Cryo-XPS monitoring of cell wall compositional changes for *Bacillus subtilis* as a function of pH and Zn²⁺ exposure

MADELEINE. RAMSTEDT*, LAURA. LEONE, ANDREY. SHCHUKAREV AND PER. PERSSON

Department of Chemistry, Umeå University, 90187 Umeå, Sweden,
correspondance: madeleine.ramstedt@chem.umu.se

Bacteria such as *Bacillus subtilis* and *Escherichia coli* adjust and alter their gene transcription and protein production depending on the environment they are exposed to. For example, membrane-bound protein complexes are up-regulated at high pH in *B. subtilis* and several enzymes that reduce acidity and transport metals out of the cell are up-regulated at low pH [1]. It has also been reported that building blocks in the cell wall change with varying pH.

X-ray Photoelectron Spectroscopy (XPS) is a surface sensitive analysis method that has been used by several researchers to successfully analyze the chemical composition of bacterial cell walls [e.g. 3,4,5]. In this presentation we will show how we have used cryo-XPS together with a recently developed curve fitting model to predict the chemical composition of the surface of bacterial cells [2]. We have used this to study changes in the surface composition of *B. subtilis* exposed to environments with varying pH and/or Zn²⁺ content. We will also compare the obtained ratios of different substances with ratios obtained using previously published methods based on equation systems [3,4,5].

[1] Wilks, Kitko, Cleeton, Lee, Ugwu, Jones, BonDurant & Slonczewski, (2009) *Applied and Environmental Microbiology* **75**, (4), 981-90. [2] Ramstedt, Nakao, Wai, Uhlin & Boily, (2011) *Journal of Biological Chemistry* **286**, (14), 12389-12396 [3] Dufrêne, van der Wal, Norde & Rouxhet, (1997) *Journal of Bacteriology*, **179**, (4), 1023-1028 [4] Rouxhet & Genet, M., (2011) *Surface and Interface Analysis* **43**, (12), 1453-1470 [5] van der Mei, de Vries & Busscher, (2000) *Surface Science Reports*, **39**, (1), 3-24

Alkenones and hydrogen stable isotopic composition of n-alkane as indicators of past temperature and salinity in Lake Van sediments

M.È. RANDLETT[1]*, M. J. L. COOLEN[2], A. BECHTEL[3], M. STOCKHECKE[1], O. KWIECIEN[1], Y. TOMONAGA[1], B. WEHRLI[1] AND C. J. SCHUBERT[1]

[1]Swiss Federal Institute of Aquatic Science and Technology EAWAG, Switzerland
[2]Woods Hole Oceanographic Institution (WHOI), MA 02543, United States
[3]Montanuniversität Leoben, Leoben A-8700, Austria
(*correspondence: marie-eve.randlett@eawag.ch)

The successful drilling operations of the International Continental Scientific Drilling Program (ICDP) PaleoVan project allowed the recovery of 220-m long sediment cores, which represents approximately the last 600 ka. This exceptional climatic archive was investigated for two relevant organic molecular proxies; alkenones and hydrogen stable isotopic composition of n-alkanes C29 (δD of $n\text{-}C_{29}$). The potential of unsaturation patterns in alkenones for reconstructing past temperatures in Lake Van was assessed through investigation of algae types responsible for alkenones biosynthesis using ancient DNA stratigraphy. The diversity of alkenones producers within the core hampered the use of a single calibration curve for reconstructing temperature based on alkenone unsaturation patterns, as found elsewhere [1,2]. On the other hand, the δD of $n\text{-}C_{29}$ co-vary with the salinity of the pore water profile in Lake Van. The latter organic proxy therefore seems to be a promising tool for reconstructing changes in the source water salinity due to variable precipitation/evaporation ratio, as previously suggested [3].

[1] Coolen, M.J.L. et al. (2009) Earth and Planetary Science Letters, **284**, 610-621 [2] Theroux et al. (2010) Earth and Planetary Science Letters, **300**, 311-320 [3] Sachse et al. (2012) Annual Review of Earth and Planetary Sciences, **40** (1), 221-249