Northern Tunisian Offshore Subsurface Architecture and Structural Model from Geophysical Field Methods

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Abstract

The Bouguer anomaly map of Northern offshore of Tunisia corrected to a background density of 2.3 g/cm^3 highlighted two major trends. The highest density trend is spreading toward the subduction- collision limit between North Africa and Europe. While the low densities trend characterize the northern Tunisian coastline exhibiting sedimentary outcrops. Furthermore, petroleum targets corresponding generally to shallow geological structures with depth not exceeding 4 Km are mapped through the residual gravity map. This latter is generated after elimination of deep sources matching Precambrian basement. Residual gravity map shows a mixture of positive and negative anomalies arranged in many directions with predominance of NE-SW and NW-SE. The applied vertical derivative filter to gravity data confirms the predominance of these major directions. Positive anomalies corresponding to geological structures with high density are considered as potential petroleum targets yet to prove. However, several major positive anomalies are related to the volcanic activity generated by the subduction between Africa and Eurasia. Accordingly, Aeromagnetic method was used also to sort out volcanic related anomalies. After correction of induced magnetization effect applied on the total magnetic intensity map (TMI), the reduction to pole map (RTP) exhibits major magnetic anomalies corresponding to volcanic bodies and high Precambrian basement mostly oriented NE-SW. The horizontal gradient magnitude map (MGH), which correspond to the maximum density heterogeneity, applied to gravity data confirms major gravity lineaments. These lineaments corresponds most likely to major fault trend within Northern offshore of Tunisia, where NE-SW and NW-SE directions remain predominant. The Source Edge Detect (SED) technique points out a gravity structural model matching MGH results confirming the predominance of NE-SW and NW-SE fault directions. Moreover, Euler Deconvolution method confirms the structural sketch established from MGH and SED maps, where fault's depth is ranging predominantly between 3 and 5 Km, with several faults extending to the surface. In the northwestern part, few NE-SW faults are rooted to 10 Km. Ultimately, the study area is subdivided into two major domains, where the western part is characterized by a high magmatism and considered as a compressional zone, while the eastern part is characterized by conjugate compressional and extensional activity and lower magmatic activity.

Key words: North Tunisia, Gravity, Aeromagnetic, Magmatism, Structural.