FACHSTELLE SEKUNDÄR ROHSTOFFE

UNIVERSITÄT BERN


| | |
|---|---|
| MSc | Johannes Reinhard |
| Supervisor | Prof. Ivan Mercolli |
| | Dr. Urs Eggenberger |
| Projectpartner | Avalon Rare Metals Inc., Canada |
| | selFrag AG, 3210 Kerzers |


# Liberation of REE-Minerals using High Voltage Pulsed Power Equipment

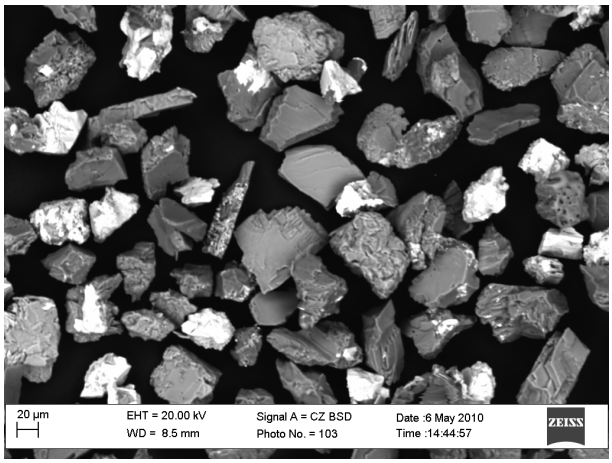
In this work the liberation of REE-minerals from the host rock by using electrodynamic fragmentation was investigated on drillcore samples from the Nechalacho REE-deposit, Thor Lake, NWT, Canada. University of Bern, Switzerland, in cooperation with selFragAG and Avalon Rare Metals Inc. initiated this study.

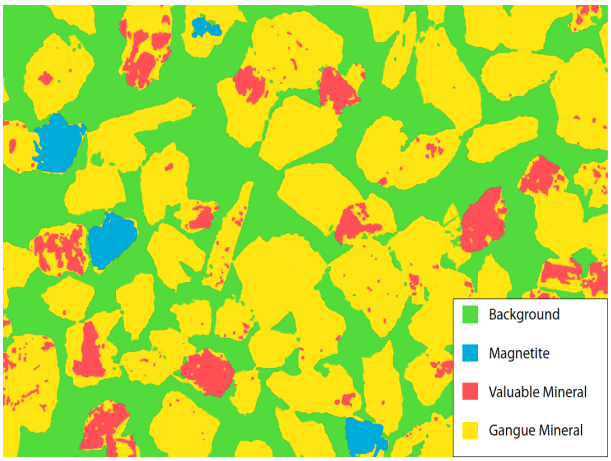
The liberation of valuable minerals is of great importance in every mining project since the efficiency of mining, in particular the recovery and the contamination of gangue material in the mineral concentrate, is mainly depending on this process. Conventional crushing and grinding processes are very energy-intensive and low selective. The here presented selective liberation process, however, promises to avoid grinding all the materialto very small particle-sizes.

Firstly the samples provided by Avalon Rare Metals were analyzed petrographically. A macroscopic description of the occurring lithologies at Thor Lake was done. Further the assemblages were analyzed in thin sections under the binocular. They are generally very fine grained and dominated by mafic minerals. It was impossible to characterize the shape and texture of the valuable minerals under the binocular due to their small size. To analyze the different ore minerals, scanning electron microscopy (SEM) was used. Two different types of zircon were identified as well as various REE-minerals (fergusonite, columbite, monazite, allanite, bastnaesite-group minerals) having a common diameter of less than 100 µm.

For the fragmentation study using electrodynamic disaggregation the drillcore samples were crushed and homogenized to a Master Composite representing the entire mineralization of the deposit. In a series of batch processes using the selFrag method with closed-system conditions as well as open-system conditions the particle-size reduction behavior was studied. The selFrag method is most efficient in the range of size reduction from 2 cm down to 500 µm. Particle-size distribution showed a maximum efficiency of the selFrag method when applying 3000 pulses per kg resulting in a $K_{80}$-value of ca. 540 µm. Selective fragmentation actually occurs, the selFrag technology evokes a chemical fractionation, some elements are depleted or enriched by factor of 2 in certain particle-size fractions.

The liberation of the valuable minerals was qualitatively described based on optical methods, in particular by SEM. Three different locking types of the valuable minerals in the gangue material were figured out. The liberation was determined semiquantitatively by using statistical area analysis. Due to the fine-grained and very complex mineralogy, a sufficient liberation for further treatment of the valuable minerals was reached only for the fraction -64/+31 µm. In coarser fractions the valuable minerals are only partly liberated and tend to stay locked in the gangue material. Following on electrodynamic fragmentation experiments a magnetic separation was done to investigate the potential for removing non-magnetic gangue material. For a sample having a $K_{80}$-value of 430 µm, the potential was estimated at about 17 ± 3 %. The non-magnetic fraction is chemically very pure and consists to more than 95 % of $SiO_2$, $Al_2O_3$ and $Na_2O$. The loss of valuable elements in this fraction is negligible.




Partical-size fraction -64/+31 um : Particles are generally edge-shaped and many of the valuable minerals are well liberated, some of them are even present as monomineralic grains.


Institut für Geologie
Fachstelle Sekundärrohstoffe
Baltzerstrasse 1+3
CH-3012 Bern

Tel. +41 031 631 87 98
rohstoff@geo.unibe.ch
www.rohstoff.unibe.ch