Time variation of radon gas emanation on the lunar surface observed by Kaguya/ARD

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We analyzed the data obtained by the Alpha-Ray Detector (ARD) onboard the lunar orbiter Kaguya and detected intensity increases of alpha-particles from ^{222}Rn on the lunar surface. Although the time variation of the radon alpha-particle intensity was implied by the observations of Apollo 15, 16, and the Lunar Prospector, we observed the variation directly for the first time. We divided the entire observation period of January to June 2008 into the time periods of 2 weeks which approximately corresponds to the time necessary for Kaguya/ARD to observe the entire lunar surface. Then, we evaluated the ^{222}Rn alpha-particle intensity using the sliding-window algorithm for each period and detected at least 7 events of statistically significant signal higher than 4s. In all cases, duration of the alpha-particle intensity increase was less than 2 weeks. The result implies that the observed radon gas emanation is a sporadic event caused by opening of some path to the lunar surface after subsurface accumulation of gas. We examined the timing of the events relative to the passage of the terminator and found that 5 out of 7 events were within 5 days around the terminator passage. Thus, at least some of the gas emission events are possibly triggered by the stress due to the temperature gradient in the lunar crust.

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