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Mg-suite plutonic rocks are inferred to have developed in bodies of magnesian basaltic magma, emplaced before the mare basalts [1]. Few pre-mare basalts are known [2,3] and only one may be related to the Mg-suite [4]. Here, we report on a basalt clast, in meteorite ALH81005, which appears also to be from Mg-suite magma.

Description: Clast U is a 750x350µm fragment in section 3,9 [5]; it consists of plagioclase An_{91.96} (~40% area), pigeonite ~En_{93}Wo_{04} (~30%), olivine Fo_{82} & Fe/Mn=~75 (~15%), and augite ~En_{90}Wo_{35} (~15%), with minor FeS, Fe metal (3.8% Ni, 0.13% Co), apatite, TiO_{2}, ZrO_{2} (~0.3% area), SiO_{2}, and Zr-Ca- armalcolite [5]. Compositions of pyroxenes and olivine are consistent with equilibration of Fe-Mg but not Ca; pigeonite is zoned from Ca-poor to Ca-rich; Ca-rich pigeonite is intergrown with augite. Grains of major minerals are up to ~200µm long in a subophitic texture (mafic minerals occupying patches among plagioclase grains). Minor minerals are concentrated along boundaries between plagioclase and pyroxenes.

Interpretation: Clast U’s mineralogy, texture, and Fe/Mn imply it is a fragment of lunar basalt. Nothing in its texture suggests that it is a cumulate (e.g., large aligned grains) or a quickly cooled impact melt (e.g., dendrites). The metal composition is consistent with a lunar or chondritic (i.e. impact melt) origin [6].

Clast U is unlike mare basalts and more like Mg-suite norites [7] in having: high Mg# (81 vs. 60-35 [8]); abundant plagioclase of An_{85}; more low-Ca pyroxene than augite; low-Ca pyroxene crystallizing prior to augite; Ca-Zr armalcolite, rutile, and baddeleyite; and little or no ilmenite [7]. Clast U was interpreted [5] as an impact melt, based on the composition of its metal. However, such metal need not be meteoritic [6], and nothing else about the clast signals an impact origin.

Implications: It seems reasonable that clast U is from an erupted magma related to Mg-norites. Density constraints imply that Mg-suite magmas should have erupted if they were generated at depths > 20 km [9], as is generally inferred [10]. The rarity of Mg-suite volcanic rocks in the Apollo collections could be explained with the fact that Mg-norites are pre-Imbrian in age (~4.3 Ga [7]). Had Mg-suite basalt been common on the (now) lunar nearside, the Imbrium impact would have destroyed some and buried much of the rest. However, the absence or rarity of Mg-suite basalts in lunar meteorites [11] suggests that they were rare across the whole Moon.