COSMIC-RAY EXPOSURE AND GAS-RETENTION AGES OF THE UNIQUE QUENCHED ANGRITE NORTHWEST AFRICA 7812.

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Introduction: Northwest Africa (NWA) 7812 is a unique, Mg-rich, quenched angrite found in Mauritania in 2013, and described in detail by [1]. Here we report the results of a noble gas analysis of this meteorite.

Methods: We analyzed all five stable noble gases (He, Ne, Ar, Kr, Xe) in one sample (45.1 mg) of NWA 7812. After weighing, the sample was wrapped in aluminum foil and exposed to ultra-high vacuum for several days. It was analyzed using a custom-built noble gas mass spectrometer at ETH Zurich. The noble gases were extracted by heating the samples in a furnace to 1800°C in a single step. Measurements were done according to an established protocol described in [2]. Blank corrections were never larger than 0.1% for He, 2% for Ne, 11% for Ar. The blank contributions for Kr and Xe were on the order of several 10%.

Results & Discussion: The Ne inventory of NWA 7812 is purely cosmogenic ($^{22}Ne/^{21}Ne = 1.22$; $^{22}Ne = 5.17 \times 10^{-8}$ cm^3STP/g), while for He and Ar, also a radiogenic and (for Ar) a trapped component are present. The isotopic compositions of Kr and Xe are, within error, insdinguishable from primordial (Q) Kr, Xe, except for a significantly increased (cosmogenic) $^{80}Kr/^{84}Kr$ ratio of ~0.11. The trapped $^{36}Ar/^{84}Kr$ ratio is ~100, while for $^{84}Kr/^{132}Xe$, a lower limit of ~1 can be given. These values are roughly compatible with phase Q [6]. The high $^{22}Ne/^{21}Ne$-ratio, a characteristic NWA 7812 shares with most other angrites (e.g., [3]), indicates irradiation of the samples by cosmic-rays close to the surface of a small meteoroid [4]. Using the elemental production rate model by [4] for chondrites, adapted for the measured major element composition of NWA 7812 [1], we calculate ^{3}He, ^{21}Ne and ^{38}Ar cosmic-ray exposure (CRE) ages of 13.1, 21.5 and 17.7 Ma, respectively. Since He seems to be affected by diffusive gas-loss (~33%) and Ar can be affected by inhomogeneities in Ca-concentration for samples <100 mg, we consider the Ne CRE age of 21.5±2.5 Ma to be the most reliable. This CRE age is different from any other CRE age measured in angrites so far (e.g., [3],[5]). The radiogenic ^{40}Ar inventory can be combined with the measured K_2O concentration of 0.01% (~90 ppm K) to deduce a K-Ar age of ~3 Ga. Assuming slightly superchondritic U, Th concentrations, the U,Th-He age is within error identical to that value, hinting at a large degassing event on the angrite parent body about ~3 Ga ago.

References: [1] A. J. Irving et al., 2013, (this meeting). [2] Wieler R. et al., 1989, *Geochimica et Cosmochimica Acta* 53:1449-1459. [3] Busemann H. et al., 2006. *Geochimica et Cosmochimica Acta* 70:5403:5425. [4] Leya I. & Masarik J., 2009, *Meteoritics & Planetary Science* 44:1061-1086. [5] Nakashima D. et al., 2008. 71st Meeting of the Meteoritical Society, abstract #5078. [6] Ott U., 2002. *Reviews in Mineralogy and Geochemistry* 47:71-100.