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Lateral extrusion of Tunisia : Contribution of Jeffara Fault (southern branch) and Petroleum Implications

R. Ghedhoui (1), B. Deffontaines (1), and M.C Rabia (2)

(1) (1) Laboratoire de Géomatique, Télédétection et Modélisation des Connaissances (GTMC) - Université Paris-Est MLV ; 5 Bd Descartes 77454 Marne-la-Vallée, Marne-la-Vallée, 77454France (rimaigs@yahoo.fr & benoit.deffontaines@univ-mlv.fr), (2) Unité de Recherche « Géomatique et Géosystèmes » 02/UR/10-01, Université de la Mannouba, Tunisie(rabiamch@gmail.com)

Contrasting to the northward African plate motion toward Eurasia and due to its geographic position in the North African margin, since early cretaceous, Tunisia seems to be submitted to an eastward migration. The aim of this work is to study the southern branch of this inferred tectonic splay that may guide the Tunisian extrusion characterised to the east by the Mediterranean sea as a free eastern boundary. The Jeffara Fault zone (southern Tunisia), represent a case example of such deformation faced by Tunisia.

Helped by the results of previous researchers (Bouaziz, 1995 ; Rabiaa, 1998 ; Touati et Rodgers, 1998 ; Sokoutis D. et al., 2000 ; Bouaziz et al., 2002 ; Jallouli et al., 2005 ; Deffontaines et al., 2008…), and new evidences developed in this study, we propose a geodynamic Tunisian east extrusion model, due to such the northern African plate migration to the Eurasian one.

In this subject, structural geomorphology is undertaken herein based on both geomorphometric drainage network analysis (Deffontaines et al., 1990), the Digital Terrain Model photo-interpretation (SRTM) combined with photo-interpretation of detailed optical images (Landsat ETM+), and confirmed by field work and numerous seismic profiles at depth. All these informations were then integrated within a GIS (Geodatabase) (Deffontaines 1990 ; Deffontaines et al. 1994 ; Deffontaines, 2000 ; Slama, 2008 ; Deffontaines, 2008) and are coherent with the eastern extrusion of the Sahel block. We infer that the NW-SE Gafsa-Tozeur, which continue to the Jeffara major fault zone acting as a transtensive right lateral motion since early cretaceous is the southern branch of the Sahel block extrusion. Our structural analyses prove the presence of NW-SE right lateral en-echelon tension gashes, NW-SE aligned salt diapirs, numerous folds offsets, en-echelon folds, and so on that parallel this major NW-SE transtensive extrusion fault zone.These evidences confirm the fact that the NW-SE Jeffara faults correspond to the tectonic accident, located in the south of the Tunisian extrusion, in favour of the eastern migration of the Sahel block toward the free Mediterranean sea boundary. Therefore this geodynamic movement explains the presence, in offshore area, of small elongated NW-SE, N-S &NE-SW petroleum transtensive basins and grabens.

To conclude, at the regional scale, the structural geomorphologic approach combined with both field work and reflexion seismic profile analyses appear to be an excellent tool to prove & confirm the east Sahel block extrusion of the central Tunisian part caused by the northward migration of African plate.
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Keywords : Geodynamics, Neotectonics, right lateral transtensive fault, Extrusion, Petroleum exploration, Geomorphometry, Digital Elevation Model, Geographic Information System (GIS), Geodatabase, Jeffara, South Tunisia.