CHAPTER IV:
Sites/ Settlemens and Their Assemblages
The objective of the present work is to understand the utilitarian value of iron, besides its nature of occurrence related to both production and consumption, that are evident from different settlement sites. The chapter attempts to highlight the archaeological contexts of the occurrence of iron, found from both production and consumption zones/settlements and their bearing on different geo-physical zones. In this connection it is to be noted that, in the previous chapters necessary attempts have already been made to summarize the data on geo-physical features of the concerned study area and the nature of raw materials and their sources which met the demand of finished products for the consumers. The present chapter tries to demonstrate the significance of iron in the settlement dynamics of the concerned study area. Here it is worth mentioning that the said reconstruction is essentially based on the reports of different excavated sites.

Since the present work has no separate chapter for discussing on assemblage analysis including scientific investigations of iron objects, the chapter has also incorporated some information related to the same.

The discussed five geo-physical zones i.e., the middle Ganga plain, the lower Ganga plain, the Chhotanagpur plateau, the Orissan uplands and the eastern littorals with their internal variations have a direct influence on the nature of the use of iron. For example, the physical ambience of the alluvial plains of the middle and lower Ganga valleys and the coastal plains enhanced the rate of consumption of iron here (in comparison to the rate of production), whereas, those of the Chhotanagpur plateau and the Orissan uplands with their variety of natural resources provide suitable conditions for the procurement of iron ore and the production of finished objects. Such traditions continue uninterruptedly for generations. Fringes of the Chhotanagpur plateau and the Orissan uplands along with the middle Mahanadi valley on the other hand are the most interesting regions which have evidence of both iron production and consumption.

**The North Bihar Plains:**

been well attested at the site. Period I (sub-divided into IA and IB) represents the Neolithic phase or the antecedent stage of the EVF phases. Period II has been identified as the ‘Chalcolithic’ period, divisible into period II A and IIB. In spite of having similar cultural assemblages, Period IIB (1000-800 BCE) is distinguished from the Period II A by the evidence of the use of iron implements from the top layer of this phase. The most notable discoveries of this period i.e., period IIB, were a fractional burial of an animal (a Neolithic axe, two tiny steatite disc-beads, one copper bead, a fairly good number of microliths and bone arrow-heads and pins were discovered while scraping the upper surface of the burial) and a miniature sarcophagus having a slip in red colour. The structures are apsidal on plan and made of reeds plastered with mud. The dwellings of this period were bigger in area than those of the previous period though the building materials remained the same. Ivory and bone arrow-heads, beads and styluses comprise the miscellaneous findings of this particular phase. The use of longitudinal ovens continued during this period also. Remains of rice, *masur*, wheat and *moong* were also obtained.

So far as the retrieved iron objects from this period are concerned, it has been observed that socketed hoes and blades dominate the assemblage. The specimens are heavily rusted. A few slags and crucibles have also been recorded during the course of excavations. Remains of several ovens as exposed during excavations probably hints towards the iron smelting activities. Prevalence of tanged arrowheads made of bones suggests their multifarious use in both hunting and fishing besides other crafts like wood working, bamboo working, leather working etc.

The use of iron proliferated in the succeeding period III (*circa* 600-100 BCE) along with the introduction of NBPW which has been identified as the early historic period. The BRW of the preceding period became coarse in fabric as compared to the previous period. Some of the sherds also bore graffiti marks. Besides, grey ware also made its appearance. The other finds from the period include terracotta human and animal figurines (*naga*), antimony-rods, stone weights of varying denominations, pestles and querns of stones, a few copper coins (both punch marked and cast), beads of semi-precious stones etc. The structural remains are characterized by wattle and daub houses. Remains of baked brick walls were exposed in the upper levels of this period. Besides, the remains of a tank have been found. A post cremation fractional burial containing animal bones and ceramics such as elongated vases, large lipped basin and a perforated
globular bowl as well as footed bowls has been considered as the most remarkable find of the period.

Iron objects found from this period include blades, tanged blades, broken pieces of lances, long blade of a knife, rusted specimen of a hinge besides fragment of a heavily rusted iron bangle piece. Bone tools comprise socketed long arrowhead having pointed top and roughly circular section, besides bone pins and styluses. However, a few specimens of dice, ring etc. have also been encountered during excavations.

The succeeding Kusana phase yielded massive structural activities consisting of baked brick structure of three to four phases. The remains of a residential complex have been exposed here which include one longitudinal hall, two bed rooms, kitchen, store, lavatory, bath room verandah, corridor besides a soak pit (attached with the southern wall). A hoard of 88 Kusana copper coins of Kanishka and Huvishka is the most significant finding of the period. Other notable finds are terracotta human figurines with typical Kusana headdresses, stone and terracotta beads, terracotta ear studs, animal and bird figurines and net sinkers, copper objects, bone dices etc. It is quite evident that iron was extensively used in the said period.

The objects found from this period comprise tanged blades, tanged knife blades, long rods, long lances, handle of a frying pan, nails, fragment of a deep cup like iron object having straight side and shallow base, fragment of an iron object probably of a hollow rod, fragments of heavily rusted iron rings, fragments of rusted iron bangle like objects etc.

After period IV the site appears to have been deserted for a considerable period of time as is evident by the presence of a sterile layer. Based on the retrieved black stone sculptures, this phase has been assigned to the Pala period. Besides, five gold coins of Srimada Gangeyadeva of Kalachuri dynasty have been found. No iron object has been documented from this phase.

**Iron objects** and implements of different varieties along with a large quantity of iron refuse have been discovered from excavations. The discovery of a fairly good number of crucibles and slags suggests the role of the settlement in iron working activities. More than 100 specimens were recorded from the cultural layers of the periods IIB, III, IV. According to the excavator, majority of them appear to be agricultural tools. However, their multifarious use in different sectors of subsistence is undeniable.
It has been observed that the recorded iron objects are in a very corroded and rusticated state of condition. Thus, a few of which have been restored are described below (Verma, 2007: 227-229):

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Reg No.</th>
<th>Description</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>987</td>
<td>Hoe, socketed</td>
<td>IIB</td>
</tr>
<tr>
<td>2.</td>
<td>346</td>
<td>Blade</td>
<td>III</td>
</tr>
<tr>
<td>3.</td>
<td>713</td>
<td>Circular piece</td>
<td>IV</td>
</tr>
<tr>
<td>4.</td>
<td>1302</td>
<td>Piece</td>
<td>IV</td>
</tr>
<tr>
<td>5.</td>
<td>289</td>
<td>Tanged blade</td>
<td>IV</td>
</tr>
<tr>
<td>6.</td>
<td>855</td>
<td>upper portion of a Blade</td>
<td>IIB</td>
</tr>
<tr>
<td>7.</td>
<td>899</td>
<td>Blade</td>
<td>IIB</td>
</tr>
<tr>
<td>8.</td>
<td>581</td>
<td>Tanged Blade</td>
<td>III</td>
</tr>
<tr>
<td>9.</td>
<td>611</td>
<td>Broken tanged blade</td>
<td>III</td>
</tr>
<tr>
<td>10.</td>
<td>848</td>
<td>Broken piece of a lance</td>
<td>III</td>
</tr>
<tr>
<td>11.</td>
<td>848</td>
<td>Broken piece of a lance</td>
<td>III</td>
</tr>
<tr>
<td>12.</td>
<td>1355</td>
<td>piece of a blade</td>
<td>III</td>
</tr>
<tr>
<td>13.</td>
<td>848</td>
<td>Similar as no. 10</td>
<td>III</td>
</tr>
<tr>
<td>14.</td>
<td>936</td>
<td>Broken lance</td>
<td>III</td>
</tr>
<tr>
<td>15.</td>
<td>848</td>
<td>Similar as no. 10</td>
<td>III</td>
</tr>
<tr>
<td>16.</td>
<td>965</td>
<td>Blade</td>
<td>IIB</td>
</tr>
<tr>
<td>17.</td>
<td>970</td>
<td>Rusted object</td>
<td>III</td>
</tr>
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<td>18.</td>
<td>914</td>
<td>Blade</td>
<td>III</td>
</tr>
<tr>
<td>19.</td>
<td>1974</td>
<td>Tanged blade</td>
<td>IIB</td>
</tr>
<tr>
<td>20.</td>
<td>971</td>
<td>Tanged blade</td>
<td>III</td>
</tr>
<tr>
<td>21.</td>
<td>945</td>
<td>Blade</td>
<td>IIB</td>
</tr>
<tr>
<td>22.</td>
<td>U.N</td>
<td>Blade</td>
<td>IIB</td>
</tr>
<tr>
<td>23.</td>
<td>143</td>
<td>Blade</td>
<td>III</td>
</tr>
<tr>
<td>24.</td>
<td>75</td>
<td>Blade</td>
<td>IV</td>
</tr>
<tr>
<td>25.</td>
<td>966</td>
<td>socketed portion of a hoe</td>
<td>IIB</td>
</tr>
<tr>
<td>26.</td>
<td>1472</td>
<td>Socketed portion of a hoe</td>
<td>IIB</td>
</tr>
<tr>
<td>27.</td>
<td>490</td>
<td>socketed portion of a hoe</td>
<td>IIB</td>
</tr>
<tr>
<td>28.</td>
<td>923</td>
<td>Socketed portion of a hoe</td>
<td>IIB</td>
</tr>
<tr>
<td>29.</td>
<td>U.N.</td>
<td>Socketed portion of a hoe</td>
<td>IIB</td>
</tr>
<tr>
<td>30.</td>
<td>1042</td>
<td>Long blade of a knife</td>
<td>III</td>
</tr>
<tr>
<td>31.</td>
<td>994</td>
<td>Handle of a frying pan</td>
<td>IV</td>
</tr>
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</table>
Metallurgical Analysis: Five samples (CRD 23, CRD 24/1, CRD 24/2, CRD 25/1 and CRD 25/2) from Chirand, datable to 700-300 BCE have been metallographically studied (Table 3). With the highly sensitive Electron Probe Microanalyser (EMPA), it has been possible to detect the traces of iron at very high magnification and analyzed
quantitatively. These five specimens comprising two knives, two scrapers and one chisel revealed pure iron with fractional amount of Si, Mn, S and P. The study of two sections (CRD 23 and CRD 25) having metal core surrounded by mineralised metal revealed layering type structure. The presence of pearlite structure at high magnification was noticed in the metal crystals surrounded by mineralised metal, relic carbide was also located in mineralised metal at very high magnification. The examination of the artefacts revealed that they were fabricated by lamination or similar technique by forging together wrought iron and low carbon iron sheet.

Sample No. CRD 23: The outer portion of the specimen is badly corroded and the remainder composed of equiaxed grains and a small amount of pearlite. The structure did not suggest that the chisel had been hardened.

Sample No. CRD 25: The core was composed of larger equiaxed ferrite grains and less pearlite grain than the outer area, with 0.1 % carbon content and grains of size 8-9. Some surface de-carburization had occurred at the extreme outer edge, where the grains were ragged and considerably larger. (Singh, 2007: 86-90)

The above database suggests that Chirand was a self-sufficient EVF settlement. This site was invariably involved in the long distance procurement process to get access to raw materials as well as finished products of both stones and metals, if not others. The occurrence of iron at the settlement can be explained in this context. The Vindhyan and the Chhotanagpur plateaus were certainly the nearest raw material bearing areas of Chirand. The nature of its iron consumption needs further explanation as it is located in the close proximity to Magadha. The habitational remains (found from the site) assignable to the Kusana period suggests further consolidation of settlement dynamics and its subsistence pattern. The presence of diverse categories of objects indicates a large scale consumption of iron in the said economic growth. Chirand can also be considered as one of counterparts of the settlement hierarchy, crystallized in the North Bihar plain wherein is located Vaisali, Pataliputra etc. Vaisali witnessed the development of political power and the emergence of religious centre whereas Chirand maintained its own identity and reciprocated with important centres of political powers patronized by various religious ideologies particularly Buddhism.

Chechar-Kutubpur (25°37’3.63” N and 85°21’50.46” E) is situated on the northern bank of the river Ganga in the Vaisali district. Excavation conducted by the then Mid- Eastern
Circle of the ASI in 1977-78 unfolded three-fold cultural sequence, of which period II represents the NBPW cultural period with the introduction of iron. Ceramics recorded from this period are NBPW and its associated wares. The BRW of the preceding phase continues but with certain changes. A huge pit, more than 2 m deep and 5 m wide, belonging to this phase was encountered. It yielded baked bricks and iron pieces. Period III has exposed a large brick structure represented essentially by the ghost walls and four successive floor-levels. No specific information is available regarding the nature of iron objects found from this period. Among notable antiquities recovered from the deposits of the period, specific mention should be made of a terracotta figurine. Based on ceramics, it can be stated that this structure seems to have been constructed during the Kusana period and continued to the Gupta period. (IAR 1977-78: 17-18; IAR 1988-89:9).

**Due to the absence of extensive report we have very limited scope to elaborate on the nature of iron consumption at the site. However, it can be stated it was an important settlement subsisted on both farming and non-farming survival strategies.**

**Maner (25° 39’ N and 84° 53’ E):** The site is situated on the dry bed of the river Son, about 32 km west of Patna along the Patna-Arrah road. Exploration at the site by the Patna University led to the discovery of a substantial number of BRW sherds. The noteworthy pottery types were a stem of a dish-on-stand, and a footed bowl. The fabric and form of this BRW showed affinity with those found from the ‘Chalcolithic’ period of Chirand. Equally significant was a single piece of fluted core, the presence of which at the site further suggests its association (according to the scholars) with the ‘Chalcolithic’ culture of the region. The NBPW and associated ceramics were collected from the overlying deposit. Besides, fragment of a sprinkler in red ware, potter’s dabber and a terracotta ball have also been recorded from the site (IAR 1965-66: 9).

The location of Maner, opposite to the already recognized archaeological site of Chirand across the river Ganga and the recorded archaeological materials from the present site have prompted the scholars on behalf of the same University to undertake excavations here. Excavations at the site was conducted for six consecutive seasons from 1984-85 to 1989-90 and again from 1991-92 to 1993-94. It revealed a continuous cultural sequence from the Neolithic to the Pala period. (IAR 1984-85: 11-12; IAR 1985-86: 11-12; IAR 1986-87: 25-26; IAR 1987-88: 11-12; IAR 1988-89: 7-8; IAR 1989-90: 10-11; IAR 1991-92: 6-7; IAR 1992-93: 6; IAR 1993-94: 10-11)
Use of iron was started from the NBPW period onwards. This cultural period, having approximately 3 m. thick deposit is represented by four layers from 6 to 3 (*IAR* 1984-85: 11-12). The layer (6) is characterized by less compact grey soil, while layer (5) is composed of ash coloured soil with a brownish tinge. The layer (4) is represented by dark ashy soil mixed with potsherds. The layer (3) is divisible into (3A) and (3), which are respectively characterized by yellowish brown soil and yellowish compact soil mixed with brickbats. Layer 6 and 5 yielded a few iron objects while an array of tools viz. points, daggers, knives, chisels, spearheads, nails etc have been recorded from the layers 4 and 3. The use of iron was definitely proliferated in the succeeding cultural periods i.e., the Sunga-Kusana (c. 1st Century BCE to 1st Century CE) and the Gupta period though the published report does not substantially mention the nature of unearthed objects.

The earlier/lower layers (layers 6 and 5) of the NBPW period yielded fine varieties of NBPW sherds with thin section in varying shades such as silvery, golden, steel blue, violet, black etc. The main types in the NBPW are bowls, dishes and some basins. The most noteworthy among the bowls are those with everted rim as well as those with horizontally splayed out rim. The dish with sharp carination at the waist was also noted. The basin type is generally characterised by a beaded rim. The associated wares of NBPW include black slipped ware (henceforth BSW), grey ware, BRW and red ware. The BSW and grey ware sherds were found in greater frequency in relation to the other wares. The artefacts found from these two layers comprise terracotta animal figurines, terracotta and stone beads, terracotta dabbers, iron implements and stone balls, stone-querns etc.

The upper layers of the NBPW deposit yielded coarser variety of NBPW sherds along with a few finer specimens. A brick-built wall consisting of eight courses of bricks was found associated with the ‘upper layers’. The wall in question rests over layer (5) and it is sealed by layer (3). Another brick wall of nine courses was traced at a depth of 2.20 m from the surface and continued to the depth of 3.20 m. The bricks used in the wall measured 40 m x 28 x 5 cm. The concerned wall was found running from north-east to south-west but it takes a turn at right angle in the south and in the south-western end. It cuts into layer 5 and is sealed by layer 3. A terracotta ring well consisting of eight courses of rings with a diameter of 74 cm was found to be associated with the upper layers.

The artefacts obtained from these upper layers, comprise (besides a substantial numbers of iron implements) stone pestles, terracotta objects like female and animal figurines with
punched designs, ram and gamesmen, sling balls, decorated weight, bone stylus and bone points, copper objects, antimony rods and a dice made of ivory showing decorative patterns on its four sides.

The succeeding period (Period IV) is marked by the remains of two walls forming part of a room-like structure at the southern end of the trench. Both the walls, which meet at right angles, form two arms of the room and run from north-west to south-east and south-west to north-east. The wall, running from north-west to south-east measures 2.70 m in length, while the other, running from south-west to north-east has a length of 2.40 m. A single brick wall measuring 2.70 m in length running from north-west to south-east was also found in the northern end of the trench. The bricks used in the construction of these walls measure 44 X 26 X 5 cm.

In addition to the red ware sherds, the period has yielded (besides, some iron objects including a spearhead) bone points and cast copper coins of thick variety usually dated to the first century BCE -first century CE. An inscribed glass sealing was found from a pit, which was sealed by layer 3. The inscribed letters of this sealing may be ascribed on palaeographic grounds to the period between first century BCE and first century CE.

The Gupta period is distinguished by the appearance of some structural remains such as terracotta ring-wells and a portion of a floor plastered with surkhi and lime. The whole cultural deposit of this period is divisible into two layers ranging from layers (3) to (2) and the total thickness of the deposit is around 1.88 m. The layer (3) having a thickness of 1.20 m is characterized by less compact blackish soil, while layer (2) is composed of compact blackish soil and its thickness is about 68 cm. The floor ascribed to this period has a thickness of 18 cm and it rests over a sub-layer having a thickness of 30 cm. Both the remains of floor and ring-well with eighteen courses of rings are sealed by layer (2). The pottery from the above layers are mainly red wares including some polished specimens and a sprinkler. Among other objects, terracotta plaques, sling balls, gamesmen, beads, etc., seal-like object of copper, copper-wire and stone beads are noteworthy.

The excavation conducted in 1993-94 (IAR, 1993-94: 10-11) has yielded the evidence of a wall (1.95 m X 0.65 m), running in north-south direction found at a depth of 4.05 m. It consists of six courses of bricks (0.25 X 0.14 X 0.6 m.) datable to the Gupta period. The antiquities belonging to this period include terracotta animal figurines, female heads, conical objects, trunk portion possibly of an elephant made of bone, terracotta and stone.
beads. The excavation also yielded sherds of polished and plain red ware apart from a sprinkler in red ware. From the topmost layer were recovered mixed materials including sherds of green glazed ware of the medieval period.

The succeeding period shows the evidence associated with the Pala period. A chisel (Table 4), yielded from period III has been chemically analyzed (Chattopadhyay, 2004: 95). The object is 14.2 cm long. It was found with deep longitudinal cracks which was due to increase of volume during corrosion. This implement was found in corroded state without any core. Chemical analysis shows the presence of high amount of silica.

**Due to meagre evidence we have a very little scope to interpret the settlement dynamics of the site and its association with the use of iron. However, there should be no hesitation to suggest that the site maintained homogenous status and reciprocated with the contemporary iron using settlements, both major and minor.**

**Manjhi** (25°50’ N and 84°34’ E): The village of Manjhi is located on the left bank of river Ghaghra in the district of Saran. Spooner had surveyed the site. The archaeological heritage of the site is represented by the cultural remains found on a large mound [with a height of 30’ (12.2m)], elliptical in shape with the evidence of brick walls having earthen ramparts (both inside and outside of the walls). The defence is further strengthened by making a ditch on north and east and naturally by the river Ganga in the south and west. The walls enclose an area of 1400 x 1000’. The bricks used in making these walls have an average size of 18” x 10” x 3”. All these evidence suggests its ancient cultural bearings (Spooner, 1922-23: 31).

In 1961-62, the Department of Ancient Indian History, Culture and Archaeology of the Banaras Hindu University under the supervision of Hari Nandan Pandey explored this ancient site (Manjhigarh). The mound showed the traces of a defence-wall and a moat. Sherds of the NBPW and the associated red ware have also been recorded from the site. A ring-well and some brick structures were also noticed at Manjhigarh (IAR, 1961-62: 9).

In 1962-63, B. S. Verma has documented the occurrence of some sherds of BRW at the said mound (IAR, 1962-63: 67).

The site was later on protected by the ASI. B. Saran of the Mid-eastern Circle of the Survey re-examined the protected site of Manjhi (on the northern bank of the river Ganga). His survey revealed that it was found to contain 12.2 m. high earthen ramparts, revetted both externally and internally with baked-bricks. The mound measures 457 m x 365.8 m., and had earlier yielded late Gupta finds. During the course of the present
exploration were found, “dishes-on-stand in red ware, plain and fine grey ware bowls and dishes, lipped bowls, rim-less *handis*, sherds of NBPW and creamish-buff ware, and iron slags”. Other finds comprised bricks measuring 45 x 25 x 7.5 cm., beads of quartz and carnelian, besides red ware of later periods. (*IAR*, 1967-68: 9)

To ascertain the extent of ancient habitation and the antiquity of the site, the Department of Ancient Indian History Culture and Archaeology of the Banaras Hindu University under the direction of T.N. Roy conducted excavation at the main mound (locally known as Manjhi-ka-Tila having nearly 14 m in height from the ground level) of the site for two field seasons of 1983-84 and 1984-85 (*IAR*, 1983-84: 15-16; *IAR*, 1984-85: 12-13; Roy, 1985-86: 29-32).

Excavations revealed a cultural sequence starting from the ‘pre-NBPW period to the medieval periods’.

Iron was introduced at the site from the middle strata of the pre-NBPW cultural period (period I) though no information is available regarding the nature of objects, made of iron. NBPW period (period II) shows persistence and proliferation of the use of the same. However, period IIA yielded a finished object of iron of indeterminate use. The succeeding layers yielded nails, daggers, hammers, blade knives etc.

Period I shows an average occupational deposit of about two metres above the natural soil. It is characterized by the occurrence of BSW, BRW and associated red ware. Of these, the BSW being the principal ceramic industry of the period, is represented mainly by bowls and dishes. Amongst the bowls, the common shapes are sub-ovaloid, carinated, straight sided, hemispherical, convex sided and round sided. The pottery types made of BRW are bowls with everted rim, platters and dish-on-stands. The artefacts recovered from this period are large number of pottery discs, a terracotta bead and a waste chip of stone and bone points. The solitary C14 date of period 1 and pre-NBPW period is 1460 BCE (3410 ± 130). Remnants of earth with reed impression indicate that the houses during this period were constructed of wattle-and-daub. Copper and stone objects were found in meagre numbers. Iron was also not recorded from the lowest levels, but it was found from the middle strata, however, the upper layers of period I overlap with the NBPW period which can be placed not later than 600 BCE.

Period II (NBPW period) started without any break of occupation from period I, and is characterized by the introduction of NBPW. It is possible to further sub-divide this NBPW period (having a deposit of 4.43 to 3.92 m in thickness) into three sub-periods,
early, middle and late. In sub-period IIA, plain grey ware appears with NBPW. The said grey ware is smooth and is of superior quality and some are painted with black over dark grey surface mainly as horizontal bands. In red ware, ‘Ahichchhatra type 10 A’ and miniature bowl made their appearance in sub-period IIB. In sub-period II C, the dominant industry is coarse NBPW (Fabric E) but top graded NBPW (Fabric A) also continued. The introduction of carinated handis and incurved bowls is a noteworthy feature of this sub-period. The remains of baked brick structures (size of bricks being 50 x 25 x 9 cm) and ring wells have been exposed in sub-period II-C. Ascribable to the last stage of this sub-period and to the beginning of the next period is a massive clay fortification. It was observed to be directly constructed over the deposit of sub-period II-C after levelling the ground. The antiquities recovered from the core of the defences were essentially the materials found from sub-period II-A and II-B indicating that the defences could not be associated with sub-periods II-A and II-B. The other details, like its various stages of construction, vertical extent height, basal width and its relation with the stratigraphy of the habitation area still remains to be ascertained. Among the artefacts found from the ‘Early Phase of NPBW’ i.e. sub-period II-A, mention may be made of large number of finished and unfinished bone tools, two stone sharpeners, a copper bangle and a finished object of iron (of indeterminate use). In the ‘Middle Phase of NPBW’ i.e. sub-period II-B, the occurrence of better finished objects of bone and ivory like arrow-beads and styluses along with a terracotta block of indeterminate use are noteworthy. Among the antiquities of the ‘Late Phase of NPBW’ i.e. sub-period II-C, mention may be made of a punch-marked coin, large number of bone points; single perforated discs of NBPW, terracotta cones, balls and wheels of terracotta; bangles of glass, copper and iron objects, a decorated terracotta figurine of a horse and a stone casket with a lid. In this context, it is necessary to mention that altogether 38 bone objects were recovered from the period II. Two inscribed sealings of terracotta which on the basis of palaeography could be assigned to 1st centuries BCE/CE are also noteworthy finds of this sub-period.

Period III started with no considerable time gap between the end of Period II and the beginning of Period III. The cultural remains of this period showed marked contrast to that of the preceding one. The coarse NBPW of sub-period II-C with its characteristic shapes like, bowls, dishes, carinated handis and lipped bowls, etc. fell into disuse. Different varieties of red ware were found in profusion. Baked brick structures ascribable to two structural phases were noticed. Several walls were noted in which the size of
baked bricks differ considerably from one another. In this connection, particular mention may be made of a structural complex lined with gravels which, however, could not be completely traced. This period yielded largest number of antiquities. The retrieved artefacts include terracotta human figurines, both male and female, terracotta animal figurines including horse, monkey and camel, stone and terracotta pestles, and stoppers, gamesmen, ear-ornaments, pendant, wheel and decorated discs of terracotta. A decorated scale of ivory from the early deposit of this period is also noteworthy. Inscribed terracotta sealing which on the basis of palaeography can be assigned to 2nd-3rd centuries CE was an important find from this period.

Period IV initiated at the site after a considerable lapse of time, the deposits of which were noticed in a very limited area. The pots were decorated with stamped, incised and appliqué designs. Among the noteworthy types in red ware mention may be made of knife-edged bowls, carinated handis with soot marks, knobbed lids, sturdy basins and shallow plates. Apart from the ordinary red ware, a few pieces of the glazed ware were also reported mainly from the late levels of the site.

That the site remained in occupation during the Gupta period may also be deduced from the fact that Spooner recorded an inscribed brick mentioning the name Sri Prathamaditya in the characters of the 6th century CE. Besides, two sculptural specimens (one of which has the depiction of Buddha in bhumisparsa-mudra) of the early medieval period, now installed in a modern Madhesvara temple have also been found from the area.

The remains of carbonised grains and seeds from the cultural period/periods characterized by a red ware industry, datable from 250 BCE to 250 CE were examined by the Birbal Sahni Institute of Palaeobotany. (IAR, 1992-93: 123; IAR, 1993-94: 143)

The food grains include bread-wheat (Triticum aestivum), dwarf wheat (Triticum sphaerococcum), barley (Hordeum vulgare), rice (Oryza sativa), field-pea (Pisum arvense), black-gram (Vigna mungo), lentil (Lens culinaris), ragi-millet (Eleusine coracana), grass-pea/Khesari (Lathyrus sativus of pigeon-pea (Cajanus cajan), Italian millet(Setaria italica), moth-bean(Vigna aconitifolia), kodon millet (Paspalum scrobiculatum),field brassica (Brassica juncea) and til (Sesamum indicum). A seed of grape (Vitis vinifera) was an important find. According to Saraswat, in all likelihood the raisins/draksha would have been imported from northwest (IAR, 1992-93: 123). Substantial numbers of weeds and other wild taxa were also identified.
Manjhi represents a village settlement of eminence. The spread of settlement area and thick occupational deposits suggests that Manjhi was definitely a major agricultural hub through the ages and it must have utilized iron in various contexts of agrarian economy. The site report is not comprehensive however the occurrence of iron in association with NBPW, nature of iron objects and other cultural materials convincingly indicates that the settlement was one of the main consumers of iron in the middle Ganga valley. Chirand which is situated a little away from the concerned site markedly displays a contrasting feature with the latter so far as the nature of the evolution of settlements is concerned. The evidence from Manjhi shows the presence of a consistent village settlement which definitely radiated in the subsequent periods to become a major centre of agrarian activities. However, Chirand actively participated in exchange network and acted as a centre of multifunctional activities. Social transformations are also quite evident from the database.

Panr /Panda (25° 41’ N and 85° 48’ E) is situated 5 km northeast of the Dalsinhsarai subdivision headquarters in the district of Samastipur. Several lakes surround the site and the river Balam flows 2 km to the south.

The site was explored by Sita Ram Ray in 1971 which resulted in the recording of a considerable number of sherds of NBPW, black ware and cast copper coins. Further field investigations at the site by Bijoy Kumar Choudhary in 1992 unfolded the evidence of brick structures (Choudhary, 2005: 81-86). The explorations conducted in 1994-95 by Dilip K. Chakrabarti, Ajit K. Prasad, S.K, Jha and A.C. Verma further revealed that the mound of Pandavasthana of the site is quite low about 2 acres in extent with no sign of fortification (Chakrabarti, Prasad, Jha and Verma 1996: 154). Further study at the site suggests that the concerned mound is much larger with an area of about 38 acres. In addition, settlement activities during the historical period at Panr are not confined to the mound but radiated and subsequently incorporated the lake (chaur) area.

The site was excavated from 1998-99 onwards by the K.P.Jayaswal Research Institute under the supervision of Bijoy Kumar Choudhary. It revealed a 7 m thick occupational deposit, divisible into five cultural periods. The ceramic assemblages of the initial cultural phases include red ware, grey ware and BRW. Panr I has also yielded bone objects such as arrowheads, points, beads made of steatite and agate and terracotta objects like beads and hop scotches.
Period II has yielded BSW in continuation of earlier ceramic types such as red ware, BRW and grey ware. The sherds frequently exhibit the remains of paddy husks in clay. The noteworthy shapes in BSW are bowls, dishes and vases. The section is generally thick and porous. Paintings depicting various designs have been done in white or yellow. Certain sherds in BRW and grey ware have white paintings in form of white dots, straight lines, oblique lines and receding curves. The shapes are dishes, bowls, dishes-on-stands, vases and basins.

During period II, the people began to use copper as evident from the repertoire of copper hooks and bangles discovered from different cultural layers. Arrowheads, points, pins, styli, bangles, beads and pendants made of bones have also been retrieved from the cultural period. Besides, steatite beads, terracotta beads, sometimes vase shaped, stone balls etc. were found in profusion. The presence of charred grains and paddy husks in sherds along with a substantial number of bone tools indicate the prevalence of a mixed economy during the concerned period.

The upper phases of this period i.e., period IIB iron makes its appearance as attested by the presence of iron arrowheads, blades and other unidentified objects.

During period III, represented by the presence of NBPW, the frequency of bone tools does not decrease in marked numbers. However, retrieval of a substantial number of iron objects, from this period suggests the proliferated use of iron as a medium of making tools. Among the inventory, mention may be made of arrowheads, nails, daggers, spearheads, knives, sickles, a ploughshare, a harpoon and a hoe. Antimony rods, earrings and finger-rings made of copper have been retrieved from this cultural period. Beads of semi-precious stones like agate, carnelian and jasper have also been recorded.

The sherds in NBPW have several colours like black, blue, golden, silvery, pink etc. The bi-chrome sherds in this type have also been found. The associated potsherds are red ware, BSW, BRW and grey ware.

Among the terracotta objects from Period III, beads and sling balls are most numerous. The terracotta balls are well fired and according to the excavator, were catapulted by some devices to serve as missiles. Several human and animal figurines have also been recorded from this period. Sometimes the symbols of spooked wheel have been punched on the body, and there are the evidences of mat impressions on the head. During the terminal phase of Panr III, copper punch marked and cast coins make their appearance.
Period IV at the site, belonging to the Sunga-Kusana phase, is marked by vigorous structural activities. It reveals two broad phases, phase I having bricks measuring 42 x 22 x 5 cm, and phase II having bricks of 38 x 22 x 5 cm. This horizon has yielded ring wells having 24, 13, 13 and 6 courses respectively. Besides, a 4.50m long wall has been exposed from this cultural period. A circular alignment of tiles has also come to light, the size of a tile being 20 x 11 x 2 cm.

Red ware predominates the ceramic industry. The shapes in the ware include bowls, lipped bowls, lids, vases, spouted vessels, pans, handled pans etc.

During the Sunga period, terracotta figurines were probably manufactured at the site as revealed by the discovery of several human and animal figurines along with a mould. Iron repertoire includes nails, sickles, and razors. Antimony rods have also been found from this period. During the subsequent Kusana period, terracotta corn rubbers and spindle whorls are found in great quantity. Glass objects also appear in greater frequency and it replaces copper as a material for making ornaments.

Period V, datable to the Gupta period is represented by the presence of red slipped ware having thin rims. The structural activities are marked by the re-use of old bricks. Among the notable artefacts, mention may be made of an inscribed ivory ring, and a bone seal having the name of Indracetasya, inscribed on it.

I have documented the following iron objects/ implements found from the site.

1. The shape of the object is difficult to determine as it is completely broken (6 cm x 1.5 cm) (PND1/ III'/ layer 2/ 0.20 m x 1.40 m -0.36 m).
2. It is a broken nail, head portion is flat. It makes an almost 90° angle with the remaining portion. This is turned in to a sharp point. (PND2/ VIII/ 0.85 m x 0.90 m - 0.25 m).
3. It is a broken nail, its middle portion is thick which is turned in to a modest point. The head has logenze shaped cross section and this is slightly thinner than the middle portion. (5.2 cm) (PND1/ III'/ 0.20 m x 2.20 m - 1.50 m.)
4. It is a broken nail, head portion is slightly flat, it has logenze shaped cross section. It has a slightly thick point. (6.1 cm x 2.1 cm) (PND1 / V'/ 0.10 m x 1.61 m - 1.97 m.)
5. It is a broken nail, head portion is slightly flat, it has oval shaped cross section. It has slightly bent/ curved point . 1/3 portion towards the top is slightly thick. (5.6 cm) (PND1/ I'/ 0.10 m x 1.32 m - 2.30 m)
6. It is a broken nail, point is broken. The middle portion is slightly thick and it has logenze shaped cross section (4.9 cm) (PND1/ II'/ 0.80 m x 1.33 m - 2.06 m).
7. Indeterminate specimen, probably the part of a knife, the cutting edge is slightly concave and flat. The tang portion is thick and has a hollow portion probably in order to tie up with wooden handle. (7 cm) (PND1/ IV'/ 0.10 m x 1.65 m - 2.41 m)
8. Indeterminate specimen, the cutting edge is flat, the remaining portion is broken 
(PND1/ VI' / 0.45 m x 2 m - 2.13 m).
9. Point portion of a nail which is quite thick. Head is completely broken. (3 cm) (PND 1/ 
VI' / 0.77 m x 0.73 m - 3.75 m).
10. Nail; head is thick and has oval shaped cross section, point is also not very sharp. (4.6 
  cm) (PND 1/ VII'/ 0.85 m x 2 m - 3.88 m).
11. Nail; head is flat and has logenze shaped cross section. This is slightly bent, point is 
broken. (2.8 cm) (PND1/ III'/ 1/ 0.98 m x 1.90 m - 0.32 m).
12. Nail; very fine specimen, head has square shaped cross section, middle portion is 
slightly broad. The specimen probably had a sharp point which is broken. (2.6 cm) 
(PND3/VIII' / 1/ 0.10 m x 3.40 m - 0.34 m)
13. Nail; broken and rusted specimen, both head and point are broken, middle portion is 
  thick and slightly curved. (3.8 cm) (PND3/ III' / 2/ 0.40 m x 1 m - 1.30 m)
14. Nail; head portion is slightly broken, just above the head portion towards the point the 
specimen is thick, the remaining portion becomes thin to make a sharp point. (4.7 cm) 
(PND 3/ O'/ 2/ 0.85 m x 3.25 m - 1.45 m).
15. Indeterminate specimen (Key type of object?) (PND 3/ II' / 4 / 0.30 m x 4.30 m - 2.05 
m.)
16. Nail; head has triangular cross section. Gradually the specimen becomes thinner to 
  make a sharp point. The specimen is slightly curved. (4.5 cm) (PND3/ pit I sealed by 
layer 3 / II' 0.40 m x 4.90 m - 2.20 m.)
17. Nail; head has quadrangular cross section, it is a curved specimen, head portion is 
  broad which is turned into a slightly bent and sharp point. (3.5 cm) (PND 3/ 4/ I' 0.55 
m x 2.50 m - 2.46 m).
18. Nail; head has quadrangular cross section, point and head is broken. (5.4 cm) (PND3/ 
pit I sealed by layer 3 / I' 0.91 m x 3.90 m - 2.71 m)
19. Nail; head is broken. It is quite broad. The specimen has a moderately sharp point 
  though it is partly broken (4.2 cm) (PND3/ pit I sealed by layer 3 / l’ 0.91 m x 3.90 m 
  - 2.71 m)
20. Fragmented object (blade like); straight cutting edge, tang portion is slightly broken. 
  (5.8 cm) (PND 3/ 4/ II’ 0.20 m x 3.10 m - 2.81 m.)
21. Fragment of an iron nail (sickle handle?); head portion is slightly broken, it has logins 
  shaped cross section. It is flat and broad. Remaining portion is thin and has roundish 
  cross section, point is broken. (PND 3/ pit I sealed by layer 3 / III’ 0.20 m x 4 m - 3.10 
m).
22. Broken blade; the cutting edge is slightly curved and concave, it has a sharp point, 
  remaining portion is broken. (4.5 cm) (PND 3/ 5/ II’ 0.20 m x 3.32 m - 3.16 m).
23. Fragment of an iron hook; head portion is broken, it becomes flat and is curved to make 
  a sharp point (4.6 cm) (PND3/ pit 2 sealed by layer 5/ l’ 0.40 m x 4 m - 3..31 m)
24. Nail; head portion has roundish cross section, head is partly broken, point is not so sharp. (3.1 cm) (PND3/ pit 2 sealed by layer 5/ III 0.10 m x 4 m - 3.45 m)

25. Nail; it more looks like an arrowhead though the head portion is broken, middle portion is broad, point is sharp. (2.4 cm) (PND3/ pit 2 sealed by layer 5/ III 0.10 m x 4 m - 3.45 m)

26. Nail; it is very small specimen, head has quadrangular cross section. Point is very sharp. (2.5 cm) (PND3/ pit 2 sealed by layer 5/ III 0.10 m x 4 m - 3.45 m).

27. Fragment of a knife; cutting edge is slightly curved, though the portion is broken. (5.3 cm) (PND3/5/0.20 m x 4.05 m - 3.71 m)

28. Broken nail; head has quadrangular cross section, from the middle portion towards the top, the specimen is bent to make a moderately sharp point. (6.6 cm) (PND3/ 7/ II 0.50 m x 3.20 m - 4.22 m.)

29. Broken razor; it is a fine and thin specimen, cutting edge is convex. It has a sharp point (7.9 cm) (PND4/ III 0.50 m x 1.40 m - 0.24 m.)

30. Indeterminate specimen (nail?); head and point are broken. Head has quadrangular cross section. (3.9 cm) (PND 8/ X 0.20 m x 2.70 m - 0.22 m)

31. Indeterminate specimen; broken, probably it is a part of a blade. (PND8/ VII 0.90 m x 2 m - 2.55 m)

32. Indeterminate specimen; it is also part of a broken blade (small), straight cutting edge, probably it had a sharp point, the remaining portion is broken. (PND8/ VII 0.90 m x 2 m - 2.55 m)

33. Indeterminate specimen; (PND8/ VII 0.90 m x 2 m - 2.55 m)

34. Fragment of a knife; it has straight cutting edge, the tang portion has quadrangular cross section, very thin specimen; (5.6 cm) (PND9/ humus/ VII 0.72 m x 1.65 m - 0.22 m.)

35. Fragment of a knife; point and tang portions are broken; tang portion has logenze shaped cross section, the point has roundish cross section, the cutting edge is slightly bent. (5 cm x 2.1 cm (max)) (PND9/ 1/ IX 0.25 m x 0.95 m - 0.24 m.).

36. Broken nail; head has logenze shaped cross section, middle portion is slightly thick, point is broken though it is quite thin. (3.8 cm) (PND9/ 1/ III 0.81 m x 2.10 m - 0.47 m.)

37. Broken nail; head is broad and has quadrangular cross section which becomes slightly thin towards the top. Point is broken. (2.9 cm) (PND9/ 1/ V’ x 1 m- 0.5 m).

38. Broken nail; head has roundish cross section, though this is broken. Point is also partly broken, middle portion is slightly broad. (3.3 cm) (PND9/ 2/ III’ x 2.12 m- 0.65 m).

39. Broken nail; head is broken and has roundish cross section, after 1/3 part towards the point the specimen is bent and makes almost 90 angle with the remaining portion. Point is sharp. (2.4 cm) (PND9/ 2/ VI’ 0m x 1.40 m- 0.70 m)

40. Broken nail; head is broad and thick and has quadrangular cross section. It becomes narrow to make a sharp point. (9.8 cm) (PND9/ 2/ 0.30 m x 1.65 m- 0.80 m)
41. Knife (broken into 2 parts); broken and flat specimen, cutting edge is difficult to determine. (PND9/3/ VI 0.90 m x 2.20 m - 1.10 m)

42. Broken nail; head is broken. It has roundish cross section. It makes 90° angle to make a point. The curving portion is broad which becomes suddenly narrow to make a point. (2.4 cm) (PND9/3/ III' 0.65 m x 0.45 m- 1.05 m)

43. Nail / looped handle; it has been identified as nail, however it is probably the looped handle of any object. (6 cm) (PND9/3/ V 0.78 m x 1.50 m- 1.25 m)

44. Knife; it is a small knife, middle and tang portions are broken, it is a flat specimen. It has logenze shaped cross section slightly convex cutting edge. (3.9 cm) (PND9/5/ II 0.73 m x 2.10 m- 1.75 m)

45. Nail; it is a rusted specimen of a nail, head has logenze shaped cross section, middle portion has broad appearance. Probably its shape has been changed due to heavy rusting. It has sharp point. (5 cm) (PND9/5/ V 0.78 m x 1.40 m- 1.82 m)

46. Broken and rusted parts of 2 nos of nails; there are probably broken parts of 2 specimens of nails, both have roundish cross section. (PND9/5/ II x 1 m- 2.03 m)

47. There are broken parts of either one small knife or more than one. The left has slightly curved cutting edge. The tang portion is difficult to identify. (PND9/5/ VI 0.0 m x 0.36 m- 2.10 m).

48. Sickle (?); it is the tang portion of a sickle. The specimen is flat and oval shaped cross section. From tang portion towards the top it is bent. The remaining portion is broken. (6.7 cm x 2 cm) (PND9/ III section, 2.20m).

49. Nail; it is the middle portion of a nail. Head and point are broken. Head portion has quadrangular cross section. From middle portion it is bent. (2.5 cm) (PND9/7/ x2.00m - 2.53 m)

50. It is lower portion of a dagger. It is flat, the portion towards the tang is narrow which slightly broadens towards the top. (5.8 cm) (PND9/7/ VI’ x0 – 3.18 m)

51. It is a broken dagger, the lower portion has logenze shaped cross section which slightly broadens towards the top. Tang and top portions are broken. (7.5 cm) (PND9/7/ III 0.50 x1.00 – 2.90 m)

52. A broken dagger, tang portion is narrow, it might have been attached to any wooden handle. It gradually broadens towards the top. Upper portion is broken. (10.8 cm) (PND9/8/ II’ 0.85 x0.55 m - 3.38 m)

53. A broken dagger; it is a lower portion of a dagger. The tang portion is very narrow to hold any handle which gradually broadens towards the top. (9.4 cm) (PND9/8/ III’ 0.23 x0.85 m - 3.37 m)

54. Hoe; probably it is the upper portion of a hoe, the cutting edge is sharp and straight. Lower and tang portions are broken, the width of the specimen is difficult to determine as a layer on its side has been completely removed. (9.5 cm) (PND9/8/ VI 0.87 x 1.85 m – 3.40 m)
55. Fragments of 2 hoes; probably there are the parts of a hoe or two hoes, though the cutting edge and tang portions are broken. (specimen 1: 10 cm and specimen 2: 6.3 cm) (PND9/8/ VI 0.87 x 1.85 m – 3.40 m)

56. A broken spearhead; it is a tanged spearhead, tang portion is narrow and has roundish cross section. Cutting edge is convex, the pointed part is broken. (9.5 cm) (PND9/8/ VI x 2.40 m – 3.45 m)

57. A socketed spearhead, cutting edge is convex, upper part is thin. (10 cm) (PND9/8a/ VI x 1.23 m – 3.59 m)

58. A broken nail, it is completely rusted, has roundish cross section. Shape of the head and points are difficult to ascertain as the specimens are broken. (4.6 cm) (PND9/7/ II’ 0.45m x 2.15 m – 3 m)

59. A socketed spearhead, spear portion is broken; (7.3 cm) (PND9/12/ V’ 0.54m x 1.00 m – 5.13 m)

60. Chisel/ khurpi? it is a complete and fine specimen of chisel. It has a narrow and solid tang portion which was in probability inserted into a socketed handle. The specimen gradually broadens, it has very sharp cutting edge. Oblong cross section. (7.2 cm) (PND9/12/ V’ 0.54m x 1.00 m – 5.13 m).

61. A small knife. The tang portion is partly broken, convex cutting edge. Oblong cross section. (8.2 cm) (PND 10/6/ X x 2.40m -1.45 m).

62. Broken part of a sickle. Both tang portion and upper portions are broken. (7 cm) (PND 10/7/ VIII’ x 0.20 m – 1.85 m)

63. A large nail, head portion has logenze shaped cross section, the remaining portion is very narrow and has a sharp point. (8.1 cm) (PND 11/2/ VIII’ 0.80m x 4.45 m – 1.03 m).

64. A broken nail, head has roundish cross section, middle portion is slightly broad, and point is broken. (PN11/5/ VII’ x 2.14m – 2.30 m)

65. Indeterminate specimen; (11.8 cm) (PND 11/5/ IX 0.65m x 3.10 m – 2.35 m)

66. Indeterminate specimen; (2.8 cm) (PND 11/5/ IX 0.65m x 3.10 m – 2.35 m)

67. It has been identified as a part of sickle/ it is more looks like a tanged spearhead (4.5 cm) (PND 11/5/ IV x 3.50 m – 2.39 m).

68. Spearhead; (4 cm) (PND 11/5/ VII x 3.00 m – 2.40 m)

69. Indeterminate specimen (5.5 cm) (PND 11/5/ I 0.10 m x 2.80 m – 2.41 m)

70. A broken spearhead (?); (6.4 cm) (PND 11/5/ VII 0.75 m x 1.85 m – 2.50 m)

71. A broken spearhead (?); (PND 11/5/ VI 0.55m – 2.55 m)

72. A broken dagger it is a very fine specimen of dagger, tang has oblong cross section, cutting edge is slightly curved, point is sharp. (16.5 cm) (PND 11/5/ IV 0.75 m x 1.20m – 2.60 m)

73. Nail; (5 cm) (PND 11/5/ V 0.70 m x 1.25m – 2.60 m)

74. Scraper; (7.5 cm) (PND 11/6/ VIII 0.52 m x 0.4 m – 2.73 m)

75. Sword tip (6.7 cm) (PND 11/6/ VII x 4.25 m – 3.02 m).
Panr being an agrarian settlement consumed iron in a large scale and definitely involved in the procurement network linking the south Bihar plateau and the adjoining Kaimur range of Uttar Pradesh to meet the demand of the finished products. It is not an isolated consumer of iron and it must have reciprocated with its immediate neighbours of the contemporary period. One could not rule out the consistent evolution of the particular settlement and its subsistence economy has definite bearing on social transformations. However, at present it is difficult to understand the role of iron in the said social transformations.

Ramchaura (25°41’ 0.10” N and 85°13’ 0.26” E): The site is situated in the Hajipur town of the Vaisali district. Occurrence of the sherds of BSW, NBPW and red slipped ware in profusion, recorded during the course of explorations at the site has prompted C.P. Sinha and B.K. Choudhary to excavate the site on behalf of the K.P. Jayaswal Research Institute in 1994-95. The site was again excavated in 1995-96 and 1997-98.

In the field season of 1994-95, two trenches, each measuring 6m x 4m were laid on a low mound just west to the Ramchaura temple.

It revealed a habitational deposit of four cultural periods.
Period I is represented by a deposit of 1.20 m ascribable to the ‘Chalcolithic’ period. Sherds of red ware and BRW comprising dishes, bowls, trough and spouts, a terracotta head and a stopper were reported.

Period II represents the settlement dynamics of the pre-NBPW period, characterized by the occurrence of BRW, BSW, terracotta beads and a copper ring.

Iron was introduced during the NBPW period (Period III). The habitational deposit of this period having a thickness of 1.50 m mainly consists of blackish earth interspersed with brownish patches mixed with plenty of potsherds and some brickbats. This period yielded sherds of NBPW, BSW, grey ware and red ware. The notable artefacts recorded from this period include terracotta figurines, both animal and human, terracotta discs bearing floral designs or other marks, terracotta stamps, bone arrowheads, broken terracotta naga figurines, terracotta and stone beads, terracotta balls, iron objects etc.

In the field season of 1995-96, the habitational deposit of the NBPW has a thickness of about 3.47 m. The entire deposit, divisible into three layers, ranging from layers (5 to 4a and 4), was found resting over the natural soil. It is composed of yellowish compact clay. The lowermost layer 5, having a thickness of 1.40 m, comprises reddish black earth, while layer 4a characterized by blackish soil, mixed with ashy deposit, is 1.22 m thick and the layer 4 is composed of blackish soil having a thickness 0.85 m. The ceramics obtained from these layers consist of sherds of NBPW in varying shades and its associated wares such as BSW, grey ware, BRW and red ware. The shapes in these wares include dishes, bowls, miniature pots and a few dishes bearing floral designs. The recorded artefacts from this period are terracotta objects such as wheels, sealings, stamps, human and animal figurines, ram-cart, nagi figurine, ghata-shaped beads, bangles etc., along with a few bone points, stylus, tanged arrow-heads, carnelian and ivory beads and of course, some iron objects. A terracotta ring-well consisting of twenty courses of rings with a diameter of 74 cm, found associated with the lowermost layer 5, which rests over the natural soil and is sealed by layer 5.

In the field season of 1997-98, the cultural deposit of the NBPW period having a thickness of 1.50 m is composed of thick brown soil with black patches.

The pottery of the period is represented by the NBPW, red ware, grey ware and black ware. The shapes in these wares include bowls, dishes, basin, rimless pans with handle etc. The antiquities associated with this period comprise terracotta animal figurines,
beads, balls, stoppers, wheels, a carnelian bead, a broken shell bangle, stone pestles and a few iron objects.

Among the recorded iron objects, special mention may be made of an axe-like implement.

Period IV is ascribable to the Sunga-Kusana-Gupta period. The habitational deposit is composed of brownish clay mixed with large quantity of brickbats. The ceramics obtained from this layer include red ware and red slipped ware. The principal shapes are bowls, dishes, handis, troughs, miniature bowls, spouts etc. Besides, the phase also yielded terracotta human heads, copper antimony rods, terracotta wheels, terracotta and stone beads and iron nails.


It was a minor iron using settlement, however, it (Munger or Mudgagiri) became a significant administrative centre (as evident from several literary sources) during the Pala period and experienced the supremacy of political powers. We have very limited scope to explain the nature of iron consumption during the early historic period. Here, one may mention that in the south Bihar plain i.e., in and around Munger there are a large number BRW associated settlements distinctly exhibiting the use of iron in different contexts. Therefore, the region can be invariably recognized as a significant iron bearing zone both in terms of production and consumption.

Lauriya Nandangarh (26° 59’ 00” N and 84° 24’ 00” E): The site is situated about 14 miles northwest of Bettiah. Cunningham first visited the site and described that nature of the ruins in his report (Cunningham’s Report, 1871, Volume I Four Reports Made During the Years 1862-63-64-65). As evident from a sketch plan of the ruins published by Cunningham in the said report, the pillar is situated about a half a mile north-east of the village. Carlleyle (Cunningham’s Report, 1885, Volume XXII Tours in Gorakhpur, Saran and Ghazipur 1877-78-79 and 80) excavated the area round the base of the pillar and revealed that the total height of the pillar is nearly 50 feet (of which about 10 feet is rough dressed, concealed underground, the rest of the pillar being polished). Inscriptions engraved on the pillar were also duly documented one of which is assignable to the Mauryan period. To the south and west of the pillar are three rows of mounds which were described as earthen barrows by Cunningham. A couple of excavations at these mounds
resulted in the discovery of ‘some laden coffins containing long human skeletons’. It was further informed that some iron coins and a solitary specimen of iron coffin, 9 feet in length, were also recorded (Cunningham’s Report, 1871, Volume I Four Reports Made During the Years 1862-63-64-65). However, Garrick (Cunningham’s Report, 1883, Volume XVI Tours in North and South Bihar in 1880-81) expressed his doubt whether the coffins were of iron at all. Carlleyle during the course of excavation at three of these mounds was able to expose an earthen stupa. He also recorded scattered pieces of pottery, charcoal and bones. Four of these mounds were re-excavated in 1904-05 by Bloch (in Marshall, 1904-05: 38-40). At a depth of 6 to 12 feet from top of the surface was exposed a deposit of burnt human bones mixed up with charcoal and a small gold leaf. A little below these deposits, Bloch noticed a long hollow shaft, running right through the centre of each mound, showing that an upright wooden post had once existed here. N.G. Majumdar (Majumdar, 1935-36: 55-66) subsequently exposed the outline of a circular structure of bricks i.e., apparently a stupa, having a diameter of 107’. Other finds in this excavation include a silver punch marked coins, a number of ex voto inscribed tablets bearing a Buddha figure with the usual creed formulae in North Indian characters of 6th-7th centuries CE. One of the mounds, partially excavated by Garrick, was also taken up by Majumdar and another circular structure or brick wall, 3’ 7” thick and 170’ in diameter was exposed, obviously encasing a stupa. Inside the stupa were discovered at the depth of 7’, a pig’s jaw, pieces of pottery, bones and an iron nail. Besides the above, remains of buttress wall, stupa structure were also found. The great stupa has been dated by Majumdar to c. 2nd century BCE. Apart from the so-called burial grounds, remains of structural edifices have been exposed at the Nandangarh mound. (Patil, 1963: 241-244)

Kumrahar (25°35’59.01” N and 85°11’6.70” E): The site is situated 3 ½ miles to the east of the Patna Junction Railway Station. Quest for one of the oldest towns of ancient India-Pataliputra and its archaeological remains has been a long-lasting endeavour among the scholars.

It is not easy to account for the name of Pataliputra. Popular legends are in favour to associate the tree Patali (Flueggea Leucopyrus in Latin) with the name of the site. It may be that a Patali tree which is uncommon in Bihar was found to grow here as a solitary specimen and so the place came to be known after it (See Altekar and Mishra 1959:3).

The settlement at Pataliputra owed its origin primarily to its strategic geographical location i.e., along the bank of the river Ganges. The kingdom of Magadha with its
administration at Rajagriha wanted to monitor the river traffic (of the Ganga, the Son, the Gandak and the Punpun) for defending the assault, of the Lichchhavis of Vaisali. Sunidha and Vassakara, two ministers of Ajatsatru therefore decided to build a fort at what was then called Pataligrama (Dialogues of the Buddha, Part II: 90-92). The settlement grew gradually till it became the capital of the Magadhan Empire. Interestingly, the Buddhist tradition stated that the settlement was still humble one when Buddha passed through it during his last journey from Rajagriha to Kusinagara. However, he has foreseen the commercial importance of Pataliputra. The Jaina tradition stated that it was Udayi, the successor of Ajatsatru, who transferred the capital to Pataliputra. This site served as one of the most significant settlements as commercial, administrative as well as military centre of dynasties of the following centuries.

We can get a fairly vivid picture of Pataliputra at about 300 BCE from the accounts of Megasthenes (Megasthenes’s Indika Fragment 26; See McCrindle, 1877: 67-69). The ancient settlement was long but narrow; it was 80 stadiums (nearly 9 miles) long and 15 stadiums (nearly 1 2/3 miles) broad and in the form of parallelogram. The circumference of the city was nearly 22 ½ miles. This description would more or less suit the present Patna, whose length is about eight miles from Golghar to Malasalami. It can be surmised that the ancient Pataliputra extended further east to Didarganj. This view obtains some other confirmation from the circumstance of the discovery of the remnants of the wooden palisades from Lohanipur in the west, through Bahadurpur, Bulandibagh, Kumrahar, Maharaikhand and Sewai Tank to Gandhi Tank in the east near the Chowk. There are, however, some difficulties in accepting the view. The location of the eastern gate, Purab-darwaja, and the western gate, Paschim-darwaja, 8 ½ and 5 miles from Golghar, would suggest that the old city did not extend much beyond these points at least at some period of its existence.

It is also doubtful that whether the old city was so closely on the bank of the river Ganga. Fa Hien in his report mentioned that he had to walk about 5 miles after leaving the river before the bank of the Ganga. This would suggest that the Ganga might be flowing further to the north of the present city and it is possible that its present course may have cut off a portion of its northern part.

Based on several literary and epigraphic texts, it was difficult to trace the exact location of Pataliputra.
The site was excavated for the first time by D.B. Spooner in 1912-13 at Kumrahar (Annual Report, ASI, 1912-13: 53-86) and again by M. Ghosh at Bulandibagh in from 1922-23 to 1927-28 (Ghosh, M, Pataliputra: Patna Museum Annual Administration Reports for 1922-23: 2; 1923-24: 2; 1924-25: 2; 1925-26: 2; 1926-27: 4; 1927-28: 2 and 16; See also Patil, 1963: 371-421).

Spooner’s excavations had led to a significant discovery of the Mauryan Pillared Hall though a number of problems remained unsolved. Subsequently, K.P. Jayaswal Research Institute under the supervisions of A.S. Altekar and Vijayakanta Mishra had undertaken the excavations at Kumrahar for five consecutive seasons from 1951-1955 (Altekar and Mishra, 1959).

Based on some diagnostic cultural materials the chronology of the site has been divided into the following cultural periods.

Period I: Before c. 150 BCE; Period II: c. 150 BCE to 100 CE; Period III: c. 100 to 300 CE; Period IV: c. 300 to 450 CE; Period V: c. 450 to 600 CE; Period VI: c. 17th Century (Altekar and Mishra, 1959: 18-19).

The most characteristic feature of the period I is the presence of grey ware of coarse fabric, usually in association with red ware. The main type met with in the grey ware is the bowl with incurved rim. Few sherds of NBPW have been found from these layers (layer 10 in KR IV and in the sixth and earlier layers in KR IV Z). Cast and punch marked coins were found from layers 7 and 8 of KR IV Z and layer 5 of KR I.

In KR IV K, Sunga terracottas and two coins of ‘Lankey Bull type of Kausambi’ were recorded at layers 8 and 9 on the basis of which the concerned cultural layers have been dated to the c. 150 BCE to 100 CE. A few copper punch-marked and cast coins were also found in layers 8 and 7. Some stone chips have also been recorded which according to the excavators probably belonged to some pillars, erected after the destruction of the Mauryan pillared hall (Altekar and Mishra, 1959: 19).

In KR II similar evidence (Sunga Terracottas, punch-marked coins and ‘Lankey Bull type of Kausambi’) have also been yielded.

In KR III B has also yielded an inscribed sherd from layer 6 which based on palaeography of its Brahmi letters na and sa has been dated to the beginning of the Christian era. Besides, some sherds of NBPW, red ware and grey ware from these layers have been stamped with symbols like Crescent Hill and Hollow Coins (which are commonly found on cast and punch-marked coins).
In KR IV K structures of the Kusana period have been exposed in the layer 6b. A few Kusana coins and terracottas with the characteristic peaked headdress have been found from layers 6 and 5a respectively. Kusana copper coins and terracottas were recorded from KR IV Z at layer 3 and from KR II N at layer 4. From layer 4 of KR II, a sealing was also discovered with legend Saghasa.

A few sherds of grey ware and NBPW have been found.

Period IV is represented by layers 3, 4 and 5 in KR IV, by layers 1 and 2 in KR IV Z, by layers 3, 3a, 4 and 4b in KR V, by layers 2, 3 and 4 and 4a in KR III B and by layers 2 and 3 in KR I. Some copper coins of Chandragupta II, terracotta sealings having inscriptions in Gupta characters, terracotta figurines of the Gupta idioms have been documented in these cultural layers. It is interesting to note that in layer 2 of KR IV Z a solitary specimen of copper punch-marked coin along with a few Gupta coins have been found. According to the excavator, the former perhaps continued to be in vogue to some extent even in earlier part of the 4th century CE (Altekar and Mishra, 1959: 20).

Period V is represented by the cultural materials found from KR I, KR III B, KR IV, KR IV Z and KR V. It is more or less a continuation of Period IV, however, here red ware of coarse fabric predominates the ceramic assemblage. Sealings and inscribed potsherds, probably datable to c. 450-600 CE have been recorded in profuse quantities.

**Iron objects** (Altekar and Mishra, 1959: 140-142).

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Length</th>
<th>Layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fragment of a nail, rectangular in section</td>
<td>2.2&quot;</td>
<td>KR IV O</td>
</tr>
<tr>
<td>2</td>
<td>Nail with expanded triangular head, bent</td>
<td>2.1&quot;</td>
<td>KR IV Y</td>
</tr>
<tr>
<td>3</td>
<td>Nail with broken head</td>
<td>1.11&quot;</td>
<td>KR IV ZE</td>
</tr>
<tr>
<td>4</td>
<td>Nail with almost circular section</td>
<td>2.2&quot;</td>
<td>KR II A</td>
</tr>
<tr>
<td>5</td>
<td>Nail with flat hook</td>
<td>1.6&quot;</td>
<td>KR III B</td>
</tr>
<tr>
<td>6</td>
<td>Similar to No. 2</td>
<td>2.1&quot;</td>
<td>KR IV O</td>
</tr>
<tr>
<td>7</td>
<td>Similar to No. 5</td>
<td>1.9&quot;</td>
<td>KR II F</td>
</tr>
<tr>
<td>8</td>
<td>Nail with circular section and broken head, gradually tapering to a point</td>
<td>2.1&quot;</td>
<td>KR IV Y</td>
</tr>
<tr>
<td>9</td>
<td>Nail with a knob head</td>
<td>2.1&quot;</td>
<td>KR IV Y</td>
</tr>
<tr>
<td>10</td>
<td>Fragment of a nail, Length 2&quot;</td>
<td></td>
<td>KR III B</td>
</tr>
<tr>
<td>11</td>
<td>Nail with expanded triangular head. Length 2.3&quot;</td>
<td></td>
<td>KR IV ZW</td>
</tr>
<tr>
<td>12</td>
<td>Nail with flat hook-head</td>
<td>1.7&quot;</td>
<td>KR III C</td>
</tr>
<tr>
<td>13</td>
<td>Fragment of a nail, Length 2.25&quot;</td>
<td></td>
<td>KR IV N</td>
</tr>
<tr>
<td>14</td>
<td>Implement; indeterminate use</td>
<td>2&quot;</td>
<td>KR IV K</td>
</tr>
<tr>
<td>15</td>
<td>Similar to No. 11</td>
<td>1.8&quot;</td>
<td>KR IV O</td>
</tr>
<tr>
<td>16</td>
<td>Fragment of a nail with a circular section</td>
<td>1.9&quot;</td>
<td>KR III D</td>
</tr>
</tbody>
</table>
17. Fragmentary head of a nail with flat head. Length 1.3”. KR II C.
18. Fragment of a nail with knob head. Length 1.6”. KR V C.
19. Fragment of a nail with circular section and circular flat head. It belongs to period I.
   Length 1.3”. KR B’.
20. Fragment of a nail with flat hook-head. Length 1.1”. KR TT.
21. Similar to No. 20. Length 1.4”. KR IV K.
22. Nail with a knob head. Length 1.3”. KR I TT.
23. Fragment of a nail with flat hook-head. Length 1”. KR A.
24. Nail with flat hook head. Length 1.2”. KR IV K.
25. Similar to No. 23. Length 1.15”. KR IV B.
27. Nail with flat shank and a broad flat head projecting to one side of the shank. Length
   3.6”. KR IV K.
28. Nail with expanded triangular head. Length 3.4”. KR IV.
29. Similar to No. 23, though bent. Length 3.1” KR IV Z
30. Nail without head and tapering to a point. Length 2.3”. KR VC.
31. Nail with a broken head. Length 3.5”. KR IV L.
32. Nail with circular section and head. This belongs to period II. Length 2.10”. KR V J
33. Nail with knob head. Length 3”. KR III B.
34. Nail with expanded triangular head, bent. Length 2.10”. KR IV H.
35. Nail with circular section and knob head. Length 2.7”. KR III.
36. Similar No. 2. Length 2.6” KR III E.
37. Nail with flattened head and tapering gradually to a point. In the middle of the head is
   small hole. Length 2.5”. KR IV K.
38. Nail with knob head. Length 2.7” KR IV X.
39. Nail with broken head, gradually tapering to a point. Length 2.5”. KR IV Z.
40. Similar to No. 22. Length 2.2”. KR II O.
41. Nail with rectangular section and broken head. Length 2.2”. KR IV ZW .
42. Nail with broken head and circular section tapering gradually to a point. Length 2.4”.
   KR IV J.
43. Nail with expanded triangular head, bent. Length 2.6”. KR IV K.
44. Nail with circular section and head. Length 2.6”. KR V J.
45. Nail of circular section with knob head, bent. This belongs to period I. Length 2.4”. KR
   D’.
46. Nail with knob head, bent. Length 3.1”. KR IV Y.
47. Wire, bent on one side. This belongs to Period I. Length 2.4”. KR IV K.
48. Nail without head and tapering to a point. Length 2.3”. KR II N.
49. Fragment of a nail gradually tapering towards the end. Length 1.6” KR V C.
50. Fragment of a ring. KR III E.
51. Fragment of a nail with knob head. This belongs to period I. Length 1.65”. KR IV J.
52. Nail tapering to a pointed end, bent. Length 4.11”. KR C.
53. Thick wire coiled at the top. Length 5”. KR IV J.
54. Fragment of a nail. Length 4.2” KR III C.
55. Latch with provision for two nails. Length 4.10”. KR IV L.
56. Fragment of a blade of tanged knife. Length 1.3” KR IV C.
57. Socket. Length 1.3”. KR II A.
58. Fragment of a blade. Length 1.3” KR IV C.
59. Fragment of a latch. Length 1.2” KR IV E.
60. Knife with pointed small blade and handle, the latter also of iron. Length 2.8”. KR IV J.
61. Fragment of a knife. Top bent. Length 2.3”.
62. Chopper-like object. Length 1.9”. KR II B.
63. Flat strip. Implement. Dimensions 9” x 2”. KR II K.
64. Fragment of a tanged knife. Length 2.9” KR III C.
65. Headless nail with circular section. Length 5.2” KR III C.
66. Implement: chisel with oblong section. Length 3.9” KR III E.
67. Sickle with tang of circular section. Length 7”. KR IV ZE.
68. Similar to above but broken. Length 6.2” KR III D.
69. Fragment of a bar, circular in section. Length 2.9” KR III C.
70. Bar with circular section. Length 9.5” KR III C.
71. Fragment of a sickle with a hole towards the top. Length 6.7”. KR VJ.
72. Tanged knife or dagger. Length 7.3”. KR III C.
73. Implement. Indeterminate use. Length 7.2”. KR IV ZE.
74. Fragment of a chisel. Length 3.1”. KR VII II.
75. Small axe. KR III N.
76. Chisel with oblong section. Length 7” KR IV XE.
77. Razor with a tang. Length 8.5” KR IV ZE.
78. Fragment of a sickle with tang of rectangular section. Length 8.3” KR II R.
79. Dagger with a tang. Length 10”. KR II S.
80. Chisel length 4.5” KR IV XE.
81. Axe. Length 5.5” KR IV XE.
82. Small tanged knife or dagger. Length 4.8” KR VII I.

At KR I (western part of the Mauryan pillared hall) A’ V-VIII, one wall of 18 courses in the western side and another of 9 courses in the eastern side ascribable to the period II (c. 150 BCE to 100 CE) have been exposed. Traces of a wall meeting at right angle to the above wall were also found in the northern section the foundation of a room. Adjoining to this room and parallel to its western wall, another wall measuring 4 feet 2 inches (running north to south) besides another wall (running east to west) measuring 4 feet 8 inches were
exposed. The northern wall continued in the northern section of the trench. These three walls formed a room measuring 13” x 8’6” (Altekar and Mishra, 1959: 35).

In the trench A’ V-VIII, a wall of nine courses measuring 2 feet 2 inches in length running north to south and sealed by layer 3A have been exposed along with potsherds and brickbats. This structural remains have been dated to c. 100-300 CE.

Traces of two hearths almost circular in shape were found in the north-east corner of the trench A’ XVII-XX about 7 feet 6 inches below the ground level. These hearths were resting on layer 8 and sealed by layer 7, thus marking the earliest occupational level of the period I. In the trench B’ I-IV towards the north five courses of a wall (datable to c. 100-300 CE) measuring only about one foot in length were exposed. A wall of just two courses of bricks (assignable to c. 300-450 CE) is seen in the northern face of the trench resting over layer 2.

At the trench B’XIII-XVI, remains of an oven made of thick burnt clay, 3 feet in thickness and oval in plan was found in layer 8 sealed by layer 7, datable to the period I. A building of the Period II is represented by a single course of complete bricks measuring about 12 inches square. The length of the wall was 8 feet which was sealed by layer 6 and it rests on layer 7. A coping stone of railing was found in this trench in a pit 3 feet 3 inches below the surface. It had three sockets under it. It was decorated with the vine creeper motif. A number of NBPW sherds were found from layers 7, 8 and 9.

In trenches KR II A and KR II F, remains of an apsidal structure datable to c. 150 BCE to 100 CE were discovered. It started between pegs V and VI and was traced up to the western section of the trench F, measuring 27’ 9” in length and 2’ 2” to 2’ 6” in breadth. It had five courses only. The topmost course was of only one brick. This structure was resting on layer 10 which was loose light blue soil with a few brickbats.

In trenches KR II, A, B, D, E, F, H, J, K, L, N, P and Q traces of a big rectangular structure measuring 77’ 10” x 75’ were found, its wall having one to thirty courses (Altekar and Mishra, 1959: 39).

In the trenches KR III and KR IIIA, period III (c. 100-300 CE) is represented by a dilapidated and fragmentary stratum showing concrete floor and two courses of bricks. A hoard of nine silver-coated punch-marked coins was also recorded at layer 4.

Period IV (c. 300-450 CE) was represented by drains at regular intervals of one foot. They were built in a box style. They had a thick concrete soling and probably they were covered by bricks-on-edge. Dimensions of bricks were 1’6” x 11” x 2.75”. Altogether,
there were eleven such drains from east to west. From the sealing layer of these drains, a few copper coins of Chandragupta and terracorras (ascribable to the Gupta period) have been recorded.

A drain built of brickbats was found in the trench KR III C at a depth of 2’7” below ground level. Trenches KR III P, KR III N and KR III O did not yield any structural remains.

To the south of the graveyard near the pillared hall, there was an extensive area (KR IV) which was taken under excavation in 1951. There was a modern Saptamatrika temple just contiguous to this area.

Remains of one monastery datable to the Kusana period were exposed in the trenches XE\textsuperscript{1} XE\textsuperscript{2} XE\textsuperscript{3} XE\textsuperscript{4} XE\textsuperscript{5} and XE\textsuperscript{6}. It has a courtyard in the centre along with rooms on its three sides having verandahs in their front (varying in size from 7’ x 9’6” to 9’3” x 6’).

The other monastery of the Kusana period (as exposed in the trenches Z, ZW, XA, ZE etc.) consists of 14 small cells, with four narrow but longish halls in their front, two of them being separated by two small rooms. Outside these halls to their west there was apparently an open verandah 129’9” x 2’9” in dimensions (Altekar and Mishra, 1959: 41).

Another important structure exposed in the western part of the KR IV is an apsidal brick Chaitya with a brick stupa in the centre. According to the excavators this structure is datable to c. 100-300 CE.

The ceramics from Kumrahar is essentially plain. Painted wares are rare and decorations are not common. It is usually wheel-turned, though production of hand-made variety was also in vogue among the settlers of Kumrahar. The earliest pottery is grey ware sometimes fine and sometimes course. The most common types consists of bowls of grey ware with incurved rims. Use of the NBPW and grey wares were in practice in Periods I and II. Only a few sherds of NBPW were found in early layers of Period III. Some of the variety of NBPW along with grey and red wares have been stamped with symbols like crescented hill and hollow cross (Altekar and Mishra, 1959: 59).

The NBPW sherds recorded from the site, according to the excavators are not so fine, as those yielded for other early historic sites of the Ganga valley. The dishes of NBPW have flared or vertical rims with or without covex sides. Some of these flared rims have also corrugations. Period II has yielded a knob of a lid, made of this ware. The other characteristic types of NBPW assignable to period I is bowl with incurved rim and
carination of the waist or flared and simple rim. If the rims were broken they were rivetted by two copper strips.

Among the decorations executed on the sherds mention may be made of both the geometric designs viz. lines, circles, parallelograms, triangles, incised triangles with perpendicular lines and the non-geometric ones like the sun, the serpent, the peacock, trees, lotuses etc. the designs are sometimes stamped, sometimes incised and sometimes in relief. Hollow cross, three-arches crescented hill and tree in railing which generally occur on cast and punch-marked coins are to be seen stamped on three fragments of dishes.

Altogether 165 coins have been yielded from the excavations. Of these, 20 coins are made of silver and the remaining are of copper or of copper coated with silver. The excavators preferred to categorize the said collection into seven broad groups: 1a) punch-marked silver coins; 1b) punch-marked silver plated coins; 1c) punch-marked copper coins; 2) cast copper coins; 3) coins of the Lankey Bull type of Kausambi; 4) Panchala and Ayodhaya coins; 5) Kusana copper coins; 6) Gupta copper coins 7) coins of the Mughal period (Altekar and Mishra, 1959: 86).

The stratification/stratigraphy shows that the punch-marked silver coins were current at Kumrahar from the early levels of the Kusana period. Punch-marked silver plated coins, altogether eight in numbers were found in KR III assignable to Period III. The cast copper coins were in use during the Sunga and the Kusana periods, though a few survived during the Gupta period also.

The Gupta copper coins are the issues of Chandragupta II. In some cases the attribution is clear, though in others it is presumed from the type. They are all round in shape. They may be divided into following four groups: a) bust of the king to left; b) king standing and holding flower in right hand bent up; c) king standing and offering oblations by right hand; d) king with umbrella bearer.

Excavations have yielded one seal and fifty sealings all made of terracotta. Some of these are oval and some are circular in shape. Some bear symbols and are uninscribed while others though inscribed, do not have any symbols. Of these, only one belongs to the period II (c. 150 BCE – 100 CE) two to the Period III (c.100-300 CE), and the remaining to Periods IV and V. Generally the space is divided into two parts, by a horizontal line, the upper one having symbols or animals and the lower one having the legend (Altekar and Mishra, 1959: 103).
Besides, inscribed potsherds, altogether eleven in numbers have also been recorded (Altekar and Mishra, 1959: 106). They are inscribed either on the base or the rim or the body of the pot. One potsherd belongs to the first century BCE while the rest hail from the Gupta or the late Gupta period (c. 300-600 CE).

A substantial number of terracotta figurines have been unearthed at almost all levels (Altekar and Mishra, 1959: 108). Female figurines essentially predominate the assemblage. Besides, small game objects were also found. These figurines are well-burnt and are generally of red colour. Most of them retain no trace of paint. Most of these are made from moulds, a few of them only are hand-made.

Terracotta animal figures altogether ninety seven in numbers were found during excavations. The clay used in making them is of the same colour and quality as was used for making the human figurines and pottery. These terracotta animals do not appear to be well baked as the figurines. Bulls are very common among the terracotta animals, some of them are with humps and some are humpless. The other animals depicted in terracotta art are lion, tiger, elephant, horse, monkey and camel.

Stone objects were found in profuse quantities from all the cultural phases. The most remarkable ones among them are fragments of polished sandstones found in periods I, II and III. Such grooved sandstones with unmistakable Mauryan polish are of special emphasis among the scholars. Some sculptures have also been found during excavations (Altekar and Mishra, 1959: 137).

Kankarbagh (25°35'53” N and 85°09’18” E): With a view to ascertain the archaeological significance of the remains of wooden posts, accidentally brought to light below the sub-soil water level (as a result of the laying of a sewer line by the Public Health Engineering Department of the Government of Bihar in the Kankarbagh area of the Patna city), a small-scale excavation was taken up by a team, consisting of B. K. Thapar, M. G. Joshi, N. C. Ghosh, B. M. Pande and Jassu Ram of the Headquarters Office of the Survey. The work was conducted in collaboration with the Department of Archaeology of the Government of Bihar. Within a limited area of the cutting, the salvage excavation revealed as many as fourteen posts, arranged in four rows. The upper ends of most of the posts tapered to a tenon-like finish. In a few cases, mortises were also observed. The posts were placed 1-50 to 1-75 metres apart. On the sides, the posts were enclosed by wooden planks fixed with iron nails, making the structure into a series of boxes which were rammed with earth and thus formed the core of the fortification wall.
On the basis of the occurrence of the NBPW in the associated strata and the existence of similar structural remains at Bulandibagh, excavated by Spooner in 1924, it is fair to assume that the recently-exposed structure formed a part of the defences/palisade of the Mauryan city of Pataliputra (IAR 1970-71: 6).

It is evident from the archaeological database (that we have already discussed) the use of iron at Kumrahar is quite extensive. Being an administrative centre of the Mauryan period, Kumrahar was not only a consumer but also monitored the existing exchange network of various commodities. Iron was definitely one of them. The emergence of the settlement, its subsequent growth and the receiving of an urban status were in all probability due to its role in the exchange network of the Ganga valley as one of the overseers. However, it is actually difficult to ascertain the nature of consumption at the site solely on the basis of archaeological data. If we believe that the wooden palace of Pataliputra justifiably identified with the evidence of Kumrahar, then invariably iron was in use in a large scale in the construction of such wooden palisade. Besides, carving of Chunar sandstones in making different monuments must have also raised the demand of iron objects. Though partially, the repertoire of iron objects recovered from the site corroborates the same. However, there is no evidence to identify the function of the settlement in the production of finished objects.

**Balirajgarh** (26°27’26.12” N and 86°19’28.21” E): Balirajgarh or Balirajpur is situated 16 miles north-east of Madhubani, the headquarters of the district. It has the remains of fort with high enclosing walls still rising to a height of 10 feet. The site was excavated for the first time by the mid-eastern circle of the ASI in 1962-63 (IAR 1962-63: 3-4). Four cuttings, two each across the defence-wall and in the habitation-area, were laid out. Due to the high water-table in the area, the natural soil could not be reached. The excavation nevertheless threw light on the structural details of the fortifications. The defence-wall consists of a mud-brick core with brick encasement, the outer one being four times the width of the inner. The wall was battered and measures 5.18 m at the base and 3.65 m at the top. The remains of three phases of construction have been exposed. The earliest phase consists of a mud-brick core with battered brick revetments, of which the outer is approximately three times the width of the inner. In the second phase, a brick-concrete ramp was built against the inner face. The third phase witnessed further reinforcement of the ramp in the shape of a 3 m. high platform of earth mixed with potsherds, built against...
the inner face of the fortifications. The reinforcements were necessitated by heavy floods as evidenced by silt deposits. From the pre-defence deposits, sherds of the NBPW were obtained. The fortifications seem to have been built somewhere in the second century BCE and remained in use till the Pala period. Other finds obtained from the associated levels include beads, coins, Sunga terracotta plaques, bone objects, etc. Besides, three more cuttings, viz. BRG-2 to BRG-4, were also made in different parts of the site. Of these BRG-2 was found to be a refuge pit and did not contain any occupational deposit. A few terracotta plaques were obtained from this area. BRG-3 revealed remains of a temple and BRG-4, located near the southern defences, revealed similar deposits such as BRG-1. Nearly after a decade, the site was again taken for excavations by the Directorate of Archaeology and Museums, Government of Bihar under the supervision of B. P. Sinha (IAR, 1972-73: 7 and 1974-75: 9-10). For two field seasons of 1972-73 and 1974-75 excavations were conducted at a large mound probably having an area of 1.75 hundred acres. Two trenches, one of 5 m width, across the rampart near the north-western corner, and the other of 10 x 5 m, in the habitational area, not far away from the southern side of the mound, were laid out.

The rampart shows two phases of construction, the earlier of which, nearly 5 m in width, was built of big-sized bricks (50 X 20 X 4 cm). After the destruction of the original rampart, perhaps due to heavy floods, a new rampart was constructed, again of bricks. The extant height of this phase was available to forty-one courses. The core of the original rampart yielded a few pieces of the NBPW. The finds led the excavator to consider the original date of construction around second century BCE.

The cutting at the habitational area likewise revealed two cultural periods. Period I has yielded a substantial number of artefacts such as terracotta plaques, showing both male and female figurines, hand-fashioned mother goddesses, terracotta animal figurines, representing mostly rams and bulls, bone pins, cast copper coins, antimony rods, terracotta beads and balls, a terracotta sealing with svastika symbol, a crucible, and beautifully-fashioned beads of semi-precious stones. The ceramics of the period are represented by the NBPW, and grey and red wares. Period II (ascribable to circa 200-600 CE) covered a deposit of about 1-60 m thickness. The associated finds comprise terracotta animal figurines, stone beads, terracotta balls, etc. Besides, rectangular tiles with circular hole were also found.
In 1974-75 (*IAR*, 1974-75: 9-10), a 5 m square trench was laid out which was excavated to a depth of 4.10 m. The excavation revealed two periods of occupation, as noticed earlier.

Period I (second century BCE to second century CE) is represented by a residential structure. Besides yielding terracotta plaques, a large number of terracotta wheels, fragments of terracotta toy-carts, antimony rods, iron nails, beads of various shapes and sizes made of semi-precious stones have been found. The ceramic industry of the period is dominated by red ware. The important shapes include vases, troughs, spouted vessels, vases and pans with handle, perforated jars, lid-cum-bowls and lid-cum-vases etc. Some sherds with mat and reed impressions have also been met with. Some of the troughs have rope-band designs on shoulder. The roof-tiles show a circular hole in the centre and a deep groove on one side for securing the other side. Besides, a few sherds of NBPW and grey ware were also recorded from the lowest levels.

Period II (second to sixth century CE) represented by a deposit of about 1.65 m, yielded terracotta animal figurines, stone beads, terracotta beads and balls. The ceramic industry of the preceding period except the NBPW and grey ware, continued during this cultural period without any marked changes.

**Buxar**: The site of Buxar (locally known as Charittarvan), is located on the left bank of the Ganga, in the old district of Shahabad. In 1926-27 a trial excavation was conducted at the earthen mound of the site which has the remains of the medieval fort. Some inscribed seals in early Brahmi and a number of beautiful terracotta having the depictions of coiffure were discovered (see Sinha, 1983-86: 213). The site was again excavated by the Directorate of Archaeology and Museums, Government of Bihar, under the general direction of B.P. Sinha for two field seasons of 1963-64 and 1965-66 (*IAR* 1963-64: 8-9 and 1965-66: 11; Sinha 1983-86: 213-217).

Excavation revealed four cultural periods at the site; the earlier three were continuous and the last following an occupational break after Period III. Period II is characterized by the use of iron at the site.

This cultural period is marked by the presence of the NBPW along with red, black and grey wares. The types obtained in NBPW include dishes and bowls. A new shape, represented by a lipped bowl in red ware, also makes its appearance during this period. Amongst other finds, terracotta female figurines, sealings bearing the symbols of punch-marked coins, bone points, antimony rods, beads of semiprecious stones, terracotta ear-
studs and iron implements are worth noting. The styles depicted in the female terracotta figurines, found from the site differ considerably from the significant characteristics of the Sunga idiom. The said figurines have special types of headdresses; faces are elongated and the ornaments on the body are not so heavy.

Period III yielded the ceramics, representative of the early Christian era, represented in forms such as sprinklers, carinated and flanged handis, spouted vases, bowls with tapering sides, lid-cum-bowls and vases. A long wall, measuring 6 m in length, perhaps part of a large hall, was also brought to light. Terracotta human figurines with typical Kusana headdresses, sealings, beads and iron objects constitute the other important finds of this period.

Period IV represents the cultural materials of the medieval period.

Chandahadih: The site is situated on the left bank of the river Bagmati, about 5 km north-west of Katragarh in the district of Muzaffarpur. The site was excavated by the Directorate Archaeology and Museums, Government of Bihar in 1977-78 under the supervision of Sita Ram Roy (IAR, 1977-78: 15). An occupational deposit of 4.10 m representing two cultural periods has been exposed. The natural soil, however, could not be reached due to high sub-soil water level.

Period I is represented by the occurrence of NBPW and iron. Noteworthy artefacts found from the period include terracotta plaques, animal and bird figurines, balls of various sizes, spindle whorls, ghata-shaped beads made of terracotta, weights and beads of semiprecious stones like carnelian, jasper, agate, rock-crystal, etc., beads and pins of bones, bangle pieces of copper; and nails of iron. This period is datable to the second century BCE - first century CE on the basis of ceramics and antiquities.

Period II is marked by the occurrence of red ware and the continuation of the grey ware of the earlier period. Structural activity is represented by the remains of a floor having the occurrence of intact pots, ovens, etc. Other finds recovered from this period include terracotta human and animal figurines, beads and pendants, beads of stone, glass and bone, bangle pieces of conch and fragments of copper and iron objects.

Kolhua (26°1′15.79″ N and 85°6′51.00″ E): This village known for its Asokan pillar is situated about 3 to 5 km from Vaisali in the district of Muzaffarpur. The pillar has found its reference in the report of Law in 1784 though full description of the pillar and the surrounding ruins was given for the first time by Stephenson in 1835 (Stephenson, 1835: 128-138). Cunningham explored the site in 1861 (Cunningham's Report: Vol. I: Four
Reports Made During the Years 1862-63, 1863-64, 1864-65: 58-64) and again in 1880 (Cunningham’s Report: Vol. XVI: Tours in North and South Bihar in 1880-81: 12-16).


The excavation of the stupa has revealed three phases of constructional activities. The earliest one was plastered with lime. In the second phase the pradakshina-patha was shortened and its floor was subsequently raised. In the final phase, the stupa was enlarged by providing another brick encasing. The last enlargement of the stupa was made over a rammed floor made of lime-surkhi.

Besides, miniature stupas of different plan and dimensions were found to have been constructed around the main stupa. A pradakshina-patha was also made between the miniature stupas and the main one. Some of the miniature stupas were also plastered.

It has been observed that a votive stupa of svastika shape was exposed superimposed by two other votive stupas at a late stage. Twenty-six other votive stupas of different shapes and designs, such as circular, squarish, rectangular, damaru and cylindrical shaped, decorated with moulded and cut-brick designs, were also unearthed. On the basis of architectural features, ceramics and antiquities, these could easily be dated to the Gupta period. It is interesting to note that all the structures have brick jelly lime-plastered floor which had been repaired successively.

The excavations have also revealed the remains of the ayakas, an extension of the main stupa during the last phase of construction.

The debris accumulated at the centre of the stupa was cleared, to expose the double-walled square relic-chamber which was found heavily damaged.

The pit was cut through the basement of the stupa into the natural soil. It was observed that the core of the stupa was built of bricks laid in criss-cross pattern, while the encasing masonry showed courses laid in headers and stretchers.

Important finds obtained from the treasure-hunter's pit comprise objects of semi-precious stones, a few of which were embedded in bricks, gold leaves of different sizes and shapes, broken pieces of stone vase with typical Mauryan polish, a terracotta plaque depicting the standing Buddha with illegible inscription and a terracotta head of monkey.
Excavation at the lion pillar has revealed the bottom stone on which the pillar stands at a depth of 5.50 m from the present ground level. The entire free standing shaft measuring 12.65 m in height was highly polished except the lower portion of 1.68 m from the base. The bottom stone was placed over the natural soil.

A vertical cutting line running north-south against Asokan pillar was noticed which had cut all the structures falling on its way. It appears that most of the structures had collapsed due to flood since 140 m thick silt deposit was uniformly noticed in all quadrants at a particular level.

Excavation in the other trenches revealed that the top two layers are extensively disturbed by pits, probably due to brick robbing. The preceding layer is mainly composed of blackish earth with the occurrence of small brick-bats and, immediately over the latest floor level.

Four trenches taken at a distance of about 80 m south-west of the Asokan pillar and the stupa complex have exposed the remains of a monastic establishment having three structural phases corresponding to the Kusana, Gupta and post-Gupta periods. The orientation of the monastery in all the three phases was the same though there were marked differences in their alignment, using the structures of earlier phase as foundation for later activities. The monastery was almost square on plan measuring externally 10.30 m (east-west) and 10.10 m (north-south). The width of the outer wall was 1.35 m. There was provision for three cells with a gallery on each side, thus making 12 cells and 4 galleries in the monastery, with a central open courtyard, almost square on plan, measuring 6.50 m x 6.65 m. The space between the open courtyard and the cells all around measures 2.30 m in width which might have formed a covered verandah in front of the cells. It appears that the monastery had its entrance on the east, facing the main stupa, which is evident from the remains of the covered portico with side chambers, one on each side. The portico in front is bigger than the side chambers, on its either sides, but the width remained the same.

The monastery had witnessed heavy thrust of flood from the west causing considerable damage to its western wall. In order to protect it from floods, a retaining wall had been provided with a buttress built in recessed offset manner, corresponding to the second structural phase of the monastery. A flat brick-paved platform, outside the monastery adjacent to western wall, was also noticed perhaps to serve as an open-air bathing platform. The platform remained in use in the successive phases as well. Further, the
platform was provided with a drain, which remained in use in the successive phases of the monastery. Among important artefacts recorded here, mention may be made of terracotta beads, balls, gamesmen, hopscotch, stone and glass beads, iron lump which were found from all these levels. A silver punch-marked coin is a noteworthy find unearthed from the earliest level of the site. Terracotta snake hoods and bangles as well as shell bangles were also found from mid-levels. A good number of terracottas comprising both human and animal figurines, antimony rods, semi-precious stone beads and stone weights were recovered from the Sunga-Kusana levels. Inscribed terracotta plaques with the Buddhist creed “yedhamma hetu prabhava hetu...” and two inscribed fragmentary sherds of red ware, one with the legend "Buddha Nandasya karakah parigraha" in Gupta Brahmi are particularly noteworthy.

The excavation, to the south of the main stupa brought to light a massive shrine with a chaitya at its back. The shrine is almost square on plan measuring 3.30 x 3.45 m. The extant courses of the structure were found to be 43 belonging mainly to the foundation of the structure. The width of the outer wall measures 2.10 m. The projections are provided to the outer walls of the main shrine at all the cardinal points. These projections measures 2.10 X 0.80 m (southern side), 2.20 X 10 m (northern side), 1.80 X 10 m (eastern side) and 2.0 X 1.0 m (western side). During the succeeding two phases, the shrine was used for residential purposes and is provided with a set of four rooms in the north-south orientation. The whole complex is provided with an enclosure wall, two construction phases of which were noticed.

To the south of the shrine, remains of a chaitya, measuring 10.50 X 1.0 m, longer axis being north-south, was noticed. Outer wall of this structure is 2.75 m in width. A small chaitya was found enshrined at the north-eastern corner of the structure. The chaitya measures approximately 1.0 m in height and 0.80 m in diameter. It has niches at the three cardinals (north, west and south) adorned with the figures of the Dhyani-Buddha sitting in padmasana and exhibiting bhumisparsamudra.

Excavation to the south of the Asokan pillar has exposed brick-lined tank measuring approximately 32.5 meters east-west and 31.5 meters north-south which is datable to the Kusana period. The northern and southern walls of the tank have got ‘Z’ shaped projection. The maximum depth of the tank exposed so far measures 4.30 meters. Further digging of the tank could not be possible due to profuse influx of sub-soil water. Entire tank was fashioned in tier-system with altogether seven tiers so far exposed in the north-
western corner. Major portion of tiers constructed in brick-masonry is in the usual header and stretcher style. The northern wall of the projected western half of the tank is fashioned in regular off-set system at every alternate course. The off-sets, varied from 8 cm to 20 cm, to the depth of three tiers when counted from top. Also noticed were the two bathing ghats, a corbelled arch, pucca drain, running from north-east.

On the basis of ceramics and other artefacts, the excavators preferred to categorize the cultural materials of the site into three periods: Period I: NBPW (circa third century to first century BCE)

Period II: Sunga-Kusana (circa first century BC to second-third century CE)

Period III: Gupta and Post-Gupta (fourth to sixth-seventh century CE)

The sherds of NBPW are found associated with that of the red, grey and black wares. The common types in NBPW are bowls of different sizes and dishes with incurved rim and incurved sides. All are made of well-levigated clay and are well-fired. The types represented in the grey ware, which is of fine fabric and is well-fired, are bowls with incurved rim and sides, dishes with featureless incurved rim. A large number of pottery types are represented in red ware, such as vases, basins, storage jars, trough, lipped bowls, etc. Red and black wares were encountered in plenty from the Sunga-Kusana period. Grey ware and NBPW are totally absent in the succeeding Sunga-Kusana period. From the Gupta and post-Gupta period, red ware was mostly encountered. The types include vases, lamps, lid-cum-bowls, deep bowls, long-handled deep bowls, sprinklers and spouts.

Vaisali (26°0’13.74” N and 85°4’54.42” E): Vaisali now represented by Basarh and neighbouring villages located in the district of Muzaffarpur of north Bihar is a place of repute so far as the literary tradition says. The Ramayana has the mention of Visalapuri which can be viewed from the northern bank of Ganga on the way to Mithila. Jaina traditions say that Vardhamana Mahavira was born here. Vaisali is further celebrated in the history of Buddhism as the site of the second Buddhist council.

The place with its archaeological heritage received considerable attention by several scholars from time immemorial. Reference to its archaeological remains was found in the works of J. Stephenson in 1834 (Stephenson 1835: 128). He was followed by Alexander Cunningham who visited the site between 1862 and 1864 and described its antiquities (Cunningham's Report: Vol. I: Four Reports Made During the Years 1862-63, 1863-64, 1864-65: 55). T. Bloch was the first to conduct excavations at its Garh site in 1903-04
which yielded the hoards of the Gupta seals (Bloch, 1903-04: 89). After a decade, D. B. Spooner undertook excavations at the same Garh site in 1913-14 (Spooner, 1913-14: 98) with a view to trace the royal palace which should have been within the moated enclosure where Bloch had excavated. The four seals engraved with the name of Vaisali by Bloch and Spooner place the identity of the site with ancient Vaisali beyond dispute.

In 1950, the site was excavated by the Department of Archaeology, Central Circle, Patna under the supervision of K. Deva and V. Mishra (Deva and Mishra, 1961). The main aim of this excavation was 1) to determine the nature of the defences of Garh site, 2) to get more evidence of the stratification of the site and 3) to find a clear sequence of the cultures of the Garh site with other sites in the vicinity.

The site of Raja Visala ka Garh, is believed to represent the remains of the citadel of Vaisali. It is a large brick-covered mound about a mile in circumference. Originally the whole area was surrounded by a moat having a maximum width of about 125 feet. The Garh is divided into two terraces, the southern terrace being slightly higher than the northern. Four trenches namely VS I to IV were taken in the Garh area and only one trench was excavated at the low site of Chak Ramdas which is situated about a mile west of the Garh and is referred to as VSC. Based on datable antiquities like NBPW, coins, sealings the chronology of the site has been classified as follows:

Period IA: c. 500-300 BCE; Period IB: c. 300-150 BCE; Period II: c. 150 BCE- 100 CE; Period III: c. 100-300 CE; Period IV: c. 300-600 CE.

The Garh area was deserted after the Late Gupta period i.e., during 600 CE whereas the Chak Ramdas appears to have been deserted at the end of the period Ib in c. 150 BCE.

Period Ia (c. 500-300 BCE): The period is marked by the presence of NBPW with silvery, golden, black and steel-blue lustre and the associated BRW with fine polish. At VSC the cultural layers with well-finished NBPW and BRW continue below the water-level and the strata are more than 6 feet thick. The commonest type of the NBPW is the dish and the most evolved type is the flanged bowls. A pinkish grey ware of fine fabric with a metallic finish has also been met with. The other associated finds recorded at VSC are bone points and iron objects like nails and knives etc (Deva and Mishra, 1961: 5-6).

Period Ib (c. 300 to 150 BCE) in the upper layers of VSC, BRW is conspicuous by its absence. NBPW and grey ware of medium to coarse fabric are found in substantial quantity along with more plentiful red ware. In some cases, this red ware shows the use of taurine symbols. The commonest type of grey ware is the dishes with sagger base, of
medium to coarse fabric. Sometimes the grey ware is treated with yellow slip externally and grey slip internally. Basins of buff or light red ware of this period have soot-stains which indicate their use in cooking. Some red ware pots are also treated with black-painted red slip inside and out. Decorated sherds with impressed leaf, *purnaghata* and solar designs occur in this period. The earliest layers of VS I, II and III have yielded the same wares. Other characteristic objects, found from this period include beads of terracotta, agate, crystal, carnelian, glass, shell and topaz, bone points, terracotta figurines. The figurine of *naga* with punched circlets is the most noteworthy find among the terracottas. No brick structures were found from VSC, but at a depth of about 5 feet from the ground level a concrete floor was exposed overlaid by 10 inches thick burnt debris, constituting the remains of a mud and timber superstructure. Two circular ovens were found lower down sealed by layer 8, comprising compact greenish clay. VS I has exposed the remains of three ring-wells or soak pits. One of these has more than nine courses sealed by pittish stuff. A second ring-well shows ornate top courses having large rings with tapering sides, decorated with a cable pattern at the shoulder. VS IV has also unearthed the remains of channel-like furnaces. They ran parallel and across each other and were found filled with burnt reddish sandy earth mixed with charcoal. As no slag or any other objects were found in or near the furnaces, their functions could not be ascertained.

Altogether 9 bone points have been found from the site, all belonging to period I. There are of different varieties viz. a) with one end pointed, b) with both ends pointed, c) with one end pointed and the other end tanged, and d) with tubular holes or hollow sockets for the shaft tenon.

Period II (c. 150 BCE to 100 CE): This period was encountered in the *Garh* area. In VS II were found the so-called Sunga terracottas from layers 6 and 7. A few copper punch-marked and cast coins came from the upper layers of this period in VS I. A votive disc of steatite carved with representations of the mother goddess, toy carts and other terracotta figurines stamped with leaf and lozenge designs besides beads of glass and terracotta constitute the cultural assemblage of the period. The red ware along with a few sherds of grey ware forms the ceramic industry of this period. NBPW is found in meagre numbers. A wall of 9 courses, measuring 5 feet long, was found meeting at right angles another wall, measuring 19 feet long and forming remains of probably two rooms (VS I). This structure is made of a single file of complete brick courses. The foundation consists of
two courses laid as headers, while the superstructure consists of seven surviving courses laid as stretchers. To period II also belonged a large brick-built house with distinctive features (VS II). It is made of complete bricks of 18” x 10” x 2.5” to 3” and shows as an offset each at the foundation and the plinth level. The house is partly exposed and shows a large hall in the north and portion of an adjoining hall in the south.

Period III (c. 100-300 CE) A small wall of seven courses (VS I), laid on a foundation of 5 inches thick concrete, was found at a depth of about 6 inches from the foundation of the Period IV structure. It is also represented by part plans of three house each belonging to an independent block (VS II). Red ware predominates the ceramic assemblage. It has also yielded distinctive types of terracotta figurines and beads of glass, faience and terracotta. In contrast to the earlier periods, the ceramics of this period is generally coarse and is not well-fired and is hence greyish in section. The NBPW and grey ware disappear altogether. The red or buff ware only continues.

Period IV (c. 300-600 CE): Terracotta figurines, characteristic of the Gupta and the late Gupta sculptural style including the Naigamesa types and terracotta sealings with the legends written in the Brahmi script (datable between fourth and sixth centuries) are the notable finds from this period. Besides, beads, made of amethyst, glass, soap-stone and terracotta were found in significant numbers. There is a basic difference between the ceramic industry of this period and the preceding ones. Decorations on sherds are more common during this period but the fabric has deteriorated. The polished bright wash or red slip is replaced by a thin slip. The ceramics mainly comprise red ware and a few sherds decorated with srivatsa symbol. The pottery is characterized by grooves on the rim, neck and shoulder. A flimsy structure (VSI) of nine courses of brickbats was exposed.

**Iron objects:** A substantial number of iron nails have been unearthed from the excavations. However, the report contains the descriptions of a few specimens (Deva and Mishra, 1961: 65-66).

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<td>1.</td>
<td>Carpenter’s adze with a thin long top and a thick sharply tapering blade. Period II. Length 7”.</td>
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<tr>
<td>2.</td>
<td>Large knife with tang incompletely preserved. Period Ia. Length: 8.5”.</td>
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<td>3.</td>
<td>Tanged lance head. Period II. Length 5.5”.</td>
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<td>4.</td>
<td>Nail of circular section with a flat head. Pointed end is broken. From Period II. Length 2.75”.</td>
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<td>5.</td>
<td>Nail of circular section with a knob head. From Period II. Length: 2.7”.</td>
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7. Fragment of tanged blade of a large knife. The tang is complete but of the knife blade only a tiny part has survived. From period II. Length 3”.
8. Fragment of a blade. From Period Ib. Length 3”.
9. Long nail of roughly circular section with a knob head. From period II. Length 7.5”.

The excavation revealed that there was a rampart of mud measuring more than 65 feet wide and over 9 feet high. This consists of different deposits belonging to layers 5 to 7. Layer 7 consists of sticky greenish clay with a few sherds. Layer 6 is a yellow sandy stratum which has yielded some sherds of NBPW, bone points, a beautiful winged female terracotta figurine and a terracotta naga figurine ascribable to period Ib. Above this deposit, compact mud with sherds was laid to strengthen the mud rampart (Deva and Mishra, 1961: 14).

There appears to be a second phase of the mud rampart when a mud brick structure of six to seven courses was put up to prevent erosion of the hump of the rampart.

In order to get a complete picture of the stratification of the defences a trench of 135 feet long and 21 feet wide was taken at one of the highest points in the south-eastern corner of the fort. In Period I the defence wall was made of baked bricks, as evidenced by thick brick debris, and possibly belonged to the Sunga period. The debris suggests that the breadth of this wall had been 20 feet in thickness. In period II, the defences consist of a massive rampart, 68 feet in width at the base, 21 feet in width at the extant top and 13 feet in extant height. It was made of earth, the digging of which left a moat around the fort. A sealing of Agnimitra was found in one of the post-rampart layers. In period III, probably of the late Kusana and early Gupta phases, a brick rampart, 9 feet wide was constructed with military barracks according to the excavators. Some of them are built of bricks measuring 14 ½ inches x 9 ½ inches. Spearheads and arrowheads and other iron implements along with a few Kusana coins were unearthed from the area.

The site was again excavated by the Directorate of Archaeology and Museums, Government of Bihar under the supervision of B.P. Sinha and Sita Ram Roy from 1958-1962 (Sinha and Roy, 1969).

This time excavations were concentrated in the villages of Basadh, Baniya, Chakramdas, Lalpura, Kolhua and Virpur.
During the excavation season of 1958-59, the excavation was conducted in the Garh area, about 200’ high from the mean sea level with a view to ascertain the character of the defences.

In the field season of 1959-60, the excavations were started at three different sites viz. Garh area, Chakramdas and Bhimsen Ka Palla. Digging operations were conducted at Chakramdas in order to know the earliest stratum of the site whereas the two earthen mounds, locally known as Bhimsen Ka Palla, about 204’ high from the mean sea level were excavated for determining the nature of the mounds in relation to the Buddhist mud stupa.

In the field season of 1960-61, excavations were carried out at two new sites, one in Baniya and other in Lalpura in order to establish stratigraphic relations, if any, between the Painted Grey Ware (discovered during 1958-59) and the BRW (found during 1959-60). The Baniya area was excavated for locating the site of the Sammatiya vihara. In the field season 1961-62, digging operations were continued at Baniya. Besides, two different new spots on the north-western and south-western corners of the Virpur chaour were taken up for excavations with a view to locating the birth place of Mahavira.

The deposits of all sites, taken together, have been studied in a chronological sequence, being broadly divided into five different periods on the basis of datable antiquities discovered from each of the cultural horizons of the excavations.

Period I is characterized by the occurrence of coarse BRW and grey ware and fragile pale-red wares. Some of the specimens of BRW are of coarse varieties while others are of fine ones. The discovery of the painted red ware in association with the NBPW at one place and with the rampart material at the other- both in the Garh area, suggests that the concerned ware was re-deposited from the lower level in course of the making the plinth of the Garh higher and during the erection of the mud rampart. It further suggests that the cultural deposits associated with the Painted Grey Ware would have belonged to Period I.

Period II is characterized by the presence of NBPW and its associated red and grey wares. The specimens of NBPW found from the present site are made of well-levigated clay and fired to a very high temperature under reducing condition, possibly in a sagger, as suggested by its uniform firing. The burnished slip and the quality of glaze, found on the ware, is of different colours, viz. golden, silvery, jet-black and metallic steel-blue, occasionally varied with reddish brown patches. Besides, bone arrowheads, silver punch marked coins (both rectangular and round in shape) and copper punch-marked coins
(square and rectangular), seal and sealings, terracotta figurines, beads of terracotta, carnelian, amethyst, shell, soap stone, crystal, agate, stone weights and ear-lobes, antimony rods and iron daggers have been found in significant numbers.

Period III: This cultural period is characterized by the complete disappearance of NBPW. The seals and sealings provides (on palaeographic grounds) the date of the lower limit of the Sunga period. The said period has also yielded a substantial number of copper cast coins and Sunga terracottas. The discovery of the Kusana coins along with a sealing bearing the script of the first or early second century CE from the upper level of the period helped us to postulate the date of the upper level of the period III. The presence of the sherds of the grey ware dishes and sprinklers on both red and grey wares throughout suggests all deposits to be grouped into one cultural period that can be assigned between c. 200 BCE and 200 CE.

The dating of Period IV is done on the palaeographic grounds. Numerous terracotta seals, sealings and tokens bearing legends in the Gupta Brahmi script were unearthed from the deposits. Terracotta figurines, discovered from the strata of this period were quite akin in characteristics to those unearthed from the Gupta Period of other north Indian sites. This particular cultural period is datable between c. 200 CE and 600 CE. Belonging to this, an approximately rectangular shrine of bricks measuring 14’ x 13.6’, having a projected opening on the south was exposed in the Baniya area. The ruins of the building were preserved in as many as ten courses of bricks. Immediately to its north-east were found the ruins of a small platform like brick structure, measuring 6’ 10” x 6’.

Period V is datable to the post-Gupta period.

The cutting near the Kharuna Tank Area (Trench No VSK II B) has revealed an index of the stratigraphy of the tank area. The first layer consists of the filling of the tank extending in thickness from 5’ 2” to 5’ 7” in IIB which has also yielded a considerable number of NBPW, black ware sherds and a piece of polished Chunar sandstone (3’ 9” below the surface) It confirms that the filling was done and the tank was excavated or enlarged in the Sunga period, datable between c. 200 and 125 BCE.

The regular layer below the filling varying in thickness from 6” to 9” consists of a concrete floor. This concrete is made of rammed brick-bats. It was scattered over by ring-well pieces and brick bats. Iron nails were found on the floor along with a few specimens of bone pins, terracotta bangles, antimony rods, carnelian beads, copper bangles, a terracotta wheel etc.
Stratified occurrence of a broken iron dagger was found in the layer 3 below the concrete. Besides, the occurrence of terracotta dogs with impressed circlets, a female terracotta head of the Sunga idiom, two cast-copper coins, glass and carnelian beads, grey ware sherds at a depth of 7’ suggests that this layer in the pre-tank period would belong to c. 150 BCE.

Below layer 3 there was a second concrete floor extending over the entire area. It is made of rammed brick-bats, and its thickness varied from 7” to 12”. Below this there was layer 4 of hard earth about 6” in thickness which yielded a few beads of terracotta and semi-precious stones. Below this layer, excavation in IIB\(^1\) revealed a concrete floor, about 14” in thickness, and made simply of bricks and brick-bats rammed together. Below the third concrete floor was layer 5, made of loose brickish earth, charcoal and sherds of other wares and those of the NBPW. Its thickness was about 2’6”. Layer 6 was the lowest occupational layer, about 6” in thickness, yielding coarse red ware in a very fragmentary form. This can be ascribed to the pre-NBPW phase. Below this layer came apparently the natural soil.

Stratified occurrence of iron objects have been traced in trenches of the Garh area during the excavations of 1959-60. A few cast copper coins and iron objects, such as spears, swords, bangles, etc., were recovered from Period II.

Excavation at Baniya revealed three periods of occupation, of which the earliest was marked by the occurrence of the NBPW along with its associated red wares and other antiquities.

From the lower levels of Period II were obtained deep bowls and sprinklers of red ware and terracotta human figurines, a few of which wore the typical Kusana turban. In the upper level of the Period was exposed an approximately 4 metre square shrine of brick having a projected opening on the south. The associated antiquities, including terracotta figurines, led the excavators to suggest that the shrine belonged to the Gupta period. Immediately to its north-east were the ruins of a small platform-like brick structure, measuring 2x1.8 metres, and it can be surmised that both the structures formed parts of a much bigger complex.

The structures of period II were sealed by a sterile, yellowish, compact earth probably a flood-deposit. From the overlying humus, however, were picked up a few sherds of the Muslim glazed ware pointing to a contemporary occupation, period III, in the neighbourhood.
Excavation in 1961-62 at Baniya, with a 2-13-m deposit, down to the sub-soil water-level, revealed a single-period occupation, represented by the occurrence of the NBPW. A coarse red ware also occurred at mid-height of the deposit. The associated antiquities include terracotta human and animal figurines, *nagas*, balls, dabbers and toy cart-wheels beads variously of terracotta, crystal, amethyst, agate and carnelian, bangles and a broken oblong object of soapstone having a crescent standard, cast and punch-marked coins, antimony-rods of copper, iron objects like dagger, bone pendants and a copper standing female figurine showing fine workmanship.

In one of the trenches, near the Chaturmukha-Mahadeva temple, an earthen heap, resembling a mud *stupa*, was exposed to a depth of 1.5 metres, the radius at the base being 8 metres. The deposit below the *stupa* contained the NBPW and its associated red and grey wares and terracotta figurines.

In another trench in the area were found a few sherds of the BRW in association with some sherds of the NBPW and a pot of grey ware with wash-like painting in black.

Excavation at the highest point in the locality of Lalpura yielded NBPW and associated terracotta figurines right from the top to the water-level—a depth of about 3 metres, indicating that the site had been deserted long before the Christian era.

A few iron objects and implements have been unearthed from different layers of the site. The specimens are listed below.

1. Dagger with a tang, having a slightly outcurved edge. From an early level.
2. Dagger with a tang, partly broken. From an early level of Period III.
3. Arrow-head with a tang, partly broken. From an early level of Period III.
4. Dagger with a tang, partly broken. Bigger in size than nos. 1 and 2. From a late level of Period II.
5. Lance of round section with a pointed end. From a late level of Period IV.
6. Knife (razor) with a tang of circular section, having a flared-out edge, partly broken. From a late level of Period II.
7. Sickle with a tang of round section, having an out-turned edge, partly broken. From an early level of Period III.
8. Implement. Indeterminate use. Partly broken. From an early level of Period III.
9. Dagger with a tang, having slightly flared-out edge, partly broken. From a mid level of Period II.
10. Nail with a flat hook-head. From a late level of Period IV.
11. Nail with an expanded round head. From a mid level of Period IV.
Archaeologically, Vaisali region is well connected with other clusters of settlements of the North Bihar Plain wherein the sites like Chirand, Manjhi, Panr etc are located. It has been also observed that Vaisali region itself can be recognized as one of the major nuclei of metal working activities. Due to its close proximity with the sites of Nepal-Tarai area and other parts of the present states of Bihar and Uttar Pradesh, Vaisali definitely enjoys a position to harbour different working groups of population since the BRW associated EVF phases. Unfortunately, the excavation at Vaisali constrains us to know extensively the settlement dynamics during the pre-NBPW period. The evidence from the Painted Grey Ware and BRW bearing levels encountered at Lalpura is also inadequate to understand the nature of metal smelting activities. Here, one may note that the evidence of metal smelting activities recorded during the NBPW period has its antecedence in the BRW bearing cultural phases. There is no doubt that the nature of the consumption of metals particularly iron during the protohistoric and the early historic period of the north Bihar plain is well represented by the database yielded from a clusters of settlements of the Vaisali region. The use of metal particularly iron and their role in social change in the upper and the middle Ganga valley remains a subject of historical discourse. The Vaisali region was definitely a significant part of the said phenomenon. The retrieved database also substantiates the same. The emergence of Vaisali as a major geo-political unit in one hand and the religious centre both Jaina and Buddhist on the other hand certainly raise the demand for extensive production of iron. The large scale constructions of religious edifices like stupa, residential complexes, assembly halls etc. sculptural specimens, architectural members particularly with Mauryan polishing definitely suggests both refinement of iron technology and their increasing rate of consumption. Implements related to warfare / defence besides the tools for wood carving, bone tool manufacturing and other objects of utilitarian value indicates the substantial role of iron in the economy of the said region and the involvement of different social groups particularly metal workers at various stages of metal production. The increasing demand of iron objects definitely guides the process of extraction of iron ingots at the production centre (in the vicinity of raw
material bearing zone) and making of finished objects and finally the distribution of the same in different settlements/ consumption zone. The above process of iron production, consumption and distribution resulted in the formation of a well connected exchange network. The existing debates on ‘iron and social change’ and ‘second urbanization’ have definite bearing on the above interactive network. The possible reconstruction of social formation, state formation, urban-rural continuum as highlighted by historians like D.D. Kosambi, R.S. Sharma can meaningfully be reappraised with the above observation. In this context, it is worth mentioning that the nature of the consumption of iron in the Vaisali region has definite connections with the rise of Magadha during the Pre-Mauryan, Mauryan and post-Mauryan cultural phases. However, the applicability of the well researched debates on verifying how far iron technology in Magadha and its adjoining north Bihar plain was responsible for the ushering of the second urbanization in middle Ganga plain, in the present context is the matter of further study.

The Alluvial Plains of South Bihar

Excavated Sites

Oriup: During the course of clearance works at the stupa-mound of Antichak, surface-explorations were conducted in the adjoining region in order to discern the extension of its (Antichak) cultural sphere. Substantial number of BRW sherds along with unique type of elongated lipped bowl bearing white paintings besides a few pieces of the NBPW of silvery hue recorded from the mounds near Oriup village, about 2 km south-west of the Antichak stupa prompted the scholars to investigate the archaeological remains of the site. A small scale excavation was conducted at Oriup by the Department of Ancient Indian History and Archaeology, University of Patna, under the supervision of B. P. Sinha and R. C. P. Singh in 1966-67. Two trenches, ORP-1A and ORP-2A, each measuring 6 x 4 m were laid out on two contiguous mounds, separated by a modern kachcha road. The excavation has revealed the archaeological remains of four cultural periods (IAR 1966-67: 6-7; Sahay, 1978:8-16)

Period I was marked by the occurrence of an oven and a circular fireplace, 26 cm in diameter. A part of the mound, during this particular cultural period, seems to have been eroded. This might be due to the rise of the level of the river which probably flowed immediately to the eastern side. The lower portion of the eroded pit has yielded sherds of
BRW. Pottery of period I was mainly represented by BRW, both plain and painted variety, BSW and red ware. Associated artefacts found from this cultural period include a large number of fishing hooks made of bones, bone-points, fluted terracotta pieces of the shape of a pipe used possibly in fishing nets, and pieces of tortoise shell, utilised as scrapers and knives, bone-talisman, bone-styluses and stone beads of agate and carnelian, besides terracotta female figurines, copper bangles and microlithic cores.

Period II was characterized by the occurrence of NBPW and its associated fabrics, viz. BSW, grey and red wares and a few iron objects. A few fragments of BRW and one or two perforated pieces in red ware have also been recorded. The entire area during this period as exposed in the Trench ORP-2A revealed that the habitation was affected by river action (as evident from the silt deposit). The NBPW shows a fine fabric. Trench ORP-1A was marked by the complete absence of the silt deposit. Other finds of this period comprise iron spear-heads and nails, ivory combs, beads of glass, stone and terracotta, ivory and terracotta bangles, terracotta chisels, bone-stylus, female figurines and a few fishing hooks, besides Neolithic stone celts and sledge hammers. The site was subsequently deserted, as evident from weathered potsherds (possibly due to long exposure).

Period III was distinguished by the occurrence of typical Pala pottery, as represented by the plain red ware with chocolate slip, plain grey ware and grey ware with black slip. The period has also unearthed the evidence of smelting.

Period IV was marked by the occurrence of the medieval green glazed pottery and red ware.

Use of iron was started from the NBPW period (Period II) onwards as revealed by the stratified occurrence of a few spearheads and nails. Interestingly, Oriup during the Pala period perhaps acted as a smelting site (either primary or secondary) as evident from the remains of slags and terracotta pipes (possibly tuyere?). Although, the present work has limited scope to explain the nature of the site during the early medieval period (Pala period), it is beyond any doubt that such evidence has enough merit to understand the actual significance of the site. Being located in a same cultural sphere of Antichak, the site definitely played a role of a feeder site of the former.

One may assume that Patharghata, known for rock cut architectural remains, situated in close proximity to the present site invariably raise the demand of
different iron objects for stone carving besides the production of sculptures and Oriup was one of the major production sites for the same.

Champa (25°14’17.33” N and 86°56’25.81” E), Champa is located in a comparatively wider alluvial tract between Sahebganj and Bhagalpur. It is generally believed that the modern village of Champa carries the remnants of the ancient ‘city’ of Champanagar. This is celebrated in literary traditions as the capital of the Anga janapada. Buchanan had noticed the large mound of Karnagarh, which had the remains of ‘a square rampart surrounded by a ditch’. (Buchanan 1939). He had also documented a few stone and bronze sculptures which were recovered from a tank dug in the vicinity of the mound. The site was excavated by the Department of Ancient Indian History, Culture and Archaeology, Patna University from 1969-70 to 1976-77 and again in 1982-83. (IAR 1969-70: 2, 1970-71: 4-5, 1971-72: 5, 1972-73: 5-6, 1974-75: 8-9, 1975-76: 7, 1976-77: 11-12, 1982-83: 15-16; Sahay, 1977:53-59; Chakrabarti 2001: 166-7). Excavations at three different locations, both on the core mound in the plateau surface and outside its ‘walled’ boundary unfolded the three-fold cultural sequence, of which Period I (as revealed in the trench CMP-IB) represents the measly/ obscure evidence of the ‘Chalcolithic’ /pre-NBPW phase. This period yielded coarse variety of BRW, black ware and red ware and an indeterminate semicircular object. Period II yielded the cultural materials of the NBPW period with its three cultural phases of IIA, II B and IIC.

Use of iron was introduced in the NBPW period, though unfortunately no detailed information is available regarding the same. During the excavations of 1982-83 (IAR, 1982-83: 15), varied objects viz. spears, daggers, knives, chisels, etc., made of iron is said to have been recorded. Besides, the excavation during 1974-75 (IAR, 1974-75: 9) has also yielded an iron dagger from the NBPW period. Its use was definitely proliferated in the succeeding Kusana and Gupta periods as revealed by the presence of iron nails in stratified contexts. Profusion of exposed structural remains also attests to the same.

In the cuttings CMP 2, the early phase of NBPW period yielded one fine female figurine of ivory, toy carts made of tortoise shell and decorated with circlet designs, stone moulds, terracotta animal figurines, including those of naga, and beads of semi-precious stones, glass and terracotta. The ceramic industry of this phase comprises NBPW, black ware, BRW, plain red and grey wares. One of the fragments of the NBPW was found painted in a pink pigment. This phase of occupation seems to have been brought to a close by a conflagration, as evident from the remains of large-scale burning on top of the layer 15.
The middle strata are marked by lesser number of finds. During this phase, the NBPW sherds decreased in frequency while the grey ware increased.

On one of the sherds of the latter ware was seen an incised human face. The structural remains (attested by the trench CMP-IM) of this phase are characterized by a terracotta ring-well having 70 cm in diameter of two courses, a brick well of 21 courses with 0.96 m diameter, and a brick wall of 13 courses running north to south. Associated finds found from this trench ascribable to the middle strata include the rim of a copper utensil, copper trinklet, stone weights, terracotta fox, stone and glass beads, bone arrowheads and terracotta earlobes.

The late NBPW phase, has yielded terracotta human and animal figurines (the latter decorated with punched circlet and nail impressions), beads of semi-precious stones and terracotta, and a few bone points and stylus-like objects. It may be noted that objects of iron and copper were found in all the phases. A number of terracotta plaques show characteristic Sunga elements. Amongst the noteworthy finds in terracotta plaques, mention may be made of a figurine of Sakti with *ayudhas* shown on the right side of the head.

This particular phase as revealed in the trench CMIJJ is characterized by the occurrence of a floor, made of rammed brickbats. Towards the eastern end of the floor, three steps, made of bricks, were noticed, which appear to have been utilized for going over the mud-rampart of the next phase. In the eastern corner of the trench was noticed an oven. Ceramics and artefacts, found above the floor, include sherds of the NBPW and its associated wares, terracotta toy carts, copper cast coins, bone points and bone arrowheads.

The digging at CMIIM revealed the remains of two parallel walls running in north-south direction, with 29 and 13 courses of bricks still *in situ*. In between the two walls was a brick-drain of two courses. The finds include NBPW, bone points, stone beads, terracotta pendants, terracotta spoons, terracotta plaques decorated with human and floral designs, pieces of crucibles, bone arrowheads, terracotta earlobes etc.

Besides, a brick wall of four courses, running north to south in the eastern section has also been exposed. The wall was 2.60 m long and 0.33 m wide with an offset of 0.06 m. Excavation in the extended trenches at CMP-IM (during the field season 1975-76) (*IAR, 1975-76*: 2) brought to light three residential structures, assignable to the late NBPW
period. Besides, two shallow well-like structures, found further to the west, might perhaps be storage pits.

Another trench in the same area revealed a brick wall and solid floor of bricks of seven courses and is assignable to the late NBPW period.

Associated finds of this period include stone and glass beads, terracotta crucibles, ear ornaments, plaques of female figures, one of which being of winged female and bone arrowheads.

Excavations during the field season of 1982-83 (IAR, 1982-83: 15) revealed the structural remains (brick walls and wells) of the NBPW period (composite stratigraphy). The brick-well, 1.15 m in diameter, consist of 63 courses of bricks. Artefacts comprise terracotta objects such as plaques, cart-rams, wheels with spokes, bull figurines, perforated balls, a female torso, and animal figurines of the typical Sunga style, punch-marked coins, ornaments, and bangles of copper besides bone arrowheads, points, ear ornaments and stylus, wheel, made of tortoise shell, and stone beads.

The succeeding Kusana period is characterized by extensive structural remains. The trench CMPIJ revealed a brick wall of one course, overlying the floor of the late NBPW period. On the northern side, associated finds of this wall include terracotta figurine of a dog, terracotta human torso and fragments of miniature incurved rimmed bowls.

The digging at CMPIM revealed four periods of constructions, of which the second period is ascribable to the Kusana period. The structure is represented by a wall running in east-west direction. The wall in question is associated with a *kuchcha* floor. It has also unveiled a structure of two rooms, measuring 1.50 x 0.90 m and 1.38 x 1.40 m, one on the north and the other on the south, with floors made of four courses of bricks. In the northern room, a brick-built well, 1.20 m in diameter, was encountered. Antiquities and ceramics associated with this period of construction include terracotta circular object with flower design, terracotta stamps, stone beads and fragments of red and black wares.

The occupational deposit of the Gupta period was exposed at the trench CMPIK. The structural remains include a brick wall, measuring 2.50 m long and 0.40 m broad, with seven extant courses of bricks, and another wall, measuring 1.70 m long and 0.30 m wide, running east to west in the north-western corner of the trench. Noteworthy artefacts found from this period include terracotta mould for making human heads, stone moulds bearing symbolic marks for making ear ornaments, stone beads, and an inscribed seal with perforation. Based on this finds, excavators prescribed that Champa was a jewellery
manufacturing during the Gupta period the genesis of which can be traced in its antecedent phases.

Excavations at CMPIJ have exposed a wall measuring 2.40 X 0.70 m, of which eleven courses were still extant. The associated finds included bone dices, terracotta talisman, antimony rods, terracotta skin rubbers, and terracotta human and animal figurines. Among pottery types, mention may be made of sprinklers in red ware, lid-cum-bowls and flattish pans with handle in red ware.

The digging at the trench of CMPIM has yielded a wall (measuring 2.94 X .42 m) made of brick-bats in east-west direction. Associated finds include fragments of red ware with smooth surface, terracotta conical objects and terracotta figurine of a dog.

Among the large repertoire of iron objects, one nail and one chopper/ sword was metallurgically analyzed (Chattopadhyay, 2004: 84).

Nail: (Regn no. 178), CMP IV, Layer 6, Location 1 x 0.96 x 1.45- 4.52m. The object was found in highly corroded state of condition and no core was found.

Chopper or sword: (Regn no. 103), CMP IV, Layer 4, Location 1 x 0.54 x 1.92- 3.30 m. The object was broken. One piece of the object represents the working edge while the other one probably used for gripping. The working edge was triangular in cross section with a breadth of 27 mm and a maximum thickness of 10.5 mm.

A small portion of the nail and chopper was metallographically analyzed (Table 5). Microstructure indicates these were full of inclusions and corrosion pits. There is no evidence of carburization or quenching. Forging was done during the process.

Chemical analysis of the chopper indicates that the percentage of Fe content is 75.8 %. The specimen was completely oxidized. High amount of silica suggests residual silicon from slag inclusions.

**Champa, situated in the middle Ganga plain was definitely a significant trading as well as distribution centre of various commodities including iron objects during the early historic period.** The site was invariably a consumer of iron and must have procured finished objects from the surrounding region and furnished the demand of the same to other significant settlements. One of the reasons behind its development as an urban centre (as evident from the literary sources) is probably due to its significant role in the exchange network of the Gangetic heartland as one of the distributors. However, there is no evidence to suggest the role of the settlement in
iron production. It may be mentioned here that Oriup and Antichak connections (as previously discussed) can also be linked to the Champa region.

**Explored sites:** The explored sites in the south Bihar plains which had association with the use of iron include, Uren, Khairadih and Rajaona.

Running parallel to the Kharakpur hill range stands the village of **Uren**. The archaeological significance of the site has been previously assessed by Cunningham (1873), Beglar (1878) and Waddell (1892). The early historic affiliation of the site is quite evident from its extant remains and the occupation of the site must have continued to the medieval period. However, its cultural antecedence may be pushed back to the EVF phases as attested by the presence of BRW, NBPW, BSW, red polished ware, red ware with chocolate slip, plain grey ware. Significant numbers of microliths and an array of bone tools viz. harpoons, awls, fishhooks, recorded during surface survey at the site substantiates the same (Chattopadhyay and Sanyal 2008: 262). However metal particularly iron occurs in form of slags. There is no doubt that the concerned settlement was one of the major iron production centres which must have met the demand of iron to other nearby sites. This settlement however achieved its religious status during the historical period which significantly witnessed the large scale consumption of iron at the site itself. In the construction of Buddhist establishment at the site besides rock cut architectures of the Brahmanical pantheon, iron must have been used extensively.

Situated within Uren- Surajgarha- Balgudar- Rajaona cluster, **Khairadih** represents an EVF settlement having association with BRW. Besides BRW, the habitational mound is found strewn with BSW and both slipped and unslipped varieties of red and grey wares as well as stone and bone objects. Substantial amount of iron slags have been recorded. Surface scatter of ceramics suggests a long cultural sequence of the settlement (Chattopadhyay and Sanyal, 2008: 263).

Reported earlier by Cunningham (1873) and Beglar (1878), **Rajaona** represents a significant EVF settlement which thrived in subsequent periods. Survey at the site resulted in the recording of two structural mounds of which one has yielded a substantial quantity of black polished ware and other habitational remains (Chattopadhyay and Sanyal, 2008: 263). Metal slag and the evidence of metal working activities have been attested at different locations of the village. Few sherds of NBPW have also been recorded. Fragmentary human and animal figurines of terracotta and bone objects for fishing are other notable finds.
Gridhreshwar beyond Indpe, carries the legendary status of having been the seat of the Gridhresvara Siva. Occurrence of substantial number of sculptural specimens and architectural members suggests the existence of a stone temple at the site. One can also encounter stray scatters of ceramics at the site which mainly includes thick dull red and grey wares sherds. The site also has extensive remains of iron smelting activities in form of broken furnaces, tuyers besides considerable amount of slags. The nature of evidence in all probability suggests their late date, however, the genesis of the said activities might have been placed not later than the historical period (Chattopadhyay and Sanyal, 2008: 266).

The Plateau Region of South Bihar

Senuwar (24°56’ N and 83°56’ E):  

Senuwar, a well known EVF settlement watered by the Kudra river, is situated 7 km west of Sasaram town in the Rohtas district. The river flows approximately 0.50 to 0.75 km away from the site. Topographically, the landform surrounding the site is flat alluvial terrain forming the part of the south Bihar alluvial plains. This alluvial deposit at its further south gradually incorporated in the foot hill region of the Kaimur hill ranges, the northern/northeast extremities of the latter being situated about 8 to 9 km away from the site. Geologically, the alluvial deposits, ascribable to the Tertiary and Quaternary age mostly consist of sands, silts, clays with occasional gravel beds (Singh, 2003: 1-2).

The ancient mound of Senuwar covers an area of 300 m from east to west and 360 m from north to south and rises to a maximum height of 9 m from the ground level. It has the spread of about 6-7 hectares in area. Field investigations in the region between the periphery of the Vindhyan extremities and the Ganga plains by B.P.Singh (Singh, 2003) resulted in the discovery of a number of ‘Neolithic settlements’. These are Sakas, Malaon, Badalgarh, Senuwar, Daindih, Akorhi etc. (Singh, 2003: 6).

In order to obtain a complete cultural sequence of site and to determine the interrelation between the Neolithic, ‘Chalcolithic’ and NBPW cultures, excavations were conducted at the site by the Department of Ancient Indian History, Culture and Archaeology, Benaras Hindu University during the field seasons of 1986-87 and 1989-90.

Altogether 10 cuttings, namely SNR1- SNR 10 were laid out in different parts of the mound. Of these, SNR 9 and SNR 10 provide complete evidence of four occupational periods (Period I: Neolithic-Chalcolithic; Period II: Chalcolithic; Period III: NBPW;
Period IV: Kusana) with a cultural break between the periods III and IV (Singh, 2003: 10).

SNR 1 (5 x 5m) was laid in the western part of the mound on the highest available point at a contour of 103.4 m. The structures of the Kusana period have been exposed in the trench. No mention was made regarding the nature of occurrence of iron objects or any iron working evidence in this particular trench. SNR 2, 7 and 8 did not yield any evidences of iron workings.

Trench SNR 9 (10 x 5 m) was laid out in the northern extreme corner of the mound with an east-west alignment. Excavations exposed an occupational deposit of 9.98m in depth, divisible into altogether 16 layers. Of these layers 5 to 3, assignable to the Period III revealed the evidence of iron workings associated with NBPW. The soil of the layer 5 was slight grey in colour and compact showing ashy patches at places. Iron pieces and slags have been documented from the surface of this layer. Layer 4, less compact yellowish in colour with an admixture of ash, charcoal and bone pieces has yielded iron rods and rings. Layer 3 is loose, greyish in colour with ash patches and very little of charcoal bits. Other noteworthy objects recorded from these layers include dabber shaped hammers, sharpeners, carnelian bangles, terracotta net sinkers, balls, skin rubbers, bird figurines, stoppers, beads, bangles and discs, bone points, arrowheads, stone hammers, anvils, balls, pestles etc. The use of most of these objects appears to continue from the preceding period. According to the excavator, the recorded cultural remains can be assigned to the early NBPW phase, however, the characteristic features of late NBPW phase are conspicuous by their absence. Based on this fact, the excavator presumed that there is appreciable time gap between the end of period III and the beginning of the period IV. Stratigraphically such hypothesis cannot be established as there is no sterile layer intervened between the NBPW cultural deposit and that of the succeeding Kusana period (Singh, 2003: 14-15).

Layers 2, 1A and 1 with a total occupational deposit of 2.47m yielded the evidence of the Kusana period. Layer 2 is marked by less compact earth, yellowish in colour. Layers 1A and 1 are composed of loose earth, the former being ashy grey in colour showing occasionally less compact patches and latter having greyish colour with ash patches at places. Iron objects like sickles, nails, rods etc. have been recorded from all these layers. Ceramic industry of the preceding period is completely replaced by plain red ware and represented by shapes like widely distributed ink pot type lids, sprinklers, Kusana bowls,
handis with loop or lug handle. Other recorded artefacts from these layers include terracotta human and animal figurines, crucible shaped pots having graffiti marks, glass bangles, antimony rods, copper wires, Ganesha image of stone besides pestles, hammers, saddle querns of stone along with terracotta balls, beads etc.

Trench SNR 10 (16 x 4m in the north- south orientation) was laid out on the southern direction of the mound at a contour of 102.5 m. It has yielded the occupational deposit of 9.04m, divisible into 19 layers. A massive pit essentially disturbed the stratigraphic sequence of the trench.

Of these, layers 7 to 3 representing period III is marked by the advent of NBPW and iron. Layers 7 and 6 are disturbed by a huge pit which is sealed by layer 5 at the face of this section. Layers 7 and 8 show overlaps between the periods III and IV. Layer 7 consists of yellowish compact earth and at places it has loose earth whereas the soils of Layer 6 are greyish compact. Layer 5, with a maximum thickness of 34 cm comprises less compact greyish earth and compact earth patches. Layers 4 and 3 consist of yellowish earth. Layer 4 is compact with loose earth patches while layer 3 is loose and it has at places ash bands and compact earth patches. A rammed mud floor of 10 cm in thickness was exposed from this particular layer. Iron nails and several indeterminate bits have been recorded on the floor and at several places of these layers. Associated artefacts include shell bangles, terracotta spindle whorls, bangles, stamps, balls, wheels, bone points, arrowheads, beads of agate and carnelian, a few microliths, hammer stones, sling stones, rubber stones and pestles (Singh, 2003: 18).

Layers 1 and 2 with an average deposit of 1.28m yielded the occupational remains of the Kusana period. Of these, Layer 1 comprises yellowish and greyish loose earth with patches of compact earth and ash. A draw well, rectangular on plan and fragmentary parts of walls, made of burnt bricks exposed from these layers. Nails, spearheads, blades made of iron have been recorded from these layers. Besides, glass bangles and beads, a terracotta bead mould, a reel of lead, antimony rods and terracotta figurines have also been yielded.

Trench SNR 2J (6m N-S x 4m E-W) was laid on the southern side on a slope at a contour of 99m in the close proximity of SNR 10. The trench exposed 7.08m occupational deposit divisible into 14 layers. Here, Period III was partially represented by layers 2 and 1. A huge pit in the section facing east largely disturbed the context of the remains. Layer 2
Excavations revealed four cultural periods, i.e. Period I-divisible into Period IA (Neolithic - C. 2200 BCE.-1950 BCE ) and IB (Neolithic- Chalcolithic- C.1950 BCE.-C.1300 BCE); Period II Chalcolithic (C.1300 BCE. to 7th-6th cent. BCE). Period III: NBPW Culture (C.7th-6th century BCE to C. 5th -4th cent BCE) and Period IV: Kusana (C.1st-3rd cent CE) (Singh, 2003: 21).

The occurrence of iron at Senuwar was first traced in the NBPW period. This particular cultural period, characterized by the emergence of the NBPW, shows the continuation of the use of cultural materials of the preceding copper using EVF phase/ ‘Chalcolithic’ period. The cultural remains are assignable to the early NBPW phase, however, the characteristic features of late NBPW phase are conspicuous by their absence. The use of iron was proliferated in the subsequent Kusana period. Cultural prosperity is also evident from the retrieved artefacts of this period.

Iron Objects:

So far as the iron objects are concerned, altogether 29 specimens have been collected from this particular period. Of these, 2 sickles, 1 Khurpi, 4 spearheads, 3 arrowheads, 1 lance, 2 knives, 3 nails, 1 ring hold, 4 rods, 6 specimens of indeterminate shapeless bits besides two pieces of slags comprise the inventory of iron objects found from this phase (Table 6) (Singh, 2003: 393-403).

So far 49 iron objects comprising nails, rods, arrowheads, sickles, knives, spearhead, khurpi, axe, ring hold have been recorded from the Kusana period. The predominance of nails and rods in the assemblage rightly explains the increasing demands of iron in making structures.

The excavation yielded altogether eighty two iron objects including indeterminate bits, slags and ore from period III and IV. Of these, twenty nine objects came from period III, forty nine from period IV and four from an unstratified deposit.

The excavator has categorized the objects into six types according to their nature of use.

I) Agricultural implements; II) Craftsmen tool; III) Weapons; IV) Objects of household use; V) Objects of miscellaneous use; VI) Indeterminate

I) Agricultural implements

A. Sickles

Seven sickles were found, categorized into two types:
i) With crescent shaped curved blades  
   Period III- 1, Period IV- 2, Unstratified-2.  
ii) With horizontal or not prominently curved blades  
   Period III- 1, Period IV- 1.  

All these specimens have roughly triangular or rectangular cross section for the blades. These are heavily encrusted and fragmentary. Only four specimens have been described. These are

1. An almost complete sickle with slightly broken tip, blade triangular in section, long tang, heavily incrusted, length of the tang is 15.8 cm. extant length of the blade is 10.8 cm, breadth 2.9 cm., Type (i), Period III, (SNR 1203).
2. Fragment, similar to above but smaller to above but smaller in size, breadth of the blade is 2.9 cm, heavily incrusted, Type (i), Period IV, (SNR 1019).
3. Fragmentary sickle, tip of the blade pointed, blade triangular in section, breadth 3.9 cm. Type (ii), Period IV (SNR 1770)
4. Fragment of a sickle blade, tang missing, blade triangular in section, breadth of the blade is 2.9 cm., Type (ii), Period III (SNR 1255).

B. Axe  

A single specimen was found from period IV.

5. Fragment with a round socket, edge convex and sharp, breadth of the edge 4.9 cm Period IV (SNR 8).

C. Khurpi

Two specimens, one each belonging to Periods III and IV, have been recovered.

6. Fragment of a Khurpi, tang intact, blade partially broken, extant length including the tang is 11.5 cm, maximum breadth of the blade 2.8 cm. Period III (SNR 1425).
7. Fragment, similar to above but differs in having blade of more width, major portion of the tang is broken, blade roughly triangular in section, tang rectangular in section, extant length is 7.9 cm, breadth of the blade is 4.3 cm. Period IV (SNR 982).

II) Craftman’s tool  

Chisel: A single fragmentary specimen represents this category. However, due to its fragmentary condition it is difficult to ascertain whether it is carpenter’s, smith’s or mason’s chisel.

8. Fragment, flattened having rectangular section, convex working edge, extant length is 5.3 cm, breadth of the working edge is 1.8 cm, thickness is 6 mm. Period IV (SNR 40).
III) Weapons

A. Spearhead: of altogether five specimens, four comes from different cultural layers of Period III. They are broadly divisible into two groups.

i) Leaf shaped with elliptical cross section. Period III -4.

ii) Triangular shaped with rectangular section Period IV-1.

The following selected specimens have been described.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Period</th>
<th>SNR</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Fragment, elongated blade, sides tapering to a pointed tip, elliptical cross section, tang is broken, extant length is 8.8 cm, maximum breadth is 2.9 cm, thickness is 5mm, Type i)., Period III (SNR 1172)</td>
<td>III</td>
<td>1172</td>
</tr>
<tr>
<td>10</td>
<td>Fragment, triangular thick blade, tang is broken, blade is rectangular in section, extant length is 6.3 cm, maximum breadth is 4.5 cm, thickness is 1.1 cm, Type ii), Period IV, (SNR 65).</td>
<td>IV-7</td>
<td>65</td>
</tr>
</tbody>
</table>

B. Arrowhead

Period III-3; Period IV-7. Ten specimens of arrowhead were found. They occur in all levels of Periods III and IV. Majority of them are very fragmentary and heavily corroded. However, their classification is difficult. The described specimens may suggest that tanged examples were common in both periods.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Period</th>
<th>SNR</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Tanged arrowhead, anterior end is broken, rhombic cross section, extant length including the tang 7.2 cm, length of the tang is 2 cm., thickness is 3mm. Period III (SNR 918). Similar specimen in bone has also been found from the same period but differs in cross section.</td>
<td>III</td>
<td>918</td>
</tr>
<tr>
<td>12</td>
<td>Tanged arrowhead, triangular shaped blade, rhombic cross section, tang is missing, extant length is 3.8 cm. maximum thickness of the blade is 8 cm. Period IV (SNR 801).</td>
<td>IV</td>
<td>801</td>
</tr>
<tr>
<td>13</td>
<td>Tanged arrowhead, anterior end is broken, square in cross section, extant length including the tang is 4.5 cm, length of tang is 1.5 cm, thickness is 6mm. Period IV (SNR 941).</td>
<td>IV</td>
<td>941</td>
</tr>
<tr>
<td>14</td>
<td>Tanged arrowhead, triangular shaped blade, irregular cross section, tang broken, extant length 6.2 cm, period IV (SNR 817).</td>
<td>IV</td>
<td>817</td>
</tr>
<tr>
<td>15</td>
<td>Fragmentary specimen of an arrowhead, both anterior and posterior ends are broken, section of the blade varies from roughly circular to irregular. Extant length 5.5 cm, maximum breadth 7mm, minimum breadth 5mm, Period III (SNR 1173).</td>
<td>III</td>
<td>1173</td>
</tr>
<tr>
<td>16</td>
<td>Fragment, tanged arrowhead, tang circular in section, blade elliptical in section, extant length 6 cm, breadth of the blade 2.1 cm, Period III (SNR 1389).</td>
<td>III</td>
<td>1389</td>
</tr>
</tbody>
</table>
C. **Lance**: A solitary fragmentary specimen has been obtained from the uppermost layer of Period III.

<table>
<thead>
<tr>
<th>Fragmentary specimen of a lance with a pointed end having rhombic cross section in the middle and rectangular towards the pointed end, extant length 9.9cm, Period III (SNR 1174).</th>
</tr>
</thead>
</table>

**IV) Objects of household use**

A. **Knives**: five specimens, two from Period III and three from Period IV have been found. These may be grouped into two types:

i) **With straight blade**
   - Period III-1, Period IV-2.

ii) **With curved blade**
   - Period III-1, Period IV-1.

All these are fragmentary and only their blade portion has been found. The selected specimens are

<table>
<thead>
<tr>
<th>Blade portion of a knife with straight edges, triangular in section, extant length 5.6 cm, breadth 3.5 cm, Type i), Period IV (SNR 849)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blade portion of a knife with straight edges, rectangular in section, extant length is 6.7 cm, breadth 1.9 cm, Type i). Period IV (SNR 1020).</td>
</tr>
<tr>
<td>Blade portion of a knife with curved edges, blade triangular in section, extant length of the blade 8.6 cm, breadth 4.3 cm, Type ii), Period III (SNR 1583).</td>
</tr>
</tbody>
</table>

B. **Clamps**

Two clamps were found from Period IV. One specimen is described below:

<table>
<thead>
<tr>
<th>Bent clamp, complete, shank rectangular in cross section, length 3.7 cm, bent portion 1.2 cm, thickness 7 mm, Period IV (SNR 1021).</th>
</tr>
</thead>
</table>

C. **Nails**

Eleven fragmentary nails have been found, three from Period III and eight from Period IV. The illustrated specimens have shanks of roughly circular, rectangular, plano convex or elliptical sections.

<table>
<thead>
<tr>
<th>A complete nail, roughly circular in section, pointed end, length 4.3 cm, maximum thickness 6 mm, Period III (SNR 1390).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fragment of an nail, elliptical section, corroded, extant length 5.1 cm. Period IV (SNR 850).</td>
</tr>
<tr>
<td>Fragment of a nail, rectangular in section, corroded, extant length 6.1 cm, Period IV (SNR 1257).</td>
</tr>
</tbody>
</table>
D. Ring-holds

Three rings, similar in shape, one belonging to Period III and two to Period IV have been found. All these are heavily corroded. They have been suggested as ‘holds for joints or support for a wooden end of an implement’.

26. Ring, outer diameter 6.6 cm, Period IV (SNR 1649)
27. Ring, outer diameter 4.5 cm, Period III (SNR 1391)
28. Ring, outer diameter 2.5 cm, Period IV (SNR 1084).

V) Objects of miscellaneous use

A. Rods

Rods are represented by twelve specimens. Of these, four came from Period III and eight from Period IV. Being heavily incrusted, none is found intact. A single specimen is illustrated.

29. Fragmentary specimen with oval cross section, extant length 6.8 cm Period III (SNR 1596).

B. Handles

Three fragmentary specimens probably of handles have been recovered from the deposits of Period IV. All are heavily incrusted.

None is described.

Metallurgical Analysis: Altogether nine specimens comprising four spearheads, three knives and two nails have been metallographically examined (Table 7) (Singh, Glover and Merkel, 1998-99: 123-128; Singh, 2004, 598-601). All these specimens are assignable to the 700-300 BCE. From the EPMA analysis it has been observed that silicon, manganese, phosphorus and sulphur are invariably present as impurities while aluminium and calcium are present in a few specimens. On the basis of impurities obtained from the analysis of iron objects and also of slag and slag inclusions, it can be suggested that they were not fabricated from meteoric iron (Nickel is absent). Instead, titaniferous ores with apatite complex might have been used. Such ores are found in profusion in Singhbhum and Mayurbhanj. The scanning Electron Microscopy and analytical data show that the specimens are wrought iron, which are characterized by the presence of slag inclusions, mechanically mixed in the soft matrix. There are several small cavities, which seem to have resulted due to dislodging of the slag particles when
the bloom was repeatedly hammered to produce the objects. The presence of small amount of iron carbide at the grain boundaries and presence of pearlite structures show that carburization was coming in vogue during the concerned period. It was probably done by heating and reheating of iron in a charcoal fire during forging. The study of the slag specimens (Table 8) indicates that the smelting could have been conducted below 1100° C. After grasping the method of carburization of wrought iron, the smelters used the technique of lamination to introduce carbon inside the metal without smelting. The study also reveals that craftsmen also acquired the technique of case hardening.

**Structural Remains:** Only one mud floor level having a thickness of 10 cm exposed at the layer 3 of the trench SNR 10 can be ascribed to the NBPW period. Chunks of burnt earth with reed marks have been recorded over this floor. The nature of structural remains shows no marked difference from that of the preceding period.

A radical change in the nature of structures has been noticed in the succeeding Kusana period. As mentioned earlier, wattle and daub houses are now replaced by the planned burnt brick structures with paved flooring. Only three trenches viz. SNR 1, 9 and 10 exposed the remains of Kusana structures (Singh, 2003: 36).

In trench SNR 1, two structural phases have been recorded. A rectangular structure of the phase I having the walls (45 x 25 x 8 cm) built of burnt bricks have been exposed in the western corner of the trench. The foundation of the structure is made of Kankar. It was found resting on the top of the layer 3 over which the plinth was built. The evidence of two door sills is present, one each on both sides of the partition wall. The superstructure was found 1.70 m below the surface. Its width is 26 cm and consists of five courses. Thus, this structure including plinth is available up to a total of ten courses. A similar structure with a length of 5.10 m runs parallel to the previous one which has been recorded in the eastern corner. Of the total 10 courses, the plinth consists of two courses and the remaining courses belong to the super structure (26cm in width). Walls 2A and 2B available to a four courses formed a small room in the northern side. The length of wall 2A built in east-west direction measures 1.50m and the width of this room remains the same. Wall 2C is of three courses and probably functions as the partition wall of the same. Remains of brick paved flooring are also evident from this structure. The structural remains of phase 2 were found 68 cm below the surface and are built of brickbats. The available length of the wall is 1.50m and its width is 0.50m. A floor having the length of 1.20m and width 0.90 m has been exposed here (Singh, 2003: 37-38).
In trench SNR 10, structural remains are found to be badly disturbed. A brick built draw well was exposed in the north-eastern end of the trench. Remains of two fragmentary walls have also been found.

Ceramics:

The ceramic industry of the period III is marked by the use of NBPW. Fine variety of NBPW sherds ranging in shade from a golden and silvery finish to different shades of black appear in this period. Occasional presence of the said specimens in red shade is also found from this period. Some of the specimens also show the combination of two colours such as yellow and grey and light red and black. Identical features found from Rajghat and Khairadidi suggests a close association of Senuwar with the other sites of the middle Ganga plains. The shapes recorded in the NBPW include dishes and bowls. Associated wares of NBPW include BSW and BRW (though their painted specimens are absent here). Of these, BSW forms 14.4 percent of the total yield of pottery. In fabric, texture, surface treatment, choice of clay and firing, BSW of this period shows no marked change from those of period II. This ware recorded from period III is often burnished and found in two shades- bright black and dull black. Bowls, dishes and vases besides a few new types such as flanged bowls, flanged corrugated bowls, vases with featureless rims having prominent ridge comprise the major types in BSW.

BRW forms 9.11 percent of the total yield of pottery. Excavator prefers to classify it into two categories. First category consists of BRW with slipped and burnished surface (In this case, the inner surface is treated with bright black surface and the outer surface with red slip in shades like dull red, bright red, light orange, dull orange, chocolate etc; the use of thick slip is noteworthy feature of this group; the clay used was not well levigated and contains husk, stone granules etc.) and those marked by dull exterior (the red slip applied on the outer surface is thin while the inner surface is treated with a comparatively thick black slip). This category seems to be very common in period II whereas occurs in less frequency in period III. The second category of BRW having thin to medium section is very much akin to BSW particularly in fabric and typology. This category which is numerically negligible in period II has been found in substantial numbers from period III. Like the previous period red ware remains the most common industry. It is broadly divisible into two groups- coarse red ware and slipped red ware. The shapes represented in coarse red ware are mostly vases of medium sizes particularly for storage purpose. The new shapes introduced during this period in slipped red ware are bowl-cum-lid with
splayed out rim, bowl with vertical and externally thickened rim, with externally collared rim, with an everted featureless rim and weakly carinated, vases with a vertically externally thickened rim, knobbed lid, vases with constricted angular neck and straight sides etc. (Singh, 2003: 135-138)

The ceramic industry of the Kusana period is characterized by red ware of both slipped and unslipped varieties which are commonly met with in the other sites of the Ganga plains. However, during the concerned period the ceramics of the preceding period were no more in use. Major shapes represented in this ware include pan with loop handle, ink pot like lid with vase shaped central depression, lid with a bowl like depression in the centre, lid with a central knob, small jar carinated at the waist, ring stand, carinated handi, handi with loop handle and spout with a knobbed mouth. The fossil type sprinkler can be considered as another noteworthy find from this period (Singh, 2003: 147-148).

The study of retrieved bone artefacts revealed that during the NBPW period the said artefacts decreased in number (23 specimens) from that of the period II (74 specimens). The recorded artefacts mainly comprises 10 specimens of tanged arrowheads, 6 specimens of double ended points with their both ends tapering, 5 specimens of broken points, 1 tanged barbed arrow heads besides one solitary specimen of partially finished cut or split bone. Thus, it has also been observed that partially finished and unfinished specimen is represented by only one example. This phenomenon can be explained by postulating inference- with the appearance of iron, the utility of bone tools gradually reduced resulting in less frequent production. Therefore, the recorded bone tools might have been used in this phase as recycled artefacts. In the succeeding Kusana period the number of bone tools further decreased and only 5 specimens (2 specimens of double ended points with their both ends tapering, 2 specimens of broken points and one partially finished specimen of cut/split bone) have so far been documented. Besides, two pieces of dice made of bone are also met with from this period (Singh, 2003: 233-235).

Recorded copper objects from the concerned periods are also very less in comparison to the previous one and these can mostly be included in the ornament category. From period III, 1 nail, 1 point/piercer, 1 copper wire along with 2 bangles and 1 finger rings have been yielded whereas, two wires, 1 rod, 1 coil, 2 bowl fragments, 3 bangles, 1 finger ring comprise the inventory of copper objects from the period IV (Singh, 2003: 386-392). 6 specimens of antimony rods have also been documented from the period IV.
The use of **stone objects** also decreased in the period III. 5 specimens of pestles and 4 specimens of legged querns comprise the food processing implements. Besides, 8 specimens of hammers have also been recorded from this phase. Period IV has yielded 8 specimens of pestles, 8 specimens of hammers, 3 specimens of pounders, two specimens of sharpeners, 1 specimen of saddle quern, 1 specimen of rubber and 1 specimen of dabber besides a considerable number of stone balls, discs etc. Among other stone objects specific mention should be made of a stone figurine of Ganesa from the period IV.

Among **shell objects** recorded from these two periods, mention may be made of 4 bangles, 1 bead, 1 peeler, 1 point with a notch from period III and 2 bangles and one peeler from period IV.

Altogether 60 specimens of **beads, pendants and amulets** made of terracotta, semi-precious stones (agate, chalcedony, chert, quartz, flint, sodalite, emerald, beryl and steatite) and glass have been recorded from period III and 76 specimens of the same from period IV.

**Human figurines made of terracotta** first appear in the period III while the number increases in the Kusana period. Altogether 8 specimens have been collected from period III. The figurines -human, animal and bird unearthed from period IV (30 in numbers) bear archetypal features of the Kusana idiom. However, other objects recorded from both the periods include skin rubbers, pottery discs, terracotta discs, terracotta balls, stoppers, toy cart wheels, potter’s stamps, crucibles, lamps, net sinkers etc (Singh, 2003: 343-344).

**The location of the site in the alluvial plain but in close proximity to the Kaimur hill ranges is one of the major reasons for obtaining a unique status of the site. The site not only played a major role in iron extraction but being a permanent agrarian habitation it also requires substantial number of finished products for consumption. Here, it is worth mentioning that the location of the site i.e., in peripheral zone of eastern Indian Plateau (iron ore bearing area) and its proximity with iron bearing settlements of Kaimur range of eastern Uttar Pradesh and Bihar like Sonpur, Agiabir, Khairadih etc. places Senuwar as a major centre of plain-plateau extraction and consumption zone. Here, one must keep in mind that the site harbours a large number of metal smith groups, involved in iron extraction and production during early phases. The raising demand of iron in the Gangetic heartland and the region itself might have been responsible for the spread of metal working groups in its nearby settlements of eastern Uttar Pradesh and Bihar,**
though the recent discovery of iron bearing settlements in the Vindhayan region like Malhar, Raja Nal Ka Tila might played a similar role for the spread of such groups. With the passage of time, the metal smith groups of this region have acquired the expertise in certain technology by new innovations and trialling. These metal smiths and their finished objects have meaningfully contributed in the existing exchange network of the Gangetic heartland. The metal working groups at the sites of Sonpur, Taradih, Agiabir which emerged since the early historic period onwards in all probability served as intermediaries in the said exchange network as relatively they had the easy access to Pataliputra or Magadha. Similarly the emergence of iron bearing settlements of Rajagriha- Nalanda area particularly during the early historic period played a decisive role in iron production and they met the demand of iron in the Magadhan state (if not much earlier) and in the settlements of the sixteen Mahajanapadas.

Sonpur (24°57’ N and 84°56’ E): Sonpur, also known as Sonitpur is situated about 24 km east of Gaya town in the Belaganj P.S. of Gaya district. Exploration at the site in 1955 resulted in the discovery of a few sherds of NBPW with golden and silvery polish along with a number of cast copper coins. With a view to determine the stratigraphic position of NBPW and unravel the cultural sequence of the site, the first trial excavation was conducted by the K. P. Jayaswal Research Institute under the supervision of Vijayakanta Mishra in the field season of 1956-57. Excavations for four field seasons 1956-57, 1959-60, 1960-61 and 1961-62 (IAR, 1956-57:19, IAR, 1959-60:14, IAR, 1960-61: 4, IAR, 1961-62: 4-5; Singh and Verma, 1977) revealed a three-fold cultural sequence at the site- Period I: Chalcolithic; Period II: NBPW; Period III: Post- NBPW (Kusana). The occurrence of iron coincided with that of NBPW. It is to be mentioned here that iron in form of the lumps of ores and slags can be traced in upper levels of Period IB i.e., in the pre-NBPW context.

Period IB is distinguished from the preceding sub-period on the basis of its finer qualities of ceramics, invariably wheel made and often well polished. Similar to the preceding sub-period, BRW is the chief ware of this period. A few painted black ware sherds have also been discovered. The motifs in white pigment are parallel strokes and zigzag lines.

Lime floors were exposed at a number of trenches. Besides, the occurrence of a few circular pits (the diameter of the circular pits varies in between 1.82 m to 2.44 m and
depth does not exceed 8 cm) containing ash, animal and bird bone pieces, microlithic cores and flakes led the excavator to assume that these pits are the collapsed portions of circular huts.

Another notable discovery from this period is a few post cremation pit burials. These, in circular shape and having a diameter of about 1.82 m to 2.12 m and a depth of 91 cm yielded great quantities of ash with charcoals, bone pieces and ceramics in red ware, black ware and BRW.

The occurrence of about 5 kg charred rice in one of the broken storage jars retrieved from the cultural debris of this sub-period can be taken as the signifier of the practice of rice domestication during this time. Among associated finds of this period mention may be made of beads of terracotta and semi-precious stones, bone arrow heads, pins styluses, a few polished stone tools along with a number of decorative items in copper. Interestingly, the bone artefacts in the manufacturing stage i.e., unfinished specimens outnumbers the finished tools. It is however, indicative of the existence of bone tool workshops at the site itself.

Period II is marked by the presence of NBPW. The documented well fired sherds are found in different shades such as steel blue, silvery, golden, pinkish and black. A few sherds also have bi-colours, one side bearing silvery and other golden hues. The main pottery types are bowls and dishes. BRW continued to be in use during this phase though a little improvisation in technology can be envisaged from the retrieved evidence (in form of fine qualities of sherds). Bowls, dishes and vases are the common types in BRW. In black ware similar pottery types have been found, though in red ware (which are generally of medium to fine fabric and without any slip), vases, carinated handis, rimless handis, basins, lipped bowls, conical bowls etc. were made. The concerned cultural period also yielded a considerable number of potsherds bearing graffiti marks.

No substantial traces of structure have been documented from this period. However, at one of the trenches in the section facing east, remains of a probable mud wall was noticed. The occurrence of a few complete pots, a saddle quern and four pestles of stones around a probable hearth on a platform was assumed by the excavators as a kitchen complex. At another place, traces of sand pockets and short channels on the floor were recorded. The exposed ring wells made of terracotta rings (each measured about 61 cm in diameters, 15 or 18 cm in height and 5 cm in thickness) are found to occur very close to each other. The number of rings in the well varies from two in one case to thirty in
another. At one place about five ring wells have been documented. Most of the ring wells have yielded decayed earth, potteries having greenish colour, animal bones and a few minor antiquities mostly terracotta objects coated with greenish colour. Excavators are of the opinion that the exposed ring wells might have been used as refuge pits or soak pits.

A large number of iron implements like lances, spearheads, arrow heads, daggers, axes, nails, chisels, blades etc. have been recorded from this period. The excavation report mentions about the occurrence of crucibles and iron slags though no specifications have been provided regarding their context of occurrence. In all probability, the site played an importance role in both production and consumption of iron.

Iron objects and implements of different types and a large quantity of iron slags have been found during the course of excavations. The discovery of two crucibles, one of medium sized and other of small sized and of iron slags is significant. The specimens are in much corroded state of preservation. On account of their encrusted surfaces, it was not possible to make out the actual shapes of the many of the pieces. However, a few of them which had been restored are described in the excavation report. The significant ones are knives, blades, lances, spearheads, small daggers and a few arrowheads, sickles, axes, nails, door fittings, rings etc.

Altogether one hundred and thirty eight iron objects have been yielded from excavations. Of these, fifty five pieces had come out from the Period II and the remaining was from the Period III.

A few pieces are described below:

1. (Regd No. 1037) A long socketed lance, highly crusted and broken into many pieces, Period II.
2. (Regd No. 1046) A broken piece of a tanged knife blade, rusted, Period II.
3. (Regd No. 346) A tanged arrowhead, upper portion is partially damaged, Period III.
4. (Regd No. 827) socketed arrowhead, broken portion of the shaft inserted in the hollow base. Period II.
5. (Regd No. 565): A medium sized ring, partially damaged, Period II.
6. (Regd No. 865): A fragmentary piece of an axe, heavily corroded, Period II.
7. (Regd No. 804): A complete tanged leaf shaped arrow head, Period III.
8. (Regd No. 1000): A broken piece of a spearhead, Period II.
9. (Regd No. 665): leaf shaped tanged arrowhead, Period II.
10. (Regd No. 153): A fragment of a crusted chisel, Period III.
11. (Regd No. 991): A broken piece of a knife blade, Period II.
12. (Regd No. 784): A broken piece of a tanged dagger, Period III.
13. (Regd No. 1017): upper portion of a broken lance, heavily rusted Period II.
14. (Regd No. 935): chisel, but heavily corroded, Period II.
15. (Regd No. 999): A tanged knife blade, Period II.
16. (Regd No. 1045): heavily corroded tanged blade, Period II.

Ascribable to this period are considerable polished stone axes of different shapes and sizes. They are all finished tools and none of them had been found in their manufacturing stage. The use of copper during this period is restricted to make ornaments such as bangles, rings etc. A noteworthy find of copper implement was a socketed arrow head.

Taradih (24°42’ N and 85°0’ E) is located to the south-west of the Mahabodhi temple at Bodh Gaya in Bihar. An extensive excavation conducted by the Directorate of Archaeology and Museums, Government of Bihar from 1981-82 to 1988-89, 1991-92 and in 1997-98 has revealed a seven-fold cultural sequence (IAR 1981-82: 10-12, 1982-83:16, 1983-84:12-13, 1984-85: 9-11, 1985-86: 7-9, 1986-87: 23-24, 1987-88: 9-10, 1988-89: 6-7, 1991-92: 4-5, 1997-98: 14-15; Prasad, 1980-81: 138-139; Prasad 1990: 605 ff) of which Period III represents the antecedent stage of the NBPW period i.e., a pre-NBPW period with the use of iron. In sharp contrast to the sites of Sonpur and Chirand (which has yielded iron slags and a fragmentary piece of highly rusted iron-blade respectively from the pre-NBPW period), Taradih finds of iron objects in pre-NBPW period are more numerous and various. From the concerned site, the finished objects comprise arrowheads, spearheads, ploughshares, chisels, nails etc. Besides, the occurrence of crucibles, slags and iron ores suggests the smelting of iron at local level.

Copper was also in use as the preceding period. Copper wires and bangles besides a substantial amount of slags have also been documented from this period.

Among stone objects obtained from this cultural period, mention may be made of pestles, saddle-querns, balls, beads besides a few axes. Bone objects include nose-stud (a significant find), arrowheads, points, scrapers, pins, stylus etc.

People lived in mud-huts with lime coated floors. Huts were round in shape with bamboo and reed screened walls plastered with mud. Several post-holes indicate that the roof rested on bamboo or wooden pillars. Evidence of hearths with ashes on floors was also noticed. These hearths or chulhas were of different shapes-circular, semi-circular depressions dug into the earthen floor.
Palaeo-botanical studies revealed the occurrence of charred rice, wheat, barley, lentils etc at this cultural period. It is also evident that rice husks were stored in large storage jars. Besides, the bones of birds, domesticated cattles, goats and fishes have also been found in profuse numbers. Some terracotta beads might have been used as net-sinkers.

BRW, black ware and red ware of the earlier period continued in this period with much improved quality and fabric. These were made of well levigated clay and well-fired. The core of these specimens does not show any mixture of paddy husks with clay. Their fabric ranges from medium to fine. Evidence of paddy husks in big pots of the BRW and black ware was also significant. The BSW and grey ware also appeared in association with iron. It seems that the potters knew to fire pots in high temperature in the kiln and also to control the heat. The pottery is well-fired, of thin fabric and gives a metallic sound when struck. A few sherds of BRW and black ware show a thin layer of glaze on black surface. All these evidence amply testify to the fact that the technique of producing NBPW is foreshadowed. The pottery types comprise vases, handis, rimless handis, storage jars, lota shaped bowls, basins, lipped bowls, lid-cum-bowls, etc. A few potsherds also have graffiti marks.

 Besides, beads of semi-precious stones like agate, carnelian along with two specimens of terracotta bull have also been recorded from this cultural period.

This cultural period based on relative dating has been placed in a time range between c. 1000 and 700 BCE.

Use of iron objects definitely proliferated in the succeeding cultural period, characterized by the introduction of NBPW. Among the noteworthy finds of iron objects, leaf-shaped spearheads, arrowheads, nails, razors, chisels, rings, sickles, knives, rods etc. deserve special mention. Besides lumps of iron slags have also been found.

This period is marked by the appearance of the NBPW along with grey ware, and BSW of the preceding period. The BRW also continued during this period though there was marked change in its fabric and types. Some red ware pieces bore black paintings of concentric circles on their interior profile. The important ceramic types include vases, handis, rimless handis, lota shaped vessels, basins, lipped bowls, lid-cum-bowls, conical bowls, horizontally splayed rimmed bowls, flat based bowls, lipped basins, bowls with thick bases and dishes with sharp carination etc. This period also yielded a few pieces of BSW having graffiti marks.

Copper beads, hemispherical rings, bangles etc. have been recorded from the period IV.
Among stone objects, besides microliths, beads, balls, bangles, Neolithic celts, hammers, pestles are of special mention. A number of terracotta objects were picked up from this period such as a female figurine, naga figures, animal heads, conical objects, beads, balls, rings, earlobes, pendants, dices, lockets, toy-carts etc. Arrowheads (both of tanged and socketed variety), bangles, pins, points, stylus, dices etc are significant finds made of bones. One red ware potsherd bore incised inscriptions in early Brahmi which read as ‘ajitasa’.

Remains of platform made of burnt bricks, post-holes, lime coated rammed floors constitute the evidence of structural activity of this period.

Trial trenches taken on the north of the Bodh Gaya temple have also yielded the remains of brick-built cells in the NBPW stratum.

Excavations have also yielded a significant numbers of punch-marked and un-inscribed cast coins besides a few steatite beads etc.

Period IV is followed by Period V without any occupational break. A substantial number of arrowheads, spearheads, nails, razors, sickles constitute the iron repertoire from this period. The excavator noticed the presence of sprinklers, high necked water vessels (Surahi), frying pans with handles and red ware (characteristic of the Kusana period) from the concerned period. It is quite interesting that no specific Sunga element is visible in the artistic depictions of terracotta plaques and figurines. Terracotta animal figurines, a terracotta human head, bangles of terracotta, copper and glass, beads of terracotta as well as of semi-precious stones and glass, conical objects, ear-ornaments, bangle pieces, stoppers made of terracotta, arrowheads and points of bones, dabbers and discs of different materials have been documented from this period. Bangles of copper were also found. The excavation during 1988-89 has also exposed a burnt brick structure of the Kusana period (1988-89:7).

The succeeding Gupta period is characterized by rampart and burnt brick structures, numerous stone objects such as beads, stone images of Buddha, Avalokitesvara, panels of thousand Buddhas, votive stupas of stone, replica of temple in stone, chhatravali, a die of bone, terracotta beads, earlobes, seals and sealings etc. One of the sealings depicting the figure of Buddha and Buddhist creed in contemporary script is noteworthy. Among iron objects, nails, arrowheads, spearheads, sickles, knives, needles, bar celt etc. are worth-noting. Copper earlobes, bangles and finger rings were also found.
During the course of excavations in 1991-92, two structural phases were encountered datable to the Gupta and the succeeding Pala period. The nature of the structures belonging to these periods suggests a monastic complex, having cells with a common verandah. (IAR 1991-92: 4)

Period VII yielded artefacts which are assignable to the Pala period.

**Metallurgical Analysis:** Four iron objects (TDH 26/1, TDH 26/2, TDH 27/1, TDH 27/2) datable to 700-300 BCE have been metallographically studied (Table 9) (Singh, 2007: 86-90; Singh and Merkel, 2000-2001: 135-142). The Electron Probe Micro Analysis suggests that the specimens contain 99.031 %, 98.235 %, 99.775 % and 98.332 % Fe respectively with various amounts of Mg, Si, Cu, Ca, S, P etc. as impurities. Two sections from Taradih revealed layered structure.

Sample No. TDH 26/1: It consists of layers with 0.3% carbon content. It comprises pearlite in a matrix of grains alternating with layers of coarser ferrite grains.

Sample No. TDH 27/2: The orientation of the layers and the elongated slag filaments had become contoured due to forging. Partial spheroidisation of the pearlite and the presence of band along the slip planes of grains at the side suggest that some hammering had occurred.

On the basis of impurities pattern obtained from the SEM X-Ray and EPMA analysis of the iron objects, it can be observed that sulphur, silicon, titanium and manganese are invariably present along with aluminium and calcium. It can be inferred that titaniferous ores might have been used for smelting.

**Rajgir** (25° 1’49.35” N and 85°25’12.11” E):

Rajagriha the capital of ancient Magadha is at present represented by the vast ruins spreading over an extensive valley (both outside and inside) situated about 60 miles to the south-east of Patna. It was known to diverse literary sources by different names viz. Girivraja, Rajagrha, Kusagrapura etc and in various contexts.

Buchanan was the first to explore the ruins of the site near the present village and in the immediate vicinity of the Vaibhara and Vipula hills and the hot springs nearby (Jackson, 1925: 179-213). Cunningham’s reports for the years 1861-62 (Cunningham’s Report: Vol. I: Four Reports Made During the Years 1862-63, 1863-64, 1864-65: 20-27) and 1872-73 (Cunningham’s Report: Vol. III: Report for the Year 1871-72: 140-144) contain sufficient data for the identification of the site as one of the significant Buddhist sites. After Buchanan, several British administrators and archaeologists surveyed its ruins, of
which the works of Kittoe, Broadley and others deserve special mention (Kittoe: 1847: 953-970; Broadley, 1872: 230-250). A systematic survey of the site especially its fortification was made in 1905-06 by Sahni and Bloch (Marshall, 1905-06: 101-102; 103-105). In 1950, A Ghosh had conducted some trial diggings (Kuraishi, 1958), while from 1954 onwards excavations were carried out by D.R. Patil, A. C. Banerji (See Patil, 1963: 432-472).

A) Old or Ancient Rajagriha: it has been generally assumed that there were two settlements of Rajagriha, viz. the earlier one situated within the valley and surrounded by hills on all sides and the other, a later one, situated outside the valley (at a distance) in the plain area to the north.

i) The fortifications: a) the outer walls:

On the top of five hills except the Chhata hill, traces of fortification walls were first noticed by Cunningham during his survey at the site in 1861-62 (Cunningham’s Report: Vol. I: Four Reports Made During the Years 1862-63, 1863-64, 1864-65: 20-27). In 1905 the area was surveyed by Wilson and an accurate map of the ancient site was prepared by giving the alignments of the fortifications. The results of his survey was published by Marshall in his report in 1905-06 (Marshall, 1905-06: 86-106) which reveals that the walls did not, continue all along the tops of these hills facing the valley, though their total length, as they exist in traces, may come to about 12-13 miles. The fortification walls were built of massive undressed stones having three to five feet in length, carefully fitted and bonded together, while the core between them is composed of smaller blocks, less carefully cut and laid with chips or fragments of stone, packing the interstices between them. No trace of mortar or cement is visible in the stone work. The maximum height of the walls is about 11 or 12 feet near the Banganga pass whereas the walls elsewhere are very much in ruined condition, with the height going hardly to 7 or 8 feet. The thickness of these walls varies between 14 and 17 feet. Along the walls sixteen bastions are observed.

b) Inner fortification walls and the town: it is generally believed that the large space of the valley in between the two northern and southern openings was once enclosed by the inner fortification wall and the main settlement site of Rajagriha was situated within it. A long ridge of earth and stone at present encloses it on all sides with a length of nearly 4 ½ miles. However, no trace of bastion, watch tower, ramp or stair has been noticed on this ridge. Moreover, the ridge is mostly an earthwork rather than a masonry work, therefore it
appears more likely that it served primarily the purpose of an embankment protecting the
habitation in the valley against the inevitable ravages of rains.

However, it is quite doubtful to infer that such fortifications belonged to which particular
chronological time bracket. Patil is of the opinion that this fortifications might have been
built in the medieval period (Patil, 1963: 438-441).

During the explorations and excavations carried out in the space enclosed by the ridge,
structural remains of the Maniyar Math, the Bimbisara Jail and traces of a few other stone
structures have been exposed.

Maniyar Math: The structure is of a hollow cylindrical shape, made up of a 4’ thick wall
with its inner surface quite smooth and with four short projections on its outer surface
facing the cardinal points. No entrance was provided for access into it. This structure may
have been constructed some time before the 4th - 5th centuries CE.

Sometime during 5th -6th centuries CE, a wall with elaborate mouldings was built upon the
outer face of the earlier structure. Bloch during his survey in 1905-06 has exposed this wall
with the stucco images carved on it (Marshall, 1905-06: 103-105). A door was now
provided through the wall to give access to the cylindrical interior of the structure down
below.

It appears the cylindrical structure with stucco figures was later encased by another circular
wall. The next stage shows a change in the plan of the structure which was made in oblong
shape with a projection on the northern side. It was apparently made to provide a flight of
steps to give access to the shrine above. Throughout these changes and modifications it is
observed that the plan of the original shrine was always kept in view by the later builders.
However, it is not clear that in which respective periods such changes had been taken
place.

A small image was discovered by Bloch in 1905-06 (Marshall, 1905-06: 103-105) during
the dismantling of modern Jaina temple. It represents the figure of a seated Naga and
contains an inscription dated V.S. 1547 (i.e., 1490 CE). It is to be noted here that within the
premises of the structure, all around the main shrine were exposed numerous low brick
built altars or platforms, circular, oblong or square which may have served some ritualistic
purposes. Near one of these platforms were found scattered pottery jars of different shapes
and designs containing spouts in the shape of snake hoods or having long necks besides a
substantial number of terracotta serpent hoods. Just to the west of the main shrine was
exposed another brick shrine showing four periods of constructions. During its excavation
an interesting sculpture (made of red sandstone) carved into different panels showing male and female figures with serpent hoods was discovered. What is most important is that this sculpture contains a mutilated inscription bearing the name *Maninaga* and *bhagini Sumagadhi*. On palaeographic grounds, this can be easily dated to the 1\textsuperscript{st}-2\textsuperscript{nd} century CE. The overwhelming number of snake figures and terracotta snake hoods and this interesting discovery of a sculpture, referring to *Maninaga*, leave no doubt that the main shrine at Maniyar Math was, in fact, dedicated to a snake deity.

About half a mile south- south east of Maniyar Math, the remains of a square fort having stone walls, 8 ½ feet thick and circular bastions at the corners was recorded by Jackson, during his survey in 1913-14 (Jackson, 1913-14: 265-271). Subsequent clearance works in 1930 resulted in the exposure of some stone cells, in one of which, as stated by Ghosh (Kuraishi, 1958), an iron ring with a loop was discovered. It has been recognized as Bimbisara Jail by several archaeologists though such identification has to be verified by more substantial data.

The Jivakamravana monastery: Along the eastern ridge which once enclosed “the inner city” is a deep ditch or rivulet after crossing which to the east is seen a comparatively plain area. This has been identified with the site of the Jivakamravana monastery. The area was excavated by the mid-eastern circle of ASI from 1953-54 onwards (*IAR*, 1953-54: 9; 1954-55: 16-17; 1957-58: 11; 1958-59: 13; 1961-62:6-8; 1962-63: 5-6; 1974-75: 10-11). This revealed elliptical-shaped structure with attached subsidiary rooms, oblong in plan, built of stone-rubble in mud mortar. Except coarse red pottery, a few iron nails and very few terracotta animal figures, no other antiquities were found associated with the structure. The pottery types include large jars, dishes, bowls etc.

From the foot of the Gridhrakuta hill, a footway (having a width of 20-24 feet) made of rough undressed stones was noticed in 1905-06 by Marshall (Marshall, 1905-06: 90-93). On its outer side, i.e., towards the valley there seems to have been a wall some 3 to 4 feet thick. There are two distinct stages on this footway or pathway, the first about 80 yards from its starting point and the second further up at a spot where there is a sharp turn towards the north. These two stages are each marked by the brick built *stupas*. Both the *stupas* were made of rough stone foundations with a superstructure of bricks. In 1905-06, during the clearance works of the ruins, Marshall reported the occurrence of two iron nails and a number of broken Buddhist images which he assigned to a period about 10\textsuperscript{th} -12\textsuperscript{th} centuries CE (Marshall, 1905-06: 90-93).
There are two rock-cut caves, adjacent to each other, excavated on the southern face of the Vaibhara hill, facing the western portion of the valley. Of these, the western one is locally called as Son-bhandar. It consists of a large chamber, 34’ x 17’ and is provided with a doorway and a window. The door has sloping jambs and the roof is of arched shape. Interestingly, the present cave is also highly polished inside. This polish, the vaulted roof and the sloping door-jambs of the entrance leave no doubt about the architectural affinities of this cave with those at Barabar, situated hardly 20 miles to the west of Rajgir. Though a short inscription carved on the wall to the right of the door has been palaeographically dated to 3rd-4th century CE, its architectural traits more safely placed this cave in a chronological time bracket of 3rd-2nd century BCE.

The new fort: According to Buchanan, who was the first to survey the ruins of Rajgir, the ancient Rajagriha was situated outside the valley, on the north side of the hills. He was also of the opinion that there had been two fortifications, of which one was much larger, an irregular pentagon in shape. This is a mud rampart which is further strengthened by a ditch. However, the smaller fortress as it now resembles a trapezoid in shape and its walls are faced with huge unhewn blocks of stones set without any mortar, the filling inside being of stone rubble and earth. The total area covered by the fort is about 70-80 acres which is found scattered with potsherds and brickbats. At a few spots in this area Daya Ram Sahni carried out small scale excavations in 1905-06 (Marshall, 1905-06: 101-102). He excavated to a depth of 8’ at one spot where he found a square cell measuring 6’ 6” along each side internally and built of bricks of the size 11” x 8” x 2½”. Inside the cell he discovered three inscribed tablets of unburnt clay, of which one is impressed with a few illegible Brahmi letters of 1st-2nd century BCE. In the upper levels, remains of brick structures, probably representing dwelling houses or chambers were exposed. In one of the chambers was found “a granary made of earthen rings about 2 feet in diameter and about 5 feet deep. It was found covered up with a stone slab.” (Marshall, 1905-06: 101). From these structural remains a substantial number of copper punch-marked and cast coins, terracotta seals and tablets etc. One of the seals bears an inscription reading: Jinarakshitasya in the Gupta characters.

With a view to ascertaining the nature of the fortification, hitherto believed to be built of rubble, the Mid-eastern Circle of the Survey, under Raghbir Singh, undertook excavation at the New Fort at Rajgir, situated outside the hill-girt valley (IAR, 1961-62: 7-8). This supposed to have been founded by Ajatasatru, the Magadhan contemporary of Buddha. A
cutting measuring about 66 m long and over 5 m wide was laid across the southern defences near its south-western corner-bastion. The excavation, carried to a depth of 18 m below the extant top of the defences, revealed three main periods with sub-divisions in the latter two. The earliest of these, represented by a deposit of the average thickness of 1.21 m, belonged to the pre-defence occupation. The lower 1 m of this deposit was essentially non-occupational whereas, occasional bits of shapeless potsherds of red ware were found from the immediate upper layers. The remaining strata showed evidence of habitation as indicated by stone foundations and ashy patches. The NBPW formed the distinctive ceramic industry of this deposit. With it were associated some sherds of red ware (medium to fine fabric) having painted linear designs in black pigment. The other noteworthy finds include terracotta human figurines, copper objects and a hoard of fourteen punch-marked coins. Iron was in use during this period. A unique discovery was a fragment of a steatite amulet showing, on the obverse, three circles, each enclosing three symbols, out of which an animal stands on top, a bird below on right and a square on left with possibly a fish inside and, on the reverse, three vertical lines. This period came to a close as a result of conflagration, indicated by the deposits of burnt materials.

The mud-rampart, ascribable to period IIA, rested directly over this layer. The basal deposits of the rampart are composed of about 1 m thick yellowish-brown mud with dark bands. Over this deposit was raised the main core of the mud-rampart to a height of 7.31 m and retained on the southern side by a brick wall, standing to a height of 2.13 m, being 1.21 m wide at the top and battered to an angle of $17^0$. The top of the rampart was hardened by yellowish mud and brickbats. The base of the mud-rampart was available to a width of 40.53 m, but on the northern side it was 3.04 m less wide. Associated with it was a moat, the full width and depth of which has not been so far determined. From the core of the rampart was found almost the same type of pottery as is found in the pre-rampart deposits.

In period II B a brick fortification wall was added to the extant top of the mud-rampart. Over the collapsed debris of the brick fortification, a 2.13-m thick deposit of earth mixed with ash was laid in period III A. Besides ceramics similar to those found in the earlier mud-rampart of period II A, some glass beads, ‘inferior pottery’ and iron objects were also recovered from this deposit. Over the top of this repaired rampart was raised, in sub-period III B, a 33.5 m wide wall, built essentially of brick-bats possibly robbed from the remains of the earlier walls. A small retaining-wall was also observed over the southern slope of the rampart of period III A.
In the absence of direct evidence, the dating of the different periods of the rampart lacks precision. It is, however, surmised that Period II of the defences may belong to the sixth-fifth century BCE.

Clearance of the brick walls at the south-western corner-bastion revealed structures of three successive phases. The lowest of these, with a 0.30 m high brick platform, was built of incomplete bricks and it covered the mud-rampart of period II A. The platform was sealed by yellowish clayey deposit, over which was raised a battered brick platform, 2.89 m in width. Over the debris of the battered platform, a wall of brick-bats was raised during sub-period III B to protect the weathering of the rampart of the preceding sub-period III A.

Unfortunately, the rubble fortification wall, with its width ranging from 4.60 to 5.50 m at places and with semi-circular bastions on the outer side, exposed elsewhere over the southern and eastern defences, was not available in the excavated trench. Thus, its stratigraphical relationship with the defences of period II of the concerned cutting remains to be established.

The resumed excavation (*IAR*, 1961-62: 7) at Rajgir by the Mid-eastern Circle of the Survey, under Raghbir Singh, brought to light the same sequence of three periods in the habitation-area as revealed during the previous year while cutting across the defences. The occurrence of the NBPW in the earliest (pre-rampart) levels was duly confirmed. It is interesting to note that C14 determination of the charcoal-samples from the pre-rampart layers indicate a date of 245±105 BCE (TF-45 and TF-46, calculated at 5730 years as half-life value). (*IAR*, 1962-63: 5-6)

The site has also yielded a substantial number of structural remains datable to post-Gupta, early medieval and medieval periods. Use of iron was quite widespread at site. Unfortunately, the nature of objects is not clear in the reports though substantial use of nails suggests its utility in the construction of structures.

**Juafardih** (25°08’ N and 85°27’ E): The site is located about 3 km south-west of Nalanda Mahavihara, 15 km south-west of Biharsharif and 93 km south-east of Patna, in the district of Nalanda. The site was originally located on the left bank of the river Paimar, however, the river has now shifted its course further west to a distance of about 2.5 km from the site. The researches so far carried out, could not authentically identified the places in and around Nalanda the mention of which have been found in many ancient literatures. Like many other queries, it is also still unresolved that from which places the chief disciples of Buddha i.e., Sariputra and Maudgalyayana are known to have hailed.
The Excavation Branch III of the ASI, Patna considering the archaeological significance of the site and also to verify the identification of Kolika or Kulika (the probable birthplace of Maudgalyayana) with the site conducted an extensive reconnaissance in the area surrounding Nalanda which resulted in the discovery of a substantial number of archaeological sites (Saran et al. 2008:59-73). Of these, three sites are located close to each other within a distance of 2-3 km on the west and south-west of the monastic complex of Nalanda.

The site at Juafardih is located on the west of Chanayana tank which measures 105 x 100 m with a height of about 10 m from the surrounding area. In appearance the mound looked like a stupa. During explorations burnt bricks measuring 36 x 27 x 6 cm were seen scattered over the ground. Besides, a substantial number of sherds of NBPW having golden and silvery hues, BSW, BRW, grey ware and red ware were also recorded from the site. A Buddha image bearing an inscription and other sculptures of Brahmanical pantheon were also seen lying at the ancient site.

The excavation at the site was planned with the following objectives a) to ascertain the sequence of cultures, b) to understand the nature and phases of the stupa, c) its association with Maudgalyayana, and d) to determine the absolute chronology of various habitational periods. The index trench ‘A’ was laid on the flat surface on the top of the mound. The mound has a gradient from west to east and north to south. In total 28 (twenty eight) trenches were laid out in horizontal pattern each measuring 10 x 10 m which were further divided into quadrants. Out of total 112 quadrants 76 were excavated in 2006-07. The excavation yielded a habitational deposit of 13 m with layers 14 to 1 divisible into 3 cultural periods.

Period I represents the cultural materials of the pre-NBPW period in which metal is conspicuous by its absence.

Period II: This period is characterized by the presence of NBPW with a habitational deposit of 10.61 m, represented by layers 12 to 3. The associated wares include BRW, grey ware and BSW. The principal shapes found in NBPW are dishes and bowls. Basins, miniature bowls, lipped bowls, handis, frying pans with handle, handi-cum-karahi and lid-cum-bowl were other shapes in use during this period. It is also deserved special mention that two sherds of Painted Grey Ware were also recovered from this phase. They were seen painted with two parallel horizontal lines quite akin to the specimens found from other sites of the Ganga-Yamuna doab.
Based on the quality of NBPW besides stratigraphic contexts, period II can further be categorized into three phases. I) early phase was represented by layers 12 to 10, having a deposit of about 1.34 m, II) middle phase by layers 9 to 6, with a deposit of 2.10 m and III) late phase by layers 5, 4A, 4 and 3 with a deposit of 7.17 m superimposed by the deposit of period III. The percentage of finer quality NBPW decreased in the late phase in comparison to middle phase. The shades are mainly golden and silvery. The NBPW is of very fine quality in the middle phase and its colour ranges from black, silver, gold, violet, purple and copper. Some sherds are bi-colour i.e., silvery exterior and the golden interior. The common shapes are convex-sided dishes and bowls with corrugated profile. One of the sherds is also found decorated diamond cut embossed designs on the exterior. Revetted NBPW sherds were also found from the deposits.

The evidence of post-holes and reed marks in burnt clay lumps were recorded from layers 8, 7, 6 which indicates that wattle and daub houses were in use for residential purposes. Besides, successive floors made of lime-surkhi, occasional post-holes, ovens, hearths were exposed in layers 9, 8, 7 and 6 respectively. During excavation it was observed that an area of about 80 m x 80 m at layer 5 was levelled and a 5 cm to 12 cm thick layer of fine riverine sand was spread all over which most probably represents the base of the earliest mud stupa in three successive phases cutting layers 4A, 4 and 3 of period II.

Iron objects were found in profusion from the period. All together 17 objects viz. chisels, daggers, knives, axes, spearheads, sickles, rods, swords, hoes besides a few indistinct objects have been documented. Besides stone objects comprising beads of agate and carnelian, sling balls, querns, pestles, mullers, pounders and fragmentary soapstone caskets altogether 13 in number, terracotta objects comprising snake figurines, beads, hopscotches, wheels, querns, sling balls and a few unidentified objects, altogether 49 in numbers, antimony rod and bone objects both tools (points and arrowheads) and other objects, altogether 5 in numbers have been yielded from the period concerned.

Period III: Remains of a massive circular brick wall around the stupa were encountered in various trenches. The deposit represented by layers 2 and 1 yielded cultural materials of the Sunga, Kusana, Gupta and post-Gupta periods having a total deposit of 1.60 m. Mainly red or pale red and black wares comprise the ceramic industry of the period. Red ware was represented by bowls, miniature pots, large basins, handis, vases, jars, large spouted vessels, surahi, lid-cum-bowls and perforated bowls. On close analysis of these sherds it was found that prior to the application of slip, fine sand was sprinkled over the body of the
pots in leather dry condition as tempering materials and to make the surface coarser and to facilitate the slip sticking over the surface. The common shapes in black ware are bowls, miniature jars of fine fabric and bowls of medium fabric treated with thin black slip on both the sides. The BRW, NBPW, grey ware and BSW were also found in meagre quantity.

Use of iron definitely proliferated in the concerned period. the repertoire comprise 3 arrowheads, 1 nail, 1 chisel, 4 daggers, 1 knife, 2 axes, 2 tools (?), 1 utensil, 1 rod and 3 unidentified objects.

A substantial number of pottery discs perforated or otherwise, altogether 325 in numbers were unearthed from the deposit of period III. Majority of these were of NBPW besides a few specimens in grey and red wares. These discs (hopscotch) range in diameter from 7.2 to 2.4 cm. One specimen in NBPW, two Brahmi letters ‘Muga’ were found engraved on obverse and single Brahmi letter containing ‘Va or Ma’ on reverse.

Besides hopscotches, a large collection of terracotta objects including human, animal, bird, snake figurines, beads, wheels, toy discs, gamesman, crucibles, querns, net-sinkers, sling balls, dabbers and a few unidentified objects have also been yielded from this deposit.

The stone objects comprise 9 beads, 8 sling balls, 2 tool sharpeners, 2 querns, 6 pestles or mullers, 1 fragmentary soapstone caskets and 4 indeterminate objects. The principal shapes of semi-precious stone beads are barrel, spherical and roughly pentagonal. They were mostly made of carnelian, agate, quartz. Etched carnelian beads were also found in significant numbers. Presence of stone debitages mainly of carnelian, agate, quartz, crystal etc along with a few unfinished beads of carnelian indicates that lapidary craftsmanship was in practice at the site.

Copper objects include 7 bangles, 3 antimony rods, 2 coins of later periods, 1 fragmentary pot, 1 broken knife, 1 arrowhead and 1 unidentified object.

29 bone objects were recovered from this period. These include 21 points, 2 discs, 2 wheels, 1 lie, 1 comb, 1 bangle and 1 unidentified object. The tanged bone points are circular in section. The comb is broken into three parts, roughly rectangular with spikes missing. The upper corners of the comb are decorated with incised oblique lines on both sides. It is lustrous and blackish and measures 6.7 x 4.3 cm. On the basis of the recorded artefacts and ceramics the lower layers of period III has been dated to second century BCE whereas the later layers can be ascribed to seventh-eighth century CE.
A good quantity of palaeobotanical samples were collected by using flotation technique from periods I and II. The evidences are as follows:

Wheat: *Triticum* sp. (*Triticum vulgare/ aestivum* type); rice: *Oryza* sp. (of *sativa* Linn.)


The exposed *stupa* at Juafardih revealed three main phases of construction.

Phase I: During excavations, it was revealed that the habitational area of about 80 x 80 m in layer 5 was levelled and uniformly spread with fine riverine sand having a thickness of about 5-12 cm, over which the earliest mud *stupa* was raised, represented by layer 4A. The mud *stupa* was erected on a solid circular base by pilling up natural earth (dug up from the surrounding area). The maximum diameter of the tumulus was 9.80 m with a maximum height of 0.97 m.

Phase II: *Stupa* was further raised upto the height of 1.45 m having semi compact greenish clay mixed with meagre quantity of brick bats and potsherds. The diameter of the tumulus was also enlarged.

Phase III: The height of the central portion of the *stupa* was further raised to 4.65 m (layer 3). Besides, the *stupa* was enlarged by depositing clay lumps which ultimately attained the shape of a hemisphere. The diameter of the tumulus was thereby enlarged and measured about 63 m during Phase III. The top of the hemispherical *stupa* was found rammed with brickbats and potsherds possibly to strengthen the top surface.

The mud *stupa* was encased with brick masonry set in mud mortar during Period III. The maximum width of the encasing was 6m enlarging the *stupa* to a diameter of 77m. The evidence of *pradakshinapatha* around the *stupa* at ground level was also encountered during excavations. Addition of another *pradakshinapatha* paved with complete bricks and brick bats at a higher level at a distance of 24.5 m from the centre of the *stupa* was unique.

On the basis of charcoal samples, the first, second and third phases of mud *stupa* could be safely dated between *circa* 600 and 400 BCE which rests over layer 5 as the calibrated date for the sample collected from layer 6 has given a date of 1002 BCE (i.e., 2850 + 80 BP). The date suggested for the period III of *stupa* is *c.* 100 BCE to 100 CE. The pre-NBPW period on the basis of radio carbon dates obtained from four samples has been dated to *c.* 1600-1200 BCE. Birbal Sahni Institute of Palaeobotany on the basis of samples obtained from layers 8, 7 and 6 (all belonging to middle phase) has suggested a long time bracket of 900-600 BCE. Since the earliest *stupa* was raised over the habitational deposit of layer 5 of
period II, its initial construction has been dated to about 6\textsuperscript{th}-5\textsuperscript{th} century BCE. However, the earliest date for period II goes as early as c. 1200 BCE.

A rich deposit of 10.61m belonging to the period II (NBPW Period) having three phases has 4 C14 dates, as 857 BC, 1002 BC, 1562 BC and 1259 BC, comparable to early dates of NBPW from Ayodhya, Agiabir, Rajdhani, Gotihwa and Jhusi.

**Ghorakatora** (25° 01' 37"N and 85° 31' 31" E): The site is situated near Giriyak in the district of Nalanda. The river Panchana flows west of the site and it is also well connected with Rajgir and Nalanda which stand about 8 km west and 19 km northwest of the site respectively. The site has a large mound with an area of about 22.74 acres measuring about 900 m north-south and 500 m east-west. The site received special attention by the British administrators and several archaeologists.

The site and its adjacent areas are scattered with several structures and artefacts which have been reported time to time. Many massive burnt brick structures (brick size 38 x 27 x 5.5 cm) up to 40 courses were noticed during explorations. About a dozen of ring wells having 15 rings have also been recorded. Ceramics include BRW, BSW, NBPW, red ware. The fabric ranges from course to fine. The significant shapes are bowls, lipped bowls and vases with narrow mouth, spouted vases and basins. Terracotta objects comprise aricanut shaped beads, barrel shaped beads, fragment of rattles, sling balls, stoppers, bangles. A terracotta plaque assignable to the Sunga period deserved special mention. Among stone sculptures, mention may be made of Ganesa, Surya, Vishnu, Uma-Mahesvara, Yonipatta which have been dated between the post-Gupta and the Pala period.

Keeping in view of the archaeological heritage of the site, it has been selected for excavation for the field seasons of 2007-08 onwards.

Period I has been accorded the ‘Chalcolithic’ status. The concerned evidence include BRW, black ware, red ware of several types (comparable to the wares found from Chirand and Sonpur), burnt daubs with reed impressions, polished stone celts, querns, pestles, sling ball, terracotta beads, hopscotches, wheel made from potsherds, bone points and a fragment of a copper antimony rod.

Iron in all probability appears in period II with the marked appearance of NBPW. Other ceramics include BRW, black ware, BSW, grey ware and red ware. The noteworthy shapes are vases, bowls, dishes, lid-cum-bowls etc. Deep bowls, basins and dishes were the most common types in BRW. A substantial number of painted potsherds have also been documented. The designs comprise loops and intersecting loops, vertical stokes from
different angles etc. The paintings were executed mostly in cream pigments on the outer surface of the pots. Corroded copper coins, terracotta human figurines, ghata shaped beads and wheels have also been encountered during the course of excavations.

The subsequent cultural period, owing to the presence of terracotta figurines, carved in Sunga idiom of art, cast coins, sealing with Brahmi script of the Kusana character, sprinklers of red ware with ochreous slip and burnt brick structures have been dated to the Sunga-Kusana period. The characteristic ceramics include red ware and grey ware. Red ware is found in both slipped and dull varieties. The fabric ranges from course to fine. The types comprise vases, bowls, basins, handis, tawas with lug handle, storage jars, spouted vessels etc. Three rooms measuring 2.5 x 2.2 m, 1.5 x 1.9 m and 1.6 x 1.9 m made of burnt bricks have been exposed in Period III.

The succeeding Gupta and post-Gupta periods have also yielded massive structural remains. 2.85m long wall having the alignment in north-south and a wall in east-west direction having the length of 1.65m and width of 28 cm have been exposed. Besides a brick wall in north-south alignment having the width of 60 cm and of 18 courses, traced to 10 m, along with another having the width of 60 cm and 11 courses traced to 4.2 m formed a house complex. Ceramics tradition not much differs from the preceding one. Both the periods III and IV have yielded a substantial amount of terracotta objects viz. human and animal figurines, beads, stoppers, gamesman, hopscotches, sling balls, wheels, discs, earlobes, amulets, bangles, dabbers, rattles, seals and sealings. Beads of semi-precious stones, pestles, sling balls made of stones besides a good number of copper objects like coins, beads, rings etc. have also been recorded.

Among iron objects, occurrence of spearheads, bells, rings and utensils are quite noteworthy. However, it is difficult to ascertain the nature of their occurrence in different periods.

Period V yielded the evidence assignable to the Pala period (personal communication with Patna Excavation Branch, ASI).

The settlement of Rajgir within the valleys was protected by a girdle of hills, generally considered as five, but variously named in different literary sources. The natural resources of the hills and those of the plains must have provided a rich hinterland for the settlement of Rajgir to grow and expand. The pastures on the slopes of the hills, the rich alluvial fertile plains immediately beyond the valley/ hill ranges, the forest products in the immediate vicinity, minerals of various types including the metallic
ores from the Chhotanagpur plateau towards a little south would have buttressed substantially for the emergence of this region as an important nodal point of several exchange networks. Apart from its distinct physiographic features, Rajgir’s location was highly favourable as transit points of several trading mechanism via streams/ rivers, tracks coming down from the hilly terrain of the Chhotanagpur plateau (Jha, 2011).

Iron was an important metal, the supply of which (in form of ingots or finished products) might have been furnished by the present site. Rise of Magadha in all probability coincides with the enhancement of iron production. Its immediate interactive zones viz. Rajgir, Gaya, Hazaribagh (south Bihar plateau) region certainly played a crucial role to meet the demand of Magadhan empire. Kosambi stated that “I suggest that its (Rajagrigha) original importance derived from the minerals; in particular iron, which is found as easily smelted surface deposits in Dharwar outcrops of which the hills about Rajgir consist” (Kosambi, 2006: 39).

At the eastern outskirt of Rajgir, stands the site of Giriya which is flanked by the river Panchana/ Panchane. This gained its volume and connectivity by having fed by four other streams viz. Dhadar, Tilaiya, Dhanaraja and Kuri all coming down from the hills of the Chhotanagpur area. Another small stream of Sankari on the bank of which Devangarh, a significant early historic centre or collection depot en-route was situated, flew hardly 5 km east of the Giriya hill.

It is quite well known that Rajgir, since the early historic period, was well connected with other significant settlements of the plateau, the plain and obviously the undulating tracts of transit zones between the two via exchange network. The genesis of such development may be traced back to the iron bearing EVF phases. Probably passed close by or through Giriya itself these roads must have connected Hazaribagh- Kodarma plateau with the plains. One of these could be connected to Wazirganj sector and to Fatehpur and beyond via Miari and Kenar and Chatti. The other could have connected Rajauli belt via Devanagarh (Chakrabarti 2001: 188-189). Recent exploration at these sites also suggests their significant roles in both iron production and consumption. There is no doubt that being well interlaced via such routes Giriya took in the bulk of rich and diverse resources and the extracted materials (in form of ingots) from the hilly tracts of the south and after converting them into finished products pushed down to other important transit centres of the
plains such as Pataligrama (subsequently Pataliputra), Rajauna, Champa etc. Substantial collection of finished objects at Champa also substantiates the above hypothesis.

It is quite certain that the Taradih region must have played a crucial role in iron production and furnishing demand of the same in the adjoining regions since the pre-NBPW phase. The BRW associated EVF settlement traceable at Taradih gradually crystallized as a religious centre certainly Buddhist as Bodhgaya in the early Christian era (if not later). Such development was responsible for the enhancement of metal consumption particularly iron. Unfortunately, excavation failed to give proper justice to this issue i.e., the delineation of iron working activities and its utility in the early historic Bodhgaya. We must keep in mind that large scale constructional activities, production of sculptures besides other settlement dynamics (both secular and religious) had enormous impact on the demand of iron so as its procurement network. Similarly the evidence from Juafardih, Ghorakatora and newly discovered sites in the nearby areas and those in the Nalanda region provide some scope to explain the iron consumption and certainly production related issues. Paucity of substantial evidence related to consumption mechanism of iron in these settlements constrain us to elaborate on other details of metal working which persisted from at least 1000 BCE to the Gupta period. In this contexts it is worth mentioning that, the evidence of rock cut architectural activities carried out in and around these settlement complexes besides the manufacture of sculptures and otherwise are crucial to assume further consolidation of metal workings and the involvement of iron working groups (the workers involved in iron extraction in the raw material bearing areas, those involved in the production of finished objects at the settlements). It is difficult to ignore the role of iron-made equipments that was extensively employed in carving the stones. Literary sources provide enough insights to trace all these social groups and their involvement in metal working.

Niranjana river which has its mention in Buddhist literatures (the modern Falgu) certainly played a crucial role in the settlement dynamics of Rajgir-Bodhgaya region. It may also be pointed out here that the via the said stream and others, the Bodhgaya region must have been connected with another transit zone of iron exchange network near the confluence of the rivers of Son and North Koel. The site of Kabra Kalan, a significant NBPW site probably acted as one of the resource mobilization centres of
the plateau which after collection of extracted materials spouted to the consumption zone.

**Explored Sites:**

**Explored sites in this region include** Admapur, Churmuliadih, Itasvagarh, Madhuri, Malhipur Naraina Patanawa in the Rohtas region and Kenar Chati, Miari and Denvangarh in the Nawada plateau.

**Exploration in the district of Rohtas**

Explorations in southern part of Bihar with special reference to the districts of Rohtas and Kaimur was conducted by B.P. Singh with a view to understand the nature of settlements, distribution pattern of sites etc. under the auspices of the Department of Ancient Indian History, Culture and Archaeology, Banaras Hindu University during the field season of 1985-86. This field survey has resulted in the discovery of the following iron bearing sites besides others.

**Admapur:** The site is located nearly 5 km south of Chenari on left bank of the river Durgauti in the district of Rohtas. The mound covers an area of about 150 x 100 m with an occupational deposit of 2 to 3 m. It has yielded BRW, BSW, NBPW, grey and red wares besides ceramics of the Sunga-Kusana period. Other artefacts include a copper coin, mullers, pestles, saddle querns etc. made of stone, lump of chalcedony with crested ridge and waste chips of chalcedony and chert along with iron slags.

**Churmuliadih:** The site is situated 1.5 km south west of the village Datiaon and can be approached from Bhabua-Chainpur road. It extends over an area of about 200 m east-west and 150 m north-south with an occupational deposit of about 2 to 2.5 m. The site is characterized by the presence of NBPW, red ware, BSW and Kusana pottery, iron slag and a bird figurine of terracotta.

**Itasvagarh:** The site is located on the left bank of river Durgauti (in Sasaram) in the district of Rohtas. It is approachable via Chenari-Malhipur road. The site is under extensive cultivation. It approximate dimension is 800 x 600 m having an occupational deposit ranging from 4 to 5m. The site has yielded a substantial number of NBPW, red ware, fine grey ware, BSW and BRW sherds, stone pestles, mullers, hammers (?), polishers, sharpeners, fluted cores, waste chips besides iron slags.

**Madhuri:** The site, having an area of about 1 sq km, is located 4 km south-west of Bhagwanpur on the right bank of the river Sura in the district of Kaimur. The site represents a significant iron bearing EVF settlement as attested by the presence of the
sherds of NBPW, BRW, BSW, grey ware besides Kusana bowls in grey ware, sprinklers etc. Iron slags were found in profusion. Associated artefacts comprise mullers, pestles, saddle-querns made of stone, lumps of chalcedony with crested ridge and waste chips of chalcedony and chert.

**Malhipur:** The site has yielded NBPW, BSW, BRW, red ware, pottery-discs, terracotta stoppers, iron slag, stone balls and hammers and waste stone chips of green and black chert.

**Naraina Patanawa:** The site is about 3 km east of Chenari of Sasaram in the district of Rohtas. It covers an area of about 200 x 100 m and rises to a height of approximately 2 m. Sunga-Kusana pottery, iron slag, BSW, grey ware (solitary piece), red ware, stone balls, terracotta stoppers, parallel sided blades and waste stone chips have been recorded from the site.

Besides, Akorhi, Raja ki Ankori, Basani, Birnagar, Bhisara, Badalgarh, Bhairodih, Kushuridih, Karanpura, Sakas, Malaon, Daindih, Digghi, Diha, Sonvagarh, Telari, Tori etc. (Singh, 1996-97: 109-117; *IAR*, 1985-86: 12-14)

**Kenar Chati** in Nawada plateau region represents a significant early medieval settlement. Large structural mound with extensive brick remains along with a substantial number of architectural members and Siva lingas have been recorded from the site. Besides, survey at the site has yielded sherds of BRW, NBPW, red slipped ware, BSW, red ware of both slipped and unslipped varieties and grey wares. Few iron pieces were also unearthed.

**Miari:** Situated south of the former site following almost the same alignment is the site of Miari. The site extends mainly in north south orientation. A few sherds of BRW and NBPW with silvery tinge have been documented. Iron slags in profusion are also found.

**Devangarh:** The site has a 10m high (280m x 200 m approximately) structural mound with extensive traces of brick activities. Several sculptural specimens along with scatters of ceramics are found on the surface. Besides, the site has the evidence of mud-fortified enclosure with definite outlines of bastions. Black polished ware and NBPW sherds along with other ceramics and small pieces of iron slags have also been documented. A uniform 15m ditch along with outer boundary of the rampart separates the fortified area from the structural area from where has recently been reported a Buddha image of bronze.
JHARKHAND

The modern state of Jharkhand is synonymous with the Chhotanagpur plateau or the eastern Indian plateau. Barudih (district Singhbhum) is the only excavated BRW associated EVF site in the Sanjai valley, Jharkhand.

Barudih: The site is situated on the bank of the river Sanjai near Sini in the district of Singhbhum. The region around Sini is an extension of the Chakradharpur peneplain. The Sanjai spreads in east-west direction. Being a part of the Chhotanagpur plateau, the region mainly comprises Achaean granites and gneiss, trap rocks (Dalma) and the rocks of the Iron ore series. The latter mainly consists of schists, slates, phyllites and quartzites. Late Tertiary and Pleistocene deposits include boulder beds, laterites, gravels, clay and silt.

During two field seasons of 1964 and 1967, the Prehistory Branch of the Department of Anthropology, University of Calcutta carried out some test diggings on a small mound of the site. The implementiferous mound stands on an open and undulating land surface bounded on the north, east and west by the Sona nullah and on the south by the Sanjai. The mound is oblong in shape and is about 115’ long, 51’ wide (maximum) and about 8’ high (at its highest) from the ground level.

Extensive trial excavations at the site revealed a three-fold stratigraphy comprising a thick deposit of sterile red soil > implementiferous compact and dark black soil > a thin mantle of reddish brown soil. The dark and compact implementiferous deposit has yielded potsherds, terracotta objects, microliths, a large number of polished stone celts of different types, pounders, hammer stones, fabricators, ring stones, saddle querns, carbonized rice grains (Oryza sativa Linn), two iron implements (a sickle-like object and a small hook), wood charcoal, burnt clay, a few bone fragments and cultural materials from two pits. The ceramic assemblage comprises both handmade and wheel made ‘red-and-black ware’, red ware, red-brown ware, black ware, grey ware, orange-brown ware and deep brown or chocolate ware. Among them red-brown and red potsherds were predominant. The representative shapes in these wares are bowls, jars, pitchers, saucers, miniature vessels. A few red sherds had incised and pitted designs (IAR 1963-64:9; Sen, 1969:17-29). Coarse handmade BRW was reported from the site (Chakrabarti, 1993:79). The metallurgical study of the sickle-like iron implement of low carbon steel indicated that it was actually a long-handled tool used to separate the stalks from the seed of the rice (Ghosh and Chattopadhyay, 1982: 63-64). The available radiocarbon dates (Agrawala, et al., 1991:329-344) place Barudih around the end of the second millennium BCE. According to
Chakrabarti, the earliest calibrated date range for Barudih is 1410-830 BCE (Chakrabarti, 1992:66, Possehl, 1988:169-196.)

The sickle like object was recorded at the eastern edge of the mound in trench I (extended) at a depth of about 3’8” (from the sloped surface of the mound and of about 4’ 6” below the datum line). This weathered and brittle specimen has a length (between the two extremities) of about 24 cm. Its thickness varies from 1.4 to .6 cm and width varies from 1.2 cm to 1.9 cm. The maximum depth of the curvature measured from the line joining the two extremities of the specimen 14.8 cm. Another iron object, probably a small hook, has been found in trench at about 1’ 9” below the datum line.

The metallographic observations at three different regions near the circular sectioned distal end of the sickle indicates that i) inclusions present were principally silicates in form of slag, there were also minute traces of sulphides, ii) the grain structure was recrystallized in the size range 7 to 8 on the ASTM standard scale and iii) the hardness, as measured under a 50 kg load ranged from 110 VHN at the outer surface, to 127 VHN in transverse section. There was no evidence of surface carburization probably due to large scale corrosion.

The objects’ microstructure, as revealed by a 3% nital etchant, was quite non-uniform and characterized, on average, by a composition of approximately 40 % pearlite and 60 % ferrite. The pearlite is mainly coarse granular to lamellar in places, and it is distributed at the corners of grains comprising the equiaxed ferrite matrix. It is clear that the metal was thoroughly forged with its working having been completed above the recrystallization temperature, before the artefact was allowed to cool slowly in air. In all probability, the forging temperature was about 900° C. Therefore, the artefact is made of low carbon steel (Ghosh and Chattopadhyay, 1982: 63-64).

The area known as Jhimjhimia-Kalistan in the district of Sahebganj, Santal Parganas is a cluster of five villages called Malkasba, Phulbagh, Turtipur, Begampur and Gadaganja. Occasional discoveries of BRW, BSW, NBPW, grey and red wares with a variety of types, have been reported. Excavations at the principal habitation mound in the village of Turtipur unfolded a four-fold cultural sequence (IAR 1987-88:12-13, 1988-89:8-9).

On the lower mound area (which was evidently not excavated), one can see a modest BRW layer overlain by a thick early historic habitation deposit containing NBPW sherds and iron slag. The main BRW settlement is found about half a km to the west of the principal mound.
Period I was represented by the presence of BRW, red and black-slipped wares. They are mostly wheel turned and coarse in fabric, the main shapes being basins, bowls, etc. Among other antiquities terracotta beads, iron rings, etc., are noteworthy.

The ceramics recorded from period II comprise NBPW, black, BSW and grey and red wares. The pottery is mainly wheel-turned and well-fired. The important types include vase, handis, storage jars, bowls, dishes, basins, lid-cum-bowls, etc. A few BSW sherds having graffiti marks were also encountered. Conical bowls with splayed-out rim, perforated bowls, lipped bowls in red ware are also worth mentioning.

Among associated finds are beads of semiprecious stones, bangles, pestles, etc., animal and human figurines, balls, ghata-shaped beads of terracotta, tanged and socketed arrowheads, and discs of bones, iron chisels and nails and iron slag, copper antimony rods and wires. Remnants of burnt clay with reed impressions indicate that houses during this period were of wattle and daub.

Period III was marked by the appearance of ceramics and artefacts characteristic of the early historic period datable between the second century BCE and second century CE. Red ware dominates the ceramic industry though some sherds of BSW, black and grey wares were also met with, the types being bowls, vases, narrow-necked vessel, lid-cum-bowls, plates, spouts, etc. Some of the red ware vessels were having slip or wash. The artefacts of the cultural period comprise terracotta animals, beads, balls, etc. A thin whitish layer of silt was noticed at the top layer of Period II below which weathered sherds were found. It shows that the site was deserted for a long time at this particular site, prior to the next occupation.

Period III is marked by the cultural materials of the medieval period.

**Saradkel:** The site is situated in the Khunti sub-division of the district of Ranchi. The archaeological heritage of the site was first examined in 1915 by S.C. Roy (Roy, 1915: 229-253). In the year 1944, the site was re-explored by A. Ghosh. According to him, it is a very extensive site, the most promising of all Asura sites.

Two decades later, the mid-eastern circle of ASI under Sunil Chandra Ray undertook excavation at Saradkel (IAR, 1964-65: 6). The excavation revealed two occupational periods, belonging essentially to the same culture. No structural remains have been yielded from period I, however, the occurrence of baked bricks in the strata ascribable to the Period I suggests the use of bricks. Besides, a substantial number of pits were also encountered.
which were filled with charcoals, iron slag and sand. They were in all probability iron smelting ovens.

Period II is marked by intensive structural activities. A massive defence wall consisting of baked bricks (41 x 26 x 7 cm) was raised along the periphery of the mound on the bank of the river. The ceramics are mainly wheel-turned and characterized by coarse fabric, thick section and red colour. Apart from red ware, grey, black and red slipped wares comprise the assemblage. According to the excavator, certain pottery types such as ledged lid, flat based bowl, sprinkler and incised decorated design strongly suggests a Kusana influence. Hooks and rods made of copper, clay sealings, coins possibly made from moulds, hopscotches, animal and human figurines made of terracotta, beads of chalcedony, agate and carnelian and a two legged saddle querns comprise the cultural materials. Iron objects and slags were found in profusion.

No datable object was reported from excavations, however, based on diagnostic objects/remains excavator ascribed the cultural phases to circa 1st-2nd century CE. However, there are two radio carbon dates which support the excavator’s dating (IAR, 1965-66: 86; IAR 1966-67: 69)

TF 369 (Charcoal from Trench SDK-2; locus C3-C4; layer 3; depth 0.01 m. (?) below surface; field No. SDK-2/65-114): 1970 +90 BP (20 BCE);

TF- 370 (Charcoal from Trench SDK-2; A1-A2; layer 3, depth 0.07 m (?); Field No. SDK-2/65-248.): 1850 +100 BP (100 CE).

The site was re-excavated by the Directorate of Archaeology and Museums, Government of Bihar under the supervision of O.N. Chauhan and Ajit Kumar Prasad in the field season of 2003-04 (Chauhan and Prasad, 2007: 121-133).

Excavations have revealed habitational remains pertaining to six cultural layers.

Layer 1 has loose soil containing brick bats. Maximum thickness of the layer ranges from 10 to 12 cm, its colour is grey.

Layer 2: Occurrence of large brick bats in this layer suggests they were of fallen debris of huge structures. Maximum thickness of the layer is 52 cm.

Layer 3: It is grey in colour containing small brick bats, quartzite pieces and charcoals. Maximum thickness of the layer is 38 cm. The layer is medium hard due to sand particles present in it.

Layer 4: It is reddish grey in colour with compact hard clay. Maximum thickness of this layer is 35 cm.
Layer 5: It is dark grey in colour containing large amount of charcoal and small brick bats. Occurrence of large quantities of charcoal in the layer led the excavators to assume that fire activity was present. The maximum thickness of the layer is 54 cm.

According to the excavators, the retrieved assemblages are datable to a single-fold early historic culture at the site. It has three phases and earlier two phases has again may be subdivided in to sub-phases IA, IB and sub-phases IIA, IIB.

From excavations, generally two phases of structural activities have been reported. Mostly burnt bricks (42 x 28 x 7 cm and 41 x 25 x 6 cm) have been used for structural activities. Evidence of clay mortar has also been attested. Evidence of steps probably suggests that some of the structures were double storied. The pattern of settlement along the river bank and the presence of fortification all around suggest that the river has been used as natural moat. During the course of excavations eight- nine courses of burnt brick structures have been traced. In specific corner area circular bastions have also been noted.

Altogether seventeen stone objects have been found from various levels of the site. The objects are axe (8.7 x 5.2 x 1.5 cm), circular bead of carnelian, quartz bead of decagonal shape, a seal, net sinker besides a few fragmentary specimens. Terracotta objects, altogether eighteen in number include fragments of wheel (probably the part of a toy cart), sling balls, beads besides Naigamesha figurines. Glass objects consist of beads and bangles. The conical stone seal with a maximum length of 2 cm and width of 1.4 cm bearing a letter of early Brahmi script can be considered as the most noteworthy find.

The ceramic assemblage consists of red ware, red slipped ware, black ware etc. Common types in red ware include vases, handis, miniature pots, lid-cum-bowls, storage jars, basins, troughs, lids etc. There is no decoration on outer surface of the sherds of dull red ware though they bear deep grooves and incised marks. The thickness of the sherds is medium to thick. Black ware is marked by fine fabric and texture. The main types are handis, bowls with out-turned everted rim.

The excavation has yielded 50 iron objects including arrowheads (Chauhan and Prasad, 2007: 129-130). The other objects are spearheads, fragments of nails, spoon, five slag pieces, one chisel, two knives, rods etc.

Selected specimens are:

1. Spearhead, working end is damaged (SKL 1).
2. A fragment of arrowhead with a length of 11.8 cm (SKL 8).
3. Broken arrowhead, butt end is intact whereas, the working end is damaged (SKL 14).
4. Broken nail (SKL 14)
5. Fragment of an arrowhead (SKL 56).
6. A well preserved arrow head (SKL 63)
7. A knife fragment from later period (SKL-73).

**Asura Sites:**

**Belwadag:** The site is situated about four miles west and south west of Khunti, the headquarters of the Munda subdivision of the Ranchi district. Field survey in and around the site by Roy in 1915 (Roy, 1915: 230-234) resulted in the recording of a large tract of upland, nearly ten acres in area, situated on the northern bank of a small hill stream Kunjta Garha. According to the local villagers, this tract was one of the reputed *Garh* sites of Asuras. On the south west corner of the tract was a comparatively rocky ground sloping down into the stream on its south which was used as the place for Asura *Kuthi*. The site was thoroughly investigated by S.C. Roy. That this area was once used for smelting iron could be easily seen from the numerous pieces of slags scattered all over the land. S.C. Roy has also collected a number of iron arrowheads from the site. He was also told that in the adjoining fields, cultivators frequently dug up bits of worn away iron. Fragments of bricks were found scattered over a large tract of land locally called *ita tanr*. Chakrabarti in his works has summarized the nature of findings referred to in the works of Roy, “Trial excavations at two points on this land unearthed what seemed to be the foundation wall of a building. The brick measurement was 1 ft 5” in length, 10” in breadth and 3” in thickness, the breadth of the brick being the measure of the thickness of the wall. Another comparatively rocky piece of ground sloping towards the stream seems to have been the site of iron smelting as was evidenced by the numerous pieces of *gera* or slag scattered all over the land.” (Chakrabarti and Lahiri, 1988: 42) Copper ornaments were also dug up frequently by villagers in the *ita tanr* and adjoining fields, some of which were found in earthen vessels which Roy felt could have been cinerary urns. Three gold coins have also been recorded from the area. Obverse of one of these coins shows the bust of a male warrior while the reverse shows the figure of a female with a long and straight nose and high forehead, clad in something like a cloak. After analyzing the coin, D.B. Spooner presumed that it was a Kusana coin of the Huvishka type. The stone objects include a roundish stone pounder made of gneissic rock, 9 ½” long and 8” in diameter, a beautifully polished hammer or mace made of silicate, which Roy felt could be jade (10”
long with a knob at one end probably for the grip) and a seven sided unperforated transparent crystal quartz piece.

**Kamanta:** Survey conducted by S.C. Roy (Roy, 1915: 229-253) recorded the occurrence of a graveyard in between Kamanta and Angira. An upland adjoining this graveyard was found strewn with bricks. At several locations he has also documented the foundations of a number of brick walls.

**Dargamma:** Five copper celts were accidentally discovered at the site by a Munda villager. Roy was successful in collecting one such specimen which weighed nearly 3 lbs. and was 6.6” long, 3 ¼” wide at the apex, 7 ½” at the cutting edge. Iron implements were also found from the site. The recording of a socketed axe-head seems to be a quite notable find (Roy, 1915: 239-240; Chakrabarti and Lahiri, 1988: 43).

**Bichna:** Broken pieces of bricks were recorded from Bichna which is generally identified as one of the garh sites of the Asuras. The retrieved objects include a thick and heavy grinder, a polished but broken celt of gneiss, the fragment of a polished stone celt, a stone hammerhead and a shaft hole made of gneissic rock. A four legged stool of gneissic rock was also found. A copper celt, 5” long, 1.9” wide at the apex and 2.8” at the cutting edge, weighing a little over 1 ½ lbs was also recorded. A substantial amount of gera or iron slags had been noticed from the said area. Besides, worn away arrowheads and adzes form the iron repertoire from the site. Stone beads of different types and sizes and potsherds of different varieties have also been found from the site (Roy, 1915: 240-242; Chakrabarti and Lahiri, 1988: 43).

**Pandu:** The site has several exposed structural remains. Earthen gharas with bones and copper ornaments were also occasionally found four feet under the ground. A stone slab with a roundish top was found by a villager on the ita tanr land which may have been a ritual stone. A low four legged stool was also recovered by a villager which was similar to the one found at Bichna. Worn away iron arrowheads and adzes were important iron objects found from the site (Roy, 1915: 240-242; Chakrabarti and Lahiri, 1988: 43).

**Toner:** On a plot of upland known as Itahasa-tanr, a large number of bricks were found. Roy was told that copper ornaments and worn away bits of iron implements from time to time were dug up by cultivators. Moreover, one villager was said to have found some bits of gold (Roy, 1915: 244; Chakrabarti and Lahiri, 1988: 44).

**Erkia:** Field survey conducted by A. Ghosh has resulted in the recording of a large mound on the bank of Kanchi river, which was found scattered with brick bats.
According to Patil, the site may have been formerly more extensive and large parts of it have been eroded by river actions. Some grey coloured pottery and iron chisels were also found in the ruins (Patil, 1963: 123; Chakrabarti and Lahiri, 1988: 45).

**Dulua:** Some structural remains are found strewn on the ground. Ghosh was informed that iron objects were found from this area (Patil, 1963: 122; Chakrabarti and Lahiri, 1988: 45).

**Namkum:** The site has yielded copper objects like bracelets and axe heads along with a number of iron arrowheads (Patil, 1963: 335; Chakrabarti and Lahiri, 1988: 45).

**Digi:** One bronze bracelet, two bronze anklets and two copper anklets were found from the site. The recorded iron objects include three bracelets and one ring (Roy, 1920: 415-417; Chakrabarti and Lahiri, 1988: 45).

The evidence from the sites of Barudih, Saradkel and the so-called Asura sites (Table 10), situated in the Chhotanagpur plateau definitely give us a clue about the nature of procurement of raw materials and the organized use of the same. The Chhotanagpur plateau and her resources are likely to be responsible for providing the economic basis for several agro-pastoral settlements and those acquired an urban or religious status from the early historical period onwards. The consistent role of these settlements as producers of several objects including iron for generations are well documented in the archaeological database. Ethno-archaeological data may also argue for the survivals of such settlement dynamics with well established non-farming subsistence strategies and the involvement of population groups in producing iron in form of ingots. The presence of extensive occurrence of slags and very fragile evidence of metal extracting infrastructure besides the distribution of present population groups traditionally involved in metal working are the common features noticeable in the above areas. The study of S.C. Roy on the Asura sites of the Netarhat plateau certainly substantiates the role of Asura population in iron extraction and production. Saradkel certainly assignable to the early historical/historical period acted as one of the major centres of iron production which met the demand of the same to other settlements of the plain, plateau and those in the plain-plateau continuum.
WEST BENGAL:
As mentioned in the introduction of the present chapter, the distribution of iron bearing sites in the district of West Bengal was studied by considering its geo-physical contexts.

In West Bengal, iron yielding sites are mainly found in four major physiographic divisions, fringes of the Chhotanagpur plateau, alluvial plains of the lower Ganga valley, a transitional zones between the two and coastal areas. Since the majority of the sites are distributed at the interface of the both lateritic fringes and alluvial plains it will be more pertinent to study the distribution of the sites along the river bed.

Iron bearing sites on the banks of the rivers Bakreswar, Mayurakshi and Kopai

Hatikra/Hatigra (23°49’25” N and 87°35’42” E): Hatigra is one of the major iron working settlements of West Bengal, situated adjacent to the undulating woodland areas of Santhal Parganas. Physiographically, it is located in the overlapping zone of the lateritic upland and the alluvium zone. The site is situated 24 km northwest of Bolpur on the right bank of the river Bakreswar. The mound measures 190 m from north to south and rises 2 to 2.50 m from the surrounding ground level. The site was subjected to excavation by the Department of Ancient Indian History, Culture and Archaeology under the supervision of N.C. Ghosh and A. Nag. The objectives of the excavations were i) to ascertain the cultural sequence of the site, ii) to find out the nature of the settlement spread during each of the phases and iii) to cross-check the evidence revealed by previous excavations at similar other sites in the region.

Four trenches (HTR 1, 2, 3 and 4) were laid at different locales of the site. Excavation revealed a habitational deposit of 2.40 m representing the Chalcolithic (Period I) and the Ferro-chalcolithic (Period II) periods with no intervening phase (Ghosh and Nag, 1984-85:116; IAR 1986-87:94-95).

Iron-free Period I is represented mainly by BRW (with out-turned rims, straight necks, angular shoulders, deep bowls/basins, dishes and channel spouted bowls), red ware (vase, bowl and dish), buff ware, a few grey and black wares. A few sherds of BRW bear thick lines in white pigment. Other finds include stone mullers, pounders, beads, terracotta beads, discs with and without perforations, balls, floors of rammed earth, post-holes and wattle-and-daub fragments. Fire places were also recorded from this level.
The earlier cultural milieu continues without any perceptible change in Period II. This cultural period is characterized by the introduction of a few wares such as BSW and fine grey ware. The settlement area during period II extended in area than that of the period I. Two floor levels have been encountered. The earlier one is more compact in nature, made of reddish clay with a hearth on it. Structural layout can be reconstructed from the positions of post-holes on both of them. Several half-burnt mud chunks with impressions of bamboo and reed have been recorded. The ceramic industry varies fine lustrous red ware to coarse gritty ware. The shapes are large jars, bowls, basins, shallow dishes, miniature pots etc.

Among other antiquities, mention may be made of stone mullers, pounders, sharpeners, stone beads and terracotta beads, balls, fragmentary figurines etc. Eight pieces of iron objects (including a corroded dagger) and few lumps of slags have been recovered.

**Metallurgical Analysis:** A dagger about 165.1 mm in length, 26.4 mm in breadth and 16.5 mm in thickness was metallographically examined (Table 11) (Ghosh, Nag, and Chattopadhyay, 1988: 21-27.). One end of the implement is rectangular in cross section and the other edge is a pointed one, and almost at the middle of the tool there is a small projection. The object was found covered with thick corrosion layer. The metallic core of the object was analyzed with the help of the ARL Quantovac. A small slice of the metal was taken from the flat end of the implement of which half portion was used for chemical analysis and the remaining for metallographic investigation.

The slice was forged to a thin section. The fire of the forge was attempted from a neutral flame, so that it might not pick up carbon from the flame. Three sparks recalibration have been taken.

It is to be mentioned here, that the value of carbon in the outer surface of the implement was much higher and it had been lost in thickly corroded zone. The other peculiarity of the composition is that the metal was found to be free from manganese, nickel, silicon etc. It is well known that the limonite iron containing 1.5 percent of $P_2O_5$ are found in plenty in these parts of Birbhum. Based on this fact, the authors presumed that the smelters of this site also used this particular ore.

The metallographic investigations of the other parts of the implement shows that it contains a trace amount of silica inclusion as slag, and no presence of sulphur could be detected in polished condition. Fr revealing the metallic matrix of the metal a 3 % Nital etchant was
used. Microstructure revealed was quite non uniform, a very common feature to all bloomery iron. The crystallized grain size in the ASTM standard was found from fine- 7 to 8 external surface to coarse – 2 to 3 at the central region. So far as carburization is concerned, a concentration of carbon was noticed more at the edges. The structure found was a normalised equixed one consisting of mostly ferrite and pearlite. As it is well known that ferrite is the structure of an almost pure iron and the pearlite is the aggregate of ferrite and cementite- a chemical compound of iron carbide.

Near the edges a typical structure called widmanstatten was found to be present along with pearlite. A photomicrograph was taken at a magnification of 100 later optically magnified to 1.5 times. The pearlites appeared to be broken lamellar at higher magnification of 500. The photomicrograph in this region was later magnified to 1.5 times.

It is to be mentioned that when hypoeutectoid steels are heated to temperatures considerably exceeding the $A_c_3$ point in the iron- carbon diagram austenitic grain growth is quite common. On subsequent cooling in addition to austentic grain growth excess ferrite precipitates as long plates or needled cutting across the pearlite grains. This unusual feature is probably owing to the stability or formation of co-occurrence of nitride needles in ferrite plates.

From the metallographic observation it is conclusively inferred that the metal under investigation is a low carbon hypoeutectoid steel. The manufacturing process indicates a long time exposure in either the smelting furnace or at the smithy forgings at a temperature around 1200°C. This ‘peculiar superheated normalised steel’ indicates that the metal was cooled in still air after final forging. The microstructure further indicates the following:

1. The implement was first shaped into a ‘bloom’.
2. The bloom was then shaped into an implement by heating in a hearth.
3. Subsequently, carburisation of the surface was taken place due to prolonged heating at around 1200 °C as evidenced by the widmanstetten structure.

The report of the Zoological Survey of India (IAR, 1986-87: 94-95) on the recorded animal bones from the site shows that the bones belonged to domesticated variety of humped cattles, buffaloes, pigs from period I. Nearly 60% of them belong to *Bos Indicus* Linnaeus (the Zebu or domesticated humped cattle). The bones of *Bos Biubalus bubal* is Linnaeus, however, are more numerous than other species in period II. The bones of zebu, pig and goat/sheep are also present in the later collection.
Thirteen soil samples (IAR, 1986-87: 95) representing entire span of habitation at the site (HTR 4), were analyzed by Indo-British Fertilizer Project, Durgapur for finding out % of phosphate, calcium carbonate, organic carbon, nitrogen, etc., content in the soil. Soil samples have been taken at 20 cms interval from entire habitational deposit of HTR-4. The analysis of the soils indicates that the maximum rise in the population had taken place in the mid level of period II. The higher content of some of them suggest increase in human activity and presence of a later domesticated animal in the habitational area. Only one C14 date, 2950±120 (1000 BCE) from the beginning of period II, is available. Chakrabarti observes that “One of the Hatikra dates (PRL – 1191: 2950±120 B.P. or 1000 B.C. is reputedly Chalcolithic in Ghosh et al., 1989 and Possehl 1989 but “Iron Age” in Agrawal et al., 1991) is 1400-1015 B.C. (calibrated)” (Chakrabarti,1993:182).

The above site situated in the lateritic uplands on the bank of the river Bakreswar and interlaced with several river channels were bestowed with congenial ecological set up for both iron production and consumption. The settlement, however, was self sufficient one subsisted on both farming and non-farming survival strategies. So far as the nature of iron working is concerned, there is no doubt that, the site had its own infrastructure to produce finished products of iron. Moreover, there should be no difficulty in visualizing the involvement of the site in primary smelting activities. However, its role in procurement network of iron may also be envisaged. As mentioned earlier, from the metallographic analysis of an iron object from the site it can be inferred that the said object was a low carbon hypoeutectoid steel. The manufacturing process indicates a long time exposure in either the smelting furnace or at the smithy forges at a temperature around 1200\(^0\) C. Thus, it is possible that the attainment of such technical skill was perhaps received at the site itself. However, difficulty arises while an attempt is made to place the site in the contour of the existing procurement network and to delineate its coherent role in the same, based on the retrieved database. I must also submit here about one of the limitations of the present work of not pursuing extensive fieldworks along the bordering areas of Jharkhand and West Bengal. Such endeavours could have successfully brought forth several information regarding the nature of correlations between the site and its immediate resource bearing areas.

**Haraipur** (23\(^0\) 52’ N and 87\(^0\)35’ E): The site is located along the Bolpur-Siuri road in the river valley of Bakreswar. The chronology of the site is yet to be established. The 2.6 m
thick ‘Chalcolithic’ deposit yielded plain and painted BRW, black-on-red ware, white painted red ware, a dull red ware, burnt clay nodules with reed impressions, a charred wooden pole (4cm in diameter), small beads, ground and polished stone celts, a stone pestle, and bone points. Significantly, ten child burials have been discovered. A small-scale excavation at Solkhana, Haraiapur, revealed a 3.5 m. thick occupation-strata represented by six layers. The lower four layers yielded both plain and painted BRW. In layers 5 and 4, a local grey ware, red-slipped, often on the outside and occasionally both on the outside and inside, was encountered. In layer 2, some fallen bricks of a structure were found. The bricks were seen resting on charred wooden logs lying horizontally. No specific mention has been made regarding the iron objects found from the site (IAR-1964-65:46).

**Kotasur** (23°58’ N and 87°45’ E) The site is located on the left bank of the river Mayurakshi in the Birbhum district about 5 km northeast of the Sainthia Railway Station. The site was excavated by the Department of Ancient Indian History, Culture and Archaeology, Visva Bharati University, under the general supervision of N.C.Ghosh and A.K. Nag during 1986-87 and 1987-88 (IAR, 1986-87: 95-96; IAR, 1986-87: 110-111). The total 3.60m excavated occupational deposit was broadly divided by the excavators into three levels i.e. upper, middle and lower in the first year of excavation. During the second season of excavation, however, a fivefold chronology has been suggested.

Period I is characterized by the presence of NBPW and iron. Indeterminate shapes of iron objects constrain us to explain its functional character. Occurrence of the remains of a couple of rammed floor levels made of mud indicates the nature of structural activity during the concerned period. The NBPW ware is inferior in quality and the sherds were found in meagre numbers. Besides, beads of terracotta were also recovered.

Period II is marked by the presence of fragments of moulded terracotta female figurines, ascribable to the Sunga period. The diagnostic shapes of bowls and other types mainly made of plain red ware from this phase are comparable to the identical shapes, found from cultural layers assignable to the Sunga period of different sites. The structural remains mainly consist of a few floor levels with post-holes.

Period III is represented by the presence of red ware, often treated with thick bright red slip. The pottery types include bowls, basins, ring-handles, pans, vases and jars. The occurrence of two baked brick walls of one and half course in width suggests proliferation of structural activity.
No specific mention has been made regarding the nature of iron objects, found from the periods II and III.

However, it is interesting to note that during the previous season of excavation i.e., 1986-87, (*IAR*, 1986-87: 95) remains of three hearths were recorded from the ‘mid-level’. Hearths II and III were brick-lined and number of iron slags were found around them. There is no doubt that the iron working activities must have been practiced here. However, the report contains no specific details about the association of ‘mid-level’ to any particular chrono-cultural phase/phases.

In all probability, the archaeological significance of Kotasur has been realized in the context of the settlement history of early historical Bengal. In the reconstruction of early historical paradigm of this region Kotasur has been considered as one of the representative settlements. The old habitational debris scattered on the low and high mounds of Kotasur signify its archaeological potentials. Unfortunately, apart from the stray exploration reports of archaeological findings and a small scale excavation at the site we remain unaware about the comprehensive features of the site. Moreover, the available data are inadequate to explain the different facets of cultural as well as other aspects of settlement history developed through the ages. Its cultural antecedence can be traced from the BRW associated EVF phases during which it was definitely involved in metal workings. Its role in the said metal working is comparable to that of the other sites of the fringes of the Chhotanagpur plateau particularly located in the district of Birbhum. What is remarkable is that the site was gradually crystallized to become one of the major settlements of Bengal during the early historical period. This is substantiated by the remains of mud fortification wall, 1 km in circuit and also perhaps part of an original surrounding moat. Its habitational character certainly changed and such ‘historically changing character’ acts on the settlements as a continuous process (Chattopadhyaya, 2003: 83). This changing character of the settlement was certainly guided by some authoritative control. It may not be unwise to visualize the significant role of the settlement in procurement network of metals which definitely contributed enough to obtain its early historical settlement dynamics. One must aware about the emergence of several geo-political units during the historical period and there should be no hesitation to identify Kotasur as a major activity area (in terms of its settlement hierarchy, socio-politico dynamics etc.) of *Uttara Radha* (one of such geo-political
We are in a safe position to assert the role played by the site in bridging the settlement dynamics of the North Bengal (*Pundravardhana bhukti*) with that of other parts of southern-western Bengal and even the littorals (*Vardhamana bhukti*).

**Kusumjatra** (23° 49'N and 87° 41'E): Kusumjatra is located about 1½ km south of Ahmadpur. The Palpara locality of the village is marked with thick occupational debris, spread over an area of about 3 acres. Chakrabarti and his associates found (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 129) BRW, red ware, microlithic flakes, iron slag and later pottery from the site. However, the recent excavation at the site by the Centre for Archaeological Studies and Training, Eastern India in 2009-10 has unearthed a ‘Chalcolithic Horizon’. Unfortunately no mention is made regarding the findings of iron (Chakraborty, Roy and Biswas, 2010: 51).

**Bahiri** (23°39'N and 87°40'E): The site received special attention by different scholars in the context of metal workings. Dilip K. Chakrabarti has meaningfully explained the archaeological significance of Bahiri especially in the contexts of its cultural antecedence related to iron workings in a very precise manner. The site is located approximately 7 km east of the large market town of Bolpur in the district of Birbhum. The village of Bahiri is locally known as a “village of eighteen neighbourhoods”. The river Ajay flows about 6 km south of the present village. Its archaeological heritage was first noted by Dilip K. Chakrabarti (Chakrabarti and Hasan, 1982: 111-149) during the course of a brief reconnaissance in the district of Birbhum on behalf of the Visva Bharati University in January 1981 (Chakrabarti, Nag, Chakrabarti 1981, 25-32). Three occupational areas were reported. Subsequent survey (cuttings/section scrapping) in March 1981 on behalf of the Delhi University has revealed an extensive occupational remains and cultural debris or otherwise (though ‘considerably disturbed’) in the eastern outskirts of the village.

One of these areas is locally called ‘Chandra Hazrar Danga’. This particular area has been encroached upon by cultivable fields, modern houses and ponds etc. In its existing form, it measures 80 m north-south and 70 m in east-west with a circumference of roughly 250 m and a height of about 2 m from the level of surrounding plain. The second occupational area was recorded at the mound which is topped by a modern school. It is roughly about 90 m (north-south) and 70 m (east-west) with a circumference of 250 m. During the course of surface survey, no sherd of BRW was noted. The nature
of cultural assemblage suggests the scholars to ascribe the same to the Gupta-post Gupta period.

The third occupation area is situated almost opposite to the primary school mound, on the other side of Bolpur-Palitpur road. This is a low mound, hardly 1 m high, but is quite extensive, roughly 300 m in circumference. A few specimens of BRW have been documented along with a few sherds which according to the scholars are similar to those found from the Pala occupational sites of West Bengal.

There were four cuttings (BHR I, II, III and IV) taken at different edges of the pond. A comprehensive cultural sequence based on retrieved data unearthed from these cuttings is as follows (Chakrabarti and Hasan, 1982: 113).

Period I: 1000-500 BCE.
Period II: 500-200 BCE.
Period III: 400-600 CE.

The floor level of BHR I has survived only in a patch. This is associated with the earliest occupation (Period I) in this cutting and, in fact, overlies natural soil. The floor has been rammed by a thin layer of plain earth and probably polished with water and cow dung. The excavators inferred that this floor level forms the part of a courtyard. Besides, the remains of a kiln were exposed at earliest level of BHR VI. A 2m wide wall with a foundation having three off-sets was detected at the layer 3 of BHR VI and above this were traced ten courses of brick alignment. Based on the size of bricks i.e., 40 x 28 x 7 cm and associated ceramics excavators prefer to assign this to the Gupta post-Gupta period. One should also note that there is a patch of sand between the layers 4 and 3 in this cutting. It is likely that the surface of the level 4 exposed for a considerable length of time to allow the sand to be deposited.

Ceramics of Period I are BRW, black ware, red ware and dirty buff ware.

BRW: Within these two basic colour schemes (black on the inside, sometimes over the rim as well and red on the outside), there is a noticeable range of variations in shades. The shades of black hover between fine and crude whereas there are many shades of red including those of chocolate, orange and grey. This variation may occur due to environmental factors. However, the specimens can be conveniently grouped into two general types 1) those which show a generally outward-turning rim and a well-defined angle between the rim and the body and 2) those which can easily be categorized into the class of slightly in-curved bowls, more often than not externally grooved. The fabric of
this invariably wheel-made pottery is generally medium to coarse. The core is invariably of a darkish hue, showing red upper crust in section.

Beside this plain variety, 15 specimens of white painted BRW have also been recorded. The whitish designs such as linear strokes, dots and herring bones were applied before firing.

Black ware: The sherds of black ware can mainly be categorized into three basic types, i.e., 1) those with thin grey section, fine slip, and a well burnished, smooth and almost glossy finish both outside and inside, 2) those with greyish dark surface and perhaps, originally had a black slip and 3) a coarse type which are ill fired specimens having clear signs of dabbing.

Red ware: There are many shades in red ware, depending on the quality of slip and the extent to which it has survived. The fabric varies from coarse to medium. These are well-fired specimens.

Dirty buff ware: The colour of this ware is dirty buff which happens to be the colour of original clay. In some cases, a red slip seems to have been applied but the slip has peeled off revealing the original clay colour.

In period II red ware mainly predominates the ceramic assemblage. Besides, a few sherds of BRW, grey ware, BSW also occur. The red ware is well-fired, of medium to coarse fabric and of different shades. Some specimens also carry fine slip.

Period III is marked by the presence of buff ware with a solitary specimen of black ware. Besides these, red painted ware and incised pottery were documented from different cultural layers.

A substantial number of implements made of splintered bones and bone arrowheads have been recorded from period I. A few of them also comes from the early historic period. All these specimens unmistakably reveal cut marks. Some of the cut marks are so smooth and well-defined that one wonders if metal implements were used in their manufacture.

The excavations have also yielded pottery discs, burnt, semi-burnt, and unburned pieces of clay with reed impressions, antlers, fossil wood etc. The stone objects, unearthed from the site include 6 beads of semi-precious stones. Terracotta objects comprise beads, net sinkers, animal and female figurines besides a few unidentified specimens.

Copper is found in negligible quantity from period I. They include only three fragments. Two of them may be fragments of a small ring while the identification of the third specimen (an ‘S’ shaped wire) remains uncertain. The last specimen has been chemically
analysed which shows a 10% deliberate alloying of tin with copper. The ore was probably malachite or arudite. The source of tin might be cassiterite.

Large number of animal bones has been found from period I of Bahiri. S. Banerjee of Zoological Survey of India has identified among them the species like cattle, buffalo, pig, dog, “chital” deer and cervus sp.

The occurrence of iron slag (Chakrabarti and Hasan, 1982: 120) and related materials at the site deserves a detailed discussion. The iron slag bearing layer 3 of BHR II and III corresponds to the layer I of BHR I. Excavators assumed that the iron smelting activity taken place at the former extended to that of the latter. BHR I is located in a cultivated field with its upper deposit cut away. Therefore, the correlation between the layer 3 of BHR II and III and layer 1 of BHR I is quite obvious. The distance between BHR II and I is about 20m in an almost straight line. The concerned layer is rich in iron slag though the intervening portion between BHR II and III is somehow disturbed by the excavation of a pond, thereby restricting our scope to unveil the nature of iron smelting activity in details. The occurrence of the clay nozzle with vitreous glaze, probably due to its exposure to fire of the furnace at layer 2 of BHR II suggests the continuation of the iron smelting activities during the subsequent periods.

Small pieces of slag have been found in layers 3 and 4 of BHR 1. There is only 1 piece from the layer 4 but there is no doubt about its being a piece of slag. So there was familiarity with iron smelting even before the level which witnessed large scale iron smelting activity. In BHR V small pieces have been recovered from the layers 4 and 5. In BHR VI, layer 6, a small piece of slag has been found. What lends further interest to the specimen is that it was found close to the kiln on top of the natural soil in that cutting. In BHR VII, iron slag occurs in layer 6 above the natural soil. While summarizing the occurrence it has been observed that out of seven cuttings, iron slag has not been found earlier than the layer 3 in three cuttings (BHR II, III, VI). However, the evidence from BHR I clearly indicates that iron slag occurred at the site before this level. In BHR V, VI and VII small pieces of slag have been found in a limited number in the level immediately above the natural soil. This may suggest that the occupation in these later cuttings is somewhat later than that of the cuttings BHR II, III and IV.

**The occurrence of iron slag (after Chakrabarti and Hasan, 1982: 120):**

<table>
<thead>
<tr>
<th>Cutting</th>
<th>layer</th>
<th>materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>BHR I</td>
<td>1</td>
<td>slag</td>
</tr>
</tbody>
</table>
BHR I   2    slag
BHR I   4    slag
BHR II  1    slag
BHR II  2    slag, nozzle of clay tube in the furnace; the nozzle has a vitreous glaze on the surface due to its exposure to furnace heat.
BHR II  3    slag
BHR III 3    slag
BHR IV  1    slag
BHR IV  2    slag, an earthen crucible
BHR IV  3    slag
BHR V   4    slag
BHR V   5    (immediately above the natural soil); Slag
BHR VI  6    (immediately above the natural soil); Slag
BHR VII 7    (immediately above the natural soil); Slag

**Metallurgical Analysis:** Two slag specimens were metallographically analyzed (Table 12) (Chattopadhyay, 1993-94: 159-163). These are from BHR VI, layer 6 and BHR IV, layer 3. The slags are dark brown in colour, friable and non-magnetic. The former one was obtained above the natural soil and was covered with a layer greenish in colour which indicates that the deposit containing slag had probably suffered a prolonged water logging. Both these specimens have been chemically analyzed though mineralogical studies were made for the former one. The mineralogical constituents were obtained at a magnification of 200X. The principal constituents include 46 % ore phase, which contains 39 % magnetite and 7% wusite. In the non ore phase of total 56 %, fayalite is 36 %, anorthite/hercynite is 15 % and glass phase is about 5 %.

Ore specimens have also been collected from the vicinity of the site, the analyses of which shows that its chemical constituents were of local limonite/ laterite ores. The analyses (Table 13) were done by wet chemical method. The specimen contains 10.23 %
The above summary of primary findings reported by Chakrabarti from Bahiri provides some scope to explain its role as one of the representative iron producing settlements in the procurement network of metals in this region. Its close proximity to the other settlements like Mahisadal, Batikar, Bergram, Khushtigri etc. in the district of Birbhum also substantiates the fact that these sites carry a homogenous character so far as the nature of iron working and the consumption of the same are concerned. It may not be unwise to record that the population involved in the process of production and distribution of iron in the said region also maintains a societal homogeneity within a broad settlement network.

Mahisadal/ Mahisadal (23°42’ N and 87°42’ E):

The nature of metal working at Mahisdal has enough similarity with that of Bahiri. Unfortunately, paucity of retrieved data from the concerned site has constrained us to explain different facets of the settlement dynamics related to metal workings.

The site is situated in the southern part of the district Birbhum on the left bank of the river Kopai. The mound at the site is located about ¼ km south west of the modern village near the railway bridge on the river kopai. R.P. Das had given an estimation regarding the size of the site which is (230X135) m or about 7.76 acres. However, according to Chakrabarti and others this could be an exaggeration (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 125). A small scale excavation (IAR 1963-64: 59-60; Ghosh 1989: 267-268) was conducted at the site by the Eastern Circle of ASI in 1963-64. Excavation revealed two cultural periods without any break, the later characterized by the use of iron.

The ceramics of period I include BRW, plain or painted in white as well as in black, black-painted red ware, of which there were only a few sherds, red ware bearing incised fillets, plain red ware, and black ware, sometimes with incised and pin-hole decorations. The lipped or channel-spouted bowls, carinated bowls with splayed-out or flaring rims and convex-sided bowls with sagger-bases were usually common to all the wares. Painted designs include oblique strokes, sigmas and interconnected loops. In period II, the ceramic tradition of the earlier period continued, but the fabric became coarser. A new feature was the occurrence of buff and grey wares. Clay daubs still remained the mode of house buildings. Only one floor level has been discovered from this period.
In period II microliths still continued to occur. Among them different types of lunates were common. Beads of steatite and other semi precious stones were found from the site.

Terracotta figurines and objects were also unearthed. Of special interest are small clay sealing with two symbols and a fragmentary terracotta figurine of an elephant in motion. Copper objects continued to be used by the people of period II. They consisted of fish-hooks, pieces of bangles, rings etc. Copper slag is also found.

The period II at Mahisdal saw the emergence of the use of iron from the very beginning. Iron objects of the period include arrowheads, spearheads, nails, chisels etc. A large quantity of iron ore and slags are also found from this phase. All of these according to S.K. Mukherjee are indicative of the attainment of developed metallurgical skill during this period (Ghosh, 1989: 267).

Four C14 dates are available from Mahisdal, three from period I and one from period II. The three C14 dates from Period I are 1380 BCE, 1085 BCE and 855 BCE (Ghosh, 1989: 267). According to Chakrabarti, the earliest calibrated date range of Mahisdal is 1619-1415 BCE. The C14 date from ‘Early Iron Age’ Mahisdal is 690 BCE (Chakrabarti 1999: 242).

**The above brief report is quite inadequate to evaluate the nature of iron working at the site, however, the presence of some finished tools and iron slags suggests its role in both iron production and consumption. Furthermore, the location of the site in the same ecological niche as that of Bahiri guides one to consider Mahisdal as one of the representative sites of both iron production and consumption (in this region). It is worth mentioning that Muluker Danga, a distinct iron ore bearing landform had close access from both the settlers of Bahiri and Mahisdal.**

**Nanur** (23°42’ N and 87°57’E): Nanur, on the bank of the river Ajay is located about 20 km northeast of Bolpur along the Bolpur Kirnahar road. The mound was excavated earlier by K.G. Goswami on behalf of the Asutosh Museum, University of Calcutta in 1945-46. The site was again excavated by the Eastern Circle of ASI in 1964 (IAR 1963-64: 60). The mound situated here is named after the famous Bengali poet Chandidas as Chandidas Bhita. The mound is intensely occupied by the villagers and much of it is destroyed. However, the excavation of 1945-46 could not identify BRW at the site. The excavation of 1964 revealed that the site was under occupation from the protohistoric to modern times intervening through the historical and the medieval periods. The lower
levels of the site are comparatively undisturbed and are divided into two periods. Period I, identified as the ‘Chalcolithic’ phase, yielded plain and white painted BRW, plain and black painted red ware, grey ware, a number of bone tools and a few copper objects. Period II, labelled as a ‘Degenerated Chalcolithic’ phase, yielded similar remains as Period I besides, iron objects (Ghosh, 1989:309; Chakrabarti, Nag and Chakrabarti, 1981:25-32). No radio-carbon dates are available from Nanur.

Explored Sites:

**Potanda** (23°53’N and 87°35’30”E): Potanda is located about 4 ½ km east of Siuri. The site is known to have yielded sherds of BRW and other ceramics of the EVF phases, microlithic flakes and Neolithic celts of the pointed butt end variety (*IAR* 1964-65: 46 and *IAR* 1965-66: 84). The mound is now severely disturbed by the excavation of several ponds and the encroachment of modern habitation (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 128). The estimated extent of the site is about 3 acres. A substantial amount of iron slags have also been recorded from the site which clearly indicates the significance of the site in iron working.


**Behariya** (23°50’N and 87°36’E): The site is located about 1-1 ½ km south of Purandarpur. (*IAR* 1967-68: 68) It was reported as a BRW bearing site. Field survey (Chakrabarti, Sengupta, Chattopadhyay and Lahiri: 1993: 128) has recorded the occurrence of an ancient mound, located on the eastern part of the village known as Kalitala which covers about 2 acres of area. Apart from the fine and coarse varieties of BRW, the site has yielded microlithic flakes, iron slag and other early historic ceramics.

**Sindurtopa** (23°49’N and 87°40’E): The site is situated about 1 km southwest of Ahmadpur. The site has been previously mentioned as BRW bearing EVF site (*IAR* 1971-72: 81) Chakrabarti and his associates (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993:129) recorded red slipped and grey wares, microlithic flakes, varieties of stone pieces and iron slag at the site. Increasing encroachments of cultivated land in and around the site have virtually obscured the heritage of the site.
Kagas (23°52’N and 87°41’E): Kagas is located about 4 km north of Ahmadpur in the lateritic gravel tract. An extensive deposit of cultural debris is recorded to the east of the village. The mound is virtually destroyed by the encroachment of modern habitation. Chakrabarti and his associates (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 129) estimated the original area of the mound which is nearly 2 acres. The place is marked by the occurrence of BRW, grey ware, microlithic flakes and iron slags.

Nirbhaitala (23°52’N and 87°41’E): The site lies adjacent to the village of Kagas (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 129). The exploration by Chakrabarti and others revealed the presence of an elliptical shaped undisturbed mound measuring 5-6 acres in extent. Occurrence of BRW, red and grey ware, microliths, iron slags etc are noticed at the site. Unfortunately, the site remains unexcavated.

Jashpur (23°46’N and 87°26’E): Jashpur is located about 1 km east of Dubrajpur. The site is known for its painted BRW, red ware and microlithic findings recorded during early sixties (IAR, 1962-63: 43). Chakrabarti and his associates (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 126) have found red slipped ware, pieces of greenish stone bowl, microlithic flakes, iron slags. The area was extensively used for pre-industrial iron smelting activities.

Pachhira (23°46’N and 87°25’E): Pachhira is located about 5 km east of Dubrajpur. The site yielded ‘late stone-age’ tools, BRW, beads of agate, fragments of crude glass bangles (IAR 1965-66: 85). Chakrabarti and his associates only recorded (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 126) red and chocolate ware at the site. The site covers an area of about 2 acres. There are outlines of a number of iron smelting furnaces on the eroded surface of a laterite outcrop nearby.

Kendula (23°46’N and 87°23’E): The site is located about 1½ km east of Dubrajpur. The occupational debris is recorded at the edge of cultivated fields in the southern part of the village. The estimated area of the site is about 2 acres (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 126). The site has yielded BRW of fine quality, slipped and coarse red wares, microlithic flakes, iron slag, remains of reed impressed burnt mud plasters, chunk of cherty stones etc.

Batikar (23°45’N and 87°31’E): The site, located about 13 km south of Siuri town, was identified as BRW bearing EVF settlement (IAR, 1967-68: 68). The Mairapara locality of the village is marked by thick habitational deposit. Besides BRW of thick and thin...
fabric, the site has yielded BSW and black ware, iron slags, Neolithic celts etc. (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 128).

**Kurmitha** (23°44'N and 87°31'E): Kurmitha lies 3 km south of Batikar. The mound of archaeological significance, locally known as Thakurkurjali Danga is situated inside the modern village. Its estimated original extent is about 1 acre. Chakrabarti and his associates (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 126-127) during exploration found fine and coarse red ware, BRW, microlithic flakes and iron slags from the site. They also have reported the occurrence of a skeleton which was found embedded in the exposed section in the western part of the mound. It was found lying in the black soil horizon with both arms flexed at the elbow and the hands placed on the shoulders.

**Khustigiri** (23°45'N and 87°33'E): Khustigiri is situated about 2 km east of Batikar. The site is about 3 acres in extent (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 128). The site is known for the occurrence of BRW, grey ware, red ware, chocolate and red slipped wares, microlithic flakes and iron slags. The banks of local ponds and road-side sections scattered with old occupational debris including iron slags provides some information about the importance of the site.

**Hansra** (23°43’N and 87°33’E): Hansra and Gorapara are the two adjacent villages. Earlier Hansra is stated to have yielded channel spouted bowls (*IAR*, 1967-68: 68) in BRW. Chakrabarti and others (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 128) noticed that the modern village overlies the ancient habitational deposit. From the surface of the mound they have collected BRW, grey ware, red slipped ware, microlithic flakes and iron slags.

**Bergram** (23°43’N and 87°34’E): The site is situated along the Bolpur-Purandarpur Road about 6km northwest of Bolpur. Channel spouts in BRW are reported from the site earlier (*IAR* 1967-68: 68). Chakrabarti and his associates (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 128) have recorded occupational debris containing substantial amount of BRW sherds. They have also collected sherds of red slipped ware, microlithic flakes and iron slag from the site.

**Nachansaha** (23°41’N and 87°36’E): Nachansaha is located 6 ½ km west of Bolpur town. The mound of archaeological importance is located on the northern portion of the village and is about 2 acres in area. The mound has been substantially damaged by the
excavations of ponds. It has yielded BRW, red slipped pottery, microlithic flakes, burin in quartz and iron slag (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 128).

**Beluti** (23° 42’N and 87° 49’E): The site, located along the Bolpur-Nanur road about 13 km east of Bolpur represents a significant EVF settlement. Absence of substantial materials related to iron workings, is a major constraint to note its role in the iron procurement networks (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 125). Sherds of BRW, broken pieces of channel spouted bowls, sherds of lustrous red ware painted in black and perforated potteries (*IAR* 1963-64:.59) have also been reported from the site. P.C.Dasgupta (Dasgupta 1964: 41) had collected microlithic waste flake and fragment of fossil wood from the site. Continuity of occupation at the site is attested by the presence of Gupta and post-Gupta bricks and other artefacts of the contemporary period.

**Kirnahar** (23° 45’N and 87° 53’E): The village is situated 5km north of Nanur. The mound, locally known as Chandidasar Pat lies on the Paschim para area of the village. The present mound measures about (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 125) a little more than one acre. BRW, red slipped ware, BSW with incised designs, microlithic flakes and tools, iron slags are collected from the site. The site is also marked by extensive brick structure of the later period.

**Charkalgram** (23° 41’N and 87° 51’E): It is situated about 5km south west of Nanur. The site is quite extensive and covers an area of about 6 acres (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 129). The ancient occupational deposit is located in the western part of the village and locally known as Kholakuchir math. Chakrabarti and others have observed the presence of BRW, red and grey ware, microlithic flakes and iron slag at the site. Later occupational debris is also noticed there.

**Iron bearing sites located in the Khari basin:**

**Banesvara Danga** (23° 24’N and 87° 59’E): The site (in the river basin of Khari) is situated in the village of Barabelun, P.S. Bhatar in the district of Burdwan. Field survey by the Directorate of Archaeology, Government of West Bengal under the supervision of D.K. Chakraboryt and S. De in 1972 has resulted in the discovery of a number of black painted red ware and BRW (both plain and painted in white and cream on interior) sherds from the rain gulleys of the site. It was excavated by the same department during the field season of 1973-74 under the directorship of P.C. Dasgupta (Ghosh, 1989: 52-53; Mukherji, 1993-94: 80-143).
The present mound is 4.28 m high from the village path around which again is 1.63 m high from the level of the surrounding paddy fields. It covers an area of 272 feet (84m) x 204 feet (63 m). In all, four trenches were laid out covering the steep slopes and the crest of the mound- BND I to the eastern side of Siva temple, measuring 6m x 5m; BND II to the east of that temple, 6 m x 5m; BND III to the east of that temple and to the north of BND I, 5 x 2.50m (Mukherji, 1993-94: 87-88).

The aim of this digging was to unravel the cultural sequence of the site which revealed cultural materials of five periods intervened by some sterile layers.

Period I consisting of layer 9 and its sub-layers represents ‘Early Chalcolithic’ period

Period II comprising layers 8 and 7 with their sub-layers represent ‘Late Chalcolithic’ period

Period III comprising layers 6 and 5 with their sub-layers represent Transitional –Early Iron Age

Period IV comprising layers 4 to 2 with their sub-layers represent Early Historic- post-Gupta to Pala period.

Period V consisting of layer 1 represents late medieval period.

Iron was introduced in period III. The cultural ensemble of period III consists of objects of bones, beads of semi-precious stones and terracottas, animal bones besides ceramics.

In period III, red ware (mostly with a red wash), BRW (not so glossy), BSW (not so glossy) and grey ware pots were more numerous. Subsequently, the number of sherds of these wares decreased considerably while that of the terracotta red ware increased. The pottery types in the first four wares consist of jars, *lotas*, bowls, dishes and lids. The types and forms made of terracotta ware comprise jars, basins, cups, sauce pans, lamps and spouted vessels. The percentage of both sides- slipped red ware pottery is 41. 7% while that of one side (exterior) slipped ware 58.3 %.

Stone tools found from this period include one blade made of quartz, fifteen flakes, twelve of quartz, one of flint and two of chert, one core tool made of quartz, one tranchet made of quartz, one lunate made of quartz, one parallel sided blade made of chert and one backed blade made of quartz.

Among copper objects found from this period, mention may be made of 3 beads of disc shape, 1 copper pellet (probably a bead), 1 fragmentary copper bangle and 1 ear-ornament have been found from period III.
Period IV is represented by ceramics made of red polished ware, terracotta red ware, grey ware and BSW. The common types are sprinklers, spouted vessels, sauce pans (mostly in red wash ware), pans and cups (in terracotta red ware). Besides, beads of semi-precious stones and animal bones have been yielded in substantial numbers besides iron objects. In periods III and IV, lime-plastered floors were commonly made. Sometimes, post holes were noticed in these floors (bamboo or wooden posts were used for raising huts). An oven was also exposed on the floor. Among copper objects, a pendant deserves special mention.

Profusion of iron slags have been obtained from the site. They were mostly recovered from layers 3E to 6 i.e., from periods III and IV. As many as 5 iron objects - swords or spearheads mostly fragile or mutilated have been unearthed from layer 2D of BND II ascribable to period IV and layers 6 and 6A respectively of BND II and I belonging to period III (Mukherji, 1993-94: 108, 112).

<table>
<thead>
<tr>
<th>Period III:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Iron spearhead or sword (?); BND I, Layer 6A, Depth 2.60m</td>
</tr>
<tr>
<td>2. Iron object (fragmentary piece); BND I, Layer 6A, Depth 2.62m</td>
</tr>
<tr>
<td>3. Iron spearhead (?); BND I, Layer 6, Depth 2.30m</td>
</tr>
<tr>
<td>4. Iron object (mutilated), BND II, Layer 6, Depth 2.30m</td>
</tr>
<tr>
<td>5. Iron object (mutilated), BND II, Layer 6, Depth 2.07m</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Period IV:</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Iron sword (mutilated piece); BND II, Layer 2D, Depth 0.70m</td>
</tr>
</tbody>
</table>

Exploration in and around the site has revealed several occurrences of potsherds, iron slags and other habitational debris. The mound of Banesvara Danga (temple complex of Banesvara Siva) however, during excavations yielded the evidence of iron consumption at the site and of course provides some idea about its involvement in the procurement networks of metals.

**Arra** (Santal Danga) (23°22’N and 87°55’E): Arra is located 13 km northeast of Burdwan Sadar town, near Amarun Railway station. An archaeological reconnaissance at the site conducted by the Directorate of Archaeology, Government of West Bengal has resulted (Ghosh, 1989: 53) in the recording of bowls and basins of BRW and dish-on-stand of red ware. A partially exposed extended human burial was recovered from the site. Another specimen of urn burial has also been exposed from a nearby area of the
site. The urn was quite large, made of BRW and found containing spiral bangles of copper, beads and a few bones. Other surface finds from the site include beads of agate, carnelian and other semiprecious stones, copper and microliths. Though no report regarding the repertoire of iron objects is available from the site, there is no doubt it played its respective role in the existing procurement network of metals and also consumed iron in substantial amount. The charcoal samples collected from the site gives a radio carbon date (IAR 1984-85: 159) of 2860+/-120 (910 BCE). The estimated original extent of the site is about 5 acres (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993:130). At present the mound is mostly destroyed due to natural erosion and human interventions.


**Iron bearing sites in the river valleys of Ajay and Kunur**

**Pandurajar Dhibi** (23°25’N and 87°39’E) in the Ajay valley, Burdwan district, is the first excavated EVF site in eastern India. The site is situated in the village of Panduk, P.S.-Ausgram, on the right bank of the river Ajay about 10 km away from the Bhedia police station. The extensive mound at the site is about 5m high and has an area of approximately 8 acres (Mukherjee, 1967: 36-42; Dasgupta, 1964, 1981; Mukherji, 1992: 5-9, 9-15; Chakrabarti, Sengupta, Chattopadhyay and Lahiri 1993: 133) The site was excavated from the field seasons of 1961-62 to that of 1964-65 and again resumed in 1984-85 by the Directorate of Archaeology and Museums, Government of West Bengal. In spite of differences in identifying the cultural stratigraphy, excavations between 1962 and 1985 (IAR 1961-62:59-62; 1962-63:43-46; 1963-64:61-62; 1964-65:46-48; 1984-85:97-98; Dasgupta, 1964, 1981), unfolded a long cultural sequence ranging apparently from the pre-metallic EVF phase to the medieval period.

Based on the retrieved artefacts and exposed structural remains yielded from the excavations of four consecutive years i.e., from 1961-62 to 1964-65, the cultural
sequence of Pandurajar Dhibi was divided by the excavators into four periods (IAR 1962-63: 43). These are

Pd I: ‘Chalcolithic’
Pd II: ‘Prosperous Chalcolithic’
Pd III: Iron Age with an overlap with the preceding culture (phase a)
Pd IV: Early Historic and Medieval (phase b)

However, due to some anomalies in the interpretation of cultural sequence and material remains, the Directorate of Archaeology and Museums, Government of West Bengal resumed excavation at the site in 1985 (Mukherji, 1992: 11-15). The cultural sequence as revealed from the excavation is as below:

Pd I: c.1600 BCE- 1400 BCE. This period has yielded handmade dull red ware and grey ware.

Pd II: c.1200 BCE- 900 BCE. The ceramic industry of this period comprises black-on-red ware, BRW, white painted and ochrous red ware. Copper objects, bone implements, beads of semi-precious stone, terracotta figurines of mother goddess are also recorded from this cultural period. Iron implements are found from the upper level of this period.

Pd III: c.899 BCE- 600 BCE. Ceramic industry is characterized by black-on-red ware, plain and painted BRW, white painted red ware, black polished and incised ware, buff ware. Terracotta beads, bone implements, copper objects and iron implements are found from this period.

Pd IV: c. 599 BCE- 300 BCE.

Pd V: c. 200 BCE- 2nd century CE

The excavation has yielded 59 copper objects and 15 iron objects.

Iron appears in Period III which has yielded one spearhead and one dagger. However, proliferated use of the same has been witnessed in the subsequent period IV. The tool repertoire includes two spearheads, four daggers, one nail and one disc. The succeeding period V has yielded altogether five specimens which comprise hook, arrowhead, engraver, plate and spearhead. However, trial digging in 1985 suggests limited use of iron at least from the upper layers of the cultural period II.

Period II of Pandurajar Dhibi has yielded a number of floor levels. They were mud plastered, sometimes burnt and often washed with lime. Occasionally these floors were also rammed with pellets of laterite or nodules of clay mixed with cow-dung. Lime
plastered ovens are also found on these floors. These floors were occasionally flanked by lanes. In trench no. 6 E an undetermined structure/floor with double curves and a small bench or altar was found.

The people of period III also lived in mud huts. These houses had floors of pelley laterite like the earlier phase (Dasgupta, 1964: 26). From Pd III, Dasgupta reported the occurrence “of a storage bin or pit abounding with a huge quantity of charred rice” (IAR 1964-65: 47-48). The houses were associated with ash pits and sullage pits. However, the most interesting feature of the period was the presence of six elliptical ovens, which were arranged in a row (IAR 1964-65: 47). They were flanked by a thick layer of ashes, containing a broken sword blade of iron and iron slags. These according to the excavators may be indicative of the iron smelting activity at the site.

Period IV, which followed after a lapse of time, showed two principal phases, the earlier of which related to the early historical period. The structural remains were represented by walls of baked bricks and a mud-oven at period IV. Foundations of a baked-brick (45 x 25 x 5 cm. and 40x20x5 cm.) structure were also noticed from period V.

The ceramics of period II was mostly wheel made (Dasgupta, 1964: 24-26; Bandyopadhyay, 2006: 72-105; Karchaudhuri, 2007: 170-178). The main ceramic types are plain and painted BRW, lustrous red ware, red slipped ware, mat red ware, chocolate or buff wares, BSW etc along with the basic types recorded from period I. A substantial number of BRW sherds are painted in white or cream generally inside the pots on black surface. The red wares are often painted in black or white on one or both the sides. The painted motifs are geometrical including the patterns like oblique strokes, dots, hyphens, chevrons, rows of curved strokes solid triangles, hatched diamonds, lattices, ladders, wavy lines sometimes flanked by sigmas, stars etc.

The characteristic ceramic industry of Pd II continued in the Pd III, though there are certain variations in their shapes and surface treatment. The plain and painted red ware, plain and painted BRW with their characteristic designs like criss-cross, ladder, horizontal bands, solid triangles, dashes, dots etc continued in this period. However, plain and painted BSW outnumbers the other ceramic types. The initial occurrence of BSW can be traced back to the upper phase of the earlier period. The paintings on this ware are executed in white or cream, akin to that found in BRW. Black burnished ware having decorative incised and stylized motifs was introduced in this period. The decorative motifs, include a pea-hen or crane holding a snake in its bill, a row of fish...
with a hatched design, pipal leaves, bull, ripples of water, hatched triangles, scallops etc. The BSW sometimes show pinhole and incised decorations.

The major shapes in BRW found from these iron bearing EVF phases consist of bowls, handis, vessels, basins, goblets (khuri), funnels (kupi) and channel spouted bowls and Jambati. Mainly six types of BRW bowls are identified from the EVF phases of the site. They were probably used for storage, serving food, as table ware, measuring pot, in religious use etc. Carinated handis with round profiles have also been recorded. They probably served multifarious functions like cooking, storage etc. They are first found in period II and the use of the same continued to period IV. The red wares can be considered as the most significant associated ware of BRW. Vessels are predominant in this ware. Besides, there are different types of bowls and handis. Red ware first appears in period II and continued to the historic period (period IV). The types found in black ware are plates, handis, bowls, jugs, channel spouted bowls etc.

So far as the shapes and sizes are concerned, both black ware and BRW have many common features. It may also be pointed out that, in some cases, the discarded BRW has been transformed into black ware by coating it with black slip. The most commonly occurred shapes in this ware are bowls and plates. Black ware is found in Pandurajar Dhibi from period I onwards and continued up to period IV (c. 600 BCE to c. 300 BCE) though in period I their number was restricted. Most of the black wares from the site are found from period IV. The ceramics of period IV are varied and include black polished ware, black on red ware, red ware, painted in translucent white or cream, pale-red ware and decorated red ware. However, a few sherds of the NBPW have also been reported. In this period the channel spouted bowls in BRW and other characteristic painted wares and incised and perforated wares continued, though in lesser number. Of the channel-spouted bowls, those recovered from the earlier levels are finer in fabric and are painted in a fugitive white pigment, while those from the upper levels are coarser in fabric and show a variant form of the spout. A few plain storage-vases of thick fabric, saucepans with handles, lids with central knob and conical bowls have also been reported.

In period V the painting tradition in pottery deteriorated.

An Analysis of the bone tools from the cultural phases of Pandurajar Dhibi shows that the repertoire includes the following tools: 1) points and arrowheads of tanged and socketed varieties made of both antler pieces and split bones 2) awls 3) bone pins or styluses 4) borers, 5) antler pieces etc. They served multipurpose. On the basis of their
use they can be divided as 1) hunting tools/ non-farming activities, 2) tools for domestic use such as boring, sewing etc, 3) implements used for ornamental purpose such as a bone pins (Bandyopadhyay, 2006: 124-127).

Among 92 objects, 13 were obtained from period I. Period II yielded 10 objects comprising points (6 in number) and socketed arrowheads (4 in numbers). The number comes down to seven in period III in which the nature of objects is same i.e., points and socketed arrowheads. The multifarious utility of bone/antler objects in period IV is evident from their diverse types. The repertoire from period IV includes 25 specimens of socketed arrowheads, 12 points, 4 borsers, 4 antler pieces, 2 arrowheads, 2 daggers, 2 chisels, 1 awl, 1 stylus, 1 pin, 1 blowpipe, 1 scraper, 1 nail, 1 blade, 1 bangle and 1 decorated bone pipe. Period V has yielded only 2 specimens of points. These bone objects, according to tests made by Zoological Survey of India were made of bone pieces of mainly wild species such as deer, carnivores etc. Some of the bone tools bear cut marks by sharp instruments.

Microlithic tools like point cum scrapers, spearheads, flakes, points, cores, blade-burins were recorded from period II. Some of the blades are made by crested medial ridge technique. Among the raw materials mention may be made of chert, fossil wood and green jasper. Microlithic tools of period III comprise flakes, fluted cores, parallel sided blades. A scraper cum blade of red carnelian had also been recovered from this phase.

A polished celt was found from period III in the year 1961-62 (IAR, 1961-62:61). Neolithic celts were also discovered from the same period in 1964-65 (IAR 1964-65: 48). These axes were tiny celts with rounded butt and thin lenticular section typical of the eastern Neolithic.

Among other stone objects mention may be made of a stone disc found from period II. A broken pestle is recovered from period II. A fragmentary piece of lapis lazuli is also met with in this period. Period II also yielded beads of agate, banded agate and steatite beads. The shapes are triangular, truncated bicone and disc. Beads of semiprecious stones like those of chalcedony and jasper are also recovered from period III (Bandyopadhyay, 2006: 131).

The use of copper started at the site during period II and it has been attested by the findings of nail parers, fish hooks, double edged precision instruments, antimony rods, heavy spiralled and ordinary bangles, rings (sometimes made of twisted wire), tubular beads etc. In period III the use of copper was continued along with the use of iron.
Copper objects of this period include a unique leaf shaped arrowhead without mid rib, bangles, rings, eye pencils, fish hooks, trinklets etc. Gold pellets and pins have also been recorded from period III. The gold pellet weighs 14 grains and there is presence of minute parallel scratches on it. It seems to be hammered on the edge (Bandyopadhyay, 2006: 128-130).

A terracotta seal according to the excavator, having a star motif on it, has been recovered from period II. Significantly, a substantial number of terracotta mother goddess figurines are found from period III. Among them some have beak head produced by pinched technique and accentuated breasts and splayed hips. Sometimes pinhole decorations are found around their waist or neck. The occurrence of two terracotta hollow heads seems to be the most noteworthy discovery from this period. They have long noses coming straightly down the forehead, large applied eyes and strong protruding chins. One of them has a peculiar hair style with slanting scratches while the other is found wearing a conical helmet with diminishing circles upwards. Among other terracotta finds of the periods mention may be made of some seals bearing double axe motifs within dotted border and having cord impressions on the opposite sides. Rubbers of terracotta were also found from this period. During the excavations in 1984-85, an interesting terracotta mother goddess head is found from Period II (Mukherji, 1992: 12). It is besmeared with black slip. Other terracotta objects of the period include one cylindrical shaft of indeterminate use, perforated spindle shaft etc. Besides terracotta balls, net sinkers, hopscotches etc, and an oblong quern of terracotta has been recorded from period III. The quern shows a depression on the working surface.

A storage pit containing cultivated species of Oryza Sativa L.Graminae is discovered from period III of Pandurajar Dhibi.

Remains of Nilgai, Sambar deer, domesticated pig, humped bull was unearthed from the period II of the site. Mention of only domesticated pig is found in the excavation report as being discovered from period III.

A large number of animal bones have been recovered from the excavation of Pandurajar Dhibi in 1985 (Ghosh and Saha, 1992: 89-100). Examination shows that there are both remains of domesticated and wild species of animals. The wild species of animals comprise barasingha, hogdeer, jungle fowl etc. The aquatic species include fishes,
turtles etc. Among the domesticated species there were humped cattles, buffalos, goats, pigs etc.

Three types of burial customs are met with in the period II of Pandurajar Dhibi. These include primary or extended burials, secondary or fractional burials and urn burials. These burials are found within the habitation area. Altogether 13 burials are recorded from period II. Among the three fractional burials, yielded during 1964-65 (IAR, 1964-65: 46) there were remains of two adult persons and one of a child. Five of these burials were found in a fully extended position oriented in east-west direction. One of these was in a slightly flexed condition with arms and legs jointed together. The legs of this skeleton are severed from the ankles. The head shapes of the skeletons from Pandurajardhibi are mainly of dolichocranic (long head) variety.

The C 14 date is available for period II of Pandurajar Dhibi (according to the excavation conducted during 1984-85, the upper level of period II yielded the evidence of the use of iron) is 1000 BCE (2950 +- 140 BP) (Mukherji, 1992: 15)

**Metallurgical Analysis:**

A dish-shaped object, unearthed from period II was metallurgically analyzed (De and Chattopadhyaya, 1989: 34-37). The specimen is about 22 mm in length and 18 mm in width with the thickness of about 2 mm. The curvature of the fragment is about 144 mm in diameter. The specimen is dark brown in colour with a yellowish surface. The following analyses were made: a) chemical analysis by Hilger-Watts Emission spectrograph. Semi-quantitative analysis of trace elements was carried out with RU standard with the wave length chosen between 2700-4400 Å and b) chemical analysis by wet methods which has revealed only iron and silicon qualitatively.

The above two analyses revealed that the specimen consists of an iron based alloy only. In optical microscope, the presence of two distinct phases could be revealed in as-polished and as-etched condition. The EPMA studies have revealed that the major constituent of matrix are iron, cobalt, oxygen, ruthenium and aluminium, whereas, inclusions are silicon, oxygen, iron and potassium.

From these analyses, it is quite evident that the dish shaped object was made of iron with a high amount of iron silicate (fayalite) inclusion in it. Such high amount of silicon made it brittle. No carbide or pearlitic structure was detected on etching. This indicates the absence of carburization in its production. However, a substantial amount of potassium in the inclusion indicates that the smelting may have been done with charcoal.
A sickle unearthed from period III is 255 mm in length with a maximum width of 22 mm. The internal curved region has a sharp cutting edge whereas the external portion is about 3 mm thick. The handle portion is roughly of a rectangular cross section and its pointed edge indicates that it might have been inserted into a wooden handle. The sickle was found coated with a layer of thick scale which was easily removable and a good metallic core was obtained for metallographic observations. A small portion was selected for chemical analysis and the other for metallography.

Chemical Analysis: A portion of sickle’s drillings was analyzed in strohlein apparatus to determine the amount of carbon which was about 0.22 wt%. The rest of the drillings was analyzed with atomic absorption spectrophotometer. Analysis (Table 14) was done by the standard method with air-acetylene flame. Since the amount of the sample was rather small, the analysis was restricted to copper, nickel, manganese, cobalt and chromium and iron was base.

Metallography: The small portion which had been cut off was mounted on a thermoplastic resin and polished using standard metallographic practices. Both the metallic matrix and inclusions were examined in the unetched condition and also after etching with 3 % Nital solutions, through a metallographic microscope.

Observations under polished condition revealed slag particles before etching. Slightly elongated inclusions, mostly of silicate type, were observed throughout the field and found non-uniformly distributed in chains. At places, sizes are very small and in a few places sizes are bigger. The microstructure in etched condition revealed non uniformity. The metallographic structure, as revealed at a magnification of 500X shows that of tempered martensite. The structure also exhibits retained acicularity at certain places. This phase is found distributed around large and massive patches of ferrite areas.

From the analysis, it becomes clear that the sickle had been thoroughly forged at sufficiently high temperature so that the slag particles were driven off. Carburization was done during the manufacture of the tool by subsequent heating and forging. The retained carbon at the core is only 0.22 %, however, considering the corrosion layers of the same and variation of the carbon concentration, it indicates that carbon was more than 0.4% initially.

Therefore, it is clear, the smiths of this region during 3rd century BCE acquired the knowledge of adding carbon to iron. They further hardened this carburized iron by heating to red hot and then quickly cooling (quenching) in water. To make the hardened...
iron less brittle, they reheated it to an intermediate temperature. For obtaining a sharp cutting edge, it was forged along the edge.

This thin surface was later polished with stone blocks to obtain a sharp edge. Therefore, this sickle can safely be considered as low carbon steel (De and Chattopadhyay, 1989: 37-38).

Iron slags: Three specimens of slag were examined. Of these, two were obtained from trench A, layer 10 (Period IIA) and layer 5 (Period III) respectively. Both chemical and mineralogical analyses were conducted on these slags (Table 15). A representative portion from each of the slag specimen was selected for determining its mineral constituents. This was done by preparing a polished section capable of being observed by a mineralogical microscope.

The chemical constituents are $\text{Fe}_2\text{O}_3$, $\text{FeO}$, $\text{Al}_2\text{O}_3$, $\text{SiO}_2$, $\text{MnO}$, $\text{MgO}$ etc. The mineralogical constituents can be represented in the ternary system as anorthite ($\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot 2 \text{SiO}_2$), Wüstite ($\text{FeO}$) and silica ($\text{SiO}_2$). The anorthite phase dissolves $\text{MgO}$, $\text{MnO}$, excess $\text{GaO}$ or $\text{Al}_2\text{O}_3$ (glass phase).

Slag A-10

The ore phase, analyzed optically, contains 34% magnetite and 6% Wüstite. In non-ore phase, of the total 60 %, fayalite is 48 %, anorthite/hercynite is 7%, and glass phase is about 5%. The microstructure reveals that dendritic Wüstite phase occurs in a fayalite matrix.

Slag A-5:

The mineralogical constituent of this slag is free from hematite. Ore phase is found to be about 36 % in which 28 % magnetite, 7-8 % Wüstite and traces of alpha-iron were noticed. The non-ore phase is 64 % in which fayalite is 40 %, anorthite/hercynite is about 15 %, and glass is about 9 %. The microstructure revealed denaritic Wüstite (light) in fayalite (in lighter matrix) and anorthite (dark matrix).

Slag C6: A special feature observed in this particular slag specimen is that it exhibits strong magnetic properties, unlike the two former specimens. Ore phase of this slag is about 65 % containing 50 % magnetite, 8% Wüstite and 6% hematite. Interestingly, the remaining 1 % or slightly less of this consists of the alpha-iron. Non-ore phase has a composition of 4 % fayalite and about 30 % of pyroxene and other glass phases.

Based on these analyses, De and Chattopadhyay assumes that smelting could have been conducted below $1100^\circ$ C and it was carried out by filling the hearth and stack of the
furnace with charcoal. After ignition, alternate layers of ore and charcoal were charges. The slags A-10 and A-5 perhaps were generated at the central portion of the hearth, below the two tuyers. However, the slag C6 might have been the product of a mixed charge, probably with a magnetite ore and only one tuyer was used (De and Chattopadhyay 1989: 33-41).

**Mangalkote** (23°31' N and 87°56' E): The site is located on the right bank of the river Kunur in the Katwa subdivision of the district of Burdwan. The mound rises 14 to 15 m above the surrounding field. The present village is placed right on the ancient mound, measuring roughly four square miles north-south and east-west and occupies the total area of ancient habitation.

The site was discovered by P.C. Dasgupta of the Directorate of Archaeology and Museums, Government of West Bengal during his explorations in the region in 1963-64 (Dasgupta, 1964: 38-39). Subsequently, the ancient ruins of Mangalkote have been reported by several scholars though the significance of such remains have largely remained unattended till 1975 after which the Department of Archaeology, University of Calcutta undertook a systematic exploration in the region. Recording to different artefacts at the site have prompted the department to take excavation at the site for four consecutive field seasons from 1986-87 onwards under the supervisions of Amita Ray and Samir Mukherjee (Ray and Mukherjee, 1992:107-134). The excavations were conducted at three different mounds viz. Vikramadityer dhibi (Sarkaridanga), Manuimiyardanga (near Madrassa School), Kaccharidanga. The excavations were resumed at the site (mound of Kolubarirdanga) again in 2005-06 by the same department under the supervision of R.K. Chattopadhyay (Chattopadhyay, Sanyal and Saha, 2006: 119-121). In 2009-2010, the Centre for Archaeological Studies and Training, Eastern India and the Deccan College, Pune jointly conducted excavations at the mounds of Neeldanga and Sarkaridanga and on the river (Kunur) banks of the site (Roychoudhury and Rajaguru, 2010: 39-48). However, the last two excavations (2005-06 and 2009-2010) yielded the evidence associated with the medieval period.

The first four seasons of excavations have yielded a thick habitational deposit of 6.05 m divisible into the six cultural periods (Ray and Mukherjee, 1992: 109).

The site yielded the evidence of both iron production and consumption. The excavators have found a restricted use of iron during period I (Ray and Mukherjee, 1992: 110). The artefacts comprise arrowheads, points, spearheads, daggers etc. From the upper level of
the period sickles, hoes, points etc have been recovered. The manufacturing of iron tools at the site were also attested by the presence of iron slags and ingots from the basal level onwards. Besides, a clay tube with a perforation and remains of rusted iron around it, was also recovered from this phase. The metallographic analysis of these specimens show that the technology of iron smelting could not be properly achieved by the people of period I. The slags contain greater percentage of iron remains which indicate that much of the iron was lost in the slag reduction at a much lower temperature than what required. Extensive use of iron began in period II. The iron tools of this period include knives, chisels, arrowheads, spear heads, nails, sickles, points etc. Huge ovens with ashes and large quantity of iron slags and half finished iron objects amply testify to the iron production at the site. The succeeding Kusana phase also yielded a substantial number of iron nails suggesting their use in constructional activities.

Period I: This period with a 2 m thick cultural deposit is characterized by the presence of BRW. Associated ceramic assemblages are of red slipped wares (with variants as tan, orange, chocolate), lustrous red ware, black polished and smoked ware. BSW appeared somewhat at a later phase of the period. The potteries are occasionally decorated with paintings done either in white or in black.

Of all the cuttings, trench A’1 (MGKT 2) seems to be the important for studying the archaeological materials of the ‘Chalcolithic’ phases of the site. Of total deposit of 4 m of this trench, 2.10 m thick deposit belongs to the ‘Chalcolithic’ phase, which is evident right below the transitional phase in layers 4, 5, 6, 7, 8. The layers above this deposit are found heavily disturbed by a pit. The structural remains of the period consists of the remains of floors, superimposed one above the other. The first floor is traced at a depth of 2 m in layer 4, the second in layer 6 at a depth of 3 m and third was found in layer 8 at a depth of 3.90 m. The floors are usually of dark brown in colour, comprising rammed earth mixed with cowdung, sand, kankar and pottery chips. It is observed that in almost all the cases, sand has been used at the base of the foundation. Remains of post holes and red marks in burnt clay have been found. Besides, a substantial number of hearths has been traced at different floor levels of one house. The houses are made of mud, bamboo and leaf or straw like materials. That the walls of the houses were made of reed screens plastered with mud are known from the remains of mud impressed reeds. From the layer 8, a highly fragmented skeletal remains of a human body along with sherds of BRW, a few beads have been found embedded in a floor level in the east-west orientation.
The ceramic repertoire of the period I (as found from the said trench) comprise mainly the characteristic type of BRW and other associated sherds ranging from fine to medium fabrics. It is essentially made on a first wheel, except for some gritty wares for making jars, troughs, basins and tumblers. The principal pottery types of the wheel-made ceramics are bowls, basins, vases and handis. Dishes are conspicuous by their absence, though dishes on stands or bowls on stands occur in limited quantities. A few sherds including one complete ‘vessel-type-object’ in BSW with rustication at the bottom has been from the layer 7. Use of groovings and incised decorations is also in vogue from the cultural phase associated with layer 7 onwards. Perforations are also common in vessels and in basins.

A large number of animal bones both of domesticated and wild varieties have been unearthed from the habitational deposit of the period. The bones of domesticated animals include those of cattles, sheeps, goats, buffalos and pigs while those of deers, nilgai, foxes and wild buffalo comprise the wild varieties. Apart from the above, the bones of tortoises, fishes and birds are also found in plenty. Evidence of rice husks found on the core of the potteries in number of case suggest the regular consumption of rice by the inhabitants. Bone tools found from this cultural period include points, daggers, arrowheads, blades and awls.

The use of iron was in vogue from the very beginning of habitation at the site as discussed earlier. Except for fish hooks, the use of copper was restricted in making ornaments.

A few terracotta figurines, besides beads of both semi-precious stones and terracotta were found from this cultural period.

The chronology of this period seems to have ranged from c. 1200 BCE to 600 BCE on the basis of a radiocarbon date (940 BCE) of a charcoal sample found from the mid level (layer 7, A’1 MGKT 2) of the period.

Period II: The succeeding cultural period, traceable in layers 7, 8 in MGKT I and layer 3 in MGKT 2 is characterized by the presence of BSW, plain red, brown, grey and fine textured red potteries along with coarser varieties of BRW and associated ceramics of the preceding period. The excavators preferred to name this cultural period as a transitional one.

Use of iron objects proliferated in this period as attested by the presence of a vast repertoire of such objects. The practice of iron smelting during this cultural period is also
evident (Ray and Mukherjee, 1992: 110-111). Bone tools were also found in substantial numbers. The basis of division between periods I and II are the occurrence of a large number of grey ware, BSW and black burnished ware besides preponderance of iron objects and a single specimen of copper bangle which shows alloying tin (10%) with copper. This cultural period datable to c. 600-300 BCE has also unearthed beads of semiprecious stones and a few terracotta figurines.

Period III (Maurya Sunga periods: c. 300 BCE to the close of the first century BCE) is marked by the complete absence of the BRW and by the appearance of ceramics like red, grey, BSW of both plain and designed ones (layer 6 in MGKT 1; layers 2 and 2A in MGKT 2). A few NBPW sherds of coarse varieties were also found in the assemblage. A few shallow dishes of both black and red varieties have been found executed with flower motifs. Other significant artefacts include a solitary specimen of punch-marked coin, a number of copper cast coins of both circular and square varieties, inscribed seals and sealings (though the inscription is not legible due to its eroded condition), bangles, amulets, lockets all made of copper, antimony rods, beads of semi-precious stones like crystal, carnelian, agate, besides of glass and shell, jewelleries like ear studs of terracotta etc. The phase has yielded a significant number of diagnostic terracotta figurines like a bull designed with punch marks besides the characteristic *Vrikshka* and *Panchchuda yakshini* affiliated to the Sunga stylistic traits. Interestingly the report seems to be mute in describing the occurrence of iron objects. It is very difficult to understand the nature of the use of iron during this cultural period.

Period III is represented by floors made of mud, rammed with pieces of potsherds, ghuetttings, small pebbles, husks and sand.

Period IV is characterized by the proliferation of structural activity, in all probability assignable to the Kusana cultural phases. The burnt brick structures seem to have appeared for the first time during this period. Of the structural remains, important evidence comes from the trenches B8, B7, B5, C5, JY10, IX3, KX3 (MGKT 1). The trench no. A1 (MGKT 2), layer 5 having a total thickness of 2m reveals a structure of two courses, made of regular bricks. People living in the layer 5 seemed to have sealed a well made of bricks used in the preceding period (layer 5A). Five courses of bricks around the well have been exposed (diameter of 1.45 m). These arranged in offsets for narrowing its mouth. The bricks used on the top of the well measure 38 x 25 x 5 cm. The working level of the well is layer 5A. The trench no B8 (MGKT 1) located on the slope reveals the
remains of the Kusana period from the top. This layer has laid bare a house complex with a ringwell attached to a room. The complex has been found extending over trenches B8 and B7. The floor is made of beaten earth, rammed with surkhi, sand and lime. On the floor are traceable at B7 two huge jars. At trench IX3, remains of a granary have also been exposed.

The evidence of a house exposed in trench JY (MGKT 1) has been considered by the excavators as a representative one of the Kusana period. The room has a well laid surki rammed brick soling floor and an attached brick lined drainage system along a brick laid courtyard. The floors of a large house seemed to have had three constructional phases from its foundation. The first has a soling made brick bats over which there was a brick platform made of well laid bricks arranged in regular rows and the third one was made of surki. The latter was further rammed with lime, small pieces of potsherds, kankars etc. The bricks used during this period varied from 40 x 27 x 7 cm to 38 x 28 x 5 cm and 25 x 25 x 6 cm. Lime plaster was also used in flooring.

A substantial number of iron nails have been yielded from this cultural period, which according to the excavators were instrumental in making different structures.

The period is marked by the disappearance of the grey ware of the earlier period and the appearance of bright red polished sturdy wares (characteristic of the Kusana period). The common types are footed bowls of various sizes, pans and handles designed with punch marks, dishes decorated with finger impressed wavy rims, sprinklers with cylindrical spouts, long necked suraiha, spouted jars, lids etc. A few sherds with stamped and punch designs have been found in the assemblage. A rich collection of beads made of precious and semi-precious stones are of special mention among the recorded artefacts from the period concerned. Besides, a number of moulded terracotta figurines, some wearing a diaphonous folded garments, seals and sealings (at least one depicting a motif of a woman holding a lamp), and other hand-modelled figurines - both male and female, a few with a grotesque face have been yielded from this cultural period.

Period V, assignable to the Gupta period (c. 400-600 CE) also witnessed a large scale structural activity. The houses were built of burnt bricks with the sizes ranging between 18 x 24 x 8 cm, 35 x 25 x 5 cm and 26 x 24 x 4 cm. The bricks were found to have been laid with clay mortar. Iron nails of various sizes were used extensively for constructional purposes. The floors are rammed with mud, brickbats, kankar, brick dust and lime.
The period is characterized by the occurrence of a thin fabricated red brown ware with wash. A kind of grey ware is also found in the assemblage. Common pottery types are bowls, dishes, vases, lids, sprinklers, spouted vases etc. Seals, unearthed from this cultural period has revealed varieties of symbols viz. tree-in-railing, couchant bull, *purna kumbha*, stupa, *dvaja*, woman standing in akimbo, conch shell etc. Rings, bangles, fragments of bowls, made of copper and bronze were found in plenty from this period. Beads of various shapes and sizes made of semi-precious stones, copper, glass, terracotta have also been recorded. Interestingly, it also unveiled a large number of beads in different stages of manufacture along with raw materials. Profusion of finished objects along with half finished ones and raw materials amply testifies to the production of beads at the site.

The terracotta figurines exhibit characteristic suppleness, pliability and sensitive rendering of flesh, the typical quality of the Gupta idiom.

The succeeding cultural period is heavily disturbed which yielded the materials ascribable to a period starting from the post-Gupta phases onwards.

The chemical analysis of the retrieved iron objects from the site has been presented in Table 16.

Besides, the brief report on excavation, the site and its cultural heritage hold a significant place in the reconstruction of settlement history of early Bengal. The present work duly considers several such works which highlighted different issues associated with iron bearing early village farming phases (Chakrabarti, 1998: 48-58; Chattopadhyaya, 2003: 66-101; Datta, 2010: 309-311).

**Documentation of iron objects (list is not exhaustive)**

**Year 1987; Area MGKT I; Trench B’5**

In 1987, altogether twenty seven iron objects and slags have been unearthed from the trench B’5 of MGKT I.

The repertoire include:

<table>
<thead>
<tr>
<th>Layer</th>
<th>Contents</th>
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<tbody>
<tr>
<td>3</td>
<td>yielded 2 pieces of slags.</td>
</tr>
<tr>
<td>4</td>
<td>yielded 11 pieces of slags and 4 specimens of nails</td>
</tr>
<tr>
<td>5</td>
<td>yielded 1 specimen of nail.</td>
</tr>
<tr>
<td>6</td>
<td>yielded 2 pieces of slags</td>
</tr>
<tr>
<td>7</td>
<td>yielded 5 pieces of slags</td>
</tr>
<tr>
<td>12</td>
<td>yielded 2 slags</td>
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</tbody>
</table>
Total: 22 pieces of slags and 5 specimens of nails.

Layer 3 of Trench A’6 yielded solitary specimen of iron object.
Altogether twenty seven pieces of slags have been reported from the trench B’6 between layers 2 and 7 with BSL ranging from 57 cm to 2.74 m.

Layer 2 yielded 2 pieces of slags
Layer 3 yielded 5 pieces of slags
Layer 4 yielded 8 pieces of slags
Layer 5 yielded 4 pieces of slags
Layer 6 yielded 6 pieces of slags
Layer 7 yielded 2 pieces of slags
Total: 27 pieces of slags

Layers 2-5 of the trench B’7 yielded 22 specimens

Layer 2 yielded 2 specimens of nails.
Layer 3 yielded 3 specimens of nails and 7 pieces of slags.
Layer 4 yielded 4 specimens of nails and 1 piece of slag.
Layer 5 yielded 5 pieces of slags.
Total 9 specimens of nails and 13 pieces of slags.

Trench B’8 of MGKT 1 has yielded 21 slags

Layer 2 yielded 11 pieces of slags
Layer 9 yielded 2 pieces of slags
Layer 10 yielded 5 pieces of slags
Layer 11 yielded 2 pieces of slags
Layer 12 yielded 1 slag
These were collected from 0.27 m to 2.16 m BSL.

Trench A of MGKT 2 yielded

Layer 2 yielded 1 slag piece.
Layer 3 yielded two corroded and undeterminate objects. Both of them unearthed from a depth of 60 cm. These two objects measure 14 cm and 9 cm in their length. They might have been identified as broken hooks/ clamps.
Trench A’1 of MGKT 2

Layer 4 yielded one leaf shaped very thin broken arrowhead. The object (3.2 cm in length) has been collected from a depth of 2.23 m BS.
Layer 9 yielded one slag from a depth of 3.29 m BS.

Year: 1988; Trench IX3 of MGKT I

A pit started from Layer 2 yielded the following specimens:
A fragmentary piece of iron object from a depth of 2.05 m B.S.
slag from a depth of 1.23 m B.S.
Part of an unidentified iron object, probably an iron nail at a depth of 3.87 m B.S.
Slag from a depth of 1.22 m B.S.
A broken nail from a depth of 0.85 m B.S.

Layer 3 yielded two slags.

Layer 4 yielded the following
Nail from a depth of 2.18 m B.S.
Slag from a depth of 2.85 m B.S.
Slag from a depth of 3.66 m B.S.
Part of an object from a depth of 4.69 m B.S.
A fragmentary object from a depth 5.17 m B.S.
Layer 5
A triangular shaped object, has a pointed tip, probably part of an arrowhead.
Slag from depth of 2.02 m B.S.
Layer 6
Encrusted object probably part of an axe or awl from a depth of 3.60m
Slag.
Layer 7
Unidentified object from a depth of 3.72 m
Slag.

Trench C’6 of MGKT I

Layer 2
Nail with rectangular section from a depth of 0.37 m.  
A thick nail with one end pointed, rectangular section from a depth of 0.36 m B.S.  
Layer 3 yielded 13 specimens of slags

Year 1989; **KY5 of MGKT 1**

Layer 3 yielded two specimens 
A broken arrowhead from a depth of 2.76 m B.S. 
A nail from a depth of 2.80m.

**A’1 of MGKT 2**

Layer 2 yielded one unidentified object from a depth of 0.23 cm B.S. The length of the specimen is 7 cm which has a pointed end. 
Slag from a depth of 0.70 cm B.S.  
Layer 3: 2 slags from depth of 0.70 m to 1.73 m B.S.  
Layer 4: 6 pieces of slags from depth 1.18m to 2.15 m B.S.  
\[1\text{ leaf shaped arrowhead with a broken tang. Approximately 7 cm in length.}\]  
Layer 5: slag from a depth of 2.43m  
\[\text{Peg with rectangular section, approximately 6 cm in section.}\]  
\[\text{Nail from depth of 2.60 m}\]  
\[\text{Unidentified object, having elongated shape from a depth of 2.60 m.}\]  
\[\text{Slag from a depth of 2.75 m.}\]

**A1 of MGKT 3**

Layer 3: nail, 4.5 cm in length, leaf shaped from depth of 1.20m x 2m x 0.95 m  
\[\text{Slag from a depth of 1.10 m}\]  
Layer 4: 4 pieces of slags from 2.27 m to 2.95 m.  
Layer 5: slag from a depth of 3.35 m.  
Layer 6: slag from a depth of 3.39 m to 3.70 m.

**A’2 of MGKT 3**

Layer 1 yielded nail, square in section.  

**B’1**

Layer 2 yielded a broken part of a nail, square in section.
Layer 4 slag from a depth of 2 m.
Pit: a razor.

A1 of MGKT 4 (KD)

Layer 2 yielded three pieces of slags
Layer 3 yielded six pieces of slags.
   Broken nail with length of 3 cm.
Layer 4 yielded nail from a depth of 82 cm
   Unidentified object from a depth of 98 cm.

A2 of MGKT 4 (KD)

Layer 2 yielded nail from a depth of 32 cm.
Layer 3 yielded 2 slags
   A broken nail from a depth of 61 cm.
   Slag from a depth of 76 cm.
   Clamp from a depth of 77 cm.
   Upper portion of a nail from a depth of 87 cm.
Layer 4: yielded slag from a depth of 4.49 x 0.95 m - 0.82 m.
Layer 5: yielded from a depth of 1.35 m BS.

Trench A3 of MGKT 4:

Layer 2 yielded slag from a depth of 23 cm.
Layer 3 yielded 4 pieces of slags.
   A broken nail from a depth of 53 cm.
Layer 4 broken unidentified object at a depth of 94 cm.

Year 1990; KX2 of MGKT 1

Layer 2 yielded 2 two slags from depth of 0.87 m.
Layer 3 yielded an arrowhead from a depth of 0.55 m.
   Slag from depth of 1.44 m.
Layer 4 yielded a broken nail from a depth of 1.75 m.
   A broken arrowhead from a depth of 1.20m.
   Nail from a depth of 2.40 x 3.61- 1.35 m.
2 pieces of slags.
Layer 5 yielded slag from a depth of 1.95 m.

KX3 of MGKT 1

Layer 3 yielded unidentified object from a depth of 0.66 m.
    Slag from a depth of 0.68 m.
Layer 4 yielded 5 pieces of slags.
    One unidentified object from a depth of 2.45 x 3.75 - 1.80 m.
Layer 5 yielded unidentified object from a depth of 2.70 m.
Layer 7 yielded a broken nail from a depth of 1.72 x 2.37- 3.40 m
    2 pieces of slags.

Trench JY 10 of MGKT 1.

Layer 1 yielded unidentified object from a depth of 1.35 m.
Layer 4 yielded a broken nail from a depth of 1.15 m.
Trench A of MGKT 3
Layer 1 yielded object from a depth of 0.11 m.
Layer 3 yielded slag from a depth of 1.35 m.

Explored sites:

Ghurisha (23º40’N and 87º30’E): The site is located about 3.5 km northwest of Ilambazar along the Ilambazar-Dubrajpur Road. Ghurisha is another important site, associated with BRW cultural phases. The *majhar* complex at the central part of the village and the banks of the ponds in the nearby area are distinctly scattered with large concentration of occupational debris assignable from the BRW bearing EVF phases to the historical period (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 126). The presence of iron slags and Jaina antiquities in this village apparently added the significance of the site associated with metal workings.

Jaydev-Kenduli (23º38’N and 87º26’E): The site is situated about 7.5 km west of Ilambazar. The mound of the site, about 1 acre in area (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 125-126) stands in the old Kamarpara locality of the village. River actions have severely affected the context of the site. It has yielded
substantial amount of BRW sherds, microlithic flakes and iron slags. However, present survey has failed to trace the occurrence of iron slags at the site.

**Mandira** (23°37’N and 87°26’E): This site is situated on the left bank of the river Ajay, about 4.5 km downstream to the site of Jaydev-Kenduli. Dasgupta (Dasgupta, 1964: 42) has reported broken pieces of carinated and hemispherical bowls made of BRW from the site. Besides, *IAR* 1963-64: 59; *IAR* 1965-66: 58) sherds of BRW and lustrous red ware, perforated potteries and microliths have also been recorded from the site. Interesting find of a small Neolithic celt from the site probably indicates its significance as one of the major EVF settlements. During 1993, Chakrabarti and his associates (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 126) documented ring stones and a substantial number of iron slags at the site. During their visit, the site measured about 1 acre in area. Presently the site is almost washed away by the floods of the river Ajay.

**Chella-Kamarpara** (23°38’N and 87°38’E): The site is situated about 1km south of Bolpur-Ilambazar road near Ramchandrapur. Datta (Datta, 1995a: 37) identified it as a BRW bearing site. Chakrabarti and his associates (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 126) noticed the occurrence of red, black and grey wares at the site. They have also collected microlithic flakes, pieces of fossilwood from the site. Recent visit at the site revealed that there are two adjacent villages hardly a km apart. Iron slags and nodules have been recorded on the bank of a huge pond, locally known as Lakshmisayer at the site of Kamarpara. This pond is supposedly constructed by local zamindars. The village of Chella has a few late medieval structural ruins. Similar occurrences of iron nodules and slags have been documented near a pond of Daranda, situated about 2 km from Chella.

**Goplnagar** (23°38’N and 87°38’ E): The site is located adjacent to Chella-Kamarpara along the Bolpur-Ilambazar Road. It has *IAR* 1967-68: 68) yielded several clusters of BRW occurrences. Chakrabarti and his associates (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 129) have collected iron slags and microliths from the site.

**Suratheswar** (23°38’N and 87°41’E): The site is located on the left bank of the river Ajay about 2.5 km south of Bolpur. The ancient occupational debris has been recorded at several locales of the site. However, the Sivtala mound of the site has yielded (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 125) sherds of BRW,
microlithic flakes of quartz, fossilwood and ceramics of the historical period. Another mound known as Suratrajardhibi or Suratheswar (IAR 1962-63: 43) and IAR 1965-66: 58) situated outside the Supur village was also stated to have yielded sherds of BRW, red ware and microliths. Dasgupta (Dasgupta, 1964: 63) have reported sherds of chocolate brown ware, retouched microliths, broken pieces of channel spouted bowls and carnelian bead from the site.

**Basantapur** (23°32’N and 87°41’E): The mound of archaeological significance at the site is located to the northeastern part of the village with an area of about 3 acres (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 133). It is locally known as Hazrardanga. Chakrabarti and his associates observed the occurrence of BRW, red ware, grey ware, BSW, iron slag and microlithic flakes at the site. The site has previously been reported in the early sixties (IAR, 1961-62: 59) as one of the important BRW bearing sites.

**Kalyanpur** (23°34’N and 87°44’E): Kalyanpur is located approximately 4 km southeast of Bhedia. The thick occupational debris of the site is destroyed by the excavations of ponds at several places. The estimated extent of the site is about 1 acre (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 132-133). The site yielded BRW, microlithic flakes and large quantities of iron slags during exploration.

**Berenda** (23°33’N and 87°42’E): The site is located about 6 km southwest of Bhedia. The occupational debris are found scattered near the entrance of the modern village. The site covers an area of about 6 acres (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 132). The eastern part of the mound is virtually destroyed due to the encroachment of modern habitation. Chakrabarti and his associates collected BRW, red ware, grey ware, microlithic flakes and iron slag from the site.

**Eruar/Jakerdanga** (23°28’ and 87°53’): Eruar is located about 22.5 km north-northeast of Burdwan Sadar town. Field survey at the site by Chakrabarti and his associates (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 130), revealed the occurrence of habitational debris. A 3-4 acre area around Bholanath Balika Vidyalaya has a large concentration of BRW and other varieties of ceramics. The area was quite disturbed due to excavations of ponds, the sections of which show blackish soil horizon, characteristic of occupational deposit. Besides BRW, the survey has also yielded black painted grey ware, red ware, red slipped ware and BSW, microliths, iron slags. During an earlier exploration (IAR, 1972-73: 36) the site yielded Neolithic celt.
Orgram (23°28'N and 87°46'E): Orgram is located on the right side of Burdwan-Guskara Road, about 9km southeast of Guskara. There are two mounds in the locality which earlier formed one (Chakrabarti, Sengupta, Chattopadhyay and Lahiri, 1993: 132; IAR 1974-75: 71). The mounds yielded sherds of BRW, fragments of copper objects and microlithic flakes and iron slags.

The nature of iron working at Pandurajar Dhibi probably facilitate in identifying it as a secondary producer of iron. The lateritic woodland areas of Kanksa, situated in its close proximity definitely played an important role in the supply of sufficient raw materials (ingots/ore) to the concerned site. Berenda, Basantapur etc. could also be identified as temporary metal working sites which might have furnished the metals (both ingots and finished products) to Pandurajar Dhibi. Furthermore, there is enough scope to locate substantial number of iron ore bearing areas along the river Ajay in the district of Birbhum which had close access from both Mangalkote and Pandurajar Dhibi. However, in absence of specific data it is difficult to identify major settlements associated with the primary smelting/extraction process which have supplied the metal in form of ingots to Mangalkote and Pandurajar Dhibi. However, the mound presently situated in the local majhar of Ghurisha has yielded substantial data which might have pushed back the cultural antecedence of the site to the EVF phases. Recording of a considerable numbers of iron slags certainly gives the clue to identify it as one of the feeder sites of Pandurajar Dhibi in the context of metal workings, production as well as consumption. Similarly, Chella Kamarpara can also be identified as an important locality associated with metal workings. Unfortunately, the absence of substantial number of information related to iron working constrains us to understand its archaeological potentials.

The sites on the banks of the rivers of Damodar and Dwarakeswar

Bharatpur (23°24'N and 87°27'E): The site is situated on the left bank of the river Damodar near Panagarh Railway station in the district of Burdwan. The extensive mound with stupa structure was found scattered with different materials datable to a long period of time ranging from the ‘Chalcolithic’ to the medieval periods. Excavation was undertaken at the site jointly by the Eastern Circle of the ASI and the University of Burdwan for four consecutive seasons from 1970-71 onwards (IAR 1974-75:77; Ghosh 1989:66-67).

The excavation revealed fourfold cultural sequence.
Period I, ascribed as the ‘Neolithic-Chalcolithic’ by the excavator, is characterized by the use of plain and painted BRW, black-on-red, buff-on-red wares, the shapes and painted designs of which are similar to those found at Birbhanpur, Pandurajar Dhibi and Mahisadal. Other finds include microliths, ground and polished stone tools, bone and antler objects, burnt clay with reed-marks, remains of floors with hearths, beads of semi-precious stones and steatite and terracotta objects. The use of copper was scarce. According to Chakrabarti, the earliest date-range of Bharatpur Period I is 1735-1417 calibrated BCE (Chakrabarti, 2006:262). However, three $^{14}$C dates (IAR 1974-75:77) are available for Period I of Bharatpur. They are 1435 BCE, 1180 BCE and 900 BCE.

Period II, representing Iron Age, overlaps with the preceding culture and is characterized by the initial use of iron. However, the report did not mention the nature of objects in details. The ceramic industry of the preceding culture continues in this period, but is represented by its coarse and gritty varieties. The upper levels of this period yielded a few NBPW sherds along with black polished ware.

Period III is marked by a baked brick structure, of which only a few courses are extant, probably belonging to the Gupta period. A cultural break was noticed between the preceding period and the present one.

Period IV is represented by a dilapidated stupa of square plan of pancharatha type, assignable to the eighth-ninth century CE.

The structural mound of Bharatpur along the river Damodar also yielded substantial materials to establish its identity as one of the iron bearing sites near Pandurajar Dhibi, Pakhanna and Dihar. Unfortunately, the excavation at the mound failed to delineate the innate character of its metal bearing phases. Most probably, the structural activities in the later period probably destroyed the evidence of the earlier habitation. However, the findings recovered during excavations suggest the consumption of iron at Bharatpur. Here, it is to be mentioned that the evidences from recently explored BRW bearing sites near Paraj, Mallar, Kasba, Ranadiha etc. help to establish the involvement of these sites in both iron production and consumption.

Pakhanna ($23^\circ 24'45"N and 87^\circ 22'40"E$): The site is situated on the south/right bank of the river Damodar, about 10 km from Barjora police station headquarters as the crow flies. The site was excavated by the Department of Archaeology, University of Calcutta under the general supervision of Chitrarekha Gupta, A. C. Pal, M. Mitra and A. Datta.

Five main areas, viz. Bhairabdanga (PKN1), Satbardanga (PKN 2), Garherdanga or Rajargarh (PKN 3), Kalyanpur (PKN 4), Etepara (PKN 5) were excavated.

Of these mounds, PKN 1 unfolded a thick cultural deposit varying between 2.10m and 3.10m divisible into eight broad and well-defined layers. Layers 1-3 carry the cultural debris belonging to the historical period which varies in depth from 0.90 m to 1.32 m whereas the layers 4-8 varying in depth from 1.20m to 1.78 m yielded the material culture of the EVF phase. During excavation in the field season of 2002-03, evidence of iron working in form of the remains of hearths associated with profuse quantities of charcoal, potsherds, ashy decomposed soil and a few iron implements at the site was found from six successive depths, 2.65m, 2.70m, 2.85m, 3 m, 3.05m and 3.10m respectively. At the lowest level (6th stage at a depth of 3.10m), terracotta basins for water storages have been found attached to the hearth. As no iron slag was found associated with this activity area, the excavator assumed that, here ‘secondary types of manufacturing activities’ have been performed i.e., the making of finished objects from iron ingots by the process of reheating and forging of the ingots. However, during this particular process the oxidised surface on the iron ingots have been hammered to get pure iron. The waste materials in some cases do not take the form of usual slag and in course of time these have been completely shattered into small pieces. It is difficult to trace them during excavations. During the previous year’s (2001-02) excavations at the same mound, the remains of mud furnace connected with iron smelting activities have been traced at a depth of 1.22m from the surface. This has been indicated by the evidence of charcoal, ash, iron ore and slag with the husk impressions found from the same area. Besides, the remains of a kiln along with ore, slag and possibly a nozzle have been exposed from the area. Both these evidences have been assigned by the excavator to the EVF phase (iron bearing) datable to the 900 BCE (Datta, 2010: 307-308). Altogether 9 classic examples of iron implements have been yielded from this phase. The types include spears, arrowheads, chisels, nails and a few indeterminate objects.

Structural remains found from the phase consist of rammed floors of beaten earth, mudclods bearing reed impressions, bits of potsherds, river pebbles and sands and
occasionally plastered with cow-dung mixed with river silt. Besides, the evidence of post holes has also been recorded. One circular mud-floor (1.50m) was found in the central portion of the south-western quadrant which traces the evidence of pit dwellings. The pit might have started from 1.55 m below surface and continued down to a depth of 1.12 m. The pit-wall shows the traces of plastering by mud and cow-dung. The floor has yielded potsherds, bones, charcoal and ashes. Another circular floor was exposed in the western section. The floor (1.45 m) had cut the virgin soil which yielded the ceramics of the EVF phases. According to the excavators both these pits neither belonged to the same level nor showed exact similarity in measurements. The EVF phases yielded wheel made painted and plain BRW, black on red ware, painted brown ware, black ware and red ware. Bowls, basins, jars are common types. Bone tools including ordinary and sophisticated socketed arrow-heads and points, beads of stone and bone, copper rings have been found along with these ceramics. One trench has also yielded a small Neolithic celt, though it has been obtained from a pit of the EVF phases.

The material remains of the historical period as exposed in the PKN 1 are highly disturbed, though it can be pertained to a cultural succession of the Mauryan, Kusana, Gupta and post-Gupta periods. The evidence of housing complex, flooring pattern, hearths, metal working activities has been recorded. Iron arrowheads, nails, chisels, knives have been documented.

I have documented altogether 15 classic examples of iron objects pertaining to the both EVF phases and historical period.

1. The object can be identified as a spear; large flattened leaf shaped blade; logenze shaped cross section; tang portion is broken (10.1 cm x 3.8 cm) (BD1/A3/ 5/1.30 m).
2. During excavations it was identified as an arrow head; it is probably a spear head; leaf shaped blade, solid point; logenze shaped cross section; tang is plain with roundish cross section. (11 cm x 3.5 cm) (BD1/A2/Pit 2/1.94 m)
3. It is probably the part of a chisel; the tang is roundish in shape; the working edge is flat with logenze shaped cross section. (9 cm x 3 cm) (BD1/A2/Pit/2.82m)
4. It is identified as a chisel; extremely damaged specimen; the tang portion is missing; slightly tapered towards the point; rhombic cross section. (16 cm x 4 cm) (BD1/A3/5/-)
5. It is probably an iron rod/nail; quadrangular cross section near the head with a tapered point. (6 cm) (BD1/A3/6/1.30m)  
6. Arrowhead, leaf shaped short blade; logenze shaped cross section; plain tang. (6.5 cm) (BD1/A2/3 (pit)/ 5.55 m x 4.63 m – 0.55m)  
7. A broken knife; tang portion is completely broken; back is slightly concave; logenze shaped cross section. (5.2 cm) (BD1/A2/3/52 cm)  
8. A broken nail; head is broken; roundish cross section; solid point. (4.2 cm) (BD1/A3/2/25 cm)  
9. A broken nail; head is broken; middle portion is curved to a tapering point. (5.5 cm) (BD1/A3/5/1.11m)  
10. It can be identified as a broken chisel; flattened working edge; the tang is missing; logenze shaped cross section. (6.5 cm x 2.2 cm) (BD1/A2/1/15 cm)  
11. It can be identified as a broken chisel; flattened working edge; the tang is missing; rectangular shaped cross section. (6.5 cm x 2 cm) (BD1/A2/1/15 cm)  
12. It is probably a broken chisel (4.6 cm x 2.6 cm) (BD1/A3/4/71 cm)  
13. It is a broken iron point, tang portion is slightly flattened with logenze shaped cross section which is tapering to a point having squarish cross section. (6.9 cm) (BD1/A3/5/105 cm)  
14. Broken clamp, it is very thick, curved portion still survives, the end portion is broken (BD1/A3/4/70 cm)  
15. It is probably a broken chisel, the working portion is flat and thin. (7 cm x 5 cm) (BD1/A2/ pit circle/250 cm)  

During excavations of 2002-03, the mound of Satbardanga (PKN 2) has yielded a deposit of 2.68 m divisible into three cultural periods viz. post-Gupta, Gupta and Kusana. The layers 1-3 with a deposit of 50 cm represent the cultural remains of the post-Gupta period. The layers 4-6 with a thick cultural deposit of 92 cm yielding a ceramic industry (red ware, pale red ware, buff ware, grey ware, black ware with stamped designs) have been assigned by the excavator to the Gupta period. Iron implements found from this phase include nails, chisels, arrowheads etc. The layers 7, 8 and 9 yielded the ceramic industry of red ware, black ware, grey ware, buff ware, besides two sherds of rouletted ware besides terracotta figurines along with a few iron artefacts which has been ascribed to the Kusana period by the excavator.
I have documented examples iron objects from this area i.e., PKN2

1. Nail; circular broad and plain head; roundish cross section; gradually tapering to a point which is slightly bent (5.1 cm) (SD1/B1/6/2.19)

2. It is probably a nail; but difficult to identify because of its corroded condition. (6.2 cm) (SD1/B1/3/0.68m)

3. It is probably a broken nail; circular in section; the tapered point is slightly bent (3.6 cm) (SD1/B1/3/0.58m)

4. Arrowhead; tang portion has circular cross section; flattened leaf shaped blade; logenze shaped cross section. (5.1 cm x 3 cm) (SD1/B1/5/1.12m).

5. Nail; with head; tapered point is bent; rhombic cross section. (3.5 cm) (SD1/B1/3/55 cm)

6. Clamp, roundish cross section; context similar to the above.

7. Nail; with triangular head; gradually tapering to a sharp point; rusted specimen, logenze shaped cross section. (12.6 cm) (SD1/B1/3/50 cm)

8. Unidentified; probably a part of an iron chisel, the working edge is gradually thinner from the remaining part; logenze shaped cross section. (5 cm x 3 cm) (SD1/B1/3/ 60 cm)

9. Nail/ peg. The head portion is broken and tapering to a point which is bent. (2.7 cm) (SD1/A1/3/42 cm)

10. It is probably a broken chisel; flattened working edge (5.6 cm x 4 cm) (SD1/A1/3/63 cm)

11. A broken nail, head portion is broken, solid point (7.5 cm) (SD1/A1/2/32 cm)

PKN 3 yielded disturbed cultural remains assignable to a long cultural deposit datable to about 400 BC to the medieval period. Black polished wares, red polished wares, stamped and incised potsherds, moulded-potsherds were among the important ceramic types, found from the mound. Iron implements include specimens of nails, one clamp, one blade, one knife besides a few indeterminate objects.

I have documented 15 such specimens.

1. It can be identified as nail; rusted specimen, quadrangular cross section. With a head and tapering to a point which is slightly bent. (6.2 cm) (GD1/A2/4/42 cm)
2. Excavator identified it as a nail; rusted and broken specimen, though it could be identified as a clamp; circular cross section. The bent portion is broken (5 cm) (GD1/A2/4/50 cm).

3. It is broken part of a nail with a head; probably with a roundish cross section. (GD1/A2/2/0.08m)

4. It can be identified as nail; rusted and broken specimen, the head portion is broken; has quadrangular cross section in the middle; tapering to a point which has roundish cross section. (4.9 cm) (GD1/A2/2/10 cm)

5. It can be identified as knife; broken specimen, without a tang; sharp point; legenze shaped cross section; leaf shaped blade. (10.1 cm x 2 cm) (GD1/A2/recorded from broken mud wall/1.20 m).

6. It can be identified as knife; broken specimen, without a tang; sharp point; legenze shaped cross section; leaf shaped blade. (8.2 cm x 0.8 cm) (GD1/A2/recorded from broken mud wall/1.20 m).

7. It can be identified as nail; heavily rusted specimen, without a head; legenze shaped cross section; slightly tapering to a point (5.5 cm) (GD1/A2/4/ 58 cm)

8. It can be identified as a broken part of a nail; without a head; roundish shaped cross section; slightly bent at its lower part (4.5 cm) (GD1/A2/3/29 cm)

9. It can be identified as nail; broken and damaged specimen, without a head; middle portion is curved into a tapered point. (5.6 cm) (GD1/A2/3/ 2.55m x 4.01m – 0.30m)

10. It can be identified as nail; with a head; quadrangular cross section (3.7 cm) (GD1/A2/4/57 cm)

11. Excavator identified as a blade; but probably it is a part of a chisel, flat shaped; oval cross section (5.5 cm) (GD1/A2/4/55 cm)

12. Excavator identified it as nail; it is damaged specimen of a clamp; the middle portion is slightly broad which is tapered to its both the ends; oval shaped cross section. (5.5 cm) (GD1/A2/4/57 cm)

13. It is part of a nail; oval cross section; with a head; tapering to a sharp point. (5.8 cm) (GD1/A2/2/0.61m x 3.40 m—0.13 m).

14. It is a part of a nail; broken specimen. (4.5 cm) (GD1/A2/6/2.10 m x 1.38 m – 0.79 m)
15. It is the part of a broken nail; with a head; quadrangular cross section which is tapered to a point (5.5 cm) (GD1/A2/3/1.47 m x 2.06 m -0.40 m).

PKN 4 and PKN 5 yielded the material remains associated with the Gupta and the post-Gupta period respectively.

**Dihar** (23°07’10”- 23°08’10” N and 87°21’-87°22’E) P.S. Bishnupur, in the district of Bankura, West Bengal, on the left bank of the river Dwarakeswar includes an area covering the entire elevated land between the dried up bed of the Kana Nadi in the north-west and the profile of a ‘presumed palaeo-channel’ along its north eastern border (Chattopadhyay, Acharya and Bandyopadhyay: 2010: 9).

During 1983-1985 and 1990-1995, the Department of Archaeology, University of Calcutta, had undertaken several excavations at Dihar, under the supervision of A.C.Pal. Pal explained his findings with reference to the emergence of a rural settlement “in a comparatively Late Chalcolithic chronological horizon”. According to Pal, “the real breakthrough in the life history of the district of Bankura comes with the advent of copper-stone technology. It is during this period that a large settlement is found to have come into existence at Dihar.” (Pal, 1992:103) Incidentally Pal reported a good number of microliths from layers 5 and 6, corresponding to the Chalcolithic period. Pal further observed that “We find that it was in the later phase at Dihar, i.e. Early Historic period, that iron was introduced without any cultural or stratigraphical gap.” (Pal, 1992:103) The early historic period, according to Pal, yielded several cast copper coins, a few specimens of terracotta game objects, a terracotta animal figurine and other terracotta objects, beads of semi-precious stones, BRW, red ware, metallic and non-metallic objects. In continuation of the earlier excavation works, the Department of Archaeology, University of Calcutta, has resumed excavation in the field season of 2008-09 under the supervision of R. K. Chattopadhyay at three unprotected and previously unexcavated mounds of Dihar. Iron was introduced in the Period II which yielded evidence associated with the metallic Early village farming phase (dominated by copper objects though presence of iron has been traced in form of slag) (Chattopadhyay, Acharya and Bandyopadhyay, 2010: 9-33). Altogether 12 specimens of iron objects have been yielded from the stratified layers of Dihar during the field season of 2008-09. Among the three excavated mounds, the mound of Manasatala has yielded consistent evidence of metal working from a depth of 15-16 cm, after removing the layer of humus. Similar pattern occurs throughout the trench up to the depth of 27cm below which a major concentration of
BRW and other associated potsherds along with the evidence of activities associated with metalwork, such as patches of burnt earth in a circular form, possibly a part of an oven/hearth, charcoal pieces have been exposed. At about the same level (i.e., 27 cm) in the south eastern quadrant, the trench yielded a small metal object (with a flat and sharp cutting edge of the size of the smallest finger nail and having a round butt or butt-end) along with iron slag and other materials possibly associated with metalwork. The spread of clusters of artefacts continued to give similar, if not the same, features at various depths of 41cm, 48 cm, 54cm and 61 cm. However, as we progressed, the amounts/concentrations of slag and other specimens related to metalwork remained the same after reaching a depth of 109 cm. Digging works were discontinued afterwards in order to make further provisions for subsequent horizontal exposures of the mound. Based on diagnostic artefacts two phases have been reconstructed at Manasatala mound both of which are associated with iron. The phases are Phase I representing EVF culture associated with BRW and metal, both copper and iron (dominated by copper objects though presence of iron has been traced in form of slags) and Phase II showing early historic/historical assemblages with the continuity of BRW (Chattopadhyay, Acharya and Bandyopadhyay, 2010: 15).

However, finished objects were found in meagre numbers. The identifiable objects include nails, broken pieces of arrowheads etc. It is quite probable that activities related to iron production in raw state along with refining activities i.e., production of finished objects from iron ingots were practiced at the site. In the early phases (i.e., EVF phases) of metal smelting activities furnaces are deliberately broken down by the smelters for getting the iron ingot as a result the characteristic feature of furnace is not discernable to the excavator. However, less number of finished artefacts in comparison to slag at the site can be explained by the fact that the retrieved artefacts do not always correspond to all the articles used by the settlers during that particular period. Many of the frequently used articles were in fact passed over to the settlers of the subsequent period. The articles were thus perhaps frequently recycled and even reshaped in accordance to the needs of the consumers. Therefore, what we get from archaeological investigations may not always be the true reflection of the then reality.

The metallic EVF phase associated with BRW can be dated to 1400/ 1300 BCE onwards. The early historic period can be dated on the basis of a single sample collected at the
depth of 41 cm. The calibrated C14 date of the said specimen is 110 Yrs BCE +-141 Years (Chattopadhyay, Acharya and Bandyopadhyay, 2010: 31-32).

**Explored Sites:**

**Saragdihi** (23°32’N and 87°04’E): Saragdihi, in the Damodar valley is located about 10 km northwest of Gangajalghati. Presently, the context of the site has been largely disturbed, due to extensive earth and stone cutting activity at the site. As the name suggests, the village was previously inhabited by the Saraks – the itinerant metal smiths, from whose name the name of the village has been derived. Field survey at the site by the Directorate of Archaeology Government of West Bengal has yielded a substantial number of red, BRW, grey ware, BSW and NBPW. Microliths and beads of semi-precious stones were also picked up from the site. *(IAR, 1975-76: 57)*

The exploration by R.K. Chattopadhyay at the site resulted in the discovery of few BRW sherds which are in a very fragmentary state. In addition, a few sherds, of grey ware assignable to late period, two pieces of red sherds, a half portion of a terracotta bead and a small collection of microlithic debitage were traced. These were all found either on the surface or in the ditches along with iron slags (Chattopadhyay, 2010:112).

**Garui:** This site of repute because of its temple complex is situated in the north-western outskirts of Asansol. R.D. Banerji (Banerji, 1933: 95) while exploring the site also reports an image of Visnu once enshrined in the temple complex, which is now preserved in the Indian Museum, Calcutta. The archaeological significance of the site is attested by several fragmentary parts of sculptural specimens, architectural members along with two specimens (113 x 50 x 12 cm) (75 x 50 x 14 cm) of herostones. Besides, the site is also strewn with bricks of abandoned structures, potsherds and iron slags (Chattopadhyay, Sanyal and Saha, 2006: 126).

**Pachera/Pachhra:** The site is situated about one km north-west of Kelejora. The site was previously explored by several scholars (Gupta 2002: 83-100; Chattopadhyay, Sanyal and Saha 2006: 127). Recent survey at the site resulted in the documentation of a considerable numbers of sculptural specimens now kept in five different locales of the village and at its outskirt. Major concentration of habitational remains was recorded at the central part of the village which is known as Chowrangee More. As the name implies, the place is located at the crossing point of four village roads. A close scrutiny of a low mound of the place reveals a substantial amount of habitational assemblages in form of potsherds, iron slags, terracotta crucible, pieces of the nozzle of terracotta, probably
tuyere and other miscellaneous objects. The thickness of habitational deposits and the nature of archaeological assemblages, recorded at Chowrangee more clearly suggest its long cultural sequence. The occurrence of slags and other metal-working evidence suggests its association with production and consumption of metals.

**Domahania/Domani:** It is a large settlement near Asansol. Local tradition suggests that this area was involved in the procurement of local trading commodities. Habitational debris, structural remains, blocks of copper and other metal bearing ores, debris of metal extraction containing slags, metal pieces etc. and potsherds had been recorded at the western and northern parts of the site (Chattopadhyay, Sanyal and Saha, 2006: 126-127). However, present survey at the site failed to locate any occurrences of iron smelting activities.

**Kelejora:** The village stands on the southern bank of a local stream (Kelejor), about a km west of Domahania. The archaeological evidence of this locality can be divided into two clusters: (a) at the entrance of the village there is a long stretch of unoccupied land scattered with burial stones reflecting the beliefs and practices of an earlier tribal group (Bhumij/Asura); (b) along the river side of this village one can notice a large concentration of iron slags, microliths and potsherds scattered over a large area (Chattopadhyay, Sanyal and Saha, 2006: 127).

**Churulia:** The village near Asansol is located near a ruined fort on the bank of the river Ajay, in the old Pargana of Shergarh. The fort and other earlier structures are said to have been constructed by a local chief named Raja Narottam who belonged to the Sikharbhum ruling family of Panchakot. Archaeological evidence of the site (Chattopadhyay, Sanyal and Saha, 2006: 127) is represented by one architectural member (85 x 15 x 15 cm) showing the depiction of a Jaina Tirthankara (Parsvanatha) in dhyana posture, now in the collection of Nazrul Academy, remains of a few stone temples besides a wide area with the remains of iron working activities. Originally this was a low mound with a good concentration of the metal and mineral ores. In all probability this place was utilized as a working areas as confirmed by the occurrence of slags, tuyers, broken furnaces etc. In the recent years, unsystematic extraction of the ores resulted in the complete destruction of the site and its contexts.

**Gopalpur/Bandra Gopalpur:** The village lies on a lateritic tract near Durgapur surrounded by low lying alluvial land. The modern habitational site of the village is located on the older one. Therefore, the earlier evidences are now almost covered by the
modern constructions. Besides a few modern temples, the village has old structural ruins and exposed habitational debris containing potsherds, terracotta objects, iron slags etc (Chattopadhyay, Sanyal and Saha, 2006: 123).

**Malandighi:** The site is located in the flood plains of the river Kunur. This village has large ponds, old occupational debris strewn with potsherds, iron slags, terracotta objects and broken pieces of polished stone tools found at different places. A few fragments of stone sculptures have also been noticed near Hat tala (Chattopadhyay, Sanyal and Saha, 2006: 124).

**Behula:** The place is very close to the city centre of Durgapur township. There is a large elevated land locally known as Bhabani Pathaker Durga (the fort of the late medieval legendary hero Bhabani Pathak who was famous for his misdeeds or ruthless behaviour) containing some habitational remains which include potsherds, iron slags and architectural fragments made of schist stone (Chattopadhyay, Sanyal and Saha, 2006: 125).

**Sarpi:** This is another important site which has the traces of habitational remains in form of potsherds, iron slags and other household objects in the north and the western part of the village. There are a few Siva lingas and an unidentified female sculpture enshrined in the modern temples of the village (Chattopadhyay, Sanyal and Saha, 2006: 125).

**Raniganj:** It is an old market town, well-populated by trading and other landholding communities. As a trading centre it has been known since the time of the Islamic period. Different localities of the site such as Kumarpara (potters’ colony), Bhakatpara, Schoolpara, Thanagara and ferryghat along the river Damodar has yielded potsherds, terracotta and stone objects, iron slags in profusion and earthen objects possibly used for iron smelting (Chattopadhyay, Sanyal and Saha, 2006: 125).

**Mongalpur:** Situated 2 kms north-east of Raniganj town along the G.T. Road, the place also has several number of small mounds scattered with iron slags, potteries, terracotta objects and broken pieces of tuyeres (?) used for smelting iron. The ceramic repertoire of the site is datable to the early historic period (Chattopadhyay, Sanyal and Saha, 2006: 126).

Hijalgoara, Badalpur, Chakdol and Paraskol are the localities near Raniganj from where stray occurrences of habitational remains viz. iron slags, potsherds, and sculptural fragments have been recorded.
Asansol: The site has long tradition of commercial activities. It has also composition of diverse landholding groups which are said to be the original inhabitants of the town. Explorations at the place either on some stretches of unoccupied land or on the exposed area, resulted in the discovery of old habitational debris in form of potsherds, iron slags and other miscellaneous objects (Chattopadhyay, Sanyal and Saha, 2006: 126).

Gaurandi-Panuria: There are two adjoining villages at a distance of about 15 kms north of Asansol situated in the flood plains of the river Ajay. The investigations around a brick manufacturing complex at the southern part of Gaurandi resulted in the discovery of old habitational ruins. Large concentration of potsherds, iron slags, burnt earth, furnaces, potters’ hearths and some other miscellaneous metal and stone objects, recorded here suggests a long cultural sequence since the BRW associated EVF phases onwards. The occurrences of microliths have also been recorded from the nearby lateritic tract (Chattopadhyay, Sanyal and Saha, 2006: 127).

Dishergarh: As the name implies, the village (as already noted that the garh in local dialect means fort) supposed to have been surrounded by fortification/rampart wall, is now converted into a modern habitational site (Chattopadhyay, Sanyal and Saha, 2006: 128). A visit to the ferryghat on the river bank of Damodar can enable to notice some clusters of assemblages comprising iron slags, potsherds, terracotta balls and fragments of stone objects.

Apart from the above, the iron bearing occurrence/ sites have been noticed in the recent years during explorations and excavations of Dihar, Pakhanna and Mangalkote by the Department of Archaeology, University of Calcutta. The present work duly considers the data from these sites. However, inadequate information is a major constraint to include the sites for detailed study.

The sites along the rivers Kansavati, Silavati, Subarnarekha, Bharabbanki and Tarafeni:

Tulsipur: (22°56’25” N and 86°46’25” E)

The site lies on the right bank of the river Kansavati, near the confluence of the rivers Kumari and Kansavati. It is situated very close to the village of Ambikanagar. The mound of the site along the bank is about 20 meters in height from the river bed. The mound is eroded and uneven with a rain gulley dissecting it. It is covered with thick, slightly dark greyish clay. Surface exploration has resulted in the documentation of
potsherds, microliths, iron slags, stone fragments and other artefacts (Chattopadhyay, 2010: 109-110).

At the mound of Tulsipur a small scale excavation was carried out jointly by J. Birmingham of the Sydney University, Australia and the Eastern Circle of the ASI (S. K. Mukherjee and others) in 1967-68. The work was done in order to ascertain, in the first instance, the nature of the ‘Chalcolithic’ and ‘early Iron Age’ cultures of the region and secondly, to obtain a stratified sequence from the late stone age through the ‘Neolithic’ to the ‘Chalcolithic’ and early Iron Age cultures (Birmingham, 1972: 1-23; IAR, 1967-68: 49-50).

The work revealed three main phases of occupational deposits. The main features of each of these phases can be briefly summarized as follows:

Phase I: The structural remains of the earliest phase consist of living floors and a pit. A substantial number of gritty red-slipped, BRW and miscellaneous wares have been yielded from this phase. Besides these, the evidence of iron has also been recorded.

Phase II: The use of iron continues in this phase. The ceramic industry includes grey polished wares, a few BRW associated gritty red-slipped potsherds, and some sherds of BRW. According to the excavators, the varieties of BRW of the site bear strong resemblance to those recorded from Birbhum and Burdwan districts of West Bengal.

Phase III has yielded a bright red ware occurring on recent sand which covered much of the site to a depth of about 50 cm. The excavation report has no further details regarding the cultural remains of the phase. J. Birmingham has studied the BRW and other associate wares of ‘Iron Age’ of the site. While making a comparative study of BRW sherds of different sites of West Bengal, she observed that the sherds of Tulsipur and other places on the bank of the Kansavati give a poor impression of quality. The common shapes of BRW and other associated wares analyzed by her are heavy-rimmed bowls, angular shallow bowls, externally grooved incurved bowls and flaring rimmed jars.

Besides that, field survey was conducted at the site by R.K. Chattopadhyay (Chattopadhyay, 2010: 109-110). A few pieces of sherds of BRW, some sherds of grey ware, red ware and a good number of late historic red-slipped ware along with nineteen pieces of microliths were recorded from the surface of the site during the course of his field investigations. Among the nineteen specimens, thirteen aredebitages. These include four fluted cores, six core trimming blades and three parallel sided blades. The finished specimens are a burin, a point, two retouched flakes and two retouched blades. Intensive
survey at the site led him to assume that that the site furnishes with the evidence of an iron-using settlement with two phases of its developments—early and mature. According to him, this, incidentally, is the solitary evidence of a major settlement associated with iron-working activities for a long duration in south Bankura. “Spread of microliths using sites in the nearby area suggests the possibility of the continuation of hunting-gathering-intensive foraging in this micro-environmental set-up. Farming, animal husbandry and even the involvement of metal working are quite evident here. Farming and non-farming activities are both significant in this settlement context and hereby we may tentatively assume that all these activities were guided by seasonal transhumance”. (Chattopadhyay, 2010: 110)

He further opined that, the particular character of the site i.e., represented by the evidence of association of iron with BRW from the earliest level has a strong resemblance with that of the site of Bahiri, in the district of Birbhum. At Bahiri the excavator (Chakrabarti and Hasan, 1982: 111-149) encountered iron from the earliest level at the site.

It would appear that Tulsipur perfectly fits in both the chronological and cultural set-up of the known metal sites of this region. It also shows a pure village settlement with an access to the raw materials bearing areas of both copper and iron since the appearance of the BRW using phase. “On one hand the small strip of flood-plain along the upper reaches of the Kumari-Kansavati certainly encouraged them to lay the foundation of farming activities as well as settlements. On the other hand, the adjoining undulating landscape of the mountainous region which harboured profuse number of games instigated them to retain their age old hunting tradition. At the same time, availability of varied natural resources including metals, minerals and forest products in the said geo-physical set-up and the demand of such resources from the nearby EVF settlements in the plains forced them to be involved in the procurement process of such products. Hence, a simple village society certainly guided by seasonal working activities gradually became a major centre of EVF settlements in the interior localities of the plateau region of south Bankura” (Chattopadhyay, 2010: 112).

Kumardanga (22°39’30” N and 86°57’40” E): The site is situated just on the high left bank of the river Tarafeni, about 4 km downstream from Tarafeni bridge along the Raipur-Silda Road. It was explored by the Archaeology and Museum Unit, Department of History, Delhi University (Chakrabarti, et al., 1982a: 44-45). Subsequent survey at the site by Chattopadhyay revealed that it has an extension of 30 m. The surface of the river
bed is mainly covered by hard compact yellowish soil mixed with a good quantity of lime nodules (locally known as ghutting). Besides, the surface is also scattered with iron slags and ores of substantial amount. Ancient habitational remains have also been exposed in form of ashy debris containing potsherds and otherwise. Chattopadhyay suggests that the general appearance of this debris indicates that it was once a potter’s furnaces/hearths which were abandoned. “Apart from the collection of antiquities, mostly consisting of BRW associated cultural material recovered either from the erosional rain gullies on the river cliff or from the surface, a trial digging on the site revealed a considerable collection apparently associated with EVF cultural phases. The collection comprises mainly BRW, other wares (grey ware and red ware) associated with it and a few clay objects. The trial digging, though limited in nature, confirmed that the site formed a settlement of the EVF communities acquainted with metal working.” (Chattopadhyay, 2010: 113)

**Dhuliapur** (22° 38’ 06” N and 86° 50’ 44” E): The site is situated on the bank of the river Tarafeni, about 6 km northwest of Belpahari in the West Midnapur district. Trial excavation at the site was conducted by the Directorate of Archaeology and Museums, Government of West Bengal in 1983-84 (IAR 1983-84: 93-94), 1986-87 (IAR 1986-87: 98-99) and 1992-93 (IAR, 1992-93: 100-101) under the supervision of Sudhin De. Trial diggings revealed that the site witnessed human activities right from the lower Palaeolithic period to the medieval one with some intermittent cultural gaps. The region comprising the high cliff of a stream (nullah) of the Tarafeni is close to the village of Belpahari. Most of the surface of the adjoining area is undulating, and thus gives an impression of alternate ridges and depressions. Stone tools pertaining to the Lower, Middle and Upper Palaeolithic periods, as also microliths and celts and adzes were found in situ from high cliff around. The Lower Palaeolithic tools comprise handaxes, choppers, cleavers and scrapers. The Middle Palaeolithic tools like smaller scrapers and handaxes were recovered from the junction of the upper loose gravel and upper silt. Most of Lower, Middle and Upper Palaeolithic tools have been made from quartz and quartzite. The geo-stratigraphic sections as exposed at the aforesaid nullah indicate that there were two gravels and two silt deposits above the bedrock and the deposits are alternate in nature indicating a diverse climatic condition. From a study of the deposits near the nullah it is apparent that the river has shifted its course and a fan-shaped alluvial deposit has also been noticed here. A fossiliferrous bed was noticed in the alluvium and fossilized
animal bones and stone tools were found embedded in the deposit (composed of cemented gravel overlying the basal rock).

The Upper Palaeolithic tools mainly comprise gravers, points, blunt-headed arrows with a tang, scrapers, bone scrapers with a tang, round scrapers etc. The retrieved microliths are parallel-sided blades, backed blades, lunates, round scrapers, denticulated or saw-like blades, arrowheads, etc., made of chert, quartz, etc. A good number of celts, one broken adze (made of dolerite) and few broken pieces of ring-stones have been recovered from the eroded surface.

On the southern bank of the aforesaid meandering river, iron slags and iron implements has been found strewn over the surface in profuse quantity (IAR 1986-87: 98-99).

In 1992-93 explorations were concentrated in two locales of the site, i.e., DHLPR-I and DHLPR-3. According to the excavator, at DHLPR-I, layers 2 and 3, yielded the remains of the iron using EVF phases and Neolithic period respectively. Layer 2 comprises compact soil (40 cm thick), brown in colour while the latter consists of compact, reddish yellow soil. Layer 2 yielded profuse quantity of iron slags and varieties of iron implements like nails, spearheads, arrowheads, blades and dagger (broken) along with lump of burnt clay and potsherds of sturdy red ware and grey ware (bowls and dishes etc). Layer 3 represents the so-called Neolithic period (2.5 m) which yielded potsherds (bowls and vessels) of dull red ware and a single piece of celt, made of fine grained sandstone.

At DHLPR-3, near the DHLPR-1 were noticed four ovens in completely worn-out condition (at a depth of 2 m from surface) with traces of burnt clay, ash and charcoal at the oven base. The habitational remains are largely destroyed by fluvial action (IAR 1992-93: 100-101). All these evidence along with a few specimens tuyers found from this layer suggests the presence of an iron manufacturing centre.

Finished implements recorded from the site include swords, nails, arrowheads, points, spearheads, knives etc along with a few shapeless bits (Chattopadhyay, 2004: 85-86).

a) The sword is 114 mm in length. This consists of a thin handle having a thickness of 5 mm, the middle part of the handle is 21 mm in breadth. The rear portion is curved with a maximum breadth of 44 mm. the remaining part of the cutting edge is 55 mm in breadth. One side of the edge is projected outside with a ridge, though its purpose is not very clear from its corroded state. However, it might be the midrib.
b) The spearhead is of thin section having a length of 61.5 mm and a breadth 19.6 mm. The maximum thickness at middle point was about 1.5 mm. the distal end had a long projected portion for fixing on a wooden handle.

c) The arrowhead has much resemblance with its lithic counterpart. This has a pointed tip, and its length is 33 mm with a cross section of ‘diamond’ shape (9.5 x 8.2 mm). The distal end has a projection (3 x 3 mm) to fix the handle of an arrow.

d) It is an arrowhead or point (?). The tip of this implement has a cross section of 4.5 x 4.5 mm and its length is 60 mm. Maximum cross section is noticed about 7 mm from one end and appears like a sharp pyramid shape. The other end is also projected with a gradual thinning.

e) Sickle (?): A fragmentary iron object of the shape of a sickle is 69.5 mm long and 22 mm in breadth. The internal portion is about 4 mm in thickness, whereas, the external portion is quite sharp.

f) Chopper or knife: This fragmentary portion of an implement, slightly curved, is 40 mm long, 24.5 mm wide and has a triangular cross section. Its maximum thickness is 8 mm. The cutting edge is characterized by a thin, sharp surface.

g) Nails: A number of nails, of varying length and irregular section, were recovered from the site. One of them is about 70 mm in length and rectangular in cross section (7 x 6 mm). The sharp end is bent. The head is triangular having a thickness of 14 x 5 mm.

h) Shapeless bits: Some semi-finished objects were also recorded. One of the specimens is selected for present analysis. It bears a dimension of 42 x 40 mm with a maximum thickness of 7 mm.

A total number of four tuyeres were recovered. One of them was made of burnt clay. One end is vitrified and slagged which is an indication of prolonged use in smelting operations. The other end is free from erosion and indicates this end is had been connected with the bellows. The tuyer is not cylindrical but resembles a truncated cone. It is not a complete specimen, though the extant length indicates that it was more than 80 mm. The approximate diameter is about 58 mm. The eroded portion of the specimen is also slanted and eccentric with an internal diameter of 31 mm and an external diameter of 62 mm with a slanting angle of 15° (De and Chattopadhyay, 1989-90: 116; De and Chattopadhyay, 1997: 51-53; Chattopadhyay, 2004: 86).

The chemical analysis of the recorded iron objects (Table 18) was done by using various methods. To determine carbon, Strohlein apparatus was used. Analysis of other elements
like copper, nickel, manganese, lead and zinc had been done by atomic absorption spectrometer. The slag analyses had been done by wet method (Table 19).
The metallographic analyses of the recorded specimens indicate the presence of inclusions which are principally silicates in form of slag.
The microstructure of the a) sword was non-uniform and the grain size number varied from 6 to 7. Prior to etching, patches of silicate inclusions were noticed at places. Fine recrystallized grains of ferrite and patches of pearlite had also been noticed. Structure is mostly ferrite though in some places about 20 to 25 % pearlites are also seen. The sword had been air cooled after forging as indicated by the normalized structure.
Microstructure of the h) shapeless bit consists of ferrite and pearlite. Presence of a few Widmanstatten ferrite indicates overheating.
The microstructure of one of the nails is found to be a non-uniform structure consisting of ferrite and non-uniform distribution of tempered martensite. Carbon inhomogeneity may be due to non-uniform preferential decarburization (Chattoapdhyay, 2004: 86-88).

Kankrajhor: The site is situated on the bank of the river Kharsoti, a tributary of the river Subarnarekha in the West Midnapur district. Trial excavations at the site were conducted by the Directorate of Archaeology and Museums, Government of West Bengal in 1983-84 (IAR 1983-84: 93-94) and 1986-87 (IAR, 1986-87: 99) under the supervision of Sudhin De.
A few cuttings were made near the slope of a denuded mound and the cliff section of the stream. A trial trench measuring 2 m x 2 m was laid at the top of the mound. The following sequences were observed:
Layer (1) recent;
Layer (2) semi-compact brown earth, iron slags, iron pins (probably collyrium sticks or styluses) and potsherds of dull red and black ware;
Layer (3) fine grey to yellow earth, sterile;
Layer (4) semi-compact yellowish sandy earth, Neolithic ground celts associated with fragments of a handmade bowl in pale black ware and other vessels of pale red ware and grey ware, thickness-0.30m.
Layer (5) compact yellowish grey earth, sterile;
Layer (6) coarse ground sandy earth with nodules yielded microliths like arrow points and blades and flakes;
Layer (7) sterile; and
Layer (8) basal rock overlain by a pebble deposit; from this layer, one Middle Palaeolithic hand-axes of quartz and one Upper Palaeolithic long blade (slightly curved) were recovered.

The site has yielded iron objects and slags. The recorded iron rod or nail has oval cross section. This is about 6 mm in diameter with a length of 46 mm. The two edges of this rod had been rounded off by wear and corrosion.

Iron slag found from the iron bearing level clearly shows that iron working activities practiced at the site. The microstructure of the iron nail or rod is represented by mertensite structure, which perhaps followed as a result of tempering operation. The specimen shows the evidence of forging, however, the tempering was probably unintentional. (Table 20, 21) (Chattopadhyay, 2004: 90-91)

The area in and around Susunia has yielded substantial evidence of iron smelting activities. Explorations in and around the sites (along the river banks of Gandheswari and Dhankora) like Suabasa, Pachasimulia, Siulibana, Bagdiha, Jamthol, Paharbeda, Kamarshol, Jhatipahari etc. revealed broken furnaces, slags, broken tuyers etc. The traditions of tribal mode of iron smelting in the forested regions in and around Susunia certainly have bearing on the above distribution of findings related to metal workings.

Ambikanagar (22°57′N and 86°46′E): Ambikanagar is situated on the right bank of the Kansavati river, just below the Kansavati reservoir in Ranibandh Police Station area. A few sherds of BRW and Neolithic pierced stones have been recorded by Birmingham in the microlith bearing region of Ambikanagar. Earlier Krishnaswami collected microliths and neoliths from the region. Besides, the site is also strewn with the habitational and structural remains of the early medieval period. Coarse red and grey pottery formed the bulk of the collection. Besides, several specimens of iron implements and slags have also been documented during the course of his survey. (IAR 1959-60:50)

Chitgiri: (22°56′55″ N and 86°46′30″ E)
This site is situated on the left bank of the river Kansavati, opposite to Ambikanagar. Rain gullies cut through the high cliff surface, covered by a yellowish sandy alluvium has yielded a substantial amount of microliths along with iron slags as mentioned by the earlier scholars. (IAR, 1959-60: 48-50)
**Paresnath:** (22°57'30" N and 86°45' E)

It is a significant site which has a long chrono-cultural succession. Explorations conducted by various scholars have resulted in the discovery of a number of palaeoliths, microliths and polished stone tools. These specimens were collected from a rain gully near the hamlet of Paresnath. Surface exploration by Krishnaswami in 1958 yielded a substantial number of iron slags (*IAR*, 1959-60: 48-50).

**Kendua:** The temple site of Kendua lies about one and a half km north of the Kansavati river, on the upper reaches of the dam. It is about 9 km from Ambikanagar. The site was reported by various scholars in different contexts. Field survey by Krishnaswami and his team led to the recording of a number of iron implements (*IAR*, 1959-60: 48-50).

**Bhagabandh:** (23°12'25"N and 87°01'55"E)

The site is situated on the bank of the local stream Ujani which is a tributary of the Dwarakeswar. During the course of field survey at the site by R.K. Chattopadhyay he has recorded the occurrence of one hand-axe, two Lower Palaeolithic flakes and a microlithic cluster. This elevated and undulated land has also yielded a considerable number of iron slags (Chattopadhyay, 2010: 65).

**Nekrapacha:** (22°47'55"N and 86°51'1'E)

The site is situated on the eastern bank of the Bhairabanki river. The occurrence of microliths and iron slags has been reported by Chattopadhyay (Chattopadhyay, 2010: 71).

**Kuchaipal:** (22°45'10"N and 86°49'15"E)

The site is situated on the east bank of the river Bhairabanki. The bank is highly eroded and forms deep rain gullies. The microliths occur both in the gullies and also on the surface. Iron slag is found in the locality (Chattopadhyay, 2010: 72). Similar occurrence have also been noted at the sites of **Raspal**, (22°44’15″N and 86°50’05″E), **Jugladanga**: (22°43’45″N and 86°53’E), **Kumar-ar**: (22°43’45” N and 86°53’45”E) etc.

**Sulgi** (23°N and 86°52’30”E): The site is located on the left bank of the river Silavati in the Taldangra P.S. area. According to R.K. Chattopadhyay the site is known to have yielded BRW besides some remains of the medieval period (Chattopadhyay, 2010: 160-161). During the exploration some microliths were found in association with two small Neolithic celts and a few pieces of iron implements in the cliff section at Sulgi (*IAR* 1981-82: 74).
Bhaluksoda: The cave (5.20m east to west) lies to the north-east of the Susunia hill. It has the entrance in the south-western part. A trial-digging at this cave site by the Directorate of Archaeology, Government of West Bengal under the general supervision of S.C. Mukherji led to the unfolding of two layers. From layer 2, which was the habitational layer, two iron spearheads, few bone implements and some pottery fragments in dull red ware having crude textures were recovered (IAR 1985-86: 85-88).

Coastal Region:
Different aspects of the settlement dynamics of littorals can be conceived by understanding the region as an extension and part of the settlement dynamics of the hinterland and the adjoining mainland areas. However, there is no doubt that fluctuations of coastline and environmental factors have definitely delineated the ‘coastal’ parameter and its subsistence patterns. In this geo-physical niche, sea-faring subsistence activities must have played a significant role. The distribution of settlements survived from the BRW associated EVF phases (though late) to the later historical period precisely suggests that coastal region was an extension of the settlement dynamics of the Ganga valley. The genesis of the iron using settlements in this region can initially be traced in the area adjacent to the hinterlands like Moghalmari, Tilda, Bahiri and even Tamluk in the districts of East and West Midnapur, Mahanad, Pandua, Boichigram in the district of Hooghly, Barrackpore, Dumdum in the old district of 24 Parganas. The core region of coastal Bengal wherein the site like Chandraketugarh is located has witnessed the subsequent growth of settlement dynamics. Unfortunately, the procurement process and the nature of metal using activities at these sites are inadequately known in spite of the retrieval of innumerable iron objects from these sites. In this context, it is worth mentioning that, the sites may not yield substantial materials related to metal works or even finished objects however the assemblages and similarities in habitational remains and artefacts with the other metal bearing sites suggest to place them in the same cultural parameter, i.e., the overall influence of iron using settlements.

Sites adjacent to the Hinterlands/ Hinterland sites:
Since the location of Moghalmari is at the transit zone of upland lateritic region of the plateau and at the close proximity of the coastal line, the present work incorporates its archaeological significance in the distribution zone of the coastal Bengal.
Moghalmari (21° 57’ N and 87° 16’ E): The site is situated in the flood-plain of the Suvarnarekha (which flows about 4.5 km west of the site) little away from the present coastal line and virtually located at the last terrace of the Chhotanagpur upland. The site was first reported by N.N Vasu in 1901. The historical significance of the site was first explained by Vasu, in his ‘The Archaeological Survey of Mayurabhanja’ (Vol.I. By citing relevant sections from Fakirnama and Blochmann’s translation of Ain-i-Akbari (Vasu, 1911:121) he not only recorded the structural remains of Sakhisenar Dhibi at Moghalmari but also referred (on the basis of H. Blochmann’s hypothesis: 1873, 209-73; 1874, 280-309) to the site being associated with the battle between the Mughals and the Pathans during the reign of Akbar.

Moghalmari was excavated by the department of Archaeology, University of Calcutta in 2003-04, 2006-07, 2007-08, and 2011-2012 (two phases) (Datta, 2008b; CASTEI, Newsletter, Nov, 2011, No.16).

Excavations were conducted in several trenches at MGM1 (Sakhisenar Dhibi) and at MGM2 (low structural mound in front of Kalipada Mishra’s house, about 300 m northwest of MGM1) and MGM 3. Excavations at MGM1 revealed the remains of massive structures (identified by the excavator as walls) just below the surface humus. According to the excavator the structural remains at MGM1 were the remains of a large monastic complex, assignable to the early medieval period.

Excavation in two trenches at MGM2 exposed five circular structures which were identified by the excavator as stupa-basements. MGM2 after a gap of 0.55 m thick sterile layer yielded a 1.48 m thick BRW associated cultural deposit. This deposit could be associated with the EVF phase and yielded black ware, red ware, grey ware, and BRW. The shapes include bowls, basins and handis etc. A few sherds exhibit white painted motifs.

This trench MGM3 yielded huge quantities of charcoal at different depths in layer 3 along with iron ore, slag materials, iron objects, etc. Layer 4 yielded a terracotta seal matrix in layer 4 besides other cultural objects.

It is necessary to note that Moghalmari, being located in the intermediary zone of the plateau and the eastern littorals must have played crucial role in the procurement network of metals and minerals. Though inadequate, the cultural remains of the BRW associated EVF phases and the occurrence of iron slags and other evidence of iron workings (near the residence of Kalipada Misra) substantiates that the site was involved in the process of
both production and consumption of iron. However, there is no doubt that the site itself was consistently involved in secondary iron production for which they must have procured extracted iron (ingots) from other sites of the Mayurbhanj region. Unfortunately, the BRW bearing EVF phases have not been properly unfolded at the site, as a result the nature of consumption and production during the particular phases is yet to be established. Its close proximity with the settlements along the coastal lines also suggests its significance in the interactive network. However, the large monastic complex or structural remains of the medieval/late medieval period must have exploited the metal in substantial amount. In this context, we may note that during the 6th century CE onwards, the territory became a major part of the political development of *Dandabhukti* as corroborated by the Sasanka’s Egara and Midnapur land grants and other literary sources. Such evidence reasonably confirms the fact that the said region was under the direct control of political authority and it will be not out of context to visualize that such development made necessary impact on the production of iron and its distribution network. It was the period when the region also started to achieve the monumental character of structural activities (both secular and religious). The existing settlement dynamics of the region received further momentum by the development of religious establishments (Buddhist and Brahmanical).

**Bahiri** (21° 51’ N and 87° 47’ E): This village, about 6 km northeast of Contai town, lies to the east of Marishda on the Tamluk-Contai road and to the west of Rasulpur river. Bahiri actually comprises three villages – Paikbar, Deulbar (J.L.No.435) and Dhibahiri (J.L.No.436). This village is locally known as Deulbar. The western, northern and eastern limits of this village are marked by a palaeo-channel known as Rasanala. The western part of this dried-up channel (which is now covered with lush paddy fields) and its adjacent sections yielded a large number of early historic remains (Chattopadhyay, forthcoming). Apart from different artefacts, this dried-up channel and its adjoining banks/elevated areas yielded structural and other habitational remains including brick wells, potsherds, terracotta objects and stone sculptural remains. Low, flat mounds with structural remains can also be observed in this village. An exploration at the site by the Asutosh Museum, University of Calcutta, resulted in the recording of terracotta figurines of the Kusana, the Gupta and the early medieval periods (*IAR*, 1956-57: 81). A local club has a notable collection of early historic artefacts comprising potsherds and a few terracotta figurines including a Sunga *Yakshini* figure which were collected during
modern constructions or diggings of tanks (Chakrabarti, 2001: 151). During the late medieval period, Bahiri was a part of the Hijli mandala and under the rule of the Orissan kings. Unfortunately, no mention was made regarding the nature of iron objects, recorded from the site. However, there is no doubt that the site has to be viewed, not in terms of isolated localities, but as a cluster of ancient settlements which has played a significant role in the procurement network of metals and minerals.

**Amritberia Ichhcapur:** This site is located on the south bank of the river Rupnarayan, few kilometers south of Tamluk. The Directorate of Archaeology, Government of West Bengal, carried out exploration at the site. Besides BRW, the site also yielded a collection of early historic antiquity (*IAR* 1977-78: 85). This collection includes fragments of rouletted dishes and other early ceramics and five uninscribed cast copper coins. In its vicinity another site of Ichhapur also yielded similar kind of assemblages (*IAR* 1977-78: 85).

**Tilda** (22° 15’ N and 87° 41’ E): This site under the Pingla P.S. is situated along the Balichak-Maina road in the district of West Midnapur. This village is also known as Tildaganj. Like Bahiri, this village is now quite away from any flowing channel, however, there is evidence of dried-up channels of former rivers in its vicinity. This area is locally known as a *garh* or a fortified complex. Evidence of mud walls surrounding this centrally situated area probably suggests fortification. Trial excavation at the Chandpur mound by K.G. Goswami of the Asutosh Museum, University of Calcutta, exposed two structural phases assignable to the Gupta and post-Gupta periods (*IAR*, 1954-55:23). However, A few decades after this trial excavation, extensive field works by R.K. Chattopadhyay (Chattopadhyay *forthcoming*) in and around the site of Tilda resulted in the recording of the occurrence of BRW associated habitation deposits from the adjoining regions of the structural mound excavated by Goswami. On the basis of the in situ remains along the exposed sections, he felt that here, the genesis of the settlement could be traced to the BRW associated EVF phases, however, more evidence are required to substantiate this early beginning. The explored database include potsherds, terracotta objects, beads of semi-precious stones, fragments of copper objects, iron slags, broken parts of stone sculptures, clay dabbers, net-sinkers, hopscotch, bone tools, etc. The database retrieved from Tilda is comparable to a certain extent to the archaeological parameters of Moghalmarri, Dantan, Bahiri, Panna and even Tamluk, but with a difference. In absence of horizontal excavations and epigraphic-literary data, the identity,
function and the nature of the settlement at Tilda are not yet clear. However, the role of the settlement in both production and consumption cannot be ruled out altogether.

**Tamluk** (22° 17’ 50” N and 87° 55’ 24” E): Tamluk, under the Tamluk P.S., lies on the right bank of the Rupnarayan river. At the outset of the field report, it is pertinent to mention that the site was often identified with the legendary ancient port-town of Tamralipta/Tamralipti. However, whether it is virtually possible to relate the findings from Tamluk and its surrounding region to the settlement dynamics of ancient Tamralipta (as available in the existing historiography) is beyond the scope of the present work.

Altogether, there is no doubt that the habitational remains recorded in and around the site testifies to the fact that it was major settlement complex involved in diverse activities. Innumerable archaeological records from the region and extensive literary references to *Tamralipta/Tamralipti* collectively suggests that it nurtured diverse activities associated with port, harbouring area, a teeming trading centre, non-secular architectural and sculptural remains (Buddhist, Jaina, and Brahmanical) and different power centres. The large scale consumption of metal, minerals and other resources of the plateau and the plain seems to be quite obvious for the settlers of Tamluk. However, earlier excavations failed to strike on the potential place of occurrence of iron.

Tamluk was first excavated during 1954-55 by the Eastern Circle of the ASI under the supervision of M.N. Deshpande (*IAR* 1954-55: 19-20). This excavation conducted at seven different places has unfurled five occupational levels ranging from the ground and polished stone tools bearing level (i.e., the so-called ‘Neolithic’ phase) to the modern level with occasional breaks. According to the excavator, period I yielded a few specimens of ground and polished stone tools in association with ill fired pottery. Period II has been assigned by the excavator to 3rd – 2nd century BCE. This period is characterized by the occurrence of NBPW, beautiful terracotta figurines and cast copper coins. Sherds of NBPW and associated BSW were found from the lower level of this period, whereas red ware, well modelled terracotta figurines and cast copper coins were found from the upper level of this period. Period III, assignable to the 1st-3rd centuries CE, is characterized by the profuse occurrence of red polished ware and rouletted ware (*IAR* 1954-55: 20). This period yielded sprinklers for the first time. Structural remains include a brick built stepped tank exposed in one trench and a ring well and soak pit from another. Banded agate beads were also reported from this period. The cultural sequence of period IV has not been clearly defined by the excavator. He mentioned some beautiful
terracotta figurines which he assigned to the 3rd – 4th centuries CE. He also attributed the influence of the so-called Kusana-Gupta art idioms in the fabrication of the terracotta figurines found from this period.

Tamluk was excavated for the second time during 1973-74 by the Eastern Circle of the ASI under the Directorship of S.K. Mukherjee (*IAR* 1973-74:33). This excavation conducted at two (10m x 10m) trenches laid in the open space behind the Munshif Bungalow unearthed four occupational levels. Period I, termed by the excavator as the ‘pre-NBPW horizon’ yielded BRW, ground and polished stone celts and a wide variety of bone tools. Period II yielded degenerated variety of BRW and its upper level yielded NBPW sherds and associated BSW in association with structural remains comprising burnt surkhi-rammed floors and a number of post holes. Period III yielded incurved bowls of red ware, a number of terracotta figurines of the Sunga period and structural remains comprising a series of hearths on a surkhi-rammed floor. Period IV yielded rouletted ware, polished red ware and other artefacts of the historic period. The overlying deposits were found disturbed at this space behind the Munshif Bungalow. A terracotta ring well with a diameter of about 80 cm was recorded from these disturbed overlying deposits of the medieval period.

During recent years, the region in and around Tamluk was intensively reexamined (with reference to the spatial extent of this ancient site) by Kaushik Gangopadhyay of the Centre of Archaeological Studies and Training in Eastern India, Kolkata (Gangopadhyay, 2010: 53-63). His explorations recorded different varieties of potsherds (black ware, grey ware, red ware and buff ware and the characteristic shapes include bowls, dishes, vases and basins), terracotta figurines, terracotta crucible, beads of semi-precious stones and glass, terracotta tiles with two grooves and double perforations, polished stone tools ‘possibly made of granite’ etc.

**Natsal/Natshal** (20°11’59.88” N and 88°2’47”E): Natsal is located on the right bank of the river Rupnarayan near its confluence with the Hooghly in the Tamluk subdivision of the district of East Midnapur. This inter-tidal zone has yielded a wide range of artefacts comprising ceramics, terracotta objects, beads, bone tools, stone tools etc. (assignable to the early historic period) from the villages of Ichhapur, Natsal, Tentulberiya and Badur-Latpatia. Natsal is exposed by river action, i.e., its remains are mostly found from the natural sections of rivers or from chance diggings. This village gradually slopes down from the west to the east. Generally, the cross-section evident from several steeply eroded
banks reveal the strata of the historical periods underlying an alluvial deposit and just below the former is a thick layer of black soil containing artefacts of the so-called protohistoric period. Chance finds (mixed-up assemblages) reported by the local people (or otherwise) from the bed only during low tides as well as the bank of the Rupnarayan, adjoining Natsal, include ground and polished stone tools (celts), a few microliths, handmade pottery, black burnished ware, BRW, ‘degenerated’ NBPW, rouletted ware, other kinds of potsherds of early historical and medieval periods, tools of different shapes and sizes (points, scrapers and blades) of fossilized and partly fossilized bones, teeth and antlers including diminutive ones which were physically and functionally comparable to microliths, worked bones bearing varied motifs which were carved, engraved, painted and clay modelled, bone harpoons, polished bone tools, fossilized human bones (mandibles, femur and clavicle), terracotta figurines and plaques, terracotta sealings bearing inscriptions, terracotta sling balls, beads of clay, bone, metal and precious and semi-precious stones, cast copper coins, a few stone images, grinding stones, dabbers, etc. Datta after studying the exposed river sections formulated a tentative chrono-cultural sequence of this locality (Datta, 1997: 25-36; 1999: 49-60). The genesis of this settlement had been traced by him to the ‘Chalcolithic period’. The Directorate of Archaeology and Museums, Government of West Bengal, undertook trial excavation during 1997-98 and 1998-99. This trial excavation reported sherds of BSW and associated wares with some fragmented early historic terracotta figurines. The Directorate again undertook excavation during 1999-2000. Natsal was studied in 2003 by S.N. Rajaguru and Kaushik Gangopadhyay. They found the following stratigraphy. “Unit I: Depth of the Unit in the scraped section is 1 m non-pottery bearing laminated coarse silt with thin inter layer of sandy silt. Weakly consolidated, yellowish grey in colour, weakly pedogenised hydromorphic soil.

Unit II: Depth of the Unit in the scraped section is between 1 m and 1.75 m approximately. In sharp contrast to the Unit I, pottery, brickbats, bones, intact bricks and semi-intact pots within the greyish mottled (moderately) silty clay – also affected by the biogenic processes as indicated by the empty holes on the surface. Thin (15 cm) lense, rich in rolled and fragmented potsherds in the middle part of the unit.

Unit III: Unit II grades into Unit III which starts from 1.75 m and continues under present deposition. It consists of brownish clayey silt with large number of non-transported early historic pottery.
As early historic pottery is associated with the brownish clayey silt, it can be said that the human settlement was associated with the tidal mud flat during the early historic period.” (Gangopadhyay, 2008: 103-104). According to Gangopadhyay, since Ichhapur, Natsal, Tentulberiya and Badur-Latpatia are located in the inter-tidal zone, the occurrence of most of their cultural remains were found to be disturbed and embedded in the late Holocene deposits (Gangopadhyay, 2008: 99-112).

**Sekua:** The site is located near Benapur under the Kharagpur police station. Besides the presence of a number of chala and ratna temples, a few mounds with ancient habitational remains also stand at the site. These mounds yielded old habitational remains, potsherds, terracotta objects, iron slags etc. The genesis of this settlement goes back to the BRW associated EVF phases which were in all probability contemporary to the BRW associated phases of Moghalmari, Narayangarh etc (Chattopadhyay forthcoming).

**Jagdih:** The site of Jagdih is located in the village of Nachhipur under the Panskura PS. The site is scattered with old habitational debris. Tarapada Santra surveyed the region and its archaeological remains which resulted in the recording of a large number of potsherds, iron objects, etc. It has the evidence of ring wells and other structural remains (Chattopadhyay forthcoming).

Besides explorations in and around the sites of **Lacchipur** (22° 39' 5” N and 87°E), **Nepura** (22° 39’ 6” N 86° 54’ 27” E) region on the western banks of the river Kansai, **Daintikri, Aguiboni, Mayta, Narayangarh, Rautmani, Jinsar** etc have yielded habitational remains associated with the EVF phases and the early historical period.

**Jai Kalir Chak** (21°42’N and 87°47’E), **Manikabasan** (21°44’N and 87°47’E): These two sites under Ramnagar P.S. have yielded a large number of potsherds, terracotta plaques, figurines, sling balls, net sinkers, bone objects and other habitational remains. Near the village temple at Jai Kalir Chak, there are some old occupational deposits. Both Jai Kalir Chak and Manikabasan are not far away from the coastal line. Arabinda Maity of Dharas has a personal collection of antiquities/arrestfacts found from both these sites. Terracotta elephants of the pre-Christian era are among the retrieved objects and most probably these two places were early historic sites (Chakrabarti, 2001:151).

**Mahanad** (23° 00’ 30” N and 88°16’ E): Mahanad is the only excavated site in the district of Hooghly. The site, under the Pandua P.S. as well as under Polba P S, is about 6.4 km south of the Pandua railway station. The site is well known for her Jatesvaranatha temple complex. During 1934-1935, the locality of Mahanad was extensively explored by
N.G Majumdar (Majumdar, 1934-35: 43). A trial trench was taken up for excavation by him at the Jattala mound of the village where a massive brick wall at a depth of 183 cm was exposed. The section yielded other structural remains including fragmentary parts of a terracotta ring well. The report does not specify the alignment of the exposed structural remains, however, it hints to the association of the structural remains with a religious complex. Other habitational remains associated with the structural remains include a large number of potsherds, a stucco head stylistically assignable to 5th-6th centuries CE, terracotta figurines, etc. A number of antiquarian remains retrieved from Mahanad and Sudarshan (an adjacent village of Mahanad) are presently in the collection of the Indian Museum, Kolkata. These include an image of Jambhala found from Sudarshan, an image of Uma-Maheswara assignable to the Pala period, an image of Vishnu found from Rosna (yet another adjoining village of Mahanad), a piece of stucco sculpture assignable to the 5th-6th centuries CE, potsherds, terracotta moulds, punch marked coins, a gold coin of Sasanka, etc. The Saradacharan Museum of Baidyabati has a collection of artefacts including terracotta lamps, pottery lids, potsherds, weights, two stone images of Vishnu, a beautifully carved section of a pillar made of basalt, a fragmentary icon of Chamunda (45 cm x 20 cm x 10 cm) etc. found from Mahanad and its adjoining region. Besides, the site has also yielded three gold coins, assignable to the Gupta period which are now preserved in the Asiatic Society, Kolkata. These coins were originally collected by Rev. K.S. Macdonald from the Mahanad region. A.F.R. Hoernle (Hoernle, 1882: 91-92) had studied these coins.

Saptagram: This site under Magra P.S. lies on the left bank of the Saraswati and is about 6.4 km north of Chinsura town (along the Grand Trunk Road). Several literary sources of the medieval-late medieval period refer to Saptagram as an important trading as well as an important administrative centre (Satgaon). However, the discovery of numerous antiquities assignable to a period ranging from the early historic to the colonial times indicate how the site survived in spite of the shifting of settlements (evidence traced) due to changing river courses. The Saraswati channel has undergone marked changes. With reference to its present course it may be stated that earlier during the early historic period, Saraswati flowed along the western flanks of this settlement but subsequently changed its course and gradually turned towards the present course of the Hooghly probably from the post-Gupta times. So far as the discovery of numerous antiquities assignable to a period ranging from the early historic to the colonial times are concerned, Saptagram yielded a
large number of potsherds, terracotta objects, sculptural remains, beads of semi-precious stones, etc. A low eroded mound used as a playground by the members of the Vivekananda Ashram/club yielded a few sherds of NBPW along with associated early historic antiquities. It must be mentioned here that the adjoining areas of Saptagram bordering the districts of Hooghly and Burdwan, have yielded BRW and associated occurrence. We may cite the findings from Hatipotar Danga in the Raigram locality and of course the evidence from adjoining Satdeulia, Gurap, Boichi, Simlagarh and even Pandua and Tarakeshwar (Chakrabarti, 2001:119). The evidence of iron slag, for example at Hatipotar Danga in Raigram indicates local smelting and the ores were probably physically transported or locally available lateritic iron ore (Chattopadhyay, forthcoming). As it is well known that Satdeulia yielded a number of Jaina remains and even her major landmark, i.e., the temple, is generally associated with the Jaina ideology. The Jaina communities are known for their metal working and it will be worthwhile to trace, if possible, the settlement dynamics of this region (during 9th to 12th centuries or later) with reference to the metal working groups and their spread from the resource bearing areas of the Chhotanagpur region and its adjoining upland areas.

**Boichigram:** The site situated under the Pandua P.S is famous for its late mediaeval and pre modern temples. Its archaeological significance is easily explicable by the existence of low habitational mounds scattered with ancient ceramics. So far as the character of habitational ruins is concerned the remnants of occupational debris from this site is closely related with those from Saptagram/ Adi saptagram. The local museum also possesses some collection of minor antiquities like potsherds of early historic period (Chattopadhyay, forthcoming).

**Hasnan:** Investigation at the site of Hasnan (located in the district of Howrah) by B.Bandyopadhyay of the ASI (Eastern Circle) has resulted in the recovery of a good number of early historic artefacts comprising potsherds, beads, terracotta objects etc. Besides these, a collection of eleven coins assignable to Gupta period was discovered from the site (IAR, 1976-77: 73).

**Sites in the core region of littorals:**

**Chandraketugarh** (22°41’- 22°43’ N; 88°42’- 88°44’ E): Berachampa, under the Deganga P.S., is located about 38 km north-east of Kolkata. The Vidyadharhi flows about 10 km away from the site. A number of palaeo-channels are visible here. The landscape in and around this site consists of several low, moderately high mounds, structural or
non-structural. The site covers an area of about 2/3 sq. miles. This site of repute is partially encircled by a huge wall of mud generally referred to by archaeologists as ‘rampart wall’ or ‘rampart’. Ancient habitational remains are found from a number of adjoining villages/sites/localities such as Berachampa, Deulia (Debalaya), Singer Ati, Shanpukur, Hadipur, Jhikra, Ranakhola, Ghorapota, Dhanpota, Chuprijhara, Mathbari, and Ghaziatala etc.

Excavations were conducted at the site under the supervisions of K.G.Goswami for the first six years (1956-57 to 1961-62) and C.R Roychoudhury for the next six years (1962-63 to 1967-68). Additionally D.P. Ghosh jointly supervised in 1964-65. Excavations were conducted at five different localities in the area. These were: i) Berachampa situated west of the Berachampa Haroa road which was perhaps very near to Itakhola locality. ii) Khana Mihirer Dhipi a 14 feet high mound northeast of Berachampa, north of Barasat – Bashirhat road, iii) Itakhola paddy field west of Berachampa- Haroa road, iv) Noongola, situated between Khana Mihirer Dhipi and Itakhola and v) Hadipur a village outside the mud fortification area in the southern quarter of Chandraketugarh. Their reports were published in the annual reviews of the ASI (IAR, 1956-57: 29-30; 1957-58:51-53; 1958-59:55; 1959-60: 50-52; 1960-61: 39-40). Finally, again in 2000 a minor excavation at the site was undertaken by ASI under Bimal Bandyopadhyay.

Excavations brought to light several successive occupational levels ranging from the pre-Mauryan to the Post-Gupta and Pala period.

Of these Itkhola has yielded four successive periods commencing with the NBPW phases to *circa* sixth century CE. Along with the NBPW, punch-marked coins were also obtained from Period I.

In Period II, besides the convex-sided bowls and dishes, plain and decorated storage-jars and vases, terracotta plaques and several corroded cast copper coins were found.

Period III, assignable to the first-third century CE, yielded dishes and bowls of grey and dark-grey wares, internally stamped at the bases, the rouletted ware and black-slipped spouted cups. A headless terracotta *naga* figure of the Sonpur type, a bird rattle and a ram toy-cart obtained from this Period are noteworthy.

Period IV, datable to the fourth and sixth century CE., yielded cups and bowls of red and buff colour with wide mouth and small flat base; fragments of cooking-pans : globular vessels narrow-necked jars and vessels with incised or thumb impressions round the neck; terracottas; ivory and conch bangles; an iron axe; and stone and terracotta beads. A
mutilated sealing, with Gupta characters reading ye dharma hetu of the usual Buddhist creed, was also recovered from this Period.

The two post-Gupta periods known at Khana-Mihirer-Dhipi could not be identified at Itkhola.

Significantly, other areas did not mention about the occurrences of iron. However, explorations at the site and in its vicinity yielded a substantial number of iron objects which are now in the collections of several museums.

Clive House (Dum Dum) (22° 37’45” N and 88° 25’ 30” E): The locality of the mound just beside the Clive House is under the south Dum Dum municipality, a part of the northern extremities of Kolkata. The mound has an elevation of about 2.85 m from the surrounding level. Surface of the mound was found scattered with potsherds, brick nodules, etc. Subsequently, this mound was excavated by the Kolkata Circle, ASI, under the directorship of S.B.Ota and subsequently by B. Bandyopadhyay during the field season of 2000-2001 (IAR, 2001-2002: 93). Excavation conducted in four trenches unearthed habitational remains which have been assigned by the excavator to two major periods. Seven layers were identified. (Bandyopadhyay, 2002: 31-37) (Kolkata Circle ASI, 2001-03). Period I, comprising Layers 3 to 7, is datable to a time span ranging from the 2nd century BCE to the 11th-12th centuries CE. According to the report, there is a gap of about three centuries after which the site was reoccupied as evident from Period II (comprising Layers 1 and 2) starting from 15th-16th centuries CE till the recent times. Layers 5 and 6 exposed flood deposits mixed with habitation remains. The upper Level yielded habitational remains of the late medieval and colonial periods. The site is highly disturbed due to modern constructional activities, etc.

Period I, comprising layers 3 to 7, yielded successive floor levels. Earliest level of the cultural layers is composed of compact yellowish clayey river silt just above the level of virgin soil. The successive floor levels of this period were made of rammed brick nodules, potsherds, sand, sticky clay, etc. The different floor levels constituting this period did not yield any evidence of brick or mud walls. So far as the ceramic assemblage is concerned, Period I is characterized by the presence of BRW, red ware with or without slip, dull red ware, grey ware of polished and plain varieties, black ware and ‘degenerated’ variety of NBPW. All the wares are of medium to fine fabrics and coarser variety is meagre. The shapes include deep and shallow bowls sometimes with ring base,
miniature pots, convex sided fine grey coloured dishes of different sizes, _lota_ shaped pots, vases of different types, _handis_ with carination and rounded bodies, storage jars, a few vase like pots with S-profiles with flayed out rims and ring or flat bases and miniature pots and dishes with incurved rims in fine grey ware. Majority of the ceramic assemblage is wheel made while some are handmade as well as moulded. Some of the potsherds bear incised decorations comprising horizontal lines, disc or sun motifs, oblique strokes, wavy lines, etc. These decorated potsherds betray a variety of rims. A few stamped sherds were also unearthed.

The concerned period also yielded bone discs, antlers, terracotta animal and human figurines, other terracotta objects like hopscotches, wheels, toy carts, medallions, seals and sealings, plaques depicting animals, _mithuna_ plaques, stoppers, sling balls, lamps, pendants, bangles, amulets and moulds, beads of semi-precious stones, cast copper coins, punch marked coins with tree, solar and other symbols, copper antimony rod, iron nails, arrowheads, etc. (_IAR_, 2001-2002: 93). Bones of turtles, fishes and birds along with charred rice and pulses have also been yielded from this period. The report states that remains of aquatic animals and food grains indicate existence of river or swampy area including forest and paddy field nearby.

**Atghara** (22° 21’ 55” N and 88° 27’ 20” E): The site lies on the left bank of the _Adi Ganga_ about 4 km away from the Baruipur railway station. Explorations at the site have resulted in the recording of a wide range of cultural materials including highly polished black ware with red and black decorations, red ware, terracotta objects, seals, varieties of copper and silver coins (both punch marked and cast), etc. (See, Chattopadhyay, _forthcoming_). In the field season of 1956-57, P.C. Das Gupta on behalf of the Asutosh Museum, University of Calcutta, extensively explored the site and reported a large number of antiquities like rouletted ware, sherds of grey ware, cast copper coins, terracotta objects, etc. (_IAR_, 1956-57: 81). During the early 90’s of the last century, Atghara was excavated by Sudhin De on behalf of the State Directorate of Archaeology and Museums, Government of West Bengal. Three trial trenches (2 m x 2 m) were selected in the Dumduma mound which lies northwest of the Sitama tank (De, 1994:14-22). Of these, the Trench II on the eastern slope of the Dumduma mound, exposed 11 occupational layers above the virgin soil layer. According to the excavator, the artefacts found from Layer II are assignable to the Pala period. The excavator assigned Layers III, IV and V to the Gupta period. Layer VI (of compact grey silt) yielded several potsherds,
however, the excavator has not provided the details of the ceramic assemblage. Faint traces of a floor were unearthed from Layer VI. Layer VII (the excavator assigned this yellowish-grey loose soil Layer to the second century CE/Kusana period) yielded a broken bone awl, unfinished beads made of agate, terracotta beads, beads of opaque stone and etched stone beads, and BRW sherds. A male terracotta bust with a tunic like attire and an almost conical headress or cap has been reported from this Layer. The excavator had assigned Layer VIII to a period ranging from the 2<sup>nd</sup> century BCE to the 2<sup>nd</sup> century CE. Artefacts retrieved from Layer VIII include grey wares with striated marks (1<sup>st</sup> - 2<sup>nd</sup> centuries CE), probable terracotta weights (1<sup>st</sup>-2<sup>nd</sup> centuries CE), potsherds of NBPW, a fragment of a NBPW basin, terracotta beads and stoppers, black ware (jar and bowl types), micaceous red ware bearing incised decorations, oxidized iron arrowheads and oxidized iron slag. Layer IX yielded bone tools some of which were found associated with red and grey ware, carinated bowl of grey ware, terracotta tiles with perforations (similar tiles were found from the so-called Sunga level at Chandraketugarh), abraded terracotta figures which could not be identified and several terracotta net sinkers datable to the Sunga period. Layers X and XI have been dated by the excavator to the Mauryan period and these have yielded terracotta net sinkers, terracotta hopscotches made of potsherds, terracotta weights, red ware with incurved rims and rounded bases, terracotta bangle with decorative punctured motifs, etc.

Trench III, in the central part of the mound exposed foundations of two brick walls.

**Tilpi & Dhosha (22° 14’ N and 88° 34’ E):** The villages of Tilpi and Dhosha are located along the river Piyali and are under the jurisdiction of Dhosha-Chandeswar Gram Panchayat under Jaynagar P.S. Explorations at the sites resulted in the documentation of a substantial numbers of artefacts assignable to the early historic period. The habitational remains retrieved from the site bears close affinity with the early historic remains from Chandraketugarh. Explorations at the mounds of Dumduma at Dhosahat, Dhoa, and Mollapara at Tilpi conducted by the Directorate of Archaeology and Museums, Government of West Bengal and CASTEI during 2004-2005, have revealed footed querns, cast copper coins, punch marked coins, terracotta figurines, grey wares, and other potteries of the early historic period. Some of these artefacts are presently in the collections of local villagers and local museums (CASTEI Newsletter, November, 2005: 16). Subsequently, the Directorate of Archaeology and Museums, Government of West Bengal undertook excavations at Dumduma near Panchanantala in the village of Dhosha.
and at Tentultala in Mollapara, Tilpi, under the supervision of Amal Roy during the field season of 2005-06 (Roy, 2006: 1-11).

**Tilpi** (22° 15’ N and 88° 33’ E): The site is situated on the western banks of the river Piyali, a cut-off channel of the Vidyadhari. The Piyali river bed has almost dried up due to the heavy deposition of silt resulting from the tidal movements. The present village covers an area of about 1.25 sq. km and appears as an elevated semicircular ground about 5 feet above the river bed. A number of creeks surround the village. Piyali river along with the Matla, Thakurani and Nabapukur constitute the drainage pattern of this region. Tilpi was initially explored by G. Sengupta, Sambhu Chakrabarty and Sharmi Chakraborty during January to March, 2003. This exploration recorded some potsherds “belonging to the later periods” from exposed sections of partially dried-up ponds (Sengupta *et al.*, 2008: 298). The site has yielded a significant number of terracottas, sculptures, seals, sealings, plaques and designed BRW, presently in the collection of local museums and private collectors.

Four trenches (XA1, XB1, XC1 and ZE3) (6 x 6m) were selected for carrying out excavations at the mound of Tentultala, located in the modern habitation of Mollapada. (Roy, 2006: 7) At the trenches of XB1 and XC1, excavations were conducted to a substantial depth whereas due to the yielding of mixed up assemblages digging works were limited at the trenches of XA1 and ZE3. The latter two trenches did not yield any burned bricks or stone structural remains. A few mud floors were exposed during excavations from XB1 and XC1. A deposit of 4.70 m, exposed at the trench of XC1 has revealed a long cultural sequence which had been classified by the excavator into three cultural periods.

Period I i.e., 5th and 6th layers (1.24 m deposit) is assignable to the 3rd century BCE to 1st century CE. Both these layers revealed even distribution of assemblages.

Period II i.e., 3rd and 4th layers (1.57 m deposit) is assignable to the 1st-2nd centuries CE. Both these layers exhibit extensive refuge pits.

Period III i.e., 1st and 2nd layers (63 cm deposit) is assignable to the 2nd-3rd centuries CE. The 2nd layer is semi-compact in nature.

The XB1 trench was excavated to a depth of 1.88 m which yielded 5 depositional layers. The 1st layer (12 cm), 2nd layer (50 cm), 3rd layer (76 cm), 4th layer (23 cm), 5th layers (19 cm), layer 5A (8 cm). Mud floors have been documented from the layers 4, 5, 5A. The layer 5A exposed the remains of five hearths in a row. Beyond this layer, the vertical
excavations were restricted due to the extensive presence of hearths. These were circular
with different diameters of 21 cm, 29 cm, 17 cm, 15 cm and 18 cm. Substantial quantities
of crucibles, iron slag, charcoal besides ashes have been recorded from these hearths. 
Associated assemblage comprises finished products such as cast copper coins, iron
objects, etc. A lump of mixed metal probably bronze was also reported. Such remains
corroborate the fact that indigenous smelting activities were carried out extensively at this
particular place. Significantly, a lump of bronze objects as debitage has been exposed
from the trench of ZE3 substantiating such metal working activities. However, the
specimens are being presently investigated by archaeo-metallurgists.
The artefacts yielded during the course of excavations include ceramics, terracotta seal,
terracotta moulds (fragmentary-2), many Yakshi images made of terracotta, terracotta
wheels (1 in number), balls (1 in number), beads (intact specimen- 10; fragmentary-5),
hop scotches (5 in number), ornaments, crucibles (1 in number) etc. besides beads of semi
precious stones (3 in number) and glass beads (3 in number). Metal objects comprise cast
copper coins (intact specimen-7; fragmentary-5), copper and bronze ingots (1), iron
objects etc.
Ceramic assemblage comprises red, grey, dark grey, dull red, ill-fired red and grey with
red patches. Most of these are wheel made and well slipped. The upper layers yielded
large number of red wares whereas the lower layers yielded grey wares in profuse
numbers. Potsherds with various designs with incised lines, appliqué works and stamp
designs are also quite common. Vases and vessels with round base, flat base and
carinations are also numerous. Another common variety is fry-pan with handle. Other
identifiable shapes are lids, bowls, lid-cum-bowls, miniature pots, handis and storage
jars.
Structural remains include mud floors with post holes, circular hearths and roof tiles
found mainly from the lower levels in all the trenches. Probably, the roofs were
structured on bamboo or wooden posts. Most of the tiles are incised and perforated with
U shaped notches.
A joint investigation/survey undertaken by the State Directorate of Archaeology and
Museums, Government of West Bengal, Deccan College Post Graduate Research
Institute, Pune and Geological Survey of India revealed that the site was abandoned due
to excessive flood activities (Roy, 2006: 8). It is again confirmed by the evidence of salt
deposits recorded at various levels of the site during the course of excavations. The
occurrence of archaeological artefacts coupled with such evidence further indicates that the site of Tilpi was probably deserted during the 2nd-3rd centuries CE and Dhosa during 4th-5th centuries CE. These settlements were again reoccupied from the medieval period onwards.

**Dhosa:** Fourteen trenches (6 x 6m) were selected for carrying out excavations at the mound of Dumduma, located near the modern habitation of Panchanantala of Dhosa. Excavation conducted by the Directorate of Archaeology and Museums, Government of West Bengal unearthed three Periods ranging from the early historic to the post-Gupta periods (Roy, 2006: 1-2).

Period I (layers 6 and 7) having a thickness of 1.24m, is datable to the 1st century CE.  
Period II (layers 5, 4 and 3) having a thickness of 1.57m, is datable to the 2nd and 3rd centuries CE.  
Period III (layers 2, 2A and 1) having a thickness of 2.34m is assignable to the 5th-6th centuries CE.

Due to encroachments of modern habitation, it is quite difficult to reconstruct the nature of structural remains found from the site. During the course of excavation a square brick edifice was exposed at Dhosa. There is a paved pathway all around this square structure. Excavator has identified it as a part of a non-secular structure, probably a shrine (Roy, 2006:2). The brick- sizes vary from 39.5 x 20.5 x 5.5 cm to 29 x 18 x 4.5 cm. The original structure was subsequently raised and extended as apparent from the remains of bricks, mortars and other building materials scattered nearby.

This site yielded a huge number of potsherds found from all the stratified deposits and the pit. The ceramic assemblage comprises red ware, dull red ware, ill fired red ware, red slipped ware, dark grey ware, grey ware, black ware and BRW. Period III yielded characteristic ceramic types of the Gupta period having well slipped and smooth textures. Besides, well slipped rouletted wares, incised designed potteries, stamped pottery also form the ceramic repertoire. Most of these are well baked and wheel modelled specimens. Major shapes identified by the excavator include vase, carinated bowl, carinated cooking vessel, fry-pan with handle, lid, bowl, lamp, storage jar, etc. Other remains comprise an inscribed tiled brick (according to the excavator, the inscription in 2nd/3rd century Brahmi reads – nibitasya), terracotta objects including sealings, figures of a yakshi, other terracotta figurines, a terracotta head identified by the excavator as the head of Buddha, plaques depicting narrative scenes, a torso, lamp, fragmentary piece of humped bull, balls
and moulds, ivory and bone points, beads of semi precious stones, iron objects, cast copper coins, shell objects etc. (CASTEI, Newsletter, 2006:14-15)

**Kundarali:** This village is situated on the west bank of the Adi Ganga, not far away from Baruipur. Sukhendu Naskar explored this village and collected BRW sherds, terracotta beads, beads of semi-precious stones, iron objects, terracotta figurines, copper coins and an inscribed architectural member.

Besides, the sites of Malikapura, Nimta (22° 40’ N and 88° 27’ E), Boral, Faratabad, Hariharpur-Mahinagar, Deulpota (22° 13’ 55” N and 88° 19’ 30” E), Harinarayanpur (22° 08’ 30” N and 88° 12’ 35” E), Baribhanga (22° 3’ N and 88° 26’ E), Tetulberiya, Dakshina Bishnupur (22° 07’ N and 88° 26’ E) etc. have the potential to unearth sufficient evidence of large scale consumption of iron (Chattopadhyay forthcoming).

**North Bengal:**

Apart from the above distribution of sites/settlements, there is another important area/region i.e., north Bengal which deserves special consideration so far as the nature of iron consumption (if not production) is concerned. Its historical significance, referred to in the several literary sources along with the excavated and explored findings substantially established its identity as an integral part of the settlement dynamics of the Ganga valley. It will be unwise if we believe that the region survived outside the pale of ‘mainstream historical development’. Its strategic geographical location facilitates this region in culturally bridging the south Bihar plain and the adjoining lower Ganga plain to the sub-Himalayan zone of the north-eastern frontier (parts of Assam, Myanmar and the adjoining regions of Chittagong coast including the Arakan region). Chakrabarti while working on Ancient Bangladesh has rightly stated that “…the Mauryas as possibly went as far east as Samatata and the Chittagong coast. They went up to the Meghna is amply clear by the location of the site of Wari-Bateshwar” (Chakrabarti, 1992a: 185). Epigraphic sources of the Guptas and the later Guptas widely mentioned about their supremacy over this territory. It is therefore quite certain that, the emergence and subsequent growth of settlements in this region has enhanced the large scale demand of non-metallic and metallic objects including iron. However, scholars, highlighted different mechanisms of settlement activities of the concerned region such as epigraphic evidence, sculptural remains and even habitational remains and others, have somehow failed to provide a comprehensive reckoning of its ancient
settlement parameters (ranging from the EVF phases to the medieval period). It is also unfortunate that the paradigms of iron working (related to both production and consumption) evident from the sites of the Gangetic valley cannot be explained with reference to the inadequate findings retrieved from the concerned region. Present work duly considers the recent findings (associated with BRW bearing EVF phases and the subsequent cultural phases) from the site of Bangarh though the present excavations have failed to trace the potential occurrence of iron at the site. However, earlier excavations confirm the extensive consumption of iron and delineate its nature of occurrence (through a considerable period of time). Jagjivanpur, a monastery site of the early medieval period also consumed iron in large scale, however, chronologically the site is beyond the scope of the present work. The database retrieved from the explored sites like Khandaran, Najirpur, Amati etc. deserves special consideration while interpreting the settlement dynamics of this region.

Bangarh (25°19'N and 88°29'E): The site is located on the eastern bank of the river Punarbhava. Bangarh, probably named after the demon king- Bana, found its necessary mention in several literary sources. The terms Devikota, Umavana (or Ushavana), Kotivarsha, Banapura and Sonitapur are synonymous and are supposed to be identical with the site of Bangarh. The Mahasthan inscription of the Mauryan period and the Damodarpur plate of the Gupta period have the references to Paundranagara or Paundravarddhana bhukti and Kotivarsa Visaya, the latter is generally identified with Bangarh. It is generally believed that, the remains of the citadel area enclosed by the rampart wall and moat buried at the present Rajibpur village and abutted on the river bank of Punarbhava contains the ruins of the old Kotivarsa.

The site was initially excavated by the Asutosh Museum, University of Calcutta under the supervision of K.G. Goswami for three consecutive seasons of 1938-39, 1939-40 and 1940-41 (Goswami, 1948). The excavations have unfolded the remains of the following cultural strataums.

Stratum V: This cultural stratum has yielded the remains of a ring well at a depth of 20 feet. The ceramics found from this stratum include both medium sized and miniature pots in red, grey and black wares. Beads of semi-precious stones besides punch marked and cast copper coins have been recorded from this particular cultural stratum (Goswami, 1948: 11).
Stratum IV: This cultural stratum, ranging from a depth of 7 ½ feet to 14 ½ feet has been ascribed to the Mauryan and the early Sunga periods. The structural activity is characterized by the remains of cess pits and a few walls. Beads of semi-precious stones, terracotta sealings bearing early Brahmi script, punch marked and cast copper coins are the artefacts recovered from the stratum. The remarkable presence of black polished potters substantiates the early historic bearing of the site. Another significant object, recorded from the stratum is gold pendant of extremely fine workmanship.

Stratum III: The cultural debris of the stratum III (assignable to the Gupta period) have been exposed at depths between 4 ½ feet and 7 ½ feet below that datum line. The remains of masonry well, residential buildings, walls characterize the structural activity of the stratum. The basic pottery types include vases, tumblers, lids (or jar covers), saucers, bowls, cooking pots, dishes etc. Terracotta objects, copper and ivory sticks, stone beads besides a vast repertoire of iron implements form the cultural assemblage of the concerned stratum (Goswami, 1948: 9-10).

Stratum I and II are ascribable to the early medieval and the Islamic period respectively. The inventory of iron objects includes different varieties of nails, chisels, awls, knives, daggers, spearheads and swords etc (Goswami, 1948: 17).

<table>
<thead>
<tr>
<th>Reg No.</th>
<th>objects</th>
<th>size in inch</th>
<th>Locus</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1029</td>
<td>nail</td>
<td>3.0” x 1.2”</td>
<td>Tr. 5</td>
<td>9.56 feet (B.D.L)</td>
</tr>
<tr>
<td>1432</td>
<td>&quot;</td>
<td>3.25” x 1.1”</td>
<td>&quot;</td>
<td>9.36 ”</td>
</tr>
<tr>
<td>1453</td>
<td>&quot;</td>
<td>2.2” x 0.6”</td>
<td>&quot;</td>
<td>9.76 ”</td>
</tr>
<tr>
<td>1462</td>
<td>&quot;</td>
<td>3.5” x 0.8”</td>
<td>&quot;</td>
<td>7.80 ”</td>
</tr>
<tr>
<td>1623</td>
<td>&quot;</td>
<td>7.5” x 2.5”</td>
<td>Tr.8</td>
<td>7.48 ”</td>
</tr>
<tr>
<td>1225</td>
<td>Chisel</td>
<td>6.0” x 1.5” x 0.5”</td>
<td>&quot;</td>
<td>5.56 ”</td>
</tr>
<tr>
<td>1117</td>
<td>Awl</td>
<td>7” long x 0.5” thick</td>
<td>&quot;</td>
<td>5.61 ”</td>
</tr>
<tr>
<td>1396</td>
<td>Knife</td>
<td>3.7” x 1.0”</td>
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<td>Dagger</td>
<td>7.4” x 1.25” x 0.25”</td>
<td>Tr.6</td>
<td>12.16”</td>
</tr>
<tr>
<td>2026</td>
<td>Spearhead</td>
<td>9” x 3”</td>
<td>Tr.5</td>
<td>15.06”</td>
</tr>
<tr>
<td>1332</td>
<td>Sword</td>
<td>8.5” x 1.5” x 0.4”</td>
<td>Tr.8</td>
<td>7.32 ”</td>
</tr>
</tbody>
</table>

with mid rib
The excavation works at the site was resumed in 2008-09 and 2009-10 by the Kolkata Circle of the ASI (Baidya and Maity, 2010: 35-37).

Recent excavations at the concerned mound unearthed remains of the hitherto unknown EVF settlement in the Barind or the old *Varendra* tract. The digging works carried out above the fortification wall yielded occupational remains of five cultural periods ranging from the pre-Mauryan to the Islamic period.

Period I datable to the pre-Mauryan period has yielded burnt clay chunks with reed impressions probably signifying the rudimentary state of structural activities. Ceramics assemblages include BRW, BSW, red ware, grey ware etc. Besides, beads of semi-precious stones and terracotta objects have also been recorded.

A floor area associated with large scale firing activity was encountered at a depth of 10.97m. Another outstanding discovery of period I is that of a hearth measuring 50cm x 76 cm. A large number of potsherds, mostly BSW and some crude sherds of BRW were found in association with the hearth. Other associated finds include a polished stone tool, heavily encrusted fragments of a copper bowl, copper sheets etc (*IAR* forthcoming 2009-10). However, Baidya and Maity (2010: 35-37) has ascribed ‘the relics of Period I, that is the pre-Mauryan levels of the site’ to ‘Chalcolithic’ period.” Earlier excavation (Goswami, 1948: 32) unearthed a ‘Neolithic tool’ below the Sunga level.

Period II started without any cultural gap at the site. Remains of a terracotta ring well and a wall made of burnt bricks characterize the structural activity of this particular cultural period. Ceramic assemblage comprises the sherds of BSW, red ware and black ware. Terracotta gamesman, punch marked and cast copper coins, beads and other terracotta objects are the interesting artefacts, recovered from this cultural period.

Period III is coeval with the Sunga-Kusana period. Brick built wall of a structure has been exposed along with a low foundation of another residential structure. Associated assemblages include terracotta plaques, cast copper coins, stamped potteries of red ware and grey ware, circular terracotta medallions with stamped designs, variety of beads etc.

Period IV, ascribable to the Gupta period has yielded a terracotta ring well with exposed height of 2.07 m and diameter of 60 cm. The evidence of structural complex, built of broken bricks has also been recorded. Evidence of one narrow drain attached to it is quite noteworthy. However, the remains of burnt clay floor exposed here seem to be the most remarkable discovery. Other finds comprise beads of semi-precious stones, antimony rods, terracotta animal figurines, terracotta plaques and a mould, terracotta seal etc.
ceramic industry is characterized by the presence of red slipped ware, red ware, grey ware etc.

It is quite unfortunate that the report on the recent excavations have not referred to the occurrence of iron. However, there is no doubt that such historically eminent place must have nurtured an infrastructure which essentially had the requirement of iron.

**ORISSA:**

**Sites in the Mahanadi-Baitarani-Mandakini valley:**

**Golbai Sasan/ Golabai Sasan** (20°01’ N and 83°33’ E): The site in the Khurda district is located on the left bank of the river Mandakini, locally known as Mallaguni, a tributary of the river Daya which flows into the Chilika lake. Surface explorations at the site in the years 1986 and 1987 resulted in the discovery of polished stone tools, bone tools and an array of painted pottery (Sinha, 2000: 323).

Excavations at this site in 1991-92, unfolded a total deposit of 8 m comprising two cultural periods. The excavator based on the presence of a solitary specimen of iron tool along with other cultural materials of the Chalcolithic period ascribed the Period IIB as ‘Ferro-Chalcolithic’.

Period I or the Neolithic level (c.2300-2100 BCE) exposed traces of post holes and floors, a few bone artefacts and many pieces of antlers and semi-mineralized bones. The ceramic assemblage includes handmade and wheel made dull red and grey wares consisting of shallow bowls, vases and a pot-on stand. Post-firing painting in red ochre has been noticed in some of the grey wares. The settlement of this period was said to have been encircled by a rubble-built wall (Sinha, 2000: 324-325).

Period II or the ‘Chalcolithic’ phase (5 m thick) has been sub-divided into IIA (Osteo-chalcolithic) and IIB (Ferro-chalcolithic). Period IIA is characterized by the presence of different types of BRW, red burnished ware, chocolate burnished ware, black slipped or black burnished ware, chocolate red ware, grey ware, buff ware, buffish red ware and dull red ware consisting of dish-on-stand, lids, jars, bowls. Among these, dull red ware is predominant. Pottery decorations are incised, appliquéd, or painted. Remains of about 13 circular structures (one with hearth) having diameters ranging from 3.9 m to 7.9 m with floors of rammed clay and small post-holes and yellow clay on the periphery have been unearthed. Other findings comprise a few microliths (cores, points and parallel sided bladelets), polished stone tools (celts, adzes, shouldered adzes, chisels, adze-sharpeners
of blackish and greenish dolerite), profuse bone tools/objects made of antlers and semi-mineralized bones (points, spearheads, barbed spear heads, barbed and tanged harpoons, needles, engravers, burnishers, adzes, blades, scrapers, side scrapers, borers, awl, denticulated blades, chisels, pendants, ear-studs), copper objects (chisel, hook, rings, bangles), terracotta objects like rounded pottery discs, spindle-whorls, sling balls and human figurines, faience beads, pendants and ear-studs of fish bones and an ivory pendant. Remains of a copper-smelting furnace and a good number of terracotta crucibles clearly exhibit that copper smelting activities took place in this period. Grains of rice and kulthi and bones of humped cattle, sheep, goat and fish (two shark teeth) have also been reported. An extended burial of a young female with a copper bangle, oriented in east-west direction was found in the upper levels of Period IIA. According to Chakrabarti, “The calibrated C\textsuperscript{14} date of Golbai IIA is in the early part of the 3\textsuperscript{rd} millennium BC.” (2006:259)

The deposit belonging to Period IIB has a thickness of over one metre comprising the top three or four layers in trench A\textsubscript{2}Qd\textsubscript{1} (Sinha, 2000: 344-345). The period yielded similar remains like Period IIA except for an iron tool resembling polished stone celts of the site. The iron tool measures 7.1 cm with a maximum width of 4 cm and maximum thickness of 1.5 cm. Earlier pottery types continued in a degenerated form. The burnished variety of wares (red, black and chocolate) was comparatively less. BRW became cruder and is represented by two new shapes (tumblers and convex sided bowls). Structural remains include floor levels with post-holes. This period is ascribable to 1100-900 BCE. (Sinha, 2000: 322-355; IAR, 1990-91:55-57; 1991-92:86-87).

Bargaon: The site is situated on the left bank of the river Brahmani in the Sundargarh district. The habitational mound measures 40 metres in length, 25 metres in width and rises to a height of about three metres above the surrounding level. Due to severe erosion potsherds were exposed along with a rich cluster of Neolithic celt-dressing flakes. It was subjected to trial excavation, during the course of which only one trench measuring 1.5 x 1.5 m was laid on the southern side of the mound. This revealed a habitational deposit of about 140 cm divisible into three layers. The first layer measuring 30 cm in thickness yielded varying shapes of wheel-made red ware and some iron objects. The noteworthy iron objects include one broken part of a bowl, one nail and a double ended point (?). The red ware shows medium thickness and compact core. In certain cases, the specimens are treated with red wash, though a solitary specimen bears a thin red slip. The common
shapes are vases, bowls, basins and carinated handis. Pots are often decorated with concentric grooves. However, in certain cases, the decoration is in form of either notches or appliqué pattern on the exterior.

The wheel-made red ware, grey ware, few sherds of BRW and reed-impressed burnt clay fragments were unearthed from the second layer. A few shapeless, coarse and gritty red ware sherds, several celt-dressing flakes and a broken semi-finished chisel have been reported from the third layer. Both these two layers represent pre-iron Neolithic phases (Behera, 2000:255-257).

The site of Kantipuleswar (20°44’5”N and 84°30’42”E) is located on the left bank of the river Mahanadi, by the side of the confluence of the Sindol nullah in the district of Angul. Two trenches, measuring 6 x 6 metres (Trench I) and 3 x 3 metres (Trench II) have been taken at two different parts of the mound. The total thickness of the habitation deposit in Trench I vary between 360 cm and 365 cm. On the basis of comparative studies of cultural materials and stratigraphy, three phases of occupation viz. Period I: Late Chalcolithic, Period II: Iron Age; Period III: Early Historic period have been identified at the site (News Letter, CASTEI: 2005: 17-18).

Khameswaripali (20° 46’ N and 83° 50’ E): The site is located about 12 km east of Sonepur town in the Birmaharajpur tehsil of the newly formed Subarnapur district and situated on the left bank of the Mahanadi. This measures nearly 130 metres in length and 80 metres in width.

With a view to understand the extension of the settlement dynamics represented at Manamunda, P.K. Behera undertook a preliminary survey in the lower part of the middle Mahanadi valley in 1995. This resulted in the discovery of BRW sherds and its associated wares besides other artefacts from a number of sites. The interesting artefacts are white painted BRW, corded ware, bone tools and ground stone axes. To ascertain the stratigraphic context of the white painted BRW and associated materials along with the cultural succession of the region, Khameswaripali was selected for digging in 1996-97.

Trench KSP II was laid on the highest part of the mound whereas trenches KSP I and KSP III were taken on the moderate slope. The cuttings were conducted to the natural soil which is composed of yellowish, compact, sandy-silty-clayey deposit mixed with calcrete nodules. The excavation revealed a 2.20-11.40 metres thick habitational deposit divisible into three cultural periods with two sub-phases in period I.
Iron is introduced in period III. The 0.25-0.30 metre thick deposit of compact, brownish grey sandy-silt soil of this period is solely traced in trench KSP I. Besides iron, this cultural period is marked by a change in the ceramic industry. Painted BRW, burnished red slipped ware and burnished black ware of the preceding periods fell into disuse. Grit-tempered red ware of thick fabric with or without a drab reddish slip was more profusely used by the settlers. In marked contrast to the earlier periods, the manufacturing of large sized vessels was in vogue. The common shapes comprise dishes, bowls, basins and vases in BRW, vases/ handis and bowls in BSW, vases/handis, storage vessels, lids, platters and basins in red slipped ware and storage jars, shallow bowls-on-stand, lids, platters, bowls, basins and perforated bowls, and four legged miniature pots in red ware. Introduction of iron definitely implies a technological advancement of the region and its use in the modification of subsistence strategies. However, repertoire contains only two specimens, one small fragment of a rod (?) and a fragment of a nail. Other finds include a few beads of banded agate, some fragments of glass bangles, one copper ring, pottery discs and four cowri shells. The excavator suggests that the cultural assemblage essentially shares some characteristic features with that of the earliest stratum of the excavated site of Manamunda, which is located about twelve kilometres southwest of Khameswaripali (Behera, 2000-2001:13-34; 2002:493-520; 2006: 33-38; Pradhan, 2002:523-524; Basa, 1999:36-37).

Kumersingha: Located on the left bank of the Mahanadi, the site of Kumersingha is situated about six kilometres from Khameswaripali and about four kilometres south-east of the tehsil headquarters of Birmaharajpur in the Subarnapur district. This site was previously reported by P.C. Rath in 1947 (Rath, 1947: 388). Quite similar to Khameswaripali, the present site was also repeatedly threatened by flood in the Mahanadi. The mound which is roughly oblong in shape measures about 175 x 100 m with its longer axis running along the Mahanadi in east-west orientation. In order to unveil the cultural sequence of the site two test trenches measuring 3 x 2.5 m (KMS I) and 2.5 x 2.5 m (KMS II) were laid in two different parts of the mound. The excavation continued to the natural soil. Altogether seven occupational layers belonging to two cultural periods have been exposed with the maximum thickness of habitation deposit of 2.25m in KMS I and 1.70m in KMS II (Behera, 2003:89). At this site, the initial use of iron has been attested by the evidence of a solitary specimen of iron nail from (a depth of 2.20m) the period IA. Its use gradually increased during the
period IB. The finds include a chisel and a flat bar-celt type axe. During the subsequent cultural period, gradual increase in the consumption of iron has been indicated by the evidence of two nails, one nail parer, one drill bit, one clamp, two chisels, one spearhead etc from the stratified layers.

Period IA with 55-65 cm thick cultural deposit is marked by the occurrence BRW, BSW, red slipped ware (colour varies from deep red to orange red, brown and chocolate) and plain red ware. They are wheel turned and generally medium to thick in fabric and medium textured. However, some fine-fabric pots in BRW and BSW were also found in sufficient numbers from the late levels of this deposit. A few pots in BRW, BSW and chocolate slipped ware exhibits painted designs (mostly wavy and zig-zag lines) in white pigment, which occur on both the exterior and the interior surface of the pots. This feature markedly contrasts with that of the ceramics of BRW associated EVF phases at Khameswaripali in which only the black inner surface of BRW pots bears white paintings. Besides paintings, pots are also decorated with appliqué and incised patterns. The interior flat base of bowls and dishes in BRW and BSW is decorated with grooved concentric circles and spiral designs. The rims of some of the bowls and vases in BRW and red slipped ware bear marks of post-firing application of red-ochre pigments. Presence of post-firing graffiti marks on BSW has also been documented. The common shapes in BRW are bowls, dishes with carinated body, vases and small jars, in BSW are bowls, dishes, vases, handis, platters and lids with mostly vertical cone-headed handle, in red slipped ware are basins, bowls, miniature vases, platters, lids and pot-stands, in red ware are storage jars, basins, vases, handis, platters, lids and bowls with multiple perforations on the base (Behera, 2003: 89).

The occurrence of a substantial number of reed impressed burnt clay lumps suggests that the houses of this period were made of wattle and daub (Behera, 2003: 91). However, no house structures or post-holes were encountered during excavations. Besides the solitary specimen of iron nail, recorded artefacts include pottery discs in large numbers, triangular pottery fragments with ground edges and a fragment of a stone pestle. The remarkable collection of charred and un-charred animal bones, some with butchery marks amply testifies to the fact that animals / animal food played significant roles in the subsistence of the site. Besides, occurrence of impressions of cereal grains and husks is noted on potteries and burnt clay lumps.
Period IB having an average thickness of 70 and 75 cm habitational deposit is characterized by a marked increase in the forms and frequency of BSW. Fine-fabric pots predominates the ceramic assemblage of the period. Bowls and dishes were mostly fabricated in BRW and BSW. Among the new shapes in BSW, mention may be made of dish-on stands. This shape along with flat-based bowls in BRW shows remarkable fineness in their workmanship. Out of total 16 sherds bearing post-firing graffiti marks, as many as 14 are on BRW and one each on BSW and red slipped ware potsherds (Behera, 2003: 93).

As mentioned earlier, a chisel and a flat bar-celt type axe comprise the repertoire of iron objects. Other artefacts include one stone muller, two beads of carnelian and a good number of pottery discs. Besides, the deposit also yielded a substantial quantity of charred and uncharred bones and reed-impressed burnt clay lumps.

The period II with its earlier level overlapping with Period IB does not show a striking change in its cultural materials from the preceding one. Ceramic industry mostly continued with a few modifications. BRW continue to exist, though the quantity of such sherds and its quality drastically decline. The plain red ware, red slipped ware and fine quality of BSW characterize the assemblage. White painted sherds are conspicuous by their absence. Evidence of graffiti marks are found on three BRW sherds (Behera, 2003: 95).

Use of iron proliferated in this period as revealed by the presence of two nails, one nail parer, one drill bit, one clamp, two chisels, one spearhead etc. However, evidence of iron smelting is absent (Behera, 2003: 95).

Associated assemblage comprises two blue coloured translucent glass bangle fragments, four beads of carnelian and quartz, one stone sling balls and a few pottery discs. Reed impressed burnt clay lumps along with the remains of a burnt floor (which was partly exposed) constitutes the structural remains of the site. Uncharred faunal remains have also been found in good numbers.

(Behera, 2003: 87-103; 2006: 42-48)

**Kurumpadar:** Situated on the right bank of the Mahanadi, the extensive mound of Kurumpadar, in the district of Boudh can be approached from Kumersingha by crossing the river Mahanadi. It measures nearly 415 m in length and 95 cm in width with the longer axis in nearly east west orientation which runs along the Mahanadi (Behera, 2003: 96). The mound is naturally cut almost into two parts by a small rain gully. The eastern
portion is larger in dimension with thick habitation deposit. In order to ascertain the cultural sequence of the site, two small cuttings (KMP I and KMP II) measuring 2.5 x 2.5 m each were laid in both the eastern and the western portion of the mound and dug vertically down to the natural soil. The thickness of the habitational deposit varies from 1.75 m in KMP I to 0.90 m in KMP II. (Behera, 2003: 97) The excavations revealed that the western portion of the mound was initially occupied and probably due to floods moved to the eastern portion. From the combined stratigraphy a sequence of three cultural periods has been identified.

The site shows the evidence of iron smelting at a depth of 1.05m (period II) from the top. It exposed a floor having lumps of iron slags, charcoal and a complete specimen of a burnt tuyere. Only three iron objects (two chisels and one unidentified) have been yielded while during the subsequent early historic period three specimens of iron nails have been yielded (Behera, 2003: 98-99).

Period II marks the beginning of the so called Iron Age settlement at the site. The ceramic assemblage of the preceding period went into disuse. This was replaced by fine fabric and well made pots in BRW, BSW and red slipped ware. In terms of vessel forms, these ceramics show close affinity with those from the periods IB and II of the site of Kumersingha. Altogether 11 sherds of BRW and 3 of BSW bear a variety of post-firing graffiti marks, some of which resembles with those from Kumersingha.

As mentioned earlier the evidence of iron smelting comes from the trench KMP I at a depth of 1.05 m from the top. The floor contains lumps of iron slags, charcoal and a complete specimen of burnt tuyere. The recovered finished objects include two chisels and one unidentified object. Other finds of the period are one cowri shell, one bladelet core, hopscotch, lumps of reed impressed burnt clay etc. besides faunal remains.

Period III is characterized principally by the occurrence of sliver plated punch-marked coin and evidence of glass manufacturing activities. The coin was encountered in the second layer at a depth of 44 cm from trench KMP I. After the chemical treatment of the patinated coins it was found that the specimen was made of silver coated/ plated copper, having five distinct symbols on the obverse and two lightly punched identical minute symbols on the reverse. From a depth of 30-35 cm in trench KMP I were recovered a huge amount of slags (about 35 kg), several blue glass ingots, drawn tubes, several fragments of semi-finished glass bangles, one monochrome (blue) and one bichrome (blue and deep orange) glass bangle fragments besides a tuyere. The evidence essentially
indicates the local glass manufacturing at the site. The ceramic industry is mainly represented by red ware and BSW. BRW and red slipped ware of the earlier period persists in negligible percentage. These are mostly utilitarian in character.

Near the trench KMP I, a portion of a stone building was exposed on the cliff section of the river Mahanadi. However, no such structural remains have been recorded in KMP I. On the circumstantial evidence this has been assigned to Period III.

Three nails constitute the repertoire of iron objects. Besides, copper bangle, cowri shells, four spherical stone beads of carnelian and quartz and a number of pottery discs have been found in substantial numbers (Behera, 2003: 100).

(Behera, 2003: 87-103; 2006: 48-57)

**Hikudi:** The site on the left bank of the river Mahanadi, is situated about three kilometres northeast of the district headquarter of Subarnapur. The ancient mound spreads over an approximate area of 170 m x 130 m. During the field season of 1996-97, a field survey conducted in the area led to the discovery of several sherds of hand-made, gritty corded ware and a few ground stone axes from the eroded surface of the mound. Besides, other parts of the mound have also the traces of some potsherds, characteristic of the early historic period and exposed section of a terracotta ring well. With a view to ascertain the cultural sequence of the site, trial excavations were carried out by the Post-Graduate Department of History, Sambalpur University during 2000 under the supervision of P.K. Behera (Behera, 2006: 23). Two small trenches measuring 2 m x 2 m were taken in two different parts of the mound. While the trench HKD 1 was laid on the highest elevation, HKD II was taken on slightly low elevation of the mound. At present the mound rises to a height of about 4-5 metres from the surrounding plains. Both the trenches were excavated down to the natural soil which is composed of yellowish, compact silty-clayey soil mixed with loose ferricretes and calcium carbonate nodules.

The combined testimony of the excavated trenches HKD I and HKD II brought to light habitational deposits of two cultural periods, Period I- Neolithic and Period II- early historical period with an occupational gap between them. However, possibility of the existence of post-Neolithic horizons in other parts of the mound cannot be ruled out altogether (Behera, 2006: 27).

Period II: The remains of this period have been traced in the trench HKD I from 0.65 to 0.75 metre thick deposit. An occupation break, represented by a 30-35 cm sterile deposit has been noted before the arrival of this cultural period. Red ware, red slipped ware,
BSW and plain BRW comprise the ceramic industry of the period. The representative shapes in the BSW and BRW include bowls, dishes, vases, basins, storage jars and dishes with central knob on the inner side of the base. According to the excavator, the nature of ceramic assemblage from this period closely resembles with that of Period I of the excavated site of Manamunda, located about four kilometres south-west of Hikudi (Behera, 2006: 32-33).

Occurrence of iron is found in form of slags. Besides, terracotta and semi-precious stone beads, stone sling balls, lumps of burnt clay with reed impressions and faunal remains have been yielded. A terracotta ring well located in the north-eastern part of the mound also belongs to this period (Behera, 2002: 502; 2006: 26-33).

**Pankital:** The site is situated on the bank of the river Mahanadi in the Subarnapur district. The site was surveyed in 1995 by Pradeep K. Behera (Behera, 2002: 501). Surface exploration led to the discovery of plain BRW, BSW, red slipped ware and red ware besides pottery discs, beads of semi-precious stones, iron slags and skeletal remains. The principal shapes in BRW are small sized vases, carinated vessels; in BSW are vases, carinated shallow bowls, and dishes with a central knob on the flattened inner surface; in red slipped ware and red ware are basins, vases, bowls, storage jars and platters. Cultural materials found from the site have been dated to the early historic period.

**Jamtangi:** The site is situated on the bank of the river Mahanadi in the Boudh district. Plain and white painted BRW, BSW, red ware and red slipped ware comprise the ceramic industry of the site which was recorded during the course of surface exploration at the site. Other objects include pottery discs, iron objects, stone beads, terracotta beads and stone pestles (Behera, 2002: 503).

**Pargalpur:** The site is situated on the bank of the river Mahanadi in the Boudh district. Surface exploration at the site was conducted by Pradeep K. Behera in 1995 which resulted in the discovery of plain BRW, red ware and red slipped ware besides iron bar-celt, microliths and stone pestles (Behera, 2002: 505).

**Haldipali:** The site is situated on the bank of the river Mahanadi in the Subarnapur district. Plain BRW, BSW, red ware and red slipped war besides a few decorated sherds form the ceramic assemblage of the site. Remains of terracotta ring wells have been recorded at the site. Associated antiquities include pottery discs, stone pestles and iron objects (Behera, 2002: 506).
Maryakud: The site is located in an island in the Mahanadi and comes under the direct administration of Boudh NAC. The mound locally known as Guriamunda, is located in the southern part of the island and covers an area of 30 m x 25 m. The site is partly disturbed due to the fluvial action of the river and the remaining part is quite undisturbed. The site has a habitational deposit of nearly 1.50m as is evident from the exposed section on the river bank. Evidence of stone circles has also been recorded in the northern part of the island. The ceramic assemblage includes BRW, black polished ware, red slipped ware and dull red ware. Besides, a large number of decorated sherds and lids have also been yielded. The common shapes in BRW comprise pots with wide mouth, dishes with sharpened rim, shallow bowls etc.; in BSW are basins, lamp on stand, bowls, basins etc.; in red slipped ware are lids with a central knob, bowls, pots, lids etc.

The settlement dynamics associated with the use of iron in the Mahanadi-Baitarani-Mandakini valley can be explained in the following way. 1) The geo-physical features of the region i.e., its location in the flood plains flanked by a wide resource bearing zone have crucial bearing on the initiation, consolidation and survival of agro-pastoral mode of subsistence economy aided by non-farming activities, the precursor of the EVF paradigm. The presence and gradual exploitation of the vast expanses of pasture lands and other natural resources of both the flood plains and easy access to the plateau ensured their survival and adoption of effective strategies. 2) It seems that the initial use of iron has hardly modified the existing settlement dynamics of the region. However, the evidence of metal working at a number of sites does not represent a fortuitous event and the occurrence of metal objects at almost every sites substantiate their involvement in the existing procurement network which must have become operative in this region. 3. However, close access to the resource bearing areas and the managed use of local resources paved the way for the consolidation of settlement dynamics and further ensured their active participation in the integral part of the said exchange system since the early historical period. The developments witnessed in the Mahanadi-Baitarani-Mandakini river valley seemed to be quite relevant in understanding its role in the socio-economic binding between the eastern Indian (Chhotanagpur) plateau region.
including its fringe areas and the Chhattisgarh region. Indeed, it can essentially be considered as one of the representative parts of the broader interactive network zone which includes the entire Mahanadi valley and the adjoining areas of the river valleys of Baitarni, Subarnarekha, Dwarakeshwar, Damodar, Rupnarayan, Ajay covering a major segments of eastern India i.e., Chhattisgarh, Jharkhand, Orissa (uplands and coastal plains) and West Bengal (fringes of the plateau and its immediate alluvial plains).

The settlements along the coastal lines or nearer to the coast

**Sisupalgarh** (20° 13’ 30” N and 85° 51’ 30” E): The site is situated about 1 ½ miles to the east-south-east of the town of Bhuvaneswar. The present name of the fort has evidently been derived from the name of a small village, Sisupal, located in the eastern sector of the fort itself. Identification of the concerned site either with Tosali as mentioned in the Asokan Edicts or with Kalinganagara of the Kharavela’s inscription was a preoccupation among the scholars. More specifically the possibility of the present site being identical with Kalinganagara had been taken into consideration. According to the Hathigumpha inscription, Kalinganagara was provided with fortifications and Kharavela repaired the gateway and fortification wall which had been damaged by a storm. No fortified town of comparable date except Sisupalgarh is known to exist near the Khandagiri-Udayagiri hills. Such preference for text aided archaeology prompted the archaeologists of the Excavation Branch of the ASI to excavate the site in 1948 under the supervision of B.B. Lal (Lal, 1949: 62-105).

This excavation was designed to ascertain a) the cultural sequence and chronology of the site, b) the nature and formation of the defences and c) the plan of one of the gateways (Lal, 1949: 67).

With a view to unearth the cultural sequence of the site, excavations were conducted in a 60 feet square area lying in the interior of the fort. On the basis of ceramics, the 24 ½ feet deep occupational deposit has been divided into following cultural periods (Lal, 1949: 68-70).

Period I is characterized essentially by plain, wheel turned dull grey to terracotta red ware. No structural remains were encountered from this period indicating that perishable materials were solely used for making them. It is a pre-defence period.

Period II: The ceramic industry got sophisticated and certain evolved types made their appearance in this period. There was predominance of the bright red polished ware which
is well fired and nicely finished. Besides, incised and applied decorative patterns were in use. The BRW appeared for the first time at the beginning of the period (in layer 20). In layer 12 A, was found the earliest specimen of the roulette ware. Besides, terracotta ear ornaments, beads of carnelian, agate, quartz etc., iron implements were also reported. Structures are made of large lateritic blocks. The presence of brick bats indicates the use of bricks in constructional activity though no brick structure was met with. A pottery ring well 1 ½ feet in diameter surmounted by a stone slab with a central aperture of the same diameter as mouth was exposed at the late phases of this period. The well continued to be used in the following sub-period II B and was then buried under structures of period III. Defences were also constructed during this period.

Period IIB: The bright red polished slip, characteristic of the ceramics of the preceding period became increasingly lesser while in some cases ochre-wash was used instead of slip. The decorative patterns too deteriorated in respect of variety and execution. Three specimens of NBPW sherds, found from the layer 7 is one of the significant discoveries. In addition to terracotta ear ornaments, iron implements and beads of semi-precious stones, glass bangles and terracotta bullae were also met with. The terracotta bullae fall into two classes, one with animal figures and the other with human heads. The latter variety is important since the heads seem to have been imitated from those on the Roman coins.

Period III: Red ware with red or yellowish-red ochre wash became more numerous during this period. Red polished ware came into disuse. However, pottery types and decorative patterns both incised and applied remained unchanged. Besides iron objects, terracottas objects and beads, etched carnelian bead and two fragmentary terracotta coin-moulds constitute the cultural assemblage. Two adjoining houses, built of lateritic blocks and lying north and south, were exposed with a 2 feet wide space between them. The northern house consists of two rooms, measuring 10 x 8 feet and 10 x 9 feet respectively, with a verandah 19 x 8 feet in the front. Details of the plan of the southern house were not clear however, its overall dimension was 33 x 25 feet. Towards the fag end of the period were built some baked brick houses, in one of which can be seen a door-still.

In order to ascertain the character of the defences, a trench, 240 feet long and 20 feet wide was cut across the fortification wall at one of the highest points between the two gateways on the western side (Lal, 1949: 72).
In the earliest phase, the defences consist of a massive clay-rampart over 25 feet high at this point and 110 feet wide at the base. The sticky clay and earth used for its construction seem to have been dug out of the area which now lies close outside the rampart. Owing to constant weathering, the original contours of the rampart wall had been lost, though in the digging activity, it seems that above the flattish ramp rose a rather steep wall whose angle of inclination (37° - 40°) is indicated by the outer face. On the top of the rampart wall occurred a series of roughly circular holes, each about a foot deep and 10 inches wide, arranged at regular intervals of 1 foot 10 inches. BRW also occurred in the deposits constituting the upper part of the rampart. During the subsequent phase (Phase II), a 4-6 feet thick layer of lateritic gravel was added to the top of the clay rampart. Phase III witnessed a change in the make-up of the defences. Two brick walls 26 feet apart and respectively 2 feet 6 inches and 3 feet 6 inches thick were built at the top of the lateritic gravel and the space between them was filled up with mud and earth. According to the excavator, this phase seems to have come to an end about the middle of the first century CE as attested by the occurrence of rouletted ware. Phase IV does not seem to have immediately followed phase III, as indicated by the presence of a new revetment, possibly after the collapse of the former. Above the rouletted ware were found, in succession, a copper coin of Huvishka dated to the second half of the second century CE and a gold coin bearing a standing Kusana figure on the obverse and a Roman head on the reverse and ascribable to the second half of third century CE (Lal, 1949: 72-75).

The fort has eight large gateways, two on each side. Of these, the one nearer the north-west corner on the western side was taken up for excavation. There were two gates, one near the entrance and further back at a distance of a little over 100 feet. The remains of door-sockets were identified. The width of each gate is 13 feet. Immediately behind the first gate, the remains of a room (?), 9 ¾ feet long and 6 feet wide were exposed. Sections cut across the passageway revealed several successive streets which were made up either by ramming hard mud or laterite gravel or, as noticed in two or three cases, by paving with brackbats. No stone paving was recorded. During their lifetime, the structures at the gateway were repaired on several occasions. In the debris, immediately overlying the latest road-level in the passage were found some Puri-Kusana coins (Lal, 1949: 75-77).

Towards the centre of the fort has been recorded a group of sixteen monolithic pillars of laterite, some which are still standing intact. No excavation was done in the said field
season. Eight of the total groups, forms roughly an east-west row, mark the northern edge of the entire area, approximately 90 feet x 80 feet. On the north-east, the semblance of a chamber (9 feet x 8 ½ feet) is indicated by the location of four pillars at the corner points. The average height of pillars above the ground is 14-15 feet (Lal, 1949: 78).

Based on the occurrence of rouletted ware, the BRW, a coin of Huvishka, a gold coin imitating the Kusana type and ‘Puri-Kusana’ coins, various periods of the site may be dated as follows:

Period I: c 300-200 BCE
Period II: c. 200 BCE – 100 CE
Period III: c. 100-200 CE.
Period IV: 200-350 CE.

Ceramics: The pottery from the period I is essentially plain and is devoid of decoration. The predominant ware is generally dull grey or red in colour, polished in a few instances. Stray finds of polished black ware occur in the period though the said ware become more prominent in the early levels of period IIA. Black or grey sherds with or without concentric grooves on the inner base round a central knob represents the most omnipresent ceramic types of the site which persisted throughout all the occupational phases. BRW occurs in the make up of the defences of period IIA though it is absent in the period I.

Introduction of applied and incised decorative patterns and comparative predominance of brightly polished red ware mark the ceramic industry of the period IIA. However, the basic types of the preceding period continued here. A few types also have a pinkish buff slip with fine core. BRW appear for the first time along with a few sherds of the NBPW. In a late level, the occurrence of the roulette ware seems to be noteworthy finds.

The ceramics from the Period IIB differ considerably from the preceding one by its coarser ware, insufficient firing and a distinct change in the slip from polished bright red to a pale one. Moreover, the variety of types and incised decorations show a marked decline. The rouletted ware and three sherds of NBPW are significant finds from the period. A unique find from this period is a turtle shaped spotted vase with a strap handle.

The pottery of the period III is definitely crude and ill-fired, representing degenerated industry. There are a few typological changes in the fabric and firing. The polished or pale red slip of the preceding period is now replaced by a thin one or wash of red or
yellowish ochre. A few imitated variety of rouletted ware also occurred in infrequent numbers (Lal, 1949: 78-80).

Other finds: One hundred and eighty beads made of carnelian (etched in one instance), onyx, agate, chalcedony, amethyst, glass, terracotta and copper have been found in substantial numbers. Terracotta ear ornaments are prolific at the site though a solitary specimen is made of lead. The specimens were made of piece moulds of such fine edges that no seam is distinguishable. The ear ornaments from the lower levels are well fired and have buff or bright red slip while those from the upper ones are treated with red ochre wash. The decorations executed on the specimens include concentric circles, raised bands, some floral patterns, spiral incisions etc. Altogether thirty one coins have come from excavations, of which one each is of gold and silver, fourteen of lead and fifteen of copper. The gold coin shows the Kusana variety of standing king and a Brahmi legend in characters of c. third century CE on the obverse and a Roman head with a Roman legend on the reverse. The specimen is found from the foundation deposit of a wall in the cutting across the defences ascribable to period III. The silver coin of the square punch-marked variety was recorded from the early levels of period IIB. 9 of the total fifteen copper coins are rectangular uninscribed coins, recorded from different layers of periods IIA, IIB and III. The remaining six coins are thick round specimens of two Kusana and four Puri-Kusana coins. Of the fourteen lead coins from excavations which are rectangular in shape only two are legible. One bears the well-known lion-type of some of the Andhra coins and the other shows a head. Besides, the excavation also yielded two specimens of moulds, both of punch-marked coins from period III. They are made of grey ware and are disc shaped showing coin sockets on one face the other face being plain (Lal, 1949: 89).

No iron object was obtained from the levels belonging to period I, though this absence may be largely due to the fact that digging in the lowest levels was confined to a very small area. Periods IIA and IIB yielded a substantial number of iron objects, while the number of the same is outstanding in period III. The common types include nails, spikes, staples, sickles, ferrules, knife-blades, borers, lances, spear-heads, tanged daggers, barbed and faceted arrowheads and caltrops. However, the database testifies to the consumption of iron in structural activities and also in warfare pertaining to the historical period (Lal, 1949: 91, 93).

The listed specimens are given below (Lal, 1949: 93-95):
1. Nail of squarish section with knob head; from the late accumulations outside the northern gateway-flank. Period III.
2. Nail of square section with flat hook-head; from the accumulations outside the southern gateway-flank, late level of Period III.
3. Nail of square section with flat circular head; from the debris overlying the ancillary passage, late level of period III.
4. Nail of square section with expanded triangular head; from the accumulations contemporary to the Phase III of the defences, Period IIB.
5. Spike of square section, bent; from the make-up of phase III of the defences, Period IIA.
6. Nail of square section tapering to a pointed end; from the accumulations outside the northern gateway-flank, middle level of the Period IIB.
7. Object of indeterminate use (probably a nail-cutter) with flattened lower end; from the accumulations contemporary to the period IIB at the gateway.
8. Chisel of oblong section; from the accumulations outside the southern gateway-flank, upper level of period III.
9. Implement with long tang and flattened broad edge, probably a chisel; from an early level of Period IIB.
10. Fragment of a hook (probably a fish hook); from the debris overlying the ancillary passage, late level of period III.
11. Fragment of a hook (or bangle?) with thin circular section; from the accumulations contemporary with the late levels of Period III.
12. Latch, with a provision for a central nail; from the accumulations outside the northern gateway-flank. Period III.
13. Staple, from the accumulations contemporary to the Period III of the defences.
14. Fragment probably of a staple; from a pit contemporary with the late levels of Period IIB.
15. Ring of roughly oblong section; from a middle level of Period III.
16. Shallow dish (probably part of a ladle) of thin section with flat base; from the accumulations outside the northern gateway-flank; late level of Period III.
17. Borer; from the accumulations outside the northern gateway-flank, middle level of Period IIB.
18. Arrowhead, barbed and socketed; from the late accumulations outside the southern gateway-flank; Period III.
19. Arrowhead, four-edged and tanged; from the accumulations outside the northern gateway-flank; Period III.
20. Arrowhead, three-edged and tanged; from the accumulations outside the southern gateway-flank, an upper level of Period III.
21. Elongated arrowhead, four-edged; from the accumulations of Period III at the gateway.
22. Leaf-shaped arrowhead with thin flattened section; from the late accumulations of Period III in the main passage of the gateway.
23. Fragment of a spearhead with fissured socket; from an upper level of Period III.
24. Spearhead; from the late accumulations of Period III at the gateway.
25. Spearhead; from a deposit contemporary to the Period IIB at the gateway.
26. Spearhead, constricted in the middle; from the accumulations of Period III outside the northern gateway-flank.
27. Object of indeterminate use, circular in section (probably an awl or stopper); from the late accumulations of Period III gateway.
28. Spearhead; from the same deposit as no. 26.
29. Harpoon of oblong section; from the late accumulations of Period III at the gateway.
30. Fragment of an indeterminate object; from the clay rampart of phase I at the gateway, Period IIA.
31. A bracelet, more probably a handcuff; from the accumulations contemporary to the Period IIB at the gateway.
32. Caltrop, consisting of four radiating spikes so arranged that whichever way the object may be thrown on the ground, one of them always projects upwards; from the accumulations outside the northern gateway-flank; late level of Period III.
33. Fragmentary knife blade; from the accumulations outside the southern gateway-flank; Period IIB.
34. Ferrule of circular section; from the accumulations contemporary with the Period IIB of the defences.
35. Fragmentary lance of roughly circular section; from the accumulations outside the northern gateway-flank, Period III.

36. Hoe with tang of circular section; from the late accumulations outside the northern gateway-flank, Period III.

37. Sickle with tang of circular section; from a middle level of Period III.

38. Ring of tripod stand, the position where the legs were revetted being visible; from the accumulations outside the northern gateway-flank, middle level of period III.

39. Ring of circular section with overlapping sharpened ends; from the make-up of phase III of the defences; Period IIA.

40. Flat strip of indeterminate use; from the same deposit as no. 38.

41. Clamp; from the same deposit as no. 30.

42. Tanged knife or dagger; from a middle level of Period III.

43. Chopper-like object; from the same level as no. 34.

Excavations and ‘geo-physical survey’ at the site was again undertaken by R.K. Mohanty and M. L. Smith from 2006 onwards for a few consecutive seasons. However, the report does not mention about the nature of occurrence of iron in great details (Mohanty et.al. 2007: 142-154).

The emergence of political power and consolidation of the ‘urban’ character of settlement defines the early historic parameter of this region. Such parameters manipulated by the dynasties of the Mauryan and the post-Mauryan periods actually signified economic prosperity, expansion of specialized agriculture, growth of crafts and industries, improvement in the art of warfare, intensification of internal and external trade and trading networks, large scale consumption of metallic and non-metallic objects/ tools, efflorescence in artistic activities, beginnings of grand rock-cut structural activities. The utilization of the vast repertoire of iron objects, retrieved from different cultural layers of Sisupalgarh has to be interpreted by considering such parameters. It is quite interesting that the formative phase of settlement dynamics (associated with the EVF phases) is absent here or meagrely known. However, there is no doubt that different productive forces (i.e., social groups involved in procurement process) operated since the development of the village settlements in this geographical setting. The exploitation
of natural resources and the expansion of agrarian settlements were responsible for the crystallization of the said early historic parameter and the articulation of the imperial power. The political appellation in all probability enhanced the utilization of iron here. Now the problem arises while searching for the probable resource bearing areas and production centres which have furnished the large scale demand of this particular metal. However, it will be unwise to ignore the remarkable reserves of such metal, found in several parts of central Orissa, the Mahanadi-Baitarani valley, the Tel river valley and even northern Orissa, which must have extensively been extracted for the consumers of the region.

**Kenduli:** The site (20°23’ N and 85° 42’ E) is located on the southern bank of the river Prachi in the district of Khurda. The significance of the site lies in the fact that another settlement of Adaspur which has already been identified as the birth place of poet Jayadeva, the author of Geetagovinda stands in its close vicinity. Sculptural remains, architectural members along with ceramics have been recorded from three mounds viz. Prahraj Diha, Chandan Mandapa and Gokula Diha near the village. The surface findings from the site give some clues about its cultural antecedence. The excavation was mainly undertaken to ascertain the cultural deposits and chronological sequence of the site. The digging was carried out in (10 m x 10 m) 12 trenches in Prahraj Diha and 16 in the adjacent mound. The excavation could not carry out down to the natural soil because of water logging. The exposed evidence indicates the presence of three stages of structural activities datable to the early historical period. The remains of potter’s hearth and well furnished drainage system made of well burnt earthen pipes are the noteworthy finds. The ceramic industry consists of red ware, buff ware, red and black ware etc. Pottery was represented by both burnished and plain variety. Important types include *handis*, bowls, miniature pots, big storage jars, dishes etc. The excavation has yielded grey ware, black ware, red ware comprising both plain and finely slipped specimens. Other artefacts obtained from this excavation include terracotta sling balls, hopscotch, gamesman, stone and terracotta beads. Recovered iron objects are nails, scrappers, axes etc (News Letter, CASTEI: 2008, No. 13: 12).

**Jaugada:** Jaugada (“Jaugarhi”, ancient Samapa) lies 35km north-west of Berampur, on the bank of the Risikulya river in the district of Ganjam. Once a provincial Mauryan capital of the newly conquered province of Kalinga, Jaugada is famed by a set of stone-cut edicts in Prakrit of the Mauryan emperor Asoka. J.D. Beglar’s survey during the late
19th century at the site had resulted in the brief reporting of the extant fortification, towers and moat (Beglar, 1882/1970 (reprint): 112).

The site was taken up for excavation by Debala Mitra on behalf of ASI in 1956-57 with a view to unveil the culture sequence and the nature of its fortification (IAR, 1956-57: 30-31; also see, Mohapatra, 1986: 224-226; Yule, 2006: 41-42). Five cuttings were made in different parts of the site and a trench laid across the rampart. According to the excavator, the recovery of celts from the surface and one such specimen from excavation, seemingly associated with a sherd of BRW implied the Neolithic appellation of the site. Otherwise, the occupation may be broadly divided into two periods.

Period I represents a full-fledged iron-using culture. The pottery unearthed from the period is essentially plain and devoid of paintings and was utilitarian in character. Three distinct wares were recognizable: i) ordinary dull-red ware of medium to coarse fabric; ii) BRW and iii) red polished ware. A substantial number of beads made of shells, bones, carnelian, agate, crystal, quartz, have also yielded from the concerned period. A few specimens of unfinished and half finished beads further suggest its local manufacturing at the site itself. No brick structure was met with, though post-holes and patches of floorings, made of rammed gravel or burnt earth were often encountered.

The principal ceramic industry of period II mainly consists of red ware. Made of medium grained clay, it was mostly under fired and had a tendency to rub off easily. The decoration comprises incised and applied patterns. The knobbed vessel, which made its appearance in period I, survived in this period as well, but the fabric degenerated considerably. The other cultural materials include brick and stone structures (scantily represented in the limited area under excavation), fine specimens of beads mostly of semi-precious stones, shell and terracotta, and copper and iron objects. A punch-marked coin was found in an early level of the period. So-called Puri-Kusana coins, eleven in all, were found scattered throughout.

The fortification consists of an earthen rampart, surviving to a height of 25 feet at places. It was roughly square on plan, each side, pierced by two gateways, approximating half a mile in length. The excavation of a trench, 117 feet long, was laid across the southern side of the rampart between its two gateways. On the natural soil was exposed a sandy layer with flimsy occupational debris, consisting of sherds of fine BRW. Over it was built the first rampart, its extant maximum height being 14 feet 6 inches and basal width 70 feet. The material to form the rampart was obtained by the cutting of a ditch into the
sandy layer and the varied natural deposits of clayey earth with *kankar-nodules*, laterite-gravel and stone chips.

The next important phase of the rampart is separated from the initial one by an intermediate phase, during which the existing top was covered by a thick deposit of earth. It witnessed the construction of a 2 feet high wall of rubble and stone chips with a cap of large boulders all laid in thick laterite-gravel and clay against the inner side. Both the sides of the wall and the major part of its top were covered up with varied deposits, leaving only one side of the top boulders exposed. One of such deposits yielded a Puri-Kusana coin.

The excavator presumed that the neoliths as well as the ceramics indicate a pre-Christian origin of the site. The availability of Puri Kusana coins from period II marked the upper limit of the period.

**Manikapatana**, once a thriving port on the Bay of Bengal, is located in the Brahmagiri Tahasil, 45 km to the south-west of Puri town along the left bank of a channel which connects Chilika lake with the sea. The site has a number of mounds of which the highest one has the Bhavakundaleswara temple, a 13th century Saivite monument. To the east of this temple stands a Muslim tomb datable to 1885 CE. Based on epigraphic evidence it has been revealed that it was a port of repute during the medieval period. The Ain I Akbari of c. 16th century CE refers to the affluence of the site based on the export of salt. Subsequent reports of the British administrators also pointed out the significance of Manikapatana (Pradhan, Mohanty and Misra, 2000: 476-479).

The site was subjected to limited excavation in 1989-90 and 1992-93 under the joint collaboration of the Orissa Institute of Maritime and Southeast Asian Studies and the Department of State Archaeology of the Government of Orissa. The trial trenches were laid on a mound adjacent to the water channel and two near the edge of the mound towards the bank of the channel in order to locate any ware house or other structural remains. Comprehensive sequence of the cultural horizon could not be determined as the digging did not reach the natural soil. The study of the exposed sections in the trenches revealed thick accumulation of the wind-blown sand. The site has been disturbed due to flood during high tide and rainy season. The water level in the adjoining streams rises to inundate the habitational site. Occurrence of potsherds in the bed of this water channel further substantiates the above statement (Pradhan, Mohanty and Misra, 2000: 479-480).
Two trenches were laid in the horizontal plain of the northern side of the mound, the excavations in which revealed occupational deposit of two cultural periods. The deposit of period I yielded two Neolithic celts, sherds of rouletted ware, fragments of amphorae, two Puri-Kusana copper coins, a sherd inscribed with Kharosthi script having the legend “Dasatradeva” and “Khida”, stamping design on pottery, sprinklers, spouts, Kaolin pottery, terracotta miniature figurines of bird, horse, terracotta smoking pipes, game pieces, arecanut beads, lamps with human figure and BRW, NBPW, red polished ware, BSW, knobbed ware, etc. Altogether 13 terracotta ring wells have been exposed. This period can be dated from 3rd-4th centuries BCE to 4th century CE (Pradhan, Mohanty and Misra, 2000: 480-488; Basa, 1999: 17-18; Tripathy, 2007: 27-41).

**Palur:** The paleo-harbours of Palur and Ghantasila (19° 27’ N and 85° 11’ E) are located close to each other towards the south of the Chilka lagoon and north of Rishikulya estuary in the Ganjam district. Among other ports and harbours of Orissa, Palur stands apart mainly due its geographical location. Significance of the site has been referred to in several travel accounts at different times. Ptolemy in his account of 1st century CE has mentioned Paloura as one of the important settlements of his time which has generally been identified with the modern Palur. The site was explored by A. Nath of ASI and K.S. Behera (cited in Patra and Patra, 2004: 109; Basa and Behera, 2000: 574-577). The important feature of the site is the discovery of artificial breakwater. They are located on the foot hills of Ghantasila and Nandighar on the bank of the Chilka. The southern breakwater of the foothills of Nandighar is 75 m long and 100 m broad and rises to a height of 9 m of which 60 cm is below the present water level. The northern breakwater of the foot hill of Ghantasila is about 700 m long, 100 m broad and rises to a height of 8.6 m of which 60 m is below the present water level. They were built parallel to the water front and were placed at such angle that it could counter stormy weather.

The survey from this site (Basa and Behera, 2000: 574) has revealed a wide array of ceramics including a pot sherd having stamped boat motif besides BRW, NBPW, grey ware, black ware, rouletted ware, few pieces of amphorae. The excavation has yielded beads of semi-precious stones, iron objects, slags, copper fragments, conch shells, *cowries*, bifacial bone points. Recent survey by K.K. Basa of Utkal University and others around Palur has resulted in the recording of one monolithic granite pillar on a hill top of about 60 to 70m height near Rahunathpur besides other objects.
Gopalpur: The site is located 72 km south of Bhuvaneswar in the Nayagarh district. Preliminary survey at the site was conducted by the Department of Anthropology, Utkal University in 1991 whereas the subsequent endeavour was made by S.K. Kar on behalf of the same department in 1996 (Kar, 1995-96: 105-106; Kar, Basa and Joglekar, 1998: 107-114; Kar, 2000: 368-391). There is a small mound locally known as Jagati, located near the village Gopalpur towards north. The mound is oriented in north-south orientation. It covers an area of 140 x 115 m and rises to a height of about 9 m. A small stream known as Khatiari flowing from west to east cuts the mound in north-south direction. The section of the mound is visible clearly from the eastern side. The exposed section shows the remains of different artefacts like celts, potsherds, burnt clays, fragments of rubbing stones and bone. The stone tools are of different categories like celts made of dolerite, perforated stones made of sandstone besides fragment of rubbing stones, sharpeners and grinding stones made of quartzite. Red ware, dull red ware, red slipped ware, cream slipped ware, grey ware, chocolate ware, BRW, burnished black ware constitute the ceramic industry of the site. The principal shapes in red ware are storage jars, vases, handis, basins, lids, dishes on stands, bowls and miniature pots; in dull red ware are vases, storage jars, basins etc, in cream slipped ware are vases, dishes; in grey ware are vases, storage jars, handis and dishes; in chocolate ware are vases and storage jars; in BRW is tumblers. Faunal remains belong to both wild and domesticated varieties of animals (cattle, buffalo, nilgai, chital, wild pig and rhinoceros).

Evidence of iron smelting has been recorded in the areas like Dangala, south eastern corner of the villages of Gopalpur and Gothapada. A substantial amount of slags and fragments of terracotta pipes (probably part of a tuyere ?) are found lying scattered on these areas.

Besides, a good collection of sculptural specimens and architectural members of the early medieval period have also been reported from in and around the site.

Narisho: The site (20° 07’ 04” N and 86° 03’ 04” E) is situated on the right bank of the river Prachi in Balipatna block of Khurda district. The river Prachi flows over a distance of 60 kms with a catchment area of 600 sq km before it discharges into the Bay of Bengal. The valley has a number of mounds scattered with habitational and structural remains. Oriented east to west the mound at Narisho measures approximately one km in length and about a half a km in breadth. Taking into account the discovery of ceramics and artefacts during the explorations carried out in the field season of 2006-07, two
trenches NSO I and NSO II measuring 4.00 m x 4.00 m and 3.00 m x 2.00 m respectively were laid in the vegetable garden of Narahari Singh (near the Ramchandi temple of the village during January-March 2009) (Pradhan, 2011: 1-5).

Cutting through six habitational layers NSO I encountered natural soil, which is composed of yellowish compact silt clayey soil at a depth of 2.65 m though the excavation was carried out to a depth of 3.10 m. In NSO II the excavation was limited to 1.40 m cutting through habitational layers.

The ceramic industry of Narisho is predominantly wheel made along with the specimens of handmade potteries. They are red ware, red slipped ware, black ware, BSW, reed impressed red ware, grey ware, BRW, micacious red slipped ware and knobbed wares. The excavation also yielded variety of decorated sherds from all layers along with graffiti marks of vertical stroke, ladder pattern, leaf pattern, floral design etc.

The excavation also unearthed 150 antiquities/ artefacts of different materials like stone, bone, metal, glass and shell. The terracotta objects include arecanut beads, inscribed beads, inscribed pendants, bullae, medallions, hopscotch, cakes, wheels, animal figures (bull), broken piece of a decorated pedestal, gamesman, weights, sling balls, ear ornaments etc. The stone objects mainly comprise pestles, saddle querns and beads of semi-precious stone viz. chalcedony, carnelian, agate, blue, green and red chert. Besides iron, copper antiquities include fragments of bangles and wires. Fragmented bangles made of glass, shell and lac also make their presence at the site. The inscribed terracotta pendant with nail-headed characters is a significant discovery along with a solitary specimen of Puri-Kusana coin. Grains of four varieties of rice, black gram and green gram have also been reported.

**Iron Objects:**

The excavation yielded twenty-nine iron objects, besides a number of shapeless slags (Table 22 and 23). They repertoire include- axe, chisels, knifes nails, spatula, spear-head, rods/bars, indeterminate objects etc. Both the objects and slag are found from all occupational layers except in layer-1. However, this absence may be due to the disturbance of the surface humus. Layer – 4 yielded maximum numbers of objects (27.58%) followed by layer-5 (24.13 %), layer-2 (20.68%) and layer-3 & layer-6 each have 13.79 %. All the recovered objects are fragmentary and heavily corroded.

1- Flat chisel made of a thin sheet of iron showing elliptical section with slightly broad working edge. The narrower butt end was meant to be hafted in a wooden handle.
<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
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<tbody>
<tr>
<td>2</td>
<td>Indeterminate pointed object.</td>
</tr>
<tr>
<td>3</td>
<td>Object made of a flattened sheet.</td>
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<tr>
<td>4</td>
<td>Fragment of a knife with sharp working edge.</td>
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<tr>
<td>5</td>
<td>Object made of a flattened sheet.</td>
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<tr>
<td>6</td>
<td>Indeterminate object.</td>
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<tr>
<td>7</td>
<td>Axe with broad working edge showing rectangular section, the butt end being broken.</td>
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<tr>
<td>8</td>
<td>Nail with broken end.</td>
</tr>
<tr>
<td>9</td>
<td>Indeterminate pointed object made of a thin sheet.</td>
</tr>
<tr>
<td>10</td>
<td>Object of a roughly flattened circular sheet.</td>
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<tr>
<td>11</td>
<td>Indeterminate object.</td>
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<tr>
<td>12</td>
<td>Fragment of a knife showing the pointed end.</td>
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<tr>
<td>13</td>
<td>Fragment of a chisel showing broad working edge, rectangular in section, pointed tang meant to be inserted in a wooden handle.</td>
</tr>
<tr>
<td>14</td>
<td>Fragment of a nail of squarish section.</td>
</tr>
<tr>
<td>15</td>
<td>Object of flattened roughly circular sheet of indeterminate object.</td>
</tr>
<tr>
<td>16</td>
<td>Fragment of a rod roughly circular in section.</td>
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<tr>
<td>17</td>
<td>Indeterminate object.</td>
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<tr>
<td>18</td>
<td>Spatula broken into three pieces.</td>
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<tr>
<td>19</td>
<td>Indeterminate object broken into two pieces, squarish in section and partly bent on one end.</td>
</tr>
<tr>
<td>20</td>
<td>Indeterminate object.</td>
</tr>
<tr>
<td>21</td>
<td>Pointed indeterminate object.</td>
</tr>
<tr>
<td>22</td>
<td>Indeterminate object.</td>
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<tr>
<td>23</td>
<td>Fragment of indeterminate object of rectangular section.</td>
</tr>
<tr>
<td>24</td>
<td>Broken piece of a nail of roughly squarish section.</td>
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<tr>
<td>25</td>
<td>Fragment of a rod/bar of roughly squarish section.</td>
</tr>
<tr>
<td>26</td>
<td>Indeterminate object broken into two pieces, flattened broad head showing rectangular section.</td>
</tr>
<tr>
<td>27</td>
<td>Fragment of a chisel with rectangular section.</td>
</tr>
</tbody>
</table>
28- Leaf shaped spear-head made of a flattened sheet with rectangular section. Its pointed working edge is heavily corroded. The tang with a circular section partly broken, meant to be inserted to a long wooden bar.
29- Fragment of a rod of squarish section.
30- Indeterminate object

Regarding the chronology of the site and its habitational layers, the report seems to be mute. However, excavator suggests that the material culture of Narisho is comparable to that of Sisupalgarh so far as the ceramic assemblage, terracotta and metal objects are concerned.

The settlement dynamics of the Orissan littorals can more or less be equated with that of West Bengal. It is well known that from the late Pleistocene period onwards, the entire low-lying mature and active delta region was subjected to the continuous progress of the deltaic formation, seasonal floods and the dynamics of a hydrographic system with regional variations. Such geo-physical connotations have certain bearing on the pattern of survival strategies of human settlements. However, in spite of having a homogenous gently sloping formation of the Bengal-Orissa coastline, lagoon formation is more pronounced in Orissan coast. Such stark contrast from the Bengal coastline made the Orissan coast more significant for trading activities. Besides this congenial geo-physical set up, several dynasties by exercising their political hegemony amidst a huge expanse of undulating and forested plateau land (for getting access to the resource bearing zones) intersected by different river valleys, and flanked by the fascinating stretches of the eastern littorals have successfully controlled the river traffic and monitored the procurement network. The phenomenal presence of iron in the coastal region of Orissa has to be interpreted by considering its use in several non-farming and sea-faring activities including boat manufacturing activities.

The sites with a name having garh as suffix or the so-called garh

Kharligarh: The site, popularly known as Kharavelagarh or Gumagarh, is located on the left bank of the river Rahul, just at a distance of 600 m from the confluence of the Tel and the Rahul. The fort partly fulfils the contour of Daivakrita or natural fort and Audakadurga. The site bordering the districts of Bolangir and Kalahandi, in fact, belongs to the Tusra block of the former. Situated on the left bank of the serpentine course of the
Rahul, the site had spread to the confluence of the said two rivers and even beyond that. By taking advantage of the available land in the horse-shoe shaped formation of the river, the fort was built which is quite an exceptional phenomenon in Indian history (Mohanty and Mishra, 2002: 474; Yule, 2006: 44-45; Mishra, 2011: 99-102).

Basically built on loose lateritic soil the fort measures 630 m on the northern side, 660 m on the southern side, 390 m on the eastern side and 400 m on the western side. Roughly rectangular in dimension, this fort has its main entrance on the western site having a gate (9 m in width). The wall is made of burnt bricks (40 x 25 cm) with stone fencing on the exterior surface. Close to the western wall, a moat spreads from the northern bank of the Rahul to its southern fringe. At either end of the ditch, brickworks in proximity to the watercourse of the river is confronted which shows some device to control the stream of water into the moat and to empty the same at another end. Other sides of the fort remain uncovered without any protective wall. Moreover, a ghat with stone steps leading from the interior of the fort into the river is noticed at its northeast corner. At a place where the western wall touches the bank of the river Rahul there are huge mounds of stone and bricks giving an indication of constructional activity in the past. The central part of the fort has a shrine on ruined structure, probably for the presiding goddess of the fort.

Excavation at the site was conducted by the Post Graduate Department of History, Sambalpur University during the field season of 2002 under the supervision of S. Pradhan (Mishra, 2011: 103). Three trenches namely KLG I, KLG II and KLG III measuring 3 x 3 m, 10 x 10 m and 10 x 10 m respectively were laid at different locales of the site. KLG I uncovered eight occupational layers without reaching natural soil whereas KLG II and KLG III have revealed the evidence of massive structural activities below the surface humus.

Layer I spreading from the surface humus to the depth of 16 cm has yielded plain red ware, red slipped ware, black ware, a few tiles, iron spearheads, beads of semi-precious stones like agate and carnelian and of terracotta. Layer II, consists of brown compact deposit has yielded tiles, red wares, red slipped ware and black ware. Iron objects include spearheads, nails, chisels etc. Besides, stone beads and bead moulds have also been unearthed along with a few specimens of hopscotch. Layer III having a deposit of dark brown and compact laterite clay is characterized by the ceramic industry, very much alike the preceding one. Iron nails and hopscotch form the other cultural assemblage. Layer IV is a sterile layer, made of compact lateritic gravel. Layer V with a deposit of compact
brown soil is associated with large sized bricks and tiles. The ceramic assemblage comprises red ware, red slipped ware and BSW. Spearheads, nails, sword fragments, clamps form the repertoire of iron objects found from this layer. Besides, legged saddle querns, pestles, terracotta hopscotch and copper punch-marked coins have also been yielded. Layer VI has yielded red ware, red slipped ware, BSW, BRW, iron objects, like spearheads, nails, chisels, stone moulds of ornament, terracotta wheels, terracotta hopscotch etc. Layer VII was found rested on pebble paved floor, consisting of dark and compact lateritic soil. BRW, red ware, red slipped ware, BSW, iron nails and chisels, terracotta objects beads, handles, cones etc. have been yielded. Layer VIII, besides yielding the usual ceramic assemblage has unearthed a good collection of iron nails.

The excavator prefers to accommodate these eight occupational layers into two cultural periods: Period I (c. 200 BCE to 200 CE) and Period II (c. 200 to 400 CE).

Intensive survey of Kharligarh and its bordering area during the field season of 2003-04 and 2004-05 has further yielded votive linga, terracotta smoking pipes, stone spindle whorls, a few pieces of tiles affixed with iron nails and bolts, iron daggers, terracotta figurines (animal), legged saddle querns, copper punch-marked coins, stone slabs, ceramics like dull red ware, red ware, black ware, BSW, black burnished ware, red slipped ware, coarse grey ware etc. iron slags. Dash in 1982 has examined 16 iron objects, highly oxidized and rusted and has also done a comparative analysis of these iron tools with those from Sisupalgarh and Jaugada.

The site provides the evidence of water management system. Stone veneer observed all along the edge of the site close to the watercourse of the river Rahul was meant to strengthen the fort as well as a barrier against the river action. At many places of the serpentine course of the said river, concave shapes are encountered because of the sudden curve of the river. At the concave point, water velocity is usually higher which could endanger the side. Masonry works, ghat or brick or stone works served as counter measure against the river action. Moreover, the ditches documented near the western wall indicate the protective measure adopted by the builders of the fort against water erosion.

Kharligarh also commanded the river traffic of the Tel. The break water system observed within the bed of the Rahul further strengthens the hypothesis of the involvement of the site in the riverine exchange network/trade. Resources of hinterland could be harnessed and exported from this centre to Kosala (south Kosala) and Kalinga. (Mishra, 2011: 105).
Dash has categorized the inventory of iron objects found from the site (Dash, 2008: 69-70)

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<tr>
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<tbody>
<tr>
<td>1.</td>
<td>Hook, Length: 35 mm, Breadth: 19 mm; round section</td>
<td></td>
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<tr>
<td>2.</td>
<td>Dagger, Length: 58 mm, Breadth: 19 mm;</td>
<td></td>
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<tr>
<td>3.</td>
<td>Sickle, Length: 65 mm, Breadth: 12 mm</td>
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<td>4.</td>
<td>Chisel, Length: 65 mm, Breadth: 12 mm</td>
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<td>5.</td>
<td>Knife, Length: 54 mm, Breadth: 13 mm</td>
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<td>6.</td>
<td>Spearhead, Length: 66 mm, Breadth: 66 mm (?)</td>
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<tr>
<td>7.</td>
<td>Leaf shaped spearhead with a tang, Length: 56 mm, Breadth: 19 mm</td>
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<td>8.</td>
<td>Spike of square section, Length: 72 mm, Breadth: 7 mm</td>
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<tr>
<td>9.</td>
<td>Latch, Length: 53 mm, Breadth: 8 mm</td>
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<td>10.</td>
<td>Knife, Length: 53 mm, Breadth: 8 mm</td>
<td></td>
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<tr>
<td>11.</td>
<td>Knife, Length: 57 mm, Breadth: 9 mm</td>
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<tr>
<td>12.</td>
<td>Latch, Length: 71 mm</td>
<td></td>
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<tr>
<td>13.</td>
<td>Nail of square section, Length: 59 mm, Breadth: 10 mm</td>
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<tr>
<td>14.</td>
<td>Nail of square section with flat circular head, Length: 42 mm, Breadth: 6 mm</td>
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<tr>
<td>15.</td>
<td>Nail with knob-head, Length: 44 mm (including the curved end), Breadth: 10 mm</td>
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<tr>
<td>16.</td>
<td>Nail with square section and broken head, Length: 70 mm, Breadth: 9 mm</td>
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| 17. | Gudavella (20° 25’ N and 83° 34’ E): The site being situated only 2 kms away from Kharligarh stands on the bank of the river Rahul. In 1970, twenty three implements were recovered from 47 cm below the surface at the site. These are now in the collection of the Orissa State Museum (Dash, 2008: 62-63). Besides the repertoire of iron objects, ringstones and microlithic flakes have also been documented at the site. The inventory of the said iron objects are the following (Dash, 2008: 67-68):

<p>| | | |</p>
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<tbody>
<tr>
<td>1.</td>
<td>Spike, 310 x 18 x 7 mm</td>
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<tr>
<td>2.</td>
<td>Borer, Length: 340 mm, Maximum diameter: 11 mm, circumference 35 mm</td>
<td></td>
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<tr>
<td>3.</td>
<td>Borer, Length: 299 mm, Maximum diameter: 12 mm, circumference 32 mm</td>
<td></td>
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<tr>
<td>4.</td>
<td>Chopper (?), Length: 274 mm, breadth at the head: 52 mm, thickness: 36 mm, diameter: 29 mm, length of the circular portion: 90 mm.</td>
<td></td>
</tr>
</tbody>
</table>
5. Spearhead, Length: 235 mm, thickness: 16mm; breadth of the spear base: 34 mm, length from the starting point of the tang: 103 mm

6. Nail Cutter (/ Chisel ?), Length: 305 mm, Thickness: 21 mm, breadth of the working end: 27 mm, length of the working end: 50 mm.

7. Spearhead, Length: 291 mm, maximum breadth at the base of the working end: 49 mm, length of the tang: 170 mm, maximum thickness of the working end: 15 mm, maximum thickness of the tang: 18 mm.

8. Spearhead, Length: 459 mm, working end 196 mm x 69 mm x 14 mm, tang breadth: 19 mm and thickness 19 mm.

9. Spearhead, Length: 371 mm, working end 87 mm x 32 mm x 15 mm, tang length: 25 mm and breadth 22 mm.

10. Spade with hollow circular hafting space, length: 156 mm, breadth of the working end: 67 mm, breadth of the hafting end: 49 mm, thickness at the working end: 11 mm, thickness at the hafting end 35 mm, thickness of the hafting ring 8 mm, hafting space: 35 mm x 36 mm.

11. Spearhead, Length: 311 mm, working end 70 mm x 44 mm x 12 mm, tang thickness: 17 mm and breadth 22 mm.

12. Dagger, 278 mm x 33 mm x 4 mm

13. Axe, length: 172 mm, breadth of the cutting edge: 58 mm, hafting end 17 mm, thickness at the working end: 6mm, maximum thickness: 26 mm.

14. Chisel, 204 x 15 mm.

15. Object of indeterminate use.


17. A lid of a container.

Besides three specimens of mould (?)

**Badmal:** The habitation site of Badmal is located on the left bank of a second order perennial stream, Harihar nullah, a tributary of the Mahanadi. The site lies some seventy kilometers south-east of the district headquarters of Sambalpur. It is an isolated settlement, situated in the upper reaches of the Harihar nullah in a rocky terrain with an elevation of 150 m above the mean sea level. The fortified site (21°06’22” N and 84°03’37” E) is roughly lozenge-shaped and spreads over an area of about four hectares (180x220 m). The site is protected on all sides by a massive earth rampart, which rises to
a height of about six to seven metres above the surrounding plains and is approximately 20-25 metres wide at the base (Behera and Chattopadhyay, 2013: 126, 128). In addition to the main fortification, two additional small earth ramparts are located on the north-western side of the site, towards the stream, presumably to protect the settlement from seasonal flood. At least three entrances to the settlement have been identified, located on the south-western, north-western, and north-eastern sides. While the north-eastern and north-western prominences of the rampart wall are to some extent better preserved, other parts have already been destroyed by the intensive surface agricultural activities carried out by the present villagers. The rampart was perhaps originally encircled by a 15-20 m wide moat, which has now been converted into agricultural land. Another important factor which has seriously impaired the preservation of the site is the frequent illegal mining operations undertaken by the present villagers inside the fortified area, particularly in the southern sector.

Trial excavations (Behera and Chattopadhyay, 2004-05: 118-125) were conducted at the site by P.K. Behera during 2002-03 under the auspices of Sambalpur University, which revealed four phases of human occupation, viz. Period IA, IB, IC & II with an occupational gap between the periods IC and II, represented by a sterile flood deposit of 30-35 cm in thickness. On the basis of excavated materials, exposed stratigraphy and radiocarbon dates, Periods-IA, IB and IC have been assigned to the Iron Age phase, while Period-II to the early historic phase.

During the Iron Age period (with Periods IA, IB and IC), the settlement was confined to a limited area, lying towards the highest north-western part of the mound, and it was also without any fortification wall. Evidence suggests that people during this phase lived in wattle-and-daub houses with rammed floor. A variety of materials, viz. iron and copper objects, bone and antler tools, earthen wares of different types, precious and semi-precious stone beads, sling balls of stone, terracotta beads, pottery discs, etc constitute the cultural assemblage of the site (Behera and Chattopadhyay, 2013: 129). The deposit of this phase yielded a large number charred and un-charred skeletal remains of wild and domesticated animals exhibiting distinct butchery marks on them. The ceramic assemblage, which demonstrates close affinity in shape, size, colour and fabric with that from other contemporary ‘Iron Age’ settlements of the middle Mahanadi Valley, is represented by BRW potteries of fine to medium fabric, red slipped ware, BSW and plain red ware potteries. Important shapes in the BRW comprise flat and round-based bowls,
vases and dishes. However, vases of different sizes and forms are the important shapes in the red slipped ware. Large-sized storage vessels are rare and are fabricated in only red ware.

After a brief occupational gap, the settlement again revived and also grew in its dimension during the subsequent early historic phase (Period-II). In Trench-I, excavated in the northern sector of the site, a 30-35 cm thick culturally sterile deposit was noticed between the two major periods. Most probably due to frequent inundation from the Harihar stream, the site was deserted by the ‘Iron Age’ people and was reoccupied subsequently during early historic times.

During the Period II, it was protected on four sides with a massive earth rampart with at least three passageways. While many of the cultural features of the earlier period continued to exist, the site during this phase served as a very large stone bead manufacturing centre. The low-lying southern part of the mound was exclusively used for manufacturing precious and semi-precious stone beads.

According to the excavator, for manufacturing beads, not only the locally available raw materials like beryl of greenish-blue, golden-yellow, and pale blue to sea-green colour, aquamarine, smoky quartz, amethyst, corundum, and tourmaline were exploited, but also the imported materials such as banded-hematite-red-jasper, agate, chalcedony, and amygdaloidal basalt, have been obtained from regional and extra-regional contexts by way of trade or exchange. In addition, beads and pendants of coral and onyx, which were directly imported from outside the region, have also been recorded.

A small trench (2 x 2.5 m) excavated in the southern sector of the mound has unearthed more than 3000 bead wastes, 347 bead roughouts and blanks, 61 semi-finished beads, and only 33 finished beads, besides craft tools, including bead polishers, small-sized pestles with sub-triangular cross-section, anvils, hammers, mulers, and two-legged querns. The trench also yielded an array of iron objects of multifarious utility, including drill bits. All these evidences essentially indicate the presence of a manufacturing activity of stone beads (Behera and Chattopadhyay, 2013: 129-130). Besides, the trench also unearthed pottery discs of various sizes and weights, and a large quantity of pottery, which also includes BRW. Despite the technological advances associated with the emergence of specialised craft industry, no marked change is noticeable in the cultural materials of the settlement during the concerned period. The early historic people continued to live in wattle-and-daub houses.
Iron objects have been found from the earliest phases of human occupation at Badmal, the use of which was proliferated in the subsequent early historic period. However, there is no direct evidence for on-site production of this metal. The cultural phases associated with the ‘Iron Age’ (metallic EVF phases) yielded only 4 objects (mainly arrowheads and spearheads). The number turns to 26 during the early historic phase (period II). Therefore during the period I, iron was scarcely used and probably served as an important implement in non-farming/fishing activities. Proliferation of the use of iron and the advent of its varied types (tools required for structural activities and craft-related tools, including drill bits, saws, nails, clamps etc.) during the early historical period was definitely necessitate by the construction of ramparts and the emergence of large-scale craft production of specialised items, such as stone beads as evidenced by the archaeological data (Table 24) (Behera and Chattopadhyay, 2013: 131).

During excavations, a lump of chromite ore was retrieved from Trench III, located in the southern sector of the mound. In order to determine the source of this iron and the technology involved in the manufacture of the iron objects found at the site, four iron objects, one from period IA and the remaining from period II, were subjected to External Particle Induced X-ray Emission (PIXE) and metallographic examinations (Behera and Chattopadhyay, 2004-2005; Chattopadhyay, et al., 2007). The analysis shows that the iron objects were possibly produced from multiple ore sources and may therefore have been procured from different locations. Interestingly, the analysis shows the presence of vanadium and chromium in three of the four samples analysed. Vanadiferous magnetite deposits are found in small pockets near the Nuasahi-Boula area on the eastern border of Keonjhar, in the Baripada-Rairangpur belt in Mayurbhanj district, and in the Betei-Rangamata area in the district of Balasore. It is known that the addition of even less than 0.1% of vanadium to steel or cast iron can significantly increase strength, toughness, and ductility. Similarly, one of the iron samples also contains chromium, sources of which are presently found in the Tomka-Daitari belt of Keonjhar district. The source lies some 180 km east of the Badmal Asurgarh site. As mentioned above, a lump of chromite ore has also been recovered from the early historic deposit at the site. In addition, the bead workers of Badmal extensively used banded-hematite-red-jasper raw material for bead production.

“For metallographic analysis, small samples were taken from each of the four objects and mounted on Perspex using a Buhler Simplimate 2 mounting press. Subsequently, the
specimens were observed in polished and etched conditions. Observations were made using a Leica DMLM microscope in different areas, with different magnifications, ranging from 50 to 1000x. Each of the specimens was heterogeneous in grain size, from large coarse grains of ASTM grain size 1 to very fine ones of ASTM grain size 8. Each sample was also subjected to 2-3 micro-hardness tests using the Leica VMHT at 300 gm load for 15 seconds. Slag inclusions were commonly observed in the analysed samples.

Sample BDM-18, a spearhead, is chronologically the earliest of the sample range. The microstructure indicates the presence of oxide scale and silica-rich slag inclusions. When etched, the heterogeneous nature of the grains was revealed, with ASTM grain sizes between 3 and 8. No evidence for carburisation was visible and the average micro-hardness obtained was 113.7 HV within a ferrite region.

Sample BDM-8 is a drill bit. At 500x, a heterogeneous microstructure was revealed, including elongated slag inclusions, massive ferrite and ferrite grains with Neumann bands. The latter structure indicates that the tool was forged at low temperatures (below 500 °C), which caused a shock to the metal. No evidence for annealing was visible, and the micro-hardness value obtained was 134.8 HV within a ferrite region.

Sample BDM-7, also a drill bit, was identified as low carbon steel. The microstructure was again heterogeneous, with evidence of partial spheroidisation of the carbides, and Widmanstatten side plates had formed in hypoeutectoid regions.

Finally, sample BDM-16, identified as a toothless saw, included a fine-grained corrosion layer with ferrite matrix. In the central region, both coarse and fine grain matrices could be observed, along with pearlite grains. A few grains with Neumann bands were also noticed, along with elongated slag inclusions. The micro-hardness value obtained in a ferrite region was 110 HV, while that in a pearlite region was 195.6 HV.” (Table 25) (Behera and Chattopadhyay, 2013: 133)

The uniform distribution of slag materials is the clear indication of wrought iron. One of the objects may be identified as low carbon steel. The earliest iron object BDM-18 is definitely primitive in technology. The total slag contents may be identified respectively as 3.59, 1.574, 2.37 and 2.79 percent. This clearly represents the technological improvement over the driving out of slag particles between the ‘Iron Age’ and early historic period. Not only there is increase in the tool types but, the introduction of low carbon steel making is also visible during the post- Iron Age period.
It is interesting to note that remarkable collection of iron nails from the site suggests their use in ships and boats and other seafaring activities. Besides, harpoons, spearheads, sickles, fishhooks have also been yielded in profuse quantities.

The site also revealed a number of antiquities in terracotta, stone and glass. Several brick and stone structures were also exposed during the excavation. The site also revealed a wide array of pottery of non-indigenous origin including moulded ware, stamped ware, Chinese celadon and porcelain wares, ‘Egg-White’ and ‘chocolate glazed Arabian ware’, brown glazed Burmese pottery, etc.

**Narla-Asurgarh:** The site (20° 03’ N and 83° 22’ E) is situated near Rupra Road Railway station, about 2 km from the Narla village in the district of Kalahandi. The site has a rectangular fort (interior east-west by north-south: 410 x 250m=10.2ha) near the river Sandul and is surrounded by moat on three sides. The 50m wide glacis measured in the interior are 6m in height, and 10m in height in the exterior. The fort has four wide gateways at four sides with guardian deities viz. Ganga Devi at the eastern gate, Kalapata Devi at the western, Vaisnavi Devi at the northern and Dokri Devi at the southern gate. The structure itself is slightly asymmetrical; the south-west corner measures 10° more than a right angle. According to Yule, “isolated brickbats reveal themselves on top of the glacis which suggests that whatever revetment was built probably consisted at least partly of fired brick. The corners are higher than the glacis itself. Especially on the northern side, the long ridges give an indication of the size and position of the original moat, which was clearly a part of the defensive system. The site was selected for its source of water and drainage for the moat. The adjacent Sandul probably has not changed its bed much since the erection of the fort”. (Yule ed., 2006: 48)

The significance of site was first comprehended in 1958 with the discovery of a hoard of 598 silver punch-marked coins. Of these, 69 belonged to the pre-Mauryan period, 272 to the Mauryan and the remaining 198 to the post-Mauryan period. The University of Sambalpur and the Department of Cultural Affairs of the Government of Orissa jointly undertook an excavation at Asurgarh under the direction of N. K. Sahu (see, Basa, 1999: 19-20; Mohanty and Mishra, 2002: 473-474; Yule, 2006: 47-49; Mishra, 2011: 82-95).

Two trenches were laid out within the fort (one in the eastern part and the other in the western part) to ascertain the sequence of cultures.

The uppermost layer shows the remains of house floor paved with brick bats. Interesting iron objects like hooks, door hinges, arrowheads, axes and beads of semi-precious stones
were recorded from the said floor level. The most noteworthy finds from this layer were 50 punch marked coins buried in the plinth level and these are ascribable to the pre-Mauryan, the Mauryan and the post-Mauryan periods. The recording of unfinished, half-finished specimens of such coins indicates the presence of a local mint at the site itself for the fabrication of punch-marked coins.

The second layer has yielded artefacts datable to the period from first century CE to fourth century CE. The layer is associated with different varieties of decorated potteries, the most common being dull grey to greyish black in colour. Occurrence of finished and half-finished beads of semi-precious stones and moulds suggests that the site served as a significant bead and ornament manufacturing centre during the third-fourth century CE. From the lower part of this phase, a few sherds of the red-glazed Kusana potteries along with a copper coin of Kanishka have been yielded. Other ceramics include black polished ware of thick fabric with concentric circles inside as well as high necked and high shouldered pink wares and pinkish wares with short handles.

The upper phase of the third layer is associated with red and black potsherds of fine texture. The polished potteries are found in substantial numbers from the lower phase of this layer, marked by ashy and light sandy soil. The excavator loosely termed it as the fourth layer. Black polished potteries of fine fabric besides a few sherds of terracotta red ware and black-and-red potteries (BRW ?) have been yielded. The layer is dated to the c. 250 BCE.

The clearance works between the two trenches revealed the remains of a shrine in form of brick structure which was dated to about fourth century CE by the excavator. By taking into consideration the cultural materials of the site, the excavator assigned a chronological time bracket of 3rd century BCE to 5th century CE for the life span of its settlement dynamics. He was also of the opinion that it was a significant part of the Atavika territory during the time of Asoka and it was under the sway of Vyghraraja of Mahakantara (whom Samudragupta claimed to have defeated during the course of his south Indian campaign) during the 4th century CE.

**Manamunda-Asurgarh:** The site of Manamunda, locally known as Asurgarh, is located on the right bank of the river Mahanadi near its confluence with the river Tel. It extends over an area of about 15 km x 0.5 km between the right bank of the Mahanadi and the State Highway no. 14. The epigraphic evidence of the local rulers of the eleventh and
twelfth centuries CE states that the region of Suvarnapura, modern Sonepur lying close to Manamunda was known as 'Lanka' and its rulers as "Paschimalankadhipati".

The site was first excavated jointly by the Deccan College Post Graduate and Research Institute and the Sambalpur University in 1981 under the supervision of H.D. Sankalia and N.K. Sahu. Six trenches were taken around the periphery of the mound which led to the discovery of artefacts of the first century CE (IAR, 1989-90: 80-86; 1991-92: 86; Basa, 1999: 20-21; Yule, 2006: 45-46; Mishra, 2011: 96-99).

Excavations were also undertaken at the site by the Department of History, Sambalpur University in the field season of 1989-90 and 1991-92 under the direct supervision of C.R. Mishra and S. Pradhan.

This excavation yielded four occupational layers. The digging works encountered the natural soil at a depth of 1.90 m from the surface. Layer 1 from the top was the surface humus with a deposit of loose brown earth. This being a deposit of only 0.20 m yielded a few sherds of inferior red ware along with pieces of tiles. Layer 2 with 0.40 m occupational deposit was characterized by compact, hard and brown earth mixed with brickbats. The ceramic industry from this layer comprises sherds of inferior red ware more in number than layer 1 and pieces of tiles. They all appeared to be heavily weathered and on rubbing leave behind an ochrous colour on fingertips. At the base of the layer was exposed a circular burnt brick structure with its pebble-paved floor. The artefacts recorded from this layer were iron objects like nails, plates, hinges and beads. Lumps of charcoal and hearth were also traced in this layer and also inside the structure on the floor. Both these layers 1 and 2 have been assigned to period II which based on the occurrence of degenerated ceramic industry and the presence of similar industry at Sisupalgarh has been dated to the end of 2nd century CE- beginning of 3rd century CE.

The underlying layer 3 ascribable to Period IB has a deposit of compact black cotton soil with 0.75m in thickness. A remarkable change in the ceramic industry was noticed in this layer. It yielded sherds of well-fired, polished and slipped red ware with a variety of incised decoration, black ware and BRW. The most important discovery from this layer was a silver punch-marked coin datable to the third century BCE. The other antiquities include a few beads and a large number of iron objects like knives, daggers, spearheads, arrowheads, axes, nails, etc. This layer also rests on a pebble paved floor level with traces of burning activities (hearth) and lumps of charcoal. Bone pieces have also been recorded from this layer. Layer 4 ascribable to period IA has a deposit of 0.55 m resting above the
natural soil. There was no marked difference from layer 3 in respect to pottery except the
predominance of black polished ware and red-slipped ware. A few sherds of Micaceous
red ware were also found from this layer. Besides iron objects, three microliths (blades)
and a broken copper ring were found from this layer. The period I may tentatively be
assigned to the third-fourth century BCE.

A circular burnt brick structure belonging to layer 3 was also encountered. Making a
cross-section of the structure excavation was continued to a depth of 2.95 m where sub-
soil water was encountered along with the base of the structure. The structure measured 2
.90 m in depth with 42 courses of brick masonry. This cylindrical brick pit yielded broken
pieces of five large pots (storage jars). Two of them were wheel made and three
handmade with beautiful floral decorations on their thick rim. Along with a few sherds of
BRW there were four complete pots at the base of the pit (well -7). The other objects
recovered from the pit were pieces of bone, charcoal, charred rice, one rectangular
polished stone of whitish colour measuring 32 cm x 13 cm. Another interesting feature of
the site associated with Layer 3 was a stone appendage noticed in an eroded section.
Below the appendage was a pit cutting across the natural soil to a depth of 1.60 m from
the stone circle and 2.10 m from the surface. The soil inside the pit was more compact,
hard and black in colour and was devoid of any cultural material. The pit at the base
yielded a thick broken red basin, patches of ash, a small piece of fragile bone near the
basin and a piece of iron. Excavator presumed that it is the remains of megalithic burial.

The ceramic industry of Manamunda comprises red ware, BSW, BRW and red slipped
and polished wares. The shapes in the red ware from layers 1 and 2 are mostly miniature
vessels, bowls and basins, without any painting or decoration. The BSW, BRW and red
slipped ware were found from layers 3 and 4. The red ware and the BSW found from
these layers are brightly polished, prepared out of well-levigated clay, wheel-turned and
well fired having incised decoration. Some of the black wares have concentric grooves on
the inner base with or without a central knob. Some of the red ware sherds bear graffiti
marks and are decorated with applique band of finger tip pattern, sometimes also with a
cord. The popular decorative pattern however is the rectangular notches arranged in
oblique rows, with a band of cord pattern, the other decoration being grain incisions in
rows and fish patterns. The handmade thick sturdy red wares found from the brick pit are
decorated with beautiful floral pattern on their rims.
The BRW found in association with the BSW and red slipped ware were altogether absent in layers 2 and 1. They are prepared of levigated clay, wheel-turned and well-fired and could be compared in fabric, texture and shape with the south Indian megalithic BRW. The BRW are without any decoration or paintings. The shapes are mostly bowls with their typical sharpened rims.

The excavation yielded 49 antiquities. Iron objects which predominates the collection include axes, daggers, knives, spear and arrowheads, nails, door clamps, hinges, sickle, etc.

The other antiquities are a silver punch-marked coin found from the upper level of layer 3; five beads of semi-precious stones (carnelian, quartz, and coral) and four microlithic blades and a broken thin copper ring from layer 4. The bricks used in the structures are well fired and are made up of clay mixed with husk and straw. They vary in length from 32 cm to 26 cm and breadth from 23 cm to 20 cm with a uniform thickness of 5 cm.

The excavation brought to light two brick structures; one in Trench VIII and another in Trench DC. The structure in Trench VII was circular in plan, the outer diameter being 6.90 metres and the inner diameter 6.20 metres. The bricks used in the structure are well fired and are made of clay mixed with husk and straw. They vary in length from 32 cm to 26 cm and in breadth from 23 cm to 20 cm with a uniform thickness of 5 cm. The pebble-paved floor inside the brick structure was at a distance of 26 cm to 30 cm from the circular wall. Traces of burning activities (hearth) were noticed inside the structure. Only two post holes could be traced. Broken tile pieces from layer 2 suggest that the circular structure had a tiled roof. The structure stratigraphically belongs to period II.

The second structure, in Trench No. DC, was a circular brick pit (well-?) measuring 2.90 metres in depth having an inner diameter of 0.87 m and outer diameter of 1.30 m. The structure had forty-two courses of burnt bricks made of clay mixed with husk and straw. The bricks used in this structure measured 30x25x9 cm. At the base of the structure subsoil water was encountered and there were four pots placed on a pebble surface. Two pots were filled with sand and other two were filled with clay which during floatation yielded charred rice and fragments of bone. These four pots were superimposed by the sherd of thick fabric hand-made as well as wheel-turned large size pots with their beautifully decorated rims. A few sherds of BRW and BSW were also recovered from this deposit. The deposit of the potsherds continued from the bottom to a thickness of 1.25 m reaching to the twenty-third course of the structure from the top. The other associated objects
found from this deposit are lumps of charcoal, pieces of bone and a polished rectangular stone measuring 32 x 13 x 13 cm. It is very difficult to associate the structure with any occupational layer of the mound because its upper portions and the sealing layers have already been washed away by the river. During the excavation in 1981 two such cylindrical structures with almost identical deposits had been reported, in one structure the pots (five complete and two broken) had been placed one upon the other resting on a rectangular brick platform.

**Nuagarh-Asurgarh** (20° 26’ 4.87” N and 84° 0’ 3” E): The site is situated between the two villages of Kumersingha and Nuagarh at a distance of about 6 km southeast of the tehsil headquarters of Birmaharajpur in Sonepur district. The mound measures 580 meters in length (east-west), along the left bank of the river Mahanadi, 300 meters in breadth (north-south) and about 7.5 meters in height above the present bed of the Mahanadi. Archaeological significance of the site was first noticed by P.C. Rath in 1947. Small scale excavation was conducted by Sadasiba Pradhan in 1999 in order to ascertain the cultural sequence of the site and its affiliation with other Asurgarh sites of western Orissa (Pradhan, 2006: 63-78).

Three trial trenches (NGH-I, NGH-II and NGH III measuring 3m x 3 m each) were laid in different locations of the mound.

Layer 1 with a deposit of 15 cm of dark grey soil constitutes the surface humus. This yielded red ware, black ware, BSW and BRW along with a few iron nails and hopscotches.

Layer 2 with an average thickness of 55 cm consists of compact hard black soil. The ceramic assemblage comprises sherds of red ware, red slipped ware, BSW and BRW. A few sherds also bear graffiti marks. Artefacts recorded from this period include iron chisels, nails, fragments, fragments of copper, glass bangles, beads, hopscotches.

Layer 3 is a deposit of 35 cm of compact dark brown soil. It yielded ceramics of BSW, red slipped ware and BRW. Graffiti marked potteries are found in substantial numbers. The documented artefacts include iron nails and fragments, beads of carnelian and shell.

Layer 4 has a deposit of 40 cm of compact brown soil. It yielded potteries of BSW, burnished black ware, red slipped ware, burnished red ware and BRW. Some of the specimens have graffiti marks. One specimen of white painted BRW, recorded from the lowest level of this layer seems to be the most noteworthy find of the site. Artefacts include iron nails, knives, terracotta hopscotches and spindle whorls.
Layer 5 has a deposit of 55 cm of light brown soil that yielded potteries of red slipped ware, burnished red ware, BSW, burnished black ware and BRW of both burnished and un-burnished variety. 20 potsherds of white painted BRW along with one specimen of white painted red ware occur in this layer. The use of hopscotches and pottery with graffiti marks continued. The recovered artefacts are clay sling balls, fragments of iron, hop-scotches, spindle whorls, beads of shell and carnelian. A marked difference in the nature of the material culture was noticed towards the lower levels of this layer, which yielded artefacts like bone points, animal bones with grooves and different stages of cutting and polishing, antlers with cut marks, ring stones and hammer stones, microliths a Neolithic celt made of basalt besides charred and uncharred bones.

Knobbed lids fabricated in various wares continued to exist throughout the above occupational layers.

Layer 6 above the natural soil has a deposit 25 cm and it seems to be the pre-iron layer.

Ceramic industry: Red ware, which constitutes a dominant type, continues to prevail all through the occupational layers. It constitutes 63.13 % of the total excavated potteries. The characteristic shapes of this ware are bowls, basins, dishes, vases, jars, handis etc. The fabric is from course to medium and fine with both thick and thin section. Few sherds also have paintings in black both in the inner and outer sides of the pots.

Red slipped ware constitutes about 6.28% of the total assemblage. The various shapes of this ware are bowls, basins, dishes, vases, jars handis etc. A black painting on the inner surface of some sherds is a noticeable feature. Some potsherds also have post firing graffiti marks.

Black ware constitutes 6.47% of the total assemblage. The important shapes are bowls, dishes, vases and jars. Bowl with featureless rim is a significant pottery type in this ware. BSW, constituting 0.92% of the total assemblage is represented by the shapes like bowls, basins, dishes, vases etc. Slip is noticed both interior and exterior sides of the pot.

BRW constituting 23.20 % of the total pottery assemblage is represented by the shapes like bowls, dishes, small vases, cups etc. A few miniature shapes are also found. Paintings in white are found in the inner surface of some pots.

Taking into account the aforesaid cultural materials and the C-14 dates of the charcoal samples from layer 5, two fold cultural sequences has been proposed by the excavator. Period I represented by layers 4, 5 and 6 have two sub-phases, Period IA represented by the deposits of layer 6 and Period IB with the deposits of layer 4 and layer 5. Both these
sub-phases are analogues in cultural materials except the occurrence of iron which is conspicuous by its absence in period IA. However, the possibility of its presence cannot be completely ruled out as suggested by the excavator. Based on C14 dates, the beginning of period IB has been precisely dated to the 6th century BCE. Iron introduced in this phase.

Period II is represented by the cultural assemblages of the layers 1, 2 and 3. Use of iron proliferated in this period as revealed by the occurrence of wide variety of iron objects like nails, chisels, knives and several fragments of unidentifiable objects besides a few slags. The ceramic assemblage is characterized by plain red ware and red slipped ware followed by lesser percentage of BRW and BSW. The excavator ascribed a time period of 1st century CE for the upper levels of period II.

**Budigarh (20°12’ N and 83°31’ E):** The site is situated on the banks of the Puruna river and the Rahul river which ultimately joins the Tel river. The mound, extensive in nature, is about 3 m in height and covers an area of 100 m x 500 m in north-south direction. A large scale survey of the site was conducted by P. Mohanty and B. Mishra. Archaeological remains recorded at the site led them to conclude that it was under human occupation since the early historic period. A plinth of the brick wall (measuring 15 m x 3m) was detected in the western part of mound (Mohanty and Mishra, 2002: 474-475; Mishra, 2011: 107-110).

Artefacts recovered from the site include microlithic blades, knives, burins along with pebble choppers, two varieties of celts etc. Ceramic industry comprises BRW, red ware, black ware, BSW having thin and thick sections. The principal shapes are bowls, jars, miniature pots, basins etc. Sherds of black polished ware of fine texture with incised lines on the exterior and red polished ware with incised decoration are found in smaller numbers. A plethora of terracotta objects like animal figurines, human heads, smoking pipes, beads besides oval shaped stone cakes, semi precious stone beads, tiles, copper bangles and rings, amulates, spiral designed hair pins, iron tools, gold particles and bricks have been yielded during the course of exploration. The size of bricks measures 45 x 30 x 10 cm.

Legged querns, bricks, copper beads semi-precious stone beads, terracotta bull, human head animal figurines have been recorded from another portion of the mound near village shrine. Iron objects like nails, knives, bolts, sickles hoes and slags in profuse quantities have been found from this particular area.
Close to Purnanala one fragment of small copper bowl and a small iron cup have been encountered during this particular survey.

Another mound of the site has yielded a good collection of ceramic assemblage. These consist of fine BSW with thin fabric, red ware, grey ware, black ware etc. The area has also revealed three sherds of NBPW along with knobbed ware. Other artefacts include bead moulds, iron nails, knives, spears, daggers, two seals, silver punch-marked coins, semi-precious stone beads, one debased copper coin etc.

**Urukupagarh:** The site is located on the right bank of the river Utei which girdles it on three sides, south, east and west. The site yielded a wide array of potteries viz. BRW of fine texture, red ware, dull red ware, red slipped ware, BSW, black burnished ware, coarse grey ware. Some of the sherds of BSW and red ware bear graffiti marks on the exterior. Varieties of terracotta figures like human bust, heads, animals, terracotta beads, lamps, hopscotch, smoking pipes etc have also been recorded at the site. Iron repertoire includes arrowheads, spearheads, daggers, nails knives etc besides a few specimens of iron slags. Copper objects like rings, bangles and fragments of a basin, an abraded silver coin, semi-precious stone beads have also been documented here (Mishra, 2011: 110-112).

The tradition of making fortifications to ensure a secured life is duly attested by the distribution of *garh* sites of Chhattisgarh and the adjacent areas of Orissa. The present work has limited scope to explore the reason behind such practice. However, the rationale behind the separate categorization of such sites is owing to the presence of some of their fascinating features. In such endeavour, some of the enlisted sites which are virtually located in the different river valleys (like the Mahanadi, the Tel etc.) have been included here. Thus while enlisting such sites, the scheme of categorizing sites by following their geo-physical bearings has not been taken into account.

A major question may arise regarding the ‘fascinating features’ mentioned above. It has been observed that most of the findings were reported from the core areas of the settlements i.e., inside the ramparts. The other parts of the settlements were either unexplored or not properly investigated by the concerned researchers. If we believe that fortification implies safety, or security, then the core region must have been utilized for either secured survival or collection of precious objects. The nature of
findings (mostly in form of finished objects) substantiates such assumption. Thus, an attempt in interpreting the context of various activities (farming/ non farming) will be far-fetched here. The chrono-cultural contexts of iron working are also not well attested by the retrieved database in spite of the presence of a vast repertoire of finished objects (made of iron). However, due to the paucity of sufficient excavated materials, it will be a premature endeavour to put forward any assumption regarding the same. It can be hypothesized that besides the large scale consumption of iron at the sites itself, the vast repertoire of such objects must have played a significant role in the existing procurement network. The crucial role of the settlements as the forwarding agencies of trade (responsible for the distribution of finished items from the production zone to the consumers along the coastal lines and beyond) can be well envisaged. The locations of these sites along the river courses though, slightly far from the river banks, have ensured not only better connectivity with other sites but also protection in form of natural ramparts for the settlements.

Tel valley surveyed sites:

**Teraisingha:** The modern village of Teraisingha is situated on the right bank of the river Tel in the Kalahandi district. The village is renowned for the discovery of a set of copper plate from its cultivated land along the right bank of the Tel in 1946. On palaeographic grounds, the charter has been dated to the first half of the 5th-6th century CE. The importance of this land grant lies in the fact that it is earliest evidence of land donation to a Brhamana in Orissa by a ruling chief and it also purports the worship of Stambheswari in the concerned valley. The second copper plate which registers the land donation by Villani during the reign of her son Sri Dakarisvara Deva of the Rashtrakuta dynasty has been yielded from the same area in 1990. This on palaeographic grounds can be dated to the 8th century CE. Exploration conducted by Mishra in 2002 has also resulted in the recovery of another copper plate grant from this area.

In eastern part of this particular provenance, close to the bank of the Tel river, brick layout and heaps of bricks have been noted. The brick size measures 31 x 15 x 0.6 cm. Ceramic assemblage documented from this area include BRW of thin and thick fabric, thin walled red potteries, red slipped ware, BSW and brick red ware etc. The ceramics are of both categories, plain and decorated. The decoration consists of horizontal bands on the neck, zigzag lines (incision), notch designs, fingertip decorations and cord marked designs etc. The common shapes are basins, pots, vessels etc. A large variety of terracotta
animal figurines such as horse, bull, elephant etc and objects like beads, hopscotch, spindle whorls, smoking pipes, votive lamps have been unearthed. Copper objects include bangles, amulates and oval shaped broken bowls one of which has a knob. Iron slags and objects like knives, nails, daggers, arrowheads and spearheads have also been obtained. Beads of semi-precious stone viz. quartz, crystal, garnet, carnelian, chert and chalcedony are the other notable findings from the site besides fragments of tiles and faunal remains (Mishra, 2011: 112-115).

**Sirpur:** The site of Sirpur lies on the right bank of the Sandol river in the Kalahandi district. The river Tel flows on the northern side of the site whereas Narla Asurgarh stands on its south. The site covering an area of about 8 hectares is highly disturbed due to intensive cultivation and human intervention. The habitation mound is located in the eastern part of the site measuring 35 m in breadth and 3 m in height. During the survey at the site, potteries like red slipped ware, dull red ware coarse fabric, black ware, grey ware of gritty and coarse, black polished ware of thin section and brick red ware etc. are documented. The common shapes are jars, bowls, vessels and dishes. Decoration executed on sherds comprises horizontal bands, fingertip decorations and incised lines etc. Terracotta animal figures viz. bull, elephant leg, objects like hopscotch, beads, wheels etc. have been yielded. Bricks from a plinth measures 21 x 7 x 4 cm. This mound has also revealed beads of semi-precious stones viz. garnet, quartz, chert and punch-marked coins. Repertoire of iron objects includes arrowheads, spearheads, knives, sickles and hoes etc (Mishra, 2011: 115-117).

**Dumervahal-ghupti:** The site is situated on the right bank of the Ret river about 20 km from Asurgarh-Narla. Intensive survey of the mound has resulted in the recording of microlithic blades, ring stones and a solitary specimen of stone ploughshare. The ceramic assemblage of the site comprises BRW, red ware, dull red ware, red slipped ware, black ware, burnished black ware etc. The common shapes are dishes, basins, vessels, jars, pots and dishes on stands. A dozen of semi-precious stone beads made of carnelian, chert, chalcedony, garnet, quartz and soft stones were documented. Among the copper objects unearthed from the site mention may be made of bangles. Iron objects include knives, nails etc. Iron slags are found scattered over this habitational area. The remains of brick structures have also been visible at places. A spherical copper coin having fish (two) symbols and a tree like motif on its obverse within dotted border and an indistinct reverse motif is another noteworthy find from the site (Mishra, 2011: 117-119).
Nehena: Situated on the right bank of the Sunder river, Nehena (20° 15’ 17” N and 82° 46’ 17” E) is situated three kilometres from Khariar town in the Naupada district. Singh Deo was the first one to explore the site and collected a number of ring stones and celts. Subsequently, a team from ASI surveyed the site and reported the occurrence of a few sherds of BRW, one of them significantly bearing paintings in white. In addition, a few sherds characteristic of the early historical period were also noticed (IAR 1984-85: 58). Two stone circles were also discovered in the southern parts of the village near the left bank of the Sunder. In 1990, the vocational stream of Archaeology and Museology, Khariar College undertook excavation at one such burial that measures 4m in circumference. Unfortunately, no proper documentation was made of its cultural sequence as well as retrieved artefacts. The antiquities obtained from this digging include a long iron spear, fine BRW, red ware, iron slags which are now preserved in the concerned department of the Khariar College. Singh Deo also reported the occurrence of NBPW at this burial site. In the private collection of Singh Deo is also preserved one unique figurine of steatite. Brandtner in 1992-93 also made an intensive survey at the site and also laid a trench. He has recorded a glossy piece of BRW and a hopscotch from stratified layers. Preliminary stratigraphy provided by him shows two distinct periods, early historic and early medieval (Brandtner, 1994: 101-114; Yule, 2006: 43). Besides, a stone seal embossing on its reverse an elephant motif was collected from the surface of the site. In addition, Singh Deo informs the finding of a damaged Gupta gold coin. A substantial number of bricks measuring 36 x 18 x 5 cm along with brick bats suggest the presence of some kind of structural activity at the site. Nehena has revealed a large variety of semi-precious stone beads and copper objects like birds, bowls, bangles etc (Mishra, 2011: 119-122).

Sandohel: It is a small village situated on the left bank of the river Sundar. J.P. Singh Deo, during the course of his exploration at the site has come across Megalithic twin urn burials. It was a stone circle or cairns measuring 9 m in diameter. A trial trench at its centre has yielded one twin burial associated with thick BRW, red ware, a sherd of black ware besides human bones. The iron repertoire comprises a few objects along with a solitary specimen of spear (Yule, 2006: 43).

In the forgoing pages, an attempt was made to delineate the pattern of the distribution of sites/ settlements which have yielded cultural matrix, bearing definite connections with the production, consumption and even supply of iron. Though
tentative, the present discourse probes certain points related to the process of iron smelting (both production of iron in form of ingots from ore and the manufacture of finished objects) and the consumption of the same in different forms of artefacts. From the above database a somewhat clear picture can be drawn on the character of sites/settlements and their relationship with the pattern of production and consumption of iron and the network involved in the exchange of the same (both ingots and finished objects). It may be recalled here that, while dealing with the pattern of site distribution, the present discourse tried to frame the database by following the geophysical bearing of the region i.e., the sites/settlements, situated close to the ore bearing areas of the Chhotanagpur plateau and the settlements found in the alluvial plains or coastal areas and those in the transitional zone between the fringes of the Chhotanagpur plateau and the alluvial plains of the Ganga valley. It has to be kept in mind that in the core areas of the eastern Indian plateau, the evidence of primary smelting is more pronounced whereas that of secondary workings of iron are mainly concentrated in the fringe areas of the Chhotanagpur plateau and in the interface between the fringes and the alluvial plains. Coastal areas and other alluvial plains in most cases yielded the evidence associated with consumption of iron. However, the said paradigm is difficult to explain while looking at the evidence of production and consumption of iron in its initial phases. There is no doubt that during the initial iron bearing EVF phases, the evidence of craft specialization are not clearly manifested in the archaeological database. It is generally believed that during the concerned period, iron was both produced and consumed locally at several independent centres. However, with the arrival of the Sixteen Mahajanapadas, the concepts of craft specialization, the demarcation of the production and consumption centres and exchange of goods were gradually developed. Thus, the archaeological database assignable to the early historic period onwards can be implemented to explain the said paradigm.

1. Oriup and Taradih (ore bearing areas of Rajgir) revealed classic evidence of both iron production and consumption. It is quite certain that the Taradih region must have played a crucial role in iron production and furnishing demand of the same in the adjoining regions since the pre-NBPW phase. The growth and development of the religious centre- Bodhgaya in the early Christian era (if not later) was instrumental in the enhancement of metal
consumption particularly iron. The sites in its vicinity must have been involved in the said interactive network. The evidence from Juafardih, Ghorakatora and newly discovered sites in the nearby areas and in the Nalanda region substantiates the above issues of iron consumption and production.

2. Rajgir or the ancient Rajagriha is another important settlement which since the early historic period, was well connected with the settlements of both the plateau, the plain and the undulating tracts of transit zones between the two via exchange network. Rajagriha in all probability served as one of the ore bearing areas, the sources of which must have been exploited by the smelters of several sites/settlements including that of Taradih. The close proximity of the raw materials bearing production zones of Rajgir to the consumption areas in and around the Taradih region can give us enough clues to hypothesize the same.

3. Senuwar was definitely a production–cum-consumption site though its role in the exchange network of iron cannot be ignored altogether. As it is already mentioned that the location of the site i.e., in peripheral zone of eastern Indian Plateau (iron ore bearing area) and its proximity with iron bearing settlements of Kaimur range of eastern Uttar Pradesh and Bihar like Sonpur, Agiabir, Khairadih etc. implies the status of the site as a major centre of plain-plateau interactive network. However, there is no doubt that the site played a major role in the extraction and production of iron in form of both ingots and finished objects and fulfil the demand of the same to the consumers.

4. Chirand was definitely a consumer of iron. However, its involvement in the long distance procurement process to get access to raw materials as well as finished products of both stones and metals, if not others cannot be overlooked.

5. Being well connected with other cluster of settlements of the north Bihar plain viz. Chirand, Manjhi, Panr etc, Vaisali region served as a major centre of metal working activity (secondary). However, it was a major consumer of iron in the north Bihar plain. The emergence of Vaisali both as the geopolitical and the religious centre increased the demand of iron from the early
historical period onwards. Kumrahar region can also be recognized as another centre of iron consumption.

6. The exploitation and production of iron in the Chhotanagpur region has a long history. While explaining the initial and subsequent use of iron in different archaeological contexts, Chakrabarti and others highlighted the Chhotanagpur region as a major production zone of iron. The sites in the Singhbhum, Ranchi, Palamau, Mayurbhanj region etc. have yielded the evidence that clearly substantiates their consistent role in the production of iron (in form of ingots). The congenial ecological setup for smelting i.e., easy accessibility to the raw material bearing zones, availability of fuel in form of charcoal and water from the small mountainous streams provide a scope to practice iron smelting for generations. Besides archaeological database from these regions, ethnographic study on the mining and smelting activities of the concerned regions also corroborate the fact that the indigenous population groups were involved in the extraction of ore and the production of ingots and also furnishing the same to the settlements of the plain, plateau and its fringes. Barudih in the Singhbhum region can be placed in the map of the core zone of such metal exploitation and production (in the plateau). The region must have harboured indigenous groups involved in metal working particularly iron. Ethnographic records available in the reports of British India about the distribution of such population in the Kharsawan and Saraikela region substantiate our assumption about the growth of such nucleated metal working settlement at Barudih assignable to c. 1000 BCE. Anthropological data also suggests that the Asuras, the Agarias, the Asura Birjhiyas besides Kols were such indigenous groups, who were consistently involved in such activities. The site of Saradkel substantiates its major role as one of the iron producers since the early historical/ historical period onwards. Unfortunately, other sites, located in the core areas of the Chhotanagpur plateau are yet to be excavated. Similarly, the evidence of iron production is attested by the sites of southern and south-western parts of Orissa. The twenty-five explored sites of Tel river valley revealed incessant production of iron throughout the ages as evident from the remains of iron slags and various implements associated with BRW, BSW, red ware, grey
ware and also some potteries of the later period. The sites in the northwestern and western parts of Birbhum, western parts of Midnapur, Purulia and Bankura in West Bengal also acted as major producers of iron from time immemorial. Unearthing of remarkable amounts of iron slags from the site of Bahiri in the district of Birbhum, Tulsipur, Kumardanga etc. in the district of Bankura, Kankrajhor and Dhuliapur in the district of Midnapur form the archaeological background for the said hypothesis.

7. The excavated sites of Dihar, Pakhanna etc. must have played a crucial role as producers (probably secondary) and consumers of iron. However, it can also be assumed that these settlements also furnished the demand of finished objects to the nearby settlements. The evidence of secondary iron smelting yielded from the recent excavations at Dihar substantiates the above statement. Similar evidence has also been yielded from Pakhanna.

8. The sites of Pandurajar Dhibi and Mangalkote, being situated in the interface of the fringes of the Chhotanagpur plateau and the alluvial plains yielded evidence of both iron production and consumption. Kanksha lateritic upland could be the nearest source of iron ore for them. Orgram and Eruar are the sites, situated on danga (lateritic uplands) surrounded by floodplains, which have substantial iron ore deposit and cultural remains associated with BRW. It had its easy access for the settlers of Mangalkote, unfortunately Eruar and Orgram remain unexcavated and the subsequent settlement activities essentially disturbed the relevant evidence related to the extraction process of iron. The temple site of Orgram and the mound of archaeological importance (where the present majhar is located) of Eruar contains substantial materials of such extraction activities. Being a major settlement, the BRW settlers of Mangalkote have certainly exploited metal ingots from the said extraction zone. However, proper investigations are a desideratum to explain the role of the sites in iron extraction and production.

9. The cultural sequences retrieved from the excavated sites of both the sides of the Mahanadi valley show the uniform use of iron since the metallic EVF phases. However, evidence of iron production (mainly secondary) in the region cannot be ignored altogether.
10. The nature of iron consumption in a number of garh sites of Orissa, suggests the active role of iron in several non-farming activities. Of these, bead production could be considered as one of the representative ones besides others. Excavated findings of drill bits (made of iron) from the site of Badmal along with unfinished specimens of beads and bead blanks led the excavator to conclude that iron tools were extensively used in bead production. These sites were situated in the vicinity of the major river valleys of the region on one hand and mineral bearing zones of uplands and the fringes of the plateau on the other. Thus, the active participation of these sites in the riverine trade since the early historic period led this region to achieve a unique status. Iron must have been used in the said activity. The database in form of unfinished beads and bead blanks from excavated and explored sites also attests to the fact that these settlements were actively involved in bead production and distribution of the same for trade via riverine exchange network.

11. This is in contrast to the evidence of iron consumption found from the sites nearer to the coastal Orissa. Here, the consumption of iron objects as evidenced by the present database is remarkable especially during the so called early historic/ historical phases. These characteristics perhaps signify the role of iron in the trading network and subsistence strategies of the coastal areas. However, the database also testifies to the consumption of iron in structural activities and also in warfare pertaining to the historical period. For example, the site of Sisupalgarh has yielded one hundred and ninety seven iron objects from different stratified layers of the early historic period. These include nails, spikes, staples, sickles, ferrules, knife blades, borers, lances, spear heads, tanged daggers, barbed and faceted arrowheads, caltrops etc. Other excavated sites in this region including Palur, Jaugada, Manikapatan, Radhanagar, Narisho, Kenduli etc have betrayed the same phenomena. Here, it is necessary to mention that, the phenomenal use of iron as apparent from the monastery sites of Lalitgiri, Udaygiri, Ratnagiri etc. offers a different dimension regarding the use of iron in eastern India. Incidentally, these monastery sites are near the coastal areas. This extensive use of iron in the structural activities of the said sites has–already started since the pre-Gupta period.
12. The growth of Buddhist establishments in the Baitarani, Mahanadi and Subarnarekha valley particularly in and around Ratnagiri Udaygiri and Lalitgiri certainly enhanced the demand for iron and invariably the lateritic uplands of Orissa were the easily accessible raw material bearing zones to meet the demand of the same. Unfortunately, the absence of proper investigation to explain the process of exploitation of raw materials and the nature of the utilization of finished products of iron in such religious establishments constrain us to visualize the nature of this interactive network.