

Distribution of Petroleum Source Rocks in Time and Space

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Kinetic modeling suggests that for a potential petroleum source rock to be an effective oil source it must have an original minimum 2.4wt% Total Organic Carbon (TOC) with a hydrogen index of 400 mg HC/g TOC. This capacity to generate hydrocarbon is necessary to saturate the rock matrix and migrate significant volumes of oil. Source rocks with this generative capacity occur most often within transgressive mudstone.

The concentration of oil-prone source rocks in the transgressive facies results from two factors. Relative rise of sea level impounds gas-prone terrigenous organic matter in fluvial valleys and coastal plains rather than offshore where it dilutes the oil-prone kerogens. Additionally, the relative rise of sea level associated with transgression brings oceanic upwelling systems onto the outer shelf where the nutrient rich waters support high organic productivity. When this productivity impinges on the outer shelf and over shelf basins, the relatively shallower water column enhances the potential for undegraded oil-prone marine algal matter to be buried in anoxic bottom water and sediment. If the rate of burial is sufficiently fast to bury the organic matter but not to significantly dilute the concentration, a potentially effective source rock is deposited.

Understanding the geological relationships behind these processes provides a model for predicting the location of probable petroleum system kitchens. If we have confidence of where the kitchen is located, and we know where current production has found economic products, we can use the stratigraphic analysis of seismic record sections to predict where oil and gas may occur along the more probable migration avenues.