COMPOSITION OF LYNCH 002 LUNAR METEORITE

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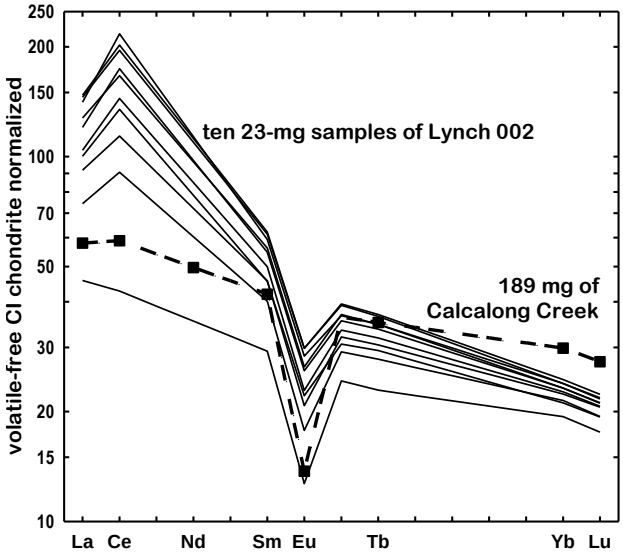
I report preliminary compositional data by INAA for ten ~23-mg subsamples of the Lynch 002 lunar meteorite from Australia [1]. With 9.0±0.3% FeO (mean ± standard deviation), the meteorite is more mafic than 75% of the brecciated lunar meteorites. It is also rich in incompatible elements; only 9% of the brecciated lunar meteorites have greater concentrations of Lu, Hf, and U. Compositionally, the meteorite appears to be a breccia composed of feldspathic, basaltic, and KREEPy lithologies, decreasing in that order, an observation consistent with the petrography [1].



The most unusual aspect of the composition are the unlunar-like relative concentrations of rare earth elements. Nine of ten subsamples have a strong positive Ce anomaly and are enriched in light REE, including Eu, compared to Apollo samples and any other lunar meteorite of similar Lu concentration.

Among the ten subsamples, La concentrations are correlated with those of Ba (R^2=0.64), Eu (0.997), Lu (0.87), and even Th (0.97) and Co (0.95), but not Hf (0.41), U (0.10), or Ni (0.00). Br concentrations are the second greatest among hot-desert lunar meteorites, 3.9±0.9 ppm (NWA 4485: 6.2±0.8). Data for other elements (ppm): Sc 18.7±0.7, Cr 1580±60, Co 46±9, Ni 260±30, As 0.4±0.3, Sr 170±20, Sb 0.2±0.2, Cs 0.32±0.09, Ba 785±230, La 35±11, Eu 1.8±0.4, Lu 0.68±0.05, Hf 4.7±0.2, Th 5.1±1.2, and U 0.73±0.03. Th/U (7.1) is 2× greater than Apollo samples of similar U concentration. Ir and Au are 10.6±1.1 and Au 4.5±1.4 ppb, typical of lunar regolith breccias.

Presumably, all these anomalies are the result of terrestrial weathering. The magnitude of the effects are much greater than observed in any other hot-desert lunar meteorite, however. The sample consisted of 2 chips provided by the Western Australian Museum. Three subsamples were from one chip, the remaining 7 from the other. There is no significant difference between the chips. In appearance, there is nothing unusual about the one "normal" and apparently least altered subsample. Based on this subsample, Lynch 002 is compositionally unique and unlikely launch paired with another known lunar meteorite.

References: [1] Smith C. L. et al. 2012. 75th Annual Meteoritical Society Meeting, Abstract #5137.