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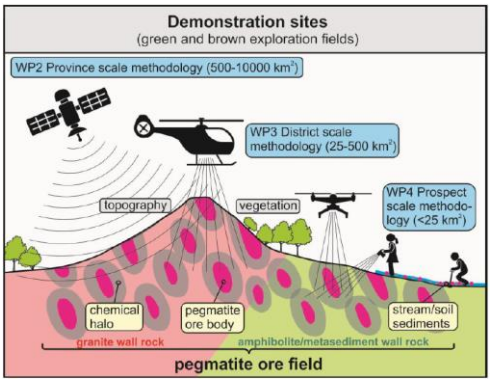
Life cycle assessment applied to exploration tools for pegmatites

Kate T Smith[1], Rob Pell[1], Xiaoyu Yan[2], Frances Wall[1]

[1] Camborne School of Mines, University of Exeter, [2] Renewable Energy, University of Exeter

The Horizon 2020 funded GREENPEG project is using life cycle assessment (LCA) to quantify impacts at the exploration and pre-mine development stages for pegmatite exploration in Europe. LCA has been applied in the raw materials sector by various industry associations who have carried out LCA to produce average impacts for their commodities, including cobalt, copper and nickel, and it is increasingly becoming an important tool for mining companies. There has however been limited research and development for LCA approaches in the exploration phase of raw material projects and exploration is commonly considered to be outside the system boundary of mining or mineral LCAs.

Many of the raw materials for green energy production, such as high purity quartz, silicon metal, lithium, rare earth elements, beryllium, tantalum, ceramic feldspar and caesium, can be sourced from a rock type known as pegmatite. The most sought-after varieties of pegmatites are relatively common in Europe.



The GREENPEG project will develop and test a set of high-level exploration technologies and algorithms to be integrated and up-scaled into flexible, ready-to-use toolsets for the identification of buried pegmatite ores at prospect, district and province scales (Fig1, Fig2). Validation of the new approach will be carried out in industry-led trials at demonstration sites in Norway, Ireland and Austria, with further studies on applications in Portugal and Spain. As well as the technical development and assessment of these technologies and algorithms, a key goal of GREENPEG is to minimise the environmental, social and the negative safety impacts of these developments.

Fig1: Exploration techniques in GREENPEG, to be assessed using LCA

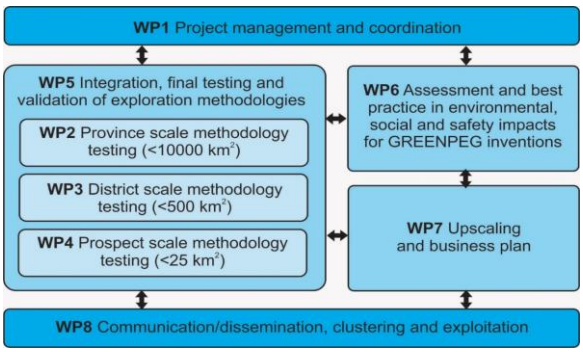


Fig2: Structure of the GREENPEG project

Fig3: Data collection, spring – summer 2021, for environmental LCA

Since Spring 2021 we have been collecting data from exploration fieldwork at the prospect (<25 km^2) scale – borehole geophysics in Austria, drone surveys and geochemical stream and soil sampling in Ireland (Fig.3). Further primary data collection in Norway for both environmental and social LCAs is planned for September, and we hope to be able collect data on helicopter-based geophysical surveys in summer 2022.

The next steps are to begin modelling this autumn. Questions we hope to tackle are:

- Can LCA at exploration stage be used to reduce impact?
- Will social LCA have relevance to social licence to explore/operate?
- Can we extrapolate from exploration stage to predict the impact of future mines?

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