mdru Mineral Deposit Research Unit

SCIENCE. EXPLORATION. DISCOVERY.

Rapid copper porphyry indicator mineral characterization by µXRF corescanners

Investigating µXRF corescanners as a prospective automated indicator mineral analytical tool on HMC till samples from central British Columbian Cu-porphyry exploration properties.

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Background

As the global population rises and the world economy transitions towards decarbonization, electrification upgrades to energy, transportation, and industrial infrastructure will result in an increase in copper demand by upwards of 350% worldwide by 2050. Cu-porphyry deposits are large tonnage low-grade intrusive mineral deposits that supply over three quarters of the global copper resources. Continued exploration for Cu-porphyries is critical to meeting this demand, however, the remaining undiscovered deposits are in regions that are mostly or entirely obscured by post-mineral surficial cover.

Effective, timely, and economically feasible exploration approaches must be developed to meet the rise in copper demand and address the challenges associated with exploring for obscured deposits. Indicator minerals (IMs) are minerals that contain textural or chemical information indicating the presence of specific mineralization in the bedrock from which the minerals were derived and are commonly used to vector towards and/or assess the fertility of a potential deposit. In Cu porphyry exploration, IMs have been widely used in regions of extensive surficial cover to explore for obscured deposit

Research Goals

1. Develop industry applicable quantitative mineral identification methods at lower costs and faster analytical times than traditional optical microscope visual analysis by an expert technician and/or automated scanning electron microscopy methods.
2. Improve, quantify, and expedite the identification of porphyry copper IMs by investigating rapid cost-effective analytical technologies and approaches.

Methods

Heavy-mineral-concentrates (HMCs) of till samples from Northwest Copper's Kwanika, Lorraine, and East Niv Cu-porphyry exploration properties in central British Columbia were analyzed using micro-X-ray-fluorescence (µXRF) corescanners and automated scanning electron microscopes with energy dispersive detectors (ASEM-EDS). The IM mineralogy of the HMCs was characterized using the Bruker AMICS automated mineralogy and ESPRIT software to identify IMs from µXRF and ASEM-EDS data.

Cu-porphyry IM identification methods were developed utilizing benchtop µXRF corescanners and ASEM-EDS. Both analytical methods both provide spectral information that reflects mineral chemistry and can be used to produce chemical or mineral maps of geological material.

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Common Copper Porphyry Indicator Minerals

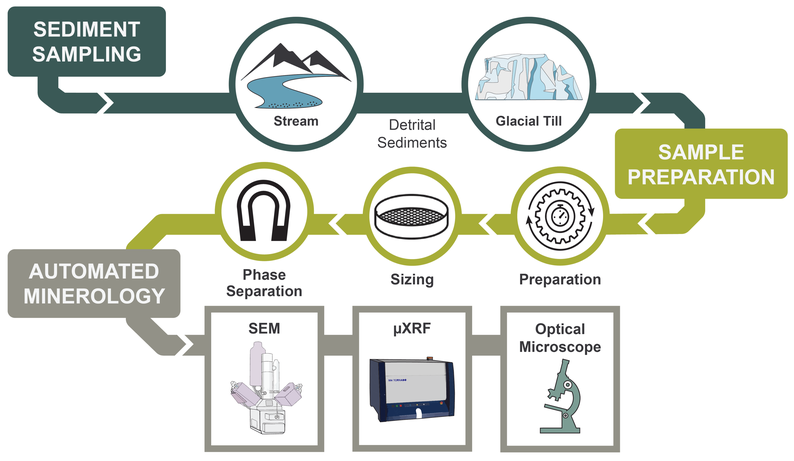
Chalcopyrite

Magnetite

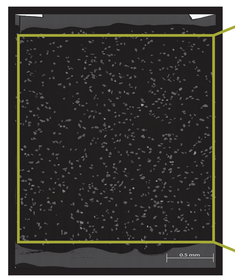
Apatite

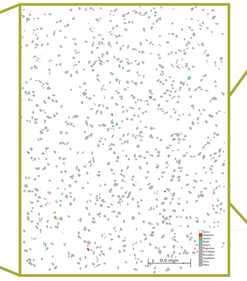
Rutile

Experimental Approach



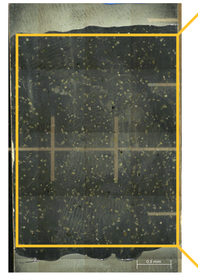
Automated Scanning Electron Microscopy (SEM) Mineralogy

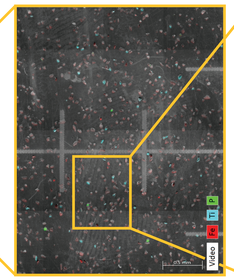

Back scatter electron image of till derived heavy mineral concentrates (HMC) mounted in epoxy in a polished thin section.

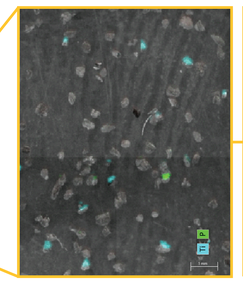

Mineral maps of apatite, rutile, and magnetite and quartz-aluminosilicate minerals identified by SEM-EDS in AMICS software.


Detailed mineral maps of apatite, rutile, magnetite, and quartz and aluminosilicate minerals. ASEM-EDS can identify fine inclusions of indicator minerals such as apatite and rutile.

µXRF Elemental Maps


Mosaic RGB image of till derived heavy mineral concentrates (HMC) mounted in epoxy in a polished thin section.


µXRF elemental map of HMCs with Fe, Ti, and P elemental abundance overlayed. Bright green, blue, and red indicates apatite, rutile, and magnetite respectively.


Inset µXRF elemental map with P, and Ti elemental abundance overlayed. Apatite (green) and rutile (blue) are readily identified in the elemental maps.


ASEM-EDS mineral map of the µXRF inset area. Apatite and rutile readily identifiable by µXRF elemental maps and SEM-EDS automated mineralogy

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