# Automated mineralogy particle dataset: dry magnetic separation of skarn ore

This data set origins from the AFK ("Aufbereitung feinkörniger Komplexerze", BMBF grant number 033R128) project. The main target within this project was to produce a cassiterite concentrate, which is suitable for the subsequent production of tin. Various processing steps and the material specific behaviour were investigated within the progress of the project. The present data set derives from dry magnetic separation tests, the applied processing procedure is shown in Figure 1.

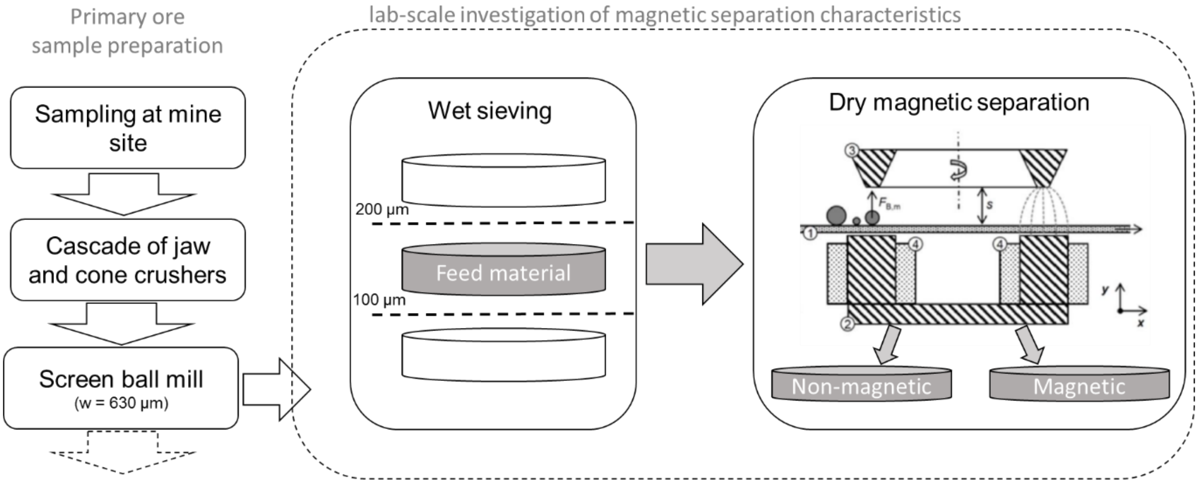


*Figure 1: Pre-processing and dry magnetic separation tests (1: conveyor belt; 2: u-shaped flat pole; 3: rotating ring; 4: wire coil) of the investigated material from the "Hämmerlein" deposit (Erzgebirge, Germany).*

The investigated samples were supplied by Saxore Bergbau GmbH and the material pre-processing was done by UVR-FIA GmbH. The lab-scale test work for the investigation of the magnetic separation characteristics was done at the Institute of Mechanical Process Engineering and Mineral Processing (MVTAT, TU Bergakademie Freiberg). The parameters of the magnetic separation tests (feed rate and magnetic field strength) were kept constant, only the feed material was changed. For each material sample of the four different sampling points in the deposit (GP-QS2, GP-4, GP-2-6b, GP-2-4), the input (feed material) and the products (magnetic and non-magnetic) of the magnetic separation tests were analyzed using scanning electron microscopy-energy dispersive X-ray spectroscopy (SEM-EDS)-based image analysis (a.k.a. Automated Mineralogy) using a Mineral Liberation Analyzer (MLA) and applying the modified approach introduced by Kern et al. (2018), Instrument settings applied to these samples can be found in Table 1. The derived particle based data sets for each material were used as inputs for the application of the particle tracking approach via machine learning by Pereira et al. (2021). Table 2 displays the mass of the magnetic separation processing products.

*Table 1: SEM and MLA operating conditions for thin sections and grain mounts; HFW = horizontal field width*

| **SEM settings** | | **MLA settings** | |
|---|---|---|---|
| Acceleration voltage (kV) | 25 | Pixel size µm | 1 |
| Probe current (nA) | 10 | Resolution (pixels) | 1000 x 1000 |
| Spot size | 5.58 | Step size (pixels) | 6 x 6 |
| HFW | 1000 | Acquisition time (ms) | 5 |
| Brightness | 96.2 | BSE trigger | 26 - 255 |
| Contrast | 18.5 | Minimum particle size (pixels) | 4 |
| BSE calibration (Au) | 244 | Minimum grain size (pixels) | 4 |

*Table 2: Mass of the magnetic separation products*

| Sample | Mass (wt.%) | |
|---|---|---|
| | Non-magnetic fraction | Magnetic fraction |
| GP-2-4 | 34.6 | 65.4 |
| GP-QS2 | 23.4 | 76.6 |
| GP-4 | 34.2 | 65.8 |
| GP-2-6b | 22.7 | 77.3 |

## References

Kern, M., Möckel, R., Krause, J., Teichmann, J.and Gutzmer, J. 2018. 'Calculating the deportment of a fine-grained and compositionally complex Sn skarn with a modified approach for automated mineralogy', *Minerals Engineering*, 116: 213-25, doi:10.1016/j.mineng.2017.06.006.

Pereira, Lucas, Frenzel, Max, Khodadadzadeh, Mahdi, Tolosana-Delgado, Raimonand Gutzmer, Jens. 2021. 'A self-adaptive particle-tracking method for minerals processing', *Journal of Cleaner Production*, 279: 123711, doi:10.1016/j.jclepro.2020.123711.