

## Mine waste and mineral potential of REE in the West Balkan countries

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### Abstract

The main objective of this manuscript is to collect, classify, and compile all available data about secondary mineral sources of REE in the West Balkan generated from the extracting and processing sector, which might be possibly transformed in the business process becoming an important raw material for another industry. The database is the ultimate tool for raw materials inventory management having a simultaneous benefit for all actors along the value chain across Europe. The management inventory guide will strengthen communication and dissemination efforts, contribute to Europe's self-sufficiency, and support transitioning to green and digital technology. Identification of the knowledge gaps associated with secondary sources of REE in West Balkan will contribute to connections between all partners being involved at the beginning, during the lifetime of products and at the end of the life cycle, represented with deposit owners, technology developers and potential processors, producers, and potential users. There are four types of deposits in the selected study area:

The SRM can be divided into four types: waste rocks, processing (flotation tailings and red mud dams), metallurgical (smelter and ironworks slags) and coal ash landfills. Most landfills belong to waste rock with 1653 landfills at 120 sites, followed by processing waste with 77 landfills at 48 sites, coal ash with 67 landfills at 24 sites, and metallurgical waste with 39 landfills at 24 sites. The total amount of all SRM is about 3.2 billion tonnes in an area of about 100 km<sup>2</sup>. Combination of different sampling techniques (surface sampling, trenching, machine drilling, and hand drilling), a total of 63 samples have been collected: 8 from Cu flotation and 29 from Pb-Zn-Sb flotation landfills, 6 from smelter slags, 4 from red mud dam and 16 from coal ash landfills. The contents of all REE (Ce, Dy, Er, Eu, Gd, Ho, La, Lu, Nd, Pr, Sc, Sm, Tb, Tm, Y, Yb) have been determined in Canada at Bureau Veritas Commodities Canada Ltd., in Vancouver.

The valorisation potential and perspectivity of REE have been calculated using the following parameters: metal/oxide ratio, oxide prices (REE<sub>2</sub>O<sub>3</sub>), and the potential values. It was calculated that the valorisation potential and perspectivity of REE<sub>2</sub>O<sub>3</sub> ( $\Sigma$  Sc<sub>2</sub>O<sub>3</sub> Y<sub>2</sub>O<sub>3</sub>, La<sub>2</sub>O<sub>3</sub>, Ce<sub>2</sub>O<sub>3</sub>, Pr<sub>2</sub>O<sub>3</sub>, Nd<sub>2</sub>O<sub>3</sub>, Sm<sub>2</sub>O<sub>3</sub>, Eu<sub>2</sub>O<sub>3</sub>, Gd<sub>2</sub>O<sub>3</sub>, Tb<sub>2</sub>O<sub>3</sub>, Dy<sub>2</sub>O<sub>3</sub>, Ho<sub>2</sub>O<sub>3</sub>, Er<sub>2</sub>O<sub>3</sub>, Tm<sub>2</sub>O<sub>3</sub>, Yb<sub>2</sub>O<sub>3</sub>, Lu<sub>2</sub>O<sub>3</sub>) is about 233 Kt. or almost 34 billion USD. The most abundant REEs are Ce, La, Nd, Y, and Sc, followed by the group comprising other LREE (Eu, Gd, Pr, and Sm) and HREE (Dy, Er, Ho, Lu, Tb, Tm, and Y).

**Keywords:** secondary sources; Rare earth Elements; West Balkan; economic perspective

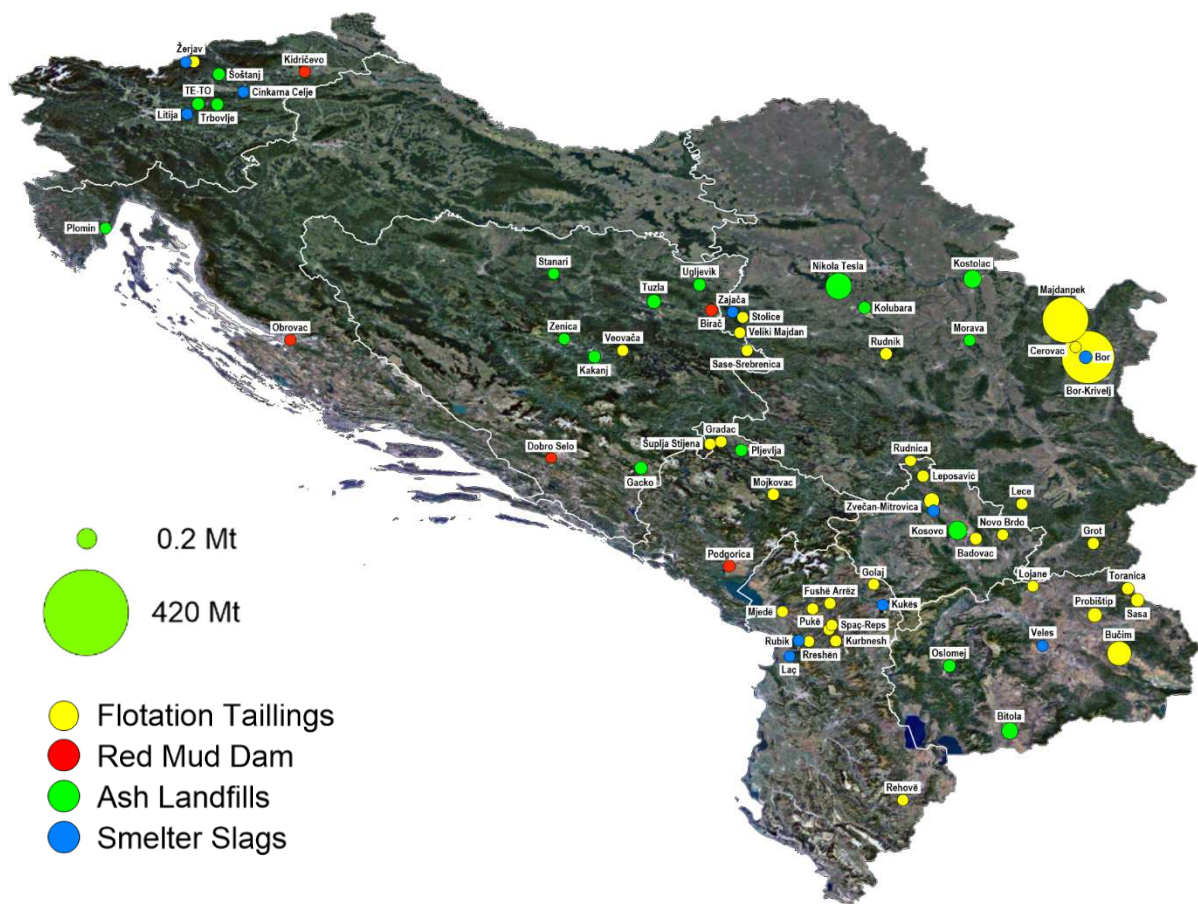


Figure 1. Perspective secondary mineral deposits across the west Balkan