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Applications of the spectral induced polarization (SIP) method to mineral exploration are limited by our knowledge of the relationships among rock texture, mineral composition, and electrical properties. Laboratory SIP responses were measured on rock samples from the Canadian Malartic gold deposit. Field SIP responses were also measured at the outcrop scale, along a profile that intersects a well-studied mineralized zone. The mineralogy and the texture of sedimentary rocks from this deposit were quantitatively determined with mineral liberation analysis. A systematic decrease (Pearson r=−0.75) in total chargeability with increasing fraction of the sulfide mineral interfaces associated with feldspar minerals (namely, K-feldspar and albite) was observed. On the other hand, total chargeability increased with the fraction of sulfide mineral interfaces associated with carbonates and micas (Pearson r=0.89). At Canadian Malartic, proximal alteration in the mineralized zones is marked by rocks that lack a foliation plane and that were subjected to pervasive K-feldspar, albite, and pyrite alteration. In contrast, distal alteration in sedimentary rocks is marked by biotite, albite, carbonate, and pyrite that are oriented along the regional S2 foliation. In the least-altered (LA) sedimentary rocks, quartz and biotite are associated with pyrrhotite and ilmenite as the main sulfide and oxide mineral phases, respectively. SIP measurements conducted at district and outcrop scales and along a drill core indicated that proximally altered sedimentary rocks were characterized by low total chargeability values (0.27±0.01 to 0.42±0.02 in the laboratory and 0.21±0.04 in the field). In contrast, the LA sedimentary rocks were characterized by total chargeability values up to 0.72±0.07 in the laboratory and 0.38±0.06 in the field. We conclude that mineralized zones associated with this type of ore deposit are characterized by low chargeability anomalies.

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