

ENGLISH

Topic/Title

Geology of lithium mineralization in volcano-sedimentary systems

Proposer (Tutor)

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Research proposal

Lithium (Li) has become a strategic raw material due to its application in the manufacture of rechargeable batteries (Li-ion batteries – LiBs) used to power electric vehicles and technological devices. The need of securing a domestic Li supply has led the European Union to classify this element as a strategic commodity, and as part of the critical raw materials. Current Li production is from hard-rock (pegmatite) and brine (salar) resources, and is largely restricted to South America, Australia and China. Ongoing proliferation of LiBs is resulting in a significant growth of the Li market, with a forecasted demand of about 1 million ton of Li by 2040, which would represent an 8-fold increase from the total global Li production of 2022. Due to predicted increase in Li demand recent academic research and mineral exploration programme are focused on unconventional Li resources that form in volcano-sedimentary (VS) settings. Recent research has shown that VS Li deposits include mineralogically complex assemblages (clay minerals, borates and borosilicates) that form in ephemeral lake systems associated with felsic volcanic provinces. The proposed project has four main research objectives (ROs):

RO1) Assessment of the mineralogical residency of lithium and potential by-products (e.g., boron) in the secondary ore assemblages.

RO2) Characterization of the initial lithium endowment of and petrological footprint

of the associated volcanic rocks.

RO3) Quantification of the lithium and other key elements pathway from the igneous source rock to the volcano-sedimentary orebodies.

RO4) Assessment of the nature of ore-forming fluids responsible for the deposition of the secondary Li-bearing assemblages.

The proposed ROs will be pursued through sampling and analysis of selected ores and associated volcanic rocks, located in Italy and abroad, through mineralogical, geochemical and isotopic modelling.

The Department of Earth, Environmental, and Resources Sciences (DiSTAR) at the University of Naples, Federico II will be the main base for the potential PhD position in Earth Sciences. The PhD research project will be carried out in collaboration with the Natural History Museum of London (NHM, UK).

The project will be conducted with the support of mining companies (specific agreements will be signed). The lithium residency will be assessed in both secondary assemblages and in volcanic rocks, in order to underscore the mechanisms of elemental transfer from the protolith to the final ore repository. The PhD project will be financially supported by specific research programs that are currently at the evaluation stage (e.g. PON and PNE), and through collaboration with mining companies.

The candidate is expected to have a solid background in mineral deposit geology, and attitude for mineralogy, geochemistry and/or igneous petrology. Knowledge of isotopic modelling, programming techniques and software for statistical analysis is desirable.

Research Plan

1^o year

- Bibliographic research

- Fieldwork and sample preparation
- Preliminary geochemical and mineralogical analyses
- Courses

II° year

- Development of advanced mineralogical and paragenetic models
- Sampling of mineral separates for isotopic analyses
- Development of mass balance models
- Development of petrogenetic models for the volcanic suites
- Courses

III° year

- Ore deposit modelling
- Participation to conferences and results presentation
- Thesis preparation