

[B-PT03] Biomineralization and Geochemistry of Proxies

Welcome!



ようこそ!

BG4.1 EDI
Experimental Approaches in Marine Biogeosciences
Co-sponsored by JpGU
Convener: Petra Heinz | Co-conveners: Hiroshi Kitazato,
Christiane SchmidtECS, Takashi Toyofuku
Presentations | Fri, 27 May, 08:30–11:49 (CEST)
Room 2.95



Inhibitors of calcification related enzyme affect calcification in foraminifera

Takashi Toyofuku^{1,2} & Yukiko Nagai^{1,3}

1. JAMSTEC

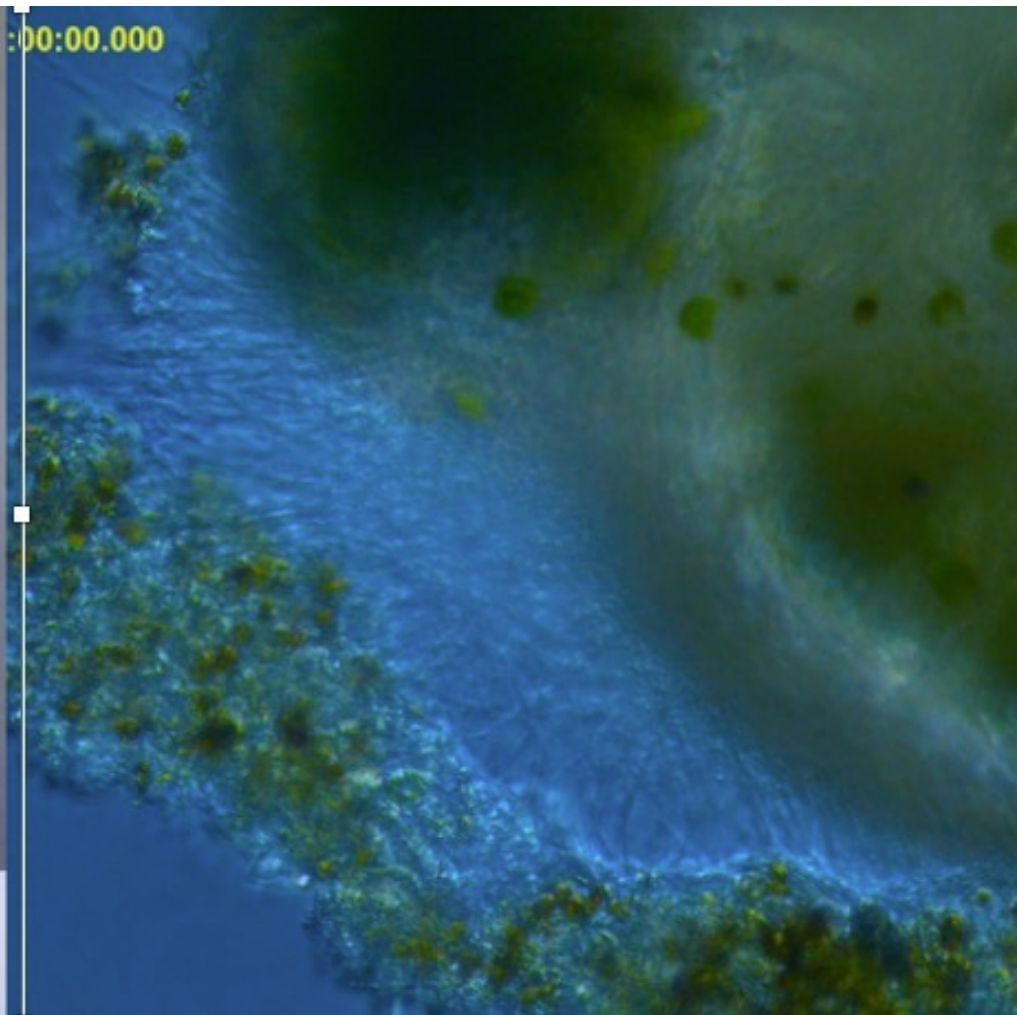
2. TUMSAT

3. National Museum of Nature and Science, Tokyo

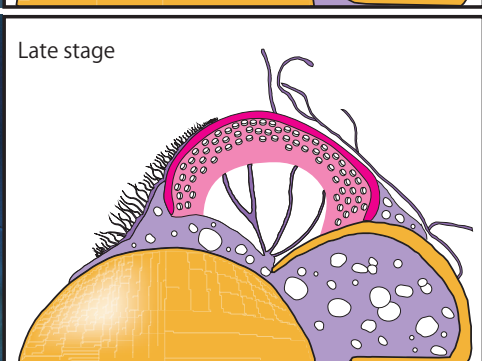
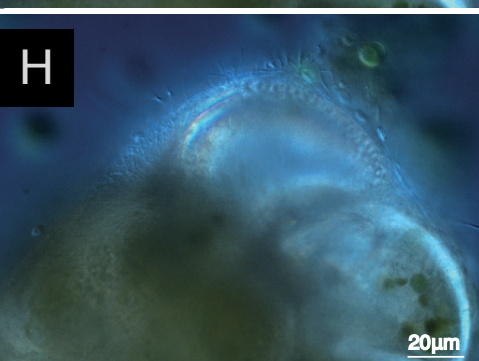
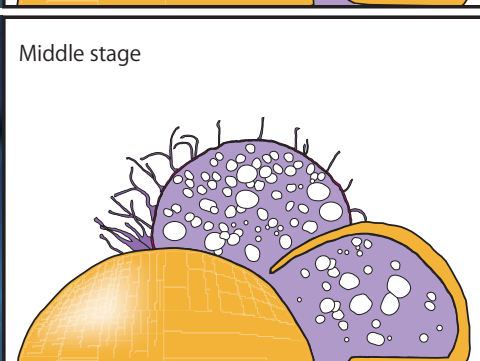
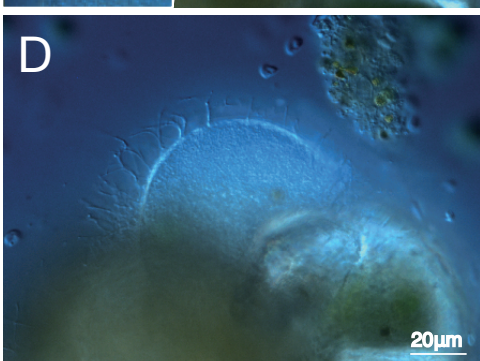
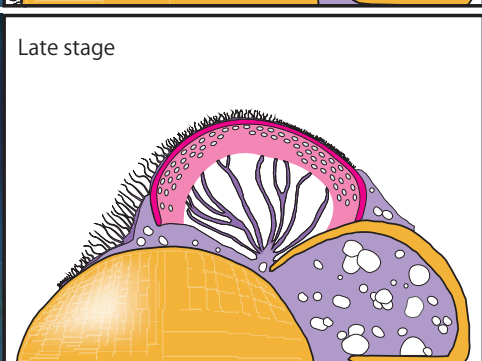
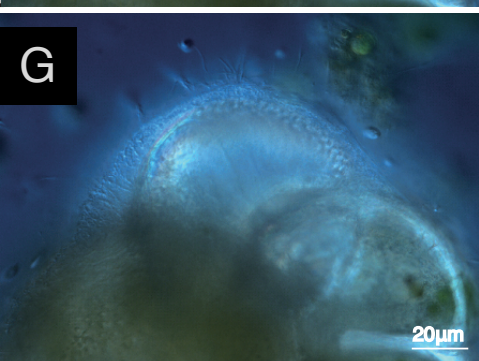
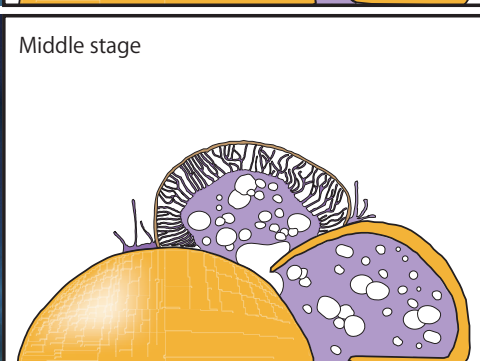
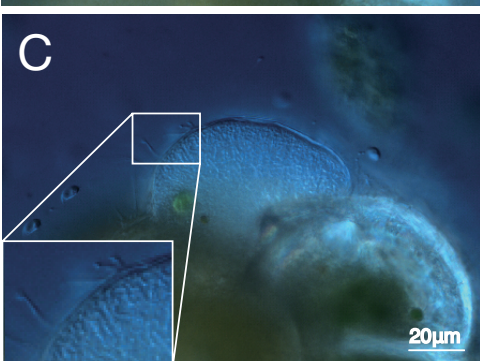
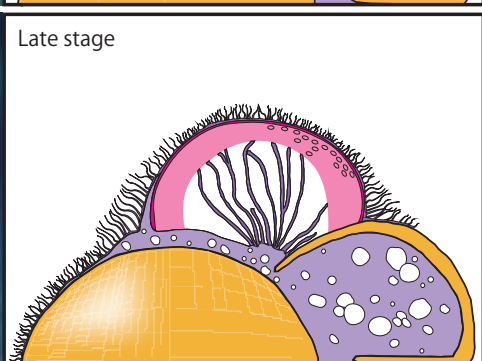
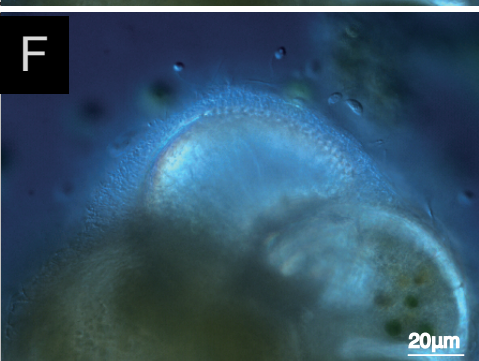
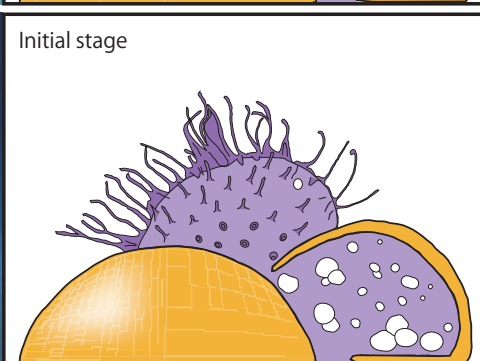
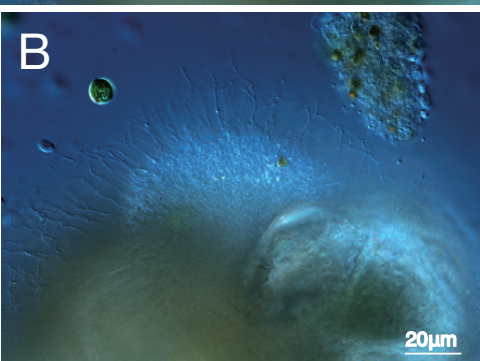
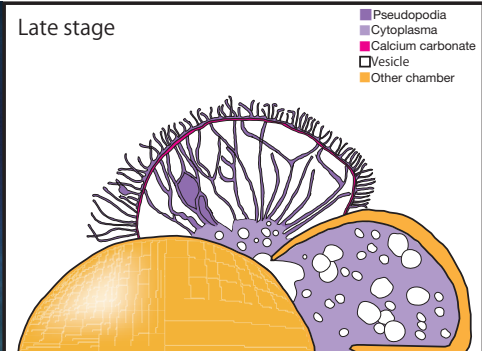
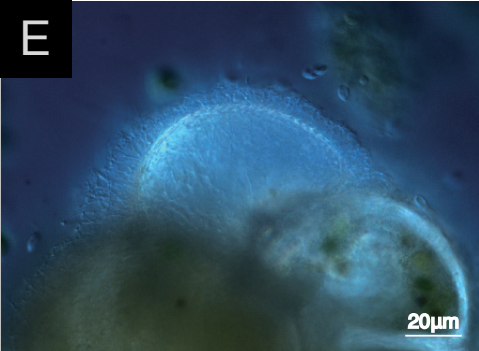
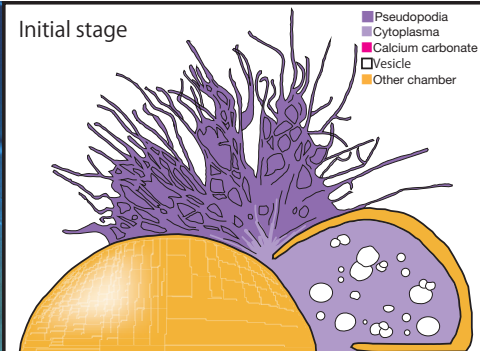
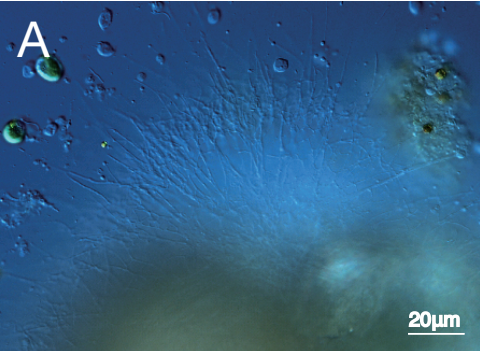
Biomining process should be studied?



Inorganic



Foraminifera

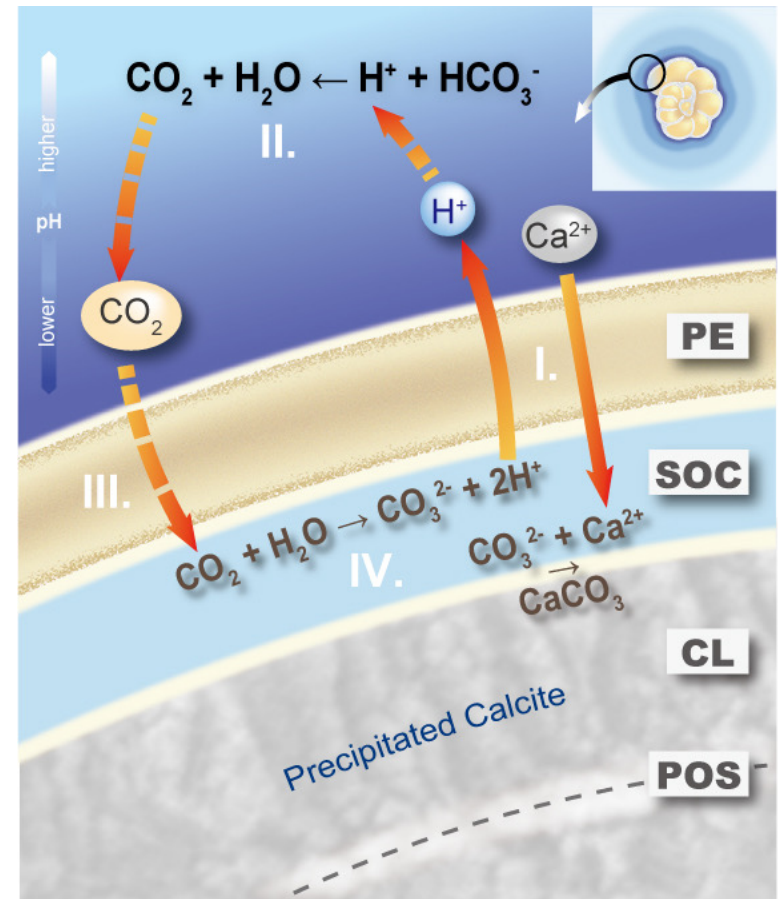


pH imaging

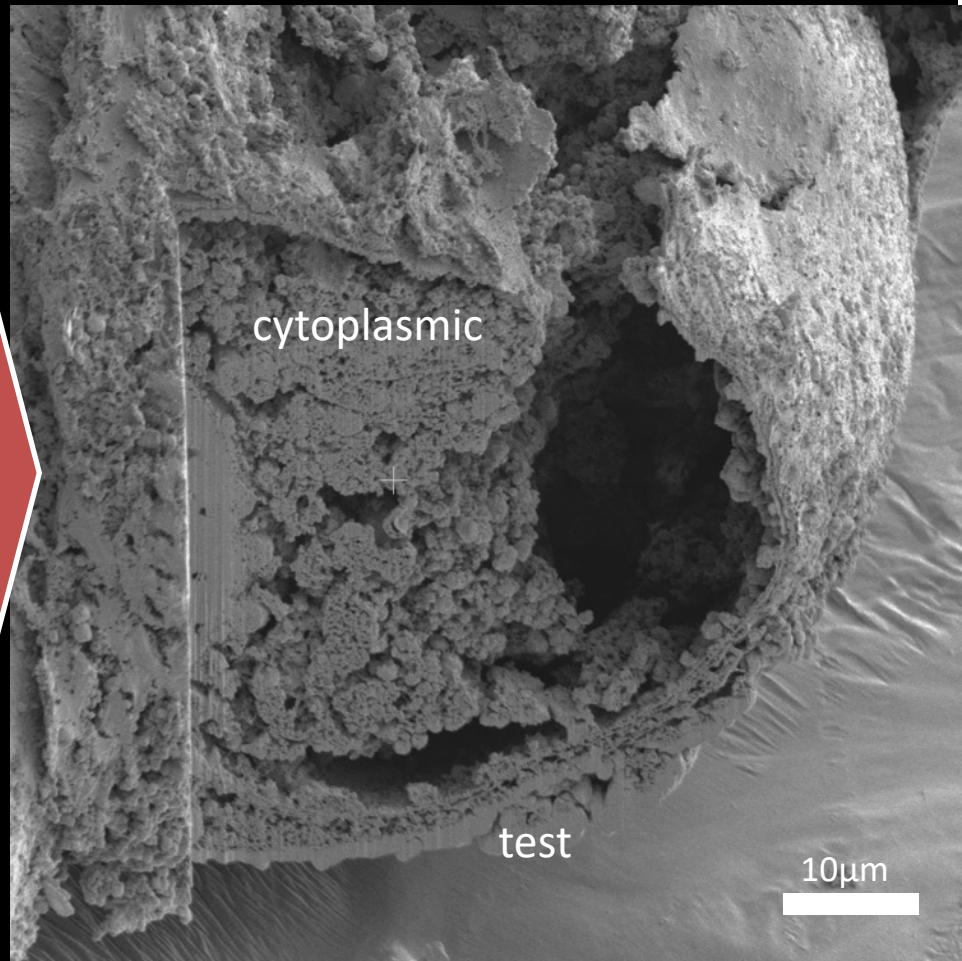
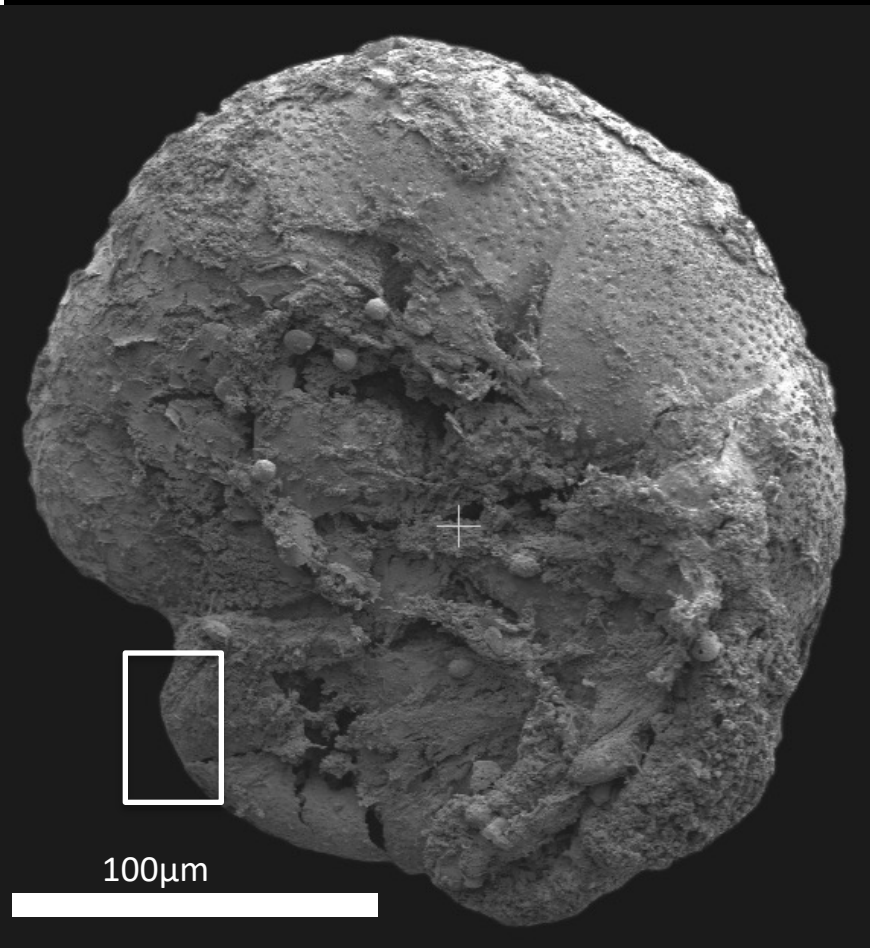
有孔虫の炭酸カルシウム殻形成は水素イオン排出がカギ
～海洋酸性化に対する予想外の耐性～



Proton pumping is key feature for
foraminiferal calcification

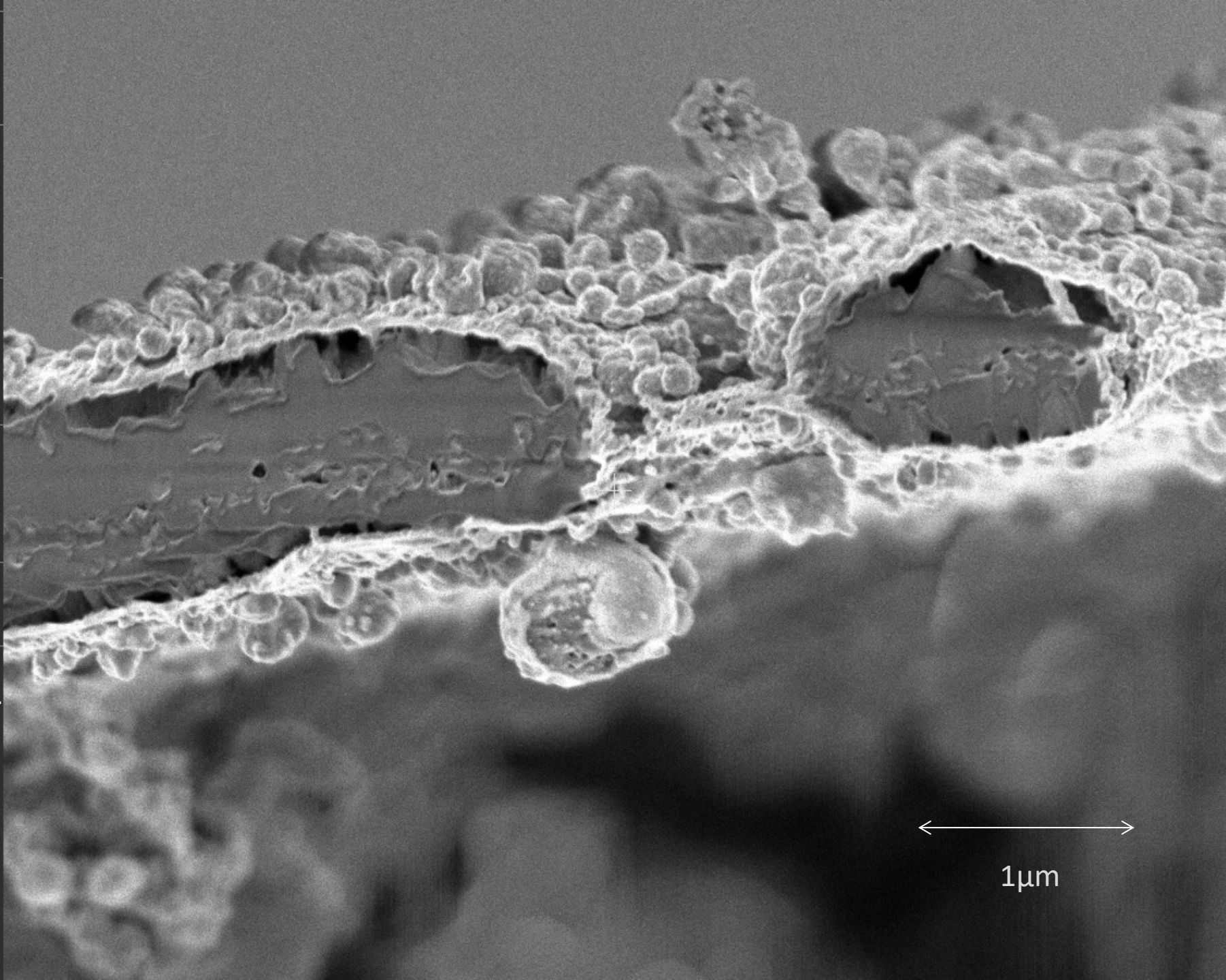


Nagai et al. (2018)



Both soft cytoplasm and hard test are cut at a single cross section by FIB.

curr
50 pA
mag
15 000 x
HFV
8.47 μm
WD
4.1 mm
det
TLD



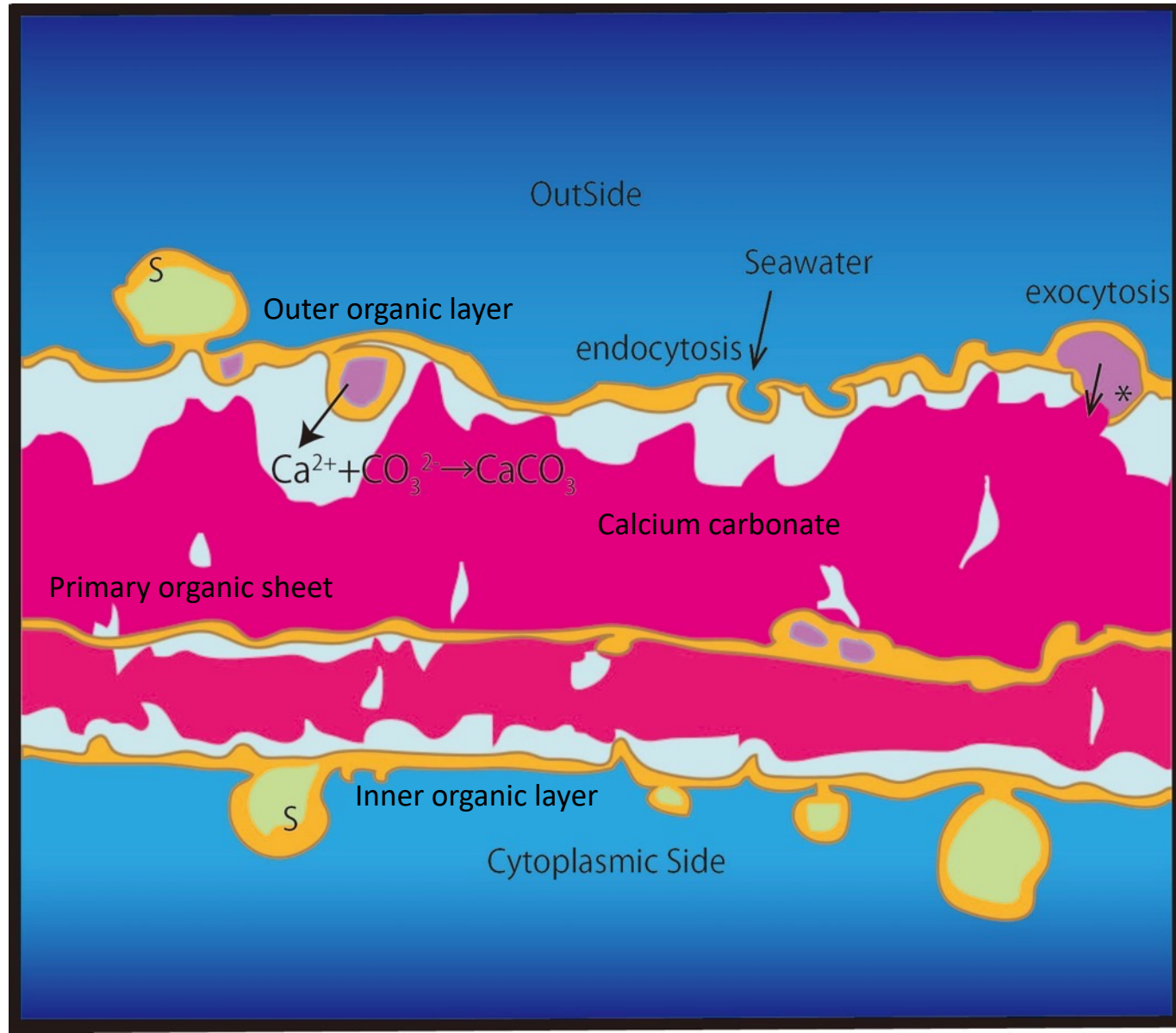
Schematic illustration of SOC (Site of Calcification)

There is a space between the membrane-like structure of the calcification site and the crystal.

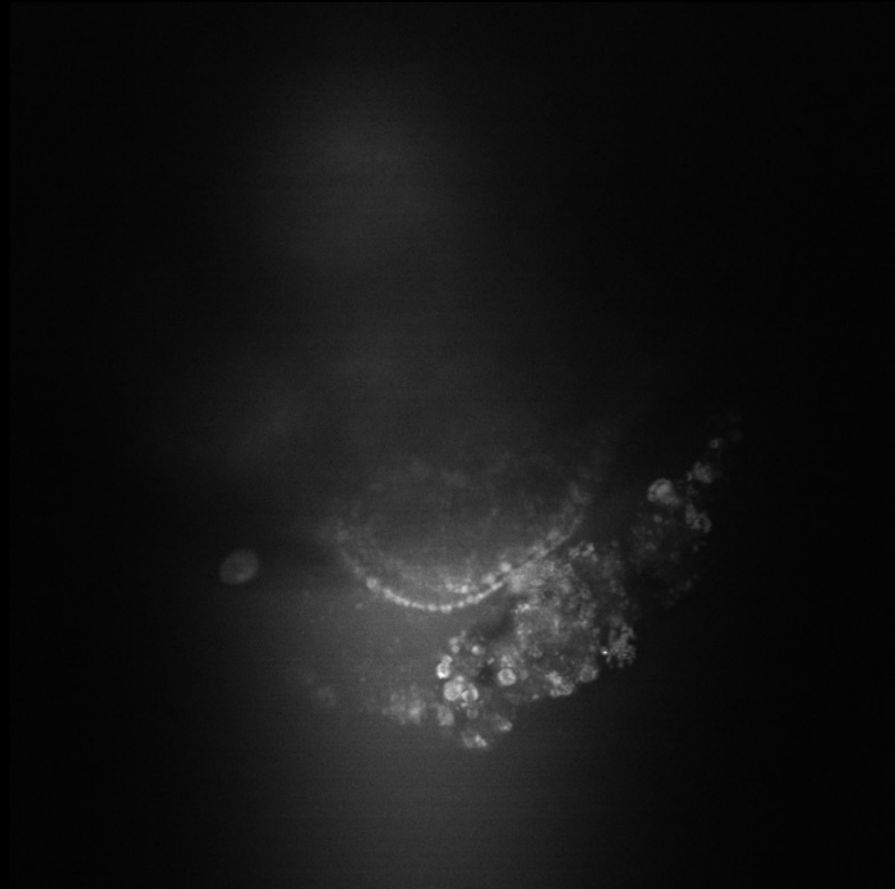
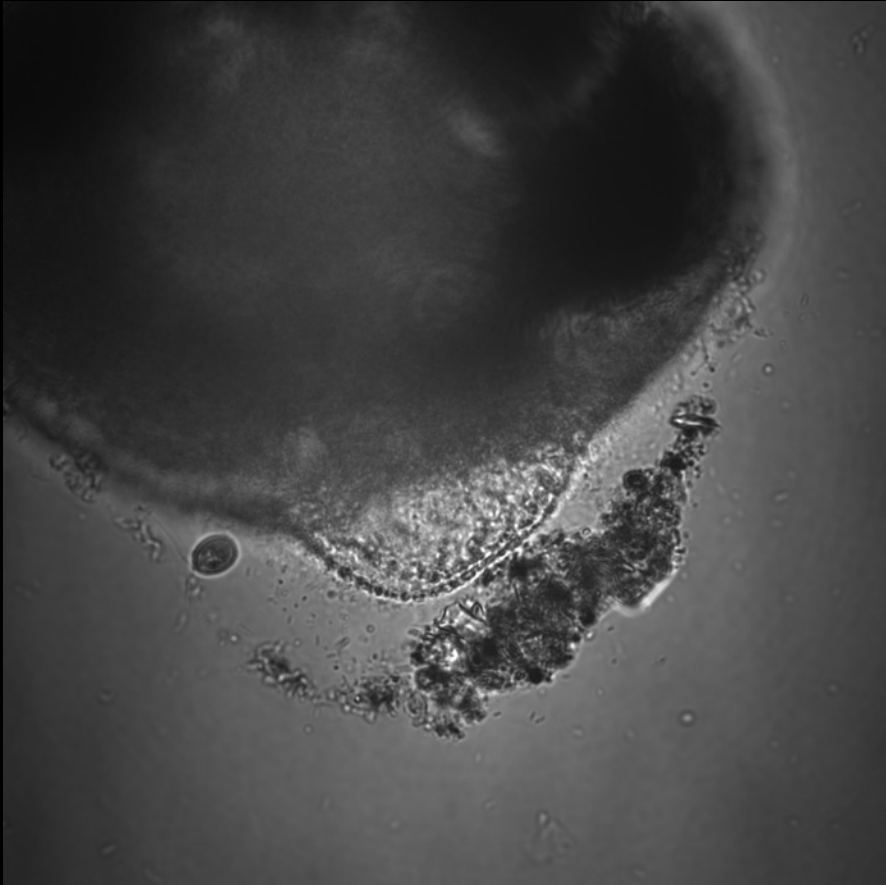
The interior of the spherical structure on the membrane-like structure is a cavity.

We found a structure that seawater was taken into the spherical structure of the external organic layer and then released.

It was observed that the crystal increased in thickness from the block shape to the layer shape.

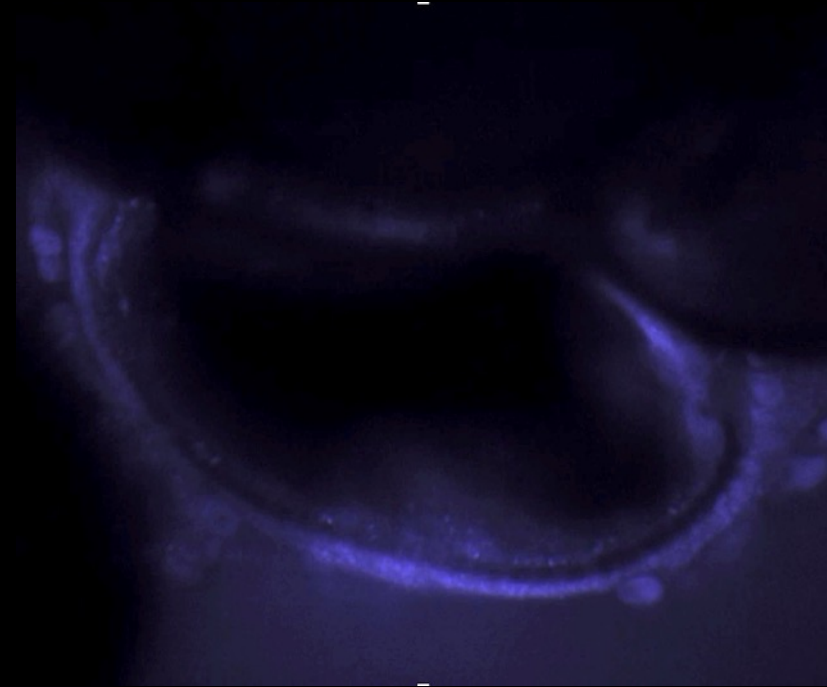
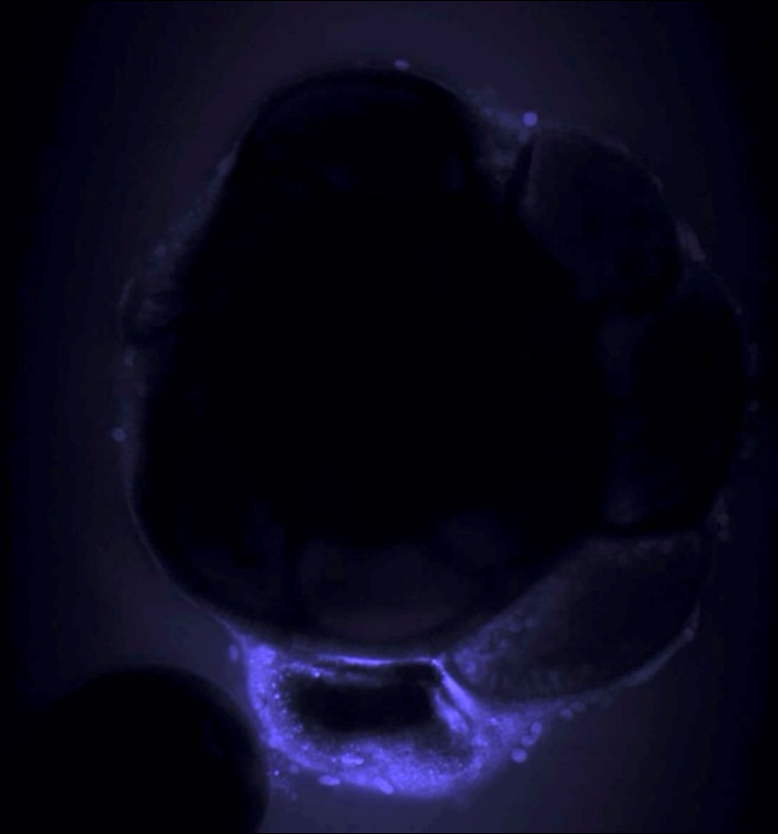


immunofluorescence staining of H^+ -ATPase antibody



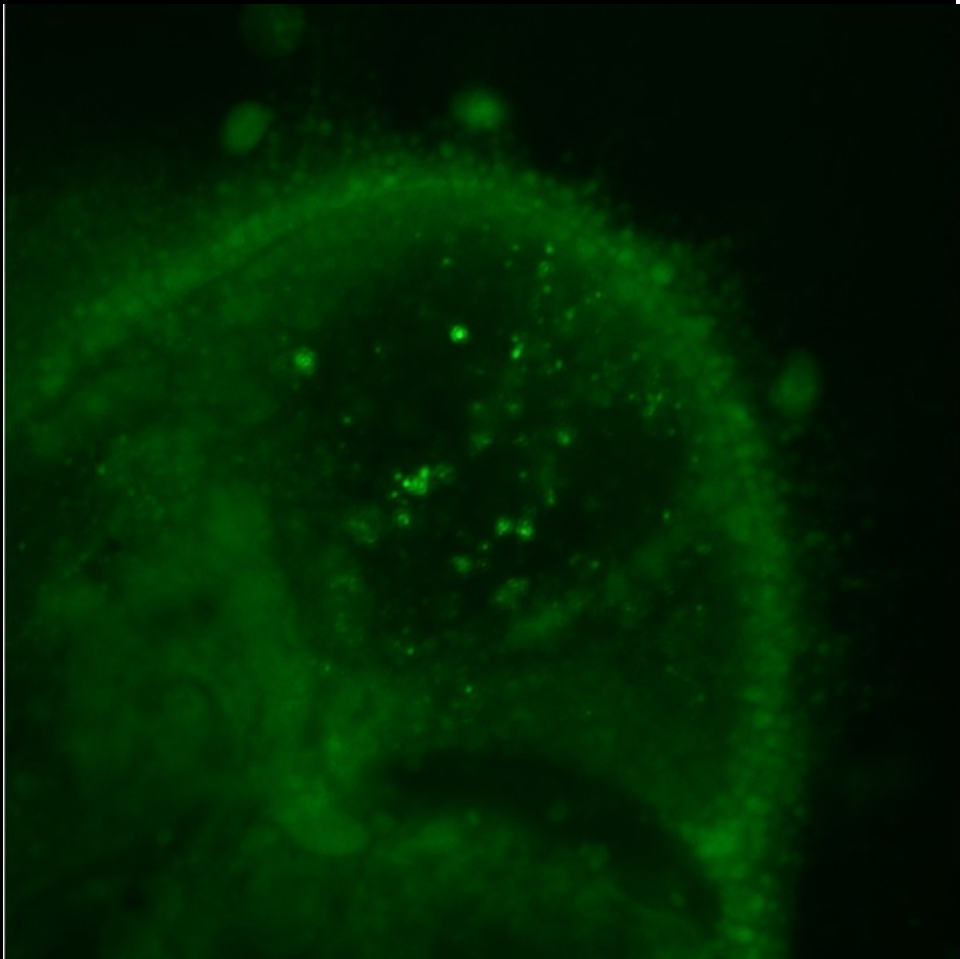
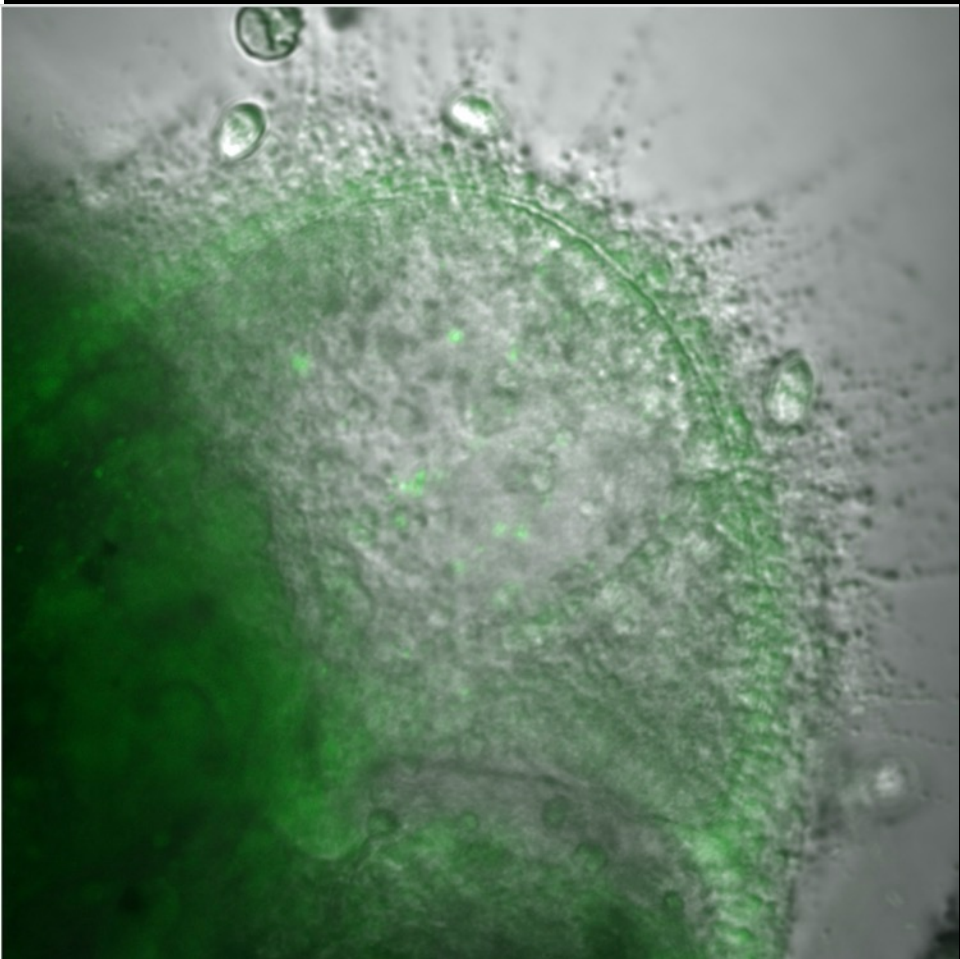
(Toyofuku, Nagai and Ikuta MS)

immunofluorescence staining of H^+ -ATPase antibody



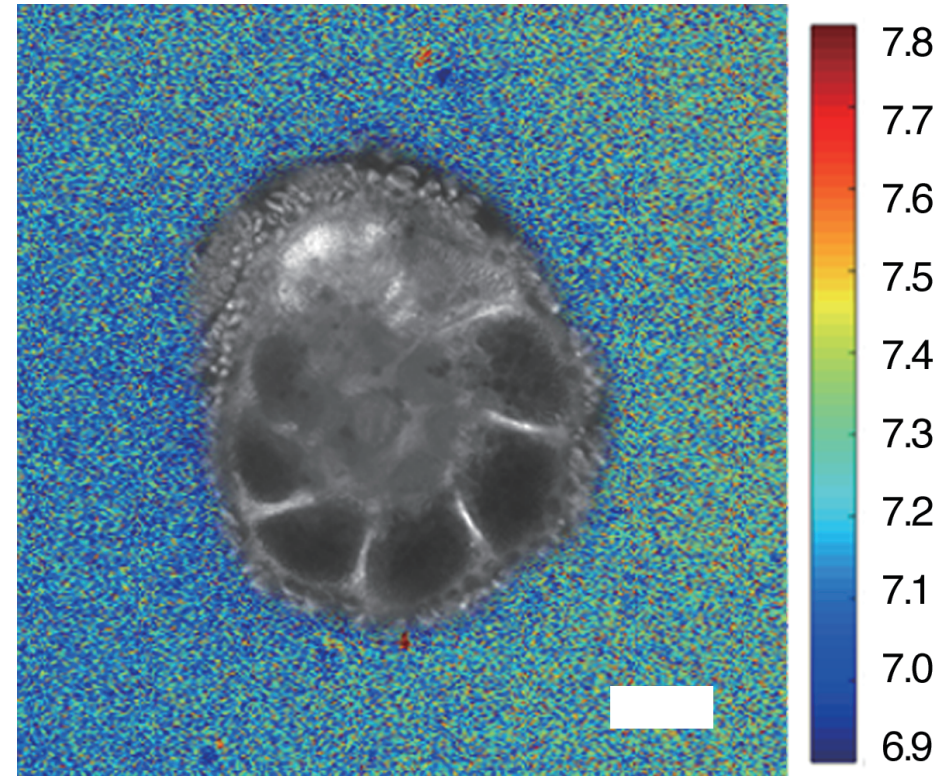
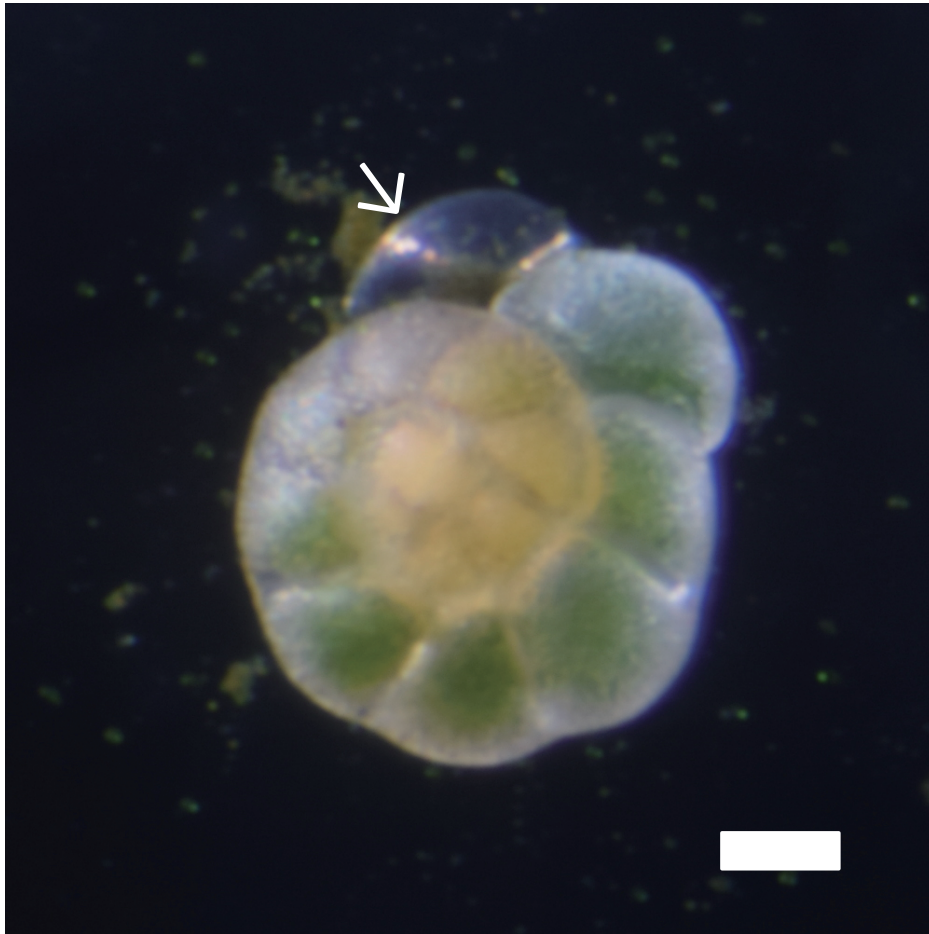
(Toyofuku, Nagai and Ikuta MS)

immunofluorescence staining of H^+ -ATPase antibody



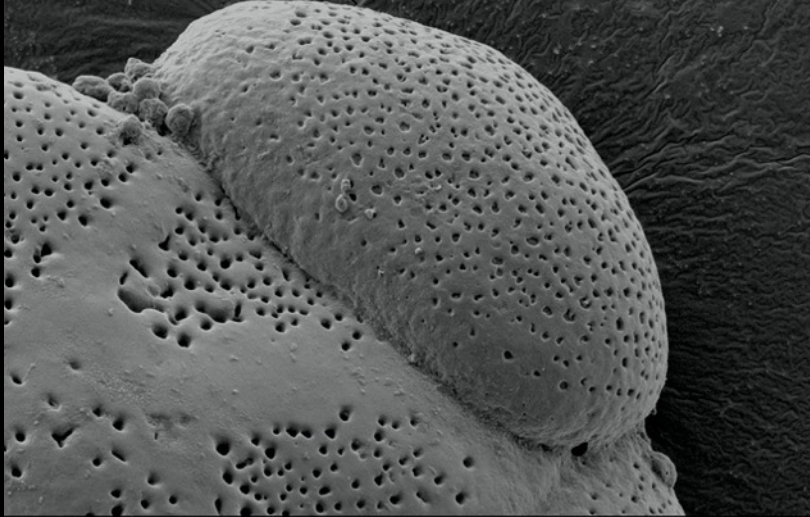
(Toyofuku, Nagai and Ikuta MS)

pH gradients disappear with H^+ -ATPase inhibitor= bafilomycin

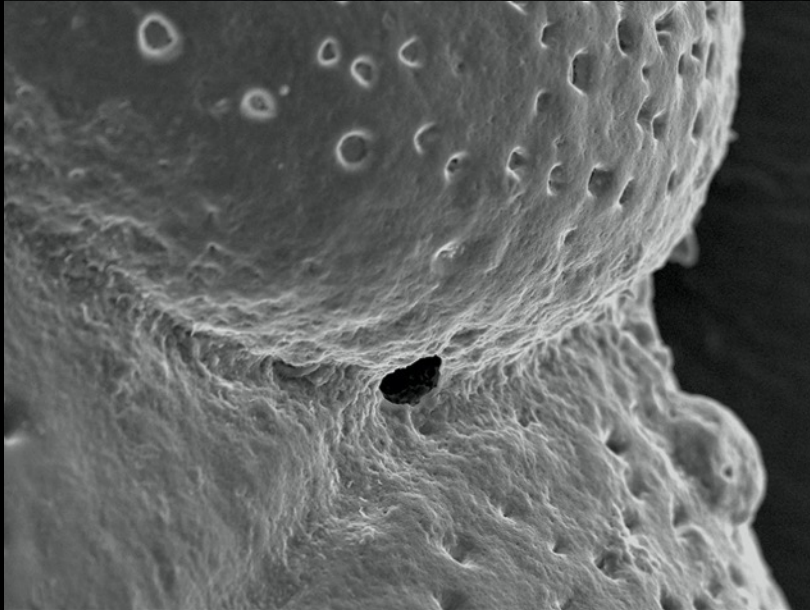


Inhibitor experiments

Bafilomycin=proton pump inhibitor (N=5)
 $1 \times 10^{-6} \text{M}$

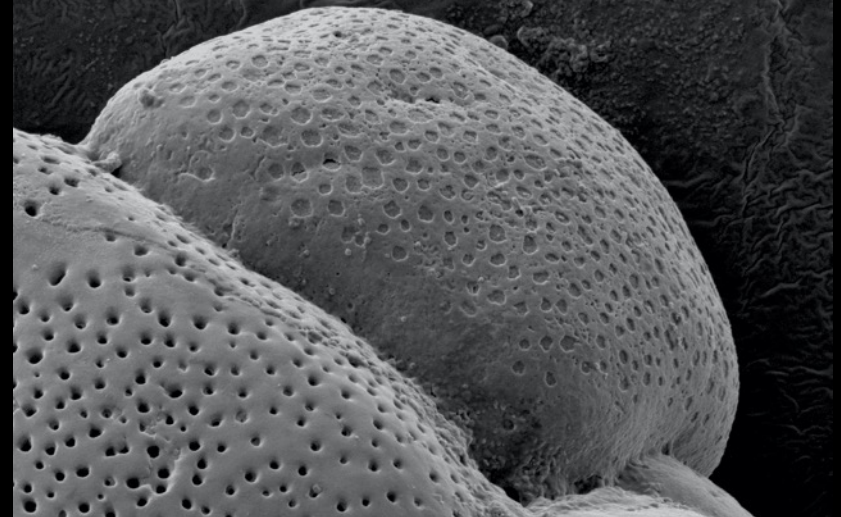


NONE LEI 5.0kV X800 WD 8.0mm 10 μm

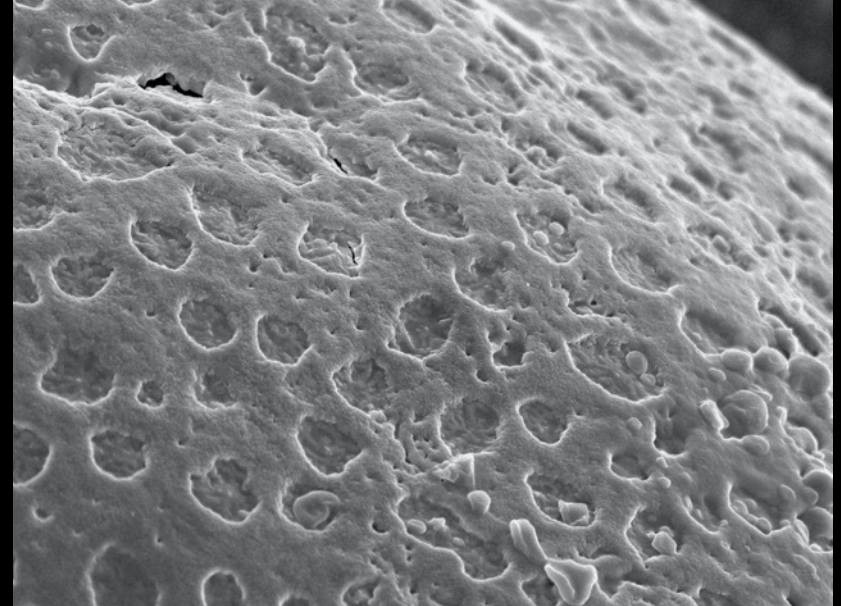


NONE SEI 5.0kV X3,000 WD 7.8mm 1 μm

Acetazolamide=carbonate anhydrase inhibitor (N=5)
 $0.5 \times 10^{-6} \text{M}$



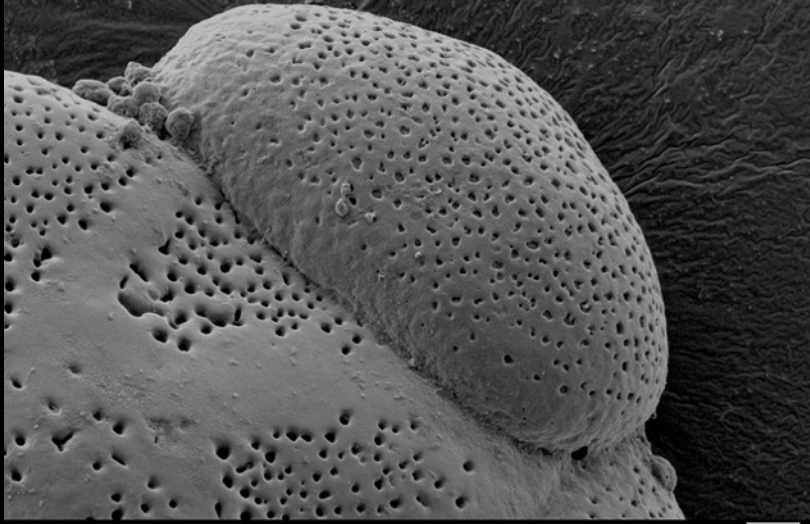
NONE LEI 5.0kV X1,100 WD 15.0mm 10 μm



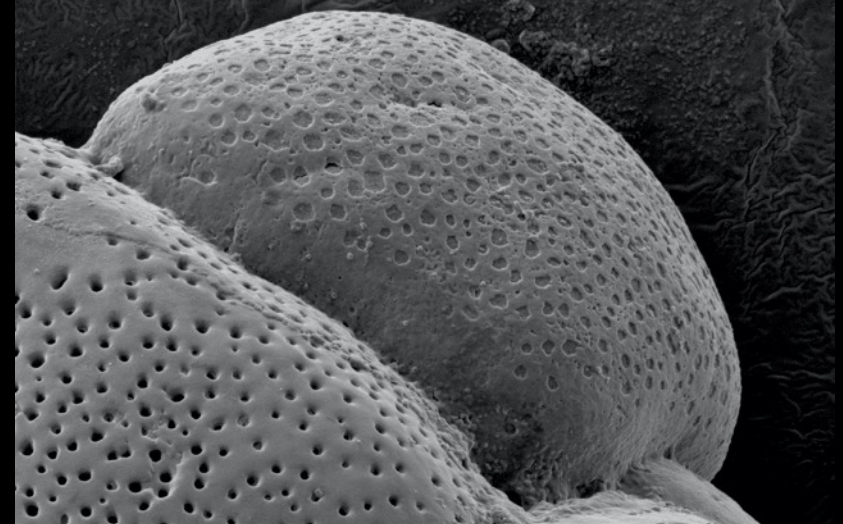
NONE SEI 5.0kV X5,000 WD 15.1mm 1 μm

Inhibitor experiments

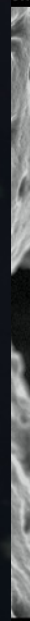
Bafilomycin=proton pump inhibitor



Acetazolamide=carbonate anhydrase inhibitor

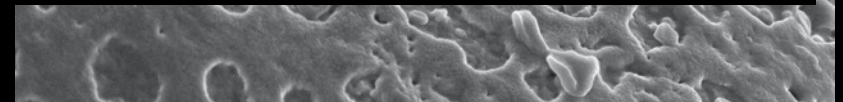


0mm



8mm 1 μm

The chamber joint (suture) is weak.
Shell thickening is not sufficiently advanced.
There is calcium carbonate precipitation.
So far, no systematic differences have been found for influences with each inhibitor.
The results suggest that calcium uptake is being made and that a small amount of carbon source is also being introduced.



NONE

SEI

5.0kV

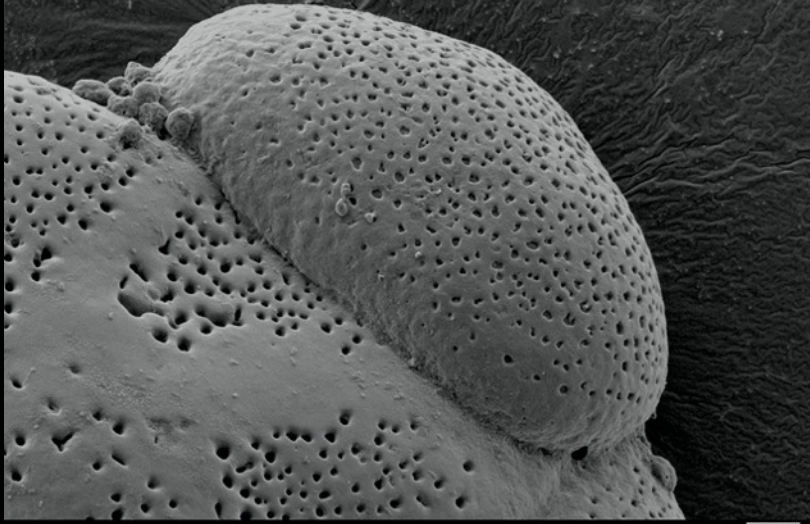
X5,000

WD 15.1mm

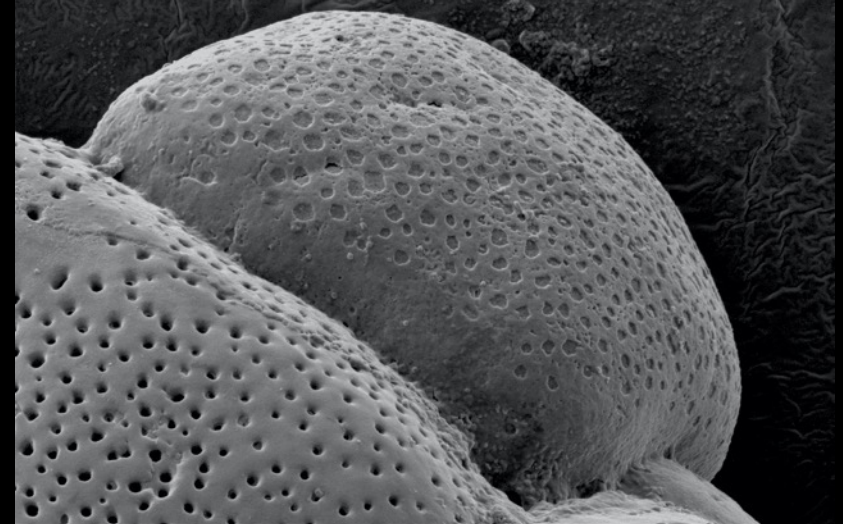
1 μm

Inhibitor experiments

Bafilomycin=proton pump inhibitor



Acetazolamide=carbonate anhydrase inhibitor

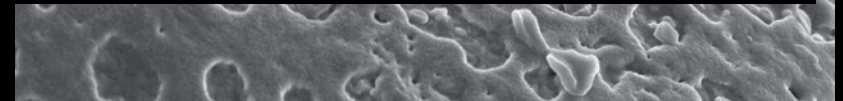


0mm



8mm 1 μm

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NONE

SEI

5.0kV

X5,000

WD 15.1mm

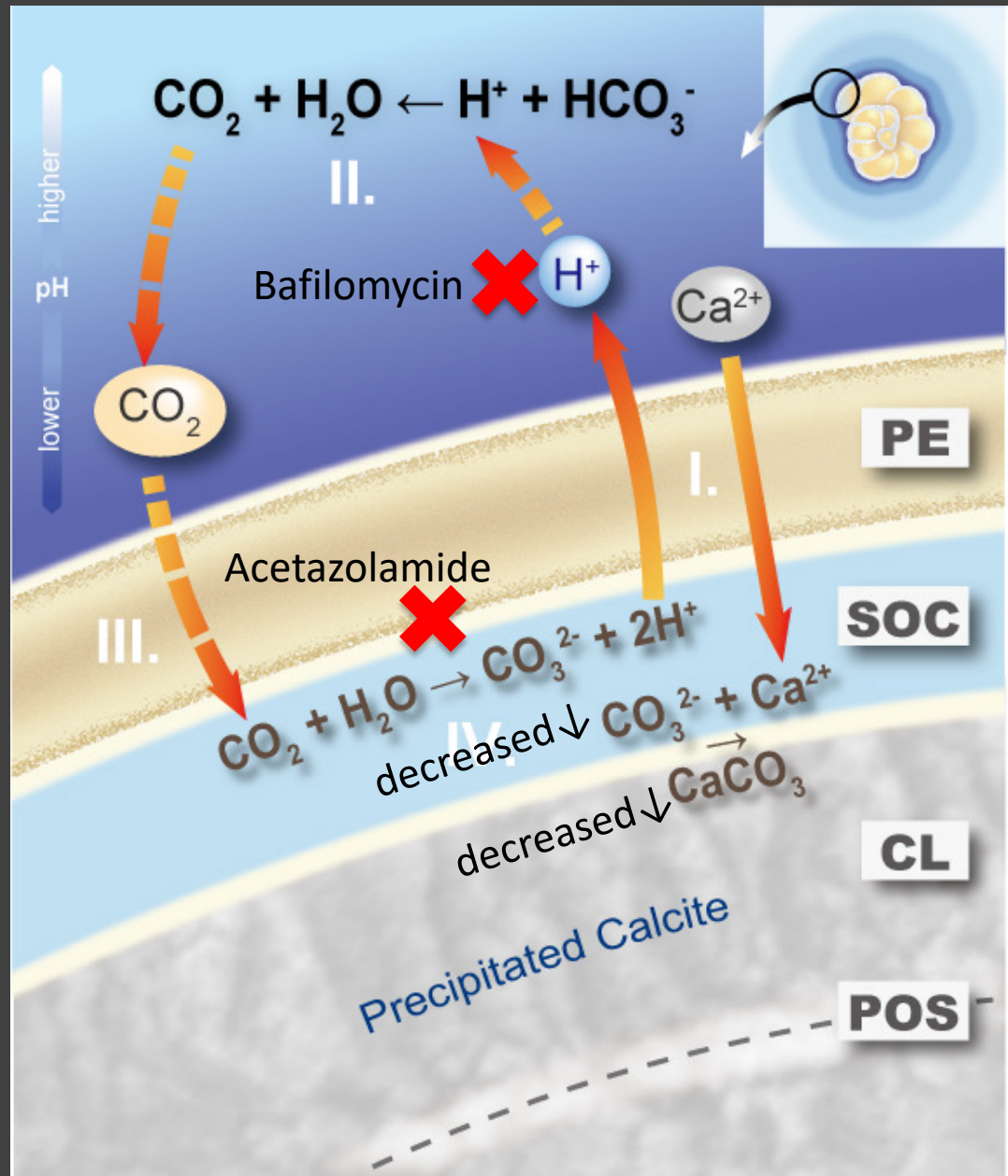
1 μm

Summary

Both inhibitors had a significant effect on shell growth. Both limit the carbon source, although the assumed sites of action are different.

As for calcium ions, they seem to be taken up. It is interesting to note that a certain amount of shells are being deposited, although carbon uptake must also be limited.

It may be possible that they are utilizing naturally existing carbonate ions or even bicarbonate ions to the extent that they are not relying on enzymes.



Thank you for your attention

