

Critical raw materials: mining, resource valorization & green transition

Liisi Rohtung, Indrek Tulp, Sirli Sipp Kulli, Kalle Kirsimäe

INTRODUCTION/ CHALLENGES

Reliable and unhindered access to **rare earth elements (REE-s)** to be self-sufficient and to facilitate the green transition is a growing concern in the European Union. The challenge is how to mine it with the least ecological impact, using all the components in the mined ore.

REE-s are essential components in the production of semiconductors, LCDs and LED lamps, as well as in energy management, including the production of wind turbines and electric vehicles.

RESOURCES



Estonia holds the largest reserves of **sedimentary phosphorite** in the European Union, which is one of the critical raw materials in the European Commission list of the elements of high importance to the EU economy.



The Geological Survey of Estonia does geological mapping, surveys, preservation of and ensuring access to geological information, advising of government authorities, and informing the public about matters concerning the earth's crust.



NPM Silmet located in Estonia is one of Europe's largest rare metal and rare earth metal manufacturers, as well as the only processor outside of China with such a wide range of high-purity products. Its rare metals factory has an annual production of **700 tonnes**.

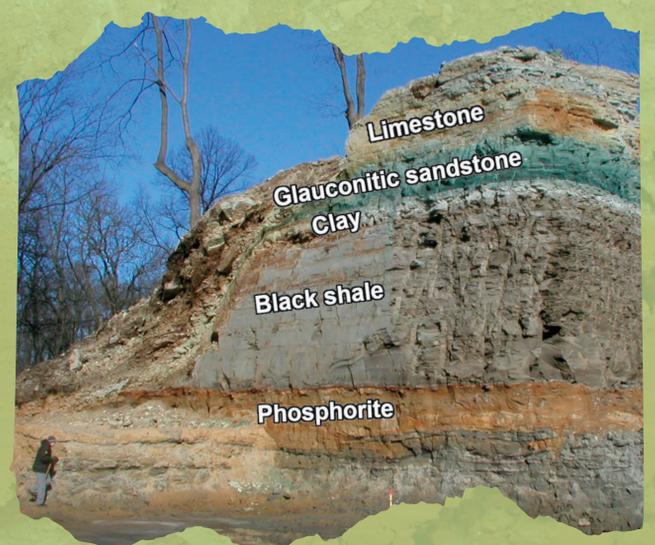
ACTIONS / SOLUTIONS

Estonian Research Council's resource valorisation program (**ResTA**, duration period **2020-2023**) supports research and development, which adds value to Estonian mineral resources industries. The aim of activities related to mineral resources is to support research focusing on the retrieval, exploration and exploitation of mineral resources containing critical elements.

In light of the phosphate raw material valorisation technologies developed in the world, the **Geological Survey of Estonia**, together with universities and Estonian Research Council, is seeking the best possible solution for phosphorite valorisation.

Research projects of ResTA focus on the following topics:

1. Quality and properties of Estonian carbophosphorite as a potential phosphorus raw material and its complex processing technologies.
2. Concentrations and distribution of rare earth metals in Estonian carbophosphorite: control mechanisms and separation possibilities.
3. Distribution and forms of vanadium in graptolite argillite and separation technologies.
4. Potentially useful components and genesis of oreization in the phenomenon of polymetallic oreization of pre-Cambrian rocks.



COOPERATION

Within the ResTA program cooperational research between two leading Estonian universities (**University of Tartu** and **Tallinn University of Technology**) is supported in order to enhance necessary knowledge and competence. The activities are curated by representatives of ministries, professional associations (including **GSE**) and relevant companies.

CONCLUSION

The Ministry of Economic Affairs and Communications and **NPM Silmet's** parent company have agreed to commence a cooperation to expand manufacturing of products from metallic rare-earth elements (REE) in Estonia. These prospective investments would substantially boost Estonian and European production capacity and supply chain reliability in the field of rare-earth metals and magnets.

In order to be able to utilise the Earth's crust prudently and to best help green transition, we need a modern level of knowledge of the mineral resources contained there, that is currently being produced by GSE and ResTA program, with the joint effort of Estonian universities. In order to make the final choice **technical feasibility studies** and **environmental impact assessments** must be carried out.

