

# **Regional Structural Complexity and its Impact on Hydrocarbon Exploration in the Eastern Mediterranean**

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## **Abstract**

The Eastern Mediterranean offshore region has been a hotbed of hydrocarbon discoveries in recent years, particularly with regards to gas discoveries. These resources have the potential to provide a reliable source of energy for surrounding markets and therefore have significant economic implications for the region. There are multiple working hydrocarbon systems, with major discoveries proven in both clastic (e.g. Leviathan) and carbonate (e.g. Zohr) reservoirs in the offshore region. The area contains mature (e.g. the Nile Delta) and frontier regions (e.g. southwest Greece offshore and west Egypt offshore).

The structural styles across the eastern Mediterranean offshore region are strongly contrasting and this impacts the petroleum systems and exploration targets. One of the most striking features is the Mediterranean ridge, which is an accretionary wedge caused by the African Plate subducting under the Eurasian and Anatolian plates. This extensive compressional regime presents a significant challenge for deep seismic imaging, which has meant that explorers have generally focused on easier targets in the region. However, as imaging technology improves, exploration interest within this area is gradually increasing as an extensive evaporite seal affords the opportunity for a large vertical hydrocarbon column and therefore large discoveries.

Apart from providing a potential regional seal, the presence of Messinian aged salt/evaporites has a strong impact on structural styles in the region. We demonstrate the different salt characteristics and tectonic styles using seismic examples across the region and highlight how this influences the petroleum system elements for explorers. The salt is shown to have moved from the Egypt and Lebanon offshore towards the Cypriot offshore region due to tectonically-driven tilting of the basin margins as well as differential loading, resulting in thickening and deformation of the evaporites around the Eratosthenes continental block in a compressive regime. These thick evaporites provide an excellent seal for the carbonate buildup structures that are reservoirs for some of the largest gas discoveries in the region. In the up-dip Levantine and Nile Delta regions the salt movement results in a more extensional regime in the post salt section.

The potential trapping structures in the pre-Messinian section are again related to regional tectonics. In the Levantine Basin the imaging of this section is superb to significant depths, and fault structures over stretched continental crust are pervasive in this area. To the west, in the Herodotus Basin, the crust type is predominantly oceanic and structures are more subtle away from the Mediterranean Ridge, likely leading to stratigraphic or combination traps being more prevalent in this region. The mature Nile Delta has a combination of both stratigraphic and structural plays working.

Understanding the highly varied structural styles and hydrocarbon trapping mechanisms is critical for the exploration and development of hydrocarbon resources in the region. This understanding can be improved using modern seismic data to compare and contrast the different structural styles.