Composition and assemblage of minerals associated with the porphyry Cu-Mo mineralization at the Gibraltar deposit, south central British Columbia

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Glacial sediments commonly contain resistant heavy minerals, such as zircon, rutile, and epidote. To identify the source of these minerals and to use them as a tool to vector mineralization, it is critical to understand the mineral assemblages and compositional variations of heavy minerals in deposits and to determine if the signatures are distinct from barren rocks. The Gibraltar deposit in southcentral British Columbia, with the geological reserves (past production plus reserves) of 2.5 Mt Cu, is hosted by the late Jurassic Granite Mountain batholith. The batholith is mainly composed of tonalite with minor variation in modal abundance of felsic and mafic minerals. Igneous minerals include plagioclase, quartz, biotite, hornblende, titanite, zircon, apatite and magnetite. The mineralization is accompanied by extensive phyllic alteration in the tonalite, which produced illite, quartz, rutile, titanite, magnetite, apatite, chlorite and epidote. Epidote group minerals are ubiquitous alteration minerals as they replace plagioclase and hornblende, chlorite is common after hornblende and biotite, and a mixture of titanite and rutile replace biotite and hornblende. Alteration, mostly Fe-rich epidote, often appears light green in thin section but because there is a large compositional variation, even within a single sample, from Al-rich (high clinozoisite component) to significant La and Ce (allanite component) and/or Fe-rich phases, it is suggested that multiple alteration events have occurred. Another abundant igneous alteration mineral is titanite, which shows a wide compositional variation that correlates to varying concentrations of Al, Mg, and Fe. Preliminary observations suggest that in the pre-existing potassic alteration zone biotite, occurring as an alteration mineral, has been replaced by chlorite. High FeO_t (>25wt.%) chlorite is abundant in the rocks and appears to be related to the occurrence of epidote, whereas low FeO_t (<25wt.%) and high Mg chlorite occurs as isolated aggregates. Identifying geochemical signatures of these minerals and their assemblages is a key component to developing a method of using heavy minerals as a vectoring tool.