Claim 9 Performance

The oil company I was working for had just purchased an oil lease with an established production. As the Petroleum and Reservoir Engineer for the asset, I was assigned the task of increasing oil production. The first phase involved revitalising suspended wells, perforating new zones and upgrading the artificial lift. This program was successful in stemming the oil production decline but the asset required a step change in performance. This could only come about via drilling and, if possible, exploration drilling. Fortunately, my oil and gas career commenced as a wireline logging engineer with the task of electronically recording wellbore geological data. A significant part of the training involved interpreting wireline logs akin to petrophysics.

Whilst reviewing the wireline geological data for a plugged and abandoned exploration well, I identified a possible oil reservoir. This well was drilled by the original tenant owner and the asset has changed operators a number of times. The original operator production tested this reservoir via a drill stem test which flowed water with a small quantity of oil. DST tests are usually a definitive test. The previous owner also noted this log anomaly but could not explain the DST result.

The geologist working with me interpreted the logs and confirmed my initial assessment. The geologist's role was to estimate the size and extent of the oil field and where we should drill. My role was to explain the misleading DST. Scouring through DST data, including daily reports, there was indication that the operation was a mechanical success and the DST packers were on depth. I tracked down the wellsite geologist and some of the rig personnel who executed the work and they could not fault the DST. I came to the conclusion there was no fault with the DST but believed it was still an oil reservoir.

The small sample of oil collected had been analysed and indicated waxy low API [high Specific Gravity] oil. This oil type was very different to that found in other fields in the area and was probably from another source-rock. This grade of oil was discovered in another oil field nearby but in a different geological reservoir. Visually looking at the oil, it became evident that flowing characteristics were influenced by the aquifer. The original oil sample from the DST was analysed in a laboratory with parameters indicating a poor mobility ratio which concluded that, if produced, preferentially water would flow. The bottom packer of the DST was placed at the water oil contact in a fluvial reservoir. In a fluvial environment, the sand grains fine upwards therefore the oil zone is in the poorer permeable section of the reservoir. From this analysis, a hypothesis was formed explaining why the DST did not flow oil.

After reviewing all the DSTs, I came across an example where the bottom packer, positioned at the water oil contact, flowed 90% water cut on the first attempt. The DST reset 3 metres higher and the test flowed oil at a 10% water cut.

With this analysis, the geologist and I advised management to redrill this prospect. Management were very supportive of this project. Therefore, the well was drilled and a significant oil field discovered.