Vulnerability analysis on potash mining dumps using tomographic measurements, modeling and petrophysical investigations

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Extended Abstract

Germany is one of the largest conveyors for potash and rock salt in the world. Over time and during the process of production, more than 100 m high mining dumps of unexplored structure and material have formed. These dumps sites are now in the research focus, as they can become a hazard to human and environment. Especially the stability of these dumps has to be explored as vulnerabilities could occur through processes linked to subsidence, leaching and material conversion. Hazardous sinkholes, fissures and cavities are developed similar to the carstification processes in natural rocks.

Recently analysis include combined geophysical and petrophysical investigations for non-invasive characterization of the dumps. The measuring concept contains tomographic methods such as geoelectrics and seismics as well as grounds penetration radar (GPR), spectral induced polarization (SIP) and nuclear magnetic resonance (NMR). Within laboratory experiments (NMR, ultra-sound, electrical resistivity), rock and mineralogical properties were estimated. Using P-wave velocities and electrical resistivity's potential zones of weakness with probably decreased strength, increased permeability and water content are identified. Additional material properties as water solubility and rock material (e.g. solid or loose rock) were considered in the model developed with the software BERT [1]. An example of the resistivity distribution of one test site is shown in Fig. **1**. The loose material at the hillsides of the waste dump have a very high resistivity compared to the immediate underlying zone of very low resistivity, which has a high concentration of Halite. Furthermore, zones of high and low resistivity have been found in greater depths, which could indicate weak areas of for example washed out material. In conclusion, with the seismic survey the detection of the location of possible sinkholes is more explicit.

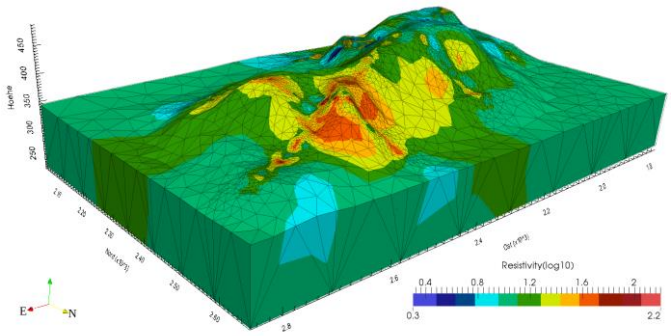

Figure 1: *3D Electrical tomography across the potash mining dump, Inversion using BERT [1]*

Key words: Mine dump, modeling

References

[1] Günther, T., Rücker, C. (2012): Boundless Electrical Resistivity Tomography BERT. User's tutorial.