Petrography and genesis of the Deer Horn Au-Ag-Te-(Pb-Bi-W) deposit, Lindquist Peak, west-central British Columbia

JA Roberts[1], J Cempírek[2], LA Groat[1]

[1]Department of Earth, Ocean, and Atmospheric Sciences, University of British Columbia, Vancouver, British Columbia; [2]Department of Geological Sciences, Faculty of Science, Masaryk University, Czech Republic

The Deer Horn property is located 150 km south of Smithers, extending over an area of 51 km^2. It is an intrusion-related system enriched in Au-Ag-Te-W-Cu and lesser amounts of Pb-Zn-Mo, with Au and Ag hosted in telluride minerals. The vein system containing the main zones of Au-Ag-Te mineralization formed at 56 ± 2 Ma in the hangingwall of a local thrust fault. Biotite from the nearby Nanika granodiorite pluton, with K-Ar ages from 57–48 Ma, indicates it is likely genetically related to the mineralizing event. Observations by optical microscope and SEM-CL revealed at least three generations of quartz associated with sulfides (pyrite, pyrrhotite, sphalerite, chalcopyrite, galena), tellurides, Ag-rich gold, Fe-oxides (magnetite, hematite), and veinlets with alteration phases (chlorite, sericite, carbonate). Telluride minerals are 0.1–525 μm and commonly form whole subhedral grains or composite grains of Ag-, Bi-, Pb-, and Au-rich tellurides (*e.g*., hessite, tellurobismuthite, altaite, petzite) that occur in a variety of petrographic environments. Cathodoluminescence imaging performed on the largest quartz grains with undulose extinction revealed bright cores with remnant zoning, rimmed by homogeneous darker zones, representing primary hydrothermal quartz I, partially overprinted by plastic deformation and recrystallization (quartz II). Locally, oscillatory zoning observed in quartz II suggests participation of hydrothermal fluids. Quartz I and II are intersected by veinlets of fine-grained quartz III, which is dark gray in SEM-CL. All quartz types are intersected by veinlets of calcite which appear as thin, bright veinlets in SEM-CL. This is evidence of at least two recrystallization and shearing events. Three types of fluid inclusions (aqueous, aqueous-carbonic, and carbonic) that are thought to be primary or pseudosecondary and related to telluride mineralization were observed. Microthermometry tests demonstrate that some characteristics of the ore-forming fluids include : (1) the presence of NaCl with minor amounts of KCl and $CaCl_2$; (2) a high liquid:vapour ratio in all of the aqueous inclusions implying that the fluid has a relatively high density; (3) the range of homogenization temperatures for aqueous inclusions was 130.0–240.5 °C (comparable to other telluride deposits worldwide); (4) the solid CO_2 melting temperatures were from –56.8 to –62.1 °C, indicating the presence of 0.5–13.2% dissolved CH_4; (5) carbonic inclusions froze from –55.9 to –56.8 °C indicating they are almost pure CO_2. $\delta^{34}S$ readings from 20 samples of pyrite are close to 0 (from 1.6 to –1.6 per mil) and indicates that the sulfur is likely magmatic in origin.