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Characterization of a relative gravity minimum in the core of the Pyrenean Axial Zone (Central Pyrenees)

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The characterization of the basement architecture of the Pyrenean Axial Zone, backbone of the chain, is crucial to understand its geodynamic evolution and the interplay between tectonism and magmatism. In this work, a new gravity-constrained cross section was built along the Central Pyrenees, between two of the largest Pyrenean Late Variscan granitic complexes, La Maladeta and Andorra-Mont Louis granites, to infer the geometry at depth of the basement host rocks. This cross section is ca. 65 km long and extends from the Mesozoic Bóixols basin in the South to the Late Variscan Bassiès granite to the North, close to the northern end of the Axial Zone. It is based on available geological maps, previous published works and new geological field data; together with newly acquired gravimetric stations (1141), to improve the existent spatial resolution of the gravity data from the databases of the Spanish and Catalan Geological Surveys, and density values from 65 rock samples covering all different lithologies in the cross section. Thus, its geometry at depth is constrained by means of an integrated 2.5D gravity/structural/petrophysical modelling.

The La Maladeta and Andorra-Mont Louis granites appear aligned in a WNW-ESE direction and both lie within the same Alpine basement unit, the Orri thrust sheet. They are separated about 40 km by the WNW-ESE-oriented Llavorsí syncline, formed by Devonian and Silurian rocks and limited to the north and south by south vergent thrusts. This syncline is located between two large Cambro-Ordovician anticlinorium structures, the La Pallaresa and Orri massifs to the north and south respectively, formed by a monotonous alternation of shales and sandstones with some intercalations of limestones and conglomerates affected by very low to medium grade of metamorphism. Most structures show southern vergence along the cross section, and its southern part is characterized by the occurrence of Triassic evaporites, a significant detachment level decoupling deformation between the Paleozoic basement and the Mesozoic-Cenozoic cover rocks.

The observed residual anomaly along the cross section shows a relative maximum, coinciding with

the southern edge of the Axial Zone (Nogueras Zone) and southern half of the Orri massif, followed to the north by a relative large minimum. This gravity minimum in the core of the Axial Zone coincides with the northern half of the Orri massif, the Llavorsí syncline and southern half of the La Pallaresa massif and must be related at depth with rocks of lower density with respect to rocks located to the North and South. Two possible solutions have been postulated to explain the presence of lower density rocks: (i) the presence of Triassic evaporites at depth as a continuation to the North of the Triassic evaporites outcropping in the Rialp window located to the South and/or (ii) the presence of buried granitic bodies equivalent to the adjacent La Maladeta and Andorra-Mont Louis granites.