ESRF

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.

ESRF	**Experiment title:** "Earliest fossilized window of sociality recorded from lensoidal to spheroidal microfossils during the Archaean"	**Experiment number**:LS-3107
Beamline:	**Date of experiment**: from: 22.09.2022 to: 24.09.2022	**Date of report**:
Shifts:	**Local contact(s)**: Kathleen Dollmann	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Jaganmoy Jodder*, Evolutionary Studies Institute, University of the Witwatersrand, South Africa

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Report:

Obejective:

Multipropagation phase contrast micro-computed tomography imaging was conducted on specific cylindrical blocks (i.e., two fossiliferous chert samples; min/max heights of >1mm–40mm and min/max diameters of >1mm–30mm approximately) on the BM 18 beamline.

We used two voxel sizes, 4.2 and 0.65 microns to image the complete samples at a lower resolution and then regions of interest at a higher resolution. This was a reconnaissance study to test the microfossil clusters and their linkages/tail-like appendages with phase contrast imaging technique at BM 18. For the first time, Archaean cellular microfossils were successfully imaged using the ESRF beamline BM 18. But the resolution obtained is insufficient to image their fine flanged appendages/tail-like linkages of these microfossils. Therefore, access to

ID16A nanotomography would provide deatiled insights on the visibility of the cellular communities. Likewise, the success of the experiment conducted at BM 18 as stated in the original proposal was crucial for our experiment to follow up with ID16A after discussions on technical feasibility assessments.

From the experiment on BM18, we were able to clearly image the cellular communities, which establishes the precedent that these microfossils can be imaged at much higher resolutions, using nano-tomography. From the results presented at BM18, we were able to determine cellular clusters, linkages with tail-like appendages and colonies distributed within large chert samples (Figure 1A-B), however, the resolution is too coarse to determine the much finer details required to complete this study. From the BM18 data, we already have an overview map of the colonies presence within the sample and can precisely prepare the samples for nanotomography (Figure 2A-B).

We are now requesting the use of ID16A to obtain higher contrast between chert silica matrix and carbonaceous microstructures. On ID16A, we intend to use a lower resolution overview tomogram at 90nm voxel size to achieve a localized region of interest. Thereafter, we will image with a with voxel size of 20 nm to obtain images of various clusters of cellular microstructures linked by flanged appendages.

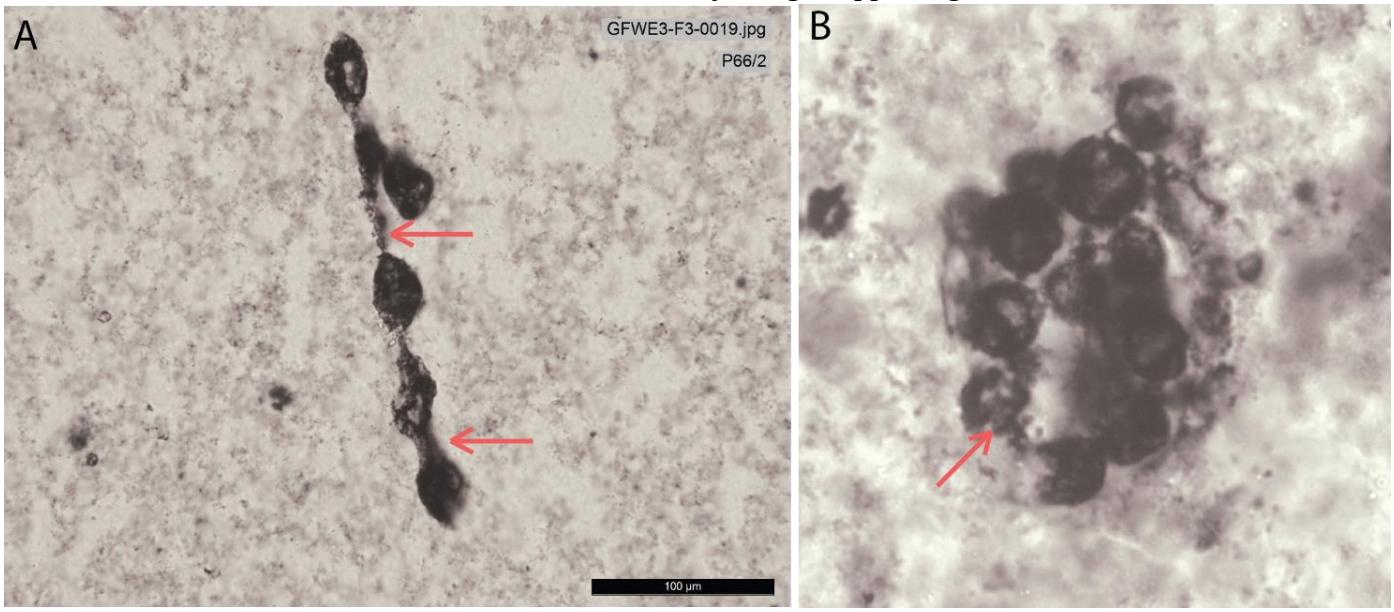

Figure 1 A-B) A.Lensoidal microfossils with tail-like appendages (indicated by red arrows). B. Spheroidal cellular microstructures in a cluster with ruptured cells (shown by red arrow) .

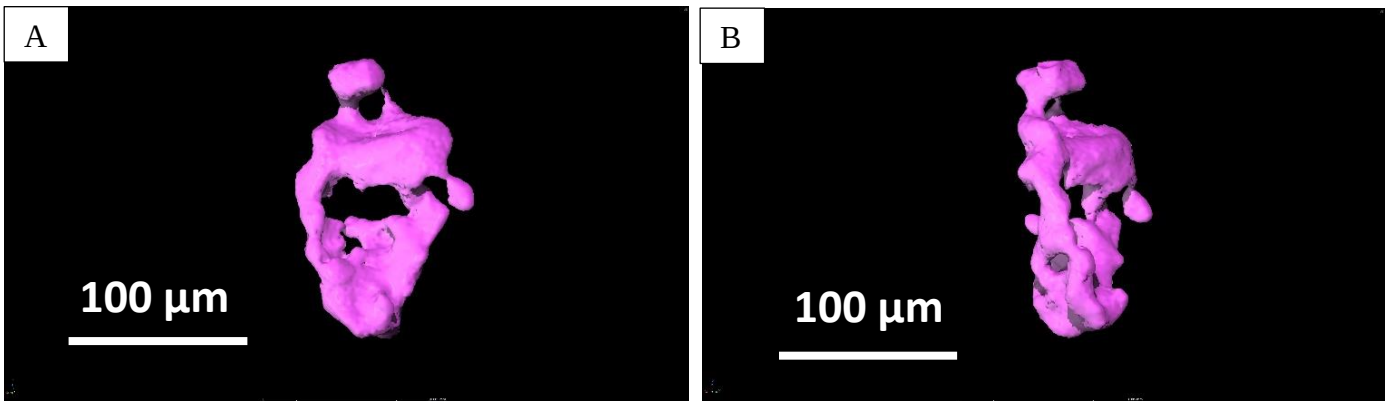

Figure 2. Slices of spheroidal cellular microstructures in colonies observed using microtomographhy (PPC-µCT), BM 18. A. Cross-sectional view of a cluster of spheroidal microstructures. B. Oblique view of spheroidal microstructures