High resolution *in situ* measurements using space instrumentation proves Ni isotopes as reliable biosignatures in fossilized microorganisms.

Investigating isotopic fractionation patterns *in situ* in microfossils is critical for site-specific ascribed isotopic signals that are needed to differentiate between abiotic and biologic microstructures. Stable isotopes of nickel have been proposed a suitable biomarker because of the experimentally proven microbial preferential uptake of the lighter isotope[1]. It has until now been unknown if such fractionation signals can be preserved and analyzed in fossilized microorganisms in ancient rocks. We have conducted *in situ* analyses of micrometer sized fossils from subseafloor ultramafic rocks, using a miniaturized laser ablation mass spectrometer (LMS) developed for space research to investigate the preservation and fractionation patterns of stable nickel isotopes. Biologic Ni isotopic signatures combined with biologic carbon isotopic signatures measured in fossils and abiotic signals measured in abiotic rock samples strongly suggest that nickel isotopes can be used as a reliable biomarker for ancient and well as extraterrestrial life. Since the fossils are collected from the deep, subsurface crystalline ultramafic rock, our results shows that trace metal isotopes may constitute an important tracer for deep life not only on Earth but also elsewhere in our solar system. Our results also proves that the instrumentation used for the measurements is sensitive enough to extract trace amounts of an element but precise enough to omit noise. Such an instrument combined with the new method of using nickel isotopes as biomarkers opens up new possibilities in space and early Earth research.

1. Cameron et al. 2009. A biomarker based on the stable isotopes of nickel. PNAS 106 (27), pp. 10944-10948