

EXPERIMENTAL RECONSTRUCTION OF BRONZE AGE CHALCOPYRITE SMELTING

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Since 2012 archaeo-metallurgical experiments are conducted within the FZ HiMAT research program (History of Mining Activities in the Tyrol and adjacent areas – impact on environment and human societies, University of Innsbruck) with the aim to reconstruct Bronze Age smelting techniques by employing traditional methods from the Himalaya region, Nepal. Starting point are well documented archaeological records of Bronze Age copper ore smelting sites in the Eastern Alps (GOLDENBERG, 2004), ethno-archaeological records of contemporary copper ore smelting in Nepal (ANFINSET, 2011) and mineralogical analysis of smelting products. The applied method combines the knowledge of the involved disciplines in order to approach as close as possible the reconstruction and reproduction of Bronze Age smelting technologies.

Smelting and roasting experiments were performed during several workshops in Jochberg, North Tyrol. The camp locality has been chosen because of its original situation in the midst of a Bronze Age copper ore mining and smelting district. In preparation of the experiments local copper ores from historic mining dumps were collected. The smelting hearth (rather than furnace) was set with local stones and completely covered interiorly with clay. Several portions of the ore concentrate (chalcopyrite + pyrite + quartz) were smelted with charcoal, using two leather bellows, each one attached to a bended tuyère. The aim of the first smelting was to produce matte. The matte was grinded into powder with stone tools and mixed with cow/horse dung. Pellets of this mixture were roasted in an open wood fire (roasting hearth, about 2 hours) and then left over night until the ongoing reaction was completely terminated and the material showed a dark red colour as a sign of successful roasting. The roasted matte was then smelted again with charcoal under the tuyères in order to obtain copper like it happens in Nepal. To date, this last step of the process could not be reproduced in a satisfying manner during the experiments. To identify the reasons for the failure the products from the experiments as well as from the Nepalese smelting process are analysed and compared using microscopy, RDA and electron microprobe analysis. The results of the experiments are presented in this paper, which also raises the issue of how several methodological approaches may be combined in order to better understand ancient copper smelting technology. (Project funding: Tyrolian Science Fund, TWF, Austrian Science Fund, FWF).

ANFINSET, N. (2011): Social and technological aspects of mining, smelting and casting copper. An ethnoarchaeological study from Nepal. Veröff. Dt. Bergbau-Museum Bochum 181.

GOLDENBERG, G. (2004): Ein Verhüttungsplatz der mittleren Bronzezeit bei Jochberg (Nordtirol). In: WEISGERBER, G., GOLDENBERG, G. (eds.): Alpenkupfer – Rame delle Alpi. Der Anschnitt, Beiheft 17, Bochum 2004, 165-176.