Mineralogical reaction modelling of partial extractions in mineral exploration samples

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Geochemical exploration using partial extractions to target specific mineral phases in soil samples allows for detection of nuanced signals from mineralization under exotic cover. Concealed deposits potentially make up a large portion of mineral resources in areas that have experienced recent glaciation, such as Canada, northern USA and northern Europe / Scandinavia. Interpretation of partial extraction data is challenging due to the uncertainty of targeting specific phases under various extraction conditions. To better constrain extractions, multi-staged mineralogical and chemical analysis of the samples and the extractive processes themselves are required. Samples collected in Canada from kimberlites in the NWT, and copper-porphyry and VMS deposits from BC present an opportunity to observe the effects of partial extraction geochemistry in exotic soils across multiple deposit types. Mineralogical and chemical characterization of these anomalous samples has been completed using XRD, TOF-SIMS, and SEM to generate trace metal distribution models. These samples have been subjected to a variety of commercial partial extraction techniques followed by re-characterisation post extraction to determine the phase changes and re-distribution of the chemistry. Experimental set up allowed for continuous pH, and Eh changes to be monitored during the extraction. The evolution of these parameters creates conditions that influence sorption and mineral precipitation within the sample. The leachate, analysed using ICP-MS, allows for a chemical mass balance and the creation of reaction models for the extractions. Results from the research will lead to improvements in the analytical methodologies and their appropriate applications.