

High-resolution 3D imaging strategies for bio-materials by LA-ICP-MS

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Laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) is a rapidly evolving field in both the geosciences and systems biology, as well as many other disciplines, due to its high sensitivity and high spatial resolution. Three-dimensional mapping is a natural progression from our current 2D capabilities and in this contribution, we discuss various strategies for creating three-dimensional volume reconstructions. In particular, we outline some advances in the automated collection and alignment of 2D “slices” into a 3D representation of the original sample. The accuracy of any alignment procedure is key to producing valid statistical comparisons between samples, and we present an approach using an advanced pyramidal pixel registration algorithm. We show the effect of using key elements (P and Au) during the automated registration process for a 3D atlas of metal distribution within the mouse brain.

The procedures outlined are applicable to any discipline using LA-ICP-MS, and we show additional examples from the geosciences.

This combined approach, leveraging expertise from biomedicine and geochemistry, demonstrates the benefits that arise from unusual collaborations.