SUMMARY

Weapons and Implements have played an important role in the political, social and economic development of human civilization. The earliest weapons and implements of human were made of stone in Palaeolithic age. Human used their tools for attack on and in self-defense from predatory animals and enemies. The evidence suggest that around 5000 B.C. invention of metal took place. Manufacturing of weapons and implements in metal started in Pre-Harappan Phase as indicated by the finds from Mehrgarh, Amari, Kotdiji, Kalibangan and Kunal etc. It was a transformation of tool technology from stone to metal. The metallic weapons and implements were stronger and sharper than stone tools. In the earliest times, the weapons were used for fighting, hunting and to protect one from the wild animals. The implements were used for cultivation, making houses, cutting the trees, overturning of the soil and in different type of works.

During Protohistoric period, various cultures originated in different regions of India. The use of metal played a prominent role in the progress of these cultures. Protohistoric age includes Pre-Harappan, Mature Harappan, Late Harappan phase, chalcolithic cultures, Copper-Hoard and Painted Grey Ware culture. The people of these cultures made progress in agricultural production, small scale industries, trade and colonization with the use of weapons and implements. Various types of weapons and implements were made of copper, bronze, stone, terracotta and ivory in the Harappan phase. Purity in copper was the main characteristic in Copper Hoard phase. Iron weapons and implements existed in PGW culture with the existing copper, stone, terracotta and ivory. The weapons and implements throw light on different aspects of life of protohistoric people. The culture which had better weapons and implements were more flourished and developed. This is pertinent even in the present context.
The aim of the present study is to analyze the characteristics, e.g. size, shape, types, category, usage, findings place and material of protohistoric weapons and implements with special reference to Haryana and Punjab. The study is based on data collection through explorations, excavation and taking photographs of unpublished weapons and implements from archaeological museums of Haryana, Punjab, Delhi and Uttrakhand. An effort has been made to collect the archaeological data mainly from the relevant sites of Haryana and Punjab for the present study. A comparative analysis of the finds has also been done between the protohistoric sites of India other than the sites in Haryana and Punjab.

The present study has been divided into six chapters. The first chapter deals with introduction under which geographical and climatic features, mines and smelting process review of the previous work, aims and objective of research works, research methodology and constraints are discussed.

Chapter–2 is based on weapons and implements in Harappan phase. It is divided into three phases Pre-Harappan, Harappan and Late Harappan. The weapons and implements are divided into four categories, viz., weapons, agricultural tools, craft implements and household implements. These categories have been explained under three phases of Harappan civilization. These are also studied and discussed on the basis of raw material, usage, measurement or size, shape, and their features.

Chapter–3 is related with the study of weapons and implements of Copper-Hoard culture. The weapons and implements are discussed under weapons, agriculture implements, craft implements and household implements categories, in a chronological order and distribution. Here origin and development of weapons and implements have also been discussed. It helps to understand the relationship of Copper Hoard culture with Late Harappan culture, OCP, Aryan and native tribes.
Chapter–4 is related to weapons and implements of Painted Grey Ware culture. They are explained in the context of different aspects like extent and distribution of PGW culture. Copper and iron weapons are discussed under the four categories like weapons, agricultural tools, crafts and household implements.

Chapter–5 is related to the technology of weapons and implements in protohistoric phase. The source of metals and metallurgical detail like smelting evidences, manufacturing—technique, metal composition and chemical analysis of metallic weapons and implements are explained in this chapter.

Chapter–6 deals with conclusion in which the present study is summarized under main topics of all chapters.

The weapon and implement played an important role in the evolution of culture and societies. In India, the use of weapons and implements has been started from the Palaeolithic Age. The first time copper tools were used in India during Neolithic Age. The copper or bronze tools were extensively used for different purposes during Harappan period. The metallic implements helped in the development of agriculture, craft and trading activity in the different phases of protohistoric period in India.

The Harappan people knew about the metallurgy. They developed in the technique of metal smelting and making various objects. Evidence of several furnaces have been reported from the different Harappan sites. The raw material (copper ores) was imported from the adjoining areas to make copper tools.

**PRE/EARLY HARAPPAN PHASE (3250 BC – 2350 BC)**

The Pre Harappan culture was a rural culture but the people of this phase used weapons and implements made up of copper, bronze, stone, bone and terracotta. The varieties of weapon and implement are found from different Pre Harappan sites like Mehargarh, Kotdiji, Amari and Kalibangan. The important sites in Haryana are Balu, Siswal, Kunal, Banawali, Rakhigarhi, Bhirrana, Kasur-II, Samlo Kalan etc. In Punjab the important sites are Ropar, Moharana, Rohira and Dhalewan.
The weapons found from these sites include arrowhead, spearhead, dagger, macehead, parasu, sling ball etc. The arrowheads were made up of copper, chert and bone. These arrowheads are of three types like leaf shaped, parallel shaped and triangular shaped. They are varied in size from 1.7 cm x 1.3 cm x 1 mm to 5.7 cm x 2.32 cm. The largest copper arrowhead has been found from Rakhigarhi. On the basis of typology it can be deduced that the arrowheads found from Haryana and Punjab are similar to those of other Harappan sites.

Some specimens of spearheads were also found at many other sites. These are made up of copper and bronze. They are varied in size and measurement. The largest triangular spearhead was found at Nausharo in Pakistan. Conspicuously, one spearhead from Kunal is thinner and shorter in its size from Nausharo.

The dagger was also used by the people during Pre Harappan phase, but the use of dagger was limited. They were made up of copper. The shapes of dagger were different like narrow, shouldered, pointed and tanged etc.

Some specimens of macehead were also found from these sites. These were made up of stone. The maceheads were found at Kalibangan and Cholistan. They were circular, and concavo-convex in shape.

The parasu was also used as weapon by the people of Pre Harappan phase. A specimen of parasu of copper was found at Kalibangan. The people of this phase also used missile or slingball. These were made of stone and terracotta round and oval in shape. These weapons were used for hunting and fighting by the people of this age. Generally, they used these weapons to hunt down the animals and birds.

The agricultural tools are sickle and plough. These were made up of copper, stone and terracotta. The axe has been reported from different Pre Harappan sites. These axes or celts are of two types- socketed and flat. The socketed celt of copper is a unique specimen found at Mundigak. The flat celts are made of
copper and stone. The edge of the celts is narrow, long and crescent in shape. The flat copper celt from Kunal is significantly sharper and finer than the other early Harappan sites except Kalibangan. However, it is smaller in size from other Harappan sites but bigger than Kalibangan.

The sickles of different shapes and sizes have reported form many early Harappan sites. They are made up of chert. The sickles from the sites other than Kasur-II in Haryana is of semi-circular shape, on contrary at Kasur-II the sickle is having parallel blade. The terracotta model of plough was found at Jalilpur. It indicates that the pre Harappan people used plough to cultivate the land. This can be postulated from the furrow marks found at Kalibangan at the early levels. The specimen of craft implements like awl, adze, borer and burin, chisel, drill, saw and scrapper have been reported from different pre Harappan sites. The awls were made up of copper, stone and bone.

Adze found at Mundigak is unique because it has shaft-hole. It is flat in shape and made of copper. The borer and burin are made up of stone. These were used by the artisans to make hole in the objects. The chisels are made of copper and they are of two types i.e. rectangular and flat in section. The drills are made up of stones and bones. The copper was used to make saw. The saw found at Nal has twenty teeth. Awls and drills of bone form Banawali are same in size and section with other Harappan sites. A copper chisel found from Kasur-II is longer than the chisel found from Nal.

The household implements include blade, knife, fishhook, hook, razor, needle, points etc. The blades were mostly made of chert, agate, chalcedony and copper. They are rectangular in shape. Some blades are pointed. Fishhook and hook are made up of copper. Knives were made up of copper and bone. They have pointed or rounded and they have tang to get fitted into wooden handle. The bone’s knife are pointed and having mid-rib and a tang. The needles are made of copper and bone. These were used
in sewing the clothes. The razors were made of copper. These are of two types i.e. dumb-bell and horse-shoe. The points are made up of copper and they are round in shape. These were used for sewing or to hunt the animals.

On the basis of weapons and tools, the society of Pre-Harppan culture can be divided into some categories such as warrior, hunter, farmer, fishermen, artisan, carpenter, etc.

**MATURE HARAPPAN PHASE (2350 BC TO 1700 BC)**

The Harappan weapons include arrowhead, spearhead, parasu, sling ball, dagger, lancehead, macehead, sword, etc. The copper and stone arrowheads are leaf shaped, triangular and parallel shaped. The bone and horn arrowheads are pointed and round section. The daggers were made of copper and bronze. These are leaf shaped triangular, shouldered, double edged with mid-rib in shape. The double axes were made of copper and bronze. These are crescent in shape at both edges. Spearheads were made up of copper and bronze. These are of two type i.e. long, narrow and short-broad type. The blades of spearhead are biconvex, flat, concave-convex and straight in shape. Their tip is leaf shaped and triangular. A unique discovery from Rakhigarhi, numerous bone spearheads have been reported, these are indicate of bone crafts and hunting life of these people. The lanceheads are pointed and are longer than spearhead. These are made up of copper and bronze. Among the varieties of weapons found from many mature Harappan sites, the region of Haryana and Punjab yielded only arrowheads, daggers, spearheads and sling balls.

The macehead are pear-shaped and rounded in shape. These are made up of copper and stone. Swords were made up of copper. Their blades are long biconvex with midrib. The antennae sword is a unique specimen among the Harappan objects. It reflects the relation of Harappan people with copper hoard people. These are biconvex with mid-rib in shape and having very sharp edges. It is estimated that antennae sword were used in war or for self-defence. These are recovered from a
grave at Sanauli. It indicates that it was grave of a soldier. The sling balls are made up of stone and terracotta. These are round and avoid in shape.

Many scholars estimated that the Harappans were peaceful in nature and did not believe in war and battle. The availability of defensive walls contemporary civilization and the availability of variety of weapon from different sites show that the Harappan cities were invaded by the foreigners and the Harappans used these weapons for defence purpose. A container made of copper has been found from Sanauli in a grave. This container was full of anthropomorph shaped arrowheads that was kept with the skeleton of an archer. It indicates the possibility of war like situation.

The agricultural implements include axe, sickle, plough, hoe, plough share etc. The axes were of two types i.e. long narrow and short broad in size. These are rectangular and crescent in shape. These were made up of copper, bronze and stone. Here, it is important to note that in comparison to the varieties of agricultural implements from the Mature Harappan sites, the sites at Haryana and Punjab yielded only axes, celts and sickles. Some specimens of socketed axe were also found at Mohenjodaro, Lothal and Mandigak. Sickles were made up of copper and stone. These are sharp and curved edged. The hoes are made of copper and bronze. These are longer and splendor. The edge of the hoe is straight, splayed and convex. The specimen of terracotta plough was found at Banawali. The ploughshares were made up of copper or bronze. They are long and narrow in shape. These agricultural implements indicate that these objects helped in the development of agriculture. The Harappans produced surplus food grain which was stored in the granaries or exported to the contemporary cities or civilization. The agricultural Implements reveal harappan farmers technique in agricultural and also metalsmith skill of in technology.

The craft implements include adze, chisel, saw, awl or reamer, drill, bead-tool, scissor, borer, burin, chopper, spindle
whorl, plumb-bob, gauge, hammer etc. The adzes were made up of copper and bronze. Some specimens of socketed adze were also found at Mohenjodaro. One edge of the adze is triangular and another one is flat. The chisels were made up of copper, bronze and stone. The edge of the chisels was pointed, round, square and rectangular in shape. The saws were made up of copper and bronze. These have flat section and the types of edge are convex, concave and straight. The awl or reamer were made up of copper, bronze, bone and ivory. The shape of section of awl is square, rectangular and round. The drills were made up of copper, bronze and stone. The shape of one section of drill is round and hollow. The drills were found at Dholavira in large quantity that indicates towards the possibility of the craft industry. It also shows that the number of craftsman were higher than any other Harappan site. The implements of crafts such as adze, chisel, awl, borer and burin have found from the sites like Mitathal, Bhirrana, Balu, Banawali, Rakhigarhi, Girawar and Farmana in Haryana, Ropar and Rohira in Punjab.

Some bead tools were also found at some Harappan sites. It has pointed tip and tubular. Two copper scissors were found from Bagasara in Gujarat. These were used to cut the leather and clothes. The borers were made up of copper and chert. These were sharp and pointed. The specimen of chopper was also found at Harappa. It was used for cutting. It is straight, thicker and sharp. The spindle whorls were made up of copper stone, terracotta, bone, shell and faience. These were having round shape and used for spinning. Plumb-bob were made up of copper, stone, ivory and shell. It is a masonry weapon and was used to make the wall vertical or perpendicular. The gauges were made of bronze and round, pointed and tubular in shape. The hammer was a common craft implements used by the Harappan. These were made of copper and stone. These craft implements were commonly used by carpenter, mason, cobbler, tailor, weaver, bead maker, metalsmith etc.
The household implements from Haryana and Punjab include knives, needles, fishhooks, razors, blades, hooks, points and scrappers. The knives were made of copper, bronze, stone, bone and ivory. They are triangular, flat and rectangular in shape. These are having one sharp edge for cutting. The needles were made up of copper, bronze, bone and ivory. These are rectangular and round in shape. These have been provided an eyelet at their one end so that thread can be inserted in the needle. The fishhooks were made of copper and bronze having roman letter shapes like 'S', 'L', and 'J'. They have barb at one or two end. The razors were also recovered from the Harappan sites. These were made up of copper and bronze. They are of different types like double blade, L-shaped, hooked shaped, simple blade, U-shaped and crescent shaped etc. These are having tang so that they can be fitted into handle. The blades were made of chert, bone and copper. These blades are of different shapes like leaf-shaped, biconvex, triangular, rectangular, plano-convex, and pointed, also sometimes were having double and single midrib. The hooks were made up of copper, bronze and lead. These have different sections like round, rectangular. These were having different shapes like 'S', 'L' and 'U' etc. The points were made of bone copper and stone, having single and double pointed and round in section. The scrappers were made up of copper, bone and stone.

**LATE HARAPPAN PHASE (1700 BC TO 1400 BC)**

In this phase the decline of Harappan civilization can be noticed easily. The weapons used by these people include arrowhead, spearhead, dagger, parasu, harpoon and sling ball. Among these weapons only arrowheads spearheads, dagger, parasu, harpoon and sling balls are reported from Haryana and Punjab. The people of this phase used copper and bone to make arrowhead. They are found in limited quantity. The shapes of the arrowheads were of leaf-shaped and without midrib. The daggers were also in continuity in its use. These were made up of copper and bone. These were rectangular and fan shaped. The parasu
was made up of copper. It was having concave and straight section. A harpoon is also recovered from Mitathal. It is made up of copper. It has mid rib, diamond section, curved barbs and a hole at the tang. The mace-heads were made up of copper and bronze. The sling balls were made up of stone and terracotta. These were round and oval in shape. These weapons were commonly used for hunting and self defence.

The agricultural implements include axe-celt, bar-celt, chisel etc. The axe-celts are made up of copper and bronze. These are flat in shape. The copper celts have been reported from Ropar, Sanghol, Siswal and Mitathal. A unique bronze has been reported from Kotla Nihang Khan in Punjab. The celts were made up of copper and stone. These are rectangular in shape. The bar-celts were made of copper. These were used for digging.

The people in late Harappan phase also used some craft implements like chisel, borer awl and hammer. The chisels were made up of bronze and copper. These are mostly found from Bara, Dadheri, Sanghol in Punjab and Daulatpur in Haryana. Most of the chisels are rectangular in shape. The awls were made up of bone and copper they have round section and pointed tip. The copper borer has been found at Bhagwanpura. It has round section and pointed tip. The hammers were made up of quartzite and pebble found from Mitathal. These are blunt on both sides.

The household implements used by the people in Late Harappan phase include knife, needle, fishhook, razor, point, blade and hook. These tools are reported mostly from Bara, Ropar, Sanghol, Kotla Nihang Khan, Dadheri in Punjab and Mirzapur, Daulatpur, Bhagwanpura, Jognakhera Samlo Kalan, Farmana, Balu, Banawali, Mitathal, Madina in Haryana. The knives used by the people were made up of copper and bone. They have thin blade and pointed tip. The needles were made up of copper and bone. These were pointed, thin and round in section. The fish hooks were made up of copper. They are round in section and of 'J' shaped. The razors were made up of copper and are of hooked and L shaped. The points were made up of
copper and bone. Most of them have two side pointed tip. The blades were also used by these people. These were made up of chert, chalcedony and jasper. These are triangular, rectangular in shape and biconvex in section. The hooks were of 'U' shaped and made of copper and bronze.

**COPPER HOARD PHASE (1700 BC – 1200 BC)**

The Harappan civilization was succeeded by copper hoard culture in India. They used variety of weapons which are recovered from the field or an area generally which was not remained under habitation. Some copper hoards were found from the inhabited sites with OCP like Nasirpur, Bahadradab, Saipai etc. The weapons of this culture include arrowhead, sword, antennae sword, hooked sword, spearhead, lancehead, harpoon, Parasu, disc, double axe etc. Almost, all the copper hoard weapons have been reported form Hansi, Rewari, Dadri, Ambala, Bhiwani, Jind, Narnaund, Jhajjar in Haryana but only one harpoon has been reported from Bhadla in Ludhiana district of Punjab. The arrowheads were recovered from Ganeshwara. These are pointed and leaf shaped. The swords are of three types, i.e. simple, antennae and hooked sword. The simple sword is 30-50 cm long and having biconvex section with midrib and triangular tip. The antennae swords are classified into two categories on the basis of length. One of them is 56.9 cm to 76.6 cm long and another one is 40.5 cm to 47.5 cm long. The blades of these swords are biconvex with midrib and having triangular and leaf shaped tip. The hooked swords are 43.6 cm to 47.0 cm long. The shape of their blade is mid-rib and triangular.

The spearheads have two types blade i.e. leaf shaped and triangular. These are having midrib and a hole at the tang so that it can be fitted in the handle. The lanceheads were some little bit longer than spear. The length of the lancehead was up to 73.2 cm. The harpoons found from the copper hoard culture are of three types on the basis of their length and weight. These are having barbs on both sides and midrib. Some harpoons have tang with hole to fit into wooden handle. The *parasu* has
biconvex blade with bow shaped. The edge of parasu is very sharp. The discs are recovered mainly from Rewari. It was thrown like chakra on the animals or enemies. The double axe with double edge was found from Bhagrapir. It is 40 cm wide and 1cm to 3cm thick. It was made by cutting on oval sheet.

The agricultural implements include axe, shouldered axe, lugged shouldered axe, splayed axe, socketed axe, bar axe or bar-celt, plough share or pick, weed chisel or khurpi and chisels. All the agricultural tools have been found from Hansi, Rewari, Dadri, Ambala, Narnaund, Jhajjar but only few flat axes are reported from Bhadla in Punjab. The flat axes were divided into seven types on the basis of length and weight. There are rectangular, U-shaped, square, concave, convex, crescent in shape. Their butt was fitted in to wooden handle to provide a good grip for the user. These are found largest in number among the copper hoard weapons. The shouldered axes were having circular working edge with straight and butt end. These are big in size having flat section and heavy weight. The lugged shouldered axes are of four types like rectangular, cylindrical, conical and incurved. The splayed axes were found from Chhota Nagpur region of Bihar. The edge is sufficiently splayed out convex. The blade axes are flattish or roundish on the side. Their length ranges from 13.5 cm to 22.9 cm. Socketed axe was found from Raja Karn-Ka-Qila near Kurukshetra. Bar axe or bar celt has rectangular section, flat bottom and convex upper side. These are having crescent shape cutting edge. These are having different section like rectangular, flat, biconvex edge, splayed cutting edge, flat convex blade and convex edge. Two specimens of ploughshare were found from West Bengal. The measurement of the specimen is 49.6 cm in long and 4.9 cm broad. About 90 weed chisel found from different find spot of Ganga-Yamuna doab and Haryana. Some of them are V shaped. Their length ranges from 13.6 cm to 29.9 cm and breadth from 2.0 cm to 6.5 cm. The chisel and saw were used as craft and household implements. The chisel has sharp convex working as its end is
flat, thick, and straight. Its both side edges are concave, straight and taper toward the butt end. A specimen saw was found from Rewari in Haryana. It is measuring 6.2 cm length, 3.7 cm breadth, 0.6 cm thickness and 50 gm in weight.

The household implements were also recovered from the different copper hoard sites. It includes anthropomorph, ring, razor, knife and fishhook. The anthropomorphs are divided into three types on the basis of length, size and weight. The first type measures 23.2 cm to 24.1 cm long and 1260 grams in weight. The second type has short hands and long legs. Its height ranges from 30.2 cm to 47.9 cm and their average length is 39.19 cm their average weight is 4500gm. The third type is thicker than the other two types. It has broader and circular head. It is 1230 gm in weight. All the anthropomorphs are flattish. The rings were made by bending a circular rod. They were used for weighing the objects or used as ornaments. The knife was an important household object. It was found from Naurangabad in Bhiwani. It has sharp, biconvex and concave blade with tang. A specimen of razor was found from Shahabad. Its blade is like the edge of axe. Its edge is convex and tang is rectangular.

THE PAINTED GREY WARE PHASE (1100 BC TO 600 BC)

The PGW culture existed after copper hoard culture. The most important feature of this culture was the use of iron objects along with copper. The important weapons of PGW culture include arrowhead, spearhead, dagger, shaft and sling ball have been reported from Daulatpur, Bhagwanpura, Hatt in Haryana and Ropar, Nagiri, Singh Bhagwanpur, Rohira in Punjab. The arrowheads were made up of copper and iron. The iron arrowheads are considered as biggest in size among the arrowheads of protohistoric period. These are having leaf-shaped, paralleled shaped and pointed. They have different sections like biconvex, elliptical, rhombic, rectangular, circular, parallel and lanceolate. Most of them have midrib and socketed tang. These are having rounded, pointed and sharp tip. The bone arrowheads were also found in large numbers. These were having pointed tip.
and socketed tang. Some of these were of two barbed and four barbed having round section. Only one specimen of copper arrowhead was found from Hastinapur. The spearheads were made up of iron. Most of them have round section with tang. The blades of the spearheads are round and triangular in shape. Two unique spearheads of iron have been reported from Hatt, district Jind in Haryana. One is of round shape and pointed and another is leaf shaped and with tang for attached the shaft to projectile by bow.

The daggers were made up of copper and iron. The specimen of dagger found from Jakhera is having biconvex edges with midrib and slightly toward the point. A fragment of dagger was from the overlapping phase at Bhagwanpura. The iron shaft was also considered part of weapon because it was used with arrowheads and spearheads. A specimen of iron hilt has been found from Ropar. It may be a hilt of sword and it indicates that the sword was also used by the PGW people. The sling balls were made up of terracotta and stone. They are round, spheroid and ovaloid in shape. Generally, the weapons were used for hunting, self-defence and war during PGW culture. Some iron and copper implements were used in agricultural activities by PGW people. There are axe, sickle, ploughshare and hoe. Some axes were found from Atranjikhera, Jakhera, Allahapur etc. These are flat and socketed. These were made of copper and iron. They have convex blade. The sickles were made of mostly iron and rarely copper. They have sharp blade. A unique iron sickle has been reported during excavation in PGW phase from Hatt. This sickle has semi-circular sharp blade such as modern sickel. The iron ploughshare was found at Jakhera. The iron hoe was also recovered from Jakhera. It was used for digging purpose.

Generally the craft implements include chisel, borer, needle, clamp, tong, awl, spindle whorl, bit and adze at PGW sites in India. The implements made of iron such as chisel, needle, clamp, spindle whorl have been reported from the sites i.e. Ropar, Nagiri, Singh Bhagwanpur in Punjab and
Bhagwanpura, Hatt in Haryana. Theses chisels were made of iron. These are rectangular and square in section with pointed, squarish and rounded edge. The copper iron and bone borer were found from these sites. These are having round section and pointed tip. The needles were made of iron, copper and bone having rectangular and round in section with pointed tip. These are having eyelets on the end to insert the thread. The clamps were made up of iron and copper. These are rectangular in section and having a hole on one side. A unique specimen of iron tong was found from Ropar. Some bone awls were found from Bhagwanpura, Allahapur Atranjikhera etc. These are having round and pointed tip. The spindle whorls were made of copper and terracotta. These were used in spinning. The iron bits were also found from Kausambi and Allahapur. It was used to make hole in an object. A specimen of iron adze was found from Sonkh. It was used in carpentry. The findings of these craft implements indicate that the P.G.W. society comprises of carpenters, weavers, black smiths, and tailors.

The household implements include knife, antimony rod, kohl stick, antimony rod-cum-parer, chopper, nail, spike, nail parer, bar and rod, fish hook, hook, spatula, points, pin, antler, stone grinder. The iron knives were found from Ropar and Atranjikhera. They have triangular section. The shapes of the edge are concave and convex. The antimony rods were made up of copper bone and ivory having long and round in section with pointed tip. A copper antimony rod-cum-parer was found from Atranjikhera. It is pointed on one end and is broader on the second end. The broader end was used to cut the nails.

A unique specimen of iron chopper was found from Ujjain. It was used in cutting. The nails were made up of copper and iron. These are found in large numbers. They have circular, rectangular and hexagonal section and pointed tip. The copper nail parers were also found. These are made from cylindrical rod. These are having round section. The copper and iron bar and rod were also found in large number. These were used for different
purposes. The fish hooks were made of copper. They have circular section and without barb. Some simple iron hook found from Atranjikhera possibly made by bending nail. These are rectangular and circular in section and having pointed tip. The spatula was made of bone and found from Bhagwanpura. The large numbers of bone points were found from PGW sites. These are pointed and circular in section. Four types of unique specimen were found from Allahapur. These were used to kill the birds and to make hole in the objects.

Several copper, iron and bone pins were found from the PGW sites. These are having circular in section and have pointed tip. The bone antlers were found from Allahapur. These were triangular and sharp. These were used for different purposes. The stone grinders were found from some PGW sites. These were used for grinding.

TECHNOLOGY IN PROTOHISTORIC PHASE

The various types of weapons and implement were used by the people of protohistoric age in India. These were made up of copper, bronze, stone, bone, terracotta and ivory.

The Pre Harappan people imported copper ores from Afghanistan, Baluchistan and Khetari in Rajasthan. The melting evidences were found from Mehargarh, Banawali, Siswal, Dholavira, Bhirrana etc. They used some special technique of casting like double mould casting and open casting. The percentage of composition of pre Harappan metallurgy is of different type. The copper celt found from Mundigak is having maximum (98.97) copper contents. The arrowhead found Kalibangan is having lowest copper contents (83.51).

The people of Mature Harappan period imported copper ores from Afghanistan, Baluchistan, Khetari and Singhbhum etc. The tin was imported from Afghanistan and Hazaribagh. They developed the technique of making alloy metal. They made bronze by alloying copper and tin. The melting evidences were found from Mohenjodaro, Harappa, Balakot, Lothal, Kuntasi, Rakhigarhi, Banawali, Badli etc. The Harappan sites such as
Ropar, Banawali, Kunal, Rakhigarhi, Mitathal, Balu etc. in Punjab and Haryana seem to be sites for smelting and manufacturing copper weapons and implements. They followed the double mould, open mould and lost wax technique of casting. The chemical composition of copper of Farmana is considered the purest from because it has maximum copper contents. The arrowhead and fish hook found at Farmana are having 100% copper contents. The copper, tin, arsenic, antimony, iron, nickel, lead and zinc were used to make alloy metal to make the metallic objects.

The Late Harappan people imported copper from Khetari and they also used the scrap of copper objects left by Mature Harappan people to make new copper objects. They used open mould technique of casting. The analysis of chemical composition of metal object found at Mitathal and Rojdi shows 97.75% to 98.57% copper contents. The copper object found at Rojdi is having copper, zinc, tin, lead, nickel, arsenic. The celt and parasu found at Mitathal are having copper 98.48% and some contents of iron and Nickel.

The copper hoard people collect copper ores from Khetari, Afghanistan, Oman, Hazaribagh and Singhbhum. They used smelting technique to purify the copper and used some casting technique like double mould, closed casting, lost wax etc. Annealing, fabrication, cold and hot working technique were also used to provide finishing touch after casting. The chemical composition also suggested that there were some contents of iron, lead, nickel, tin and arsenic along with copper in the copper objects.

The copper axe found from Rewari is having very less copper contents (66.2%). The people in painted grey ware culture used iron and copper to make weapons and implements. The iron ore was imported from Singhbhum, Bengal, Rajasthan and Kumaun hills, Jharkhand, Odisha, Mandi in Himachal Pradesh etc. The smelting evidences were found from Noh, Atranjikhera and Jodhpur. They used open mould, close mould, lost wax
technique of casting. They also used hammering, spinning, cold and hot work, annealing technique to provide finishing touch to the object. They were known to smelting technique. They smelt iron at 1540°C and copper at 1083°C. The copper objects found from Atranjikhera were having copper, tin, lead, zinc, iron oxide, aluminum oxide, sulphur and nickel. The iron objects found from Atranjikhera were having silicon oxide, aluminum oxide, calcium oxide, magnesium oxide, copper, nickel, zinc, arsenic, cobalt, titanium dioxide, phosphorus oxide sulphur, carbon and manganese dioxide.

Besides, stone and terracotta were also used to make weapons and implements in the protohistoric age in India. They imported stone from the difference mine e.g. Sukur Hill, Rohiri Hill in Pakistan. Same time they used local stone to make object. chert, chalcedony, agate, quartzite and pebble. They used some technique for making tools such as stone hammer technique, pressure technique, drill technique, lathe technique, burnishing, polishing and heating.