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Silicate Neutralization Potential of Serpentinized Peridotites at Tamarack Mine Project

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Talon Nickel (USA) LLC is seeking to advance the Tamarack Project to extract high-grade Ni-Cu-PGE ore from the Tamarack Deposit in Minnesota, USA, via an underground mine and surface facilities. Peridotite host rocks of the Tamarack deposit are variably altered to serpentine as partial replacement of primary olivine. Silicates can provide meaningful acid buffering, though typically at slow rates. Determining if Tamarack host rocks can provide sufficient neutralization potential (NP) to buffer acid generating potential (AP) from sulfide mineral oxidation is an important component of mine waste characterization. Results from acid-base accounting (ABA), leach testing, kinetic testing, and mineralogy are used to investigate the source and possible implications of available silicate neutralization for waste rock management.

Conclusions from ABA testing of 70 samples of variable sulfur and carbon concentrations depend greatly on the NP measurement method. When neuralization potential ratio (NPR) is calculated with modified Sobek NP, all samples are predicted to be non-acid generating (NAG). Fewer samples meet that criteria when NPR is calculated using only carbonate-carbon.

To better understand the disparity between the two NPR calculations, and the mineralogical source of the modified Sobek NP results, the acid buffering characteristic curve (ABCC) was measured in 6 samples. Results suggest silicate NP is attributable to serpentine and to forsterite in Tamarack peridotites.

Samples contain 11 to >50% serpentine, and 9 to 53 wt.% amorphous content. The source of the amorphous content was further investigated in a detailed X-Ray Diffraction (XRD) and automated mineralogy study which determined that a significant amount of the XRD-amorphous content likely corresponds to poorly crystalline serpentine.

Long-term kinetic testing of 30 variably serpentinized peridotites suggests that silicates are actively contributing NP to buffer circumneutral-pH in humidity cell tests that have been operating for 3 years, as the carbonate NP was forecast to be depleted in less than 3 years in some cases. Further investigation into the source of the contrast between predicted and observed behavior suggests that silicate neutralization is a meaningful characteristic of Tamarack host rocks.