Introduction

The present work deals with the role played by iron technology in the region of Vidarbha during the early Iron Age. The period was marked by a transition from the dominant use of copper to the increasing use of iron as evident from the different zones in the Indian subcontinent. The Early Iron Age of Vidarbha is marked by the presence of megaliths, and the maximum presence of iron artefacts during this period are in the form of funerary offerings. Therefore the period of study should be termed as the Early Iron Age Megalithic period. Tripathi (1973, 2001), Tewari (2003), Gullapalli (2009), Vaidya (2014) have individually made attempts at answering the questions regarding the role of iron technology in the urbanization of the multiple zone, and the knowledge of iron metallurgy at that time. Possehl and Gullapalli (1999) have rightly pointed out that to understand the origin and development of Iron Age in a certain zone like India it is pertinent to understand and take into consideration all the Early Iron Age cultures developing at the same period of time over a varied zone as their relationships with each other needs to be understood. The present work attempts firstly to understand the impact of iron technology on the Vidarbha megalithic culture, secondly how far iron-technology was developed and finally the socio-cultural dynamics involved in a primitive iron-producing society.

To understand the above mentioned dynamics, the investigation was concentrated in a part of the Vidarbha region, with the main foci on the area comprising Nagpur, Wardha and Gadchiroli districts. The eastern and north-eastern part of Maharashtra state is termed as Vidarbha. Eight sites have been included in this study, namely Dhamna Linga, Dhavalameti, Vyahad Mahurjhari, Bhagimohari, Borgaon and Naikund from Nagpur District and Khairwada from Wardha District. The cultural chronology and their geographical settings have been discussed in detail in Chapter – I.

The sites represent both burial and habitation sites and Naikund is the only known site which has brought to light actual evidence of iron production.

0.1 Metals and Cultural Development of Humankind

The identification of ore deposits, quarrying and processing it is projected as one of the greatest achievements of mankind. The usage of metal and fashioning finished metal artefacts marked a significant developmental stage in the techno-cultural history of human population.

Usage of iron artefacts in the Indian subcontinent became prominent only about 1000-500 BCE in the Gangetic basin because it was one of the later metals to be exploited by people, as the technology involved in the extraction of iron was highly advanced. Additionally, the process and knowhow required for iron was entirely different from that of copper, which had been already successfully mined and its extraction process mastered. While discussing the developmental stages of iron technology, questions have been asked about the beginning of iron technology or how was iron ore first smelted as iron requires 1540°c for smelting, which means an advanced knowledge of pyro-technology.

The earlier researches on iron technology and its advancements were made on the basis of literary data and scientific analysis was not taken into consideration. Before Banerjee's work (1965), studies on the beginning of iron technology in India were at a nascent stage. The works of Banerjee (1927) and Neogi (1914) dealt with the roots of iron technology; however their analysis were based primarily on literary works such as the *Rigveda* where the identification of *ayas* with iron was the major concern. Similar studies were later undertaken by Kosambi (1963) who tried to trace the beginning of iron technology based on the Buddhist literary text, *Suttanipata*. The importance of literary works in the study of iron technology continued till the twentieth century, for example Prakash (1997) has postulated that the vedic *havankund* or fire altar was the place of origin of iron technology in the Indian sub-continent and he reconstructed the entire process of ancient iron making in India based on the verses (*ritchas*) of the *Rigveda* and *Yajurveda*.

Some of the earliest metallographic studies on iron artefacts were conducted by Bhardwaj (1973 and 1979) on the assemblage from the Early Historic context of Rajghat and by Hegde (1973a and 1973b) on the iron artefacts from Dhatwa. These were the first attempts at co-relating archaeological data with metallographic analysis

and also supplementing the data with ethnographic survey. Similar attempts were made by Chattopadhyaya (1982; 1989) by studying the iron artefacts from eastern India. Archaeo-metallurgical studies were also done by Anantharaman (1996) on the famed Delhi iron pillar. Although we do have written records for this period, the metallurgical techniques adopted in constructing the pillar were better reconstructed based on scientific examinations done by colonial metallurgist Hadfield (1912). They showed that the iron used was of very pure quality i.e carbon content was only at 0.08% and Fe at 99.72%. Similarly, metallurgists came to the conclusion that the iron used for constructing this pillar was never in the molten state and huge balls of hot iron were hammer-forged or forge-welded. The techniques used by the Gupta period iron-smelting could be reconstructed based on the metallographic studies by Bardgett and Stanner (1963), Wranglen (1970) and Ghosh (1963) and the reasons behind the 'rustless wonder' was also answered using these chemical analysis data. The high phosphorous content (0.8%) checked corrosion activity as it forms a protective film on the pillar surface, and the presence of low sulphur content (0.006%) and the absence of manganese also helps in prevention of corrosion.

Attempts have been made by various scholars to trace the origin of iron technology in the Indian sub-continent. One of the foremost propositions is that the earliest evidence of iron technology is from Baluch and Persian Makran (Banerjee, 1965). According to Wheeler (1948), the megalithic tradition visible in specific zones in southern India and northern India was probably spearheaded by the independent origin of megalithic practice in southern India. However according to Banerjee (1965) the influence of the southern Indian megalithic culture on the northern megalithic culture of Baluch and Persian Makran do not hold ground. However, the similarity in the post-holed cists and megalithic architecture along with the similarity in funerary offerings reflect broad similarity and probably suggest that the iron technology moved from the Mediterranean or Caucasus region to the Indian sub-continent. According to Krishnaswami (1949) the structural features of the dolmenoid cists at Dambakoh and the southern India megaliths like Brahmagiri point towards a cultural amalgamation and assimilation. The dolmenoid cists at Damnbakoh have been described as square chambers with a circular or square opening on the side which has been identified as a port-hole. This feature has a striking resemblance with the southern Indian megaliths. Similarly, scholars like Childe (1948) opine that the origin of iron technology, which

was later adopted in the Indian Sub-continent, can be traced to the cairn burial zone of Iran and the North-Western Pakistan border, as the architectural styles, the port-hole like opening and the presence of horse remains display similarity between the southern Indian megalithic sites. The finding of iron artefacts associated with both cultures also led to the linking of Iran cairn burials, North-Western Frontier Province burials and the southern Indian megaliths which led Gordon (1950) to postulate that the predecessors of the Early Iron Age Megalithic Culture of India were the cairn burials associated with Londo ware of Iran.

The other theory of the origin of iron technology is associated with migration theories, i.e. ideas of change from outside. Forbes (1950) felt that the idea of iron smelting activity required prior expertise therefore, according to him, the art of iron smelting originated at a different place and then the developed idea was adopted by the inhabitants of the Indian subcontinent. The propounders of this influence from geographical spheres, like Neogi (1914) and Banerjee (1929) usually credited the so-called 'Aryans' with the introduction of iron technology, and therefore, the beginning of iron technology was assigned the Rig-Vedic Age. Similarly, Lallanji Gopal (1960) has assigned the advent of iron technology to the Later Vedic Age. The association of Aryans with the Painted Grey Ware (PGW) culture in the Ganga-Yamuna plains and their association with iron points to the first users of iron have been pointed out by Lal (1986). The advent of iron in the PGW dominant zone is contemporary to the period when defensive fortifications were built using mud bricks at Ujjain and Kausambi (Sharma, 1960). The weapons found such as arrow-heads, spears-heads and daggers have been associated with the warring class. Along with the iron tools, copper artefacts were also in circulation for example, a copper borer was found from the site of Hastinapur (Lal, 1954-55).

In stark contrast, the advent of the Early Iron Age culture in Vidarbha and southern India has no such enigmatic forts or fortifications to its credit. Till date very few habitation sites pertaining to this period have been reported, and those reported, such as Takalghat - Khapa (Deo, 1970), Vyhad (Meshram and Kellellu, 2009 and Kellellu, 2015), have brought to light that agro-pastoral communities had started to adopt iron technology and were successful in manufacturing a variety of artefacts. It can even be argued that iron had brought in a significant change in their livelihoods. Similar

activities were being earlier performed during the Chalcolithic period, such as agriculture and defensive -offensive activities with copper artefacts; however with the introduction of iron, the material of the tools changed along with their functionality.

0.2 Defining 'Early Iron Age' and its Different Zones

The term Early Iron Age marks the transition from the usage of bronze artefacts to the use of iron artefacts. The rudimentary use of iron does not suggest the true beginnings of iron technology. Instead, it is marked by the beginning of proper smelting activity, as is evident from the remnants of furnaces, slags circlers and ore lumps. It can be rightly said that the origins of iron technology do not have a single nucleus, and have developed over a period of time at different centers because utilization of new materials, employing new technologies, indicates the beginning of a new lifestyle and the need to adapt to the changing natural and man-made environs. The transitional phase raises questions as to whether successful iron smelting was the outcome of an accidental process; was it an acquired knowledge or was it an indigenous development? Some believed that smelted iron was an accidental by-product of copper smelting activity, however furnaces used for copper smelting required a temperature of about 1083°C whereas for iron smelting minimum temperature required is 1540°C.

The Early Iron Age of Vidarbha is marked by heavy duty tools made from iron along with multiple blade tools and tools with pointed ends. Copper artefacts also continued to be in use in the form of decorative artefacts such as lids with bird and bud finial; copper horse facial ornaments and bangles were still in use. Therefore it can be very well understood that iron technology at its inception was mastered but copper still continued to be an integral part of the tool assemblage.

0.2.1: Different Zones of Early Iron Age in the Indian Sub-continent

While assessing the antiquity of iron in India, Chakrabarti (1976; 1985) as well as Tripathi (1973; 2001) have divided the entire sub-continent into six zones as listed and individually described below:

- North-West Frontier
- Baluchistan
- Ganga Valley
- Eastern India
- Malwa and Berar in Central India
- Deccan Peninsular and Southern India

0.2.1.1 North-West Frontier (Gandhara Grave Culture and Swat Region)

One of the earliest evidences of the Early Iron age has been recorded from the Swat valley region**.** According to Allchin (1983), the artefactual assemblages from the Gandhara Graves have features similar to the sites in Iran like Tepe Hissar, Shah Tepe and others. The Gandhara Graves in the Swat valley have yielded iron implements from the earliest known dates (1000-900 BCE). However no precise radiocarbon dates are yet available from the Gandhara Graves type sites. The Gandhara grave culture has been divided into three periods by Dani (1967): Period I to 1600-1300 BCE, Period II to 1200-1000 BCE and Period III to 900-600 BCE. According to Dani (1967), these dates also signify the beginning of Iron Age in the Pakistan and Kashmir region. According to Stacul (1970) the pottery recovered from this period is handmade and crude grey ware which is broadly comparable to the Neolithic Phase I ceramic of Burzahom in Kashmir. The earliest dates that can be assigned to the Gandhara Grave culture go back to 1600 BCE, although iron appears at about 800 BCE (Tripathi, 2003). The material evidence revealed by this grave culture is a variety of iron tools like arrowheads, spearheads, nails, finger rings as well as horse cranial bones (Stacul, 1969 and 1971 and Dani, 1967).

According to Stacul (1969), iron appears in this zone only around 1000 BCE and according to Allchin (1983) some of the graves predate the occurrence of iron. However, a few iron objects such as spearheads, arrowheads, nails, spoons, flat axes and horse ornaments have been recovered from some graves (Tripathi, 2003). Katelai a Gandhara grave culture site has yielded two human burials along with two horse burials and the associated funerary goods are iron spearheads, arrowheads, along with a horse bit (Stacul, 1971). The contents of the burials show a close similarity with some megalithic burials at Vidarbha.

0.2.1.2 Baluchistan

Cairn burials from this area were first reported by Mockler (1876). Later, Stein (1929) and Fairservis Jr. (1956) carried out extensive explorations in the Quetta valley and reported numerous cairn burials that fall in the bracket of 1000 BCE to 7th c ACE. Mughal Ghundai (Stein, 1929), one of the more well known sites, has brought to light about 100 cairns in which multiple varieties of iron objects, along with bronze artifacts, had been interred as burial offerings. Similar evidences have been found from sites like Zangian (Stein, 1931) and Gatti (Mockler, 1876 and Stein, 1931), along with horse burials. Evidences of habitation have been found from sites such as Basot (Stein, 1931) and Dambakoh (Stein, 1931) where houses with several rooms with a square plan were found. The associated objects found were glazed pottery with green enameling, terracotta beads, cord impressed ware, and grinding stones associated with food production (Mockler, 1876). Along with these, two iron javelin heads and an iron vessel were also recovered. Despite these finds, evidences of iron production and use are meager. Based on the iron assemblage and the cairn burial pottery, Gordon (1950) propounded that the cairn burials in the Baluchistan belt had strong affinity with Sialk VIB, and that the occurrence of iron objects in Baluchistan are due to this affinity. The similarities between the two groups were drawn based on the shared horse motif on the Londo Ware (De Cardi, 1951) and the horse friezes on the painted pottery of Sialk VI B. However, according to De Cardi (1951), Londo Ware and the cairn burial pottery have no similarities and they have never been found associated with each other, and thus no affinity can be drawn based exclusively on the occurrence of the pottery. On the other hand, the artefact assemblages from Baluchistan have been identified as having a strong affinity with Sirkap/Taxila (Tripathi, 2003).

Pirak (Jarrige and Enault, 1973) is known for its lengthy multi-cultural sequence. However, iron artefacts are found in large number only during period III (1000-800 BCE). The associated pottery assemblages are handmade ceramics along with bichrome pottery, buff ware and cream slip red ware, having designs such as motifs of multiple triangles as well as intricate latticed decorations. One of the more interesting finds is the two-winged arrowheads lying with bits of iron, mixed with a large quantity of ash near a small apsidal oven (Jarrige and Enault 1973:167). Other

associated finds from this level include terracotta seals with compartmented designs, and beads with zigzag patterns and concentric circles.

0.2.1.3 Ganga Valley

The western zone of Ganga valley is dominated by Painted Grey Ware whereas the eastern zone is marked by Black and Red Ware (BRW). PGW levels have been reported from sites such as Atranjikhera (Gaur, 1983), Hastinapur (Lal, 1954-55), Jakhera (IAR 1974-75, 1975-76, 1985-86, 1986-87), Jodhpura (Agrawala and Kumar, 1976), to name a few examples. This BRW culture was first identified at the site of Ahichchhatra (IAR: 1963-64, 1964-65). Iron slag from the BRW level of Jodhpura (Agrawala and Kumar, 1976) gave indications of local iron smelting activity, as it was associated with a crucible shaped furnace. However, the evidences are marginal, except for slag from the PGW levels of Hastinapur (Lal, 1954-55), and evidences of an iron-smelting kiln, associated with iron slag from Atranjikhera (Gaur, 1983), and cannot be used as the only indicator for indigenous iron-smelting activity in the Indo-Gangetic doab (Agrawala and Vijay Kumar, 1976).

Absolute dating of iron technology in this region led to a renewed understanding of this ambiguous phase in Indian history, with the finding of iron at the earliest cultural levels of Jhusi (Allahabad) and dated to 1107-844 cal BCE (Tewari, et al. 2000). Similar evidences have been unearthed from Raja-Nala-Ka-Tila (Tewari and Srivastava, 1997 and 1998), Malhar (Tewari et al.2000), Dadupur (Tewari, et al.2002) and Lahuradeva (Tewari, et al. 2002a) where the iron bearing levels have been dated to 1400-800 BC, associated with period II (Pre-NBP level). Artefacts such as nails, arrowheads, knives and chisels along with iron manufacturing waste (slag), were recovered. Structural remains such as tuyeres and a furnace-like structure were unearthed from Period II at Malhar, and dated earlier than the corresponding layer at Raja-Nal-Ka-Tila, through stratigraphic association with cord impressed coarse ware. A mound known as *Lohsan* or *Lohsanwa* located adjacent to the main mound of Malhar has brought to light evidences of large scale iron smelting activity associated with Red, Grey and Black Slipped ware, tuyeres and furnace and a finished axe. All the findings have been dated to the beginning of early iron technology to the second millennium B.CE (Tewari, et al. 2000).

0.2.1.4 Eastern India

The term 'Ferro-Chalcolithic' phase is associated with eastern India which comprises Bengal, Bihar and Orissa. From the region of Bengal, evidences of iron smelting and finished artefacts have been unearthed from the basal levels of the Chalcolithic period (Datta, 1998). According to scholars like Datta (1998), iron technology developed independently in different zones. Where West Bengal is concerned, the earliest form of iron technology appeared during the Chalcolithic period as reflected in the material assemblages of Pandurajar Dhibi (Burdwan district), Mangalkot (Burdwan district), Dihar, Mahisdal, Hatigra (Ghosh et al. 1987-88) and Banswardanga. Some of the important artefact types are daggers, spearheads, arrowheads, sickles, chisels and so forth. At Bahiri, remnants of iron slags have been found (Chakraborty and Hassan, 1982) and similar evidences have been unearthed from Mangalkot (Personal communication, Suchira Roychoudhury 2010). However, the artefacts are extremely corroded and thus indeterminate in nature. In recent years, chemical analysis of artefacts from Pandurajar Dhibi, Hatigra and Mangalkot has been carried out and according to Datta (1998) the presence of nickel (Ni), cobalt (Co) and copper (Cu) indicates the usage of meteoric iron for the earliest iron production. However, there are questions regarding its origin as the percentage of nickel is too low (0.20 – 0.036%) to ascertain a meteoric origin.

0.2.1.5 Malwa and Berar in Central India

Madhya Pradesh and Rajasthan are grouped within this zone and the earliest evidences of iron use here are available from post Chalcolithic levels. Madhya Pradesh is endowed with a large number of high grade iron ore deposits. The site of Eran (Sagar district) (Tripathi, 1995), having features conforming to the Malwa Chalcolithic complex, has brought to light evidences of iron from Period II-A dated to 1300-700 BCE. However according to the excavator, the stratigraphy of the site was disturbed due to the formation of pits, therefore 1300-700 BCE for the iron artefacts is too an early date and instead, places the iron bearing level at 800-700 B.C. (Tripathi, 1995). In the case of Rajasthan, the earliest evidences of iron were recorded from the Chalcolithic levels of Ahar (Banas culture). Sahi's (1979) re-examination of the iron objects assemblages from the different stratigraphic levels enabled him to propose that iron objects at Ahar was present in Period Ic, which yielded at least 10 objects

with Black and Red Ware. The C14 date for Period Ic obtained by the excavator ranges from 1550 to 1270 BC.E Sahi (1979) proposed that the start of iron smelting in India may be placed as early as the sixteen century BCE.

0.2.1.6 Deccan Region

In the Vidarbha region, a large number of Iron Age and Megalithic remains have been found, including a large number of burials and a few settlements. Some of the excavated sites are Takalghat Khapa, Naikund, Khairwada, Mahurjhari, Borgaon, Raipur, Hingna, Dhamna linga, Junapani, and very recently at Dhaulameti and Vyahad. Some of the sites are exclusively burial sites, which gave evidences of human burials interred with burial goods as well as animal remains. Vyahad (Kellellu, 2015), Takalghat Khapa (Deo, 1970), Naikund (Deo, 1982), Khairwada (I.A.R. 1981-82) and Mahurjhari (Deo, 1973, Mohanty, 2003a and 2003b) have yielded habitation remains stratigraphically associated with the burial remains. These megalithic burials, as well as the habitations, can be dated back to the Early Iron Age levels. An excavation at Naikund has brought to light remains of iron smelting furnace and the surrounding soil has a very high ferrous content, due to weathering of the locally found rocks with ferruginious haematite. The high ferric content also suggests that the area was utilized for smithery. The forging of hot iron appears to have resulted in the scatter of iron-containing slag nodules which got mixed with the soil.

The iron artefacts along with copper artefacts have been found from these megalithic burials as offerings and also from habitation levels.

These two un-calibrated dates from Takalghat-Khapa places the iron implements, as well as the culture pertaining to the burials and the habitation, to the mid-seventh century BCE. The dating from Naikund, along with archaeological evidences, suggests an indigenous development of iron and its early appearance. The iron assemblage from the site does not project much variety in the tool typology in comparison to sites like Bhagimohari and Mahurjhari. The microscopic analysis of the artefacts found from Naikund also show stages of development. Not all artefacts achieved complete steeling and the impurity in the form of silica which was rather high suggesting that smelting and smithery activity was still at an experimental stage. Based on the dimensions of the smelting furnace (Deo, 1970) and the results of the

compositional analysis of Gogte (1982) on the samples ore and slag, it appears that the whole iron industry had not yet reached a state of advancement. This shows that the iron smelters and smiths of Vidarbha had the know-how of iron metallurgy but were still mastering it. It can thus be suggested that the megalithic culture of the Vidarbha region of Maharashtra falls within the bracket of the Early Iron Age period. Rao (1988) attempted at categorizing the Early Iron Age Megalithic societies of Vidarbha into five professional groups namely, agriculture, smithery, carpentry, pottery making and stone cutting masons based on the iron artefact assemblage recovered from the sites and have tried to draw similarities with the megalithic sites from Andhra Pradesh.

0.2.1.7 Southern Region

The megalithic tradition present during the Early Iron Age and continuing to the Early Historic period was first brought to notice by Babington (1823) and during the colonial period many 'Megalithic' sites were discovered and 'excavated' by colonial officers, missionaries and treasure hunters. Major investigations were done in the Peninsular region by Taylor (1841, 1851, 1852 and 1862), Breeks (1873), Krishna (1931), Sundara (1979 and 1985), Rajan (1990 and 1994), among others. The first scientific excavation was done by Wheeler (1948) at the site of Bramhagiri which placed the megalithic culture in a stratigraphic context and placed it at 200 BCE to the 1st century CE. Thermoluminiscence dating of the burial pottery from Komaranahalli also suggests a similar age. Subsequently, more sites were excavated all over peninsular India, namely Maski in Raichur district (Thapar, 1957), Hallur in Dharwar district (Nagaraja Rao, 1971), Porkalam in Kerala (Thapar, 1952), Sanur in Tamil Nadu (Banerjee and Soundara Rajan, 1959), Ramapuram (IAR: 1980-81). A variety of monuments fall under the category of megalithic burials. Sites without lithic appendages also fall under this category because of their association with the culture and are termed as habitational sites. It is important to note that earlier 'Megalith' or 'Megalithic site' was used for denoting only sepulchral stone monuments. Later however, 'Black and Red Ware', whether associated with sepulchral monuments or not, was designated as part of the Early Iron Age megalithic burial or habitation site (Mohanty and Selvakumar, 2002).

Krishna Swami (1949) has done pioneering work in classifying megalithic architectures and has given local names for these stone structures. The earliest evidence of iron has emerged from the site of Hallur in the Raichur Doab located between the two rivers Krishna and Tungabhadra. Hallur is located on the left bank of Tungabhadra River and provides evidence of a cultural level which shows the transitional features between the Neolithic-Chalcolithic Phase to the Early Iron Phase (Nagaraja Rao, 1971). The presence of Early Iron Age traits is associated with the presence of Black and Red Ware, along with remnants of copper technology. The region termed as 'South India' has provided one of the earliest evidences of iron working and smelting in the Indian subcontinent. Although iron technology and megalithism is contemporaneous in the peninsular region, iron technology is a technological advancement which had its repercussions on societal formations; the megalithic tradition is deemed to be the end product of socio-religious behavior. Moorti (1994) has attempted to construct the subsistence economy and societal formation of the Megalithic society of South India based on the cultural, zoological and botanical remains which was one of the earliest works which looked at reconstructing the cultural systems forming the megalithic society based on archaeological data.

0.3 Debates Regarding the Role of Iron Technology in Urbanization

As mentioned earlier, the use of iron led to the diversification and modification of the cultural backdrop and ushered in the phase of the Second Urbanization in the Ganga plains. The introduction of iron in this region has been traced by Tewari (2003) to the second millennium BCE. The first Urbanization has been marked by the development of copper and bronze technologies which led to the emergence of the Harappan or Indus Valley Civilization; the Second Urbanization was characterized by the clearance of forested tracts, appearance of cities and the development of kingship in the Gangetic-Yamuna doab (Banerjee, 1965). The period of the Second Urbanization is contemporary with the Northern Black Polished Ware (NBPW) culture; however the beginnings of the Iron Age can be traced to the Painted Grey Ware (PGW) culture. According to Ray (2006), iron tools and implements used during the PGW culture conformed to hunting category and agricultural tools found, such as hoes, were not

suitable for large-scale agricultural activity. This suggests that agriculture, a marker of sedentary lifestyle and development of urban centres (Childe, 1950) was not yet achieved. Therefore, the term *urbanization* cannot be used for this phase, whereas the Ganga-Yamuna valley during the NBPW culture experienced urbanization under the Nandas and the Mauryas as they had access to advanced iron technology due to their association with West Asia.

On the other hand Lal (1986) suggests that advancement in iron technology and diversification in the tool types during the NBPW culture, and its considerable influence on urbanization was just a myth. He opines, in Atranjikhera (Gaur, 1983) not much change is visible in the tool types between the two cultures, and quantitatively there has not been much change. He also suggests that the concept of forest clearance for arable agricultural land was also a myth, as the thick forest cover in this area was constant till the late $16^{th} – 17^{th}$ century ACE.

The second urbanization was not a by-product of the advanced iron technology, but it happened due to the emergence of multiple socio - political institutions, which aided in controlling and distributing the natural resources available. In recent times, however, urbanization has been studied in a different way. Vaidya (2014) in his PhD thesis has shown the role of technology in urbanism by looking at it from different points of view such as the Marxist approach, which is the king or chief, who had control over the natural resources of the region and could control the utilization of the resources, would be the supreme authority of the region (Kosambi, 1965). Sharma (2007) also propounded a similar theory. Additionally, Vaidya (2014) also suggested the concept of surplus (Childe, 1950) where technology led to increase in production and greater surplus required an authority for its safekeeping. He opines that iron technology did create social and political changes.

0.4 Defining Megalithic Culture

The word ‘megalithic’ has its origin in the Greek words, *megas* meaning ‘big’and *lithos* meaning ‘stone’. Therefore, the word ‘megaliths’ primarily stands for funerary

monuments made of stone boulders or slabs. Megalithic remains have been found in different parts of the world, of which the best known is, of course, the Stonehenge of Avery belonging to the Neolithic period. These megaliths are either primary or secondary in nature and few of them are commemorative. No written records are available for the megalithic tradition prevalent during the Early Iron age in Vidarbha. Therefore the mode of disposal of the dead and the society which buried their kith and kin in such an elaborate manner is still shrouded in mystery. However, references to megalithic practices in the peninsular region have been found in the Tamil Sangam texts and according to Srinivasan (1946), the megalithic tradition was prevalent before 300 BCE, however with the advent of the so-called Aryans, the tradition started to disappear.

However, beliefs and rituals associated with megalithic traditions have been studied through ethnographic parallels from contemporary megalithic practicing societies by scholars like Binodini Devi (1993), Jamir (1997-8) and others. The ethnographic studies have revealed that the practice of erecting megaliths does not just suggest a funerary process but also commemoration of an important event.

The different types of megaliths found in the Deccan Peninsular region and southern India have been categorized by Krishnaswami (1949).

Megalithic Culture in India has been divided into separate zones based on their burial type and the prevailing culture. The megalithic burials have been segregated into categories based on their architectural differences. The first category is the pit burial, within which we have stone circles, cairn circles and cairns. All of these types are concentrated in the Vidarbha region. The second category consists of urn burials, sarcophagi, umbrella stones, hood stones and hat stone burials (*topikal*). The last three types are found only in Kerala and the others are found in Tamil Nadu. It is important to point out here that a sarcophagus burial type in association with a cairn circle has been found also from Vidarbha. The third category of burials is of the chambered style and has been mainly associated with a southern Indian megalithic culture. Within this category we have the dolmens, dolmenoid cists, port-holed dolmens and rock cut burials. Dolmens have been also reported from Hirapur, a site in Vidarbha; however its actual cultural context is still in doubt. The fourth category is burials

which are of commemorative or memorial value such as the menhirs, which are either single standing rocks or aligned in rows. In the study area, such structures have been encountered at Nagbhid (Chandrapur District). These burials are of commemorative type and these types of burials have been rarely chosen for excavation. Megalithism cannot be given a single time bracket since it evolved in different zones by different cultures and is a continuing tradition in certain zones even today.

0.4.1 Importance of the Present Study

The review of the earlier works on this zone has indicated that the studies on this region were mostly concerned with the mere typological analysis of material culture and technological aspects of the artefact assemblage were neglected. Therefore, to understand the importance of iron technology in the cultural evolution of humankind, not only traditional analysis but also scientific analysis of a sample of the material culture is deemed necessary.

In India, analytical studies of metals and their by-products have been carried out on sites in different zones. However, attention has been concentrated only on compositional and manufacturing techniques, whereas the study of ancient metallurgy cannot be confined only to the scientific analysis, as it also involves the society that produced those artefacts. Therefore, it is necessary to understand the role of the socio-economic development of a culture.

0.4.1.1 Aims of the Present Study

The development of a socio-cultural model for the study of iron technology of the Vidarbha megalithic culture and its general role in society has been formulated along the following lines:

- Understanding the chemical composition and the microstructural features of the iron artefacts, which would better characterize the artefacts from a physical perspective.
- Assessing the manufacturing processes of the iron implements and the stages of development of the manufacturing techniques. This would help understand the chaine operatoire of the entire process of iron extraction and processing.

- Understanding the functional attributes of the artefacts, taking aid of ethnographic artefacts. As India has a unique history of cultural continuity in different aspects, the use of select modern day communities as ancient behavioural analogs would help in bridging the gap between the theoretical and empirical realms of megalithic archaeology.
- Overall assessment of the societal formation of the Early Iron Age society in the Vidarbha region based on the ethnographic survey of the megalithic region. This is one of the least understood aspects of megalithic society and requires more attention. A preliminary attempt is made to offer different observations and work towards developing hypotheses regarding social interactions and associated hierarchies in the Vidarbha megalithic culture. The ancient knowledge and practice of iron technology is viewed as a driving catalyst in shaping this society and culture in this region.

For fulfilling the above mentioned aims a structured methodology is incorporated. First, the materials from the excavated sites, housed in various institutions were studied including typological classification. The method and parameters used have been discussed in detail in Chapter III. Following the typological classification, the iron tools were sampled and these samples were analysed using various labs for microscopic and chemical analysis methods. The methods and tests done have been discussed in detail in Chapter III. However, to comprehensively understand the ancient smithery practices it was necessary to also incorporate ethno-archaeological and experimental approaches. Based on these collective results, the intangible traits of the Early Iron Age society of Vidarbha were better understood. Another beneficial outcome of the work is that it resulted in the first proper multi-site database of iron implement descriptions and scientific analyses for an important period in Indian history for broad-scale comparative purposes within the Indian subcontinent and outside it. The work and the results also indirectly highlight the urgent need for more research on the megalithic period in the region, particularly in light of the rapid destruction of archaeological sites in relation to various human activities including development and encroachment.

0.5 The Socio-Cultural Processes Within a Society

With the advent of Harappan Civilization, the firm technological base that was prevalent continued through the Early Iron Age and into the Early Historic Period. The traits of state formation visible from the Early Historic Period are evident through the tangible remains of forts and fortifications, which can be attributed to the PGW and NBPW periods. According to Ghosh (1973), it was the birth of political supremacy which gave rise to the urban features (permanent settlements, division of labour, standardization and many more attributes). However, according to Thakur (1981), it was iron technology which aided in ushering in the urban features, as surplus in agricultural production led to the practice of exchange or barter. The role of iron technology in ushering in the Second Urbanization did not have similar effects on all the zones.

The Early Iron Age of Vidarbha is marked by flimsy habitation remains with no evidence of forts or fortifications. However, the megalithic society of Vidarbha has brought to light a variety of iron implements suggesting various modes of production. The various modes of production suggest certain intangible behavioral elements; for instances labour specialization. Therefore, the mode of production plays an important role in the creation of political processes. The division of labour, which is considered a marker of urbanization, was an offshoot of the technological advancement as mentioned earlier; it led to a surplus in production and according to Thakur (1981), with an increase in surplus, supply of food grains to satellite settlements also began. This led to the birth of a class of people (like religious or political heads) who possibly controlled the entire process of iron production and export to satellite settlements.

The increasing surplus led to the need of a state or 'bureaucracy' which would control the distribution of the surplus. Surplus production led to craft specialization, which in turn led to the production of more sophisticated and finer products. The production of a variety of iron implements led to the development of other specialized crafts (Dhavalikar, 1999). The concept and theories regarding socio-political formations were based on the archaeological evidence from the Early Historic Period; however in the present work an attempt is being to understand the Early Iron Age society from the intangible cultural evidence.

The setting up of satellite settlements suggests there was a marked demographic increase (beyond the carrying capacity). Along with it came the concept of social stratification which gave rise to land owners or administrators, craftsmen, defence warfare specialists and many more.

There are multiple theories regarding the socio-cultural formation of a society. Weber (1958) opines that urbanisation happens only when there is a socio-cultural transformation. That is to say, an agro-pastoral society changes its form to an agriculture based society with multiple craft communities. Wheatley (1972) suggests that a relationship between agricultural communities and industrial or technological activity based communities results in a complex society. The market plays an important role in the socio-cultural transformation as it aids in the exchange of goods and services, without which satellite settlements and communities within a settlement cannot coexist. Kosambi (1965) opines that the royal dynasties or the 'king' or supreme authority was responsible for accumulating new viable arable lands and bring them under cultivation. This also required a centralized control over all the natural resources and also manual power (labour) who would till the land and produce the surplus. The surplus would enter the market for exchange and supply.

0.6 Limitations of the Present Study

Firstly, the results do not include 100% sampling of all concerned sites as only eight sites were selected for the study. In later researches more sites could be included in the study and the sample size could also increase which would represent all the artefacts and their variants. Secondly, the results shouldn't be used to generalize all the Early Iron Age Megalithic zones, however studies on the artefactual assemblage from other megalithic zones could be carried out then a comparative analysis would be possible. The scientific analysis done on the artefacts are preliminary and more multi-disciplinary work such as corrosion studies and soil chemistry could be attempted to understand the effects of the surrounding soil on the preservation of the artefacts. Finally, this work contributes to our understanding of iron technology, the societal impact and the spatial distribution of Early Iron Age in Vidarbha. However still nothing much could be said about the duration of occupation of Vidarbha by the Early Iron Age people and was there any contact between them and the succeeding Early Historic Period.