

# Elements

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## Minerals, Microbes, and Remediation

ANHUAI LU and HAILIANG DONG, Guest Editors

**Mineral–Microbe Interactions**

**Minerals as Substrates for Life**

**Remediation of Chromium  
and Uranium Contamination**

**Clay–Microbe Interactions**

**Microbial Oxidation of Sulfide Tailings**

**Semiconducting Minerals and Bacteria**

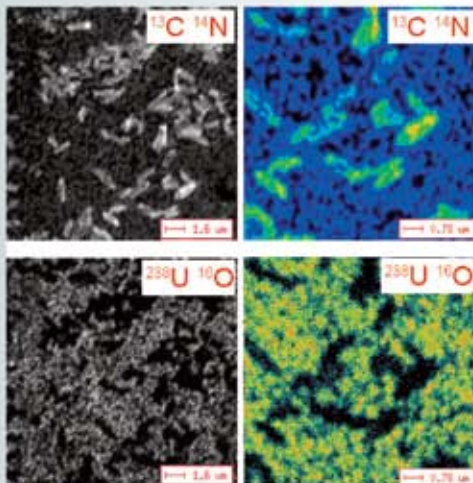


# Sub-micron Analysis of Isotopes & Trace Elements in Terrestrial Biogeochemistry

## NanoSIMS 50L

### CAMECA's Ion Microprobe for Ultra Fine Feature Analysis

- Trace element mapping down to **50nm lateral resolution**
- **Reproducibility** of stable isotope measurements in the low **sub-permil** range
- **Parallel detection** of up to 7 masses



## Uranium fixation with bacteria

*G. Sulfurreducens* from a biofilm incorporated  $^{13}\text{C}$ -labeled acetic acid and reduced U6+ to U4+, which was precipitated as uraninite on the surfaces of the bacteria. **NanoSIMS** can be used in combination with HR-TEM to track the uptake of radionuclides and identify the bioprecipitated mineral phases.

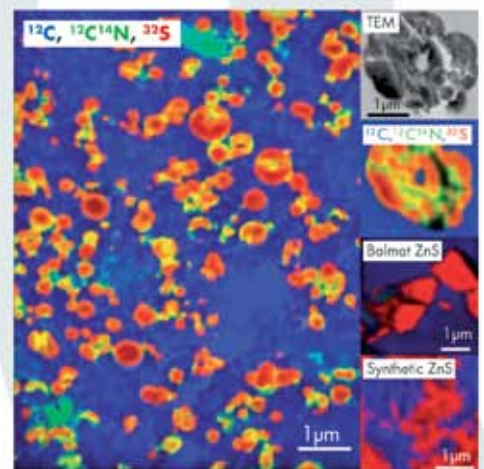
From: *Mastafa Fayek et al., The Canadian Mineralogist, Vol. 43, pp. 1631-1641 (2005)*

## Study of Biogenic Nanoparticles

The composite C, N, and S mapping of a biofilm with **NanoSIMS** demonstrates that microbially derived extracellular proteins can limit the dispersal of nanoparticulate metal-bearing phases, such as the mineral products of bioremediation.

*Red regions represent relatively pure Sulphur (as ZnS), Orange & Yellow: increased levels of Nitrogen in presence of ZnS. Light blue: presence of both C and N, with little to no S (no ZnS).*

From: *Extracellular proteins limit the dispersal of biogenic nanoparticles, John W. Moreau et al., SCIENCE, vol 316 (2007)*



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