Evolution of Alkalinity-Acidity of Fluids and its Role in Multi-Stage Mineralization

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Granite-related hydrothermal mineralization of many typical fold belts is characterized by a standard succession of ore-metasomatic assemblages (OMA) irrespective of the mineralization age and rock geochemistry of a particular region: 1) magnesium skarns ± Fe mineralization; 2) calcium skarns ± Fe, boron or scheelite; 3) K-feldspar alteration ± Mo; 4) albitization ± Be; 5) greisens ± W, Sn, Be, Li; 6) tourmalinites ± Sn or Au; (injection of earliest basic dykes); 7) beresites or sericite alterations ± Au or Cu-Pb-Zn ores; 8) near-surface argillic or alunite alterations with the simultaneous adularia (± Au-Ag) or chloritic alteration (± Sn or Pb-Zn) below. Within every OMA, a wall rock alteration is always predating ore precipitation. Not all above listed OMAs occur in a particular ore region, some may be absent, but general succession is always preserved.

The above shown succession can be interpreted in terms of evolving alkalinity-acidity of mineralizing fluids: from sub-neutral skarn-forming fluids through rise of alkalinity (feldspathization and albitization of granites) and successive rise of acidity (greisens, tourmalinites, beresites) with its consecutive decrease and final rise of acidity near surface (argillization, alunitization) conjugated with the rise of alkalinity below (adularia, chlorite formation). All pH changes can be explained by a temperature and pressure-dependent hydrolysis reactions in a system $NaCl$-KCl-H_2O during a multi-stage mineralization and the repeated wall-rock / fluid interactions.