

Deriving Mars Surface Mineralogy Using Spectroscopy

Launch JMars on your computer using the following link:
<http://jmars.asu.edu/download/public/webstart/jmars-public.jnlp>

Do not use your usual login. Use the following:

Username: joshband@u.washington.edu
Password: marsisdusty

Go to 76.5E, -25.5 and re-center the projection (found under the View menu on the main window).
Zoom to 128ppd.

Load the THEMIS Day IR Global Mosaic (Add New Layer → Maps by Instrument → THEMIS ...).

Go to: Add New Layer → Custom Maps → CRISM Olivine Index → View Graphic Data

This is a map of the strength of the 1 micron wavelength olivine absorption feature shown below. Weak features are shown in cooler colors (e.g. blue and cyan) and strong features are shown in hotter colors (e.g. orange and red). Generally, the stronger the feature, the more olivine is present. In this map, the highest abundances are ~30%.

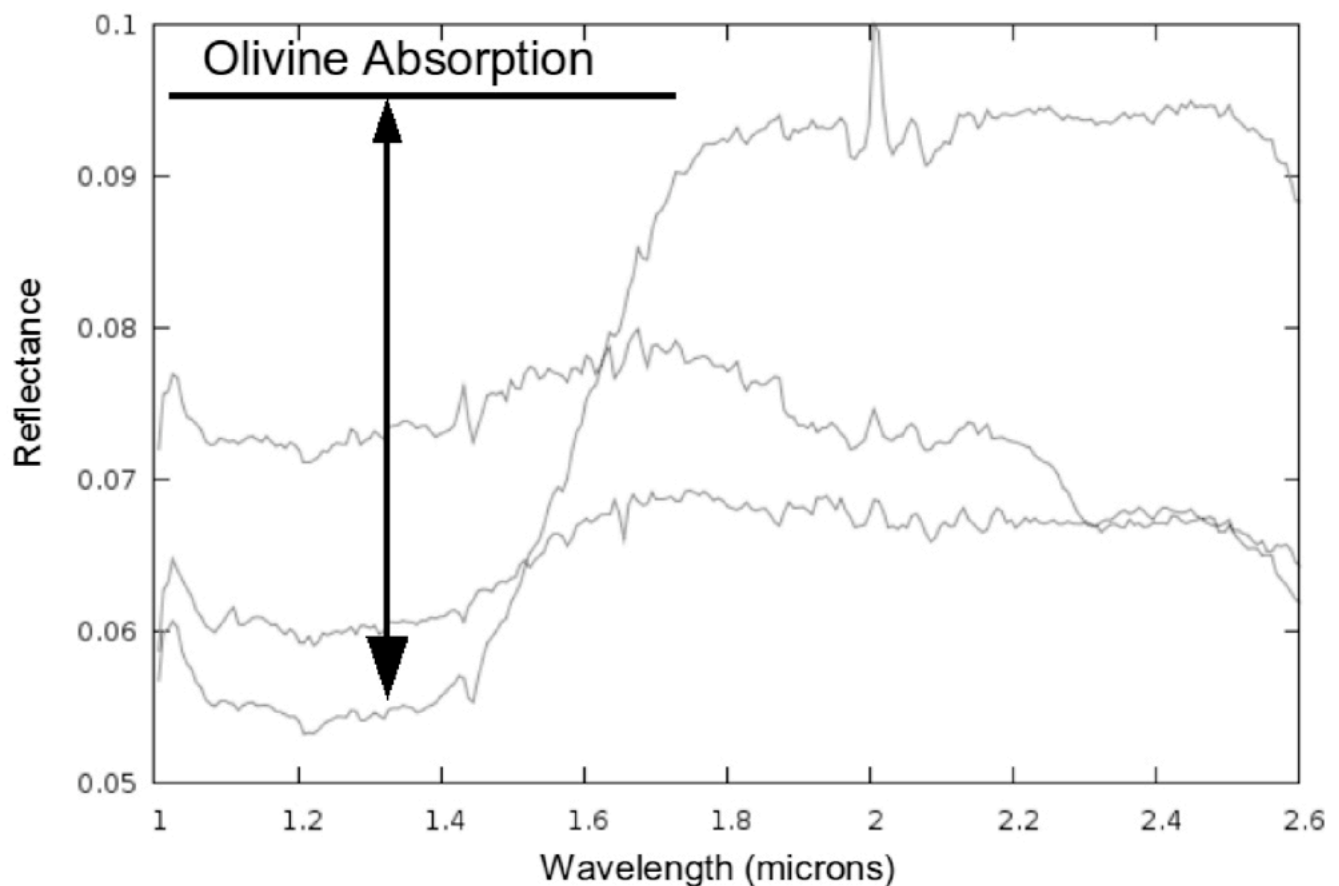


Figure 1. CRISM spectra showing olivine absorptions of variable strength
What types of surface features are the highest concentrations of olivine associated with?

Crater rims and mounds

Go to: Add New Layer → Custom Maps → THEMIS Decorrelation Stretch B875 → View Graphic Data

This is a color thermal infrared image, which is sensitive to different absorptions. Olivine tends to have absorptions at longer wavelengths than other silicates (see plot below).

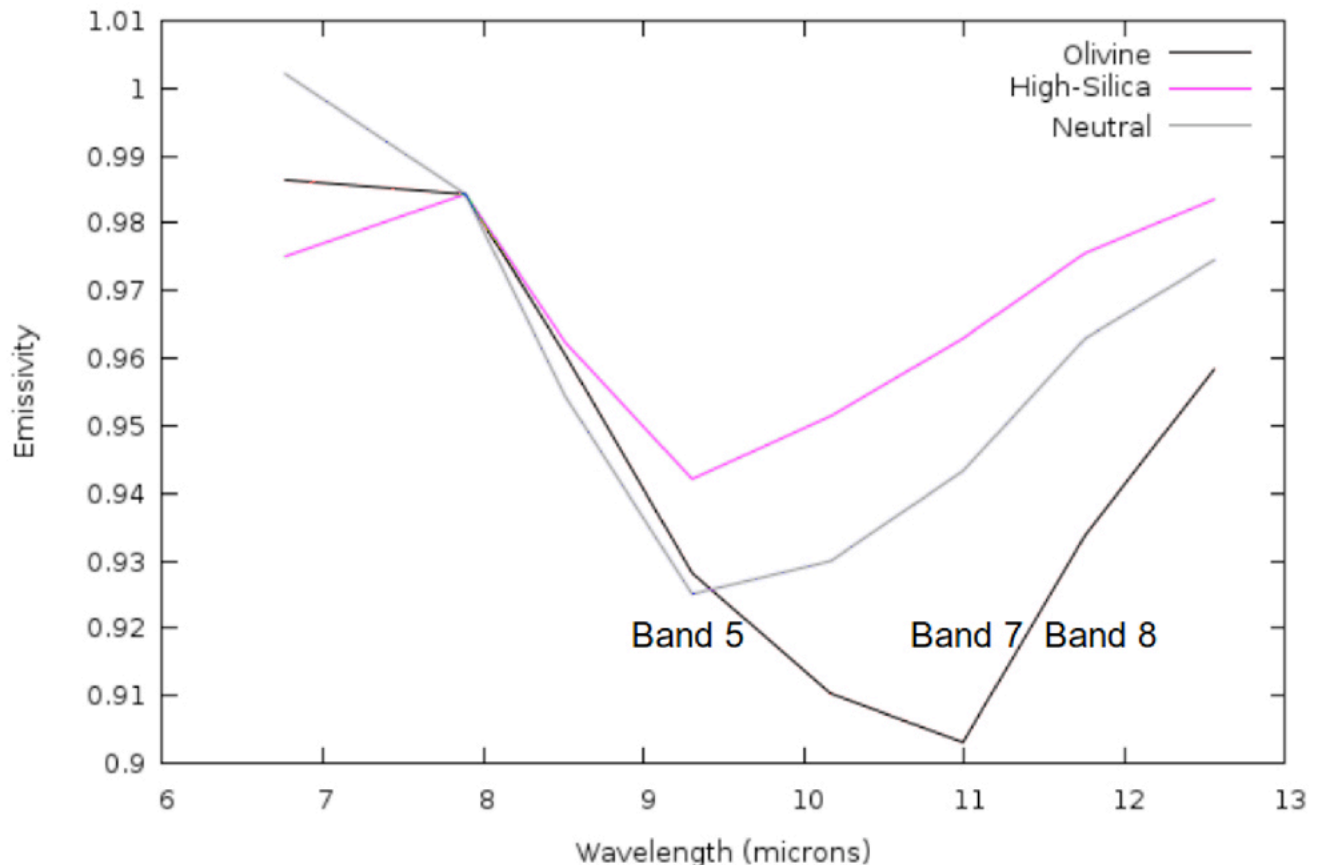


Figure 2. THEMIS spectra of olivine-rich, neutral, and silica-rich surfaces. In the THEMIS JMars color image, THEMIS band 8 is projected as red, band 7 is projected as green, and band 5 is projected as blue.

Does a certain color in the THEMIS color image correspond with the olivine-rich surfaces identified in the CRISM data? Based on the spectra shown in Figure 2, does this make sense? (think about how colors combine – for example green + red = yellow, red + green + blue = white, green + blue = cyan, red + blue = magenta...)

You may also look at HiRISE image ESP_011683_1540_RED to help your interpretation. Use the IAS Viewer selection by right clicking on the stamp outline to view the image at full resolution.

Load the THEMIS Night IR Global Mosaic (Add New Layer → Maps by Instrument → THEMIS ...). You will need to align the THEMIS Night IR layer with the Daytime IR layer. Find a small crater that appears in each layer, and nudge the Night IR layer until the crater lines up in both layers.

Remember how warm surfaces at night generally have higher thermal inertia and are probably rockier. Is there a correlation between the olivine-rich surfaces and thermal inertia? Is there a geologically reasonable scenario for any correlations that you see? (Hint for one possibility: Olivine is very easy to weather away).