SIMS-24
24th International Conference on Secondary Ion Mass Spectrometry
8-13 September 2024
La Rochelle, France
www.sims-24.com

ToF-SIMS analysis of biological and fossil samples

Peter Sjövall

RISE Research Institutes of Sweden, Borås, Sweden

The arguably most important feature of ToF-SIMS is its capacity to combine detailed molecular information with high spatial resolution, allowing for association of microscopic structures with molecular content. This capacity makes ToF-SIMS an extremely attractive method in various research areas, often capable of providing information not accessible by any other technique. However, the possibility to obtain correct answers to the analytical questions at hand depends on several factors, including proper sample preparation and data evaluation, and there are plenty of pitfalls to look out for. In this presentation, examples from ToF-SIMS analyses of biological samples and fossils will be discussed, where these aspects are particularly important. For biological samples, examples including biological tissue [1], liposomes [2] and skin demonstrate the importance of sample preparation, e.g., to ensure the integrity of the biological structures under study. For fossil samples, ToF-SIMS imaging and molecular characterization of microstructures in fossilized soft tissue provides important input to identification of anatomic features and biomolecular residues, as well as evidence for their endogenous origin [3,4], in particular, in combination with scanning electron microscopy (SEM).

[1] L. Carlred, et al., Simultaneous Imaging of Amyloid-β and Lipids in Brain Tissue Using Antibody-Coupled Liposomes and Time-of-Flight Secondary Ion Mass Spectrometry, J. Am. Chem. Soc. 136, 9973−9981 (2014)

[2] L. Wogelred, et al., Toward multiplexed quantification of biomolecules on surfaces using time-of-flight secondary ion mass spectrometry, Biointerphases 13, 03B413 (2018)

[3] J. Lindgren, et al., Molecular preservation of the pigment melanin in fossil melanosomes, Nat. Commun. 3:824 (2012)

[4] J. Lindgren, et al., Fossil insect eyes shed light on trilobite optics and the arthropod pigment screen, Nature 573, 122 (2019)