

PETROGRAPHY OF LUNAR METEORITES DHOFAR 925 AND 961.

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Introduction: Lunar meteorites Dhofar (Dho) 925 and 961 are brecciated lunar meteorites of intermediate Fe composition (7-17 FeO wt%) [1-3]. They are reputedly paired with each other, and are also grouped with the Dho 960 and Sayh al Uhaymir (SaU) 449 stones [1-3]. As Dho 961 is compositionally similar to regoliths in the South Pole-Aitkin (SPA) basin, it has been hypothesised that the group may have been launched from SPA on the farside of the Moon [3-5]. As such, they may contain chronological evidence to date the oldest lunar basin, helping to constrain the early impact history of the Moon.

Methods: One thick section from each meteorite was carbon coated and analysed using the NASA JSC JEOL-7600F field-emission SEM and Cameca SX100 electron microprobe (EMP).

Results: Dho 925 and 961 are petrographically distinct [1,5], but contain lithics with similar textures and mineral chemistries:

Dho 925: The sample (~7 × 6 mm) is composed of a clast-bearing dark-grey impact melt breccia. Clasts range from small (<10 μm) mineral and glass fragments up to 2 mm lithics (equilibrated magnesian anorthositic plutonics (plagioclase typically >60% by area, An₉₄₋₉₇; mafics typically <40%, Mg#68-80 [see also 1,5]); very-low Ti (VLT) and low-Ti basalts (quenched variolitic and ophitic texture); impact melts and melt breccias; fragmental breccias; and rare Si-K-feldspar assemblages).

Dho 961: The sample (~22 × 12 mm) is a fragmental breccia with a notable large (~4 × 2 mm) dark-grey, clast-bearing, impact melt breccia clast and a large (~5 × 3 mm) cream-coloured ophitic basalt clast (similar to the KREEPy igneous rocks described by [1]). Dho 961 contains a more diverse textural range of clasts than seen in Dho 925. For example, plutonic igneous fragments are typically more mafic (20-60 % mafics), and VLT and low-Ti basalts are texturally diverse (variolitic, subophitic, ophitic textures). A 300 μm thick melt vein in Dho 961 has a composition similar to the Dho 025 bulk rock [3].

Impact melts: Impact melts and clast-bearing melt breccias (of size range 4 mm to 300 μm) in Dho 925 and 961 were analysed using a 20 μm defocused EMP beam. Most are normative anorthositic gabbro, with compositions similar to the Dho 025 bulk rock [3]. A few clasts are normative anorthositic troctolite and troctolitic anorthosite. All are alkali poor (<0.6 Na₂O + K₂O wt%), similar to KREEP-poor feldspathic lunar meteorites, but are comparatively less aluminous: their Al-contents are more akin to Apollo VHA-impact melts (e.g., 20-25 Al₂O₃ [6]). We found no clasts in either stone of the olivine-bearing, ITE-rich, mafic impact melt breccia (Al₂O₃ ~15.4 wt%) reported to be a dominant component of Dho 961 [4-5] and used as supporting evidence for an SPA basin origin [4].

References: [1] Demidova S. I. et al. (2005) Abstract #1607. 36th Lunar & Planetary Science Conference [2] Demidova S. I. et al. (2007) *Petrology* 15:386-407 [3] Korotev R.L. et al. (2010) Abstract #2126. 41st Lunar & Planetary Science Conference [4] Jolliff B. A. et al. (2008) Abstract #2519. 39th Lunar & Planetary Science Conference [5] Zeigler R. A. et al. (2010) Abstract #1985. 41st Lunar & Planetary Science Conference [6] Spudis P. D. & Davis P. A. (1986) *J. of Geophys. Res.* 91:E84-E90.