Compositional characterization of the enigmatic irregular mare patches via M^3 and Diviner data analyses

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Abstract. Irregular mare patches (IMPs) are small to mesoscale hypothesized volcanic features on the lunar nearside that occur primarily in host mare settings[1,2,3]. IMPs are characterized by two distinct morphological deposits: smooth mounds with uniform texture and no blocks, and surrounding deposits with rough surface textures and a range of block densities[4,5]. Lunar Reconnaissance Orbiter Camera (LROC) observations suggest that the IMPs may be contemporaneous features (~ 10 – 100 Ma)[4]. Formation mechanisms for IMPs include: sublimation[3], small lava intrusions and caldera collapse[1], episodic outgassing and removal of surface regolith within the past 10 Ma[6], lava flow inflation[7], small basaltic eruptions within the past 100 Ma[4], pyroclastic eruptions[8], and lava lake processes and magmatic foam extrusions[9].

Here we will characterize compositional trends in the four largest IMPs that will allow us to constrain IMP formation scenarios. Compositional characterization will be performed for the IMPs that exhibit the largest spatial (e.g., 3 – 5 km max. length) extents: Sosigenes (8.335°, 19.071°), Ina (18.65°, 5.30°), Cauchy-5 (7.169°, 37.592°), and Maskelyne (4.33°, 33.75°). The compositional data for these IMPs will be compared to their surrounding terrains to investigate their similarities and differences. Moon Mineralogy Mapper (M^3) observations (~ 0.4 – 3 μm wavelength range) will be used to identify prominent absorption bands for these IMPs and the spectral parameters that best distinguish the IMPs from their surroundings (e.g., band depth, band center, band ratios). Thermal infrared observations from the Diviner Lunar Radiometer (Diviner) will be used in conjunction with M^3 spectral measurements. Diviner's three mineralogical channels near 8 microns[11], which were chosen to map the Christiansen feature (CF) in silicate minerals, will be used to further characterize the compositional similarities and differences between the IMPs and the surrounding maria. We intend to define major compositional similarities or differences based on the IMP geological context and their morphological characteristics. This analysis will be extended to smaller scale IMP features based on available M^3 and Diviner data products as well as the likelihood for these features to be resolved spatially within these respective datasets.

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