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EGU General Assembly 2022

How Hg isotope source signatures can be overprinted by biogeo-chemical processes in the subsurface of contaminated legacy sites

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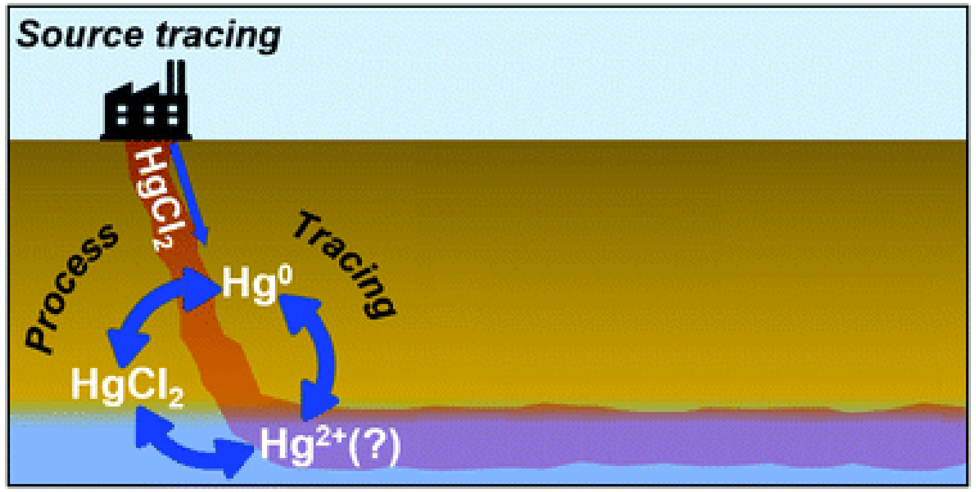
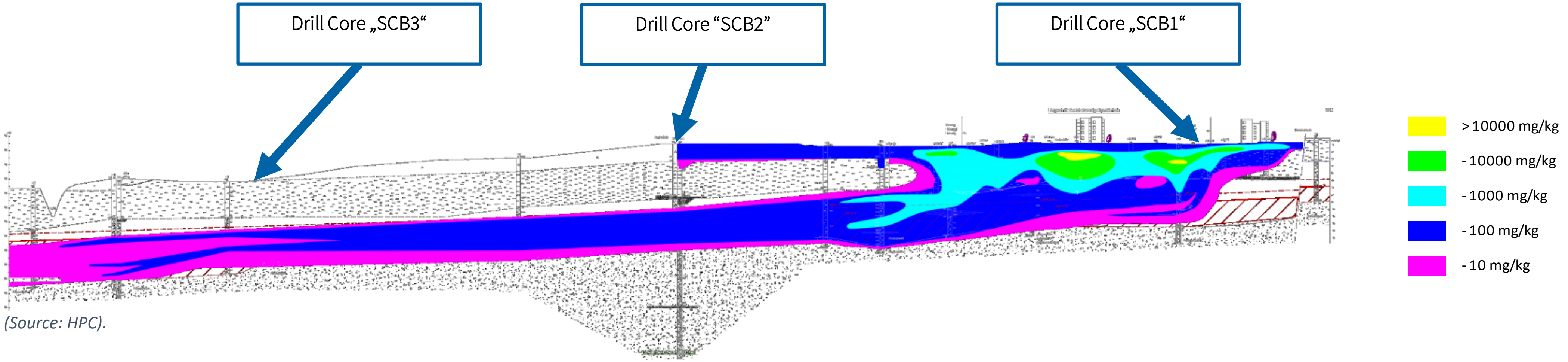


Introduction

- Contaminated legacy sites can act as long-term sources from which mercury (Hg) is released to waterbodies, soils and air
- Example from a former „kyanization“ facility – treatment of timber with $HgCl_2$

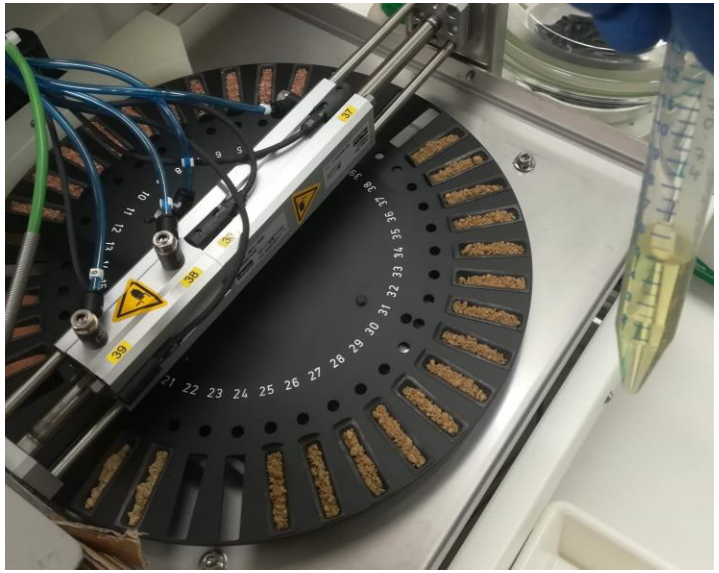


(Source: HPC).

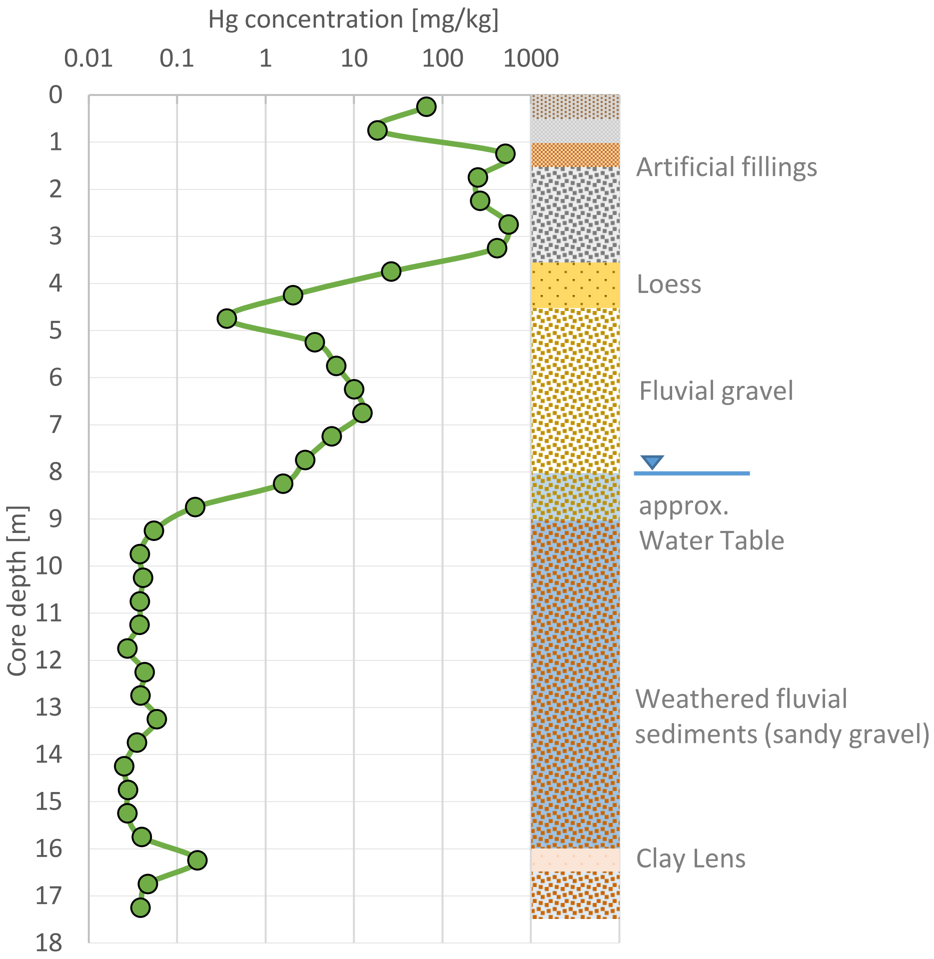
- Goal: Use Hg stable isotopes to better understand in situ transformation processes

Sampling / Methods

- General characterization and Hg concentrations (THg)
- Hg binding forms
  - Pyrolytic thermodesorption (PTD)
  - Sequential extractions (SEP)
- Hg isotopes
  - Bulk samples
  - Extracts from SEP

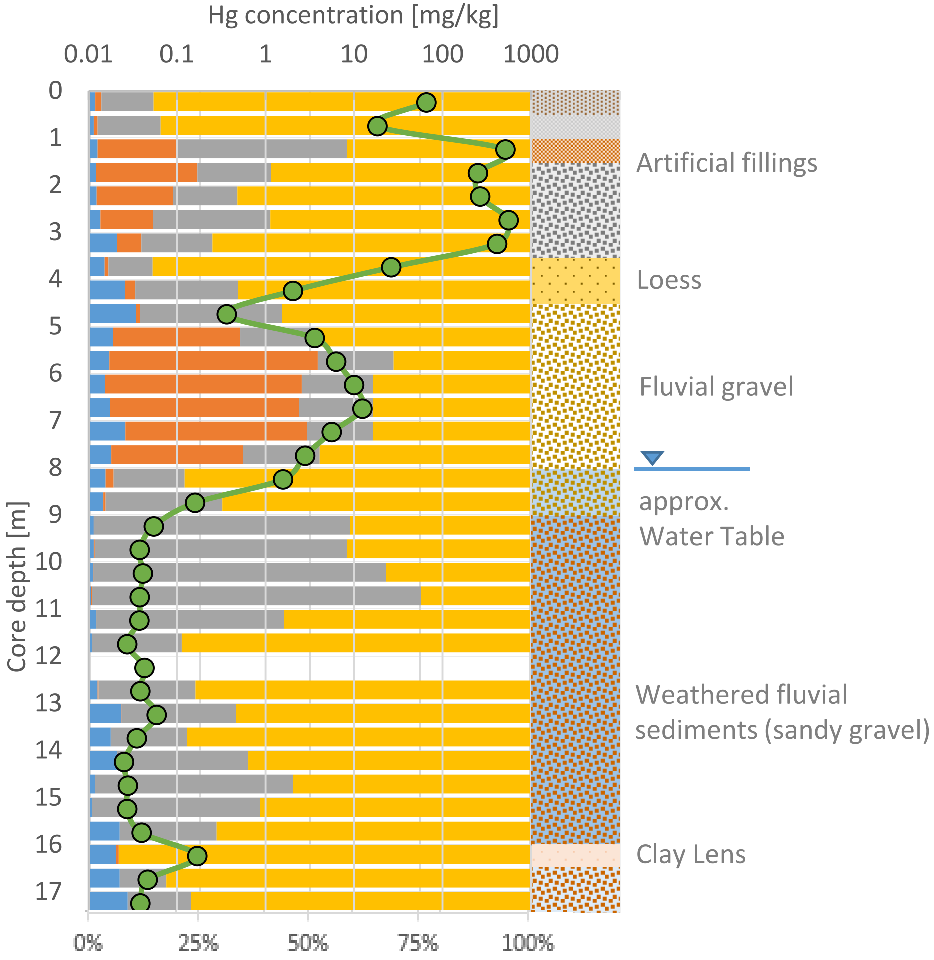


Results demonstrated on one drill core - THg



- Highly contaminated upper most meters (artificial fillings)
- Below the loess layer there is much less Hg

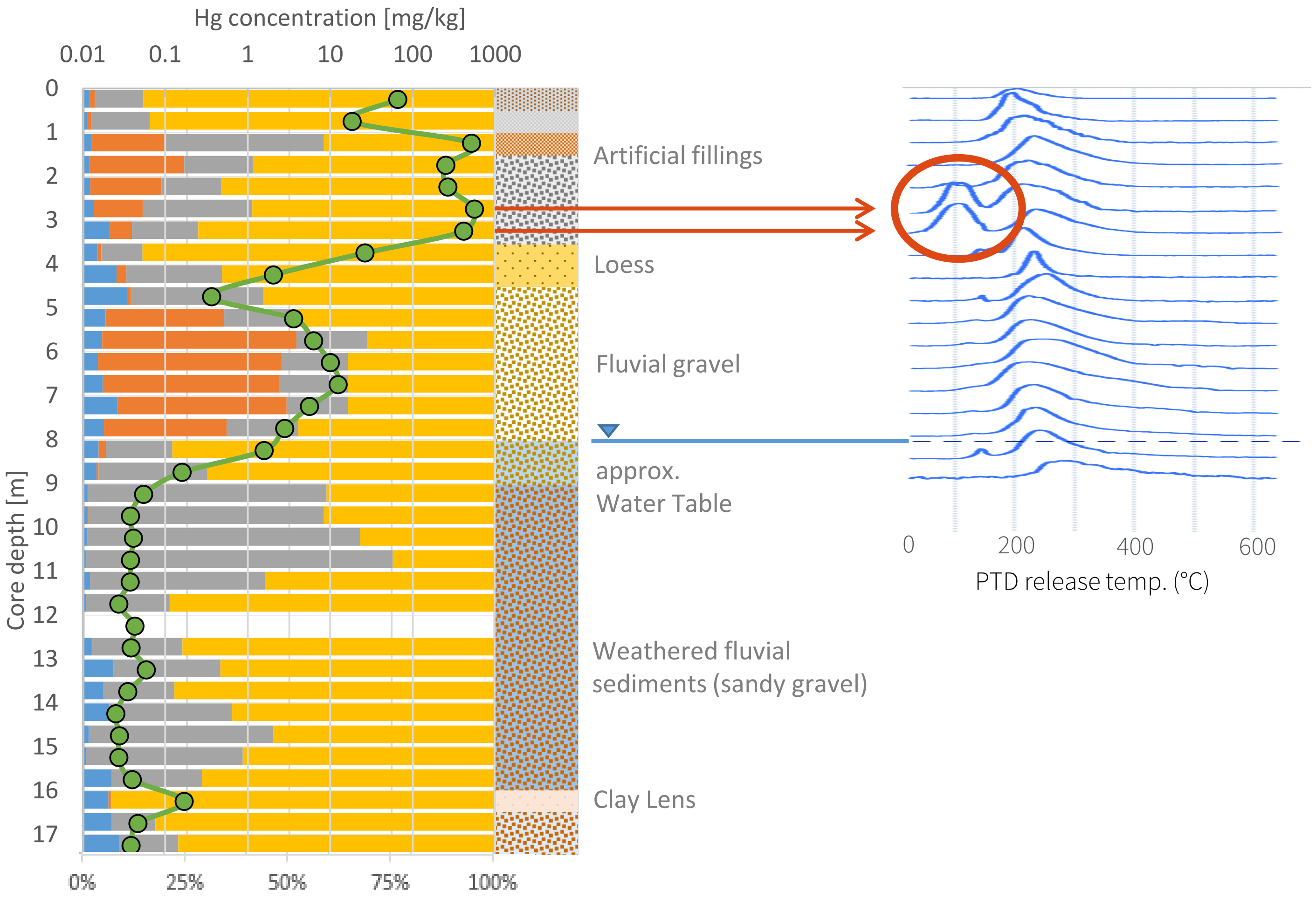
Results demonstrated on one drill core - SEP



- In SEP $HgCl_2$ is usually attributed to F1
  - There is Hg in F1, but it is a relatively small fraction
- Clearly more Hg in F2 extract in the highly contaminated layers
  - Not all $HgCl_2$ extracted in F1?

- F1: Soluble species (Water extractable)
- F2: labile, bioavailable (Weak acid extractable)
- F3: Tightly bound species (strong acid extractable)
- F4: Remaining species (Aqua regia extractable)

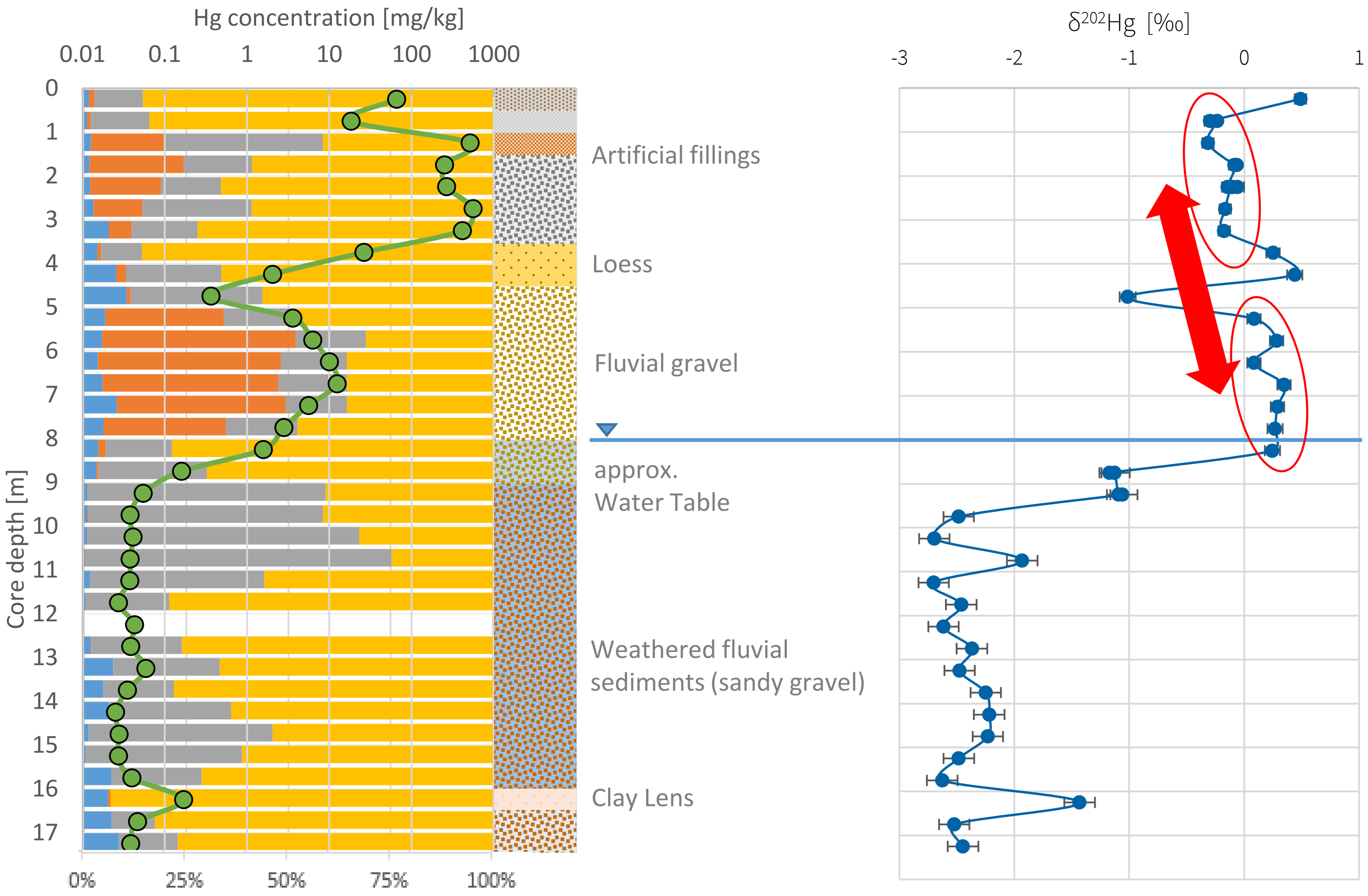
Results demonstrated on one drill core - PTD



- Hg(0) above loess layer
- Reflected by Isotopes?
  - Would cause an isotopically light extract

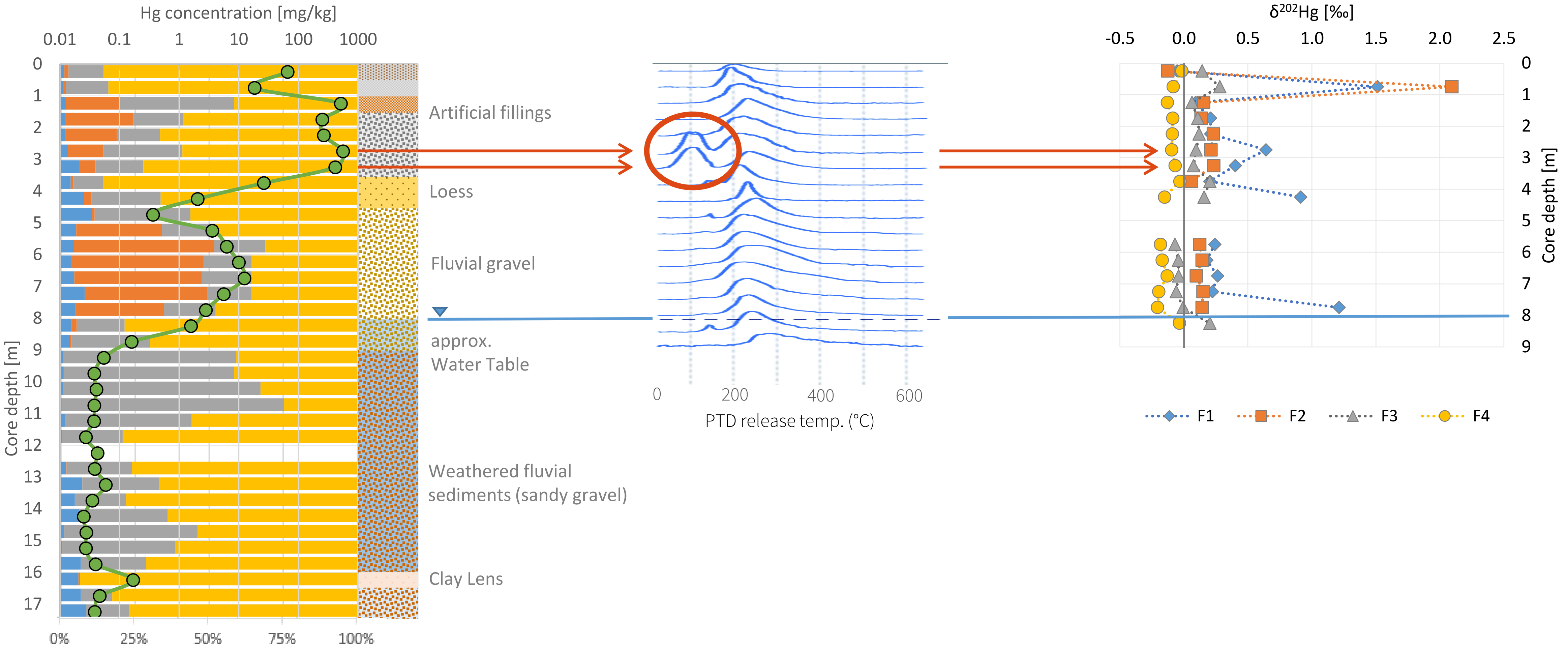
- F1: Soluble species (Water extractable)
- F2: labile, bioavailable (Weak acid extractable)
- F3: Tightly bound species (strong acid extractable)
- F4: Remaining species (Aqua regia extractable)

Results demonstrated on one drill core – Bulk isotopes



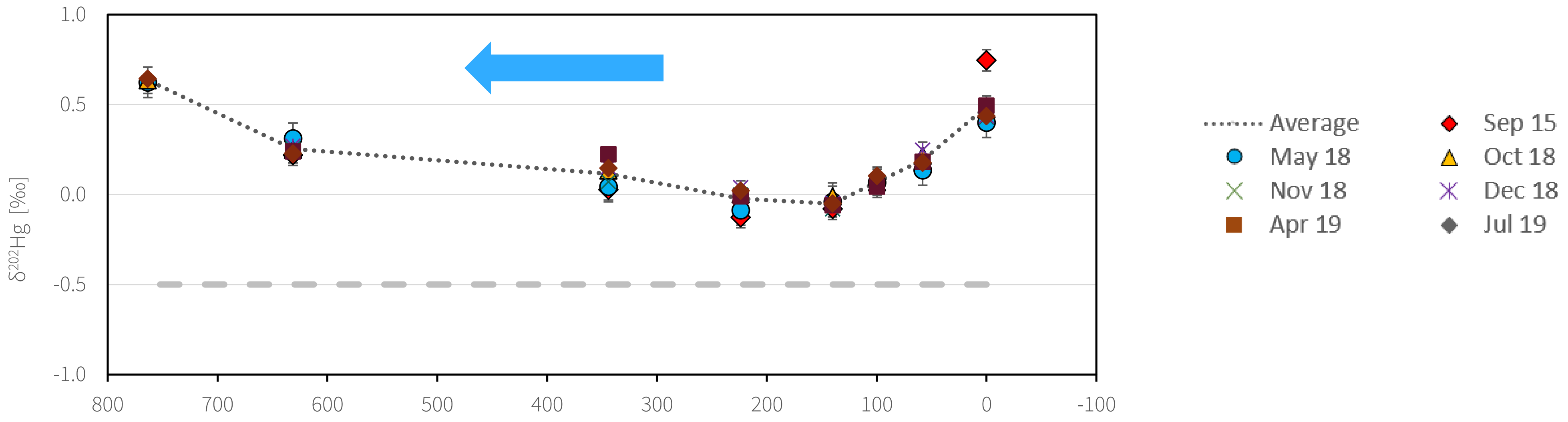
- Major shifts in the isotopic values along the depth profile of drill cores
  - Sorption processes → lighter value in remaining pool
  - Downward transport → continuously increasing δ^{202}Hg value
- Bulk isotope values would not reflect Hg(0) formation

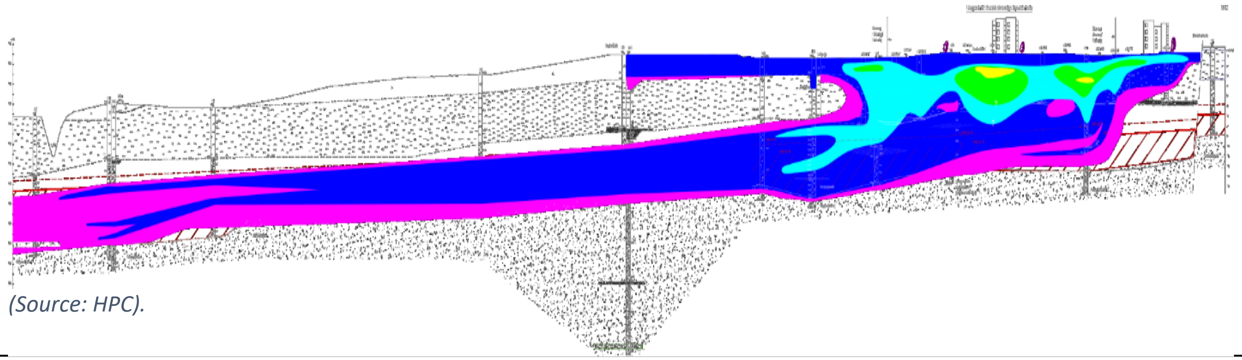
Results demonstrated on one drill core – SEP isotopes



Hg isotopes in groundwater

- Progressively more positive liquid phase $\delta^{202}Hg$ values compared to the solid phase





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Publication:

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https://doi.org/10.1039/D1EM00368B

Demystifying mercury geochemistry in contaminated soil–groundwater systems with complementary mercury stable isotope, concentration, and speciation analyses†

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