Basin Hydrodynamics in the Southern Llanos basin: De-risking the Heavy Oil Plays

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ABSTRACT

We will present a case study in a foreland basin with important heavy oil accumulations in which we document the instrumental role of groundwater flow in the mobility of the hydrocarbon during the exploration phases. We produced structure contour maps for the top of the basement and modern geothermal gradient and reservoir temperature maps to understand the location of the 80°C isotherm and to understand the controls on biodegradation. In addition, we generated freshwater hydraulic head maps for the main reservoirs as well as salinity maps in order to understand the patterns of groundwater flow. Maps showing the pods of active source rocks were also done with the goal of assessing which traps are closer to modern kitchens. Finally, this study also included a detailed assessment of the structural setting using available surface and subsurface information. All these data sets were compared with the location of successful and dry wells to define our main conclusions. Traps located away from modern kitchens with reservoirs that have documented connection with the surface and located in hydraulic highs are riskier for future hydrocarbon mobility. The previous factors seem to be more important than temperature and depth. Traps having reservoir rocks with a clear connection with the surface always have fresh waters with salinities of less than 300 ppm. However, other traps that have reservoir rocks connected with the surface have always been successful, with the most important factor being the presence of a pod of active source rock very close to the potential accumulations.