Using the Modified Gaussian Model (MGM) to identify cryptomare and mare basalt mineralogy

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The Moon presents an ideal laboratory to study early geologic processes due to the preservation of surface features, such as the mare deposits. The extent of the nearside mare suggests volcanism was an important process on the Moon during the first half of its history. Remote sensing data has enabled us to observe both the most recent mare deposits as well as ancient mare deposits, known as cryptomare. Further investigation of the cryptomare can address outstanding questions about lunar volcanism, including when mare volcanism started and how the composition and emplacement style has changed (or not) over time.

Using the Moon Mineralogy Mapper (M^3)[1] spectrometer data we have analyzed the mineralogy of identified cryptomare and associated mare deposits to determine the variation within and between these two types of deposits. Average spectra are sampled from small (<5 km) fresh craters from the identified mare and cryptomare deposits and processed using the Modified Gaussian Model[2] (MGM) to determine pyroxene band centers. These calculated band centers are then compared with laboratory data of synthetic pyroxenes[3,4] to constrain the mineralogy of the deposits. Our results indicate that the identified cryptomare deposits overlap with the calculated mare basalt compositions and cryptomare have a narrower range in composition. However, most of the calculated mineralogies are pigeonites and only a few are calculated as augites, based on comparisons with the synthetic pyroxenes. The calculated compositions indicate that there are observable differences between study regions.

[1] Pieters et al., M3 paper
[2] Sunshine et al., 1993.
[3] Klima et al., 2007
[4] Klima et al., 2011