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Integration of geological and geophysical data to constrain basement host rock architecture in the Central Pyrenees

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In the frame of the GEOPIRI3D Project (financed by the Spanish Ministry of Science, Innovation and University), two new gravity-constrained cross sections have been made. The goal of this study is to analyze the Axial Zone of the central part of the Pyrenees to better constrain the geometry of the basement host rocks and genesis of the Late Variscan igneous bodies. The igneous rocks involved in the new cross sections presented here comprise the Maladeta granite complex and the Arties granite, which are emplaced in the metasedimentary Cambrian to Carboniferous successions, and the Stephanian-Permian volcanoclastic rocks.

The geological cross-sections extend ca. 40 km from the Mesozoic Bóixols-Cotiella basin in the South to the Gavarnie basement thrust in the North. They are based on available geological maps, previous published works and new geological and geophysical field work data. Cross-sections are constrained by gravity data by means of 2.5D gravity modelling. Density values for gravity modelling were derived from 83 laboratory measurements of all rock types outcropping in the study area.

In the constructed cross-sections all structures have a southern vergence, in both the Axial and South Pyrenean Zones. The structure of the Axial Zone is defined by north-dipping thrusts with intermediate to steep dips that cut across, or re-activate Variscan structures. Alpine structures involving the Palaeozoic series are in general parallel to the Variscan fabric that is controlled by folds and cleavage showing a northward dip. The southernmost front of the Axial Zone shows an imbricate system (normally between one and three) foreland-dipping, south-verging thrusts (the so-called têtes plongeantes) involving the Palaeozoic (both pre- and post-Variscan, either Stephanian volcanics or Permian red beds) and the Triassic (red beds and dolostones). A significant décollement exists between this unit and the Mesozoic-Cenozoic cover that shows in general a much simpler structure except for several diapirs (also associated with the Upper Triassic detachment level) that were re-tightened during the Pyrenean compression. These diapirs show a complex inner structure in which basic hypabyssal rocks (dolerites) are relatively common. With the available petrophysical data, the position of the southernmost basement hanging-wall cutoff and the overall interpreted geometry in the study area fits well the observed gravity data.