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GEOLOGICAL SURVEY OF CANADA
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Report of Cruise 2014006PGC
SeaJade-II: Seafloor Earthquake Array Japan-Canada Cascadia Experiment
OBS recovery

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2014

Canada

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Publications in this series have not been edited; they are released as submitted by the author.

Table of Contents

List of Figures (with short captions)

List of Tables

1 Overview

The Seafloor Earthquake Array–Japan-Canada Cascadia Experiment (SeaJade) is a multiyear, two-phase collaboration involving the Geological Survey of Canada (GSC), Japan Agency for Marine Earth Science and Technology (JAMSTEC), and the University of Victoria. The present phase of the NRCan-JAMSTEC collaboration is defined by the *Implementation Agreement for a Cooperative Project on Seismicity and Structure of the Northern Cascadia Subduction Zone,* under an MOU between NRCan and JAMSTEC. The first phase of SeaJade-I consisted of the successful deployment and retrieval of 32 short-period ocean bottom seismometers (OBS) from JAMSTEC using the *CCGS John P. Tully* from July to October 2010. The OBS instruments detected more than 1400 earthquakes during their 3-month deployment, ranging in magnitude from about zero to 3.8. Most of these earthquakes were located along the Nootka fault zone, while only a few tens of events occurred beneath the continental slope and shelf. Based on the low rates of seismicity recorded during SeaJade-I, it was concluded that a 3-month recording period was insufficient to characterize the general seismicity pattern and a longer-duration experiment was devised (SeaJade-II). In SeaJade-II, 35 OBSs were deployed in December 2013 for a period of 10 months. This cruise report summarizes the retrieval of these instruments in September 2014. Figure 1 shows the OBS locations, superimposed on the seismicity determined from SeaJade-I. Compared to SeaJade-I, the OBS instruments are more closely spaced at the Nootka fault zone, the region of highest seismicity recorded, with approximately the same spacing in the southern portion of the study area.

The main questions to be addressed in SeaJade-II are:

1) Can we confirm the low level of seismicity along the Cascadia megathrust recorded during SeaJade-I, and can we locate this seismicity precisely (horizontally as well as in depth)? What are the implications of the seismic quiescience to the locking state of the megathrust?

2) Can we determine the detailed structure of the Nootka Fault Zone (NFZ), particularly the landward limit of the plate boundary seismicity as the fault reaches beneath the Vancouver Island margin? How does the kinematics of the NFZ affect the seismogenic behavior of the megathrust to both sides?

Two scientists and two technicians from JAMSTEC participated in the offshore expedition, as well as work related to the preparation and post-expedition demobilization at the dock/hangar facilities of the Institute of Ocean Sciences in Sidney, BC. JAMSTEC personnel provided all technical handling of the OBS, including dismounting the radio antennae and flash-lights after instrument recovery at sea, as well as final data transfer from each OBS. Recovery of the OBS on the aft-deck of the vessel was carried out by NRCan and Coast Guard personnel according to NRCan and Coast Guard standard offshore operating procedures.

Two copies of the raw data were kept at the GSC-office in Sidney in different locations for backup purposes.

Prior to the cruise, tools and other parts were air transported to Sidney under an ATA Carnet and shipped back to Japan after the cruise with the Carnet closed. The recovered OBSs were shipped back to Japan in a regular 20-ft container by ocean freight. Sagami Transportation in Japan, through Kintetsu World Express (Canada) Inc., was responsible for both the air and ocean shipment before and after the cruise this year. King Brothers Co., our shipping broker for temporarily importing the OBSs in 2013, was not officially involved this time because, per Customs memorandum D20-1-1, goods imported under an E29B do not require a B13 Export Declaration. But King Bro. still provided useful advice at different stages of the shipping processes this year.

One of the 35 OBSs deployed in 2013 (Station #30) drifted away sometime after the deployment and was found by a fisherman off Oregon on September 14, 2014, just before the recovery cruise. Arrangement was quickly made for this OBS to be returned to Sidney in time to be shipped back to Japan together with the other 34 OBSs.

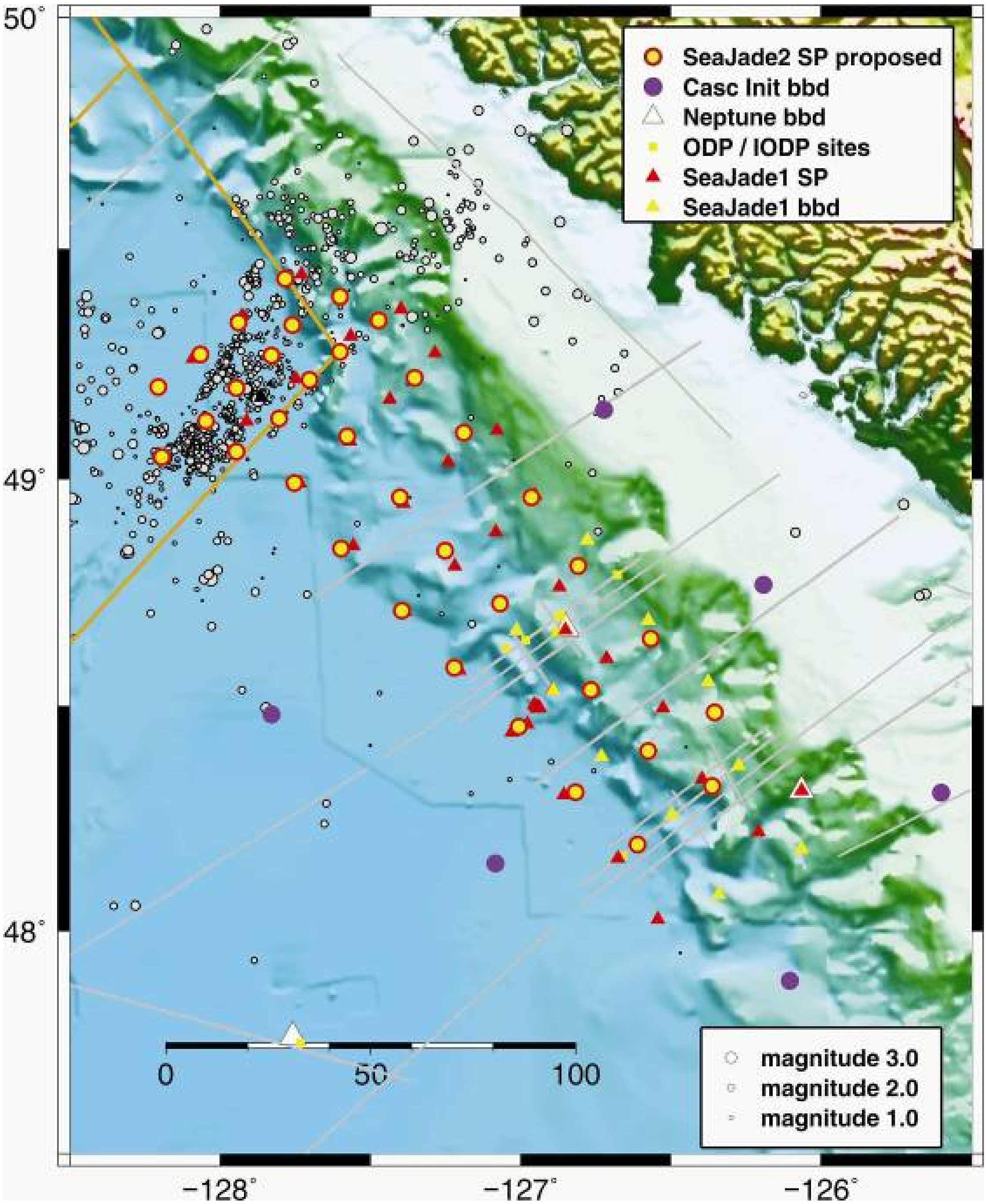

Figure 1: Map of the grid of OBS that were deployed during SeaJade-II operations with *CCGS John P. Tully*. Earthquakes as detected from SeaJade-I OBS (short period (SP), and broad band (bbd)) are shown as grey dots. Regional seismic data acquired in 1989 are also shown as grey lines; [Cascadia Initiative broad-band: Stations of the US-based Cascadia Initiative broad-band seismometers; Neptune bbd: permanently installed broad-band seismometer along cabled observatory].

2 Cruise Narrative

All times reported in this section are in Pacific Daylight Time (PDT)

Tuesday, September 23

The first fall storm with winds up to 50 knots, and 7-8 meter wave height in the offshore prevented us from leaving IOS on time. We used this day to start loading gear and prepare the laboratory for departure.

Wednesday, September 24

We continued loading equipment, mostly in preparation of the expedition following SeaJade-II. The weather was still unfavourable for departure.

Thursday, September 25

Due to unforeseen circumstances, a replacement officer was required. We waited for his arrival (17:35 flight from Toronto). During the day, we finalized all preparations. A safety briefing was held at 13:00 with all science crew.

20:00 Departure from IOS

Friday, September 26

13:00 Fire and lifeboat Drill

14:00 Arrived at first OBS Station **OBS #08**

Sea still rough (3 meter swell, but only 10 knot winds)

14:16 Release command sent to OBS and accepted

14:40 OBS released

The anticipated burn-time was 15 minutes;

It took 24 minutes, about 1.5 times as long as the calculated time

15:04 OBS on surface

15:48 OBS secured on deck

En route to Station OBS #01, 3.5 kHz in standby mode as topography too rough and sea state too severe for data acquisition

17:05 Arrived at **OBS #01**

17:11 Release command sent to OBS and accepted

18:03 OBS released, burn time of 52 minutes almost 4-times longer than expected, OBS may have been buried in mud

18:44 OBS on surface

19:05 OBS secured on deck

En route to Station OBS #02

19:08 SOL 3.5 kHz Line 01; File name root: 0003_270_0207

The target of the line was the mouth of the Barkley Canyon System and sand-waves on abyssal plain

20:17 EOL 3.5 kHz Line 01

20:20 Arrived at **OBS #02**

20:22 Release command sent to OBS and accepted

20:37 OBS released, normal burn time of 15 minutes

21:23 OBS on surface

21:55 OBS on deck

22:05 SOL 3.5 kHz Line 02; File name root: 0004_270_0504, 0004_270_0544

At the start of this line, the northern edge of the sand-wave structure is captured. However, steep slopes en route to OBS #03 reduced data quality significantly for most of this remainder of the line

23:03 EOL 3.5 kHz Line 02

23:05 Arrived at **OBS #09**

23:08 Release command sent and accepted

23:25 OBS released, normal burn time of 17 minutes

23:55 OBS on surface

<u>Saturday, September 27</u>

00:12 OBS on deck

No 3.5 kHz data acquired due to steep slopes and unfavourable sea state

01:28 Arrived at **OBS #10**

01:30 Release command sent and accepted

01:53 OBS released, burn time of 23 minutes 1.5 longer as expected

02:14 OBS on surface

02:26 OBS on deck

No 3.5 kHz data acquired due to steep slopes and non-favourable sea state

03:33 Arrived at **OBS #03**

03:35 Release command sent and accepted

03:53 OBS released, burn time of 18 minutes slightly longer than expected

04:39 OBS on surface

04:50 OBS on deck

04:58 SOL 3.5 kHz Line 03; File name root: 0005_270_1158

05:58 EOL 3.5 kHz Line 03

06:05 Arrived at **OBS #04**

06:08 Release command sent and accepted

06:25 OBS released, burn took of 33 minutes twice as long as expected

07:08 OBS on surface

07:22 OBS on deck

07:26 SOL 3.5 kHz Line 04; File name root: 0006_270_1425, 0006_270_1432, 0006_270_1438

08:20 EOL 3.5 kHz Line 04

08:20 Arrived at **OBS #11**

08:23 Release command sent and accepted

08:36 OBS released, normal burn-time of 13 minutes

09:13 OBS on surface

09:23 OBS on deck

09:25 SOL 3.5 kHz Line 05; File name root: 0006_270_1432 (note: no file-break across OBS station was made; line was acquired with many changes in gain)

10:37 EOL 3.5 kHz Line 05

10:38 Arrived at **OBS #05**

10:40 Release command sent and accepted

11:03 OBS released, burn-time of 23 minutes is 1.5 times longer than expected

11:45 OBS on surface

11:52 OBS on deck

11:54 SOL 3.5 kHz Line 06; File name root: 0007_270_1853

12:46 EOL 3.5 kHz Line 06

12:48 Arrived at **OBS #12**

12:52 Release command sent and accepted

13:20 OBS released, burn time of 28 minutes almost twice as long as expected

13:53 OBS on surface

14:04 OBS on deck

14:05 SOL 3.5 kHz Line 07; File name root: 0008_270_2105

14:53 EOL 3.5 kHz Line 07

14:58 Arrived at **OBS #13**

15:00 Release command sent and accepted

15:16 OBS released, normal burn-time of 16 minutes

15:50 OBS on surface

16:04 OBS on deck

16:06 SOL 3.5 kHz Line 08; File name root: 0009_270_2306

17:12 EOL 3.5 kHz Line 08

17:14 Arrived at **OBS #06**

17:16 Release command sent and accepted

17:46 OBS released, burn time of 30 minutes took twice as long as expected

18:26 OBS on surface

18:39 OBS on deck

18:42 SOL 3.5 kHz Line 09; File name root: 0010_271_0141

19:36 EOL 3.5 kHz Line 09

19:36 Arrived at **OBS #07**

19:38 Release command sent and accepted

20:00 OBS released, burn time of 22 minutes ~1.5 times of normal

20:36 OBS on surface

20:50 OBS on deck

20:54 SOL 3.5 kHz Line 10; File name root: 0011_271_0354

21:43 EOL 3.5 kHz Line 10

21:44 Arrived at **OBS #21**

21:45 Release command sent and accepted

22:13 OBS released; OBS echoes are noisy, release time not accurate, probably at nominal burn time of ~15 minutes

22:45 OBS on surface (rise time suggest that release was at accurate time after 15 minutes of burning)

22:58 OBS on deck

23:02 SOL 3.5 kHz Line 11; File name root: 0012_271_0602

23:35 EOL 3.5 kHz Line 11

23:40 Arrived at **OBS #27**

23:43 Release command sent and accepted

Sunday, September 28

00:17 OBS released and coming up, burn time of 34 minutes about twice as long as expected

00:47 OBS on surface

00:56 OBS on deck

01:00 SOL 3.5 kHz line 12, File name root: 0013_271_0800

01:42 EOL 3.5 kHz Line 12

01:43 Arrived at **OBS #26**

Three attempts to trigger, ship drifting in wind, too far off station

01:44 1st attempt

01:58 Ship re-alignment with station

02:08 2nd attempt

02:23 3rd attempt, continue to send commands for 34 minutes

03:07 OBS finally accepts trigger command

03:22 OBS released, normal burn time of 15 minutes

04:08 OBS on surface

04:12 OBS on deck: record-breaking speed of recovery by crew!

04:16 SOL 3.5 kHz line 13, File name root: 0014_271_1115

05:00 EOL 3.5 kHz Line 13

05:02 Arrived at **OBS #32**

05:04 Release command sent and accepted

05:45 OBS released, burn time of 41 minutes more than twice as long as expected, OBS may be buried in mud

06:24 OBS on surface

06:30 OBS on deck

06:35 SOL 3.5 kHz line 14, File name root: 0015_271_1335

07:15 EOL 3.5 kHz Line 14

07:20 Arrived at **OBS #33**

07:35 Trigger attempt failed, move vessel 0.5 nautical miles west of station

07:44 2nd trigger attempt

07:49 OBS finally accepts trigger command

08:10 OBS released, 21 minutes burn time, 1.5 longer than expected

08:51 OBS on surface

09:02 OBS on deck

09:04 SOL 3.5 kHz line 15, File name root: 0016_271_1602
This line crosses the northern edge of the Nootka fault zone

09:37 EOL 3.5 kHz Line 15

09:37 SOL 3.5 kHz Line 16, File name root: 0017_271_1637
This line crosses the northern mud volcano (Figure 2);

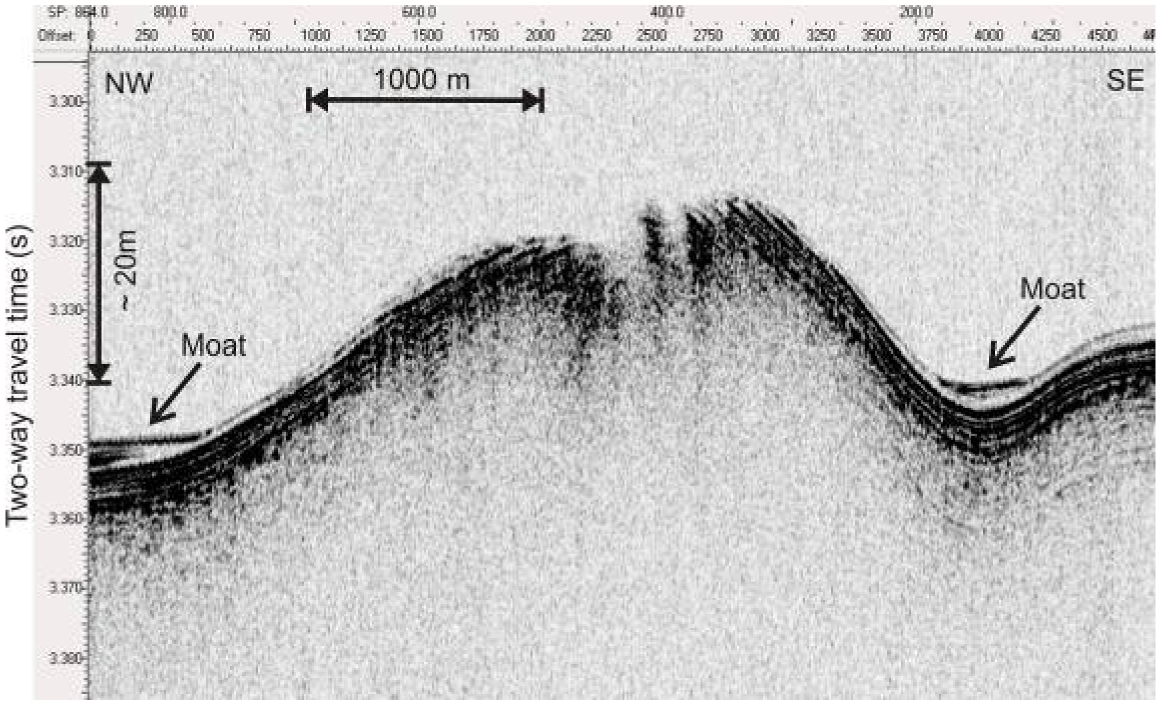

Figure 2: 3.5 kHz data showing a series of normal faults across the northern mud volcano. Note the asymmetrical moat development.

10:07 EOL 3.5 kHz Line 16

10:07 SOL 3.5 kHz Line 17; File name root: 0018_271_1707

This line connects back to the next OBS station

10:23 EOL 3.5 kHz Line 17

10:25 Arrived at **OBS #28**

10:26 OBS accepts trigger command

10:41 OBS released, normal burn time

11:23 OBS on surface

11:36 OBS on deck

Starting a set of three lines across the southern mud volcano

11:37 SOL 3.5 kHz line 18; File name root: 0019_271_1837

11:54 EOL 3.5 kHz line 18

11:54 SOL 3.5 kHz line 19; File name root: 0020_271_1856

This line (Figure 3) crosses the southern mud volcano

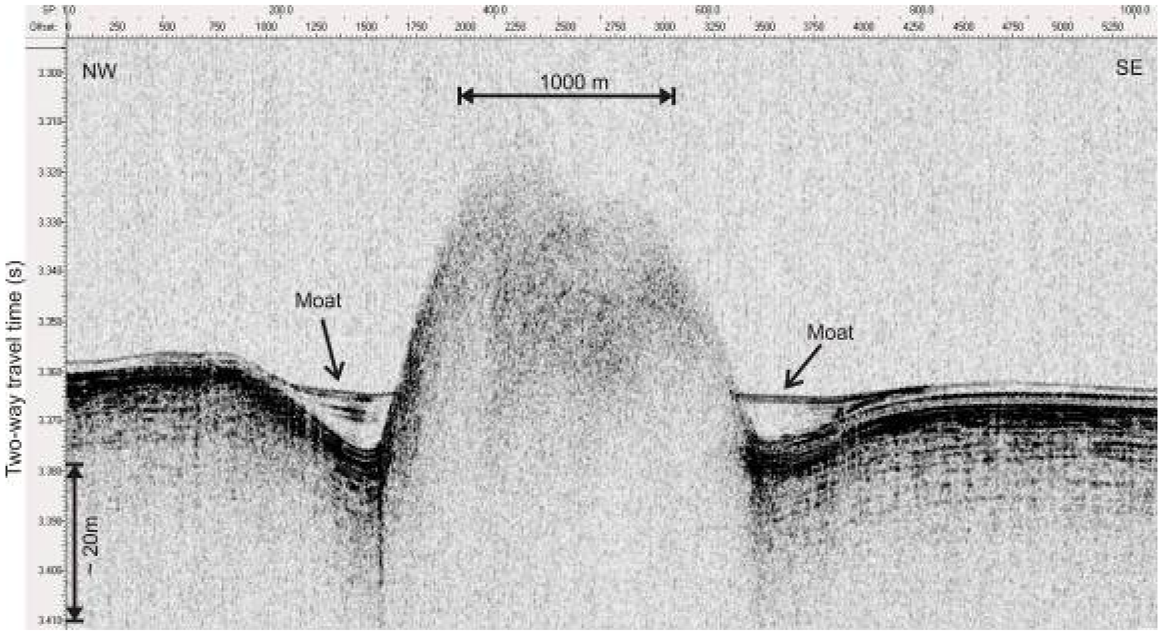

Figure 3: 3.5 kHz data showing laminated moats to both sides of the southern mud volcano as well as a weakly reflective top mound surface.

12:33 EOL 3.5 kHz line 19

12:33 SOL 3.5 kHz line 20; File name root: 0021_271_1932

12:53 EOL 3.5 kHz line 20

12:53 Arrived at **OBS #22**

12:54 OBS accepts trigger command

13:10 OBS released, normal burn time

13:48 OBS on surface

13:55 OBS on deck

14:01 SOL 3.5 kHz line 21, File name root: 0022_271_2101

14:52 EOL 3.5 kHz line 21

14:52 Arrived at **OBS #14**

14:58 OBS accepts trigger command

15:14 OBS released, normal burn time

15:47 OBS on surface

16:09 OBS on deck

16:46 SOL 3.5 kHz line 22, only for portion of abyssal plain, not across steep topography, File root name: 0023_271_2346

16:58 EOL 3.5 kHz line 22

17:00 Arrived at **OBS #23**

17:02 OBS accepts trigger command

17:19 OBS released, normal burn time

18:02 OBS on surface

18:12 OBS on deck

18:14 SOL 3.5 kHz line 23, File root name: 0024_272_0114

18:27 EOL 3.5 kHz line 23

18:30 Vessel paused for burial at sea ceremony

18:40 Continuation of survey

18:42 SOL 3.5 kHz line 24, File root name: 0025_272_0142

19:09 EOL 3.5 kHz line 24

19:10 Arrived at **OBS #29**

19:12 OBS accepts trigger command

19:28 OBS released, normal burn time

20:40 OBS on surface

This OBS had non-functioning radio beacon and non-functioning light-strobe. We quickly re-deployed the transducer to define distance between vessel and floating OBS; during this process, we determined that the distance between vessel and OBS was steadily reducing; using vessel's search-lights to identify OBS in water using reflections from metal pieces and special reflective safety tape on the OBS;

OBS was spotted within few minutes by crew on bridge;

20:50 OBS on deck

20:55 SOL 3.5 kHz line 25, File root name: 0026_272_0355

21:27 EOL 3.5 kHz line 25

21:30 Arrived at **OBS #34**

21:31 OBS accepts trigger command

21:53 OBS released, burn time of 22 minutes slightly longer than expected

22:36 OBS on surface

22:42 OBS on deck

22:45 SOL 3.5 kHz line 26, File root name: 0027_272_0545

23:26 EOL 3.5 kHz line 26

23:35 Arrived at **OBS #35**

23:36 OBS accepts trigger command

<u>Monday, September 29</u>

00:14 OBS released, burn time of 38 minute is twice as long as expected, OBS maybe buried in mud

00:33 OBS on surface

00:45 OBS on deck

00:47 SOL 3.5 kHz line 27, File name root: 0028_272_0747

01:19 EOL 3.5 kHz line 27

01:44 Arrived at **OBS #31**

01:46 OBS accepts trigger command

04:22 OBS released; extremely long burning time; maybe deeply buried

04:52 OBS on surface

05:05 OBS on deck, OBS shows sign of biological growth on its surface

05:11 SOL 3.5 kHz line 28; File name root: 0029_272_1211

05:40 EOL 3.5 kHz line 28

05:41 Arrived at **OBS #25**

05:42 OBS accepts trigger command

05:59 OBS released; normal burn time

06:22 OBS on surface

06:33 OBS on deck

06:36 SOL 3.5 kHz line 29, File name root: 00_30_272_136
This line connects to the area of eroded anticline and possible mound/reef structures on shelf edge; same site where Huntec data (Figure 4) were acquired in 2012 and a multi-beam test was conducted during December 2013 OBS deployment cruise.

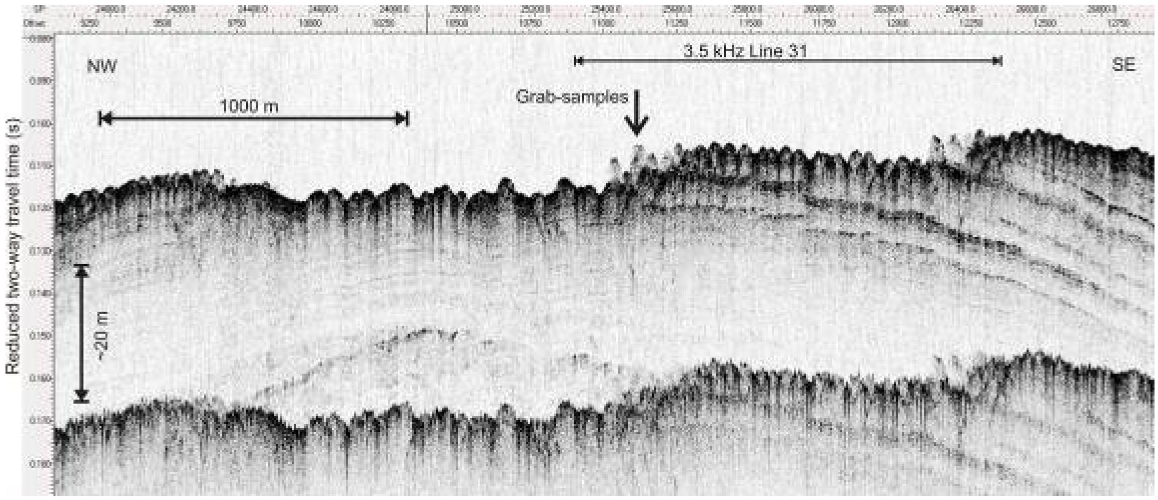

Figure 4: Portion of the 2012 Huntec deep-tow data across an eroded anticline structure with abundant small mounds on seafloor.

08:08 EOL 3.5 kHz line 29

08:22 Bottom-camera deployed to photograph potential mound/reef structures

No communication to depth-finder hydrophone

Testing system with JAMSTEC receiving hydrophone

No communications to the pinger, abandon idea of photo-transect;

08:54 Camera back on deck

Started running 3.5 kHz line while testing hydrophone listening equipment

08:56 SOL 3.5 kHz line 30

09:18 EOL 3.5 kHz line 30

09:18 SOL 3.5 kHz line 31

09:47 on top of location for grab-sample; centre of mound structure

09:57 EOL 3.5 kHz line 31

10:06 Shipek grab-sample #1; only little mud and solidified mud stone

10:18 Shipek grab-sample #2; little mud mixed with solidified mud stone

Potentially foraminifera-rich sediment

10:26 SOL 3.5 kHz line 32

12:59 EOL 3.5 kHz line 32

13:00 Arrived at **OBS #24**

13:06 OBS accepts trigger command

13:20 OBS released; normal burn time

13:56 OBS on surface

14:06 OBS on deck

14:09 SOL 3.5 kHz line 33; File name root: 0034_272_2109

14:58 EOL 3.5 kHz line 33

15:00 Arrived at **OBS #20**

15:03 OBS accepts trigger command

15:38 OBS released; difficulties hearing signals from OBS, release may have been earlier

15:46 OBS on surface

16:01 OBS on deck

16:04 SOL 3.5 kHz line 34; File name root: 0035_272_2304

16:55 EOL 3.5 kHz line 34

16:58 Arrived at **OBS #19**

16:59 OBS accepts trigger command

17:16 OBS released; normal burn time

17:43 OBS on surface

17:53 OBS on deck

17:57 SOL 3.5 kHz line 35; File name root: 0036_273_0057

19:01 EOL 3.5 kHz line 35

19:03 Arrived at **OBS #18**

19:05 OBS accepts trigger command

19:20 OBS released; normal burn time

19:37 OBS on surface

19:48 OBS on deck

19:55 SOL 3.5 kHz line 36; File name root: 0037_273_0255

20:50 EOL 3.5 kHz line 36

20:52 Arrived at **OBS #17**

20:54 OBS accepts trigger command

21:08 OBS released; normal burn time

21:32 OBS on surface

21:45 OBS on deck

21:52 SOL 3.5 kHz line 37; File name root: 0038_273_0452
This line deviates from a straight line between the OBS stations
It crosses the zone of previously acquired Controlled Source Electromagnetic (CSEM) data showing an unusual 10 Ohm-m resistivity anomaly, possibly related to cold vent activity

23:38 EOL 3.5 kHz line 37

23:40 Arrived at **OBS #16**

23:41 OBS accepts trigger command

Tuesday, September 30

00:02 OBS released; slightly longer burn time of 21 minutes

00:21 OBS on surface

00:40 OBS on deck

00:44 SOL 3.5 kHz line 38; File name root: 0039_273_0744

01:45 EOL 3.5 kHz line 38

01:55 Arrived at the last **OBS #15**

01:59 OBS accepts trigger command

02:14 OBS released; normal burn time

02:31 OBS on surface

02:40 OBS on deck

Official end of recovery;

All OBSs were retrieved with the exception of station #30. OBS #30 self-released likely during the summer and was found floating off the coast of Oregon by fishermen on September 14. OBS #30 was recovered by the fisherman and returned to IOS as mentioned in Overview.
A summary of ship-track during cruise 2014006PGC is shown in Figure 5.

We started our journey home, with an expected arrival at IOS near 20:00

20:30 Alongside IOS, Customs cleared, end of cruise

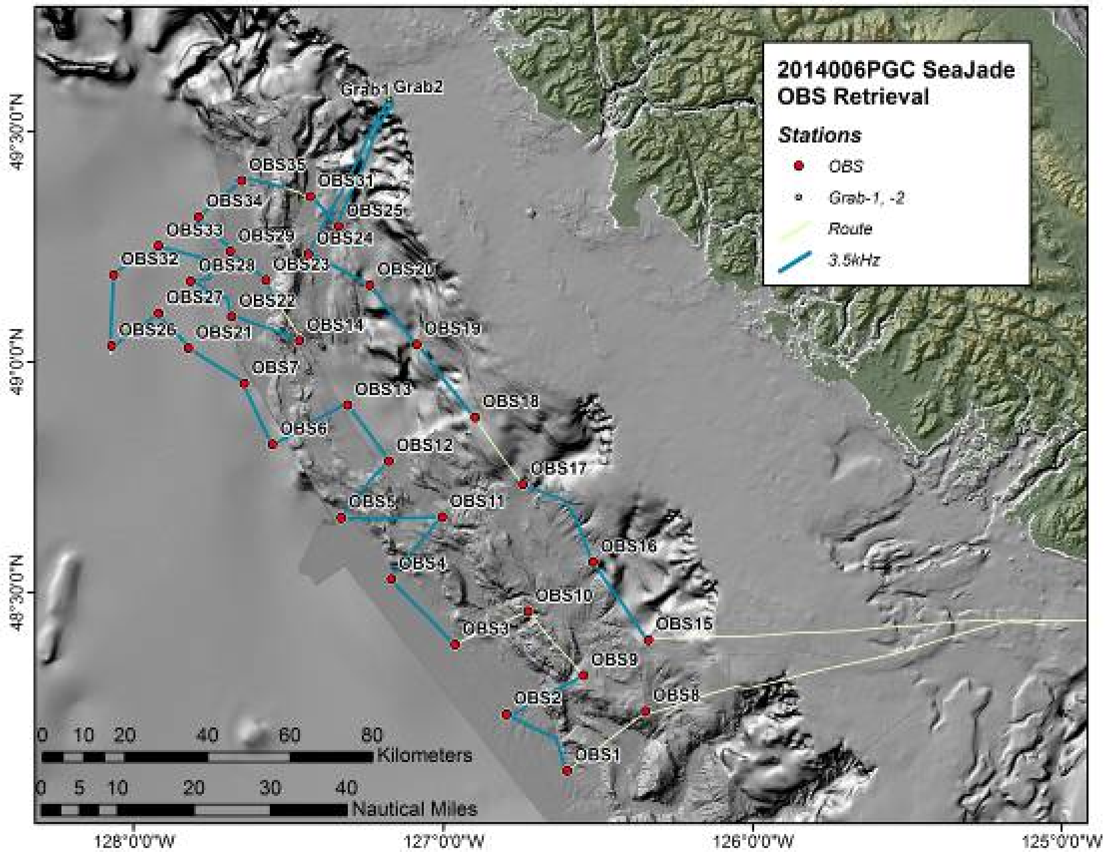

Figure 5: Map of cruise track, 3.5 kHz data acquisition, and OBS stations recovered. Locations are listed in Table 1.

<u>Wednesday, October 1</u>

07:00 – 09:00 Unloading of JAMSTEC OBS and equipment

10:00 Handover of vessel to Gwyn Lintern, chief-scientist of next expedition

3 Summary of 3.5 kHz data collection

Prior to the expedition 2014006PGC, technical difficulties with the hull-mounted 3.5 kHz sub bottom profiler were reported. After verification that the problem was not related to the NRCan-owned acquisition hardware and software, but the vessel's internal system, the wiring and electronics were removed from the Tully over the summer period and repaired and re-installed just prior to the OBS recovery mission.

After an initial test of functionality while still alongside at IOS, the 3.5 kHz system was tested "in the field" along transit to the first OBS station. Initial data collection was slightly impeded by the sea-state but progressively improved throughout the expedition. The quality of the data acquired was excellent. Of particular note is the high quality data acquired in the deep-water, which traditionally has been challenging to collect.

Due to the departure delay, there was very little time to acquire data over features of interest. Only few deviations from the direct route between OBS were made, focusing on four targets:

(a) Sand-waves at the mouth of the Barkley canyon system,
(b) Mud volcanoes along the Nootka fault zone,
(c) Shelf-edge eroded anticline with potential mound/reef features,
(d) Potential cold vents along previously acquired Controlled-Source EM data.

Initial data collected onboard were post-processed (navigation, envelop-attribute calculation) immediately upon acquisition and imported to the West-Coast Kingdom Suite project.

4 Summary of echo-sounder data collection

During the entire expedition, the multi-frequency echo-sounder suite was used to collect additional data, with a focus on potential gas-emissions on the accretionary prism. A total of two new, previously unknown, vent sites were detected (Figure 6a, b). Interestingly, no gas emissions were detected across the two prominent mud volcanoes along the Nootka Fault zone.

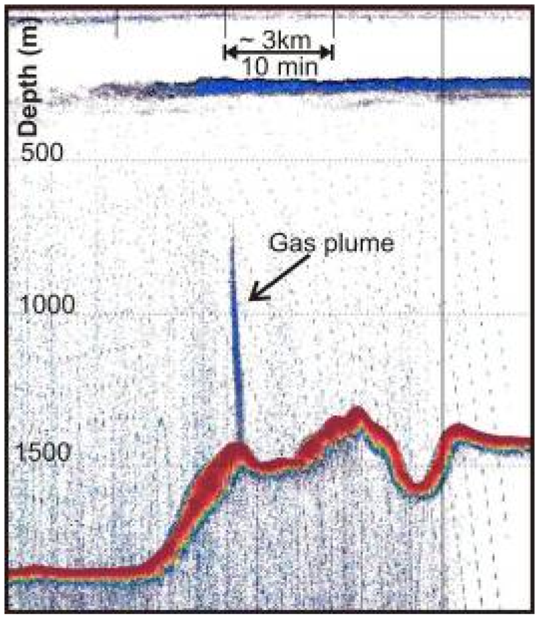

Figure 6a: Vent 1: 49º 14.917’ N; -127º 26.933’ W (along 3.5 kHz line 33)

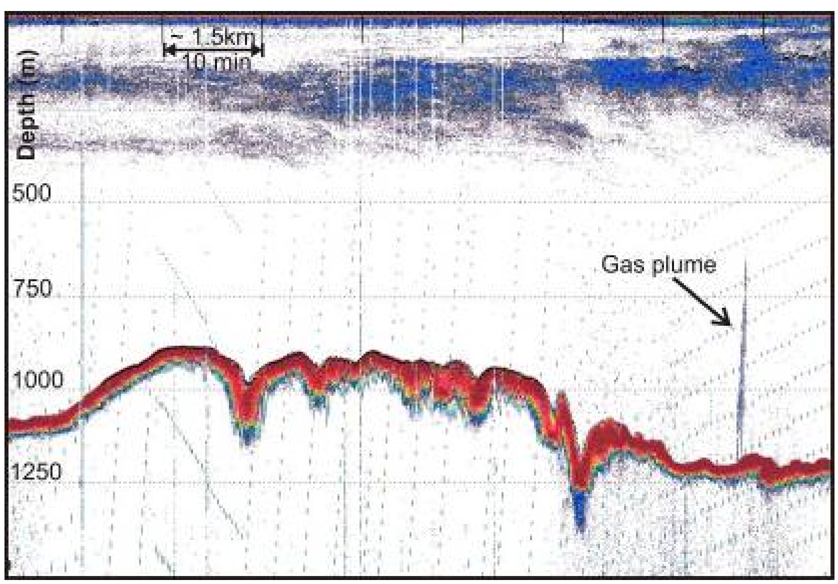

Figure 6b: Vent 2: 48º 40.865’ N; -126º 35.155’ W (along 3.5 kHz line 37 of previous CSEM data acquisition).

5 Recovery procedure

The OBS recovery sequence consists of two parts. In the first part, the vessel is positioned at the expected OBS location and a single hydrophone is deployed over the star-board side. This hydrophone is used to communicate to the OBS, still located on the seafloor. After an initial contact response by the OBS, a release command is sent to the OBS to start the process of detaching the OBS from its anchor. This detaching-, or burning-process, takes about 15 – 20 minutes, but can take longer (up to one hour) depending on the physical state of the OBS (e.g. if the instrument sank in to the mud). Once the OBS is detached from the seafloor, it rises with a speed of ~1m/s. Rise-times for the SeaJade-II instruments ranged from 18 to 45 minutes. Once on the surface, the OBS can be located visually (yellow floats, strobe-light, reflective tape) or by directional radio-communication. The second part of the OBS recovery starts with positioning of the vessel in such a way, that the OBS floats alongside of the starboard side of the vessel. On the starboard side of the aft-deck, personnel use grab-poles with a snap-hook and rope attached to attach the rope to the metal frame of the OBS. Once the rope is attached, the OBS is dragged to the stern, where it gets connected to the 3/8" winch-wire. Once attached to the winch-wire, a second rope is attached to the OBS to aid in the recovery. The OBS is finally pulled up with the winch through the A-frame, secured on deck, and finally hand-carried into the laboratory for dismantling and data recovery.
A sequence of images is shown in Figure 7 to highlight the second part of the recovery sequence.

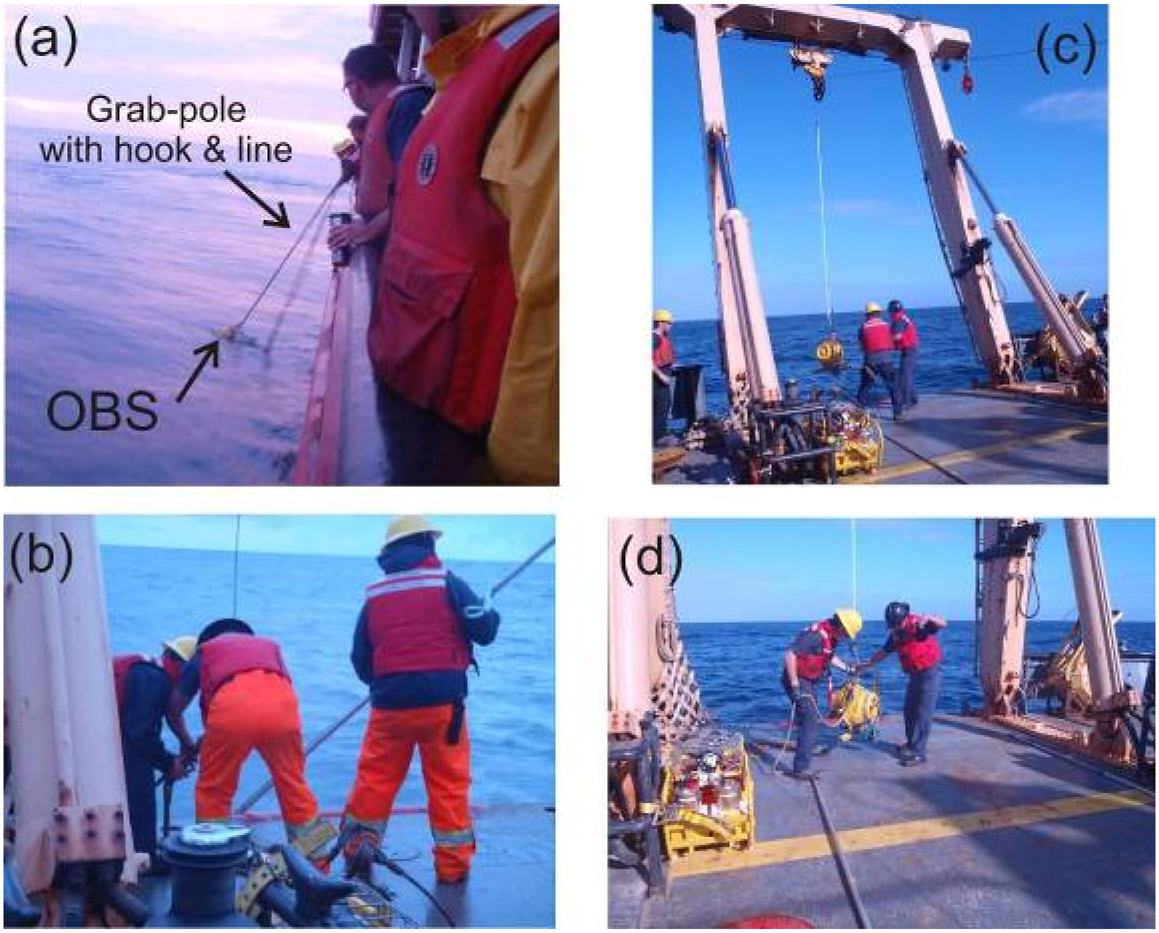

Figure 7: OBS recovery sequence: After the OBS is spotted on surface, the vessel is positioned that the OBS is brought alongside the starboard side. (a) Personnel equipped with grab-pole, to which a snap-hook and line is attached are positioned on the starboard aft-deck and attaché the hook to the metal frame of the OBS, (b) The OBS is then pulled to the stern, where the rope is attached to the winch-wire and a second line is attached to the OBS in the same manner as seen in (a) to aid in recovery, (c) the OBS is pulled in across the A-frame and winch, and (d) secured on deck.

Acknowledgements

We would like to thank Captain Mike Corfield and the entire crew of CCGS John P. Tully for their exceptional effort during the OBS recovery program of SeaJade-II. Deck and ship operations, especially the challenging manoeuvre of the vessel to align it to the floating OBS, attaching the lift-rope and final recovery of the instrument with the A-frame went smooth and without incident. With an average of only 10 minutes from sighting of the OBS on the surface to the instrument on deck demonstrates the efficiency and professional behaviour of the entire crew involved.

Table 1. Location of Ocean-Bottom Seismometers (OBS) recovered.

SITE	OBS position		
	Latitude	Longitude	Depth(m)
1	48º 11.5315 ‘N	126º 36.6788 ‘W	2490
2	48º 18.5037 ‘N	126º 49.0979‘W	2557
3	48º 27.0616 ‘N	127º 00.1712‘W	2570
4	48º 35.0942 ‘N	127º 13.2697‘W	2563
5	48º 42.5409 ‘N	127º 23.8284‘W	2546
6	48º 51.4478 ‘N	127º 38.4448‘W	2538
7	48º 59.3875 ‘N	127º 45.1804‘W	2521
8	48º 19.3705 ‘N	126º 21.8280‘W	1172
9	48º 24.0637 ‘N	126º 34.5630‘W	1554
10	48º 32.1465 ‘N	126º 45.9833‘W	1420
11	48º 43.5741 ‘N	127º 04.1895‘W	2045
12	48º 50.5884 ‘N	127º 15.0705‘W	2057
13	48º 57.5214 ‘N	127º 24.1013‘W	2066
14	49º 05.5740 ‘N	127º 34.7452‘W	1976
15	48º 29.0900 ‘N	126º 22.1704‘W	1016
16	48º 38.9461 ‘N	126º 34.0430‘W	1137
17	48º 48.5406 ‘N	126º 48.5275‘W	1341
18	48º 56.9382 ‘N	126º 58.7283‘W	1069
19	49º 06.0507 ‘N	127º 11.3425‘W	1603
20	49º 13.1937 ‘N	127º 21.3190‘W	1411
21	49º 03.4490 ‘N	127º 56.7407‘W	2502
22	49º 07.8774 ‘N	127º 48.4937‘W	2504
23	49º 12.8808 ‘N	127º 42.1518‘W	2495
24	49º 16.8517 ‘N	127º 33.8351‘W	1804
25	49º 20.7111 ‘N	127º 28.4464‘W	1505
26	49º 02.8102 ‘N	128º 11.4981‘W	2461
27	49º 07.4625 ‘N	128º 02.8116‘W	2469
28	49º 11.9350 ‘N	127º 56.8634‘W	2478
29	49º 16.2545 ‘N	127º 49.7415‘W	2468
30	49º 20.1759 ‘N	127º 45.5063‘W	2445
31	49º 24.1512 ‘N	127º 34.3890‘W	1799
32	49º 12.0197 ‘N	128º 12.3770‘W	2435
33	49º 16.2231 ‘N	128º 03.9716‘W	2436
34	49º 20.5225 ‘N	127º 56.4194‘W	2443
35	49º 25.6055 ‘N	127º 48.2291‘W	2422

Table 2: Science Staff on expedition 2014006PGC (in alphabetical order).

NRCan	Conway, K.
	Côté, M.
	Middleton, G.
	Neelands, P.
	Riedel, M. (Chief-Scientist)
	Stacey, C.
	Ulmi, M.
JAMSTEC	Obana, K.
	Saijo, T.
	Takahashi, T.
	Terada, I.