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Application of ALD Images and Caliper Data for the breakout analysis from the wells which were drilled in the Caspian Sea of the Azerbaijan Republic

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Wellbore instability while drilling, trip in or trip out can be cause of nonproductive time (NPT). Mainly this is the drilling surprises often encountered while drilling, trip in or trip out which were not predicted in advance, monitored, interpreted or recognized properly, which can give rise to wellbore instability problems. These surprises include also formation tops, overpressure zones occurring at different depths than predicted and the presence of unexpected faults or other fractured/fissile/compartmentalization zones.

In general while drilling the wells, downhole PWD data cannot be very useful for understanding wellbore stability. Much of what we can use is indirect measurements such as torque and drag observations, rpm, vibrations, cavings, annular pressure measurements and etc. In order to understand what is going on in the subsurface and therefore mitigate the wellbore instability problems, we need more information from LWD (logging while drilling) tools.

In order to monitor and get direct observations of the state of the borehole we need to determine where, how and in which direction the wellbore is failing and enlargement is taking place. LWD calipers and wellbore Azimuthal Lithodensity Images can provide such information for breakout analysis while drilling, trip in and trip out activity.

The modes of wellbore instability can be generated in different ways and through different mechanisms. Therefore these zones of breakout can be potentially identified by the ALD imaging and LWD caliper tools. Instability can be governed by a combination of factors such as: the strength of the rock, the subsurface stress field, maximum and minimum horizontal stresses, pre-existing planes of weakness, the angle of the wellbore which intersects with these planes of weakness and chemical reaction of the rock (minerals) with the drilling fluid.

Compressional failure (breakout) of an isotropic rock can occur when the compressive stresses around the borehole exceed the compressive strength of the rock. This can create the enlargement of the borehole with two failure zones opposite to each other with circumference at 180 degrees (for instance top side vs bottom side of the borehole or right side vs left side of the borehole).

The image tracks for Rhob (density), Pe (photoelectric absorption) and Caliper can show the data such as edges of the track from the top, right, bottom and left sides of the hole (the center of the track is the bottom side of the borehole). Generally the color gradation (different spectrums) can be used in order to show the orientation change in the measurement around the wellbore. The azimuthal density, Pe, and Caliper data can be pointed and visualized as a log curves which can represent the average of all available data (an average of the top, right, bottom and left sides (or quadrants) or as 8 (RT) or 16 (RM) individual bins and as an ALD Image log. In addition, the Caliper data can give us information about the diameter and geometry of the borehole while drilling, trip in and trip out activities (for more detailed breakout analysis and interpretations).

This paper (abstract) will present the results of a breakout analysis conducted from the wells which were drilled in the Caspian Sea of the Azerbaijan Republic in order to evaluate the available ALD images, caliper information and eventually incorporation of all available data into the wellbore stability monitoring service (breakout analysis).