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:** Biogenic calcite single crystal doping: a 3D insight into the brittle star eye-sight principles	**Experiment number:** EV-217
Beamline: ID-16B	**Date of experiment:** from: 21.10.2016 to: 25.10.2016	**Date of report:** 10.09.2017
Shifts: 12	**Local contact(s):** Julie VILLANOVA	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Prof. Boaz Pokroy

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Mr. Stanislav Kozachkevich

Report:

During the 12 shifts that were givven to our use the following experiments were conducted:

#	Sample description	Applied experimental techniques
1	Untreated biogenic Mg-Calcite single crystal brittle-star lens.	Holo-Tomography, Micro-XRF, X-ray Diffraction
2	Biogenic Mg-Calcite single crystal brittle-star lens, heated 30 minutes at 400^{0}C in CO2 environment.	Holo-Tomography, Micro-XRF, X-ray Diffraction
3	Untreated biogenic Mg-Calcite single crystal brittle-star lens.	Holo-Tomography, Micro-XRF, X-ray Diffraction
4	Biogenic Mg-Calcite single crystal brittle-star lens, heated 30 minutes at 400^{0}C in CO2 environment.	Holo-Tomography, Micro-XRF, X-ray Diffraction

Holo-Tomography reconstructed and proccesed results showed the general phenomena of layers/bands alterning in contrast from darker to ligher in a radial fashion across the lens perimiter. Since the contrast in Holo-Tomography is attributed to the radiodensity of the present elements in place, we could conclude that these layers are different in their density, possibly showing bands that are richer and poorer in Mg content that substitues Ca in the crystal lattice (figure 1a). Upon heating the layers do not disappear though some of them seem to be more smeared probably due to diffusion, and in addition pores are formed mainly at the lens surafce, represented by dark spots in figure 1b.

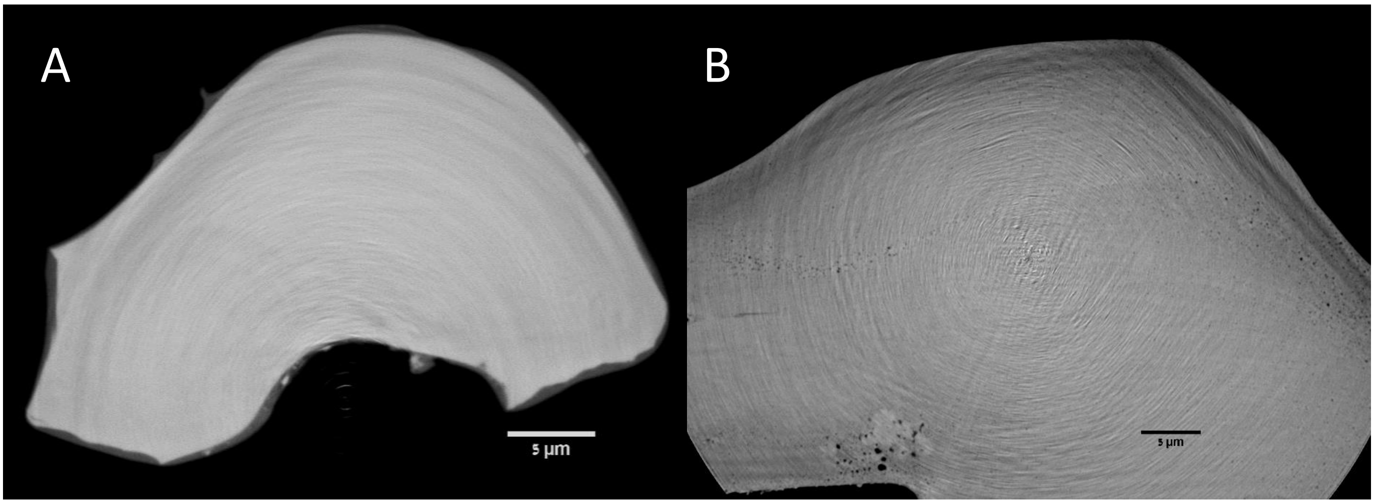

Figure 1 – Holo-Tomography images of (A) #1 lens sample showing alterning density layers in the radial direction along its perimeter. (B) #2 lens sample after heating showing the alterning density layer in addition to pore formation mainly at the samples surface (dark spots).

Analized Micro-XRF data showed two main prominent signals from Ca-Kalpha and Sr-Kalpha peaks. In addition efforts have been made to extract the signal of Mg-Kalpha but unfortunately its signal was too weak due to sample self absorption and air-absorbption. Reconstructed data indicated a radial elemental distribution along the sample perimeter both for Ca and Sr (Figure 2).

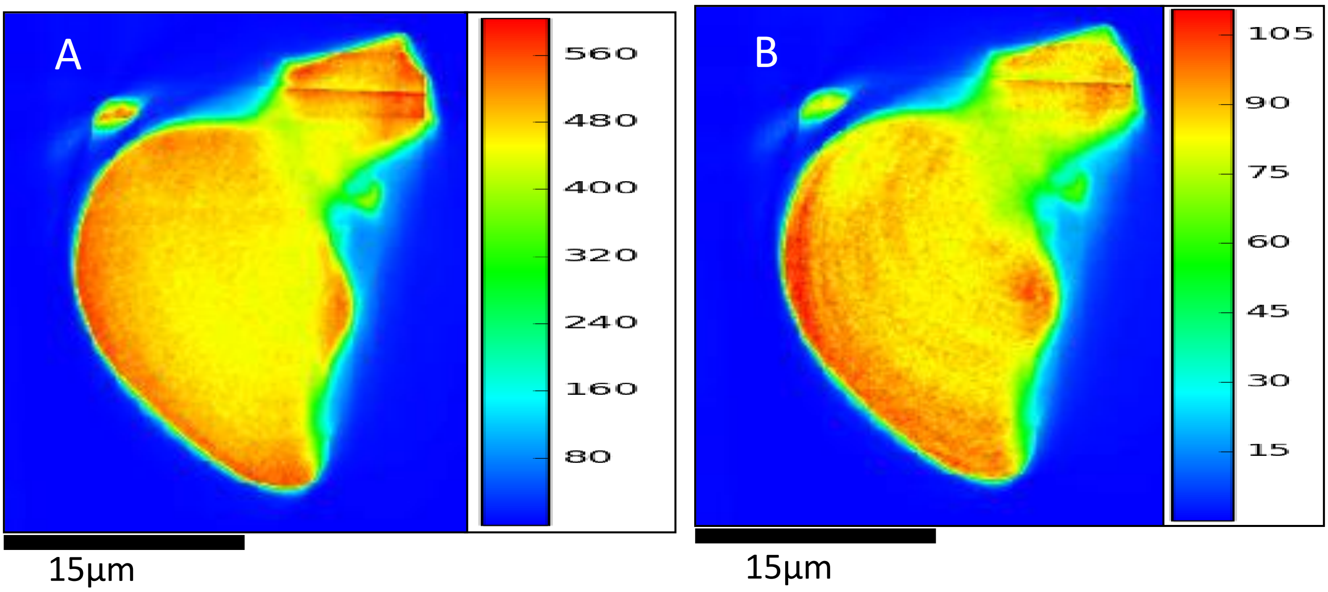

Figure 2 – #1 lens sample of (A) Micro-XRF for Ca signal and (B) Micro-XRF for Sr signal, indicating the radial elemental distribution.

In addition to the elemental distribution, signal intensity line plots in the radial direction indicated fluctuations of the elements which resembled to the fluctuations in intensity seen with the Holo-Tomography images.