Your PLANETS
Science Data Packet

for:

Worlds Apart! Remote Sensing of Mars

Activity 7
Mineral Fingerprinting
(*Level Up! with Four Sites)*

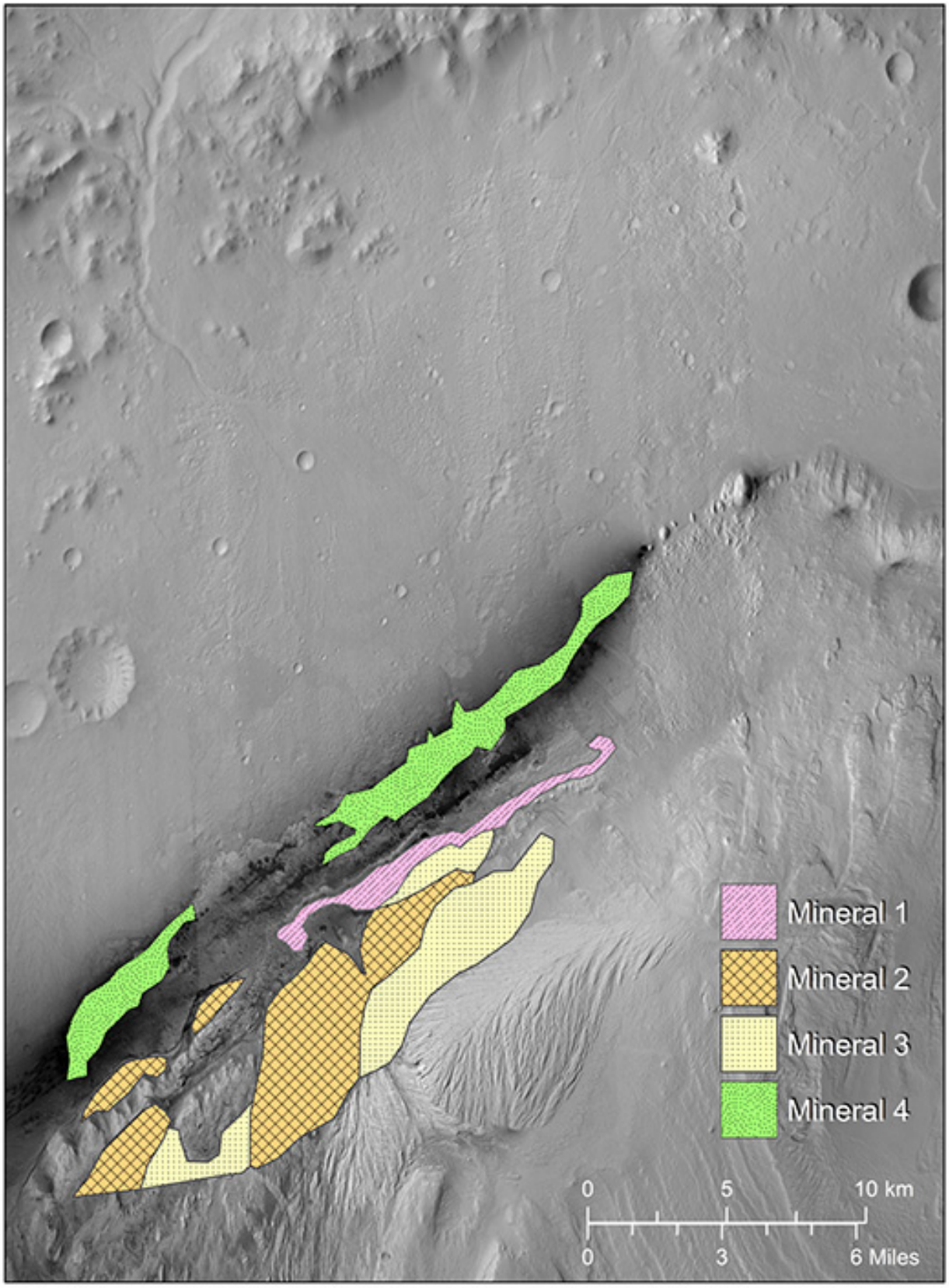
Gale Crater Data

Mineral data at **Gale Crater** gathered by the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) on board the Mars Reconnaissance Orbiter.

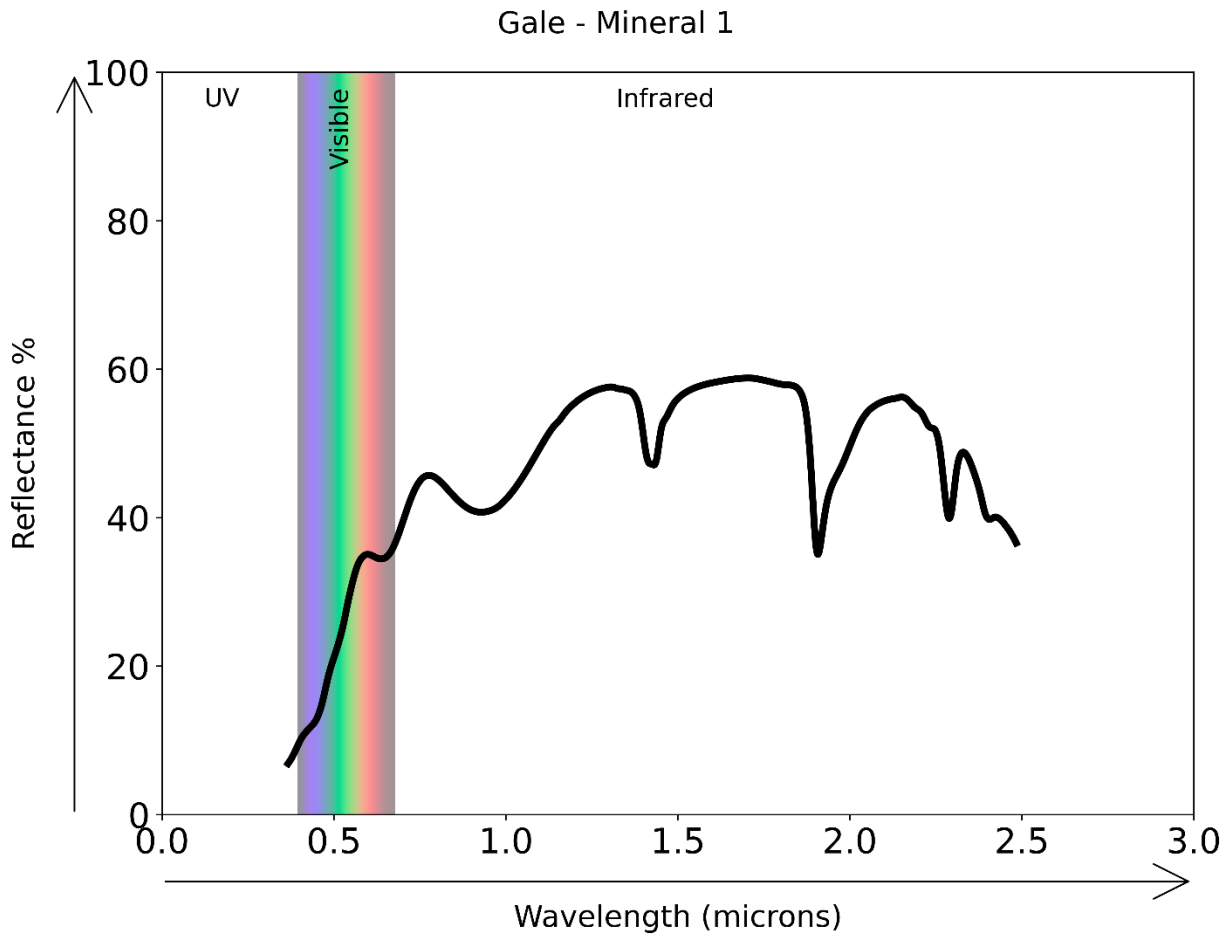
The image on the next page shows the possible Gale Crater landing site. The area of the image that had a narrow, bright ridge is colored with a pink diagonal striped pattern, which corresponds to Mineral 1 in the key. Mineral 2 is indicated in the map with an orange color and cross-hatching and Mineral 3 is marked with a yellow color and a grid of small dots. These two minerals appear on the map in the area with many buttes of layered rock, on the flank of the large mountain that fills the bottom half of the image. Mineral 4 is marked with bright green and a pattern of random small dots. It occurs in the areas of the image containing dark sand dunes.

See next page for image.

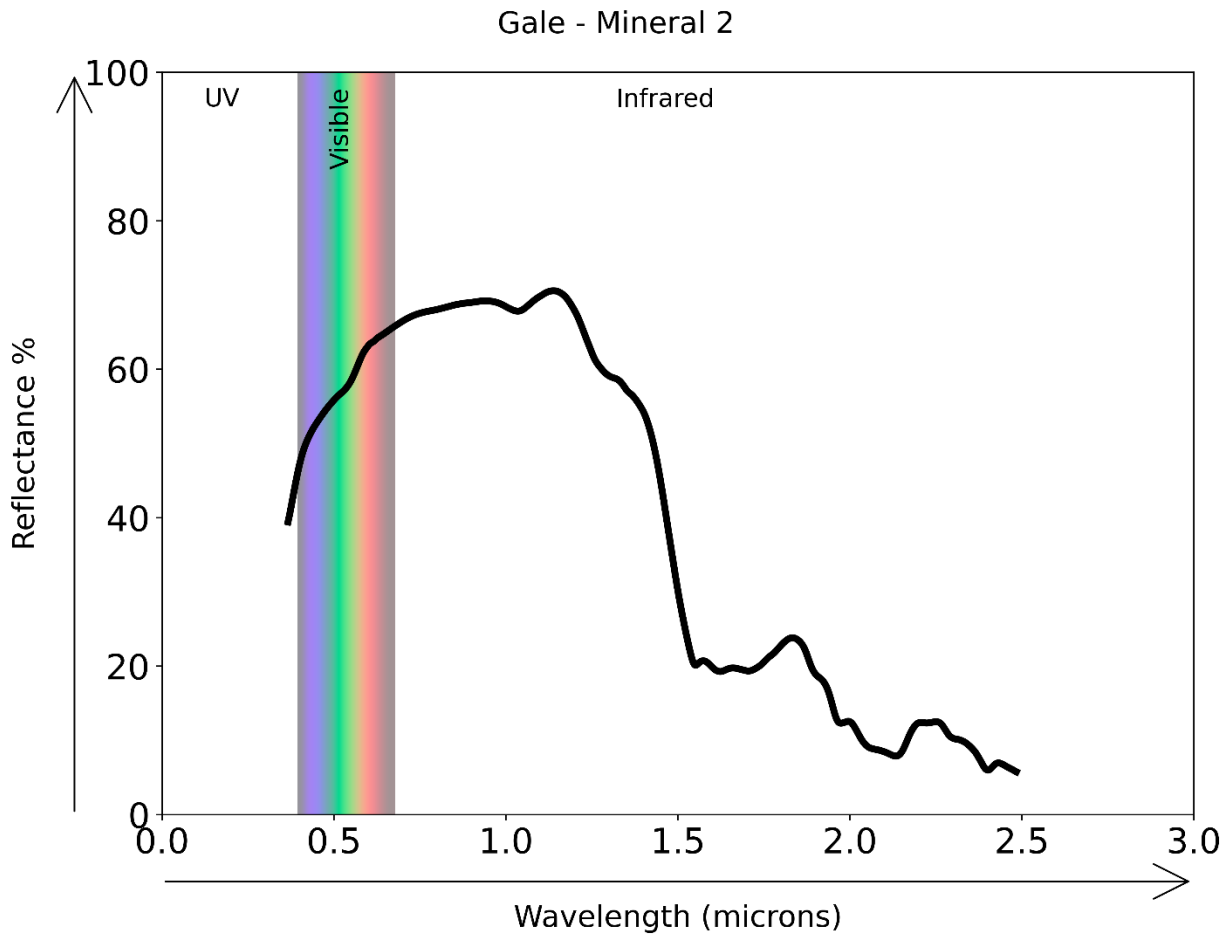
Gale - Mineral Map



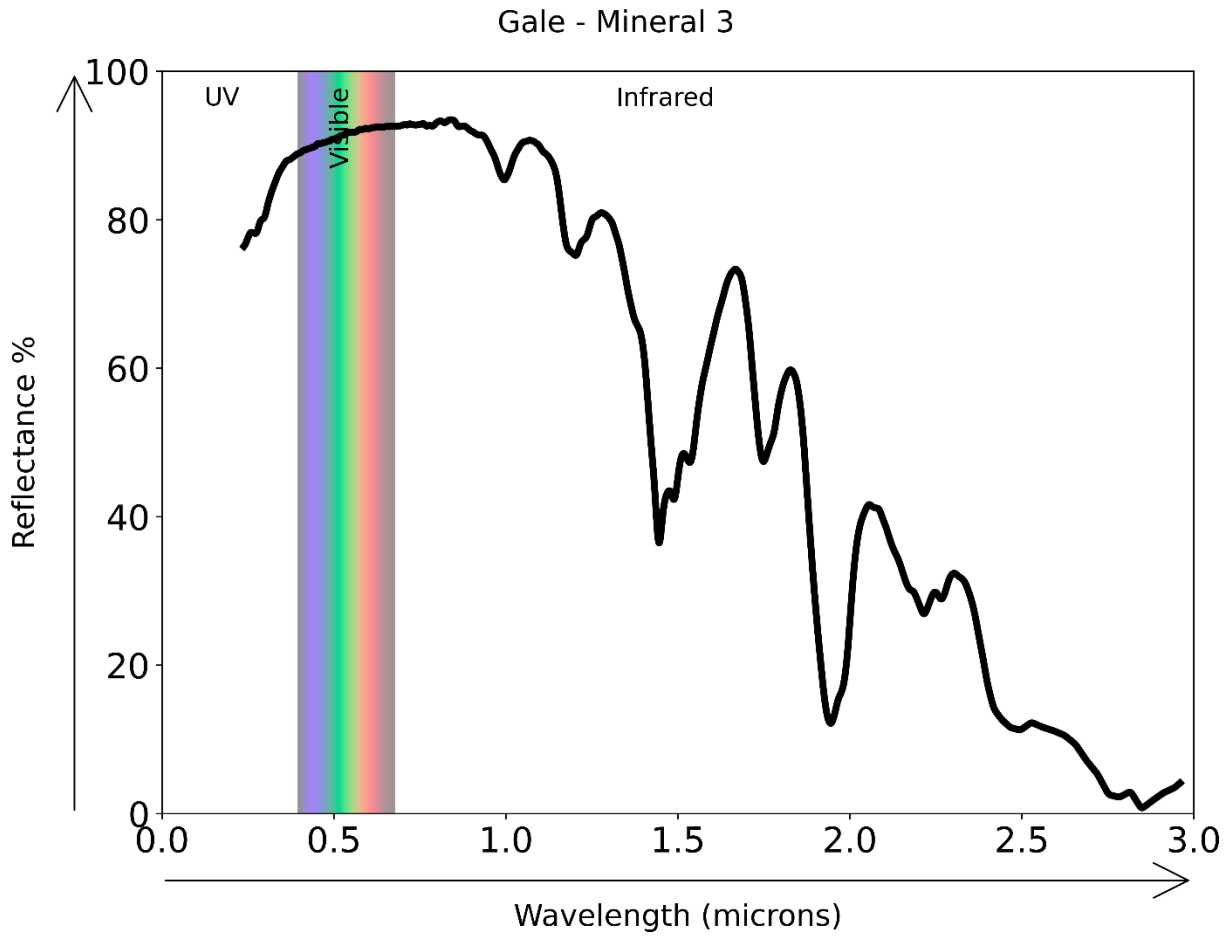
Source: Compact Reconnaissance Imaging Spectrometer for Mars (CRISM)



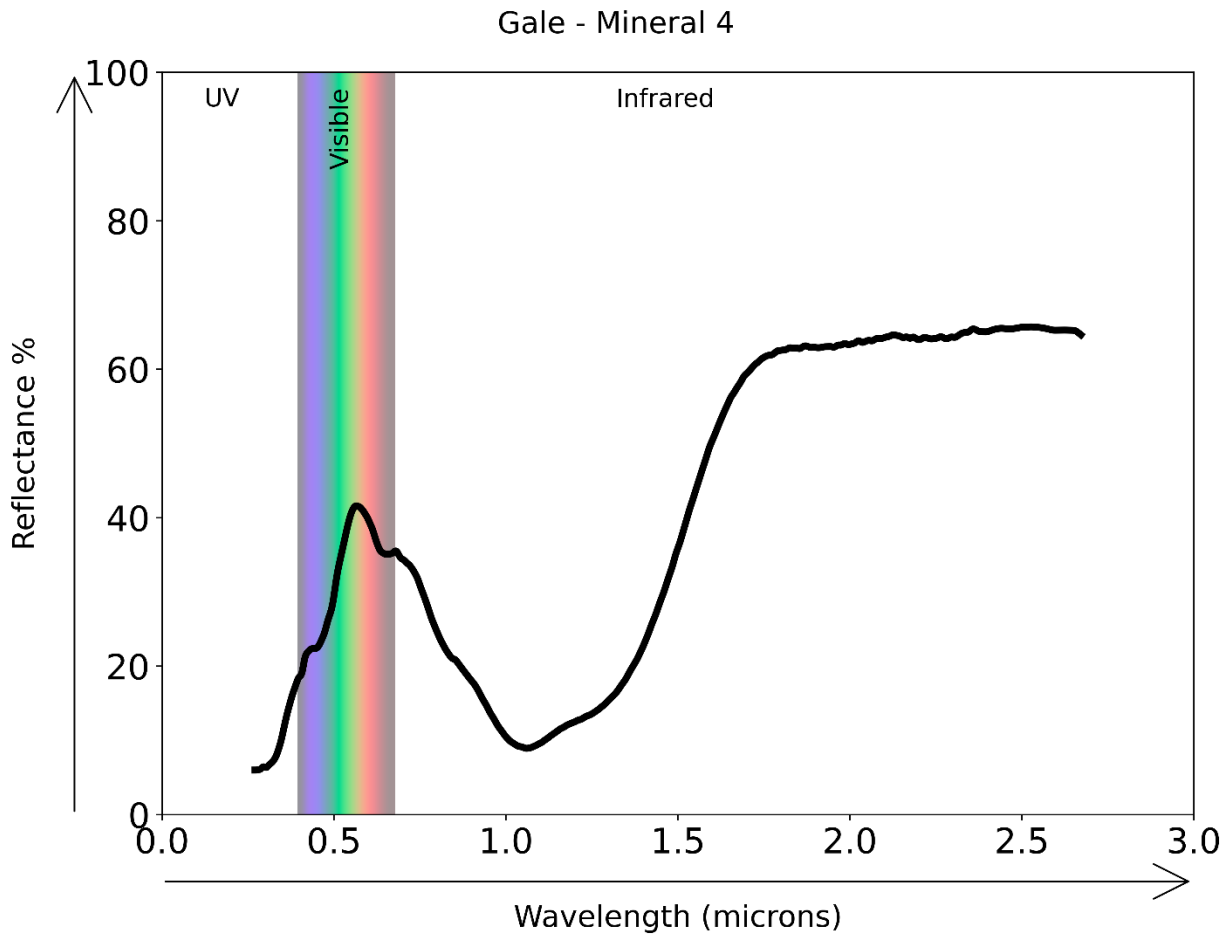
A graph of the reflectance spectrum of Gale Crater mineral 1. The Y axis shows the percent of reflected light ranging from 0 – 100 and the X axis shows the wavelength of light in microns ranging from 0 – 3.0. Human eyes can see only a small range of wavelengths, about 0.4 to 0.7 microns. The reflectance of this mineral increases from less than 10% in the UV range up to about 60% around 1.7 microns. There is a slight dip in the reflectance in the red part of the visible range and a broader dip around 1 micron. Three more sharp, narrow decreases in reflectance occur at 1.4. 1.9, and 2.3 microns. These are caused by water molecules in the crystals absorbing particular wavelengths of infrared light.



A graph of the reflectance spectrum of Gale Crater mineral 2. The Y axis shows the percent of reflected light ranging from 0 – 100 and the X axis shows the wavelength of light in microns ranging from 0 – 3.0. Human eyes can see only a small range of wavelengths, about 0.4 to 0.7 microns. The reflectance spectrum of this mineral increases from about 40% in the UV range to 70% around 1 micron. It then drops sharply down to about 20% at 1.5 microns. Beyond 1.5 microns, the reflectance varies, forming a wiggly line on the plot, but generally continues to decrease except for a peak at about 1.8 microns and a smaller peak at 2.2 microns.



A graph of the reflectance spectrum of Gale Crater mineral 3. The Y axis shows the percent of reflected light ranging from 0 – 100 and the X axis shows the wavelength of light in microns ranging from 0 – 3.0. Human eyes can see only a small range of wavelengths, about 0.4 to 0.7 microns. The spectrum for this mineral starts with a reflectance of about 75% in the UV range which increases to 90% in the visible range and beyond to about 1 micron. From 1 micron to 3 microns, the spectrum varies up and down dramatically, making a jagged line that overall decreases down to very low reflectance near 3 microns. The largest dips in reflectance occur at 1.4 microns, where the reflectance drops from 80% to 40% and then back up to 75%, and 1.9 microns, where the reflectance drops from about 60% to 10% and then goes back up to 40%. These large dips in the spectrum are due to water in the crystals.



A graph of the reflectance spectrum of Gale Crater mineral 4. The percentage of reflected light ranges from 0 – 100 on the Y axis and wavelength in microns ranges from 0 – 3.0 on the X axis. Human eyes can see only a small range of wavelengths, about 0.4 to 0.7 microns. For this mineral, the reflectance increases from a very low value at 0.4 microns, up to a peak of about 40% in the green to yellow portion of the visible range. The reflectance then drops down to a minimum at about 1 micron in the near-infrared. From that minimum the reflectance increases again and is pretty constant at about 60% for wavelengths greater than 1.6 microns.

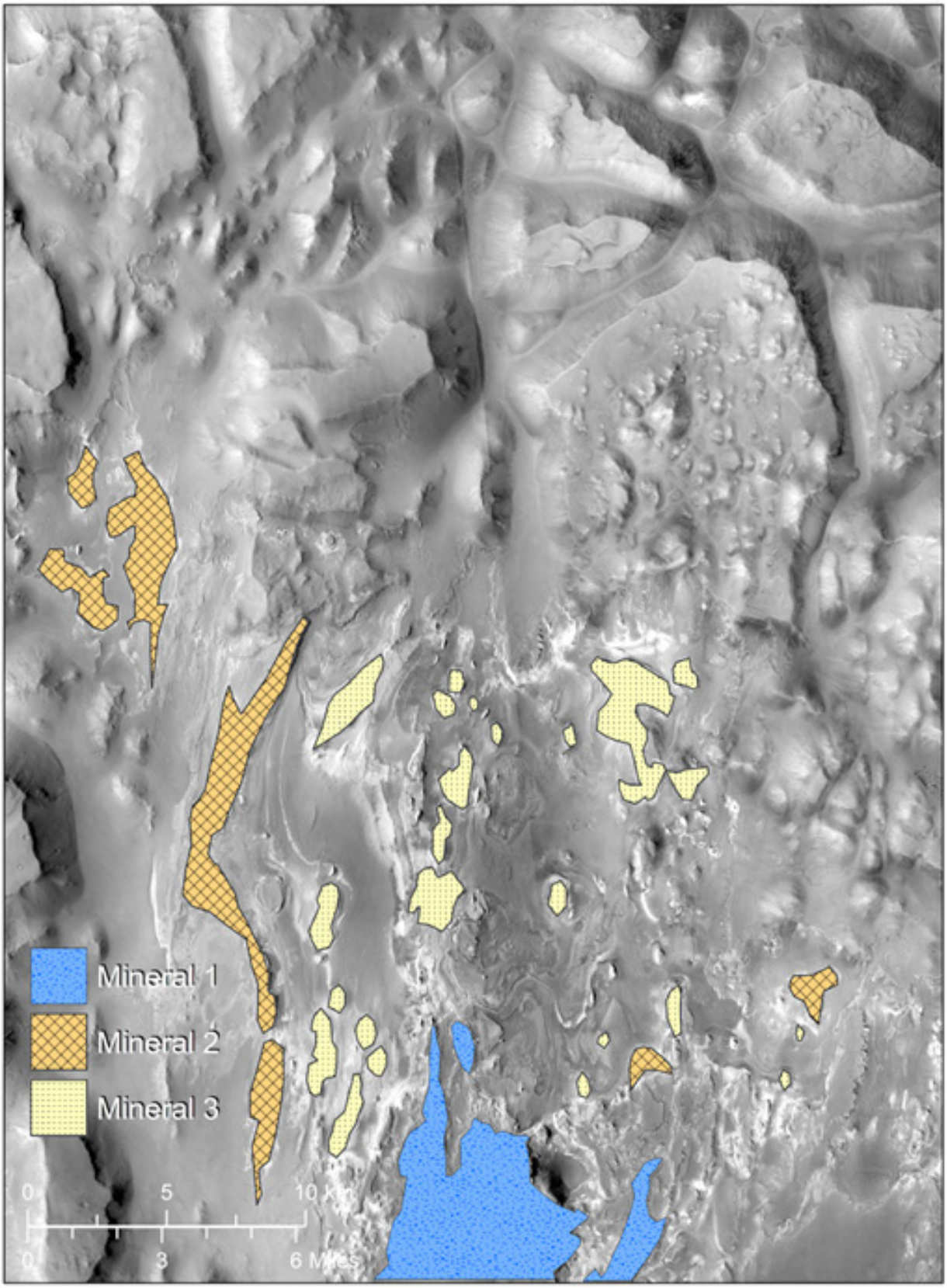
Iani Chaos Data

Mineral data at **Iani Chaos** gathered by the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) on board the Mars Reconnaissance Orbiter.

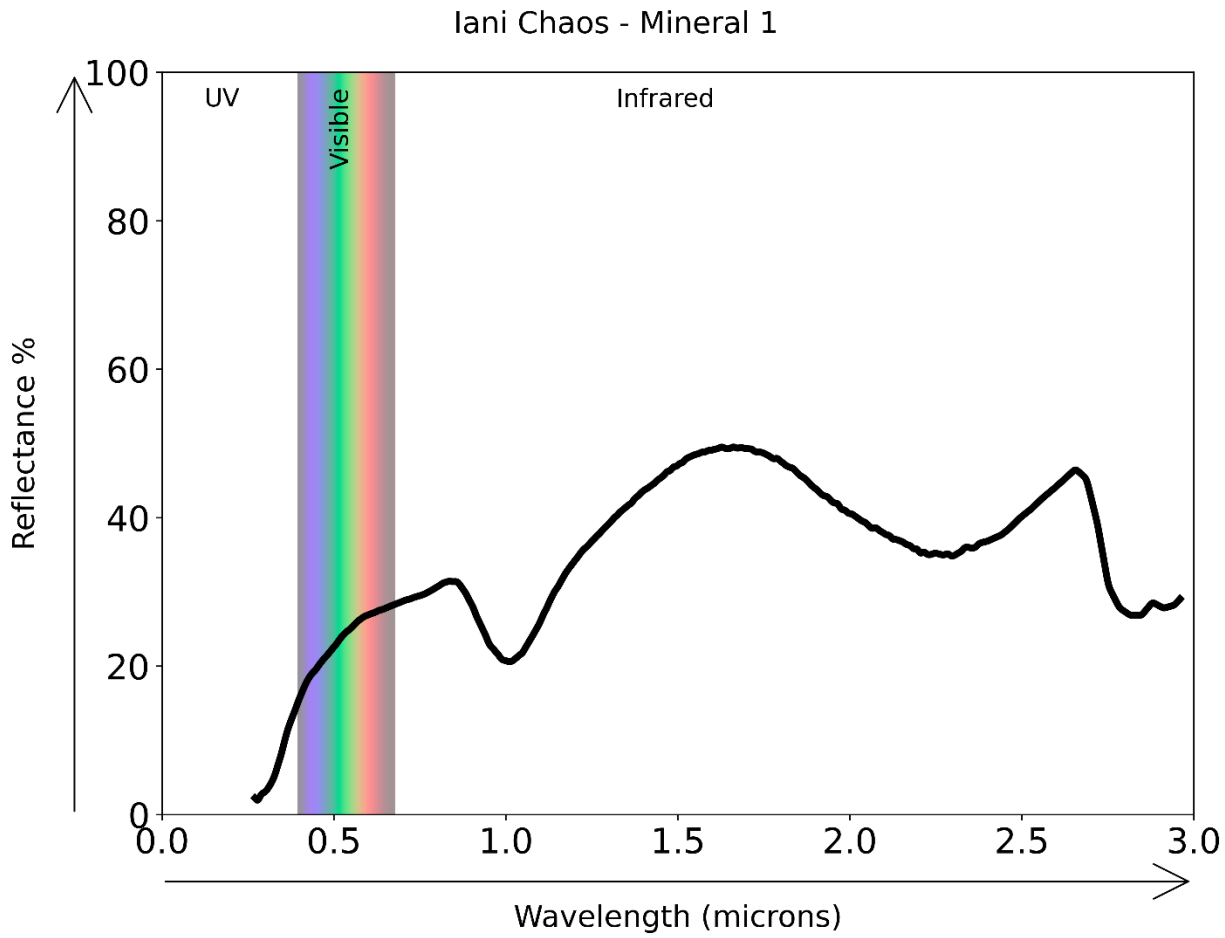
The image on the next page shows the possible Iani Chaos landing site. The broad, flat-topped mesa at the bottom of the image is colored with a blue speckled pattern, which corresponds to Mineral 1 in the key. Mineral 2 is indicated in the map with an orange color and cross-hatching and Mineral 3 is marked with a yellow color and a grid of small dots. Mineral 2 appears on the map in areas where broad patches of bright rock are exposed. Mineral 3 appears in small patches on the map, corresponding to the many small hills and mesas of layered rock in the site.

See next page for image.

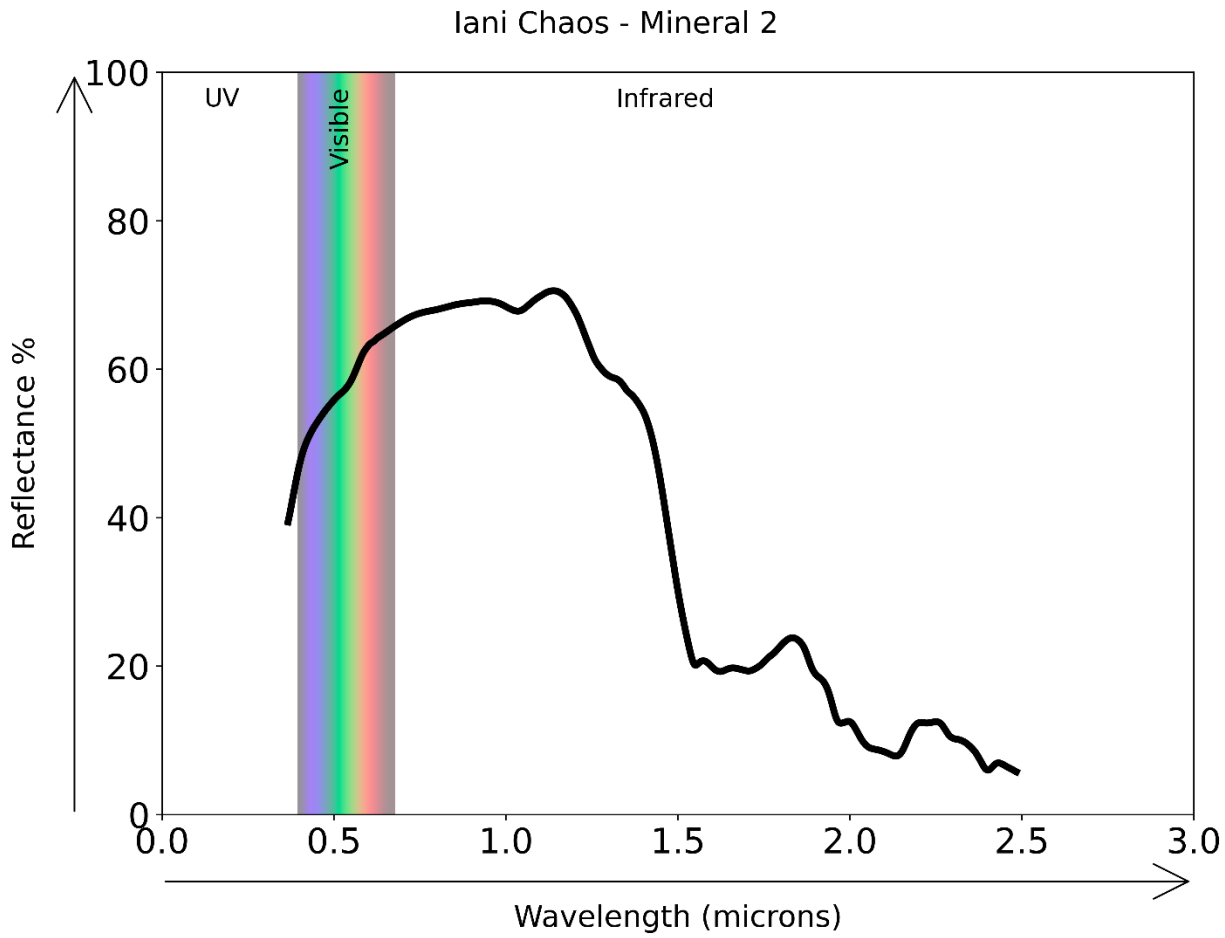
Iani Chaos - Mineral Map



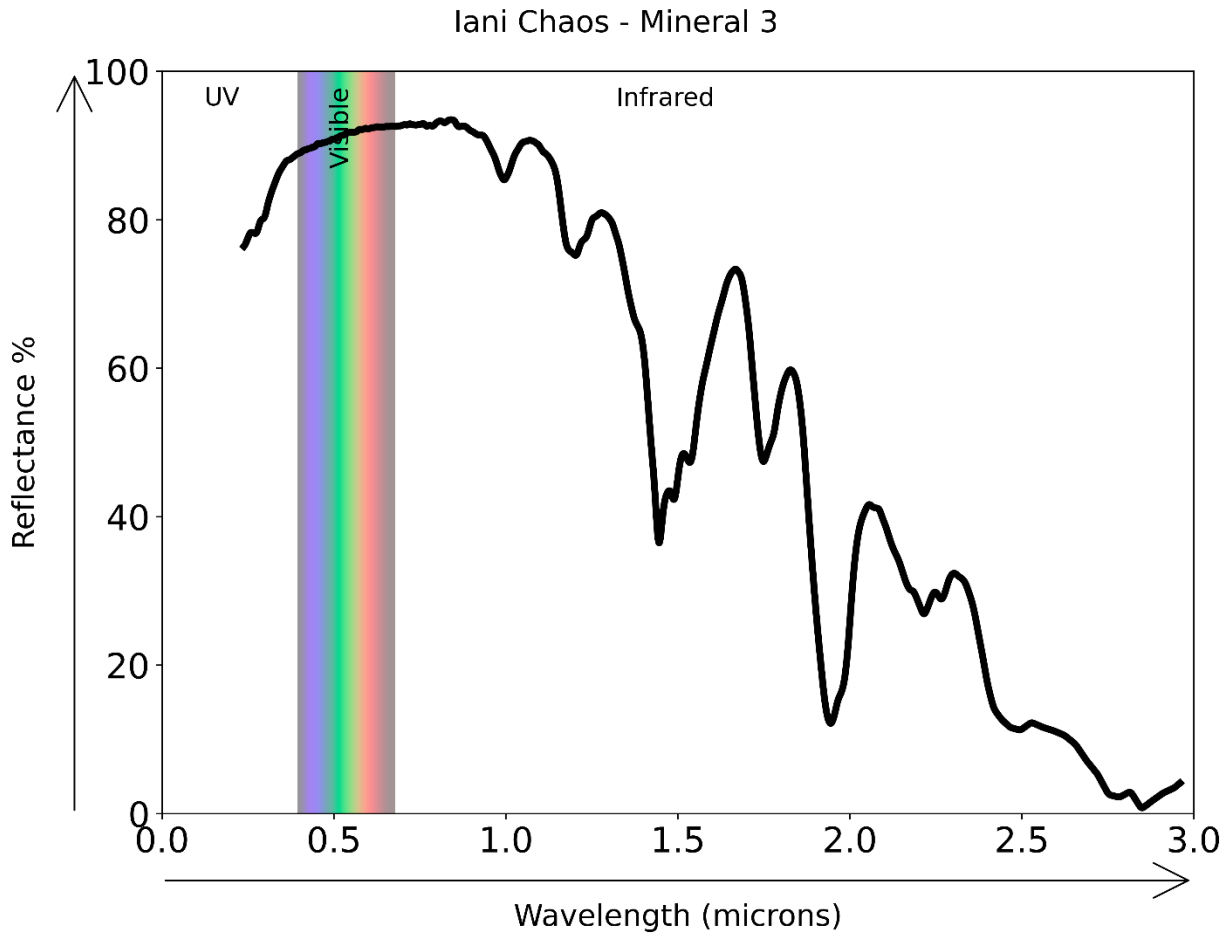
Source: Compact Reconnaissance Imaging Spectrometer for Mars (CRISM)



A graph of the reflectance spectrum of Iani Chaos mineral 1. The Y axis shows the percent of reflected light ranging from 0 – 100 and the X axis shows the wavelength of light in microns ranging from 0 – 3.0. Human eyes can see only a small range of wavelengths, about 0.4 to 0.7 microns. For this mineral, the reflectance starts off very low in the UV range and steadily increases through the visible range to about 30% at 0.8 microns. Then there is a small dip in reflectance down to 20% at 1 micron. After the dip, the reflectance rises again to a broad maximum around 50% at 1.6 microns, followed by a broad minimum of about 35% at 2.25 microns. A sharper reflectance peak of about 50% is at 2.6 microns, followed by a sharp drop off down to 30%.



A graph of the reflectance spectrum of Iani Chaos mineral 2. The Y axis shows the percent of reflected light ranging from 0 – 100 and the X axis shows the wavelength of light in microns ranging from 0 – 3.0. Human eyes can see only a small range of wavelengths, about 0.4 to 0.7 microns. This mineral's reflectance spectrum increases from about 40% in the UV range to 70% around 1 micron. It then drops sharply down to about 20% at 1.5 microns. Beyond 1.5 microns, the reflectance varies, forming a wiggly line on the plot, but generally continues to decrease except for a peak at about 1.8 microns and a smaller peak at 2.2 microns.



A graph of the reflectance spectrum of Iani Chaos mineral 3. The Y axis shows the percent of reflected light ranging from 0 – 100 and the X axis shows the wavelength of light in microns ranging from 0 – 3.0. Human eyes can see only a small range of wavelengths, about 0.4 to 0.7 microns. This mineral's spectrum starts with a reflectance of about 75% in the UV range which increases to 90% in the visible range and beyond to about 1 micron. From 1 micron to 3 microns, the spectrum varies up and down dramatically, making a jagged line that overall decreases down to very low reflectance near 3 microns. The largest dips in reflectance occur at 1.4 microns, where the reflectance drops from 80% to 40% and then back up to 75%, and 1.9 microns, where the reflectance drops from about 60% to 10% and then goes back up to 40%. These large dips in the spectrum are due to water in the crystals.

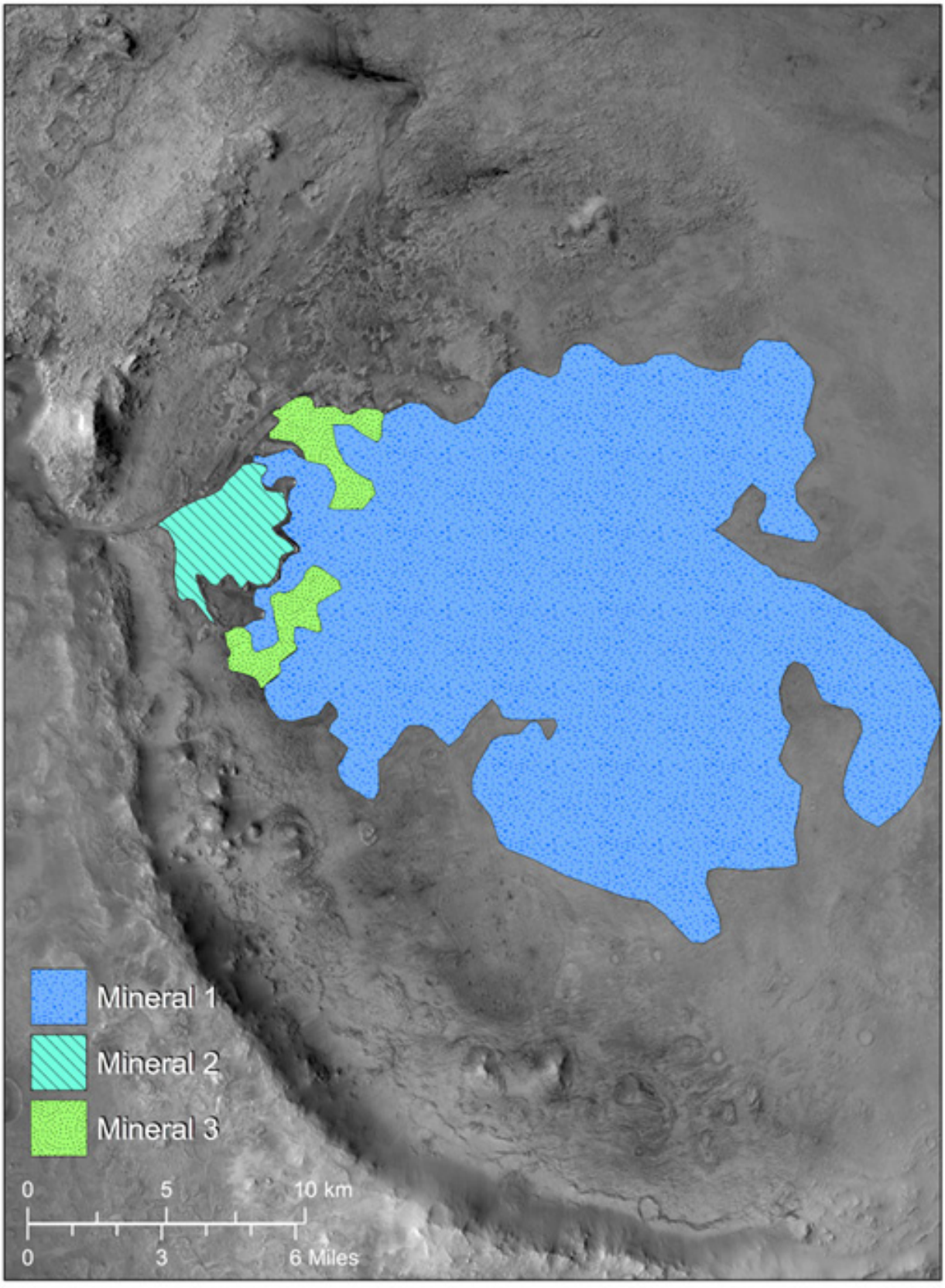
Jezero Crater Data

Mineral data at **Jezero Crater** gathered by the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) on board the Mars Reconnaissance Orbiter.

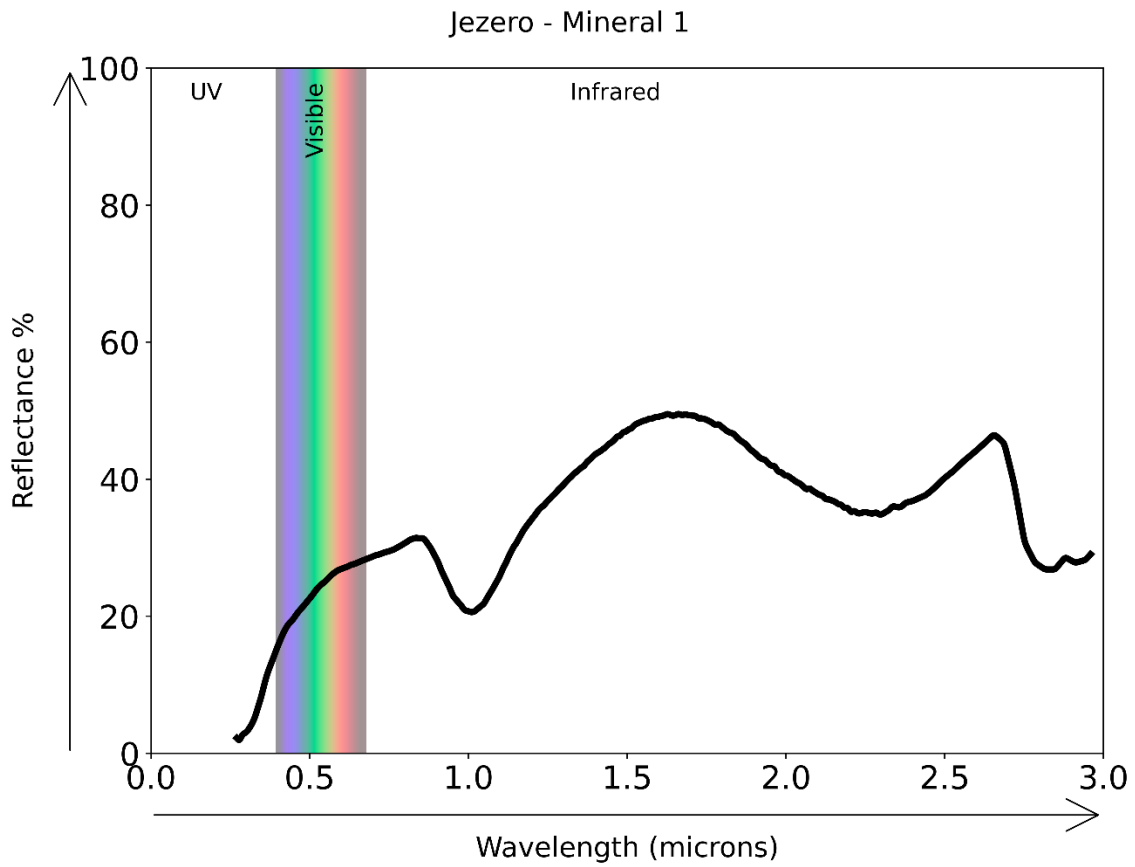
The image on the next page shows the possible Jezero Crater landing site. The crater floor unit with rounded edges like a lava flow is colored with a blue speckled pattern, which corresponds to Mineral 1 in the key. Mineral 2 is indicated in the map with a cyan color and diagonal lines and appears only on the delta landform inside the western crater rim. Mineral 3 is marked with bright green and a pattern of random small dots and appears in the rougher portions of the western crater floor.

See next page for image.

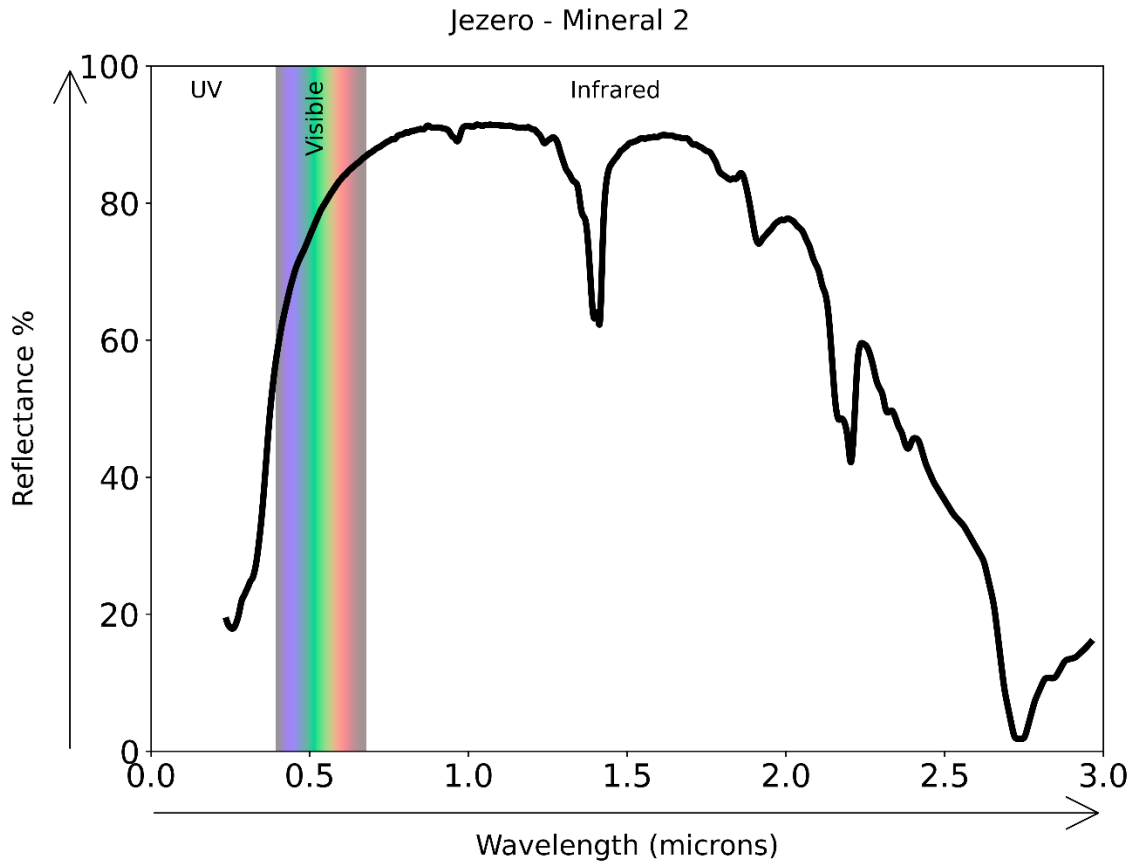
Jezero - Mineral Map



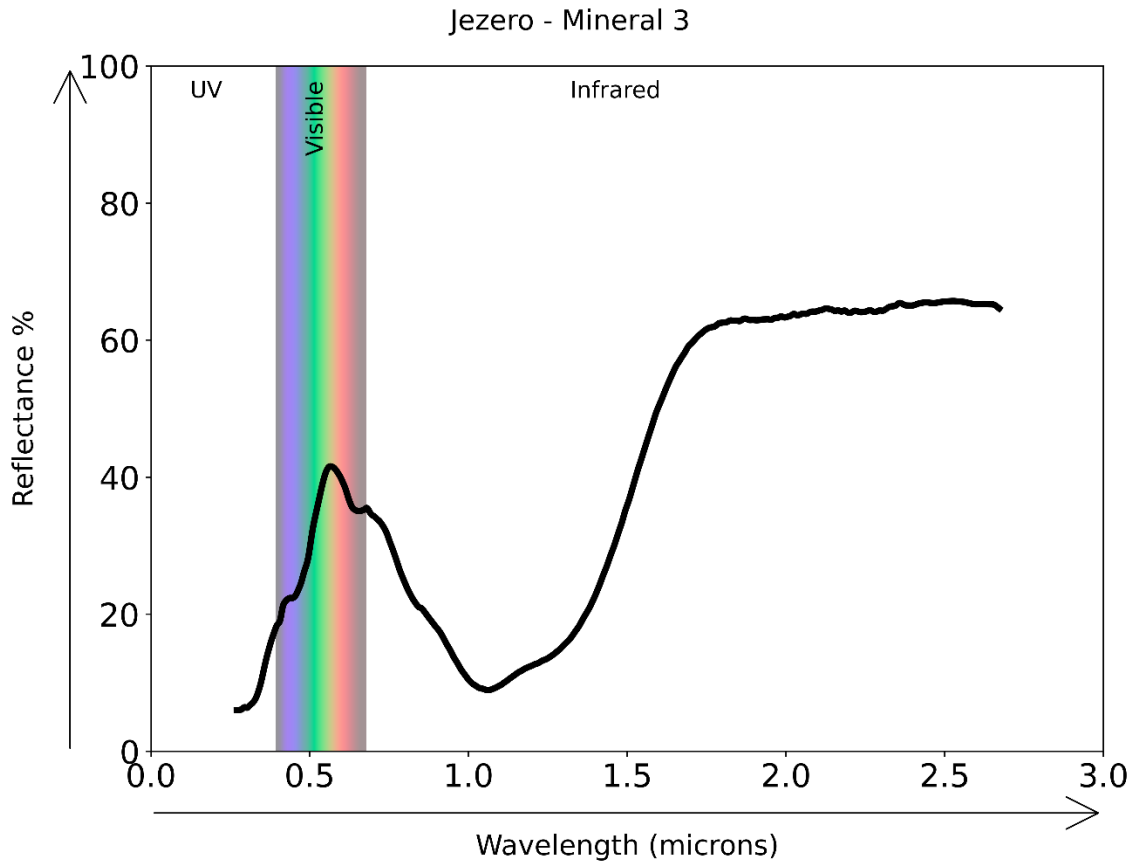
Source: Compact Reconnaissance Imaging Spectrometer for Mars (CRISM)



A graph of the reflectance spectrum of Jezero Crater mineral 1. The Y axis shows the percent of reflected light ranging from 0 – 100 and the X axis shows the wavelength of light in microns ranging from 0 – 3.0. Human eyes can see only a small range of wavelengths, about 0.4 to 0.7 microns. For this mineral, the reflectance starts off very low in the UV range and steadily increases through the visible range to about 30% at 0.8 microns. Then there is a small dip in reflectance down to 20% at 1 micron. After the dip, the reflectance rises again to a broad maximum around 50% at 1.6 microns, followed by a broad minimum of about 35% at 2.25 microns. A sharper reflectance peak of about 50% is at 2.6 microns, followed by a sharp drop off down to 30%.



A graph of the reflectance spectrum of the Jezero Crater mineral 2. The Y axis shows the percent of reflected light ranging from 0 – 100 and the X axis shows the wavelength of light in microns ranging from 0 – 3.0. Human eyes can see only a small range of wavelengths, about 0.4 to 0.7 microns. The reflectance of this mineral starts at about 20% in the UV range but rapidly rises through the visible range to a maximum of about 90% in the range between 1 and 1.5 microns. From there the reflectance decreases down to almost zero at 2.7 microns before rising slightly. The smooth curve of the reflectance graph is broken up by many small, sharp drops in reflectance. These are caused by water molecules in the crystal absorbing infrared light at particular wavelengths. The largest drop is at 1.4 microns, with a minimum reflectance of about 60%.



A graph of the reflectance spectrum of Jezero mineral 3. The percentage of reflected light ranges from 0 – 100 on the Y axis and wavelength in microns ranges from 0 – 3.0 on the X axis. Human eyes can see only a small range of wavelengths, about 0.4 to 0.7 microns. For this mineral, the reflectance increases from a very low value at 0.4 microns, up to a peak of about 40% in the green to yellow portion of the visible range. The reflectance then drops down to a minimum at about 1 micron in the near-infrared. From that minimum the reflectance increases again and is pretty constant at about 60% for wavelengths greater than 1.6 microns.

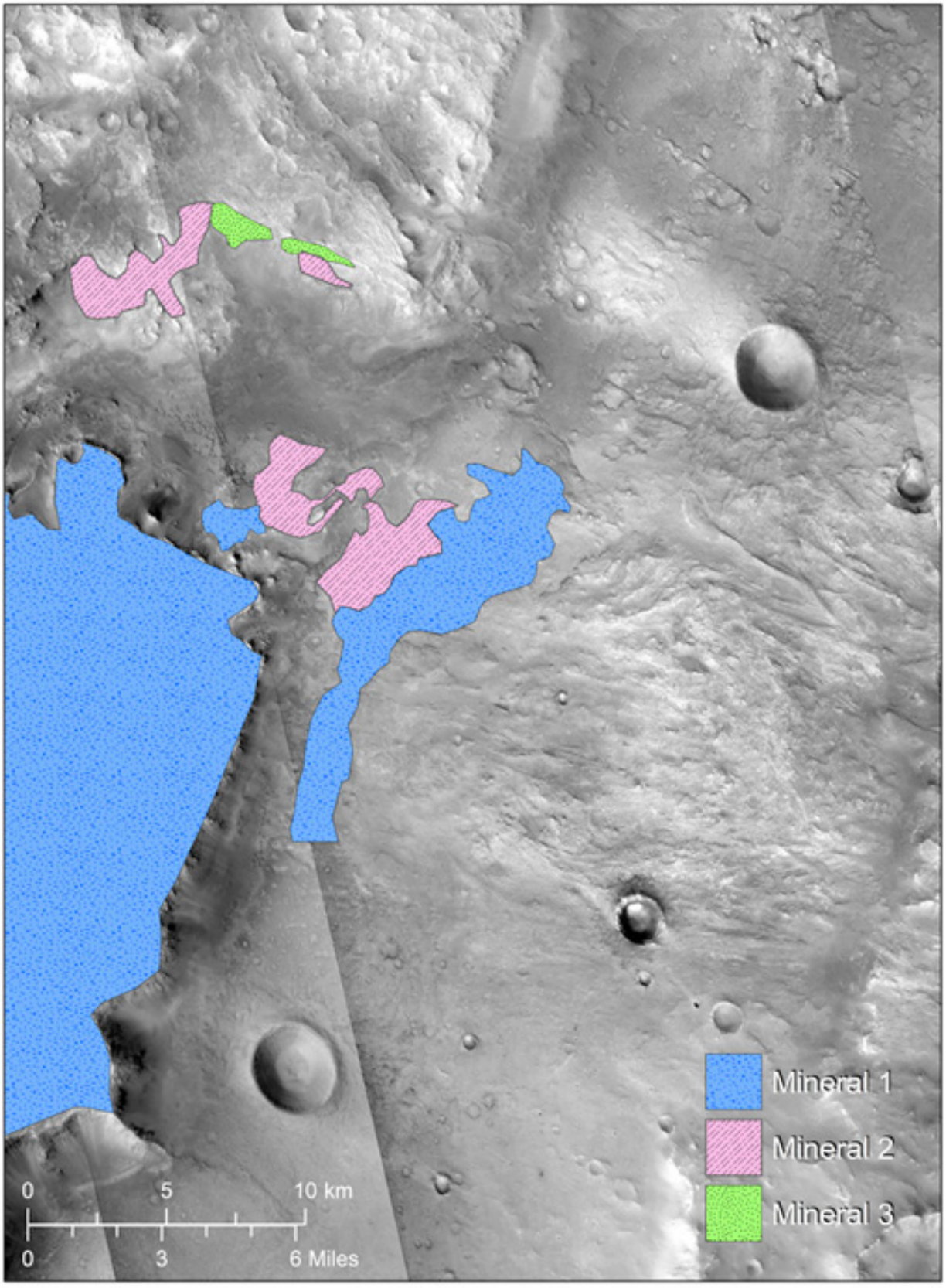
Nili Fossae Data

Mineral data at **Nili Fossae** gathered by the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) on board the Mars Reconnaissance Orbiter.

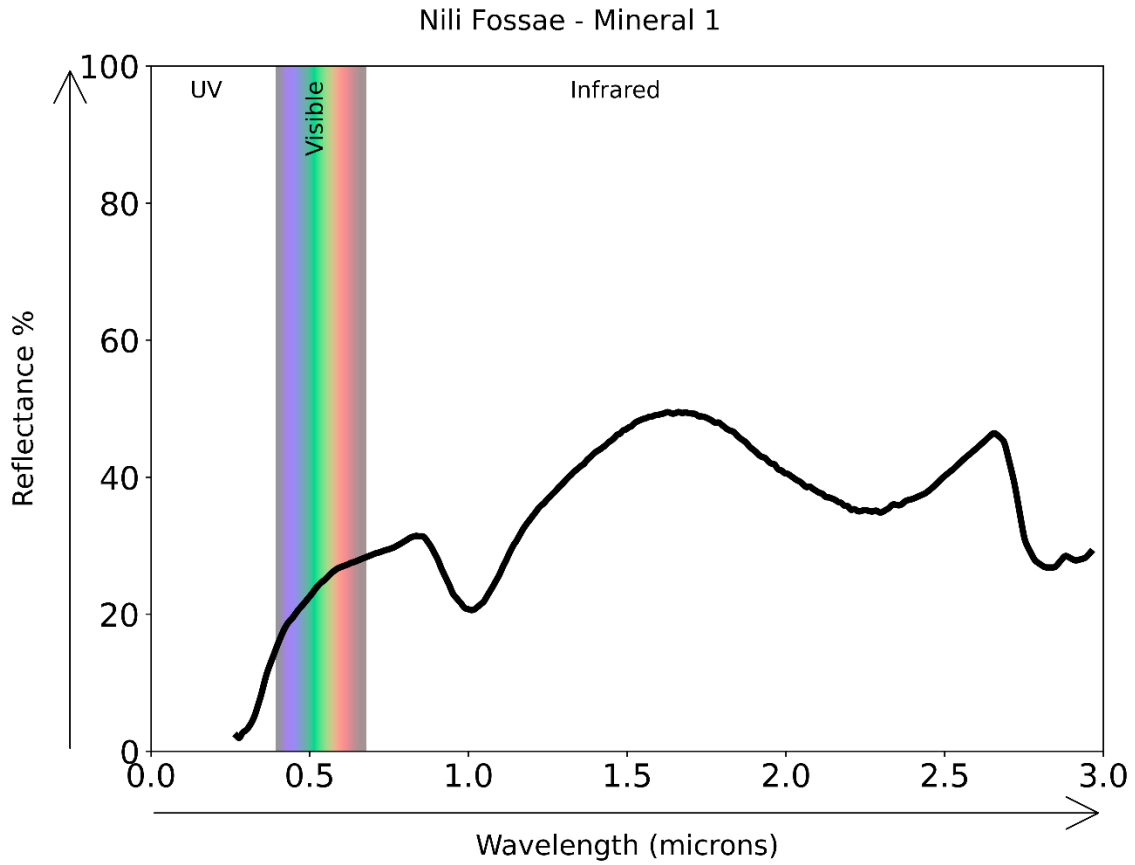
The image on the next page shows the possible Nili Fossae landing site. The high elevation area on the western side of the image is colored with a blue speckled pattern, which corresponds to Mineral 1 in the key. Mineral 2 is indicated in the map with a pink diagonal striped pattern and occurs in patches in the area where the cliff has been eroded away and the exposed rock is bright. Mineral 3 is marked with bright green and a pattern of random small dots and appears in small patches on the northern side of the eroded area.

See next page for image.

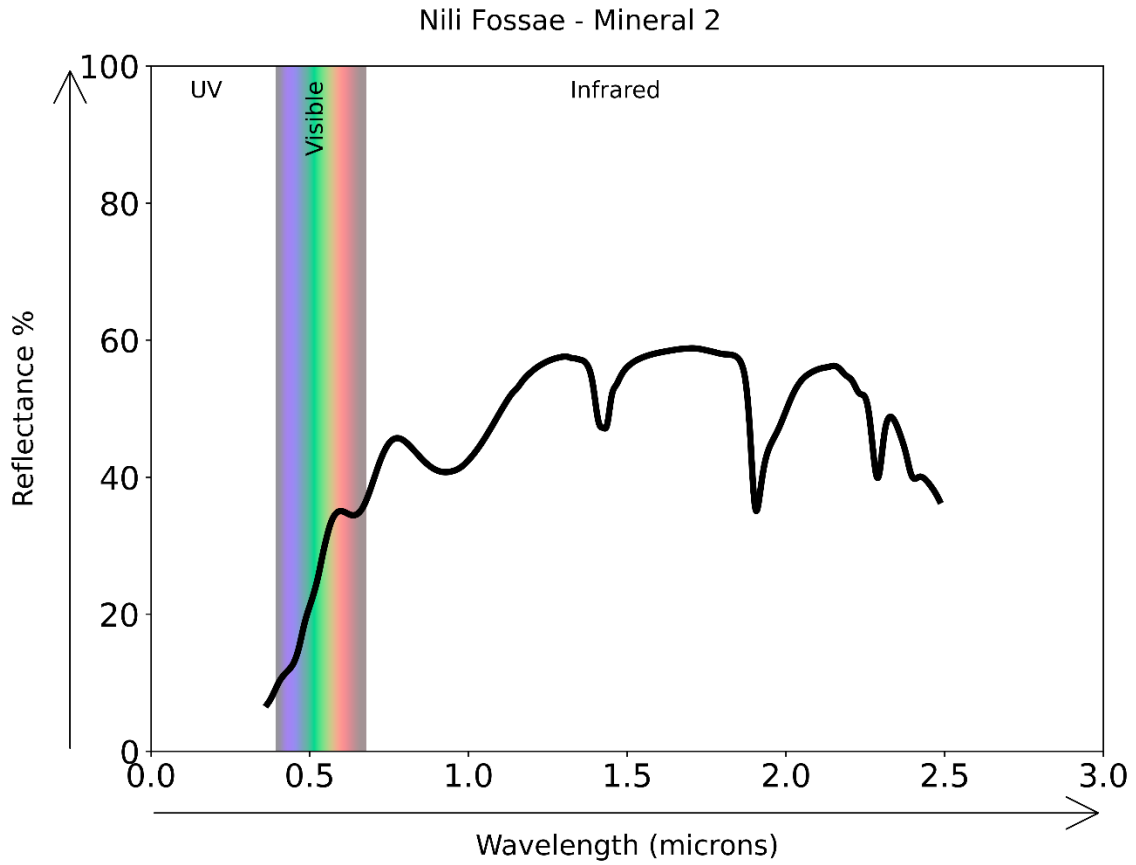
Nili Fossae - Mineral Map



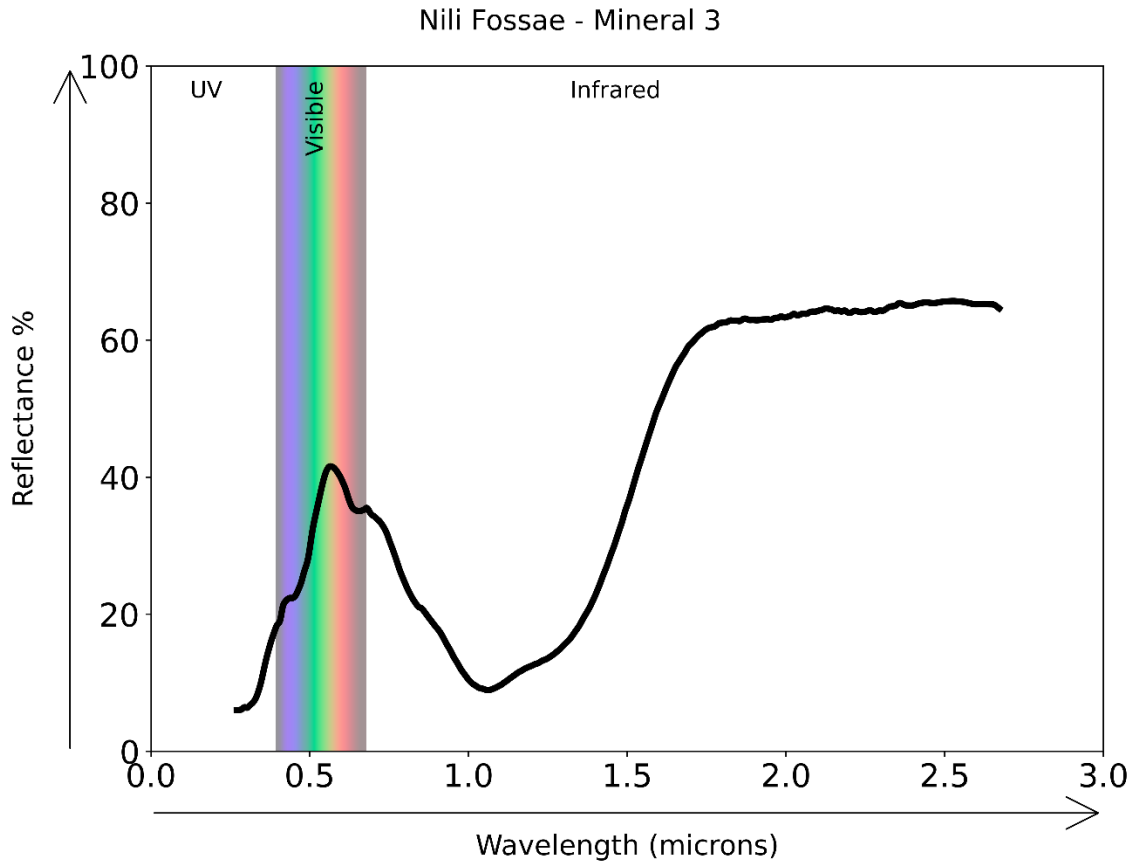
Source: Compact Reconnaissance Imaging Spectrometer for Mars (CRISM)



A graph of the reflectance spectrum of Nili Fossae mineral 1. The Y axis shows the percent of reflected light ranging from 0 – 100 and the X axis shows the wavelength of light in microns ranging from 0 – 3.0. Human eyes can see only a small range of wavelengths, about 0.4 to 0.7 microns. For this mineral, the reflectance starts off very low in the UV range and steadily increases through the visible range to about 30% at 0.8 microns. Then there is a small dip in reflectance down to 20% at 1 micron. After the dip, the reflectance rises again to a broad maximum around 50% at 1.6 microns, followed by a broad minimum of about 35% at 2.25 microns. A sharper reflectance peak of about 50% is at 2.6 microns, followed by a sharp drop off down to 30%.



A graph of the reflectance spectrum of Nili Fossae mineral 2, which forms in water. The Y axis shows the percent of reflected light ranging from 0 – 100 and the X axis shows the wavelength of light in microns ranging from 0 – 3.0. Human eyes can see only a small range of wavelengths, about 0.4 to 0.7 microns. The reflectance of this mineral increases from less than 10% in the UV range up to about 60% around 1.7 microns. There is a slight dip in the reflectance in the red part of the visible range, and a broader dip around 1 micron. Three more sharp, narrow decreases in reflectance occur at 1.4 microns, 1.9 microns, and 2.3 microns. These are caused by water molecules in the crystals absorbing particular wavelengths of infrared light.



A graph of the reflectance spectrum of Nili Fossae mineral 3. The percentage of reflected light ranges from 0 – 100 on the Y axis and wavelength in microns ranges from 0 – 3.0 on the X axis. Human eyes can see only a small range of wavelengths, about 0.4 to 0.7 microns. For this mineral, the reflectance increases from a very low value at 0.4 microns, up to a peak of about 40% in the green to yellow portion of the visible range. The reflectance then drops down to a minimum at about 1 micron in the near-infrared. From that minimum the reflectance increases again and is pretty constant at about 60% for wavelengths greater than 1.6 microns.