Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.17610

K-feldspar as a monitor of crystallization processes in felsic igneous systems

AURORE TOUSSAINT, THOMAS GROCOLAS AND OTHMAR MÜNTENER

University of Lausanne

Presenting Author: aurore.toussaint@unil.ch

Diffusion and crystal growth are keys to understand magma dynamics, and thus the evolution of igneous systems (e.g., [1], [2]). As k-feldspar is a major mineral in felsic plutonic rocks, investigating k-feldspar provides valuable information on crystallization processes and magma dynamics. K-feldspar has been used to determine timescales of crystal growth or residence times for volcanic and plutonic systems (e.g., [3], [4]).

Chemical zoning (e.g., Sr, Ba zoning) is often observed in k-feldspar megacrysts. This makes K-feldspar an ideal target for studying and developing methods to distinguish crystal growth from diffusional re-equilibration. We investigated trace element chemistry and zoning patterns (EPMA and LA-ICP-MS) of k-feldspar megacrysts from two granitoid batholiths (Bergell, Switzerland; Sardinia, Italy) to identify growth and/or diffusion patterns. Results from the different samples show preserved Ba zoning despite perthite exsolutions (Bergell), with an average of 7 to 10 zones of variable spacing and thickness per crystal. Petrography and EPMA data highlight three different features. (1) Sawtooth chemical profiles encompassing textural growth patterns combined with Ba zoning and a more evolved composition towards the borders correlated with the zones of higher Ba composition. (2) Sawtooth and relaxed step-function profiles (potentially related to diffusion) when megacrysts display textural growth patterns associated to Ba zoning (Bergell). (3) No obvious zoning on high-resolution maps but relaxed step-function profiles within single crystals (Sardinia). (1) and (2) could be observed within a single rock sample. In addition, various inclusions are related to Ba zoning (zoned plagioclase, biotite, quartz, apatite, zircon, and oxides - Bergell), located on and parallel to the growth planes. Inclusions from Sardinia samples (mostly zoned plagioclase and biotite) are more randomly distributed. These findings suggest different growth mechanism in the Bergell and Sardinia granitoids, potentially indicating different melt fractions during crystallization.

References:

[1] Costa (2021) *Annual Review of Earth and Planetary Sciences*, *49*, 231-252; [2] Costa, Shea & Ubide (2020) *Nature Reviews Earth & Environment*, *1*(4), 201-214; [3] Moore & Sisson (2008) *Geosphere*, *4*(2), 387-400; [4] Rout, Blum-Oeste & Wörner (2021) *Journal of Petrology*.