

Tectonic Evolution of Al-Wajid Graben, Southwestern Saudi Arabia

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ABSTRACT

Al-Wajid Graben extends over several hundred kilometers in southwest Saudi Arabia and represents a potential for structural and stratigraphic hydrocarbon traps. In this paper, we sought to understand the tectonic evolution of Al-Wajid Graben using seismic, gravity, and magnetic data. The seismic interpretation suggests that Al-Wajid graben is a deeply trough with about 8 km sedimentary fill bounded by major vertical faults. The 2D forward modelling of both gravity and magnetic data suggests that this trough sits over igneous rock of high density and susceptibilities contrasts. The spectral analysis of magnetic data shows 31 km for the Curie depth, which is relatively deeper and agrees with the observed lower temperatures in surrounding wells. This study proposes that Al-Wajid area was intruded with a dense magmatic body before opening the graben during late of the plate accretion 620 million years (MY). The cooling of this igneous body has caused local densification that implied downward bending of the crust as indicated from the relatively deeper Curie depth. The area underwent local higher subsidence rate due to densified crust thus creating the basin as a cratonic graben. The graben was filled with sediments since 620 MY to 582 MY. From 582 MY onwards, the basin and its hosting region (i.e., West Rub Al-Khali) was subjected to continuous subsidence that was interrupted by several tectonic phases, ending with positive inversion since late Cretaceous to present.