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Using cathodoluminescence as a traceability tool for lithium ores and concentrates

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Nowadays, the ubiquitous use of electronic devices and the generalization of electric powered vehicles results in an unprecedented need for batteries. Lithium, one of batteries main components, is found in brine and rock deposits. Rock deposits represent ca. 60% of the world production. The first step of the extraction of Li from these rocks is the extraction of the Li-bearer minerals through crushing, sieving, and magnetic, density and flotation separation steps to obtain a mineral concentrate. Most common Li-bearer minerals are spodumene and lepidolite.

This study is part of the EU-funded MaDiTraCe (Material and Digital Traceability for the Certification of critical raw materials) project working at setting up traceability methods for critical raw materials used in the manufacture of electric vehicle batteries (lithium, cobalt, REEs and graphite). This comes as a response to the growing demand from manufacturers and consumers to promote materials from environmentally and ethically responsible sources, and to the rapid evolution of regulatory frameworks aiming to ensure the respect of local legislations and to protect states sovereignty. One of the objectives of the MaDiTraCe project is the development of cost efficient and easy to implement analytical protocols to be applied at key steps of the value chain and that can be used routinely to monitor the origin of materials and transformed products. Optical cathodoluminescence is a relatively cheap analytical method that has shown its potential for source tracing (e.g. [1], [2]). Mineral concentrate pellets from various origins are exposed to the cathodoluminescence electron beam and data are recovered under the form of RGB images. The complete imaging of a pellet takes at most 15 minutes. Images are treated to extract each sample luminescence characteristics such as colors, intensities, and proportions of color/intensity groups. Data obtained define sample specific signatures that can be used to differentiate concentrates of different origins. Results rely mainly on the general luminescence of the sample (controlled by the main Li-bearer) and on the luminescence of accessory minerals present as traces.

[1] Augustsson & Rekker (2012) in Ore Deposits: Origin, Exploration, and Exploitation

[2] Baele et al. (2019), Journal of Sedimentary Research, 82, 559-570