



Behavior of Cl and REE during granite melts degassing caused by pressure decrease

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Introduction. The rare earth elements (REE) is an important geochemical indicator of magmatic systems evolution. Experimental investigations of water fluid–granitic melts systems under high pressures show the essential dependence of REE distribution coefficients between fluid and melt $[D(\text{REE})^{V/M}]$ from Cl content in fluid. The increase of $D(\text{REE})^{V/M}$ with the growth of Cl concentration in a fluid $(C(\text{Cl})^V)$ evidences that REE are present in a fluid, mainly, as Cl-bearing complexes and their behavior is associated with the one of chlorine in the process of granite magmas degassing [1,2 etc.]. In this report we present the results of numerical simulation of REE distribution between melt and fluid during the degassing of H_2O and Clbearing granite melts, caused by pressure decrease.

Model. The computer model is able to calculate fluid-melt distribution of volatile components (H_2O and Cl) and REE during decompression degassing of granite melt with given initial H_2O , Cl and REE contents [3,4]. The computation of REE concentrations in coexisting equilibrium phases in melt and fluid was based on empirically established dependence of $D(\text{REE})^{V/M}$ from the $C(\text{Cl})^V$ at 2 kbar and 800°C [2]. Model calculations of degassing were implemented within pressure range of 0.5-3 kbar as under the closed conditions when the separated fluid phase remained in the system, as under open conditions when the fluid phase escaped from magma in the process of its formation.

Results. Total concentration of REE (as the one of each element in this group as well) in a fluid separating from the melt $[C(\text{REE})^V]$ slumps in the process of pressure de-

crease and corresponding decrease of Cl content in the fluid. The most significant decrease of $C(\text{REE})^V$ takes place at the first stages of degassing under open system conditions. With pressure decrease below 1-0.7 kbar in closed system (or below 1.5 kbar in open system) the concentrations of REE in fluid are stabilized and remain approximately at constant level. Altogether with general decrease of $C(\text{REE})^V$ during degassing the change in Eu and other REE concentration ratio takes place. As a result the spectrum of REE in fluid phase essentially varies. If initial REE concentrations in melt were identical the first fractions of fluid phase formed under high pressures are characterized by rather uniform REE spectrum with general trend to concentration descent for elements with greater nuclear number. However in the process of decompression starting from some pressure value the concentration maximum of europium in REE spectrum arises and becomes more and more pronounced. The pressure value at which it arises and its relative magnitude are mainly determined by initial content of volatile components (Cl, H₂O) in the melts altogether with the degree of the system openness, i.e. the dynamics of fluid phase separation from magmas in the process of their rising to the surface of the Earth.

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References

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