

IODP EXP 358 Daily Geomechanics Report

Report #023 20181202 Final 4995

RTG Team

RTG Supervisor(s)	David Castillo / Thomas Finkbeiner / Demian Saffer
RTG Watch Lead (00:00-12:00)	Kan Aoike
RTG Watch Lead (12:00-24:00)	Adam Wspanialy
RTG Office Support	N/A

Well Status (as of 06:00 Dec.3 2018)

Site Name:	C0002	Hole Name:	Q
Water Depth:	1,939.0 m	RT-MSL:	28.5 m
Current Depth:	5000.0 mBRT (4,998.0) mTVD	Section TD:	5,667.5 mBRT (5,665.5) mTVD
Section #:	1	CSG Depth / Size:	(4855.0) mBRT 11-3/4 "
Static MW:	1.37 sg	Current ECD:	1.43 sg
FIT/LOT/XLOT:	FIT maximum pressure = 1.45 sg, Possible "LOP" = 1.43 sg @4855 mBRT		
Current formation/ lithology:	Shale		
Sensor Offsets from the Bit:	PDC Bit: 0 m arcVISION 675: (APWD: 3.59 m, Resistivity: 4.30 m, GR: 4.35 m) TeleScope 675: (IWOB: 8.47 m, Direction + Inclination: 11.84 m)		
Other BHA Offsets from the Bit	8-1/4" Stabiliser: 17.463~19.051 m 8-1/2" x 12-1/4" Z-reamer: 28.475~29.823 m 11 x 6-3/4" Drill Collar: 30.629~133.833 m Jar: 190.654~200.229 m		
Current Operations:	Continued reaming down with 8-1/2" x 12-1/4" BHA with Z-reamer opened. Experienced a few high torques but no stall. Slow and steady reaming was observed. Took inclination surveys twice at 4980 mBRT (TeleScope at 4968 mBRT) and obtained 4.18 and 4.12 deg. Reached the Kick-off hole TD 4990 mBRT at 23:15 but no obvious change observed in DTOR and DWOB after starting drilling down. Reached 4995 mBRT at 01:00 Dec.3. Pulled back the BHA to 4925 mBRT (bit depth) and took inclination surveys every 5 m. Obtained data suggesting that hole deviation occurred at somewhere between 4916~4928 mBRT. Resumed to drill down at 04:10 Dec.3. 5000 mBRT as of 06:00 Dec.3		

2Geomechanics Alert

GREEN	<p>Green = Projected model remains accurate</p> <p>White = Unanticipated deviation from model which <i>should not</i> affect drilling</p> <p>Yellow = Unanticipated deviation from model which <i>may</i> affect drilling</p> <p>Red = Imminent requirement to stop drilling</p>
Basis for Alert Level + Recommendations	No issue with 1.37 sg MW for Section 1

Principal Findings

N/A

Observations Summary

Use this space to discuss any observations while drilling, running casing etc.

Fracture Gradient	N/A
Pore Pressure	Total gas < 1%.
Wellbore Breakout	N/A

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Tensile Failure	N/A
Drilling Parameters	Steady ECD of 1.42~1.43 sg with slight short cycle fluctuation. DTOR 1.5~3.5 kNm while STOR 15~30 kNm. DWOB 20~70 kN while SWOB 80~120 kN. 600gpm and 100-110 rpm.
Other	No seepage losses have been observed in last 24hrs.

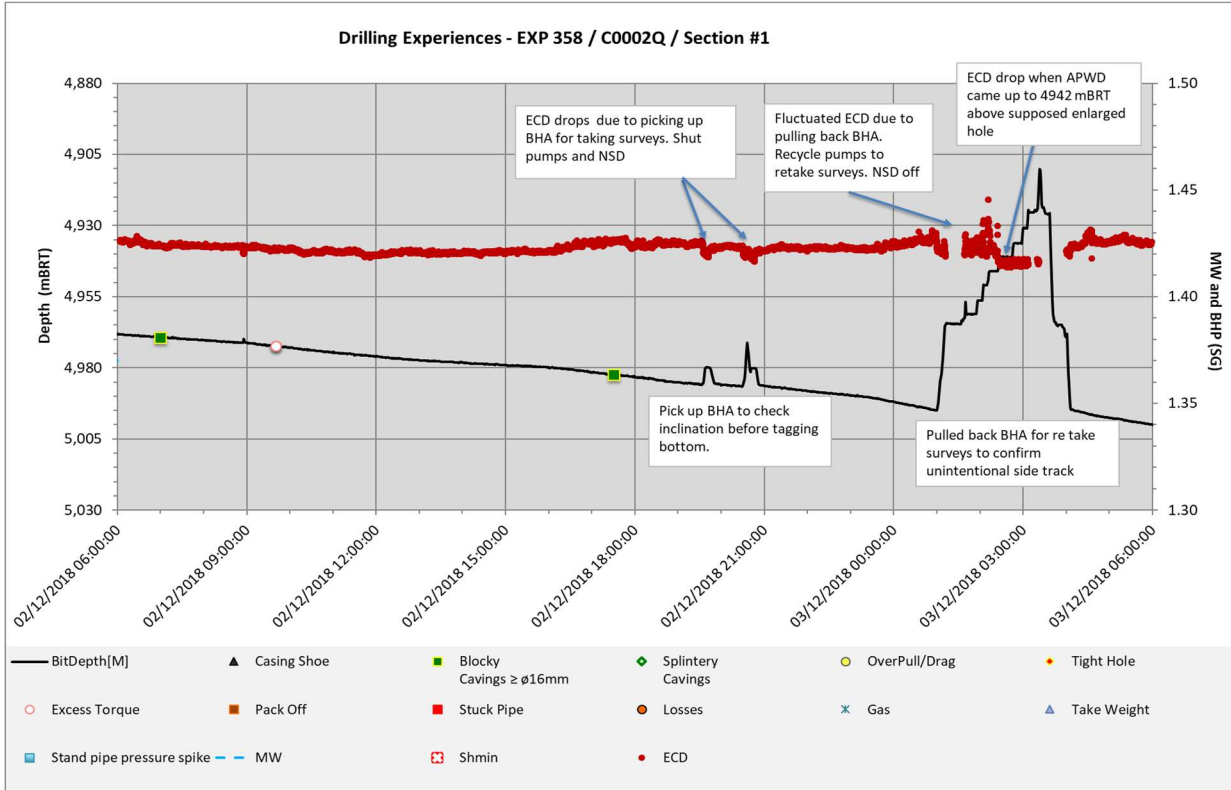


Figure 1. Drilling experiences in Section 1 of the C000Q well between 2nd Dec 2018 06:00 and 3rd Dec 2018 06:00.

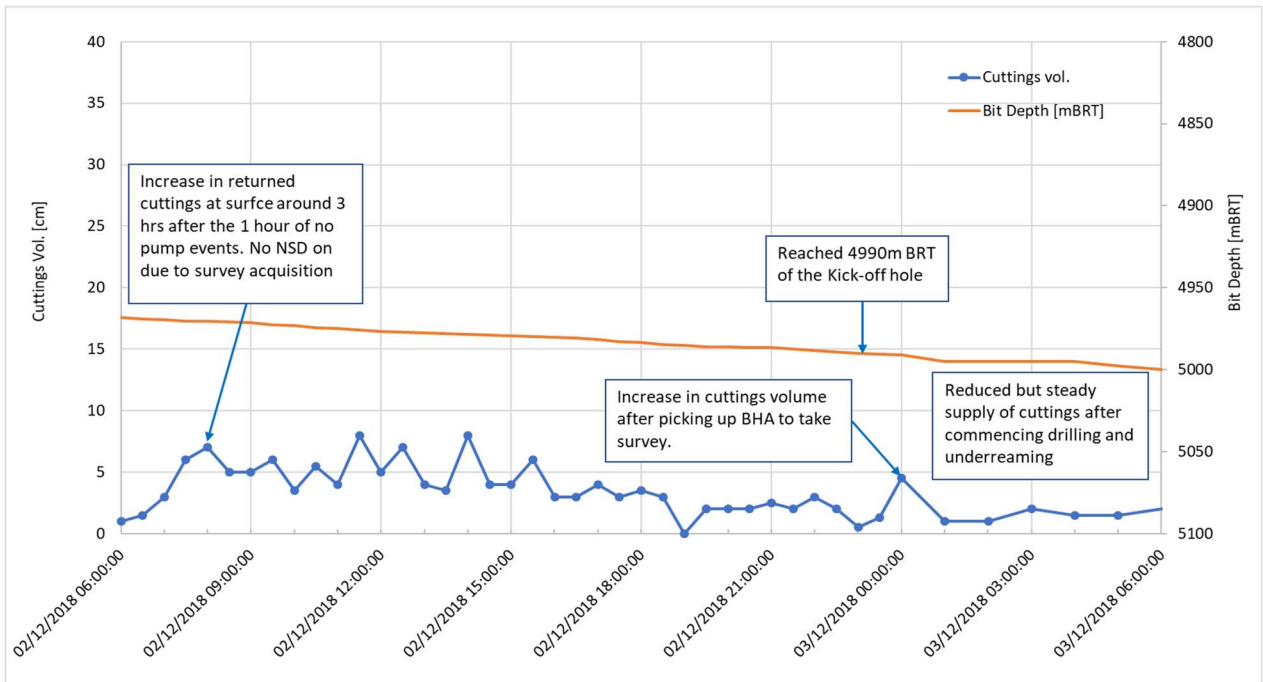


Figure 2. Cuttings/Cavings vs time and drill bit position between 2nd Dec 2018 06:00 and 3rd Dec 06:00

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Analysis

Drilling Experience Analysis

Figure 1. shows under reaming and drilling operations during last 24 hrs. At 4985m BRT (bit depth) the string was picked up to collect surveys before tagging bottom of the hole at 4990mBRT. The acquired survey (inclination) showed 4.5°. The repeat survey confirmed initial results of inclination at 4.5° indicating that the BHA side tracked unintentionally. The drilling/under reaming continued to 995 where another check survey as collected. With the same inclination result the NSD was shut and BHA pulled up to ~4920 mBRT (bit depth) in order to take survey checks and locate side track kick off point. One event of high surface torque was recorded at 4972.3 mBRT (bit depth). Downhole torque remained low and steady (1.5 – 3 kNm). Surface WOB was varied between 80 -120 kN in order to improve ROP output. Downhole WOB was between 30 – 50 kN. RPM was between 100 -120 c/min. Surface and Downhole Torque / Surface Downhole WOB relation suggest that the main cutting action is performed by the under reamer and not the bit. There is a likely possibility that some of the weight distribution is locked up by the restriction further up uphole. Some blocky mixed subrounded and fresh cuttings / small cavings were also seen. ECD remained between 1.42 and 1.44 SG EMW. Again, the comparison between cuttings/cavings arrival at surface (Fig. 2) and APWD tool response shows some delay indicating the cuttings/cavings remain in the well for prolonged time, potentially filling the enlarged parts of the hole between 4855 – 4930 m BRT (bit depth) as per resistivity plot.

Cuttings Analysis

Variations of cuttings volume with time are plotted in Fig.2. The blue dots show cuttings accumulation amounts (cm / 5 min) generally every 30 minutes. The orange line shows the bit depth in mBRT. After 06:00 Dec 2, the cutting volume increased due to NSD shut off during survey acquisition. Cuttings levels varied with time and decreased to 0 at 4985. 9 mBRT where another set of surveys was collected. The returned cuttings remained at reduced levels after 4985 mBRT (bit depth) with a brief increase in volumes after 4991 mBRT (bit depth). This may reflect that some large volume of cuttings/cavings were staying in the enlarged interval suggested from the arcVISION resistivities. Cuttings and small cavings are often subrounded with some fresh more angular ones. 5 - 10% of soft clayey aggregates related to soft claystone are also seen in the samples. Sub rounded to rounded pieces of cement are also occasionally observed.

Cavings Analysis

Amounts of cuttings/cavings >ø4mm per unit volume of all solids varied 10~30 % in the last 24 hours (06:00 Dec.2 ~ 06:00 Dec.3). Within the solids >ø4mm, populations of cuttings/cavings with sharp edges and those with rounded edges varied with time. Grains < ø1cm made up 90~100 % of cuttings/cavings >ø 4mm. Cement fragments were rare in general, however, increase of cement fragments ~10 % was observed in some intervals. Some of the observed cuttings show scratches on their surface. These are most likely mechanically derived from either bit/under reamer impact during under reaming operations or other parts of rotating BHA.

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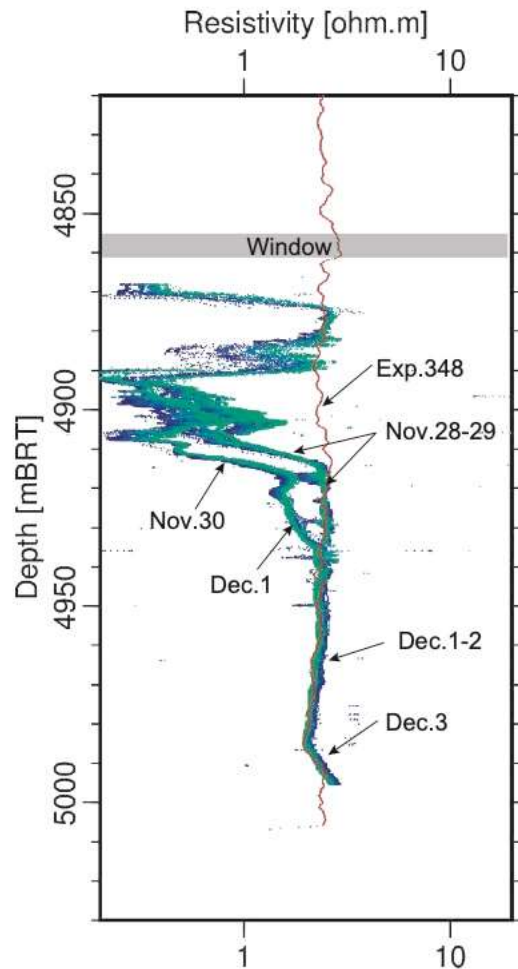
Residues of a 400-cc cuttings sample after washing with 4-mm mesh sieve. Some light gray grains are soft clayey cuttings aggregates are still remained after sieving. Brownish gray blocky grains in the right side are cement fragments. There occasional splintery cavings but they are likely to be product of mechanical action of the BHA rather than pore pressure increase.

LWD Data Analysis (updated from DGEM #022)

The figure below is showing LWD resistivity comparisons between (arcVISION) collected from Nov to Dec 3rd in this hole (green to blue dots, representing shallow to deep resistivities) and that resistivity collected in 2013 during Exp.348 (red line) (after Yabe, Logging Scientist). Resistivities between 4875~4880 mBRT and below 4915 mBRT in the current expedition indicate similar resistivities as observed during Exp.348, which may imply reasonably good hole conditions in C2Q, at least on the 29th of November 2018. In contrast, the resistivities between 4910 and 4890 mBRT indicate low values and appears to have become less resistive on Nov 30th compared to the Nov 28th-29th. This significant reduction in resistivity suggests that hole enlargement has occurred over this 3-day period. During underreaming operations on Dec 1st, a less significant decrease in resistivities and also less separation among shallow to deep resistivities over the interval between 4915~4935 mBRT. Below 4935 mBRT, the LWD resistivity data is markedly identical with the Exp 348 data, suggesting (at least on Dec 1st) that little to no hole enlargement has occurred.

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SFIB Analysis

N/A

Geomechanical Model Review (a review of the FIT results)

Potentially no changes to the pre-drill geomechanical model because FIT (Formation Integrity Test) does not directly contribute sufficient information for constraining or refining subsurface earth stresses. By design, FIT is intended to determine whether the planned mud weight can be supported by the formation.

The planned mud weight of 1.37 sg with an operational safety upper margin of +0.06 sg (surge pressure), required a formation pressure integrity up to 1.43 sg. The FIT in the C0002Q rat-hole achieved that objective. It is possible that a leak-off pressure of 1.43 sg may have occurred, but a maximum pressure of 1.45 sg was achieved before the pumps were shut-in. If a leak-off pressure of 1.43 sg did occur, this implies a leak-off-test (LOT) had occurred (no longer a FIT). A leak-off-pressure of 1.43 sg may be interpreted as a possible approximation of S_3 or Sh_{min} stress magnitudes.

This interpretation would require a pass of the LWD image log across the rat-hole section to identify whether a new tensile was created, or drilling fluids leaked into a pre-existing bedding plane or natural fracture. The former would have direct implications of S_3 , while the latter would require further information such as bedding plane orientation.

However, since no LWD data acquisition is planned for the rat hole section, we will have no chance to confirm which case occurred. Therefore, we continue to call this test a FIT.

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