3D geologic model for the Cenozoic evolution of the Tuz Gölü Basin (Central Anatolia, Turkey) based on seismo-structural analysis

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The Neogene Central Anatolian Orogenic Plateau (CAP), being relatively small when compared with its larger counterparts, as the Andean Altiplano or the Tibet, represents a great opportunity to study spatiotemporal mechanisms of plateau formation, which is the main goal of the ESF-sponsored Vertical Anatolian Movement Project (VAMP). This morphotectonic feature has a semi-arid and roughly-flat highland flanked by the Pontide and Tauride mountain ranges in the north and south, respectively. The Tuz Gölü Basin (TGB), located in the central sector of the CAP, is the biggest of several Neogene plateau-interior basins at an elevation of about 1.2-1.5 km. This elongated NW-SE trending depression is more than 100 km long and filled with a Neogene sedimentary sequence, several km thick. East and west boundaries of TGB are considered to be fault-terminations, with dextrally oblique normal movement that actively contributed to basin formation.

Seven seismic reflection lines located at the eastern and southern boundaries of the present Tuz Gölü Lake were conceded by Turkish Petroleum Corporation (TPAO) and interpreted in this contribution. Analysis of these seismic profiles shows that the Tuz Gölü Fault is not a basin-forming fault but only one of the several SW-dipping NW–SE-striking normal faults involving basement, as two analogous faults appear in the west, constituting the Sultanhanı Fault Zone. These two fault systems might have formed the eastern side of a NE-SW extensional zone that accommodated more than 5 km of Paleogene rocks and a minimum of 3.5 km of post-Paleogene sediments at its deepest points. An hitherto undiscovered compressional event sometime in the Late Miocene disrupted the extensional tectonics, accommodating in some areas horizontal displacements almost 2 orders of magnitude bigger than those accounted by the extensional phases. As our data shows, the present-day TGB is tectonically active and dominated by extension, possible continuation of the younger extensional tectonism that superseded the earlier phase of contraction and erosion. This is clearly revealed in the seismic lines by extensional inversion of contractional features, i.e. a roll-over anticline with a harpoon structure.

A regional 3D geologic model for the tectonic evolution of the Tuz Gölü Basin and surrounding areas is here proposed on the base of the study of sediment geometries and tilted blocks in depth-converted profiles in combination with the analysis of subsidence curves, isopach maps and a restored cross-section.