

# Tracing Critical Raw Materials: Using Geothermal Fluids as Subsurface Probes to identify Platinum Group Element (PGE) Distributions

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Abstract

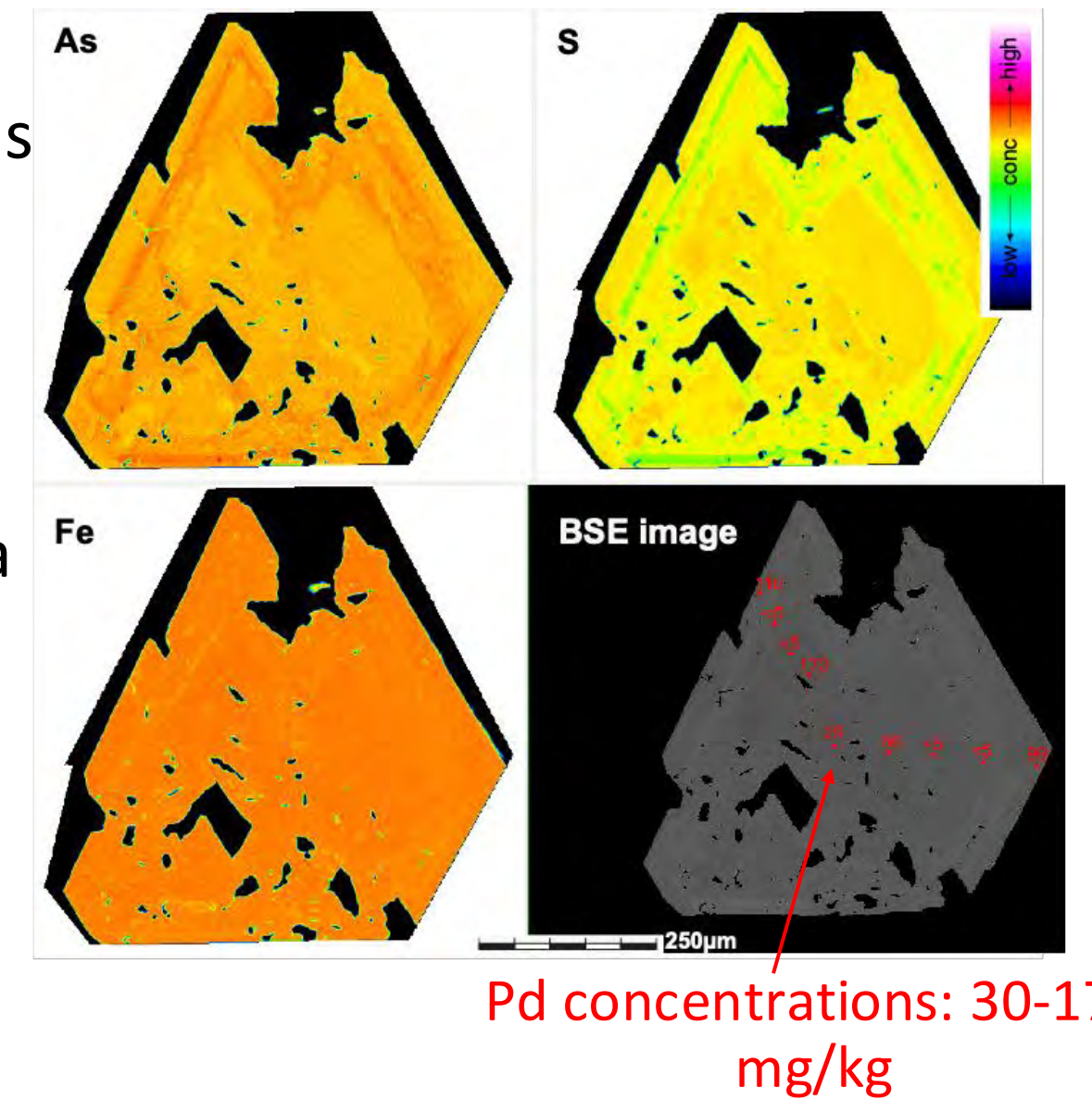
Can we use geothermal fluids as subsurface probes?

Yes, we can!

- Geothermal wells extract hot fluids from the **deep subsurface**
- The fluids are rich in dissolved metals, that is why they are often targeted for **co-extraction** of e.g., Li, Cu or Pb together with geothermal heat
- This "**geochemical fingerprint**" can reveal information about subsurface lithology, geochemical composition, and fluid flow pathways or interactions



- **Fluids** from a geothermal well in Cornwall had **elevated Pd concentrations**
- After further investigations of the corresponding solids, Pd was **confirmed in the host rock**:
  - EPMA element map of As-pyrite within a brecciated granite. Inset D shows a BSE image with **unusually high Pd concentration** in mg/kg.<sup>1</sup>

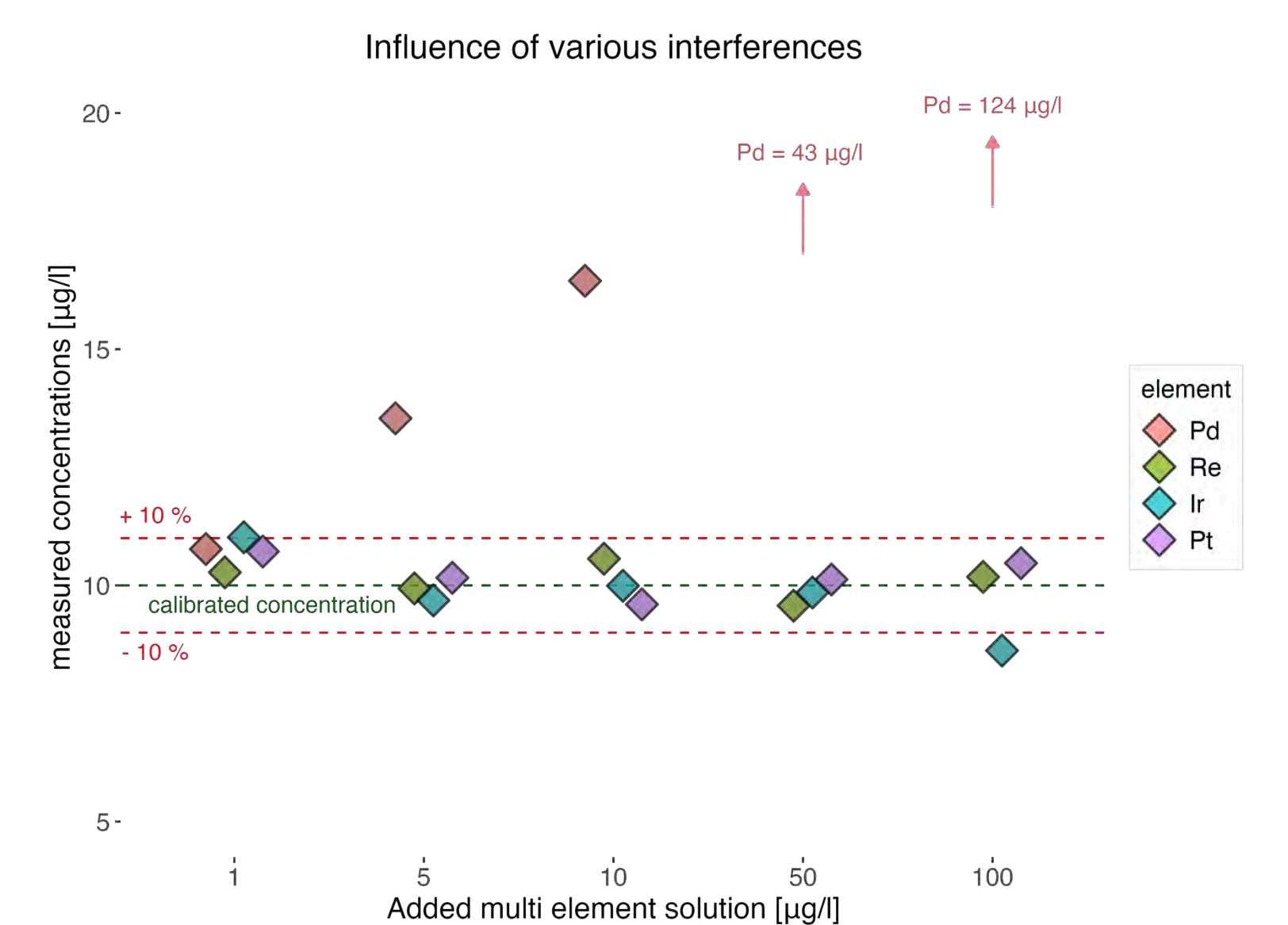
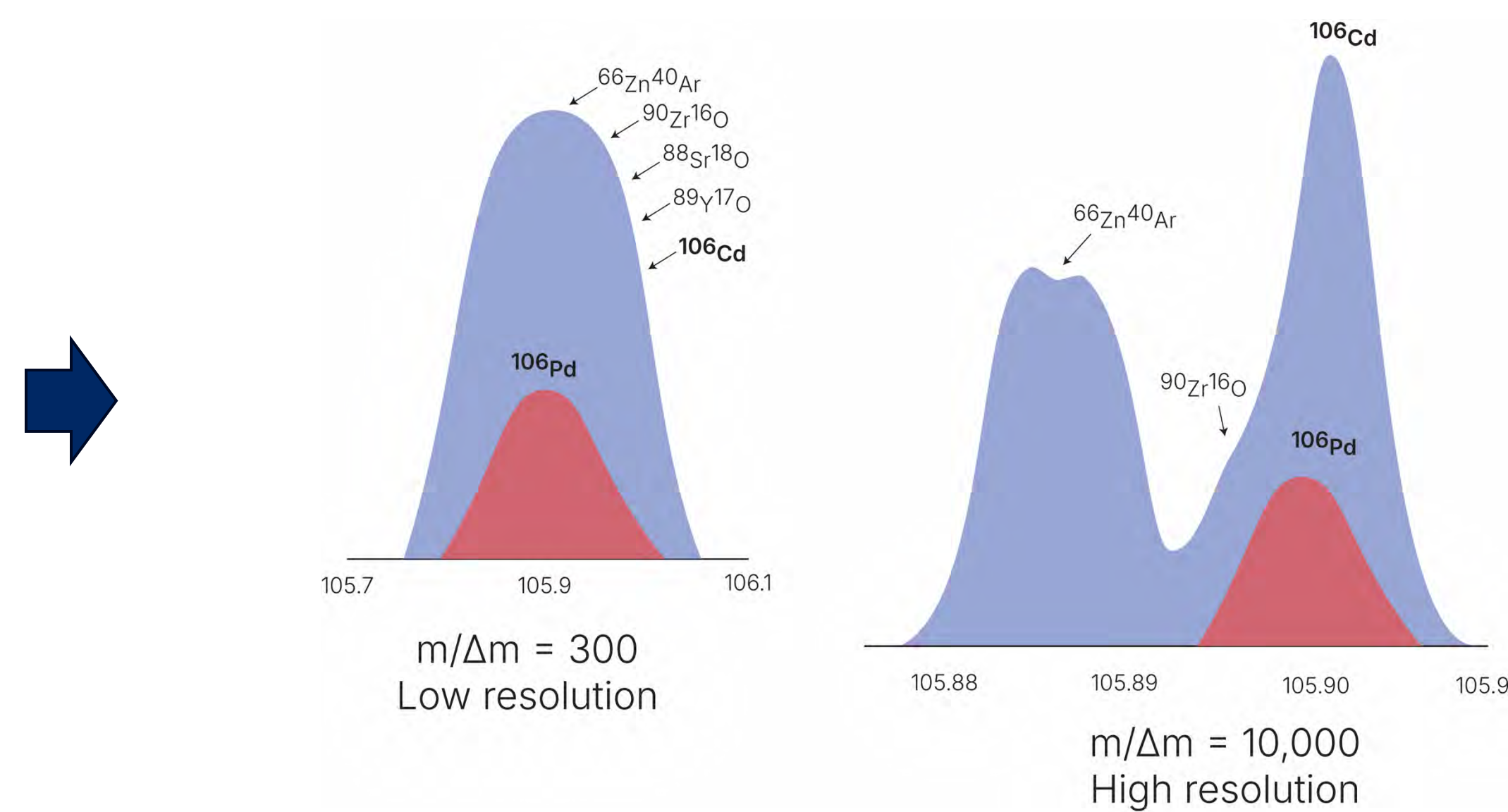
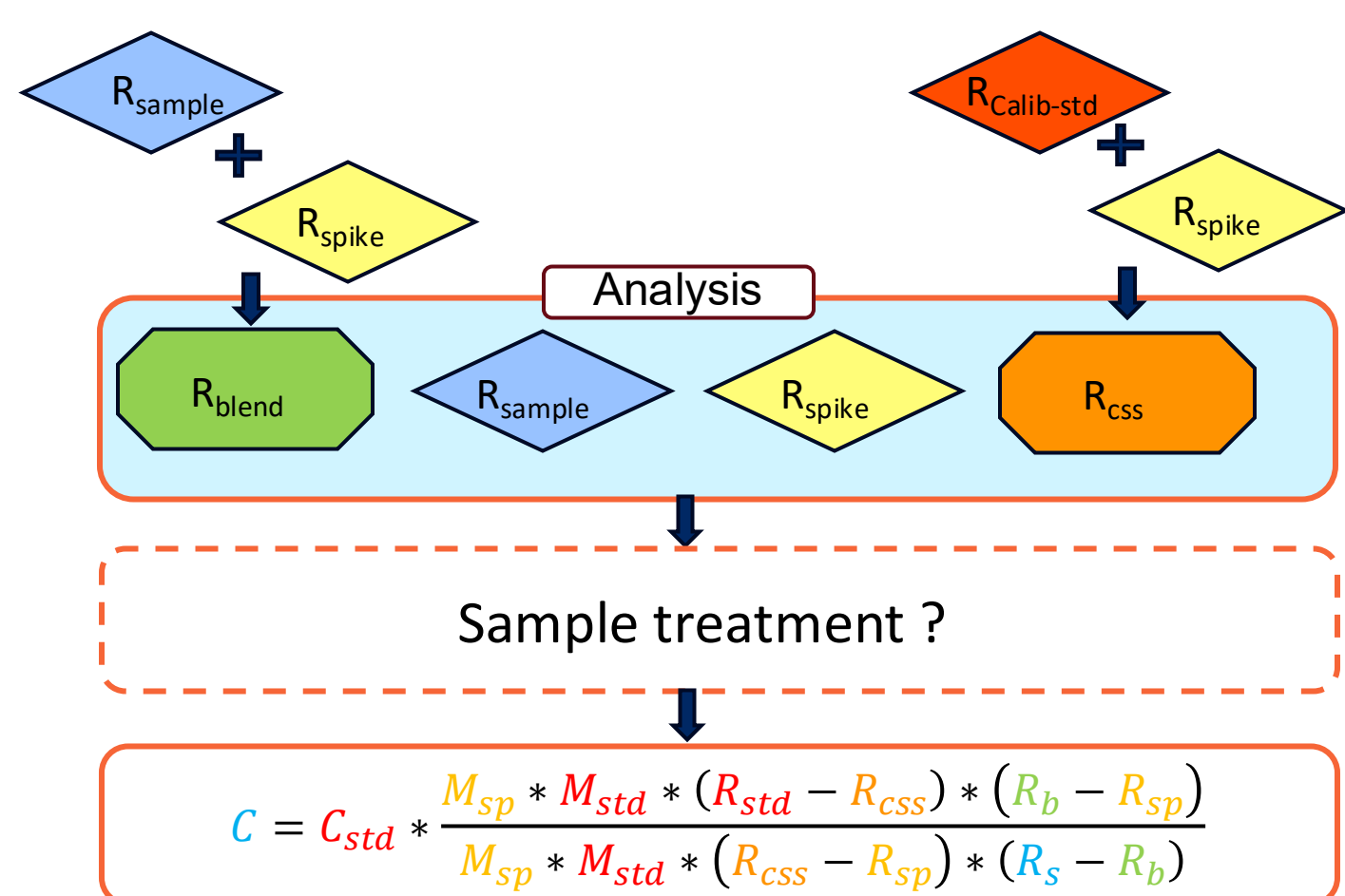


## Analytical approach

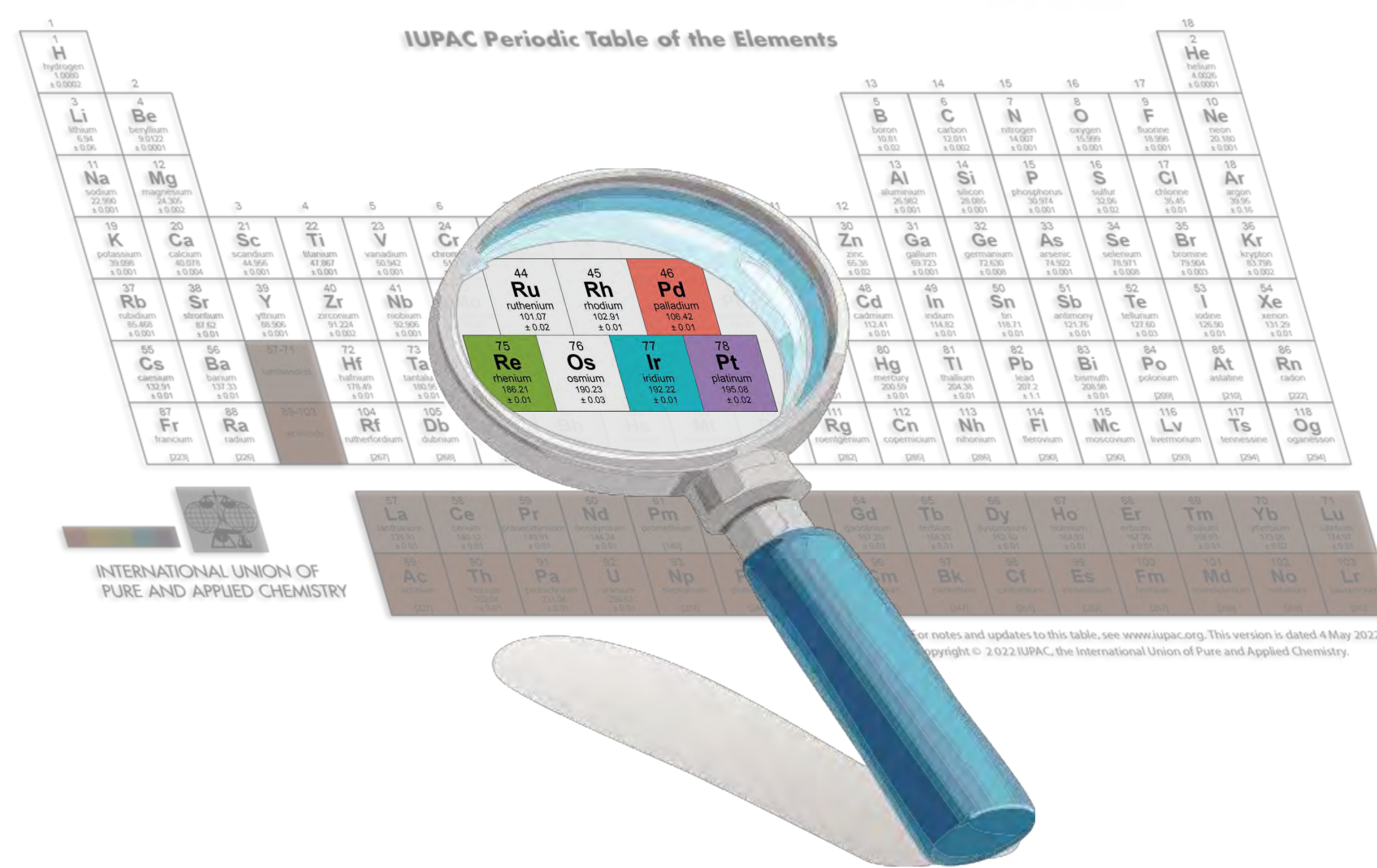
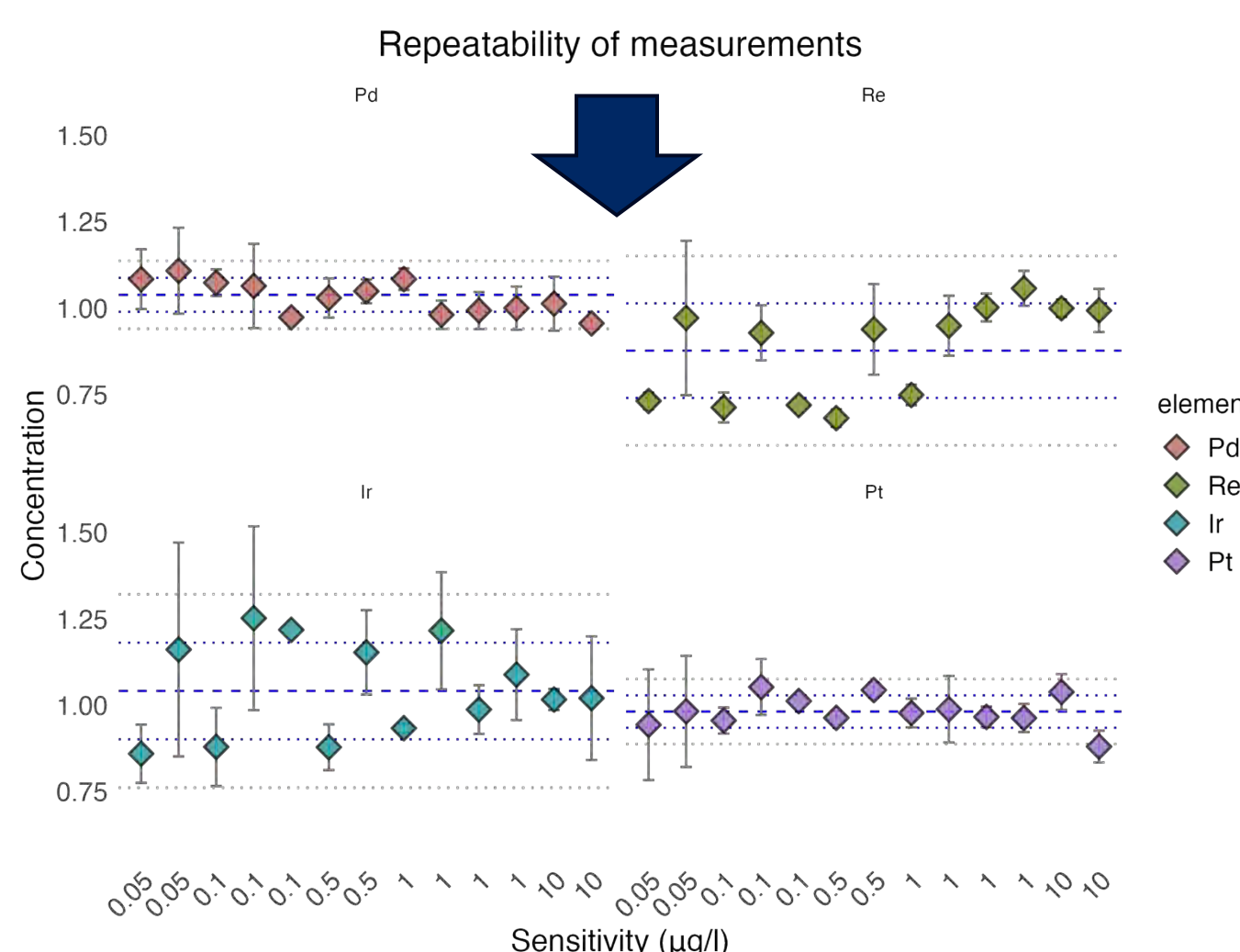
We use **Isotope Dilution (ID) ICP-MS**, spiking elements <sup>106</sup>Pd, <sup>185</sup>Re, <sup>191</sup>Ir, <sup>194</sup>Pt

**High resolution ICP-MS**  
Element XR (Thermo Fisher)

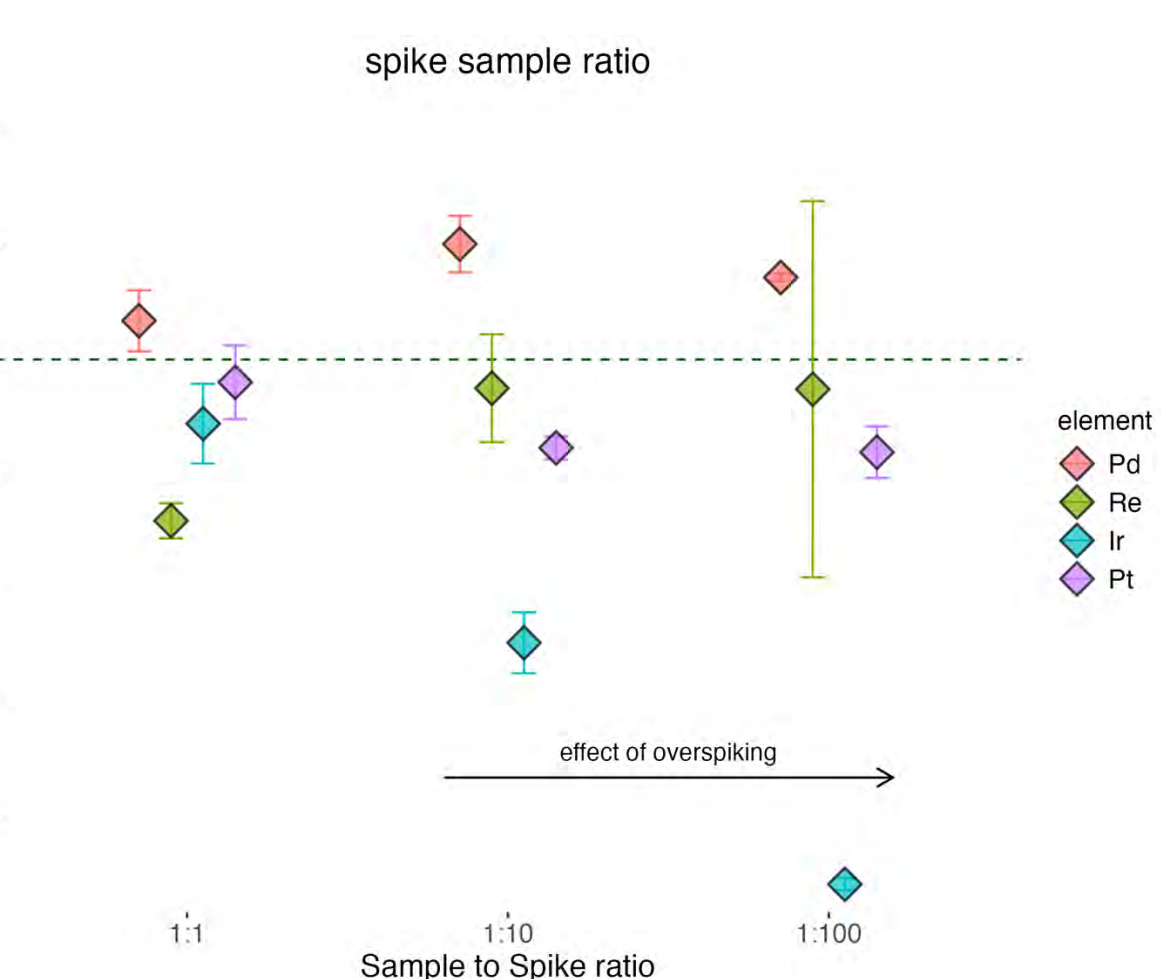
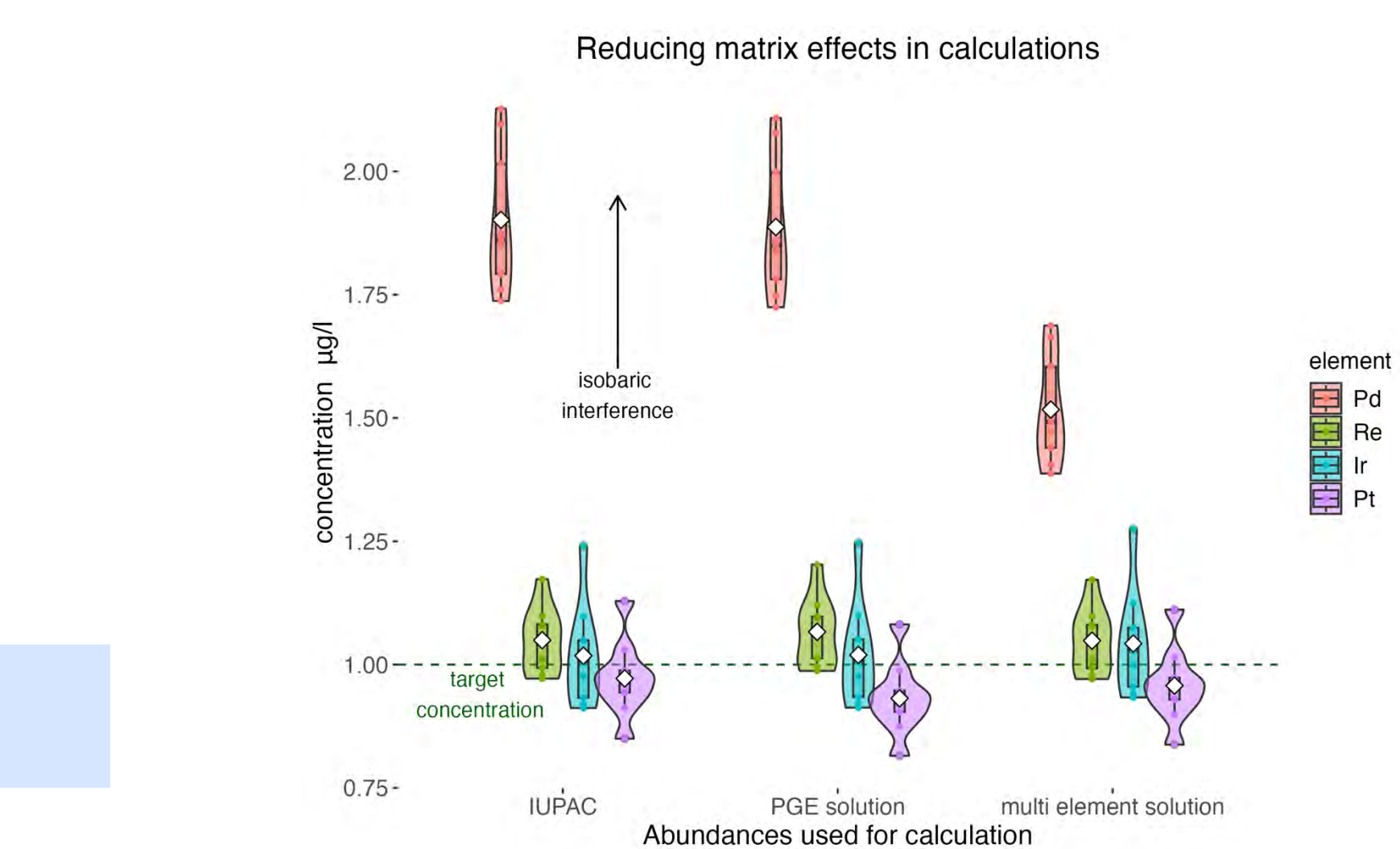
**Added multi-element solution** shows interference is significant on Pd despite correction



The **correction strategy** is using "interfered" isotope ratios to account for procedural blanks, interferences and mass bias, albeit requiring additional measurements



**Accuracy is good, repeatability could be improved**



## Why Platinum Group Elements?

- Platinum Group Elements (PGEs) are **valuable metals** with significant economic and geological relevance
- They are typically enriched in the geologic record through **magmatic processes**, which also generate geothermal heat
- Despite the economic value of PGEs, there are **limited reports** of PGEs in geothermal occurrences.

Type of calculation is crucial!

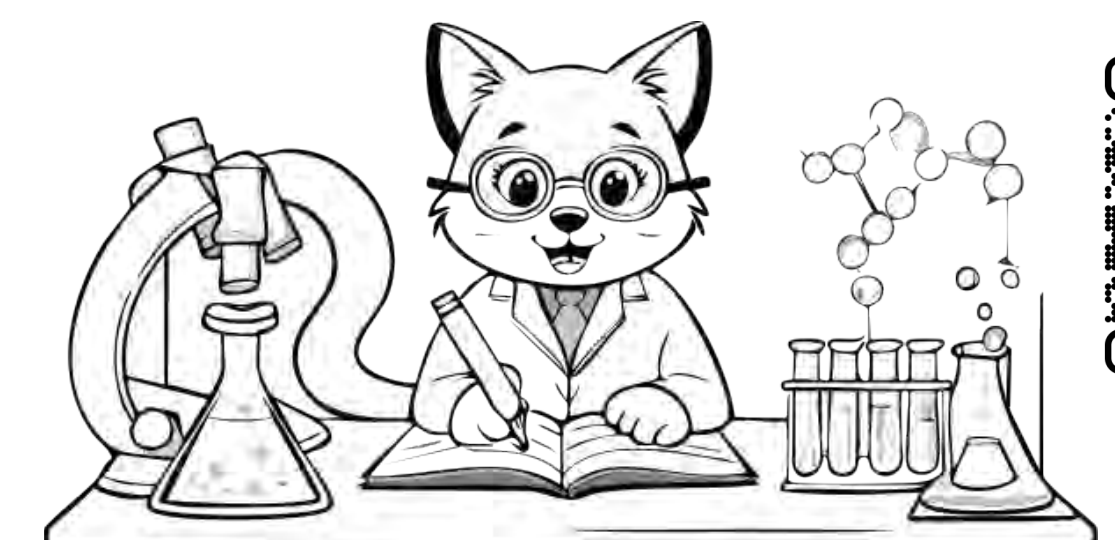
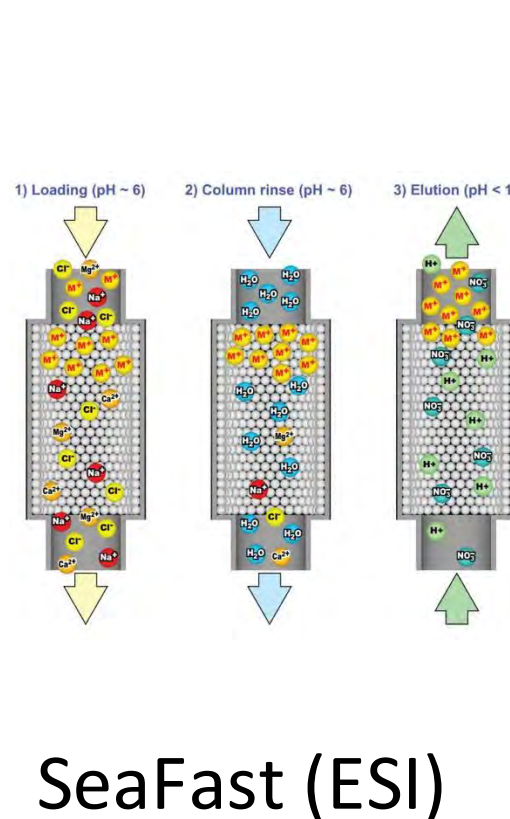
Isobaric interference, e.g. Cd remains challenging

## Outlook and next steps

## Interested?

## Get in touch!

- Refine analytical calculations and improve **data processing**
- comprehensive assessment of **error propagation**
- Extend methodology to **solid geological samples**, including host rock and mineral scales for comprehensive mass balance
- Investigate sample treatment, such as **pre-concentration and matrix removal**



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<sup>1</sup> Strauch, B.; Frigo, S.; et al. (2024): CRM-geothermal - gas geochemical results of pump tests at borehole GWDD-001 of Cornish Lithium Company, Cornwall, UK. GFZ Data Services. <https://doi.org/10.5880/GFZ.3.1.2024.001>