

IODP EXPEDITION 311 DAILY SCIENCE REPORTS
19 September–28 October 2005

Note: The ship was in transit from Balboa, Panama, to Astoria, Oregon, from 28 August to 15 September.

TO: Tom Davies
FM: Mitch Malone

Daily report for Expedition 311, September 19, 2005

LOCATION: In Transit to Site U1325 (CAS-02C)

SCIENCE UPDATE: We left the port of Astoria at 10:00 heading towards Site U1325. A science meeting was held in the conference room to introduce publication procedures and related IODP publications standards. The generic structure of each site chapter was described and contact persons for each science group were identified. The first in a series of subgroup meetings was held to discuss laboratory sampling procedures and protocols and individual sample requests.

Daily Report for IODP Expedition 311, September 20, 2005

LOCATION: Site U1325 (CAS-02C)

SCIENCE UPDATE: We arrived on site, switched to DP mode, settling on location at 07:25. While deploying the LWD tool string, we determined that the ProVision NMR tool was not communicating to the surface. However, the ProVision began to function after spudding the hole. A "tool-box" meeting was held to review LWD protocols immediately prior to initiating drilling. Hole U1325A was spudded at 23:10.

Planning for coring progressed today with a general science meeting to discuss core flow and sampling procedures. Subgroup meetings to discuss lab procedures and sample requests continued. An integrated gas hydrate sampling plan was developed and circulated to the scientific and technical staff to address sampling protocols on the catwalk including safety issues for H₂S and core handling hazards.

Daily report for IODP Expedition 311, September 21, 2005

LOCATION: Site U1325

SCIENCE UPDATE: Hole U1325A was logged without incident and within the prescribed protocol guidelines. Several minor pressure increases were observed, which were likely related to drilling performance issues. Increases in electrical resistivity above background were noted in several intervals above the base of the predicted gas hydrate stability field. Hole U1325A was drilled to 350 mbsf. The drill string was tripped to the rig floor for the downloading of LWD/MWD logging tools while transiting in DP mode to Site 1326 (CAS-03C). Subgroup meetings discussing shipboard sampling continued. A general science meeting was held to discuss schematic catwalk sampling plans and protocols.

Daily report for IODP Expedition 311, September 22, 2005

LOCATION: Site U1326 (CAS-3C)

SCIENCE UPDATE: Through the morning of September 22, 2005, the LWD/MWD tool string was re-initiated and deployed after completing Hole U1325A. Hole U1326A was spudded at 14:50 at a water depth of 1839 mbrf. Approval had been sought to deepen Hole U1326A to 350 mbsf (from an approved depth of 300 mbsf); however, the hole was completed (on the morning of September 22, 2005) before this request could be acted upon. LWD/MWD operations in Hole 1326A proceeded throughout the day without any significant problems. However, to improve drilling efficiencies, relative to our experience in Hole U1325A, the average ROP was increased to 35 m/hr. At a depth of 88 mbsf, an electrical resistivity log inferred gas-hydrate-bearing section was encountered, with measured resistivity values exceeding 10 ohm-m (over a background measurement of ~1.5 ohm-m). While drilling this inferred gas hydrate occurrence, the APWD measured annular pressures dropped slightly (only several psi) and ROP decreased to about 6 m/hr.

In preparation for coring, a science meeting was held to review PCS degassing experimental procedures and equipment setup. Other operational and technical meetings were conducted throughout the day. The gas hydrate core sampling plan was updated and modified according to suggestions from the science party. A H2S evacuation and fire drill was conducted at 13:00.

Daily report for IODP Expedition 311, September 23, 2005

LOCATION: Site U1327 (CAS-1B)

SCIENCE UPDATE: LWD/MWD operations in Hole U1326A were completed to a permitted depth of 300 mbsf. The bit was pulled above the seafloor at 06:00 ending operations in Hole U1326A. We transited ~8.5 nmi to Site U1327 (CAS-1B) in DP mode arriving at 1630. Hole U1327A was spudded at 18:30 at water depth of 1333 mbrf. After a controlled rate spud-in to maintain the quality of the near-surface LWD/MWD logs, Hole U1327A was advanced at a relatively high real-time penetration rate of 50 m/hr. Laboratory meetings held throughout the day dealt mainly with the planned deployment of special downhole tools and core systems, including the APCT and the prototype (third party) APC3 tool, the APC-Methane tool, the acquisition of bottom-water samples with the WSTP, and the use of PFTs to analyze core contamination for microbiological studies. The PCS core handling team met to further develop the core handling and analytical procedures in support of scheduled PCS degassing experiments.

Daily report for IODP Expedition 311, September 24, 2005

LOCATION: Site U1328 (CAS-6A)

SCIENCE UPDATE: LWD/MWD logging operations at Site U1327 were completed at 08:00 at a total depth of 300 mbsf. The most notable borehole log response in Hole U1327A was a 20-m thick zone (105-125 mbsf) of relatively high electrical resistivity, with measured log values exceeding 8 ohm-m over an average background resistivity of about 2 ohm-m. After completing Hole U1327A, the BHA was pulled back to a safe distance above the seafloor for a DP mode move to Site U1328. We arrived at the new site at 13:00 and spudded Hole U1328A at 15:55 at a depth of 1279 mbrf. Prior to spudding Hole U1328A, a bottom-camera survey was conducted to ensure that no chemosynthetic communities were present. Logging at this site showed very high electrical resistivity values in the top 30 mbsf with values exceeding 10 ohm-m, probably representing relatively highly concentrated gas-hydrate-bearing intervals.

A meeting was held to review and discuss IODP marine mammal policy in preparation of the upcoming VSP survey. Sampling classes were conducted as well as a demonstration of the core IR imaging system to the IODP marine laboratory specialists. A science meeting was held to review the logging results from the first three sites.

Daily report for IODP Expedition 311, September 25, 2005

LOCATION: Site U1329 (CAS-05D)

SCIENCE UPDATE: LWD/MWD logging hole, Hole U1328A, reached a total depth of 300 mbsf at 04:15. The downhole electrical resistivity logs from Hole U1328A appear to infer the occurrence of significant gas hydrate occurrences immediately below the seafloor and extend to a depth of ~40 mbsf. Several other notable higher resistivity intervals are present below the near-surface high resistivity section. After completing Hole U1328A, the tool string was pulled back to the ship and the LWD/MWD data from the three previous drill sites were successfully downloaded. The DP mode move to Site U1329 took ~8.5 hrs, with the spudding of Hole U1329A at 18:35 at a water depth of 970 mbrf. Preparation for coring continued, with several core handling and processing review meetings with both the IODP technical staff and the science party throughout the day. The science party also participated in a H2S safety training session with the shipboard Lab Officer.

Daily report for IODP Expedition 311, September 26, 2005

LOCATION: Site U1329 (CAS-05D)

SCIENCE UPDATE: LWD/MWD operations were completed at 08:00 with the termination of the Hole U1329A at a depth of 220 mbsf. Based on preliminary analysis of the resistivity and other LWD/MWD acquired downhole logs, it appears that Site U1329 may contain only limited amounts of gas hydrate. However, at the seismically defined BSR depth of 126 mbsf there is a notable resistivity log response that might be related to the occurrence of gas hydrate and/or free-gas. The lower portion of the Hole U1329A was also characterized by unusually high resistivities and density log values, possibly indicating a highly indurated section. LDEO scientists and the Schlumberger engineers were able to quickly process all of the critical LWD/MWD

log data and produce several large scale montages of the log data from each site; which is now posted throughout the ships laboratories and is proving to be an invaluable resource as we plan the coring program. Planning for coring continued throughout the day with a pre-spud meeting and a HYACINTH pressure coring meeting. The laboratory groups continue work on refining laboratory procedures, sub-sampling, and sample preservation routines. In the morning, we learned that the LWD/MWD-transfer boat had to return to Coos Bay, Oregon due to engine problems. However, the transfer boat was quickly repaired and left Coos Bay at 10:25 and is expected to rendezvous with the *Resolution* at 16:00 on Tuesday, September 27, 2005.

Daily report for IODP Expedition 311, September 27, 2005

LOCATION: Site U1329 (CAS-05D)

The exchange boat for the LWD/MWD tools and personnel arrived at 16:30. Offloading of the tools and personnel transfer was completed and the boat was away at 21:25. While waiting for the boat and during transfer operations, the drill string was tripped to near the seafloor. Hole U1329B was spudded with first core on deck at 21:05. Core U1329B-1H was a full core so we picked the bit up 5 m and spudded Hole U1329C to obtain a mudline core. Core U1329C-1H recovered 8.19 m. By midnight the hole had been advanced to 36.6 mbsf with an average recovery of 106%.

Daily report for IODP Expedition 311, September 28, 2005

LOCATION: Site U1329 (CAS-05D)

SCIENCE UPDATE: APC coring in Hole U1329C continued to 140.2 mbsf (106% recovery) where we switched to XCB coring and advanced the hole to 188.5 mbsf (82% recovery). Two PCS cores were collected at 55.6 and 114.6 mbsf, the deeper one was recovered without pressure. IR scanning and visual observation of cores do not yield any evidence of gas hydrate, consist with the initial interpretation of the Hole U1329A MWD/LWD data. Cores U1329B-1H and Cores U1329C-1H through 4H are Pleistocene gray and dark greenish gray clay. Initial interstitial water analysis indicates the sulfate/methane interface is between ~9.5-12.5 mbsf, coincident with a shallow alkalinity maxima (21.8 mM).

Daily Report for IODP Expedition 311, September 29, 2005

LOCATION: Site U1329 (CAS-05D)

SCIENCE UPDATE: After coring Hole U1329C to a depth of 188.5 mbsf (106% recovery), the PCS cutting shoe was lost in the hole during the third deployment of the PCS (Core U1329C-23P). It was determined that it was not possible to advance the hole beyond 189.5 mbsf. We also decided that the hole was not deep enough to wireline log, which is now scheduled for a dedicated logging hole (i.e., U1329D). At

the same time weather conditions degraded to the point that it was determined to be unsafe to conduct further coring operations. After some improvement in the weather, we pulled out of Hole U1329C to drill Hole U1329D as a dedicated logging hole. At 19:55 hr, after advancing Hole U1329D to 165.6 mbsf, the ship's heave increased enough that we needed to suspend operations again (>6 m heave). With improving conditions we returned to drilling Hole U1329D, which had been advanced to a depth of 180 mbsf by midnight (target total hole depth is 220 mbsf). We also are scheduled to drill a spot coring and pressure-coring hole at Site U1329 with interspersed temperature measurements using the APCT and DVTP probes. Cores U1329C-1H through 16H Pleistocene gray and dark greenish gray clay. Core U1329C-17H marks an abrupt change to late Miocene age sediments. Initial interstitial water analyses suggests a very uniform pore-water salinity profile with depth, averaging about 31.5 ppt, with some evidence of additional "freshening" near the bottom of U1329C. The chemistry of headspace and void gases also appear to be generally uniform in Hole U1329C, with a slight increase in ethane and propane concentrations in Core U1329C-22X (C1/C2=3980).

Daily Report for IODP Expedition 311, September 30, 2005

LOCATION: Site U1329 (CAS-05D)

SCIENCE UPDATE: After relatively slow drilling (~5 m/hr) in the lower ~35 m, we decided to take a single XCB core (Core U1329D-1X) at the bottom of Hole U1329D, which was completed to a total depth of 210.5 mbsf at 10:15 hr. Core U1329D-1X recovered only 1 m of "biscuited" sediment. Analyses of the interstitial water from Core U1329D-1X yielded a salinity of 22, which is about 30% fresher than the interstitial waters in the overlying sediments. This may indicate the flux of fluid from a deeper source. Changes in gas chemistry, with notable increases in ethane and propane in the void gases, with depth in Hole U1329C also suggests the influence of a different fluid regime. After reaching total depth in Hole U1329D, we switched over to the wireline logging program. The first tool deployed was the standard triple-combo, which was able to reach a depth of 209 mbsf and the hole was logged without incident. The second logging run consisted of two passes of the FMS-sonic tool. On the first lowering the FMS-sonic tool reached a depth of 209 mbsf, but on the second lowering the FMS-sonic tool only reached a depth of 171 mbsf. The caliper log showed that parts of the hole were severely enlarged.

Daily Report for IODP Expedition 311, October 1, 2005

LOCATION: Site U1329 (CAS-05D)

SCIENCE UPDATE: Coring operations started in Hole U1329E at 02:35 hr. High-resolution sampling was performed for microbiological and geochemical studies of the sulfate-methane interface. The IODP pressure core sampler (PCS) was deployed three times in Hole U1329E at 33.5, 73.5, and 125.0 mbsf. The PCS run at 33.5 mbsf was recovered without pressure. The runs at 73.5 and 125.0 mbsf appeared to be successful and the core degassing process was started after initial X-Ray and density imaging of the sealed pressure corer inner barrel. The Fugro pressure corer (FPC) was deployed at 104.0 mbsf; however, the tool did not retrieve any core. The HYACE

rotary corer (HRC) was deployed at a depth of 114.5 mbsf and retrieved a full core under pressure. Additional formation temperature measurements were made in Hole U1329E with the APC3, APCT and DVTP tools; some of the temperature surveys were adversely affected by the relatively high ship heave conditions. The total depth of 125 mbsf was reached in Hole U1329E with the DVTP deployment at 21:45 hr. The BHA was pulled to the ship in preparation for a short transit (~9 mni) to Site U1327. The CI profile from Hole U1329C is consistent with the salinity profile with a freshening trend at the bottom of the hole. Although log caliper data indicate enlarged hole conditions in Hole U1329D, acoustic wireline log data are of high quality.

Daily Report for IODP Expedition 311, October 2, 2005

LOCATION: Site U1327 (CAS-01B)

SCIENCE UPDATE: At 04:15 hr we arrived on location at Site U1327. We spudded Hole U1327B at 08:55 hr, returning a full core. We picked the bit up 5 m and spudded Hole U1327C with a 6.1 m mudline core, providing an estimated seafloor depth of 1315.4 mbrf. We deployed the APC3 and APCT alternating on every other APC core for temperature measurements. Two PCSs were deployed, Core 6P at 44.1 and Core 15P at 121.8 mbsf. Core 6 P was returned without pressure. Initial analyses of the pore waters indicates that the SMI is ~11-15 mbsf. We will develop a high-resolution subsampling procedure in the top few cores for the next hole based on the estimated SMI depth. The first IR anomaly (inferred gas hydrate) was recovered in Core 13X (109 mbsf), which was removed and stored in liquid nitrogen. By midnight, Core 14X was recovered, which also contained distinct IR anomalies (several degrees colder than surrounding sediment) along with bubbling, although no direct physical observation of gas hydrate was made.

Daily Report for IODP Expedition 311, October 3, 2005

LOCATION: Site U1327 (CAS-01B)

SCIENCE UPDATE: Coring operations continued in Hole U1327C, which was advanced to depth of 228 mbsf by midnight. Numerous recovered cores exhibited notable IR thermal anomalies (inferred gas hydrate), including Cores U1327C 13X, 14X, 16X19X, 22X, 23X, and 25X within the approximate depth interval 105-210 mbsf. One of the most notable IR anomalies was observed at the top of Core 17X, which had a 2.5-m-long very cold continuous thermal anomaly. The IR inferred gas hydrate occurrences in Cores 13X17X appear to correlate with a thick high electrical resistivity interval observed in the LWD/MWD log data from Hole U1327A. In addition to standard sampling protocol, most of the IR inferred gas hydrate occurrences were subsampled for special pore water and microbiological analyses. Samples believed to contain gas hydrate were preserved in liquid nitrogen. Visible evidence of gas hydrate was seen in Core 19X (small flakes) and as well as in Core 22X, where larger nodules several mm in diameter were observed. The PCS was deployed twice, both Cores U1327C-15P and 24P were returned with pressure and full cores. The PCS core degassing process was started after initial X-Ray and density

imaging of the sealed pressure corer inner barrel. Additional formation temperature measurements were made with one deployment of the DVTP tool.

Daily report for IODP Expedition 311, October 4, 2005

LOCATION: Site U1327 (CAS-01B)

SCIENCE UPDATE: Coring at Site U1327 continued throughout the day to the target depth of 300 mbsf. The lowermost IR anomalies (inferred gas hydrate) were observed in Core U1327C-27X at ~220 mbsf, coincident with the depth of the BSR. Additional temperature measurements were made using the DVTTP probe at 170.4, 218.5, and 300.0 mbsf. After completing Hole U1327C and displacing it with weighted mud, we offset 15 m to the northeast to spud a dedicated tool hole (Hole U1327D). Two APC cores were taken to 16.4 mbsf for ultra-high resolution sampling for pore water and headspace geochemistry, and microbiological analyses. By midnight, the hole was washed down to 83.0 mbsf and the first PCS was deployed (Core U1327D-3P), which returned without pressure.

Daily Report for IODP Expedition 311, October 5, 2005

LOCATION: Site U1327 (CAS-01B)

SCIENCE UPDATE: Hole U1327D, which has been designed as a special tools hole, was drilled to a depth of 124.3 mbsf by 02:40 hr in preparation for a run of the HRC pressure core system (Core U1327-3P). However, the recorded ship heave had increased to more than 4.5 m and it was determined that it would be impossible to keep the HRC or any of the other pressure core systems on the bottom of the hole. A review of the weather forecast indicated that the adverse conditions should subside by early afternoon. As the day advanced we were subjected to competing swells from the west and southeast, while the ship heave conditions did not improve through the evening. By 22:45 hr the heave conditions had improved with a ship's course change and preparations began to return to coring. Preliminary analysis of the interstitial waters from the near-surface ultra-high resolution sampling performed on two APC cores from Hole U1327D revealed a well defined sulfate gradient with depth, but the transition at the base of the sulfate reducing zone appears to fall at the break between the cores. Plans have been developed to quickly re-core this upper interval in a short core hole after completing Hole U1327D. PCS Core U1327C 24P was degassed throughout the day with more than 107 millimoles of gas released so far. Cores U1327B-1H and U1327C-1H through 35X (0-300.0 mbsf, 88% recovery) are Pleistocene very dark greenish gray silty clay and dark gray clay with varying diatom abundance.

Daily Report for IODP Expedition 311, October 6, 2005

LOCATION: Site U1327 (CAS-01B)

SCIENCE UPDATE: The swell conditions that suspended drilling operations for most of 5 October subsided enough to allow coring operations to commence with the recovery of HRC Core U1327D-4E at 00:50 hr on 6 October. The special tools hole (Hole U1327D) was advanced throughout the day with six pressure core deployments within LWD/MWD targeted zones. The HRC and FPC was first deployed within 16-m-thick high electrical resistivity zone previously identified from the LWD/MWD logs. The HRC was recovered under pressure, but during the transfer for P-wave velocity and X-ray scanning the transfer system lost pressure. The first FPC core system fired prematurely (similar to the problem experienced in Hole U1329E) and recovered a sediment core without pressure. Both of these pressure cores were X-ray and P-wave velocity scanned, and were made available for geochemistry and physical property subsampling. The hole was advanced by XCB coring to 155.1 mbsf and the PCS was deployed, which yielded a complete core under pressure (Core 10P). Core 10P was X-rayed and moved into the PCS lab for degassing. The hole was advanced by XCB coring to 170.5 mbsf and the HRC was deployed and Core 12E was recovered with sediment and under pressure. The FPC was deployed again at a depth of 203.3 mbsf and recovered a core (Core 13Y) under pressure. Most of the XCB cores obtained between the pressure core sections contained IR cold-spots that were subsampled for interstitial water analysis and microbiology subsampling. A few samples were preserved in liquid nitrogen.

Daily Report for IODP Expedition 311, October 7, 2005

LOCATION: Site U1327 (CAS-01B)

SCIENCE UPDATE: Operations continued in Hole U1327E, a special tools hole, by advancing the hole by drilling to 217.7 mbsf, and the HRC was deployed, which recovered a complete core under pressure. Two additional XCB cores (15X and 16X) were taken through the depth interval of the BSR. The IR-scan of Core U1327E-15X revealed a 3-m-thick low temperature thermal anomaly at the core depth of the seismically identified BSR at about 219 mbsf. The IR cold-spots in Core U1327E-15X were subsampled for interstitial water analysis and microbiology characterization. A 5-cm-thick sand section from this low temperature interval had a measured pore water salinity of only 5. The hole was advanced by drilling to 246 mbsf and the PCS was deployed, which recovered a complete core (Core U1327E-17P) under pressure. The PCS deployment at 246 mbsf marked the end of pressure coring at Site U1327, which concluded with ten total pressure core deployments with eight containing cores under pressure (4 PCS, 3 HRC, 1 FPC). Hole U1327E was drilled to a total depth of 300 mbsf and then was prepared for wireline and VSP logging. Adverse ship heave conditions, exceeding 3.0 m, delayed the start of the downhole logging program until near midnight.

Daily Report for IODP Expedition 311, October 8, 2005

LOCATION: Site U1327 (CAS-01B)

SCIENCE UPDATE: After completing pressure coring operations in Hole U1327D, we switched over to the wireline logging program. Adverse ship heave conditions delayed the start of the downhole logging program until just after midnight. The first

tool deployed was the standard triple-combo, which was able to reach a depth of 295.4 mbsf and the hole was logged without incident until near the top of the log run. The combination of a ship heave event (+3.0 m) and the oversized borehole apparently caught and tore off the density tool caliper arm. The damaged triple-combo tool string was returned to the ship without further incident. The VSP logging program in Hole U1327D began at 07:20 hr in the morning with the pre-shooting, one-hour marine mammal observation period. After this period we started to ramp up the firing pressure for the GI gun. At 10:00 hr the VSP tool (WST) had reached TD at 276.4 mbsf and the VSP program began. We moved in 5 m increments up the hole and had completed sixteen positions at about 11:00 hr. Around 136 mbsf the WST was unable to clamp although the caliper log from the triple-combo run showed that the hole should have been suitable for clamping. It was decided to pull the WST back to the ship for inspection. Unfortunately the tool became stuck at the drill bit and we were unable to pull it back into the drill pipe. Two attempts to clamp the logging wireline were unsuccessful; however, the tool was finally worked back into the drill pipe and pulled to the surface by 23:00 hr. Because of the critical nature of the downhole acoustic log data to achieve the goals of the expedition, it was decided to drill a dedicated wireline logging hole and to acquire additional PCS, HRC, and FPC pressure cores from several critical intervals not successfully cored in the two previous holes at this site.

Daily Report for IODP Expedition 311, October 9, 2005

LOCATION: Site U1327 (CAS-01B)

SCIENCE UPDATE: Hole U1327E was spudded at 08:50 hr as a special wireline logging and pressure core tools hole. The hole was started by drilling to 3.0 mbsf and then taking a single APC core for high resolution geochemical and microbiological sampling. An earlier attempt to sample across the sulfate-methane interface (SMI) in Hole U1327C was unsuccessful; Hole U1327E presented us with an opportunity to resample the SMI at this site. The hole was then advanced by drilling to 40.0 mbsf and the PCS was deployed to obtain a pressure core (Core 2P), which yielded a complete core but it was not pressurized. The hole was advanced by drilling to 80.0 mbsf and a second PCS core (Core 3P) was acquired, this time with a full core and at pressure. Core 3P was X-rayed and moved into the PCS van for degassing. The hole was drilled to 128.0 mbsf, the HRC was deployed, and Core 4E was recovered with sediment but the flapper valve failed to completely seal. A deployment of the FPC was planned at 134.0 mbsf, but was canceled because of growing ship heave conditions that had exceeded 3.5 m near the end of the HRC deployment. We decided to drill Hole U1327E to the target total depth of 300 mbsf and make ready for wireline logging.

Daily Report for IODP Expedition 311, October 10, 2005

LOCATION: Site U1327 (CAS-01B)

SCIENCE UPDATE: Hole U1327E was drilled as special wireline logging hole to a total depth of 300 mbsf, which was reached at 16:30 hr. Because of the continued high ship heave conditions (ranging from 2.5 to 3.5 m) it was decided to make only one

log run with the non-standard IODP tool string of the HNGS-DIT-DSI, which will yield natural gamma, resistivity, and acoustic transit time data. Note that this tool string contains no caliper devices, which have been damaged in other holes on this expedition under similar ship heave conditions. By midnight we had completed the first run of this tool string from the loggers maximum total depth of 287 mbsf to the drill pipe which was set-back to 72 mbsf. The resistivity and acoustic log data from this survey appear to be of relatively high quality. After completing a short repeat wireline survey, we will prepare for transiting to Site U1328.

Daily Report for IODP Expedition 311, October 11, 2005

LOCATION: Site U1328 (Prospectus Site CAS-06A)

SCIENCE UPDATE: After relocating the ship to the "cold vent" Site U1328, the VIT camera system was deployed to inspect the seafloor for the occurrence of chemosynthetic communities. We conducted a 130 m long camera survey along the proposed coring transect across the vent site. We did not observe any living clam colonies; however, wide-spread carbonate outcrops were observed. Before spudding the first hole, we also deployed the WSTP to collect a bottom water sample. The first APC core was spudded at 13:10 hr in Hole U1328B with 4.5 m of core returned to the surface, thus the mudline was recovered successfully. Core recovery in the second APC core was only 1.7 m with an incomplete stroke. Numerous gas hydrate pieces, some measuring up to 5-8 cm in diameter were recovered and preserved in liquid nitrogen. In addition, a number of smaller pieces of gas hydrate were used for shipboard gas and water analyses. The next core was taken with the XCB system to the target depth of the first PCS (Core U1328B-4P) at 14.5 mbsf. The APC taken after Core U1328B-4P was again an incomplete stroke with only 1.89 m of core recovered. We switched back to XCB coring and advanced the hole to the target depth for the second PCS deployment (Core U1328B-7P) at 20 mbsf. Both PCS deployments yielded core under pressure and were X-rayed and moved to the degassing laboratory. Gas hydrate was recovered in Cores U1328B-2H, 5H, 6X, and 8H. By midnight Hole U1328B had been advanced to 37.5 mbsf, with two additional APC cores. First analyses of the interstitial-waters from this gas-hydrate-rich section show very high salinities in the range of 40 to 46, similar to what was observed at Southern Hydrate Ridge on ODP Leg 204.

Daily Report for IODP Expedition 311, October 12, 2005

LOCATION: Site U1328 (CAS-06A)

SCIENCE UPDATE: Due to strong winds and severe ship heave conditions (exceeding 8 m), we had to suspend operations at 03:15 hr to wait for the weather conditions to improve, eventually pulling out of Hole U1328B at 07:45 hr. Up to that point we had cored the top 56 mbsf in Hole U1328B and had taken two PCS pressure cores (U1328B-4P and U1328B-7P). The first PCS core from only 15.0 mbsf, which was targeted to sample several LWD/MWD imaged high electrical resistivity sections identified in Hole U1328A, yielded 22.4 liters of gas and most likely had contained gas hydrate. The second PCS core (U1328B-7P) was still being degassed at the end of the day. After waiting on the weather for 16 hours, the sea conditions had

improved to the point to allow drilling and coring operations to continue. We offset the ship by 15 m from location of Hole U1328B and spudded Hole U1328C at 20:30 hr, drilling down to the maximum depth of Hole U1328B (56.5 mbsf) to resume APC coring.

Daily Report for IODP Expedition 311, October 13, 2005

LOCATION: Site U1328 (CAS-06A)

SCIENCE UPDATE: We started APC coring operations in Hole U1328C after drilling to 56 mbsf, where operations were halted because of weather in Hole U1328B. We successfully recovered a pressurized PCS core at a depth of 92 mbsf. At a depth of 103.5 mbsf we switched to XCB coring due to APC refusal. DVTTP temperature measurements were carried out at ~150 and ~197 mbsf, but the data from both runs were degraded by an apparent electronic problem in the tool. By midnight, Hole U1328C had been advanced to 235 mbsf. Core recovery is relatively good, varying between 70 and 75% with the XCB core system. Unlike the upper 35 mbsf cored in Hole U1328B, most of the section within the predicted depth interval for the methane hydrate stability zone in Hole U1328C, is characterized by only subtle IR anomalies, suggesting low gas hydrate concentrations. However, special high resolution pore-water analyses of some low-magnitude IR anomalies showed that gas hydrate was preferentially occupying sand layers possibly at higher concentrations. A core recovered from just above the depth of the seismically inferred BSR depth showed significant low temperature IR anomalies that were subsampled for interstitial water and microbiological analyses. PCS Core U1328B-4P, recovered from 14.5 mbsf in the Hole 1328B, was extruded after degassing (22 L of gas) and X-ray imaging. Comparing the X-ray images from before and after the degassing experiment showed major disruption of the sediment, especially around X-ray inferred massive gas hydrate lenses. Almost the entire core was subsampled for interstitial and headspace gas analyses.

Daily Report for IODP Expedition 311, October 14, 2005

LOCATION: Site U1328 (CAS-06A)

SCIENCE UPDATE: Hole U1328C was advanced by XCB coring to a total depth (TD) of 300 mbsf at 10:00 hr. The hole was prepared for wireline logging with a short wiper trip. At 16:50 hr the triple-combo logging tool was lowered to a TD of 294 mbsf, which is only 6 m shallower than TD for the hole (300 mbsf). The up-hole triple-combo run was completed without incidence and the tool was back to the rig floor at 19:40 hr. Next the FMS-sonic tool was deployed, which was lowered at 21:40 hr, reaching the same depth as the triple-combo log run. Two passes of FMS-sonic were completed without incident. Initial analysis of the density caliper log from the triple-combo log run shows a significantly enlarged hole. However, the resistivity log from the DIT and the compression/shear wave acoustic data from the DSI tool appear to indicate the presence gas hydrate and free gas near the predicted depth of the seismically identified BSR at 219 mbsf.

Daily Report for IODP Expedition 311, October 15, 2005

LOCATION: Site U1328 (CAS-06A)

SCIENCE UPDATE: With the FMS-sonic logging run completed at 02:45 hr, we switched over to VSP operations. The marine mammal watch began at 07:30 hr, followed by the 30 minute ramp up of the GI gun at 08:30 hr. The start of the VSP log run began at 09:00 hr with the first clamping position at 286 mbsf. The VSP was run successfully to the shallowest clamping position of 106 mbsf. Shallower positions were too noisy due to interference with the drill pipe, which had been set back to 76 mbsf. VSP operations were completed at 14:00 hr and the GI gun was pulled back on deck and the marine mammal observers left station. Over the 180 m interval surveyed, we lost only two clamping positions due to bad hole conditions. Preliminary interpretation of the observed VSP derived travel times yielded a surprisingly uniform P-wave velocity of ~ 1640 m/s. After securing the logging tools, we moved 35 m to Hole U1328D for a high-resolution combined microbiology and geochemistry study of the sulfate/methane interface. The first two deployments of the APC resulted in bent core barrels and we switched to the XCB coring system. Two XCB cores were recovered followed by deployment of the FPC pressure core at 14 mbsf, which did not recover core.

Daily Report for IODP Expedition 311, October 16, 2005

LOCATION: Site U1328 (CAS-06A)

SCIENCE UPDATE: After completing Hole 1328D to a total depth of 15.0 mbsf, the drill pipe was pulled back to the surface and the ship was offset 50 m to prepare for the coring of a special tools hole. Hole U1328E was spudded with the XCB at 00:40 hr. The primary focus of Hole U1328E was pressure coring, with XCB spot cores to recover gas hydrate from the top 40 mbsf, which contains the highest gas hydrate concentrations at this site, as interpreted from LWD data and previous scientific coring. The XCB coring in Hole U1328E did yield a number of high-quality samples of gas hydrate-bearing sediment as well as isolated gas hydrate pieces that were preserved in liquid nitrogen. XCB coring advanced the hole to 8.5 mbsf, where the FPC was deployed (Core U1328E-3E), which did not return under pressure. An XCB core was taken, followed by a PCS run at 15.1 mbsf (Core U1328E-5P), which did not return pressurized. Another XCB core was taken and then the HRC was deployed (Core U1328E-7Y), which also failed to return a core under pressure. Two XCB cores advanced the hole to 46.0 mbsf, followed by the center bit to drill the hole to 92.0 mbsf. The PCS Core U1328E-10P was deployed, returning under pressure, followed by a DVTP temperature measurement. The center bit was redeployed and the hole was drilled to 197.0 mbsf and FPC pressure core system was deployed, but it improperly retracted into the autoclave and failed to yield a pressurized core. An additional DVTP survey was conducted after the last FPC core run at 199 mbsf.

Daily Report for IODP Expedition 311, October 17, 2005

LOCATION: Site U1325 (CAS-02C)

SCIENCE UPDATE: Hole 1328E was completed at a total depth of 235 mbsf with the successful recovery of a PCS core from the bottom of the hole at pressure. The drill pipe was pulled from the hole and back to a water depth of 1,000 mbrf. The ship was then moved in DP mode 5.5 nmi to Site U1325, which was previously LWD/MWD logged earlier in this expedition. Hole U1325B was spudded with an APC core at 19:10 hr and at a water depth of 2206.2 mbrf. The APC spud core was sampled on the catwalk as a high resolution geochemical and microbiology core. Interstitial fluid analysis of this core indicated a very shallow depth to the sulfate/methane interface (< 2 mbsf). When trying to recover the second APC core from this hole the inner core barrel became stuck near the drill bit and it took several hours to work the core barrel loose. The second APC core contained a relatively large amount of fine sand, which probably contributed to the core recovery problem. By midnight we were planning to run back into the hole with an XCB core barrel to work the hole below the sand section identified in the second APC core.

Daily Report for IODP Expedition 311, October 18, 2005

LOCATION: Site U1325 (CAS-02C)

SCIENCE UPDATE: By midnight Hole U1325B had been advanced by a combination of APC, XCB, and pressure coring (PCS, HRC) to a depth of 140.5 mbsf. We successfully cored most of the upper 72 mbsf with the APC system and had three deployments of the APC temperature tools (APC3) that returned very high quality data. At 71.5 mbsf we had an incomplete stroke of the APC and switched to XCB coring. The first pressure core (PCS) was taken at 82.4 mbsf but did not return with a pressurized core. In Core U1325B-10X (~73 mbsf) we found the first evidence of gas hydrates at this site with the occurrence of several small, IR imaged cold spots. Since Core U1325B-10X, we have found in most every core cold spots measuring ~5 to 10 cm thick. Cold sections typically are associated with sand layers. Temperatures in the IR imaged gas-hydrate-bearing sands are reduced by up to 4°C below background and show reduced pore-water salinities as low as 22. An HRC was deployed at 129.9 mbsf but did not return core under pressure. With the completion of the VSP survey at Site U1328, the marine mammal observer, Scott Toews, returned to shore via helicopter at 12:30 hr.

Daily Report for IODP Expedition 311, October 19, 2005

LOCATION: Site U1325 (CAS-02C)

SCIENCE UPDATE: Throughout the morning and into afternoon, we continued XCB coring Hole U1325B to a depth of 206 mbsf. Interspersed with the XCB cores was a DVTP run at 140.5 mbsf, which yielded high quality temperature data. We also deployed the FPC at 169.4 mbsf and the HRC at 197.4 mbsf; both pressure cores did not recover sediment under pressure. XCB core recovery within the interval from 160-206 mbsf was drastically reduced to less than 27%. We attribute the reduced recovery and the problem with pressure coring to the combined effect of the sandy turbidite sections and the occurrence of gas hydrates in these sands (as interpreted from the LWD/MWD data) that is apparently dissociating during coring and blowing

the core out of the core barrel during recovery. At a depth of 206 mbsf we attempted to deploy the PCS but the tool was jammed in the BHA after penetrated 20 cm into the formation. We were unable to retrieve the tool despite numerous attempts and had to terminate Hole U1325B and trip the pipe back to the surface. After checking for potential problems, the drill string will be tripped back to the seafloor, and we will spud Hole U1325C. We are scheduled to drill down to about 188 mbsf and resume XCB coring operations.

Daily Report for IODP Expedition 311, October 20, 2005

LOCATION: Site U1325 (CAS-02C)

SCIENCE UPDATE: We spudded the new continuous core hole at this site, Hole U1325C, at 08:20 hr and advanced the hole by drilling to a depth of 188 mbsf where coring recovery in Hole U1325B began to deteriorate. Coring operations were initiated with the deployment of the XCB system at 21:15 hr and the first core returned with only 3.28 m of sediment. This core contained a IR imaged core spot that was sampled for interstitial water analyses. We decided to try cutting XCB half cores (~5 m long) to see if this would increase core recovery. The first short XCB core recovered only 0.73 m of sediment that also contained a prominent cold spot. The first half section was used for interstitial water analyses. The second short XCB core, which was taken into the next morning, was recovered without any sediment. We decided to switch back to standard full length XCB core deployments.

Daily Report for IODP Expedition 311, October 21, 2005

LOCATION: Site U1325 (CAS-02C)

SCIENCE UPDATE: XCB coring operations in Hole U1325C continued without major interruption. One FPC pressure core was deployed at a depth of 217.6 mbsf, but it did not return with sediment under pressure. A PCS pressure core was successfully taken at a depth of 256.1 mbsf and the degassing experiment was started after X-ray scanning the core through the aluminum outer barrel. The BSR at this site was seismically predicted at a depth of ~230 mbsf. XCB coring through this interval yielded several cold spots well below the predicted BSR depth (greater than 20 m below the BSR). Extra samples for interstitial water and head-space gas analyses were taken to investigate the possibility that these cold spots may be related to gas hydrate or possibly the occurrence of free gas. The acoustic wireline logging planned for this hole will help resolve this analysis. Unlike previous Expedition 311 sites, interstitial water chloride increases with depth, reaching constant values of ~600 mM with discrete freshening excursions that are typically associated with gas hydrate occurrence. Near midnight the DVTP tool was deployed at a depth of 275.4 mbsf to collect temperature data from a depth well below the BSR.

Daily Report for IODP Expedition 311, October 22, 2005

LOCATION: Site U1325 (CAS-02C)

SCIENCE UPDATE: Through the early morning we continued XCB coring with the last core on deck at 07:15 hr, taken from 294.7-304.3 mbsf. This additional core, below the target TD of 300 mbsf, was taken to extend the geochemical profiling to a slightly greater depth and to offset the low core recovery in the previous two cores. Sea state had, however, severely deteriorated during the night resulting in a sustained ship heave of 5 m. With the next scheduled operation wireline logging, two meetings were held at 08:00 hr and 10:30 hr to review the current weather forecast and decide upon the logging program. It was concluded that two separate logging runs would be attempted, however, we decided to run only tools without calipers to reduce the potential risk of damage to the tool string. The first run included the phasor Dual Induction Tool (DIT) and the Hostile Environment Gamma Ray Sonde (HNGS). The second run included the Dipole Sonic Imager, (DSI), the Scintillation Gamma Ray (SGT) tool and the Temperature/Acceleration/Pressure (TAP) tool. The first logging run was started at 15:30 hr at a new hole TD of 259.8 mbsf, which is 44.5 m shallower than the TD achieved with coring. The run was successfully completed at 16:55 hr, with some difficulty re-entering the drill pipe after the logging run. The first pass of the sonic tool (without the FMS) deployment was started at 21:54 hr at a TD of only 185.8 mbsf and was successfully completed at 22:19 hr. The repeat (second) sonic-tool run reached 183 mbsf and by midnight the tool string was in the drill pipe and being pulled back to the ship.

Daily Report for IODP Expedition 311, October 23, 2005

LOCATION: Sites U1325 (CAS-02C)/U1326 (CAS-03C)

SCIENCE UPDATE: After completing logging operations in Hole U1325C we collected a single mudline core from Hole U1325D, because doubts had risen about the depth of the sulfate/methane interface (SMI) as sampled in Hole U1325C. The new 4.7-m-long mudline core yielded measurable sulfate levels at the bottom of the core, indicating a SMI deeper than 4.5 mbsf, which is ~2.0 m deeper than the SMI in Hole U1325C. After completing Hole U1325D, we pulled the drill pipe back to ~1600 mbrf and transited in DP mode to Site U1326. We spudded Hole U1326B at 12:05 hr but the core contained only 1.55 m of sediment and we spudded a new hole. The first core at Hole U1326C recovered 3.93 m of sediment and we continued to advance the hole by APC coring. At an unexpected shallow depth of ~30 mbsf we hit APC refusal and switched to the XCB coring. Core U1326C-6X contained the first IR imaged cold spot at a depth of ~44 mbsf. One of the thermal anomalies from Core U1326C-6X was subsampled for interstitial water (IW) analysis. Closer inspection of the IW sample indicated that the IR imaged cold-spot was an 8-cm-thick sand unit apparently saturated with gas hydrate. The sample also contained several larger visible pieces of gas hydrate. It was also determined that the surrounding clay-rich sediments did not show any cold temperature or chlorinity anomalies. By midnight Hole U1326C had been advanced to 69.1 mbsf.

Daily Report for IODP Expedition 311, October 24, 2005

LOCATION: Sites U1326 (CAS-03C)

SCIENCE UPDATE: Hole U1326C was advanced to a depth of 82.7 mbsf with the deployment of two XCB cores, which was followed by three consecutive pressure core deployments within a high electrical resistivity zone identified on the pre-core LWD/MWD downhole logs taken more than a month ago in Hole U1326A. The first pressure core system deployed was the FPC, which did not recover a core under pressure. The next system to be deployed was the PCS, which appears to have recovered a partial core under pressure. The PCS core (Core U1326-12P) was moved to the degassing van for processing. The next pressure core system deployed was the HRC, which was apparently damaged at the bottom of the hole because of excessive ship heave (greater than 4 m) and formation sands packing around the outer barrel. The HRC cutting shoe and a spacer section was missing when the tool was recovered to the ship, which resulted in the termination of Hole U1326C at a total depth of 86.7 mbsf. After tripping the BHA back to the seafloor, the ship was moved 30 m to the southwest (15 m southwest of Hole U1326A) and Hole U1326D was drilled to a depth of 78.8 mbsf in preparation for continued coring operations. By midnight we had advanced the hole to 98.1 mbsf with two XCB cores. Because of problems associated with the heave state, which continued to grow through the day, and because of end of cruise schedule issues, it was decided to suspend all pressure coring operations for the remainder of the expedition. If the conditions improve we still hope to make additional DVTP deployments and possibly wireline log this hole. The last several days has seen the start up of several new special gas hydrate core experiments with a focus on time series measurements of cores that contain varying amounts of gas hydrate. The experiments have ranged from time series thermal conductivity and electrical resistivity measurements, and linked IR and conventional core imaging comparison studies.

Daily Report for IODP Expedition 311, Tuesday, October 25, 2005

LOCATION: Sites U1326 (CAS-03C)

SCIENCE UPDATE: We continued coring in Hole U1326D under less than favorable weather conditions, with ship heave continuously over 4 m, which has adversely affected core recovery (average = 63.5%). However, within the recovered cores we continue to see isolated IR anomalies associated with gas hydrate-bearing sand intervals, which in most cases are sampled for interstitial water analysis or shore-based microbial studies. We have also preserved several of the IR imaged anomalies from this hole in liquid nitrogen with the expectation that pieces or possible disseminated gas hydrate as been preserved in the core. As noted, if the IR temperature anomaly is relatively weak ($\sim 3\text{-}5^\circ$ temperature reduction) the anomalies are sampled for either interstitial water samples or for microbiological samples. By midnight we had advanced Hole U1326D to a depth of 232.9 mbsf. The ship's heave has been too high to attempt deployment of the DVTP, but we hope to deploy it at least two times before we reach the total depth of 300 mbsf.

Daily Report for IODP Expedition 311, October 26, 2005

LOCATION: Sites U1326 (CAS-03C)

SCIENCE UPDATE: Throughout the morning we continued coring in Hole U1326D. The last core of this expedition was on deck at 09:00 hr. Due to reports of deteriorating weather conditions, it was decided to stop coring at a depth of 271.4 mbsf and deepen the hole to a total depth of 300 mbsf by drilling to gain time and complete logging, rigging down, and securing the rig floor before the expected arrival of forecasted storm. Because heave conditions had slightly improved through the night and early morning, we did attempt three deployments with the DVTP tool (at 252.2 mbsf, 271.4 mbsf, and 300 mbsf). All three deployments yielded only marginally useful data but may be sufficient to establish a simplified linear temperature gradient for this site. The last three cores in Hole U1326D showed unexpectedly strong IR imaged cold-spot anomalies at depths below the seismically inferred BSR at $\sim 230 \pm 5$ mbsf. Uncertainty remains in the position of the BSR until the velocity data from the planned wireline logging survey and the data from the deep DVTP surveys are completely processed and analyzed postcruise. After completing coring operations we started to rig up for downhole logging. It was decided to conduct a single novel downhole log run with a non-standard IODP tool string, which included the Scintillation Gamma Ray (SGT) Tool, Phasor Dual Induction (DIT) tool, and the Dipole Sonic Imager (DSI). Logging operations started at $\sim 23:00$ hr and continued throughout the night. All of the labs continued to process the remaining cores throughout the afternoon and into the night. Pore fluid salinity measurements were completed and showed an unexpected trend with depth, where salinity and chlorinity remain almost constant from the seafloor to the base of the cored interval (271.4 mbsf). Pore-water freshening from gas hydrate dissociation showed an unexpected inverted profile with depth, with the strongest anomalies at shallower depths and decreasing towards the predicted depth of the BSR.

Daily Report for IODP Expedition 311, October 27, 2005

LOCATION: Site U1326 (CAS-03C)/ In Transit to Victoria

SCIENCE UPDATE: Because of deteriorating weather conditions, we had no other options than going with a single downhole log run with a non-standard IODP tool string (without a caliper arm), which included the Scintillation Gamma Ray (SGT) Tool, Phasor Dual Induction (DIT) tool, and the Dipole Sonic Imager (DSI). The tool was deployed and lowered to 298.4 mbsf and after two successful passes from this depth, the tool was back on deck at 03:45 hr. The drill string was pulled clear of the seafloor at 05:30 hr, ending operations in Hole U1326D. After tripping the drill string to the rig floor, recovering two beacons, and securing the ship for transit, we departed at 13:20 hr under deteriorating sea state (with 40-45 kt sustained winds gusting to >50 knots). For the first five hours of transit we were able to average a speed of about five knots per hour, increasing to ~ 7 knots per hour by 22:00 hr.

Daily Report for IODP Expedition 311, October 28, 2005

LOCATION: In Transit and Arrival in Victoria

SCIENCE UPDATE: After departing Site U1326 on 27 October, we made the 157 nmi transit to Victoria, B.C. at an average speed 6.8 kts. Expedition 311 officially concluded with the first line ashore at 12:25 hr on 28 October, 2005.