Hydrocarbon generation, migration, leakage and potential climate feedback of southern Atlantic continental margins: examples from the offshore Colorado Basin and the on/offshore Austral Basin, Argentina

Victoria F. Sachse[1], Zahie Anka[1], Markus Lögering[1], Hugo J. Belotti[2], Marcelo Cagnolatti[2]; Jorge Rodriguez[2], Denis Marchal[2], Rolando di Primio[1]

[1]Helmholtz Centre Potsdam, GFZ German Research Centre for Geosciences, Section 4.3., Telegrafenberg, 14473 Potsdam, Germany

[2]Petrobras Argentina S.A., Buenos Aires, Argentina

Sedimentary basins worldwide are known for their enormous potential of generating and hosting greenhouse gases, which may give a significant contribution to the carbon cycle. Marine and terrestrial systems host large amounts of hydrocarbon accumulations, whereas significant amounts get lost at the surface through leakage structures within the sediments. Gas escape structures/ sequestration features were described by many authors and were postulated to be i.e. gas chimneys, pockmarks, carbonate mounds and mud volcanoes. An integrated study including detailed mapping of leakage indicators, their distribution, their association to heat flow anomalies or structural elements, as well as their relationship to the hydrocarbon system has yet not been carried out so far in the South Atlantic Argentinean margin.

To illustrate the evolution of the southern continental margin of South America, two Mesozoic basins were chosen: the Colorado and the Austral Basins. These basins offer, due to their geological history and natural hydrocarbon leakage structures, ideal conditions for the investigation of basin evolution and hydrocarbon systems. The project includes a detailed interpretation of seismic lines covering wide areas of the basins, identification of hydrocarbon leakage features and seepage pathways, and finally a reconstruction of the basin evolution using basin modelling. Calibration and input parameters for the integrated petroleum system modelling are based on well information as well as on the identification and characterization of the petroleum system elements (source rock, reservoir, cap rock) using geochemical/geophysical approaches. Preferred leakage sites will be identified based on the flow modelling results (calibration of cap rock lithologic properties will be performed using observed gas chimneys). This approach will allow a better understanding of the hydrocarbon leakage dynamics and main hydrocarbon migration routes in these basins. Estimations of the leaked volumes of thermogenic methane could give an idea about the impact of this process in the carbon cycle.

Keywords: Basin modeling, hydrocarbon systems, leakage dynamics