Comparison of Density Log Datasets Acquired in a Horizontal Production Well, White Rose Field, Jeanne d'Arc basin, Offshore Newfoundland

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Abstract

A horizontal production well in the White Rose Field, offshore Newfoundland was drilled and evaluated over a 2100 metre interval of the Ben Nevis – Avalon reservoir interval in 2005. As a result of operational and regulatory requirements, overlapping log data were acquired over several portions of the wellbore. Density log data from two different wireline density tool types run in one drillpipe-conveyed logging pass will be compared with that acquired during multiple passes of logging-while drilling (LWD) tools during the drilling of the well. Neutron, resistivity and image data will be presented in support of the density data.

The pre-drill operational plan for the well included a contingency to immediately sidetrack the well if the real-time LWD data showed penetration of a threshold amount of non-reservoir facies. This was considered necessary since there was only one previous vertical well in the Central mega-block of the field that provided local information on reservoir quality and continuity.

When the well was drilled, the harsh drilling environment led to the need for multiple bit trips to replace bottom hole assembly components as they wore out. In several cases this included partial or complete LWD failures which real-time monitoring and comparison against offset well data identified shortly after occurrence. The need to trip past intervals previously drilled and logged with LWD tools provided an opportunity to acquire additional time-lapse data to illustrate the effect on the LWD density data of near-wellbore filtration effects and wellbore deterioration with time. Statistical comparison of the data after the well had finished showed these anticipated effects to be very small.

Drillpipe-conveyed wireline logging provided two types of wireline density data for comparison. The data from the older LDT density tool was of particular interest. The technology used in it has been

modified for use in the current generation of LWD density tools. The current standard density tool (Platform Express) provided the baseline data to compare the other density log types against in subsequent analysis. In this case the combination of 216mm wellbore size, horizontal orientation, synthetic oilbase mud, and environmental conditions for tool calibration on deck led to several iterations of playback before there was confidence in this answer.

The data results from this well establish that the different density tools provided consistent answer products in this well. However, the use of LWD or wireline tools in future development wells of the White Rose field will continue to be influenced by external factors such as the additional rig costs incurred in drillpipe-conveyed logging after TD is reached, delay to ongoing rig operations caused by attempts to wireline log in bad weather, and reliability of LWD tools in harsh drilling environments. Already, drilling and equipment changes brought about by the results of the early horizontal development wells in the field have led to changes in drilling practices and BHA components. Increased LWD tool reliability is resulting.

Thus both LWD and wireline logging have a place in the evaluation of future White Rose field wells – although duplication of tool types will be unlikely.

Post-acquisition review of these datasets has also established the difficulty in directly comparing wireline and LWD data from tool types such as resistivity and neutron due to the non-radial formation attributes and time-lapse fluid filtration effects around horizontal wellbores – an aspect not previously considered in the design, testing and development of tools in vertical wells. Image data such as that provided by LWD tools in this well provide key information on boundaries, fluids and textures around the horizontal wellbore that influence all tool readings and the analysis results that follow.