Lunar mare volcanism on the nearside of the Moon:A geologic study of lunar mare basalt using Clementine UVVIS data

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Clementine UVVIS multispectral data were used to map mare basalts on the nearside of the Moon to understand the temporal and spatial variations of lunar mare volcanism. An array of Clementine and Clementine-derived data were used to classify mare basalts; these include: 750 nm albedo, UVVIS ratio, 1-micron absorption signatures, and Clementine-derived FeO and TiO2 contents. The stratigraphy of mare units was constructed based on their superposition and compositions of crater floors and ejecta. The analysis has successfully identified new geological units and has determined their spectral characteristics for each mare region. The stratigraphy constructed from the spectral analysis indicates that the mare basalts are younger in the western maria than in the eastern maria in a global scale, whereas northern mare units tend to be younger than southern mare units in a local scale. According to the relationship between the titanium contents of the mare units and their stratigraphy, the titanium contents tend to become higher with time, and this fact suggests that a similar magma generation process might exist in the lunar interior. In connection with the distribution of mare basalts, the titanium is rich in the western Tranquillitatis and central Oceanus Procellarum region, while other mare regions are largely covered by low- to intermediate-Ti basalts. The very low-Ti basalts were observed in the northern parts of Oceanus Procellarum and Mare Imbrium and in Mare Frigoris. The iron contents show a similar distribution to that of titanium. These results suggest a lateral diversity of the lunar upper mantle compositions on a basin scale.