Cruise Report for R/V *Atlantis*/Alvin Expedition AT26-18:

Completing single- and cross-hole hydrogeologic and microbial experiments: Juan de Fuca Flank

Expedition Dates and Ports: 10 August 2014 to 24 July 2014, Astoria, OR to Astoria, OR
(mobilization: 8–9 August 2014, demobilization 24–25 August 2014)

Supported by NSF project: OCE-1260548 Wheat
(and linked proposals to Fisher, Becker, Clark, Cowen, and Edwards)

Project Co-PIs:

A. T. Fisher[1], K. Becker[1], J. Clark[1], M. Rappe[1], K. J. Edwards[1], C. G. Wheat[1,2]

[1] Co-PI on OCE-1260548 and linked proposals

[2] AT26-18 chief-scientist and primary contact: University of Alaska Fairbanks, PO Box 475, Moss Landing, CA 95039; 831-633-7033; wheat@mbari.org

Expedition Overview

AT26-18 was the culminating expedition of a decade-long project that included assets from three deep-sea drilling expeditions (ODP 168, IODP 310 and 327) and numerous submersible and ROV operations. The link among all of these expeditions was (1) a cross-hole pumping, flow, and tracer transport study, the first ever in the oceanic crust; (2) a systematic sampling and analytical program for quantifying biogeochemical and microbial compositions to assess a range of parameters from the direction of flow within the crust to the unique microbial populations that inhabit this subsurface environment; and (3) the first in situ microbial experiments within basaltic crust, one of the largest reservoirs on Earth.

The focus of AT26-18 was to finish the cross-hole experiments that were initiated four years ago on IODP Exp 327. During that expedition, tracers (SF_6, Cs, two rare earth elements, fresh water, fluorescent beads, and stained cells) were injected into one well (1362B) with the anticipation of these tracers reaching other boreholes along flow paths in the oceanic crust. To assist in documenting tracer transport, we deployed continuous fluid samplers within and on four boreholes (1301A, 1362A, 1362B, and 1026B). Also we deployed several microbial colonization experiments in the same boreholes. During the past 4 years we have deployed similar samplers and experiments on the wellheads as a "back-up" to downhole systems. These wellhead samplers and experiments have clearly documented the passage of tracer among the boreholes; however, the wellhead records are incomplete because of a cruise that was scheduled for 2012 was cancelled because of a problem with the propulsion system on the ship. Thus, we anticipate the downhole records will provide a complete record of tracer concentrations and timing in the wells. In addition, in 2011 and 2013 we opened large diameter ball valves on two of the wellheads, allowing overpressured formation to vent so that we could determine the pressure responses in the ocean crust. This experiment will help to determine the large-scale hydrogeologic properties of the oceanic crust, and provided high-quality fluid and microbial samples for collection at the seafloor.

To meet the objectives in the proposal we requested 11 full dives and one partial dive, for a total expedition length of 12 days on site. An additional day was added to the schedule for an engineering dive, one of the two issued to WHOI every year. During our two week-period at sea we

collected:

- pressure data from 1301A, 1362A, 1362B, and 1027C (1026B is logging pressure data to the ONC cable, and the logger on 1301B failed in 2012 and was recovered in 2013);
- temperature measurements of the venting fluids at 1026B, 1362A, and 1362B;
- venting fluids from open boreholes at 1026B, 1362A and 1362B using Squeezer syringe samplers, gas-tight samplers, and a Major Titanium sampler.
- fluids from umbilicals using the GeoMICROBE sled at 1362A and 1362B;
- a swab of a rust biofilm from 1362A;
- fluids from two background CTDs; and
- nine push cores near 1027C.

recovered:
- a pressure logger from 1027C;
- the flow meter chimney with thermistors (1362A);
- wellhead OmsoSamplers from 1026B, 1301A, 1362A and 1362B;
- downhole OsmoSamplers systems from 1026B, 1362A, and 1362B; and
- rope from the 1301A borehole during a fishing attempt.

and deployed:
- a pressure logger at 1027C;
- top plugs to seal the open boreholes at 1026B, 1362A and 1362B; and
- wellhead OsmoSampler systems at 1362A and 1362B (Each with Standard, Copper, and BOSS OsmoSamplers for long-term monitoring changes in microbial and tracer compositions).

This was a highly successful expedition, however, because of weather on the last dive day, we have some unfinished business. This includes the collection of fluids from 1301A, deploying the top plug at 1301A, and collecting a rust biofilm from 1362B. In addition, it will be worthwhile to download additional long-term pressure data from 1027C, 1362A and 1362B in the next several years, to assess the record of formation recovery following closure of the second ball valve on 1362A in Summer 2014 and recover and analyzed samples from the OsmoSampler systems for a long record of change.

Many of the tasks listed above have been completed on a regular basis, such as downloading pressure data and using the GeoMICROBE sled to collect and filter fluids in situ. The striking difference in this expedition was the recovery of downhole sampler strings. We recovered three downhole sampler systems (1362A, 1362B, and 1026B) with the aid of a winch brought from MBARI. This number of downhole instrument string recoveries sets a record for one cruise! This recovery resulted in over 10,000 samples. These samples will be used to piece together a 4 or 6 year-long record.

Last year, with the ROV Jason, we attempted to recover the downhole instrument string in 1301A with little success. We pulled out the top plug, spectra line to the middle sinker bar, and several thermistors, leaving behind more spectra, a bottom plug and OsmoSampler systems. This year we attempted to recover these items using a fishing tool. The fishing tool worked as designed, and recovered several meters of spectra. However the samplers remain stuck in the hole. From the look of the line, the line parted under tension during our attempt to pull out these items. Although some rope was recovered, the instruments remain trapped in the casing at depth.

AT26-18 was a group effort, one that could not have been completed without the skilled help from the Atlantis and Alvin crews. They worked to complete our scientific objectives and in doing so they also offered many helpful suggestions to either expedite operations, make operations safer, or to make operations possible. Some of our subsea operations were complex and required special rigging. Likewise, some of our deck operations were complex, but easily and safely handled by the Bosun and deck crew. We are indebted to all of their help.

AT26-18 Cruise Participants: Names and affiliations are listed in Table 3.

Contents of Cruise Report

I. Operational Issues

Operational the pilots were very skilled in maneuvering the submarine. The three pilots (Pat, Bob, and Phil) have decades of experience driving and manipulating the submarine. This was critical because the operations that were required to complete the science objectives were complicated, many with big packages and lines in the water. There were two pit dives. We accomplished a lot on these dives, both of which were complicated. Jefferson did a great job completing many difficult tasks associated with manipulations on and around the wellheads.

The expedition included thirteen dive days, one of which was an engineering dive. WHOI is awarded two engineering dives per year to work on vehicle performance. This left 12 potential dive days for scientific operations. We lost two days (Monday August18, 2014 and Saturday August 23, 2014) because of poor weather. It appears that the weather window for the new submarine is tighter than before. The new vehicle seems to move more relative to the old vehicle when it is picked up by the A-frame.

Other difficulties resulting in the loss of time on bottom working:

4751 – An hour was lost because a problem with the variable ballast delayed the launch.

4751 – An hour was lost because a navigational error occurred while the submarine was on the seafloor.

4752 – An hour was lost because of weather (swells).

4577 – Time was lost because of a wiring issue with the ODI pressure connector. This was a science issue and not a submarine issue.

4578 – Three and a half hours were lost because of weather (swells).

II. Daily Summaries

Sunday August 10, 2014

We left the port of Astoria Oregon at 09:00 and headed to 1362B.

Monday August 11, 2014

We arrived on site a 1362B at 03:00. We sat on station until Dive 4750 commenced at 08:00. The general order of operations was to turn the pressure valves at 1362B to hydrostatic; turn the valves at 1362A to hydrostatic; measure temperature of the venting fluids that flowed from the flow-meter chimney; collect fluids that were venting from the flow-meter chimney; recover the flow-meter chimney; close the ball valve and deploy a dust cover (dummy plug); recover two OsmoSampler systems that were positioned on the wellhead; return the pressure vales to the formation (1362A and B); and uncouple the pressure logger at 1027. The ball valve at the flow meter closed easily and the meter was easily removed. In contrast, during the expedition last year we had difficulties removing the flow meter and closing the ball valve at 1362B.

Only a dust cover for the ball valve was deployed during the dive (1362A); however, we collected fluid samples (6 squeezer samplers and 2 gas-tight samplers), recovered two OsmoSampler systems from 1362A (the Blue and Black OsmoSamplers), and recovered the flow meter chimney with 4 thermistors inside.

Dive 4750 Scientists: Beth and Trevor Pilot: Bob

Basket:

- Gas-tight (2)
- Squeezer Syringe Samplers (6)
- Wrench for flow meter
- Low temperature probe
- Dust cover for the 4” diameter ball valve at 1362A
- Knife

Time (GMT)	Hole	Event
15:05	n.a.	Alvin in the water
16:53	n.a.	Alvin on bottom
17:03	U1362B	approaching CORK
17:06	U1362B	at MBIO/Flowmeter bay (mistakenly thought it was pressure bay)
17:07	U1362B	turned upper MBIO valve 90deg CCW (mistakenly)
17:08	U1362B	turned lower MBIO valve 90deg CCW (mistakenly)
17:10	U1362B	leaving site, heading for U1362A
17:21	U1362A	approaching CORK
17:22	U1362A	initial video of free-flow chimney flow
17:27	U1362A	far field view of free-flow chimney starts

17:30	U1362A	far field view of free-flow chimney ends, start close view
17:45	U1362A	move to pressure bay, turn middle and lower valves 180deg CCW to seafloor for hydrostatic check
17:49	U1362A	move back to flowmeter bay, remove umbilisnork
17:50	U1362A	temperature probe measurement in free-flow chimney, max temp 55.2
17:56	U1362A	squeezer #1 fired in free-flow chimney, bad sample, plunger stuck
17:59	U1362A	squeezer #2 fired in free-flow chimney, good sample
18:01	U1362A	squeezer #3 fired in free-flow chimney, good sample
18:04	U1362A	squeezer #4 fired in free-flow chimney, plunger came up too fast, questionable
18:05	U1362A	squeezer #5 fired in in basket, bottom water
18:08	U1362A	squeezer #6 fired in free-flow chimney, good sample
18:12	U1362A	gas-tight blue fired in free-flow chimney
18:13	U1362A	gas-tight red fired in free-flow chimney
18:15	U1362A	turned handle 90 CW to close ball valve of free-flow chimney
18:22	U1362A	clean flow-meter clamp with toilet brush
18:24	U1362A	slide flow-meter clamp ring right to release dogs
18:26	U1362A	flow meter chimney removed from clamp
18:28	U1362A	temperature probe measurement on top of closed ball valve, max temp 2.9
18:31	U1362A	place dust cap on closed ball valve
18:34	U1362A	remove black milkcrate from well-head
18:45	U1362A	temperature probe measurement in outflow of blue milkcrate, max temp 13.9
18:53	U1362A	close lower right valve 90 CW in chem bay (connected to blue milkcrate)
18:54	U1362A	removed Jannasch connector from lower right valve in chem bay, removed blue milk crate
19:05	U1362A	move to pressure bay, turn middle and lower valves 180deg CW to interval
19:06	U1362A	leaving site, heading for U1362B
19:25	U1362B	return MBIO valves to original position
19:28	U1362B	notice weeping of water around closed ball valve in MBIO bay
19:30	U1362B	move to pressure bay, turn middle and lower valves 180 deg CCW to seafloor for hydrostatic check
19:43	U1362B	turn middle and lower valves back 180deg CW to interval to end hydrostatic check
19:45	U1362B	leaving site, heading to U1301A
20:11	U1301A	arrived at U1301A
20:14	U1301A	in pressure bay, turn upper and lower valves 180 degrees for hydrostatic check
20:25	U1301A	turn upper and lower valves back 180 degrees to interval to end hydrostatic check
20:28	U1301A	removed dive plate from top plug on well-head, very corroded
20:32	U1301A	leaving site, headed for 1027C
21:42	1027C	arrived at 1027C
21:45	1027C	turn valve below pressure umbilical 90deg CW

21:48	1027C	removed Jannasch connector with pressure umbilical and placed on platform
21:53	1027C	Alvin off bottom

After dinner we deployed the plasma line at 1362A and conducted a CTD hydrocast. It took 1.5 hours to get the plasma line to the seafloor and release the surface floats. The CTD was lowered to within 10 m of the seafloor and all of the 24 bottles were activated.

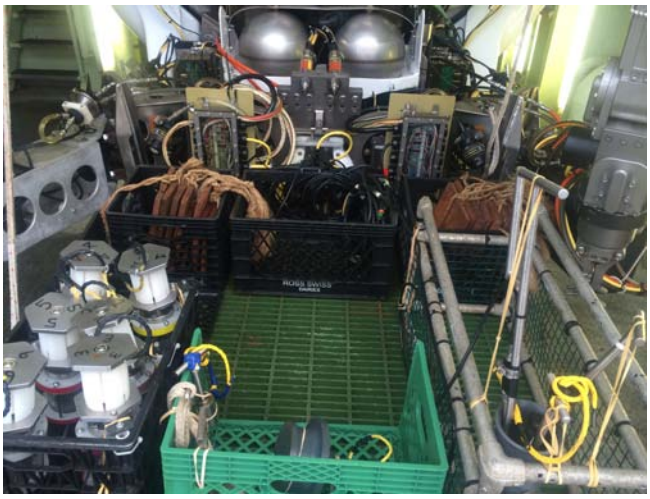


Image of the Alvin basket before launch and the wellhead at 1362A in the MBIO bay. Note the venting water from the flow meter chimney (a 4”-diameter PVC tube) and the microbial material on the wellhead.

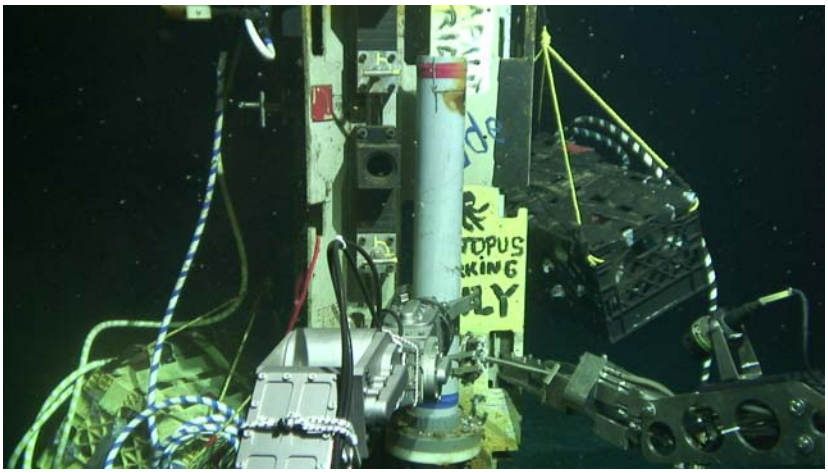
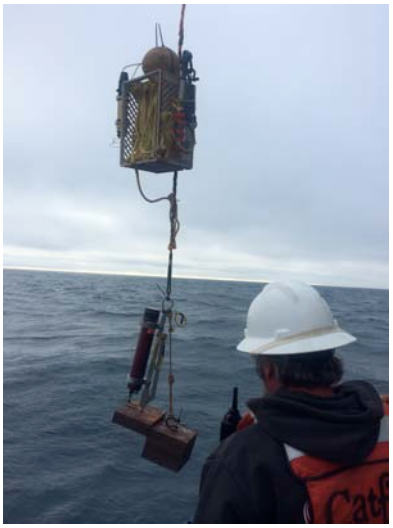


Image of 1362A prior to the removal of the flow meter chimney. The black and yellow milk crates contain OsmoSamplers systems and are connected to the formation via umbilicals.



Images of the bottom portion of the plasma line and two surface floats. One of the surface floats had two flashing lights that were activated by darkness. This was the general configuration for 3 of the 4 lowerings of the plasma rope. The fourth, associated with the recovery of the fishing tool, only had one weight and did not use the transponder (dark red item). The transponder did not work well. The homer probe did work well and was hose clamped to the milk crate. The homer coupled with the sonar made it easy to find the plasma rope on the seafloor. Lastly, we lowered the line so that the boom (not the location of the GPS antenna) was over the well. The line was typically within 19-30 m of the wellhead.

Tuesday August 12, 2014

We started the dive an hour late because of a problem with the variable ballast. The dive was successful but we had a navigational problem that cost us an hour on the seafloor. The general order of operations was to locate and move the plasma line near the wellhead at 1362A, download pressure data, recover the yellow OsmoSampler system, connect the plasma line to the top plug and release the dogs so that the latches are definitely open. In theory the dogs that hold the top plug in place are released with the GS pulling tool, but we wanted to make sure and released them manually, too. Note that both wellhead bolts need to be turned 3-3/4 turns CW to release the dogs. While a tool was used, it is possible to use the Alvin manipulators directly to turn the nuts.

The GS pulling tool, which was attached to the plasma line, was deployed on the wellhead top plug (1362A) and the Yellow OsmoSampler system was recovered from the same hole.

Dive 4751 Scientists: Keir and Eric Pilot: Phil

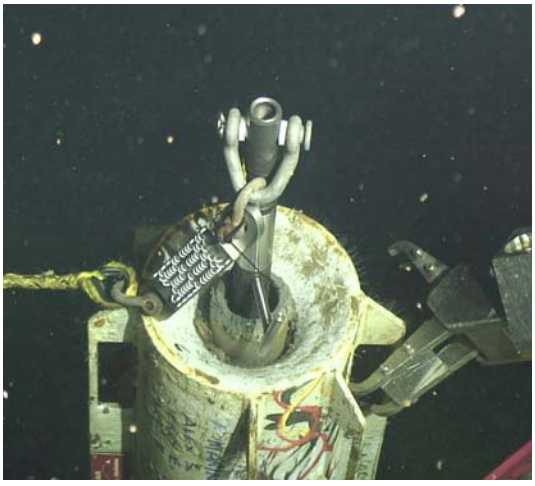
Basket:

Toilet brushes (2)
Wrench for nuts on wellhead
Low temperature probe
ODI connector for pressure loggers
Knife
GS pulling tool
Boot for ODI connector for 1026B temperature string (not used on this dive)

Time (GMT)	Hole	Event
16:08	n.a.	Alvin in the water
18:03	n.a.	on bottom 2656m, 170m 157 degrees to rope package
18:20	n.a.	at rope package
18:27	n.a.	grab rope package with stbd arm, cloud of dust
18:43	n.a.	big weight released from rope package, picked up package
18:45	n.a.	drop 5 plates away from Alvin basket
18:48	n.a.	transit to U1362A, range 150m according to inisub navigation
19:12	n.a.	realize error in navigation (doppler not reset), change course for new target
19:38	U1362A	arrive at U1362A
19:50	U1362A	release rope package ~30m from hole
20:04	U1362A	start downloading pressure data
20:45	U1362A	end downloading of pressure data
20:45	U1362A	move to Chem bay
20:47	U1362A	see shimmering water in outflow of yellow OsmoSampler in chem bay
20:49	U1362A	measure temperature in outflow of yellow OsmoSampler, max t 17.7C

20:57	U1362A	close valve for yellow OsmoSampler
20:58	U1362A	remove Jannasch connector for yellow OsmoSampler
21:00	U1362A	transfer yellow OsmoSampler to basket
21:02	U1362A	move to rope package, kick up dust
21:14	U1362A	variable ballast system not working, back up, drop plates
21:32	U1362A	back at rope basket
21:35	U1362A	rope basket gripped, moving back to hole
21:42	U1362A	inspect top plug, clean with brush
21:50	U1362A	install latch into top plug
21:59	U1362A	unscrew one bolt for top plug
22:05	U1362A	unscrew second release bolt
22:18	U1362A	fly by after rope package weight released

After dinner we proceed to recover the OsmoSampler system that was in the borehole in 1362A using the plasma winch. The winch was set with a 7500 lb weak link that was in line with 4-ton shackles and a 10-ton sheave. We started at 18:30 and finished the next morning at 03:30. Because of the wire angle it took about 3 hours to get over the well and then 2 hours to get the top plug to the ship. We pulled at a rate of 6 m/min while in the hole and 30-40 m/min once the sampler was out of the borehole. Because of the wire angel we had to spool the wire so that it was under the stainless steel roller on the level-wind portion of the winch instead of between the stainless steel and coated rollers. **In the future we should mount the winch 2 feet forward so that it is more in-line with the sheave.** There was no real pull out tension. The weight on the line ranged from 500 to 1100 lbs. We estimate the string weighted 800 lbs, including the 200 lbs sinkerbar.



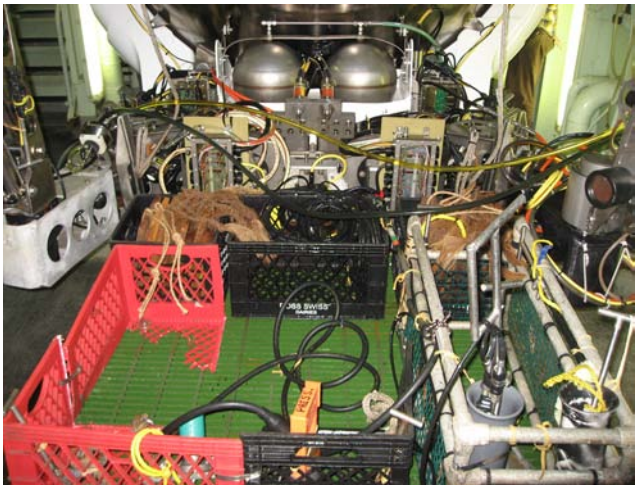


Image of the top of the 1362A wellhead with the GS pulling tool and weak-link in place and the basket prior to the dive.

Work on a downhole OsmoSampler (1362A). We recovered standard, copper, acid-addition, enrichment, and BOSS OsmoSamplers. A close-up of one of the downhole pumps from 1362A.

Wednesday August 13, 2014

We started the day at 06:00 with the launch of the GeoMICROBE sled near 1362A. The general order of operations was to locate and move the sled near 1362A, measure the temperature in the outflow at the top of the wellhead, collect fluid samples (6 squeezers) from the top of the wellhead, deploy the top plug with the help of the Otis tool and a stack of 4 dive weights, connect and communicate with the GeoMICROBE sled, and recover both OsmoSampler plates at 1026B. We had to engage the two nuts on the wellhead (3-3/4 turns CCW) to latch the dogs.

The top plug was deployed at 1362A with the help of the Otis tool and the copper and Teflon OsmoSampler plates were recovered from 1026B.

Dive 4752 Scientists: MIke and Oliver Pilot: Pat

Basket:

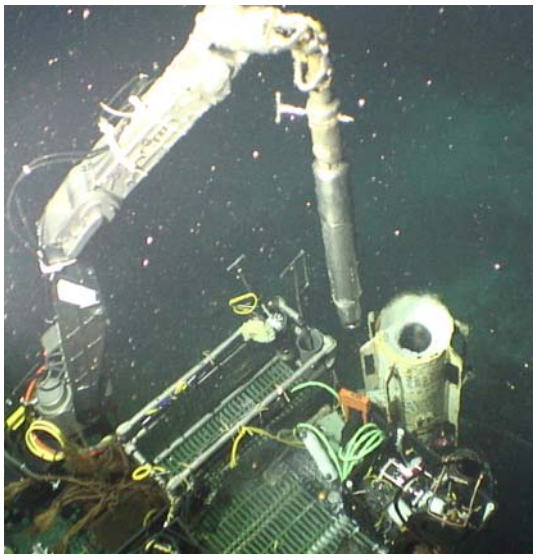
Toilet brushes (2)
Top plug for 1362A and Otis tool
Wrench for nuts on wellhead
Low temperature probe
ODI connector for GeoMICROBE
Knife
GS pulling tool
Squeezer Syringe Samplers (6)
4-dive-weight stack

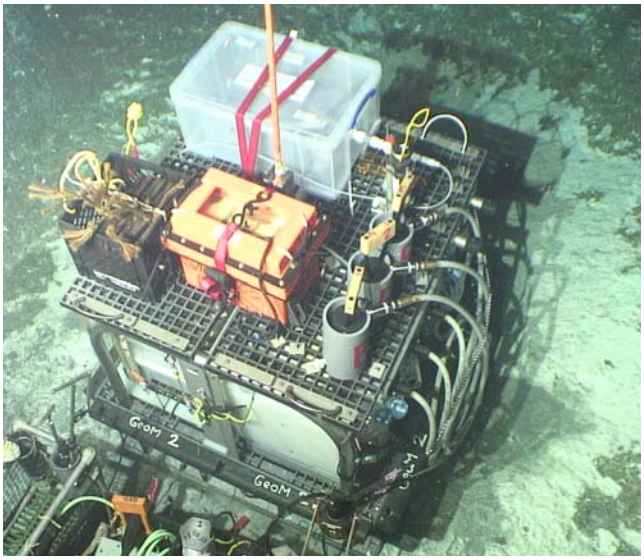
Time (GMT)	Hole	Event
16:40	n.a.	start dive
17:42	2657m	Alvin on bottom
18:00	sled	Found sled ~215 N from drop target at Hole U1362A
18:13	sled	pitched 5-7 weights off sled, too light
18:39	U1362A	At wellhead, lots of shimmering water
18:49	U1362A	temperature measurements in open hole at top of CORK, max temp 61.1C)
18:52	U1362A	squeezer #4 fired in open hole at top of CORK
18:53	U1362A	squeezer #1 fired in open hole at top of CORK
18:55	U1362A	squeezer #5 (red) fired in open hole at top of CORK
18:56	U1362A	squeezer #2 fired in open hole at top of CORK
18:57	U1362A	squeezer #3 fired in open hole at top of CORK
18:58	U1362A	squeezer #6 fired in basket, background seawater
19:17	U1362A	Placing top plug in open hole, not seated, still leaking, placed dive weights on top
19:23	U1362A	attempting wrench tool, not going well
19:32	U1362A	couldn't get wrench to work, so turned nuts with manipulator
19:36	U1362A	cleaning parts for GeoMICROBE sled
19:49	U1362A	GeoMICROBE sled moved to CORK
19:55	U1362A	(need to pull pin everything)

20:05	U1362A	added 2 alvin weights to sled
20:45	U1362A	bioline connection made but would not turn, flow valve turned 90deg
20:53	U1362A	chem1 line connection made (using line3 on sled)
21:06	U1362A	chem3 line connection made (using line2 on sled)
21:12	U1362A	ODI for sled plugged in (not easy)
21:37	U1362A	finished communicating with GeoMICROBE sled, pulled the ODI, begin transit to 1026B
21:47	1026B	arrived at 1026B
21:53	1026B	turned valves below OsmoSamplers to horizontal
22:08	1026B	removed two OsmoSampler plates
		View Temp logger and cable

After the dive we deployed the plasma line at 1362B (see 8/14/14). It took 1.5 hours.

Image of the basket before the dive and the two OsmoSampler plates that were recovered from 1026B. Below is the top plug and Otis tool getting deployed in 1362A and the GeoMICROBE sled near 1362A.





Thursday August 14, 2014

We started the day with a PIT dive. The general order of operations was to conduct a pressure download at 1362B, recover the red OsmoSampler system from the wellhead, and attach the plasma line to the top plug at 1362B. Again we had to disengage the two nuts on the wellhead (3-3/4 turns CW to release the dogs).

We recovered the Red OsmoSampler system from the wellhead at 1362B and deployed the pulling tool, which was attached to the plasma line, to 1362B.

Dive 4753 Scientists: Katie Pilot: Bob and Jefferson (PIT)

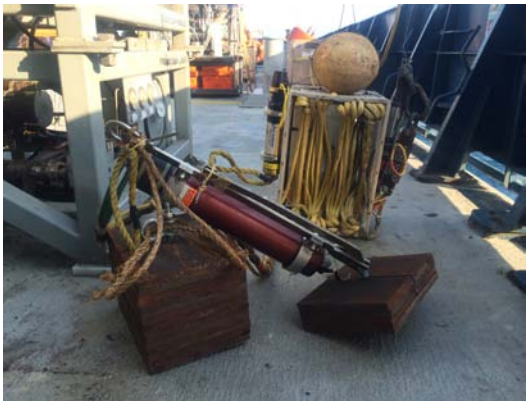
Basket:

Toilet brushes (2)
Wrench for nuts on wellhead
Low temperature probe
ODI connector for Pressure
Knife
Otis tool for 1301A (not used)

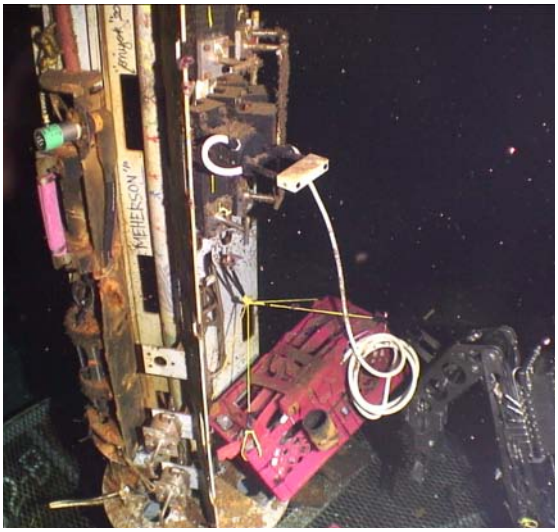
Time (GMT)	Hole	Event
		floats 33m 180deg from wellhead
16:56	n.a.	on bottom, 2658m
17:26	U1362B	at wellhead
17:49	U1362B	ODI attached to pressure bay
17:58	U1362B	starting download
18:23	U1362B	ending download, 7F94 LBA, 32661 Blks, clock 87,273 second behind, HP mini clock correct
18:26	U1362B	clock sync, memory clear
18:32	U1362B	disconnect ODI
18:36	U1362B	move to Chem bay, observe shimmering from outflow of Red OsmoSampler
18:48	U1362B	measuring temperature in outflow of red OsmoSampler, max temp 24.3C
19:02	U1362B	closed valve for Red OsmoSampler
19:05	U1362B	transferred Red OsmoSampler to basket
19:27	U1362B	raised to top plug, turning first nut 3 turns, hit stop, move to other nut
19:49	U1362B	turned 2nd nut
20:00	U1362B	cleaning top plug
20:04	U1362B	transit to milkcrate with latch assembly
20:06	U1362B	found milkcrate
20:26	U1362B	pitched two plates from milkcrate assembly
20:35	U1362B	returned to package
20:56	U1362B	drop weight released from milk crate package
21:12	U1362B	transiting back to wellhead with milkcrate package
21:15	U1362B	set down milkcrate package

21:36	U1362B	top plug latch in manipulator
21:55	U1362B	latched into top plug, checked
22:27	U1362B	4 weight stacks released
22:34	U1362B	line vertical off wellhead

After the dive we recovered the plasma line and the downhole OsmoSampler system from 1362B. We started at 0830 and ended at 00:15. Much of the downhole line was spooled directly on the winch, saving hours of time, instead of using Yale grips. Note that more dive weights were added to the seafloor portion of the plasma line. We used 13 plates for the descent weight and 4 plates to keep the package on the seafloor but moveable.



Images of the bottom portion of the plasma line system and the basket before the dive. Below is an image of the red OsmoSampler system on the wellhead at 1362B.



Friday August 15, 2014

We started the day with a successful dive. The general order of operations was to check the top plug at 1362A, release the GeoMICROBE sled, deploy the virus sampler, drive to 1362B, collect fluids and measure the temperature from the top of the wellhead, deploy the plug, transit to 1026B and disconnect the ODI connector to the thermistor cable. Again we had to engage the two nuts on the wellhead (3-3/4 turns CCW to latch the dogs).

We deployed the top plug at 1362B and a virus sampler at 1362A. We recovered 8 fluid samples from 1362B and the GeoMICROBE Sled from 1362A.

Dive 4754 Scientists: Sean and Gus Pilot: Phil

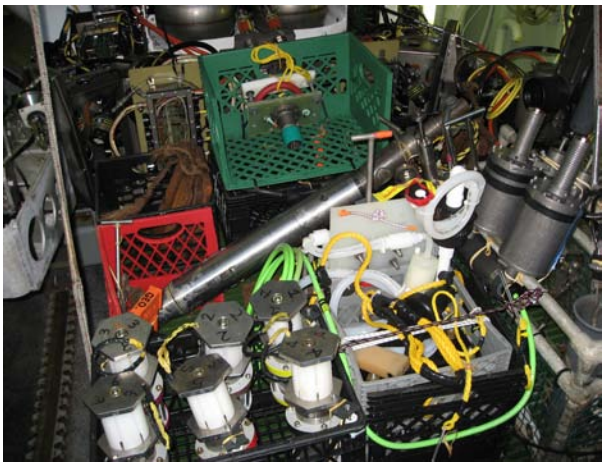
Basket:

Toilet brushes (2)
Wrench for nuts on wellhead
Low temperature probe
ODI connector for Pressure
Knife
Gas-tight (1)
Double Major Titanium Sampler (1)
Squeezer Syringe Samplers (6)
Otis tool and top plug for 1362B
4 dive weight bundle for top plug
virus sampler

Time (GMT)	Hole	Event
15:06		In water
16:55		Seafloor (2654m)
17:01	U1362A	arrival at wellhead
17:02	U1362A	Checking bags on GeoMicrobe sled, full
17:10	U1362A	Top plug checked (not leaking)
17:27	U1362A	Unplugged GeoMICROBE sled
17:28	U1362A	Closed valves in MBIO bay
17:54	U1362A	Pulling sled off wellhead
17:56	U1362A	decision to allow lines for ascent
17:59	U1362A	Sled floating away
18:26	U1362A	back to seafloor w/ sled
19:11	U1362A	GeoMICROBE sled release
19:24	U1362A	Back at wellhead
19:33	U1362A	Bungee release on Virus Sampler
19:45	U1362A	Viral sample line purging (10min)
19:48	U1362A	Measure temperature on Virus Sampler outflow, Max temp 27.0C
19:54	U1362A	Begin Viral Sampling

19:59	U1362A	Transit to U1362B
20:19	U1362B	Arrive at wellhead
20:23	U1362B	Fluid sampling from top of open hole with Gas tights
20:26	U1362B	Fluid sampling from top of open hole with Majors
20:30	U1362B	Fluid sampling from top of open hole with Squeezers (yellow, black, tan, red, purple, white. White failed)
20:42	U1362B	measure temperature in open hole, max temp 62.5C
20:45	U1362B	Insert top plug attached to Otis tool, difficult
21:01	U1362B	Finally plugged into the borehole
21:03	U1362B	Otis tool detached
21:05	U1362B	Place weight stack over top plug
21:16	U1362B	Turn both bolts 4X CCW to engage dogs
21:32	U1362B	Seal verificatied
21:33	U1362B	Departed for 1026B
21:59	1026B	Arrival at wellhead
22:01	1026B	Visual of Top of CORK 1026B
22:04	1026B	Pulled top cable out
22:07	1026B	Finally disconnected
22:18	1026B	Plug rested on CORK platform
22:19	1026B	Verifiation of Neptune Canada Cable position, lines going NW from wellhead
22:48	1026B	off bottom

After dinner we deployed the plasma line at 1026B. It took 1.5 hours. The configuration was identical to that described on 8/14/14.



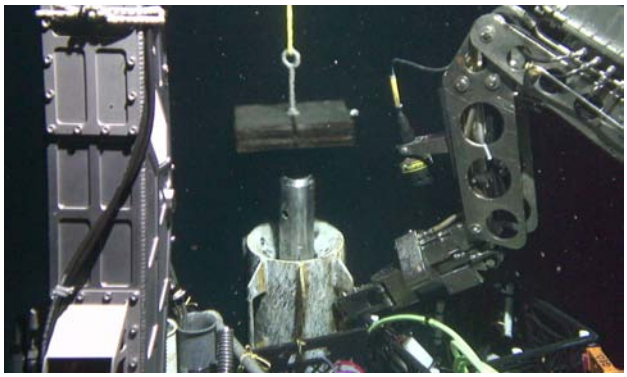
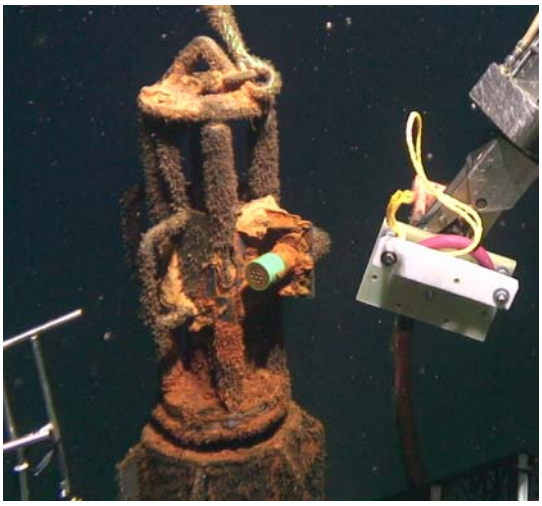
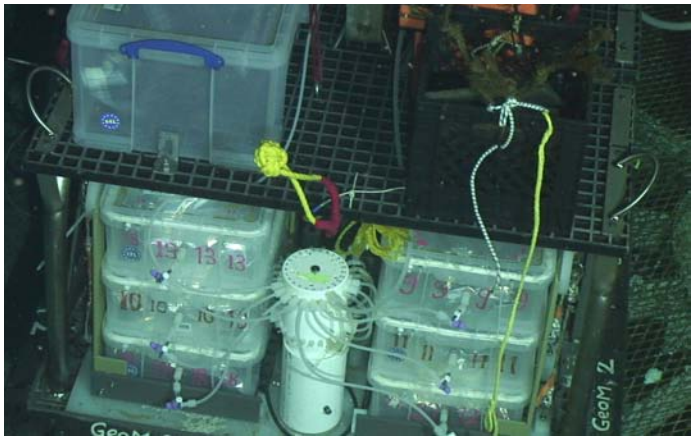


Image of the basket before the dive and the top plug just before the weight stack was added. The four-Alvin weights lowered the top plug in place, then the nuts on the side of the wellhead were engaged to lock it in place and seal the borehole.





Images of the 1026B wellhead and the ODI connector mated with the dummy connector before it was placed on the ROV platform and sample trays in the GeoMICROBE sled.

Saturday August 16, 2014

We started the day with a deployment of the GeoMICROBE sled at 1362B (06:00). After breakfast we started the dive at 1026B. The general order of operations was to connect the plasma line to the bail at 1026B, transit to 1362B and hook up the GeoMICROBE sled to two of the umbilicals, transit to 1301A, remove the top plug, and recover 3 OsmoSampler plates

We deployed GeoMICROBE sled at 1362B and the plasma line with a hook at 1026B. We recovered 3 OsmoSampler Plates and the top plug from 1301A.

Dive 4755 Scientists: Tina and Oliver Pilot: Pat

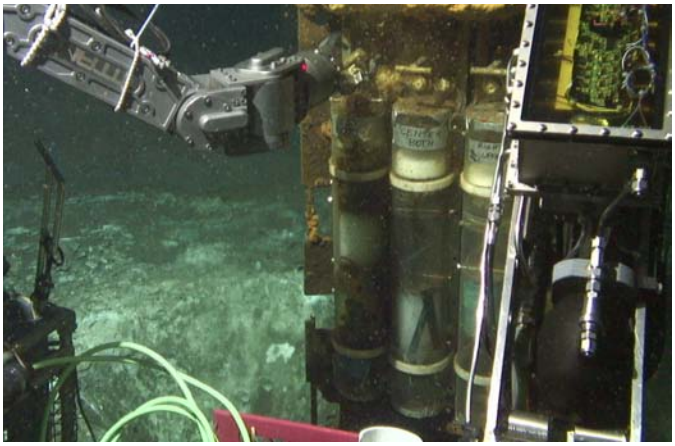
Basket:

Toilet brushes (2)
Otis tool for 1301A
Low temperature probe
ODI connector for GeoMICROBE sled
Knife

Time (GMT)	Hole	Event
16:45		alvin in the water
18:17		on bottom
18:22	1026B	both plasma line and sled on sonar, line in sight
18:25	1026B	grab plasma line with manipulator
18:31	1026B	move plasma line to 1026B CORK
18:33	1026B	arrive at wellhead
18:41	1026B	sediment cloud
18:50	1026B	waiting for sediment cloud to move
18:54	1026B	move to get line from package, sub having issues going up and down
18:57	1026B	holding pin on milkcrate
18:59	1026B	holding shackle on milkcrate, try to connect latching tool to top plug
19:07	1026B	pull pin from shackle (hooray!!)
19:12	1026B	pulling line up to release weight
19:17	1026B	pin pulled
19:19	1026B	check that line is straight over CORK
19:25	1026B	transit to get sled
19:39	U1362B	at sled, dropping a "hang" weight and wait for sediment cloud to disperse
19:50	U1362B	drop another hang weight off sled
19:52	U1362B	transit to wellhead
20:09	U1362B	arrival at wellhead
20:12	U1362B	parking sled on U1362B
20:13	U1362B	inspect chem bay
20:18	U1362B	inspect mbio bay

20:22	U1362B	clean MBIo bay valves with toilet brush
20:30	U1362B	got stuck on umbilical from sled, remove a T-handle from A.bas
20:34	U1362B	pick up bioline Jannasch connector from sled
20:39	U1362B	attempt to turn bioline connector to "lock" position, not accomplished
20:47	U1362B	turn chemistry/steel line to "lock" position
20:53	U1362B	valves opened
21:00	U1362B	Connecting ODI to sled for communications
21:06	U1362B	ODI connected to ODI1 on sled
21:10	U1362B	disconnect ODI
21:12	U1362B	ODI conencted to ODI2 on sled
21:16	U1362B	disconnect ODI
21:18	U1362B	transit to U1301A
21:43	U1301A	arrival at wellhead, observing top of CORK
21:47	U1301A	insert Otis tool into top plug
21:52	U1301A	top plug pulled out
21:54	U1301A	drive away to drop dive weight from Alvin
21:58	U1301A	back at wellhead
22:00	U1301A	at Chem bay
22:04	U1301A	remove OsmoSampler plates (3x)
22:11	U1301A	Alvin off bottom

After dinner we recovered the plasma line from 1026B. We started at 18:30 and finished at 00:10. Once the data logger was in hand, we pulled the string up using the spectra strength member directly on the winch. We peeled off the thermistor cable and the other strength member until we got to the OsmoSamplers and the little sinker bar at the bottom.



Images of the basket before deployment and the three OsmoSampler plates that were recovered from 1301A.

Sunday August 17, 2014

We started the day with an engineering dive near 1027C. The general order of operations was to deploy the new pressure logger at 1027C and recover the old one, conduct engineering tests, and collect 9 push cores.

We deployed a pressure logger at 1027C. We recovered a pressure logger from 1027C and 9 push cores that were ~100 m from 1027C.

Dive 4756 Scientists: Rick and Josh (PIT) Pilot: Bob

Basket:

Push cores (9)
Pressure logger for 1027C
Engineering materials

After the dive we took the night off.

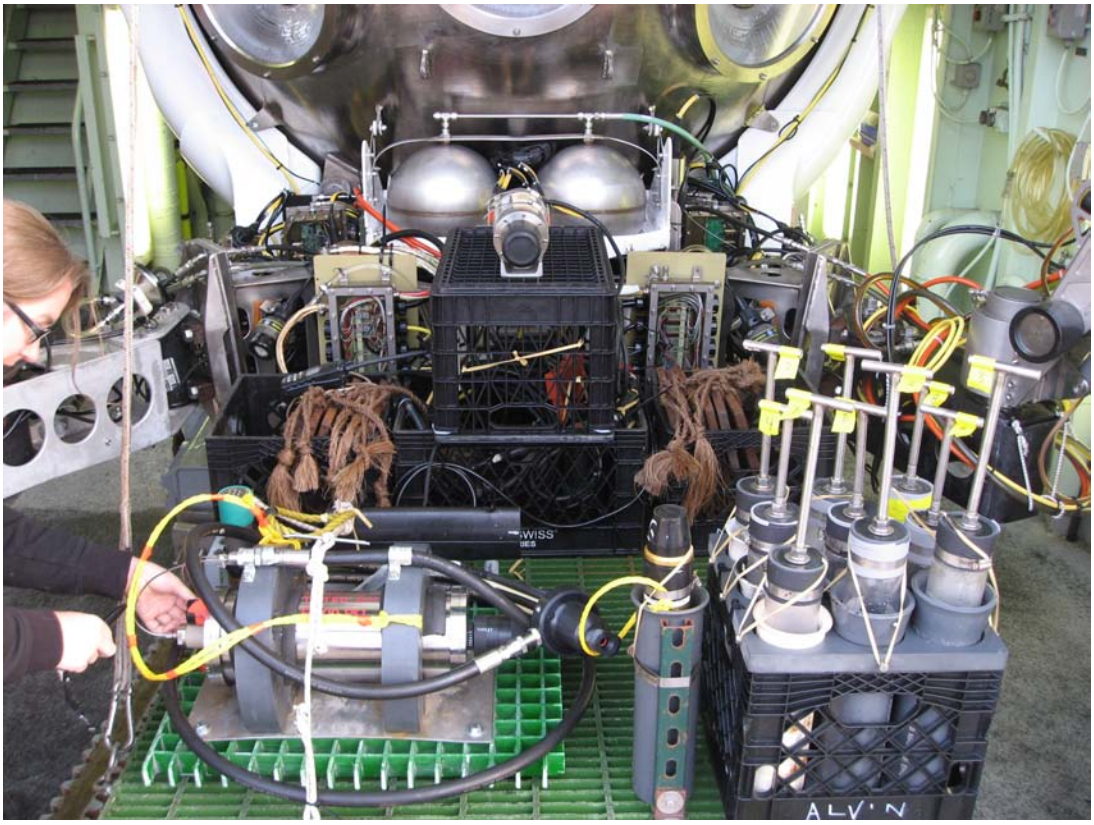
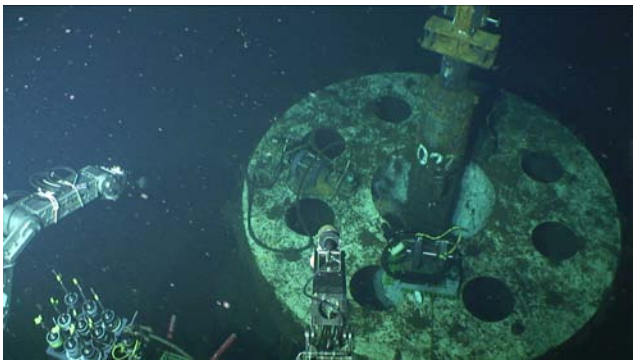


Image of the basket before the dive.

Push Core arrangement on the seafloor



Old logger disconnected on a previous dive at 1027C.

The new logger is connected to wellhead.

Monday August 18, 2014

The weather picked up and canceled our dive. There were no operations during the day. We used the time to process samples that were collected on previous dives and to prepare new OsmoSampler systems for deployment.

Tuesday August 19, 2014

We started the day with a dive at 1301A. The general order of operations was to deploy the fishing tool down the hole, recover pressure data, and then to go to 1362A to pump more fluids and to recover the GeoMICROBE sled. There was a problem when deploying the fishing tool. It only went down the hole 70 m. It should have gone down further! Thus 200 m of line was up and out of the hole. Another problem was that we were unable to download pressure data from 1301A. It turned out to be a faulty wire in the ODI connector. This connector was fixed Tuesday evening and tested.

We deployed the fishing tool. We recovered the GeoMICROBE sled.

Dive 4757 Scientists: Keir and Everett Pilot: Phil

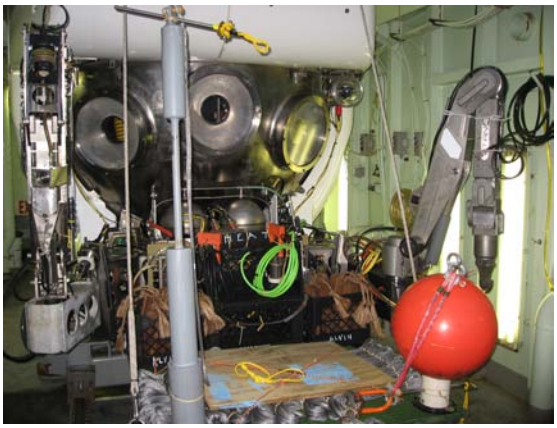
Basket:

270 m of spectra line, 28 lb float and Pettigrew fishing tool
ODI for pressure and GeoMICROBE

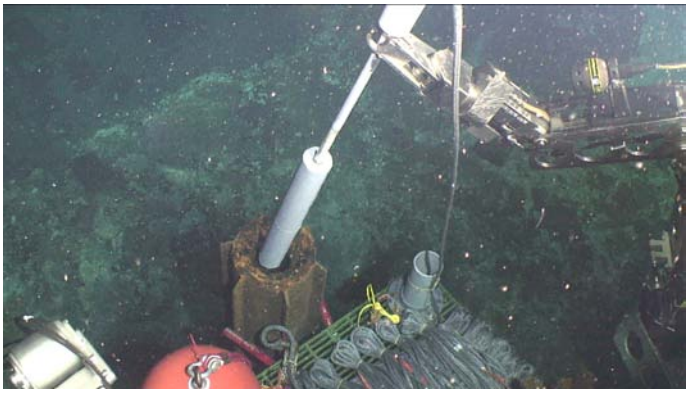
Time (GMT)	Hole	Event
16:45		on bottom, two sonar targets
16:54	U1301A	at wellhead
17:03	U1301A	plywood cover over ropes dumped, fishing tool into top of hole
17:10	U1301A	ropes releasing from basket
17:22	U1301A	mate ODI - unit on logger loose?
17:30	U1301A	attempt to start download, no comms, reseat ODI, retry several times, no luck
17:50	U1301A	give up comms with logger, remove ODI
17:52	U1301A	pull pin to release fishing tool into hole, first 60m descended at good rate
	U1301A	slowed then stopped after 210m mark (from top of rope = 60m up form bottom)
18:02	U1301A	grab rope with intent of driving up 30-40m and re-releasing fishing tool
18:18	U1301A	driving up, only got 4m up at full vertical thrusters (150 lbs pull)
18:25	U1301A	pull up rope at top of wellhead and release, multiple times
	U1301A	got a few more meters in but no more
18:32	U1301A	drive up rope to find next mark, got to 190m mark with sub up 8m = 72m rope in hole, 198m up to float
18:35	U1301A	head to U1362A for GeoMICROBE sled work
19:11	U1362A	at wellhead, but there is no sled (wrong hole)
19:15	U1362A	head to U1362B
19:30	U1362B	at wellhead, with sled
19:54	U1362B	mated sled ODI to #1, no comms
20:09	U1362B	in-hull CPC connector mated, now good comms
20:12	U1362B	switch to sled ODI #2
	U1362B	top lab called down to say that operations need to be finished by

		20:30
20:34	U1362B	first sled coupler disconnected from wellhead
20:36	U1362B	second coupler off wellhead
20:39	U1362B	moving sled off wellhead
20:43	U1362B	sled released to surface
20:45	U1362B	head back to U1301A
21:00	U1301A	at wellhead
21:00	U1301A	repeated attempts over next hour fifteen to work rope with no success
22:15	U1301A	inspect pressure logger in case it needs to be pulled off
	U1301A	swtiched top valve to prepare to pull logger off, then decided against it and returned position
22:20	U1301A	end of dive, dropped 3 weights

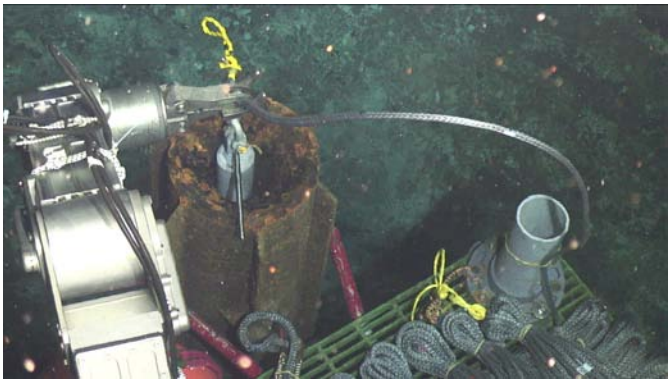
Tuesday evening we deployed the plasma line. We used only one weight because the plan was to not move it on the seafloor. We landed the line about 25 m from the wellhead with a target of 15 m south of the wellhead. This line only had the homer (no Transponder), because the transponder was acting up and they needed the good transponder for the GeoMICROBE sled, which drifts about 300-500 m from the drop point, whereas the plasma line appears to drop directly below the boom and has been within 15-30 m of the wellhead.



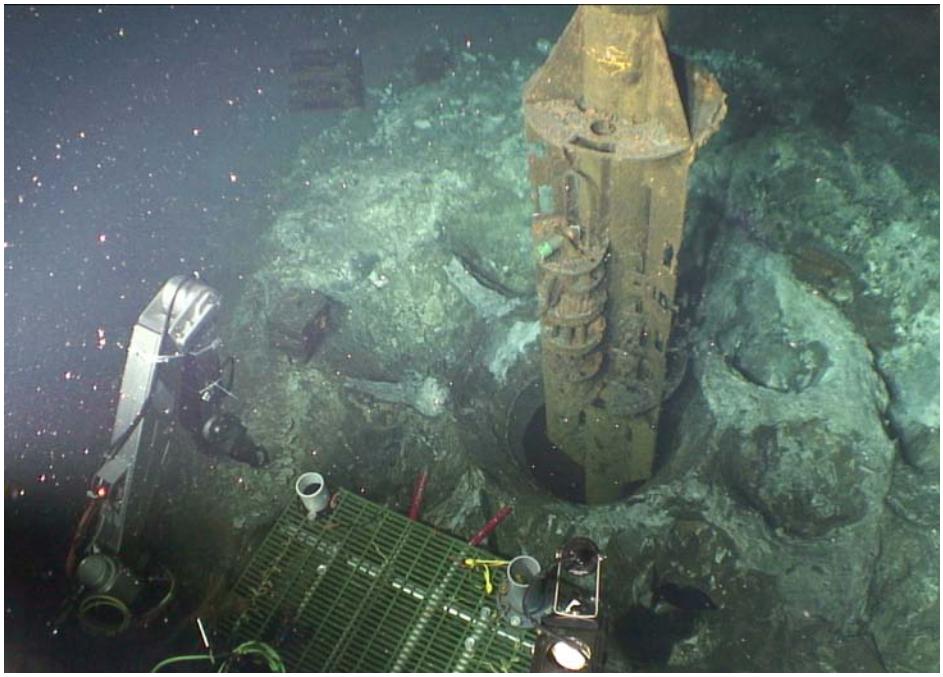
The basket before the dive. The fishing tool was developed by Tom Pettigrew for use in 1301A and 395A. The tool has numerous barbs and a sliding cover that helps to keep the line from coming off during retrieval. The pulling tool was attached to 270 m of 3/8" spectra and a 28 lb float. Operationally, the plywood covering the rope was released then the fishing tool was placed in the well and kept in place with a pull pin. Then the float was released and the line spooled out over the fishing tool in the hole. Finally the pin was removed and the fishing tool descended into the hole. It descended 70 m and became "stuck". Pulling on the rope did not get it released.



Fishing tool going into the hole.



Fishing tool in the hole.



1301A prior to download attempt

Wednesday August 20, 2014

We started the day with a dive at 1362B. The general order of operations was to deploy the yellow OsmoSampler package (gas (4 membrane, 2 coils), standard (4 membranes (2 coils), and a BOSS (4 and 2 membrane and 4 coils) at 1362B, then ascend the fishing tool line at 1301A and connect a 15-lb float. This float was allowed to move along the line and was designed so that the line was always up and out of the way when we brought the top float down to the seafloor where it was connected to the plasma line. The plasma line only had 50 m of scope so it could not be flown up to the fishing tool line (in addition, to fly this line up one would have to fight the surface currents and waves). Thus, when the fishing tool line was brought down to the plasma line and clipped in. The basket on the plasma line was moving back and forth, affected by surface waves and currents. The connection was made, weights were released, and the package floated up. We then moved to 1301A to download pressure data.

The sub was deployed at 11:30 am because of a weather delay.

We deployed the yellow OsmoSampler crate at 1362B and a float that was attached to the fishing line at 1301A. We recovered pressure data from 1301A.

Dive 4758 Scientists: Geoff and Sarah Pilot: Pat

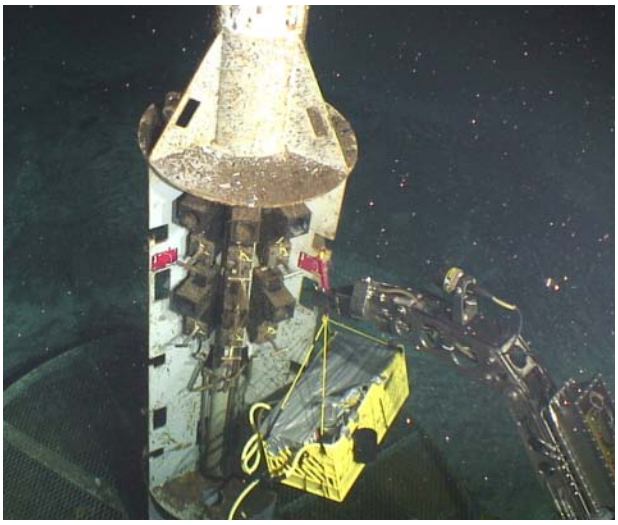
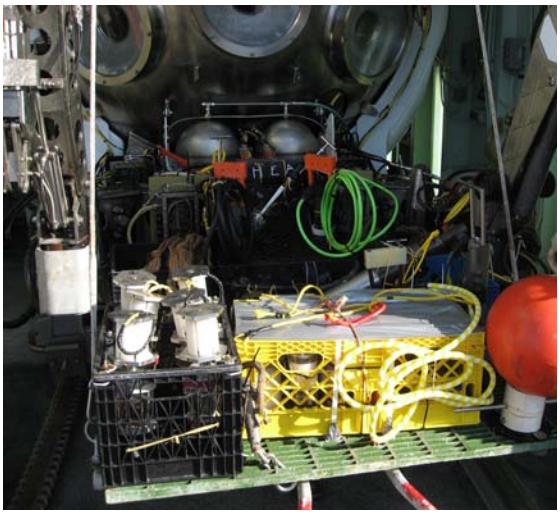
Basket:

Float (15 lbs buoyancy)
Squeezer syringe samplers (6)
Toilet brushes (2)
Otis tool and top plug for 1026B
Low temperature probe
ODI connectors for GeoMICROBE sled and Pressure
Knife
Yellow OsmoSampler (two milk crates bundled together)
Stack of 4 dive weights for top plug at 1026B

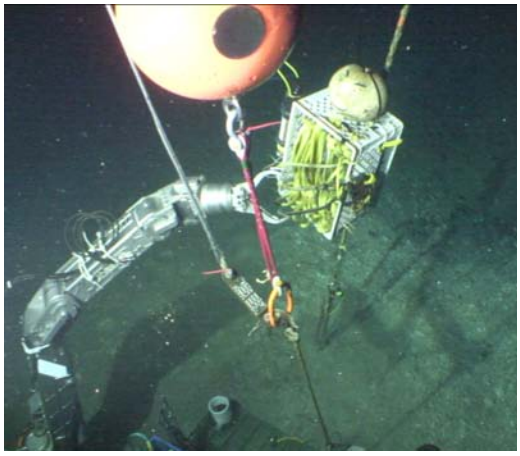
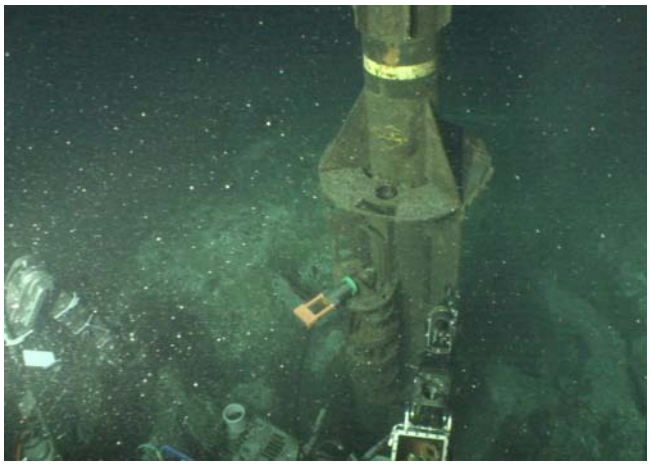
Time (GMT)	Hole	Event
20:00		trim ballast
20:03		on bottom 2658m
20:008	U1362B	at wellhead
20:13	U1362B	Yellow OsmoSampler basket hung on wellhead
20:21	U1362B	Jannasch connector for Yellow OsmoSampler connected to valve (Upper 1) and opened
20:47		transited to milk crate with plasma line near 1301A
20:50	U1301A	at wellhead
20:52	U1301A	going up the 270-m-long line with fishing tool and float attached
21:14	U1301A	at D-ring on line
21:16	U1301A	extra float is attached (2461m) below the D-ring

21:45	U1301A	back down at wellhead, have rope from top of fishing tool
21:51	U1301A	at 2659m -transiting over to the plasma line
21:57	U1301A	attached the fishing line to the plasma line and plasma line in the milk crate is coming out
21:57	U1301A	one weight released from the plasma line and the entire system is going up
	U1301A	download data from pressure logger
22:34	U1301A	leaving site to drop weights
22:35	U1301A	off bottom

Wednesday night we recovered the plasma line and fishing tool. The plasma line has 2871 m of rope on it. Thus, in 2660 m of water there is 210 m of scope. This means that the floats are about 900 to 950 m from the wellhead when they are picked up. Then we have to move the ship while taking in slack without pulling too much (start with a maximum of 200 lbs and increase it to 300 lbs as we get within 400 m of the wellhead). This process takes about 2 to 3 hours because we have to watch the wire angle. Then once we are within 25 to 50 m of the wellhead we start pulling at 5 m per minute until weight is released. We pull at 6 m/min until the package is out of the well and then at 30-40 m/min once it is in the water column. All three prior pulls had a maximum pull of 1100 lbs and a minimum of 500 lbs. Essentially none of the systems were stuck and held in place with gravity as designed. However, on this night since we had the 210 m of scope in the plasma line and 200 m of rope from the fishing tool. As a result we were 1400 m from the wellhead when we picked up the surface floats. It took 3 hours to get over the top of the wellhead. We began to pull and tension went to 5000 lbs. We cycled back and forth from 5000 to 0 and on the 4th try the weight was released at 6200 lbs and we pulled up the line. There was essentially no weight on the line 0-200 lbs during the retrieval of the line. We recovered the plasma line and all parts of the fishing tool. The shock of the pull must have been too much for the floats in the milk crate (plasma line) because they did not return. We recovered some rope in the fishing tool. It was clear that the top part of the rope (the piece that was broken last year) was stretched and flattened like it was between the middle sinker bar and a wall. The other end was stretched apart. Apparently, spectra rope loses some of its strength at higher temperatures. This spectra rope was exposed to 65°C for 4 yeas and parted at a pulling force that was way below the published breaking strength. On the basis of the Jason dives last year, we thought that the bottom plug reseated because we did not see any shimmering water when we returned to plug the hole. Given the depth of the plasma line that was recovered it is clear that the bottom plug was NOT seated. It must have been in the casing. Currently 1301A has a section of spectra at 70 m below the seafloor and the OsmoSampler string and 50-lb sinkerbar are somewhere in the casing.

Images of the Alvin basket before the dive and the Yellow milkcrate with OsmoSamplers deployed on 1362B.

Images of the fishing line being attached to the plasma line and pressure download at 1301A.

Thursday August 21, 2014

We started the day with by deploying the GeoMICROBE Sled at 1362A. The goal of the dive was to find and move the sled to 1362A, then deployed the Black OsmoSampler (two milk crates with a Standard (4 membrane and 2 coils) a Gas (4 membrane and 2 coils), and a BOSS (4 membrane, 2 membrane, and 4 coils). The Black OsmoSampler was moved so that the virus sampler could be recovered. Then the GeoMicrobe sled was hooked up to the wellhead. While the sled was pumping they went to 1026B to collect 6 squeezer samples. Because of a low battery they did not have enough power to deploy the top plug and return to 1362A to release the sled. When they returned to the sled, the bags were not full and they elected to keep the sampler on the seafloor to pump additional fluids overnight.

We deployed the black OsmoSampler crate and GeoMICROBE sled at 1362A. We recovered 6 fluid samples from 1026B.

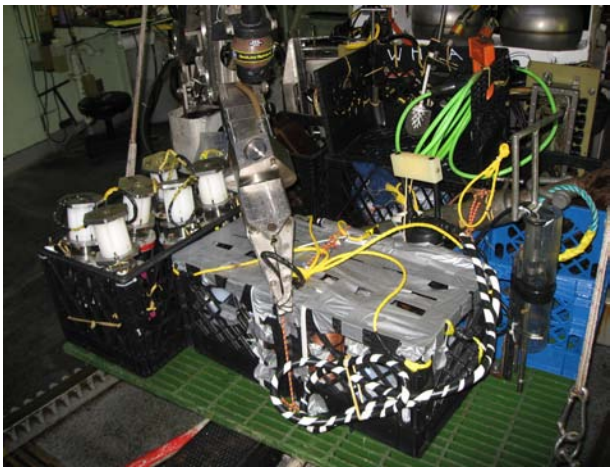
Dive 4759 Scientists: Oliver Pilot: Bob, Jefferson (PIT)

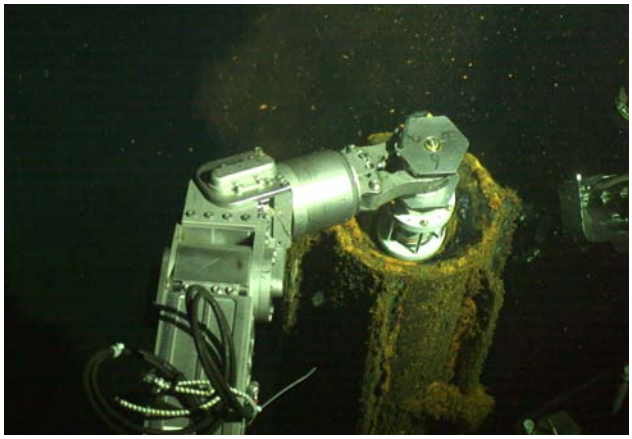
Basket:

Low temperature probe
ODI for GeoMICROBE sled and Pressure
Microbial swabs (2)
Push cores for Microbial swabs (2)
Squeezer syringe samplers (6)
Toilet brushes (2)
Otis tool and top plug for 1026B
Low temperature probe
Knife
Black OsmoSampler (two milk crates bundled together)
Stack of 4 dive weights for top plug at 1026B

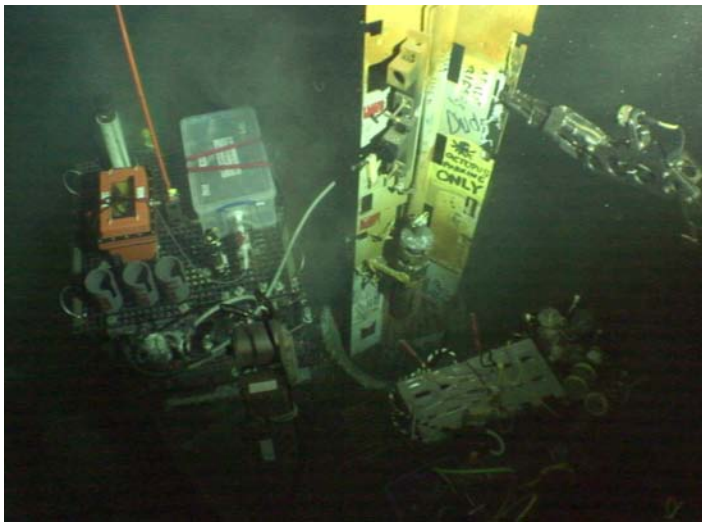
Time (GMT)	Hole	Event
17:48	U1362A	find sled
18:42	U1362A	virus sampler disconnected from Bioline
20:33	1026B	collect squeeze samples from open hole
21:21	U1362A	Deploy Black OsmoSampler in Chem Bay valve #1
21:39	U1362A	put virus sampler on Alvin basket

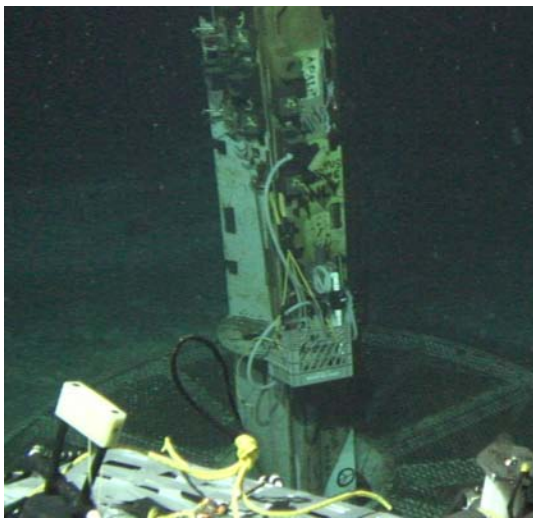
After dinner we conducted a hydrocast about 1 km west of 1362A. All of the bottles were tripped at 10 m above the bottom.





Images of the basket before the dive and collecting fluids using the Squeezer Samplers at 1026B.





Images of the GeoMICROBE sled and the virus sampler connected to the wellhead at 1362A.

Friday August 22, 2014

We started the day with a dive at 1362A. The general order of operations was to release the GeoMICROBE sled, measure the temperature at the outflow of the wellhead OsmoSampler, collect a swab for microbiology, survey the wellhead, move to 1362B to measure the temperature at the outflow of the wellhead OsmoSampler, collect a swab for microbiology, and survey the wellhead. Then they moved to 1026B to deploy the top plug and survey the wellhead. Finally they went to 1027C to download pressure data and survey the wellhead.

We deployed the top plug in 1026B and recovered GeoMICROBE sled from 1362A and pressure data from 1027C. Only one of the swabs was recovered.

Dive 4760 Scientists: Katie and Lance Pilot: Phil

Basket:

Low temperature probe
ODI for Pressure
Microbial swabs (2)
Push cores for Microbial swabs (2)
Toilet brushes (2)
Otis tool and top plug for 1026B
Low temperature probe
Knife
Stack of 4 dive weights for top plug at 1026B

Time (GMT)	Hole	Event
16:49		on bottom
16:55	U1362A	at wellhead
17:00	U1362A	closed valve to Bioline
17:04	U1362A	disconnected GeoMICROBE sled
17:06	U1362A	360 degree photos, mbio then pressure then chem ays
17:13	U1362A	moving sled away from wellhead
17:17	U1362A	sled released
17:20	U1362A	good shot of top plug with weights
17:26	U1362A	probing outflow of OsmoSampler w/ low temp probe
17:34	U1362A	max temp 12.9C, shimmering
17:40	U1362A	pick up biofilm swab #2
17:42	U1362A	collecting rust biofilm from mbio bay top
17:49	U1362A	no apparent shimmering from top plug
17:50	U1362A	heading to U1362B
18:15	U1362B	at wellhead
18:18	U1362B	view of shimmering from OsmoSampler
18:25	U1362B	max temp 13.9C
18:29	U1362B	pick up biofilm swab #1

18:32	U1362B	collecting rust biolfim from mbio bay top
18:39	U1362B	lost biofilm swab #1, too buoyant
18:48	U1362B	360 degree photos completed, checking top plug
18:52	U1362B	heading to 1026B
19:08	1026B	at wellhead
19:13	1026B	lifting plug from basket
19:14	1026B	top plug rotating in hole
19:24	1026B	Weights added to plug
19:25	1026B	latch tool removed
19:36	1026B	360 degree start
19:49	1026B	360 degree end, heading to 1027C
21:00	1027C	at wellhead
21:10	1027C	ODI on
21:19	1027C	start download
	1027C	download end, no memory clear, 632 Blks, no clock cync, LBA 277
21:25	1027C	ODI off, start 360 degree photos
21:36	1027C	moving away from wellhead
22:05	1027C	off bottom

No activities were conducted at night.

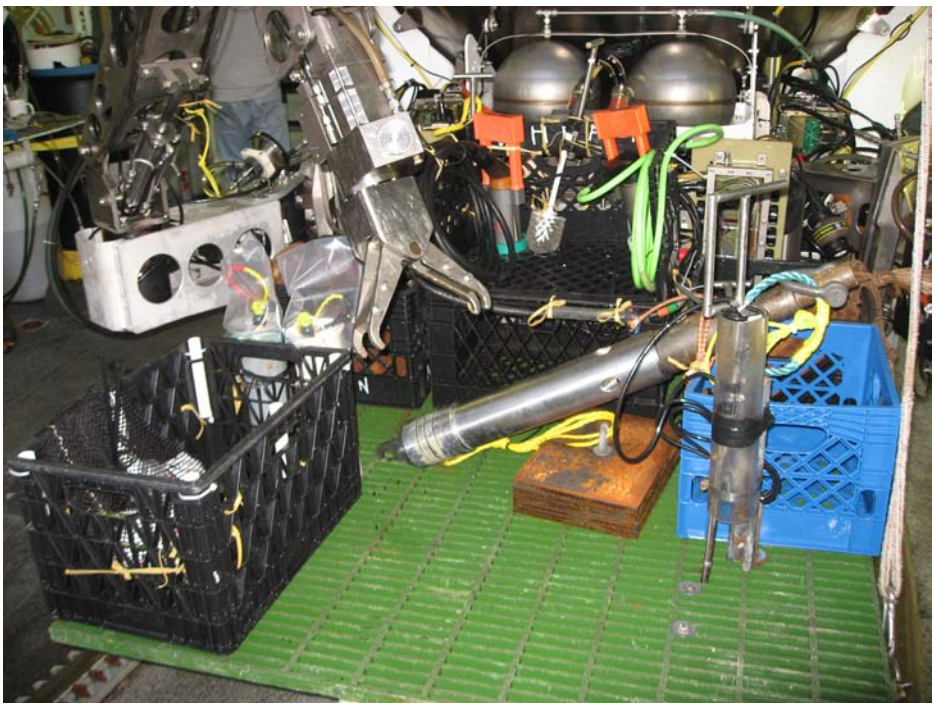
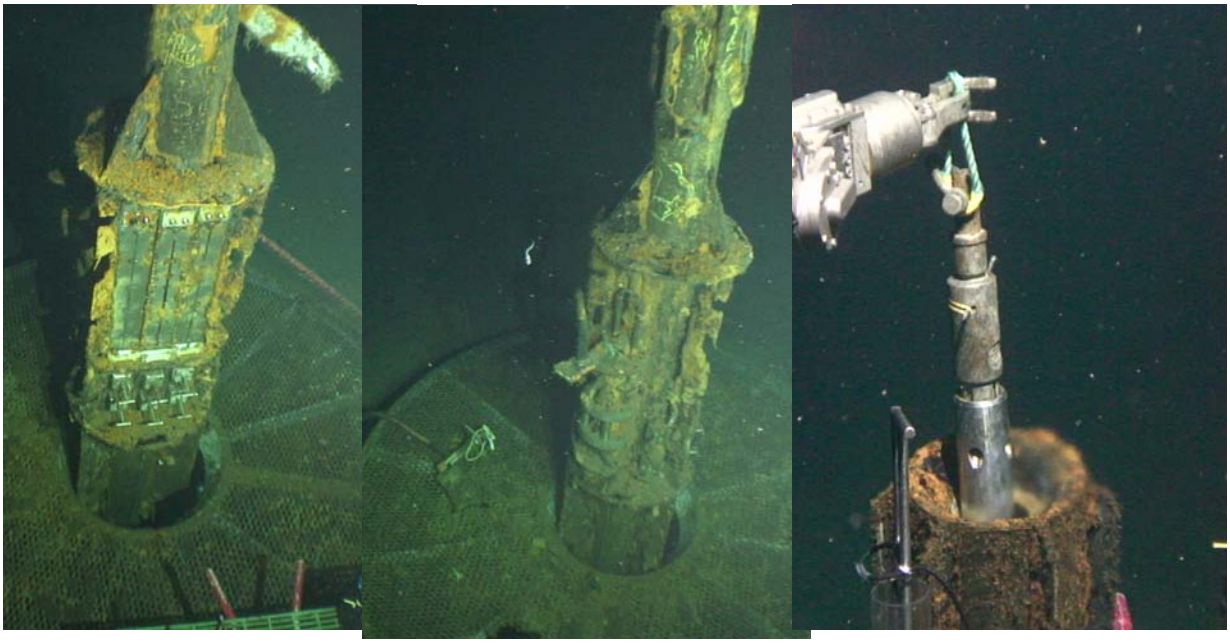
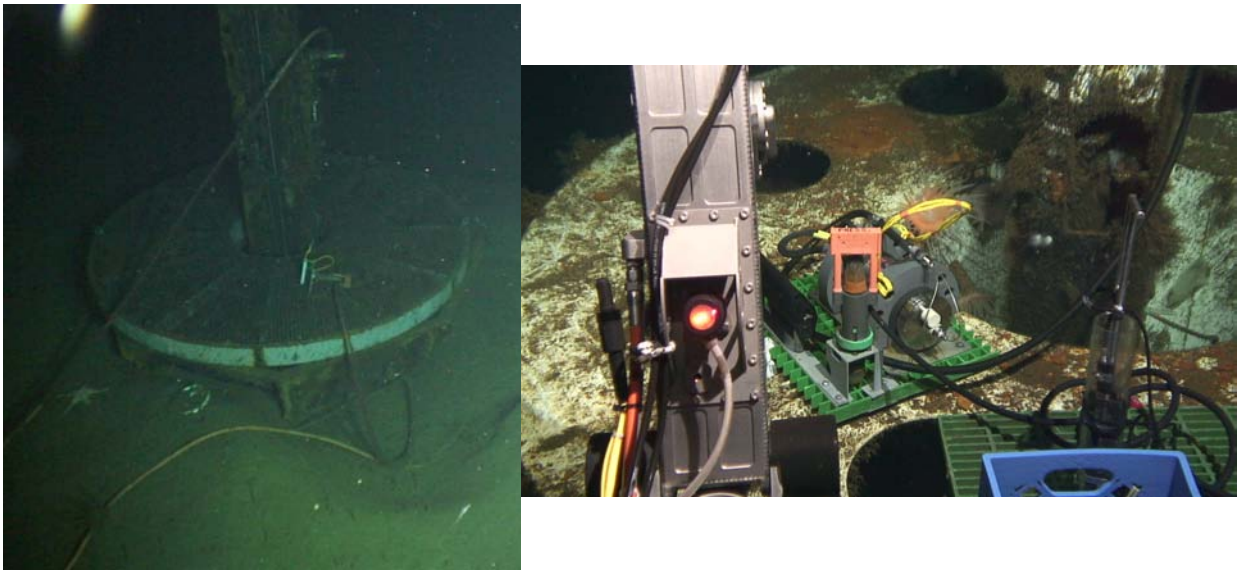


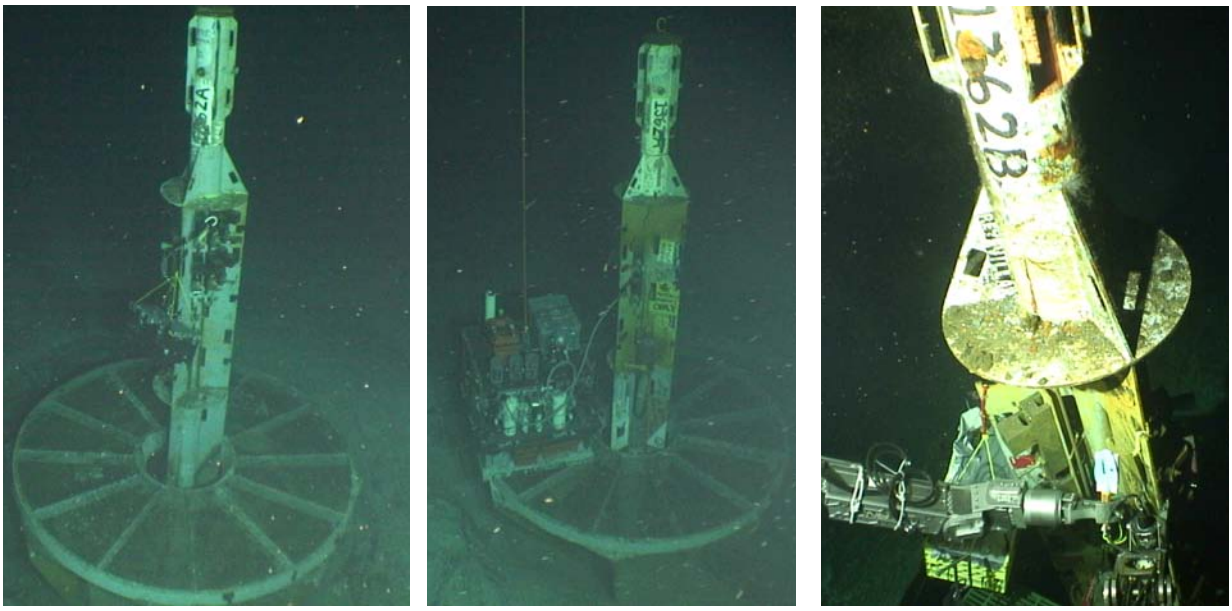
Image of basket before the dive.



Images of the chemical and pressure bays at 1026B and deployment of the top plug in 1026B.



Images of the cables at 1026B and pressure download at 1027C.



Images of 1362A with the Black OsmoSampler and GeoMICROBE sled and an image of collecting a bio-swab at 1362B.

Saturday August 23, 2014

The planned dive was canceled because of weather. We slowly steamed to the port of Astoria, which is about 180 miles away.

Sunday August 24, 2014

We offloaded our gear for shipment.

Monday August 25, 2014

We departed from the ship.

Table 1. Primary work sites for Summer 2014 with the R/V *Atlantis* and the submersible *Alvin* on AT26-18.

Location ID	Latitude	Longitude	Water depth (m)	Date installed	Expedition installed
CORK 1026B	47°45.759'N	127°45.552'W	2658	1996/2004	Leg 168/Exp. 301
CORK 1027C	47°45.387'N	127°43.867'W	2656	1996/2011	Leg 168/AT18-07
CORK 1301A	47°45.209'N	127°45.833'W	2658	2004	Exp. 301
CORK 1301B	47°45.229'N	127°45.826'W	2658	2004	Exp. 301
CORK 1362A	47°45.662'N	127°45.674'W	2658	2010	Exp. 327
CORK 1362B	47°45.499'N	127°45.733'W	2658	2010	Exp. 327

Table 2. Summary of tasks completed during the Summer 2014 expedition with the R/V *Atlantis* and the submersible *Alvin* on AT26-18.

Hole	Pressure	Wellhead OS	Downhole OS	Plugs	Fluid Sampling	GeoMICROBE sled
1026B	-----	4752	4755	4760	4759	-----
1027C	4751/56/ 60	-----	-----	-----	-----	-----
1301A	4758	4755	4758	-----	-----	-----
1301B	-----	-----	-----	-----	-----	-----
1362A shallow	4751	4750 Recovered 4751	4751	4752	4750/52	Deploy 4752, 59 Recover 4754, 60
1362A deep	4751	Deployed 4759	4751	4752	-----	Deploy 4752, recover 4754
1362B	4753	Recovered 4753 Deployed 4758	4753	4754	4754	Deploy 4755, Recover 4757

Table 3. Scientific staffing for AT26-18.

Number	Last name	First name	Institution	Role	Email
1	Wheat	Charles Geoffrey	UAF	Scientist	wheat@mbari.org
2	Fournier	Trevor	UAF	Grad	tfournier@csumb.edu
3	Inderbitzen	Katherine	UAF	Postdoc	kinderbitzen@alaska.edu
4	Hsieh	Chih-Chiang	U Hawaii	Grad	oliver.hakka@gmail.com
5	Jungbluth	Sean	U Hawaii	Grad	seanpj@hawaii.edu
6	Fisher	Andrew	UCSC	Scientist	afisher@ucsc.edu
7	Mura	Gavin	U Hawaii	Student	gmura@hawaii.edu
8	Johnson	Sarah	MLML	Student	Srj73@nau.edu
9	Orcutt	Beth	Bigelow	Scientist	borcutt@bigelow.org
10	Fitzgerald	Eric W.	MBARI	Engineer	efitzgerald@mbari.org
11	Ramirez	Gustavo	USC	Grad	garamire@usc.edu
12	Clark	Jordan	UCSB	Scientist	jfclark@geol.ucsb.edu
13	Becker	Keir	U Miami	Scientist	kbecker@rsmas.miami.edu
14	Lin	Huei-Ting	U Hawaii	Postdoc	hueiting@hawaii.edu
15	Rappé	Michael	U Hawaii	Scientist	rappe@hawaii.edu
16	Omori	Everett	U Hawaii	Technician	everetto@hawaii.edu

Table 4. Temperature loggers recovered from the flowmeter retrieved from 1362A.

Type/SN	Distance from end (cm)
Onset 768612	5
Onset 768613	15
Onset 768614	30
Onset 768615	80

Table 5. Temperature loggers recovered from the OsmoSampler string in 1362A.

Type/SN	Depth (msd)	Depth (mbsf)	Depth (msb)
Onset 768608	8.4	2.2	-233.8
Onset 768609	19.7	13.4	-222.6
Antares 1857021	227.2	220.9	-15.1
Antares 1857022	237.4	231.2	-4.8
Antares 1857023	294.9	288.6	52.6
Antares 1857024	305.1	298.8	62.8
Antares 1857027	344.1	337.9	101.9
Antares 1857028	380.0	373.8	137.8
Antares 1857031	415.9	409.7	173.7
Antares 1857025	OsmoSampler	438.6	202.6
Antares 1857026	OsmoSampler*	454.1	218.1

msd = meters Spectra depth, mbsf = meters below seafloor, msb = meters sub-basement
* In BOSS OsmoSampler assembly, will be recovered on shore.

Table 6. Temperature loggers recovered from the OsmoSampler string in 1362B.

Type/SN	Depth (msd)	Depth (mbsf)	Depth (msb)
Antares 1857034	9.0	2.9	-239.1
Antares 1857038	14.0	8.0	-234.0
Antares 1857039	20.0	14.2	-227.8
Antares 1857040	30.0	24.4	-217.6
Onset 768607	246.3	245.0	3.0
Onset 768610	273.8	273.0	31.0
Antares 1857035	OsmoSampler	301.4	59.4
Antares 1857037	OsmoSampler*	310.0	68.0

msd = meters Spectra depth, mbsf = meters below seafloor, msb = meters sub-basement
* In BOSS OsmoSampler assembly, will be recovered on shore.

Table 7. Pressure data files generated during AT26-18.

CORK	Files	Start	End	Comments	Processed/Units
1301A	14p1301a_1.raw 14p1301a_1.log 14p1301a_1.dbg 14p1301a_1.flg 14p1301a_1.err 14p1301a_1.spk 14p1301a_1.bin				
	14p1301a_1.dat	16-Jul-13 08:17:00	12-Aug-14 20:14:00	none	mldat9/kPa
1027C	14p1027c_1old.raw 14p1027c_1old.log 14p1027c_1old.dbg 14p1027c_1old.flg 14p1027c_1old.err 14p1027c_1old.spk 14p1027c_1old.bin			Old logger	
	14p1027c_1old.dat	17-Jul-13 10:03:00	18-Aug-14 01:56:00	SF gauge non-op	mldat9/kPa
1027C	14p1027c_2new.raw 14p1027c_2new.log			New logger	No calibration data, can't process
	14p1027c_2new.dbg	Unknown	Unknown		
1362A	14p1362a.raw 14p1362a.log 14p1362a.dbg 14p1362a.bin 14p1362a_fixed.bin 14p1362a.dmp 14p1362a_despiked.dmp				
	14p1362a_despiked.dat	16-Jul-13 08:17:00	14-Aug-14 16:42:00	none	dumpBin, calibrateLogfile/decibars
1362B	14p362b_1.raw 14p1362b_1.log 14p1362b_1.dbg 14p1362b_1.bin 14p1362b_1fixed.bin 14p1362b_1.dmp 14p1362b_1despiked.dmp				
	14p1362b_1despiked.dat	14-Jul-13 23:06:00	14-Aug-14 16:42:00	Clock sync error 7/23/13, need to add 1 hr after download	dumpBin, calibrateLogfile/decibars

Table 8. Summary of OsmoSamplers and salinity of DI pump reservoirs during AT26-18.

Hole/OS package	Interval	Dive recovered	Date	OS type	Pump DI salinity
U1362A Blue	Deep upper valve #1	4750	8/11/14	Blue Osmo	0
				Blue FLOCS	0
U1362A Black	free-flow chimney	4750	8/11/14	Black copper	0
				Black BOSS #1	0
				Black BOSS #2	0
				Black BOSS intake (regular)	0
U1362A Yellow	Shallow low valve #3	4751	8/12/14	Yellow Osmo	0
				Yellow Copper	48
				Yellow FLOCS	>160
				Yellow Enrich delivery	5
				Yellow Enrich	0
1026B plates	n.a.	4752	8/13/14	Plate copper	31
				Plate Osmo	0
U1362A downhole	downhole	n.a.	8/13/14	Regular Osmo	180
				Copper	OFF
				AA top pump	164
				AA pump 2ML4	96
				Enrich pump	64
				Enrich delivery 2ML4	97
				MBIO	70
U1362B downhole	downhole	n.a.	8/14/14	Regular Osmo	44
				Copper	32
				AA top pump	36
				AA pump 2ML4	37
				Enrich pump	130
				Enrich delivery 2ML4	70
				MBIO	82
U1362B Red	lower valve #1	4753	8/14/14	Red Osmo	0
				Red Copper	0

				Red FLOCS	0
				Red Enrich	0
				Red Enrich delivery	2?
U1301A plates	n.a.	4755	8/16/14	Regular	3
				Copper	7
				FLOCS	7
1026B downhole	downhole	n.a.	8/16/14	Standard	Off
				2nd standard	34
				Copper	35
				Upper FLOCS	no H2O?
				Lower FLOCS	34
				Fisk Upper Pump	off
				Fisk Lower Pump	5

Table 9. GeoMICROBE deployments during expedition AT26-18.

GeoMICROBE deployment	Deploy/recovery dives	Deploy/recovery dates	Borehole	FDL
1	4752/4754	13-15 Aug 2014	1362A	Bio (PTFE) Chem1 (ss) Chem3 (ss)
2	4755/4757	16-19 Aug 2014	1362B	Bio (PTFE) Chem (ss)
3	4759/4760	21-22 Aug 2014	1362A	Bio (PTFE)

Table 10. Summary of biological, chemical and particle tracer samples collected via the GeoMICROBE and associated instrumentation during expedition AT26-18.

Sample type	Characteristics	Purpose	Borehole	Quantity	Total fluid
Sterivex	Particles >0.2 um filtered in situ via GeoMICROBE	Nucleic acids	1362A 1362B	84 80	335 L 320 L
Sterivex	Particles >0.2 um from fluids collected via bag samplers on GeoMICROBE	Nucleic acids	1362A 1362B	18 9	165.7 L 50 L
Sterivex	Particles >0.2 um from seawater collected via CTD	Nucleic acids	n.a. (CTD)	2	47 L
Polycarbonate membrane	Particles >0.2 um filtered in situ via GeoMICROBE	Microscopy	1362A 1362B	3 2	9 L 6 L
Polycarbonate membrane	Particles >0.2 um from fluids collected via bag samplers on GeoMICROBE	Microscopy	1362A 1362B	33 16	3.1 L 1.4 L
Polycarbonate membrane	Particles >0.2 um from seawater collected via CTD	Microscopy	n.a. (CTD)	4	0.2 L
Cryovial	Cryopreserved aliquots of raw fluids collected via bag samplers on GeoMICROBE	Cell sorting/ cultivation	1362A 1362B	100 100	0.1 L 0.1 L
Raw water	Raw fluids collected via bag samplers on GeoMICROBE	Chemistry/enrichment culture/metabolic rate measurements	1362A 1362B	67 34	75 L 24 L
Viral concentrate	Particles between 0.2 um and 30 kD from fluids collected via bag samplers on GeoMICROBE	Viral analysis	1362A 1362B	6 3	136.5 L 40.5 L
Viral and microbial concentrate	Particles >0.2 um and between 0.2 um and 30 kD from fluids collected in situ	Viral and microbial analysis	1362A	1	10,500 L