The discovery of the evidence of smelting and manufacture of iron objects at Ujjain has been mentioned already. It will be worthwhile to consider at this stage the details of the industry, not merely because of the importance of the discovery but also of its unique features. The industry at Ujjain was centrally located, within the bounds of the fortifications along the western area and was practised extensively during Periods II and III. Considering the fact that the fortifications served as a citadel and the iron objects found in the excavations, by and large, were mostly weapons of war, this location is easily understandable.

The evidence of smelting is provided by enormous deposits of iron slag, unsmelted or partially smolten iron ore, lumps of a crystalline material identified as calcite or aragonite, and quantities of a whitish powder, presumably lime, the result of smelting in close association in the fillings of a canal or channel of Period II. This would date the evidence from a later phase of Period II (500-200 B.C.) to an early phase of Period III (200 B.C. onwards). These deposits have a tendency to lie on the sides
The use of calcium compounds as a flux in the smelting of iron is well known. In this context, the co-occurrence of calcite or aragonite with iron slag is easily explained. The whitish powder, referred to above, would, in all probability, represent the calcium compound resulting from the smelting operation. The juxtaposition of the canal is also significant. The waters in the canal were possibly used for the iron industry. It will not be out of place, therefore, to described the canal as an integral part of the industry at Ujjain. It is easy to guess, in the light of this evidence, that considerable importance was attached to the industry as it supplied the sinews of warfare, and accordingly elaborate arrangements were made for the success of the undertakings.

As regards the actual mode of smelting the evidence is not clear, though certain broad inferences are possible. Alternate deposits of charcoal mixed with the iron slag and a whitish powder, possibly lime, as stated above, occurring in an exposed section point to a simple method of smelting employed at Ujjain. The modus operandi consisted, inferably, in laying several alternate courses of charcoal and iron ore and covering the entire pile
thickly with clay to prevent the heat from escaping. The sides of this heaped simple kiln, which should have been circular in plan, must also have been provided with passages for the intake of air and escape of gases, and outlets for molten iron. The molten liquid, after collection, was, no doubt, first cooled by dipping into water and then beaten with hammer to drive out the charcoal, which went into the molten iron, giving it the properties of steel, and thus to eliminate the slag.

While the evidence at Ujjain on the process of smelting is inconclusive as to the actual methods employed it is, nevertheless, clear that charcoal was used as fuel, the hearths were of the 'open' type, and the iron smelters had reached the technical advancement to have realised and met the need of using a calcium flux to aid them in smelting. Such a stage of development would itself be the result of prolonged experimentation involving much trial and error, and would indicate a still much earlier beginning of iron workings in the area, which quite fits in with the evidence. The primitive form of the kiln in combination with the evidence of a flux would perhaps suggest a local development.

As regards the method of forging adopted in the period range of circa 500-200 B.C., the remains of a forge (pl. IX) with a groove for the introduction of the working end of a blower or bellows, an improvised stand made from the sturdy and large neck of a broken jar
for a water jar to store water for quenching, a small or miniature jar to collect small quantities of water according to necessity, and a shallow but large enough bowl to contain water near at hand for quenching help to reconstruct the process of a blacksmith's working. The use of an anvil, also of iron, and iron tools like pincers for handling the red hot iron bar or tool, is clearly indicated. The iron nail and chisel lying near the forge, lined with bricks and clay, burnt hard, and containing ash and charcoal, suggest the variety of objects produced, sharpened or remade at the forge. This method is even now in vogue, and would by itself indicate, for the evidence in question, an advanced stage of development of the process of iron working, with a long background. That the iron workers of Ujjain, also called Avanti, set up a tradition early enough and achieved renown far and wide including the distant Tamil country in the south is testified by the pointed references to them in the Tamil works, 569 Menimekalei and Perungadai of the early centuries of the Christian era, respectively. In one context they are described along with different categories of artisans, who were obviously employed for the construction of the golden pavilion of the Chola king, Killi Valavan. The passages under consideration would suggest that they were surely among the best workers of iron in the country, otherwise they would not be called upon to travel to the far south and work alongside the
specialists in different crafts employed on the works. These references cannot be without significance as to the building up of an iron industry at Ujjain in early times. A trade by virtue of its initial advantages displays a tendency to get localized and the high technical skill that is achieved in course of time is disseminated from this centre. Such a phenomenon must have developed in Ujjain from the earliest days of the manufacture of iron objects in the area. This itself would suggest the early beginnings of the industry at Ujjain.

K. R. Srinivasan writes as follows:

"Manimekalai (XIX,11.107-9) and Perungadai (I, 11.40-44) though later than our period, aptly summarize this development. The former says in one context (XIX,107-9) that "the artizans from Magadha, the metal workers from Merattta the blacksmiths from Avanti, and the Yavana carpenters all worked in unison with the artizans of the Tamil country". The passage reads as follows:-

"Magadha vinaiñarum, Marattta-k-kammaram, Avanti-k-Kollaram Yavana-t-tachcharum, tan Tamil vinaiñar-t-tamamgou Kudi-k-Kondu - Inidu-tyarrria."

It may be observed here that the words employed for the iron workers of Ujjain (Avanti) are Avanti-k-Kollaram.

Srinivasan continues, "The latter (I,11.40-44) is a little more elaborate: "Yavana carpenters, the blacksmiths of Avanti, the jewellers (or expert artizans)
born in Magadha, the workers on fine gold born in Patali (Patliputra) the artists (painters and modellers) who flourished in Kosala and the metal smiths of the Vatsa country."

The passage runs as follows:-

Yavana-t-tatchcharum Avanti-k-Kallarum
du Magattu-p-piranda pasam pon vinairarum
Kosalttu - iyana obiva-t-tojilarum
Vatta pattu vanna-k-Kammarum

The words Magadattu-p-piranda Mani_vinairarum
also means lapidary and bead work craftsmen.