P55E-1981 - New insights into lunar magmatism: Investigating open system processes in basaltic magma reservoirs on the Moon.

Friday, 17 December 2021

17:00 - 19:00

Convention Center - Poster Hall, D-F

Abstract

Extensive research on Earth throughout the past several decades has demonstrated the dynamic nature of magmatic storage regions within the crust. Molten material at depth likely exists in the form of crystal mushes, where crystals and liquid coexist (and interact to varying degrees) prior to transport and emplacement. Within this dynamic framework, magmas within a storage reservoir may exist separately from each other and evolve to have distinct compositions through both closed and open system processes. In addition, during recharge, remobilization, and ascent, distinct magma batches may mix and mingle leading to the preservation of phenocrystic, antecrystic, and xenocrystic crystal populations in the magmatic rock record. At present, the occurrence of such processes in magmatic systems on other bodies in our Solar System remains largely unexplored. The research presented here aims to investigate the petrogenetic history of crystal cargoes within Apollo lunar basalts in order to evaluate whether magmatic processes on the Moon operated in open and/or closed systems. Specifically, six Apollo basalts (10057, 12038, 12043, 15085, 15556, 70017) are being investigated using in-situ analytical techniques including scanning electron microscopy (SEM), electron probe microanalysis (EPMA), and laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). Initial mapping of major elements via SEM energy dispersive spectroscopy (EDS) has revealed that pyroxenes in all samples are zoned in Mg, Fe, and Ca. The zoning in finer-grained samples (e.g., sample 10057 from Apollo 11) is normal, whereas a transition from Mg- and Fe-rich cores to Fe-poor zones, and finally to Fe-rich rims is preserved in the coarser grained samples (e.g., Apollo 15 sample 15085). Furthermore, several of the samples contain megacrysts (e.g., pyroxene in Apollo 12 sample 12043 and olivine in Apollo 15 sample 15556) that preserve normal zoning with respect to Mg and Fe. Additional SEM-EDS mapping, complemented by quantitative EPMA and LA-ICP-MS analyses, will be utilized in order to 1) evaluate the presence of distinct crystal populations (as determined by morphology, texture, and elemental abundances) and 2) assess the extent to which these populations interacted in open magmatic systems prior to crystallization on the lunar surface.

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