

RE-EVALUATION OF THE SEISMO-TECTONICS OF THE MARMARA REGION



Naci Görür

Istanbul Technical University, Faculty of Mines, Department of Geology, Maslak, 34469, Istanbul, Turkey (gorur@itu.edu.tr)

The large part of the Marmara Region, including the Thrace and the Sea of Marmara Basins, constitutes the western part of a right-lateral shear zone in northern Turkey (the North Anatolian Shear Zone). This zone was established in the region during the medial Miocene after the final closure of the remnant fore-arc Thrace Basin in the Oligocene. Its deformation resulted in the generation of a number of tectonic structures, leading to the formation of both the Sea of Marmara and the North Anatolian Fault (NAF) (Fig. 1). These structures may be

defined according to the stages of shear evolution in the Riedel Experiment: pre-peak, peak, post-peak, and pre-residual (Tchalenko, 1970; Şengör et al., 2005). The first two structure stages occurred probably during the medial to late Miocene, whereas the others took place during the Pliocene to Pleistocene (Görür and Okay, 1996; Görür and Elbek, 2014). The pre-peak structure stage includes NE-SW trending folds and dip-slip faults of NW-SE and NE-SW orientations. The peak structure stage is represented mainly by NW-SE-trending strike-slip faults or Riedel shears. The post-peak structure stage is characterized by NE-SW-striking right-lateral strike-slip faults or P-shears. Pre-residual structure stage consists of a number of P-shears in a narrow belt between the Saros Bay and Gulf of Izmit with a strike, parallel to the tectonic trend. This stage perhaps marks the initial state of the development of a master fault, the submarine portion of the NAF (Marmara Fault) (Şengör et al., 2005; Görür and Elbek, 2014). The Sea of Marmara appears to have formed during the Late Pliocene to Pleistocene along a variety of Riedel, anti-Riedel and P-shears of the post-peak and pre-residual structure stages.

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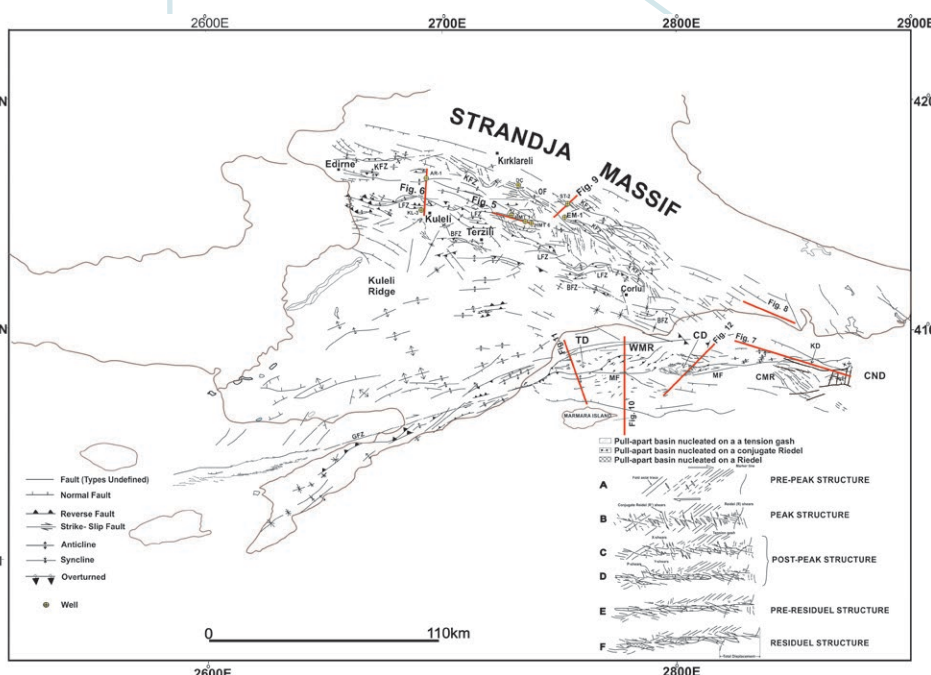


Figure 1

EARTHQUAKE TRIGGERED LANDSLIDES: IMPLEMENTATION OF A LONG TERM OBSERVATORY



Pascal Bigarré

Pascal Bigarré, Delegate Director at INERIS, French National Institute for Industrial Environments and Risks

WP6

If landslides are “local-scale” geohazards that differ profoundly from major earthquakes, they still show strong links with these deep tectonic events. In hilly and mountainous regions, earthquakes trigger landslides, adding secondary societal disruptions, increasing death toll, damaging infrastructures and hindering rescue operations. Coseismic landslides show time persistence along with seismic aftershocks and rainfall conditions. Eventually, submarine landslides may also be source of tsunamis.

The main objective of MARSITE WP6 is to carry out multidisciplinary research with different groups to enhance our capabilities to assess earthquake triggered landslides, aiming eventually to improve preparedness, prevention and resilience.

The research focuses on two sub-regional test areas of high interest close to the North Anatolian Fault and that benefit from previous in-depth studies and campaign of geotechnical and geophysical observations. First, the hilly Cekmece-Avcilar peninsula, located westwards of Istanbul, is a highly urbanized concentrated landslide prone area, showing high susceptibility to rainfalls while affected by significant seismic site effects. Second, the off-shore entrance of the Izmit Gulf, close to the termination of the surface rupture of the 1999 earthquake, that shows an important slump mass with a priori tsunamigenic potential and facing the Istanbul coastline. The specific aims of the multidisciplinary research are three-folds:

- The improvement of seismic landslide assessment susceptibility and mapping tools, modelling all relevant data while combining the important transient triggering factors that are seismic shaking and heavy rainfall. This includes thorough assessment of remote sensing methods to map landslide distributions;
- The implementation of a long-term multi-parameter field observatory of a representative well-constrained landslide prone slope, along with the testing of an integrated early warning system, to better understand the trigger factors;
- The development of a methodology to assess and map the landslide tsunamigenic susceptibility, ranging from high resolution sea-floor observational data to laboratory physical and numerical modeling.

The research is also expected to pave the way towards a prototype infrastructure featuring near to real-time mapping and monitoring capabilities to process, fusion and share landsliding long term data, in seamless connection with both strong ground motion and weather monitoring networks.



Topview of a landslide event occurrence, in 2006, on the shore line, located in the test area (Mapping data : Google, DigitalGlobe)