Subsurface Structures Delineation and Tectonic History Investigation Using Gravity, Magnetic and Well Data, In the Cyrenaica Platform, NE Libya

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Abstract

Around one hundred wells were drilled in the Cyrenaica platform north-east Libya, and almost all of them were dry. Although the drilled samples reveal good oil shows and good source rock maturity. Most of the upper Cretaceous age and the above deposit successions are outcrops in different places. We have a thorough understanding and mapping of the structures related to the Cretaceous and above Cenozoic Era. But the subsurface beneath these outcrops still needs more investigation and delineation. This study aims to give answers to some questions about the tectonic history and the types of structures that are distributed in the area using gravity,magnetic, and well data. According to the information that has been obtained from groups of wells drilled in concessions 31, 35, and 37, one can note that the depositional sections become ticker and deeper southward. The topography map of the study area shows that the area is highly elevated at the north, about 300 m above the sea level, while the minimum elevation (16–18 m) exists nearly in the middle (lat. 30°). South to this latitude, the area is started elevated again (more than 100 m). The third-order residual gravity map, which was constructed from the Bouguer gravity map, reveals that the area is dominated by a large negative anomaly working as a sub-basin (245 km x 220 km), which means a very thick depositional section, and the basement is very deep. The mentioned depocenter is surrounded by four high gravity anomalies (12-37 mGal), which means a shallow basement and a relative thinner succession of sediments. The highest gravity values are located beside the coast line. The total horizontal gradient (THG) map reveals various systems of structures, the first system where the structures are oriented NE-SW, which is crosscut by the second regime extending NW-SE. This second system is distributed through the whole area, but it is very strong and shallow near the coast line and at the south part, while it is relatively deep at the middle depocenter area. The total magnetic intensity map shows the variety of anomalies, low frequency (deep sources) anomalies dominated most of the area and trending NE-SW, and high frequency anomalies (shallow sources) dominated the south part.

Keywords

Cyrenaica, Gravity, Magnetic, structures, basement.