In-situ Rb-Sr age mapping of micas captures examples for petro- and thermochronology

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Recent advances in reaction cell technologies allows laser ablation-based in-situ analysis of beta-decay controlled isotope systems (e.g., ^{87}Rb-^{87}Sr-^{86}Sr), close to inaccessible due to isobaric interferences. Chemical separation of $^{87}Sr^{+}$ from $^{87}Rb^{+}$ within an ICP by N_2O as a reaction gas turns out to be an efficient, straight-forward approach that opens up applications in several areas of Earth Sciences (see Zack & Hogmalm 2016, Hogmalm et al., 2017).

Analyses of several 1000 micas at the University of Gothenburg over the years has revealed that it is not uncommon to encounter micas dominated by ^{87}Sr from decay of ^{87}Rb within the crystal (radiogenic Sr) in relation to ^{87}Sr incorporated during crystal growth (common Sr). With a ratio of 10:1 or higher it approaches conditions comparable to most U-Pb in zircon, hence allowing calculation of spot ages (making isochrons obsolete).

In this study, conditions have been optimised to produce Rb-Sr age maps from 100's of single spots with a spatial resolution of 30x30 µm. Combining Rb-Sr apparent ages with BSE maps as well as 20 major and trace element concentration data gives unprecedented insight to processes controlling the Rb-Sr system in micas.

I will show several examples of biotites where apparent core to rim age variations for several 100 micron follow simple error functions, together with pristine grain boundaries and no major change in composition. This can be best explained with temperature-controlled volume diffusion and hence falls into the field of thermochronolgy. In contrast, at least in one case (from the Gothenburg area), biotite also shows core-to-rim age decrease, but here the age decrease can be tied to microfractures and changes in elemental composition. This is best explained by fluid-mediated recrystallization below its closure temperature, following the spirit of petrochronology.