ORGANIC GEOCHEMICAL INVESTIGATIONS ON PETROLEUM SOURCE ROCK SAMPLES IN THE CONGO BASIN

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Palaeozoic and Mesozoic core and outcrop samples from the central Congo Basin were studied by organic geochemical and petrological methods. Samples of the Alolo shales, which belong to the Lindi Supergroup (late Neoproterozoic / early Paleaozoic) are in general very poor in TOC and contain a high amount of degraded organic matter. All samples of this formation revealed a type III kerogen. Permo-Carboniferous sediments from the Lukuga Formation (well Dekese) contain moderate contents of organic carbon. T_{max} values indicate immature or early mature organic matter, whereas a higher level of maturity within the oil window is indicated by vitrinite reflectance and PI values. This observation is tentatively explained by the presence of abundant resedimented organic matter. Outcrop samples from Lukuga Formation show similar results, but partly with higher maturity indicated by vitrinite reflectance data and T_{max} values. All samples contain hydrogen-poor type III kerogen with low hydrocarbon generation potential.

1-D numerical modeling was done for Dekese well, in the central part of the Congo Basin, based on the vitrinite reflectance data as calibration values and general geological information. The burial history supports the assumption of tectonic evolution including a significant subsidence at the Permo-Triassic transition. In particular in the Dekese well, the rocks belonging to the Lukuga formation and the underlying Red Beds formation are all inclined (20 to 40 ° in average and up to 90° locally) and affected by numerous reverse to strike-slip faults. The bedding planes are also often reactivated, thus pointing to an important compressional tectonic stage after the deposition of the Permian. One possible model of deformation could be a combination of reverse faulting, tangential slip on the bedding planes and folding in relation to a ramp formation. In this context, the Karoo and underlying rocks could have been uplifted tectonically in the Dekese area.

Organic geochemical investigations on Late Jurassic (Stanleyville formation) to Early Cretaceous (Loia formation) samples from the Samba well, in the north-eastern part of the Congo Basin, revealed moderate to high contents of organic carbon (up to 19 %). The kerogen is characterized by very high hydrogen index values reflecting type I kerogen of excellent quality in the Stanleyville Formation and type I/II kerogen in the overlying Loia Formation. These samples show T_{max} values between 430 and 440 °C, but very low PI values. This is attributed to the presence of thermally quite stable kerogen that has not yet reached temperatures high enough for significant petroleum generation. Outcrop samples from the Stanleyville Formation have variable, partly high TOC contents and are characterized by very high Hydrogen Index values. Both Stanleyville and Loia Formations can be regarded as excellent petroleum source rocks and could be part of a petroleum system if sufficient burial and maturation has occurred. The samples studied here are too immature for petroleum generation. The Lukuga Formation contains much organic material, but only type III/IV kerogen having a very minor gas generation potential. The Alolo shales cannot be considered as a potential source rock. We conclude that Exploration for conventional oil should focus on positions in the basin where the Late Jurassic/Early Cretaceous sequence has reached greater maturity than in case of the areas studied here.