Reconstruction of a Complex Depth Model for the Onshore Area of Axios-Thermaikos Basin in Greece by Integrating Seismic, Borehole, and Potential Fields Data

Konstantinos Chavanidis[1], Alexandros Stampolidis[2], Dicky Harishidayat[1], Markos Tranos[2], Grigorios Tsokas[2], Israa Abu-Mahfouz[1], Ahmed Salem[3], Pantelis Soupios[1]

[1]King Fahd University of Petroleum and Minerals
[2]Aristotle University of Thessaloniki
[3]Saudi Aramco

Abstract

The onshore Axios-Thermaikos basin in northern Greece is a sedimentary composite depocenter of 4km depth, that developed tectonically during the Cenozoic extending over the alpine basement of the Internal Hellenides. It consists of Lower Eocene to Quaternary sediments deposited unconformably over the Mesozoic emplaced ophiolite and sedimentary rocks of the Axios zone. The basin has been considered promising for hydrocarbon resources, with a proven gas field in the offshore Epanomi area in the Thermaikos gulf. Several geological and geophysical surveys, including drilling conducted during the previous decades. However, a complete model of the basin regime has yet to be constructed. This paper seeks to understand the tectono-stratigraphy of the Axios-Thermaikos basin by analyzing various remote sensing geophysical data, including gravity, magnetic, well logging, and seismic reflection data. Our approach starts with a qualitative analysis of the gravity and magnetic data to extract the structural and lithologic trend information controlling the basin's formation and development. The basement rocks' density and magnetization are investigated using two-dimensional (2D) forward modeling. The lineaments extracted from the gravity and magnetic data analysis suggest that the large scale tectonic structures are mainly trending NW-SE, NE-SW, and E-W. Most of these structures have been activated by the late- and post-orogenic processes destroying the NW-SE trending mountainous alpine terrain of the Internal Hellenides and forming basins like the Axios-Thermaikos basin. The 2D forward modeling of the gravity and magnetic data was constrained by seismic and well logging data and indicated several possible traps, with hydrocarbon presence in some of them. A detailed 3D modeling is highly recommended to delineate more information about these potential traps. Moreover, these tectonic structures might be useful for other economic benefits, such as natural gas storage and CO_2 sequestration.