Indigenous Lunar Nitrogen

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• 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.

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

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 IIm. > 3.8 b.y. and minimal exposure ages.

Previous indigenous N$_2$ studies vs. this study

Lunar Magma Ocean & the Origin of Mare Basalts

- 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

- Experimental Techniques: Simultaneous Multi-collection Mass Spectrometer

- Mare Basalts

- Adapated from PIRD website.