PAIRED FINE GRAINED, PERMAFIC OLIVINE-PHYRIC SHERGOTTITES NORTHWEST AFRICA 2990/5960/6234/ 6710: TRACE ELEMENT EVIDENCE FOR A NEW TYPE OF MARTIAN MANTLE SOURCE OR COMPLEX LITHOSPHERIC ASSIMILATION PROCESSES.

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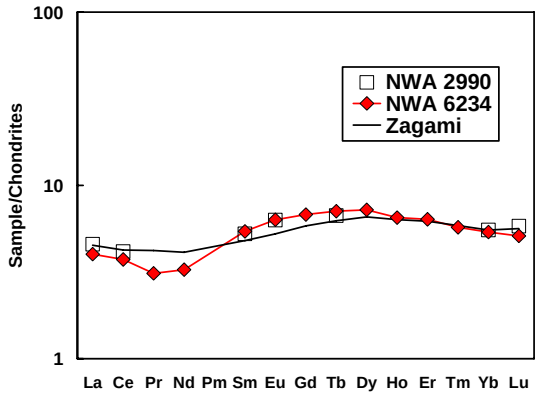
Background: NWA 2990 was the first of at least five fresh crusted stones allegedly found in Mali representing an unusual type of Martian igneous lithology. Our initial studies [1] established that NWA 2990 is an olivine-phyric shergottite with unusually fine grainsize, and based upon its REE abundances we suggested that it had affinities to "enriched" shergottites. Bulk major and trace element compositions were measured on a very small fragment of the stone; however, subsequent analyses on more representative powders of paired stones now lead us to present revised compositional data, which are much more consistent with the observed mineralogy and have significant implications.

Paired Specimens: NWA 5960, NWA 6234 and NWA 6710 all share with NWA 2990 the same microporphyritic texture, mineralogy and mineral compositions. Bulk XRF analyses of NWA 5960 and NWA 6234 in the same laboratory establish that these are all permafic shergottites [2] with CaO = 6.5 wt.%, MgO = 16.6 wt.% and Mg/(Mg+Fe) = 0.572. The major element composition reported previously [1] evidently was on powder that undersampled the olivine and chromite microphenocrysts, yet bulk abundances of incompatible elements (residing in groundmass phases) were accurate. REE data for NWA 6234 by ICPMS show good agreement for common elements with INAA data for NWA 2990, but new data for Pr and Nd require that the affinity of these specimens be revised from "enriched" to intermediate.

Discussion: The more complete REE pattern implies either that NWA 2990 and pairings are related to a Martian mantle source distinct from the depleted, intermediate and "enriched" sources already known [3], or else that assimilative interaction of an "enriched" Martian magma with lithospheric materials (possibly hydrothermally altered?) changed its Sm/Nd ratio.



References: [1] Bunch, T. et al. (2009) *Lunar Planet. Sci.* **XL**, #2274 [2] Irving A. et al. (2011) *Lunar Planet. Sci.* **XLII**, #1612 [3] Borg L. and Draper D. (2003) *MAPS* **38**, 1713-1731; Lapen T. et al. (2010) *Lunar Planet. Sci.* **XLI**, #2448.