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

Deadlines for submission of Experimental Reports

Experimental reports must be submitted within the period of 3 months after the end of the experiment.

Experiment Report supporting a new proposal ("relevant report")

If you are submitting a proposal for a new project, or to continue a project for which you have previously been allocated beam time, you must submit a report on each of your previous measurement(s):

- even on those carried out close to the proposal submission deadline (it can be a *"preliminary report")*,
- even for experiments whose scientific area is different form the scientific area of the new proposal,
- carried out on CRG beamlines.

You must then register the report(s) as "relevant report(s)" in the new application form for beam time.

Deadlines for submitting a report supporting a new proposal

- 1st March Proposal Round - **5th March**
- 10th September Proposal Round - **13th September**

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.

Instructions for preparing your Report

- fill in a separate form for each project or series of measurements.
- type your report in English.
- include the experiment number 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.

	Experiment title: Investigation of the 3D modulation of light elements in the skeleton of the red algae	**Experiment number**: MA-5298
Beamline: ID16A	**Date of experiment**: from: 06.05.2022 to: 09.05.2022	**Date of report**: 01.08.2022
Shifts: 9	**Local contact(s)**: Peter Cloetens	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Prof. Boaz Pokroy, Technion - Israel Institute of Technology Department of Materials Engineering

Prof. Paul Zaslansky, Charité – Universitätsmedizin Berlin

Report:

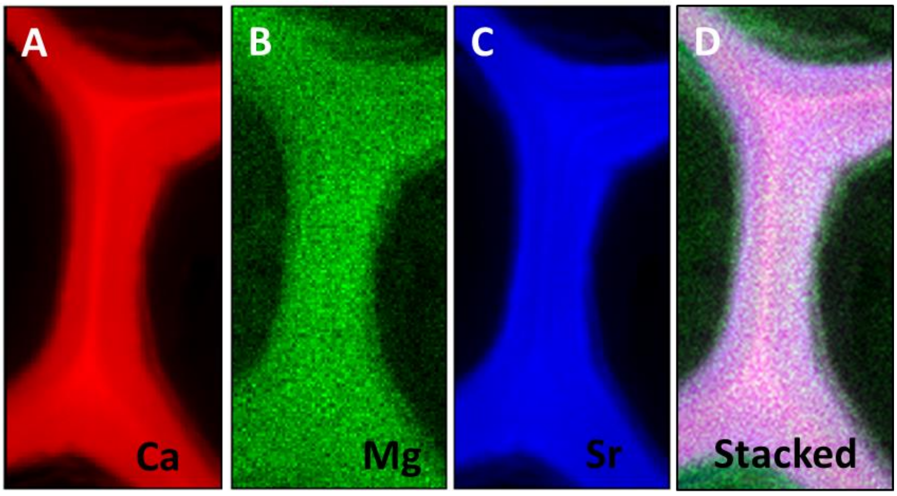

Figure 1- calcareous alga Jania sp. elemental mapping using fluorescence emission. (A) Ca mapping. (B) Mg mapping. (C) Sr mapping. (D) stacked mapping of Ca,Mg and Sr.

Figure 1 shows the density of Ca, Mg and Sr and the stacked mapping of the three elements in a sample taken from the calcareous alga *Jania sp.* As expected, Ca is dispersed throughout the triple junctions and their connecting bridge, presenting higher intensity deeper in the porous wall (*figure 1, A*). Mg mapping resulted in an even dispersion throughout the sample as well, which further expands to the void (*figure 1, B*). Mg is a small atom resulting in highly energetic x-rays with low-distance dispersion, as a result, the Mg dispersion might not be accurate, explaining its appearance in the void. Sr mapping revealed an interesting result, presenting layered structure in the sample. (*figure 1, C*). In *figure 1, D* the stacked image can be seen, it reveals the intensity differences between the different elements, where Ca is the dominant, and further emphasizes the "leaking" of the Mg signal.

Similar results were observed with the *O.wendetti* optical lens as can be depicted in *figure 2*.

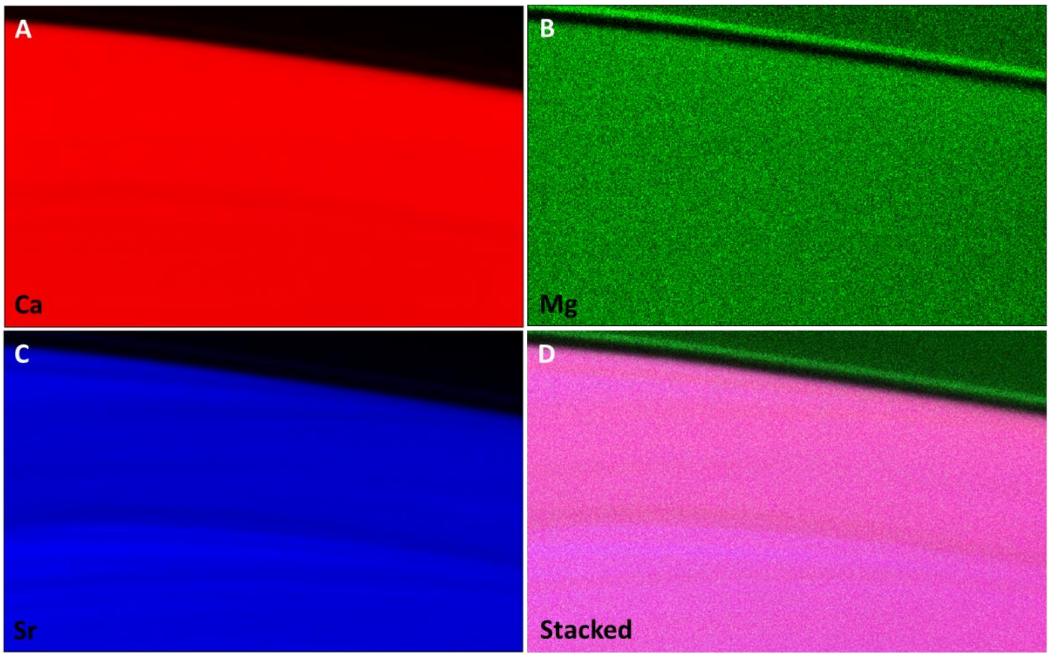

Figure 2 - O. wendetti brittlestar lens element mapping using fluorescence emission. (A) Ca mapping. (B) Mg mapping. (C) Sr mapping. (D) stacked mapping of Ca,Mg and Sr.

Both Ca and Mg appear to be evenly dispersed throughout the optical lens (*figure 2, A-B*). While for Ca this is the expected result, previous work done by our group revealed layered structures throughout the lens composed of high-Mg calcite inclusions; which contradicts the received results. The aforementioned explanation is valid for this case as well, explaining the even Mg dispersion in the optical lens and its appearance in the carbon coating layer. Sr mapping revealed an interesting result, similar to what was seen in the *Jania sp.* , a layered structure in the optical lens can be seen which was previously undetectable using various characterization methods. (*figure 2, C*). in *figure 2, D* the stacked image can be seen, revealing the intensity differences between the different elements, where Ca is the dominant element, the stacked image emphasizes the previously described "leakage" of Mg atoms signals in the carbon coating layer.

XRF measurements uncovered the presence of Sr atoms. While presence of Sr as replacement to Ca atoms is known in biomineralization, the surprising distribution both in the *Jania sp.* and in the *O. wendetti* optical lens was previously unknown and went undetected until now.