INTEGRATION OF MUD GAS DATA ENHANCES OIL PRODUCTION: A CASE STUDY FROM SOUTHERN ITALY

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Introduction

Hydrocarbon gas detection in mud logging is a common practice in the oil industry since the late 1930s to identify and validate pay horizons while drilling (Erzinger et al. 2006; Whittaker 1991). Hydrocarbon gas data, i,e, C1 -C5+ and total gas, are typically collected when a well is drilled but rarely used for further evaluation and interpretation. Standard state of the art mud logging equipment acquires, however, data providing additional information for a comprehensive reservoir identification and evaluation. In some settings (e.g. unconventional reservoirs) and situations (e.g. tool failure or hole instability), gas concentrations may be the only formation evaluation data collected, making it even more critical to gain the maximum reservoir information possible from this data. The use of dedicated gas data interpretation approaches (Ritzmann et al. 2016), can be the key to distinguish productive zones in a reservoir as shown in this case study for a well in Southern Italy.

The challenge for this well was to clearly indentify the oil-water-contact to eventually optimize production. Collected real-time information comprises logging while drilling (LWD) and gas while drilling (GWD) data. Since the LWD tool run on this job only measures the formation gamma ray (GR) and resistivity response, it was difficult to define the oil-water-contact (OWC) precisely for these particular geological formations. Additional wireline data acquisition was planned, but due to hole instabilities in the reservoir section, not possible. For further well testing, a 4.5inch slotted liner was put in place covering all the reservoir section.

Results

The initial stage of the well testing showed a water cut above 95%. After two water shut-offs various logging runs inside the liner, 3 memory production logging tool (MPLT) runs and one acidification have been carried out , the water cut was still around 80% and production was not continuous. Due to these unsatisfying results an advanced integration of the available data was initiated.
The mud gas data in combination with the LWD logs, MPLT runs and data gathered from the previous well shut offs finally allowed a clear identification of the water invaded zone. Once the invaded zone was identified a cement plug was set to isolate the interval with a higher water saturation. After the cement plug sealed off the potentially water bearing zone, the water cut decreased to 4-10% and the oil production increased from around 70 bbls/day to 400bbls/day.

Conclusion

The advanced mud gas analysis showed how powerful the use of mud-logging derived gas data can be, especially when other data are missing or are not planned. The clear identification of the oil bearing intervals based on the mud gas data interpretation together with the MPLT Log enabled an improved completion, and led to a significant change in water cut and in approximately 5 times increased amount of oil produced from the reservoir in this case study.

References

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