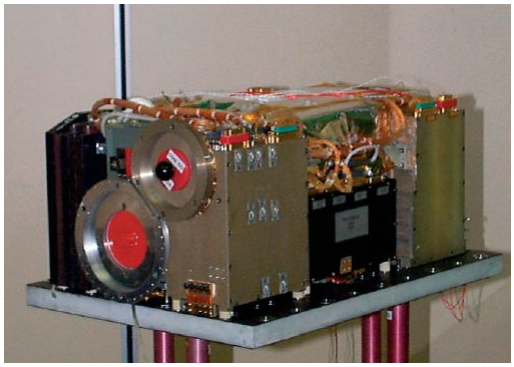
Studying Mars with OMEGA

(**Observatoire pour la Minéralogie, l'Eau, les Glaces et l'Activité)**



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Agenda

- OMEGA
- Reflectance spectroscopy
- Tyrrhena Terra, Mars

OMEGA details

- Imaging spectrometer
- Spectral range: 0.38µm – 5.1µm
  - Two channels: VNIR and SWIR
  - VNIR pushbroom
  - SWIR whiskbroom
- Spatial resolution ~350m
- Spectral resolution 7-20nm
  - 352 ‘spectels’

What can we do with OMEGA?

- Determine the composition of
  - Dust
  - Ices
  - Atmospheric gases
  - Surface rock
- Through spectra showing
  - Absorption features
  - Thermal emission

Reflectance spectroscopy

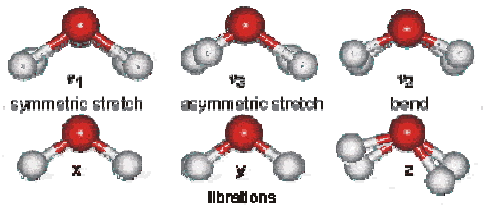
- *"The study of light as a function of wavelength that has been reflected or scattered from a solid, liquid, or gas"*

- Diagnostic absorption processes
  - Crystal field absorptions (VIS-NIR)
  - Charge transfer (UV-VIS)
  - Vibrational modes of atomic bonds (NIR)

So, what are we looking for?

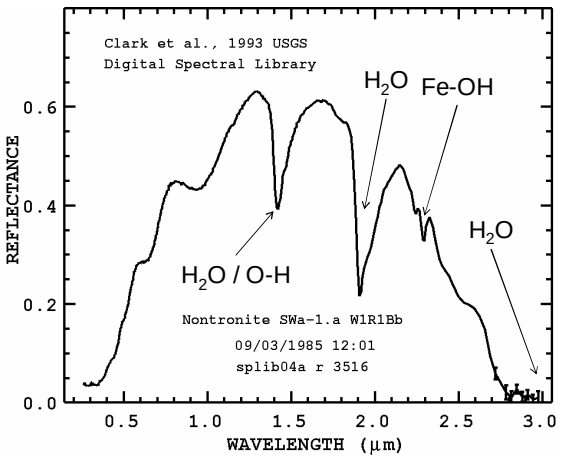
- Evidence for liquid water
  - Phyllosilicates (clay)
  - Sulphates (gypsum, monohydrates)
- Volcanics
  - Olivine $(Mg, Fe)_2SiO_4$
  - Pyroxenes $XY(Si,Al)_2O_6$
- Organic activity
  - Carbonates

H_2O, vibrational modes



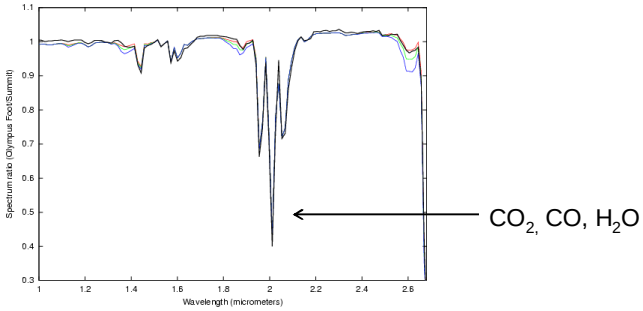
	Featur	Gas	Liquid	Ice
Fundamentals →	v_1	2.74 µm	3.05 µm	3.17 µm
	v_3	2.66 µm	2.87 µm	2.96 µm
Combinations →	v_2+v_3	1.875 µm	1.93 µm	2.02 µm

Lab spectrum - Nontronite



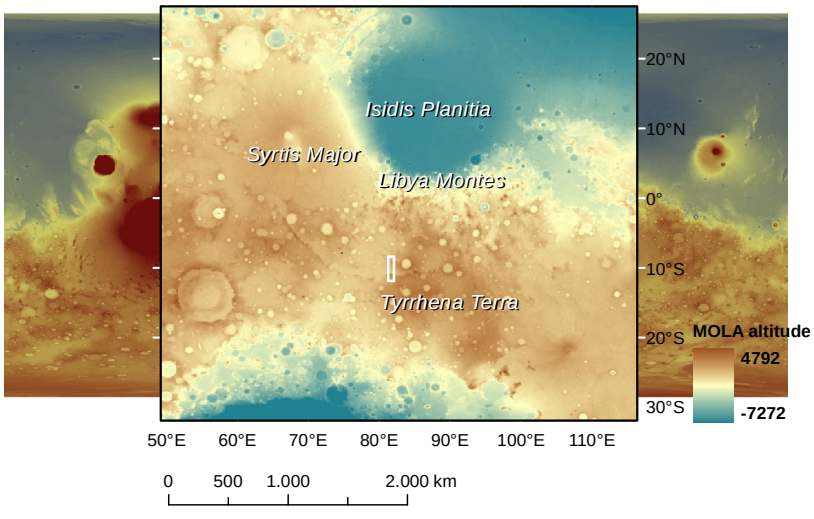
Spectral detection

- Atmospheric correction

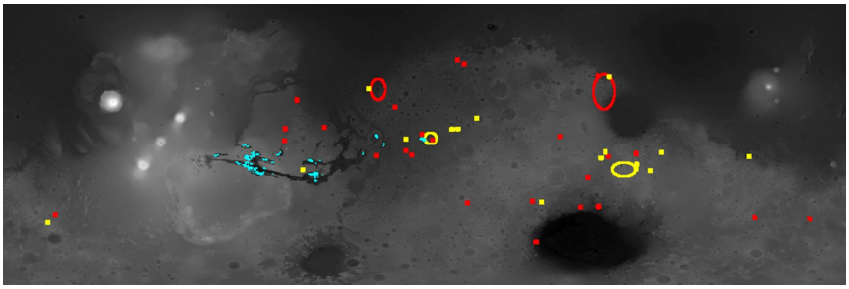


- Summary (ratio) products
  - Ratio band center with shoulders
  - Pelkey et al. 2007, JGR 112

Tyrrhena Terra, Mars

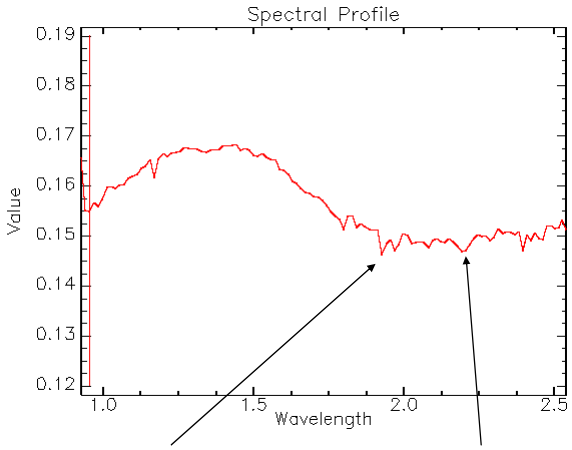


Hydrated mineralogy



- Which process?
  - Sedimentary?
  - Hydrothermal?

Sample OMEGA spectrum



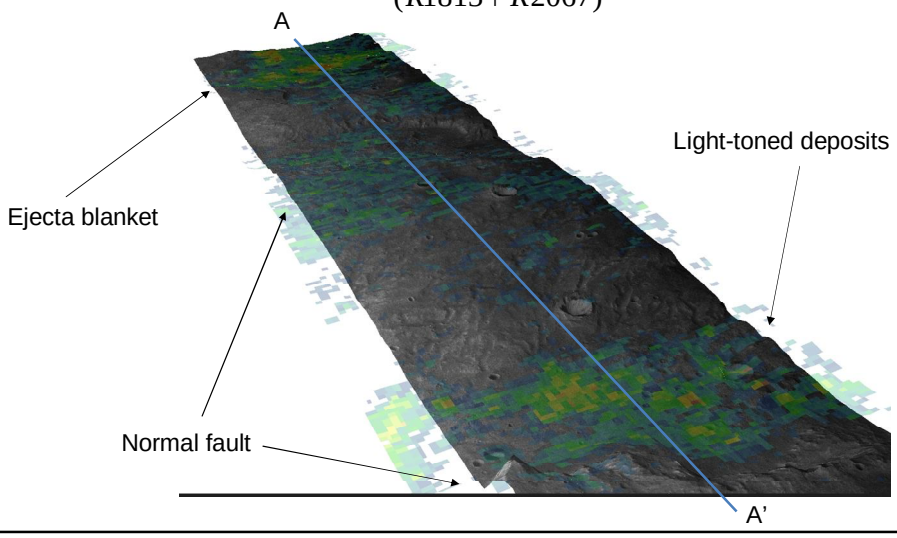
- Feature: 1.93 µm, Feature: 2.2 µm
- Overall shape: Pyroxene -> Intimate mixture

OMEGA issues

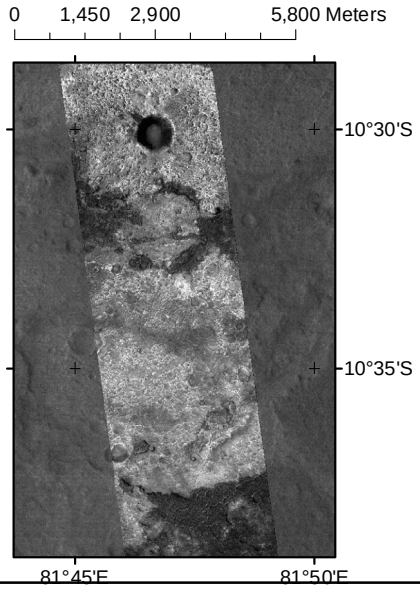
- Relatively low S/N ratio
- Hot / cold spectels
- Atmospheric variability
- “Mixels” due to spatial resolution
- Dust wipes out features

Geological context

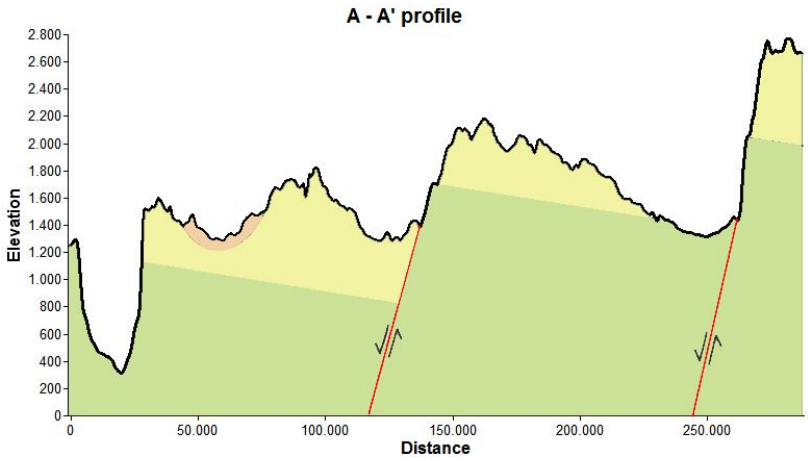
- Spectral ratio $1-\frac{(R1930+R1940)}{(R1813+R2067)}$



Light-toned deposits



Cross-section



Conclusions

- OMEGA S/N troublesome
  - Visible geology verification needed
- Hydrated layer 10^2m thick
- Two episodes of hydration
  - Channels and hydrated unit
- Likely to be of hydrothermal origin
  - No layering visible
  - Thickness
  - Proximity to major fault region