

Sustainable Mining and Circular processing of Construction Minerals in Estonia

Summary

The doctoral project focuses on optimizing resource efficiency in the mining of construction minerals in Estonia, using the principles of the circular economy and sustainable mining practices. The goal is to develop innovative technologies and strategies that promote sustainable mining, recycling of construction minerals, and effective handling of mineral waste. By integrating the principles of the circular economy, the aim is to reduce environmental and social impacts, address regional shortages, and contribute to the sustainable development of Estonia's mining sector through the development of alternative mining technologies.

Research field:	Earth sciences
Supervisor:	Erik Väli
Availability:	This position is available.
Offered by:	School of Science Department of Geology
Application deadline:	Applications are accepted between June 01, 2024 00:00 and June 30, 2024 23:59 (Europe/Zurich)

Description

Over half of the mineral resources mined in Estonia are used in the construction sector. Forecasts indicate that the demand for construction raw materials will increase in the coming years, but at the same time, there is increasing pressure to reduce the environmental and social impacts of mining. Regional shortages of building materials are emerging, and various wastes are awaiting recycling. The doctoral thesis aims to find new solutions for more sustainable mining of construction minerals, optimal upcycling of primary raw materials, and reduction of waste generation, and to explore different circular economy uses of secondary mineral resources.

Within the scope of the doctoral thesis, mining sites of construction minerals and secondary raw materials will be analysed, along with their geological and mining conditions and properties. Prospective sample sites will be selected. Various selective extraction methods for carbonate rocks (e.g., surface miner, magnetic hammer) will be analysed, their efficiency and the quality of the material obtained compared to drilling and blasting operations will be studied. The expected results are to enable the use of construction mineral reserves with variable quality or other constraints, reduce material transport, and offer new solutions for reclamation of mined areas.

The PhD candidate will work closely with other team members who specialize in resource-efficient production, use of construction materials and minerals, and reduction of environmental footprint.

Responsibilities

- Develops a research methodology that includes the analysis of geological, mining, and other data (including research reports, spatial data), on the basis of which case study sites with significant positive impacts (carbon footprint, environmental disturbances, social impact, energy consumption reduction, material quality improvement, future material prospects) will be selected;
- Researches and tests various selective extraction methods for carbonate rocks (e.g., surface miner, magnetic hammer, etc.) on case study sites, determining their efficiency and quality compared to drilling and blasting;
- Conducts laboratory experiments and analyses at TalTech and other laboratories to clarify the properties of various raw materials and new materials;
- Organizes experiments to find the best opportunities for treating and upcycling materials;
- Presents results at seminars, workshops, and conferences in Estonia and abroad;
- Writes scientific publications (three articles in international peer-reviewed journals are required) with other team members;
- Participates in doctoral courses and undergraduate teaching in accordance with TalTech's doctoral program specifications.

Requirements



- MSc degree in mining, geotechnology or geosciences, practical experience in the mining sector;
- proficiency in English;
- strong and demonstrable writing and analytical skills;
- capacity to work both as an independent researcher and as part of an international team.

The successful candidate is expected to have a good understanding of the subsurface and developments in the mining sector in Estonia.

We offer:

- Friendly community and modern working environment within TalTech campus in Tallinn, capital of Estonia.
- Guidance from top experts in the mining field.
- Joining national Estonian research projects and multi-institutional teams.
- Close international cooperation and regular visits to other European research centers, participation in conferences and workshops aimed at presenting results annually and building a network of scientific contacts.
- A minimum salary rate for full-time work (1.0 FTE) is €1830 (gross), with potential increases based on performance.

TalTech Department of Geology

The Department of Geology is the centre of expertise in geology, mineral resources, and mining at TalTech. Our researchers focus on bedrock geology, paleoenvironments, mineral resources, mining engineering and circular economy. We are responsible for study programmes on Earth systems and georesources, and host various labs and the largest geological collections in Estonia.



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