Analysis of 1.9 Ga chert with a miniature mass spectrometer for space: Chemical profiling of microfossils preserved in the host mineral

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Chemical analysis on the surfaces of planetary bodies is a challenging endeavour that requires set of specific parameters to comply with for onboard instrumentation. This applies to the quality of information gathered from a wide range of samples, to the size and power consumption of the instrument and to the ability to operate within harsh conditions.

Recent studies have shown, that the ability of cherts to preserve and encapsulate organic material from extensive heating and rapid degradation makes them an attractive target to look for remnants of organic material, similar to possibly preserved organic matter within Martian sedimentary successions [1].

In this contribution we present data gathered from 1.9 Ga chert sample from Gunflint formation with our miniature laser ionization time of flight mass spectrometer (LMS, mass analyzer: 160 mm x Ø 60 mm) designed for *in-situ* planetary research. We collected chemical information using IR-775 nm, UV-387 nm, and UV-258 nm femtosecond laser for ion formation, *in-situ* from the solid sample. Additionally, we tested the performance of the newly established double pulse UV-258 nm laser source. We will present high-resolution chemical depth profiles collected from host areas and dense microfossils zones and will discuss in detail the analysis of major to trace element abundances in the depth profiles. Altogether, chemical and optical material probing on a microscale provide us with an ability to target an area of interest and unambiguously differentiate between microfossils and inorganic host areas with the LMS suite [2].

[1] McMahon, S. et.al., A Field Guide to Finding Fossils on Mars. J. Geophys. Res.: Planets, 2018.

[2] Wiesendanger, R., et al., Chemical and optical identification of micrometer-sized 1.9 billion-year-old fossils with a miniature LIMS system combined with an optical microscope. Astrobiology, 2018.