Mapping faults in an urban environment from borehole data (Oviedo, NW Spain)

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The detailed geological mapping in built-up areas presents challenges that arise mainly from the covering of outcrops, and the erase of natural geomorphological features during earthmoving works related to urban development. However, it also benefits from the existence of closely spaced site investigation data, including boreholes, not commonly available outside the cities.

This contribution explains the procedure carried out to improve the interpretation of faults below the city centre of an urban core located in NW Spain. Oviedo is placed on a basin formed by an alternation of sub-horizontal carbonate and siliciclastic formations of Cretaceous age, over which lies an unconformable cover of Paleogene fluvial-lacustrine deposits mostly composed by clays and marls. The paleorelief over which the Paleogene was deposited results in great lateral changes in the thickness of these sediments. Moreover, the basin was deformed during the Alpine convergence in northern Iberia developing an open syncline oriented East-West. During the shortening, a number of minor faults cutting across the gently dipping Cretaceous and Paleogene deposits affect moderately the cartographic pattern of lithostratigraphic units.

Therefore, this research was focused on the preferential use of information on the ground provided by hundreds of rotary boreholes managed through a GIS-type geotechnical database. The procedure of semiautomatic identification consisted essentially of investigating the spatial variations of the boundary between two Cretaceous formations, in order to find anomalies attributable to fault displacements. In using this boundary as a strain marker for post-depositional deformation, two scales were approached, one aimed at the identification of large faults, and another with greater detail based on trend-surface analysis for fractures of smaller size and local incidence (vertical offset less than 10 m).

The research has allowed to discuss faults deduced in previous geological maps, helping to interpret thickenings related to the paleorelief, and also to recognize the existence of structures not described in the regional literature. This study provides also better constrains to the analysis of the structural relationships between the faults affecting the Mesozoic-Palaeogene basin, and the Alpine reactivation of the underlying Palaeozoic basement.