Crude oil and gas from the Campos Basin of Brasil: a geochemical characterization

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Introduction
The Campos Basin is located in the Southeastern Brazilian Margin and has a total area of about 300,000 km². It is part of a series of basins formed along the Brazilian Atlantic margin during the breakup of Gondwana in Early Cretaceous times. The Campos basin is limited by the Vitória High, which separates it from the Espírito Santo Basin to the north, and by the Cabo Frio High, that separates it from the Santos Basin to the south. The Campos Basin has for long accounted for the largest reserves of Brazil in Late Cretaceous and Tertiary post-salt reservoirs and after the BM-C-33 Repsol operated block, pre-salt discoveries also revealed to be the place of large pre-salt accumulations.

Results and Discussion
The pre-salt oils are mixed oils with intermediate lacustrine-marine organic matter input, or oils generated by a source rock with mixed organic matter (marine-lacustrine). These crude oils were generated by a clay-rich source rock. Two oil groups (A and B wells) show presence of moderate-high relative concentration of gammacerane compound, being the major concentration in the B Well oils. Gammacerane indicates that increased water salinity during deposition of the source rock. The m/z 191 terpane chromatograms for C Well oils show low signal-to-noise ratios. Highly mature oils have low concentrations of biomarkers (very low relative concentrations of branched saturate hydrocarbons). C Well oils are more mature than A and B well oils.

Geochemical evaluation support oil-oil correlation between A, B and C well oils.

Some geochemical signals suggest that the oils are affected by biodegradation. The only explanation for biodegradation evidences could be that the oils have been affected by microbial processes before the reservoir reached temperatures of 80°C (paleo-biodegradation). Generally oil accumulations which contain a number of distinct charges or charge over time at different rates, exhibit mixed geochemical signatures: mixing of fresh and degraded oils. The biodegradation is not a significant feature that affect the oil quality.

Gas samples from both Post- and Pre-Salt series were analyzed. The A Well gases are of thermogenic origin (Post Salt gases: mainly oil associated gas; Pre-Salt gases: mainly condensate associated gas). The B Well gases are also of thermogenic origin. The C Well gases are of thermogenic origin (mixing of deep dry gases with associated gases). Biodegradation process apparently did not affect the sampled gases.

Geochemical analyses of post-salt hydrocarbons from Late Cretaceous and Tertiary reservoirs, are compared with the previous ones and allow revealing similarities and differences.

Conclusions
The pre-salt oils are mixed oils with intermediate lacustrine-marine organic matter input, or oils generated by a source rock with mixed organic matter (marine-lacustrine). The oils are mature to highly mature. Geochemical evaluation support oil-oil correlation between A, B and C well oils. The analyzed gases are of thermogenic origin.

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