



The Dead Sea Basin as a unique natural experiment with surprising results about the lithospheric rheology

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The Dead Sea Basin (DSB) is the major sedimentary basin at the Dead Sea Transform fault separating African and Arabian plates. Two new seismic profiles crossing the DSB close to its deepest part show up to 10 km of sedimentary cover in the basin, which is not associated with visible deflection of the inter-crustal boundary and Moho, thus suggesting that major extension associated with the formation of the basin was almost entirely limited to the upper crust. This crustal structure as well as the asymmetric structure of the Basin itself can be well reproduced by the 3D thermomechanical modelling, demonstrating that the DSB is indeed a “classical” pull-apart basin, with negligible fault-perpendicular extension.

However, in order to reproduce DSB structure by modelling, the lithosphere below and around the basin must be assumed to be either significantly hotter than expected from the observed very low surface heat flow (40-45 mW/m²), or much weaker than suggest broadly accepted rheological models for the crustal and, especially, for the mantle rocks. In particular, if surface heat flow is indeed as low as reported, the strength of the mantle rocks beneath the DSB must be much lower than predicted by the weakest “wet” olivine rheology.