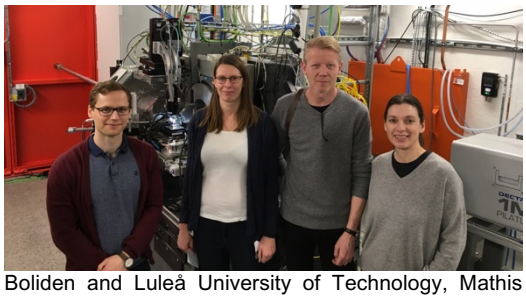
INDUSTRIAL PILOT PROJECT

Nanoscale characterization of ore samples – optimizing the recovery of metals important for the green shift

THE INDUSTRIAL CHALLENGE

Trace element characterization of complex ores is of importance for Boliden and the rest of the global mining industry as the generation of by-products are becoming more and more common practice in mining. These by-products (metals) typically occur in small concentrations and often irregularly distributed in the ore. To be able to extract these by-products, of which some are vital for the green shift, it is crucial to optimize the analytical procedures used in the planning of metal extraction from mining. Boliden therefore joined forces with ore geological expertise at Luleå University of Technology, to address potential by-product metals in the ore.



Boliden and Luleå University of Technology, Mathis Warlo, Iris McElroy, Glenn Bark and Christina Wanhainen, at the NanoMAX beamline at MAX IV.

WHY USING A LARGE SCALE FACILITY

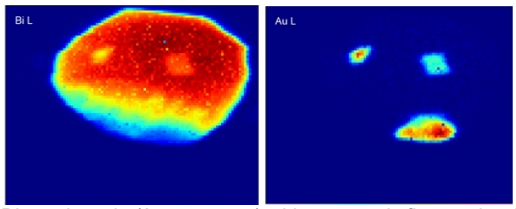
Compared with current analytical routines used by the mining industry (typically different types of electron beam techniques), synchrotron-based nano-XRF allows for a nanoscale spatial resolution of the elemental distribution in the ore samples. Going from conventional micron scale characterization to nanoscale enables frontier science within the scientific fields of ore geology and mineral processing. With the synchrotron analysis (as complementary to the routine techniques used) we aimed at finding out where in the ore sample the metals that are of interest for renewable energy are located. Finding this out, it is then possible to develop mineral processing schemes for an optimized extraction of these metals.

HOW THE WORK WAS DONE

To test the additional value that synchrotron analysis might bring to the analytical routines of the mining industry, we selected a suitable ore sample that is representative of a complex ore that Boliden will mine in the near future. To start with, we went to the synchrotron in Taiwan. There we did some preliminary measurements to test the technique. With an improved understanding of the analytical technique from Taiwan we could then go to the NanoMAX beamline (nano-XRF) at the MAX IV synchrotron in Sweden to do the final and critical measurements. At MAX IV, with the help of expert beamline scientists, detailed maps of the elemental composition of the sample were obtained, using different analytical parameters such as spot size variation (down to 50 nm). This was the first time that ore samples were analyzed at this beamline.

THE RESULTS AND EXPECTED IMPACT

Through this project, we could find out the nanoscale distribution of several metals that are important for green technologies (wind- and solar power), in the complex Boliden ore. Having this knowledge, Boliden can now plan for an improved metal extraction procedure, and recovery of the trace metals. The project team has gained valuable skills regarding synchrotron-based analysis and is now in a really good position to generate new ideas for projects that will use synchrotron-based techniques as a way of generating important scientific data.



Bismuth grain (3 µm across) with extremely fine-grained gold. The nano-XRF image pixel size is 50 nm.

"Future advances in metal extraction enabled by synchrotron nanoscale characterization."
/Iris McElroy, Boliden and Glenn Bark, Luleå University of Technology

Contacts: Iris McElroy – Boliden, Iris.McElroy@boliden.com
Glenn Bark – Luleå University of Technology, Glenn.Bark@ltu.se

Vinnova's project No: 2018-04426 **Duration:** November 2018 – April 2020

Funded by Sweden's Innovation Agency, Vinnova, in order to build competence and capacity regarding industrial utilisation of large-scale research infrastructures such as MAX IV and ESS.