NEOGENE MUD DIAPIRISM, STRIKE-SLIP TECTONICS AND SEISMICITY IN NORTHEASTERN TUNISIAN MARGIN

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Abstract

Subsurface seismic and surface geologic studies conducted on northeastern Neogene series of Mediterranean Tunisian margin had permitted to highlight mud diapir, mud volcanoes and intrusives related to lithostatic pressions of Plio-Quaternary thick deposits and transtensive and transpressive movements of North-South and East-West flower fault corridors. Along the corridor fault borders took place historic and recent seismicity with deepseated faults epicentre location. The instrumental seismic magnitudes vary between 3 and 6 Richter degrees with some historic catastrophic events. This major seismic epicenter distributions seems to be related to strike-slip fault corridors where occurs a mudkinesis movements.

Key Words : Mud Diapirs, Strike-slip, Seismicity, Tunisia.

Introduction

Geologic and geophysic studies carried out on the Neogene deposits of the Eastern margin of Tunisia (1-5) and the north regions by seismic sequence stratigraphy and tectonics had permitted to recognize sequence and basin structuring accompanied by mud diapirs and intrusive structures with seismicity activities of deepseated faults (6, 7, 2, 3, 8). Several petroleum and high resolution seismic reflexion profils, petroleum well and historic and instrumental seismicity data covering the Sahel, Kéchabta and Medjerda Onshore and gulf of Hammamet and Pelagian sea Offshore zones had been used for the Neogene horizon correlations, isochrone and isopach mapping, seismic stratigraphy and seismic tectonic analyses.

Lithostratigraphic characteristics

In Northeastern Tunisia, Neogene deposits are composed by several hundred meters of alternating packages of clays, marls, Lignites and sandstones from Miocene, Pliocene and Quaternary series. These deposits show important changes in lithologic facies and thicknesses. They are very thick in the gulf of Hammamet, the Sahel (7), the Pelagian sea (4) and in the Northwest Medjerda and Kechabta basins (9, 10). Particularly, Miocene and Pliocene clays are very thick in the Eastern margin of the Cap Bon, the Sahel and the pelagian zones comprising Miocene sand Pliocene sandstone turbidite sequences outcropping in the Jebel Abderrahman (2) and in the coastal Nabeul and Hammamet regions (11).

Tectonic framework and kinematics

The Northeastern margin is structured by North-South and Est-West subsurface transtensive and transpressive strike-slip flower fault corridors that limit platform, graben, syncline and fold structures (6, 7). These corridors have been reactivated by Langhian-Serravallian distensive strains and Tortonian-Messinian and Quaternary compressive stress. Neogene sequence deposits are distributed around these structures where their thiknesses is very important in syndepositional subsiding zones of graben and synclines (7, 2). The main tectonic structures that constitute the background and the guide of the Neogene sequence deposit distribution. Vertical and lateral claykinesis movements are attested by depocenter migrations and inversions along fault corridors.

Mud diapirs, volcanoes and sequence structuring

Diapiric and intrusive seismic structures seems to be strongly associated to the faults that limit the graben, syncline and platform zones. Evidence of mud volcanoes structures is showed in the Sahel offshore Pelagian sea by high resolution seismic profils. The mud material come from Miocene sequences marked by Lower Miocene decollement level of Langhian limestone Ain Ghrab Formation. These features had been recognized in small outcrop scale in the Sahel and in the North Atlassic Miocene deposits of Medjerda and Kéchabta zones (3) in the Upper Miocene sequences showing metric to decametric lenticular intrusive shales and sands along kilometric strike-slip faults (1, 3, 11) and micro-sand and micro-clay volcanoes seismits. Seismic sequence deposits show around mud diapirs flanks high angle downlap prograding system tracts at the base, overlapped by aggradational and retrogradational onlap and toplap erosional unconformities and pinch outs.

Seismicity and basin modeling

The seismicity of eastern onshore and offshore Tunisian margin follow the master fault corridors oriented North-South, East-West and associated faulted dragfold structures oriented Northeast-southwest. The great seismic richter magnitudes situated between three and five richter degrees of epicenters are located along these fault corridors. This distribution relay subsurface mud diapirs, mud volcanoes, intrusives and fold structures. Therefore, there is a straight relationship between deepseated faults, seismicity and mud diapir structures. As a combination of these results, new structural, sequence stratigraphic and seismicity origin, basin model highlights mud diapirs distribution guided by the bordering faults of grabens, folds and syncline corridors.

The structuring of Northeast-Southwest en echelon folds and synclines inside and outside Est-West right lateral and North-South left lateral tectonic corridors indicates the strike-slip type of bordering faults and their seismogenic nature. Wrench fault movements induce mud diapirs and intrusive ascensions. This Neogene kinematic reconstruction highlights the neotectonic system inducing the actual seismicity on this margin.

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