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M E M O R A N D U M

TO: Dr. Arthur E. Maxwell

FROM: Yosio Nakamura

SUBJECT: Cruise Report, *F/V Olympic* OBS Experiment Off Coast of Oregon

We participated in the onshore-offshore large-offset seismic experiment conducted across the Oregon subduction zone by recording the offshore portion of seismic signals on our ocean-bottom seismographs. The OBS cruise took place from 17th to 19th of September 1989 on board *F/V Olympic*, while the seismic source was provided by a large-volume air-gun array of *GeoTide* operated by Digicon.

The objective of the experiment was to obtain a two-dimensional image of the velocity structure of the subducting oceanic crust and overlying material from the toe of the accretionary wedge arcward to beneath the Coast Ranges. The experiment was supported by an NSF grant, through a subcontract from Oregon State University, with Dr. Anne Trehu of Oregon State as the Principal Investigator. USGS provided the land stations across the Coast Ranges.

Relevant technical details of the experiment are as follows:

Seismic Line:	BOL:	44°51.25'N, 124°08.41'W
	EOL:	44°49.00'N, 125°43.18'W
	Length:	125 km (67.5 nm)
Signal Source:	Digicon large-capacity air-gun array, fired every 30 seconds; average ship speed 4.25 knots (shot spacing 70 m approx.)	
Detectors:	UTIG OBS with a single 4.5 Hz vertical geophone, Mark Products L-1B (LD), or a gimbal-mounted set of three 4.5 Hz geophones (two horizontals and a vertical), Mark Products L-15 (HD)	
Recording:	20.4-second single-component recording of every other shot on Qantex 650A recorder at 10.008 ms sampling rate (LD), or 50.7-second three-component recording every minute to cover two shots per record on Tandberg TDC-3660 recorder at 4.968 ms sampling rate (HD)	

OBS locations:

Site	OBS	Type	Deployment Location	Recovery Location
1	81-5	LD	44°51.21'N 124°10.13'W 45 fms	44°51.16'N 124°10.17'W 44 fms
2	85-2	HD	44°51.05'N 124°17.41'W 71 fms	44°37.42'N 124°23.78'W
3	81-6	LD	44°50.75'N 124°35.29'W 186 fms	44°50.68'N 124°35.26'W
4	83-1	LD	44°50.48'N 124°49.47'W	44°50.41'N 124°49.38'W 210 fms
5	81-4	LD	44°50.11'N 125°07.45'W 1013 fms	44°50.30'N 125°07.46'W 1015 fms
6	83-2	LD	44°49.61'N 125°23.24'W 1552 fms	44°49.82'N 125°23.12'W 1552 fms
7	85-3	HD	not deployed	
8	83-3	LD	44°49.08'N 125°42.31'W 1555 fms	44°48.84'N 124°42.14'W 1551 fms

The location coordinates are from the display on a Furuno Loran-C receiver on board *F/V Olympic* with unknown ASF corrections.

The field condition for this experiment was significantly better than that of our earlier experiment in the Gulf of Alaska. A spacious laboratory at the Hatfield Marine Science Center of Oregon State University was available for the preparation of the instruments. Although it was a wet lab, the inevitable high humidity apparently did not affect the performance of our instruments very much – probably because of the cool atmosphere and because we took a special caution to purge our OBS with dry nitrogen more thoroughly than before. We also had ample time to prepare our instruments before deployment.

The 75-foot OBS deployment/recovery ship, *F/V Olympic*, was adequate for the operation, although the available space was very limited as expected for a fishing vessel. The equipment available on board was nearly perfect for deployment and recovery of OBS, and above all, the ship's crew was extremely eager and helpful in all aspects of the operation.

The overall result of the field experiment was close to what we normally expect for an OBS cruise, although we could have done better. Of eight OBS's we planned to deploy, we were able to deploy seven of them. Six of these eight were of our old standard type (designated LD – low density – in the table above). We deployed all six of them and all but one of them recorded full data. OBS 83-2 at site 6 functioned properly up until the deployment, executing all test recordings, but did not record any real data on the sea floor – a familiar but yet unsolved problem.

Two of the eight were of the new type (HD – high density). We deployed one of this type during the Alaskan experiment for the first time, but we failed to recover it, leaving us with no clues as to what went wrong. This time, one of them, for site 7, malfunctioned before we had a chance to deploy it, revealing to us the problem this new unit had. The problem was a software bug, which caused the clock to jump several hours. The other unit, for site 2, had already been deployed when this problem was discovered. This unit thus recorded

partial data and then was released earlier than planned. However, we were able to recover it. The recorded data covered the first six hours of the 16-hour shooting. The failure of the new high-density OBS is highly regretted because if the software bug were detected earlier they would have given us the first successful recording on this new OBS, especially at site 7, which was to be located right above the accretionary wedge.

A chronological narrative follows, with all times given in local Pacific Daylight Time (PDT), which is 7 hours behind UT.

Wednesday, September 6

Phil Roper and Yosio Nakamura arrived at Portland, Oregon; rented a car and drove to Corvallis; met with Anne Trehu of Oregon State University; all three drove to Newport, met Terry Thompson, the skipper of *F/V Olympic*, and inspected *F/V Olympic*; drove back to Corvallis.

Thursday, September 7

PR went back to Austin on emergency; AT and Ivan Pavlov of Oregon State picked up equipment shipped from Austin at Eugene airport, loaded an OSU truck and drove to Newport; YN drove directly to Newport; unloaded and unpacked equipment at the Hatfield Marine Science Center.

Friday-Saturday, September 8-9

Setup a lab for OBS preparation; checked out OBS's and support equipment.

Sunday, September 10

Further tested HD-OBS; rechecked clock drift; joined AT and her 2.5-year-old son Mark in selection of land station sites.

Monday, September 11

Selected OBS deployment locations with AT at OSU; picked up Gary Lux at Eugene airport; revised HD-OBS software to get around a minor problem.

Tuesday-Wednesday, September 12-13

Tested HD-OBS with revised software; Finalized the shot line and OBS locations; arranged to have backup shot timer sent to *GeoTide* from Galveston.

Thursday, September 14

Mounted new batteries on all OBS's; performed the final check out of each OBS.

Friday, September 15

YN drove to Port Angeles, Washington, to meet *GeoTide*; set up and tested a shot-time logger on board *GeoTide*; discussed detailed experiment plan with AT, Casey Moore of UC - Santa Cruz, Guy Cochrane of USGS, Mark Lambert of Digicon and Terry __ (party chief); AT and YN left Port Angeles to go back to Newport; *GeoTide* sailed from Port Angeles with GC on board.

Saturday, September 16

Arrived at Newport early in the morning; started each of the eight OBS's and closed up the spheres; practiced OBS deployment procedures in port; loaded OBS's and support equipment on *F/V Olympic*.

Sunday, September 17

02:42 *F/V Olympic* sailed from Newport, with Terry Thompson - captain, John - mate, Tim - deck hand, YN - scientist, GL - technician and John Shay - OSU student on board.

05:31:25 Deployed OBS 81-5 at site 1.

06:30:10 Deployed OBS 85-2 at site 2.

08:22:10 Deployed OBS 81-6 at site 3.

09:48:52 Deployed OBS 83-1 at site 4.

11:45:38 Deployed OBS 81-4 at site 5.

13:31:10 Deployed OBS 83-2 at site 6.

Finding that high-density OBS 85-3 for site 7 prematurely in data acquisition mode, decided not to deploy this OBS.

15:39:15 Deployed OBS 83-3 at site 8.

Monday, September 18

00:00:00 *GeoTide* started shooting the line.

16:00 ca. GeoTide crossed the end of the line.

20:58:28 OBS 83-3 surfaced at site 8; on board at 21:06; all indications normal.

Tuesday, September 19

01:07 OBS 83-2 surfaced at site 6; on board at 01:34; no strobe; no clock signal at recovery.

04:03 OBS 81-4 surfaced at site 5; on board at 04:12; clock wire cap broken; water in sphere; weak clock signal outside sphere, but good signal inside; all other indications normal.

07:00 ca. OBS 83-1 surfaced at site 4 (not observed); on board at 07:10; recovered upside down – lost balancing weight; beacon C-3 filled with pressurized water; all other indications normal.

10:00 OBS 81-6 surfaced at site 3; on board at 10:06; beacon E-6 filled with pressurized water; all other indications normal.

13:00 No sign of OBS 85-2 at site 2 when expected; channel B beacon signal heard on ship's receiver; headed south and signal got stronger; turned around at 44°46' to recover another OBS at site 1 first.

15:01 OBS 81-5 surfaced at site 1; on board at 05:05; all indications normal.

Channel B beacon signal from OBS 85-2 reacquired on ship's receiver at 44°47.10'N, 124°13.99'W; TT contacted several fishing boats in the area to gather information on the whereabout of the OBS from the strength of the beacon signal; upon arriving within the range of the hand-held direction finder, followed its direction.

17:08 OBS 85-2 recovered on board, 26.6 km (14.4 nm) SSW of the deployment site; beacon D-2 not functioning; clock ahead by 24 hours; tape motor power indicator light left on; all other indications normal.

19:20 Returned to Newport.

Unloaded equipment; examined the acquired data.

Wednesday, September 20

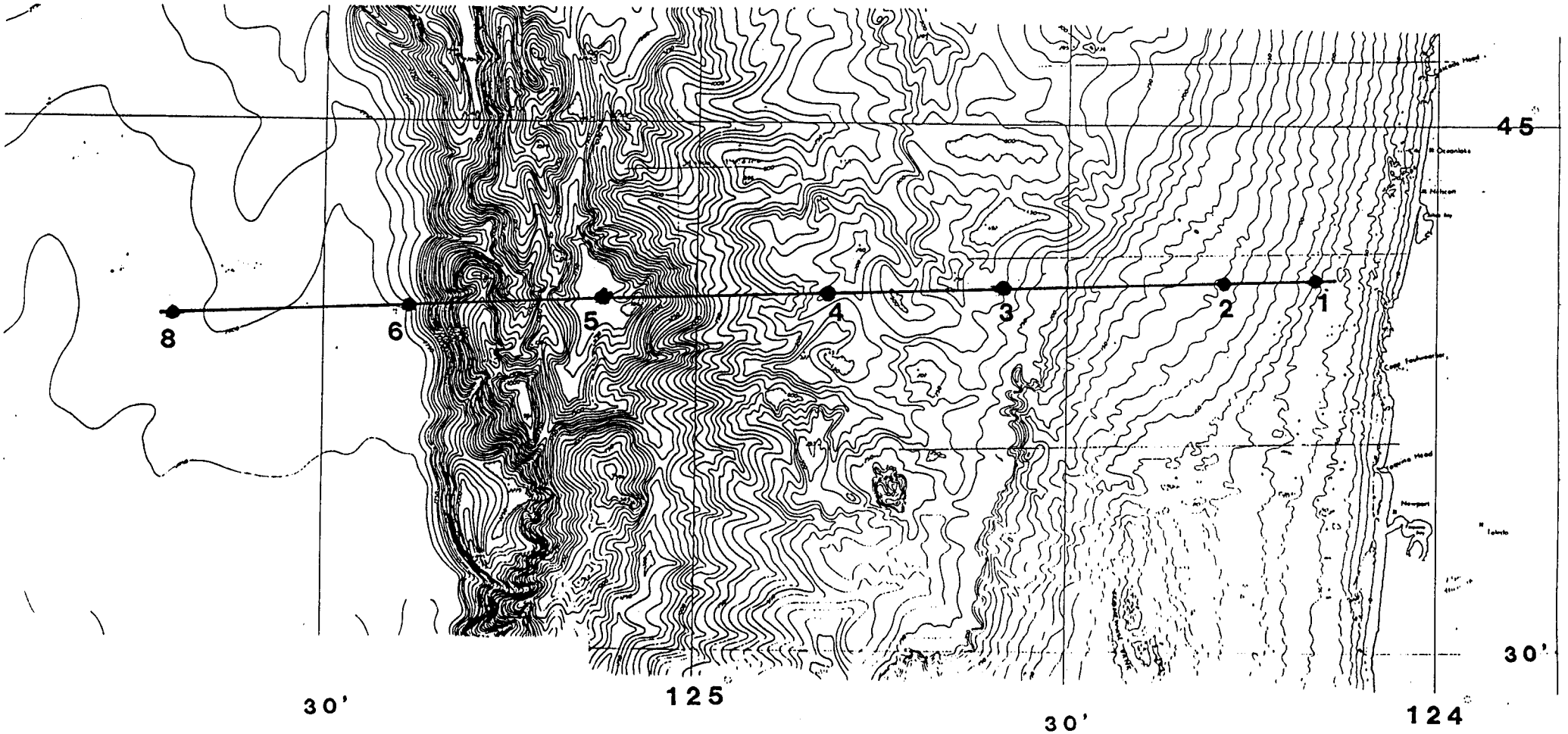
Further examined the acquired data; packed equipment.

Thursday, September 21

GL and IP drove an OSU truck from Newport to Eugene to ship equipment back to Austin; GL returned to Austin; YN in Corvallis for post-cruise discussion with AT.

Friday, September 22

YN returned to Houston.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