



Magnetic anomalies associated to extensional detachments? An example at Xistral Tectonic Window of the Lugo Dome (NW Spain)

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The Eastern Galicia Magnetic Anomaly (EGMA) is one of the most conspicuous features observed in the aeromagnetic map of Iberia. It structurally overlaps the Lugo and Sanabria domes, which together define an elongated late Variscan extensional structure. Both domes delineate a segment of the western part of the Ibero-Armorican arc. In the northern part of the Lugo Dome, the Xistral Tectonic Window exposes a deep section of the continental crust which includes the relative autochthon of the Mondoñedo thrust sheet and several extensional detachments. The latter were folded by the development of the dome itself, which in turn is bounded to the W by the Viveiro Fault and its associated extensional shear zone.

Recently acquired land magnetic data of the Xistral Tectonic Window highly improves the resolution of the aeromagnetic data and shows that the anomaly features several low-wavelength anomalies reaching up to 1214 nT. Their location in relation with outcropping rocks and structures, together with 2D modeling of four sections across the tectonic window, shows a link between anomalies and extensional detachments, including the Viveiro extensional shear zone. Two sets of models are presented, one using magnetization entirely induced by the present earth magnetic field, and another including a remanent magnetization which, according with laboratory measurements, represents a significant contribution to the anomaly (mean $M_r = 0.267 \text{ A m}^{-1}$, $Q_n = 0.875$, $I = -28^\circ$, $D = 156^\circ$). Models including remanence seem more accurate, as they match better the geometry of large structures such as the Viveiro Fault. However, the ability of models to constrain the geometry of the structures is limited by the inhomogeneous and largely unknown distribution of magnetic properties associated to the shear zones.

Ferromagnetic minerals appear in high-grade metasedimentary rocks deformed in late Variscan extensional structures and their anatectic derivatives. Large metamorphic grains of magnetite occurring in Lower Cambrian and Neoproterozoic quartzites, schists, paragneisses, migmatites and inhomogeneous granites, are the primary carrier of induced magnetization. Other iron oxides resulting from alteration, exsolution and replacement, perhaps including single domain magnetite, seem responsible for the remanent magnetization.

Radially averaged power spectrum of the ground-based magnetic anomaly of the Xistral Tectonic Window indicates that the deepest sources lie at ca. 4 km. However, the same spectrum calculated for the aeromagnetic data of the whole EGMA, including the Lugo and Sanabria domes, shows depths down to 12.5 km. implying that the migmatites and inhomogeneous granites continue downward. This implies that extensional detachments continue beneath the surface south of the Xistral Tectonic Window, buried due to the southward plunge of the dome axis.

To a larger scale, the EGMA forms the northern part of a huge anomaly occupying the core of the Central Iberian arc. It is suggested that this broad magnetic anomaly is related with extension caused by gravitational collapse of the thickened Variscan crust, and that like the EGMA, local anomalies might reflect extensional structures, many of which may remain buried.