Shortening History of a Complex Anticline Structure in the South Caspian Sea

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The South Caspian Sea is a Mesozoic depression associated with the Alpine-Himalayan collision floored by a probable oceanic basement. The basin contains one of the major sedimentary accumulations in the world, with a thick fluvio-deltaic sequence: the Productive Series (Early-to-Late Pliocene). The youngest formations are referred here as the post-Productive Series (Late Pliocene-to-Recent), and are comprised by the Akchagyl, Apsheron and Gelasian series. Both Productive Series and post-Productive Series are intensely deformed by Pliocene-to-Recent folds. Antiform cores contain overpressured muds, which come from the organic-rich shales of the Maykop Formation (Oligocene-Early Miocene).

We have used a depth-migrated seismic cube tied with logging and drilling data in offshore Azerbaijan. In this sector of the basin, we analyse the folding history of a complex anticline culmination (the KAD fold), addressing the problem of fitting the shape using nonparametric statistics. Two culmination domains are recognized in the folded surface, which are widely pierced by teardrop mud diapirs. At the fold crest, normal faults with a curved shape affect the shallower units. Along the axial trace, some of these fractures extend downwards but their deformation regime and dip change forming a major reverse fault.

Folding occurred simultaneously to mud diapirism, whilst tilting and differential subsidence toward the basin centre. The complete shape of the folded surface has been fit in different parallel fold profiles by robust nonparametric regression methods. We have implemented the standard length and area-balanced algorithms for detachment folds to estimate the shortening magnitudes and rates, inferring that the décollement surface is at 9.5-11 km depth. The study of syn-growth sediments evidences two different pulses of folding. A minor event is registered during the middle Pliocene toward the end of the deposition of the Productive Series, whereas a maximum shortening episode is recognized just after the Akchagyl Unit at ~1.6-1.7 Ma.