

Quality control for novel isotope analyses

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Research in isotope geo- and cosmochemistry is often driven ahead by investigations that interrogate novel isotope systems or particularly ‘difficult’ sample types, whereby analytical challenges are frequently addressed by the use of advanced instrumentation and/or new techniques of sample preparation and data acquisition. Testament to this are the numerous isotopic ‘methods’ articles that are published by geochemists and the even more frequent contributions that present and discuss novel data from, prominently, studies of (still) ‘non-traditional’ stable isotope systems, extinct radionuclides and nucleosynthetic isotope anomalies.

Such leading edge work faces similar but distinct analytical difficulties and additional metrological challenges. In particular, it cannot rely on well-characterized pure-element isotope standards and geological or environmental reference materials (RMs), for evaluation and documentation of data quality. The geochemical community has, however, been very adept in finding pragmatic solutions to such challenges in quality control, through innovative work of individual laboratories, critical peer review of journal articles and, most importantly, generally good-natured competition and extensive collaboration, both formal and informal, between research groups.

With regard to reference materials and method validation, geochemists and metrologists share a common interest in improving data quality and intercalibration but communication and collaboration between these communities on isotopic research is often limited. This is unfortunate because both sides could readily profit from improved interaction, for example in the preparation, characterization and distribution of RMs.

Field Sampling for Porewater Mercury and Methylmercury using DGT

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Dissolved porewater concentrations have the potential to better relate to mercury methylation rates than bulk mercury sediment loadings. The diffusive gradient in thin film (DGT) technique is applied to determine aqueous mercury and methyl mercury vertical porewater concentration profiles. DGT probes were deployed in the South River (Virginia, USA) where previous industrial activities had led to mercury contamination. The river is primarily a sand and gravel stream with limited microbial productivity. The DGTs were used to evaluate methylation rates and extent and identify locations contributing significantly to methyl mercury. A potential remedial option of biochar amendment was evaluated in a small floodplain pond. The DGTs were used to measure the performance of the sediment amendment including changes to available mercury and methyl mercury. Sampling of bulk sediment, surface water, porewater, and biota was carried out in parallel. Specific redox couples were also measured over depth using cyclic voltammetry. Conclusions were drawn as to the sources of significant methylation and relationship to sediment geochemistry.