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**High Resolution Geochemistry Technology (HRGT) and Quantitative Modeling Applied to the Petroleum Systems Assessment**

Hydrocarbon exploration in offshore deep-water frontier areas of the South Atlantic margin entails both high costs and increased inherent risk of dry holes. The main uncertainty in this exploration setting is the presence of active petroleum systems. In this context the prediction and characterization of generative hydrocarbon source rocks to charge potential traps is imperative. This paper shows an example of the application of high resolution geochemical and petroleum systems modeling tools as fully integrated models in the search for ultra deep water probes in the Espírito Santo basin, Brazil. The HRGT tools, ranging from age-related molecular geochemistry, diamondoids, gas geochemistry, compound specific isotope analyses of biomarkers (CSIA-B) and of diamondoids (CSIA-D) are of fundamental importance to evaluate and predict the presence of hydrocarbon charge in frontier areas of deep water areas of the South Atlantic. When the HRGT data are integrated with 3D Petroleum Systems Modeling in a petroleum systems context, these techniques are powerful tools for regional as well as prospect-scale evaluations of hydrocarbon charge and accumulation risk.

In the Espírito Santo basin, Brazil, gas geochemistry and age-related biomarkers in conjunction with diamondoids, CSIA-B and CSIA-D analyses were used to understand and predict the presence of deep reservoirs containing accumulations of highly cracked liquids (condensates) and gas generated from very deep lacustrine sources mixed with shallow marine deltaic Tertiary oil. This data allows the characterization of deep reservoir plays, promoting therefore the idea of deep drilling for gas and cracked liquids from very deep sources.