THERMAL NEUTRON FLUENCES IN FRAGMENTS OF A LARGE L3-6 CHONDRITIC REGOLITH BRECCIA

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Introduction: The abundance of solar-gas regolith breccias varies greatly among different meteorite types, ranging from <1% for most achondrites to 100% for CM chondrites, and even varies significantly among ordinary chondrites [1]. Regolith breccias are much more common among H-chondrites (15%) than among L (3%) and LL chondrites (5%). Possible explanations for the low abundance of regolith breccias among L-chondrites include that they were ejected from smaller parent bodies (produced during the L-chondrite breakup) than the H-chondrites or that they were degassed during the main L-chondrite parent body break up event ~470 Myr ago. The latter explanation would be consistent with the observation that many L-chondrites are fragmental breccias, often with the typical light-dark textures of regolith breccias, but without the high solar gas abundances [1]. To investigate the possibility that the L-chondrite breccias lost their solar-gas inventory, we measure the Sm isotopic composition in several fragments of the L3-6 chondritic regolith breccia, Northwest Africa, NWA 869, which fell as a shower of many thousands of fragments [2,3]. This meteorite has a CRE age of ~5 Ma as 4-5 m object, while elevated ^{21}Ne concentrations in individual clasts show evidence of a previous exposure up to ~10 Ma on the parent body. All samples contain trapped solar gases, but the low value of trapped ^{4}He/^{20}Ne indicates that part of the solar gas inventory was lost before compaction into a rock.

Method: Due to the large cross section of ^{149}Sm for thermal neutron capture, the measured ^{150}Sm/^{149}Sm ratio in meteorites is a measure of the total thermal neutron fluence. This neutron fluence provides a measure of the total residence time of samples in the top 1-3 meters of the regolith on their parent body, and is not affected by thermal heating events that led to noble gas losses.

Samples: We selected four fragments of the NWA 869 meteorite shower, including MB-13, SM-03-1, M05-38-1 and M05-38-2, which show a wide range in parent body exposure ages [2]. We dissolved ~0.5 g of each sample in HF/HNO_3 and separated Sm using standard ion exchange procedures [4]. The isotopic composition of Sm is measured by thermal ionization mass spectrometry on a Thermo Finnigan Triton instrument. Preliminary results will be presented at the meeting.

References: [1] Bischoff A. et al. 2006. *Meteorites and the Early Solar System II*, pp. 679-712. [2] Metzler K. et al. 2011. *Meteoritics & Planetary Science* 46:652-680. [3] Welten K. C. et al. 2011. *Meteoritics & Planetary Science* 46:970-988. [4] Hidaka H. and Yoneda S. 2007 *Geochim. Cosmochim. Acta* 71: 1074-1086.