EUROPEAN SYNCHROTRON RADIATION FACILITY

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 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:** Reconstructing genome evolution in teleost fishes with 3D visualization of bone-cell spaces	**Experiment number**: LS-2614
Beamline: ID19	**Date of experiment**: from: 20/04/2017 to: 23/04/2017	**Date of report**: 08/09/2017
Shifts: 9	**Local contact(s)**: Vincent FERNANDEZ	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Donald DAVESNE*, Department of Earth Sciences, University of Oxford, Oxford, United Kingdom

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Report:

For this experiment, we were allocated 9 shifts (3 days), instead of the 12 initially requested due to a highly-competitive round of proposals.

The experimental setup, aiming for a resolution of 0.7 µm, used an indirect detector microscope in high dose configuration and a PCO.edge gold 4.2 camera. Phase contrast was performed, adapting the propagation distance to the energy.
We applied a range of energies: 19 keV (that proved inadequate for achieving satisfying results with most samples), 35 keV (adequate for most extant taxa), 69 keV (adequate for most fossil fragments), 112 keV (used for some of the biggest extant and fossil specimens). Scanning time was variable, depending on the size of the specimen. It was substantially longer for bigger specimens consisting in entire bones.

During this experiment we were able to scan a total of 93 specimens:

- 59 fossil specimens (fragments of/complete lower jaw bones)
- 34 extant specimens (complete lower jaw bones).

We received the complete dataset in mid-August 2017, meaning that most of the data has not been treated yet.
Based on the data we've treated so far (**Fig. 1**), the experimental setup was adequate, allowing us to:

- accurately visualise bone cell lacunae,
- reconstruct them in 3D,
- measuring their volumes using tools incorporated into the software VGStudio Max.

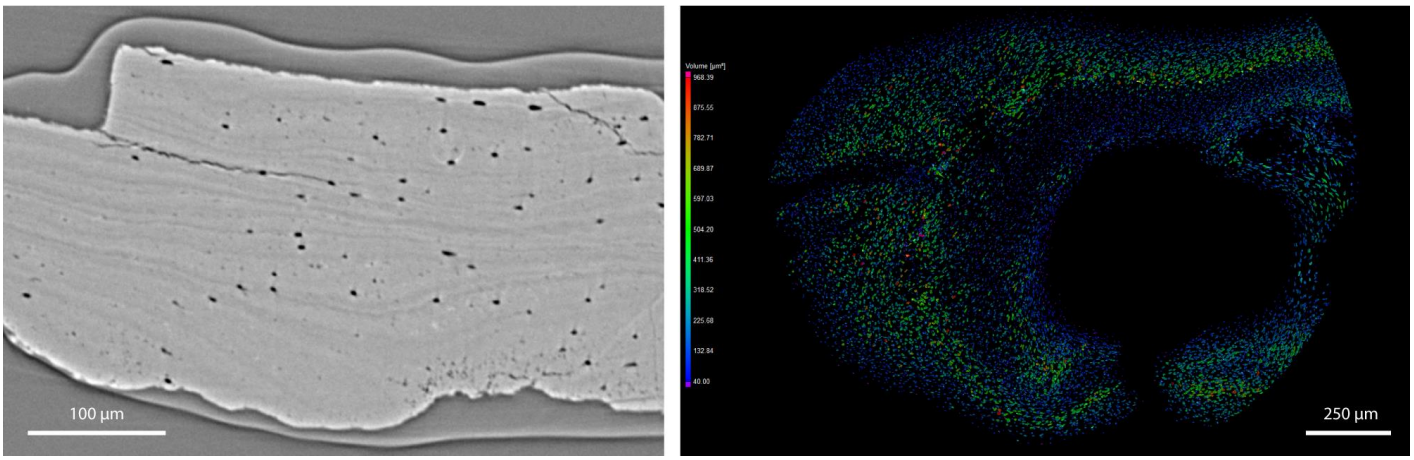

Figure 1: *Example of data obtained from the experiment LS-2614.*
[left]: *reconstructed virtual section of a lower jaw bone fragment from the Jurassic fossil fish* Pachycormus*, clearly showing osteocyte lacunae (black lenticular structures) due to adequate phase contrast.*
[right]: *3D thin section of the rib of an extant carp (*Cyprinus*), with osteocyte lacunae reconstructed in 3D and coloured according to their measured volume.*

The numerous and high-quality data obtained at the ESRF will then be at the core of our collaborative scientific project, aiming at reconstructing genome size variations in teleost evolution.