

Strain localization in the Sea of Marmara. From pull apart basin to the Main Marmara Fault.

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During the Plio-Quaternary the Sea of Marmara has been the site of progressive localization of strain. This active tectonic zone is presently the site of pure dextral strike slip faulting that connects the Izmit Fault in the east to the Ganos Fault in the west along a linear strike slip fault that is part of the north-western branch of the North Anatolian Fault (NAF). This active Main Marmara Fault (MMF) cuts across a succession of depocenters and highs.

Analysis of a large data set that includes bathymetry, imagery, industrial multichannel seismic lines, sparker and 3.5 KHz echo sounder recording, the rough bathymetry of this basin can be interpreted as the inversion of former pull apart basins. Crustal N 120° trending normal faults framing these depocenters are inactive and are sealed by post tectonic sediments. Listric growth faults only were mapped in the Cinarcik basin and are probably related to superficial gravity sliding. The Central Basin is interpreted as a rotational mini basin along the MMF. The prominent highs correspond to a series of anticlines locally framed by reverse faults and are interpreted as inverted transform faults of this former pull apart basin system. The same interpretation can be proposed for the emerged Armutlu peninsula, and the same elongated folds were mapped on the southern Marmara shelf at the western termination of theFault indicating this transpressive shear zone was 50 km wide at least.

Motion along the MMF was estimated by to be close to 4 km taking into account the offsets of significant markers observed in the bathymetry along the fault. Using the instantaneous rate of motion along this fault, motion along the MMF was fully initiated 300 000 to 100 000 yr. ago. This does not take into account the motion along the Genlik Fault in the south and its continuation in the Sea of Marmara but this offset is more difficult to estimate by the past. The normal faults of the pre-existing pull apart basin system are blanketed by a 300m average thickness of sediments. Using an average 500m/ to 1km/My sedimentation rate into the uppermost sediments in this basin, cessation of crustal extension can be estimated to be 300 000 to 600 000 yr. old.

Consequently the recent localization of the MMF was preceded by fast tectonic inversion of the pull apart basins that probably lasted around 100 000 yr. At the western termination of the Genlik Fault this inversion is probably still in progress. This structural inversion of the Marmara pull apart basins marks the transition between transtension to transpression.

According to our reconstructions (figure 1), the total amount of motion accounted for in the Sea of Marmara is about 34 Km including the offset along the recent MMF. At the present rates of motion of the Anatolian plate with respect to Eurasia, these correspond to only 1.5 Myr of motion. This outlines the fast propagation of the NAF towards the west.

Figure 1: Reconstruction of the Sea of Marmara shear zone since the Pliocene from Rangin C., X. Le Pichon, E. Demirbag and C. Imren: Strain Localization in the Sea of Marmara, *Tectonics*, 23, TC2014, doi:10.1029/2002TC001437, 2004.

