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Tectono-stratigraphic evolution and exhumation of the Haymana basin: Unravelling the subduction and collision history of Neotethys in Turkey

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The Haymana basin straddles the Izmir-Ankara-Erzincan Suture Zone (IAESZ) in the north and Intra-Tauride Suture Zone (ITSZ) in the south. The two suture zones developed in response to the subduction and demise of Neotethys Ocean in Turkey during the late Cretaceous to early Tertiary; the tectonic significance of the basin and its relationship with the ITSZ are still poorly constrained. In order to unravel subduction and subsequent collision history of the Neotethys in the region, we have carried out a detailed analysis of the stratigraphy and sedimentology of the Haymana basin infill and, using a combination of palaeomagnetic and thermochronometric data we have unravelled its structural evolution since its formation. The basin developed on the IAESZ and comprises fore-arc late Cretaceous to foreland Middle Eocene sedimentary sequences. The analysis of the sedimentogical facies and depositional environments indicate four Late Cretaceous to Paleogene key sequences in the basin. These sequences grade laterally and vertically into each other and are continuous from the late Cretaceous to Eocene whereas local progressive syn-sedimentary unconformities and frequent depocenter migrations are common. Late Cretaceous sequences fine upward whereas coarsening upwards sequences are common in the later units. These characteristics possibly reflect the response to local uplift and subsidence in front of south-verging thrust faults associated with the transition from fore-arc to foreland basin settings, following the terminal subduction of the Neotethys at the end of Cretaceous.

About 4000 paleomagnetic and magnetostratigraphic data from the basin infill units and the Neogene cover indicate large clockwise vertical axes rotations in the NW and counter-clockwise rotations in the SE part of the basin. We suggest that these rotations are related to the northward movement and indentation of the Gondwana-derived continental blocks into Eurasia. A model of southward thrust propagation is also supported by apatite fission track (AFT) and (U+Th)/He thermochronometric data from 12 samples of basin infill, which show a consistent northward age increase. The major change in the rotation senses and structural trends within the basin are related to a large strike-slip fault which might be the westward extension into the Haymana Basin of the Savcılı Thrust Zone, an important structural feature that separated the Kırsehir Block into two sectors.Fault kinematic analysis, based on 2000 fault slip data from 50 stations, indicates that the basin was subjected to NE-SW directed compression and coeval E-W extension during the late Cretaceous to Neogene.

Constructed and balanced cross-sections for different time intervals indicate northward thickening, wedge-like geometry of the basin and large vertical axes rotations.

We propose that the Haymana basin was a fore-arc basin developed at the southern margin of Eurasia along the northwards subducted Neotethys Ocean. From the Palaeogene, the basin evolved into a foreland basin in front of a south-vergent fold and thrust belt developed during continental collision. The northward movement of KB caused the basin to rotate along vertical axes, whereas the thrust propagation promoted its exhumation.