



**HAL**  
open science

## Mineral Prospectivity Mapping at European scale of energy critical elements (lithium, cobalt, graphite)

Guillaume Bertrand, Martiya Sadeghi, Eric Gloaguen, Bruno Tourlière, Håvard Gautneb, Tuomo Törmänen, Daniel de Oliveira

### ► To cite this version:

Guillaume Bertrand, Martiya Sadeghi, Eric Gloaguen, Bruno Tourlière, Håvard Gautneb, et al.. Mineral Prospectivity Mapping at European scale of energy critical elements (lithium, cobalt, graphite). 2020. hal-02452789

**HAL Id: hal-02452789**

**<https://brgm.hal.science/hal-02452789v1>**

Preprint submitted on 23 Jan 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

## Mineral Prospectivity Mapping at European scale of energy critical elements (lithium, cobalt, graphite)

Guillaume Bertrand<sup>1,2</sup>, Martiya Sadeghi<sup>3</sup>, Eric Gloaguen<sup>1,2</sup>, Bruno Tourlière<sup>1</sup>, Håvard Gautneb<sup>4</sup>, Tuomo Törmänen<sup>5</sup>, Daniel de Oliveira<sup>6</sup>

<sup>1</sup> – BRGM (Geological Survey of France), Orléans, France

<sup>2</sup> – ISTO UMR7327 (Univ. of Orléans, CNRS, BRGM), Orléans, France

<sup>3</sup> – SGU (Geological Survey of Sweden), Uppsala, Sweden

<sup>4</sup> – NGU (Geological Survey of Norway), Trondheim, Norway

<sup>5</sup> – GTK (Geological Survey of Finland), Rovaniemi, Finland

<sup>6</sup> – LNEG (Geological Survey of Portugal), Alfragide, Portugal

### Abstract

Lithium, cobalt and natural graphite are essential for energy storage technologies. Lithium and cobalt are used in rechargeable batteries. Natural graphite is used as refractory for steel production, but its consumption for batteries is growing significantly. Demand for these elements is expected to surge with the increasing electrification in the transport sector. Both natural graphite and cobalt are critical raw materials (CRM) for the EU, while lithium is above the supply risk threshold. As these elements are produced outside Europe, their supply for the European industry is potentially a threat. To address this issue, the FRAME project has been designed to research CRM in Europe that are essential for “green” energy supply technologies. An objective of FRAME is to produce predictive assessments of CRM based on GIS exploration tools at continental scale, in order to identify high potential mineral provinces and mining districts. In this contribution, we present mineral prospectivity maps of Europe for primary lithium, cobalt and graphite. They are based on CBA (“Cell Based Association”) that is an alternative to GIS supported prospectivity methods, developed by BRGM to better manage uncertainties related to cartographic data (e.g., lithological contours or point locations). We present the approach, benefits for continental scale MPM and results. We have also applied a classical Weight of Evidence (WofE) method and hybrid fuzzy WofE model for mineral potential mapping that generates fuzzy predictor patterns based on (a) knowledge-based fuzzy membership values and (b) data-based conditional probabilities applied to a comparison of the results.

248 words (maximum allowed is 250 words)

Submitted to 36<sup>th</sup> International Geological Congress (<https://www.36igc.org/>) and accepted for oral presentation.