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Geoelectrical characterisation of the lithosphere below the Eastern Pyrenees: Constraints from three different types of electromagnetic data

Joan Campanya i Llovet (1,2), Juanjo Ledo (2), Pilar Queralt (2), Alex Marcuello (2), Josep A. Muñoz (2), Montserrat Liesa (3), and Alan G Jones (1)

(1) Dublin Institute for Advanced Studies (DIAS), Ireland (campanya@cp.dias.ie), (2) Departament de Geodinàmica i Geofísica, Universitat de Barcelona, Spain, (3) Departament de Geoquimica, Petrologia i prospeccio geofisica, Universitat de Barcelona, Spain

The Pyrenees resulted from the continental collision of the Iberian and European plates during the Late-Cretaceous to Early Miocene. Due to tectonic and stratigraphic differences observed along strike at crustal depths, the Pyrenees are divided into three main regions: the West-Central Pyrenees, the Central Pyrenees and the Eastern Pyrenees. Previous studies in the West-Central and Central Pyrenees show the presence of two main geoelectrical features associated with low electrical resistivity values; (i) partial melt of the Iberian Subducted Lower Crust (IBSLC) and (ii) the asthenosphere, suggesting a European plate thicker than the Iberian plate beneath the Pyrenees.
In this study we present the results of new electromagnetic data acquired in the Eastern Pyrenees. The geoelectrical model has been obtained from inversion of three different types of electromagnetic data: MT impedance tensor responses (Z), geomagnetic transfer functions (GTF) and inter-station horizontal magnetic transfer-functions (HMT). A non-linear sensitivity test has been performed to ensure the reliability of the fit of the analysed geoelectrical structures to the observed data. The models show that the low electrical resistivity structure associated with the Iberian subducted lower crust (IBSLC) is not present below the Eastern Pyrenees, suggesting a lack of partial melt below this profile and also implying significant differences in the geological evolution of the Eastern Pyrenees compared to the Central and West-Central Pyrenees. This difference is most probably due to the opening of the Mediterranean Sea subsequent to continental collision. The EM results also show that the lithosphere-asthenosphere boundary (LAB) in the Eastern Pyrenees is at a similar depth to that observed beneath other parts of the Pyrenees. The electrical resistivity models have been compared to independent available geological, geophysical and petrological data to better constrain the geological and physical processes of the study area.