Mineralogy of lunar farside mare basalts on the feldspathic highland terrain: Spectral assessment using M^3 datasets of Chandrayaan-1

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Abstract. Understanding the mineralogy and composition of the lunar nearside and farside mare basalts will provide insights into the thermal evolution of the Moon. Unlike the vast volcanic regions on the lunar nearside that lasted from ~4.2 Ga to ~1.2 Ga [1,2], the lunar farside displays a more localized and discrete distribution of mare basalts, with episodic eruptions between ~3.8-1.5 Ga including the cryptomare regions [3,4,5]. Some of these small scale volcanic deposits are also correlated with high-Th content [6]. Our study focuses on the mineralogy of the mare volcanic deposits on the lunar farside and their spatial and spectral heterogeneity. The Chandrayaan-1 Moon Mineralogy Mapper (M^3) datasets are used to study the reflectance spectra characteristics of these basalts. The spectral parameters such as band center at the absorption centers (near ~ 1µm and ~2µm) and the integrated band depth ratio (IBDR near ~1µm and ~2µm) are used to assess the comparative mineralogy of the mare basalts studied (Fig. 1). The study shows that farside volcanism exhibits diverse spectral characteristics in the lunar volcanic history, implying compositional differences in the source regions of the magma.

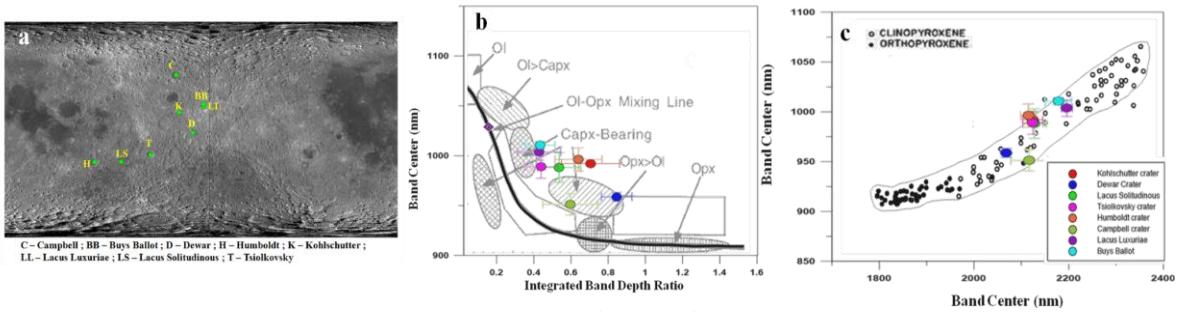

Figure 1. (a) The study regions mapped on the LROC WAC mosaic of the lunar farside. (b) The IBDR vs Band Center near 1µm shows the possibly varying amount of abundance of olivine in the spectra. A small diamond in the figure is attributed to the olivine-rich mare basalt excavated by a ~2.5 km size crater on the floor of Lacus Luxuriae. Some of the study regions such as Kohlschutter crater, Lacus Solitudinous in shows spectral variations within the respective unit implying compositionally different volcanic emplacements in these regions. (c) shows the spectral diversity near bands 1 and 2 µm implying the characteristics of abundant pyroxene type in the spectra. The spectral plot clearly shows the spectral parameter variations among the study regions.

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