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A synthesis on fault geometry, earthquake rupture and fault creep along the North Anatolian Fault in the Sea of Marmara

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The westward propagation of North Anatolian Fault Zone's (NAFZ) M>7 earthquakes since 1939 is one of the most well-known rupture series of an active continental transform fault within the instrumental period. During the last twenty years following the devastating Mw 7.4 1999 Izmit earthquake, immense number of observations gathered from the Sea of Marmara (SoM) which is the site of next big earthquake rupture along the NAFZ. High-resolution geophysical surveys portrayed how the submarine segments of the NAF controls the subsidence of deep basins and slip-partitioning along these segments. Accordingly, NAF carries a more transtensional behavior in this section of its course. Presence of fresh fault scarps with cumulative vertical offsets at the seafloor is an evident indicator of this behavior. More significantly, imaged submarine fault scarps are most probably associated with well-known large historical earthquakes that hit Istanbul and its surrounding in the past (i.e. 1509, 1766a, 1766b, 1894, 1912 earthquakes). These past earthquakes and their hazardous nature force us to unravel the earthquake recurrence interval on the submerged fault segments of the NAF. Sediment cores recovered from the submarine basins of SoM reveal deposits of earthquake triggered sediments so called seismoturbidites which are critical records to evaluate submarine earthquake history. Sediment core analysis predict a ∼200 yrs interval based on C14 dating consistent with the previously suggested geodetic and seismological predictions for the NAF. A challenging task is to relate analyzed seismoturbidites to significant fault segment ruptures in the SoM. While we try to solve the relation between seismoturbidites and fault segments, another challenge rises from recent studies suggesting fault creep occurring on some of the submarine segments of the NAF. Several world-wide examples of strike-slip faults have creeping zones (i.e. San Andreas Fault, Garlock fault and North Anatolian Fault) and presence of microseismicity can helps us to illuminate the locked and unlocked sections of these fault zones. However, the behavior of large earthquakes on creeping continental faults is still not well known. It is essential to identify the locked and creeping sections of NAF to have a better estimate on earthquake recurrence. This study aims to make a synthesis based on several geophysical, geological, sedimentary and geodetic datasets to modestly challenge some of the puzzles regarding the NAF's behavior in the SoM.