



# Solid Phase Thermal Desorption

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## A Tool to Identify Mercury Species in Contaminated Soils and Sediments



## *Why speciation analysis?*

Dependent on species and binding forms:

- Transport
- Bioavailability
- Potential species transformation (e.g. MeHg)

**→ Essential to estimate environmental risks**



## ***Content:***

- Introduction
- Solid phase thermal desorption
- **Applied case studies**
- Advantages/Disadvantages



## **Methods:**

- Sequential extraction
- X-ray adsorption fine structure spectroscopy (EXFAS)

- Limitations:**
- insufficient selectivity
  - dependend on substrate
  - very extensive
  - high detection limit (EXFAS)

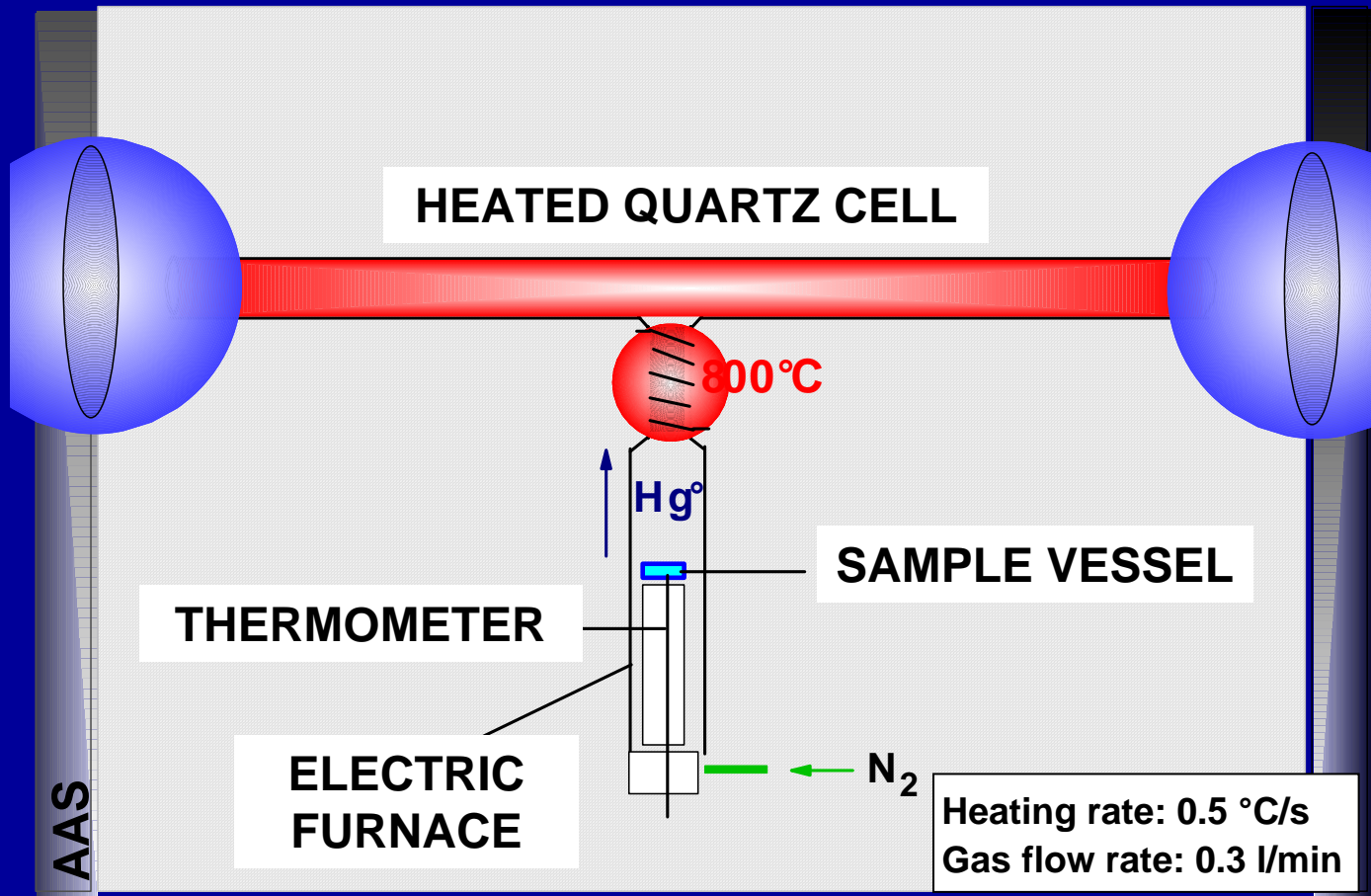
## **Solid phase thermal desorption**

Idea: Hg is volatile at ambient temperatures

→ Determination of Hg binding forms based on their thermal desorption behaviour

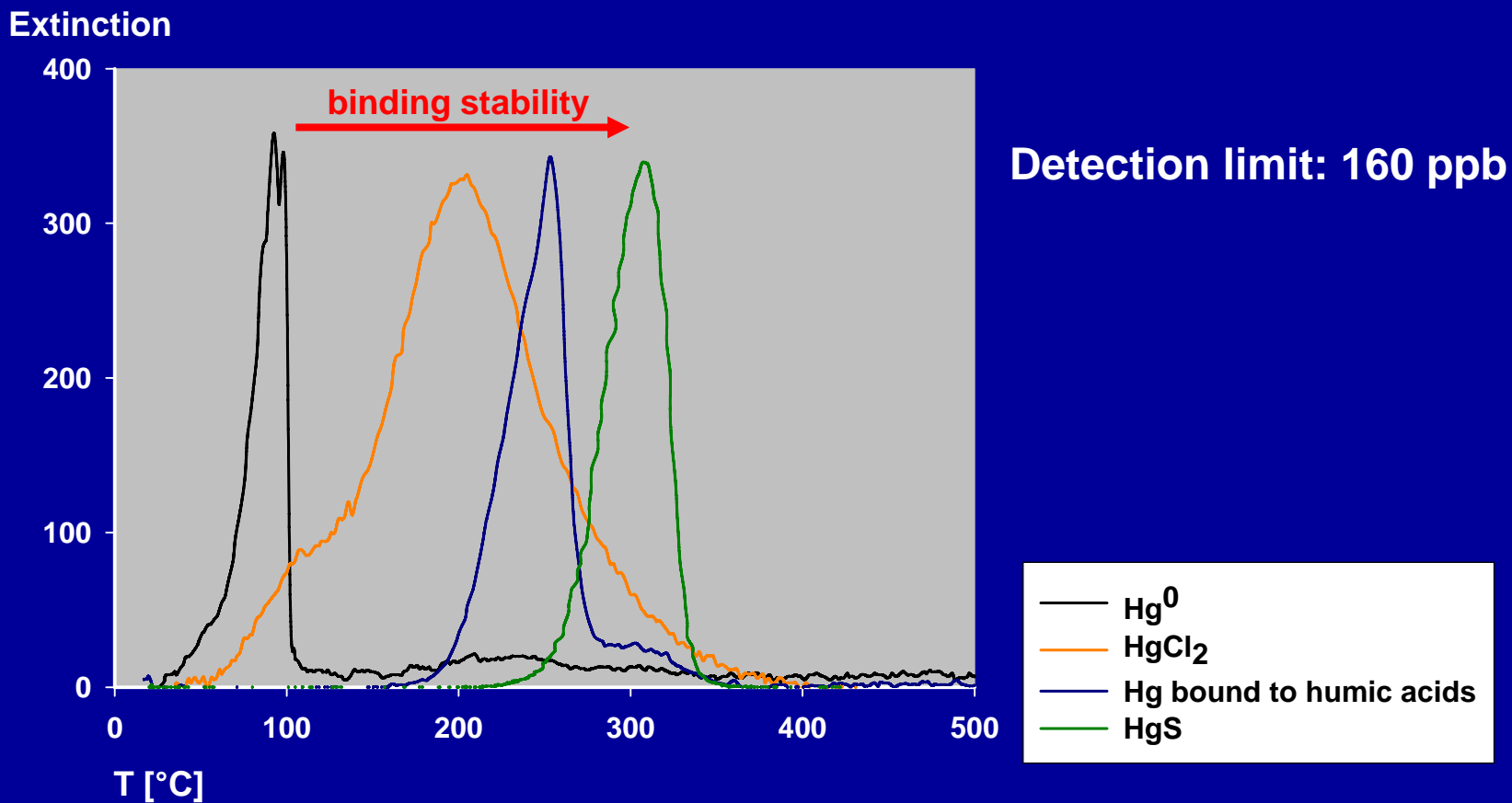


*Schematic diagram of the Hg pyrolysis apparatus*





## Thermo-desorption-curves of Hg-standard materials



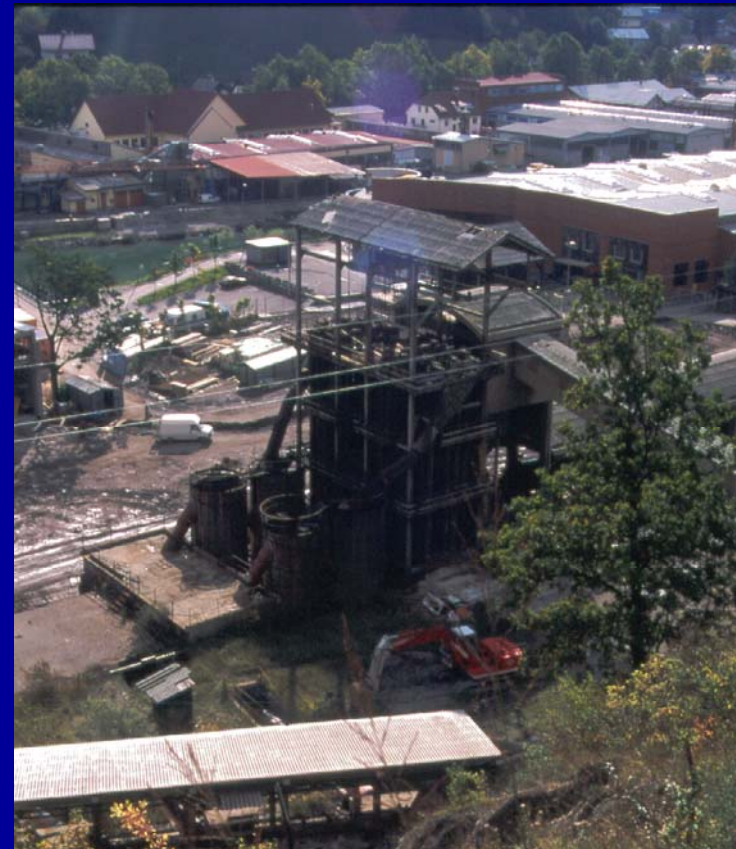


## *Case Study 1:*

# *Mining area Idrija*

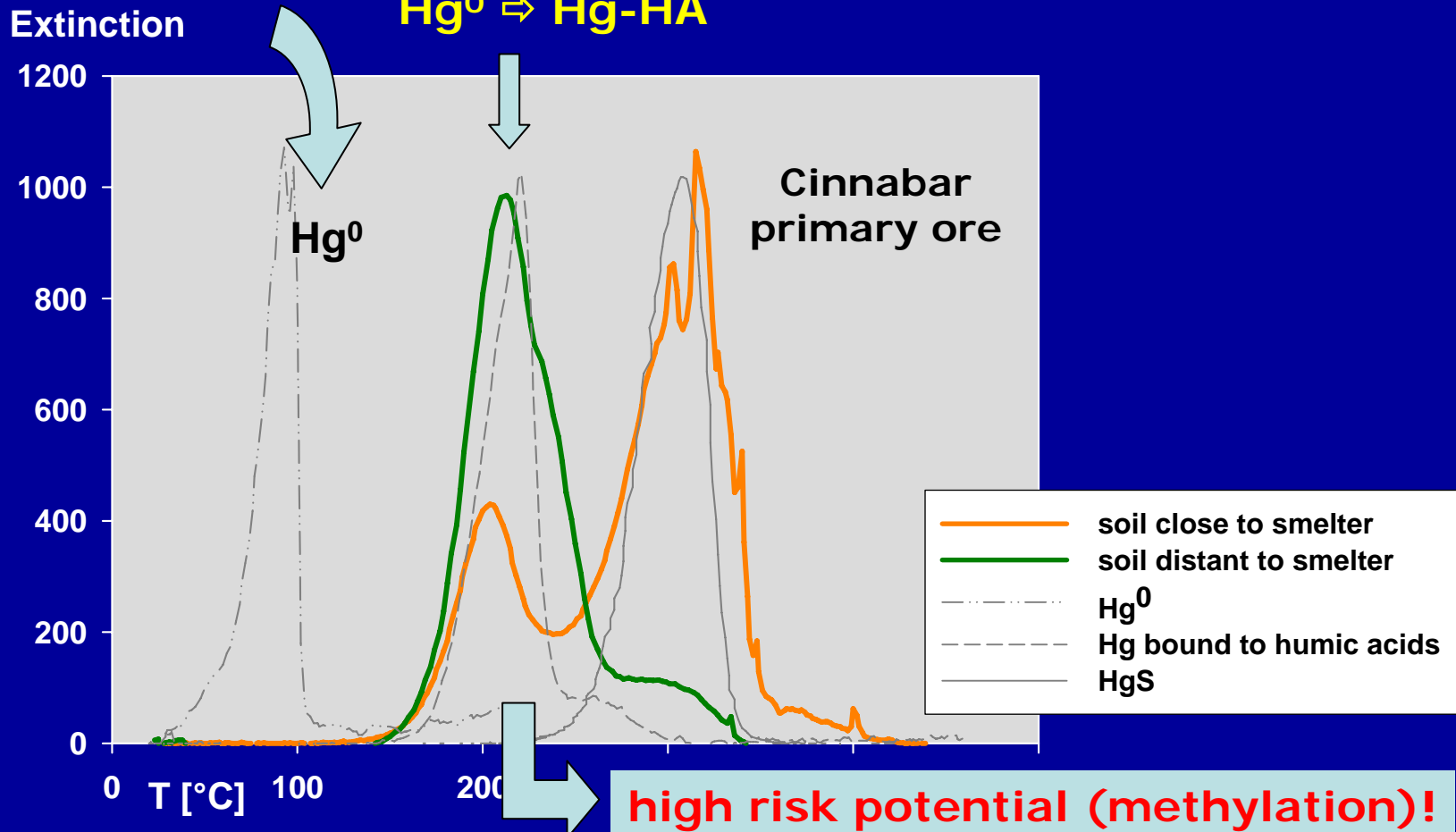


Cinnabar





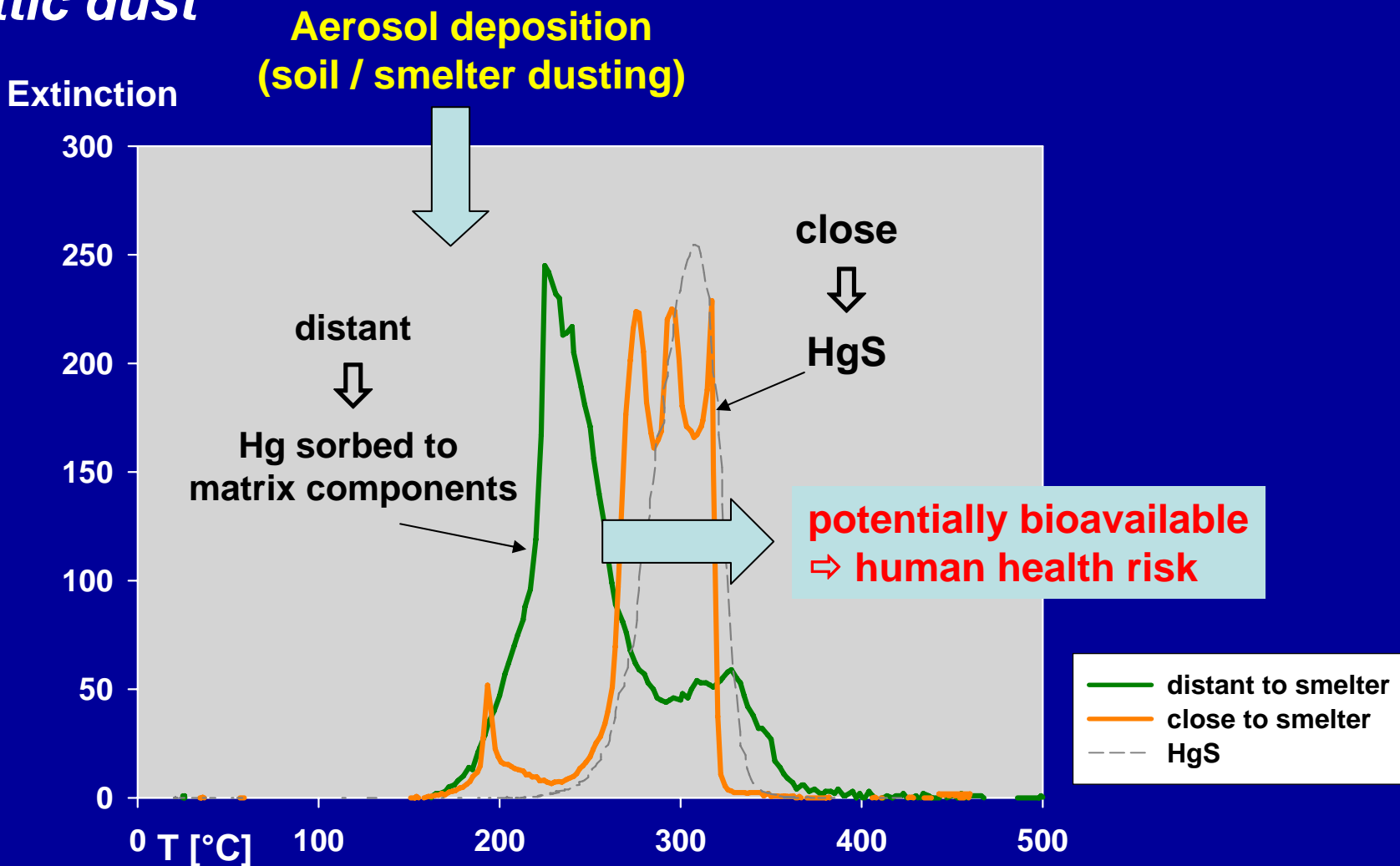
*Atmospheric  
Deposition of Hg<sup>0</sup>*      *Species-  
Transformation  
Hg<sup>0</sup> ⇌ Hg-HA*







## Attic dust





## Contaminated industrial sites:

- chlor-alkali plants:  
emission and deposition of  $\text{Hg}^0$
- wood preservation site:  
spillage of  $\text{HgCl}_2$



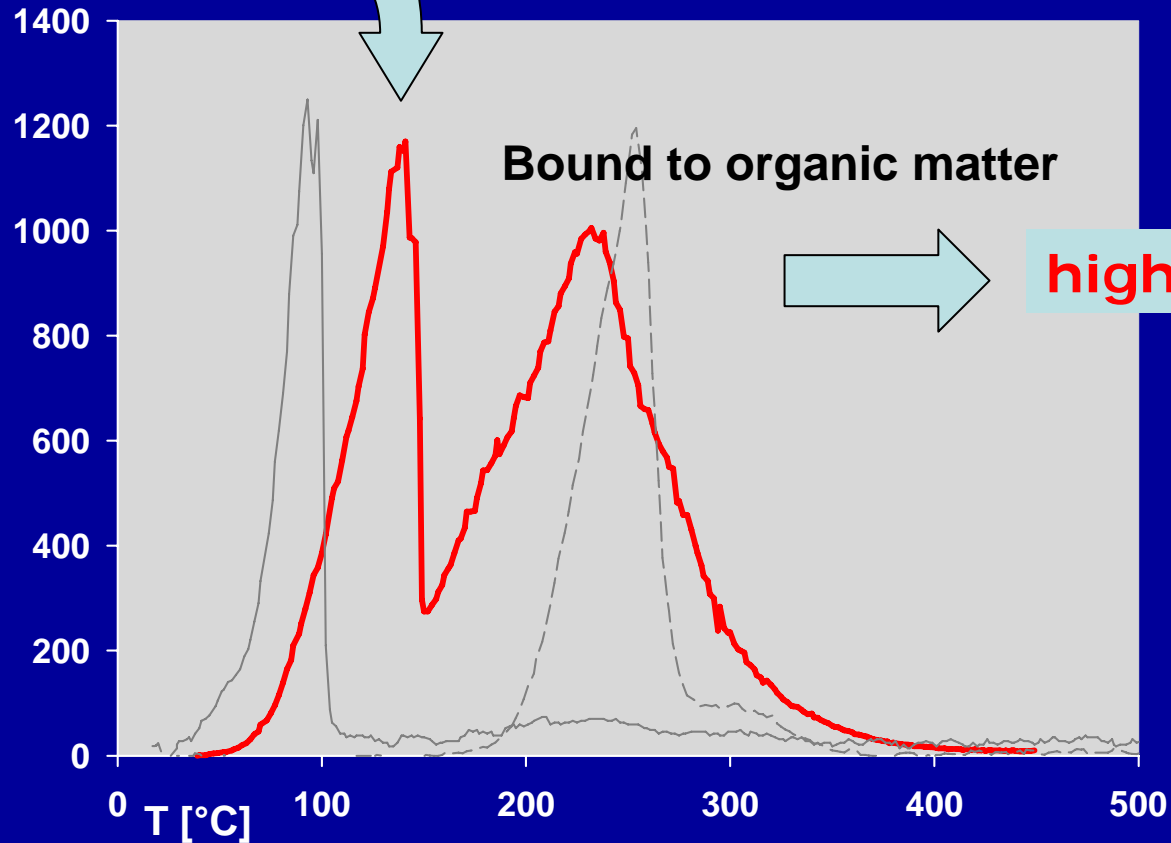
Chlor-alkali plant



Soil with high organic matter!

Spillage  $\text{Hg}^0$

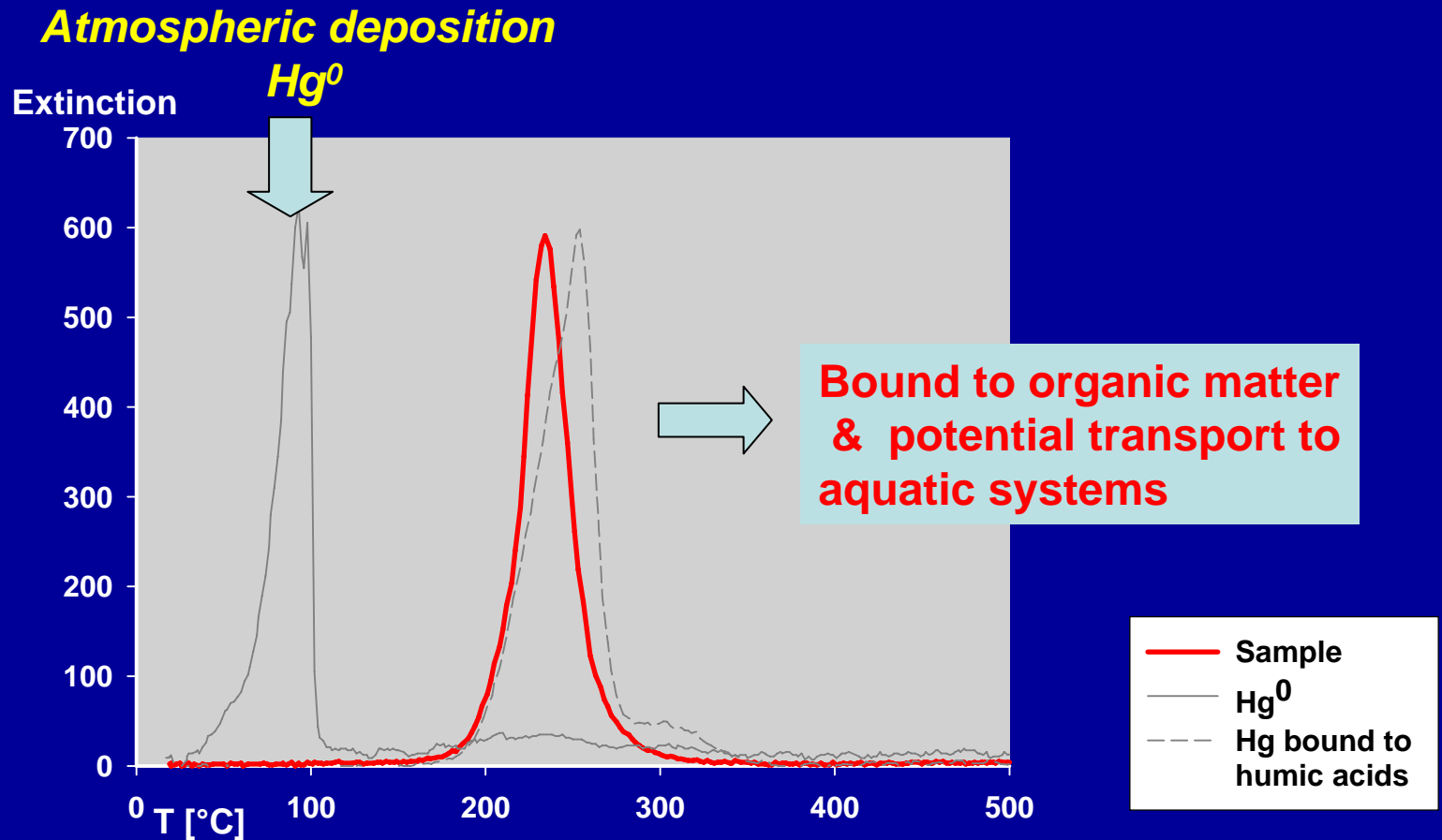
Extinction





Reemission / Transformation

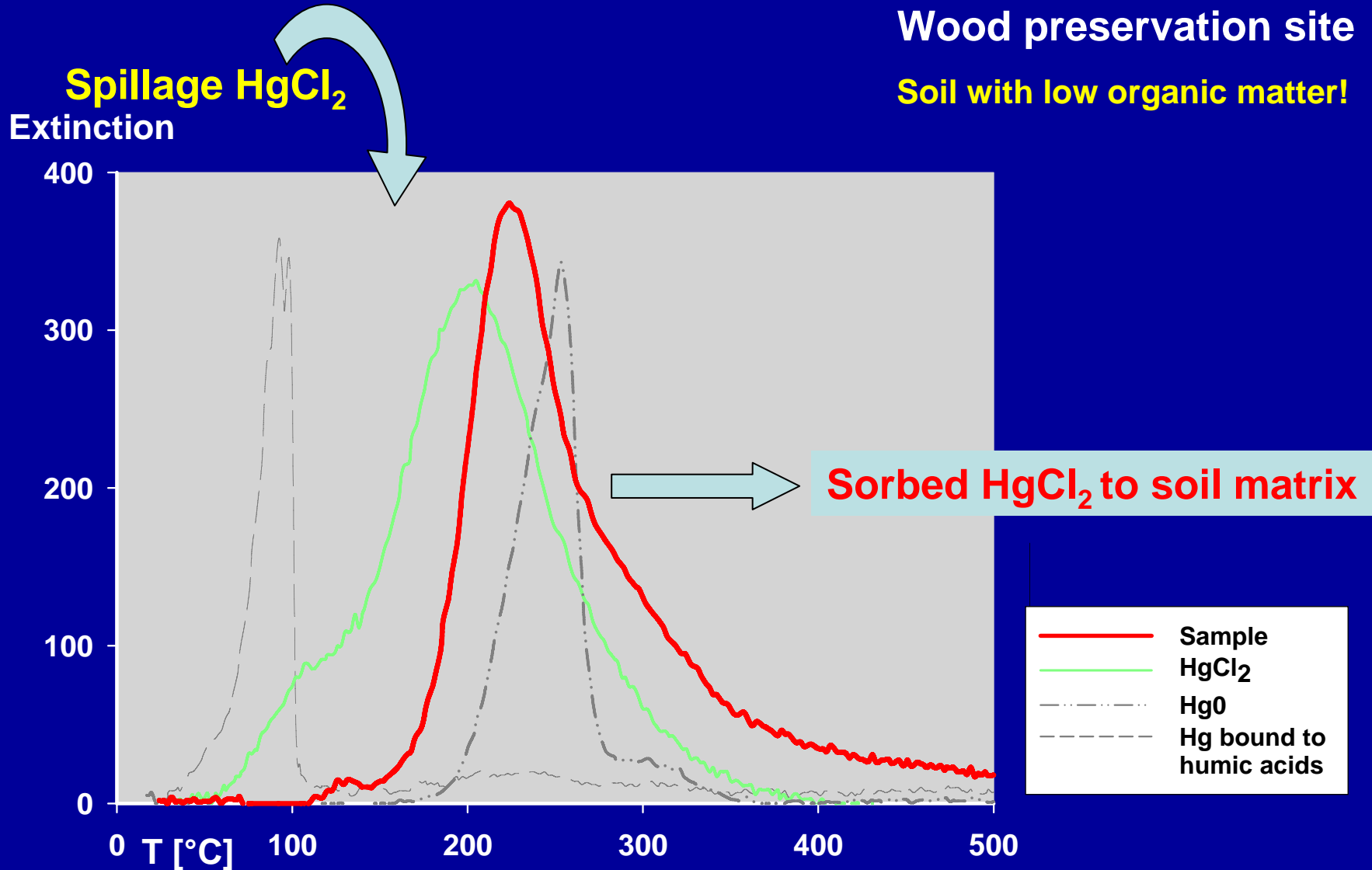
Soil with high organic matter!





Wood preservation site

Soil with low organic matter!





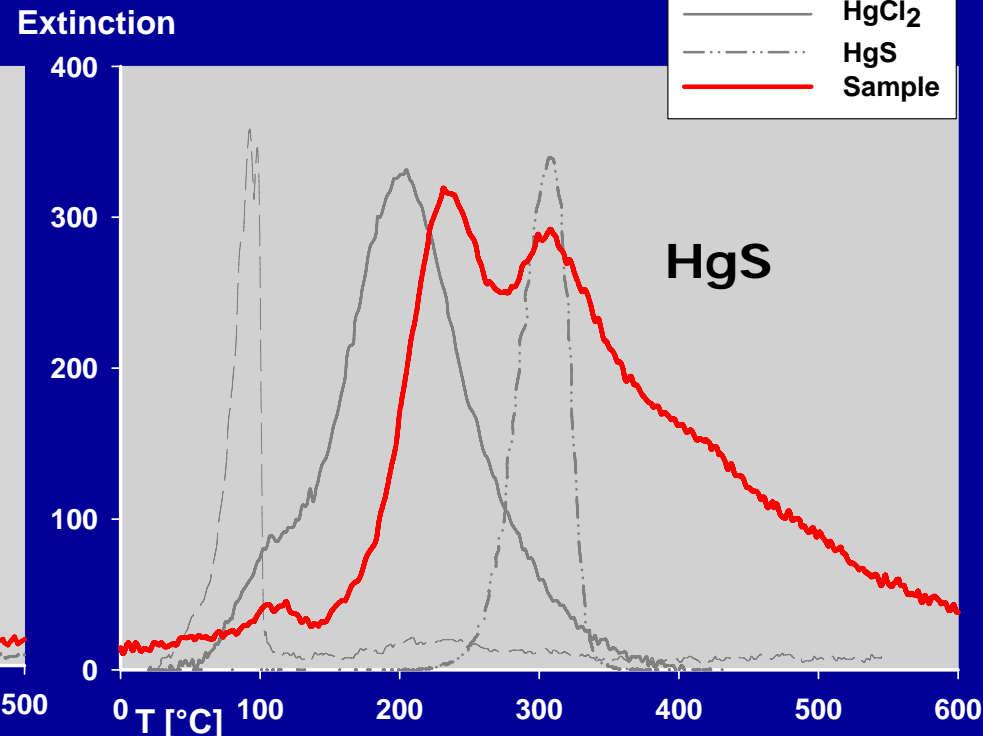
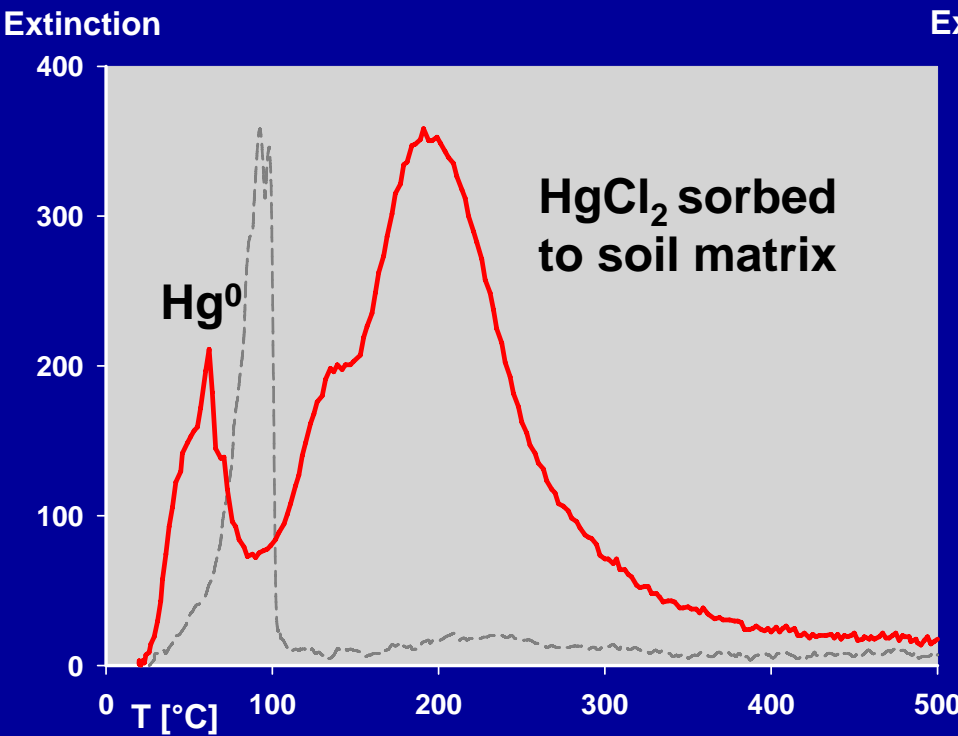
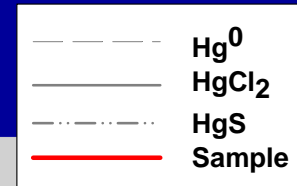
## Species-Transformation

Secondary reduction



Changing redox conditions in aquifer

$\Rightarrow$  Formation of HgS



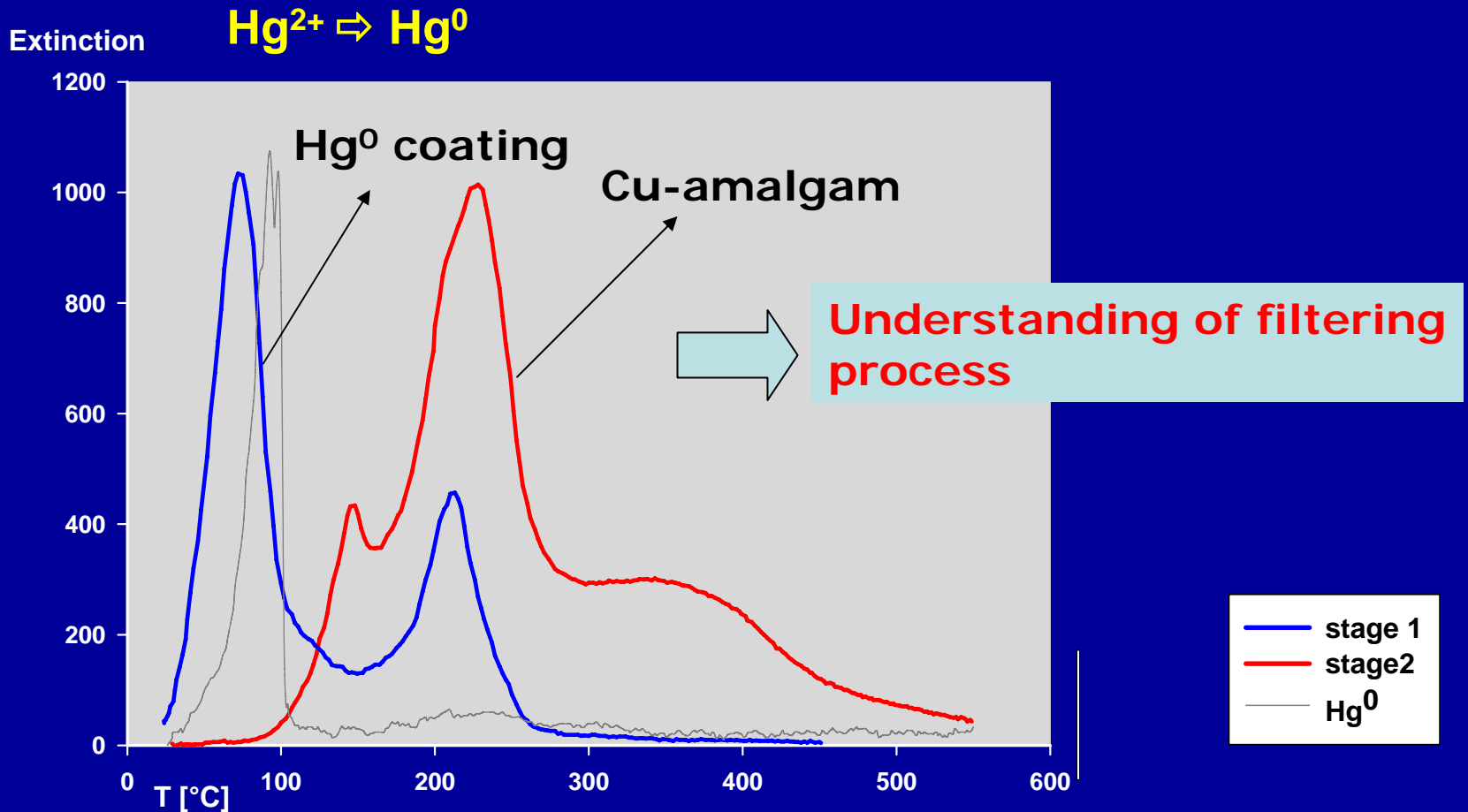


## Application in remediation strategies:

- Groundwater remediation:  
Permeable reactive barriers (Cu, brass): Hg-retention through **amalgamation**
- Soil remediation:  
**Immobilisation** of Hg in soil through sulfide formation



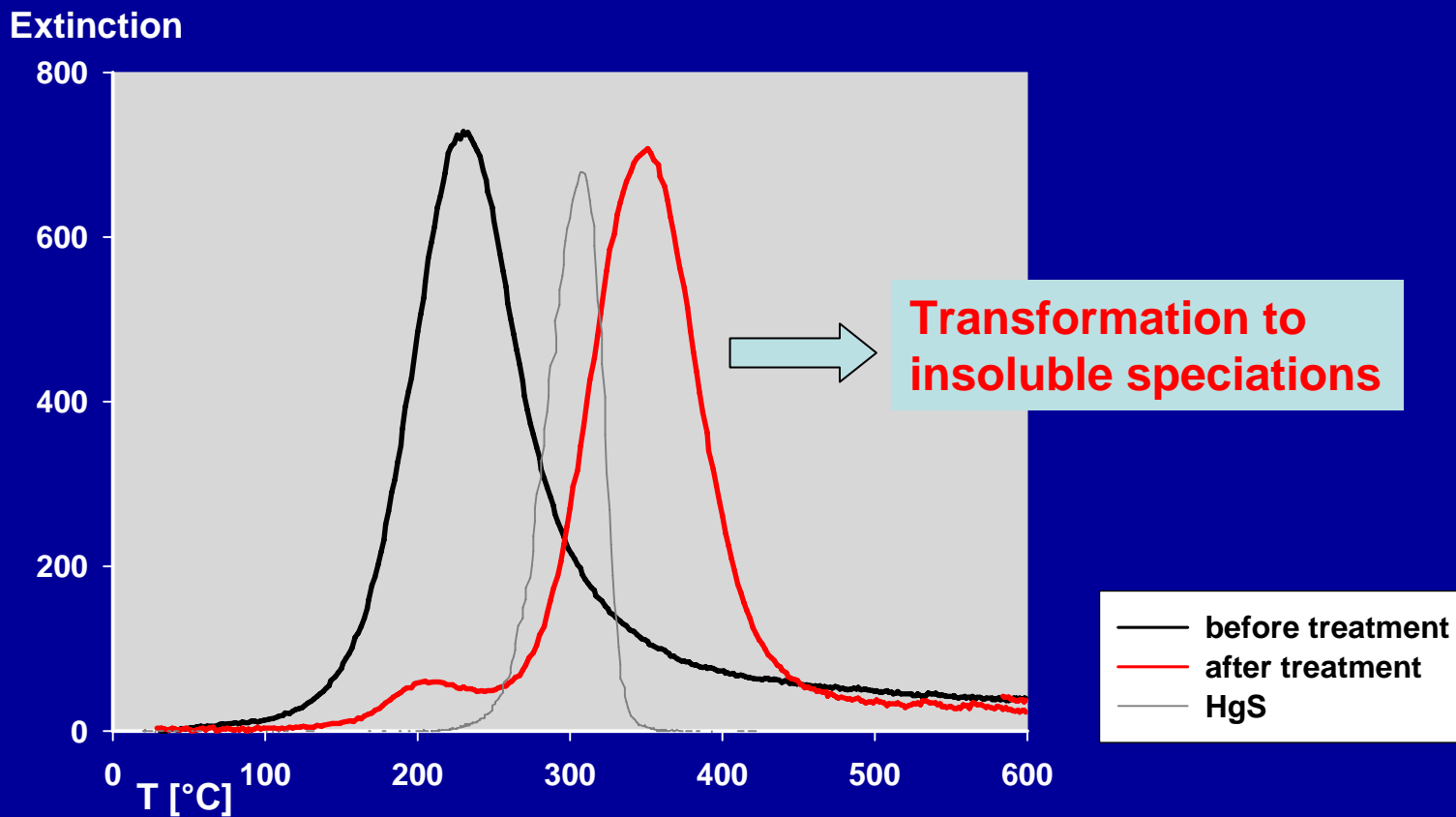
## Filter amalgamation (2000h of $\text{HgCl}_2$ filtration):







## Immobilisation using Polysulfide





## Conclusion

### *Advantages:*



**Fast method (10 min)**



**Highly selective for Hg<sup>0</sup> and cristalline Species (HgS)**



**Cheap**



**Good reproducibility**

### *Disadvantages:*



**No specific selectivity for matrix-bound Hg**



**No information on solubility**



**Semi-quantitative**



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**Thank you for your attention**