MINIATURE LIMS SYSTEM FOR IN SITU DETECTION OF BIOSIGNATURES. A. Riedo[1,2], M. Tulej[1], M.B. Neuland[1] and P. Wurz[1], [1]Physics Institute, Space Research and Planetary Sciences, University of Bern, Switzerland (andreas.riedo@space.unibe.ch), [2]Leiden Observatory, Sackler Laboratory for Astrophysics, University of Leiden, Netherlands.

Introduction: In situ detection of biosignatures and biomarkers on planetary surfaces is highly challenging and continuously drives the development of new sample collection strategies, extraction procedures, and measurement techniques and protocols with improved figures of merit, including e.g., quantitative nature of measurement and detection sensitivity, for future space missions.

In our contribution, we will present the current measurement performance and capabilities of our miniature Laser Ablation Ionization Mass Spectrometer (LIMS, instrument name LMS) for sensitive and quantitative in situ chemical analyses (element, isotope and molecular) of solids on planetary surfaces. The studies are performed with high spatial resolution (lateral and in depth) suitable for investigations of grain-size samples.

LIMS Instrument and Measurements: The LIMS system developed in our group is a miniature (160 mm x 60 mm) reflectron-type time-of-flight laser ablation ionization mass spectrometer designed for in situ space research. The high detection sensitivity (10 ppb, atomic fraction), the high dynamic range (about ten orders of magnitude) and the application of a femtosecond laser system ($\lambda = 775$ nm, $\tau = \sim 190$ fs) for ablation and ionization of sample material allow to conduct sensitive and quantitative measurements of the chemical composition (element, isotope and molecular) of highly heterogeneous solids with high lateral (10–15 µm) and vertical resolution (sub-nanometer) [1].

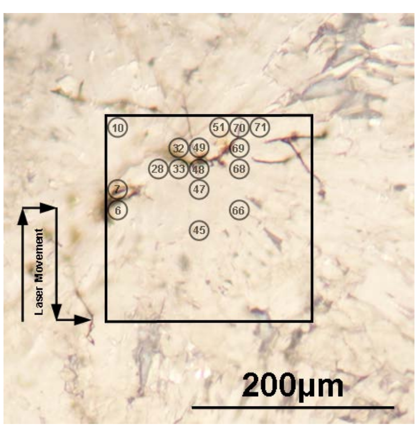

Figure 1: Fossils (black veins) of micrometer dimensions are embedded in a host matrix. The spot-wise sensitive chemical analysis using the miniature LIMS system allowed the identification of fossil structures within the heterogeneous sample material. Image taken from Tulej M. et al., 2015 [2].

Measurements conducted on various complex sample structures will be discussed in detail to present the current measurement capabilities of the miniature LIMS system, including e.g., fossils of micrometer dimensions embedded in serpentinized harzburgite matrix (see Fig. 1), mineral phases in a heterogeneous rock sample, or chemical heterogeneity in Pb-Bronze alloys [2, 3].

Furthermore, the current design of the LMS instrument allows switching between the harsh atomization and the gentle desorption mode at sample depth of interest. Including the high spatial analytical capabilities of the instrument and the in situ onscreen visualization of measurements molecular studies at interfaces between different crystalline domains within the sample material can be conducted [4]. This measurement protocol will be presented as well and is of considerable interest in various field of research, ranging from geology to astrobiology.

References: [1] Grimaudo V. et al. (2015) *Anal. Chem., 87,* 2037 – 2041. [2] Tulej M. et al. (2015) *Astrobiol., 15,* 669 – 682. [3] Neubeck A. et al. (2016) *Int. J. Astrobiol., 15,* 133 – 146. [4] Moreno-García P. et al. (2016) *Rapid Commun. Mass Spectrom.,* in press, doi: 10.1002/rcm.7533.