Indigenous Lunar Nitrogen

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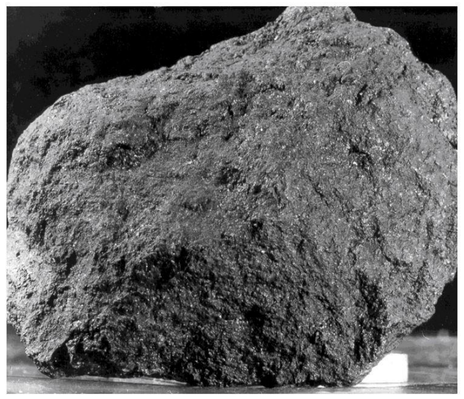


Figure 1: Photo of 12008,0 after dusting. NASA photo # S70-47882. Sample is 2 cm across.

12008: Ol vitrophyre basalt, Ar/Ar dated at 3.2 b.y., exposure age of <50 m.y.

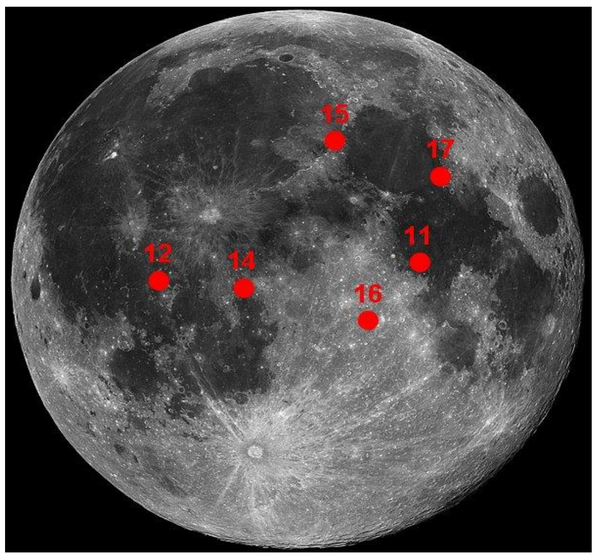
- **Objective**: Measure nitrogen isotopes ($\delta^{15}N$) in pristine lunar basalts, in order to better constrain the indigenous lunar nitrogen isotope component
- **Implications**: Reconstructing Earth-Moon formation history, constraining the initial lunar volatile inventory and understanding elemental and isotopic N evolution
- Lunar surface nitrogen isotope variability: between ~ -234 ‰ and +177 ‰.
- Mixing of various N_2 components: 1) Indigenous, 2) Solar wind, 3) Cosmogenic, 4) "non-solar" impactors, 5) Unknown N_2 sources.
- Limited indigenous N_2 data is available due to: 1) scarcity of indigenous volatiles, 2) low N_2 concentration in lunar basalts (<1 ppm N_2) and 3) the overprinting of solar wind particles and/or secondary nuclides produced by cosmic ray exposure.

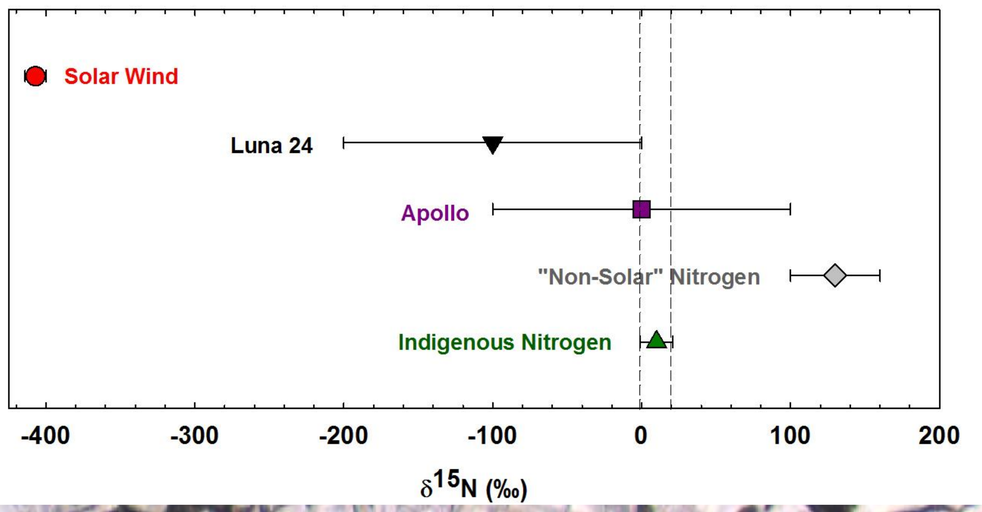
Figure 1: Color photo of fine-grained basalt 70255. Cube is 1 cm. NASA S75-24191.

Figure 1: Photo of 71556. Cm scale. S73-33453

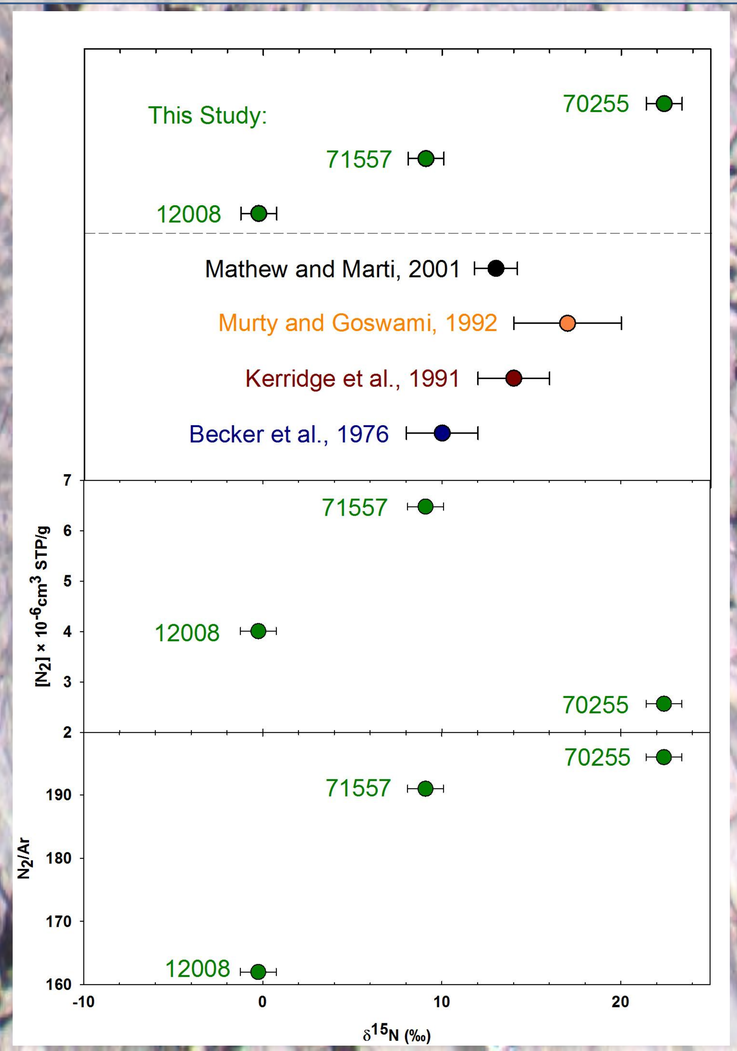
70255: Fine-grained, Ti-rich, blocky, subangular Ol and Si rich basalt. > 3.8 b.y. and minimal exposure ages.

71557: Coarse-grained basalt; large plates of Plg poikilitically enclose crystals of Px, Ol and Ilm. > 3.8 b.y. and minimal exposure ages

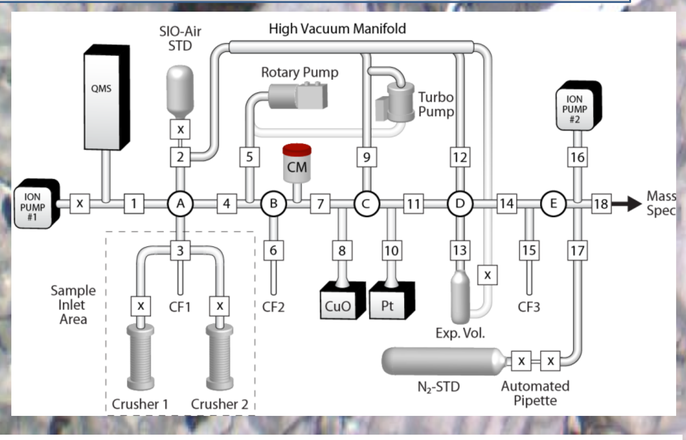


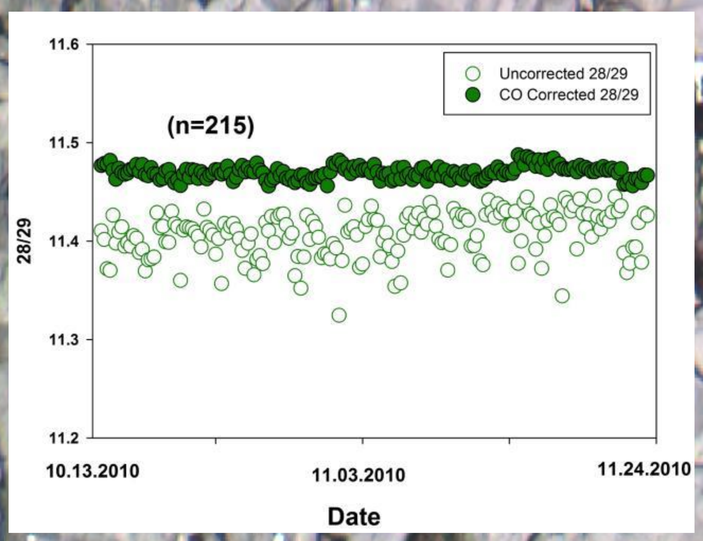


Previous indigenous N_2 studies vs. this study

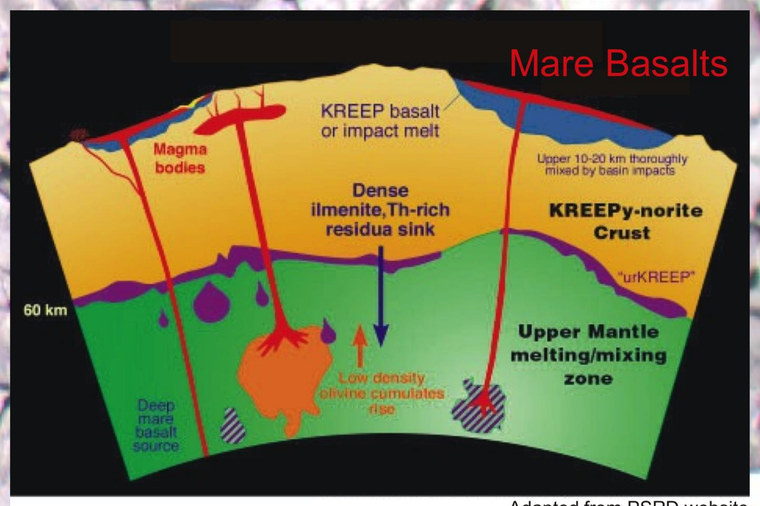


Experimental Techniques: Simultaneous Multi-collection Mass Spectrometer





Lunar Magma Ocean & the Origin of Mare Basalts



Adapted from PSRD website

- Lunar N_2 inventory is important for deciphering the petrological evolution of the moon
- Preliminary results confirm previous findings & expand the limited database for indigenous lunar N_2
- A Possible N-isotope distinction exists between Apollo 12 (low $\delta^{15}N$) & Apollo 17 (high $\delta^{15}N$) samples
- Analytical difficulties (i.e., high blank contributions) still persist due to limited sample availability and low N_2 concentrations
- **Future work**: Improved access to larger sample quantities & additional analysis of "pristine" samples