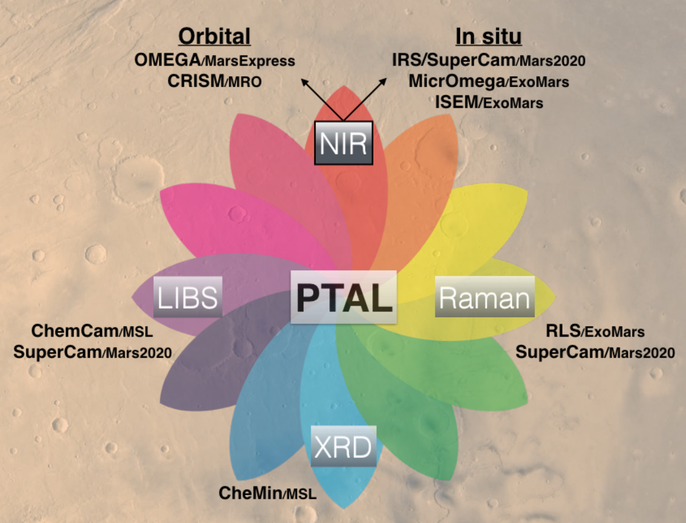
Coordinated spectral analysis of H2020/PTAL mineral samples

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The **PTAL** project [1] aims at building and exploiting a **database** [2], the ***Planetary Terrestrial Analogues Library***, in order to characterize the mineralogical evolution of terrestrial bodies, starting with **Mars**.
94 Earth rock samples have been collected from selected locations around the world in order to get analogues for martian geology. The PTAL samples represent a variety of rocks and sediments: i) igneous rocks of different plutonic and volcanic origin and composition, and ii) several different weathering and alteration products.

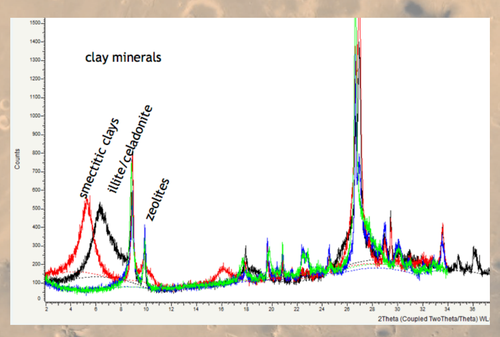


The objectives of the spectral characterization of the PTAL samples are to acquire:
- **XRD** measurements and thin section analyses (UiO/Oslo),
- **NIR** spectra (IAS/Orsay),
- **Raman** spectra (UVA/Valladolid),
- **LIBS** spectra (IRAP/Toulouse) — analysis to come.

These techniques are similar to the instruments on board current and forthcoming martian missions. Such **combined analysis** will give the opportunity to prepare and understand ExoMars/ESA and Mars2020/NASA observations.
We show below the spectral analyses of a few PTAL samples. All the data will be available in the database.

XRD

Sample	Location	Context	Thin section description	XRD analysis
IS1603	Lagafell (Iceland)	Ferropicrite	Unaltered rock. Coarse grains of plagioclase, olivine, pyroxene. Some hematite.	Plagioclase (feldspar), pyroxene, olivine
LE1604	Leka (Norway)	Dunite	Pervasively serpentinized dunite, where 30-70% of all olivine has been replaced by serpentine. Pyroxene/ amphibole less altered and still recognizable.	Dominated by forsterite (olivine), augite (pyroxene), and serpentine. Talc (?) present as well.
FA1603	Gran Canary (Spain)	Altered Phonolite	Green-brownish fine matrix with largely unaltered phenocrysts. Secondary precipitation on some phenocrysts, possibly zeolites (analcime). Sericite (mica) replacement of feldspar	Analcime (zeolite), sanidine (feldspar), illite (mica).

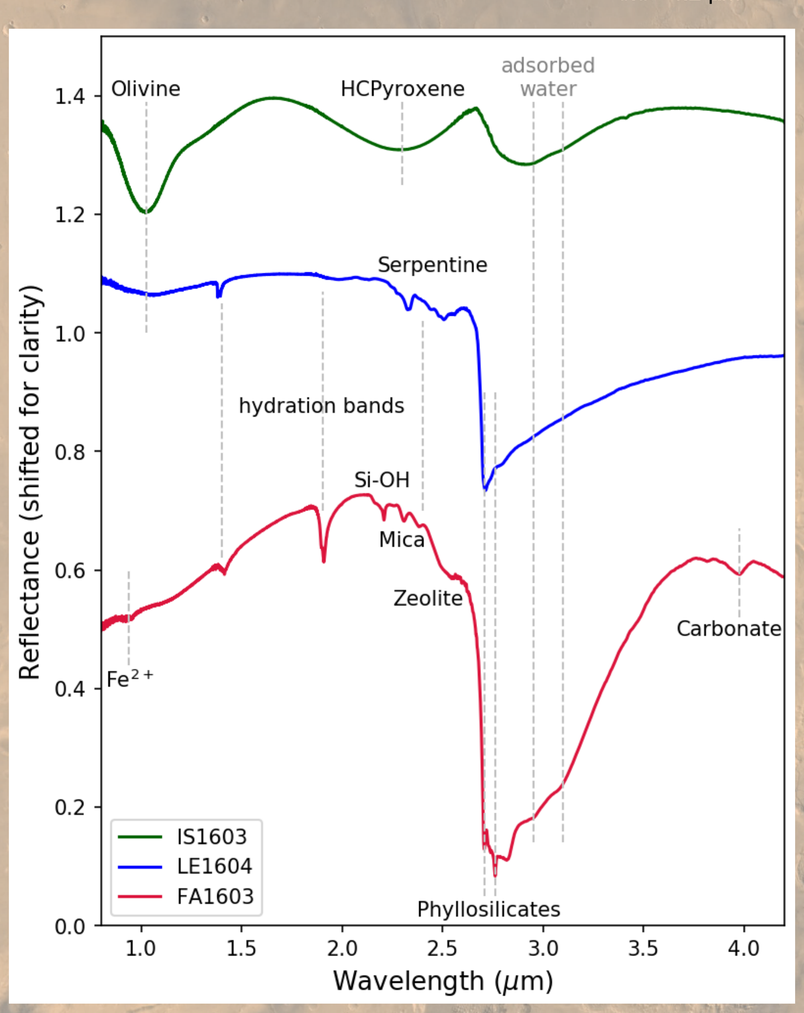


Example of XRD measurements.

The analysis of all the powder samples with the three techniques is now complete. The very exciting step of coordinated analysis including compositional comparison is still ongoing.

NIR

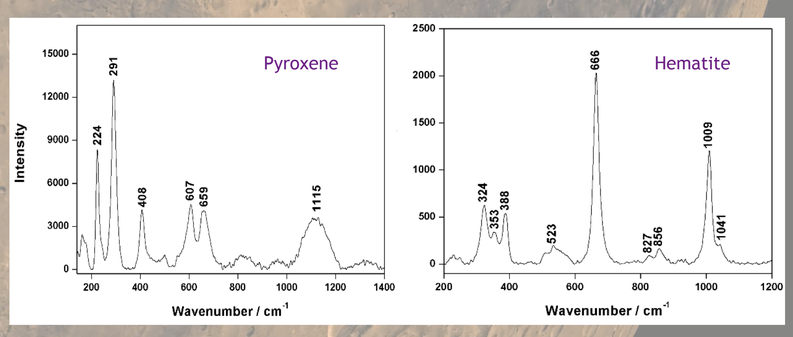
0.8 - 4.2 µm



Raman

130 - 3780 cm^{-1}

Sample	Detected compounds with Raman						
	Feldspar	Pyroxene	Quartz	Hematite	Olivine	Serpentine	Anatase
IS1603	✓	✓			✓		
LE1604		✓			✓	✓	
FA1603	✓		✓	✓			✓



Examples of Raman spectra (633 nm laser).

COORDINATED ANALYSIS

We notice a good agreement between the techniques even though some discrepancy can occur (no hydrated minerals detected with Raman for the last sample). Furthermore, there are minerals identified with Raman and XRD (quartz, feldspar) that are largely featureless in the IR range.
We show it is crucial to combine the measurements for an accurate mineral characterization.

Measurements with a flight spare of **MicrOmega** [3] will also be performed on the heterogeneous bulk samples with constituents at the scale of grains. This will highlight the link between micro- and macroscopic NIR measurements.

References: *[1] Werner et al. 2018, Second International Mars Sample Return, No. 2071, 6060. [2] Veneranda et al. 2018, Second International Mars Sample Return, No. 2071, 6069. [3] Bibring et al. 2017, Space Science Reviews 208.*

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