

The role of volcano-plutonic complex for simulation of origin of rare-metal granites from Transbaikalia, Russia

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The composition of rocks, melts (on the basis of melt inclusions study), isotopic-geochemical and geochronological characteristics (Rb-Sr and Sm-Nd isotopic systems) of rare-metal granites and accompanying sub-volcanic rocks in the ore clusters of Transbaikalia (Orlovka, Etyka, Shumilovka Li-F granites – Ta deposits, Scherlovaya Gora granites, greisen and rhyolite – Sn-W deposit, Bukuka – vein-greisen W deposit) were studied [1-3]. Close age interval of its formation, a similarity of geochemical specialization, crustal isotope-geochemical characteristics with signs of depleted of finite terms of series of differentiation allow us to consider the association of acid rock as a co-genetic volcanic-plutonic complexes. [4]. Dedicated rock types - ongonites, rhyolites, ongorhyolites, trachyrhyodacites – differentiates by the P-T regimes of crystallization, by the specialization of volatile, by the concentration levels of trace elements in the melts, by the isotopic and geochemical characteristics. These indicators reflect the levels of origin of melts, their degree of differentiation and extent of mantle-crust interaction. Ascertained shift of the isotopic compositions of late members of the series of differentiates toward depleted is reflected in a reduction of IR_{Sr} and, on the contrary, increasing of $^{147}Sm/^{144}Nd$ and values of $\epsilon_{Nd}(T)$, and occurs simultaneously with the accumulation of trace elements. Such situation may be explained by additional juvenile (depleted) component in the form of fluid phase with mantle characteristics produced by plume processes of Northeast Asian hot mantle field [5].

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Kinetics of Fe-isotope exchange with pyrite at hydrothermal conditions

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The lack of data for the rates of Fe mass transfer between hydrothermal fluids and Fe-bearing minerals presents a challenge to the interpretation of seafloor alteration processes at mid-ocean ridges (MORs). Field studies have relied on observations made from experiments performed at ambient conditions and also equilibrium theoretical models to understand the processes and mechanisms of sulfide precipitation/recrystallization [1-3]. Quantification of rates of isotopic exchange will add constraints to the chemical and isotopic evolution of hydrothermal vent fluids and minerals.

The rate of Fe-isotopic exchange between pyrite and hydrothermal fluid ($FeCl_{2(aq)}$) was examined at 350C, 500 bars using an isotopically enriched ^{57}Fe tracer at pyrite saturation equilibrium. The experimental design took advantage of liquid sulfur hydrolysis to buffer redox and pH, ensuring that pyrite is the only Fe-bearing mineral in the system exchanging with the hydrothermal fluid. The degree of Fe-isotopic exchange between $FeCl_{2(aq)}$ -pyrite rapidly approached ~100% within days (2.14×10^{-6} mmol/s). The low pH (in situ) and conditions of high dissolved sulfur may facilitate isotope exchange, as has been reported for sulfur isotope systematics [4] at similar chemical and physical conditions.

Speciation of the measured concentrations of dissolved ΣCl , H_2S , H_2 , ΣFe^{++} , ΣSO_4^{--} and pH indicate that the fluid is saturated with respect to pyrite. Moreover, measured dissolved H_2 is in excellent agreement with that predicted from phase equilibria calculations, confirming that full equilibrium was achieved. The reaction quotient for $S^0 + H_2 \rightleftharpoons H_2S$ equilibrium was also determined ($\log K_{eq} \sim 4.1$).

The rapid rate of isotopic exchange between pyrite and fluid at acidic, high temperature systems, such as back-arc basins, implies that sulfide minerals may record the effects of short term temporal isotopic/chemical perturbations.

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