ROCKS UNDER WESTERN HANSON LAKE – BUILDING A CHEMOSTRATIGRAPHIC MODEL TO AID BASE METAL EXPLORATION; HANSON LAKE ASSEMBLAGE, FLIN FLON DOMAIN, SASKATCHEWAN, CANADA

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Introduction

The Paleoproterozoic Flin Flon Greenstone Belt (FFGB) is an economically important mining district extending from north-central Manitoba into east-central Saskatchewan. It has been divided up into seven island arc assemblages and contains a number of large felsic volcanic-hosted massive sulphide (VHMS) deposits. The Hanson Lake Assemblage (HLA), one of these island arc terranes (Syme et al. 1999), is located in east-central Saskatchewan, and is felsic volcanic rock dominated, with subordinate interbedded mafic flows and clastic sedimentary rocks (Byers 1957; Sibbald 1989; Maxeiner et al. 1999). Unfortunately, its southern portion is unconformably covered by flat lying Ordovician basal sand and dolostone (Byers 1957; Sibbald 1989; Maxeiner et al. 1999). Two significant VHMS deposits occur in the HLA: (*i*) the Hanson Lake deposit is located north of the Paleozoic unconformity and was mined in the 1960's, (Sibbald 1989) and (*ii*) the un-mined McIlvenna Bay deposit is located south of the Paleozoic unconformity (Kozial 1993).

Methodology

Correlations of lithologies intersected in drill core south of the unconformity with exposed rocks on Canadian Shield provide important geological clues that allow recognition of prospective target horizons and opportunities for new discoveries in the HLA. Unfortunately, such correlation is difficult due to high frequency changes in volcanic facies and stratigraphic thicknesses, and the effects of hydrothermal alteration, metamorphism, and deformation. As a result, rocks may be inconsistently described and identified, a problem that creates significant correlation challenges.

Fortunately, lithogeochemical data analysis methods can provide consistency in the classification of volcanic rocks, regardless of the above impediments. In this study, lithogeochemistry has been used to create a chemostratigraphic section of the HLA using rocks exposed on the western shores of Hanson Lake, north of the unconformity. Five hundred and eight lithogeochemical samples were collected from all major rock types in the stratigraphic succession. Total geochemical analyses were measured on these rocks for all major oxides, a large suite of trace elements, plus carbon and sulphur. Data were evaluated using a number of techniques to assist in proper classification, to 'see through' metamorphism and deformation, and to quantify the effects of hydrothermal alteration.

Results

Cogenetic rock samples were identified using conserved element concentrations and ratios procedures (Hallberg 1984), and assigned names using these ratios and bulk silica concentrations. Petrographic observations, field notes, and spatial relationships were used to constrain these results. Intrusive and extrusive felsic rocks displayed the best sensitivity to classification using conserved element ratio procedures, and seven distinct compositional groups (3 intrusive, 4 extrusive) were successfully classified. Molar element ratio procedures (Stanley & Russell 1989; Stanley & Madeisky 1994; Stanley 1996) were used to create models to recognize and quantify the effects of hydrothermal processes in these rocks. Feldspar alteration to muscovite, and subordinate muscovite alteration to chlorite represent the two alteration reactions recognized, and likely reflect distal hydrothermal alteration environments.

Mafic rocks in the study area were lithogeochemically classified using conserved element ratios and rare earth element (REE) ternary diagrams (Wood 1980; Meschede 1986; Pearce 1996) and spider plots (Sun & McDonough 1989). These mafic rocks, although not related to VHMS mineralization, serve as important marker horizons to better correlate stratigraphy. Interbedded clastic sedimentary rocks in the study area were likely deposited during volcanic hiatuses. These rock compositions were lithogeochemically evaluated using a new molar element classification procedure capable of constraining sediment source, and quantifying chemical maturity and the effects of clastic sorting processes.

Discussion & Conclusions

With the above results, a chemostratigraphic section of the HLA was constructed and compared with a prior lithostratigraphic column produced by previous researchers (Coleman et al. 1970; Parslow & Gaskarth 1986; Maxeiner 1993; Maxeiner et al. 1993). This comparison resulted in several consistencies that confirmed prior hypotheses made about the greenstone belt succession. In addition, this comparison also resulted in several inconsistencies that provide new perspectives about the geology of the area. These insights have important implications to both strategic and tactical exploration efforts in the HLA, and may substantially benefit future base metal exploration in covered portions of the greenstone belt to the south.

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