

Analogue modeling of the spontaneous formation of a pull-apart basin above a thick viscous evaporitic layer: The case study of El Hamma pull-apart basin, Gabes, Tunisia

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The El Hamma graben system located west of Gabes, Tunisia, represents an extensional relay between two major dextral shear zones trending N110-120: the Hadhifa-Fejej fault corridor in the North, and the OglatMerteba-Matmata fault in the South. This extensional area has a 35km width and a 40km length. Well data show that this basin contains a Mesozoic and Cenozoic sedimentary cover, starting from early Jurassic until Neogene. Yet, the presence of an outcrop of viscous evaporitic triassic salt along Hadhifa-Fejej fault proves the existence of this evaporitic layer below the sedimentary cover, and that these evaporites have been able to rise up through at least 5 km of sedimentary overburden.

We hypothesized that during the tethyan rifting and Cretaceous transtension phase, two salt ridges formed by reactive diapirism along the two main fault corridors well before shortening began. The pull-apart basin initiated first during the Cretaceous transtensional phase. The NW-SE Tortonian-to Present shortening phase reactivated these ridges as dextral transpressional strike-slip zones, leading to the reactivation of the El Hamma pull-apart basin.

Using analogue models made of dry sand and viscous silicone polymer, we tested the possibility of generating a pull-apart basin above a thick viscous layer and between two pre-compression viscous ridges that were offset across strike, and overlapping along strike. This model did not require the use of any basal discontinuity. Indeed, results from our experiments prove that the interaction between the two salt ridges in a transpressional regime makes it possible for a pull-apart basin to form spontaneously within the relay zone between these pre-existing ridges.