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The SEICHE Project: intraplate seismic source characterization for hazard assessment

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SEICHE – "seismicity of plate interiors and challenges for hazard assessment" is a research project funded by the Portuguese Research Foundation FCT under the typology "Line of Excellence", which brings together under the same umbrella different research initiatives that share a goal. The project started in 2013, and will end in 2017. We report here on the results of the first phase of the project, which aimed at the identification and characterization of intraplate seismogenic structures, and site selection for in-depth studies. Taking advantage of previous work the following structures were selected: a) the Eastern Lower Tagus Valley Fault System (ELTVFS) in Portugal; and b) the Inhaminga-Machaze fault in Central Mozambique. The two systems were approached with distinct methodologies, given the available resources.

Whereas the Lower Tagus Valley historical seismicity has been well documented, and geomorphology and secondary deformation pointed clearly towards ongoing tectonic activity in a sinistral strike-slip regime (Besana-Ostman et al., 2012), no unequivocal field evidence of surface rupture had been put forward until this study. Contrary to previous work that focused on the northern margin of the Tagus River, the analysis of geomorphological and drainage anomalies in a 90m-resolution (SRTM) DEM and in aerial photos led the fieldwork to the southern margin. DTM's of increasing resolution were then acquired, first from IfSAR data (5m-resolution), then from LiDAR data (0.5m-resolution) and finally using a UAV (0.04m-resolution), to guide the investigation to suitable trenching sites.

Palaeoseismic work provided the first unequivocal evidence of multiple surface rupture (Canora et al., 2015, see Foroutan et al., this section, for a detailed description of the Santa Maria Creek site). Geochronological analyses are underway to assess the chronology of past earthquakes and to constrain – in conjunction with displacement measured from surface imagery – the slip-rate.

In Central Mozambique, local seismicity recorded with a temporary network (Fonseca et al., 2014) allowed the delineation of a ∼300km-long active normal fault connecting the known structures of the Malawi rift further north to the epicentral region of the M7 Machaze earthquake of 2006 (see Fonseca et al., this session, for a detailed description). Ambient noise tomography (Domingues et al., 2016) allowed the correlation of the structure delineated by the seismicity with the transition from cratonic crust (Kaapvaal, Zimbabwe) to the extended crust of the Mozambique Coastal Plains.

The next phase of Project SEICHE will aim at understanding the driving mechanisms behind the deformation in these two distinct intraplate settings, using GPS, InSAR and FE modelling, and taking into account the possible roles of basal drag, horizontal gradients of potential energy, or other effects that may be irrelevant in interplate settings.