



3D structural model of the Sea of Marmara

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The North Anatolian Fault Zone (NAFZ) is one of the most famous active strike-slip fault system which is plate boundary between the Anatolian block and the Eurasian plate. The relative plate motion is about 2.5 [cm/a] and the NAFZ has a length of 1100 km. In its western part, the fault cut through the Sea of Marmara. In this area, basins have been evolving due to the NAFZ in a complex transitional setting. This region represents a seismic gap in the NAFZ where is close to the Megacity of Istanbul with more than 12 million inhabitants.

Comprehension and detailed description of the geological structure in the Sea of Marmara are essential keys to understanding the tectonic processes and geodynamic evolution. In particular, the structural setting is probably the control for segmentation of the seismic faults and would determine the maximum possible earthquake magnitude to be expected south of Istanbul in the seismic gap east of the Bay of Izmit where 1999 the last major earthquake hit the region and which has not ruptured since 1766 over a length of app. 150 km.

In this study, we integrate different geological and geophysical data such as existing structural models, well data, seismic observations and gravity to build a new 3D lithospheric-scale structural model which is additionally constrained by 3D gravity modeling. The 3D gravity field indicates significant density heterogeneities in the crystalline crust. We have tested different crustal configurations to find the best fit to the observed gravity field.

The final 3D structural model suggests that the gravitational anomalies are mostly due to the density contrasts in the upper-middle crust rather than due to the presence of a high-density lower crustal body or the Moho depth. The derived density structure indicates lithological heterogeneities within the crust that may result in different rheological behavior along the NAFZ. This could potentially have an impact on the rupture propagation and segmentation of the fault system.