Characterisation of Quaternary scarps in the Baix Ebre Basin (NE Spain) and analysis of their potential seismogenic origin

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1. Introduction

The Baix Ebre Basin (BEB), located in the NE of Spain (Fig. 1), is a passive margin where different systems of normal faults exist, oriented NNE-SSW, oblique-to-parallel to the coast. Those intraplate faults are considered slow faults, with slip rates around 0,02 mm/yr [1]. The most outstanding fault in this area is the El Camp Fault (ECF), located towards the NE of the BEB, which has recently been studied through paleoseismology due to its remarkably geomorphological expression and due to its proximity to the Vandellós nuclear power plant.

Recently, some morphological scarps affecting Quaternary alluvial fans have also been detected along the BEB, from Pla de Sant Jordi Basin (NE of the BEB) until Sant Mateu (SW of the BEB). Those scarps are oriented in the same direction as the ECF, suggesting a possibly tectonic origin related to the same stress field. In that case, they would have to be considered as the ECF propagation to the south, which could imply a big impact on the seismic hazard of the entire region.

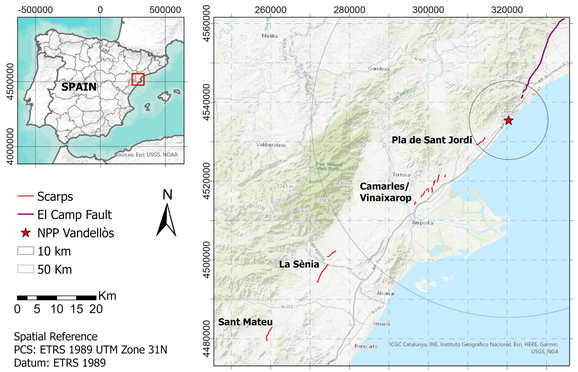

Fig. 1: Location of the recently discovered scarps along the Baix Ebre Basin (NE of Spain)

2. Geological setting

The scarps detected are located in different generations of Quaternary alluvial fans with ages ranging between 735 Kya and recent days [2]. These alluvial fans are the result of the erosion of both the Catalan Coastal Ranges and the Iberican Massif, as the area is located where these two mountain ranges merge. The basement of the area is mainly composed by Jurassic and Cretacic rocks, so the alluvial fans are rich in carbonates and have developed significant caliches.

It is on progress a detailed geomorphological analysis in order to identify and characterise all the possible scarps along the BEB, to stablish the different generations of alluvial fans and to locate the suitable places for paleoseismological studies. (Fig. 2)

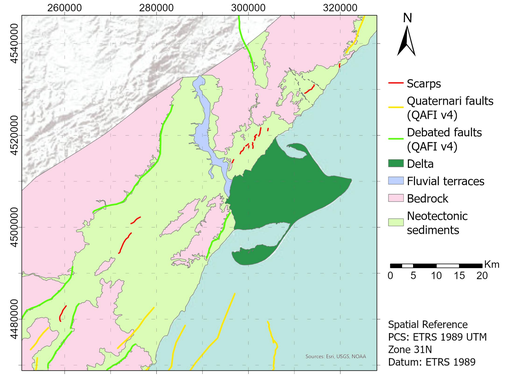

Fig. 2: Geomorphologic map of the studied area.

For the geomorphological analysis we are using recent and ancient (flight 1956-1957) aerial orthophotographs and a digital terrain model (DTM) (2 m resolution) of the area. The maps will be supplemented with information collected through fieldwork.

3. Topographic offsets

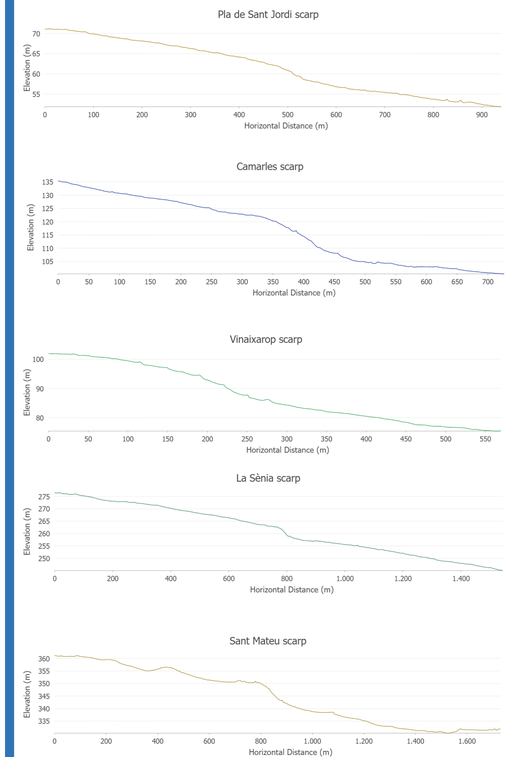

Fig. 3: Topographic profiles along the different studied scarps, from NE to SW. The vertical scale has been exaggerated.

4. Geophysical analysis

The scarps are interpreted as tectonic, but other possible origins should be explored, as some kind of karstic or gravitational processes. In order to find out their origin, a geophysical survey is being done, in which it is planned to use different techniques (Ground Penetrating Radar (GPR), Electrical Resistivity Tomography (ERT) and Magnetotellurics (MT)) with the aim of exploring its combined use and to analyse the subsoil structure from shallow to depth. In case of demonstrating their tectonic origin, it is planned to, firstly, carry on a paleoseismological study (to determine their seismological history) and, secondly, to analyse their contribution into the seismic hazard models of the region.
ERT and MT have already been applied at the Vinaixarop scarp, but the data interpretation is still ongoing.

- ERT: 72 electrodes placed along a 710 meters profile. Measures taken through Dipole-Dipole and Wenner-Schlumberger configurations.
- MT: 8 stations placed at distances between 100-150 between them, while two control stations were placed at the edges of the profile. We measured at 3 bands of frequencies, 4096, 512 and 128 Hz, and 4 Hz frequencies have been obtained through digital filtration. The measure times varied between 4 and 16 hours.

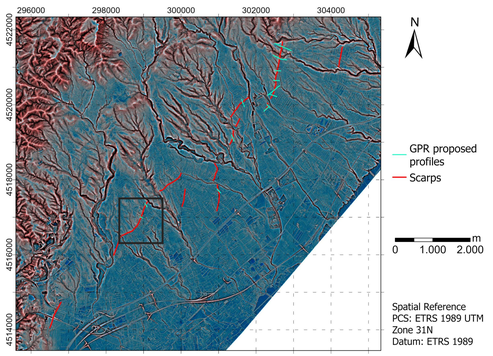

Fig. 4: Camarles/Vinaixarop area and location of GPR proposed profiles.

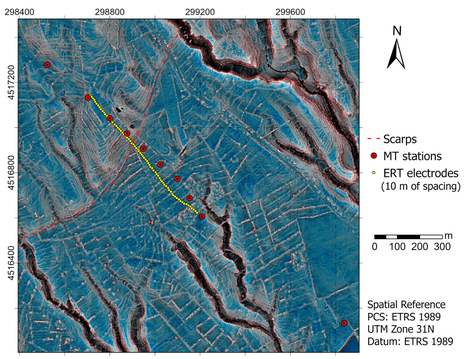

Fig. 5: Situation of ERT and MT profiles. Location of Fig. 5 is shown on Fig. 6.

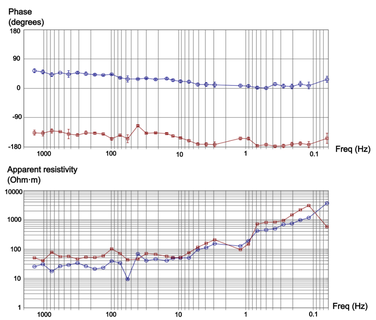

Fig. 6: Preliminar results obtained from MT. We are getting responses (apparent resistivities and phases) for a range between 0,001 and 1 seconds, whereby we expect to characterise the electrical resistivity of, at least, one kilometer depth.

Acknowledgements

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References

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