Unveiling the mineralogical composition of lunar farside mare basalts

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Abstract. One of the Moon's most surprising characteristics is its crustal asymmetry; the farside hemisphere, dominated by ancient highlands and covered with a few mare deposits, has a different volcanic history than the (sampled) nearside[1]. Surface dating of the lunar mare basalts revealed that the volcanism on the Moon lasted between ~3.9-4.0 and ~1.2 Ga, with a peak in the volcanic activity ~3.6-3.8 Ga ago[2]. A recent study further demonstrated that the mineralogy of the nearside mare basalts reveals a late stage volcanism with high titanium and olivine contents[3]. More recent spectroscopic analyses focused on the farside's crustal rocks composition (e.g. [4] for South Pole-Aitken [SPA] basin), but no comprehensive study of the farside mare compositions has been conducted up to now. In this work, we used spectroscopic data of the Moon Mineralogy Mapper (M3) onboard Chandrayaan-1 to survey the mineralogy of all mare deposits in the VNIR domain (0.4-3 µm). Each mare unit was mosaicked separately and processed using the method of [5]. Finally, we applied statistics on spectral parameters (e.g. band centers) to survey the variation in mineral signatures and compositions of farside maria. We find that mare basalts spectra are dominated by pyroxene signatures. However, some band characteristics seem to differ for SPA mare units when compared to nearside mare units from [3] and Mare Australe (Figure 1), which suggests different pyroxene compositions with a distinct mineralogy within SPA.

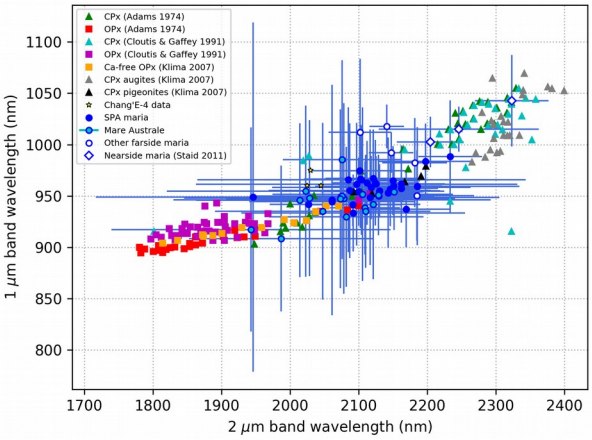

Figure 1: Variations in pyroxene band 1 and band 2 absorptions within the farside maria. Synthetic pyroxenes from [6] [7] and nearside mare units from [3] are shown for comparison.

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