

NONFERROUS MATERIALS HERITAGE OF MANKIND

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ABSTRACT

The symbiotic relationship between materials and civilization has been receiving increasing attention in recent years. In this article a brief history of the nonferrous metals in antiquity is narrated. The metals include gold, copper, silver, lead, tin, mercury and tin. A few alloys of antiquity, in particular electrum, tumbaga, arsenical and tin bronzes, are also described. Further silk and diamond have been added in view of the prominence they have enjoyed since antiquity. The historical development of these materials is viewed against the geographic landscape of continental Africa, Asia, Europe and America. The transition from the predominant use of one material to that of another material is discussed from technical and socio-cultural perspectives. The anticipation of modern science in ancient metallurgical practice is a recurrent theme.

SHAPING OF BRONZE IN ANCIENT INDIA – SOME CASE STUDIES FROM SOUTH INDIA

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ABSTRACT

The history of metals and their shaping is as ancient as the history of civilization. Many of the artifacts excavated and preserved as well as some of the metallurgical arts still being practiced are standing examples depicting the excellent metallurgical skill possessed by mankind. The Indian subcontinent too stood at par with the rest of the world in ancient metallurgical skills and expertise. Indian artisans and craftsmen had been great masters in extracting and shaping metals and alloys. Indian craftsmen's knowledge of metallurgy predates technologies of many other civilizations. Archaeological finds from the 2nd and 3rd millennium BC testify to the antiquity of the Indian metallurgical knowledge. Further, these metallurgical arts revealed the presence of a high degree of technical excellence in shaping metals and alloys in general and bronze in particular as a single system. This presentation brings out the case histories of the study carried out by the authors on a few ancient metallurgical arts of shaping bronze, which are still being practiced namely, Arammula metal mirror making, Kadavaloor high tin bronze eating bowl and gong making and lost wax process utilised for making icons, utensils and bells in Swamimalai and Mannar.

ASPECTS OF THE HISTORY AND METALLURGY OF GOLD IN INDIA IN EARLY TIMES

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ABSTRACT

Gold has fascinated the mankind worldwide, and India is no exception. In fact, India has a very old and rich history of gold. In the present paper, various aspects of the history and metallurgy of gold in India from the earliest times till the beginning of the Christian era on the basis of literary evidences have been discussed. It has been shown that India had an abundance of gold right from the beginning of the *Rgvedic* age. Various aspects of mining, extraction, refining, melting and fabrication were known to people, and these are discussed. A novel variety of gold powder known as *Pipīlika* or Ants' gold as described in the great epic *Mahābhārata* has also been discussed. *Suvarṇabhūmi* and *Suvarṇadvīpa* were a sort of El Dorado for the traders and explorers in ancient India. It has been shown that gold was brought to India from these places in the ancient time.

BRONZE ICONS

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ABSTRACT

Art objects are scientific marvels which reflect the history, tradition and cultural heritage of a country. Investigations on art objects are undertaken for scientific and comprehensive fingerprinting and authentication and also to help in restoration/conservation. One of the outstanding art objects of India is the South Indian Bronzes. Famous for their aesthetic beauty, iconometry, iconography, and casting quality of high order, they are standing examples of the fusion of technology with cultural traditions. This paper outlines the lost wax process used for making these bronzes and also the results of the non-destructive analysis carried out on more than 100 rare South Indian Bronzes. Radiography revealed the presence of porosities as the major defects while X-ray fluorescence revealed that copper is the major constituent of all icons with additive elements such as Sn, Pb, and Fe present with varying compositions. Microstructural studies revealed the presence of large pores and cavities combined with gray phases and globular particles. Analysis also revealed that the ancient science and technology of casting the icons was rather qualitative, empirical and adhoc with rather small amount of theoretical underpinning.

ARCHAEOMETALLURGY OF ANCIENT INDIAN COPPER

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ABSTRACT

Copper is one of the most important metals in the history of the Indian sub-continent. Some extractive and physical metallurgical characteristics of ancient Indian copper have been reviewed. Physical metallurgical observations provide information about the extraction methodology of ancient copper. Analysis of microstructures reveals interesting and important clues about the possible material extraction and thermomechanical processing route(s) employed. These characteristics have been illustrated with examples. The need for a detailed study of ancient Indian copper objects, collaboratively involving archaeologists and metallurgists, has been set forth. As the electrochemical behavior of ancient copper is almost similar to that of modern copper, an important result of the study of ancient Indian copper is the serious consideration of selecting copper as the material of construction of canisters for long-term underground storage of nuclear wastes. Characterization of surface patina on archaeological copper objects sheds light on understanding long-term corrosion mechanisms in copper and validating theoretical models for predicting long-term corrosion.

ZINC AND RELATED ALLOYS : THE PIONEERING TRADITIONS IN THE ANCIENT AND MEDIEVAL INDIA

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ABSTRACT

India achieved the distinction of being the only country in the ancient and the medieval world to produce pure zinc metal and high zinc-brass alloys. This article provides a brief summary of the pioneering traditions in zinc and related alloys in ancient and medieval India. It also includes hitherto unpublished material on the Bidri alloy.