Discovering mineral deposits through till with surface geochemistry and landscape evolution modelling.

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Canada, as with many northern latitude environments, presents a challenge to mineral exploration with many prospective mineral belts being covered with a blanket of glacial products, including till, alluvium, organic veneers and post-glacial re-worked materials. Whilst indicator mineral trains have proved highly successful at identifying broad target areas, the pre-drilling surface evaluation of individual discrete targets remains an obstacle to effective and efficient mineral exploration. Geochemical evaluation of surface soil and vegetation with sequential leaching; Cu and Pb isotopes; and landscape mapping at two distinct sites: Highmont South, Highland Valley Copper Mine, Central BC - temperate forest climate; and DO18 kimberlite, Northwest Territories - Sub-arctic/tundra climate, has clarified the process by which anomalous responses may form at the surface.

At the DO-18 kimberlite, concealed by 10m of till, a distinct low-level Nb-Ni-Cr-Mg response is identified directly over the kimberlite and tails off in the down-ice direction. The response dominantly resides in resistant mineral phases, and although subtle (6ppm Nb, 45ppm Cr, 20ppm Ni), can be identified by portable XRF instruments. A portion of the anomaly is concealed by post glacial alluvial processes. The response was generated by ice transported clastic material locally enhanced through frost boil transport to the surface.

At Highmont South, where ice movement parallels the strike of an elongate mineralised body buried under 5-10m of till; a tight Cu (>360ppm) – Mo (>10ppm) – Ag (>0.054ppm) – Bi (>0.24ppm) signature is present directly over and down-ice of mineralisation within a broader regional anomaly from Highland Valley. The Mo surface response has been enhanced through vegetation (lodgepole pine) cycling, which has significantly enriched Mo (7-19ppm in needles) directly over mineralisation.

At both locations, conventional exploration geochemical techniques coupled with a clear knowledge of the glacial and post-glacial history would have identified the presence of the targets of interest.