

Multi-elemental LA-ICP-TOFMS study of Mn nodules

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The occurrence of large-scale poly-metallic deep sea deposits (“Mn nodules”) and the prospect of deep-sea mining this resource, has caused high interest internationally, potentially having a major economic impact. These deposits are rich in major technical metals, rare-earth elements, precious metals, and other trace elements valuable in specialised applications.

With sequential ICP-MS detection (e.g. quadrupole, sector-field), analytes are selected on the basis of commercial interest, or likely presence of an analyte, and increasing the scope of the method has knock-on effects on total analytical time. Elements not selected as analytes will go unnoticed, which might lead to significant misinterpretation of complex, multi-phase samples like the ones in this study.

Using ICP-TOFMS as the detector has significant advantages, since thousands of full mass spectra are acquired every second. “Ultra-fast” sample transport modes of laser ablation (signal shot washout times <1ms) can be employed for high-resolution fast imaging to create images at pixel rates up to 1kHz. An entire Mn nodule can be imaged in a few hours at high resolution, providing significantly more information than simple line scan transects or spot analyses.

Here, we present LA-ICP-TOFMS analysis data of Mn nodules, and data processing approaches for phase differentiation and identification, as well as semi-quantification of elemental concentrations.