Structural Setting Along The Western North Anatolian Fault and Its Influence on the 2014 North Aegean Earthquake (M 6.9)

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Abstract

We investigated microseismicity, geodetic slip and structural setting along the western North Anatolian Fault NAF to characterize their influence on pre-, co- and post-seismic stages of the 2014 North Aegean Earthquake (M 6.9). We identified that the NAF in North Aegean Sea (NAS) operates beneath three basins and two transpressional ridges rather than a single through-going basin. Refined hypocenters indicate that NAF is a narrow shear-zone in the east, and systematically expands towards the west. Microseismicity has a wide spread epicentral pattern at pre-seismic stage of the 2014 earthquake, but later tightens during post-seismic stage. This suggests that pre-seismic strain accumulation was completed on the main fault and transferred to surrounding secondary structures, and the slip returns back to the main fault following the mainshock. Overall microseismicity pattern shows that seismogenic zone becomes deeper to the west and shallower to the east. Three fault segments merged with two step-overs have failed during the 2014 North Aegean Earthquake rupturing a _˜90 km section of the NAF. There, co-seismic slips reach up to _˜80 cm beneath western step-over and remains below _˜60 cm beneath eastern step-over. Along-fault pre- and co-seismic slips show a complementary pattern verifying that the 2014 mainshock generated the highest slip at pre-seismically locked patches, located beneath transpressure ridges hosting two step-overs. High pre-shock concentrations underneath suggest fracturing at seismogenic basement overcoming frictional strength at these two fault step-overs.

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