

# Preliminary catalogue of valuable by-product elements



ERA-MIN2

RESEARCH & INNOVATION PROGRAMME ON RAW MATERIALS  
TO FOSTER CIRCULAR ECONOMY

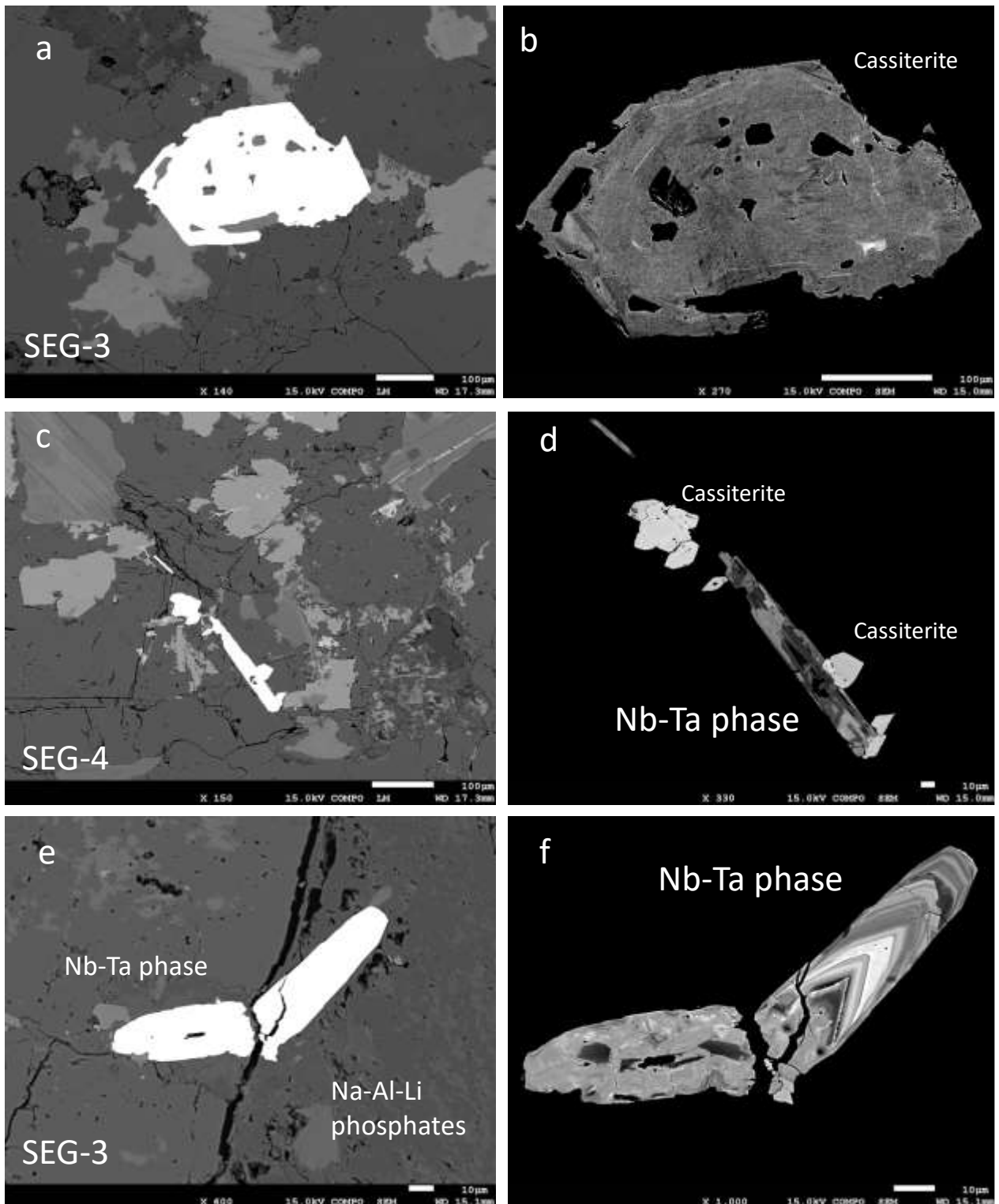
ERA-MIN Joint Call 2019 (EU Horizon 2020 ERA-NET Co-fund  
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**FCT**  
Fundação para a Ciência e a Tecnologia  
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR

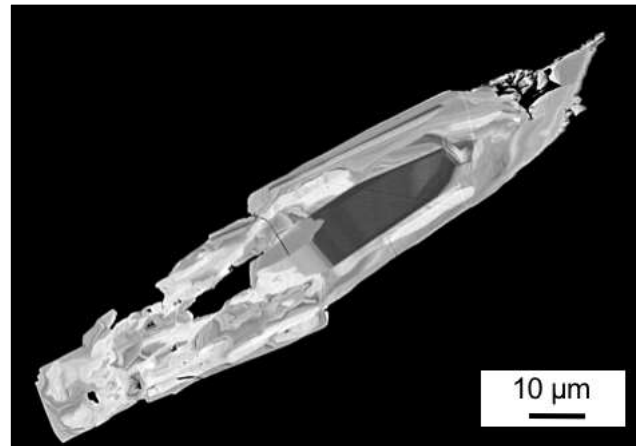
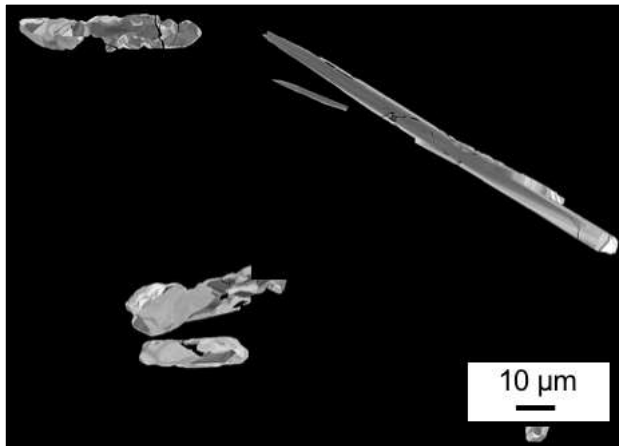
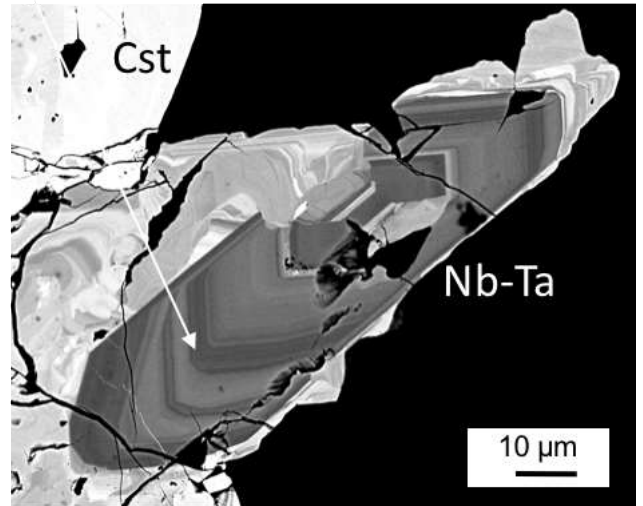
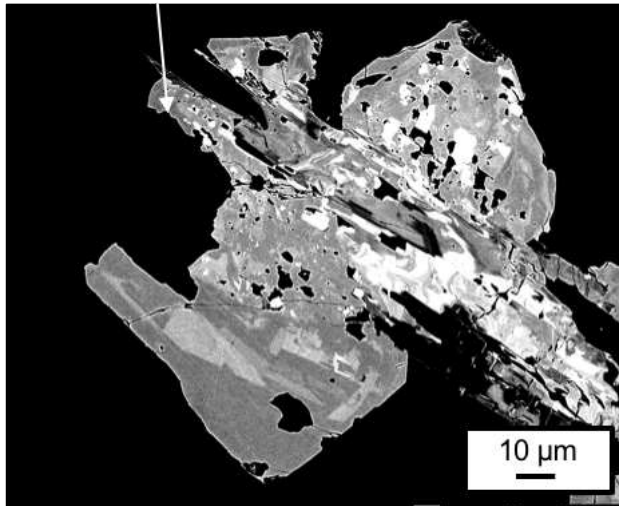
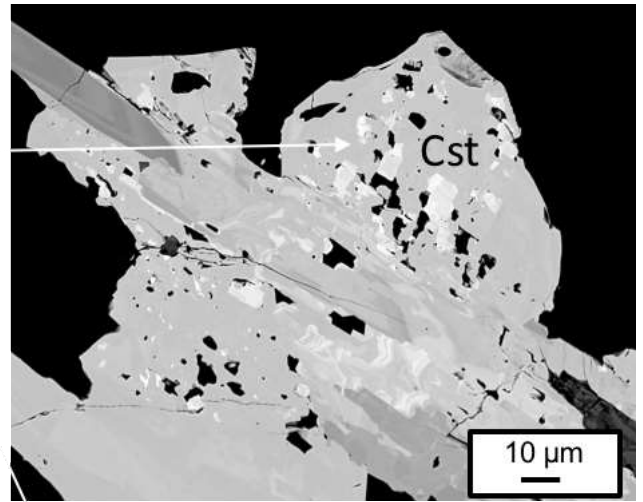
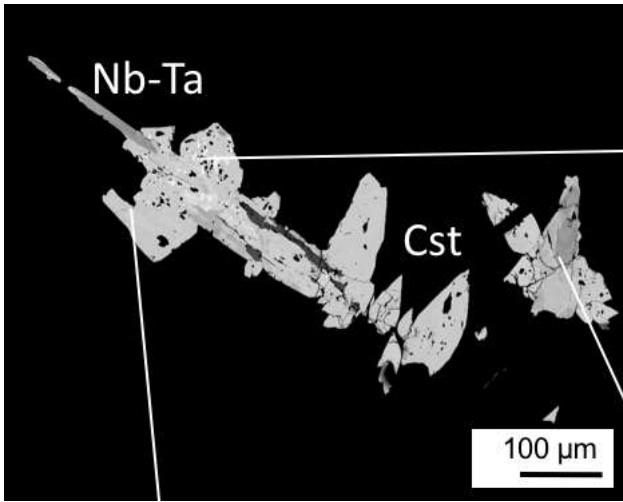
AGENCE NATIONALE DE LA RECHERCHE  
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The exposure conditions in many old Sn-W mining sites (*e.g.* Pedra Alta, Mata da Rainha, Segura) and abandoned exploration works (*e.g.* Monsanto, Mata da Rainha, Medelim) greatly limited the performed sampling, hindering the intended detailed characterisation of mineral infillings of several aplite-pegmatite swarms and quartz lodes. Despite these difficulties, new results were obtained for the aplite-pegmatite bodies of Segura, mostly those forming the Cerro Queimado array, complementing the information available for this system. Additional information could be obtained in:

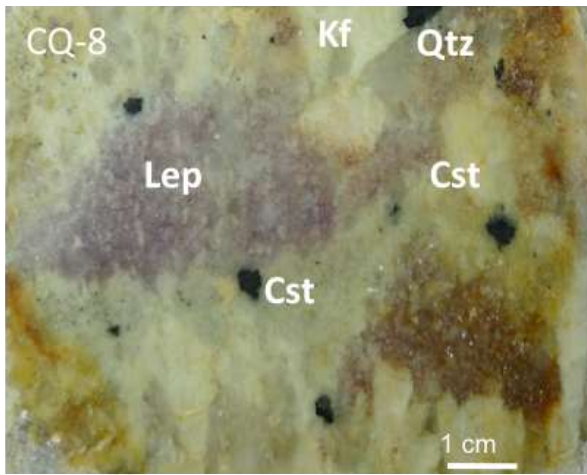
Cathelineau M.; Boiron M.-C.; Lecomte, A.; Martins, I., Dias da Silva, Í.; Mateus, A. (2024) Lithium-, Phosphorus-, and fluorine-rich intrusions and the phosphate sequence at Segura (Portugal): a comparison with other hyper-differentiated magmas. *Minerals* 14(3), 287. <https://doi.org/10.3390/min14030287>



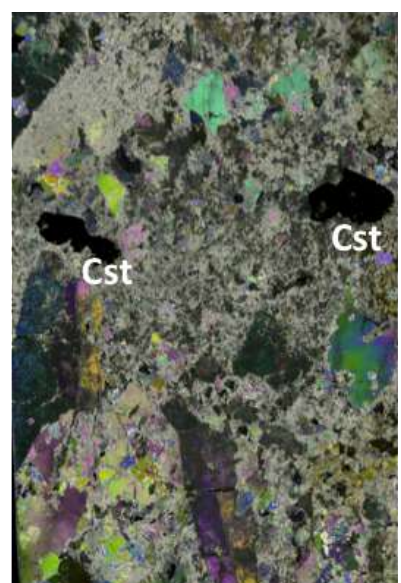
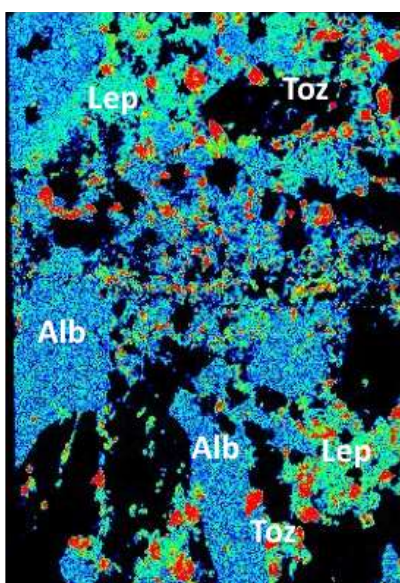
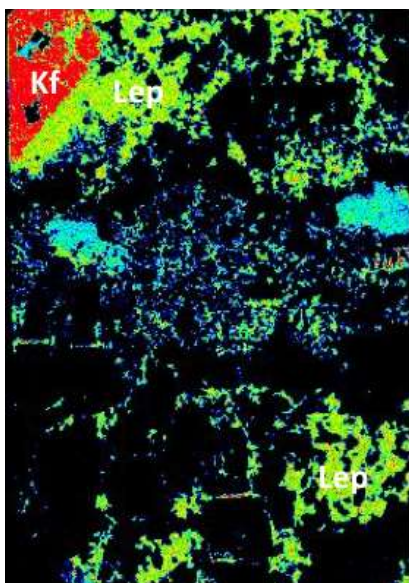
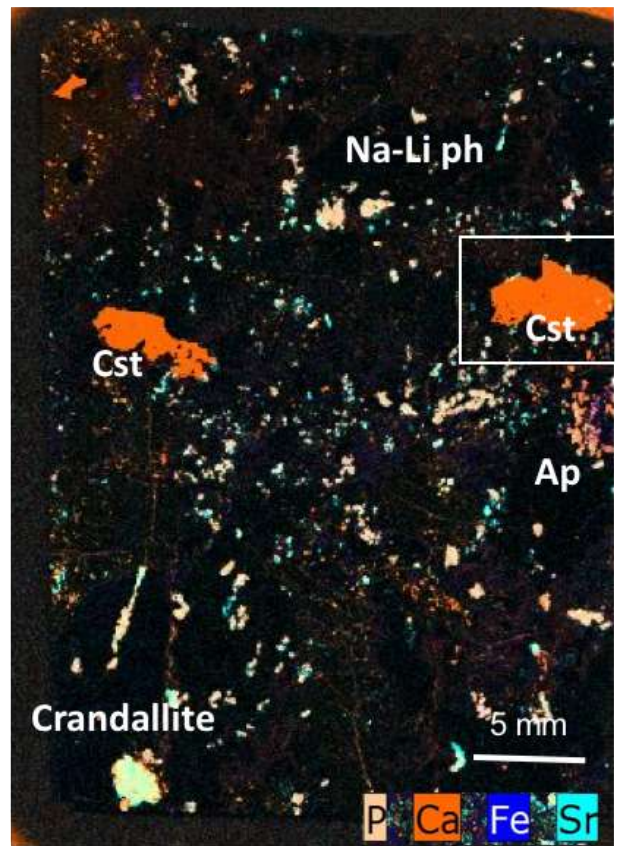
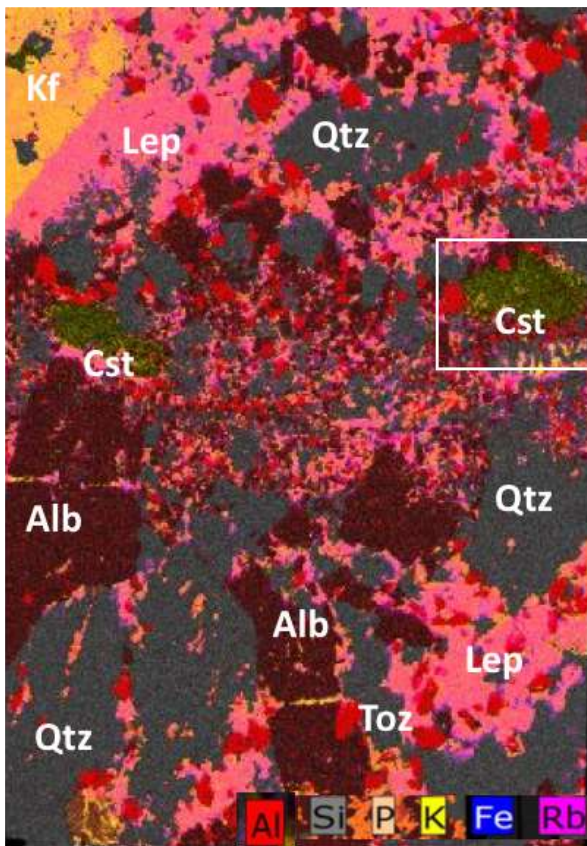
Sn and Nb-Ta phases in Segura aplite and pegmatites. SEG3 **a, b**: cassiterite grain; euhedral with inclusions, b reveals the growth bands which are not discriminated by significant substitutions, SEG 4 **c,d**: Nb-Ta phase with euhedral cassiterite crystallised its surface, indicating that cassiterite saturates later than Nb-Ta phase in the magma; SEG 3 **e, f**: Nb-Ta phase crystallised first together with a-quartz and feldspars, showing a zoned overgrowth crystallised in a cavity now filled with Na-Al-Li phosphates (assemblage lacroixite-montebrasite).

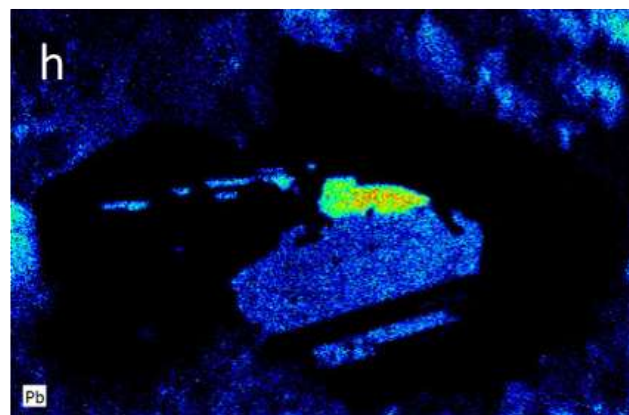
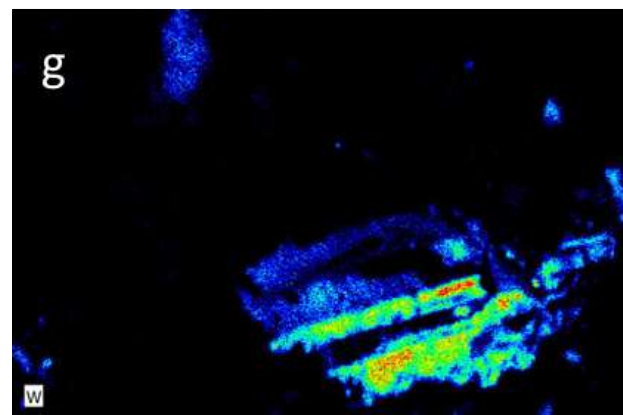
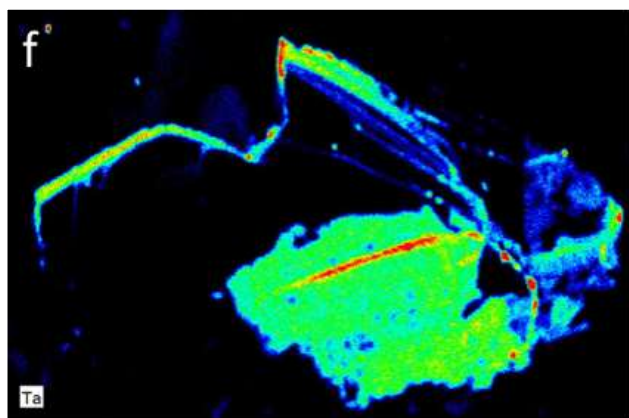
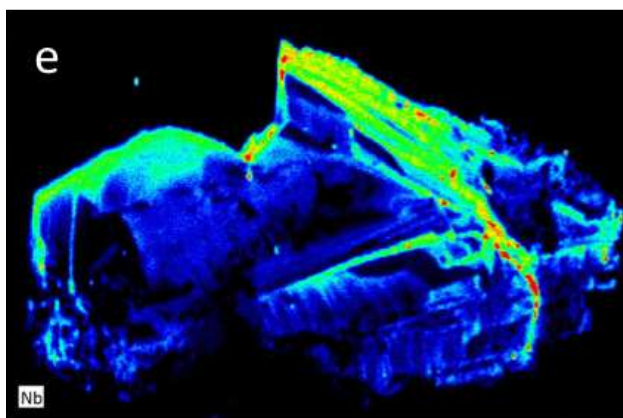
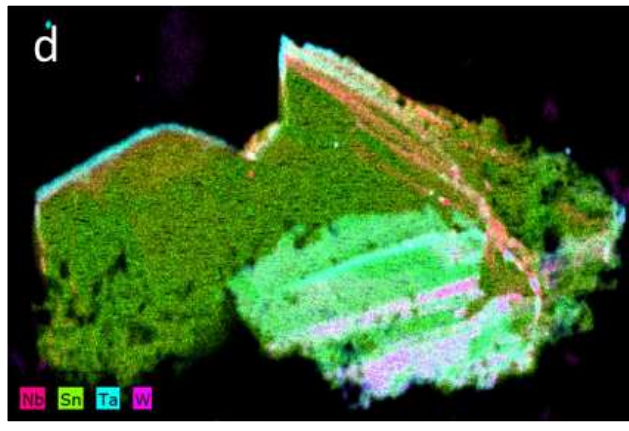
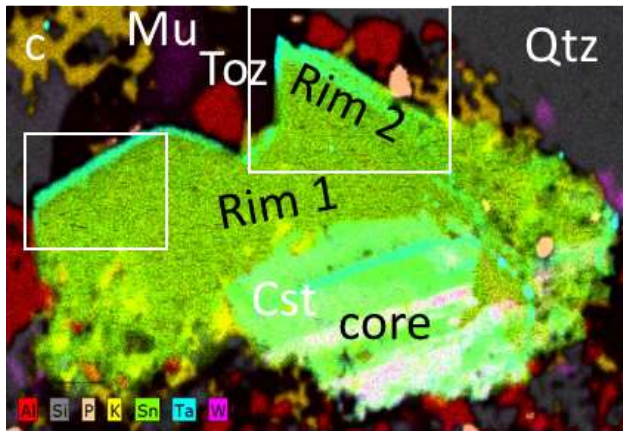
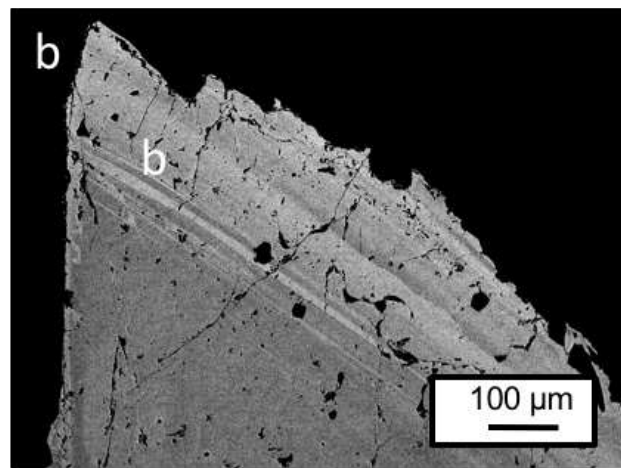
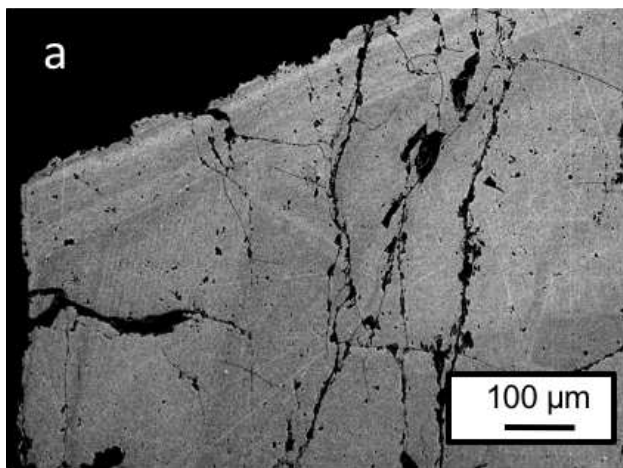


Sn and Nb-Ta phases in Segura aplite and pegmatites. SEG-4-(5) (sept21) **a**: euhedral cassiterite grains crystallised onto Nb-Ta acicular crystals; **b**: detail of the cassiterite; **c**: detail of the Nb-Ta phase; **d**: relationships between the two minerals; **e**, **f**: other euhedral acicular Nb-Ta phases.

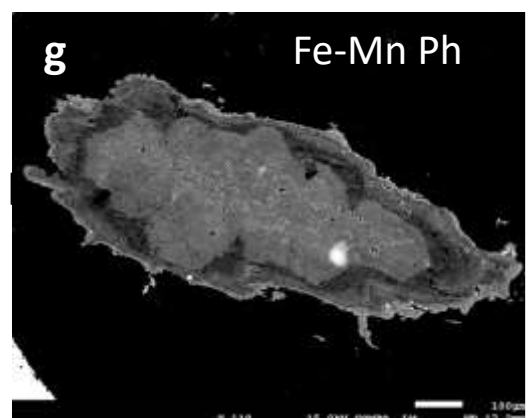
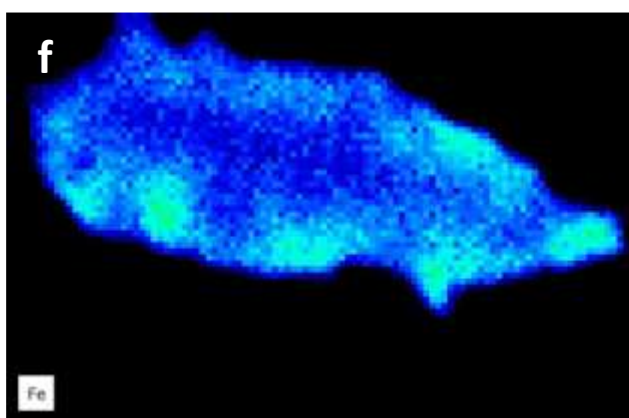
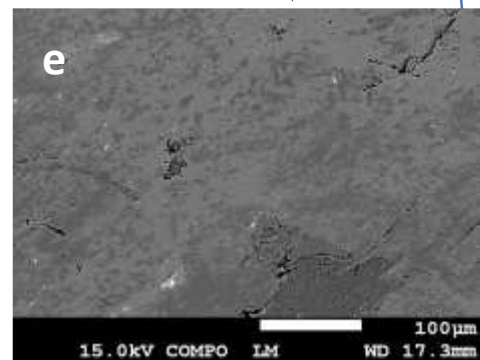
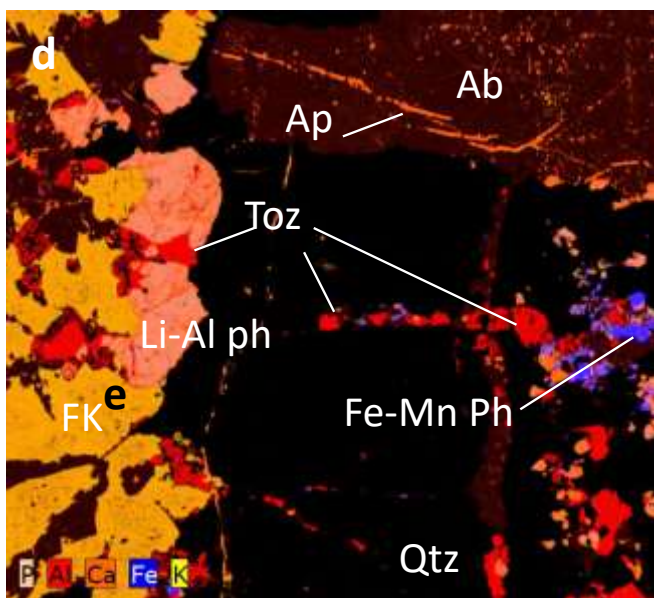
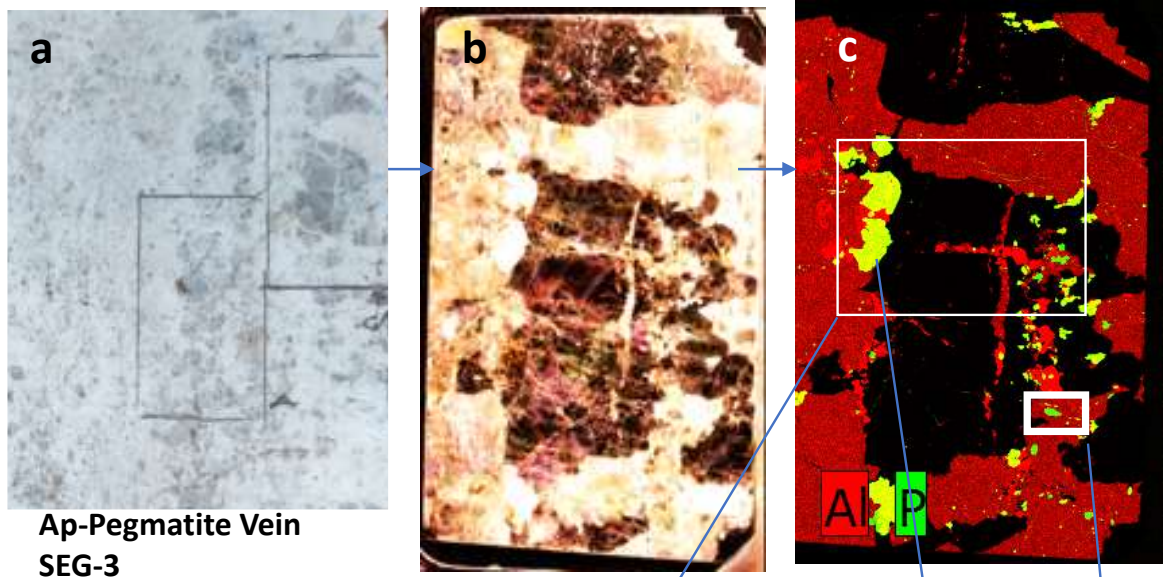


Cassiterite in the Segura aplite sampled in September 2021 (CQ8) euhedral cassiterite grains crystallised in the lepidolite-rich facies and micro-XRF maps of the corresponding thin section showing the abundance of lepidolite and topaz around the cassiterite grains. Phosphates such as apatite, amblygonite and crandallite are also dispersed in the rock.





Cassiterite in the Segura aplite sample CQ8 (cassiterite at the right-hand side from Fig. 3). Details of euhedral cassiterite grains (BSE images) showing the external growth bands. The location of the two images, a and b, are indicated in squares from c. c: composite chemical map showing the core and two rims of the cassiterite, d: same image with Nb-Ta, Sn, W, and e,f,g,h, are the individual chemical maps (Nb, Ta, W, Pb) with scales of signal intensity.



Distribution of major mineral phases in microXRF maps (example of sample SEG 3). **(a)** Macro-photograph of the aplite and pegmatite layers. **(b)** Thin section; **(c)** microXRF map showing most phases: in black: quartz, in red: feldspars (undifferentiated). **(d)** Detail showing the relationships with Li phosphates and topaz (in red), growing onto K-feldspar towards the cavity later filled by quartz. Fe-Mn phosphates are dispersed (blue phases) in quartz. **(e)** Detail of the lacroixite (light grey)-montebrasite (grey) relationships. **(f)** and **(g)** Map of the Fe-Mn phosphate grain from map c), showing a series of overgrowths onto the euhedral crystals. Ap: apatite, Ab: albite, Li-Al ph: LiAl phosphates, Fe-Mn Ph, Fe-Mn phosphates, FK: K-feldspar, Toz: topaz, Qtz: quartz.