Characterization of remaining oil saturation for naturally fractured reservoir under nitrogen-assisted gravity drainage mechanism

There are some projects in naturally fractured carbonate reservoirs which have taken advantage of gravity drainage drive mechanism to recover "matrix-trapped" oil in zones where a gas cap (primary or not) is present. Even this drive mechanism has allowed recover “matrix-trapped” oil in water-invaded zones (through dewatering process or double displacement process). In cases when a pressure maintenance is required some projects

However in those projects there are some uncertainties about how much oil has been recovered due gravity drainage mechanism and how much oil could be recovered in the future if this mechanism is still present.

This research study consists on performing a laboratory experiment using a stack of core samples in vertical position at low-pressure and low-temperature conditions which emulates gravity drainage drive mechanism in a naturally fractured reservoir where low-conductivity medium (matrix) is surrounded by nitrogen (i.e. fractures fully-saturated with nitrogen).

The main objective focuses on the evaluation of residual matrix-oil saturation and matrix-oil recovery rates in a naturally fractured reservoir under nitrogen-assisted gravity drainage mechanism for different block-matrix geometries.

Workflow

Set up initial conditions for each core sample
Create a stack and put it into a Gravity Drainage Cell
Displace oil by nitrogen inside Gravity Drainage Cell
Perform gravity drainage experiment

Track produced fluids (expelled from the stack) during experiment
Track distribution of fluids inside the stack using CT Scanner during experiment

Results analysis.

Reproduce experiment through either analytical or numerical models.

Future work

These steps could be performed simultaneously