NEW GEOCHEMICAL DATA FOR SOME POORLY CHARACTERIZED LUNAR METEORITES.
R. L. Korotev (Department of Earth and Planetary Sciences, Washington University, Campus Box 1169, Saint Louis, MO 63130; korotev@wustl.edu)

We have obtained compositional data by INAA for several poorly characterized lunar-meteorite stones from hot deserts. Most are FLMs (feldspathic lunar meteorites). Our goal is to use compositional data to address whether any of the stones are paired with others that are better characterized.

Dar al Gani 996. DaG 996 is a 12-g FLM stone. We analyzed 9 subsamples totaling 234 mg. Our sample had veins containing alteration products that led to enrichment in As, Se, Rb, Sr, Cs, Ba, REE (LREE more than HREE), Hf, Zr, Th, and U over their lunar concentrations. After correcting for contamination, our results for DaG 996 are all but indistinguishable from our previous results for two subsamples of much larger (513 g) DaG 262 [1]. Faces of sawn slabs of the two stones appear similar. Dar al Gani stones 262 and 996 are paired.

Dhofar stones 280 and 910. We analyzed four subsamples (total mass: 103 mg) of Dhofar FLM stone 280 (251 g), two from one location (L) of a slab an two from another location (R) separated by 12 mm. In slab view, the R subsamples appear to be from a dark, glassy clast; the L subsamples appear more typical of the slab. The R subsamples are somewhat more mafic (5.2% FeO) than the L subsamples (3.2% FeO) and have greater concentrations of IEs (incompatible elements; Fig. 1). There is textural and CRE evidence that Dhofar 081 (174 g) and 280 are paired [2,3]. The stones were also found close together in the field (Fig. 2). Our results for the L subsamples (62 mg) of Dhofar 280 are sufficiently, but not ideally, similar to those of [4] for a larger subsample of Dhofar 081 (408 mg) that our results support pairing of Dhofar stones 081 and 280. Dhofar 280, at least, is clearly heterogeneous. We did not analyze a sufficient mass of Dhofar 280 material to unambiguously establish a compositional relationship between the stones.

Dhofar 910 (142 g) was found in the vicinity of Dhofar 081 and 280 (as well as several other lunar meteorite stones; Fig. 2). Sawn faces of the three stones appear similar, e.g., all three stones are characterized by a high (~5%?) modal volume of vug space. We analyzed a total of five subsamples from two slabs of Dhofar 910 (total mass: 107 mg); results for all subsamples are similar. Dhofar 910 is less mafic (mean: 2.8 % FeO) and has lower concentrations of IEs (Fig. 1) than any lunar meteorite stone other than the numerous but apparently unrelated Dhofar magnesian anorthosite stones [5]. Our results for Dhofar 910 do not provide evidence that the stone is paired with either Dhofar 081 or 280. However, it is possible that all three stones are fragments of a single glassy-matrix breccia that is heterogeneous at the decigram scale.

Dhofar 961. We analyzed eight subsamples totaling 232 mg of Dhofar stone 961 (22 g). The stone is classified as a feldspathic impact melt breccia that may be paired with Dhofar stones 925 and 960 [6]. The three stones were found together in the field distant from other lunar meteorite stones except highly dissimilar Dhofar 489 [5]. With 9–13% FeO, Dhofar 961 is not highly feldspathic; it likely contains a significant proportion (~40%) of mare basalt. The stone is also considerably richer in IEs than any feldspathic (<6% FeO; Fig 1) lunar meteorite. Two unusual aspects of Dhofar 961 are (1) that it contains greater-than-usual abundance of metal, which leads to high concentrations of siderophile elements (Fig. 1), and (2) our small subsamples differed from each other in composition to a greater degree than we have seen in other lunar meteorites (Fig. 1), with no correlation between "mafic" elements (Fe, Sc) and IEs (Sm, Th). As a polymict breccia, the stone is a 3-component system: anorthosite, mare basalt, and some type of KREEP component. No compositional data have been published for possibly paired stones Dhofar 925 and 960. (We have not yet analyzed our sample of Dhofar 925.) Except perhaps for these two stones, Dhofar 961 is not compositionally similar to any other Dhofar stone. Compositionally, Dhofar 961 bears some resemblance to Calcalong Creek. In detail, the compositional and textural differences (Calcalong Creek is a regolith breccia) are sufficiently great that we do not suspect a launch-pairing relationship.

Dhofar 1084. Dhofar 1084 (90 g) was found near Dhofar 490 and both were found distant from other lunar meteorite stones (Fig. 2). The two stones may be paired; sawn faces appear similar in texture and color. We analyzed five subsamples of Dhofar 1084 (total mass: 135 mg); all are compositionally similar to each other. Compositionally, the stone is a 'average' FLM. The composition is similar to, but in detail distinguishable from, that of several other lunar meteorites, including Dhofar stones 025 and 026 (Fig. 1), which are texturally different. Our results do not provide strong evidence that Dhofar 1084 is paired with any other Dhofar stone. No compositional data are yet available for the most likely pair (Fig. 2), Dhofar 490, however (we have a sample that we have not yet analyzed).

Northwest Africa 2200. NWA 2200, a 552-g glassy-matrix, feldspathic impact-melt breccia [7], is compositionally similar to NWA 482, a crystalline-matrix impact-melt breccia [1,4,8]), but with concentrations of IEs that are 35–70% greater (Fig. 1). The compositional similarity is not a strong argument in favor of pairing in light of the textural dissimilarity.

Northwest Africa 3163. NWA 3163 (1634 g), a ferroan, feldspathic granulitic breccia that is compositionally distinct from all other FLMs (Fig. 1), is discussed in another abstract [9].

Closing words. Lunar meteorites are far more compositionally diverse than meteorites from any other parent body. Several are dissimilar to any Apollo samples. We may be experiencing the peak in lunar meteorite finds at this time. Lunar meteorites are ephemeral in that for some stones from hot deserts there may not be material available for scientific study in 5–10 years because the stones are small and owners are distributing the bulk of the mass to collectors as small pieces.

NASA credit: Grant NNG04GG10G to L. A. Haskin.

References: [1] Korotev et al. (2003) *Geochim. Cosmochim. Acta* **67**, 4895–4923. [2] Grossman & Zipfel (2001) *M&PS* **36**, A293–A322. [3] Nishiizumi et al. (2004) *LPSC XXXV*, #1130. [4] Warren et al. (2005) *M&PS* **40**, 989–1014. [5] Korotev (this volume). [6] Russell et al. (2005) *M&PS* **40**, Suppl, A201–A263. [7] Kuehner et al. (2005) *M&PS* **40**, Suppl., A88. [8] Daubar et al. (2002) *M&PS* **37**, 1797–1814. [9] Irving et al. (this volume). [10] Hill & Boynton (2003) *M&PS* **38**, 595–626.

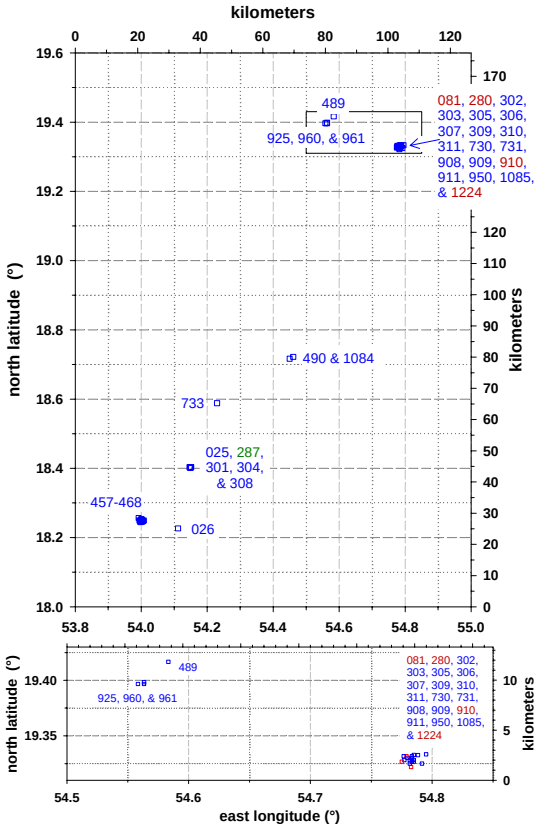

Figure 2 (above). Schematic maps of locations of Dhofar lunar meteorite finds. The boxed area at the top is enlarged below.

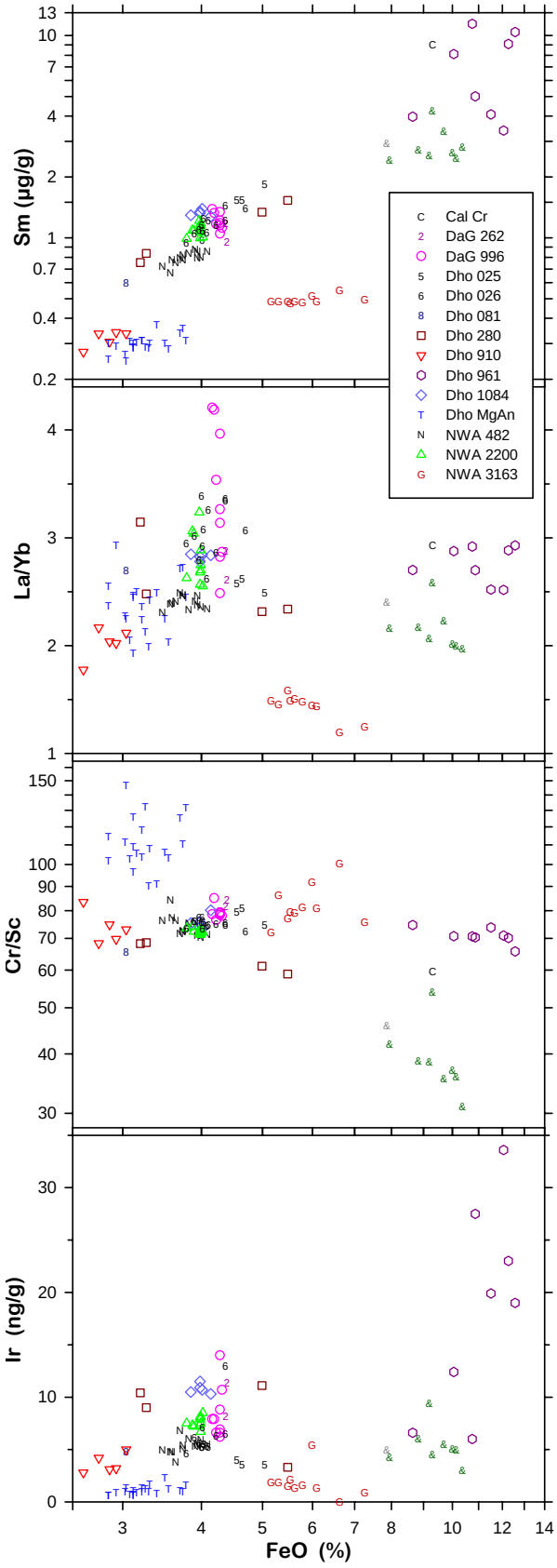

Figure 1 (right). Compositions of subsamples of most of the lunar meteorites discussed in the text. The "Dho MgAn" points (T) are for several paired stones of troctolitic anorthosite composition discussed in a separate abstract [5]. All data from this lab except data for Dhofar 026 (and paired stones 457, et al.) and Dhofar 081 are from [4] and Calcalong Creek are from [10].