

Evaporites in the Central Asian Pricaspian and Amu Darya basins: Stratigraphy, salt tectonics and the potential as petroleum seal

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Substantial volumes of evaporites are present in sedimentary basins throughout the world. Well known examples include the Gulf of Mexico, the continental margins of the Atlantic Ocean, and the Mediterranean Sea. Basin wide evaporite precipitation is commonly the consequence of basin isolation from the main seawater bodies such as the oceans and significant evaporation. The resulting evaporite precipitates cover the full basin floor. In addition to the academic, process orientated, value, evaporites are of interest to the hydrocarbon companies for their sealing capacity.

In two hydrocarbon bearing sedimentary basins in Central Asia, the Pricaspian and Amu Darya Basin, basin wide deposited evaporites are known to be of importance as regional hydrocarbon seal. The evaporites in the Pricaspian Basin are Kungurian (Lower Permian) in age and composed predominantly of salt, but include anhydrite, gypsum and more exotic evaporites. Their deposition follows the isolation of the Pricaspian Basin during the early Permian. Although originally precipitated as a discrete stratigraphic interval, diapirs and salt windows characterize the present day morphology of the Kungurian salt. The latter acting as fluid conduit for hydrocarbons. Halokinesis probably started soon after accumulation of the salt and appears to be enhanced by the topography of the sediments below.

The evaporites in the Amu Darya Basin, known as the Gaurdak Formation, are Jurassic in age and on average much thinner when compared to the Pricaspian evaporites. Salt dominated interval occurs in the centre of the basin with more anhydrite and gypsum in the basin edge. In general, the evaporite interval forms a basin wide stratigraphic interval without diapirs. Vertical salt migration is observed only along the WNW-ESE trending Repetek fault in the centre of the basin forming a “salt wall”. The presence of hydrocarbon reservoirs above the salt wall, in post salt sediments, could be indicative of hydrocarbon migration along the Repetek Fault.

We postulate that this difference in morphology of the Pricaspian and Amu Darya evaporite intervals is related to the differences in tectonic activity during and after precipitation, basin subsidence, and the antecedent topography on which the evaporites were originally deposited.