

The development of geochemical exploration techniques for discovering concealed kimberlites under glacial drift, Northwest Territories

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Diamondiferous kimberlites in the Lac de Gras region of the Northwest Territories are one of the many deposit types in Canada that are covered by glacial drift, which makes them challenging to detect. An investigation on the DO-18 kimberlite (Peregrine Diamonds), which is buried under 5-20m of glacial cover, identifies surface geochemical responses directly related to the buried kimberlite and differentiates between physical and chemical transport mechanisms. A detailed grid of 150 samples of oxidized upper B soil horizons were taken from till above and peripheral to the DO-18 kimberlite. Surficial mapping characterised soil type and rock fragment lithology, topographic variation and physical features. Multi-element geochemistry, analysed using 4-acid, Aqua-Regia and distilled water extractions coupled with ICP-MS, identifies and differentiates between elements that are migrating by chemical processes and physical transportation. Analysing hydrocarbons, using the Gore-Sorber technique (AGI), characterises the type and abundances of complex hydrocarbons in the till above the kimberlite deposit relative to the granite gneiss host. Preliminary results from the 4-acid digestion analysis show a clastic dispersion of Nb, Ni, Mg, Co, Cr and Cs from directly above the deposit out to the edge of the sampling grid, 500m northwest of the buried kimberlite. Surface materials have a strong control on geochemical composition as trace elements are being controlled by major elements (Al, Fe, Mn) in each surface material type, and, in some cases, these elements are heavily influenced by the presence of organic carbon. The evaluation of these relationships will distinguish the natural background noise, which will enhance the understanding of geochemical responses and contrasts in the glacial cover proximal and distal to the deposit.