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Abstracts

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Finding the invisible smelt: using new attributes to find the furnace

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During the fieldwork season of 2010, the Ferricum Noricum Project at Hüttenberg (Austria) undertook a short campaign of experimental iron smelting. During the last smelt, the furnace had to be breached to retrieve the bloom. Afterwards, the landowners requested that the site we had been using be cleared and returned to its original state. This cleaning event presented an invaluable opportunity.

The experimental smelting area was transformed from something recognizable, to something entirely unidentifiable. Any stranger to the site would have extreme difficulty in judging what events had previously taken place. It became our aim to record the remains. How visible were the smelting episodes after significant post-depositional disturbances?

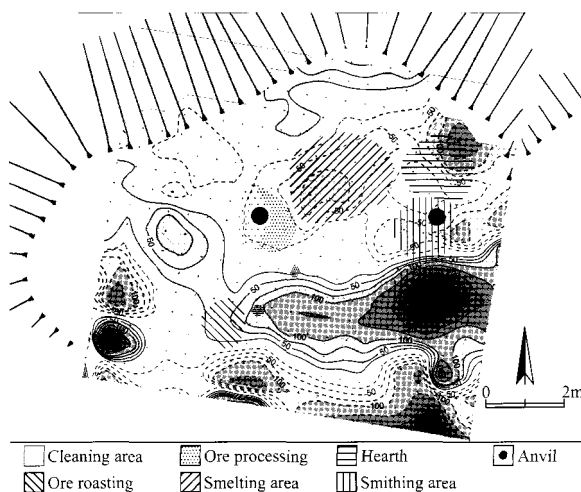
The fieldwork methodology employed were a combination of standard fieldwork techniques combined with techniques dedicated to the recovery of archaeometallurgical residues (Bayley et al 2001; Bayley et al 2008). A topographic fieldwork survey was carried out along with a geomagnetic survey (Figure 1). Attempts were made to collect surface debris via a magnetic survey, but the magnetic nature of the secondary disposed gravels rendered this technique ineffective. Features were finally recorded and excavated.

Geophysical prospection by means of geomagnetic mapping is based on contrasts in the magnetic susceptibility of the archaeological objects (e.g. furnaces) and the surrounding natural soils and rocks. These variations cause anomalies in the earth magnetic field which can be measured with a proton precession magnetometer. Shape and intensity of the magnetic anomalies give information about the dimensions and the type of the soil monument. In the working area of the smelting experiment in Knapenberga a geomagnetic survey has been conducted. 346 measuring stations with a grid size of 0.5 x 0.5m covered an area of 10m by 9m (maximum). The intensity of the total magnetic field (TMI), the vertical gradient (VG, sensor level 0.5m and 2m) as well as the magnetic susceptibility K on the ground level has been observed.

Figure 1 shows the result of the magnetic survey with archaeological features on top. Positive anomalies of the TMI are shown by grey shaded areas with solid lines while negative areas are grey shaded with dashed lines. The maximum intensity of the TMI (+300nT) can be identified in a zone between the smithing area in the southeast and the ore roasting area in the center which fits well with the data of the susceptibility measurement. The area of the furnace where high values of K have been observed, is characterized by a negative anomaly of the TMI (-150nT). The hearth and the northern smithing area (lower values of K) appear as negative anomalies with a minimum intensity of -250nT. The magnetic dipole at the western border of the measuring area is likely caused by a shallow buried metallic body.

The geomagnetic mapping and the archaeological evidence confirm that heating episodes had taken place. This information alone, however, would not be able to specify the nature of these heating events. It quickly became apparent that, despite the adoption of dedicated fieldwork techniques combined with standard methods, the smelting activities that had taken place were virtually invisible. Whilst the

Fig. 1: Results of the magnetic survey.



exercise provided a critical evaluation of fieldwork methods, it also yielded further information concerning the discovery of 'the smelts'.

The construction and repair of the furnace had produced a fine lens around the structure, consisting of a mixture of ash, fired clay, raw clay and charcoal fragments. These attributes clearly distinguished the furnace vicinity from other areas of burning, such as the smithing hearth and ore roasting area. The ore roasting had left a coarse residue. Despite the ephemeral nature of our short campaign of smelting, these lenses provide an invaluable insight into the events that occurred. These fine lenses, which we term 'attributes', may imply the occurrence of smelting. It is these attributes that this paper wishes to emphasize, and these attributes that should be considered in future archaeological investigations, where smelting may be implied.

The attention made to the lenses helped shed new light on the archaeological evidence recorded from the Roman smelting complex of Hüttenberg (see Cech 2008). All furnaces recorded so far have yielded a wealth of information concerning aspects of Roman smelting. Much of the material associated with smelting, such as furnace debris, slag and rubble, have often been used to infill areas. This year, we looked upon such debris more suspiciously. In light of the excavated remains of the experimental smelt, layers normally interpreted as infill may also contain heavily disturbed traces of smelting activities. During excavation, lumps of raw and tempered clay no longer were regarded as infill products. Similarly, coarse textured purplish-red lenses looked surprisingly similar to the residual deposits generated through experimental ore roasting. These archaeological features could be further be understood in terms of furnace production and ore processing respectively. Associated with contexts containing mixed layers of burnt material, raw and fired clay, these attributes may provide the negative imprint of heavily disturbed/removed furnaces, which can be distinguished from other heating activities.

The minor traces left behind after the experimental smelt, the 'attributes', may act as a referent and be applied to archaeological contexts in order to reconsider and re-interpret those same attributes discovered archaeologically.

Alone, these individual attributes may not seem that significant. When considered together, they can prove fundamental in identifying the invisible smelt.

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