EGU25-20829, updated on 28 Nov 2025
https://doi.org/10.5194/egusphere-egu25-20829
EGU General Assembly 2025

Airborne IP driven exploration for greenfield exploration: an application in the SEMACRET project

Francesco Dauti[1], Andrea Viezzoli[2], Jian Chen[1], Ana P Jesus[3], Isla Fernandez[4], and Gianluca Fiandaca[1]
[1]The EEMteam for Hydro & eXploration, Università degli Studi di Milano "A. Desio", Milano, Italy
[2]EMERGO s.r.l., Cascina, Pisa, Italy
[3]Instituto Dom Luiz, Universidade de Lisboa, Lisbon, Portugal
[4]GAIA Exploration, Valverde del Camino, Huelva, Sp

The critical raw materials (CRMs) exploration and supply is crucial to achieve the objectives defined by the European Critical Raw Materials Act to reach the green energy transition. In order to reduce the social and environmental impact of the exploration, innovative indirect techniques have to be adopted for the mineral targeting. Among the various geophysical methods, two of the most common techniques for exploration are the Induced Polarization (DCIP) and the Electromagnetic (EM) to map, respectively, chargeable and conductive bodies in depth. Although these techniques have been considered sensitive to different physical properties for a long time, it has been recognized that the effects of a polarizable ground can be measurable by inductive EM measurements (Smith et al., 1996), both airborne and ground. It has then been shown that is possible to model the inductive IP (Viezzoli et al., 2013) to retrieve the ground chargeability distribution and how novel modelling approaches (Dauti et al., 2024) can increase the inductive chargeability sensitivity in depth with good relationships with known mineralized bodies. In this context, with this contribute we propose a case study for which the retrieved inductive chargeability models have been actively used to define the next steps of the exploration workflow for a real green-field exploration research project in Portugal (within the HORIZON SEMACRET European project) with chargeable and resistive targets.

First, two Airborne EM surveys have been flown with different base frequencies (12.5 Hz and 25 Hz) to increase the data sensitivity to IP effects and to improve the near surface resolution. Then, a modelling approach that pointed to reduce the equivalencies among the parameters of the "IP-expanded" model-space has been applied to the data. These have been both independently and jointly modelled (between 12.5 and 25Hz), to better define where to follow-up on the ground. The inversions defined different chargeable targets that, integrated with the ancillary information, had allowed to define where to follow-up on the ground with the DCIP survey. The ground data have been acquired over the AEM lines and the chargeable anomalies have been confirmed by the

galvanic measurement. To conclude, a joint inversion between all the methodologies have been

carried and the IP effects from a methodological multi-frequency prospective have been investigated, merging the sensitivities of different methodologies to resolve the ground chargeability within a unified IP bandwidth.

With this contribute we thus worked in a twofold direction: from an applied standpoint, we used the AIP method as a tool to define targets for a large-scale greenfield project and we successfully downscaled the exploration defining where to follow-up on the ground using the airborne result. Then, from a methodological standpoint, we resolved the ground chargeability merging the sensitivities to IP effects of the galvanic and of two inductive methodologies.