

Oil and Gas Generation and Migration from Lower Cretaceous-Jurassic Source Rocks, Mesopotamian Basin, Iraq

George J. Grabowski¹ and Ana L. Braun¹

¹ExxonMobil

Abstract

Lower Cretaceous-Jurassic source rocks generated the majority of oil found in Iraq. Our study evaluates the composition and relative importance of three source rocks, along with timing of generation and pathways for migration, in a well from a field in the Mesopotamian Basin

The source rocks are:

- Lower Chia Gara Formation (25 m thick, 1.86 %TOC avg, 2.50 %TOC max)
- Naokelekan Formation (18 m thick, 7.77 %TOC avg, 12.82 %TOC max)
- Sargelu Formation (73 m thick, 1.05 %TOC avg, 1.84 %TOC max)

The present-day TOC values are low due to the maturity of the source rocks. Original TOC in the Naokelekan was likely greater than 30 wt%. The organic matter in all three source rocks is dominated by Type-II organic matter, with some minor land-plant input to the Chia Gara. The present maturity of these source rocks is 0.85-0.90%Ro equivalent, based on thermal modeling calibrated to biomarkers (Tmax values indicate higher maturity). Generation of oil and gas started in the Late Cretaceous and increased in the Neogene. The Naokelekan is calculated to have generated 4-5 times that amount of oil as either the Chia Gara or Sargelu.

Geochemical analysis of oils extracted from stained core and cuttings samples of Upper Cretaceous reservoirs indicate that they were generated from restricted and anoxic, marine carbonate source rocks of Jurassic age containing mainly algal and bacterial organic matter. The oil stains have maturities of about 0.85 %Ro, and oils in the Upper Cretaceous are biodegraded. Limestones of the upper part of the Chia Gara are stained with lighter unbiodegraded oil from similar source rocks.