Chapter 6

LITERARY EVIDENCE ON THE USE OF IRON IN ANCIENT INDIA

The Rigveda mentions ayas as one of metals, repetitively in different contexts. It has been variously interpreted to connote iron, copper or metals in general. Monier Williams translated ayas as iron, metal, an iron weapon, gold and steel. Gordon Childe thought that it refers to copper. M.N. Banerjee has sought to prove that of the three metals mentioned in the Rigveda, namely, hiranya, rajata and ayas, the last named could not be any other metal than iron. From several references to ayas in the Rigvedic literature it becomes clear that it should be very hard, malleable enough to be beaten into vessels, and capable of being rendered sharp so that with swords or axes, described as asi and svadhiti, respectively, the horse at sacrifice could be decapitated at a blow, and with razors (ksura), made of iron, heads could be shaven clean. The strength and sharpness of ayas became standards of comparison and qualities to be coveted. Gold and silver are easily ruled out by these standards. It is also stated that ayas was purified by smelting and that it could be welded. Copper by itself could not perhaps come up to the utilitarian and qualitative expectations in
respect of the *arya* of the Vedic bards. Bronze was obviously out of the question, as, tin, an essential component of bronze, in combination with copper, is not separately mentioned in the Rigveda. The fact that the mixed metal or alloy has no separate term to denote it in the Vedic literature is quite significant in this context. Furthermore, the smith who produced objects of *arya* is called in the Rigveda *karmara*, a term which has come down to our times in the slightly modified forms, *kāmar* in Hindi and *kamār* in Bengali, etc. In Tamil the blacksmith is called *kollan*, though *kamman* also stands for a blacksmith, while *kommalan* covers the blacksmith as well as any metal worker. Thus the phonetically connected synonyms signify the blacksmith whose sole or prime business is to deal with iron and—me—other metal.

The process of smelting (iron) ores mentioned in the Rigveda is shown by Banerjee to be remarkably akin to the methods of the indigenous smelters of iron in contemporary India, as will be seen in Chapter 9, only to suggest a continuity of the tradition. The process described in the Rigveda would imply the use of "medicinal plants," as fuel, "shining stones" as ore and "fans of geese feather" as bellows. It only suggests an open hearth furnace where a carbonaceous firewood was used to render the smolten metal from orestones hard and steely and wherein, for introducing the blast, some contraption of bellows was used by the *karmakara*. 
Karmara (smith). The tools and equipments, namely, sasi and svadhiti etc., mentioned in the Rigveda were such as would have the hardness which only such a metal would possess. The industry seems to have been confined to the Udmatris, who, as the analysis of the term would suggest, blew and 'hammered' to ply their trade and would, therefore, clearly be recognised as metal workers.

The fundamental difference between the metallurgy of copper and that of iron has been indicated above (see Chapter 1, pp. 1-2). Owing to the low smelting point of the copper ores it was dealt with by heating in some kind of crucible, and the desired objects were produced by pouring the liquid metal into moulds, and finished by hammering etc, when the metal had cooled and hardened in the cast. The excavations at Ujjain have shown the use of this method in the early years of Period III, i.e., after circa 200 B.C., when small terracotta or ceramic crucibles were employed for smelting copper. As a result of the high temperature to which heating was continued, the clayey component of the walls of the crucible became vitrified.

It has been shown that the Aryans should have had full knowledge of the use of iron before their advent into India. It should not, therefore, cause surprise if their earliest literature, which is admittedly later than their earliest days of acquaintance with iron, should bear ample though casual
references to this metal, not being a treatise on metallurgy. In this context Banerjee’s unequivocal identification of *ayas* with iron appears cogent and would be worth consideration. Even a metallurgist like R.J. Forbes has admitted the cogency of the argument and accepted the possibility of iron being in use in India in the earliest days of the Aryans in the country.

Of the other Vedas, which evolved later than the Rigveda, the *Yajasaneyi Samhita* of the White Yajurveda mentions six metals, namely, *ayas*, *Hiranya* (gold), *loha* (copper), *Svāma* (iron), *Sīsa* (lead) and *Trapu* (tin).

Later still the *Brahmanas* and *Upaṇiṣadā*, which are admittedly of a later date than the Vedas, mention *Lohitayas* or *Lohavas* and *Kārṇayas* or *Krisnayas*, dividing the metals into the red metal and the black metal, respectively. These have been identified broadly as copper and iron respectively. But the modern Hindi and Bengali term *loha*, no doubt, derived from *lohitā*, has stuck to iron. Iron is red when it is heated red hot, black or steel-grey when it is in normal temperature and reddish again when it is rusted. On the other hand copper is red or reddish brown when first manufactured, blackish when it is held in use and greenish when it rusts or oxidizes.
As iron is black in cold and normal condition it may have been designated as *karsgayas*, and copper, which is red when first manufactured, may have been called *lohitayas*. It is possible, therefore, that *ayas* was used to cover both copper and iron to begin with i.e., in the Rigveda. It would *ipso facto* imply that the iron was already known.

The etymology of the word and its variants or equivalents in different languages of to-day, namely, *Eisen* in German, iron in English, *ayaš* in old Persian (Bartholomew's Dictionary), all of which mean iron, would, however, plead in favour of the interpretation that *ayaš* probably did mean iron in the oldest Vedic literature, though its use to denote a few other metals like copper or gold in suitable contexts is not ruled out.

Herodotus wrote that the Indians in the Persian army were armed with cane arrows tipped with iron. This is the earliest literary evidence, after the Vedas, on the use of iron in India. Even this would presuppose a time-lag of considerable extent during which iron was worked and the industry developed.

Ktesias, who was in the court of Persia in the fifth century B.C., wrote that he was presented with two remarkable swords of Indian steel by the Persian king and his mother respectively. The
manufacture of steel would imply a considerable knowledge and experience of the metallurgy of iron, as steel could have been produced only by an admixture of a proper percentage of carbon, which could be achieved only under high temperature in specially built furnaces. Thus the manufacture of steel objects in India would, on this evidence, go back to a still earlier date.

Quintus Curtius mentions that Alexander of Macedon, after the victory over Porus of Taxila about 326 B.C., received from him a gift of 400 talents or 30 lbs. of steel. It may be noted that a uniformly victorious warrior of the position of one who had traversed and conquered the entire land between Greece and India could condescend to accept such an ordinary or paltry gift! Yet the same Alexander, after his loot and sack of Persipolis, had allowed his soldiers to leave behind thousands of arrowheads and spear-heads of iron in the course of the removal of the treasures of the palace which lasted for days, now recovered by excavation in the debris. The clearly deliberate abandonment of such precious equipments of warfare would only indicate that they were amply provided with equipments of iron. This would only mean that 'steel' was not produced at all, or if so, in inadequate quantities or of poor quality in the west, and that India at this time enjoyed a reputation for the manufacture of steel, which was
then as now, a coveted metal. In this context one can understand that the gift of Porus was not considered unworthy of royal acceptance, towards the end of the fourth century B.C.

Pliny (first century A.D.) refers to fine swords made of Indian steel. The Periplus of the Erythraean Sea, the work of an unknown author, also of the first century A.D., describes the occurrence of Indian iron and steel in African ports and in Abyssinia.

There is evidence to show that the Romans imported iron and steel from India and made it into fine cutlery and armours at Damascus and Irenopolis.

Much of the Roman trade, however, was with Peninsular India as indicated by the finds of Roman ceramics and coins etc.

Kautilya's *Arthasastra* does indeed have references to the large scale use of iron in his time, namely, during the rule of the first Maurya king, Chandragupta, though it is admitted that it is a later compilation.

The *Arthasastra* presents the picture of a society where mining was well established and subjected to state control. Tīksna dhātu is recognised as iron. "Those ores which are of orange colour (Kurumba) or pale red (paṃcudurohita) or of
the colour of the flower of Sinduvira (*vitex trifolia*) are the ores of Tikona.

The Superintendent of metals, (Lohadhyakṣah) shall carry on the manufacture of copper, lead, tin, vaikritaka (mercury) Ārakuta (brass), Vṛitta (?) Kamsa (bronze or brass metal), Tāila (sulphate of Arsenic and lodhra(?)) and also commodoties (bhānda) from them.

Among the objects made of iron, the armour are classed as Lohajālika, Lohapatṭa, Lohakavacha, and Lohasūtra.

R.K. Mookerjee writes about the Superintendent of Mines in the following words: "The Superintendent of Mines is to collect the imposts payable of mines such as those of silver, diamond, gems, metals, salts, and other minerals extracted from the earth, stone or oil fields (rasa) like mercury".

The elaboration of state activities to regulate and control the mines and mineral products speaks of much earlier beginnings of the operational activities in respect of them.

The literary evidence regarding the use of iron in ancient India, steering clear of interpretational controversy, can take us back, at the remotest, to the period of the Brahmāṇas, and at any rate, very much earlier than the date of the Buddha or Mahāvīra Jīna as the practice of rituals.
and sacrifices must have been long enough in vogue to have provoked the new religious reforms of Buddhism and Jainism, respectively, which emerged largely in protest against the Kamakanda of the Vedas. This would incidentally also rule out the tentative suggestion by Wheeler that it was the Persians who introduced iron into India as the Persian conquest of north-western part of the Indo-Pakistan subcontinent could scarcely be pushed back earlier than 531 B.C.

The existence of a brisk trade between the Roman empire and India in the early centuries of the Christian era involving the import by the former of ores and objects made of iron and steel from India (c. 25 B.C. - 25 A.D.) is amply described by E.H. Warmington. He writes that, 'The Roman trade in Indian iron and steel was the important one. ..... (the excellent Parthian metal was perhaps India. Evidently they (the Greeks) learnt the secret of production, for Saumaise points out a special treatise (in Greek) on the tempering of Indian steel. .............. The Romans worked it into fancy cutlery as Clemens shows, and perhaps into armour at Damascus (whither Indian metal was sent). The steel is called bright iron."

It is also interesting to note that almost contemporaneously, the Tamil works Purānānāṟṟu (170, 11-15-17) and Aganānāṟṟu (224, 11, 2, 3) describe the iron worker, his anvil, bellows made of leather and other appurtenances.

Thus it is evident that literary accounts are not without their use