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Interpreting earthquake-triggered mass transport and soft sediment deformation in Lake Lisan, Dead Sea Basin

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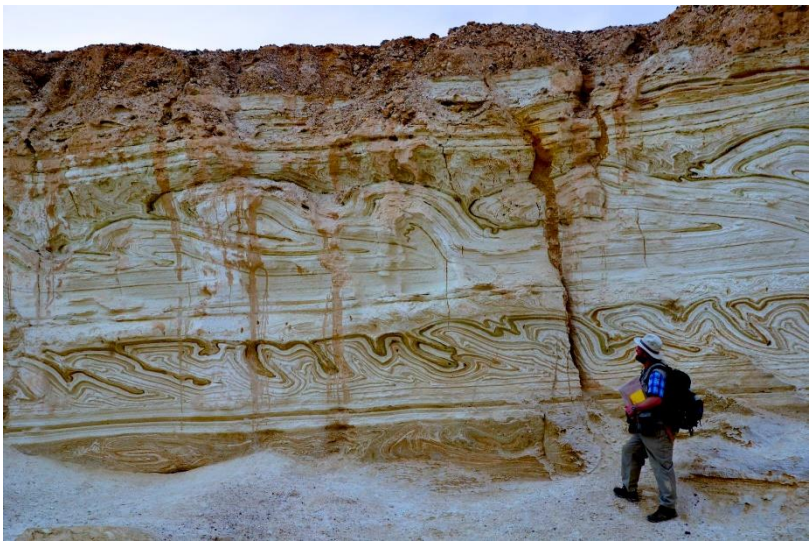
Extensive exposures of spectacular slump sheets in lake deposits within the Dead Sea Basin (Fig. 1) are interpreted as seismites related to the activity of the plate-bounding Dead Sea Fault [1]. The late-Pleistocene Lisan Formation comprises aragonite laminae precipitated from the hypersaline lake, while detrital laminae are formed from material washed into the lake during winter flood events. The detritus-aragonite ratio in the layers affects their style of deformation, where ductile folding preferentially occurs in detritus-rich strata and brittle faulting is more common in aragonite-rich strata. We interpret the large variety of folds and thrusts as showing evolutionary sequences that reached different points of development.



We conclude that the slump sheets were triggered by earthquakes, facilitated by detrital-rich horizons, and controlled by the palaeoslope orientation [2]. The stable stratification, asymmetry of the folds that evolved from open moderate folds through billow-like asymmetric folds, coherent vortices, and finally turbulent chaotic structures, are explained by shear instability (Kelvin-Helmhotz) as the governing mechanism [3].

Figure 1: Slump sheets in the southern Dead Sea Basin, Israel.

Individual slump sheets appear to consist of multiple coeval second-order flow cells, each includes normal faults and pinched strata as well as folds and thrusts. The cells interact with neighboring cells during translation of the slump [4]. Slumps with alternating systematic reversals in fold vergence up through the sequence that are truncated at the top and capped with upward-finning breccia layer are interpreted as the result of earthquake-triggered seiches [5].

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