



# Phosphatised microstructures in ancient and modern phosphorites

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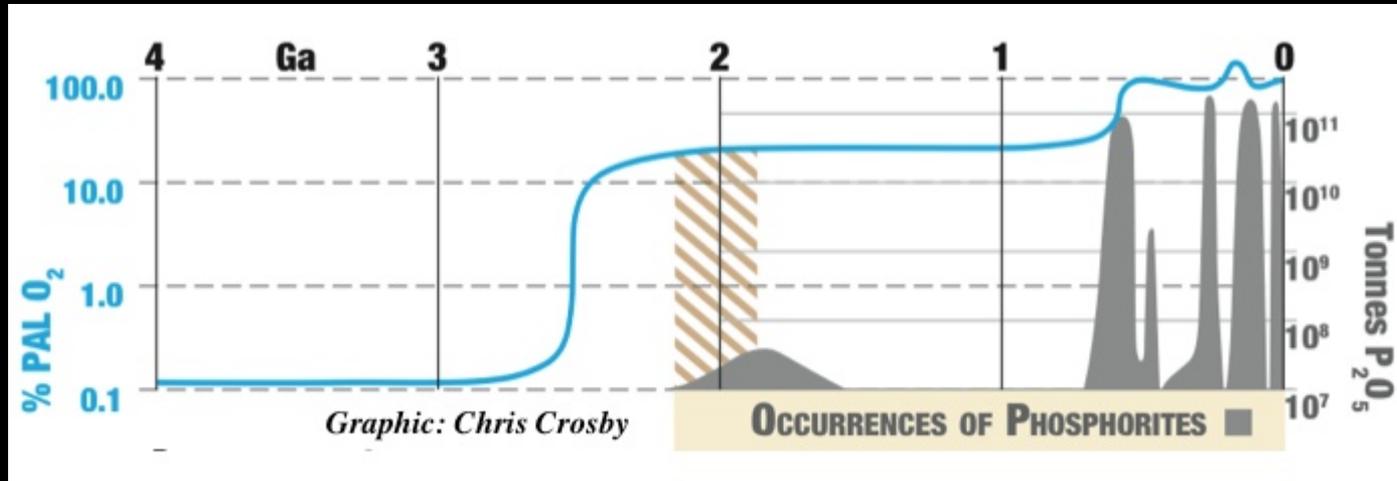
UNIVERSITY OF TARTU



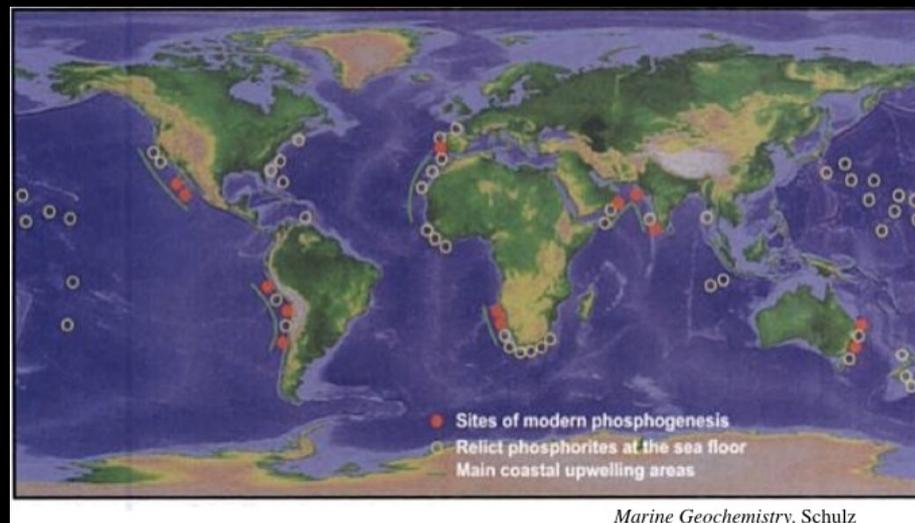
UNAM  
UNIVERSITY OF NAMIBIA

# Phosphogenesis

- Occurs as distinct episodes in geologic time.

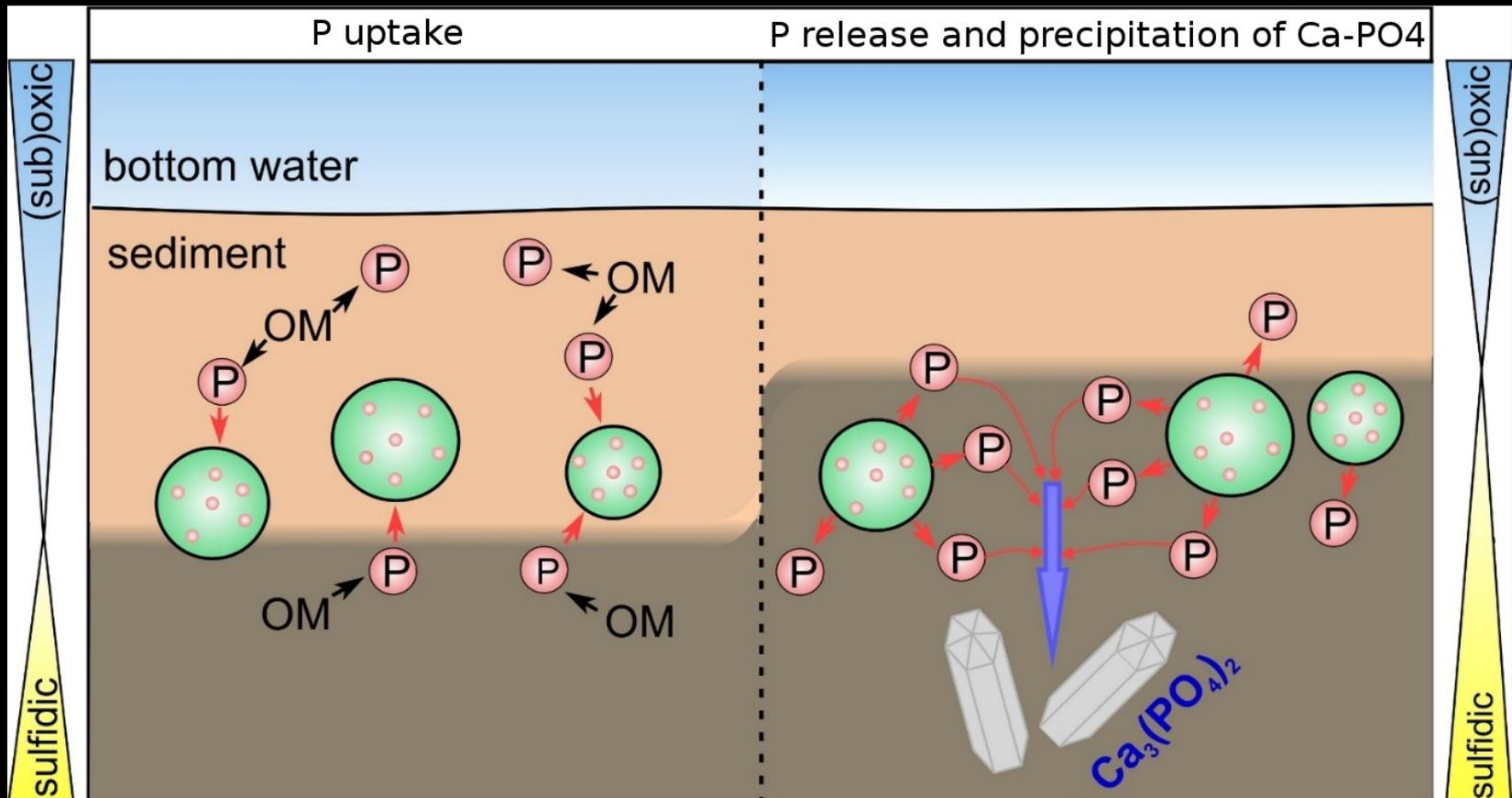


- Wide-spread in modern upwelling zones.



# Phosphogenesis

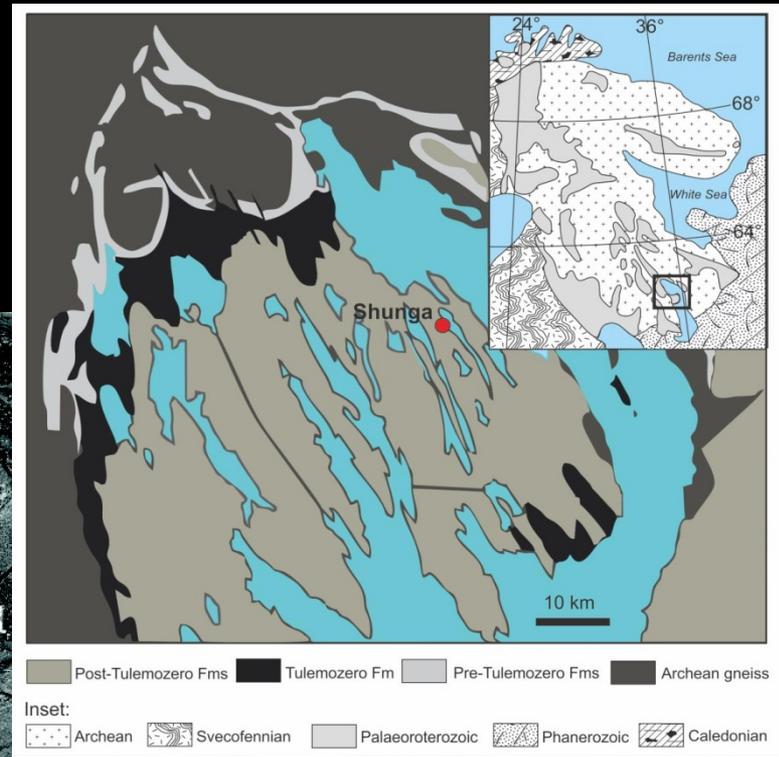
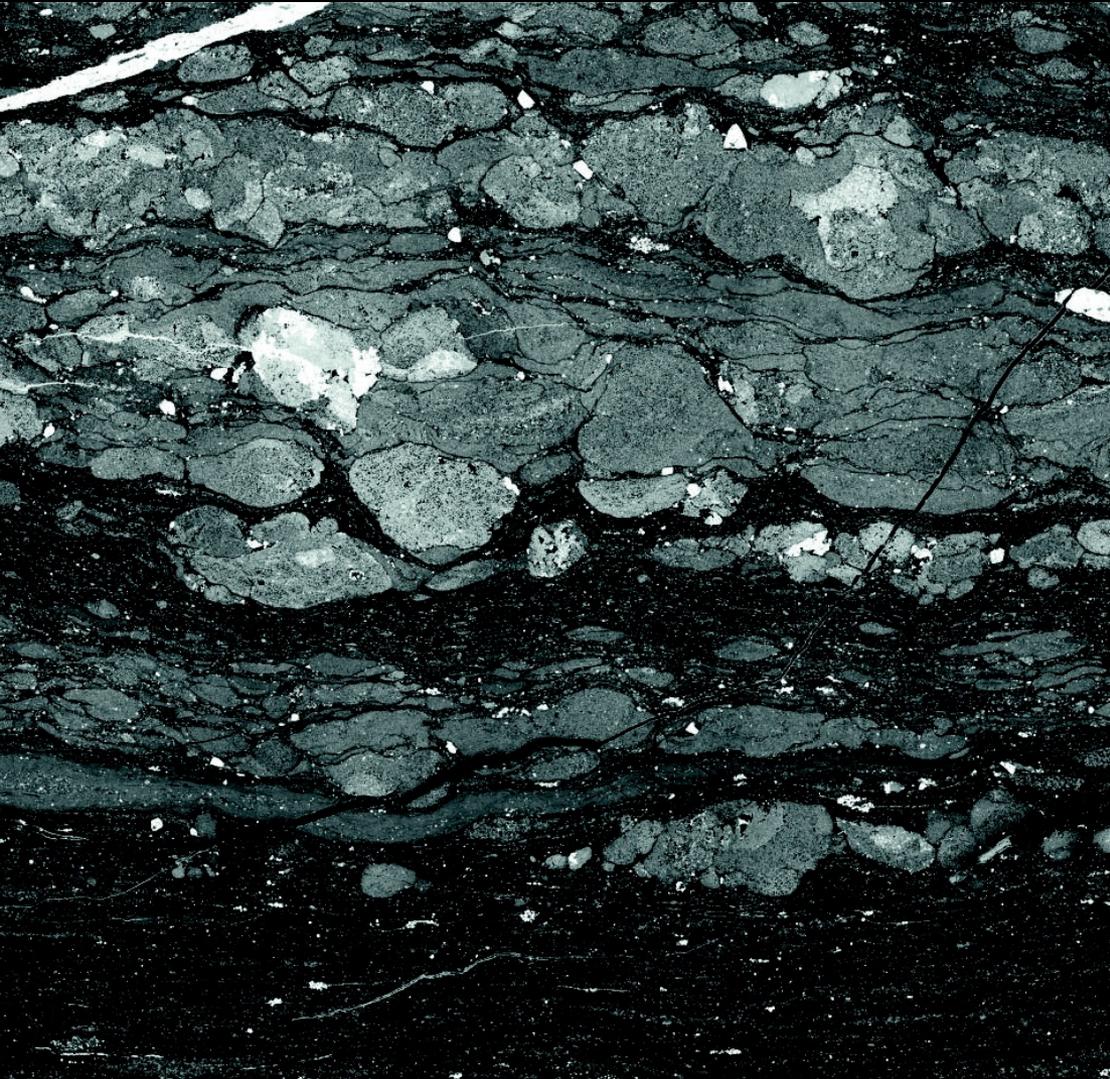
- The concentration mechanism is strongly microbially mediated (S-oxidising bacteria).



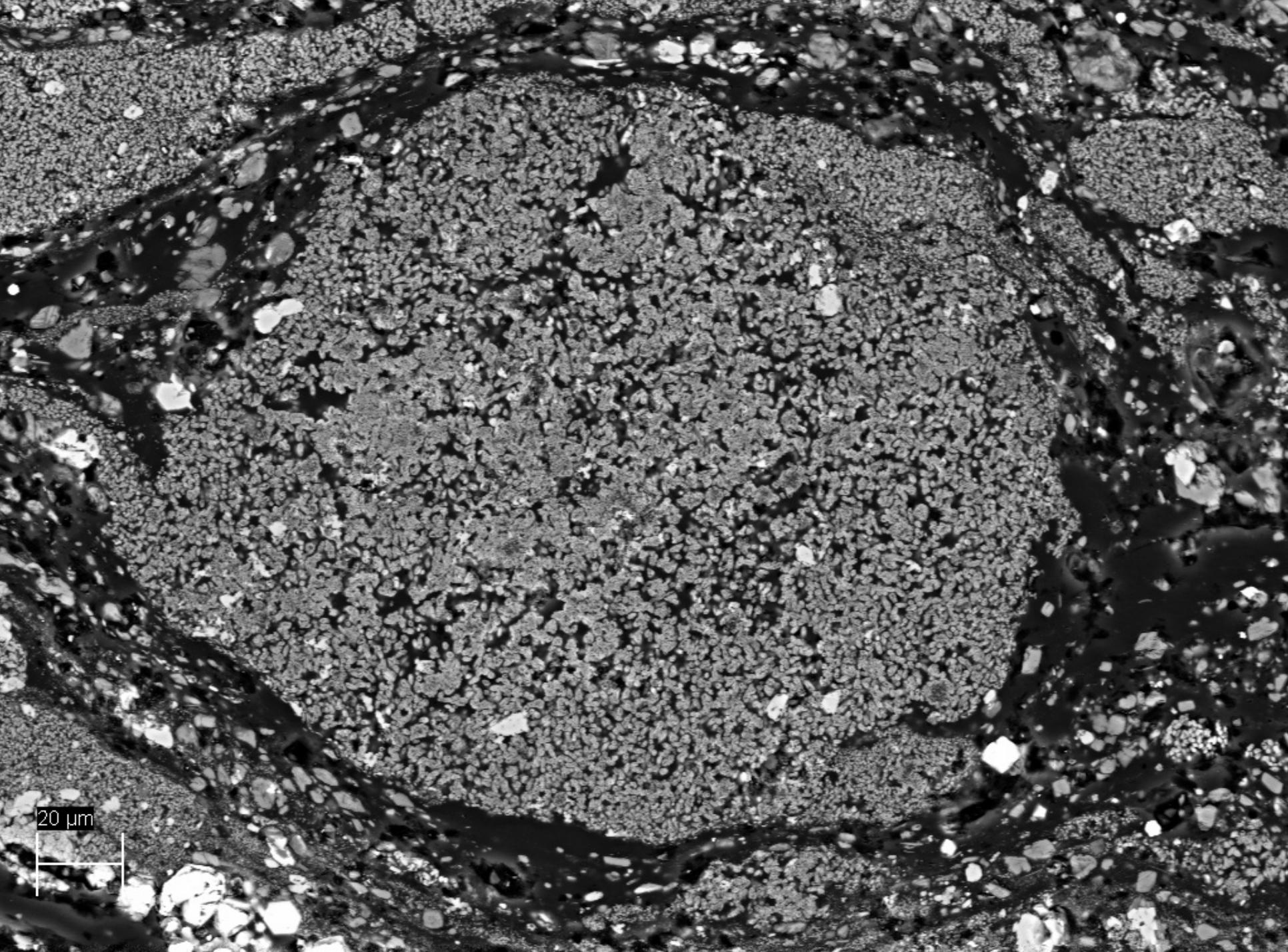
# Goals

- Fine-grained comparison of ancient and modern phosphorites.
- Identify potential remains of microbial communities.
- Implications for the interpretation of other ancient phosphorites.

# Russian Karelia, 2.0 billion yr ago...

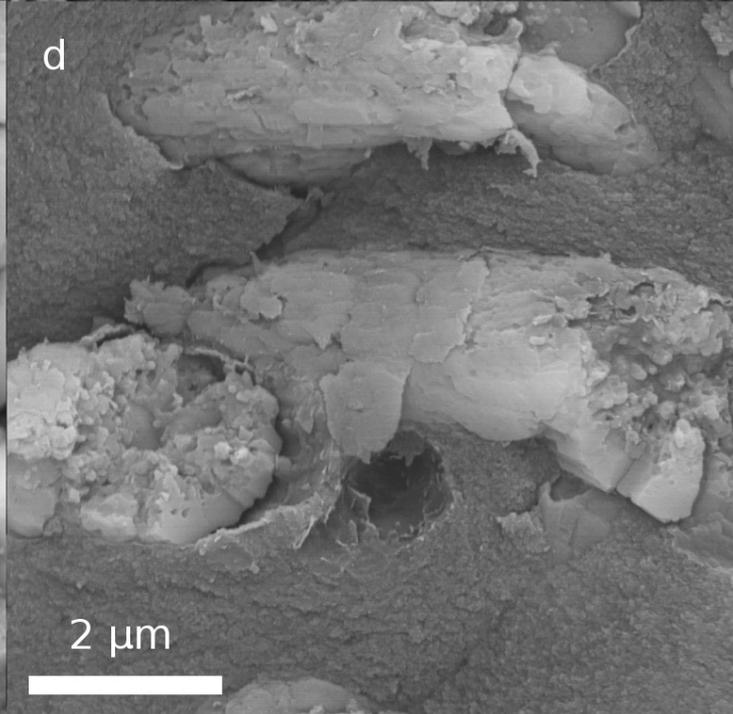
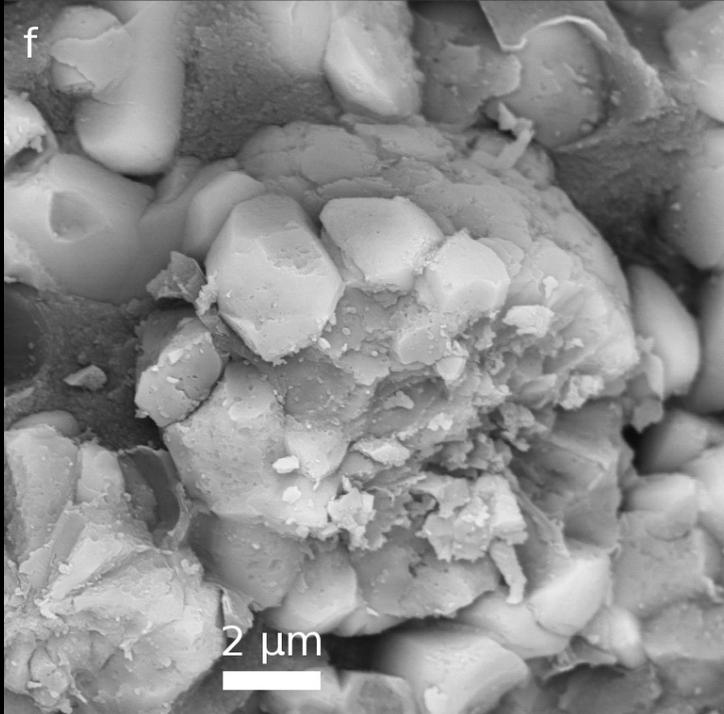
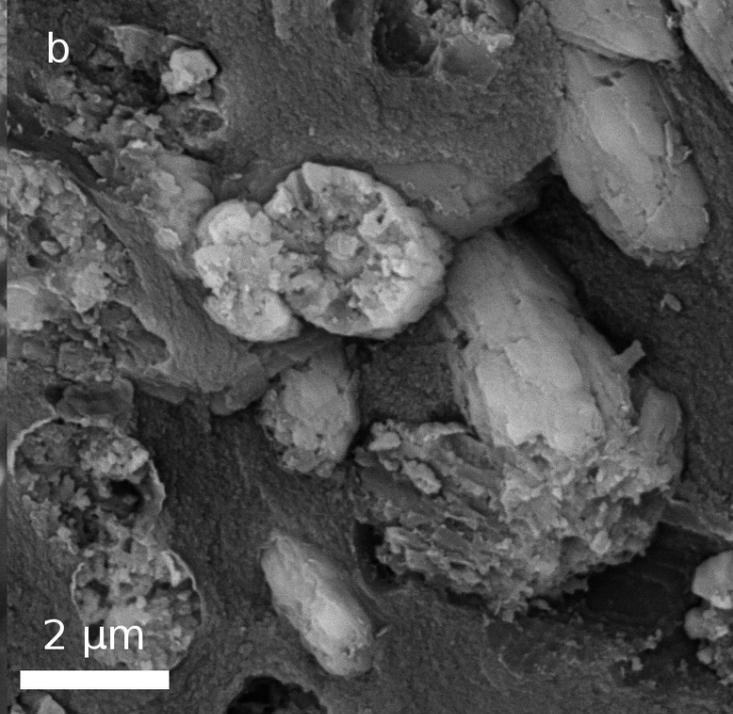
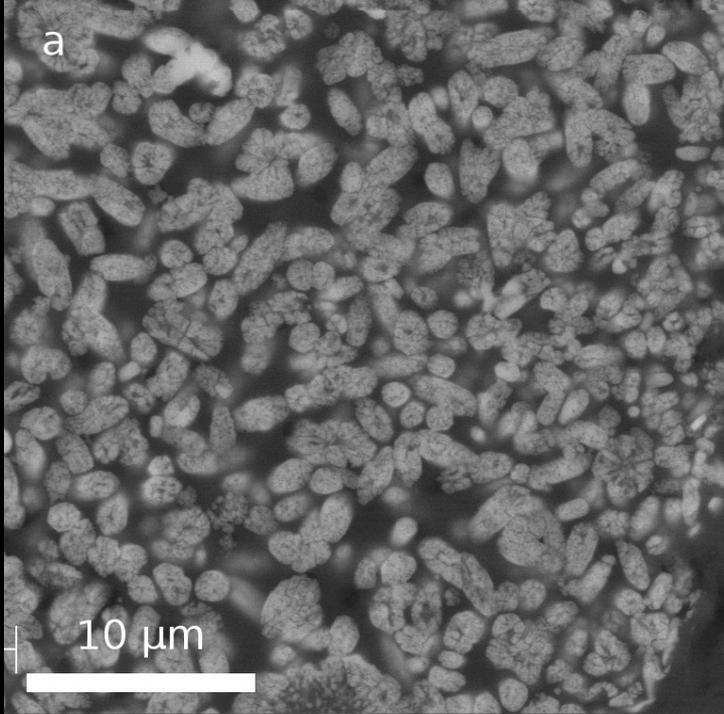


2 mm

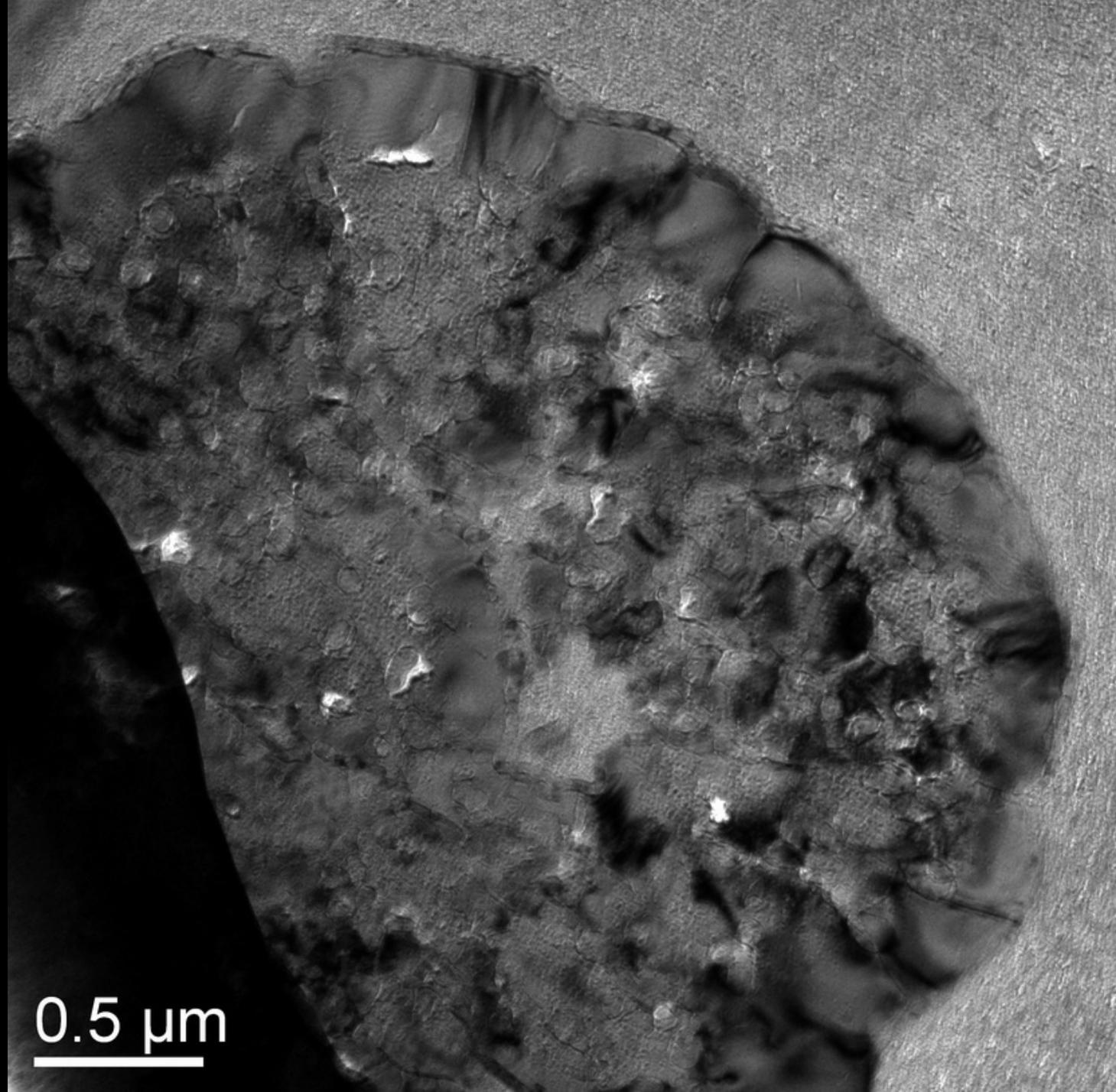


20 μm

# Cylindrical microstructures



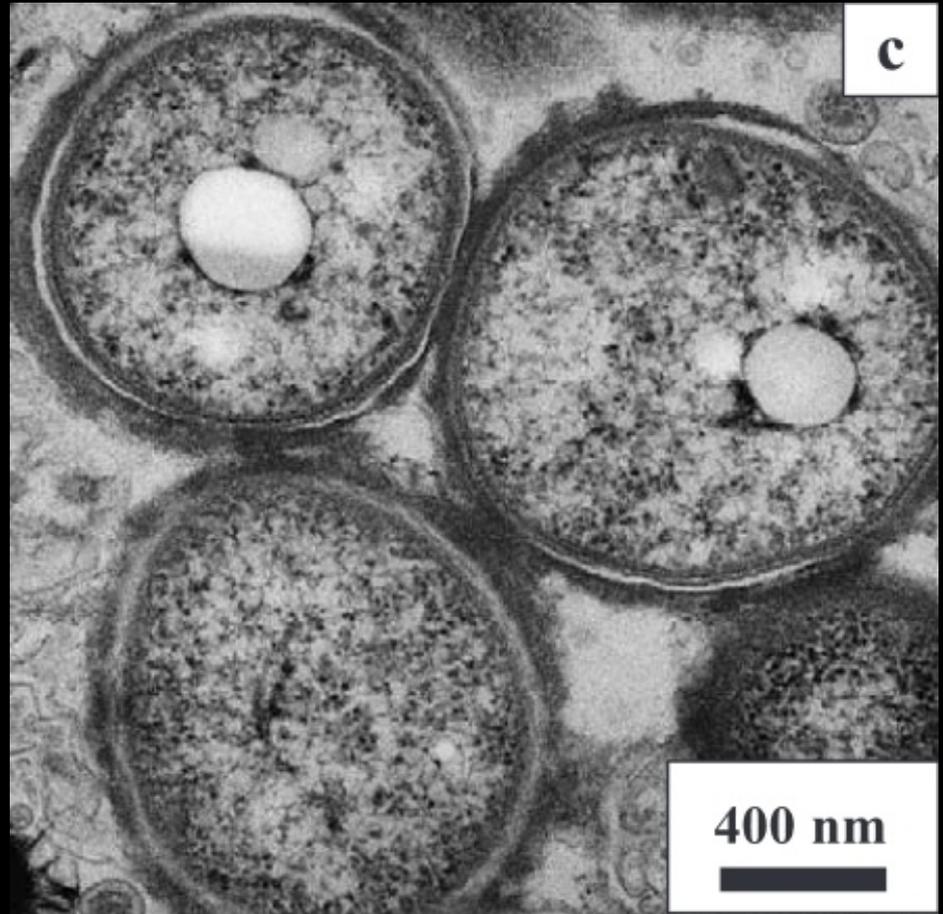
# TEM - nanostructure



0.5  $\mu\text{m}$

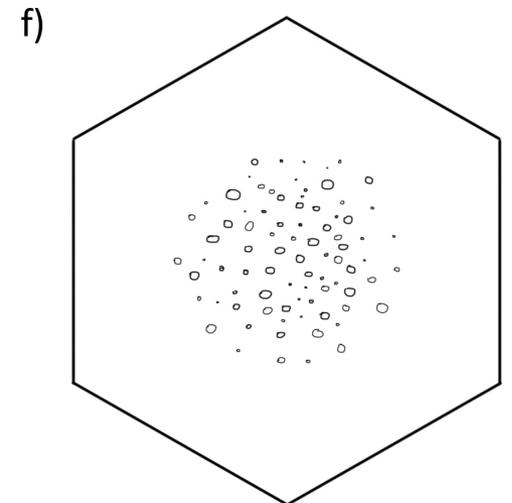
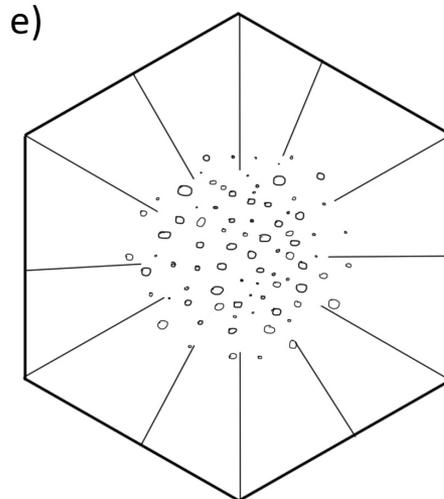
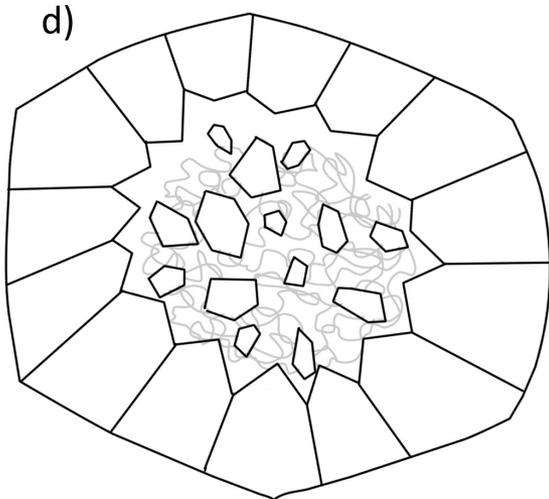
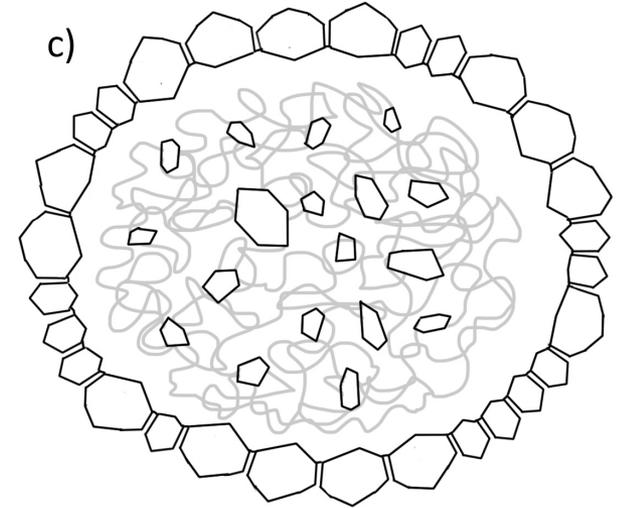
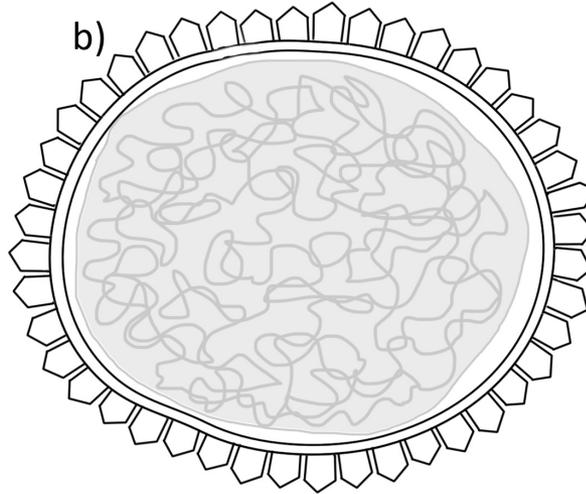
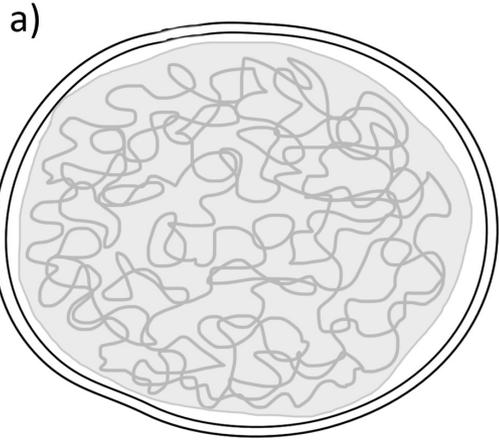
# Fossils?

- Phosphate minerals like to precipitate on nucleation templates.
- Cell membranes may act as such.



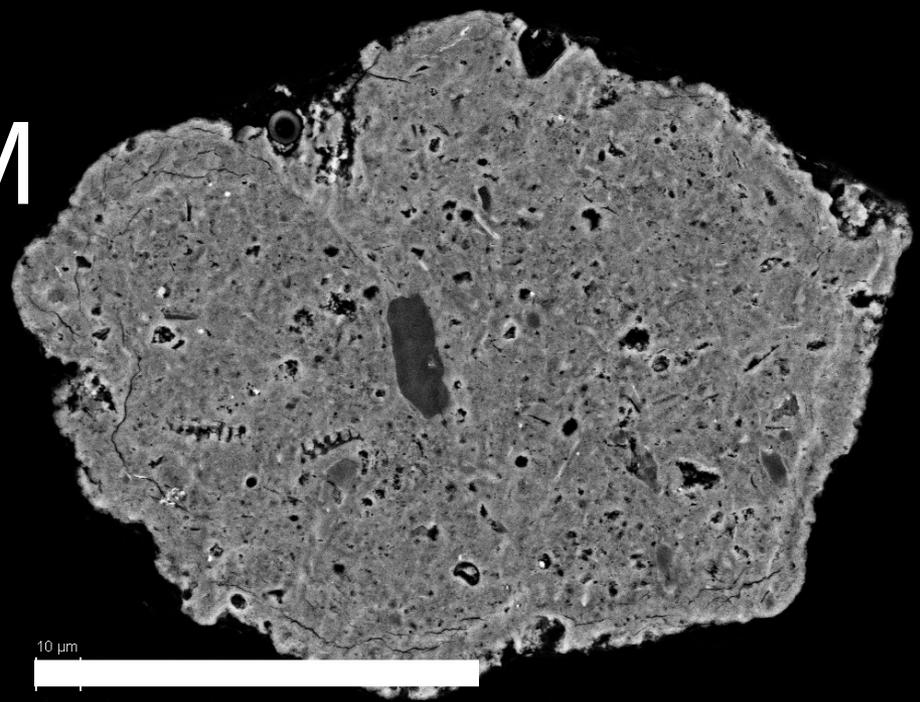
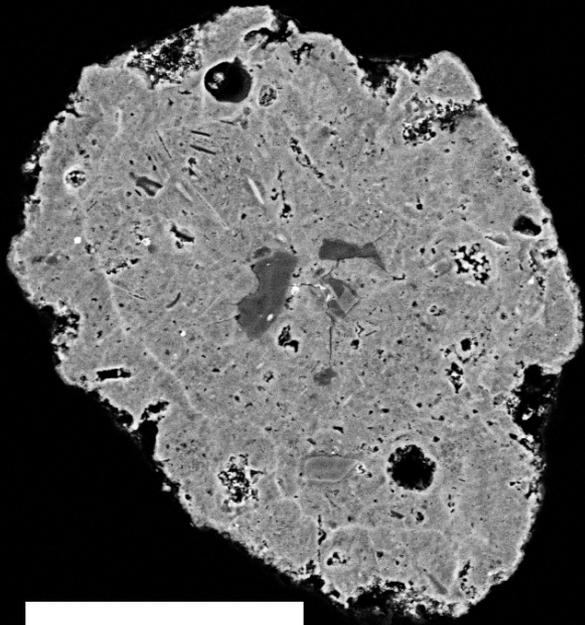
Benzerara (2004)

# Fossilisation and recrystallisation



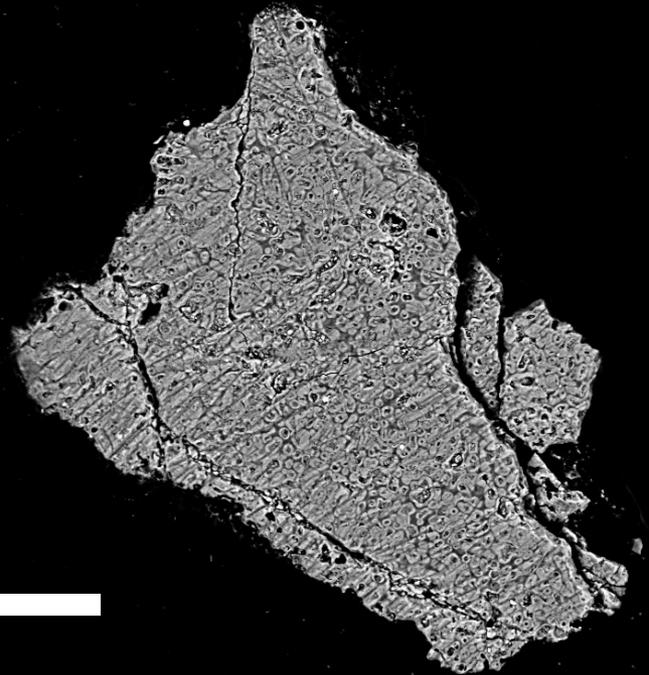
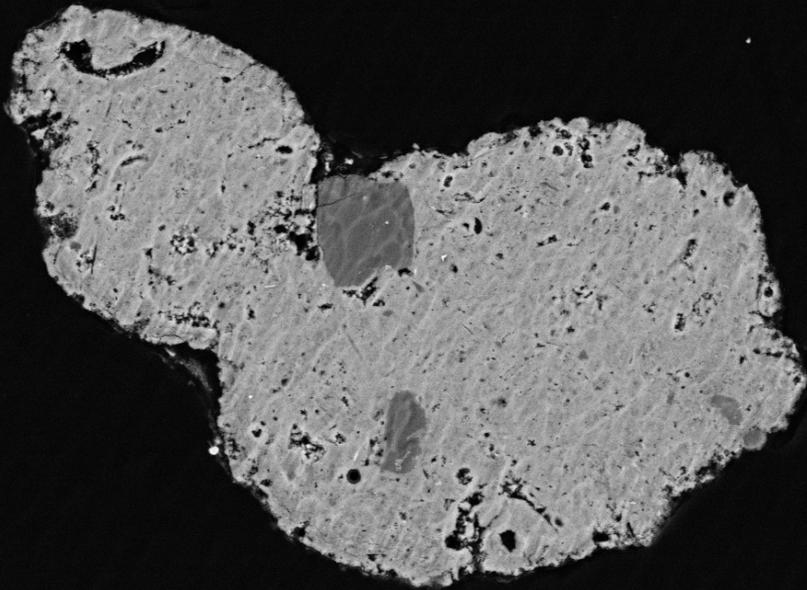


SEM



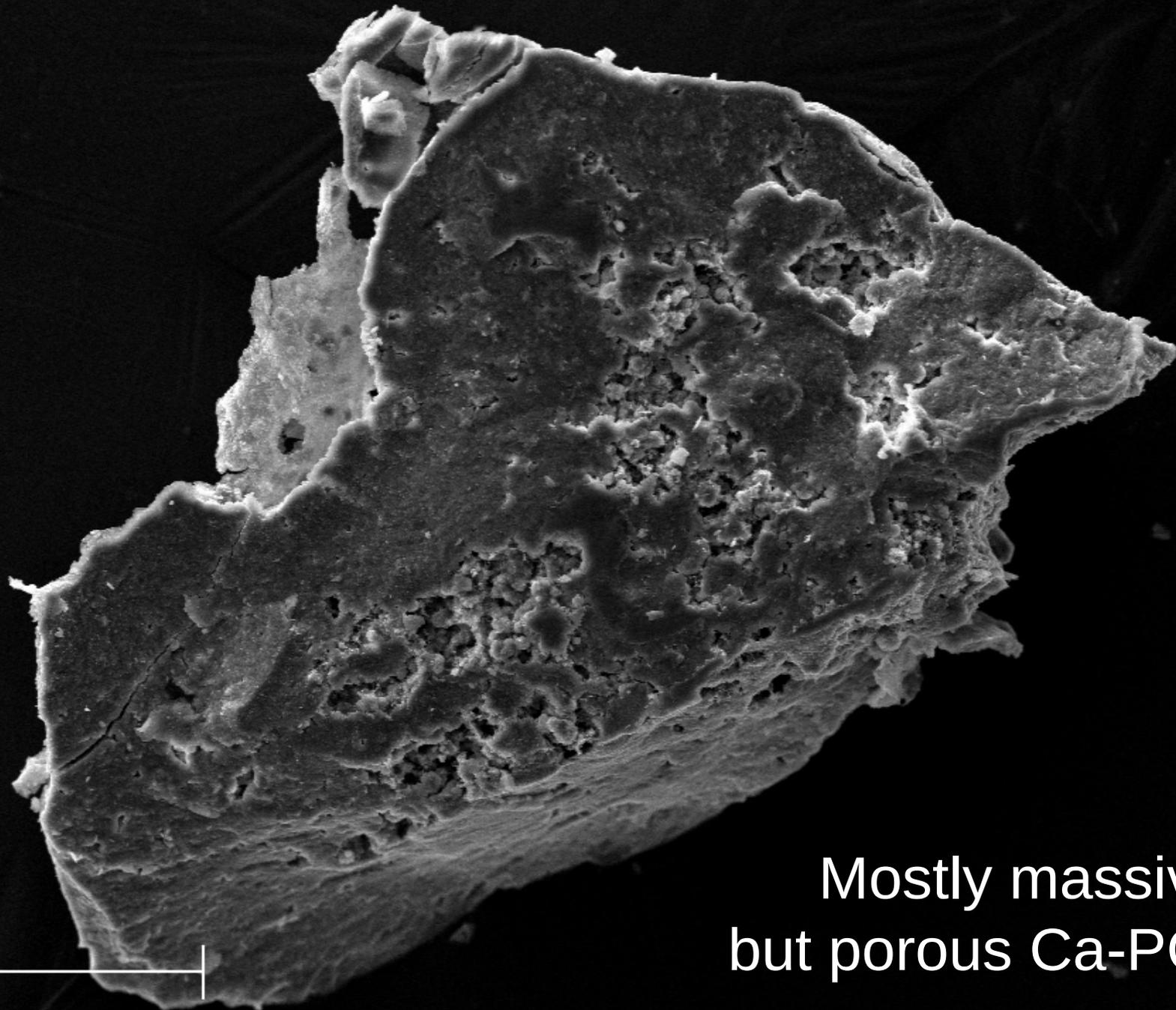
20  $\mu$ m

10  $\mu$ m



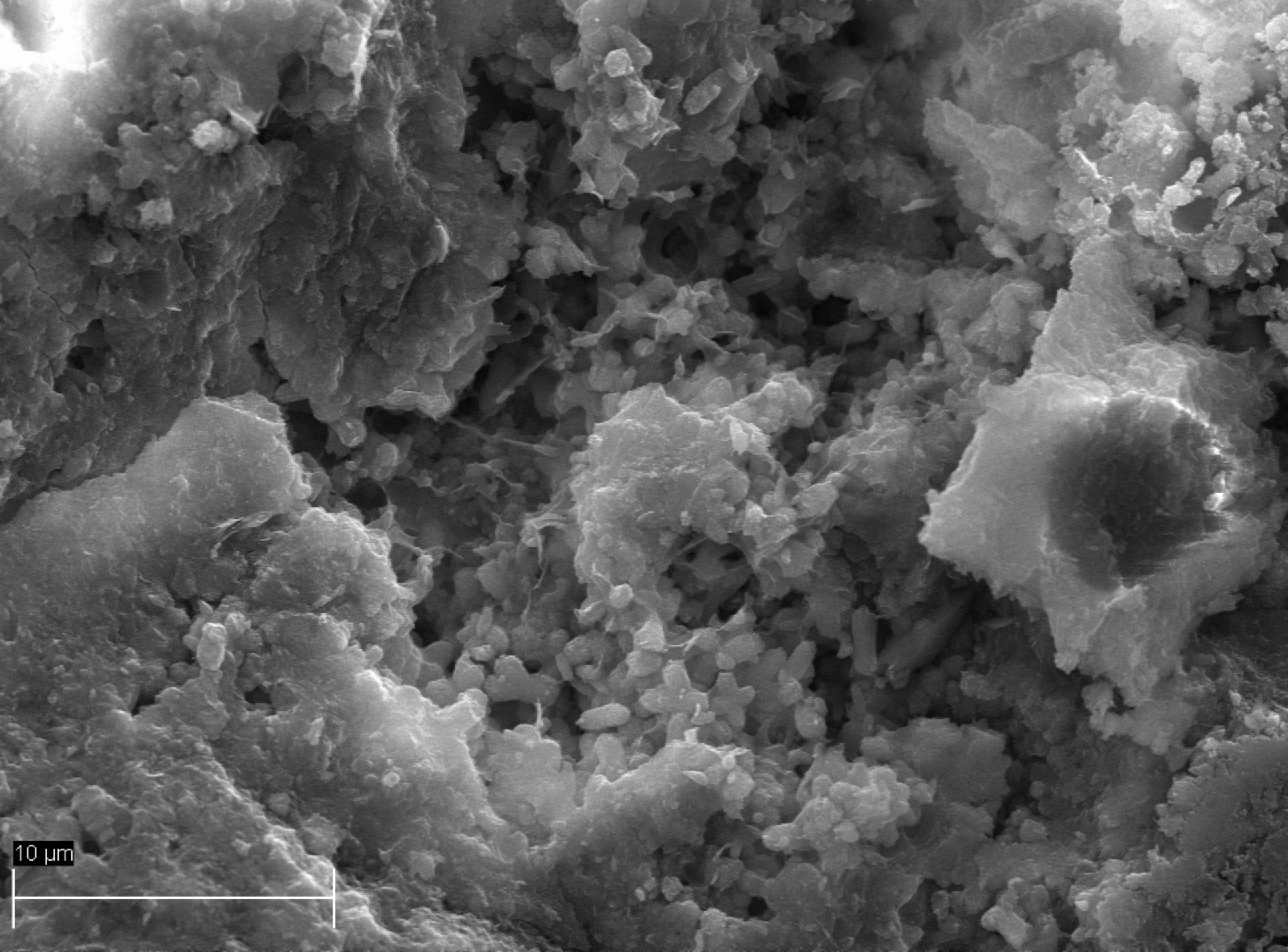
20  $\mu$ m

10  $\mu$ m



Mostly massive,  
but porous Ca-PO4

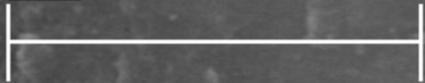
100  $\mu\text{m}$

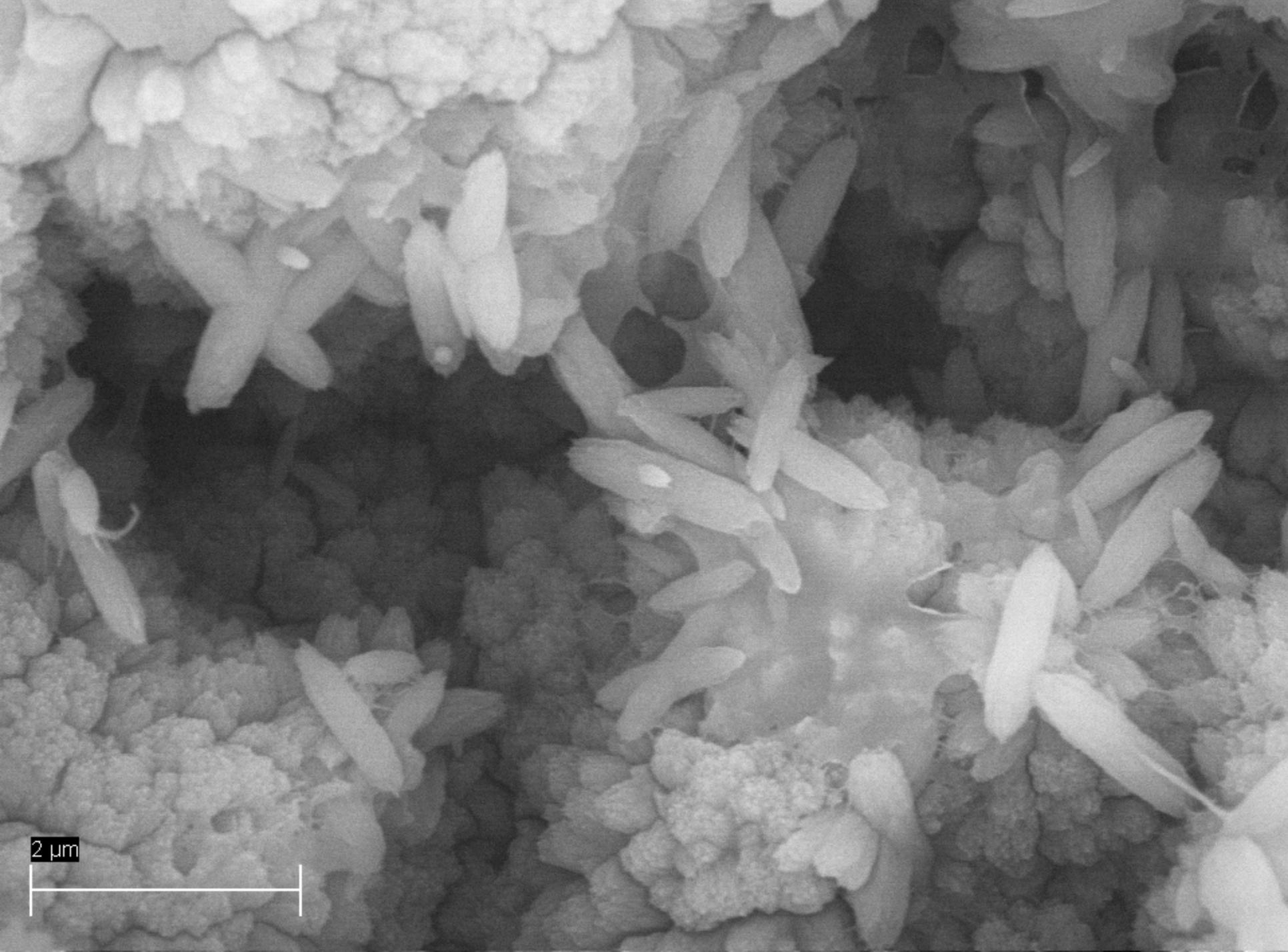


10 μm

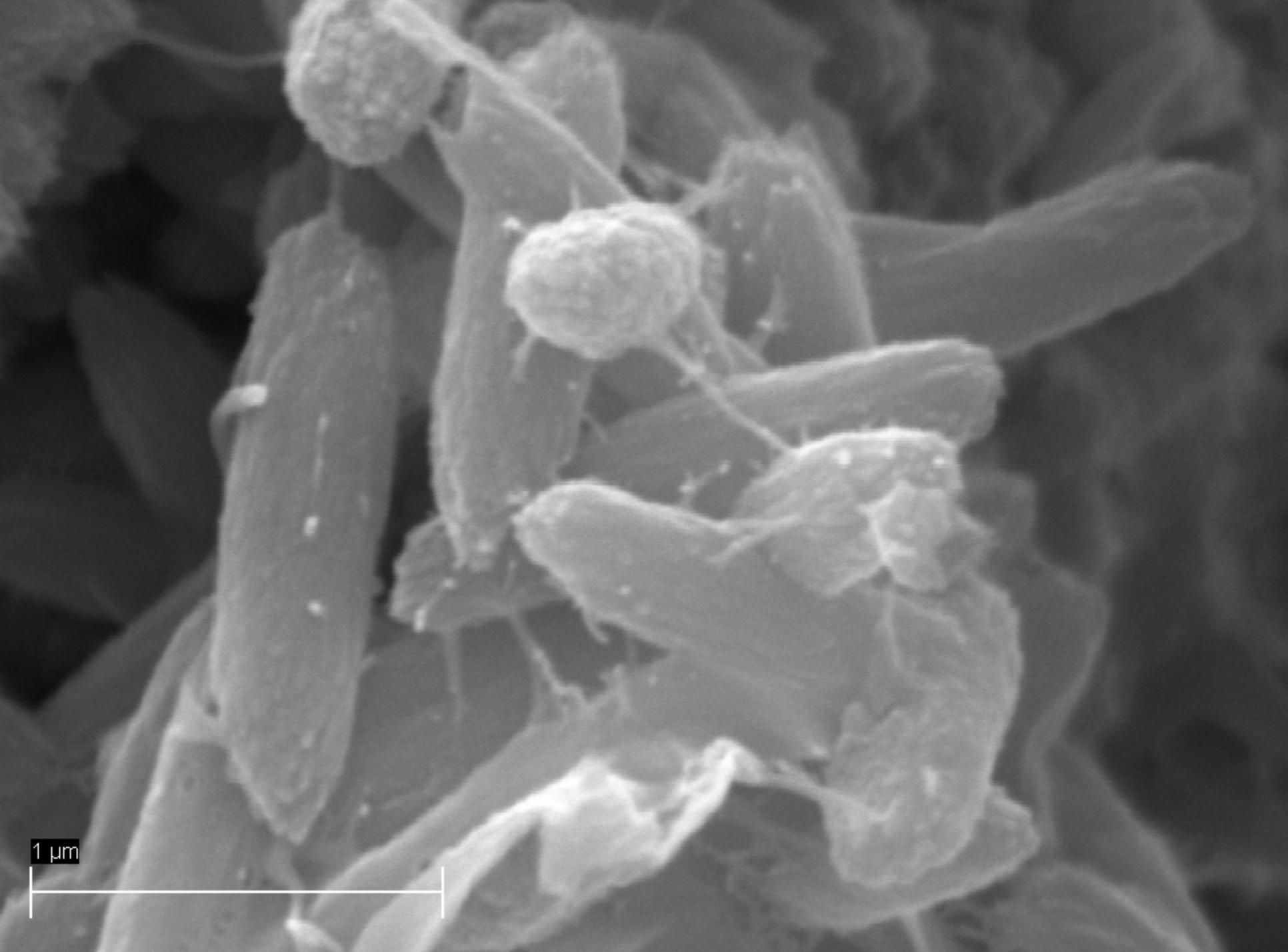
Ca-P  
cylinders

2  $\mu\text{m}$





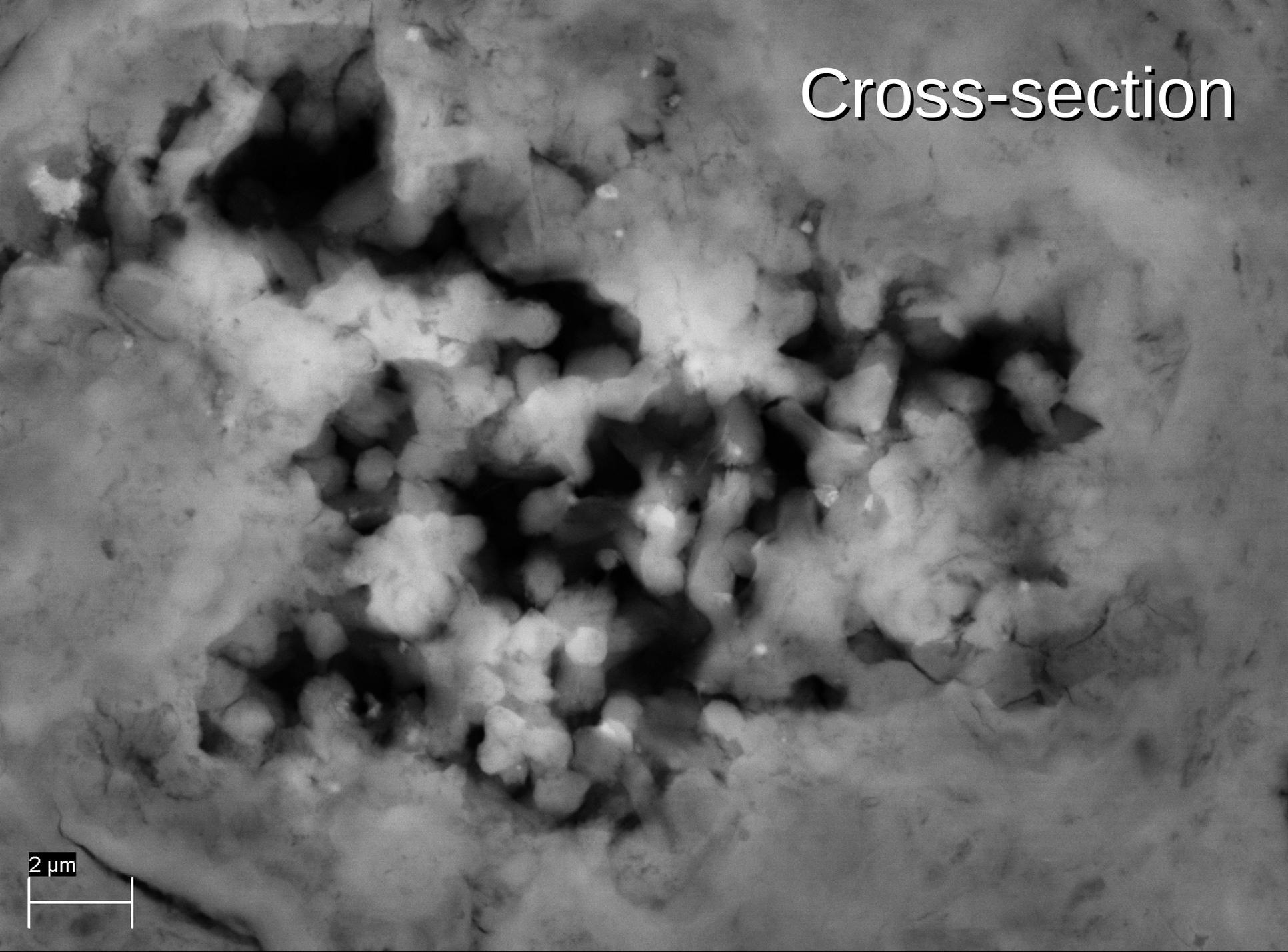
2  $\mu\text{m}$

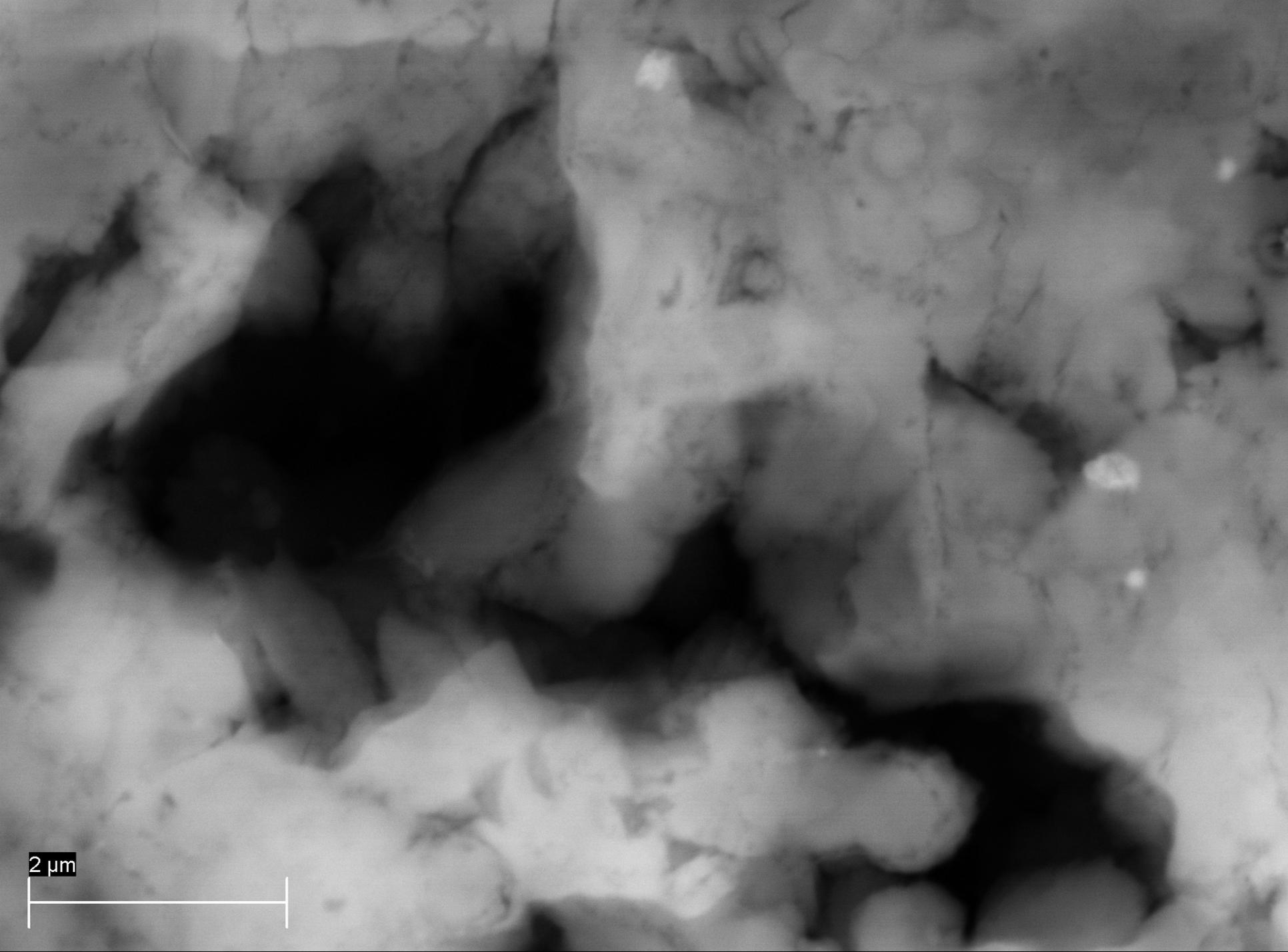


1 μm

Cross-section

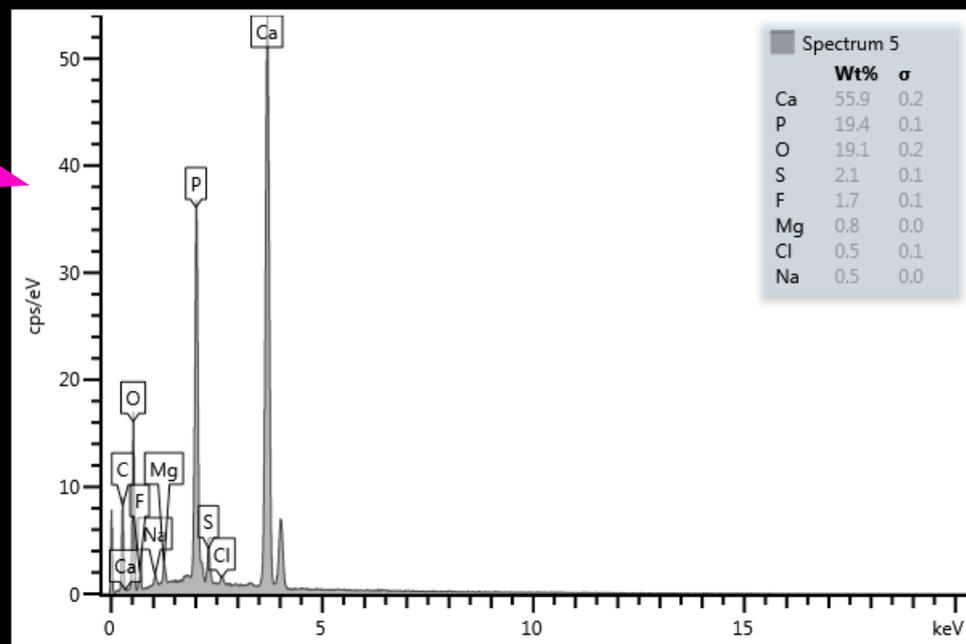
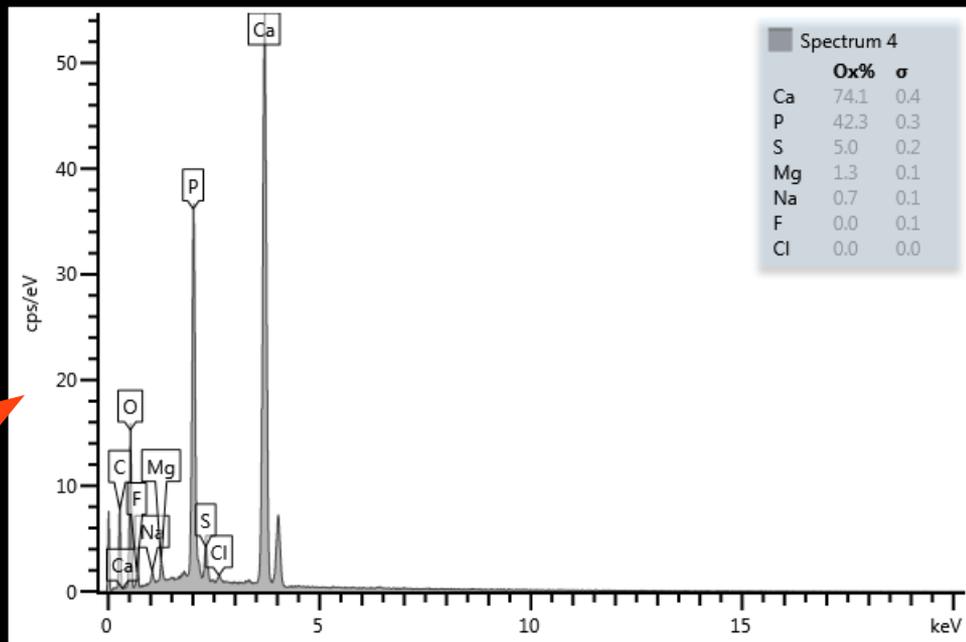
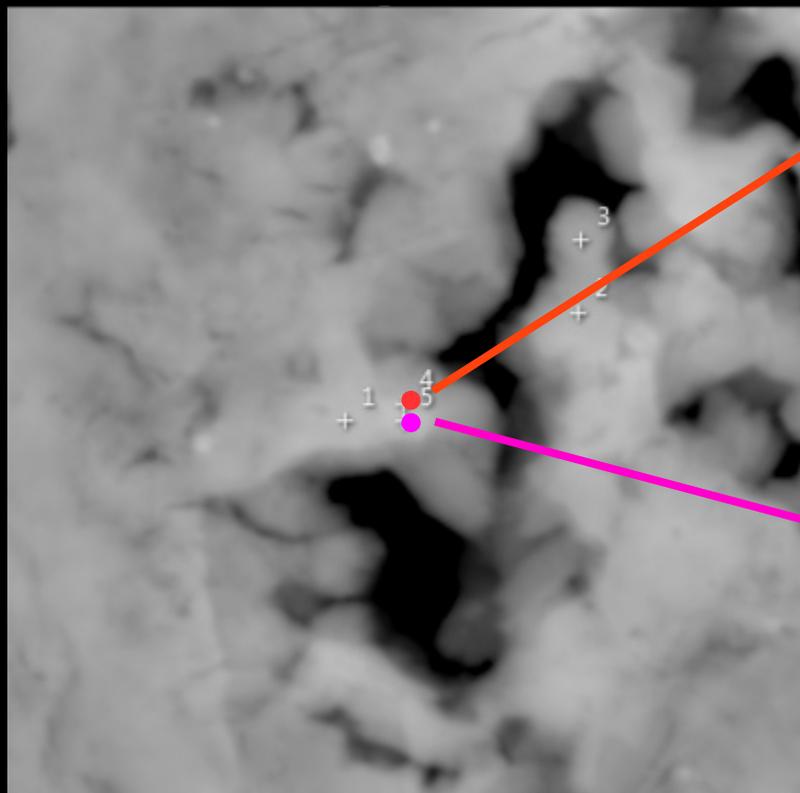
2  $\mu\text{m}$



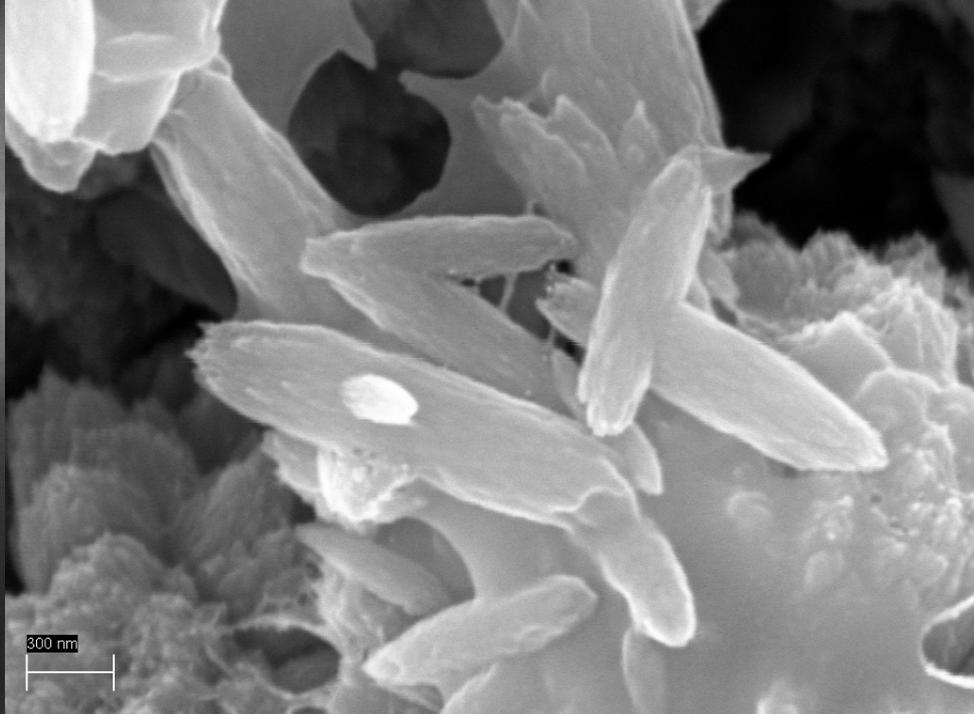
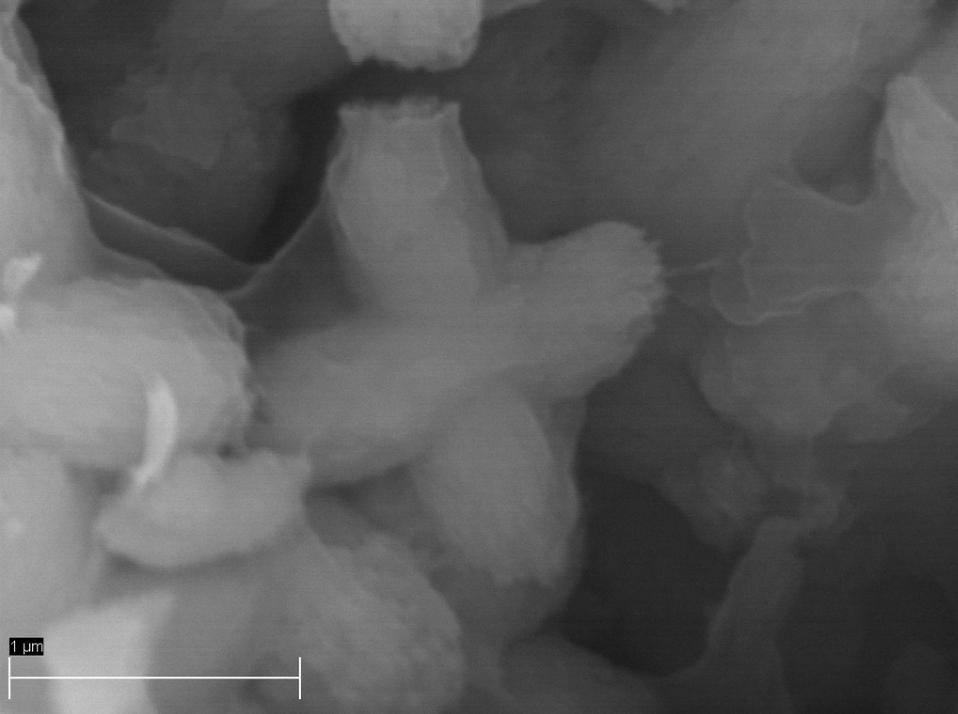
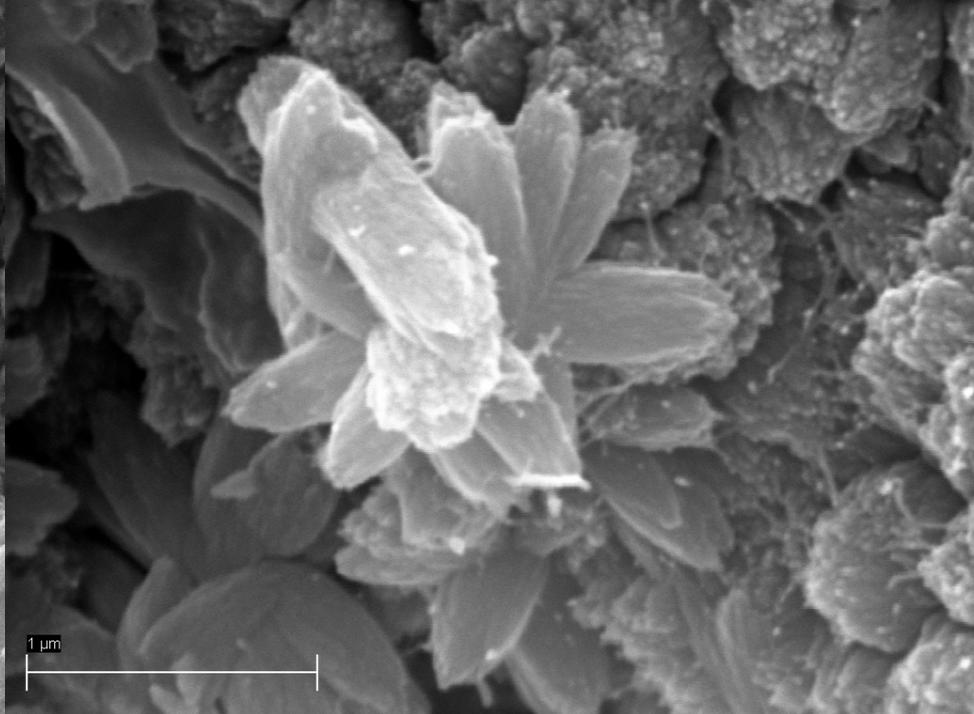
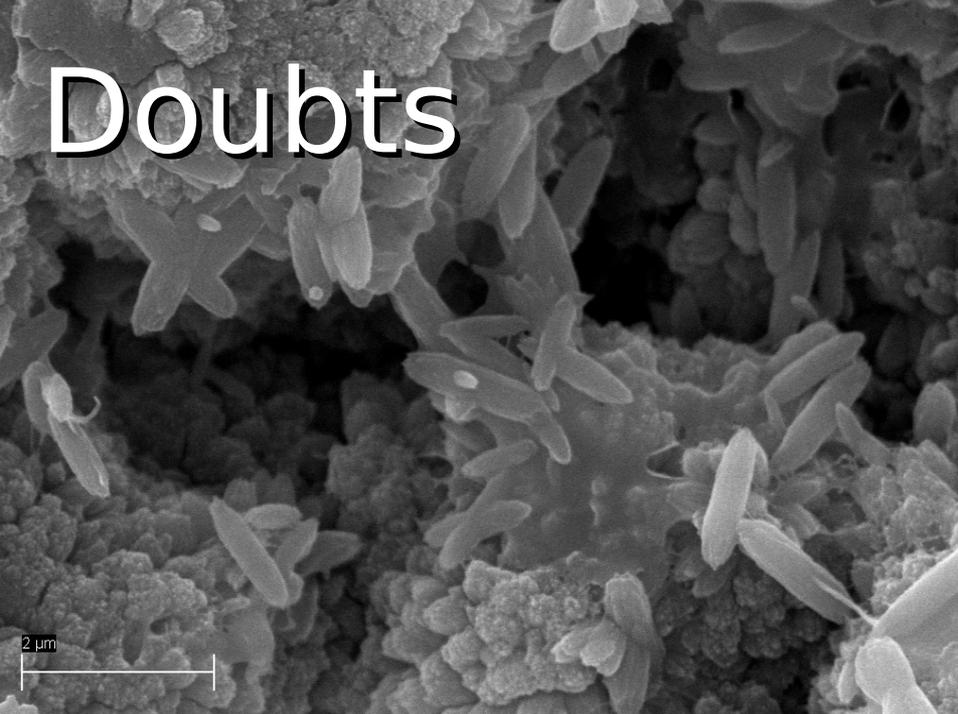


2 μm

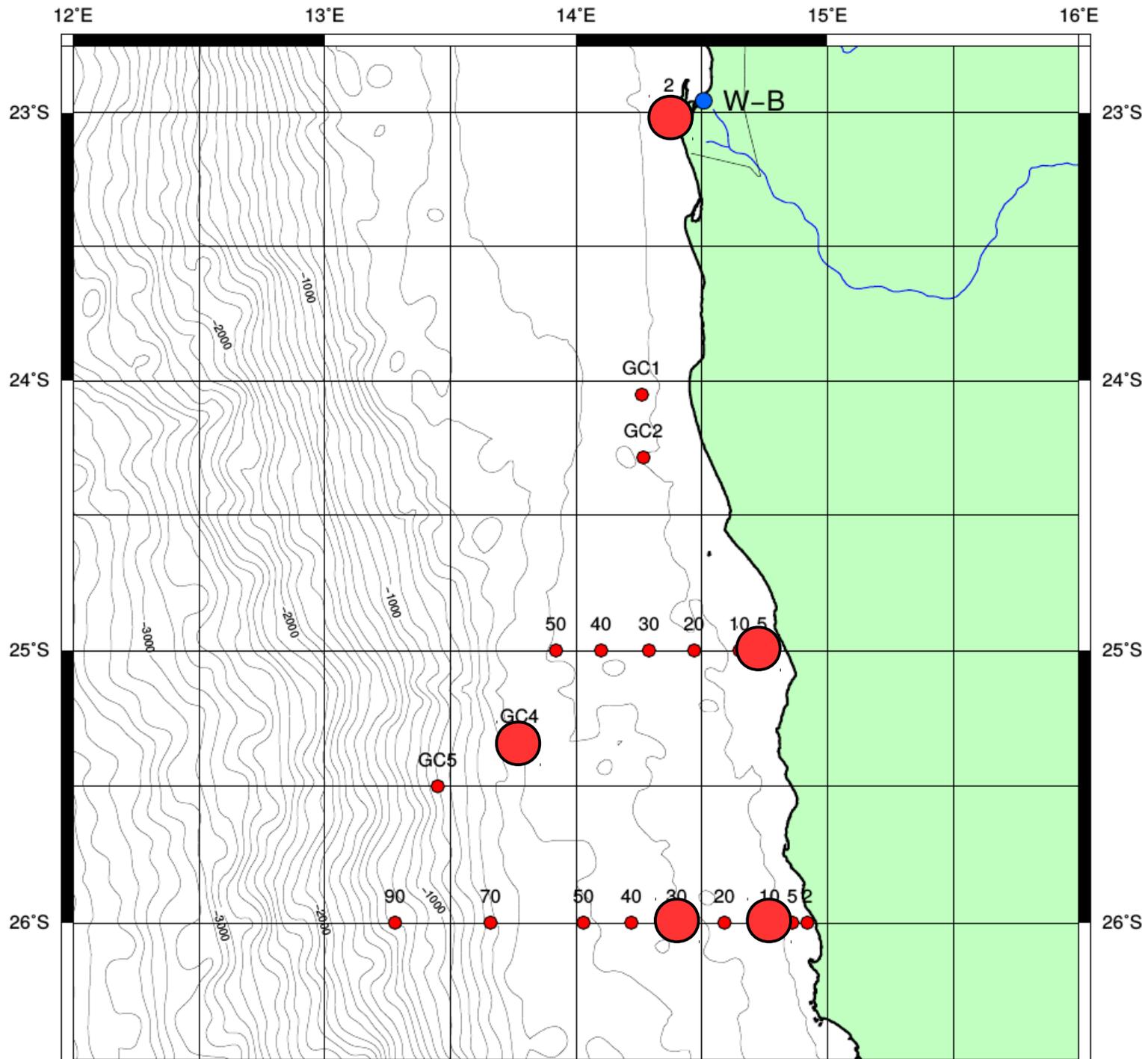
# EDX



# Doubts



# Sampling



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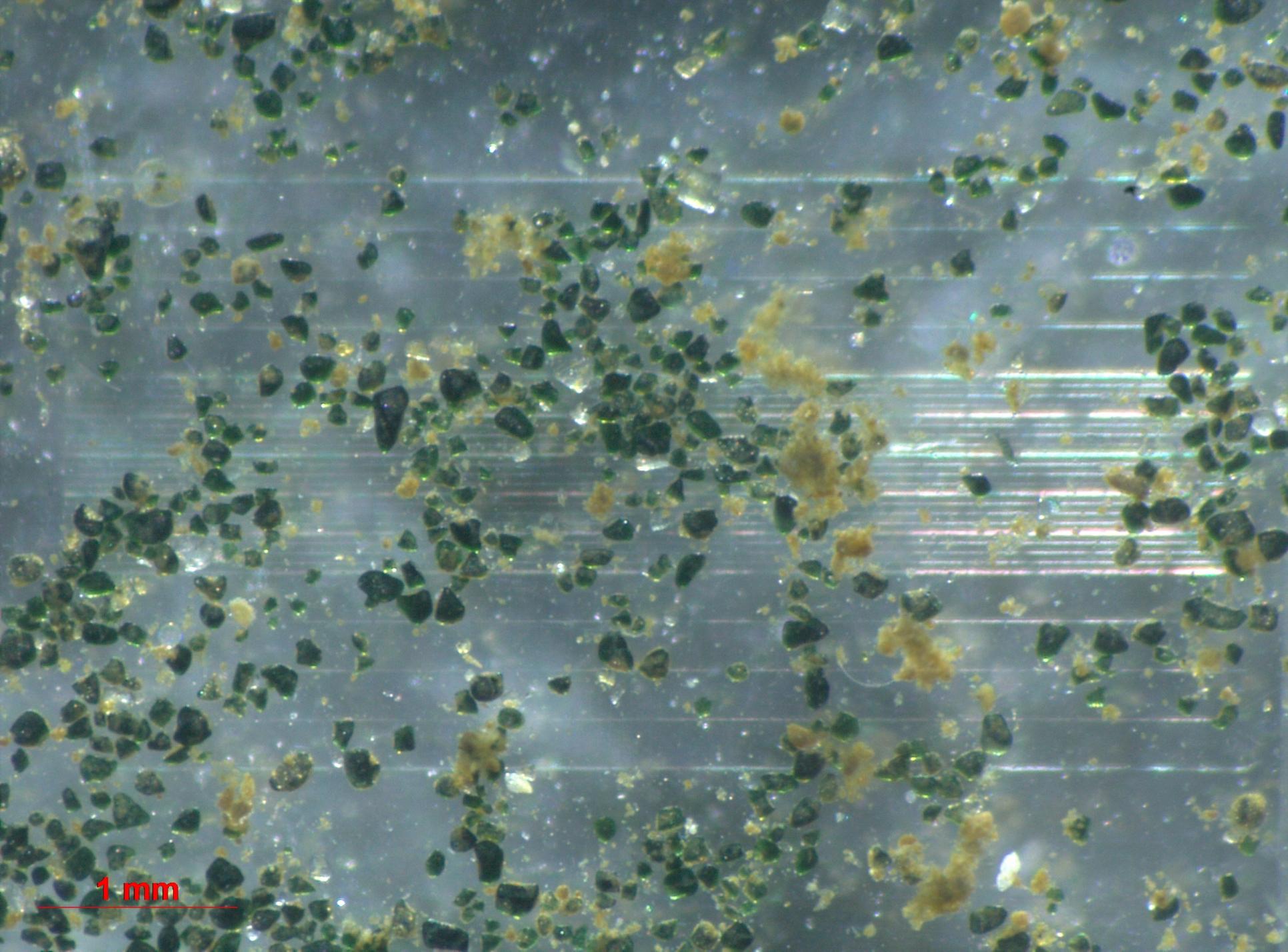
- „Diatomaceous ooze” at 23S (40 m)
- Mudbelt at 25S (47 m)
- Deeper shelf at 25.34S (301 m)
- Central shelf at 26S (198 m)
- Central shelf at 26S (116 m)



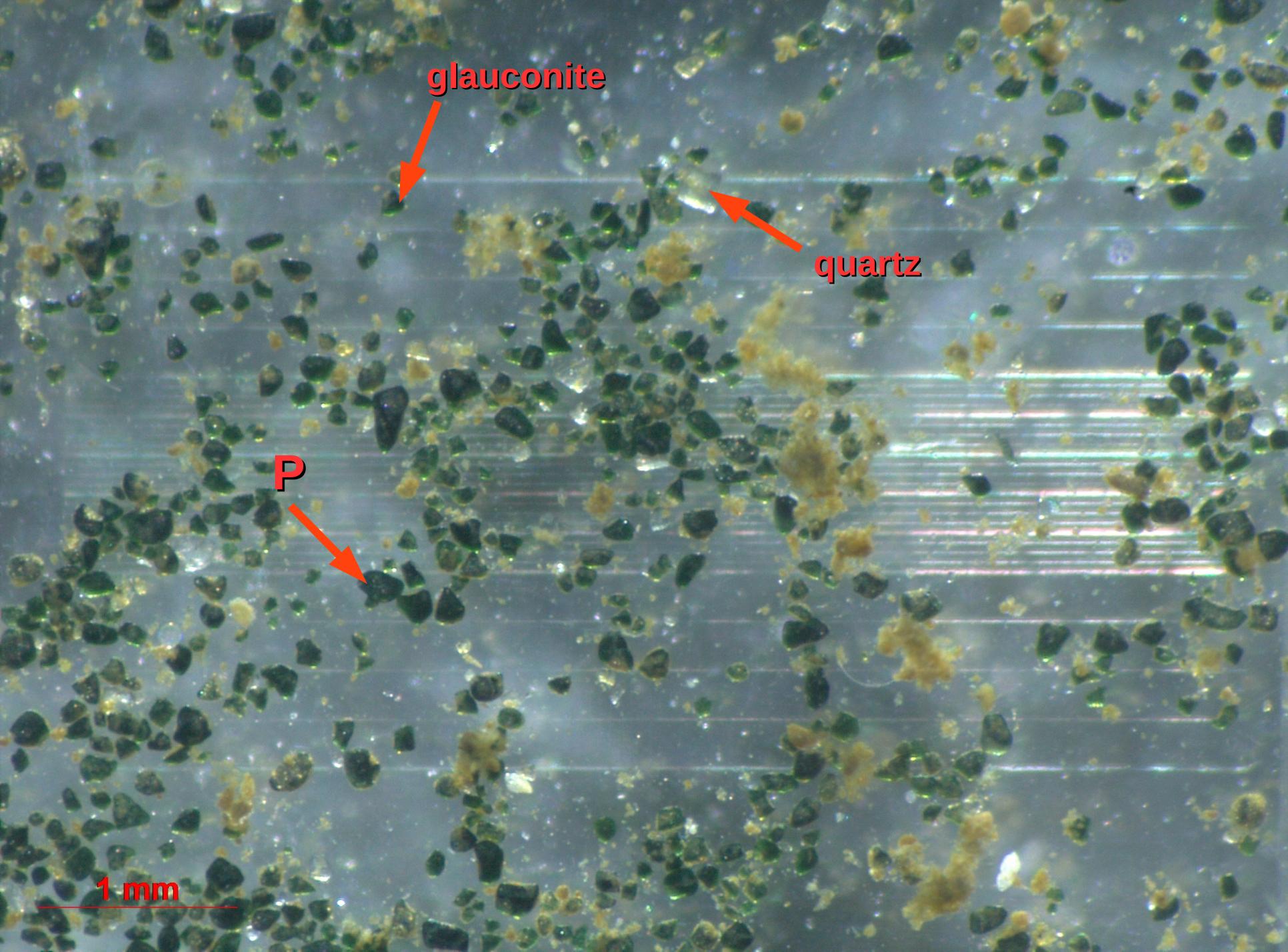
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1 mm



glauconite

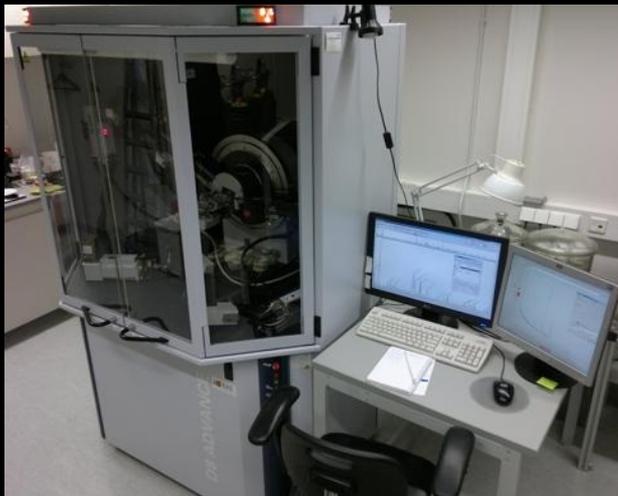
quartz

P

1 mm

# Method

- Microstructure: SEM-EDX and FIB-TEM
- Geochemistry: XRD and LA-ICP-MS



# Data

- High-resolution mineralogical and geochemical profiles.
- Porewater geochemistry and P speciation (Jake Bailey).

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- **Detailed micro- and nanostructure.**
- Authigenic phosphate?

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# Acknowledgements:



- NatMIRC
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- UNAM Sam Nujoma Campus
- RGNO instructors and organisers

