MSCA-ETN SULTAN

European Training Network for the Remediation and Reprocessing of Sulfidic Mining Waste Sites

Development of a sampling protocol for the resource assessment of sulphidic Cu-Zn-Pb tailings in an industrial tailings storage facility

Rosie Blannin (ESR3), Dr. Max Frenzel, Dr. Jens Gutzmer

Helmholtz Institute Freiberg for Resource Technology, Helmholtz Zentrum Dresden-Rossendorf | Freiberg | Start date: 02.01.2019

Objectives, milestones and deliverables

The sedimentary-style deposition of tailings within their dedicated Tailings Storage Facilities (TSF) results in a structure of sub-horizontal layers, which may be overprinted by chemical redistribution of elements. Minerals of interest are typically heterogeneously distributed throughout the TSF. A lack of understanding of how to sample tailings materials in a way that allows the characterisation of both the horizontal and vertical variability, limits the ability to build accurate and reproducible geospatial models of TSFs.

This study aims to develop a sampling protocol for the resource characterisation of TSFs. The project can be split into a series of tasks, seen in the Gantt chart in *Fig. 1.* The Milestones include:

1. Resource data set, based on sampling of TSF case studies and geochemistry, XRF, MLA results – M24
2. Combined geostatistical assessment for Davidschacht TSF and sampling protocol for TSFs – M40

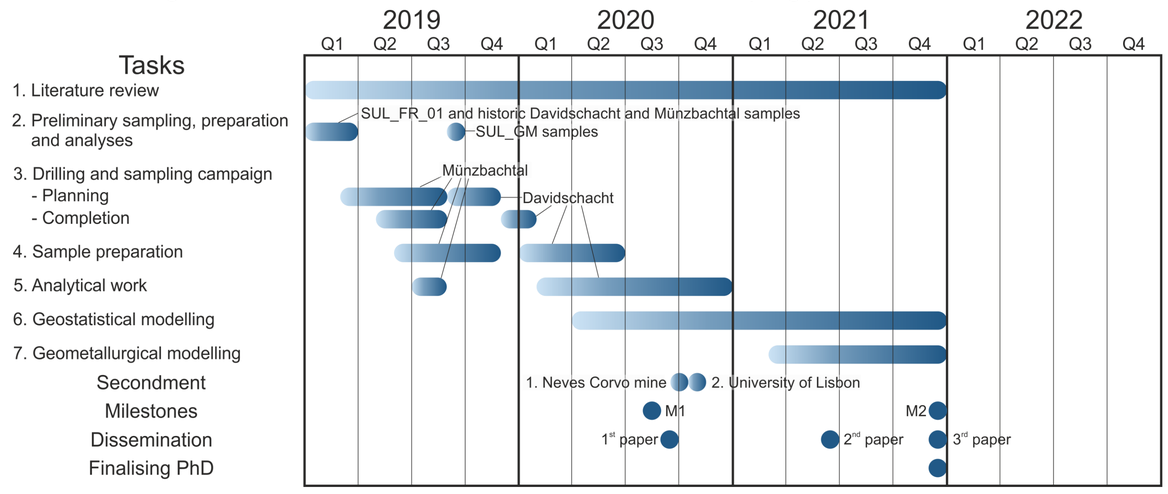


Figure 1: Gantt chart to illustrate the main tasks, objectives, milestones and deliverables of the PhD.

Case studies

Two TSFs of Cu-Zn-Pb tailings from the processing of polymetallic hydrothermal sulphide veins, located near Freiberg, Germany, are used as case studies (*Fig. 2*). The Davidschacht and Münzbachtal TSFs have a volume of 760,000 m^3 and 835,000 m^3, respectively. Both were deposited from around 1944 to 1969.

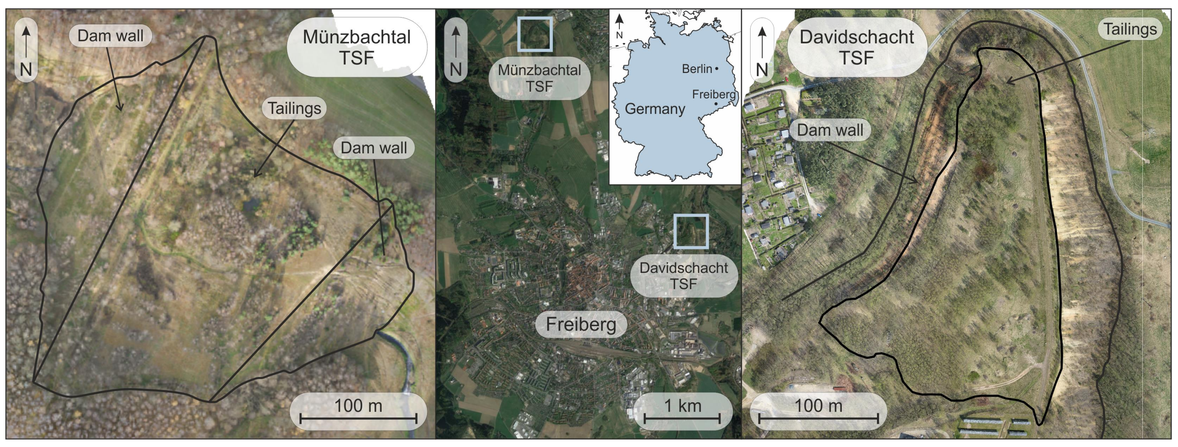
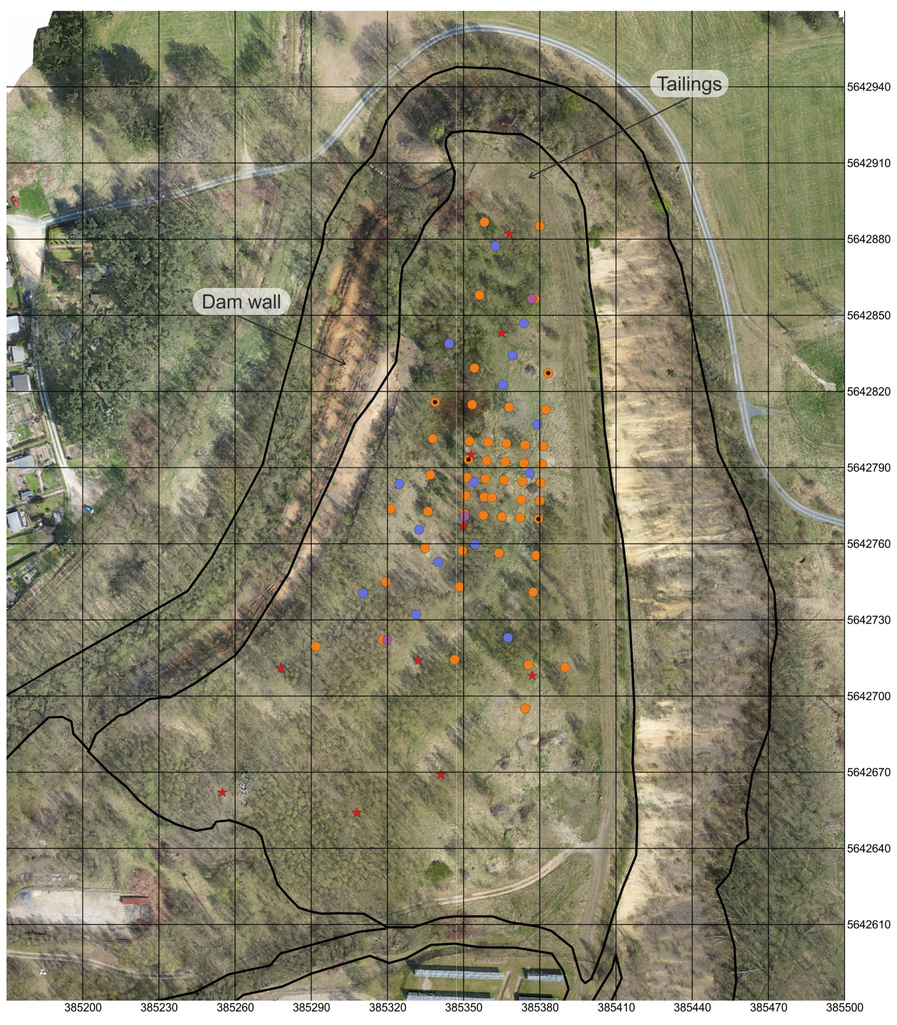


Figure 2: Maps of the Münzbachtal (left) and Davidschacht (right) TSFs, their location in relation to Freiberg and Germany (centre).

Davidschacht sampling points



- Historic drill holes
- Drill holes on grids
- Random drill holes
- 20 cm samples
- Duplicate holes

- Drilling completed from December 2019 to January 2020
- Total of 70 drill holes, as seen in *Fig. 3*
- Drill holes on a grid of ~30 m and nested grids of ~15 m and ~7.5 m in the centre of the TSF. Additional random drill hole points within the grids. Three holes were duplicated, with a twin hole at <1 m distance
- Samples taken for each 1 m interval to a depth of 3 m. For four drill holes, samples were taken for 20 cm intervals

Figure 3: Map of the Davidschacht TSF with the numbered drill hole points. Black lines outline the extent of the tailings material and the dam walls.

Davidschacht sampling and analysis plan

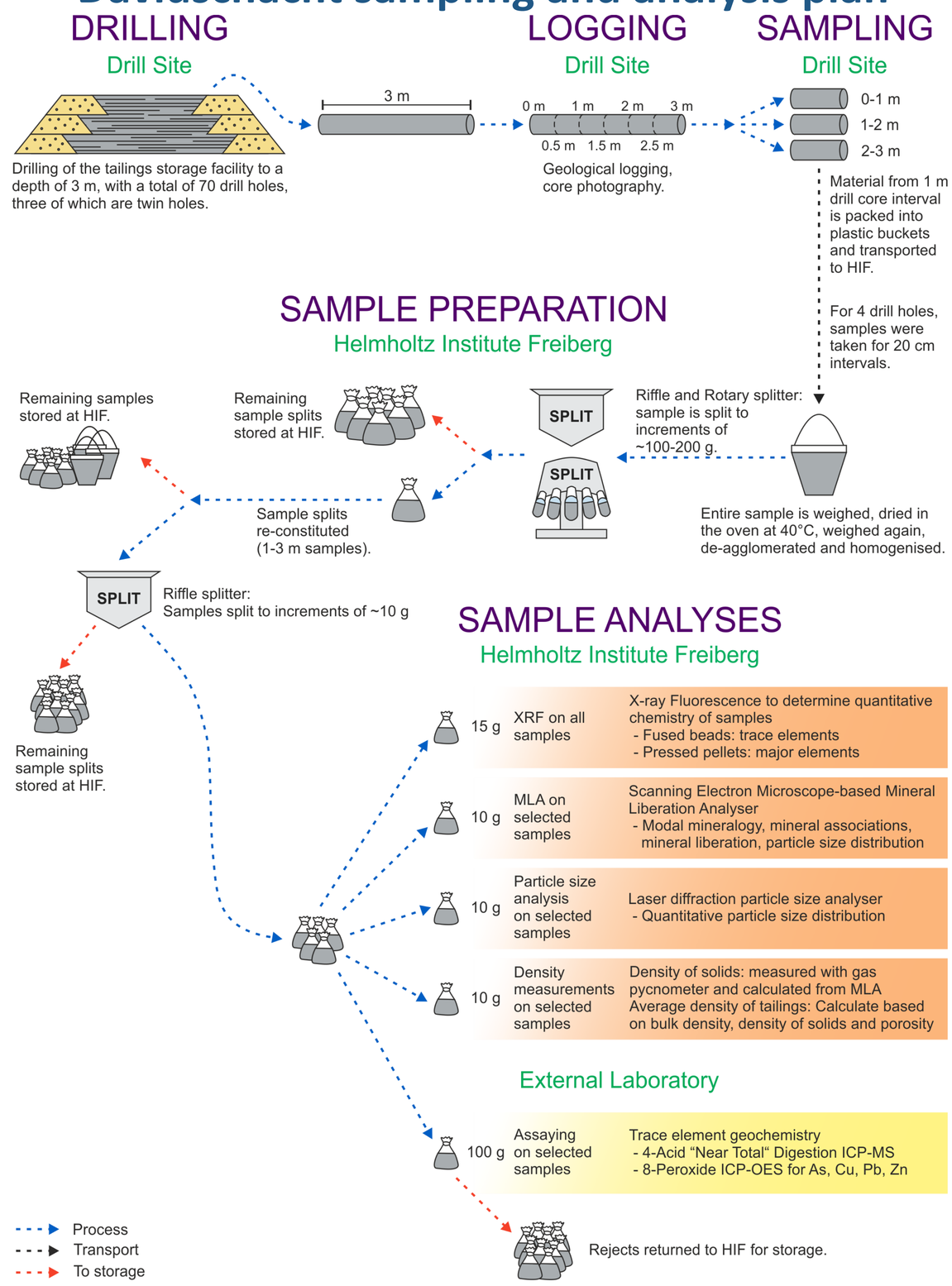


Figure 4: Schematic diagram to illustrate the sampling protocol developed during this study. Sample preparation and analyses are ongoing and a provisional plan is shown.

Davidschacht drill core photographs

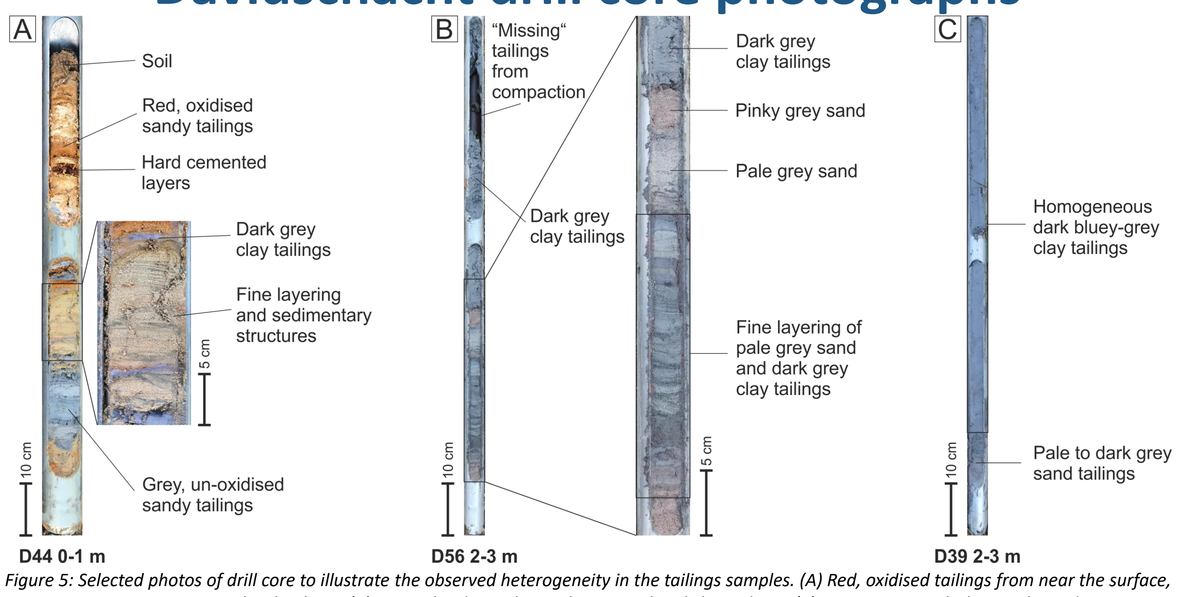


Figure 5: Selected photos of drill core to illustrate the observed heterogeneity in the tailings samples. (A) Red, oxidised tailings from near the surface, transitioning to un-oxidised tailings. (B) Un-oxidised, interlayered grey sand and clay tailings. (C) Homogeneous dark grey clay tailings.

Conclusions and upcoming steps

Conclusions

- Sampling campaign on Davidschacht tailings completed in January 2020. Preliminary sampling on the Münzbachtal tailings was completed in August 2019.

Upcoming steps

- Sample preparation and analyses of samples from Davidschacht tailings, mainly X-ray Fluorescence and Scanning Electron Microscope-based Mineral Liberation Analysis
- Geostatistical and geospatial modelling of the Davidschacht TSF

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