SPATIALLY RESOLVED, CORRELATED VARIATIONS IN APPARENT $^{40}$Ar/$^{39}$Ar AGES AND Ca/K RATIOS IN APOLLO 17 IMPACT MELT BRECCIA 77135.


As part of an interdisciplinary study of the polylithologic Station 7 boulder at the base of the North Massif in the Taurus-Littrow Valley on the Moon [1], Stettler et al. [2-4] reported $^{40}$Ar/$^{39}$Ar spectra for whole-rock fractions from sample 77135, generally interpreted to be the youngest impact melt breccia present in the boulder. The spectra were highly disturbed, with young apparent ages (ca. 2.17-1.70 Ga) for the low-temperature (T) steps at the beginning of the experiment rising to older apparent ages (ca. 3.87-3.79 Ga) for the high-T steps. The corresponding Ca/K ratios for these release spectra are low (ca. 4-5) for the low-T steps, and higher (ca. 48-119) for the high-T steps. The simplest interpretation of such spectra is that the low-T steps reflect partial Ar loss due to one or more reheating events or prolonged cooling, whereas the higher-T steps more closely approximate the formation age of the melt. One potential implication of this interpretation is that any total-gas or whole-rock fusion dates, such as those obtained by laser ablation techniques, would be systematically younger than the formation age of the melt. We have revisited 77135 with the UV laser ablation microprobe (UVLAMP) $^{40}$Ar/$^{39}$Ar method and have found that this is not necessarily the case.

BSE and X-ray element maps were made for 77135,209 using the electron microprobe at Washington University in St. Louis, and UVLAMP analyses were conducted at Arizona State University following the methods of [5]. The maps show that K is highly concentrated in discrete interstitial pockets (typically <100 µm in diameter) scattered throughout the melt matrix. We specifically targeted these small K-rich domains with cylindrical laser spots (ca. 110-180 µm in diameter with typical ablated depths of 40-60 µm) and obtained $^{40}$Ar/$^{39}$Ar dates between ca. 3.56-3.36 Ga and corresponding Ca/K ratios of 26.5-7.9. When we tried to avoid the K-rich domains (using similar spot sizes), we obtained a narrow range of dates between ca. 3.77-3.66 Ga with corresponding Ca/K ratios between 91.2-69.6.

Owing to the small sizes of the K-rich domains compared to the laser pit sizes required for each analysis, we were not able to ablate a sample volume containing only the K-rich material. However, mixtures of the K-rich domains and surrounding materials have low apparent ages. In contrast, our analyses with higher Ca/K ratios tend towards the formation age of the melt, implying that UVLAMP techniques permit us to avoid the analysis of material that has a tendency to experience preferential post-crystallization Ar loss.