



Validation of the Earthquake Archaeological Effects methodology by studying the San Clemente cemetery damages generated during the Lorca earthquake of 2011

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The intensity scales determined the damage caused by an earthquake. However, a new methodology takes into account not only the damage but the type of damage "Earthquake Archaeological Effects", EAE's, and its orientation (e.g. displaced masonry blocks, conjugated fractures, fallen and oriented columns, impact marks, dipping broken corners, etc.) (Rodríguez-Pascua et al., 2011; Giner-Robles et al., 2012). Its main contribution is that it focuses not only on the amount of damage but also in its orientation, giving information about the ground motion during the earthquake. Therefore, this orientations and instrumental data can be correlated with historical earthquakes.

In 2011 an earthquake of magnitude Mw 5.2 took place in Lorca (SE Spain) (9 casualties and 460 million Euros in reparations). The study of the EAE's was carried out through the whole city (Giner-Robles et al., 2012). The present study aimed to a.- validate the EAE's methodology using it only in a small place, specifically the cemetery of San Clemente in Lorca, and b.- constraining the range of orientation for each EAE's. This cemetery has been selected because these damage orientation data can be correlated with instrumental information available, and also because this place has: a.- wide variety of architectural styles (neogothic, neobaroque, neorabian), b.- its Cultural Interest (BIC), and c.- different building materials (brick, limestone, marble).

The procedure involved two main phases: a.- inventory and identification of damage (EAE's) by pictures, and b.- analysis of the damage orientations. The orientation was calculated for each EAE's and plotted in maps. Results are NW-SE damage orientation. This orientation is consistent with that recorded in the accelerometer of Lorca (N160°E) and with that obtained from the analysis of EAE's for the whole town of Lorca (N130°E) (Giner-Robles et al., 2012). Due to the existence of an accelerometer, we know the orientation of the peak ground acceleration and we have been able to constrain the ranges of orientation for each EAE's. The orientation of the damage is not usually recorded after an earthquake; however, it can provide information on seismic source in historical earthquakes.

References

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