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SEISMOTECTONICS OF THE ARMUTLU PENINSULA, NW TURKEY, FROM GEOLOGICAL FIELD OBSERVATION AND REGIONAL MOMENT TENSOR INVERSION

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The Armutlu peninsula, located in the eastern Marmara Sea, coincides with the western end of the rupture of the 17 August 1999, İzmit MW 7.6 earthquake which is the penultimate event of an apparently westward migrating series of strong and disastrous earthquakes along the NAFZ during the past century. We have jointly analyzed geological field observation and moment tensor inversion to evaluate previous seismotectonic models and their implications for seismic hazard assessment of the eastern Marmara region. Long term kinematics were investigated by performing paleo-strain reconstruction from geological field investigations by morphotectonic and kinematic analysis of exposed brittle faults. Short term kinematics were investigated by inverting for the moment tensor of 13 small to moderate recent earthquakes using surface wave amplitude spectra. Our observations confirm previous models interpreting the Armutlu peninsula as a horst zone in a transtensional active pull-apart environment of the Marmara Sea Region associated with significant NNE–SSW extension and significant vertical displacement. At the northern part of the peninsula, long term deformation pattern did not change significantly since Pliocene times contradicting regional tectonic models which postulate a newly formed single dextral strike slip fault in the Marmara Sea Region. This area is interpreted as a transtensional horsetail splay fault structure associated with a major normal fault segment that we call the Waterfall Fault. Apart from the Waterfall Fault, the stress strain relation appears complex associated with a complicated internal fault geometry, strain partitioning, and reactivation of pre-existing plane structures. At the southern Armutlu peninsula, recent deformation indicates active pull-apart tectonics constituted by NE–SW trending dextral strike slip faults. Considering the inferred fault geometries, large earthquakes generated by stress release along large rupture zones as observed for the İzmit 1999 earthquake seem to be less probable at the northern, but more probable at the southern peninsula. In addition, transtensional faulting at the Armutlu peninsula is consistent with the southwest directed far field deformation of the Anatolian plate. Consequently, we support the hypotheses that regional seismicity is predominantly driven by plate boundary stresses.

REFERENCES

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