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Quantitative investigation of the mineral pyroxene using NIR SIR-2 data

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One of the most important objectives of lunar remote sensing remains the investigation of the abundance and distribution of the major minerals across the Moon's surface. The ongoing investigation of basalt suites from the Moon and terrestrial planets shows characteristic compositional differences relating to their evolution, source regions and mode of eruption, which are typical of each particular geological setting and thermal history.

Pyroxenes are the dominant mafic minerals on the lunar surface and most solid planetary bodies. Broadly speaking, orhtopyroxene and pigeonite (ca-poor pyroxenes) are characteristic of primitive melt bodies, while clinopyroxene, the calcium-rich phase, has been found to be the major mafic phase in the maria and typical of more evolved magmas. Coexisting and zoned high-Ca and low-Ca pyroxenes can reveal the petrological origin and evolution of a wide range of rocks.

Pyroxenes' prominent spectral absorption features at one and two microns in the near-infrared (NIR) spectral region make them ideal targets for remote sensing investigations (i.e. Hunt and Salisbury, 1970; Adams 1975, 1975; Rossman, 1980).

Several lunar maps of pyroxene distribution have been produced (i.e. McCord et al., 1981), most based on data products from the Clementine mission (i.e. Shkuratov et al., 2005). Hyperspectral data from recent space missions, such as the Chandrayaan-1, which carried several spectrometers (M3, HySi, and SIR-2), provide unprecedented high spectral and spatial resolution (away from the laboratory) to attempt a quantitative approach on the mineral's distribution (i.e. Sunshine and Pieters, 1993).

Here we report on the identification and abundance measurements of pyroxenes through the analysis and interpretation of NIR data from the SIR-2 instrument.

References

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