

## COMPOSITION, AGE AND REGOLITH HISTORY OF FELDSPATHIC LUNAR METEORITES.

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**Introduction:** Lunar meteorite samples provide a key record of impact cratering processes from regions outside of those sampled by the Apollo missions [1-3]. We are currently studying the mineralogical and chemical makeup and Ar-isotope age record of impact melts in several lunar meteorites to test global models of impact bombardment and investigate compositional heterogeneity of the lunar crust.

**Methods:** Polished blocks of regolith breccia Northwest (NWA) 2998, granulitic breccia NWA 3136, and impact melt breccias NWA 482 and 7022 were analysed using SEM and EMPA. We conducted <sup>40</sup>Ar/<sup>39</sup>Ar dating of small sample masses (0.41 to 3.9 mg) using a Thermo Scientific<sup>TM</sup> Argus VI<sup>TM</sup> MC mass spectrometer coupled to a CO<sub>2</sub> laser for step heating.

**Results:** *NWA 482:* is an impact melt breccia that sampled FAN-like and intermediate FAN-MAN like anorthositic parent lithologies [4]. A small 0.41 mg chip has a disturbed release profile, similar to that reported by [4], with a range of ages 3147±25 (2σ) to 3656±24 Ma. Our <sup>37</sup>Ar-Ca exposure age is 199±9 Myr (2σ), younger than that reported by [5] to be ~2.07 Gyr.

*NWA 3136:* is a granulitic breccia with a heterogeneous granoblastic to poikiloblastic texture and FAN-like noritic precursor target rocks [6]. A 25.4 mg chip of the stone has previously been argon dated by [6] to have an age of 3327±29 Ma and a space exposure duration of 14.5±1.2 Myr. We measured a similar release profile in a 1.08 mg chip with high trapped <sup>40</sup>Ar at low temp releases and a high temp release profile with an age of 3184±14 Ma and an exposure duration of 25.1±1.1 Myr.

*NWA 7022:* The impact melt breccia portion of this stone has clasts of FAN gabbroic-noritic anorthositic rocks and an interclast matrix with sodic glass and plagioclase. A 3.9 mg chip of the melt has a disturbed lower temp release profile and an older release age of 3916±22 Ma and an exposure duration of 32.5±1.7 Myr.

*NWA 2998:* is a polymict highly feldspathic breccia with a high-Th component. It has a range of lithic clasts from granulites to FAN derived igneous lithics and impact melt breccias. The average regolith portion of the stone has a large solar wind trapped component, which gives unrealistic >6 Ga ages. Two granulite clasts (1.16 and 1.13 mg) have disturbed Ar release profiles with max ages of 3680±15 Ma 2874±18 Ma and similar exposure ages of 307±10 Myr and 327±11 Myr.

**Discussion:** All four meteorites are dominated by predominantly FAN-like precursor rocks. NWA 7022 sampled an impact event at 3.9 Ga similar to the Imbrium basin-forming event witnessed by Apollo samples and KREEP-rich lunar meteorites [7]. NWA 482, 2998 and 3163 have bulk or component ages that record <3.9 Ga impact argon loss events, consistent with the general trend of feldspathic lunar meteorites sampling a range of post-basin-forming impact events [2,3].

**References:** [1] Taylor G. J. (1991) *Geochim. et Cosmochim. Acta* 55:3031–3036 [2] Cohen B. A. et al. (2005) *Meteoritics & Planetary Science* 40:755–777. [3] Fernandes V.A. et al. (2013) [4] Daubar I. J. et al. (2002) *Meteoritics & Planetary Science* 37:1797–1814 [5] Lorenzetti S. et al., (2005) *Meteoritics & Planetary Science* 40:315–327 [6] Hudgins J. A. et al. (2011) *Geochim. et Cosmochim. Acta* 75, 2865–2881. [7] Lui D. et al. (2011) *Earth and Planetary Science Letters*, 319-320:277–286. **Acknowledgements:** Thanks to Tony Irving and Vera A. Fernandes for sample loan.