Re-evaluation of ^{39}Ar-^{40}Ar Ages for Apollo lunar rocks 15415 and 60015.

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We re-analyzed ^{39}Ar-^{40}Ar ages of Apollo lunar highland samples 15415 and 60015, two ferroan anorthosites analyzed previously in the 1970's, with a more detailed approach and with revised decay constants. From these samples we carefully prepared 100-200 mesh mineral separates for analysis at the Noble Gas Laboratory at NASA-Johnson Space Center. The ^{39}Ar-^{40}Ar age spectra for 15415 yielded an age of 3851 ± 38 Ma with 33-99% of ^{39}Ar release, roughly in agreement with previously reported Ar-Ar ages [1-4]. For 60015, we obtained an age of 3584 ± 152 Ma in 23-98% of ^{39}Ar release, also in agreement with previously reported Ar-Ar ages of ~3.5 Ga [5,6]. Highland anorthosites like these are believed by many to be the original crust of the moon, formed by plagioclase floatation atop a magma ocean [7], however the Ar-Ar ages of 15415 and 60015 are considerably younger than lunar crust formation. By contrast, recently recovered lunar anorthosites such as Dhofar 489, Dhofar 908, and Yamato 86032 yield older Ar-Ar ages, up to 4.35 Ga [8-11], much closer to time of formation of the lunar crust. It follows that the Ar-Ar ages of the Apollo samples must have been reset by secondary heating, and that this heating affected highland anorthosites at both the Apollo 15 and Apollo 16 landing sites but did not affect lunar highland meteorites. One obvious consideration is that while the Apollo samples were collected from the near side of the moon, these lunar meteorites are thought to have originated from the lunar far side [8-13].

References:

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