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Microthermometric, Laser Raman Spectroscopic, and Volatile-Ion Chromatographic Analysis of Hydrothermal Fluids in the Paleozoic Muruntau Au-Bearing Quartz Vein Ore Field, Uzbekistan

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Abstract

Fluid inclusions in quartz and scheelite from flat, steeply dipping central, and stockwork-type quartz veins within the Muruntau Au-bearing quartz vein ore field have been investigated in a reconnaissance study, using fluid inclusion mapping, microthermometry, laser Raman spectroscopy, and integrated gas and ion chromatography for bulk volatile and cation-anion analysis. Muruntau central veins are dominated by inferred early CO_2-bearing fluid inclusions. In contrast, flat quartz veins contain considerable numbers of low-density, pure aqueous inclusions on deformation- and recrystallization-related microstructures. Fluid phase separation is indicated for samples from the Muruntau central ore veins by fluid inclusion observational work, as well as by microthermometry and bulk fluid geochemistry (CO_2/CH_4, CO_2/N_2, and CO_2/C_2-, and C_3- hydrocarbon ratios; salinity data). However, in flat veins and all samples from the Myutenbai deposit no evidence for fluid immiscibility could be found. Quartz microstructural results and fluid inclusion data suggest formation of the low-grade mineralized flat veins before the main stage of hydrothermal activity and considerable variation in the geochemical conditions during fluid evolution in the Muruntau and Myutenbai deposits. Mixing of fluids from different sources in variable proportions may be inferred from halide geochemistry. Furthermore, fluid inclusion Br/Cl ratios differ significantly for samples from different vein types. Fluid phase separation is suggested as a mechanism for the precipitation of Au from the hydrothermal fluid in the Muruntau high-grade Au mineralized central veins.