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Structural Evolution of the Alasehir (Gediz) and Buyuk Menderes Grabens: Implications for Cenozoic Extensional Tectonics in Western Turkey

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In western Turkey, the Cenozoic extensional tectonics was initiated in late Oligocene and produced the Menderes Metamorphic Core Complex (MMCC) and associated extensional structures. The Alaşehir and Büyük Menderes Grabens are two major E-W trending grabens that border the central part of the MMCC to the north and south, respectively. These two grabens were previously considered by many researchers as symmetrical grabens developed under the control of two oppositely dipping detachment surfaces; the north-dipping Alaşehir detachment to the north and the south-dipping Büyük Menderes detachment to the south. These researchers proposed that the detachments were formed in early Miocene as high angle normal faults and rotated to low angle detachment faults. Detailed field mapping and structural interpretation of seismic reflection profiles by many previous studies in the Alaşehir Graben suggest the presence of a well-developed roll over structure associated with the listric geometry of the north-dipping Alaşehir detachment surface.

Recently, we have interpreted several N-S and E-W trending seismic reflection profiles in the Büyük Menderes Graben. The seismic lines reveal that the south dipping normal fault along the northern flank of the Büyük Menderes Graben is not listric and does not contain a roll over structure on its hanging wall. Kinematic modeling using backstripped cross sections and tectonic subsidence rates suggests that the evolution of the Büyük Menderes Graben was controlled by two active planar boundary faults, one on each margin with numerous internal planar subsidiary faults. Therefore, we suggest that the kinematic development of the Büyük Menderes Graben fundamentally differs from that of the Alaşehir Graben. The Büyük Menderes Graben seems to have been initiated by slip on the boundary faults during the early Miocene. The development of the graben was largely controlled by slip on the south-dipping (master) boundary fault that merges with a planar mid-crustal detachment, but the sedimentary fill was alternatively controlled by slip on the bounding faults as well as locally on internal faults. The various units in the entirely syn-tectonic sedimentary section thicken into different faults in different parts of the graben, including the internal faults. This suggests multiple polarity change during its development. In the Pliocene, the graben experienced a slow subsidence rate, probably in response to decrease in extension rate in western Anatolia.