Integration of Mineralogy and Rock Physics Proprieties Applied to the Footprint of the Canadian Malartic Gold Deposit

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Abstract

The Canadian Malartic gold mine contains over 14 Moz of gold (past production and current resources). Gold mineralization is mostly hosted in meta-sedimentary units of the Pontiac Subprovince, which are cut by a variety of felsic to mafic intrusions. Eleven representative samples of meta-sedimentary non-mineralized host rocks (siltstone, mudstone and greywacke: Au < 0.005 ppm) and of various styles of mineralization (Wolfe, Zone A and CM Keel zones) were studied in detail to determine the relationship between their rock physical properties and mineralogical composition. The results reveal that the non-mineralized sedimentary rocks have higher saturated bulk density (2.76-2.81 g/cm^3), apparent porosity (0.37-0.57 %), magnetic susceptibility (3.3-7.5 10^{-4} SI) and remanent magnetization (1.5 10^{-3} - 2.1 10^{0} A/m) than the mineralized samples. Auriferous samples have higher average resistivity (4 - 34 10^{3} Ohm.m). The range of Koenigsberger ratios (Kn: 0.03-0.93) and chargeability (2.5-27. ms) data are similar for non-mineralized and auriferous samples, except for one anomalous non-mineralized sample with the highest proportion of pyrrhotite. The non-mineralized samples with high magnetic susceptibilities have higher proportions of pyrrhotite and/or ilmenite (up to 0.5 %). In the auriferous samples, these minerals are replaced mainly by pyrite (up to 4%), which explain their lower magnetic susceptibilities (3.6-23 10^{-5} SI). The higher average resistivity values in most of the mineralized samples are interpreted to be due mainly to replacement of the phyllosilicates and plagioclase aligned along the main tectonic fabric by variable proportions of quartz, alkaline feldspar and/or carbonate; however the highest values are observed in a weakly mineralized sample (0.013 g/t Au) with porphyroblasts of amphibole. The relationship between porosity and saturated bulk density is intriguing and will be further investigated. These preliminary results will be further integrated with a larger data base to determine the critical parameters that would be applied to better understand the Canadian Malartic footprint and explore for similar gold deposits.

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