TU Clausthal

REWIMET
Recycling-Cluster wirtschaftsstrategische Metalle

Tailing ponds
Risks and chances

Dr.-Ing. Kai Rasenack

Tailing Ponds

- Tailings: left overs from procesing ores
- Tailig ponds: storage of (mostly) fine grained material as sludge or suspension

- Number of tailing ponds, estimations:
  - app. 3.500 active (Mine tailings dams: when things go wrong; Davies et al)
  - app. 18.000 of these ca. 2.000 in registry (https://www.churchofengland.org/about/leadership-and-governance/church-england-pensions-board/pensions-board-investments/investor)
  - 29.000 – 35.000 of these app. 50% - 60% active (https://worldminetailingsfailures.org/estimate-of-world-tailings-portfolio-2020/)

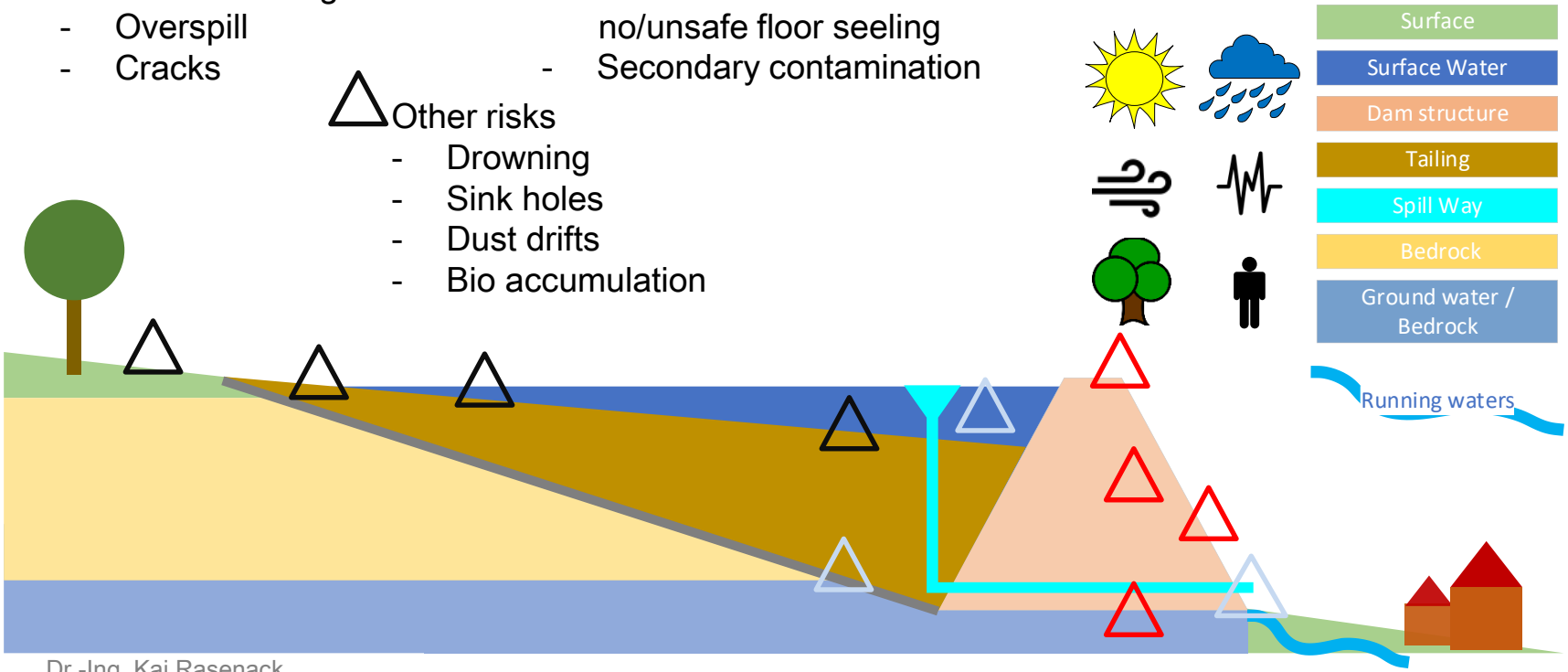
- In this presentation: focus on inactive/ old tailing ponds

Risks

Dam stability
- Design failure
- Unsafe underground
- Overspill
- Cracks

Water contamination
- Direct contact
- Ground water risk due to no/unsafe floor seeling
- Secondary contamination

Other risks
- Drowning
- Sink holes
- Dust drifts
- Bio accumulation



Chances and Outcomes

„Do-nothing“ option:

- Local recreation area
- „natural“ habitat

Positives:

- Locals are used to it
- No additional construction site/ processing noise
- Established flora and fauna undisturbed

Chances and Outcomes

„Do-nothing“ option:

- Local recreation area
- „natural“ habitat

Negatives:

- Risk of fatal failures
- Pollution
- Perpetuity costs
- Landuse without benefit

€

€€€€

Von Senado Federal - Bento Rodrigues, Mariana, Minas Gerais, CC BY 2.0, https://commons.wikimedia.org/w/index.php?curid=45118989

https://www.btlliners.com/wet-vs-dry-storage-for-mine-tailings

Chances and Outcomes

Deconstruct dam and tailings option:

- Secondary raw materials
- Removal of environmental hazard

Positives:

- Potential of valuable materials
- Avoid risks of fatal failures and longtime contamination
- No Perpetuity costs
- Clean slate for:
  - Renaturation
  - Water management facility
  - Etc.

https://www.geo.uni-bremen.de/projektarbeiten/Lucy-Schlicht/images/L121_1.JPG

Von I, Kuebi, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=2290392

Chances and Outcomes

Deconstruct dam and tailings option:

- Secondary raw materials
- Removal of environmental hazard

Negatives:

- Efford to understand the complexity
- Construction of processing facilities and operation of a new „mining site“
- Residents experience traffic and noise for years

→ €€€€

→ €

https://vm.baden-wuerttemberg.de/de/mensch-umwelt/laermschutz/laermquellen/massnahmen-gegen-strassenlaerm-in-baden-wuerttemberg

Rammelsberg mine and the Bollrich pond

Rammelsberg mine and the Bollrich pond

- 1000 years uninterrupted mining activities
  - Lead, zinc, copper, silver, gold
  - Baryt
- Froth flotation:
  - from 1935: rich ores
  - from 1953: poor ores
  - End of mining activities: 1988
- App. 7 Mio. t of tailings from the froth flotation
  - Storage: Bollrich tailing pond

Wikipedia, Gavailer; Bergwerk Rammelsberg.jpg

Chances Bollrich

Valuable materials:
- CRMs
- Usable minerals

Good potetial for sustainable subsequent use
- Renaturation
- Water management facility

Existing infrastructure
Favourable legal situation
Public sees tailing pond as potential risk

REWIMET
Recycling-Cluster wirtschaftsstrategische Metalle

Projects

REWITA
033R136A-G

GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

REMINTA
033R266A-G

CUTEC
BIG
geiger
HZDR
HELMHOLTZ ZENTRUM DRESDEN ROSSENDORF
HMG
PPM
M PURE METALS
geocycle
For a zero-waste future
pdv software 10111100
STÖBICH®
BGG
Bergbau Goslar GmbH
Hochschule Harz
Hochschule für angewandte Wissenschaften
Harz University of Applied Sciences
IBU | tec

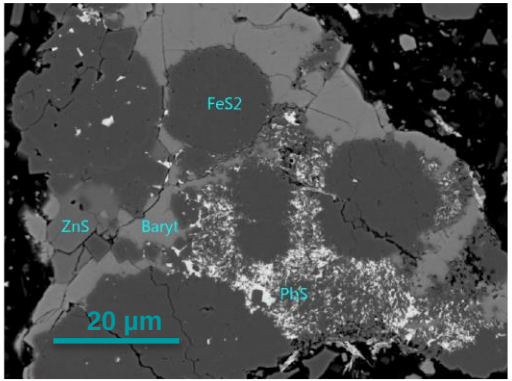
Project REWITA + REMINTA

© Siehe Folie 8

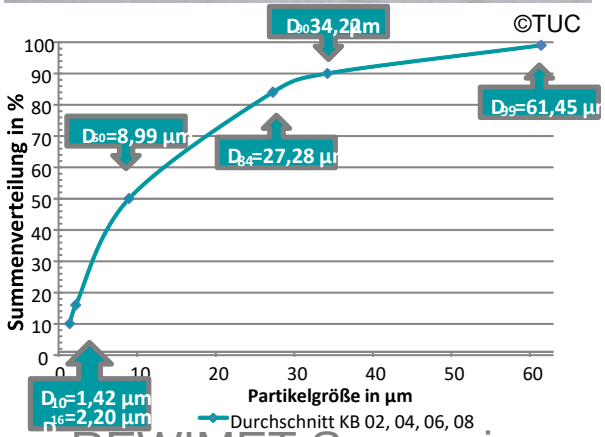
Bilder © 2023 GeoBasis-DE/BKG,GeoContent,Maxar Technologies,Kartendaten © 2023

Gold	1,5 t
Indium	44 t
Gallium	170 t
Silver	234 t
Cobalt	1.220 t
Copper	10.650 t
Lead	85.200 t
Zinc	120.700 t
Barite	1.356.000 t

* Critical Raw Materials

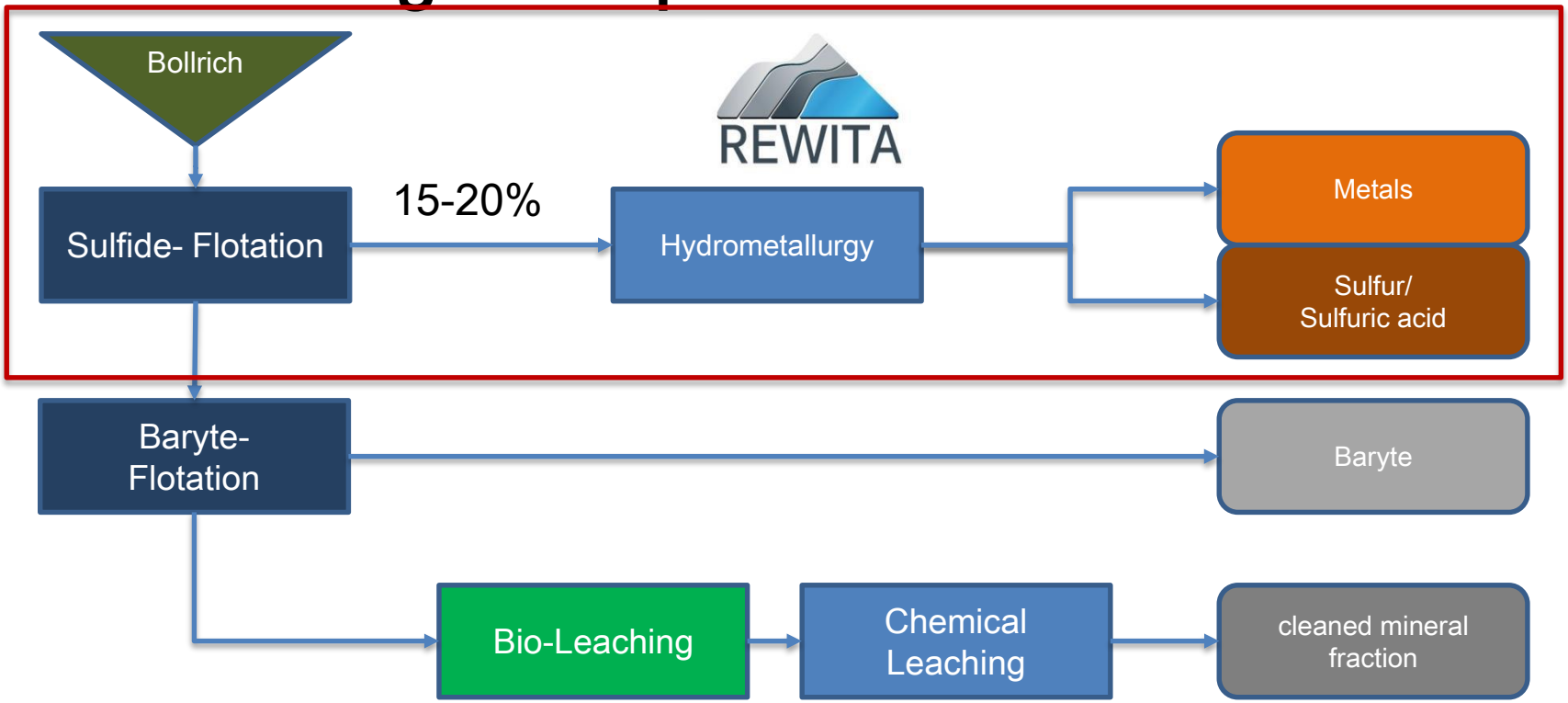


©TUC

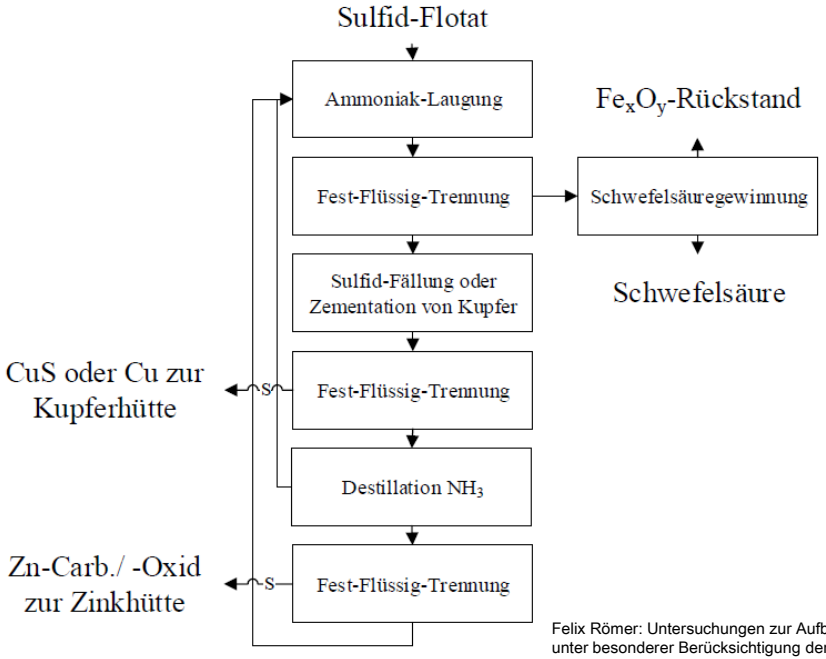


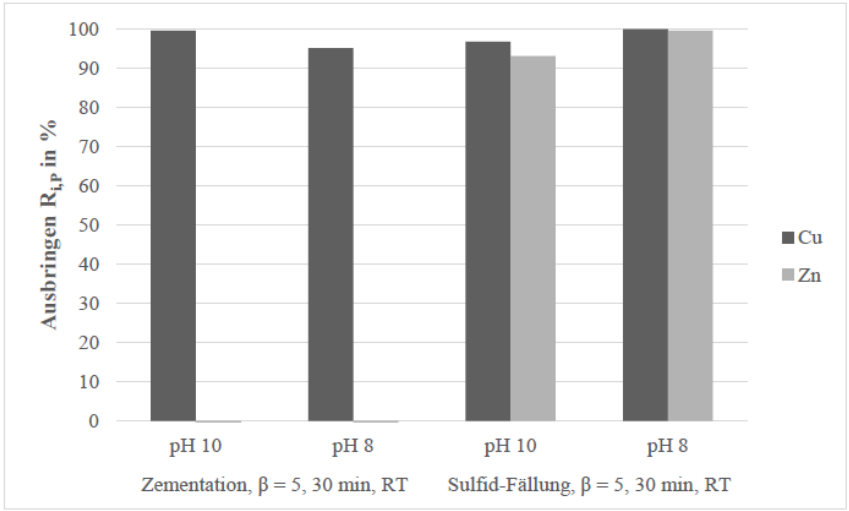
Dr.-Ing. Kai Rasenack
REWIMET /TU Clausthal

Processing concept



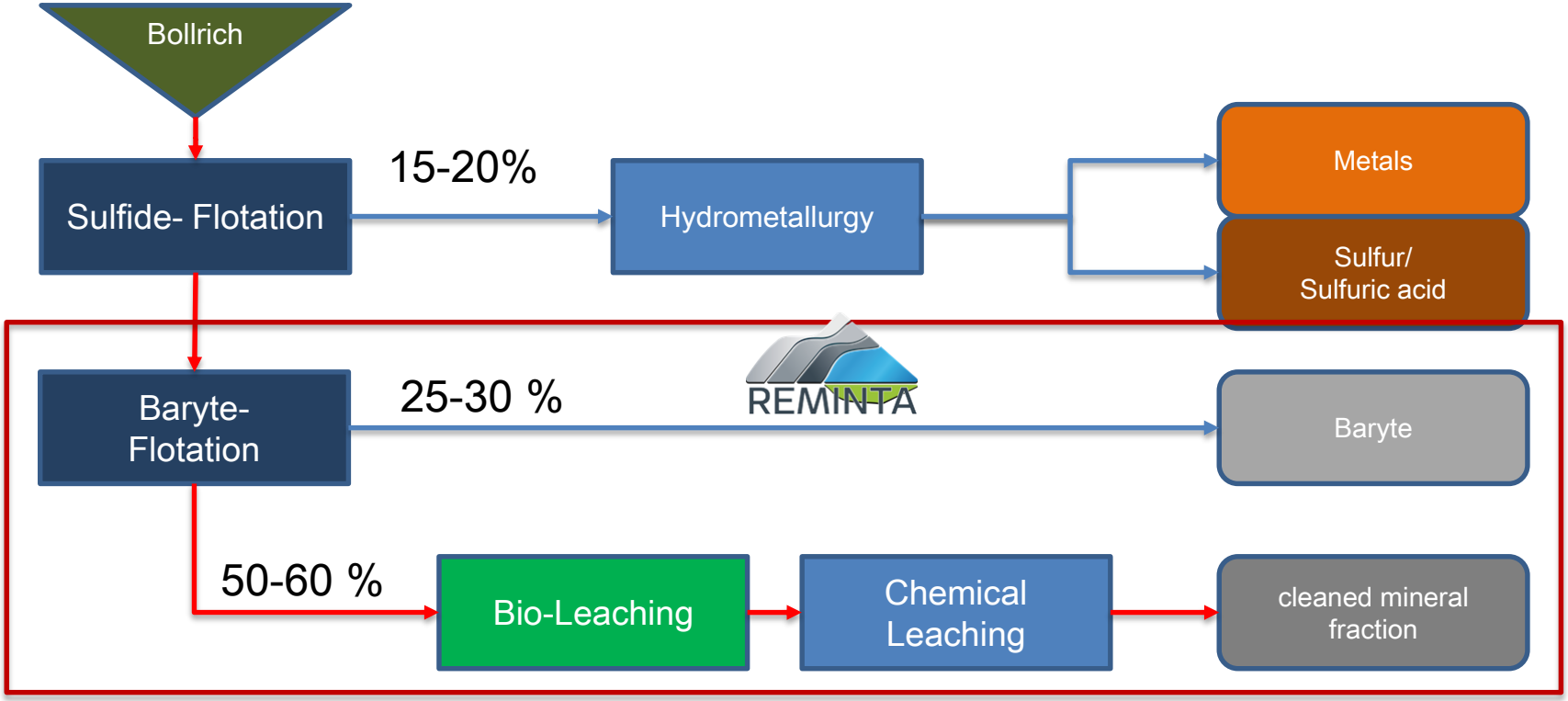
Sulfide Concentrate



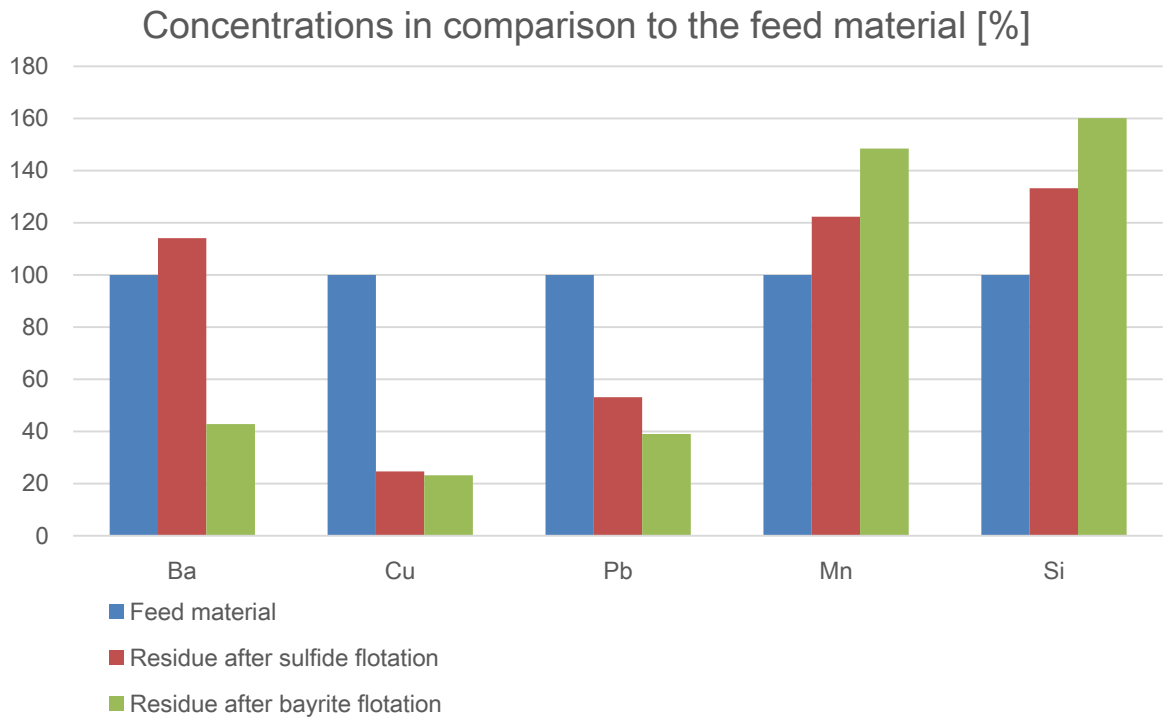


Felix Römer: Untersuchungen zur Aufbereitung abgelagerter Flotationsrückstände am Bergeteich Bollrich unter besonderer Berücksichtigung der Gewinnung wirtschaftsstrategischer Rohstoffe

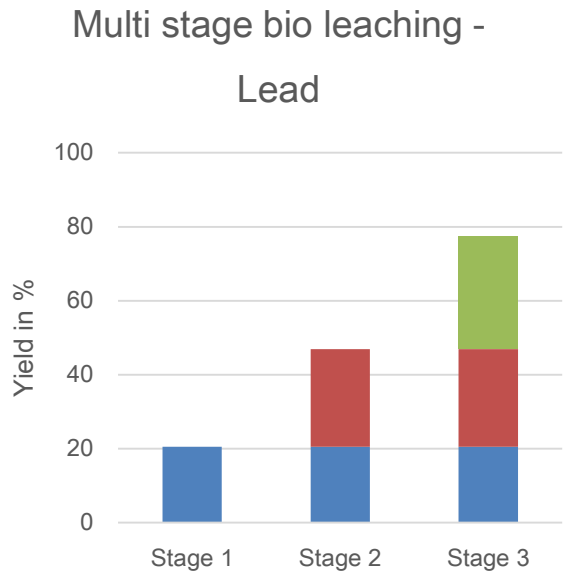
Processing concept

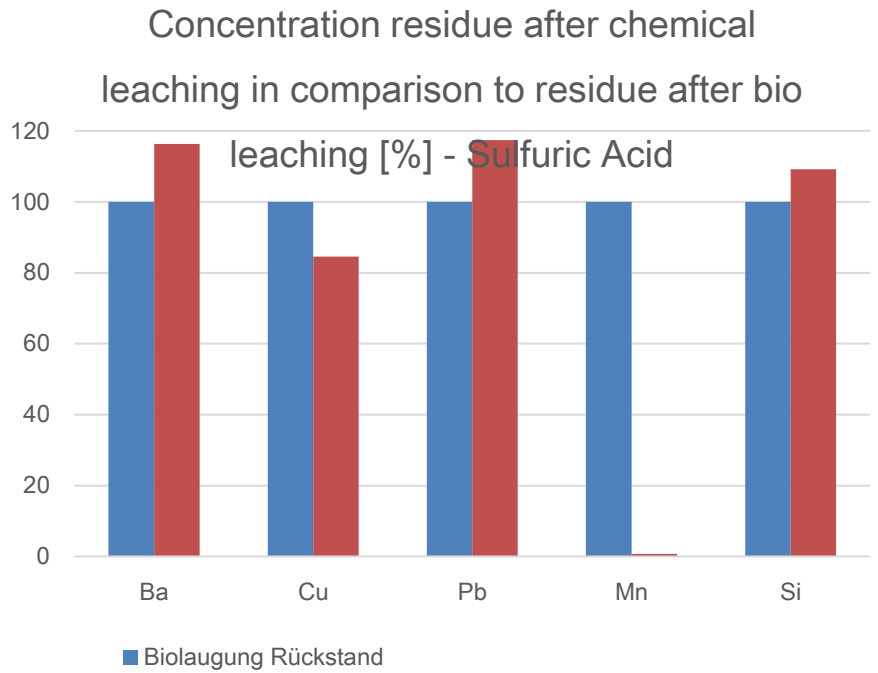


Results Processing



Results REMINTA





Outlook Bollrich - minerals

- Mineral substitute building material according to ErsatzbaustoffV
- Dam structures
  - Fillings
  - Traffic route construction
- Special building materials
  - Addition to lightweight construction materials
  - anthropogenically produced aggregates
  - Ceramics
- Geotechnical special building materials
  - Backfilling of mining cavities
  - Use in non-construction industries
- Landfill construction
- Cements

Conclusion

- Long time risks and costs throughout the lifetime of an existing tailing structure

- Afford in setting up the deconstruction
- Material needs new (valuable) purposes
  → processing and reliable sinks
- Support from the locals is needed

Rammelsberg pond:

- Good opportunity for realization
- Model for future projects

But:

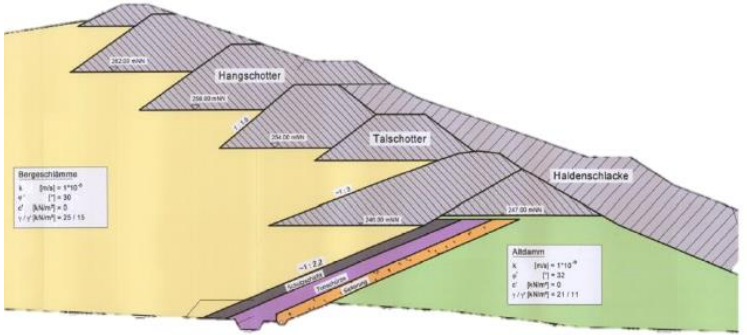
- Scale up necessary
- Industrial partners
- Funding needed

Dr.-Ing. Kai Rasenack
Tel: 05323-72-6127
kai.rasenack@tu-clausthal.de
kai.rasenack@rewimet.de

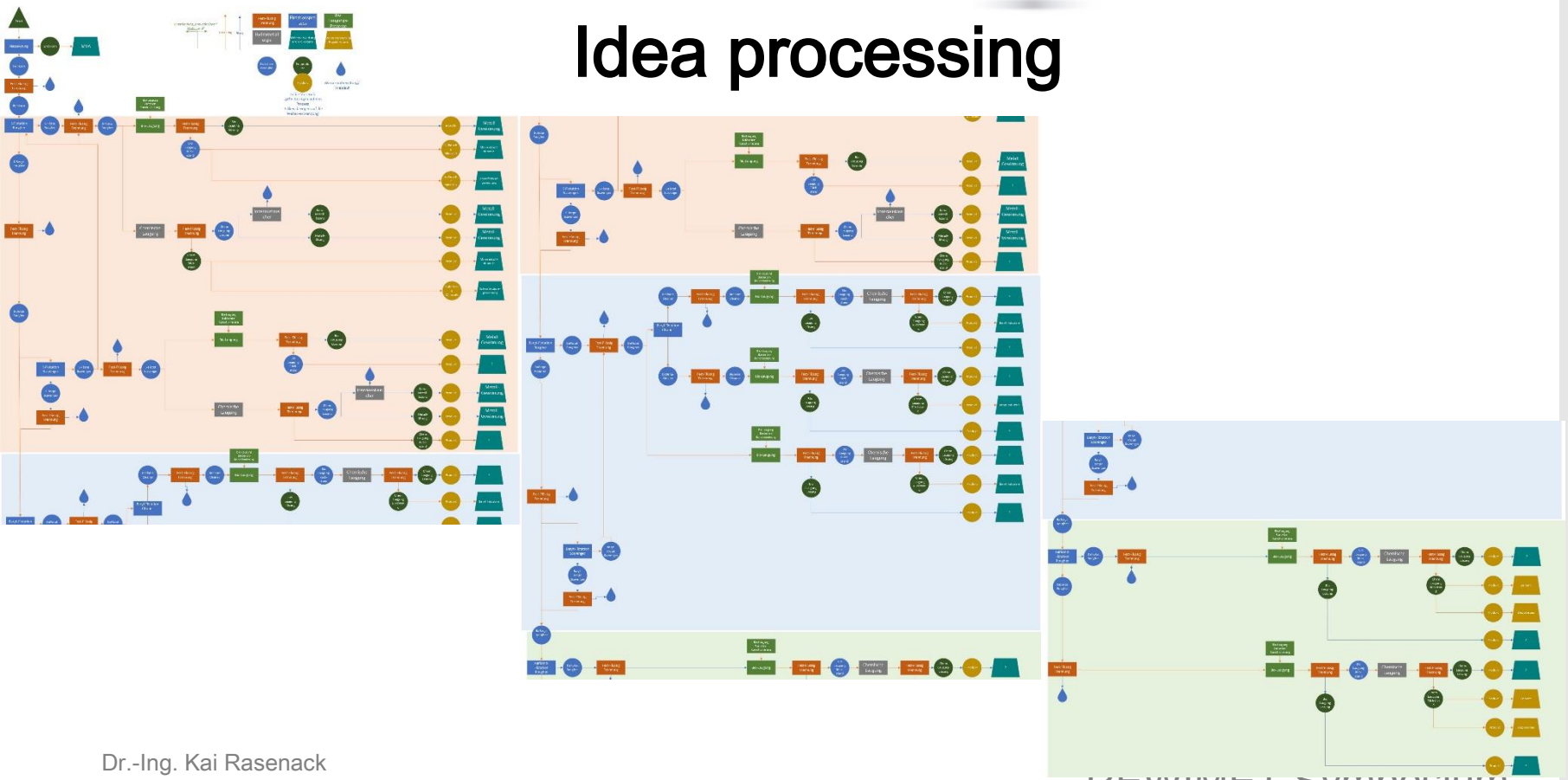
Old rail track at Bollrich-Teich

Bergeteich, Damm und Umgebung

- Tixotropes Material
- Untergrund teilweise auf Karst
- Neutralisierte Grubenwässer des Rammelsberges
- Nahe Oker



Idea processing



Social Liscence to operate