SpringerLink

Journal of Ocean University of China

Journal of Ocean University of China

Volume 23, Pages 1515-1533, (2024)

Implications of Salt Tectonics on Hydrocarbon Ascent in the Eastern Persian Gulf: Insights into the Formation Mechanism of Salt Diapirs, Gas Chimneys, and Their Sedimentary Interactions.

Yang Xue, Xiwu Luan, Thanuja D. Raveendrasinghe, Xinyuan Wei, Long Jin, Jian Yin & Jianghao Qiao

Publication: Journal of Ocean University of China, Volume 23, Issue 6, pp. 1515-1533

Pub Date: December 2024

DOI: 10.1007/s11802-024-5821-8

Abstract

Gas chimneys, salt domes, and faults are vital to the movement of hydrocarbons within geological systems. Accurate identification of these geological features is crucial to modeling hydrocarbon resources. This study explores the processes that have shaped the eastern Persian Gulf, focusing on salt diapir characteristics, origin, and fluid migration. Plate collisions between the Indian, Eurasian, and Arabian Plates have considerably impacted salt tectonics, developing key features such as the Hormuz salt, Qatar-South Fars Arch, and Zagros and Oman orogenic structures. Salt-related features were discerned through two-dimensional seismic data and drilling records, salt movement sequences were reconstructed, and fluid expulsion patterns were delineated using

attribute preferences. The results of this study revealed that fractured substrates influenced by regional tectonic forces contribute to the creation of salt diapirs, which serve as conduits for guided fluid transport. Moreover, these results showed that gravity-driven downbuilding mainly controls salt flow, while the circular arrangement of salt structures results from regional stress and interactions between different salt sources. Distinct stress-induced basement incisions compounded by the hindrance of initial salt movement by the Qatar Arch further contribute to the complex salt structure geometry. Crucially, the uplift of the Qatar Arch and stresses from the Oman and Zagros orogenies profoundly affect the salt structure geometry and depositional patterns across diverse regions, resulting in circular salt structures and gas chimneys. This study offers valuable perspectives for oil and gas exploration and provides a comprehensive understanding of the regional dynamics governing salt tectonics and hydrocarbon ascent in the eastern Persian Gulf.

Keywords:

Persian Gulf; salt tectonics; salt diapirs; gas chimneys; salt-sediment interaction; fluid ascent