Evolution of transform ridges and basins with special reference to the Marmara region

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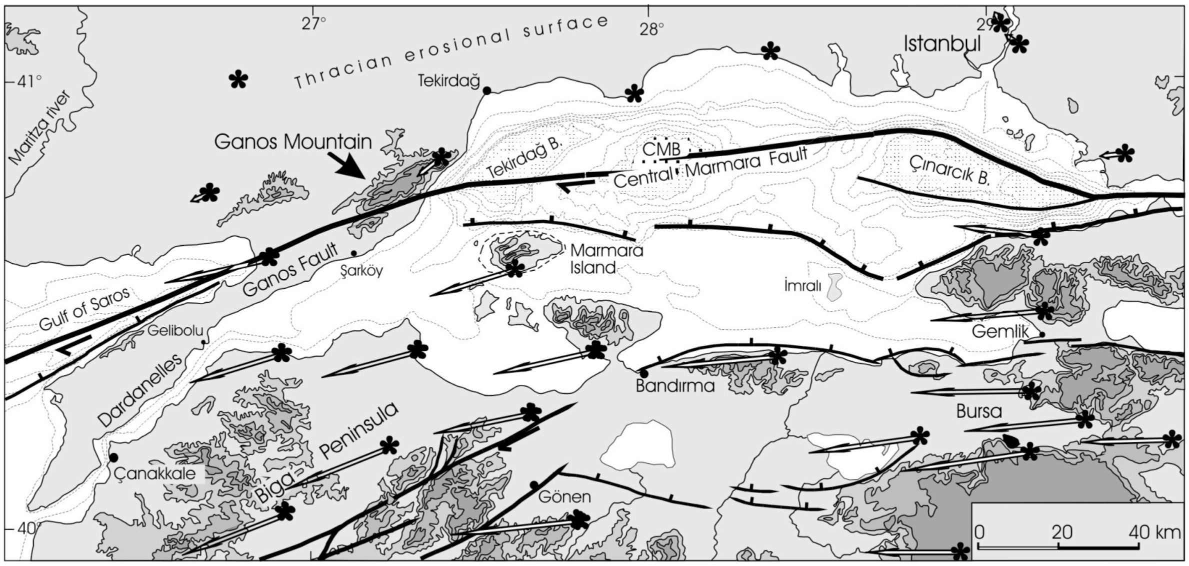
The obliquity between the orientation of the strike-slip faults and that of the relative plate motion leads to the formation of the transform ridges and basins, which are ubiquitous along major strike-slip fault zones. To conserve energy, however, strike-slip faults should be parallel to the relative plate motion. There are probably two main reasons as why most major strike-slip faults deviate from this condition. The first is the influence of the pre-existing faults on the location of the active fault, and the second is temporal and spatial changes in the relative plate motion. These two factors counteracted by the tendency of the strike-slip fault to follow the relative plate motion results in a complex evolution of the transform ridges and basins.

The Marmara Sea region provides a good example of the influence of the former fault geometry on the formation and evolution of the transform ridges and basins. In the Marmara Sea the North Anatolian Fault (NAF) is strongly segmented forming the İzmit, North Boundary (45 km long), Central Marmara (105 km) and Ganos faults. The almost pure strike-slip İzmit fault bends 26° in the west to form the strongly transtensional North Boundary Fault. An active transform basin with syntransform sediments, over 3-km in thickness, is forming southwest of the North Boundary Fault. The major bend and the associated transform basin most probably owe its origin to a Miocene strike-slip fault zone, which was followed by the NAF. Despite claims to the contrary the NAF has not yet cut a new fault through the basin, although this would energetically be favorable. In the central Marmara region the plate motion vectors between the Anatolian and Eurasian plates show an anti-clockwise rotation induced by the increasing pull of the Hellenic subduction zone. This creates transtension in the western section of the Central Marmara Fault opening the Tekirdağ basin, and transpression in the eastern part, forming the anticline of the Central Marmara ridge. The 17° contractional bend between the Central Marmara and Ganos faults is resulting in the uplift of the Ganos Mountain. Recent apatite fission track studies have shown that the Ganos Fault and Ganos Mountain have a history going back to the Oligocene; the Ganos fault bend and the associated structures are also apparently imposed on the NAF.



North Anatolian fault and other active faults in the Marmara region in northwest Turkey (Okay et al., 2004).