
Symposium: Archaeometallurgy

Paul Craddock

Pre-mechanical tin smelting in the Nok Region, Nigeria

Yashim Isa Bitiyong

Tin ore has been known and smelted on the Jos Plateau and adjoining lowlands of the Nigeria middle belt for a millennium. Two recorded instances of cassiterite smelting at the settlement of Liruein Delma in 1910 and 1918 give an insight into the nature of this technological achievement. Tin oxide was collected from streams and rivers and smelted in clay furnaces. The furnace was an upright conical cylinder with holes at the rear. These allowed insertion of clay tuyeres, with skin bellows attached. The smelting process involved filling up a furnace with alternate layers of cassiterite and charcoal. These contents were lit and kept heated for hours by the aid of draught forced in through the tuyeres. Refining involved reheating of the metal in an earthen bowl. To separate the metal from impurities, the liquid tin was scooped into moulds where it solidified and was ready for local consumption or distant market(s). The exchange network of pre-colonial West Africa is understood to have aided the spread of early metal technology seen in the Nok and Agadez of sub-Saharan Africa.

Leads anchors and ingots from Is Piscinas

G.M. Ingo, D. Salvi, G Chiozzini, GH Bultrini and T. de Caro

During a series of surveys along the coast of the Montevecchio mine basin (south -western Sardinia, Italy), several Phoenician, Punic and Roman anchors from shipwrecks have been found at Is Piscinas. It is worth noting that these ships are characterised by the presence of charges of lead ingots and further, other lead ingots have been found scattered along the coast. 11 Roman lead anchors and some lead ingots have been studied. Some were manufactured during the time of Hadrian (AD 117-138), while others are similar to the late Republican ingots found also in Sardinia (first half of the 1st century BC). Others ingots have a very different form, although no marks or signs have been observed on them. The most important lead ore deposits of Sardinia have been sampled and lead isotope ratios were determined. From the comparison between the lead isotope ratios for the lead ingots and anchors it is possible to identify two main sources, namely Spanish lead mines and the Montevecchio basin. In particular, evidence from the Sardinian lead ore source, shows that it was exploited to produce the later ingots.

Microchemical studies of Aes Rude from treasures (Montevecchio mine basin, south-western Sardinia Italy)

G.M. Ingo, D. Salvi, G. Chiozzini, G. Bultrini, and T. De Caro

During a series of surveys in the Montevecchio mine basin several mining and smelting sites have been identified where lead, copper and silver were produced during the Punic and Roman period. In this area, at Terrasebis a large amount of *Aes Rude* dating back to VI BC has been found. These findings indicate a foregoing pyrometallurgical activity with the presence of a metal production centre very close to the metal ore deposits. The *Aes Rude* were made to no fixed weight and their colour varies. The differences between the *Aes Rude* found in other zones of Italy, and those from Terrasebis are due to their very large different chemical compositions and microchemical structures, which have allowed for classification of these materials. Lead isotope analysis for the metal ores from Montevecchio basin and for the *Aes Rude* found at Terrasebis suggests local production. The above cited results indicate that several types of *Aes Rude* were contemporaneously produced at Terrasebis and that the leaded-copper production has not superseded the practice of making highly ferruginous copper but both were produced at the time.

Archaeometallurgy in southern Levant. Faynan/Jordan. A case study

Mohammad Najjar

Starting from the ninth and eighth millennia BC the presence of the copper ores has become the main focus of human activities in the area. Copper ores in the form of "green stones" (Malachite and copper silicates) were collected and redistributed in the eastern Mediterranean. These stones were found in the course of archaeological excavations in many Pre- Pottery Neolithic sites. Jewellery and cosmetic powders were manufactured of these "green stones". The source of all these Neolithic stones and almost all the Chalcolithic copper artefacts was the copper ore deposit enclosed in the Middle and Upper Cambrian White Sandstone of "Araba and more precisely Faynan. With the progression of know-how at the end of the fourth and the beginning of the third millennium the lower ore-bearing deposit both in Faynan and Timma have become the

main source of copper ores. Copper ore mining in the area continued, with some lapses through the Bronze, Iron Ages, Roman/Byzantine periods and Islamic era. The latest archaeological evidence for copper mining and production came from an Ayyubid-Mamlouk village in the fourteenth century AD.

Analysis of artefacts from Anyang Site during the Bronze Age

Chunyan Zhao and Jigeng Tang

About 100 bronze artefacts of the Shang Dynasty from Anyang site have been analysed by inductively coupled plasma spectrometry and atomic absorption spectrometry. The results of the analysis are compared with previously unpublished analyses of contemporary material from Yanshi site and with small finds of the same period from Erlitou site. The comparisons show both similarities and differences in techniques and alloys of the various civilisations and classes of objects.