Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.11309

Mineral chemistry and spectroscopy of metasedimentary host rocks of aplite-pegmatite dykes: one step closer to the detection of buried Lithium (Li) pegmatites in the Fregeneda-Almendra area

JOANA CARDOSO-FERNANDES[1,2], ENCARNACIÓN RODA-ROBLES[3], JON ERRANDONEA-MARTIN[3], IDOIA GARATE-OLAVE[3], ALEXANDRE LIMA[1,2], MARIA DOS ANJOS RIBEIRO[1,2], CÁTIA RODRIGUES DE ALMEIDA[1,2] AND ANA C. TEODORO[1,2]

[1]Department of Geosciences, Environment and Spatial Planning, Faculty of Sciences, University of Porto

[2]ICT (Institute of Earth Sciences) – Porto pole

[3]Departamento de Geología, Universidad del País Vasco (UPV/EHU)

Presenting Author: joana.fernandes@fc.up.pt

Previous work and study area

Recently, comprehensive reflectance spectroscopy studies of Li-minerals and pegmatites in the Fregeneda-Almendra area showed great potential to discriminate Li-pegmatites using hyperspectral sensors onboard drones or satellites. In the area, several dykes intruded Neoproterozoic to Cambrian psammopelites, ranging from barren pegmatites to highly evolved Li-rich pegmatites. Systematic whole-data of the pegmatites' host rocks allowed modeling the geochemical haloes and proceeding with mass-balance quantifications that pointed to an enrichment of several elements such as Li, Rb, and Cs in the host rocks.

Methods

Mineral chemistry studies were conducted in thick sections of the same samples analyzed for whole-rock geochemistry, namely microprobe analyses of major-elements at University of Oviedo and LA-ICP-MS analysis of several trace elements (including Li, Rb, and Cs) at University of the Basque Country. Reflectance spectroscopy studies (350-2500 nm) were performed in the respective rock slabs at University of Porto.

First results and future perspectives

There is a very good correlation between the sample averaged Li, Rb and Cs contents found in micas and the respective whole-rock data (Pearson r = 0.90, 0.95 and 0.95, respectively). These contents in micas show a decreasing trend with increasing distance to the dykes (Fig.1), as observed in whole-rock data. When looking at Fig.2, both Fe-rich and Al-rich micas define two compositionally convergent trends towards zinnwaldite. For the Fe-rich micas, the biotite-polylithionite ($SiLi_2R^{2+}_{-3}$) exchange vector seems responsible for Li incorporation. However, for Al-rich micas it is not clear which substitution mechanisms are in place, and further studies are needed.

Reflectance spectroscopy studies allowed identifying several minerals, namely: biotite, chlorite, white mica, tourmaline, montmorillonite, kaolinite, and carbonates. Compositional changes were identified in white micas and chlorites near the contact with dykes that will be confronted with the mineral chemistry results. Lastly, machine learning algorithms will be used to assess the possibility of using the spectral proprieties of the host rocks to remotely detect the geochemical halos and, consequently, buried Li-pegmatites.

Acknowledgments

This study is funded by European Commission's Horizon 2020 innovation program under grant agreement No 869274 (GREENPEG project). FCT also contributed through the projects UIDB/04683/2020 and UIDP/04683/2020 —ICT.

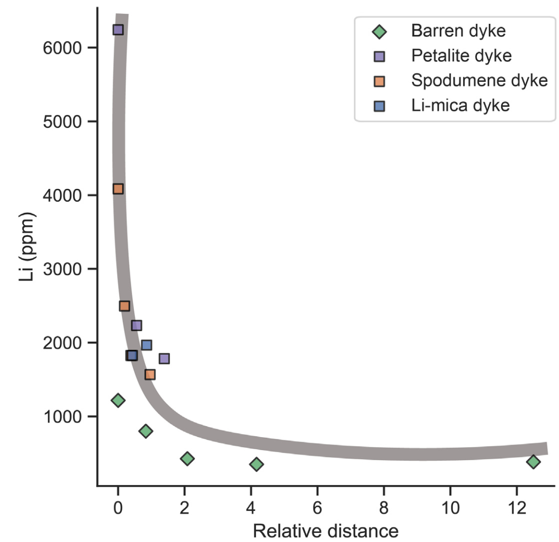

Fig.1. Relative distance (distance to the dyke/thickness of the dyke) vs. measured Li content on micas of the metasedimentary host rocks (averaged by sample).

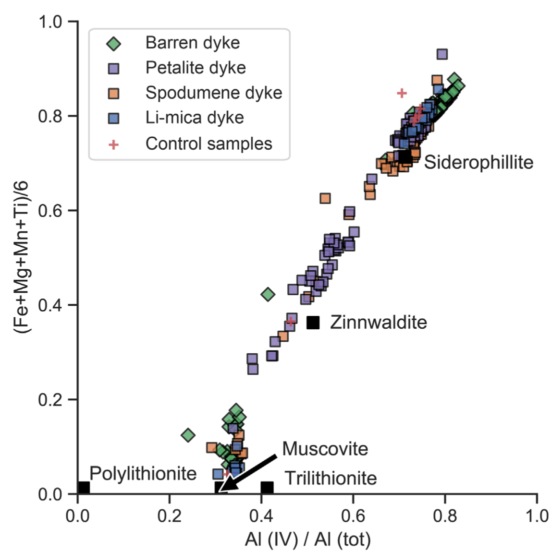

Fig.2. Variation of (Fe+Mg+Mn+Ti)/6 vs. AlIV/Altot for the analyzed micas (all data in a.p.f.u.) showing compositional convergent trends towards zinnwaldite.