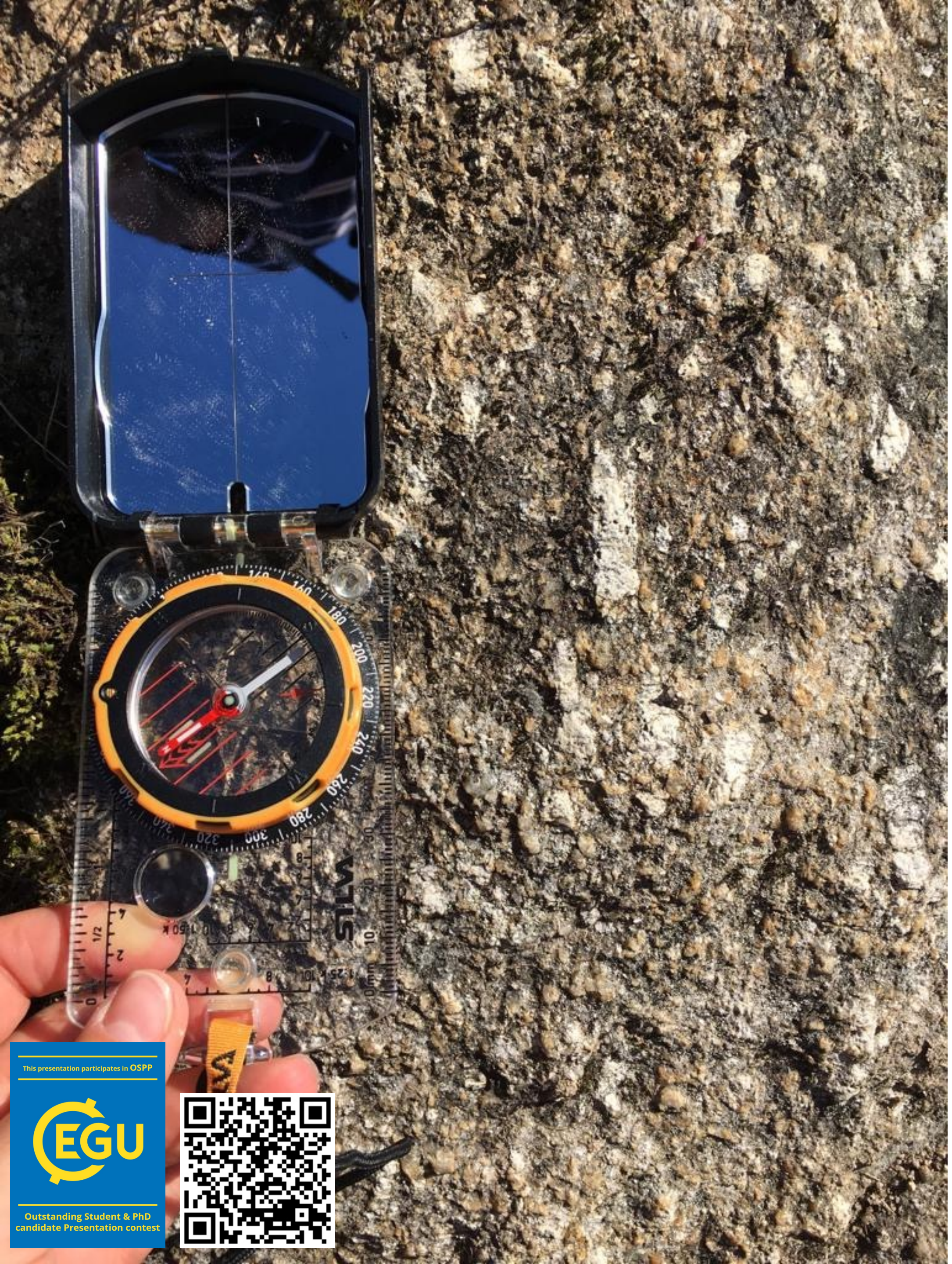

EGU

Petrofabric patterns of two contrasting plutons: example of Penedos and Borralha granites (Montalegre, Northern Portugal)

EGU22-5153

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1. Penedos-Borralha area (PBA)

1.1. AIM

- ✓ Multidisciplinary approach (viz., **fieldwork, petrography,** and **anisotropy of magnetic susceptibility** (AMS))
    - ✓ To understanding of the **magnetic anisotropy patterns of Penedos (PG, post-D_3) and Borralha (BG, syn-D_3)**.

1.2. GEOLOGICAL SETTING

- **Galícia-Trás-os-Montes Zone** (Fig. 1a)
    - Outcropping lithologies: **Silurian metasediments** and **Variscan granites** (Fig. 1b).
- **Three Variscan ductile deformation phases** were recognized:
    - D_1 (360-337 Ma); D_2 (337-320 Ma) and **D_3 (320-310 Ma)**.
        - **D_3 implied a regional subvertical crenulation (N120ºE) and the deformation of syn-D_3 granites (321–312Ma).**

1.3. STUDIED GRANITES

- **Penedos granite** (PG): **circumscribed outcrop** in a triple point marked by the contact between BG, Borralha tonalite and metasediments.
    - **Leucocratic, medium- to coarse-grained granite with garnet**.
- **Borralha granite** (BG): **WNW-ESE outcrop**
    - **Biotite-rich, medium- to coarse-grained porphyritic granite**.

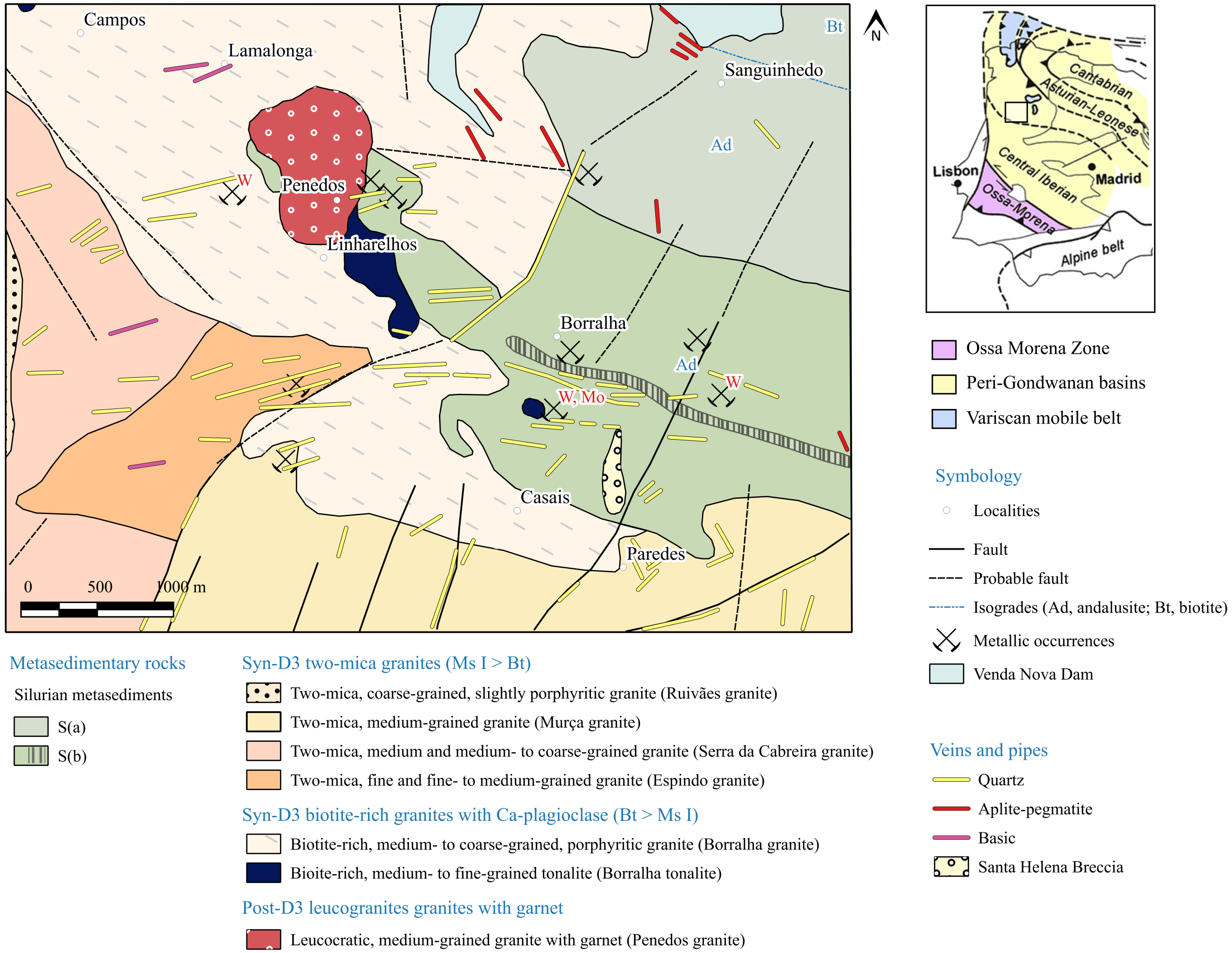
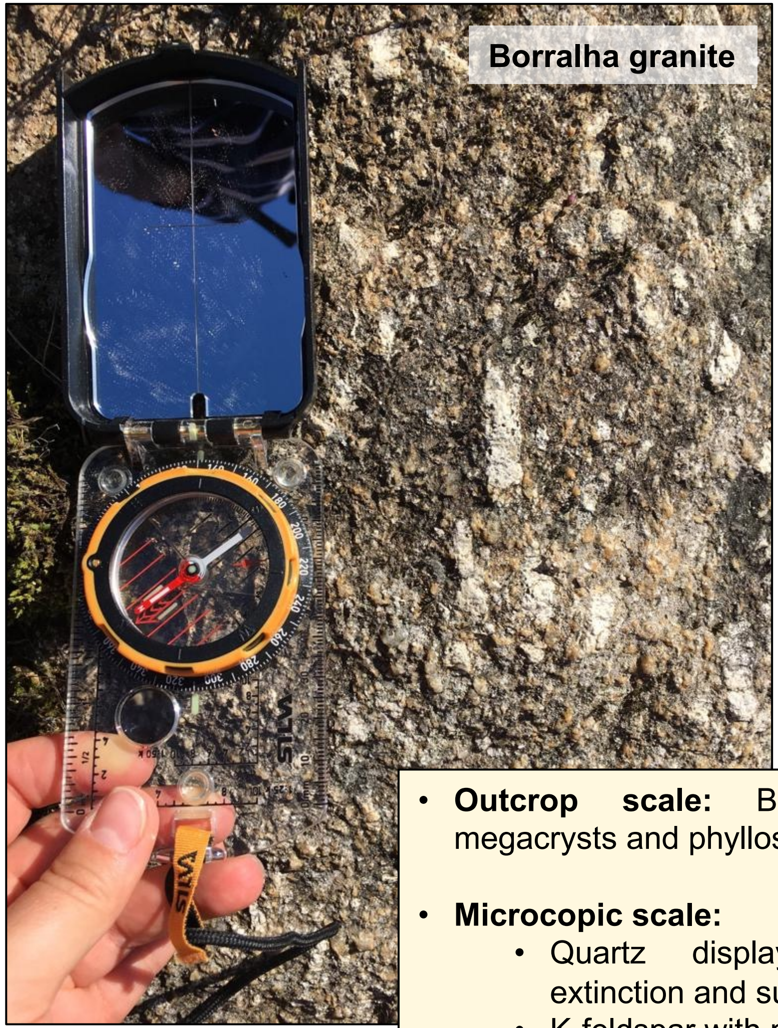
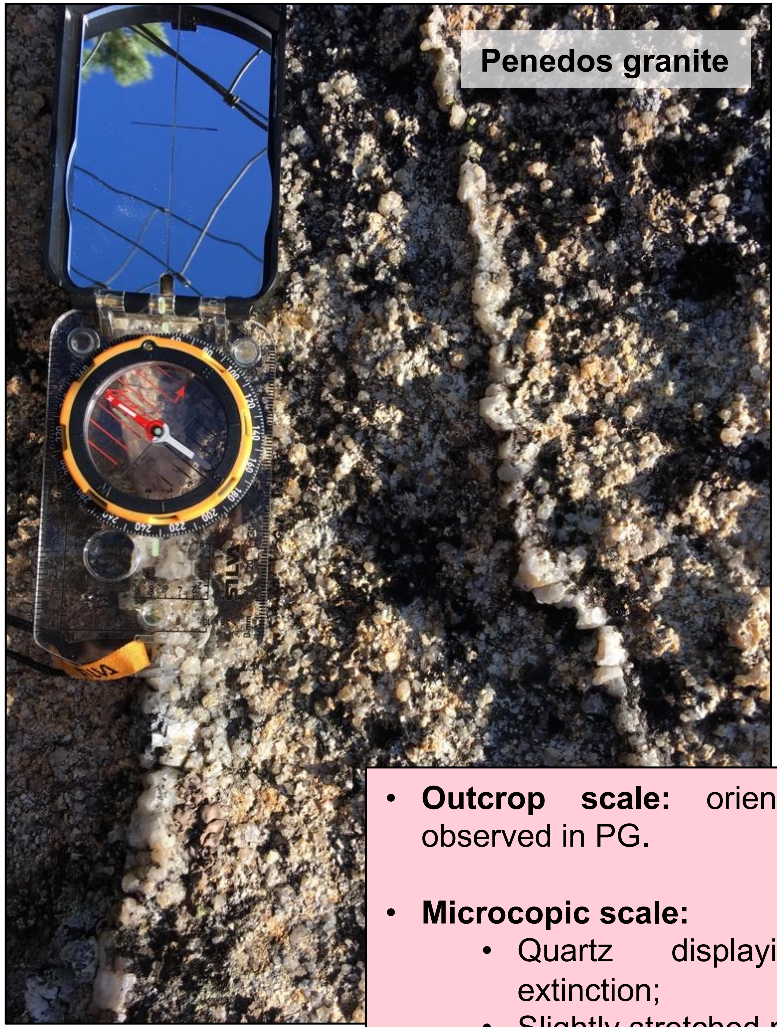


Figure 1 (a) Simplified map of the Iberian Massif with distinction of the paleogeographic zones according to Lotze (1945), Julivert et al. (1975) and Farias et al. (1987) (adapted from Martínez Catalán et al., 2014). (b) Simplified geological map of the Penedos-Borralha area (adapted from Noronha and Ribeiro (1983); Ferreira et al. (1987); Ribeiro et al. (2001)).

2. Textural patterns



- **Outcrop scale:** BG exhibits K-feldspar megacrysts and phyllosilicates N120ºE oriented.
- **Microcopic scale:**
  - Quartz displaying strong undulose extinction and subgranulation;
  - K-feldspar with poikilitic texture,
  - Plagioclase presenting curved twins;
  - Well-developed kinked phyllosilicates.



- **Outcrop scale:** oriented patterns were not observed in PG.
- **Microcopic scale:**
  - Quartz displaying slightly undulose extinction;
  - Slightly stretched plagióclase;
  - Euhedral garnet crystals;
  - Phyllosilicates occurring as clustered flakes.

3. Anisotropy of Magnetic Susceptibility (AMS): scalar parameters

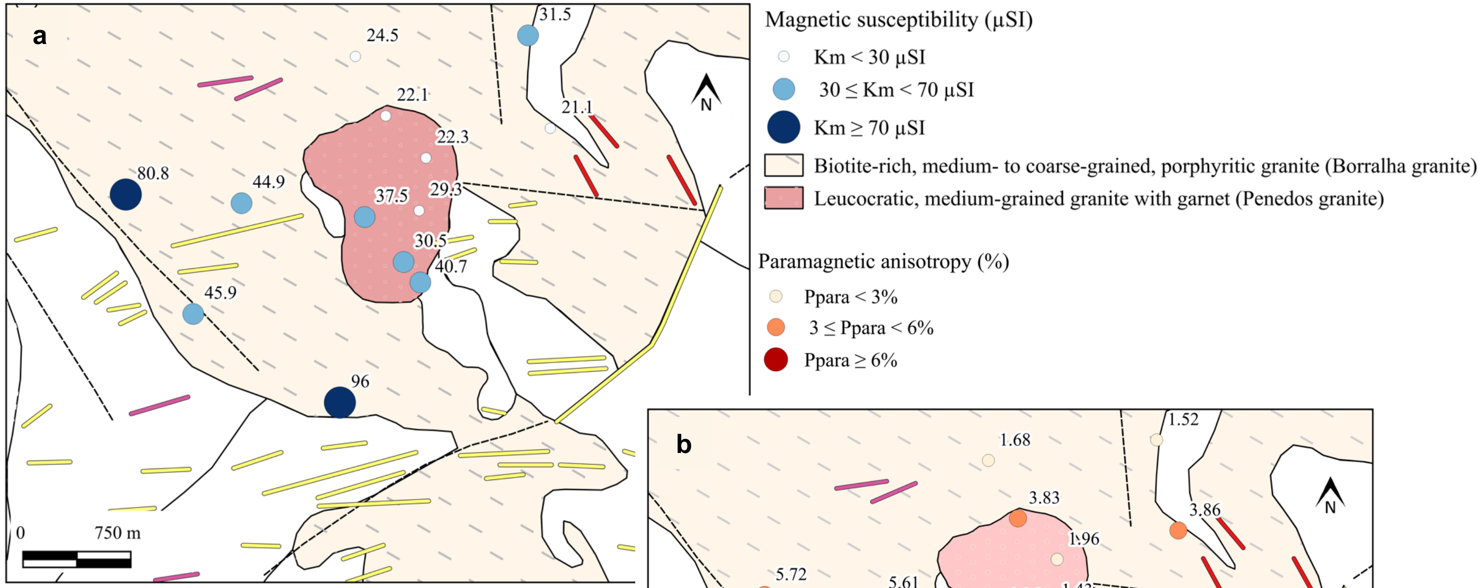
AMS

1. Scalar parameters

- **1.1. Magnetic susceptibility (K_m):** K_m = M/H
- 1.2. Paramagnetic anisotropy (P_{para})
- 1.3. Magnetic ellipsoid shape (T)

2. Vectorial parameters

- **2.1. Magnetic Foliation (K_3, pole of magnetic foliations):** $K_{3,min}$ is perpendicular to the cleavage (or basal) plane (001) of the phyllosilicates.
- **2.2. Magnetic Lineations (K_1):** $K_{1,max}$ is contained in the cleavage plane of the phyllosilicates



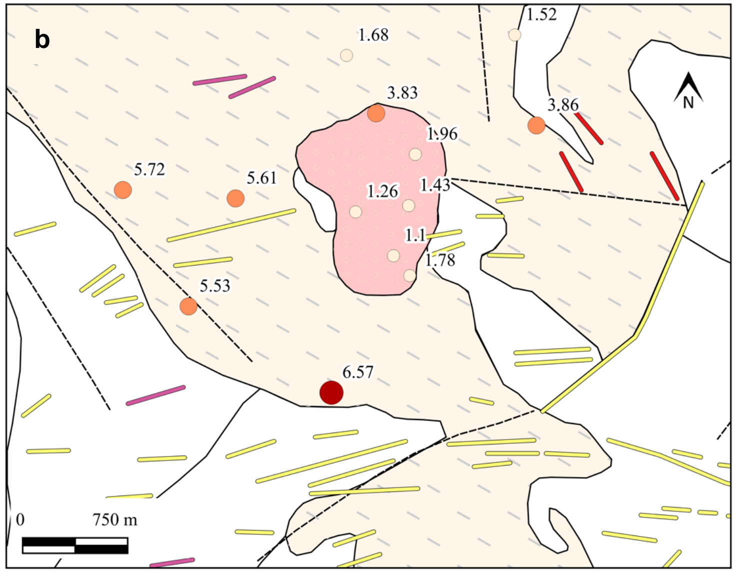


Figure 2 (a) Spatial distribution of the bulk magnetic susceptibility (K_m) in the Borralha and Penedos granites and microgranite. (b) Spatial distribution of the paramagnetic anisotropy (Ppara) in the Borralha and Penedos granites and microgranite.

MAGNETIC SUSCEPTIBILITY

- ✓ **K_m indicated paramagnetic behaviour for both BG and PG** (53.9 and 30.39 µSI, respectively) (Fig. 2a)
  - ➢ **Ilmenite-type granites**.

PARAMAGNETIC SUSCEPTIBILITY

- ✓ **BG exhibits the highest P_{para} values** (4.4%), result of the **strong K-feldspars and biotite alignment** (Fig. 2b).
- ✓ **PG exhibits the lowest P_{para} values** (1.89%) compatible with the no-oriented patterns.

3. Anisotropy of Magnetic Susceptibility (AMS): vectorial parameters

Directional parameters (K_1 and K_3) → Fabric patterns → Understanding of emplacement kinematics

PENEDOS GRANITE FABRIC

- **$\perp K_3$ are very heterogeneous** ranging from NW-SE to E-W;
- Generally, **$\perp K_3$ are subvertical in the E side**, where the PG is intrusive in the metasediments and **subhorizontal in the W side**, where the PG cuts the BG;
- K_1 display NNE-SSW to W-E azimuths with subhorizontal to intermediate dips.

BORRALHA GRANITE FABRIC

- **$\perp K_3$ are** essentially **subhorizontal**, tends to be **parallel to the contacts** with the regional rocks;
- **K_1 are strongly subhorizontal** with azimuths ranging from WNW-ESSE to ENE-WSW.

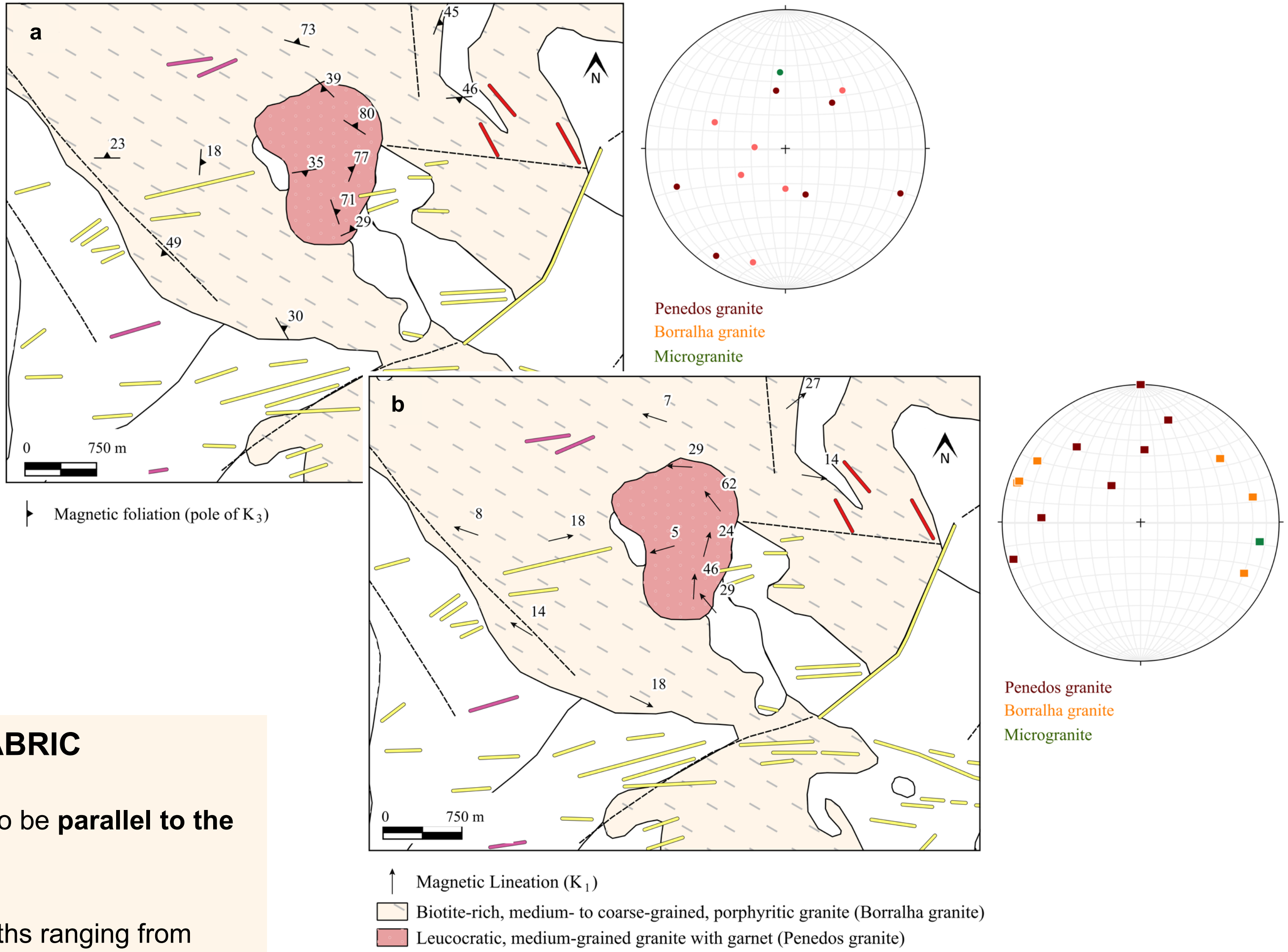


Figure 3 (a) Map of magnetic foliations with Schmidt stereoplots (lower hemisphere) of density diagrams of K3. (b) Map of magnetic lineations with Schmidt stereoplots (lower hemisphere) of density diagrams of K_1.

4. Discussion & Final Remarks

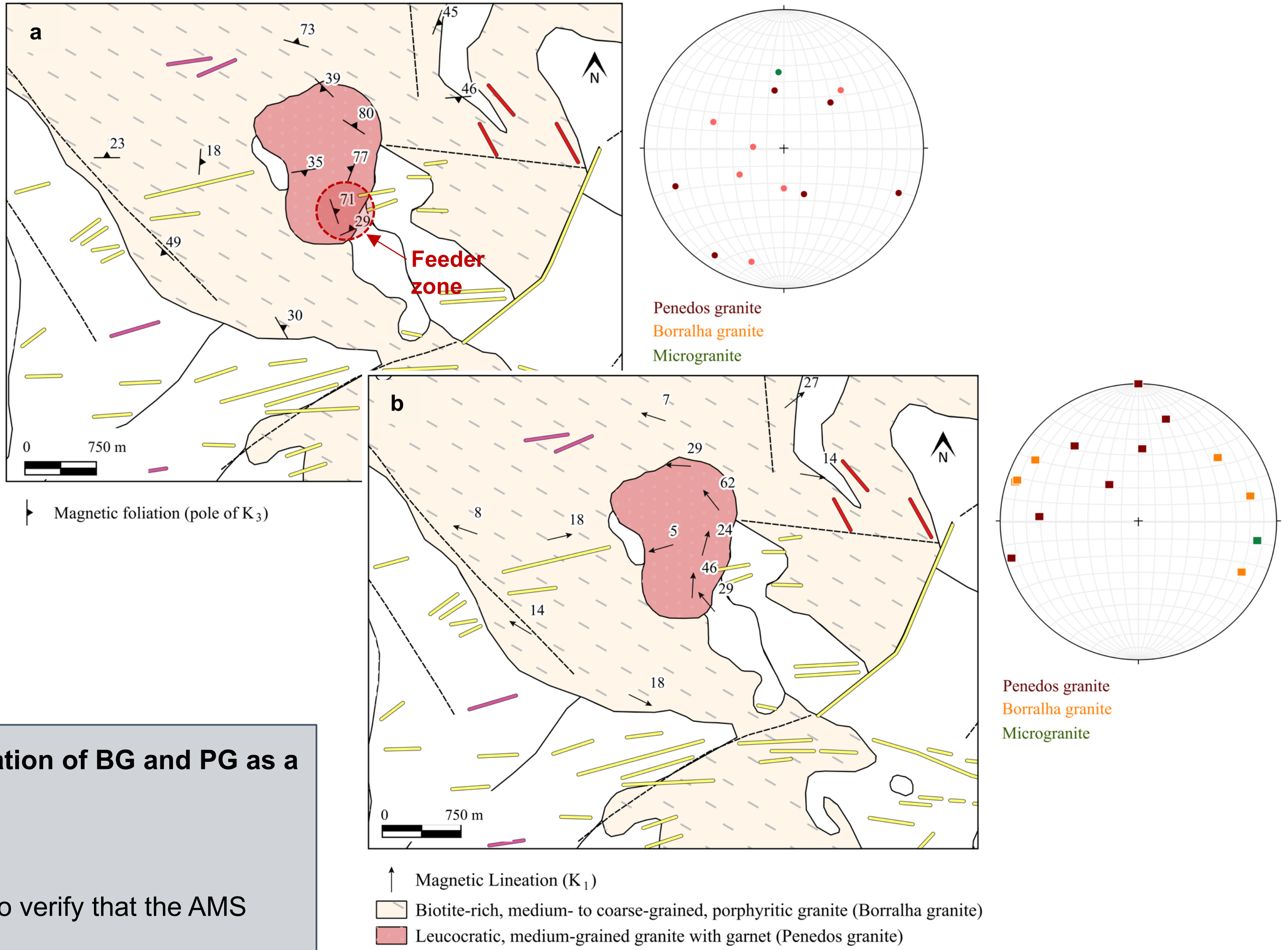
- **The petrofabric obtained for both granites resulted from distinct phenomena:**

- **PG petrofabric was inherited from magmatic stages:**
  - ***K_1* trajectories suggest the location of a feeder zone in the SE border and continuous magmatic flow to NW.**
  - subvertical $\perp K_3$ in the E side of PG suggests a **tongue-shaped intrusion** thicker on this side.

- **In contrast, the BG petrofabric was acquired in the subsolidus and resulted from tectonic processes.**

✓ **The obtained petrofabric agrees with the proposed classification of BG and PG as a syn-D_3 and post-D_3 granites, respectively.**

❖ These analyses applied to two contrasting intrusions allowed us to verify that the AMS depend on several parameters and must be interpreted with caution.



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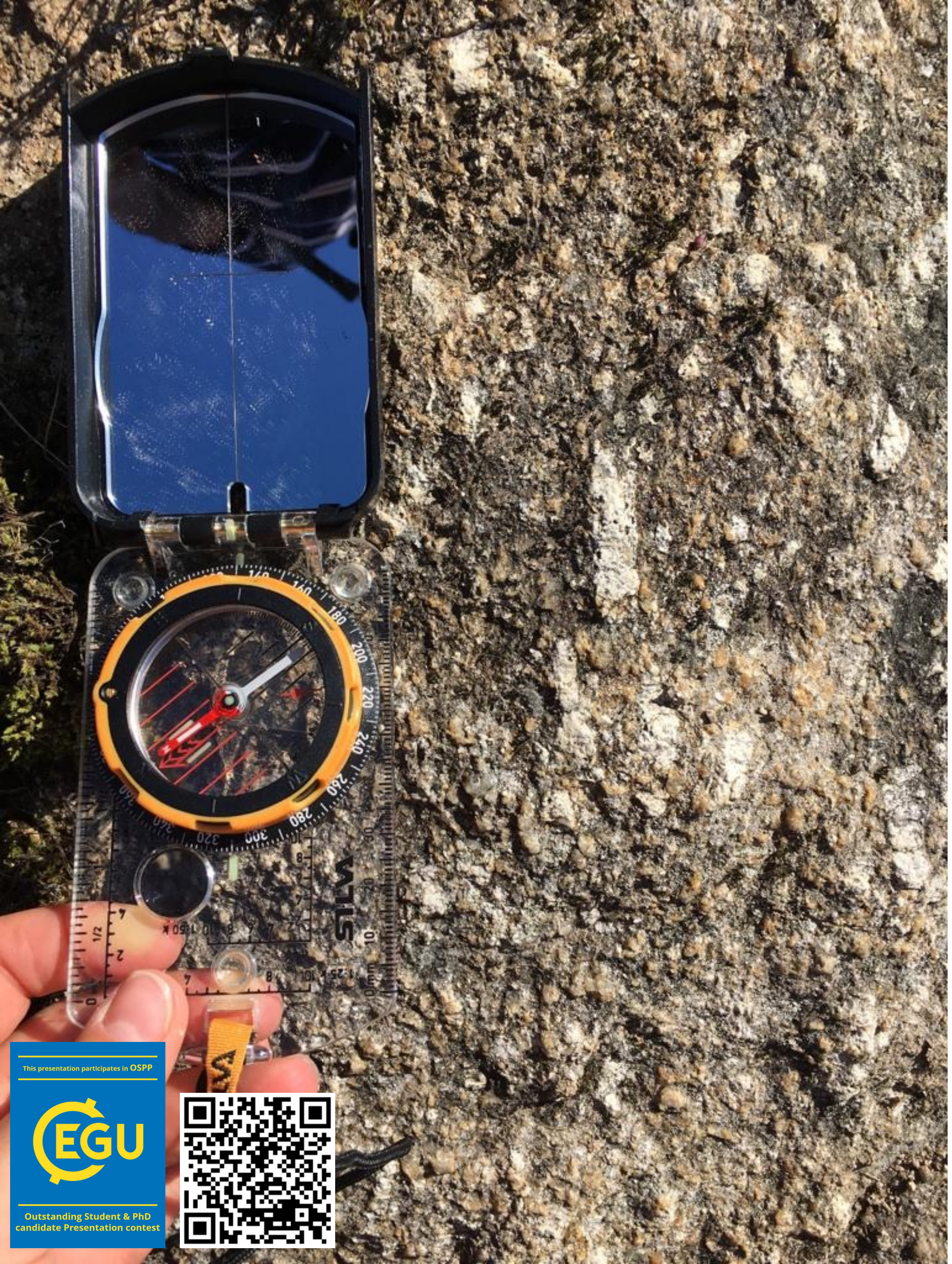

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