IODP Expedition 319 Logging Operations and Data Processing Report

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Hole: C0010A

Location: Nankai Trough

Latitude: 33°12.5981'N Longitude: 136°41.1924'E

Logging Date: August 6-9 and 12, 2009

Seafloor depth: 2552 m BRF/DRF/LRF

Total penetration: 555 m DSF/LSF (3107.0 mDRF/LRF)

Lithologies/Oldest sediment recovered: No core

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Logging Operations Summary

Hole C0010A borehole assembly includes TeleScope MWD and geoVISION, which measures various drilling parameters, resistivity and image (**Table 1, Figure 1, 2**). Upon making up the MWD-GVR assembly at 1230 hr on 6 August, 2009, a toolstring shallow hole test was made at 1345 hr and running into the hole while the ship was drifting to the low current area. At 1230 hr on 7 August 2009, the drilling assembly entry was made at Hole C0010A through 20 inch conductor pipe for 41 m and began to control drilling with speed of 20 m/hr (16.6 m/hr average) from 1315 hr. The section between 2846 and 2858 mLRF was re-logged due to poor data quality. As stick-slip increased with depth, a sweep of high-viscosity mud at pipe stands and a wiper trip was made at 1615 hr to the 2573 mLRF (inside conductor pipe). A repeat section was made again between 2921 and 2928 mLRF and reamed at multiple depths. Drilling stopped at 1245 hr on 9 August 2009 to move the ship away from a typhoon's path. At 0300 hr on 12 August, the ship was back to the location and re-entry was made into the hole and continued running to the depth of the repeat section. Repeat logging was made from 0600 hr between 2900 and 2972 mLRF and continued running into the hole. Drilling resumed from the depth of 3034 mLRF at 1145 hr with the control speed of 30 m/hr. Stick-slip was reduced with depth, and drilling finished at 1715 after reaching target depth of 3107 mLRF.

Table 1. Site C0010A drilling and logging operations.

Operation	Data	Depth (mLSF)
Riserless 12-1/4" drilling	MWD-GR-GVR	41-482
Riserless 12-1/4" drilling	MWD-GR-GVR	482-555

Notes: Depths are used here only logging depth below seafloor where depth from the rigfloor to the seafloor is 2552 m and datum of the rotary table is 28.3 m.

DATA PROCESSING NOTES

Available Data

Logging data was recorded by Schlumberger drilling and measurement team for LWD/MWD operations. Data were processed during cruise by field engineer in terms of environmental corrections. Final processing and depth shifting was done in CDEX.

Gamma ray and resistivity of several depths of investigation were logged together with drilling parameters (rate of penetration, stick-slip, etc.) (**Figure 3, Table 1)**. Two sets of data corresponding to two phases of drilling operations were collected: Run 1 for the interval of 41-482 mLSF (2590–3033 mLRF) and Run 2 for the interval of 482-555 mLRF (3034–3107 mLSF) with a re-logged interval of 348-418 mLSF (2900–2970 mLRF). Hole C0010A was jetted down for the 20 inch conductor pipe and then drilled from 2593 m LRF (DRF) to 3107 m LRF (DRF) TD with 12 1/4 inch MWD-GVR drilling assembly (**Figure 2**). Realtime data from both MWD and GVR, and memory data from GVR were environment and inversion corrected.

Processing

Depth shifting: The depth references are shown graphically in Figure 1. The height of the rotary table (rig floor) is 28.3 m above sea level (presuming minimal variation in this parameter during drilling operations), and the water depth is reported as 2552.0 m. The depths of the MWD logs are tied to the drillers' depth at rig floor, which means that LRF is equal to DRF and LSF is equal to DSF.

Environmental correction: Field engineer made primary corrections and details are explained in their end of well report.

Image processing

Processing is required to convert the initial measurements into a gray or color-scale image. This is achieved through two main processing phase, the first shortly after the data is downloaded from the tool by the Schlumberger engineer and the second post-cruise at CDEX before putting in moratorium database.

1) Azimuthal orientation and conversion to depth

The main processing steps are performed using Schlumberger's 'Ideal' software, just after the raw data is downloaded from the tool. The azimuth of the sensors relative to north is set at the rig floor, and subsequent pipe rotation is tracked during drilling so that the image is oriented correctly. A shallow, middle and deep focused button electrodes mounted on one side of the tool measures azimuthial resistivities with rotating the tool. A full revolution samples 56 sections of azimuthal image.ROP is typically in the 25-50 m/hr range, and the rotation is typically around 60 rpm.

The depth assigned to LWD data is derived from the known length of pipe and the vertical position of the top drive at the rig floor. After the LWD data is downloaded from the tool, the depth data are merged with it based on accurately synchronized time data. 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 exactly determine the depth of the bit based on measurements on the rig floor. The LWD data is output from the Ideal software as a depth-indexed DLIS file.

2) Depth Shift and Image Generation

The DLIS file is loaded into the Schlumberger GeoFrame software at CDEX, where the image for each measurement is shifted so that the depth is relative to sea floor, and output PDS, PDF and TIFF, DLIS files are produced. The amplitude of resistivities are normalized in 128 colors. The window length for dynamic image is 1m. The image is displayed as an unwrapped borehole cylinder. A dipping plane in the borehole appears 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.

LOG DATA QUALITY

In comparison to the data from the Hole C0004B, which is 30 km away across the Kumano Basin, Run 1 for the top section of the Hole C0010A had high stick continuously. In addition, continuously high (1.2–2.5m) heave due to a passing strong typhoon from the west and another from the south may have affected data quality. The re-logged section during Run 2 in calm sea conditions after the typhoons passed showed different values. Resistivity image logs have good data at the top, middle, and bottom, where bad data are in the short range at the middle part, base of the prism wedge, and a few meters in the bottom part as well (**Figure F3**). Unlike the resistivity (particularly bit resistivity), gamma ray has uniform values and gradually changes across the boundaries.

Repeatability

To ensure data quality, repeat runs were made between 238 and 318 mLSF (2790 and 2870 mLRF), 294 and 306 mLSF (2846 and 2858 mLRF) and 348 and 418 mLSF (2900 and 2970 mLRF). The comparison between the main logs and the repeat section were not identical as the repeat section was made 2 days after the main logs due to the wait on weather.

References

Saffer, D., McNeill, L., Araki, E., Byrne, T., Eguchi, N., Toczko, S., Takahashi, K., and the Expedition 319 Scientists, 2009. NanTroSEIZE Stage 2: NanTroSEIZE riser/riserless observatory. *IODP Prel. Rept.,* 319. doi:10.2204/iodp.pr.319.2009

Figure Captions

Figure 1. MWD-GVR runs at Hole C0010A.

Figure 2. MWD-GVR toolstring used in the Expedition 319.

Figure 3. Composite MWD-GVR-GR logs from Hole C0010A with data quality indicators. From left to right, depths, runs and logging units; gamma ray; bit-, ring-, shallow-, medium-, and deep-resistivities; rate of penetration (ROP); stick and data quality indicator columns for resistivity image; and scalar logs.

Figure 1.

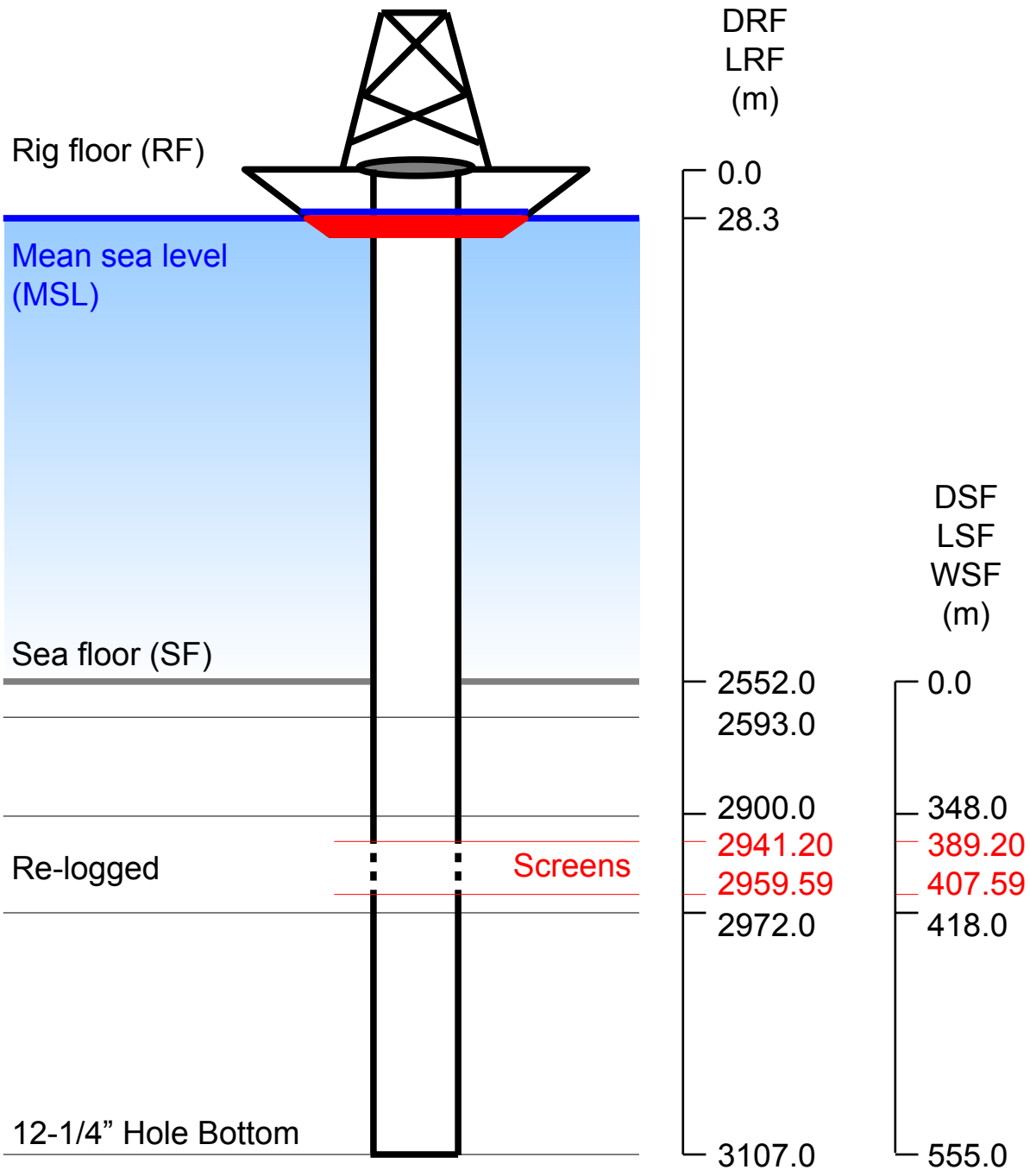

DRF
LRF
(m)
Rig floor (RF)
0.0
28.3
Mean sea level
(MSL)
DSF
LSF
WSF
(m)
Sea floor (SF)
2552.0
0.0
2593.0
2900.0
348.0
Re-logged
Screens
2941.20
389.20
2959.59
407.59
2972.0
418.0
12-1/4” Hole Bottom
3107.0
555.0

Figure 1.

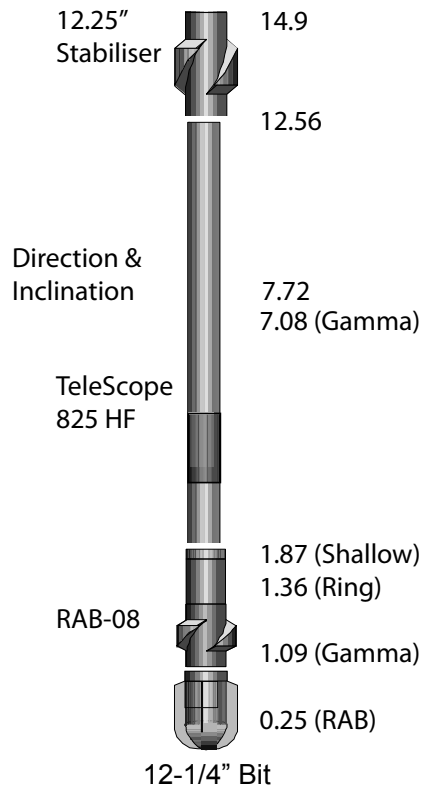
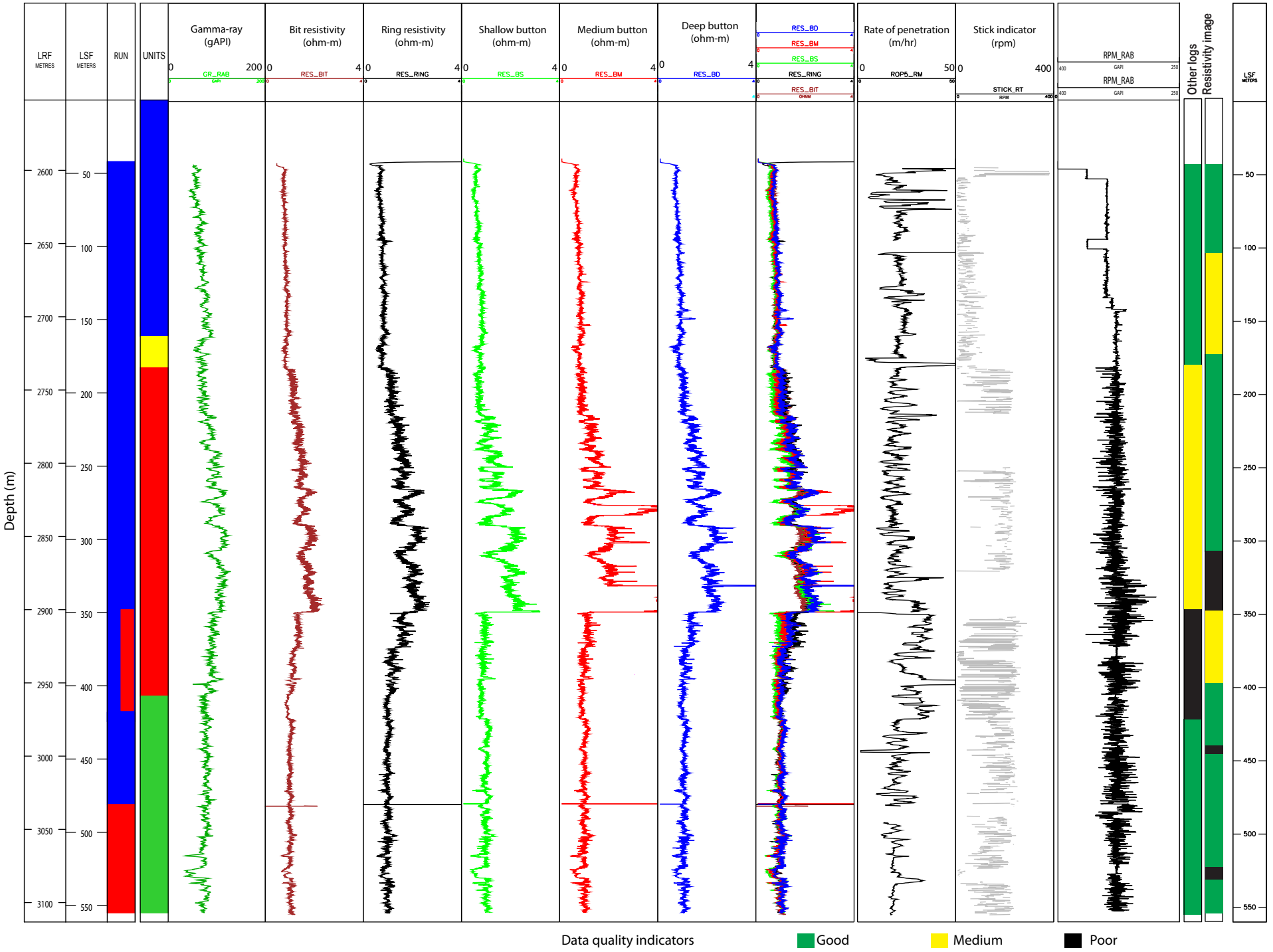

12.25"
Stabiliser
14.9
12.56
Direction &
Inclination
7.72
7.08 (Gamma)
TeleScope
825 HF
1.87 (Shallow)
1.36 (Ring)
RAB-08
1.09 (Gamma)
0.25 (RAB)
12-1/4" Bit

Figure 3


LRF METRES
LSF METERS
RUN
UNITS
Gamma-ray (gAPI)
GR_RAB
Bit resistivity (ohm-m)
RES_BIT
Ring resistivity (ohm-m)
RES_RING
Shallow button (ohm-m)
RES_BS
Medium button (ohm-m)
RES_BM
Deep button (ohm-m)
RES_BD
RES_BD
RES_BM
RES_BS
RES_RING
RES_BIT
Rate of penetration (m/hr)
ROP5_RM
Stick indicator (rpm)
STICK_RT
RPM_RAB
RPM_RAB
Other logs
Resistivity image
Depth (m)
Data quality indicators
Good
Medium
Poor