Mars Mineral Analysis Using OMEGA Data

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Presentation Outline

- Objective
- Satellite/Sensor Information
- Geographic Locating
- Literary Review
- Spectrum Analysis
- Statistical Analysis
- Challenges to Research
- Conclusions
Objective

- Determine mineral content of Martian impact craters.
- Is there a difference in mineral content on the outside of the crater versus the inside of the crater?
- Is there a difference in the mineral content of impact craters in between the two major regions?
- Minerals of interest: gypsum, olivine, and nontronite.
OMEGA

- Visible and Infrared Mineralogical Mapping Spectrometer
- Scales of 100 to 500m
- Spectral resolution of 7-20 nm per band
- Wavelength 0.35 to 5.1 microns
- 352 contiguous band
- Inclination 86°
- IFOV of 1.2mrad
Dichotomy Boundary

- Glaciation
- Impact crater
- Tectonics and erosion
Locations of Tested Craters
Crater Satellite Images
Mars Surface Diversity as Revealed by the OMEGA/Mars Express Observations

- Discussion of Nontronite and Olivine absorption spectra.
- Discussion of High Calcium (HCP) and Low Calcium Pyroxines (LCP).
Sulfates in Martian Layered Terrains: The OMEGA/Mars Express View


Discussion of Gypsum and other sulfate minerals, and the resulting spectra.
Sulfates in the North Polar Region of Mars
Detected by OMEGA/Mars Express

- Example of processed signal, corrected for atmospheric interference.
Olivine and Pyroxene Diversity in the Crust of Mars

- Spectra of characteristic olivine signal.
- Discussion and examples of HCP and LCP signals.
Gypsum Spectrum

Note the downward sloping spectrum, characteristic of sulfates, with absorption features at 1.42 µm and 1.9 µm.
Olivine Spectrum

Note the U-shaped absorption feature from 0.8 µm to 1.1 µm.
Nontronite Spectrum

Note the absorption spike feature at 0.9 μm.
We also found a spectrum at the center of some of the craters that seems to be for a mineral which we have not yet been able to identify.
## Statistical Analysis

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<th>Variable</th>
<th>P-value</th>
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Gypsum was present in all areas sampled.

Olivine showed no pattern in either hemisphere, or sample location.

Nontronite showed up more preferentially outside the craters in the Northern hemisphere but both inside and outside in the Southern hemisphere.

Mineral X was found inside craters, and in both hemispheres.
Challenges to Research

- Availability of Satellite Imagery
- Image Processing
- Not able to isolate certain spectral features in spectral profile
- Lack of ability to “check for accuracy”
Conclusions

- The Martian impact craters we studied are composed primarily of olivine, nontronite, and an unknown mineral. All of the surfaces tested were coated with gypsum.
  - Nontronite was found outside craters in the Northern Hemisphere more, but in the Southern Hemisphere it was found both inside and outside of impact craters.
  - The unknown mineral (mineral X) was found inside craters.
  - Olivine and gypsum showed no pattern in location.