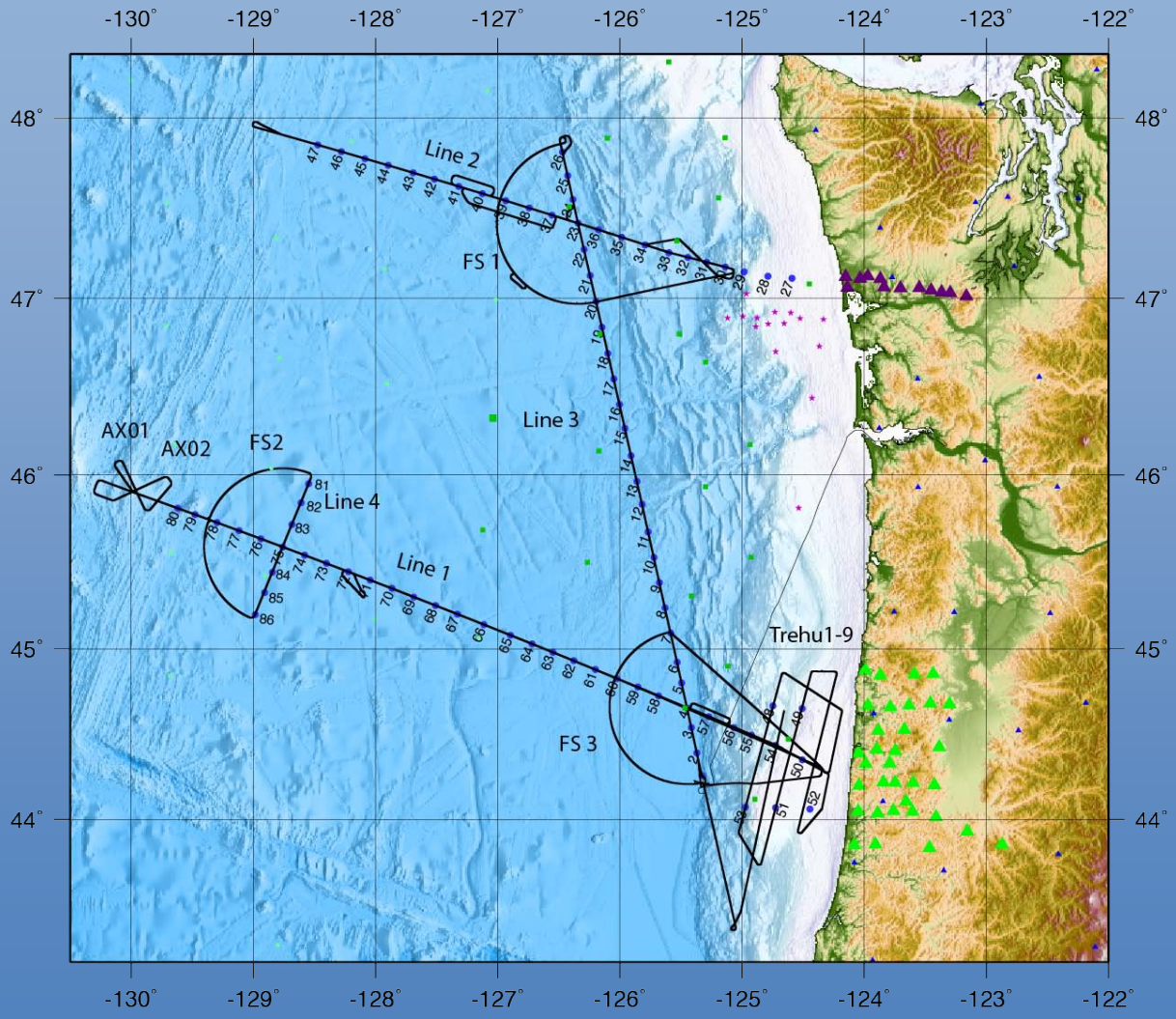
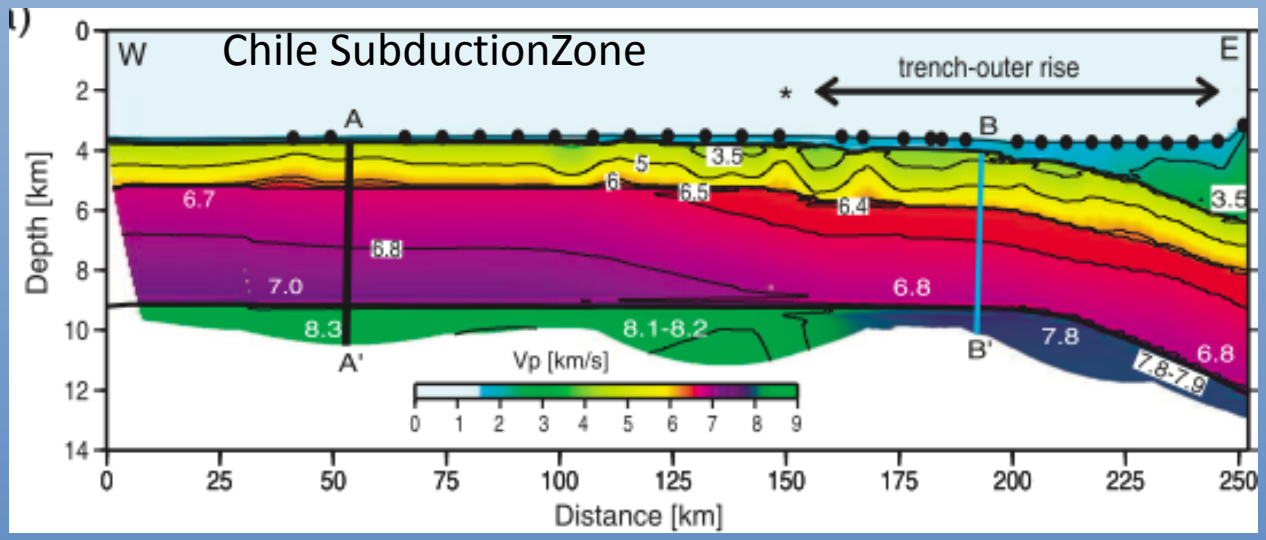
MGL1211: Cascadia Basin Ridge to Trench



June 13-July 8, Astoria-Astoria

Motivation

1. How does the JdF plate evolve from ridge to trench and is there significant hydration of the crust and upper mantle prior to subduction at this warm young plate?



Contreras-Reyes et al 2008

Juan De Fuca Plate: Documented progressive alteration of L2A (Nedimovic et al., 2008), faulting in plate interior (Nedimovic et al (2009).

Alteration deeper in crust/upper mantle? Is plate interior faulting pervasive to trench? Bending related faulting at trench?

Motivation

2. How does the structure of the downgoing plate vary along the trench across distinct structural regimes of the Cascadia subduction zone?

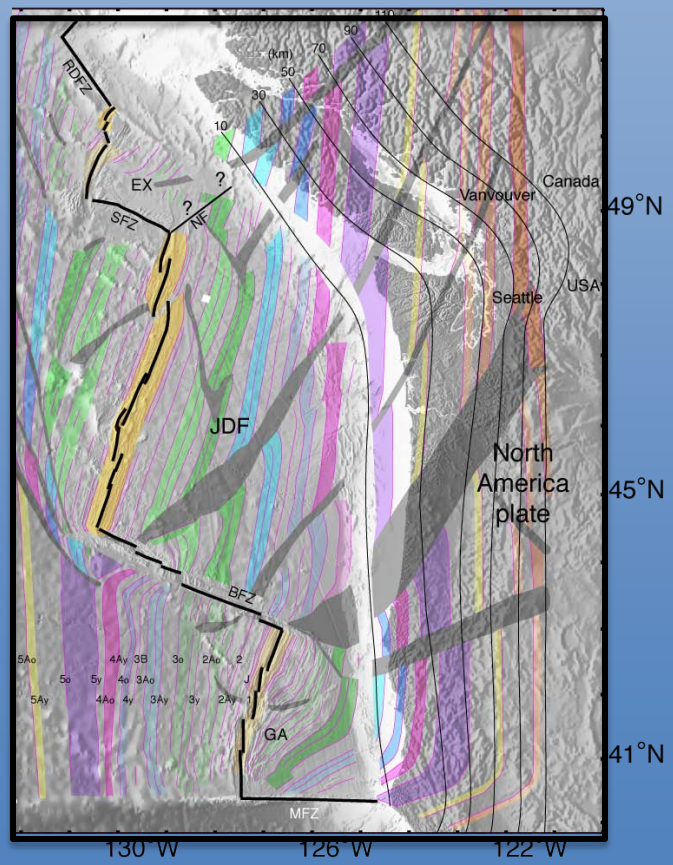
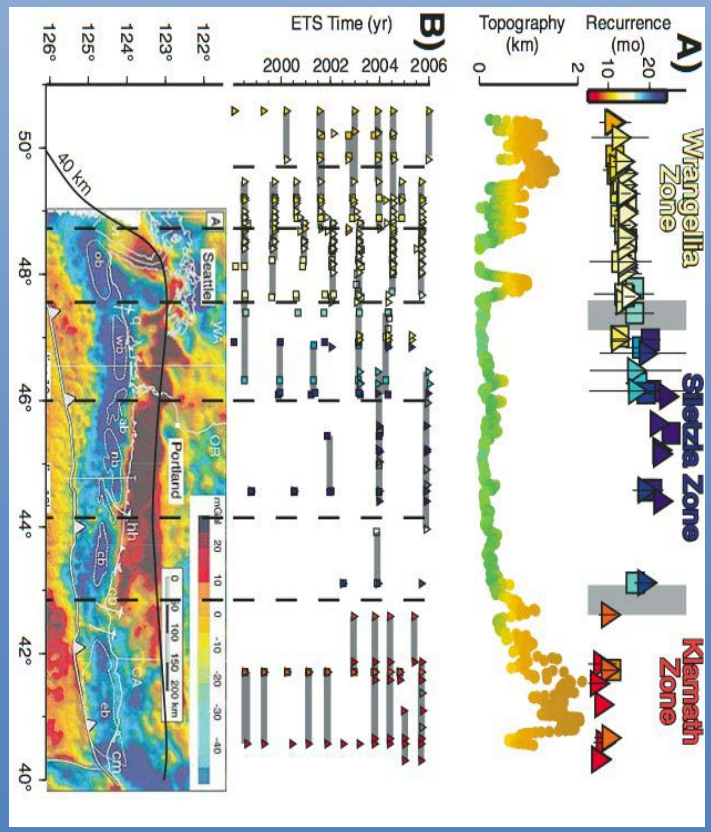


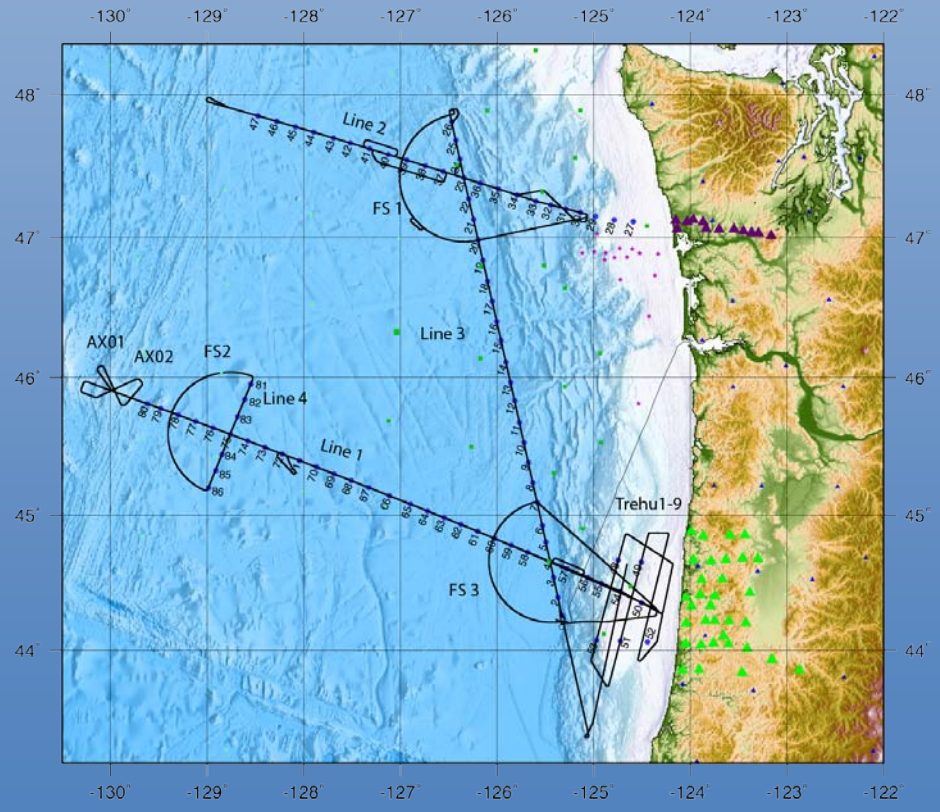
Plate Isochrons: Wilson, 1993; 2002
Plate Isodepth: McCrory et al., 2004



Brudzinski et al GLG 2007

The Experiment

- Coincident long streamer MCS (8 km) and wide-angle OBS (85 ST)
- Complete plate transects from JdF Ridge to the trench.
- ~ 400 km long transect parallel to deformation front.

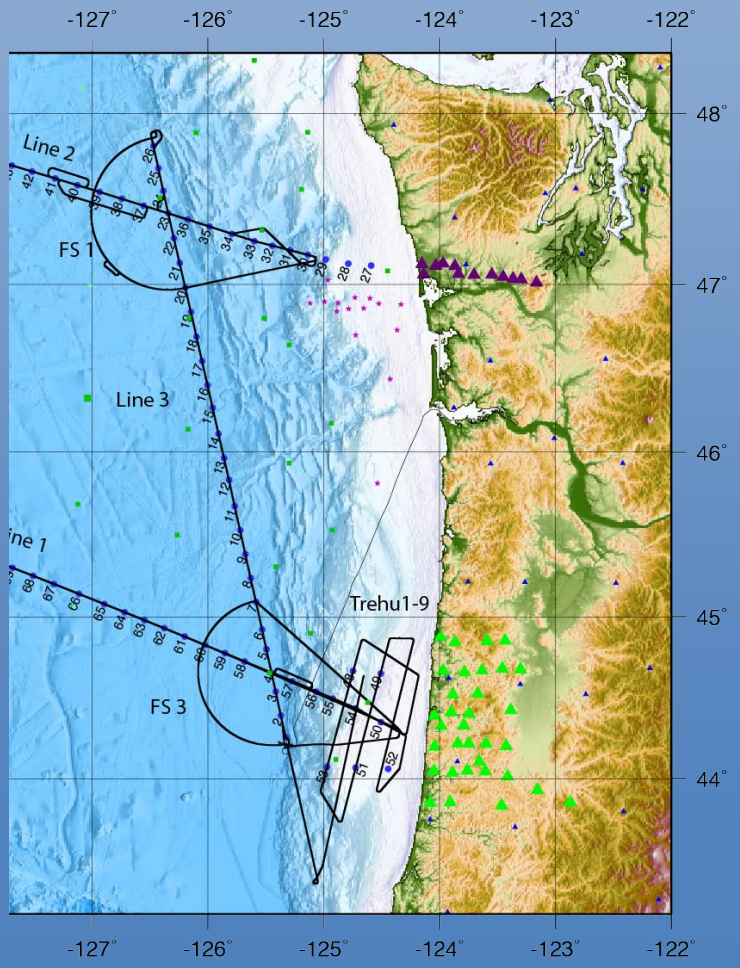


- Fan shoots for study of mantle anisotropy, 2 MCS lines at Axial
- Crustal structure, crustal and shallow mantle seismic velocities, fault distribution across plate and at deformation front

- R/V *Langseth* MGL1211
June 13-July 8
- R/V *Oceanus* OC1206A
June 7-July 13

Add-on Program - Imaging the Cascadia Subduction Zone: A Ship-to-shore Opportunity

Trehu/Abers/Carton co-PIs

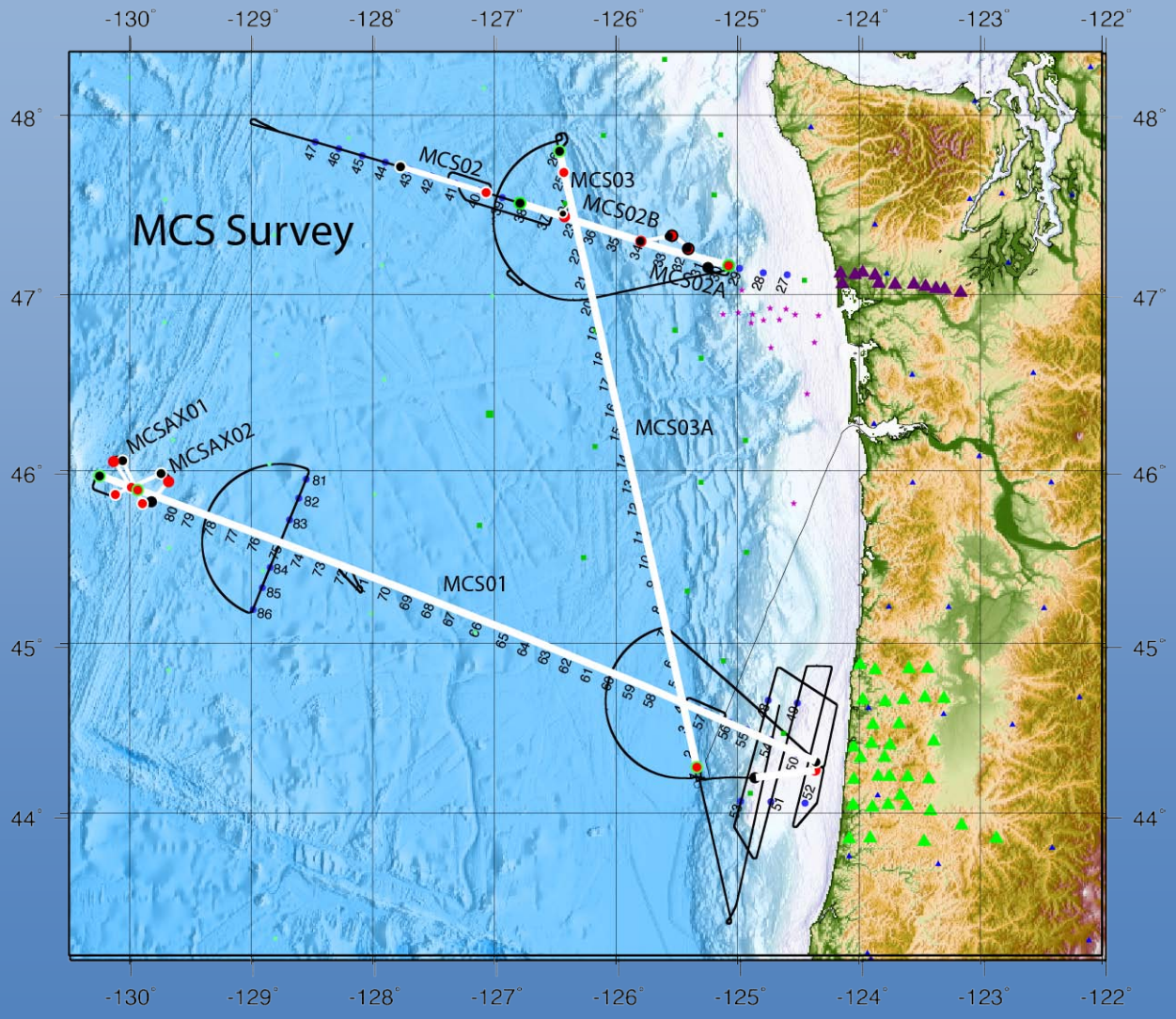


Goals: Image Subduction zone structure

- 6 OBS, 2 deployments
- Land stations:
- 3D array in Oregon
- 2D array in Washington along CAFÉ transect

2 days Langseth acquisition

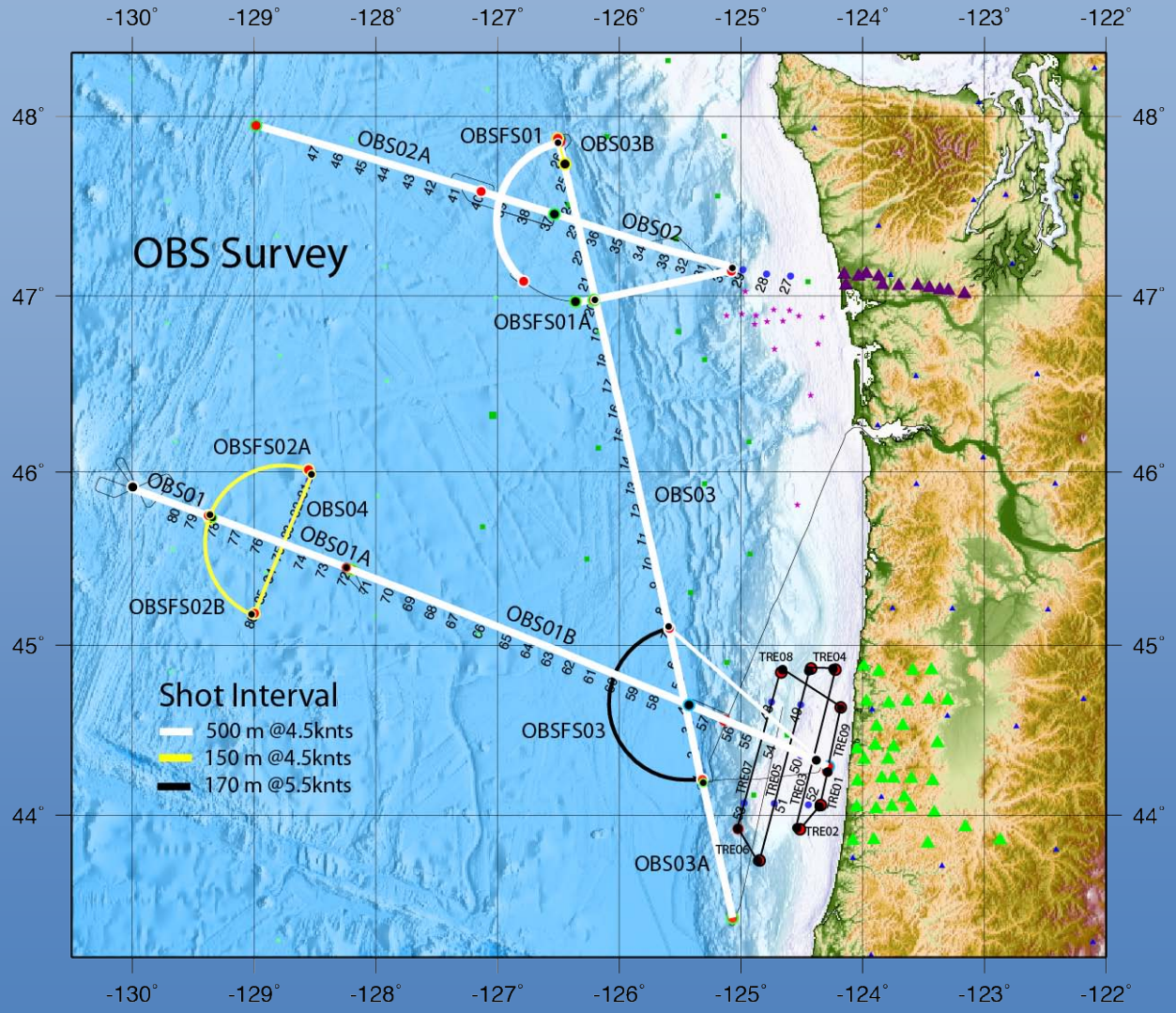
MCS Survey



6600 cu in array
9 m source depth
7950 m streamer
636 channels
37.5 m shot interval
2 ms sample interval
12.28 s record length

Eastern 50 km of line 2 acquired on Holbrook MGL1212

OBS Survey



47 OBSs:
Short-period XYZ geophone
Hydrophone
200 samples per second
85 Deployments

6600 cu in array
12 m source
500 m/150/170 m

Summary of Acquisition

Gun/Streamer Maintenance & Deploy/Recover	Marine mammal mitigation (days)	Number PD/SD*	OBS km acquired	OBS days acquired	MCS km acquired	MCS days acquired
0.4 days & 1 day	3 days	64	2343	11.6 days	1581	7.2 days

*PD/SD – Power Down/Shut Down

Lost ~ 220 line km of planned acquisition, ~200 km impacted by PD/SD

Contingency

Budgeted -3 days

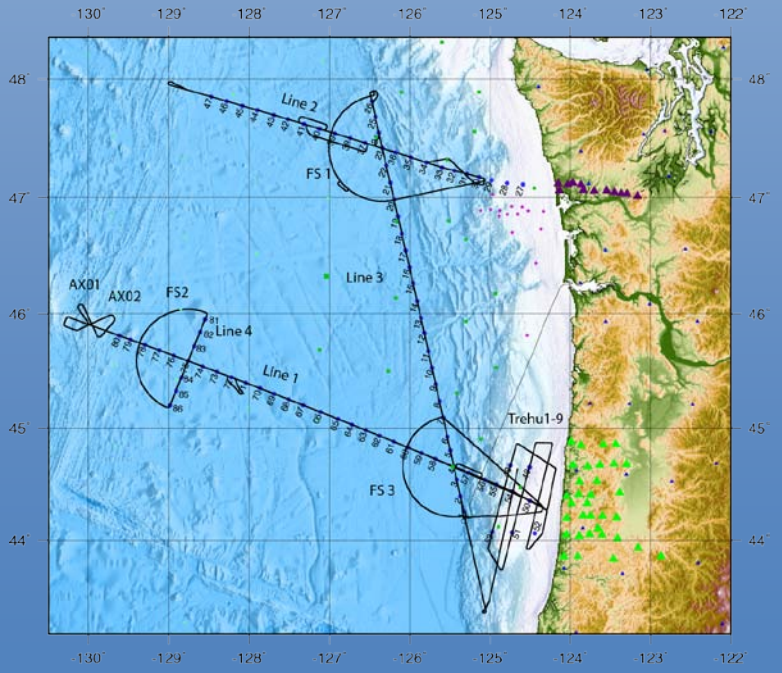
No time lost to weather delays, minimal to equipment

Needed:

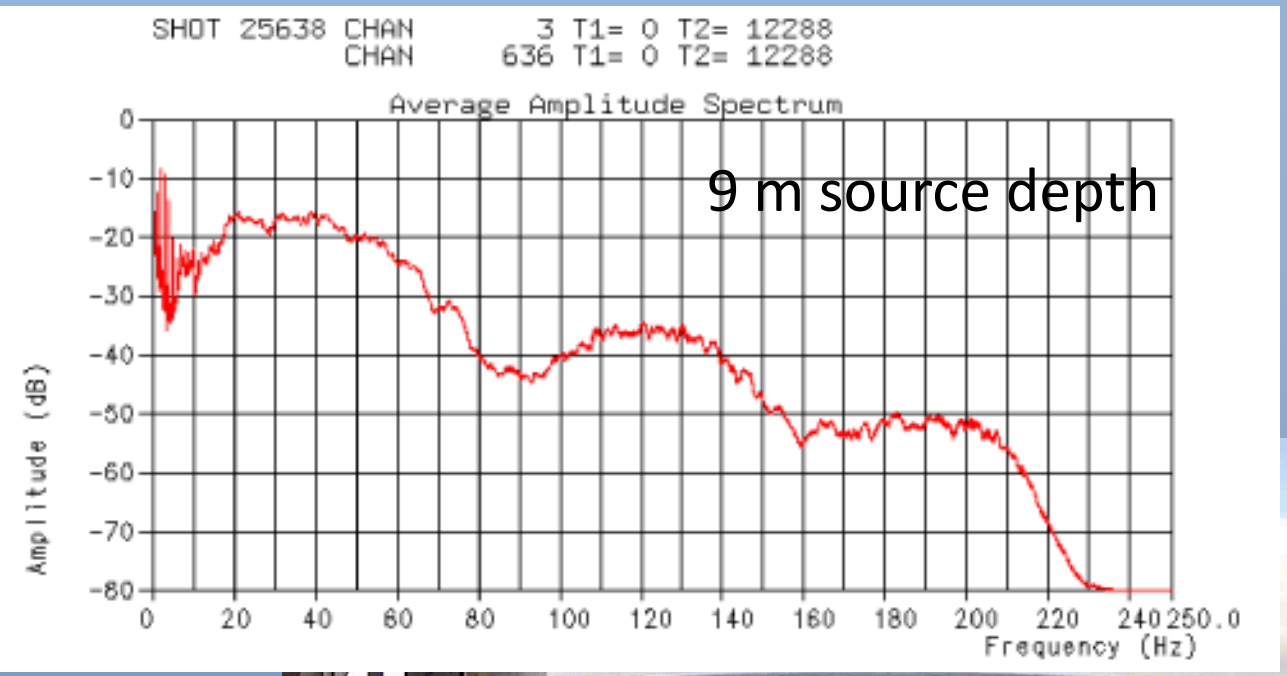
- Delayed departure for IHA – 2 days
- Mammal Mitigation – 3 days +
- Gun/streamer maintenance - .5 days

Mammals encountered primarily near deformation front, along Washington Line, Oregon shelf

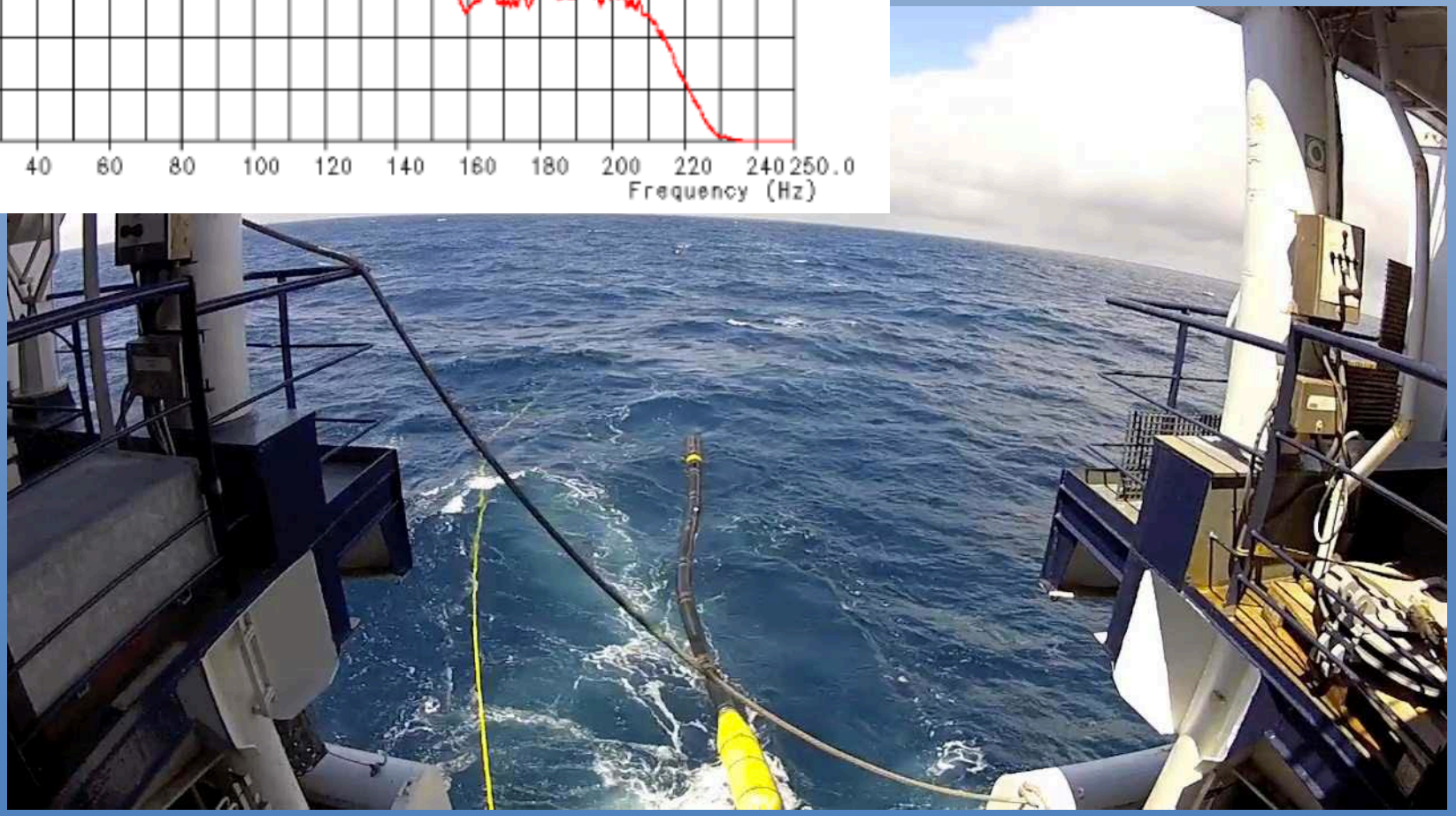

Northern Fur Seal




Dolphins off Oregon coast



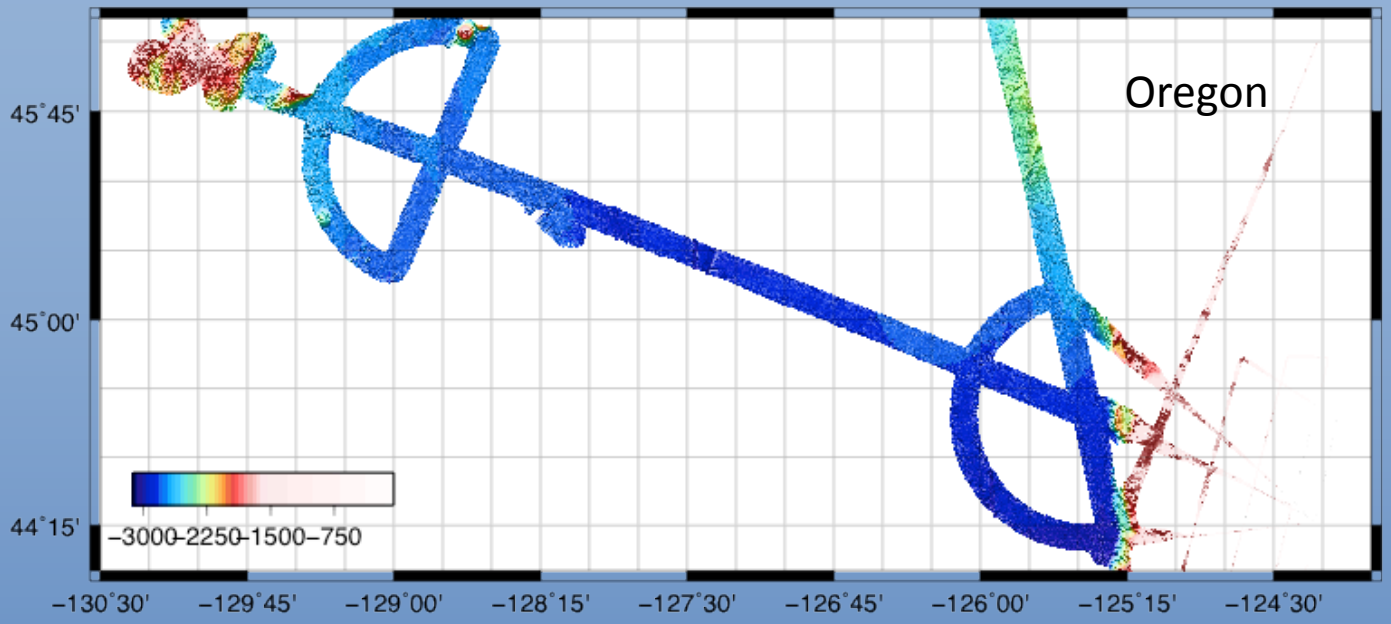
Total shots fired ~45,000



Streamer Deployment:

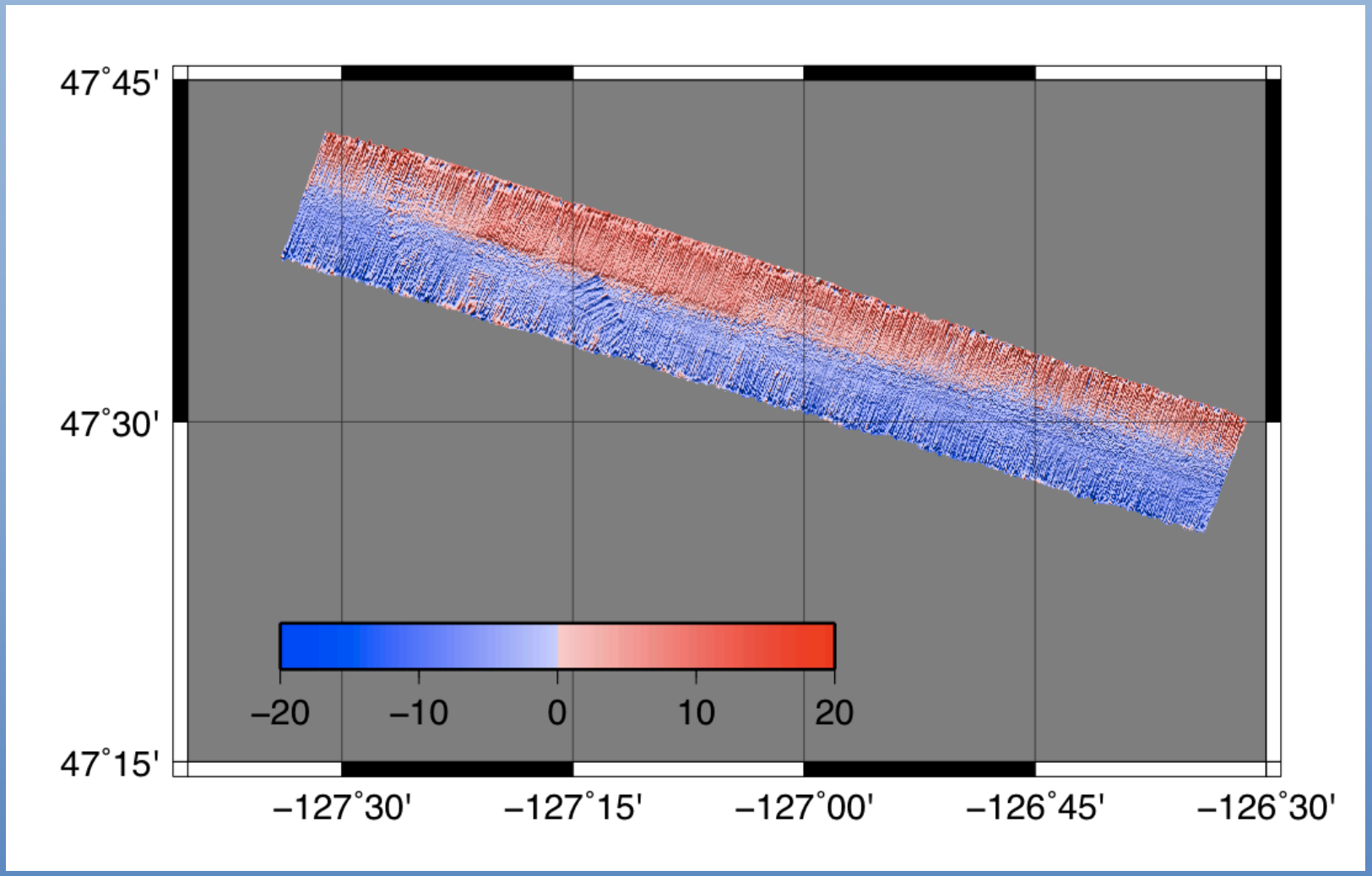
2 km from streamer 1 added to #3 – Took 14 hrs

Onboard Multibeam Processing



Usable swath ~ 10 km (deep water)

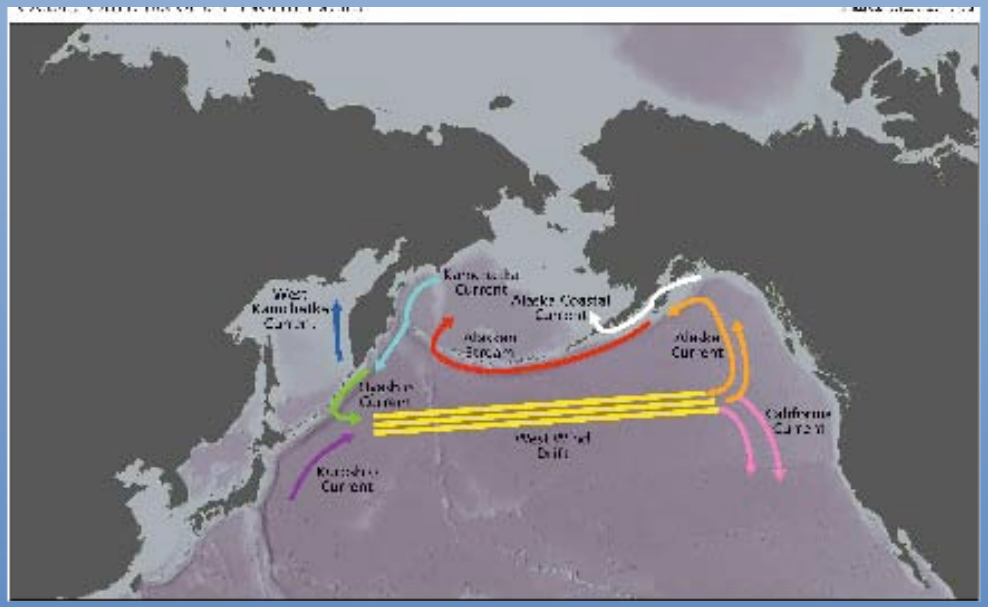
Gridded to 50 m (25 m)



Differencing of coincident 180° tracks revealed small roll bias.

Seismic Oceanography Program

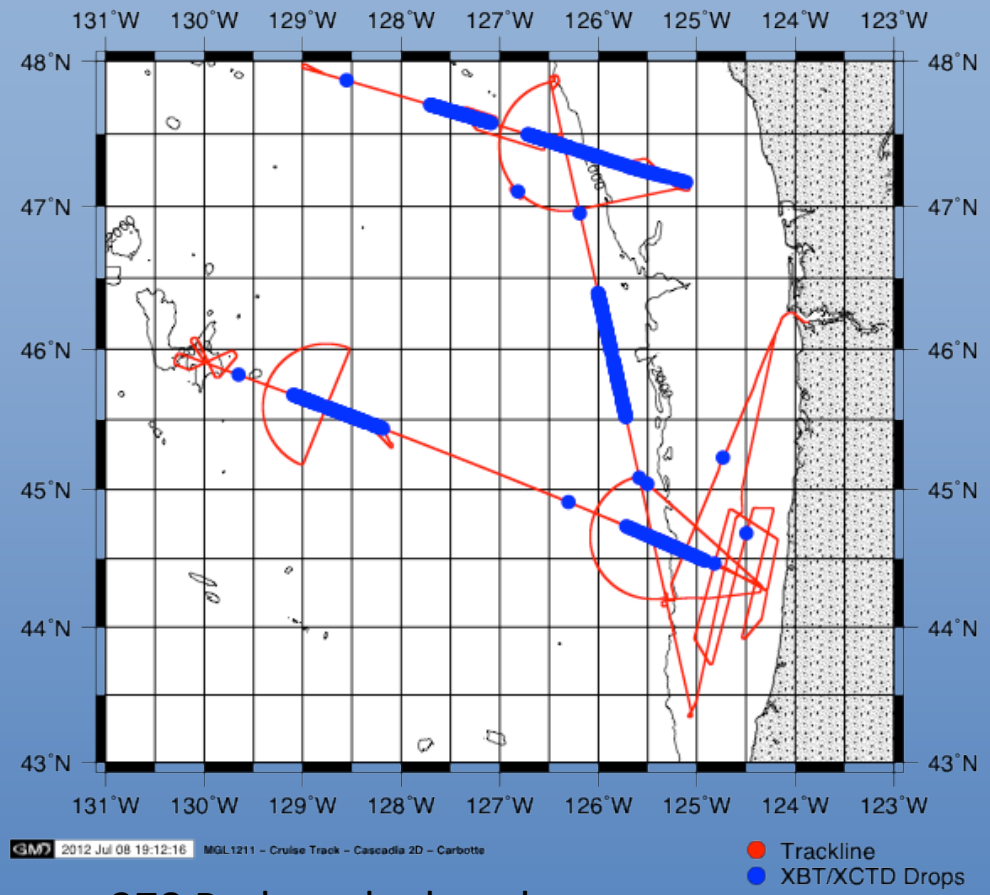
Led by Berta Biescas and Guillermo Bornstein, Dalhousie University

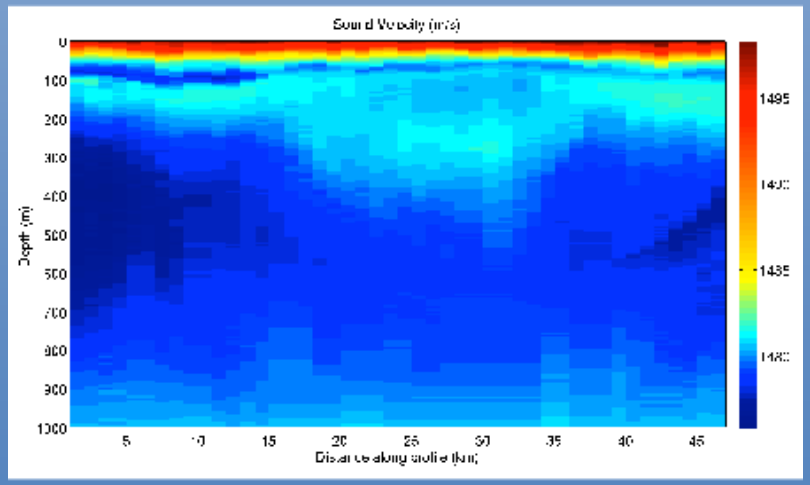


North Pacific Current System splits into Alaska and California Currents

3 different water masses in Cascadia Basin – reflectivity expected

Seismic Oceanography Program



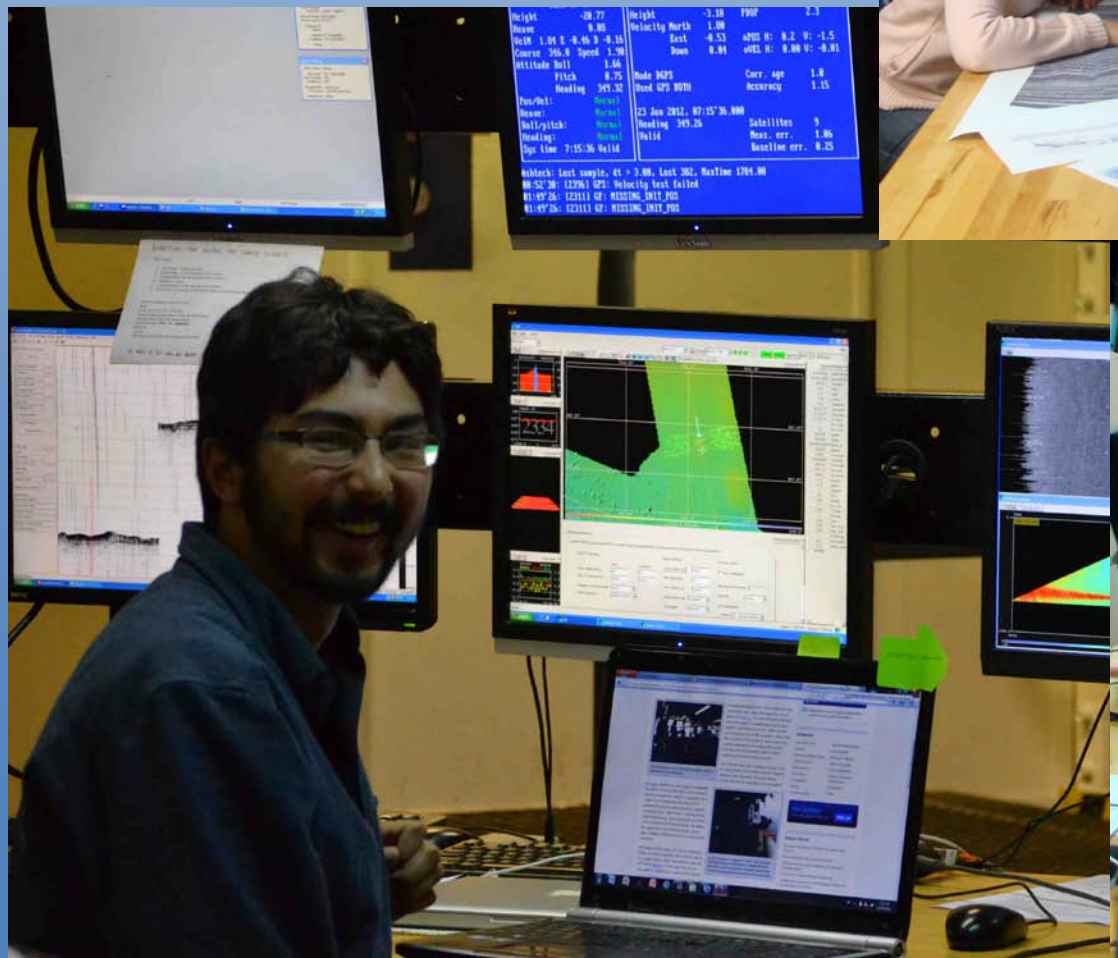


378 Probes deployed:
237 XBT-T5, 120 XSV-02, 21 XBT-T7

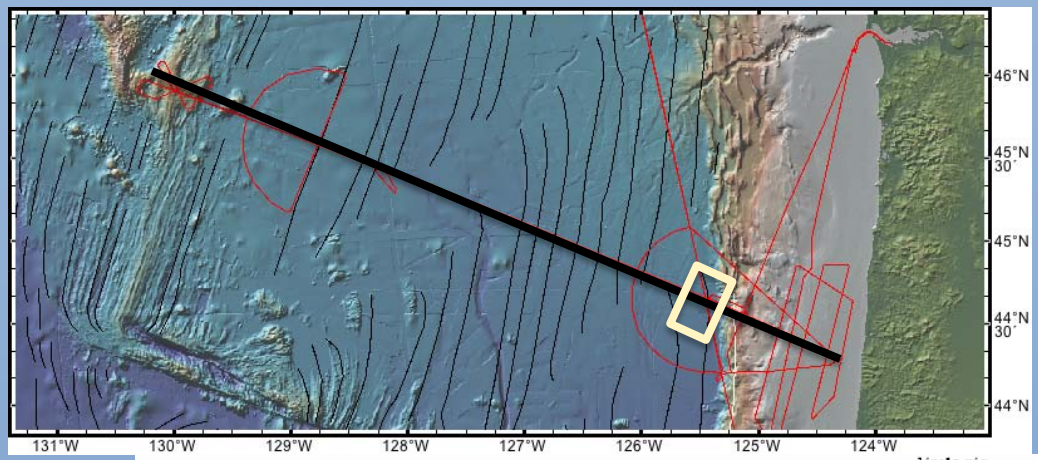
Deployed at 1-3 km spacing

Sound speed profile acquired along Oregon Line with XSVs

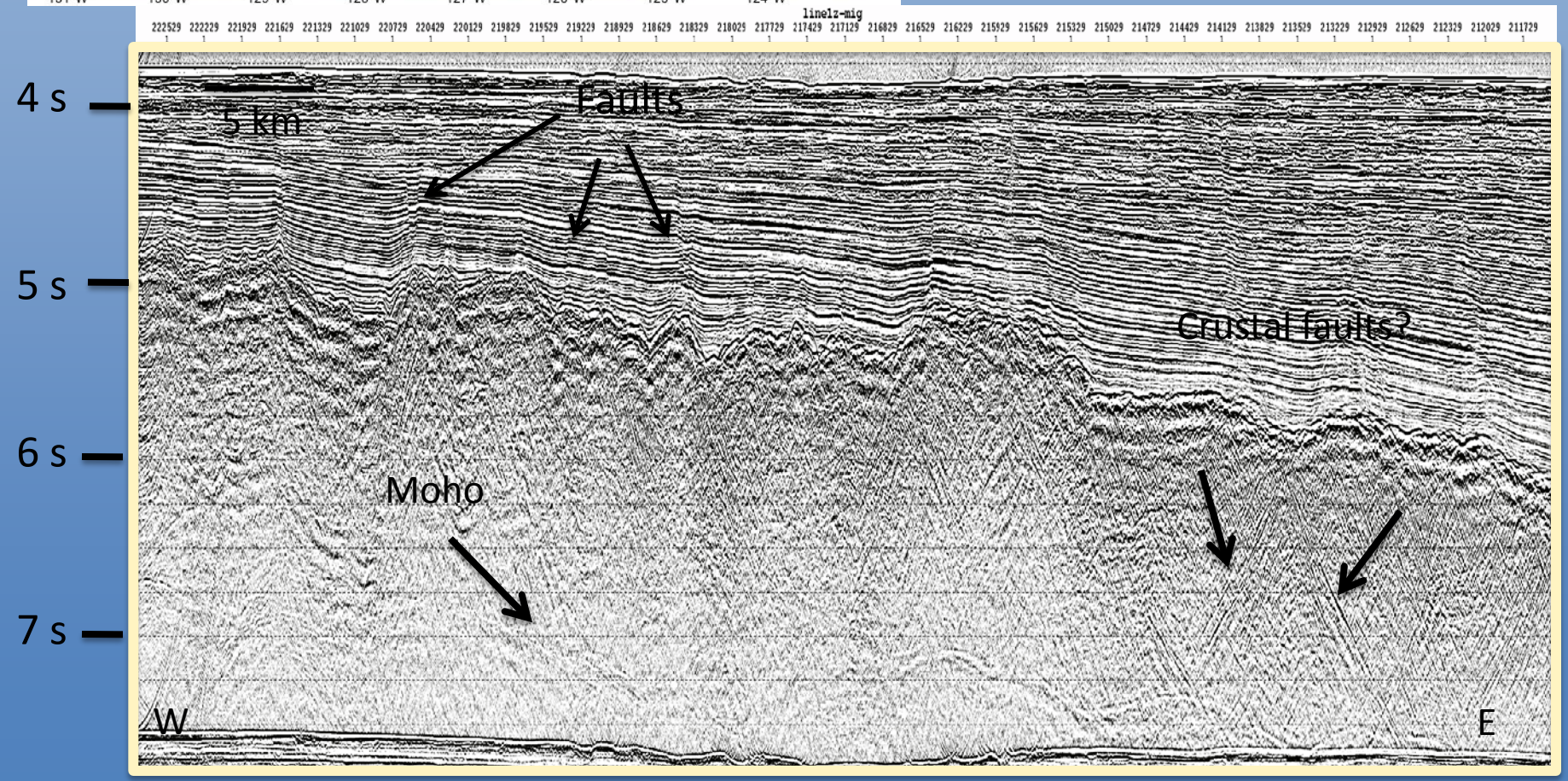
Science Party:
9 grad/undergrad
2 post-docs
1 junior faculty

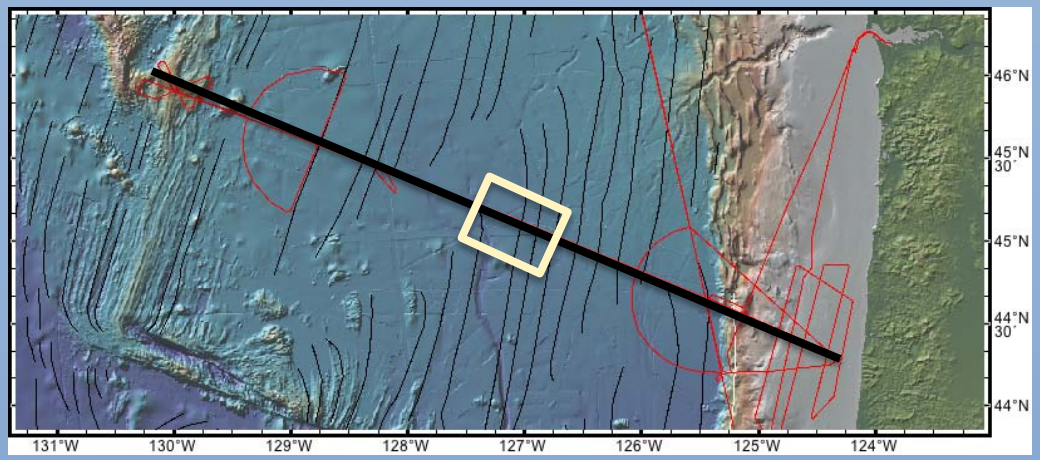


Oregon Line



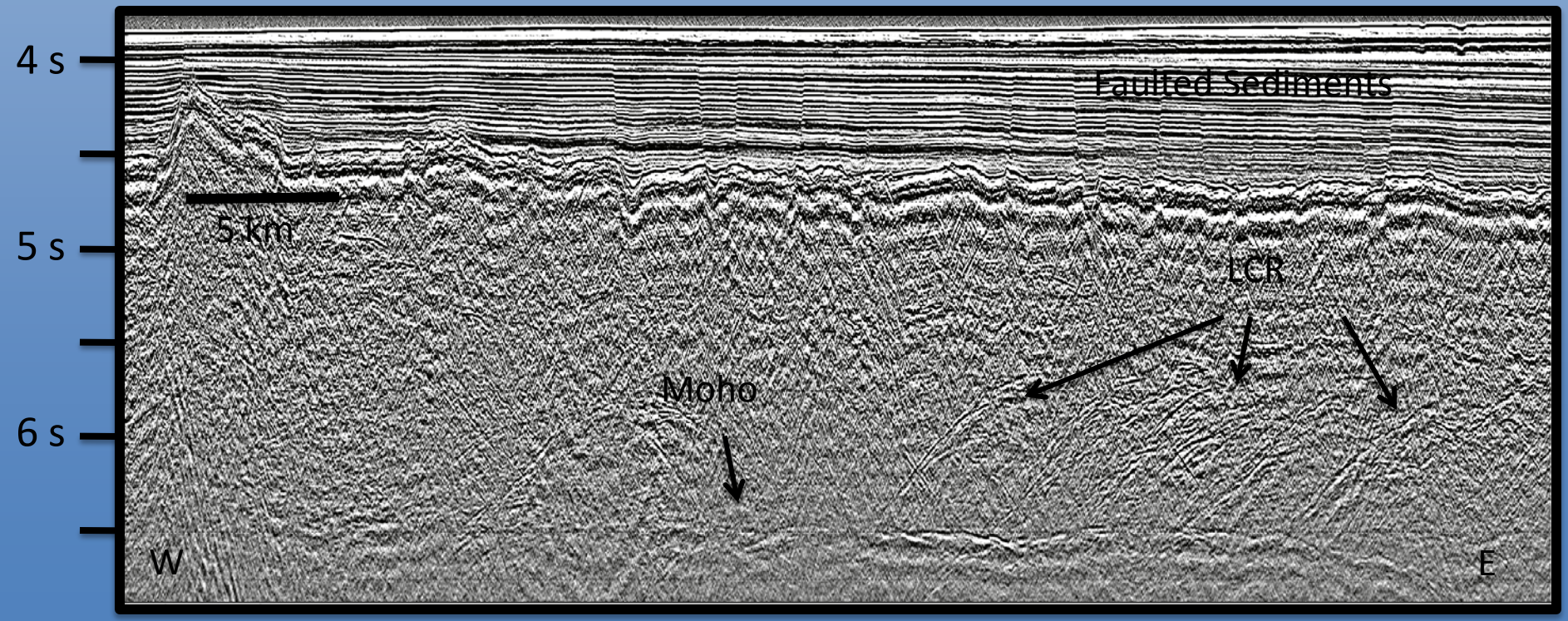
- Faulted sediments
- Antithetic through-crust reflectors
- Moho relief-possible fault offsets
- Bend-related faulting



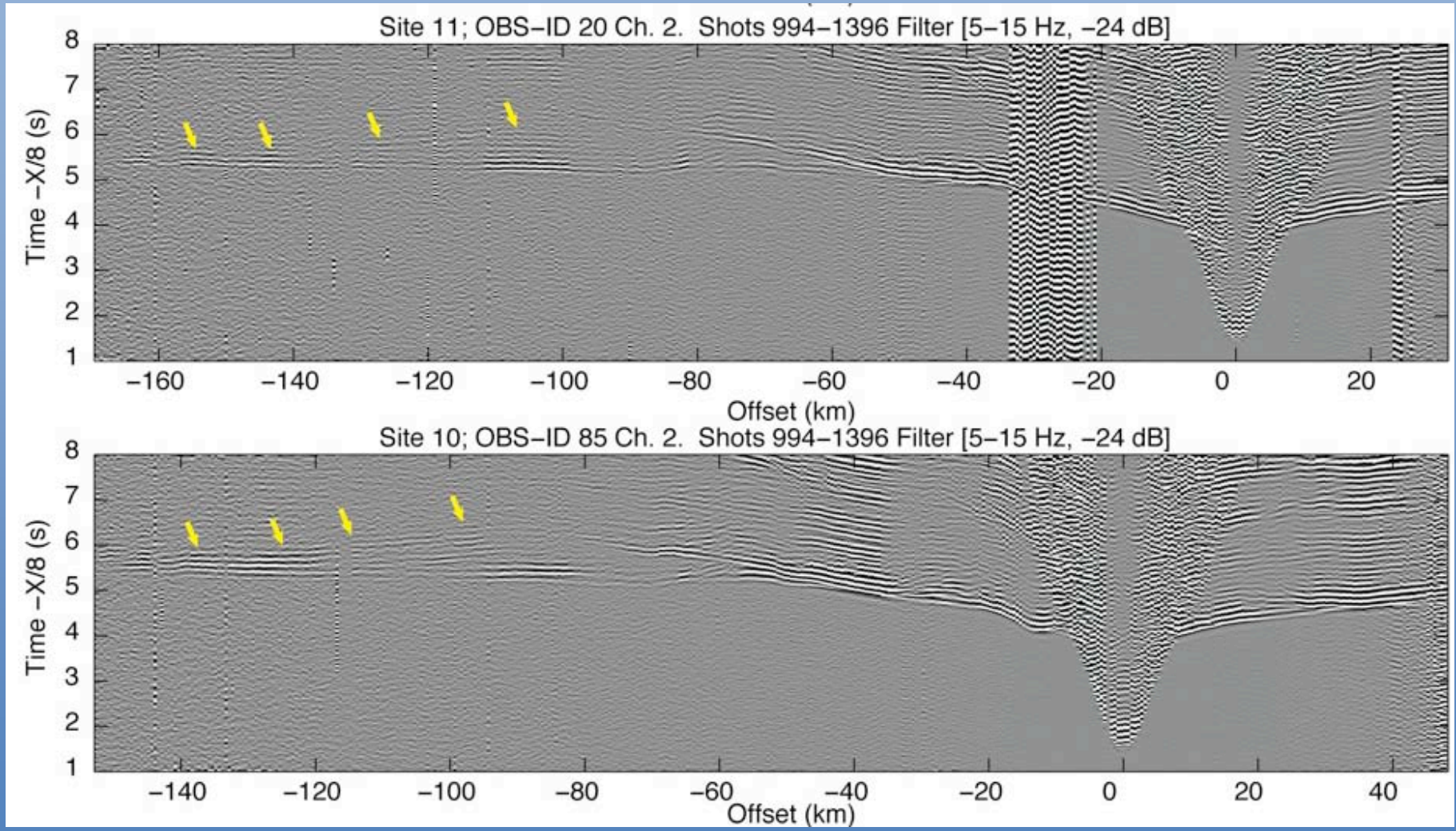


Oregon Line

Faulted sediments - reactivated abyssal hill faults
Lower Crustal Dipping Reflections, ridgeward facing, 30-35°, 2-10 km spacing



OBS Data: Long-offset *Pn* recordings



Equipment Problems

- Starboard Compressor failed 2 days from end- only 10 shots lost with switch to port
- Knudsen deck unit failed (2 days from end)

Primary Challenges (OMO)

- ITAR restrictions for gravimeter (precruise)
- Oceanus Canadian Clearance (precruise)
- IHA/Marine Mammal Mitigation

Recommendations

- More contingency time needs to be budgeted for near coast studies
- IHA process – procedural changes to allow time for survey modifications?
- More licenses for Echo/Landmark
- Multibeam roll bias patch test at least once/yr
- HighSeasNet inadequate
- New capability- short streamer high res

AGU presentations

T11 Before and after Subduction

- Monday 8 am: T11A-2523 Han et al, Moscone South
- Monday 1:40pm: T13H-01 Carbotte et al, 308 Moscone South

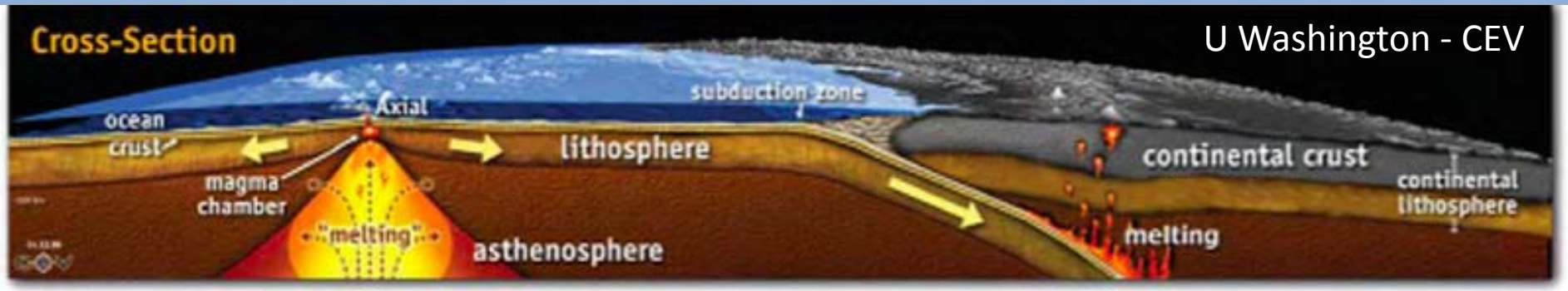
OS51 Ocean Exploration Posters

Friday 8 am: OS51D-1904. Biescas et al, Moscone South

Thanks to Technical Staff, Officers, & Crew

Sponsored by

Motivation



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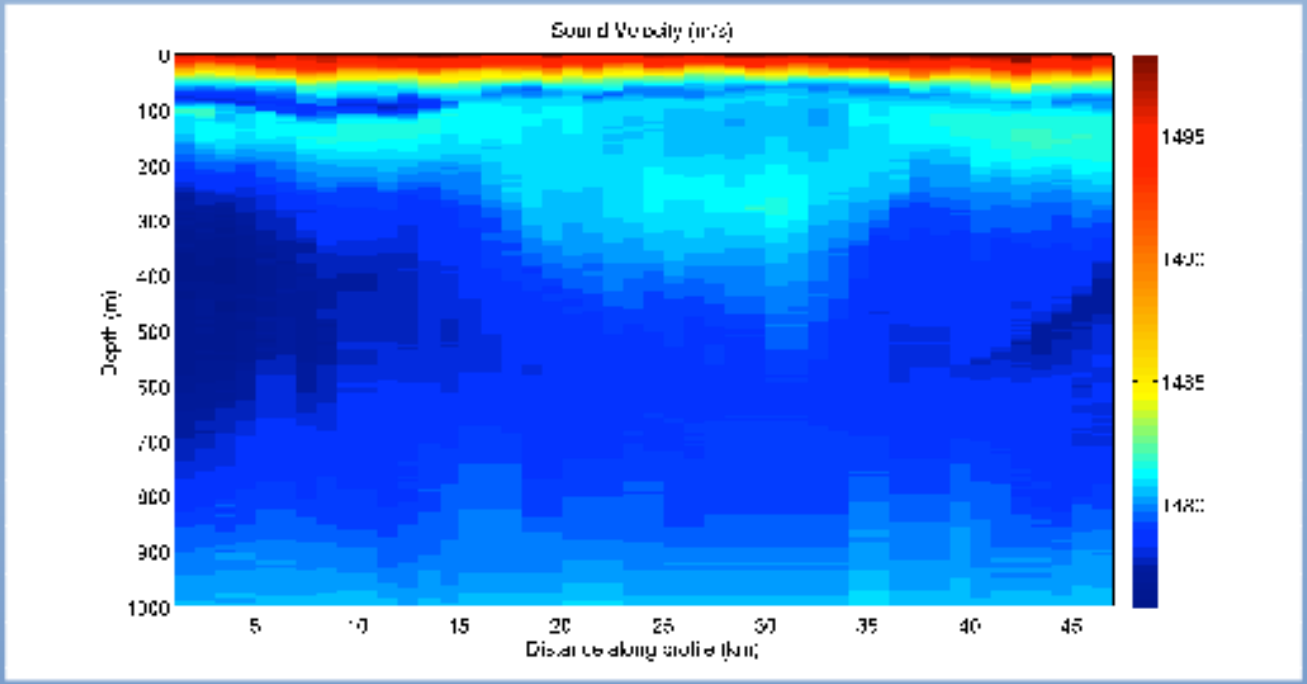


Figure 9: Sound speed profile acquired along Line 1 with XSVs.

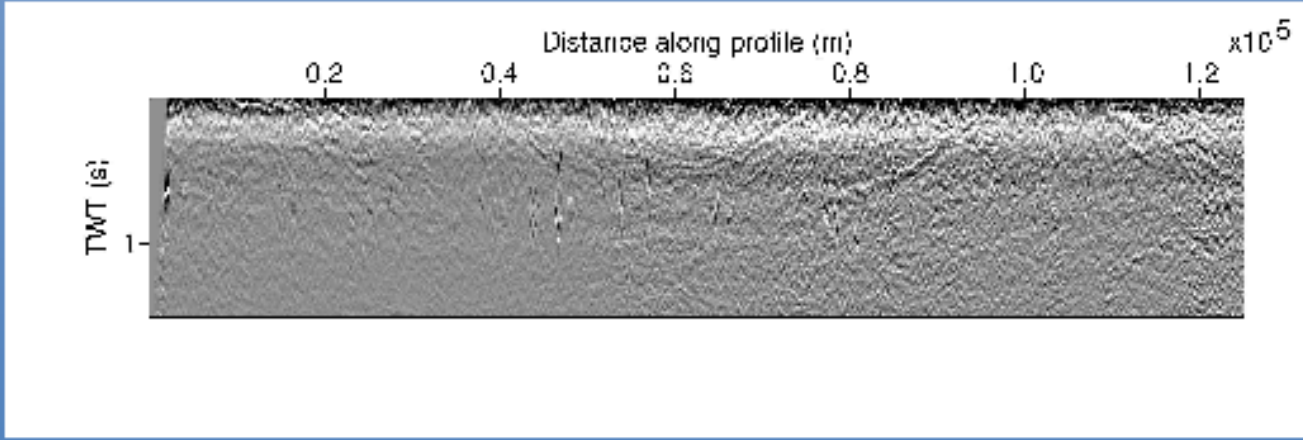
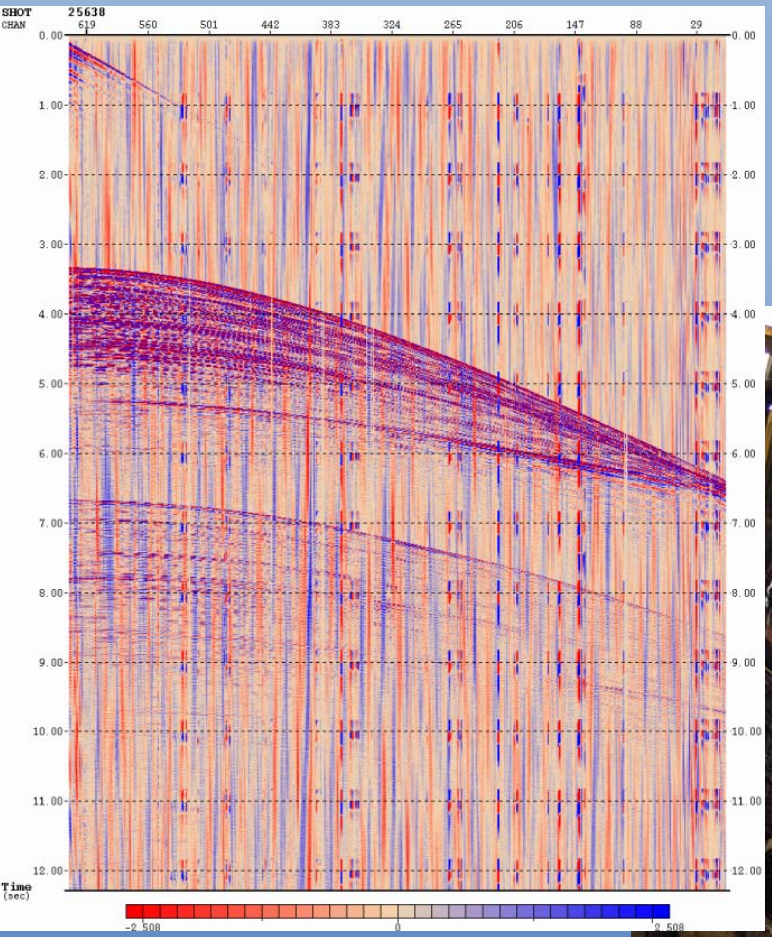


Figure 10: Seismic stack section coincident with the oceanographic probes deployed along Line 1.



Streamer Deployment:

2 km from streamer 1 added to #3 – Took 14 hrs

Raw shot gather – noise bursts

OBS recording of MCS shots