EUROPEAN **S**YNCHROTRON **R**ADIATION **F**ACILITY

INSTALLATION EUROPEENNE DE RAYONNEMENT SYNCHROTRON

ESRF

Experiment Report Form

The double page inside this form is to be filled in by all users or groups of users who have had access to beam time for measurements at the ESRF.

Once completed, the report should be submitted electronically to the User Office using the **Electronic Report Submission Application:**

http://193.49.43.2:8080/smis/servlet/UserUtils?start

Reports supporting requests for additional beam time

Reports can now be submitted independently of new proposals – it is necessary simply to indicate the number of the report(s) supporting a new proposal on the proposal form.

The Review Committees reserve the right to reject new proposals from groups who have not reported on the use of beam time allocated previously.

Reports on experiments relating to long term projects

Proposers awarded beam time for a long term project are required to submit an interim report at the end of each year, irrespective of the number of shifts of beam time they have used.

Published papers

All users must give proper credit to ESRF staff members and proper mention to ESRF facilities which were essential for the results described in any ensuing publication. Further, they are obliged to send to the Joint ESRF/ ILL library the complete reference and the abstract of all papers appearing in print, and resulting from the use of the ESRF.

Should you wish to make more general comments on the experiment, please note them on the User Evaluation Form, and send both the Report and the Evaluation Form to the User Office.

Deadlines for submission of Experimental Reports

- 1st March for experiments carried out up until June of the previous year;
- 1st September for experiments carried out up until January of the same year.

Instructions for preparing your Report

- fill in a separate form for each project or series of measurements.
- type your report, in English.
- include the reference number of the proposal to which the report refers.
- make sure that the text, tables and figures fit into the space available.
- if your work is published or is in press, you may prefer to paste in the abstract, and add full reference details. If the abstract is in a language other than English, please include an English translation.

ESRF	**Experiment title:** Comparison of elemental concentration in fluid inclusions hosted in opaque and transparent minerals using synchrotron radiation X-ray fluorescence.	**Experiment number**: EC-311
Beamline: ID18F	**Date of experiment**: from: 26 June 2008 to 30 June 2008	**Date of report**: 29 August 2008
Shifts: 9	**Local contact(s)**: Dr. Pierre BLEUET	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Jean Cauzid[*a,b], Anne-Sylvie André-Mayer [*a]

[a]G2R, Université Henri Poincaré – CNRS, BP 239, 54506 Vandoeuvre-lès-Nancy Cédex
[b]ESRF, 38042, Grenoble, France

Preliminary Report

Aim of the experiment

Fluid inclusions are tiny droplets of fluids trapped in minerals. They provide valuable information on geological processes linked to massive fluid transports in the Earth's crust. Mineral deposit of economic interest are built by solubilization, transport and deopsition of specific elements. Scientific studies focused on the understanding of mineral deposits mined for metal resources therefore benefit from the study of fluid inclusions linked with the ore deposition stage. However, most economically-interesting metal-bearing minerals are opaque to visible light and fluid inclusions they host cannot be localised for analysis. Analogues hosted in transparent minerals petrographically linked to the opaque minerals are therefore used. However, little data is available on how similar fluids hosted in transparent and opaque minerals are. Establishing a new method for solving this particular point was the core of this experiment.

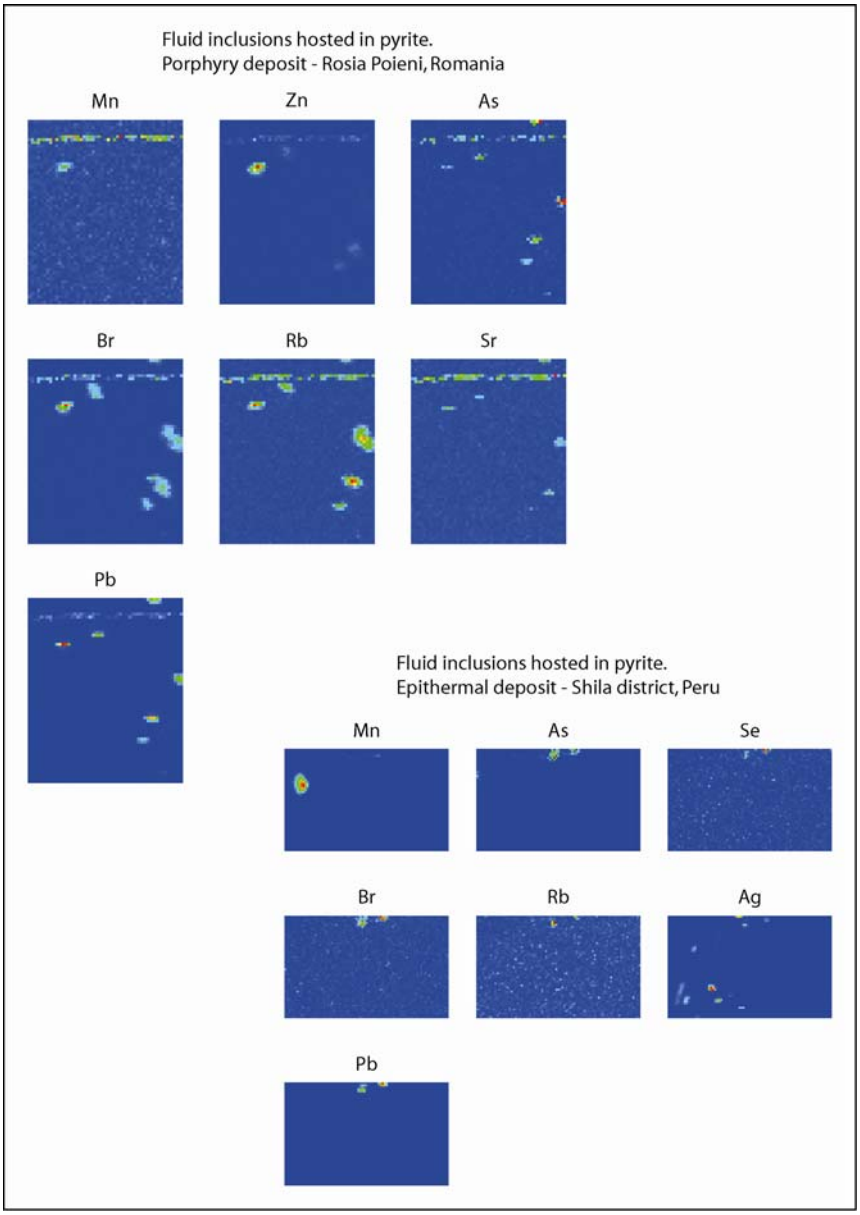
Experimental method

Rock samples of two metal deposits were prepared as chips of quartz and pyrite hosting fluid inclusions. The two metal deposits were a gold-silver low-sulphidation deposit from the Shila district, Peru and the Rosia Poieni porphyry copper deposit, Romania. These samples were doubly polished to a thickness of 100 to 300 microns. Fluid inclusions were localised with either a visible light microscope (in quartz) or an infrared camera (in pyrite) prior to the experiment. Samples were glued on the top of a quartz capillary and held vertically in the beam. For inclusions hosted in quartz, localisation of fluid inclusion was done using the beamline long-working distance video microscope. For inclusions hosted in pyrite, inclusions were localised by performing a radiograph of the sample using the CCD camera installed behind the sample. Once inclusions were localised, a set of CRLs were inserted in the beam to focus it onto the sample. The beam position was measured either using a gold test-object (video microscope) or by direct visualisation (CCD camera). The set-up was easy to switch from the control room from its full field imaging to its microfocus characteristics.

Results and conclusion

This experiment was dedicated to establishing the experimental method for such analysis of inclusions hosted in opaque minerals. Two energies were tried for X-ray radiograph: 14 and 28 keV. The imaging result in pyrite is by far better at 14 keV. However, this energy do not enable accurate quantification as the incoming beam and fluorescence X-rays do not easily cross the mineral layer. At 28 keV the incoming beam is not strongly absorbed, it decreases the positioning easiness using the full field imaging set-up but increases the number of reachable elements and the accuracy of their quantification. By scanning the beam onto the sample, we were able to image fluid inclusions hosted in pyrite in both types of deposits. The fitted images are provided below. The main informations are that:

- elements of atomic number lower than Fe can be imaged (Figure 1: top, Mn in the porphyry deposit).
- radiographs allow accurate positioning gof the sample
- fluorescence filtering is compulsory as Fe signal is extremely high
- low-Z elements (Ca and lighter) cannot be detected due to absorption in matrix and filter



Quantitative results are still under processing, however, these first results demonstrate that ID18F standard setup allows analysis of fluid inclusions hosted in opaque minerals, thus offering a method for estimating fluid compositions directly in ore minerals.