New chances to handle Airborne IP – Abra Case study

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Modelling IP parameters, including dispersive resistivity, from AEM data showing clear IP effects is possible nowadays. Using the spatially constrained inversion approach, with forward response that account for the full Cole and Cole model, we can recover realistic chargeability and "IP corrected "resistivities sections. The "IP corrected" resistivity sections often show better agreement with known geological features, while improving dramatically the data fit, with respect to those obtained without IP modelling. While the majority of the IP effect originate from shallow chargeable layers, there seems to be some positive correlation between an isolated deep chargeable anomaly and known base metal deposit location. The recent improvements in data acquisition (thanks to instrumentation characterized by high performance) and processing, allowed to resolve challenging targets (shallow and/or small), having a relevant importance for most of the engineering-geotechnical applications.

This case study refers to the Abra deposit, a lead-dominated base metal orebody, located in the eastern part of the Capricorn orogen, Chloritic alteration is intense below and adjacent to, while rapidly decreasing above the deposit. Hematite and magnetite are present throughout the deposit, including in the vein feeder system, but not in the host sediments. The Abra deposit was found by targeting a confined regional magnetic high show as a profile (magenta) in Figure 1, and has been intersected at depth of around 250 m by several drill holes. The VTEM data were inverted both 1) without modelling IP parameters (treating all negatives as noise) and 2) modelling IP parameters (retaining all negatives). Figure 1 shows a comparison between CSIRO's 30 layers inversion using the GA-LEI (Brodie 2012) without IP modelling, and Aarhus Inv's 25 layers inversion accounting for and modelling the IP.

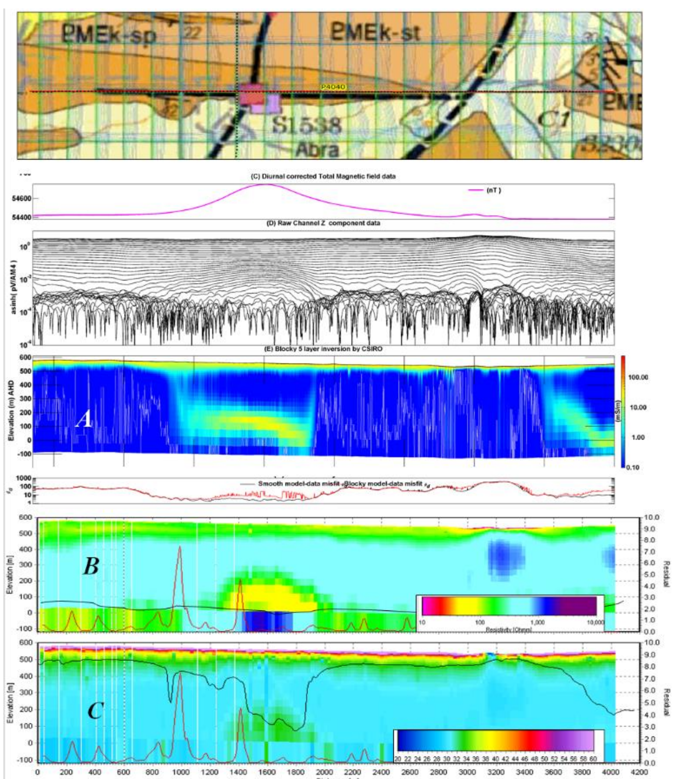

Figure 1

All sections (resistivity without IP, resistivity with IP, chargeability) do show an anomaly in the proximity to the known lateral location of the mineral deposit. Section A, however, shows both poor data fit and resistivity values anomalously high for the host rock (sandstones). This is the result of trying to fit an anomalously fast, IP-affected, EM transient. The resistivity section obtained modelling IP (B) fits the data significantly better and produce more realistic resistivities for the host rock. It also shows better match with geology (outcrop and faulting). The chargeability section (C) shows very near surface highly chargeable layers (possibly iron rich cover) across most of the section. It also recovers an indication of a chargeable anomaly at depth, in the proximity to the know mineralization. Admittedly this anomaly is very proximal to the estimated depth of investigation, hence could be easily questioned. On the other hand it shows similarities with ground IP anomalies gathered in the proximity of this flight line.

Figure 2 displays results from where a coincident airborne and ground IP/resistivity line has been acquired. Once again, the resistivity section (running North-South) obtained modelling airborne IP produces results that fit the measured data, and are consistent with the available geological information. Notice the good correlation with outcrop geology, especially considering that the first gate of the system was at approximately 80 μs after end of ramp, and therefore the near surface resolution is expected to be limited. As shown in the figure the coincident line of airborne derived resistivity (accounting for IP) also matches better the resistivity section obtained from ground resistivity survey (shown at the bottom).
Two typical transients are shown on the left: A shows the characteristic crossover due to IP, while B refers to the same sounding, but with the cut-off of the negative gates.

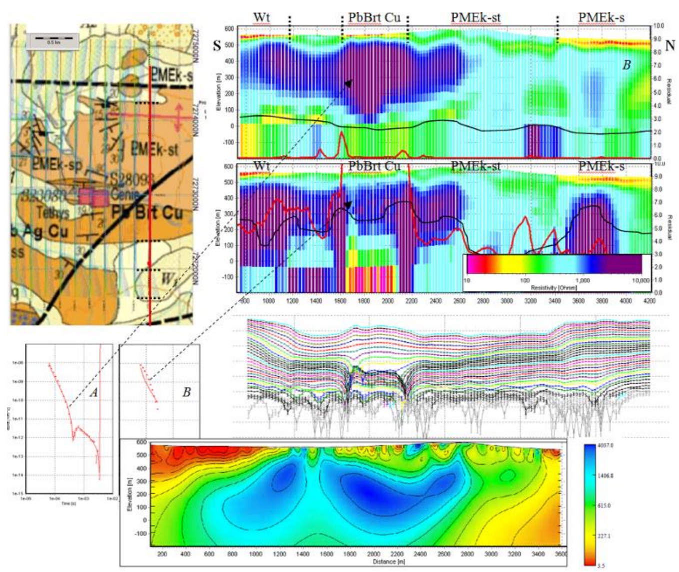

Figure 2

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