GEOCHEMICAL CHARACTERIZATION OF BIODEGRADATION AND MULTIPLE CHARGE EVENTS: CAMPOS BASIN, BRAZIL

TRINDADE, L.A.,CERQUEIRA, J.R., MELLO,M. R., JAHNERT, R.J., OLIVEIRA, F.R.B, Petrobras, Rio de Janeiro, Brazil

Petroleum accumulations in the Campos Basin are derived from Barremian lacustrine brackish/saline water shales, deposited during the rift phase of the basin. Vertical migration to the marine sequence reservoirs was controlled by windows on the salt layers and faults. Despite a single source rock unit, geochemical heterogeneities of the oils are observed, reflecting maturity and biodegradation effects as well as mixing, associated with multiple charge events. These variations do not follow a straightforward distribution pattern, suggesting that not a single geological control explains the compositional trends. Temperature presents a good correlation with oil density, but subtle variations are observed on a short scale. The amount of mixing between first migrating, heavily biodegraded oils and more mature, non-biodegraded oils, plays an important role on the oil quality.

Geochemical investigation allowed the classification of oils according to their thermal evolution, extent of biodegradation and amount of mixing. Thermal evolution of the oils, as measured by sterane maturity parameters, tends to increase to deeper horizons. Within the same stratigraphic unit, higher maturity is generally associated with structures closely related to pods of active generation, in agreement with recent charging events. Maturity of the oils based on C7 compounds, do not always follow the same trend proposed by biomarkers, suggesting mixing of several charges and a pronounced contribution of a recent pulse of highly thermally evolved oil. Biodegradation affected the oils accumulated in the marine sequence to various extents. Accumulations in which the sedimentary burial and reservoir temperature are not high can be significantly biodegraded. However, the presence of 25-norhopanes and other biodegradation indicators, together with light compounds, indicates mixing of more than one migration pulse. oil quality is enhanced in areas where recent migration charges mixed with previously biodegraded oil, associated with meteoric water influx due to sea level drop. Combined evaluation of thermal evolution and biodegradation of the oils allowed the assessment of the amount of mixing, indicating the areas where the process was more effective. Detailed investigation of light ends indicates the occurrence of evaporative fractionation in some oil fields, suggesting oil remobilization. Mixing of oils with different thermal evolution is also supported by the presence of diamondoids. Integration of this study with the geologic evolution of the basin, allow a better understanding of the importance of the several factors on petroleum quality in different areas of the basin.