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XRF scanning and element correlation in lithium-rich pegmatites and host rocks of the SN-1 core from Las Navas (Cáceres, Spain)

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The Las Navas-Cañaveral area (NW Cáceres, Spain) is a strategic region for the European Union because of its LCT-type granite pegmatites hosting a Li-rich mineral paragenesis: spodumene, amblygonite-montebrasite, lepidolite, cassiterite and columbite-tantalite [1]. Originally investigated in the 1990s [2] for their Sn and W content, these pegmatites are currently under re-evaluation by Spanish companies Lithium Iberia and CRS Ingeniería, in partnership with IGME-CSIC. (PIEMAX-GEO4TREE and HELiCE projects).

The SN-1 drill core [2] housed in the IGME-CSIC Core-repository (Córdoba, Spain), intersects Neoproterozoic metasediments of the Schist-Greywacke Complex (slates, phyllites and greywackes) and Li-rich aplopegmatitic dikes. In situ portable XRF analyses, coupled with the BoxScan multisensor core-scanning platform, were conducted in 2025 on the 352 m-deep SN-1 core (1 analysis/2-10 cm). The objective was to identify geochemical anomalies associated with Li through continuous core scanning.

The petrographic study of the SN-1 pegmatite samples reveals three distinct pegmatite facies, which differ in texture and mineralogy, ranging from types dominated by Li phosphates, Li silicates, or both. The metasedimentary host rocks show evidence of thermal metamorphism and metasomatism, revealed by a locally mottled texture of biotite ± andalusite ± cordierite, and by an important increase of newly formed quartz, tourmaline, and mica close to the pegmatites.

XRFp scanning reveals pronounced enrichments of selected incompatible elements (Rb, Sn, Nb, W, and more interestingly, Hg), which correlate positively with Li and Cs [2] contents in pegmatites and metasomatized host rocks. These patterns suggest that the critical elements in the pegmatite system were distinctly partitioned among the main and accessory phases of the different pegmatitic facies (e.g., Sn-W in cassiterite-wolframite; Li in spodumene, amblygonite-montebrasite, lepidolite), probably related to the volatiles and critical element availability and variations in the Al-Si activities during the evolution through magmatic and hydrothermal stages of the pegmatite system. The intriguing correlation of Hg with Li-Rb, poorly documented in lithium-rich pegmatites, could provide a clear indication of Li-enriched pegmatites in exploration campaigns using XRFp.

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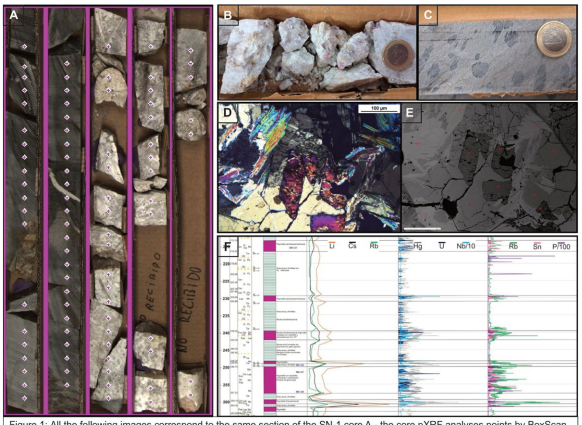


Figure 1: All the following images correspond to the same section of the SN-1 core A.- the core pXRF analyses points by BoxScan. B.- Pegmatites. C.- Host rock. D.- Pegmatite image by transmitted light microscopy. E.- Same "D" Image by electron microscopy (EPMA). F.- Stratigraphic column with Li, Cs, Rb whole-rock laboratory analyses and Hg, U, Nb, Rb, Sn and P pXRF analyses.