

New evidence of the holokinetic sequences around Suakin-1 and -2 in the Sudanese Red Sea area using integrated geophysical interpretation

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ABSTRACT

The hydrocarbon generation had been proved by previous studies in Sudanese Red Sea segment, however, no reasonable reserve was evidenced due to the complexities of the surrounding salt structures. Six seismic lines were tied to wells Suakin-1 and -2 to delineate the controlling salt tectonics. The salt evacuation (Roho) and other salt bodies were recognized and matched with similar salt structures in analogous stratigraphic conditions in the Gulf of Mexico and Angola margin. Three seismic features indicated the presence of a salt dome (autochthonous): velocity pull-up, dragging of the sedimentary layers forming mini basins around the third feature, which is the relative transparency of the seismic signal in two piercing-like bodies. This interpretation similarly demarcated that the salt escaped east-wards, thus the mapped welded salt is believed to be formed after the salt evacuation. A 3D Seismic with a far offset and wide range of azimuth is recommended for detailed imaging.

Keywords: salt tectonic, seismic interpretation, Dungunab, Red Sea

INTRODUCTION AND STRATIGRAPHY

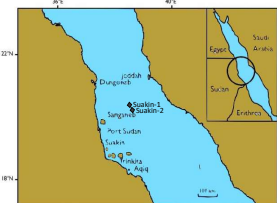
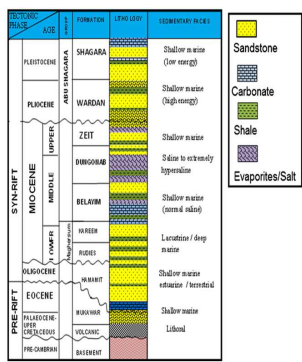


Fig.1: Locations of Suakin-1 and -2 wells along the Sudanese Red Sea.

Tectonically, the area is divided into two major phases: Pre-Rift and Syn-Rift stratigraphy, the latter is divided into three phases: pre-salt, salt, and post-salt (Fig.2).

Fig.2: Salt-evaporate (Belayim & Dungunab) were deposited during the sea level rise and fall cycle, indicating a change in climate and a prolonged period of desiccation.



SALT OCCURRENCES

Salt is unstable due to its fluid rheology and incompressibility under low temperatures and differential stresses [2]. The primary driving force for salt tectonics Halokinesis is differential loading. Roho's term was restricted by [3] to the discontinuous, high-amplitude seismic reflections caused by remnant salt along welds as salt-evacuation surfaces /salt-withdrawal surfaces.

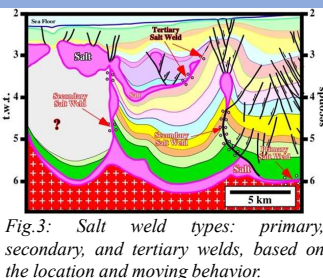


Fig.3: Salt weld types: primary, secondary, and tertiary welds, based on the location and moving behavior.

SEISMIC INTERPRETATION

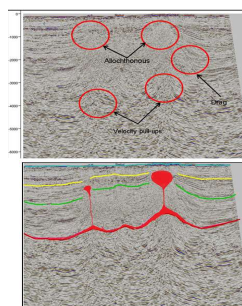
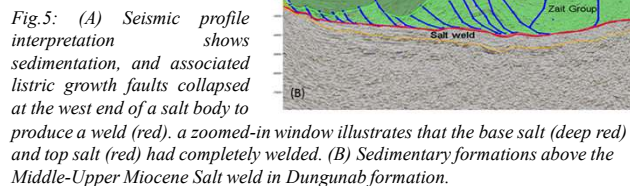


Fig.4: Three observed features of the salt dome (autochthonous), velocity pull-up, a drag of the sedimentary layers forming mini-basins, and transparency of the seismic signal in two piercing-like bodies.



COMPARATIVE INTERPRETATION

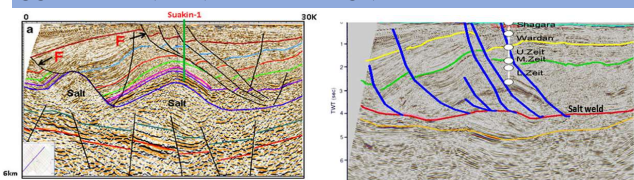


Fig.6: A Comparative interpretation is shown above in [4] interpretation of anticlinal features created by the salt movement of Dungunab due to high thermal regimes and sliding of sediments through the listric faults. Compared to (below): the present interpretation Dungunab salt is welded and moved east-wards, as identified by the discontinuous, high-amplitude seismic reflections caused by the remnant salt along welds or salt-withdrawal surfaces along the entire sections.

CONCLUSION

Integrated six seismic lines and are tied to two wells Suakin 1 and 2 are used to interpret the seismic data were no reliable previous studies. Utilizing the stratigraphy and the seismic characteristics, adding to the logs data, the final interpretation had been matched with salt evacuation (Roho) and salt bodies. A comparison shows the inconsistency of interpreting the same data by a national study in 2012 as they observed the high amplitude horizon of anticlinal shape as the top of Dungunab formations whereas in the current study captured this horizon as top of lower Zeit. For a comprehensive delineation of the salt structures and their flow direction along the Sudanese Red Sea area, a 3D Seismic with a far offset and wide range of azimuth is recommended.

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