In-Situ Stresses and Palaeostresses around Salt Diapirs: a Structural Analysis from the Gulf of Mexico and Amadeus Basin, Central Australia

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IN-SITU STRESSES AND PALAEOSTRESSES AROUND SALT DIAPIRS: A STRUCTURAL ANALYSIS FROM THE GULF OF MEXICO AND AMADEUS BASIN, CENTRAL AUSTRALIA

IN-SITU STRESSES AROUND SALT DIAPIRS

ABSTRACT

Stable drilling directions are directly affected by the in-situ stress orientations and magnitudes involved. For example, in the Gulf of Mexico delta top normal fault stress regime, where the maximum horizontal stress (σ_H) is margin-parallel, vertical wells are most stable. However, in-situ stress orientations are deflected around salt diapirs and have major implications for horizontal drilling risks. This study assesses the deflection of in-situ stress orientations and palaeostress orientations in close proximity to salt diapirs using 3D seismic data from the Gulf of Mexico and structural field observations from the Amadeus Basin, central Australia. Seismic interpretation of salt diapirs in the Ship Shoal seismic cube (Gulf of Mexico) reveals gravitational collapse on the flanks of the salt diapirs, implying net normal displacement. This is consistent with the hypothesis that σ_H becomes locally deflected sub-parallel to the salt-sediment interface. The salt diapir in the Amadeus Basin field area is within a more complex structural setting compared to the Gulf of Mexico and is associated with a large NW-SE striking thrust fault. This implies that it has reacted to north-south shortening from the Alice Springs Orogeny. Palaeostress analysis from conjugate fracture pairs in the field area reveals a large variation in orientations for σ_1 and σ_3. However, σ_2 is consistently sub-perpendicular to bedding, thus σ_1 and σ_3 orientations are restricted to the plane of bedding. Evidence from both the 3D Ship Shoal seismic cube and the structural field data suggests that in-situ stress is deflected around salt diapirs. However, the results from the field structural analysis are dissimilar to seismic interpretation from the Gulf of Mexico. In-situ stress deflections along the flanks of salt diapirs are associated with complex perturbations. These deflections are dependent on the structural setting of each salt diapir and whether it is interpreted as active, passive or reactive.

KEYWORDS

In-situ stress; palaeostress; salt diapir; Gulf of Mexico; Amadeus Basin.

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