



## **Imaging the Mudurnu Segment of the North Anatolian Fault Zone From Waveforms of Small Earthquakes**

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An identification of down-dip extension of faults and detailed structure of the upper crust is key issue in imaging locations and geometries of future earthquake ruptures. Active wide aperture and multichannel seismic profiling can provide such information but require substantial budgets for data acquisition. However, both cannot image near-vertical fault planes. These difficulties can be overcome by studying local seismicity. Local earthquakes generate high frequency seismic waves, which can be reflected and/or converted at structural horizontal or inclined interfaces or faults representing a first-order discontinuity with a velocity contrast.

In this study, we analyze waveforms of local earthquakes occurring before, between, and after the two consecutive 1999 Mw > 7 İzmit and Düzce earthquakes in NW Turkey. The waveforms were recorded at three seismic stations located around the Mudurnu segment of the North Anatolian Fault Zone. We focus on the interpretation of a distinct secondary phase contained in the P-wave coda that is well separated from the direct P wave. The phase is visible in many waveforms of most seismicity clusters and has a specific constant time delay after the direct P-wave arrivals at each station, irrespective of epicentral distance, hypocentral depth, or back-azimuth. Based on a polarization analysis of records at one of the stations, this secondary phase is interpreted as a PS wave converted at an interface near the stations. Its particle motion is consistent with the direct S wave and displays S-wave splitting produced by the anisotropic upper crust. Synthetic modeling indicates that this PS phase can be either converted at a horizontal interface or at a steeply inclined interface. The steep Mudurnu fault zone with the near-surface setting indicating a juvenile pull-apart structure fits well into these interpretations, which are in agreement with the eastward progressing transtensional tectonics known for the region.