



Seismicity and Faulting Patterns of Earthquakes Beneath the Marmara Sea

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Following the 1999 İzmit, Turkey earthquake, the Marmara Sea has been the focus of an increasing interest since it may accommodate a destructive future earthquake. In spite of this risk, faulting pattern beneath the Marmara Sea that houses the North Anatolian Fault (NAF) is not well-known. In this study, I only focus on events beneath the Marmara Sea corresponding into four years of seismicity. In this context, precise locations of the studied events and their source mechanisms will provide significant contribution to the assessment of a future seismic risk and carry additional clues about the imprints of the NAF beneath the Marmara Sea.

As inferred from bathymetric studies, the Marmara Sea consists of three submarine depressions; Tekirdağ, Central and Ç1 narc1 k Basins from west to east and two highs that separate these depressions; Western High and Eastern High. Studied events are rather distributed along the northern branch of the NAF, referred as the Main Marmara Fault from marine-based studies. They appear with local clusters at those submarine regions, corresponding into the Central Basin and the Western High. On the other hand, seismicity rate is significantly increasing to the east covering the eastern Marmara Sea and to the west between the Marmara Island and the Tekirdağ province. Also, a linear but sparse cluster is lying along the southern shoreline of the Marmara Sea. This seismicity is generally attributed to the middle branch of the NAF. But, there is no seismicity in the central Marmara Sea that is accommodated between the northern and middle branches of the NAF.

Faulting patterns of small to moderate sized events within those clusters are investigated using the regional moment tensor inversion technique and the first motion analysis. Focal mechanism solutions in eastern Marmara Sea are mostly characterized with strike-slip focal mechanisms compatible with the submarine branches of the NAF.

Other events located to the south of the Çınarçık Basin are mostly associated with normal faulting located inland as well as some strike-slip faulting located offshore. Within the Central Basin and the Western High along the northern branch of the NAF, presence of a right-lateral strike slip fault is clearly observed for many moderate-sized earthquakes. To the southern shoreline of the Marmara Sea source mechanisms are mostly constrained with strike slip faulting with a nodal plane striking in ENE direction. This strike is consistent with other branches of the NAF located inland to the south of the Marmara Sea. Based on the localities and focal mechanism solutions in the southern Marmara Sea, it is concluded that the middle branch may not be associated with a single segment, it may consist of multiple segments that cut the southern shoreline of the Marmara Sea with an angle ranging from 20° to 30°. Substantial normal faulting with strike slip component only exists within the gulf of Gemlik. This makes a contradiction with previous studies that assign some part of extensional component in the northwestern Turkey to the middle branch of the NAF.