$^{40}Ar/^{39}Ar$ and CRE ages of plagioclase crystals from Apollo 17 regolith, 78461

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Single plagioclase crystals, which are abundant within lunar regoliths, can provide chemical and isotopic constraints on the nature of the ancient lunar protolith, in a manner analogous to information from Jack Hills zircons about the Hadean Earth [1]. Like a first-order model of the Moon developed from a petrologic study of mm-sized rock fragments from the Apollo 11 regolith [2], single crystal isotopic studies can expand knowledge of the Moon's chemical evolution. To explore this strategy, 11 plagioclase crystals (0.06 to 1.2 mg each) from Apollo 17 regolith 78461 were characterized by electron microprobe, and irradiated. Ar was extracted from each crystal using a CO_2 laser to measure isotopic composition. $^{40}Ar/^{39}Ar$ ages of grains (based on ^{40}Ar corrected for trapped ^{40}Ar) range from 4.05 Ga to 4.32 Ga except Plag # 10 grain that yielded an apparent age of 5.04 Ga. Measured $^{40}Ar/^{39}Ar$ for Plag #10 is ~600, almost twice the values obtained on the other grains. A possible correlation between $^{40}Ar/^{39}Ar$ ages and ^{36}Ar abundance suggests that the ages may be affected by the presence of solar wind implanted, parentless ^{40}Ar. Also, Plag #10 grain has the highest ^{36}Ar abundance. ^{38}Ar cosmic ray exposure (CRE) ages for individual grains calculated using the target chemistry, and production rates [3], range from 3 to 28 Ma with the highest CRE age for Plag # 10. CRE ages cluster in three groups, suggesting at least three episodes of regolith mixing. In general, a grain with higher CRE age has a higher $^{40}Ar/^{39}Ar$ age, indicating grains that spent longer duration on the lunar surface tend to acquire more parentless ^{40}Ar . The presence of parentless ^{40}Ar in Plag #10 may account for its geologically meaningless $^{40}Ar/^{39}Ar$ age, as well as those previously reported associated with low temperature steps of plagioclase step heat experiments [e.g., 4].

[1] Harrison *et al* (2008). *Earth Planet. Sci. Lett.*, **268**, 476-486. [2] Wood et al (1970). *Proc. Apollo 11 Lunar Sci. Conf.,* 965-988. [3] Hohenberg *et al* (1978). *Proc. Lunar Planet. Sci. Conf.* 9th, 2311-2344. [4] Fernandes et al (2013) *Met. Planet. Sci.*, **48**, 261-269.