

Evidence for a Jurassic Source Rock in the Guyana – Suriname Basin

Clyde Griffith and Anthony Richardson

Staatsolie, State Oil Company Suriname

Abstract

Mid to Upper Jurassic age source rocks and their related petroleum systems have played a major role in generating some of the world's largest oil and gas fields. They are mainly found in the Middle East (Hanifa-Naokelkan-Sargelu-Dukhan formations), the Caspian region (various formation names), West Siberia (Bazhenov Formation), the North Sea (Kimmeridgian Clay) and the Gulf of Mexico (Haynesville Shale). These rocks are predominantly marine shale and marly limestone with kerogen types II and III, and have charged Upper Jurassic to Cretaceous oil and gas reservoirs.

During Late Jurassic-Cretaceous times, Pangea was fragmented to form new continents that drifted apart, forming the present oceans on their trails. The central and southern Atlantic Ocean resulted from the drifting apart of the African and South American continents. Along the trailing edges of west Africa and eastern South America, several Jurassic age rifted basins developed and were filled in with syn-rift lacustrine to shallow marine sediments. As drifting apart continued from the mid Cretaceous to present, these graben basins were overlain by post-rift, passive margin, open marine sedimentation.

The Guyana – Suriname basin displays the geologic elements described above. Mid to late Jurassic age graben structures, filled with syn-rift sediments, overlain by post rift, passive margin, prograding marine sediments from mid Cretaceous to present, can be identified on seismic lines offshore Suriname. None of these graben structures have been penetrated by wells. The question remains therefore: 'Are there mature source rock and related petroleum systems within the grabens of the Guyana – Suriname Basin similar to that of the North Sea graben and the Kimmeridgian Petroleum System?'

Analysis of crude oil in the Upper Cretaceous reservoirs onshore Suriname reveals the presence of a possible Mid Jurassic source rock. These oils were derived from an unknown source rock, probably a strongly restricted lacustrine environment, of Jurassic or less likely Cretaceous age. All onshore Cretaceous oil impregnations, and some Palaeocene oils analyzed, fall in this category. It is believed that this oil was generated by source rocks within the Jurassic grabens and is likely to be part of an intra-grabenal petroleum system that has not yet been drilled.

Offshore well A2-1, drilled on the Demerara Plateau in the Guyana – Suriname basin, penetrated pre rift lower to middle Jurassic sediments and confirmed the presence of non-graben related Jurassic source rocks in the basin. The depositional environment is interpreted as continental to shallow marine, within which was deposited lacustrine sediment containing much organic material. Subsequent subsidence of the sediments through the oil window initiated oil generation. This source rock is interpreted as type I and has TOC of 1-2%. Similarly, the Takutu Graben of onshore Guyana, interpreted as a failed arm of the early Jurassic North Atlantic rifting, has proven source rock and a unique petroleum system within the graben. This evidence indicates the strong possibility of a Jurassic grabenal petroleum system in the Guyana-Suriname basin.