SPECTRAL SIGNATURES OF MARTIAN METEORITES AND WHAT THEY CAN TELL US ABOUT ROCKS ON MARS.

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Introduction: Martian meteorites provide important compositional information about crustal rocks and enable ground truthing of orbital data. Coordinated VNIR and mid-IR spectral analyses of the meteorites and mineralogy of Mars are important in order to fully understand the composition of the surface. Hamilton et al. [1] used TES data to identify several olivine and orthopyroxene-bearing regions near Nili Fossae, Ganges, Argyre and Hellas that are consistent with ALH A77005, Chassigny and ALH 84001 meteorites, as well as clinopyroxene-rich locations in parts of the Valles Marineris region and Syrtis Major resembling Nakhla-type meteorites. More recently, VNIR spectra collected by OMEGA and CRISM have been used to document mafic outcrops on Mars [2, 3]. Here we present a summary of the VNIR and mid-IR spectral properties of several Martian meteorites correlated with their compositions. These data are compared to regions on Mars where mafic outcrops with similar spectral characteristics are observed.

Spectral Properties of Martian Meteorites: We have acquired VNIR reflectance and thermal emissivity spectra of several Martian meteorites including: ALH 84001, EETA 79001, Los Angeles, Dar al Gani 670, and NWA 1068. These samples contain pyroxenes ranging from orthopyroxene to pigeonite to augite, feldspar (and maskelynite), fayalitic and fosteritic olivine, silica, and glass. We are comparing the mineral modeling results of the two spectral regions with each other and with the meteorite petrology from other studies. Gaussian modeling is used for the electronic absorptions in the VNIR region spectra based on code developed by Sunshine et al. [4, 5] and adapted by Parente et al. [6]. Gaussian modeling of Martian meteorite spectra has revealed the presence of pyroxene, olivine and glass. Modeling of the thermal emission spectra is based on vibrational absorptions [7] and modeling of Martian meteorite spectra has shown the presence of feldspar, pyroxene, olivine and glass [1, 8].

Coordinating Spectral Properties of Meteorites with the Surface of Mars: Mafic outcrops are observed across the surface of Mars in non-dusty areas where the caprock has been eroded. Spectral analyses of Martian meteorites are assisting in interpreting these mafic outcrops. Many of these surface mafic outcrops are small; thus, the better spatial resolution of THEMIS and CRISM has enabled improved resolution of these mafic regions. CRISM can detect features due to olivine and pyroxene as they have Fe excitation bands. TES (and sometimes THEMIS) can detect these minerals as well as feldspar.

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