

# AMS INTERPRETATION OF MAJOR SHEAR ZONES WITH CONTRASTING ROCK RHEOLOGY (BRAGANÇA MASSIF, NE PORTUGAL)

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## SUMMARY

AMS techniques were used to analyze two major shear zones in the Bragança Massif, a key element for the interpretation of the Paleozoic evolution of the Iberian Variscides. 587 samples, from 49 sites (including granulites, gneisses, peridotites, pyroxenites, amphibolites and greenschists) were studied. High field and Curie cycle measurements, as well as micro-probe analysis, were made to establish the magnetic mineralogy and to constrain the AMS results. AMS was critical to the kinematics and dynamical characterization of the Variscan orogeny in Iberia. Three of the deformation phases of the Variscan Orogeny identified previously on the Bragança Massif were well characterized by AMS. The first seems to be the result of post-collisional isostatic recovery (after the closure of the pre-Variscan ocean) followed by continental rifting. The other two, are attributed to continental collision, responsible for the closure of the Variscan Ocean, and to the gravitational collapse that followed as a result of the nappe piling during the closure of the Variscan Ocean.

## 1. Introduction

Shear zones (particularly those separating different terranes) are major features of orogenic belts, and hence the importance of analyzing them in terms of geometry, kinematics and dynamics. In this work we analyzed two major shear zones in the Bragança Massif, in northern Portugal, in order to use the advantages of AMS techniques when compared to standard structural techniques. We also tried to extract from the AMS analysis new constraints for the geodynamic evolution of the Iberian Variscides.

We sampled rocks with a great variety of mineral stretching lineations and mylonitic foliations, but also rocks where no lineations and/or foliations can be observed, probably due to post-kinematic recrystallization. Magnetic data were checked against field observations in all cases where recrystallization did not mask the structures produced by shear during emplacement of the allochthonous terranes.

The study area comprises the uppermost terrane of the Bragança massif and its contact with the underlying ophiolitic terrane, where a great diversity of lithotypes can be found (mafic granulites, gneisses, peridotites, pyroxenites, amphibolites and greenschists). Here, we present a detailed analysis of the petrofabric deduced from the AMS study, and we try to characterize the magnetic behavior of the most significant units, comparing our results with conventional mesoscopic surveys, made previously by Marques (1996) and complemented during the sampling for the present study.

## 2. Results

From all magnetic and mesoscopic data, we can conclude that magnetic directional parameters are in

good agreement, with a few exceptions, with the conventional mesoscopic analysis in all cases where both methods can be applied. AMS proved to be an excellent tool for the kinematic analysis of mylonitic shear zones, especially those lacking mineral lineations or where they are dubious, as a result of post-kinematic recrystallization, and/or strong pure shear component, and/or interference between tectonic events.

At the base of the CAT the amphibolite facies lineation is mostly clustered between NNW-SSE and N-S. In the underlying NOT two situations have been found: 1) in the SW limb of the VBOS the dominant lineation has an identical orientation to the base of the CAT; 2) in the NE limb the dominant orientation of the lineation is approximately E-W and was generated in a younger, retrogressive greenschist facies. Making use of the higher metamorphic grade of the NNW-SSE lineation within the NOT to the south, we come to the conclusion that this D4 lineation was produced during thrust to the NNW as also suggested by Marques *et al.* (1996). AMS revealed an E-W lineation (commonly not observed in outcrop) within the NOT greenschists in the NE limb of the VBOS. In major shear zones like the roof thrust only the older lineation (E-W of D2; Fig. 15) is preserved in the more competent granulite

## References

- Marques, F. O., Ribeiro, A. & Munhá, J., (1996). Geodynamic evolution of the Continental Allochthonous Terrane (CAT) of the Bragança Nappe Complex, NE Portugal. *Tectonics*, 15, 4, 747-762