Toward a better comprehension of the Variscan crustal structures in the SW Iberia

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SUMMARY

The Southwest (SW) Iberia is a geologically complex and significant region in the Iberian Massif, which stands out with its unique exposure to the Western European Variscan belt. This region experienced successive contractional, extensional deformation stages and strike-slip movements during the Carboniferous period. The Alpine deformation later reworked these Variscan structures. In SW Iberia, there are three main geotectonic units from north to south: the Central-Iberian Zone (CIZ), the Ossa-Morena Zone (OMZ), and the South Portuguese Zone (SPZ). These geotectonic units seem to be separated by major suture zones, although there is some debate about the early stages of their geodynamic evolution. They also show significant differences in the distribution of the Alpine faults whose relationship with crustal-scale Variscan structures remains to be properly known in depth.

The main magnetotelluric (MT) soundings in SW Iberia were conducted between 1997 and 2002 using the MMS03E and GMS-06 systems from METRONIX. Each profile spans a distance of 16-22 km, with an inner profile spacing of approximately 5 km. The electric field components Ex and Ey were measured in the N-S and E-W directions using a dipole length of roughly 100 m. The two horizontal magnetic field components (Hx and Hy)) were measured in the same direction as the electric field. The vertical magnetic component (Hz) was only measured in some soundings.

Previous MT studies were conducted in this region using 2D inversion and 3D modelling. This study provides detailed information about resistivity distribution through a 3D inversion algorithm (ModEM). Additionally, the study aims to explore the relationship between subsurface electrical conductivity anomalies detected by MT surveys and the occurrence of seismic events in SW Iberia. We seek to investigate how combining MT data with seismic data can enhance the understanding of fault zones and improve earthquake hazard models.

Keywords: Magnetotelluric, 3-D Inversion, Variscan Deformation, Portugal