EUROPEAN SYNCHROTRON RADIATION FACILITY

INSTALLATION EUROPEENNE DE RAYONNEMENT SYNCHROTRON

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 via the User Portal:

https://wwws.esrf.fr/misapps/SMISWebClient/protected/welcome.do

Reports supporting requests for additional beam time

Reports can 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:** Investigation of P speciation in Lake sediments by means of synchrotron based methods	**Experiment number**: EC-795
Beamline: ID 21	**Date of experiment**: from: 03/30/2011 to: 04/05/2011	**Date of report**:
Shifts: 12	**Local contact(s)**: Murielle Salome (email: salome@esrf.fr)	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Charline Giguet-Covex*[1], Emilie Chalmin*[1, 2], Jérôme Poulenard*[1], Jean-Philippe Jenny*[1], Fabien Arnaud[1], Jean-Marcel Dorioz[3]

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Report:

The results of the experiment was published in Geochimica and Cosmochimica Acta :

C. Giguet-Covex, J. Poulenard, E. Chalmin, F. Arnaud, C. Rivard, J.-P. Jenny, J.-M. Dorioz, **2013**. XANES spectroscopy as a tool to trace phosphorus transformation during soil genesis and mountain ecosystem development from lake sediments. *Geochimica and Cosmochimica Acta* **118**: 129-147

Abstract

The aim of this study was to investigate phosphorus (P) species modifications triggered by soil genesis and mountain ecosystem development after glacial retreat using a lake sediment archive (Lake Anterne, North French Alps). Five lake sediment samples, representative of different stages of soil and ecosystem development, were selected for P speciation analyses. Furthermore, a sequence of current soils from the catchment was analyzed to better constrain our interpretations of the lacustrine archive. Synchrotron techniques (X-ray Fluorescence (XRF) mapping and P K-edge X-ray absorption near edge structure (XANES) spectroscopy) were applied to lake sediments, soils, and standards (mineral and organic) to distinguish between different P species (Fig. 1, 2). The results show that soil development during the first millennia of the Holocene triggered increased P species diversity (Fig. 2). At the onset of the Holocene, P was present as apatite when rocks and leptosols dominated the catchment. Pedogenic processes then led to apatite dissolution and the formation of large amounts of P on metal/clay-organic complexes. P geochemistry during the main step of soil genesis (early leptosols dominated by apatite, low weathered cambisols with P mainly adsorbed on iron oxides, highly weathered podzols with large amounts of P on Al/Fe/clay organic complexes) is thus clearly recorded in lake sediments. P K-edge XANES spectroscopy is particularly relevant as qualitative method to study P species in soils and lake sediments at high spatial resolution. Such resolution is needed to reveal the diversity of small P particles and like this better characterize the P cycle and improve our understanding of ecosystem evolution.

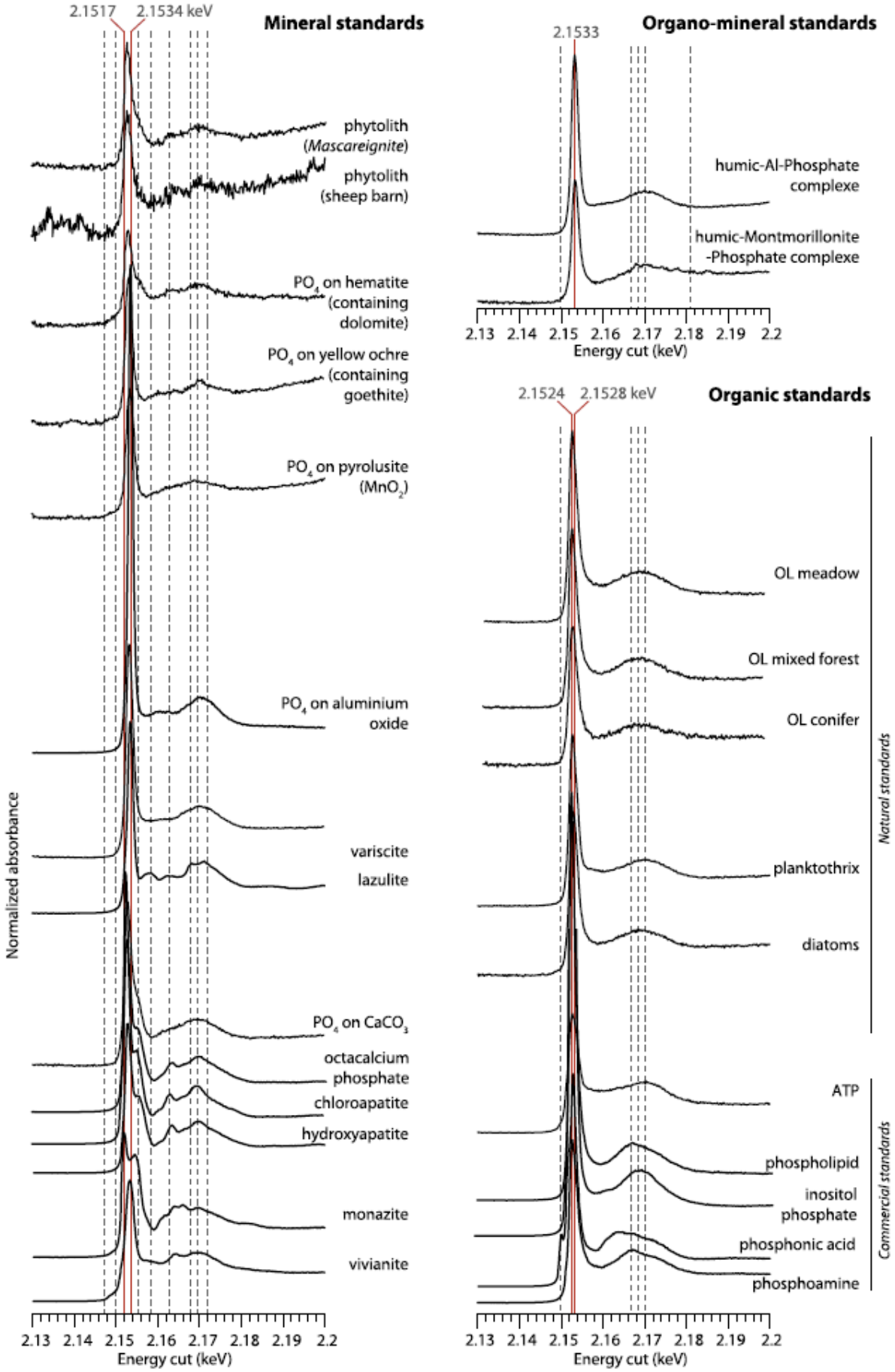

Figure 1: K-edge XANES spectra of organic, mineral, and organo-mineral standards.

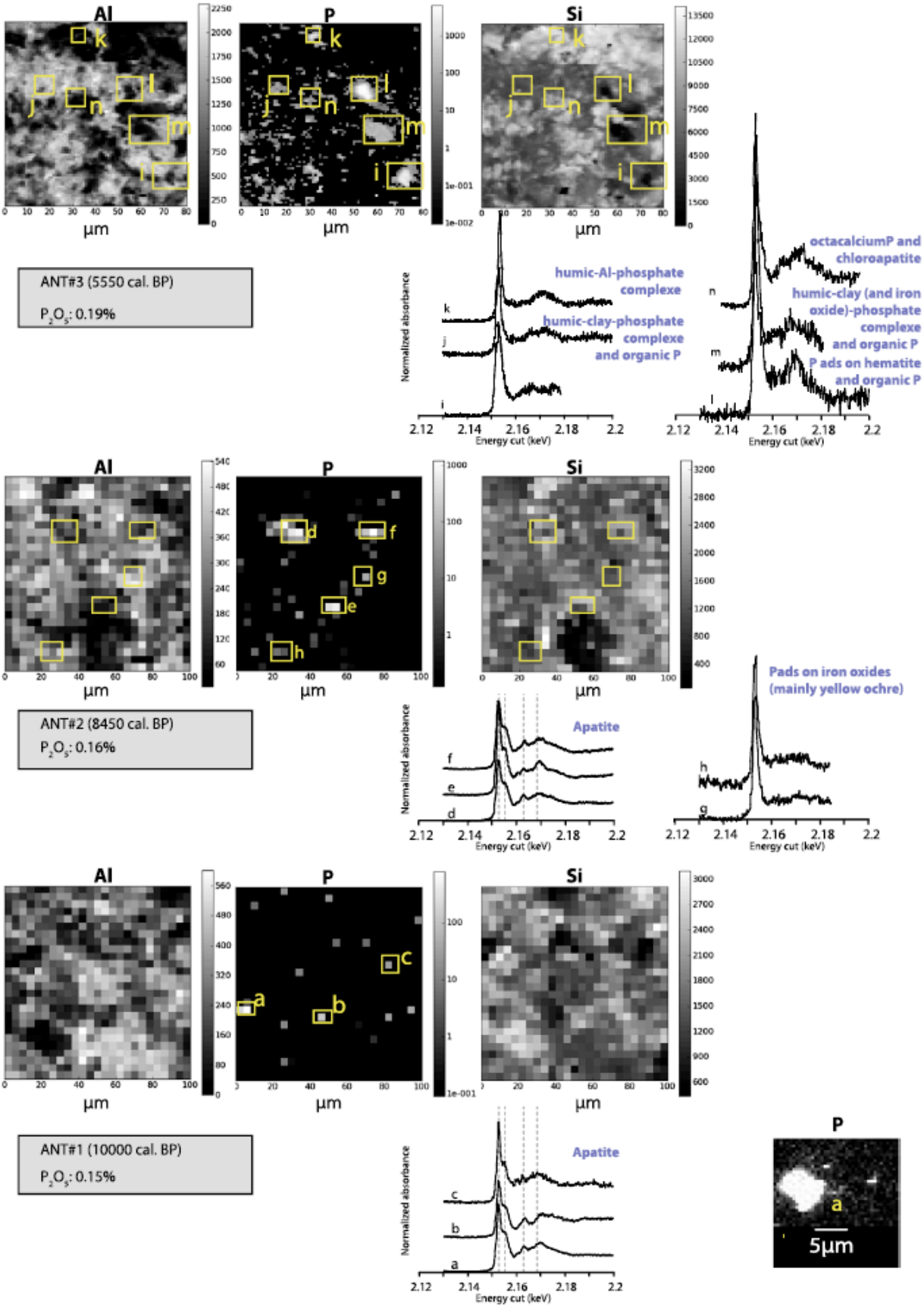

Figure 2: XANES spectra and elemental maps (Al, P, and Si) of some lake sediment samples (ANT#1, ANT#2 and ANT# 3). We see the increasing in P species diversity with the time triggered by the soil genesis in the catchment.