Geological characteristics of the Argemela-Fundão, Mata da Rainha and Segura sectors

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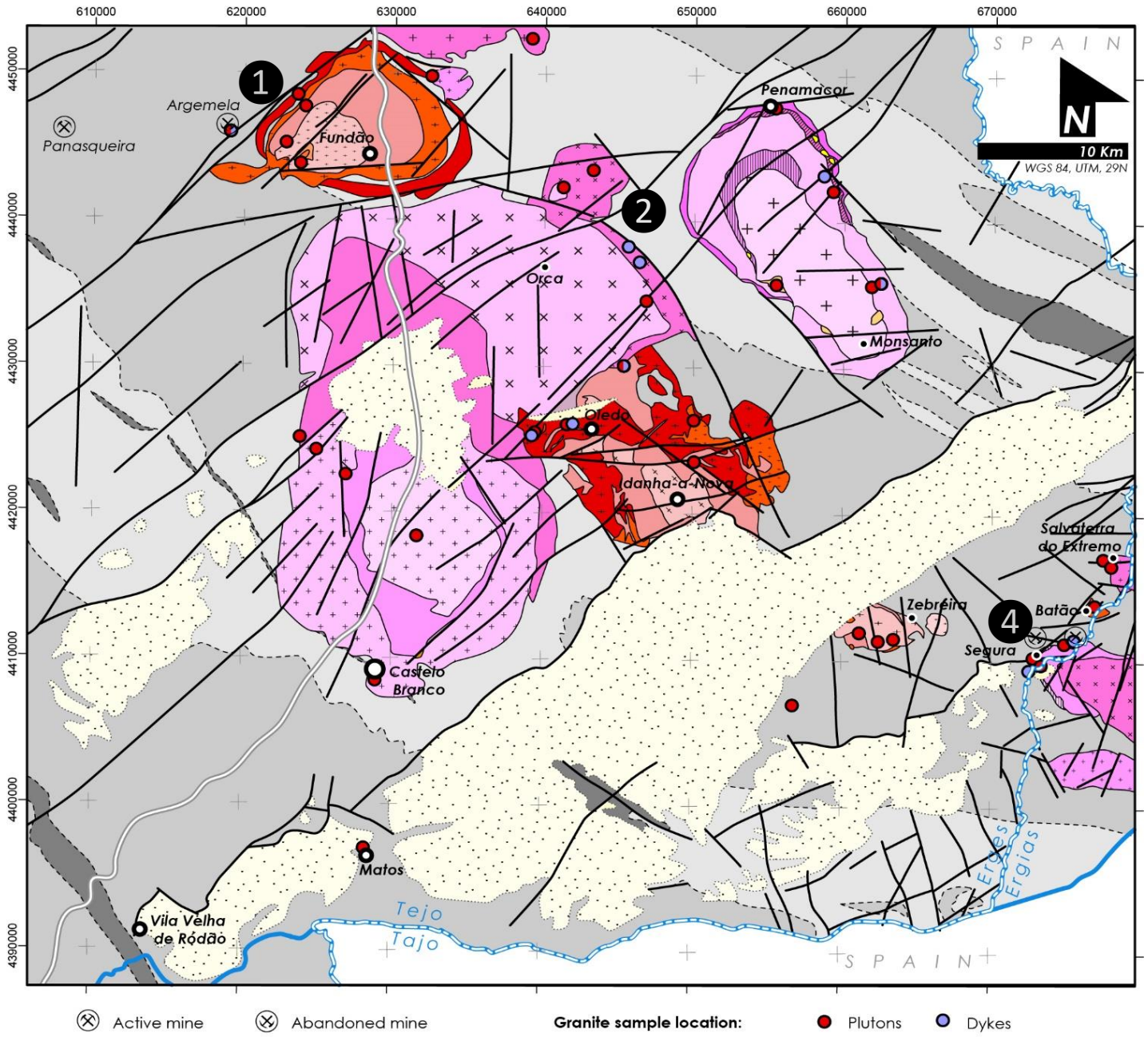
https://mostmeg.rd.ciencias.ulisboa.pt/

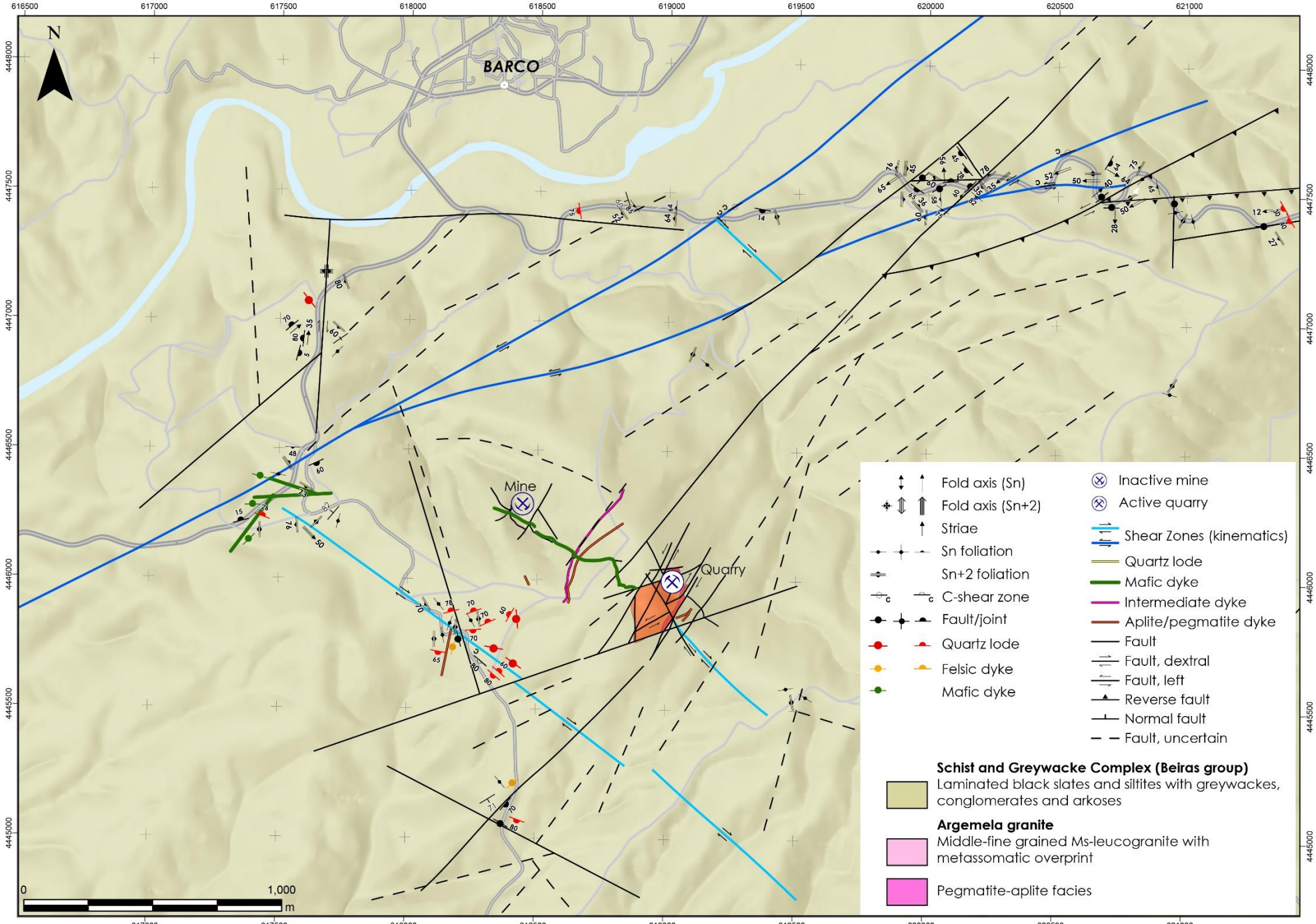
ERA-MIN Joint Call 2019 (EU Horizon 2020 ERA-NET Co-fund Project ERA-MIN2, Grant agreement Nº 730238)

Selected sectors

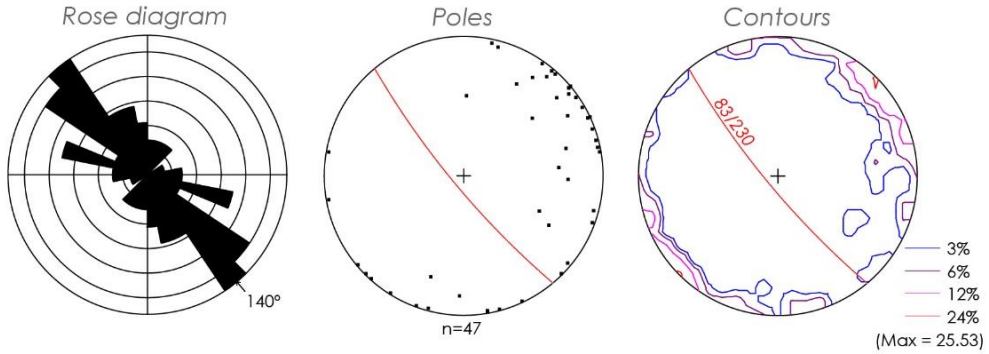


1. Argemela-Fundão
2. Mata da Rainha
3. Segura

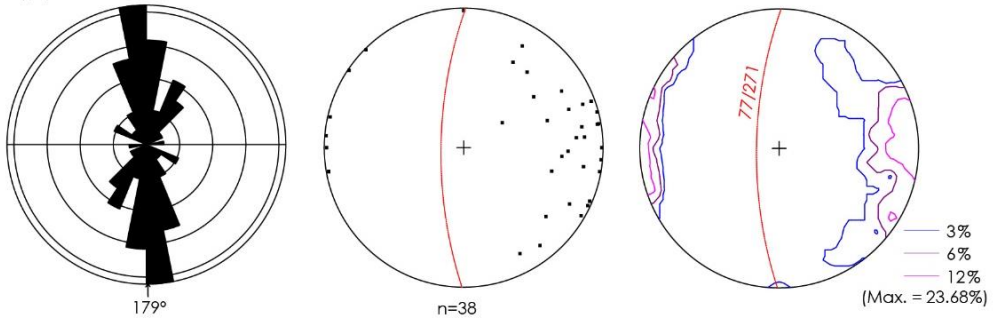

Argemela-Fundão N-NW subsector


N
BARCO
Mine
Quarry
0
1,000
m
Fold axis (Sn)
Fold axis (Sn+2)
Striae
Sn foliation
Sn+2 foliation
C-shear zone
Fault/joint
Quartz lode
Felsic dyke
Mafic dyke
Inactive mine
Active quarry
Shear Zones (kinematics)
Quartz lode
Mafic dyke
Intermediate dyke
Aplite/pegmatite dyke
Fault
Fault, dextral
Fault, left
Reverse fault
Normal fault
Fault, uncertain
Schist and Greywacke Complex (Beiras group)
Laminated black slates and siltites with greywackes, conglomerates and arkoses
Argemela granite
Middle-fine grained Ms-leucogranite with metassomatic overprint
Pegmatite-aplite facies

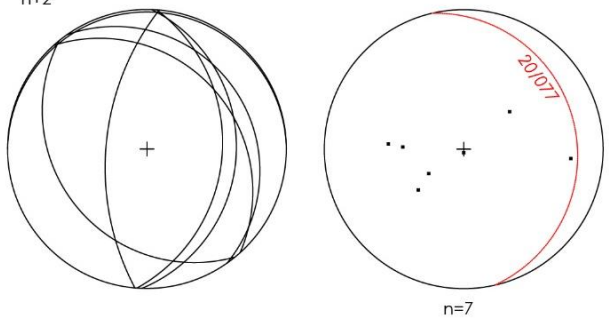
S_n foliation



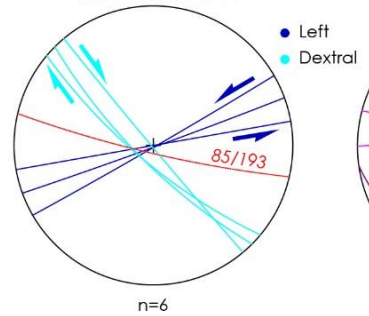
S_{n+1} foliation



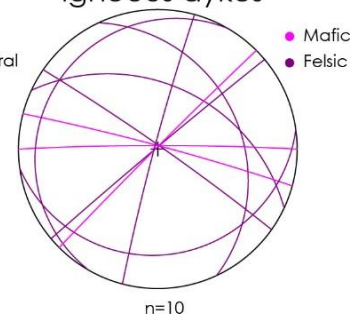
S_{n+2} foliation



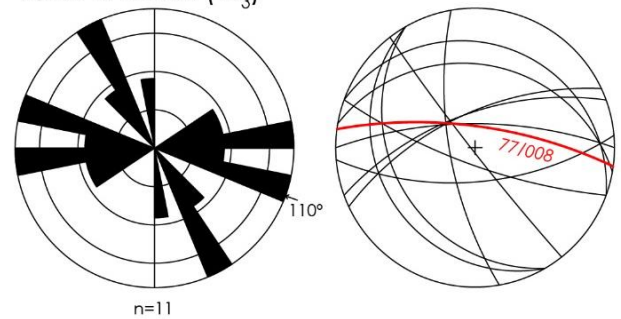
Shear zones



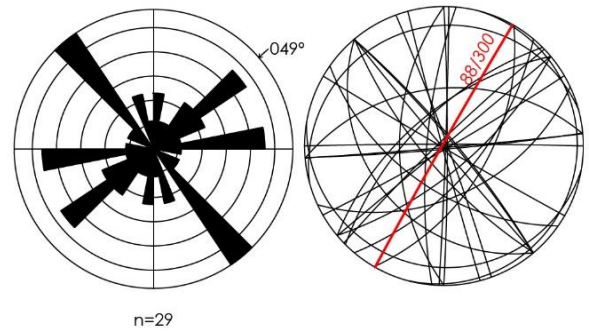
Igneous dykes



Quartz lodes (G_3)

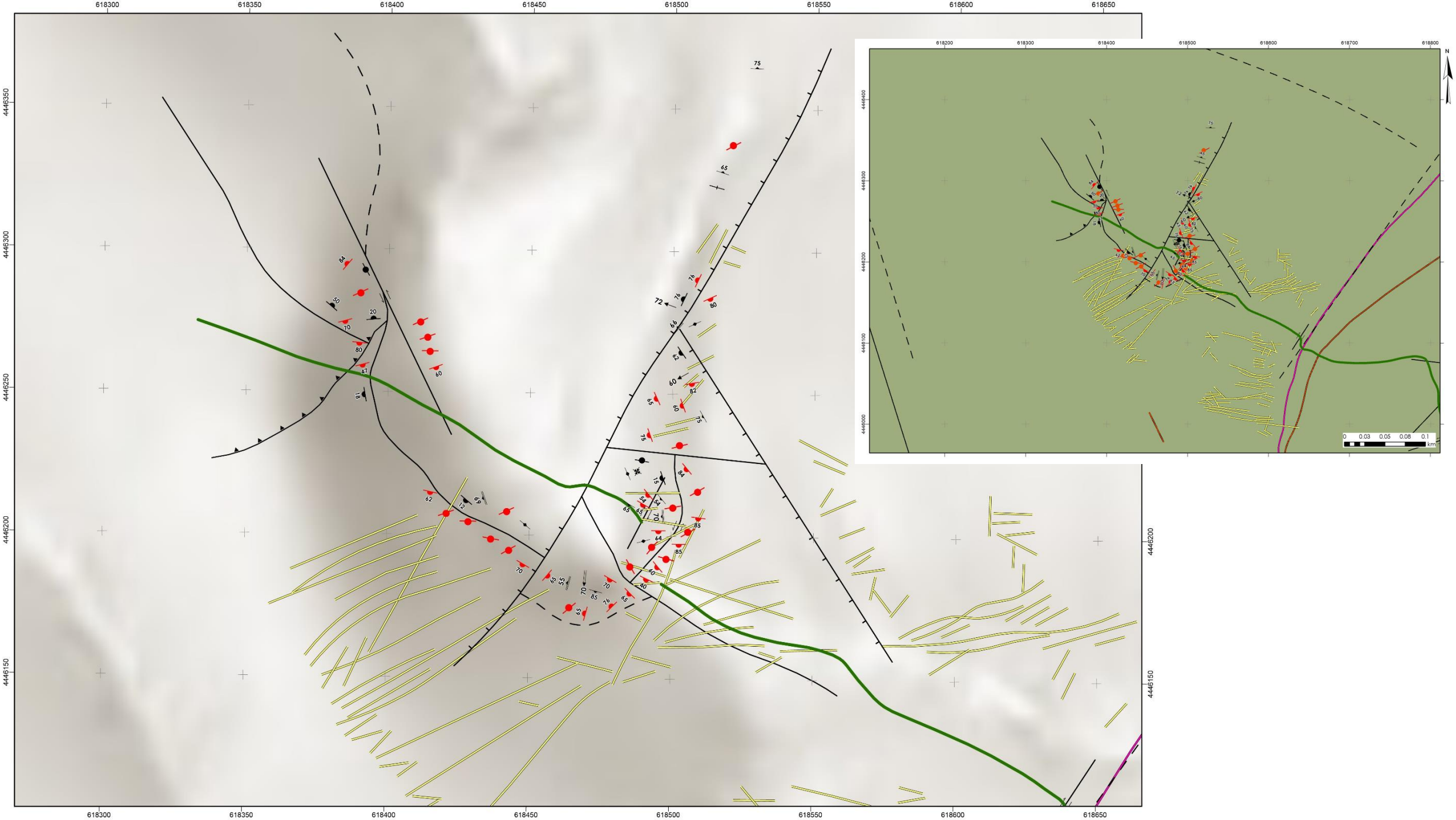


Faults




3D
Google
100%
Imagery date: 5/26/19–newer
60 m
Camera: 946 m 40°09'27"N 7°36'33"W 560 m

Pedra Alta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618800
4446400
4446300
4446200
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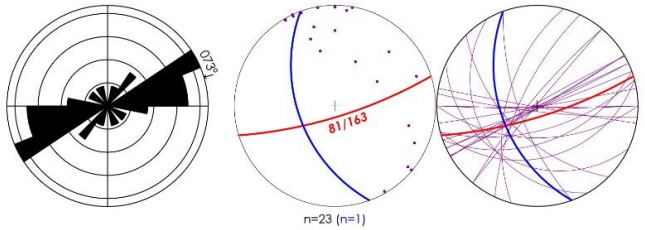
N
0 0.03 0.05 0.08 0.1
km

MOSTMEG-ERAMIN2 Project

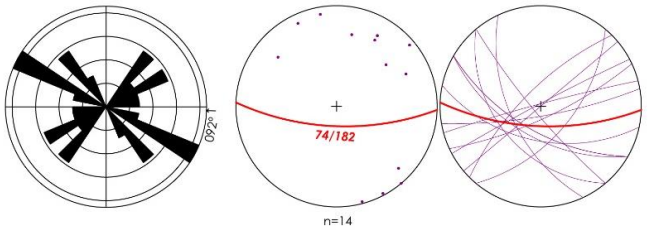
Stereographic projection: Argemela mine | ***Data source***: New data (1:1.000 surveys)

Quartz lodes

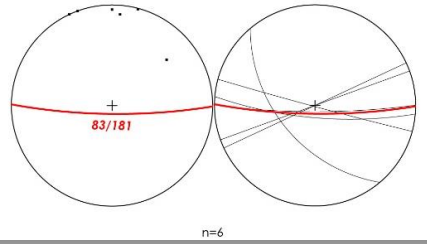
G3 (G3*: with Sn and W)



G3' (early, folded, boudinaged)

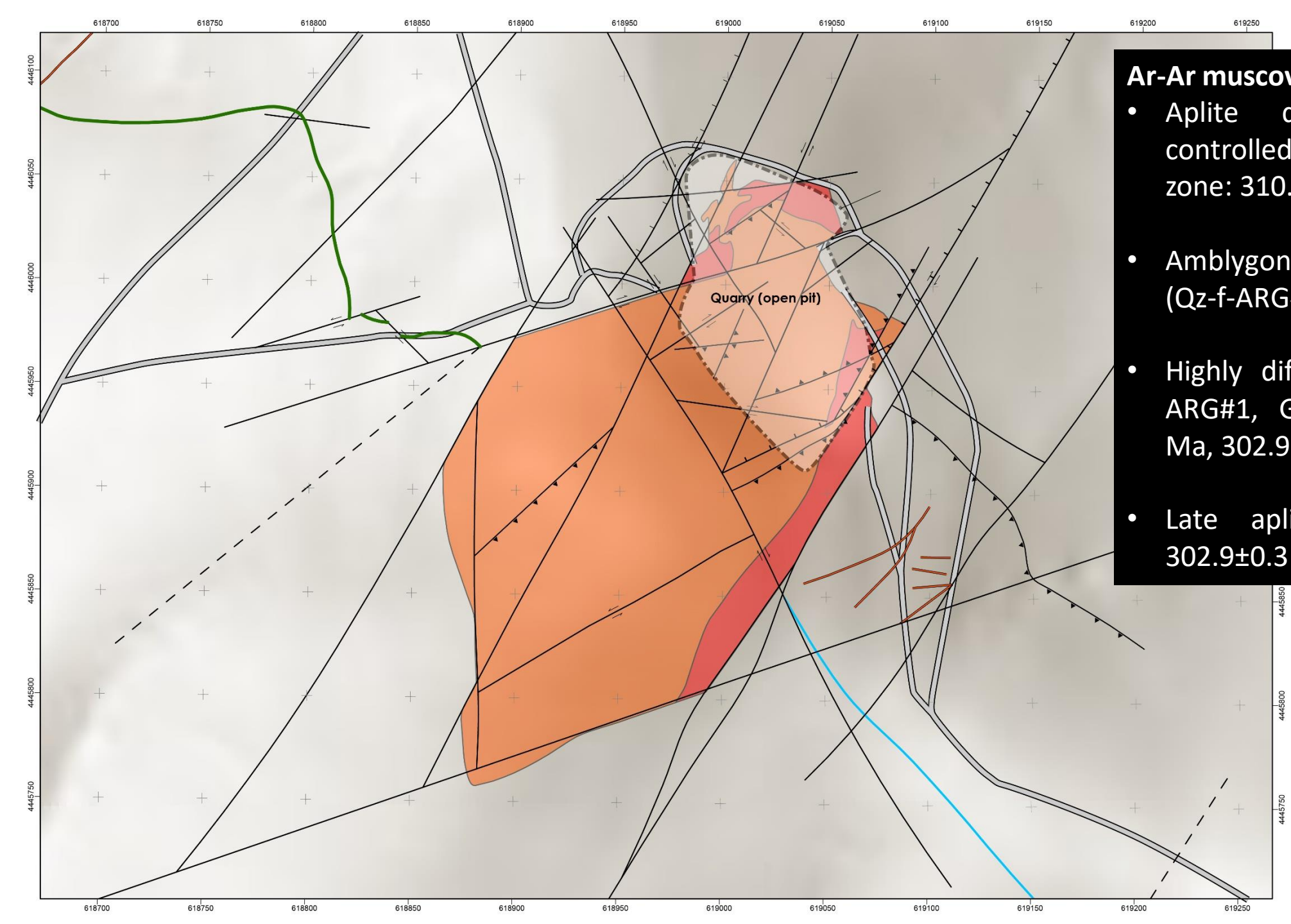


"Phosphate"



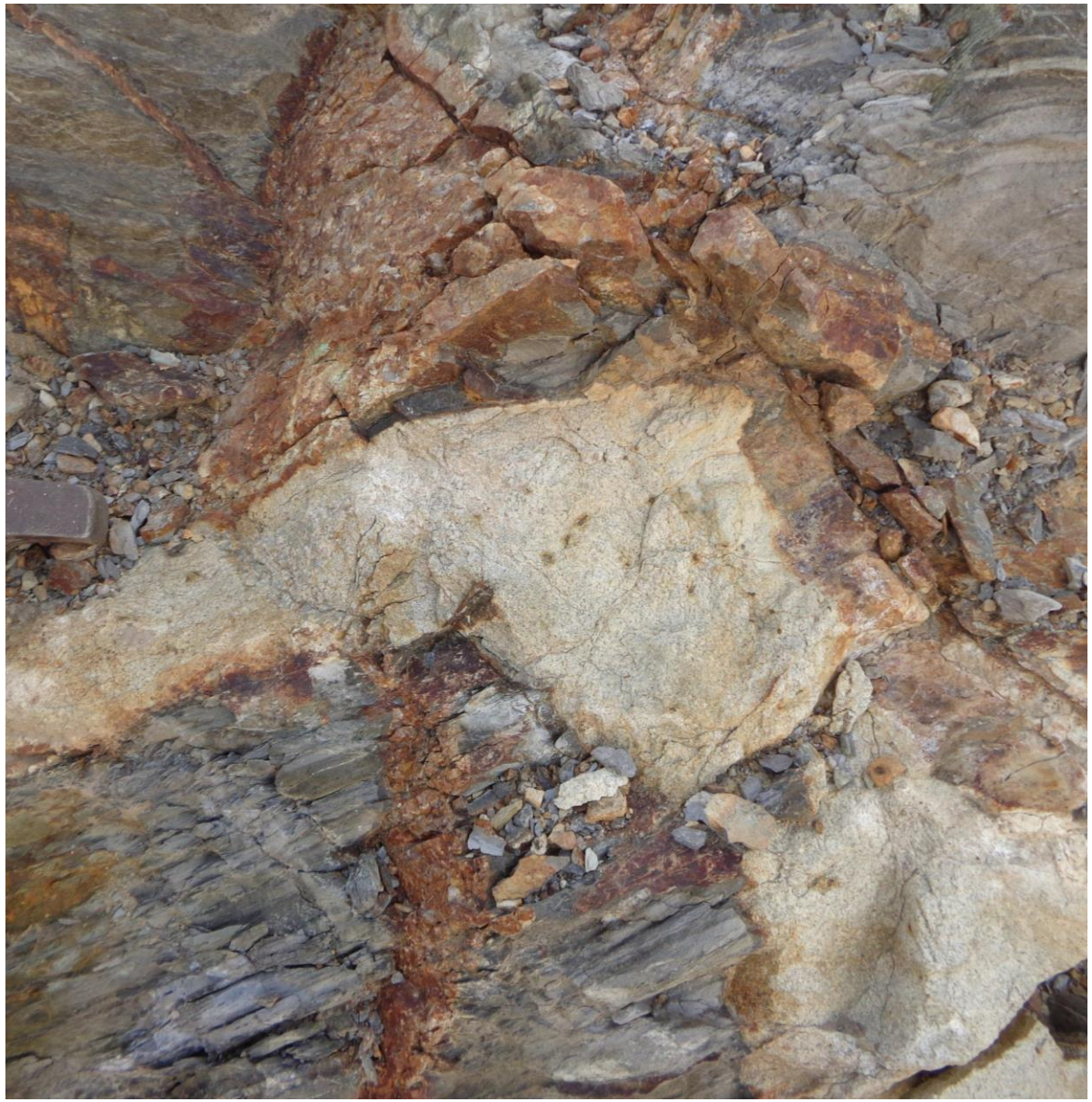

D BOOK
MEG
ADOWS
Office

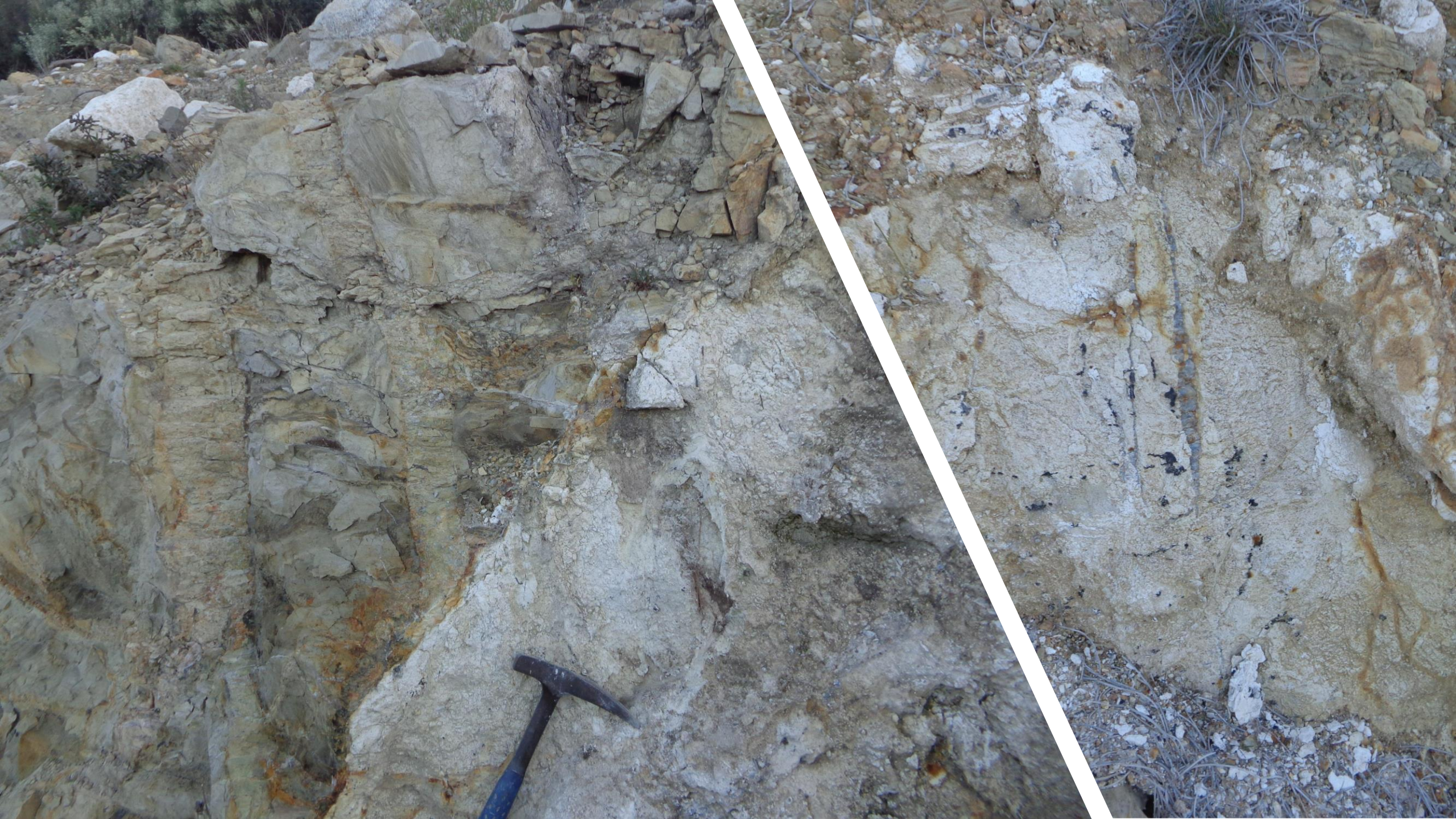
Cabeço de Argemela

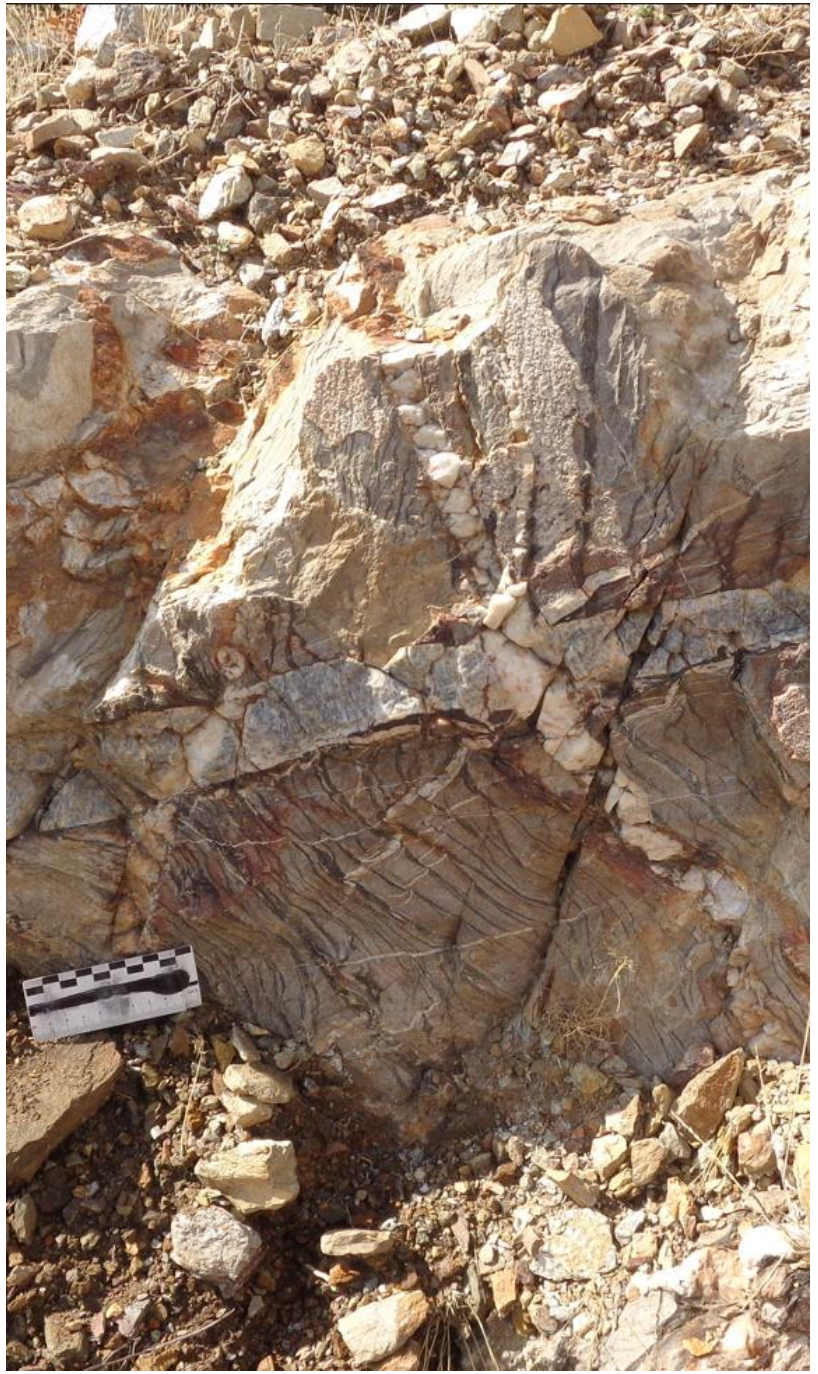


Ar-Ar muscovite:

- Aplite dyke deformed and controlled by a regional shear zone: 310.9 ± 0.3 Ma
- Amblygonite-bearing quartz veins (Qz-f-ARG#2): 308.3 ± 1.9 Ma
- Highly differentiated granite (G-ARG#1, G-ARG#2): 302.6 ± 0.6 Ma, 302.9 ± 0.3 Ma
- Late aplite dyke (Gf-ARG#4): 302.9±0.3 Ma





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MEADOWS
Outdoors
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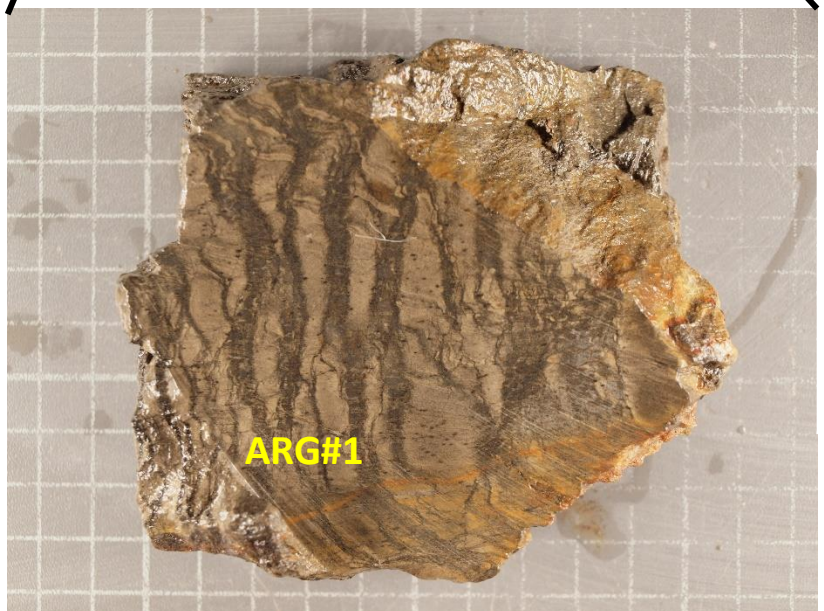
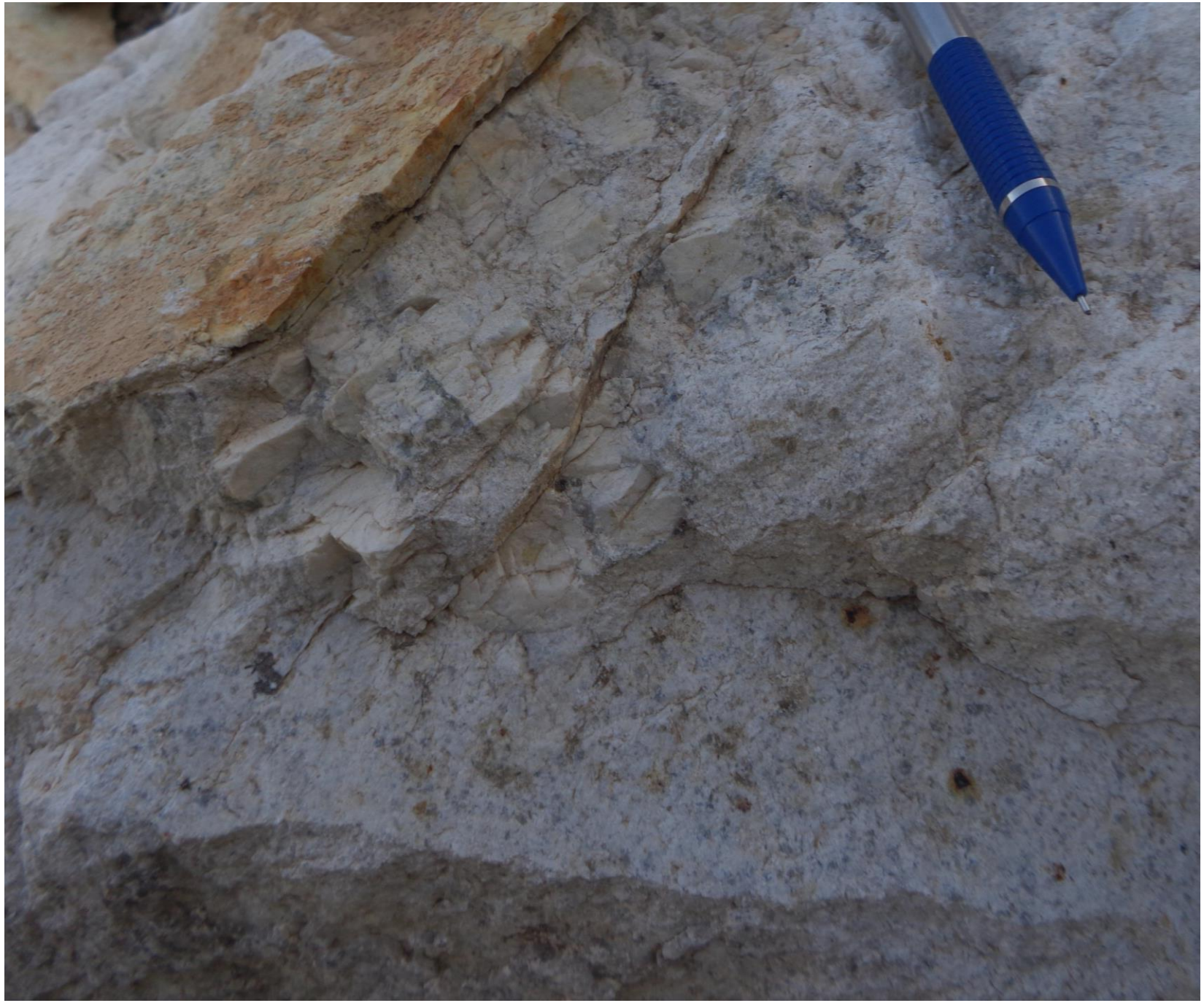
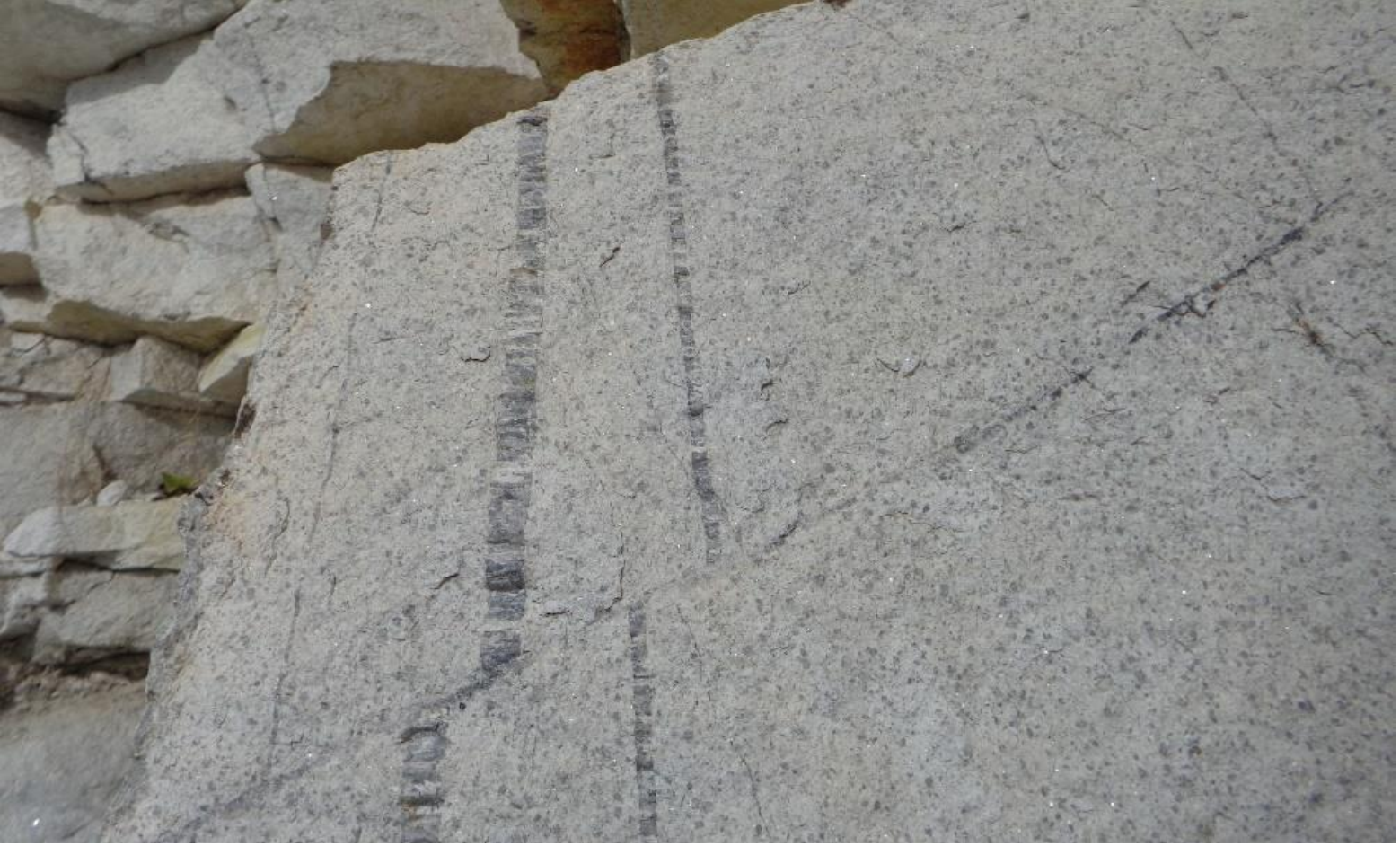


Sample	F	Be	Li	B	Cs	Ba	Nb	Ta	Sn	Rb/Sr
ARG#1	4800	14	1120	1980	448	589	14	1.01	62	22
G_ARG#1	2500	114	1110	56	115	26	60.1	65.7	588	6
G_ARG#2	2300	108	2240	40	45.6	7	55.7	51.2	687	38
Gf_ARG#1	1600	44	900	85	77.2	22	86.6	114	803	23
Gf_ARG#2	1500	107	800	36	74.7	4	32.9	32.1	62	232

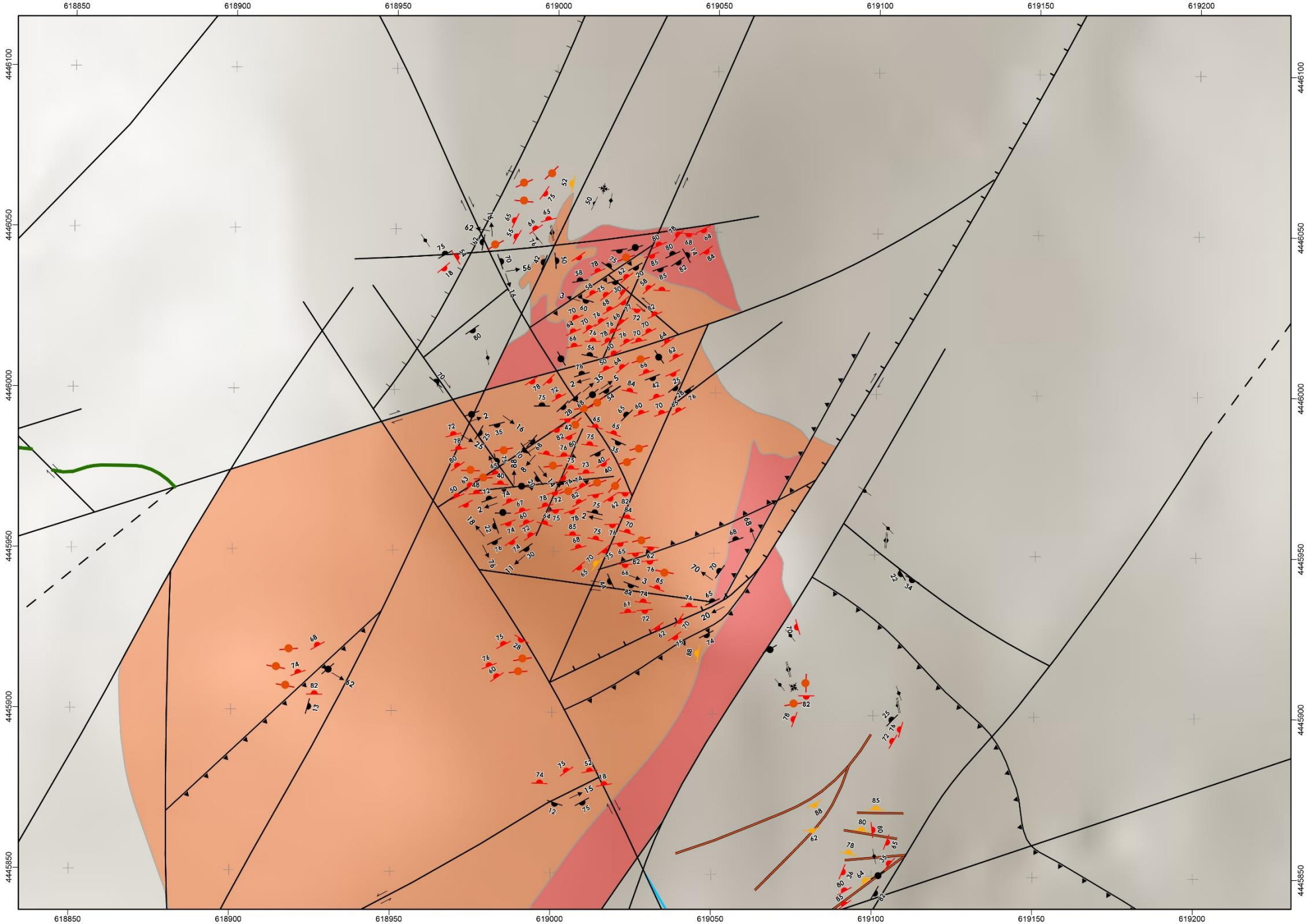





FIELD BOOK
MostMeg
2021 –


6


BOOK
EG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4446050
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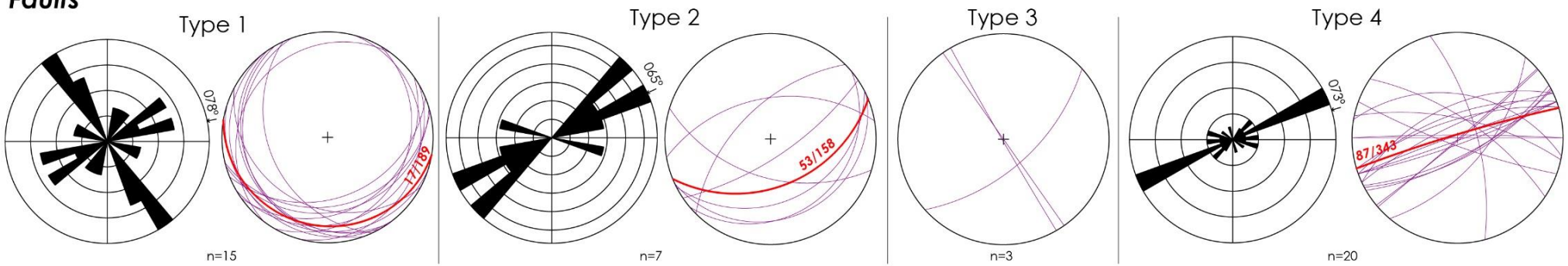
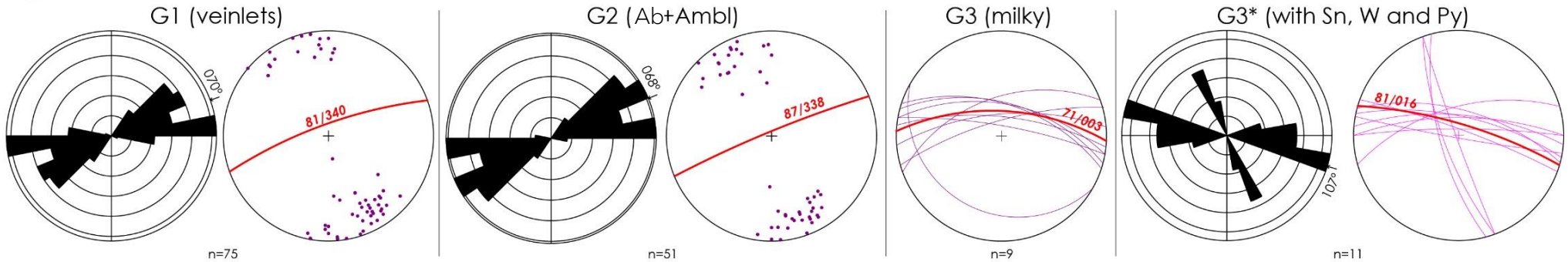
4445850

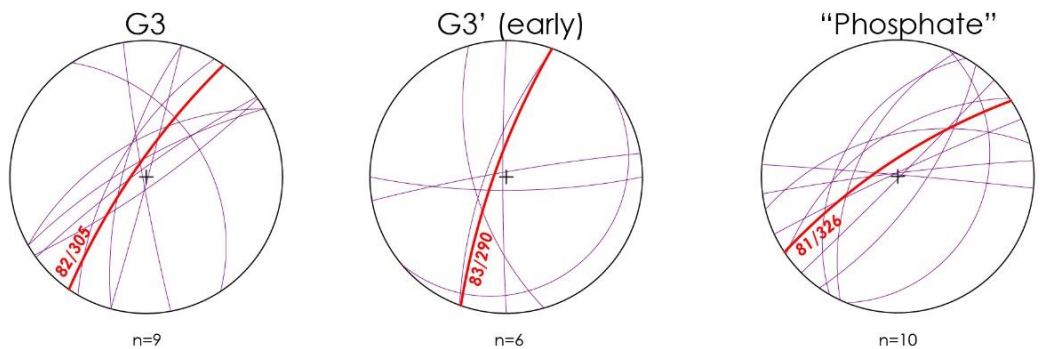
Faults



Quartz lodes



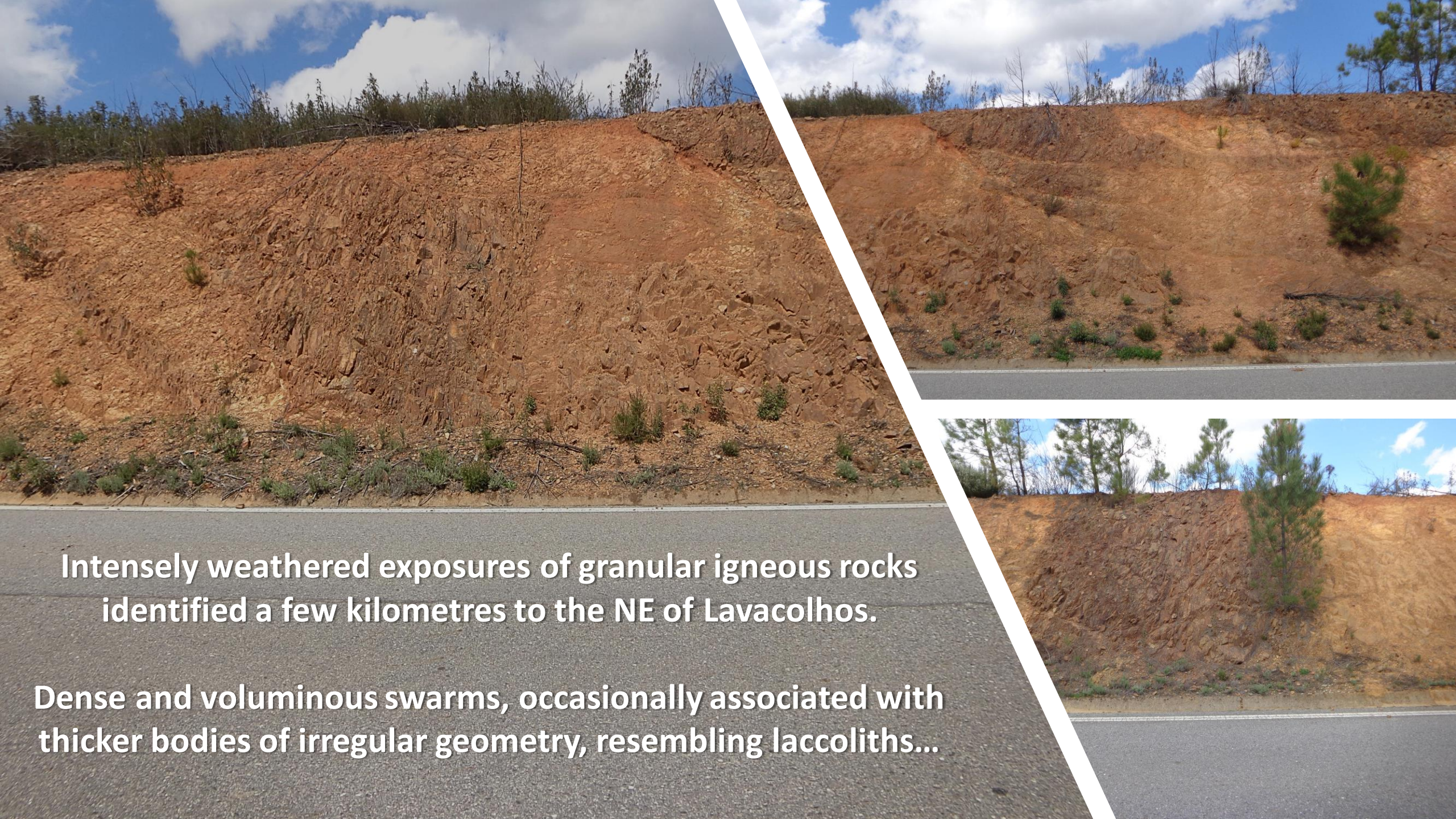
Quartz lodes (Slates and greywackes, Argemela granite host rocks)



SUMMARY

- Some quartz infillings of NW-SE dextral shears were tentatively explored in the past, revealing distinct attributes of quartz veins in Cabeço de Argemela and Pedra Alta;
- The various groups of veins recognized in Cabeço de Argemela and Pedra Alta share several features, but straightforward comparisons between them should be avoided because some vein sets in the latter site preserve evidence of a long evolution, suggesting spatial superposition of effects due to diachronic mineralizing events;
- The hydrothermal alteration affecting metasediments adjoining the Cabeço de Argemela granite is strong, leading to significant compositional changes and obliterating early-developed blastesis due to contact metamorphism;
- This alteration, conceivably related to the mineralising events (or, at least, some of them) and expressed mainly by the growth of fine-grained mica (*bt>ms*) aggregates variably enriched in tourmaline, is identifiable macroscopically until ca. 25-30 m away from the contact with the granite;

- Retrogression path indicates an early mineral blastesis, prior to the Cabeço de Argemela granite emplacement (and subsequent changes associated with mineralising processes).
- Spotted schists extend over a vast area, going far beyond the contact metamorphic halo (strictly) related to the Fundão pluton, which appears to be limited to a band of several tens of meters around the intrusive body (locally including banded hornfels).
- **Could this spotted schists indicate a large, sub-superficial, Variscan granite body?**
- This hidden granite, acting as a likely root zone for the Argemela plug, could also have served as the source of multiple magma batches feeding different suites of aplite dykes observed in the region.

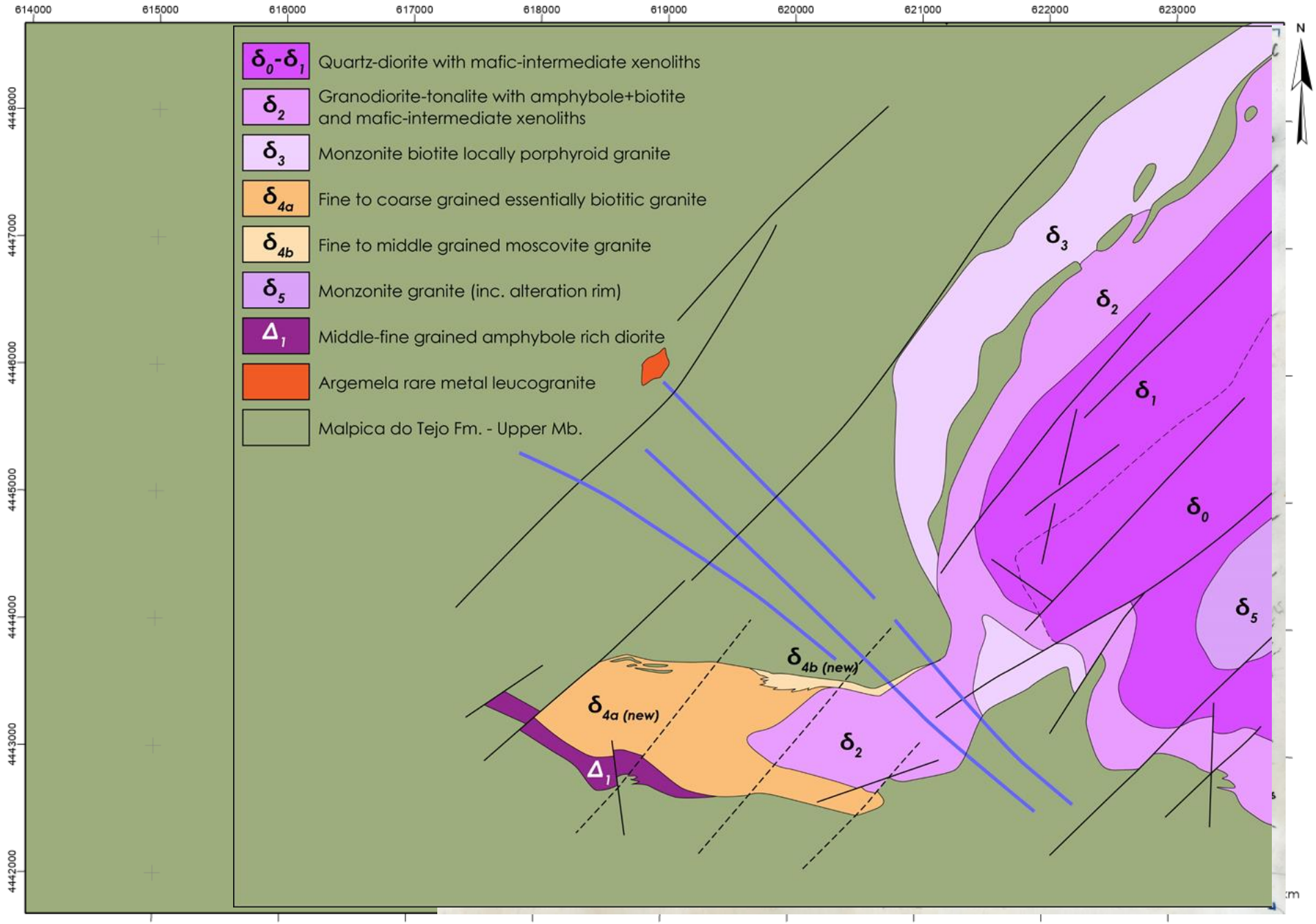


Intensely weathered exposures of granular igneous rocks identified a few kilometres to the NE of Lavacolhos.

Dense and voluminous swarms, occasionally associated with thicker bodies of irregular geometry, resembling laccoliths…


Are they concurrent of the
Argemela granite suites?


Argemela-Fundão S-SE subsector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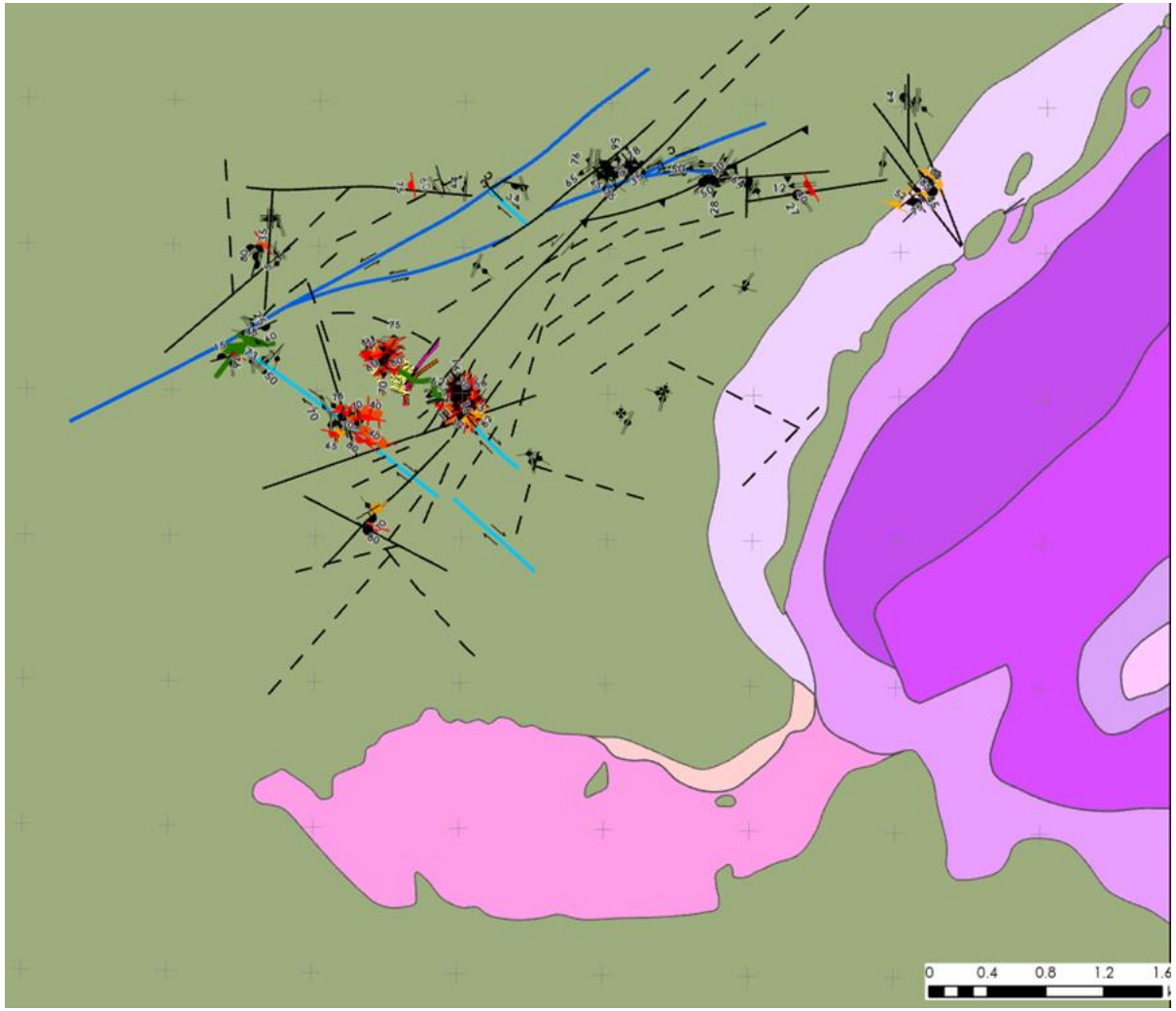
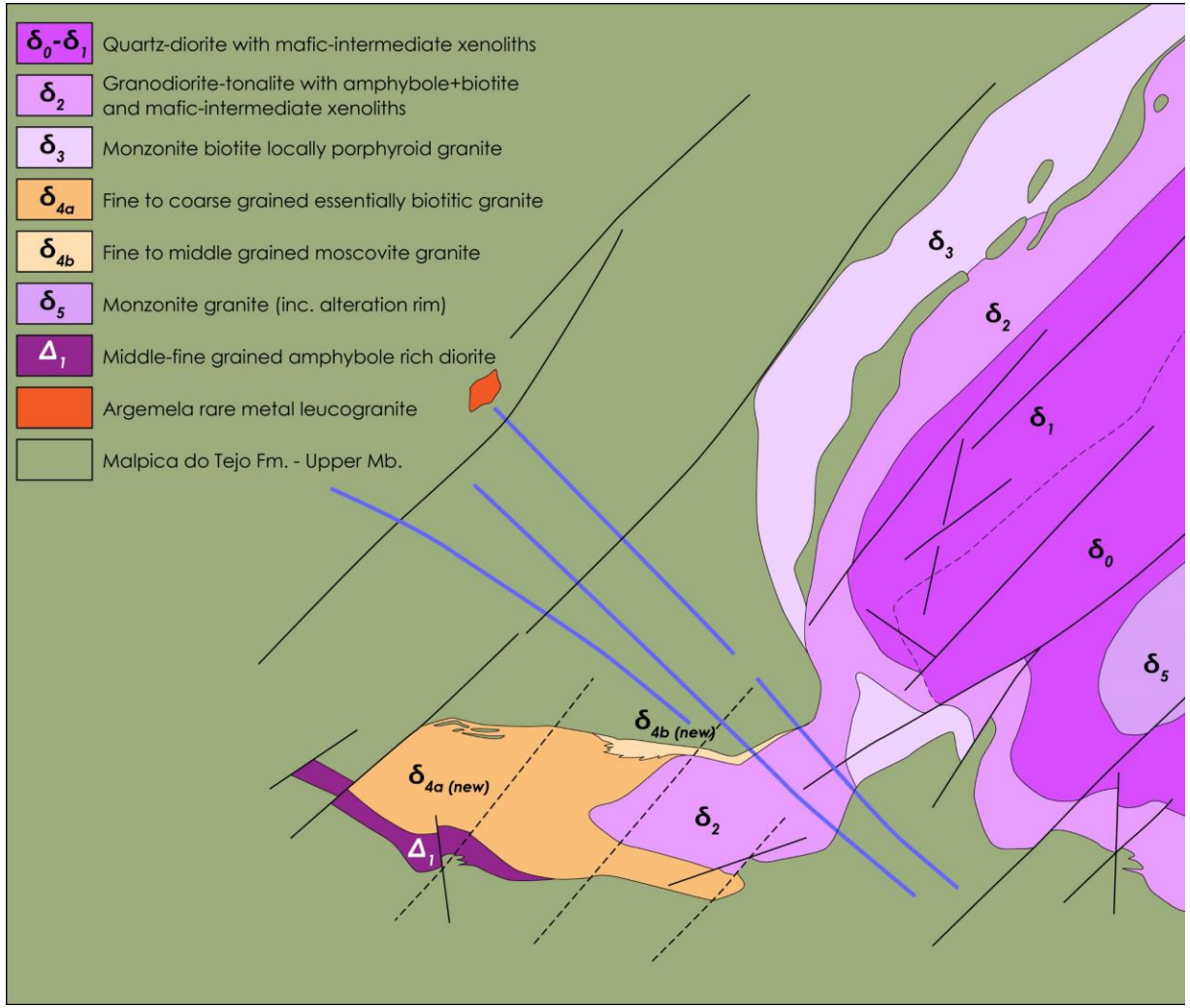
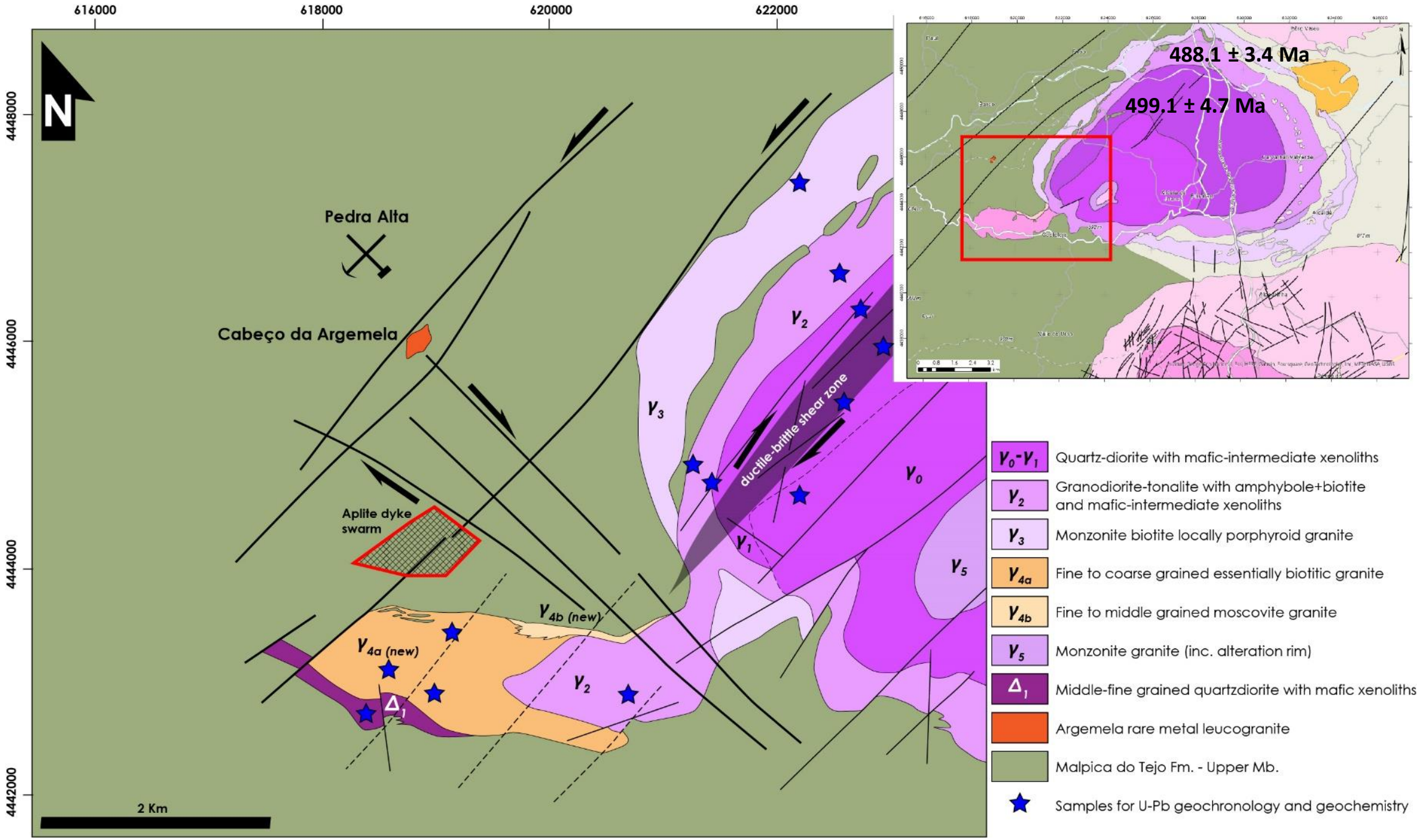
4443000
4442000
N
δ0-δ1 Quartz-diorite with mafic-intermediate xenoliths
δ2 Granodiorite-tonalite with amphybole+biotite and mafic-intermediate xenoliths
δ3 Monzonite biotite locally porphyroid granite
δ4a Fine to coarse grained essentially biotitic granite
δ4b Fine to middle grained moscovite granite
δ5 Monzonite granite (inc. alteration rim)
Δ1 Middle-fine grained amphybole rich diorite
Argemela rare metal leucogranite
Malpica do Tejo Fm. - Upper Mb.
δ3
δ2
δ1
δ0
δ5
δ4b (new)
δ4a (new)
δ2
Δ1





Work in progress, making use of an extended sampling program, will allow us to verify: (1) if the geochemical characteristics displayed by the main granitoid facies are shared by all the rock types that make up the southwestern extension/branching of the Fundão pluton; and (2) if the generation/emplacement of the latter rocks, along with the various dyke suites that cut the outer ring of the pluton, could be ascribed to the Cambrian-Early Ordovician magmatic event.


616000
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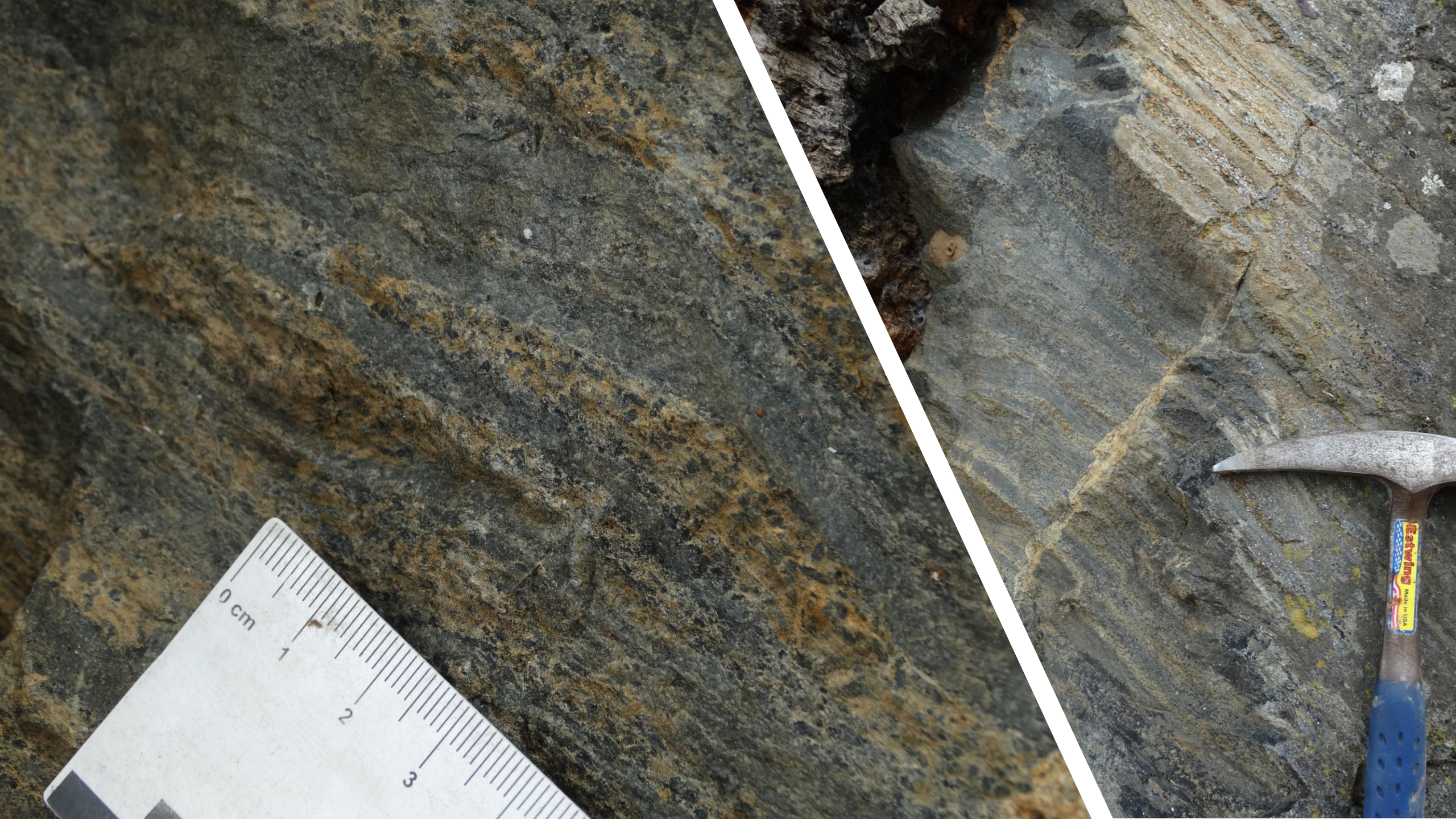
N
Pedra Alta
Cabeço da Argemela
Aplite dyke swarm
ductile-brittle shear zone
γ_2
γ_3
γ_0
γ_1
γ_5
γ_{4b} (new)
γ_{4a} (new)
Δ_1
2 Km
488.1 ± 3.4 Ma
499.1 ± 4.7 Ma
γ_0-γ_1 Quartz-diorite with mafic-intermediate xenoliths
γ_2 Granodiorite-tonalite with amphybole+biotite and mafic-intermediate xenoliths
γ_3 Monzonite biotite locally porphyroid granite
γ_{4a} Fine to coarse grained essentially biotitic granite
γ_{4b} Fine to middle grained moscovite granite
γ_5 Monzonite granite (inc. alteration rim)
Δ_1 Middle-fine grained quartzdiorite with mafic xenoliths
Argemela rare metal leucogranite
Malpica do Tejo Fm. - Upper Mb.
Samples for U-Pb geochronology and geochemistry


0 cm
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Estwing
Made in USA


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5
6
7
8


0 cm
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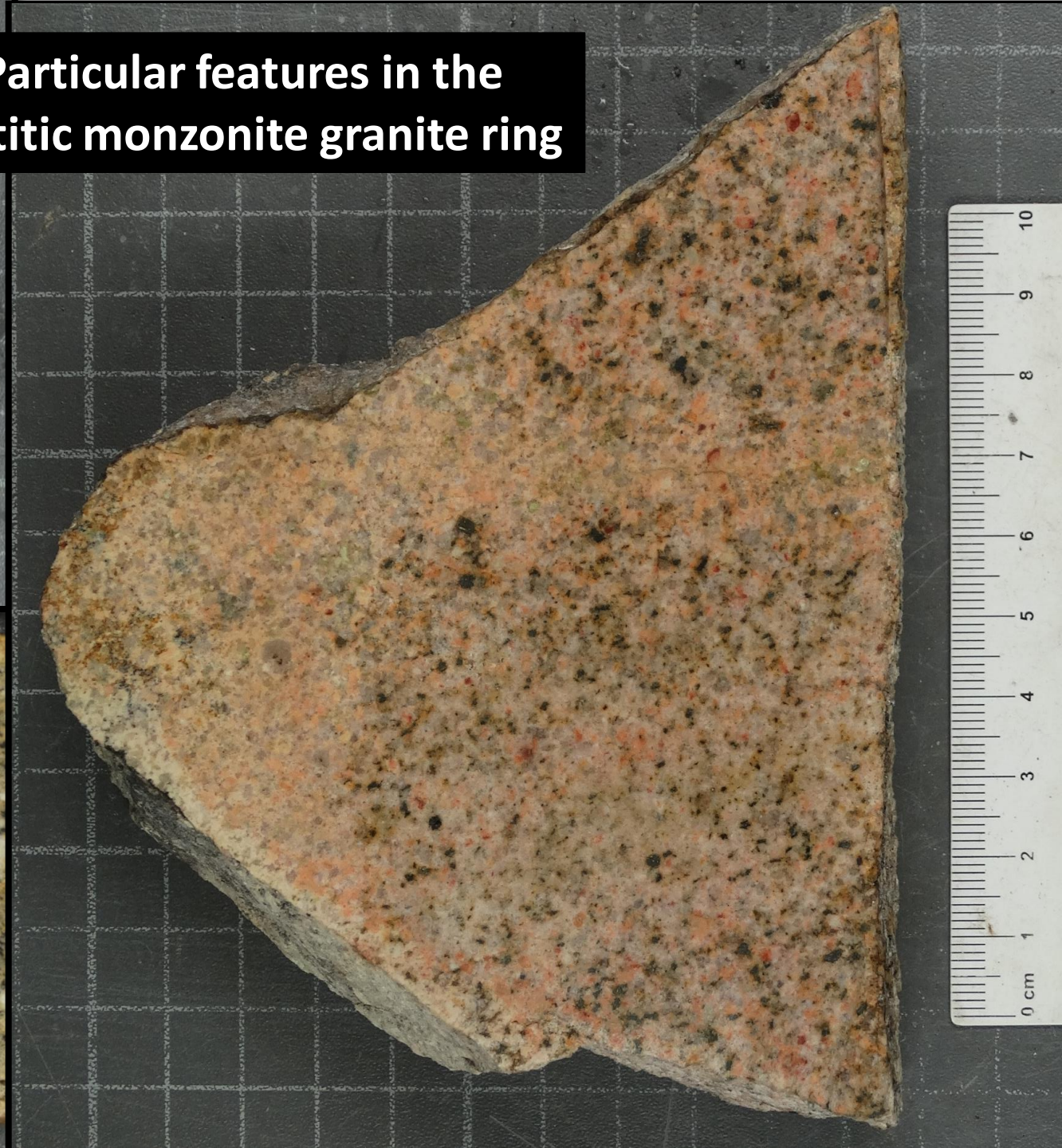
6

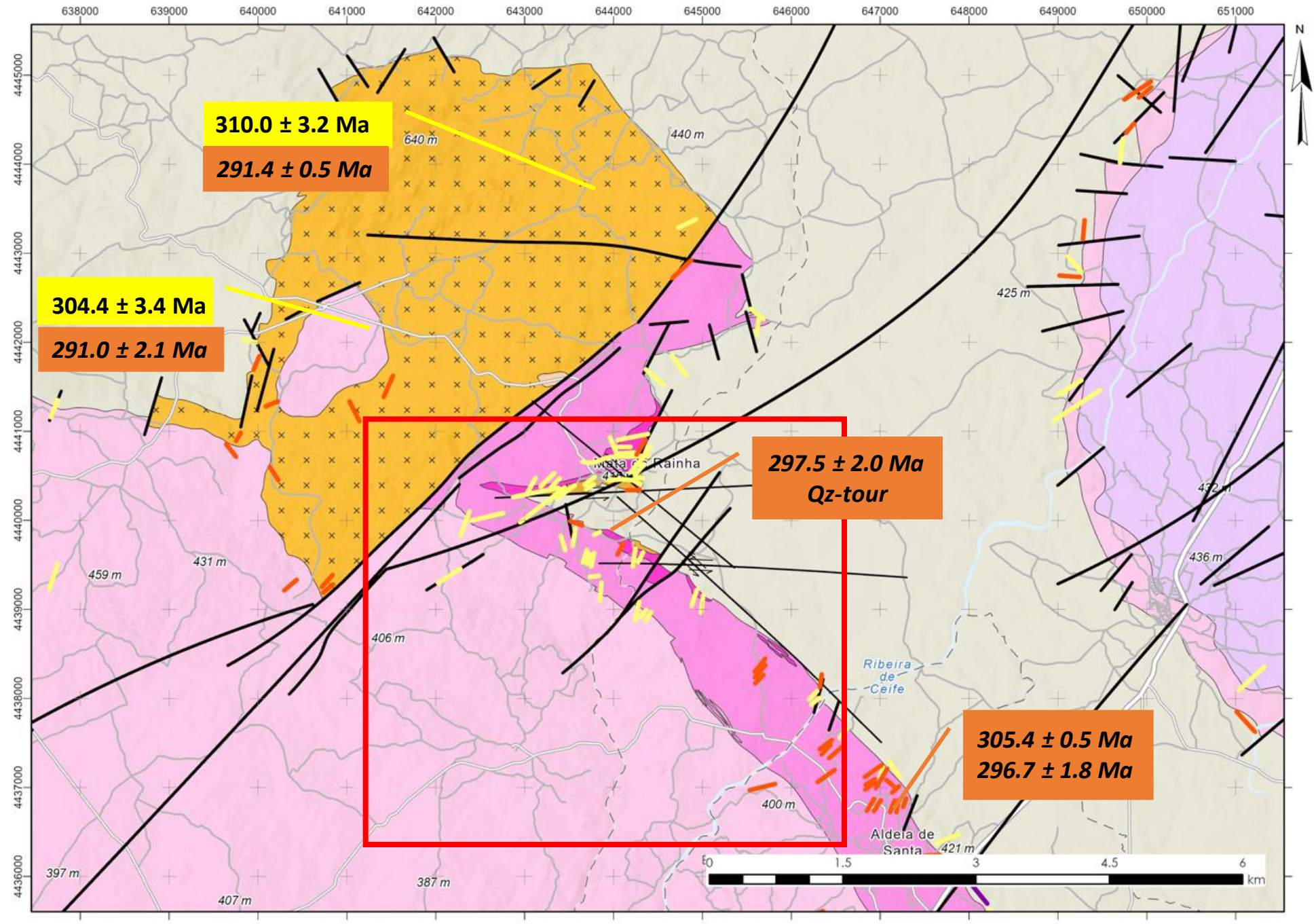
Particular features in the biotitic quartz-diorite ring

Particular features in the biotitic quartz-diorite ring

Particular features in the biotitic monzonite granite ring




Mata da Rainha sector



Main features:

- Distinct border facies,
- Several swarms of aplite-pegmatite dykes, often complemented with *qz-tour* veins (e.g. Aldeia de Sta Margarida).
- Increasing of tourmaline abundance towards NW (along with cassiterite dissemination?) in dense arrays of aplite dykes
- Profusion of *qz-tour* veins in domains nearby old mining works (Mata da Rainha)

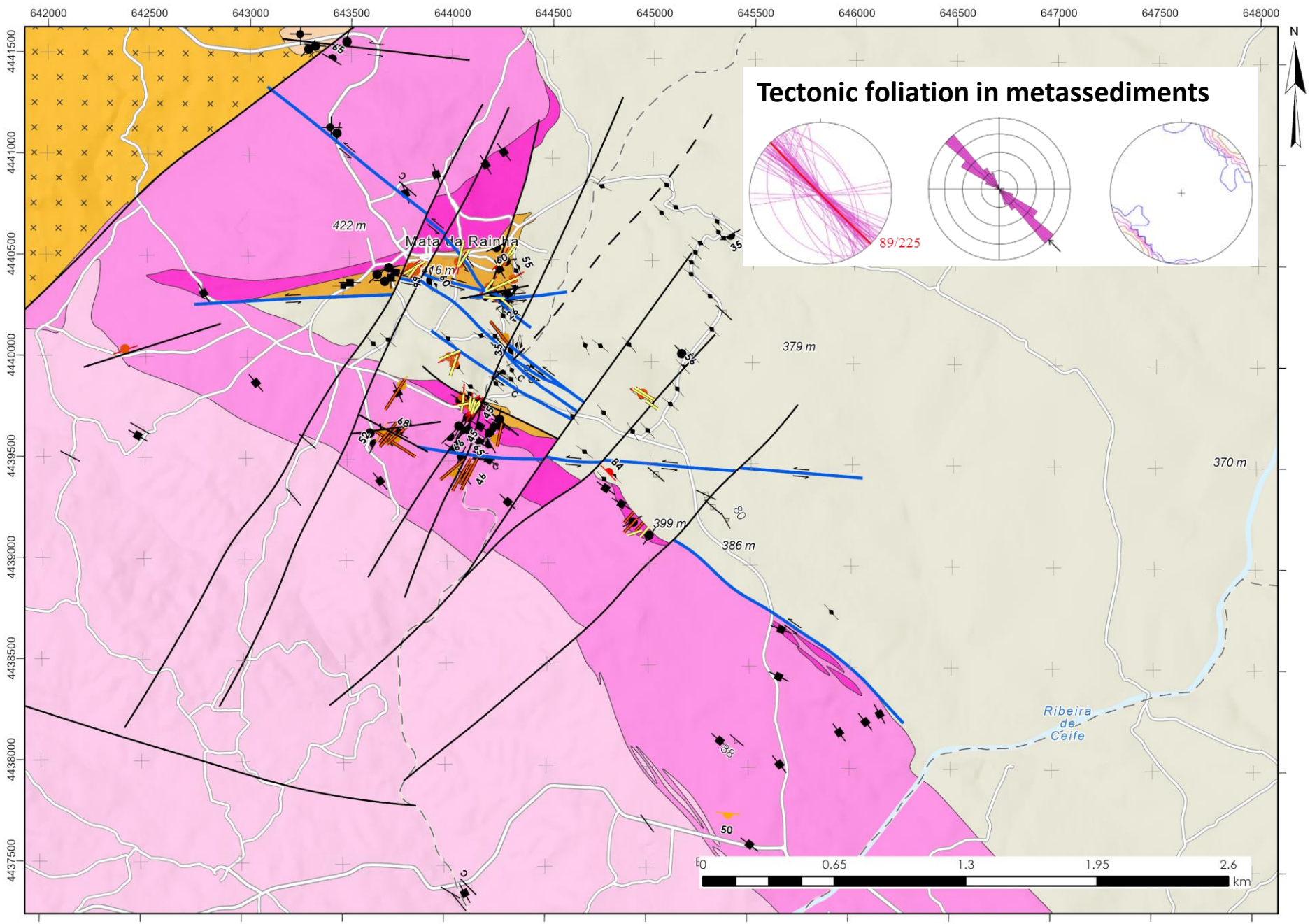
U-Pb zircon (SHRIMP)

Ar-Ar muscovite

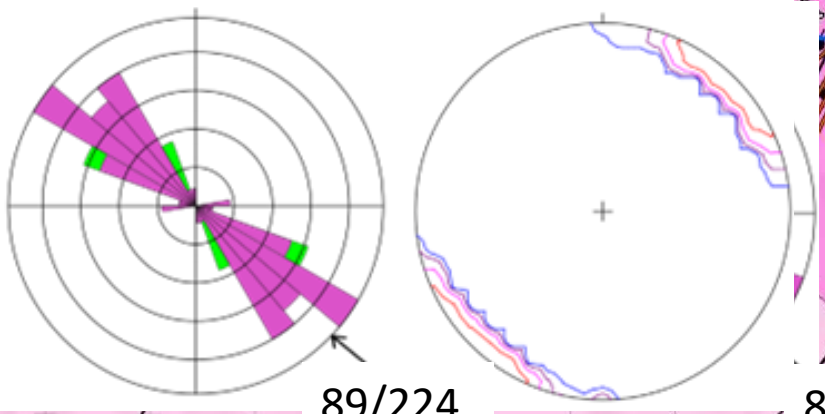
Main achievements:

- Structural datasets,
- Database on the aplite(-pegmatite) dyke swarms and quartz lodes,
- Complete revision of the exposed:
  - granite facies,
  - metasedimentary units, and
  - contact metamorphic aureole

Work in progress!



Tectonic foliation in granites



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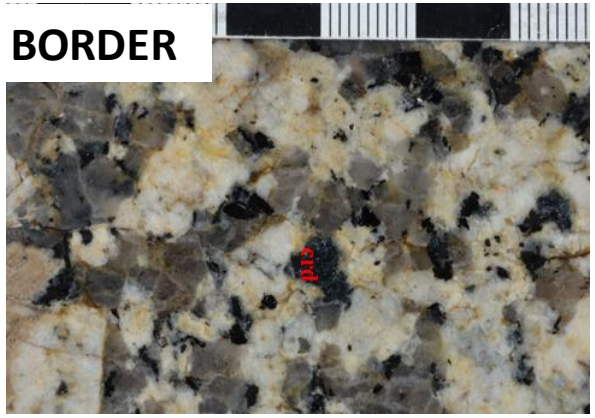
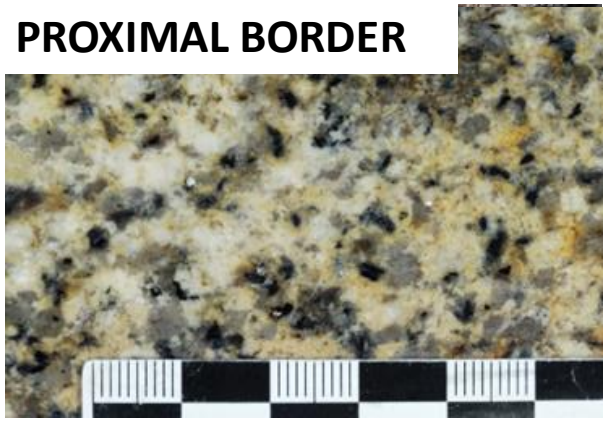
CORE

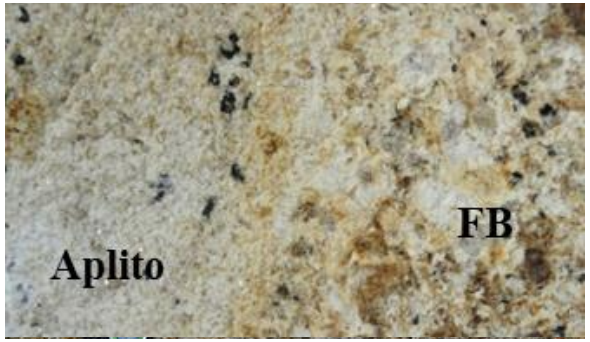
BORDER



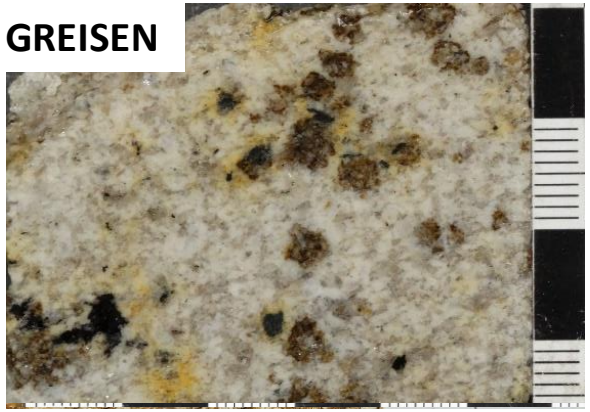
PROXIMAL BORDER



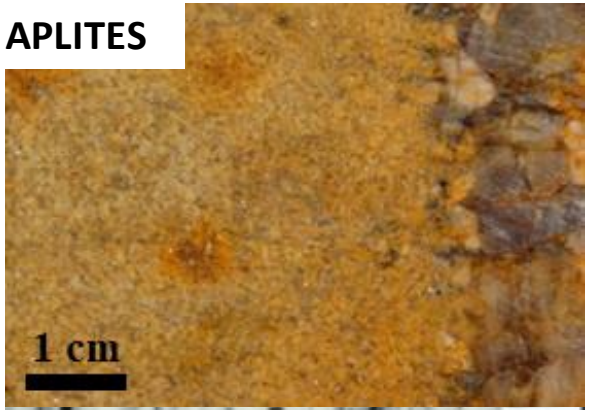
APLITES IN THE PROXIMAL RIM



GREISEN

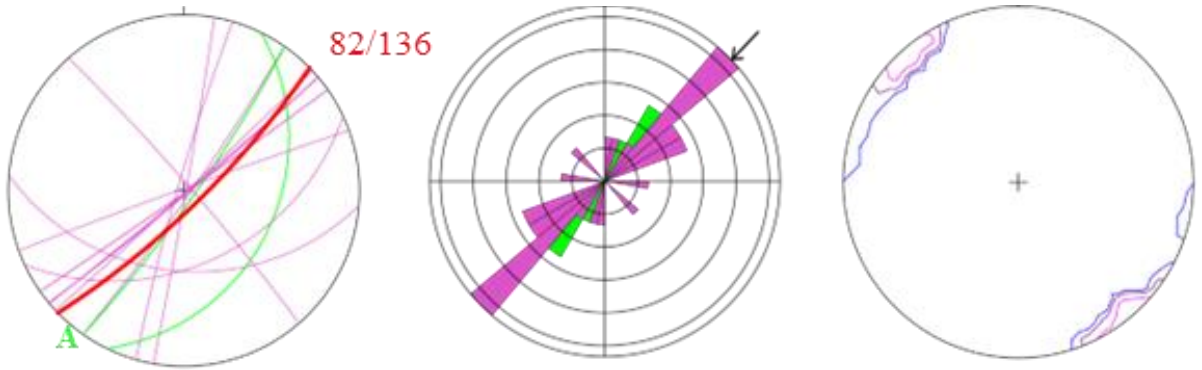


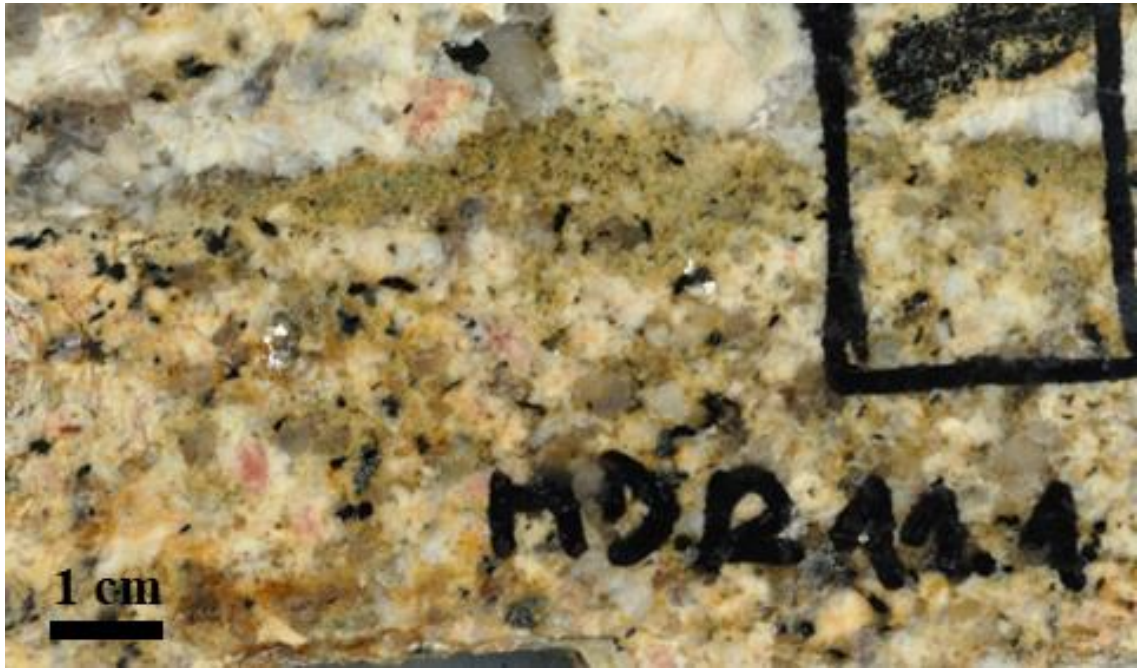
APLITES

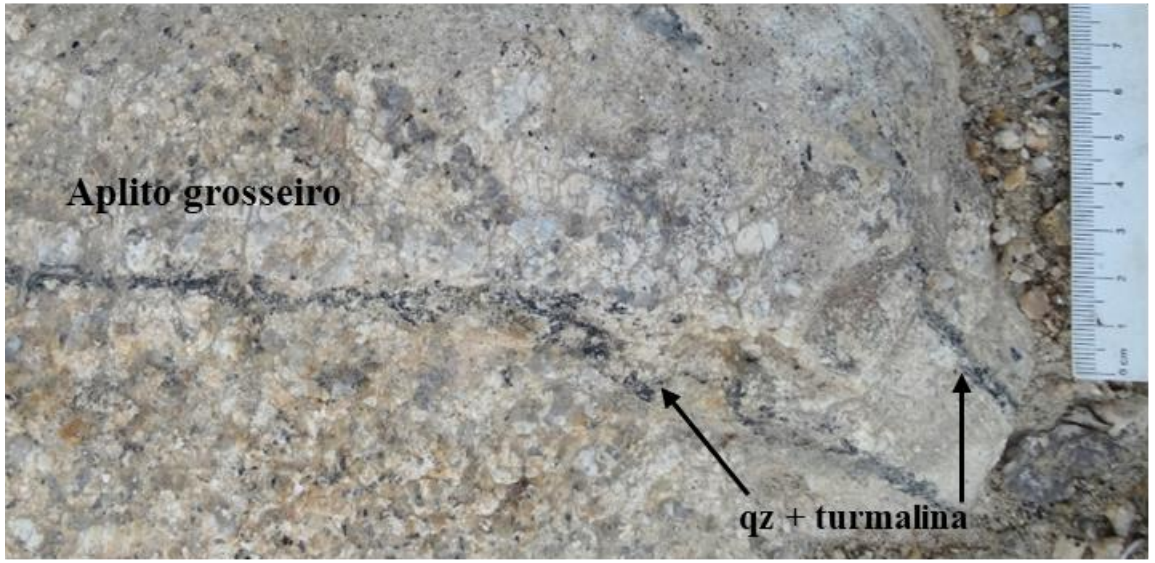


The “greisen-like” facies comprises clusters of tourmaline-rich **aplite dykes** (bearing cassiterite), frequently coupled with *qz-tour* veins in the granite and metasediments, some of them subjected to artisanal mining in the past.

APLITE DYKES

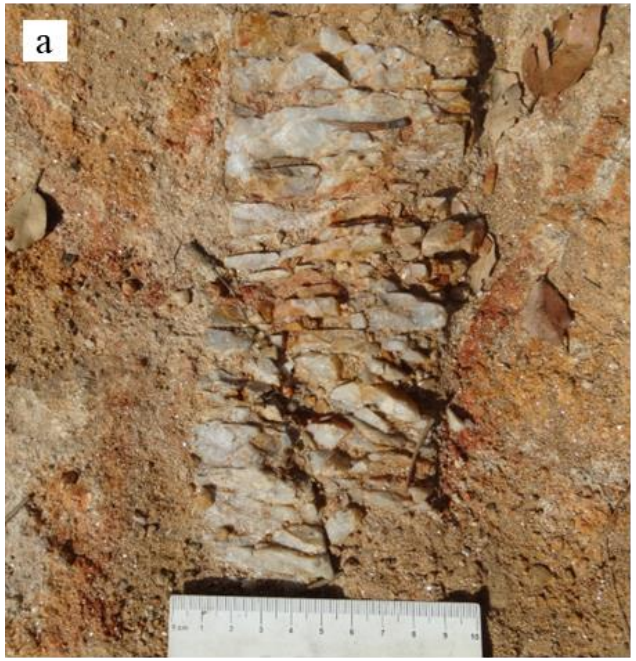


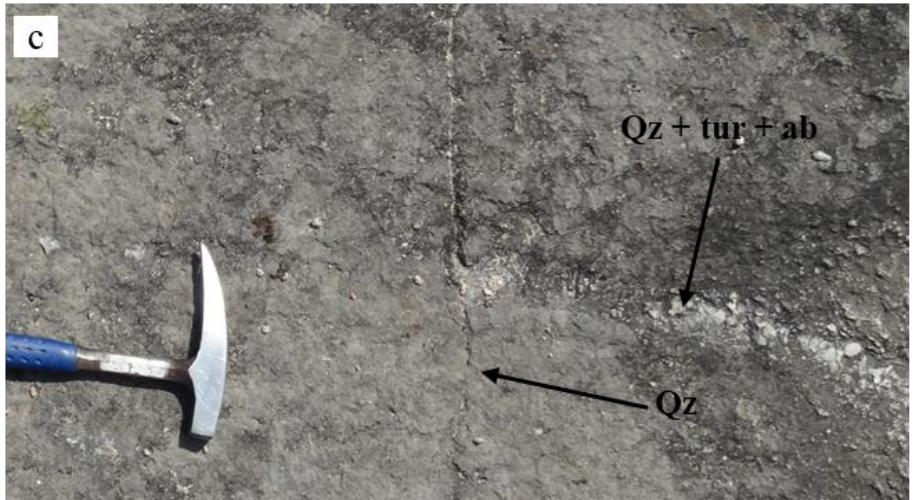




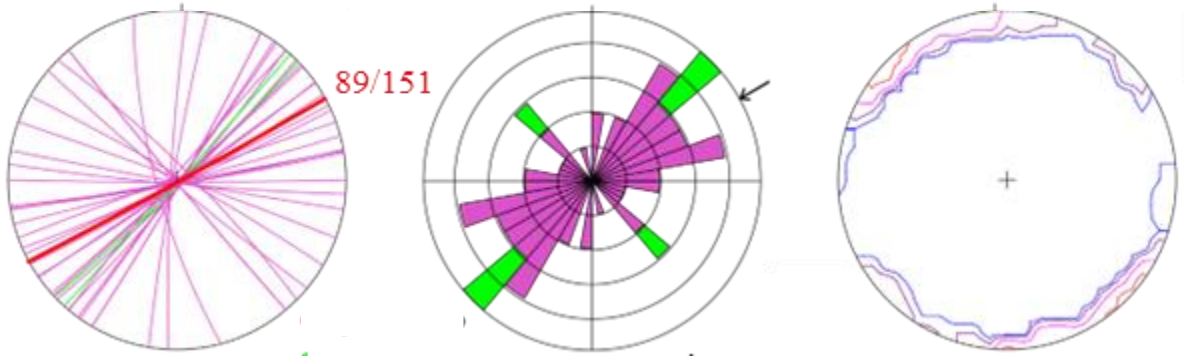
Near the gradual contacts with “greisen-like” facies, the coarse-grained granite forming the regional border of the Orca pluton preserves evidence of significant mineral/textural transformations, developing enrichments in muscovite and tourmaline. These transformations have enabled the mapping of a transitional zone between the Orca border granite and the “greisen-like” facies, provisionally labelled “proximal border” facies.

W-Sn quartz lodes largely hosted in strongly modified (tourmaline-enriched) spotted schists (Rosmaninhal Fm., Distal Mb., Beiras Group) near the “greisen-like” facies, probably associated to qz+tour lodes and to the tourmalinites in the greisen

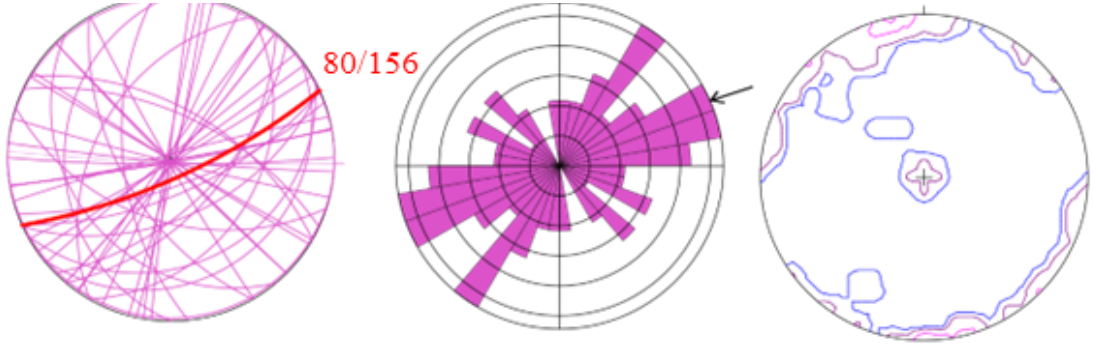




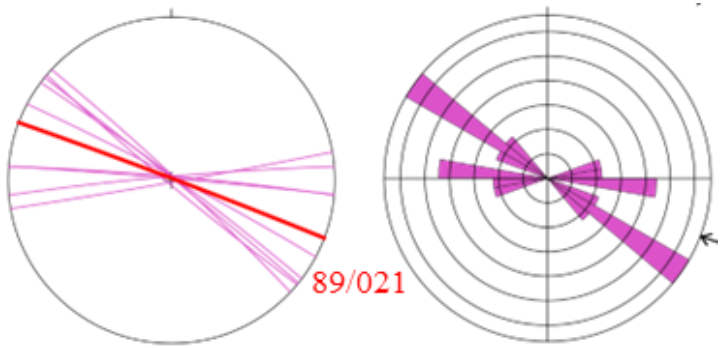
Qz lodes without turmaline



FAULTS AND FRACTURES



SHEAR-ZONES



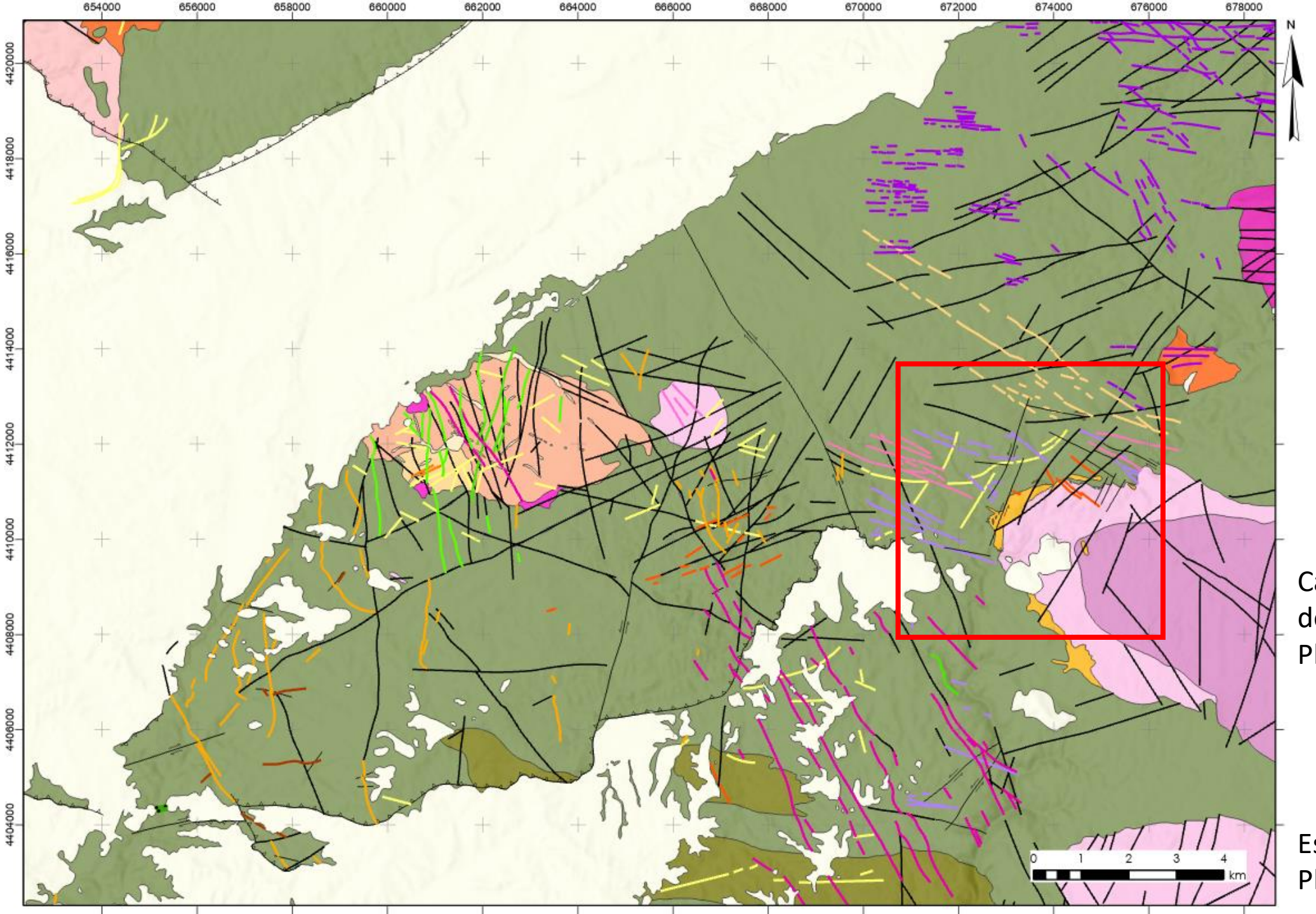
In the Mata da Rainha sector we have identified

- Different granitic facies, including border metassomatization associated with mineralization in the metassediments in the host rocks

- Close relationship with semi-ductile transcurrent shearing affecting 305Ma Orca granite, increasing permeabilization.

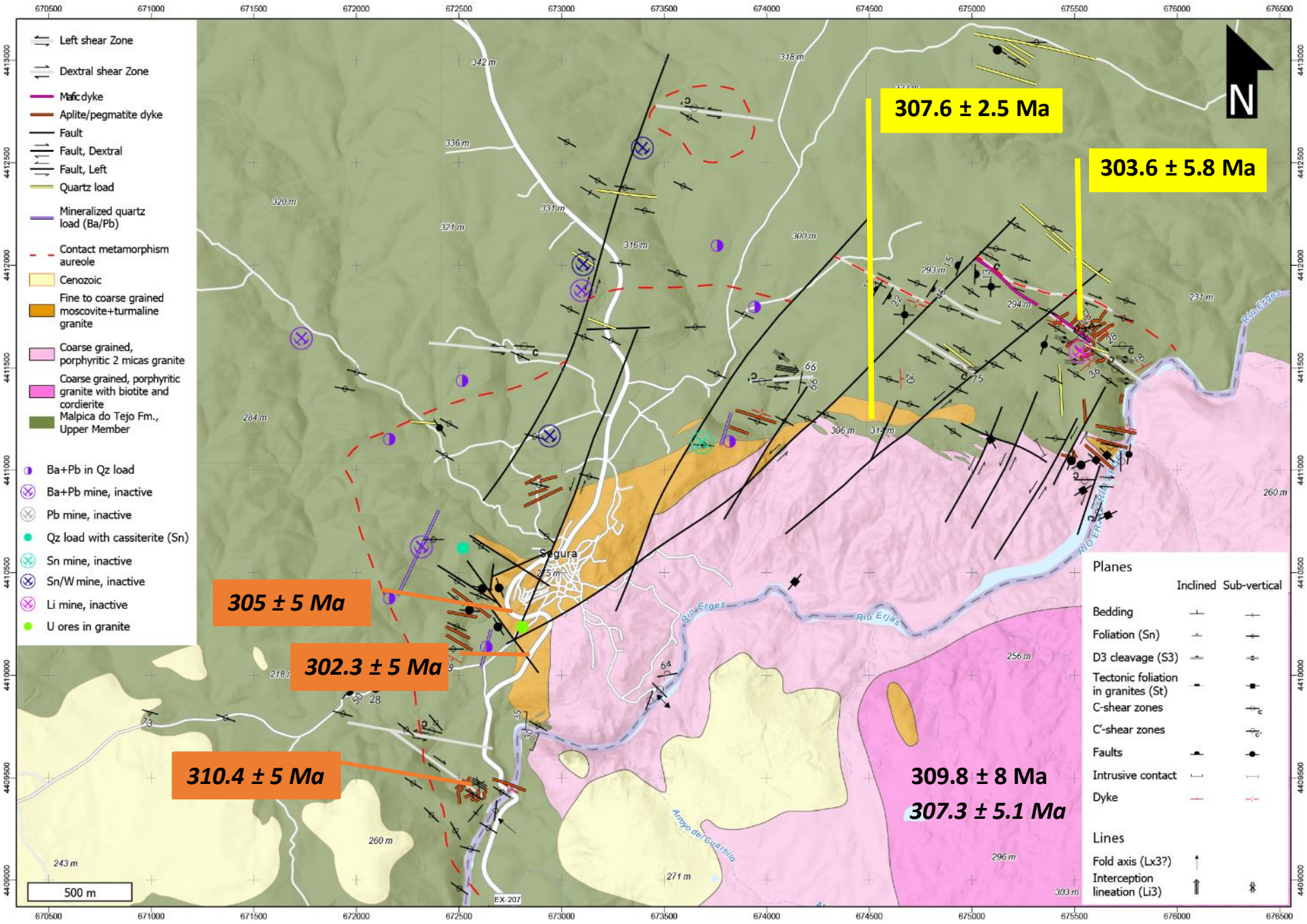
- Metassomatization led to mineral replacements in the Orca granite and in the (previously deformed) metasedimentary sequences.


Segura sector



Cabeza de Araya Pluton

Estorniños Pluton



Main achievements:

- Structural datasets,
- Database on the swarms of Li-bearing aplite and pegmatite dykes,
- Complete revision of the exposed:
  - granite facies,
  - metasedimentary units, and
  - contact metamorphic aureole

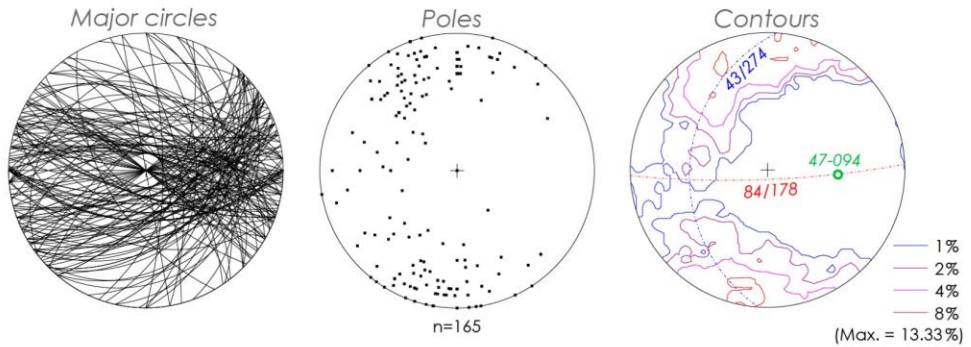
U-Pb zircon (SHRIMP + LA-ICP-Ms)

K-Ar muscovite

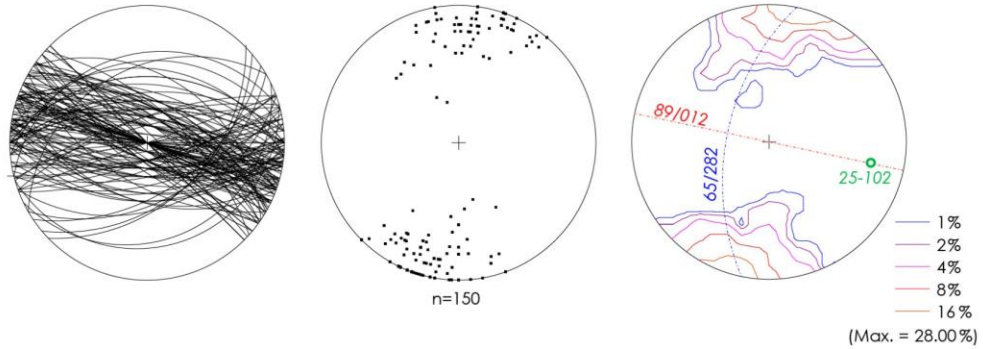
MOSTMEG-ERAMIN2 Project

Stereographic projection: fabric measurments; **Segura-Zebreira area** | ***Data source***: 1:50.000 geological maps (published and unpublished by LNEG)

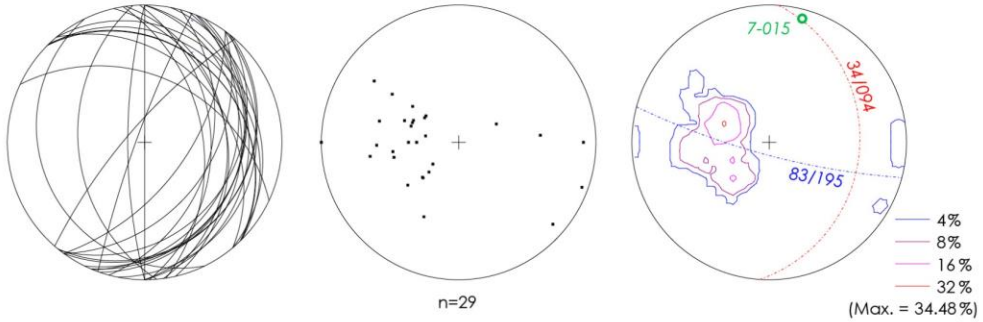
Bedding (S_0)



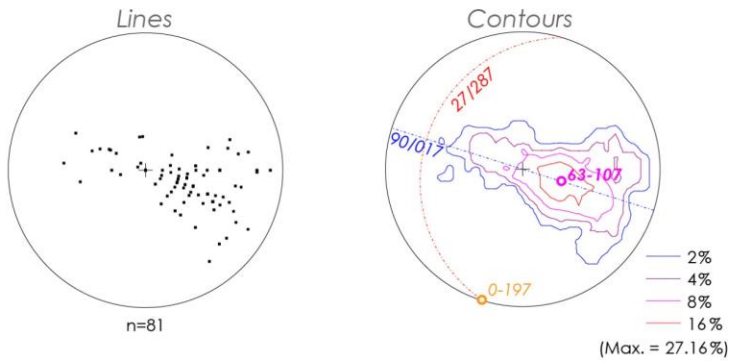
S_1 foliation



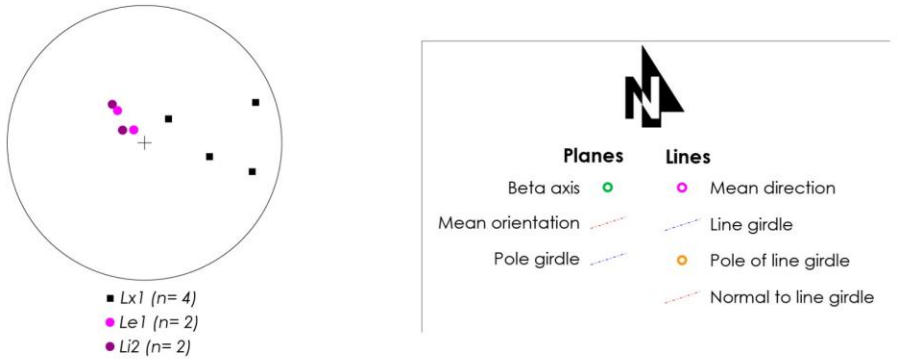
S_2 foliation

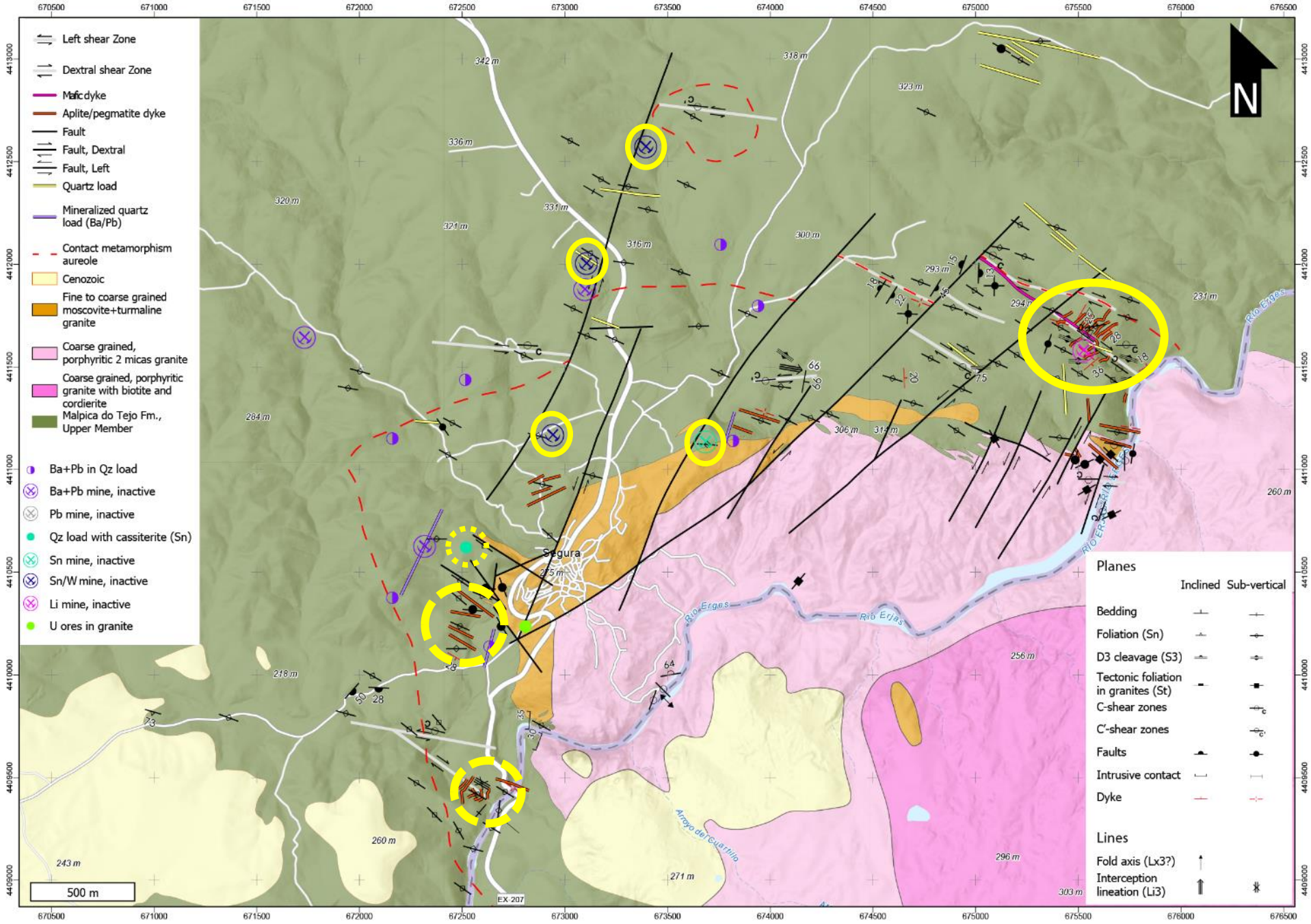


Intersection lineation (Li_1)



Fold axes (Lx_1), streching lineation (Le_1) and second intersection lineation (Li_2)





Sn-W quartz lodes

Sn quartz lodes

Li(-Sn) aplite-pegmatite dykes [*Cerro Queimado*]

Other aplite(-pegmatite) dyke swarms comprising *cst* and locally enriched in *tour*

Segura

old mining works in Sn-W quartz lodes

Segura

Most common features at Cerro Queimado (Li)

Segura

Other aplite(-pegmatite) dyke swarms

Segura

Summary

- **Temporal relationship of the different granitic facies** of the NE tip of the Cabeza de Araya Pluton

- Evidences of massive **metasomatism** affecting the border of the cordierite-biotite porphyroid granite, leading to extreme **moscovitization** (outer rim facies)

- Age (**304 Ma**) of **Li-bearing dykes** of Cerro Queimado are constrained by geochronology

- **Different generations of aplite-pegmatite dykes** and their relationship with late Variscan deformation (D3)

- Processor deformation with bedding transposition, affected by late-Variscan shearing and flattening - **spotted schists as markers**

Thank you for your attention!

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

Malpica do Tejo Fm in Segura, transposed bedding with folded quartz veins.