IMPACT MELT COMPOSITIONS IN LUNAR METEORITE DHOFAR 025. B. A. Cohen[1], L. A. Taylor[1], and M. A. Nazarov[2], [1]Planetary Geosciences Institute, University of Tennessee, Knoxville, TN 37996 (bcohen@utk.edu), [2]Vernadsky Institute of Geochemistry, Moscow 117975, Russia.

Introduction: Lunar meteorite Dhofar 025 (Dh25) was found in Oman in January 2000. Mineralogy/petrography, bulk composition, and oxygen isotopes indicate it is a highlands regolith breccia with little to no basaltic component [1, 2]. Approximately 75% of the clasts are crystalline impact melts; the largest have coarse- (10 µm) to fine-grained (<1 µm) microporphyritic textures. Some clasts contain relic pyroxene and olivine fragments. The relationship between feldspathic and mafic (relic and cogenetic) phases is reported in [1]. This abstract presents the bulk composition of five large (>200 µm), uniform, crystalline, clast-free impact melt clasts being further analyzed for ^{40}Ar-^{39}Ar dating. The dissimilarity of Dh25 impact melts to Apollo impact melts makes them excellent candidates for age dating in order to further constrain lunar bombardment history.

Technique: Defocused-beam analyses (DBA) were performed on selected portions of thin sections of Dh25. The location and size of the studied clasts are shown in Fig.1. A 30-µm beam on a Cameca SX-50 electron microprobe was employed at 15kv and 20nA for all analyses. Within each melt clast, a representative area was identified that avoided gross textural heterogeneity and clast edges. A grid was set up and analyses taken at programmed, regular intervals. Because of the DBA technique and the large number of cracks/voids in the sample, some analyses had low totals. All analyses with totals between 95 and 100% were considered acceptable (>75% of analyses).

Each melt clast is heterogeneous on scales of 1's to 10's of µm (Fig 1b). The 30-µm defocused bean averages small-scale heterogeneity but can still hit a point where the clast is mostly feldspathic or mostly mafic. This results in a wide scatter in the mafic elements Mg and Fe (Table 1). The scatter within a clast in Figure 2a represents the compositional diversity on scales of ~30 µm within each clast.

The DBA technique is known to give absolute elemental abundances that are different from true abundances because of the interaction of excited elements from multiple phases. Lighter elements are more intensely affected than heavier ones. For instance, Al is excited by Si, but in this study, all phases are Si-rich. Therefore, we expect that our Al values are systematically low by a few percent, but this does not affect averaging or comparison. We also use heavier elements (Ti and Fe) to compare clasts.

Results: An unweighted average of all analyses in a clast is plotted in Fig. 2b. The compositions in all five clasts actually overlap each other, within the error bars. Thus, the clasts cannot be readily distinguished from each other based on major-element chemistry alone.

For comparison, the bulk composition of Dh25 is plotted in Fig. 2b. The impact melt compositions tend to cluster near the bulk composition, indicating that they are locally derived. Furthermore, the textural va-

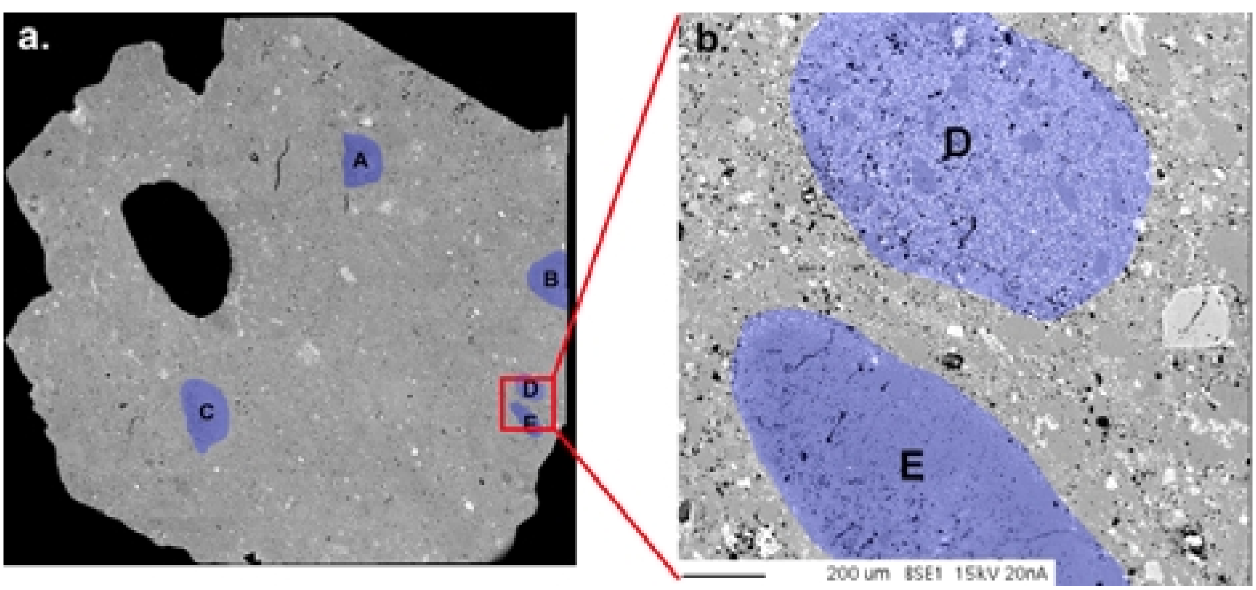

Figure 1: a) BSE mosaic of Dhofar 025 thin section (f.o.v. ~ 2 cm), with analyzed melt clasts in blue; b) enlarged area showing textural characteristics and scale of heterogeneity within clasts D and E (scale bar = 200 µm).

riety among the chemically similar clasts may indicate origin in more than one impact event though the target material has a similar composition over large areas of the surface. On the other hand, the Mg# of the Dh25 impact melts (Mg# = 71-84) is significantly higher than the whole-rock (Mg# = 70), indicating that the impact melts may have incorporated an HMS component that the breccia does not.

Comparison: The bulk composition of Dhofar 026, a lunar meteorite composed mostly of crystalline impact melt [3], is also plotted in Fig 2b. Dh26 is more aluminous than bulk Dh25 or Dh25 melt clasts, possibly as a result of having incorporated more plagioclase component in the melt.

The Dh25 impact melts are significantly lower in Ti than Apollo 14, 15, 16, and 17 impact melts [4], consistent with a highland origin. On the other hand, Dh25 impact melts appear to be systematically richer in mafic components (Mg and Fe) than those in DaG262, DaG400, QUE93069, or MAC88105 [5], though their Mg# is comparable. This may indicate that Dh25 samples a different highlands area than these other highlands meteorites, incorporating more non-anorthositic material into the melt.

Conclusions: The impact melts within Dh25 are similar in major-element chemistry to each other as well as to the bulk meteorite, indicating their origin in the lunar highlands local to the Dh25 assembly location. This location may have had a target lithology different from other highlands meteorites.

The Dh25 impact melts contain no chemical signature of KREEP or high-Ti basalts, implying that they were formed by impact onto the lunar east limb or farside. Such impact melts are a valuable new source of information constraining the bombardment history of the Moon, as they are much less likely to have been affected by the epoch of nearside, equatorial basin formation than the Apollo or Luna impact melt rocks.

Trace element and ^{40}Ar-^{39}Ar analyses are in progress, which will help us understand the impact history in the Dhofar 025 area.

References: [1] Cahill, J. et al. (2001) *this volume*. [2] Taylor, L.A. et al. (2001) *this volume*. [3] Cohen, B.A. et al (2001) *this volume*. [4] Taylor, G.J. *et al*. (1991) *Lunar Sourcebook* p. 183-284. [5] Cohen, B.A. et al. (2000) *MAPS 34*, A26.

Table 1: Average impact melt compositions in Dhofar 025 melt clasts. The number of analyses is given after the clast name. The 1σ standard deviation in the average is shown in parenthesis (variance in last digit).

	A: 97	**B: 35**	**C: 121**	**D: 45**	**E: 19**
SiO_2	42.3 (3)	42.4 (14)	43.4 (9)	43.8 (4)	42.9 (1)
TiO_2	0.23 (5)	0.14 (1)	0.21 (1)	0.27 (2)	0.08 (1)
Al_2O_3	29.9 (5)	27.2 (28)	29.7 (24)	26.6 (17)	28.3 (1)
FeO	2.17 (37)	3.23 (173)	3.11 (137)	4.75 (392)	2.82 (20)
MnO	0.04 (1)	0.05 (1)	0.05 (1)	0.07 (1)	0.03 (1)
MgO	5.87 (177)	7.43 (717)	4.60 (266)	6.82 (257)	8.31 (77)
CaO	16.5 (5)	15.9 (27)	16.8 (11)	15.4 (8)	15.5 (1)
Na_2O	0.25 (1)	0.31 (1)	0.31 (1)	0.34 (1)	0.26 (1)
K_2O	0.03 (1)	0.05 (1)	0.03 (1)	0.04 (1)	0.04 (1)

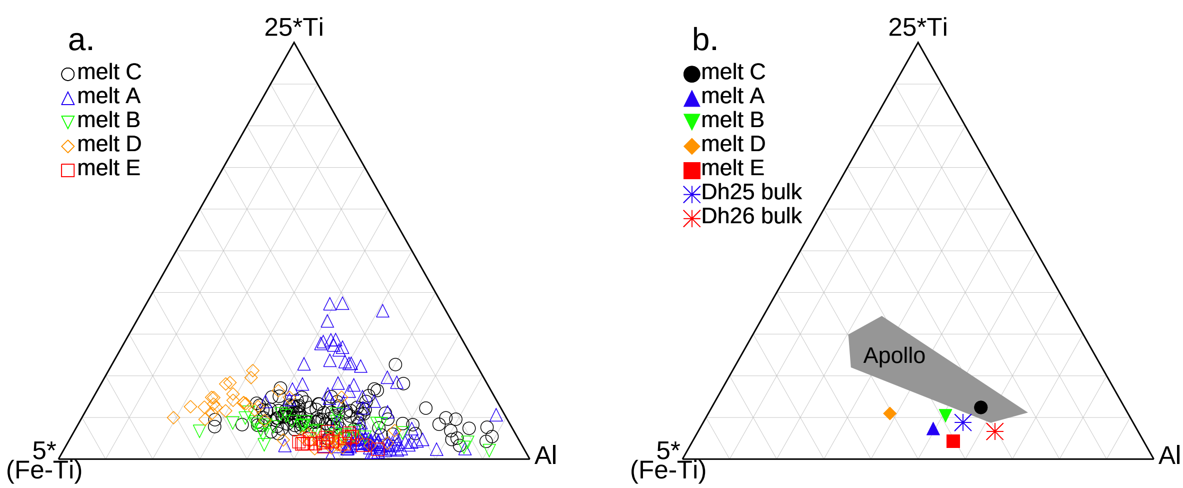

Figure 2: a) all analyses of impact melt clasts; b) clast averages, with bulk meteorites and Apollo impact melts.