Integration of geophysical methods and fractures study for the Vallès geothermal system characterization (NE Spain)

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The Vallès geothermal system is located in the Catalan Coastal Ranges (CCR) (NE Spain). The CCR are formed by horst and graben structures limited by NE-SW and ENE-WSW striking normal faults, developed during the opening of the Valencia Trough (northwestern Mediterranean) (Gaspar-Escribano et al., 2004). In the Vallès Basin area, the thermal anomaly is located in the northeastern horst-graben limit, where a highly fractured Hercynian granodiorite is in contact with Miocene rocks by a major normal fault. This main structure seems to control the heat and the hot-water flow, nevertheless, the geological structure of this area, as well as the role of the Vallès normal fault, is poorly understood.

Magnetotellurics and gravity methods together with a detailed geological map have been applied in this area to understand the main structure. Although the geophysical part makes up most of the study, we are also elaborating a detailed geological map of the area, making a fractures study at different scales. We are working with DEM alignments analysis, and fractures study from outcrops and thin sections.

Our preliminary results in gravity show a strong gravity gradient in the NE-SW Vallès half-graben system and the recent MT profiles image the main fault of that system (Vallès normal fault). These results show a basin geometry with the major thickness of the basin towards the depocenter, disagreeing with the roll-over geometry assumed in previous works.

Interpretations of the fractures study, together with geophysical data and models, have allowed a preliminary characterization of damage zones associated with the fault system, which are directly related to the fluid flow and the hot springs. The nature of this damage zones could be related to relay ramps, commonly regarded as efficient conduits for fluid flow (Fossen and Rotevatn, 2016).