UNIT 10 USES OF IRON AND ITS IMPLICATIONS*

Structure

10.1 OBJECTIVES

In this Unit, we will discuss the beginning of the technology of iron **smelting** and the change associated with the introduction of iron as the metal of choice by early *c.* fifteenth century BCE.

After reading this Unit, you will be able to:

- Explain the emergence of iron;
- Understand the process of iron smelting;
- Locate the beginnings in the use of iron in various parts of the world;
- Estimate the impact of iron in the process of social formation; and
- Appreciate the uses of iron in the initial and later stages of its usage.

10.2 INTRODUCTION

Emergence of the Iron Age is concomitant with the decline of Bronze age cultures, changes in warfare, coming of nomadic groups, transformation in trade relations, etc. Most distinguished impact of iron was the transformation in methods of warfare, in terms of armoury, weapons, chariots, etc. Gradually, iron was introduced in agricultural tools by *c.* eighth-seventh century BCE which resulted in significant social and economic changes.With the use of hoe, ploughshare, etc. made of iron technological innovations in the agricultural sector could take place. This led to better production and socio-

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economic changes. Unlike bronze, which was an elite metal, as it was difficult to procure copper as well as tin, iron as an **ore** was available in plenty in every region. Thus it had a deeper impact on the society than could be seen earlier with the use of bronze.

The shift from bronze to iron, as a metal of choice, was considered to have brought in remarkable changes in the society, especially in terms of technological changes. L.H. Morgan, quoted in J.D. Muhly (1985), holds that the development of iron technology was as important as animal domestication in human history. Iron was cheap as well as hard thus it could be used in military as armours and weapons and later was used for agricultural tools as well. Usage of iron can be traced from the second millennium BCE when its potential was not fully recognized to seventh century BCE when it became the dominant metal. In a short span of time iron became important not just in terms of technological changes associated with it but also for bringing many other changes.

The spread in the use of iron is seen in terms of its abundance, ease of extraction (a chemical process by which oxygen is removed and metal can be extracted from the ore) and relative hardness of the metal. V. Gordon Childe, quoted in Ian Morris (1989) held that cheap iron democratized agriculture, industry and warfare. Unlike bronze, which was difficult to access, especially for the non-elite sections of the population, iron because of its availability was accessible and therefore could bring in major early historical transformations.

Early evidence of iron can be seen in the form of daggers, amulets and other by-products found in large numbers from second millennium BCE. This period also coincides with decline of the Bronze age and end of the palatial systems. Scholars such as P. Villard, (1996), mention the link between collapse of the Bronze age power structures and emergence of iron as a metal of choice. He mentions that one of the factor for such political development was the new technologies such as iron smelting which played some role in bringing about change specially in terms of military capabilities. Scholars such as Mario Liverani (1996), talk about increase in the spread of settlements during the Iron Age as compared to the Bronze Age and links it to the popularity of iron. She mentions new state models wherein nomads and semi-nomads provide an alternate political model in some regions such as the eastern Mediterranean which was connected to use of the iron technologies and its accessibility. According to McNeill, quoted in J.D. Muhly (1985), role of iron could be understood in the context of a utilitarian metal which was used to produce armoury, weapons, etc. and was linked to waves of invasions and migration in the Middle East around 1200-1000 BCE. As local deposits of iron ore were commonly found in every region, once the knowledge of smelting was known it was possible to use the metal on a scale not possible with bronze. Copper and tin both were scarce ores, which makes bronze, which is an alloy, a luxury metal. In a way, the knowledge of iron smelting and strength of iron could bring in changes, which could impact a large section of the society as it could be used in military and producing other utilitarian objects.

At the same time, technological changes alone cannot explain transformation in a society. Rather the society should be conducive to such change, thus socio-political-cultural as well as human agency plays an important role in bringing about change. Therefore, when we mention the role of iron in bringing about change we must keep in mind the role played by other factors such as environment, society, economy, etc. which played an equally significant role.

10.3 TECHNOLOGY OF IRON SMELTING

Smelting of iron is a very complex process. Although the method of working with metal has been practiced as early as sixth millennium BCE in many parts of the world, but the

technical superiority required was higher in iron working. The standard method is to melt iron (melting point of iron is 1540° Celsius whereas for copper its 1083° Celsius). Following that, iron ore has to be purified which requires flow of oxygen in the furnace. Alongside, reduction conditions have to be maintained which involves removal of oxygen from the oxide ore. This process requires addition of fuel at regular intervals and as a result carbon monoxide dominates carbon dioxide.

In the bloomery process, practiced during the earlier times, it was difficult to attain the melting point of iron as the early metal workers could not reach as well as maintain the required temperature. Thus, a semi-solid slag was obtained. This slag was reheated and hammered into wrought iron, which was then utilized to make tools. The process had to be repeated many times before iron was usable. From this raw iron, bloom or ingot, iron bars and plates were forged. In this form, the tensile strength of iron is similar to that of bronze. Methods were developed which made iron harder and thus more useful.

One such technique is called Steeling of Iron i.e. carburization, a process in which the bloom is directly in contact with charcoal. This leads carbon to diffuse into iron, thus converting it into carbon steel. In this form, iron has the microstructure of steel which makes iron harder. By twelfth century BCE, this technique was successfully used to make knives and blades in the eastern Mediterranean.

Using the **quenching** technique, iron was further hardened. The process of quenching involved heating of the material and then rapidly cooling it in water, oil, or air. How quick the hot iron has been cooled is significant in the quenching technique. However, at the same time, quenching makes the metal brittle therefore the technique of tempering was used. **Tempering** is reheating the iron again, making it ductile as well as hard. In a way it could be shaped according to need. But this process was mastered gradually by fourth century BCE.

By seventh century BCE, the process of **carburization** and quenching was used to produce form of iron i.e. steel which had a higher tensile strength. A harder iron could then be utilized to make better weapons and tools as compared to bronze.

Scholars point out that, besides a standard procedure, there were regional variations of iron smelting, which originated from traditions or ways of copper smelting and working. Therefore, iron smelting is also believed to have started as a by-product of copper technology. Iron artefacts were found in many Bronze Age cultures especially in eastern Mediterranean and Southwest Asia such as in Alaca Huyuk in Central Turkey, *c.* 2500-2300 BCE. Iron was also found in Troy (in modern-day Turkey) associated with bronze artefacts. Evidence of smelting of iron during the Bronze Age refutes the earlier notion of technological specialization and Hittite supremacy which would be discussed later in the Unit.

10.4 EMERGENCE OF IRON

Scholars point out two approaches to understand the shift from bronze to iron, first the circulation model, where scholars point out that decline in long distance trade with the decline of the Bronze cultures led to shortage of bronze and there was an increase in the use of iron and iron-based economies. Second is the deposition model, according to which, since iron was widely available it was the best metal for daily use. And as method of iron smelting was mastered by this period, iron became the metal of choice.

Pierre Villard (1996) mentions three stages of use and spread of iron: first, the initial phase when iron objects were found but the technology of iron working was not known. Second, when quality of iron (especially for tools and weapons) was recognized but

bronze was still in use. And finally, when most tools and weapons were made of iron, but copper was still in use. During the initial phase of its emergence, iron was considered as precious as gold and silver but later as the knowledge of its availability, access and the technological skill was attained, iron lost its status as an elite metal and became a metal for everyday use.

Yalçin (1999) proposes that in Anatolia, iron smelting can be seen through four stages. His classification is similar to that of Villard. Besides the first two, he puts the third stage between twelfth-ninth century BCE, when regular production of iron had started, it became dominant and was used for making weapons, tools, etc. Lastly, by the eighth century BCE onwards, iron was employed in daily use and number of weapons and tools made of iron increased manifold.

V. Gordon Childe (1956) is of the view that with the coming of the Iron age, civilization expanded to larger areas than it had during the Bronze age. According to him, iron and alphabet changed the nature of relationship between elites and commoners. With cheaper iron, commoners were no longer dependent on the elite household and farmers could clear land better with their iron tools. Iron thus brought about a change in the position of the peasants vis-à-vis the elites. In a way, Childe emphasized on the prominence of technology as it brought far-reaching changes. Starting from Asia and Greece and moving towards west with the Etruscans, a confederacy in Italy, dated to around seventh century BCE, and Phoenicians which was a maritime trading civilization in the eastern Mediterranean region from roughly fifteenth century BCE.

Thus, with the coming of the Iron Age we enter a new stage in history which is different from the Bronze Age empires. We notice change in technology, expansion of habitations and new political systems.

10.4.1 Evidences: Texts and Inscriptions

By the second millennium BCE, iron had emerged as an important metal. During this period, iron was considered valuable and was compared in worth with gold and silver. In the early texts iron symbolized monarchy. The Assyrian King Shalmaneser I (1274-1245 BCE) mentions in his records that he donated valuable stones, gold, silver, iron, copper, tin, etc. when he built the temple at Assur. Another Assyrian ruler Tigalth Pileser I (1115-1077 BCE) also records his pride in owning an iron weapon. The Hittite texts belonging to the second millennium BCE also use the word iron in connection with royalty. The king was sometimes compared with the hardness and endurance of iron. Thus during this period, iron was linked to the royalty as it was a precious metal.

Documentary evidences of iron and its products are dated from about second millennium BCE. Early Assyrian inscriptions found at Kültepe in early second millennium BCE, an ancient merchant colony in present-day Turkey, mention use of iron instead of copper in exchange for gold and silver. Iron was considered forty times more valuable than silver, which drastically changed later.

Sources used different local terms to refer to iron. For instance, the early Kültepe texts, second millennium BCE in the Akkadian language use the term *amutum* to refer to iron, while the Mesopotamians used the term KU.AN. The Hittites, on the other hand, used the Sumerian term AN.BAR in their inscriptions. These terms used in the texts represented power and strength. By 1800 BCE, as utility of iron was recognized it became a preferred metal for weapons and soon its use increased manifold.

Archaeological records from this period onwards show prevalence of weapons such as daggers, sword blades, knives, etc. made of iron. For example, Alaca Huyuk, Turkey where six iron daggers were found in the royal tomb besides other precious items such

as pins with gold heads etc. as early as 2800 BCE. During wars iron was mentioned as spoils of war as well as tribute. This was probably raw iron which could be used as required. The Assyrian king Tikulti-Ninurta II (890-884 BCE) mentions receiving hundred daggers as tribute.

References to usage of iron during the third-second millennium BCE in textual sources are available which tell us the relevance of iron in these early societies. These also tell us that iron was a precious metal as it was referred to in royal inscriptions and was mentioned as something worthy enough to be possessed as well as mentioned in records.

10.4.2 Archaeological Evidences

Early iron objects were mostly accidental by-products and the technological knowledge and skill of iron smelting developed and improved over a period of time. By first millennium BCE evidences in forms of weapons that have been found in Asia and after eighth century BCE agricultural tools such as hoe, ploughshare etc. have been found in excavations in many parts of the world.

Earliest archaeological evidence of an iron object is a smelted piece of iron found from a grave in Samarra, Northern Iraq around fifth millennium BCE. In Tepe Sialk, Iran, three balls of iron were found dated around *c.*4600-4100 BCE. These iron balls were described as heavy and hard. Because of their structure and the high nickel content these were thought to have been either originated from a **meteor** (small rocky or metallic bodies in outer space) or as accidental by-products of smelting.

Iron objects have also been found in Anatolia dating to *c.*3000-2000 BCE. Nine objects have been reported from Mesopotamia which include two broken dagger blades made from smelted iron, two fragmentary tools of meteoric origin and five of unknown origin. Yet recent researches show that both meteoric iron (metal found in meteorites) and **terrestrial iron** (iron that originates on Earth, also called Telluric iron) was originally a precious metal with ornamental and symbolic significance.

Evidences of iron from Assyria have been found in Khorsabad, Nineveh and Nimrud. These include iron daggers, pin heads, swords, scabbard tip, arrowheads, spearheads, lanceheads etc. belonging to mid-ninth century BCE. Armours made of iron were found from Assyria belonging to seventh century BCE; picks, adzes, hoe, plow, knives, sickle, saw, hammer etc. have been found in Nineveh, Khorsabad and other sites. During this period references to fetters, cuffs made of iron are available in the texts as well. In Khorsabad, iron used in construction was also found. Heaps of big chain links and cauldron hooks have been found. Later the Greeks and Persians used iron in constructions as well.

Check Your Progress Exercise-1

1) What textual and archaeological evidences of early use of iron are available for the ancient world?

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2) Describe the iron smelting technology and what role did it play in making iron as the metal of choice?

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10.5 SPREAD OF IRON AND ITS IMPLICATIONS

Iron technology and alphabetic writings developed by the end of the Bronze Age cultures. W.H. McNeill, quoted in J.D. Muhly (1985), describes that in the Middle East, diffusion of iron working skills precipitated a new wave of invasions and migrations between 1200-1000 BCE. New people entered historical records inaugurating a barbarous and much more egalitarian age. Iron as a metal to make weapons was believed to be a reason for the military success of the Hittites, special reference is made to the Battle of Qadesh, *c*. 1285 BCE, the Hittites having upper hand over Ramesses II, the Egyptian Pharaoh and the subsequent peace treaty between the two ruling states, i.e. the Treaty of Qadesh dated 1269 BCE.

As you will learn in Unit 11, by second millennium BCE, nomadic groups replaced the Bronze Age empires, which brought profound changes in socio-economic as well as cultural patterns across societies. This period saw the growth and expansion of the Assyrian empire in the East (you will learn the details of the Assyrian empire in **Unit-12**). The Assyrians were a military power and utilized iron to full extent because of their proximity to the source of the metal, for example, in the Taurus mountains. Evidence confirms that iron was used for making weapons. Many scholars suggest that the disruption of trade led to the scarcity of copper thereby leading to rise in the use of iron. As the 'Iron Letter' (Details discussed in **Section 10.7**) attests, iron was certainly an important article for commercial relations during this period.

Gradually by sixth century BCE, iron was used not only to make weapons but also agricultural tools such as ploughshare, hoe, picks, axes, etc. The introduction of these tools brought in large-scale changes in agricultural sector and led to increase in production. Thus, we notice a gradual shift from stone and wood used by the peasantry in metal tools which were stronger and durable. The wide spread of iron was described as a democratic metal due to its availability in all parts of the world. But these changes happened later and would be discussed later in the Course.

By the early first millennium BCE, iron was clearly playing an important role in the economy by facilitating better tools, territorial expansions, etc. Implications of the use of iron were widespread in the field of warfare also, as discussed below.

Military Strength and Role of Iron

Iron brought in a major transformation in warfare because it was stronger as compared to bronze (Discussed above in **Section 10.3**). The emerging states, such as the Assyrians, the Hittites and the Mittanis,were well versed in weapons that were used for warfare. As these cultures discovered the relative advantage of iron over other metals, they introduced changes to their weapons and armoury. These new states could assert their military power with the use of iron weapons such as swords, daggers, spearheads, besides body armours and helmets, etc. According to P. Villard (1996), the increase in the demand of iron,which was used for weapons and tools by the Assyrians, gave a spurt to the development and popularity of iron. It was also seen as a reason for the success of these states as centres of power. These three states were major contenders of power in the Near East and had supremacy in terms of iron weapons and tools during the early first millennium BCE.

Another important change during this period was the introduction of horse in war. Horse had been domesticated and brought to the region of Near East before second millennium BCE and gradually its usefulness in war was recognized. Besides, bringing in a new technique in terms of warfare, it led to the introduction of a specialized warrior class on chariots and horses. Chariots with solid wheels had been used earlier by the

Sumerians but spooked wheel chariots drawn by horses was introduced by first millennium BCE.

Chariots and horse riding groups had an important role to play in the success of these new kingdoms. Along with the use of iron weapons it had a major impact on the military capabilities of the Mittanis and the Hittites. The new military technique soon spread to other regions and became a symbol of military superiority.

Use of iron in agriculture was noticed later by the seventh century BCE, when ploughshare made of iron was found in Mesopotamia. Sennacherib (*c.* 704-681 BCE) mentions use of iron implements to cut canals through mountains in order to provide irrigation in the region of Ninevah (Villard, 1996).

10.6 IRON AGE IN THE NEAR EAST

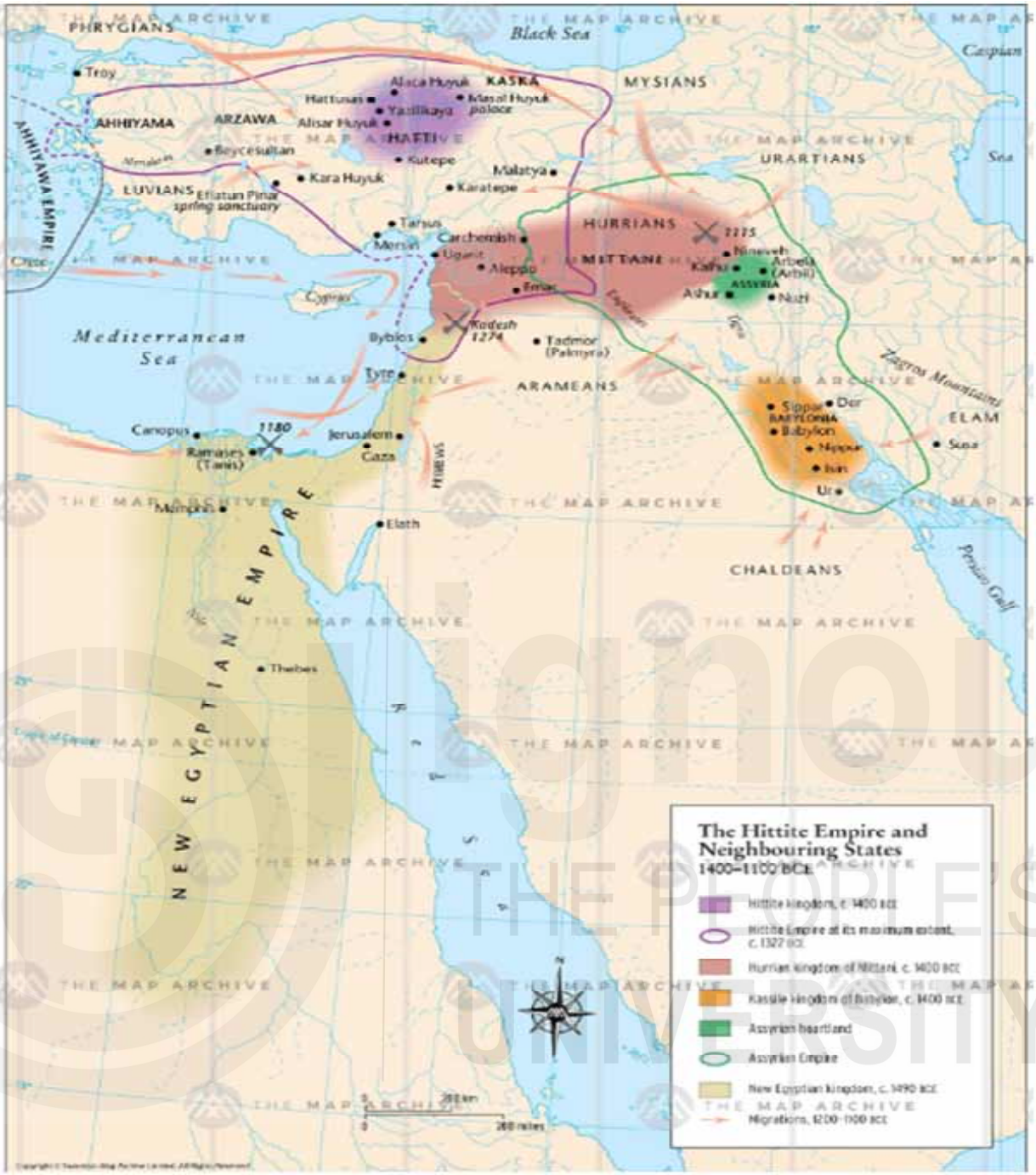
For a long time, scholars believed that the Hittites invented the process of iron smelting and it was only after their decline that it could spread to other parts of the Near East and later on to the West. References were made to the inscriptional as well as textual sources. Evidence of iron products could be found from the second millennium BCE and the first millennium BCE attests to its widespread use. Geologically, the Black Sea region contains sand rich in hematite. As Pierre Villard (1996) mentions, that early Greek scholars such as Strabo believed that iron was discovered in this region. Mining of the iron ore is attested to from about second millennium BCE in the region.The question that becomes pertinent here is whether iron smelting was introduced from the Near East to other parts of the world. Therefore, we need to look at the evidences from this region to understand the spread of iron technology. We take into account the use and spread of iron by the Hittites, Mittanis and Assyrians.

The Hittites, Mittanis and Assyrians

Map 10.1: The Hittite Empire (outlined region) and Extent of Hittite Rule (shaded region) *c.* 1350-1300 BCE

Credit: Near_East_topographic_map-blank.svg: Semhur

Source: Creative Commons (https://en.wikipedia.org/wiki/File:Map_Hittite_rule_en.svg)



Map 10.2 : The Hittite Empire and Neighbouring States 1400-1100 BCE
Source: https://www.themaparchive.com/the-hittite-empire-and-neighbouring-states-14001100-bce.html

Around two hundred Hittite documents mention iron, on the basis of which scholars believed that the Hittites were large scale producers of iron objects. A letter written by a Hittite ruler (possibly Hattusilis III [1282 BCE– 1250 BCE]) to an Assyrian prince, which is popularly known as the 'Iron Letter' also acknowledges the Hittite command over technology. As mentioned in the letter, it not just refers to the metal but also talks about 'good iron' (believed to be indicating to steel). This would reflect their technological skill and ability to utilize iron as a strong metal. Iron ores found in the Anatolian region corroborates the Hittite capabilities in terms of iron production.

Scholars in support of Hittite supremacy refer to the 'Iron Letter' which mentioned the inability of the Hittite king to provide 'good iron' at that moment. This letter has been used to point out that the Hittites had iron production under their control and iron was a product of commercial exchange. Besides it was also used as a reference to their

technological superiority i.e. they could produce 'good iron' which has been understood as a reference to steel.

J. Siegelová, mentioned in Cordani (2016), outlines the process of proliferation of iron during the Hittite period as: first, during the Old Hittite Period i.e. from 1700-1600 BCE when iron was considered precious and was associated with rituals. Second, the Middle Hittite Period (1500-1400 BCE), when number of iron objects increased and iron was included in ceremonial items as well. Third, the period of the dominance of Hittite Empire (1300-1200 BCE) which saw the production of a range of iron products including daggers, knives, spearheads, etc. Although the use of iron jewellery had declined in this period. Through these divisions, Siegelova thus traces the trajectory of the use of iron from being hailed as a precious metal to a metal of common usage.

During the early period (1700-1600 BCE), the Hittites used iron solely for ritual purposes and it was mentioned along with lapis lazuli and other precious and semi-precious goods. In the clay tablets found in the palace of Bogazkoy (Turkey), iron is mentioned along with gold, silver, bronze and copper. An early Hittite text mentions iron throne and a scepter (decorated stick or wand held by a monarch). The written records mention knife, dagger, sword blades and other assorted tools. The Hittite texts mention iron workers as well.

However, scholars such as Yalcin, and others point to various regions like Anatolia where iron could have been smelted besides the Hittite empire. And on this basis, these scholars question the notion of the Hittite monopoly. However, the Hittite documents as mentioned above undoubtedly show that they could successfully produce iron and its implements by the second millennium BCE despite the fact that limited iron artefacts have been found in the archaeological remains. The political history of the region reflects power struggle between the Hittites and the Mitannis over resources. One of the causes of attack on the Mittanis by Hittite ruler Suppilulimas I (*c.* 1380-1346 BCE) and his subsequent control over Aleppo and Alaka may have been related to the need to control routes leading to the Mittanian sources of iron. Thus, it refutes the notion that only Hittites had the knowledge of iron working.

Scholars point out that well-made iron tools can be dated as early as the ninth century BCE. The evidence of an iron-bladed axe with bronze handle was found at Ras Shamra, Ugarit, which was a gift made to the Pharaoh, Amenophis III (1413-1375 BCE) by the Mittani king, Tusratta in *c.* fourteenth century BCE as mentioned in the Amarna tablets from Egypt. This again challenges the notion that only the Hittites had knowledge of iron working. Besides the gift list also makes a distinction between steel dagger and iron dagger. Thus, the Mittanis had technological knowledge regarding smelting of iron and could produce carborized iron i.e. steel.

Further, the earliest Assyrian evidence comes from iron hoards found at Khorsabad, Nimrud and Ninevah. Excavations of these palaces revealed evidence of spear-heads, daggers, arrowheads, helmets, fragments of armour, axes, sickles, picks, hammers, etc. Earliest evidence comes as a reference made to temple donations. Shalmanesar I (*c.* 1274-1245 BCE) in his inscription mentions valuable donations, which included iron, made to the temple at Assur (an Akkadien city). Similar to Hittite records, here iron was considered a precious metal during the early period. Later, iron was mentioned as weapon for the royalty. Another king Tiglath Pilesar I (*c.* 1115-1077 BCE) mentions using iron tipped arrows for hunting in his inscriptions. Thus iron was used by the royalty and was considered as prestigious. For example, Assyrian King, Tukulti Ninurta II (*c.*890-884 BCE) received a tribute of silver and hundred iron daggers. Even in the later seventh century BCE another ruler Assurbanipal (*c.* 668-627 BCE) mentioned

using iron dagger during hunts. The ninth century BCE Assyrian records mention iron as a tribute to kings. Similarly, Assyrian King Assurnasirpal II (883-859 BCE) mentions working in mountains with hatchets of iron and copper axes. Thus iron was important enough to be mentioned in inscriptions, sought as gift and offered as tribute to kings. It was a symbol of king's military strength.

Assyrian records as well as archaeological evidences show use of iron in implements by the late eighth century BCE. References were made to hoes, axes, picks, etc. in inscriptions of various rulers. Iron picks have been found during the excavations at Khorsabad. Similarly axe-adze have been found in the excavations at Nimrud. Iron plough was mentioned in records by seventh century BCE[1]. Some carpenter's tools also have been found in Khorsabad excavations (Pleiner et. al, 1974). Thus, iron which was earlier referred to as a prestigious metal for rulers, by the later eighth century was used for household purpose.

Check Your Progress Exercise-2

1) In what ways did the knowledge of iron technology support the emergence of new states in the Near East.

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2) Why were the Hittites considered to have a supremacy in iron production?

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10.7 IRON AGE IN EUROPE

In Europe, the evidence of iron products is found around the twelfth-tenth century BCE and it was only after the eighth century BCE that its widespread use is attested to in the Greek colonies. After the collapse of the Mycenaean-Minoan Bronze age around 1200 BCE there was the so called Dark Age or the early Iron Age. Most significant, from technological point of view, was the adoption of the method of iron smelting. Iron was cheap as well as abundant and was used for a variety of tools.

In the European context, Iron Age saw the rise of tribes such as the Celts, Etruscan, Iberians and others. The Greeks obtained iron daggers and swords as well as the technology of iron working from Levant (Eastern Mediterranean) and West Anatolia. Iron working spread from the Hittite world to Iran and from the north-east across the Caucasus to Kobane regions. The early Iron tools such as swords found by the tenth century BCE in Europe were similar to those made during the Bronze Age.

The late Bronze Age cultures in Europe like the Urnfield people in Western Hungary

[1] Iron plough was mentioned as a metaphor in Vassal treaties of Esarhaddon (*c*.680-669 BCE).

(1800-1200 BCE) did not have a centralized state structure but could well utilize their environment. They included farmers, traders and metallurgists. Their trade networks played a significant role in the spread of iron technologies across Europe after 1000 BCE. It is generally held that the technological innovations related to iron working had originated in Anatolia and were diffused to other regions by the eastern Mediterranean settlers as well as by the semi-nomadic groups of the Black Sea region. One of the early iron objects found included bronze sword hilts from Switzerland, sword blades and arrowheads from France, among others.

As mentioned in the earlier Section, iron technology was different from bronze techniques but at the same time as it was widely available, it was a cheaper source and could be utilized for making weapons as well as implements. The use of iron in agricultural implements such as axes, hoes, ploughshare led to higher crop yields, and better food surplus, therefore played a prominent role in bringing change in Europe.We will look in detail at the Hallstatt culture, which is one of the early cultures, as a case study of the European Iron Age.

The Hallstatt Culture

The Hallstatt culture emerged in the south of Austrian city of Salzburg where golden amber, glass, bronze and iron was found in burials. Swords, daggers, axes, etc. were also found in large number. The Hallstatt culture shows a transition from Bronze to the Iron Age in Central Europe. It started by the eighth-seventh century BCE and spread to the area which was earlier inhabited by the Urnfield people, a warrior group in Western Hungary dated to late second millennium BCE. They were defined by their burial pattern wherein the dead were cremated and ashes deposited in an urn. Later they spread to central and parts of western Europe. They were known for their bronze working and fortifications.

The Hallstatt, in Austrian Alps, emerged as a major trade centre around 800 BCE. Cemetery near the salt mines shows evidence of early Iron Age as many iron weapons such as large knives, spearheads, swords, etc. were found besides bronze articles. Trade in this region was well developed and it soon emerged as an important commercial centre, for example Heuneburg. Important feature of the period was appearance of burials in wooden chambers. The graves represented a warrior class as helmets, shields etc. made of bronze were found, along with various other kinds of vessels. Swords found in the graves were made of iron and sometimes were made of bronze.

During the Hallstatt period, the elites in West-Central Europe built fortified hilltop settlements which were also the seats of the administration and they buried their dead with exotic objects such as jewellery, shields, weapons etc. It reflects a civilization where war, raids etc. were important aspects of the society. They had well established connection with the Mediterranean region. Peter S. Wells (1994) characterized the western Hallstatt fortified settlements as ‘towns’, which had a commercial function. Whereas Arnold suggests that they were more symbolic in their function. The final phase of the Hallstatt culture was defined by short swords and some of the centres shifted towards west by 500 BCE. Heuneburg was one such seat of the Hallstatt chief. It was on a hilltop over the Danube, Germany. The fortification was renewed between 650-450 BCE. The walls were sometimes built with mudbricks which reflects Mediterranean influence. They traded from Massalia, a trade centre of Greeks near Rhine, in amphorae (jars and jugs) besides black fig, vases, silk, etc.

The wealth accumulated by the elite can be seen in the burials. The tombs had a variety of goods made of bronze, besides wood, bead, vessels etc. Although Mediterranean trade did not stop altogether but there was decline in the trade relations. By 400 BCE,

the site was abandoned and burials were no longer found. The Hallstatt culture was followed by the La Tene culture which is dated to the late Iron Age i.e. 600-400 BCE. During this period, regional centres of manufacturing and trade were found in Poland besides other regions. During this period iron working further disseminated and was no longer restricted to the elite groups.

Check Your Progress Exercise-3

1) Explain the emergence of Iron Age in Europe.

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2) What is the nature of the settlements established during the Hallstatt period?

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10.8 SUMMARY

The transformations seen in Asia and Europe during the second-first millennium BCE were supported by the new technological development i.e. smelting of iron. Iron smelting specially with the introduction of carburization and quenching methods, led to a stronger and better metal which could be used as weapon as well as implements. Although during the first phase, iron was treated as a valuable metal and symbolized monarchy but by the later phases, it had infiltrated deeper into everyday lives. Iron was a harder and tougher metal besides being widely available. In the beginning, iron was utilized to make weapons but as the technology further developed, better and harder tools could be made, which were used in agriculture as well. Along with spread of civilization, horse riding warrior class, money, towns, trade etc., iron brought in major transformations in the society. From weapons to agricultural tools, iron had far reaching implications for the society.

10.9 KEY WORDS

Carburization : process of heating iron in the presence of a carbon-bearing material such as charcoal in order to harden the metal.

Meteor : small rocky or metallic bodies in outer space.

Meteoric iron : iron found in meteorites.

Ore : a natural rock or soil from which a metal or mineral can be extracted.

Quenching : the process of heating and rapidly cooling a metal with water, oil, forced air or inert gases in order to obtain certain material properties such as hardening of the metal.

Smelting : process of applying heat beyond the melting point to an ore to melt out a pure metal.

Tempering : process of reheating iron to harden and strengthen it.

Terrestrial iron : iron that is available on the upper layer of the earth.

10.10 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise-1

1) Mention textual as well as archaeological evidences which points to the earliest use of iron. Add on the gradual process of use of iron. See Sub-sections 10.4.1 and 10.4.2.

2) Mention bloomery process and how caburization, quenching and tempering makes smelting of iron different from other metals such as copper. See Section 10.3

Check Your Progress Exercise-2

1) Mention coming of the new states and how did they base their power on iron weapons and horses. See Section 10.6.

2) Refer to the 'Iron Letter' and other evidences such as availability of iron ore to elaborate on the Hittite supremacy. Also mention why do scholars object to this notion now. See Section 10.6.

Check Your Progress Exercise-3

1) Mention the beginning of Iron Age in Europe. See section 10.7.

2) Mention the establishment of towns and the evidence of rich prosperous settlements. See Section 10.7.

10.11 SUGGESTED READINGS

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10.12 INSTRUCTIONAL VIDEO RECOMMENDATIONS

Prehistoric Iron Smelting Demonstration
https://www.youtube.com/watch?v=KP4DjM3jBsw

Forgotten Empires: The Hittite Kingdom | Discovery History Channel
https://www.youtube.com/watch?v=5SmUAlFFwbk