Salt tectonics in the Eastern Mediterranean: Chronology, kinematics, and driving forces

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In the Late 1970's, a slope-parallel normal fault system has been recognized offshore Israel. ~25 years later, a system of folds and thrust faults was recognized farther west in the deep Levant Basin. Initially, this combination of updip extension and downdip contraction seemed to fit the classic paradigm known from other salt basins around the world in which sediments overriding salt glide basinward and produce extension upslope and contraction in the deep basin. However, later studies in the Levant Basin showed that the shapes of the updip extension system and the downdip contractual system do not match; the updip normal faults are trending to the NNE, whereas the deep basin folds are trending to the NW and even to the WNW.

We propose that while extension of the Levant continental slope expresses basinward gliding, the deep basin shortening belongs to the circum-Nile deformation belt (CNDB) that was previously interpreted as an expression of salt squeezing-out from under the Nile Delta. However, careful mapping of the salt-overburden thicknesses around the Nile delta and its submarine cone clearly shows that in the majority of the study area salt squeeze-out cannot be the dominant driving force, because the thick delta load (nearshore) does not reach the thick basin salt (distal basin). The dominating driving force in the western side of the Nile Delta towards the Herodotus Basin, as well as along the Levant continental margin, is simply the elevation gradient towards the lowest place leading to downslope gliding of the sediment-salt sequence.

Only in the easternmost side of the delta, towards the Levant Basin, does the squeeze-out model work. Here, the delta front covers a thick salt layer and differential loading promotes basinward salt flow. Particularly interesting is the southeast corner of the Mediterranean where the CNDB, driven by differential loading (salt squeezing), is pushed against the Levant margin belt, driven by downslope gliding. By improving the chrono-stratigraphy of the Levant Basin we show that during the first 2.5 my after salt deposition only minor deformation occurred. Then, tilting of the Levant margin (inland uplift) initiated downward gliding and rapid extension; and only ~1 my later the CNDB reached the Levant Basin and started suppressing the downward gliding.

In a wider perspective our analysis shows that the role of salt squeezing by differential loading was previously overestimated in the Eastern Mediterranean and raises the need to carefully map the boundary of the salt basins prior to any interpretation. This conclusion is especially relevant to
young basins where deltas and shelves have not propagated far enough into the basin.