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Magnetic Resonance in Chalk Horizontal Well Logged With LWD

Arve K. Thorsen, SPE, Tor Eiane, SPE, and Holger Thern, SPE, INTEQ, and Paal Fristad and Stephen Williams, SPE, StatoilHydro ASA

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Abstract

This paper describes geological and petrophysical evaluation of a new structure of a mature field to evaluate the reservoir potential in un-produced reservoir zones. The well was drilled in a carbonate with variations in rock quality and with minor sub-faulting occurring. Gamma, Resistivity, Density, Neutron, and Image services were used in the horizontal part of the well in addition to Magnetic Resonance. To achieve the best possible real-time wellbore placement, reservoir navigation and continuous follow-up on the horizontal log interpretation was performed during drilling.

For the first time a low gradient Magnetic Resonance (MR) while drilling technology was deployed in a virgin carbonate horizontal well on the Norwegian Continental Shelf. The MR Service was run to obtain porosities (incl. partitioning of movable and bound fluids), HC saturations, and permeability estimates. Fluid saturations based on traditional methods and the MR were evaluated and compared by core data, enhancing the understanding of the measurement and the reservoir. For post-processing the MR data were integrated and interpreted together with the other measurements performed in the well delivering an accurate and consistent reservoir description.

First part of the horizontal part of the well was drilled with conductive drilling fluid and the latter part with non-conductive drilling fluid. Lab measurements for the two mud filtrates were performed to understand the influence of the two different drilling fluid types on the MR measurements. In the absence of oil based mud filtrate invasion, the MR data show better agreement with saturations from core confirming the quality and reliability of the MR data.

Comparison of the MR T2 distribution and volumetric with image data indicates that even fine variations in rock quality and lithology are reliably resolved by the MR data. Prior to logging, old core data was used to refine the constants used in the Timur-Coates MR permeability equation. MR permeability showed changes in reservoir quality. Values will be calibrated when Timur-Coates constants are derived from the core plugs from this well.

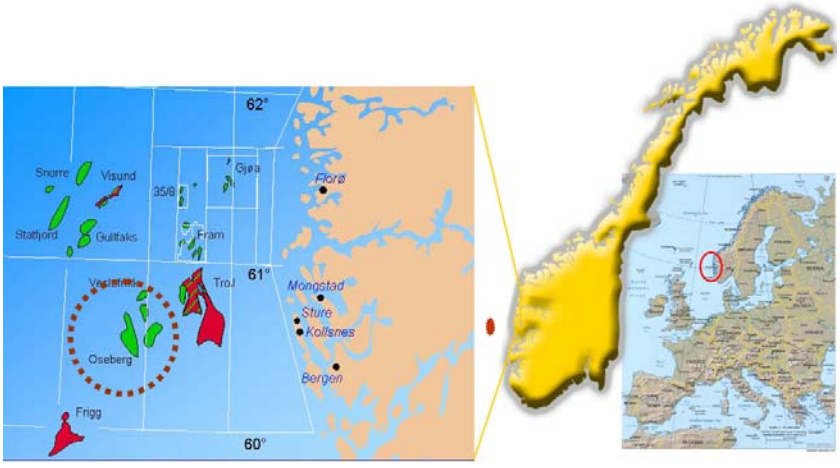

Figure 1: Oseberg Field location

Introduction

The Oseberg field is located in the northern part of the North Sea, 130 km NW of Bergen, Norway. The sea depth in the area is 100 meters[i].

The Oseberg field consists of several sandstone reservoirs in the Middle Jurassic Brent group, and is divided into several structures. The main reservoir is located in the Oseberg and Tarbert formations, but production also takes place from the Etive and Ness