Using a portable XRF spectrometer to determine geochemical and spatial correlations between alteration and gold mineralization at the Beaver Dam deposit, Nova Scotia

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The Beaver Dam deposit is a metaturbidite-hosted mesothermal gold deposit, consisting of bedding-parallel auriferous quartz veins containing variable amounts of

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carbonate, hosted by slate and subordinate metagreywacke. A portable X-ray fluorescence (XRF) spectrometer was used in the analysis of over 4300 samples to determine whether there are geochemical and spatial correlations between alteration and gold mineralization. The samples were collected from over 45 drill holes within and surrounding the mineralized zone, which has a strike length of about 140 m and a width of 50 m. A set of 10 samples was reanalyzed 10 times each to ensure the reproducibility of the data, and 30 samples were analyzed by ICP-MS to test the accuracy of the XRF spectrometer. When plotted against ICP-MS data, the XRF elemental plots created linear trends with a slope close or equal to one.

The coarser clastic metasedimentary rocks are dominated by silica and enriched in denser detrital minerals such as zircon. In contrast, finer grained rocks are relatively depleted in silica, and enriched in elements that reflect higher abundances of micas and clays (e.g., K, Rb, and Ba) and redox-sensitive transition elements (Ti, Mn, V, and Cr). Bivariate plots of V vs. Ti, V vs. Cr, and Ti vs. Cr show excellent correlation and little to no mobility; sandstones show relatively lower abundances of immobile elements, whereas slates have higher concentrations of these elements, and quartz veins have concentrations approaching the origin. Samples with elevated Mn and Ca (when plotted against Ti and V) likely reflect carbonate either associated with quartz veins, or occurring naturally in the host rock. Plots of K, Rb, Ba, and Sr vs. Ti and V show good correlation, indicating that there is little to no mobility of alkali and alkaline elements. A small proportion of samples show slight elevations in As and Zn when plotted against immobile elements, suggesting that they were introduced during alteration. However, As and Zn show no correlation with Au, and therefore may not have been introduced at the same time; gold may have been introduced at a later stage, or else remobilized during late stage quartz veining. A plot of Au vs. V indicates that fine-grained gold is concentrated in the slate samples. To determine the spatial distribution of the various elements, the data will be contoured on cross-sections and longitudinal sections.