10.09.2018

Summary of Tomasz Małysa's doctoral thesis entitled:

"Application of the GPR method and Electrical Resistivity Tomography for solving of selected geological and mining problems in the mines of KGHM Polska Miedź S.A."

The doctoral thesis analysed the possibility of applying two selected geophysical techniques, i.e. the GPR (Ground Penetrating Radar) and ERT (Electrical Resistivity Tomography) to solve three issues specified by KGHM Polska Miedź S.A., i.e.:

1) Detection, from the mining excavations, the fractured zones induced by mining activity and natural fractures and zones of increased porosity. Such zones may accumulate water, gas, clay and watersand, while inflow of these media into the excavations may pose a danger to people and make it difficult or temporarily impossible to carry out efficient mining operations. Currently, the identification of water and gas hazards is carried out at KGHM on the basis of data obtained from the boreholes spaced every 20m to 30m, which provides only for a limited possibility of detection of dangerous zones.
2) Outlining of the zones of increased polymetallic mineralisation, containing Cu and Fe as well as, occasionally Ag and Pb. Currently, copper deposits are analysed along vertical profiles, located about 10m apart, at the sidewalls; sampling on each profile is carried out with an interval of 10÷20cm. As a result, exploration of the deposit in the vertical direction is very accurate, but much less accurate in the horizontal direction. As there was no information in the depth direction, the GPR and ERT methods,

supplemented by electromagnetic profiling (EMP), were applied to study polymetallic mineralization.

3) Detection of anhydrite bodies and breccia in the salt deposits from the boreholes, by means of the GPR method. Currently, the rock mass is identified in front of the excavation from a borehole drilled in the axis of the planned excavation. Such a technique does not allow for identification of the rock mass in the whole cross section of the planned excavation, drilled with a heading machine. Appearance of anhydrite in cross section of the excavation may damage the head of a heading machine adapted to soft salt. The presence of anhydrite located in the excavation or in its vicinity may result in the inflow to the excavation a gas (mainly hydrogen sulphide) accumulating in the anhydrite.

Application of selected geophysical methods, which are much more cost-effective than drilling, less time-consuming and less labor-intensive, non-invasive and most importantly, provide quasi-continuous information about the studied rock mass, allowed for detection of fractured zones, outlining of ore mineralization zones and detection of anhydrite in salt.