

Many areas in southern Poland are affected by historical mining and smelting activity. Since many centuries the exploitation of local ores and on site smelting of iron, lead or silver was carried out by applying primitive technologies based on charcoal as a fuel. Tracers of this activity can be found in many areas of Upper and Lower Silesia, Little Poland and Holly Cross Province. Currently, areas of former mining and smelting activity are located on forests, are wastelands or used for agriculture. Some of such areas are even used for recreational purposes or are protected as a nature reserve. Soils of these areas are in many cases developed on landfills of waste rocks removed from old mine or ash and slag layers remained after historical smelting. In the literature, such areas after lead and silver ore's exploitation are known as "warpie". These areas have a specific terrain morphology with numerous hills and pits, but sometimes geomorphology of such areas is not much different from the surrounding terrain and they are difficult to identify.

The aim of the project is using the combined geophysical methods (magnetometry, conductometry, electric resistivity tomography, induced polarization) for the precise spatial delineation of anthropogenic layers present in subsoils in areas of historical ore mining and smelting. The second aim of the study is an ecological assessment of the influence of the anthropogenic layers on surrounding water and soil environment.

The first stage of the study based on the field measurements using soil magnetometry will be done by surface measurement using MS2D Bartington apparatus and magnetic gradiometer GRAD 601-2 Bartington. On the basis of these initial measurements the location of soil magnetic anomalies will be revealed and the further geophysical prospection using conductometry, electric resistivity tomography, and induced polarization will be performed only on these anomalous areas. Based on integrated data from all applied methods the magnetic and electrical properties of anthropogenic material will be characterized and precise delineation of anthropogenic horizon or layer containing artifacts associated with former mining and smelting activities will be set. In the second stage, these anthropogenic layers will be sampled for chemical and mineralogical analyses, which are necessary for determination of the type and origin of wastes or artifacts, degree of the weathering and mineralogical transformation and the chemical composition of potentially toxic elements. The next step will be sampling of water infiltrating the anthropogenic layer and adjacent soil horizons as well as performing the leaching tests in laboratory using samples taken from waste material to assess the ecological impact of anthropogenic waste material on soil and water environment.

Study conducted in the frame of the project will allow the verification of the actual state of knowledge concerning the possibilities of integration of five different geophysical methods to improve the precision of determination the spatial and vertical extent of anthropogenic horizons. Applied analyses conducted on the buried historical waste materials will give information about their magnetic and geoelectrical properties, chemical and mineralogical stability/instability and will be helpful in ecological assessment of the potential risk for water and soil environment. The results of this study could make a significant contribution to a new branch of geophysics - Environmental and Engineering Geophysics, soil science, and history of mining and metallurgy development.