Interlaboratory Comparison of Rock Physical Properties from the Canadian Malartic Gold Deposit

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Abstract

The measurement of rock physical properties is an essential tool for modern integrated mineral exploration. Nevertheless, there are few standards and interlaboratory comparisons reported to check the reliability and accuracy of the results. As a principal activity in the Petrophysics Technical Group of the Canadian Mining Innovation Council Footprints project, carefully chosen suites of samples from target deposits are being measured in multiple laboratories. The first such study is a collection of 217 samples from in and around the Canadian Malartic Gold mine from the Abitibi district in Quebec, with measurements made on sister samples at the Geological Survey of Canada Paleomagnetism and Petrophysics Laboratory (~11 cm^3) and the École Polytechnique Department of Civil, Geological and Mining Engineering (~200 cm^3). The geophysical and mineralogical implications are discussed in companion posters. Measurements of saturated bulk density were identical to better than $\pm 10^{-2}$ g/cm^3 (difference $median_{25\%ile}^{75\%ile} = 0.0006_{-0.0050}^{0.0065}$), and magnetic susceptibility to better than ±20% (quotient $0.98_{0.82}^{1.13}$). These excellent correlations prove that despite sample heterogeneity and different measurement equipment and protocols reliable results are being produced. Measurements of porosity, however, show systematic differences, with the measurement quotients (i.e., École measurement / GSC measurement) significantly below unity ($0.79_{0.60}^{0.96}$). Electrical resistivity measurements have much poorer correlation (measurement quotients $1.2_{0.80}^{1.9}$) and the two labs produce incompatible measurements of electrical chargeability, requiring more investigation and the development of standards. Thus, physical properties related to mineralogy are observed to be much better correlated than those related to texture. We will continue our collaboration to increase the reliability of petrophysical measurements, and especially decrease the uncertainties in the electrical properties of rocks by innovating better measurement protocols and methods of interpretation. Our preliminary results are very useful when integrated with detailed lithology and mineralogical studies.

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