Rb-Sr & Sm-Nd ISOTOPIC SYSTEMATICS OF NWA032.

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Introduction: The lunar meteorite NWA032 is an unusual low-Ti mare basalt that is characterized by high incompatible element abundances, elevated LREE/HREE and Th/REE ratios, and a young Ar-Ar age of 2779 ± 14 Ma [1-2]. Fagan et al. [1] speculated that NWA032 either: (1) underwent an unusual, and unidentified, petrogenetic mechanism that fractionated Th from REE or (2) was derived from a unique, possibly KREEP-like, source region that has not been identified in other lunar samples. We have completed Rb-Sr and Sm-Nd isotopic analyses on NWA 032 in order to unambiguously determine its crystallization age and to constrain the composition of its source region.

Analytical procedures. NWA032 contains 15-20% phenocrysts of olivine and pyroxene in an extremely fine groundmass consisting primarily of these phases and calcic plagioclase. The fined grained nature of NWA032 prohibited hand-picking the mineral fractions. Consequently, the sample was crushed and sieved at 44-75 μm and then run through a Frantz isodynamic separator. The magnetic fractions were washed in water, leached at ~25 °C in 2N HCl for 15 minutes, and finally leached in 4N HCl at ~65 °C for 30 minutes. The initial wash and 2N HCl leachate primarily removed terrestrial contamination, whereas the 4N HCl leachate primarily dissolved plagioclase, producing a greater spread in parent/daughter ratios on isochron plots. Sm-Nd and Rb-Sr were separated from the residues and leachates at LLNL, and analyzed with VG Sector 54 and Triton TI mass spectrometers at UCB. Preliminary results are presented here.

Results. Rb-Sr analyses yield a crystallization age of 2852 ± 65 Ma and initial Sr isotopic composition of 0.700337 ± 98, whereas Sm-Nd analyses yield an age of 2692 ± 160 Ma and an initial ε_{Nd} of +11.9 ± 1.4. Several fractions on both isochrons demonstrate evidence for terrestrial contamination. In addition, very limited variation in Sm/Nd ratios in the residue fractions result in large uncertainty on the Sm-Nd age. Nevertheless, these ages are concordant with the Ar-Ar age and indicate the Ar-Ar data have not been reset by a metamorphic event [2]. The initial Sr and Nd isotopic compositions indicate that NWA032 was derived from a strongly incompatible-element-depleted source region. This feature is not consistent with its relatively high bulk rock incompatible-element abundances and elevated Th/REE and LREE/HREE ratios that are typically interpreted to imply that KREEP was involved in its petrogenesis [e.g. 3]. Instead, these data require a mechanism to produce incompatible-element-enriched magmas from incompatible-element-depleted sources without the addition of KREEP. This implies that there may be several mechanisms to impart KREEP-like geochemical signatures on lunar rocks. One possibility, is that NWA032 is produced by a much smaller degree of partial melting than other lunar samples. Alternatively, the source region of NWA032 might have been enriched in incompatible elements by a metasomatic event near the time of eruption. This mechanism might also account for the unusually high Th/REE ratio of NWA032. In any case, the apparent discordance between the incompatible-element-geochemistry of the bulk rock and the Sr-Nd isotopic systematics of its source region suggests that this sample has had a petrogenetic history that is different from other lunar basalts.

References: [1] Fagan et al. (2002) *MAPS* **37,** 371-394. [2] Fernandez et al. (2003) *MAPS* **38,** 555-564; [3] Neal & Taylor (1992) GCA, **56,** 2177-2211.