Magnetic fabric of Lamas de Olo Pluton: AMS and AARM fabrics comparison

Cláudia Cruz, Helena Sant'Ovaia, Maria Irene Bartolomeu Raposo, and Fernando Noronha

1University of Porto, Faculty of Sciences, Instituto de Ciências da Terra-Polo Porto, Departamento de Geociências, Ambiente e Ordenamento do Território, Porto, Portugal
2Instituto de Geociências da Universidade de São Paulo, São Paulo, Brazil

The Lamas de Olo Pluton (LOP) is a small outcrop located in the Northern part of Central Iberian Zone from the Iberian Variscan belt. The LOP is a post-tectonic (ca. 297.19 ± 0.73 Ma) pluton composed of different granites: Lamas de Olo (LO; medium to coarse-grained porphyritic granite, ilmenite, and magnetite-type), Alto dos Cabeços (AC; medium to fine-grained porphyritic, ilmenite-type granite), and Barragem (BA; leucocratic fine- to medium-grained, slightly porphyritic, ilmenite-type granite). The magnetic fabric was characterized by measurements of anisotropy of magnetic susceptibility (AMS), and anisotropy of anhysteretic remanent magnetization (AARM). Both techniques are based on the magnetic properties of rock minerals, but while AMS consider the contribution of all rock minerals (paramagnetic, diamagnetic and ferromagnetic s.l.), in the AARM, the fabric is exclusively given by the ferromagnetic s.l. minerals. A correlation between AMS and AMR tensor was established, in order to compare both fabrics. The magnetic lineation is $\mathbf{K}_{\text{max}}$ or $\mathbf{AARM}_{\text{max}}$ and the magnetic foliation is perpendicular to $\mathbf{K}_{\text{min}}$ or $\mathbf{AARM}_{\text{min}}$. Considering the global magnetic fabric for all samples from all the granite set, the magnetic foliations (AMS: N166°, 82°NE; AARM: N167°, 83°NE) and the magnetic lineations (AMS: 23°- N166°; AARM: 68°- N163°) are coaxial in both tensors. On the other hand, the analysis of each site sampling shows some differences in the ilmenite-type granites. Magnetic lineations and foliations given by both tensors (AMS and AARM) are coaxial in the magnetite-type granites, meaning that the magnetite and paramagnetic (or diamagnetic) minerals have the same orientation. The coaxial AMS and AARM magnetic foliations are due to magnetite grains imitating the fabrics of paramagnetic phases, through preferred collage, or crystallization of magnetite along grain boundaries, or exsolutions of magnetite along biotite cleavage planes. However, in the ilmenite-type granites, the AMS and AARM foliations are parallel, but the AMS and AARM lineations are not coaxial. Previous magnetic mineralogy studies (e.g. thermomagnetic experiments and isothermal remanent magnetization) pointed out the presence of magnetite/Ti-poor magnetite in all LOP granites, even in the ilmenite-type, but in different proportions. The petrographic observations also showed that, in the ilmenite-type granites, the magnetite is often oxidized to hematite (martite). The presence of martite may justify non-coaxility linear fabrics. Regarding the LOP emplacement, WSW-ENE opening structures provided the space for magma ascending, with an NNW-SSE magmatic flow controlled by regional structures, as shown by the magnetic foliations and lineations ca. N170° trending. The absence of outcrop deformation and the lack of solid-state microstructures precludes the substantial
deformation after full crystallization of LOP.