GLOBAL COMPARISONS OF MARE CRATER SPECTRA FROM CLEMENTINE UVVIS AND NIR DATA. M. I. Staid[1], E. Eliason[1], L. R. Gaddis[1], and C. M. Pieters[2] [1]U.S. Geological Survey, Astrogeology Program, 2255 N. Gemini Dr., Flagstaff, AZ 86001. [2]Brown University, Box 1846, Providence RI 02912.

Introduction: The relatively crystalline and unweathered regolith exposed at young impact craters in the lunar maria exhibit diagnostic visible to near-infrared reflectance properties related to their mineralogy [e.g. 1, 2]. As a result, spectral measurements of small mare craters provide an opportunity to directly investigate the mineralogy of emplaced basalts, while circumventing many of the complications associated with the space weathering and non-mare contamination of mature lunar soils. The reflectance properties of small craters representing the least weathered and uncontaminated surfaces in the lunar maria are examined using high spatial resolution data from the Clementine UVVIS and NIR cameras. This study extends previous analyses of mare crater spectra from several deposits on the near side of the Moon [3] in order to examine the global distribution and diversity of lunar volcanism.

Analysis Approach: Clementine NIR data was radiometrically calibrated as described in [4] and then normalized to Apollo 16 soil measurements [3, 5]. The UVVIS and NIR data were then merged into a single nine-band cube to obtain reflectance spectra of mare craters and associated soils. The addition of the first four NIR wavelengths (1.1-2.0 μm) to previous studies of mare craters using Clementine UVVIS data (0.4-1.0 μm) provides new information for determining the abundance and composition of pyroxenes, olivines and glass components within unsampled mare deposits.

A broad range of near and far side maria have been selected to provide a global comparison of mare crater spectra. Clementine UV/VIS and mafic band ratios are plotted for these regions in **Figure 1**. For each deposit, density scatterplots of albedo versus mafic band strength (1.0/0.75 μm) were created to identify the spectral properties and weathering of emplaced basalts and surrounding highland materials [6]. Uncontaminated mare materials were then identified within each scatterplot and divided into different levels of optical maturity based on optical models of mare weathering [6,7,8]. Spectral data were then extracted from each uncontaminated mare region as a function of maturity to compare the spectral properties of mare crater materials among different compositional units.

Discussion: Current results identify differences in the visible to near-infrared reflectance properties of several near and far side maria, providing new information about the mineralogy of unsampled basalts. **Figure 2** compares regoliths from unsampled Eratosthenian basalts in Oceanus Procellarum with older basalts on the eastern near side. Fresh mare crater deposits within the Procellarum basalts exhibit a strong, broad and long wavelength 1 μm absorption and a weak 2 μm absorption compared to the older basalts. These spectral properties are consistent with previous studies suggesting that these last major eruptions of mare basalt consisted of an iron-rich composition with an abundant olivine or glass component [3,9,10]. Current results support the interpretation of abundant olivine within these basalts and suggest that the compositions of the western high-titanium basalts are unique among the major mare deposits on the lunar surface.

Among the far side mare deposits, those within the South Pole-Aitken (SPA) basin are of particular interest due to their unique geologic setting within the largest established basin on the Moon. Clementine spectra from two distinct mare types within the far side SPA basin are shown in **Figure 3**. The low titanium basalts that dominate the central mare deposits in the basin are observed to be very similar to the low-titanium, high iron deposits within Mare Serenitatis, which also were emplaced within a major basin and an area of thinned crust (**Figure 1**) [11]. Mare soils and craters examined within the Apollo basin of SPA have a lower albedo and a slightly higher UV/VIS ratio (indicating a somewhat higher titanium content). Mare craters in Apollo also have a moderately strong 1 μm ferrous band similar to deposts within the major near side basins. In contrast, mare deposits outside of major basins on both the near and far side (e.g. Lacus Somniorum, **Figures 1-3**) generally have weaker bands and very low estimated titanium contents. Such deposits occur preferentially in regions of thicker crust, suggesting that the density of emplaced basalts and regional crustal thickness are related in determining whether a given mare composition reaches the surface of the Moon.

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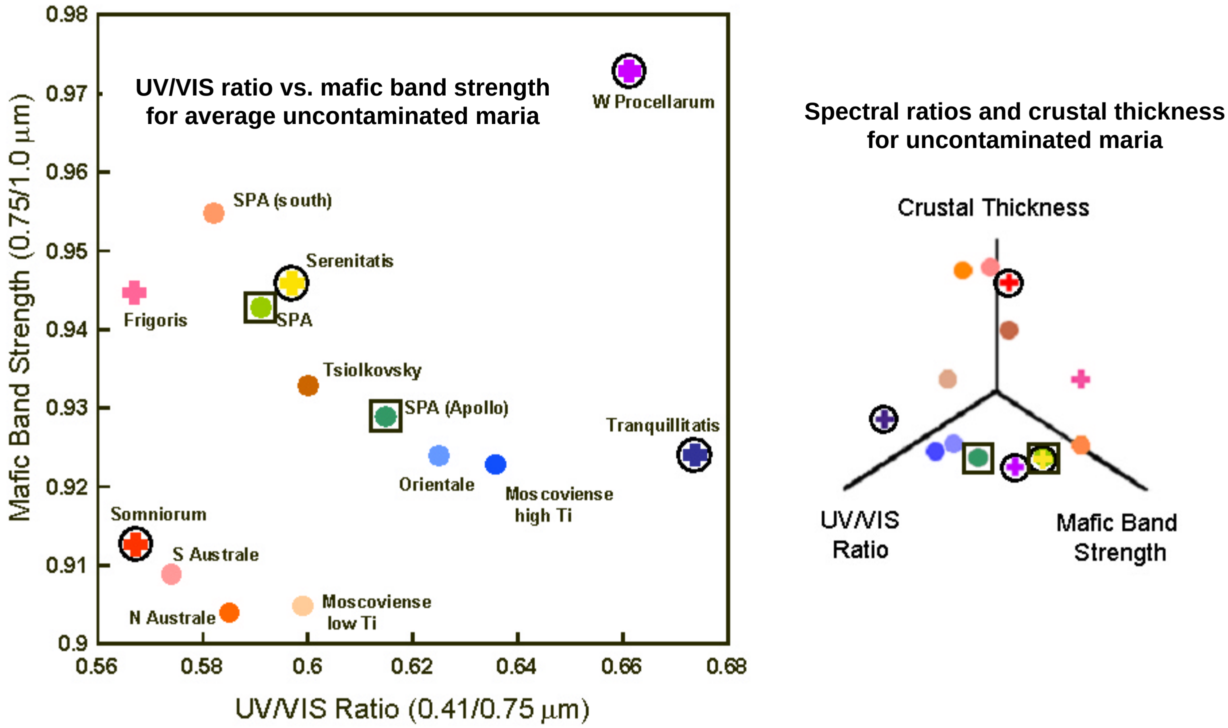

Figure 1. *Left*: Spectral ratios derived for uncontaminated areas of 14 major mare regions. The UV/VIS ratio provides an estimate of titanium content while the mafic band strength is related to the abundance of ferrous minerals for regions with similar average optical maturities. UVVIS and NIR spectra of crater materials from several near side (circle) and far side (square) maria are presented below. *Right*: Mare spectral ratio values plotted as a function of crustal thickness [11].

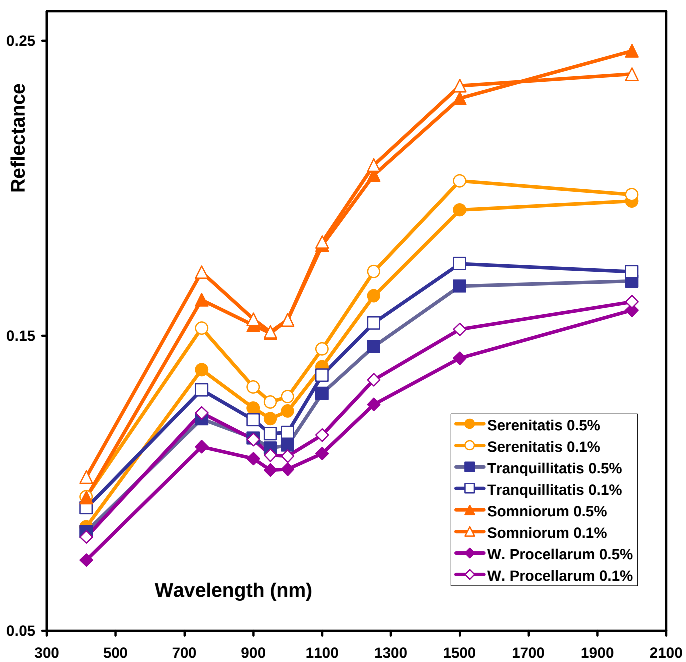

Figure 2. 9-band Clementine spectra comparing the least weathered 0.5% and 0.1% of several near side mare surfaces. The unsampled western Procellarum basalts display a uniquely strong and long wavelength 1 µm absorption.

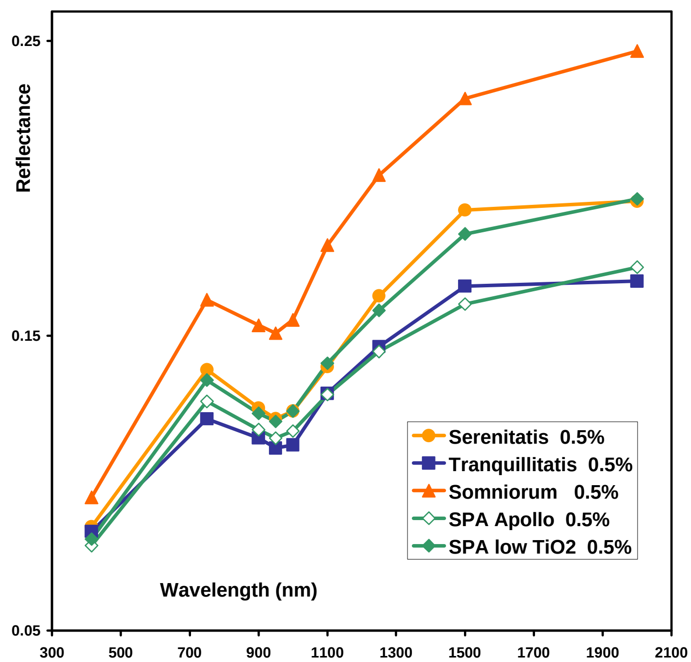

Figure 3. 9-band Clementine spectra comparing the least weathered 0.5% of surface materials within two mare deposits in the South Pole-Aitken basin to unweathered mare materials from three eastern near side deposits.