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Geochemistry of Cretaceous source rocks and crude oil from the Anambra Basin: A new perspective into the Cretaceous petroleum system of the Niger Delta.

ABDULKAREEM TOYIN[1], ZHONG NINGNING[1] AND FALILAT OMOTOLANI IDRIS[2]

[1]China University of Petroleum, Beijing
[2]Federal University Lokoja, Nigeria
Presenting Author: abdulkareem_toyin@yahoo.com

The Anambra Basin is ranked next to the Niger Delta in terms of hydrocarbon reserves. However, despite the successful oil and gas explorations in the Niger Delta and other WCARS basins, no significant progress has been made in the Anambra Basin. This study integrates geochemical data, bulk carbon, CSIA of n-alkanes and vitrinite reflectance to assess Cretaceous source rocks, crude oils and condensates from Anambra and Niger Delta Basins. Well cuttings, outcrop rocks and a crude oil were collected from Anambra Basin, two crude oils and condensates each from onshore wells and one crude oil from offshore in the Niger Delta were also collected. These enable us deduce organic matter richness, thermal maturity, and organic matter inputs. From the results, source rocks in well-x and outcrop mudstones are majorly types III and II/III, whereas outcrop coals are type II/III. Organic matter richness shows that outcrop coals>mudstones>well-x. Maturity parameters indicate that in well-x, the samples are in immature-wet-gas generation stages, in contrasts, samples from outcrops are immature. The source rocks were deposited under sub-oxic to oxic conditions based on molecular indices. In well-x, there was dominant input from lacustrine algal as evident from high abundance of C_{28} sterane, moderate GI and C_{21}TT, while the outcrop mudstones, coals, crude oils and condensates from the Anambra and Niger Delta received major inputs from land-plants. Further, shales in well-x exhibit excellent compositional similarities to crude oils and condensates from Anambra and Niger Delta, whereas the outcrop mudstones and coals are genetically similar to crude oil from the Anambra Basin. The outcrop mudstones are also compositionally and genetically similar to crude oils and condensates from the onshore Niger Delta whereas the coals are only genetically similar. Crude oil from the Anambra Basin is compositionally and genetically similar to the onshore crude oils and condensates from the Niger Delta. However, geochemical evidences which indicate compositional and genetic similarities between the Upper Cretaceous source rocks of the Anambra Basin, and crude oils/condensates from onshore/offshore oilfields of the Niger Delta, absence of maturity and isotopic imbalances, there is possibility of deep Cretaceous source beds within the Niger Delta.