LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

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Storage of LDS Sludge in a Flooded Underground Mine

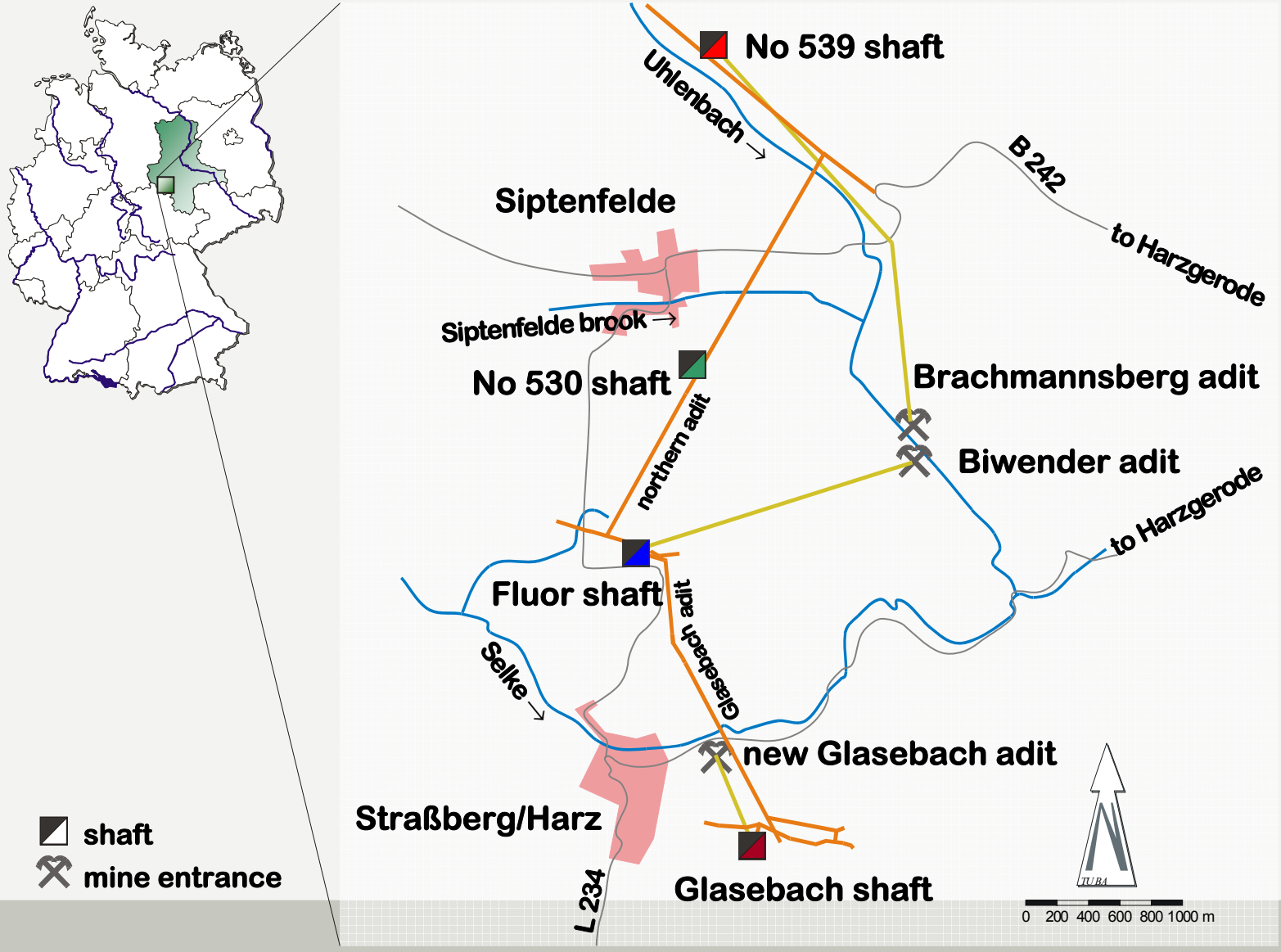
Tracer Tests and Water Quality Development

13th BC/MEND Workshop Vancouver, November 30 2006

Outline

- Geographical overview
- Some mine details
- Sludge disposal
- Tracer test
- Results
- Conclusions
- Acknowledgements

Straßberg/Harz: Location



Mine Details

Mine field	Total volume, m^3	Flooded, m^3
Straßberg	182,000	178,300
Brachmannsberg	43,400	42,500
Glasebach	57,400	56,250

- Largest Flourite Mine in (Eastern) Germany
- Flooding started in 1994
- Discharge: ≈ 7.5 $m^3\ min^{-1}$ (max: 18 $m^3\ min^{-1}$)

Conventional Treatment (Straßberg Plant): Mine Water Inflow

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Conventional Treatment (Straßberg Plant): Liming

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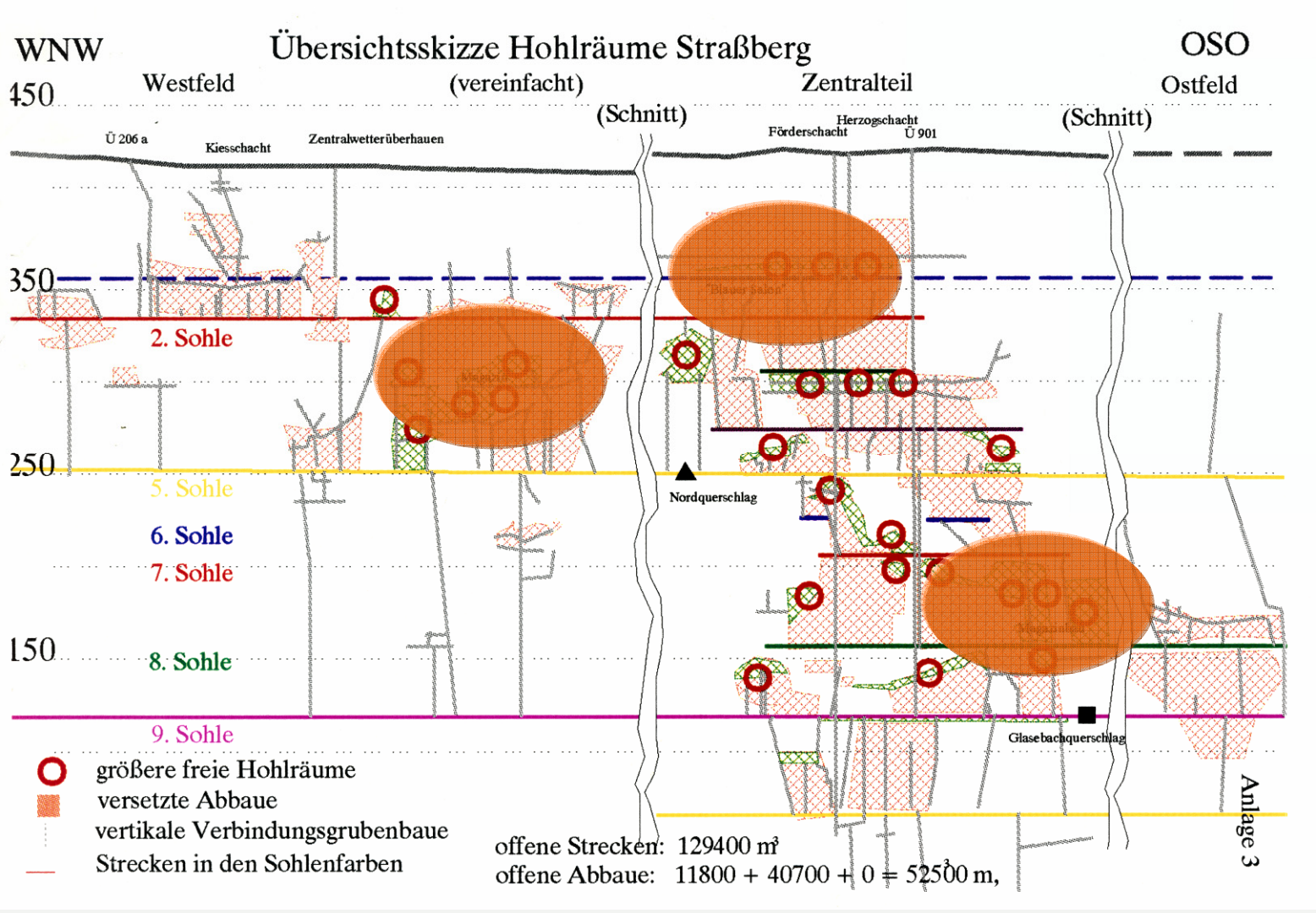
Conventional Treatment (Straßberg Plant): Settling Pont 3

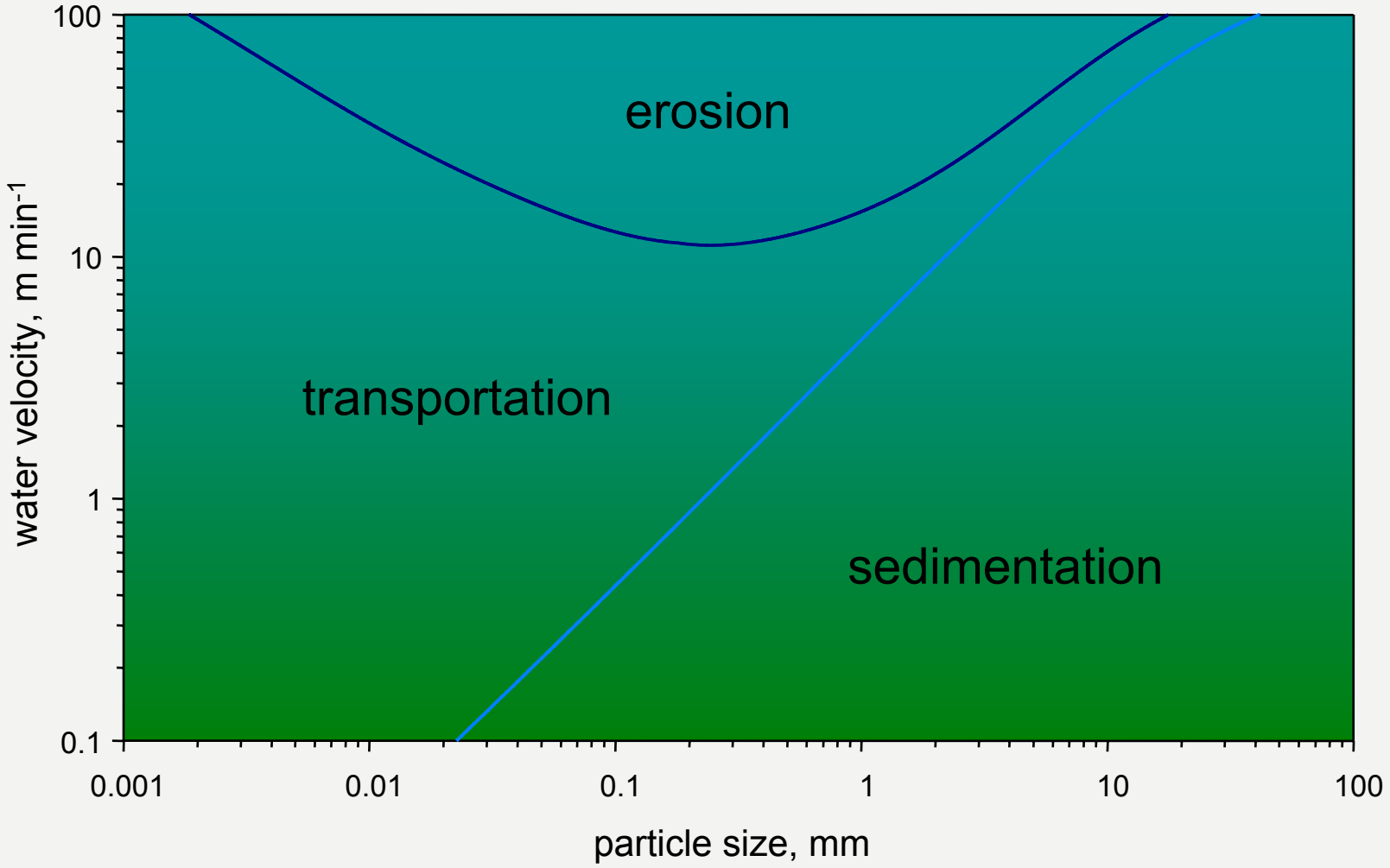
Conventional Treatment (Straßberg Plant): Settling Pont 1

Conventional Treatment (Straßberg Plant): Sludge Storage

Potential Storage Capacities



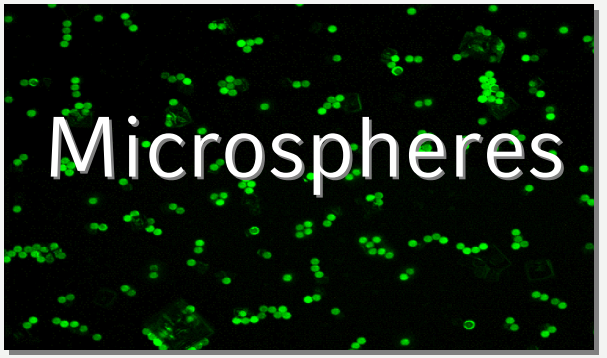
Sludge Transport



after HJULSTRÖM 1935

Demands

- As deep as possible
- Injection without contamination
- More than one injection point
- Suitable tracer for mine water
- Tracer test must be repeatable
- Cheap and easy to handle



The “LydiA” Technique

Injection system “LydiA”

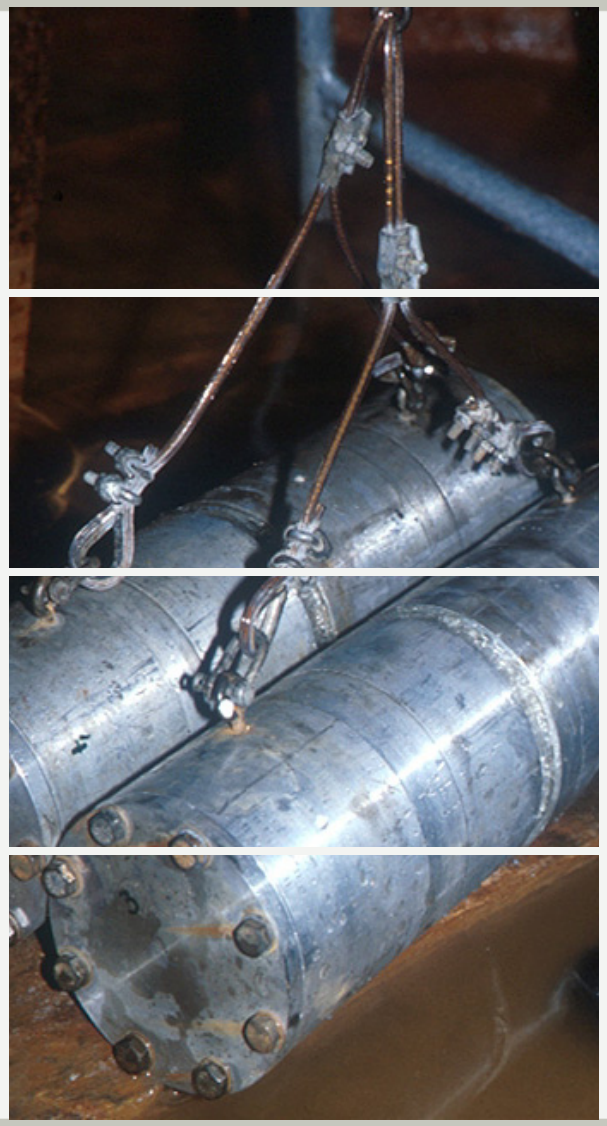
Filter system

Probe with chemical lock

Coarse and fine filter meshes

Injection System „Lydia“

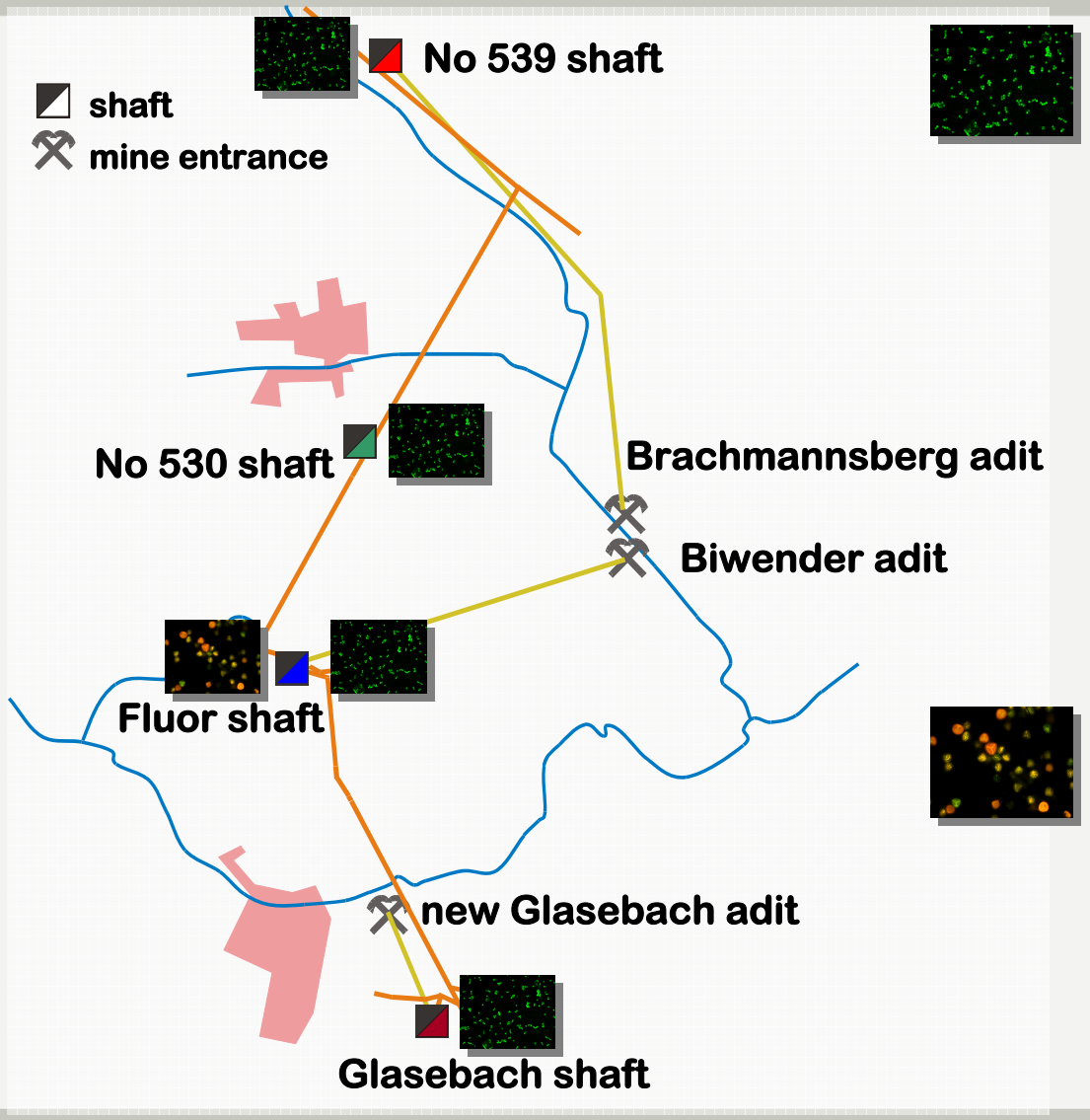
- Probe with soluble chemical lock
- Probe tracer filled in laboratory
- No contamination of mine water by tracer
- Tracer released in predetermined depth
- Probe can remain in mine water throughout the test



Filter System

- Coarse and fine plankton filter meshes
- Separate high suspension load of mine water
- Regular sampling intervals possible (0.5—99 hours)
- Minimisation of contamination
- Suitable for rough underground conditions

Straßberg/Harz: Tracers used



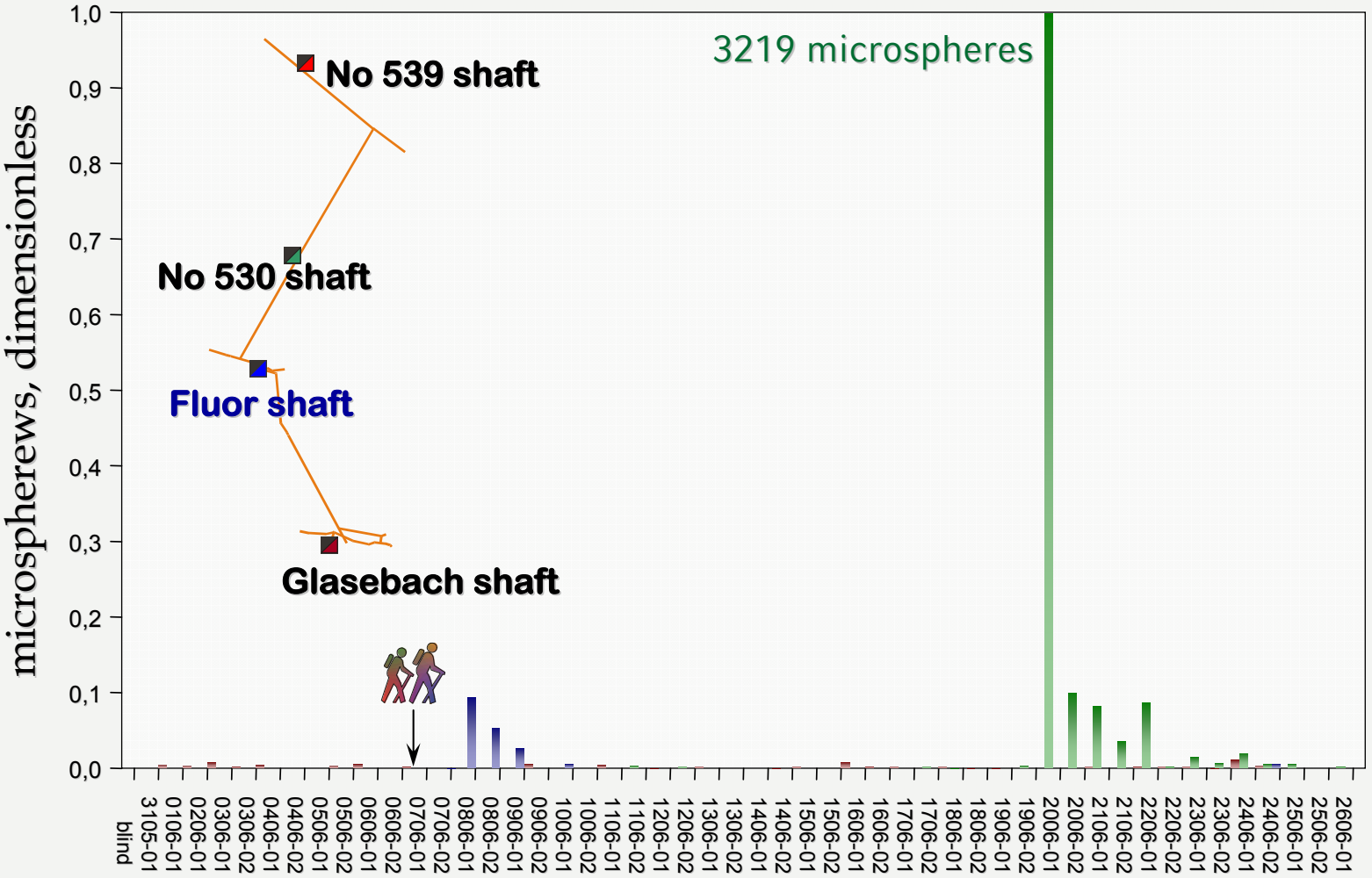
Microspheres

- 4 × 40 mL
- No 539 shaft
- No 530 shaft
- Flour shaft
- Glasebach shaft

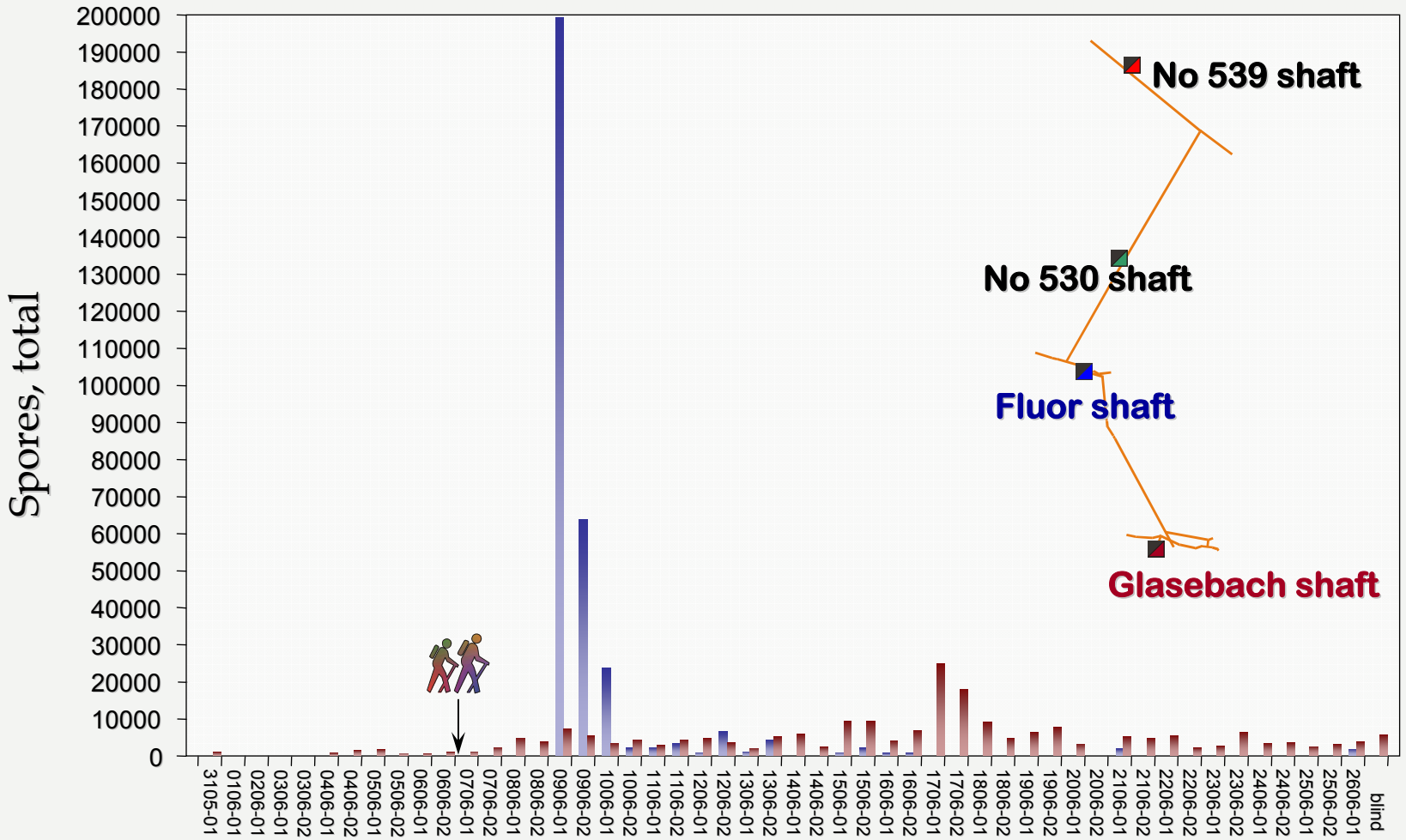
Lycopodium

- 544 g
- Flour shaft

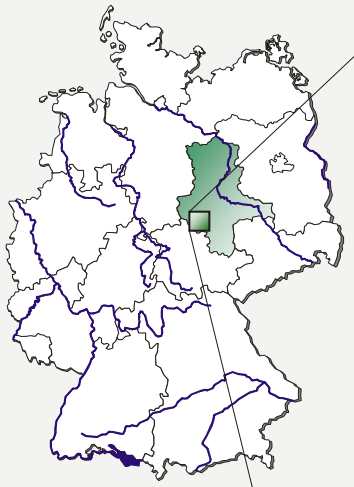
Sampling point: Microspheres Fluor shaft

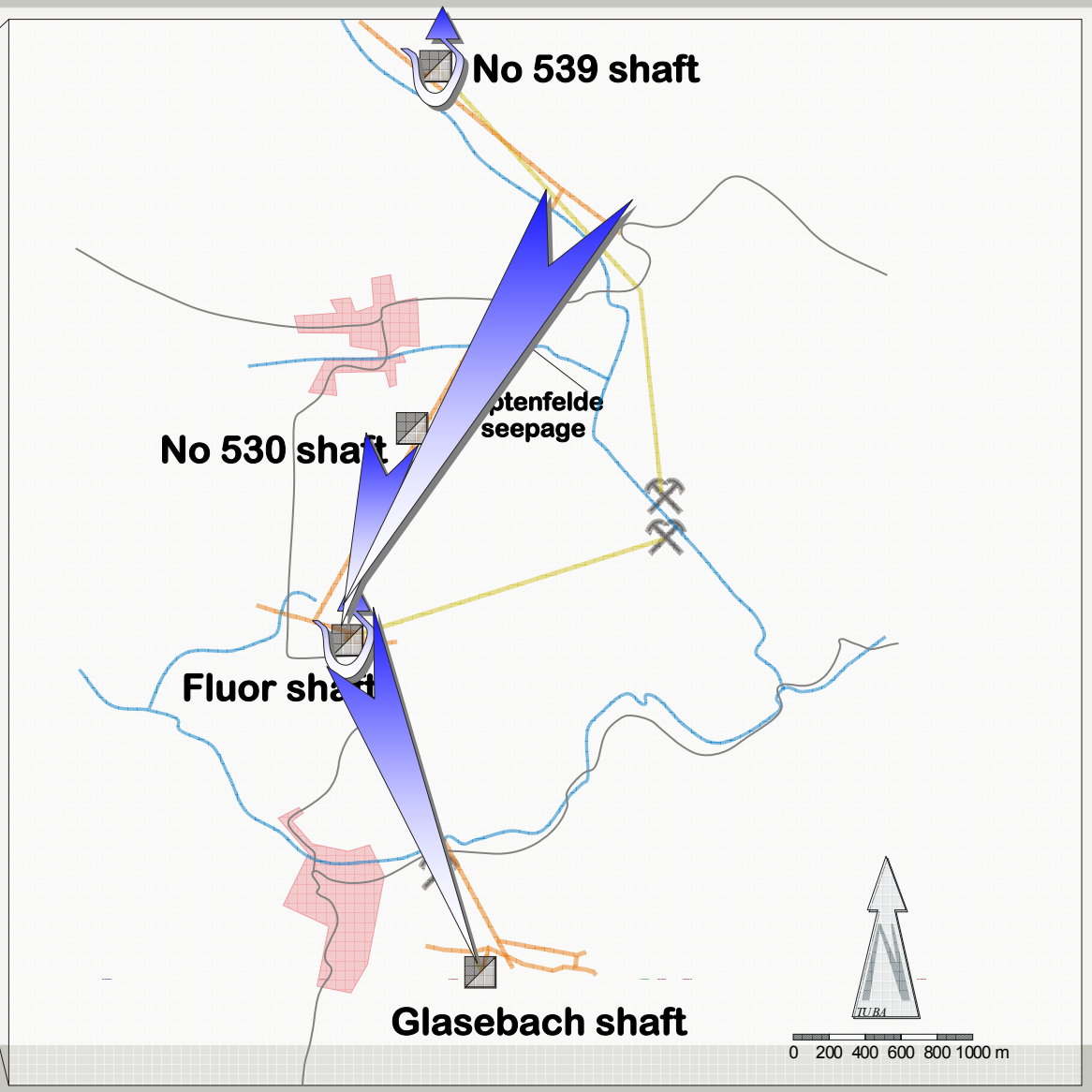


Injection point: *Lycopodium* Fluor shaft



Straßberg/Harz: Result 2000

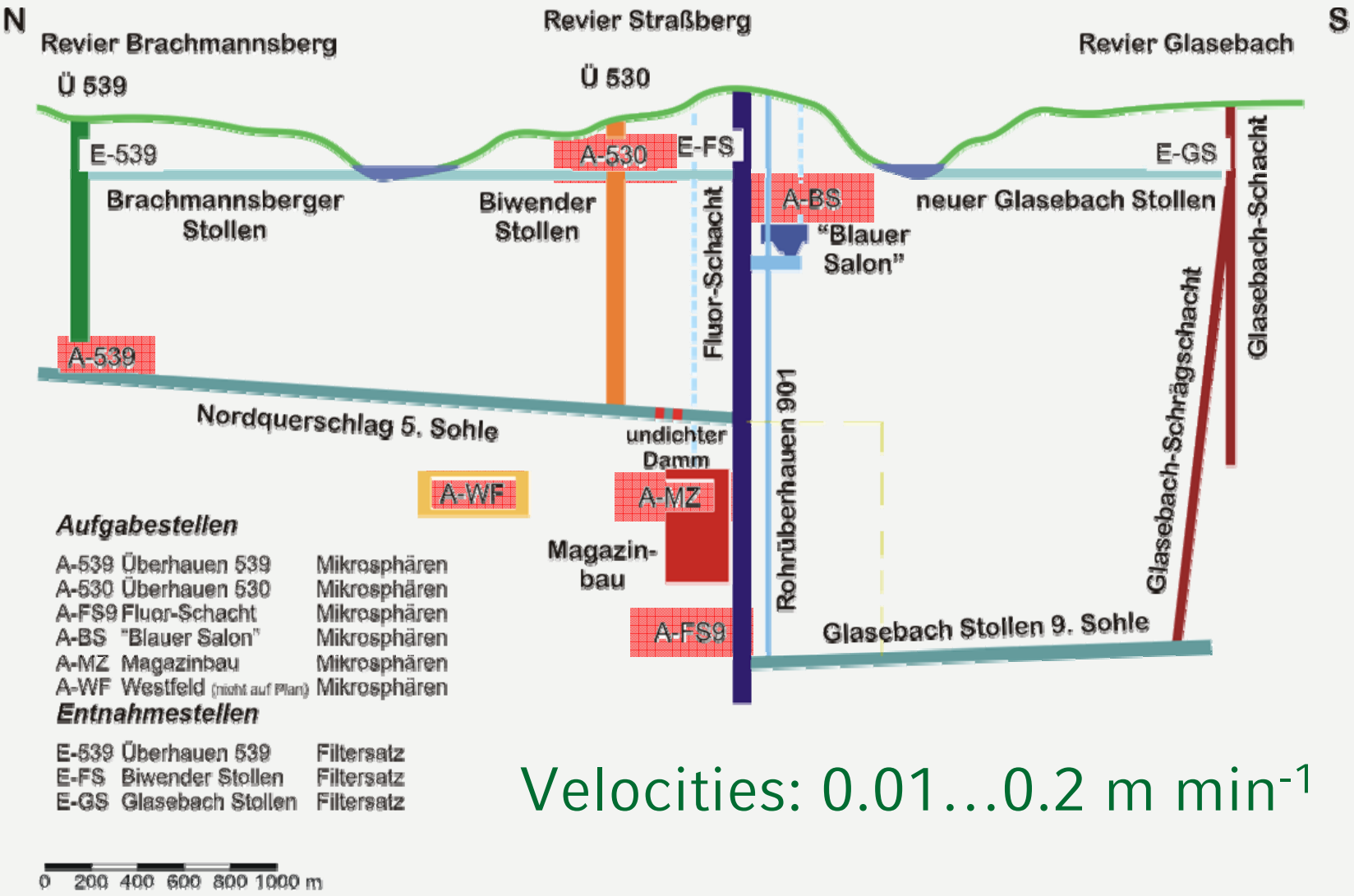




shaft

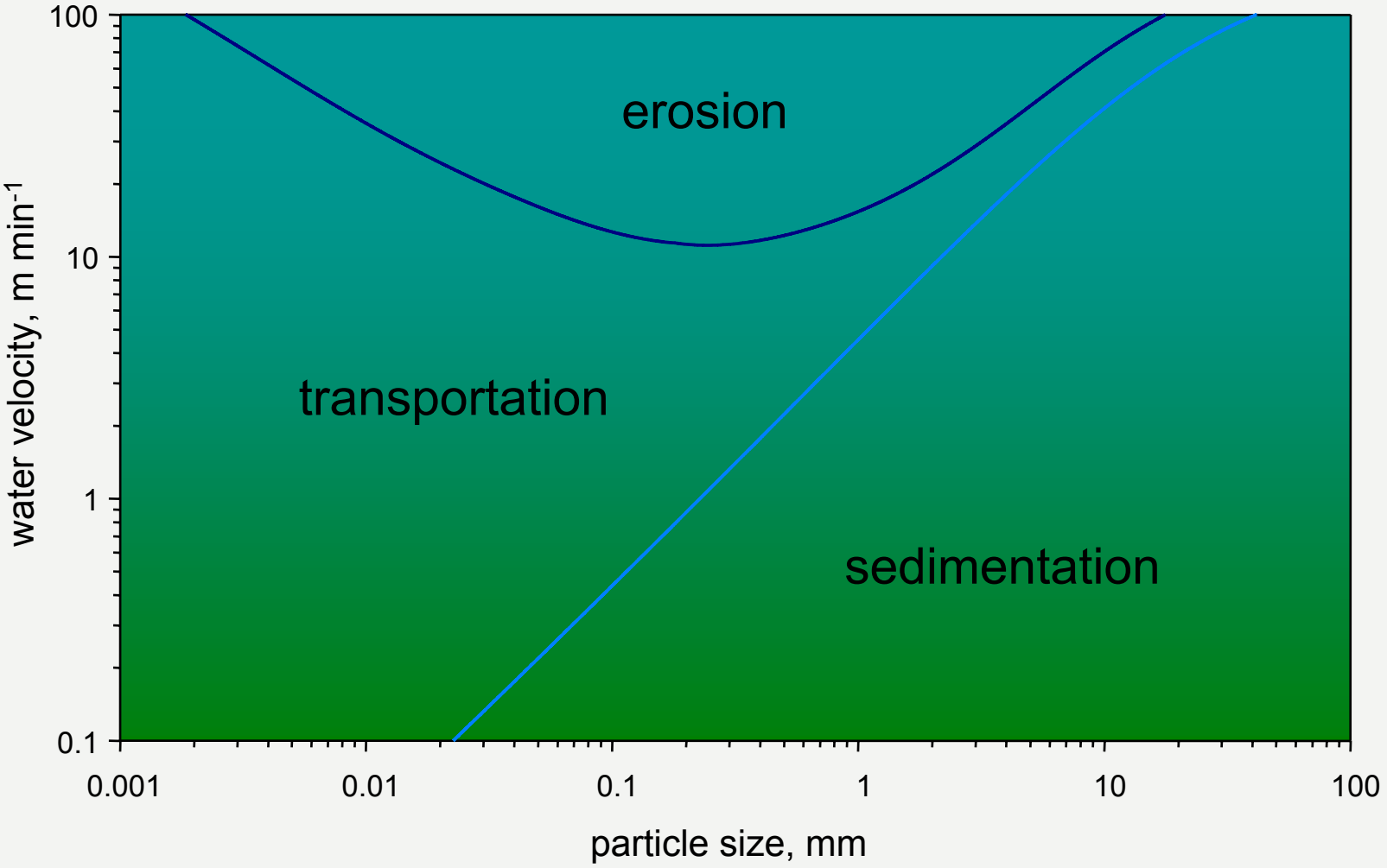
mine entrance

Straßberg/Harz: 2003 Tracer Test



Velocities: 0.01…0.2 m min^{-1}

Sludge Transport



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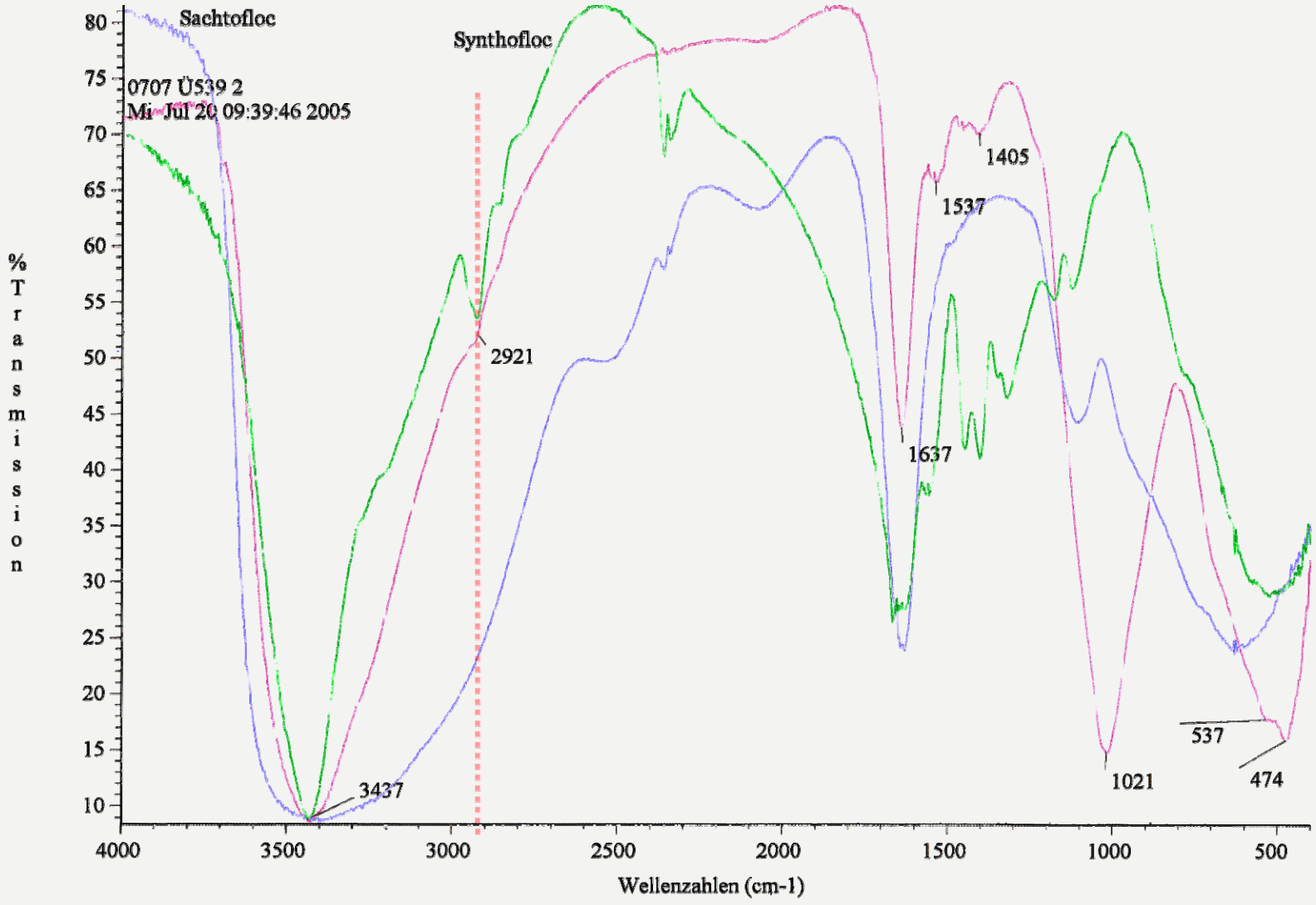
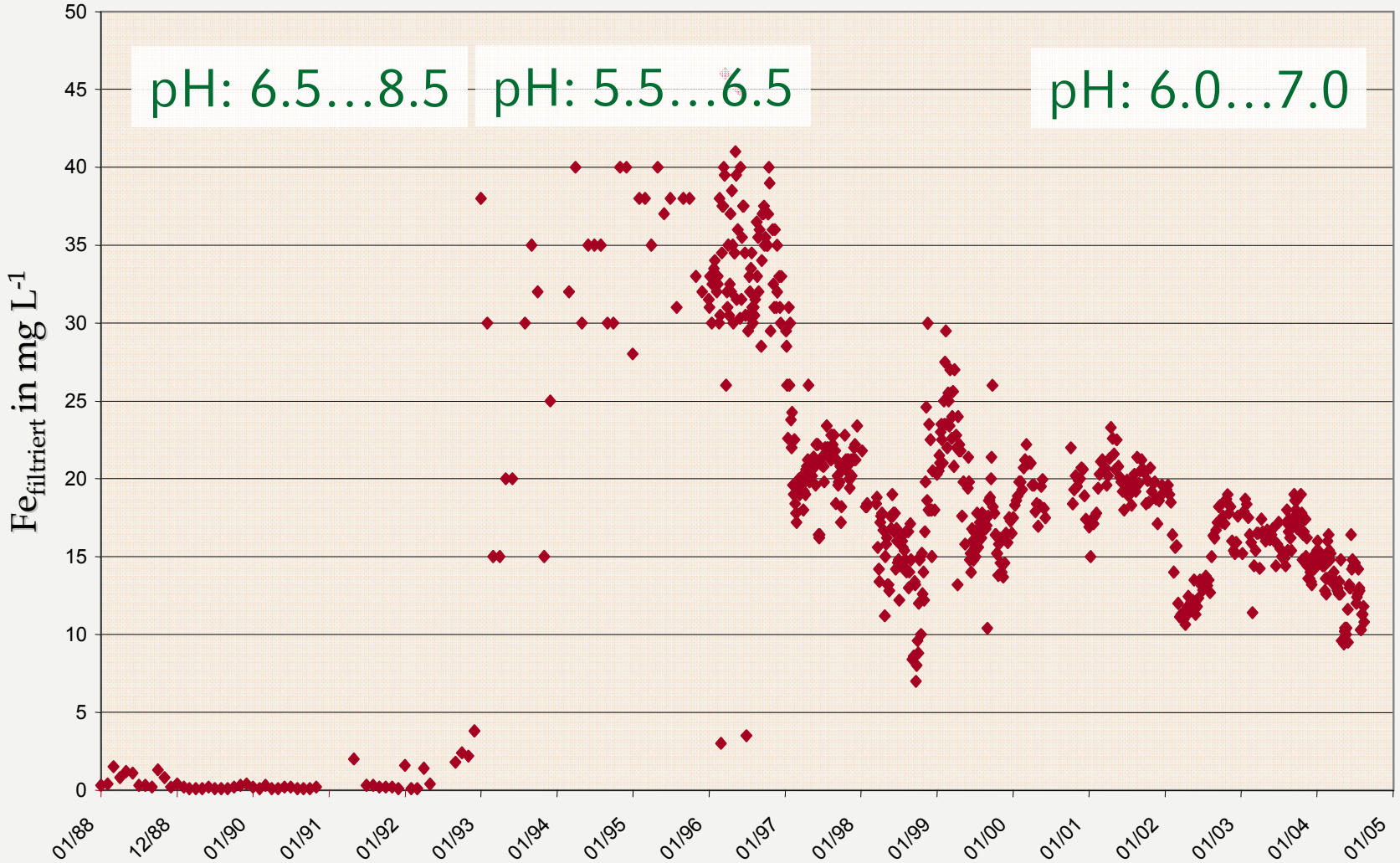
IR Spectra of Flocculent and Fe-Flocks in Mine Water



Straßberg/Harz Fe-Development



after WINKLER 2001; DEGNER

... Conclusions

- investigated area hydraulically well connected
- contaminated mine water from deeper parts of the mines is transported to higher levels
- LDS sludge buffers the mine water pH
- No additional metals are released to the environment

Thanks to everybody!

- TU Bergakademie Freiberg
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- You – for coming and listening