Characterization of downhole fractionation for *in situ* Rb-Sr dating in natural micas and synthetic reference materials

Collision/reaction cell technology in tandem mass spectrometry (ICP-MS/MS) enables inline separation of isobaric interferences, including the radiogenic systems in which the parent and daughter products are isobaric (i.e., ^{87}Rb decays to ^{87}Sr, ^{176}Lu to ^{176}Hf). This facilitates laser-based approaches to Rb-Sr geochronology that reduce the time required for sample preparation and analysis, and preserve the spatial and textural information of the minerals that are dated. Accuracy of the *in situ* Rb-Sr analyses via laser ablation (LA)-ICP-MS/MS varies within and in between sessions, depending on materials behavior during ablation. Here, we characterize the Rb/Sr downhole inter-element fractionation (DHF) in natural micas and reference materials, including a recently produced synthetic glass with a phlogopite matrix and high Rb/Sr ratio. The new synthetic glass show a significant potential to replace reference materials that are used thus far: (i) pressed nano-powder pellets (e.g., MicaMg and MicaFe) that are compositionally similar to natural micas but ablate differently, and/or (ii) synthetic glasses (e.g., NIST SRM 610, BCR-2G) that ablate more similarly to natural micas but deviate compositionally. We characterize the DHF across a variety of ablation conditions by varying beam energy density, repetition rate, spot size, and spot shape. We observe many differences in ablation behavior between glasses, nano-pressed powder pellets (used as reference material), and natural minerals that have been observed in other studies. We also show that minerals of differing composition (biotite versus muscovite) exhibit very different DHF patterns, which has not been tested elsewhere. This suggests that the optimal ablation conditions and data reduction strategies may differ for different types of micas. Varying optimal conditions based on mineral type will impact the accuracy of age determination, especially for applications on rocks containing multiple generations of Rb-bearing minerals (particularly K-feldspar and mica minerals) that potentially reflects multiple geologic events.