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Geophysical Framework of the Sea of Marmara

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Western Turkey has undergone dominantly N-S extension causing the formation of E-W trending grabens and similarly oriented normal faults (Eyidoğan, 1988). Marmara Sea is the extension of the Trakya basin in the north. Neogene lateritic depositions are present at the borders of this basins. The islands which are also called Marmara, are made up of crystalline Paleozoic rocks of marbles and granites. The Caspian-Black Sea region up to Italy in the west is at present tectonically very labile. Rapid subsidence characterizes a series of more-or-less elongated basins run subparallel to and are interrupted by areas undergoing uplift. Thus, during the Quaternary, the Sea of Marmara has subsided an amount well in excess 1000 m, accompanied by extension and transform motion. On the other hand, Quaternary uplift in western Anatolia is widespread. The early Quaternary erosional plateau has raised to up to 300 m in Trakya, 950 m on Tekirdağ and almost 2000 m on Uludağ in the south. These uplifts and subsidences are tha extensive phenomena traceable to regional tectonics. During the final phase of the destruction of the Tethys, readjustments of the microcontinents and collision lead to the development and reactiviation of transforms, as well as non-rigid deformation of continental crust along the collision front. As a result, north-south crustal shortening and secondary east-west stretching occurred. The primary vertical tectonics is uplift, but where transform faults cut across the direction of transform motion, crustal attenuation and subsidence prevail, leading to the formation of pull-apart basins.

Marmara region has different seismic characteristics from the rest of western Anatolia and appears to act as a separate tectomic unit (Crampin and Erans, 1986). This region shows higher seismic activity than the western Turkey in general indicating that this region is partly under the influence of the western end of the North Anatolian Fault which splays into a number of branches in and around the Sea of Marmara (Dewey and Şengör, 1979). The norhernmost branch becomes a graben and follow the Gulf of İzmit, connecting the Çınarcık pull-apart basin in the Sea of Marmara (Şengör et al., 1985). Based on fault mechanism solutions, Crampin and Evans (1986) suggested that the Marmara block is beging rotated and sheared in order to accommodate the right-lateral motion of the North Anatolian Faault and extensional tectonics of the southwestern Anatolian province.

The structures of the Sea of Marmara show the characteristics of rapid subsisdence acconpanied by extension and transform motion. In this area, pure strike-slip motion changes into extensional strike-slip movement responsible for the creation of the basins of the Sea of Marmara and the North Agean where the Ganos Dağ area active faults joins these two basins. It migth be well possible that the Saros trough and the Sea of Marmara basin (Adatepe, 1988; Ergün et al., 1988) were activated after the extension ceased in the north where the Trakya basin is situated having 3 to 4 km of Neogene sediments.

The seismological, seismic reflection , gravity and magnetic geopysical data will be reviewed for the Sea of Marmara and the surrounding area. Earthquake data indicate seismolgically very active region. The estimated crustal thickness is around 30-35 km determined from the earthquake data. The northern side of the Sea of Marmara shows smoother gravity and magnetic anomalies than the southern side. Magnetic anomalies are very much affected by the magmatic end volcanic intrusions on the southern side of the Sea of Marmara. The basement (most probably made up of the crystalline rocks df the Biga Peninsula on the south and the Istranca in the north) has been obtained to be around 2 to 5 km determined by the gravity modelling and power spectrum analysis. Neotectonic movements show their effects even within the very recent sediments indicated by shallow seismics in the area. Also, there exists a crushed zone in the middle of the basin marking the effects of strike-slip motion coupled with tensional movement. İzmit Bay area in the east of the Sea of Marmara was found to be a half graben from the gravity interpretation with the vertical movements taking place on the south side.

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