Reservoir Evaluation Challenges in Mexico Deep Water

Leonardo Aguilera [2], Javier Contreras [2], and Ulises D. Bustos [1]
[1]Geosciences, Schlumberger, Villahermosa, Mexico.
[2]Exploration, Pemex, Ciudad del Carmen, Mexico.

Summary
Due to the hydrocarbon production declination in Mexico, Pemex, the National Oil Company, put in place since late 90's an important exploration campaign in deepwater areas.
By the end of 2008 the offshore exploration was increased due to the good results obtained. The gas reserves were increased in the project.

At the beginning of the campaign, the reservoir evaluation was performed with conventional approaches and based on conventional triple combo data. This was not enough to encounter, evaluate and define the reservoir potential, due to the degree of complexity encountered in these targets.
The reservoirs are gas bearing shaly-sand. The shale distribution is very variable, so there is scarce contrast between sands and shales with conventional logs. This means, the clay volume and effective porosity faced a high degree of uncertainty when estimated with conventional techniques.
The photoelectric factor is affected by barite whereas shaliness affects the neutron log, limiting the lithology evaluation. Because of this, incorporating capture spectroscopy data the lithology and primary mineralogy was properly assessed.

Laminated sands, affecting the resistivity response, also represented a limitation for water saturation assesment. Therefore, horizontal and vertical resistivity was incorporated as a way to avoid the negative impact on hydrocarbon volumes definition.

An accurate determination of the free water volume in the porosity was critical due to its impact in the reserves estimation/recovery factor. Integrating Nuclear Magnetic Resonance and Resistivity Anisotropy we defined the volumes of hydrocarbons, irreducible water and free water with a very acceptable accuracy. The petrophysical models were confirmed/validated with Dynamic Tester information, enabling to obtain dynamic data and to support the reserves certification.

Conclusions
-The conventional logs are limited to proper evaluate the deep water reservoirs.
-Nuclear Magnetic Resonance was critical to define the storage capacity and to estimate the flow capacity.
-Horizontal/Vertical resistivity was critical to avoid bypassing hydrocarbon bearing zones and to better assess the water saturation.
-The incorporation of dynamic testers to evaluate the flow capacity and hydrocarbon type identification is critical in these environments.
-The integration of static and dynamic data, allowed to detect, analyze and to define the reservoir potential in deep water targets.