Elemental and Isotopic Imaging Using NanoSIMS

Guagliardo, P.[1], Jiang, H.[1], Bougoure, J.[1], Martin, L.[1] and Kilburn, M.[1]

[1] Centre for Microscopy, Characterisation and Analysis, The University of Western Australia, Australia

Mass spectrometry traditionally requires material to be extracted in bulk from samples, at the expense of information about the complex spatial relationships of the individual components. However, to understand large-scale phenomena, such as ore-producing hydrothermal systems, or nutrient trafficking in terrestrial and marine ecosystems, researchers are increasingly looking at the chemical processes occurring at the micro-to nano-scale. NanoSIMS (nanoscale secondary ion mass spectrometry) is an ion microprobe which combines high spatial resolution (50-100 nm) and high sensitivity. NanoSIMS is particularly well-suited to isotopic and elemental imaging, allowing the simultaneous detection of seven ion species with high mass resolution. We will describe how combining stable isotope labelling with NanoSIMS allows us to directly visualise the distribution of labelled components within an experimental system, without changing the system's chemical nature. For example, ^{15}N and ^{13}C labels can be attached to specific molecules used in biological systems (nutrient tracking, drug delivery), and deuterated ^{18}O labelled water may be used to investigate mineral-fluid interactions. Furthermore, isotopic labels can be conjugated to specific antibodies to identify proteins, or to oligonucleotides to identify specific species of bacteria.