



Phosphatised microstructures in ancient and modern phosphorites

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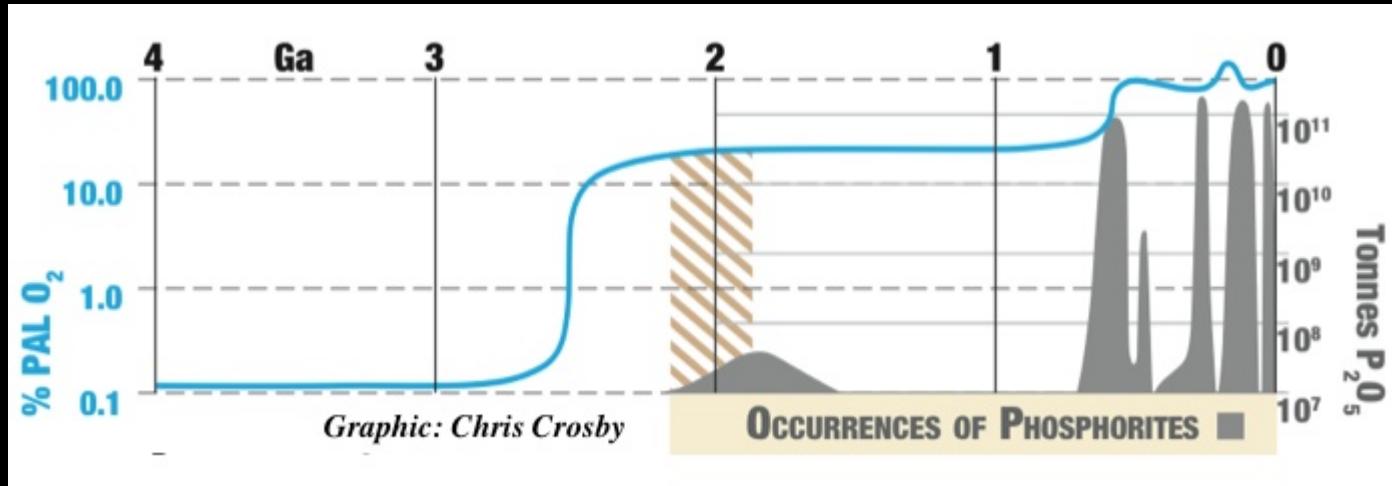


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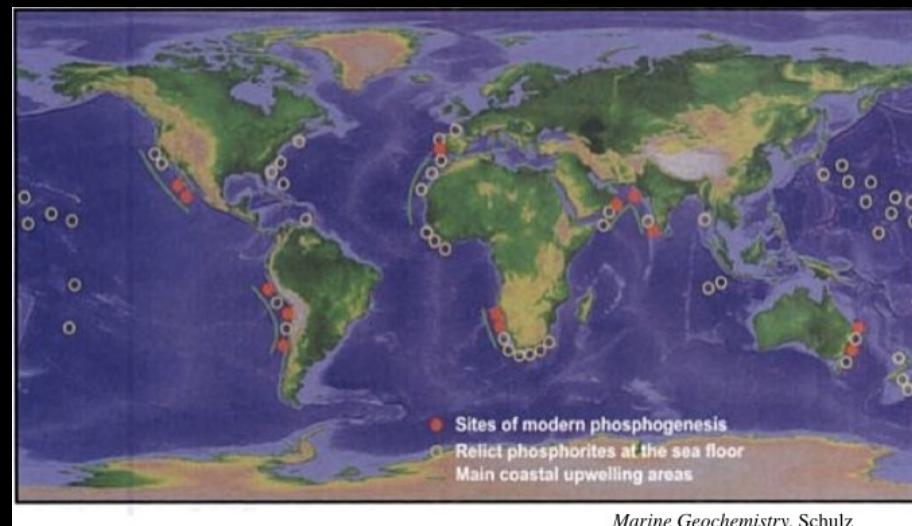


Phosphogenesis

- Occurs as distinct episodes in geologic time.

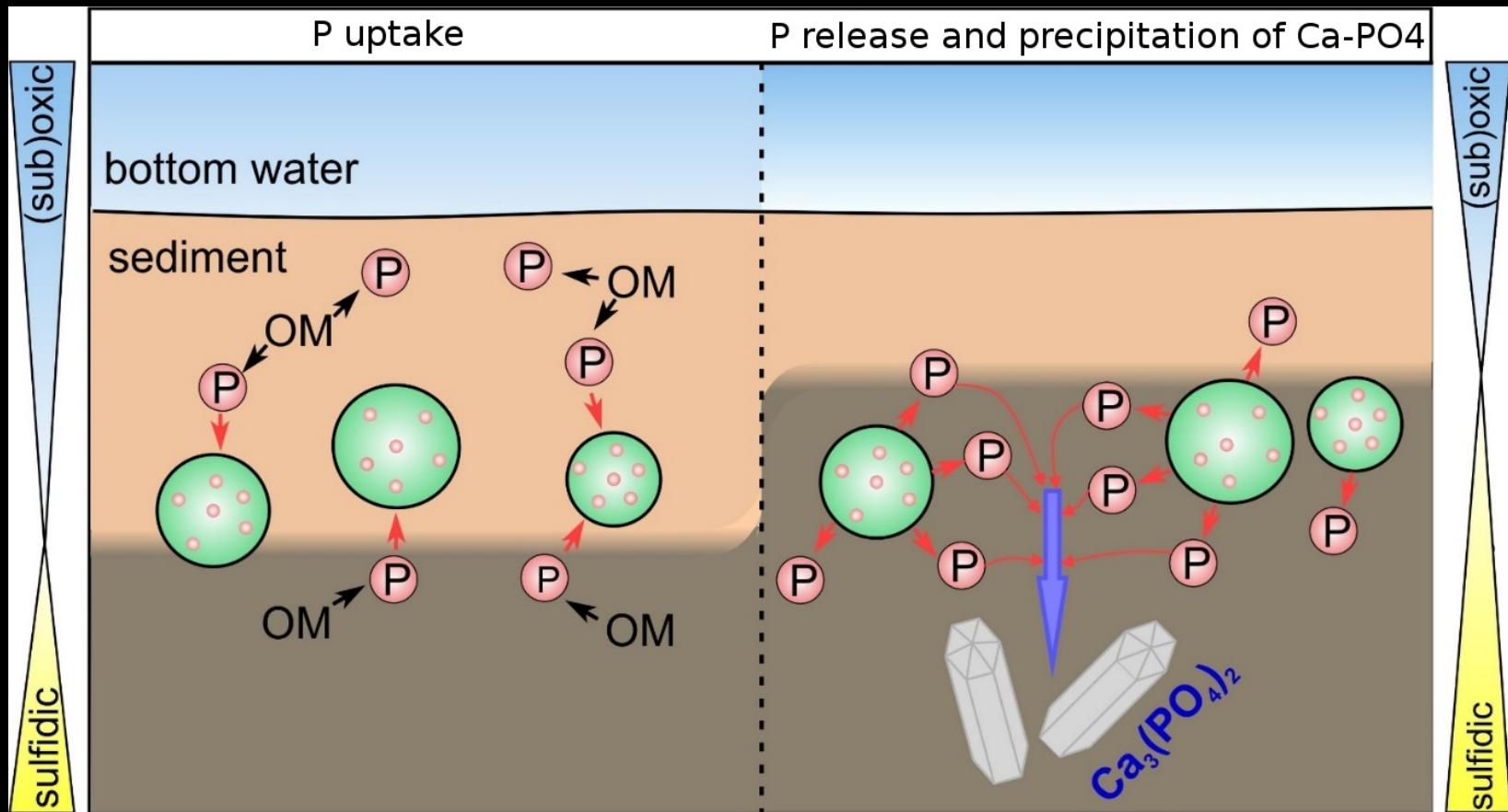


- Wide-spread in modern upwelling zones.



Phosphogenesis

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

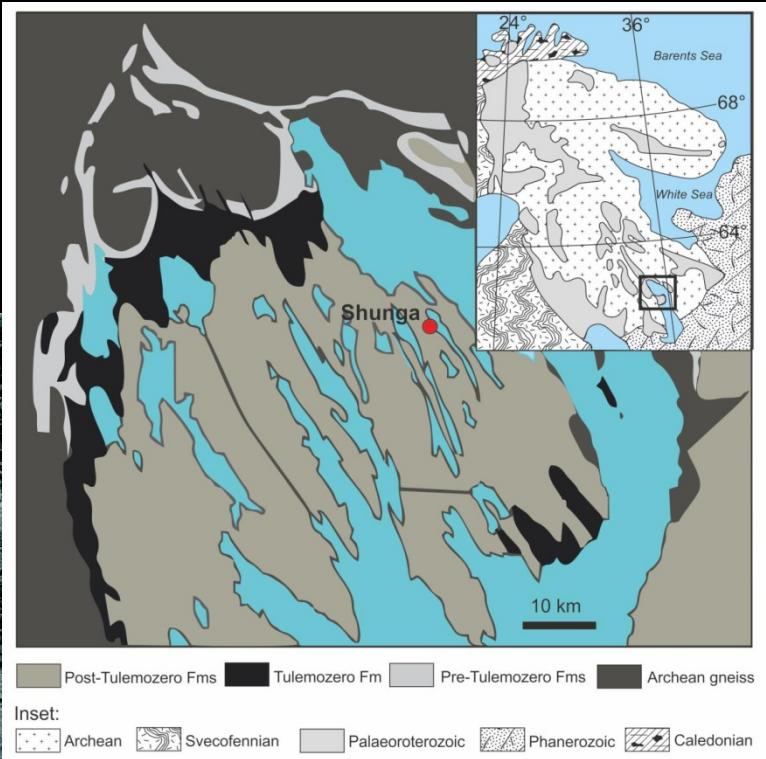
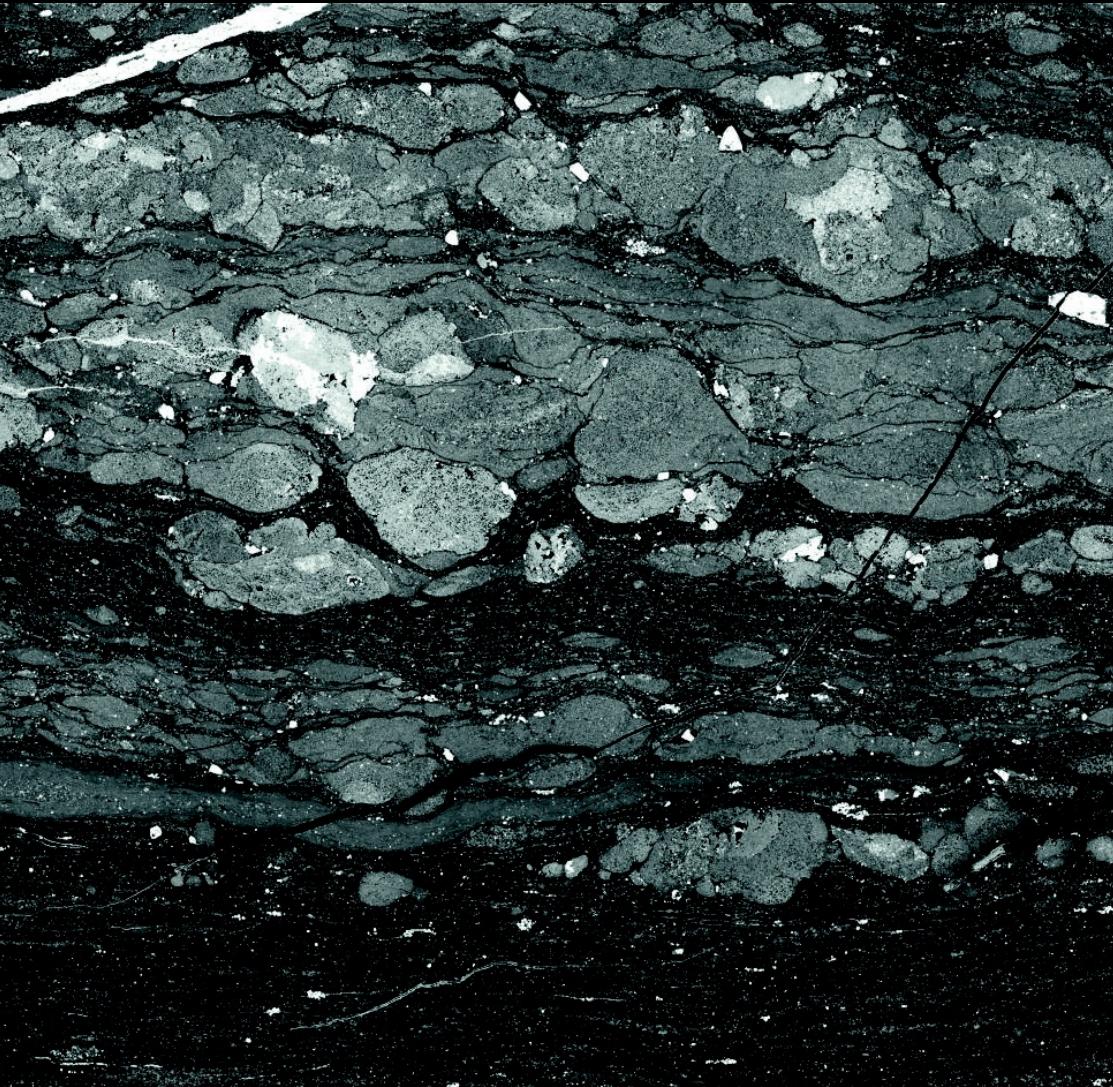


Modified, Brock and Schulz-Vogt (2011)

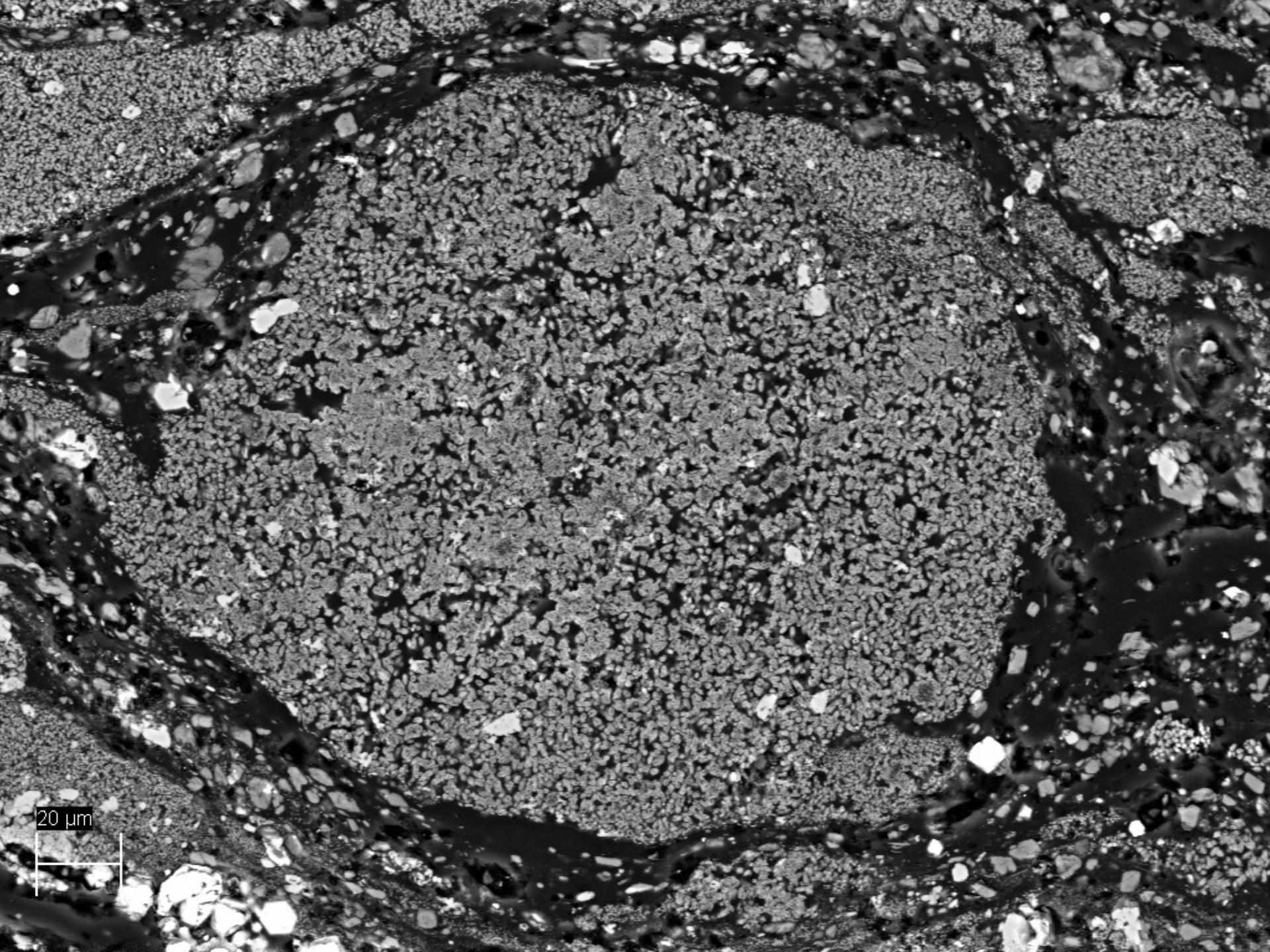
Goals

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

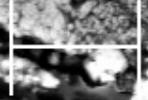
Russian Karelia, 2.0 billion yr ago...



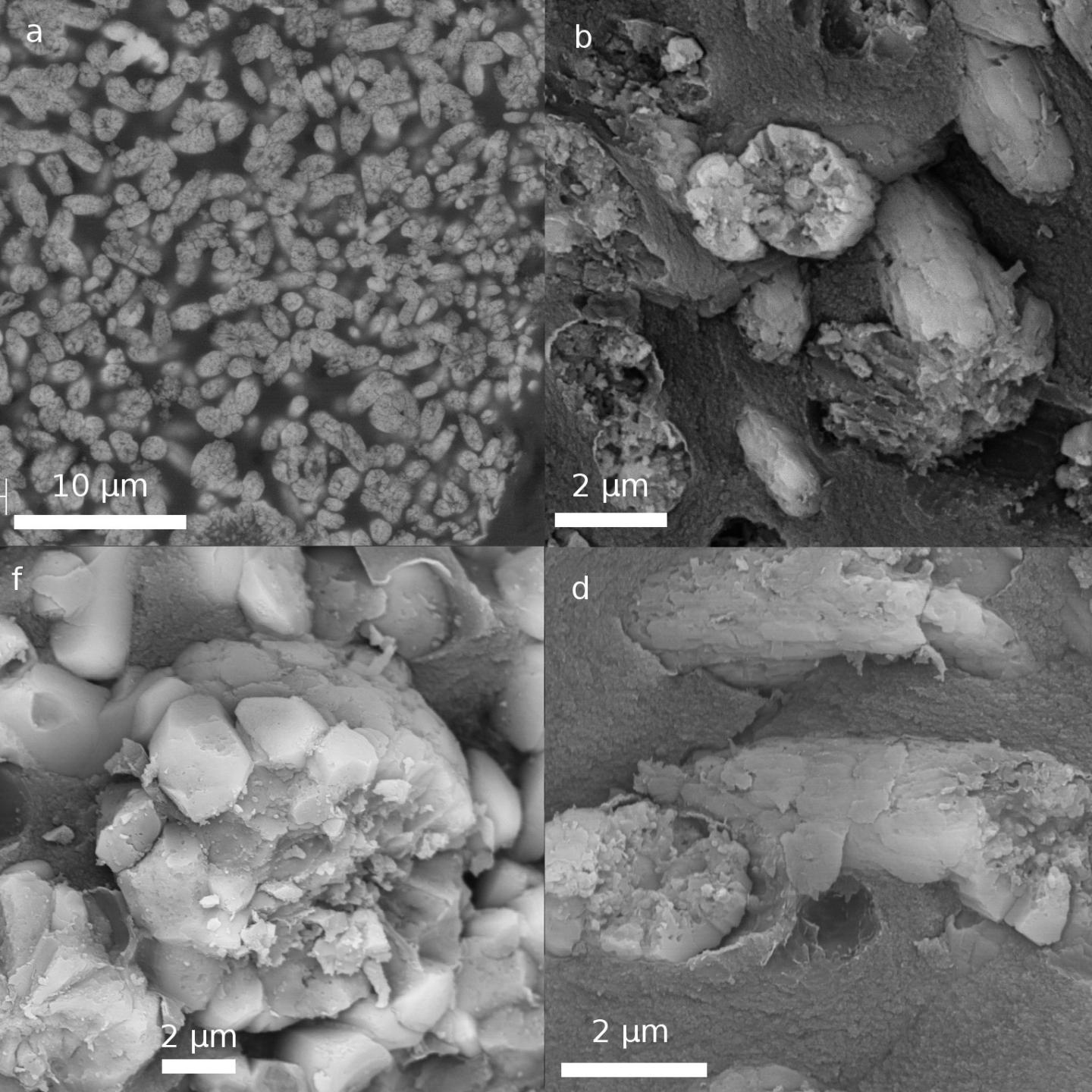
2 mm



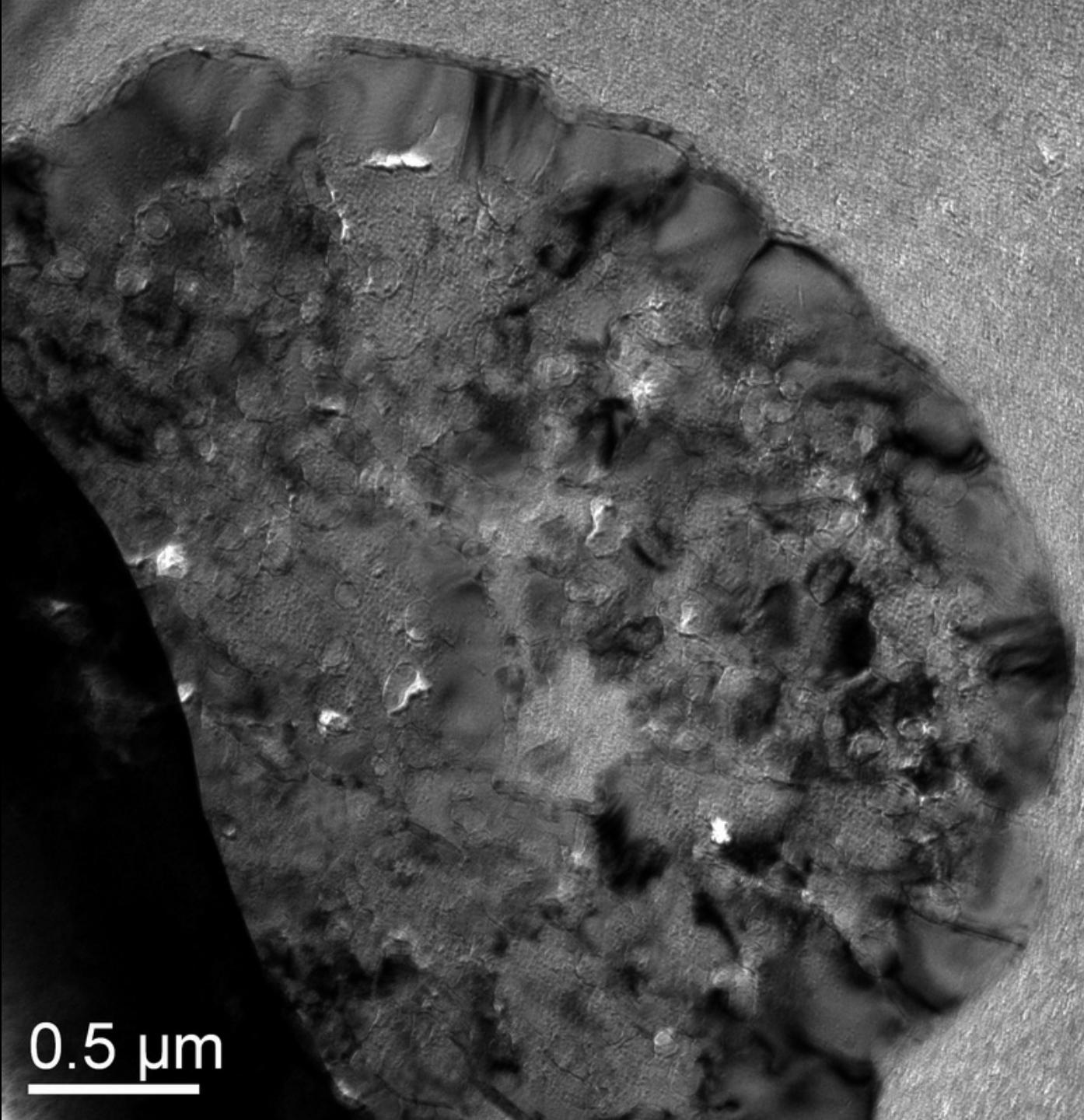
20 μm



Cylindrical microstructures

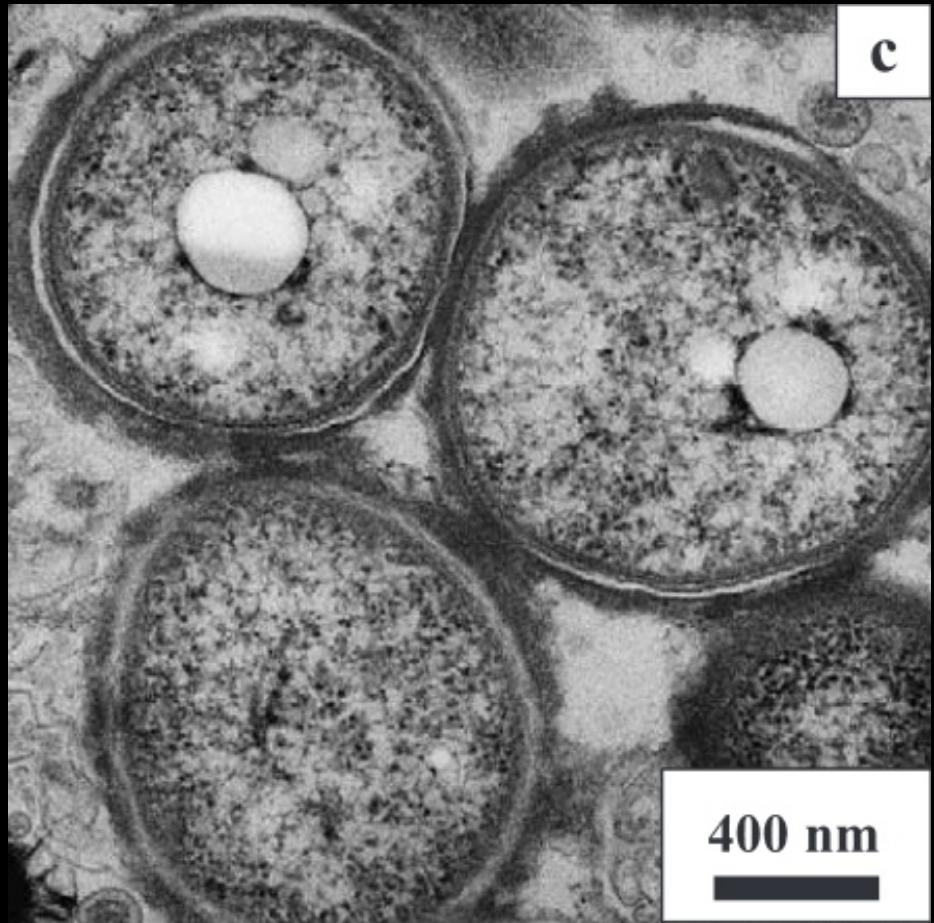


TEM - nanostructure



Fossils?

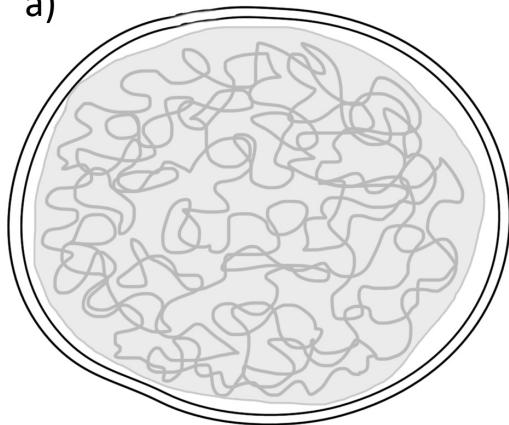
- Phosphate minerals like to precipitate on nucleation templates.
- Cell membranes may act as such.



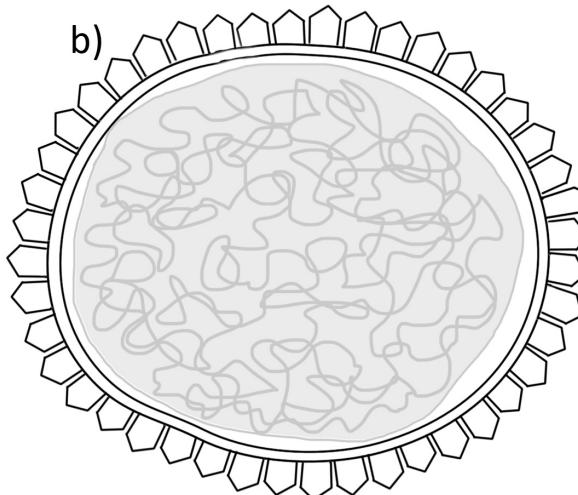
Benzerara (2004)

Fossilisation and recrystallisation

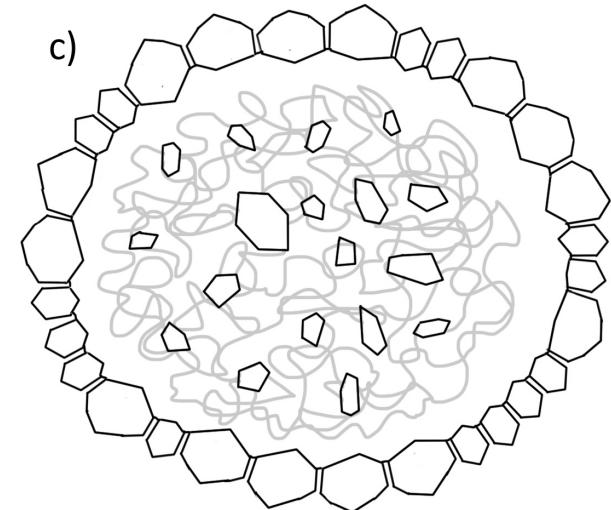
a)



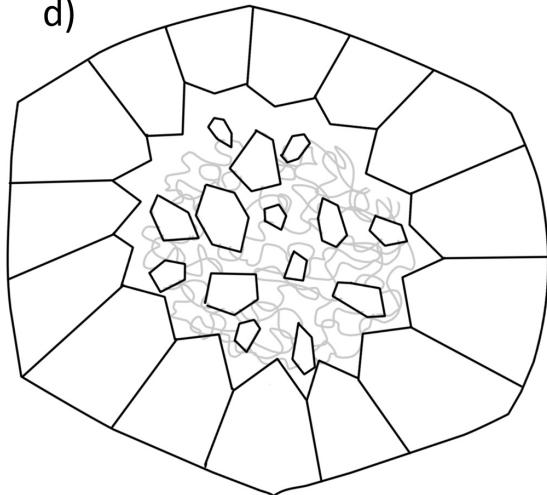
b)



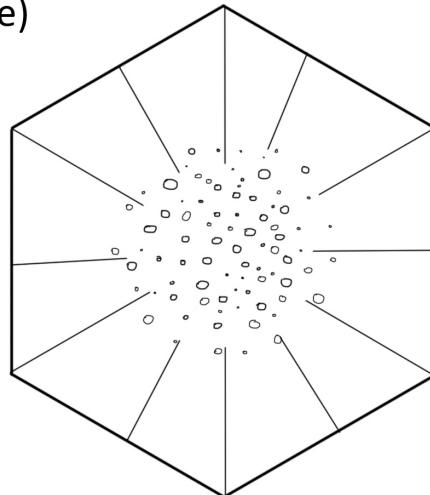
c)



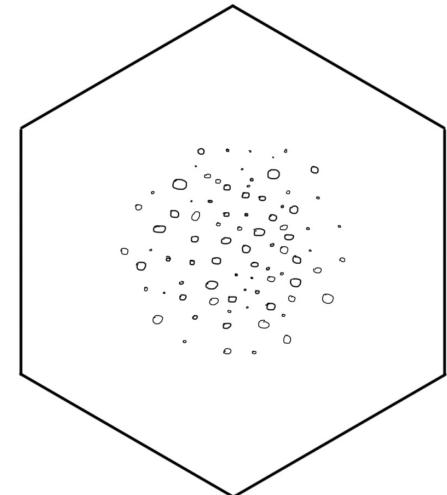
d)



e)



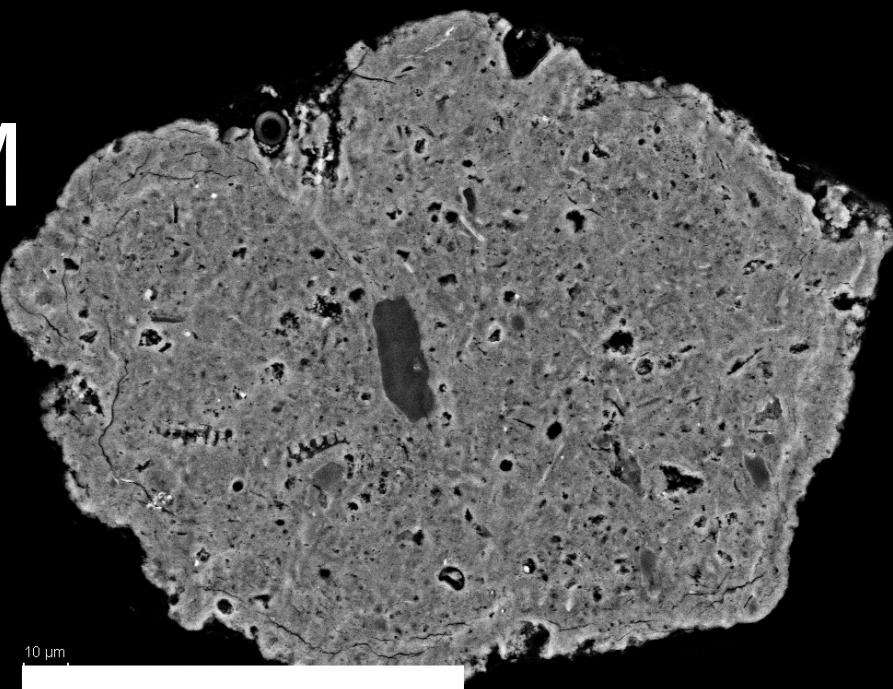
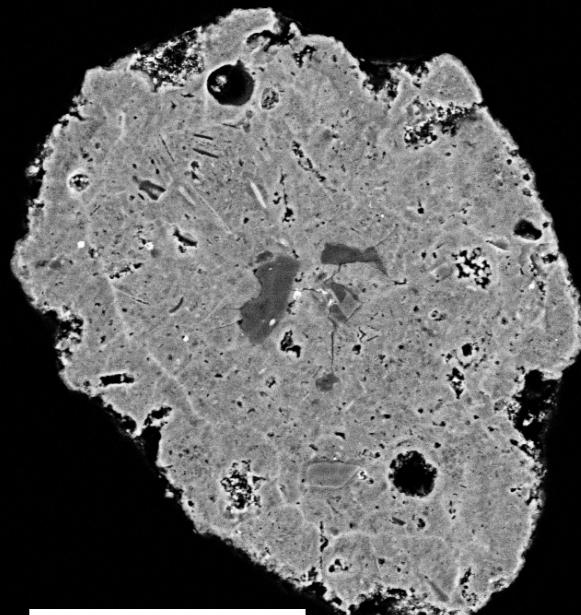
f)





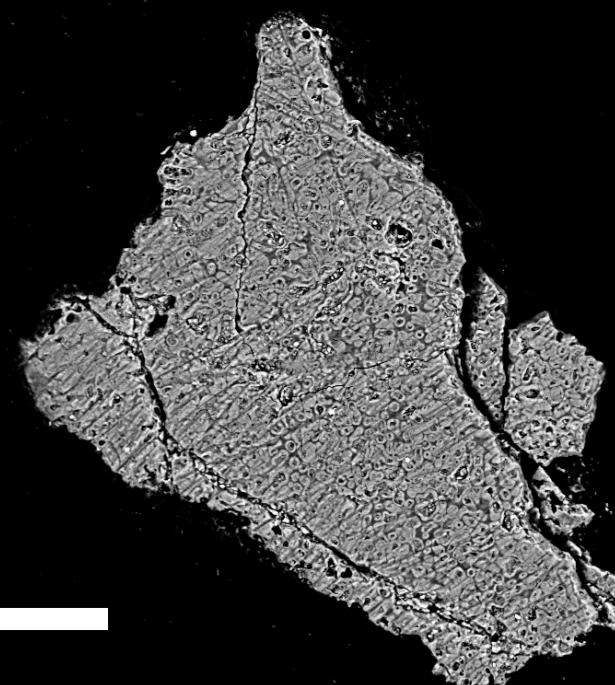
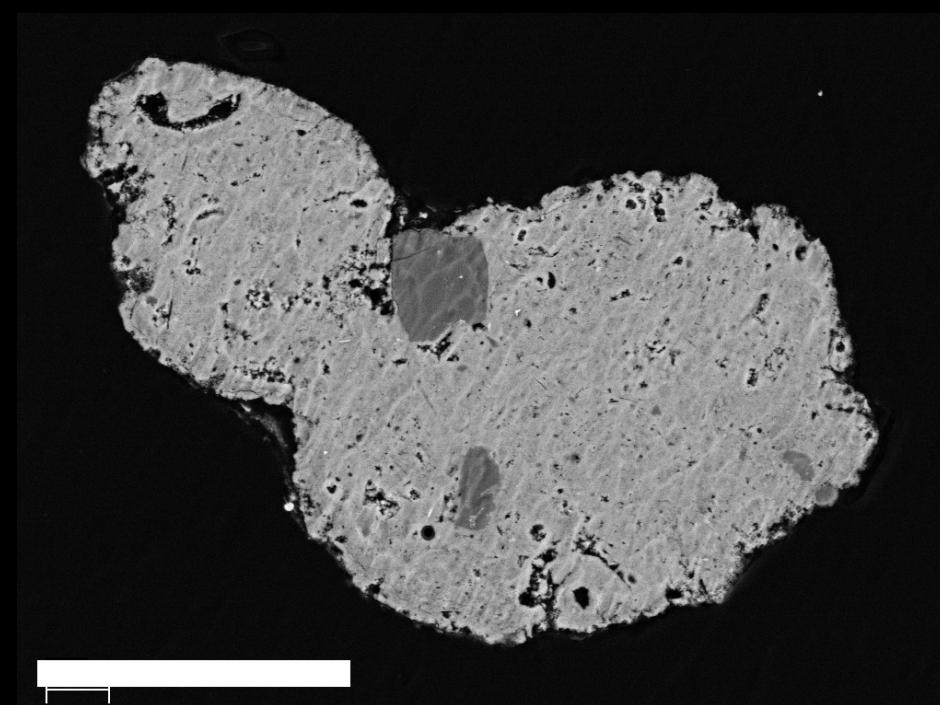
NASA, Blue Marble

SEM



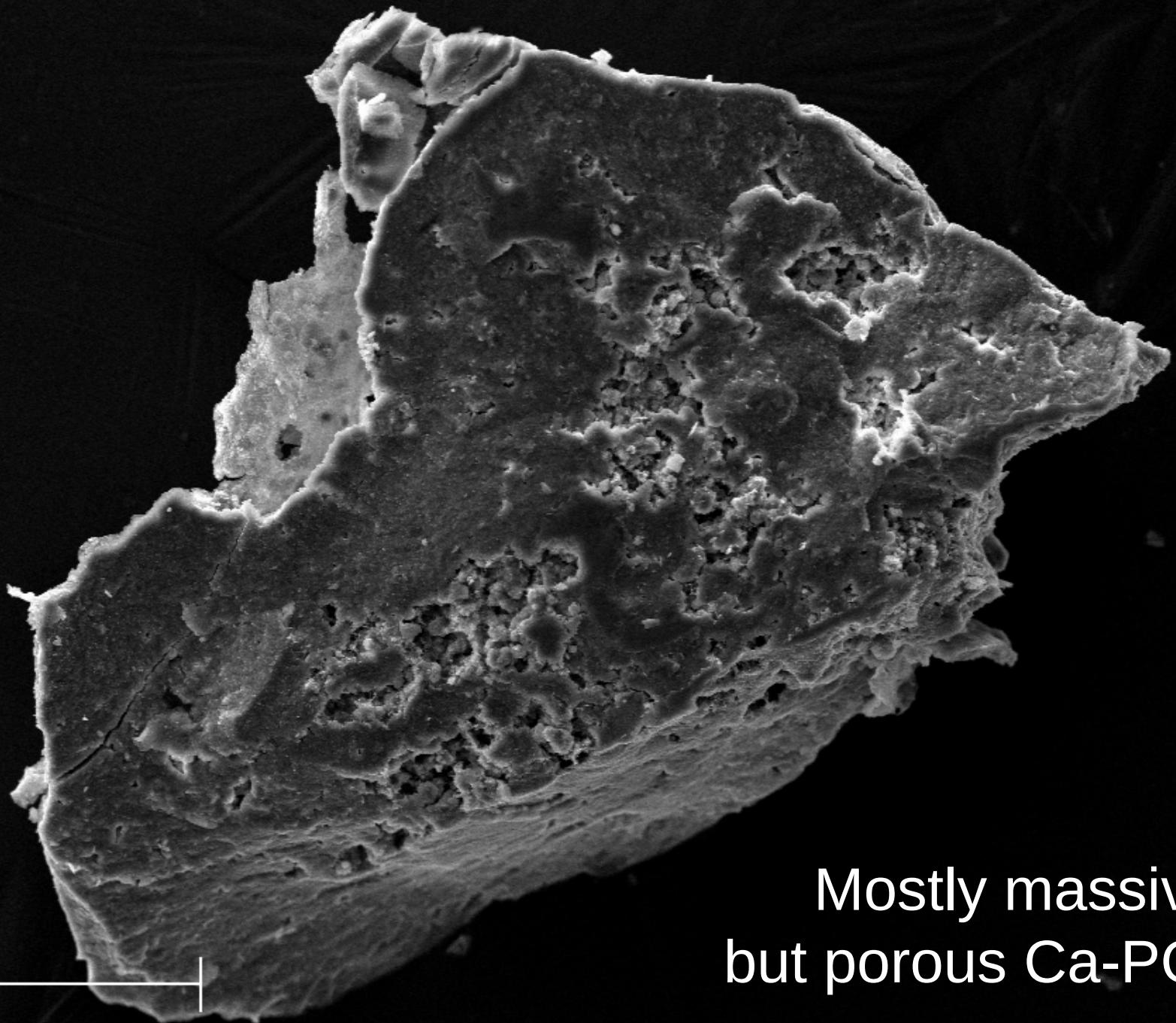
20 µm

10 µm



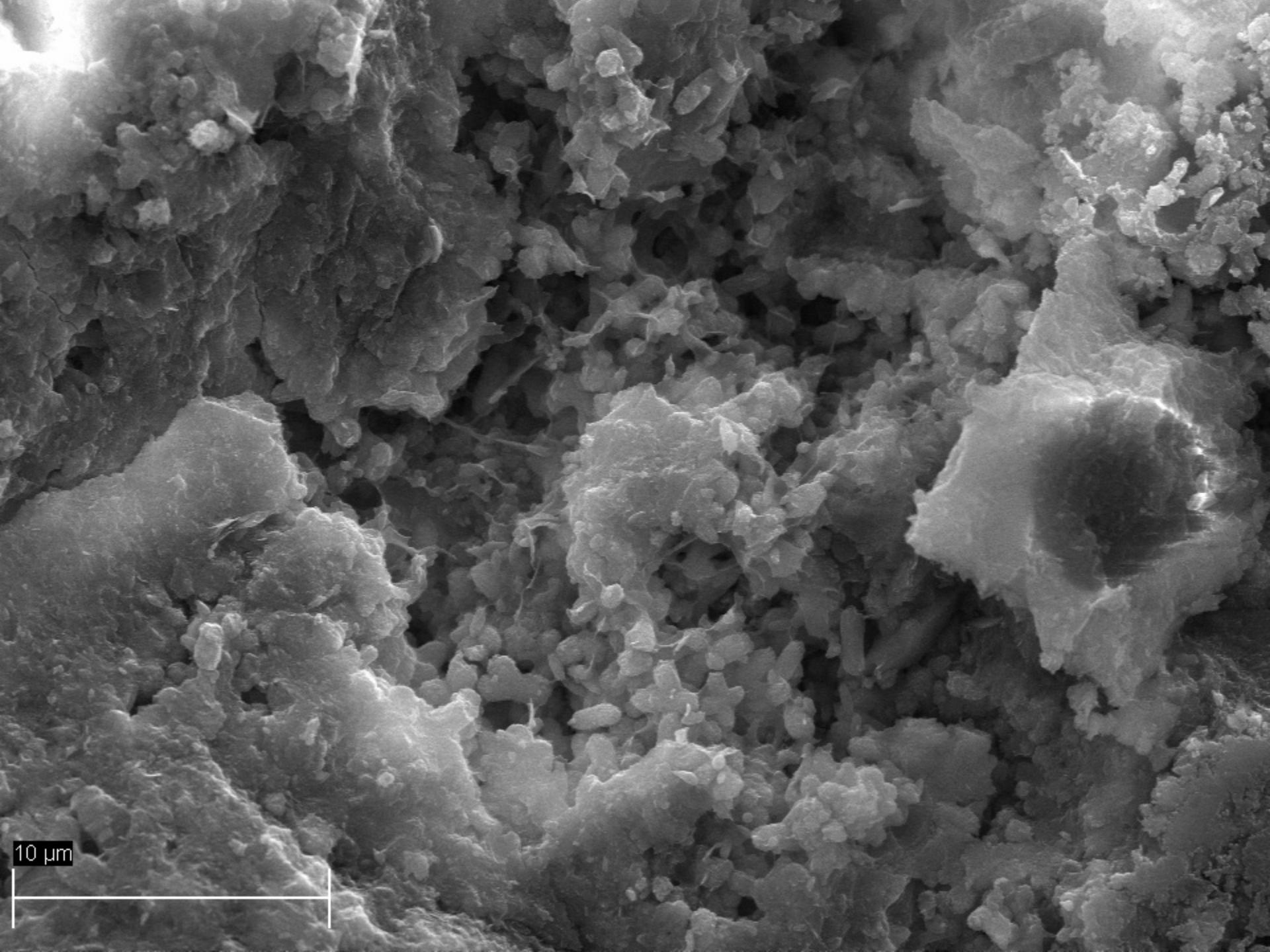
20 µm

10 µm



Mostly massive,
but porous Ca-PO₄

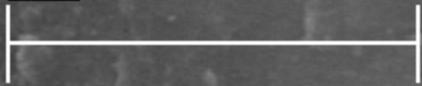
100 µm

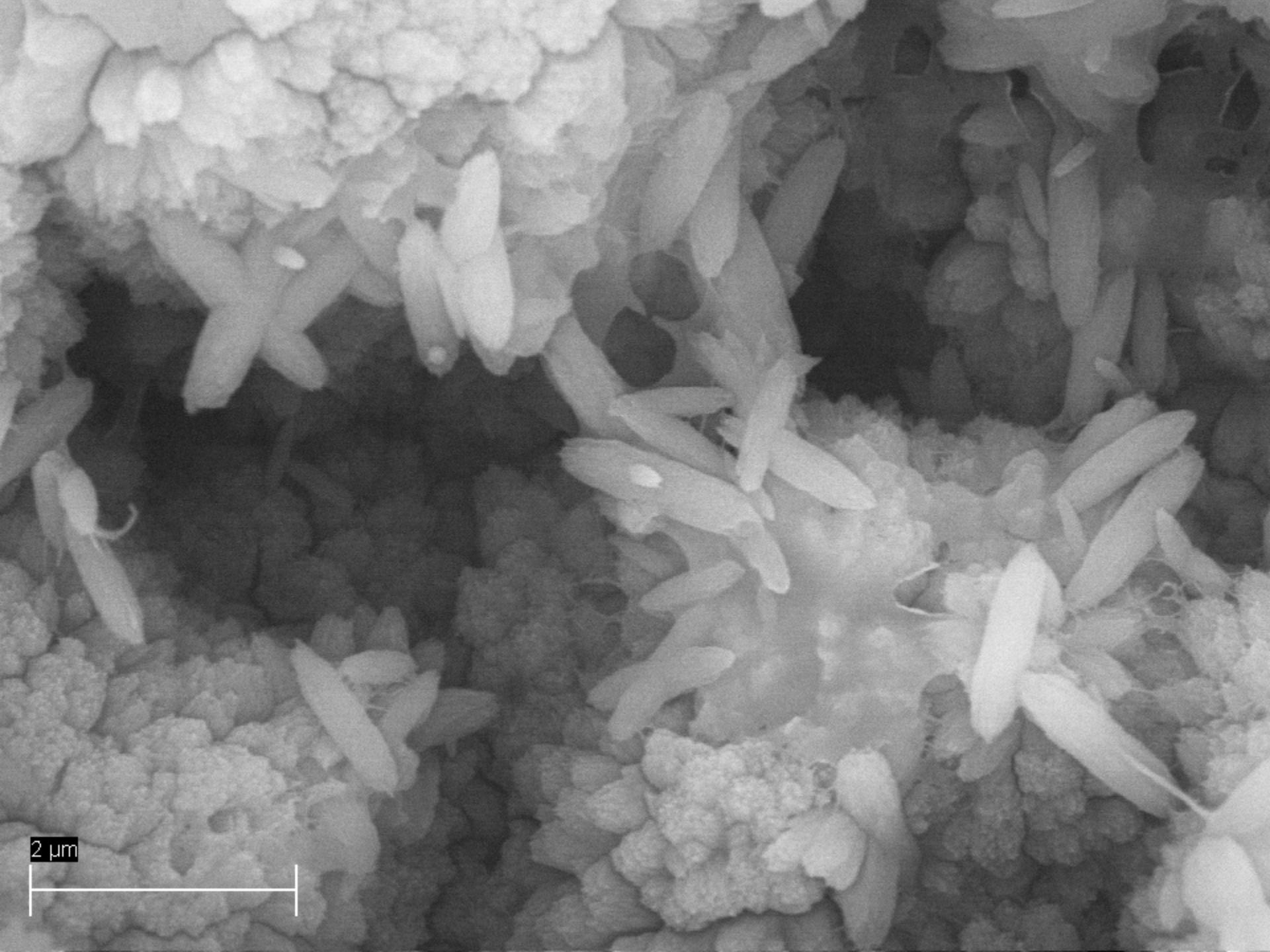


10 μm

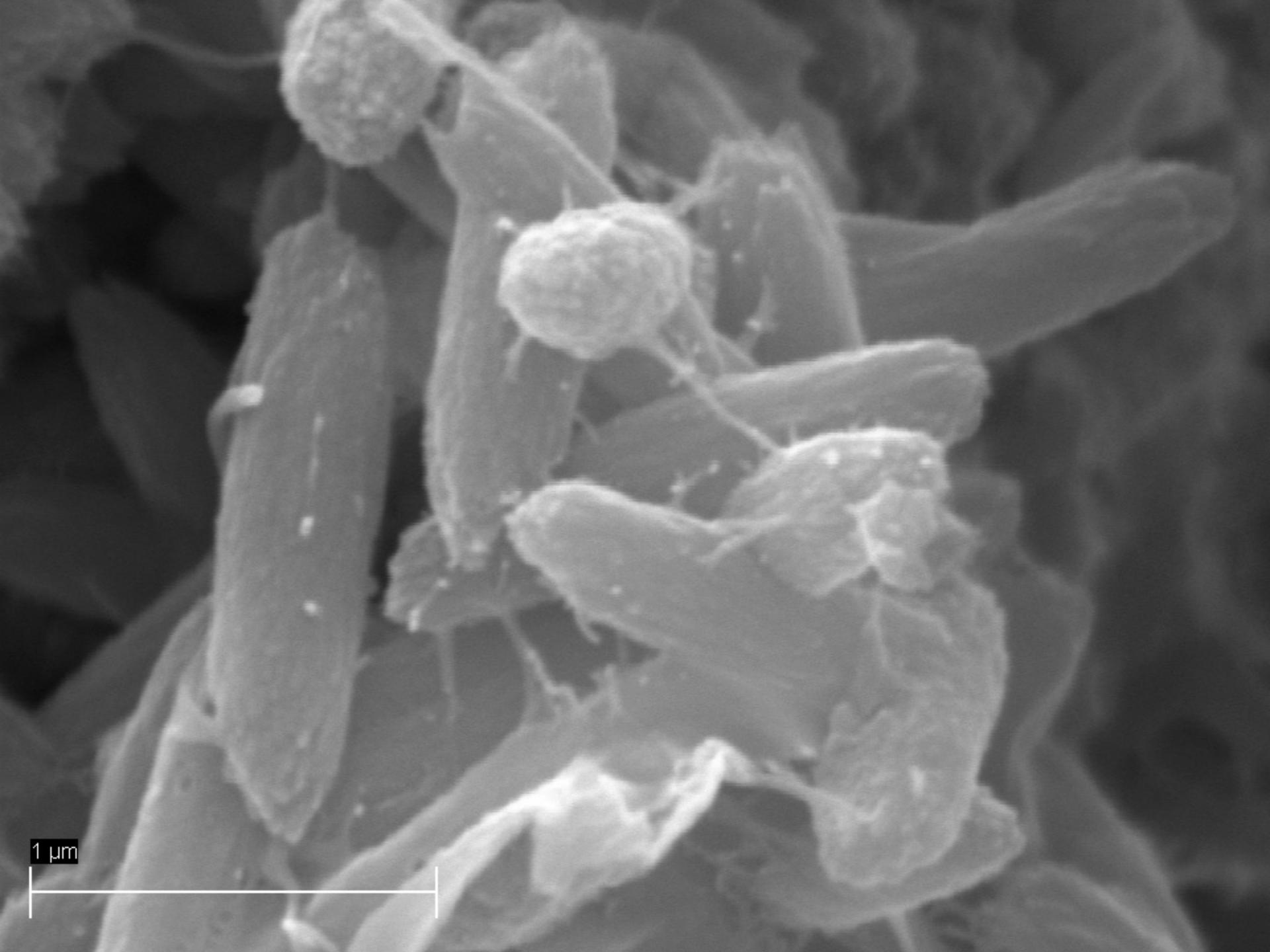
Ca-P
cylinders

2 μ m





2 μm

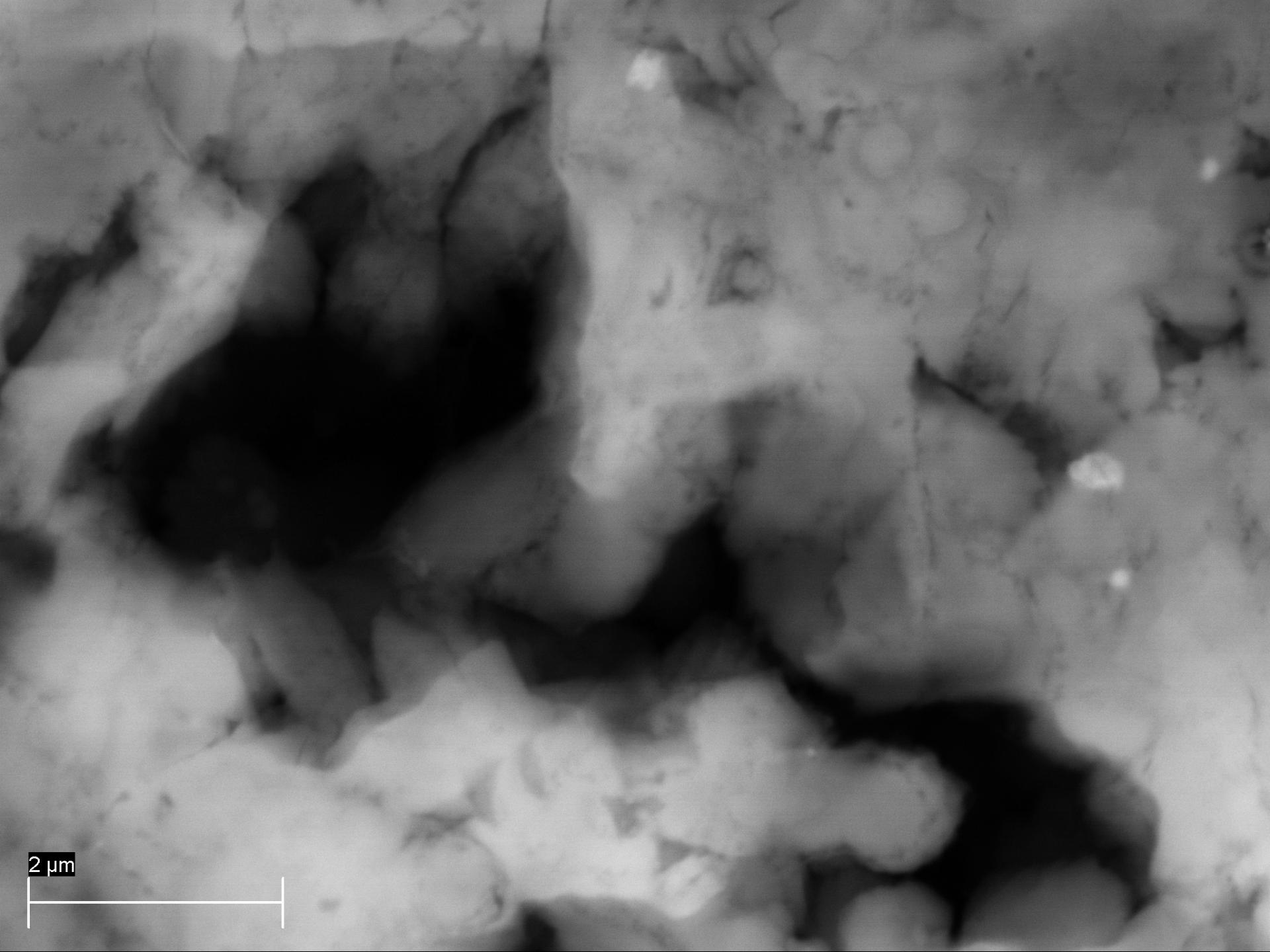


1 μm

Cross-section

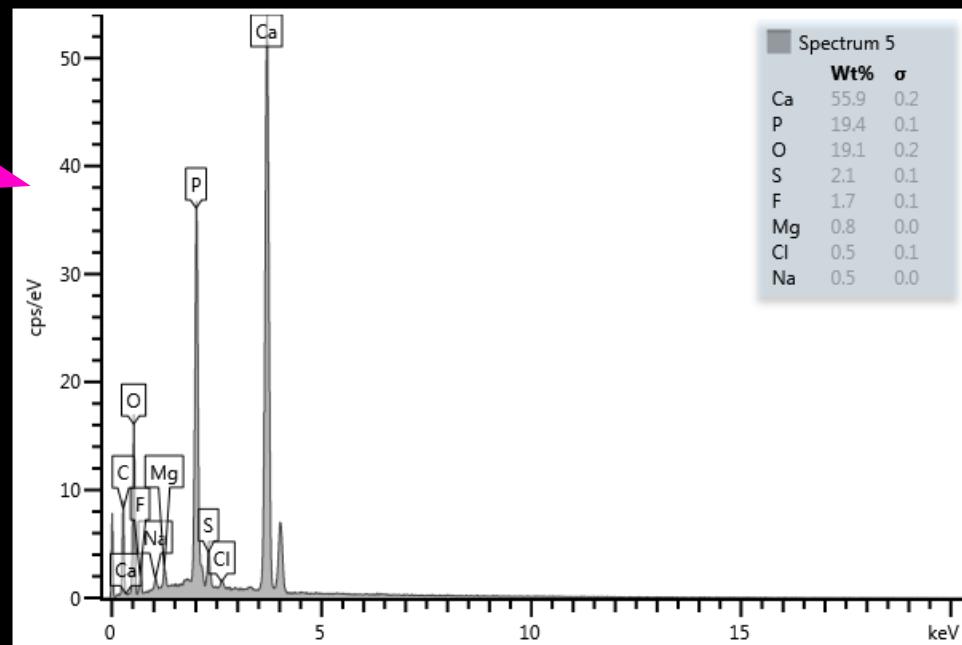
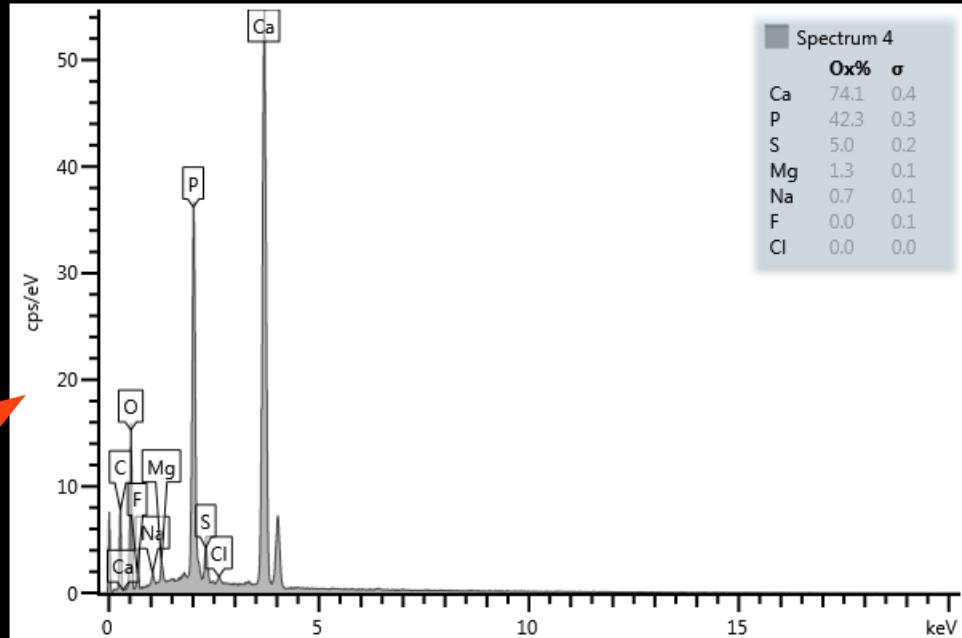
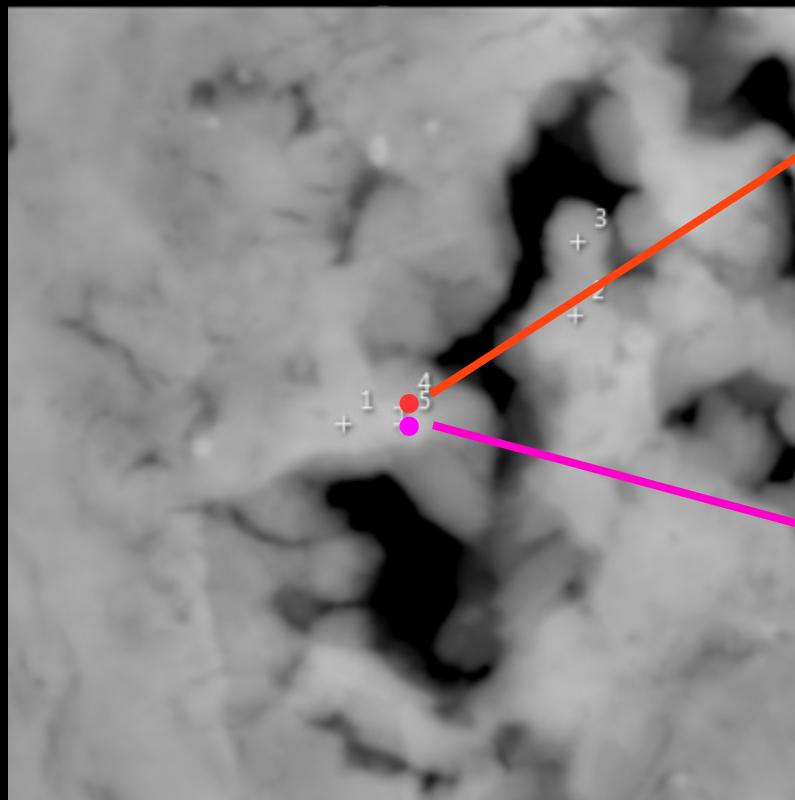
2 μm



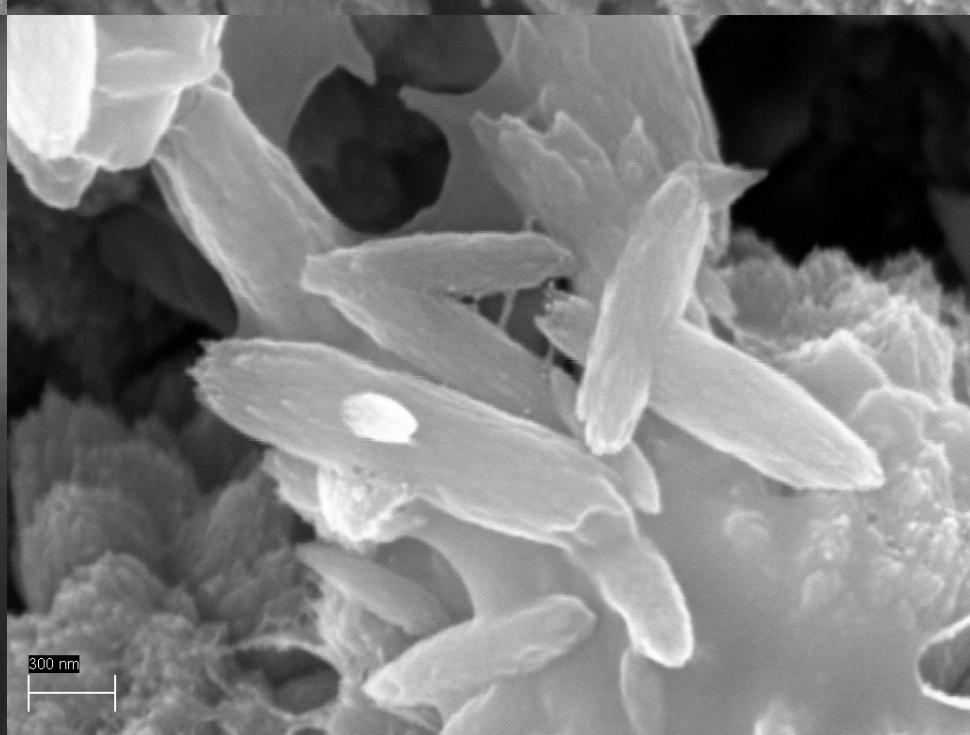
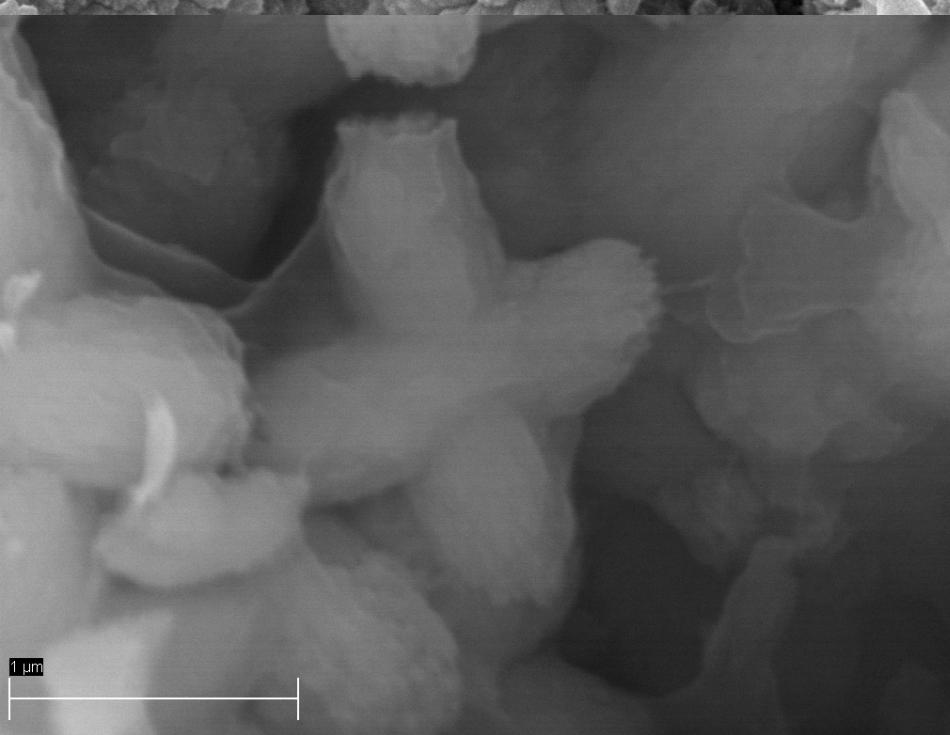
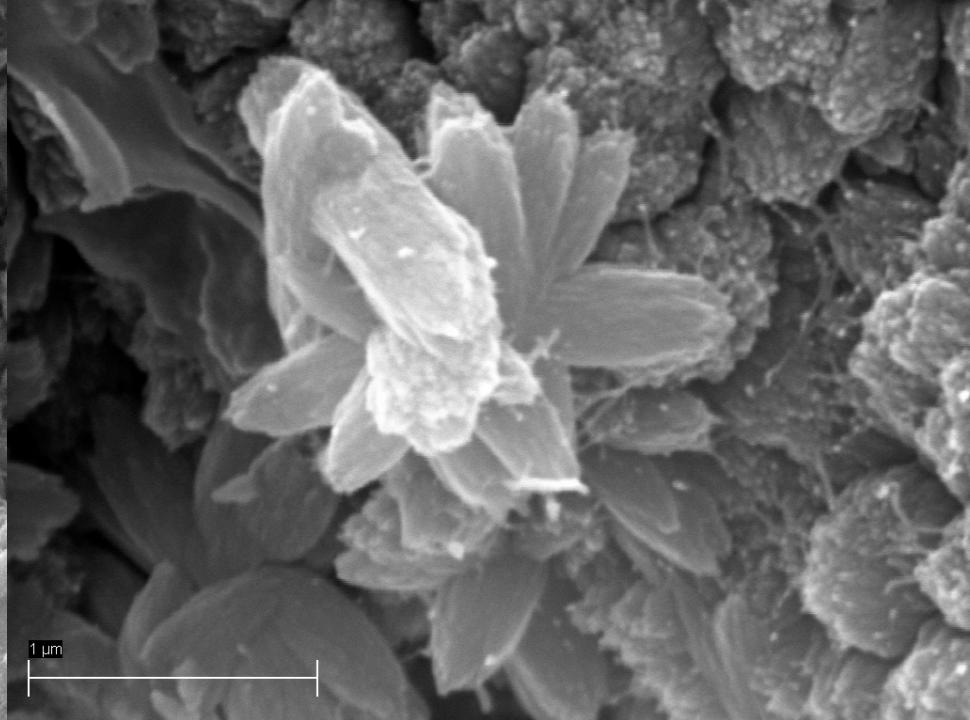
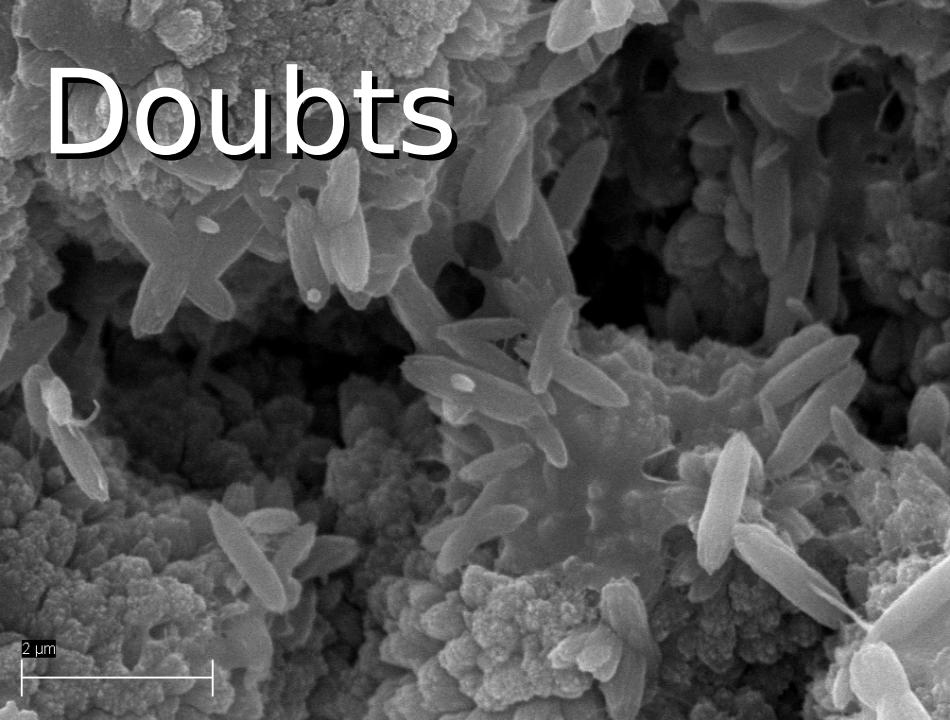


2 μ m

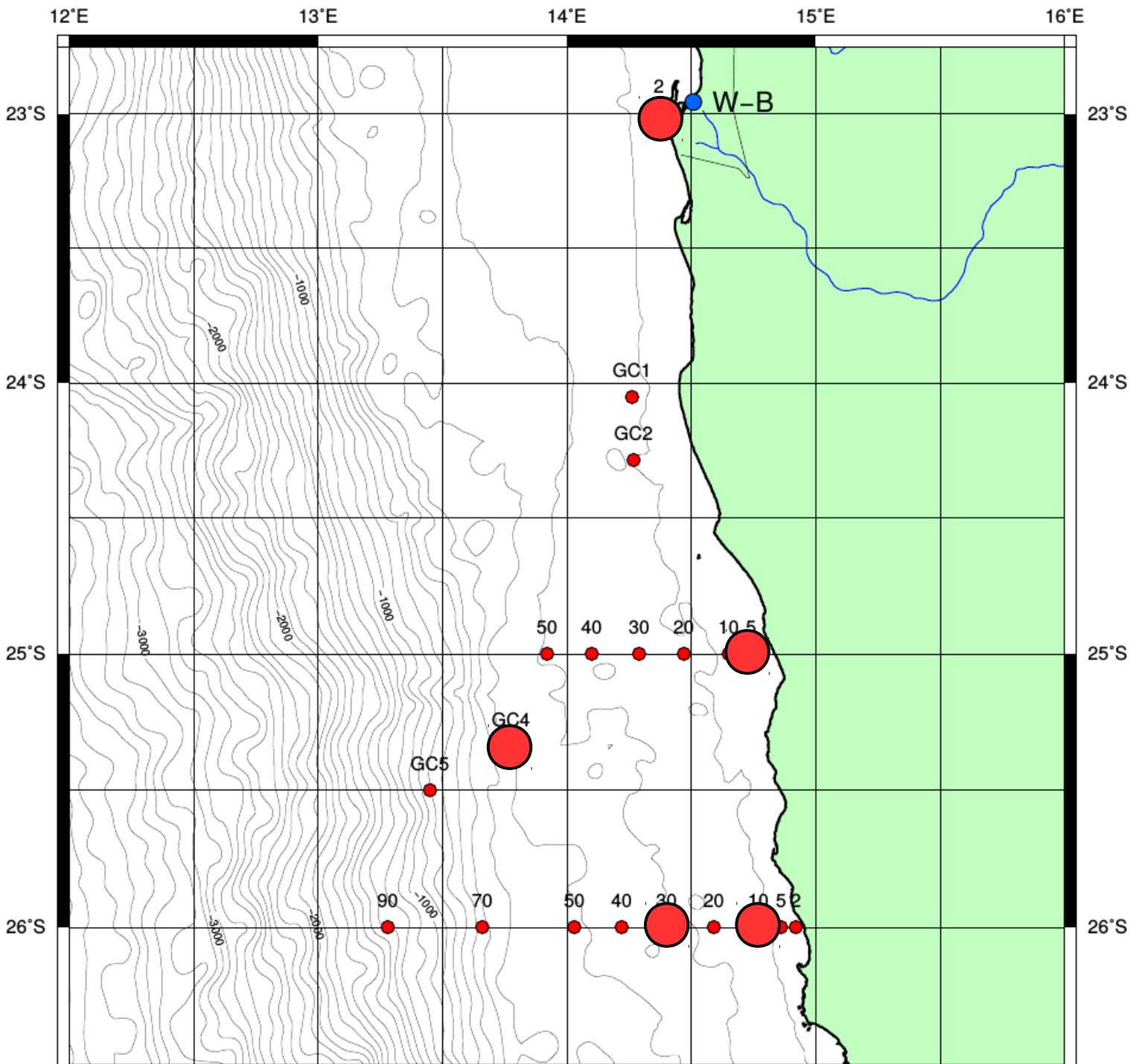
EDX



Doubts



Sampling



Sampling

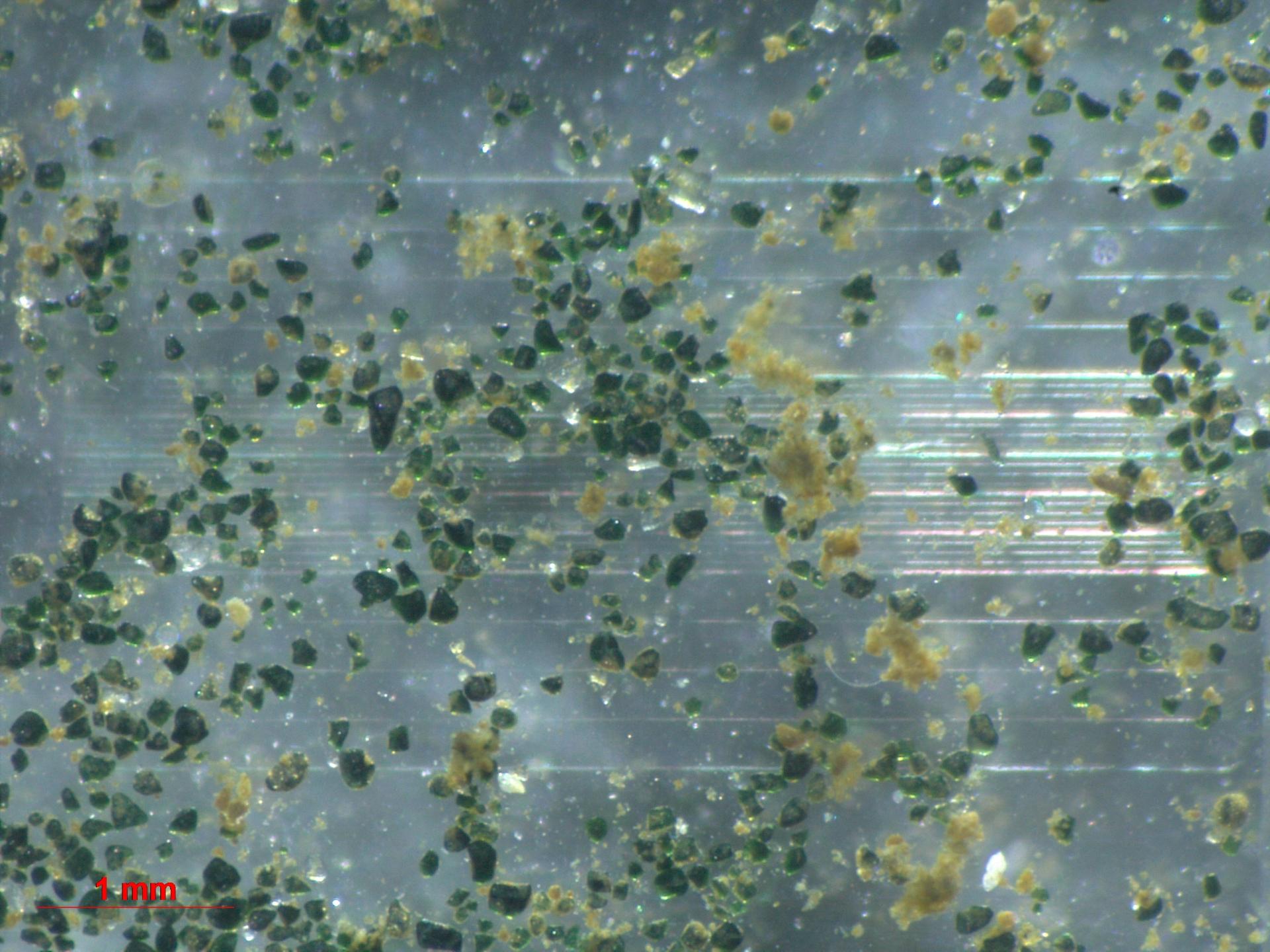
- „Diatomaceous ooze“ at 23S (40 m)
- Mudbelt at 25S (47 m)
- Deeper shelf at 25.34S (301 m)
- Central shelf at 26S (198 m)
- Central shelf at 26S (116 m)



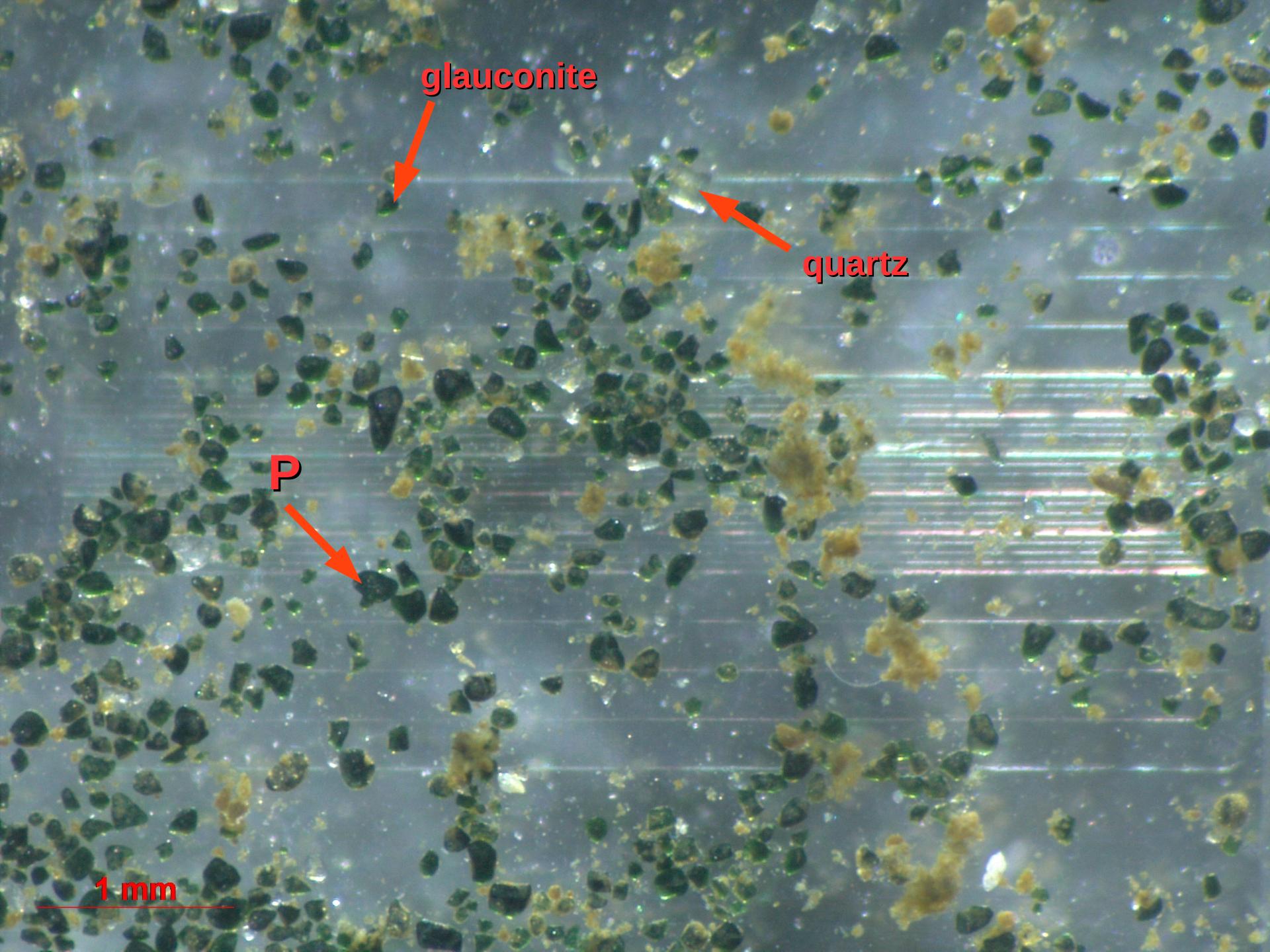
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1 mm



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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- Porewater geochemistry and P speciation (Jake Bailey).
- **Detailed micro- and nanostructure.**
- Authigenic phosphate?

Outlook

- Detailed comparison with ancient phosphorites.

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If not, what then?

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- **Implications for the interpretation of other ancient phosphorites.**

Acknowledgements:

- NatMIRC
- RV Mirabilis crew
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- RGNO instructors and organisers



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