**Secondary Ion Mass Spectrometry for quantitative imaging of microbial-mediated biochemical processes**

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The high-resolution correlative microscopy technique at the ProVIS Centre for Chemical Microscopy offers a powerful platform for comprehensive studies on microbial activity in biofilms and aquifers, interaction of microbial cells with metals and minerals. Application of a broad variety of microscopy techniques available at the ProVIS Centre in environmental studies gains the information of structure, function, activity of microbial communities and their interaction with the environment on a nanometer scale that facilitate the elucidation of complex biochemical processes from microbial-mediated mater conversion to global element cycling. Detailed information on molecular composition of organic substances is gained from ToF-SIMS experiment on ToF.SIMS-5 instrument (IonTOF) comprising cluster ion sources (Bi, Ar) and focused Ga ion beam source (FIB) for high-resolution depth profiling and molecular ion mass spectrometry. Nano-scale secondary ion mass spectrometer NanoSIMS 50L (Cameca) and time-of-flight mass spectrometer ToF.SIMS-5 are employed in combination with stable isotope tracer experiments and in situ hybridization techniques for the study of metabolic function and metabolic versatility of individual microbial cells in complex microbial communities. Stable isotope probing (SIP) targets a function of microorganisms in environment via labeling of specific cellular biomarkers such as lipids, proteins, DNA or RNA.

In our presentation we will report on the correlative studies of metabolic activity of microbial cells by means of the bulk SIP analysis, molecular-resolved SIP (lipid-SIP and protein-SIP) and SIMS-SIP employing the imaging Secondary Ions Mass Spectrometry (SIMS) techniques implemented within the ProVIS facility at the Helmholtz Centre for Environmental Research - UFZ in Leipzig.