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South Asian Archaeology Series 2

Iron Age in South Asia

edited by Akinori Uesugi

Research group for South Asian archaeology
Archaeological Research Institute
Kansai University

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Cover photo: Megalithic burials at Kadiriraya Cheruvu, Andhra Pradesh.
Back cover photo: Fortification wall and gate at Maheth, Uttar Pradesh.

IRON AGE IN SOUTH ASIA

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PREFACE

This publication is a collection of the papers presented at the International Conference on the Iron Age in South Asia held at Kansai University on June 2 and 3, 2018, which includes six papers by the scholars who participated in the conference.

The Iron Age in South Asia mainly during the first millennium BCE was a period when social transformations towards the formation of urban society and states occurred in various parts of the region. In North India, an urban society emerged in the mid-first millennium BCE as a result of the socio-cultural developments in the Ganga valley that started in the latter part of the second millennium BCE. In the last few centuries of the first millennium BCE, the vast area of South Asia came into an extensive politico-economic network, in which flows of population, goods and information were facilitated, as exemplified by the emergence of the Mauryan Empire. In the southern part of South Asia, the Megalithic culture connected various parts of peninsular India and developed a resource exploitation system and an extensive socio-cultural network, although its chronological developments have not fully been revealed. By the end of the first millennium BCE, urban centres also emerged in the peninsula accelerating the interaction with the urban society in North India and the expansion of the urban network over South Asia. The trades with Southeast Asia and the Middle East can be regarded as a result of this expansion of the urban society in South Asia.

However, there are many issues to be investigated to fully understand the significance of the Iron Age in South Asia. The lack of a well-established chronology for this period makes it difficult to trace the socio-cultural developments in the Iron Age society/ies. Our understanding of the technological developments of iron production and its role in the social evolution is also meagre.

The articles in this volume summarize the present state of research and future perspectives of the Iron Age archaeology in South Asia. The article by Akinori Uesugi overviews the features of the Iron Age in South Asia. Vivek Dangi's article focuses on the evidence for the Iron Age culture in North India. The Megalithic culture in peninsular India is discussed in region-wise by three scholars; Virag Sontakke's article on the Vidarbha region in the eastern part of modern Maharashtra, K.P. Rao's article on Telangana and Andhra Pradesh and Abhayan's article on Kerala. The article by Tomoki Yamada examines the literary evidence on base metals described in Vedic texts. While it is certain that the vast area of South Asia witnessed regional developments of the Iron Age society in various parts of the region, there is no doubt that the different parts of South Asia had common features indicating the interconnection and interaction between regions. It is crucial not only to discuss the regional diversity and uniqueness of Iron Age cultures but also to examine the relationships between the regions to develop a better understanding of the dynamic social transformation of the Iron Age society.

Last but not least, I am grateful to the contributors to this volume and the participants to the conference.

Akinori Uesugi
Editor of this volume

AN OVERVIEW ON THE IRON AGE IN SOUTH ASIA

Akinori Uesugi
(Kansai University)

INTRODUCTION

This paper overviews the various aspects of the Iron Age in South Asia to show the perspectives for future studies.

The Iron Age in South Asia is characterised by a diverse range of historical events, such as the migration of Aryans, the growth of cities and urban society, the emergence of states and empires, the spread of Megalithic culture in South India and the developments of distant trading activities including not only South Asia but the surrounding regions. However, these historical events have not thoroughly been studied and explained by means of archaeological evidence. There are a number of issues to be investigated including chronological and technological studies that are fundamental to archaeology.

This paper attempts to set the issues out and to overview archaeological issues of the Iron Age in South Asia.

ISSUES ON THE INTRODUCTION OF IRON TECHNOLOGY TO SOUTH ASIA

Summarizing the previous studies on the origin of iron in South Asia, two major theories can be categorised, the external origin theory (e.g. Wheeler 1959; Banerjee 1965) and the indigenous origin theory (e.g. Chakrabarti 1992). Regarding the former, R.E.M. Wheeler (1959) argues that the iron technology was brought to South Asia by the Achaemenids in the fifth century BCE. N.R. Banerjee seeks the origin in Aryans who brought the iron technology from West Asia. He puts the date of the introduction of iron around 1000 BC based on increasing archaeological evidence predating the fifth century BCE. On the contrary, the indigenous origin theory that has become favoured among archaeologists since the 1970s (Chakrabarti 1976, 1992; Sahi 1994; Hegde 1981; Tewari 2010; Tripathi 2013) is based on the emphasis on the rich iron ore in various parts of South Asia and the ethnographic records of pre-industrial iron production among tribal people in addition to the examinations of archaeological evidence.

Recent archaeological excavations with ^{14}C dating have increasingly been revealing that the earliest iron dates back to the second millennium BCE in various parts of South Asia supporting the indigenous origin of iron in South Asia (Tewari 2010). In the Ganga valley, several sites have yielded ^{14}C dates pointing to the early second millennium for the earliest iron, which is associated with the Black-and-Red ware (BRW). Also in South India, ^{14}C dates have been demonstrating

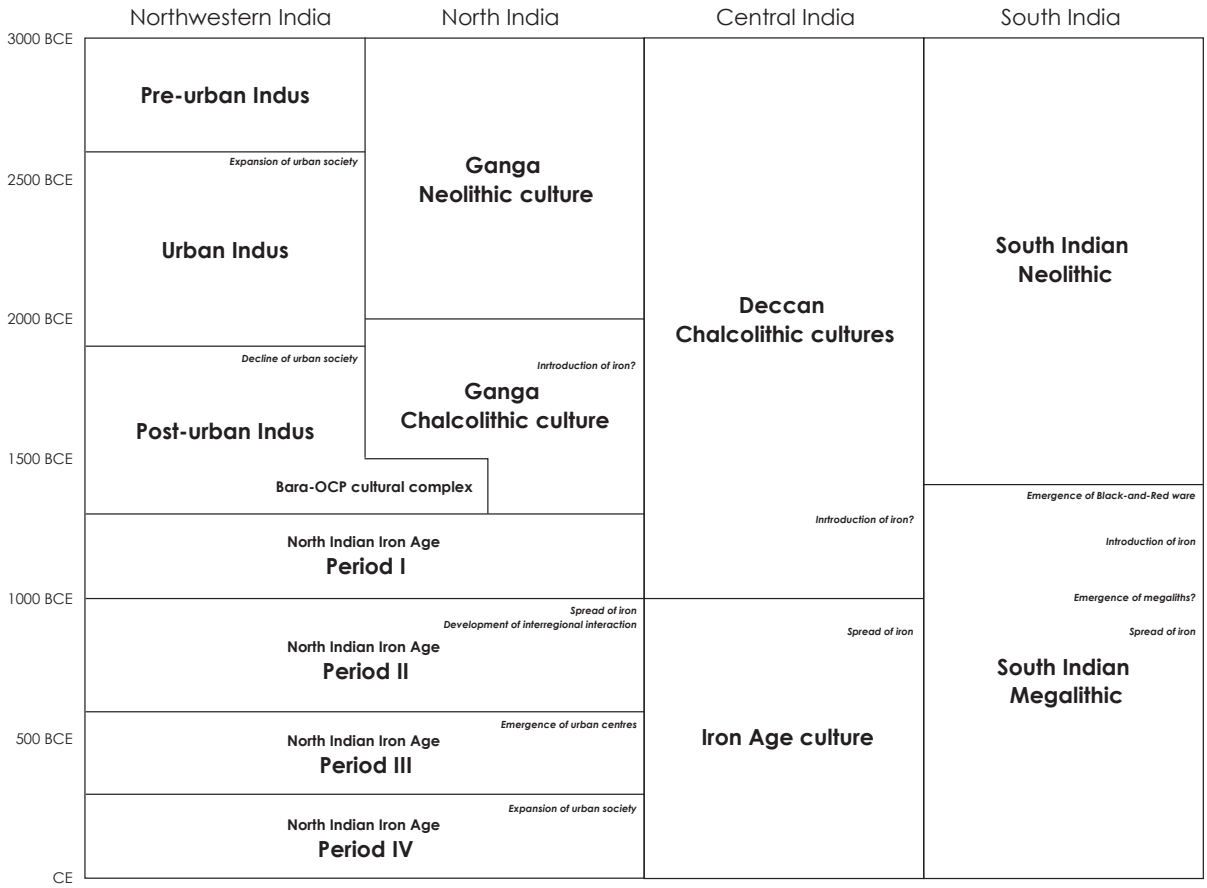


Figure 1 Cultural sequence and chronology of South Asia

that iron made its appearance in the second millennium BCE.

The current state of research on the origin of iron in South Asia is more pragmatically based on archaeological evidence with scientific dating than the previous hypothetical arguments based on speculation. However, the entire process starting from the introduction to the prevalence of iron production technology and iron tools has not been well understood. To reconstruct the process, the features, such as its morphology, function and technology, and the cultural contexts of the earliest iron must be examined in detail as a first step. Then the diachronic changes and developments on iron technology are to be investigated to trace the entire process of prevalence and innovation of the technology. Chronometric methods such as ^{14}C dating can give us a crucial clue to date archaeological evidence and phenomena, but the oversimplistic arguments on the antiquity of iron based on chronometric dates cannot lead to the understanding of the spreading process of iron technology.

A limited number of excavated Iron Age sites have fully been published resulting in the limitation of our knowledge on iron objects from sites and iron technology in general. Much more data are needed to draw an entire picture of the Iron Age in South Asia.

The process of the spread of iron technology in North India

Figure 2 illustrates the diachronic developments of iron objects in North India (Uesugi 2003). As mentioned earlier, the earliest iron in North India appears to date back to the early second millennium (Tewari 2010), but the full presence of iron objects across the region can be dated to North Indian Iron Age Period II (c. >1000 BCE - 600 BCE). North Indian Iron chronology used in this paper is based on the chronological parallels of ceramic sequences in various

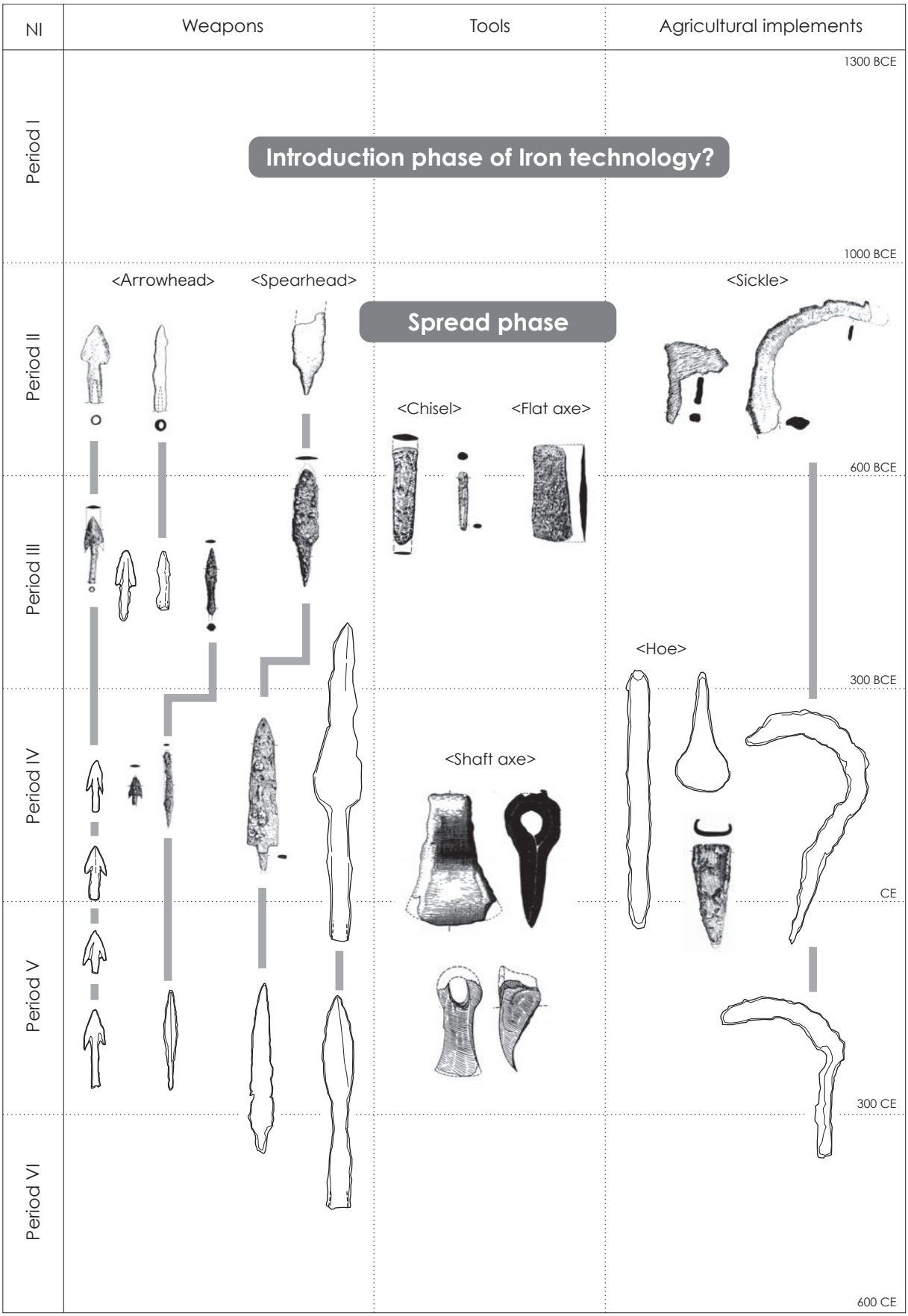


Figure 2 Chronological developments of iron tools in North India

parts of the Ganga valley[1)], not on the chronometric evidence. The recent increase of ^{14}C dates may rewrite the absolute dates of the periods in this chronology, but the conventional dates are used in this paper.

It is interesting to note that a wide range of tools was present across the Ganga valley in this period demonstrating that iron was used for a wide range of purposes. It suggests that an iron production system was already established in the region by this period. Thus this period around 1000 BCE can be termed as the "Spread Phase". It further implies that the origin of iron or "Introduction Phase" of iron can certainly go back to the second millennium BCE, as the ^{14}C dates from recent archaeological excavations in the Ganga valley clearly exhibit. It is expected that further researches will reveal more details of iron technology during the second millennium BCE.

Overviewing the archaeological iron objects from North Indian sites, it is quite apparent that the tool assemblage that was established around 1000 BCE persisted up to c. the sixth century CE without any significant change, except for some elements, such as cooking pan, that were added to the assemblage in later phases. In North India, iron was used only for utilitarian purposes. Therefore iron objects are found in habitational contexts, not in graves as grave goods. It is quite possible that the original assemblage of iron tools are left to us with great modification as iron objects are likely to have been reused. For example, large iron objects like armour, which are not attested in archaeological records, might have been reused and transformed into other objects. In any case, it is worthwhile to note that iron was exclusively used for utilitarian purposes and are found in habitational contexts in North India.

At Maheth (Śravasti) in the central Ganga valley, an iron production workshop dating to around the third century BCE was identified (Aboshi et al. 1999; Aboshi and Takahashi eds. 2000; Takahashi et al. 2000; Takahashi ed. 2005). No clear furnaces except for shallow pits with burnt clay was found, but a number of wrought iron that has profiles of vessels (crucibles) with a flat or round base and straight sides were recovered (Figure 5). These examples quite apparently exhibit that this wrought iron was produced using crucible iron smelting technology. It is also worthwhile to note that no tuyere, fragments of furnace walls and other tools for iron production like hammer were not retrieved from the excavation.

The crucible iron smelting technology is considered as a unique method for producing wootz steel, which has been well studied in South India. The findings from Maheth may show a possibility that a similar crucible smelting technology was used in North India as well.

According to Vibha Tripathi who has been pioneering the Iron Age archaeology in North India over decades, the iron objects from the mid-first millennium BCE onwards (the NBPW period) are made of carburized iron with high strength, while the ones from the second millennium contexts are of pure wrought iron with low strength (Tripathi 2013: 11). She also notes that the amount and variety of iron objects increased from the second to first millennium BCE at North Indian sites.

Based on these pieces of evidence, it can be summarised that the second millennium BCE can be termed as the Introduction Phase, and the iron technology widely spread during the first millennium BCE. As stated earlier, the new ^{14}C dating of ancient iron in North India pushes back the origin of iron well into the second millennium BCE, but more important is to trace the spread and innovation of iron technology based on archaeological evidence in space and time.

Iron in South India

In South India (in this article, the Indian Penisula to the south of the Narmada River is called South India in a conventional sense), iron objects were widely used in graves as mortuary goods. Since very few megalithic burials have been dated by scientific chronometric dating, it is difficult to examine when iron objects began to be buried in graves and how that custom spread over South India. A few of megalithic burials with iron objects that have been dated in South India (e.g. Porunthal in

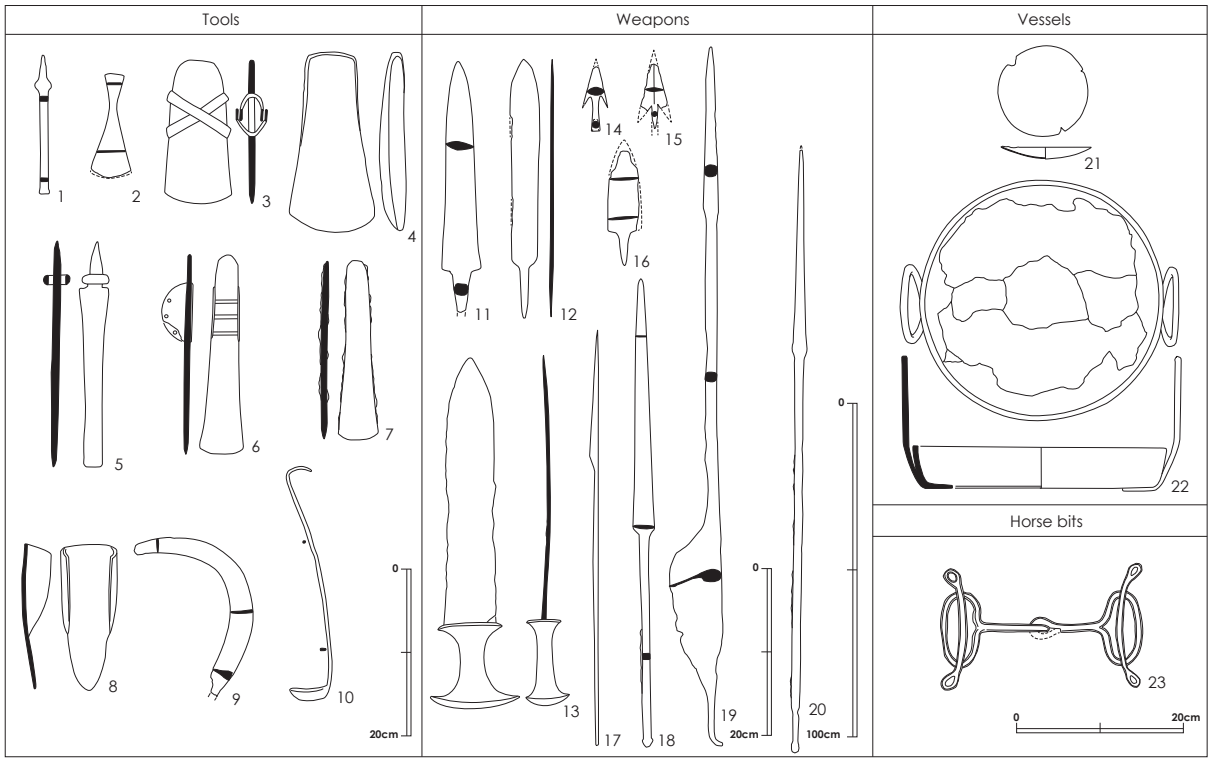


Figure 3 Iron tool types in South Indian Megalithic culture

Tamil Nadu, Kuttikol and Niramakulam in Kerala) indicate that the iron objects were used as grave goods throughout the first millennium BCE.

At the site of Malli in the Gondia district, Maharashtra, both a settlement area and a graveyard were excavated (Sontakke and Bhoyar 2014; Sontakke 2015). At the former site, an iron production workshop was unearthed. The ^{14}C dates from this settlement area indicate that the iron production workshop where the entire process of iron production starting from smelting and forging was evidenced dates back to the early first millennium BCE. In Karnataka, the earliest evidence of iron found at Hallur (Nagaraja Rao 1971) dates back to around 1200 BCE. Veerapuram in Andhra Pradesh also gives a date around 1200 BCE to the earliest iron. Thus the evidence of iron from South India is almost contemporary with the case in North India, and this period of the late second millennium BCE can be termed as the Introduction Phase of iron in the region.

It is well known that iron objects are commonly found in megalithic graves, but the well-reported evidence is quite limited resulting in a difficulty to compare the assemblage of iron objects between sites and regions as well as through time. Looking at the examples from the sites in the Vidarbha region in eastern Maharashtra such as Mahurjhari (Deo 1973), Takalghat and Khapa (Deo 1970) and Naikund (Deo and Jamkhedkar 1982), from Nagajunakonda (Subrahmanyam ed. 1975) in Telangana, and from Brahmagiri (Wheeler 1947) in Karnataka, it can be understood that the iron objects of the Megalithic culture are comprised of weapons, agricultural implements and tools (Figure 3). The weapons include arrowheads, spearheads and javelins, and the agricultural implements and tools are composed of axes, sickles, hoes, chisels, ladles and so on.

It is worthwhile to note that some iron objects with a particular shape have a wide distribution over the Indian peninsula. The best example is the axe with an X-shaped belt (Figure 3: 3). This type of celt is distributed in the northern and southern parts of the peninsula, showing that these two regions shared the identical type of axe through connection and in-

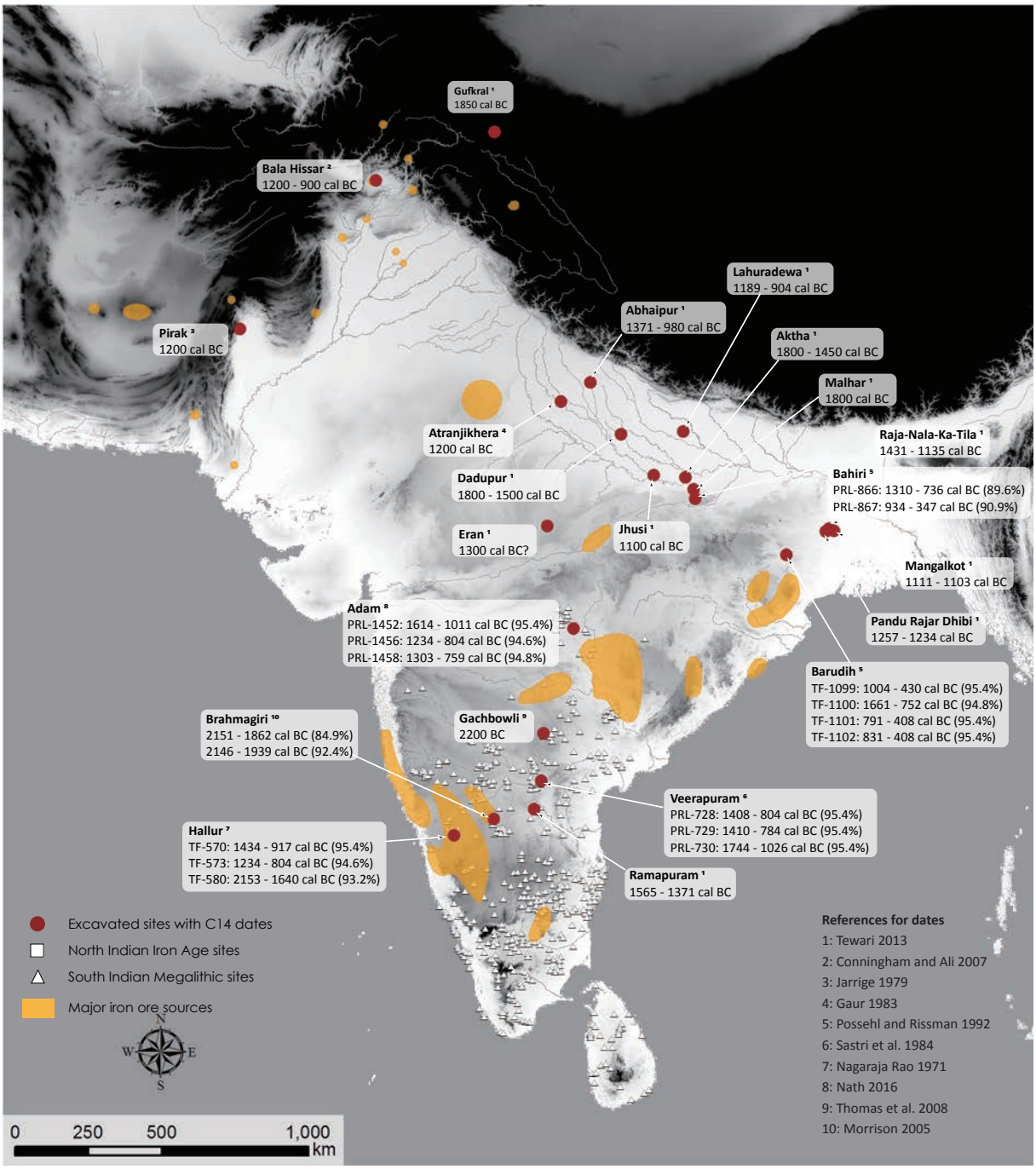
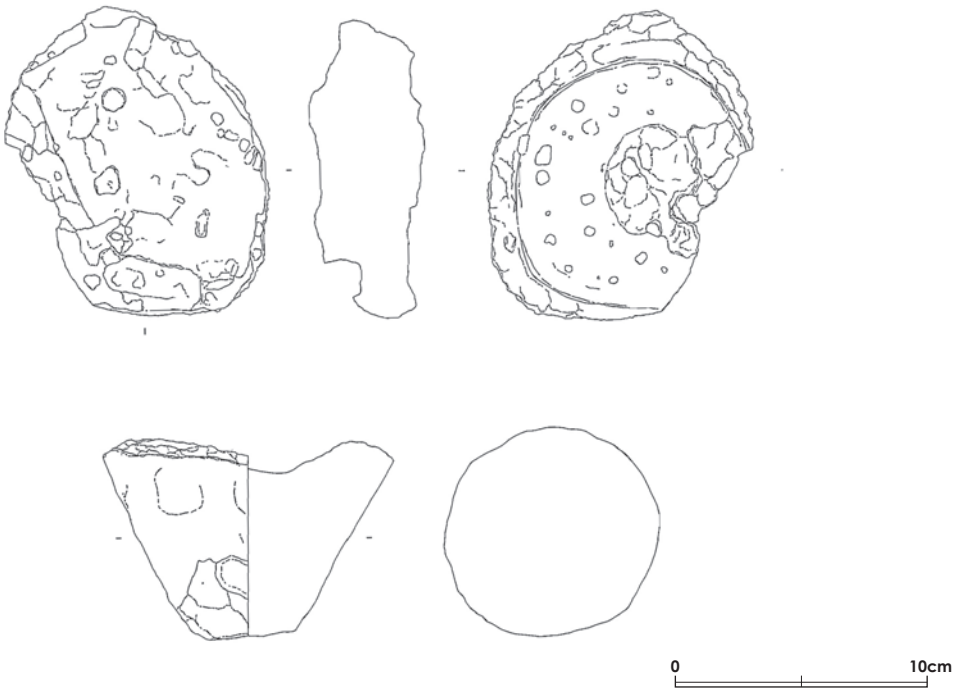


Figure 4 Distribution of major iron ore sources in South Asia and chronometric dates for the early iron or early Iron Age sites

teraction. It is also possible that the iron production technology was also transferred to various parts of the peninsula in the course of dispersals of iron during the Megalithic period. The relations between regions regarding the iron production technology is one of the critical issues for understanding the Megalithic period.

Regarding the iron production technology in South India, the crucible steel production technology is noteworthy (Srinivasan 2007). In this method of iron smelting, crushed iron ore and fuel are placed in a crucible and heated to obtain wrought iron. This method is closely connected to the production of wootz steel.

As mentioned earlier in this paper, a similar iron smelting technology was possibly present in North



Maheth, Uttar Pradesh (Aboshi and Takahashi eds. 2000)

Malli, Maharashtra (Courtesy of the Nagpur Division, State Department of Archaeology, Maharashtra)

Figure 5 Wrought iron and iron slags

India around the third century BCE. It is essential to examine the connection between North and South India in the iron production technology.

At the site of Malli in eastern Maharashtra, an iron production workshop was unearthed in the excavation (Sontakke and Bhoyar 2014). Based on the examination on iron slags from this site, it can be understood that an entire process starting from smelting to forging was conducted at this workshop. However, no crucible for iron smelting was retrieved from this site suggesting that a technology different from that attested at Maheth and some sites in South India was used at this site (Per. comm. Virag Sontakke and Tomotaka Sasada). It is most likely that there were different iron production technologies developed in South India from region to region and from period to period. Therefore it is crucial to examine the origins and dispersals of iron production technologies in South Asia to better understand the history of iron in this region.

Another critical issue pertaining to the spread of iron technology is the distribution of iron ore sources. As shown in Figure 4, iron ore is scattered in the hilly regions surrounding the alluvial plain of the Ganga valley in North India. In contrast, the Indian peninsula has a number of iron ore sources in broad areas. Although it is not known what kind of iron ore and which iron ore sources were utilised during the Iron Age, it is quite apparent that South India had a great potential in producing iron.

It is highly likely that diverse ways of iron production and distribution were occurring across the subcontinent as exhibited by the example of iron production at Maheth located in the middle of an alluvial plain that has no iron sources in the vicinity and by the case at Malli which has rich iron sources in the surrounding areas. A widespread trading network connecting various parts of the subcontinent, some of which had no iron sources and others of which had rich sources, and some of which had centres of iron production and others of which did not, can be presumed. In the case of North India, the relation between the alluvial plain that was a focal point of increasing social complex towards urbanisation and the surrounding hilly regions with rich iron sources is relevant. The society in the alluvial plain should have had a necessity to develop and maintain the relations with the surrounding regions to have a stable supply of iron ore or iron products. In South India, it appears that the widespread association of iron objects with mortuary practices accelerated the spread of iron technology across the region with the expansion of the Megalithic culture. It is also not unlikely that there were connections between North India and South India through which iron was traded. It is quite apparent that iron technology was a crucial socio-cultural resource both in North India and South India despite the significant difference in the mode of consumption, that is utilitarian or ideological related to mortuary practices. Such socio-cultural importance of iron might have promoted and strengthened the connection and interdependence between regions during the Iron Age.

There are a number of issues to be investigated to better understand the society/societies of the Iron Age, but future studies must be oriented to the understanding of the entire process starting from production, distribution and consumption of iron.

SOCIETY DURING THE IRON AGE IN NORTH INDIA

In order to better understand the process of the spread of iron, it is crucial to examine the society of the Iron Age. The Iron Age is a stage in the human history that witnessed the emergence of cities, urban societies, states and empires. These historical events occurred upon various factors of human societies and physical environments, but it can be stated that iron played an

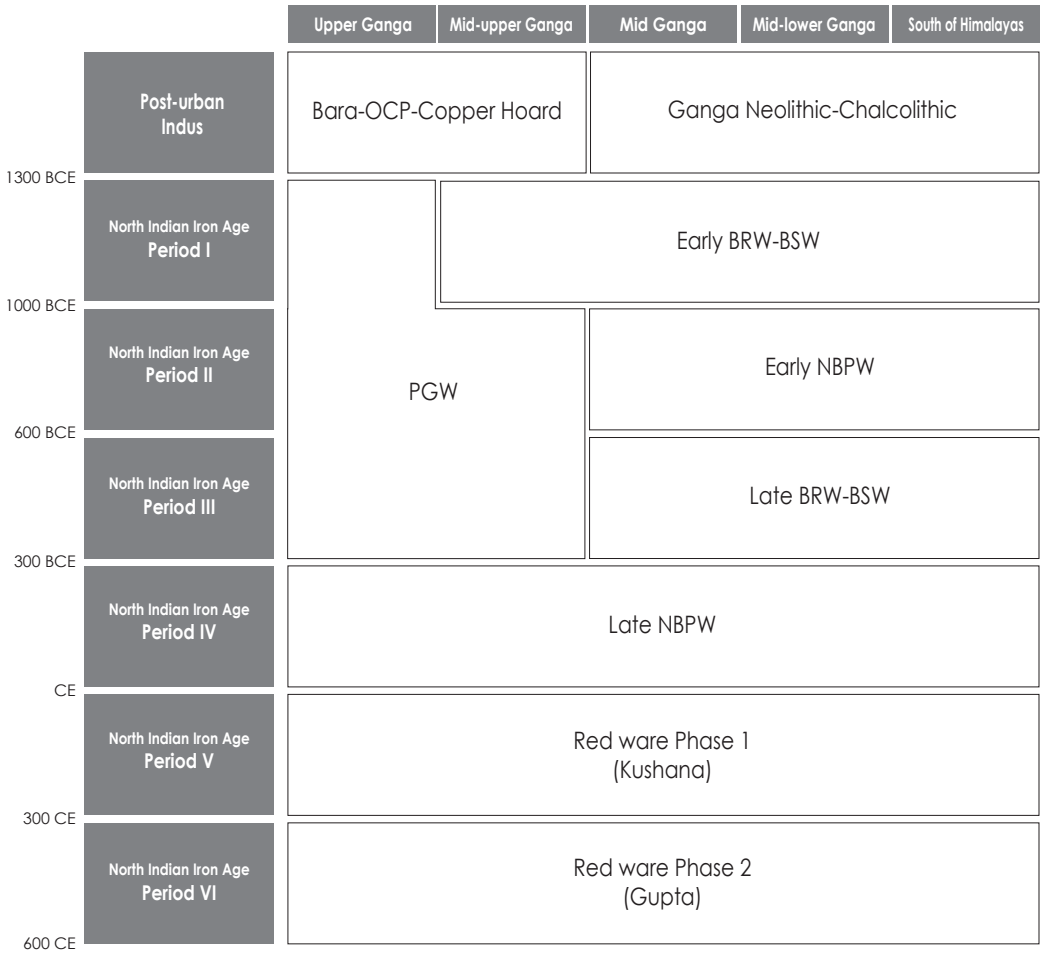


Figure 6 Cultural sequence and chronology of North Indian Iron Age/Early Historic period

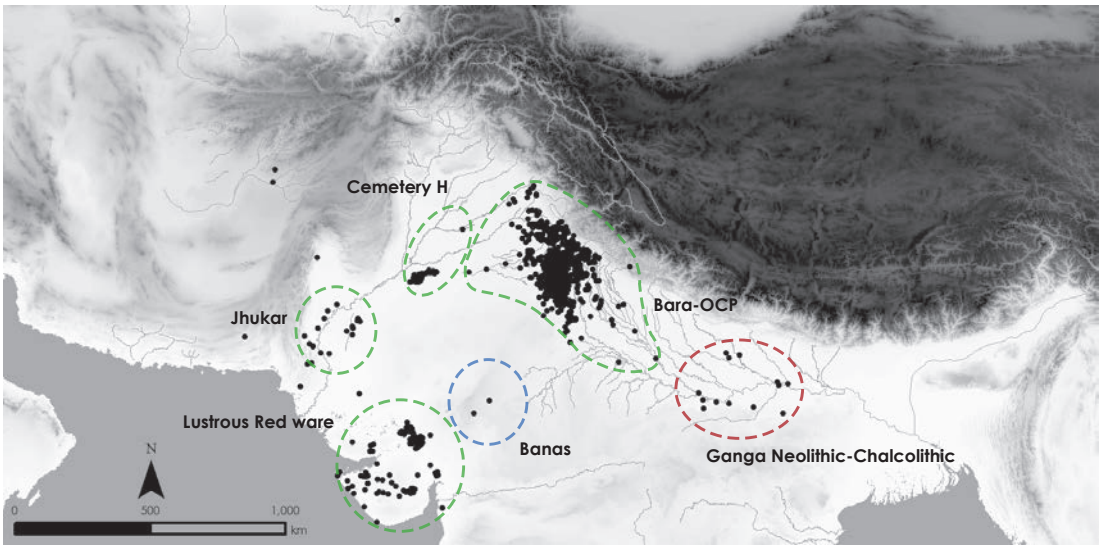
important role not only as a useful tool but also a socio-cultural resource that facilitated societies develop into more complex ones.

Iron implements have greater strength than other materials contributing not only to the land developments but also to warfares in the human societies. Iron sources are not available everywhere but in particular places. The production of iron requires high technology using well-developed pyrotechnology. Due to these reasons, iron technology augmented agricultural production and political power in competing with neighbouring societies.

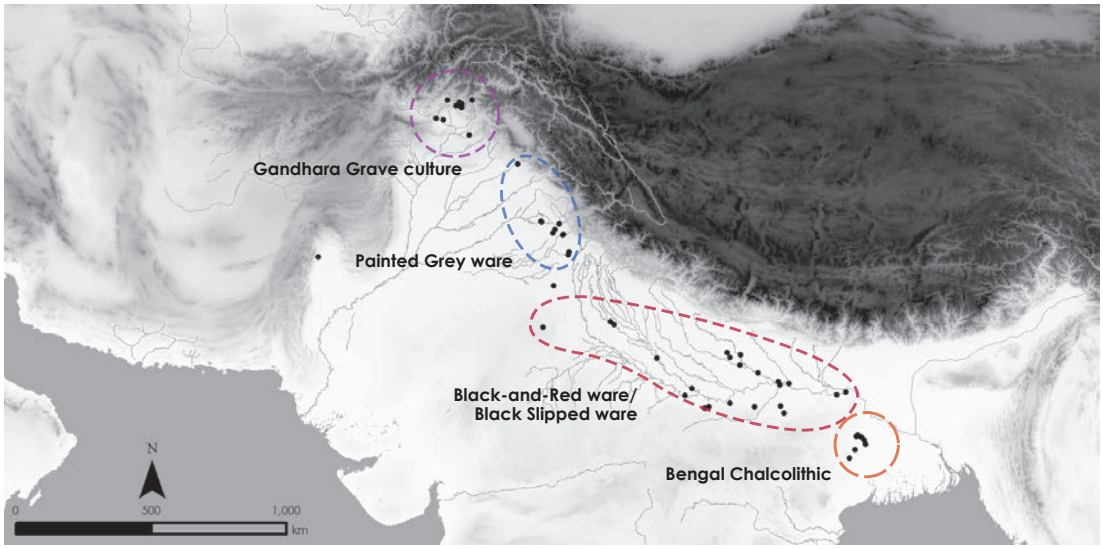
Also in South Asia, it has been stated that the extensive introduction of iron played a significant role in the emergence of states in the Iron Age/Early Historic period. Some scholars argue that the rich iron source in the Vindhya range contributed to the political rise of the Magadhas among the Sixteen Mahajanapadas during the Nanda and Mauryan dynasties (e.g. Kosambi 1965), although there is a critical view towards this theory (Chakrabarti 1992: 159). It is still difficult to examine this theory based on the archaeological evidence available to us, but it is apparent that the North Indian society developed into a highly complex one during the Iron Age. Therefore it is one of the most important issues to examine the role of iron in the developments of society in North India. Thus, our understanding of the Iron Age society can lead to a better understanding of the historical significance of the introduction of iron.

North India during the second millennium BCE

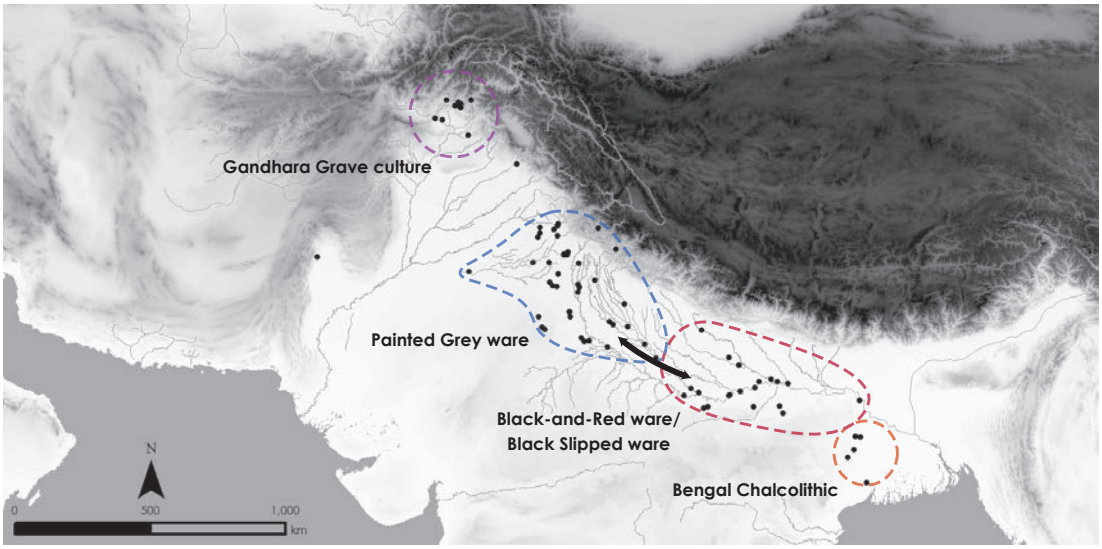
The socio-cultural aspects in North India during the second millennium BCE have not been well attested in the archaeological records as very few sites have



1. Post-urban Indus period (early second millennium BCE)

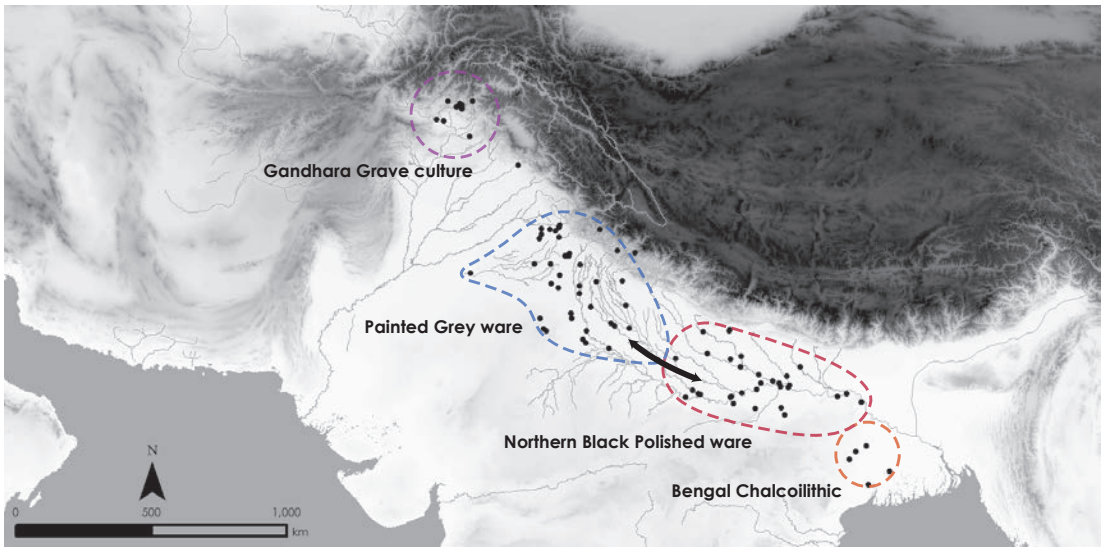


2. North India Iron Age Period I (late second millennium BCE)

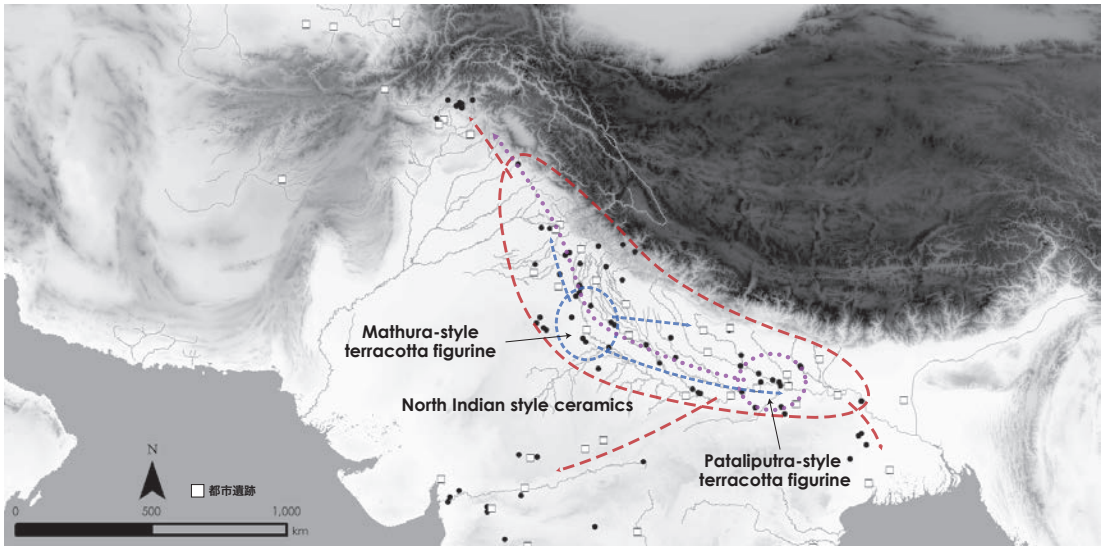


3. North India Iron Age Period II (early first millennium BCE)

Figure 7 Diachronic changes in the distribution of cultures in North India



4. North India Iron Age Period III (mid-first millennium BCE)



5. North India Iron Age Period IV (late first millennium BCE)

Figure 7 (contd.) Diachronic changes in the distribution of cultures in North India

been excavated and reported. Most of the excavations conducted at several sites are of trench digging making it difficult to understand the nature of settlements of this period. The limited publication of the results of excavations also makes it difficult to examine the socio-cultural aspects of this region. One of the possible approaches is to examine the spatio-temporal patterns of material culture in North India (Uesugi 2002).

In the early part of the second millennium after the collapse of the Indus urban system around 1900-1800 BCE (Figure 7: 1), there is an increase of settlements in the Ghaggar plain, the Ganga-Yamuna Doab and the western part of the Ganga valley to the east of the Indus valley. This period is characterised by the Bara pottery (Uesugi and Dangi 2017) that developed out of the Harappan pottery and the ceramic style local to the Ghaggar valley, that is the Sothi-Siswal pottery. The Ochre-Coloured pottery (OCP) that have been identified in the Ganga-Yamuna Doab and the western part of the Ganga valley is a part of the Bara pottery sharing many elements with the latter. Thus this early second millennium BCE can be regarded as a phase of expansion of the Bara-OCP complex towards east. This expansion of the Bara-OCP complex can also be seen in the distribution pattern of the Copper Hoards. Therefore it can be presumed that

the population in the western Ganga valley remarkably increased during this period resulting in the broad colonisation of the region.

In the later part of the second millennium BCE (North Indian Iron Age Period I), the Painted Grey Ware (PGW) made its appearance in the Ghaggar valley and the upper Ganga valley, and the black ware industry consisting of the Black-and-Red Ware (BRW) and the Black Slipped Ware (BSW) widely spread over the western part of the Ganga valley and the eastern part of Rajasthan (Figure 7: 2). The origin of PGW, which is conspicuously different in style from the Bara pottery, is still vague. At some sites in the Ghaggar valley, the overlap of the Bara pottery and PGW have stratigraphically been attested (Joshi 1993; Manmohan Kumar et al. eds 2016), but the nature of the relationships between these two ceramics is unclear.

The black ware industry, which had its origin in the Ganga Neolithic culture of the eastern part of the Ganga valley and the northern part of the Vindhyan range (Tewari 2010; Tripathi 2013) was widespread over the western Ganga valley, the Ganga-Yamuna doab and eastern Rajasthan during this period. Even in the Ghaggar valley, this black pottery is sporadically known in association with PGW. The stratigraphic evidence from several sites in these regions clearly demonstrates that BRW appeared in a period postdating the Bara horizon suggesting that the spread of BRW into these regions can be dated to the mid-late second millennium BCE.

The reason for the wide dispersal of the black ware during this period is uncertain, but the partial association with PGW implies some relations between the black ware industry and PGW. While PGW have no morphological and technological connection with the Bara pottery as stated earlier, PGW and BRW/BSW show morphological similarities, especially in sharing the formal assemblage consisting of bowls and shallow bowls (dishes), which differs from the formal assemblage of the Bara pottery. This similarity suggests that BRW/BSW have some relations with the emergence of PGW. As argued in the later section of this article, the emergence of BRW in the Indian peninsula around 1400 BCE may have been related to this expansion of BRW in the north.

North India during the early first millennium BCE

In North Indian Iron Age Period II dating to the early first millennium BCE, PGW spread into the western part of the Ganga valley resulting in the development of interaction between PGW and BRW/BSW (Figure 7: 3). In the eastern part of the Ganga valley, the predominance of BSW has been attested at some sites such as Prahladpur (Roy 1968), Rajghat (Narain and Roy 1977) and so on. Since very few sites have been horizontally excavated, the nature and features of settlements and society of this period have not been fully understood, but it is likely that more solid political and economic entity/ies developed in the eastern part of the Ganga valley with the progress of colonisation and the emergence of interaction networks over the region.

As argued in the earlier section, iron was fully introduced in various parts of the Ganga valley by this period. The production system of iron has been scarcely understood, but it appears that the production and distribution system using iron ore from the Aravalli and Vindhya ranges was well established involving the alluvial plain and the surrounding hilly regions. The wide occurrence of PGW and BRW in the northern part of the Aravalli range may well have been related to the exploitation of iron ore sources in the region.

It is noteworthy in connection with the developments of social complexity that stone bead production became predominant during this period (Figure 8). The evidence of stone beads of the late second millennium BCE is very limited possibly due to the collapse of the Indus urban centres and urban craft production

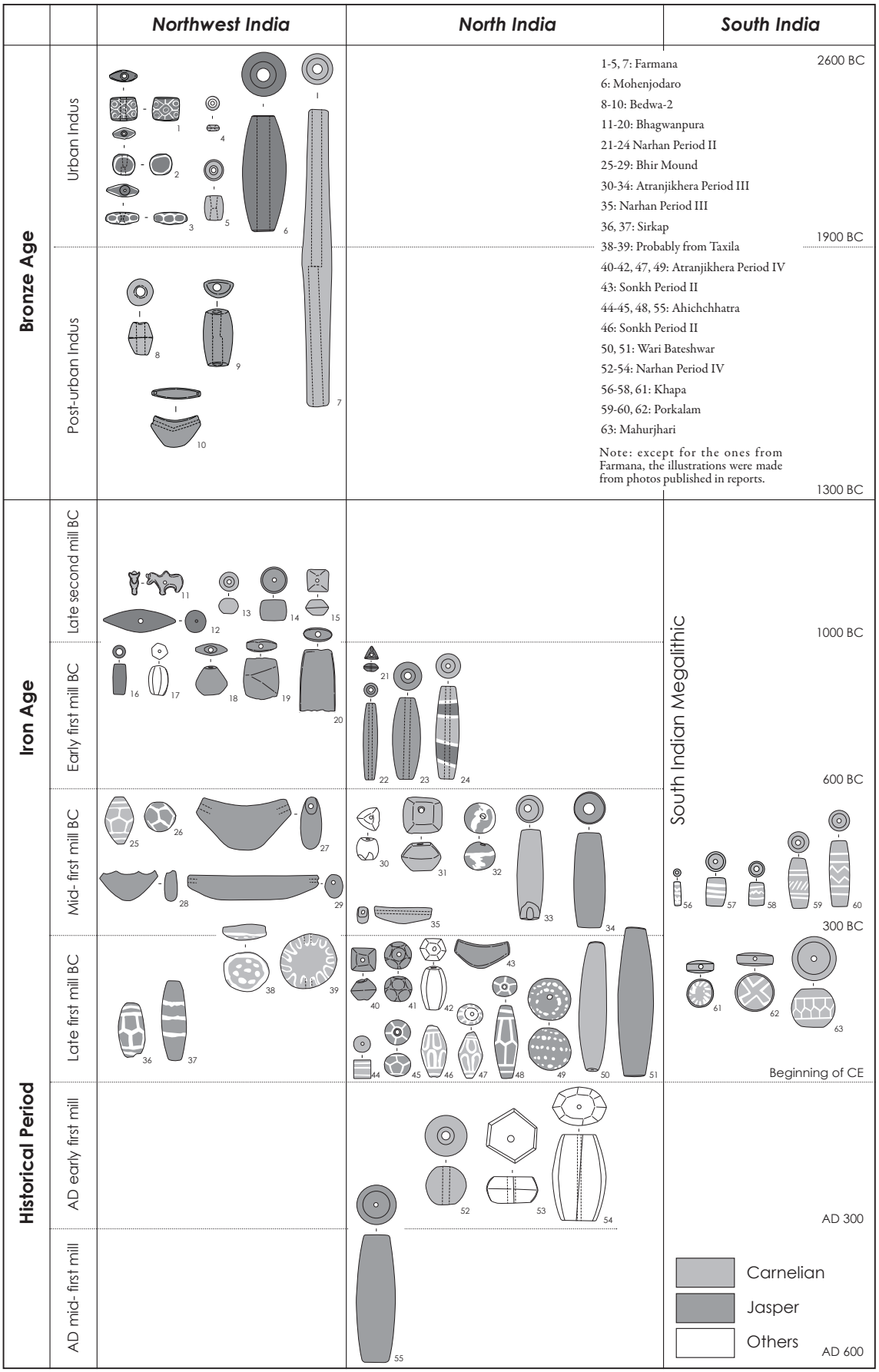


Figure 8 Diachronic developments of stone beads in South Asia

system, but the evidence of stone beads increases in North India during the early part of the first millennium BCE.

Among the stone beads of this period, the continuation of some traits of the Indus bead tradition such as some shapes and decorations made by the bleaching technique and the introduction of new shapes and a new drilling technology using a so-called diamond drill can be noticed. Especially the bleaching technique clearly demonstrates the continuation and transmission of the Indus bead technology into the Ganga valley. It is not unlikely that the Indus bead technology was transferred into the Ganga valley along with the expansion of the Bara pottery during the early second millennium BCE.

The so-called diamond drill is distinct in having a thin drill rod, most probably made of iron, on to which a small chip/s of hard material is embedded. This drill enhances the effectiveness of drilling compared to the stone drill used in the Indus Civilization (Kenoyer and Vidale 1991). The exact origin of this new type of drill has not been specified, but it is quite clear that this new drilling technology became popular in the Ganga valley when the demand for stone beads became strong. As the case of iron, the raw materials for stone beads such as carnelian, agate, rock crystal and so on are available not in the alluvial plain of the Ganga valley but in Gujarat and the Vindhya range. Therefore it can be presumed that the increase of stone beads in this period was based on the development of the well-established production system using raw materials occurring in remote regions.

The emergence of cities in North India during the mid-first millennium BCE

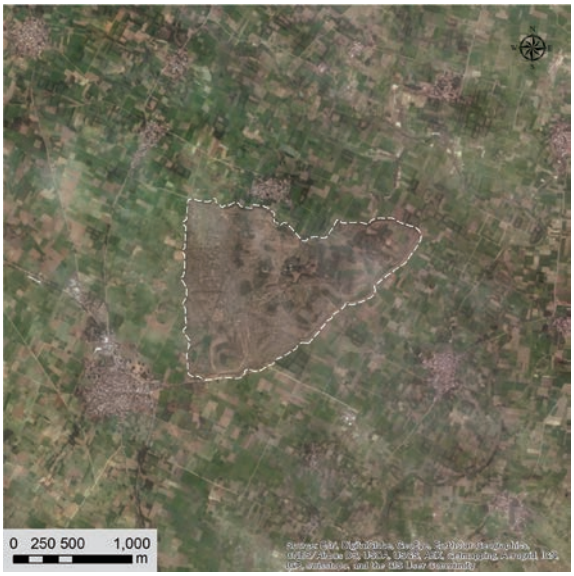
North Indian Iron Age Period III (c. the mid-first millennium BCE) is characterised by the appearance of the Northern Black Polished Ware (NBPW) in the eastern part of the Ganga valley (Figure 7: 4)(Roy 1983, 1986). This fine pottery, which belongs to the black ware tradition of BRW and BSW, is distinct in having thinner walls, well-finished surface with some metallic slip and the firing technique in a reduced atmosphere using a high temperature, all indicative of a highly innovative ceramic production technology.

Another significant socio-cultural phenomenon of this period is the emergence of cities or urban centres (Figure 9). A number of settlement sites having a large-scale area or fortification walls that can be identified as a city or an urban centre are well known in North India. Although the internal structure of those settlements and how they developed have not been well revealed in their excavations, it is quite well evidenced that the fortification walls at those sites had been constructed by the late first millennium BCE (North Indian Iron Age Period IV). At the site of Maheth (Śravasti) in Uttar Pradesh, a workshop producing iron, glass beads and stone beads was revealed in the excavations (Aboshi et al. 1999; Aboshi and Takahashi eds. 2000) suggesting that some controlled intensive craft production was being conducted inside the city.

Noteworthy is that the raw materials for the production of iron and stone beads were brought into the city of Maheth from remote sources. The intensive craft production, regardless of the distance to the raw material sources, can be a significant feature of urban centres of this period.

Expansion of urban society during the late first millennium BCE

By the late first millennium BCE, a number of urban centres in North India came to be surrounded by massive fortification walls (Figure 9) suggesting that the urban centres in the region became more established. In this period, the spatial division between the PGW zone and the NBPW zone disappeared, and an identical ceramic style spread over the Ganga valley (Figure 7: 5). While it seems that PGW and the black wares respectively were respectively connected to the



Ahichchhatrā

Kauśambi

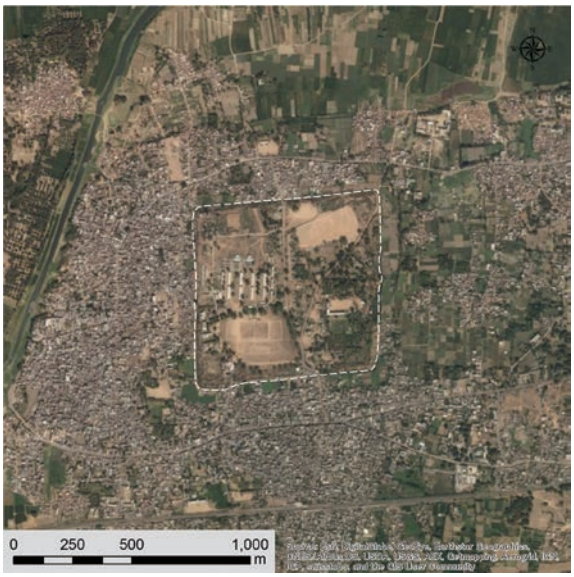
Maheth (Srāvastī)

Rajgir (Rājagṛha)

Balirājgarh

Chandraketugarh

Figure 9 Early Historic urban centres in South Asia



Champā

Mahāsthāngarh

Taxila

Ujjain

Sisupālgarh

Adam

Figure 9 (contd.) Early Historic urban centres in South Asia

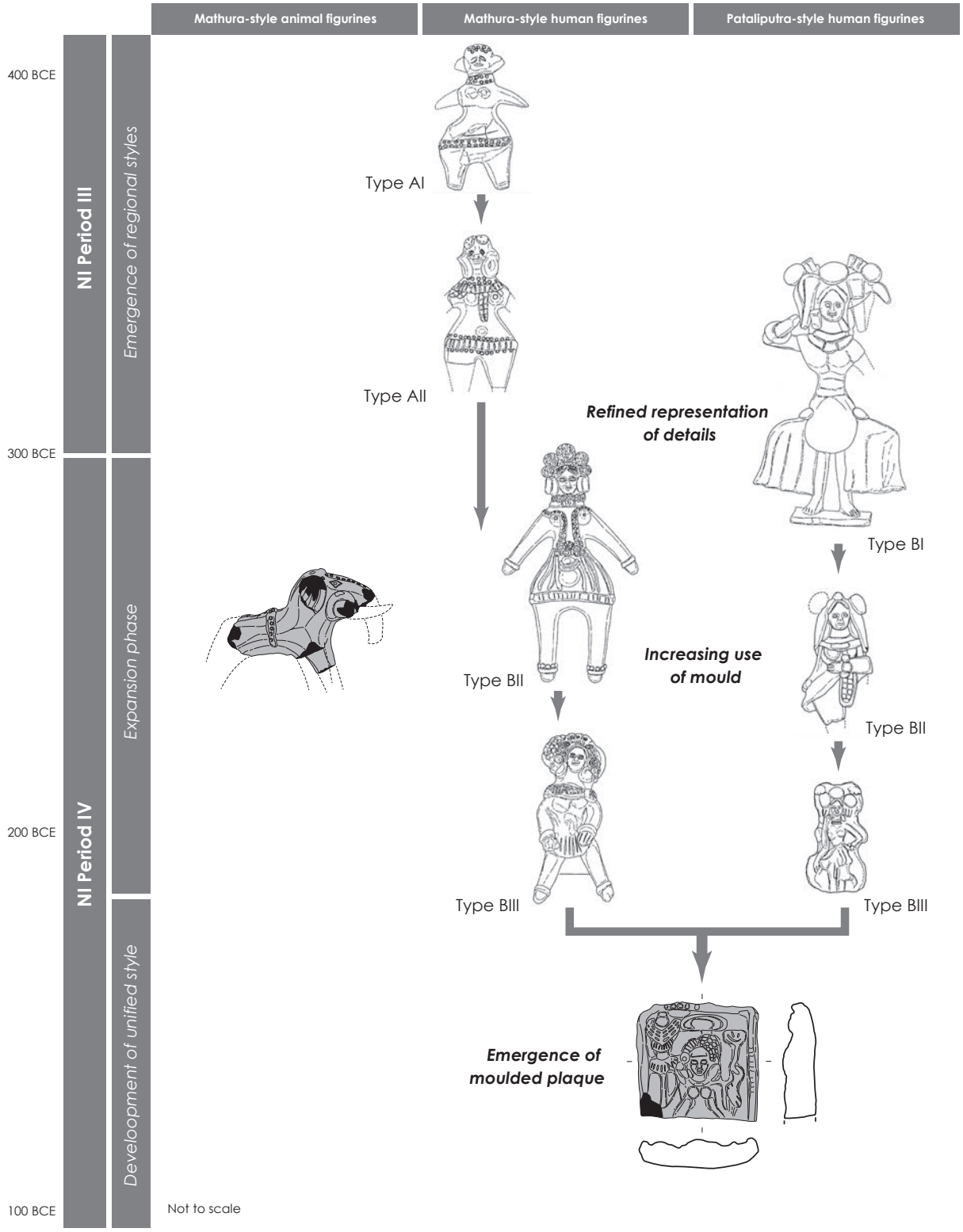


Figure 10 Diachronic developments of terracotta figurines in North India

socio-cultural identity in the preceding periods, the ceramics became more utilitarian during this period, and a simple red ware industry became predominant. The special ceramics produced with high technology lost their meaning in the society. This ceramic style that uniformly spread over the Ganga valley expanded into the surrounding regions of the northwestern, central and eastern parts of the subcontinent showing the expansive nature of North Indian urban culture. As mentioned in the preceding section, craft produc-

tion activities were located in the urban centres.

A similar process of the formation of homogeneous material culture can be attested in the developments of terracotta figurines (Figure 7: 5, Figure 10). While terracotta human figurines occurred sporadically in the Ganga valley during the mid-first millennium BCE, more distinctive styles dominantly of female or goddess figurines made their appearance respectively in the eastern and western parts of the region. The figurine style that appeared in the region around Mathura is called the Mathura style terracotta human figurine and the one occurring in the eastern part is termed the Pataliputra style terracotta human figurine in this article. Type A of the Mathura style, which has its primary distribution zone around Mathura, exhibits a sporadic distribution in the eastern part of the Ganga valley, while Type B of the same style has been known dominantly in the Mathura region. In contrast, Type BII of the Pataliputra style spread not only over North India but also to the northwestern part of the subcontinent (e.g. Taxila). Interestingly both the Mathura style and the Pataliputra style evolved into new types with an increasing use of moulds for modelling figurines, and finally, the so-called Sunga terracotta plaque made exclusively with a mould emerged. This moulded plaque-type figurine spread over North India.

For animal figurines, a type that seems to have developed in the Mathura region dispersed into various parts of the Ganga valley during the late first millennium BCE. While the distribution patterns of human figurines and animal figurines differ from each other, it can commonly be observed that different regional styles that appeared in different parts of the Ganga Valley developed into one similar style that spread over the region. Thus the trajectory of the formation of uniform material culture over North India can be seen in various cultural traits during this period.

The formation process of the urban society in North India

It seems likely that the formation of uniform material culture over North India was a part of social transformation caused by the developments of urban society in the region. The progressive colonisation of the vast alluvial plain of the Ganga valley resulted in the emergence of regional societies represented by PGW and BRW/BSW. The primary colonisation of the region was done by the Neolithic community local to the Ganga valley, but the expansion of the Bara-OCP cultural complex into the western part of the region may have facilitated the colonisation process. It is not unlikely that the spread of BRW/BSW into the western part of the Ganga valley in the mid- to late second millennium BCE was triggered by the expansion of the Bara-OCP cultural complex. The appearance of PGW must have been connected to the colonisation and the formation of new regional societies in the Ganga valley.

It appears that the developments and interactions between regional societies represented by PGW and BRW/BSW during the early first millennium BCE led to the emergence of a complex social and interactive sphere over the Ganga valley. Although it is difficult to examine the developments of political power in the region based on archaeological evidence, it is quite likely that regional societies became more consolidated with certain developments of political power and that competitive interactions towards state formation was in progress, taking into consideration that urban centres and the Sixteen Mahajanapadas emerged in the following period. It may be that the spread of iron technology during this period was closely connected to the emergence of complex societies through the maintenance of strategically essential resources and the developments of land. The reappearance of stone beads may also reflect the emergence of socio-cultural ideology related to the development of complex societies. As the production and distribution system of

rare commodities like iron and stone beads is still not better understood, future studies must focus on the nature of craft production and its relationship with the society of this period.

A city is the central place of the regional society and the focal point connecting neighbouring societies. The emergence of urban centres in the Ganga valley during the mid-first millennium BCE can exhibit the growth of regional societies and the expansion of interaction networks over the valley. These regional societies must have been connected to the Sixteen Mahajanapadas suggesting the rise of political power behind the emergence of urban centres. Thus, the advent of urban centres was apparently based on the social environments in the Ganga valley. Further excavations at urban sites in the region are expected to reveal the development process of the urban space.

As evidenced by the construction of fortification walls by the last few centuries of the first millennium BCE, the urban centres became strategically more important in the society/ies by this period. During this period, the urban centres emerged in the surrounding regions of the Ganga valley, most probably as a result of the politico-economic integration of a wider part of the subcontinent by the Mauryan empire. The installations of the Asokan pillars in the Ganga valley and the rock edicts in the peripheral regions clearly tell us that most of the continent was integrated into one social system even if superficially. Almost contemporary with this political event, North Indian cultural traits found their way to South India. In the following period, South Indian artefacts were imported into the north. These pieces of evidence suggest that the connection between the regions facilitating the mobility of people, goods and information was further strengthened.

Thus the Iron Age in North India can be regarded as a process of socio-cultural integration of the Ganga valley and beyond including the emergence of urban centres, states and empire. Then one question arises: Did the connection between the north and the south happen only in the last few centuries of the first millennium BCE? How does the picture of the Iron Age in North India look like when we examine the aspects of the Iron Age society in South India?

IRON AGE SOCIETY IN SOUTH INDIA

The beginning of the Iron Age in South India

There are several criteria to define the beginning of the Iron Age in South India. In the Indian peninsula, especially in the present states of Andhra Pradesh and Karnataka, the South Indian Neolithic culture developed from the third millennium BCE to the mid-second millennium BCE. Ash mounds, which is built with ashes of cow dung, and ground stone axes have been well known for representing the Neolithic culture in the region, but recent researches have revealed that the Southern Neolithic culture is distinct in having millet cultivation and animal husbandry and in shifting from mobile agriculture to sedentary life through its history (Roberts et al. 2015; Fuller et al. 2007). Handmade pottery associated with this culture. In Tamil Nadu and Kerala, the cultural contents of the Neolithic culture are yet to be fully understood, but the sporadic occurrence of stone axes clearly indicates the presence of Neolithic cultures in the region.

One of the crucial problems in pre/protohistory in South India is the transition from the Neolithic period to the Iron Age. At the site of Sanganakallu in Karnataka, the introduction of BRW, which is different from the Neolithic pottery, around 1400 BCE, has been confirmed by recent excavations (Roberts et al. 2015). At Hallur in Karnataka, the earliest iron objects are dated to around 1200 BCE (Nagaraja Rao 1971; Fuller et al. 2007), and also at Veerapuram in Andhra Pradesh, a date of 1200 BCE has been given to the earliest occurrence of iron (Sastri et al. 1984).

The emergence of another important cultural marker of the South Indian Iron Age, megalithic monuments, has not been well understood. Some of the megalithic burials have chronometrically been dated by ^{14}C dating, but how the monuments developed and spread over South India is still unknown. The chronological order of the introductions of BRW, iron and megaliths is the issue for further research. At some sites in Andhra Pradesh, such as Ramapuram, burials dating to the later part of the Neolithic period have been excavated, but the hiatus between these Neolithic burials and megalithic burials is not negligible. In this paper, the earliest occurrence of BRW that exhibits the beginning of cultural transition is regarded as the beginning of Iron Age in South India. However, it should be noted that the transition from the Neolithic period to the Iron Age in South India may be more complex than generally thought and be gradual.

One of the critical problems is the lack of well-established chronology for the Iron Age in South India. It is mainly due to the absence of clues for dating megalithic monuments consisting of graves and menhir. These outstanding monuments have attracted great attention of scholars and antiquarians for the last 200 years. A number of sites were explored and some of the monuments were excavated mainly by Europeans as early as the nineteenth century (e.g. Branfill 1880, 1881a, 1881b; Caldwell 1877a, 1877b, 1899; Cole 1868, 1869, 1873; Congreve 1844, 1847, 1861; Taylor 1841, 1851, 1852, 1862, 1870, 1873; Walhouse 1873, 1874, 1878a, 1878b). However, due to the lack of scientific archaeological excavations and recording methods, the details of monuments were not properly documented and reported. In the early twentieth century, a more established methodology of archaeology was introduced, but still, the dating of monuments was a great problem.

R.E.M. Wheeler conducted an excavation at Brahmagiri where both a settlement area and graveyards were noticed along with an Asokan rock edict in 1947 (Wheeler 1947). Introducing a stratigraphic excavation method, he attempted to establish a relative chronology of the cultural sequence at the site and to give absolute dates to the Megalithic and Early Historic cultures at the site. He gave a time bracket between the second century BCE and the first century CE to the Megalithic culture (Wheeler 1947: 300). Following his excavation at Brahmagiri, cross-dating based on distinct artefacts and ^{14}C dates from excavations were used to estimate the date of Megalithic sites in South India (e.g. Thapar 1952). Now the time bracket between 1000 BCE and the beginning of the Christian Era is widely accepted by scholars for the date of the Megalithic tradition, although some regional deviation has been argued.

However, very few attempts have been made to establish the internal chronology of the Megalithic culture with limited studies on relative chronology of megalithic monuments and artefacts. In order to establish the chronology of the Megalithic culture, typological and stylistic analyses on artefacts from graves to set the relative chronology along with ^{14}C dates and the stratigraphic analysis on evidence from settlement sites should be combined.

Typology of megalithic graves in South India

More than 2,000 Megalithic sites have been recorded since the nineteenth century. It is well known that there is a great diversity in the morphological types of megaliths. A number of reports and articles describe the diverse types of megalithic graves, but the typological classification of megalithic graves in this article (Figure 11) focuses on the examples that the author actually visited to avoid any fallacy and misinformation in the author's understandings.

The typological classification of megalithic graves can be made on the basis of the features and locations of burial facilities and the presence/absence of

Figure 11 Classification of megalith types in South India

mounds made of stone filling. Six broad categories can be divided.

Type 1: Circular stone alignment + mound of stone filling + no clear burial chamber

This type is distinct in having a mound of stone filling (cairn) with a circular stone alignment made of massive boulders. The burial/s is found in/beneath the mound, but no clear chamber was built for human burial. This type is distinctively found in the region around Nagpur, Maharashtra (ancient Vidarbha).

Type 2: Circular stone alignment + no mound + underground chamber (cist) or pit

This type is similar to Type 1 in having a circular stone alignment, but no clear mound is associated. A pit was dug in the centre of the stone alignment, in which a cist was built for burial, or the human bones and grave goods were directly placed without any stone chamber. Many of cists have a porthole and a passage on one side of the chamber. At some graves of this type, pebbles are filled inside the stone alignment on the ground level, although the filling does not form a clear mound. This feature may be related to Type 1. This type exhibits a wide distribution in Telangana, Andhra Pradesh, eastern Karnataka, Tamil Nadu and Kerala.

Type 3: No clear mound + ground level chamber (dolmen)

The chamber, which has a feature identical to that of Type 2, is built on the ground level in this type. Many of the chambers have a porthole on one side. Some examples have an alignment/s of slabs around the chamber. This type has a distribution zone over Karnataka, southern Andhra Pradesh, Tamil Nadu and Kerala.

Type 4: Platform + mound of stone filling + ground level chamber

This type is similar to Type 3 in having a ground level chamber, but has no porthole. Many examples of this type have a rectangular platform and multiple

chambers on the platform. This type is also distinctive in having chambers of lower heights and stone filling over the chambers. This type can distinctively be seen in the Marayoor region, Kerala.

Type 5: No mound + stone structure made of stone slabs
The stone structure of this type is built by leaning long stone slabs. Some of this type has a thick round capstone. The entire shape looks like an umbrella or mushroom. This distinctive type occurs in the southern Karnataka and northern Kerala.

Type 6: Rock-cut chamber grave
This type consisting of a passage and a chamber occurs in the lateritic zone of Karnataka and Kerala. There are two types of chambers; the one with a domed ceiling with a circular hole and the other with a flat ceiling. Some of this type have an alignment of erected slabs or stone blocks on the ground level. This type occurs in southern Karnataka and northern Kerala along the coastal area.

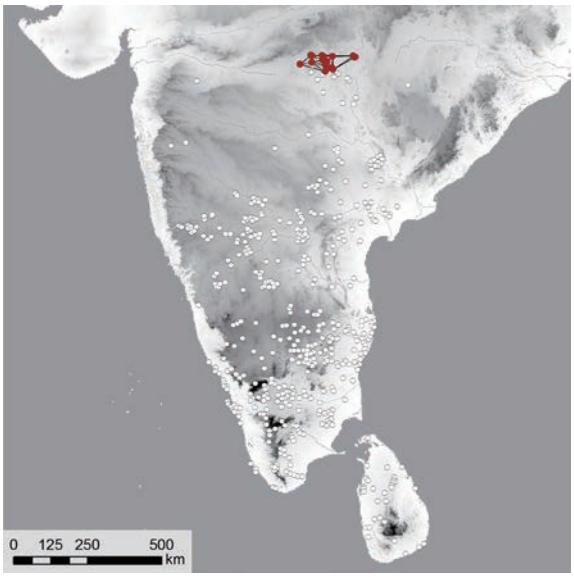
While the types with a mound or an underground chamber still preserve human bones and grave goods, Type 3 with a ground-level chamber have already been open for a long time resulting in the absence of any clue to date them. Therefore the chronology of megalithic graves must be established based on undisturbed examples of Types 1, 2 and 6.

In terms of burial facilities, four groups can be categorised; 1) no clear burial facility (Type 1), 2) the chambers made of slabs (Types 2, 3 and 4), 3) the structure made of long slabs (Type 5), and 4) the rock-cut chamber (Type 6). From the viewpoint of the location of burial facilities, two groups can be discerned; A) the ones set beneath the ground (Types 2 and 6) and B) the ones above ground (Types 1, 3, 4 and 5). For the presence or absence of a mound, three groups can be categorised; a) the ones with a prominent mound (Types 1 and 4), b) the ones without a mound (Types 3, 5 and 6), and c) the ones with no prominent mound but stone filling over the burial facility (Type 2).

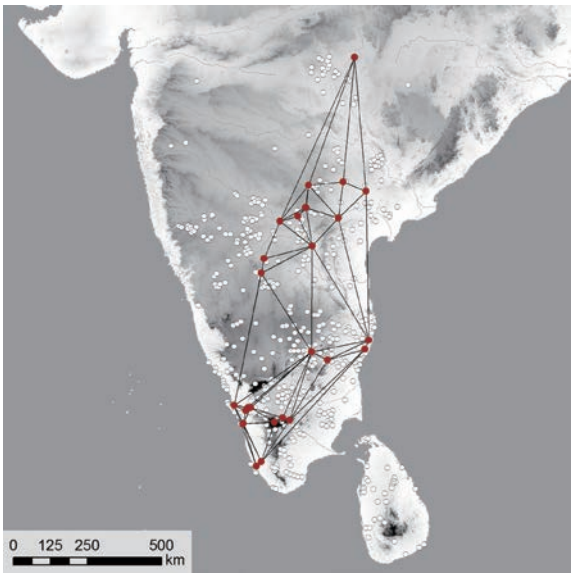
Based on this classifications, Type 2 can be placed between Type 1 and Type 3 in the sense that this type has 2) chamber and c) stone filling. This type also shares the circular stone alignment with Type 1. Types 2 and 3 share an almost identical type of stone chamber including the porthole, regardless of the difference in the location of the chamber. Types 3 and 4 have a striking similarity in sharing ground-level chamber, but Type 4 shows a remarkable difference from Type 3 in having a stone platform and multiple chambers. It may be presumed that Type 4 is an evolved type of Type 3 or a type influenced by Type 3. Type 5 is similar to Types 3 and 4 in having a ground-level chamber, but its construction method and structure remarkably differ from those types. Type 6 is differentiated from the other types.

Each type has its particular distribution zone and dominates at one site (Figure 12), although several types coexist in some parts of South India at even one site. The distribution zones of Types 2 and 3 partially overlap with each other and Types 5 and 6 occur in an almost identical region, i.e. southern Karnataka and northern Kerala. Although further research is needed to reveal the relations between types, it appears that Types 2, 3 and 4 are closely connected in their developments. Types 1 and 2 are also in a closer relationship in sharing several elements. Type 5 may have had a connection with Types 2, 3 and 4, but it is distinct in its unique elements. Type 6 seems to be of local development in the lateritic region in Karnataka and Kerala.

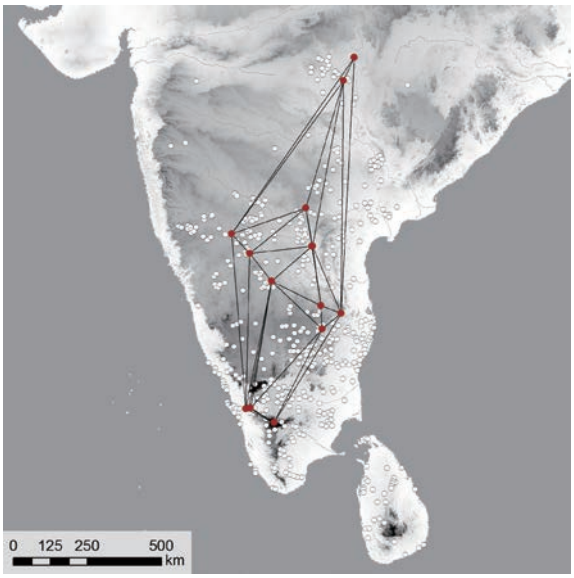
In contrast to the other types, Type 2 has a broader distribution over Telangana, Andhra Pradesh, Tamil Nadu and Kerala. At some sites, this type co-occurs with other types. As this type has an underground burial facility, this type cannot occur in the zones or spots where natural bedrock develops. At sites in the



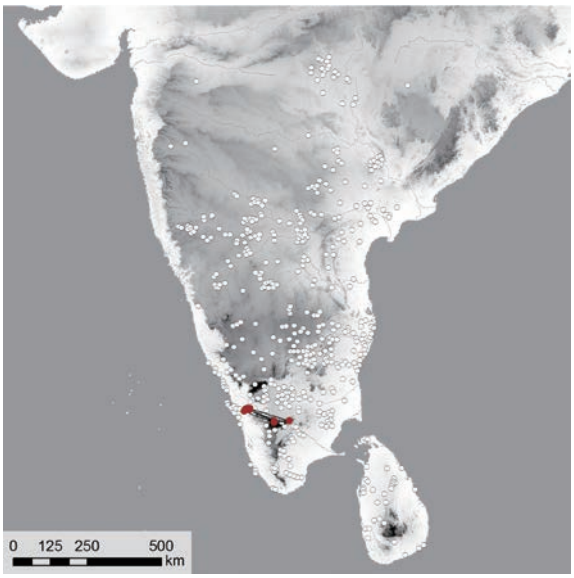
Type 1



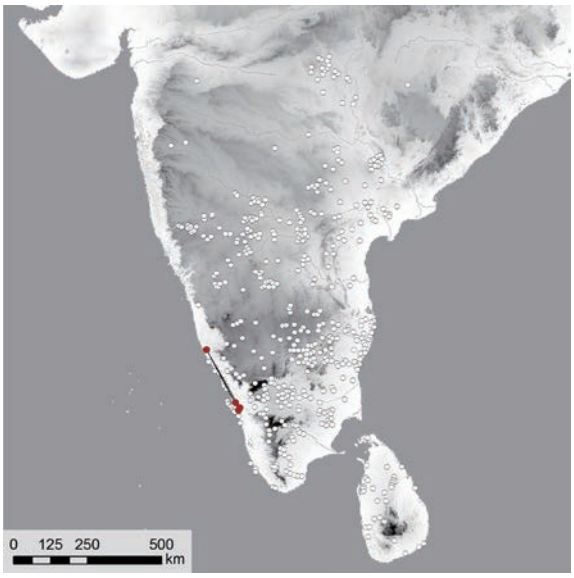
Type 2



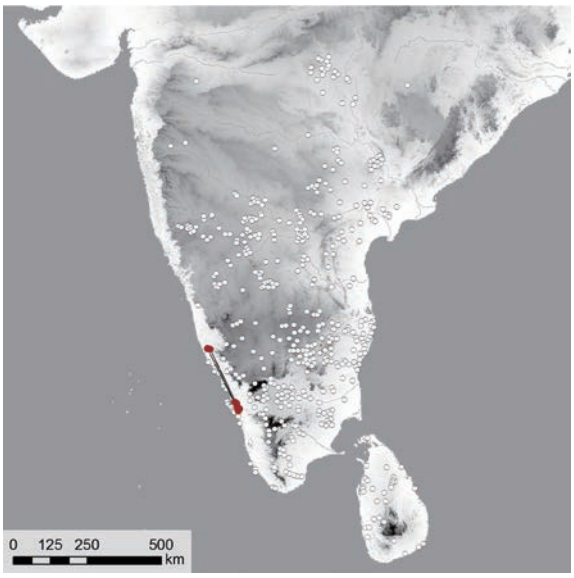
Type 3



Type 4



Type 5



Type 6

Figure 12 Distribution of megalith types in South India

Marayoor region where this type is concurrent with Types 3 and 4, the graves of Type 2 are located in spots where soil deposits are available. Although it is difficult to explain what this intermingling occurrences of Type 2 with other types indicate, the different types of megalithic graves may indicate the presence of different socio-cultural groups in a region. Otherwise, they may be the results of chronological developments of megalithic graves. To answer this problem, intensive surveys must be conducted to reveal the distribution pattern of different types of megalithic graves.

Another significant feature to be noted regarding the graves is the location of graves. The Indian peninsula is characterised by a diverse range of physical environments including coastal areas, alluvial plains, gentle hills, higher hills with exposed rocks, mountain ranges and so on. Megalithic graves are located in various landscapes (Figures 13 - 18)

For example, the region around Nagpur (ancient Vidarbha) is characterised by hilly areas with gentle slopes. The megalithic graves are located on such gentle slopes of the hilly areas (Figure 13). At sites, more than 100 graves spread in a certain area. This large number of graves indicates a continuous use of a specific place for burials of the deads over generations, but the relations between the graves and the geographical configurations are not so outstanding.

In southern Telangana, Andhra Pradesh and Karnataka, isolated hills made of huge boulders are widely scattered in the landscape. Megalithic graves stand on the top of such hills at some sites, such as Hire Benkal and Aihole in Karnataka, and Kadiriraya Cheruvu in Andhra Pradesh, or are located on the foot of hills at sites, such as Kandur in Telangana and Brahmagiri in Karnataka (Figures 14 and 15). It is also interesting to note that the graves on the top of hills are ground-level chambers (dolmen), while the ones on the foot are represented by underground graves (cists or pit burial). In any case, it is apparent that isolated hills were intentionally selected by ancient people for the location of graves due to some reasons.

Also in Kerala, ground-level chamber graves tend to be located on the top of hills (e.g. Kovilkadavu in Marayoor) or on the edge of elevated areas that are visible from the surrounding low-lying areas (e.g. Anakottappara in Marayoor) (Figures 16 and 17). In the Pazhayannur region where low hills interspersed by low-lying areas and rivers form the landscape, megalithic burials also occur on the top of hills, but their visibility from the surrounding low-lying areas is not so high. In the Kasargod district, northern Kerala, megalithic graves are situated on the top of the hilly landscape, but the number of graves built at one site is remarkably limited (one or two). Thus the distribution pattern of graves differs from the examples in other parts of Kerala. In contrast, graves are found in a certain number at sites in the coastal areas of the Thrissur region.

As is well known, megalithic graves are distributed in a cluster at many sites suggesting a continuous use of one place as a graveyard. It can be regarded as a prominent feature of the Megalithic culture. It is also important that the locations and distribution patterns of graves differ from site to site or from region to region. Although it is difficult to reveal the details of the subsistence basis of the Megalithic people, it is noteworthy that the Megalithic builders migrated and penetrated into various geographical zones and created the socio-cultural landscapes incorporating physical environments. As mentioned earlier, the Megalithic landscapes can be reconstructed by conducting intensive surveys on megalithic graves in connection to the geographic features[3]. Such socio-cultural landscapes are likely to have been connected to the subsistence and the social stratification of the Megalithic society.

South Indian Iron Age as seen from ceramics

In our project 'Establishing the chronology of South

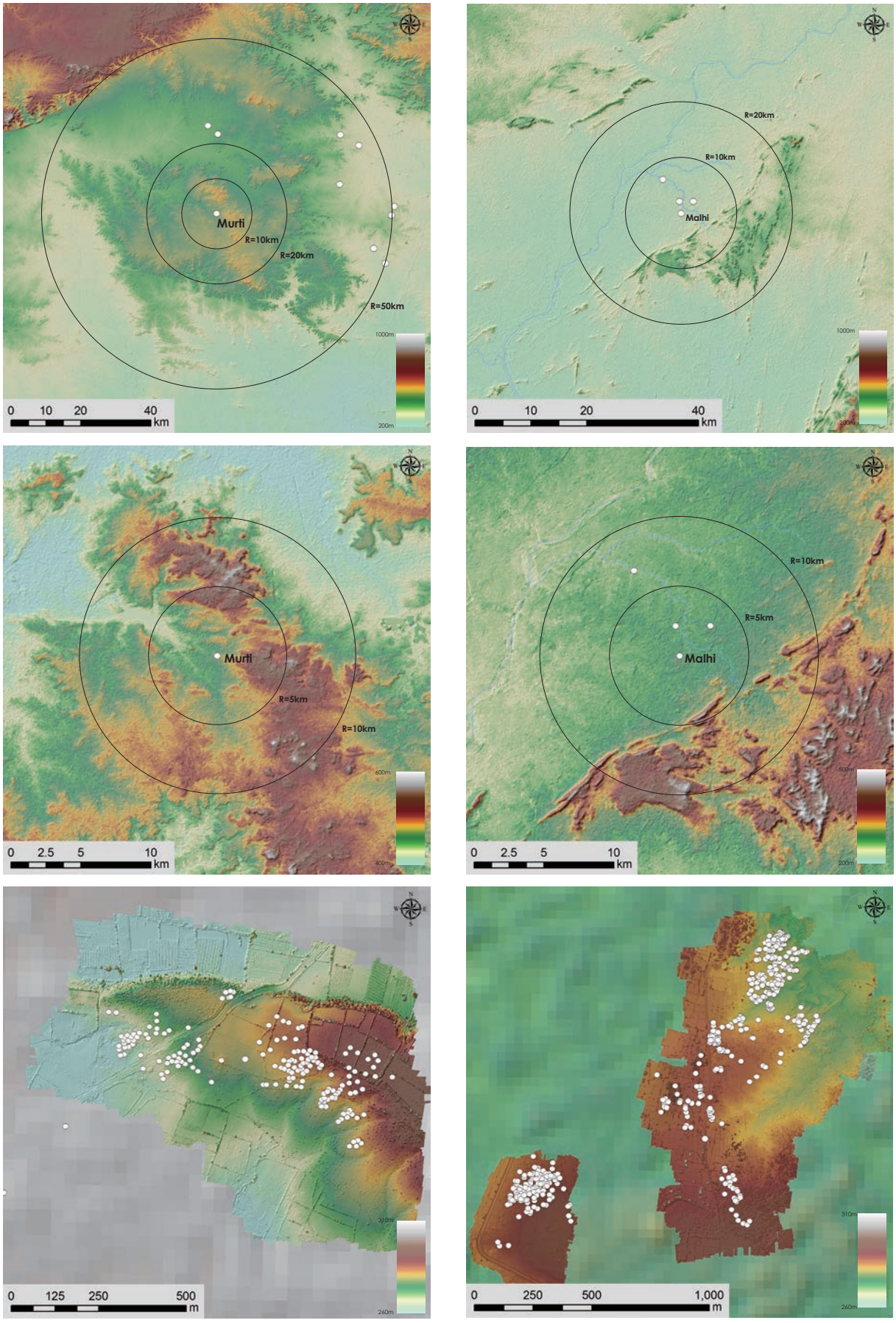


Figure 13 Locations of Megalithic graveyards in Maharashtra
(Left row: Murti, right row: Malhi; Courtesy of Maharashtra State Department of Archaeology/Vidarbha Megalith Mapping Project)

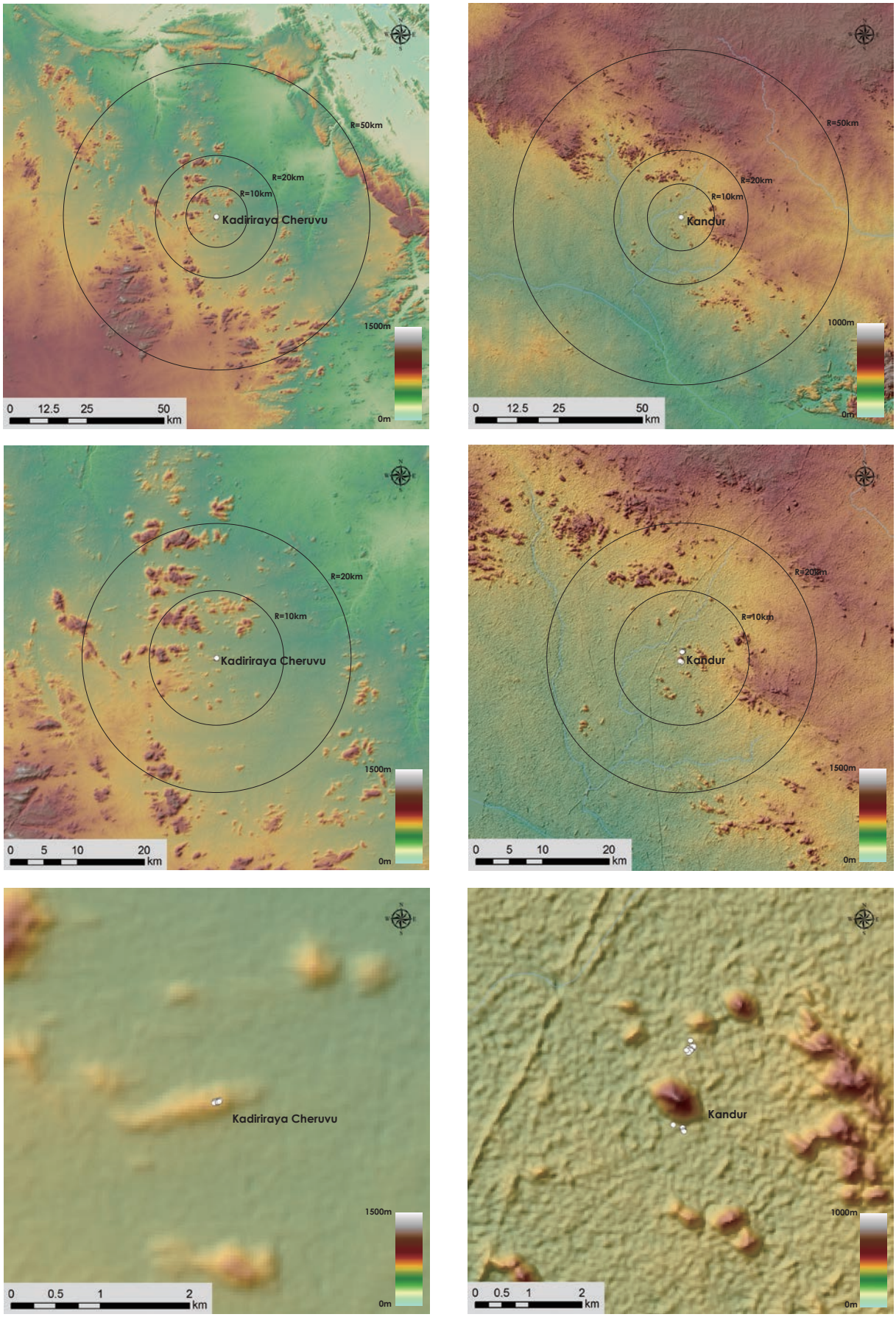


Figure 14 Locations of Megalithic graveyards in Andhra Pradesh
(Left row: Kadiriraya Cheruvu, right row: Kandur; Courtesy of Department of History, University of Hyderabad)

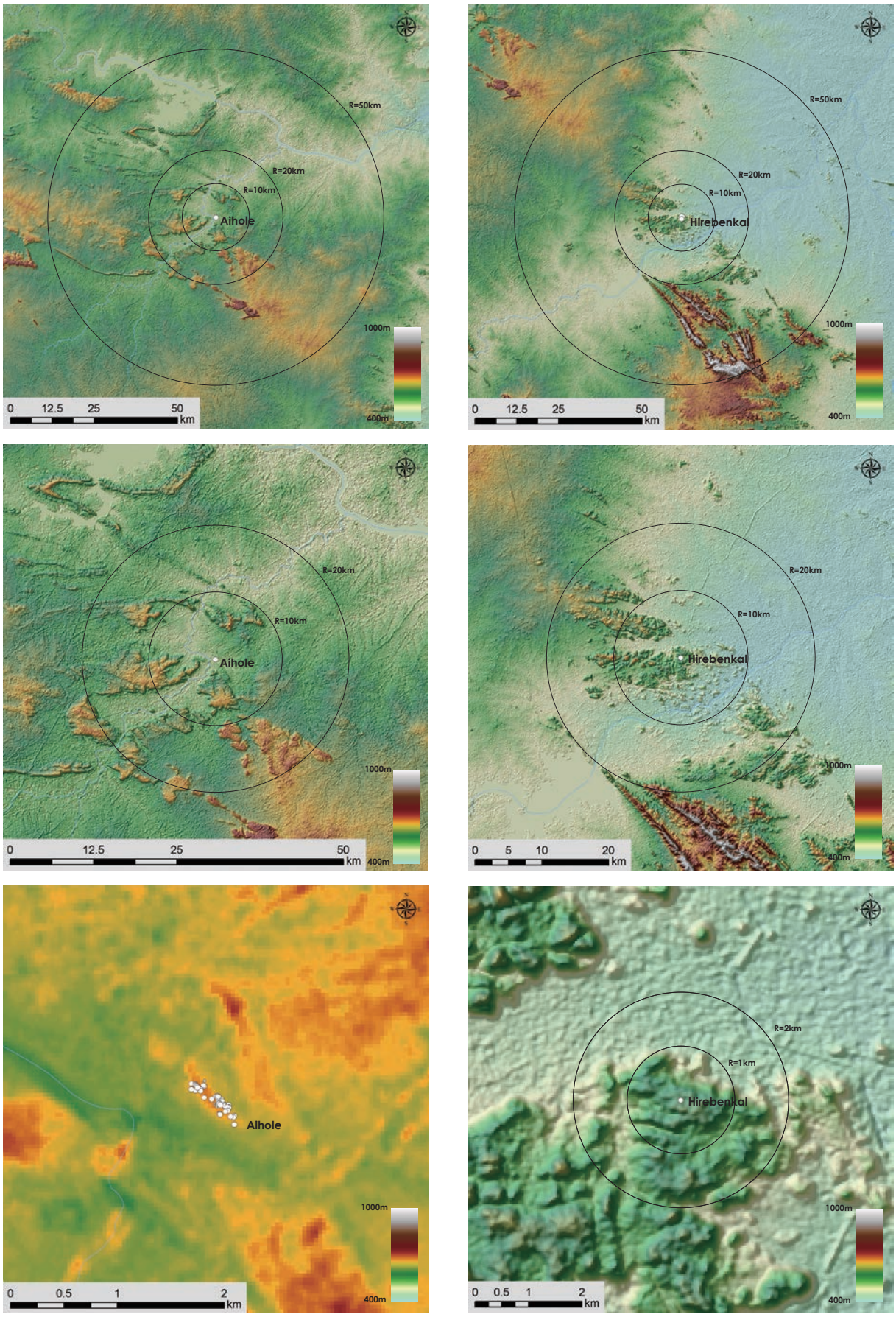


Figure 15 Locations of Megalithic graveyards in Karnataka (Left row: Aihole, right row: Hire Benkal)

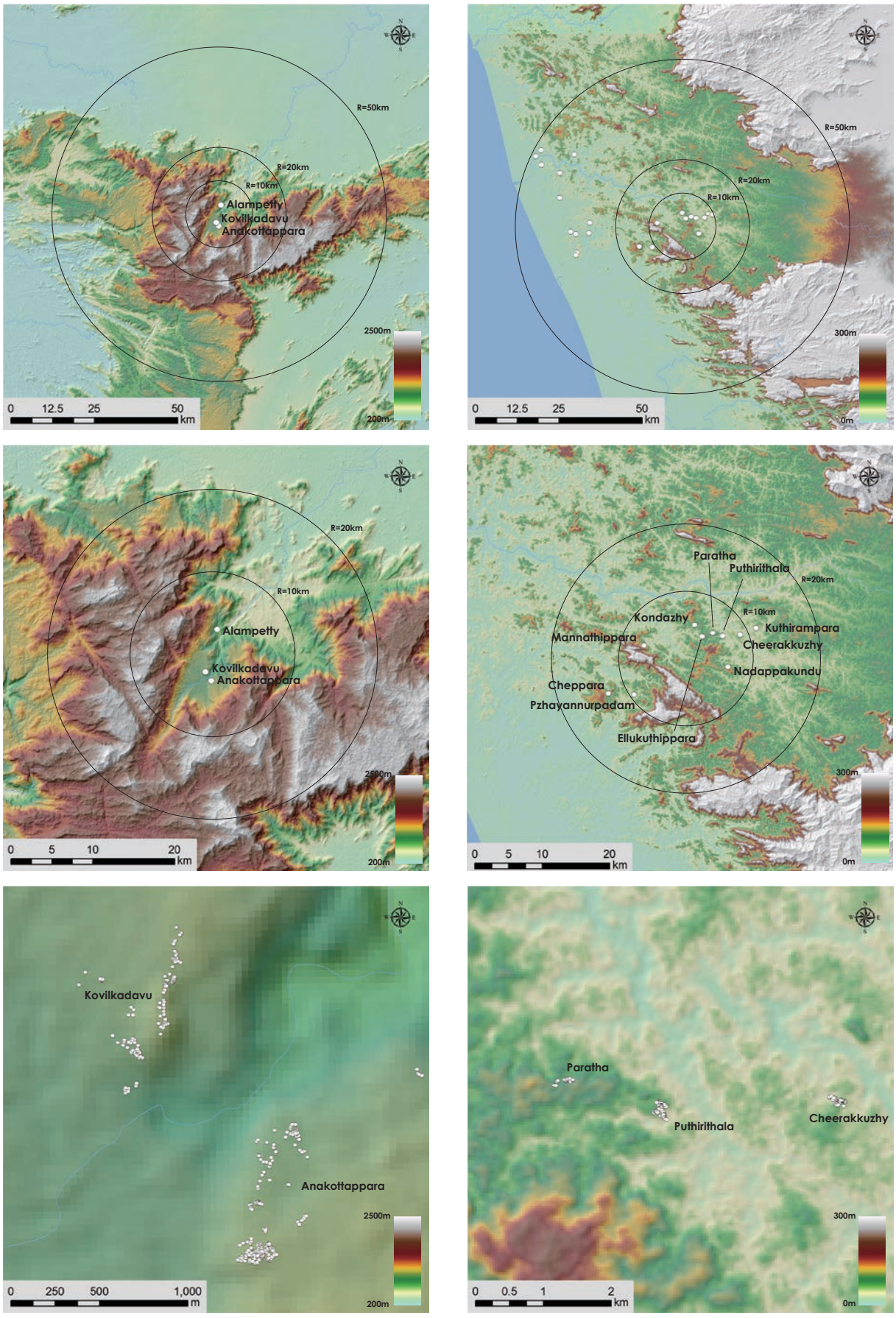


Figure 16 Locations of Megalithic graveyards in Kerala
(Left row: Marayoor, right row: Pazhayannur; Courtesy of Department of Archaeology, University of Kerala/Kerala Megalithic Gazetteer Project)

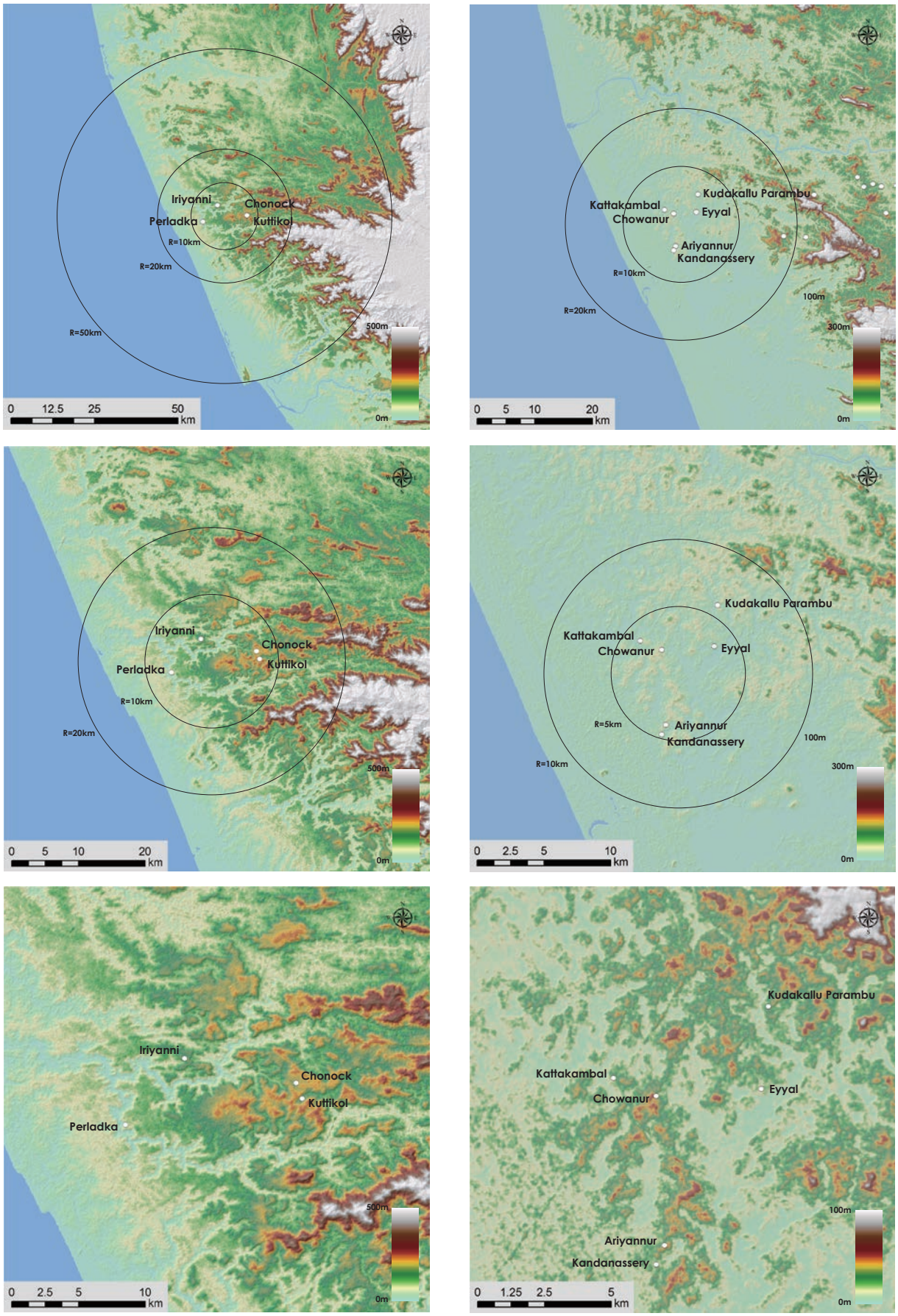


Figure 17 Locations of Megalithic graveyards in Kerala
(Left row: Kasargod, right row: Thrissur; Courtesy of Department of Archaeology, University of Kerala/Kerala Megalithic Gazetteer Project)

Raipur-Hingna, Maharashtra

Hire Benkal, Karnataka

Aihole, Karnataka

Brahmagiri, Karnataka

Kadiriraya Chevuru, Andhra Pradesh

Iralabanda, Andhra Pradesh

Nadappakundu, Kerala

Anakottappara, Kerala

Figure 18 Landscape of Megalithic sites

Indian prehistory', typological analysis on artefacts to establish the chronology of the Megalithic culture with the help of ^{14}C dates has been conducted. Although the analysis is still in progress, ceramics and stone beads were selected for this chronological study. For ceramics, a good number of Megalithic pottery and ^{14}C dates have been obtained from Kuttikol and Niramakulam in Kerala. The data on ceramics have also been collected from some sites in Maharashtra, Telangana and Andhra Pradesh. Based on this ceramic evidence, the author is attempting to conduct a comparative analysis between regions to build a ceramic chronology that can cover entire South India.

The evidence from Kerala (Figure 19) have revealed 1) that the emergence of Megalithic pottery including BRW dates back to the early part of the first millennium BCE (Phase I), 2) that the ceramic assemblage became diverse in the mid- to late first millennium BCE (Phases II-III), and 3) that the Megalithic ceramic tradition continued at least to the beginning of the Christian Era.

The first point is significant in the sense that the Megalithic culture penetrated into the southern part of the Indian peninsula by the early part of the first millennium BCE. This phase is evidenced by the ceramics and ^{14}C dates of the seventh century BCE from a rock-cut chamber grave at Kuttikol in the Kasargod district (Uesugi et al. in press). This grave is associated with iron objects as well. The association of BRW and iron objects from this early phase is noteworthy.

The ceramics from Phase II attested by the evidence from a cist grave at Niramakulam date to the fourth century BCE by ^{14}C dating. Some morphological changes from Phase I can be observed on the ceramic evidence from this site. Iron objects and carnelian beads are associated with this grave (Ajit Kumar and Ambily 2014).

In the possible following phase (Phase III) represented by the evidence from Porkalam (Thapar 1952), the formal assemblage of Megalithic pottery became more diverse with the appearance of shallow dishes and medium-sized pots. This diversified assemblage can also be seen at sites in Tamil Nadu, Telangana and Andhra Pradesh. The appearance of the pointed base seems to happen in this phase. These features indicate that various parts of South India were interconnected.

The evidence from Machad and Pazhayannur (Mehta and George 1978) exhibits further morphological changes and additions of new elements such as tall-necked pots and incised decorations. Similar pots with a tall neck have been reported from Brahmagiri in Karnataka as well also implying the interconnection between regions in South India.

For the ceramics from Telangana, Andhra Pradesh and Tamil Nadu, it is still challenging to reconstruct the chronological sequence of Megalithic pottery, but the occurrences of some shapes similar or identical to the specimens from Kerala, such as shallow bowl and hourglass-shaped stand from Nagarjunakonda (Subrahmanyam et al. 1975) in Telangana and Sanur (Banerjee and Soundara Rajan 1959) in Tamil Nadu, suggest their contemporaneity with Phases III and IV in Kerala.

At Sanur, short stands identical to the examples from Niramakulam and Porkalam in Kerala have been reported. A knobbed lid from this site also has identical specimens from Kerala. On the other hand, tall stands, shallow bows with a flaring rim and bowls with a pointed base, which are absent in Kerala, are widely present in Telangana and Andhra Pradesh. The shapes that widely occurs in different parts of South India clearly indicate the interconnection between the regions (Figure 20) and can be a key to establish the parallels in the chronology of ceramics in South India, while the presence of the shapes that occur in particular regions suggest regional developments in ceramics. Thus the widespread homogeneity and regional variations, which can be a clue for understanding not only the chronology but also the social aspects of the Megalithic culture, can be found in the Megalithic pottery

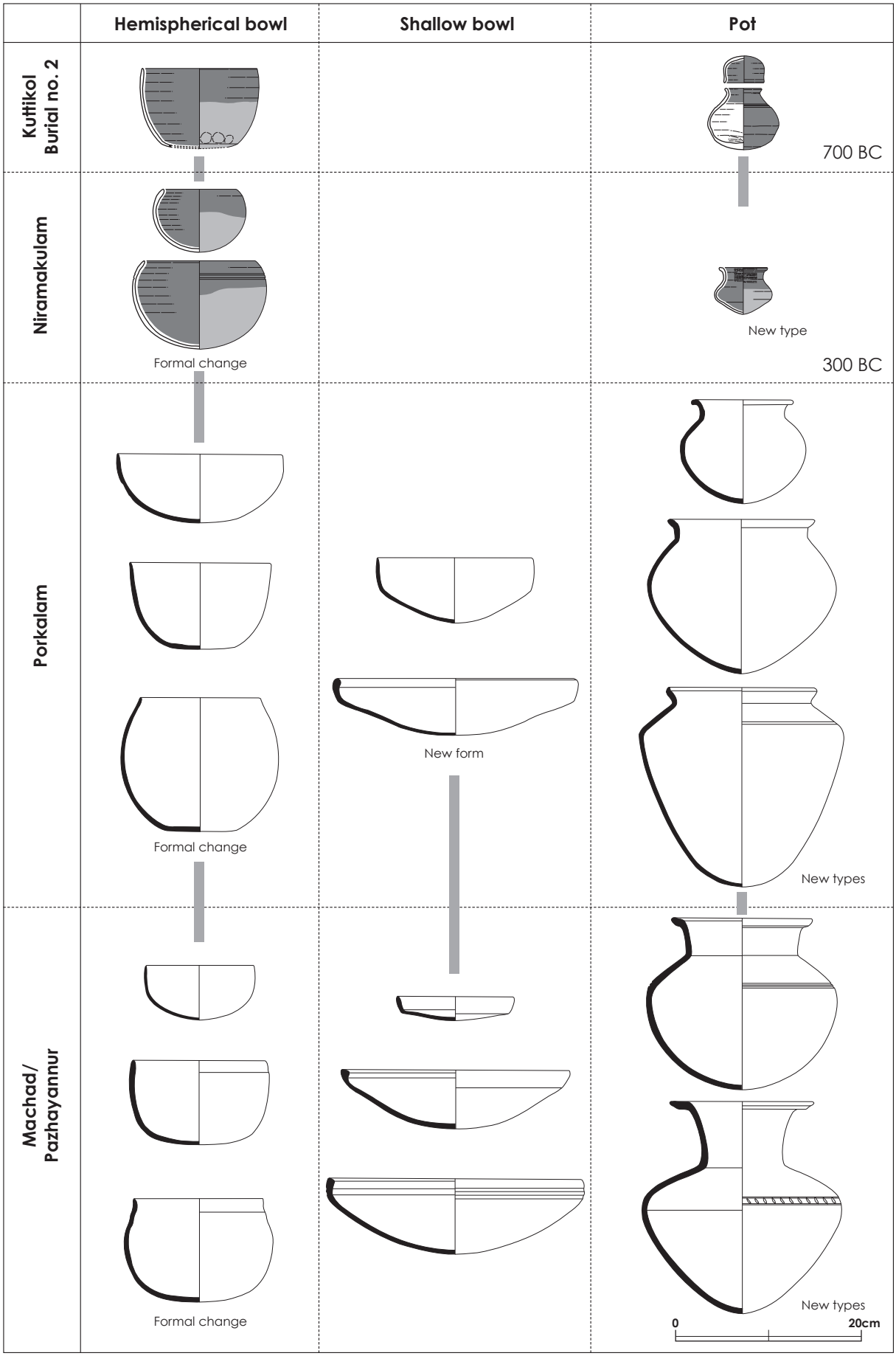


Figure 19 Hypothetical ceramic sequence of Megalithic pottery in Kerala

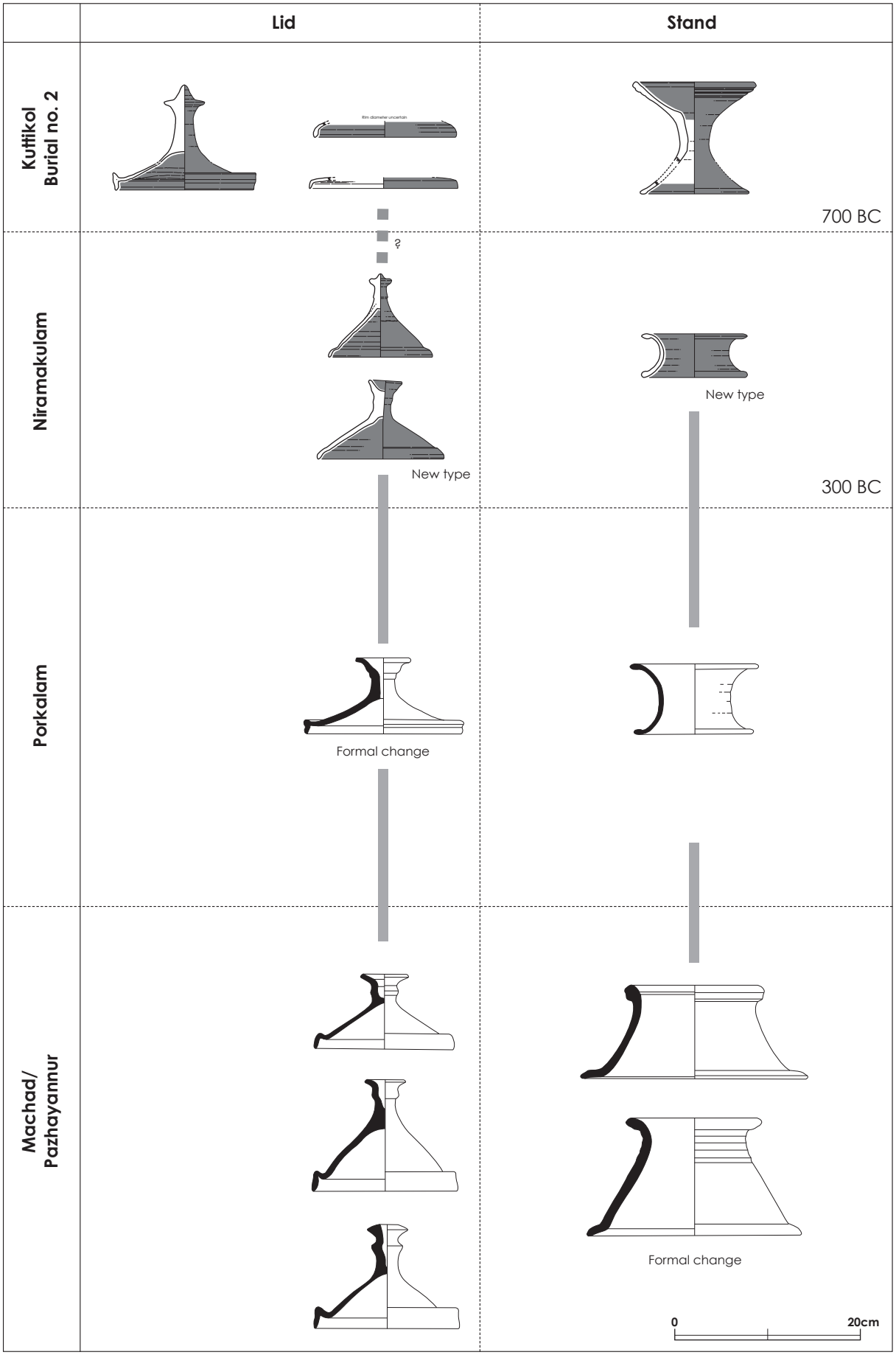
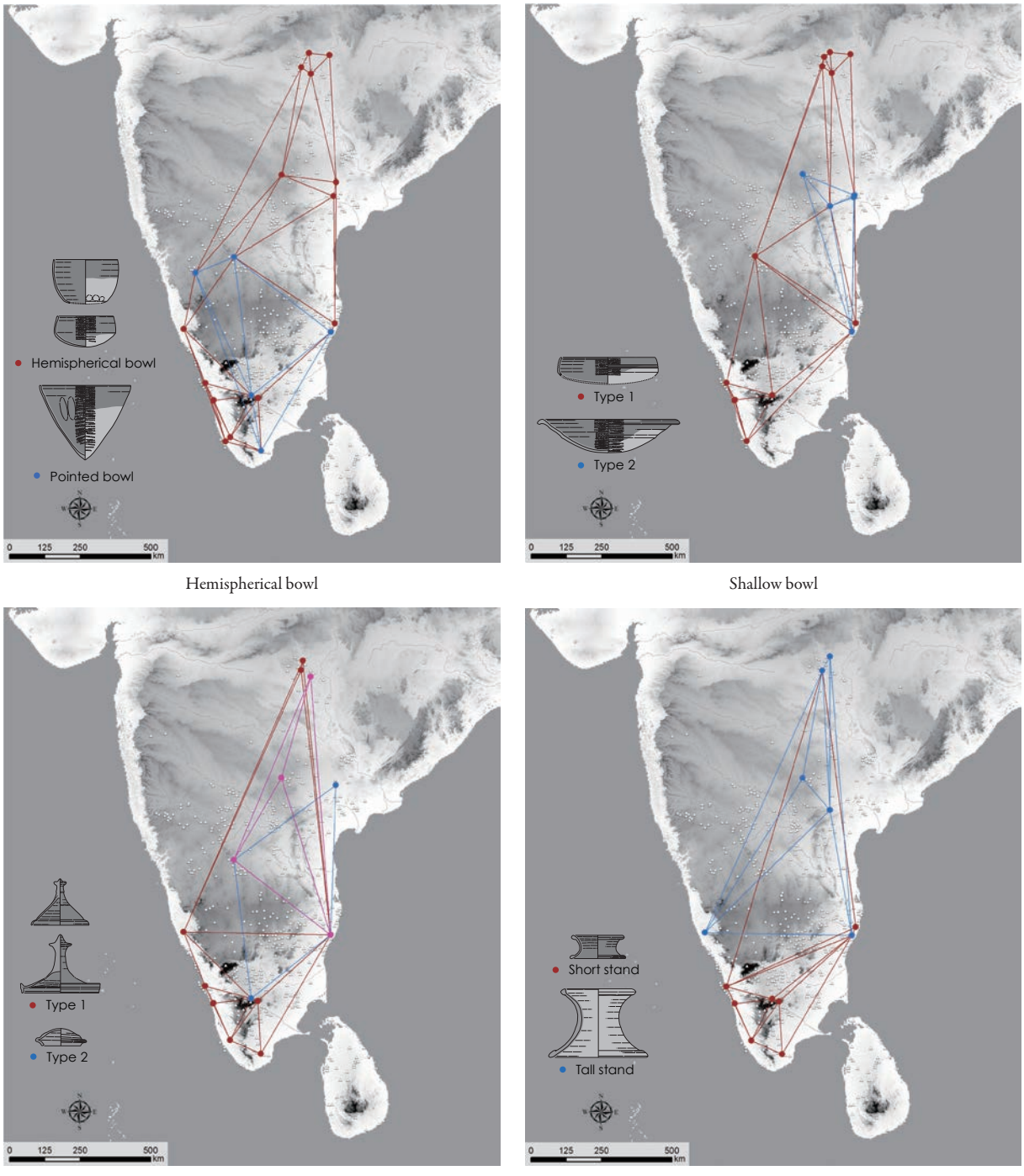


Figure 19 (contd.) Hypothetical ceramic sequence of Megalithic pottery in Kerala



Hemispherical bowl

Shallow bowl

Lid

Stand

Figure 20 Distribution of Megalithic pottery

Although further study is needed on ceramics as there are a number of issues to be investigated, the examinations on ceramics from various parts of South India can provide a significant clue for establishing the chronology of the Megalithic culture and for revealing the social aspects of the culture that are characterised by widespread homogeneity and regional diversity. While the widespread presence of common elements in ceramics suggests the society made up of interconnection between regions, the regional diversity shows developments of regional societies within the entire Megalithic culture. As the homogeneity and diversity can also be seen in the developments of megalithic graves, it is important to examine the Megalithic culture from multi-spatial levels to better understand the social developments of the culture.

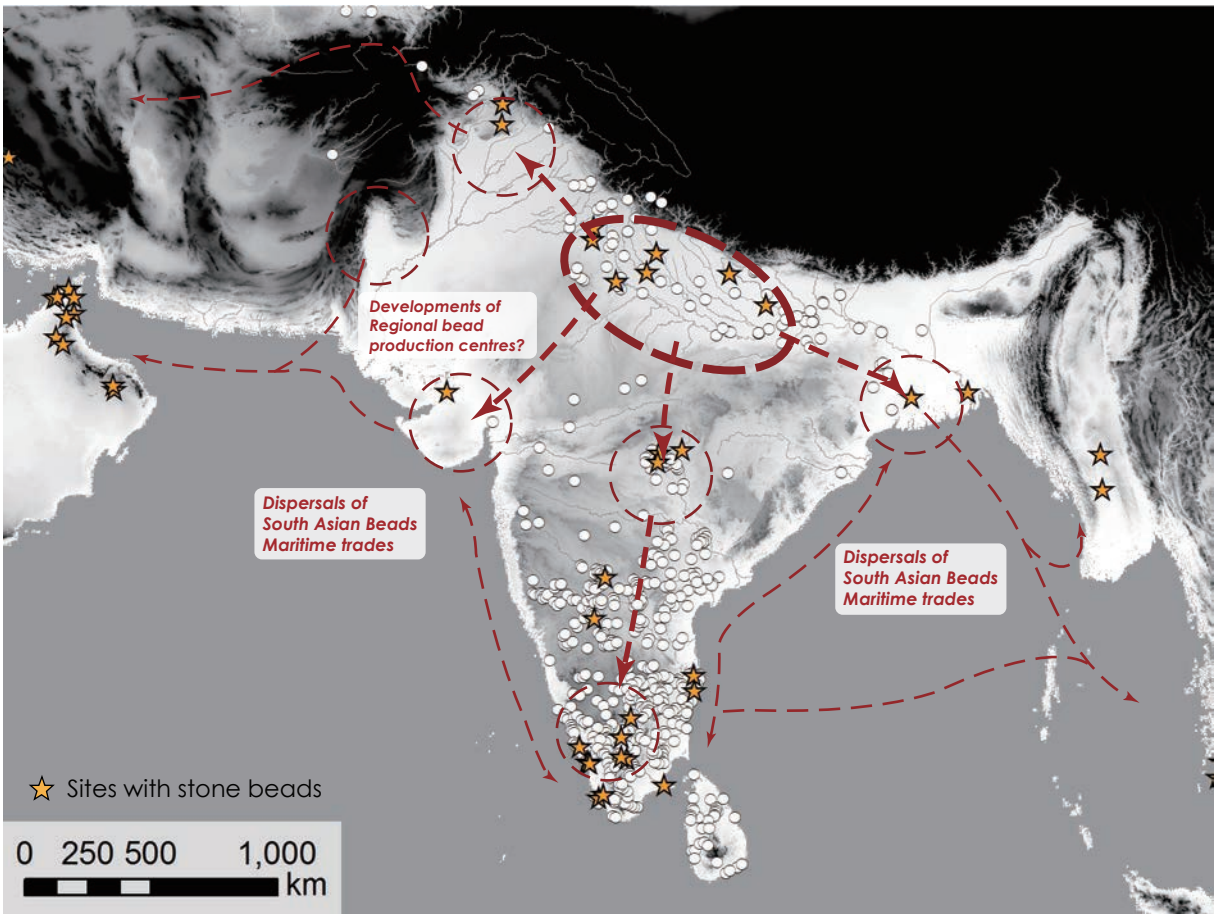


Figure 21 Distribution of stone beads in South Asia during the first millennium BCE

Developments of stone beads in South India

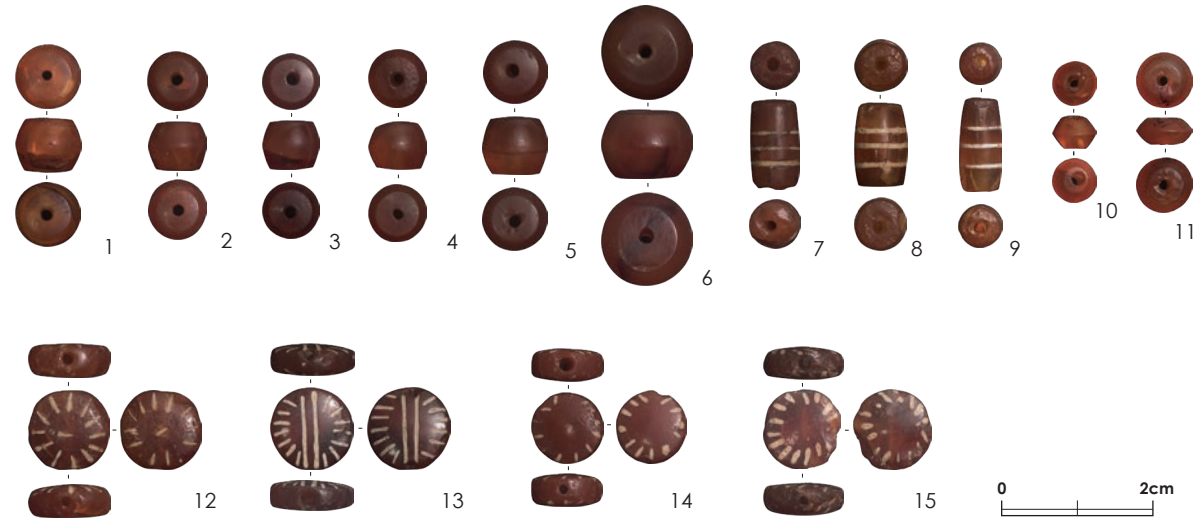
As stated earlier, the production and use of stone beads became predominant in North India during the early first millennium BCE (North Indian Iron Age Period II). Slightly late than in North India, stone beads widespread over South India in the context of the Megalithic culture.

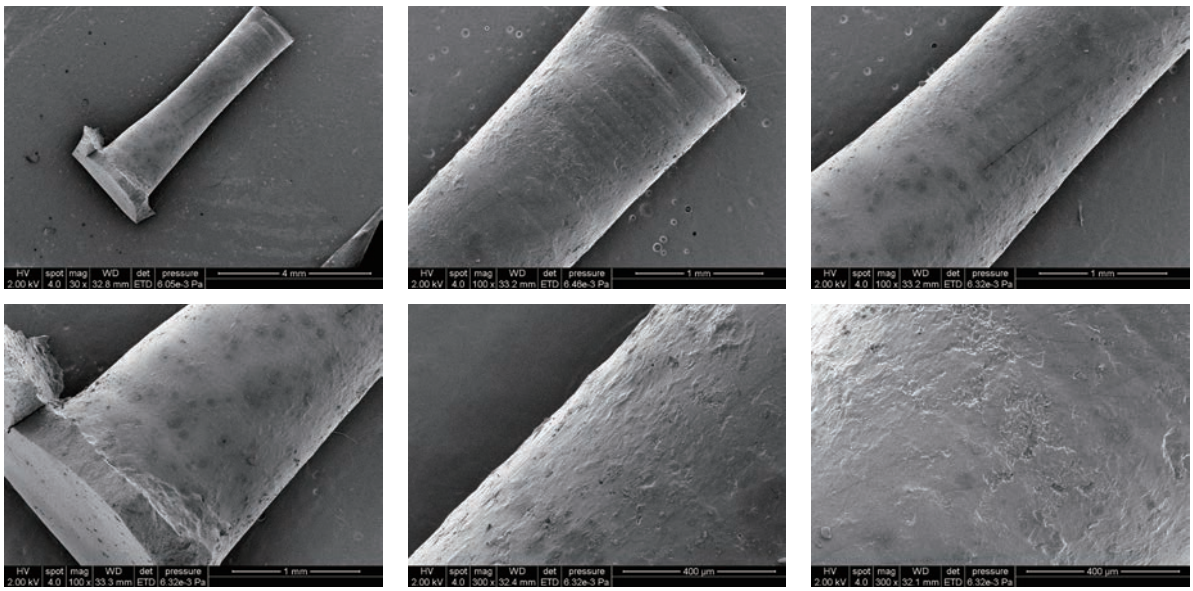
There was no tradition of stone beads in the Southern Neolithic culture, but it started to occur by the mid-first millennium BCE in South India (Figures 21 and 22), although well-dated examples are still limited. At Niramakulam, a cist burial with carnelian beads along with pottery and iron objects is dated by ^{14}C to the fourth century BCE.

The stones used for beads predominantly include carnelian, agate, jasper and crystal, which are common to North Indian beads, among which carnekuan beads are predominant in the south. The shapes, drilling technology using a diamond drill and bleached decorations are also common to the examples from North India.

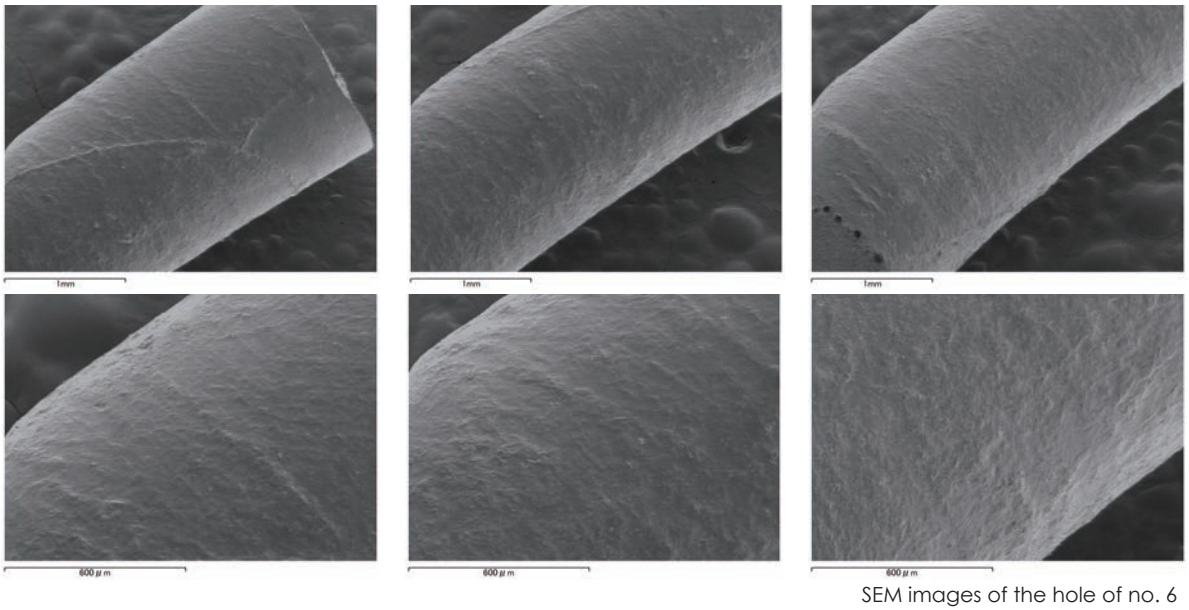
At Mahurjhari in the Nagpur region, Kadebakele in Karnataka and Kodumanal in Tamil Nadu, stone bead workshops belonging to the Megalithic period have been identified (Mohanty 1999; Vaidya and Mohanty 2015; Kelly 2016; Rajan 1991a, 2015). These sites are situated near stone sources. This evidence suggests that production and distribution systems of stone beads were established for supplying beads for the use at settlements and graves. The use of beads as grave goods is a predominant feature of the Megalithic culture, which may have facilitated establishments of stone bead production in South India.

Thus, it can be well evidenced that stone beads characterised by a similar set of materials, shapes, production technology and decoration technique occur both in North India and South India in an almost





SEM images of the hole of no. 2



SEM images of the hole of no. 6

Figure 22 Stone beads from South Indian Megalithic
(Niramakulam, Kerala; courtesy of Department of Archaeology, Kerala and Ambily CS)

contemporary time-period. Based on the stylistic and technological similarities, it seems highly likely that the beads in the Megalithic context were the result of influence from North India.

However, the spread of stone beads over South India cannot be explained merely as an influence or acculturation from the north. The contexts of use of stone beads differ between the north and the south. In South India, stone beads were profusely used in burial contexts, which is not the case in the north. It appears that different values and ideologies were given to stone beads in the Megalithic contexts, which seemingly facilitated the establishments of local productions and distribution systems in the south. It can be stated that the Megalithic society imported products or borrowed technology from the north through contacts but incorporated it into their society to suit their socio-cultural demands. In contrast, stone beads in North India are found only in habitational contexts as the custom of burial of dead seems to have ceased most probably with the spread of cremation. It suggests the values and ideology different from that in South India given to stone beads in the north.

This different use of stone beads between the north and south further suggests that the societies in North India and South India had contact with each other that caused import of goods and technological transfer, but the contacts between the two regions was not of a nature of coercing the societies into the entire socio-cultural integration and developments of a homogeneous culture.

The developments of interactive relations between the north and the south may have been the results of the dynamic social transformation in the Ganga valley that was in progress since the late second millennium BCE. It is likely that the surrounding regions including the Indian peninsula were incorporated into the socio-cultural networks in the process of colonisation and urbanisation in the Ganga valley. The Megalithic society in the south introduced the stone bead tradition from the north and fit it into its socio-cultural system.

During the late first millennium BCE, the relationship between the north and the south was further strengthened through the expansion of the Mauryan enterprise, the formation of urban centres in the south, the developments of maritime trades and so on. The strengthened relations between the two regions consequently caused the transformation of the Megalithic culture and the urbanisation in the Indian peninsula towards the end of the first millennium BCE. It seems likely that the social transformation in the south led to the decline of 'Megalithic' beads in the region.

THE RELATIONSHIP BETWEEN NORTH INDIA AND SOUTH INDIA DURING THE IRON AGE

The various aspects of the Iron Age societies in North India and South India were overviewed above. Then the question is: What kind of relations were there between the two regions during the Iron Age and how did the relations affect on the social developments of the two regions? In this section, the nature of the relationship between the two regions is to be examined in order to describe 'the Iron Age in South Asia'.

In the Ganga valley of the north, the society changed drastically during the second millennium BCE. Triggered by the expansion of the Bara-OCP or the late Harappan culture, the colonisation of the Ganga valley considerably progressed. The spread of BRW/BSW into the western part of the Ganga valley may have been connected to the progress of the colonisation in the region. This colonisation led to the further developments of societies in the region.

Also in South India, there was a social transformation during the late second millennium BCE. This transformation is characterised by the advent of new

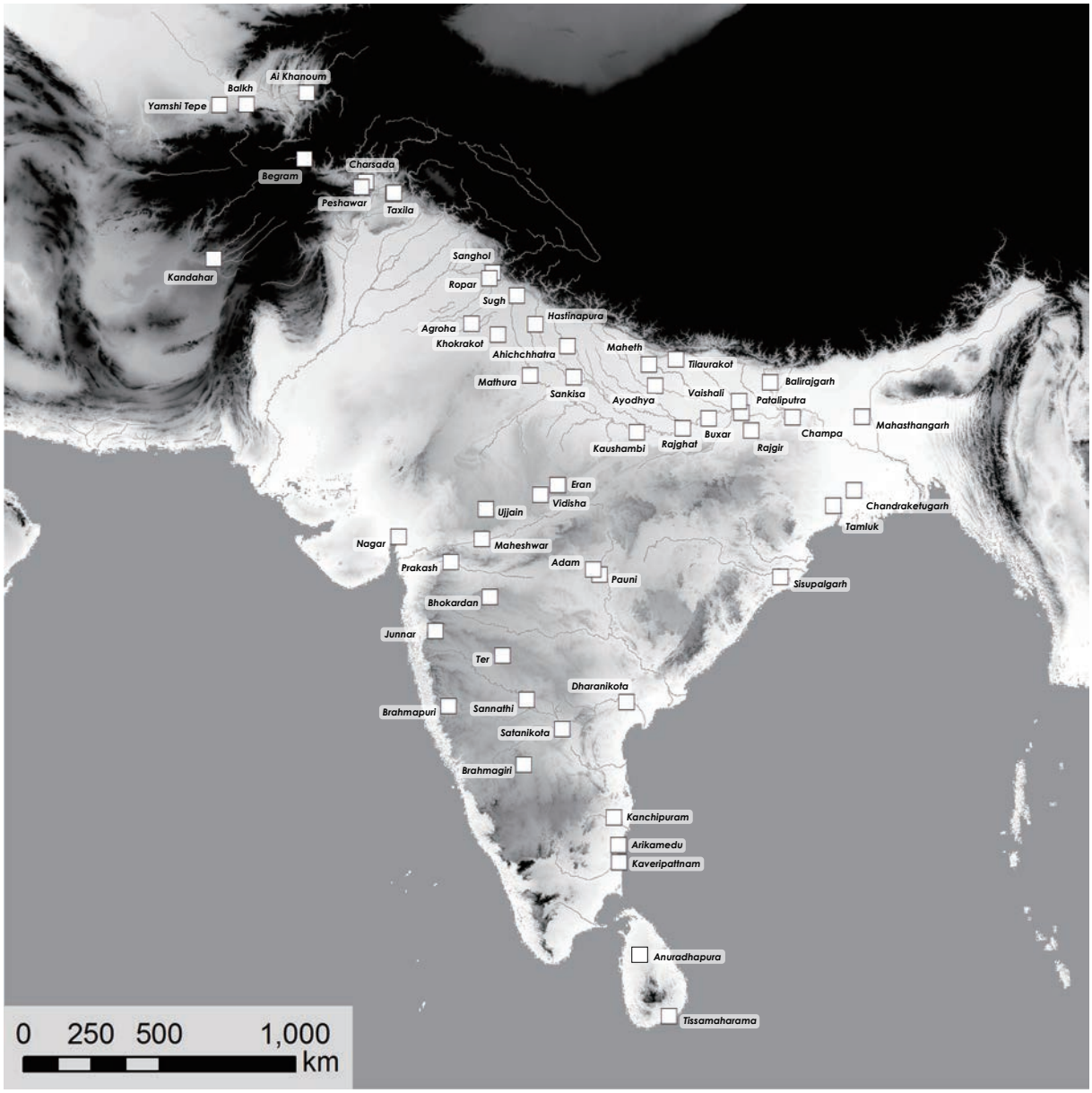


Figure 23 Distribution of urban centres during the late first millennium BCE

technologies, new material culture and a new society. The black ware industry including BRW appeared around 1400 BCE, the iron by 1200 BCE and megalithic graves around 1000 BCE. All these elements have no roots in the South Indian Neolithic culture suggesting that there was a drastic socio-cultural change and technological innovation happened somewhere in the south or that there was an introduction of these elements unknown in the Neolithic society from the north. It is not to say that the changes in South India during the late second millennium BCE were either indigenous or extraneous, but the reality must be searched in the middle of the two. For the black ware industry and iron, it is not unlikely that they were introduced from the north with the development of an expansive society in the Ganga valley. The advent of megalithic graves using stones local to the south seems likely to have its origin in the social transformation and the emergence of new ideology in the South Indian society.

During the early first millennium BCE, the Ganga valley witnessed the developments of a consolidated regional society and interaction networks over the region. Also in South India, the interaction networks

through the dispersal of Megalithic tradition spread into various parts of the peninsula, and cultural and technological elements were shared by regions. Thus the formation and emergence of consolidated social systems can be witnessed both in the north and the south. The spread of stone beads over South Asia by the mid-first millennium BCE is noteworthy regarding the developments of further interaction network connecting the north and the south. The common stylistic and technological features of beads suggest that the spread of stone beads was a result of the close connection between the two regions. The technological transfer also occurred from the north to the south based on the high demand for beads as grave goods in the Megalithic culture.

The different mode of use of stone beads between the north and the south is significant in understanding the nature of the societies in these two regions. While stone beads were used for symbolising the social status of living people in North India, they were given different ideological meanings as an item connected to the deads in South India. The stage of social developments or socio-cultural demands and ideology was different between the societies in the north and the south.

The same situation can be seen in iron. While the iron was exclusively utilitarian in North India, it was used in mortuary contexts in South India. It is highly likely that both iron and stone beads were a kind of precious items and critical social resources. The use of these essential resources in the mortuary contexts in the Megalithic culture suggests that the mortuary practices using these important items were essential means to maintain the social system of the Megalithic society.

The urban centres in North India exhibit further developments as regional centres and focal points of interregional interaction network during the last few centuries of the first millennium BCE. The North Indian interaction network expanded into the surrounding regions accompanied by dispersals of North Indian material cultural elements. It is highly likely that this wave of urbanisation affected the Megalithic society in the south.

In the Indian peninsula, a number of settlement sites of urban nature have been excavated (Figure 23); Ujjain in Madhya Pradesh, Kaundynapura (Dikshit 1968) and Adam (Nath 2016) in Maharashtra, Sisupalgarh (Lal 1949) in Orissa and so on. At Adam, the fortification wall was built in the period when BRW of the Megalithic tradition was in use.

Further south, Satanikota (Ghosh 1986) in Andhra Pradesh and Sannathi (Howell 1995) in Karnataka also emerged as an urban centre with fortification walls by the end of the first millennium BCE. At Satanikota, megalithic burials are situated near the settlement indicating a continuous use of a particular place as a strategically important regional centre. Although further research is needed for better understanding the process of urbanisation in the peninsula, the distribution of urban centres ranging from coastal areas to inland areas strongly suggests the development of networks connecting various parts of the south. It is also to be noted that the urbanisation process in South India did not begin only with the impetus from the north, but the Megalithic people played a vital role in the process as this evidence demonstrates.

It is well known that maritime trades traversing the Arabian Sea and the Bay of Bengal developed around the beginning of the Christian Era. The ends of this trading network were connected to the Roman world and Southeast Asia. Spices and other exotic items pleased Romans. However, the process of the developments of the maritime trades has not been well understood. *The Erythraean Sea of Periplus* of the first century CE records the details of the maritime trades, but it does not narrate the history of the maritime trades. Therefore archaeological evidence is the only source for understanding how the maritime

trading networks developed.

The excavations at Arikamedu in Tamil Nadu in the 1990's has revealed that this port town date back to the second century BCE (Begley 1983; Begley et al. 1996, 2004). The Indian artefacts including stone beads and high-tin bronze objects from Ban Don Ta Phet in Thailand were dated to the fourth century BCE by ^{14}C dating (Glover et al. 1984; Glover 1996; Glover and Bellina 2003, 2011). This evidence shows that the developments of the maritime trades across the Bay of Bengal date back to the late first millennium BCE, but it is yet to be revealed that which region of the subcontinent played a significant role in developing the maritime trades. It is a crucial question whether North Indian or South Indian society was the first coloniser of the ocean. Also in the Arabian peninsula, a number of Indian artefacts, mostly stone beads, have been reported (Salman and Andersen 2009) suggesting that the trades across the Arabian Sea became very active by the end of the first millennium BCE. It is strongly expected that future excavations at sites along the coastal areas of the subcontinent would provide evidence for the developments of the maritime trades. It is also essential to examine how the developments of the maritime trades affected the social evolution in the subcontinent, both in North India and South India.

Regarding North India, it is not unlikely that the expanding urban society of the Ganga valley incorporated the communities living along the coast into its urban system to develop the maritime trades. In this process, the urban centres in the delta of the Ganga river, such as Chandraketugarh and Tamluk connected the coastal area and the urban centres in the Ganga valley. It is also likely that overland routes were established in the process for connecting urban centres in the inland area.

For South India, the relationship between the Megalithic culture and the urbanisation during the late first millennium BCE is yet to be better understood, but it is apparent that the Megalithic people located and exploited various resources in the Indian peninsula in the process of their expansion and developments of craft productions for their demands. It is highly likely that this resource exploitation system and craft production tradition were integrated into the new urban system.

It is an important issue of how to divide the Iron Age and Early Historic period based on the archaeological evidence. Concerning the spread of the urbanisation process over South Asia, it can be said that the Iron Age ends around the end of the first millennium BCE. The end or marginalisation of the Megalithic culture by this time matches well with this chronological division. In any case, our understanding of the process of socio-cultural transformation in the subcontinent including the spread of urbanisation, the developments of maritime trades and the marginalisation of the Megalithic culture is much more important than the chronological division.

The Iron Age in South Asia can be regarded as a process of socio-cultural integration within North India and South India and between the two regions. Regional societies were integrated into larger societies through interaction, and the socio-cultural system covering the entire subcontinent emerged by the end of the first millennium BCE. This statement does not mean that the uniqueness and traditions of regional societies/cultures faded away in this process. Rather such unique features of regional societies/cultures were the principal driving force for connecting regions and the formation of larger interaction networks.

This integration or interaction process entails political developments of social power, state, and broad economic phenomena of flows of resources, goods and information, and of technological transfer. Through this process, a social system maintaining the interconnection and interaction between regional societies, which can be called the South Asian world system, emerged. This entire process represents the

significance of the Iron Age, and further researches must be conducted to better understand the process.

PROBLEMS AND PERSPECTIVES FOR FUTURE STUDY

There are two categories of problems to be solved by future research and study. One is related to the methodological issues, and the other pertains to the actual topics to be studied.

The methodological issues are;
1) The resolution of chronology used in archaeological studies. For example, the Iron Age in North India is divided into four periods based on ceramic evidence. Each period has a time span of 300-400 years, which is too broad to trace the changes in the material culture and social transformation. In South India, the changes in material culture cannot be traced because of the lack of chronological frames, especially for the Megalithic culture, except for some sites and regions that have a few ^{14}C dates. Both in North India and South India, the societies dynamically and drastically changed over time. Therefore it is an urgent task to establish chronologies of higher resolution to trace the social and cultural changes. Both the relative chronology based on the stylistic and technological changes and the absolute dating using chronometric methods are important in this task.
2) Publication of primary data for enabling to make a comparative study on material culture to see the temporal and spatial variations in the Iron Age culture. A number of archaeological sites have been excavated by the efforts of many scholars both in North India and South India, but the publication of primary data is quite limited. The paucity of primary data published makes it difficult to share not only the data themselves but also the perspectives for future research among scholars. The ongoing destructions of many archaeological sites in the subcontinent due to the recent economic developments endanger the future archaeological studies. In the case of South India, a number of megalithic monuments are in danger of destruction without any records. Especially for the large-scale graveyards of the Megalithic culture, the documentation of every archaeological feature is essential to examine the distribution patterns of features including graves and to reconstruct cultural landscapes. However, such well-documented sites are limited in number. Our project 'Establishing the chronology of South Indian prehistory' has been attempting to record megalithic graveyards using UAV (unmanned aerial vehicle)-SfM (structure from motion) method and high-resolution GNSS, and to create data for examining the spatial pattern of megalithic graves. Important is to share these data in the academic society and to create data of higher resolution. It is essential to share the primary data among scholars to have a better understanding of archaeological evidence and cultural heritage. To accomplish this, publication of detailed reports and more scientific records are necessary. Rapidly developing digital technologies over recent years have been enabling us to create different types of data, which undoubtedly lead to more diverse and fruitful perspectives to archaeology.

The actual topics for future study are;
1) To identify the earliest iron in various parts of the subcontinent. As discussed in this paper, the spread of iron dates to the North Indian Iron Age Period II (the early first millennium BCE), but the Introduction Phase of iron (the North Indian Iron Age Period I) is also essential to examine the origin and the process of spread of iron in North India. Besides, the social contexts and material culture of the Introduction Phase must be fully understood.

It is likely that the use of iron in megalithic graves became predominant in South India during the early first millennium BCE. However, the origin and

process of spread of iron in South India prior to the Spreading Phase have not been fully traced. Further evidence on the use of iron before 1000 BCE can reveal how iron was introduced and spread in South India and how the transition from the preceding stage to the Megalithic culture happened.

As stated earlier in this paper, there are two major theories on the origin of iron in South Asia; indigenous and external. However, taking the physical and cultural diversity of South Asia into consideration, it can be assumed that the origin and spread of iron must have also been diverse. By refining the chronological resolution as mentioned above, the earliest occurrences of iron in various parts of the subcontinent and the process of spread of iron must be investigated.

2) Regarding the spread of iron, the different modes of use of iron between North India and South India are noteworthy. In the north, iron was used for utilitarian purposes and in the south, iron was predominantly used in mortuary contexts. Iron as a vital resource is likely to have been given some non-utilitarian and ideological meaning. The different modes of use between the two regions suggest that the value of iron, practical or ideological, was also different in these two regions. It can further be assumed that the motives for the spread of iron were also different. In order to better understand the socio-cultural values given to iron, much more evidence of iron from the Introduction and Spreading Phases are needed.

3) The last issue to be investigated regarding iron is the iron production technology. At a handful of sites, iron production workshops have been unearthed, but very few technological reconstructions of the iron production process have been done except for the studies by Vibha Tripathi (e.g. Tripathi 2001, 2013). Only the chemical analysis of iron objects and slags cannot lead to the reconstruction of the entire production process. The types of iron ore used, the structure of furnaces and the tools used for making iron objects must be studied. The investigation into the diachronic developments and spatial variations of the iron production technologty is crucial for our understanding of the origin and spread of iron in South Asia.

4) A number of events are relevant to our understanding of the developments of the Iron Age society in North India; the expansion and colonisation by the Bara-OCP culture in the western part of the Ganga valley during the early second millennium BCE, the spread of the black ware ceramics including BRW over the western part of the Ganga valley in North Indian Iron Age Period I (the late second millennium BCE), the formation of consolidated regional societies and interaction system over the Ganga valley in North Indian Iron Age Period II (the early first millennium BCE), the emergence of urban centres in North Indian Iron Age Period III (the mid-first millennium BCE), the expansion of the urban society and the spread of the North Indian material culture into the surrounding regions in North Indian Iron Age Period IV (the late first millennium BCE) and so on. Future research must be oriented to these issues to better understand the actual role and significance of these events in the social developments in North India.

Looking over the social transformation in North India, the developments of regional societies and interaction system connecting regional societies are important. In order to reveal the aspects of regional societies, horizontal excavations of settlement sites are essential. Trial excavations conducted so far was important in the sense of reconstructing the cultural sequence of sites. If the spatial use patterns at sites can be examined in horizontal excavations, our understanding of settlements and regional societies will be much more profound.

In order to trace the expansion of the interaction network, examining the distribution patterns of specific cultural elements is useful. The cultural elements that we can archaeologically examine are diverse including iron objects. Among them, ceramics and stone

beads are more plentifully retrieved in excavations at many sites making it possible to examine them across regions and over time. While ceramics produced usually for daily use are the item of mass production and consumption, items like stone beads and iron objects, which are made of raw materials of limited availability, are produced in a lesser amount than ceramics. Consequently, these items would be given some special values or meanings. Stone beads and iron objects are also different in values from each other. Therefore, the spatial and temporal distribution patterns of these items can differ from each other. By examining the distribution patterns of different items of different values can provide important clues to reveal various aspects of the interregional interaction system.

5) Regarding the South Indian Megalithic culture, the earliest occurrence of various elements like black wares, iron and graves that characterise the Iron Age society in South India is the issues to be urgently investigated. To trace the occurrence of these elements that are absent in the Neolithic culture of the preceding period leads to revealing the process of transition to the Iron Age Megalithic culture. It is entirely possible that there was some impetus for the socio-cultural transformation from the Neolithic culture to the Iron Age culture, whether it was indigenous or external. The emergence of a significant number of monumental graves in the Megalithic culture must have been based on the reorganisation of community or relations between communities. The widespread dispersal of the Megalithic culture in the various parts of the Indian peninsula also exhibit the reorganisation of the interaction system. It is very crucial to trace these drastic changes happening in South India to understand the emergence of the Megalithic culture.

The earliest occurrence of BRW is dated to the late second millennium BCE except for the date of 2000 BC from Brahmagiri (Morrison 2005) and the date of 2200 BC from Gachbowli (Thomas et al. 2008), and the earliest iron is to 1200 BCE. More ^{14}C dates are needed to examine the introduction of these cultural elements. The process of transition from the Neolithic culture is also to be archaeologically traced. Excavations of graves with an underground burial facility can also provide ^{14}C dates, and stratigraphic evidence from settlements sites can give clues for establishing a chronology of higher resolution.

6) The process of cultural changes in the Megalithic culture have not been well understood, but the examination of ceramics, stone beads and iron objects can exhibit their temporal and spatial variations, based on which cultural homogeneity and diversity of the Megalithic culture can be revealed. The chronological parallels with the North Indian culture can also be pursued, especially in the case of stone beads.

As argued earlier, it is highly likely that the expansion of the urban society during the late first millennium BCE gave impetus on the Megalithic culture in the south to change. This period of social transformation both in North India and South India must be further investigated from the viewpoint of the interaction between the two regions.

7) Finally but not least, the homogeneity and diversity of the Megalithic culture are to be mentioned. The contrast between the diversity in megalithic graves and the homogeneity in other material cultural elements characterises the Megalithic culture in South India. The diversity in megalithic graves is partly due to the different physical settings of the regions in the Indian peninsula. Where stone slabs are readily available in granitic gneiss zones, ground-level chamber (dolmen) was adopted for graves, and where natural bedrock of laterite develops, especially in Kerala, rock-cut chambers were built. In other words, the physical settings of the region made up a particular type of graves through which a social tie among the community living in a region was formed and strengthened. The homogeneity in material culture including stone beads common to North India clearly indicates that the Megalithic societies in various parts of the south

were not closed ones but had an open system connecting to their neighbouring societies or communities. This homogeneity and diversity are the prominent features of the Megalithic culture that spread over a vast area of South India. It is important to ask why and how such a socio-cultural system was created and maintained.

In order to better understand the Iron Age in South India, a multi-spatial-scale analysis ranging from one site through a regional society's level to a broader interconnected societies' level must be conducted as the Iron Age can be regarded as a process of the social transformation at various levels towards the formation of the 'South Asian' world system. If how such a multi-layered social system was formed and developed over time is well examined, the historical significance of the Iron Age for the South Asian history would more clearly be explained.

Notes

1) The North Indian Iron Age chronology is based on the chronological parallels of ceramic sequences in various parts of North India (Uesugi 2002); in the upper Ganga valley region including the Ghaggar valley, the ceramic phases change from the Bara-OCP phase through the PGW phase to the Late NBPW phase represented by the coarse type of NBPW; in the mid-upper Ganga valley region covering western U.P. and eastern Rajasthan, the sequence starting from the Bara-OCP phase through the BRW phase and the PGW phase to the Late NBPW phase can be attested; in the mid-Ganga valley region (the southern part of U.P. along the Ganga river and the northern foot of the Vindhyan range) and the mid-lower Ganga valley region (southern Bihar) and the plain area region to the south of the Himalayas (northern U.P.), the sequence is comprised of the BRW/BSW phase, the Early NBPW phase characterised by the fine variety of NBPW and the Late NBPW phase.

In the upper Ganga valley region, the Bara-OCP phase can quite securely be dated to the early second millennium BCE, but the chronological position of the PGW phase is not so clear as the date of the first occurrence of the PGW has not been well established. It can tentatively be dated to the late second millennium BCE.

In the mid-upper Ganga valley, the Bara-OCP phase is followed by the BRW/BSW phase and then by the PGW phase. The presence of the BRW/BSW phase, which can date to the late second millennium BCE, pulls the beginning of the PGW phase in this region down to the early first millennium BCE.

The NBPW has its origin in the eastern part of the Ganga valley, i.e. mid- and mid-lower Ganga valley region and the plain area region to the south of the Himalayas as it developed out of BRW/BSW. The NBPW includes the fine and coarse varieties, the former of which can date to the mid-first millennium BCE and the latter of which to the late-first millennium BCE based on the stratigraphic occurrences at a number of sites in this region. As most of the specimens of NBPW from the western part of the Ganga Valley, i.e. the upper and mid-upper Ganga valley region, belong to the coarse variety, it can be presumed that the spread of NBPW into this region happened in the late first millennium BCE. Therefore it is highly likely that the PGW phase in this region continued to the mid-first millennium BCE.

Based on the parallels of these regional ceramic sequences, the Iron Age in North India can be divided into four phases; Period I (the late first millennium BCE) is represented by the PGW phase in the upper Ganga valley region and the BRW/BSW phase in the other regions; Period II (the early first millennium BCE) is defined by the PGW phase in the western part of the Ganga valley and the BRW/

BSW phase in the eastern part; Period III (the mid-first millennium BCE) is demarcated by the emergence of the fine variety of NBPW in the eastern part of the region, while the PGW phase continued in the western part; Period IV (the late first millennium BCE) is characterised by the spread of the coarse variety of NBPW over the Ganga valley. This chronology has some problems in our limited evidence for describing the details of the ceramic sequences in regions and in the limited number of ^{14}C dates to give absolute dates to this chronology.

2) Also in South India, ^{14}C dates are pushing back the date of the beginning of the Megalithic culture. ^{14}C dates of a charcoal sample collected from a BRW pottery found by R.E.M. Wheeler in a deposit beneath Megalith 6 at Brahmagiri has been dated to 2140-1940 cal BC (Morrison 2005). Usually, this date around 2000 BCE is included in the South Indian Neolithic culture. If the emergence of the Megalithic culture dates back to this date as this ^{14}C date suggests, not only the chronological issue but also the entire relationship between the Neolithic culture and the Megalithic culture must be reconsidered. The South Indian Neolithic culture has also been dated by a good number of ^{14}C dates from the recent excavations at Sanganakallu in Karnataka between 3000 cal BC and 1400 cal BC. Then we have to assume that the Neolithic culture and the Megalithic culture were concurrently residing in a region, which seems to be untenable.

3) K. Rajan and his team have vigorously been conducting surveys on Megalithic sites in Tamil Nadu over the last 30 years refreshing our knowledge on the Megalithic culture in the region (Rajan 1990, 1991b, 1992, 1994, 1997, 1998, 2003). The American mission led by C. Sinopoli and C. Morrison also has been conducting systematic and intensive surveys in the area around Hampi in Karnakata (Bauer 2011, 2016; Bauer et al. 2004; Bauer and Trivedi 2013; Bauer et al. 2007; Johansen 2004, 2010, 2014; Johansen and Bauer 2013, 2015). The author of this article has also started conducting intensive surveys in Kerala and Maharashtra. These intensive surveys will bring out a new set of knowledge on the Megalithic landscapes.

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IRON AGE CULTURE OF NORTH INDIA

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INTRODUCTION

The Painted Grey Ware (PGW) culture holds an important position in the protohistoric archaeology of North India as it represents the emergence of a new cultural tradition in the chronological gap between the Harappans (2500 - 1900 BCE) and the Early Historic Period (600 - 300 BCE). Not only does Painted Grey Ware represent a complete departure from its predecessors in terms of the material culture, but also yields the earliest evidence of iron metallurgy in northern India.

The Painted Grey Ware was first discovered in 1940-44 during an analysis of the ceramics from the lowest levels of Ahichchhatra (Ghosh and Panigrahi 1946). B.B. Lal made a similar discovery while digging test pits at Hastinapura, and upon learning of the discovery at Ahichchhatra, decided to conduct a full excavation at Hastinapura in 1950-52 (Lal 1954). On the basis of the comparative stratigraphy, the Painted Grey Ware settlement at Hastinapura was dated to 1100 - 800 BCE. Explorations following the Lal's project at Hastinapura yielded hundreds of Painted Grey Ware sites throughout the states of Haryana and Uttar Pradesh (Lal 1954). To date, there are about 1161 Painted Grey Ware sites in India (Tripathi 2012: 285-335) and additional sites in Pakistan. The main concentration of sites is in the states Haryana, Punjab, Rajasthan and Uttar Pradesh. Six hundered and twenty-seven of the approximately 1161 Painted Grey Ware sites are located within the borders of Haryana alone, making Haryana a dense concentration of these sites. However, the human societies living in the semi-arid and sub-humid plains of northern India depended on their environment for food and subsistence. It is therefore necessary to precede a discussion of the Painted Grey Ware with a detailed discussion of the local environments.

PHYSIOGRAPHY

The area within the borders of modern Haryana is characterized as a semi-arid alluvial plain with the exception of the Shivalik hills in the north and the Aravalli hills to the south. Physiographically, Haryana can be divided into three units (Thussu 2006: 10-13), which are given below:

a) Structural and denudation hills of Delhi supergroup in the south and west

This type of morphology occurs in Bhiwani, Mahendragarh, Rewari, Gurgaon, Jhajjar, Faridabad and Nuh districts. These hillocks rise approximately 200 - 650

m above the mean sea level and comprise a part of the Aravalli hills.

b) Central alluvial plains with semi-deserted tract in the western and southern part

The Central Alluvial plain is bounded by the Shivaliks in the northeast and the Aravalli hills in south and southwest. This plain forms a portion of the Indo-Gangetic divide. The general elevation of the plain region ranges between 199 - 250 m average mean sea level and 300 m above the mean sea level. It has a general slope towards north and east in the southern part and southwest in northern and central parts (Thussu 2006: 10) and the general groundwater flow direction is from northeast to southwest (Arun Kumar 2007: 7). These well-irrigated plains, which contain most of the state's developed cities, have made Haryana a major focal point for India's agriculture.About 30 % of the total plains contain aeolian sand dunes which occur regularly in the districts Jind, Hissar, Rohtak, Kurukshetra, Fatehabad, Sirsa, Bhiwani, Mahendragarh, Rewari and Jhajjar.

c) Sub-Himalayan structural ridges and valleys in the northeast

The outer Shivalik or the lesser Himalayas lie in northeastern part of Haryana. There are folded and parallel ridges here. Pinjor Dun and Nalagarh Dun represent a low lying area within the mountain ridges. Rivers and rivulets like Ghaggar, Markanda and Tangri, originate in this region and cause heavy flooding in northern Haryana during the rainy season. The highest point in the region is the Karoh peak (1500 m) on the Nahan border (Singh 1995: 87).

DRAINAGE

The availability of water is one of the key factors for agriculture. Only one perennial river flows through Haryana and the rest of all rivers are seasonal streams. But the water from most of the rivers is used for irrigation in this region. The location of Haryana is very important in the sense of the water divide. It is located between the Indus river system and the Ganges river system and hence forms a divide between the two. Haryana is irrigated by two important river systems, viz. the Yamuna and Ghaggar river systems. Apart from these two, a number of rivulets, viz. Tangri, Markanda, Surasti (Saraswati), Rakshi, Chautang, Patali, Jaintidevi, Sukhna, Begna, Sabhi, Dohan and so on, also contribute to irrigation (Figure 1). The major rivers of Haryana are described below alphabetically. Most of the Painted Grey Ware sites are located along with the courses or in the flood plains of these rivers or seasonal streams.

Ghaggar

The Ghaggar is the second important water source in Haryana after the Yamuna. It originates in the Sirmur district, Himachal Pradesh and has a catchment area in the Lesser Himalayas. It enters Haryana near the village Bariser where it takes a sudden curve towards the south and cuts across the northern ridge of the Morni hills. After flowing for a few kilometres, it takes another sharp turn towards the northwest where it flows through a deep gorge for about 10 km. The stream is then joined by a tributary called the Budhi-Ghaggar near the village Thapli Sikh. The Ghaggar enters the plains near Panchkula. In its upper courses, the river carries water throughout the year, but in lower courses it is generally dry during the summer, but often carries a large amount of water during rainy seasons. Many rivulets and hill torrents feed the river. There are two major areas of its catchment in its upper reaches, i.e. one is Pinjor dun and the other is the foothill zone. The Ghaggar, more or less, forms the boundary between the Punjab and Haryana states. Passing through Haryana and Punjab, it enters the Hanumangarh district of Rajasthan and a few kilo-

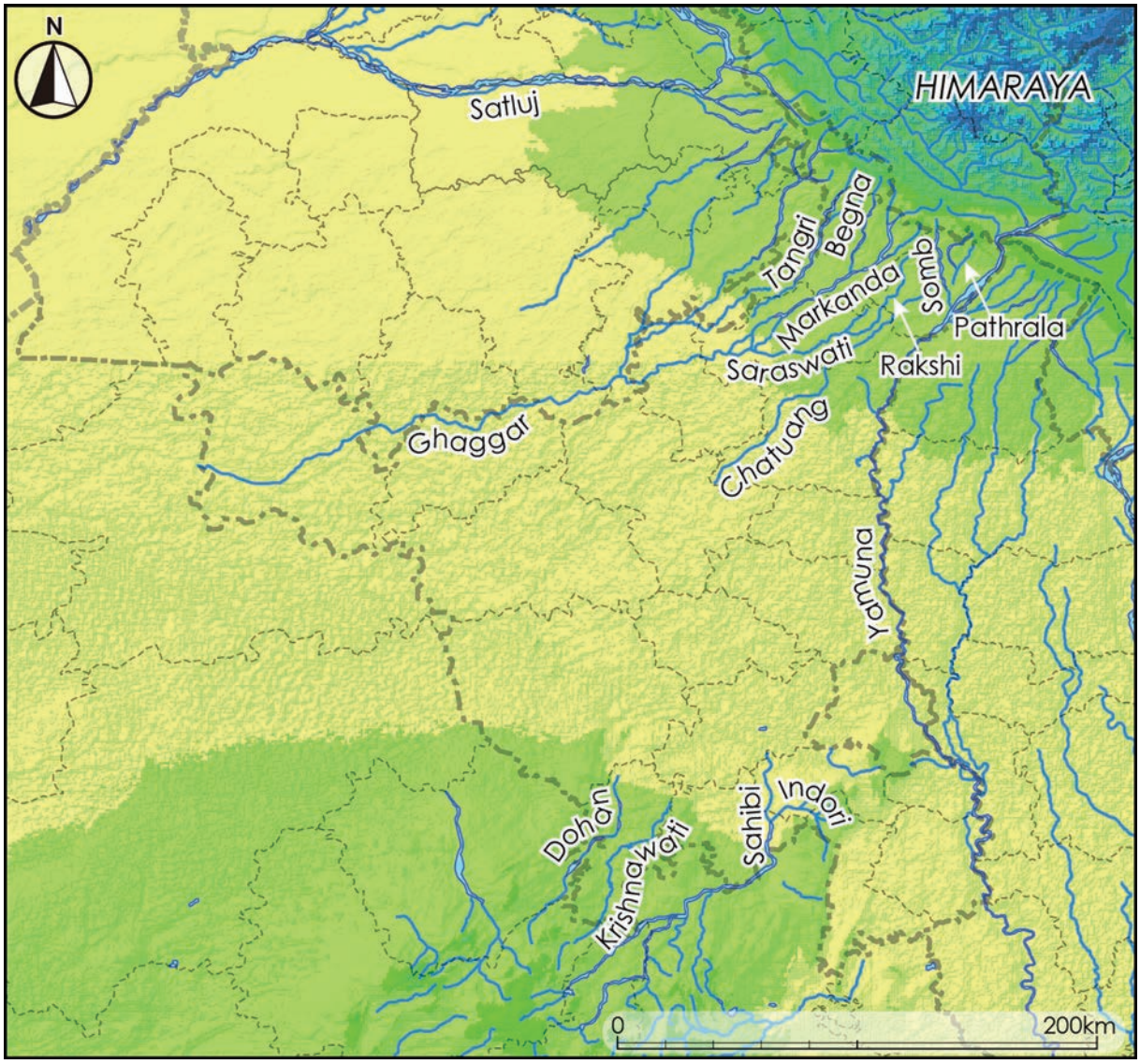

Figure 1 Rivers of Haryana

metres west of Anupgarh (district Sri Ganagnagar), it enters the present-day Pakistan where it is known as the Hakra. The Ghaggar seems to have been a mighty river in the past as indicated by a dry bed which is 2 - 3 km wide.

Tangri

The Tangri is a large and destructive stream that originates in the Morni hills. It enters the plains near the village of Chhajju Majra and after a few kilometres it is joined by the Baliali *nadi* (river). It passes through the Ambala cantonment and crosses the Ambala-Jagadhri railway line and turns southwest. Near the village of Segta, two other streams namely the Omla and Amri join it and at the same place the Narwana branch of the Bhakra canal crosses the Tangri. Near the village Niharsi, the district Patiala, it turns southwards and joins the River Markanda.

Markanda

The Markanda also originating in the Dharti Dhar range of the Sirmur-Shivalik hills, cuts through the Shiwalik range and enters the plains near Kala Amb. The Nakti, a small stream, joins it near the village Sherpur. The river channel that is broad between Kala Amb and Mullana becomes narrow south of the Mullana town. The Markanda then continues through the town of Shahabad Markanda. A little above Jh-

hansa, the Markanda divides itself into two streams. The western one is known as the original Markanda. About 5 km southwest of Pehowa, near village Jalbeda, it joins the Saraswati. This is the only river after the Ghaggar which has terraces in the present study area.

Begna

The Begna, a wild torrent, has two sources of water; one in the Morni hills and the other in the Sirmaur region. It enters into the plains near the village Fatehpur and flows east of Shahzadpur, Badhauli and joins the Markanda near Mulana. This is a wide hill torrent and causes heavy damages during the rainy seasons. It carries a huge amount of water which results in sudden and violent floods.

Saraswati

The Sarusti nadi/Saraswati nala (river) has been identified as the Vedic Saraswati River. According to traditions, the Saraswati originates from Adi Badri but actually the rivulet which originates near Adi Badri is the River Sombthat flows towards the east and joins the Yamuna. Actually this river originates in the jungles of Sandhai, then crosses Bilaspur, Kakrauli, Chanda Kheri and Tej Jattan, and then it crosses the Ambala-Saharanpur road near the Chappar village and passes through Mustafadbad, Gadhana, Ghalaur and Bura, where it is called the Khand Nadi. After moving a few kilometres, its channel disappears in the sand but reemerges before going underground. The account for its disappearance is mentioned in the legends as "Saraswati was the daughter of Mahadeva, but her father, one day, in a drunken fit, approached her with the intention of violating her modesty. She fled and dived underground whenever she saw her pursuer gaining upon her and the river which sprang up in her track, still disappears underground at the same spot" (Manmohan Kumar 1978: 11). The Sarusti passes through Bilaspur, Mustafabad, Thanesar, Bibipur and Pehowa, but nowadays its course has been channelized.

It is proved by a number of scholars that the Saraswati was a perennial and glacier fed river during the past. The Saraswati nala is regarded as a sacred river in Haryana. This is evident from the presence of several historical temples, pilgrimage and Hindu ritual sites. Relics of archaeological sites all along the course of this river indicate it to be a perennial river in the past.

Local populace performs different Hindu rituals along the river course. The important feature of the Saraswati and its tributaries is that these rivers do not have well-defined channels. As a result, most of the time, due to the gentle slope of the plain, these have sheet flow instead of channel flow. Due to this factor, the water flowsover a vast area and in agriculture fields too. As a result, there remains abundant water in fields for paddy crop cultivation. This sheet flow is also referred in the Puranic literature.

Rakshi

The Rakshi is a very small stream rising in the plains at Shahpur near the village Bilaspur, the district Yamunanagar. It flows Ladwa, Daulatpur and Thanesar and discharges itself into the Sanhit tank and joins the Saraswati near Harsh-ka-Tila (district Kurukshetra). Its course can be defined through the steep banks. It carries a large amount of water during the rainy seasons and causes floods in the region.

Chautang

The Chatuang originates in the plains, a few kilometres southeast of the Saraswati and these two streams move parallel to each other for a few kilometres, later the Chautang turns southwards and runs parallel with the Yamuna for some distance. After passing through the Jagadhari tehsil of the Yamunanagar district, it crosses National Highway No. 1 near Nilokhheri and after passing through the Nisanag village of the district Karnal, it loses itself in the sand dunes of Jind. After Jind, its dry course can be traced

from Hansi to Hissar. It then enters Rajasthan and passes through Nohar, Badhara and Ravatsar. It joins the River Ghaggar about 2 km east of Suratgarh. Well-known archaeological sites like Rakhigarhi, Siswal, Kharal Aliipur, Sothi, Nohar and Rang Mahal are located along its dry bed.

Somb

The Somb is a broad hill torrent that originates in the Sirmur-Shivalik hills and moves southwards between the Rivers Patharala and Saraswati. After moving for about 40 km, it discharges its water in the Yamuna near the village of Kanalsi in the Yamunanagar district. For most months of a year, it remains dry but during rainy seasons, it carries a plentiful amount of water and floods over a wide area around it. Its floods are extremely rapid, but quickly drain off.

Yamuna

The Yamuna is the only perennial river that flows through Haryana and is the largest tributary river of the Ganges in northern India. It originates from the central Himalayas at the Yamunotri glacier at a height of 6,387 m on the southwestern slopes of the Banderpooch peaks in the Lower Himalayas. It travels a total length of 1,376 km and has a drainage system of 3,66,223 km^2, i.e. 40.2 % of the entire Ganges basin. It enters the Haryana plains near Yamunanagar, where the Hatni Kund barrage is situated. Flowing through Yamunanagar, the Karnal and Sonipat districts, it enters Delhi. After Delhi, it flows towards the southern districts of Haryana, viz. Faridabad and Palwal. Then it enters Uttar Pradesh and joins the Ganges at Allahabad. This river is a major source of irrigation in Haryana. The western Yamuna canal originates from the Hathni Kund barrage that irrigates most parts of Haryana.

Sahibi

The Sahibi is the main stream of south Haryana. It rises from the Mewat hills in Alwar of Rajasthan and after gathering water from several tributaries, forms a broad stream. It enters into Haryana near the village Ranawi of the district Rewari. It again enters Rajasthan and then re-enters Haryana near the village Jarthal. During the rainy regions, it carries a largeamount of water and causes floods. To moderate these floods, a barrage has been constructed near Masani in the district Rewari and is called the Masani barrage. Finally it empties itself in the Najafgarh lake.

GROUND WATER

The average depth of water level varies from 1.87 - 11.35 m below ground level, the deepest being inthe extreme southern part. The area experiences a rise in the water level between the pre- and post-monsoon periods due to the increased rainfall. The general groundwater flow direction is from northeast to southwest. The long-term water level fluctuations show a rising trend in the northwestern part. The rise in the water table is due to the less withdrawal of groundwater and also due to its unfit and marginal quality as well as availability of canal water to meet the requirement for agricultural purposes. The water table elevation ranges from 208 - 217 m average mean sea level (Arun Kumar 2007). Any change in the groundwater storage is reflected in terms of the water level fluctuations. As the rainfall (monsoonal) is the major source of groundwater recharge, a general water level rise is noticed in the month of October. When irrigation and monsoon rainfall coincide, deep percolation increases and there is a corresponding rise in the ground water level. This leads to the accumulation of salts in the soil due to the adequate leaching (Arun Kumar 2007). In the area under the investigation, the reasons for the development of water logging and salinity are partially natural and partially man-made. In the shallow water areas, when evaporation increas-

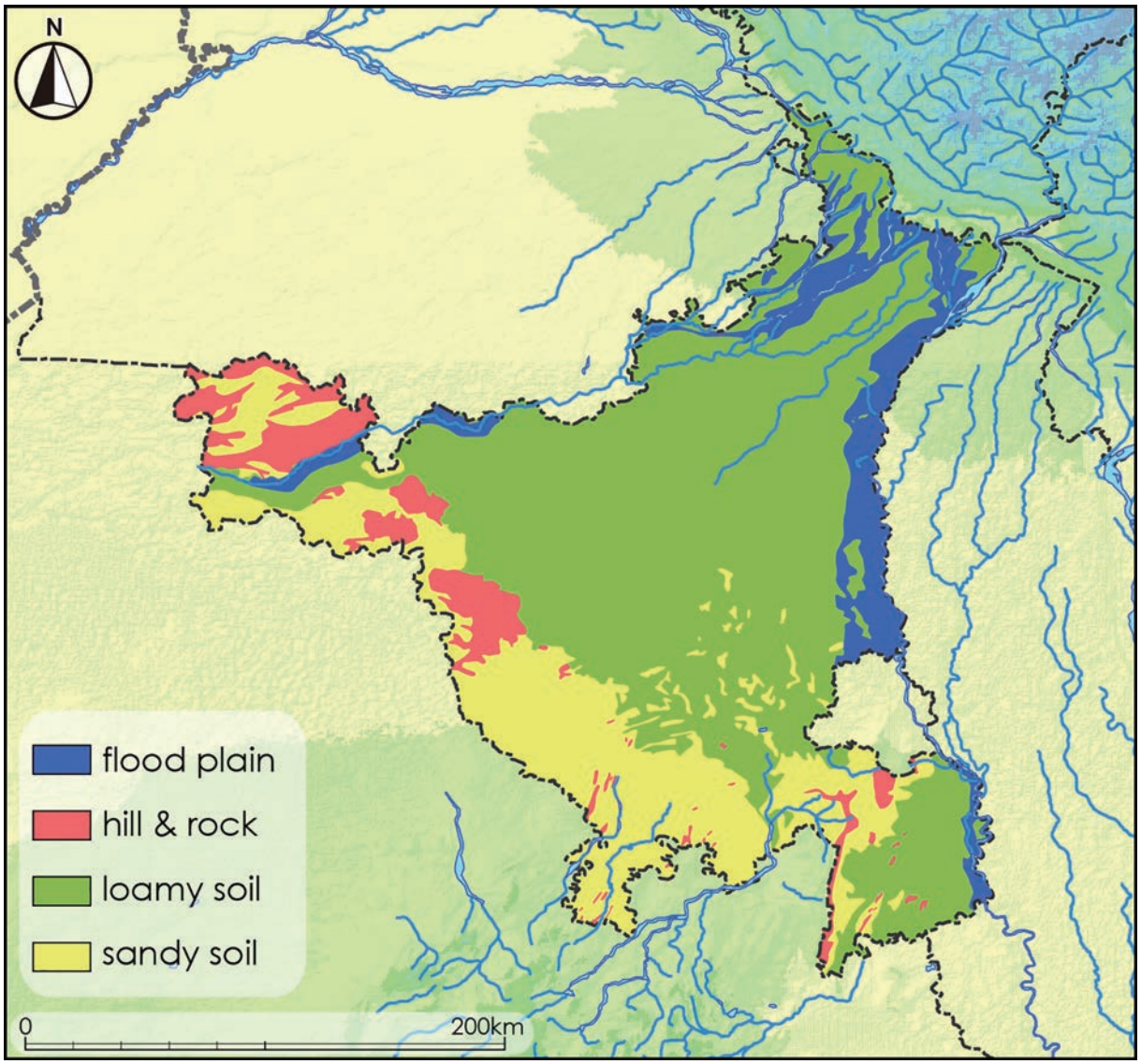

Figure 2 Soils of Haryana (modified from Dangi and Endo 2016: Figure 1.8)

es, salts get accumulated in the soil zone and cause the salinization of soil. The natural causes include unfavorable geohydrological setup that restricts the groundwater flow and also on account of the restricted flow of flood water in low-lying areas. The various anthropogenic factors include the expansion of canal irrigation network without proper water management measures like canal lining, farm developments, inadequate drainage and the construction of railways and roads. During the survey and after plotting sites on the map it was noticed that most of the sites are located in the area where underground water is good for human consumption.

SOILS

The soil of the area under study belongs to the alluvial class, typical of the Indo-Gangetic plains (Figure 2). The majority of the soils are loams or sandy loams, with a soil crust of varying depth. The character is generally alkaline due to the presence of sodium in the clay. The soils are rich in phosphorus and potash but are deficient in the organic matter and nitrogen. These are fairly good for cultivation, provided that rainfall is adequate or irrigation facility is available. R.L. Singh (1995: 92-93) has classified various kinds of the soils, which are given below. Most of the Painted Grey Ware sites are located on the alluvium soil and not even a

single site is located in the sandy area.

Bhangar

The old alluvium is known as the *Bhangar* in the local parlance and is one of the two main divisions of the Haryana's soil zones. A narrow strip of it stretching in north-south is situated between the *Nardak* in the west and the Yamuna flood plain in the east in the Karnal district. The major part of the old alluvium is located west of the *Nardak* covering the western parts of the Kurukshetra and Karnal districts. It extends further to the west and the south of the districts of Jind and Rohtak, the eastern part of Hissar and the northeast part of Bhiwani. This area is higher than the *Nardak* (Government of India 1981: 34). This zone consists of the varied soil types, such as loam, sandy loam, clay and sand dunes. Here the subsoil water is saline.

Nardak

The *Nardak* area is located between the Bangar and the *Khadar* in the southern and western regions, viz. Ambala, Kurukshetra and some parts of the Karnal districts. This being the repository of the seasonal streams like the Rakshi, Ghaggar, Saraswati, Markanada, Tangri and Patialicho, contains silty clay that is hydromorphic in nature. It is very thick and sticky while wet and very hard when dried up and lies in a floodplain-kind soil group. This type of soil is very good for paddy cultivation.

Khadar

The new alluvium, which is locally known as the *Khadar* is formed by the present flood plain. This type of alluvium is found along the upper reaches of the Ghaggar in the Ambala district and along side the River Yamuna.

GEOLOGY OF THE AREA

Physiographically, the area has almost flat to undulating topographies. The Ghaggar and Yamuna flow through the area. The whole study area is marked by a network of canals, tributaries and minors. The thickness of the alluvium in the study area varies with space and steadily decreases southwards where the basement is at shallow depth. This heterogeneous alluvium ranges in age from the Upper Pleistocene to the recent and is generally classified into the Older and Newer Alluvium. These quaternary alluvial deposits consist of clay, gravel, sand, silty sand and silty clay with varying proportions of *kankars*. In the western and southwestern parts, this alluvium is occupied by the wind-blown, fine grained and buff-coloured sand, in the form of dunes (Singh 1995: 87-89). The study area lies on the crest of the postulated Aravalli-Delhi ridge. The area is in the close vicinity of a large evaporite basin, widely known as the Trans-Aravalli Vindhyan basin. The highest part of the Aravalli-Delhi ridge which is about 400 m in height passes through the Sirsa, Mansa and Faridkot areas (Arun Kumar 2007: 22). The basement rocks go down rapidly from Toshaam to Bathinda. In the east of Sirsa, rocks of granites and rhyolites and Delhi quartzites are encountered below the Quaternary sediments. The maximum depth of the basement in the Punjab plains is about 4 - 5 km and the depth increases to some extent under the Siwaliks.

FLORA

Forests provide neighboring settlements with valuable resources. Most of agriculture toolsare made of locally available wood. Ropes and cords are made from locally available shrubs. Many plants are used to cure illness. The forests of the region fall under the category of tropical desert thorn and comprise predominantly

xerophytes. The flora is scanty and sparse. The floral types found in the area under study are Jand (*Prosopis cineraria*), Rohera (*Tecomella undulate*), Khairi (*Acacia senegal*), Beri (*Zizphus mauritiana*), Reru (*Acacia leucophloea*), Jal or Van (*Salvadoraoleoides Decne*), Barh (*Ficus bengalensis* L.), Pipal (*Ficus religiosa* L.), Mesquite or Paharikikar (*Prosopis juliflora*), Kachnar (*Bauhinia racemosa* Lamk), Amaltas (*Cassia fistula* L.), Lasura (*Cordia dichotema*), Imli (*Tamarindus indica* L.), Banna (*Crateva adansoni*), Shisham (*Dalbergia sissoo* Roxb.), Kikar (*Acacia nilotica*), Neem (*Azadirachta indica* Juss. Syn. *Melia azadirachta* L.) and Gulmohar (*Delonix regia*).

Shrubs

Most of crops were earlier grown locally and by natural selection new varieties have been developed. Even now wild wheat, barley and rice are visible at places. The wild rice known as *saunka* is widely available. It is not considered to be a cereal and is therefore eaten during fasting. The other similar wild varieties are also consumed by local farmers. Bathua and Kaundra are the wild plants used as vegetables by villagers. Apart from these, a number of other shrubs are available whose products are used for agriculture. Some shrubs are used for making sacks and ropes. Some are described here. Hins (*Capparis septaria* L. *Carissa spinarum* L.), Castor (*Ricinus communis*), Panwar (*Cassia tora* L. (ii) *Cassia occidentalis* L.), Babool (*Acacia jacquemontii* Benth.), Mallah (*Zizyph*), Karir (*Capparis decidua*), Khip (*Leptadeniapyrotechnica*) and Akk (*Calotropis procera*) are the common shrubs. Elephant grass, dub and so on are also commonly found. These are used for making ropes for packing agriculture materials. The medicinal plants found in the region are Bansa (*Adhatoda vasica* NZ), Indirain (*Citrullus colocynthis*), Asgandha (*Withania somnifera*) and so on.

CULTIVATED CROPS

The alluvial plain of Punjab and Haryana can be called as the 'agriculture hub' of India and its significance can be seen in the fact that more than 70 % of the total population depend upon agriculture. There are mainly two groups of crops in a year, viz. the *rabi* which is locally called *sadhru* (or *sadhu*) in Haryana and *sauni* in Punjab that mean the winter crops, and the *kharif* locally called *sammu* in Haryana, and *haehi* in Punjab that means the summer crops. The major *rabi* crops are wheat, barley, chickpea, mustard, berseem, methi, tobacco, potatoes and other vegetables. The dominating crop is wheat; it occupies more than 50 % of the total *rabi* cultivation, followed by mustard. In the sandy area, only the *sadhru* is sown. In December, a few thunderstorms occur in association with the western disturbances and it is very useful for wheat crops. The *kharif* crops consist chiefly of rice, sorghum, pearl millet, maize, sugarcane, cotton, cluster bean, green gram, moth bean, sesame, jute and groundnut.

Humidity

The humidity in Haryana reaches its maximum in July and August, but the period of its high percentage is generally from July to September. The humidity declines in two phases. The first from September to October and the second from December to March, while in August, the rise in humidity is quite rapid.

Rainfall and cloudiness

Most of rainfall occurs during the monsoon season from July to September, after which there is almost no rain and November is the driest month of the year. About 74 % of the annual rainfall occurs during the southwest monsoon in the month of June to 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. In the month of January, there is also a good amount of rainfall due to

the western disturbances from Pakistan. During the monsoon season, the sky is mostly moderate to heavily cloudy. During the rest of the year, the sky is generally clear or slightly cloudy. The cloudy sky prevails for brief spells of the day or two in association with the passing western disturbances in the cold seasons.

Winds and dust storms

Winds are generally slow during the post-monsoon period and the winter months. They are strengthened a little during the summer and monsoon months. They are predominantly easterly or southeasterly in the monsoon season and mostly westerly or northwesterly in the other seasons. From April to June, the winds blow steadily from the west, which are normally hot. When the hot season is on the peak, the dry winds locally called '*loo*' blow at high speeds and they are totally dry and hot. Another unpleasant feature of the climate is the dust storms which are very common in the region before monsoon especially in the south and southwest of the region. In the months of December and January, the western disturbances strike the area and cause rapid decreases in temperature. This occasionally causes rain which is very good for wheat and mustard crops.

PETROLOGY OF THE AREA

Rocks

In southwestern Haryana, a series of igneous outcrops emerges from the plains in the vicinity of Tosham. Most of the hillocks in the area are composed primarily of Pre-Cambrian grey granite (Grover and Kumar 1980). One of them (Tosham hills) contains a rich polymetallic ore deposit and has been proposed as a possible source of tin for the Harappan Civilization (Kochhar et al. 1999). About 30 km farther southeast of the Tosham outcrops are the westernmost outliers of the Delhi Quartzite, a formation which makes up the large parts of the northern Aravalli hills. Unlike the most heavily metamorphosed Delhi quartzite, which typically has a silicious or "glassy" texture, the material found in these particular outliers has a sandy texture and, in a few places, an unusual "flexible" quality that actually permits the stone to be significantly deformed before it breaks (Pande and Gupta 1969: 589-590). The Tosham hills were the only source of stone for the people of Haryana since the proto-historic times. Some agricultural tools like *kolhadi* (stone soil crasher) and *ukkhal* (stone mortar) are made from the stone of the Kaliana hills.

Granite

Granite exposures occur on the area around the Tosham hills. Porphyrutic granite is found in the Khanak hills. This is the grey-coloured fine grained granite porphyry with large phenocrysts of quartz. The medium to coarse grained porpyhyritic granite is found around Teosar, which is located about 4 km west of Bhiwani.

MINERALS RESOURCES

The area under the present study is not so rich in mineral resources. The minerals found in the area under study as given below.

Copper

Malachite, azurite stains and particles of chalcopyrite are found near the village Khodana. Recently the mineralization of copper has been reported from the Tosham hills. It is in the form of intense staining of the secondary minerals of copper in malachite, azuritie and chrysocolla. The primary sulphid such as chalcopyrite, pyrite, pyrrholite and galeana are present as dimmeminations, stingers and cavity filling. (Murao et al. 2008). The famous copper mines of Khetri are located in the vicinity of Haryana.

Tin

Trace amounts of tin occur in the polymetallic ore deposit at the Tosham hills (Murao et al. 2008).

Flexible sandstone

This type of sandstone is very rare as it is flexible like plastic. The only source of this type of stone in India is in the Kaliana hills. A band of about 2 - 3 feet thick is located along with the southern ridge of the Kaliana hills (Government of Haryana 1982: 16). The author collected some samples from the hills.

Iron

At a number of places around the Kaliana hills, magnetite occurs in black quartzite. In the area near the village Kaliana, heaps of iron slag are seen suggesting some type of iron smelting activity of the past (Government of Haryana 1982: 15). Local villagers informed us that the iron from this area was used for making agricultural tools in the recent past.

Mica

Mica is found almost everywhere in the area under the present study. But rich sources of mica have been reported from the Bhiwani and Ambala districts. About 2.5 - 3.0 cm size flakes of mica were found in the vicinity of the village Khodana, the district Bhiwani (Government of Haryana 1982). Mica from here is used for pottery making in past.

Kankar

The term *kankar* has been used for travertine or tufa which is found at various places, generally at a depth of a metre or below the soil cover. It is grayish white, hard and fragmentary in nature. Its basal part is however soft and silicious. It contains rich fauna of gastropod shells which attributes its depositions in lakes and ponds in which fresh water organisms thrived. *Kankars* are found almost in the entire study area. *Kankar* is grinded into powders and is mixed in the fields to increase fertility of soil as it is a good source of various minerals.

PREVIOUS ARCHAEOLOGICAL WORK

There were many stray explorations that brought to light a number of Painted Grey Ware sites, but the specific work on the Painted Grey ware was initiated by Vibha Tripathi (1976), and later, Brahemdutt (1980) as a part of his doctoral thesis studied various aspects of the Painted Grey Ware culture in Haryana. He based his thesis on the earlier published data and has done very little field work. Later, Vibha Tripathi (2012) revised her earlier work and took up the study on this culture as the Gangetic Civilization. She undertook no field work but based her study on published materials. The region under the present study (i.e. Haryana and western Uttar Pradesh) is extremely rich in archaeological evidence and, therefore, has been the focus of research for a long time.

In the early 1950s, B.B. Lal started exploration in the region in order to identify the sites mentioned in the Mahabharata epic (Lal 1954: 138-146). In the 1970s, Suraj Bhan carried out extensive explorations in the Sutlej-Yamuna divide, which includes the area under the present study and discovered a number of proto-historic and historic sites (Suraj Bhan 1975: 121-126). Since the work of Suraj Bhan was general in nature and was not based on village-to-village surveys, there was a scope for further explorations. In the 1970s, several research scholars from Kurukshetra University also explored this area and conducted village-to-village surveys and brought to light a number of sites. Silak Ram conducted explorations in the Rohtak and Hissar districts (Silak Ram 1972), Manmohan Kumar (1978) explored the area of the Ambala and Kurukshetra districts and Amar Singh (1981) surveyed the Jind and Karnal districts. D.S. Punia (1976) explored the Mahendragarh and Gurgaon

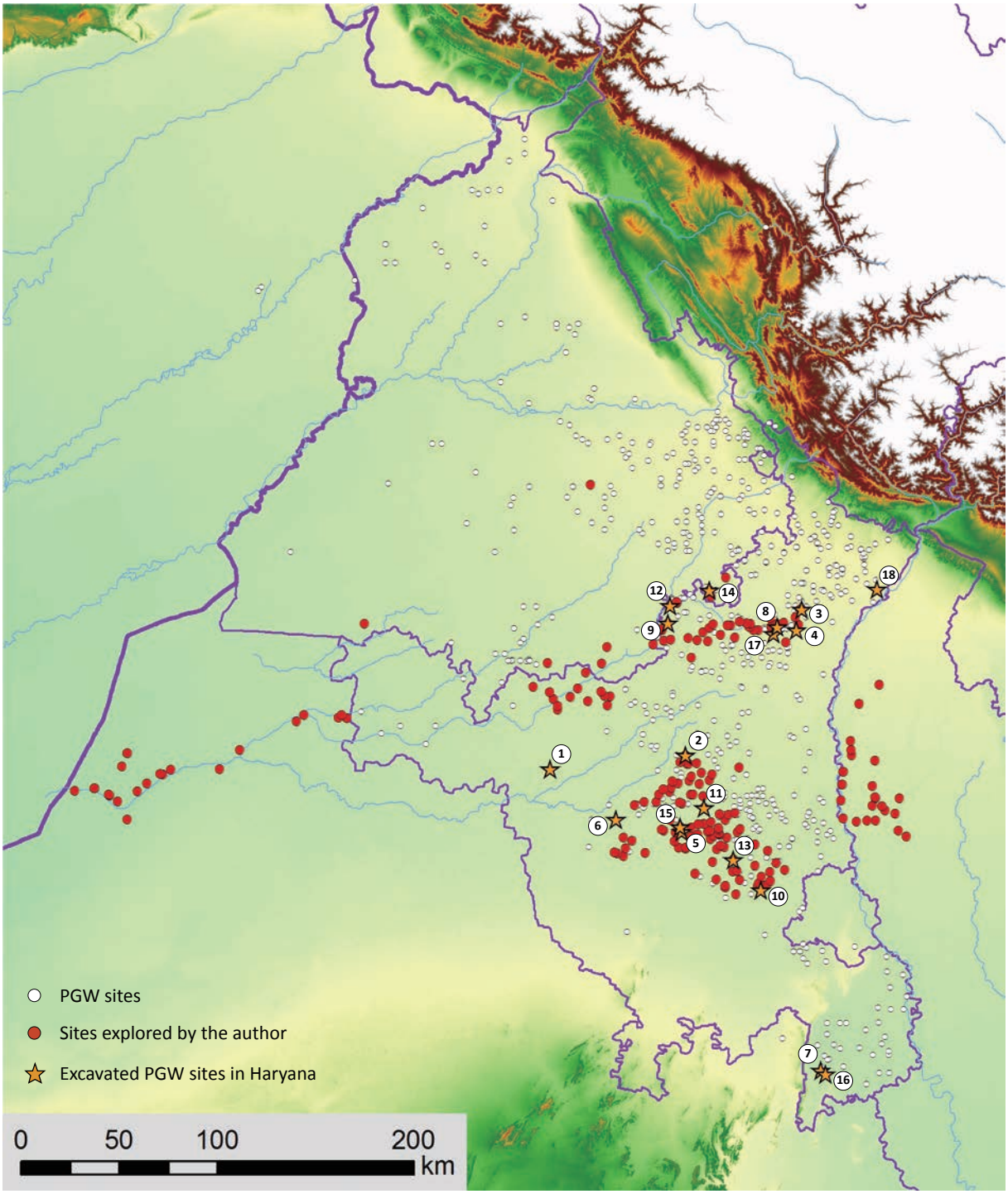

Figure 3 Distribution of Painted Grey Ware sites in Punjab and Haryana
(The numbers on the map correspond with the ones in Table 1)

districts. At this time, however, much of the region was inaccessible and therefore left a scope for further intensive explorations.

J.P. Joshi and Madhu Bala explored Kurukshetra, Patiala and other parts of Haryana and Punjab (Joshi 1993: 251-254; Bala 1992). The Archaeological Survey of India also did a few random surveys and their brief reports can be found in various volumes of *Indian Archaeology - A Review*. Manmohan Kumar again carried out an exploration in the Rohtak district (Manmohan Kumar 2007: 196-204). The present researcher also conducted explorations in the region and added 56 new sites of the Painted Grey Ware culture to the archaeological map (Dangi 2006, 2007,

Table 1 Excavated Painted Grey Ware sites in Haryana

No.	*Site*	*Latitude*	*Longitude*	*References*
1	Agroha	29°19'58.56"N	75°37'14.53"E	IAR 1978-79: 68-69, 1979-80: 31, 1980-81: 15-16
2	Burj	29°39'23.28"N	75°38'28.52"E	Singh et al. 2010: 13-23
3	Bhagwanpura	30° 3'22.80"N	76°57'20.60"E	Joshi 1993
4	Daulatpur	29°57'50.66"N	76°56'23.66"E	IAR 1968-69: 8, 1976-77: 19, 1977-78: 23
5	Ganganagar	28°57'46.29"N	76°19'41.83"E	Thakran et al. 2013: 158-163
6	Hansi	29° 6'19.68"N	75°57'49.48"E	
7	Harnol	27° 53' 26.93" N	77° 00' 31.97" E	IAR 1997-98: 31-54
8	Harsh-ka-Tila	29°58'34.10"N	76°49'35.87"E	IAR 1987-88: 28-31, 1988-89: 21-24, 1989-90: 27-32
9	Hatt	29°20'9.64"N	76°36'56.66"E	Personal Communication with Prof. Manmohan Kumar.
10	Jogna Khera	29°58'49.29"N	76°47'44.85"E	Malik et al. 2007
11	Karsola	29° 9'2.94"N	76°25'36.31"E	Shinde and Sengar 2011: 179-212
12	Kasithal	30° 3'21.25"N	76°56'53.68"E	Joshi 1993
13	Khokhrakot	28°54'45.33"N	76°34'36.24"E	IAR 1986-87: 34-36
14	Kunal	29°37'17.76"N	75°39'32.77"E	IAR 1985-86: 23-25, 1991-92: 37-39; 1993-94: 47-51, 1994-95: 26-27
15	Madina	28°55'11.34"N	76°25'11.70"E	Manmohan Kumar et al. 2016
16	Muhammadnagar	27° 54' 55.83" N	77° 02' 25.53" E	IAR 1997-98: 31-54
17	Raja-Karan-ka-Quila	29°57'1.43"N	76°48'7.73"E	IAR 1970-71: 15-16
18	Sugh	30°10'21.87"N	77°21'7.21"E	IAR 1963-64: 27-28, 1965-66: 35-36.

2009a, 2009b, 2010, 2011).

Numerous students from Punjab University, Chandigarh as well as Kurukshetra University and Maharshi Dayanand University, Rohtak undertook village-to-village explorations in the region, as a part of their dissertations and theses: the Naraingarh tehsil of the Ambala district (Malhotra 1964), the Ambala tehsil (Palahia 1964), the Safidon tehsil of the Jind district (Dhattarwal 1978), the Jind tehsil of the Jind district (Satdev 1980), the Meham block of the Rohtak district (Surender Singh 1989), the Lakhan Majra block of the Rohtak district (Krishan Kumar 1990), the Bhiwani block of the Bhiwani district (Surender Kumar 1999), the Narnaund block of the Hissar district (Vijay Kumar 2001), the Agroha and Adampur blocks of the Hissar district (Parmod Kumar 2002), the Meham block of the Rohtak district (Dangi 2006, 2009), the Hansi Block II of the Hissar district (Sandeep 2006), the Ratia Block of the Fatehabad district (Krishana 2008) and the Hissar block I and II of the Hissar district (Rajesh Kumar 2008). These explorations were conducted in a limited area and as most villages were easily accessible, a large number of new sites were discovered. Apart from explorations, 18 sites of the Painted Grey Ware culture have been excavated. The final reports of most of the excavations have not been published except for Bhagwanpura (Joshi 1993) and Madina (Manmohan Kumar et al. 2016). A list of excavated sites is given below (Table 1; Figure 3). The present researcher undertook the study in a more specific manner in order to reveal the regional variation in this culture.

RESEARCH METHODOLOGY

The present researcher conducted extensive village-to-village surveys in the region. A GPS handset

(Garmin, GPSmap 60CSx) was used to record the correct coordinates of the sites. Systematic sampling of pottery and other remains from the surface and the visible sections was done. The researcher attempted to collect all of possible samples from sites, though there might be some errors because of the badly disturbed nature of sites. The photography of the sites and visible features was done with a help of a digital camera. On the basis of the ecological conditions and the detailed analysis of the ancient settlements, different categories of sites like regional centres and villages were identified. The main emphasis was laid on locating sites and on observing the distribution pattern of the cultural remains in the area. The time period of the sites was decided on the basis of the diagnostic ceramics of ancient cultures. The estimation about the size of sites has been made on the basis of the area up to which cultural deposit were found. The cultural materials recovered from excavations like Madina, Hatt and Jogna Khera were studied. Similarly, the cultural materials housed in different museums were also studied and analyzed. The available published literature and survey reports housed in the libraries of various universities in the form of M.Phil. and Ph.D. research works were examined and their data were used herein. To study the regional variations in the material culture of the Painted Grey Ware, the present researcher carried out explorations in the adjoining regions of Rajasthan and western Uttar Pradesh.

DWELLING STRUCTURES

Most of the excavated sites in the area under the present study have multiple cultural strata, most of which belongs to the historical period, leaving a very little of Painted Grey Ware culture deposits to be studied. Therefore, our knowledge about the domestic structure of the Painted Grey Ware culture is limited. For this purpose, we also studied the single culture sites excavated in Haryana, specifically Bhagwanpura and Madina. The dwelling structures found in the excavations at various sites can be broadly divided into three types, viz. dwelling pits, huts and mud-walled houses. Post-holes have been reported from Hulas, Hastinapur, Sonkh, Allahpur, Atranjikhera and Jakhera. But no detailed plan of huts has been available from the sites of the area under the present study. So we have to depend upon the data available from the adjoining area.

The huts of this period may have supported sloping thatched roofs. The excavations at Madina yield the evidence of this type of traditional huts in the form of two large post-holes in front and back supporting beams and two small postholes on each side (Manmohan Kumar et al. 2009: 98). A large number of burnt clay lumps having impressions of bamboo, wood and reed were found, which indicated that the Painted Grey Ware people did not construct the mud walls but used mud and reed screens, plastered with mud as the side walls (Manmohan Kumar et al. 2009: 96). The evidence of post-holes has also been reported from Daulatpur (IAR 1977-78: 23). These post-holes represent the evidence for the use of wooden structures, but provide no plan of a specific structure. At Madina, even after the close examination of the post-holes, no pattern of arrangements of huts was discernible as these post-holes were dug repeatedly, likely reflecting the periodic rearrangement of residential spaces.

These huts were situated in close proximity to each other and the spaces between huts were used for cooking and heating. The clusters of post-holes were punctuated by *chulas*, ovens (*harae*) and hearths (Figure 4). These huts were arranged at the site so that the area between huts provides a sufficient space for domestic activities. Potter's clay levigation pits were also found near some huts.

At Jakhera, a circular hut of 6 m in diameter was recovered in the excavations and the interior of this

Figure 4 Dwelling structures at Madina (after Manmohan Kumar et al. 2016)

hut was partitioned by mud walls. Apart from this hut, a large hut complex was unearthed which consisted of three circular huts (Sahi 1994: 144). The excavations at Hatt produced the evidence of dwelling pits in association with the Painted Grey Ware level. These pits were plastered with ochre and the floor of these pits were made up of rammed clay and plastered. These pits were cut into the natural soil, having vertical sides, and some of them had steps. Post-holes were also noticed along with these pits, which indicated that these were covered with a thatched structure as roof. The pit dwellings at Hatt were surrounded by a 'V'-shaped moat, which acted as a defensive facility. No other site has yielded the evidences of dwelling pits during the Painted Grey Ware period.

At Bhagwanpura, a rammed mud-walled house was unearthed. This house complex consists of 13 rooms, five rooms in the western side and seven rooms on the eastern side. It is roughly oriented from north to south. The size of the rooms varies from 1.60 × 1.60 m to 3.35 × 4.20 m. There is a corridor in the complex that measures 14.35 m in length and 2.20 m in width (Joshi 1993: 40). The excavations at Atranjikhera yielded both sun-dried and kiln-baked bricks measuring 8 × 4 × 4 cm, as well as some larger varieties, however not a single baked brick structure was reported.

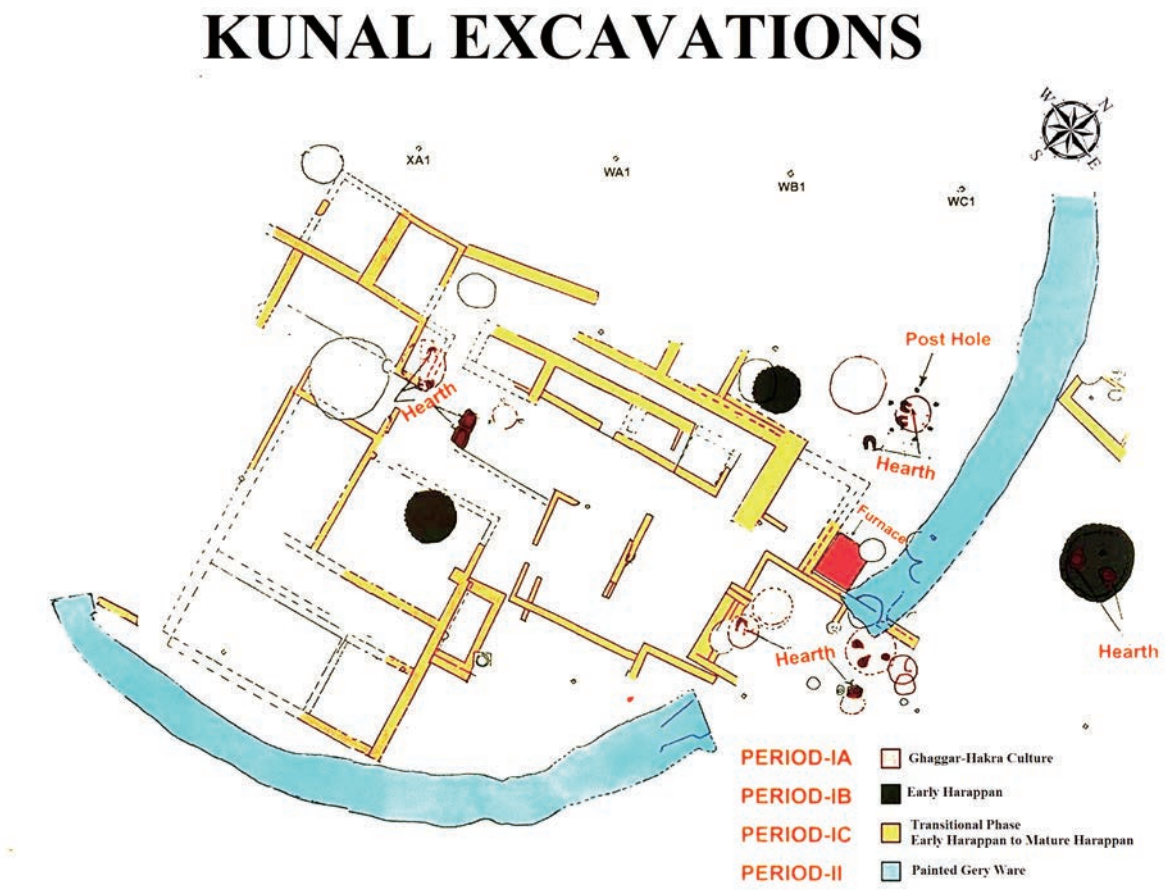

Figure 5 V-shaped moat at Kunal (Courtesy: Department of Archaeology and Museum, Haryana)

Some burnt bricks measuring 30 × 24 × 24 cm, 33 × 30 × 10 cm and 30 × 30 × 6 cm were recovered from Jakhera (Sahi 1994). This type of bricks may have been used for preparing platform probably for bathing or ritualistic purposes.

DEFENCE

Unlike the Mature Harappan defence walls, some Painted Grey Ware settlements were found to have been surrounded by a 'V'-shaped moat, and a mud bund. A mud bund has been reported from Atranjikhera surrounding the Painted Grey Ware settlement (Gaur 1983: 126). A moat or ditch has been reported from Jakhera, but the details are not given. At Hatt (Manmohan Kumar, personal communication) the earliest habitation of the area was surrounded by a 'V'-shaped moat. Similar evidence has been recovered from the Painted Grey Ware levels of Kunal with its maximum depth and width being 3.45 m and 4.15 m respectively (Figure 5). The excavators also encountered a moat at Jogna Khera that was filled with water and silt and was likely used as a defence against wild animals. The moats at Hatt appear to be too small and shallow to protect the settlement against larger animals, but may have served for the protection from intruding smaller reptiles. Such defences represent the strategies used by the Painted Grey Ware people to adapt to the local environments.

ECONOMY

The economy of the inhabitants of this culture was basically based on agriculture and animal husbandry

along with hunting. In the area under the present study, a few paleobotanicalspecies were identified at Madina, viz. wheat, barley, Italian millet, black gram, green gram and Indian jujube (Kajale 2016: 248). In the adjoining region, wheat, rice, ragi, sawan, etc. were reported from Hulaskhera (Tiwari et al. 1996). Moong, urad, massor, moth, kulthi, khesari, wild oat, tulsi and bathua have been reported from Siyapur (Tiwari and Srivastava 2004, 2005) apart from these gram, horse gram, pigeon pea, sesame, *ber*, *gular* and *pakad* were also reported. Above-mentioned seeds indicate that the Painted Grey Ware people were cultivating both *rabi* and *kharif* crops.

Madina is the only site in the area under the present study that provides us details regarding animals of the Painted Grey Ware period. The faunal utilization pattern at the site during the Painted Grey Ware period shows that throughout this period, the people depended mainly on cattle, buffalo, sheep and goats for meat, milk, wool and bones. The diverse range of wild animals is interesting as the people of Madina hunted large bovine such as gaur, nilgai, antelopes, deer, wild pigs, fox, panther, hyena and peafowl. In all faunal materials of Madina, 30 species in total were identified among which 10 were domesticated and the other 20 wild species (Joglekar and Sharada 2016: 209-247).

MISCELLANEOUS OBJECTS

At most of the sites excavated and explored, terracotta *ghata* (vase)-shaped beads (Figure 7), balls, bangles and net sinkers were found. Terracotta discs of various sizes decorated with notches along circumference are very common during this period. These were probably used for playing various games (Figure 6). Beads of semiprecious stones, such as agate, jasper, carnelian and amethyst are not negligible during this period (Joshi 1993; Manmohan Kumar et al. 2016; Shinde and Sengar 2011: 179-212; Thakran et al. 2013: 158-163; IAR 1963-64: 27-28, 1965-66: 35-36). A large number of terracotta figurines were found in excavations, among which two horse-rider figurines recovered from Madina are noteworthy. The terracotta *ghata*-shaped beads are the hallmark of this culture and found at all Painted Grey Ware sites.

TEXTILES

The societies of the Painted Grey Ware period had the textile industry that is not well understood. A number of sites, such as Hatt (Manmohan Kumar 2010: 229-230) and Atranjikhera (IAR 1965-66: Pl. XXVI A) yielded sherds bearing textile impressions. Hatt yielded many terracotta spindle whorls along with copper spindle rods, some of which had notches at one end to facilitate the spinning of yarn. An analysis of textile impressions on a potsherd at Hatt suggests that cotton yarn was woven almost like the present-day *khadi* handlooms (Manmohan Kumar 2010: 229-230).

METALLURGY

In the area under the present study, iron was first introduced by the Painted Grey Ware-using people (Figures 8, 9 and 10). Whether this invention was indigenous or introduced from an external source remains a topic of debates. Many scholars argue that the iron technology and artifacts were introduced in India from the contemporary cultures outside India (Gordon 1950: 67-69; Allchin and Allchin 1993). But the recent research indicates that the iron technology was an indigenous industry (Agrawal and Kharakwal 2003; Chakrabarti 1992; Tewari 2003). The scholars arguing for an indigenous origin of the iron technology have demonstrated that the central Himalayan, northern Indian states and the Kashmir region have rich iron deposits and these regions produced the evi-

Figure 6 Terracotta discs
(1: Madina-1; 2: Madina-3; 3: Kendala-3; 4: Daulatpur; 5: Jogana Khera)

Figure 7 Terracotta *ghata* (vase)-shaped beads
(1: Kandela-3; 2: Talwara; 3: Madina-2; 4: Agondh; 5: Ganganagar-1; 6: Daulatpur; 7: Jeeta Kheri; 8: Manoharpur; 9: Jogna Khera; 10: Mirrana)

Figure 8 Iron objects from Madina (after Manmohan Kumar et al. 2016)

Figure 9 Iron objects from Jogna Khera
(photographed by the author with courtesy of Department of Archaeology and Museum, Haryana)

Figure 10 Iron objects from Jogna Khera
(photographed by the author with courtesy of Department of Archaeology and Museum, Haryana)

Figure 11 Copper Objects (1: Dhani; 2: Kasithal; 3: Jogna Khera; 4: Agondh)

dence of the early metallurgy as well. The radiometric dates of the Iron Age material culture and the relative stratigraphic position of iron artifacts, slag and crucibles at the sites also support the indigenous origin of iron smelting and the manufacturing of iron objects around c. 1000 BCE (Tewari 2003). The area under the present study yields a large quantity of magnetite near the Kaliana hills, as well as the evidence for iron smelting.

The skill of the iron producrion of the Painted Grey Ware people is evidenced by the discovery of iron objects from various excavated sites. About 14 iron objects have been recovered from the excavation at Madina alone. From Hatt, more than 140 specimens were recovered in the excavations including ploughshares and axes. Many other sites have also yielded iron objects in excavations but the number and the types of the iron objects have not been published. The excavations conducted at Khokhrakot yielded some kilns for smelting iron from hematite. Prof. K.T.M. Hegde identified the materials found from these kilns as hematite (Manmohan Kumar, personal communication). The adjoining region of Jodhpur in Rajasthan has yielded more of such evidence, two furnaces from the early phase of the Painted Grey Ware period. These furnaces were of the open type and provided with bellows as indicated by the presence of holes (Agrawala and Kumar 1976: 243). An iron working area was reported at Atranjikhera (Gaur 1983: 127). A large amount of iron slag has been recovered from Madina indicating the local production of copper and iron. The possible sources of metals exist in varying degrees in the neighbouring Himalayan regions of Kangra, Mandi Almora, and Garhwal and in the Aravalli terrain of Alwar, Jaipur, and Bharatpur in Rajasthan and in the Gwalior region immediately south of the Chambal.

The iron objects used by the Painted Grey Ware people fall under four broad categories: (1) household objects and craft tools; (2) tools for agriculture and (3) weapons used for warfare or hunting. Under the first category come objects such as nails, pins, hooks, needles, knives, which are reported from various sites, notably at Madina and Hatt. While these sites have not yielded any specific agricultural tools, a sickle and a hoe was found at Jakhera (Sahi 1978: 103). Chisels, borers, clamps, nails and hooks that may have been used in carpentry were recovered from Hatt in a large number. A beautiful iron sickle found in the lowest levels of Khokhrakot demonstrates the sophisticated techniques used by the inhabitants of the site, as similar sickles are currently still in use for harvesting. A total of four arrowheads were recovered from Madina, including one barbed. The arrowheads are found in simple forms as well as barbed and tanged ones that are sometimes socketed. Spearheads were mounted on wooden shafts and used as weapons. Unlike arrows, which were used for long-distance attacks whether on an enemy or a wild animal, the spear could be used only at a close range.

Although iron had come into use during the Painted Grey Ware period, copper was still an important metal. Copper arrowheads have been found at various sites such as Bhagwanpura, Madina, and Hatt in Haryana. It is very likely that the copper objects were used primarily for hunting. Among tools and other objects of copper that were used for cutting or in the manufacturing of goods, mention may be made of axe, chisel, borer, pin and clamp. Toiletary objects included antimony rod (Figure 11), nail-parer, antimony rod-cum-nail-parer and toothpick. The find of a needle indicates stitching, most likely for clothes or textiles. Among ornaments, rings and bangles are worthy of mention.

POTTERY

The fine grey ware painted with black paintings some time with white and chocolate is known as the Paint-

ed Grey Ware (PGW) and is considered as a marker of the cultural phase termed as the Painted Grey Ware culture. Many scholars have studied the Painted Grey Ware and its associated red ware. Among these studies, A. Uesugi's (2016) work is remarkable. He classified pottery recovered from Madina in the district Rohtak, Haryana into two groups on the basis of colour, i.e. Red ware and Black-Grey ware group and each group was further divided into sub-groups on the basis of morphological and technical features.

i) Red ware
ii) Black-Grey ware
    Painted Grey ware
    Grey Ware
    Black Slip Ware
    Black-and-Red Ware

Red Ware

The red ware (Figure 12) associated with the Painted GRey Ware consists of pots and bowls, and have shapes totally different from the Black-Grey ware group, although some specimens of bowls show similarity to that of the Painted Grey Ware and the Grey Ware. In terms of the manufacturing technique, there is a variation in combination like those finished only with rotational techniques, those with rotational and non-rotational techniques, and those with non-rotational techniques. It is noteworthy that the use of the paddle-and-anvil technique can be observed. As for their fabric, two types can be found, i.e. those with fine levigated clay and those with plant tempers like husks and straws. There is an regional variation in the Red ware of this period. The pottery of the districts Hanumangarh and Sri Ganganagar (mid-Ghaggar Basin) is more sturdy and fine as compared to the pottery of the Haryana and Uttar Pradesh region.

Black-grey Ware

In the Black-Grey ware group, four sub-groups can be defined, based on their surface treatment, i.e. the Painted Grey Ware, the Grey Ware, the Black Slipped Ware and the Black-and-Red Ware.

Painted Grey Ware

The Painted Grey Ware (Figures 13, 14 and 15) is characterized by its thin and hard walls fired into grey at a high temperature in a reduced atmosphereand paintings over the surface. The paintings are made dominantly with a black pigment, but some specimens show orange and white paintings. It consists of bowls, dishes (shallow bowls) and pots, and is made of fine clay. In terms of their manufacturing technique, the rotational techniques of smoothing and scraping are dominantly used, although the non-rotational scraping can be observed on some specimens. The paintings occur on both internal and external surfaces.

Grey Ware

The Grey Ware (Figure 16) shows the same features in forms and techniques as of the Painted Grey Ware, but has no painting. In forms, bowls, dishes (shallow bowls) and pots are included.

Black Slipped Ware

This group is distinguished by its black slip covering the entire surface (Figures 16 and 17). The section shows a grey colour. In forms, bowls and dishes can be identified like other Black-Grey wares, but their shapes are different. In terms of the manufacturing technique, the rotational smoothing and burnishing techniques can be observed on many specimens.

Black-and-Red Ware

This group represented by bowls is characterized by its colour distribution, i.e. a black colour on its internal surface and on the upper part of the external surface, and a red colour on the lower part of the external surface (Figures 18 and 19). It seems likely that its black portion is derived from the carbon absorption onto

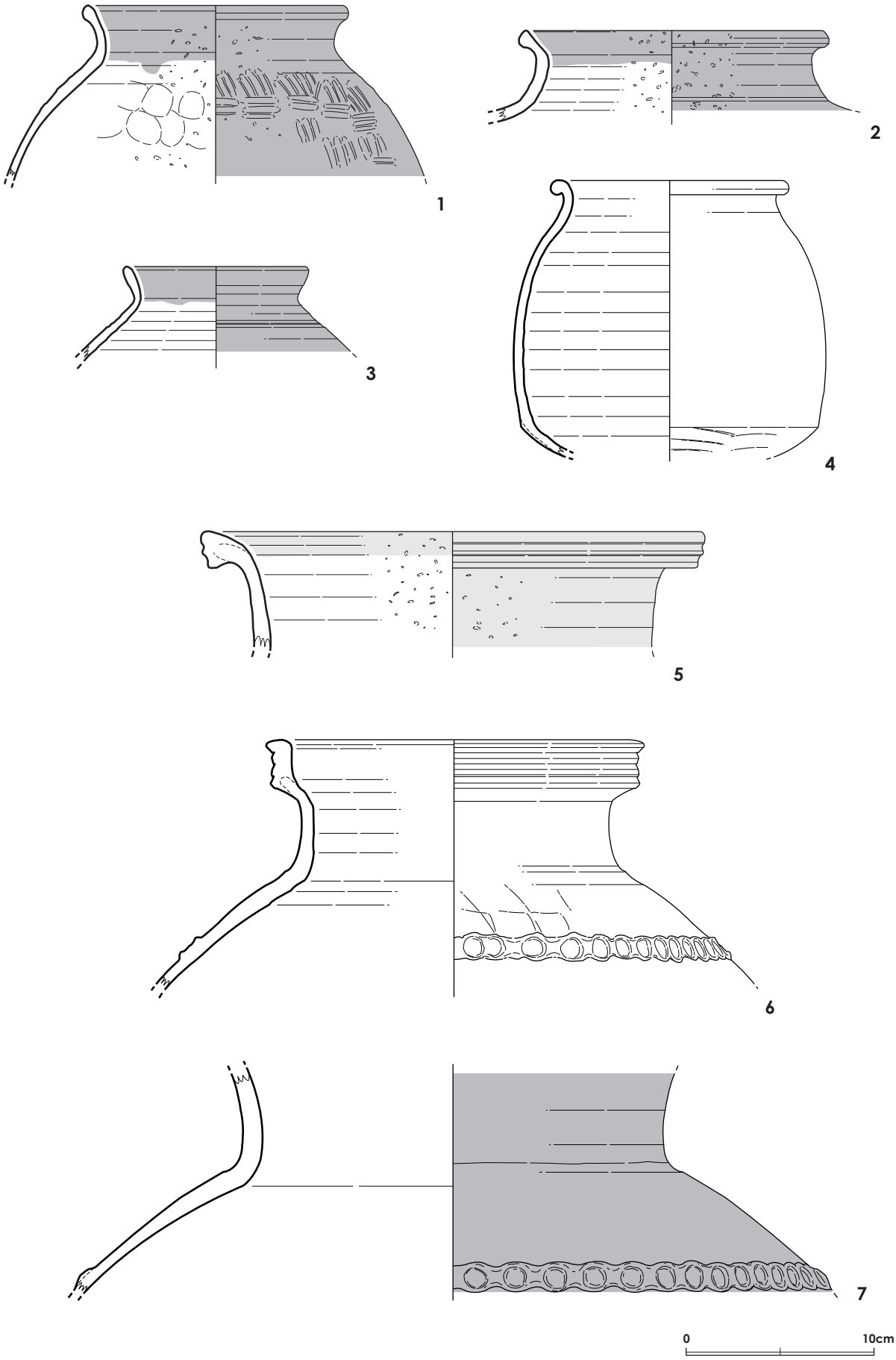

Figure 12 **Red Ware** (1, 3: Manoharpur; 2: Girawad-1; 3: Nindani; 4, 6, 7 Madina-3)

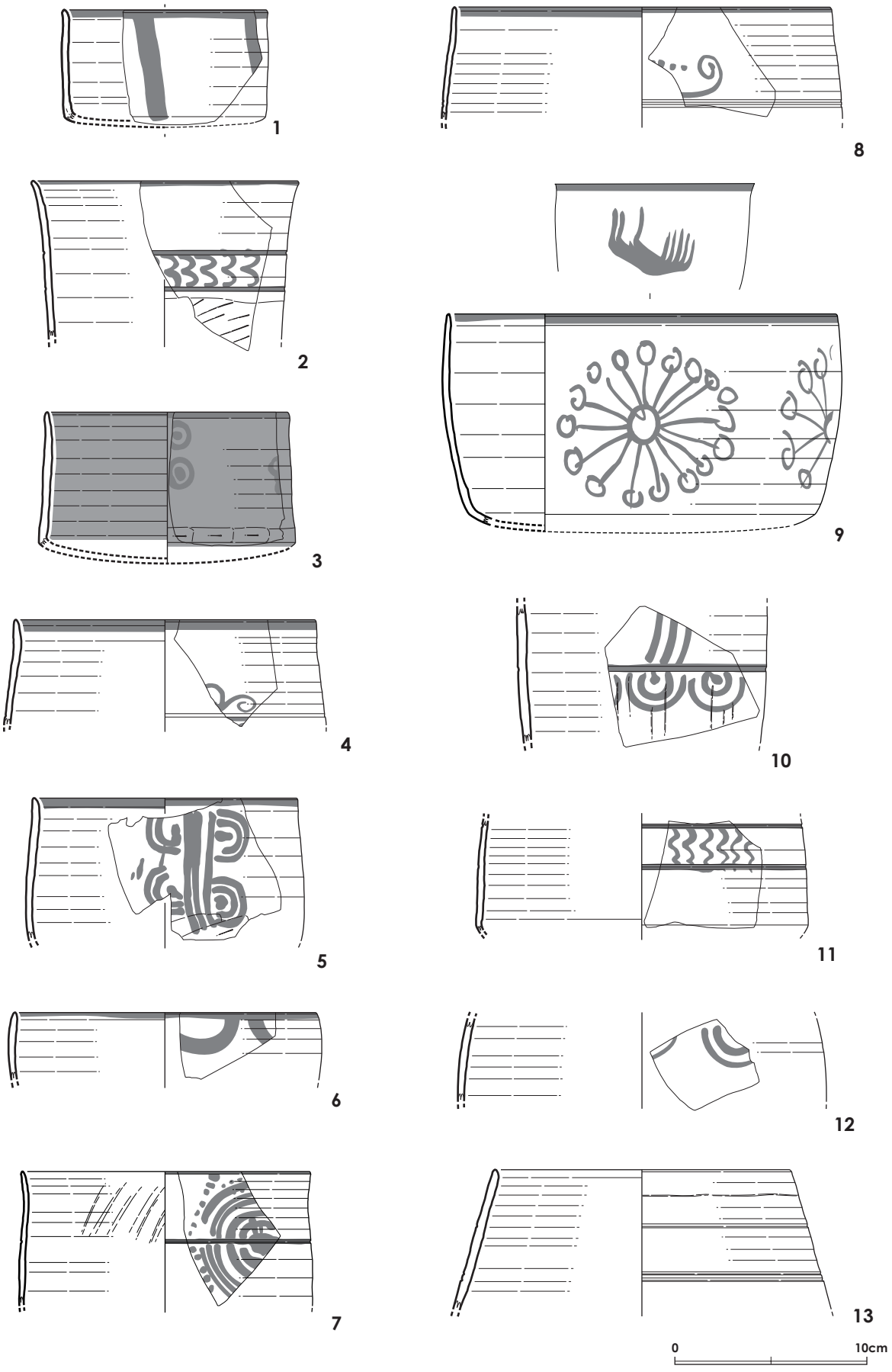

Figure 13 Painted Grey Ware

(1: Madina-2; 2: Asan-1; 3: Kharak Ramji-3; 4: Ghimana-1; 5: Gausai Khera; 6, 7, 8, 13: Agondh; 9: Madina-3; 10: Ajaib-1; 11: Kasaur; 12: Bedwa-3)

Figure 14 Painted Grey Ware (1: Ram Kali; 2: Asan-1; 3: Madina-3; 4: Ajaib-1; 5: Madina-3; 6: Agondh; 7: Jeeta Kheri)

Figure 15 Painted Grey Ware (1: Daulatpur; 2: Gausai Khera)

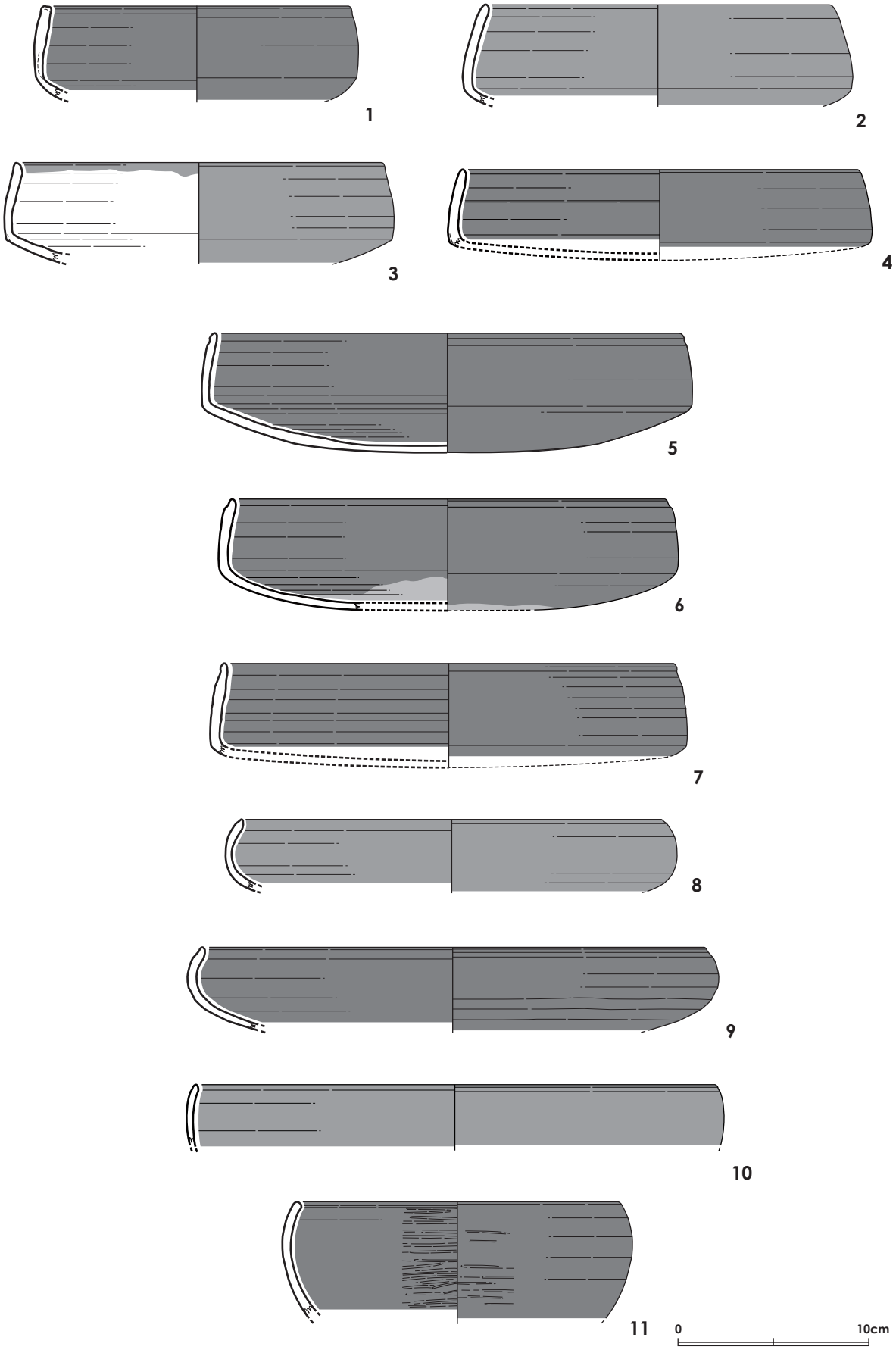

Figure 16 Grey Ware, Black Slipped Ware and Black-and-Red Ware
(1: Kasital; 2: Manoharpur; 3: Manoharpur; 4: Karsola-1; 5: Madina-1; 6: Kandela; 7: Jamalpur; 8: Mokhra-3; 9: Jeeta Kheri; 10: Kandela; 11: Rasulpur)

Figure 17 Black Slipped Ware from Madina-1

Figure 18 Black-and-Red ware from Kunal
(photographed by the author with courtesy of Department of Archaeology and Museum, Haryana)

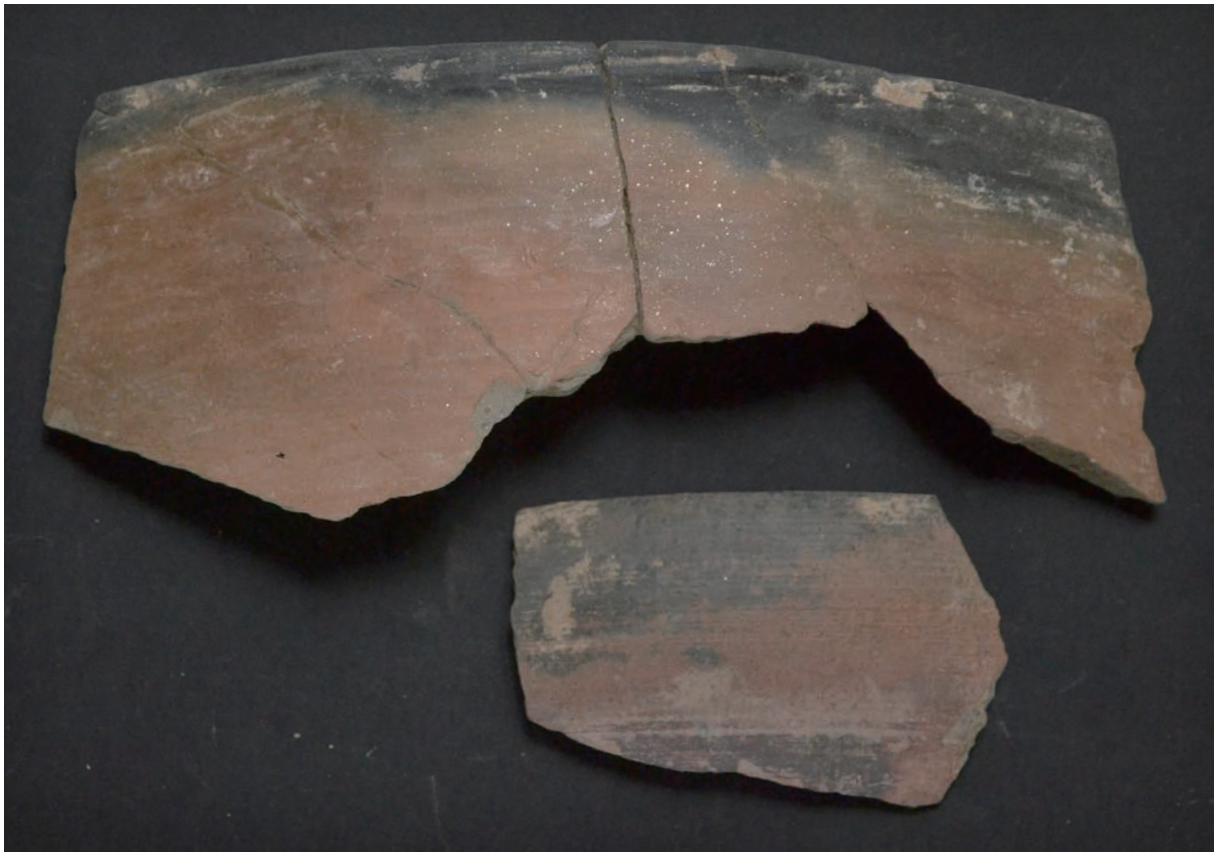

Figure 19 Black-and-Red ware from Kunal
(photographed by the author with courtesy of Department of Archaeology and Museum, Haryana)

the surface. The use of this ware is very limited in the region. A significant quantity of this ware have been recovered from the Painted Grey Ware level at Kunal. However a very few sites have yielded this ware.

FUNERARY PRACTICES

The life cycle, birth and death, is an important aspect of human society. As per the available evidence, Neanderthals were the earliest hominids who buried their dead. These ceremonies can often entail the designation of food and goods for departed individuals indicating a possible belief in an afterlife. The human attempted to venerate the memory of departed souls by erecting memorial installations to remember close relatives or respected members of a given society. Due to the absence of burial sites associated with the Painted Grey Ware culture, it is commonly assumed that the members of these societies began to dispose of their dead in new ways, such as cremation. The excavations at Bhagwanpura (Joshi 1993: Pl. LII A & B) and Abhaipur (Mishra and Arora 2005-06: 76, Pl. IV) have yielded two graves, one of a child and the other one of an adult respectively, but no grave good was found with them. The absence of graves in the Painted Grey Ware culture is a sharp contrst to the contemporary Iron Age Megalithic sites of South India where a large number of grave goods are found along with erected tombs.

CHORONOLOGY

The chronology of the Painted Grey Ware culture is discussed by various scholars (Table 2) by both relative as well as absolute dating methods. In terms of the absolute chronology, this culture has been placed

Table 2 Dates of Pained Grey Ware culture

Site	*Method*	*Dates in BP*	*Dates in BC*	*Caribrated dates*	*References*
Hastinapura	Stratigraphic			1100 - 800 BCE	Lal 1954: 21-23
	Stratigraphic			800 - 300 BCE	Dikshit 1973: 150
	^{14}C dating	2270±90	385±95	399, 515 cal BC	Possehl 1994: 4
Bhagwanpura	Stratigraphic			1600 - 1100 BCE	Joshi 1978: 101
	Thermo-Luminescense dating	4868±584	2890±584		Possehl 1994: 21
		4038±325	2060±325		Possehl 1994: 22
		3241±442	1291±442		Possehl 1994: 21
Noh	^{14}C dating		820±225	900 ± 225 cal BC	Lal 1986: 83-100
		2690±220	820±225	822 cal BC	Possehl 1994: 77
		2600±145	730±150	797 cal BC	Possehl 1994: 77
Atranjikhera	^{14}C dating	2890±105	1025±110	1155 cal BC	Possehl 1994: 10
		2415±100	535±105	410 cal BC	Possehl 1994: 10
Bateswar	^{14}C dating	2490±90	615±95	758, 697, 650 cal BC	Possehl 1994: 18
		5130±240	3335±245	3958 cal BC	Possehl 1994: 18
Mathura	^{14}C dating	2390±150	510±155	405 cal BC	Possehl 1994: 18

around 1200 BCE. However, in relative stratigraphic contexts, the Painted Grey Ware has been found in two different archaeological contexts, viz. overlapping with the Late Harappan assemblage and also in an independent context. The excavations at the site of Bhagwanpura have thrown a new light on the relationship between the Late Harappan and the Painted Grey Ware using people. While Sub-period IA at Bhagwanpura is represented by the Late Harappan culture, Sub-period IB is marked by a co-occurrence of the Late Harappan and Painted Grey Ware ceramics (Joshi 1993: 27). The similar evidence has been reported from Dadheri (Joshi 1993: 245), Nagar (Joshi 1993: 246), Manda (Joshi 1993: 241) and Katpalon (Joshi 1993: 245-46).This overlap of two different cultures and social groups is very significant as the Painted Grey Ware people are often associated with the Aryans (i.e. an intruding culture from Central Asia). A similar situation has also been reported from the recently excavated site of Madina, which is situated about 80 km west of New Delhi. Here, the excavator does not exactly explain the Late Harappan - Painted Grey Ware overlap, but rather notes that Late Harappan elements like pottery and antiquities continued from the lowest level to the uppermost level of the Painted Grey Ware deposit towards the end of the second millennium BCE (Manmohan Kumar et al. 2009: 114). There may be many more sites that exhibit this overlap as the study area contains hundreds of sites that have yielded both the Late Harappan and Painted Grey Ware remains. Hence we can place the overlapping phase around from 1300 BCE to 1100 BCE. For more precise dating of this Iron Age culture we need to excavate more sites and collect datable material.

CONCLUSION

The land of Haryana is very fertile with numerous sources of water as mentioned above. The availability of natural resources and favourable environmental conditions makes this region attractive for settlement by humans. This stands attested by the fact that 54

percent of all Painted Grey Ware sites have been found with in the border of Haryana (Figure 3; Tables 1 and 2). Vibha Tripathi has documented 481 sites whereas prior to her work, there were 572 Painted Grey Ware sites were reported by various scholars in separate works. This figure now stands 627, out of which 122 sites are single culture sites. On the basis of single culture sites, we can say that the average size of the settlements is 3.54 hectare indicating that Painted Grey Ware sites were generally rural sites. The area under the present study was again explored by the author and 199 sites including 56 new sites were systematically documented. The area of the settlements apart from the material culture itself suggests that this culture was primarily rural with no urban element. The artifacts used by the people of this culture were typically made of locally available material. However, the presence of material like semiprecious stones, etc. from far flung areas suggests that people of this culture did engage themselves in trades of some scale.

The huts of the better people was made of reed and tiles, whereas huts of the people at lower strata of society was made of simple available material. The discovery of horse bones and terracotta figures does suggest that horse was quite in use. As to whether horse was used by all alike in the society is a matter of speculation.

As discussed avove, iron came to be introduced in the area under study during the Painted Grey Ware culture. On the basis of the presence of iron, we can divide the Painted Grey Ware culture into two phases, viz. Pre-Iron and Iron Phases. At most of the sites, the Pre-Iron and Iron Phases are available. At Madina, the iron objects started appearing in the fourth phase, whereas Phases 1 to 3 can be regarded as the Pre-Iron phases (Manmohan Kumar et al. 2009: 169). The chronology of the Painted Grey Ware culture has not been determined as yet authentically. ^{14}C dates have so far been obtained at none of the sites in the region. The archaeologists have no single opinion as to the arrival of iron in region, i.e. whether from Central Asia or from the central Ganga Plain. The discovery of iron artifacts in the Painted Grey Ware context does suggest that the iron technology had developed in India as early as 1100 BCE. However, it requires thorough and in-depth study and further excavations to fix the time range of this culture.

Acknowledgments

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Table 3 Painted Grey Ware sites explored by the author

(GH=Ghaggar-Hakra, EH=Early Harappan, MH=Mature Harappan, LH=Late Harappan, PGW=Painted Grey Ware, H= Historic, M=Medieval)

No.	*Site*	*Latitude*	*Longitude*	*District*	*Size (ha.)*	*Cultural Sequance*
1	Igara	28.9319	76.0014	Jind	7.0	LH, PGW, H, M
2	Baroli	28.9450	75.9699	Jind	2.5	LH, PGW, H
3	Gusai Khera-1	28.9467	76.1157	Jind	1.0	LH, PGW
4	Ghimana-1	28.9483	75.9551	Jind	2.0	LH, PGW
5	Gusai Khera-2	28.9639	76.3278	Jind	3.0	LH, PGW
6	Ker Kheri	28.9675	76.2920	Jind	2.0	PGW, H
7	Kandela-3	28.9677	76.3278	Jind	5.0	EH, LH, PGW, H
8	Kirsola-2	28.9693	76.0134	Jind	50	PGW, M
9	Kharenti-1	28.998	76.2712	Jind	5.0	EH, LH, PGW
10	Nidani-1	29.0032	76.0489	Jind	2.0	LH, PGW
11	Bharan-2	29.0176	76.0035	Rohtak	2.0	PGW
12	Farmana-1	29.0186	76.3558	Rohtak	18.0	GH, EH, MH, LH, PGW, H
13	Farmana-5	29.0384	76.2771	Rohtak	1.6	PGW, H
14	Ganganagar-1	29.0406	76.3084	Rohtak	2.5	LH, PGW
15	Ganganagar-2	29.0461	76.2164	Rohtak	1.0	PGW
16	Girwad-1	29.0530	76.2028	Rohtak	1.3	LH, PGW
17	Kharkhra-1	29.0616	76.3605	Rohtak	2.0	LH, PGW, H
18	Madina-2	29.0637	76.3006	Rohtak	5.0	LH, PGW, H
19	Madina-3	29.0782	76.4226	Rohtak	2.0	LH, PGW
20	Ajaib-1	29.0959	76.2479	Rohtak	2.0	LH, PGW
21	Balelba-1	29.1508	76.4268	Rohtak	3.5	LH, PGW, H, M
22	Balelba-3	29.1713	76.3120	Rohtak	6.5	PGW
23	Bedwa-3	29.1767	76.3007	Rohtak	2.3	LH, PGW, H, M
24	Bhaini Bharo-2	29.2038	76.4233	Rohtak	2.0	PGW, M
25	Madina-7	29.2129	76.3594	Rohtak	2.0	PGW
26	Meham-1	29.2129	76.3711	Rohtak	50.0	LH, PGW, H, M
27	Meham-4	29.2240	73.1273	Rohtak	2.3	PGW, H, M
28	Mokhra-2	29.2250	76.2464	Rohtak	2.0	PGW
29	Mokhra-3	29.2367	73.2292	Rohtak	2.0	LH, PGW
30	Mokhra-5	29.2437	76.2562	Rohtak	2.1	LH, PGW
31	Nindana-1	29.2610	76.4040	Rohtak	2.15	PGW
32	Seman-5	29.2641	76.2936	Rohtak	2.3	EH, LH, PGW, H, M
33	Madina-6	29.2732	76.2621	Rohtak	1.5	PGW
34	Bawani Khera-2	29.2750	76.3518	Bhiwani	2.0	PGW, H, M
35	Alak Pura	29.2764	76.4565	Bhiwani	2.0	PGW
36	Bawani Khera	29.2955	76.3635	Bhiwani	2.0	PGW, H, M
37	Jamalpur	29.3035	76.4715	Bhiwani	2.0	PGW, H, M
38	Mathana-1	29.3113	76.4170	Kurukshetra	2.5	LH, PGW
39	Dhindsa	29.3348	76.6153	Sangrur	2.5	LH, PGW
40	Moonak	29.3539	76.3408	Sangrur	2.5	PGW, H, M

Table 3 (contd.) Painted Grey Ware sites explored by the author

(GH=Ghaggar-Hakra, EH=Early Harappan, MH=Mature Harappan, LH=Late Harappan, PGW=Painted Grey Ware, H= Historic, M=Medieval)

No.	*Site*	*Latitude*	*Longitude*	*District*	*Size (ha.)*	*Cultural Sequance*
41	Saspali	29.3546	76.3496	Sangrur	2.0	PGW
42	4MSR	29.3561	76.3922	Sri Ganganagar	1.5	PGW
43	Hanumangarh	29.3606	76.3050	Hanumangarh	10.0	PGW, H, M
44	Burj	29.3929	76.3343	Fethabad	4.0	GH, EH, PGW, H
45	Chander Kalan	29.5844	74.3259	Fethabad	2.0	PGW, H
46	Dher	29.6256	75.9269	Fethabad	3.0	PGW, H, M
47	Kanherri-2	29.6469	75.8229	Fethabad	2.0	EH, PGW, H
48	Kaul Garh	29.6573	75.6417	Fethabad	2.0	EH, PGW
49	Kullan	29.6666	75.9388	Fethabad	2.0	PGW, H
50	Loha Khera	29.6674	75.7293	Fethabad	4.0	PGW, H, M
51	Mirrana	29.6689	75.9087	Fethabad	1.0	PGW
52	Batheri	29.6880	75.6206	Kurukshetra	1.57	PGW, M
53	Dangra	29.6891	75.8927	Fethabad	2.0	PGW, H, M
54	Hansala	29.7044	75.7709	Kurukshetra	2.0	PGW, H
55	Samain	29.7132	75.5356	Fethabad	3.5	PGW
56	Kheri Shishgarh	29.7775	75.8134	Kurukshetra	2.0	PGW, H, M
57	Machinghan	29.8202	75.8960	Patiala	5.0	LH, PGW, H, M
58	Rasuli	29.8228	75.6120	Kaithal	2.0	LH, PGW
59	Ratta Khera	29.8955	75.9266	Kaithal	2.13	PGW
60	Rattan Dera	29.9049	76.1702	Kurukshetra	1.67	LH, PGW, H
61	Puthi-Seman-5	29.9075	76.8690	Hissar	0.5	EH, LH, PGW
62	Majra-1	29.9175	76.4568	Hissar	2.0	LH, PGW
63	Jamalpur-2	29.9221	76.2244	Bhiwani	2.5	PGW, H
64	Jeeta Kheri	29.9226	76.4018	Bhiwani	3.0	LH, PGW
65	Pur-1	29.9271	76.2617	Bhiwani	2.0	EH, LH, PGW, H, M
66	Asan-1	29.9320	76.3549	Jind	1.0	EH, LH, PGW
67	Biri kalan	29.9326	76.6014	Jind	1.67	PGW
68	Chabri-1	29.9441	76.5259	Jind	3.0	PGW
69	Igara-3	29.9518	76.8032	Jind	1.0	LH, PGW
70	Kandela-1	29.9576	76.4330	Jind	3.0	PGW
71	Kila Japhargarh-1	29.9635	76.7263	Jind	2.0	LH, PGW
72	Manohar Pur	29.9644	76.6993	Jind	3.0	EH, MH, LH, PGW, H
73	Ram Rai Khera	29.9673	76.7984	Jind	2.0	PGW
74	Ramkali	29.9700	76.2185	Jind	3.0	EH, LH, PGW
75	Kakear	29.9746	76.2124	Kaithal	4.0	PGW, H, M
76	Kasur-2	29.9773	76.8260	Kaithal	4.0	GH, EH, LH, PGW, H, M
77	Nauch	29.9778	76.4682	Kaithal	1.0	LH, PGW, H, M
78	Rasulpur	29.9803	76.7955	Kaithal	1.57	PGW, H, M
79	Saravla-2	29.9805	76.6787	Kaithal	1.0	PGW, H, M
80	Bohar Saidan	29.9872	76.9379	Kurukshetra	6.0	PGW, H, M

Table 3 (contd.) Painted Grey Ware sites explored by the author
(GH=Ghaggar-Hakra, EH=Early Harappan, MH=Mature Harappan, LH=Late Harappan, PGW=Painted Grey Ware, H= Historic, M=Medieval)

No.	*Site*	*Latitude*	*Longitude*	*District*	*Size (ha.)*	*Cultural Sequance*
81	Seonser	29.9881	76.5801	Kurukshetra	2.0	LH, PGW, H
82	Surmi-2	29.9892	76.5636	Kurukshetra	2.5	PGW
83	Bhaini Matoo	29.9926	76.8250	Rohtak	1.7	EH, LH, PGW, H
84	Bibipur Kalan	29.9951	76.6834	Kurukshetra	2.0	LH, PGW, H
85	Murtazpur	29.9965	76.8593	Kurukshetra	2.5	PGW
86	Asrpggarh	29.9966	76.6640	Jind	6.5	LH, PGW, H, M
87	Hatt	30.0009	76.2484	Jind	10.0	PGW, H, M
88	Pali	30.0055	76.6285	Hissar	3.0	PGW, H
89	Khokhari-1	30.0211	76.9214	Jind	2.0	LH, PGW
90	Khokhari-2	30.0212	76.7882	Jind	1.0	LH, PGW
91	Morthala	30.0559	76.9483	Kurukshetra	1.5	PGW, H
92	Mirzapur	30.0563	76.9556	Kurukshetra	5.0	PGW, H, M
93	Kasithal	30.0826	76.2625	Kurukshetra	3.0	PGW, H, M
94	Kagsar	30.0935	76.2974	Hissar	1.0	PGW
95	Narnaund	30.0991	76.2962	Hissar	2.0	PGW, H
96	Harash Ka Tela	30.1210	76.4781	Kurukshetra	25.0	PGW, H, M
97	Kunal	30.1520	76.4706	Fethabad	1.3	GH, EH, MH, PGW
98	Bhanwan Pura	30.2075	76.5579	Kurukshetra	1.5	LH, PGW
99	Bhiwani Khera	28.7495	76.5872	Kurukshetra	2.0	LH, PGW
100	Jogana Khera	28.7674	76.7195	Kurukshetra	2.0	LH, PGW, H
101	Pehowa	28.7819	76.5348	Kurukshetra	?	PGW, H, M
102	Amain	28.7884	76.7036	Kurukshetra	15.0	PGW, H, M
103	Ghuram	28.7897	76.5334	Patiala	10.0	LH, PGW, H, M
104	Agond	28.7921	76.7526	Kaithal	5.0	PGW, H, M
105	Kasur-1	28.8008	76.7087	Kaithal	2.0	PGW, H, M
106	Ladana Chakoo	28.8087	76.7689	Kaithal	2.0	PGW, H, M
107	Ramthali	28.8171	76.6087	Kaithal	1.0	PGW
108	Saravla-1	28.8199	76.4857	Kaithal	2.0	LH, PGW
109	Garhi Roran	28.8291	76.7241	Kurukshetra	4.0	PGW
110	Untsal	28.8482	76.3774	Kurukshetra	1.0	PGW, H, M
111	Bhasamara-2	28.8561	76.5748	Patiala	1.0	PGW
112	Madan Heri-1	28.8517	76.7689	Hissar	2.0	LH, PGW
113	Madan Heri-2	28.8576	76.5961	Hissar	2.0	PGW, H
114	Bhadar Kali	28.8585	76.8449	Hanumangarh	4.0	PGW, H
115	Talwara	28.8807	76.6913	Fethabad	2.67	GH, EH, PGW, H
116	Theh Polar	28.8926	76.8024	Kaithal	5.0	PGW, H, M
117	Urani	28.9008	76.4691	Kurukshetra	7.0	PGW, H, M
118	Rohtak (Khokhrakot)	28.9081	76.5764	Rohtak	200.0	PGW, H, M
119	Chak 86	28.9108	76.5762	Sri Ganganagar	2.0	LH, PGW
120	Narakatari	28.9492	76.7590	Kurukshetra	1.0	LH, PGW

Table 3 (contd.) Painted Grey Ware sites explored by the author
(GH=Ghaggar-Hakra, EH=Early Harappan, MH=Mature Harappan, LH=Late Harappan, PGW=Painted Grey Ware, H= Historic, M=Medieval)

No.	*Site*	*Latitude*	*Longitude*	*District*	*Size (ha.)*	*Cultural Sequance*
121	Madh	28.9602	76.4929	Hissar	2.67	PGW
122	Chak 48GB	28.9681	76.5308	Sri Ganganagar	3.0	PGW, H, M
123	Purani Kupli	28.9747	76.5109	Sri Ganganagar	7.0	PGW, H, M
124	Chak 39GB	28.9785	76.6927	Sri Ganganagar	1.0	EH, PGW, H
125	Chak IstAPD-1	29.0029	77.4847	Sri Ganganagar	1.0	PGW, H, M
126	Chak 15GB-3	29.0063	76.4589	Sri Ganganagar	3.0	PGW, H
127	Chak 15GB-4	29.0111	76.5444	Sri Ganganagar	3.0	PGW, H
128	Chak 5GB-b	29.0192	76.4750	Sri Ganganagar	1.0	PGW, H
129	Chak 87GB	29.0244	76.5068	Sri Ganganagar	4.0	PGW, H
130	Shivpuri Garh	29.0292	76.3914	Sri Ganganagar	3.0	PGW, H
131	Suratgarh	29.0303	77.4416	Sri Ganganagar	1.0	PGW, H, M
132	Alamgirpur	29.0306	76.5028	Meerut	1.3	LH, PGW, H
133	Kurdi	29.0317	76.5004	Baraut	9.7	PGW, H, M
134	Isopur Til	29.0366	76.6013	Baraut	10.43	PGW, H, M
135	Rohira	29.0389	76.4444	Sangrur	2.0	GH, EH, MH, LH, PGW, H
136	Thehdi Nathan	29.0457	76.4528	Hanumangarh	3.0	LH, PGW, H
137	Kunal	29.0486	76.5014	Fethabad	2.0	GH, EH, MH, LH, PGW, H
138	Atayal	29.0501	76.6165	Rohtak	2.0	PGW, H
139	Bahu Akbarpur	29.0569	76.5006	Rohtak	3.0	LH, PGW, H
140	Baliana-2	29.0750	76.3972	Rohtak	2.0	PGW
141	Bhagotipur-1	29.0753	77.2246	Rohtak	2.0	PGW
142	Chandi-1	29.0794	77.3257	Rohtak	1.5	LH, PGW, H, M
143	Gandra-1	29.0809	77.2796	Rohtak	2.0	LH, PGW
144	Giazi	29.0833	76.4625	Rohtak	2.0	PGW, H
145	Hasangrah-2	29.0917	76.5389	Rohtak	1.5	LH, PGW
146	Humaynpur	29.0928	77.1554	Rohtak	2.0	LH, PGW, H
147	Indergarh	29.0948	73.4033	Rohtak	3.0	LH, PGW
148	Ismaila-1	29.1094	77.4284	Rohtak	3.5	LH, PGW, H, M
149	Ismaila-2	29.1181	76.5556	Rohtak	2.0	LH, PGW, H, M
150	Ismaila-3	29.1208	76.5069	Rohtak	2.0	PGW, H
151	Kabulpur-1	29.1248	77.3765	Rohtak	3.5	LH, PGW, H
152	Kalanaur-5	29.1250	76.5875	Rohtak	5.0	PGW, H
153	Kharanti-1	29.1442	77.3604	Rohtak	2.0	PGW
154	Khokhrakot/Rohtak-1	29.1466	77.3083	Rohtak	2.0	PGW, H
155	Krontha-2	29.1656	76.0633	Rohtak	1.0	PGW, H
156	Kultana	29.1756	77.1467	Rohtak	2.0	PGW
157	Lakhan Majra-2	29.1779	73.3539	Rohtak	4.0	PGW, H
158	Maina-1	29.1796	76.1777	Rohtak	1.0	LH, PGW, H
159	Nidana-1	29.1797	77.4530	Rohtak	1.0	LH, H
160	Patwapur-1	29.1803	76.1137	Rohtak	2.0	LH, PGW, H

Table 3 (contd.) Painted Grey Ware sites explored by the author
(GH=Ghaggar-Hakra, EH=Early Harappan, MH=Mature Harappan, LH=Late Harappan, PGW=Painted Grey Ware, H= Historic, M=Medieval)

No.	*Site*	*Latitude*	*Longitude*	*District*	*Size (ha.)*	*Cultural Sequance*
161	Polangi-1	29.1808	77.3282	Rohtak	2.0	PGW, H
162	Rithal Phoughat-1	29.1868	77.3244	Rohtak	4.0	PGW
163	Samergopalpur-1	29.2033	73.3119	Rohtak	3.0	GH, EH, LH, PGW, H
164	Sanghi-1	29.2092	73.3049	Rohtak	2.0	PGW, M
165	Sanghi-3	29.2124	76.1914	Rohtak	5.0	PGW
166	Sudana-1	29.2257	73.4552	Rohtak	5.0	PGW, H
167	Sudana-2	29.2368	73.2287	Rohtak	3.0	LH, PGW, H
168	Sunaria Kalan-1	29.2368	73.2287	Rohtak	2.0	PGW
169	Achaaz Khera	29.2370	76.2146	Baghpat	8.0	LH, PGW, H, M
170	Asara-2	29.2382	77.3128	Baghpat	6.0	PGW, H
171	Asarfpur Thal	29.2468	77.1542	Baghpat	4.0	PGW, H
172	Badka-1	29.2471	77.1542	Baghpat	3.0	PGW, H
173	Bamnoli	29.2626	73.5034	Baghpat	10.0	PGW, H, M
174	Barnava-1	29.3052	73.5886	Baghpat	30.0	PGW, H, M
175	Bdawadh	29.3063	77.1606	Baghpat	3.0	PGW, H, M
176	Dhikana	29.3067	77.1607	Baghpat	2.0	LH, PGW, H
177	Kakor Kalan-1	29.3071	73.5749	Baghpat	8.0	PGW, H, M
178	Kurdi	29.3269	73.6288	Baghpat	10.0	PGW, H, M
179	Kotana	29.3317	73.8857	Baghpat	4.0	PGW, H
180	Mavikalan	29.3376	73.3716	Baghpat	6.0	PGW, H, M
181	Milana	29.3539	77.3286	Baghpat	3.0	PGW, H
182	Nangal	29.3817	77.2053	Baghpat	3.0	PGW, H
183	Ranchar-2	29.3996	73.3996	Baghpat	7.0	LH, PGW, H
184	Bhura-3	29.3996	73.3996	Kirana	3.0	LH, PGW, H, M
185	Gagor	29.4069	77.2032	Kirana	2.0	LH, PGW, H
186	Hulas	29.4197	73.9905	Kirana	5.0	LH, PGW, H
187	Ishopurtil	29.4470	77.2020	Kirana	20.0	PGW, H, M
188	Kairana-1 (Teli Khera)	29.5534	74.2890	Kirana	3.0	LH, PGW, H
189	Kairana-3	29.5707	74.5530	Kirana	3.0	PGW, H
190	Kiwana	29.5717	74.5098	Kirana	1.5	LH, PGW, H
191	Chak 48 GB	29.5853	74.5265	Sri Ganganagar	4.0	EH, PGW, H
192	Chak 59 GB (Ramsingh Nagar)	29.6072	75.6641	Sri Ganganagar	3.0	PGW, H
193	Chak 67 GB	29.6181	77.2516	Sri Ganganagar	4.0	LH, PGW, H
194	Chak 71 GB	29.6239	75.6641	Sri Ganganagar	5.0	PGW, H
195	Chak 86 GB	29.7044	77.3593	Sri Ganganagar	4.0	PGW, H
196	Chak 13CDR	29.8417	76.3708	Hanumangarh	2.0	EH, PGW, H
197	Chak 15CDR	29.9944	76.4861	Hanumangarh	2.0	EH, PGW, H
198	Chak 2SRW	30.0039	74.6441	Hanumangarh	1.5	EH, MH, LH, PGW, H
199	Chak 34STG-2	30.6416	75.8453	Hanumangarh	1.0	PGW, H

Table 4 Painted Grey Ware sites explored by various scholars
(GH=Ghaggar-Hakra, EH=Early Harappan, MH=Mature Harappan, LH=Late Harappan, PGW=Painted Grey Ware, GW=Grey Ware, NBPW=Northern Black Polished Ware, H= Historic, M=Medieval)

No	*Site*	*Latitude*	*Longitude*	*Size (ha.)*	*Cultural Sequence*	*Reference*
1	Agwanpur	29.1041	76.9666	5.86	PGW, H, M	Silak Ram 1972: 1-7
2	Pali-2	29.1701	76.0784	2.0	EH, H, PGW	IAR 1966-67: 13
3	Dharodi	29.6394	76.0677	3.0	EH, LH, PGW	Amar Singh 1981: 105
4	Rukhi-2	29.0494	76.6811	2.0	EH, LH, PGW	Dangi 2007: 31
5	Samargopalpur-1	28.9633	76.5125	2.0	EH, LH, PGW	Krishan Kumar 1990
6	Thurana-2	29.1583	76.1125	1.67	EH, LH, PGW	Sandeep 2006: 22
7	Manak Majera	0	0	2.0	EH, LH, PGW	Suraj Bhan 1975: 125
8	Farmana-2	28.9666	76.8166	1.5	EH, LH, PGW	Thakran 2000: 105
9	Kharak Pandwan	29.6791	76.2666	8.0	EH, LH, PGW, H	Brehamdutt 1980: 138
10	Kalayat	29.6666	76.2666	10.0	EH, LH, PGW, H	Brehamdutt 1980: 138-39
11	Dhakal	29.5888	76.1291	10.0	EH, LH, PGW, H	Brehamdutt 1980: 139
12	Baroda-2	29.1175	76.6019	1.0	EH, MH, LH, PGW	Thakran 2000: 69
13	Ghadwal	29.2000	76.7333	1.0	EH, MH, LH, PGW	Thakran 2000: 79
14	Surha	28.5611	76.7347	4.0	EH, MH, LH, PGW, H, M	Silak Ram 1972: 43-44
15	Daroli Khera	29.4900	76.1091	2.0	EH, PGW	Amar Singh 1981: 103
16	Sanghi	29.0000	76.5833	6.0	EH, PGW	Silak Ram 1972: 9
17	Baliyana	28.8708	76.6833	3.0	EH, PGW	Silak Ram 1972: 3-7
18	Jind-3	29.3106	76.3068	5.0	EH, PGW	Suraj Bhan 1975: 124
19	Mana	28.8416	76.6055	6.0	EH, PGW, LH	Silak Ram 1972: 3-7
20	Khanpur	29.1611	76.7925	7.0	GH, EH, LH, PGW, H, M	Dangi 2007: 20
21	Lochab	29.6227	76.1185	3.0	GW	Amar Singh 1981: 116
22	Surewala	29.5066	75.9186	2.0	GW	Amar Singh 1981: 121
23	Dahola	0	0	3.5	GW	Amar Singh 1981: 78
24	Topar Khurd	30.1361	77.1888	12.0	GW	Brehamdutt 1980: 85
25	Babain	30.0694	76.9805	5.0	GW	Manmohan Kumar 1978: 62
26	Pipli	29.9777	76.8833	2.0	GW	Manmohan Kumar 1978: 74
27	Pharal	29.8333	76.5833	6.0	GW, H	Brehamdutt 1980: 130
28	Sajuma	29.3944	76.2833	4.0	GW, H	Brehamdutt 1980: 138
29	Singhpura	30.4833	76.9250	3.5	GW, H	Brehamdutt 1980: 89
30	Kokori	30.3808	76.9125	10.0	GW, H	IAR 1964-65: 61
31	Faras Majra	29.8555	76.3166	1.0	GW, H	Manmohan Kumar 1978: 57-58
32	Sandhal Kalan	29.5055	76.9666	12.0	GW, H	Silak Ram 1972: 1-7
33	Thanesr	29.9708	76.0833	100.0	GW, H, M	IAR 1964-65: 34
34	Chand Kheri	30.2833	77.2888	15.0	GW, NBPW	Brehamdutt 1980: 85
35	Hato	29.6166	76.1833	9.0	H, Lh, PGW	Brehamdutt 1980: 140
36	Sandhal Khurd	29.0555	76.9666	2.0	LH, H	Thakran 2000: 121
37	Nizampur	29.2333	76.5011	2.0	LH, H	Thakran 2000: 86
38	Bhongra	29.4363	76.1533	2.0	LH, PGW	Amar Singh 1981: 102

Table 4 (contd.) Painted Grey Ware sites explored by various scholars
(GH=Ghaggar-Hakra, EH=Early Harappan, MH=Mature Harappan, LH=Late Harappan, PGW=Painted Grey Ware, GW=Grey Ware, NBPW=Northern Black Polished Ware, H= Historic, M=Medieval)

No	*Site*	*Latitude*	*Longitude*	*Size (ha.)*	*Cultural Sequence*	*Reference*
39	Dumarkha Kalan-2	29.5566	76.1611	1.0	LH, PGW	Amar Singh 1981: 106-107
40	Gharwali	29.1683	76.3419	2.0	LH, PGW	Amar Singh 1981: 80
41	Naguran	29.4361	76.3736	1.0	LH, PGW	Amar Singh 1981: 90
42	Samdo	29.4919	76.3975	0.67	LH, PGW	Amar Singh 1981: 93
43	Khapran	29.4205	76.1716	3.0	LH, PGW	Amar Singh 1981: 97-98
44	Nuru Khera	29.9055	77.0166	2.0	LH, PGW	Brehamdutt 1980: 41
45	Badsi Khera	29.6083	76.23333	4.0	LH, PGW	Brehamdutt 1980: 139
46	Lawana	30.2555	77.1388	3.0	LH, PGW	Brehamdutt 1980: 106
47	Pipli Khera	29.9666	76.8750	5.0	LH, PGW	Brehamdutt 1980: 114
48	Hansyala	30.0222	76.7888	7.0	LH, PGW	Brehamdutt 1980: 115
49	Nainnnan	29.8000	76.5333	3.0	LH, PGW	Brehamdutt 1980: 135
50	Moana	29.4333	76.5666	13.0	LH, PGW	Brehamdutt 1980: 79
51	Bahloli-2	0	0	5.0	LH, PGW	Brehamdutt 1980: 91
52	Saraula	30.1000	76.3000	9.0	LH, PGW	Brehamdutt 1980: 97
53	Mangoli Ranghran	30.1361	77.0166	5.0	LH, PGW	Brehamdutt 1980: 110
54	Bahauli-1	29.4750	76.8833	3.0	LH, PGW	Brehamdutt 1980: 42
55	Puthi	29.0611	76.6991	1.2	LH, PGW	Dangi 2007: 31
56	Baroda-1	29.1488	76.6158	1.2	LH, PGW	Gulab Singh 1990: 10-11
57	Mehmudpur-2	29.1772	76.7125	1.5	LH, PGW	Gulab Singh 1990: 19
58	Badhauli	30.3583	77.0416	9.0	LH, PGW	IAR 1963-64: 27
59	Badhauli	30.3594	77.0444	5.0	LH, PGW	IAR 1963-64: 27
60	Bhagwangrah	30.3500	77.3500	4.0	LH, PGW	IAR 1963-64: 27
61	Lukhi-2	30.0277	76.7333	5.0	LH, PGW	IAR 1964-65: 34
62	Banhera	30.0166	76.4166	3.0	LH, PGW	IAR 1966-67: 13
63	Jatheri	29.7430	76.5166	3.0	LH, PGW	IAR 1966-67: 13
64	Bachpadi	30.4911	77.0311	3.0	LH, PGW	Joshi 2003: 58
65	Chaowala-1	30.2572	77.2894	3.0	LH, PGW	Joshi 2003: 61-62
66	Fatehpur	30.5472	77.1052	1.5	LH, PGW	Joshi 2003: 68
67	Kheri Brahmana	30.2905	77.2819	1.5	LH, PGW	Joshi 2003: 81
68	Kurali	30.4133	77.0808	3.0	LH, PGW	Joshi 2003: 83-83
69	Rampur-1	30.5069	77.1397	0.5	LH, PGW	Joshi 2003: 98
70	Sunaria Khurd	28.8666	76.5666	1.5	LH, PGW	Lamba 1989: 108
71	Cheeka	30.0492	76.3444	3.0	LH, PGW	Manmohan Kumar 1978: 52
72	Baur Sham-1	29.7558	77.0627	2.0	LH, PGW	Manmohan Kumar 1978: 76
73	Behlolo-1	30.4111	76.9597	4.0	LH, PGW	Manmohan Kumar 1978: 46
74	Nakhrauli	30.3427	77.1036	4.0	LH, PGW	Manmohan Kumar 1978: 48
75	Bhatol Rangran	29.1208	76.0833	4.0	LH, PGW	Sandeep 2006: 15
76	Ugalon	29.1583	76.2666	1.5	LH, PGW	Sandeep 2006: 23
77	Bass-1	29.1166	76.2250	2.0	LH, PGW	Sandeep 2006: 13
78	Bass-4	29.1000	76.2166	3.0	LH, PGW	Sandeep 2006: 14

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No	*Site*	*Latitude*	*Longitude*	*Size (ha.)*	*Cultural Sequence*	*Reference*
79	Khanda Kheri-2	29.1930	76.2083	2.0	LH, PGW	Sandeep 2006: 16
80	Puthi-4	29.0965	76.2774	2.0	LH, PGW	Sandeep 2006: 19
81	Ahullana	29.1083	76.6666	6.0	LH, PGW	Silak Ram 1972: 3-7
82	Gandhara	28.8375	76.7166	2.0	LH, PGW	Silak Ram 1972: 3-7
83	Bhawa	29.1958	76.5250	3.0	LH, PGW	Silak Ram 1972: 4
84	Bhawa- 2	29.1916	76.5250	4.0	LH, PGW	Silak Ram 1972: 4
85	Nuran Khera	29.2000	76.5333	4.0	LH, PGW	Silak Ram 1972: 4
86	Bhawani Khera	29.9944	76.8250	4.2	LH, PGW	Singh 1976: 29
87	Bhukhari	30.1833	77.3500	3.0	LH, PGW	Suraj Bhan and Shaffer 1978: 66
88	Bahola	29.8111	76.7833	4.0	LH, PGW	Suraj Bhan 1975: 125
89	Ritauli	29.4166	76.5000	2.5	LH, PGW	Suraj Bhan 1975: 125
90	Bhatgaon	29.9833	76.9000	1.0	LH, PGW	Thakran 2000: 100
91	Bohla	29.0833	76.8513	1.0	LH, PGW	Thakran 2000: 101
92	Dodwa	29.0988	76.8291	4.0	LH, PGW	Thakran 2000: 104
93	Harsana-Kalan	28.9500	76.0333	1.0	LH, PGW	Thakran 2000: 107
94	Sisana-1	29.8833	76.8838	2.0	LH, PGW	Thakran 2000: 122-23
95	Sisana-2	29.8666	76.8352	1.0	LH, PGW	Thakran 2000: 123
96	Butana	29.1672	76.6183	0.05	LH, PGW	Thakran 2000: 64-75
97	Bali-1	29.2000	76.9000	0.5	LH, PGW	Thakran 2000: 68
98	Bhainswan Khurd	29.0972	76.6805	1.0	LH, PGW	Thakran 2000: 71
99	Busan Kalan	29.2333	76.7344	0.05	LH, PGW	Thakran 2000: 74
100	Ghilaud Kalan-1	29.0055	76.6500	1.0	LH, PGW	Thakran 2000: 80
101	Ghilaud Kalan-2	29.0500	76.6000	1.0	LH, PGW	Thakran 2000: 80
102	Isapur Kheri	29.2016	76.6500	1.0	LH, PGW	Thakran 2000: 81
103	Kakana	29.1388	76.6500	2.0	LH, PGW	Thakran 2000: 84
104	Sargthal	29.1166	76.8336	2.0	LH, PGW	Thakran 2000: 93
105	Kurukshetra-2	29.8547	76.8777	5.0	LH, PGW	Manmohan Kumar 1978: 82
106	Malikrai Pur	30.3250	77.2722	12.0	LH, PGW, GW	Brehamdutt 1980: 87
107	Maudi-3	29.7944	76.7750	3.5	LH, PGW, H	Amar Singh 1981: 57-58
108	Saga	0	0	2.0	LH, PGW, H	Amar Singh 1981: 60
109	Jodhkan	29.7500	75.1666	5.0	LH, PGW, H	Brehamdutt 1980: 103
110	Chandlana	29.8611	76.6333	19.0	LH, PGW, H	Brehamdutt 1980: 130-31
111	Sangrauli	29.8083	76.6444	50.0	LH, PGW, H	Brehamdutt 1980: 135
112	Malar Khera	29.3333	76.5000	8.0	LH, PGW, H	Brehamdutt 1980: 76
113	Amrali Khera	29.3666	76.4833	5.0	LH, PGW, H	Brehamdutt 1980: 77
114	Chika	30.0500	76.3333	9.0	LH, PGW, H	Brehamdutt 1980: 96
115	Kasaur	29.9666	76.2166	7.0	LH, PGW, H	Brehamdutt 1980: 98
116	Brahman Majra	30.4458	77.1166	9.0	LH, PGW, H	Brehamdutt 1980: 88
117	Nuran Khera	29.2030	76.5833	3.0	LH, PGW, H	Gulab Singh 1990: 20-21
118	Kanjala	30.3930	77.1000	2.0	LH, PGW, H	Joshi 2003: 78-79

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No	*Site*	*Latitude*	*Longitude*	*Size (ha.)*	*Cultural Sequence*	*Reference*
119	Hamayunpur	28.9000	76.8151	2.0	LH, PGW, H	Kailash Kumar 1987: 15-16
120	Kansala-1	28.8968	76.7809	3.0	LH, PGW, H	Kailash Kumar 1987: 17-18
121	Nandu Khera	29.1333	76.6666	10.0	LH, PGW, H	Manmohan Kumar 1978: 72
122	Nandu Khera	29.9955	76.6638	3.0	LH, PGW, H	Manmohan Kumar 1978: 72
123	Dharam Kheri	29.1972	76.2638	3.0	LH, PGW, H	Sandeep 2006: 15
124	Pujam	0	0	4.5	LH, PGW, H	Suraj Bhan 1975 : 125
125	Bani	29.5992	74.6268	6.0	LH, PGW, H	Suraj Bhan 1975: 123
126	Daulatpur	29.9611	76.9277	14.0	LH, PGW, H	Suraj Bhan 1975: 124
127	Bhawar	29.1833	76.5000	2.5	LH, PGW, H	Thakran 2000: 72
128	Maina-1	28.8500	76.6000	1.8	LH, PGW, H	Lamba 1989: 107
129	Saunkhra-1	29.7930	76.8652	2.0	LH, PGW, H, M	Amar Singh 1981: 61
130	Badhara	29.8666	76.7750	7.0	LH, PGW, H, M	Brehamdutt 1980: 134
131	Barota	29.6416	76.9375	5.9	LH, PGW, H, M	Brehamdutt 1980: 42
132	Kakana Bhandri	29.1327	76.8036	3.0	LH, PGW, H, M	Dangi 2007: 18
133	Barhi	29.9750	76.8083	11.0	LH, PGW, M	Brehamdutt 1980: 117
134	Dhantori-1	30.0744	76.8838	2.0	LH, PGW, NBPW	Manmohan Kumar 1978: 65
135	Baroda-3	29.1525	76.5838	1.0	MH, LH, PGW	Thakran 2000: 69-70
136	Chhapada	29.2166	76.5341	1.0	MH, LH, PGW	Thakran 2000: 75
137	Chhapar	28.5833	76.0166	10.0	MH, LH, PGW, NBPW	Silak Ram 1972: 3-7
138	Pondri-2	0	0	2.0	OCP, PGW	Mohinder Singh 1990: 114
139	Imamnagar	28.4500	76.9330	1.0	OCP, PGW	Mohinder Singh 1990: 131
140	Mundeta-1	0	0	8.0	OCP, PGW	Mohinder Singh 1990: 141
141	Harsaru-2	28.4247	76.9541	1.0	OCP, PGW	Mohinder Singh 1990: 68
142	Jhajgarh	0	0	1.0	OCP, PGW	Mohinder Singh 1990: 71
143	Uleta	0	0	4.0	OCP, PGW, H	Mohinder Singh 1990: 119
144	Dhamtan-2	29.6977	76.0183	3.0	PGW	Amar Singh 1981: 104-05
145	Jalalpur Khurd	29.3163	76.9558	0.5	PGW	Amar Singh 1981: 83
146	Zainpur	0	0	2.0	PGW	Brehamdutt 1980: 41
147	Jalubee	30.1750	76.9666	6.0	PGW	Brehamdutt 1980: 109
148	Bashadar	30.5000	76.8333	5.0	PGW	Brehamdutt 1980: 119
149	Mundakhera	29.9750	76.7541	4.0	PGW	Brehamdutt 1980: 122
150	Arnai-2	30.3361	76.6250	5.0	PGW	Brehamdutt 1980: 125
151	Jorasi Khurd	30.6666	76.5833	5.0	PGW	Brehamdutt 1980: 126
152	Theh Malboda	29.9166	76.5833	4.0	PGW	Brehamdutt 1980: 127
153	Mangana	29.9555	76.4916	5.0	PGW	Brehamdutt 1980: 127-28
154	Safidon	29.4000	76.6666	10.0	PGW	Brehamdutt 1980: 75
155	Arnauli	30.2250	77.2958	12.0	PGW	Brehamdutt 1980: 85
156	Saphera	30.3416	76.9333	5.0	PGW	Brehamdutt 1980: 92
157	Malaur-2	30.3166	76.5930	5.0	PGW	Brehamdutt 1980: 94

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No	*Site*	*Latitude*	*Longitude*	*Size (ha.)*	*Cultural Sequence*	*Reference*
158	Tikoran	29.9875	76.6916	10.0	PGW	Brehamdutt 1980: 122-123
159	Chhatehra	29.2333	76.7091	1.5	PGW	Gulab Singh 1990: 12-13
160	Lakhnaur Saheb	30.2750	76.7708	3.0	PGW	IAR 1963-64: 27
161	Segta-2	30.2194	76.7125	5.0	PGW	IAR 1963-64: 27
162	Lakhnaur	30.2763	76.7691	5.0	PGW	IAR 1963-64: 27
163	Gundana	30.1555	77.1458	6.0	PGW	IAR 1964-65: 34
164	Murthala	30.0500	76.9166	14.0	PGW	IAR 1964-65: 34
165	Sasa Talhedi	0	0	8.0	PGW	IAR 1964-65: 34
166	Ramsaran Majra	30.0833	77.3333	2.5	PGW	IAR 1964-65: 34
167	Satora	45.9791	76.5416	2.5	PGW	IAR 1966-67: 13
168	Bora	0	0	7.0	PGW	IAR 1966-67: 13
169	Guhla	30.0333	76.3000	5.0	PGW	IAR 1966-67: 13
170	Ittal	0	0	3.0	PGW	IAR 1966-67: 13
171	Ratta Tiba	0	0	5.0	PGW	IAR 1966-67: 13
172	Rupanwali-1	29.6252	75.4263	5.0	PGW	IAR 1966-67: 13
173	Hallan	0	0	5.0	PGW	IAR 1966-67: 14
174	Mehawa Kheri	30.0916	77.0333	4.0	PGW	IAR 1968-69: 64-65
175	Mukandpur-1	0	0	5.0	PGW	Joshi 2003: 89
176	Karontha-2	28.8000	76.6333	3.5	PGW	Lamba 1989: 107
177	Sanghi-3	0	0	1.0	PGW	Kailash Kumar 1987: 27-28
178	Kharanti-1	29.0244	76.4680	1.5	PGW	Krishan Kumar 1990: 45
179	Teora	30.1222	76.8833	4.0	PGW	Lal 1954: 141
180	Mangat Wala Theh	29.9858	76.6900	4.0	PGW	Manmohan Kumar 1978: 70
181	Jalubi	30.1766	76.9600	3.0	PGW	Manmohan Kumar 1978: 37
182	Kalawar	31.0902	77.1694	2.0	PGW	Manmohan Kumar 1978: 42
183	Harbri-3	29.7055	76.6280	2.0	PGW	Manmohan Kumar 1978: 59
184	Jandola	29.8944	76.5777	2.0	PGW	Manmohan Kumar 1978: 59
185	Khera Raiwala	29.8722	76.5500	2.0	PGW	Manmohan Kumar 1978: 60
186	Shergarh	29.7777	76.4222	5.0	PGW	Manmohan Kumar 1978: 61
187	Silla Khera	29.7833	76.3638	5.0	PGW	Manmohan Kumar 1978: 61-62
188	Thambalaboda	29.8944	76.5861	5.0	PGW	Manmohan Kumar 1978: 62
189	Garhi	0	0	2.0	PGW	Manmohan Kumar 1978: 66
190	Mangal Wala Theh	29.9938	76.6766	4.0	PGW	Manmohan Kumar 1978 : 71
191	Munda Khera	29.9666	76.7555	5.0	PGW	Manmohan Kumar 1978: 72.
192	Suraja Pur	30.0977	76.9511	1.0	PGW	Manmohan Kumar 1978: 75
193	Untsal	30.0361	76.9266	2.0	PGW	Manmohan Kumar 1978: 75-76
194	Naya Goan	29.9888	76.6833	7.0	PGW	Manmohan Kumar 1978: 73
195	Garli Kalan	0	0	1.0	PGW	Mohinder Singh 1990: 62

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No	*Site*	*Latitude*	*Longitude*	*Size (ha.)*	*Cultural Sequence*	*Reference*
196	Golapur-2	0	0	1.0	PGW	Mohinder Singh 1990: 65
197	Gurgaon	28.4833	77.0333	2.0	PGW	Punia 1976: 28
198	Bhaklana-3	29.1486	76.2361	3.0	PGW	Sandeep 2006: 15
199	Kultana	28.7500	76.6666	2.0	PGW	Silak Ram 1972: 18
200	Bhatla	29.1675	75.9258	2.0	PGW	Silak Ram 1972: 7
201	Farmana	28.9166	76.7500	8.0	PGW	Silak Ram 1972: 17
202	Rithal	28.9166	76.6666	6.0	PGW	Silak Ram 1972: 9
203	Ghadwal-2	0	0	3.0	PGW	Silak Ram 1972: 3-7
204	Nakoli-1	28.9666	76.8666	5.0	PGW	Silak Ram 1972: 3-7
205	Dubaldhan	28.6666	76.9166	6.0	PGW	Silak Ram 1972: 7
206	Gijhi	0	0	3.0	PGW	Silak Ram 1972: 3-7
207	Chandi	29.0000	76.5000	7.0	PGW	Silak Ram 1972: 3-7
208	Dabkheri	0	0	6.0	PGW	Singh 1976: 29
209	Naraingarh	30.4766	77.1275	4.0	PGW	Suraj Bhan 1975: 124
210	Sambhi	29.8000	76.8333	5.0	PGW	Suraj Bhan 1975: 125
211	Jind-2	29.2905	76.3063	3.0	PGW	Suraj Bhan 1975: 124
212	Asandh	29.5222	76.6111	4.0	PGW	Suraj Bhan 1975: 125
213	Popra	29.4773	76.5530	2.5	PGW	Suraj Bhan 1975: 125
214	Karthala	27.9333	77.0166	15.0	PGW	Suraj Bhan 1975: 126
215	Kheri Majara	28.5000	76.9500	4.0	PGW	Suraj Bhan 1975: 126
216	Mohammad Heri	28.5166	76.9333	2.0	PGW	Suraj Bhan 1975: 126
217	Gorad	28.0833	76.8180	1.0	PGW	Thakran 2000: 105-06
218	Gumad	29.1222	76.9750	2.0	PGW	Thakran 2000: 106
219	Halalpur	28.8500	77.0166	1.0	PGW	Thakran 2000: 107
220	Jawahari-1	29.0333	77.0166	2.0	PGW	Thakran 2000: 109-10
221	Bichpari	29.1666	76.7500	0.5	PGW	Thakran 2000: 73
222	Dhanana	29.1055	76.5011	1.0	PGW	Thakran 2000: 76
223	Gohana-2	29.2022	76.7005	1.0	PGW	Thakran 2000: 81
224	Kailana Khas	29.1669	76.6666	3.0	PGW	Thakran 2000: 84
225	Rindana-5	29.1188	76.5300	1.0	PGW	Thakran 2000: 91
226	Badli Ki Sarai	29.0000	76.5000	30.0	PGW	Tripathi 1976: 124
227	Kagser	29.2369	76.2146	2.0	PGW	Vijay Kumar 2003: 16
228	Hartan	30.1111	77.1166	43.0	PGW,	Brehamdutt 1980: 108
229	Jharsa	28.1500	77.0500	5.0	PGW, M	Brehamdutt 1980: 66
230	Gangauli	28.1500	77.1166	3.0	PGW, M	Suraj Bhan 1975: 126
231	Jagadari	30.1688	77.3016	-	PGW, GW	Brehamdutt 1980: 38
232	Raiwali	0	0	3.0	PGW, GW	Manmohan Kumar 1978: 49
233	Bhana	29.4363	76.1811	3.0	PGW, H	Amar Singh 1981: 101
234	Sedha Majra	0	0	1.0	PGW, H	Amar Singh 1981: 120
235	Aunt	0	0	2.0	PGW, H	Amar Singh 1981: 123

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No	*Site*	*Latitude*	*Longitude*	*Size (ha.)*	*Cultural Sequence*	*Reference*
236	Chatan	0	0	3.0	PGW, H	Amar Singh 1981: 124
237	Barthal	29.8825	76.8725	3.0	PGW, H	Amar Singh 1981: 51
238	Bir Badaloa	0	0	5.0	PGW, H	Amar Singh 1981: 52
239	Alewa	29.4816	76.4483	1.67	PGW, H	Amar Singh 1981: 74
240	Badsikri Kalan-2	29.6113	76.3177	3.0	PGW, H	Amar Singh 1981: 112-113
241	Sink	29.3000	76.6500	20.0	PGW, H	Cunningham 1882: 88-90
242	Garhi Jattan	29.9166	77.0333	3.98	PGW, H	Brehamdutt 1980: 39-40
243	Pinjor Khera	29.9055	77.0166	4.22	PGW, H	Brehamdutt 1980: 40
244	Tahar Pur	29.6583	76.9222	4.69	PGW, H	Brehamdutt 1980: 41
245	Dhanaura	30.0250	77.0416	12.0	PGW, H	Brehamdutt 1980: 84
246	Kapal Mochan	30.3250	77.3180	10.0	PGW, H	Manmohan Kumar 1978: 120
247	Kakrala Gujran	30.0333	76.4666	4.0	PGW, H	Brehamdutt 1980: 96
248	Buddha Khera	29.5930	76.2583	6.0	PGW, H	Brehamdutt 1980: 129
249	Khera Kalan	30.2388	77.1722	9.0	PGW, H	Brehamdutt 1980: 106
250	Rawa	0	0	15.0	PGW, H	Brehamdutt 1980: 109
251	Sujra	30.0916	76.9555	2.5	PGW, H	Brehamdutt 1980: 111
252	Khairi	30.0208	76.9750	7.0	PGW, H	Brehamdutt 1980: 112
253	Sanwala	29.0000	76.8833	5.3	PGW, H	Brehamdutt 1980: 114
254	Arnai-3	30.3291	76.6138	5.0	PGW, H	Brehamdutt 1980: 125
255	Tikri	30.0250	76.6166	5.0	PGW, H	Brehamdutt 1980: 125-26
256	Rasulpur Mughal	29.9208	76.4083	5.0	PGW, H	Brehamdutt 1980: 128
257	Kaul	29.8416	76.6666	5.0	PGW, H	Brehamdutt 1980: 130
258	Raisan-1	29.0388	76.7083	8.0	PGW, H	Brehamdutt 1980: 131
259	Sakra	29.8083	76.6875	6.0	PGW, H	Brehamdutt 1980: 135
260	Beri Khera	29.3933	76.4500	5.0	PGW, H	Brehamdutt 1980: 77
261	Hudia	30.1416	77.0722	7.0	PGW, H	Brehamdutt 1980: 108
262	Kharindwa	30.1111	76.9416	3.0	PGW, H	Brehamdutt 1980: 111
263	Jaipur	29.4000	76.5166	7.0	PGW, H	Brehamdutt 1980: 76
264	Kheri Damkan-1	29.1083	76.7650	2.0	PGW, H	Dangi 2007: 19
265	Gangeshara	29.2027	76.6766	2.0	PGW, H	Gulab Singh 1990: 14-15
266	Dhin	30.2416	77.1000	9.0	PGW, H	Handa 1976: 120
267	Mustafabad	30.2069	77.1458	20.0	PGW, H	Handa 1976: 120
268	Hamayum Khera	29.4500	74.9666	10.0	PGW, H	IAR 1966-67: 13
269	Balana	30.3211	76.7311	1.5	PGW, H	IAR 1963-64: 27
270	Bansantaur	30.3686	77.4197	15.0	PGW, H	IAR 1963-64: 27
271	Chand Khera	30.2916	77.2936	1.12	PGW, H	IAR 1963-64: 27
272	Kardhan	30.3180	76.8658	3.0	PGW, H	IAR 1963-64: 27
273	Mallaur	30.2805	76.6536	3.0	PGW, H	IAR 1963-64: 27
274	Auth	27.9000	77.1500	4.0	PGW, H	IAR 1964-65: 33-34
275	Asthi Pur	0	0	36.0	PGW, H	IAR 1964-65: 34

Table 4 (contd.) Painted Grey Ware sites explored by various scholars
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No	*Site*	*Latitude*	*Longitude*	*Size (ha.)*	*Cultural Sequence*	*Reference*
276	Hamirpur	0	0	5.0	PGW, H	IAR 1964-65: 34
277	Kadasan	30.3800	77.0105	6.2	PGW, H	IAR 1964-65: 33
278	Khera	30.1916	77.2458	5.0	PGW, H	IAR 1964-65: 33
279	Mahbvbpur	0	0	5.0	PGW, H	IAR 1964-65: 33
280	Aharwan	28.1166	77.2500	40.0	PGW, H	IAR 1966-67: 13
281	Kaulagarh	0	0	3.0	PGW, H	IAR 1966-67: 13
282	Morthali	29.9944	76.5722	4.0	PGW, H	IAR 1966-67: 13
283	Rupanwai -2	0	0	4.0	PGW, H	IAR 1966-67: 13
284	Mundah	0	0	3.0	PGW, H	IAR 1966-67: 14
285	Rajaund	29.5500	76.4833	3.0	PGW, H	IAR 1966-67: 14
286	Topra	30.1250	77.1625	5.0	PGW, H	IAR 1968-69: 64-65
287	Saran	30.2105	77.1041	2.0	PGW, H	Joshi 2003: 103
288	Saranwi	30.3416	77.2216	5.0	PGW, H	Joshi 2003: 103-104
289	Alawalpura	30.1425	77.0638	0.5	PGW, H	Joshi 2003: 48
290	Amadalpur	30.1366	77.3666	5.4	PGW, H	Joshi 2003: 49
291	Chappar	30.2175	77.1697	3.0	PGW, H	Joshi 2003: 63
292	Kalkhera	30.2375	77.1736	7.5	PGW, H	Joshi 2003: 77
293	Manakpur	30.3325	77.2019	3.0	PGW, H	Joshi 2003: 85
294	Mukandpur-2	0	0	2.0	PGW, H	Joshi 2003: 90
295	Nanhera	30.4394	77.1575	1.0	PGW, H	Joshi 2003: 92-93
296	Naraingarh	30.4788	77.1286	1.0	PGW, H	Joshi 2003: 93
297	Panjola	30.4597	77.1205	3.0	PGW, H	Joshi 2003: 94
298	Kabulpur	28.7333	76.5333	3.5	PGW, H	Lamba 1989: 106
299	Kalanaur	28.8333	76.4000	1.8	PGW, H	Lamba 1989: 107
300	Patwapur	28.8000	76.4666	2.0	PGW, H	Lamba 1989: 108
301	Sundana-2	28.7833	76.5166	1.5	PGW, H	Lamba 1989: 108
302	Pakasma-1	28.8333	76.6666	4.0	PGW, H	Kailash Kumar 1987: 23-24
303	Tilpat	28.4500	77.3666	30.0	PGW, H	Lal 1954: 141
304	Gwmar	29.1222	76.9750	6.0	PGW, H	Lal 1954: 141
305	Palwal	28.1500	77.3166	40.0	PGW, H	Lal 1954: 140
306	Mirzapur-2	29.9500	76.7944	4.0	PGW, H	Lal 1954: 141
307	Tandwal	30.2344	76.9833	3.0	PGW, H	Manmohan Kumar 1978: 39
308	Deen	30.2455	77.1055	4.0	PGW, H	Manmohan Kumar 1978: 36
309	Bara Khera	30.2388	77.1750	4.0	PGW, H	Manmohan Kumar 1978: 40
310	Jatwar	30.4444	76.9416	5.0	PGW, H	Manmohan Kumar 1978: 48
311	Chamba	30.1083	76.2708	9.0	PGW, H	Manmohan Kumar 1978: 51
312	Ratta Khera	30.0833	76.2666	4.0	PGW, H	Manmohan Kumar 1978: 54.
313	Urlana	29.9375	76.1930	5.0	PGW, H	Manmohan Kumar 1978: 55
314	Dadyod Kheri	29.7800	76.4416	1.0	PGW, H	Manmohan Kumar 1978: 57
315	Dhanora	0	0	2.0	PGW, H	Manmohan Kumar 1978: 64-65

Table 4 (contd.) Painted Grey Ware sites explored by various scholars
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No	*Site*	*Latitude*	*Longitude*	*Size (ha.)*	*Cultural Sequence*	*Reference*
316	Hudia-1	30.1372	77.0750	2.0	PGW, H	Manmohan Kumar 1978: 69
317	Kharepur	0	0	2.0	PGW, H	Manmohan Kumar 1978: 70
318	Khrihdwa	0	0	3.0	PGW, H	Manmohan Kumar 1978: 70
319	Rawa	30.1783	76.9183	2.0	PGW, H	Manmohan Kumar 1978: 74
320	Jalbui	30.1755	76.9530	4.0	PGW, H	Manmohan Kumar 1978: 37
321	Kambas	30.1638	77.0186	5.0	PGW, H	Manmohan Kumar 1978: 37
322	Kharu Khera	0	0	2.0	PGW, H	Manmohan Kumar 1978: 37
323	Sapeda	30.3416	76.9322	2.0	PGW, H	Manmohan Kumar 1978: 39
324	Thakurpura	30.3333	77.0600	1.0	PGW, H	Manmohan Kumar 1978: 40
325	Harnauli	30.2250	#VALUE!	2.0	PGW, H	Manmohan Kumar 1978: 41
326	Lawana	30.2527	77.1444	2.0	PGW, H	Manmohan Kumar 1978: 43
327	Marwa Kalan	30.3266	77.2733	2.0	PGW, H	Manmohan Kumar 1978: 44
328	Panjlasa	30.2630	76.6133	0.5	PGW, H	Manmohan Kumar 1978: 48
329	Patrehri-1	30.3908	77.0316	3.7	PGW, H	Manmohan Kumar 1978: 48-49
330	Patrehri-2	30.3897	77.0291	3.7	PGW, H	Manmohan Kumar 1978: 48-49
331	Balai-1	28.2083	77.4500	10.0	PGW, H	Mohinder Singh 1990: 121
332	Banarsi	0	0	8.0	PGW, H	Mohinder Singh 1990: 122
333	Biwan-2	0	0	2.5	PGW, H	Mohinder Singh 1990: 125-26
334	Gangwani-1	0	0	8.0	PGW, H	Mohinder Singh 1990: 127
335	Sekhpur	0	0	1.0	PGW, H	Mohinder Singh 1990: 148
336	Bass Kushal	0	0	2.0	PGW, H	Mohinder Singh 1990: 49
337	Birsu	27.9166	77.3666	35.0	PGW, H	Punia 1976: 81
338	Hathin	28.0333	77.2166	40.0	PGW, H	Punia 1976: 70-71
339	Khajurka	0	0	30.0	PGW, H	Punia 1976: 95
340	Sondh	27.9166	77.3166	10.0	PGW, H	Punia 1976: 98
341	Tanyi	28.1000	77.0500	30.0	PGW, H	Punia 1976: 76
342	Bhadsha	27.9500	77.0166	16.0	PGW, H	Punia 1976: 80
343	Paimakhera	0	0	12.5	PGW, H	Punia 1976: 87
344	Sihi	28.3833	77.3666	30.0	PGW, H	Punia 1976: 102
345	Pabra	29.9208	76.4083	4.0	PGW, H	Silak Ram 1972: 68
346	Dhaturi	29.0708	77.0500	2.0	PGW, H	Silak Ram 1972: 1-7
347	Pipali Khera	29.0833	77.0000	8.5	PGW, H	Silak Ram 1972: 1-7
348	Khanpur Khurd	29.1666	76.7500	10.0	PGW, H	Silak Ram 1972: 3-7
349	Jamal Pur	29.1000	75.8333	5.0	PGW, H	Silak Ram 1972: 7
350	Kanwari	28.9750	75.8197	6.0	PGW, H	Silak Ram 1972: 7
351	Polangi	28.9166	76.7500	2.0	PGW, H	Silak Ram 1972: 54
352	Chitiyaaulia	29.0666	76.9555	7.0	PGW, H	Silak Ram 1972: 1-7
353	Narkatori	29.9663	76.8109	5.0	PGW, H	Singh 1976: 29

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No	*Site*	*Latitude*	*Longitude*	*Size (ha.)*	*Cultural Sequence*	*Reference*
354	Habri	29.7000	76.6333	10.0	PGW, H	Suraj Bhan 1975: 123
355	Ghasua	0	0	12.0	PGW, H	Suraj Bhan 1975: 125
356	Sarsa Bhor	0	0	15.0	PGW, H	Suraj Bhan 1975: 124
357	Uplan	29.5875	76.6666	5.0	PGW, H	Suraj Bhan 1975: 125
358	Bahauli-2	29.4663	76.9013	14.24	PGW, H	Suraj Bhan 1975: 125
359	Chatia-Aulia	29.0666	76.9555	2.5	PGW, H	Thakran 2000: 102
360	Nagal Khurd	29.0333	77.0833	1.0	PGW, H	Thakran 2000: 118
361	Panchi Gujjran	29.1833	77.0333	3.0	PGW, H	Thakran 2000: 118
362	Samri	29.1833	76.7833	4.0	PGW, H	Thakran 2000: 94
363	Siwana Mal-1	29.0027	76.5958	1.0	PGW, H	Thakran 2000: 94
364	Siwana Mal-2	29.2833	76.5833	3.0	PGW, H	Thakran 2000: 94
365	Tandwali	30.2345	76.9824	6.0	PGW, H	Tripathi 1976: 30
366	Petwar-1	29.1696	76.1596	2.0	PGW, H	Vijay Kumar 2003: 24
367	Petwar-2	29.1778	76.1706	2.0	PGW, H	Vijay Kumar 2003: 25
368	Pasawal Kalan	29.8875	76.2388	15.0	PGW, H	Brehamdutt 1980: 128-29
369	Gheshpur	30.5000	77.1333	15.8	PGW, H, M	Brehamdutt 1980: 39
370	Sadhaura	30.3866	77.2222	10.0	PGW, H, M	Cunningham 1882: 72
371	Sirsa	29.5333	75.0166	50.0	PGW, H, M	Brehamdutt 1980: 103
372	Ramgarh	30.1208	77.1083	8.0	PGW, H, M	Brehamdutt 1980: 107
373	Dholara	30.0333	76.8111	4.5	PGW, H, M	Brehamdutt 1980: 115
374	Raisan-2	29.0472	76.7152	12.0	PGW, H, M	Brehamdutt 1980: 131
375	Barsham	29.8708	76.8000	9.0	PGW, H, M	Brehamdutt 1980: 134
376	Ngdhu	29.8375	76.7388	50.0	PGW, H, M	Brehamdutt 1980: 135
377	Deodhkheri	29.7750	76.4750	33.0	PGW, H, M	Brehamdutt 1980: 136
378	Kaithal	29.8011	76.3722	50.0	PGW, H, M	Brehamdutt 1980: 137
379	Shergoan	29.7750	76.4208	3.0	PGW, H, M	Brehamdutt 1980: 137
380	Barahkalan	29.3000	76.3666	14.0	PGW, H, M	Brehamdutt 1980: 73
381	Rodh	29.4500	76.6000	10.0	PGW, H, M	Brehamdutt 1980: 79
382	Karsa	29.6277	76.0444	5.0	PGW, H, M	Brehamdutt 1980: 80
383	Jind-1	29.3250	76.2833	4.0	PGW, H, M	Duttt 1980: 71
384	Konla	29.1819	76.6144	1.5	PGW, H, M	Gulab Singh 1990: 19
385	Tandwal	30.4458	77.0500	12.0	PGW, H, M	IAR 1964-65: 61
386	Thal	30.5000	76.7111	5.0	PGW, H, M	IAR 1963-64: 27
387	Karasan	30.3790	77.0097	14.0	PGW, H, M	IAR 1964-65: 33-34
388	Damla	30.0916	77.2222	62.57	PGW, H, M	IAR 1964-65: 27
389	Otha	27.9000	77.1500	5.0	PGW, H, M	IAR 1964-65: 33-34
390	Nakora	29.5000	74.7333	7.0	PGW, H, M	IAR 1966-67: 13
391	Sonipat	28.9833	77.0166	50.0	PGW, H, M	Lal 1954: 145
392	Badhurgarh	28.6833	76.9333	11.0	PGW, H, M	Lal 1954: 139

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No	*Site*	*Latitude*	*Longitude*	*Size (ha.)*	*Cultural Sequence*	*Reference*
393	Buland	29.1666	76.0833	50.31	PGW, H, M	Lal 1954: 141
394	Baghaula	28.2166	77.3166	30.0	PGW, H, M	Lal 1954: 138
395	Raja Karan Ka Quila	29.9458	76.8055	30.0	PGW, H, M	Lal 1954: 141
396	Dhankot	28.4833	76.8833	23.5	PGW, H, M	Lal 1954: 140
397	Dhulkot	28.4833	76.8833	75.0	PGW, H, M	Lal 1954: 140
398	Kurukshetra-1	29.9666	76.8500	40.0	PGW, H, M	Manmohan Kumar 1978: 37
399	Lodhar	29.5705	76.2580	8.0	PGW, H, M	Suraj Bhan and Shaffer 1978: 61
400	Bensi-2	0	0	8.0	PGW, H, M	Mohinder Singh 1990: 102
401	Rahpuva	0	0	8.0	PGW, H, M	Mohinder Singh 1990: 115
402	Bichhor-2	0	0	4.0	PGW, H, M	Mohinder Singh 1990: 124
403	Garhi (Navalgarh)	0	0	6.0	PGW, H, M	Mohinder Singh 1990: 127-28
404	Karehera Firozpur	0	0	4.0	PGW, H, M	Mohinder Singh 1990: 133
405	Laherwari	0	0	8.0	PGW, H, M	Mohinder Singh 1990: 135
406	Marora-4	0	0	8.0	PGW, H, M	Mohinder Singh 1990: 139
407	Mohammadpur-2	0	0	4.0	PGW, H, M	Mohinder Singh 1990: 140
408	Sakras	0	0	4.0	PGW, H, M	Mohinder Singh 1990: 148
409	Umri	0	0	8.0	PGW, H, M	Mohinder Singh 1990: 154
410	Chandu Budhera	28.4833	76.9166	3.0	PGW, H, M	Punia 1976: 60
411	Fatehpur Khera	28.4333	77.0500	3.0	PGW, H, M	Mohinder Singh 1990: 60
412	Akera	0	0	8.0	PGW, H, M	Mohinder Singh 1990: 99
413	Bahmni Khera	28.0833	77.3500	-	PGW, H, M	Punia 1976: 93
414	Balaj	28.2083	77.3833	25.0	PGW, H, M	Punia 1976
415	Bunchari	0	0	35.0	PGW, H, M	Punia 1976
416	Gohana	28.0000	77.0333	30.0	PGW, H, M	Punia 1976: 82-83
417	Havana Nagar-1	0	0	35.0	PGW, H, M	Punia 1976: 84
418	Havana Nagar-2	0	0	15.0	PGW, H, M	Punia 1976: 84
419	Janisingh Pur	28.0333	77.1166	30.0	PGW, H, M	Punia 1976: 72
420	Malab	28.0500	77.0000	35.0	PGW, H, M	Punia 1976: 73
421	Manakoula	28.1500	77.1500	35.0	PGW, H, M	Punia 1976: 74
422	Mandi Khera	27.9333	77.0166	25.0	PGW, H, M	Punia 1976
423	Manpur	28.0000	77.2833	30.0	PGW, H, M	Punia 1976
424	Mitnol	28.0500	77.3333	25.0	PGW, H, M	Punia 1976
425	Panakhera	0	0	30.0	PGW, H, M	Punia 1976
426	Phophunda	28.3083	77.3833	20.0	PGW, H, M	Punia 1976
427	Sangel	0	0	40.0	PGW, H, M	Punia 1976: 75
428	Ujina	28.0500	77.0833	35.0	PGW, H, M	Punia 1976: 77
429	Umpa	27.9833	77.0583	25.0	PGW, H, M	Punia 1976: 77
430	Banchari	28.9500	78.2000	8.0	PGW, H, M	Punia 1976: 77
431	Biwan-1	0	0	16.0	PGW, H, M	Punia 1976: 81
432	Jamalgarh	0	0	8.0	PGW, H, M	Punia 1976: 84

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No	*Site*	*Latitude*	*Longitude*	*Size (ha.)*	*Cultural Sequence*	*Reference*
433	Harnol Khera	27.9333	77.0166	10.0	PGW, H, M	Punia 1976: 87
434	Shikrawa	27.9500	77.1333	12.0	PGW, H, M	Punia 1976: 88
435	Umra	27.9833	77.0500	10.0	PGW, H, M	Punia 1976: 90
436	Chhainsa	28.2666	77.4666	5.0	PGW, H, M	Punia 1976: 99-100
437	Bhaklana-1	29.1583	76.2236	5.0	PGW, H, M	Sandeep 2006: 15
438	Molaha-1	29.1375	76.2472	2.0	PGW, H, M	Sandeep 2006: 17
439	Molaha-2	29.1305	76.2555	4.0	PGW, H, M	Sandeep 2006: 18
440	Khera	28.4833	76.9166	30.0	PGW, H, M	Silak Ram 1972: 7
441	Indergarh	29.02472	76.5077	1.5	PGW, H, M	Silak Ram 1972: 33
442	Hansi	29.1000	75.9666	40.0	PGW, H, M	Suraj Bhan 1975: 125
443	Rania-3	29.5333	74.8333	5.0	PGW, H, M	Suraj Bhan 1975: 123
444	Arnai-1	30.3333	76.6277	6.0	PGW, H, M	Suraj Bhan 1975: 124
445	Rattak	29.5833	76.6333	4.5	PGW, H, M	Suraj Bhan 1975: 125
446	Ladwa	29.9944	77.1166	5.0	PGW, H, M	Suraj Bhan 1975: 125
447	Sugh	30.1425	77.3561	100.0	PGW, H, M	Suraj Bhan 1977: 1-30
448	Chirasmi	29.1666	77.0500	2.0	PGW, H, M	Thakran 2000: 103
449	Lahorada-1	28.9708	76.0125	1.5	PGW, H, M	Thakran 2000: 114
450	Gamara-3	29.4469	76.0986	2.0	PGW, H, M	Vijay Kumar 2003: 14
451	Petwar-3	29.1529	76.1980	3.0	PGW, H, M	Vijay Kumar 2003: 25
452	Khokhrakot	28.9080	76.5763	300.0	PGW, H, M	Manmohan Kumar 1996: 95-114
453	Dhamtan-1	29.6977	76.0183	2.0	PGW, M	Amar Singh 1981: 104
454	Hathra	29.9044	76.6863	0.7	PGW, M	Amar Singh 1981: 54
455	Kirmach	29.9022	76.7555	0.75	PGW, M	Amar Singh 1981: 57
456	Nissang-3	29.6950	76.7555	3.0	PGW, M	Amar Singh 1981: 58
457	Segta-1	30.2166	76.6888	5.0	PGW, M	Brehamdutt 1980: 95
458	Kaunala	30.3500	76.8000	4.0	PGW, M	IAR 1963-64: 27
459	Malaur-1	30.2861	76.6583	5.0	PGW, M	IAR 1963-64: 27
460	Kasuhan	29.6225	76.3997	3.0	PGW, M	IAR 1966-67: 13
461	Bijopur	28.5000	77.2000	3.0	PGW, M	Narender Kumar 1999: 15
462	Raipur Kalan	28.3666	77.4500	2.0	PGW, M	Narender Kumar 1999: 24-25
463	Khatela	28.0000	77.3666	20.0	PGW, M	Punia 1976 : 95
464	Singar	27.8666	77.2500	30.0	PGW, M	Punia 1976: 89
465	Thurana-3	29.1527	76.1069	2.0	PGW, M	Sandeep 2006: 22
466	Ismaila	28.7938	76.7372	9.0	PGW, M	Silak Ram 1972: 3-7
467	Nakoli-2	28.9666	76.8666	10.0	PGW, M	Silak Ram 1972: 3-7
468	Lakhan Majara-2	29.0441	76.4763	1.0	PGW, M	Silak Ram 1972: 36
469	Neesang	29.6888	76.7555	4.0	PGW, M	Suraj Bhan 1975: 123
470	Kakrauni	30.3083	77.2888	12.0	PGW, NBPW	IAR 1963-64: 27
471	Jalkheri	30.0750	76.9250	12.0	PGW, NBPW	IAR 1964-65: 34
472	Barota-1	29.8972	76.5333	1.0	PGW, NBPW	Manmohan Kumar 1978: 55

Table 4 (contd.) Painted Grey Ware sites explored by various scholars
(GH=Ghaggar-Hakra, EH=Early Harappan, MH=Mature Harappan, LH=Late Harappan, PGW=Painted Grey Ware, GW=Grey Ware, NBPW=Northern Black Polished Ware, H= Historic, M=Medieval)

No	*Site*	*Latitude*	*Longitude*	*Size (ha.)*	*Cultural Sequence*	*Reference*
473	Dhantori-2	30.0666	76.7500	2.0	PGW, NBPW	Manmohan Kumar 1978: 65
474	Qamaspur	29.0000	77.1000	2.0	PGW, NBPW	Thakran 2000: 120
475	Rewali	29.0166	77.0666	2.0	PGW, NBPW	Thakran 2000: 120
476	Kardhan	30.3166	76.8666	12.0	PGW, NBPW, H	IAR 1963-64: 27
477	Thuska	29.1000	76.6791	4.0	PGW, NBPW, H	Thakran 2000: 95
478	Mirzapur	30.2777	76.8458	10.0	PGW, NBPW, H, M	IAR 1963-64: 27
479	Panipat	29.3980	76.9819	50.0	PGW, NBPW, H, M	Lal 1954: 141
480	Akbar Pur Barota	28.9166	77.0333	3.0	PGW, H, M	Brehamdutt 1980: 46
481	Saula	29.0038	76.8850	3.0	PGW. H	Manmohan Kumar 1978: 75
482	Gudhrana	28.0166	77.3666	30.0	PGW, H, M	Punia 1976: 94
483	Mirachpur-2	29.3226	76.1838	3.0	PGW	Vijay Kumar 2003: 22
484	Mulana	30.2805	77.0444	3.0	PGW, H	Manmohan Kumar 1978: 38

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Indian Archaeology - A Review 1979-80: 31

Indian Archaeology - A Review 1980-81: 15-16

Indian Archaeology - A Review 1985-86: 23-25

Indian Archaeology - A Review 1986-87: 34-36

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THE STONES OF DEATH: ARCHAEOLOGY OF EARLY IRON AGE IN CENTRAL INDIA

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INTRODUCTION

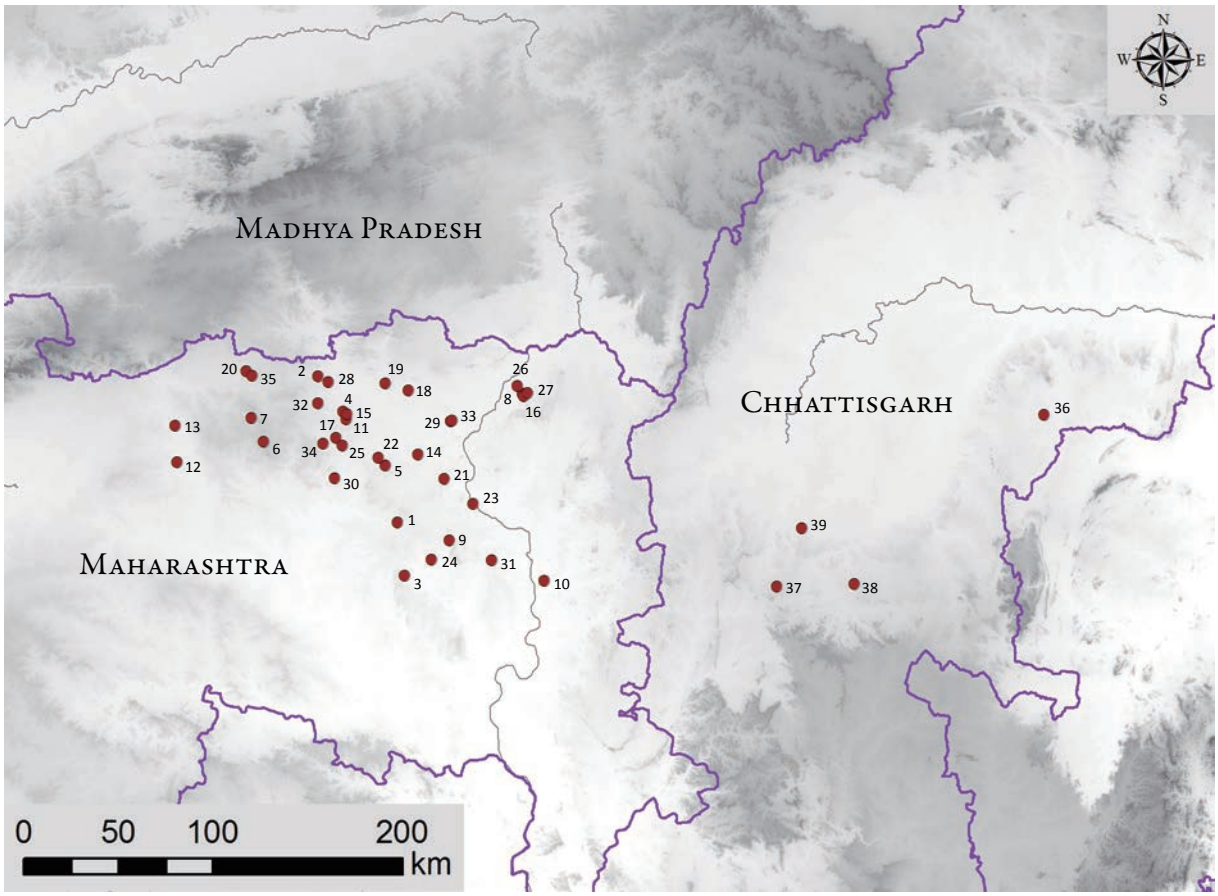
The Early Iron Age in Central India is associated with the Megalithic culture which first witnesses the use of iron on a large scale. This age was the time of master iron smelters and craftsmen - Megalithic people and that is why the associated culture with the Early Iron Age is termed as the Megalithic culture in general. The cultural remains of Early Iron Age in Central India therefore constitutes an important chapter in the history of region since it heralds the beginning of iron technology that was ushered in by the advent of the Megalithic population.

AREA OF STUDY

As the name itself suggests, the area of study (Figure 1), i.e. Central India, lies in the middle part of India and is sandwiched between northern Gangetic plain and Deccan plateau. Politically speaking, this region covers the states of Chhattisgarh, Madhya Pradesh and Vidarbha region of Maharashtra in India. The Satpuda range extending for a distance of 900 km is the main feature of the elevation in this region since there are no major hill areas. This range runs parallel the Vindhyan range, which lies to its north (*Geography of India*, htpps://www.cs.mcgill.ca). The region is notable for its uneven terrain, lakes, springs and thick forest cover. It is drained by many large and small rivers whose valleys are rich grounds for Megalithic habitation. Most of the rivers in the region have terraces on their sides and the larger ones often present thick alluvial section. Special mention must be made of the upper Wainganga valley and Mahanadi valley from where the cultural remains of Early Iron Age were reported in abundance. The majority of settlements in the area of study are located either on the banks of major rivers or their tributaries. This region is also rich in forest cover and the mineral resources which chiefly include coal, manganese, limestone, copper, chromite, bauxite and iron ore. The region has metamorphic rock formations and abounds in granite, schist, phyllite, gneiss outcrops.

PREVIOUS WORKS

The inquiry into Megalithic studies in India began after the Babington's discovery of the first Megalithic site in 1823 in the Malabar region and it initiated a new era in Indian archaeology (Babington 1823: 324-330). Soon after, several Megalithic sites were explored, and diggings of burials were carried out in



No.	Site	WGS84_E	WGS84_N	State
1	Adam	79.2674	20.7080	Maharashtra
2	Bhagimohari	78.8542	21.4008	Maharashtra
3	Bhiwapur	79.3054	20.4556	Maharashtra
4	Borgaon	78.9827	21.2340	Maharashtra
5	Champa	79.1998	20.9776	Maharashtra
6	Davalameti	78.5818	21.0836	Maharashtra
7	Dharti-Murti	78.5172	21.1972	Maharashtra
8	Gangla	79.8966	21.3279	Maharashtra
9	Hirapur	79.5297	20.6237	Maharashtra
10	Janva	80.0132	20.4343	Maharashtra
11	Junapani	78.9990	21.1983	Maharashtra
12	Kaundinyapura	78.1428	20.9811	Maharashtra
13	Khairwada	78.1313	21.1552	Maharashtra
14	Khopadi	79.3677	21.0341	Maharashtra
15	Mahurjhari	79.0037	21.2222	Maharashtra
16	Malli	79.9019	21.3164	Maharashtra
17	Nagalwadi	78.9498	21.1092	Maharashtra
18	Nagardhan	79.3157	21.3369	Maharashtra
19	Naikund	79.1973	21.3716	Maharashtra
20	Nipani-Thugaon	78.4882	21.4193	Maharashtra

No.	Site	WGS84_E	WGS84_N	State
21	Pachkheri	79.5000	20.9167	Maharashtra
22	Panchgaon	79.1634	21.0167	Maharashtra
23	Pauni	79.6500	20.8000	Maharashtra
24	Pimpalgaon	79.4402	20.5305	Maharashtra
25	Raipur-Hingna	78.9821	21.0712	Maharashtra
26	Sarandhi	79.8677	21.3634	Maharashtra
27	Satona	79.9226	21.3323	Maharashtra
28	Savner	78.9050	21.3739	Maharashtra
29	Silli	79.5328	21.1927	Maharashtra
30	Takalghat and Khapa	78.9450	20.9165	Maharashtra
31	Tilota Khairi	79.7447	20.5319	Maharashtra
32	Ubari	78.8539	21.2728	Maharashtra
33	Vadegaon	79.5370	21.1955	Maharashtra
34	Vyahad	78.8828	21.0803	Maharashtra
35	Walegaon	78.5158	21.3981	Maharashtra
36	Bartia Bhata	82.5520	21.2230	Chhattisgarh
37	Chirchuri-Majghahan-Karhibhadar	81.1907	20.4118	Chhattisgarh
38	Dhanora	81.5818	20.4210	Chhattisgarh
39	Karkabhat	81.3186	20.6883	Chhattisgarh

Figure 1 Sites relevant in this article

various parts of the country (Mohanty and Selvakumar 2002: 313-351). It appears that Central India escaped the notice of early explorers as in those days the area was covered with thick dense forests infested with wild animals and had no approachable roads. Just fifty years after the first finding, many British officials started investigations in the Central India amongst which noteworthy were Scottish Missionary Hislop (Wilkinson 1982: 15-18), Rivett Carnac (1879: 1-16), G.G. Pearse (1869: 428-29) and J.D. Beglar (1878). As a result of their efforts, numerous sites were explored and subsequently excavated in Central India. The first reporting of megaliths in Chhattisgarh was in 1873 when Beglar in his report on Central Provinces mentioned the presence of upright stones looking like pillars in the Chirchuri-Majghahan-Karhibhadar complex in Durg (Beglar 1878). Beglar never imagined them to be menhirs or Megalithic remains as at that time the knowledge about this culture had not developed (Sharma 2000). The first recognition of these sites came in 1933-35 (ARASI 1930-31) wherein they were described as Stone Age cemeteries and were declared 'Protected monuments'. It was in 1956-57 that first Megalithic excavations in Chhattisgarh were carried out at Dhanora in the district Durg where nearly 500 megaliths were located (IAR 1956-57) by Dixit of Madhya Pradesh Department of Archaeology. However, this initial excavation focused mainly on ascertaining the nature of the burials and possible connections with the megaliths of the peninsular India and did little besides documenting megalithic typology. Though Chhattisgarh was first in Central India to be taken up for Megalithic excavations after the independence but statistically speaking, majority of Early Iron Age sites in Central India were situated in the Wardha-Waingangā basin of the Vidarbha region. Nevertheless, these initial works plotted this region as a home to a distinct typological variant of the Megalithic culture. This was a period of discovery and documentation and it laid the very foundation for consequent works carried out in this region.

This quest for further study of distribution and cultural assemblage of Megalithic sites led to fruitful discovery of numerous sites after the India's independence. Thereafter many successful excavations were carried out at Megalithic sites chiefly in the Vidarbha region of Central India. With the coming of 1960s, a new movement was gathering momentum in field of archaeological studies. This was the period when the basic postulates of New Archaeology were being laid by R. Binford and others. This definitely had a major influence on the ongoing archaeological studies in India. It was a beautiful coincidence that some of the pioneer institutes in the field of Indian Archaeology were functioning in Central India- Deccan College, Pune, A.I.H.C & Archaeology Department, Nagpur University, Nagpur and State Department of Archaeology, Nagpur. They not only had the vision for developing archaeology in India but also had the required access and means to do so. No wonder, stalwarts from these institutes utilized their energies to bring the Megalithic culture out of pure typological closet and focused on finer details re-fabricating Megalithic ways of life. Excavations in the last few decades of the twentieth century gave importance to minute observations and understanding of various facets of this culture besides the routine documentation of finds. Such a work needed help from other disciplines too and the result was the initiation of interdisciplinary methodology to bring forth the subtle attributes of the Megalithic people and their culture that were hitherto overlooked.

As a result, studies carried out were oriented towards the distribution pattern (Deo 1970; Moorti 1994; Mohanty 1993), the socio-economic perspective (Deo 1985; Moorti 1994; Mohanty 1993; Joshi 2004), the subsistence strategies (Deo 1970, 1985; Moorti 1994; Mohanty 1993; Thomas 1993; Kajale 1989), trade and exchange (Deo 1985; Mohanty 1999a; Moorti 1994), ethnoarchaeology (Geetali 1999), technical studies (Deo 1981), the urbanization

and development of complex societies (Vaidya 2014) pertaining to the Megalithic period of this region on the basis of data gathered from important sites like Takalghat and Khapa (Deo 1970), Naikund (Deo and Jamkhedkar 1982), Mahurjhari (Deo 1973; Mohanty 2002), Raipur-Hingna (Deglurkar and Lad 1992), Karkabhat-Sorar (Sharma 2000), Dhanora (IAR 1956-57: 35), Malli (Sontakke 2014a) and so on. With the beginning of the twenty-first century, attempts were made to integrate the hitherto unexplored areas of Central India in search for remains of Early Iron Age remains. The result was the discovery and documentation of several Early Iron Age sites, some of which were taken up for excavation by the State Department of Archaeology, Nagpur, Maharashtra. These efforts also added to the existing typology of megaliths as they brought to light new distinct burial types hitherto unknown from India in general and this region in particular.

DISTRIBUTION OF MEGALITHS IN CENTRAL INDIA

Technically speaking, Central India is comprised of Chhattisgarh, Madhya Pradesh and Vidarbha. Of these three constituents, there is a paucity of Megalithic remains in Madhya Pradesh which otherwise has a long history of human occupation. This may be attributed to the paucity of work taken up for Megalithic exploration in the state. Amongst 27 districts of Chhattisgarh, Durg, Rajanandgan and Bastar are prominently associated with Megalithic remains. Most of these sites are in hilly rocky outcrops with nullahs, natural springs and rivers nearby. Though a large number of Early Iron Age Megalithic sites have been explored and reported from Chhattisgarh, in absence of any large-scale scientific excavations, the cultural identities of these sites and their relationship with those of other areas are not very clear. Prolific megalithic occurrences are known from the Vidarbha region of Maharashtra and the bulk of Megalithic sites are known from this area. Luckily for us, some of these sites are properly excavated and interdisciplinary studies have been done to access the results which form the crux of the present work.

MEGALITHIC TYPOLOGY OF CENTRAL INDIA

Central India is notable for its different typological variations amongst the Megalithic burial complex.

Stone circles

Stone circles are one of the most frequently encountered megalithic types in Central India (Sudkya 2011: 360-389). Stone circles are generally built with crude stones and are normally constructed over natural soil or bed rock (Figures 2 and 3). In most of the sites, peripheral stones are found placed with ground level in half buried and half exposed condition and incorporate pit, cist, dolmen and so on. Undressed basalt stones were mainly utilized for constructing stone circles. It is noticed that stone circles are situated close to one other and often form a cluster. Further it is observed that a cluster normally incorporates five in minimum to 20 stone circles, in maximum, erected adjacent to each other. Generally, the circles are represented by a single stone circle but double and triple peripheral circles are also documented. The double and triple peripheral stone circles made of undressed lateritic stones are found in the Wainganga valley. A variety of stone circles are also reported from Chhattisgarh and these have been divided into seven types (Table 1).

The present data bring forth a disparity with regard to the features of stone circle in Central India. One observes that the most significant trait of stone circles in Vidarbha region is the placement of single/

Table 1 Types of stone circles

No.	*Type*	*Description*
1.	Type A	Stone circle with low cairn heap rising to a height of 0.30m
2.	Type B	Stone circle with distinct cairn heap rising to a height of 0.40-0.60m
3.	Type C	Stone circle with a single menhir in the centre and surrounded with heaped cairn packing.
4.	Type D	Stone circle with two menhirs erected side by side in northern half of the circle and surrounded with heaped cairn packing.
5.	Type E	Stone circle with two menhirs erected side by side, one in northern half and other in the southern half of the circle and surrounded with heaped cairn packing.
6.	Type F	Stone circle with multiple menhirs of varying sizes kept in two rows in northern and southern half of circle respectively.
7.	Type G	Stone circle with capstone in the centre resting over a heap of stones (Fig.2.).

double/multiple cist inside stone circle (Figure 4). Cists are generally located in centre of circle. Orthostats of the cist are half buried and half exposed. Cists are erected inside circle by digging a pit into the natural soil. However, stone circles in Chhattisgarh usually have cairn heaps and menhirs inside stone circles and never a cist.

Cairn circle

A cairn is a barrow made of heaped-up stones usually enclosed within circle of boulders (Krishnaswami 1949: 35-45). Cairn circles of Central India are marked by a heap of stone rubble generally within peripheral stones (Rao 1972). Small pebbles are the main filling component of the cairns (Figure 5). The most common structure of the cairn circle is pit dug at the centre of the burial, which contains skeletal remains and burial appendages in most of the cases. These pits were dug out in the soil or bed rocks at various depths. They were normally sealed with capstone over the heap of cairn periphery. Cairn circles with multiple stone enclosures are noticed at the Karkabhat-Sorar group of megaliths in Chhattisgarh in Central India (Sharma 2000: 300). The use of small boulders for construction of heap and the periphery of circle is noticed here. Usually a single row of small boulders is used for making the periphery of cairn.

Cist

Cist is a box like construction whose sides are built of orthostatic slabs placed under the surface (Sudkya 2011: 360-389). It is important to state at the onset that cists were not reported from any site in Chhattisgarh (Sharma 2000: 301). It appears that Megalithic community in Chhattisgarh had a specific preference for cairns, stone circles and menhirs and an altogether dislike for cists. But their presence is documented in Vidarbha. Cists found inside the circle are usually situated in the centre of the circle (Figure 6). These cists are half buried and half exposed. Usually dressed lateritic stones are used for orthostats and slabs of schist, gneiss, sandstone and conglomerate are used as capstones. No porthole was observed in any of documented cists in the upper Wainganga valley. Generally, cists are rectangular in shape and their orientation is east-west. Besides stone circle, few cairn circles also incorporate cist inside periphery. In case of cairns, orthostats of cist are found almost buried inside the deposit. Cists are also found independently. They are generally large in size and are located close to each other and their occurrence is often recognized in form of clusters. Huge capstones were used as roof of cists. According to Newbold, capstones were carved out by two methods. One by firing and another by making a series of holes on slab's surface by an iron chisel

Figure 2 Stone circle at Nipani Thugaon

Figure 3 Stone circle at Malli

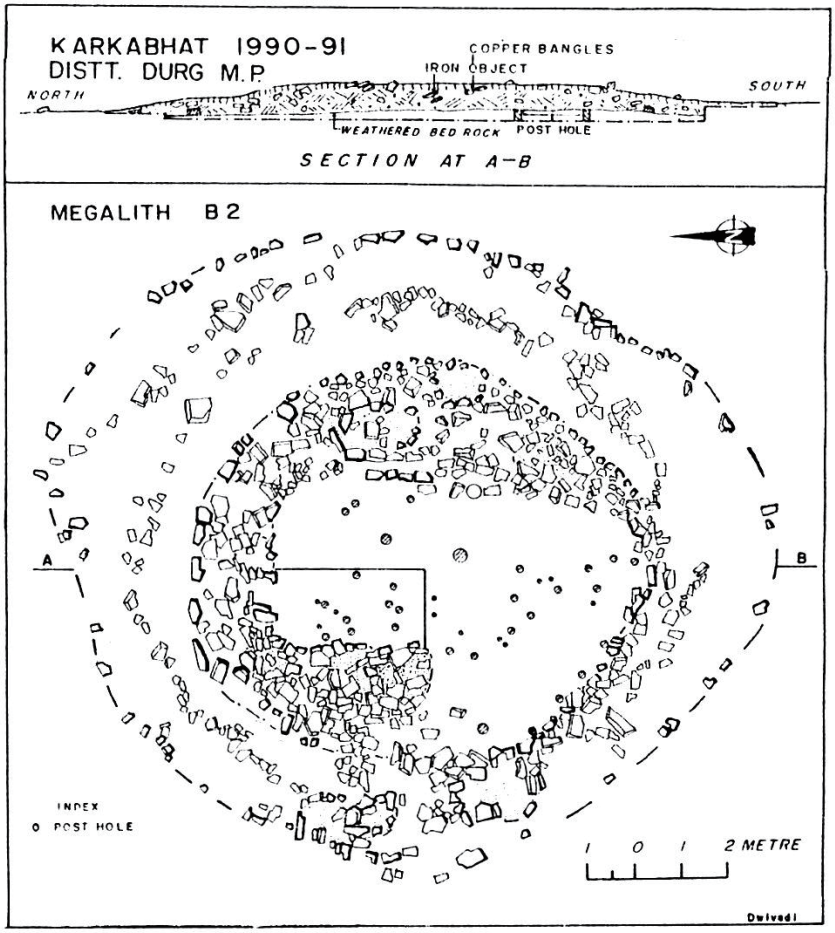


Figure 4 Stone circle with capstone in the centre resting over a heap of stones at Karkabhat, Chhattisgarh (after Sharma 1991)

with highly tapered steel points (Newbold 1851: 90-95). It seems that both but the second method was predominantly employed in Central Indian megaliths as cutting marks are visible on a few capstones. It was believed that cist was not the familiar burial type of the Vidarbha Megalithic complex (Deo 1970).A sparse evidence of cist is noticed at Hirapur (Pawar 2012: 173-197). Fewer occurrences of cists indicate that cist was not a common type of megalith architecture in the Vidarbha region possibly because of the non-availability of raw material in the close proximity. However, recent explorations carried out in the upper Wainganga valley brought to light many cists. Cists are dominantly reported from Malli (Sontakke 2014b: 493-515).

Menhirs

Menhirs are monolithic pillars erected vertically into ground (Rao 1972). In Vidarbha, menhirs are reported from Pachkhedi (Nath 2002: 81-82), Bhiwapur and Tilota Khairi (ARASI 1930-31: 141). As like cists, a sparse occurrence of menhir is observed in the Vidarbha region. However a greater frequency of the occurrence of menhirs is noticed in other parts of Central India especially in Chhattisgarh and in the upper Wainganga valley. These menhirs can be divided into two categories; first independent menhirs and second menhirs inside a circle. With regard to the upper Wainganga valley, independent menhirs are reported from Janva, Gangla and Vadegaon, while menhirs inside stone circle are only reported from Malli (Figure 7). Numerous menhirs are identified at Janva where life-size menhirs made of a variety of

stones are noticed. Menhirs at Gangla and Satona are small as compared to those from Janva. A few vertical stone slabs found in Malli can also be safely identified as menhirs. Menhirs inside stone circles are reported from Silli, Gangla and Satona (Sontakke 2015).

Menhir in centre of cairn is a peculiar feature of megaliths of Chhattisgarh (Durg district). Menhir usually stands at centre of cairn and is generally surrounded by a small cairn heap up to a height of 30 cm to 70 cm. Small stones were used to support menhir from its base. Double menhir located inside cairn is another remarkable feature of Karkabhat-Sorar megaliths in Chhattisgarh. This type of burial incorporates two menhirs near the periphery inside a cairn. Generally, menhirs were erected in northern and southern parts of the cairn and were surrounded by a heap of the cairn packing (Sharma 2000). Multiple menhirs inside a cairn were observed in Karkabhat. Their numbers vary from three in minimum to eleven in maximum. Five menhirs in a circle were reported from Dhanora (IAR 1956-57: 35). One important feature of menhirs in Chhattisgarh is presence of carved menhirs or anthropomorphs usually carved out of granite and sometimes of sandstone. These were reported from Bartiabhata in the district Raipur of Chhattisgarh. A large quantity of iron objects like daggers, spearheads, knives and arrowheads were recovered below these menhirs. Such types are hitherto unreported from the other areas of Central India. In morphological features, they strikingly resemble those found in Nagaland, Manipur, Meghalaya and Assam (Sharma 2000: 290).

Dolmens

Dolmens are box like graves of square or rectangular shape built with several orthostats (Rao 1972). The whole construction is set up above the ground by erecting dressed/ undressed stones or stone slabs capped by a capstone. Architecturally, dolmen and cist are very close to each other, only a difference being that while cist is half-buried and half-exposed, dolmen is always constructed over the ground. Cist, sarcophagus and urns are also reported from base of dolmen (Rao 1988: 13-14). Generally speaking, dolmens are completely absent in Chhattisgarh and represent an uncommon megalithic type in Vidarbha. They are mostly found in South India. The evidence of dolmen in Vidarbha was reported from Pimpalgaon (ARASI 1928-29: 37), Tilota Khairi (ARASI 1930-31: 141) and Hirapur (Pawar 2012: 173-197). Recent explorations carried out in the upper Wainganga valley of Central India led to discovery of a few new dolmens (Figure 8). Two specimens of dolmen were documented in Malli (Sontakke 2014b). Amongst them, one stands in a good condition, while the other is in a dilapidated condition. It was also observed that dolmen type of burial is found only in the lateritic belt.

Capstones

Capstones are represented a horizontally laid flat stone. These stones are directly placed over the natural surface without any lithic architecture. Capstones are used in various ways in the Megalithic architecture of South India (Rao 1972). However, it has a limited occurrence and usage in Central India. In the aforesaid region, this type of burial architecture is noticed at Karkabhat-Sorar, Gimmelwada and Dhanora in Chhattisgarh and Malli in Vidarbha. In Chhattisgarh, capstones usually lie in centre of cairn (Pradhan 2011: 29-31). It was observed that in most of the cases, capstones were placed over a properly-arranged cairn heap. One of the excavated burials belonging to Type G of the Karkabhat-Sorar group in Chhattisgarh is a capstone measuring 3.10 m x 1.95 m x 0. 69 m. Circle was made over the natural soil and the capstone was arranged during final stage of burial construction. The megalithic grave at Gimmelwada has a capstone above stone circle (Sharma 2000: 295). At Dhanora, apsidal stone enclosures of Types I and II had a capstone lying on top of a cairn heap (Sharma 2000). The capstones

Figure 5 Cairn circle at Dharti-Murti

Figure 6 Cist inside a stone circle Malli

Figure 7 Menhirs at Gangla

Figure 8 Dolmen at Malli

Figure 9 Capstone at Malli

at Malli are numerically few as compared to other the megalithic types at site. Nevertheless, it was observed that the capstones at Malli were generally made of schist, gneiss and sandstone with a varying thickness (Figure 9). Source of raw material of capstone was located within a range of 800 m to 2 km from Malli (Sontakke 2015: 43-53).

Thus, we see that the recent explorations and excavations carried out in Central India aptly demonstrate the potential of the region with regard to the variety of burial architecture with a wide range of typological variations. The recent studies have also brought to light a specific pocket of Megalithic remains in the upper Wainganga valley where a new type of inner architecture and lesser known types inside stone circle like cist inside stone circle, double chambered cist inside stone circle, multiple cists inside circle and menhir inside stone circle were documented.

MATERIAL CULTURE OF EARLY IRON AGE OF CENTRAL INDIA

Settlement pattern

Until recently, it was believed that Megalithic people were pastoral communities for reason of relative scarcity of habitation deposits. In recent years, mainly in Vidarbha, habitation deposits were located at several sites in close proximity of burial sites, such as at Mahurjhari (Mohanty 2005), Pachkhedi (Nath 2002), Vyahad (Ismail 2006) in the Nagpur district and Malli in the Gondia district (Sontakke 2014a). Mohanty and Joshi classified Megalithic sites in Vidarbha into three categories (Mohanty and Joshi 1996). Category A includes all sites that directly contribute for better understanding of culture of Megalithic community of Vidarbha. Sites like Mahurjhari, Naikund, Takalghat-Khapa, Raipur, Borgaon, Bhagimohari, Vyahad and so on have either megalithic monuments or megalithic

Table 2 Quantitative distribution of megaliths in Central India

No.	*Site*	*Number of Megalithic burials*
1.	Karkabhat-Sorar	3500-4000
2.	Bartia Bhata	600-700
3.	Khalari	As many as 500
4.	Dhanora	As many as 500
5.	Chirchari-Majghahan-Karhibhadar complex	Several hundreds
6.	Lilar-Bhawarmara	Hundreds
7.	Mothe	26
8.	Handaguda, Sankanpalli, Nelakanker, Marhipar, Godma, Tengna, Parond	Many

burials along with a habitation area. Sites of category B have no trace of megalithic burials in vicinity but are characterized by the presence of the Megalithic phase succeeded by Early Historic period in a stratigraphic context. Sites like Kaundinyapura in the Amravati district and Arni in the Yavatmal district are placed in this category. Category C includes sites where evidence of Megalithic and Early Historic culture is found in vicinity of megalithic burials (Mohanty 2015). Observations on locations of megaliths in Vidarbha suggest that almost all discovered megalithic burial sites in the region are located either on non-agricultural barren land on Deccan trap or on the hills. On the other hand, habitation sites are located close to water sources with abundant arable land around. Mahurjhari, Naikund, Khairwada, Bhagimohari, Takalghat and Vyahad are located either on small streams or near the tributaries of the Wardha-Wainganga system. It is also noticed that burials are either close to habitation or just across water body as in Takalghat, Naikund, Mahurjhari and Vyahad.

In Chhattisgarh, one can identify big sites teeming with megalithic burials, while there are sites with a lesser frequency of megaliths indicating small sites (Sharma 2000). A table can thus be formulated (Table 2). This table demonstrates hierarchy at sites of Chhattisgarh. The biggest site accommodates as many as 3500 burials. Then there were other sites with several hundreds of burials followed by those with hundred burials and less. Frequency of burials at sites is also indicative of its population and nature as well. The picture in Chhattisgarh exhibits three tiers of settlement sizes in proximity of one another. One also notices specialized burial types as in Bartia Bhata where all burials are menhirs with some of them being carved anthropomorph menhirs. Such anthropomorphic menhirs are not found at other sites in Chhattisgarh thus indicating a special purpose or special belief or special people who only constructed anthropomorphic menhirs residing at Bartia Bhata in a close-knit Megalithic community.

With regard to locational selection and preference of the Megalithic sites, Moorti commented that location of habitation sites is mainly determined by environments and resources both for the subsistence economy and the construction for burials (Moorti 1994: 11-18). This is true for sites in Vidarbha and Chhattisgarh as well. Megalithic sites are located mainly in areas of rich resources of iron, copper, gold, mica, rocky outcrops, biotic resources, arable land and water. Moorti further emphasized that some of the sites were located on trade routes convenient for trade activities (Moorti 1994: 16-17). Observations on burial-cum-habitation sites, mainly from Vidarbha, indicate the combination of barren and arable land with the availability of water sources as important criteria for selection of sites. Selection of such combination of landscapes was probably ideological. Respect towards

ancestors probably influenced the people to stay close to the burial site. Hence barren land close to settlements was selected for burial. The respect for dead and the preference for burying dead in close proximity or even inside house was prevalent since Chalcolithic period in western Maharashtra and is seen at Nevasa, Inamgaon, Daimabad and Chandoli. Therefore, it may not be an exaggeration in logically thinking that Megalithic people preferred to accommodate 'dead' near habitation instead of inside habitation and selected barren lands for the burial construction for two reasons; i) need of a large space to construct elaborate burials ii) keeping the burials safe from agricultural activities for future generations. Therefore, the sites like Mahurjhari, Khairwada, Vyahad Malli and Bhagimohari represent the landscape that has combined factors of barren and arable lands with resources available. No excavated habitation sites have produced architectural or other remarkable difference in material culture which can be taken as the evidence of the site hierarchy. However, iron smelting sites like Naikund and Kodumanal might represent specialized sites catering to specific needs.

The remains of houses in form of huts have been recovered from excavations at Takalghat (Deo 1970), Naikund (Deo and Jamkhedkar 1982), Bhagimohari (IAR 1982: 61-62, 1983-84: 57-58), Mahurjhari (Mohanty 2005b: 106-07), Vyahad (Ismail 2006) and Karkabhat (Sharma 1991: 21-34). Repeated use of floor and the evidence of plaster have been found from all these excavations. Generally in Vidarbha, floors were made by capping a hard rammed black soil at base with kankar. On this capping, plaster of fine soil topped by layer of lime plaster was applied. In Chhattisgarh, the use of kankar in floors was not seen. The excavations at Naikund revealed house pattern of Megalithic community in form of circular hut with a diameter of 4.9 meters and post-holes encircling the hut. This hut also gave evidence of a hearth and kitchen artefacts like pounders along with botanical remains. The excavations at Takalghat uncovered remains of a floor made of rammed clay plastered with lime with wooden posts sunk into it. The excavations at Bhagimohari furnished houses of circular plan with a diameter ranging between 3.25 m and 3.80 m. Post-holes were found around the periphery of hut (IAR 1983-84: 57-58). They were meant for supporting the superstructure. A semicircular hearth was found inside the hut. Besides this, a number of floor levels each made of a bedding of black clay covered by compact brownish clay, the surface of which was plastered with lime, occurred in excavations. Similarly, the recent excavation at the site has revealed houses with rectangular plans having a courtyard in the front (Mohanty: pers. comm.). Successive floor levels indicate continuation of habitation of the early Iron Age community. Evidence of mud wall was also documented from excavations of habitation area at Vyahad.

The excavations at Karkabhat-Sorar in Chhattisgarh revealed two types of habitation. One is a usual open-air habitation area with the evidence of rammed clay and lime floors with periodical repairing. Wooden posts were sunk in these floors for supporting the roof made of grass and straw above. The second type of the habitational remains comes in the form of a low rock shelter near natural spring. Due to constant use, floors of these shelters became smooth gaining a sort of a polished surface. Though it is difficult to say if these were used by the Megalithic folks or not, the presences of microliths in vicinity of shelters do indicate their usage in late Stone Age (Sharma 1991: 21-34).

Subsistence strategies

There are various views pertaining to the subsistence strategies of the Megalithic culture ranging from a pastoral economy with pastoral agricultural mode of subsistence, to a complete agricultural mode and finally that of specialized pastoral mode (Deo 1970, 1985: 89-99). These views are based on paucity of agricul-

tural implements, scanty botanical remains, small-area excavations, few habitation sites as compared to burial sites and large occurrence of bones of domesticated animals in excavations. However, the excavations at Naikund in Central India proved a breakthrough in the study of subsistence strategy of Central Indian megaliths as it provided a great variety of botanical remains like wheat, lentil, common pea, black gram and Indian jujube which were recovered by the flotation technique (Kajale 1982). Excavations at Bhagimohari also documented large number of burnt grains including wheat, barley, black gram, rice and so on. These crops indicate production of double crop during *rabi* and *kharif* seasons (Kajale 1989). The availability of agricultural tools such as hoes and sickles also indicate prevalence of the agricultural practice. Stone pounders and mullers along with circular bins are found from habitation floors at Naikund, Bhagimohari and Mahurjhari, which suggest storage of surplus food grains in houses (Deo and Jamkhedkar 1982; IAR 1982: 61-62, 1983-84: 57-58; Mohanty 2005). With regard to Chhattisgarh, it appears that the Megalithic people here practiced a mixed economy consisting of agriculture, hunting, gathering and crafts production. Their being agriculturist is supported by recovery of iron hoes and ploughshare from ceremonial ground (Sharma 2000: 303). Proximity of habitation to perennial water springs with abundant water for irrigation can also be related to agricultural demands.

Animals served for various demands of the Megalithic society such as agricultural, dietary consumption and transportation. Since there were dense forests around the habitation, small game hunting of less dangerous animals would not have been so difficult. In absence of animal bones from burials in Chhattisgarh, it is difficult to say if the Megalithic people of the area practiced animal husbandry or not (Sharma 2000: 303). This paucity of animal remains vanishes as one enters Vidarbha. Animal bones recovered from excavations in Vidarbha are mainly of horses, cattle, sheep, goats and pigs. Numerous cattle bones indicate that they were most preferred animal probably for domestication and agricultural purposes followed by sheep and goats. Besides these, a large number of bones of wild animals and birds were recovered from various stages of occupation suggesting the animal consumption in society (IAR 1982: 61-62, 1983-84: 57-58; Badam 1982; Thomas 1992a, 1992b, 1993, 1995). Thus, it is apt to suggest presence of hunters and butchers in the Megalithic society.

The construction of burials seems to have also been an important activity in the Megalithic community. Evidence for the stone cutting technique for making megaliths comes from Karkabhat in Chhattisgarh. Here the advantage was taken of a thick deposit of uniform granite outcrops out of which it was easy to cut out and shape menhirs. Transportation of stones was also easy as manufacturing site was located near the burial ground and habitational area. It appears that for separating huge blocks from mother rock, first holes were created at regular intervals and probably boiling water was poured into these holes to develop cracks (Sharma 2000: 299). It is also agreed that a number of people with different skill sets were involved in making and erecting a burial. However, it is still not clear if it was a conscious collective effort mandatory for members of the Megalithic society or it was result of paid labour. Mohanty proposes a hypothesis which suggests an off-season burial construction. Experimental re-construction of megalithic burials at Mahurjhari shows that a burial with 13.5 m diameter and 0.82 m deposit needed almost 185 men a day to erect a complete circle (Mohanty and Walimbe 1996: 136-149). If this was the level of effort put in the constructions of burials, then it appears that a certain section of society was actively involved in burial making activities. Empty burials found at Raipur and Davalameti may be taken to indicate construction of burials in advance by Megalithic people during off-season when agricultural work was not carried out

(Thakuria 2010).

Other crafts production such as pottery making, bead making and metal working and so on also constituted important modes of occupations.

Ceramic assemblage

The Megalithic builders of Central India used wheels and kilns for the ceramic production (Deo 1985: 89-99). The main ceramics found from the Megalithic habitation and burials are Black-and-Red ware, micaceous red ware, coarse red ware and black burnished ware besides other minor varieties. A typical Black-and-Red ware is completely black from inside to rim portion of external surface of vessel, whereas rest of the outer surface of pot has a reddish slip. The main shape of this ware as noticed from Megalithic period is restricted to only tableware (Deo 1970; Shete 2009: 66-76). The common shapes are bowls, dishes and pots with lids (Figure 10). A variety of bowls are found in this category which includes rimless bowls, shallow bowls, bowls-cum-dishes, bowls with carination and so on. The dishes of this ware generally have convex sides. The lids with an animal/bird finial are characteristic feature of this variety reported from megalithic burials. These are found in form of birds, goat and other animal figures (Deo 1970, 1973).

Painted Black-and-Red ware is a characteristic feature of Megalithic culture of Vidarbha. Painted sherds are generally reported from habitation sites like Naikund and Raipur (Deo and Jamkhedkar 1982; Deglurkar and Lad 1992; Joshi 1992) and are rarely found in burials as in Mahurjhari, Junapani and Raipur. Paintings are done in various shades of red such as matt red, chocolate red and bright red. Painted designs includes pairs of horizontal lines, vertical strokes generally over rim (both on exterior and interior), wavy parallel lines, hatched diamonds, grilled squares and comb pattern (Figure 11). It is observed that paintings are generally done over the body and shoulder portions of pottery.

After the Black-and-Red ware, micaceous red ware forms the dominant pottery type in Megalithic community of Central India. This ware is closely associated with the Vidarbha Megalithic society and it gained a special regional significance due to its occurrence in all excavated burials and habitation sites of Vidarbha that too in large quantities. As its name suggests, in the ceramic of this ware, clay is often mixed with mica flakes varying from small to large ones. Occasionally, pottery of this ware is ill-fired and sometimes flakes of mica are so large that they led to breakage of pots (Deo 1973) whereas small flakes of mica resulted in imparting a glittering finish to the pot's surface (Deo and Jamkhedkar 1982). Micaceous red ware is generally found in burials and settlements alike. It is significant to note here that Nagpur region has a good source of mica. Its local abundance was probably responsible for its frequent usage by Megalithic community for ritual or shining purposes. Common shapes in this ware include large-size storage vessels, pots with globular body and a funnel mouth, basins and dish-on-stands.

Along with typical micaceous red ware, the presence of mica slipped ware is also noticed from many excavations in Central India (Deo 1973). Mica slipped red ware has a medium to thick mica coating. It is well fired and more importantly its core does not contain any trace of mica flakes. Pots with a funnel mouth, pots with a concave neck and pots with a constricted neck constitute the main shapes in this ware. Black burnished ware resembles Black-and-Red ware so much that at times it becomes difficult to distinguish both wares without base of bowl or dishes intact (Deo 1973). The entire surface of this ware is black, and its exterior surface has a shiny surface. The bright shining on black surface is the result of a post firing process. Black burnished ware prominently includes shapes such as bowls and dishes. Bowls are generally rimless with convex body. There are a variety of dishes. Apart from bowls and dishes, lids with animal/bird finial and lids with a cylindrical knob also figure as an im-

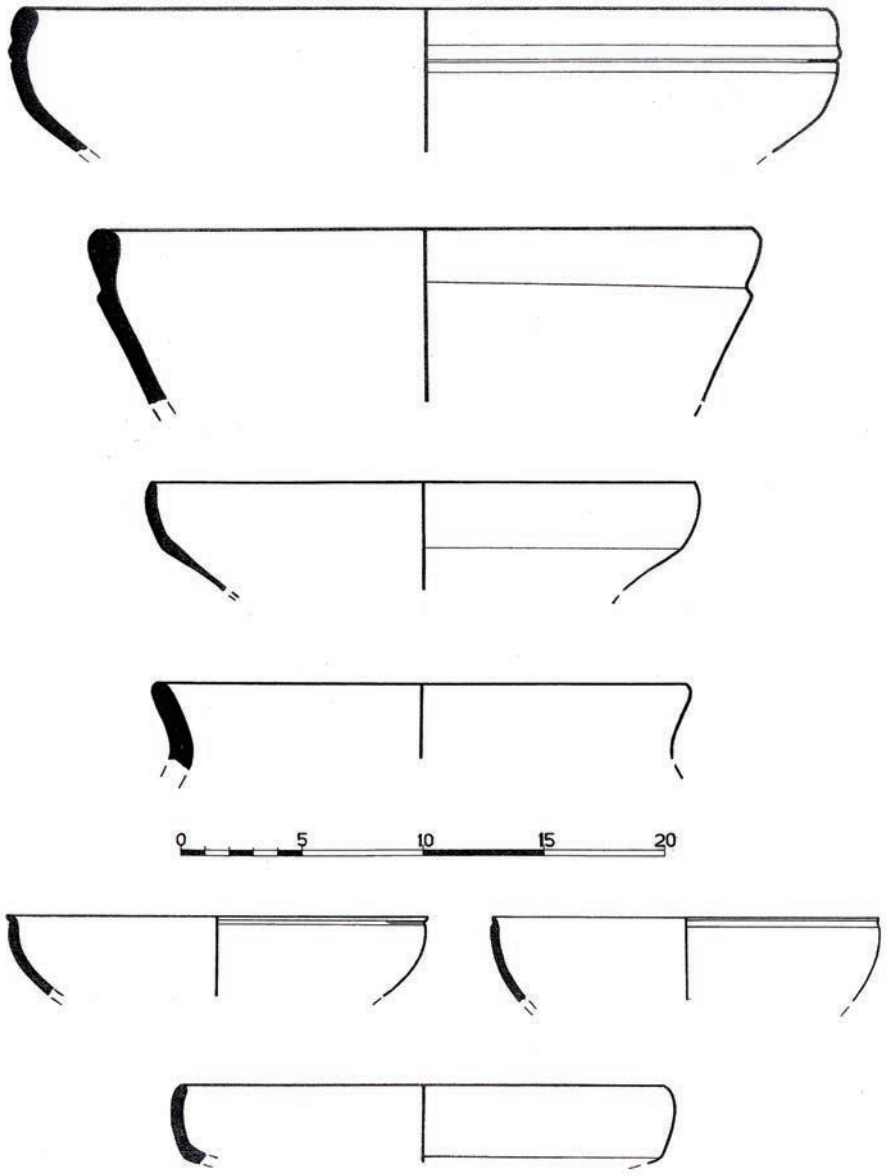


Figure 10 Ceramics of Early Iron Age from Malli

portant type in this ware. Other than the above-mentioned ceramics, coarse red wares and red burnished ware are also reported from Early Iron Age sites of Central India (Deglurkar and Lad 1992; Shete 2009: 66-76). Just as in Vidarbha, fine Black-and-Red ware, burnished black ware, dull thick red ware and some painted sherds were recovered from the excavations at Karkabhat-Sorar in Chhattisgarh (Sharma 1991: 21-34).

Stone artefacts

Stone objects can be divided into two broad categories. First category consists of objects for domestic and ornamental usage. Domestic stone objects are found in both habitation and burial. They generally include mullers, pestles, querns and pounders made out of sandstone (Figure 12). Pounders have cylindrical body with flat or convex ends. Such pounders are documented from the Karkabhat-Sorar in Chhattisgarh, from stone circles at Junapani (IAR 1961-62: 32-33), Mahurjhari (Deo 1973) and Raipur (Deglurkar and Lad 1992), and from the habitation deposit at Naikund (Deo and Jamkhedkar 1982).

Amongst ornamental stone objects found from

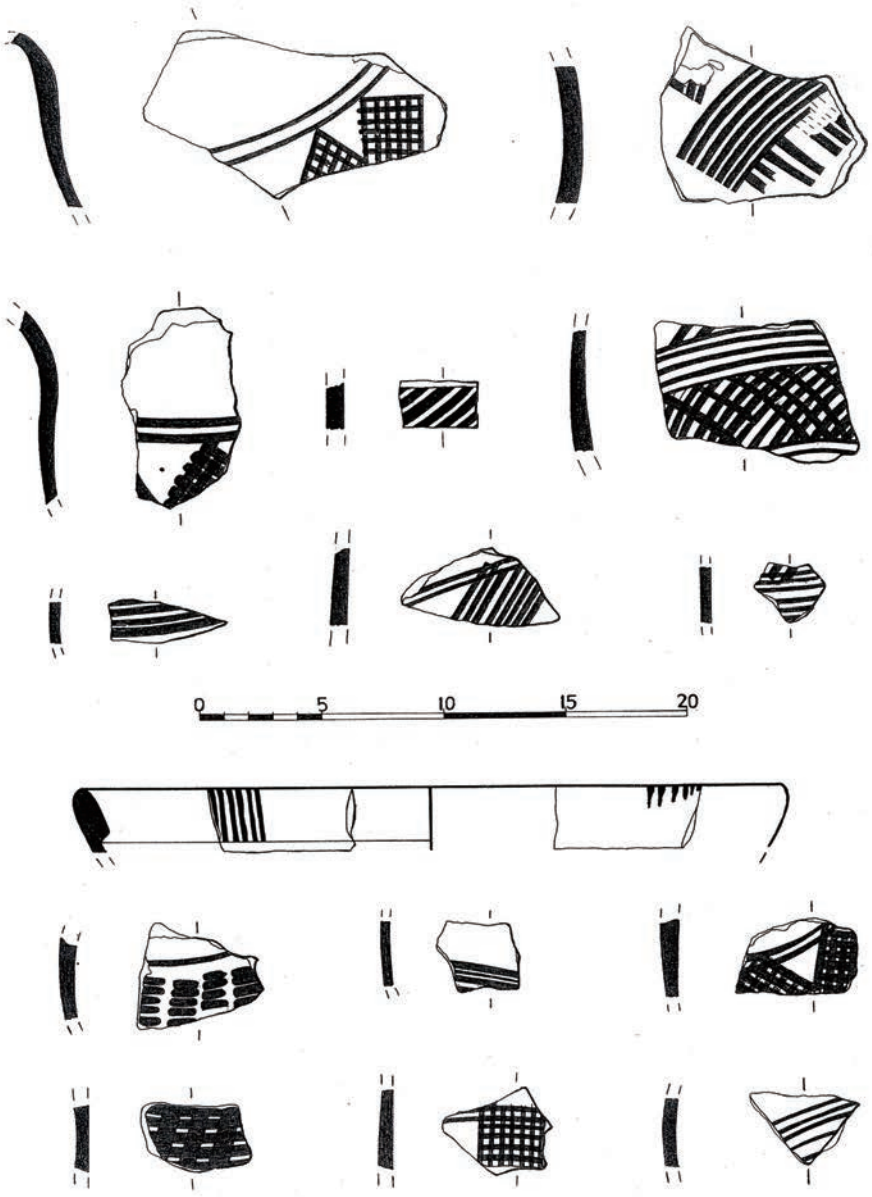


Figure 11 Paintings of Early Iron Age from Malli

megalithic burials most noteworthy are variety of beads of semi-precious stones. Megalithic burials of this region produced beads of agate, carnelian, jasper, garnet and quartz (Deo 1973; Mohanty 1999a, 1999b; Thakuria 2010). Mahurjhari, Junapani and Raipur yielded a large number of circular, square, rectangular, tabular and hexagonal beads (Thakuria 2010). Infact, Mahurjhari has been identified as a centralized bead manufacturing centre in Central India during the Megalithic period (Mohanty 2003b, 2008). Source of raw material for bead manufacturing in this area has been identified in dykes in the Deccan trap available in vicinity of Mahurjhari. It is significant to note here that while Vidarbha abounds in bead findings in the Megalithic period, beads reported from limited excavated sites in Chhattisgarh are very meagre. At Dhanora, a few beads are documented (Sharma 2000).

Metal and metallurgy

A variety of iron, copper and gold antiquities were recovered from excavations of Megalithic sites in Central India, chiefly in Vidarbha. They probably indicate technological and metallurgical advancements

Figure 12 Stone object from Malli

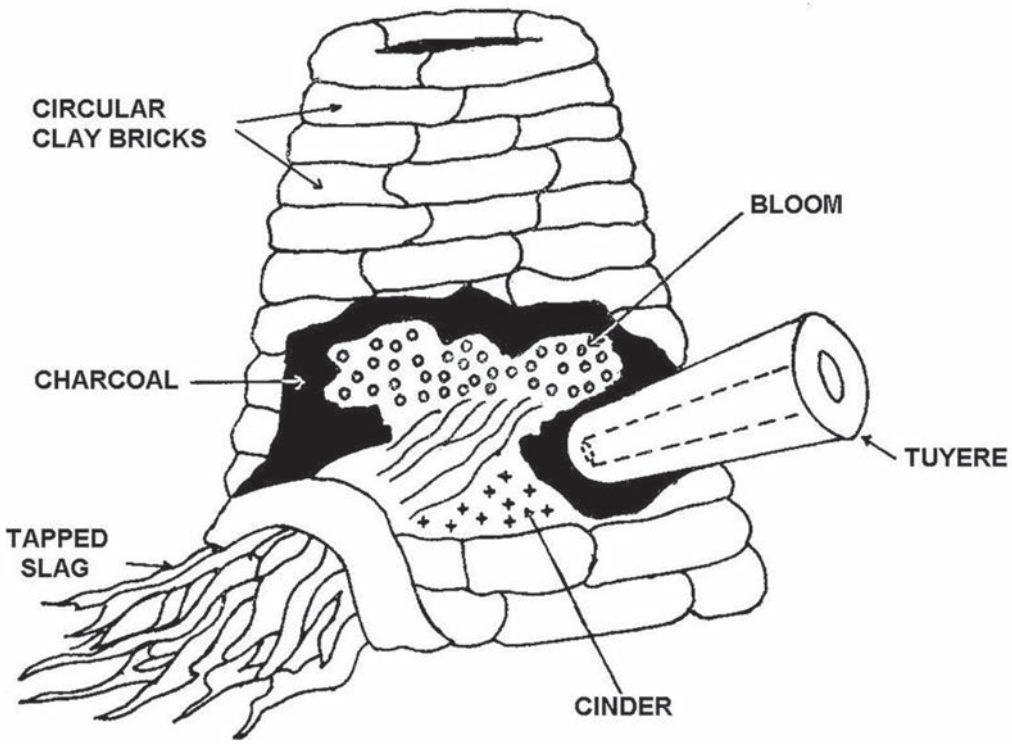


Figure 13 Reconstructed furnace from Naikund (after Gogte 1982)

of the Megalithic society. Early use of iron is reported from excavations at megalithic burials and habitation sites. Iron objects relating to various usages can be identified. Dishes, ladles, lamps, nails, clamps and so on were used for domestic purpose while daggers and knives were probably utilized for defensive purpose. Adzes, hoes and sickles were meant purely for agriculture while axes and chisels were used mainly for carpentry (Deo 1970, 1973; Deo and Jamkhedkar 1982; Deglurkar and Lad 1992). Excavations at Naikund brought to light an iron smelting clay furnace having a diameter of 30 cm and height of 25 cm in habitation area (Gogte 1982a, 1982b). Two tuyeres were also found near the furnace. It appears that these were used for blowing air into the furnace by bellow. Furthermore, about 40 kg slag was also found in situ in vicinity of the furnace (Figure 13).

It is also estimated that technology of the Naikund Megalithic smelters was such that they used 10 to 12 kg iron ore for a single smelting operation that produced 3 to 4.2 kg pure iron (Gogte 1982a). The source of iron was located nearly 1 km away from the site. The micro-analysis of ore from smelting area revealed the presence of crystalline to microcrystalline micaceous hematite quartzite which is generally associated with manganese ore lying 3 km away from site. It is suggested that due to availability of raw material for iron smelting in the vicinity, this site was consciously chosen as a settlement by the Megalithic people. Scientific studies have also confirmed that Naikund was major manufacturing and distribution centre of the region which probably supplied its finished iron items to the neighbouring sites like Takalghat and Mahurjhari (Gogte et al. 1984: 49-52). Though no iron smelting furnace has been recovered from Megalithic sites in Chhattisgarh but there is no doubt that these people were skilled artisans. They knew smelting of iron from the rich ore available nearby. A variety of iron objects like dagger blades, spearheads, spikes, arrowheads and ploughshare attest to their skill (Figure 14). These well fabricated tools speak of their acquired mastery over the iron technology (Sharma 2000).

Besides iron, plenty of copper items were also found in excavations at burial and habitation sites of Central India. Copper antiquities may be classified into groups on the basis of their probable usage. Bowls, lids and dishes were used for domestic purpose. Bangles, finger rings, antimony rods were utilized for personal ornamentation. Majority of copper objects found in the Megalithic period constituted of horse ornaments like bells and horse face ornaments. Besides marked variety of copper objects when compared to the preceding chalcolithic period, there is also a marked technological enhancement in copper technology as represented by bird motifs on lids, daggers and especially horse ornaments seen during this period (Deo 1973) (Figure 15). It is important to note that whereas greater usage of copper as compared to the preceding Chalcolithic culture is seen in the Megalithic period in Vidarbha, the same was not true for Chhattisgarh where only limited number of copper objects are reported. Solitary documented evidence comes in form of a copper vessel recovered from the megalithic burial at Dhanora (Sharma 2000: 288).

No copper smelting evidence is hitherto found from the Megalithic complex in Central India. Nevertheless, scientific studies on copper objects from Vidarbha megaliths have revealed that copper antiquities are mainly made of bronze and gunmetal alloy. For hardness, 1.0 to 1.3 % iron was mixed in it (Munshi and Sarin 1970). Source of copper used by the Megalithic people is uncertain. Sporadic evidence of copper mineralization is found at Chandrapur, Bhandara and Nagpur (Soitkar 1999). But it is not yet clear if these sources were utilized by the Megalithic community of Vidarbha. There is also a probability that Megalithic people of Vidarbha exchanged their iron implements for copper with their South Indian counterparts.

The limited use of gold is observed in the Megalithic

Figure 14 Iron Objects from Mahurjhari

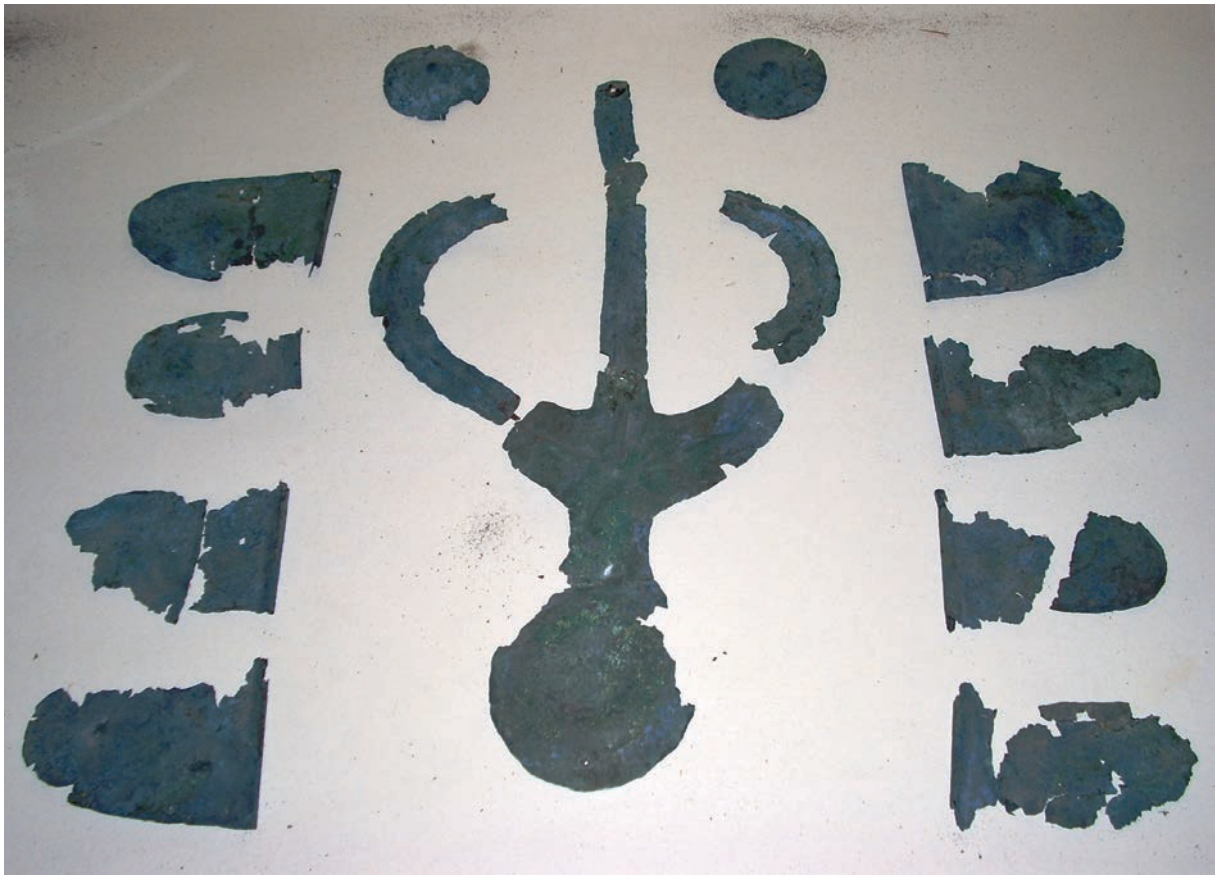


Figure 15 Horse ornaments from Takalghat and Khapa

context in Central India. Gold is found in the form of ornaments like necklaces, earrings and wires. There is no solid deposit of gold in the region but the Son river (alluvium) which is a tributary of the Wainganga river, is famous for gold particles. Few gold and silver objects are also recovered from Chhattisgarh but probably these were acquired as a result of contact with other people in adjoining areas who had better knowledge of these metals (Sharma 2000: 304). As of now, not much can be said about the provenance of gold used by the Megalithic community of Central India.

Mortuary practices

Burial customs always represent collective effort in any society. However, the archaeological vestiges suggest that special emphasis on burial custom was given by Megalithic people as witnessed in their burial monuments spreading over the length and breadth of the country. Different modes of disposing the dead were prevalent in Early Iron Age society in Central India. It is noticed that most of the excavated burials do not yield full skeletal remains save a few cases at Mahurjhari where two extended burials have been reported (Deo 1973). In contrast, secondary burials are greater in number. Tradition of burying multiple persons in a single circle was also in vogue. Recent excavations at Dhamnalinga (IAR 2000-01: 97-107) and at cemetery area in Mahurjhari (Mohanty 2005a: 106-107) yielded burials along the periphery of main building. These peripheral burials may belong to the family of the main deceased whose burial is in the centre. Evidence also shows that megalithic burials were not built for every member of the Megalithic society. Skeletal remains bearing burnt marks suggest that cremation was also popular as a mode of disposing dead in the society. Main burial goods observed were pottery especially micaceous red ware. Metal objects of iron, copper and gold were also found as burial goods in megalithic burials in concerned region.

DATE OF EARLY IRON AGE IN CENTRAL INDIA

As indicated earlier, early use of iron in Central India is mainly associated with the Megalithic culture. First attempt to impart a time frame to the Megalithic culture in India was done by R.E.M. Wheeler for South Indian megaliths (Wheeler 1948: 181-308). There is only one properly excavated Megalithic site in Chhattisgarh that has sent ^{14}C samples for dating. But unfortunately, so far no results of ^{14}C dates from Karkabhat are available. Nevertheless, presence of an extraordinary number of megaliths in the region of Chhattisgarh substantiates that the Megalithic culture flourished for a very long time. On the basis of similarities in antiquities with other dated sites, it could reasonably be deduced that this culture flourished in Chhattisgarh during the first millennium CE (Sharma: 2000).

In Vidarbha, first scientific ^{14}C dating of the Megalithic period was done by S.B. Deo at Takalghat where date of the middle phase of the occupation came out to be 2505±100 = 555 BCE. Taking this into consideration, the excavator believed that Early Iron Age in Takalghat possibly began in the 7th century BCE (Deo 1970). He also pointed out that, based on date of Hallur i.e. around1000 BCE (1030 ±105 BCE), cultural affiliation of Hallur to Takalghat could be possibly earlier than the 7th century BCE. ^{14}C samples collected from excavations at Naikund have given various dates ranging between 690 ± 110 BCE. and 300 BCE. According to the excavator, the Megalithic remains at Naikund can be placed between the 6th and 4th centuries BCE (Deo and Jamkhedkar 1982). The site of Khairwada has provided ^{14}C dates of 510 ± 100 and 420 ± 100 BCE. It is significant to note that these dates are from the middle phase of the Megalithic habitation. The site of Bhagimohari also gives a number of ^{14}C dates from various depths of habitation (Thakuria 2010). The earliest date at

Bhagimohari goes back to the 8th century BCE.

Some Early Iron Age sites have been relatively dated on the basis of some elements of the material culture, mainly ceramic assemblage. The excavations at Kaudinyapura revealed a six-fold culture sequence wherein the earliest stratum belonged to Early Iron Age. The absence of coins and NBPW in this stratum led the excavator to put this period somewhere between 800 - 600 BCE. The main characteristic features of this period were Black-and-Red ware and etched carnelian beads. On the basis of the available ^{14}C dates from Hallur, date of Early Iron Age in South India was taken back to around 1200 BCE. Recent dates from Veerapuram provide a date of 1500 BCE to the earliest iron at this site. (Chakrabarti 2006). The site of Adam has also provided a few ^{14}C dates that take the earliest date of iron prior to 1400 BCE. Recent studies carried out in Middle Ganga plain clearly show the beginning of Early Iron Age dating back to second millennium BCE (Tewari 2003). In light of above advances, it is that suggested that the beginning of Early Iron Age in Vidarbha can also be pushed back to around the middle of second millennium BCE by future research.

REGIONAL IDENTITIES AND DISPARITIES

It is significant to note that divisions like Madhya Pradesh, Chhattisgarh and Vidarbha, actually are not geographical divisions. That is to say, we may classify the Megalithic cultures of these parts of Central India as the Vidarbha Megalithic and the Chhattisgarh Megalithic but they share commonality and differences on account of the fact that the Megalithic people was free to move and explore. Since the concerned region, i.e. Central India is a vast entity in itself, cultures are bound to have their degree of similarities and dissimilarities as well depending on the closeness with the adjoining region. For example, the districts Rajanandgaon, Raipur and Durg of Chhattisgarh are closer to Vidarbha and show cultural affinities with the same, whereas the site of the district Bastar of Chhattisgarh is far from Vidarbha and so are the similarities which are far and few. Nevertheless, these Megalithic communities of Central India were bound together by common thread of paying regards to the dead by erecting memorial stones thus displaying unity in diversity.

Though it may appear at first that stone circles and cairns are the main burial types prevalent in Indian Megalithic culture in general, on a closer look we see that regional variation is clearly visible in terms of typology and the inner architecture of megaliths in the upper Wainganga valley, Vidarbha, Chhattisgarh and South India. The types like rock cut caves, umbrella stones and hood stone which are typical to Kerala not found in the region, even though the raw material like lateritic rock is available. Menhirs inside stone circles and cairns constitute popular megalith types in Chhattisgarh. In Vidarbha, stone circles and cairn circles are predominantly found. Cists inside stone circles are first time found in Maharashtra from the upper Wainganga valley. Moreover, stone circles and cairns of South India, Chhattisgarh and the upper Wainganga valley incorporate cists, dolmens, menhirs, stone slabs and so on, inside them. However, rarely visible inner architectural variations have also been noticed in Vidarbha Megalithic complex. It is well known that construction of a megalith is a community act that requires labour, time and money (Mohanty and Walimbe 1996: 93-103). Other than ordinary megaliths, more labour effort was needed for creating the inner architecture. Thus, it can be considered that megaliths which yielded the inner architecture probably belonged to important or wealthy people of Megalithic society.

It is also significant to note that the regional variation is so pervasive that even the common megalith type seen in each region have remarkable differences,

which can be identified as a 'regional Megalithic trait'. For example, though stone circles are reported from Chhattisgarh, Vidarbha, South India and the upper Wainganga valley, nonetheless regional variation amongst them can be easily identified. The stone circles and cairns of Chhattisgarh, especially of the Durg district are without large peripheral boulders, whereas huge peripheral boulders are a prominent feature of the Vidarbha Megalithic culture. Anthropomorphic/carved menhirs constitute an important type in the Chhattisgarh megaliths, whereas they are completely absent in Vidarbha. Regionalism amidst megaliths becomes more evident in terms of type of raw material and its usage for burial construction. Undressed basalt boulders were mainly employed by Vidarbha megalithians for the construction of megaliths. As against Vidarbha, in the upper Wainganga valley, the use of both dressed and undressed lateritic stones is documented. In Chhattisgarh, granite and sandstone are employed for menhirs. The distribution of megaliths and their variation in terms of the inner architecture and the detailed architectural feature inside megaliths in the area of study can be summarized thus (Table 3).

This disparity in the megalithic typology also extends to the cultural appendages as well. Beads which constitute an important part of the Megalithic culture in Vidarbha are relatively uncommon in Chhattisgarh. Furthermore, intricate copper workings in bird top finials and other vessels are all together missing in Chhattisgarh. It appears as if copper was not popular as a working metal in the Chhattisgarh Megalithic community, which otherwise displays wonderful craftsmanship when it came to iron working.

OBSERVATIONS

The evidence suggests that environmental adaptation certainly played a vital role in the Megalithic society. The regional variations amongst burial practices are considerably governed by availability of raw material at the place of the erection of burial. It has been pointed out that geological features also influenced burial type prevalent in a particular region (Krishnaswami 1949: 35-45). However, in a few cases, evidence of carrying of a particular type of stones from far distance in order to construct a megalith is also seen in Raipur (Deglurkar and Lad 1992). It appears that availability of raw material played a vital role in building burials. The locational analysis carried out in and around the site of Malli shows that site is situated close to source of raw material which was very essential for constructing megaliths. Similar evidence is observed in case of Karkabhat (Chhattisgarh) where stones for menhirs were brought from a quarry located near the burial ground. The other Megalithic sites of Chhattisgarh are also situated in a landscape where raw material is profusely available locally. The burial sites of South Indian Megalithic culture are also situated the near raw material resource.

Predominantly stone circles and cairns without any inner architecture are found in the Vidarbha and Chhattisgarh regions. Though a few megaliths of these two areas incorporated cist and crude chamber, still it appears that cist was not a characteristic megalithic type neither in Vidarbha nor in Chhattisgarh. Probably geophysical conditions or socio ideological beliefs restrained Megalithic community in these areas from constructing the inner architecture in megaliths. Therefore, it is possible that cist found inside the megalith circle at Raipur-Hingna was erected for a person who had connections or relations with South India or the upper Wainganga valley or that it was result of cultural contact with the Megalithic society of South India or the upper Wainganga valley. This hypothesis becomes significant in light of Moorti's work (1994) which pointed out that major Megalithic sites were situated on trade routes. Another interesting fact is that Megalith 1 of Raipur-Hingna yielded a cist of white micaceous schist. This raw material is not found

Table 3 Distribution pattern of megalithic types in Central India

Typology	*Upper Wainganga Valley*	*Vidarbha*	*Chhattisgarh*
Stone circle	✓	✓	✓
Cairn circle	✓	✓	✓
Cist	✓ (less)	✓ (rare)	×
Menhir	✓ (less)	✓ (less)	✓ (popular)
Dolmen	✓ (less)	✓ (rare)	×
Capstone	✓ (less)	×	✓ (popular)
Rock cut cave	×	×	×
Umbrella stone	×	×	×
Hood stone	×	×	×

in and around Raipur. On the other hand, a number of cists of the upper Wainganga valley are made out of white micaceous schist. Therefore, a possibility of a cultural contact of Vidarbha with the upper Wainganga valley cannot be altogether ignored. This contact is more evident on account of the closeness of Vidarbha and the upper Wainganga region.

Micro-surface survey carried out at Malli revealed that fragments of pottery were placed at various places within the cemetery. These fragments of pottery over surface perhaps represent a different type of a burial tradition of lower strata of the society which could not afford to construct a megalith. Multiple usages of megaliths are also documented from some sites of Vidarbha like Takalghat and Khapa (Deo 1970), Mahurjhari (Deo 1973), Raipur-Hingna (Deglurkar and Lad 1992). It is agreed that construction of megaliths represents a collective effort on part of society and requires a heavy input of labour, time and money (Mohanty and Walimbe 1996: 136-49). Multiple usages of megaliths may be taken to denote an effort towards economizing cost, labour and time. In Chhattisgarh, it is difficult to presume the multiple usages of megaliths in absence of study of same custom. However, the type E at Karkabhat-Sorar complex where stone circles with multiple menhirs of varying sizes may be related to erections of menhirs at different times. In Malli, one cairn circle had eight cists. Again, there is a minor possibility of it being an example of the multiple usages. Thus, it appears from a current scenario that multiple usages of burials were not as common in the upper Wainganga valley and Chhattisgarh as in Vidarbha.

Another peculiar feature of megaliths in Central India is that they consist of a variety of burial furniture and ceramics inside them. Micaceous red ware, painted black-on-red ware and a variety of metal objects are found from megalithic burials. Ceramics like red ware with a coarse surface and micaceous red ware were typically used in burial as evidenced from excavations at several sites. Iron antiquities from burials are comprised of agricultural, hunting, and household and carpentry items while copper and gold objects were mainly found in form of ornaments. Vessels and pots of copper are also found in megaliths. A variety of beads of semi-precious stones are also found from many of these burial monuments. The study pertaining to iron objects of Vidarbha revealed that iron implements manufactured at Naikund were found at other Megalithic sites of the region (Gogte 1982a, 1982b). Beads of semiprecious stones made in Mahurjhari were also reported from various sites of Vidarbha (Thakuria 2010). The ceramic evidence from Sorar in Chhattisgarh and data in respect of metal objects show a close resemblance with those from the sites excavated in the Vidarbha region of Maharashtra

(Sharma 2000: 303). If further scientific trace element analysis works of this kind relating to the provenance of antiquities are done at sites of Chhattisgarh and the upper Wainganga valley, fruitful correlations regarding the regionalism and the commonality may be derived.

Nevertheless, the regional variation is also observed in the burial furniture in megaliths of South India, Chhattisgarh, Vidarbha and the upper Wainganga valley. Occurrence of the Early Iron Age pottery without any stone objects like beads, pounders, mullers, pendants are seen in the upper Wainganga valley as in Chhattisgarh. But stone objects are known from Vidarbha megaliths. The stone circle with cairn filling both compact and loose is trademark of the Vidarbha Megalithic culture (IAR 1981-82: 51-52, 1982-83: 61-62, 1983-84: 57-58). But the cairn filling is not very popular in the adjoining region of Vidarbha, i.e. the upper Wainganga valley. Again, in contrast to South India and Vidarbha megaliths, a few evidence of skeleton and other antiquity remains are reported from the upper Wainganga valley and Chhattisgarh Megalithic complex. Horse skeletal remains along with horse ornaments are peculiar feature of Vidarbha Megalithic complex but sporadic evidence of horse remains are found in Chhattisgarh, the upper Wainganga valley and South India.

Such variations probably relate to the people who practiced or believed different customs or belonged to different clans or bands of the Megalithic society. The construction of variety of megaliths within same site can also be attributed to the people practicing different beliefs and customs in same society. Ethno-archaeological studies have also proven that every megalithic constructing tribe has its own processions and persuasions related to the burial construction and appendages and that the variety of megaliths basically depends upon the social customs and beliefs of the society (Binodini Devi 1993). For example, ethno-archaeological studies in the Vidarbha region show that menhirs were erected for a person who met a natural death. The archaeological evidence taken into consideration suggests that burial was not for all people, but it seems that select few from a given society who died unnatural death were given ceremonial burials (Mohanty and Walimbe 1996: 136-49). On the other hand, a different type of megalith was made in case of death of a child and women during pregnancy (Geetali 1999, Thakural 2005). Such evidence suggests that architectural variation in megaliths is probably because of the socio-religious aspects of the Early Iron Age people.

It appears from the ongoing discussion that Early Iron Age culture in the upper Wainganga valley bears much resemblance with that of the districts Durg, Raipur and Rajanandgaon in Chhattisgarh except the Bastar district. While Thapar and Hiene Galdern have grouped the megaliths in Bastar, Chhattisgarh to the north eastern region encompassing Assam, the Chhotanagpur area, A.K. Sharma postulates that tradition is an indigenous one. When it comes to the burial typology, the capstones and the stone circle without filling are found in the aforesaid districts in Chhattisgarh and these types are also reported from the upper Wainganga valley except menhirs which had a huge popularity in these districts of Chhattisgarh. Another important observation with regard to megaliths in the upper Wainganga valley and Chhattisgarh is that at both places attention was given to construction of burials and not so much on the burial appendages. In Karkabhat, over ten megaliths were excavated but not a single contained any skeletal remains just as Malli where out of eight megaliths, skeleton remains were found in only one megalith. Excavations also reveal that megaliths of both regions incorporate lesser burial furniture such as ceramics, iron and other objects. Only difference between two regions was that while cists are reported from the upper Wainganga valley, they are meagre in Chhattisgarh. Nevertheless, resemblance of the Megalithic tradition of the upper

Wainganga valley with the neighbouring Chhattisgarh Megalithic complex cannot be altogether ignored. These similarities can be accounted for by similarity in geophysical setting of both the regions. This is a preliminary hypothesis as it is based upon the results of little work carried out in both regions. Future endeavours are bound to shed more light on this hypothesis. However, as of now, it appears that area between the Mahanadi and Wainganga rivers represents a different set of the Megalithic community different from Vidarbha and South India.

The aforesaid observations aptly demonstrate that Early Iron Age represents a brilliant chapter in history of Central India. Culture they created bears testimony to rich social, religious, economic and technological heritage amidst regional differences and similarities. It has been derived from the current research that the cultural contact and influence of one Megalithic community over the other might have played an important role in the developments of megalithic types and the Early Iron Age culture in Central India. This is region with the ethnographic parallels to the megalith making tradition and this could provide valuable inputs regarding thought process, mechanisms and intricacies behind the megalithic making. However, the constant threat of deforestation and urban expansion with the activities like road construction and quarrying has posed a great threat not only to the Megalithic heritage of the region but also to tribal communities practicing the same. I would conclude by reminding and requesting all researchers in Indian archaeology and history to cooperate to ensure the safety and survival of this heritage.

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IRON AGE CULTURE IN SOUTH INDIA: TELANGANA AND ANDHRA PRADESH

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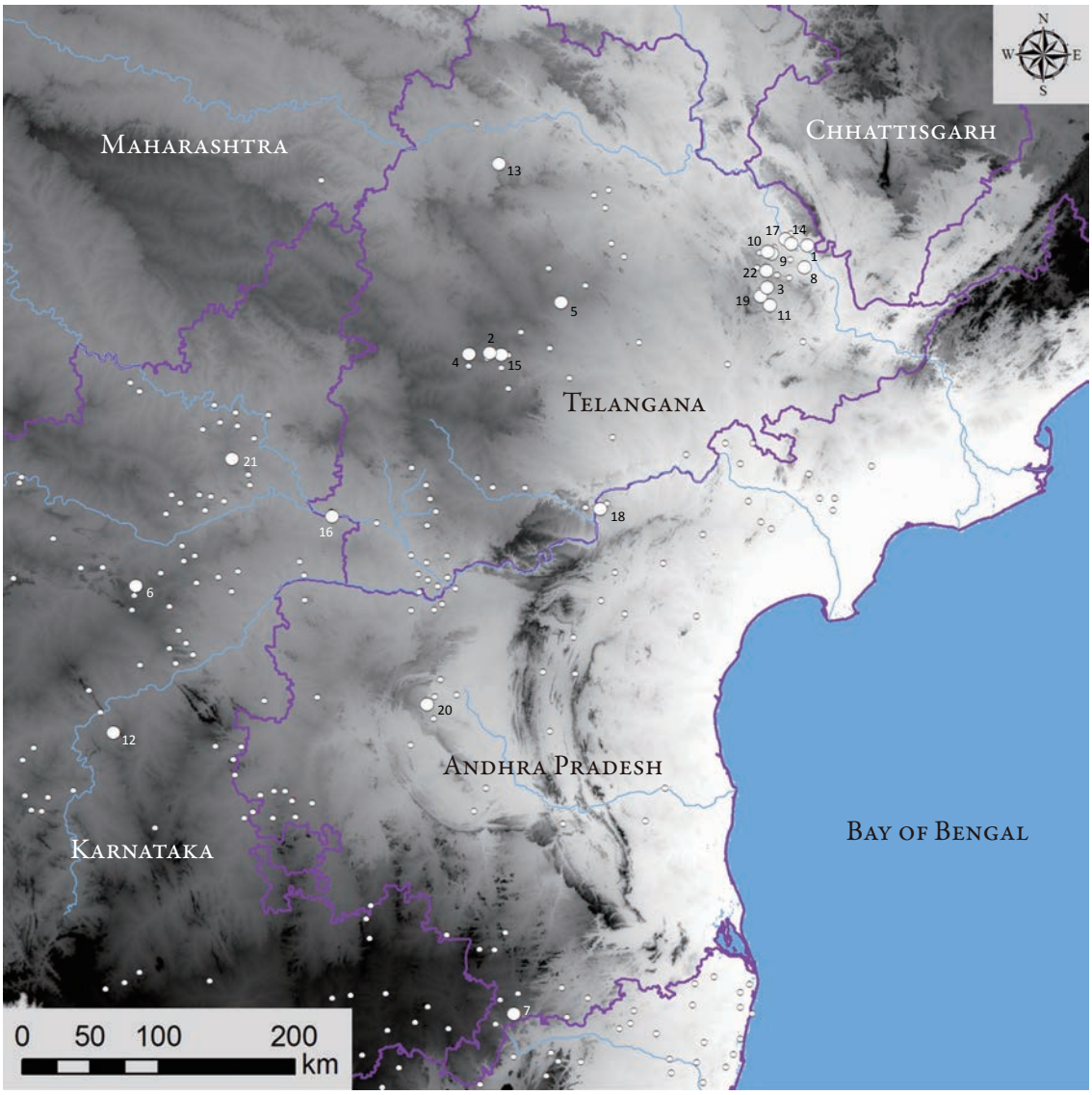
The states of Andhra Pradesh and Telangana (Figure 1) lie on the eastern board of the peninsular India. Two major rivers, Godavari and Krishna, traverse through the region, apart from other minor rivers. Geographically, the region has low altitude coastal plains as well as the elevated rocky Deccan region. The Deccan region has the oldest Gondwana formations, which are volcanic in origin. Some of the southwestern parts of Andhra Pradesh are covered by the aquatic formations rich in limestone, which is known as the Cuddapah basin. A major portion of Andhra Pradesh and Telangana contains granitic stone as basal rock. The granites have been extensively used for the construction of megalithic monuments in the study region.

Ever since Babington published data on the megaliths from the Malabar coast, the attention of the scholars is drawn to these graves. The study of Iron age graves in the present region has a history of more than one and half centuries. Captain Newbold (1851: 90-95) excavated some cist burials near Chittoor. Colonel Meadows Taylor published a series of articles (Taylor 1851: 179-193, 1853: 380-427, 1873: 329-362) on the megalithic sites from the Deccan region in various journals. He studied several megalithic sites at Maula Ali and Bowenpally, and published details with very impressive line drawings (Taylor 1852: 88-120). Mulheran has published details about the megaliths in the Khammam forests (Mulheran 1868: 116-118). William King, a geologist by profession, published in the Journal of Asiatic Society of Bengal (1877: 179-182) an interesting article with the megalithic monuments containing stone crosses (anthropomorphic statues) from Mungapet and Kaperlaguru in the erstwhile Nizam's Dominions. Branfill (1881: 97-100) studied the megalithic monuments from the Mysore region and also an elaborate study on the Iralabanda monuments near Chittoor. This site had one of the biggest megalithic complexes in South India with a total of 680 monuments when Branfill made the study. Venkataramanayya made a general study of some of the megalithic sites in his article published in 1971 (Venkataramanayya 1971: 21-50). One of the megalithic sites excavated extensively is Nagarjunakonda (Subrahmanyam et al. 1975). These are some of the pioneering studies on the megalithic monuments from Andhra Pradesh and Telangana. Srinivasan and Banerjee made a general survey of the South Indian megaliths in their article (Srinivasan and Banerjee 1953: 103-115).

The Telangana region lying in the central Deccan area has a rich tradition of iron and steel production since very early period. The region has several iron-rich mineral zones, which must have been exploited by the early communities for producing iron and steel.



No.	*Site*	*WGS84_E*	*WGS84_N*	*State*
1	Albaka	80.6757	18.2037	Telangana
2	Bowenpally	78.4774	17.4746	Telangana
3	Dongatogu	80.3946	17.9264	Telangana
4	Gachbowli	78.3339	17.4632	Telangana
5	Gajagirigutta	78.9684	17.8155	Telangana
6	Hanamsagar	76.0721	15.8832	Karnataka
7	Iralabanda	78.6925	13.0864	Andhra Pradesh
8	Janampet	80.6558	18.0594	Telangana
9	Kaperlaguru	80.4277	18.1524	Telangana
10	Katapur	80.3981	18.1625	Telangana
11	Kistapuram	80.4164	17.8071	Telangana
12	Komaranahalli	75.9410	14.9094	Karnataka
13	Konasamudram	78.5223	18.7297	Telangana
14	Malur	80.5644	18.2168	Telangana
15	Maula Ali	78.5565	17.4615	Telangana
16	Mudumal	77.4075	16.3746	Telangana
17	Mungapet	80.5227	18.2473	Telangana
18	Nagarjunakonda	79.2510	16.4479	Andhra Pradesh
19	Padugonigudem	80.3511	17.8681	Telangana
20	Ramapuram	78.0783	15.1330	Andhra Pradesh
21	Shakapur	76.7119	16.7419	Karnataka
22	Tottigutta	80.3907	18.0370	Telangana

Figure 1 Sites mentioned in this article

There have been studies on the iron production in the Telangana region right from 1832, when H.W. Voysey published an article in the Asiatic Society of Bengal on the process of iron production at a village known as Konasamudram.

Earlier studies of iron and steel production in Telangana including a survey of near about 250 sites in northern Telengana revealed that at least 183 sites were associated with metal working (Juleff et al. 2014: 1030-1037). Iron ore is available in two types of mineral formations, i.e. the magnetite and laterite. Both the minerals can yield up to 60 % iron. The Telangana region seems to have mastered the steel production. They adopted the crucible technology for manufacturing steel. The aim was to increase the carbon content in iron, so that it acquired the properties of steel. Thus they were achieving by inserting wet sticks into the furnace. The slow burning of the wet sticks was probably resulting in larger absorption of carbon by the iron, making it acquire the properties of steel. During the medieval period, the Indian steel known as 'wootz' used to be in high demand from the Middle East for production of swords.

With reference to the South Indian Iron age, we have to understand that there is some ambiguity regarding its origin or adoption of the technology. With the commencement of the Iron Age, we see sudden perfection in the variety of iron objects. We do not come across the rudimentary developmental stages we usually expect when a new technology is introduced in a region. On the other hand, we see profusion in the variety and quantity of objects we find in the Iron Age graves. This might suggest the adoption of technology from some other region, where already, the technology had been sufficiently developed. The other possibility is that we are yet to locate the early Iron Age sites from South India, where the technology might have the inception and development.

In South India, it is a common feature that we find rich repository of iron objects in most of the megalithic graves. Varieties of tools, weapons and many miscellaneous objects have been found in these graves. Some of the tools reveal the craft specialization and provide a peep into the kind of professions pursued by the megalithic folk. Agricultural tools like sickles, ploughshares and hoes were found in a good number at several places. Similarly, carpentry tools like several varieties of chisels, adzes, axes and nails have been reported. More impressive are the weapons probably used in hunting and fights. Battle axes, javelins, spears, tridents, daggers, knives, etc. are found at several places. The horse bits, harnesses and horse ornaments suggest riding and active engagement in martial activities.

CHRONOLOGY OF THE IRON AGE CULTURE

The Iron Age cultures in South India have given different dates, generally ranging from about 1500 BC and 300 BC. This is only a general range of dates available from different regions, but late as well as early dates have come from some sites. The following are some of the dates available for the megalithic culture in South India.

Komaranahalli	1440 BC: Thermo-luminescence (Nagaraja Rao 1990: 319)
Naikund	545 - 505 BC: Radio-carbon (Deo and Jamkhedkar 1982: 7)
Takalghat	555 BC: Radio-carbon (Deo 1970: 13)
Gachibowli	2795 BC and 2145 BC. Thermo-luminescence OSL (Thomas 2008: 781-790)

The megalithic burials located in the campus of the University of Hyderabad have given the earliest date for megaliths as well as iron from South India (Rao 2010: 102-111; Thomas 2008: 781-790). Even if we ignore the earliest date of 2795 BC, the second date

of 2145 BC is also the earliest date available for iron in India. Thus, it is important to note that the Telangana megaliths have given the earliest date for the culture and also for the use of iron in India. Though we cannot say that all the megalithic sites in Telangana would go back to such antiquity, we still have to consider the possibility of some of the sites going back prior to the 1st millennium BC. In this context, it might be mentioned here that the present author has collected some pottery similar to the Neolithic wares from some disturbed layers under the menhirs from Mudumal. This indicates that some of the megalithic sites with the menhirs might go back to the Neolithic period. From the above, we can understand that the megalithic culture in India can be dated broadly between 2000 BC and 300 BC based on the latest scientific dates available from various sites in South India. It has been noticed at some of the sites that the Chalcolithic phase was succeeded by the megalithic phase, and hence we can postulate that some of the chalcolithic communities have adopted iron as well as the megalithic practices and, thus succeeded into the megalithic phase. In this respect, Ramapuram in Kurnool has given good evidence of such succession (IAR 1980-81: 3-7, 1981-82: 3-7).

It is necessary to mention here that the megalithic practices have not completely disappeared from the region, and even to this day, some of the secluded communities' practice megalithism (Kapp 1985: 493-531). We can consider 300 BC as the date for end of the active megalithic phase, as evidence suggests its gradual fading away after this date. The evidence from several excavated sites suggests that the megalithic phase was succeeded by the Early Historic/Historic phase at several places.

UNIQUE TRIMMED STONE CICLES AND ANTHROPOMORPHS

In the districts of Khammam and Warangal, we come across unique type of monuments, which are not found elsewhere in India. In this region, we find perfect circles formed out of trimmed stone blocks. (Figure 2). The trimming of the stone blocks of the circles is so perfect that each slab has a slight curvature that helps in forming a perfect circle by the use of these trimmed blocks. These circles enclose dolmenoid cists made of very thick stone slabs cut out of sandstone. The dolmenoid cists are also constructed out of perfectly trimmed stone blocks which give geometrical dimensions to these monuments. Most of the monuments in this group have their capstones and orthostats as thick as 50 cm. A squarish 'U'-shaped port-hole (Figure 3) is provided usually on the western direction. Among these monuments, we also find dolmens, but in a lesser frequency. The dolmenoid cists and some dolmens contain stone sarcophagi, which are again a unique feature in Indian megaliths. Each monument contains two to six sarcophagi. The rectangular sarcophagi measure anywhere between 1 meter and 2.5 meters in length with a width between 50 cm and 80 cm having an average height of about 50 cm (Figure 4). The earlier excavations carried out by Ahmed have reported that these coffins contain pottery and iron objects like ploughshares, horse-bits, hoes, etc., but not skeletal remains (Ahmad 1900). It is likely that the retrieval of skeletal remains in the hardened soil in the sarcophagi was difficult, and possibly, they contain skeletal remains. These monuments are found in large groups mostly in forested areas. The Janampet burial complex is estimated to contain about 3000 monuments. The sites of Padugonigudem and Kistapuram recently discovered by the present author also contain more than 1000 burials each (Rao 2014: 172-178). The unique features like the trimmed stone circles, the anthropomorphic statues and the

Figure 2 Dolmen enclosed by a trimmed stone circle, Padugonigudem

Figure 3 Dolmen with a porthole and a fallen door slab, Padugonigudem

Figure 4 Stone sarcophagi, one with lid, Kistapuram

Figure 5 Anthropomorphic statue (asexual), Padugonigudem

Figure 6 Female anthropomorphic statue, Padugonigudem

Figure 7 Female anthropomorphic statue, Padugonigudem

stone sarcophagi call for identifying the megaliths in this region as a separate megalithic complex with specific features which are very rare or not found in other regions (Rao 1991: 363-369).

The largest concentration of the anthropomorphic statues is found at a site known locally as 'Rakshasi mitta' (Demon's hill) near Padugonigudem (17.8681N, 80.3510E) in the Khammam district, where more than 40 figures have already been noticed, and further exploration in the dense forest area is likely to yield more statues. The initial discoveries of such figures were made at Albaka, Malur and Katapur by Mulheran (1868: 116-117). Subsequently, William King also published a report about such statues from Mungapet and Kaperlaguru (1877: 179-182). Later, the present author reported some statues from Dongatogu and Tottigutta in the Khammam district (Rao 1988: 25-26, Pls. 15,16, 1991: 363-369, 2014: 172-178). The general features of these statues, as mentioned elsewhere (Rao 2000: 112) are as follows:

1. These statues represent the human body in a very simple and abstract form.
2. The statues are carved in the round, though it is very difficult to distinguish between the ventral and dorsal views in most of them.
3. Organs such as the eyes, ears, mouth and nose are not carved.
4. The upper limbs are sometimes suggested by the elongations at the shoulder area, but the full limb is never carved.
5. The lower limbs are not distinctly represented. Probably, however, the elongation of the lower body is meant to represent the lower limbs.
6. The sex of most of the statues cannot be distinguished as no sexual features are depicted on them (Figure 5). A very few statues reveal female features such as breasts.
7. So far, no statue with male anatomical features has come to light.
8. The statues usually measure 1.5 to 2.6 meters in height, though both smaller and larger statues are reported from various places.
9. These statues are usually planted vertically within the circle of the monument or near the monument. A good number of these statues have fallen on the ground in course of time.

Some of the most interesting statues have been discovered recently at Rakshasi Mitta near Padugonigudem in the Khammam district. Here statues with prominent female features are noticed in a good number (Figures 6 and 7). It has already been pointed out that these statues probably represent the earliest stone carving tradition in India (Rao 1993: 664-67). Though, the Indus valley examples are dated much earlier, we are not sure whether these statues were made locally, and the limited number of examples does not suggest any local tradition. In this situation, we have to consider the megalithic anthropomorphic statues as the earliest sculptural representations, and the megalithic community deserves the credit for the initiation of this art tradition on Indian soil from the Telangana region.

The purpose for which such figures were erected could not be understood until the beliefs of the Savaras were studied. The Savaras erect rough wooden figures in human form to accommodate the spirit of the dead until the Gaur ceremony is performed (Elwin 1955: 345).

There are also stories regarding the erection of menhirs during a ceremony, known among the Savaras as 'Gaur' ceremony. The Savaras tell the following story in connection with the Gaur ceremony:

"Long ago a brother and a sister lived together. The brother had a wife and children, but the girl was unmarried. While she was still young she died, and her brother burnt the body and buried the bone. But he did not plant a stone for her, for that was not the

Figure 8 Rows of Menhirs at Mudumal

custom. The girl became a shade, and whenever her brother went to his clearing at night to guard it, she used to wander round in the forest weeping and calling to him 'O brother, you have so much, fields and house and children but what use is it? I am your sister and I wander here, naked and hungry, yet you do nothing for me.' After she talked like this for several nights, the brother said to himself, 'My sister is dead; how is it that she can talk as if she was alive?', and the following night he called her to come near and asked her, 'What can I do to help you?' She said, 'plant a stone and kill a buffalo for me.' He did so, and the ghost complained no more." (Elwin 1955: 359).

MEGALITHS AND ASTRONOMY

The megalithic community in the study region also seems to have made considerable progress in the developments of astronomy and in the understanding of the movements of the celestial objects. We have a sufficient amount of definite evidence suggesting that the megalithic people followed certain orientations while constructing the burial monuments and in interring the burial material in graves. In a period when magnetic compass was not available, it must have been a tough task to determine the orientations. They must have been depending on the observations of the celestial objects like the Sun, Moon and the star constellations for determining the directions. Various sites in the study region have yielded evidence on complying to various orientations by the megalithic folk. It is obvious that they have been depending on celestial objects for determining the orientations.

It is well known that the megalithic monuments from Europe are well related to the celestial bodies (Heggie 1981; Thom 1954: 396-404). But, as far as the Indian megaliths are concerned, except passing references to such relationship, especially with the Sun, no systematic study has been carried out so far. The inter-

est of the megalithic community in the cosmic objects is first suggested by the notice of such representations in graffiti and art. For example, the graffiti found on the megalithic pottery contain representations of sun, moon and stars (Yazdani 1917: 57). Similarly, Yadu Vanshi (1942: 40-45) also published the graffiti found on the pottery from the Deccan, which also showed such symbols. For instance, the graffiti on the megalithic pottery published by Yazdani (1918: Figure 1) show sun (no.70), crescentic moon (no.129) and star (no.69). The sun symbol was also noticed on the pottery from Iralabanda (Branfill 1881: 99). Such cosmic representations were also noticed in the art of the megalithic people. At Perisandra in Karnataka, the sun and the moon are engraved on a menhir (Cole 1873: Figure 1). The above examples suggest, to some extent, the interest of the megalithic community in the cosmic objects. At several places, it has been observed that the megalithic monuments are aligned in the east and west directions, probably suggesting some relationship with the rising and setting sun.

With a view to verifying the hypothesis of astronomical relationship of the megalithic monuments, the present author has explored some regions in Andhra Pradesh and Karnataka to study megalithic sites having menhirs. This approach was adopted as it was felt that the alignments and avenues are best suited to determine directional features, unlike the stone circles, cairn burials etc., which are round and cannot help in determining the orientations. Though, the dolmens can be used to determine the directions, the alignments could be more precise.

With the above objectives in mind, literary survey was first taken up to find references to sites with megalithic alignments and avenues. Allchin (1956: 133-5) reported alignments from Hyderabad, Gudebelur, Gopalpur and Devarkadra. A survey of these sites revealed that most of these monuments have been completely destroyed without any trace. Probably, the site of Mudumal is mentioned as the Gudebelur site, as the places are separated by about 6 km and Gudebelur is a well-known place, located on the highway, that was prominent since very early period. Fortunately, the monuments at Mudumal are well preserved (Figure 8) as the local people have some superstitious belief as mentioned later in this paper. The Annual Reports of the Archaeological Department of His Exalted Highness the Nizam's Dominions reported several megalithic sites with alignments such as Hanamsagar, Ivathalli and Shakapur (Yazdani 1931: 44). The present author studied the alignments at Mudumal near the Muraridoddi village (Rao 2006: 421-432). Later Kameswara Rao and his team also has studied the alignments at the same site (Kameswara Rao et al. 2011: 211-220).

REPRESENTATION OF URSA MAJOR CONSTELLATION

Mudumal (16.379156N, 77.411489E) located in the Mahbubnagar district of the Telangana state is a remarkable megalithic site as it provided the earliest depiction of night sky from South Asia. One of the most significant discovery from this site is the physical representation of the constellation Ursa Major also known as Great Bear (Figures 9 and 10). This constellation is known as 'Saptarshi Mandala' in Indian mythology and folklore and has a significant association with various traditional rituals of several Indian communities. Another important aspect is that the group of these seven stars forming a rectangle attached with an arm are used, since time immemorial, to locate the north star or pole star which indicates the northern direction, as the top two stars of the rectangle are always aligned in line with the pole star. The representation of the group of stars depicting the Ursa Major constellation along with the neighbouring stars was found on a squarish, table-like rock having a flat slanting top, which appears to have been delib-

Figure 9 Stone with cup-marks depicting Ursa Major, Mudumal

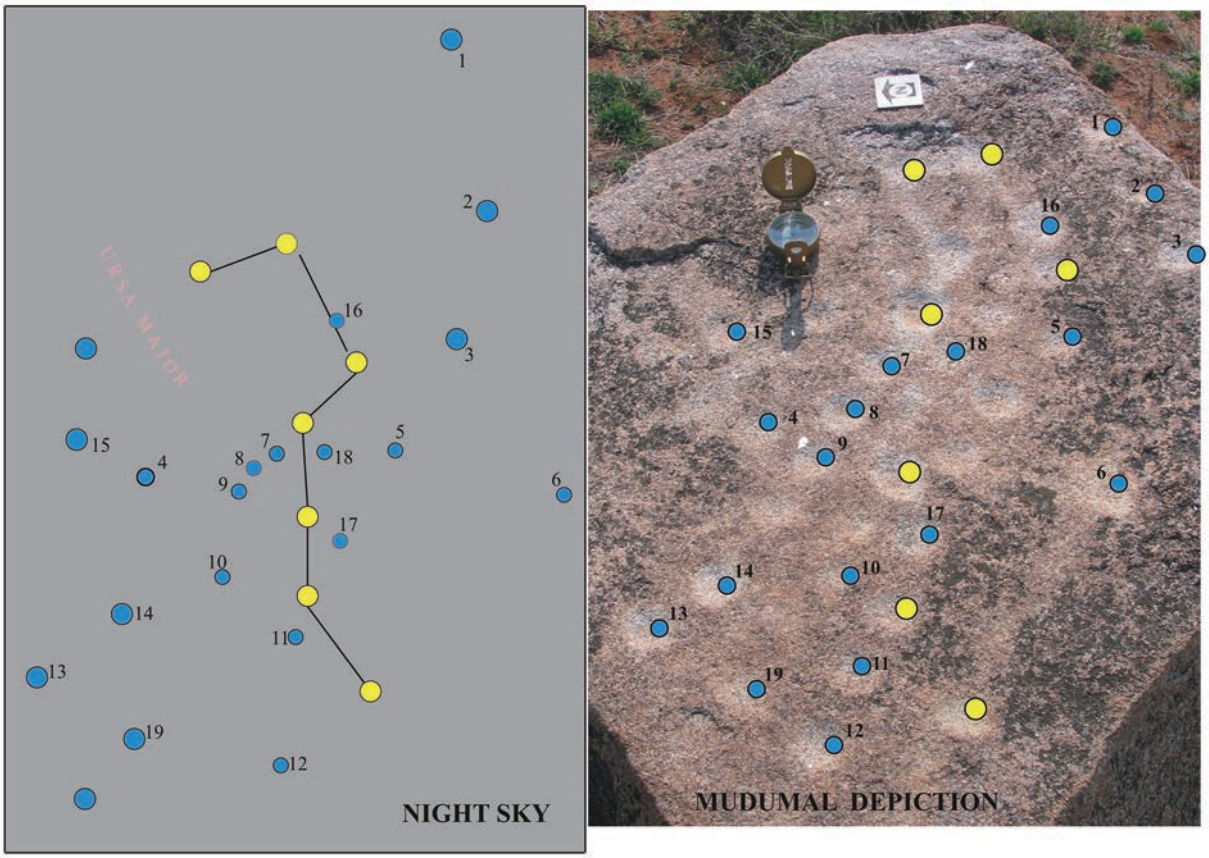


Figure 10 Comparison of the Mudumal depiction with sky chart

erately planted by the megalithic people to plot this constellation in the form of 'cup-marks', each of which have about 4 cm in diameter with a shallow depth of less than half a centimetre (the stone containing the sky map is located on the south-western periphery of the site on an elevated place surrounded by megalithic stone circles. This 'sky map' is probably the earliest known such physical representation of the night sky from India. Tentatively, this 'sky map' could be dated to around 1000 BC, considering the general chronology available for the Indian megaliths. It is remarkable that the megalithic people (or artist) could draw the sky map with such accuracy that the seven stars along with the neighboring stars were plotted very faithfully in a period when instrumental aids were not available. One of the significant aspects of this representation is that the top two stars of the rectangle are aligned to the north, as in the case of the real constellation. This is definitely a confirmatory factor to the identification of this representation as that of the Ursa Major.

The reasons for plotting this constellation are not clear. We have to note that this representation is plotted on a stone planted on the highest point in the locality. Determining north during night by the people having knowledge to identify the north star is easy. However, during the day, when the stars are not visible, determining the exact north is difficult by depending on the sun as the direction of its movement in the sky changes seasonally, relative to earth (apparently only, as it is actually the rotation of the earth). Probably due to this reason, the megalithic people at Mudumal wanted to have a bearing point of one of the prominent cardinal directions. This also must have been required for planning the intricate layout of the complex of menhirs found at this place.

The Mudumal site has more than 80 menhirs arranged in different formations and rows. The central area of the complex has a concentration of about 80 tall (up to 14 feet) menhirs which are arranged in rows forming alignments and avenues. The rows are oriented in different directions. A study of the complex on the days of solar significance like the days of summer and winter solstice revealed that one particular row aligns with the Sun in the morning and another row in the evening. For example, on December 21 in 2005, it was observed that three of the tall menhirs align with the setting Sun (Figure 11). Thus, on the days of solstice, a total number of four rows are aligned to the Sun. The area with the larger menhirs also has a formation of stones arranged in concentric circles with standing menhirs interspersed with horizontal blocks (Figure 12). It has been observed that, two of the taller menhirs of this circle align with the Sun in both morning and evening on the day of equinox. On the whole it appears that this megalithic complex served as an astronomical observatory, both in the day as well as in the night. This information must have been used to determine the orientations and for understanding the seasonal variations and also probably for working out the calendars.

The Mudumal site being so important as it served as an astronomical observatory, which could help the ancient community in understanding the seasonal changes and in working out the calendars, certainly needs to be preserved well. Probably, with this aim in mind, an interesting myth was floated by the local community. They say that the tall-standing menhirs are the people cursed by Goddess Ellamma and the smaller stones are the cattle, which were turned into stones. As per the story, long ago, when the farmers were busy in their cultivation, they request Goddess Ellamma to tend their cattle. And for the task they promise to give a basket full of gold. When it was time to present the gold, the farmers fill the basket with husk, and only on the top, they spread gold coins. When Ellamma pushes her hand into the basket, she realizes the trick played by the farmers. Then she curses the farmers and their cattle to become stones. Due to the prevalence of this myth, the local people are afraid of causing any damage to the menhirs and the

Figure 11 Sunset observation on December 21, 2005, Mudumal

Figure 12 Circle of Menhirs, Mudumal

Figure 13 Cist and skeleton aligned to north, Gajagirigutta

Figure 14 Ortholes in successive circle of slabs, Iralabanda

alignment stones.

A thorough study of the megalithic monuments from India would probably reveal such astronomical features from other sites as well. At several megalithic sites, it has been observed that the burial pits, skeletal remains, cists and port-holes are arranged to conform to particular orientations. At Gachibowli, it has been observed that the rectangular burial pit has its longer axis aligned in the north-south direction with a precision of less than 3° deviation when compared to the Polaris (Rao 2006: 429). Similarly, at Gajagirigutta in the Jangaon district of the Telengana state, one of the sites recently excavated by the author, it has been noticed that the cist as well as the skeleton has been exactly oriented in the north-south orientation (Figure 13). At Iralabanda in the Chittoor district, Andhra Pradesh, it has been noticed that the successive slabs of the slab circles have their port-holes arranged in such a slanting manner (Figure 14) that the rising sun shines directly into the chamber of the dolmen, which is in the center of the concentric circles. All these evidence indicate that the megalithic community has sufficient astronomical knowledge, which has been used by them in determining the orientations and in calculating the seasonal variations.

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IRON AGE CULTURE IN KERALA, SOUTH INDIA: AN APPRAISAL

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INTRODUCTION

The antiquity of burial practices in India can be stretched to the Mesolithic period (Allchin and Allchin 1982: 62-96) and these burial practices continued to exist in different modes in the subsequent Neolithic and Chalcolithic periods (Leshnik 1974: 21-5). The 'Megalithic' burials that appeared during the onset of iron technology became largely popular in the southern part of India and to some extent in northern India too. This tradition continued to prevail during the Early Historic and later periods and even during the modern days in certain regions.

The term 'Megalith', meaning 'huge stone', has been derived from the Greek words *megas* (huge) and *lithos* (stone) (Wheeler 1959: 150). Though this term was initially used to denote the burial monuments with huge stone associations, the cultural realms including the habitational contexts identified with the presence of Black-and-Red Ware and other related cultural materials were started to be designated as 'Megalithic'. In spite of several discussions on the inaptness of this term, it has been widely accepted by the academicians and become a well-established term (Mohanty and Selvakumar 2002). The Megalithic culture possesses several similarities and regional variations in their material culture.

KERALA: THE REGION

The State of Kerala, an elongated strip of land, is situated in the southwest of India (Latitude 10.8505 N; Longitude 76.2711 E). The geographical features such as the Arabian Sea in the west and the Western Ghats in the east play a crucial role in the formation of the cultural identity of the State of Kerala. The State shares its border with Tamil Nadu in the south and Karnataka in the north. It has been divided into 14 administrative districts. Physiographically, the region can be divided into the Low land (the coastal region having less than 10m MSL), the Mid land (the laterite-capped areas between 30-200 m MSL), the Foot hills (the Western Ghats ranging from 200-600 m MSL) and the High land (the steeply rising high ranges between 600-2700 m MSL). This division indicates the undulated nature of the terrain. There are a few natural passes/gaps along the Western Ghats on the east, namely Aruvamozhi and Chengottai in the south and Palakkad in the centre. The climate is featured by heavy rainfall (the average annual rainfall is 300 cm) and hot and humid weather. The State of Kerala, reputed for the presence of water bodies, consists of 44 rivers and its tributaries, back waters, estuaries and ponds. The length of the coastal line is 560 km. The state has a span of 38,864 km^2 area, which is constitut-

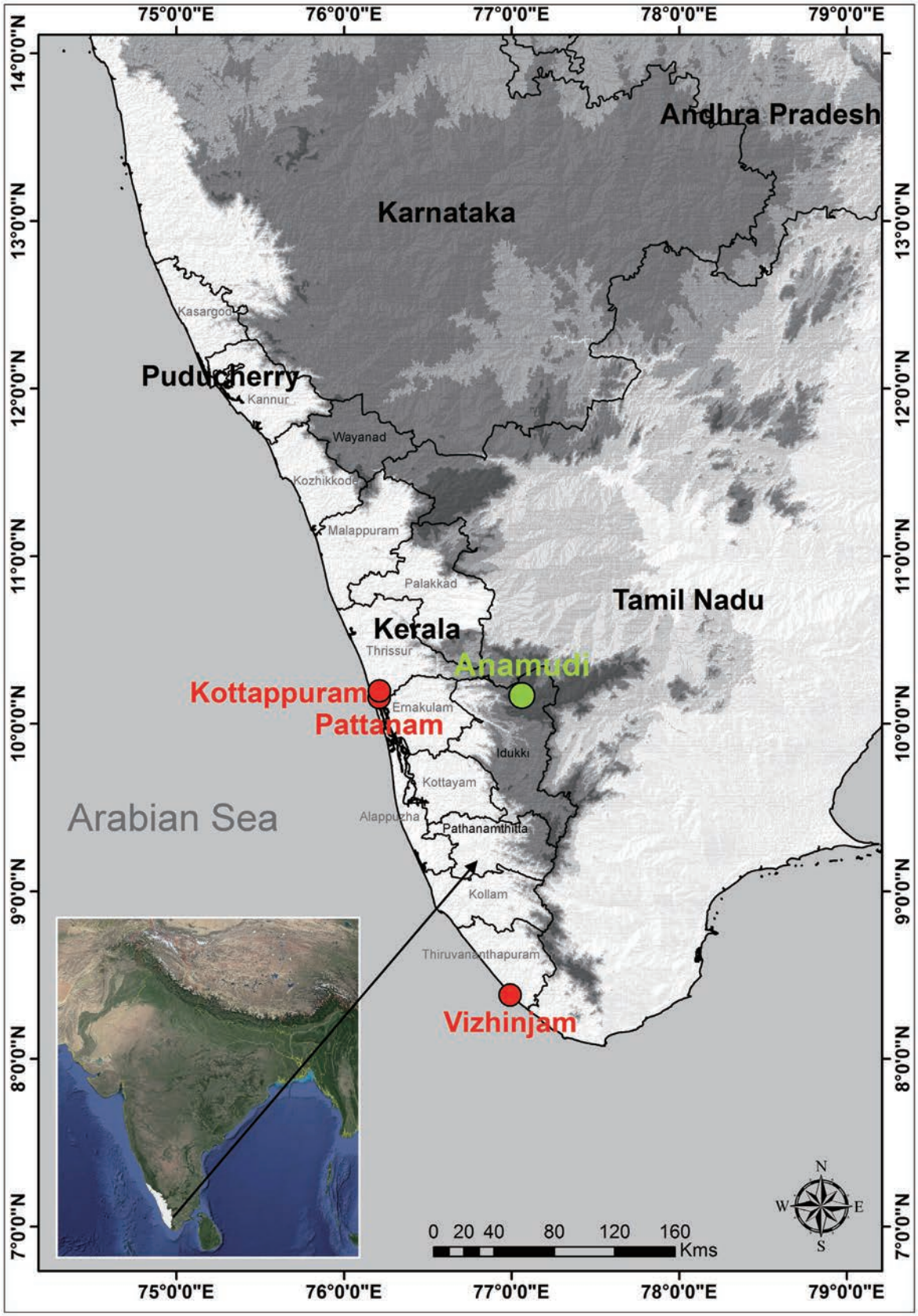


Figure 1 Map of Kerala showing elevation features

ed of hard rock crystalline and soft sediments (Soman 2002; Rajan and Kumar 2005) (Figure 1).

The prehistoric occupation of Kerala was in absolute obscurity till the discovery of Palaeolithic sites in 1974 by Rajendran (1989). As per the evidence of the Chopper-Scraper-Flake tradition of Palaeolithic tools, the prehistoric occupation in Kerala was dated back to circa 70,000 BP. Subsequent discoveries of microlithic tools and excavations at rock shelter sites revealed the Mesolithic occupation that could be datable between 10,000 BC and 3,000 BC. On the basis of the stray evidence of polished celts, the Neolithic period is attributed between 3,000 BC and 1,000 BC. Interestingly, a distinct Chalcolithic phase has not been identified in Kerala, instead the Neolithic phase gives way to the Iron Age which is referred to as Megalithic culture. Thus, the Megalithic cultural period in Kerala spans through the Iron Age (beginning of the iron technology/Megalithic burial practices to third century BC) and the Early Historic periods (third century BC to fifth century AD) (Gurukkal and Varier 1999: 103). The Early Historic period can be designated based on the evidence such as Roman coins, Punch-Marked coins, archaeological excavations and inscriptions.

Different terms are being used to denote the Megalithic period in Kerala such as Pandoo Coolies (Babington 1823), Death houses (Logan 1887: 181), Prehistoric monuments (Iyer 1929), Pandukal complex (Leshnik 1974), Early Iron Age Culture (Satyamurthy 1992), Protohistoric Culture (Rajendran 1999), Iron Age-Early Historic Culture (Krishnan 2017), and more commonly the Megalithic Culture. However, the 'Megalithic Culture' is the term used mostly in this paper for further discussions.

HISTORY OF IRON AGE RESEARCH IN KERALA

The history of the archaeological research in Kerala can be placed under two broad phases, viz. the Pre-independence phase (before 1947) and the Post-independence phase (after 1947). The former is generally referred to as the phase of antiquarian activities and the latter is considered to be the phase of problem-oriented or systematic researches (Peter 2002; Darsana 2009). However, some of the works done during the former phase are credited with high academic excellence more than mere antiquarian activity, for instance, Logan's (1887) works in northern Kerala are commendable with regard to his logical interpretations. On the other hand, a few works that came out during the Post-independence phase do not possess any academic orientation and are somewhat equal to the antiquarianism.

Pre-independence phase

The discovery and excavation of Megalithic burials at Chattanparamba in the Kozhikkode district by J. Babington in 1819 (Babington 1823) is considered to be the first reporting of Megalithic remnants from the Peninsular India. Babington also reported Megalithic burials such as Urns, Rock-Cut Chambers and Umbrella Stones from the other parts of Malabar. Subsequent to this, noticeable published works are available of Logan (1879, 1887), Ward and Conner (1863), Robert Sewell (1882), F. Fawcett (1896), Longhurst (1915), Joseph (1928), L.A. Cammiade (1930), Krishna Iyer (1929, 1938-39), Plenderleith (1930), Aiyappan (1933), Poduval (1939-40), Krishnaswami (1949), Govinda Menon (1937), Raghavan (1936), Srinivasan (1946) and Codrington (1930).

It should be noted that a few publications have put forward some attributions to Megalithic remains without having much rationale. For instance, Walhouse (1882) regarded them to be the remains of virgins sacrificed by the local chieftains for the welfare of their country and Jouveau-Dubreuil (1922) attributed the Vedic connection and the sacrificial functions to them. On the other hand, Darsana (2009: 178-9)

has explicitly pointed out the value of the contributions made by the so-called "antiquarians" during the Pre-independence phase. Many of these "antiquarians" were keen in documenting the remains as well as in interpreting the data. Most of the facts we know about the Megalithic culture today are originally observed by them.

Apart from reporting and describing them, the "antiquarians" were concerned about the preservation of such discovered artefacts as indicated in the report of Longhurst (1915: 160) about handing over the remains to the Madras Museum for the safe keeping. Several reports were comprehensive and included the drawings and complete description of the findings. The best example is the earliest report by Babington (1823) which clearly portrays the antiquities. So that even today one can easily observe the features which are required to study their stylistic affiliations. But, presently even in this digital age, many of the works including some Ph.D. dissertations do not present their data properly.

Attempts have been made by Joseph (1928), Srinivasan (1946) and Codrington (1930) to connect the Megalithic burials and the burial practices mentioned in the ancient Tamil *Sangam* literature which speak about the ancient Tamil country that included the Tamil Nadu and Kerala regions. Scientific analysis of black glaze of the black polished pottery from the Wayanad region is one of the examples for the earliest studies in application of scientific techniques (Plenderleith 1930).

Post-independence phase

The studies happened during the Post-independence phase was mostly problem-oriented and the fixing of chronology was on the top among the prioritized research questions. Thapar (1952) was among the first to ascribe the date, the third century BC to the first century AD to the urn burials at Porkalam. This dating was based on the typological similarity with the Brahmagiri excavations of Wheeler (1947). Krishnaswami (1949) introduced a comprehensive typological classification of the Megalithic burial monuments; otherwise, the monuments were earlier called by different names including the colloquial ones. The study and documentation of Rock-Cut Chambers of the Cochin region by Sharma (1956) was a remarkable one in terms of clarifying the contextual aspects of them.

The doctoral research by George (1975) was the first contribution from a university on Megalithic archaeology of Kerala, as part of which several new discoveries and excavations of Megalithic sites at Machad and Pazhayannur were done (Mehta and George 1978). Leshnik (1974) and McIntosh (1985) studied on the typological comparison of South Indian Megalithic remains and attempted to ascribe chronology to them. A study of interpretative nature on Umbrella Stones was remarkable (Nayar 1989).

The excavation of urn burials at Mangadu in the Kollam district was remarkable for its publication of a comprehensive report and also for bringing out radiocarbon dates of charcoal samples which pushed back the antiquity of the Megalithic practice in Kerala to the early part of first millennium BC (Satyamurthy 1992) (Table 1). Short reports on the excavations of Megalithic remains were published by Raghavan and Devasahayam (1974), John (1974, 1982) and Raman (1976). S.P. Thampi (1975, 1983) brought to light the significance of rock art sites in Marayur and also researched on the archaeology of the Anjunad valley including the Megalithic remains.

Rajendran (1989, 1999, 2005) has the credit of discovery of several Megalithic sites. The importance of scientific analysis and dating of Megalithic remains were propagated through his interdisciplinary researches. The attempts of Fluorine test to relatively date child bones from Poredam (Rajendran and Kshirsagar 1993), and the metallurgical characterization of the gold and copper objects from Arippa were

noteworthy (Rajendran and Iyer 1997).

After the 1990s, several doctoral researches were undertaken. Paulose (1990) studied the regional aspects of the Megalithic remains of Palghat through a fieldwork-based archaeological research. Another region-specific study was undertaken on the Megalithic and Early Historic periods of the Periyar and Ponnani River basins by Rajan Chedambath (1997). The study by Shinu Abraham (2002) was on the intra-site and inter-site variability and the ceramic assemblages of the Palghat region. Jenee Peter (2002) has done a compilation of data on Megalithic remains till then and discussed the distribution of Megalithic monuments in various parameters. The works of Jayashree Nair (2005, 2007) was based on the excavation of Rock-Cut Caves and the explorations in the Kasargod region, and interpretations were drawn with regard to the landscape. Nihildas (2014) researched on the rock art and the Megalithic aspects of the Anjunad Valley in the Marayur region. The study of archaeology of the Pamba basin by Ambily (2017) brought to light a few discoveries and presented the results of the excavation of a Cist burial at Niramakulam. Dineesh Krishnan's (2017) focus of research was the settlement pattern of the Iron Age-Early Historic period in central Kerala. In addition, ethnographic and ethnoarchaeological studies have also been attempted by a few (Iyer 1967; Kumar 2006a; Poyil 2007, 2013).

Rajan Gurukkal and his team from the Mahatma Gandhi University, Kottayam excavated burials at Anakkara in the Malappuram district in 2008 for which publications are unavailable (c.f. Darsana 2010). The works of the State Department of Archaeology and the Archaeological Survey of India have appeared in Indian Archaeology - Review (IAR 1961-62, 1981-82: 27, 1982-83: 36, 1990-91). Detailed reviews on Megalithic researches in Kerala are available in publications as well as doctoral dissertations (Gurukkal and Varier 1999; Darsana 2006, 2009, 2010; Peter 2002; Nihildas 2014).

On the basis of the nature of research, the recent publications on Megalithic culture (i.e. during the last two decades) can be categorized into six groups as following;

Exploration/Survey Reports

A category of publications which are brief reports of explorations/surveys conducted in smaller geographical units such as river belts, taluks, panchayats, etc. (e.g. Rajesh 2014; Jaseera 2016). This category may include accidentally exposed Megalithic remains as well.

Preliminary Excavation Reports

Short accounts of findings during the excavations are another category of publications which may include the results of salvage and formal excavations (e.g. Kumar and Ambily 2014; Nambirajan and Kumaran 2011).

Report of Accidental Discoveries

A large number of publications are available in the form of site reporting and discoveries. Many of them are the results of accidental discoveries which are exposed during modern digging and earth removal for constructional and agricultural purposes (e.g. Kumar 2006b).

Dissertations

Dissertations or projects are done by the students as part of the partial fulfilment of the graduate, postgraduate, M.Phil. and Ph.D. programmes in various universities and colleges. Many of such works bear information about new sites in addition to the earlier reported sites. An exhaustive list of references available to the author is given for information, and needless to say much more works of such a kind can be found unpublished in several institutions (Liju 2006; Renjinimol 2013; Pillai 2014; Fasalu 2014; Soorya 2014; Kumbodharan 2016; Ramya 2016; Sujanpal 2016; Aswani 2017; Hasanath 2017; Raja 2017; Unnimaya

2017; Sandra 2018). Several of them deal with a small geographical unit and hence they present the results of intensive surveys.

Interpretative Nature

There are publications that attempt to synthesize new views based on the interpretations of the existing information (e.g. Gurukkal and Varier 1999; Kumar 2003; Rajesh 2017). Several aspects of the Megalithic life styles can be inferred from this interpretative approach. While considering the nature of the available Megalithic cultural assemblages, some of the observations tend to be speculative or illogical. Many of them lack a suitable theoretical framework to explain the cultural aspects.

Newspaper reports

Newspapers are another important source of information for the existence of Megalithic vestiges in some parts of Kerala. Such reports are usually presented along with the statements of some archaeologists on the genuineness of artefacts and the context of the findings. They often bear photographs of the artefacts too. The statements are given mostly by a representative of central or state departments of archaeology or academicians who are familiar with the Megalithic culture (e.g. Govind 2018). Hence, mostly such reports can be considered reliable to be accepted into the database of sites.

The above categories of publications perhaps with the exception of Newspaper reports often carry interpretations and some observations on the Megalithic culture. Many of them explain the regional peculiarities of artefacts and the burial monuments, the distribution pattern, the location (geo-coordinates), photographs or drawings of artefacts and the burial architecture, etc. Moreover, all these together build a database which can be useful for future researches in further levels of interpretations and varied applications. Yet, it should be noted that this database also suffers from its own limitations such as the lack of uniformity, the poor quality of presentations, etc.

Another important issue is the direct involvement of non-archaeologists and amateurs in the Megalithic research in Kerala through conducting informal excavations and explorations. This group includes non-archaeologists from academic departments of universities and colleges, school teachers and also common people. This tendency has created several adverse effects. Most severe among them is the destruction of valuable archaeological evidence. The material subjected to their study remains unknown to the academic community because of the lack of any publication on it. Another problem is the unsafe and unscientific custody of delicate artefacts which become unavailable for further studies. For instance, during the author's field visits to Palakkad, the Megalithic artefacts were found to be kept in the Government Lower Primary school at Bhimanad, and in the M.E.S. College at Mannarkkad.

Darsana (2010: 104-5) has given a list of 38 sites as excavated in Kerala. In addition to them, several other sites have been excavated later. As per the data based on a project by French Institute of Pondicherry titled as 'Historical Atlas of South India' (*http://ifpindia.org/histatlas/*), the total number of Megalithic sites in Kerala are 866. It should be noted that the survey under this project was incomplete since several places were not surveyed. The total number of sites is likely to increase since several intensive surveys on regional levels recently brought to light many new sites which were not reported earlier (e.g. Kumbodharan 2016).

MEGALITHIC BURIAL TYPOLOGY

The burial typology of Megalithic monuments has been discussed widely (Krishnaswami 1949; Rao 1972; Leshnik 1974; Allchin and Allchin 1982; John

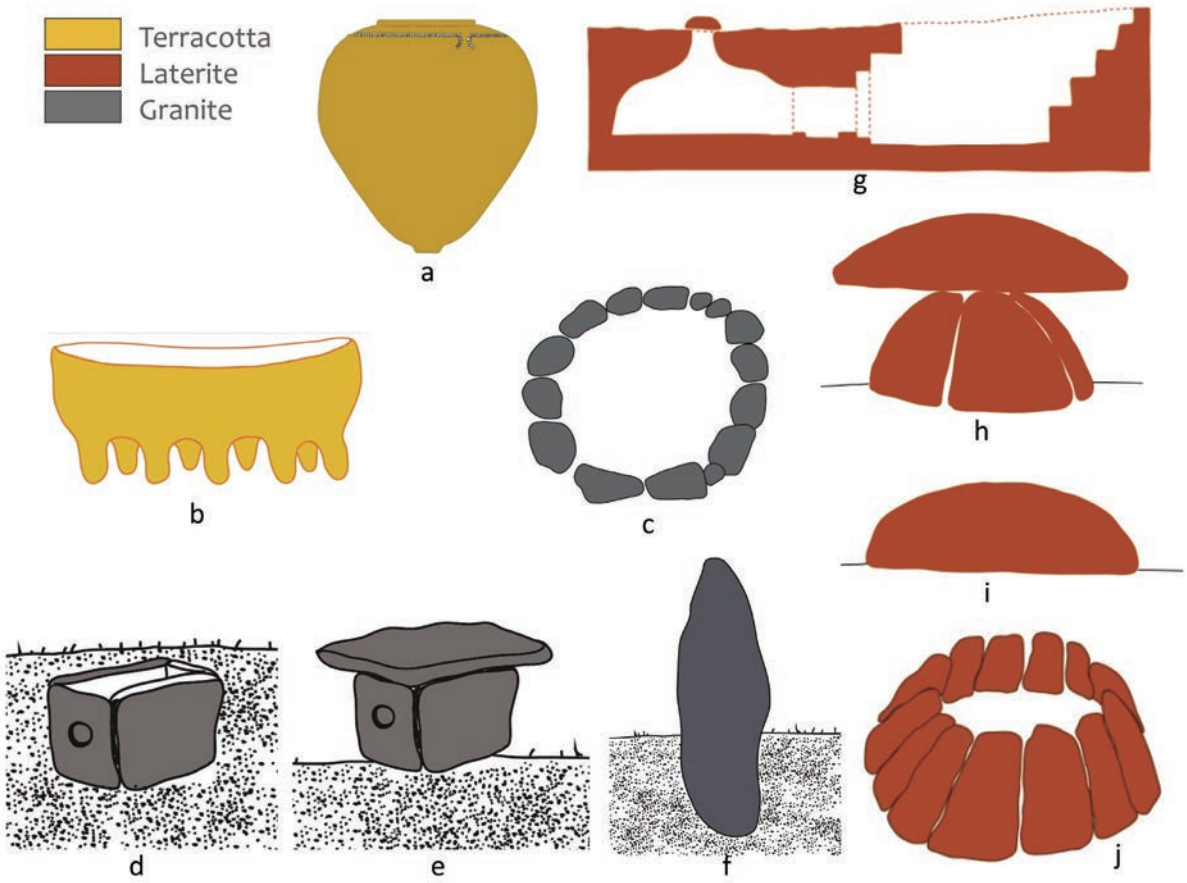


Figure 2 Illustration of Megalithic burial types in Kerala; a. Urn, b. Sarcophagus, c. Stone Circle, d. Cist, e. Dolmen, f. Menhir, g. Rock Cut Chamber, h. Umbrella Stone, i. Cap Stone, j. Hood Stone

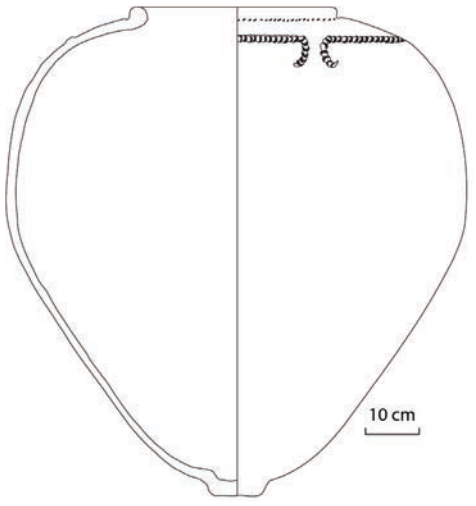


Figure 3 Illustration of burial Urn from Nannagadikkunnu, Palakkad

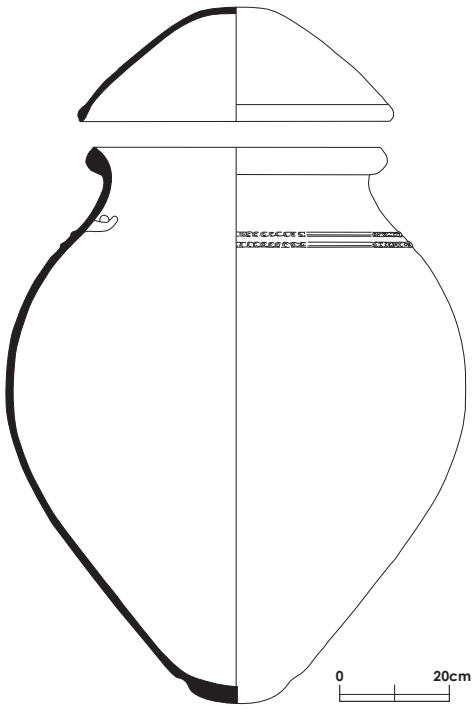
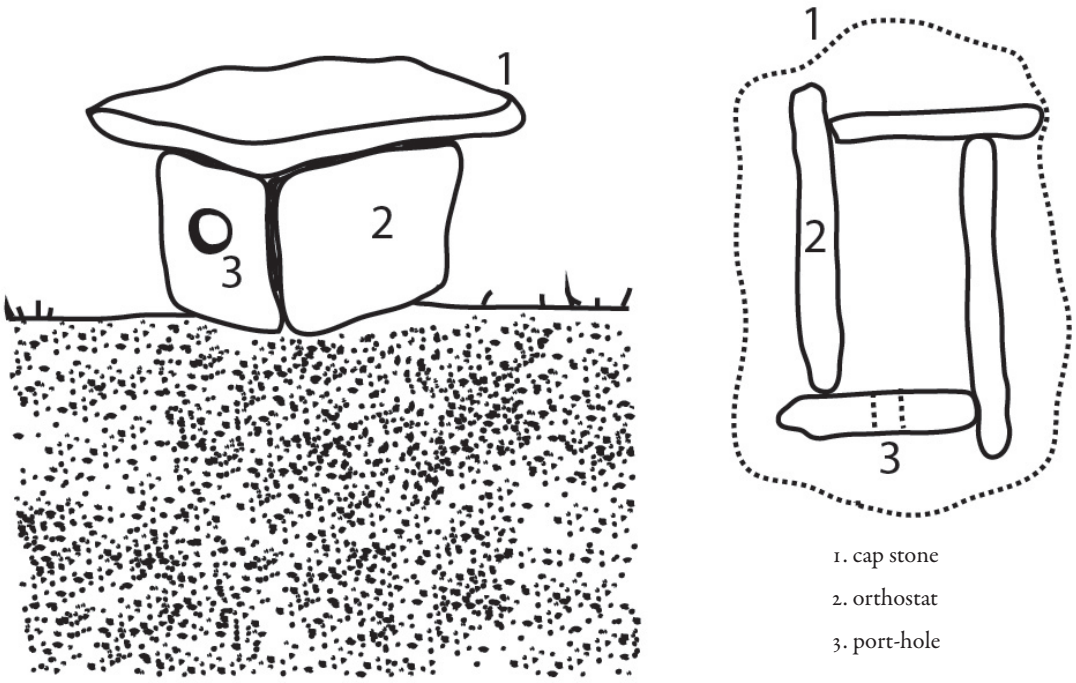


Figure 4 Illustration of burial Urn showing hook inside the rim and lid from Porkalm, Thrissur (Thapar 1952)

Figure 5 Sarcophagus revealed at Koyilandy, Kozhikode (Courtesy: The Hindu Daily)

Figure 6 Dolmen at Marayur, Idukki



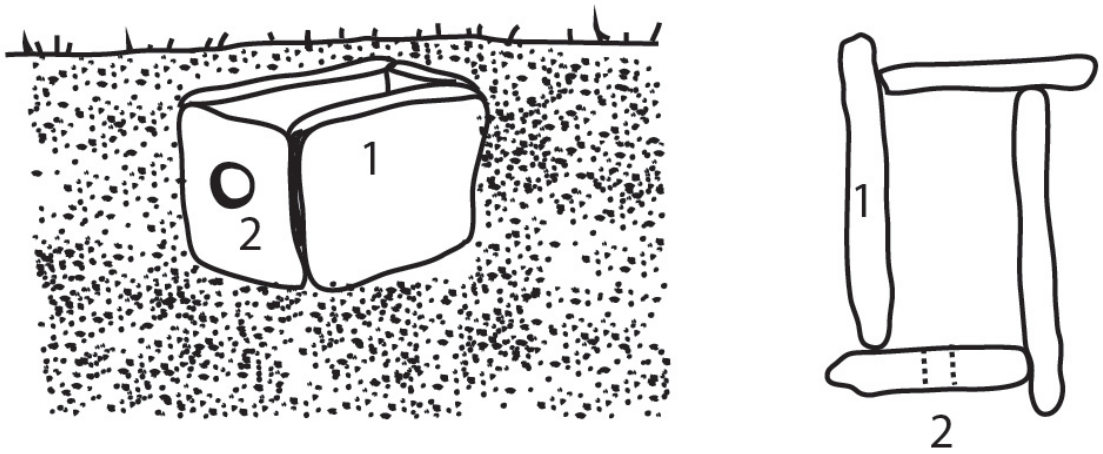
1. cap stone
2. orthostat
3. port-hole

Figure 7 Illustration of dolmen showing ground plan and elevation

Figure 8 Dolmen with U shaped port hole at Marayur, Idukki

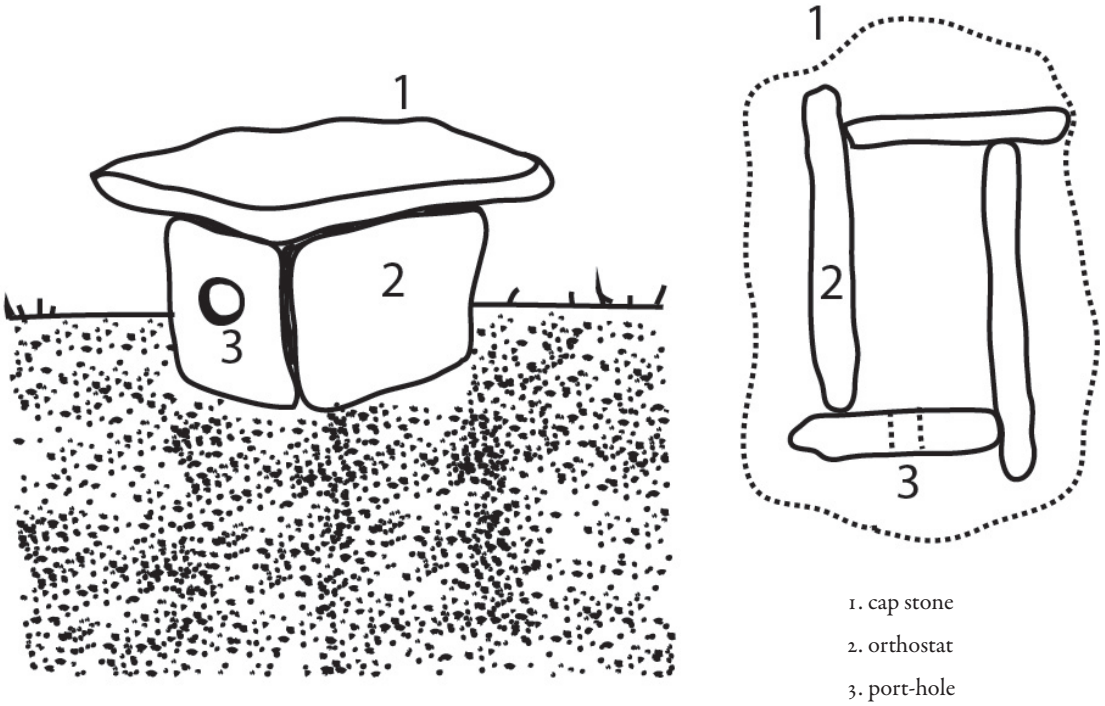
Figure 9 Dolmen with dressed wall casing at Marayur, Idukki

Figure 10 Dolmen with lost capstone showing miniature chamber inside



1. orthostat
2. port-hole

Figure 11 Illustration of Cist showing ground plan and elevation



1. cap stone
2. orthostat
3. port-hole

Figure 12 Illustration of Dolmenoid Cist showing ground plan and elevation

1985; Rao 1988; Moorti 1994; Peter 2014; Nihildas 2014). The classifications of different scholars give different categorizations, and an unanimous opinion has not been formed. Yet, a broad categorization gives two major types; sepulchral and non-sepulchral (Moorti 1994).

The sepulchral kinds of Megalithic burials are generally noticed as an interment space beneath the earth which accommodates a variety of burial goods. This space is usually found in the form of Urns, Sarcophagi, Pits, Chambers of stone slabs or Rock-Cut Chambers. These are externally marked by large stone/s arranged in particular fashions such as Stone Circle, Cairn Circle, Umbrella Stone, Capstone, Menhir and so on. A combination of more than one such feature is common. Certain pit burials and urn burials do not

Figure 13 Menhir at Ramavarmapuram, Thrissur

Figure 14 Umbrella Stone at Anthialamkoodam, Malappuram

Figure 15 Umbrella Stone at Cherumanangad, Thrissur

Figure 16 Capstone at Cherumanangad, Thrissur

Figure 17 Hood Stone at Cherumanangad, Thrissur

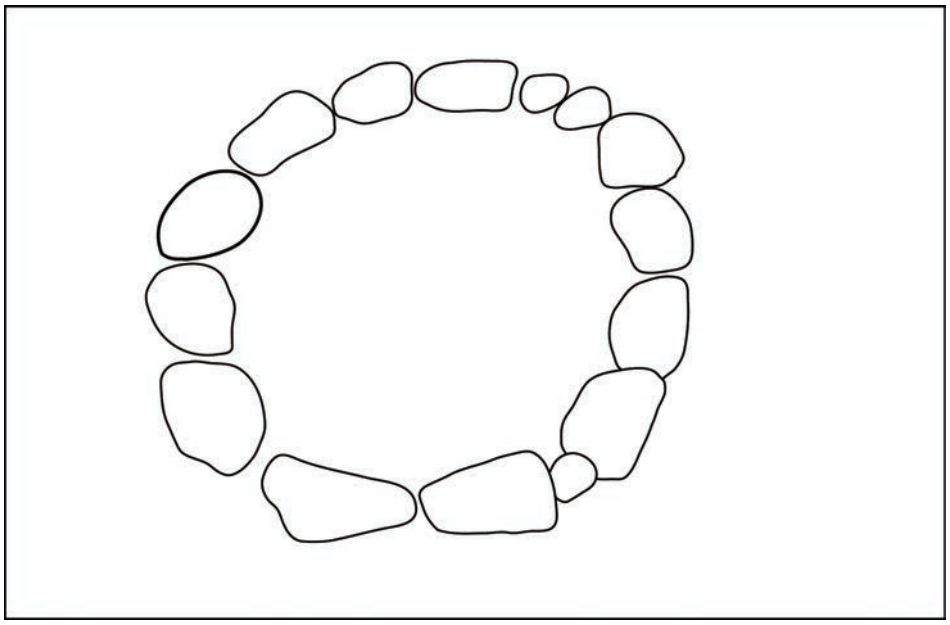


Figure 18 Illustration of Stone Circle

possess surface markers. The non-sepulchral kinds are apparently symbolic in nature where no artefactual association is noticeable. The burial types such as Menhirs, Umbrella Stones and Dolmens are mostly like that. Brief descriptions on the Megalithic burial types are given here with an emphasis on features peculiar to the region of Kerala (Figure 2).

Urns

The Urn burial is a practice of placing the burial goods

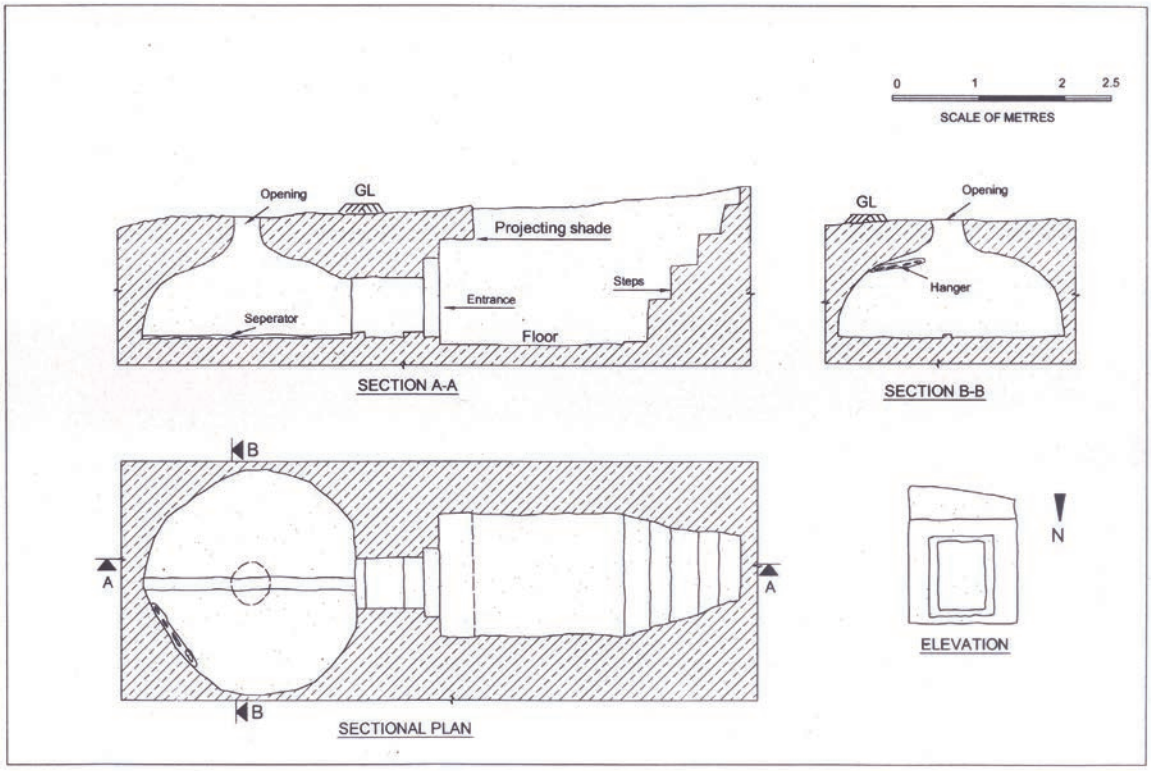


Figure 19 Illustration of Rock Cut Chamber showing ground plan and elevation at Ummichipoyil, Kasargod (Courtesy: Archaeological Survey of India, Thrissur Circle)

Figure 20 Bench inside the Rock Cut Chamber at Cheroopa, Kozhikode (Courtesy: Aswani O.K.)

Figure 21 Three hemispherical projections inside the Rock Cut Chamber at Cheroopa, Kozhikode (Courtesy: Aswani O.K.)

Figure 22 Rock Cut Chamber at Kuttikkol, Kasargod

in large-sized pottery like jars. They are found to be placed mostly in pits, but they are also noticed to be present in Cists and Rock-Cut Chambers. Urn burials beneath the earth are usually marked by different kinds of stone arrangements superficially such as Stone Circles, Capstones, Umbrella Stones, etc. In certain occasions, urns are noticed without any such markers where the markers might have been lost or disturbed. The Urns are made mostly of Red Ware or Black-and-Red Ware with a very coarse fabric and are ill fired. The rim is thick and short. Multiple techniques must have been used for making them. They usually possess a pyriform base sometimes with a disc-like lower portion. Appliqué designs usually referred as rope designs, nail impressions and finger impressions can be seen running parallel on the shoulder portion of the Urns. The designs look like a rope tied around the Urn that does not meet at one point, instead hatches, and turn slightly downward (Figure 3). Sometimes these designs appear in more than one row close to each other. Some Urns possess a small hole in the lower part of the body. Logan (1887: 182) observed this feature in connection with the symbolism of *bhudevi* and the concept of return back of the mortals into the mother earth. Some others have pointed out it to be the reuse of storage jars for burial purpose (Kumar 2003: 51). According to them, the hole is originally for taking out the grains from them. Some Urns possess a small hook like projection in the inner surface of the Urn just below the rim which was probably used for hanging some articles like a garland made of stone beads (Thapar 1952) (Figure 4). Though the Urns vary in size and shapes, certain features mentioned above are commonly found in most of the urn burials. Hence the identification of Urns can be easily made without having much ambiguity even when the storage jars of other cultural contexts are met with. The Urns often possess a roughly conical-shaped pottery lid or a stone slab as the capstone placed above. Urn burials are the most widely available type in Kerala. Anyway, the concentration of Urn burials is noticed to be higher in low land regions. Urns are locally called as *nannangādi*, *mutumakkattāzhi*, etc.

Sarcophagi

Sarcophagi are the zoomorphic forms of terracotta coffins with legs. They might have depictions of animal face (mostly bovines) (Figure 5). Sarcophagi can be considered as a variant form of burial Urns-like legged pottery. They are found in pit burials or other forms of burials mostly in Rock-Cut Chambers. In Kerala, Sarcophagi have been reported from a few sites such as Chevayur, Koyilandy (Kozhikode district), Perunkulam and Kattakambal (Thrissur district).

Dolmens

Dolmens are made of four stone slabs called orthostats arranged in a pattern that makes a square box-like structure. Another big stone slab is placed above this as a capstone (Figures 6 and 7). Dolmens are seen over the ground. They are made usually of granite stone, but rarely laterite was also reported. Some of them have an opening called port hole in one of the orthostats. The shape of the port hole varies from circular, U-shaped and square-shaped (Figure 8). Dolmens are found single and also multiple in cluster on a platform made of stone rubbles and soil filling. Some of such platforms possess definite shapes like a rectangle or a circle with an outer lining of roughly dressed stones. At times, Dolmen cluster platforms are given with an additional wall-like structure of dressed stones (Figure 9). Dolmens rarely possess burial goods within them; or they are easily lost due to their visible nature. Some Dolmens have a small chamber made of small stone slabs on one end (Figure 10). Dolmens are commonly found in the highland regions where they are located directly over the granitic bed rocks with the built platform. Sometimes Dolmens are made in elongated shapes in which instead of four orthostat slabs, more of them can be seen. Dolmens are locally called as *mu-*

niyara.

Cists

Cists are similar in structure to the Dolmens, but the main difference is that Cists are seen below the ground. Cists are generally marked externally by Stone Circles. Usually Dolmens, they contain burial goods inside. They are found in single and multiple chambers (Figure 11). Cists are distributed all over Kerala. Many Cist burial sites have been excavated such as Kadanad, Niramakulam, etc.

The Dolmenoid Cists are a variant form of Cists and Dolmens as proposed by Krishnaswami (1949). In this type, the upper half portion of the slabbed chamber is projected over the surface and the lower half is buried under the earth (Figure 12). The distribution of this type is mostly seen along the Mid lands. However, it is difficult to distinguish this type from Dolmens and Cists due to the disturbed nature of most of burial sites.

Menhirs

Menhirs are large monolithic stones erected in a perpendicular fashion on the ground. The Menhir at Ramavarmapuram in Thrissur is an example of a huge sized one (Figure 13). In most of the excavated cases, Menhirs were found without association of any burial goods; those can be considered non-sepulchral symbolic burials. But, rarely excavations have revealed urns beneath them. The excavation of a Menhir at Marayur revealed a capstone slab and an urn with iron tools and pottery (Gurukkal and Varier 1999). These are made of granite or laterite. The selection of material depends on the availability of rock types in the surrounding areas. Almost the half portion of the Menhir is visible above ground and the remaining portion is in the soil. The concentration of Menhirs can be noticed in higher numbers towards the high land regions like Idukki. The Menhirs are locally known as *nāttukal* meaning an installed stone. It is also called *pulacchikkal* where the word *pulacch* was derived from the Tamil word *puratchi*, which means fame. Peter (2002) has attempted to correlate the Menhirs and the practice of erection of Herostones by some tribal groups of the Attappadi region in Palakkad. The Menhirs are found as single or multiple. The multiple Menhirs arranged in a row are referred as 'Alignments'. A few Alignments can be seen in the Marayur region.

Umbrella stones

One of the unique forms of burial monuments of Kerala, the Umbrella Stones, as implied by its name, which is a mushroom-shaped structure made of laterite, is found to be well preserved in the sites of Cherumanangad and Ariayannur. A domical capstone is placed over a combination of four orthostats (Figures 14 and 15). These are locally called as *Kudaikkal* or *Kudakkal*. In the Malayalam language, the word *kuda* or *kudai* means umbrella and *kallu* means stone. Umbrella Stones are considered to be the most beautiful among the burial architecture in Kerala. They are observed to be a modified or evolved form of dolmens where four orthostats are placed in slanting positions with the capstone having a domical shape. Some Umbrella Stones in Kasargod exhibit features close to that of Dolmens and these may be considered to be an earlier form of Umbrella Stone which originally transformed from Dolmens. An Umbrella Stone was reported from Kasargod with the upright laterite stones placed in the form of a Stone Circle encircling the Umbrella Stone (Nair 2007). The excavations of some Umbrella Stones revealed nothing beneath them, but in other cases urns and burial goods were recovered. The distribution of Umbrella Stones is limited to northern Kerala, specifically between Thrissur and Kasargod.

Capstones

Capstones or Hat Stones are the domical shaped laterite stones which rest directly on the ground without

having orthostats (Figure 16). Like Umbrella Stones, these monuments are also present in northern Kerala and are unique to the region of Kerala only. They are also found in clusters along with Umbrella Stones. The sites of Cherumanangad and Eyyal are well known examples for the presence of Capstones. Excavations have proved the presence of urn burials beneath them. Locally these structures are called as *Toppikkal*. In the Malayalam language, the word *toppi* means hat and *kallu* means stone. The archaeologists are often confused between the terms, Umbrella Stones and Capstones and hence are used interchangeably by some publications (Gurukkal and Varier 1999).

Hood stones

The Hood Stones are circular alignments of five to twelve orthostats made of laterite (Figure 17). They are arranged similar to the orthostats of Umbrella Stones in slightly tilted positions. They are bigger than the orthostats seen in Umbrella Stones. They may be considered as a variant form of Stone Circles. The Hood Stones may appear as single or in association with other Megalithic types like Capstones, Umbrella Stones and Urn burials. Cherumanangad is an example for the site where Hood Stones are found.

Stone circles or cairn circles

The Stone Circles are arrangements of laterite or granite stone boulders in a circular fashion. The circular arrangements can be noticed with intermittent spacing between the stones in a circle (Figure 18). Sometimes the stones are placed close to each other. The Marayur region shows the occurrence of multiple Stone Circles in a concentric manner. The Stone Circles are usually seen as external markers of the burials like Cists and Urns. Occasionally Umbrella Stones, Capstones and Rock-Cut Chambers can be seen with Stone Circles. Several important excavated sites in Kerala such as Machad, Porkalam, Cherumanangad, Mangadu, etc. are burials marked with Stone Circles.

Cairn Circles are the circular arrangements similar to the Stone Circle, but with additional filling of small and large stone rubbles as a heap in the space inside the circle. Such Cairn Circles can be seen in the Marayur region.

Rock-cut chambers

These are roughly hemispherical chambers scooped into the laterite rock formations. It usually has a domical roof with or without a circular port hole in the centre. A rectangular shaped entrance is also given with stepped cuttings all around. The port hole and square entrance are usually found closed by using dressed laterite stones. Often, an open corridor with a flight of steps leads to the entrance (Figure 19). Inside the chamber, short benches or cots are carved to keep the burial goods (Figure 20). Sometimes a cylindrical pillar is provided in the middle or a partition wall is retained in the centre to support the structure from collapsing. Apart from single chambered structures, the multiple chambered (up to four chambers) are also seen. On the floor, three small hemispherical projections carved closely similar to a hearth have been noticed from the Kozhikode region (Figure 21) (Logan 1879; John 1974; Aswani 2017). Similarly, slightly raised circular platforms with a concave depression in the centre have been observed on the floor (Sharma 1956). These two features apparently function as the stands for supporting the small pottery which are kept as burial goods. These seem to be built-in stands alternative to ring stands and iron tripod stands. Some Rock-Cut Chambers are externally marked with Stone Circle. The dressed laterite stones are inserted into the groove cut on the bed rock surrounding the chamber. Such examples can be seen at Kuttikkol, Anakkara, etc (Figure 22). Several Rock-Cut Chambers were excavated and almost all of them revealed burial goods. Rock-Cut Chambers are unique to the Kerala region, mostly distributed in north Kerala, specifically from Thrissur to further north till Kasargod. One site has

Figure 23 Black and Red Ware pot from Ummichipoyil, Kasargod
(Courtesy: Archaeological Survey of India, Thrissur Circle)

Figure 24 Black and Red Ware goblet from Kallimali, Idukki

Figure 25 Black and Red Ware ring stands from Ummichipoyil, Kasargod
(Courtesy: Archaeological Survey of India, Thrissur Circle)

Figure 26 Red Ware pots from Ummichipoyil, Kasargod (Courtesy: Archaeological Survey of India, Thrissur Circle)

Figure 27 Red Ware legged jars from Ummichipoyil, Kasargod (Courtesy: Archaeological Survey of India, Thrissur Circle)

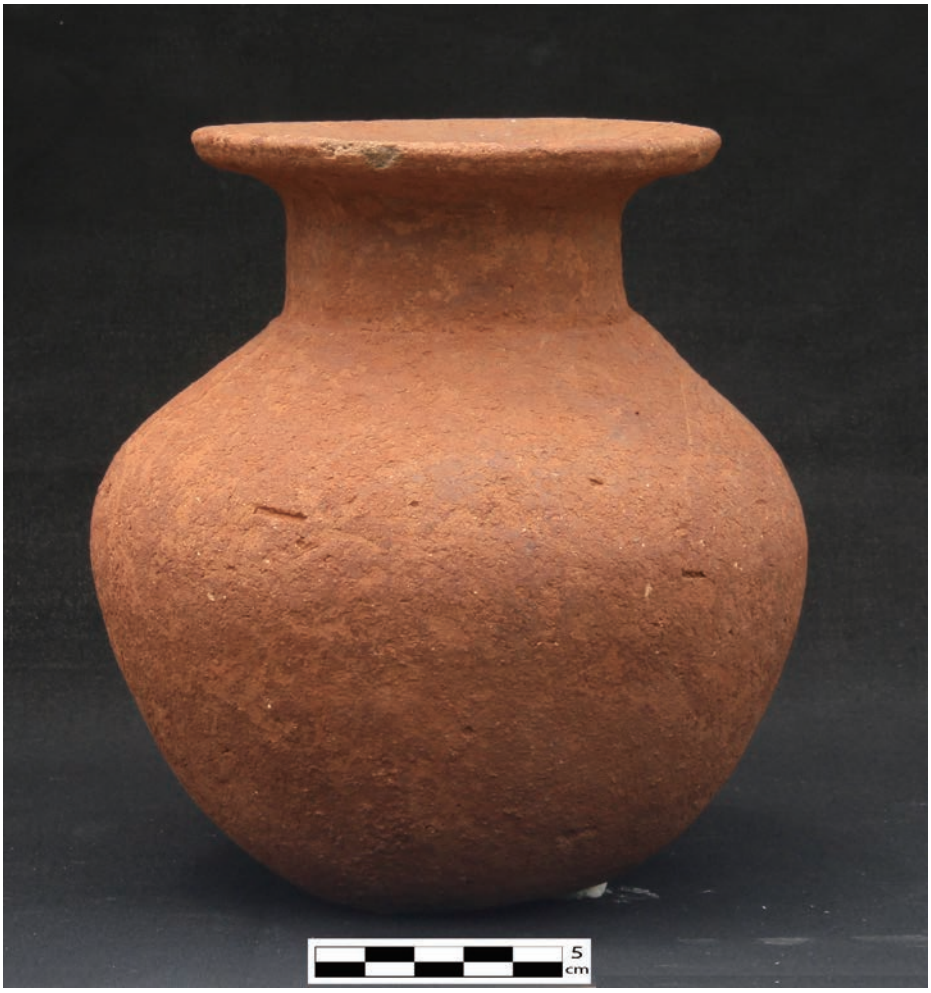


Figure 28 Red Ware small pot from Kallimali, Idukki

Figure 29 Red Ware lipped bowls from Ummichipoyil, Kasargod
(Courtesy: Archaeological Survey of India, Thrissur Circle)

Figure 30 Black Ware lid from Ummichipoyil, Kasargod (Courtesy: Archaeological Survey of India, Thrissur Circle)

Figure 31 Black Ware miniature pot and bowl from Kuttikkol, Kasargod

Figure 32 Sherds of Russet Coated and Painted Ware from Pattanam (Courtesy: KCHR)

been reported from Udupi in Karnataka State which is close to the border of Kerala (John 1974).

PRESENT UNDERSTANDING OF IRON AGE/ MEGALITHIC CULTURE IN KERALA

The Megalithic culture in Kerala is represented in the form of burial monuments and burial goods. The burials are secondary burials; hence the interment is fractional in nature. Megalithic burial monuments are widely distributed in every districts of Kerala and are the most visible and common archaeological remains that are even familiar to common people. Megalithic remains can be considered as part of the religious practice of humans during the Iron Age and Early Historic periods pertaining to the death and belief in life after death. Since the habitation remains of the Megalithic culture are unavailable in Kerala, the burial goods are the only sources which can impart some clues on various cultural aspects of Megalithic populations.

Pottery

The burial goods of almost all the burial contexts have showed the presence of pottery which includes the types such as Black-and-Red Ware, Red Ware, Black Ware, and Russet-Coated and Painted Ware. The vessel shapes include jars, bowls, dishes, vases, pots, cups and legged vessels. Apart from the vessels, the shapes like ring stands meant for keeping the vessels and lids are very common and unique to the Megalithic contexts.

Black-and-Red Ware

This is considered to be the most characteristic pottery during the Megalithic period. The shapes are bowls, vases, dishes, lids and ring stands (Figures 23 - 25). The vessels are usually small to medium in size. The fabric is fine to medium. The surface shows burnishing.

It is argued that the 'inverted firing' technique was used for the production of this pottery where the inner surface and some portion near to the rim on the outside are black in colour while the rest of the outside portions are red. The black and red colours are the result of carbonization and oxidization processes respectively happening inside the kiln. Thus a bichrome effect is attained (Wheeler 1947; Subbarao 1961; Rao 1963). The Black-and-Red Ware with white dotted paintings have been reported from Arippa (Rajendran and Iyer 1997).

Red Ware

The Red Ware is dull red in colour with a pale slip. The common shapes are regular jars, legged jars, pyriform jars, bowls, vases, dishes (Figures 26 - 28). Appliqué and incised decorations are common on Red Ware. The fabric is fine to medium. The large jars have a coarse fabric with gravely grits of quartz. Most of the burial urns belong to this class. Based on the occurrence of lipped bowls in Red Ware from burials in Kasargod region, the affiliations with Neolithic-Chalcolithic periods have been proposed (Figure 29) (Nair 2007: 101).

Black Ware

The Black Ware is with a jet black coloured slip. The surface is mostly burnished. The usual shapes are bowls, vases, dishes, lids and ring stands (Figures 30 and 31). Many shapes of Black Ware match with Black-and-Red Ware type. Their manufacturing must have been the same, but the difference is in firing technique. Black Ware seemed to be made by carbonization.

Russet-Coated and Painted Ware

The Russet-Coated and Painted Ware is characteristic pottery with a fine slip of a russet or ochre colour. Sometimes white paintings of lines in rectilinear or

Figure 33 Iron tools from Kadanad, Kottayam (Courtesy: Archaeological Survey of India, Thrissur Circle)

Figure 34 Gold leaf from Kadanad, Kottayam (Courtesy: Archaeological Survey of India, Thrissur Circle)

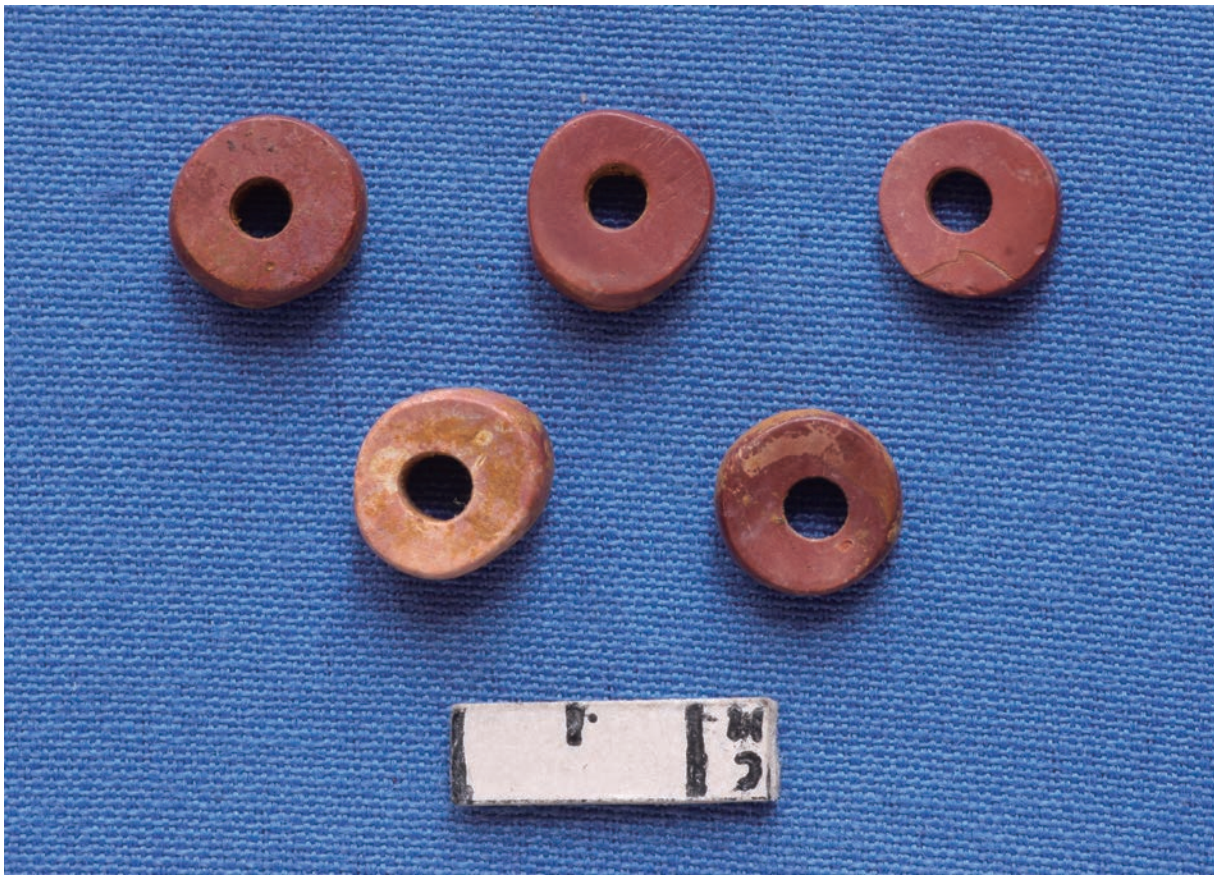


Figure 35 Stone beads from Kadanad, Kottayam (Courtesy: Archaeological Survey of India, Thrissur Circle)

Figure 36 Stone beads from Kadanad, Kottayam (Courtesy: Archaeological Survey of India, Thrissur Circle)

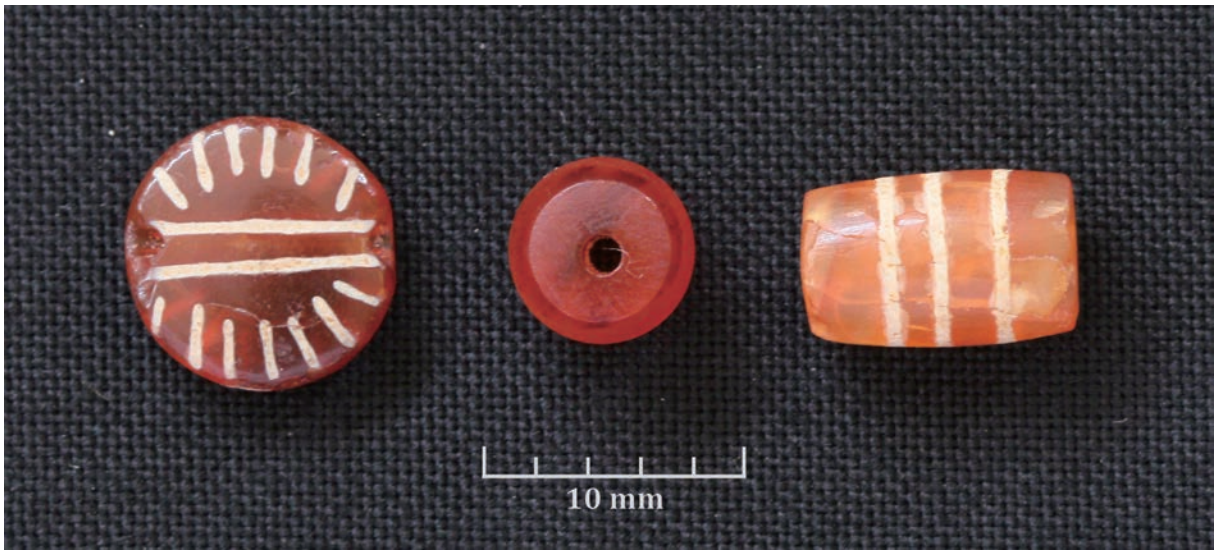


Figure 37 Etched Carnelian beads from Niramakulam, Pathanamthitta (Courtesy: Ambily C.S.)

Figure 38 Quartz pendants from Kadanad, Kottayam (Courtesy: Archaeological Survey of India, Thrissur Circle)

curvilinear patterns can also be seen (Figure 32). Vases, dishes and bowls are the usual shapes. This pottery is noticed from northern Kerala.

Metal objects

Even though the Iron objects are the most commonly found burial goods in the Megalithic contexts in Kerala, only a few of them have been subjected to scientific studies. However, the excellence in iron metallurgy of Megalithic people is evident from these pilot studies. Iron specimens from Pazhayannur have been analysed scientifically that revealed the higher

Figure 39 Terracotta human head from Thrikkanaya, Thrissur (Courtesy: Arya P.N.)

Figure 40 Polished stone celt from an Urn burial at Kallimali, Idukki

purity of iron which is 99.62 % (Mehta and George 1978). Also, it was found that the thin iron sheets were beaten into the shape of tools which is a clear indication of their iron metallurgical skills. Niramakulam specimens were analysed by using XRF method, and the chemical compositions of iron tools and slag were given (Ambily 2017: 222-23). Though the iron samples from Naduvil, Atholi and Monanthody have been reported to be analysed at the National Research Laboratory, Lucknow (IAR 1990-91: 163), the results are unavailable.

The iron objects can be broadly divided into two groups; weapons and implements (Darsana 2010). The iron weapons include axes, daggers, arrowheads, knives, spearheads, swords and tridents. The implements include sickles, billhooks, chisels, nails, rods, tripod stands, wedges, ploughshares and lamps with a handle (Figure 33). However, there is a great deal of variations in shapes and dimensions of each type of iron objects. Certain objects can have multiple uses like defence, hunting, agriculture, domestic, etc. Many of the iron tools found are tanged tools without proper handle (e.g. knife, sickle, etc.), which were probably used by hafting with wooden handles. An evidence for this was noted in a knife from Niramakulam where an impression of wood can be noticed on the tang (Pers. comm. Akinori Uesugi). Darsana (2010: 109-110) has classified the occurrence of iron tools with respect to the burial monument types where they were found. Pillai (2014) attempted to typologically classify the iron objects from two sites namely Kunnukara and Okkal in the Ernakulam district.

The occurrence of types of iron objects varies from burial to burial. Most of the iron tools found from Niramakulam are of agrarian utility, the tool types being sickles, knives, knife-cum-sickle and nail (Ambily 2017). The tools found from Kadanad are mostly of defence purpose as indicated by swords and knives (Nambirajan and Kumaran 2011) and tools from Ummichipoyil are of utilitarian purposes such as chisels and knives (Nair 2007). It is quite possible that the iron tool assemblage in burials has some associa-

Figure 41 Crucible from an Urn burial at Kallimali, Idukki

tion with the occupation of the buried person. Since iron is a material that is prone to corrosion very easily, the specimens are found in fragmentary or deformed manner in most of the burials. The humid climate and heavy rainfall in Kerala has been detrimental to the preservation of iron artefacts. Hence mostly being found in indiscernible shapes, it is difficult to classify them into definite types. However the occurrence of a variety of iron objects from burials indicates their wide use and several possible applications of them by the Megalithic people in their daily lives.

A few sites have revealed copper objects which include earrings, bangles, bowls, etc. Compositional studies on copper from Tiruvilvamala have been done (Menon 1937). Gold ornaments have been recovered from sites such as Arippa and Kadanad (Figure 34). An XRF analysis was done on the gold and copper objects found from Arippa (Rajendran and Badam 1995; Rajendran and Iyer 1997).

Skeletal remains

A complete human skeleton has not been found from Megalithic burials reported till date in Kerala. A few burials have shown fragmentary human bones. It is considered that during the Megalithic period the dead body was kept exposed to natural forces and then the left-over bones were collected and buried (Leshnik 1974). Some instances for cremation were also noticed as indicated by the ash, charcoal and charred bones in burials (Mehta and George 1978; Satyamurthy 1992; Mushrif-Tripathy et al. 2016). The bones of a child cranium having an age of below 6 months, adult human and animal bones have been reported from the Urn burial unearthed at Arippa (Rajendran and Iyer 1997). Human skeletal remains from Anakkara burial excavations have been studied and as result some osteophytic growth on vertebral body portion and possible case of maxillary sinusitis were observed (Mushrif-Tripathy et al. 2016). The fragmentary nature of evidence of human bones from Kerala is a

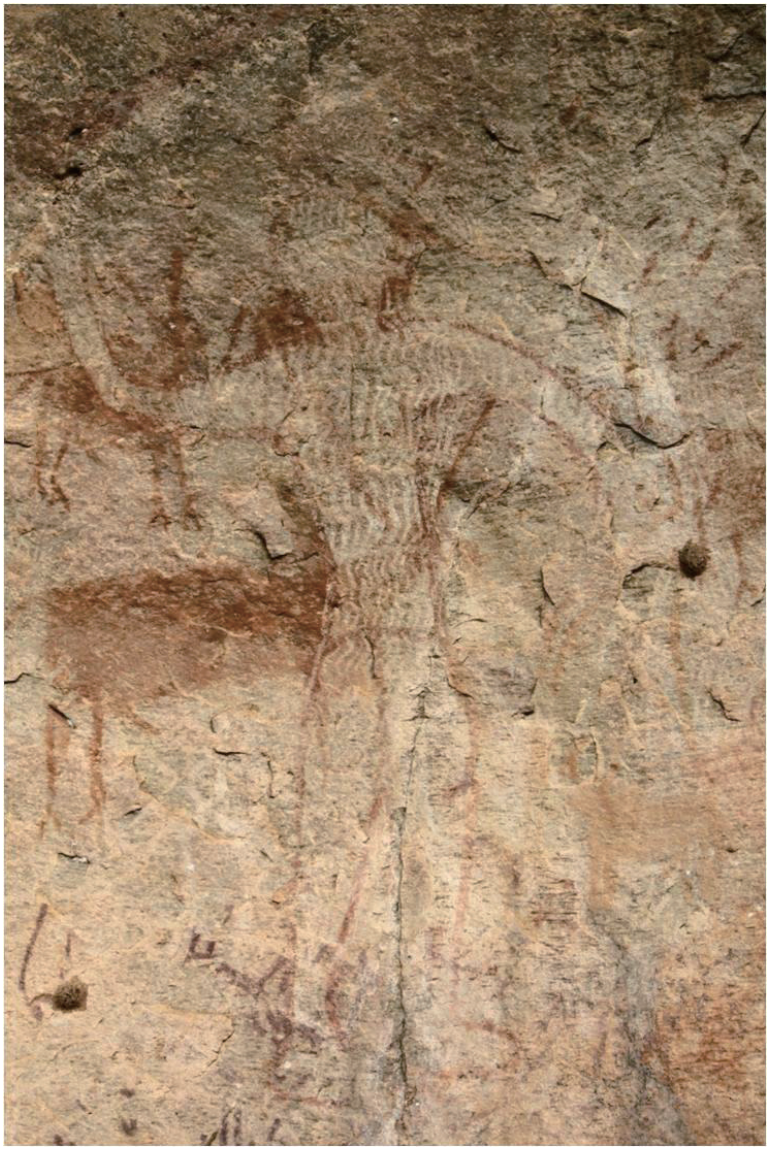


Figure 42 Rock paintings at Marayur, Idukki

hurdle to undertake physical anthropological studies on them.

Beads

Semiprecious stone beads are another significant finding from the Megalithic burials. These beads are reported to be made of carnelian, quartz, chalcedony, agate, jasper and feldspar (Figures 35 and 36). A few terracotta and glass beads were also reported (George 1975). Stone beads have been found from more than 30 sites in Kerala and among them Machad (147 specimens), Kurumassery (136 specimens), Porkalam (48 specimens), Mangad (30 specimens), Niramakulam (15 specimens) are notable for the presence of greater varieties and large numbers of beads. Some of the carnelian beads bear etched designs which consist of closely placed concentric circles (called 'eye' designs), vertical, horizontal, circular and radial lines (Figure 37). The commonly seen shapes are barrel, spherical, disc, tablet, etc. Some of the beads were perhaps used as pendants since a perforation is found on one end (Figure 38). Thapar (1952) has attempted to attribute a date to carnelian beads on the basis of comparing it with the evidence of similar beads excavated from other regions in India. The silicone impressions were taken from the drilled perforations of carnelian beads from Niramakulam and their SEM images show evidence regarding the use of diamond drills. The per-

Table 1 Radiocarbon dates for Megalithic period in Kerala

No.	*Site and Sample No.*	*Material*	*Date (YBP)*	*Calibrated date*		*Laboratory*	*References*
				1σ calibration	*2σ calibration*		
1	Mangadu (BS-958)	Charcoal	2890± 70	cal BC 1207- 1203 (1.3 %) cal BC 1195- 1140 (21.2 %) cal BC 1134- 977 (77.4 %)	cal BC 1299- 902 (100%)	BSIP, Lucknow	Satyamurthy 1992: 22
2	Mangadu (BS-957)	Charcoal	2850± 90	cal BC 1189- 1180(2.3%) cal BC 1156- 1145 (3.43%) cal BC 1130- 904 (94.29%)	cal BC 1289- 1282 (0.37%) cal BC 1269- 821 (99.63%)	BSIP, Lucknow	Satyamurthy 1992: 22
3	Oliyani (B.S. 1883)	Charcoal	810± 80	cal AD 1059- 1063 (1.7%) cal AD 1155- 1281 (98.3%)	cal AD 1030-1297 (99.6%) cal AD 1373- 1377 (0.4%)	BSIP, Lucknow	Rajendran 2005: 45
4	Niramakulam (NKM-12-1)	Charred material	2190±30	cal BC 356- 286 (68.1%) cal BC 234- 198 (31.9%)	cal BC 364- 176 (100%)	Beta Analytic Inc., USA	Ambily 2017: 238
5	Niramakulam (NKM-12-2)	Charred material	1790±30	cal AD 140- 151 (7.9%) cal AD 169- 194 (17.7%) cal AD 210- 258 (56.3%) cal AD 298- 319 (18.1%)	cal AD 132- 263 (76.7%) cal AD 277- 330 (23.3%)	Beta Analytic Inc., USA	Ambily 2017: 238
6	Nannangadikkunnu (NDK1) Urn-1	Organic sediment	2350±30	cal BC 482- 467 (11.2%) cal BC 415- 386 (88.8%)	cal BC 512- 382 (100%)	Beta Analytic Inc., USA	Abhayan et al. 2018
7	Nannangadikkunnu (NDK2) Urn-2	Charred material	490±30	cal AD 1418- 1439 (100%)	cal AD 1405- 1449 (100%)	Beta Analytic Inc., USA	Abhayan et al. 2018
8	Kuttikkol (PLD-31830 Sample no.: KTL-1) Feature: Burial no. 1	carbonized herbaceous species	328±19	cal AD 1514-1529 (10.7%) cal AD 1543-1600 (43.9%) cal AD 1617-1634 (13.7%)	cal AD 1490-1603 (76.3%) cal AD 1611-1641 (19.1%)	Paleo Lab, Japan	Uesugi et al. 2018
9	Kuttikkol (PLD-31831 Sample no.: KTL-2) Feature: Burial no. 1	carbonized wood	430±19	cal AD 1439-1456 (68.2%)	cal AD 1431-1476 (95.4%)	Paleo Lab, Japan	Uesugi et al. 2018
10	Kuttikkol (PLD-31832 Sample no.: KTL-3) Feature: Burial no. 1	carbonized wood	385±18	cal AD 1452-1490 (59.5%) cal AD 1603-1610 (8.7%)	cal AD 1446-1516 (78.5%) cal AD 1596-1619 (16.9%)	Paleo Lab, Japan	Uesugi et al. 2018
11	Kuttikkol (PLD-31833 Sample no.: KTL-4) Feature: Burial no. 2	carbonized wood	2526±20	cal BC 788-751 (33.7%) cal BC 683-668 (12.5%) cal BC 636-626 (5.3%) cal BC 614-591 (16.7%)	cal BC 792-744 (37.1%) cal BC 686-665 (14.3%) cal BC 644-551 (44.0%)	Paleo Lab, Japan	Uesugi et al. 2018

forations often seemed to be made from both the ends (Ambily 2017: 231). The presence of carnelian beads deserves a special attention because they are made from stones that are not naturally available in Kerala. And the raw material for carnelian beads is largely found in the Western and Central Indian regions. Therefore, their presence in Kerala indicates trade or exchange networks of Megalithic populations. Though other materials like quartz used for making beads are commonly available in Kerala, the evidence for their local production were not found yet.

Other objects

Other materials like querns and pestles (Raghavan and Devasahayam 1974) and grinding stones (Mehta and George 1978) were also reported. As per the reports, three terracotta dog heads (Aiyappan 1933), bull/goat head (Cammiade 1930), human figures (Paulose 1990), human figures ascribed to be mother goddess figurines (Kumar 2004), human and animal figurines (Pers. comm. Arya P.N.) were collected from the Megalithic burial contexts in Kerala (Figure 39). Association of these terracotta figurines with the burials is an important indication of the possible ritualistic activities of Megalithic population. This particular aspect too deserves a serious research attention. The presence of 'Neolithic' polished celts from Kasargod (Nair 2007: 101) and Idukki (Sandra et al. 2017) in Megalithic burial contexts; and crucible from a Megalithic Urn burial at Kallimali in Udumbanchola taluk of Idukki district are notable findings (Figures 40 and 41) (Sandra et al. 2017). Presence of rice husk from

Figure 43 Iron Slag at Varanampadam, Thrissur

Perumbantalli (Aiyappan 1933) and unidentified grains from Arippa were also reported from burials (Rajendran and Iyer 1997).

Architecture

Apart from locating some of the quarry sites near the burial sites, the burial architecture of Kerala has not been studied in detail by properly emphasizing the techniques of stone quarrying and transportation. It is observed that the stone cutting techniques were entirely different from the wedge cutting method which was in vogue during the Early Historic and later periods. It is very much evident from the disturbed Dolmens at Tiruvilvamala (Thrissur). The intact Dolmens do not bear any visible quarrying marks, but the ones disturbed (for the reuse of stones) during the later periods show marks of wedge cutting method. The role of iron tools in the quarrying of stones needs to be investigated in order to assess the techniques of erecting the burial monuments. The transportation of large stones from distance for the construction of Megalithic burials is another issue for further examination.

Rock art

The rock art evidence of Kerala from Marayur, Edakkal, Tovari, Ancode and Ettukudukka have been connected with the Megalithic populations (Thampi 1983; John 1985; Mathpal 1998; Rajesh 2017). Apart from the proximity of Megalithic sites to the rock art locations, the presence of certain motifs like human figures with wavy line filled depictions are comparable with the paintings on the Russet Coated and Painted Ware of the Megalithic period. The superimposition of motifs has also been a factor in ascribing them to the Megalithic period. The themes like domestic and wild animals, hunting and human activities depicted in the rocks are helpful for understanding the cultural

Figure 44 Stone beads from Pattanam (Courtesy: KCHR)

aspects (Figure 42) (Nihildas 2014).

Chronology

The chronology of Megalithic practices has always been a matter of debate and has been revised as a result of several studies. Instead of narrowing the chronological range, the newer researches have proposed broader chronological brackets in Kerala. B.K. Thapar (1952) proposed 330 BC to 100 AD; J.R. McIntosh (1985) ascribed a date range of 550 BC to 100 BC on the basis of stylistic affiliations of artefacts. Rajendran (2005) on the basis of radiocarbon dates from Oliyani (Table 1) and ethnographic parallels to the Megalithic burial traditions, suggests a late date of 10th century AD and further continuation of Megalithism to the present days.

The radiocarbon dates are useful for having an impression of the overall chronological span of the Megalithic remains (Mohanty and Selvakumar 2002: 320). Apart from the relative dating based on stylistic features of artefacts, the radiocarbon dates available for the region of Kerala are limited. However, the recently revealed eight radiocarbon dates from Niramakulam (Pathnanamthitta District), Kuttikkol (Kasargod District) and Nannangadikkunnu (Palakkad District) are helpful in the progress of further discussions on the chronological aspects of the Megalithic culture in Kerala. These dates in connection with the earlier reported dates can substantiate a broader time bracket for the Megalithic practices in the region.

Based on the two radiocarbon dates from Niramakulam, the continuous use of the same burial monument in consecutive periods has been suggested (Ambily 2017: 237). Two samples give date ranges between cal 364 and 176 BC and between cal 132 AD and 263 AD (Table 1). However, this proposition has not been supported by the presence of burial goods having later date.

Two burials have revealed four dates from Kuttikkol. Among them, the three dates from Burial no.1 are very late as it shows the 15th century AD. This could be because of the later disturbances. If it is not the exact date of a Megalithic burial practice, then it is an indication of human activities or interferences into these structures occurred during the 15th century AD. Burial no.2 gives a date of the 7th to 6th centuries BC which can be considered as reliable (Table 1).

Among the two dates from Nannangadikkunnu, the date of a large burial urn is given as the 4th to 5th centuries BC whereas another small burial jar gives a date of the 15th century AD (Table 1). However, a series of further dates from Megalithic contexts may clarify the antiquity of Megaliths and their continuation into the later periods. Also the radiocarbon dates should be validated with the comparative study of pottery and other artefacts from different Megalithic

Figure 45 Excavated wharf structure and wooden canoe from Pattanam, Ernakulam (Courtesy: KCHR)

contexts in Kerala.

Based on collective information on chronology, and in consensus with the earlier researches, the Megalithic culture in Kerala may be dated with confidence between circa 900 BC and 500 AD (Gurukkal and Varier 1999; Rajesh 2017). When the radiocarbon dates from Oliyani and Nannangadikkunnu are considered as the upper limit, the Megalithic culture in Kerala may be stretched up to 1000 AD. There are possibilities of the continuation of Megalithic practices into the later periods as indicated by the radiocarbon dates and the living Megalithic traditions among the present-day ethnic groups (Iyer 1967; Kumar 2006a; Poyil 2007, 2013). Still, the problem of the internal chronology of Megalithic burials remains to be an unresolved issue. However, the present propositions are tentative in nature as the chronology needs to be revised with the support of comprehensive evidence.

Habitation/settlement

The habitation-cum-burial sites have not been reported from Kerala unlike the neighbouring states of Tamil Nadu and Karnataka where a few habitation-cum-burial sites have been reported (Narasimhaiah 1980; Moorti 1994; Rajan 2013, 2014). The entire absence of habitation deposits poses a serious hurdle in understanding the ways of living of the people existed during the Megalithic period. Several reasons have been proposed for the lack of habitation evidence; the reasons might be because of the life styles of the Megalithic people varying from the pastoral, nomadic to semi-settled agriculturist ways of life (Leshnik 1974; Narasimhaiah 1980). These kinds of habitation must have left very meagre traces of habitation deposits which are indiscernible during the archaeological investigations. The possible reasons for the entire absence of habitation evidence in Kerala might include the dispersed nature of settlements, the frequent shift-

ing of settlements, the use of easily perishable organic materials for construction purposes, the heavy fluvial activities that restrict the formation of archaeological mounds, the consequent intensive land use pattern and also the inadequate archaeological survey methods to locate habitation deposits. Hence, the lack of habitation deposits cannot be considered as a result of the absence of human settlements (Gurukkal and Varier 1999).

At many sites, the burial monuments dominate the landscape and are observable from a distance, meanwhile there is the absence of identifiable habitation evidence in the vicinity. However, the usual pattern is the presence of burial clusters on the hill slopes overlooking the valley which is arable and likely to be inhabited (Iyer 1967).

Significant evidence come from recent excavations at Pattanam which is located on the bank of river Periyar (Ernakulam district). The site provided ample evidence for the maritime trade contacts during the Early Historic period in Kerala. With the support of a series of radiocarbon dates, the earliest occupation levels at Pattanam have been dated to the early part of the first millennium BC, which is referred as the Iron Age (c. 1000 BC- 500 BC); and the succeeding periods are the Iron Age - Early Historic Transition (c. 500 BC - 300 BC) and the Early Historic (c. 300 BC - 500 AD) (Cherian et al. 2009; Cherian and Menon 2014). However, this habitation context for the Iron Age is claimed on the basis of the presence of a few Black and Red Ware sherds and fragmentary bones. Their connections with the Megalithic people are yet to be ascertained.

A recent report of the habitation evidence from the Marayur region (Das et al. 2012) even though preliminary, is significant and it stimulates the further need for an extensive search of habitation evidence. Such stray habitation evidence is less reliable due to the lack of authentic evidence such as pottery and other artefacts that could convincingly connect them with the burial goods. Peter (2014) proposes some sites like Marayur, Anakkara and Ummichipoyil which might have the potential scope for getting the habitation remains as indicated by the stone quarrying evidence in the proximity.

Evidence of iron production and appearance of urban centres

The contextual evidence of early iron working in Kerala is unavailable due to the lack of habitation deposits. Still, some regions close to the Megalithic burial sites have showed evidence of scattered iron slags which could be the remnants of iron production during the Megalithic period. One such evidence of scattered iron slags and large block of tapped slag (Figure 43) produced as a result of iron smelting was reported from the place of Varanampadam in the Thrissur district. This place is approximately 2 km away from the Megalithic burial site Kuthiranpara in the Tiruvilvamala region (Pers. comm. Arya P.N.). The occurrence of iron slags has been reported from the regions close to the Periyar river basin where Megalithic burials are available in plenty (Krishnan 2017). Further intensive surveys in the region may bring out evidence in contexts.

The antiquity of iron production in Kerala may be indirectly inferred from the earliest dates of Megalithic burials which reveal iron implements as burial goods. So far, the earliest calibrated radiocarbon date comes at least around 900 BC (a possible date can be between the 13th and 8th centuries BC). On the basis of the radiocarbon dates from the excavated site of Pattanam in central Kerala, the appearance of Iron Age belongs to the half of the first millennium BC. The evidence from Pattanam also shows architectural features of an urban nature like brick structures, a wharf, ring wells, toilet features, craft productions and so on (Figures 44 and 45) (Cherian et al. 2009). Similarly, a few excavations at Vizhinjam, Kottappuram, Cheramanparambu and surveys in the Kollam region

also disclosed a material culture including iron artefacts and urban settlements of the Early Historic and later periods which were hitherto unfamiliar to Kerala (Abhayan et al. 2014; Premkumar 2014; Kumar et al. 2015, 2016).

A sample of iron nail from the Pattanam excavations was analysed by Srinivasan (2007) and it revealed the occurrence of high carbon steel. Pliny's *Natural History* and anonymous Greek work *Periplus of Erythrean Sea* refer to the high-quality steel imported from south India during the first century AD from the regions of the Chera rule which included Kerala and Tamil Nadu (Schoff 1912, 1915). Also, there are literary references to iron smelting in *Sangam* literature.

DISCUSSION

Even though several researches have been conducted in Kerala so far, a comprehensive picture of the Megalithic cultural aspects could not be framed with clarity. Many vital aspects of the culture remain unknown owing to several reasons. As far as the typology of Megalithic burials is concerned, the knowledge regarding their affiliations, if any, with particular cultural groups is unclear. Still, based on the size, shape, location and contexts, attempts have been done to glean into the aspects of social stratification and ethnic variability. A general understanding is that they believed in practicing the burials of secondary nature with stone markings. Among the stone markings, the circular plan was the most popular. Several combinations of burial architecture were in practice, such as Stone Circle with Urn, Menhir with Urn, Circle with Cist, etc. Hence a strict classification is impossible with regard to the typology of burial architecture. The burial goods placed within them strongly indicate their beliefs in the life after death and burial offerings or customs. The burial goods also give indirect indications to their material culture. It may be summarised that the Megalithic society was having specialized craft groups, especially superior iron technology and exchange networks with the neighbouring regions. These are possible with surplus production and distribution. However, based on the material culture, as well as reading through the ancient Tamil *Sangam* literature such as *Akananuru*, *Pathittupathu*, etc., it can be assumed that the economy must have been of agro-pastoral, greatly supplemented by hunting and gathering. It must have been a multifaceted culture (Leshnik 1974; Gurukkal and Varier 1999; Kumar 2003). Apart from these, plundering and piracy could also be part of economy as evident from *Sangam* literature and other written records (Rajesh 2017).

The presence of Neolithic-Chalcolithic pottery and polished celts in the Megalithic burial contexts (Nair 2007: 101; Sandra et al. 2017) and the presence of Neolithic polished adze near the Megalithic Cist burial site of Oliyani (Rajendran 2005) point to the connections of Megalithism with the preceding cultures of the region or the continuation of Neolithic cultural elements. This aspect demands further investigations especially in the background of the lack of researches on the Neolithic period in Kerala apart from stray discoveries of polished Neolithic tools. The origin of Megalithic culture in Peninsular India, in general, has been attributed to Ethiopian, Mediterranean and West Asian regions based on several assumptions. Anyhow, the origin of Megalithic culture in the Kerala region has been suggested to be a diffusion from the Tamil Nadu and Karnataka regions mainly through the natural passes in the Western Ghats.

The chronological overlapping of the Megalithic culture with the Early Historic period has been identified on the basis of the chronological indicators from both of the cultural realms. Gurukkal and Varier (1999: 102) point out the possibilities of attracting the Megalithic populations into the major religious ways of life such as Buddhism, Jainism, Saivism and

Vaisnavism during the later periods. They attempt to find similarities in the material cultures. For instance, the iron tools like trident could be of the Saivite connection and rock-cut architecture could be of Buddhism. The semiprecious stone beads from Megalithic burials strongly indicate the mutual interactions and exchange of materials between the Megalithic and Early Historic cultures. The scarcity of excavated Early Historic habitation sites is a severe issue. Even though the recent excavations at Early Historic sites of Pattanam and Vizhinjam revealed a large quantity of pottery, none of them apparently show similarity to the Megalithic burial pottery. Rather, the pottery from these two sites have not been analysed closely with an objective to check any such similarities. At several places in Kerala, habitation deposits have been noticed in recent explorations (Pers. comm. Reni P. Joseph, Rajesh S.V., Preeta Nayar). But the pottery collected from these sites have not been placed in definite chronological time brackets. Though they apparently do not match typologically with the Megalithic pottery, exploring their chronological link with the Megalithic culture cannot be ruled out. It becomes significant as there is a lack of the habitation evidence of the Megalithic culture. In the neighbouring regions like Tamil Nadu, the later phase of the Megalithic culture has been linked with the Early Historic periods as evidenced from the Porunthal and Kodumanal excavations (Rajan 2013, 2014; Rajan et al. 2013; Rajan and Kumar 2014). These kinds of links might have been existed in the Kerala region as well. Such possibilities of the chronological overlapping have to be seriously addressed by raising research questions and analyzing the recent findings mentioned above.

The research in Megalithic remains is challenging in Kerala particularly in the backdrop of rapid developmental activities and dispersed habitation pattern of the present day. Certain methodological shifts may be helpful in making the future researches more productive.

The existing information gathered from researches on the Megalithic culture of Kerala is partial or it does not have uniformity in structure. There is a need of a basic database comprising all the reported Megalithic remains. This primary data is essential for taking the future research to new levels. This is crucial for making interpretations in a meaningful manner. An attempt in this direction has been initiated by Department of Archaeology, University of Kerala under a project 'Kerala Megalithic Gazetteer Project' which aims to create a primary database of the Megalithic remains of Kerala.

There should be a change in the pattern of site reporting including the salvaged ones. Even though adequate material remains are available in many occasions, the proper documentation does not happen apart from preliminary descriptions. The pottery drawings, photographs of high quality, geo-coordinates of location, sample collections (including the geological samples), etc. should be done because such data can be immensely useful for the future studies. The interested researchers should be allowed to study the excavated and surveyed materials available in the custody of various agencies like State Department of Archaeology, Archaeological Survey of India, universities and other government and non-government institutions so that new dimensions of earlier retrieved materials can be made possible with the most modern ideas and methods available.

There should be a shift in the focus of research from 'site' to 'region' or 'landscape' (Mohanty and Selvakumar 2002: 334). Intensive surface surveys have to be employed by using all the possible techniques to bring out the flimsy features of the habitation deposits which might have been resulted from the short duration of occupation and dispersed settlement pattern. The site catchment analysis and the study of landscape and resources may be helpful in this regard. The horizontal excavations of existing burial sites can further lead us towards the missing links such as the

ritualistic aspects which could have been performed prior to/during the burial process in and around the site. The scientific investigations of artefacts and other evidence such as chemical analysis, X-ray diffraction analysis, archaeobotanical studies including analysis of phytoliths and pollen grains, isotopic and DNA based studies on human skeletal remains, etc. are the need of the hour in the area of Megalithic researches in Kerala.

CONCLUSION

The Megalithic culture represents the beginning of habitation of iron using people in Kerala. The researches till date have revealed largely their burials while habitation remains are almost lacking. Apart from the burial architecture and burial goods that are showing numerous similarities with the Megalithic cultures of neighbouring regions, the Kerala region has very unique types of burial architecture such as Umbrella Stones, Capstones, Rock-Cut Chambers and Hood Stones. The Megalithic people of this region exhibits efficient deployment of the local environment and the physiographic features through the use of diverse combinations of burial monuments. Hence, it can be inferred that the local environment must have played a crucial role in the formation of their social structure as well. The recent information including the proposed habitation evidence and investigations into the Early Historic period in Kerala impart hope to have further thoughts in interpreting the cultural milieu of the Megalithic populations. These new evidence strongly point to the cultural overlapping between the Iron Age and Early Historic period in Kerala. The evidence of the emergence of urban centres during the late part of first millennium BC are very significant in understanding the Megalithic culture in Kerala. This paper attempted to give an overview of various aspects of the Megalithic culture in Kerala hovering through the published and reported materials. Additionally, some recent evidence such as a series of radiocarbon dates and a few new intensive region-specific investigations in certain areas have been put forward for further discussions.

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ON BASE METALS IN VEDIC LITERATURE

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INTRODUCTION

The aim of this paper is to understand, using philological methods, the material culture of ancient times in South Asia. Through comprehensive analysis of recent studies and examples of "verbal evidence" concerning base metals, especially "*áyas*-"[1] and metallurgy at every stage of Vedic literature, this study aims to examine how the usage of base metals developed during the Vedic period.

VEDIC LITERATURE

Vedic literature comprises texts in Vedic Sanskrit, the oldest Indo-Aryan language. The oldest text, the Ṛgveda, is said to have been composed around 1200 B.C., and the later ones, the Upaniṣads, around 500 B.C.

The central subject of Vedic literature was almost always rituals, and the authors at that time did not record concrete historical facts. However, this huge complex of texts handed down with extraordinary accuracy regarding the correct use of words, still has great value when studying ancient South Asia.

PREVIOUS STUDIES

Wilhelm Rau conducted a comprehensive and detailed study of metals in Vedic literature in his book *Metalle und Metallgeräte im vedischen Indien* in 1974. Even today, it remains the most significant such study. However, little attention has been given to the chronological order of each Vedic text in his study and since its publication, additional research has been completed in the field of Vedic study, allowing us to improve on his findings.

After Rau's work, in 1987 and 1989, Michael Witzel discussed the localization and chronology of each Vedic text, and his hypothesis is widely accepted among scholars, although further discussion is still needed. Furthermore, each Vedic text has its own internal chronology.

The table below, based on Witzel's summary (1989: 115f.), illustrates a group of Vedic texts with abbreviated names, their chronology, and the geographical location of each group.

THE ṚGVEDA (RV)

The RV is a collection of hymns devoted to various gods. It is assumed that it was composed around 1200 B.C. The RV was possibly composed in the geographical region of present-day Punjab. However, the text strongly reflects the environment of the semi-nomadic lifestyle led by Indo-Aryans in Afghanistan.

In the RV, *áyas*- is the only word used as a general

Table 1 Vedic texts, their approximate dates and regions of composition. Cf. Witzel (1989)

Group	*Text*	*Chronology*	*Geographical location*
Ṛgveda (RV)	RV	1200 B.C.–	Punjab and surroundings, max. extension: Kabul River to Ganges
Atharvaveda (AV)	AVP	1000 B.C.–	Western North India, up to Kāśī (Benares).
	AVŚ		Central North India, up to Aṅga (Bhagalpur).
Yajurveda-Saṁhitā (YVS)	MS$^{m/p}$	m (mantra) 1000 B.C.– p (prose) 800 B.C.–	Kurukṣetra, with southward expansion.
	KS$^{m/p}$		Eastern Punjab / Kurukṣetra; early eastward expansion.
	TS$^{m/p}$		Pañcāla country (Uttar Pradesh)
	VSM	1000 B.C.–	Videha (Northern Bihar)
	VSK		Kosala (Eastern Uttar Pradesh)
Brāhmaṇa	AB	650 B.C.–	Older part: Eastern Punjab, later part: Videha
	ŚBM		Videha (Northern Bihar)
	ŚBK		Kosala (Eastern Uttar Pradesh)
	JB		"Where the rivers flow northwards": area between Gaṅgā, the Vindhya, Rajasthan desert, the sea: Matsya, Baghelkhand, Malva; Eastern border unclear.
Old Upaniṣad	JUB	500 B.C.–	
	BĀUM		Videha (N. Bihar)
	BĀUK		Kosala (E. Uttar Pradesh)

term for base metals in contrast to *híraṇya-*, "precious metal,"[2] and there is no reference that describes the relative characteristics of base metals, although it is assumed that the chronology of the RV corresponds to the Bronze Age.

Metallurgy in the Ṛgveda

RV X 72,2ab[3] "Brahmanaspati smelted (*sáṃ adhamat*) these, like a smith (*karmā́ra-*). "

This passage describes the creation of the world by Brahmanaspati, the creator. His creation is compared to the work of a smith. It is assumed that the practice of metallurgy was mainly followed by the *kármāra-* (smiths), who were not included in the Indo-Aryan community.[4] References to them are limited in Vedic literature as well as subsequent Vedic texts.

Metallurgy in the Ṛgveda

RV X 81,3[5] "He, the god alone (Viśvakarman), who has eyes, mouths (faces), arms and feet in every directions, smelts (*sám dhámati*) with his arms and wings (fans), producing heaven and earth."

The verb *sam-dham*^{i} connotes "to smelt metal with bellows." The first process, blowing (*dhmā/dham*^{i}) with leather bellows (*dṛ́ti-*), represents the whole process of the work involved.[6] This fact suggests that people during the Ṛgvedic period had some degree of metallurgical knowledge.

BASE METALS AND METALLURGY IN THE ATHARVAVEDA (AVP, AVŚ)

The Atharvaveda mainly comprises magical formulas for cures, curses or achieving desires. It is assumed that the oldest parts of the Atharvaveda were composed around 1000 B.C. During this period, *áyas-* was considered as "black (*śyāmá-*)" and "red (*lóhita-*)." The former is said to denote iron and the latter copper, but there is no evidence that directly supports this idea yet. It was also at this time that other base metals like "tin (*trapú-*)" or "lead (*sī́sa-*)[7]" came to be known.

AVŚ XI 3,7-8[8] "Black metal (iron?) is its (*odaná-* "porridge") flesh. Red [metal] (copper?) is its red one (blood). (7) Tin (*trapú-*) is its ash. Greenish-yellow one (gold) is its color. Lotus is its smell. (8)"

~AVP XVI 53,12[9] "Black metal and/or red metal are/is its (*odaná-* "porridge") flesh. Tin (*trapú-*) is its ash. Whitish [one] (silver) is its bone. Greenish-yellow one (gold) is its color. Lotus is its smell."

AVŚ I 16,2;4[10] "The lead, Varuṇa blesses. Toward the lead, Agni behave friendly. Indra bestowed the lead to me. It is verily the repeller of the sorcery[11]. (2) ... If you slay our cows, if you [slay our] horses, if [you slay our] man, then we pierce you by the lead so that you would be the no slayer of our heroes."

kaṁsá- meaning "metal vessel," possibly a loan word, first appears in AVŚ X 10,5[12]. While its etymology is unclear, its derivative *kāṁsya-* means "the raw material of kaṁsa." In later texts, it was used to denote brass (ŚrSū). This fact suggests that Indo-Aryans at that time had incidental knowledge of metals.[13]

BASE METALS IN MANTRAS OF THE YAJURVEDA SAṀHITĀS (YVS^{M}: MS^{M}, KS^{M}, KPS^{M} TS^{M}, VSM/K)

Mantras of the Yajurveda Saṁhitās, the part of the Yajurveda composed of verses, includes the complex of formulas (mantras) used for rituals. The oldest parts of the YVS^{m} were composed around 1000 B.C., the same time as the AV. The verses of the YVS^{m} state that *áyas-* is divided into "black (*śyāmá-*)" and "red (*lóhita-*)," similar to the AV. The parallel passages of the MS^{m}, KS^{m}, KpS^{m}, TS^{m} and VSM/K shown below are good examples.

MS II 11,5: 142,5–7^{m}[14] **~ KS XVIII 10: 272,8–10^{m} ~ KpS XXVIII 10: 147,10–11^{m}** "[May] mountains for me. [May] welcoming songs for me. [May] sands for me. [May] trees for me. [May] non-earthen thing for me. [May] precious metal (*híraṇya-*) for me. [May] base metal (*áyas-*) for me. [May] lead (*sī́sa-*) for me. [May] tin (*trápu-*) for me. [May] black (*śyāmá-*) [metal] (iron?) for me. [May] red metal (*lohitāyasá-*, copper?) for me."

VSM XVIII,13[15] **~ VSK XIX 5,1~ TS IV 7,5,1^{m}** "...[May] precious metal for me. [May] base metal for me. [May] black [metal] (iron?) for me. [May] copper (*lohá-*) for me. [May] lead for me. [May] tin for me."

It is noted that MS, KS and KpS use the compound *lohitāyasá-*, while the word *lohá-*, the substantive for "copper" in later texts, is first used in a passage of the VSM/K and TS.

THE YAJURVEDA SAṀHITĀ PROSE (YVS^{P}: MS^{P}, KS^{P}, TS^{P})

YVS^{p} is the explanatory prose added to the mantras of the MS, KS, and TS. These were composed around 800 B.C. and provided more specific images and explanations than verses, although every topic was referred to in a ritualistic context with the usage of numerous metaphors.

A Myth concerning "The Metal without Tin": KS VI 3: 51,9–11^{p} and MS I 8,2: 117,12–19^{p}

The following two parallel passages speak of a myth concerning "the metal without tin."

KS VI 3: 51,9–11^{p}[16] "The sun and Agni (fire) were verily in the same womb. From there, the sun rose upward. His semen fell off. Agni seized it with the womb, with the metal (*áyas-*). It burned[17] [the semen]. He put the burned one in a cow. It is this milk here. Therefore, the metal vessel (*ayaḥpātra-*) without tin (*atrapu-*) burns the fresh milk which is still warm."

MS I 8,2: 117,12–19^{p}[18] "These two, Agni and the Sun, were verily together in the same womb, in the red metal (*áyas- lóhita-*). Then, Āditya (the sun) rose upward. His semen fell off. Agni seized it with the womb. It (semen)

burned out it (the womb) (?).[19] Therefore, the metal without tin (*áyas- atrapú-*) burns out the fresh milk which is still warm. Therefore, one offers this (milk). The rice and the barley, they are the milk of cattle. Therefore, one offers this (milk). One should not use the overboiled [milk]. He will dry the semen out. If [the milk] spills out (boils over), a man fond of drinking will be born into his descendant. This semen of that sun is verily offered. The unboiled milk is unsuitable for the sacrifice. One should offer the [milk] [boiled] up to the rim, because it is boiled, suitable for sacrifice, the pair, and generative."[20]

The Interpretation of These Myths

In the KS, "the metal (*áyas-*)" is equivalent to "the metal vessel without tin (*atrapu- ayaḥpātra-*)" Rau (1974: 19f). points out that the *áyas-* in this text refers to copper. On the other hand, in the MS, "the red metal (*áyas- lóhita-*)" is called "the metal without tin (*áyas- atrapú-*)." It is possible that the metal referred to in these two contexts corresponds to pure copper.

In this myth, the semen of the sun is identified with the fresh milk which is still warm, and Agni in the womb, with the vessel of pure copper put over the fire. So, what these passages from mythology convey is that the milk will easily burn if the vessel is pure copper, indicating the property of high thermal conductivity of "pure copper."

THE BRĀHMAṆAS: ŚATAPATHA-BRĀHMAṆA (ŚBM, ŚBK), JAIMINĪYA-BRĀHMAṆA (JB), ETC.

The Brāhmaṇas constitute the prose for the explanation of rituals and were composed around 650 to 500 B.C. The characteristics of *lohá-* as a red metal are sometimes emphasized (ŚBM V 4,1,1-2), while *áyas-* tends not to be classified by its color (ŚB XIII 2,2,16). This suggests that during this period, *áyas-* referred to iron and *lohá-* copper.

ŚBM V 4,1,2[21] "If it is copper (*lohāyasá-*), it is neither iron nor gold. If it is the mordacious ones (snakes?), they are neither worms nor non-worms. Then, the copper is used, for the mordacious ones are like reddish ones..."

ŚBM XIII 2,2,16[22] "The butcher's knife for horses made of gold is used. The butcher's knife for paryaṅgya (body-encircling)[23] animals made of copper (*lohamáya-*) [is used]. The butcher's knife for others made of iron (*āyasá-*) [is used]."

The Difference in Melting Points of Metals

ŚBM XIV 2,2,54[24] "If it is made of wood (*vānaspatyá-*), it will be burnt. If of gold (*hiraṇmáya-*), it will melt down. If of copper (*lohamáya-*), it will be poured out (melted)[25]. If of iron (*ayasmáya-*), it will burn the two handling-sticks. And it (hot milk) was stable to it (earthen vessel). Therefore, one offers this with earthen one."

A ritual application for the raw material of vessels is explained in this passage. In this ritual, an earthen vessel called "mahāvīra" is put over a strong, "explosive" fire. If the vessel is made up of gold (*hiraṇmáya-*) or copper (*lohamáya-*), it will melt in the fire, but if made up of iron (*ayasmáya-*), it will not melt and instead will burn the wooden handling-sticks. The melting point of *áyas-* is clearly higher than *lohá-* as per this passage.

The Process of Refining Metals

There are few passages describing the process of refining metals in Vedic literature. The following passage from mythology, however, speaks of imaginary refining.

ŚBM VI 1,3,5[26] "From the sand, he (Prajāpati) created the pebble. Therefore, sand finally becomes a pebble. From the pebble, he created the stone. Therefore, a pebble finally becomes a stone. From the stone, he created the iron. Therefore, people blow (*dhamati*, i.e. smelt) iron from stone. From the iron, he created the gold. Therefore, the iron smelted a lot (*áyas- bahudhmāta-*) has the appearance of gold (*híraṇyasaṃkāśa-*) ."

Table 2 The list of the tools made from áyas- in each Vedic text

Group	*Chronology*	*Material*	*Tools*
RV	1200 B.C.–	ayas	blade (*dhā́rā-*), knife for slaughter (*así-*), adze (*vā́sī-*), ax (*paraśu-*), vajra (a name of a weapon, *vájra-*), cookpot (*gharmá-*), arrowhead (*íṣvāḥ múkha-*), bucket for soma (*yóni-* "womb"), piller (*sthū́nā-*), fort (*púr-*)
AVP, AVŚ	1000 B.C.–	red ayas	hatchet (*lóhita- svádhiti-*)
		black ayas	knife for slaughter (*śyāmá- así-*)
		ayas	knife for slaughter (*así-*) ax (*paraśu-*), cup, vessel (*pā́tra-*), spear (*ṛṣṭí-*), hook (*aṅká-*, *aṁkuśa-*), shackle (*dhā́man-*), rope, chain ? (*pāśá-*, *bandhapāśá-*), net (*ā́la-*), aromr (*varman-*), stake (*drupadá-*), door (*dvāra-*), gatepost (*khīla-*), building (*vimita-*)
MS^m, KS^m, TS^m, VSM, VSK	1000 B.C.–	red ayas	hatchet (*lóhita- svádhiti-*)=AV, cup, vessel (*pā́tra-*), vajra (identified with *aruṇapiśaṅga- áśva-*)
		black ayas	
		ayas	shackle (*dhā́man-*), piller (*sthū́na-*), fort (*púr-*)
MS^p, KS^p, TS^p (prose)	800 B.C.–	red ayas	
		black ayas	knife for slaughter (*śyāmá- así-*)
		ayas	stick (*kuśí-*)
Brāhmaṇa	650 B.C.–	red ayas	needle (*lohamáyī- sūcí-*), razor (*kṣurá-* JB:*lauhāyasa-*, TB:(*lohitāyasá-*, ŚB:*lohá-*), knife for slaughter (*lohamáya- śāsá-*), cookpot (*lohamáya gharmá-*)
		black ayas	cookpot (*ayasmáya gharmá-*)
		ayas	needle (*sūcí-*), stich (*kuśí-*), knife for slaughter (*así-*), ax (*paraśu-*), hammer (*kūṭa-*), cup, vessel (*pā́tra-*), pot (*kamaṇḍalu-*), pan(*carú-*), shackle (*dhā́man-*), fort (*púr-*)
Upaniṣad	500 B.C.–	red ayas	beads (*lohamaṇi-*), hatchet (*lóhita- svádhiti-*=AV)
		black ayas	nail clipper (*kārṣṇāyasa- nakhanikṛntana-*)
		ayas	pot (*kumbha-*)

THE LIST OF TOOLS MADE FROM *ÁYAS*

We find evidence of a variety of major metal tools such as blades, knives and arrowheads in the early stages of Vedic literature (Table 2). However, it is very difficult to determine the real from imaginary as the word *ayás-* was often used to symbolize strength.

SUMMARY

In the RV (1200 B.C.), *áyas-* is solely used as a general term for the base metals in contrast to *híraṇya-* "precious metal", and there is no reference that describes the relative characteristics of base metals. On the other hand, the verb *sam-dhā/dham*[i] is probably used as a meaning for "to smelt metal with blow bellows" and this fact suggests that people at that time had had the knowledge for metallurgy in some degree. However, it is assumed that the operation of metallurgy was mainly done by the *kármāra-* "smith," those who were not included in the community of Indo-Aryans, so the references to them are inevitably limited in this conservative literature: this tendency is applicable in the following Vedic texts.

In the stage of the AV (1000 B.C.), *áyas-* is divided into two types, "black (*śyāmá-*)" and "red (*lóhita-*)." It seems that the former denotes "iron", and the latter "copper", however, we cannot find any evidence that supports this idea. At the same time, other base metals

Figure 1 A woman using goat-leather bellows (*dhaman*).
Gadulia Lohars usually use a hand-operated fan (*paṅkhā*). The woman in the picture is the only woman in her family who still knows how to use the leather bellows.

like "tin (*trapú-*)" or "lead (*sī́sa-*)" become known. The situation in the YVS^{m} (1000 B.C.) is almost the same as the AV, however, the word *lohá-*, the substantive for "copper" in later texts, is first used in a passage of the VSM/K and TS.

A pair of passages in the YVS^{p} (KS^{p} and MS^{p}, 800 B.C.) suggestively tells the property of "pure copper"; its high thermal conductivity. In the stage of Brāhmaṇa (600 B.C.), the characteristic of *lohá-* as a red metal is sometimes stressed, and *áyas-* tends not to be classified by color. This fact suggests that the former denotes "iron" and the latter "copper" specifically. In addition, some passages describe the difference of the melting point between gold, copper and iron, or the process of the refining metals. It is assumed that the general knowledge for metals or metallurgy had established in this stage.

PERSPECTIVES

Since metallurgy was mainly carried out by members who were not included in the Indo-Aryan community, the number of the examples related to metallurgy is rather small. Furthermore, Vedic literature mainly deals with rituals and the authors did not record historical facts. In comparison, later texts such as the Arthaśāstra and early Buddhist literature provide substantial information about metallurgy and the material culture during the ancient times.

Besides philology, the study of fields such as archaeology or cultural anthropology adds perspective to the subject. To help interpret relevant aspects of Vedic literature, I conducted a field survey on Gadulia Lohars[27], a community of blacksmiths in Udaipur, Rajasthan, India in March 2018.

Although traditional metallurgy and metallurgical practices have disappeared with industrial progress, I had the opportunity to see traditional goat-leather bellows called "*dhaman*" in a family. It is noteworthy that the word *dhaman* etymologically goes back to the old Indo-Aryan verb *dham/dham*^{i}, "to blow," and in the RV, the leather bags (*dṛ́ti-*), as seen above[28], are used as bellows.

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NOTES

1) Cf. *EWAia* I, p. 104: n. base metal [in contrast to *hiraṇya-* 'precious metal']; ... Old Avestan *aiiah-* n. the ore for the ordeal used in the last judgment. New Avestan *aiiah-* n. "metal," Proto Indo-European **aḭes-*, Latin *aes* "ore."
2) While the word *híraṇya-* had a single meaning, "precious metal" in the Ṛgvedic period, this word was distinguished by its color in the stage of Atharvaveda and Yajurveda Saṁhitās as *háritaṁ híraṇyam* "yellow precious metal, i.e. gold" or *rajatáṁ híraṇyam* "whitish precious metal, i.e. silver." Cf. Rau (1974: 18f).
3) RV X 72, 2ab *bráhmaṇas pátir etā́ | sáṃ karmā́ra ivādhamat*.
4) Cf. Gotō (2014: 243, 247); Yamada (2016: 277f).
5) RV X 81,3 *viśvátaścakṣur utá viśvátomukho | viśvátobāhur utá viśvátaspāt | sám bāhúbhyāṃ dhámati sám pátatrair | dyā́vābhū́mī janáyan devá ékaḥ ‖*
6) Cf. Sakamoto-Goto (1985: 174-176); Falk (1994: 5); Gotō (2004: 416f).
7) Lead (*sī́sa-*) is sometimes connected with the infertility. Falk (1991: 115f). points out that this image is based on the poisonous substance emitted by the burning of lead, harming the reproductive abilities of workers.
8) AVŚ XI 3,7 *śyāmám áyo 'sya māṃsā́ni | lóhitam asya lóhitam ‖ 8 trápu bhásma háritaṃ várṇaḥ | púṣkaram asya gandháḥ ‖*
9) AVP XVI 53,12 *śyāmam ayo lohitam | ayo 'sya māṃsam ‖ 13 trapu bhasmārjunam asthi | haritam varnaś puśkalaṃ gandhah ‖*
10) AVŚ I 16,2 *sī́sāyā́dhy āha váruṇaḥ | sī́sāyāgnír úpāvati | sī́saṃ ma índraḥ prā́yachat | tád aṅgá yātucā́tanam ‖... 4 yádi no gā́ṃ háṃsi yády | áśvaṃ yádi pū́ruṣam | táṃ tvā sī́sena vidhyāmo | yáthā nó 'so ávīrahā ‖*
11) Cf. ~AVP I 10,1 *amīvāyāyāstu cātanaṃ* "May the exorcism to the disease."
12) AVŚ X 10,5 *śatáṃ kaṃsā́ḥ śatáṃ dogdhā́ra | śatáṃ goptā́ro ádhi pṛṣṭhé asyāḥ | yé devā́s tásyāṃ prāṇánti | te vaśā́ṃ vidur ekadhā́ ‖* "A hundred metal vessels, a hundred milkers, a hundred guardians are on her back. They, the gods who breath in her, know the cow singly."
13) Cf. Sakamoto-Goto (1984: 60ff).
14) MS II 11,5: 142,5-7[m] *árvatāś ca me girā́yaś ca me. śíkatāś ca me vánaspátayaś ca me. 'śmā ca me amṛ́ttikā ca me. híraṇyaṃ ca mé 'yaś ca me. sī́saṃ ca me trápu ca me. śyāmā́ṃ ca me lohitāyasáṃ ca me*.
15) VSM XVIII,13 *...híraṇyaṃ ca mé 'yaś ca me śyāmā́ṃ ca me lohā́ṃ ca me sī́saṃ ca me trápu ca me...*
16) KS VI 3: 51,9-11[p] *samāne vai yonā āstāṁ sūryaś cāgniś ca. tatas sūrya ūrdhva udadravat. tasya retaḥ parāpatat. tad agnir yoninopāgṛhṇāt ayasā. tad akrūḍayat. tat krūḍyamānaṃ gavi nyadadhāt. tad idaṃ payas. tasmād atrapv +ayaḥpātraṃ* (cf. Mittwede p. 51. Ed. Schloeder *atrapvayaḥ pātraṃ*.) *pratidhuk krūḍayati*.
17) Kulikov (2012: 465ff). discussed the verb (*krūḍ*), referring to previous studies. It has been translated as "make thick" (*PW* II: 507) or "curdle" (Caland *Kleine Schriften*, p. 211, Rau (1972: 19f), or *EWAia* I: 415). However, Kuiper (1991: 75f) criticized these ideas because they are mere assumptions based on traditional interpretations. He concluded that the verb should be translated as "scorch," in light of the parallel passage in which *vi-dah* "burn up" is used instead of *krūḍ*. Kulikov, ibid. introduces the translation of Bodewitz (1976: 34f) "stick (burn) (to the iron pan)" as a possible meaning of this word.
18) MS I 8,2: 117,12-19[p] *sahá vā́ etā́ āstām agníś ca sū́ryaś ca samāné yónā áyasi lóhite. sá ādityá ūrdhvá údadravat. tásya rétaḥ párāpatat. tád agnír yóninópāgṛhṇāt. tád enaṁ vyàdahat. tásmād áyo 'trapú pratidhúk kṣīráṁ vídahati. tásmād etáj juhvati. paśūnā́ṁ vā́ etát páyo yád vrīhiyaváu. tásmād*

etáj juhvati. nā́tiśṛtaṃ kāryàm. rétaḥ śoṣayet. yád viṣyándetonmā́duko 'sya prajā́yām ā́jāyeta. amúṣya vā́ etád ādityásya réto hūyate. 'medhyám áśṛtam. samúdantaṅ hotavyàm. tád dhí śṛtáṃ médhyaṃ mithunáṃ prajaniṣṇú ‖

19) A ritual application is explained in the style of mythology in this passage: "people should offer the properly boiled (*samúdanta-*) milk in the ritual, not the overboiled (*átiśṛta-*) or unboiled (*áśṛta-*) one." So, we naturally expect that the burned out one is the milk, however, this passage exclusively does not make us interpret so. The next footnote has further information.

20) Rau (1974: 20): "Der [d.h. der Samen] verdarb ihn [d.h. den Mutterschoß] durch Hitze. Daher verdirbt Nutzmetall Kupfer ohne Zinn[-beimischung] frishce Milch durch Hitze." Amano (2009: 284): "er (der Same) verbrannte ihn (den Mutterschoß); deswegen verbrennt die gerade gemolkene, frische Milch Nutzmetall (Kupfer) ohne Zinn[-beimischung]."

21) ŚBM V 4,1,2 … *nàitad áyo ná híraṇyaṃ yál lohāyasáṃ. nàite krímayo nā́krimayo yád dandaśū́kā átha yál lohāyasám bhávati. lóhitā iva hí dandaśū́kās...*

22) ŚBM XIII 2,2,16 *hiraṇmayó 'śvasya śāsó bhávati lohamáyāḥ páryaṅgyāṇām āyasā́ ítareṣāṃ.*

23) Cf. Eggeling (1900: 300f)

24) ŚBM XIV 2,2,54 *sá yád vānaspatyáḥ syā́t prádahyeta. yád dhiraṇmáyaḥ syā́t prálīyeta. yál lohamáyaḥ syā́t prásicyeta. yád ayasmáyaḥ syā́t prádahet parīśāsā́v. áthaiṣá evàitásmā atiṣṭhata. tásmād etám mṛnmáyenaivá juhoti.*

25) In AVŚ XI 10,12, we come across the expression "to pour (sec) *vájra-* (the name of a weapon)," which means "to put the melting metal on an anvil before forging." Cf. Gotō (2002: 40).

26) ŚBM VI 1,3,5 *síkatābhyaḥ śárkarām asṛjata | tásmāt síkatāḥ śárkaraivàntató bhavati. śárkarāyā áśmānaṃ. tásmāchárkarāśmaivàntató bhavaty. áśmanó 'yas. tásmād áśmanó 'yo dhamanty. áyaso híraṇyaṃ. tásmād áyo bahudhmātaṃ híraṇyasaṃkāśam ivaivá bhavati.*

27) Misra (1977) has conducted comprehensive studies on Gadulia Lohar.

28) Here is another example that describes a scene of smithing; RV V 9,5 *ádha sma yásyāarcáyaḥ | samyák saṃyánti dhūmínaḥ | yád īm áha tritó divíy | úpa dhmā́teva dhámati | śíśīte dhmātárī yathā* ‖ "Then he (Agni) whose smoky flames come together, when Trita blows (*dhmā/dhami*) him in heaven like a blower (*dhmā́tar-*, smelter), sharpens himself as if by the blower (*dhmātár-*, bellows)."

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