1.16। रजस्याय, यजु0 16.45
अश्मा, अ0 12.1.26, यजु0 18.13, तैत्ति0 सं0 4.7.5.1
किंशिलाय, यजु0 16.43, तैत्ति0 4.5.9.1
इरिण्याय, यज0 16.43, उर्वर्याय, यजु0 16.33
सिकव्याय, यजु0 16.43

The Atharva Veda, Yajur Veda and TaitariyaSamhita mentioned many type of Soil Soil such as Mrida (clay), Mrittika (silty soil), Rajas Bhumi (general soil), Ashma, Ashmnvati (granular soil), Kinshil, Irinya (unfurtilesoid), Urvara (fertile soil), Sikta, Sikatya (sandy soil).

Relation Among Soil-Rain-Sun-Wind in the Vedic Text :-

कृष्णंनियानंहरयः सुपर्णा
अपोवसानादिवमुत्पतन्ति। RV-1.164.47, pg. 230
समानमेतदुदकम् उच्चैत्यवचाहभिः।
भूमिंपर्जन्याजिन्वन्तिदिवंजिन्वन्त्यग्नयः।। RV-1.16.51

Evaporation :

Evaporation is the process of substance in a liquid state changing to a gaseous state due to an increase in temperature and or pressure.

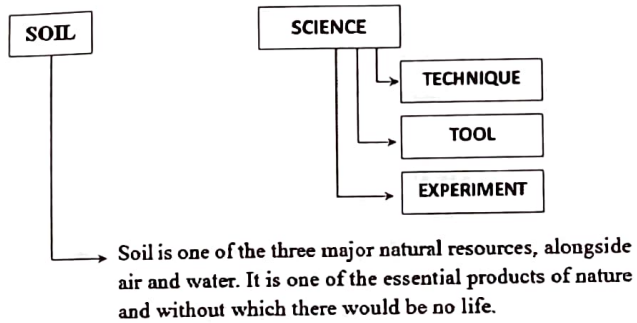
पुरोवातोवर्षन् जिन्वरावृत्...वातावद् वर्षन् उगरावत्...भीमरावृत्...
त्वेषरावृत्...पूर्तिरावृत्...श्रुतरावृत्...विराड्आवृत्...भूतरावृत् ।

TaitariyaSamhita 2.4.7

Rain increases fertility of land so the plants and vegetation alive on earth It also reinforce the Human life.

Soil Science in Modern Era :

Soil Science is the study of soil as a natural resource on the surface of the earth including soil formation, classification and mapping; physical, chemical, biological and fertility properties of soil; and these properties in relation to the use and management of soils.



SOIL-Forming Factor : 1. Climate, 2. Topography, 3. Time, 4. Biosphere

Formation of Soil :

Physical Weathering - Any process that breaks down rocks into smaller pieces without changing chemistry of rock. - Mechanical weathering. - Wind and air.

Chemical Weathering : Result of chemical interactions between water and atmospheric gases and the bedrock of the region.

Biological Weathering :

- Takes place as a result of activities of living organisms.
- Roots of trees creating fissures in rocks exposing them to further mechanical weathering.
- Chemosynthesis of bacteria.

SOIL Classification :

A. Horizon - the dark-colored upper zone of organic accumulation composed of leaf litter that is decaying and mixing with mineral Soil.

B. Horizon - is composed dominantly of minerals with minimal organic content; most of the original rock structures have been obliterated by Soil-forming processes.

C. Horizon - It lies above bedrock, can be deeply weathered but is relatively unaffected by Soil-forming processes.

Soil Conservation : Soil is the most important resource on which agriculture is based but soil loss is not only a problem for the farmer, with the loss of organic matter and fertility, it is also an environmental problem. Soil conservation practices are tools the farmer can use to prevent Soil

degradation and build organic matter. These practices included: **crop rotation,** and **multiple reduced tillage, mulching, cover cropping and cross-slope farming.**

What do the colors indicate? Reddish, yellowish or brownish: Iron oxides (Variation from amount at -

• Hematite - red. • Goethite - yellowish brown, • Ferrihydrite - reddish brown. • **White :** Carbonates, gypsum, other salts, or very leached. • **Black/very dark brown :** organic matter. • **Purple/black :** Manganese oxides.

Soil pH is a Factor :

- Soil pH (a measure of the acidity or alkalinity of the Soil).
- Soil pH is one of the most important Soil properties that affects the availability of nutrients.

(Nutrients that plants obtain from the Soil)

Macronutrients (Needed in large amount)		Micronutrients (Needed in Small amounts)
Nitrogen (N)	Primary	Chlorine (Ci)
Phosphorus (P)		Cobalt (Co)
Potassiun (k)		Copper (Cv)
Calcium (ca)	Secondary	Iron (Fe)
Magnesium (mg)		Manganese (Mn)
Sulfure (S)		Molybdenum (Mo)
		Nickel (Ni)
		Zinc (Zn)

Soil Analysis : 1. To know Fertility of Soil. 2. For classification of Soil. 3. To know about the changing process of the soil.

Phosphate Analysis :

- Phosphates arising principally from human and animal feces and urine, discarded foodstuffs and bones.
- To determine the likelihood that cultural activities occurred there without digging an enormous hole.

Archaeological Implication :

- Archaeological features, differentproperties between pathway and activity areas of the site.
- Land use pattern over site, food consumption/production area.
- Refuse deposit areas.
- How people were creating and using their own landscapes.

Magnetic Susceptibility (MS) :

- Depends on Iron content of soil.
- Heating increases MS due to oxidation of Iron.

Archaeological Implication :

• Firing techniques of the pottery. • Local & imported clay material.

• Different magnetic property of the different Soil.

Conclusion : 1. The People of Vedic era were also familiar with type, conservation, virtue, treatment and several function of the soil.

2. Sustainable Development: The thought of Sustainable development is established to save natural resources which are presently in use and our coming posterity can be also use them.

A. Soil Card - B. Neem Coated Fertilizer - C. Warmi Compost

SOIL Treatment :

(A) Physical Methods

(i) Heat treatment
(ii) Hot water treatment
(iii) Vapor treatment
(iv) Electrical Heat treatment

(B) Chemical Methods

(i) Soil drenching
(ii) Furrow application
(iii) Broadcast
(iv) Fumigation
(v) Ball placement

Biological Methods and their continuity till present :

1. Sprinkle water in the farm in which you have cleaned the utensils storing milk and curd as well as that water in which you have washed fishes.
3. Utilization of the remaining crop on the soil.
4. Utilization of wood ashes and cow dung as a natural fertilizer.

Time to Action :

1. Significantly the student should study about the source language (Sanskrit).
2. Need to establish such laboratories in India.
3. Find out the correlation between the ancient and modern practices.

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The Megaliths in India

Arti Chowdhary*

The megalithic monuments of peninsular India, believed to have been erected in the Iron Age (1500BC – 200AD), can be broadly categorized into sepulchral and non-sepulchral in purpose. Though a lot of work has gone into the study of these monuments since Babington first reported megaliths in India in 1823, not much has been understood about the knowledge systems extant in the period these were built – in science and engineering, especially mathematics and astronomy.

However, megaliths, especially sepulchral megaliths are an even stranger constructs since they are designed not only to bury the dead, but also to help us remember where they were buried long after they are gone. It is a strange use of space, designed to defeat the cruelty of time, which wishes to move on from every occurrence of an important event! In revenge, time also has a strange property of acting on common memory. Humans forget, and generations ignore much faster than we would like them to. Hence, it is necessary that to remember the most important facts of the past, they create markers in space to aid their memory. And yet, in most cases these original memories get lost in the mist of time and have to be recreated as best as we can.

Sepulchral Megaliths therefore have dual use. At the time.around their construction, they serve as memorial markers for the dead and at later times, they are a rich source of material to understand human lives and beliefs from time immemorial.

There exist another class of megaliths, which again merge space and time in a more direct manner. Some of these at least have long been suspected of being astronomical observatories. These objects spread over space are *constructed* to keep track of time! These are the most curious of objects in that they connect concrete experiences of movement of time and space, its periodicity and its relation to nature and environment. Megaliths for time keeping are the earliest clocks that work on the time scale of months and keep a track of the movement of Sun and Moon in order to keep track of seasons. They represent the first example of applied science since the architecture of stone observatories is astronomy. They are also the first scientific tools in the sense that they are not empirical constructs that are utilitarian, but are designed based on pre-existing observations and complex correlations which are then formalised into a utilitarian entity. These megaliths are the earliest observatories to predict seasons and give order to human life a measurement too that extends beyond the day to day existence. They are a product of a great inventive genius and a major break of human existence from that of other animals on the planet. While humans certainly controlled fire, had language and used wheel well before this time, these were ad hoc and empirical adaptations without any clarity about underlying behaviour of nature. In that sense, therefore megaliths are the first *intellectual constructs* of humans the others being more intuitive.

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Megaliths are therefore important structures that can provide a lot more information about not only the lifestyle of the people who made them but can also reveal details about their faiths and beliefs.

In the Indian context, megaliths stretch from dates before 3000 BC till about 900 AD, but are known to be a continuing traditions in some parts of the country5. The oldest megaliths in India are found in the westernmost part of the country in the present day Afghanistan in the upper Indus Valley. Dated to about 3000 BC, they are in the form of stone circles. But they are also found in almost all parts of the subcontinent including central, southern and eastern India where they are a part of continuing traditions. There is also a broad time evolution with the megaliths in central India dated to be between 1000 BC and 500 BC while those in the east are much later and are dated till 900 AD. A large fraction of these are assumed to be associated with burial or post burial rituals including memorials for those whose remains may or may not be available. The most famous case-example is that of Brahmagiri, which was excavated by Wheeler (1975) and helped establish the culture-sequence in south Indian prehistory. However, there is another distinct class of megaliths that do not seem to be associated with burials. We discuss their broad features first and then discuss their relation to astronomy and cosmogony later.

In the subcontinent, megaliths of all kinds are found. These are broadly (potentially overlapping) of two classes (after Moorti, 1994, 2008):

1. Sepulchral (containing remains of the dead) in which we include memorial stones where mortal remains may not be present but clear seem to be associated with a human life.
2. Non-sepulchral including large patterned placement of stones over a wide area.

Sepulchral Megaliths :-

The sepulchral (containing remains of the dead) megaliths can store the remains of the dead in a variety of forms. They could be primary burials, in which case the dead is interned soon after his or her death and it will contain a complete skeleton (in either flat or curled up positions) with some additional material as homage to the dead for the dead to use in afterlife. In some cases, these primary burials may also be in a sarcophagus made of terracotta. The whole chamber of burial therefore is a rich source of information. Similarly, secondary burials are also common when the remains of the dead, essentially his or her bones, are put in urns or pits are found. The location of the dead is most often marked with stone circles but Cairns, slab circles are also found on the surface. A common feature of these megaliths is that they generally are of dimensions of a typical human or even smaller and on occasion the area is isolated with stone circles. The structures tend to have largestones made into a construct of one form or the other that is an abstract replication of living habitat. However, a major difference is that unlike the house of the living, the house of the dead tend to be more sturdy and while it is nearly impossible to find an intact habitation site dating to 3000 BC, megaliths in good state of preservation can certainly be found. In the imagination of the people, the dead seem to live longer than the living and need better accommodation.

Apart from the direction of non-circular burials, it is not unusual for these to see the surface marker to have additional markers to mark a specific (often northern) direction. The bodies tend to be aligned either north - south (with the head in the north) or east west (with the head in the east) but random directions are also known (Sundara, 1975).

There is however, one class of non-sepulchral megaliths that should probably be classified with the sepulchral ones are the Hero Stones. These typically have an engraving on it either of a warrior or of god and generally assumed to have been installed to mark a bygone hero or someone lost from the group while travelling or in some accident. A distinct feature of these is that they are isolated, may or may not be dressed or carved. They also tend have little relation to the larger canvas of space in their neighbourhood except for an occasional tree providing a shade to the stone. However, it is believed that some of the dolmens are also probably equivalent of memorial construct of the dead with or without a burial under it.

Non-sepulchral megaliths :-

The most common amongst the non sepulchral megaliths are the menhirs, stone alignments and avenues (Moorti 1994, 2008). These are certainly more difficult to make, more elaborate in their construct and more spectacular to look at. They tend to be spread over a much larger area of several hundred square meters. They also seem to have been planned with care and set up with the labour of an entire community. It is likely that unlike the sepulchral structures, these have a certain time evolution and long traditions that are now lost. In most cases, their use is obscure and local speculations can include opinions that they were for the ghosts, for some unknown dwarf people or even for tying horses. However, invariably they are far too complex to admit of such simple explanations. They always have alignments which are either north south or east west with one prominent marker stone or a porthole in one stone pointing to either north or east. The earliest of these tend to have large stones put at specific locations but the later ones tend to be thin well-worked stones made with care and the boulder type ones also tended to be dressed.

In a separate chapter in this book, we (Menon and Vahia, 2010) will discuss examples of menhir sites in south India that seem to mark several cardinal directions.

Junapani :-

Junapani is a small area about 10 km north west of Nagpur, a city in central India. The region is referred to as Vidarbha region. Suvrathan (2010) has discussed thelandscape and megaliths of this region in a detailed comparative study of history and archaeology of the region.

The region was well populated with several centres of habitation from around 1000 BC to present and is believed to be an important region in the north south corridor of India. It boasts of several megalithic sites dated to between 1000 BC and 300 AD. The dates are based on the artefacts found in the graves connected with the megaliths which tend to have iron implements and iron enters this region around 1000 BC. One interesting feature of the region is that the megaliths tend to be essentially stone circle groups close to riverbeds. They are in a region known for its rich metallic soil. They are believed to be associated with local groups and clans. They also tend to have stones with cup marks on them placed around the stone circles.

Stylistically, they are uniform in typology, unlike the megaliths in southern India which tend to be menhirs, dolmens and other non-sepulchral structures as well as sepulchral megaliths including the stone circle typology. These will be discussed by Menon, S. M. separately in these proceedings.

Eighty-nine megalithic sites have been catalogued in Suvrathan (2010) in Vidarbha region out of which 51 are around Nagpur region. Out of these, 54 sites have only stone

circles, 4 sites have a dolmen while 1 has a dolmen and a stone circle. Forty sites are purely habitation sites. Amongst these the largest site is Khairwada with about 1400 stone circles, cairns and habitation deposits spanning from megalithic to early historical period (Jamkhedkar, 1981). Junapani is the second largest site with 150 stone circles of similar period. The site was excavated by Thapar (1961). Three of the stone circles were excavated and two of these had human remains along with other funerary objects and in one case, the remains of an animal from the Equidae (horse) family were found. All the circles seem to belong the same period. However, the most usual features were the presence of cup-marked stones in the stone circles.

In order to understand the stone circles and to study whether they have any connection with astronomy or cosmogony of the people of this region, we conducted a preliminary survey of the same last winter. A detailed report of this study is in preparation (Abbas et al., 2010).

Megaliths, astronomy and cosmogony

The term Megaliths is a very broad term used to classify any large stone object placed at a specific location for some presumed purpose. Its utility has often been speculated upon and the purpose is often difficult to define. The sepulchral ones were obviously built in the memory of the dead but amongst the non-sepulchral ones, a fair number of such stone structures have been shown to be for astronomical purposes in other parts of the world. We call them astronomical observatories in the sense that they track the sunrise or sunset points over the period of a year to determine seasons and then probably expanded to study rising points of stars that were considered important for the people who built the structures.

On the other hand, it is quite reasonable to assume that humans have viewed the heavens with awe and wander from time immemorial and sooner or later, all the civilisations have declared the skies above as the abode of the gods. The connection between the ancestors, gods and humans is especially strong in Indian belief system from the earliest periods. In another paper in this volume, we (Menon and Vahia, 2010) has shown that a case can be made to show that some of the megalithic structures of ancient India involving menhirs seem to be of astronomical origin. It is therefore not surprising that from earliest periods, the human burials are in specific parts of the town and the bodies are oriented in some specific directions.

Conclusion

The idea of space and time have always fascinated humans from the first time they looked around and noticed long term variations that they assigned to forces beyond their reach. Appalled by the idea of leaving the dead to the elements with all the mutilations that would be inevitable, they soon began to give a resting place to the dead.

From menhirs to dolmens of different shapes and sizes one can see their rising desire to keep track of the dead and the universe. With the arrival of use of architecture for habitation, they arrived at the first attempt to control their immediate environment for privacy and for better living. However, death continued to give a sense of time and its limitation to them and soon the megalithic architecture began to appear that would result in a fascinating variety of megalithic structures that seem to continue with the advent of worship of the great heroes and the gods that can be seen today in the form of temples. The megaliths of the temples are no longer recognisable for their roots, but then human limitations are not the nature's problem. The megaliths in central India also have carefully

laid out stones with cup marks of typical size of a few centimetres. These are placed at specific locations along the stone circles. The patterns of these cup marks and their orientation suggest that they were probably designed to mark out specific locations in the sky that corresponded to rising and setting time of specific stars associated with important changes in seasons and especially with the arrival of monsoon.

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CONTENTS

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CONTENTS

Material Culture of Rakhigarhi (Hissar, Haryana) – An Overview

Arti Chowdhary *

The discovery of the Indus Civilization in the 1920's was hailed as the most significant archaeological find in the Indian subcontinent, mainly because it filled in a major chronological gap between the stone age and the Early Iron Age of South Asia. On the basis of new sites excavation, old site re-excavation and several new interpretations based on the old and new discoveries, the momentous information about the Indus Civilization has increased gradually. On the other hand, though the enormous information has been steadily growing and continue to grow. Yet many aspects of the civilization remain mysterious and subjects of vigorous debate. The areas covered by the Indus Culture zone is huge, ranging between 980,000 to 800,000 sq. km, this region lies between the modern Indus and gangetic hydrological system, is the most important region in the subcontinent for better understanding the major cultural transitions particularly the rise and fall of urban centers of the civilization during 3rd and 4th millennium BCE. Many Indus sites have been reported from different parts of the sub-continent for instance, from Afganistan; in the Punjab. Sindh, Baluchistan, North-West frontier provinces of Pakistan and Jammu, Punjab, Haryana, Rajasthan, Gujarat and Western Uttar Pradesh in India. Haryana Comprisesrichest Indus sites. It is located in the North of India. A lot of archaeological survey has been done on this region already showing the evidence of begging of settled village life in the 3rd millennium BCE. Remarkably it has been shown that there were Protohistoric settlement pattern present over there.

A multidisciplinary collaborates team under the direction of R.N. Singh and C.A. Petrie consisting of researchers from Banaras Hindu University (R.N. Singh, A.K. Pandey, A.K. Singh and M. Singh), the University of Cambridge (C.A. Petric, S, Neogi,, D. Parikh and C.Lancelotti) the M.D. University Rohtak (VikasPawar) conducted survey in the district Hisar and Jind, which was focused village to village survey of the Hinterland of the major urban sites of Rakhigarhi in district Hisar, Haryana. This has been called **The Rakhigarhi Hinterland Survey.** One of the objective of this survey was to revisit all known Harappan period sites in the study area in order to establish their precise location, size and to determine when they were occupied. A total of 127 sites were located during the survey upto 73 of these have not been recorded in previous survey reports, it means that many sites within this particular area are new to knowledge. The number of sits dating to each period is as follows : 29 early Harappan, 15 mature Harappan, 32 Late Harappan, 18 PGW, 6 NBPW, 78 early Historic and 26 mediaeval, the urban sites of Rakhigarhi being occupied only in the Early and mature Harappan Periods. No detailed report of the excavations has yet been published excavation and survey is going on.

Material Culture of Rakhigarhi : Rakhigarhi [$29^0$17'19"N$76^0$06'47"E] is Hisar district Haryana had emerged as the largest Harappan site, spreading over 350 hectares and more older and larger thenMohenjodaro. In 1963 'Surajbhan' discover the site, further excavation were conducted by AmrendraNath from Archaeological survey of India and more recent excavations have been performed by VasantShinde from Deccan College. The site is situated

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n the dry bed of river Saraswati, which once flowed here and is believed to have dried up by 000 BCE.

According to the archaeologist Rakhigarhi is an ideal candidate to believe that the eginning of the Harappa Civilization took place in the Ghaggar basin in Haryana and it radually grew from here and slowly moved to the Indus Valley. Archaeological remains at Rakhigarhi extend over a radius of 350 hectares encompassing a set of nine mounds of which to 6 are protected by ASI but some parts of remain mounds were occupied by the villagers or cultivation and rearing of buffaloes. The excavation in mound four has yielded a ornucopia of artefact, including seal and potsherd both inscribed with the Harappan script; otsherds painted with concentric circles, fish-net designs; wavy patterns, floral designs and eometric designs; terracotta animal figurines, cakes, hopscotches and shell bangles, all elonging to the mature Harappan phase of the civilization. The five trenches have revealed esidential rooms, a bathroom with a soak jar, drainages, a hearth, a platform etc. Mound even is burial mound. On the surface of mound nine, some burnt clay clots and circular urnaces, indicating this was the industrial area of the Harappan site of Rakhigarhi. The site xcavation reveals a mixed subsistence economy wherein agro-pastoral needs were prioritized y cultivating two crops rabi and kharif besides domestication of animals. Apart from above haracteristics other cultural materials like terracotta objects, copper objects, beads industry, hell object are also notable. Short description of above mentioned below :

Terracotta Object (Terracota figurines) -

The main features of terracotta figurine of Rakhigarhi are as follows :

The street area of RGR-I has revealed more number of Terracottas.

The RGR-2 mound has revealed more variety of Terracotta objects. The male torso is found on podium of RGR-2.

The dog figurines are found from layer (11) RGR-2 indicates that dog was not among demonstrated animal in early and formative phases of Rakhigarhi.

The early Harappan period is characterized by bull terracotta figurines. Where as the mature Harappan period is marked by various animals, human, bird and other types of Terracottas.

The early Harappan bulls have different characteristics features than the mature Harappan bulls. But, evolution of Bull figurine is visible as early and mature Harappan Terracotta share common features of Harappan Terracotta.

The maximum number is a bull terracotta figurines. It was certainly an important animal for agriculture for transportation (of trade goods as well) and certainly played a vital role in the religious life of the Harappans.

The cow figurine is obscurely missing.

The mechanical toys show creativity and source of human in Harappan society.

The buffalo terracotta figurine share common characteristic feature with the buffalo terracotta found at Harappan and Mohenjodaro. At Rakhigarhi they are found from layer no. 12 RGR-2 onwards. The more number of Buffalo figurines suggest that sedentary pastoralism & milk production was a separate - economic activity.

The typical Harappan 'Mother Goddess' figurine which is characteristic feature of Teracottas from Indus Valley is missing at Rakhigarhi. The similar feature is noticed in all Harappan sites in Ghaggar-Drishdvati divide.

er Objects :

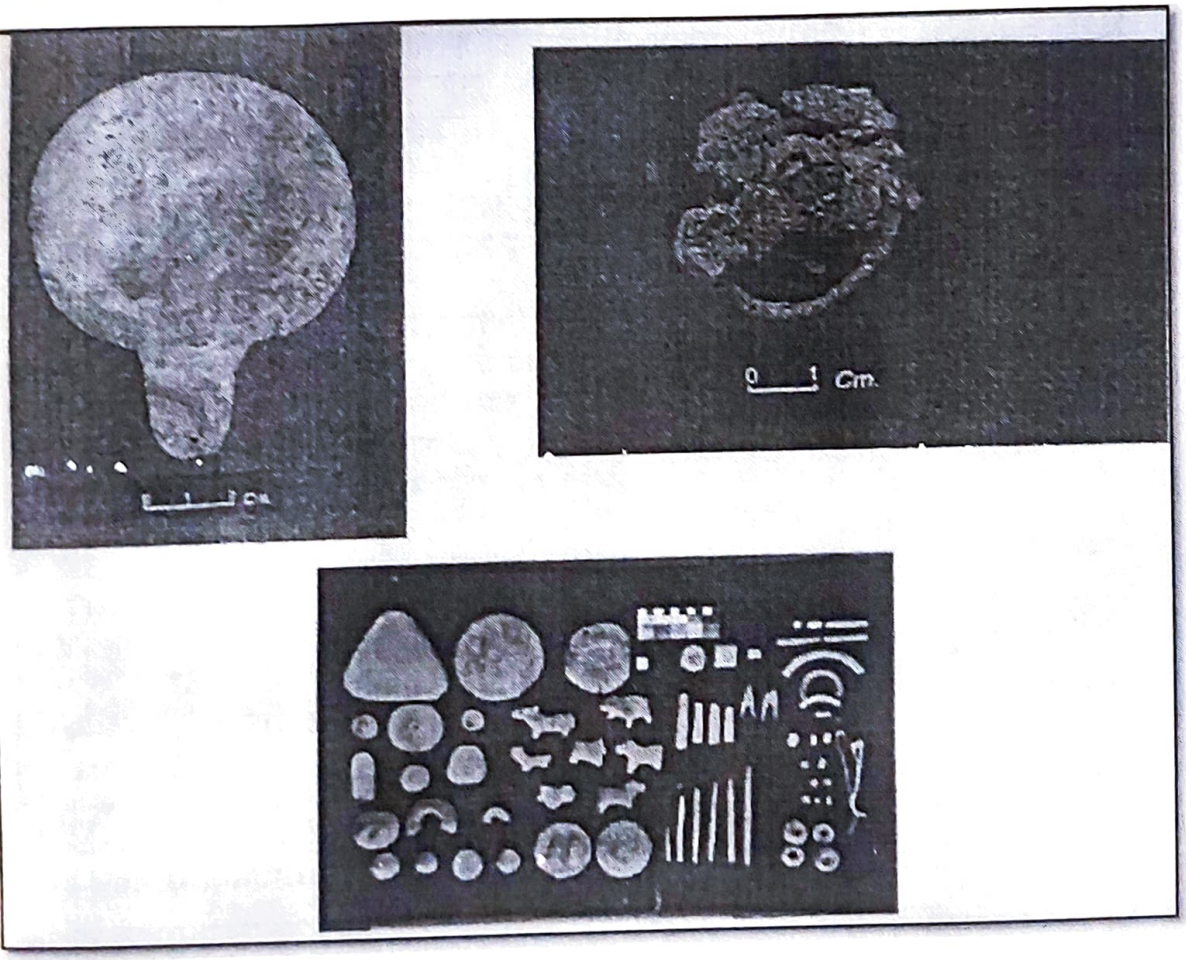
The metal objects found at Rakhigarhi are essentially made of copper. The chemical sis of these objects is still in progress; hence details about the chemical components are nown yet. But typologically these objects can be divided into following category :

Tools and weapons - arrow-heads, chisel, stylus, needle etc.

Personal Ornaments - bangles and spiral ring.

Miscellaneous - head, knife, chisel, nails and balance bar and stylus

mong the Miscellaneous objects buckle, clip, inlays, disc, beads are reported. Gold fillet eads, Silver bangles are also reported from the excavations but they are very few in er. In themetal objects copper articles are dominant.



ad Industry :

The evidence of use of beads by Harappan people came from different sites relate... us civilization form very beginning. It suggests that the bead Industry well finished the... early development phases of the Indus Civilization. According to Mackey in India, ... king was one of the most ancient art since in most places the requisite material were ... hand. The important sites from where different types of beads were unearthed are -

rly Harappan Sites

Mehargarh, BhutShamsi, Jagjai, Nal, Balakot , Lewan, TarakaiQila, Sarai Kha... Gumla, Jalipur, KotDizi, Kalibangan, Banawali, Rakhigarhi.

ature Harappan Sites

Mohenjo-daro, Channu-daro, Jhukor, Allhadeno, Harappa, Gumla, Kalibang... Banawali, Mitathal, Rakhigarhi, Lothal, Surkotda, Bhagatrav

ate Harappan Sites

Harappa, Lohunjo-daro, Dodheri, Balu, Mitathal, Rangpur, Rojdi, Sanghol

eatite Bead

Rakhigarhi has yielded a large collection of beads of different material. Steatite ... the most popular material at Rakhigarhi for making beads. From all mounds ... Rakhigarhi, a large number of steatite bead have been reported.

Table of Percentage of Steatite Beads found inn Rakhigarhi

Session	Total No. of Beads	Steatite	Percen...
97-98	51306	4214	72.1...
98-99	3035	1986	65...
99-2000	3079	2217	72...

able of Shapewise Distribution of Steatite Beads

Shapes	97-98	98-99	99-2000	41...
Disc	1243	1319	1628	12...
Short Cylindrical	794	309	248	12...
Short Cylindrical	1208	78	168	14...
Biconvex Circular	56	32	73	16...
Elliptical	-	18	11	2...
Discular	102	82	53	2...
Tabular	55	10	6	7...
Discular with Axial Perforation	55	11	11	7...
Globular	-	6	5	1...
Etched	189	5	7	20...

aience Beads

Faience Beads industry was the second famous industry of the Indus people. ...akhigarhi common shapes of this materials were cylindrical, globular, elliptical, gairom... gmented etc.

ble of Percentage of Faience Beads found at Rakhigarhi

Session	Total	Faience	Percenta...
97-98	5306	392	7.3...
98-99	3035	477	15.72...
99-2000	3079	277	9...

Bone and Ivory Objects at Rakhigarhi

Almost all the tools have been manufactured by bones of butchered or dead animals. The natural long bones of dismembered carcases, fragments of artificially broken done ribs of large animals, phalanges and antlers etc, have been used as raw materials because they were both spongy and resistant. The natural shape of these was most suitable for making tools by using simple techniques like splitting, scraping, notching, retouching and grinding. In this series antier's bone is better because it is very resilient in a fresh state.

RGR-1 : The total number of bone objects found from this mound is one hundred twenty three, out of which only in 110 objects has found from layer number 1 to 6. The frequency of bone objects higher in the layer I to 6 but suddenly frequently decreases in lower level.

RGR-2 : The total number of bone objects found are 212. Out of which 179 bone objects are found between layer 1 to 6. In trench 5-18 there is very high frequency of bone tools, this shows that there was a bone industry in this place. From layer 1 to 6 there are 6 ivory objects and a horn pieces found.

RGR-4 : During the excavation conducted by Chandigarh circle in 1997- 1998, many bone objects were found from RGR-4. Most important of them is an ivory comb one cubical weight and one ivory handle.

RGR-5 : Many unfinished bone tools, five ivory pieces and one Ivory comb fragment found in RGR-5, which shows that there was Ivory industry in this place during Harappan civilization. Polishing stone is also found which was used for making bones sharp and polished. So we can say that there was a bone industry there.

RGR-6 : Total 22 bone objects are found here in the session 1999-2000. Different Types of Bone Objects from Rakhigarhi :-

1. Points

The points are generally made out of splinters of long bones.They are made of groove-splinter techniques. This technique of making bone points is like as the upper palaeolithic age. In the Shafts of long bones, grooves were cut with a burin along with the shaft of the bone. After that, the bone splits into narrow strips along these grooves. One end was thinly scraped with a knife. Finally, the pointed end was further ground on a sharpner and very sharp points were achieved. There are two types of points :-

(i) Oblique Points : We found many points of this type of Rakhigarhi. It is very difficult to state the exact length of the tool because ends of almost all of them are broken. Short points with thin and sharp ends might have been used as arrow heads to kill small animals.

(ii) Bifacial Points : These points are normally made on shafts of long bones and both the edges or scraped in order to get a point. There are two sub type of these points.

(a) Thin Points : These points are special feature of mature Harappan phase. It was very thin and sharp. They have been prepared from shafts of small animals like goats, sheeps etc.

(b) Thick Points : These points have been shaped out of shafts of long bones of large animals and have been polished very nicely. The polishing on their surface suggests that they might have been used as bone needles in stitching.

(iii) Unpoints : These types are very crude and their surface shows encrustations effects. These might have been used as bards for the fishing spears.

These types of bone points reported from RGR- 1, RGR-2, RGR-3, RGR-4, RGR-5, RGR-6 and also reported from Harapa, Mohan-Jodaro, Surkotda, Chanhundara, Lothal and Kalibanga etc.

Engravers : 51 intact engravers has been reported from Rakhigarhi and also large number of broken engravers are found. They were also shaped out of long bones of small and

igonimals. This tool was used for engraving pottery decorating probably and for cutting
ngraving soft objects like steatite. It is also reported from Harappa, Mohenjodaro, Surko
Chanhundaro, Lothal etc.

Stylus :

Fifty nine pieces of intact stylus fire found from Rakhigarhi.There seem to have
used for engraving and for writing or scratching and incising.

Hair Pin :

The hair pin comes from RGR-1, RGR-2 and RGR-5, they havea tapering shaft a
large button head above tow sharp ridges. They have been chipped rubbed and fashione
make them sharp.

Arrow Head :

Twenty Eight arrowhead of bone have been reported from Rakhigarhi excavat
They have basically two features one is working edge and another one is long tang for haft
in wooden stick, in these arrow heads.

Spearhead :

A huge number spearhead found from the excavation at Rakhigarhi. The work
edge of most of the spearheads are well polished and their hafting end is left unpolished a
only chiseling was done. Most of the spearhead have circular section, but some of them ha
triangular and rectangular section also.

Different Types of Ivory objects from Rakhigarhi :

1. Comb : Two broken ivory combs has been found from Rakhigrahi. One is from RGR
and another is from RGR-4. The comb found from RGR-5 is totally fragmented but the com
found from RGR-4 has only three broken teeths and the rest teethes has been destroyed by t
ravages of time. It was decorated on both side.

2. Handle : One ivory handle have been reported from the RGR-4. It identified as a handle
dagger. Handle is well polished, has a copper screw suggests that it was a dagger with handl

3. Spatula : One well polished spatula of ivory found from RGR-2. It'scolours is yellow.

4. Bead : Pale yellow colour one ivory has been found fromRGR-2.

5. Weight : A well polished and finally made single cubical weight is found from Rakhigarh

6. Square Dice : Ivory square Dice have been found from RGR-2. They are found both
rectangular and squarish shape.

At Rakhigarhi, we found a well established bead manufacturing factory havi
thousand of bead roughouts, waste flakes and cores, tools and implements and bea
polishers. All these things were placed on a mud brick floor in a very special manners.
indicates that bead makers of Rakhigarhi presents a good example of highly advanced ski
and craftsmanship. They use varieties of agate, amazonite, carnelian, Chalcedony, jaspe
lapis-lazuli, crystal, sodallite for making beads. There sense was excellent in selecting the ra
materials among the variety of precious and semi precious stones. Rakhigarhiexcavation ha
also yielded a good number of bone and ivory object. These objects have been prepared aft
splitting, flaking, polishing and very careful manner, it also indicates the mastery of craftsma
at Rakhigarhi.

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ECOLOGY OF HARYANA

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The climate of Haryana owes to its continental location on the outer margins of the Monsoon region over 1600 Km away from the ocean and between the Thar Desert and the Himalaya in the northwest of the Indian subcontinent. It is the south-easterly current of the summer monsoon that brings here the much needed rains from July to September. From October to the end of June next, the weather remains dry excepting for a few showers received from the westerl depressions. Speaking broadly. it has a sub-tropical, semidry. continental. monsoonal climate. The range of temperature. both daily and annual, is great (Duggal, S.L. 1970:11). The summers are scorchingly hot, but, the winters are fairly cool.

Humidity: Humidity is the general term which describes the invisible amount of water-vapour present in the air. Relative humidity in the mornings is generally high during the monsoon season and during December to February, usually being about 70 per cent or more. Humidity is comparatively less during the rest of the year. The driest part of the year being the summer season with the relative humidity being about 30 percent m the afternoons.

Rainfall and Cloudiness : Most of the rainfall occurs during the monsoon seasons from July to September after which there is no rain almost and the November is the driest month of the year. About 74% of annual rainfall occurs during the south-west monsoon in the month of June-July. There is a significant amount of rainfall in the month of June in the form of thundershowers and in the rest of the year there is very little rainfall (Duggal, S.L. 1970:10-11). In the month of January there is also good rainfall due to the western disturbances from Pakistan. During the monsoon seasons the sky is mostly moderate to heavily cloudy. The rest of the year the sky is generally clear or lightly cloudy. Cloudy sky prevails for brief spells of the day or two in association with the passing western disturbances in the cold seasons.

Temperature: The state has 3 main climatic regions-Hot Arid region, hot semi-arid region and Hot sub humid region. The mean rainfall (mm) in hot arid region ranges from 300-500, whereas 500-750 mm in hot

semi-arid region and 750- 1050 in hot sub humid region of Haryana. The mean temperature ranges from27°C, 26°C, and 24°C respectively.

The thermometer records about 45-48°C during the afternoons of May and June. Scorching dust laden winds which blow during the hot season render the weather very tiring. Afternoon thunder showers which occur on some days bring some relief although only temporarily. With the onset of the monsoon by the end of Tune or beginning of July there is a drop in the day temperature but the nights are nearly as warm as in June. Due to the increased humidity in the air the weather is oppressive between the rains (HDG Jind 1986:15). After the withdrawal of the monsoon by about the middle of September there is a decrease in temperature. The fall in the night temperature being more rapid. After October both day and night temperature decreases rapidly and in December and January nights sometimes freezing temperatures are recorded. Frost is common in December, January and February when the plains are filled in with a cold air mass coming down the Northern Mountains (Duggal, S.L. 970:10). From February onwards the temperatures go on increasing till with the onset of rains a drop is recorded. There is no lack of sunshine in any part of the year.

Winds and dust storms: Winds are generally slow during the post-monsoon period and winter months. They are strengthened a little during the summer and monsoons months. They are predominantly eastern or south- eastern in the monsoon season and mostly westerly or north-westerly in other season. From April to June winds blow steadily from the west which are normally hot practically (HDG Hisar 1987:14). When the hot season is on the peak, dry winds locally' bo blow it high speeds and they are totally dry and hot. Another unpleasant feature of the climate is the dust storms which are very common the region before monsoon and especially in the south and scuth-west of the region in the months of December and January western disturbance strikes the area and make rapid decrease in the temperature and occasionally causes rain and is very good for the wheat and mustard crops.

Fauna: Due to the growing population the expansion of cultivation and the reclamation of jungles and barren lands wild animals are disappearing very fast. Thus finding no refuge and shelter, animals and birds have migrated and are still migrating to other places (HDG Jind 1987:14-19). However a few wild animals are still found in the region. Animals found in the region are given below.

Mammals: Rhesus macaque or Bandar (Macaca Mulatta), common langur *(presbytis entellus)*, common Mongoose *(Herpestes edwardsi)*, Jackal *(canis aureus)*, indian fox *(Vulpes bengtalenis)*, stripped hyaena *(Hyaena hyaena)*, Bheriya *(canis Lupus)*, Grey musk- shrew or Chuchunder *(Suncus murinus)*, common yellow bat *(sco tophilush-*

thi), Tickell's bat (*Hesperop tenustickelli)*, five stripped palm squirrel gilheri (*Funambulus Pennanti)*, indian porcupine or sahi *(Hysrix dica)*, common house rats (*Rattus rattus)*, house mouse *Musmusculus)*, indian hare (*Lepus nigricollis)*, Chinkara or ravine deer. *Gazella gazelle)*, Black buck (*Antilope cervicapara)*, Bluebull or nilgai *Bos elaphus tragocamelus)* are the mammals found in the region (HDG Hissar 1987:10).

Birds: The common birds found in the area under present study are, Brahminy duck (*Tadorna ferruginea)*, common shel duck *(Tadorna Tadorna)*, Pintail (*Anasacuta)*, Mallard (*Anas Platyrhynchos)*, Wigeon (*Anas Penelope)*, Bluewinged teal (*Anasquerquedula)*, Ferruginous duck (*Aythya fuligula)*, Tufted duck (*Aytha Fuligula)*, comb duck *(Saki diorni smelanotos melanotos)*, cotton teal (*Nettapus coroinan delianus coromandelianus)*, Spotbill duck (*Anas Poecilorhyncha)*, tree duck (*Dendro cygnajavanica)*, Black partridge (*Francolinus francolin usasiae)*, Grey partridge (*Francolinus pondicerian usinterpositus)*, grey quail (*Coturnix coturnix)*, Blue rock pigeon (*Coltimba livia)*, western turtle dove (*Streptopelia orientalisineena)*, Indian ring dove (*Streptopelia decaocto decaocto)*, Indian spotted dove *(Streptopelia chinesissuratensis)*, Pariah kite (*Milvusmi grams)*, king vulture *(Torgos Calvus)*, Tawny eagle (*Aquila rapaxv indiana)*, House crow *(Corvus splendens)*, Indian jungle crow (*Corvus macror hynchoscluminatus)*.

Reptiles: Common Indian krait (*Elapide Bungaruscaeruleus)*, (*Echiscarinatus)*, Indian python (*molurus)*, John's sand boa (*Eryxjohnijohni)*, rat snake (*Plyas mucosus)*, sand snake (*Psammgphisleithi)*, common lizards (*Haemi dactylusbrooki)*. Kirla or girgit (*Calotes versicolour)*. Sanda (*Uromastrixhardwicki)* are the reptiles species found here.

Amphibians: Tortoises (*geoclemyshamitloni* (II) Kachugadhongoka), indiand bull frog (*RanidaeRanatigrina)*, Indian cricket frog (*RanaLimnocharis)*, indian burrowing frog (*Ranabreviceps)*, common toad (*BufonidaeBufomelanostictus)*, Parri (*Notopterusnotopterus)*, Katla (*catlacatla)*, Magur (*Clariasbatrachus)*, singhara (*Mystusseenghala)*, Ghally (*Ompok bimaculatus)*, Mallee (*Wallagoattu)* and Dolla (*Channa punetatus)* are the amphibians found in theregion.

Flora: The forests of the region fall under the category of tropical desert thorn and comprise predominantly xerophytes. Flora is scanty and sparse (HDG Jind 1986:6-9). The floral types found in the area under study are as below. Jand (*Prosopis cineraria)*. Rohera (*Tecomella undulate)*, Khairi (*Acacia Senegal)*, Ben (*Zizphus mauritiana)*, Reru (*Acacia Leucophloea)*, Jal or van (*Salvador aoleoidesdecne)*, Barb (*Ficus bengalensis L.)*, Peepal (*Ficus religiosa L.)*, Mesquite or pahari kikar (*prosopis juliflora)*, kachnar (*Bauhinia racemosa Lamk)*, Amaltas

(cassia fistula L.), Lasura (Cordia dichotema), Imli *(Tamarindus indica L.)*, Banna *(Cratava adansoni)*, Shisham *(Dalbergia sissoo Roxb.)* Kikar *(Acacia nilotica)*, Neem *(Azadirachta indica Juss. Syn. Melia azadirachta L.)*, Gulmohar *(Delonix regia)* (HDG Hissar 1987:9).

Shrubs: Hins *(Capparis septaria L. Carissa spinarum L.)*, castor *(Ricinus Communis)*, Panwar *(Cassia tora L. (II) Cassia occidentalis L.)*, Babool *(Acacia jacquemontii Benth)*, Mallah *(Zizyphus nummularia)*, Kanr *(Capparis deciduas)*, Khip *(Lepta deniapyro technica)*, AK *(Calotropi sprocera)* are the common shrubs.

Medicinal plants: The medicinal plants found in the region are, Bansa *(Adhatodav asidanees)*, Indirain *(Citrulluscolocynthis)*, Asgandha *(Withaniasomn ijèra)*, Ginger *(Zingiberofficinalis)*, Turmeric *(Curcuma demestica)*, Brahmi *(Hydrocotylevulgaris)*, Jalap *(Exogeniumpurga)*, Muihatti *(Glycyrrhizaglabra)*, Ephedrine (Ephedra gerardiana), Neem *(Azadlrachta indica)*, Tulsi *(Ocirnum sanctum)*, Dhatura *(Datura stramonium)*, Bhakhra *(Tribulus terrestrial)* are the main medicinal plant those use local people of the region.

Cultivated crops: There are mainly two groups of crops in a year, viz, the rabi locally called Sadhrzt (or sadlzu). In Haryana it is locally called Sauni which means winter crops and the Kharif locally called Samnu. In Haryana the major rahi crops arc wheat, gram. barle, mustard. barseem. methi, tobacco, potatoes and other vegetables. The dominating crop is wheat; it occupies more than 50% of total Rahi cultivation followed by mustard. In the sandy area only Sadhru is sown. During the December a few thunder storms occur in association with the western disturbance and it is very useful for wheat crop. The Kharif crops consist chiefly of sugarcanc. cotton, jowar, bajra, gawara. paddy, maize. moong. moth, mash. san and ground nut.

Forest: The majority of natural forests are situated in the Siwalik belt of the State comprising of the Forest Divisions of Yamuna Nagar. Momi-Pinjore and Ambala. Few of pristine natural forests are also situated in Aravalli region of State in Mewat. Rewari and Mahendragarh Forest Divisions. The rest of Forests are artificial plantations in the form of Forests Strips situated along Rail, Road and Canals.

The aim of the present study is to determine the course of events responsible for the emergence of early farming cultures and their settlements in this area and factors responsible for urbanization and to determine factors responsible for the expansion, dispersal, diffusion and migration of Harappan culture in Haryana.

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Ethnoarchaeological Study of The Animal Remains Found from The Harappan Sites in The Plains of North West India

Arti Chowdhury

Indus Civilization is an undeniable landmark of the human development History in the world, where the people civilized and cultured in the 2nd & 3rd millennium B.C. Last a from few genuine quarries, for instance-How did we know about this civilization? and at what context this hidden history came into the light? The ruins of Harappa were first described by Charles Masson' in 1842 in his writing "Narrative of Various journeys in Baluchistan, Afghanistan and the Punjab" where the locals talked of an ancient city extending to about twenty five miles but no one, either an archaeologist or a historian were interested in its reference. Even Alexander Cunningham visited the ruins of the Harappan city in the year 1 but after looking the ruins of bricks structure, he could not guess the original potential of the site. Unfortunately in 1870 Harappan had suffered massive destruction at the hands of railway constructions who had plundered it for bricks, but every destruction formed a new beginning. The Indus Civilization marked its presence on the world map in the beginning of the half of the 20th century with the efforts and work of Sir John Marshell, D.H. Gardon, Stuart Piggo Daya Ram Sahni, Rakhal Das Banerjee, M.S. Vats, E.J.H. Mackay, Raibahadur, K.N. Dikshit, Mortimer wheeler and obviously many others. These enthusiastic people were described its significance and uniqueness. The history of Indian subcontinent attained a new dimension with the excavations of its two principal sites- Harappa (excavated by Daya Ram Sahni) and Mohenjodaro (excavated by Rakhal Das Banerjee). This accidental discovery at once pushed back the antiquity of urban culture in the sub-continent to the third millennium B.C. This Indian evidence gives a plethora of information regarding environmental factors, optimal adaptation in settlement pattern and social and religious fabric of the civilization. The entire scenario is based on material evidences which tends to give new insight in understanding the Indus Civilization.

The area covered by the Indus Civilization is huge, ranging between 680,000 to 800,000 sq km. Sites have been reported from Afghanistan, Punjab, Sindh, Baluchistan and North West frontier Province of Pakistan and Jammu, Punjab, Haryana, Rajasthan, Gujarat and Western Uttar Pradesh in India. The northernmost site is Manda in Jammu district of Jammu and Kashmir, the Southernmost is Malvan in Surat district in Southern Gujarat. The western most site is Sutkagendor on the Makran Coast of Pakistan, and the easternmost is Alamgirpur in the Saharanpur district of Uttar Pradesh (Singh, 2015) when India got freedom from the British Domination in 1947 it is the time of Partition of the country as well, and all major sites of Indus Civilization at that time went to Pakistan. To compensate the loss of Indus sites, Indian archaeologists devoted their attention to search the Harappan Sites in India and a new phase began and numerous explorations started in the different parts of Punjab, Gujarat Rajasthan, Uttar Pradesh, Haryana and Jammu & Kashmir etc. resulting a large number of sites discovered with the same culture in Indian territory. Different explorations revealed the highest number of Harappan sites in Haryana (C. 350 sites and more than it). The number of sites has increased significantly by the recent explorations, excavation and surveys conducted by several universities, Institutions. All these discoveries clearly proved that the frontiers of this culture extended in several parts of India, particularly in North-West India.

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North-West India produces dynamic results regarding the Indus Civilization Excavations at the different sites regarding Harappa Civilization in India have provided new opportunities and dimensions to study the different aspects of the Indus Culture. Every civilization needs time to grow and flourish on the earth with the help of Bralny or encephalic peoples. This is also applyd by the Harappan People. On the basis of evidences a long and complex cultural process-Early Harappan, mature Harappan and Late Harappan Phase accepted by the Archaeologists. The early Harappan was the formative phase also says Proto Urban phase. The mature Harappan Phase was the Urban Phase, the full-fledged stage of civilization. The late Harappan phase was the post-urban phase, when the city declined (Singh; 2015). A great deal of research has been done on the various aspects of the Indus Civilization since its discovery and inhance our understanding of this highly developed fully urbanized and most expanded civilization of South Asia in the context of its social, cultural and technological development. To explain these developments in Harappan context, we depends on the finding material, artefact and so many antiquities, not only the Homogenions evidences, the animal remains are also help us a lot to reconstruct the Past Culture, The Study of past animal evidences is known as 'Archaeozoology'.

Archaeozoology : Archaeology or Zooarchaeology is the study of animal remains from archaeological sites to understand all aspects of past human and animal interaction. Basically it is the study of past human interaction with animals through the analysis of their material remains. This module provides a practical introduction to the identification analysis and interpretation of animal bones from archaeological sites. It is the study of faunal remains. Faunal remains are the items left behind when an animal dies, it includes : Bone, shells, Lair, chitin, scales, hides, proteins and DNA etc. (Joglekar, 2015)

Archaeozoology : The development of Zooarchaeology is started from Eastern North America which can be broken up into three different periods. The first period is formative period starting around the 1860s, the second is systematization period beginning in the 1950s and the integration period which began about 1969. Full time zooarchaeologist did not come about until the systematization period. Before this it was just a technique which was applied but not specifically studied. Specialist of zooarchaeologists started their work in specifically in this zone because a new approach of archaeology known Post Processual Archaeology. This approach puts more emphasis on explaining why things happened, not just what happened?

Many other name is also given by the scholars to this (archaeozoology) discipline like zooarchaeology, osteoarchaeology, Palaeontology and Palaeozoology. Here one thing is notable that each of these name has their specific meaning in different academic circles. In Palaeontology fossilized animals remains and their impressions from remote past before emergence of humans are studied. On the other hand archaeozoology is focussed on examining the animals in relation to human cultures. Since archaeology essentially deals with the ecological and cultural aspects of human relationship with animal, it is inter-disciplinary in nature. It draws important methodological tools and concepts from anthropology and environmental science, besides zoology (Joglekar, 2015). Any animal that provides information about past environment and subsistence are considered important in archaeozoological investigations. These investigations have several aims most common of which are:

(a) Palaeoenvironmental and environmental change
(b) Hunters and their prey
(c) Origins of animal domestication

(d) Development and disintegration of animal breeds.
(e) Animals in economy, social structure and belief system of ancient societies.
(f) Formations of archaeologists sites and associated archaeofaunal assemblages.
(g) Technologies associated with animal use and management (Joglekar; 2015)

Zooarchaeology can also tell us what the environment might have been like in order for the different animals to have survived.

The Faunal remains are divided into two parts - (a) Macro remains and (b) Micro remains.

Animal Remains (Joglekar, 2015)

Marro-Remains
- Bones
- Cartilage
- Egg shells
- Gastroliths
- Otolithis
- Antlens
- Teeth
- Feathers
- Exokeletons/shells
- Bones and anther objects
- Teeth (ivory) and shell objects

Micro-Remains (Biomolecules)
- Carbohydrates
- Lipids/Fatty Acids
- Proteins/Amino Acids
- DNA/Nucleic Acids

On the basis of these two category archaeozoological information derived. Except macro & micro remains other evidences can also be used to get information about animals. For instance feather impressions of past birds, these evidences are very rare Archaeology Griffin found feather impressions in case of a pottery type called Nukleet at site of Jyatayet in Alaska (Joglekar, 2015). Footprints or track marks of Past animals another kind of evidences. Ichnology, which is related to palaeontology branch gener discuss with the traces of borrows and footprints. Favourable geological or geograph conditions required for the preservation of such materials.

1. Food Animals : These evidences consists all those animals who were hunted or tra and domestic animals culled for food items. Basically they are reported from the food re or garbage disposal pits. In most of these cases the faunal material is foimd along with br pottery, brlckbats and other debris depending on the origin of these materials.

2. Pets and Working Animals : The next category is related to non-food usage of ani such as bulls, he-buffaloes, horse/ass. They are live in our society. After death such an are likely to be thrown outside the settlement often remains of such animals are missed i habitation deposit sometimes scavengers such as dogs some of these seletal elements into the settlement, this type of evidences are isolated and without butchering, cutting charring marks.

Animal Burials : These animals were not used as food items but they got special trea from their masters so they intentionally buried. These are also important in archaeol context. Many examples of animals burials are available in literature, could be relat rituals or justsimply emotional attachment with their master. At the site of Balath

Rajasthan burials of several animals like cattle, blackbuck, gaur and cat has been reported (Joglekar; 2015). It is also possible that some faunal evidence with human remains will also reported in future such as the megalisthic burials in Vidrabha region of Maharastra. Horse teeth were reported from human megalithic burial at Raipur in Maharashtra (Joglekar; 2015).

Raw Materials : It is generally realted to the hard parts of the animals like teeth, shells, bones, nails, Molluscan shells. Good quantity of raw material obtain from the Harappan sites of NagwadanandBagsara in Gujarat. At these sites several complete shells of TurbinellaPyrum were brought from elsewhere and various products such as bangles and rings were manufactured there. At the mature Harappan site farmana, a dump of cattle astragali was noticed. These astragali were perhaps stored for making bone objects because a few astragali of cattle and sheep/goat which were polished have been noticed.

Activity Area : Some animal remains finds in activity area in context of archaeologic habitation site. The main characteristics of such faunal material is finding articulated skeletal remains, that is skeletal elements found in their original anatomical sequence. Similar articulated skeletal remains have been recovered at Karanpura, Hanumangarh district, Rajasthan from mature Harappan context which is very important to reconstruct the settlement system of the site.

Rituals/Offering : An interesting case regarding this procedure was noticed in Lahuradeva in Uttar Pradesh. In a dump a select part of twelve tumpedcanle (Bosindicus) were found like a heap (Joglekar; 2015) all cattles were shorthorn type. Many skeletal elements showed evidence of cutting and charring. All these evidences looked fresh and had no signatues of any post-depositional damage.

Commensal Animals : According to OconnorCommensalism is a cultural coevolution, a mutual process of learning to live together. Commensal animal are associated with human dwellings since the hunting-gathering stage. For a long period several animals existed within human habitation zones, co-evolved to adjust with environment of human settlements, and the chance of fmding their remains is there. Rat (Rattusrattus) and bandicoots (Bandicotaindica) are two remarkable species to be found in archaeological record.

Accidental Inclusion : There is also a chance that some animal species would land up in archaeological record because of purely accidental causes. Suchspecies would not have important in past human culture. Finding molisucan shells in habitation that have come through river or sea sand brought as building material is an example of such accidental inclusion (Joglekar; 2015).

Later Intrusions : It is easy to identify the later insrusions based on their externalappearance, patina and consistency. One good example fromDamadama, Mesolithic site in Uttar Pradesh, there were only twofragments of domestic animals (Bosindicus and Capra hicus) among4054 identifiable fragments and rest were later intrusions (Joglekar,2015).

The importance of faunal material found from the archaeological sites in India was recognized in the 19th century, this study is not very old in Indian context, Guha and Prashad made initial attempts to describe animals found at two important Harappan sites Harappa and Mohenjo-daro where faunal study carried out successfully. After Independence of India excavations began in the 1950s. The Archaeologists as F.R. Alichin and H.D. Sankalia in the early part of 1950s and 1960s were interested in knowing about animal at their archaeological sites. Therefore, they actively participated in archaeo-faunal studies. In this early phase J.C. George, Bhola Nath, D.R. Shah, V.V. Rao and K.R. Allur were the main contributors to the faunal studies. Till 1970s a few faunal experts such as K.R. Allur, BholaNath and DR. Shah continued to study faunal material from few sites, but these effort were individual-level effort.

major change occured with establishment of the Archaeozoological Laboratory at ...ican College due to support from V.N. Mishra and help given by A.J. Clason. P... Thomas. Very to day this laboratory made successful effort to study the faunal studies from ... different archaeological sites (Joglekar, 2015). Some of the recent excavations in West... India, especially in Gujarat, Haryana and Rajasthan have brought out significant accounts ... the faunal assemblage of the Harappan Period. The excavations and remains analysis ha... revealed a wide spectrum of animal species associated with the Harappan culture. A major ... of animal remains both ekmestic and wild, contributed to the food economy and wealth of ... Harappans of Western India. Animals from different habitats such as the terrestrial, aviam ... aquatic were exploited for various purposes. The evidence also suggests the significance ... animal by products as well as animal power in the Harappan economy (Agrawal, 2005).

Animal in Harappan Sites:-

Shirrana (Fatehabad District) : This site is excavated by the Archaeological survey of In... from 2003 to 2006. The excavator has indentified two periods that were divided into ... phases each period IA (Hakra Ware), Period IB (Early Harappa) Period hA (Early Ma... Harappa) and Period II B (Mature Harappa). The Faunal remains were studied by Deshpan... Mukherjee and Sen. This study revealed dominance of cattle and buffalo in the fau... assemblage. The domestic species she has identified are cattle, buffalo, sheep, goat, dog a... pig. Severlal wild mammals also gives their contribution in food economy of Harappa... They were gaur, nilgai, chital, blackbuck, four-homed antelope, gazelle, barking deer, p... hare and Panther.

Rakhigarhi (Hisar district) : P.K. Thomas made initial observations about the spec... fromthat the site and later uparathana examined a small random sample fromRGR(6) (One ... the six mound at the site). The species identified atRGR6 were cattle, buffalo, sheep, goa... domestic pig, nilgai, wild pig(Cervus) deer and mongoose.

Shikarpur (Kutch District, Gujarat) : The faunal material recovered from Shikarpur ha... large number of animal species :Seven domestic mammals (cattle, buffalo, sheep, goat, p... dog and cat) twelve wild mammals (nilgai, wild pig, blackbuck, chinkara, sambar, spot... deer, elephant, Hyaena, an equidecies. porcupine, hare and rodents, (house rat), Bi... (domestic fowland common crane), reptiles (Chitra turtle and soft shell turtle and sixte... species of molluscan shells).

Kuri : Faunal material showed presence of five domestic (cattle, buffalo, sheep, goat a... dog) and eight wild species-nilgai, spotted deer, blackbuck, gazelle, wild pig, mongoo... porcupine and hare. Besides these mammals a few non-mammals were identifiedcommon ... (Anas sp.), rohu (Labeorohita), Lamellidens sp. Diginostomapuichella and Corbicula sp.

Bhagwanpura(Kurukshetra District, Haryana) : Two period have been recognized ... Period IA: Late Harappan (1700-1300 BCE) and Period 1B : PGW overlapping on the l... Harappan Period (1400-1000 BCE). The domestic animal remains identified at Bhagwanp... during late Harappan phase were cattle, buffalo, sheep and goat and dog. Domestic pigs w... not identified. The wild mammals identified at the site were chital and pig. Also, ... unidentified species of turtle was present.

Bhola Khera (Karnal District, Haryana) : This site revealed presence of the L... Harappan, Painted Grey ware (PGW) and Early Historic occupation. The faunal remains w... analysed. Domestic cattle, buffalo, sheep, goat, dog, wild pig, four horned antelope and h... besides a species of bird-Anas Crecca(Common teal). A few skeletal elements were modi... to make objects such as tools by polishing and cutting with sharp instruments.

Girawad (Rohtak District, Haryana) : The faunal material revealed presence of cattle buffalo, sheep, goat, pig, clog and wide spectrum of wild animals such as pig, deer, antelope, porcupine, rodents and hare.

Lohat (Jlaaj jar district, Haryana) :-

This site revealed presense of cattle, buffalo, sheep, goat, domestic fowl, blackbuck, wild pig, Indian mud turtle (Lissemyspunctata) and two species of silurid fish.

Bagasra (Rajkot District) Gnjrata : Presence of cattle, water buffalo, sheep, goat, wild pig, nilgai, gazelle, blackbuc and wild ass has been reported. Skeletal fragments belonging to canids, rodents, fish, birds and crab have also been identified. At Bagsara a few skeletal elements of the rhinoceroses have been found.

Nageswar : This belongs to the mature Harappan site and identified as a shell working area. The faunal assemblage showed presence of several species of domestic animals (cattle, buffalo, sheep/goat, pig and dog),

Mithathal (Bhivani District, Haryana) : The assemblage consisted of skeletal elements of several venebrates as well as many invertebrates. Mammals identified at Mithathal included cattle, buffalo, sheep, goat, pig, dog, and a wide spectrum of wild animals such as the wild pig, spotted deer, barking &er. blackbuck, porcupine and hare. The non-mammalian animals included birds, fishes and molluses-Lamellidens, sp. Diginostomapdchella, Indopianorbisexusths and Pita globosa. Two wild aiiimals were newly identified-four-homed antelope and gazelle.

Farmana (Rohtak District, Haryana) : Five speccies of domestic mammals utilised as food at Farmana were cattle, buffalo, sheep, goat and pig. Domestic Dog, Cats, rats and ndicoot rats were non-food mammals at Farmana. Several wild mammals hunted/trapped and consumed were nilgai, spottted deer, mouse deer, sambar, blackbuck, bear, wild pig, wolf, porcupine, mongoose, common squirrel and hare. Besides mammals several species of non-mammals were identified at Farmana. These were common teal (Anascrecca) Peafowl (Pavocristatus) Ganges Soft shell turtle (Triyonyxgangeticus) Indian mud turtle (Lissemyspunctata) etc.

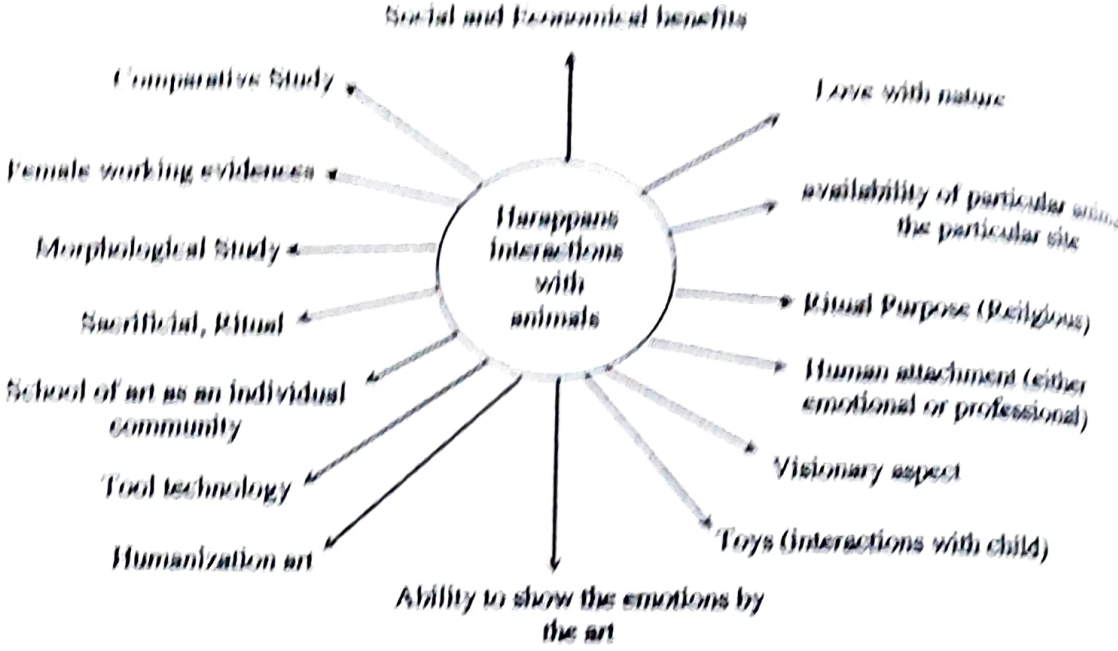
SampoliaKhera (Masndpur 1) (Haryana) : Mammals identified were cattle (Bosindicus), Buffalo (Bubalusbubalis), Goat (C'aprahircus), Sheep (Ovisaries), domestic pig (Sus dornesticus), nilgai (Baselaphus), four homed antelope (Tetracerusquadricornis), spotted deer (Axis axis), Wolf (Canis lupus), Fox (Vulpesbengalensis), elephant Elaphus maximus), house rat (Rattusrattus). The non-mamalian species identified were peafowl (PavoCfrstatus), Carp (Catlacatia), freshwater mussel (Lamellidens 'cp.) and freshwater gastropad species (Digoniostomapulcheila). All three phases of Harappa culture have been reported from this site.

BhimwaraJodha (Masndpur VII) : The species identified were cattle (Bosindicus), buffalo (Bubalusbubalis), dog (Canisfamiliaris), nilgai (Boselaphus. tragocamelus) biackbuck (Antilopecervicapra) and rohu fish (Labiorohita).

Karanpura (Hanumangarh District, Rajasthan) : Many fragments of animal skeletal elements were examined. The mammalian species identified were cattle, buffalo, sheep goat, dog, nilgai, barking deer, gazelle, wild pig and mongoose. The non- mammals were domestic fowl, Trionyx, gangeticus, Lissemyspunctata, Labeorohita, Digonoiostornapuichella. The faunal sample examined showed a clear evidence for bone tool manufacturing centre.

Harappans established a full fledgedProsprons culture in their society which was full with art, architecture, painting etc. If we focus our mind in their art marking virtues, we will

study describe their contemporary society culture. Here is discussion of some cultu informations which we have noticed from their depictions on seals, drawing and figurine



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Regional Archaeology and it's different Paradigm

Arti Chowdhary[*]

The territory of archaeology much extended then before. Regional archaeology, ethno archaeology is the new arising debates among the galaxy of archaeologists. Discovering regional settlement patterns is significant research and exciting, intellectually challenging work. Regional archaeology always seems to produce new and unexpected insights. It is foundational for other studies at different scales and it is or should be essential for heritage preservation. Settlement pattern studies of the type carried out by archaeologists in the Middle East, Europe and the New World have only recent begun in India. No such study however has yet been made in Whole of Haryana but some partly work has already done. During the past thirty years, settlement pattern studies have become common in archaeological researches throughout the world. G.R. Willey has played a critical role in this development he defines the term settlement pattern as the way in which man disposed his products of various over the landscape on which he lived. Settlement pattern refers to arrangement of dwellings, the nature and disposition of building pertaining to community life etc. These patterns are influenced by natural environment, level of technology of the people and interaction of social and cultural institutions (Willey, G.R. 1953:1).

Trigger said "The settlement pattern is an expression of the societal aspects of ancient cultures. The study of change in settlement falters thus becomes study of the development of social and political organization". (Trigger, B.G. 1965:2)

Let's have a look on the previous work done by many scholars. there are many tremendous studies has been done like Willey (1953) in Peru, Winter (1967-69), and Fining (1969) in North America; Flemming (1971) and Jones (1960,61) in Europe; Hester & Hobler (1969) and Trigger (1965) in North-East Africa; Adams (1965) and Wright (1969) in Mesopotarnia; Coe and Flannery (1967) and Spores (1969) in Mesoamerica; Green (1967), Kennedy (1969) in East Polynesia; Mughal (1983) in Cholistain region etc.

In India H.D. Sankalia (1960) brought about a brief report on archaeological settlement pattern. Significant studies in this field came after a gap only in the late seventies. The studies carried out are by N.

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Akhtar (1972) in Northern India, M.K. Dhavaliker and G.L. Possehl (1974, 1982, 2008), Y.M. Chitaiwala (1977, 1982) in Western India, S. Bhan (1977), M.K. Dhavaliker (1977, 1978, 1983) in Deccan, K.N. Dikshit (1979), M. Lal (1978, 1984) in Ganga-Yamuna Doab, V. Shinde (1984, 1990), V.H. Sonewane, and R.N. Mehta (1985) in Gujarat, M.L.K. Murty (1989) in the Lower Godavari, Krishana etc. river basin, D. Raju (1985, 1990) in the Lower Krishana Valley, R. Ray (1987) in Eastern India and Venkatasubbaiah (1992) in the Pennar Basin; V. Pawar (2013) in Hanumangarh District (Rajasthan); R.C. Thakran (2000) in the Sonipat, S. Malik (2006) in Hansi, N. Parmar (2008, 2013) in the Bhiwani and Appu (2009) in Julana Block all in Haryana state.

There are two school of thoughts in settlement archaeology is developed, In one school, regards as old school of thought. Settlement has a purely locator connotation of artefacts and tangible remains in localities showing evidence of domestic activity. The other school called the new School-defines settlements archaeology as a study of social relationships using archaeological data and not as an analysis of archaeological settlement of site. Although everyone agrees that an analysis of settlement archaeology is a crucial category for the understanding human behaviour. There are multifarious approaches to the study itself Trigger suggested that settlement should be studied at three levels viz. Individual building, Settlement layout which is equivalent to community layout, Settlement distribution or the spatial relationships between different communities of a zone scale (A, Trigger 1967:151) The different factors to be studied in an analysis of settlement pattern have been summarized by Tringham, Ruth (1972:18) which are Location of the settlements and their relation to the ecology, the natural resources and system of communication. Density and distribution of the settlements, Distribution of specialized activity loci-burial sites, butchering sites etc.

A very important method of study of archaeological site is through geological analysis. It was first introduced by Butzer who classified the site on their location in different geological deposits like Alluvium. Aeolian, Lacustrine etc. (Ray 1987:9-10) He observes that through study of the archaeological sites as geological classified method it is possible for an archaeologist to reconstruct the local habitat or setting of a site with respect to terrain feature. water resources, ground water resources, and possibilities of flooding.

Reconstruct the regional environment.

Establish a local stratigraphy that may be integrated into the chronology of a wider area.

If we took Haryana as a case study then no such study however has yet made in the Haryana Because of the lack of horizontal excavations (except Banawali) and intensive explorations of limited areas we do not have a clear picture of the patterns of distribution, density and spacing of settlements in the different cultural periods and the role of ecological factors in shaping these aspects of the cultures. In this chapter Trigger 's third level of settlement pattern studies i.e. Zonal pattern has been studied as well as taking help of other studies (Lal 1984, Thakran 1983, Possehl 1982, etc.) either in the same region or period.

The present work is primarily based on the available archaeological data; substantial help has been taken from Ethnography and Geography. Data gathered in the exploration have been used to reconstruct the settlement pattern through wherever relevant and useful.

There were several limitations to the reconstruction of the settlement pattern in the area of present study. First of all one of the most problem is that it is rather difficult to say that the total number of sites discovered are exactly the same that were occupied during this period. Yet another problem lies in the categorization of the settlements. Various scholars have adopted different parameters for denoting the village sites, town sites and city sites. Even in determining the hierarchy of settlements, scholars have their own set of determinants.

The size of sites during different cultural periods has been decided on the basis of pottery. It is also difficult to determine whether a site was temporarily or permanently occupied or the whole site was occupied in a given period or only small portion was occupied.

There is yet another problem, however with data from the surface of a site besides the spatial distribution of materials. This problem relates to the content of a surface collection. There are two major aspects of this problem. The first is whether there is an item-to-item correspondence between surface and subsurface artefacts inventories. That is does a surface collection include all classes of artefacts that are represented in the site as a whole? The second aspect of the problem is whether there is an identity in the relative frequencies of items in artefact classes that occur on and below the surface.

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Living in the Hinterland: Survey and Excavations at Masudpur 2018-2019

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Introduction: Archaeological settlement sites that lie in the vicinity of the modern village of Masudpur, Hissar District, Haryana, were first recorded by D. Singh and C. Singh of the Department of Archaeology and Museums Haryana[1], and subsequently reported by Joshi et al.[2]. The precise location of these sites is not known, however. A reconnaissance survey by the Land, Water and Settlement project (http://www.arch.cam.ac.uk/rivers/) in 2008 visited the site now known as Masudpur I, which is situated to the north-north-east of Masudpur village (Fig. 01 & 02 [A & B])[3]. This mound was selected for detailed surface survey and preliminary excavations in 2009[4], and was revisited in 2009 and 2014 during the Rakhigarhi Hinterland Surveys[5].

Again under the direction of R.N. Singh and C.A. Petrie, but this time under the auspices of the *Two Rains* project[A], a collaborative team from Banaras Hindu University (BHU) and the University of Cambridge has now carried out further regional survey around Masudpur, and a second major season of horizontal excavation at the site of Masudpur I. This work was carried out with the permission and support of the Archaeological Survey of India (F.No.1/26/2/2008-EE) and was conducted between January 19th and February 24th 2018. The following preliminary report presents an overview of the results of this season of survey and excavation.

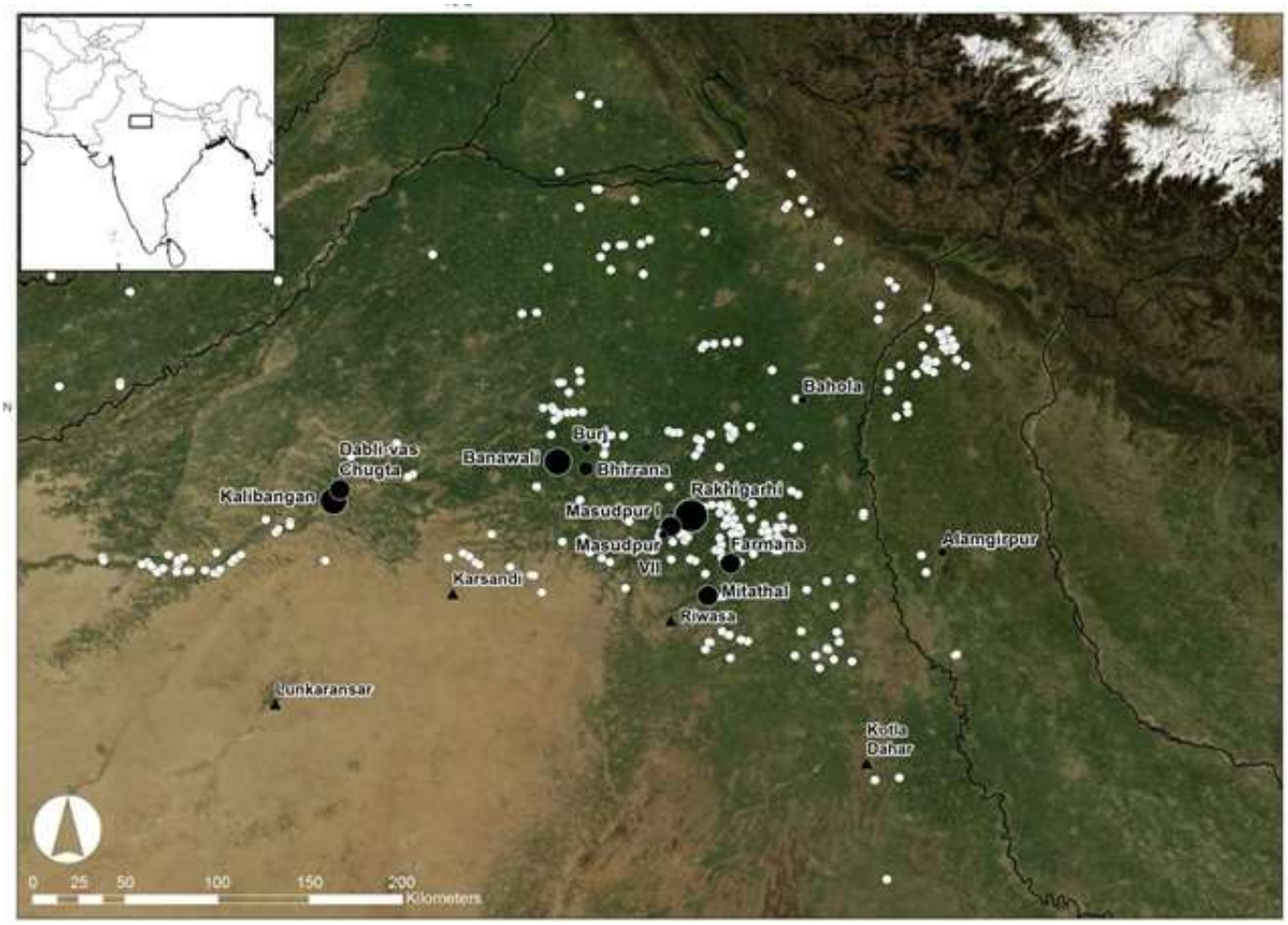


Fig. No. 1. Location of Masudpur I in relation to other major Indus sites in northwest India

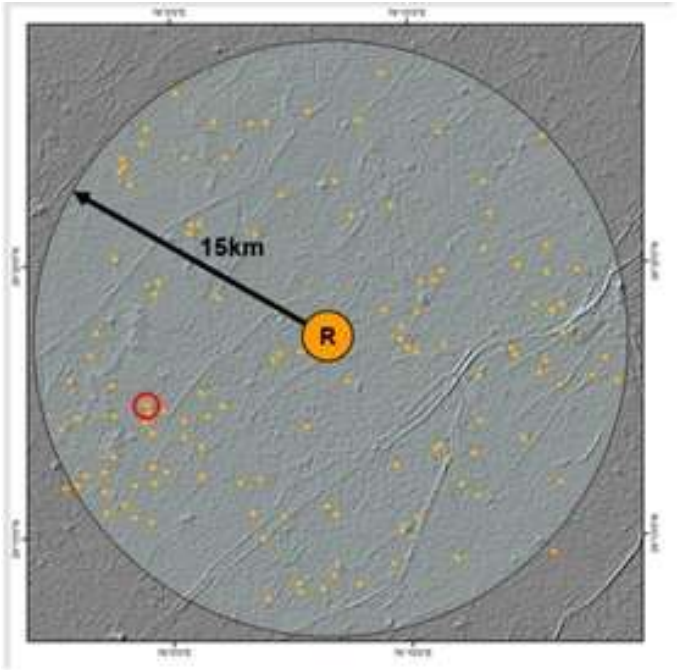


Fig. No. 2 (A): Location of Masudpur I (circled and in red at left, and in red at right) in relation to Rakhigarhi (R) and other settlements to the SW of the urban site

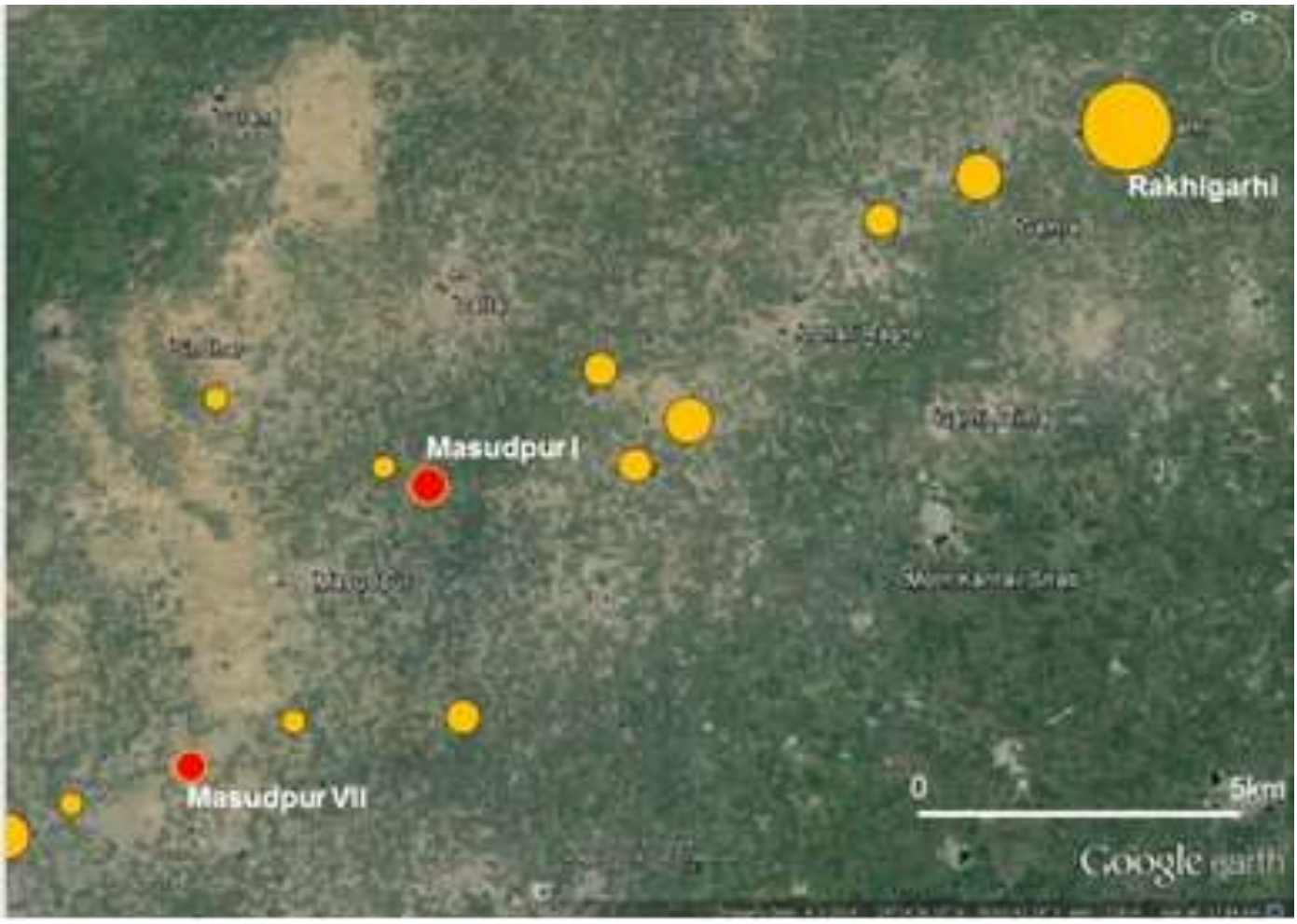


Fig. No. 2 (B): The location of Masudpur VII and modern villages are also indicated

Previous research at Masudpur I in 2009, and subsequent findings: The archaeological mound now referred to as Masudpur I is known locally as Sampolia Khera (Fig. 2), and was visited during the survey conducted by members of the Land, Water and Settlement Project in March/April 2008[6]. At that time it was selected for further investigation as the material recovered from the surface indicated that the site was occupied during the Mature and Late Harappan phases[7]. The Land, Water and Settlement project was a multidisciplinary endeavour co-directed by R.N. Singh from Banaras Hindu University (BHU) and C.A. Petrie from the University of Cambridge that also involved scholars from several other Indian and UK institutions, and investigated the relationships between archaeology, geography, landscape and climate in northwest India. The archaeological component of the Land, Water and Settlement project was primarily focused on establishing the relationship between archaeological sites and their geographical and landscape context in two primary zones: the area northeast and east of New Delhi in western UP; and the central Haryana Plains, between Hisar and Karnal. The preliminary survey around the village of Masudpur and the excavations at the mound sites of Masudpur I (Sampolia Khera) and Masudpur VII (Bhimwada Jodha), which will now be described briefly,

were designed to satisfy a range of project aims, most specifically to collect cultural material in association with archaebotanical and archaeozoological material that would be suitable for a range of archaeological science based analyses.

Exploration of the hinterland of Masudpur I in 2009: The initial survey of the area around Masudpur village by Singh and Singh recorded the existence of four mounds, and these have typically been listed as Masudpur I, II, III and IV and given one geographic location[8], although this location has varied in different reproductions of the site location data[9] (E76° 00', N29° 14' - Ref- Joshi *et al*. 1984; or E75° 58' 12", N29° 12' 47"). The area around Masudpur village does not appear to have been revisited by archaeologists for the purpose of survey until the reconnaissance carried out by the *Land, Water and Settlement* project in 2008[10]. During the 2008 reconnaissance, an attempt was made to identify the four mound sites that had previously been visited, and this was followed up further during additional survey in 2009. The initial four mounds could not be clearly identified, but the 2009 survey identified a total of 13 mounds in the vicinity of Masudpur village, and many of these appear to have been occupied during the periods proposed for the previously identified mounds[11]. It was thus impossible to be precise about which mounds corresponded to those that had been previously identified, so it was decided to re-number the mounds as MSD I–XIII and assign specific geographical co-ordinates to each mound. The one geographical location that was previously given for the Masudpur sites corresponds most closely with the location of a mound known as Mamanwala, which is referred to now as Masudpur V[12].
It is worth reiterating that the surveys undertaken by the *Land, Water and Settlement Project* in 2008, 2009, 2010 and 2014 showed that many of the unprotected Harappan period sites in Haryana have been flattened and/or destroyed by buildings and farming activities[13]. In particular, the 2009 reconnaissance around Masudpur village showed that agricultural/ploughing activities and road building have flattened most of the sites close by, and all mounds have been at least partially reshaped and truncated by ploughing[14].

We noted in 2009 that all of the sites in the vicinity of Masudpur lie between 12 and 16 kms of the urban site of Rakhigarhi (E 76° 06.715', N 29° 17.365'), and are all thus likely to have been situated in its hinterland[15]. We also argued that it is highly likely that there lay within Rakhigarhi's socio-economic and political catchment during the Mature Harappan period, when it was occupied to its greatest extent[16].

Surface survey and excavations in 2009: In addition to the 2009 survey that located the thirteen proto-historic and historic period mound sites, excavations were carried out at Masudpur I (Sampolia Khera) and Masudpur VII (Bhimwada Jodha). During the excavations in April-May 2009, members of the *Land, Water and Settlement* project carried out topographic mapping and

preliminary excavations at both sites (Fig. 3)[17]. The systematic surface mapping of Masudpur I demonstrated that most of the mound has been levelled for agriculture, and this form of disturbance produces what has now been described as a low terraced mound (Fig. 3).

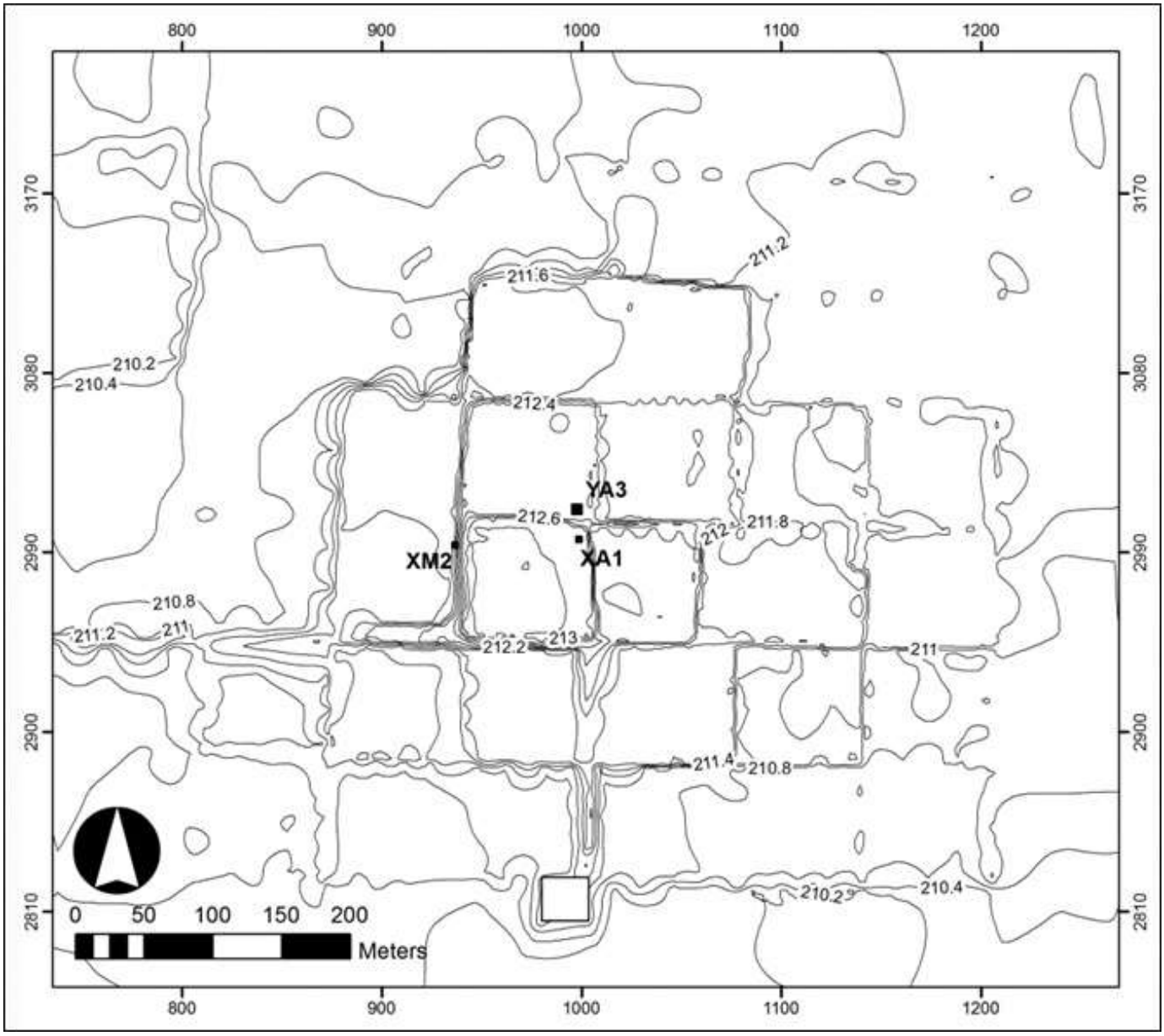


Fig. No. 03. Digital elevation model of Masudpur I based on surface mapping carried out in 2009. Location of Trench XK2 excavated in 2018 is also shown as a blue square (plan produced by C.A. Petrie)

The topographic survey showed that some areas of Masudpur I rise to a height of 3 m above the plain, and in total it covers an area of approximately 6 hectares, suggesting that it was a large village during the proto-historic period. However, as the entire mound has been levelled to some extent to produce fields, large areas that now appear to be 'mound' are the product of a range of cut and fill operations, which have increased the distribution of cultural artefacts beyond the extents of the original mound. During the detailed topographic survey of the site, trenches were

laid out in three areas, labeled XA1, YA3 and XM2 (Fig.3), and it will be useful to briefly reiterate the original findings[18].

Trench MSD I/XA1: was sited to reveal a complete sequence of the occupation on the mound. A total of 38 separate stratified deposits were delineated, comprising what appears to be 9 individual stratified phases of occupation. The lower phases of the trench appear to be characterized by locally made *Early-Mature Harappan* ceramics. These are overlain by deposits containing *Mature Harappan* and then *Late Harappan* ceramics[19].

Trench MSD I/YA3: was placed in the field adjacent to XA1, and total of 9 separate stratified deposits were delineated, comprising what appears to be 4 individual stratified phases of occupation. The lower phases of the trench were characterized by locally made *Mature Harappan* ceramics, overlain by a deposit containing a mix of *Mature* and *Late Harappan* material[20].

Trench MSD I/XM2: was placed in an area on the western side of the mound exposed by field levelling, where section cleaning had shown the remains of a mudbrick structure. A total of 24 separate stratified deposits were delineated, comprising up to 10 individual stratified phases of occupation. The lower phases of the trench appear to be characterized by *Mature Harappan* ceramics, which were overlain by deposits characterized by *Mature* and then *Late Harappan* ceramics[21].

The absolute height of the natural sand at the base of each trench is variable, suggesting that the site was established on an irregular surface that was not entirely flat and that the site was either established on naturally raised ground, or that the area around the mound has been deliberately lowered in recent years.

Subsequent to the excavation fieldwork, a range of post-excavation analyses have been carried out on the material from Masudpur I, including detailed analysis of the geoarchaeology[22], ceramic material[23], absolute dates[24], animal bones[25], archaeobotanical remains[26], and this has been complemented by stable isotope analysis of selected bones and seeds[27].

Geoarchaeological analysis has shown that the mound appears to have been situated on an area of raised land in a braided floodplain[28]. It is notable that the absolute height of the natural sand at the base of is 0.75 m below the average height of the ground surface immediately around the mound. This either indicates that the ground surface around the mound has risen after the settlement was established, or the mound is substantially deflated[29]. Ceramic analysis has shown that the pottery vessels used at the site are distinct from material known at larger Indus sites, and bear similarities to the so-called Sothi-Siswal ceramics identified at Mitathal[30], and also seen at Farmana[31]. The absolute dates obtained from a range of crop seeds including wheat, pulses, millet and rice demonstrate that the site was occupied during the Mature and Late Harappan periods,

but also that all of these economic species were being exploited during the Indus urban period at this site[32]. The dates for occupation at the site demonstrated that the site was also occupied before, during and after the dramatic weakening of the Indian Summer Monsoon at around 4.2-4.1 ka BP/2200-2100 BP, which has been documented in Lake Kotla Dahar[33]. As such, Masudpur I was selected for further investigation by the Two Rains project, which is investigating the relationship between humans and their environment in the face of climate change – investigating the core question "Does climate change cause collapse?" in the Indus context.

Survey and Excavations in 2018

Open area excavations: The 2018 season of excavations was carried out in January and Februaryand focussed on XK2 (Fig. 3), which was adjacent to the XM2 sounding that was excavaed in 2009. As noted above, Trench XM2 had revealed evidence for well-preserved mud-brick architecture and associated occupation deposits dating to the final phases of the Indus urban period, and it was recognised that this period was ideal for investigating the research questions of the *TwoRains* project.

MSD XK2

Trench XK2 was laid out immediately adjacent to the track that runs north-south across the mound (Fig. 3). This area was under cultivation at the time of the excavations, but it was selected as the ideal location for open-area excavations, aimed at exposing household structures and working areas relating to the different periods of occupation at the settlement.

Excavations and documentation were carried out over five weeks between 19/01/2018 – 24/02/2018, and the excavations were conducted across an area of 10 x 10 m (Fig. 4). Single context recording methods were used throughout to document the deposits. A total of 126 distinct stratigraphic contexts were exposed, relating to at least four phases of occupation – which span both the *Mature Harappan* and *Late Harappan* periods. These exposures included a small sounding into the southeast corner of the trench (Figs 6-7). The deposits revealed include structural remains, a number of distinct activity areas including areas for storage and what appears to be food preparation (Figs 4-6). It is notable that a number of pit features were exposed, which appear to date to the *Mature Harappan* and *Late Harappan* phases, and typically contained an abundance of ceramic material and organic material, which should help with absolute dating.

Fig. No. 04: Photo showing excavated area of Trench XK2, looking east (photograph C.A. Petrie)

Fig. No. 05: Photo showing excavated area of Trench XK2, looking south (photograph C.A. Petrie)

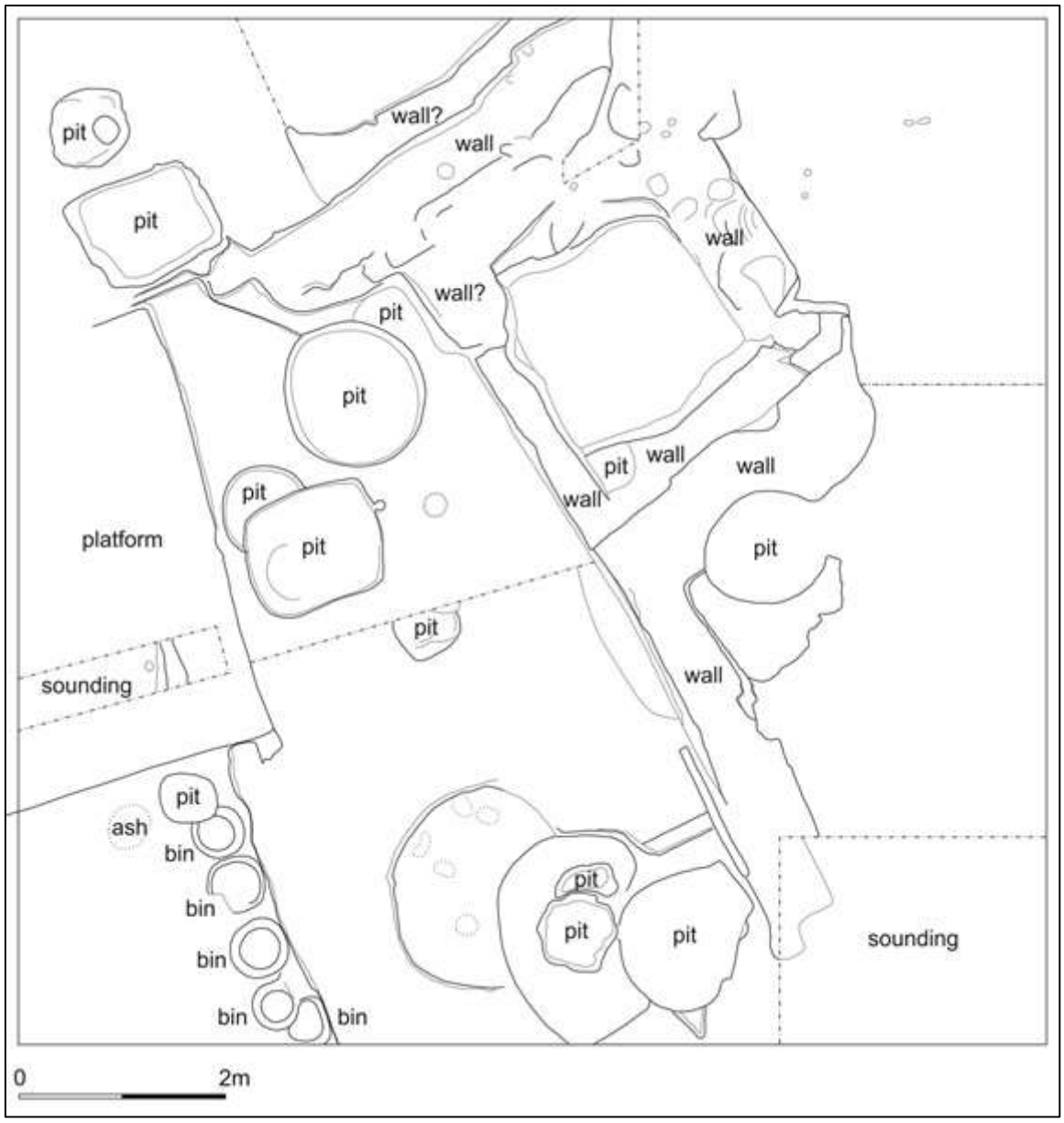


Fig. No. 06: Architecture exposed in Trench XK2 (plan C.A. Petrie)

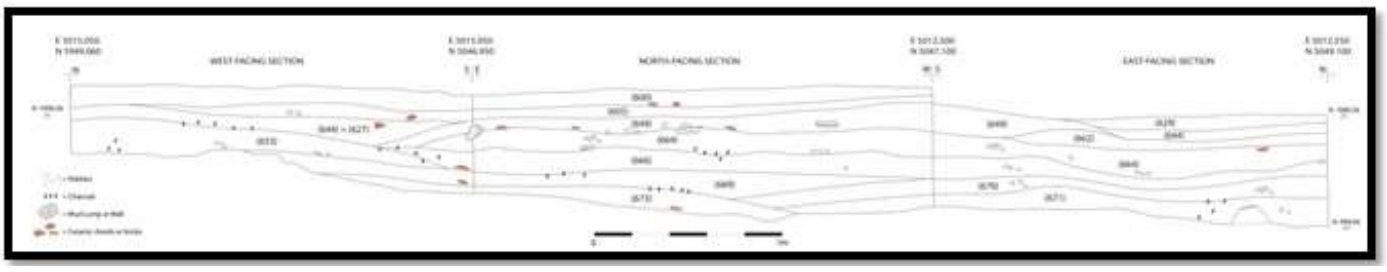


Fig. No. 07: Sections of the sounding excavated into the southeast corner of Trench XK2 (drawing A. Ceccarelli)

The excavated deposits were systematically sieved and/or hand-sorted, resulting in the recovery of 34,000+ pottery sherd fragments, weighing 653 kg, and 405 small find antiquities. The ceramic material was processed in the field, and registration and drawing was subsequently carried out at

Banaras Hindu University. Analysis of technological and compositional characteristics from selected samples is currently in process.

Animal bones and samples for flotation and phytolith analysis were systematically collected. Flotation was carried out using a recycled flotation system with a pump that prevented excessive water usage, and in general 100 litres were collected from every sampled deposit. Also, 100% of the soil collected from pits was floated, including pits ranging size from 20cm in diameter to over one meter, hence material collected ranged between 4 and 250l. A total of 72 samples, and ~7000 litres of soil was floated overall. Flotation samples were dried in a well-aired and shady area in order to prevent any shattering or degradation due to quick drying. Heavy residues were bagged and transported to BHU for storage and further analysis in order to see if there remains any wood charcoal that was not recovered by flotation process. Non-floating charcoals and seeds can be common in areas where mineral inclusion or waterlogging is high. Phytolith samples were collected from structural remains and several floor surfaces to investigate variation in the distribution of phytoliths in different features and areas. Animal bones will be analysed at BHU at a future date.

An additional sounding was excavated in January/February 2019 in order to check the extend of occupation and its preservation in a small area of the site adjacent to an access road (Fig. 8). This sounding identified occupation deposits similar to those identified in other areas of the mound.

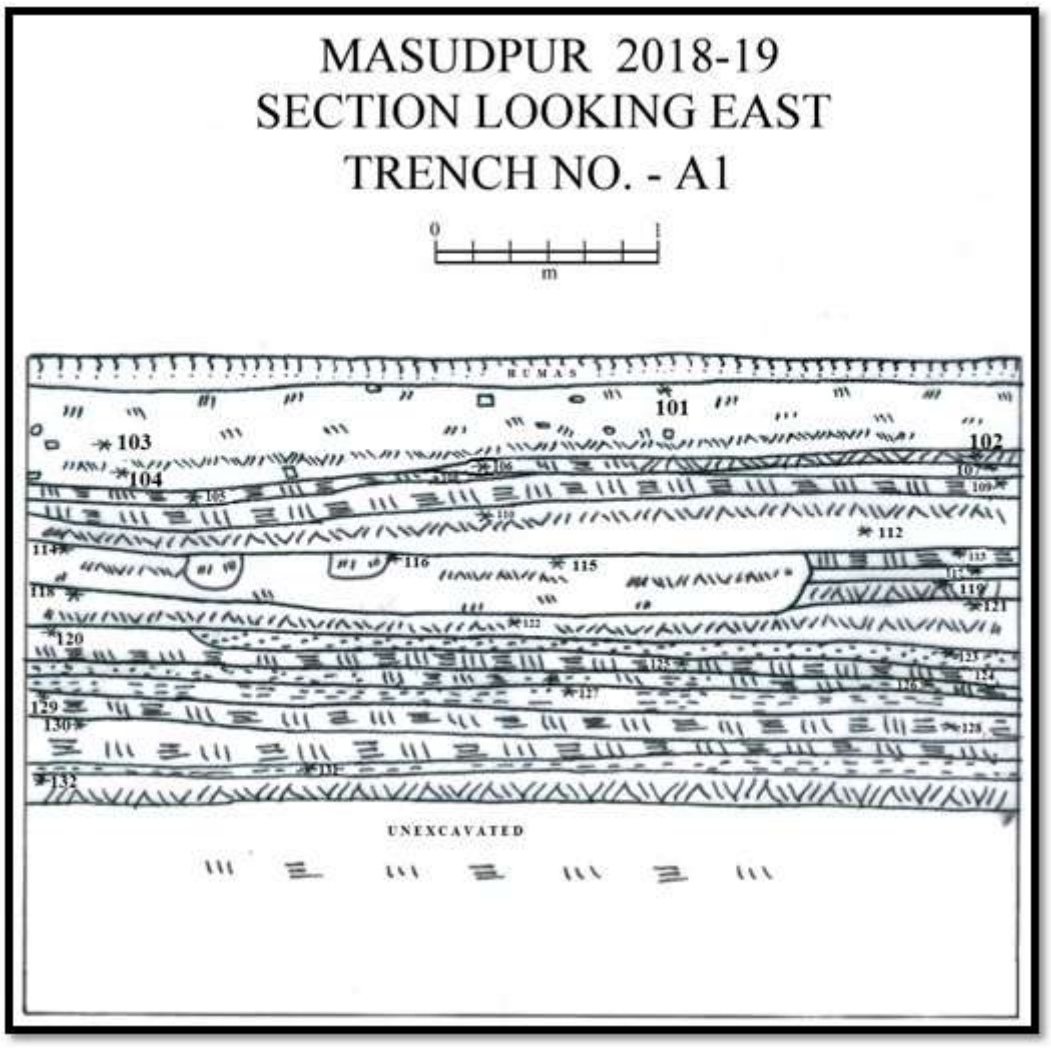


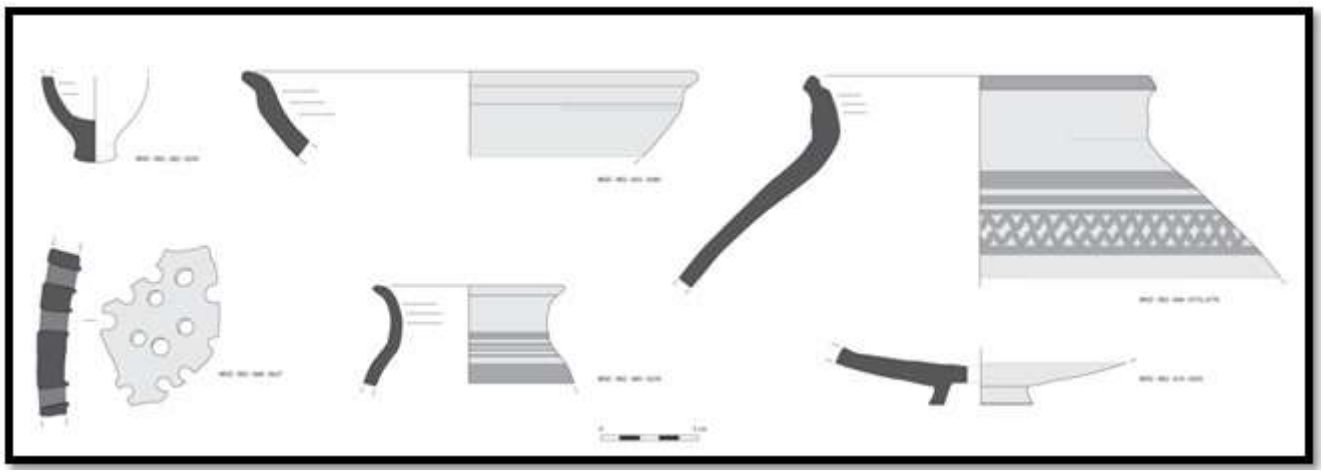
Fig. No. 08: Sections of the sounding excavated into the southeast corner of Trench XK2 (drawing A. K. Pandey)

Work in the hinterland of Masudpur I: In addition to the work on-site, a coring survey was carried out around Masudpur I to identify sub-surface features. This involved the investigation of variation in the surrounding sub-surface landscape across a roughly 4km^2 area around the mound, which was cored with transects extending 750m-1km in each. Each core's sedimentological sequence was fully described with attention paid to the colour, composition, and humidity of units; any inclusions found within a unit; and, depth and nature of transitions between sedimentological units. The sampling strategy allowed for initial mapping of various sub-surface palaeo-environments, which was used for the identification of locations for high-resolution sampling and OSL dating. Specific areas for high-resolution sampling were identified and investigated in slot trenches excavated with a JCB. A significant number of flooded and ponded deposits, but there was no clear evidence for any sort of developed bank environments. A range of channel deposits, related to mid-Holocene and older channel beds that appear to have had varying intensity of water flow.

As with the 2017 season, more wide-ranging settlement survey was also carried out to ascertain and identify the correct locations for previously identified archaeological sites, establish whether features visible on historic maps and remote sensing imagery are actually archaeological sites, and ascertain the degree of archaeological site preservation in the greater region. This second phase of survey was carried out by assessing a database of thousands of previously reported or potential sites, and investigating locations within a regional grid of 100 square kilometer hexagons, which was projected over the project study region. The survey re-visited and re-documented previously recorded site locations in each of the sampled regional grid units, updating and confirming the location of at least 32 previously reported sites. A total of 511 locations were visited, but the previously reported archaeological sites were either not present, or the feature visible in the historic maps was not an archaeological site. However, 148 sites were visited, and up to 116 of these appear to have been previously unrecorded.

Cultural Material: A wide range of cultural material was recovered from the new excavations at Masudpur I, and although the analysis of this material is ongoing, in general it reinforces our knowledge from the initial season of excavation in 2009. As before, the most common material recovered was fragments of fired ceramic vessels, and the ceramic material has clear parallels with material from the previous excavations at Masudpur I (Mature and Late Harappan; Figs 8-9), and also Masudpur VII and Farmana.

Fig. No. 09: A



B

Fig. No. 09 (A & B): 'Local' style Mature Harappan pottery from Masudpur I (photograph A. Ceccarelli)

The small-find artefacts from the excavations included a range of material types, including large numbers of ceramic and faience bangle fragments (including segmented and painted examples), fragments of several different types of ceramic figurines and toy carts, beads of various types, including examples made from steatite and agate, as well as what appear to be fragments of vitrified slag and crucible fragments. The latter in particular suggest that metal working was being carried out at the site, which is a new finding.

Discussion: The new season of excavations at Masudpur I focused on recovering well stratified cultural material, carbonized organic remains for new radiocarbon assay, samples for phytolith and soil micromorphological analysis, and samples for flotation to collect macro-botanical remains. A multi strand analysis of this material is currently underway, and this will allow for a refined interpretation of site date range, use and function than is currently available. It will also be possible to carry out a focused spatial analysis of activities across several areas of the site, to identify different types of behaviour.

The survey of the sub-surface landscape around the site has revealed important new insights into landscape formation and change, and the expanded survey of sites in the area to the north and west of the site has produced important new insights into the nature of environmental and landscape variability in this part of Haryana.

Notes:

[A] This collaborative project is funded by the European Research Council (ERC) and the UK India Education and Research Initiative (UKIERI) – Department of Science and Technology (DST) joint funding programme. The fieldwork undertaken by this project is possible thanks to the help and assistance of a large number of individuals, and the directors of the project would like to thank Dr Rakesh Tewari and Director Generals, Archaeological Survey of India, Government of India for granting us permission to carry out this field research. We have been given abundant support by the head of Department of AIHC and Archaeology, BHU.

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CONTENTS

Living in the Hinterland: Survey and Excavations at Lohari Ragho 2015-2017

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The archaeological investigations have identified archaeological settlement sites near the village of Lohari Ragho. Sites were first recorded by D. Singh and C. Singh of the Department of Archaeology and Museums Haryana (*IAR* 1980-81: 16), and subsequent surveys were undertaken by T. Garge (2006: 43-49), before the most recent surveys by the *Land, Water and Settlement* project (Singh *et al.* 2010a: 37-53). The site referred to here as Lohari Ragho I was first recorded in the 2009 and 2014 seasons of the *Rakhigarhi Hinterland Survey*, which was carried out by *Land, Water and Settlement* Project researchers under the direction of R.N. Singh and C.A. Petrie (Singh *et al.* 2010a: 37-53).

Singh and Singh had located two Late Harappan sites near Lohari Ragho, but did not specify their location nor their direction from the modern town (*IAR* 1980-81: 16). Garge (2006: 43-49; Nath *et al.* 2014) recorded three sites (LR 1: Early Harappan, Mature Harappan and Historic; LH 2: Mature Harappan and Historic; LH 3: Early Harappan, Mature Harappan and Historic) and stipulated their location in relation to the modern village, with all three being situated to the east. Garge was not able to establish whether these were the same sites discovered by Singh and Singh, and notably there is no affinity between the periods of occupation identified at the sites found in each of these surveys, which may be a product of different approaches to the interpretation of the ceramic material.

The region around Lohari Ragho village was surveyed in 2009 and 2014 during the *Rakhigarhi Hinterland Survey*. In contrast to previous surveys, the *Rakhigarhi Hinterland Survey* and work had used a robust and repeatable approach to locating archaeological sites (Singh *et al.* 2008: 71-87, 2010a: 37-53, 2011: 88-

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106), by revisiting some sites as part of the *Two Rains* project in 2017 (Singh *et al.*, in press). The site survey data have been dated through comparison with material from known periods of occupation from local and more distant excavated assemblages from Masudpur I, Masudpur VII, Burj, Dabli vas Chugta, Bahola and Alamgirpur (Singh *et al.* 2009: 35-49, 2010b: 94-101, 2012a: 133-147, 2012b: 5-11, 2013a: 32-54, 2013b: 27-37, *IAR* 2008-09: 55-71; Petrie *et al.* 2009: 38-49, 2017: 1-30), and material from other sites in the region. No sites with periods of occupation corresponding to those observed by Singh and Singh were identified during the *Rakhigarhi Hinterland Survey* and it proved difficult to find all three sites identified by Garge. However, by comparing his site location descriptions it appears that only one of his mounds was re-located - Garge's Lohari Ragho III appears to be the same as RHS Lohari Ragho II. We have mistakenly referred to this mound as Lohari Ragho I in previous publications (Singh *et al.* 2016: 44-52, 2017: 158-163), but as published in Singh *et al.* (2010a: 37-53), this site should henceforth be referred to as Lohari Ragho II. The spatial extent of the Rakhigarhi Hinterland Survey was significantly greater than that of the previous surveys, and this led to the identification of an additional settlement site in the area to the south-west of the modern village, which was labelled Lohari Ragho I (Singh *et al.* 2010a: 37-53). We have also mistakenly referred to this mound as Lohari Ragho II in previous publications (Singh *et al.* 2016: 44-52, 2017: 158-163), but as published in Singh *et al.* (2010a: 37-53), this site should henceforth be referred to as Lohari Ragho I. These naming conventions should be followed for all future publications.

When Lohari Ragho I was visited by the *Land, Water and Settlement* team in 2009, it showed evidence for Early, Mature and Late Harappan occupation on the surface. In March/April 2014, the *Land, Water and Settlement* project revisited all of the sites recorded in the Rakhigarhi Hinterland Survey in 2009. Unlike many of the settlement sites in the survey area, the site of Lohari Ragho I showed no signs of recent damage and disturbance, and it appeared to be the best-preserved Indus period settlement site in the hinterland of the major urban centre of Rakhigarhi. It was thus ideal for further investigation in order to understand the relationship between villages, towns and cities during the rise, floruit and decline of the nearby urban centre of Rakhigarhi (Fig. 1a and b).

Fig. 1a and b: Location of Lohari Ragho I (circled and in red) in relation to Rakhigarhi (R) and other settlements to the SW of the urban site. The location of modern villages is also indicated

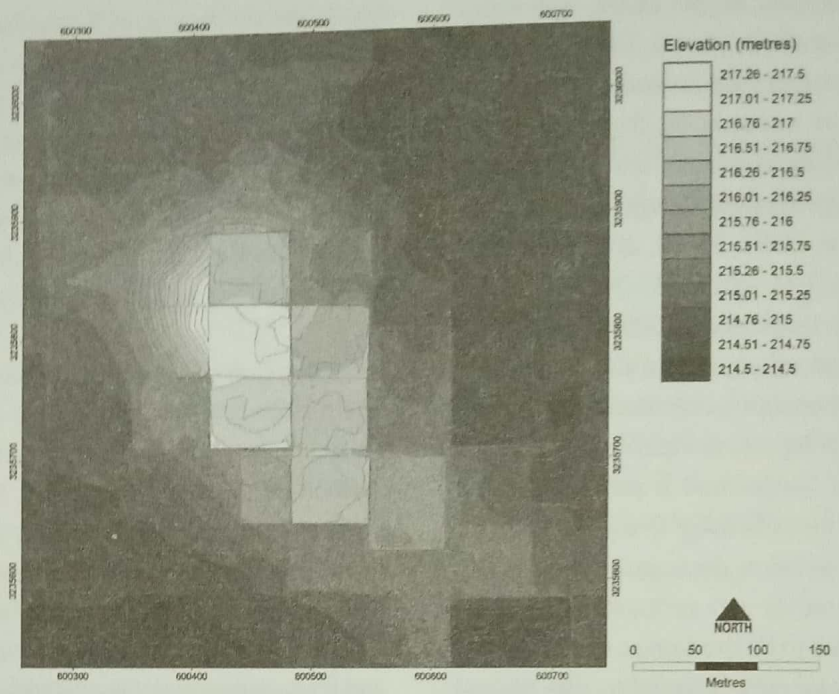

Fig. 2: Digital elevation model of Lohari Ragho I based on surface mapping carried out in 2015

This report reviews three seasons of work at Lohari Ragho I (March-April 2015, March 2017, September-October 2017). The initial season set out to:

- carry out detailed surface mapping of the site (Fig. 2),
- initiate the systematic analysis of the distribution of cultural material on the surface of the site using a stratified surface collection strategy that involved collection from 2 m diameter circles around points on a 20 x 20 m site, and
- conduct preliminary excavations to assess the quality and level of preservation of the archaeological deposits.

The second season focussed on:

- excavating soundings in different locations on the site to identify areas of good preservation that would benefit from larger scale horizontal exposure.

The third season focussed on:

- conducting horizontal excavations aiming to reveal structural remains and their associated occupation deposits, which will enable the characterisation of lifeways during the Mature Harappan period.

Survey and Excavations in 2015

Detailed surface mapping

Starting on March 17th, 2015, a topographic survey of the Lohari Ragho I mound was undertaken using a Leica Systems 1200 Differential GPS sensor (DGPS), which is capable of with sub-centimetre accuracy that is more than sufficient for most archaeological applications. In total, a 650 x 550 m area was surveyed, which enabled the production of a digital elevation model (DEM) of the settlement and the landscape in the neighbouring area (Fig. 2).

The DEM demonstrated that substantial parts of the mound site have been levelled for agriculture, creating a terraced mound (flattened areas in Fig. 2). It also confirmed that there are significant areas of the

site that appear to be relatively undisturbed by modern cultivation, particularly the areas at the north and west of the site (areas showing natural slope in Fig. 2). In fact, in these particular areas, some of the natural topography is preserved, with damage being limited to ploughing of the modern ground surface.

Overall, the mound rises to a height of approximately 2.5-3 m above the surrounding plain. The deposit area is approximately 8.6 hectares in extent, and appears to be situated at the distal end of an area of raised land, which is perhaps a relic rise within a braided floodplain. This landscape context suggests that Lohari Ragho I sits in a broadly similar context to a number of other sites in the area including Masupur I (Petrie *et al.* 2009: 38-49; Neogi *et al.* in press).

Systematic surface survey

In conjunction with the topographic survey of the mound, a systematic surface collection was also carried out, which utilised the DGPS to lay out a site grid of 20 x 20 m squares marked with labelled 1 m high bamboo poles. With the assistance of students from MD University Rohtak, a systematic collection of cultural material from within 2 m diameter circles around each point on the 20 x 20 m site grid was undertaken. In total, the grid covered an area of 440 x 440 m, and included 23 grid lines in both N-S and E-W directions.

Through this method it was possible to plot the distribution of different categories of cultural material across the surface of the site both spatially and chronologically. Similar approaches have been used to good effect in the investigation of the surface of Indus settlements during the Beas Landscape and Settlement Survey, particularly the site of Vainiwal (Wright *et al.* 2005: 327-335; Wright 2009: 127ff). Examples of the results from the surface collection, showing the

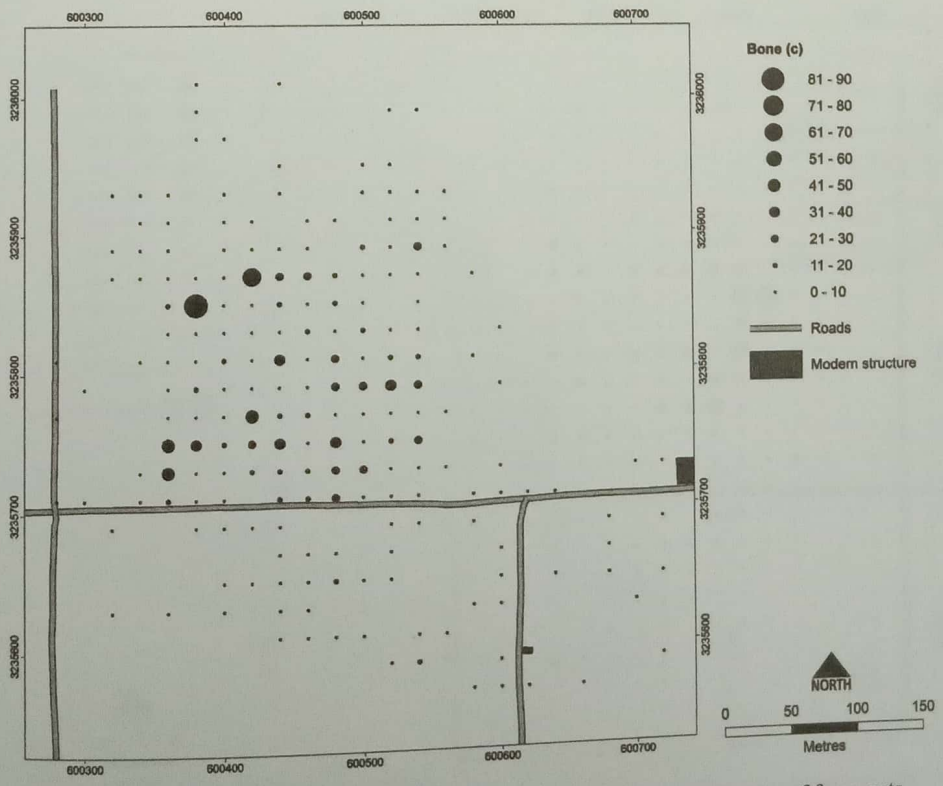

Fig. 3: Distribution of bones in the surface collection, differentiated by count of fragments

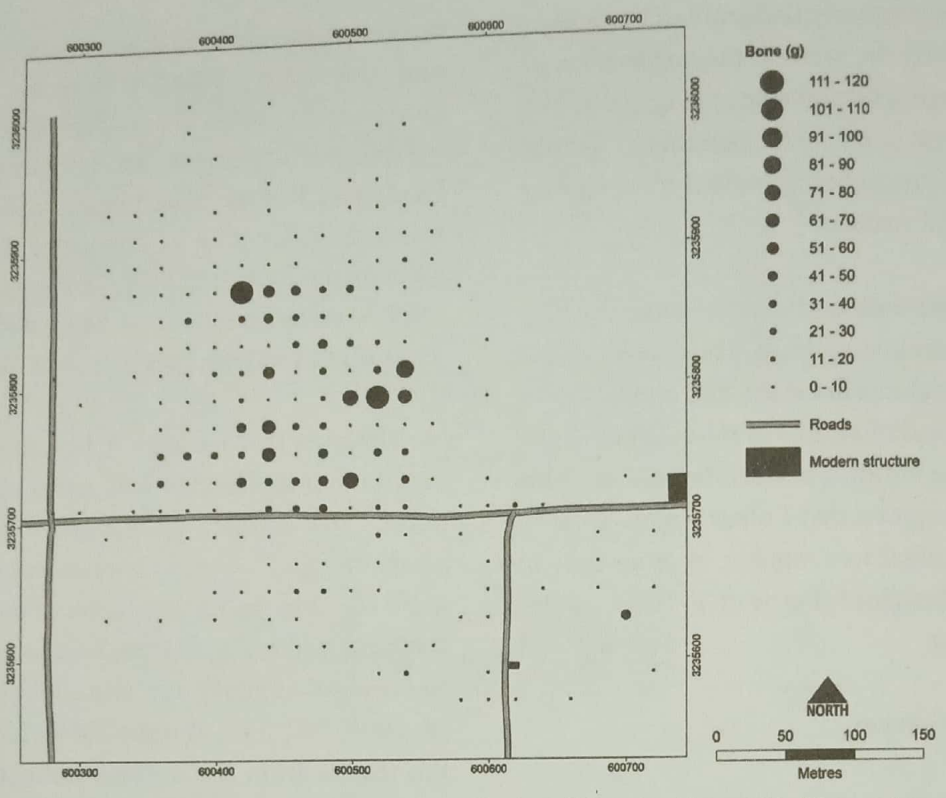

Fig. 4: Distribution of bones in the surface collection, differentiated by weight of fragments

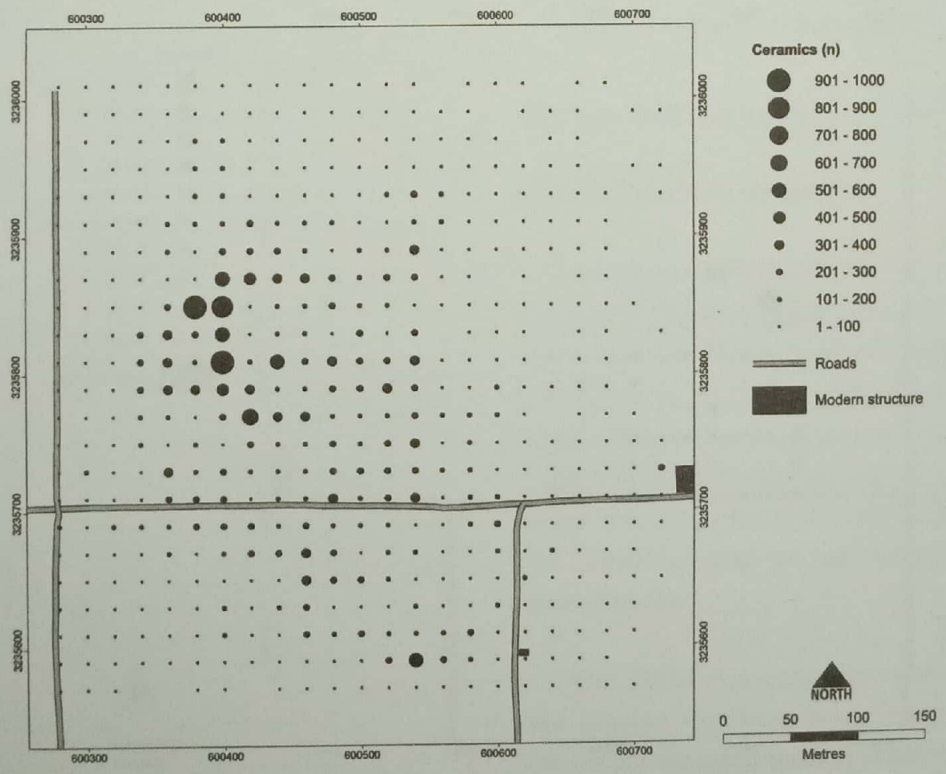

Fig. 5: Distribution of ceramics in the surface collection, differentiated by count of fragments

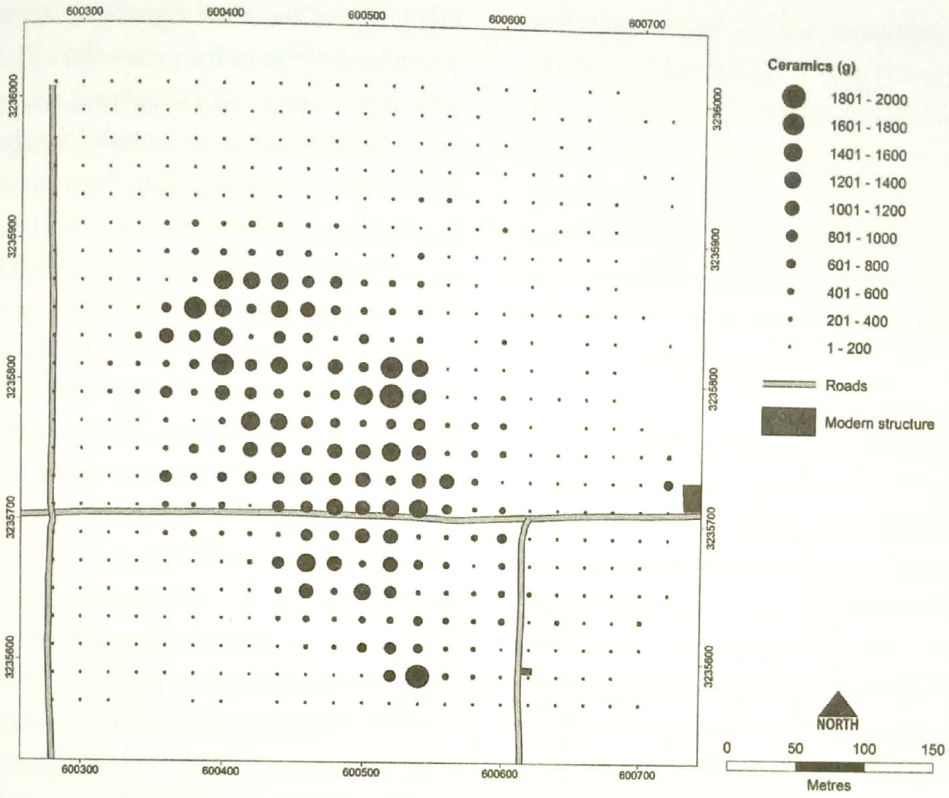

Fig. 6: Distribution of ceramics in the surface collection, differentiated by weight of fragments

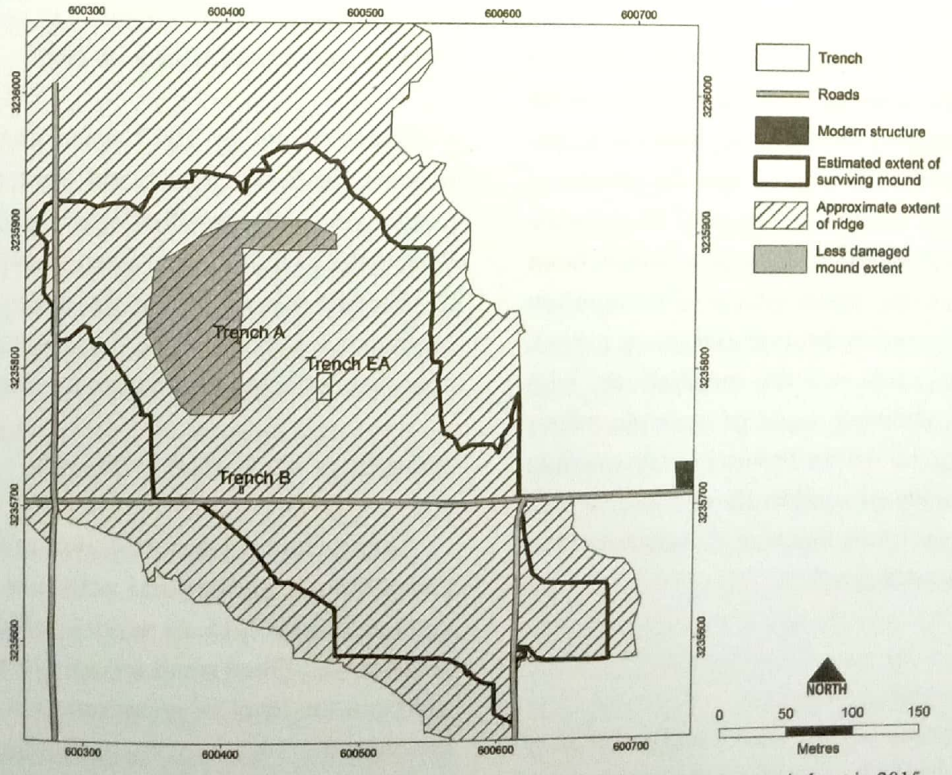

Fig. 7: Digital elevation model of Lohari Ragho I based on surface mapping carried out in 2015

distribution of bone and ceramics, by both count and weight are shown below (Figs. 3-6). The full results of this surface survey are in preparation (Redhouse *et al.* in prep).

The systematic surface survey demonstrated that Lohari Ragho I was occupied in the Early, Mature and Late Harappan periods, as well as in the Early Historic period.

Preliminary excavations

In conjunction with the systematic surface mapping and collection, preliminary excavations were carried out in two areas to assess the quality and level of preservation of the archaeological deposits: a 2 x 2 m sounding excavated at the high point in the NW quadrant of the mound (Trench A), and a 5 x 2 m sounding adjacent to a standing section (Trench B) (Fig. 7).

LHR Trench A

This small 2x2 m sounding was excavated to establish the level of preservation in the NW part of the site, which appears to be undisturbed by ploughing, and also to ascertain the distribution of specific phases of occupation at the site (Plate 1). A total of 28 separate contexts were excavated, and these appear to have been primarily related to one major phase of occupation dating to the Early or early Mature Harappan period. The excavations revealed two fire installations, with the larger of these showing signs of multiple stages of rebuilding (Plate 1). These features were overlain by substantial deposits of mud-brick collapse, which suggests that this part of the site was abandoned rather than destroyed in a conflagration.

Discussion

The surface mapping, surface survey and preliminary excavations at Lohari Ragho I in 2015 demonstrated that this is one of the most significant settlement sites in the hinterland of the Indus urban site of Rakhigarhi, both in terms of its size and its cultural sequence, and also on the basis of the artefact material that has been recovered from its surface. The ceramic material recovered from the surface collection and the limited excavations demonstrated that the site was inhabited during the Early, Mature and Late Harappan periods, and also the Early Historic period. Given the paucity of Harappan black on red-slipped pottery, there is likelihood that the majority of the ceramic vessels at the site were either produced at the site itself or close by, where evidence for ceramic production was discovered during the Rakhigarhi Hinterland Survey (MSD V) (Singh *et al.* 2010a: 37-53). As discussed below, the diversity of grinding stone fragments recovered from the surface demonstrate that the inhabitants were also connected to what might be described as mid- and long range interaction networks stretching into northern Rajasthan, the Himalayan foothills, and also as far to the west as the Sulaiman Rang.

Survey and excavations in 2017

Excavations in 2017 were carried out in two seasons, the first in March and April, and the second in September, with some final documentation in October. During the March season, three soundings were opened to identify areas suitable for open area excavation. During the September/October season, one of these areas was selected for a larger exposure.

Soundings excavated in March

Lohari Ragho I was revisited in late March 2017, and although agricultural activities at the site have continued since 2015, no major levelling appears to have taken place. Three small soundings were excavated to ascertain the level of preservation in different parts of the mound.

LHR Trench EA

A 2 x 2 m trench was opened on the highest preserved part of the site, adjacent to mud bricks visible at the edge of a field. Beneath a layer of plough soil, archaeological deposits were encountered containing Mature Harappan ceramics. Traces of a mud structure or platform were encountered at a depth of approximately 45 cm below the ground surface (Plate 2).

LHR Trench EB

A 2 x 2 m trench was opened on the eastern part of the main mound. Beneath a layer of plough soil, mixed/ disturbed archaeological deposits were encountered containing limited cultural material, and clear evidence for site levelling in the form of plastic and modern brick fragments. From 50 cm below the modern ground surface, compact deposits containing archaeological materials were encountered, but few pottery fragments were recovered. Kankar was encountered from 150 cm below the surface, and natural soil at a depth of 175 cm (Plate 3).

LHR Trench NA1

In the field to the north of Trench EA, another 2 x 2 m trench NA1 was excavated. Beneath a layer of plough soil, clearly differentiated archaeological deposits were encountered, containing ceramics, bone and brick fragments. At a depth of around 65 cm below the modern ground surface, two mud bricks walls were found (Plate 4).

Open area excavations in September/October

Following the excavation of soundings in March and April, the area around Trench EA was selected as the ideal location for open-area excavations, aimed at exposing household structures and working areas relating to the different periods of occupation at the settlement. These excavations commenced with a standard excavation approach focussed on 5 x 5 m trenches, but this was converted to an open-area excavation once structures were encountered. Single context recording methods were used throughout to document the deposits of large horizontal areas.

LHR Trench EA

Excavations and documentation were carried out over five weeks during September and October 2017. Work focussed on an area immediately adjacent to Trench EA, and although an area of 20 x 10 m was cleared, detailed excavations were only conducted across an area of 10 x 10 m (Fig. 8). A total of 97 distinct stratigraphic contexts were exposed, relating to at least three phases of occupation – which span both the Early and Mature Harappan phases. The deposits revealed include structural remains, a number of distinct activity areas, and clear evidence of structural collapse (Plates 5-7).

The excavated deposits were systematically sieved and/or hand-sorted, resulting in the recovery of 27,500+ pottery fragments, weighing 359 kg, and 242 small finds.

Animal bones and samples for flotation and phytolith analysis were systematically collected. Flotation was carried out using a recycled flotation system with a pump that prevented excessive water usage, and in general 100 litres were collected from every sampled deposit. Around 4000 litres of soil was floated overall. Phytolith samples were collected from structural remains and several floor surfaces to investigate variation in the distribution of phytoliths in different features and areas. We also recovered samples for OSL dating from the deposits immediately below the occupation layers in an area that was excavated through to the natural soil (Plate 7).

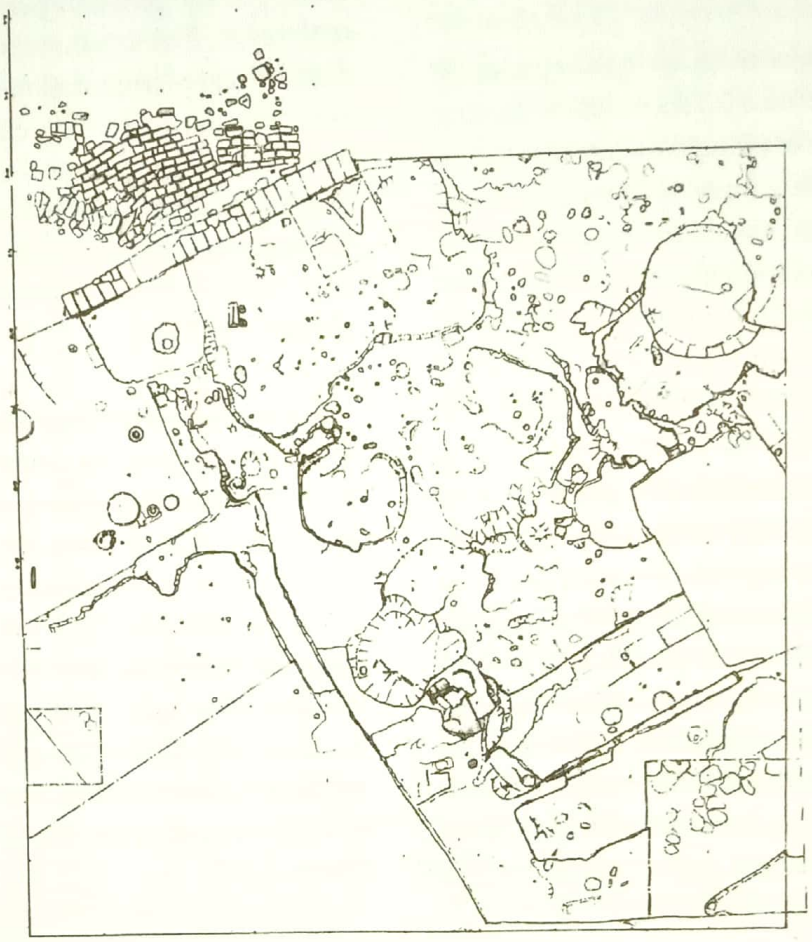

Fig. 8: Architecture exposed in Trench EA

Work in the hinterland of Lohari Ragho I

In addition to the work on-site, a coring survey was carried out in the surrounds of Lohari Ragho I to identify sub-surface features. This involved systematic coring of a 4 km^2 area around the mound, with transects extending approximately 1 km in each direction. Each core's sedimentological sequence was fully described with attention paid to the colour, composition, and humidity of units, any inclusions found within a unit, and, depth of transitions between sedimentological units. The sampling strategy allowed for initial mapping of various sub-surface palaeo-environments, which was used for the identification of locations for high-resolution sampling and OSL dating.

More wide-ranging settlement survey was also carried out to ascertain the correct locations for previously identified archaeological sites, establish whether features visible on historic maps and remote sensing imagery are actually archaeological sites, and ascertain the degree of archaeological site preservation in the greater region (Singh *et al.* in press). The survey was carried out by assessing a database of thousands of previously reported or potential sites, and investigating locations within a regional grid of 100 square km hexagons, which was projected over the project study region. The survey re-visited and re-documented previously recorded site locations in each of the sampled regional grid units, updating and confirming the location of at least 26 previously reported sites. A

total of 413 locations were visited, but the previously reported archaeological sites were either not present, or the feature visible in the historic maps was not an archaeological site. However, 88 visited locations were archaeological sites, and many of these may have been previously unreported.

The settlement survey was accompanied by a wide-ranging collection of soil samples that will be used to establish a Strontium baseline for the region around Lohari Ragho I. Sampling of modern pottery and clay was also carried out, and this will be used to support a variety of analyses, including isotope and technological analysis. In addition, sampling for palaeoclimate analysis was also carried out, including the collection of water samples from various locations, and gypsum and sediment samples from a number of palaeolakes. These samples will similarly help to provide an isotopic baseline for the region and further expand our knowledge of its paleoclimate.

Cultural Material

A range of cultural material was recovered from the surface and the excavations, and the analysis of this material is ongoing. As noted above, the ceramic material from the surface of the site ranged in date from the Early, Mature and Late Harappan periods, and also included Early Historic material. The ceramics from the excavated areas included both Early and early Mature Harappan vessel forms (Plate 8). A small number of fragments of Harappan black paint on red-slip pottery were collected from the surface and the excavations, reinforcing the impression that this particular ware is rare outside of urban centres during the Mature Harappan period. The ceramic material has clear parallels from sites in Masudpur VII, Girawad and Farmana.

Small-find artefacts collected from the surface and excavations included a range of material types, particularly grinding stone fragments and beads, with the latter including a diverse range of fired steatite examples (Plate 9). Perhaps the most interesting discovery during the surface survey and collection was the recovery of approximately 240 fragments of grinding stones, including querns, mortars, mullers, pestles, whetstones and hammer stones (Plate 10). A small number of fragments of such items were recovered during the excavations. Many of the grinding stones from the surface were preserved to such an extent that it was possible to see typological similarities to examples that have been recovered from Rakhigarhi (Nath *et al.* 2014: Plate 6). Although no formal attempt at identification has yet taken place, the stone raw material used to make these grinding stones appears to be predominantly red/pink Delhi quartzite from the Kaliana Hills. However, examples of what appear to be granite from Tosham, Pab sandstone from the Sulaiman Range in Pakistan, rounded cobbles possibly of Himalayan origin, and other stone types discussed by Law (2011: 103-123; Nath *et al.* 2014: 95-96) were also attested. Further analysis is clearly warranted.

The frequency of these grinding stones on the surface of the site suggests that intensive crop processing was being carried out at the settlement, though it is not yet possible to establish which period or periods this activity was concentrated in. Unlike the other cultural material, the distribution of these grinding stones was not particularly informative, as almost all of them were recovered from field boundaries, where they have either been deposited deliberately by farmers, or as a result of ploughing. The diversity of their geological origin is significant and appears to match that seen at Rakhigarhi, suggesting that the inhabitants of Lohari Ragho I were integrated into the same raw material acquisition networks that were open to the inhabitants of the urban centre situated 10 km to the east.

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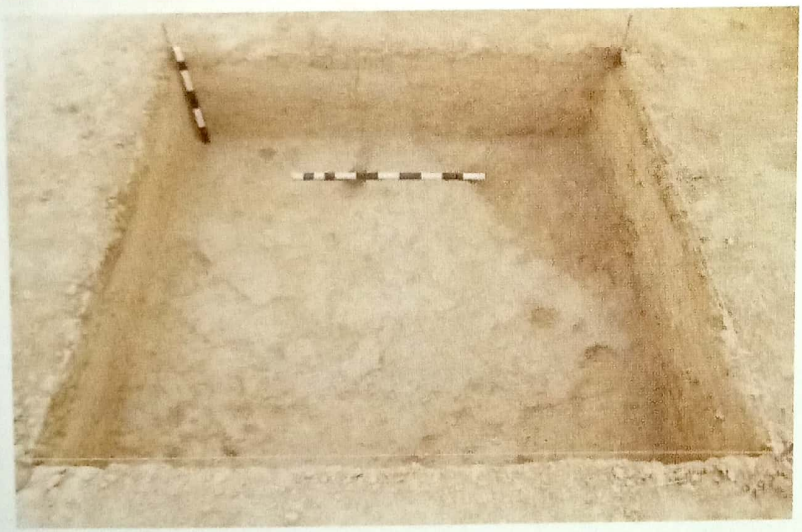
Singh *et al.*, Pl. 1: Trench A showing two fire installations, Lohari Ragho I



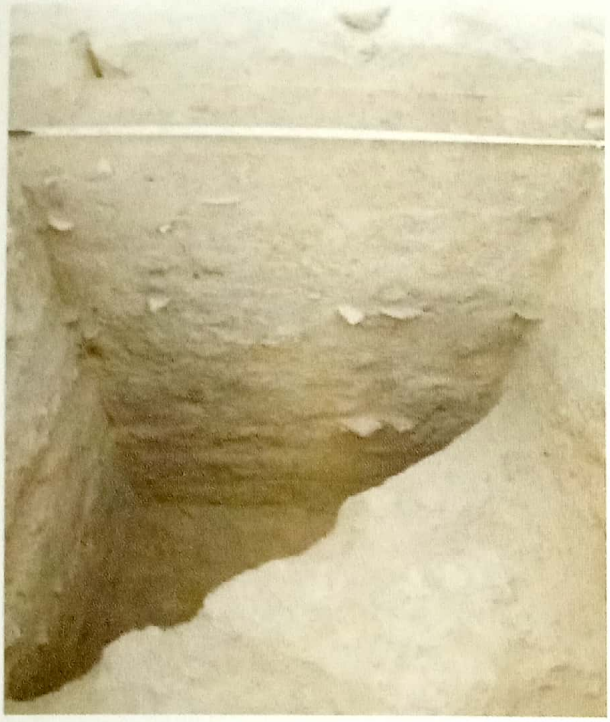
Singh *et al.*, Pl. 2: Mud structure exposed in Trench EA , Lohari Ragho I

Singh *et al.*, Pl. 3: Section facing north, Trench EB, Lohari Ragho I

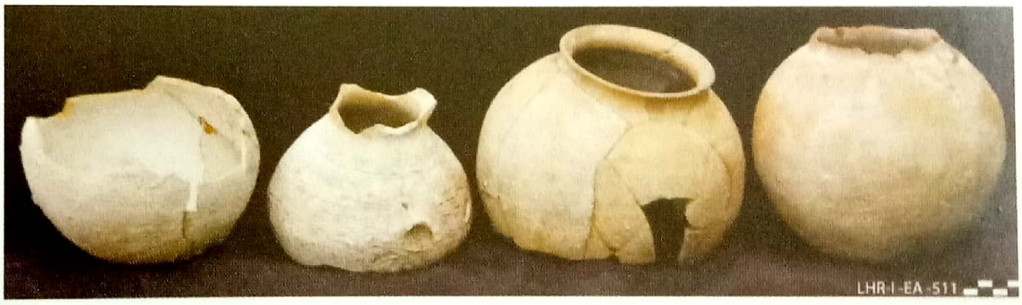
Singh *et al.*, Pl. 4: Trench NA1, mud brick structures, Lohari Ragho I

Singh *et al.*, Pl. 5: Excavated area in Trench EA , Lohari Ragho I

Singh *et al.*, Pl. 6: Another view of excavated area in Trench EA , Lohari Ragho I



Singh *et al.*, Pl. 7: Sounding within Trench EA showing natural soil, Lohari Ragho I



Singh *et al.*, Pl. 8: Earthen vessels excavated from Lohari Ragho I (*Courtesy: Alessandro Ceccarelli*)

Singh *et al.*, Pl. 9: Carnelian, faience and steatite beads from Lohari Ragho I (*Courtesy: Barun Sinha*)

Singh *et al.*, Pl. 10: Grinding stones collected from the surface of Lohari Ragho I during the surface survey (*Courtesy: Cameron Petrie*)