

Raman characterization of mineral fibres: chrysotile and erionite

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Raman characterization of the fibres: chrysotile and erionite

Sample preparation:

- Powder fixed on a double-sided tape, covered by a glass and sealed.
Sample preparation carried out in a fume-hood.

μ -Raman analysis

At Physics Department, University of Parma

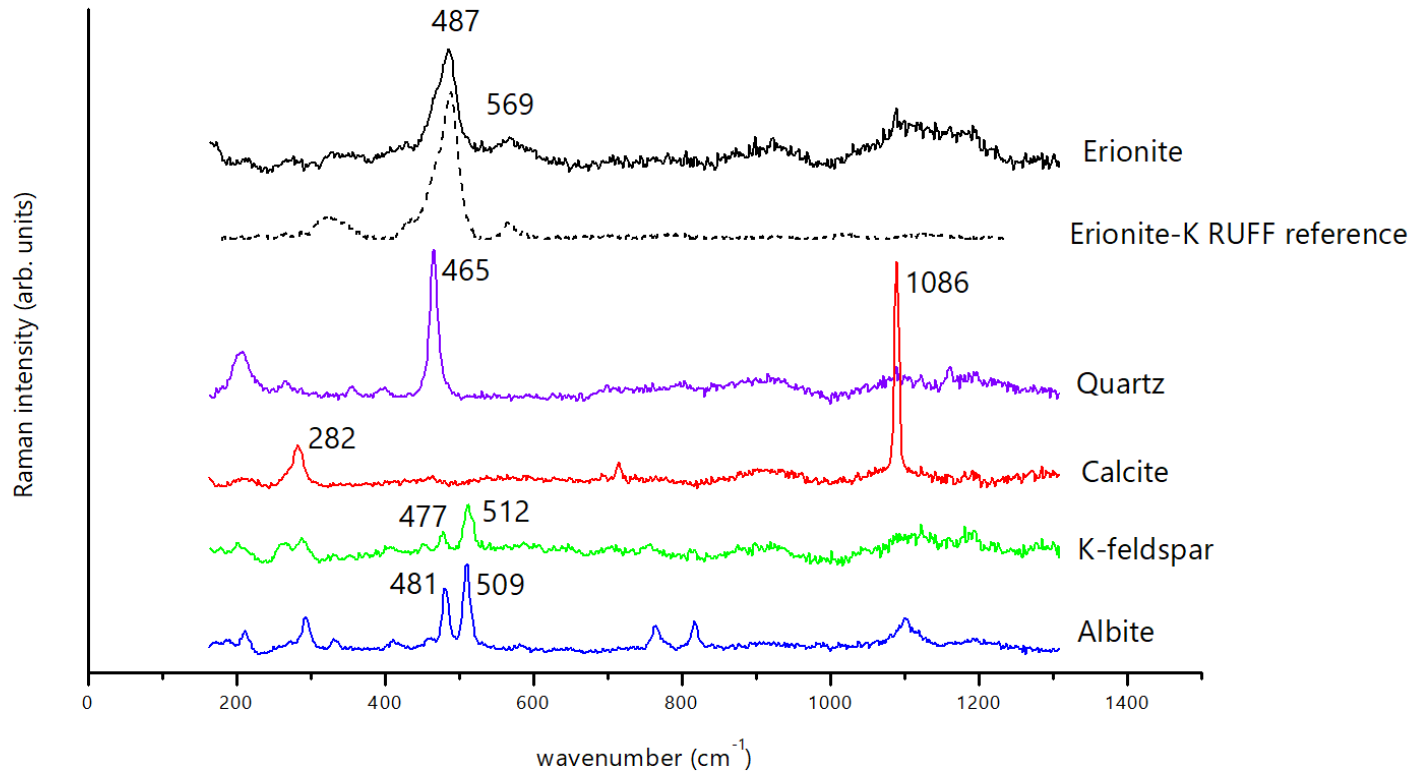
- LabRam Horiba spectrometer
- Confocal microscope with objective 50x
- Laser excitations: He-Ne 632.8 nm and Nd:YAG 473.1 nm
- Density filters to reduce laser power and avoid heating effects
- Spectral resolution of $\sim 1 \text{ cm}^{-1}$ (632.8 nm) and $\sim 2 \text{ cm}^{-1}$ (473.1 nm)



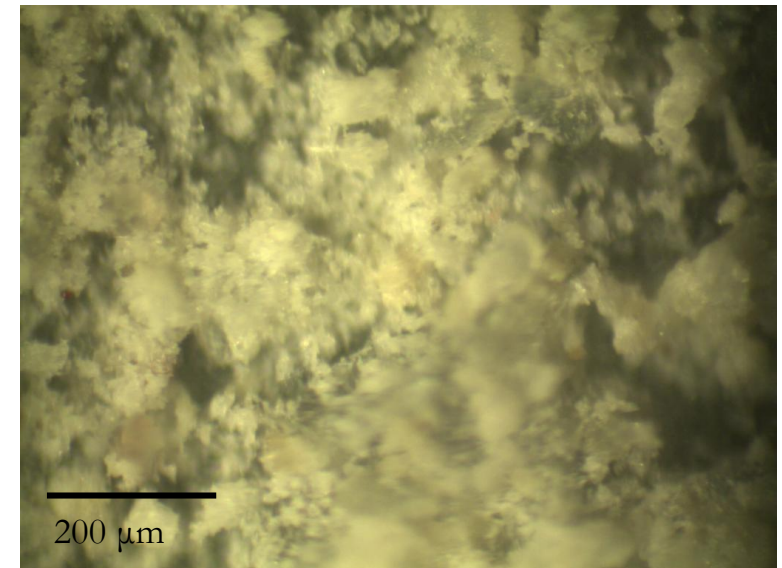
Raman characterization
of the fibres

Erionite

Raman spectra of erionite and minerals found in the sample

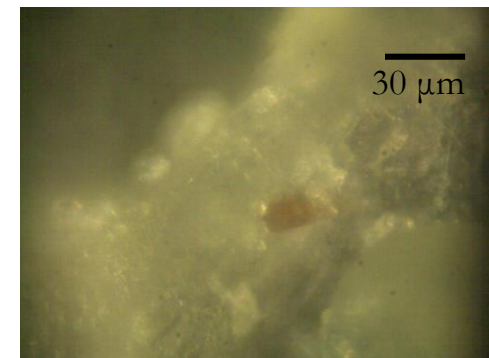
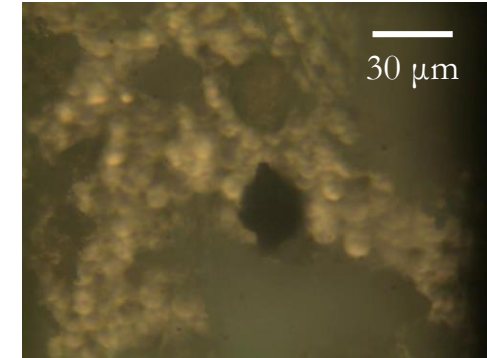
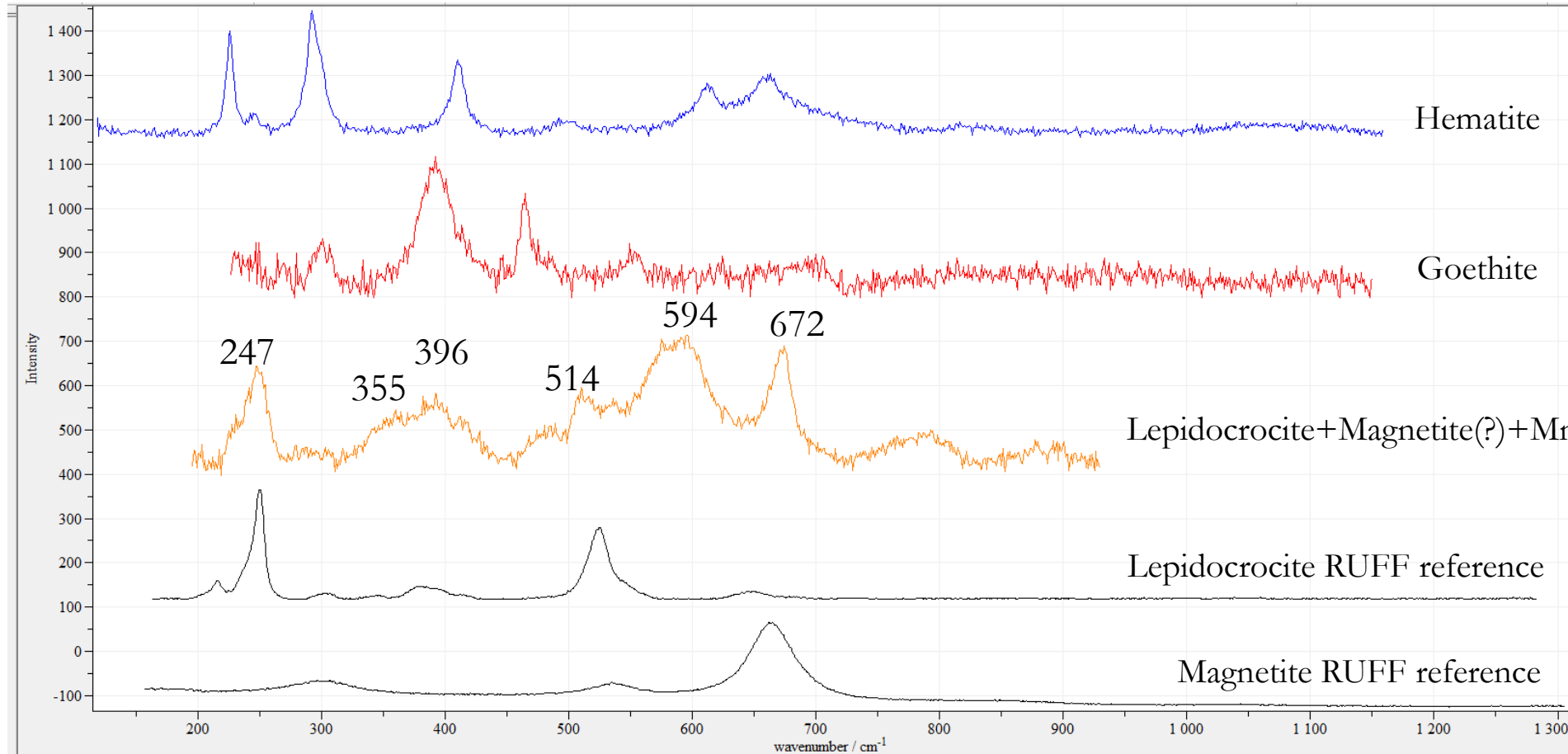


- Erionite main Si,Al-O bending mode at 487 cm^{-1}
- Gas not detected in the CH-stretching region (e.g. CH_4)
- Minerals found in the sample: quartz, calcite, feldspars (K-feldspar, albite)



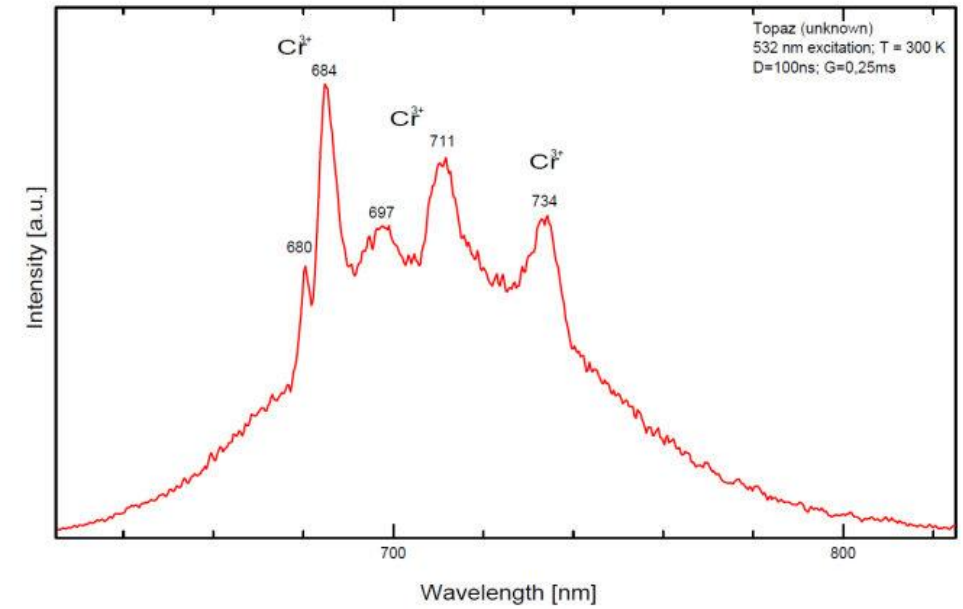
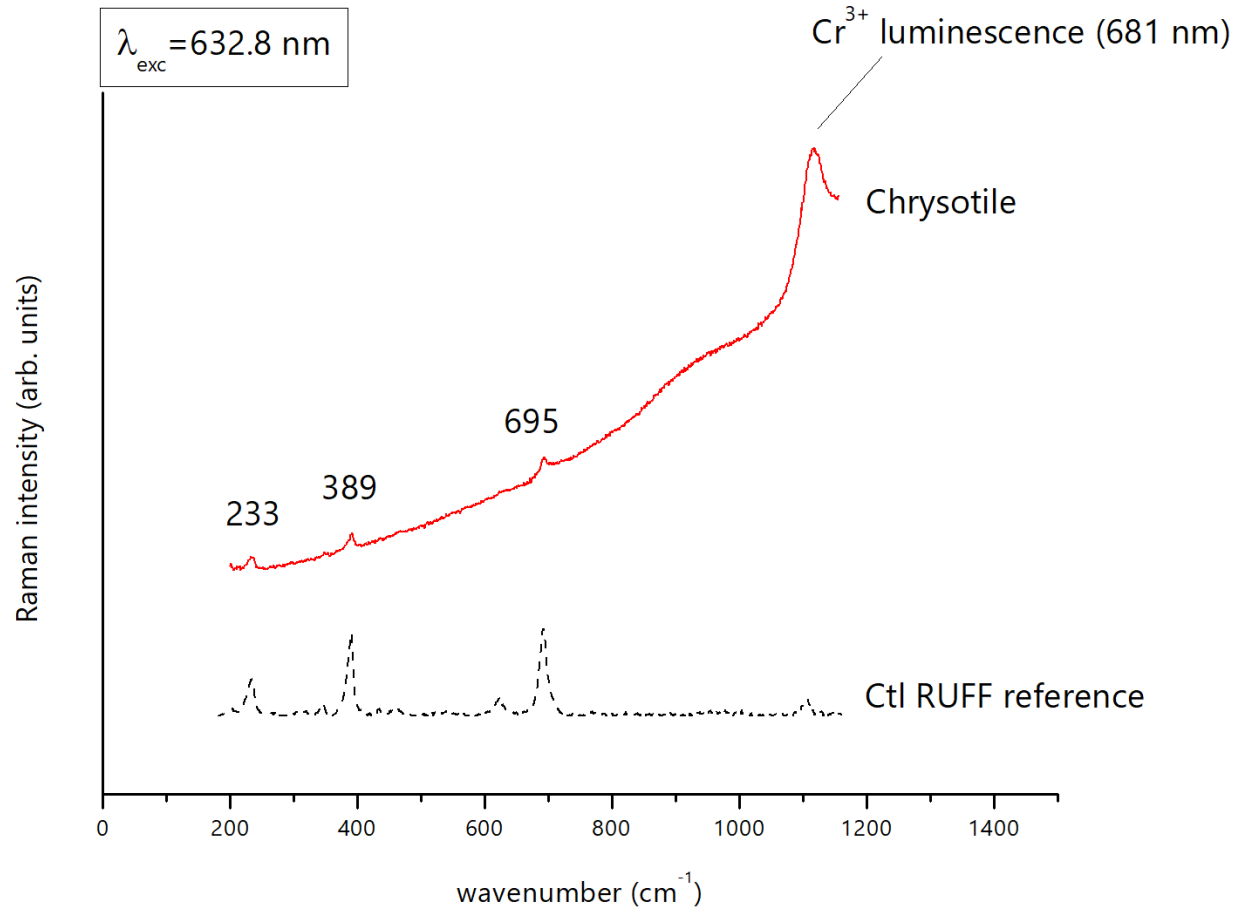
Erionite: iron compounds found on black and brownish/reddish microparticles

Microparticles of about 15-30 μm

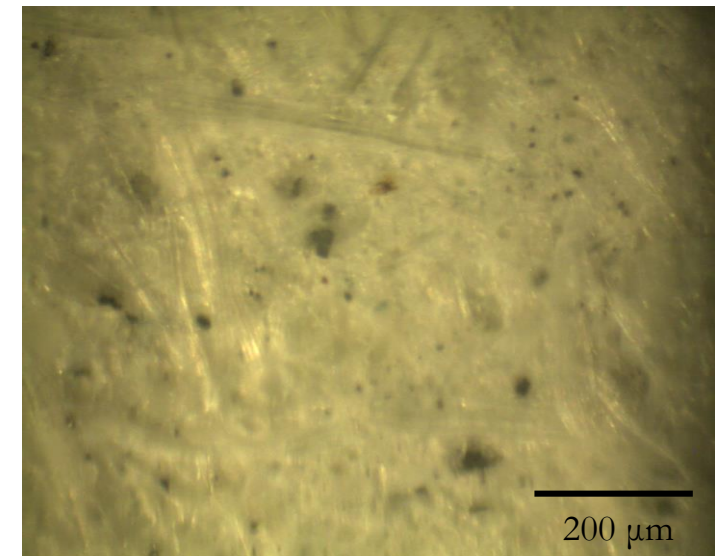


Chrysotile

Raman spectra of chrysotile

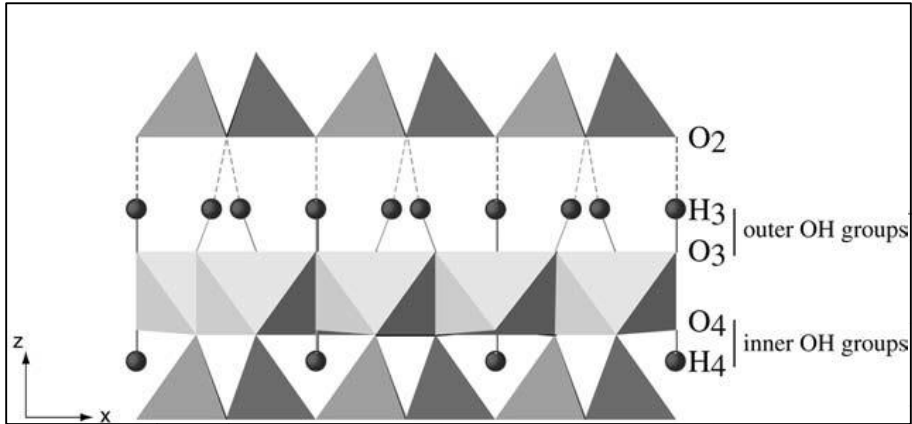


Gaft M., Reisfeld R., Panczer G., Luminescence Spectroscopy Of Minerals And Materials, Springer, Berlin Heidelberg

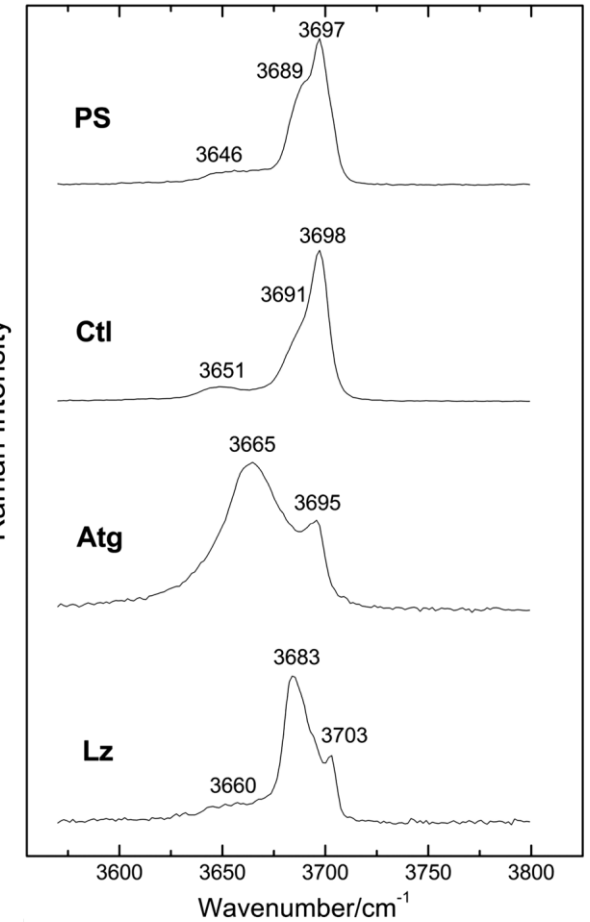
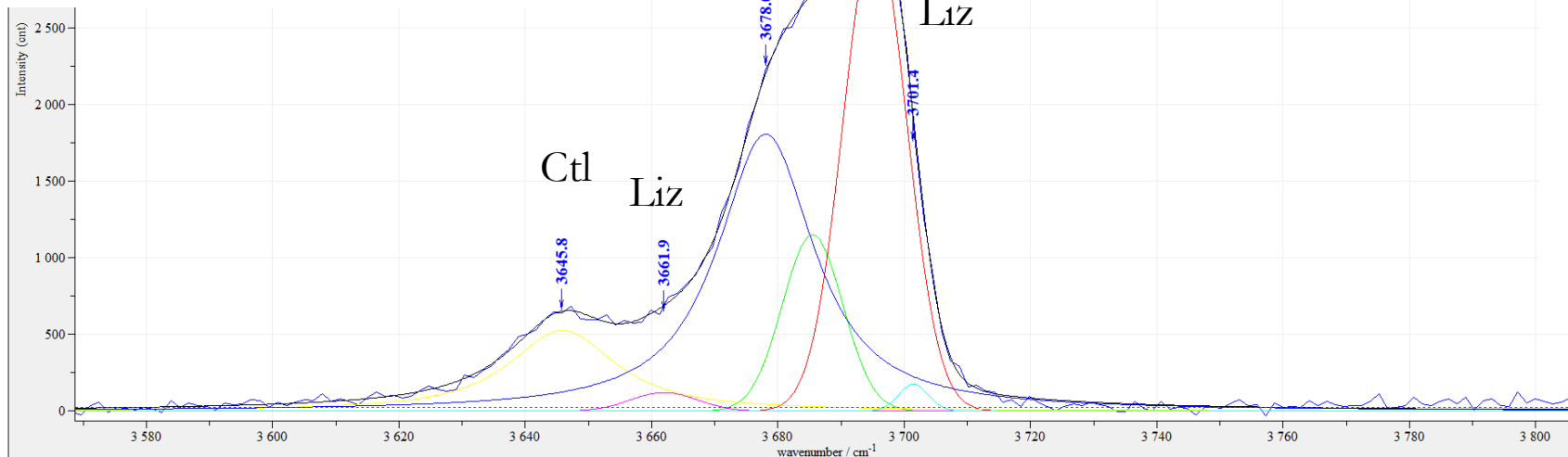


Chrysotile fiber

Raman spectra of chrysotile – OH stretching modes



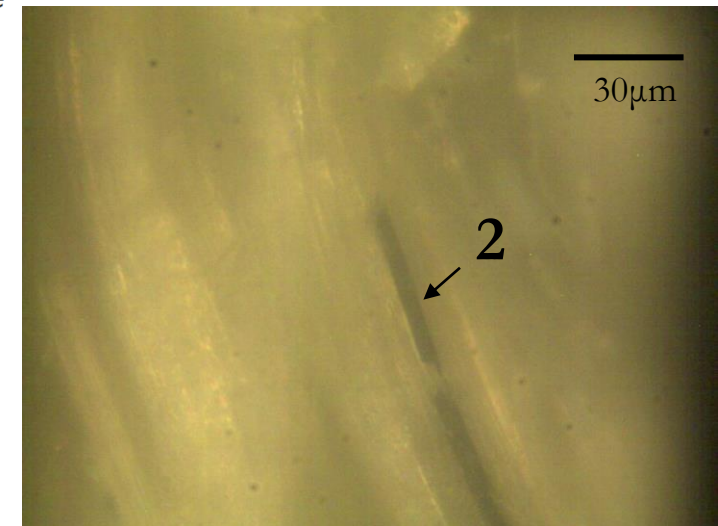
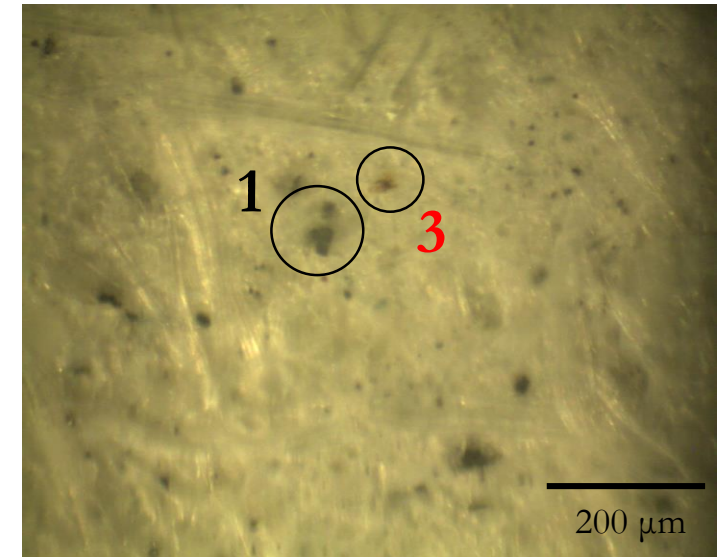
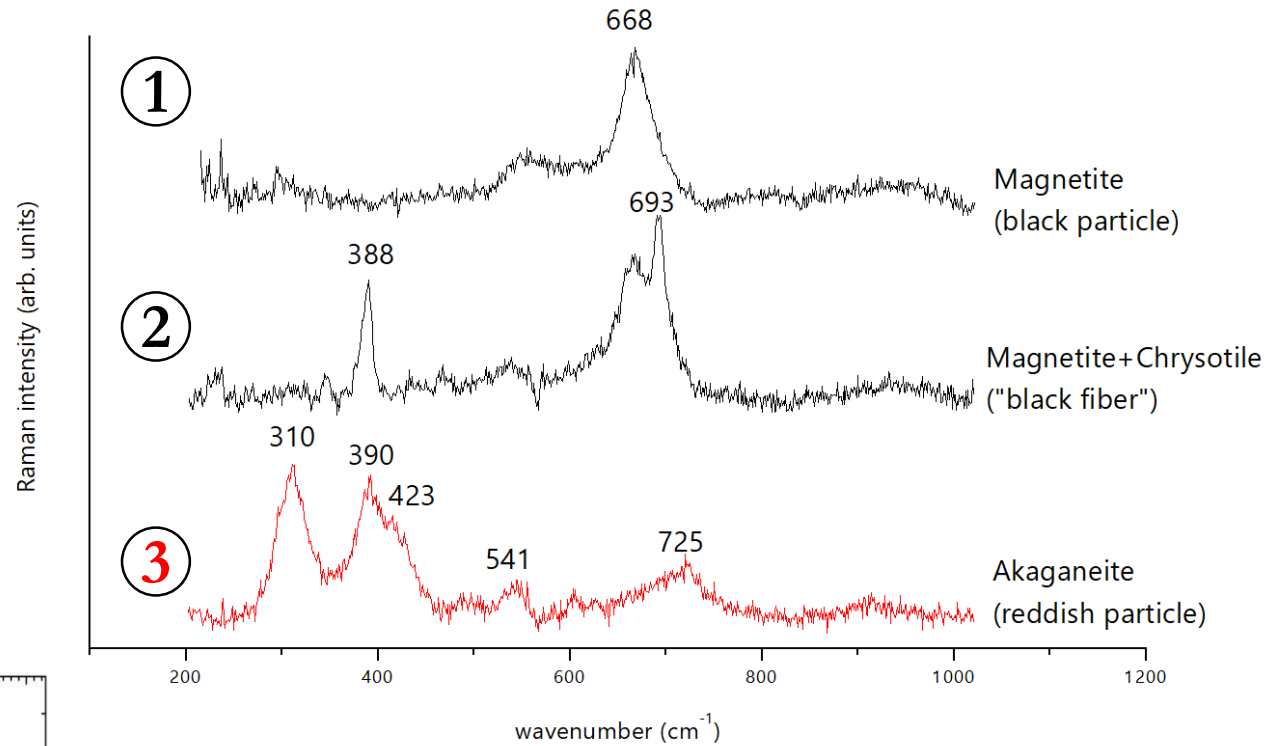
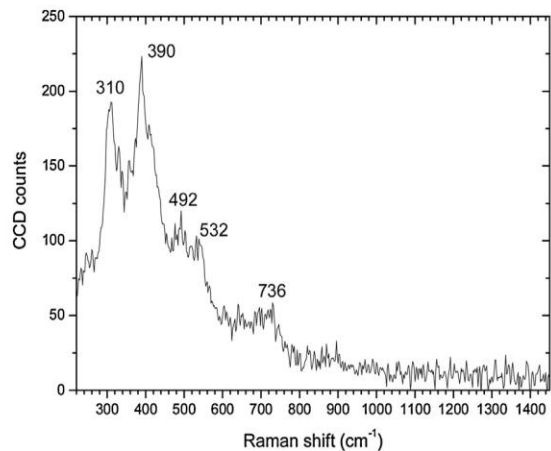
Auzende A.L. et al, *Phys Chem Minerals* (2004)
31: 269–277



Petriglieri J.R. et al., *J Raman Spectrosc* 2015, 46, 953–958

Black and reddish particles in Chrysotile: magnetite and akaganeite

β -FeOOH
(akaganeite)



Microparticles $\sim 30 \mu\text{m}$

De la Fuente D. et al, *Corrosion Science* 110 (2016) 253–264 Magnetite and akaganeite in Ctl sample

Raman results

Erionite

- Main Si,Al-O bending mode at 487 cm^{-1}
- Not detected gas (CH_4 , CO_2 ...) if trapped in the zeolite
- Minerals presence: calcite, quartz, feldspars
- Iron compounds found on reddish and black particles: hematite, goethite, magnetite (?), lepidocrocite
- Possible Fe and Mn oxides mixture

Chrysotile

- Cr^{3+} luminescence at 681 nm
- Diffuse black microparticles on the sample: magnetite
- Sparse reddish/brownish particles: akaganeite ($\beta\text{-FeOOH}$)
- Lizardite presence confirmed by OH-stretching modes

Future analysis

- Micro-Raman analysis on *in vitro* samples to study possible modifications of fiber structure and composition (erionite, chrysotile and crocidolite) due to fiber-fluids interactions (from UNIGE)
- Micro-Raman characterization with different excitation lines (473, 532, 633, 785, 1064 nm)
- Effect of different crystal orientation on the Raman spectrum
- Online Raman database of mineral fibres
- Influence of cations in fibrous zeolites or amphiboles on the Raman spectra



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UNIPR

Thank you for the attention