Microscopy TODAY

Coming Events

2017

2017 MRS Fall Meeting
November 26–December 1, 2017
Boston, MA
www.mrs.org/fall2017

American Society for Cell Biology
December 2–6, 2017
Philadelphia, PA
http://ascb.org/future-ascb-annual-meetings

2018

Semiconductor Interfaces (PCSI-45)
January 14–18, 2018
Kona, HI
https://pcsi2018.avs.org

Biophysical Society
February 17–21, 2018
San Francisco, CA
www.biophysics.org/Meetings/AnnualMeeting/Future/tabid/495/Default.aspx

PITTCON 2018
February 26–March 1, 2018
Orlando, FL
https://pittcon.org

255th ACS National Meeting
March 18–22, 2018
New Orleans, LA
www.acs.org/content/acs/en/meetings/nationalmeetings/meetings.html

2018 MRS Spring Meeting
April 2–6, 2018
Phoenix, AZ
www.mrs.org/spring2018

Histochemistry 2018
April 21–25, 2018
San Diego, CA
http://histochemicalsociety.org/Meetings-and-Courses/Histochemistry-2018.aspx

Microscopy & Microanalysis 2018
August 5–9, 2018
Baltimore, MD
www.microscopy.org

2019

Microscopy & Microanalysis 2019
August 4–8, 2019
Portland, OR
www.microscopy.org

2020

Microscopy & Microanalysis 2020
August 2–6, 2020
Milwaukee, WI
www.microscopy.org

2021

Microscopy & Microanalysis 2021
August 1–5, 2021
Pittsburgh, PA
www.microscopy.org

2022

Microscopy & Microanalysis 2022
July 31–August 4, 2022
Portland, OR
www.microscopy.org

More Meetings and Courses
Check the complete calendar near the back of this magazine.

Carmichael's Concise Review

Corals May Be Able to Save Themselves

Stephen W. Carmichael
Mayo Clinic, Rochester, MN 55905

carmichael.stephen@mayo.edu

Many people are aware that corals are threatened by ocean warming and acidification, among other factors. A better understanding of the formation of coral skeletons could help predict the ability of corals to respond to these threats. It is known that stony coral skeletons are largely composed of aragonite, a crystalline polymorph of calcium carbonate ($CaCO_3$). However, there is no clear consensus on how these aragonite skeletons are formed. The two prevailing hypotheses are that this is either a physiochemical-dominated process based on complex metabolic control of calcifying fluid chemistry or a biologically controlled process. In the latter the skeletal organic matrix (SOM) secreted by the animal plays the most important role. Recently, Stanislas Von Euw, Paul Falkowski, and colleagues combined high-tech imaging and local spectroscopy techniques to show that mineral deposition is biologically driven [1].

Von Euw et al. used the well-studied ubiquitous stony coral *Stylophora pistillata*, commonly known as hood coral or smooth cauliflower coral, as a model for investigating the coral biomineralization process. They applied a materials science approach that combined Raman imaging and spectroscopy, scanning helium ion microscopy (SHIM), and solid-state nuclear magnetic resonance (NMR) spectroscopy. This approach revealed the crystallization pathway of aragonite and provided unprecedented insights into the relation between the mineral phase and the SOM across different spatial scales.

Raman spectroscopy not only demonstrated the presence of organic material concentrated in centers of calcification (COC), but it also showed the presence of "immature" aragonite particles spatially closely related to the SOM in the COCs. To examine the role of the SOM concentrated in the COSs, Von Euw et al. applied SHIM to provide ultrahigh-resolution three-dimensional images with excellent depth of field, which can be applied to an intact piece of coral skeleton (Figure 1). The organic material was observed as fibers perpendicular to the plane in which the aragonite fibers grew. The "immature" aragonite

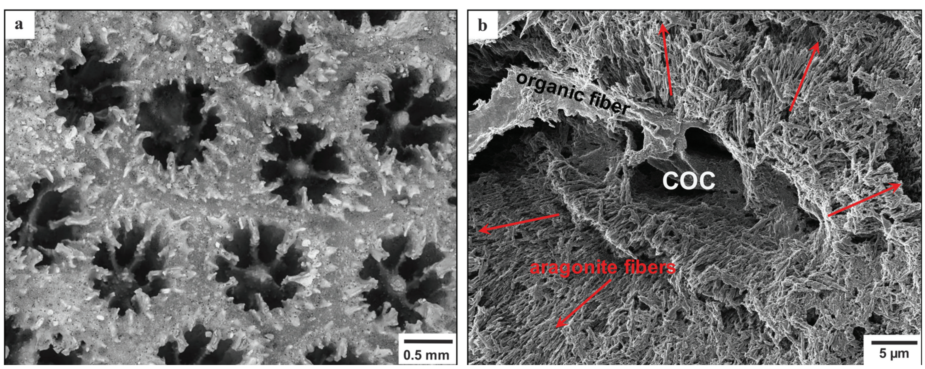

Figure 1: Coral skeleton surfaces. (a) Scanning electron microscope image showing the intact surface of a skeletal branch. Image width = 0.5 mm. (b) Scanning helium ion micrograph of a center of calcification surrounded by aragonite fibers obtained from the broken, unpolished, etched-surface of a skeletal branch. Image width = 50 μm. Credits to Viacheslav Manichev and Stanislas Von Euw of Rutgers University.

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evidence by Raman spectroscopy was in the form of nanosized particles intercalated in the organic fiber surface.

These and other results indicated that mineral deposition in stony corals is initiated by the formation of a transient disordered precursor phase, which is probably in the form of amorphous calcium carbonate nanoparticles. The results of Von Euw et al. also revealed that these nanoparticles are deposited in microenvironments that are enriched in SOM secreted by the animal, specifically the COCs. Additional results obtained by solid state NMR further support the suggestion that the ability of corals to calcify is biologically controlled.

Von Euw et al. have shown that of the two prevailing mechanisms for formation of coral skeletons, the most likely is the biologically controlled process. This suggests that stony corals may be able to sustain calcification even in a more acidic environment than would be possible by physical chemistry alone. One can speculate that this biological process could undergo evolution over a period of decades or centuries to allow corals to survive in an even more hostile future.

References

[1] Von Euw et al., *Science* 356 (2017) 933–8.
[2] The author gratefully acknowledges Dr. Stanislas Von Euw for reviewing this article.

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