Fisher, A.T., Urabe, T., Klaus, A., and the Expedition 301 Scientists
Proceedings of the Integrated Ocean Drilling Program, Volume 301

Site 1026[1]

Expedition 301 Scientists[2]

Chapter contents

Site summary

Three Circulation Obviation Retrofit Kit (CORK) borehole observatories were installed during Expedition 301 in Holes 1026B, U1301A, and U1301B. The first of these systems replaced a CORK observatory deployed during an earlier expedition; the second and third are in newly drilled and cased holes. The new Hole 1026B CORK system was the simplest of the systems deployed during Expedition 301. It comprised a CORK-II body with 4½ inch casing extending to 201.5 meters below seafloor (mbsf) and a single packer element set in casing near the bottom of the 4½ inch casing. No 4½ inch casing was installed below the packer element sub because the hole was completely cased at depth, and there was no need to provide additional protection for the instruments hanging below the bottom plug.

The umbilical run in Hole 1026B comprised a single ½ inch packer inflation line and three ¼ inch pressure-monitoring and fluid-sampling lines. The three ¼ inch lines were run through the single packer and ended in small wire-wrapped screens that were attached just below the inflation element. All of the CORK systems deployed during Expedition 301 included nine pass-throughs within the packers and across the upper 10¾ inch casing seal so that we could use a single design for these systems and achieve sampling and monitoring goals within multi-interval CORKs. Most of the extra pass-throughs in the Hole 1026B CORK were capped, but one line through the 10¾ inch casing seal was plumbed into a two-way valve in the CORK head so that during a future submersible or remotely operated vehicle (ROV) dive expedition it will be possible to check pressure below the casing seal but above the packer element. If the pressure monitored below the packer is different from that above the packer, this will give a positive indication that the CORK system is properly sealed. As with all other valves in the CORK head, this one was left open during deployment to prevent air from being trapped in the sampling and monitoring lines.

The Hole 1026B instrument string included three OsmoSampler packages and two autonomous temperature loggers. One OsmoSampler contains copper coils for gas sampling, another has polytetrafluoroethylene (PTFE) tubing for fluid sampling and tracer injection, and the third contains microbiological growth substrate and an acid-addition OsmoSampler for metals analyses.

[1]Expedition 301 Scientists, 2005. Site 1026. *In* Fisher, A.T., Urabe, T., Klaus, A., and the Expedition 301 Scientists, *Proc. IODP,* 301: College Station TX (Integrated Ocean Drilling Program Management International, Inc.). doi:10.2204/iodp.proc.301.107.2005
[2]**Expedition 301 Scientists' addresses.**

Operations

Transit to Hole 1026B

Following cementing of the 10¾ inch casing in Hole U1301B, we moved 0.55 nmi to Hole 1026B in dynamic positioning (DP) mode while retrieving the drill string. We deployed a seafloor positioning beacon at 2356 h on 16 August 2004. A summary of operations conducted in Hole 1026B is shown in Table T1 in the "Expedition 301 summary" chapter and Table T1.

Hole 1026B

Minicone removal

During Expedition 301, we planned to retrieve the Hole 1026B CORK that was installed during ODP Leg 168 and install a new CORK-II. After Leg 168, an ~1.0 m diameter minicone was placed in the top of the CORK (Fig. F1) by submersible to facilitate wireline reentry during nondrillship operations. We had to remove this minicone so it would not interfere with engagement of the CORK-pulling tool. The minicone could not be removed by submersible. Because we did not know what problems we might encounter when trying to remove the minicone, we wanted to try this early in the cruise so that we would have time to devise a solution should there be problems. We fabricated a special fork-shaped, jetted fishing tool (Fig. F2) to remove the minicone. We could maneuver the tool by rotating the drill string and pumping seawater through a port on the back side of the tool to move the bottom of the drill string.

We slid the fork-shaped fishing tool around the CORK, raised it, and broke the minicone off at the base of the conical portion. The minicone fell and landed on the ROV platform, and we used the fishing tool to nudge it off onto the seafloor immediately beside the reentry cone (where it still remains). We felt that the lower tubular portion piece of minicone remaining on top of the CORK head would not interfere with our ability to latch the CORK pulling tool to retrieve the old CORK. The entire minicone removal process only required ~15 min, and then we retrieved the drill string. We finished the fishing operation at 1200 h on 17 July when the fishing fork was back on the rig floor.

Transit from Hole 1026B to Hole U1301A

While retrieving the fishing bottom-hole assembly, we moved back to Hole U1301A (0.55 nmi) in DP mode.

Transit from Hole U1301B to Hole 1026B

After completing logging operations in Hole U1301B, we moved the ship back (~0.55 nmi) to Hole 1026B in DP mode.

Hole 1026B

Recovery of CORK assembly

We started assembling the CORK retrieving tool at 2330 h on 2 August. We engaged the CORK and extracted it from the reentry cone at 0545 h on 3 August. The CORK extraction and pick up of the ROV platform assembly was visually observed with the camera system prior to raising the entire assembly back to the ship. Once the recovered hardware reached the ship, we spent 3 h disassembling the structure and laying out the various components (Figs. F3, F4); this was completed at 1500 h on 3 August. Recovered components included the ROV platform, which was cut off in the moonpool area; the CORK head with drill collars attached below it were disassembled on the rig floor. The drill collars consisted of one 30 ft 8¼ inch drill collar, one 20 ft drill collar pup joint, two 10 ft drill collar pup joints, and one 20 ft knobby joint.

Installation of new CORK-II

At 1500 h on 3 August, we prepared to assemble the new CORK-II. A 4½ inch casing packer was made up to a casing seal sub. We lowered it to the moonpool where we attached three miniscreens just below the bottom of the packer. The lower end of the umbilical (leftover from Ocean Drilling Program [ODP] Leg 205) was attached to the top of the packer, and we attached 14 joints (189.95 m) of 4½ inch casing. The umbilical was strapped to the casing using plastic tie wraps and stainless steel banding. Thirty-six rigid casing centralizers were attached to the casing to protect the umbilical during deployment. We attached the CORK-II running tool to the top of the CORK-II head (Fig. F5), secured the head to the top of the 4½ inch casing string, and lowered it into the moonpool to make the final umbilical connections at the bottom of the head. Figure F6 shows the CORK-II assembly.

After making up a stand of 8¼ inch drill collars to the top of the CORK-II running tool, we connected the packer inflation hose from the running tool to the CORK-II head. Dual tethers were attached at 180° from the running tool to the quick disconnect on the top of the head; these are used to release the quick disconnect on the packer inflation line when the running tool is removed from the head after the CORK-II is fully installed.

We lowered the CORK-II assembly to the seafloor, deployed the camera/sonar system, and were prepared to reenter Hole 1026B to install the CORK-II at 0400 h on 4 August.

Fishing BioColumn sampler from reentry cone

As we were preparing to reenter Hole 1026B with the fully assembled CORK-II, a ~1 m long(?), cylindrical, white foreign object was observed lying inside the reentry cone. We ultimately determined that the object was a BioColumn sampler lost during a submersible visit following Leg 168. This instrument had fallen through a hole in the old-style ROV platform and was hidden from view with the drillship camera system until the platform was recovered during Expedition 301.

After meeting to discuss our options, we decided to retrieve the camera/sonar system and attach a grapple-fishing tool to the camera frame. We ran back down to the seafloor and attempted to fish the object out of the reentry cone. Unfortunately, when the grapple touched the object, it slid down the reentry cone and slipped into the throat of the cone. We recovered the camera/sonar system again, removed the grapple-fishing tool, and ran back to bottom to observe the reentry cone, thinking that the object might have fallen inside the casing and continued all the way to the bottom of the hole. However, we could see that the object remained inside the throat of the reentry cone, likely resting on top of the casing hanger assemblies. We lowered the end of the CORK-II's 4½ inch casing into the throat of reentry cone in an attempt to dislodge it so that it might fall freely to bottom of the hole. Instead, the casing passed by the object. We pulled the casing back up and observed the object catching on the casing stabilizers, lifting it out of the throat. The object fell off and slid back down into the throat of the reentry cone. This process was repeated each time a casing centralizer was lifted out of the cone throat. We decided that we needed another fishing tool, so we pulled the casing clear of the reentry cone at 1155 h on 4 August and recovered the camera/sonar system. We removed the grapple fishing tool and attached a modified wireline spear (added two sets of three 6 inch long hex-head bolts welded at a 45° upward angle) to the camera/sonar system frame using a wire rope sling. This time we successfully engaged the object, pulled it from the reentry cone, and, while moving the ship 20 m away from the reentry cone, we observed the object being dragged through the seafloor mud. When we retrieved the camera/sonar system with the fishing tool, the object was not attached; it had apparently dislodged during retrieval and fallen to the seafloor.

Once again we deployed the camera/sonar system, and we reentered Hole 1026B with the CORK-II assembly at 1850 h on 4 August. During reentry, we once again observed what appeared to be a white tubular object lodged inside the throat of the reentry cone. We continued to lower casing to 2849 meters below rig floor (mbrf); however, it was apparent by the drag that something was still inside the reentry cone assembly. When we pulled the casing back up through the reentry cone, we observed the object jammed onto one of the casing centralizers. We pulled the casing clear of the reentry cone at 1945 h on 4 August and offset the ship 35 m away from the hole to ensure that if the object fell off it would not go back into the hole. We inspected the object and verified that it was not the same one that had been removed in the earlier fishing operation, but it may have been a part of that assembly that had broken off. The new object had what appeared to be a stainless steel T-handle. To remove the object, we worked the camera/sonar system up and down over it until it fell off. While offsetting the ship back to Hole 1026B, we observed the first fished object lying on the seafloor 20 m from hole; it appears that this object fell straight down.

Ultimately, we reentered Hole 1026B at 1945 h on 4 August and the casing, packer, and umbilical assembly was lowered to 2849 mbrf without meeting any resistance. The top drive was picked up, and the casing was further lowered to 2859 mbrf just short of landing the CORK-II head in the reentry cone. We lost about 24 h as a result of having to fish the BioColumn from Hole 1026B.

Deploying instrument string inside 4½ inch casing

The instrument string deployed inside the 4½ inch casing of the CORK-II consisted of a sinker bar, three OsmoSamplers, lower seal (gravity) plug, Spectra rope, a sinker bar, Spectra rope, and a top seal (gravity) plug (Fig. F6). This was made up and deployed in the same manner as it was for the Hole U1301A CORK-II. Once the instrument string was installed, the CORK-II head was landed without difficulty. We inflated the single 4½ inch casing packer (without using a go-devil) and began preparing to deploy the ROV/submersible platform.

Deployment of Hole 1026B ROV/submersible platform

Final assembly of the ROV platform was completed and the platform was deployed as before using the logging wireline and the mechanical deployment tool (Lula) (Fig. F7). When the mechanical deployment tool carrying the reentry cone touches down on the CORK-II head, the mechanical release is activated, releasing the platform, which free falls around the CORK-II down onto the top of the reentry cone.

The platform was successfully released without any of the difficulties we experienced when deploying the platform in Hole U1301A; repairs and modification to Lula prior to Site 1026 operation and modified deployment procedures were successful. We recovered Lula at 1015 h on 5 August. We then deployed the camera/sonar system to inspect the platform and CORK-II and to observe the release of the CORK-II running tool. When the camera reached the seafloor, we observed that the platform had not landed properly. One side of the platform hung up on the plate at the base of upper set of gussets on the CORK-II head during the free fall. After reviewing the engineering drawings of the CORK-II head and platform, it became clear that in some orientations it is possible for the platform to hang up on the CORK-II head. This can easily be prevented by installing three additional vertical gussets to the top of the CORK-II head. We modified the remaining CORK-II head assemblies.

We disconnected the running tool from the CORK-II head at 1125 h on 5 August. Strictly by chance, the camera/sonar system was aligned perfectly with the J-slot on the CORK-II running tool, and we were able to observe the unjaying process. Once the running tool was released, we used the running tool to nudge the high side of the platform and it dropped into place on top of reentry cone at 1130 h. It should be noted that this was the first deployment of the considerably lighter (expanded metal) ROV platform design. This design flaw had existed in earlier CORK-II installation designs, but the greater weight of the earlier platforms probably was enough to overcome any momentary hangups. The installation of the new Hole 1026B CORK-II was successfully completed at 1130 h on 5 August.

Transit from Hole 1026B to Hole U1301B

While retrieving the CORK-II running tool, we moved the ship 0.55 nmi back to Hole U1301B to attempt remedial cementing of the backed-off 10¾ inch casing string.

Hole completion

Hole 1026B was drilled and cored during Leg 168 to a maximum depth of 295.2 mbsf, but hole conditions in basement were poor (Shipboard Scientific Party, 1997). The exact depth of top of basement is not known, but hard formation was encountered during drilling at 247.1 mbsf, suggesting that the hole penetrated 48.1 m into basement. The 10¾ inch casing shoe was placed at 248.5 mbsf. At the end of coring operations, the top of fill was tagged at 269.9 mbsf and a liner was subsequently fabricated from 5 inch drill pipe, extending access to the upper 31.8 m of basement (Shipboard Scientific Party, 1997). There was no open hole remaining in Hole 1026B; all formation access was past the liner and 10¾ inch casing that stabilized the basement interval.

The CORK set in Hole 1026B during Leg 168 included a thermistor string, an OsmoSampler, pressure gauges, and a data logger. These instruments were recovered in 1999, except for the OsmoSampler and a sinker bar, which were stuck in the hole either inside the liner or between the liner and the casing. When we arrived on site during Expedition 301, there was no instrumentation installed in the CORK but all mechanical and hydraulic systems remained in place. We needed to recover the CORK before we could install a replacement observatory. Once the old CORK was recovered and the cone was cleared of a BioColumn instrument (as described in **"Operations"**), we prepared the new observatory for deployment.

The new Hole 1026B CORK system was the simplest of the systems deployed during Expedition 301 (also see **"Operations"** and **Fisher et al.,** this volume). It comprised a CORK-II body with 4½ inch casing extending to 201.5 mbsf and a single packer element set in casing near the bottom of the 4½ inch casing (Fig. **F8**). No 4½ inch casing was installed below the packer element sub because the hole was completely cased to a depth below the liner and there was no need to protect the instruments hanging below the bottom plug (Fig. **F8**).

We used surplus umbilical from Leg 205, comprising a single ½ inch packer inflation line and three ¼ inch pressure-monitoring and fluid-sampling lines. The three ¼ inch lines were run through the single packer and ended in small wire-wrapped screens that were attached just below the inflation element. All of the CORK systems deployed during Expedition 301 included nine pass-throughs within the packers and across the upper 10¾ inch casing seal so that we could use a single design for these systems and achieve sampling and monitoring goals within multilevel CORKs. Most of the extra pass-throughs in the Hole 1026B CORK were capped, but one line through the 10¾ inch casing seal was plumbed into a two-way valve in the CORK head. This valve was topped with an Aeroquip connector so that during a future submersible or ROV dive expedition it will be possible to check pressure below the casing seal but above the packer element. If the pressure monitored below the packer is different from that above the packer, this will give a positive indication that the CORK system is properly sealed. As with all other valves in the CORK head, this one was left open during deployment to prevent air from being trapped in the sampling and monitoring lines.

After we deployed the CORK system from the ship and reentered Hole 1026B, the CORK body was held a few meters above the cone so that we could deploy the instrument string. The Hole 1026B instrument string was also relatively simple, including three OsmoSampler packages (Fig. **F8**). The uppermost OsmoSampler contains copper coils for gas sampling, the middle one has PTFE tubing for fluid sampling and tracer injection, and the lower one contains microbiological incubation substrate and an acid-addition OsmoSampler for metals analyses. There is a single, self-contained temperature logger in each of the lower two OsmoSamplers. We decided to not deploy additional temperature loggers in Hole 1026B because earlier studies had already determined the upper basement temperature at this site and because this sampler and measurement string were too short to extend into basement. We elected to keep this string short to make sure that the samplers and data loggers can be recovered during a future drilling or dive expedition and will not be caught in or alongside the liner that fills much of the lower part of the hole.

Instrument string deployment went smoothly, and the CORK was set in the cone and the packer was inflated in casing. The submersible/ROV platform was assembled in the moonpool and lowered onto the CORK by wireline. We went back down with the camera to inspect the landing platform prior to releasing the CORK running tool and found that the platform was cocked and held above the top of the valve and sampling bays. We released from the CORK head and used the running tool to “nudge” the high side of the landing platform. It uncocked and slid down the CORK head, landing on the rim of the cone, ending seafloor operations in Hole 1026B.

References

Shipboard Scientific Party, 1997. Hydrothermal transition transect (Sites 1023, 1024, and 1025). *In* Davis, E.E., Fisher, A.T., Firth, J.V., et al., *Proc. ODP, Init. Repts.,* 168: College Station, TX (Ocean Drilling Program), 49–100.

Publication: 31 October 2005
MS 301-107

Figure F1. Photograph of Hole 1026B CORK installed during Leg 168. An ~1 m diameter minicone (white cone-shaped object on top) was placed by submersible on top of the CORK head (brown vertical tubular shape in middle) to facilitate wireline reentry during nondrillship operations. This minicone had to be removed prior to retrieving the CORK and ROV platform (large, flat circular object surrounding the CORK head).

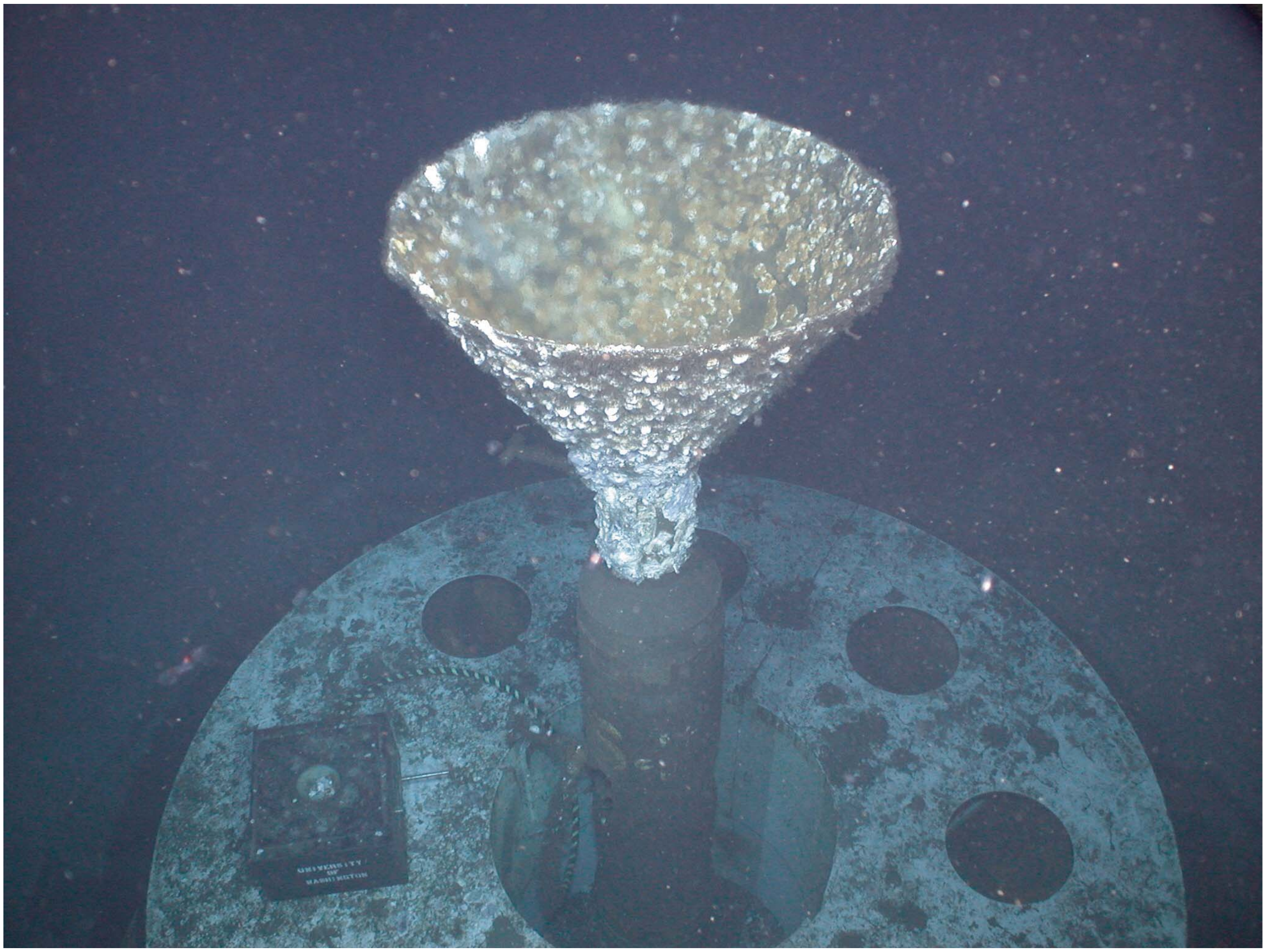


Figure F2. Fork-shaped fishing tool fabricated to remove the minicone in Hole 1026B. **A.** Construction of fishing tool. **B.** Deployment of fishing tool through the moonpool.

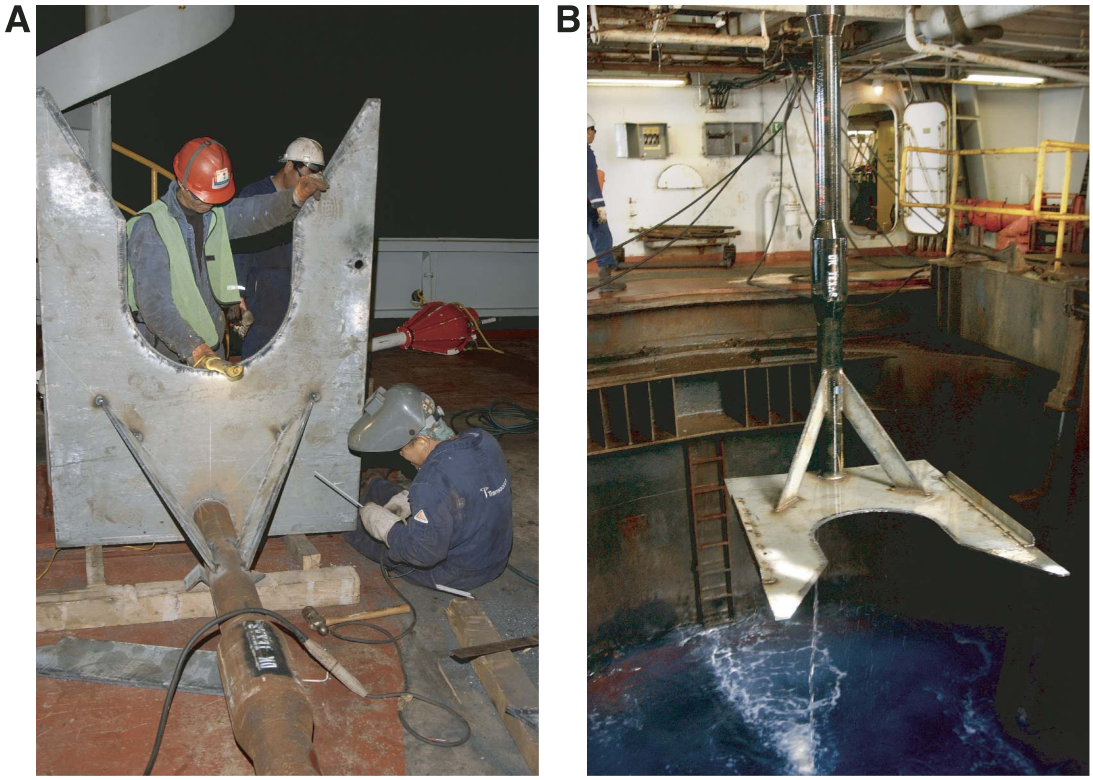


Figure F3. A, B. Retrieval of the old Hole 1026B CORK and ROV platform through the moonpool. It was originally installed during Leg 168. The brown pipe above the ROV platform is the CORK pulling tool, which has the old CORK head latched inside.

Figure F4. The old ODP Leg 168 CORK body on deck shortly after retrieval. **A.** Upper half of CORK head with sampling/monitoring port access. **B.** Lower part of CORK head. **C.** Lower half of CORK head. **D.** Borehole seal. The lower right portion was exposed at above the seafloor; the upper left was sealed in the borehole.

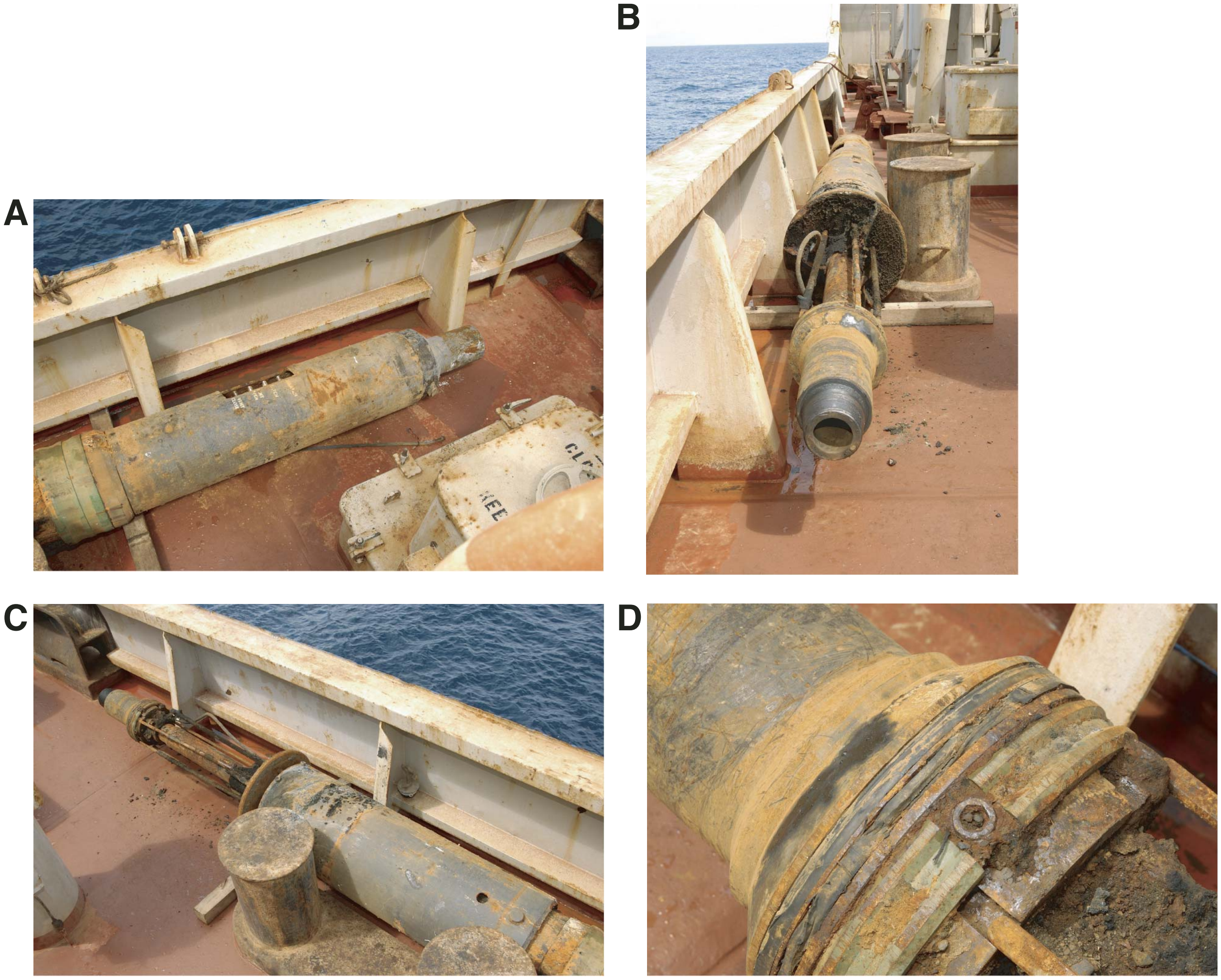
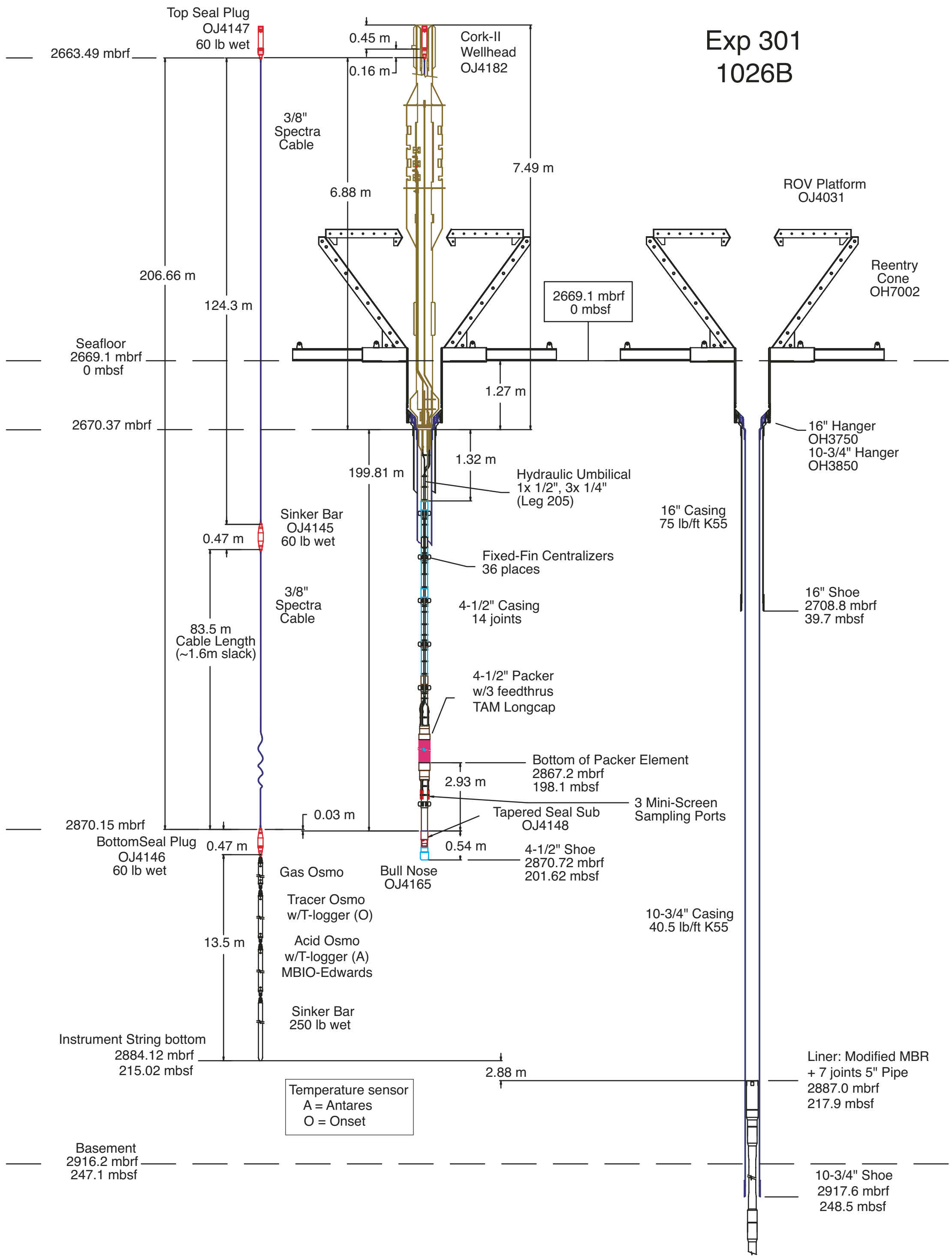


Figure F5. The Hole 1026B CORK-II head being lifted into the derrick using the CORK running tool.

Figure F6. Schematic showing the Hole 1026B reentry cone and borehole casing (right), CORK-II borehole completion (center), and the instrument string deployed through the 4½ inch casing of the CORK-II (left). ROV = remotely operated vehicle. MBR = mechanical bit release. MBIO = microbiology sample. TAM = TAM International.



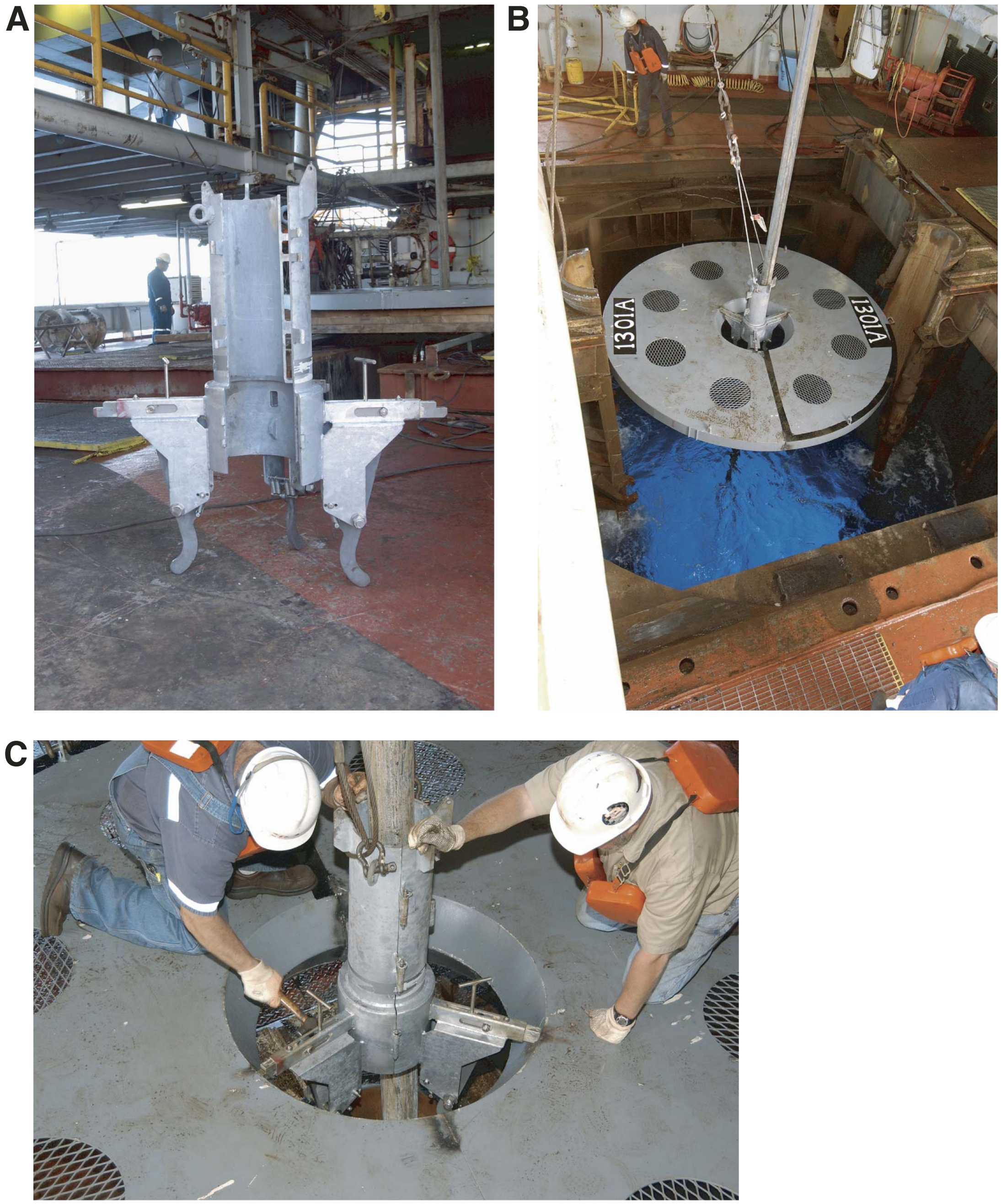


Figure F7. The wireline-conveyed mechanical deployment tool (Lula). **A.** Lula shown in its open position before being placed around the drill string. When the legs on the bottom touch down on the top of the CORK head, the ROV platform is released. **B.** The logging wireline is attached to the top of the Lula and is used to lower the entire assembly to the seafloor. **C.** Lula being latched into the center of the ROV platform.

Figure F8. Drawing showing observatory completion at depth in Hole 1026B. Positions and geometries of OsmoSamplers (OS), temperature loggers (T), and intake screens are highly idealized. Please see drawings of complete CORK system in Figure F6 and in Fisher et al. (this volume). MBIO = microbiology sample.

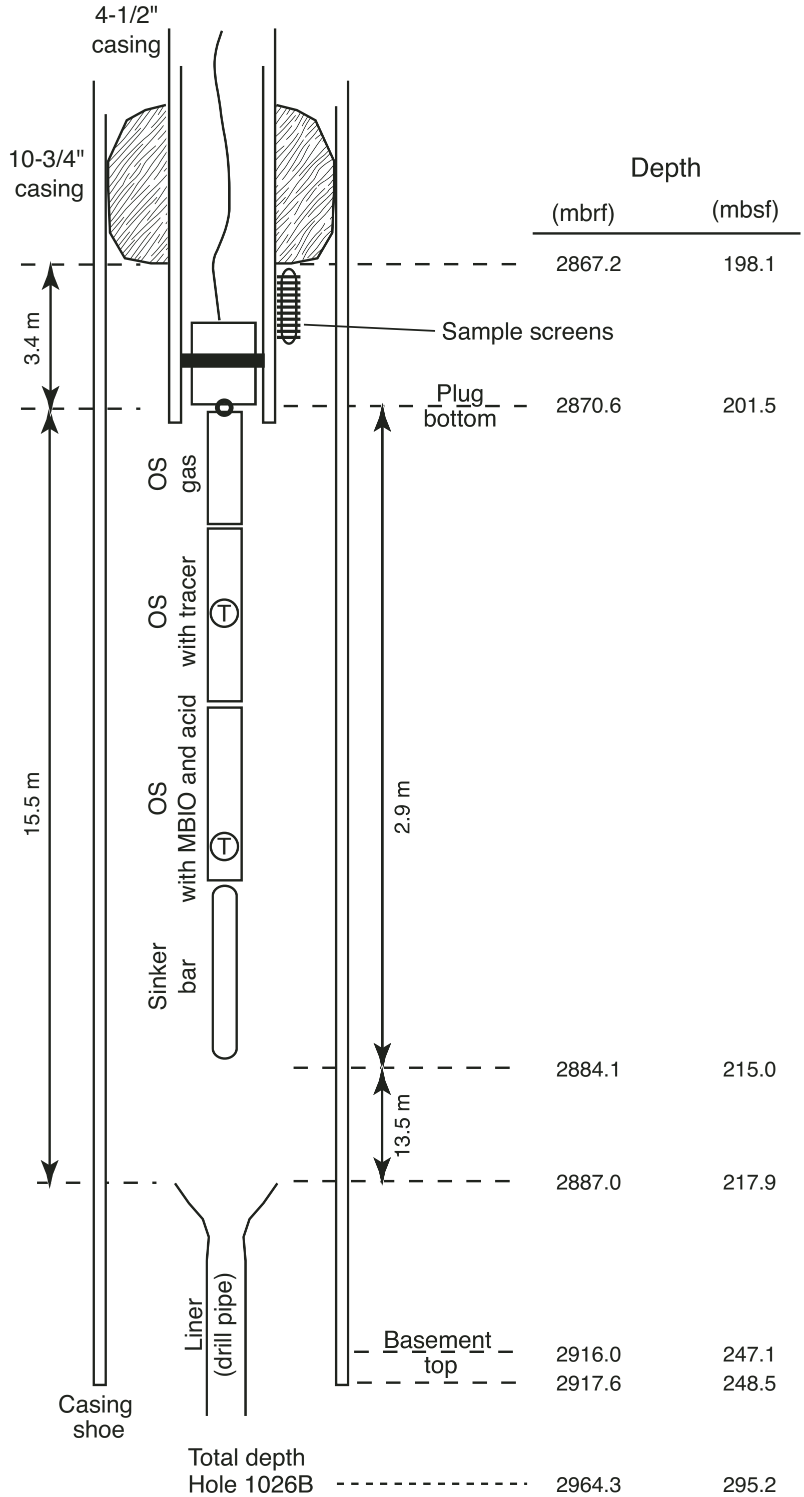


Table T1. Hole 1026B operations summary.

Hole 1026B

Latitude: 47°45.7571′N (based on Expedition 301 Global Positioning System data)
Longitude: 127°45.5482′W (based on Expedition 301 Global Positioning System data)
This position is 6.6 m at 122° from the position occupied during Leg 168
Seafloor (drill pipe measurement from rig floor, m): 2669.1
Distance between rig floor and sea level (m): 11.1
Water depth (drill pipe measurement from sea level, m): 2658.0
Total depth (from rig floor, m): 2964.3 (during ODP Leg 168)
Total penetration (m): 295.2 (during ODP Leg 168)
Total length of cored section (m): 0
Total length of drilled intervals (m): 0
Total core recovered (m): 0
Core recovery (%): 0
Total number of cores: 0
Total number of drilled intervals: 0

Operations: (1) Minicone fishing; (2) removing CORK installed during ODP Leg 168; (3) installing new CORK-II