



Paper

## From Orechalkos to Paktong: Common and uncommon copper alloys and casting techniques from the Bronze Age to the 16th century

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### Abstract

The paper will briefly outline the development of copper alloying traditions from the beginning of the Bronze Age to the 16th century based on a database of more than 25.000 European analyses. A special focus will be put on some unusual alloys that have been identified in recent studies of objects from different periods. A number of case stories will range from special surface coatings in the Bronze Age to the remains of alchemy in the Renaissance.

Furthermore, new knowledge about the use of copper alloys in the Roman Iron Age has been achieved by larger series of analyzes of finds from graves and votive deposits combined with statistical evaluation of the results.

Finds from Danish excavations has recently shown two different technologies used for casting of copper alloys in the 15th century. From Elsinore, Copenhagen, Ribe and other places, fragments of imported, probably hessian, crucibles are known. Often used for the casting of tin-bronze or leaded tin-bronze. Opposed to these highly refractory crucibles stands a number of apparently very large crucibles made from ordinary clay. Impressions in the clay shows that it was applied as a lining within a kind of basket made from iron, and the vitrification of the surface reveals that they were heated from above. The remains are interpreted as a kind of ladle described by Biringuccio in *De la pirotechnia*, published in 1540. The ladle served both as a container for the molten metal and as a sort of furnace.

All of the examined fragments of Biringuccio type ladles have been shown to having been used for the casting of a bronze with a fairly low tin content and a high content of antimony. Some of the bronzes were heavily leaded.

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