

## CHAPTER VI

Epilogue

The preceding Chapters have given us almost a complete picture of technical skills and metallurgical knowledge of the Chalcolithic Period copper metal workers in India. But the study has also brought to light some lacuna in our knowledge. They can be filled up by further work in the field as well as in the laboratory.

Further work in the field is necessary to fill up the gap in our knowledge regarding the Chalcolithic Period copper smelting furnace. In this connection, further excavation of the site at Ahar, which has been proved, in this study, to be one of the copper metallurgical centres of the Chalcolithic Period, and excavation of the other 'Ahar Ware' sites in the Banas Valley, in the Aravalli region is likely to yield fruitful results.

It has been pointed out above that, the minimum temperature needed for smelting of chalcopyrite ore is about  $1200^{\circ}\text{C}$  and the maximum temperature that can be had of the wood charcoal fire is about  $750^{\circ}\text{C}$ . How actually was the temperature of the wood charcoal fire raised to  $1200^{\circ}\text{C}$ ? A device for forced draught of air in the furnace was certainly used. But what was this device like? Only further work in the field, particularly at Ahar and

the other 'Ahar Ware' sites can throw light on this important technical problem of the Chalcolithic Period copper metallurgy.

Gap also exists in our knowledge regarding the casting moulds. The metallographic examination of the objects above has indicated that both sand moulds, without proper ventilation for free escape of evolved gases as well as clay moulds with proper ventilation for free escape of evolved gases were used. But it is pertinent to ask when actually the progress from the crude sand mould casting to ventilated clay moulds took place? The question can be answered only by further field work.

It is not known whether the axes recovered from the Indus Valley sites are porous and how actually they were cast. Their metallographic study is necessary to throw light on this point.

In fact laboratory work is necessary to carry out complete metallurgical study of the Chalcolithic Period copper artifacts recovered from Baluchistan, Makran coast, Indus Valley sites in Pakistan and India, as well as the objects recovered from Gilund, Eran and Pandu-rajar-dibbi.

Evidence of the use of native copper in the Indian sub-continent is non-existent. A complete metallurgical study of these early objects is likely to throw light on this point.

Among other things, such a study, together with the data collected from the spectroscopic analysis of the

samples of copper bearing mineral deposits observed in the sub-continent as well as in Afghanistan and Iran, can help to correlate the copper ore deposits with the artifacts.

Alongwith implements of copper and bronze a few utensils of the metal and the alloy were also recovered during the excavation of Mohenjodaro.<sup>1</sup> Marshall<sup>2</sup> has indicated that these utensils were probably either cast by cire perdue technique or raised to their present shape from sheet metal. Metallographic examination of these utensils will indicate how exactly they were produced from the solid metal.

Interalia , this study has also brought to light the vast scope for metallurgical study of stratified metal objects, not only of copper but also of silver and iron, recovered from excavations in the country. Such a study, if carried out for different cultures, can furnish important material evidence regarding the relative technological position of the different cultures. If it is carried out on objects of one culture, belonging to different periods, it can provide with information regarding technological progress or degeneration of the culture.

References

1. Marshall, Mohenjodaro and the Indus Civilisation,  
Vol.II, London, 1931, p.489.
2. Ibid.