Hole C0019B, Expedition 343: geoVISION Image Processing Report

The geoVISION LWD (Logging While Drilling) tool maps the electrical resistivity of the borehole wall at three depths of penetration. Because the tool is rotating while drilling, its three electrodes (one for each penetration depth) provide 360° data coverage of the borehole wall. These data are displayed as an electrical image of the formation in color scale. The purpose of this report is to describe the images processing. The geoVISION tool also takes total gamma radiation and resistivity logs, which are presented with the 'standard' data.

Hole C0019B

Location: Miyagi-oki
Latitude: 37°56.3367N
Longitude: 143° 54.8100E
Logging date: April 23th, 2012
Water Depth (as seen on logs): 6918 mbrf
Total penetration: 850.5m
GEOVISION depth range: 0-850.5 mbsf

The images are fair quality. The hole condition looks good in drilling down. The shallow geoVISION images are probably the most reliable. Breakouts can be observed in the images.

Depth Shifting

The geoVISION data is output from the MAXWELL LWD acquisition system as a depth-indexed DLIS file. The main processing steps are performed using Schlumberger 'GeoFrame' software package, just after the raw data is downloaded from the tool.
The depth index is shifted with 6918m from the rig floor to the mud line identified from gamma-ray and resisitivities in geoVISION and arcVISION memory data hard copy.

Image Processing

Processing is required to convert the electrical current in the formation, emitted by the geoVISION button electrodes, into a color-scale image representative of the resistivity changes. This is achieved through two main processing phases, the first shortly after the data is downloaded from the tool by the Schlumberger engineer.

1) Azimuthal orientation and conversion to depth

An azimuth and a depth are assigned to each measurement based on measurements of the pipe orientation and position at the rig floor. The resolution of the azimuth is about 6.4°, because the resistivity measurements are assigned to 56 radial bins. The resistivity data is sampled every 10 seconds, therefore the data density in terms of depth depends upon the rate of penetration (ROP) into the formation – the slower the penetration, the more densely sampled the formation will be. For this hole, the ROP was varied in the 10-70 m/hr range, and RPM approximately 45-130 rpm.

The geoVISION tool does not move with a constant velocity down the hole: ship heave is never completely compensated. This means that there will often be repeat measurements for one particular depth in the borehole. The measurement that is used is the first one taken at a particular point, before the borehole has had time to deteriorate.

The effects of ship heave are sometimes apparent as horizontal discontinuities in the image. They exist because it can be difficult, with a long drill string, to accurately determine the depth of the bit based on measurements on the rig floor.

2) Image Normalization:

The DLIS file is loaded into the Schlumberger GeoFrame software, where the depth-based image for each depth of penetration (shallow, medium, and deep) is normalized both statically and dynamically.

In "static normalization", a histogram equalization technique is used to obtain the maximum quality image. In this technique, the resistivity range of the entire interval of good data is computed and partitioned into 128 color levels. This type of normalization is best suited for large-scale resistivity variations.

The image can be enhanced when it is desirable to highlight features in sections of the well where resistivity events are relatively subdued when compared with the overall resistivity range in the section. This enhancement is called "dynamic normalization". By rescaling the color intensity over a smaller interval, the contrast between adjacent resistivity levels is enhanced. It is important to note that with dynamic normalization, resistivities in two distant sections of the hole cannot be directly compared with each

other. A 2-m normalization interval is used.

The normalized images are converted to PDS, PDF, and Tiff files. The image is displayed as an unwrapped borehole cylinder. A dipping plane in the borehole will be displayed as a sinusoid on the image; the amplitude of this sinusoid is proportional to the dip of the plane. The images are oriented with respect to north, hence the strike of dipping features can also be determined.

For further information or questions about the processing, please contact:

Yoshinori Sanada
E-mail: sanada[at]jamstec.go.jp

Yukari Kido
E-mail: ykido[at]jamstec.go.jp

Saneatsu Saito
E-mail: saito[at]jamstec.go.jp