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Geoelectrical characterization of the lithosphere beneath the Cantabrian Mountains and Duero Basin

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The Cantabrian Mountains, which extend for more than 250 km along the northern border of the Iberian Peninsula, constitute the western prolongation of the Pyrenees. To the south, the range is flanked by the Tertiary Duero foreland basin and, to the north, it overlies the northern Iberian continental margin and the Bay of Biscay abyssal plain. The range evolved from different tectonic regimes in Paleozoic, Mesozoic and Cenozoic times. The present Cantabrian Mountains represent a block of Variscan basement uplifted over the Duero basin as a consequence of a southward displacement along a basement-involved thrust during the Eocene-Oligocene convergence between Europe and Iberia.

We present a new long period magnetotelluric profile across the Cantabrian Mountains and the Duero basin acquired in the framework of the TOPO-IBERIA project. The MT profile consists of eighteen magnetotelluric sites over a 200 km-long, N-S oriented profile. The five component of the electromagnetic field were recorded, with periods ranging from 0,001s to 1000s for all the sites, and reaching 10000s in ten sites. The dimensionality analysis revealed a dominant direction of N110. Accordingly, a 2D model was obtained by joint inversion of tipper, TM and TE modes.

In the southern part the resistivity model presents a shallow conductor associated with the sediments of the Duero basin, over a high resistive and homogeneous lithosphere. Towards the north, the lithosphere beneath the Cantabrian Mountains presents a heterogeneous and conductive behaviour, in which various dipping conductors in the upper and middle crust can be associated with the frontal thrust of the Cantabrian Mountains over the Duero basin and other Alpine thrusts. A deeper, N-dipping conductive band (between 20 and 35 km depth) images the Iberian crust subducting to the north, as revealed by previous seismic experiments. Possible explanations for such a high conductivity zone are discussed with the aid of geothermal and rheological modelling.