Outcrop-scale physical properties mapping and integration of multidisciplinary mineral exploration data from the Canadian Malartic gold deposit Bravo zone, Québec, Canada

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No specific magnetic or electromagnetic signature has yet been identified at the Canadian Malartic gold deposit. Thus geophysical prospecting for this type of deposit in similar geological environments is poorly defined. Physical properties of the ore and host rock are dependent on their mineralogical composition and textures which relates to their original composition, deformation, metamorphism, and fluid-rock interaction history. The aim of this study is to measure the physical properties of the various rock types from the core of the mineralized system to the outer zones of the gold deposit to help anticipate the signals that could be detected by geophysical surveying. As part of this study, physical properties were measured at the outcrop-scale using regular 50 cm spacing grids in order to study the spatial relationships between physical properties and gold mineralization, and to assess the scaling effects between laboratory and in-situ scales. Physical properties measurements were collected over an area of 5 by 34 meters at the Bravo outcrop zone, a weakly mineralized area located southeast of the main deposit. Physical properties measurements include magnetic susceptibility, natural gamma-ray radiation, resistivity, chargeability and short-wave infrared spectroscopy. Additionally, the main geological features were mapped and samples were assayed for gold. Ground level magnetometer and 5-meter-spacing dipole-dipole induced polarization surveys were also conducted over the area. The Bravo zone outcrop consists of both unaltered and mineralized greywacke, cut by narrow porphyritic dykes. Gamma-ray radiometry shows that potassium enrichment is present as halos in gold-bearing greywackes around quartz-veins with variable amounts of carbonate, microcline, biotite, pyrite and chalcopyrite. These halos are also associated with a decrease of magnetic susceptibility from 2.5E-04 to 5.0E-05 SI. Petrographic investigation indicates that the decrease in magnetic susceptibility is mainly caused by the formation of pyrite, which replaced the pyrrhotite observed in unaltered greywackes. Potassium enrichment is observed in the same region where white mica also becomes more phengitic, as indicated by the increase in the wavelength of the 2200 nm short-wave infrared feature. Additionally, the 2250 nm feature variations indicate that biotite and chlorite have a higher Mg/Fe ratio in the mineralized area. These observations suggest that the formation of gold was accompanied by changes of both mineral chemistry and physical properties. A high chargeability and low resistivity anomaly is detected above weakly mineralized graphitic mudstones. The induced polarization response of mudstones therefore overprints the response expected from pyrite enrichment associated with high gold grade. Future work includes additional exploratory data analysis, data interpolation and stochastic inversion of ground magnetic data to integrate all mineral exploration data collected at the Bravo zone. CMIC-NSERC Exploration Footprints Network Contribution 077