Characterization of early Cretaceous West African source rocks using integrated molecular and stable isotope approach

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Sedimentary basins in the South Atlantic contain multiple petroleum systems with source rocks formed in different depositional environments. Published information on organic geochemistry of source rocks in these basins is still very limited. Lacking in particular are molecular level studies that integrate biomarker and stable isotope methodologies. This project was designed to reduce this gap in knowledge by investigating 57 core samples from Lower Cretaceous lacustrine sources rocks in the pre-salt sections of the Gabon, Congo, and Kwanza sedimentary basins.

We calculated carbon preference index (CPI) in the range of *n*-C_{24} to *n*-C_{34} alkanes and determined C and H isotope compositions of *n*-C_{19}, *n*-C_{23}, and *n*-C_{27} alkanes. The data were subjected to principal component analysis to identify which fingerprint properties were the most diagnostic with regard to discriminating the source rocks in the above basins. We found that PC1, which accounted for 62.63% of data variability, weighed heavily upon C and H isotope compositions as discriminators between the sources rocks in the Congo basin versus the Kwanza/Gabon basins as well as between the latter two basins. PC2, which explained 16.81% of the data varience, on the other hand, weighed heavily upon the CPI values as discriminator among the source rocks within the Congo basin, but also between the Kwanza and Gabon basins. The observed variations in the $\delta^{13}C$ and $\delta^{2}H$ values of *n*-alkanes most likely resulted from differences among organic matter sources and depositional environments during sediment accumulation. The variability in the CPI values could potentailly be attributed to different proportions of aquatic and terrestrial biomass contributing to sedimentary organic matter.

This study demonstrates the power of an integrated molecular and stable isotope investigation of *n*-alkanes for characterizing palaeolacustrine source rocks in West African sedimentary basins. Such an approach will result in a more detailed understanding of petroleum systems not only in these basins but also in the contemporaneous Brazilian petroleum systems on the other side of the Atlantic.