

Volcanic reconstruction of Neoproterozoic volcanic rocks of the Sunset Lake area, Beaulieu River greenstone belt, Slave craton, NWT

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Summary

The Neoproterozoic Beaulieu River greenstone belt (BRGB) occurs in the Sunset Lake area, approximately 100 km east northeast of Yellowknife. The BRGB is made up largely of basaltic and andesitic volcanic rocks with smaller amounts of rhyolite. The BRGB structurally overlies the northeast margin of the ca. 2.8 Ga Sleepy Dragon Complex, a basement complex composed of granodiorite, tonalite, and granite gneisses. The BRGB is also overlain by the greywacke-mudstone turbidites of the Burwash Formation. A rhyolite dome at the northern end of Sunset Lake is spatially associated with the Sunrise volcanogenic massive sulfide (VMS) deposit hosted in the BRGB. The focus of this study are BRGB volcanic rocks of the south Sunset Lake area, which were originally mapped almost exclusively as a coherent rhyolite, known as the Sunset Lake Rhyolite. A forest fire in 2014 left the study area with phenomenal outcrop exposure. Detailed mapping (1:2000) in the south Sunset Lake area completed over two field seasons (2018 and 2019) shows a more complex volcanic lithofacies. The area is dominantly massive to pillow basalt and andesite with lesser amounts of massive to in-situ brecciated, weakly quartz-plagioclase porphyritic rhyolite, mafic tuff to tuff-breccia, heterolithic tuff to lapilli-tuff and felsic tuff to tuff-breccia. Felsic clasts are similar in composition to the coherent rhyolite. Units have trace element geochemical signatures that vary from tholeiitic to calc-alkaline, with trace element characteristics typical of modern arc rocks.

Though volumetrically dominated by lavas, the stratigraphy contains a significant amount of volcaniclastic rocks ranging from tuff to tuff-breccia. These volcaniclastic rocks are interpreted to be a result of debris flows and eruption-fed density currents in a submarine environment. The volcanic strata associated with the Sunset Lake Rhyolite shares similar characteristics in terms of lithofacies and geochemical attributes, to the volcanic strata that host the Sunrise deposit. Though significant mineralization has not yet been discovered within the Sunset Lake Rhyolite, its similarity to rocks that host the Sunrise deposit at the north end of Sunset Lake (e.g., rhyolite dome, syn-volcanic intrusions, peperite and an accumulation of porous volcanic rocks on the seafloor, evidence of synvolcanic faulting and hydrothermal alteration) suggest it has significant potential to host VMS-type mineralization.