Title:	Records of fluid-rock interactions in the Degana tungsten deposit, India: Inferences from mineral paragenesis, whole-rock and mineral chemistry, and fluid inclusions
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Abstract:	The Degana Granite, a F-rich, peraluminous, Neoproterozoic intrusion in NW India hosts the richest tungsten deposit in the country. This study on the Degana W deposit outlines its alteration history, and nature (and evolution) of pre-ore and ore-stage fluids. Moderate salinity (5.4 to 9.6 wt% NaCl equiv.), H2O-CO2 fluids with nearly consistent CO2/(H2O + CO2) ratios of 0.05–0.07 represent the magmatic stage. A pervasive, post-magmatic K (±Na) alteration occurred in a fluid regime dominated by moderate salinity H2O-CO2 fluids. In subsequent alteration stages, the activity of greisen fluids led to the development of steeply-dipping quartz veins (poorly-mineralized), sub-parallel wolframite-bearing greisenized granitic wall-rock (main ore body), and and a late phase of stockwork-type greisen veins. The greisenization is attributed to the incursion of moderate to high salinity (12–22 wt%) H2O-CO2 ore fluids. Such fluids led to K-feldspar and muscovite hydrolysis, and the growth of lithian ferroan muscovite, secondary topaz, and wolframite (±cassiterite, fluorite). Greisenization introduced additional Fe and Li (+W, Sn) in the wall-rock zone and concomitantly leached out Na, K, Cu, Ba, Sr, U, Zr, and Th. Greisen fluids caused Fe leaching along with incorporation of Li in the micas. The compositions of tri- and di-octahedral micas are controlled by distinct substitution mechanisms --VILi1+1 IVSi4+2 VIAl3+1 VIξ1 VIFe2+-3 IVAl3+-2, and VILi1+4 IVSi4+1 VIFe2+ -1 IVAl3+-1 VIAl3+-1 VIξ-2 (where ξ = vacancy), respectively. We constrain the P-T conditions of W enrichment (380–450 °C and 1.2–1.8 kbar) by means of isochore intersections for coexisting aqueous and carbonic fluid inclusions hosted in greisenized wall rock. The fall in pH of the ore fluid due to fluid-silicate hydrolysis in concomitance with H2O-CO2 immiscibility promoted the decrease in W solubility and subsequent wolframite precipitation. It is surmised that the pervasive, post-magmatic potassic alteration that preceded the ore mineralization acted as a critical pre-conditioning process for ore formation. Both tri- and di-octahedral micas were critical for W enrichment, the former being the likely source for Fe (+W, Sn), and the latter as a reactant for pH-neutralization of greisen fluid, thereby limiting its W solubility.
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