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RESEARCH & INNOVATION PROGRAMME ON RAW MATERIALS
TO FOSTER CIRCULAR ECONOMY

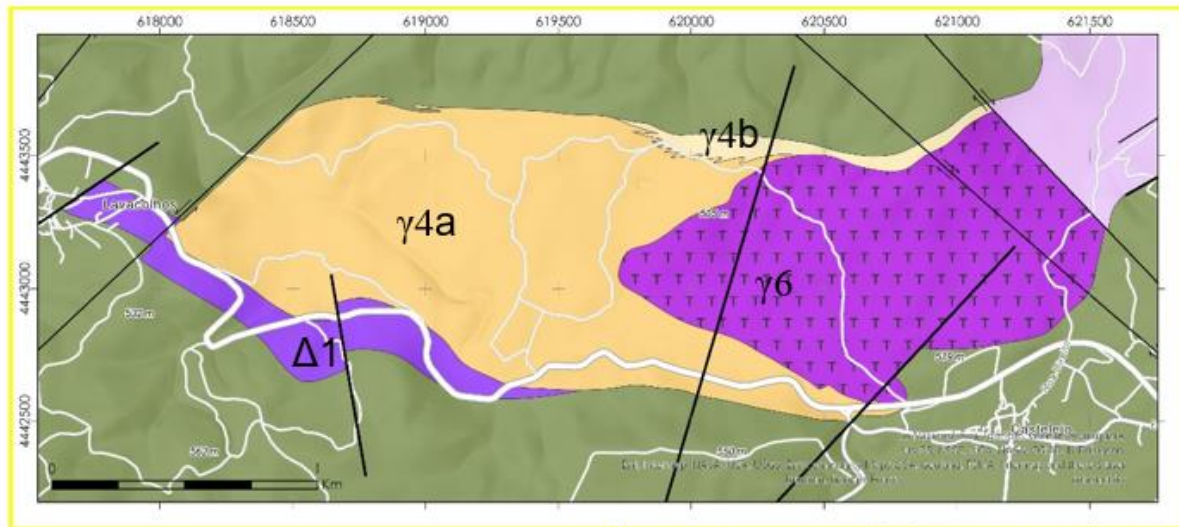
ERA-MIN Joint Call 2019 (EU Horizon 2020 ERA-NET Co-
fund Project ERA-MIN2, Grant agreement N° 730238)



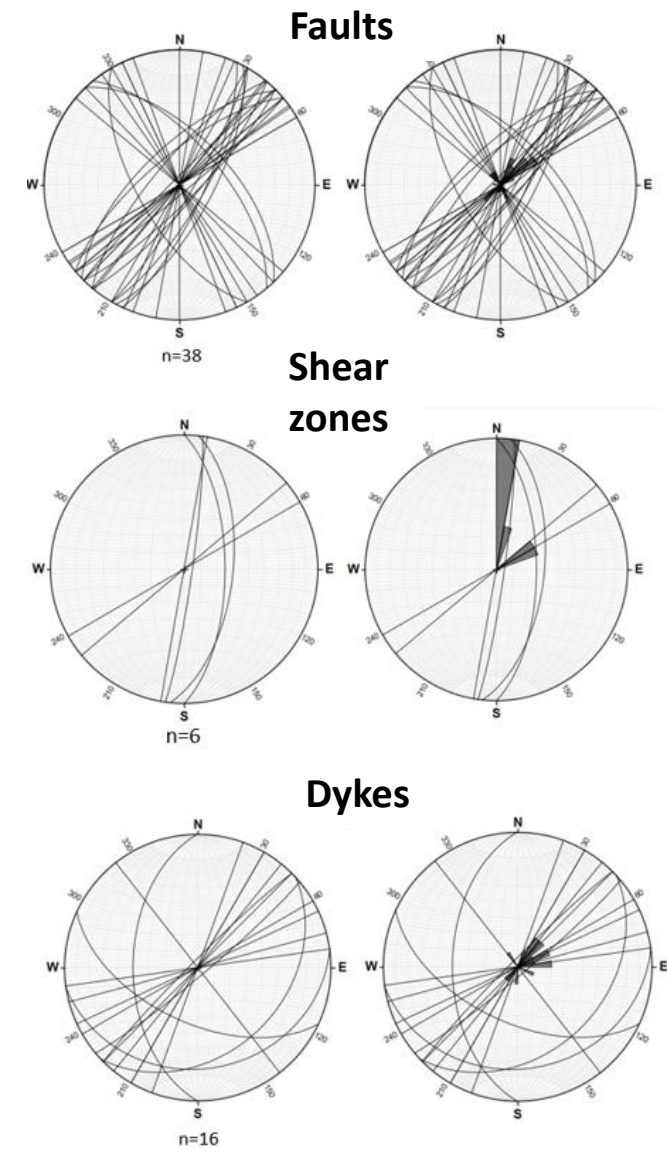
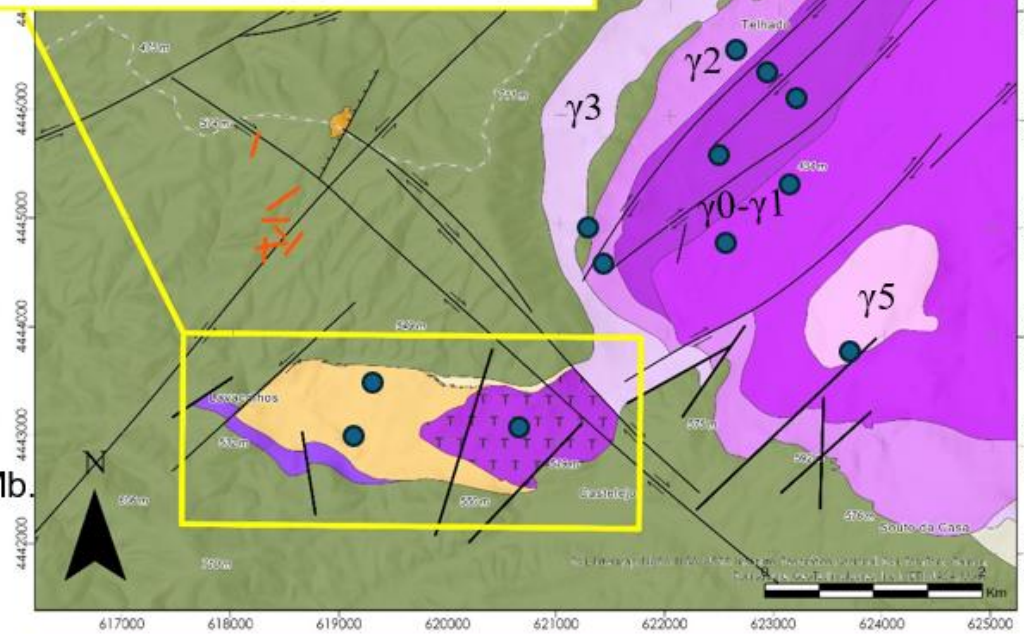
Geochemistry and geochronology of
granitoid rocks forming the W-SW
border of the Fundão pluton.

Ana Rita Andrade; Ícaro Dias da Silva;
António Mateus; Pilar Montero; Aitor
Cambeses

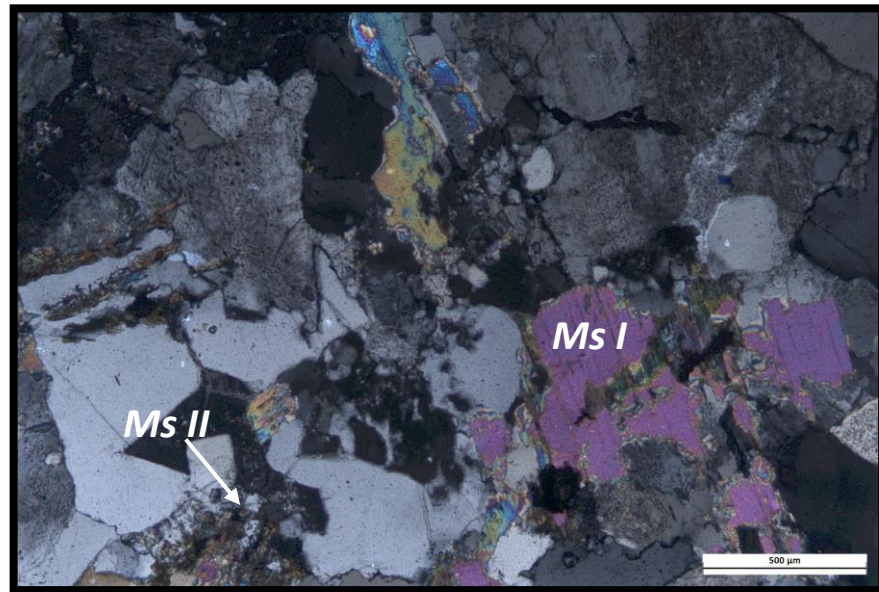
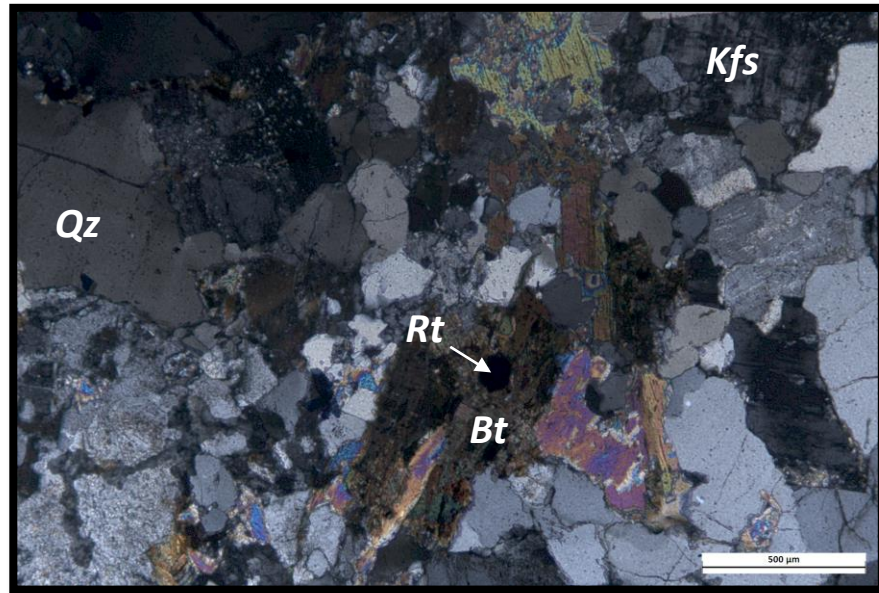
W and SW border of Fundão pluton: objectives and main features



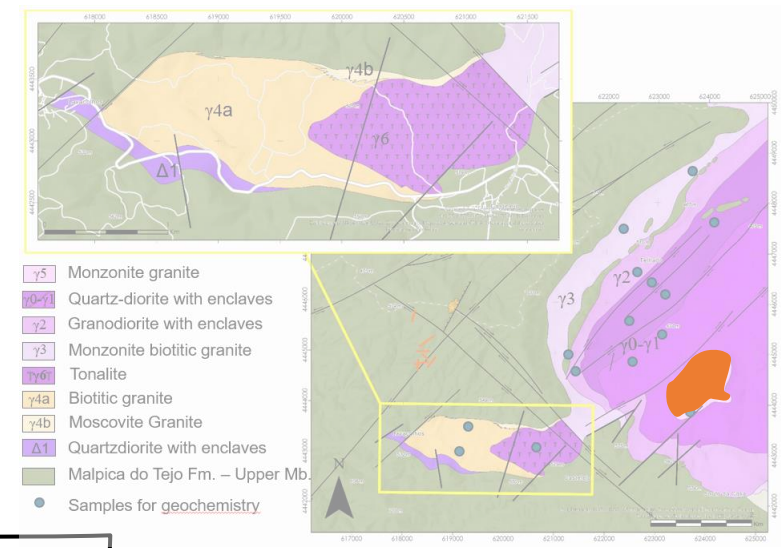
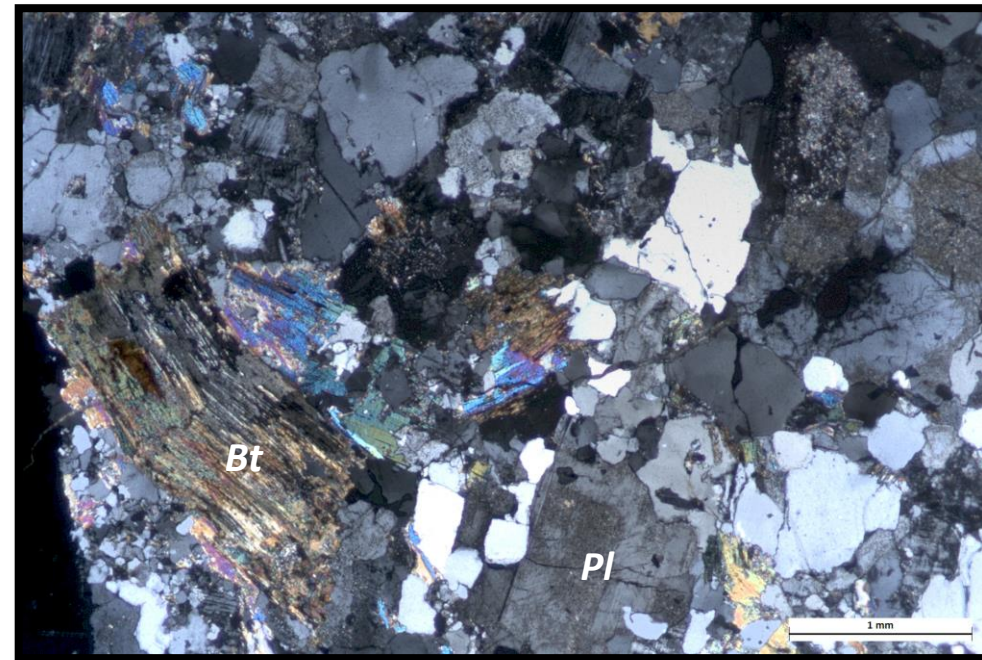
- γ5 Monzonite granite
- γ0-γ1 Quartz-diorite with enclaves
- γ2 Granodiorite with enclaves
- γ3 Monzonite biotitic granite
- γ6 Tonalite
- γ4a Biotitic granite
- γ4b Moscovite Granite
- Δ1 Quartzdiorite with enclaves
- Malpica do Tejo Fm. – Upper Mb.
- Samples for geochemistry



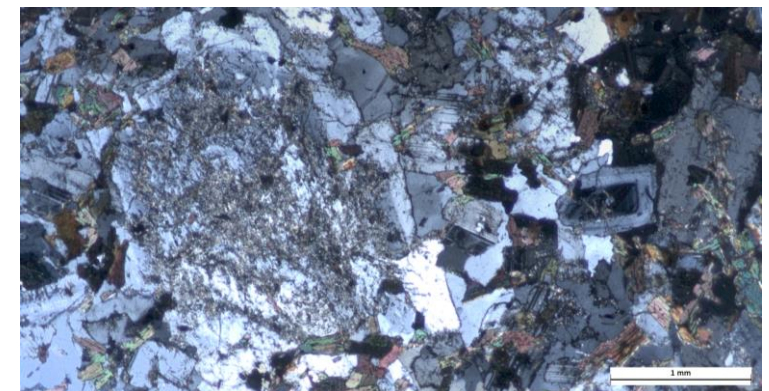
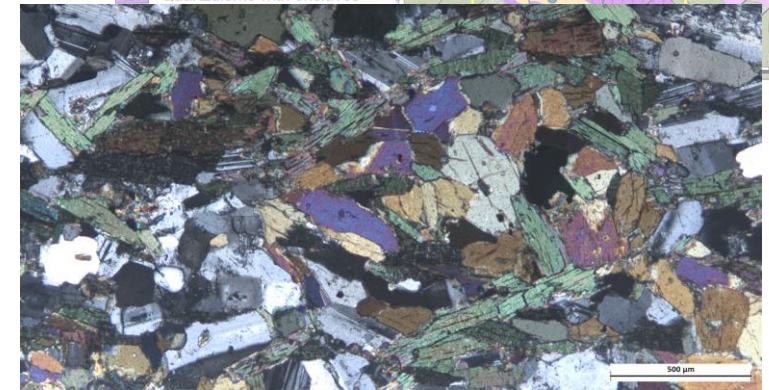
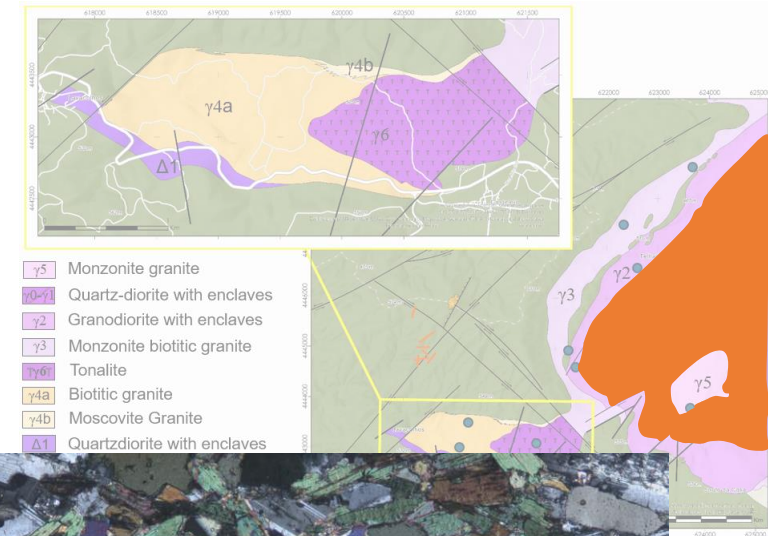
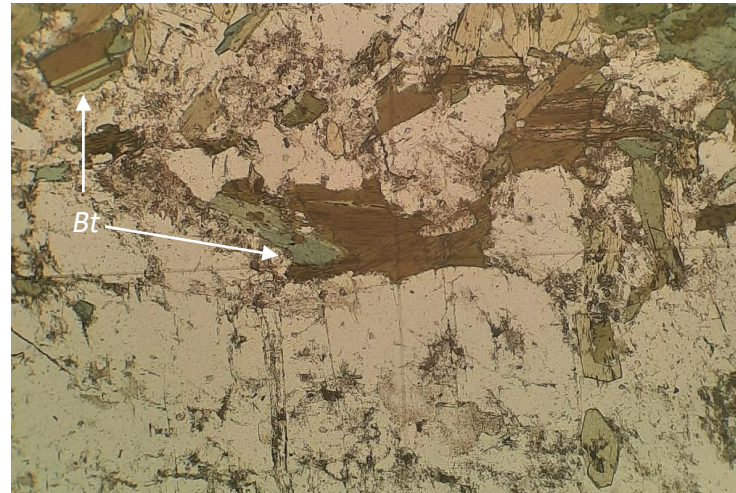
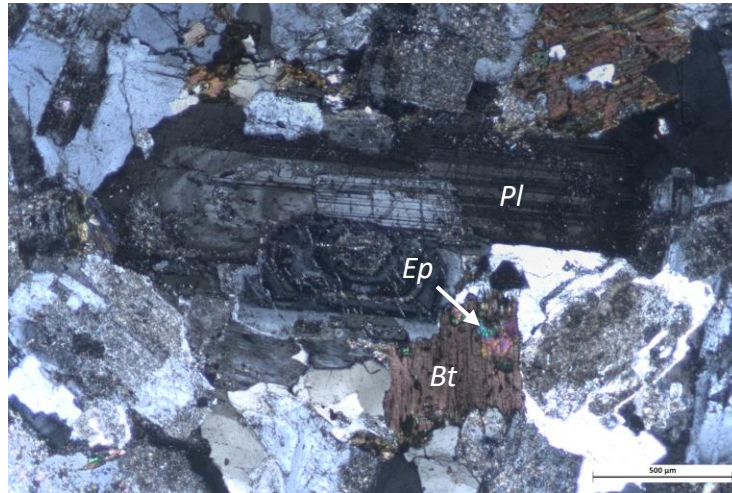
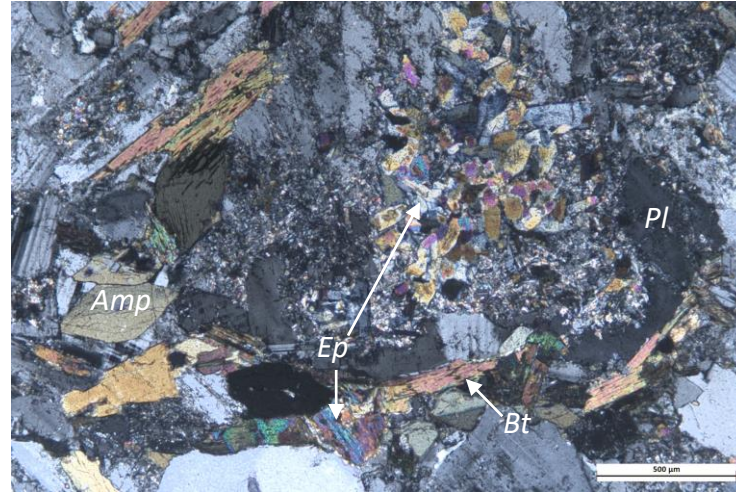
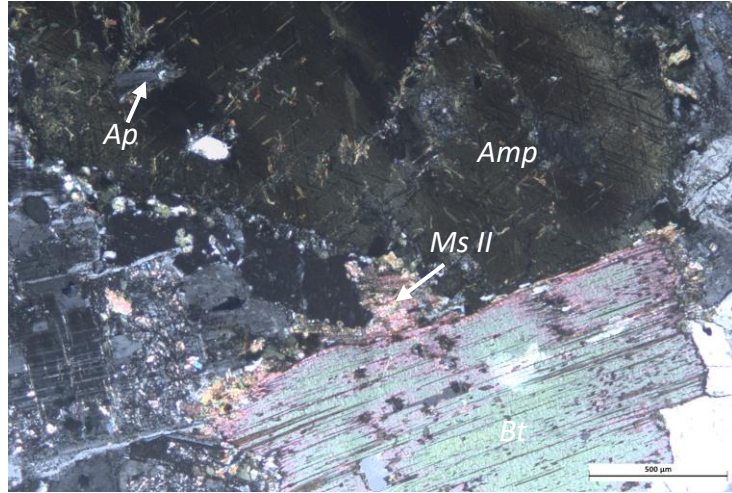
Petrography I Monzonite granite (γ5)



Qz+Pl+Kfs+Ms+Bt±Rt±Ap



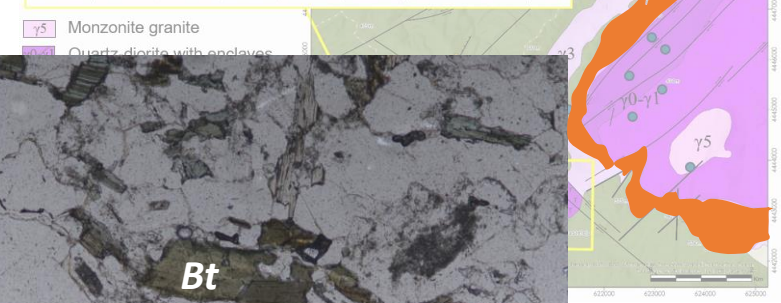
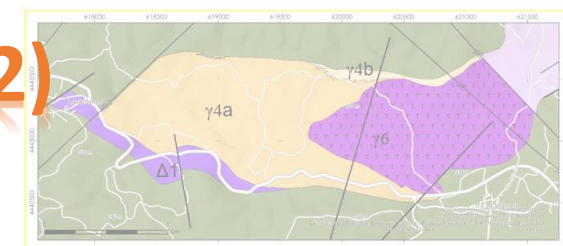
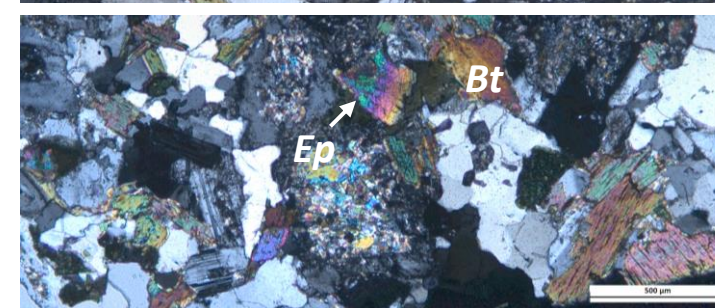
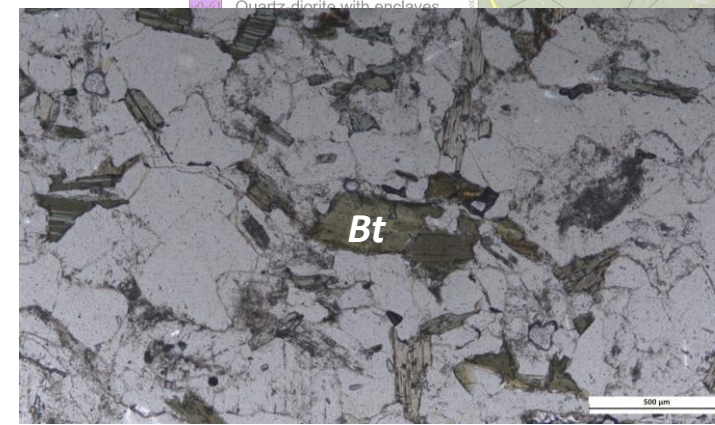
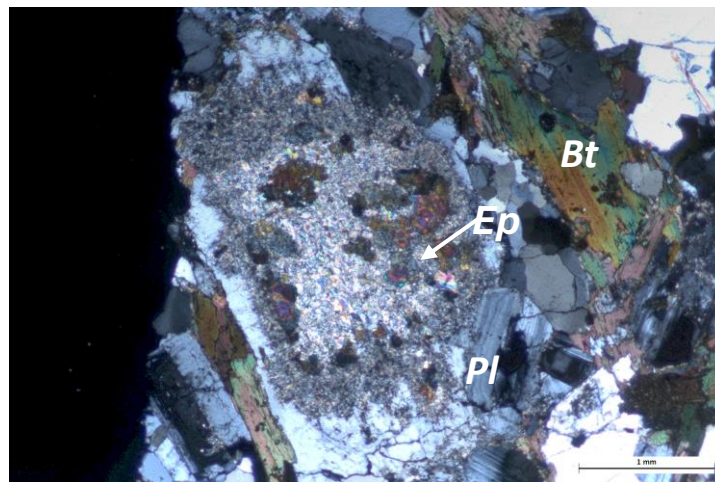
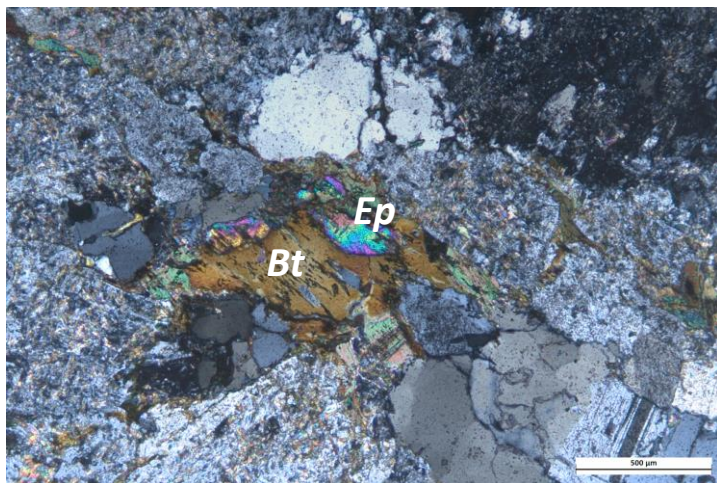
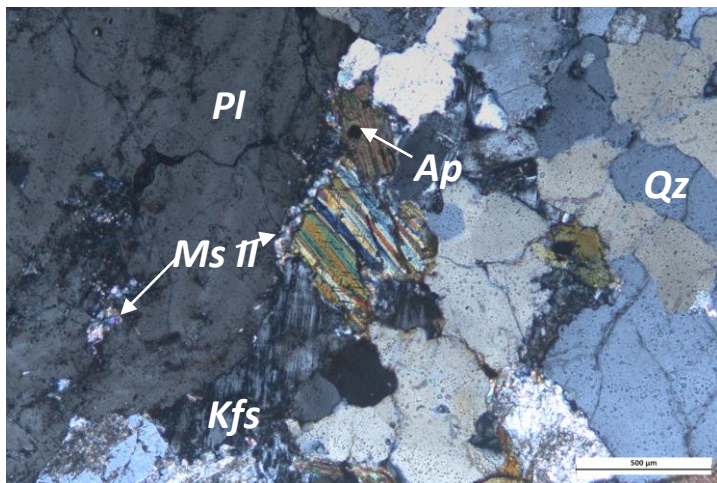
Petrography | Quartz- diorite with enclaves (γ0-γ1)



Pl+Qz+Bt+Amp+Kfs±Ms±Chl±Ep±Ap±Ilm

Pl+Qz+Bt+Amp±kfs

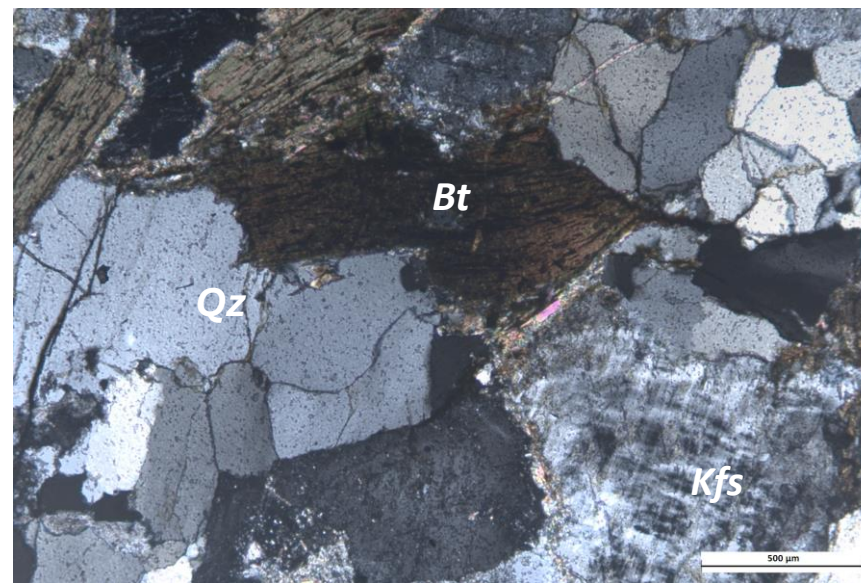
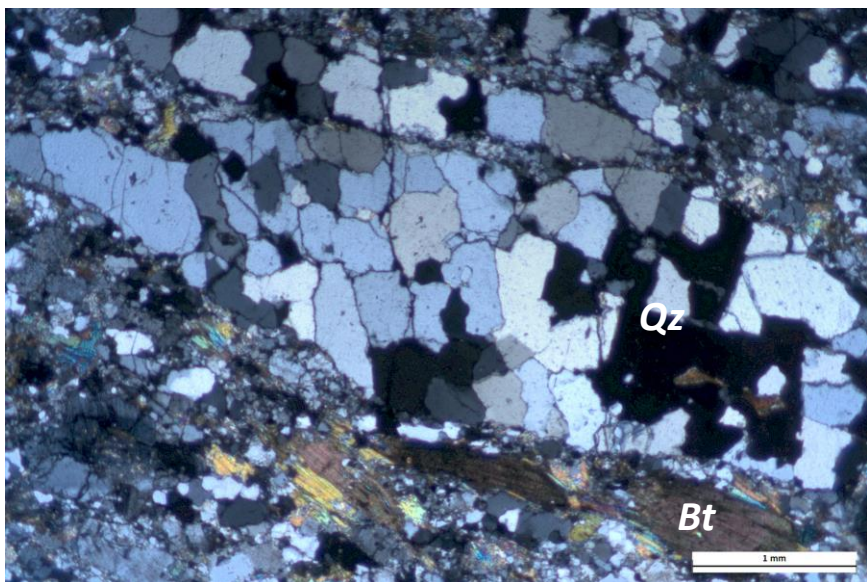
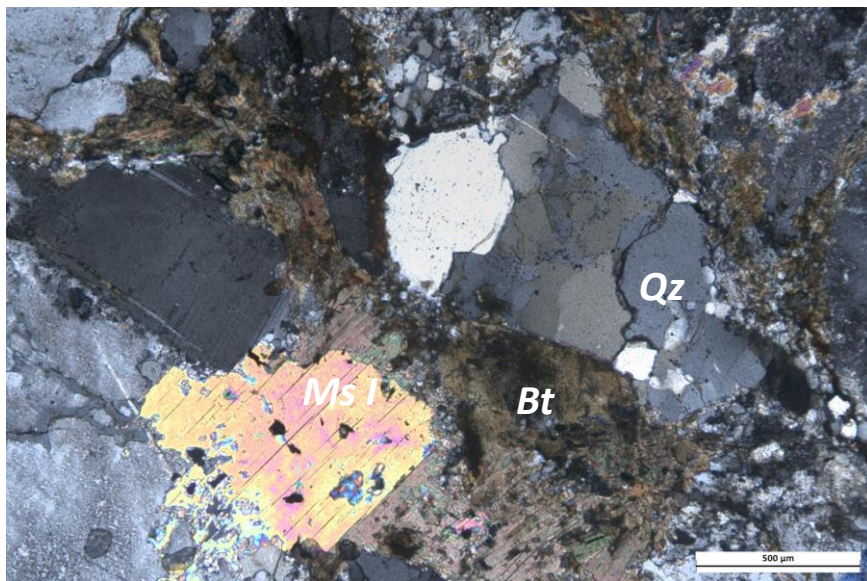
Petrography | Granodiorite with enclaves (y2)



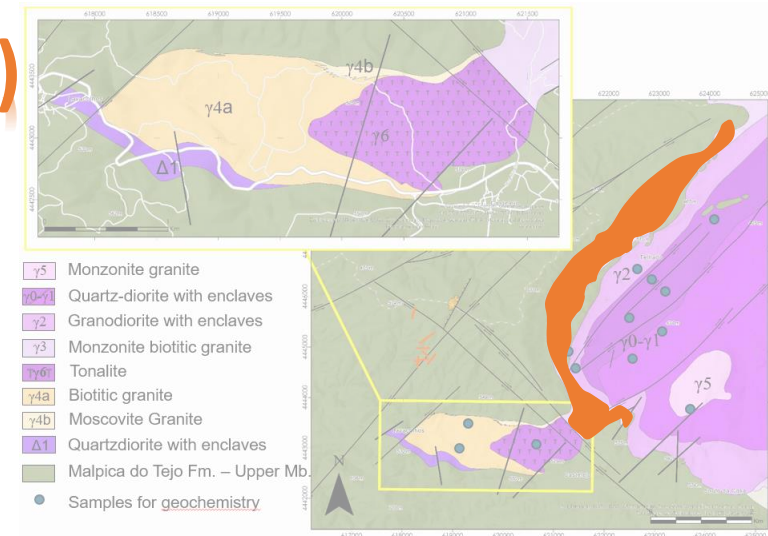
Qz+Pl+Kfs+Bt±Ms±Ep±Chl±Ap

Pl+Qz+Bt±Ep±Ms

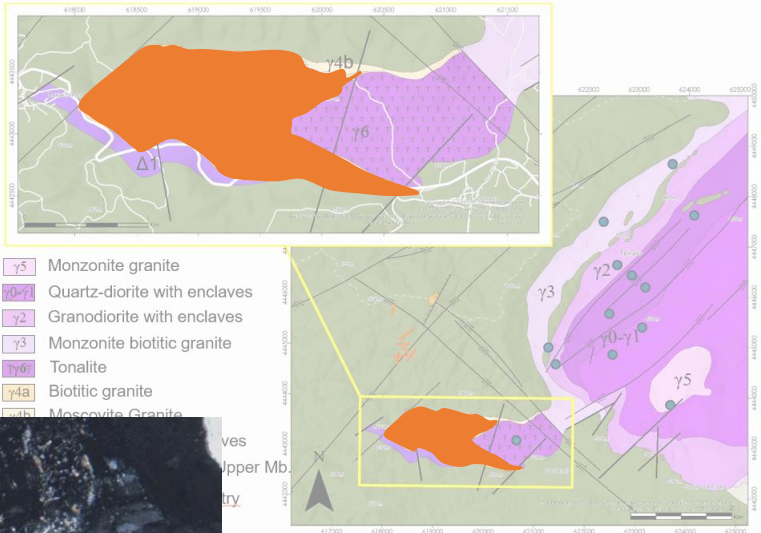
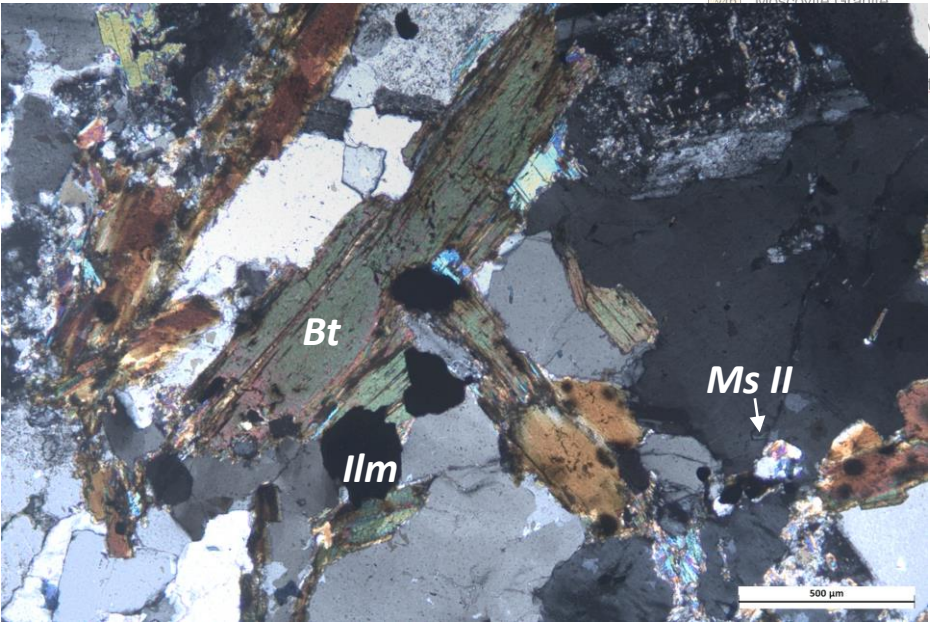
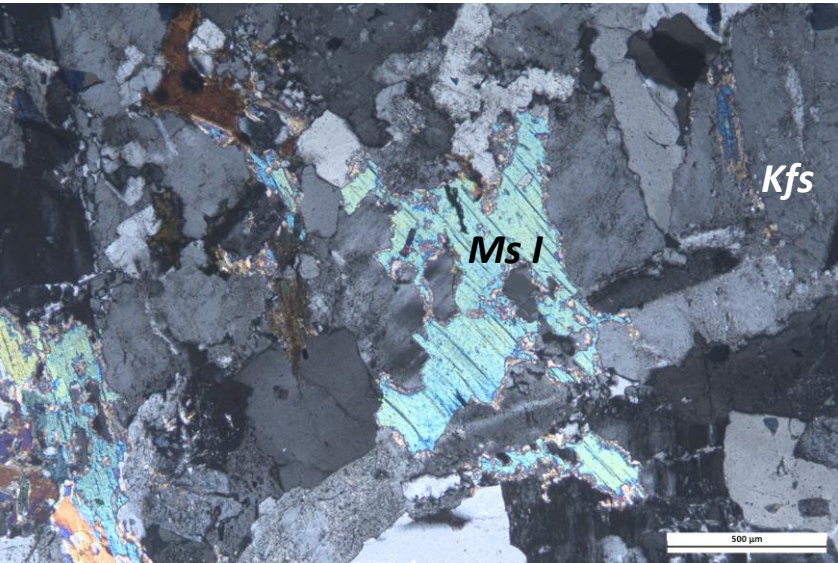
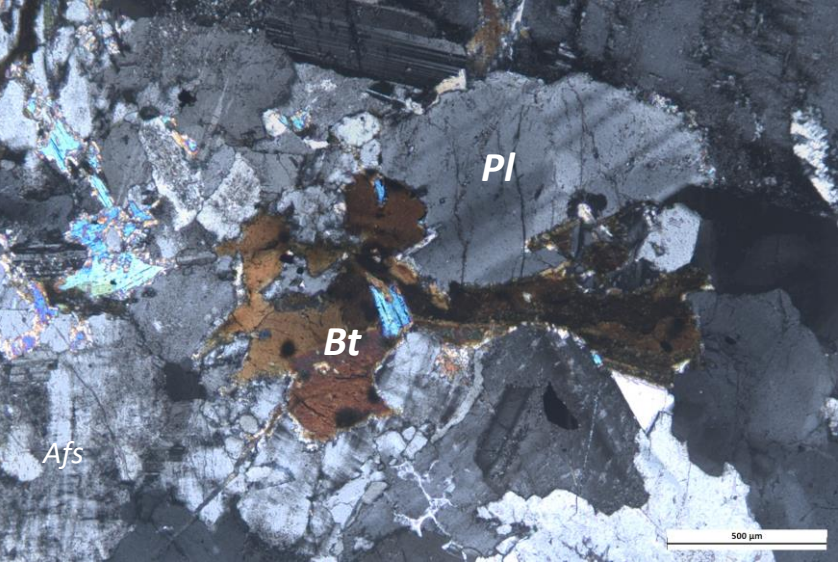
Petrography | Monzonite biotitic granite (γ3)



Qz+Pl+Kfs+Bt±Ms±Ap±Ilm

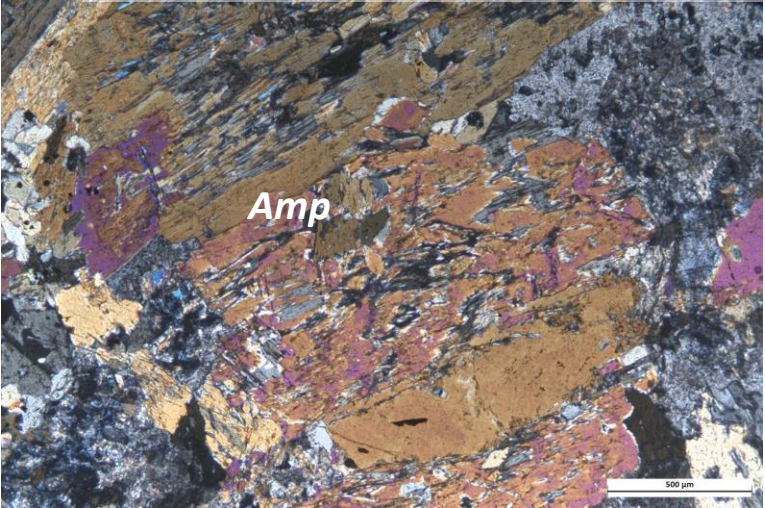
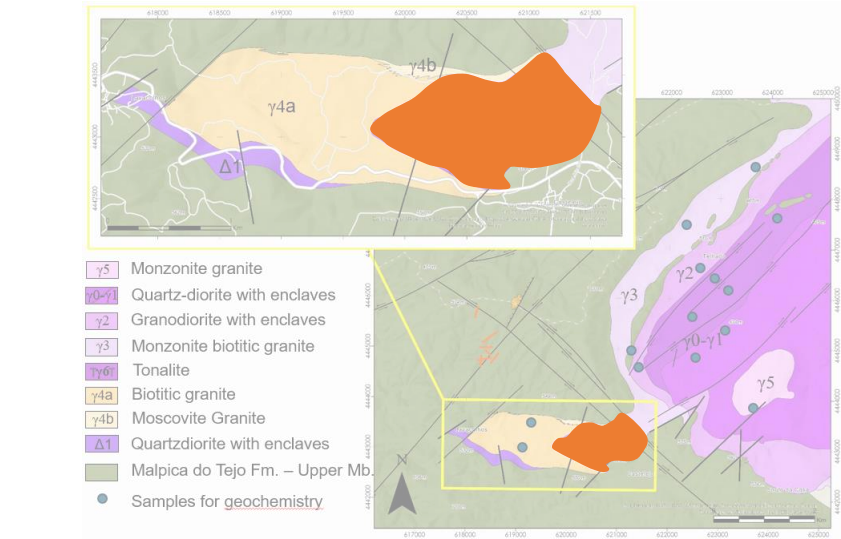
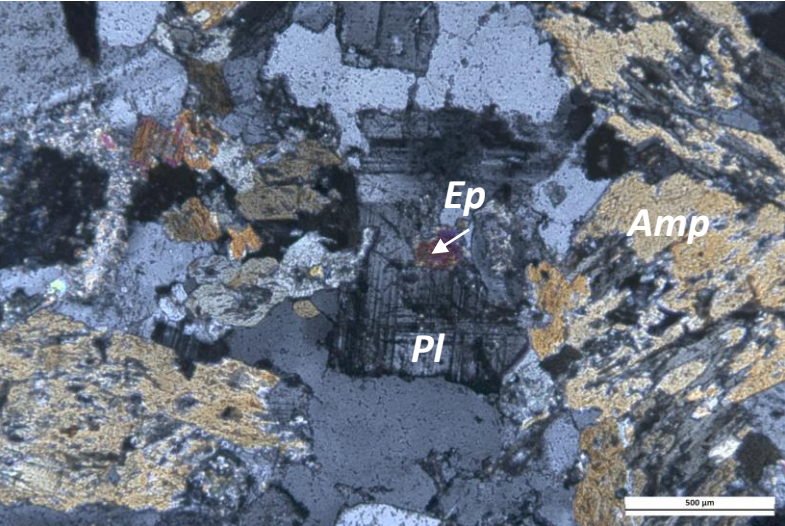
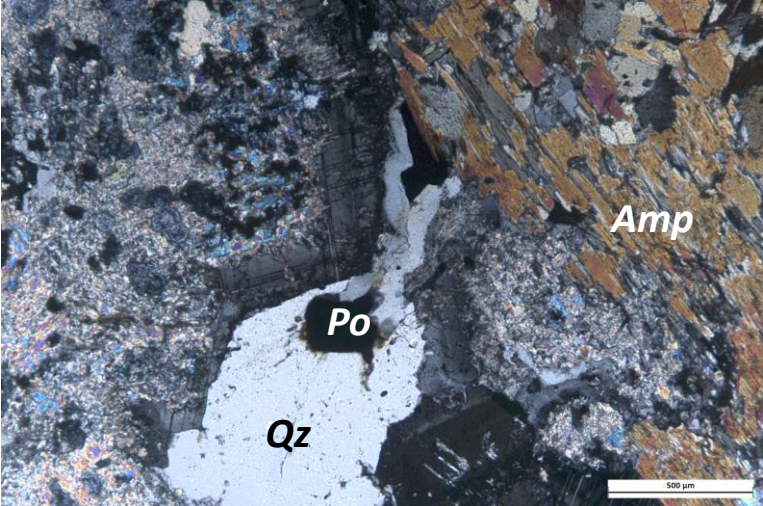
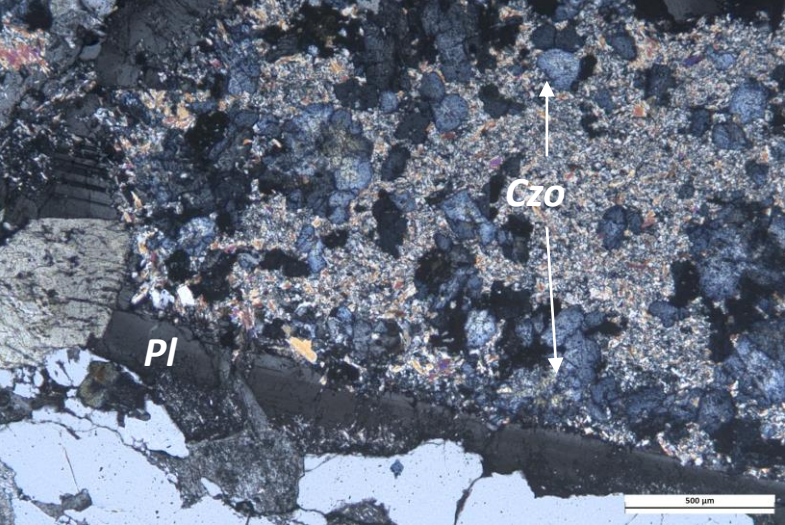


Petrography | Biotitic granite (γ4a)



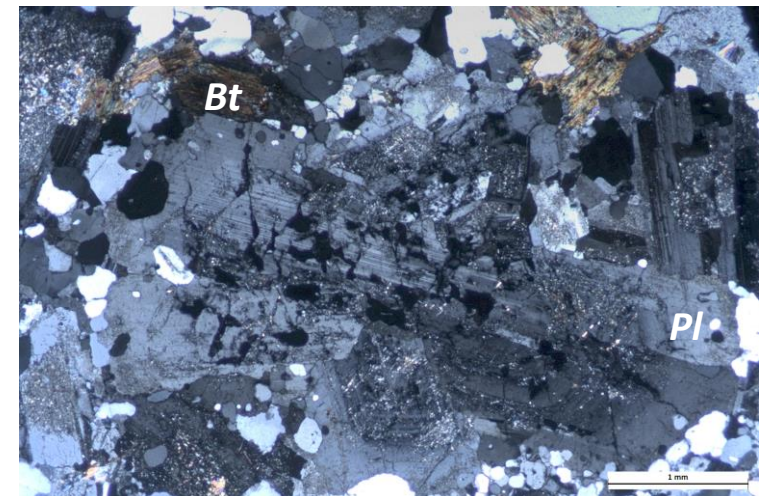
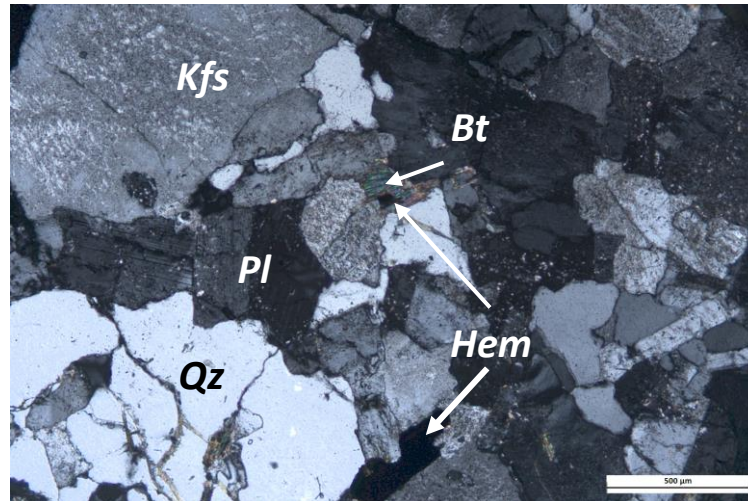
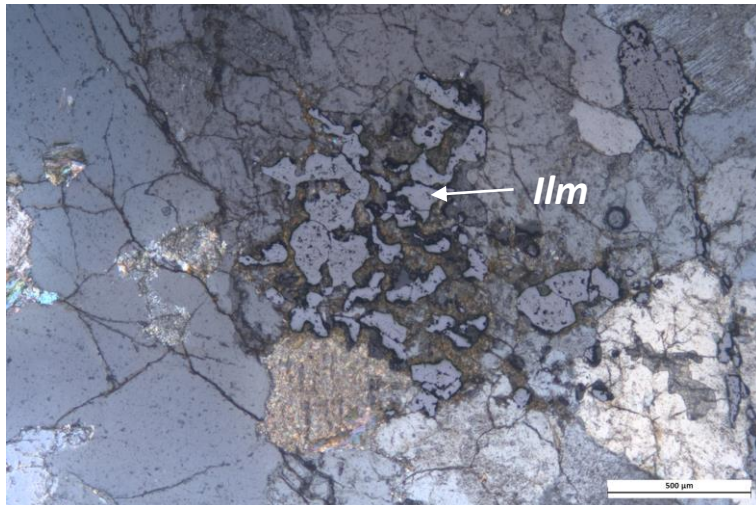
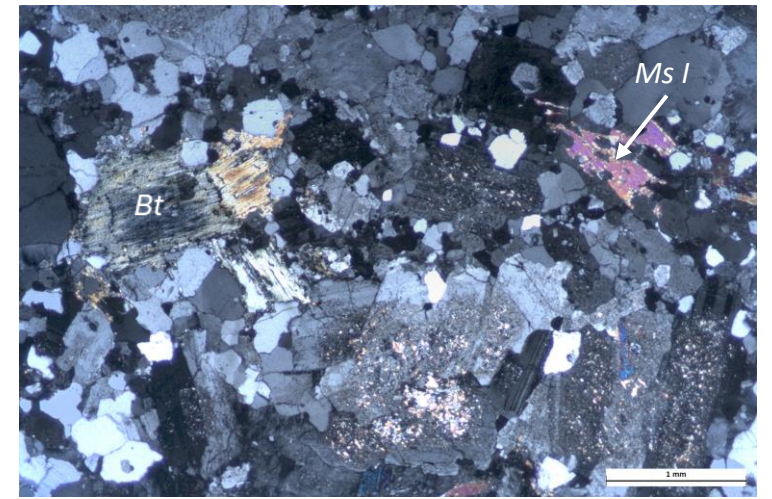
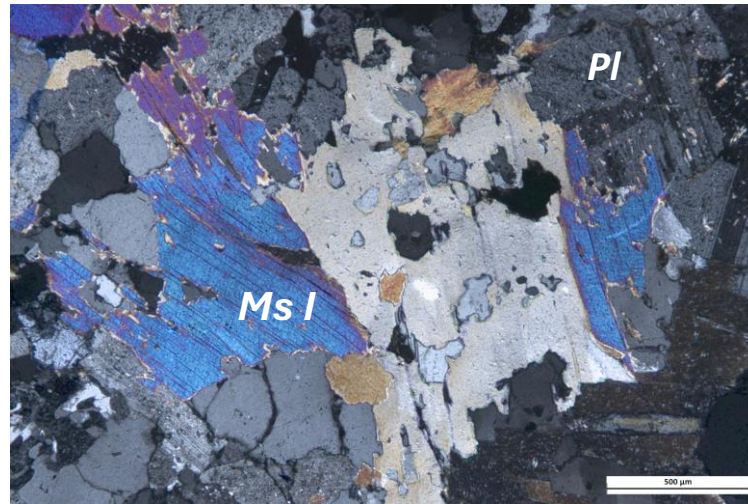
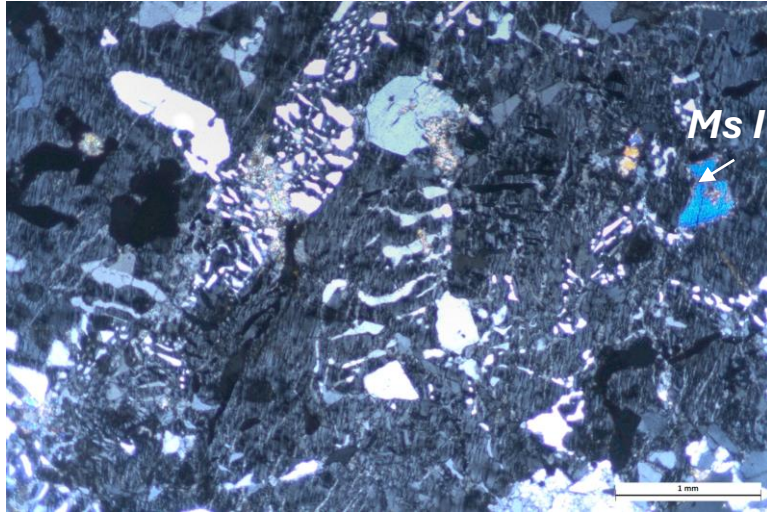
Kfs+Qz+Pl+Bt ± Ms ± Ilm

Petrography | Tonalite (γ6)



Amp+Pl+Qz ± Czo ± Ep ± Ms ± Po

Petrography – Felsic dykes

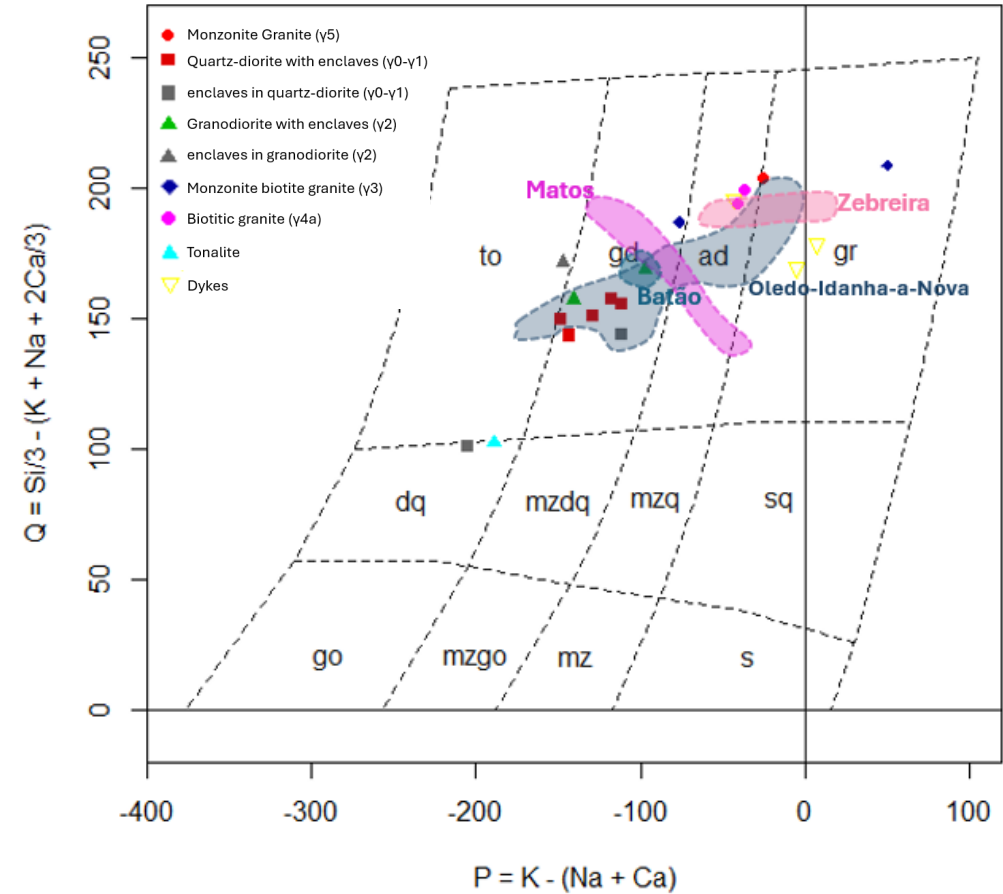
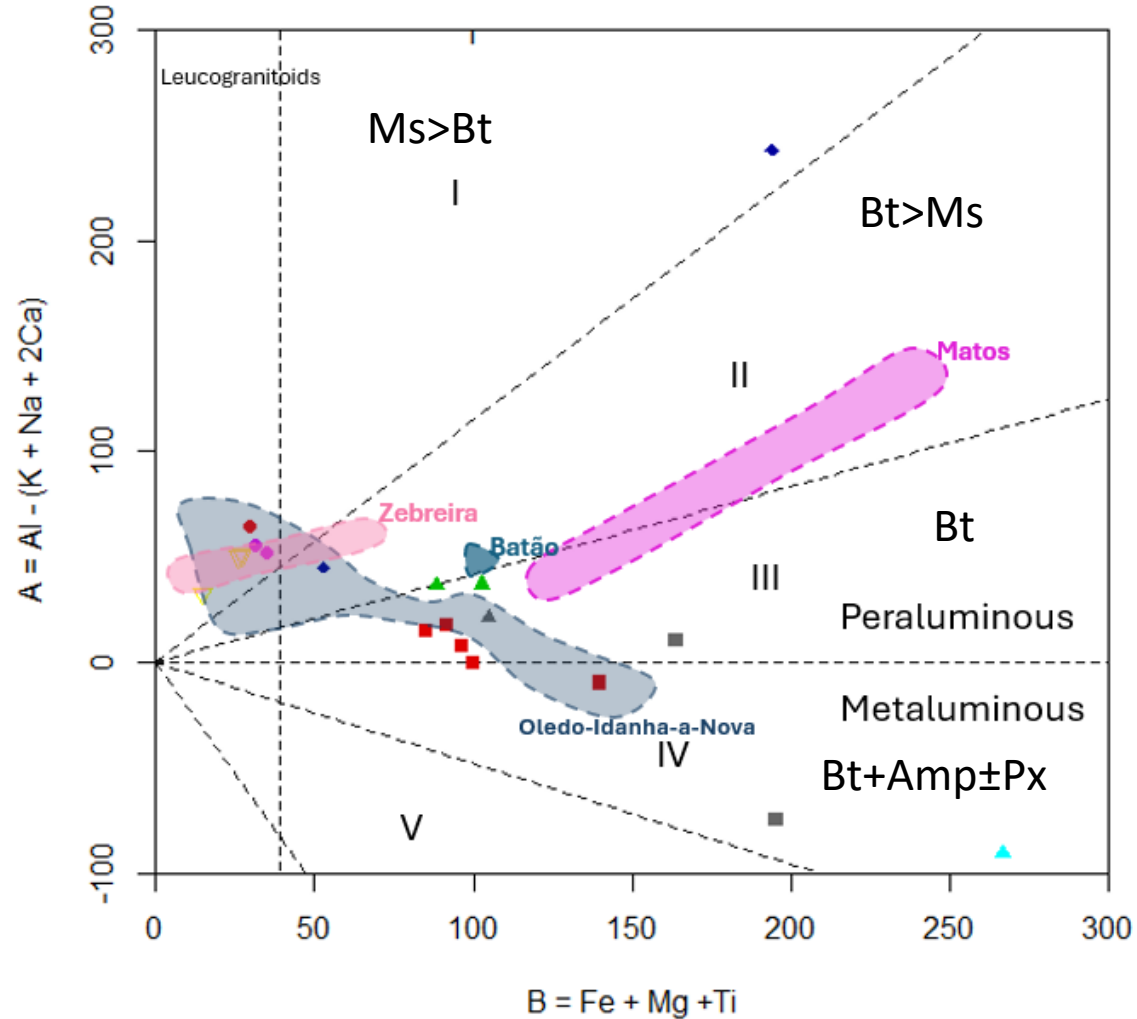


Qz+Kfs+Pl+Ms ± Bt ± Ilm

Qz+Pl+Kfs+Ms ± Bt ± Hem

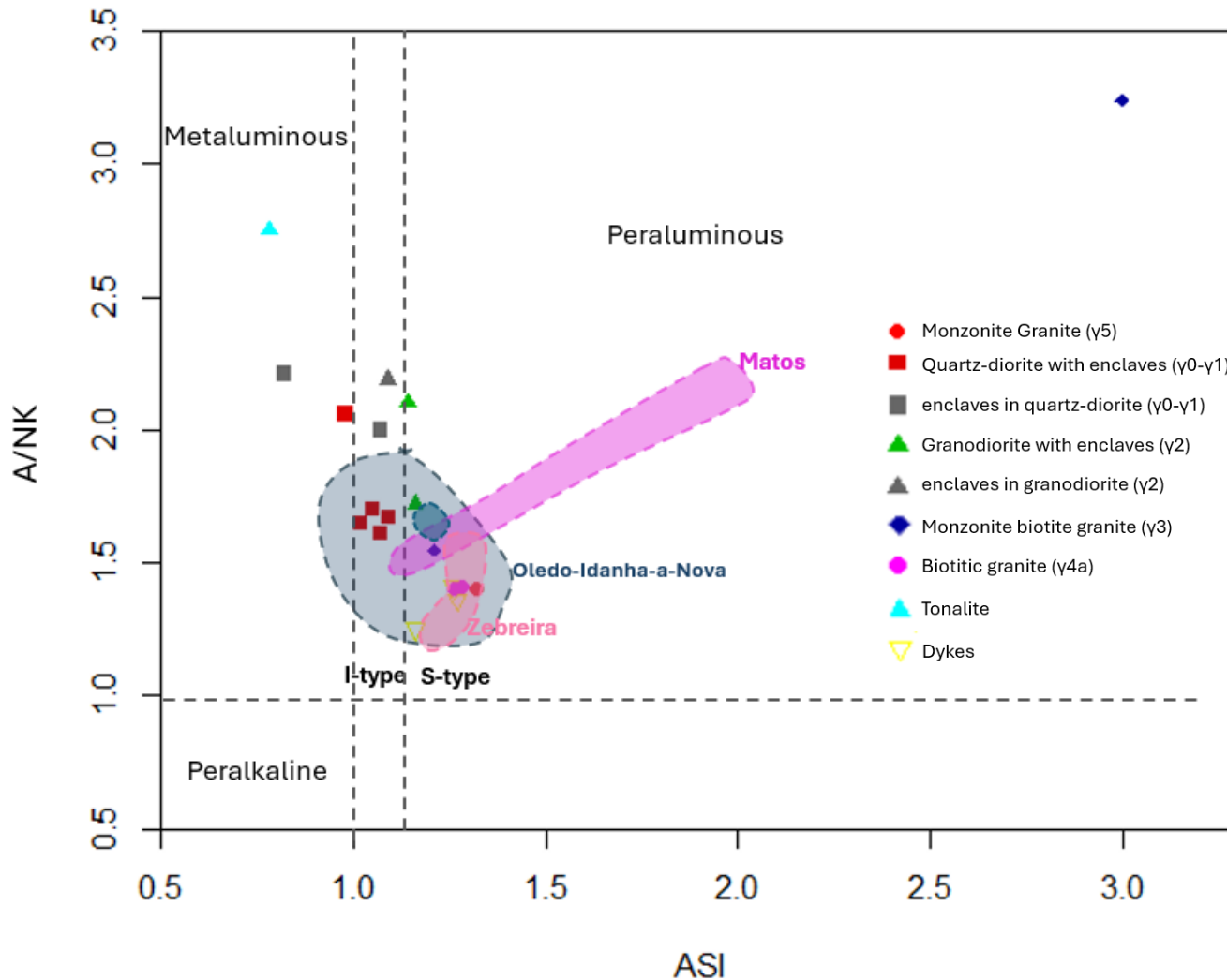
Qz+Pl+Kfs+Bt ± Ms

Compositional features



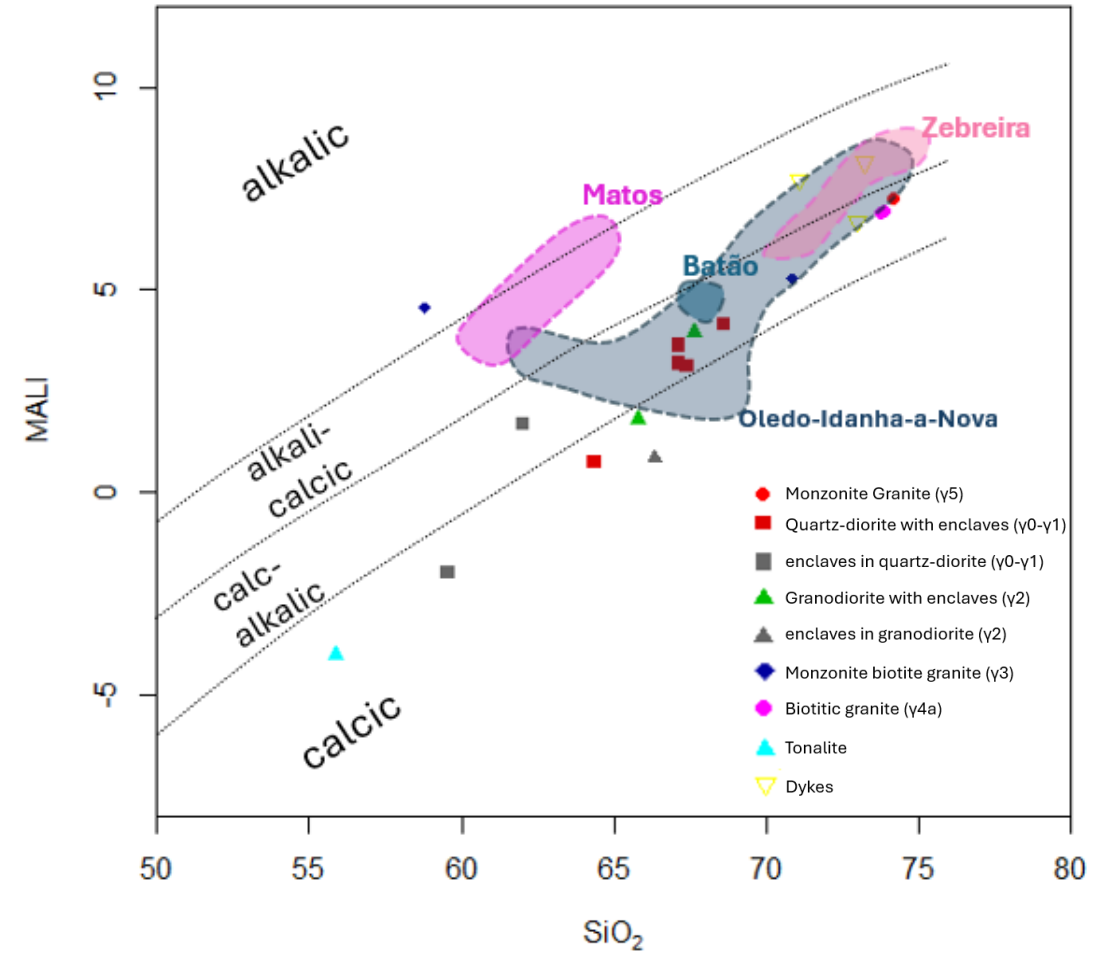
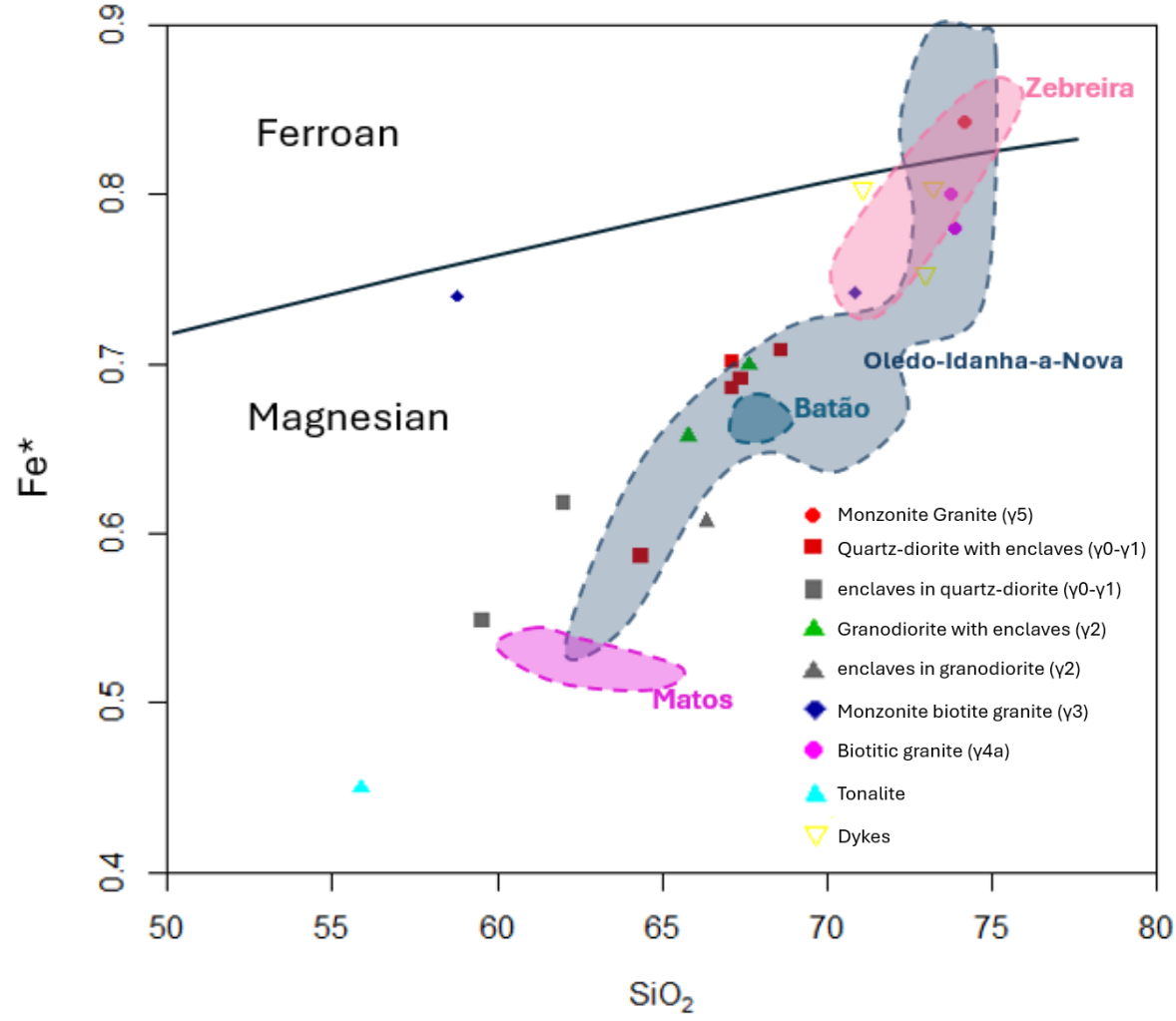
- **Ms>Bt granite to adamellite** : dykes, monzonite granite (γ5) and biotitic granite (γ4a)
- **Bt>Ms granodiorite** : monzonite biotite granite (γ3)
- **Bt granodiorite to tonalite**: quartz-diorite (γ0-γ1) and granodiorite with enclaves (γ2)
- **Bt+Amp±Py tonalite to quartz diorite**: enclave from quartz diorite facies and tonalite (γ6)

Compositional features



- **Weakly peraluminous I-type:** Quartz diorite (γ0-γ1) and enclaves (both γ2 and γ0-γ1);
- **Weakly peraluminous S-type:** Granodiorite (γ2), monzonite biotite granite (γ3), biotitic granite (γ4a) and all dykes;
- **Metaluminous:** Tonalite (γ6) and one sample from quartz diorite facies and the respective enclave

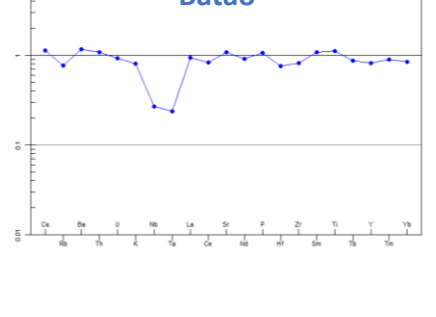
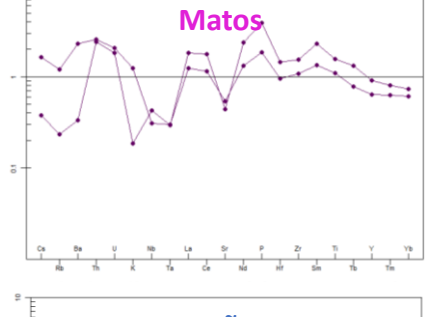
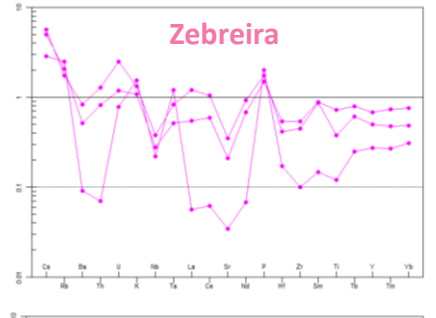
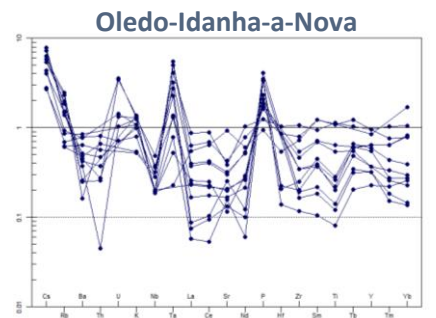
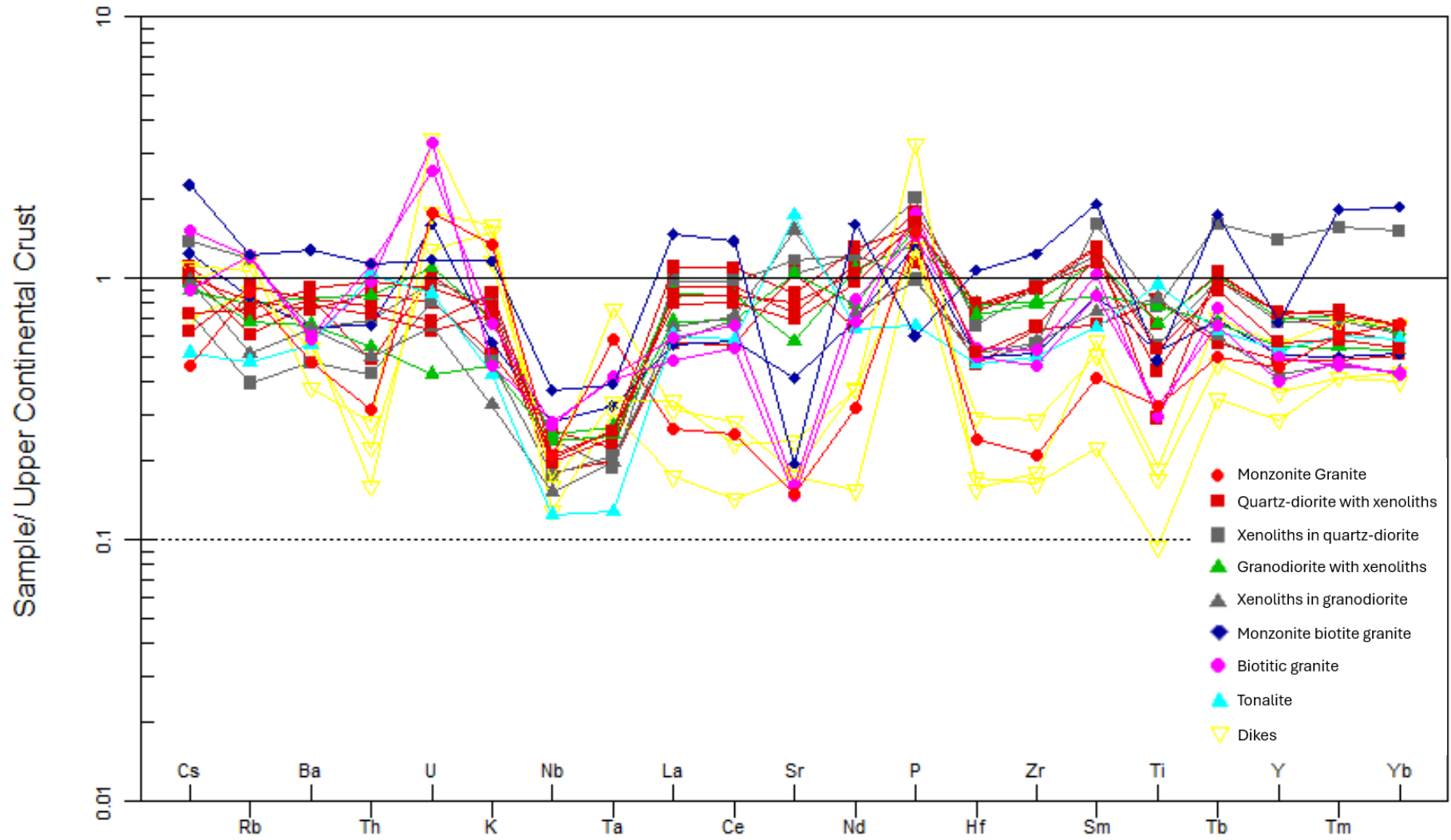
Compositional features



- Magnesian rocks (except monzonite granite – γ_5);
- Calcic to calc-alkali series (alkalic monzonite biotite granite and alkali-calcic dykes)

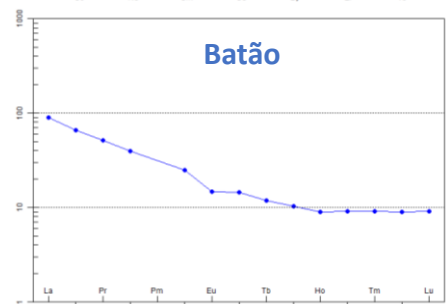
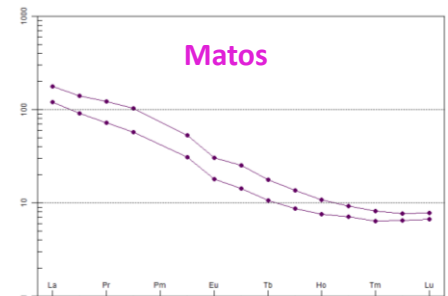
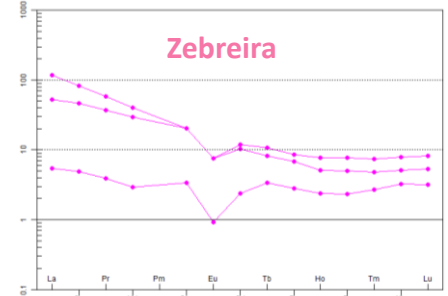
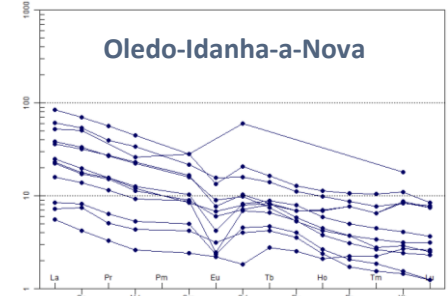
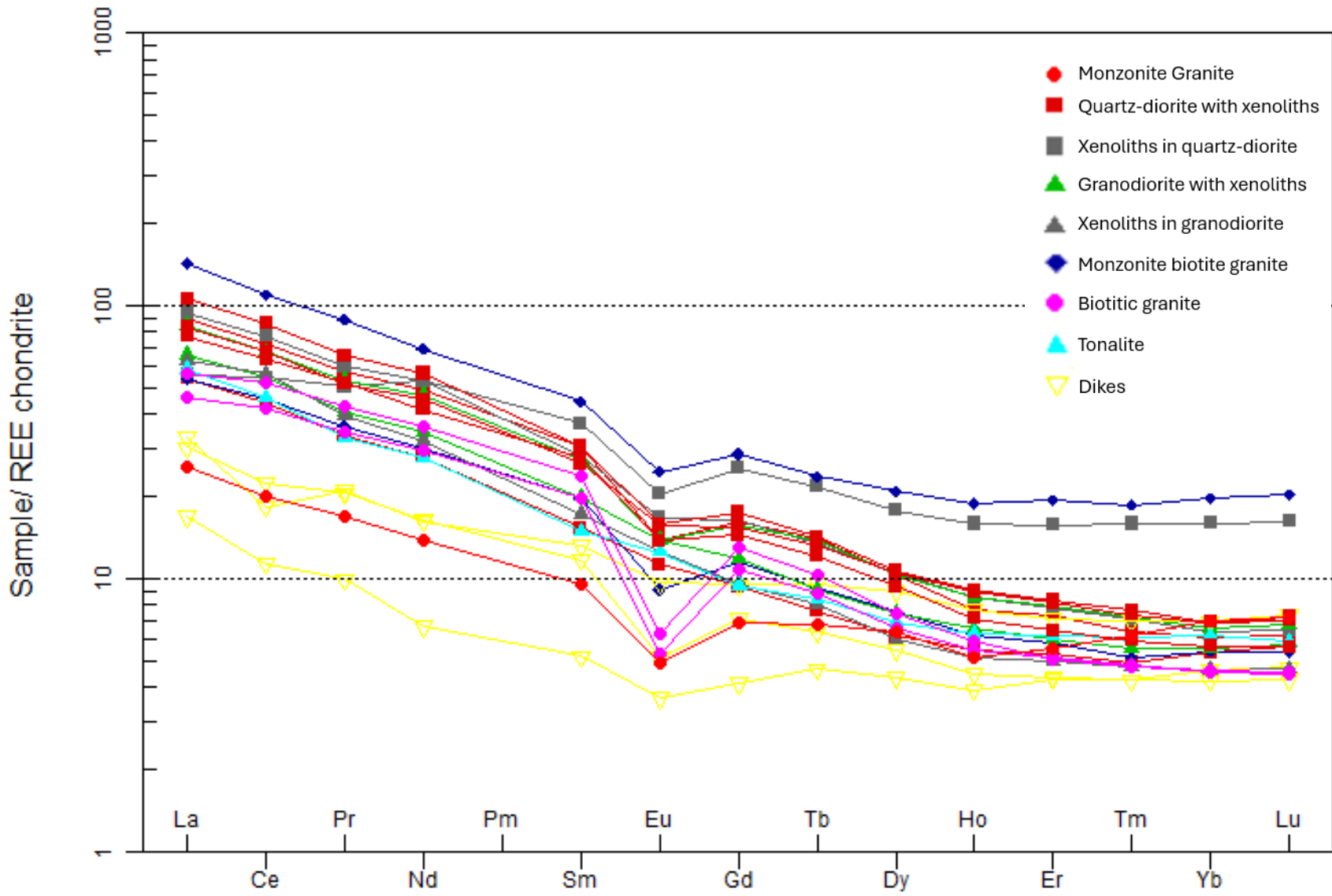
Compositional features

Upper Continental Crust (Taylor and McLennan 1995)



Compositional features

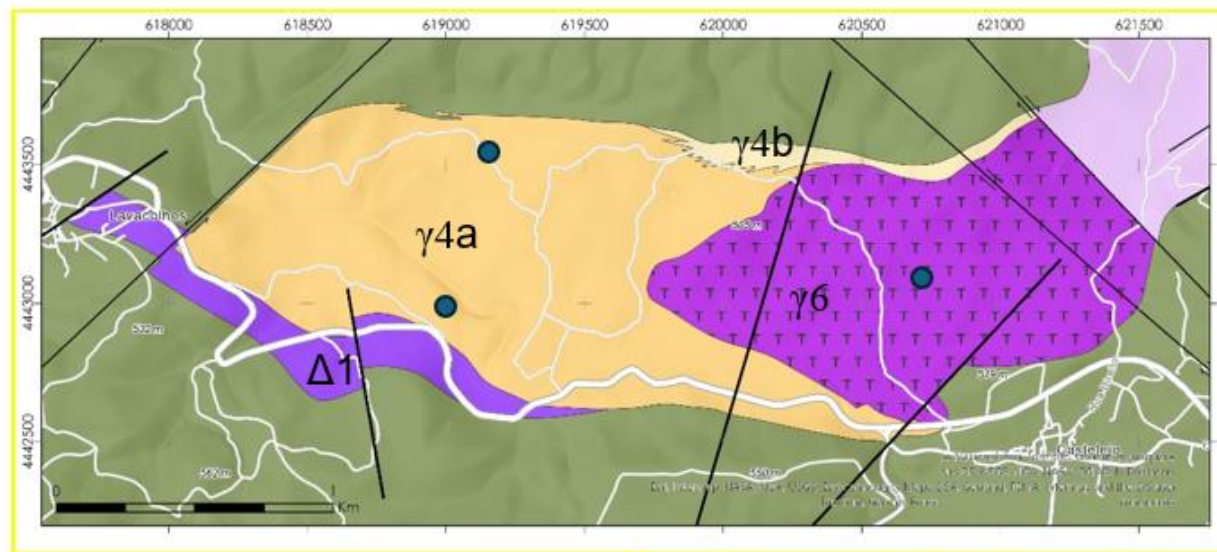
REE chondrite (Boyton 1984)



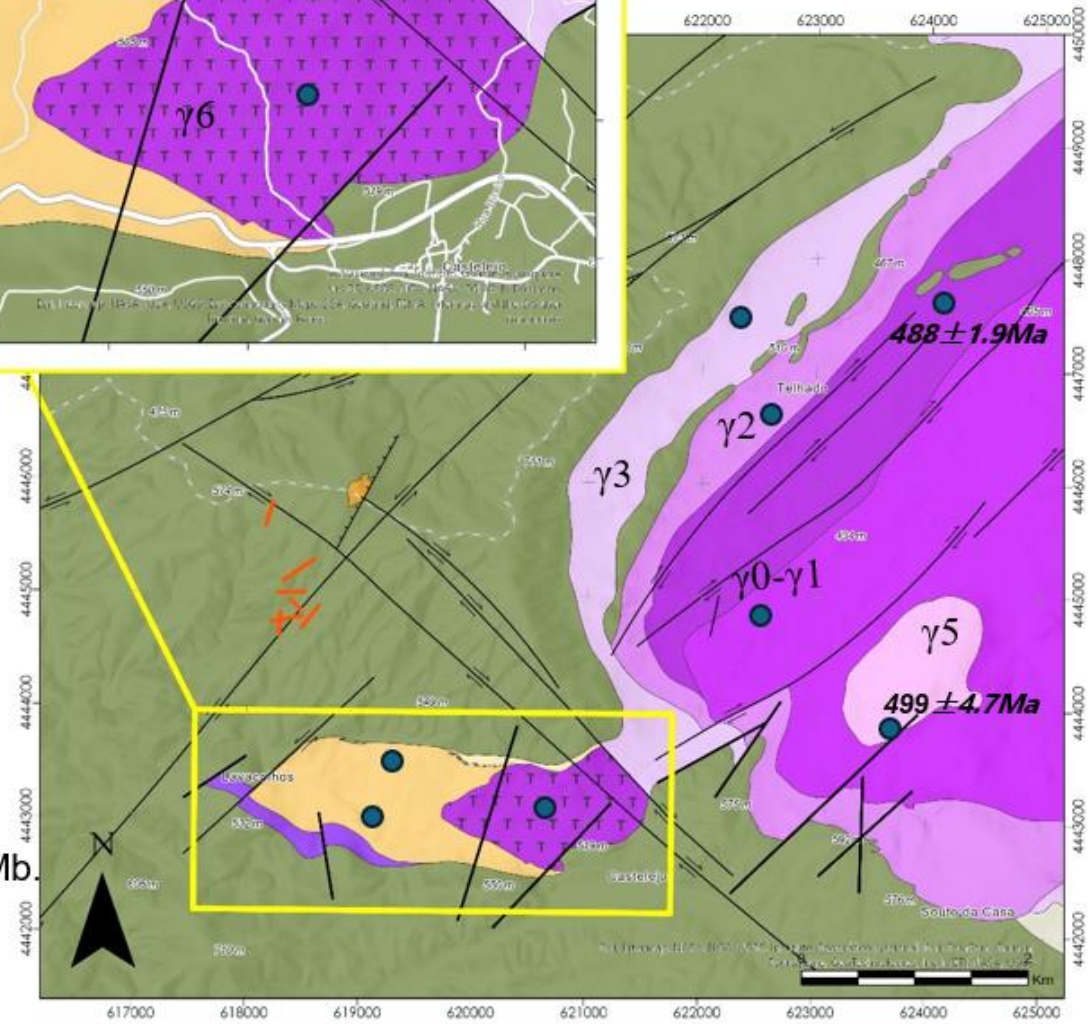
Geochronology

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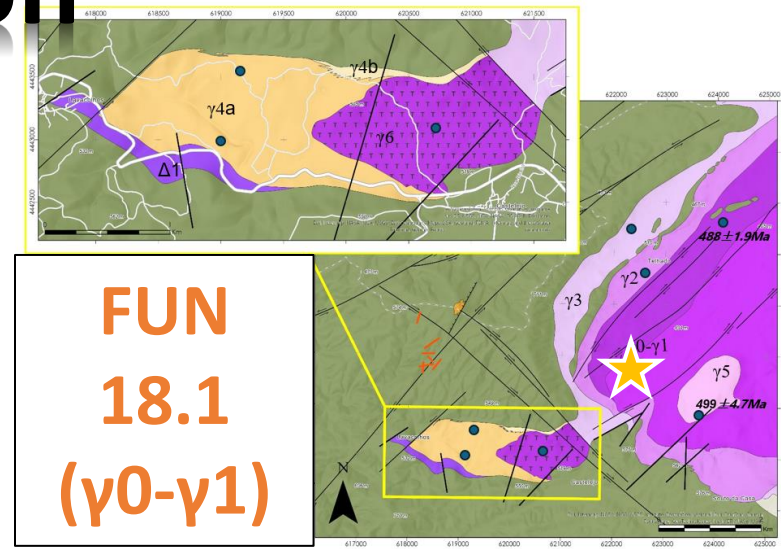
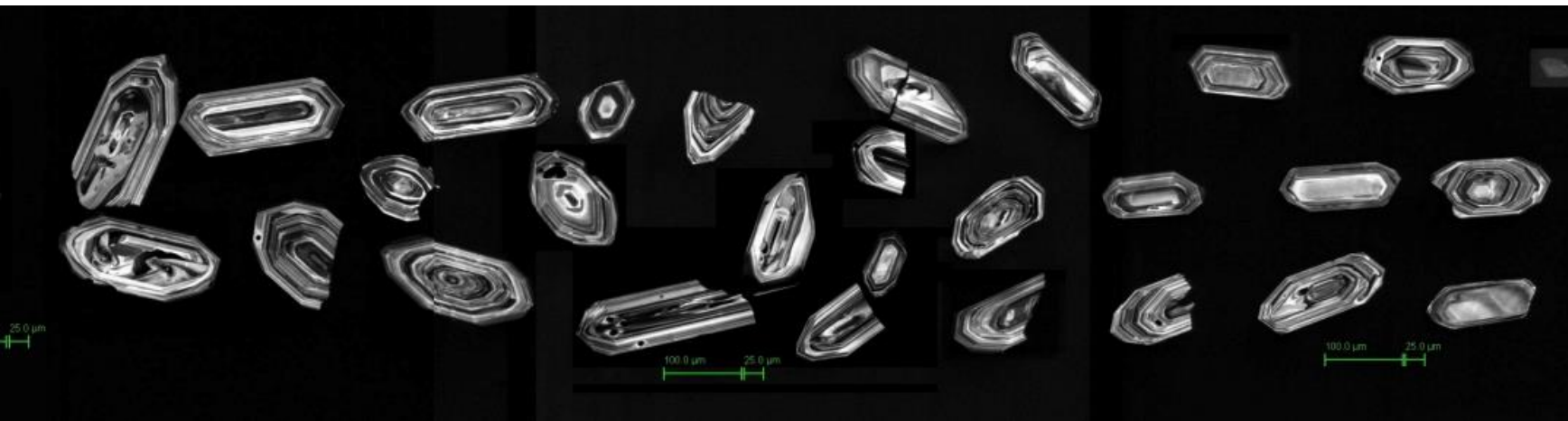
the Shrimp Ion-Microprobe Laboratory of The University of Granada



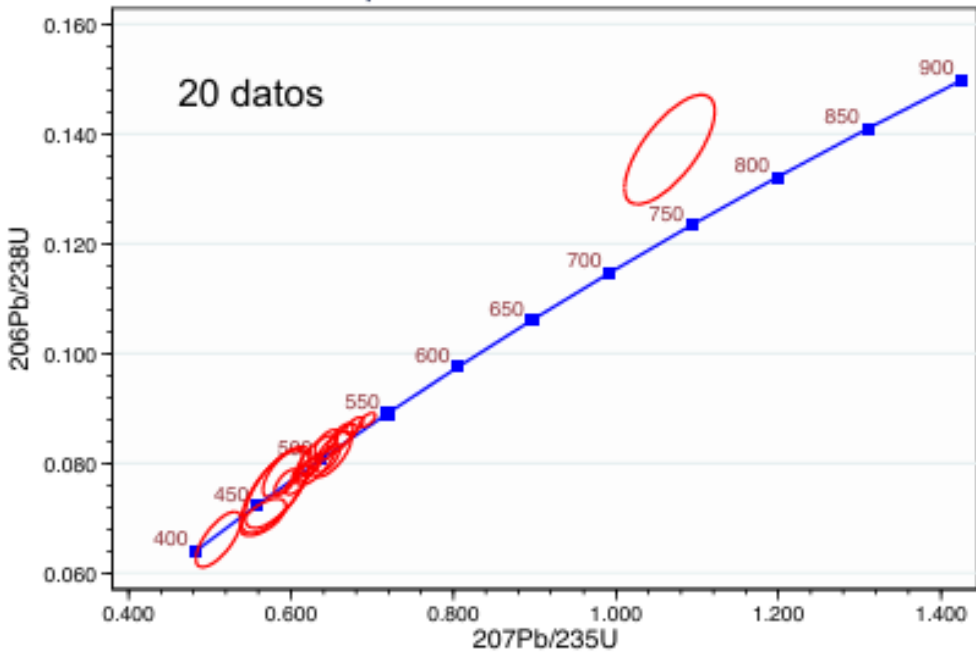
- $\gamma 5$ Monzonite granite
- $\gamma 0-\gamma 1$ Quartz-diorite with xenoliths
- $\gamma 2$ Granodiorite with xenoliths
- $\gamma 3$ Monzonite biotitic granite
- $\gamma 6$ Tonalite
- $\gamma 4a$ Biotitic granite
- $\gamma 4b$ Moscovite Granite
- $\Delta 1$ Quartzdiorite with xenoliths
- Malpica do Tejo Fm. – Upper Mb.
- Samples for U-Pb geochronology



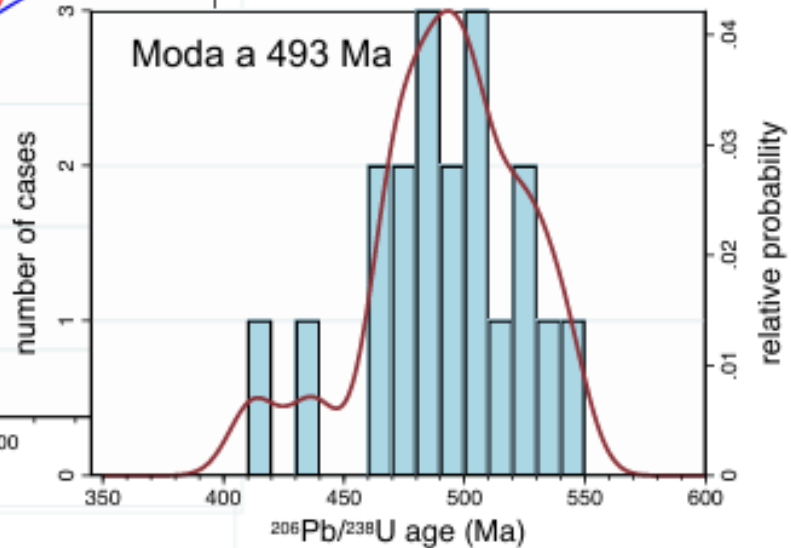
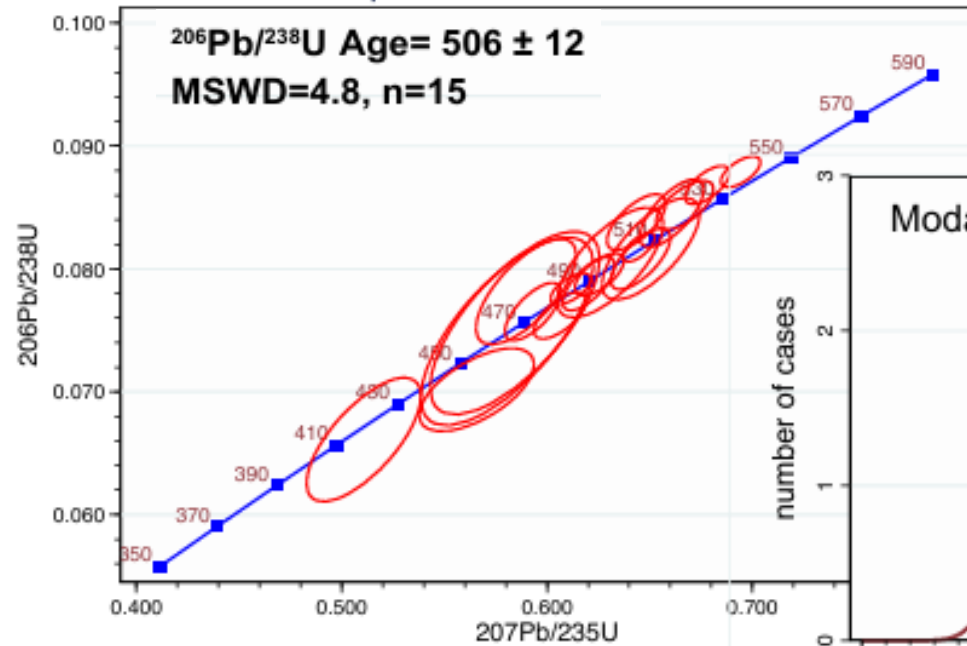
Geochronology – SHRIMP U-Pb zircon



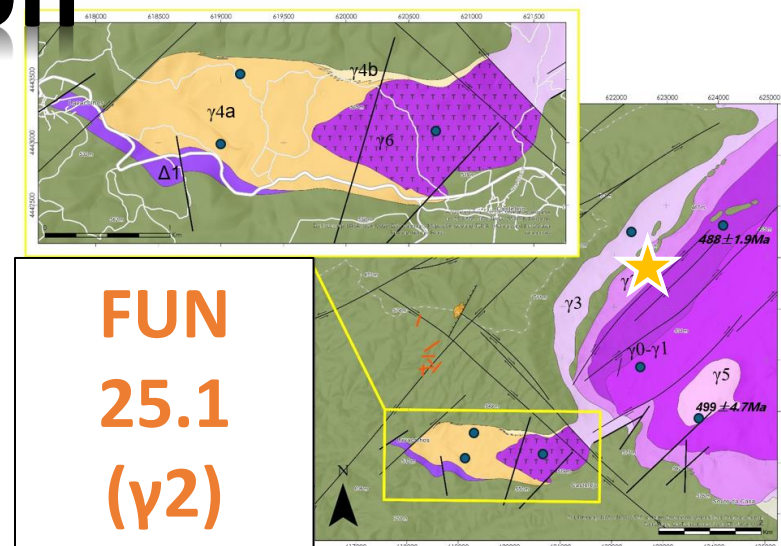
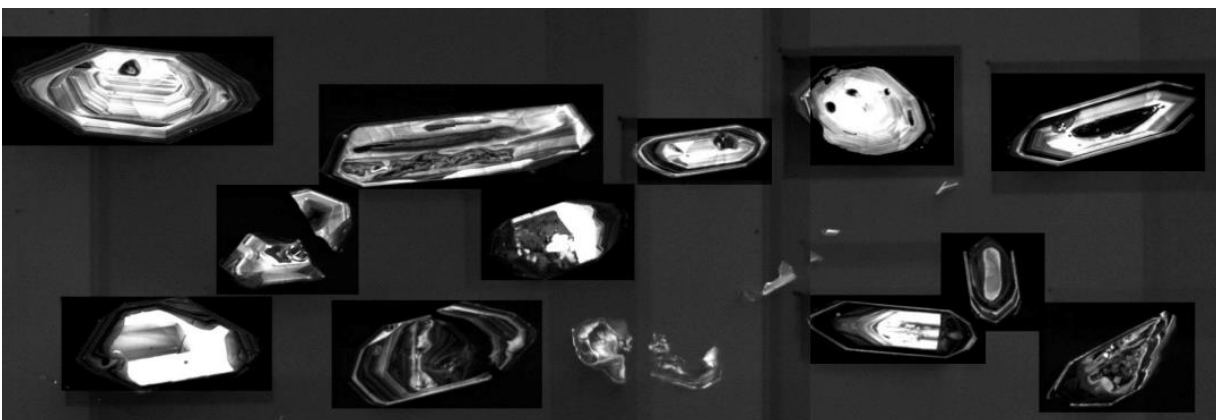
Wetherill plot. Common-lead uncorrected



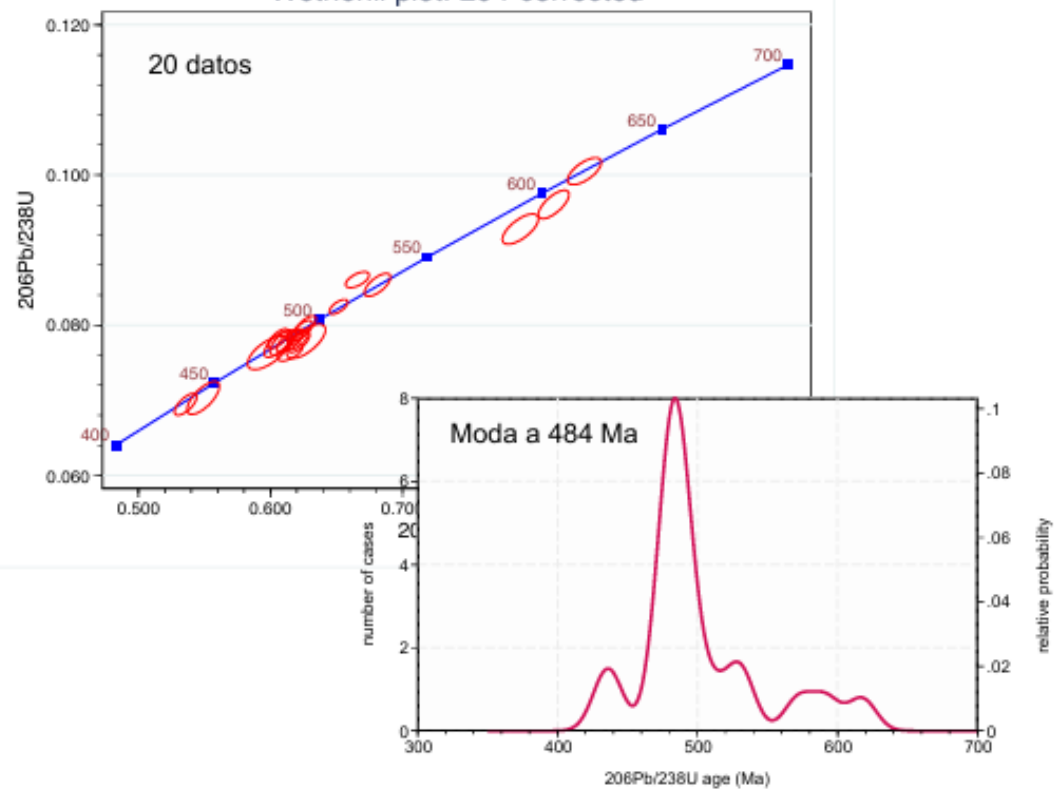
Wetherill plot. Common-lead uncorrected



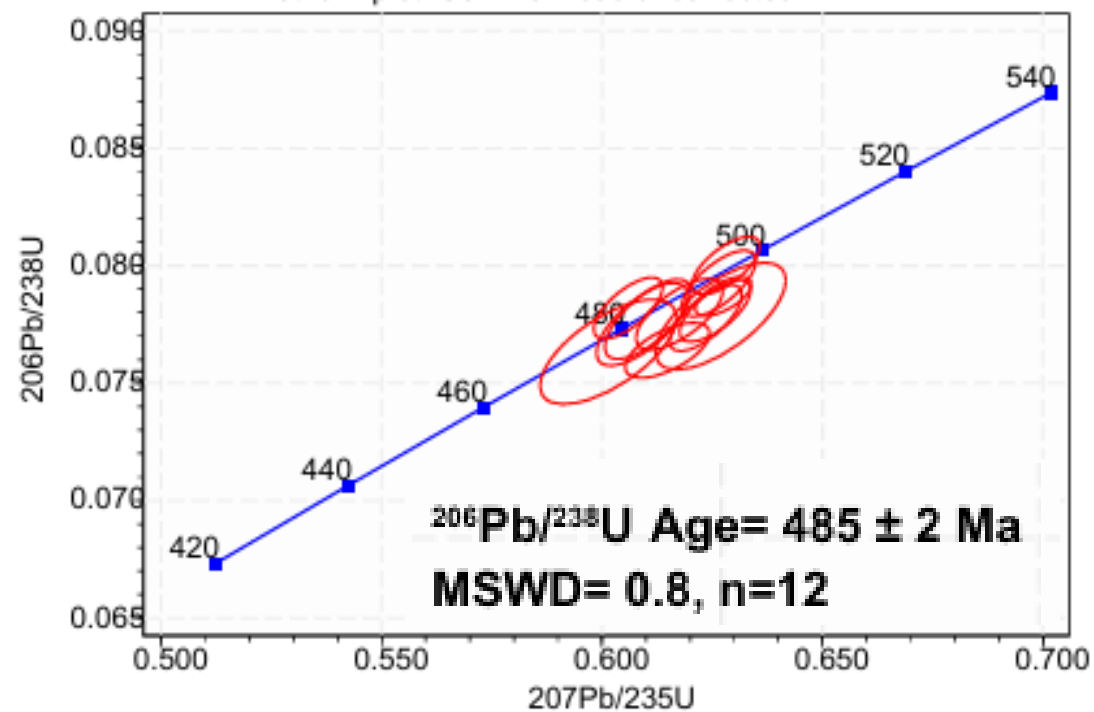
Geochronology – SHRIMP U-Pb zircon



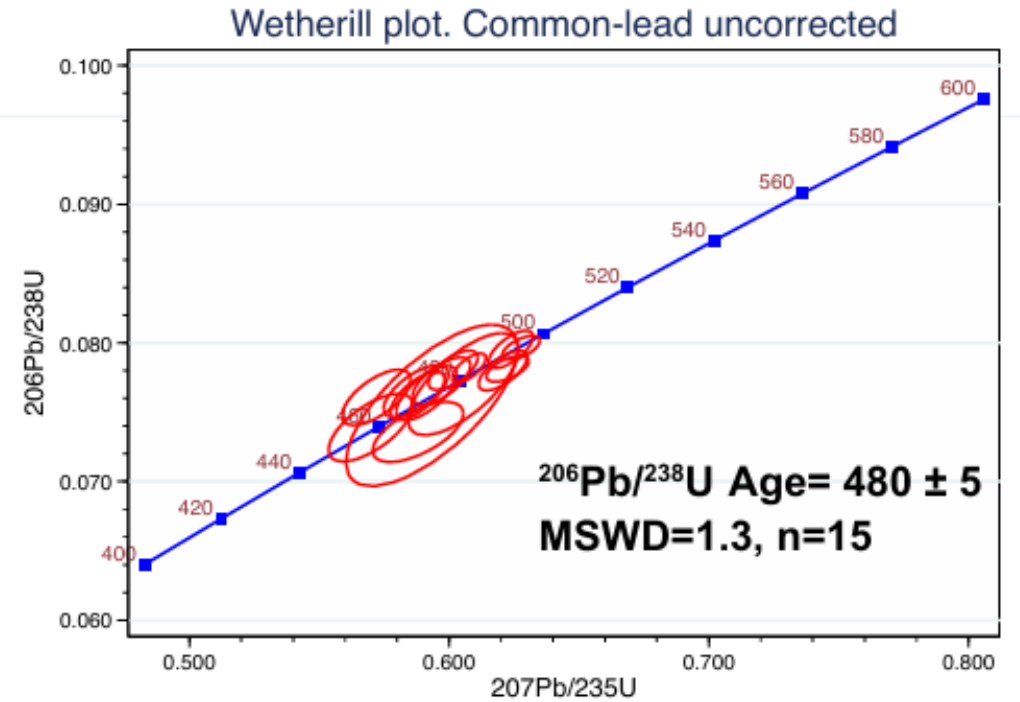
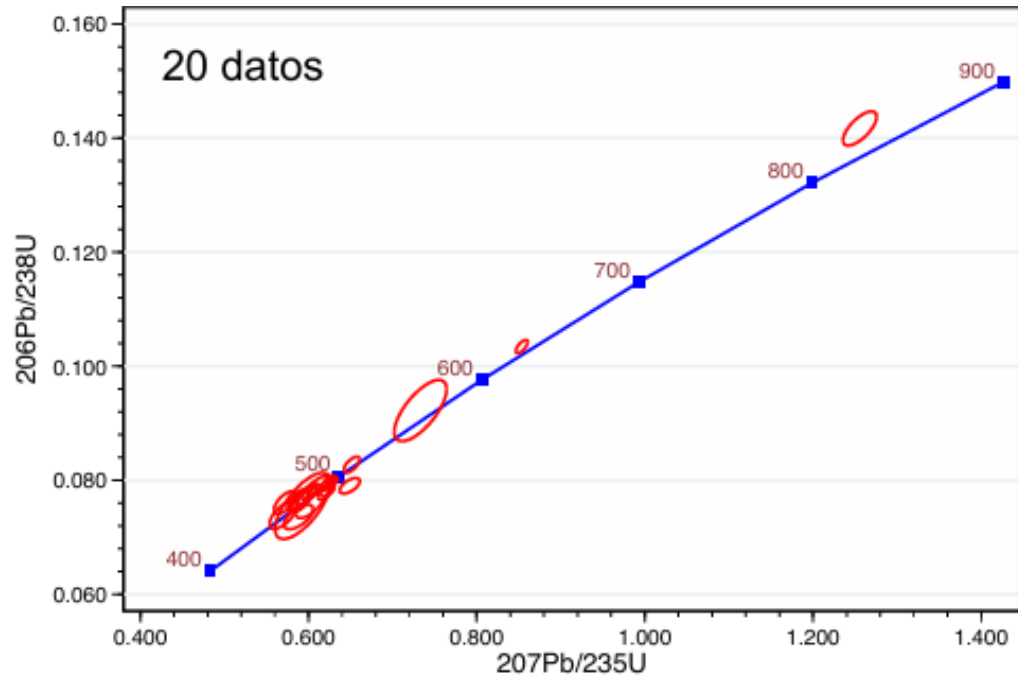
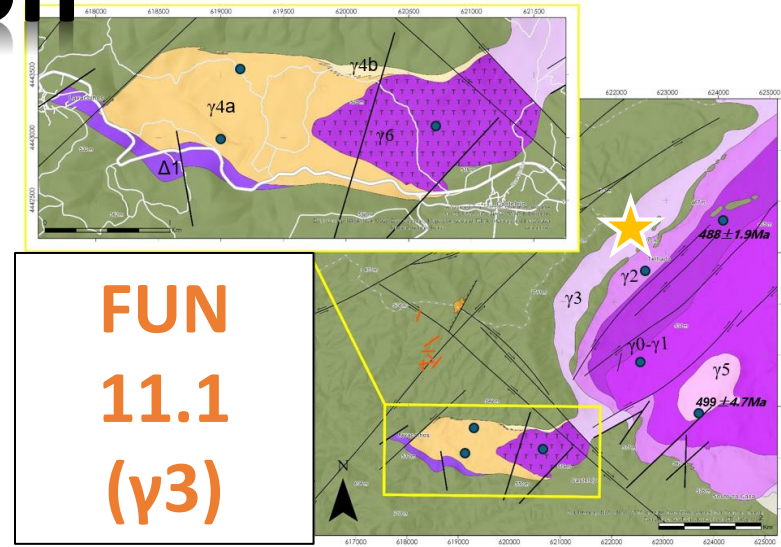
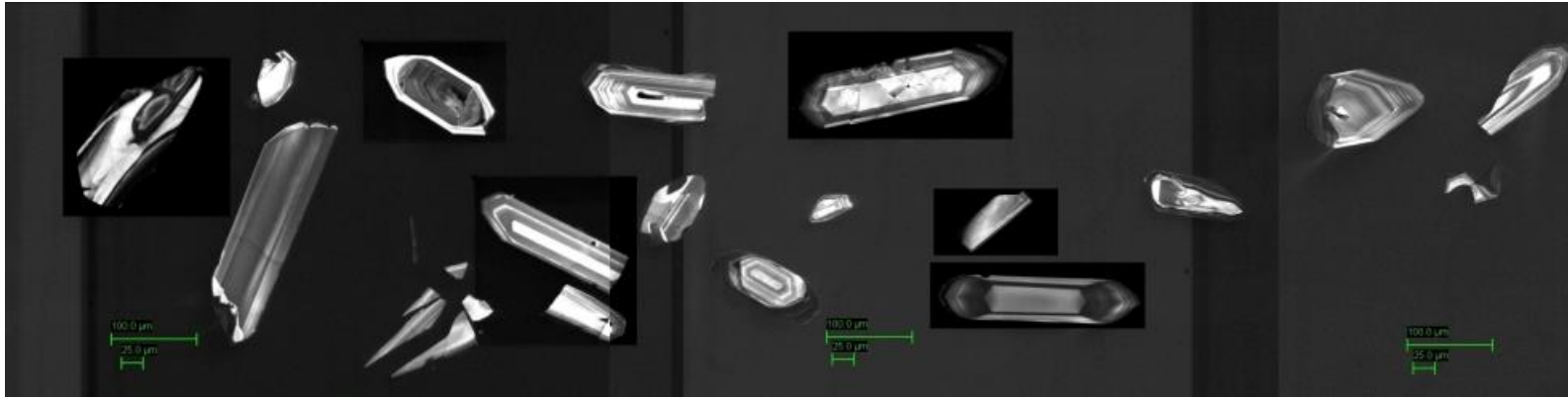
Wetherill plot. 204-corrected



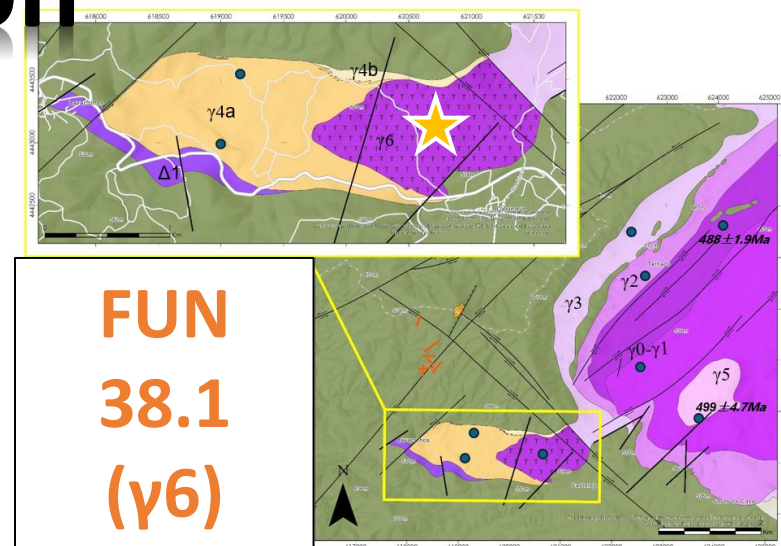
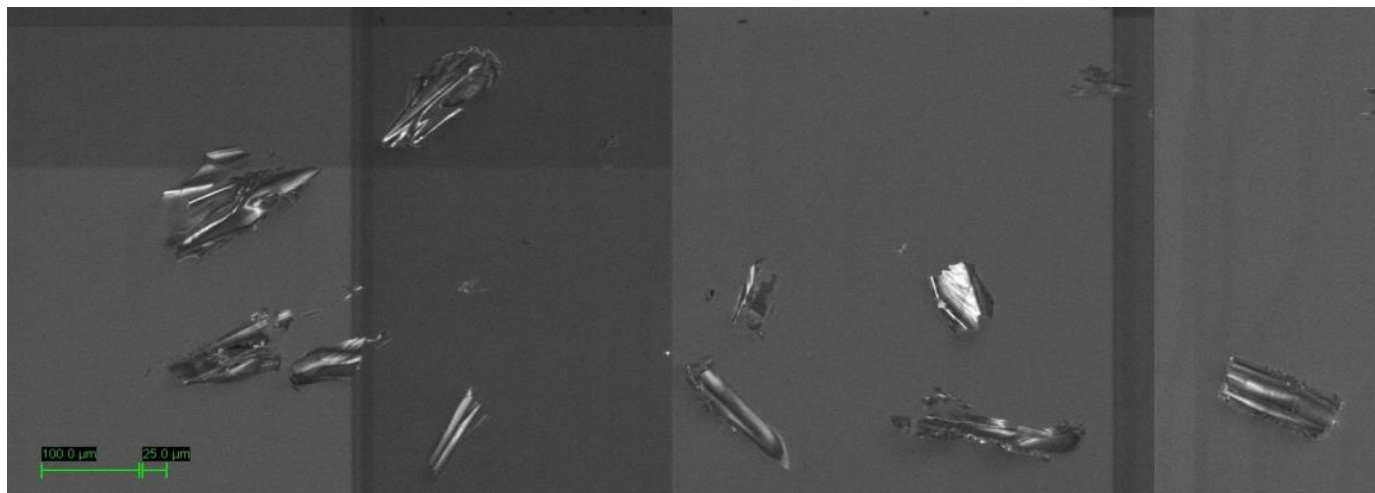
Wetherill plot. Common-lead uncorrected



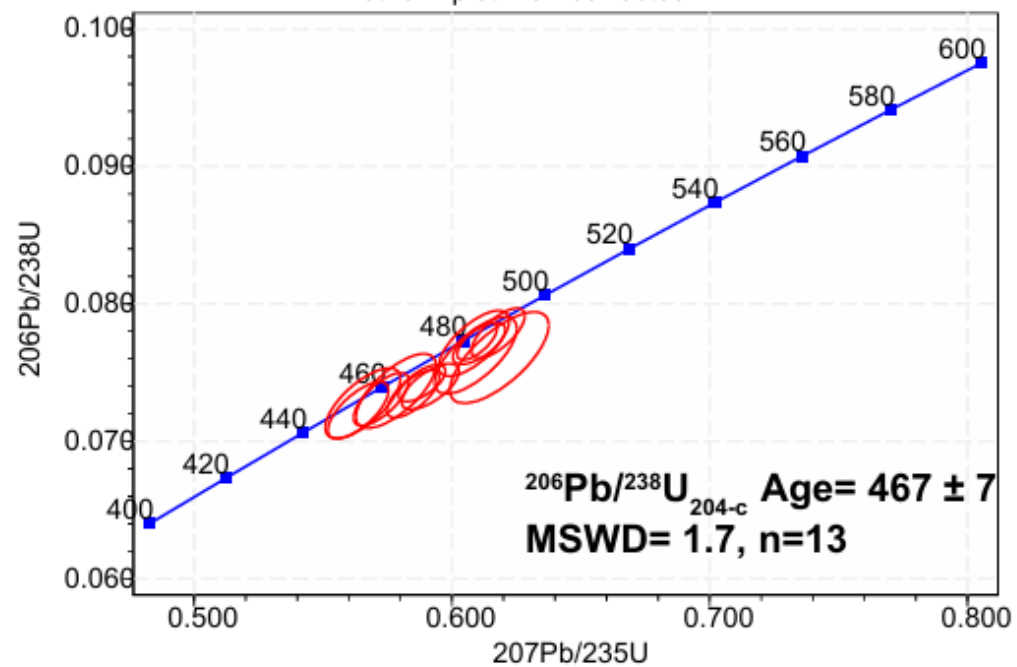
Geochronology – SHRIMP U-Pb zircon



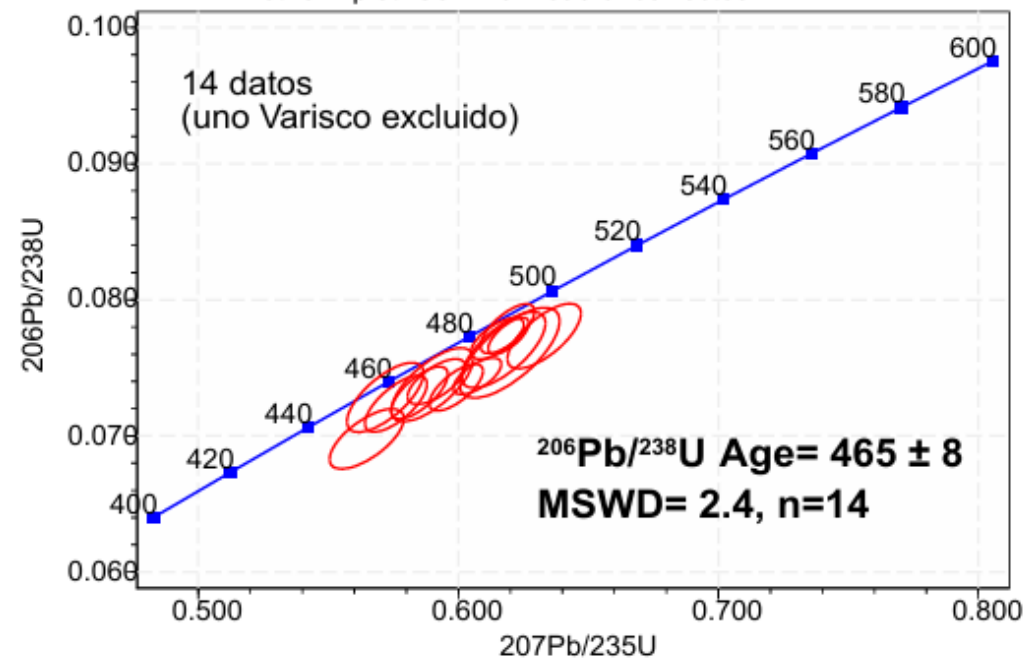
Geochronology – SHRIMP U-Pb zircon



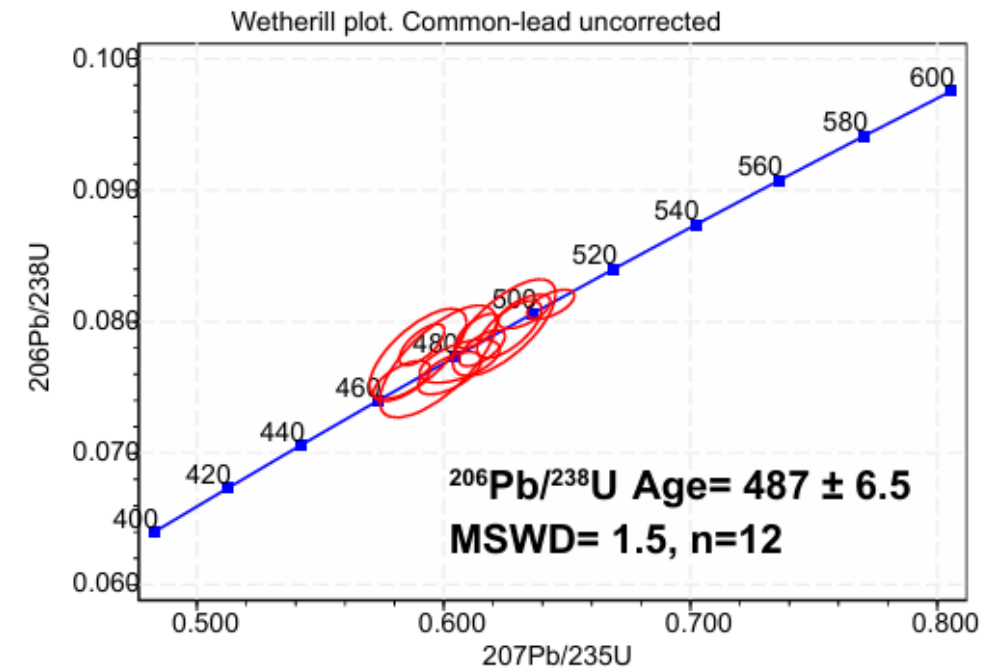
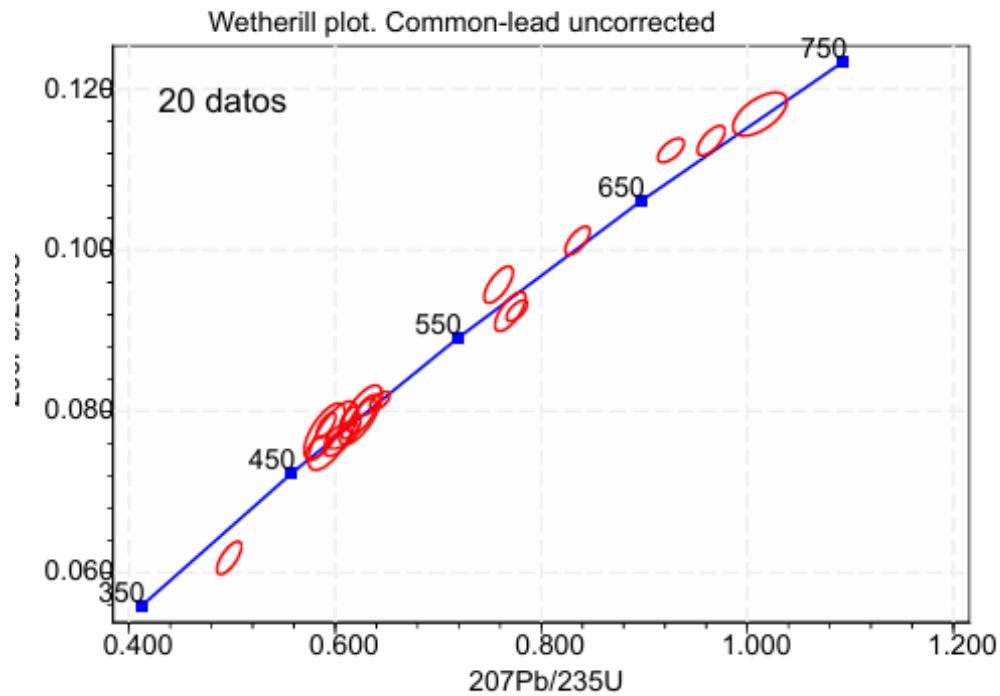
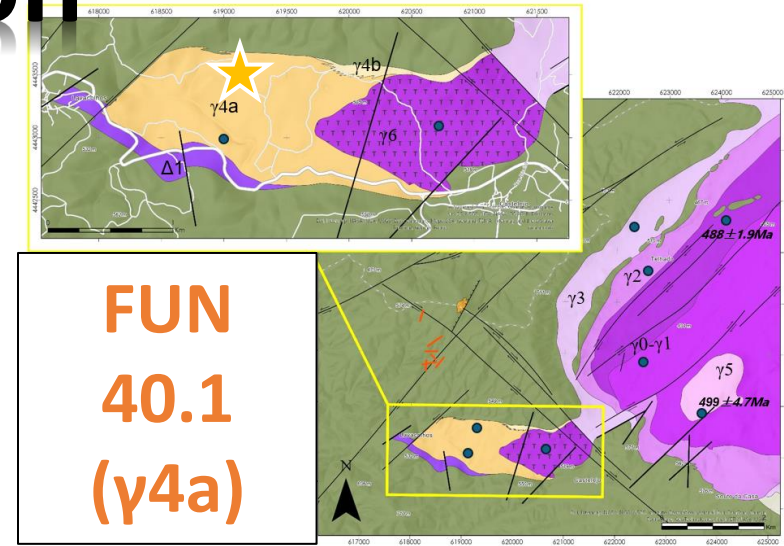
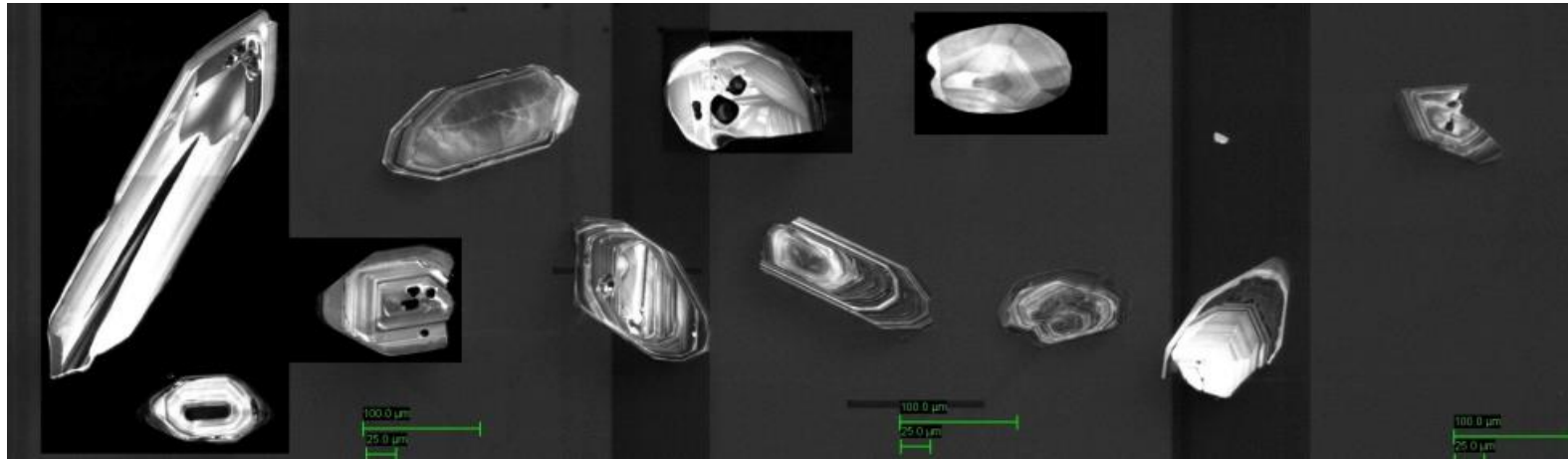
Wetherill plot. 204-corrected



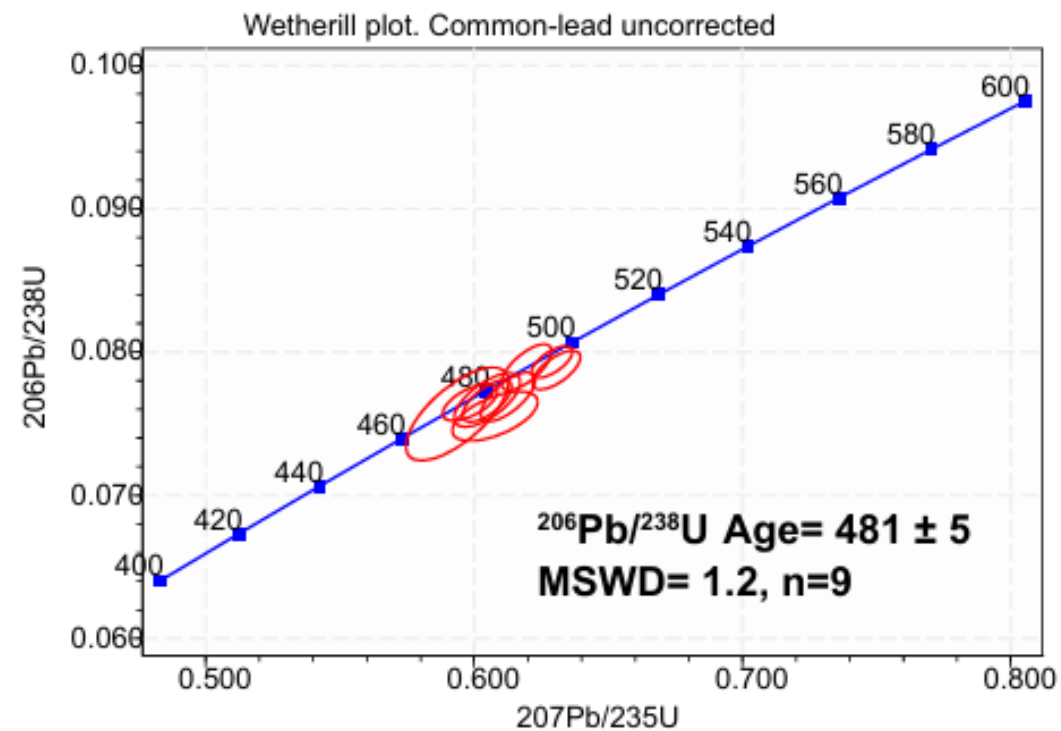
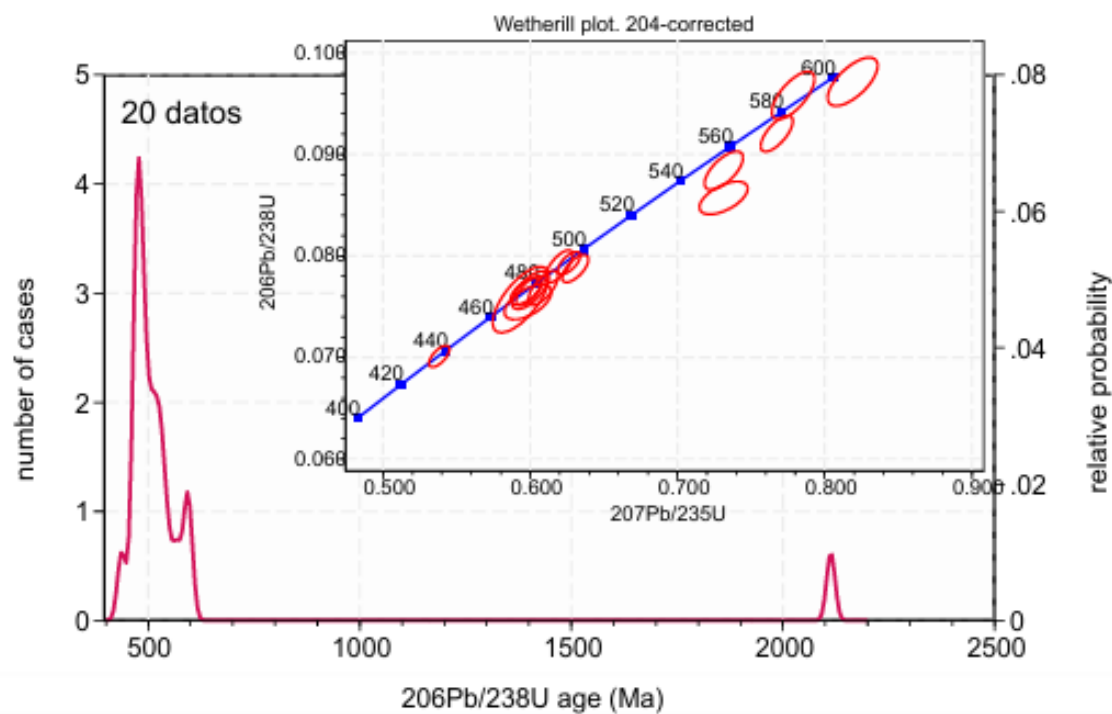
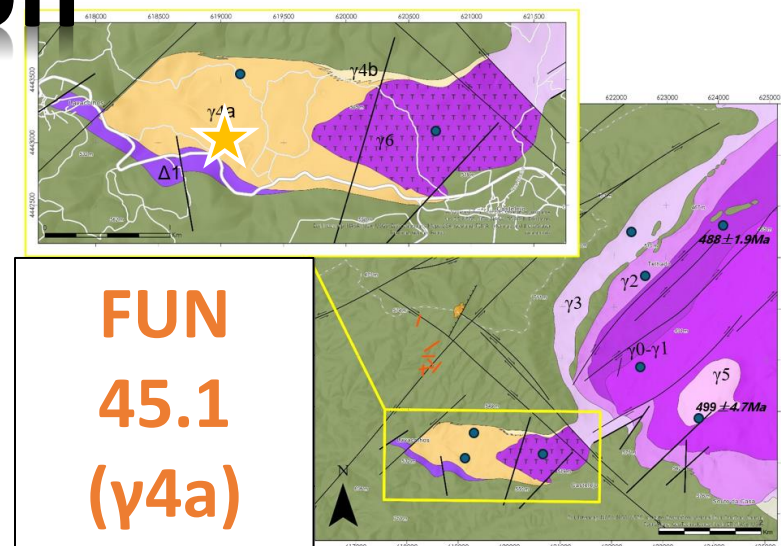
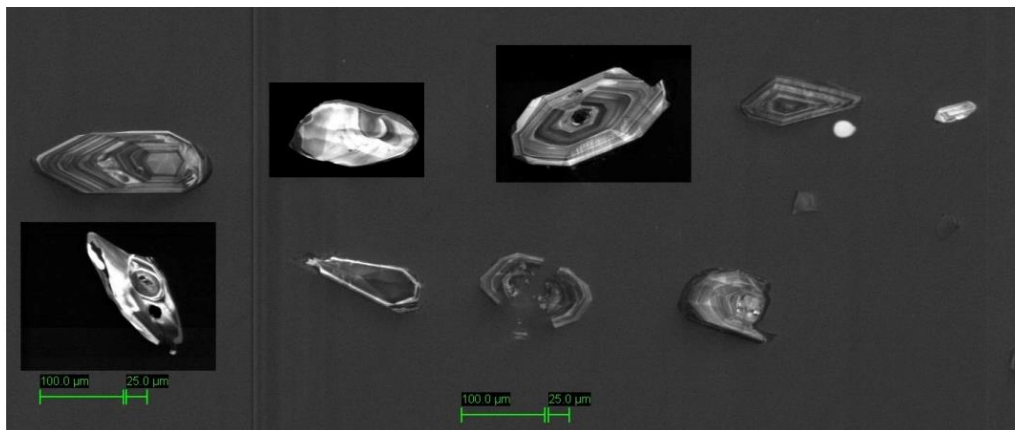
Wetherill plot. Common-lead uncorrected



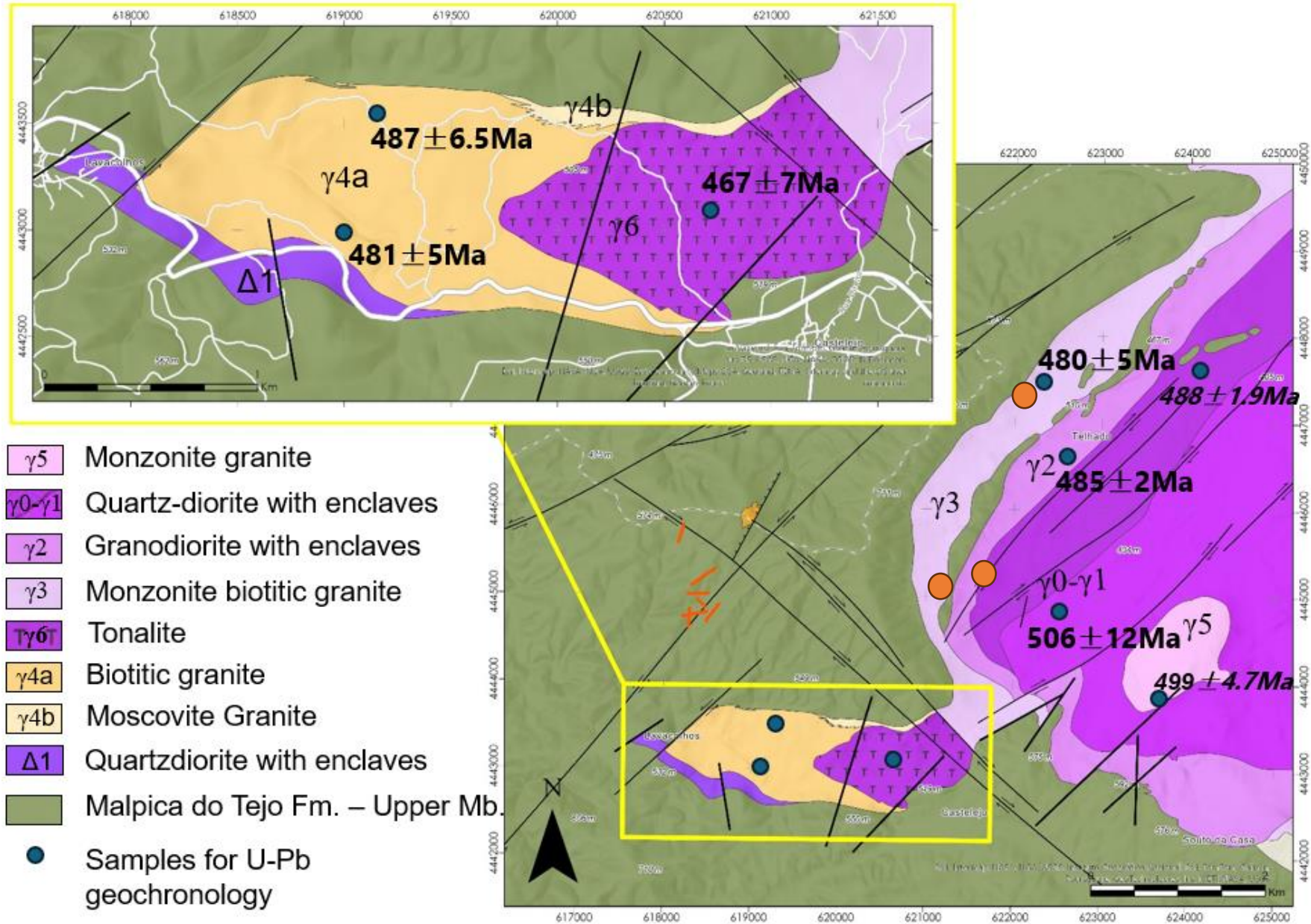
Geochronology – SHRIMP U-Pb zircon



Geochronology – SHRIMP U-Pb zircon



W and SW border of Fundão pluton: Magmatic ages



Fundão pluton facies

- Tonalite to granite rocks;
- Calcic to calc-alkalic series and magnesian granitoid rocks;
- Most rocks are weakly peraluminous I-type and S-type except the tonalite (γ_6) and one sample from quartz-diorite facies and his respective enclave;
- Enrichment (up to 4x UCC) in Cs, U and P and depletion in Th, Nb, Ta, Sr and Ti, similar with the other Cambrian-Ordovician granitoids;
- Negative Eu anomalies in the concentration of REE normalized to chondrites;
- Direct zoning, with the oldest core relative to the border (apart from the branched facies) with concordia ages ranging approximately from 500Ma to 467Ma.



<https://mostmeg.rd.ciencias.ulisboa.pt/>

Thank you for your attention!

Outcrop of quartz- diorite rocks (γ_0 - γ_1 facies) of Fundão pluton (Fundão)