

Imaging active faults in the diffuse plate boundary between Iberia and North Africa

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The repeated occurrence of large magnitude earthquakes in southwest Iberia in historical and instrumental times suggests the presence of active fault segments in the region. However, due to an apparently diffuse seismicity pattern, which defines a broad region of distributed deformation west of Gibraltar Strait, the question of the location, dimension and geometry of such structures is still open to debate. In the Gulf of Cadiz, earthquake catalogs show the existence of individual clusters whose relationships with known geological features remain unclear. In order to address this question, we combine results from earthquake location, waveform similarity analysis and moment tensor inversion. We first determine absolute and relative locations in the vicinity of one of those clusters for more than 2000 earthquakes using a 3D velocity model compiled from previous studies. We then investigate waveform similarity between neighboring events from cross-correlation and compute focal mechanism solutions by waveform inversion. The consistent results obtained from those independent techniques suggest an apparent concentration of events, beneath the Guadalquivir Bank, along a low angle northward-dipping plane rooted at the base of the crust, which could indicate the presence of a major, previously unseen fault in a region that has unleashed large magnitude earthquakes.