Element Chemistry of Garnets and Epidote Minerals at the Cantung W-Cu Skarn: Implications for Nature of Ore Forming Fluids

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The Cantung W-Cu skarn, located in the Flat River Valley in the Northwest Territories, Canada, is approximately 400 km to the northeast of Whitehorse, Yukon Territory. The deposit is a part of the Canadian Cordilleran and belongs to the Tombstone-Tungsten Belt, a series of Mid-Cretaceous felsic plutonic suites which intruded into ancestral North American continental margin ultimately resulting in a variety of tungsten mineralized magmatic-hydrothermal systems. The deposit consists of a Mid-Cretaceous peraluminous biotite monzogranite which intruded into an overturned recumbent anticline. The anticline is comprised of a series of interbedded Lower Cambrian limestones and siltstones. The skarns at Cantung occur on the upper and lower contacts of the ore-limestone and form an inwardly zoned array of anhydrous and hydrous skarns with variable W-Cu-Au mineralization.

Alterations are inwardly zoned from hydrous skarn assemblages on the outermost parts to progressively more anhydrous skarn assemblages at the centres. The mineral assemblages at the innermost parts of these skarns exhibit infill textures and often show strong oscillatory zoning. A progressive transition from fine grained chlorites to amphiboles, followed by pyroxenes, and then garnets with epidotes and carbonates forming the innermost parts of the “veins.” The epidote group minerals often show a compositional zoning, from allanite at the center, which are surrounded by epidote and eventually clinozoisite. Many of the allanite crystals have epitaxial overgrowths of REE rich epidote. The garnets in the sample transition from more grossular compositions at the outermost parts of the vein (core of minerals) toward more andraditic compositions at the innermost parts of the veins (rims of minerals).

The minerals present within this assemblage suggest a transition from a more reduced assemblage toward progressively more oxidized assemblages. The majority of mineral assemblages present at Cantung are indicative of reducing conditions. All minerals exhibit oscillatory zoning within the infill textured skarn minerals. A lack of boiling assemblages or influx of meteoric waters based upon previous work suggests that these textures indicate a transition from more pervasive fluid flow at the skarn reaction front to more focused channelized fluid flow along high permeability zones. It is also believed that these textures suggest that equilibrium between the skarn minerals and the mineralizing fluids was not reached.