

Evolution and control of the Late Messinian Nahr Menashe fluvial system, Northern Levant basin, Offshore Lebanon

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The presence of fluvial deposits at the top of the Messinian salt in the Levant basin was mentioned by several authors, e.g. Bertoni and Cartwright, 2007 and, above all, Madof et al. (2019), who described the geometry of a large fluvial system, called Nahr Menashe, from 3D seismic data.

In the Levant basin, the evaporite sequence is truncated by a major erosional surface (M horizon, IMTS or IES depending on the authors) extending into the deep Levant basin. On top of it (i.e. on top of Messinina salt), several fluvial systems were identified from 3D seismic data (Isopach, coherency and spectral decomposition maps): 1) Meandering channels, incising into the salt; salt dissolution features (sinkhole-like), synchronous from these channels, were identified in the north-western part of the study area. They indicate the occurrence of a phase of emersion that exposed the top of evaporite sequence. 2) Meandering constructive channel belts and coeval 200m-thick aggrading flood plain. The locations of these meander belts were likely controlled by folds crest formed in the salt during the Messinian gravity deformation phase. 3) Deep fluvial incisions, which cut through the previously deposited fluvial deposits. Within these incised valleys, braided stream systems can be identified. This incision is related to a final base-level drop prior the following Pliocene transgression. 4) The resulting canyons were later filled during the Pliocene transgression by marine sediments drapping the remnant morphologies.

This fluvial system came from the North (Syria and Turkey). It was likely connected to Messinian canyons, mapped onshore, which collected several drainage systems like the paleo-Oronte river. Its outlet was located South of Eratosthenes sea mound where low stand deltas, prograding in a restricted basin and truncated by a sharp erosional surface interpreted as a wave cut, were evidenced.

These observations prove a subaerial origin of the truncation surface with evidences of dissolution features on top salt. Several stages of incisions that affected the top salt, the intra-Nahr Menashe unit and the top of Nahr Menashe deposits were also identified.

These observations definitively rules out the salt deposition in a “ deep” brine at least at the end of the crisis.

Key words: Eastern Mediterranean Sea, Levant basin, Messinian Salinity Crisis, IMTS, Nahr Menashe deposits, Dissolution features, Sinkholes, Fluvial canyons, Meandering channels, Meander belts, Subaerial erosion, Emersion