

Same-day Strontium ($^{87}\text{Sr}/^{86}\text{Sr}$): A case study for Sr purification using the SpinChemTM technique, and exploring feasibility of single-day turnaround for time-critical applications

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The uses of radiogenic Sr isotope ratios— $^{87}\text{Sr}/^{86}\text{Sr}$ —in natural water for source-tracing applications are extensive. This is in part due to (i) $^{87}\text{Sr}/^{86}\text{Sr}$ being a robustly “conservative” isotope system (ratio does not significantly change during source-to-sink processes), and (ii) $^{87}\text{Sr}/^{86}\text{Sr}$ differences between natural water reservoirs often being statistically significant/resolvable. These attributes make radiogenic Sr isotopes in natural waters intensely useful not just in academic pursuits, but in commercial, industrial and government applications, where standardization, high throughput, and rapid turnaround are all critically important, meanwhile world-leading analytical uncertainty is less so.

Here, we explore optimization of the sample preparation and data reduction aspects of an end-to-end methodology for $^{87}\text{Sr}/^{86}\text{Sr}$ determination, with focal points on minimization of turnaround time and maximization of data reduction standardization and efficiency. To do so, we will provide case study results for:

- Deployment of the SpinChemTM technique for Sr isolation from natural water samples, utilizing direct acidification of incumbent samples, and accelerated separation chemistry via centrifugation
- Comparative utilization of ICP-QQQ and MC-ICP-MS determination of total Sr and $^{87}\text{Sr}/^{86}\text{Sr}$ along the methodological pipeline
- Direct importation of solution-based measurements to iolite v4 for data treatment and metadata capture
- Exploration of direct-to-cloud upload into open-source (FAIR) geospatial databases

This work is in complement to Wainwright *et al.* (2025), which compares/contrasts automation of the Sr separation chemistry and therefore focusses on “hands-off” enhancement to throughput (as opposed to fastest possible turnaround). Trade-off considerations and discourse on suggested application areas where each methodology—automated vs rapidly accelerated—may be most appropriate will be provided.

Wainwright A.N., Manestar G.N. & Mahan B. 2025, Abstract 27951, Session 6i, Goldschmidt 2025