**High Resolution Characterization of Recent and Ancient Microbial Systems using ToF-SIMS**

Christine Heim1, Tim Leefmann2, Volker Thiel1

1Geoscience Centre Göttingen, Department of Geobiology, University of Göttingen, Goldschmidtstr. 3 37077 Göttingen, [cheim@gwdg.de;](mailto:cheim@gwdg.de;) [vthiel@gwdg.de](mailto:vthiel@gwdg.de)

2Department of Earth and Planetary Sciences, Macquarie University, North Ryde, Australia

This presentation introduces molecular Time-of-flight secondary ion mass spectrometry (ToF-SIMS) as a tool for biomarker analyses at the microscopic level, with focus on applications in geomicrobiology and organic geochemistry. A combination of optical microscopy and ToF-SIMS imaging enabled a clear-cut assignment of biomarkers to specific microorganisms within cryosections of recent microbial mats. ToF-SIMS spectra and ion images of individual microalgal cells revealed their molecular inventories, including fatty acids, mono-, di-, and triacylglycerols, intact polar lipids, carotenoids, and chlorophyll. In a second example we show how a combination of ToF-SIMS, ‘destructive’ techniques (electron microprobe, laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS), and isotope analyses (δ13C, δ18O and 87Sr ⁄ 86S)) enabled the detection of microbial remains in fracture minerals, thus identifying an ancient ‘deep biosphere’ in granitic rocks of the continental subsurface (450m below sea level).