

## Cruise Report

### R/V Oceanus - OC1509A

### Gorda OBS Experiment & Cascadia Initiative Leg 2 2015

September 8 - September 18, 2015

Newport, OR - Newport, OR

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## Table of Contents

Cruise Objectives and Assessment .....	3
OC1509A Science Party .....	5
OC1509A Crew .....	6
Cruise Narrative .....	7
OBS Operations .....	19
Acknowledgements .....	23
Table 1 .....	24
Figure 1 .....	26

## Cruise Objectives and Assessment

**Background.** As part of the 2009 American Recovery and Reinvestment Act (ARRA), NSF's Earth Sciences (EAR) and Ocean Sciences (OCE) divisions each received \$5M toward facilities that support EarthScope and GeoPRISMS science objectives with an initial emphasis on onshore/offshore studies of the Cascadia margin. ARRA funds have been used by UNAVCO (University NAVSTAR Consortium), IRIS (Incorporated Research Institutions for Seismology), and OBSIP (Ocean Bottom Seismograph Instrument Pool) to improve real-time GPS capabilities, densify onshore seismic networks, and construct and deploy 60 ocean-bottom seismographs (OBS).

The Cascadia Initiative (CI) is an onshore/offshore seismic and geodetic experiment to study the megathrust, its potential for large earthquakes and the formation, deformation and hydration of the Juan de Fuca and Gorda plates. Articles in the GeoPRISMS Newsletter<sup>1</sup> and Oceanography Magazine<sup>2</sup> describe CI scientific objectives, offshore deployment plans developed at an open community workshop, and formation of the Cascadia Initiative Expedition Team (CIET). Over its planned 4-year data acquisition period, the CI offshore portion will involve deployment and recovery of about 280 OBSs at about 160 sites and a total of about 25 cruises. This year, 2015, marks the final set of cruises to recover CI OBS.

In addition to CI, NSF funded a PI driven Gorda OBS Experiment to study seismicity, tectonics, and lithosphere structure of the internally deforming region. The second year of the PI experiment and the final CI deployment both covered the Gorda region and the two projects collaborated tightly resulting in a joint, consistent deployment approach splitting tasks between groups and leading to an increased station density.

**Cruise Objectives:** The objective of the cruise was to recover 39 3-component OBS from the OBSIP instrument pool that had been deployed along the Blanco Transform Fault Zone and within the Gorda plate region in the Northeast Pacific. Locations are listed in Table 1 and are shown on Figure 1.

Recovery included 29 broadband and 10 short-period OBS from the Scripps Institution of Oceanography (SIO) Institutional Instrument Center (IIC) pool. Broadband instruments were equipped with Nanometrics seismic sensors (SIO-LP: 14 Trillium 240s; SIO-Abalone: 15 Trillium-Compact 40s sensors). 10 of the LP instruments had regular '4x4 loggers' with standard SIO configuration and gain 0.102. 4 LP instruments had 'new data' loggers with gain 1 and are marked as such in the *Cruise Narrative*. The 4x4-loggers have higher power consumption and run out of power about 20 days before the new-logger LP instruments. The 10 short-period instruments were equipped with Mark-L28 tri-axial geophones and run with

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<sup>1</sup>McGuire et al., 2011, Cascadia Initiative Workshop Update, GeoPRISMS Newsletter, 26, <http://www.geoprisms.org/newsletters/42-newsletter-articles/scd/cascadia/258-cascadia-update-s2011.html>

<sup>2</sup>Toomey et al., 2014, The Cascadia Initiative: A Sea Change In Seismological Studies of Subduction Zones, *Oceanography* 27(2):138–150, <http://dx.doi.org/10.5670/oceanog.2014.49>

a gain of 16. All instruments included a differential pressure gauge run with gain 64. For SIO-LP and short-period instruments, all channels were sampled at 100 Hz; SIO-Abalones packages were sampled at 50 Hz for consistency with earlier CI deployments. The instruments had been deployed in 2014 during the cruises OC1407B and OC1408A.

Station names follow CIET naming scheme when reoccupying CIET sites (4 letter site names ending in D; D signifies year-4 deployment) and Nabelek/Braunmiller OC1309B and OC1407B/OC1408A conventions for other sites (5 letter site names [B|G][B|S]xxx, xxx: number; last digit 1 indicates reoccupation of 2014 deployment site).

We left Newport on September 8, 2015 and reached the first OBS recovery site shortly before midnight (local time). Until recovery of the last OBS in the evening of September 17 operations took place 24/7 and nearly continuously. The recovery area was 40°-45°N and 131°-124.25°W. Weather conditions varied through the cruise. During the first 3-4 days, windy conditions (~20 knots) with relatively low sea state prevailed. Wind and sea state picked up during the weekend and reached sustained winds of 30-35 knots and 10+ feet swell height late Sunday and on Monday (Sept. 13-14). Due to safety concerns, we postponed one recovery early Monday morning. Tuesday (Sept. 15) was calm before wind and waves picked up for the remainder of the cruise (wind ~15 knots). All deck operations went smoothly and were performed in, what we think, a safe manner. Communication between the science lab, bridge and crew worked well.

We recovered 37 of 39 instruments. Two SIO Abalone OBS responded to the acoustic release signal but did not rise and surface despite sending multiple burn commands and both burn wires. The sites are BB850 in the Juan de Fuca plate near 44.5° N and 128° W and the focus site FS19 near Cape Mendocino.

In addition, we retrieved 8 instruments where the flash disk card could not be read resulting in total data loss for these sites and 2 instruments that, for currently unknown reasons, stopped operating after 2 days constituting essentially also total data loss. Overall, of 39 instruments, 37 were recovered and 27 that recorded data.

The deployment zone is of U.S. national security relevance and OBS data are of interest to the U.S. Navy. A U.S. Navy – NSF memorandum of agreement for Ocean Observing System Security addresses the at-sea recovery and control of data collected from the OBSIP OBS. All recovered OBS sites were selected for data screening, which means initially only data below 3 Hz are available to scientists and, after completed screening, all data except for retracted time windows will become available (with 90 days of the cruise). SIO personnel recovered the data and Blake Walker from Leidos (Navy contractor performing data screening) applied a low-pass filter to all high-sampling rate channels (more than 3 samples per second) on ship. BY the end of the cruise, we had obtained all low-pass filtered data from Blake Walker (Leidos).

## **OC1509A Science Party**

Chief Scientist Jochen Braunmiller (University of South Florida)

USF graduate student Kathryn Dorn

Apply-to-Sail student Patricia Pyda

OBSIP SIO Ernest Aaron

OBSIP SIO Martin Rapa

OBSIP SIO Mark Gibaud

OBSIP SIO Sean McPeak

Leidos/Navy Blake Walker

OSU Marine Technician Robert Hagg

OSU Marine Technician (Superintendent) Andrew Woogen

## **OC1509A Crew**

Captain Jeff Crews

Chief Engineer Robert Cruise

First Mate Eric Balianz

Second Mate Don Heffern

Bos'n Patrick Breshears

AB Mark Simpson

AB Gene Otto

Engineer Ray 'Chip' Millard

Engineer Ross Messenger

Steward Donald Highsmith

Messman Steve Tomsic

## Cruise Narrative

September 7, 2015 (Monday)

Scripps Institution of Oceanography (SIO) OBSIP group loads empty instrument racks for recovery. SIO group sets up their lab in the main lab of the Oceanus. Rest of science crew arrives.

September 8, 2015 (Tuesday)

Safety drill at 10:00 for science crew led by Marine Tech Robb Hagg. Newcomers (and others who haven't done so in a year) try on a survival suit followed by a ship etiquette and procedures run-through by First Mate Eric Balianz and A/E Patrick Breshear.

We depart at about 11:00 am PDT. Calm seas and sunny weather. About one hour into the cruise, 16-17 knots wind from the N. Increasing wind (20-23 knots at 2 pm).

Reached first site J20D at about 22:40 (PDT; DoY 252 05:40 UTC). Task: Recover SIO Abalone.

### Station J20D - Recovery

On Site:	05:44 252 2015 (UTC)
OBS Type:	SIO Abalone Trillium Compact 40s
Acoustic Release Time:	05:44 252 2015
OBS on Surface:	07:20 252 2015 (sighted)
OBS Rise Rate:	31 m/min
OBS on Board:	07:22 252 2015
Depart, Time on Station:	07:35 252 2015            1 hrs 51 min
Comment:	Neither strobe nor radio worked for night recovery.

September 9, 2015 (Wednesday)

### Station BB830 - Recovery

On Site:	10:17 252 2015 (UTC)
OBS Type:	SIO LP Trillium 240s
Acoustic Release Time:	10:15 252 2015
OBS on Surface:	11:30 252 2015
OBS Rise Rate:	39 m/min
OBS on Board:	11:31 252 2015
Depart, Time on Station:	12:21 252 2015            2 hrs 06 min

Comment: LP instrument with 'new datalogger.'

Station BB850 - Recovery

On Site: 15:45 252 2015(UTC)  
OBS Type: SIO Abalone Trillium Compact 40s  
Acoustic Release Time: 15:49 252 2015  
OBS on Surface: N/A  
OBS Rise Rate: N/A  
OBS on Board: N/A  
Depart, Time on Station: 21:50 252 2015 6 hrs 05 min  
Comment: Sent burn sequence for both releases, instrument stays on bottom. Try to get it off bottom by sending burn sequence multiple times. Repeated 16 times before deciding we could not succeed.  
**NOT RECOVERED.**

Station J23D - Recovery

On Site: 04:38 253 2015 (UTC)  
OBS Type: SIO LP Trillium 240s  
Acoustic Release Time: 04:28 253 2015  
OBS on Surface: 06:17 253 2015  
OBS Rise Rate: 25 m/min\*  
OBS on Board: 06:19 253 2015  
Depart, Time on Station: 06:29 253 2015 1 hrs 51 min  
Comment: (1) \*burn cycle kicked out after ~1 min instead of completing burn; sent multiple (8) burn sequences to release #2; took its time but worked.  
(2) Water depth: echo sounder returns during deploy were weak. Actual depth of deployed site is 2687 m (rather than 2726 m from deploy report).  
(3) LP instrument with 'new datalogger.'

Station BB751 - Recovery

On Site: 10:28 253 2015 (UTC)  
OBS Type: SIO LP Trillium 240s  
Acoustic Release Time: 10:24 253 2015  
OBS on Surface: 11:26 253 2015  
OBS Rise Rate: 46 m/min  
OBS on Board: 12:10 253 2015  
Depart, Time on Station: 12:39 253 2015 2 hrs 11 min  
Comment: (1) Strobe did not work.  
(2) **Could not read CF card.**



(3) Main battery pack had died before recovery, i.e. data acquisition stopped early, but due to (2), we do not know when or how early.

September 10, 2015 (Thursday)

Station BB870 - Recovery

On Site: 16:15 253 2015 (UTC)  
OBS Type: SIO Abalone Trillium Compact 40s  
Acoustic Release Time: 16:15 253 2015  
OBS on Surface: ~17:30 253 2015  
OBS Rise Rate: 43 m/min  
OBS on Board: 17:55 253 2015  
Depart, Time on Station: 18:08 253 2015 1 hrs 53 min  
Comment: Neither strobe nor radio worked but day recovery.

Station BB711 - Recovery

On Site: 21:58 253 2015 (UTC)  
OBS Type: SIO LP Trillium 240s  
Acoustic Release Time: 21:53 253 2015 (success at 02:02)  
OBS on Surface: 02:48 254 2015  
OBS Rise Rate: 53 m/min  
OBS on Board: 02:56 254 2015  
Depart, Time on Station: 03:07 254 2015 5 hrs 09 min  
Comment: Had to initiate burn sequence several times before instrument was released. Probably due to low battery not able to complete full burn cycle (seen before by SIO personnel).

Station BB721 - Recovery

On Site: 05:39 254 2015 (UTC)  
OBS Type: SIO LP Trillium 240s  
Acoustic Release Time: 05:33 254 2015  
OBS on Surface: 06:58 254 2015  
OBS Rise Rate: 37 m/min  
OBS on Board: 07:06 254 2015  
Depart, Time on Station: 07:17 254 2015 1 hrs 38 min

September 11, 2015 (Friday)

Station J06D - Recovery

On Site: 11:25 254 2015 (UTC)  
OBS Type: SIO LP Trillium 240s

Acoustic Release Time: 11:14 254 2015  
OBS on Surface: 12:25 254 2015  
OBS Rise Rate: 46 m/min  
OBS on Board: 13:10 254 2015  
Depart, Time on Station: 13:30 254 2015 2 hrs 05 min  
Comment: DPG did not work.

Station BB860 - Recovery

On Site: 16:41 254 2015 (UTC)  
OBS Type: SIO LP Trillium 240s  
Acoustic Release Time: 16:42 254 2015  
OBS on Surface: 17:43 254 2015  
OBS Rise Rate: 44 m/min  
OBS on Board: 17:55 254 2015  
Depart, Time on Station: 18:10 254 2015 1 hrs 29 min  
Comment: **Could not read CF card.**

Station BB840 - Recovery

On Site: 20:31 254 2015 (UTC)  
OBS Type: SIO Abalone Trillium Compact 40s  
Acoustic Release Time: 20:31 254 2015  
OBS on Surface: 22:08 254 2015  
OBS Rise Rate: 34 m/min  
OBS on Board: 22:14 254 2015  
Depart, Time on Station: 22:24 254 2015 1 hrs 53 min  
Comment: Neither strobe nor radio worked but day recovery.

Station BS820 - Recovery

On Site: 01:26 255 2015 (UTC)  
OBS Type: SIO short-period Mark-L28  
Acoustic Release Time: 01:19 255 2015  
OBS on Surface: 02:24 255 2015  
OBS Rise Rate: 45 m/min  
OBS on Board: 02:34 255 2015  
Depart, Time on Station: 02:52 255 2015 1 hrs 26 min  
Comment: **Stopped recording after 2 days of operation.**

Station BS810 - Recovery

On Site: 06:06 255 2015 (UTC)  
OBS Type: SIO short-period Mark-L28  
Acoustic Release Time: 06:04 255 2015  
OBS on Surface: 07:13 255 2015

OBS Rise Rate: 43 m/min  
OBS on Board: 07:27 255 2015  
Depart, Time on Station: 07:45 255 2015 1 hrs 39 min

September 12, 2015 (Saturday)

Station BS641 - Recovery

On Site: 10:49 255 2015 (UTC)  
OBS Type: SIO short-period Mark-L28  
Acoustic Release Time: 10:51 255 2015  
OBS on Surface: 11:55 255 2015  
OBS Rise Rate: 44 m/min  
OBS on Board: 12:20 255 2015  
Depart, Time on Station: 12:40 255 2015 1 hrs 51 min

Station G37D-GB061 - Recovery

On Site: 14:46 255 2015 (UTC)  
OBS Type: SIO Abalone Trillium Compact 40s  
Acoustic Release Time: 14:47 255 2015 (second burn at 15:30 success)  
OBS on Surface: 16:32 255 2015  
OBS Rise Rate: 45 m/min  
OBS on Board: 16:40 255 2015  
Depart, Time on Station: 16:55 255 2015 2 hrs 09 min  
Comment: Radio did not work but day recovery. Strobe on, at least on deck.

Station G30D-GB181 - Recovery

On Site: 22:30 255 2015 (UTC)  
OBS Type: SIO LP Trillium 240s  
Acoustic Release Time: 22:05 255 2015  
OBS on Surface: 23:20 255 2015  
OBS Rise Rate: 42 m/min  
OBS on Board: 23:32 255 2015  
Depart, Time on Station: 23:55 255 2015 1 hrs 25 min  
Comment: **Could not read CF card.**

Station GB111 - Recovery

On Site: 04:45 256 2015 (UTC)  
OBS Type: SIO LP Trillium 240s  
Acoustic Release Time: 04:41 256 2015  
OBS on Surface: 06:26 256 2015  
OBS Rise Rate: 42 m/min  
OBS on Board: 06:38 256 2015

Depart, Time on Station: 07:05 256 2015 2 hrs 20 min  
Comment: LP instrument with 'new datalogger'

September 13, 2015 (Sunday)

Station GB171 - Recovery

On Site: 09:08 256 2015 (UTC)  
OBS Type: SIO LP Trillium 240s  
Acoustic Release Time: 09:10 256 2015  
OBS on Surface: 10:52 256 2015  
OBS Rise Rate: 36 m/min  
OBS on Board: 11:20 256 2015  
Depart, Time on Station: 11:45 256 2015 2 hrs 37 min  
Comment: (1) LP instrument with 'new datalogger'.  
(2) no time tag at end, no drift correction.

Station GS221 - Recovery

On Site: 15:39 256 2015 (UTC)  
OBS Type: SIO short-period Mark-L28  
Acoustic Release Time: 15:37 256 2015  
OBS on Surface: 16:45 256 2015  
OBS Rise Rate: 45 m/min  
OBS on Board: 16:52 256 2015  
Depart, Time on Station: 17:17 256 2015 1 hrs 48 min  
Comment: **Could not read CF card.**

Station G12D-GB291 - Recovery

On Site: 19:19 256 2015 (UTC)  
OBS Type: SIO LP Trillium 240s  
Acoustic Release Time: 19:14 256 2015  
OBS on Surface: 20:30 256 2015  
OBS Rise Rate: 38 m/min  
OBS on Board: 20:42 256 2015  
Depart, Time on Station: 21:07 256 2015 1 hrs 48 min  
Comment: **Could not read CF card.**

Wind has picked up considerably (around 25-30 knots from northerly directions.  
Seas building up and swells of 10+ feet. Clear sky, sunny. Continue recoveryies.

Station GB341 - Recovery

On Site: 23:40 256 2015 (UTC)  
OBS Type: SIO LP Trillium 240s

Acoustic Release Time:	23:38 256 2015	
OBS on Surface:	00:25 257 2015	
OBS Rise Rate:	38 m/min	
OBS on Board:	00:32 257 2015	
Depart, Time on Station:	00:52 257 2015	1 hrs 12 min

At about 6 pm local time (01:00 UTC). Stipulated by the captain, we decided to change recovery order. Instead of heading towards GB331, a SIO-Abalone, we are now turning to G11D. For Abalones neither strobe nor radio seem to be working, based on 5 previous recoveries, which makes night time recovery difficult under good conditions. We are heading NE and into strong winds (~30 knots) from the N at reduced speed; swells of around 15 feet.

At 6:30 pm local time, the ship temporarily comes reduces speed and comes to a near stop for an unknown reason (for the science party). Ship resumes moving at 7:10 pm local time. Due to strong winds and heavy seas, ship speed is reduced from 11 knots to around 9 knots.

September 14, 2015 (Monday)

At about 1 am local time (08:00 UTC). When arriving at the site G11D, Scripps personnel evaluate the situation on deck and we decide that safe operations are not possible considering sea state, water on deck, wind, and lack of daylight. We decide to suspend operations. The current plan is to slowly head back to GB331 with the wind in the back to have a relatively comfortable ride and to retrieve GB331 at daybreak.

Station GB331 - Recovery

On Site:	13:57 257 2015 (UTC)	
OBS Type:	SIO Abalone Trillium Compact 40s	
Acoustic Release Time:	13:46 257 2015	
OBS on Surface:	~15:15 257 2015	
OBS Rise Rate:	36 m/min	
OBS on Board:	15:22 257 2015	
Depart, Time on Station:	15:48 257 2015	1 hrs 51 min

Station G11D-GB301 - Recovery

On Site:	17:25 257 2015 (UTC)
OBS Type:	SIO LP Trillium 240s
Acoustic Release Time:	17:24 257 2015
OBS on Surface:	18:34 257 2015
OBS Rise Rate:	38 m/min

OBS on Board: 18:45 257 2015  
Depart, Time on Station: 19:08 257 2015 1 hrs 43 min

Station GB321 - Recovery

On Site: 22:13 257 2015 (UTC)  
OBS Type: SIO LP Trillium 240s  
Acoustic Release Time: 22:05 257 2015  
OBS on Surface: 23:08 257 2015  
OBS Rise Rate: 37 m/min  
OBS on Board: 23:20 257 2015  
Depart, Time on Station: 23:47 257 2015 1 hrs 34 min

Station GS311 - Recovery

On Site: 03:40 258 2015 (UTC)  
OBS Type: SIO short-period Mark-L28  
Acoustic Release Time: 03:38 258 2015  
OBS on Surface: 04:37 258 2015  
OBS Rise Rate: 38 m/min  
OBS on Board: 04:43 258 2015  
Depart, Time on Station: 04:57 258 2015 1 hrs 13 min

September 15, 2015 (Tuesday)

Station FS04 - Recovery

On Site: 07:59 258 2015 (UTC)  
OBS Type: SIO Abalone Trillium Compact 40s  
Acoustic Release Time: 08:00 258 2015  
OBS on Surface: 08:31 258 2015  
OBS Rise Rate: N/A  
OBS on Board: 08:35 258 2015  
Depart, Time on Station: 09:03 258 2015 1 hrs 04 min

Station FS09 - Recovery

On Site: 09:29 258 2015 (UTC)  
OBS Type: SIO Abalone Trillium Compact 40s  
Acoustic Release Time: 09:30 258 2015  
OBS on Surface: ~09:50 258 2015  
OBS Rise Rate: N/A  
OBS on Board: ~09:55 258 2015  
Depart, Time on Station: 10:10 258 2015 0 hrs 41 min

Station FS19 - Recovery

On Site: 11:51 258 2015 (UTC)  
 OBS Type: SIO Abalone Trillium Compact 40s  
 Acoustic Release Time: 11:52 258 2015  
 OBS on Surface: N/A  
 OBS Rise Rate: N/A  
 OBS on Board: N/A  
 Depart, Time on Station: 15:07 258 2015 3 hrs 16 min  
 Comment: Sent burn sequence for both releases, instrument stays on bottom. Try to get it off bottom by sending burn sequence multiple times. Repeated 7 times before deciding we could not succeed.  
**NOT RECOVERED.**

Station FS44 - Recovery

On Site: 16:19 258 2015 (UTC)  
 OBS Type: SIO Abalone Trillium Compact 40s  
 Acoustic Release Time: 16:16 258 2015  
 OBS on Surface: 17:10 258 2015  
 OBS Rise Rate: N/A  
 OBS on Board: 17:15 258 2015  
 Depart, Time on Station: 17:16 258 2015 0 hrs 57 min  
 Comment: Needed second burn cycle (both on burn #1).

Changed recovery order. We are sailing straight to Abalone sites G10D and GB281 in order to reach and recover them during daylight (which will be tight for GB281). The reason is that neither light beacon nor radio work for Abalones upon surfacing (they work once they are really out of salt water, i.e., on deck) and for deep water sites (>3,000 m) we do not want to risk missing them in surf. Incidentally, today is calmest of entire cruise with almost flat seas and wind around 10 knots.

Station G10D - Recovery

On Site: 20:25 258 2015 (UTC)  
 OBS Type: SIO Abalone Trillium Compact 40s  
 Acoustic Release Time: 20:19 258 2015  
 OBS on Surface: 22:28 258 2015  
 OBS Rise Rate: N/A  
 OBS on Board: 22:35 258 2015  
 Depart, Time on Station: 22:41 258 2015 2 hrs 16 min  
 Comment: Needed three burn cycles (tried both cycles).

Station GB281 - Recovery

On Site: 01:15 259 2015 (UTC)

OBS Type: SIO Abalone Trillium Compact 40s  
Acoustic Release Time: 00:57 259 2015  
OBS on Surface: 02:30 259 2015  
OBS Rise Rate: 34 m/min  
OBS on Board: 02:37 259 2015  
Depart, Time on Station: 02:49 259 2015 1 hrs 34 min

On way back to pick up SP instrument GS261 during the night.

September 16, 2015 (Wednesday)

Station GS261 - Recovery

On Site: 06:57 259 2015 (UTC)  
OBS Type: SIO short-period Mark-L28  
Acoustic Release Time: 06:47 259 2015  
OBS on Surface: 07:54 259 2015  
OBS Rise Rate: 46 m/min  
OBS on Board: 08:07 259 2015  
Depart, Time on Station: 08:25 2015 1 hrs 28 min

Station GS151 - Recovery

On Site: 14:57 259 2015 (UTC)  
OBS Type: SIO short-period Mark-L28  
Acoustic Release Time: 14:56 259 2015  
OBS on Surface: 16:01 259 2015  
OBS Rise Rate: 46 m/min  
OBS on Board: 16:07 259 2015  
Depart, Time on Station: 16:20 259 2015 1 hrs 23 min  
Comment: **Could not read CF card.**

Station GB101 - Recovery

On Site: 18:22 259 2015 (UTC)  
OBS Type: SIO Abalone Trillium Compact 40s  
Acoustic Release Time: 18:14 259 258 2015  
OBS on Surface: 19:51 259 2015  
OBS Rise Rate: 37 m/min  
OBS on Board: 19:59 259 2015  
Depart, Time on Station: 20:04 259 2015 1 hrs 42 min

Station BS611 - Recovery

On Site: 01:36 260 2015 (UTC)  
OBS Type: SIO short-period Mark-L28



Acoustic Release Time: 01:17 260 2015  
OBS on Surface: 02:22 260 2015  
OBS Rise Rate: 42 m/min  
OBS on Board: 02:32 260 2015  
Depart, Time on Station: 02:44 260 2015 1 hrs 08 min

Station GS031 - Recovery

On Site: 05:35 260 2015 (UTC)  
OBS Type: SIO short-period Mark-L28  
Acoustic Release Time: 05:19 260 2015  
OBS on Surface: 06:20 260 2015  
OBS Rise Rate: 43 m/min  
OBS on Board: 06:29 260 2015  
Depart, Time on Station: 06:43 260 2015 1 hrs 08 min  
Comment: **Could not read CF card.**

September 17, 2015 (Thursday)

Station GS141 - Recovery

On Site: 10:52 260 2015 (UTC)  
OBS Type: SIO short-period Mark-L28  
Acoustic Release Time: 10:40 260 2015  
OBS on Surface: 11:55 260 2015  
OBS Rise Rate: 42 m/min  
OBS on Board: 12:19 260 2015  
Depart, Time on Station: 12:45 260 2015 1 hrs 53 min  
Comment: **Could not read CF card.**

Station M16D - Recovery

On Site: 15:51 260 2015 (UTC)  
OBS Type: SIO short-period Mark-L28  
Acoustic Release Time: 15:51 260 2015  
OBS on Surface: 16:19 260 2015  
OBS Rise Rate: 31 m/min  
OBS on Board: 16:24 260 2015  
Depart, Time on Station: 16:36 260 2015 0 hrs 45 min

Station G33D - Recovery

On Site: 21:42 260 2015 (UTC)  
OBS Type: SIO short-period Mark-L28  
Acoustic Release Time: 21:36 260 2015  
OBS on Surface: 22:05 260 2015  
OBS Rise Rate: ~26 m/min

OBS on Board: 22:13 260 2015  
Depart, Time on Station: 22:30 260 2015 0 hrs 48 min  
Comment: Binary file corrupted, read access to JD 236, 2015.

At 15:30 local time (22:30 UTC), we finished recovering our last instrument and straightening up the deck for the transit back to Newport.

September 18, 2015 (Friday)

Return to Newport at 8:30 am local time. All gear is unloaded via crane onto the pier. Work starts immediately after ship is secured and is finished close to noon. Trucks to ship OBS gear back to SIO are scheduled to be loaded on Monday.

## **OBS Operations:**

The SIO group and the ship's crew worked very efficiently. We were able to finish cruise OC1509A ahead of schedule. Weather conditions varied through the cruise; we had few very calm days but also only two days of rough seas (Sept. 13-14) where ship speed was reduced at times (from ~11 to ~9 knots) and where we delayed recovery of one site due to safety concerns. Otherwise operations were continuous, 24/7. Additional delays were incurred at sites that did not surface – we kept sending burn commands for 3-5 hours - and some minor delays at sites that required one or two additional burn cycles. Minor delays were compensated, overall, by generally sending the acoustic commands before reaching station.

### *Data Screening*

All OBS deployed during last year's OC1407B and OC1408A cruises and recovered during OC1509A are located in areas of importance to U.S. Navy operations. In accordance with the agreement between the U.S. Navy and the National Science Foundation for Ocean Observing System Security, data from all recovered OBS are being screened by the Navy to remove security sensitive time periods from records. The Navy representative for the cruise is Blake Walker from Leidos. All data are made available to the scientists after 3 Hz low-pass filtering. The Navy will screen raw data and security relevant time periods will be redacted from raw data before returning high-sampling rate data to the science party (within 90 days of the cruise).

### *Data Recovery Notes*

BB850 did not lift off from ocean bottom and was not recovered. We repeatedly sent the burn command to the instrument. The acoustic communication worked fine. Tried both available burn wires and repeated burn sequence a total of 16 times. After six hours we decided that further trials would not be successful either and moved on to next site. NOT RECOVERED. – We immediately contacted the OBSIP management office (Brent Evers) and the Cascadia Initiative team (Doug Toomey) about this hoping that last CI recovery cruise in October on the R/V Thompson could try to recover BB850 with the ROV onboard the Thompson. Chief scientist William Wilcock is aware of the situation.

J23D water depth actually is ~2687 m. Depth from echo sounder during 2014 deploy (2726 m) was based on weak signals. Final site depth should be 2687 m in agreement with available multibeam data for the site.

BB751 flash card cannot be read. 0 data.

BB860 flash card cannot be read. 0 data.

BS820 stopped recording after ~2 days of operation. Basically no data.

G30D flash card cannot be read. 0 data.

GB171 no time tag at end, no drift correction.

GS221 flash card cannot be read. 0 data.

G12D flash card cannot be read. 0 data.

G11D stopped recording after ~2 days of operation. Basically no data.

FS19 did not lift off from ocean bottom and was not recovered. We repeatedly sent the burn command to the instrument. The acoustic communication worked fine. Tried both available burn wires and repeated burn sequence a total of 7 times. Based on BB850 experience, we decided that further trials would not be successful. NOT RECOVERED. – As for BB850, we notified the OBSIP management office (Brent Evers) and the Cascadia Initiative team (Doug Toomey) about this hoping that last CI recovery cruise in October on the R/V Thompson could try to recover FS19 with the ROV Jason. Chief scientist William Wilcock is aware of the situation.

GS151 flash card could not be read. 0 data.

GS031 flash card could not be read. 0 data.

G33D binary file corrupted. With help from Blake Walker able to remove corrupted later part of the binary file and to process preceding data. Data end on JD 236, 2015 (24 August), ~1 month before instrument recovery.

#### General notes.

SIO used one 64 GB flash card per site for data storage. Storage use for complete sites is on the order of 28-29GB (Abalones), 52-53GB (4x4 LP loggers), 57GB (LP 'new dataloggers'), and 56-57GB (SP). The deployment period (roughly Julian Day 206-224 of 2014 for installation to 252-260 of 2015 for recovery) exceeded one year and not all types of loggers recorded for the entire period. Abalone and LP 'new dataloggers' recorded the entire period. SP instruments, depending on noise conditions, recorded the full period or fell short by up to about 10 days. 4x4 LP loggers operated for slightly over a 1 year on average and stopped about 1-1.5 months before recovery.

Unfortunately, we encountered 8 sites (installed during OC1407B) where the CF flash card was unreadable. All cards have the same lot number (B130928013B). The cards had passed pre-check out tests at SIO where they could be accessed, formatted and written to; it is not clear why they failed in the field. The same problem had occurred last year for recoveries during OC1407B and OC1408A but by the time these recoveries had been completed, we already, on the same cruise (OC1407B) had deployed instruments equipped with CF cards from the faulty lot. The affected sites are LP 4x4 instruments BB751, BB860, G12D, and G30D and SP instruments

GS031, GS141, GS151 and GS221. SIO personnel clarifies that a minority of cards from that batch actually did work, but majority did not.

We could not recover two sites (BB850 and FS19). Both are SIO Abalone OBS. They responded acoustically and burn commands were sent repeatedly to both burn wires to initiate release. We sent a total of 16 and 7, respectively, commands to initiate the burn sequence without success. We notified the OBSIB Management Office (Brent Evers) and the Cascadia Initiative Expedition Team (Doug Toomey) such that alternative recovery options could be considered. The final CI recovery cruise on October 1-15 (chief scientist William Wilcock) has an ROV on the R/V Thompson and, time permitting, they likely will try to rescue the two OBS. FS19 is part of the 2015 focus site and well within the food print of the Thompson cruise while BB850 is located near 44.5° N and 128° W in the Juan de Fuca plate.

Two sites failed recording after only 2 days. Reasons are currently unknown but likely not related (same length is a coincidence) since BS820 is an SP instrument and G11D is a 4x4 LP instrument with different electronic components.

Preliminary, cursory data screening indicates dead seismometer channels for GB111 (channel 1) and GS311 (channel 2), dead seismometers for GB321 and (for 2015) GB341 and a flat-line channel 3 (DPG) for J06D. SIO group will investigate reasons for failure back in their lab.

### *Strobes and Radios for Recovery*

Neither strobe nor radio worked for the very first recovery (site J20D). The instrument package was expected at surface around midnight local time. We received no light or radio signals. Last acoustic ping return indicated a distance (slant range) of about 500 m; we received no further ping responses indicating the instrument had reached the surface. Fortunately, the bridge was able to locate the instrument using the searchlight after about 15-20 min of searching.

Upon resurfacing, the strobe did not work for OBS package BB751 complicating night recovery.

Neither strobe nor radio worked upon surfacing for BB870. Both started working once they were lifted (crane) out of the water. Strobe and radio on Abalones lie flat and capacitive 'on switch' seems not to work (well). This was a daylight recovery, so not an issue. But problem seems to be consistent for Abalones. Same observation was made for BB840.

After these initial observations – neither strobe nor radio work for Abalones when they reach the sea surface – we decided to limit Abalones recovery to day times except for the very shallow focus sites FSxx near Cape Mendocino where we positioned the ship immediately behind the drop location to spot the OBS when it surfaced (worked for FS04 and FS08). In addition to the lack of visual or radio

contact, the Abalones (as they are configured currently) also cannot be acoustically pinged once they reach surface. During nighttime the only remaining way to find an Abalone became the ship's searchlight looking for an orange flag. We deemed this to be too risky for losing an OBS in choppy sea conditions. The change in operation required adjustments to the planned recovery route to ensure daylight conditions when an Abalone reached the surface. The adjustments are reflected in the recovery track (Figure 1). Fortunately this added only several hours of cruise time due to relatively close stations spacing (and luck). The mechanism for the on switch needs to be modified for strobe and radio to work properly. This problem had not occurred previously and seems to be due to a change in vendor.

### *Deck Space*

We recovered a total of 37 OBS with the R/V Oceanus. All SIO gear was stored on the main deck. The CTD rosette was removed before the cruise to provide space for all SIO instruments. The SIO group placed the gear very efficiently on deck. In addition, we ensured that LP instruments with their external ('dangling') broadband seismic sensors were recovered during the earlier part of the cruise since their recovery requires additional open deck space to bring the instrument safely on board.

**Acknowledgements:**

We would like to thank captain Jeff Crews, his crew and Marine Technician Robb Hagg and Marine Tech Superintendent Andrew Woogen for their exceptional helpfulness during OBS recovery. At least one member of the crew assisted in each recovery operation and Robb or Andrew were available around the clock for recoveries and help in the lab.

Thanks to Blake Walker for help in reading the non-corrupted part of the binary file for site G33D.

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**Gorda OBS Experiment - Oceanus OC1509A - OBS Recoveries, Braunmiller**

#	Sta. ID	Ins type	Drop location					Final location from OBSIP			Release		Data
			JD	hr:mn	Lat d	Lon d	Dpt 3.5	Lat d	Lon d	Dpt.	JD	hr:mn	2015
1	J20D	Abalone	206	7:54	44.3602	127.1085	2937**	44.3604	127.1085	2936	252	5:44	252
2	BB830	LP-T240	206	15:49	44.0251	127.6330	2937**	44.0244	127.6311	2939	252	10:15	252
3	BB850	Abalone	206	21:01	44.5338	128.0476	2876	44.5332	128.0460	2875	N/A	N/A	0
4	J23D	LP-T240	207	8:18	44.8275	129.6815	2720*	44.8274	129.6805	2726	253	4:28	253
5	BB751	LP-T240	207	14:03	44.5897	130.6578	2872*	44.5903	130.6532	2872	253	10:24	0
6	BB870	Abalone	208	2:08	44.0471	130.1031	3219	44.0454	130.1018	3219	253	16:45	253
7	BB711	LP-T240	208	11:32	44.1713	129.1426	2441	44.1684	129.1427	2441	253	21:53	224
8	BB721	LP-T240	208	17:57	43.7496	129.4129	3171	43.7499	129.4137	3171	254	5:33	226
9	J06D	LP-T240	209	3:31	43.2526	128.8037	3245	43.2526	128.8041	3245	254	11:14	214
10	BB860	LP-T240	209	12:33	43.7329	128.5042	2660	43.7308	128.5037	2660	254	16:42	0
11	BB840	Abalone	210	0:28	43.4252	128.0307	3278	43.4253	128.0334	3278	254	20:31	254
12	BS820	SP	210	7:29	43.5801	127.3629	2935	43.5799	127.3618	2935	255	1:19	211-14
13	BS810	SP	210	15:??	43.2203	126.7106	2940	43.2176	126.7093	2940	255	6:04	246
14	BS641	SP	211	3:11	43.9931	127.3023	2840	42.9939	127.3020	2840	255	10:51	245
15	G37D	Abalone	211	10:20	42.6286	127.3013	2805	42.6285	127.3009	2805	255	14:47	255
16	G30D	LP-T240	211	21:31	41.9515	128.2962	3179	41.9509	128.2975	3179	255	22:05	0
17	GB171	LP-T240	212	9:51	41.5967	127.4234	3469	41.5970	127.4254	3469	256	9:10	256
18	GB111	LP-T240	212	14:30	41.9228	127.1712	3403	41.9217	127.1716	3403	256	4:41	256
19	GS221	SP	213	2:53	41.0770	126.9134	3005	41.0760	126.9152	3005	256	15:37	0
20	G12D	LP-T240	213	7:19	40.7747	127.1364	2884	40.7730	127.1362	2884	256	19:14	0
21	GB341	LP-T240	213	10:26	40.3750	127.4410	1791	40.3721	127.4423	1791	256	23:38	217
22	GS311	SP	214	15:23	40.4577	125.1322	?	40.4554	125.1320	2498	258	3:38	258
23	GB321	LP-T240	214	21:02	40.3912	125.9110	2284	40.3922	125.9117	2284	257	22:05	227
24	G11D	LP-T240	215	3:53	40.7864	126.4681	3145	40.7845	126.4683	3145	257	17:24	216-14
25	GS151	SP	215	16:33	41.6965	126.3606	2964	41.6943	126.3597	2963	259	14:56	0
26	GS141	SP	216	0:21	41.6521	125.6513	3118	41.6537	125.5548	3119	260	10:40	0



<b>Gorda OBS Experiment - Oceanus OC1509A - OBS Recoveries, Braunmiller</b>													
#	Sta. ID	Ins type	Drop location					Final location from OBSIP			Release		Data
			JD	hr:mn	Lat d	Lon d	Dpt 3.5	Lat d	Lon d	Dpt.	JD	hr:mn	2015
27	GS031	SP	216	11:49	42.3580	125.8565	2625	42.3568	125.8614	2625	260	5:19	0
28	BS611	SP	216	20:29	42.8371	126.0136	2720	42.8374	126.0116	2720	260	1:17	253
29	GB101	Abalone	222		42.0233	126.5846	3585	42.0205	126.5880	3585	259	18:14	259
30	GS261	SP	222		40.9792	125.2197	3077	40.9785	125.2135	3077	259	6:47	257
31	G10D	Abalone	222		40.7854	125.5570	3015	40.7888	125.5544	3015	258	20:19	258
32	GB281	Abalone	223		41.0334	126.0933	3124	41.0284	126.0899	3124	259	0:57	259
33	GB331	Abalone	223		40.5122	126.5847	3171	40.5130	126.5840	3171	257	13:46	257
34	FS04	Abalone	223		40.2526	124.5044	155	40.2528	124.5052	155	258	8:00	258
35	FS08	Abalone	223		40.3343	124.4650	132	40.3347	124.4653	132	258	9:30	258
36	FS19	Abalone	224		40.6241	124.4703	100	40.6239	124.4704	100	N/A	N/A	0
37	FS44	Abalone	224		40.7610	124.7030	837	40.7609	124.7028	837	258	16:16	258
38	M16D	Abalone	224		41.6615	124.8068	882	41.6618	124.8071	882	260	15:51	236
39	G33D	Abalone	224		42.6656	124.8024	686	42.6653	124.8020	686	260	21:36	260
*: unreliable 3.5KHz depth			**: depth from 12KHz										
BB830 new datalogger			J23D, GB171, GB111 new datalogger, glass ball										

Table 1. Drop and final OBSIP-supplied instrument locations of 39 OBS recovered during OC1509A (and deployed 2014 during cruises OC1407B and OC1408A). All are SIO OBS; seismic sensors are Trillium 240s (LP-T240), Trillium Compact 40 s (Abalones) and Mark L-28 short period (SP), respectively. All have a DPG. JD is day of year instrument was deployed (year being 2014), respectively, recovered (year 2015); times (hr:mn) are in UTC. Dpt is depth from 3.5 KHz echo sounder. Depth of final location is fixed to depth read from 3.5 kHz echo sounder at drop point. Data indicates end JD of recordings (year 2015 unless ending in -14 then 2014); '0' means no (or essentially no) data recorded. Red: Instruments that could not be recovered. Orange: Instruments with no data (CF card issues) or ~2 day recording lengths. Light pink: Instruments with other issues such as non-working channels and lack of clock drift control, etc., see text for details.

# OC1509A - September 8 - 18, 2015

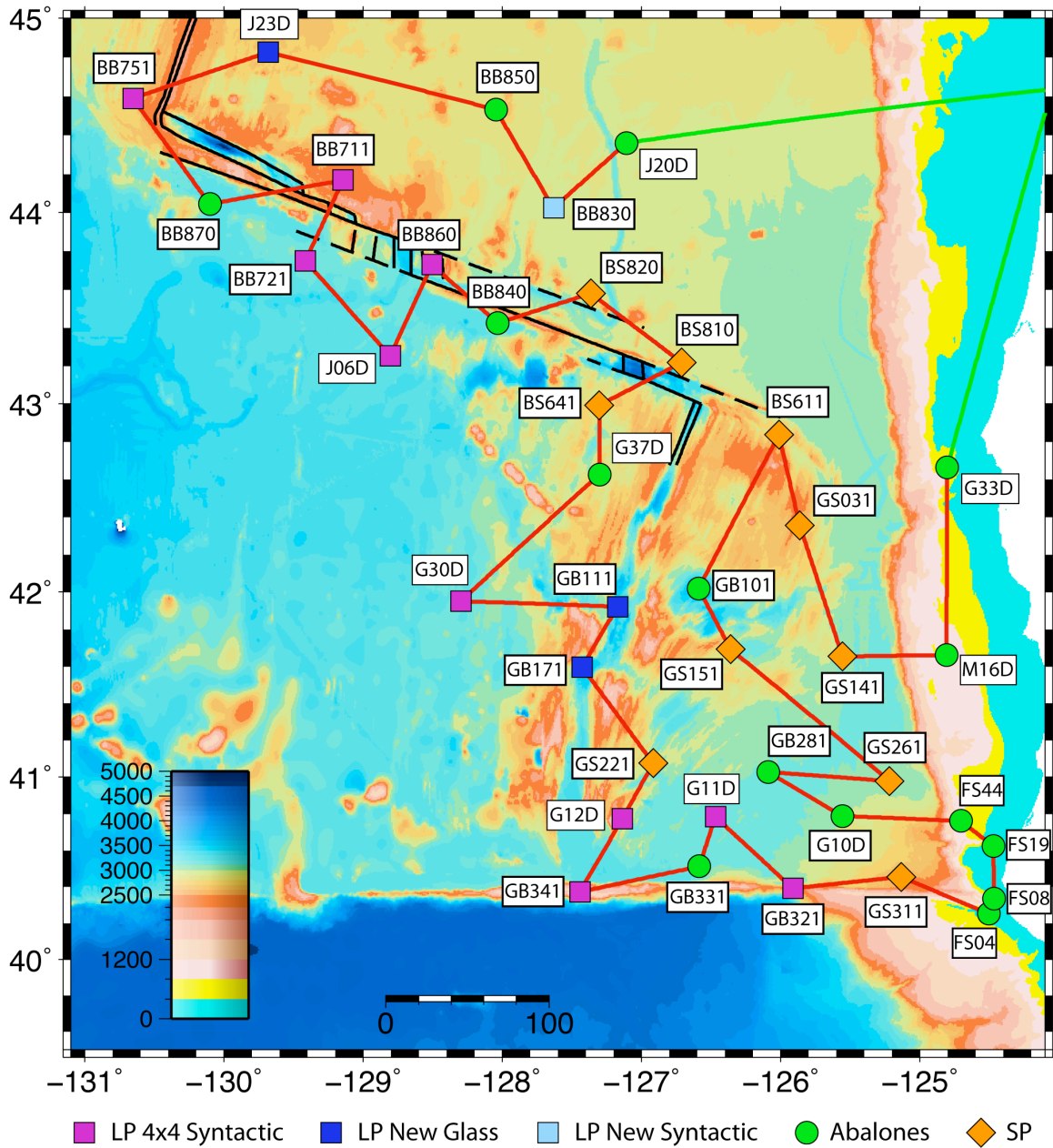


Figure 1. Track line (green and red) and SIO OBS recovery sites for cruise OC1509A. First recovery: site J20D. Purple ('4x4' LP) and blue ('new datalogger' LP) squares: broadband, green circles: broadband (Abalone Trillium Compact 40-s) and orange diamonds: short-period (SP) instruments. Major issues: We could not recover BB850 and FS19; Sites BB751, BB860, G30D, GS221, G12D, GS151, GS031 had unreadable CF cards; BS820 and G11D each worked for 2 days only. Scale in [km].