



Anne-Marie Flank  
Scientist in charge



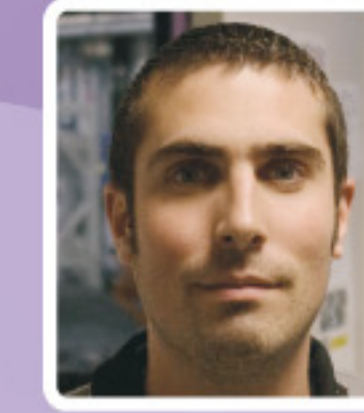
Pierre Lagarde  
Scientist



Delphine Vantelon  
Scientist

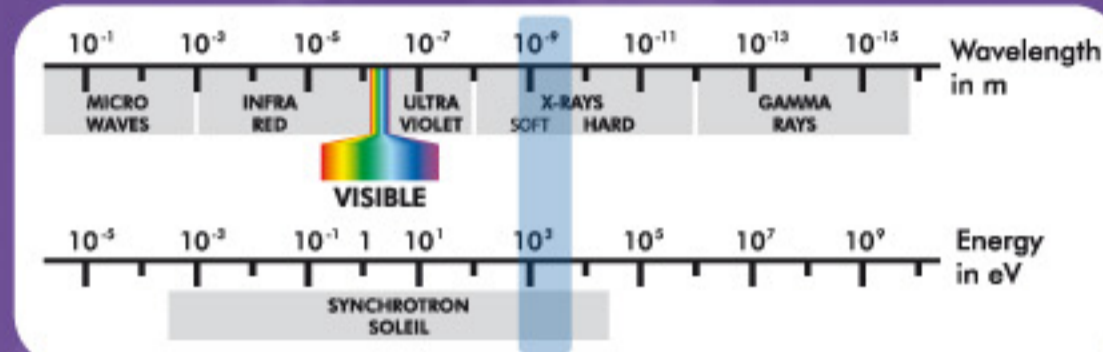


Nicolas Trcera  
Scientist



Damien Roy  
Assistant engineer

Energy range of LUCIA: 800-8000eV



Light source: Apple II type undulator, with variable polarization

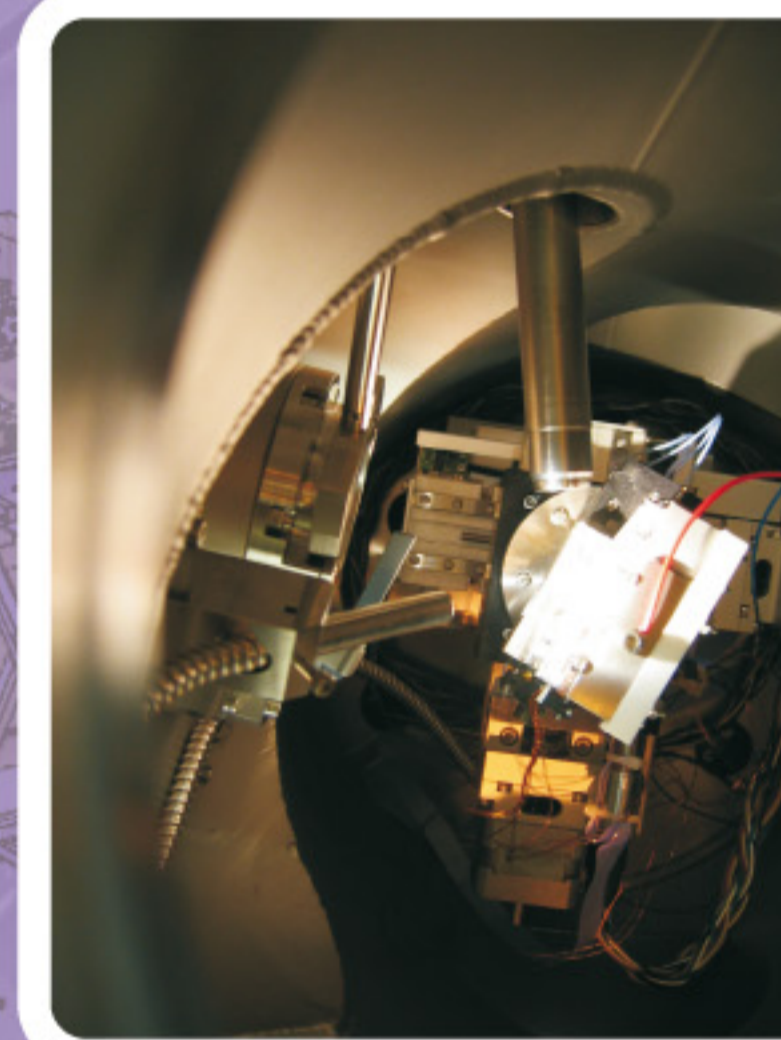
Experimental techniques:

- X-ray micro-absorption (EXAFS and XANES)
- X-ray micro-fluorescence

LUCIA provides a tunable monochromatic light spot of a few square micrometers ( $2 \times 2 \mu\text{m}^2$ ). It can be used for non destructive analysis of heterogeneous and microstructured samples, elemental mapping and determination of the chemical state and of the environment of a given element.

## LUCIA Line for Ultimate Characterization by Imaging and Absorption

### Zoom: Experimental chamber



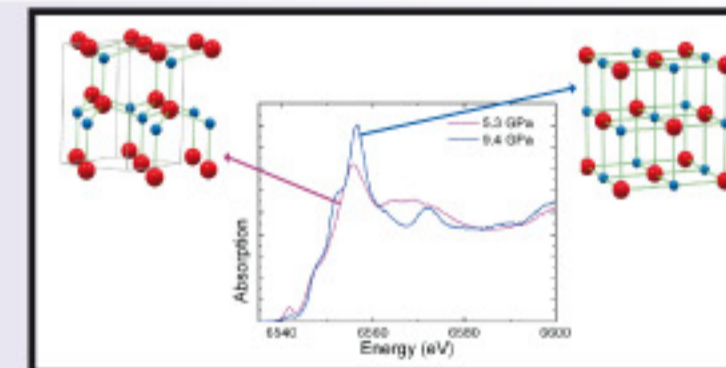
The monochromatic beam is sent onto the sample mounted on a very precise xyz motorized stage. By recording the intensities of selected fluorescence lines as a function of the beam position on the sample, elemental cartographies are obtained. These images provide the localization of the elements of interest, their relative concentration and their mutual association. Regions of interest can thus be identified and then analysed using X-ray absorption spectroscopy (local selective probe providing electronic and structural information).

Both techniques (X-ray micro-fluorescence and micro-absorption) can be combined with other micro-techniques, e.g. RAMAN spectroscopy, to obtain additional information on the sample.

## Topics and applications

### Material science, solid state physics and chemistry

Analysis of cements, composites, ceramics, concrete... Studies of deterioration processes. Catalysts. Materials in extreme conditions (high temperature, high pressure): studies of phase transitions.



Observation of a phase transition of the ZnMnO compound. The effect of pressure is to change the coordination of manganese with oxygen from 4 to 6.

### Geoscience, environmental science, Cultural heritage

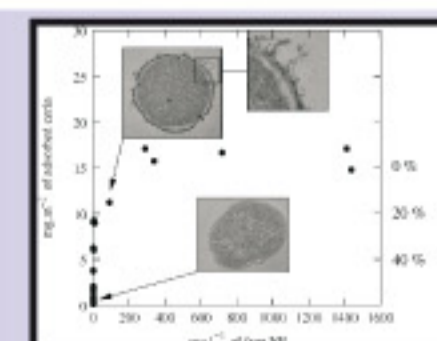
Studies of natural glasses, magmas, rocks samples, polluted soils. Metal speciation in sediments. Corrosion studies of fragile or precious objects. Study of archaeological artefacts.



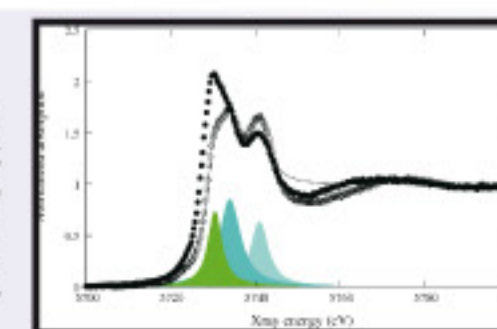
Silicon (Si) mapping and speciation to characterise silicate minerals present in a mineral crust (Joeri valley, Switzerland).

### Life science

Mutagenic effects of nanoparticles

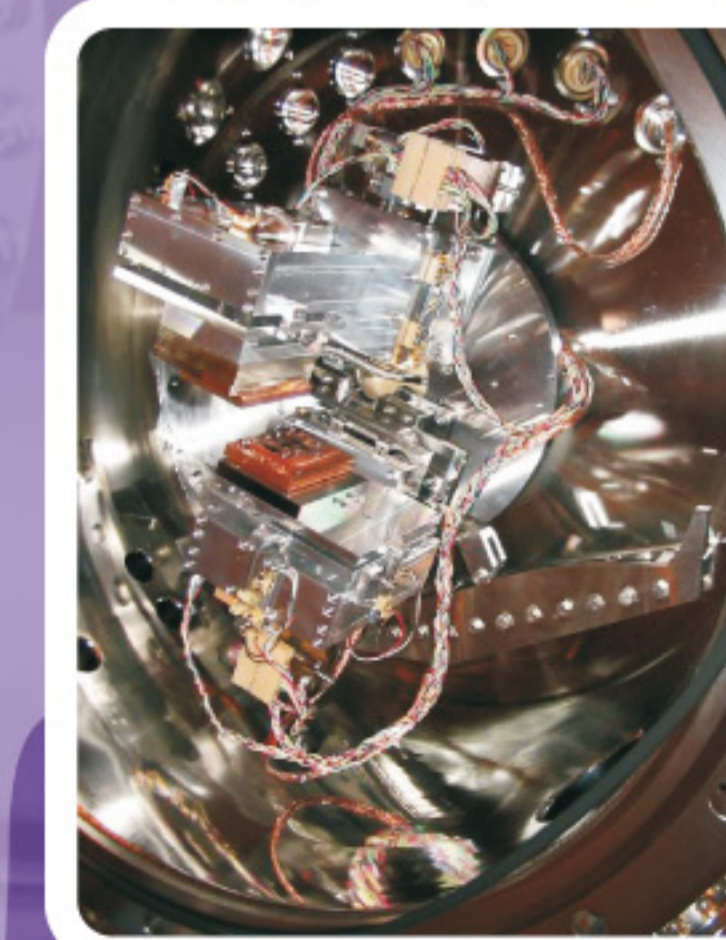


CeO<sub>2</sub> nanoparticle adsorption isothermal curve on a bacteria (*Escherichia coli*). Positively charged nanoparticles are subjected to a strong electrostatic attraction from bacteria membranes observed by electronic microscopy (see photos in Inserts).



The variation of the X-ray absorption spectrum of CeO<sub>2</sub> nanoparticles at the L3 edge of Ce (open circles prior to contact, full circles after a 1 hour contact with bacteria) is a signature of their interaction with bacteria.

### Zoom: the monochromator



The monochromator is equipped with 4 crystal pairs and covers an energy range from 0.8 to 8 keV ("tender" X-ray range).