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Palladium Enrichment and Mobilization through Alteration and Replacement of Base Metal Sulfides in the Parisien Lake Zone, East Bull Lake Intrusion, Ontario, Canada

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The East Bull Lake intrusion occurs approximately 80 km west of Sudbury, Ontario, and hosts a widespread, disseminated sulfide mineralization that has been classified as contact-type PGE-Cu-Ni mineralization. Contact-type mineralizations occur at the base and margins of most of the co-eval mafic-ultramafic intrusions in the greater Sudbury region, though none of these occurrences have proven to be currently economically viable. The lowermost stratigraphic units of the East Bull Lake intrusion hosts Pd grades in the range of 1-10 g/t. The Pd mineralization is associated with an altered, chalcopyrite-dominated disseminated sulfide mineralization. Units containing sulfides associated with secondary hydrous silicates are strongly correlated to high Pd whole-rock grades. Core samples were taken from seven DDH with >1.0 g/t Pd at the Central Parisien Lake Zone, which is >1.0 km². DDH were quartered, with half used for whole-rock geochemistry, and the remaining material was billeted for 54 thin sections. Optical mineralogy and automated mineralogy scanning electron microscopy (MLA-SEM) were used to analyze mineralogical and textural characteristics of the samples for in-situ trace element analyses. Laser-ablation inductively coupled plasma-mass spectrometry (LA-ICP-MS) was used to define trace element chemistry of sulfides and platinum group minerals (PGMs). The aim of these analyses is to identify PGE mineral hosts and to compare sulfide chemistry changes during alteration to better understand its effects on the Pd mineralization. Mineral chemistry results indicate that Pd occurs mostly as a stoichiometric replacement in sulfides such as (in order of highest Pd concentration to lowest) pentlandite, chalcopyrite, bornite, pyrrhotite, and pyrite. Alteration enriched Pd in sulfides, before being remobilized on the millimeter scale to form PGMs such as kotulskite (Pd(Te,Bi)). By further characterizing the alteration effects within the Parisien Lake Zone of the East Bull Lake intrusion, we hope to develop more robust techniques for future exploration.