**A LASER PROBE $^{40}\text{Ar}^{39}\text{Ar}$ AND INAA INVESTIGATION OF FOUR APOLLO GRANULITIC BRECCIAS**

J.A. Hudgins$^1$, J.G. Spray$^1$, S.P. Kelley$^2$, R.L. Korotev$^3$, and S. Sherlock$^2$. $^1$Planetary and Space Science Centre, University of New Brunswick, Canada; $^2$CEPSAR, Open University, U.K.; $^3$Department of Earth and Planetary Sciences, Washington University, St. Louis, U.S.A.

**Introduction:** Infrared laser probe $^{40}\text{Ar}^{39}\text{Ar}$ geochronology, instrumental neutron activation analysis (INAA) and analytical electron microscopy have been performed on four rock tiles of Apollo granulitic breccias (60035, 77017, 78155, and 79215). Granulitic breccias are high-temperature (~1000ºC) metamorphic rocks with homogeneous mineral chemistry [1]. The mineralogy and chemistry of these rocks, as well as exhumation constraints, indicate that the source of metamorphism was shallow via juxtaposition of footwall lithologies with overlying impact melt sheets or hot ejecta blankets, potentially making them akin to basal suevite lithologies in terrestrial impact craters.

**Ar-Ar results:** $^{40}\text{Ar}^{39}\text{Ar}$ data from this study and compiled from the literature [2] indicates a range of ages from 4.2 Ga to 3.9 Ga for the granulitic breccia suite. All studied granulitic breccias were metamorphosed and cooled initially at, or prior to, 3.9 Ga. This range of ages sets limits on the extent of surface processing during the late heavy bombardment. However, the fact that all of these rocks contain high concentrations of meteoritic siderophiles provides evidence for significant impact prior to 4.0 Ga (i.e., pre-LHB). These impact events may have provided the heat responsible for high-temperature metamorphism.

**Post-LHB thermal reprocessing:** We detected partial resetting events in the finer grained granulites that occurred significantly later than 3.9 Ga. These events were low-temperature (<300ºC) and, therefore, did not alter the mineralogy or texture of these rocks, but only resulted in minor brecciation and the partial release of argon from plagioclase. Interpretation of this low-temperature overprint indicates partial thermal resetting of the argon systematics to as young as 2.3 Ga.

**Conclusions:** Our results increase the amount of high-precision data available for the granulitic breccias and the lunar highlands crustal samples in general. The data alludes to the survival of pre-LHB material on the lunar surface and documents the effects of contact metamorphic and impact processes during the pre-Nectarian Epoch, as well as the low-temperature partial resetting of ages by smaller event impacts after 3.9 Ga.