REEXAMINATION OF THE FORMATION AGES OF APOLLO 16 REGOLITH BRECCIAS.

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Introduction: Regolith breccias are lithified samples of the regolith that have been fused together by impact shock and thermal metamorphism. In lunar regolith samples, the ratio of trapped $^{40}Ar/^{36}Ar$ is a useful indicator of antiquity and can be used to model the closure age / lifithication event of the regolith (i.e. the apparent time when Ar became trapped [1]), thus providing important insights into specific times when that regolith was being gardened by impacting asteroids and comets [2].

Ages of the Apollo 16 regolith breccias: McKay et al. [3] used this antiquity indicator to identify two groups of regolith breccias at the Apollo 16 (A16 RB) landing site: (i) the 'ancient' group, representative of immature (i.e. <30 I_s/FeO) pre-3.9 Ga regolith, and (ii) the 'younger' group that generally have higher levels of maturity and were formed after 3.9 Ga (see also [4-6]).

New Age Estimates: Here we readdress the timing of formation of these A16 RB in light new calibrations of the relationship between trapped $^{40}Ar/^{36}Ar$ vs. sample isotopic age as proposed by Eugster et al. [7]. The model ages derived from this calibration indicate that the ancient A16 RB are not as old as suggested by the McKay et al. [3] calibration (4.5-3.93 Ga), and that the ancient breccias only sample post-basin regolith processes from 3.67-3.26 Ga.

We have modified the Eugster et al. [7] calibration to revise reported Ar-isotope ages for updates in decay constants and to include data from feldspathic lunar meteorite Yamoto-86032 [8] and additional Apollo 16 regolith breccia components [9-10]. We also selectively removed the Eugster et al. [7] Apollo 14 data points that have variable reported Xe, Ar and U-Pb isotopic ages.

Using our new calibration, we determined model ages for the ancient breccias of 3.81-3.38 Ga that are consistent with A16 RB sample isotopic ages and ages of clast components within them.

Implications for accessing the record of impacting projectiles: Our model results indicate the ancient A16 RB were lithified during the last stages of basin formation on the Moon. This suggests they may not provide a window to pre-Imbrium regolith processes. The young A16 RB samples provide an opportunity to investigate the nature of impacting projectiles through ~2.5 to 1.7 Ga. This period is associated with quiescent impact bombardment. Samples that have low trapped $^{40}Ar/^{36}Ar$ ratios were lithified very recently and are comparable with the impact record preserved in present day Apollo 16 soils [3].

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