

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

Supported by:

 Federal Ministry for Economic Affairs and Energy
 on the basis of a decision by the German Bundestag



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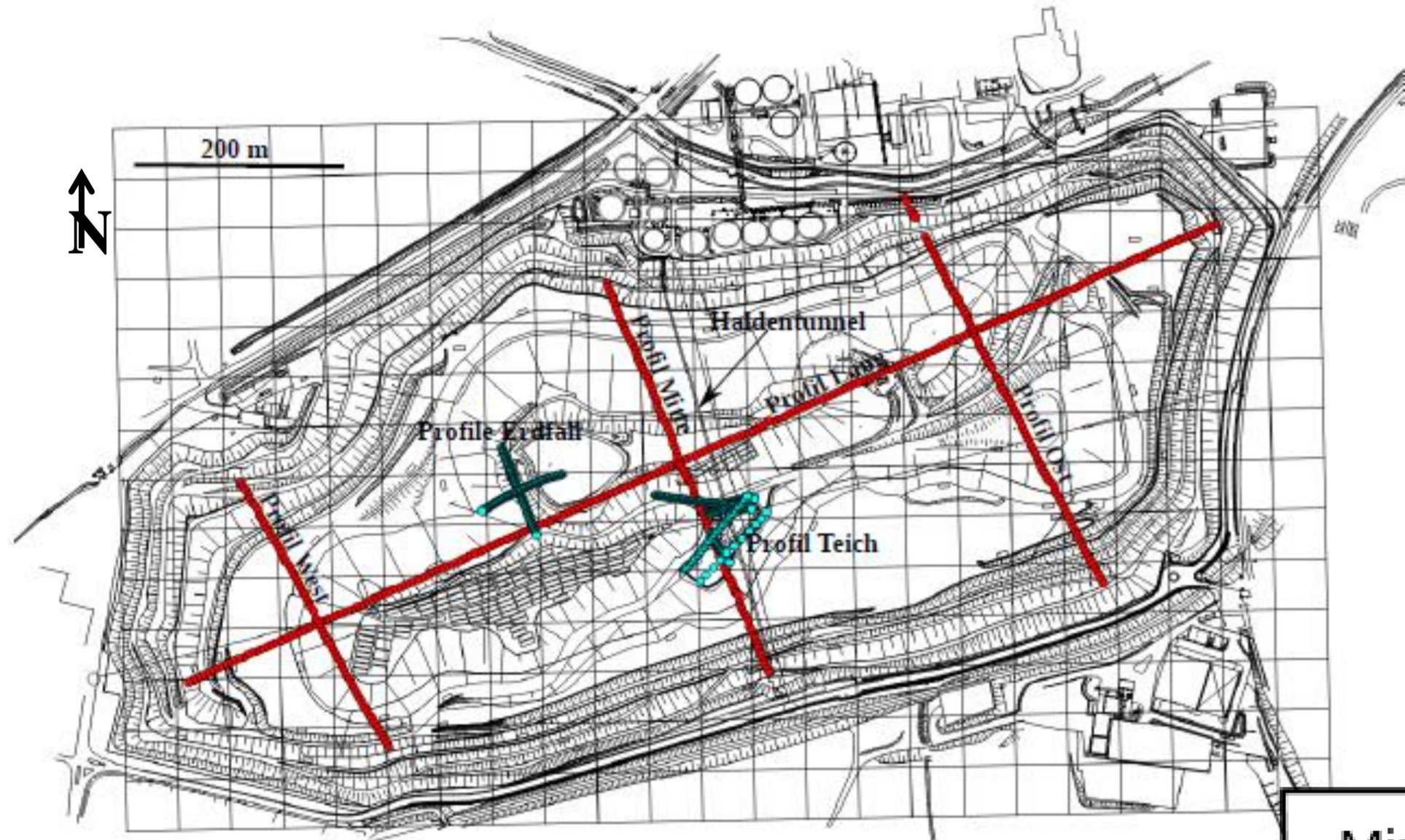
History:

- Germany is one of the largest conveyor for potash and rock salt in the world
- More than 100 m high mining dumps of unexplored structure and material
- Inside dumps there are subsidence, solution and eluviation processes and chemical actions -> hazards for human and environment

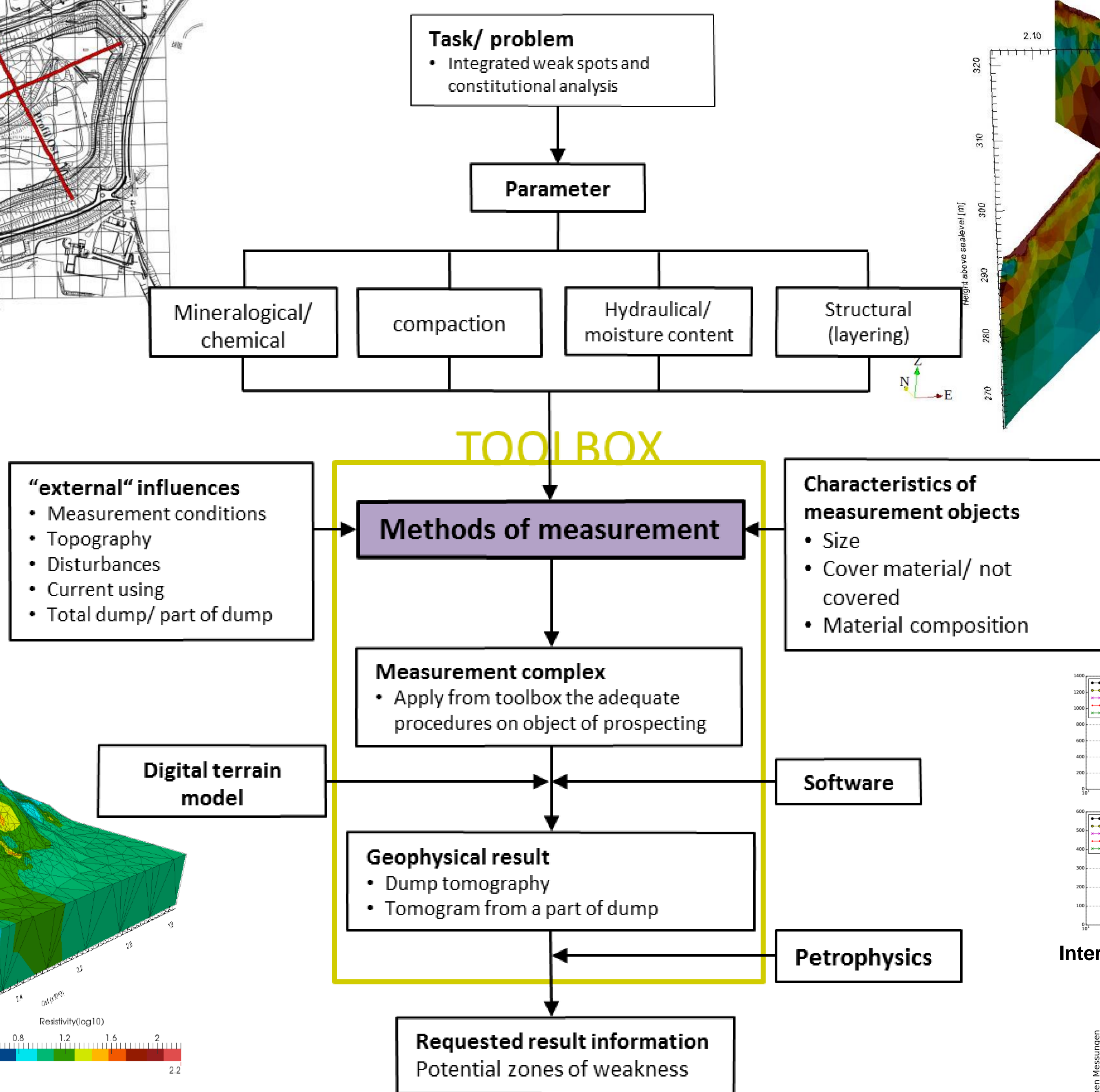
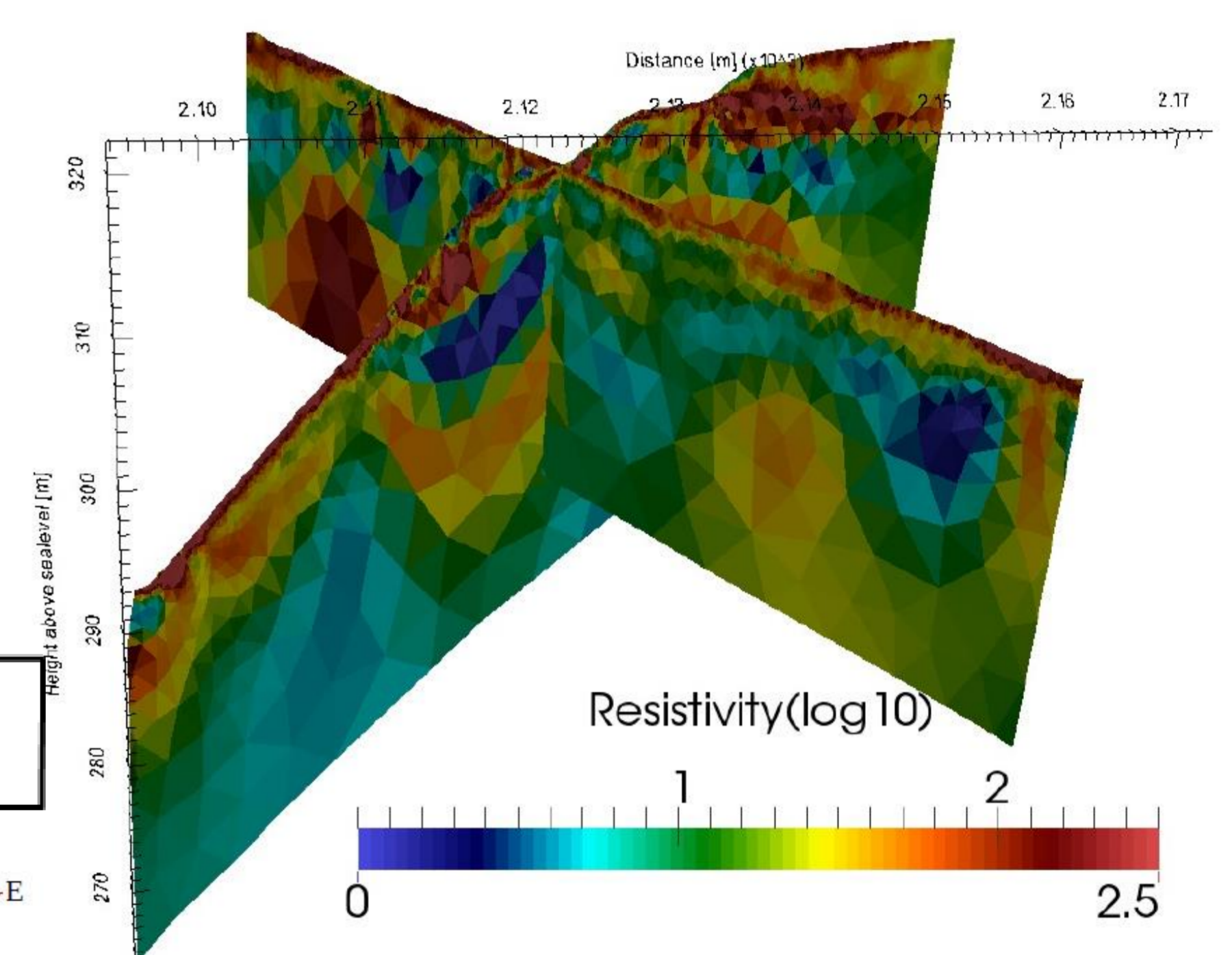
Aim:

- Knowledge about inner structure of dumps and their destabilizing acting processes with 12 profiles across the potash mining dump
- Identifying water content, increased permeability and decreased strength with P-wave velocities and specific electrical resistivity
- Explore stability of these dumps with combined geophysical and petrophysical investigations (e.g. geoelectrics, seismics, GPR, SIP, NMR)

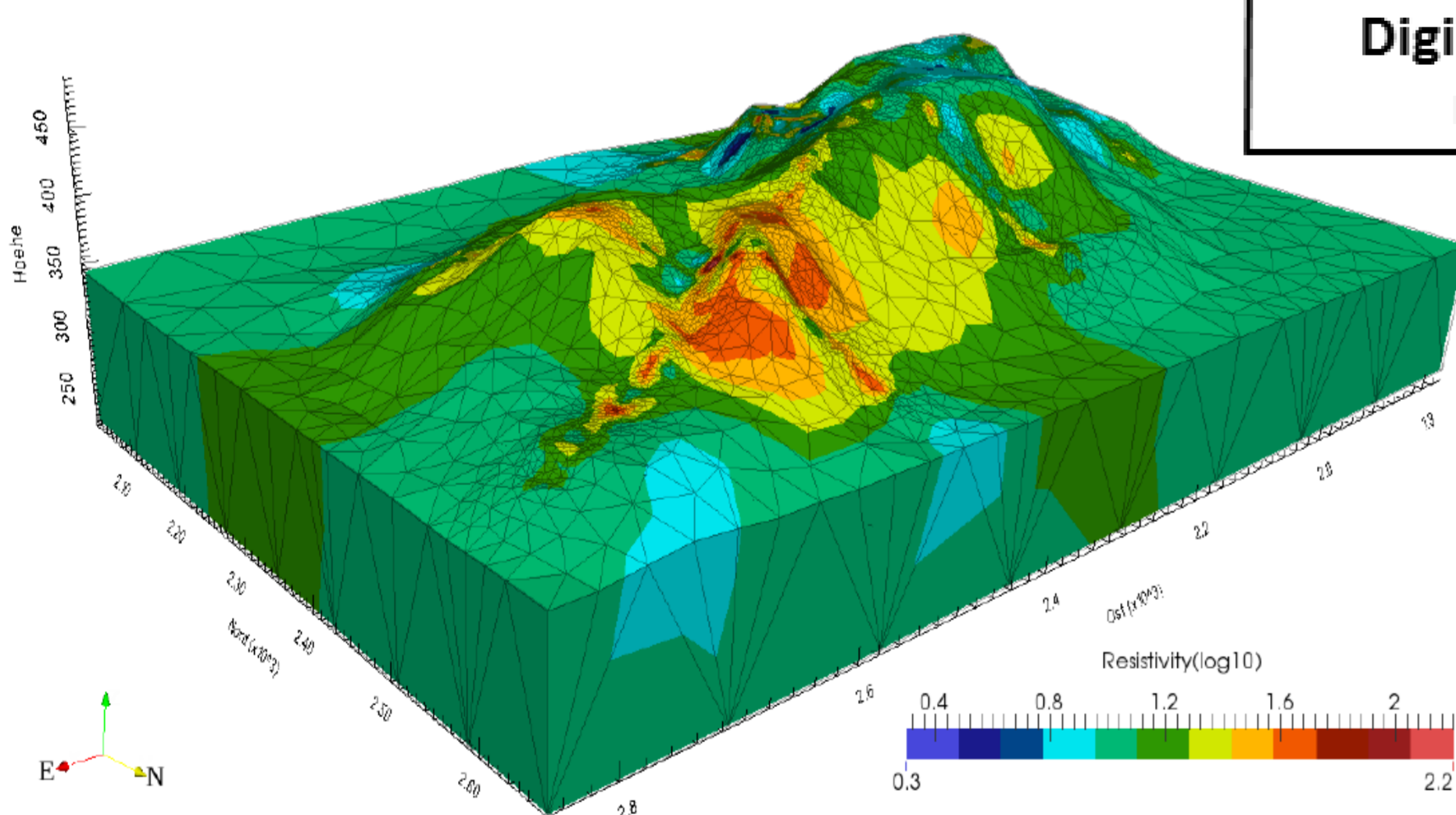
Study area potash mining dump Bleicherode with 12 profiles across the dump



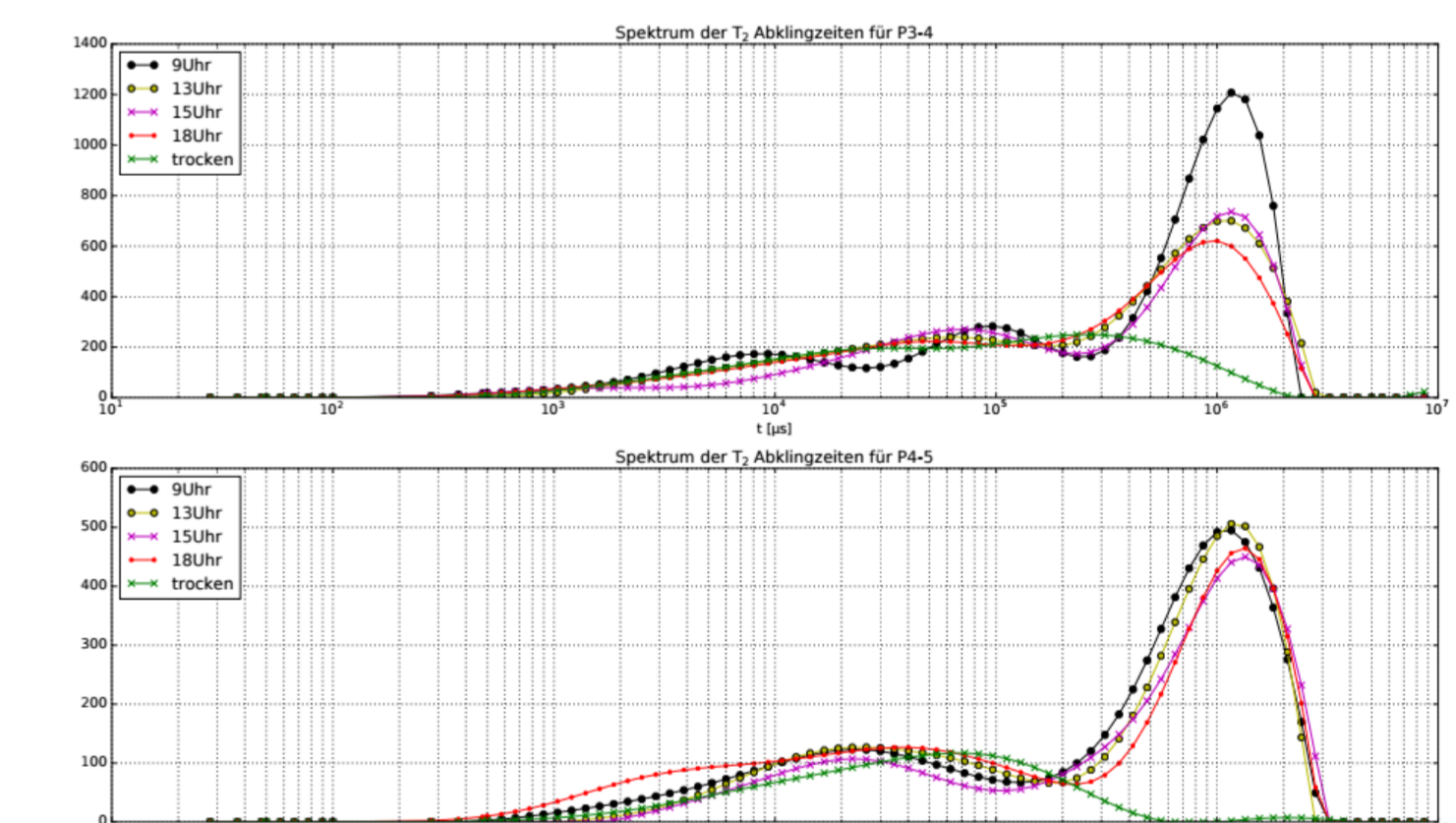
Results of geoelectrical measurements (2D-inversion profile at sinkhole)



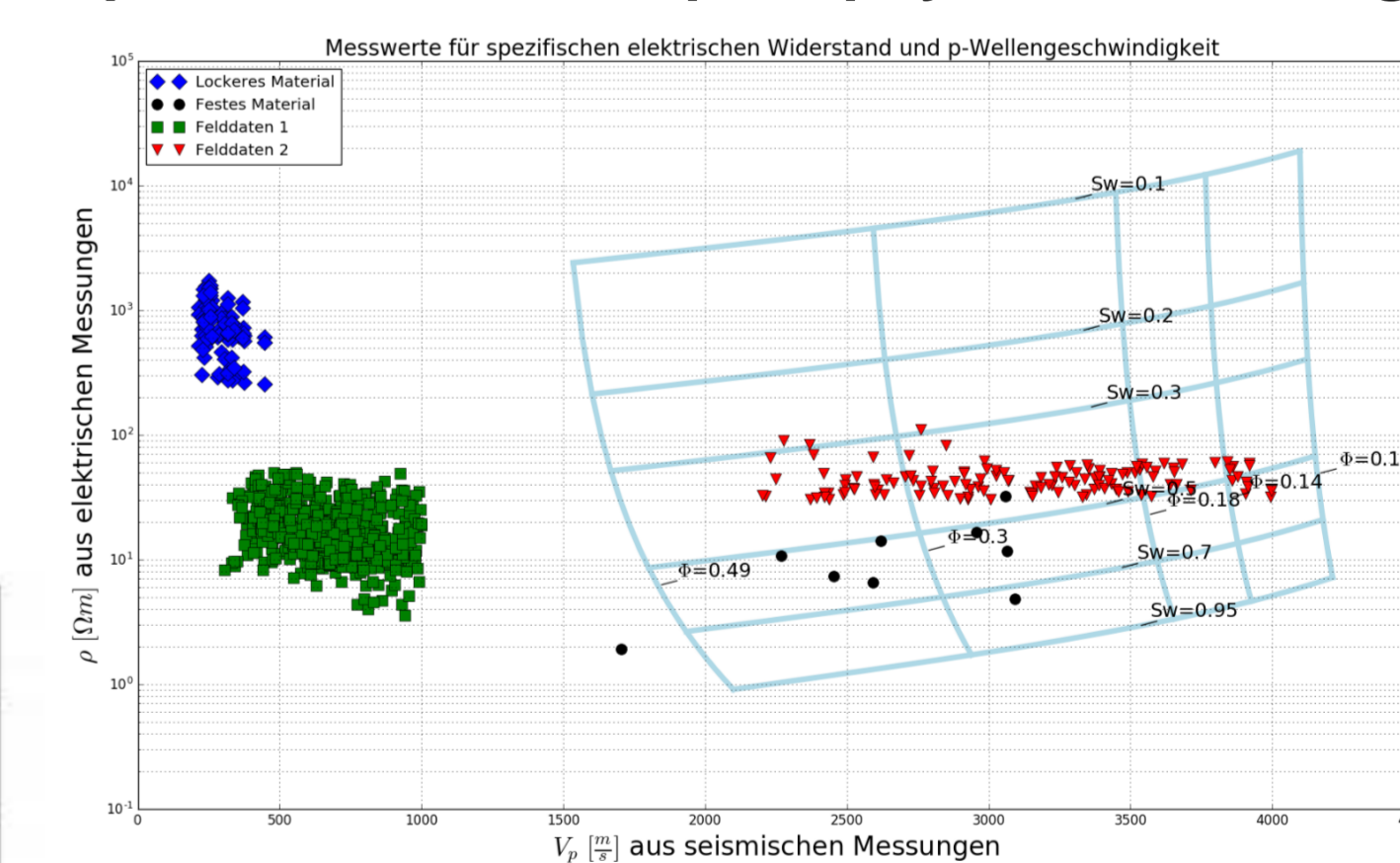
Combination of geoelectrical measurements and digital terrain model



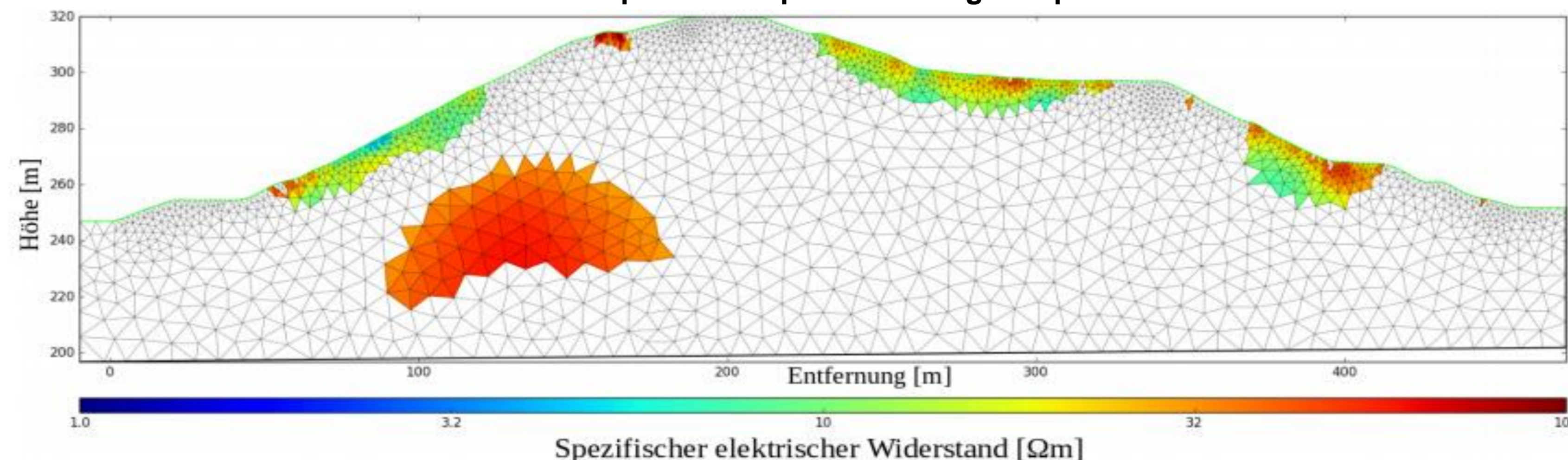
Results of NMR measurements



Interpretation based on petrophysical modelling



Potential weak spots of the potash mining dump Bleicherode



Summary:

In the course of the project, several measurement methods (e.g. geoelectrics, seismics, GPR, SIP and NMR) were tested at two potash mining dumps in Thuringia (Bleicherode, Sondershausen). Both dumps show instabilities because of their material content. The aim was to localize weak spots within the dump body.

The result of petrophysical measurements is a material model for the potash mining dumps which was correlated with seismic and geoelectric data to deduce porosity and water content / material variations which are connected to weak spots. At both dumps, 21 profiles were measured and tomograms were calculated. Seismic and geoelectrical measurements, as well as the combination of both methods, were qualified to find zones of weakness within a dump. GPR measurements are sufficient to detect shallow weak spots. For data processing, a special inversion application was used to assess all geoelectric, seismic and petrophysical data for a combined inversion. As a result of the inversion calculation, potential weak spots could be visualized in 3D-graphics. At the end, a toolbox with instructions for tomographic prospecting of potash mining dumps showing each potential procedure together with their operational criteria could be created."