Geophysical prospection of subsurface monuments in a highly noisy environment

Walach, G.K. [1] **& Scholger, R.**[1]

[1] Department of Applied Geological Sciences and Geophysics, Chair of Geophysics, University of Leoben, Peter Tunner Str. 25, 8700 Leoben

The investigated area in Semlach near Knappenberg (Carinthia) was a Roman iron production site between the 1st and the 4th century A.D. Due to the long period of industrial utilization, a considerable number of relics (walls, melting furnaces, slag heaps, etc.) have been preserved in the subsurface. The delimitation of such monuments by means of geophysical prospection is based on contrasts in their petrophysical parameters compared with the natural soil or under laying rock. In general, relics of iron production processes with a high magnetic susceptibility can be identified with relative ease in a magnetic survey, e.g. by high (dipole) anomalies. The variations of the total magnetic field exceed 2000nT for huge slag heaps and reach up to 500nT for smelting furnaces. Contrastingly, minor decreases of about 250nT, may give evidence for buried walls.

Recent archaeological excavations on the site Semlach yielded remains of a large building, which is assumed to be a roman depository. For the prediction of the further extension of the external walls, a combination of different geophysical methods was applied. A magnetic survey with an extension of 34 x 45m and a grid of 0.5 x 0.5m was executed using GEM proton precession magnetometers. The apparent conductivity and the inphase response of the soil were measured with a Geonics EM38 electromagnetic instrument. Additionally, the resistivity method (geoelectric mapping and multielectrode geoelectrics) and the self potential method (SP) were applied on selected profiles crossing the excavation area.

The new results from the site Semlach yielded several zones of relative minima of the magnetic field over the suspected areas, which were indicative of walls. However, the interpretation was complicated by a highly noisy background, which was caused by deposits of slag from the iron melting process. Such slags were extensively distributed in the surrounding environment. They are characterised by high magnetic susceptibility values (max. 3796 x 10^{-3} SI) and, thus, has a significant effect on the magnetic survey results, as well as on measurements of the electric conductivity and related parameters. The presented susceptibility models are based on an integrative interpretation of the different geophysical survey results and petrophysical measurements.