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# New Evidence of Archaeometallurgical Activities During the Bronze Age in Trentino

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## The Project

Since 2005, the Archaeological Heritage Office of Trento, in the context of its activities to safeguard the regional archaeological heritage, has commenced extensive archaeological investigations at several smelting sites. Within this framework, wider archaeometallurgical research is being carried out in collaboration with the Department of Geoscience of the University of Padua and the Materials Engineering Department of the University of Trento. The main aim of this research is to improve our understanding of the technological and physicochemical processes regarding the extraction and smelting of mineral ores in the Trentino region. The starting point is represented by the archaeological data available from stratigraphic excavations.

This research includes several activities:

- Revision of available archaeometallurgy bibliography;
- Archaeological study of the findings uncovered in smelting sites (millstones, hammer stones, tuyères, etc.);
- New excavation activities in sites known for slag accumulations.

These activities lead to:

- Catalogue in a database of quantitative and qualitative characteristics of slags uncovered in the smelting sites;
- Chemical and mineralogical analyses on slags, mainly by the research team directed by Gilberto Artioli (Anguilano et al., 2002);
- The experimental reconstruction of smelting furnaces. This aims at reproducing the technological aspects and the different phases of the smelting process, still largely unknown.

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\* The contribution of the authors is equivalent.

## Background

Archaeometallurgical studies in Trentino have a significant background: the first research projects were carried out by Ernst Preuschen in the sixties (Preuschen, 1968) and Giuseppe Šebesta in the eighties (Šebesta, 1992). Since 1968 further smelting areas were found by Renato Perini during systematic archaeological excavations (Perini, 1992). Since 1981 the Archaeological Heritage Office of Trento and the Deutsches Bergbau-Museum, Bochum (Germany), have been undertaking a systematic investigation of prehistoric smelting sites (Cierny, 2008; Cierny et al., 1998).

Evidence of ancient metallurgical activity in Trentino has been found in many archaeological sites which date back to two distinct periods: the Late Copper Age-Early Bronze Age and the Late Bronze Age. At this moment the research is mainly focusing on this second phase, in which the ore deposits most commonly utilized were largely made up of mixed copper sulphides, chalcopyrite in particular. The smelting activity took place in mountain areas above 1,000 m asl, in eastern Trentino. This is demonstrated by slag accumulations and the remains, although rarely preserved, of smelting furnaces built on slopes near water and timber resources. Contrary to what has been found and what is known north of the Alps, in this region no ancient mines have been identified yet. The end product of the whole smelting process is also not yet known, as findings (such as black copper, copper ingots) are still unavailable. However, some hypotheses about the origins of copper ores have been advanced on the basis of chemical and mineralogical analyses of slags (Cattoi et al., 2000).

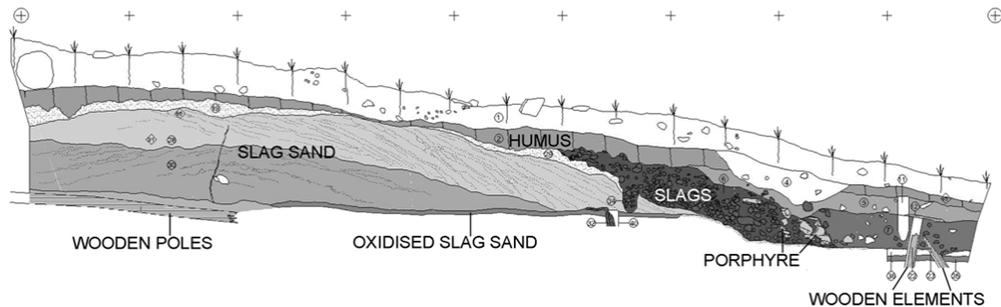
## New Excavations

We are currently carrying out new excavations in three smelting sites: Segonzano Peciapian (Cembra Valley, number D1-18 in Cierny, 2008), Transacqua Pezhe Alte (Primiero area) and Luserna Platz von Mozze (Luserna and Lavarone Plateau). In Segonzano a large accumulation made up by slag sand alternated with slag layers and millstones have been found (Fig. 1). This site is particularly important as it is located in a peat bog and the conditions make the conservation of organic material possible. Radiocarbon datings place the site chronologically between 1400 and 1000 cal. BC. The research includes dendrochronological and palynological analyses, aimed at investigating the environmental context and the utilization of the landscape during the exploitation of the smelting area. At the bottom of the deposit, under the slag sand, horizontal wooden poles have been found. They have been interpreted as functional structures, such as drainage or containers for waste materials. Preuschen found a similar structure in Vetriolo, close to a mining dump (Preuschen, 1962).

Excavation in Transacqua unearthed some slag accumulations, parts of demolished furnaces and stone tools, dating back to the Late Bronze Age.

The research carried out in the site called Luserna Platz von Mozze, already known in the archaeological context thanks to previous surveys and excavations (Cierny, 2008), involves extensive investigation. A large area dedicated to prehistoric metallurgical activities has been unearthed (Fig. 2). Two phases have been recognised, but the complete chronology of the archaeological materials found is however substantially homogeneous and can be referred to the Late Bronze Age. The probable remains of two smelting furnaces, with a N-S orientation and at a distance of about 5 m from each other, have been found. Some long oval shaped structures with burnt clay and surrounded by stones have been identified but not yet excavated. The hypothesis is that they may be roasting beds. The site is not directly related to the presence of ore nearby, the closest copper mines being at Calceranica and Vetriolo in the Valsugana, both about 10 km to the North.

The extensive investigation of the sites, through small trenches, has revealed that there are smelting areas of different dimensions: the dispersion area of slags is about 1050 m<sup>2</sup> in Segonzano, 1150 m<sup>2</sup> in Transacqua and about 4000 m<sup>2</sup> in Luserna.



*Fig. 1. Segonzano Peciapian: cross section of the deposit.*



*Fig. 2. Luserna Platz von Mozze: general view of the excavation area.*

## The Slag Database

The slag database records the visual and macroscopic characteristics of the fragments, in order to recognize typological classes and differences between site samples. The main aim of the research is to understand why slags are so macroscopically different and to reconstruct the phases of the chaîne opératoire. At this moment the database has recorded 2000 slags from Luserna, Segonzano and Transacqua.

The database fields are: slag type, sides, thickness, weight, presence and type of edge, quartz presence/absence, max diameter of quartz pieces, presence of sand, copper oxide, iron oxide, charcoal alveola, slag fragments included, hypothetical diameter of the entire slag. The analysis of the recorded characteristics highlighted five different clusters.

The quantitative analyses are particularly complete in Luserna, where a slag area has been sampled with the aid of 30 x 30 cm excavation trenches.

## Gardolo di Mezzo

Gardolo di Mezzo is situated in the Adige Valley, about 5 km to the north of the city of Trento. It is a very important example of the presence of metallurgical remains in a place of settlement and worship, not specifically used as a smelting area. This fact is probably connected to the exploitation, during the Bronze Age, of the mineral resources of the Monte Calisio nearby, a well-known mining area in the Middle Ages (Brigo and Tizzoni, 1997).

The site has provided traces of a large settlement and two tumuli have been found nearby, with a complex stratigraphic sequence in which colluvial lenses alternate with anthropic structures.

The more ancient levels of one of this platform have brought to light a subcircular burial mound with a subrectangular enclosure covered by stones. The anthropological studies carried out on skeletal remains showed the presence of a buried individual of about 5 years  $\pm$  16 months of age. Inside the enclosure there were 12 pieces of slag and a ceramic jug which can be dated to the beginning of the Early Bronze Age.

The area was frequented from the Early to the Late Bronze Age, but the chronology for the founding of the structures may be further anticipated as more research is carried out. The presence of many coarse slags and several millstones in the whole area suggests intense activities for the production of copper in the various phases of occupation. These data are particularly significant given that, until the discovery of the Gardolo di Mezzo site, evidence of metalworking activities in the Trentino region was concentrated in two distinct geographical and chronological contexts, leaving a substantial chronological gap between the Early Bronze Age and the Late Bronze Age.

## Conclusion

Archaeological evidences in Trentino show that copper ore deposits have been exploited intensively throughout Prehistory. The smelting process is still largely unknown but the research carried out until now is providing important information about ancient technology. We expect that the gap of knowledge will be filled by the laboratory and field work.

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