EUROPEAN SYNCHROTRON RADIATION FACILITY

INSTALLATION EUROPEENNE DE RAYONNEMENT SYNCHROTRON

ESRF

Experiment Report Form

ESRF	**Experiment title:** The differential degassing of iodine and xenon for the Primitive Earth	**Experiment number**: HC1314
Beamline:	**Date of experiment**: from: 2/07/2014 to: 08/07/2014	**Date of report**: Feb. 11, 2016
Shifts:	**Local contact(s)**: Denis Testemale	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Clémence Leroy, IMPMC, Université Pierre and Marie Curie, Paris, France

Hélène Bureau, idem

Chrystèle Sanloup, ISTEP, Université Pierre and Marie Curie, Paris, France

Konstantin Glazyrin, DESY, Hamburg

Zuzana Konopkova, DESY, Hamburg

Report:

The purpose of this proposal was to use the Kα and Kβ rays of iodine (26.61; 32.29 KeV) and xenon (29.78 and 33.62 KeV) to quantify by Synchrotron X-Ray Fluorescence (SXRF) their concentrations in hydrous melts (molten silicate) and in aqueous fluids in equilibrium at pressure and temperature, in a diamond anvil cell (DAC). From these concentrations, partition coefficient could be calculated for both elements such as in our previous studies for pressure and temperature conditions relevant for a magma ocean analogue (800 – 1000°C, up to 4 GPa).
We used a X-Ray beam of 35 KeV focused at 10x10 µm such as in our previous study (Bureau et al., 2013). The high resolution of the X-Ray detectors used on the FAME beamline (30-element Canberra Ge solid state detector or Si-drift detector) allowed the separation of iodine (26.61; 32.29 KeV) and xenon (29.78 and 33.62 KeV) lines in the case of experiments performed with both elements. We have calculated a detection limit of 50 ppm for xenon, and we used glasses doped at the level of the weight% for calibration purposes. For data processing we used the PyMCA software and the densities determined in our previous experiments.

A number of problems unfortunately occurred during our beamtime, mostly related to misalignment of the detector with our high pressure cells and to lack of reproducibility of the slits position for the incoming x-ray beam. Due to the challenging temperature conditions we were targeting, it was very difficult to realign the set-up when high T were reached.
Even though we did reach the full melting and homogeneization of the sample at high pressures, X-ray fluorescence measurements were systematically progressively misaligned during the heating ramp, thus preventing collection of data in the fully molten state. Data could nonetheless be collected at the start of the heating ramp, i.e. in the cold fluid and silicate glass phases.