European Mineralogical Conference
Vol. 1, EMC2012-111, 2012
European Mineralogical Conference 2012

Magma mingling: natural origin for rare mica polytypes

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The rhyodacite of the Ruiz Peak Vulcan (New Mexico, USA) contains different kinds of mica polytypes: two third are 1M and 2M1 polytypes and one third are long period polytypes. The last ones are rare and their mechanism of formation is not yet entirely understood. Few works dealing with the structures of long period polytypes have been reported in literature, but only a study have been carried out to propose a hypothesis of formation, combining the crystallographic and geological approaches (Pignatelli, 2011). The results presented here concern the petrography characterisation of Ruiz Peak rhyodacite. This characterisation allows to understand why these polytypes have been found only in few rock samples and what the geological conditions of their formation are. A detailed macroscopic and microscopic description of a rock sample shows that the rhyodacite is formed by two groundmasses of different colour (dark and red) and also of various phenocrysts (plagioclases, ferrian phlogopites, oxides and minor hornblendes, augites, olivines and fluoroapatite). Most of them present disequilibrium textures as well as "percussion figures" for phlogopites, rim formation for hornblendes, resorption effects for plagioclases, dentritic morphologies for olivine, etc. The mineral heterogeneity and the disequilibrium textures observed in the Ruiz Peak rhyodacite indicates that this rock is probably the result of a mingling of two distinct magmas with small compositional differences and coming from two chambers located at different depths. The mingling event can explain the occurrence of rare long period polytypes in this rock: the chemical-physical variations caused by the mingling of magma can perturb their formation by spiral growth. Indeed spiral-spiral interactions, spiral-crystals and crystal-crystals interactions have been enhanced by the mingling, promoting the formation of long period polytypes according to the model proposed by Nespolo (2001).

Nespolo (2001), Clays Clay Minerals, 49 (1), p.1-23.
Pignatelli (2011), PhD Thesis, 225 p.