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Integration of Gravity and Seismic Methods in the Geometric Characterization of a Dune Reservoir: Case of the Zouaraa Basin, NW Tunisia

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Abstract : Gravity is a continuously advancing method that has become a mature technology for geological studies. Increasingly, it has been used to complement and constrain traditional seismic data and even used as the only tool to get information of the sub-surface. In fact, in some regions the seismic data, if available, are of poor quality and hard to be interpreted. Such is the case for the current study area. The Nefza zone is part of the Tellian fold and thrust belt domain in the north west of Tunisia. It is essentially made of a pile of allochthonous units resulting from a major Neogene tectonic event. Its tectonic and stratigraphic developments have always been subject of controversies. Considering the geological and hydrogeological importance of this area, a detailed interdisciplinary study has been conducted integrating geology, seismic and gravity techniques. The interpretation of Gravity data allowed the delimitation of the dune reservoir and the identification of the regional lineaments contouring the area. It revealed the presence of three gravity lows that correspond to the dune of Zouara and Ouchtata separated along with a positive gravity axis espousing the Ain Allega_Aroub Er Roumane axe. The Bouguer gravity map illustrated the compartmentalization of the Zouara dune into two depressions separated by a NW-SE anomaly trend. This constitution was confirmed by the vertical derivative map which showed the individualization of two depressions with slightly different anomaly values. The horizontal gravity gradient magnitude was performed in order to determine the different geological features present in the studied area. The latest indicated the presence of NE-SW parallel folds according to the major Atlasic direction. Also, NW-SE and EW trends were identified. The maxima tracing confirmed this direction by the presence of NE-SW faults, mainly the Ghardimaou_Cap Serrat accident. The quality of the available seismic sections and the absence of borehole data in the region, except few hydraulic wells that been drilled and showing the heterogeneity of the substratum of the dune, required the process of gravity modeling of this challenging area that necessitates to be modeled for the geometrical characterization of the dune reservoir and determine the different stratigraphic series underneath these deposits. For more detailed and accurate results, the scale of study will be reduced in coming research. A more concise method will be elaborated; the 4D microgravity survey. This approach is considered as an expansion of gravity method and its fourth dimension is time. It will allow a continuous and repeated monitoring of fluid movement in the subsurface according to the micro gal (μgall) scale. The gravity effect is a result of a monthly variation of the dynamic groundwater level which correlates with rainfall during different periods.

Keywords : 3D gravity modeling, dune reservoir, heterogeneous substratum, seismic interpretation
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