

IODP EXP 358 Daily Geomechanics Report

Report #021 20181130 Final 4990

RTG Team

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|------------------------------|--|
| 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.1 2018)

| | | | |
|--------------------------------------|---|-------------------|------------------------------|
| Site Name: | C0002 | Hole Name: | Q |
| Water Depth: | 1,939.0 m | RT-MSL: | 28.5 m |
| Current Depth: | 4,990.0 mBRT (4,988.0) mTVD | Section TD: | 4,990 mBRT (4,988.0) 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" Stabilizer: 17.463~19.051 m 8-1/2" x 12-1/4" Z-reamer: 28.475~29.823 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. HPS stalled with continuous high STOR between 4902.5 and 4913.7 mBRT (bit depth). DTOR and downhole RPM responses suggest the restriction occurred above bit and LWD/MWD tools section of the BHA. Under reaming continued steadily past 4914m BRT (bit depth) with occasional HPS stall. Bit at 4925.5 mBRT as of 06:00 Dec.1 | | |

2Geomechanics Alert

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|---|---|
| GREEN | <p>Green = Projected model remains accurate White = Unanticipated deviation from model which <i>should not</i> affect drilling Yellow = Unanticipated deviation from model which <i>may</i> affect drilling 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

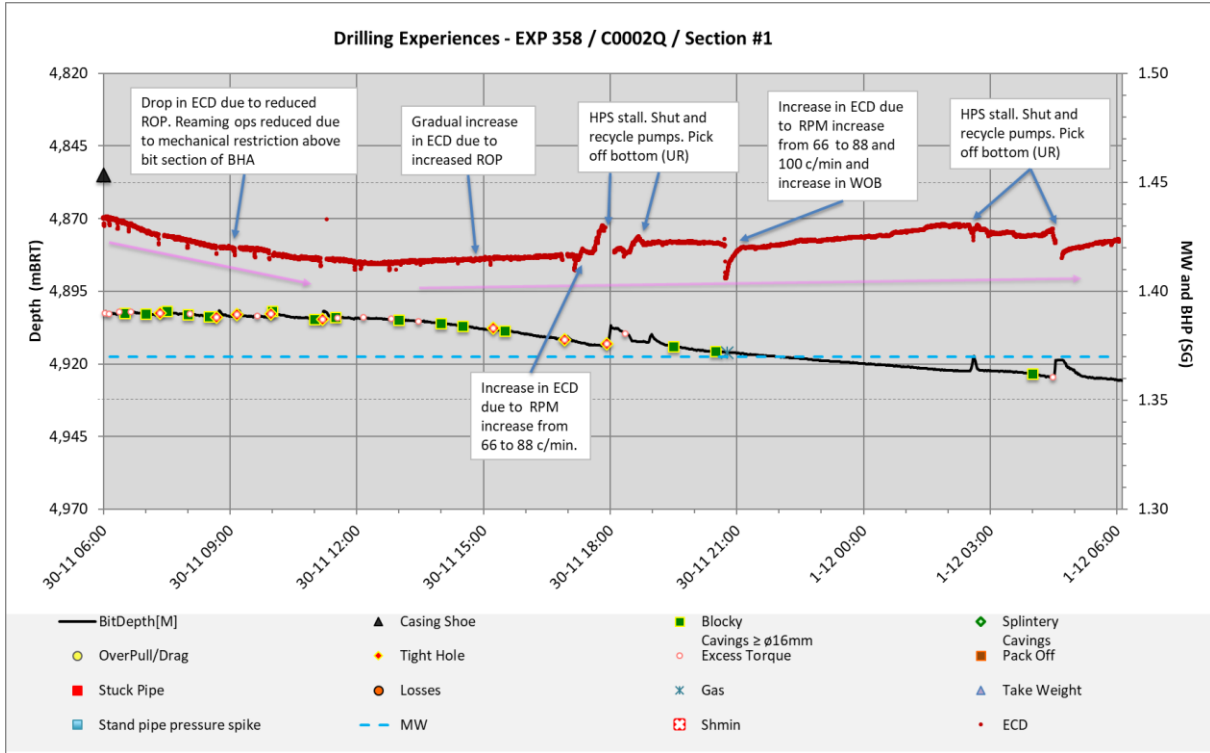
Use this space to discuss any observations while drilling, running casing etc.

| | |
|------------------------|---|
| Fracture Gradient | N/A |
| Pore Pressure | Total gas elevation ~1.6 % at 20:10~21:10 (4916 mBRT) |
| Wellbore Breakout | N/A |
| Tensile Failure | N/A |
| Drilling Parameters | Some fluctuation to ECD between 1.41 and 1.43 SG EMW. Negative SWOB and DWOB until 13:20. Identical SWOB and DWOB 70-80kN from 21:00. |

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| | Variable STOR 15-30-35 kNm while steady DTOR 6-7kNm until 19:40 (4914 mBRT bit depth). Steady STOR 18-20 kNm and DTOR 6-8 kNm past 4914 mBRT (bit depth). |
| Other | <i>No seepage losses have been observed in last 24hrs.</i> |



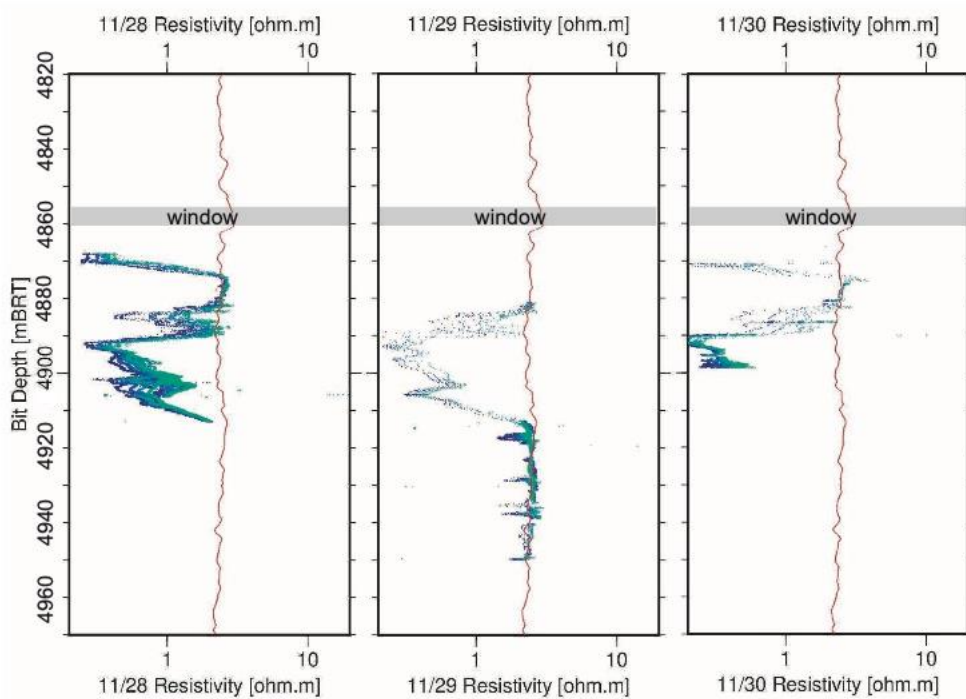
Analysis

LWD Data Analysis (copied from DGEM #020)

The figure below is showing LWD resistivity comparisons between (arcVISION) collected on Nov.28, 29 and 30 2018 (blue to green dots) and that resistivity collected in 2013 during Exp.348 (red line) (after Yabe, Logging Scientist). The intervals with steady resistivities, around 4875~4880 mBRT and below 4910 mBRT, show the identical values of that of Exp.348, suggesting reasonably good hole condition, at least on the 29th of November. We have no new information to document hole condition beyond 4910 mBRT after the 29th of November. On the other hand, the resistivities around 4900 mBRT indicate obviously low values and have shifted negatively with time. This suggests that hole enlargement is likely occurring. The steady and systematic stream of cavings material is consistent with a hole enlargement hypothesis.

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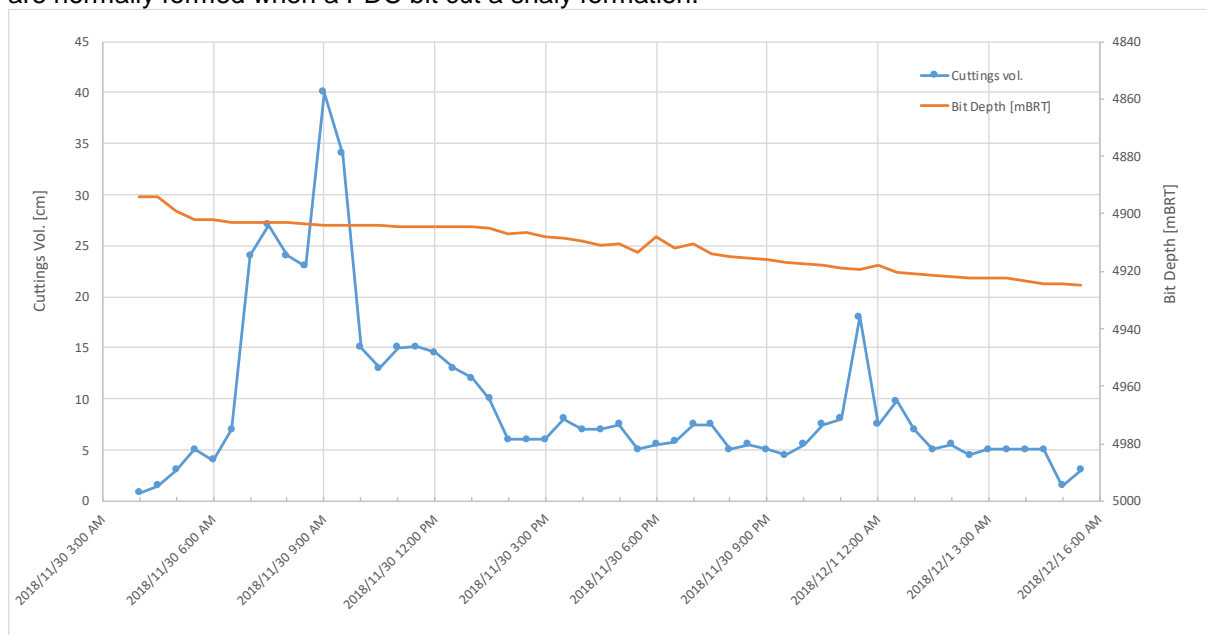


Drilling Experience Analysis

N/A

Cuttings Analysis

Variations of cuttings volume with time are plotted below. The blue dots show cuttings accumulation amounts (cm / 5 min) generally every 30 minutes. The orange line shows the bit depth in mBRT. They increased rapidly after reaming started, peaked at 09:00 Nov.30 while the BHA was forced to stay at the same depths and then decreased exponentially with time. At around midnight, second peak was observed. This may reflect the timing when Z-reamer (approximately 30 m above the bit) was passing the interval around 4885 mBRT where a less enlarged hole size is expected from the arcVISION resistivities. In fact, cuttings collected during this period were associated with clayey cuttings which are normally formed when a PDC bit cut a shaly formation.



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Cavings Analysis

Cuttings/cavings $> \phi 4\text{mm}$ per unit volume of all solids were 30 % when the total volume peaked at around 09:00, and then decreased to 15~25 % by 17:00 Nov.30. In contrast, those amounts were rather small during the second peak of total cuttings volume in which fine cuttings including soft clay were dominated.

Within the solids $> \phi 4\text{mm}$, angular blocky cavings $< \phi 1\text{cm}$ in diameters made up more than 50%. Rounded blocky and angular cavings made up less than 20 %, respectively. Angular platy shaped cavings (perhaps, splintery) or cuttings were contained ~5%. Cement fragments were rare in general, however, increase of cement fragments ~10 % was observed from 19:00 to 24:00 Nov.30. Scratches due to mechanical impact are evident in some grains.



Residues of a 400-cc cuttings sample after washed with 4-mm mesh sieve. Brownish gray blocky grains in the right side are cement fragments.

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Residues of a 400-cc cuttings sample after washed with 4-mm mesh sieve. Brownish gray blocky grains in the right side are cement fragments. Rounded light gray grains are aggregates of clayey cuttings.

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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