



Reservoir Characterization of Unconsolidated Coastal Plain and Littoral Sandstones Case Study of a New Heavy Oil Shallow Play, Neuquina Basin, Western Argentina

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The Centenario heavy oil trend is located north of the Colorado River in Mendoza and La Pampa provinces, Argentina. In 2004, a consortium operated by Petro Andina Resources Ltd. (50% partnership with Repsol-YPF) discovered and started developing a 19° API gravity oil accumulation at an average depth of 600 m. Viscosity ranges (200-500 cP), an underpressured regime (400 psi at 600m) and the unconsolidated nature of the reservoirs had no analogies in the basin. These factors motivated an intensive rock and fluid sampling program for reservoir and fluids characterization. In parallel, different drilling, completion and development strategies were tested at the field operation. After three years of activity, more than 470 wells have been drilled, production has ramped up to 30,000 BOPD, four water flood programs are being executed and a steam injection pilot is ongoing.

Reservoirs are part of the Centenario Formation (Hauterivian), deposited in a coastal plain to shallow marine environment. This formation is composed of two third order sequences that at this position in the basin, only preserved the highstand and transgressive system tracts. Reservoirs are mainly concentrated at the uppermost portion of the highstands and correspond to very fine and fine grained feldspathic litharenites with an open fabric (porosity from 25 to 38%, and permeability from 0.5 to 4 Darcy). Trapping is dominantly stratigraphic and it is caused by the updip shale out or truncation of the reservoir units.

In spite of the excellent degree of sorting, subtle changes in grain size distribution strongly impact pore throats sizes, thus affecting the production performance and recovery factor. These changes are not evident on conventional E-Logs. Therefore, an intensive coring and robust logging program allowed classifying four reservoir rock types with singular capillary pressure ranges. These rock types show different levels of hydrocarbon saturation, down to irreducible oil saturation in the poorest type (very fine silty sandstones, “soggy rocks”).

The integration of core data, E-Logs, geological/geophysical interpretations and production performance, played a key role in reservoir characterization. A better recovery factor assessment has been achieved using these rock types and very low resistivity “soggy rocks” are now being included in the water flooding projects. This characterization has positively affected net pay determination and it is playing a key role on reservoir management.

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