The Caspian Sea has been a major focus for hydrocarbon exploration for many years, with particular attention on the Precaspian and South Caspian Basins. However, hydrocarbon exploration in the Central Caspian Sea has been sparse, with drilling activity largely focused near shore and little to no activity within the central part of the basin. Primary hydrocarbon discoveries have been made in the deeper Triassic to Cretaceous strata, with potential still remaining in the shallower Tertiary sequences.

The illustrated seismic section is an arbitrary line oriented south-east, north-west to west across Kazakhstan and Russia within the Central Caspian Sea. A number of key markers have been interpreted throughout the section to highlight the different sequences from rift to drift stages. Primary source rocks are situated within the deeper Triassic rift section with reservoirs within the Jurassic through to Cretaceous. Potential secondary source rocks and reservoirs can be found in Tertiary sequences within large-scale clinoform systems, in particular within the Maykop Series.

Caspian Sea: Frontier Exploration in the Middle Caspian Basin

CGG’s study area covers the offshore Middle Caspian Basin within Russia and Kazakhstan. A regional 3D survey grid has been used to assess the area’s petroleum potential.

The comprehensive dataset consists of 96 long-offset 2D seismic lines imaging over 10,000 km of the Central Caspian Basin. Just over 5,000 km were acquired in the Russian sector in 1995 and subsequently reprocessed by CGG in 2009, while another 5,000 km of modern seismic were acquired and processed in 2010 in the Kazakh sector.

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The Middle Caspian Basin extends onshore into parts of Russia and Azerbaijan, with the offshore area in Russia and Azerbaijan. The basin is bounded by the Great Caspian Fold Belt on the west and south-west, and the Karabogaz regional basement high on the east and south-east. The northern boundary of the basin extends along the Karpinsky ridge and the Mangyshlak fault. The west and south-west areas of the basin are a typical foreland basin whereas the eastern area is a typical foreland basin whereas the eastern area is an inverted basin.

Exploration History
Approximately 160 oil fields have been discovered in the Middle Caspian Basin, with primary reservoirs consisting of Jurassic and Cretaceous sands, while secondary reservoirs are found within the Tertiary. The first discovery in the Middle Caspian Basin occurred in 1953 within the Tertiary. The first oilfields in the Jurassic and Cretaceous were found in 1954 near shore in Russia. Other onshore and offshore discoveries in Russia include Krichindrevky (122 bcm and 94 mmorillion cubic meters of gas), Yulianovsk (170 MMboe) and Tauridesal (80 MMboe), which is a shared discovery between Russia and Kazakhstan.

Seismic Stratigraphy
Seismic data clearly illustrates that seal thickness varies considerably from west to east, due to basins architecture and heterogeneity. In the deeper section from basement to base Jurassic, clear rift features can be seen, and faulted basement blocks are present with deep and thick stratigraphic units. Evidence of compression and volcanism can be seen in the section through deep rifts and strong amplitude seismic reflections within the South Mangyshlak Sub-basin. Seismic data offshore Kazakhstan shows karstic relicts directly overlaying basement highs, indicating areas where the Triassic is absent.

The base Jurassic is marked by an unconformity, which is a prominent basin-wide marker indicating the interface between the top of the rift sequence and the base of the post-rift section. In a significant event representing the transition from a continental to a marine environment and a period of basinal subsidence and quiescence which dominated from the Jurassic to the Lower Cretaceous. The Late Cretaceous section thickens and becomes shallower to the east with the top of the sequence marked by another unconformity. The post-rift section in this thin, uniform and fairly undeformed section only partially affected by faulting. The Lower Cretaceous is thought to be a karstictic complex, especially within the Aptian and Albian, and the Late Cretaceous is dominated by a carbonate sequence. The Late Cretaceous has been significantly eroded, and deep incised canyons (up to 300 m) are observed as a result of deep erosion (Figure 3). The Middle Jurassic massive reefal lobe of the Tertiary sequence. Large-scale clinoforms are evident with chaotic reflectivity at the base, indicating flexures and sharp changes in depth. These gas chimneys are located directly above deep, high-angle extensional faults at depth and clearly show that a working petroleum system is in place, especially in the less explored central part of the basin.

Areas of Potential and Undrilled Structures
Exploration so far has focused onshore and near shore in the basin, with little information about the offshore area. One can assume there are analogies to be made between the two parts of the basin when looking at the geology and hydrocarbon potential. Discoveries located in the Great Caspian Fold Belt consist of structural traps within shallow and narrow faulted anticlines trending north-south to north-east. In Stavropol Arch and Prikum Arch (see map), hydrocarbon accumulations are found in economic, low relief anticlines located along deeper Tertiary reflectors or basement highs (Dyman et al., 2001). The petroleum and connectivity of many hydrocarbon reservoirs found in the Tertiary is thought to be highly dependent on fracturing. This has been observed in Cretaceous carbonates near the South Mangyshlak Sub-basin and in Jurassic. Lower Mymen-Ach and Mymen-Ach (see Figure 2). Potential can also be found within the Tertiary carbonates with minimal reservoir spacing and permeability likely to be preserved. Due to their shallow burial, the presence of a regional seal in this case may be an issue, forcing exploration to be reliant on more localized seals (Figure 2). The Maykop Series marks the base of the Tertiary sequence. Large-scale clinoforms are evident with chaotic reflectivity at the base, indicating flexures and sharp changes in depth. These gas chimneys are located directly above deep, high-angle extensional faults at depth and clearly show that a working petroleum system is in place, especially in the less explored central part of the basin. More Than Just... “The Industry's Fastest Color Log Printer” The NeuraLaserColor II is a purpose-built log printing solution designed with reliability and ease of use in mind, it also happens to be the fastest log printer on the market. Whether you are a service company printing thousands of logs a day or an exploration company looking for quality logs, the NeuraLaserColor II is a must have for any field or office operation.