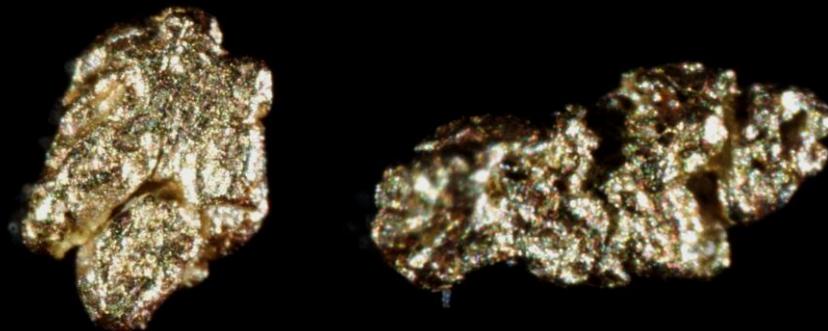




The biogeochemistry of gold

Gordon Southam
School of Earth &
Environmental Sciences
The University of Queensland

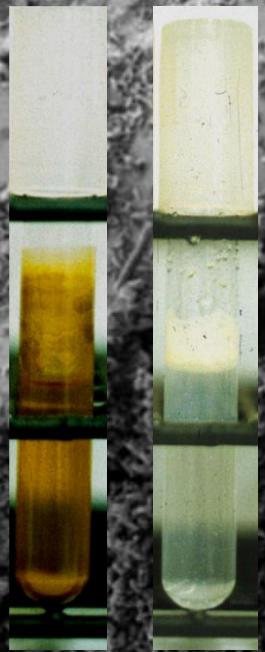
Placer gold
San Luis Range, Argentina
(Márquez-Zavalía et al., 2004)

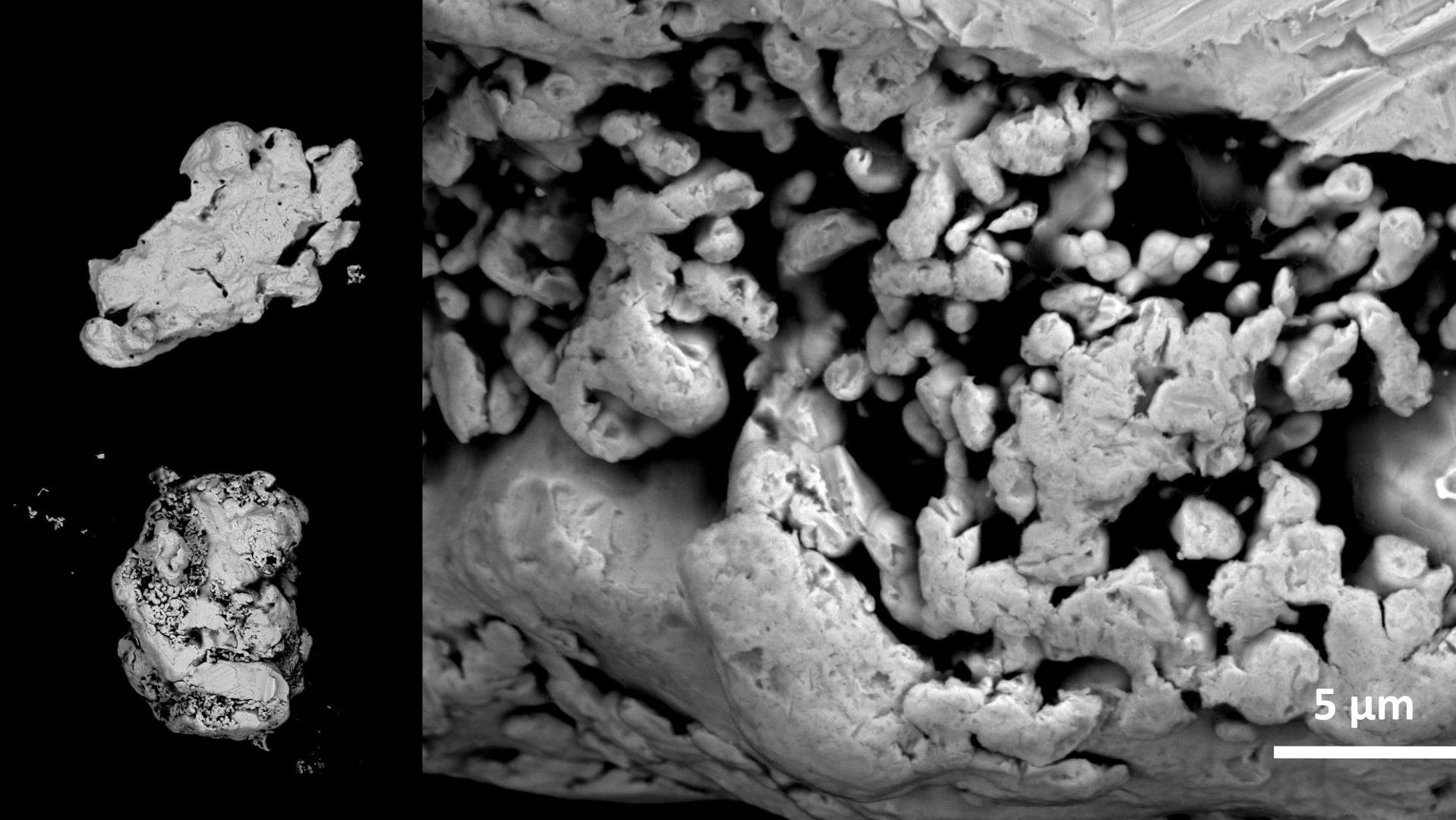


500 μm



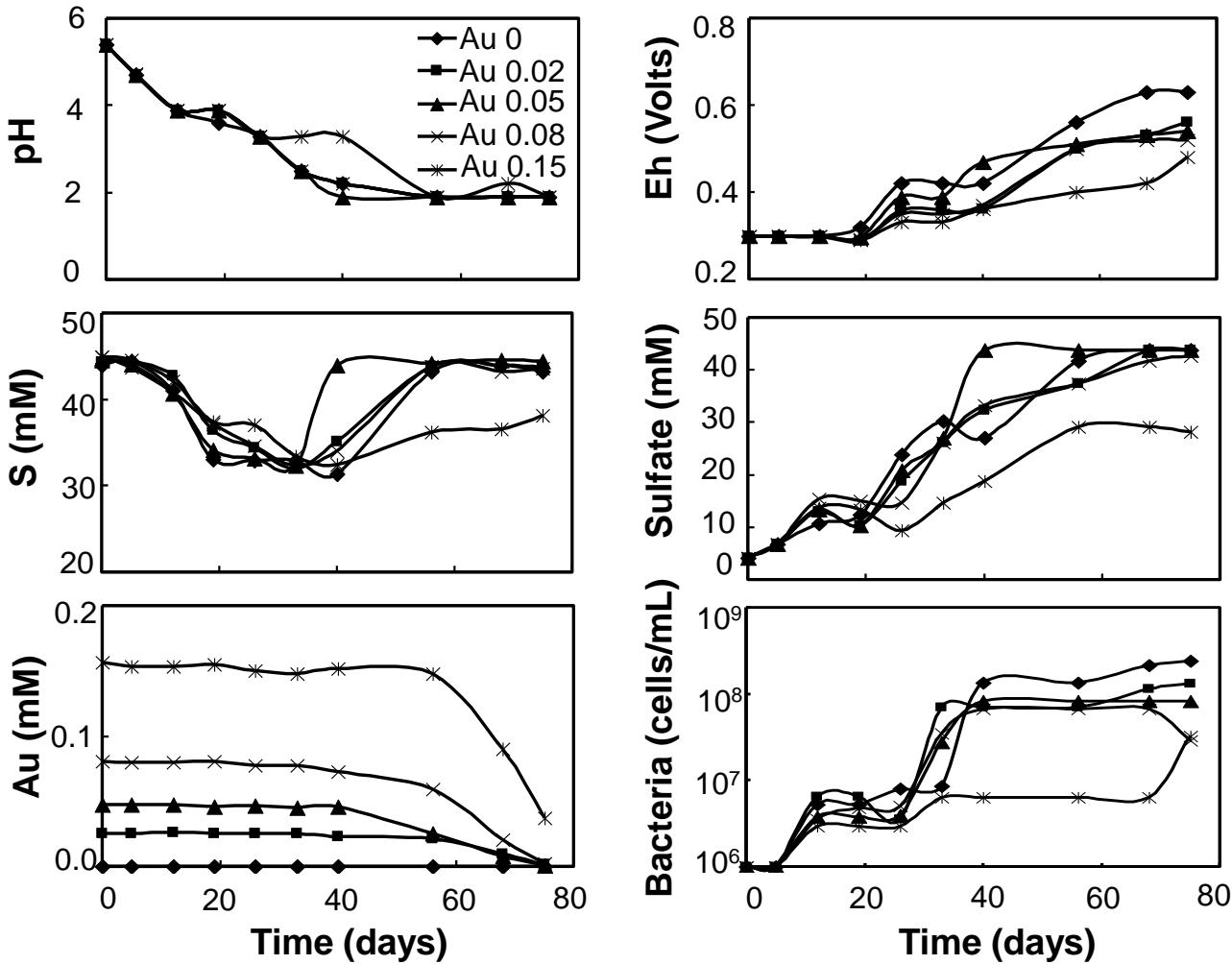
100 μm

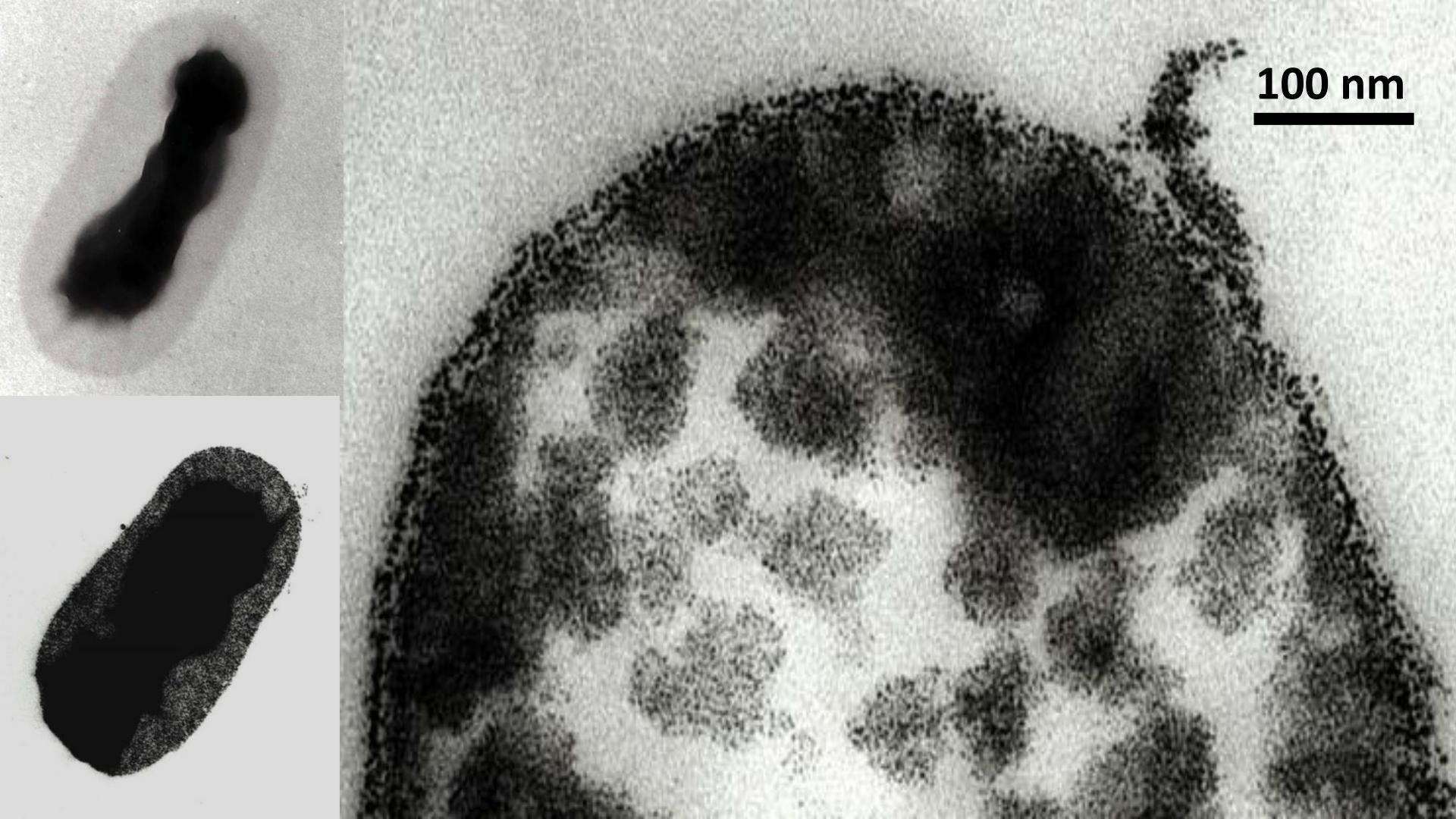




$5 \mu\text{m}$

Acidithiobacillus
thiooxidans
 $S_2O_3^{2-}$ /
 $Au(S_2O_3)_2^{3-}$
(Lengke et al.,
2005)



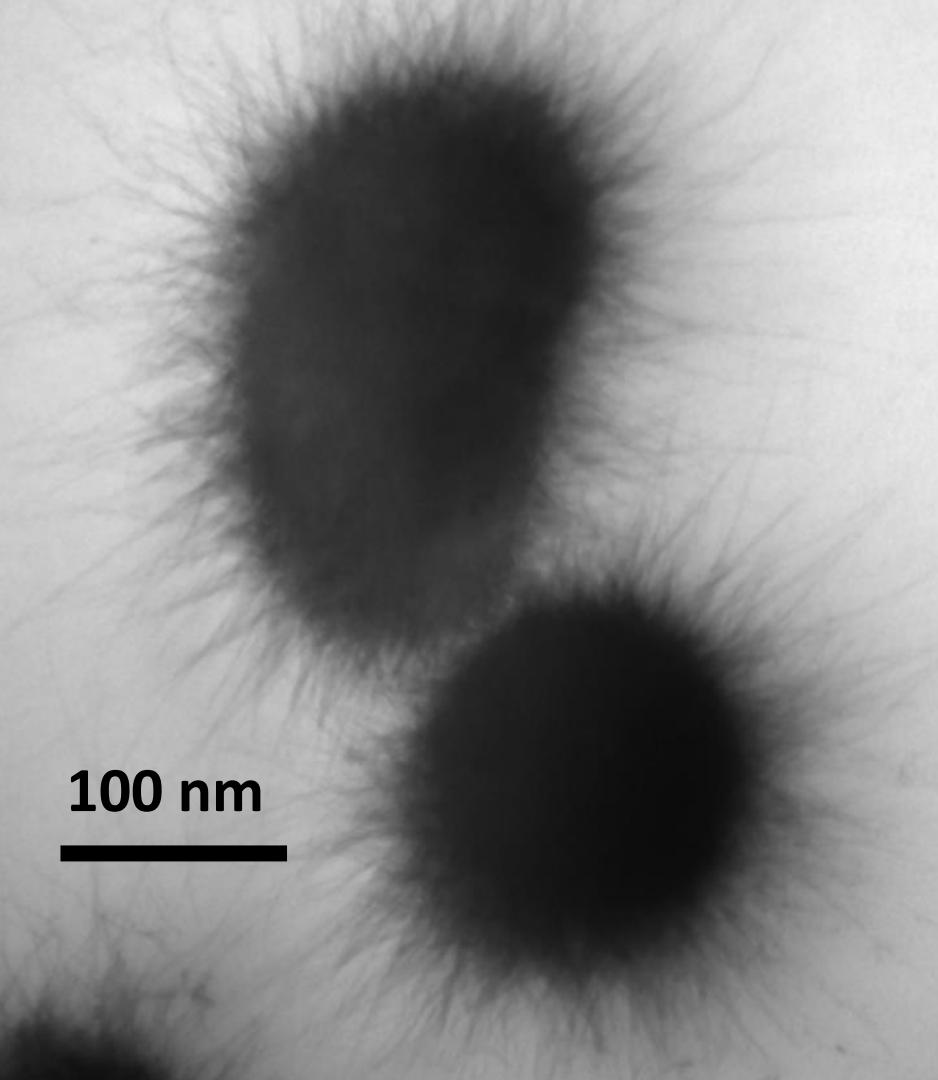


100 nm

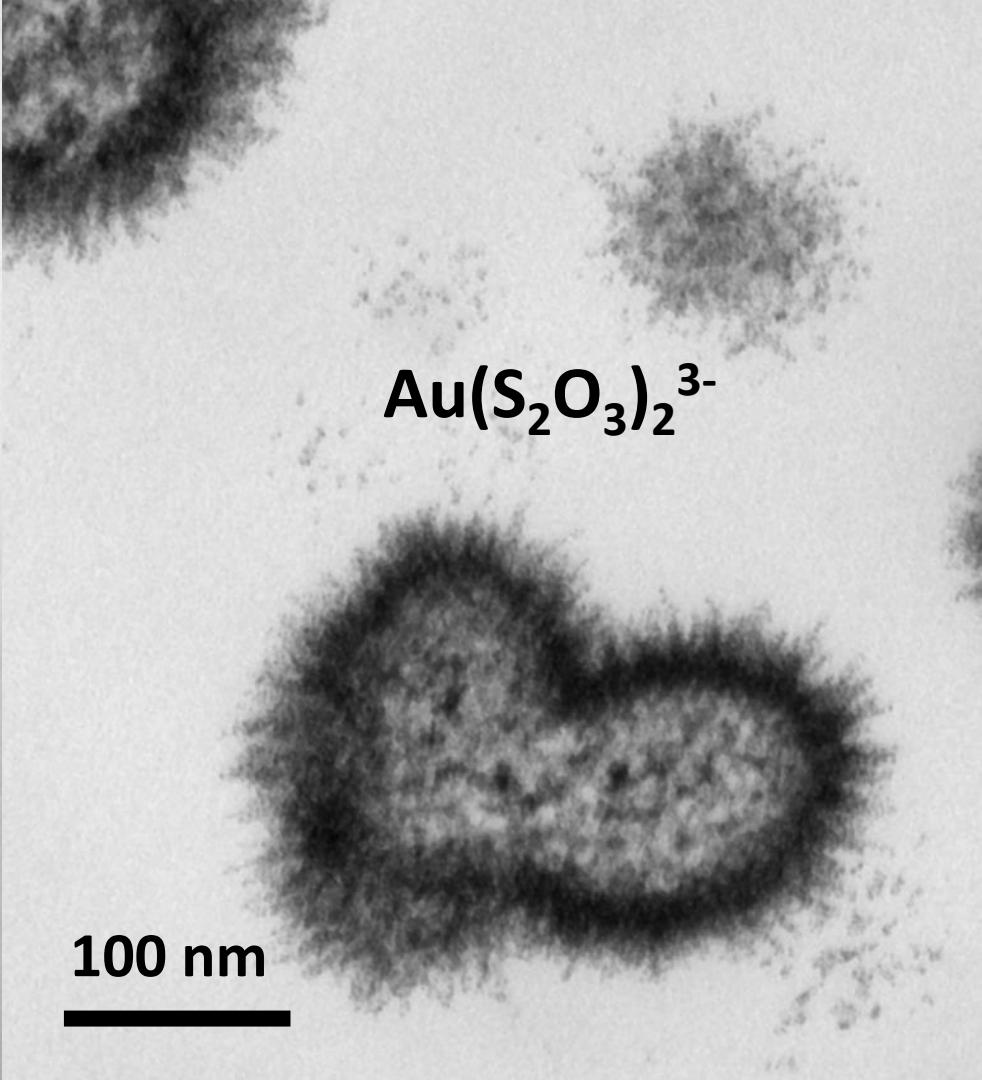


Acidithiobacillus ferrooxidans + $\text{Au}(\text{S}_2\text{O}_3)_2^{3-}$

1 μm

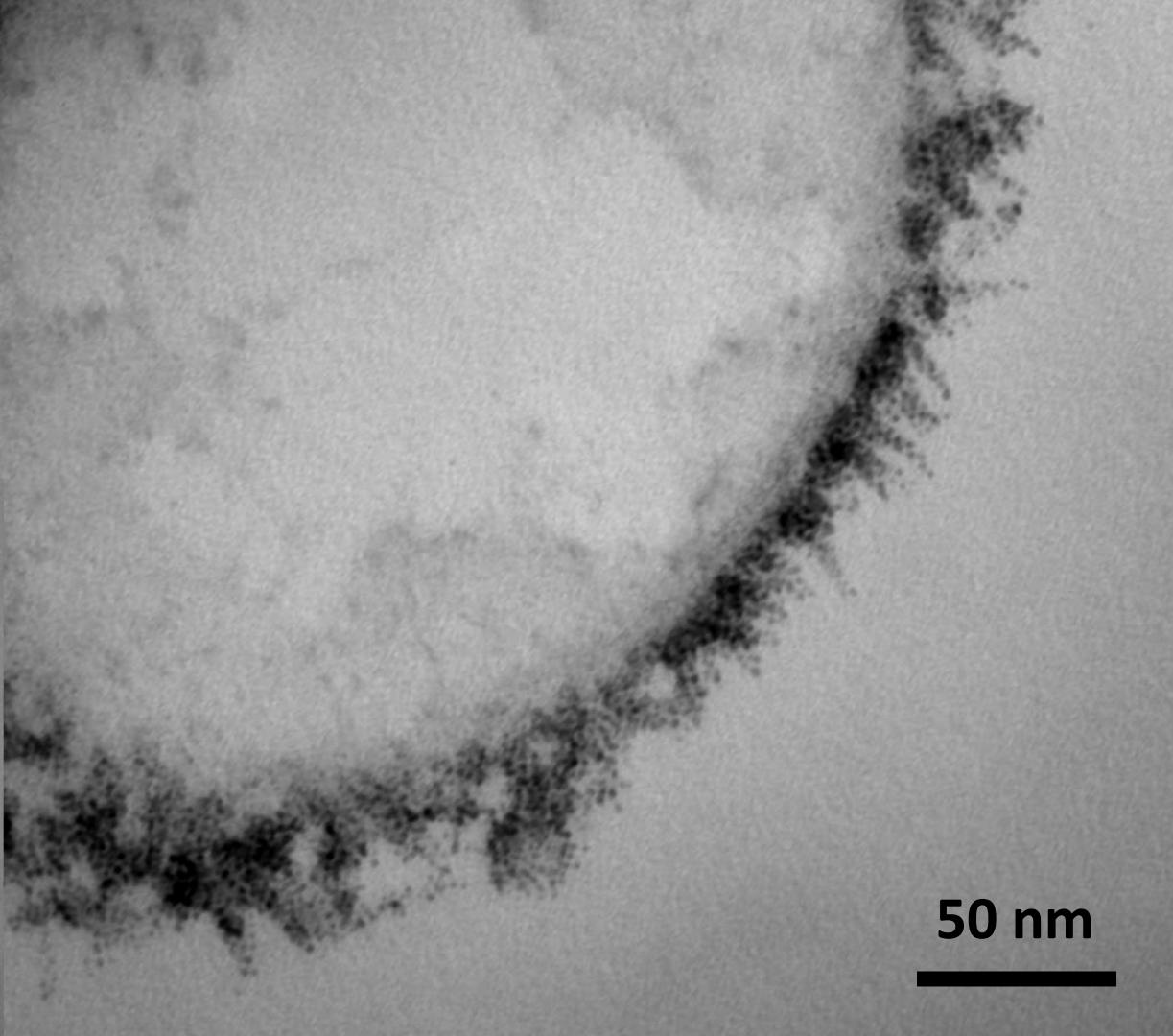
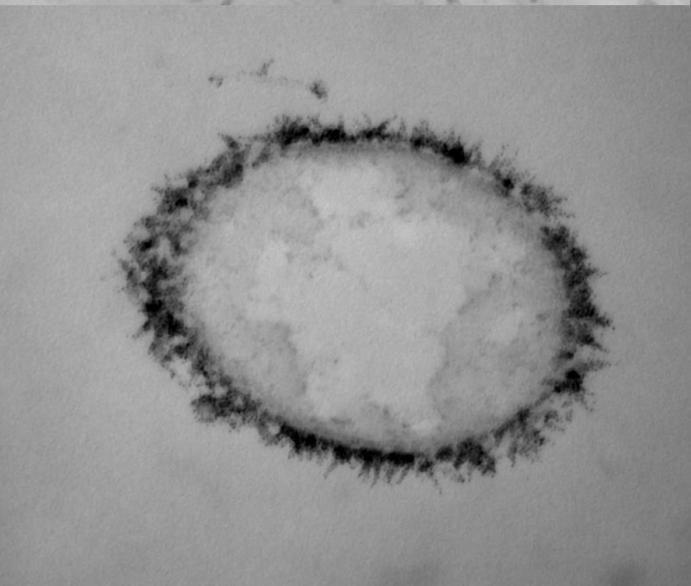
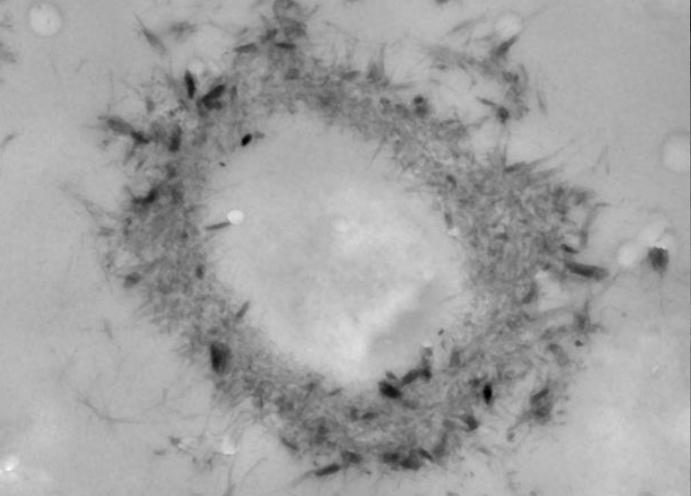


100 nm



100 nm



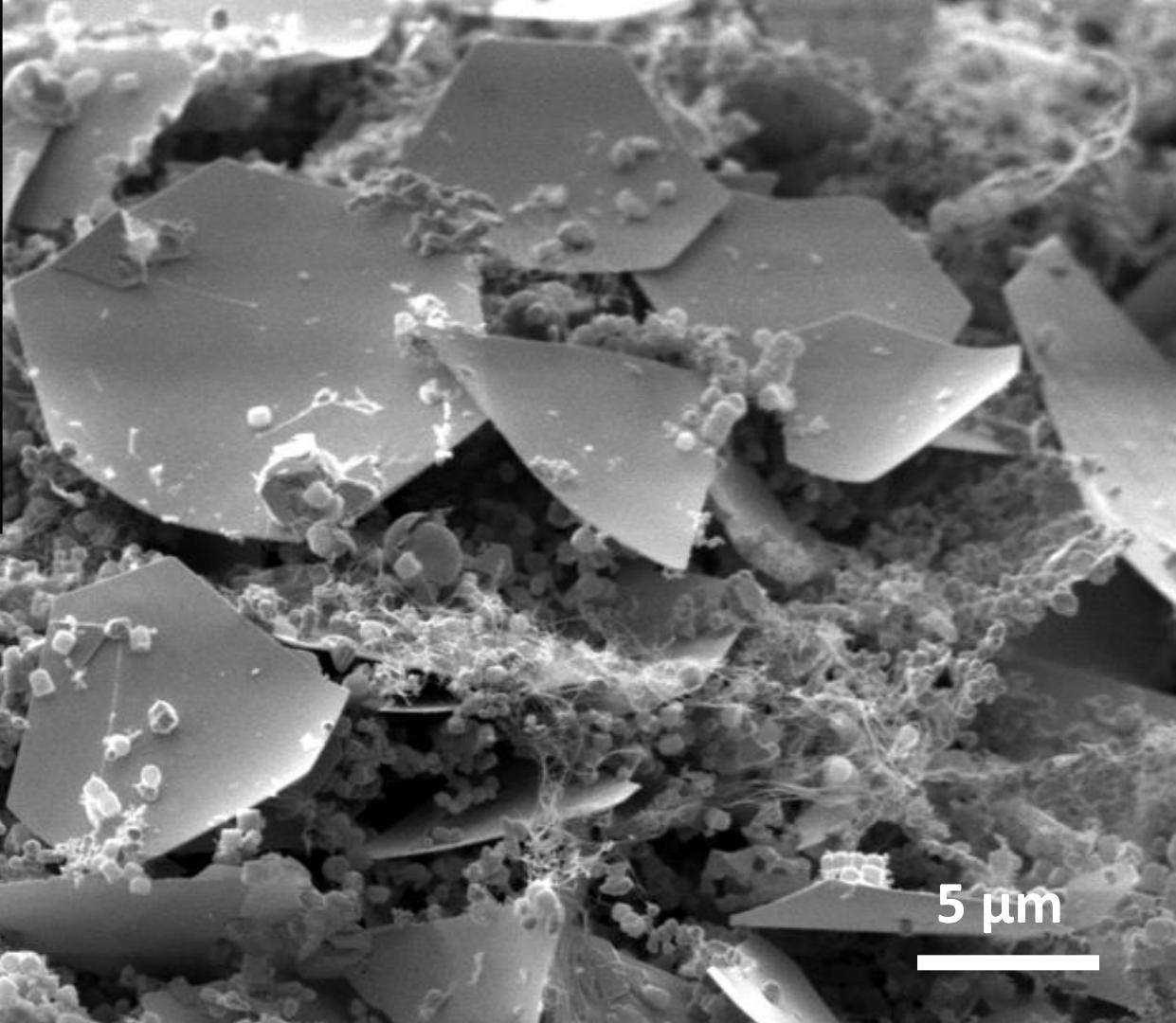
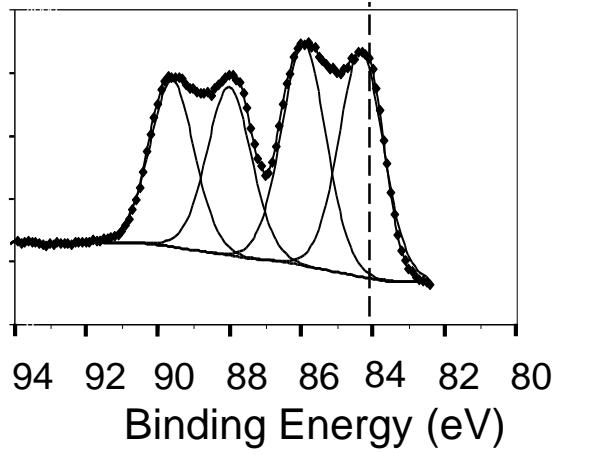


50 nm

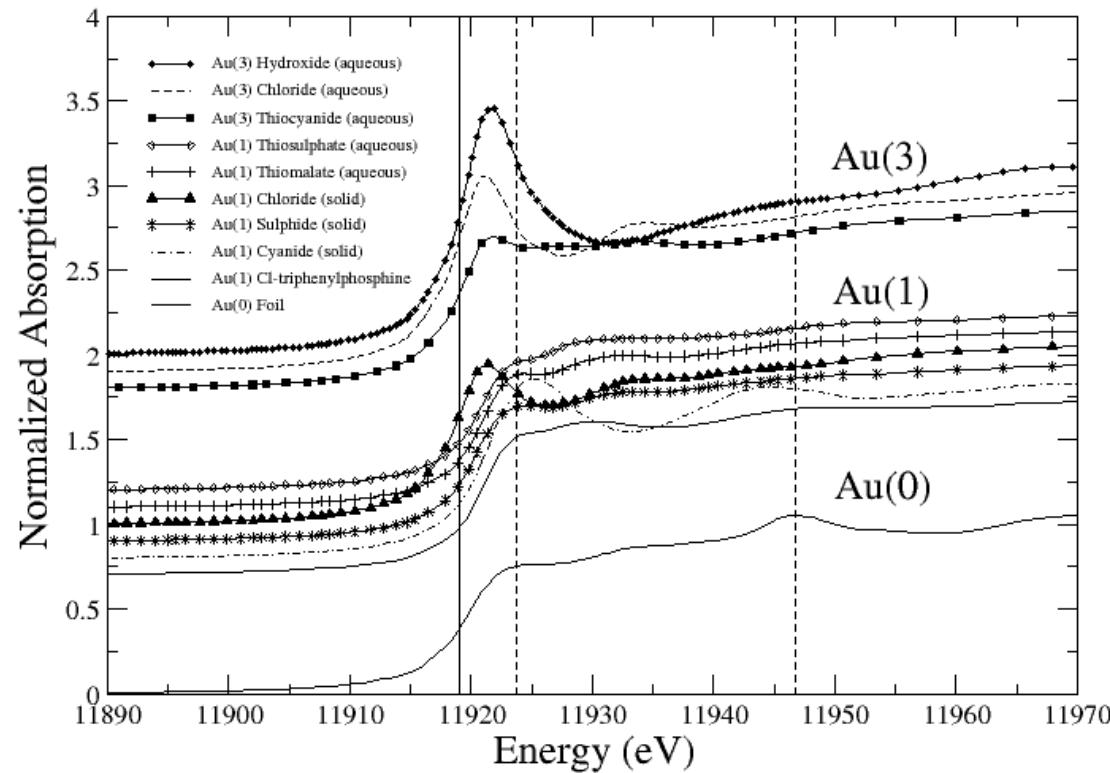
Plectonema boryanum UTEX 485 + Au(III) chloride
(Lengke et al., 2006)

1 μm

Au[°]

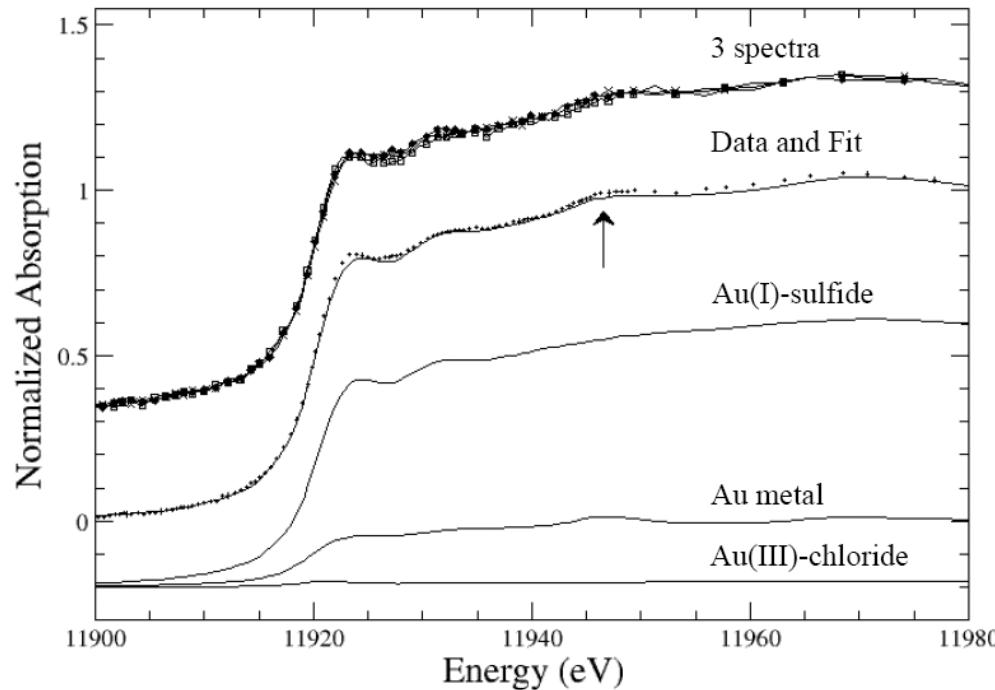


Synchrotron Methods; XANES/EXAFS

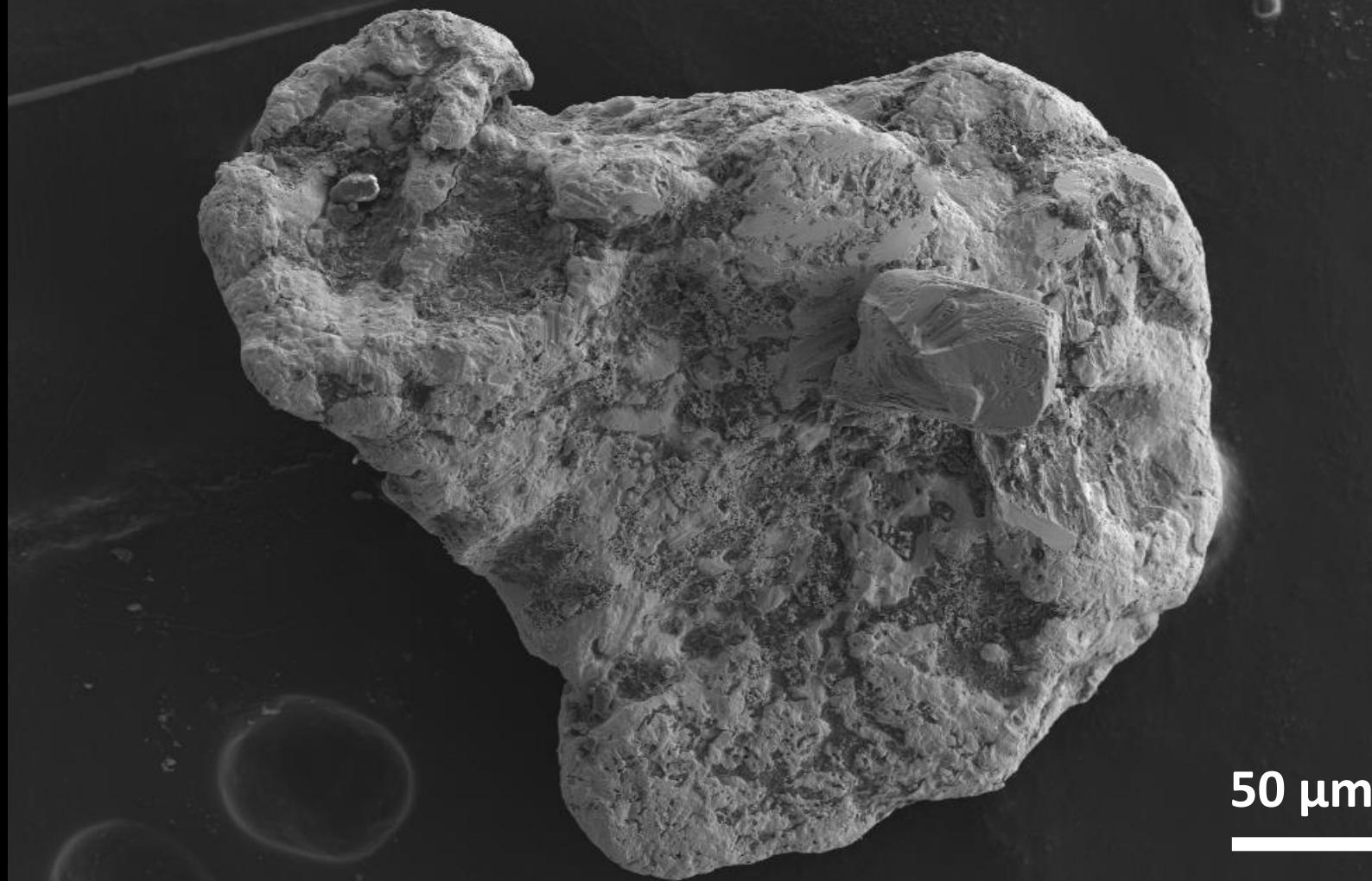


$0.8 \text{ mM HAuCl}_4 \cdot 3\text{H}_2\text{O}$

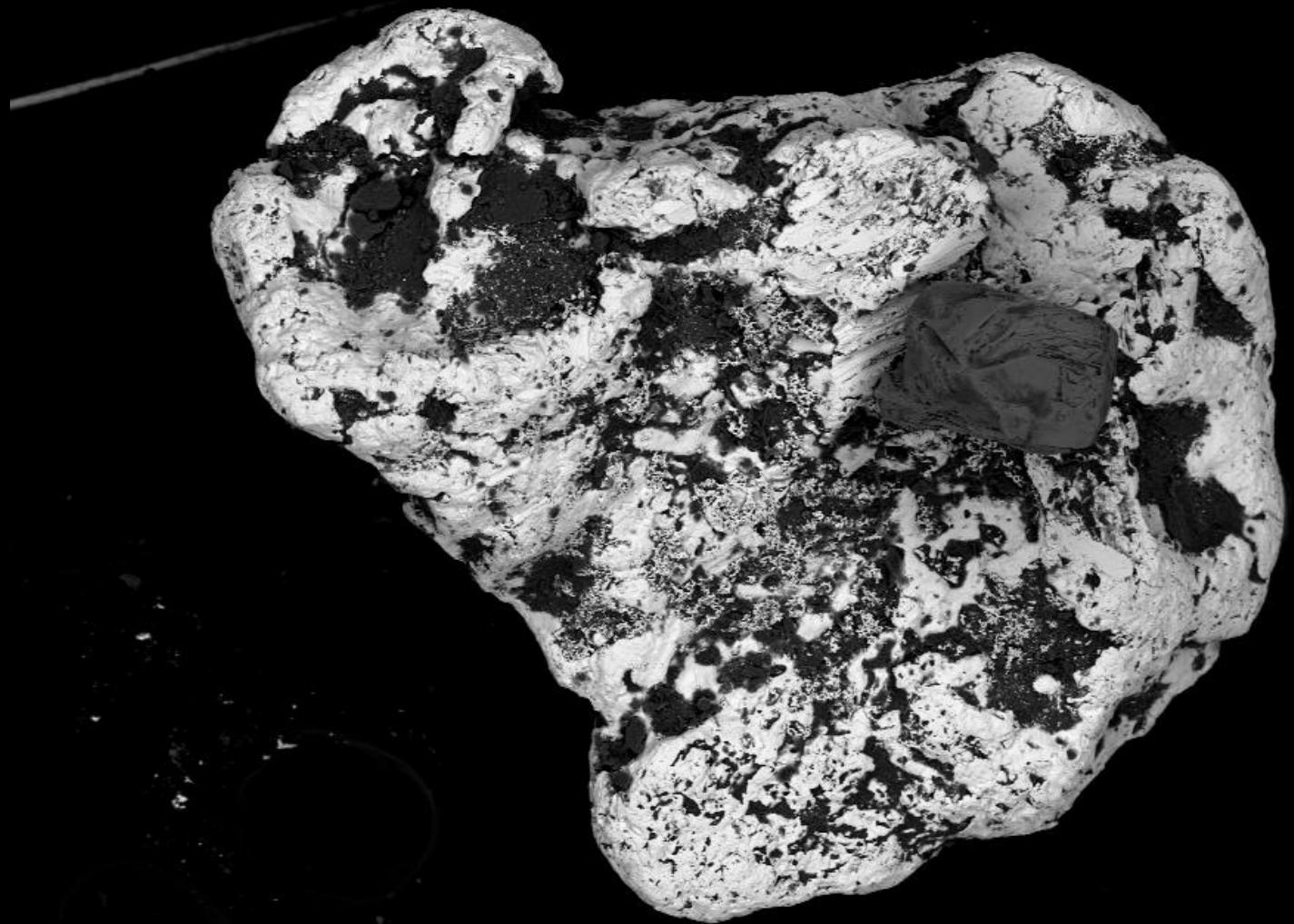
(150 ppm Au^{3+} + 20 mg/ml *Plectonema boryanum*)



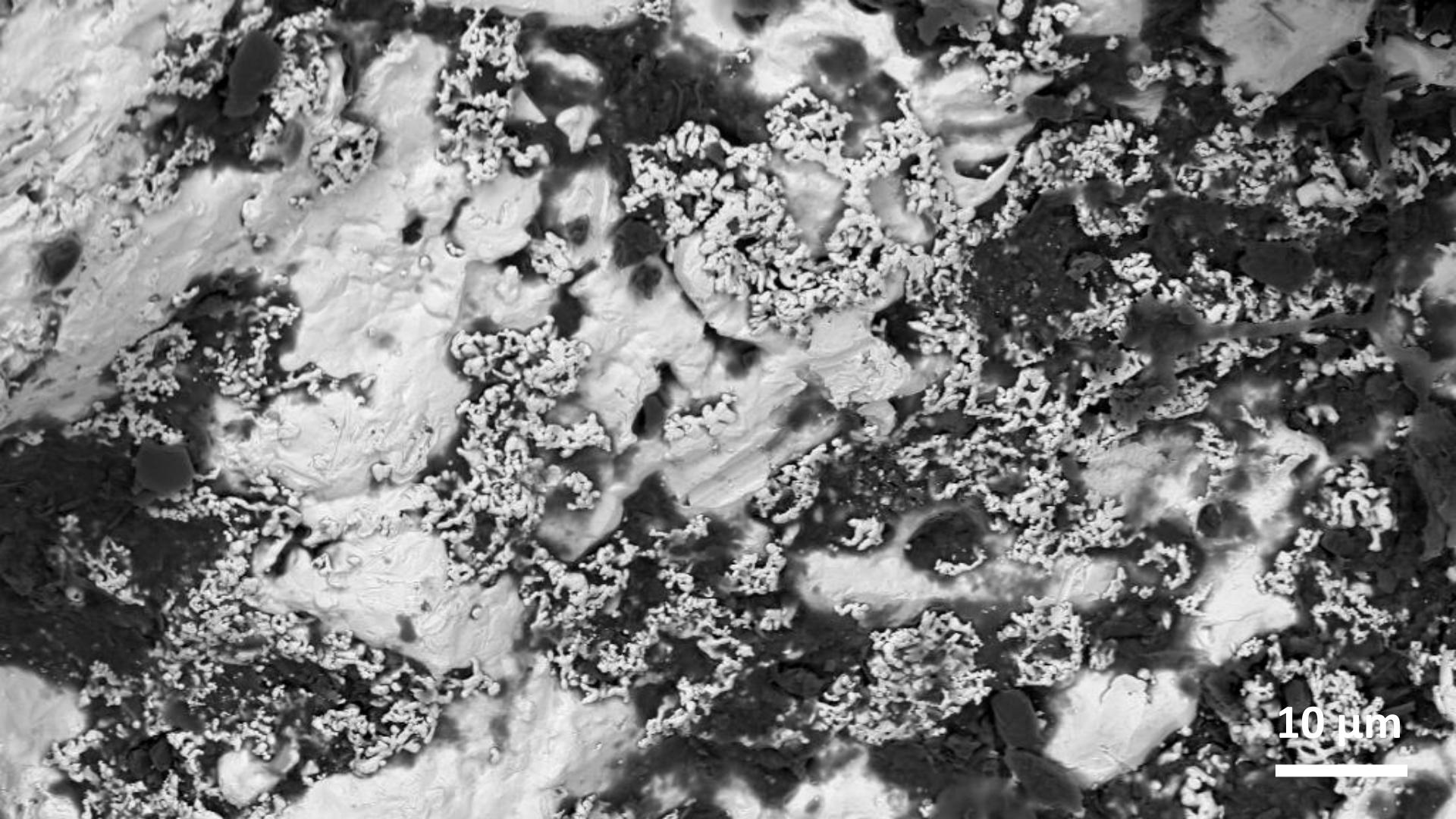




50 μm



50 μm



10 μm



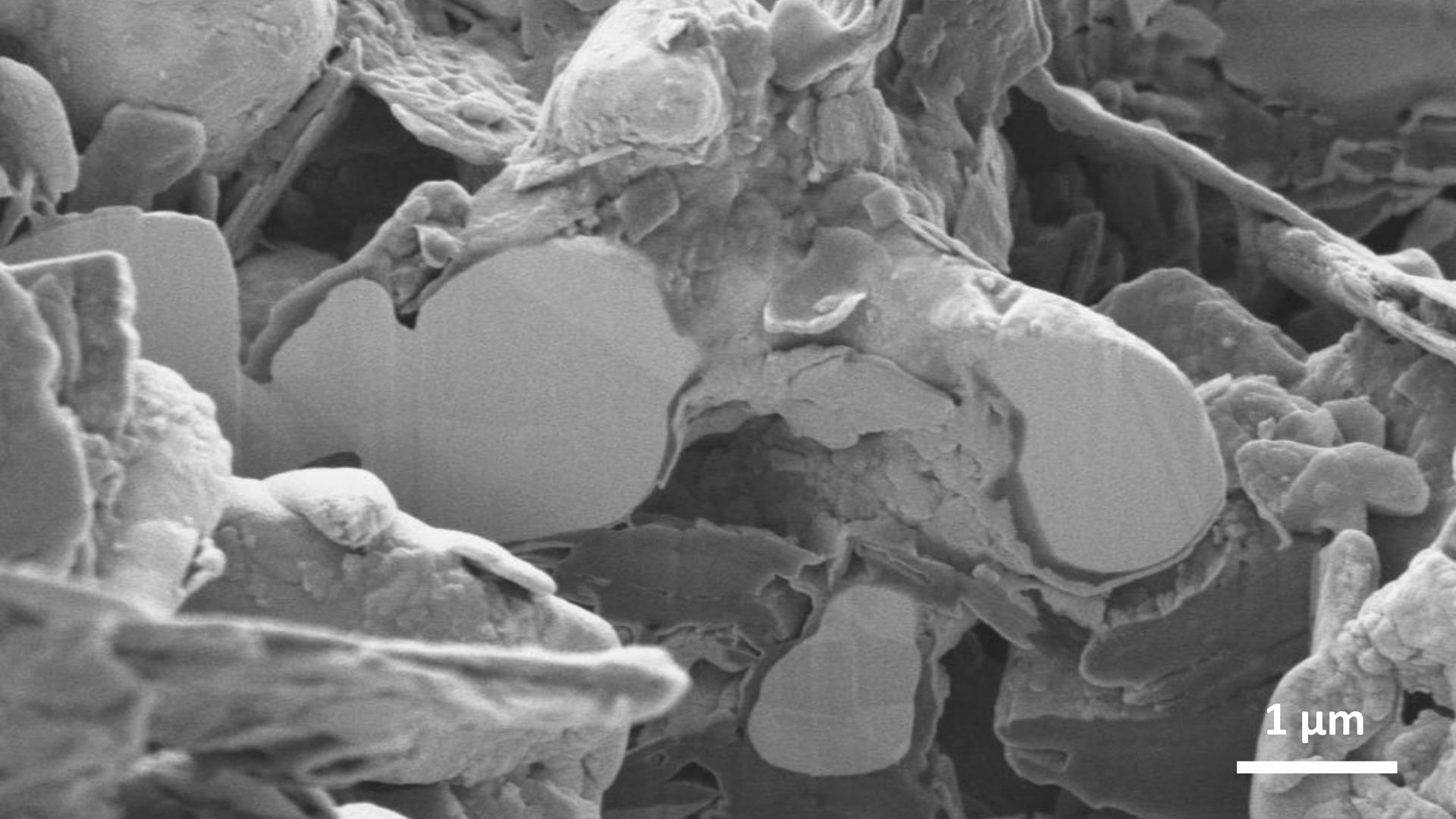


5 μ m



1 μm

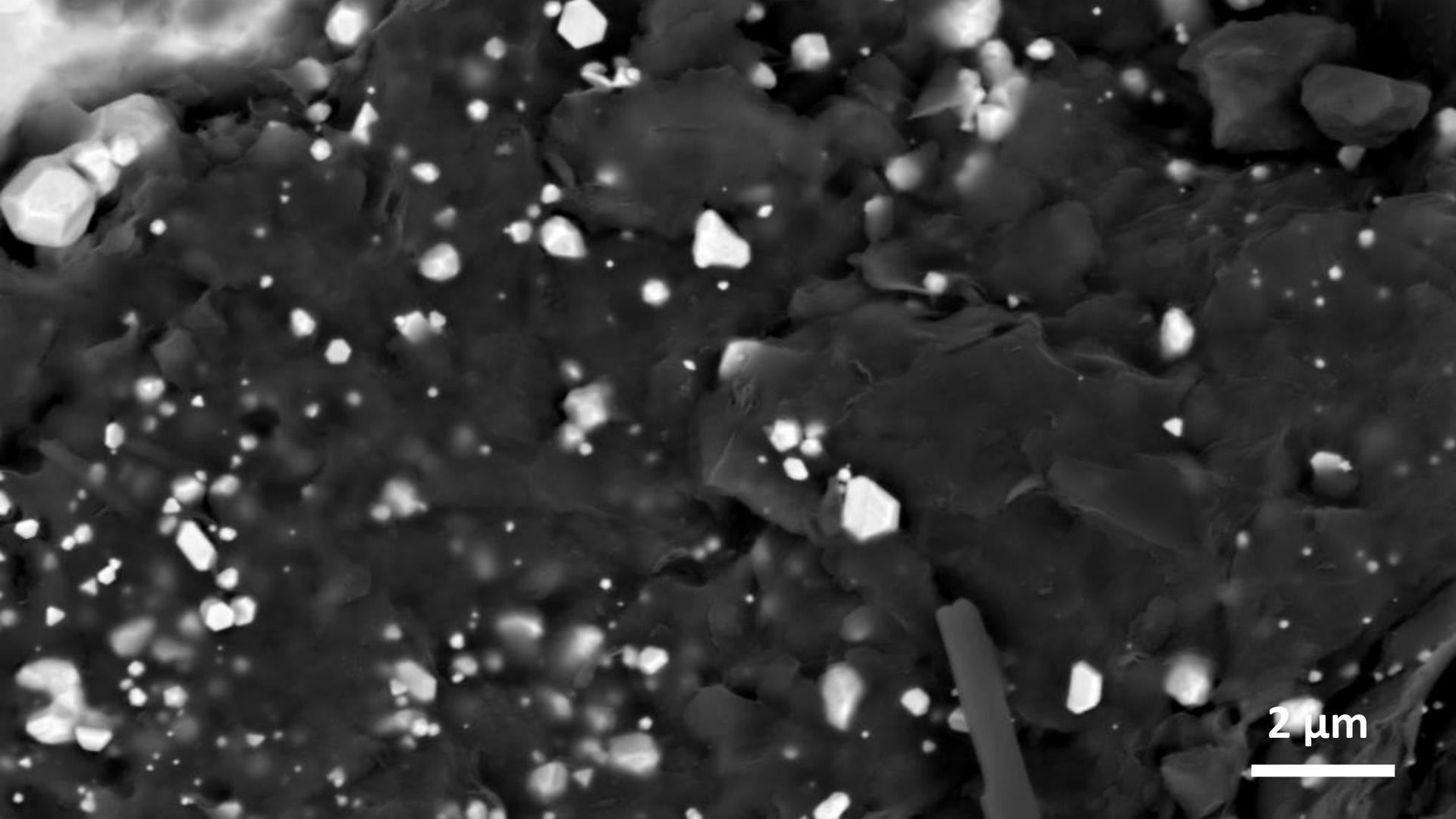
A scanning electron micrograph showing a complex, porous structure composed of numerous small, rounded, and somewhat irregular particles. These particles are interconnected, creating a dense network of void spaces. The overall appearance is granular and somewhat organic in nature. In the bottom right corner, there is a white scale bar consisting of a horizontal line with a vertical line extending from its right end, labeled "1 μm".



1 μm

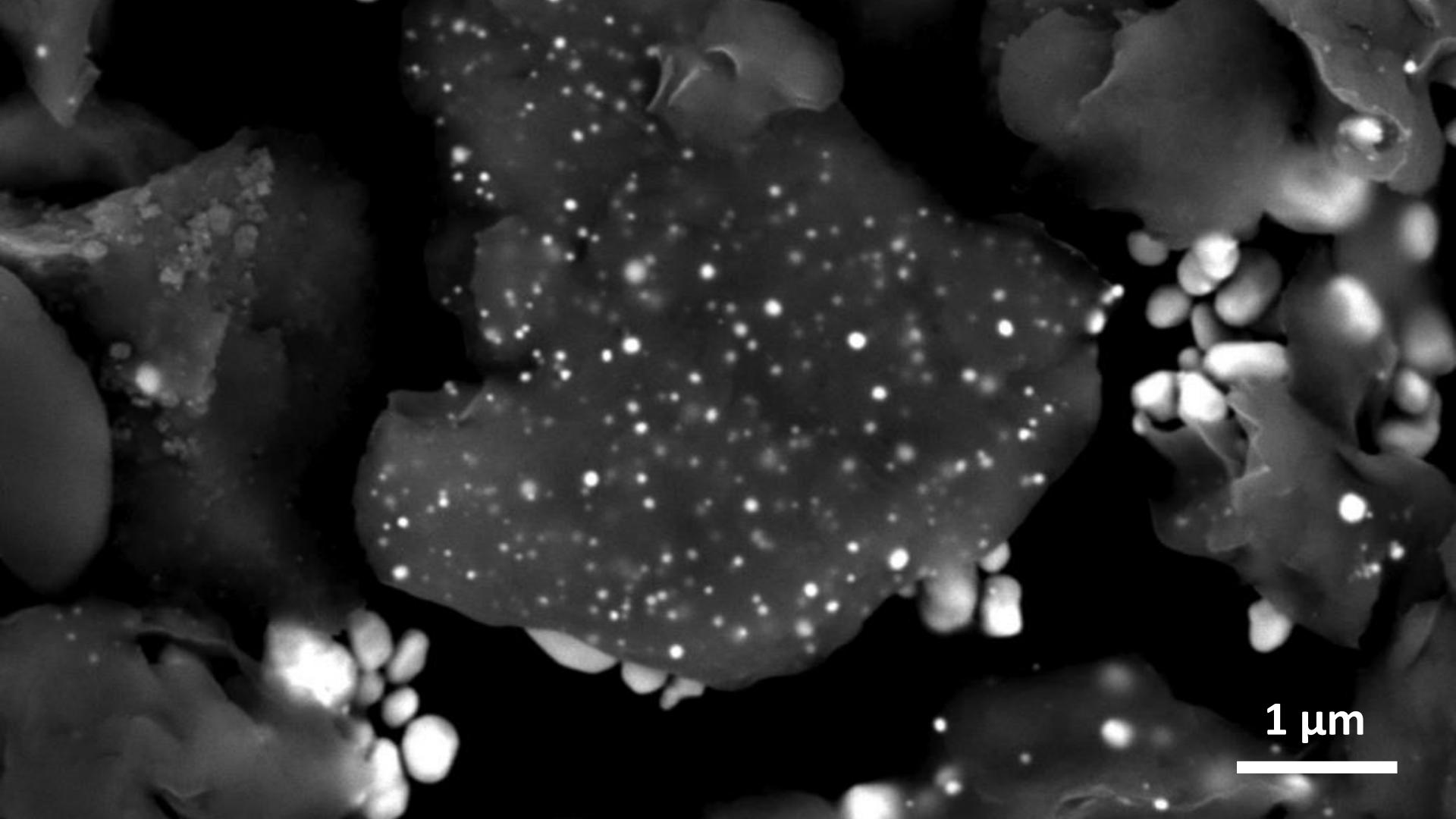


2 μm



2 μ m



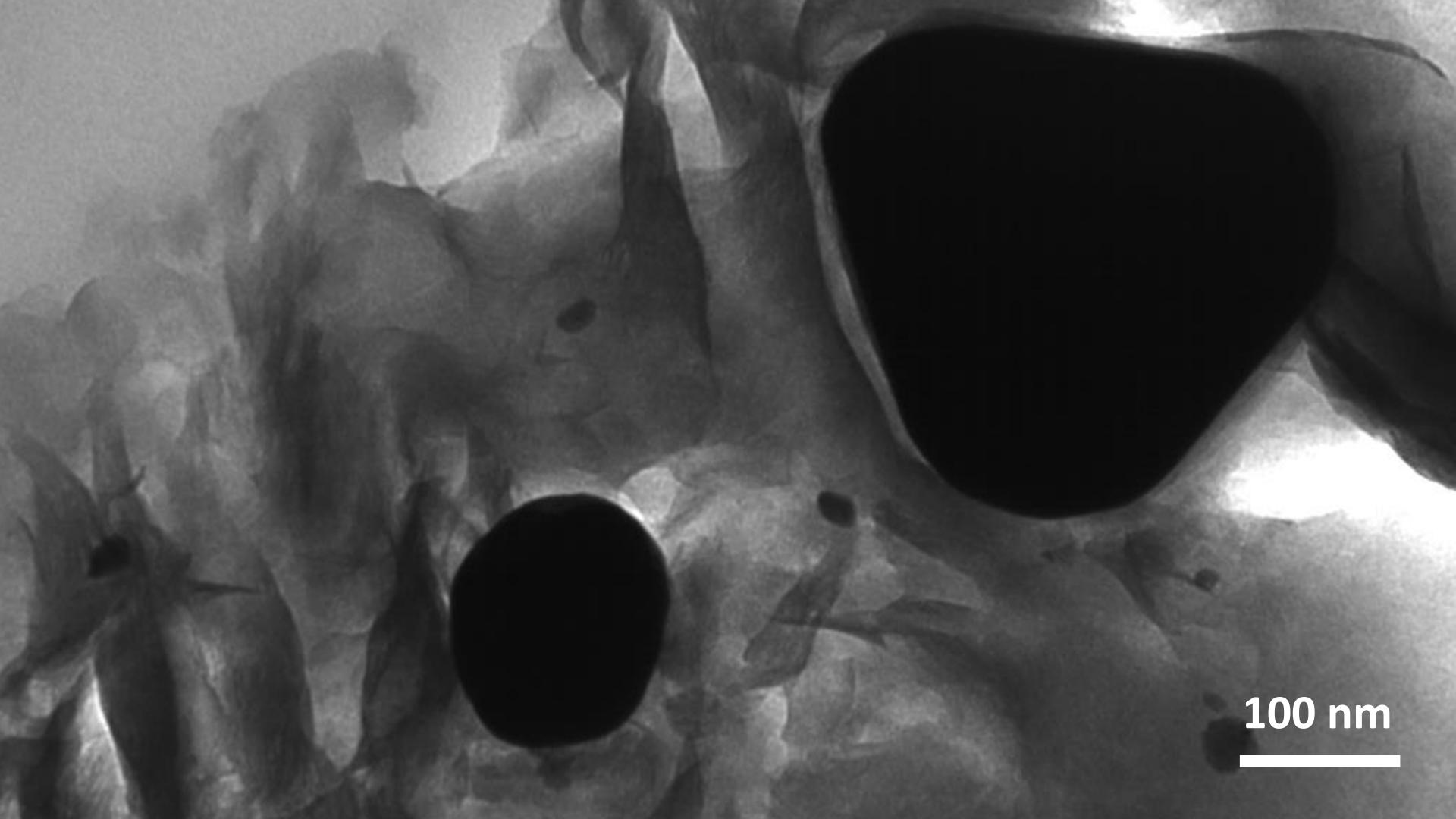


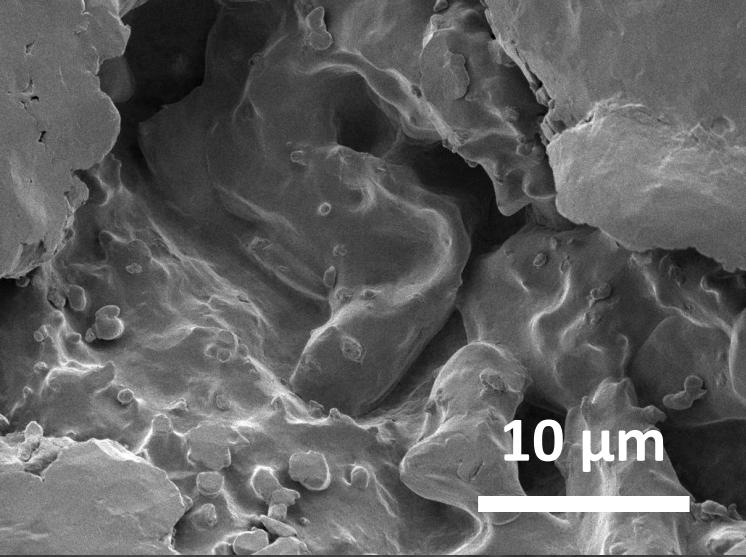
1 μm

This scanning electron micrograph (SEM) shows a complex, irregular surface, likely a biological tissue or cell cluster. The surface is covered with numerous small, bright, circular features, possibly viruses or cellular organelles, which appear as white dots against a darker background. A prominent, rounded structure is visible in the center-left, characterized by a dense distribution of these bright spots. To the right, there are more rounded, less densely packed clusters. A scale bar in the bottom right corner indicates a length of 1 micrometer ($1 \mu\text{m}$).



100 nm

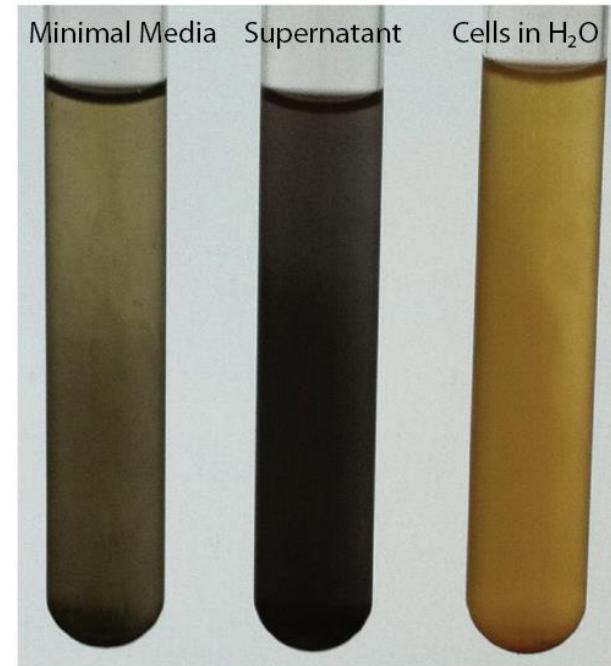
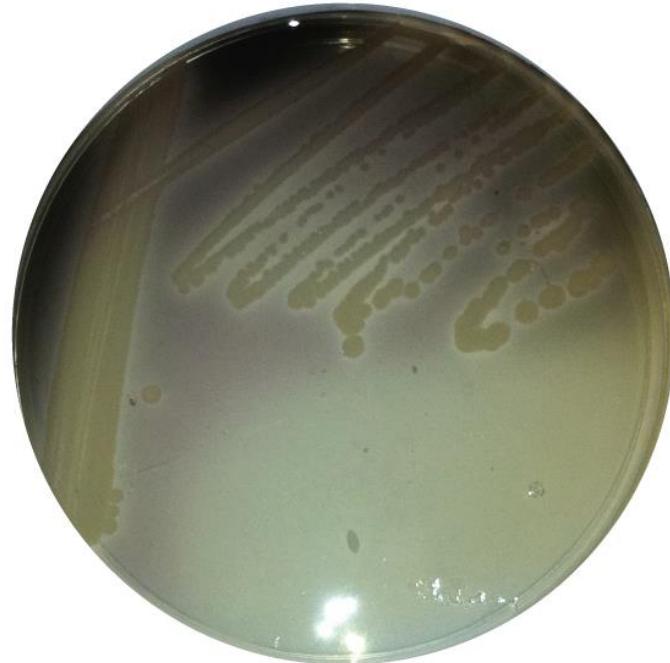




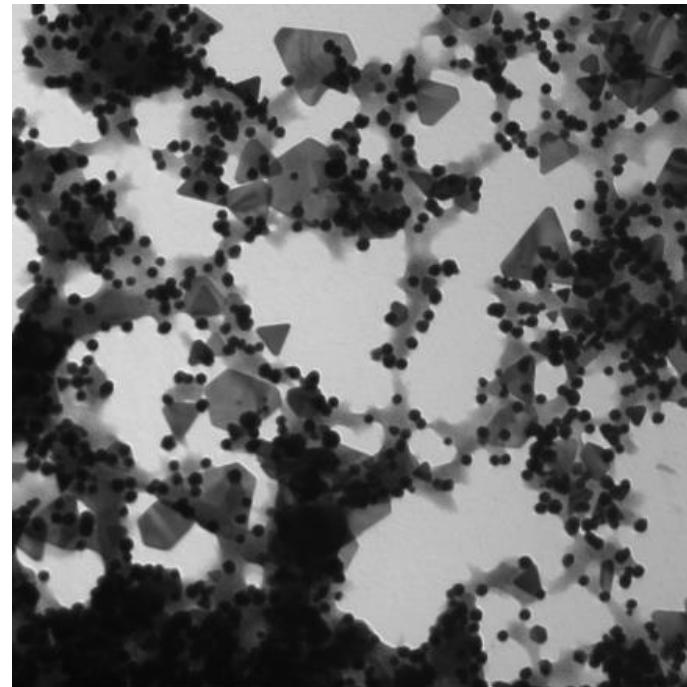
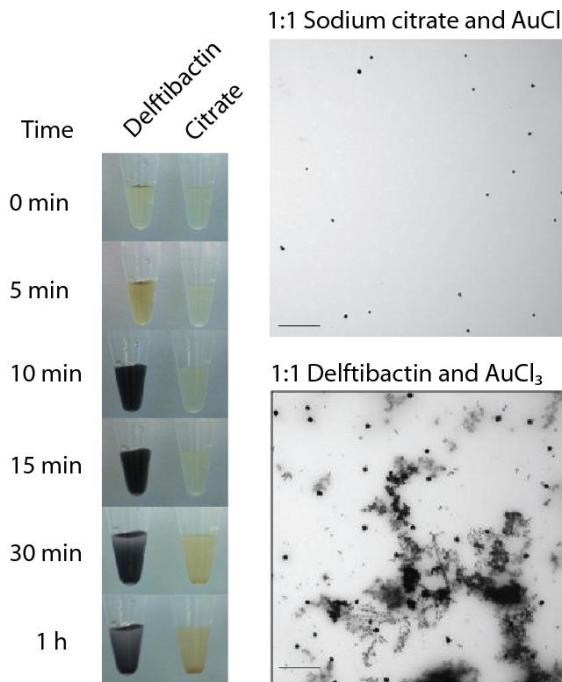
10 μm

500 nm

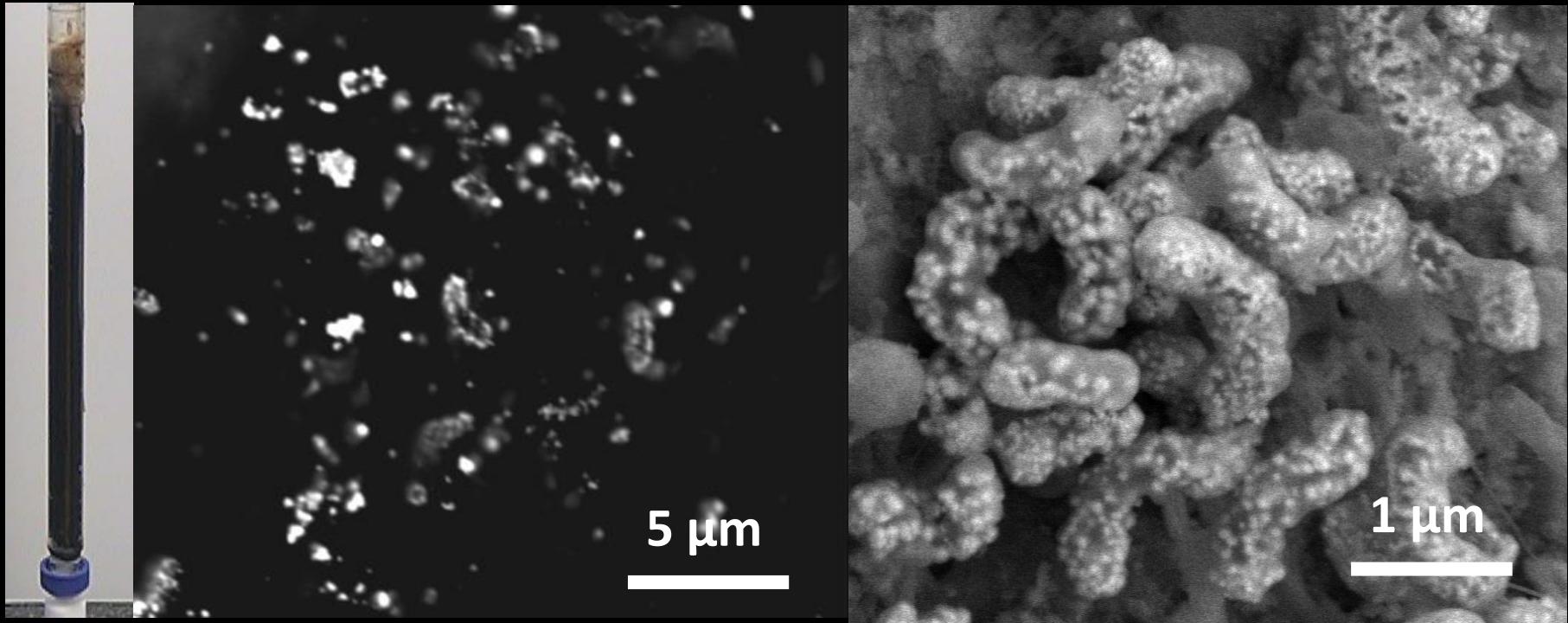
Delftibacter acidovorans; Delftibactin (Johnston et al., 2013)

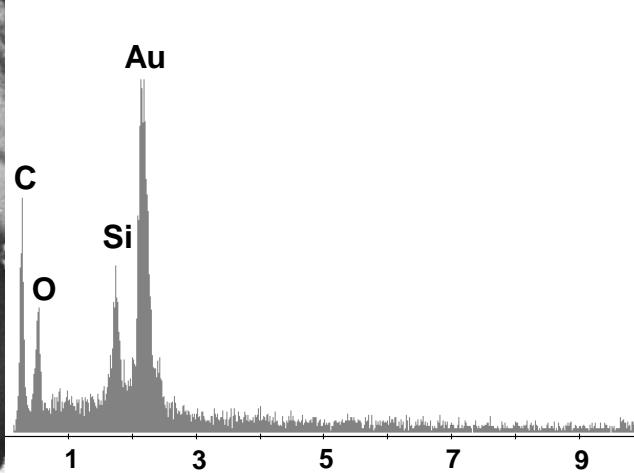
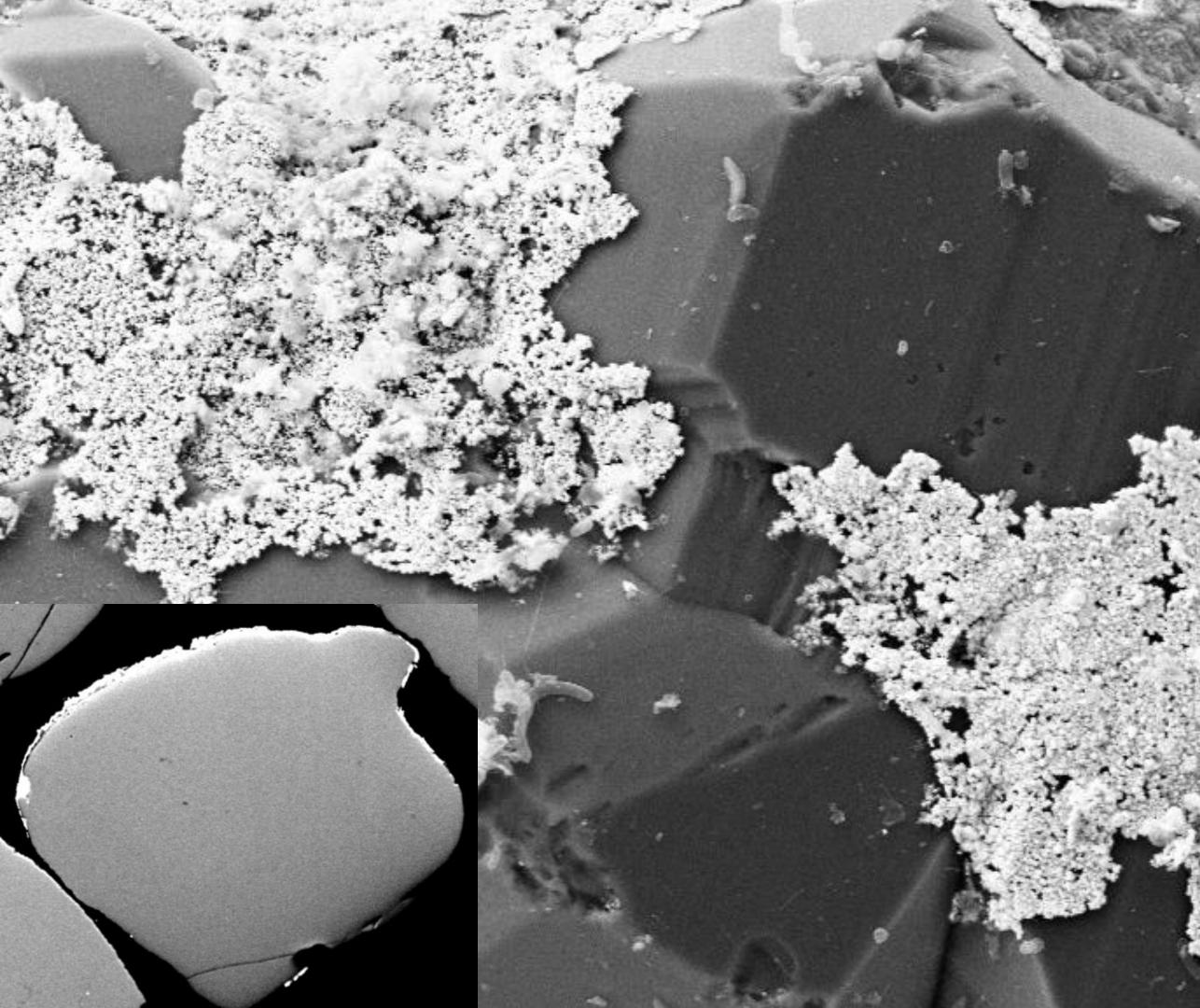


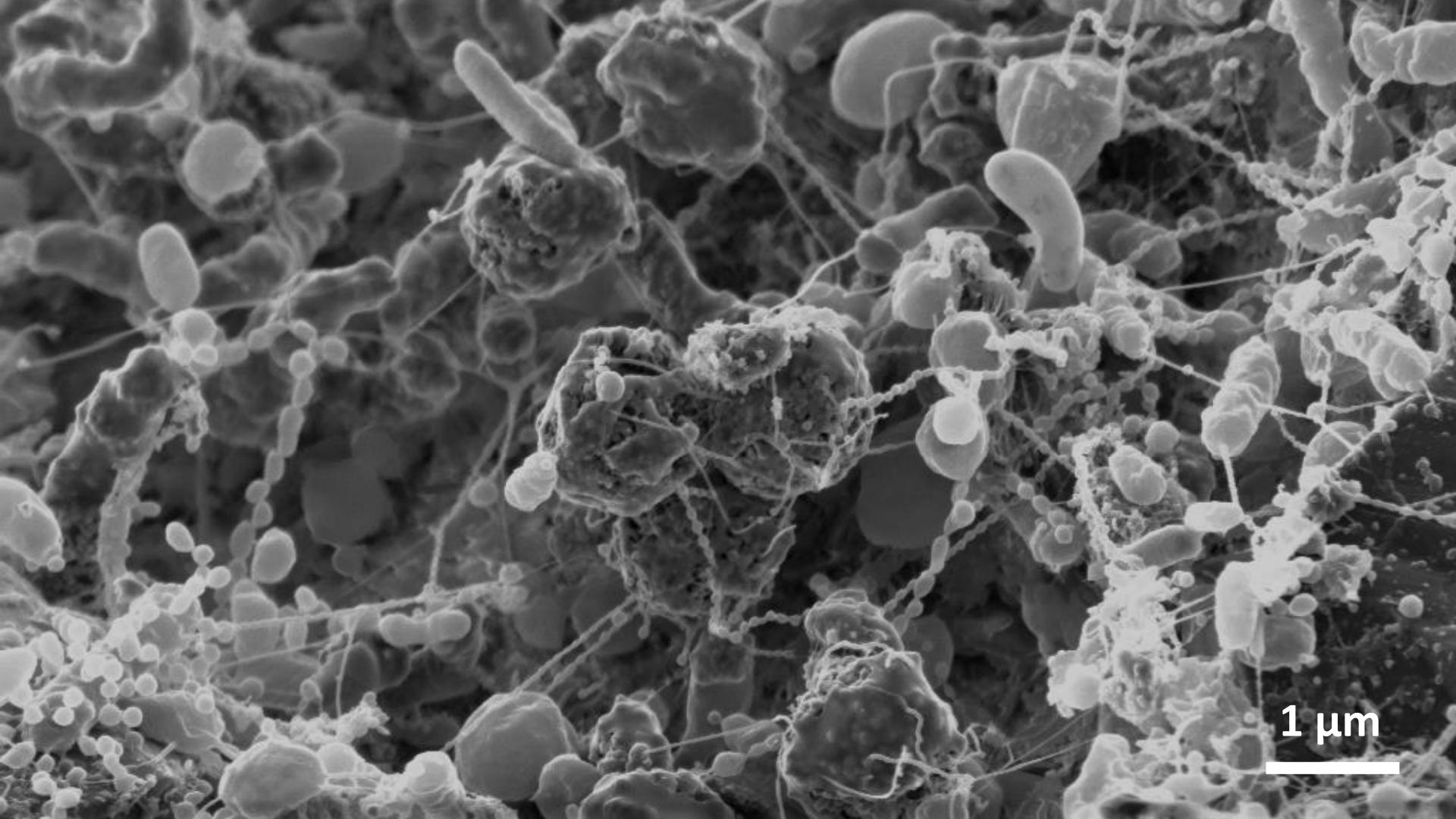
Gold biomineralization by a metallophore from a gold-associated microbe (*Delftia acidovorans* – Delftibactin A)



Desulfovibrio desulfuricans + Au(I) thiosulphate
(Lengke and Southam, 2007)

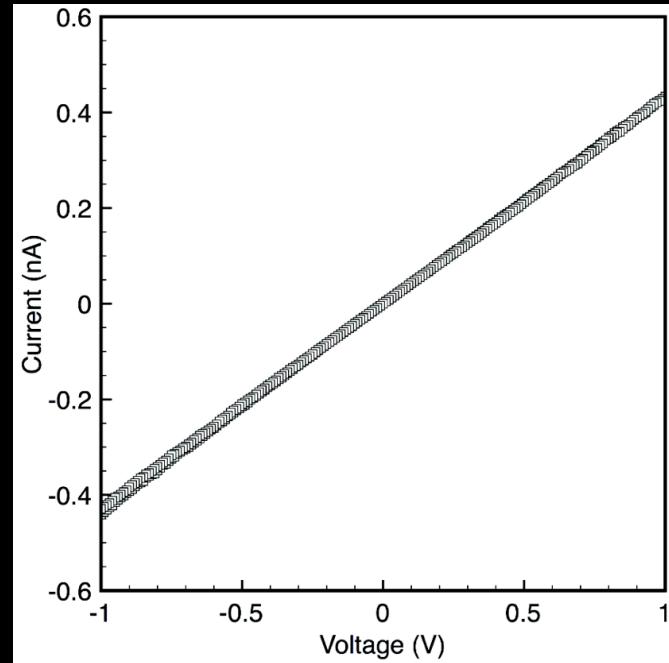
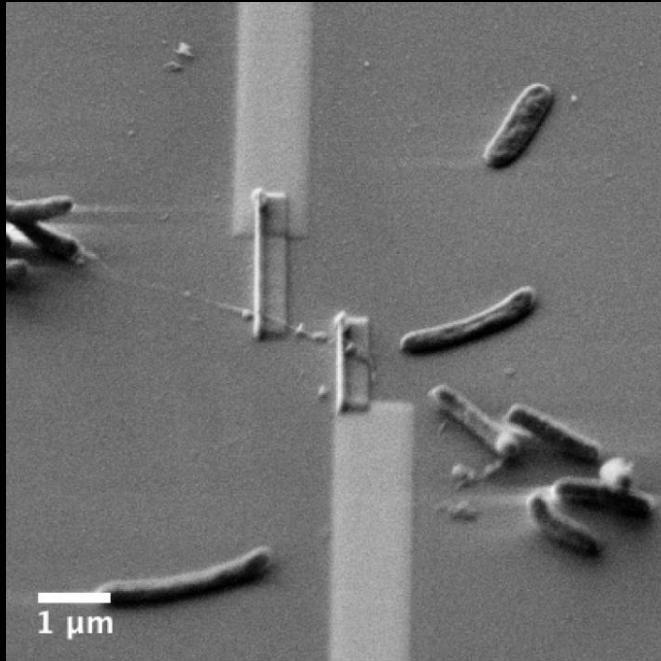




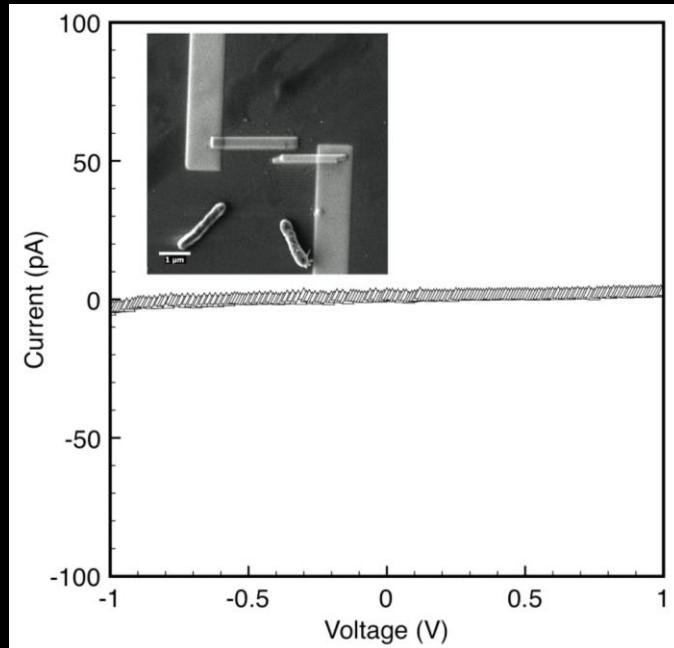
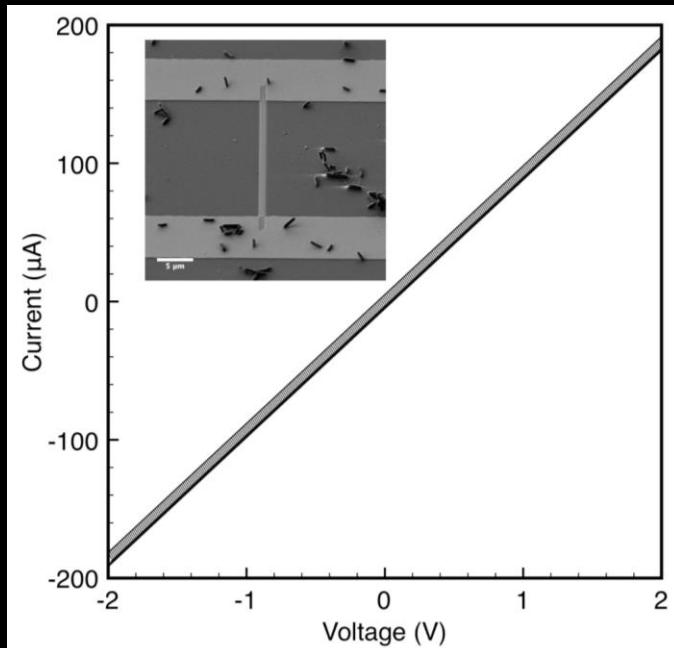


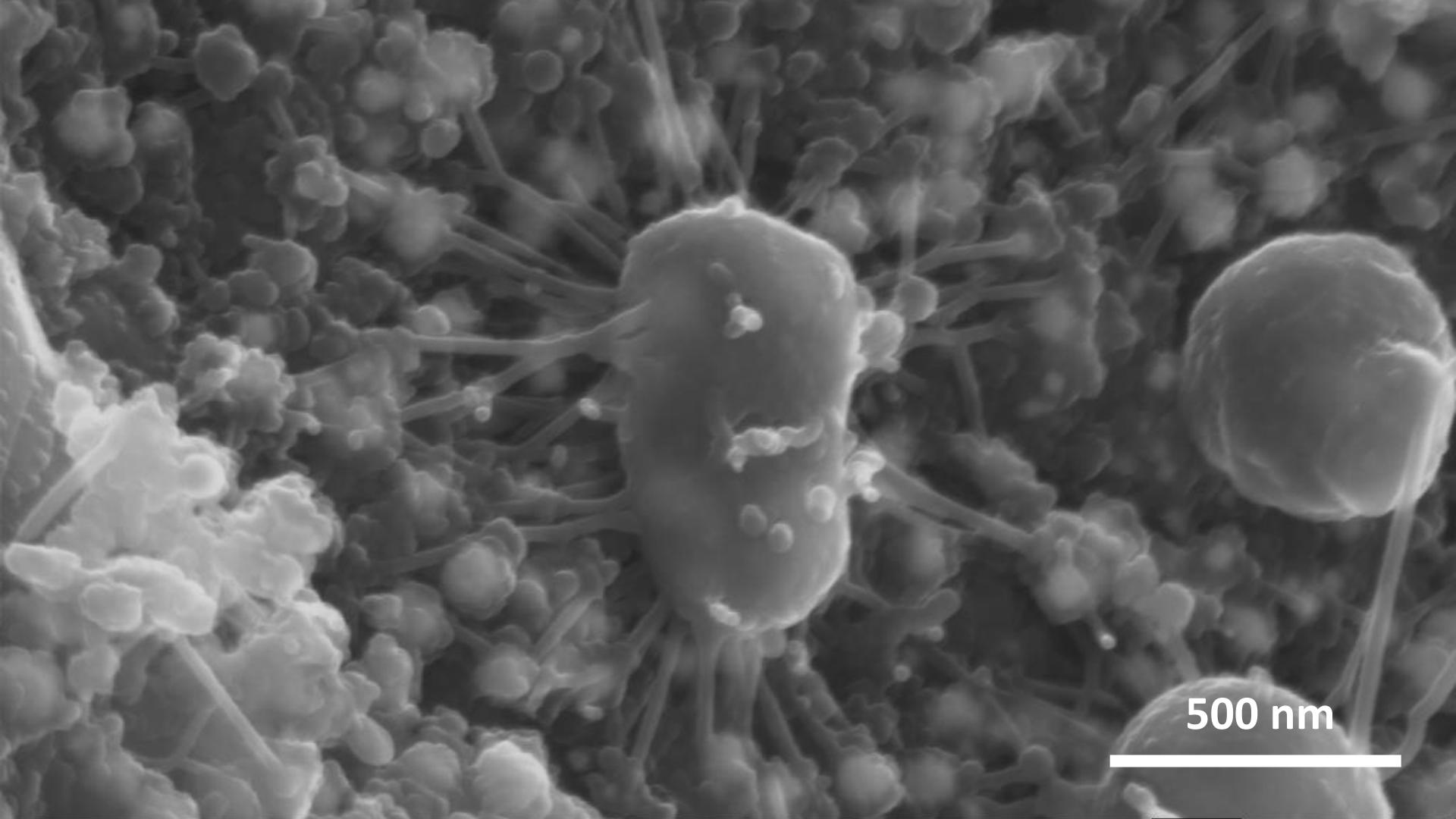
1 μm

Electrical transport along bacterial nanowires from *Shewanella oneidensis* MR-1 (El-Naggar et al., 2010)



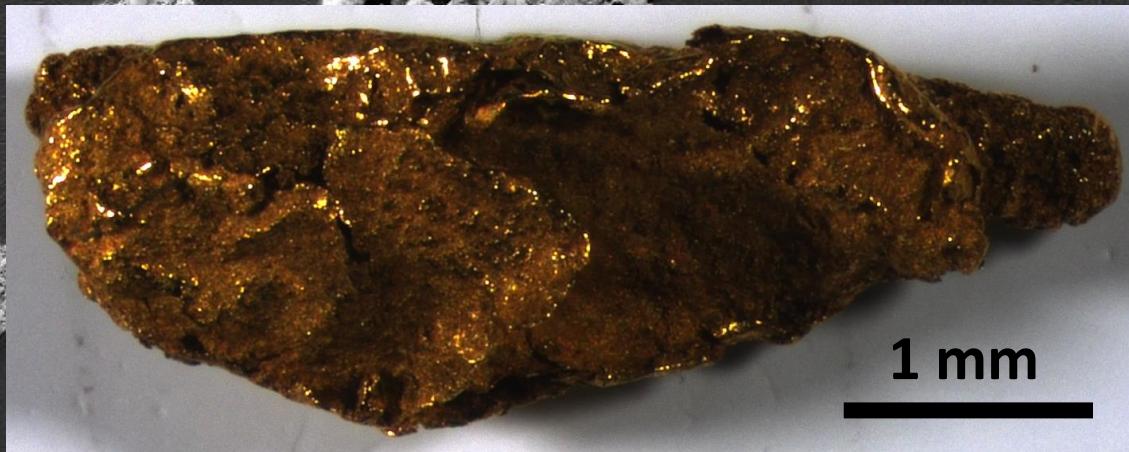
Electrical transport along bacterial nanowires from *Shewanella oneidensis* MR-1 (El-Naggar et al., 2010)





500 nm





$100 \mu\text{m}$