Rapid Cu-Porphyry Indicator Mineral Characterization by µXRF: Automated Detrital Indicator Mineral Analysis of British Columbian Cu-Porphyry Exploration Properties

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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. Continued exploration for Cu-porphyries is critical to meeting this demand; however, the remaining undiscovered deposits are in regions 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 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 bedrock from which the minerals were derived, and they 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 deposits.

The project's research goal is to improve, quantify, and expedite the identification of porphyry copper IMs by investigating rapid, cost-effective analytical technologies and approaches. In this study, Cu-porphyry IM identification methods were developed utilizing benchtop micro-X-ray-fluorescence (µXRF) corescanners and automated scanning-electron-microscopes with energy-dispersive-detectors (ASEM-EDS). Heavy-mineral-concentrates (HMCs) of stream sediment samples from Northwest Copper's Cu-porphyry exploration properties in central British Columbia were analyzed using µXRF core scanners and ASEM-EDS. The IM mineralogy of the HMCs was characterized using the Bruker AMICS automated mineralogy software to identify IMs from µXRF and ASEM-EDS data. HMC mineral characterization and IM identification by µXRF core scanners and ASEM-EDS is presented, and the opportunities and challenges associated with applying µXRF core scanners to rapid Cu-porphyry IM characterization are discussed. Benchtop µXRF core scanners appear to be a promising IM analytical tool; however, relatively low spatial resolution and resulting mixed mineral spectra may complicate identification of fine minerals or textures.