MAPPING CLAY SOILS USING TIME-DOMAIN INDUCED POLARIZATION AND ELECTRICAL RESITIVTIY SURVEYS

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Recent developments in multi-channel electrical resistivity systems allowed collecting Electrical Resistivity (ER) and Time-Domain Induced Polarization (TDIP) data simultaneously using multiple electrode arrays. The ER data is routinely used for mapping of near-surface geology and groundwater, characterization of contaminated sites, delineation of engineered structures, and locating voids and fracture zones. However, shallow groundwater and the presence of high fines content materials at survey sites result in ambiguity in identifying different soil deposits (e.g., sand vs. clay) using the ER results alone. On the other hand, the average chargeability of unmineralized sedimentary rocks derived from IP data increases with respect to clay content due to its ionic exchange characteristics, making the IP method a more powerful tool for mapping ore bodies and clay soil than the ER method. However, the signal to noise ratio (SNR) associated with the TDIP measurements is much smaller relative to the resistivity measurements, makes collecting, processing and interpreting the measured chargeability data challenging.

This work demonstrates few challenges associated with processing and interpreting TDIP and ER data through synthetic and field studies. The studies focus on dipole-dipole array configuration given its data acquisition speed advantage compared with other nested arrays. Additionally, this work presents strategies for editing TDIP data (e.g., dealing with negative chargeability measurements) and TDIP/ER processing approaches that offer potential improvements in the final ER and TDIP subsurface models. Despite the ER and TDIP limitations, the combined processing of both data types and other available data (e.g., from bore logs) improve the interpretation of soil heterogeneities and mapping clay soil.