Geomorphological and geophysical approach to the North Maladeta fault recent activity

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The analysis of the macroseismicity of the Mw= 5.8 Vielha earthquake (1923, November 19th) points towards the North Maladeta Fault (Central Pyrenees of Spain) as the most probable seismogenic source. Detailed air-photo interpretation and field work in the area has led to recognition of the surface expression of this fault, which is partly coincident with the alpine Gavarnie thrust fault and has a length of 17.5 km. Geomorphologic analysis shows that the fault has been reactivated recently as a normal fault offsetting peneplain relicts dating approximately from Upper Miocene times. Maximum vertical displacement of the peneplains reaches 475 m and allows assigning vertical slip rates of 0.04-0.05 mm/yr to the fault.

The presence of lacustrine sediments adjacent to the trace of the fault in the hanging wall suggests the possibility of this material as being trapped in a tectonic depression associated to the North Maladeta Fault activity.

Further work consisted of a magnetotelluric survey performed along a 1.5 km transect perpendicular to the fault near the lacustrine deposits outcrop. The acquired data were modeled using a two dimensional inversion code. The resulting model reveals the existence of a tectonic graben associated to the North Maladeta Fault and a sediment filling made up of low resistivity (lignites) and moderate resistivity (glacial till) materials. Identification of vertical resistivity gradients coincident with smooth topographic scarps helped to locate secondary conjugate faults developed in the downthrown block.