The Perched Synclines of Central Tunisia: An Example of Diapir Rise – Fall – Rise Illustrated by Field, Seismic, and Experimental Data

Nedhir Sebai*[1], Bruno C. Vendeville [2], Noureddine Boukadi [1], and Ferid Dhahri [1,3].

1: LR18ES37 : Laboratoire de Recherche Géodynamique, Géo-ressources, Géo-numérique, Faculté des Sciences de Tunis, Université de Tunis El Manar, Tunisia.

2: Univ. Lille, CNRS, Univ. Littoral Côte d'Opale, UMR 8187, LOG, Laboratoire d'Océanologie et de Géosciences, Lille, France.

3: Département des Sciences de la Terre, Faculté des Sciences de Gafsa, Université de Gafsa, Campus Universitaire Sid Ahmed Zarroug, Gafsa, Tunisia.

Abstract

Central Tunisia has been subjected to a complex series of successive regional tectonic phases, both extensional and compressional. This history is made even more complex by the presence of mobile Triassic evaporites that generated halokinetic deformation and partly decoupled the subsalt "basement" from the overburden.

At the southern end of a major regional lineament called "the North-South Axis" are some enigmatic structures cored by the Upper Eocene Jebs Formations: the Kef Ennsour and Zebbeus structures. The center of these structures is made of synform (concave-upward) strata of Upper Cretaceous to Cenozoic age resting unconformably onto the Triassic evaporites. A significant part of the stratigraphic series (i.e., Lower Cretaceous) is missing in the perched syncline. The Cenozoic strata are particularly thick within the synclines, whereas they are thin or absent outside the synclines. In contrast, the Mesozoic series is continuous and thicker outside the synclines. These form topographic highs raised above the regional datum.

We hypothesize that these perched synclines have a halokinetic, rather that solely tectonic origin. The absence of parts of the lower stratigraphic series in the center of the structure indicates that the Triassic evaporites were rising as a passive diapir. During the Cenozoic, source-layer depletion combined with local extension forced the diapir to fall and its crest to subside, thus trapping thicker overburden strata within the syncline and bending them, resulting in a concave-upward geometry. During the latest stage a phase of regional shortening rejuvenated the fallen diapir, raising its synform roof above the regional datum.

We provide field and seismic data, as well as results from a set of analogue models of such a Rise-Fall-Rise structural history. The final geometry changes when varying the amounts and rates of passive diapir rise, sedimentation, extension, and late shortening. Results from most experiments closely match the geometries of the field examples from Central Tunisia. In addition, one model, in which the amount of diapir fall (and extrusion) was extreme, is very similar to the Tumb Diapir located offshore SW Iran.

Keywords:

Central Tunisia, perched synclines; salt diapirs