Petro Physical Properties and Geophysical Responses of the Benambra VHMS Deposits, Victoria, Australia

Will Rowlands,[1] Michael Roach,[1*] and Jacob Paggi[2]

[1]CODES, University of Tasmania, Private Bag 79, Hobart. Australia
[2]Independence Group, 85 South Perth Esplanade, South Perth, Australia

*E-mail, michael.roach@utas.edu.au

The Benambra volcanic-hosted massive sulfide (VHMS) deposits in northeast Victoria are polymetallic sulfide bodies containing 2 to 3% Cu, 4-5% Zn, 30 to 40 g/t Ag, and 1 g/t Au. The two largest ore lenses, Currowong (10.3 Mt) and Wilga (3.7 Mt), were initially identified by time-domain electromagnetic surveys in the 1970s. Recent downhole time-domain electromagnetic surveys led to the discovery of the Eureka and Bigfoot lenses proximal to the Currowong deposit.

Petrophysical measurements on drill core have been used to characterize the ore, host, and alteration assemblages and have been used to evaluate the potential application of a range of geophysical techniques for direct detection of economic mineralization at depth in the Benambra area. Mineralization is moderately conductive, chargeable, moderately magnetic and dense. Host rocks are effectively non-conductive, weakly chargeable, variably magnetic and not particularly dense.

Ground and airborne magnetic measurements are unlikely to unambiguously detect mineralization despite the fact that the ore is moderately magnetic. This is due to the highly variable nature of the host magnetic response which obscures the low amplitude anomalism due to mineralization. Gravity measurements may be able to detect large orebodies such as the Currowong deposit but are unlikely to detect smaller mineralized zones at depth.

Surface time domain electromagnetic measurements detect the large deposits but downhole electromagnetic measurements are required to detect smaller mineralized zones at depth. Forward modelling suggests that both resistivity and induced polarization methods can potentially detect both large and small mineralized bodies at depth in this environment even in areas of significant topographic relief. The pole-pole electrode distribution is the most effective survey configuration for detection of deep orebodies.