Cruise: W0807A
Vessel: R/V Wecoma
Port: Yaquina Bay, Newport, Oregon
Captain: Rick Verlini
Chief Scientist: Anne Trehu
SIO Personnel: Paul Georgief, Ernest Aaron, Phil Thai
OSU Watch Stander: Mark Williams, Jochen Braunmiller
OSU Marine Tech's: Daryl Swensen, Jeremiah Cypert
Guest Technical Staff: Marc Ambros Ferrer
OBS Sample Rate: SP 3 channel/100Hz, LP 4 channel/100Hz
Cruise Dates: (07/01/08 – 07/06/08)
By: Ernest Aaron, SIO Development Technician

R/V WECOMA

I. Summary of Activities

In support of the Trehu Cruise W0807A, we made 14 total recoveries, and 6 new deployments of ocean bottom seismometers (OBS) off the coast of southern Oregon. Our research vessel was the Wecoma, employed between 07/01/2008 and 07/07/2008. The initial complement of seismometers included 11 short period LC4X4s and 3 long period LC4X4s, all from Scripps Institution of Oceanography (FIG-1 & FIG-2). We completed 14 successful LC4X4 OBS recoveries, and 6 LC4X4 deployments. One OBS (OBS03) was recovered with significant damage to the instrument. A trawl wire, or other fishing equipment likely struck it at the base, disconnecting the sensor cable and dislodging the run-plug. All data recovered during this cruise will be processed after correction for linear clock drift between offsets to GPS time at the start and end of each deployment. These data will be duplicated for security and a copy will be given to the chief scientist.

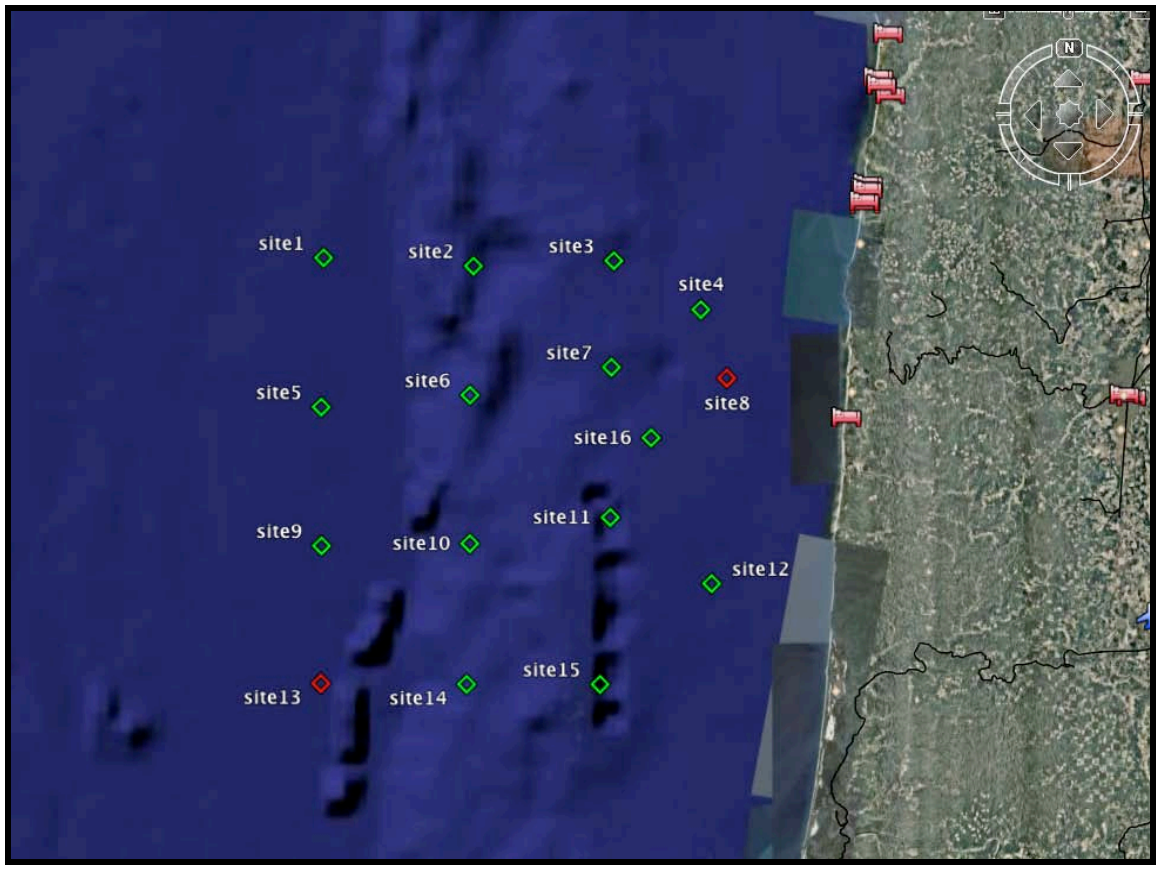


FIG-1, Locations of OBS deployed in 2007 during W0709A

Fig-2 below shows the locations of OBS deployed during W0709A and the temporary seismometers on shore that comprise the Central Oregon Locked Zone Array (COLZA). (Anne Trehu, OSU)

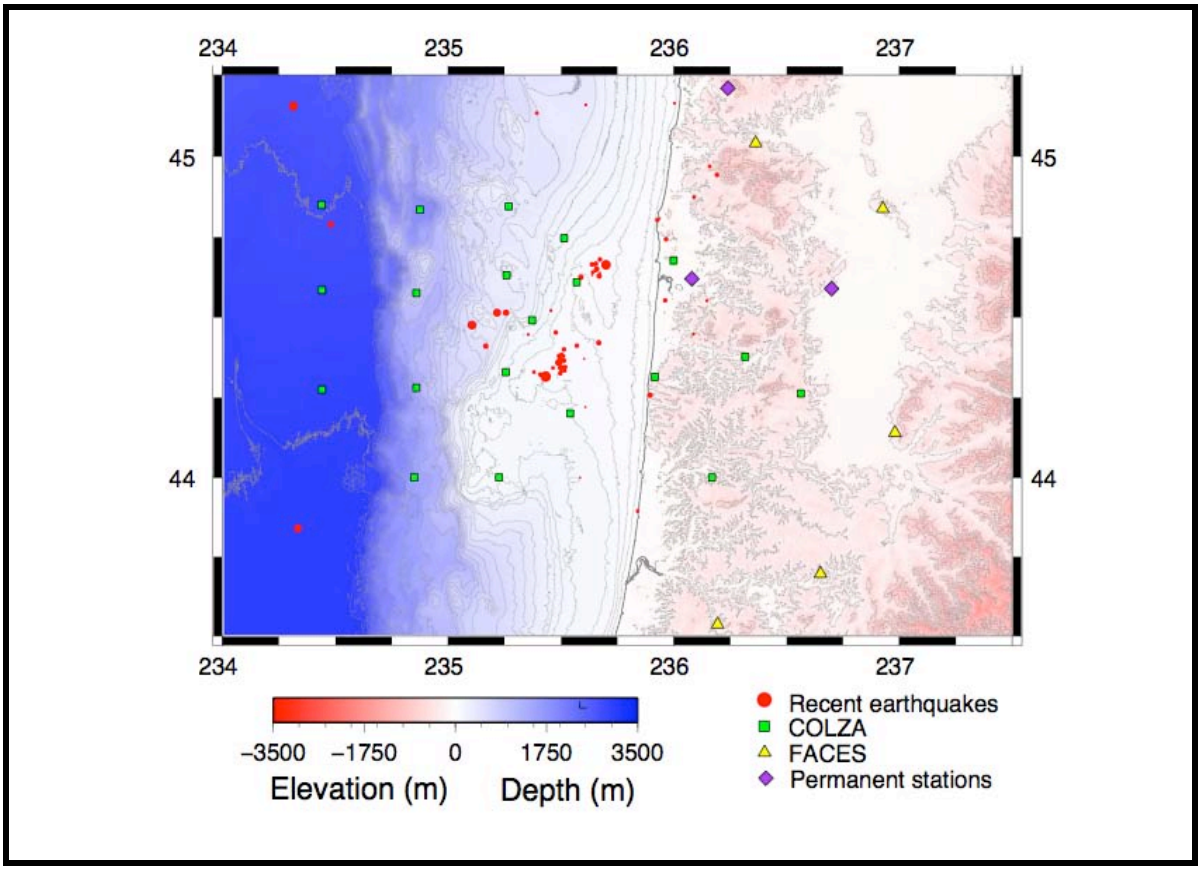


FIG-2, Provided by Anne Trehu, OSU

II. Instrumentation

SIO LC4X4

The Institute of Geophysics and Planetary Physics at Scripps Institution of Oceanography (IGPP/SIO) provided sixteen LC4X4s for this experiment. The sensors on the LC4X4s are a hydrophone and a three component L-28 seismometer. Each instrument is comprised of an anchor, a McLane glass float assembly on which the lifting bail is attached, two syntactic foam blocks are added for additional floatation to compensate the full payload of lithium batteries for this particular experiment, and a polyethylene frame holding the sensors, an acoustic release transponder, a 4X4 data logger, and a mechanical release. The float and frame components are stored separately in a custom rack system, and are assembled and tested prior to deployment on a square preparation platform, which is bolted to the deck. The complete instrument weighs approximately 300 pounds in air. The anchor is a

100-pound iron grate held to the base of the poly frame by a single 2" oval quick-link when the release mechanism is cocked and secured. After the anchor is released for recovery, the four 12" glass balls in the float package, as well as the syntactic foam blocks provide sufficient buoyancy to lift the instrument at about 43 m/min to the sea surface. To increase visibility at the surface, an orange flag on a 48" fiberglass-resin staff is attached to the floats. The recovery aids also include a Novatech low-pressure activated strobe beacon and radio, which operates at 160.725 MHz.

The acoustic release transponder developed in conjunction with ORE/EdgeTech is comprised of a main circuit board, a SIO developed battery array, and an ITC-3013 transducer manufactured by International Transducer Corp. These are all installed in and on a 4-5/8" aluminum pressure case. All SIO transponders interrogate at 11kHz and respond at 13kHz. Alkaline batteries provide 18 volts power for the burn, 12 volts power for the transponder, and 9 volts power for the circuit board logic. The release mechanism includes two double wire burn elements. When fresh, two battery strings are combined to provide the 18 volts to burn one of two release wires in an average of 6 minutes for water depths encountered during this experiment.

III. Areas of Concern

This experiment has our OBS deployed in heavily fished waters off Newport Oregon's coastal shelf. The OBS are also at the shallowest depths we've ever deployed, for a yearlong period. Our main concerns are with possible damage from fishing operations, heavy bio fouling inhibiting the burn, fouling the movement of the release, or countering of the floatation. Also, heavy sedimentation already witnessed in the first six recoveries could prevent an OBS from releasing, or ascending.

IV. Ships Equipment and Condition

Excellent. The addition of the articulated crane has made the recovery and deployment efforts routine. Also, there is ample deck & dry storage.

V. Journal of Events in Chronological Order

Local Time is Oregon - USA
All times and dates in this report are local unless otherwise noted.

1. Loading

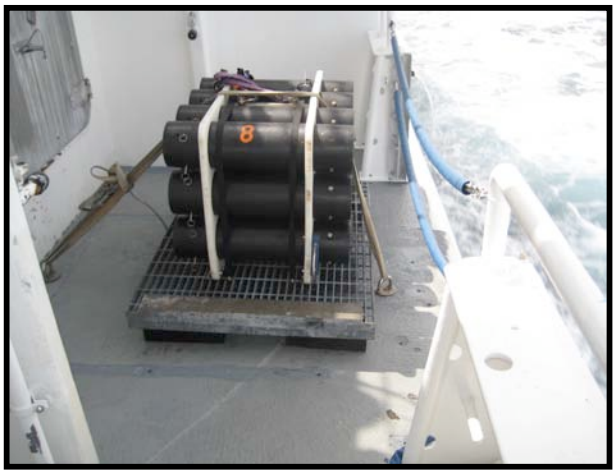
06/27/08
Our gear arrived in Newport, OR by way of UHaul. It was an uneventful 20-hour road trip, which I broke into two days.

06/29/08
All equipment was loaded on the R/V Wecoma and properly secured. Electronics were setup and tested.

07/01/08 09:50
We departed the OSU Marine Facility at Yaquina Bay, Newport and are anticipating a 2-hour transit to site OBS03 where we will perform the rosette test in approximately 450 meters depth, then begin the recovery efforts for 6 SP OBS.

2. Rosette Test

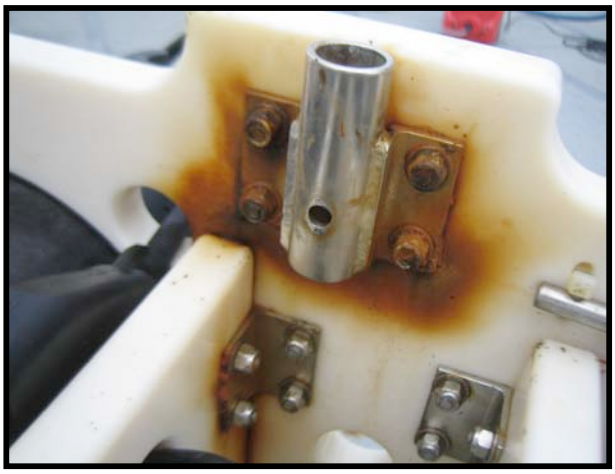
The rosette was lowered to ~400 meters off the starboard mid-ship A-frame. All 7 of the acoustics worked perfectly. For the 6 new OBS to be deployed, the deepest site will be just over 500 meters.



3. OBS Recoveries

Site OBS03 SP4X4
07/01/08 13:22

The first recovery went perfect with exception to the fact that fishing net, or possibly a trawl wire smashed the OBS at some point. The run-plug and sensor cable were damaged. The radio antenna was snapped, the flag was gone, the bumper boot was lost, and the run-plug shorted due to saltwater exposure subsequently draining the batteries. There is significant corrosion of the SS components of the frame and float package in the areas where it makes contact with titanium. Also, there is moderate corrosion of SS components not touching titanium. Fortunately, we used titanium bolts to secure the floatation last year.



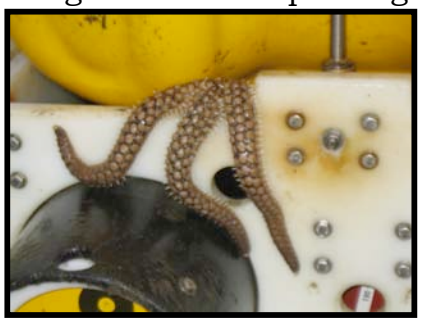
Approximately nine gigs of data were recovered from logger #92.

Site OBS04 SP4X4
07/01/08 15:47

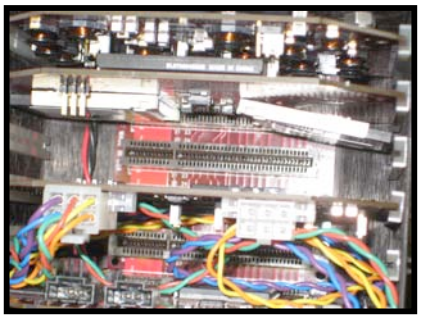
The recovery was successful. The calculated rise rate for this unit was 21 meters/minute. This is half the rise rate as the first recovery. We believe the reason for the slow ascent was the massive quantity of mud, and biological growth found on and in the OBS. It easily had several pounds of mud pour out as it was dismantled on deck. The corrosion was minimal on this OBS.

Site OBS07 SP4X4
07/01/08 17:35

The recovery went perfectly. There was biological growth encompassing this OBS, but there wasn't a serious mud inundation issue. I've noticed that the OBS that have the strobe & radio positioned to the logger side are floating with an excessive tilt.



Thus far, the majority of the loggers have had CF card mount detachment issues on at least one of the three CF slots. This is due to the spacing issue of the CF to the card guides. Unfortunately, it has compromised data collection for some of the cards that detached from the CF boards. (See 5. Data Acquisition Issues)



-Side Note-
The seas have been exceptionally flat. It reminds me of working on Lake Tahoe. The idea of performing a float test with an OBS, absent the flag seems like an unrealistic case study, but we will likely do it anyway. I'm interested to see how the colored radio & strobe stand out by themselves.

The new, new tag hooks that were sent to Oregon with Phil are working great. They are a very nice solution to the previous, heavy units.

Site OBS16 SP4X4
07/01/08 19:07

We are performing a ranging survey for this OBS. Anne wants to compare this survey with the 2007 survey, partially because this OBS is positioned on a slope.

The recovery went perfect.

Site OBS11 SP4X4
07/01/08 21:04

The OBS responded to the first enable command at 21:05, but would not provide ranges until the ship was repositioned north of the drop position. I then received three good ranges, so we decided to run a survey. I could not receive a single range during the 360-degree sweep of the survey pattern. I had the ship position itself near the north position where we received the only ranges. We still couldn't communicate with the acoustic. I then deployed the dunk ducer and finally received a reply. I immediately sent a burn command and it was accepted. The OBS took 13 minutes to release and breach the ocean surface. Considering a depth of 122 meters and an approximate burn time of 6 minutes, the rise rate was likely 17 meters/minute.

It all made sense when it reached the surface. It was practically lying on its side from the weight of all of the mud packed within it. Even after tagging the OBS alongside the ship, we had to dunk it several times to rinse off the remaining sediment. It must have been covered in mud.

Site OBS12 SP4X4
07/01/08 23:24

The recovery started with no acoustic communications. I had to use the deck box and dunk ducer to receive a weak response. This OBS was also inundated with mud. It had to be dunked several times before we brought it onboard. It was covered with barnacles, and a multitude of invertebrates, brittle starfish, and a variety of egg sacks.

An area of concern is with the weight of the mud packed in the logger and acoustic tube. This additional weight prevented the top of the yellow float hat to protrude from the sea surface for this recovery. The mud and biological growth also slowed the ascent rate significantly.

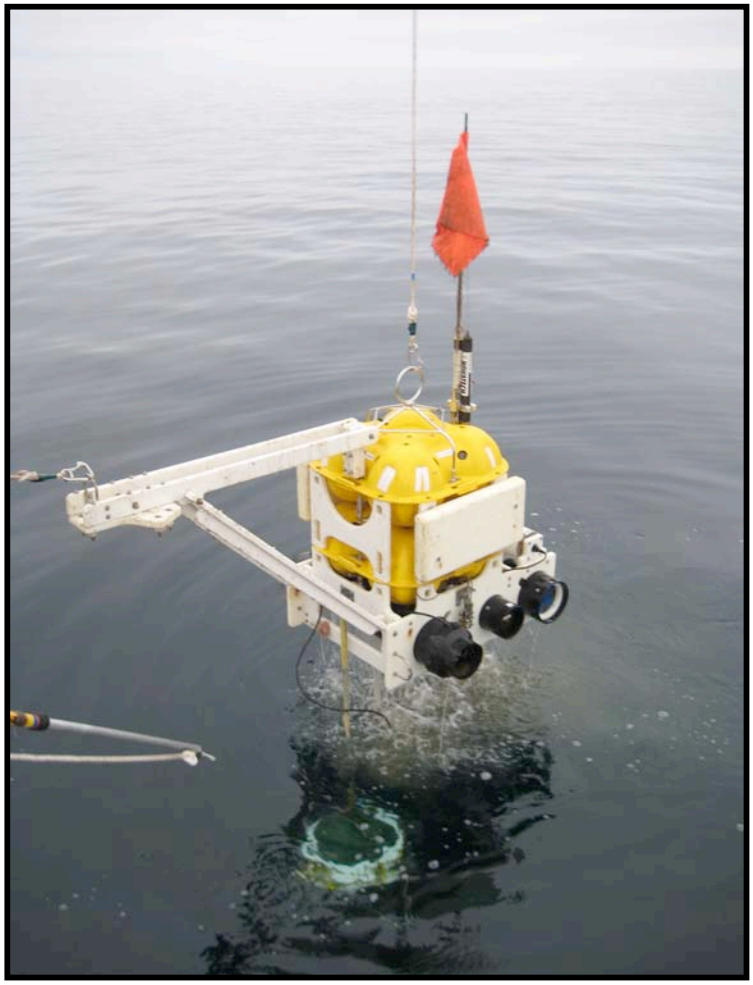
The two possible arguments that might stem from this is issue are:

-In rougher seas the mud would have been washed out of the OBS allowing it to be more visible at the sea surface.

-Even in calm seas, such as we have been experiencing; the absence of a flag would render the OBS practically invisible during a daytime recovery.

Site OBS02 LP4X4
07/02/08 13:13

This was the first of three LP OBS to be recovered. The acoustics responded perfectly, but the instrument would not release from the floor after three full burn #1 command cycles. At 14:07 local time I sent the first burn #2 command. The OBS released within 7 minutes. The calculated rise rate based on the change in slant range over a 10 second period was 24 meters/minute. Anne stated that this drop site was a sediment filled depression, likely full of mud. At a later point during the ascent we recalculated the rise rate and found it to be 36 meters/minute. We believe that the majority of the mud washed off the OBS by that point. During recovery, the OBS had some mud trailing off of it, but nothing significant. It was also coated with minor bio fouling.

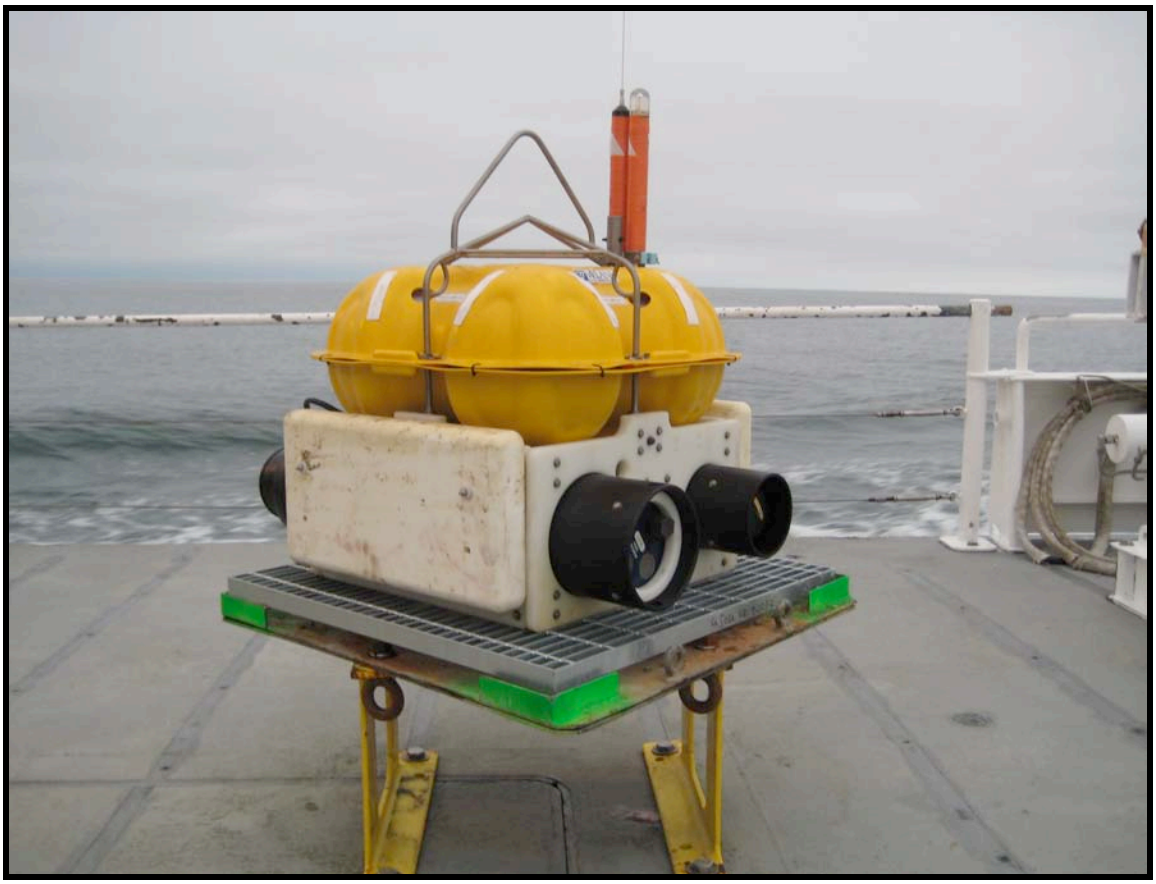


Close inspection of the mechanical releases showed that both sides had successfully burned. There was no visible damage to the wires, or mechanical releases. The OBS could have been temporarily stuck in the mud, or the lanyard may have hung due to bio fouling. We obviously lost the lanyard in the process of activating both primary and secondary burn wires.

4. OBS Deployments (6 SP4X4 Total)

Site OBS03.1 SP4X4
07/02/08 17:12

The deployment went off without a hitch. We decided to give Anne her 6 flag-free OBS, this being the first of which. She agreed to try and schedule these flag-free OBS for night recoveries.



Site OBS03.1, Flag-Free SP4X4

Site OBS04.1 SP4X4
07/02/08 19:25

Perfect deployment. Survey in progress.

Site OBS07.1 SP4X4
07/02/08 21:05

Perfect deployment. Survey in progress.

Site OBS16.1 SP4X4
07/02/08 22:42

Perfect deployment. Survey in progress.

Site OBS11.1 SP4X4
07/03/08 00:16

Perfect deployment. Survey in progress.

Site OBS12.1 SP4X4
07/03/08 02:12

Perfect deployment. Survey in progress.

5. OBS Recoveries Continued

Site OBS01 SP4X4
07/03/08 15:58

This OBS is in 2800 meters of water. Its rise rate is approximately 44 meters/minute.

It was a successful recovery.

Site OBS05 LP4X4
07/03/08 18:57

This OBS is in 2900 meters of water. The 1st burn #1 attempt did not release the unit. This is the same situation we had with the first LP OBS. I wonder if the Amsteel lanyard is binding with the steel eyebolts after being exposed to saltwater for such a long period of time. I think we should consider putting some Lanocoat, or AquaLube on the eyebolts at the point where the Amsteel lanyard makes contact.

I just sent the 2nd burn #1 command successfully and if it fails to release, I'll sent a burn #2 command.

No release from the 2nd burn #1 attempt. I have sent the 1st burn #2 successfully.

We have a confirmed release 15 minutes after the 1st burn #2 was sent. The lanyard must be binding in the eyebolts.

Successful recovery. There is minimal biological growth on this OBS.

Site OBS09 SP4X4
07/04/08 23:03

Perfect recovery. There was minimal biological growth present.

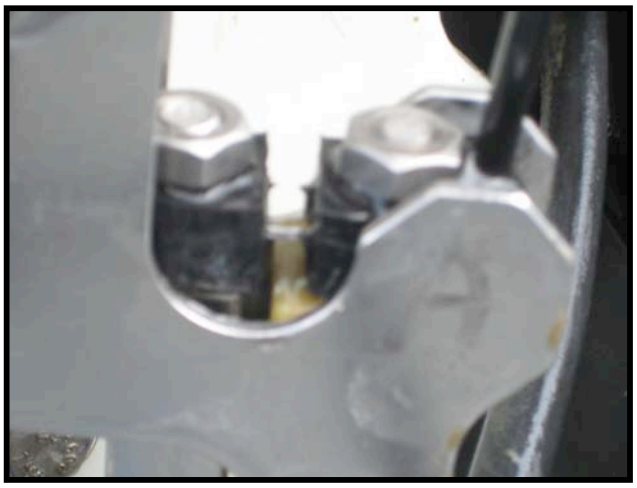
Site OBS06 SP4X4
07/04/08 02:52

Perfect Recovery. The data transfer had a few issues. The main CF card detached limiting the data collection.

Site OBS10 LP4X4
07/04/08 15:35

As with the first two LP OBS this one did not release from the anchor with just one side burn (burn #1). It took two burn #2 attempts before I received an 'off-bottom double ping'. I believe that the lanyard did not move freely through the eyebolts again.

The recovery effort was perfect. After inspection of the mechanical releases, the #1 burn wire was only partially burned. Based on the time of surface, I calculated that the 2nd burn #2 released the OBS.



2nd burn, #2 sent - 16:17
LP rise rate = 43m/min
Depth = 1320 m
Expected ascent = 30 min
Average burn cycle = 7 min
Surface time = 16:55 (audible)
Actual elapsed time = 38 min

Acoustic #29 deck test revealed – 14.6V

This is low enough to justify the requirement for two burns.

The Amsteel lanyard showed signs of friction melt, or possibly welding from the oxidation of the steel eyebolts. The melted patch is present on both sides of the lanyard at the point of contact with the eyebolt.

Site OBS14 SP4X4
07/04/08 19:11

Perfect recovery. There was minimal biological growth present.

A school of dolphin played around the ship as the OBS drifted alongside.

Site OBS15 SP4X4
07/04/08 21:40

Perfect recovery. There was quite a bit of biological growth present, and the inundation of mud made this unit take almost twice the calculated rise time to reach the surface. We even had a few stowaways, which crawled out during the wash down.

He was freed after a few pictures were taken and we decided that we didn't want it for dinner.

Paul, Marc, Aaron, Phil & Jochen

6. Data Acquisition Issues

We are experiencing compact flash (CF) detachment issues with all of the instruments recovered to date. The two side-mounted CF, of the three installed CF cards, are too tight to the card guides. This has caused the CF mount to detach from the card; preventing data storage on those affected CF.

This detachment issue was identified in the lab several months ago and measures have been taken to prevent the CF detachment issue for all future deployments. However, the likelihood is very high that we will see additional CF detachment issues for the remaining instruments to be recovered on this cruise.

7. Instrument Deployment Table

The table below gives OBS drop points (BB signifies a broadband OBS; the others are short period OBS). OBS08 released prematurely and washed up on a beach in Washington in December 2007. The other 14 OBS are to be recovered during this cruise.

Site	Latitude	Longitude	Depth (meters)	Depth (fathoms)	Drop time (m/d/yr)	Drop time (hr:min:sec)
OBS01	44°51.009'	-125°33.654'	2808	1535	9/7/07	7:48:30
OBS02-BB	44°50.096'	-125°07.488'	1849	1011	9/7/07	3:41:46
OBS03	44°50.732'	-124°43.972'	542	296	9/6/07	22:59:52
OBS04	44°44.818'	-124°29.135'	147	80	9/6/07	19:27:22
OBS05-BB	44°35.119'	-125°33.549'	2881	1575	9/6/07	10:39:05
OBS06	44°34.619'	-125°08.528'	836	457	9/6/07	7:19:51
OBS07	44°37.906'	-124°44.447'	270	148	9/7/07	23:56:13
OBS08	44°36.596'	-124°25.814'	75	41	9/6/07	18:13:52
OBS09	44°16.496'	-125°33.627'	2984	1632	9/9/07	3:24:27
OBS10-BB	44°16.852'	-125°08.503'	1323	723	9/8/07	23:17:39
OBS11	44°19.800'	-124°44.712'	122	67	9/8/07	4:06:29
OBS12	44°12.000'	-124°27.582'	97	53	9/8/07	6:29:40
OBS14	43°59.995'	-125°08.996'	1530	837	9/8/07	18:09:29
OBS15	43°59.986'	-124°46.501'	123	67	9/8/07	15:36:43
OBS16	44°29.499'	-124°37.733'	163	89	9/8/07	2:08:47

Table-1 Provided by Anne Trehu, OSU