

Rift-tectonic control on palaeoenvironment conditions and hydrocarbon system development (most northern Upper Rhine Graben, SW-Germany)

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Abstract

The palaeoenvironment conditions of Cenozoic sediments in the most northern Upper Rhine Graben (URG) were controlled not only by relative sea-level fluctuations but even more by rift-related tectonic activity. Thus also the hydrocarbon generation potential of known source rock units varies strongly, depending on the time of deposition related to the different phases of subsidence and due to the structural position. Here we focus on a multidisciplinary palaeoenvironmental and source rock analysis of the three main transgressive intervals during the graben formation. During episodes of major subsidence, the palaeoenvironments in these transgressive marine intervals such as the Middle Pechelbronn Beds and the Rupel Clay are terrestrially dominated due to high terrestrial input from the graben shoulders. On the contrary, transgressive marine intervals with low tectonic activity such as the Cerithium Beds, Corbicula Beds and Upper Hydrobia Beds are dominated by marine/brackish palaeoenvironments. These differences in kerogen composition result in mainly marine/brackish dominated, oil-prone kerogen in transgressive marine intervals during phases of low tectonic activity, but mainly terrestrial dominated, gas-prone kerogen in transgressive marine intervals during phases of high rift-tectonic activity.

Additionally to the analysis of palaeoenvironment and kerogen composition, an integrated study of the palaeothermal history during graben formation provides a better understanding of the development of potential hydrocarbon systems in the northern URG. Although several oil fields were discovered in this area, results indicate that only minor hydrocarbon generation can be expected from the source rock units in wide areas of the most northern URG. This gives evidence for oil generation within areas of higher maturation, locally restricted within the most northern URG or further to south, which would require lateral long distance migration towards the north.