Comparison of field portable X-ray fluorescence (pXRF) results to certified laboratory geochemical analysis at the Nash Creek Zn-Pb-Ag deposit, New Brunswick, Canada: analysis of reproducibility and application of pXRF geochemical data

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Field-portable X-ray fluorescence (pXRF) is a well-established non-destructive analytical technique capable of rapidly collecting multi-element geochemical data. The heterogeneity of the volcanic rocks hosting the Nash Creek (Zn-Pb-Ag) sulphide deposit provides an excellent opportunity for the application of the pXRF analytical technique. It is capable of assisting with protolith identification, identification of alteration, sample selection, and assessment of geotectonic setting. Using an Innov-X X-5000 pXRF, thin section cut-offs have been analyzed to assess the accuracy, reproducibility, and applicability of pXRF geochemical data compared to geochemical data obtained from a certified laboratory. Prior to comparison and subsequent plotting of geochemical data, the data obtained from the pXRF were subjected to rigorous data quality assurance and quality control (QA/QC), by the assessment of consistently inserted procedural blanks and matrix-matched certified reference materials.

Of the elements analyzed, Ti, Y, Zr, Nb, Th, and Rb were determined because of their common use in trace element-based discrimination diagrams. The comparison showed that in the majority of the basaltic/andesitic rocks analyzed, Ti, Y, and Nb values were reproducible to within 10% and Zr to within 15%, whereas Th consistently returned an overestimated value leading to a >25% difference. Within the basaltic/andesitic rocks, the majority of element ratios assessed (Zr/Ti, Y/Ti, Zr/Y, Zr/Nb, and Nb/Y) were reproducible to within 10%, except for Zr/Y, reflecting the propagation of the Zr variation. Rhyolite trace element data showed that Rb was frequently reproducible to within 5%, Y within 10%, Ti and Zr to within 15%, and Nb and Th to within 20%; variations may reflect heterogeneities such as porphyritic textures, flow layering or mineral phase distributions. Within the rhyolites, the majority of element ratios (Zr/Ti, Y/Ti, Zr/Y, Zr/Nb, and Nb/Y) were reproducible to within 15%, reflecting the propagation of Zr and Nb variation. Despite the variations, plotting both the pXRF and certified laboratory geochemical data on appropriate trace element discrimination diagrams including the Ti-Zr-Y, Nb-Zr-Y, Rb-(Y+Nb), Nb-Y, Zr/TiO_2–Nb/Y, and Ti-Zr diagrams showed that the data commonly plot within the same fields, leading to the same geotectonic and protolith assignments, including recognition of high- and low-Zr rhyolites. While the results are relatively comparable between the pXRF and laboratory, and the trace element discrimination diagrams comparable to previously conducted studies, caution should always be taken when assessing and interpreting pXRF data.

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