KEEPING UP WITH THE LUNAR METEORITES – 2009. R. L. Korotev[1], R. A. Zeigler[1], A. J. Irving[2], and T. E. Bunch[3], [1]Campus Box 1169, Dept. of Earth and Planetary Sciences, Washington University, Saint Louis MO 63130; [2]Dept. of Earth & Space Sciences, University of Washington, Seattle, WA 98195; [3]Dept. of Geology, Northern Arizona University, Flagstaff, AZ 86011; korotev@wustl.edu

We report results of compositional analyses of 16 new lunar meteorite stones for which names have been approved (in **bold**) since our report of last year [1] and speculate about pairing relationships on the basis of composition and preliminary petrographic data.

Shişr 160 (symbol # in Fig. 1), a feldspathic regolith breccia from Oman, is most similar in composition to Dhofar 302 (?), NWA 482 (!), and NWA 2200 (G). Of these 3, texturally it most closely resembles NWA 2200. **NWA 4881** (|), a feldspathic granulitic breccia, is another stone of the pair group that includes NWA 3163 (<) and NWA 4483 (>; Fig. 2) [2]. **NWA 5406** is a pair to 4936 (J). NWA 4936/5406 is distinct in having concentrations of incompatible elements several times greater than those of other feldspathic lunar meteorites and an overall composition very similar to regolith of the Apollo 16 site, including the same nonchondritic Ir/Au ratio [3]. **NWA 4734** (●), a mare basalt, is compositionally and texturally indistinguishable from the LaPaz Icefield basalts of Antarctica. The meteorite thus appears to be another stone of the NNL launch-pair group that likely also includes NWA 032 [4,5]. **NWA 3333** (H), a fragmental breccia containing both basalt and cumulate olivine gabbro, is another stone of the NWA 773/2727/3160 pair group.

A number of the new lunar meteorites are at the mafic (high-Fe,Sc,Cr) end of the range of feldspathic lunar meteorites (Fig. 2). **MIL (Miller Range) 07007** (M, a *feldspathic*, not "basaltic" [6] breccia) is very similar in composition and texture to Yamato 791197 (A) and a possible launch pair. **Dhofar 1436** ($), an impact-melt breccia, is compositionally, but not texturally, also similar to MIL 07007, as are (but to a lesser extent) PCA 02007 (B) and NEA 001(C). **Shişr 161** (%), a fragmental breccia, has unusually low concentrations of incompatible elements and is comparable only to granulitic breccia NWA 3163/4483/4881 in this regard [7].

SaU 449 (X), an impact-melt breccia from Oman, was reportedly found 4.2 km from SaU 300 (U). Although both are mafic anorthosites in composition, the meteorites are distinct from each other (Fig. 2). The composition of SaU 449, however, is indistinguishable from that of our small sample of Dhofar 925 (d), which was collected 212 km to the south. This similarity is curious in light of the compositional difference between our samples of Dhofar 925 and Dhofar 961 (D), which were collected within 200 m of each other and are apparently paired [8]. SaU 449 and Dhofar 925 are candidate launch pairs, as are SaU 300 and NWA 4932 (R).

Subsamples of moderately mafic breccias NWA 2995 (5), **2996** (6), **3190** (0), **4503** (4), **5151** (1), **5152** (2), **5153** (3), and **5207** (7) vary considerably but mutually overlap in composition (Fig. 3). Although they

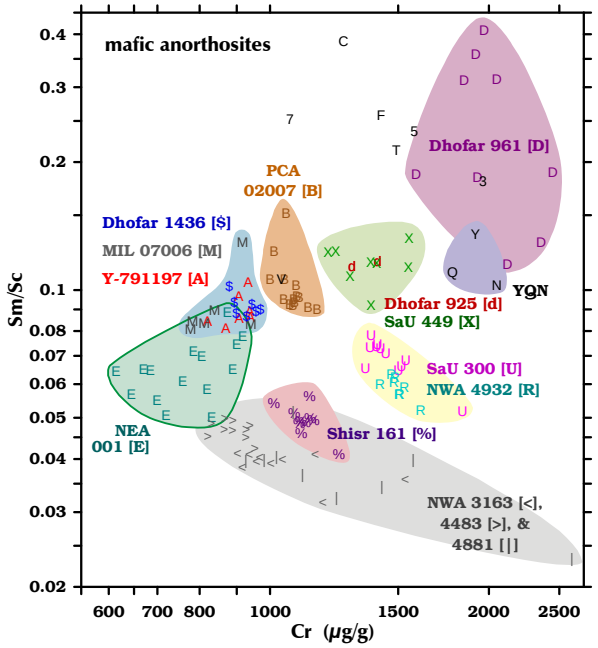

Figure 2. Groupings for subsample data ($MA, Xd, and UR) depicted in this plot are supported by all elements measured. Mean compositions are plotted for Calcalong Creek [C], Dhofar 1180 [V], NWA 2995 et al. [5], NWA 4819 [F], NWA 4884 [N], NWA 5153 [3], NWA 5207 [7], QUE 94281 [Q], Yamato 981031 [Y], and Yamato 983885 [T].

range from fragmental to melt breccias, all or most are likely paired. NWA 5207 and NWA 5153 are the most compositionally (Fig. 3b) and texturally different from the others and may not be part of the pair group. All 8 differ from others of similar Sc and Sm concentration in being richer in Na_2O (0.43–0.50%) and Eu (0.99–1.14 μg/g), presumably due to a slightly more albitic mean plagioclase composition. (In comparison, Y-983885 (T), which plots within the group in Fig. 3, has only 0.36% Na_2O and 0.83 μg/g Eu).

Discussion: We suspect, largely on the basis of petrographic evidence (i.e., mare basalt clasts are rare), that a number of the meteorites plotting along and to the high-Sm side of the mixing line of Fig. 1 are not, as the mixing line implies, largely anorthosite-basalt mixtures but instead consist mainly of brecciated nonmare material, i.e., mafic anorthosites, norites, gabbronorites, and troctolites. These meteorites include SaU 300, SaU 449, Dhofar 925, Dhofar 961, Dhofar 1180, NWA 4819, NWA 4932, the NWA meteorites of Fig. 3a, Shişr 161, and Yamato 983885.

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References: [1] Korotev et al. (2008) LPSC 39, #1209; [2] Irving et al. (this conf.). [3] Korotev (1997) *M&PS* **32**, 447–478; [4] Zeigler et al. (2005) *M&PS* **40**, 1073–1102; [5] Fernandes et al. (this conf.); [6] *Ant. Met. Newsl.* 31(2) (2008); [7] Foreman et al. (this conf.); [8] Demidova et al. (2005) *LPSC36*, #1607.

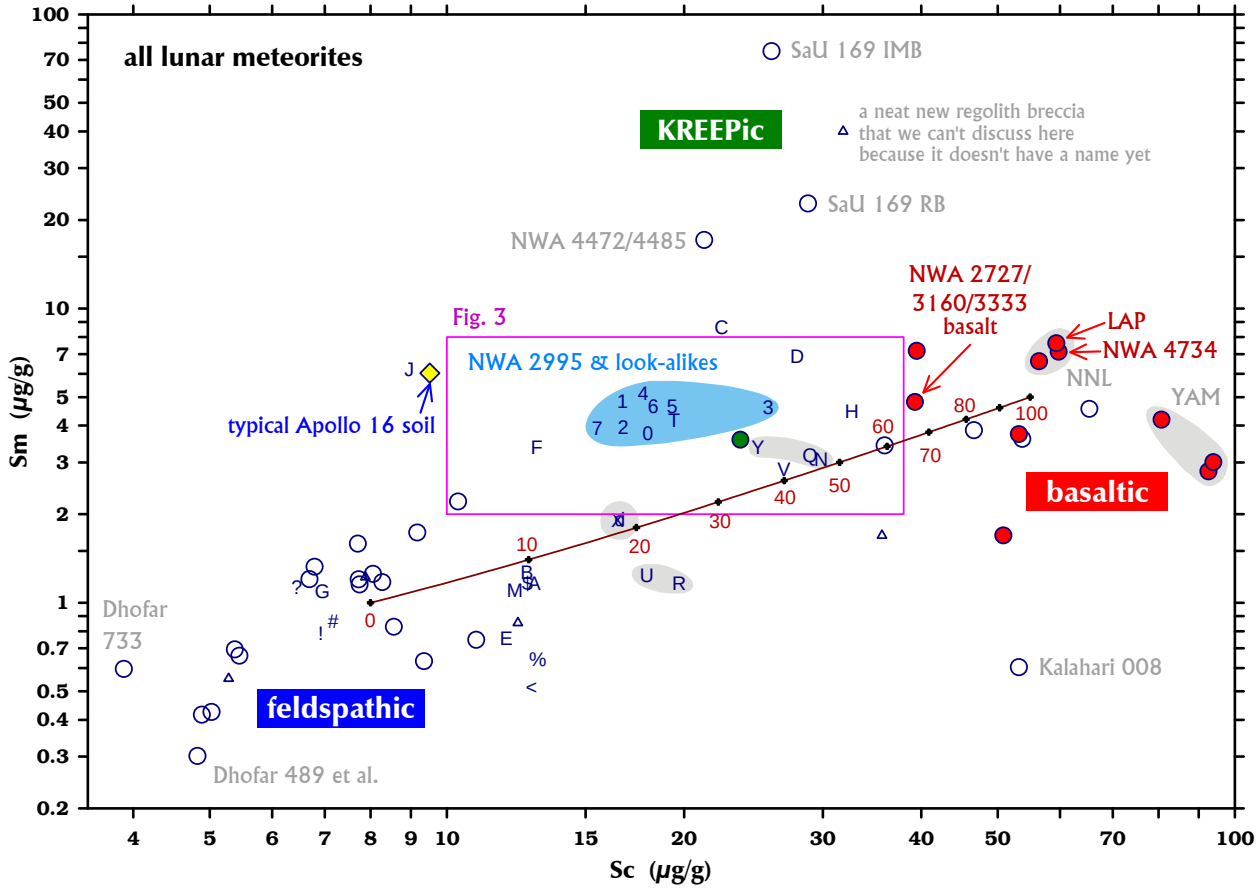

Figure 1. Lunar meteorites in Sc-Sm space. Each point represents the mean composition of all analyzed stones of a meteorite. For multilithologic meteorites, there is one point for each lithology. Alphanumeric and keyboard symbols represent meteorites discussed in the text. Circles represent meteorites not discussed and triangles are meteorites that we have analyzed but which do not yet have names. Red circles = unbrecciated basalts, green circle = NWA 773/2977/3333 olivine gabbro. All others are brecias. Gray ellipses comprise meteorites suspected of being launch pairs; other launch pairings likely exist among the numerous feldspathic meteorites. The diagonal line is a mixing line between the mean composition of the feldspathic lunar meteorites and the mean composition of the basalts of the six source craters represented by the red points, with ticks for % basalt.

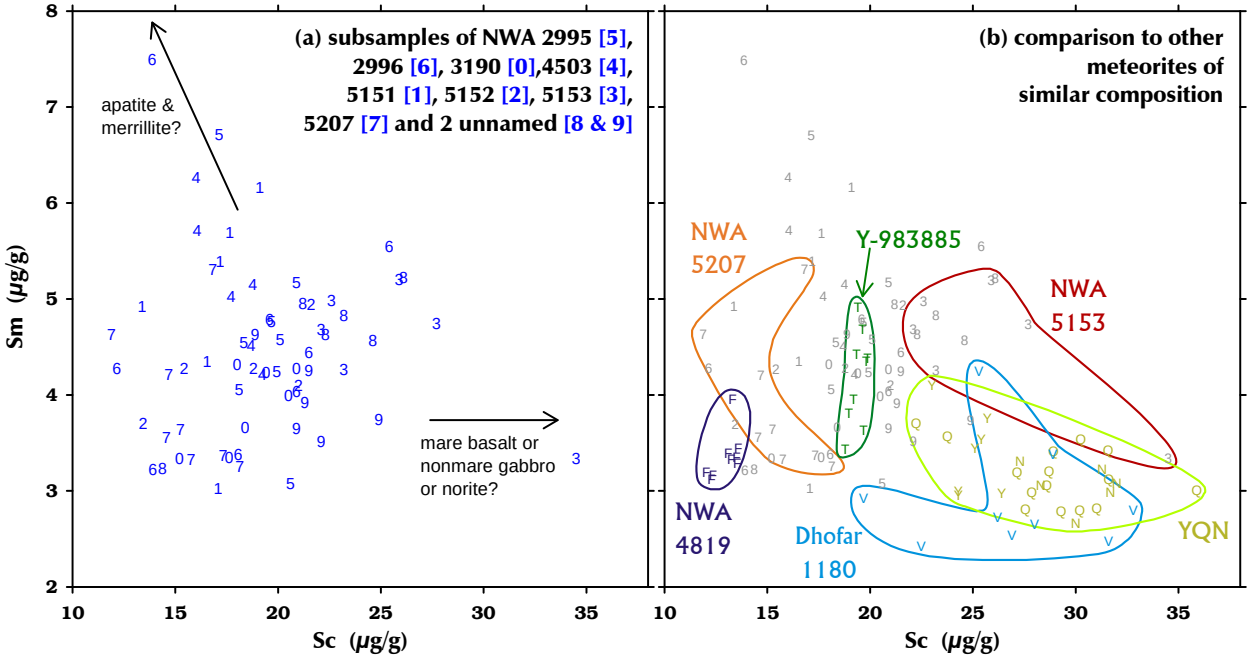

Figure 3. (a) Subsample splatter for the NWA 2995 clan. (b) YQN = Yamato 981031 [Y], QUE 94281 [Q], and NWA 4884 [N].