Electron microprobe analyses of Dar al Gani lunar meteorite, a sample of the Feldspathic Highlands Terrane of the Moon. B. Jolliff[1], R. Korotev[1], and S. Arnold[2]. [1]Department of Earth and Planetary Science and the McDonnell Center for the Space Sciences, Washington University, St. Louis, MO 63130, [2]International Meteorite Brokerage, 8177 S. Harvard #610, Tulsa, OK 74137. (blj@levee.wustl.edu)

Introduction. The Dar al Gani 262 meteorite (DaG 262) was the first lunar specimen found among the growing number of meteorites that has been recovered from the Sahara Desert [1, 2]. One of us (SA) recently obtained several samples of this meteorite, and we have analyzed a small piece of one of those samples by electron microprobe techniques. We report here mineral, matrix, and fusion crust compositions, and we compare these compositions to those of QUE93069, which has been suggested to be part of a launch pair with DaG 262 [2]. From the similarity of compositions, we find no reason to argue against the hypothesis that these two meteorites came from the same area of the Moon's surface.

Results. From one of the meteorite pieces, we sawed a slice with a relatively flat surface (~70 mg) and, after light polishing, mounted it for electron microprobe analysis. From the other fragment, we obtained a small piece for INAA (not yet done). The fragments are shown in Figure 1 and Figure 2.

Figure 1. Photograph of larger of the two specimens of Dar al Gani 262. Scale is mm.

These rock fragments are clast-rich breccias wherein the clasts consist of lithic, mineral, and glass fragments. Plagioclase is abundant (dark gray in Fig. 2). Small mafic silicate grains appear bright in the BEI, but some magnesian olivine is present and difficult to distinguish in this image. Glass, including fusion crust, glass fragments, and glassy matrix are dark in BEI attributable to their feldspathic compositions (see below). The rock is heavily fractured as a result of multiple shock events, but it remains tough and coherent, reflecting it's glassy, welded matrix, which is typical of the lunar highland meteorites. Dar al Gani 262 is reported to be a regolith breccia on the basis of solar-wind-implanted noble gases [1], but we have not observed obvious regolith components such as agglutinates or glass spheres in the small samples we have examined.

Results. The fusion crust provides a measure of the bulk composition of the meteorite, and for the thin fusion crust present on one edge of the section shown in Fig. 2, we found it to be highly feldspathic, containing some 29% Al_2O_3 and only ~ 4–5 wt.% each of FeO and MgO (Table 1). This is somewhat more aluminous than the bulk composition derived by analysis of several different bulk samples of DaG 262 by [1]. The fusion crust composition of DaG 262 is extremely similar to that of QUE93069 [3].

Table 1. Fusion crust compositions.

	DaG 262		QUE93069	
	avg, n=15	stdev	avg, n=10	stdev
SiO_2	44.7	0.34	44.2	0.2
TiO_2	0.23	0.05	0.24	0.01
Al_2O_3	28.7	0.9	29.0	0.2
Cr_2O_3	0.07	0.05	0.07	0.02
FeO	4.31	0.39	4.38	0.07
MnO	0.06	0.04	0.07	0.03
MgO	4.94	0.45	4.52	0.03
CaO	16.6	0.3	16.8	0.1
Na_2O	0.36	0.03	0.29	0.03
K_2O	0.03	0.01	0.03	0.01
P_2O_5	0.07	0.02	0.03	0.01
sum	100.1		99.6	
Mg/(Mg+Fe)	0.67		0.65	

The chemical compositions of the main silicate minerals pyroxene, plagioclase, and olivine are typical for these minerals in lunar highland rocks in general, and in other feldspathic lunar meteorites in particular. The Fe and Mn concentrations of DaG olivine clasts are plotted in Fig. 3 along with olivine from other lunar meteorites and several other planetary suites. The Fe/Mn molar ratio for the DaG samples is ~ 90, distinguishing this as lunar material. Plagioclase is highly anorthitic, with An contents > 95 for all grains analyzed, and pyroxenes consist mostly of quadrilateral components of intermediate Mg′ [Mg/(Mg+Fe)]. The Mg′ values range mainly from 0.5 to 0.7 (Fig. 4); these values, coupled with the highly anorthitic plagioclase, suggests an affinity to the ferroan-anorthositic suite for much of the material of this meteorite.

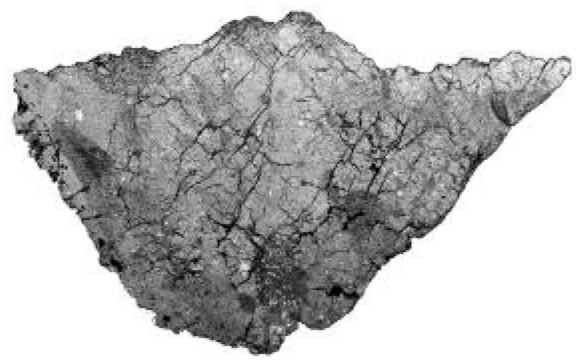

Figure 2. Backscattered-electron image (BEI) of the ~ 70 mg piece of Dar al Gani 262 that we analyzed for this abstract. Fusion crust is located along the left edge where there is finely vesicular glass. Field of view = 1 cm.

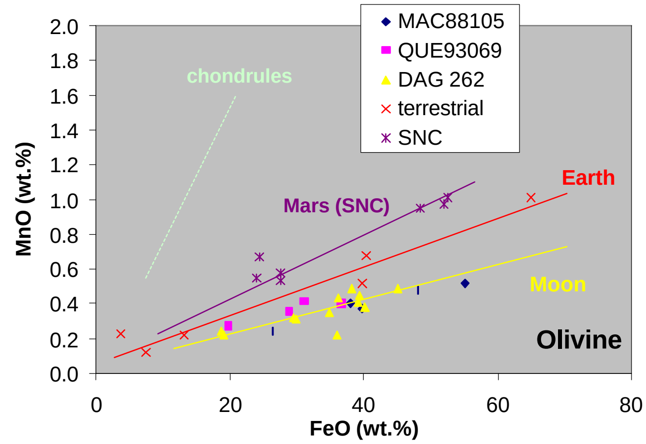

Figure 3. Olivine Fe and Mn concentrations in DaG 262 compared to olivine from QUE93069 [3] and MAC88104/5 [4], and to a suite of terrestrial olivine [5], SNC olivine [6], chondrule olivine[7].

Discussion. The highly feldspathic bulk composition and apparent paucity of mafic and KREEP-like components indicates that the DaG 262 and QUE93069 meteorites, like Yamato 791197, Yamato 82192/3, Yamato 86032, and MacAlpine Hills 88104/5 [8], derived from impacts into the Feldspathic Highlands Terrane [9]. The bulk compositions and the compositions of lithic and mineral clasts reflect precursor rock formations dominated by the ferroan-anorthositic suite (anorthosite – noritic anorthosite – anorthositic norite) and impactite lithologies derived largely from the ferroan igneous precursors. Glasses also have relatively low Mg′ values (Fig. 4). Although the fusion crust composition indicates a somewhat more magnesian bulk composition than the clast population that we happened to analyze (Fig. 4), it remains that magnesian mafic clast compositions are subordinate to ferroan ones. The paucity of magnesian-suite lithic clasts and impactites derived therefrom supports the hypothesis (e.g., [8,9]) that rocks of the magnesian suite, as sampled by the Apollo missions, derive largely from the central nearside of the Moon, especially the region of the Procellarum KREEP Terrane and within the ejecta of basin impacts that struck near or within that terrane.

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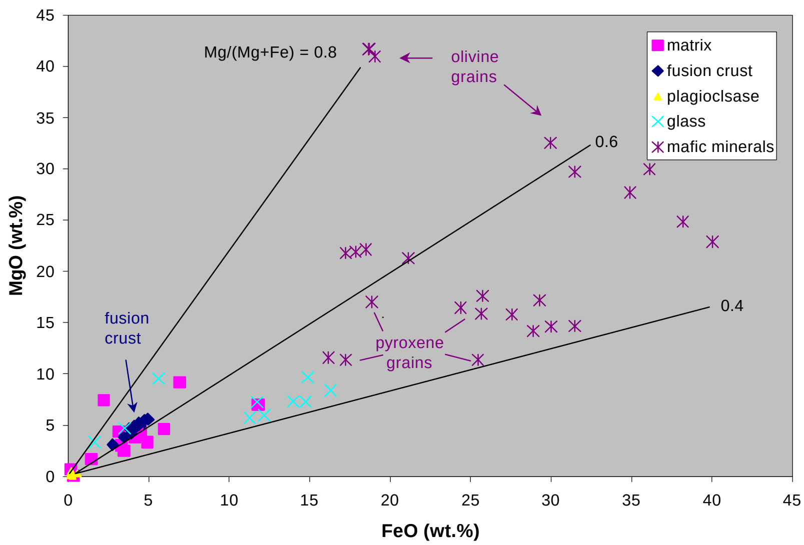

Figure 4. Concentrations of FeO vs. MgO for constituents of DaG 262 as

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