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Cryptic geologic events revealed by single spot Rb-Sr dating of biotite by LA-MC-ICP-MS/MS

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Metamorphic micas preserve a rich record of tectonism, thermal perturbations, and fluid interactions, but are challenging to date *in situ*, and often exhibit complex Ar/Ar and Rb-Sr age spectra. Recent developments in tandem mass spectrometry enable precise *in situ* Rb-Sr mica geochronology, and potentially permit deconvolving individual (re)crystallization events. Here we measured simultaneous isotope ratios of $^{87}Sr/^{86}Sr$ and $^{87}Rb/^{86}Sr$ in metamorphic micas from the contact aureole of the Mooselookmeguntic pluton in western Maine, USA, using an ESL™ image GEO™193 excimer laser-ablation system coupled to a Thermo Scientific™ Neoma MS/MS MC-ICP-MS. These mica-bearing metasediments were subject to regional metamorphism during the Acadian Orogeny (ca. 400 Ma) followed by thermal metamorphism during post-orogenic plutonism, including the Mooselookmeguntic pluton (ca. 370 Ma). Fully integrating the data from each biotite spot analysis yields sample isochrons with average Rb-Sr dates of ~290 Ma; however, single spot Rb-Sr isochrons constructed from individual integrations within each spot reveal peaks at 303, 270, and 240 Ma (see also Cruz-Uribe et al., this session). These individual Rb/Sr dates are apparently independent of Rb/Sr ratio, suggesting decoupling between biotite elemental compositions and isotopic ages. Previous amphibole Ar-Ar plateau ages from the Mooselookmeguntic pluton range from 370–305 Ma [1,2], consistent with our oldest Rb-Sr dates and indicative of lengthy Carboniferous metamorphism in Maine. Slightly discordant U-Pb dates for the nearby Mt. Mica pegmatite ca. 270 Ma [3] indicate a possible intrusive heat source in western Maine during the final stages of the Alleghanian orogeny. Biotite Ar-Ar cooling ages in the Mooselookmeguntic and adjacent plutons range from 229–249 Ma [2], consistent with our youngest Rb-Sr single-spot isochron dates. The punctuated nature of events recorded by Rb-Sr in biotite suggests the ability for micas to record complicated heating, cooling, and fluid histories of rocks, and may elucidate cryptic metamorphic events in western Maine associated with the Alleghanian orogeny and subsequent breakup of Pangea.

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[2] DeYoreo et al. (1989), *Studies in Maine geology: igneous and metamorphic geology* 3, 19–34.

[3] Bradley et al. (2016), *The Canadian Mineralogist* 54, 945–969