

4D RESERVOIR GEOCHEMISTRY – THE BEHAVIOUR OF PHENOLS AND VOLATILE FATTY ACIDS DURING PRODUCTION

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One aspect of reservoir geochemistry involves the monitoring of slight differences in the chemical composition of oils produced from one reservoir to interpret reservoir compartmentalisation (flow barriers over geological timescales), charging and reservoir filling histories, as well as flow barriers on production timescales (England, 1989). The periodical analysis of compositional variations in produced oils is termed 4D reservoir geochemistry and allows monitoring production dynamics and rapidly detecting irregularities in production (Davis et al., 2005).

We will present results from the temporal monitoring of oils from three reservoirs, located in the 1) Dampier Basin, offshore Western Australia, 2) Cooper Basin, central Australia, and 3) North Sea. Oil 1 is a 46° API low viscosity oil, and both oils 2 and 3 are condensates. The fields were sampled over intervals of four times in three years, three times in five years, and eight times in one year respectively. Oil samples were separated into saturated hydrocarbons, aromatic hydrocarbons and fractions enriched in carbazoles and phenols, respectively carboxylic acids. All fractions were characterised using gas-chromatography and mass-spectrometry. The in-house developed small-scale separation methods that were employed allowed the recovery of fractions without losing low-molecular weight compounds and analyses included volatile species including *n*C8, toluene, phenol and acetic acid. Analyses were performed in duplicate to ensure quantitative reproducibility.

Preliminary results show that in Field 1, a breakthrough of gas that was injected in a nearby field could be monitored, leading to a rapid increase in gas to oil ratio (GOR). A subsequent decrease in water-cut suggested the forming of a gas cap by the injected gas (Davis et al., 2005). Field 2 showed no differences in composition of the saturated and aromatic hydrocarbon fractions over a period of 3 years.

This presentation will focus on the compositional changes of more polar and hydrophilic species such as phenols and volatile fatty acids (VFA) that parallel a decrease in API gravity throughout the monitored production periods. The results support 4D reservoir geochemistry as a rapid and inexpensive tool for screening production dynamics.

REFERENCES

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