Portable Rb-Sr, Pb-Pb, and Sm-Nd Dating Using CODEX

F. S. ANDERSON[1], T. J. WHITAKER[1], AND J. LEVINE[2]

[1]Southwest Research Institute, 1050 Walnut St, Boulder CO (*correspondence: anderson@boulder.swri.edu)
[2]Colgate University, Hamilton, NY

The Chemistry, Organics, and Dating EXperiment (CODEX) measures elemental abundance, organics, and isotopes of Rb, Sr, Pb, Sm, and Nd. CODEX is designed for use on the Moon, Mars, and Earth. By making raster maps at 1-cm^2 scales with ~50 μm spacing, we plan to reassess inner solar system chronology, search for biomarkers, and provide context and concordance. Our primary goal is to improve understanding of the timing of events during the first 1.5 Ga of solar system history that define the planets as we know them today. Specifically, the duration of many processes remain uncertain, and in some cases, have dramatic implications for the history of the solar-system [1, 2].

Previously we have demonstrated Rb-Sr measurements with accuracy and precision of ≲±200 Ma for Zagami, a martian meteorite, and the Duluth Gabbro, a lunar analog. More recently we have demonstrated the importance of mineralogic context for dating the Boulder Creek Granite [3], and have demonstrated Pb-Pb dates for zircons, lunar, and martian meteorites with accuracy and precision of ≲±100 Ma. In some cases, we obtained ages that were inconsistent with other isotopic measurements, but consistent with previous unleached Pb-Pb TIMS results. These differences are likely explained by terrestrial contamination, or incorporation of Pb from isolated reservoirs during the impact processes producing these meteorites [4]. However, CODEX measurements made on the Moon or Mars would not suffer from these issues, and might provide insight into the fundamental processes driving these observations. Using LARIMS to produce both Pb-Pb and Rb-Sr data allows us to date a wider range of samples, provides an independent test of concordance, permits new insight into potential sample contamination, facilitates understanding of initial Th/U and $^{87}Sr/^{86}Sr$ reservoirs, and enables confirmation of the presence of previously unidentified but geologically meaningful isotopic contributions. We are currently testing other isotope dating systems using our approach, such as Sm-Nd, and in the future, expect our accuracy and precision will continue to improve.

[1] Anderson F.S. et al (2015), *RCMS* 29, 1-8. [2] Anderson F.S. et al (2015), *RCMS* 29(2), 191-204. [3] Foster S. et al (2016) *LPSC*, 47 abs. #2070. [4] Bellucci J. et al (2016) *EPSL* 433, 241-248.