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Innovative IFP Group Methodologies To Improve The Naturally Fractured Reservoirs Characterisation Through The Increased Use Of Dynamic Data

Thierry Le Maux[1]

thierry.lemaux@beicip.com

1. Introduction

With the acceleration of unconventional fields' development and the use of improved recovery techniques in traditional reservoirs, the oil and gas industry is increasingly facing the difficulties associated with fields characterised by the presence of natural fractures.

These difficulties range from the simple estimation of wells' placement to the evaluation of the hydrocarbon in place and the associated reserves. To successfully address these challenges, it is paramount to improve the characterisation of those reservoirs. This can only be performed through the integration of all available data and, in particular, dynamic data.

In the last 10 years development of tools such as Bore Hole Imagery (BHI) and their increasing use in horizontal wells, have enabled to improve our understanding of those complex reservoirs. Using the DFN (Discrete Fracture Network) methodology, we are now capable of easily translating this knowledge into useful static and dynamic models. Because natural fractures organisation and influence on fluid flow cannot be inferred from static data only, all available dynamic data have to be used to improve the characterisation work.

2. Key Features

We first show how all types of dynamic data can improve the characterization of the fracture network either qualitatively or quantitatively. Through examples of studies performed on naturally fractured carbonate reservoirs, we first demonstrate how dynamic data enable to understand the impact of the fracture network on fluid flow.
Associated with static data (seismic, logs, cores …) they can also be used to confirm the organization of the fracture network and the type of objects (diffuse fractures or fracture corridors) present in the reservoir.
We also focus on the benefits that can be gained from the use DFN models of fracture distribution to simulate measurements such as flow-meter and transient well-tests. The matching procedure enables first to validate the conceptual model derived from static and dynamic data analysis and then to quantify the dynamic properties of the fractures (porosity, permeability, anisotropy and matrix blocks dimensions or shape factor).
Finally, we show how it is possible, once the fracture organisation is understood, to re-visit the dynamic data (mainly gas/water breakthrough and transient well tests) to improve the fracture model in between wells in the absence of BHI logs or reliable seismic data.

3. Conclusions

Dynamic data should systematically be used to characterize all type of reservoirs, naturally fractured or not. At the well scale, it enables to confirm the information obtained from log and core. In between wells it reduces the uncertainty. In non-fractured reservoirs, the absence of integration at the characterization stage is often compensated by the relative good knowledge of the matrix properties and of the depositions and diagenesis processes.
Natural fractures are on the other hand still too poorly understood, data are still too limited to ignore the added knowledge brought by the dynamic data. Their early integration enables to find the type of fractures that are present, their organization and their influence on fluid flow. It also greatly improves the history matching process.

[1] *Beicip-Franlab,F-92502 Reuil-Malmaison, France*

Speaker's Biography

Thierry LE MAUX is a senior reservoir engineer with 11 years of experience. He has acquired a strong knowledge of fields' development, both gas and oil, with a North Sea operator. At Beicip-Franlab, he is co-leading the fractured reservoirs business unit. He has specialized in fractured reservoir studies (dynamic characterization and dual media simulation). He has participated as project manager to numerous projects in the Middle East (Saudi Arabia, Kuwait, UAE) and North Africa. He is also a specialist in Well Test Interpretation.