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# A combined approach to extract remanent magnetization from magnetization vector inversions using an active source

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Measuring local perturbations in Earth's magnetic field is one of the most successful methods in geophysical exploration, even though it's inherent ambiguity. To avoid misinterpretations more and more interpreters gravitate towards techniques that allow including not only induced, but also remanent magnetization in the modeling process. One of these approaches is magnetization vector inversion (MVI), which has been successfully applied on many data sets with very promising results. However, in 3D modeling and inversion, this further increases the degrees of freedom, and therefore independent information on petrophysical properties or the geometry of the causative bodies are becoming more important.
The application of vector sensitive magnetometers or gradiometers, e.g. full tensor magnetic gradiometery (FTMG) systems, provides additional directional information. This is very useful, in particular in MVIs. However, susceptibility information is still necessary to perform a separation of the magnetization types. One possibility to gain such information, independent from Earth's magnetic field, is the application of electromagnetic systems, e.g. frequency domain electromagnetics (FDEM). This approach has been tested in archeological applications and even using airborne systems, yet the capability regarding remanence estimation is not fully explored. FDEM systems are mainly built for exploring the electrical conductivity.
In this study, we follow a robust staged approach, which includes dc-resistivity (electrical resistivity tomography, ERT), electromagnetic and magnetic (gradiometry, FTMG) measurements. Therefore, we can obtain a robust resistivity/conductivity model (ERT, EM) at the beginning. This will allow for a more stable inversion of the EM data in order to get susceptibility information. A MVI of the FTMG data will result in magnetization models, which can be separated into induced and remanent contributions by subtracting the susceptibility model.
In order to test this staged approach, we collected dc-resistivity, FDEM and FTMG measurements over a basaltic lava flow in the West Eifel Volcanic Field. This flow features a very high magnetization with significant remanence. It is covered by 5 – 10 m of fluvial sediments and has a thickness of about 10 – 20 m. Orientated rock samples for paleomagnetic analysis have be collected nearby to evaluate the magnetization directions calculated during the MVI. In this presentation we show the data and first results of this staged approach.