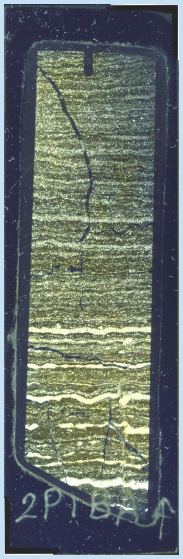
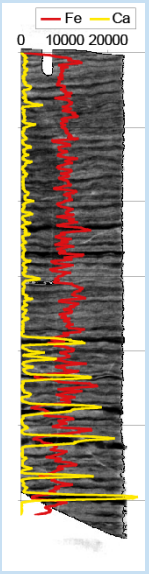
Some examples for marine sediment, lake sediment cores and rock samples are decribed below:

Lake sediments: Lake Yoa, Ounianga Kebir, Sahara:

Thin section



Radiograph + XRF profiles

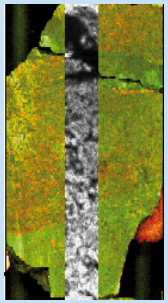


- Annual laminations (+/- 1mm) are resolved,

- Varve counting based on chemical fluctuations,

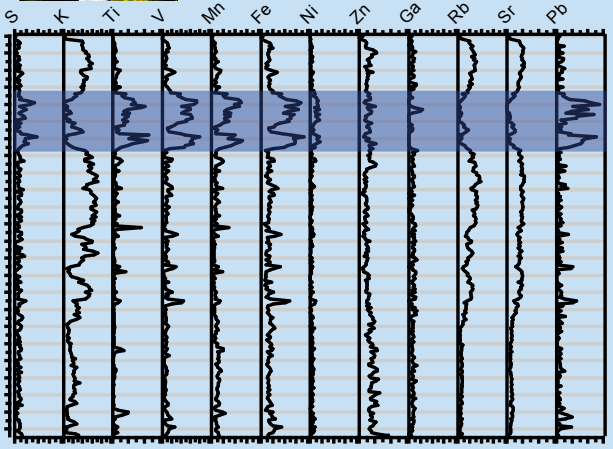
- Measurement of annual calcite fluxes.

(P. Francus and J-F. Cremer, INRS Centre Eau-Terre-Environnement)

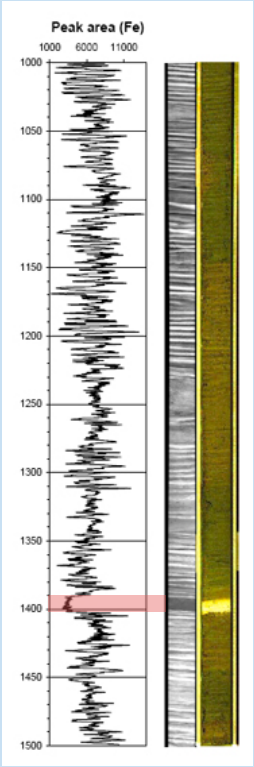


Rock samples:

- Chemical concentration profiles across hydrothermal alteration zones, veins and mineralization (*shaded area below*).



Marine sediments: Saanich Inlet, British Columbia:



- Succession of detritic and organic laminated sediments are resolved using radiograph and Fe profile,

- In these ITRAX data, the Mazama ash (7645 yrs), one of the well-known tephra markers is well identified.

(courtesy of K. Kanamaru, University of Massachusetts, Department of Geosciences)

GIRAS facility users:

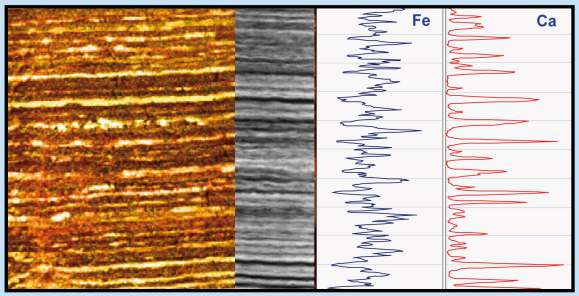
- Geological Survey of Canada
- Centre d'études nordiques, Laval University, QC
- University of Quebec in Rimouski (UQAR), QC
- Queen's University, Kingston, ON
- University of New-Brunswick, Fredericton, NB
- University of Massachusetts, MA, USA
- University of Texas in Austin, TX, USA
- Bates College, Lewiston, ME, USA
- University of Buffalo, NY, USA
- University of Cologne, Germany
- Ghent University, Belgium
- University of Savoie – Technolac, France

Cost estimations can be obtained from our Website:
http://www.ete.inrs.ca/giras

GIRAS

Géochimie, Imagerie et Radiographie des Sédiments

Geochemistry, Imagery and Radiography of Sediments



ITRAX Core scanner

A non-destructive tool for high-resolution chemical analysis by X-ray fluorescence scanning and micro-radiography analysis of rocks and sediment cores.

INRS
Université d'avant-garde

Institut national de la recherche scientifique (INRS)
490 rue de la couronne
Québec, Québec G1K 9A9, CANADA

http://www.ete.inrs.ca/giras

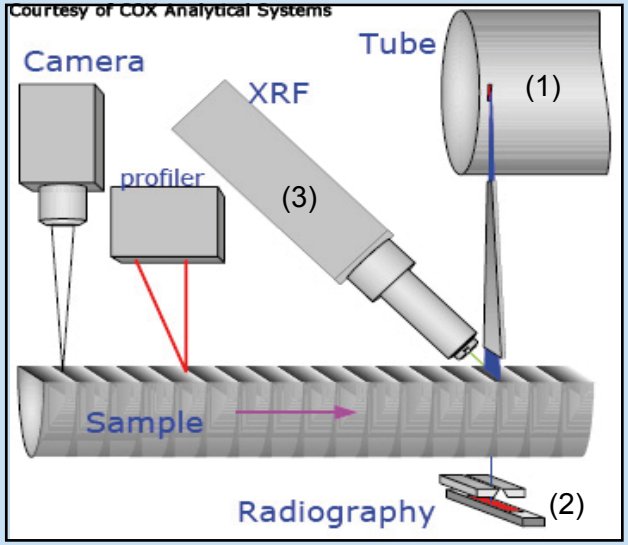
Phone: 1-418-654-3780
Fax: 1-418-654-2600
Email: pierre.francus@ete.inrs.ca

Fondation canadienne pour l'innovation
Canada Foundation for Innovation

PRINCIPLES

More informations are available on our Website:
http://www.ete.inrs.ca/giras

The principle of operation is based on the simultaneous acquisition of microdensity (radiography) and micro-compositional variations (XRF) using two separate X-ray detection systems. A high resolution digital line scanning camera and a magnetic susceptibility sensor are also incorporated into the system to respectively provide an optical colour image and the magnetic susceptibility. The analysis is performed without touching the sample surface and is completely non-destructive.

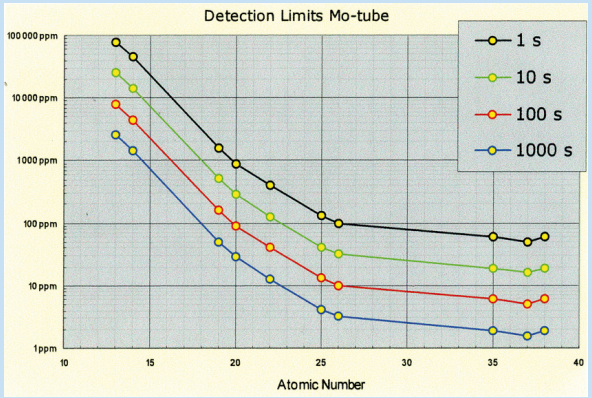


(1) X-ray source:

An intense source of X-rays is provided using a Molybdenum X-ray tube anode (maximum power load is 3 kW at 50 mA). These X-rays are squeezed through a flat-beam capillary optic that generates a beam with a rectangular cross-section of nominally 22 mm x 100 microns.

(2) Microradiography:

The transmitted X-rays are recorded with an array of 1024 diodes, each 25 microns wide. Successive radiographic lines are acquired strictly perpendicular to the core as the sample moves through the beam, therefore minimizing the blur and distortion that usually occur at the edges of classic radiography.



Detection limits of elements (in ppm) for micro X-ray fluorescence analysis with differents exposition times

(3) Micro X-ray fluorescence analysis (XRF):

Chemical profiles along sediment samples are recorded for a broad range of elements. The concentrations of elements (from Si to U, for the Molybdenum tube) can be determined simultaneously, based on X-ray fluorescence. Most of these elements can be determined in concentrations down to 20 ppm depending on the element, analysis time and matrix composition. Two other tubes are also available to improve the detection of light elements from Al to Ti (Cr anode) and for Mo and Nb (Rh anode).

Samples characteristics:

The maximum measurable core length is 1.8 meters. The sample thickness for XRF analysis is from 20 to 80 millimeters. The maximum sample thickness for density analysis is 50 millimeters. Half cores, slabs and U-channels can be analyzed. Samples need to have a reasonably flat surface.

Some applications of the ITRAX core scanner:

- Sub-mm scale analysis and counting of sediment laminea (varves),
- Rapid detection of volcanic tephras in lake or marine sediments,
- Mineral exploration: chemical concentration profiles across hydrothermal alteration zones, veins and mineralizations in rock samples,
- Detecting metal pollutants in lake and fluvial sediments,
- High resolution analyses of speleothems.

ITRAX CORE SCANNER

TECHNICAL SPECIFICATIONS

- Radiography
- Chemical analysis
- Magnetic susceptibility
- High resolution (down to 100 µm)
- Non-destructive
- Fast

Optical image:

- RGB line camera,
- 640 pixels per line,
- Field of view: 80 mm,
- 1 pixel = 50 microns in scan direction.

Micro-radiography:

- 1 pixel = 100 X 25 microns (100 microns in scan direction),
- Digital 16-bit image format,
- Density changes below the %,
- Successive radiographic lines → no distortion.

Micro-fluorescence:

- 1 spectrum for each sampling point,
- Effective spot size = 0.1 x 4 mm,
- Analytical spatial resolution = 100 microns,
- From Al to U,
- Different X-ray tube anodes available (Rh, Mo, Cr),
- Detection limit element dependent.

Kind of samples:

- Sediment and soil cores,
- Drill cuttings,
- Speleothems,
- Split rock cores,
- Archaelogical artefacts.