

Graphical detection of hydrothermal alteration in slates and greywackes from the Goldboro Saddle Reef Au vein deposit, Nova Scotia, Canada: A projective geometry approach

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Hand samples of: (1) slate, (2) mixed slate, siltstone and greywacke, (3) greywacke, and (4) greywacke with well-developed pressure solution cleavage from host rocks to the Goldboro saddle reef Au-quartz vein deposit, Goldenville

Formation, Meguma Supergroup, eastern Nova Scotia, exhibit demonstrable macroscopic color and modal mineralogy changes proximal to Au-bearing veins. These consist largely of purple coloration due to increases in the biotite mode, and

the presence of disseminated sulphide minerals and organic carbon. However, these samples exhibit little geochemical evidence of hydrothermal alteration on conventional geochemical scatterplots. Although the observed hydrothermal alteration is relatively subtle, the lack of geochemical expression of metasomatism is most likely due to the lack of power of conventional geochemical diagrams (major and trace element scatterplots) to discriminate the effects of hydrothermal alteration.

Consequently, matrix algebra has been used to design molar element ratio (MER) diagrams (scatterplots) that are special projections of the 8 dimensional geochemical space ($\text{SiO}_2\text{-Al}_2\text{O}_3\text{-FeO-MgO-CaO-Na}_2\text{O-K}_2\text{O-H}_2\text{O}$) in which the host rocks reside. These projections consider the modal mineralogy of the unaltered host rocks (quartz-plagioclase-chlorite-biotite-muscovite), and view the geochemical data from specific locations in the geochemical space that

maximize the geochemical contrast between unaltered and altered samples.

Results demonstrate significantly enhanced graphical differences between hydrothermally altered and unaltered samples. This allows geochemical identification of and accurate quantification of the extent of hydrothermal alteration in all samples. Samples identified as significantly altered by this means exhibit consistently anomalous Au, As, and S concentrations, despite nugget effect variations. Thus, geochemical discrimination of hydrothermally altered rocks using MER diagrams can be used in exploration to reliably explore for hydrothermal alteration zones about saddle reef Au-quartz veins in the Goldboro region. Potential exploration applications are also possible in other saddle reef Au-quartz vein camps at similar metamorphic grade within the Meguma Supergroup.