

COAST: Cascadia Open-Access Seismic Transects



W. Steven Holbrook

Graham Kent

Katie Keranen

Paul Johnson

Anne Trehu

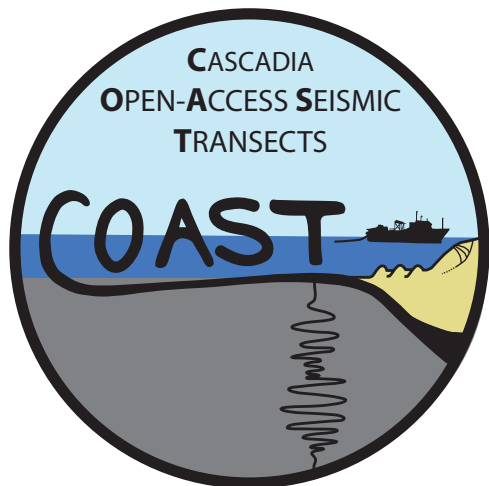
Harold Tobin

Jeff Beeson

Jackie Caplan-Auerbach

Ashton Flinders

The COAST 2012 Team



Talk Outline

1. Cruise Overview
2. Open Participation & Shipboard Education: Newbies ahoy!
3. Data Acquired
 - Multibeam bathymetry & backscatter
 - Gravity & magnetic
 - Seismic
4. Preliminary Findings
5. Notional Future Work

R/V *Langseth* cruise MGL1212

Astoria, Oregon - Astoria, Oregon

July 12-24, 2012

Vital Statistics:

- ~1100 km MCS data acquired
- Full coverage multibeam bathymetry in deeper water (>2 km)
- Gravity, magnetic data acquired
- No 3.5 kHz data (mech failure)

Seismic Acquisition:

- 8-km, 636-channel streamer (2D)
- 36-gun, 6600 cu. in. array
- Two tow depths for guns and streamer: 9 m and 15 m (data comparison)
- Onshore Reftek piggyback conducted (Trehu/Abers)

R/V *Langseth* cruise MGL1212

Scientific & Operational Goals:

- Locate the offshore plate boundary
- Identify downdip variations in plate boundary structure
- Determine the nature of the plate boundary interface (subducting sediment, etc.)
- Quantify upstream inputs to ETS zone (porosity, fluid pressure, etc.)
- Image offshore methane system
- Produce data in support of future 2D and 3D seismic surveys of Cascadia margin

Education & Outreach Goals:

1. Conduct an Open-Access cruise:

- **All geophysical data immediately available**

Raw data: www.marine-geo.org/tools/search/entry.php?id=MGL1212

Migrated stacks: www.ig.utexas.edu/sdc/cruise.php?cruiseIn=mgl1212

2. Conduct an Open-Participation cruise:

- Shipboard party selected from ~60 applicants
- Every available berth filled

Open Access: Download COAST Data!

Migrated stacks: www.ig.utexas.edu/sdc/cruise.php?cruiseIn=mgl1212

▼Program Summary Information

NGDC Number
Platform *Marcus G. Langseth*
Platform Operator Lamont-Doherty Earth Observatory
Beginning Date 2012-07-12
Ending Date 2012-07-23
Start Port Astoria, Oregon
End Port Astoria, Oregon
Line Names MCS: 01_6-40HZ, 02_6-70HZ, 03_6-70HZ, 03_6-40HZ, 04_6-70HZ, 05_6-40HZ, 06_6-70HZ, 07_6-40HZ, 08_6-40HZ, 09_6-70HZ, 10_6-70HZ
Location Pacific Ocean
Navigation [Field](#)
Cruise Report [PDF](#)
Links
Comments

▶Scientific References

▶Seismic Acquisition Parameters

▼General Processing Description

▶Seismic Section Images











▼Available SEG-Y Data - Processed

Click on a file link (seggy, nav, gif, hst) to add the file to your [cart](#) or click 'view' to view it. Ordered by Data Type, Line Name, Processing Level

UniqueID	Line Name	Data Type	Process Level	SEG-Y file	Nav	Image	Processing History	Data Provider	Start Date	Start Time	End Date
ar55.7329	01_6-40hz	mcs	migration	seggy	nav	gif (view)	hst (view)	Holbrook	2012-07-14	13:10:27	2012-07
ar55.7330	02_6-70hz	mcs	migration	seggy	nav	gif (view)	hst (view)	Holbrook	2012-07-20	17:08:53	2012-07
ar55.7332	03_6-40hz	mcs	migration	seggy	nav	gif (view)	hst (view)	Holbrook	2012-07-15	05:15:14	2012-07
ar55.7331	03_6-70hz	mcs	migration	seggy	nav	gif (view)	hst (view)	Holbrook	2012-07-21	05:08:45	2012-07
ar55.7333	04_6-70hz	mcs	migration	seggy	nav	gif (view)	hst (view)	Holbrook	2012-07-20	00:18:41	2012-07
ar55.7334	05_6-40hz	mcs	migration	seggy	nav	gif (view)	hst (view)	Holbrook	2012-07-16	01:06:14	2012-07
ar55.7335	06_6-70hz	mcs	migration	seggy	nav	gif (view)	hst (view)	Holbrook	2012-07-19	07:44:32	2012-07
ar55.7336	07_6-40hz	mcs	migration	seggy	nav	gif (view)	hst (view)	Holbrook	2012-07-16	21:02:05	2012-07
ar55.7337	08_6-40hz	mcs	migration	seggy	nav	gif (view)	hst (view)	Holbrook	2012-07-18	22:33:39	2012-07
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ar55.7339	10_6-70hz	mcs	migration	seggy	nav	gif (view)	hst (view)	Holbrook	2012-07-22	00:19:41	2012-07

Open Access: Download COAST Data!

Raw data: www.marine-geo.org/tools/search/entry.php?id=MGL1212

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<input type="checkbox"/>	MGL1212.005.MCS03.003.tar	2012-09-17	3863.0	Line:MCS03	SEGD (TAR )	2012-07-15 17:17:14	2012-07-15 18:37:34	- 126.07711	46.82508	- 126.20246	46.81338
<input type="checkbox"/>	MGL1212.006.MCS05.001.tar	2012-09-17	15850.4	Line:MCS05	SEGD (TAR )	2012-07-16 01:04:15	2012-07-16 06:08:31	- 126.38456	46.65374	- 125.85753	46.69956
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R/V Langseth cruise MGL1212: Open-Participation



R/V *Langseth* cruise MGL1212: Open-Participation

PI's:

W. Steven Holbrook, Univ. of Wyoming
Graham Kent, Univ. of Nevada
Katie Keranen, Univ. of Oklahoma

Honorary PI's:

Harold Tobin, Univ. of Wisconsin
Jackie Caplan-Auerbach, WWU

Postdocs:

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Danielle Sumy, USGS-Pasadena

Students:

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Robert Anthony, New Mexico Tech
Shahar Barak, Stanford Univ.
Jeff Beeson, Oregon State Univ.
Janine Buehler, Scripps Inst. of Oceanography
Brian Covellone, Univ. of Rhode Island
Brady Flinchum, Univ. of Nevada
Ashton Flinders, Univ. of New Hampshire
Will Fortin, Univ. of Wyoming
Dalton Hawkins, Univ. of Oklahoma
Annie Kell, Univ. of Nevada
Dara Merz, Western Washington Univ.
Marie Salmi, Univ. of Washington

20 Participants: 5 faculty, 2 postdocs, 13 grad students

14 institutions represented

13 “newbies”:

8 people had never been to sea

5 others had never participated in an MCS cruise

Interpretation Lessons

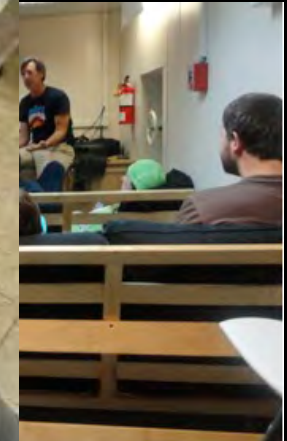
Deck Operatio



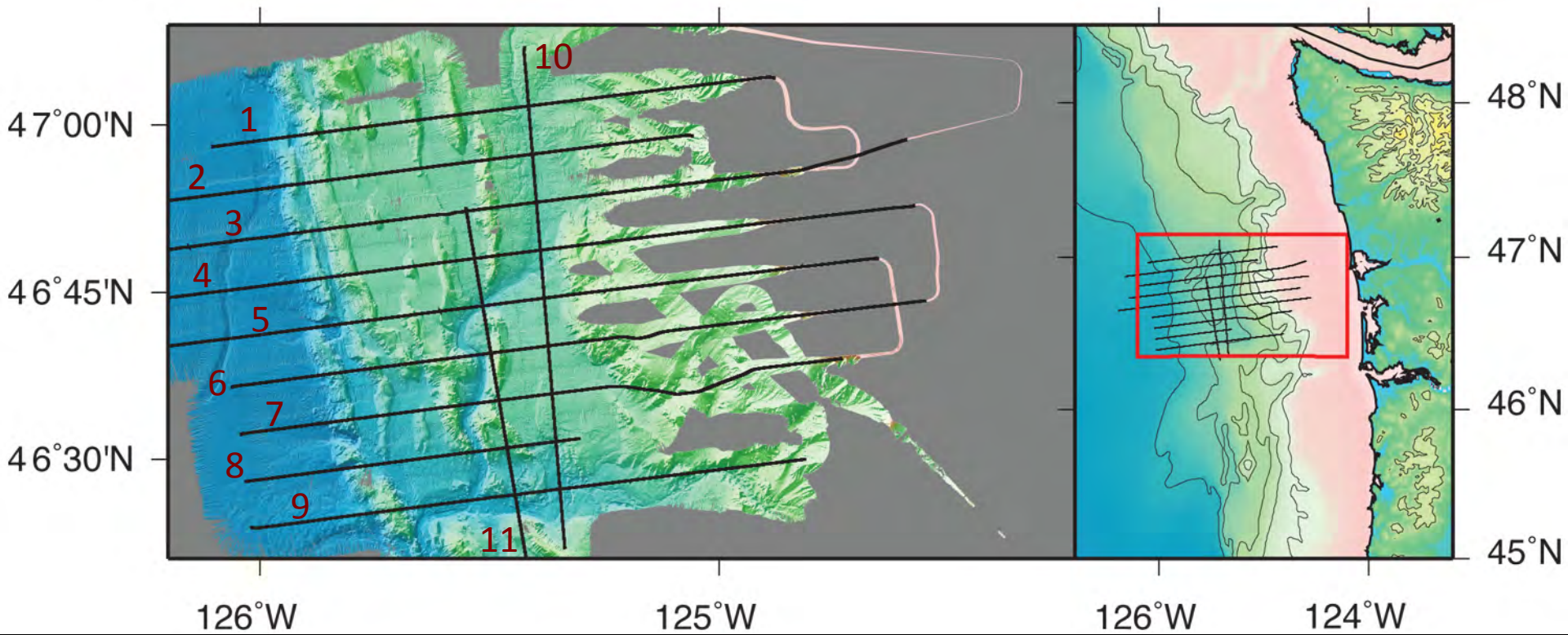
g Instruction



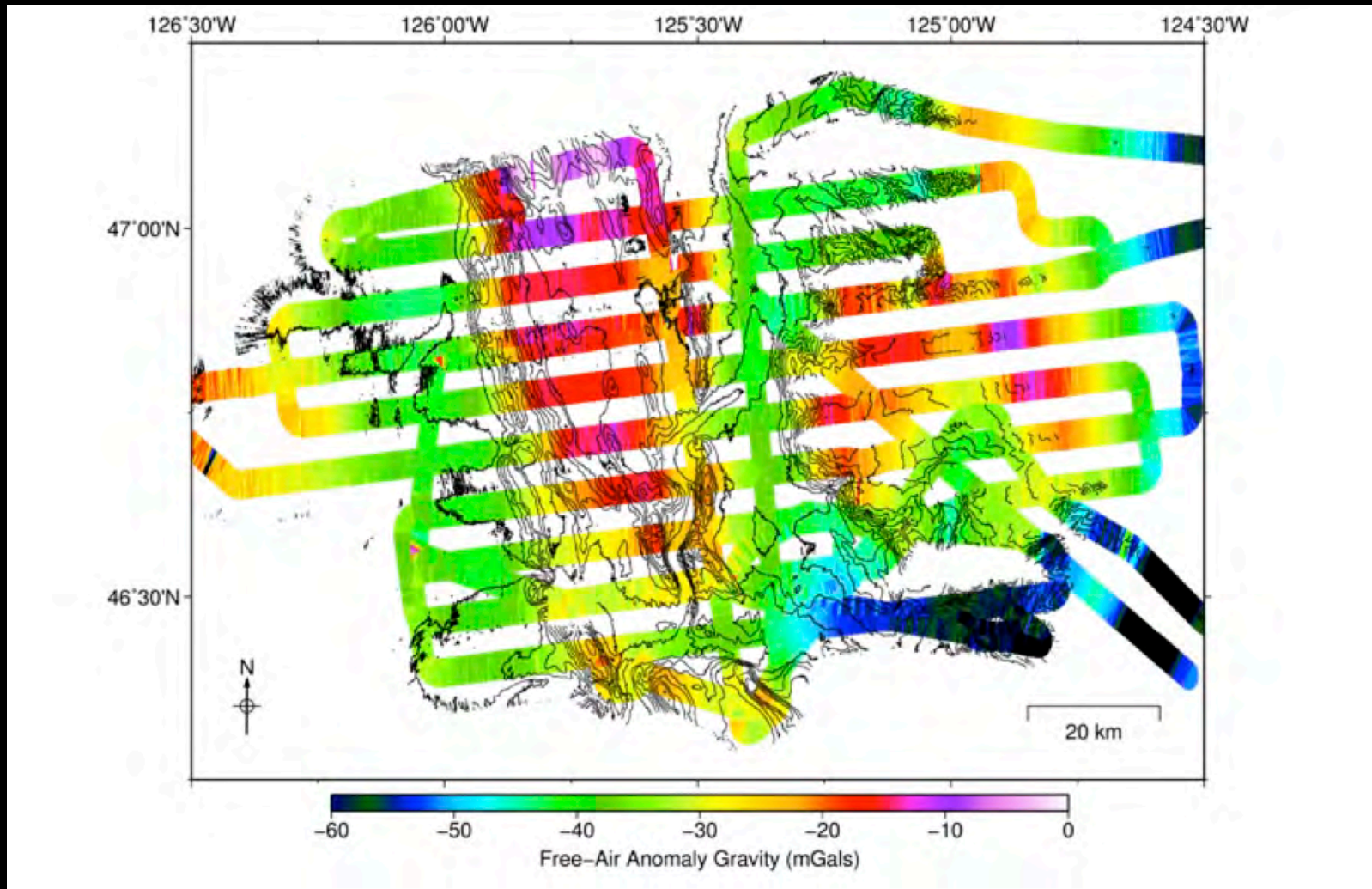
Lab Ops/Wat



Cruise Overview

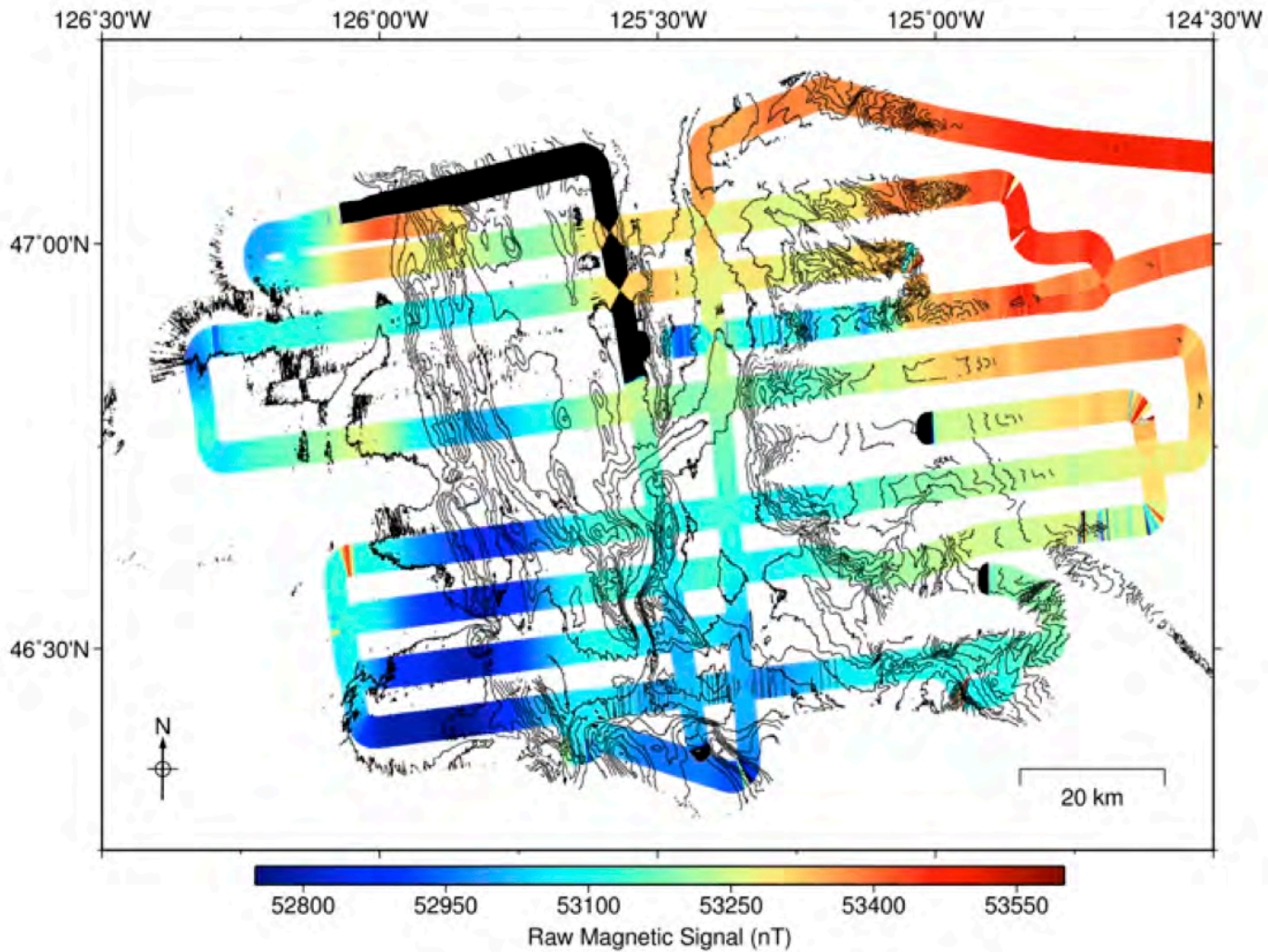


Free-air Gravity Data

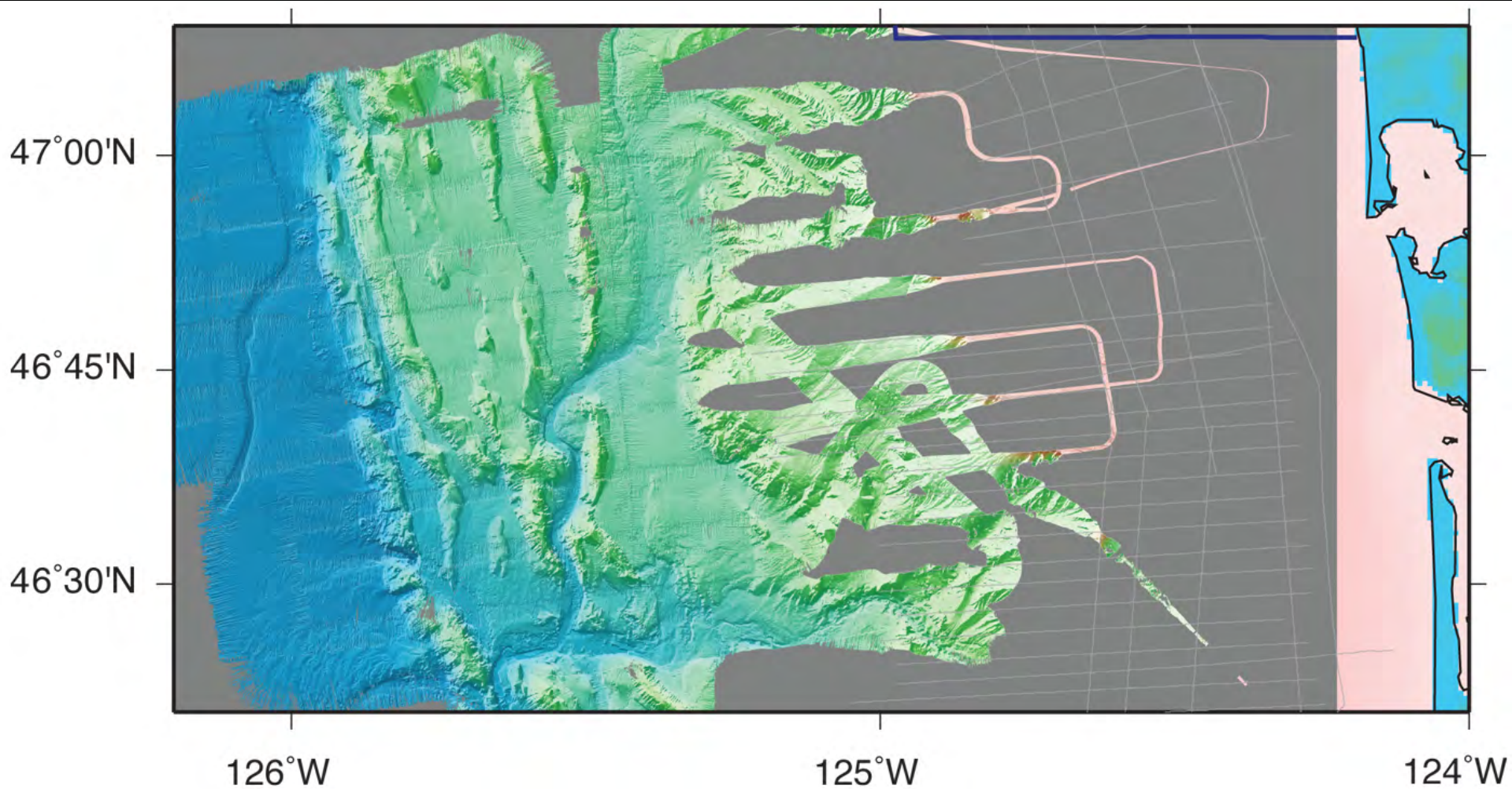


See poster by Caplan-Auerbach et al., T23E-2722

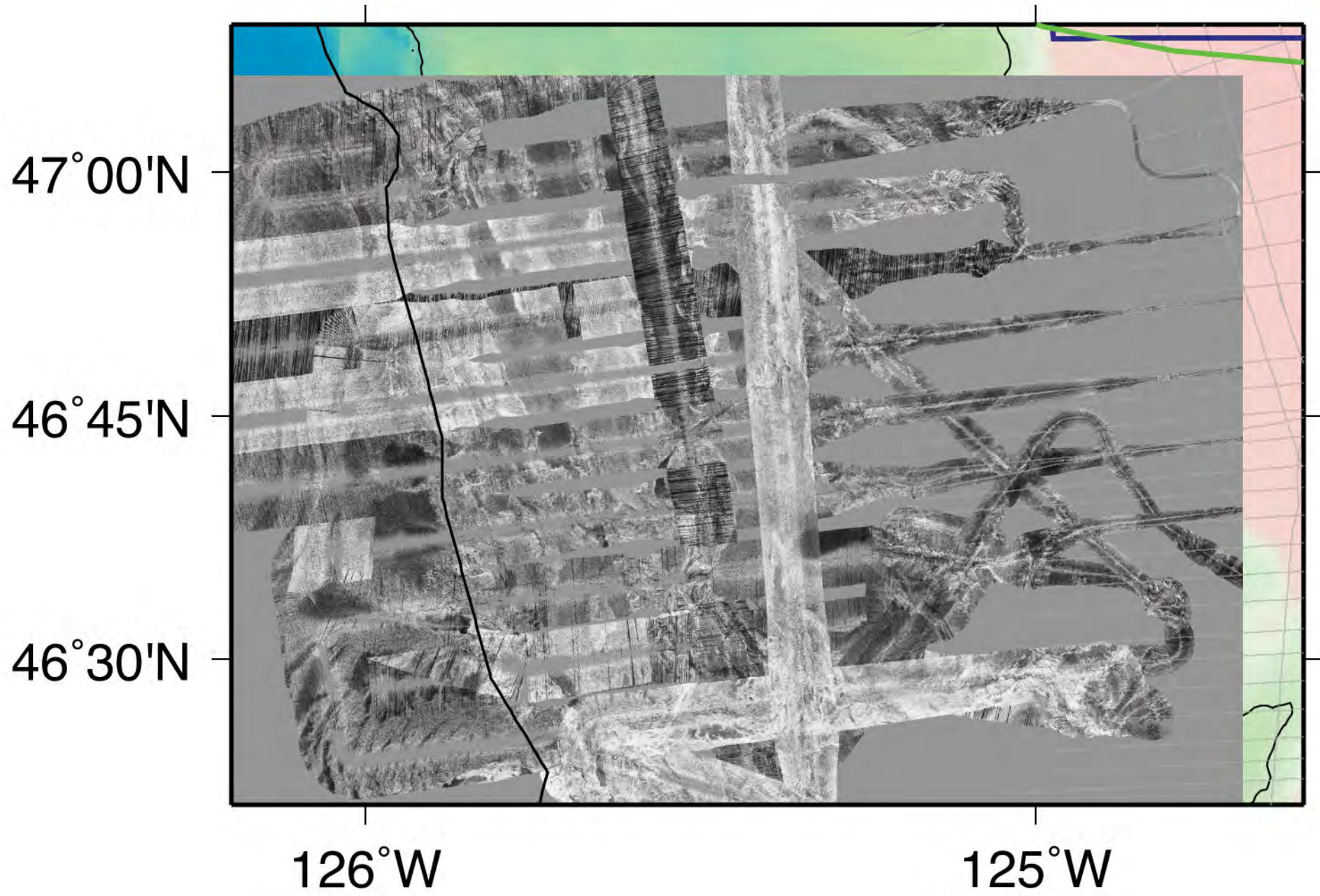
Magnetic Data



Multibeam Bathymetry Data



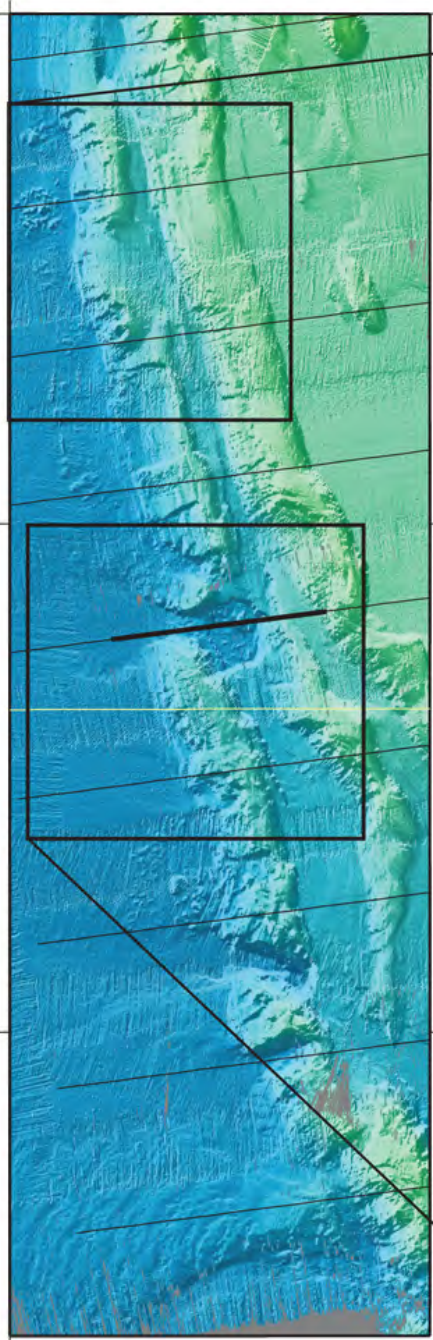
Backscatter Intensity Data



Preliminary Findings: A Brief Tour

1. Slope failures
2. Methane hydrate system
3. Active normal faults
4. Accretionary wedge structure
 - Landward vergence
 - Undeformed zones
5. Plate boundary structure
 - Landward weakening of oceanic crust reflection
 - Where is the décollement?

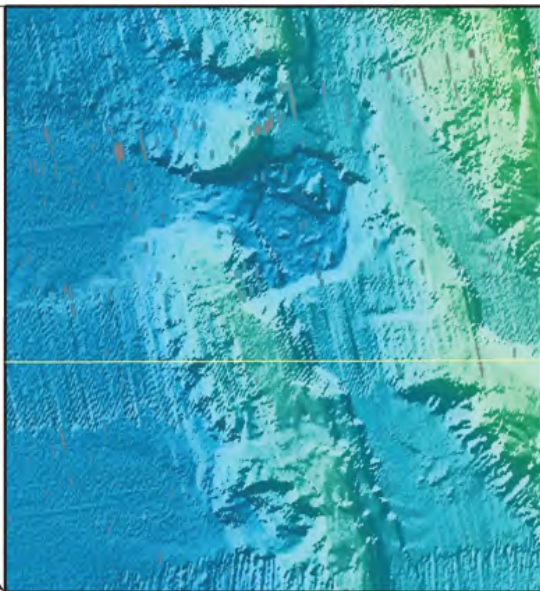
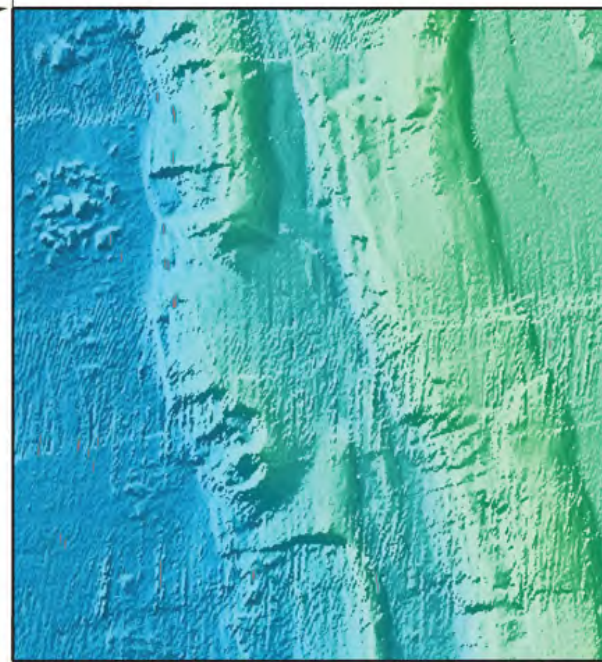
47°00'N



46°45'N

46°30'N

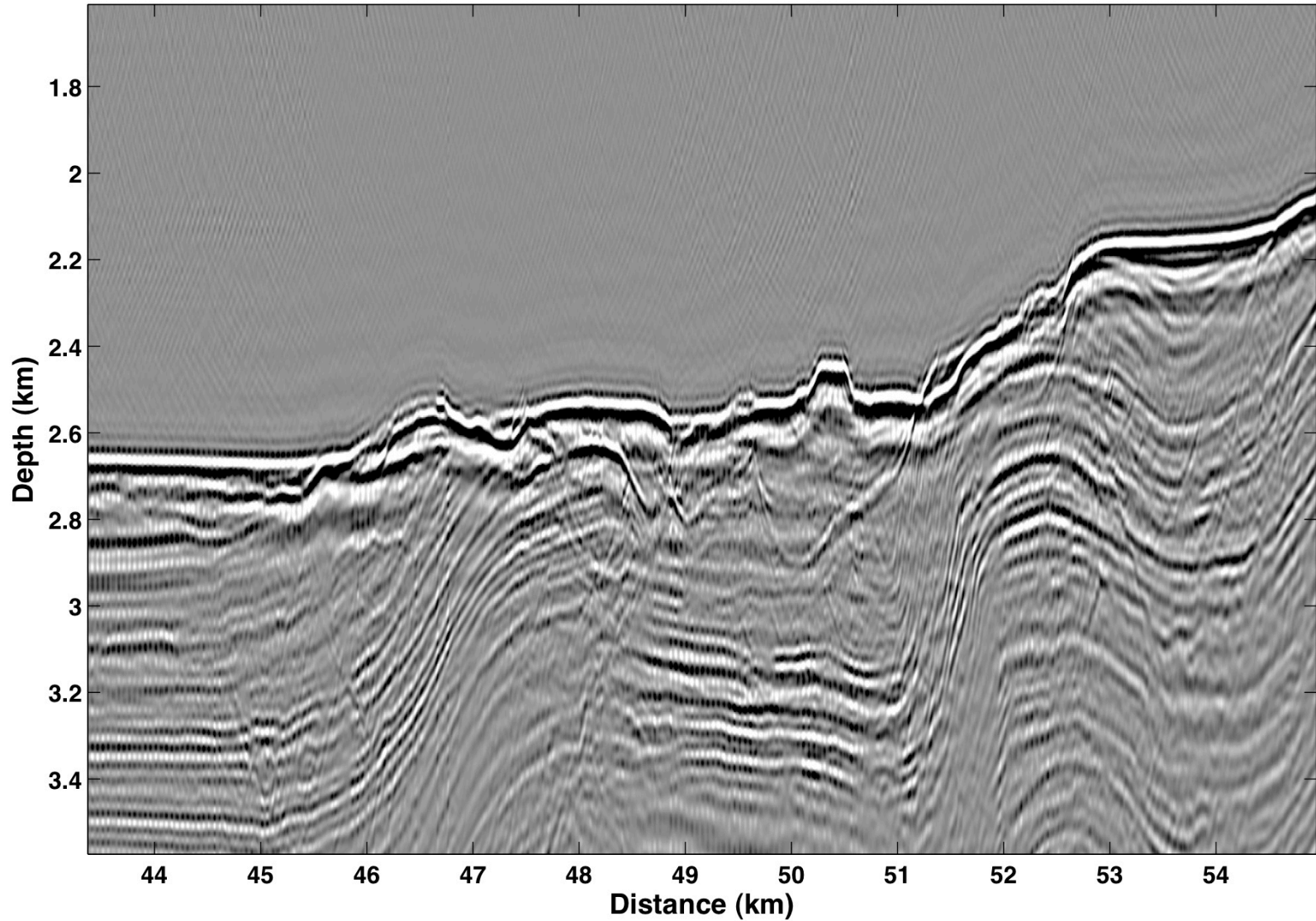
126°W



Slope Failures

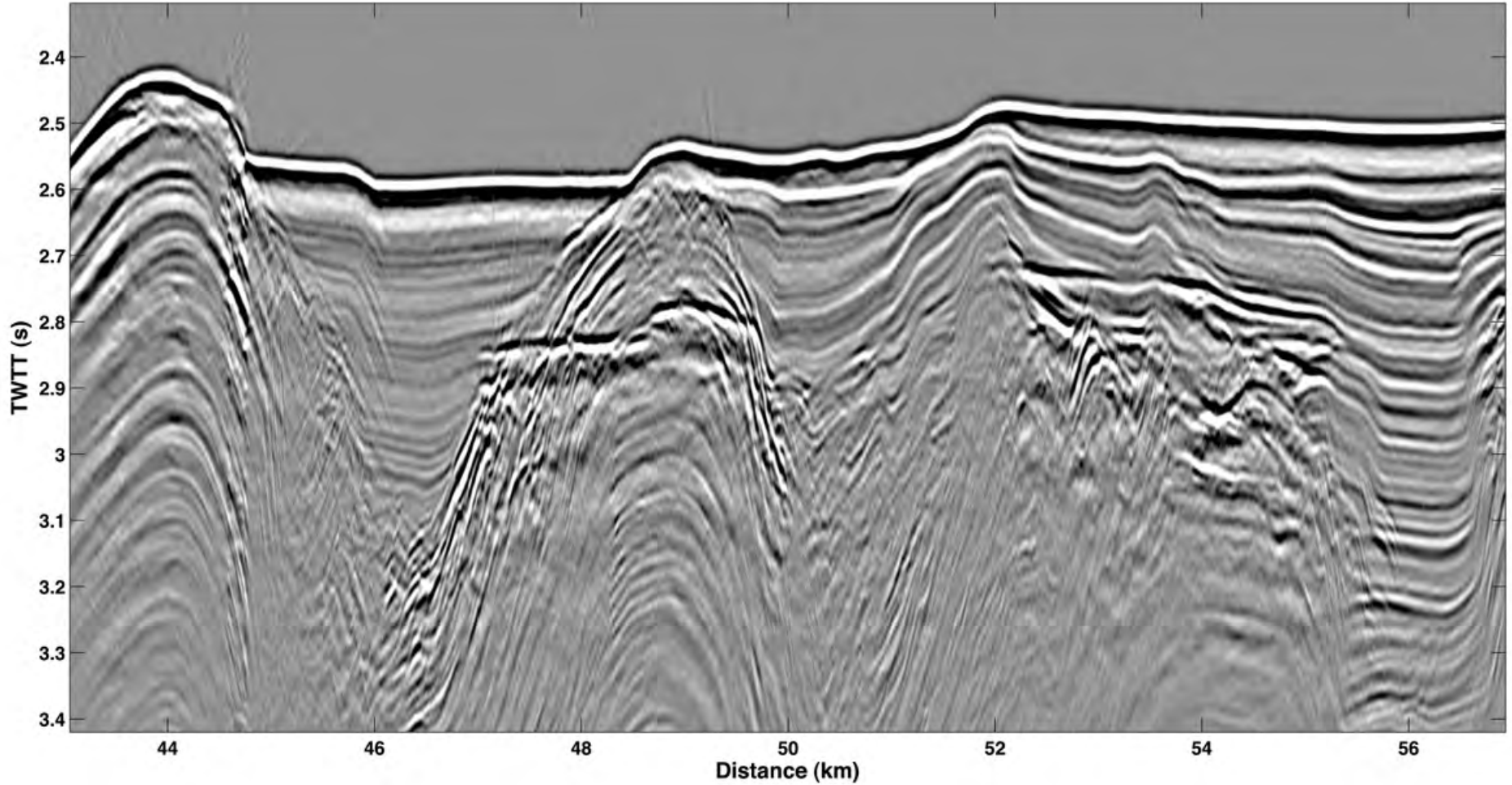
Slope Failures

Line 5 PSDM

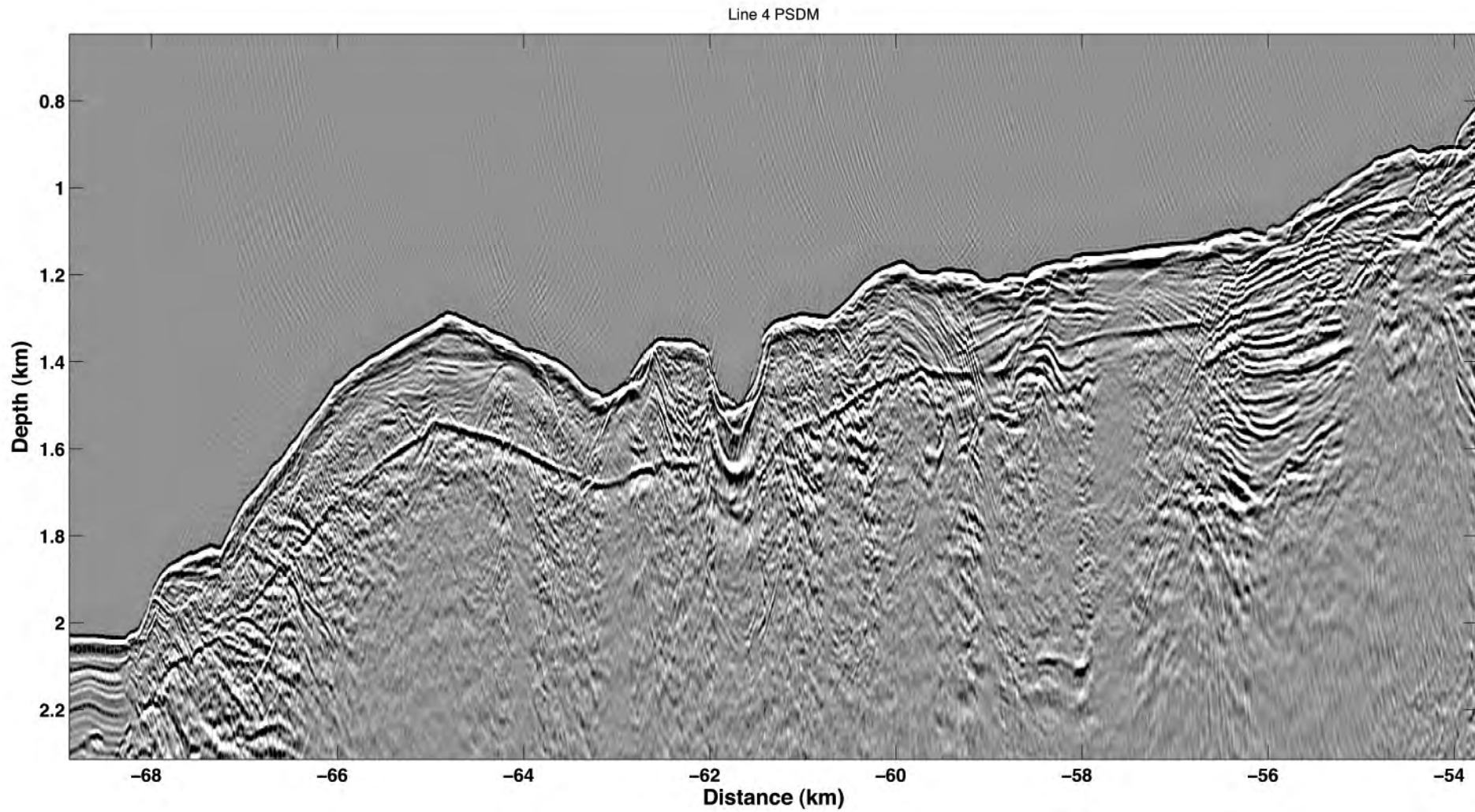


Abundant BSR's

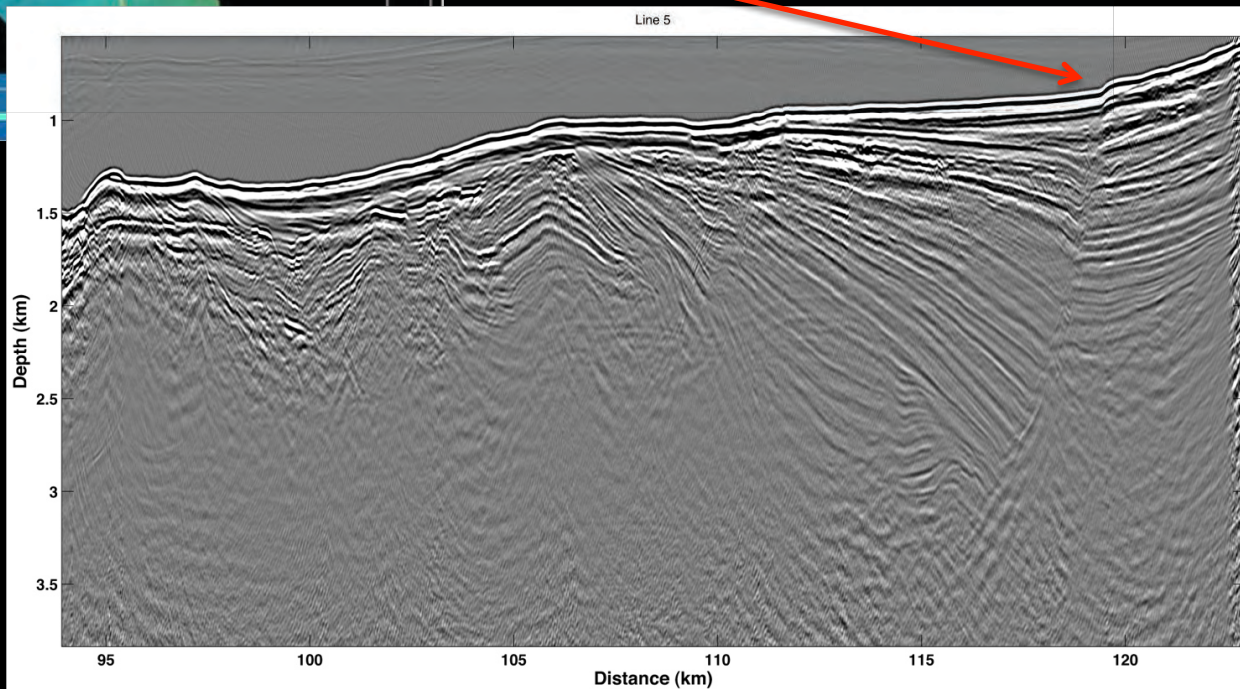
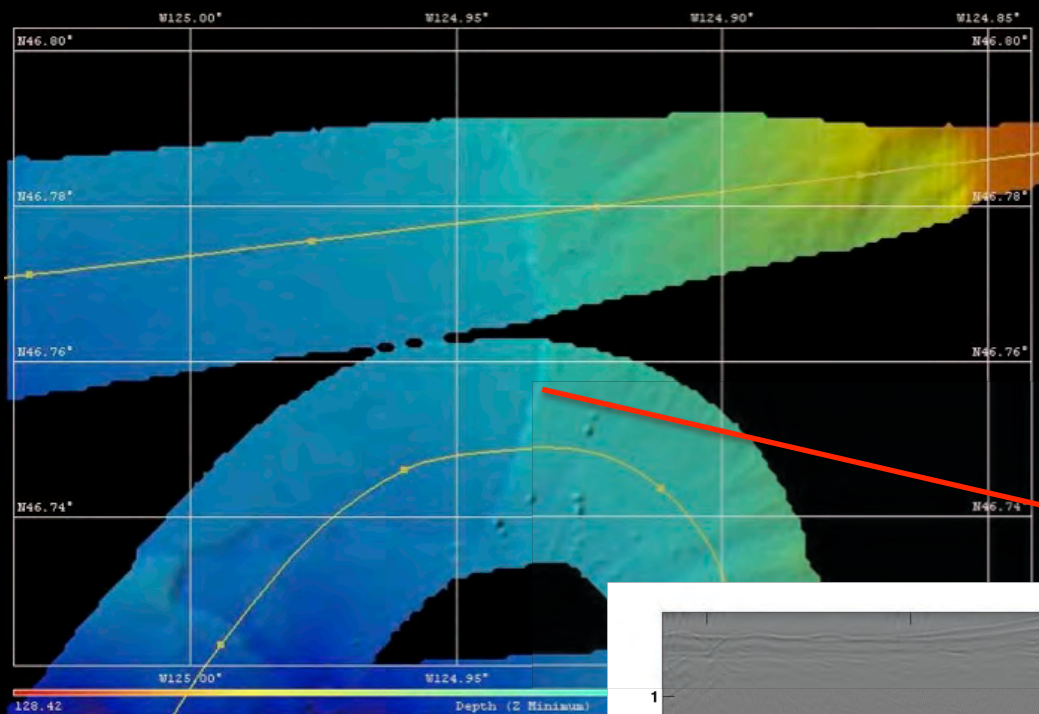
Line 2



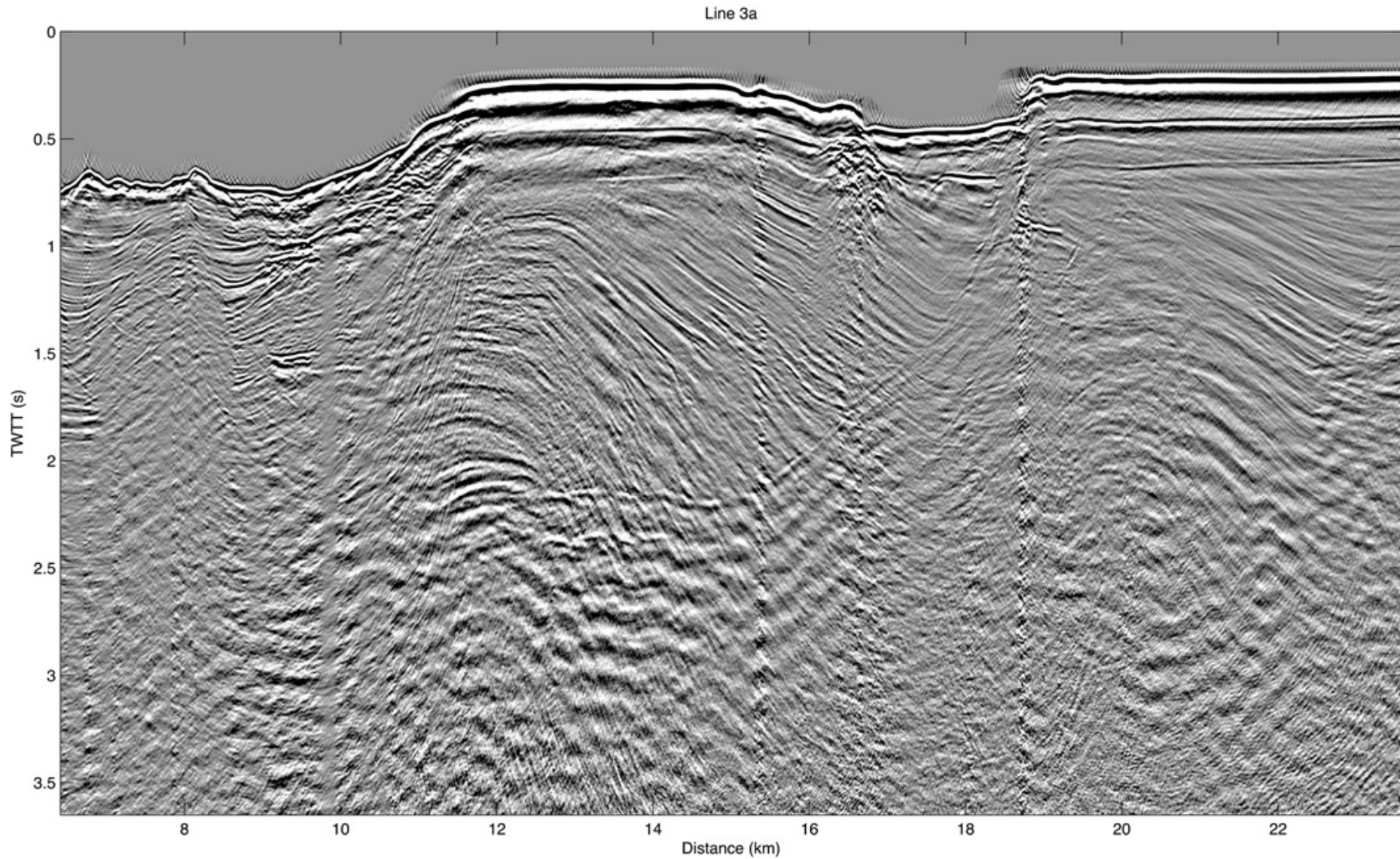
Abundant BSR's



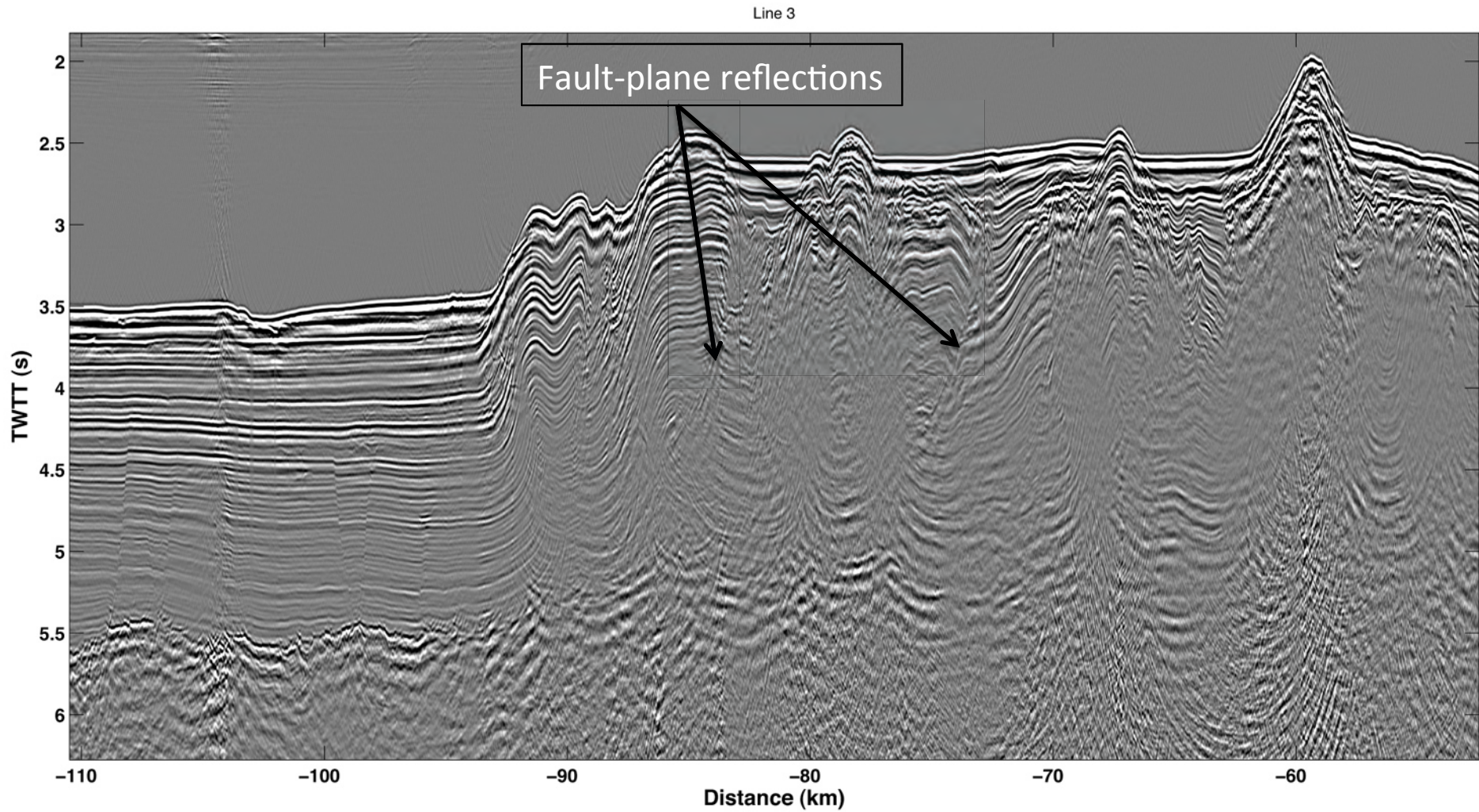
Active Normal Faults



Active Normal Faults

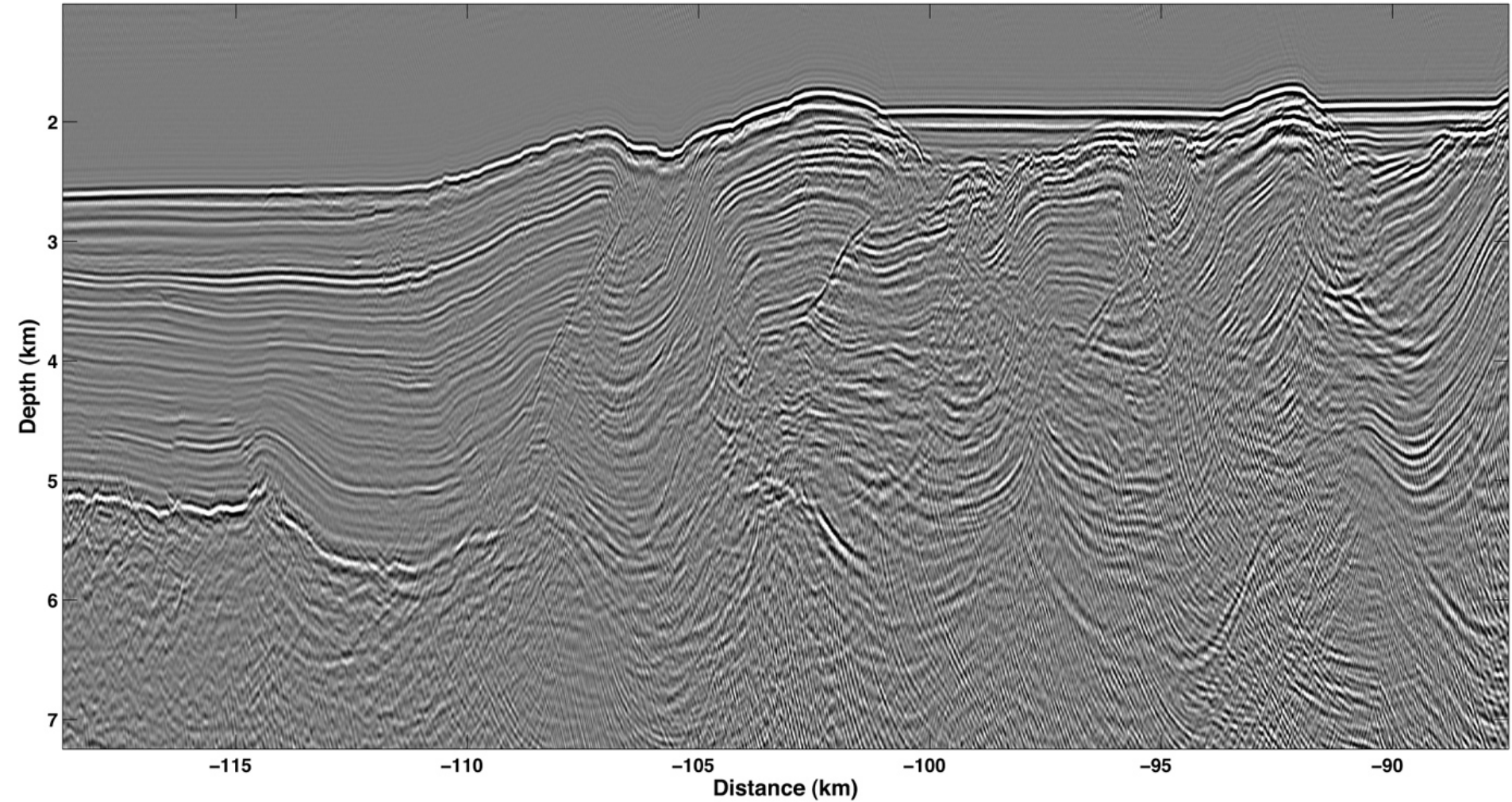


Landward-Vergent Structures

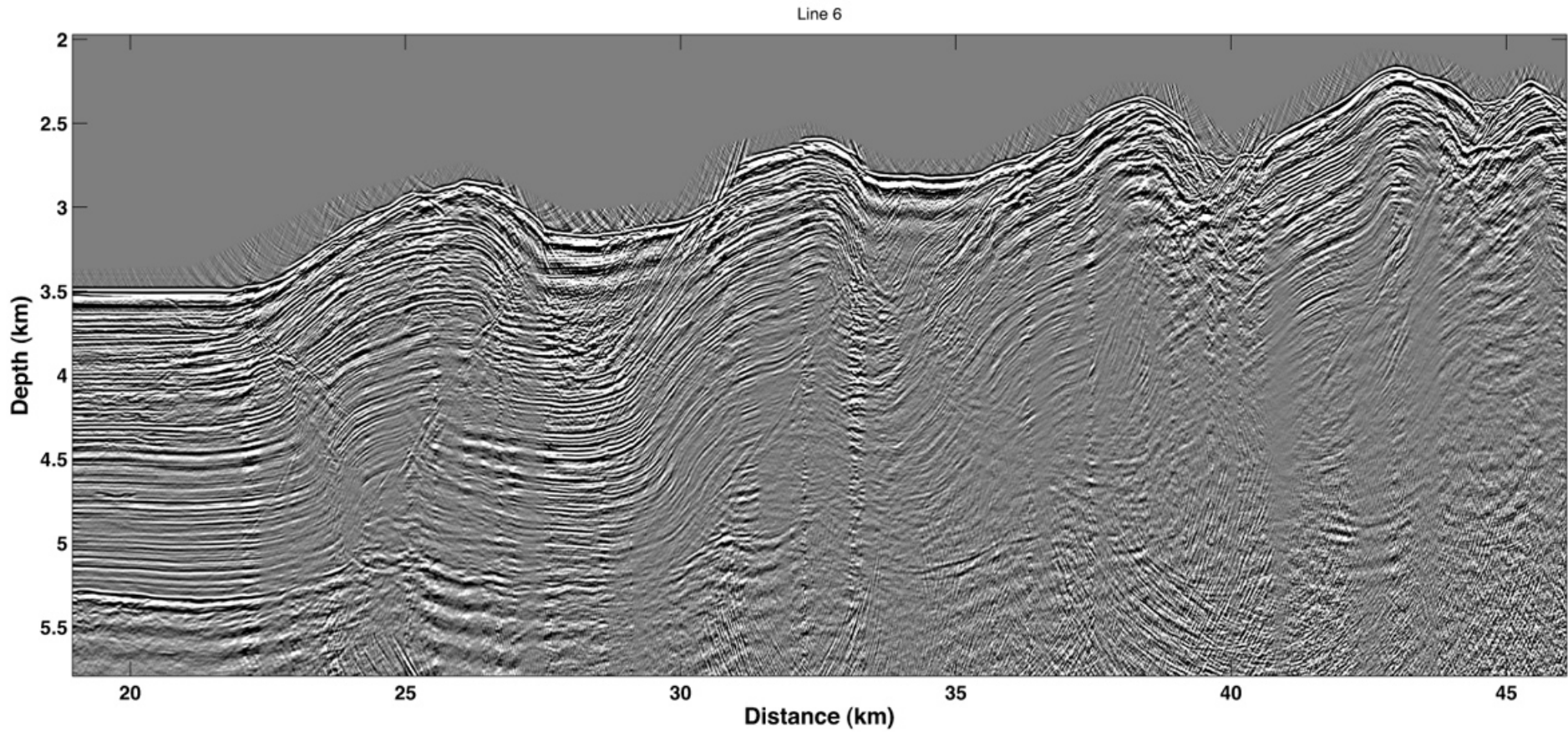


Landward-Vergent Structures

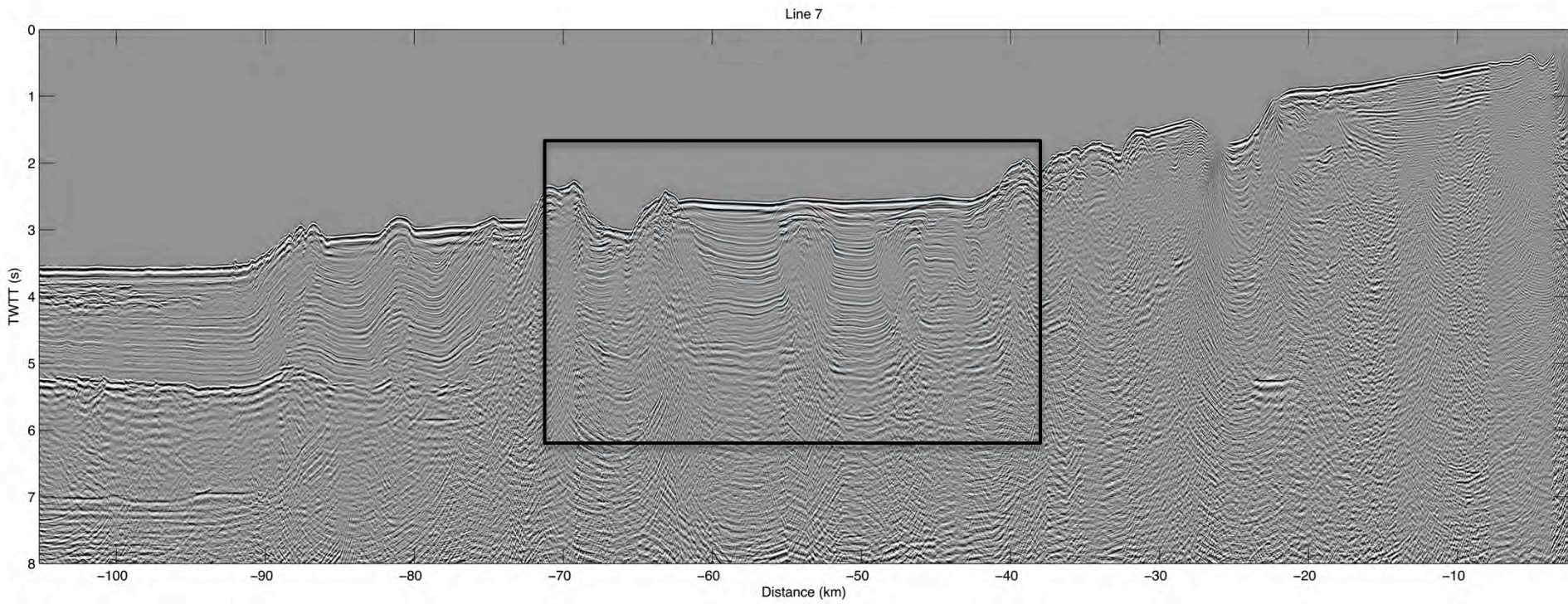
Line 4 PSDM



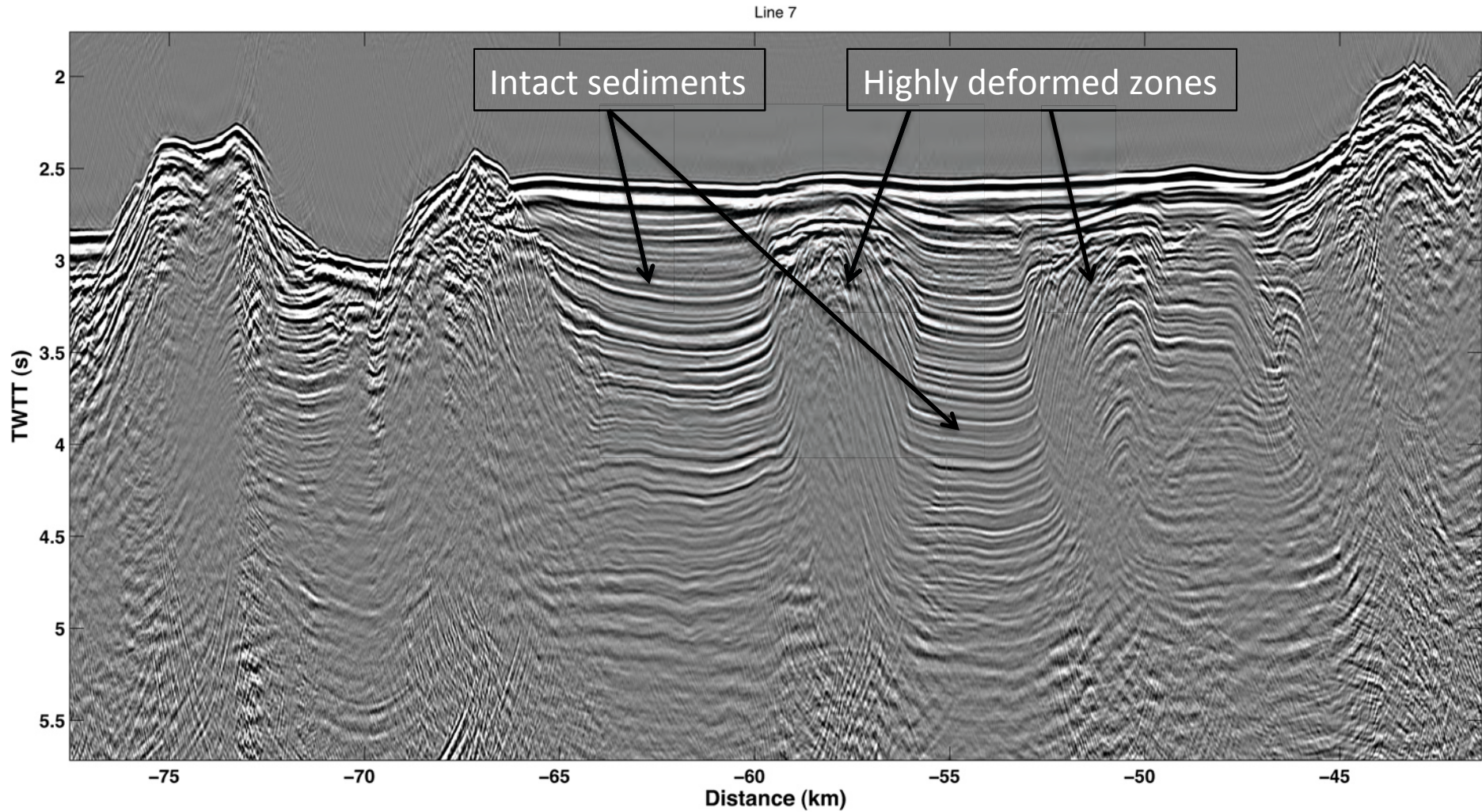
Landward-Vergent Structures



Undeformed "Oases"



Undeformed "Oases"



Landward-Weakening Top of Oceanic Crust Reflection

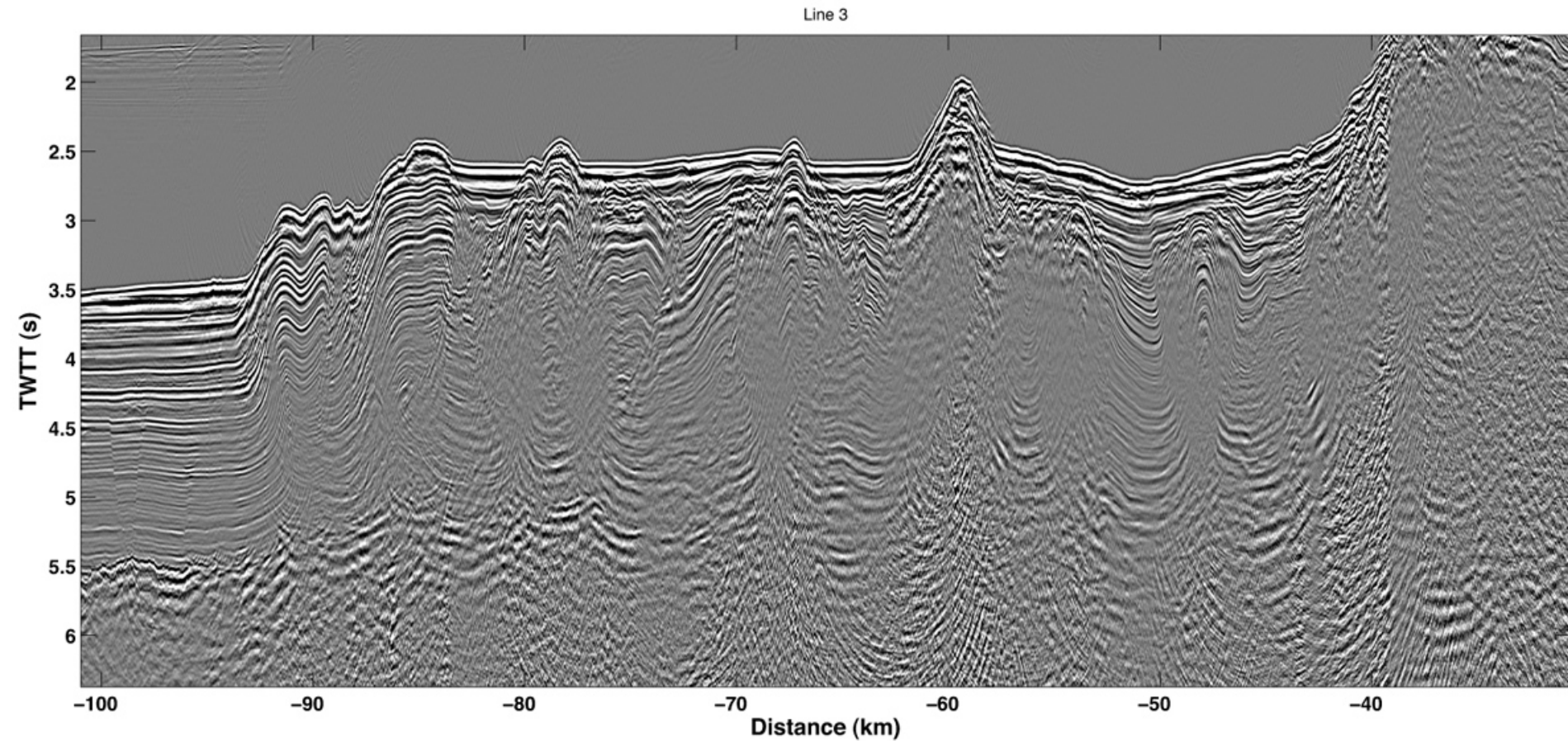


Plate Boundary Structure

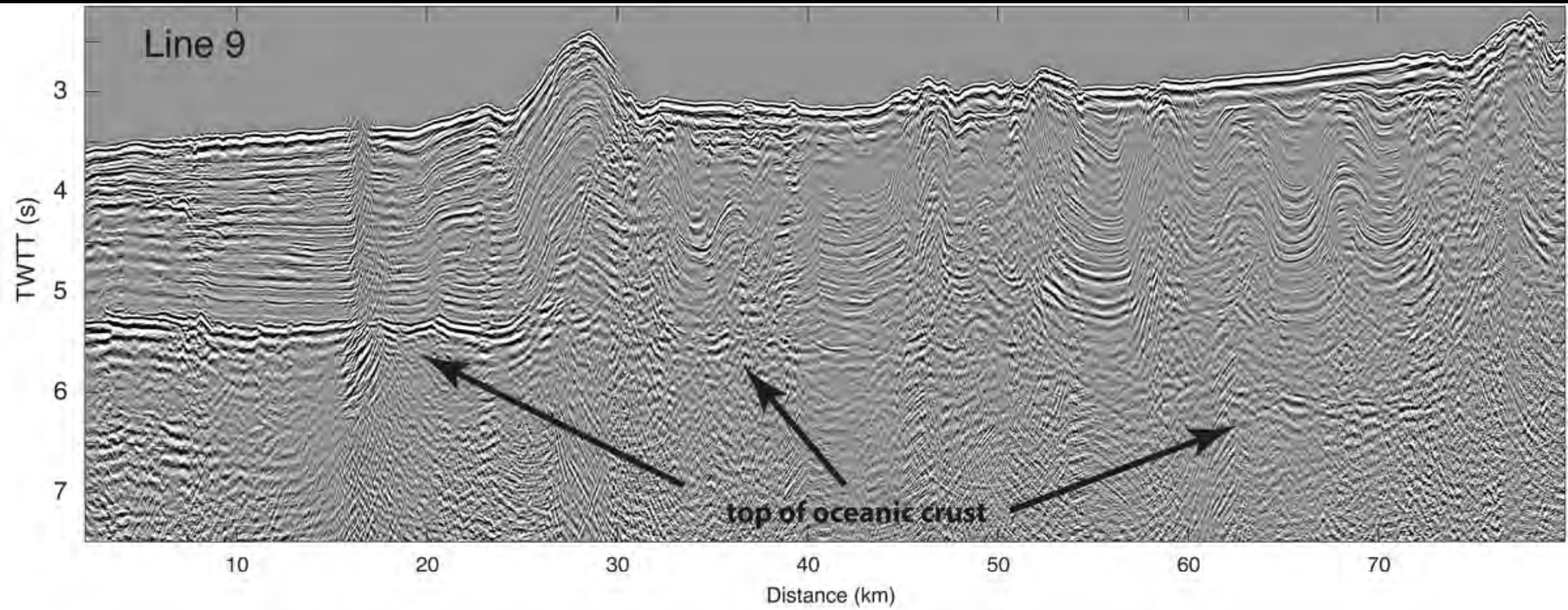


Plate Boundary Structure

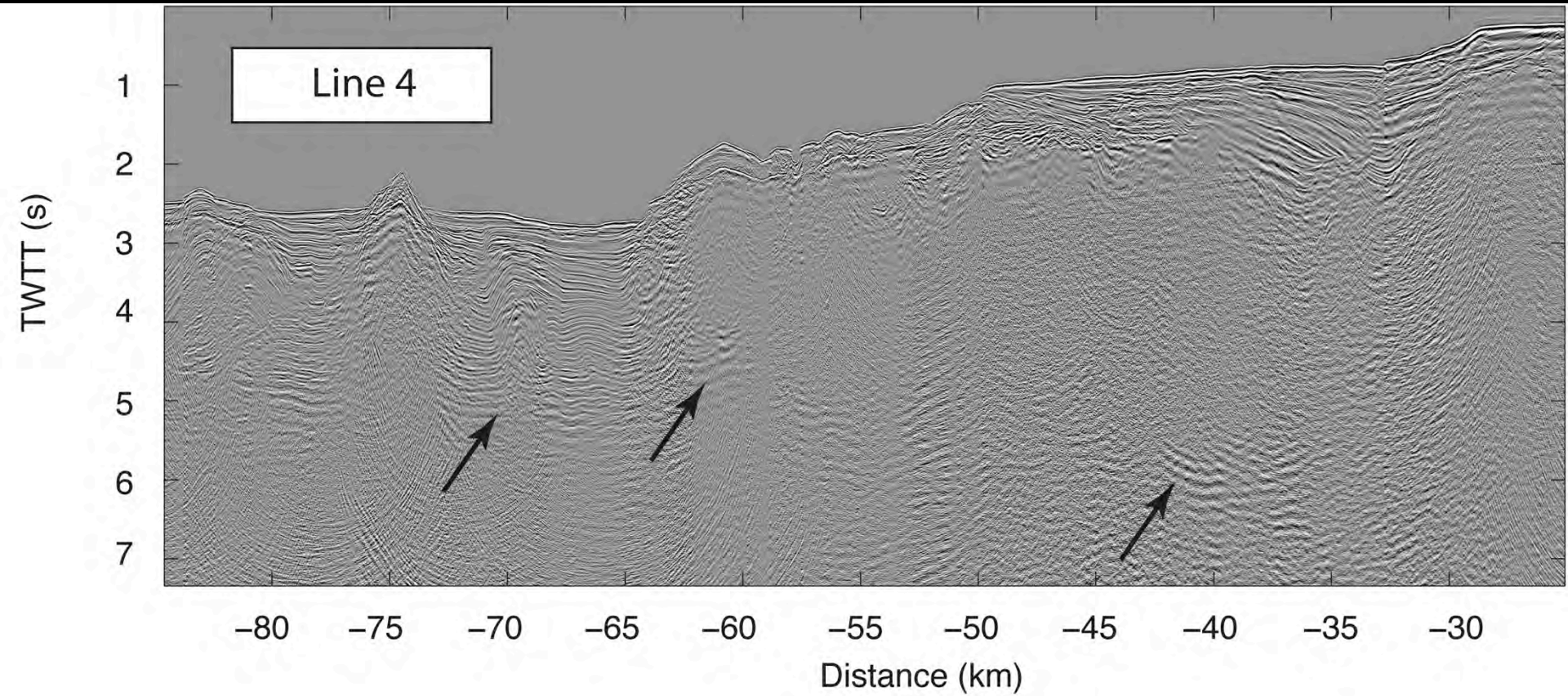


Plate Boundary Structure Where is the Décollement?

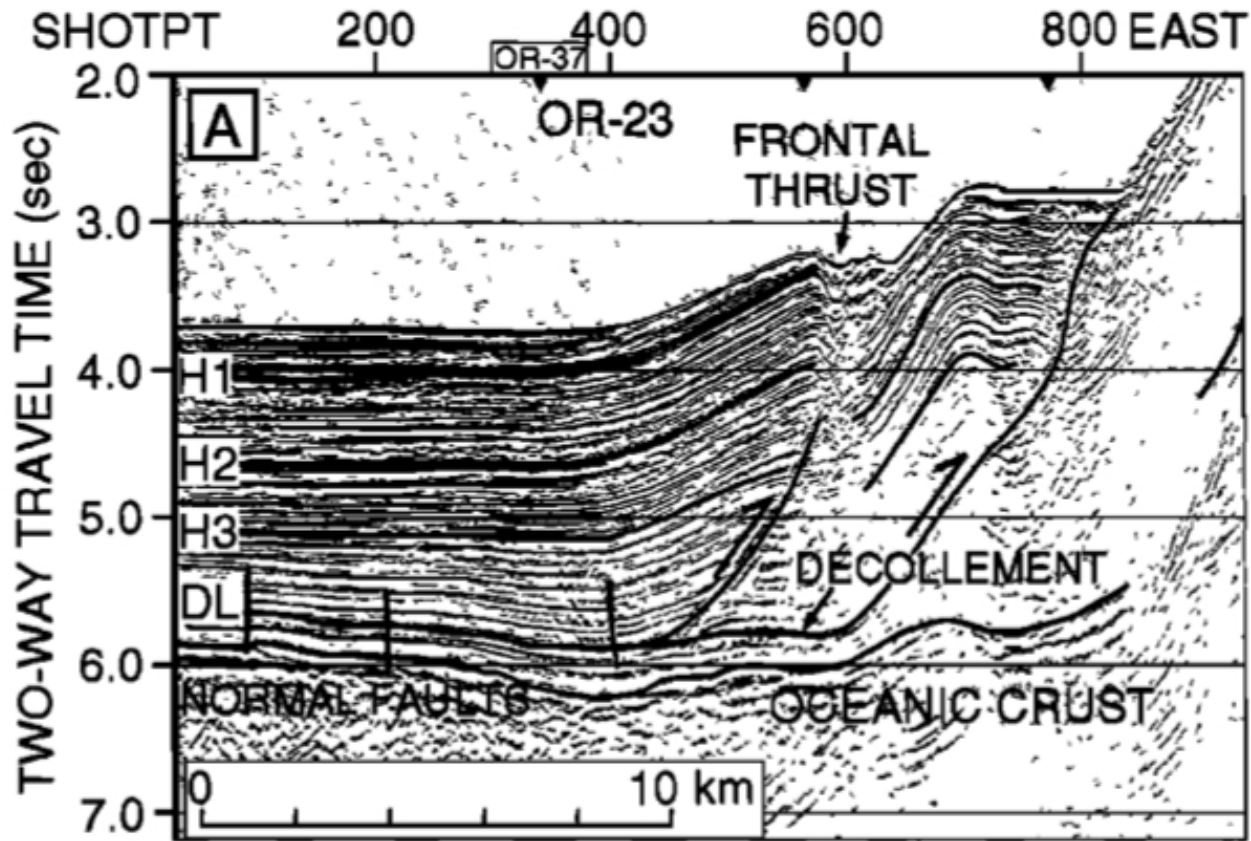


Plate Boundary Structure Where is the Décollement?

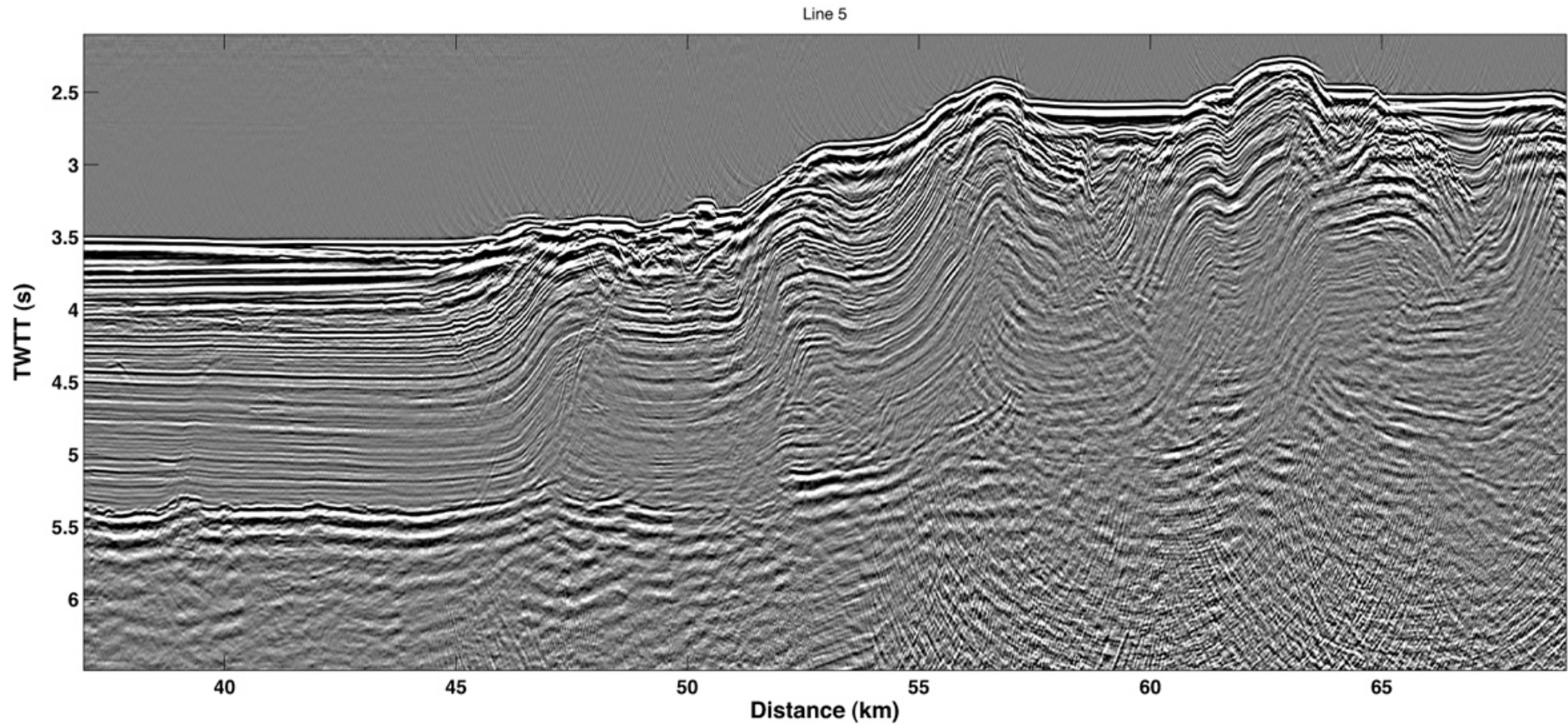


Plate Boundary Structure Where is the Décollement?

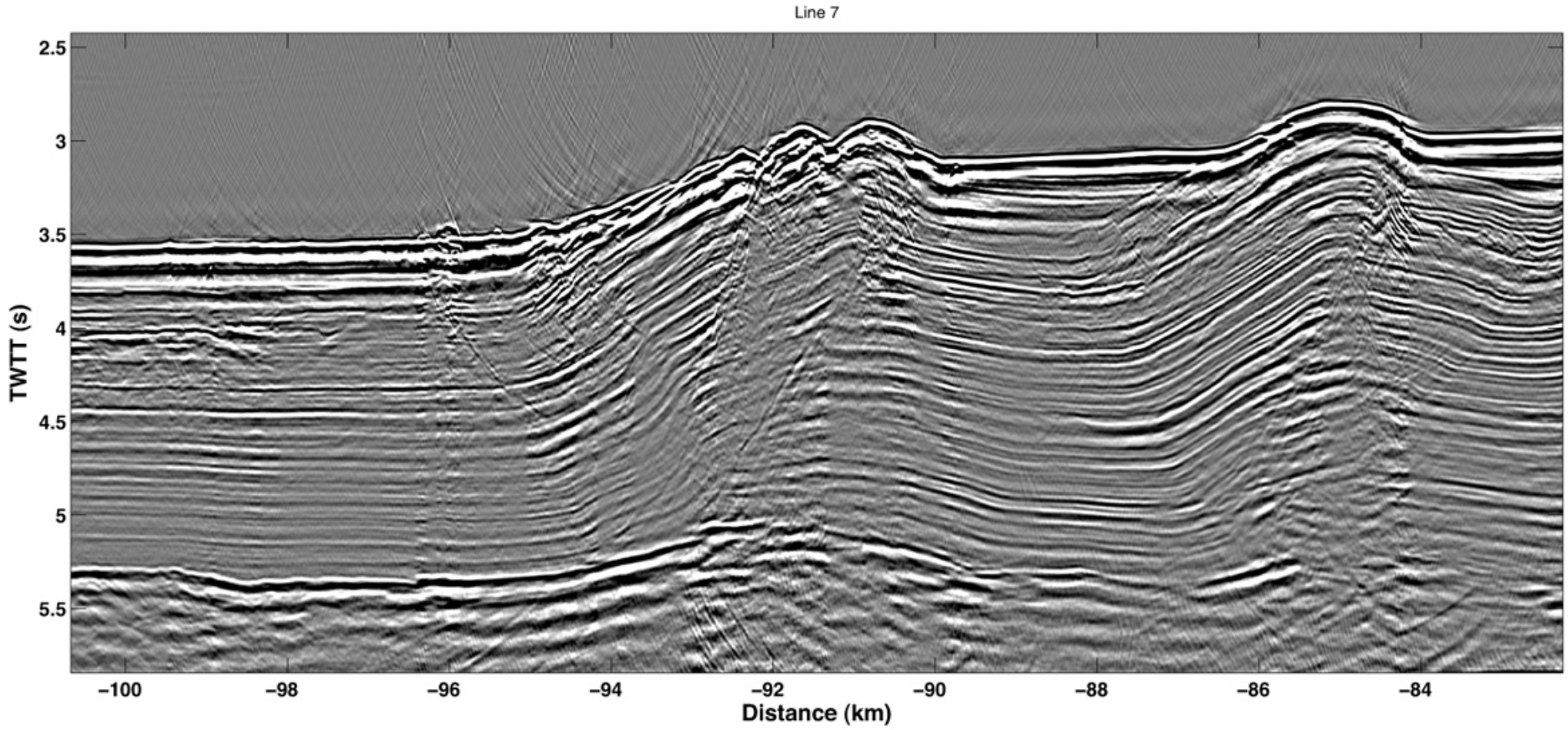


Plate Boundary Structure

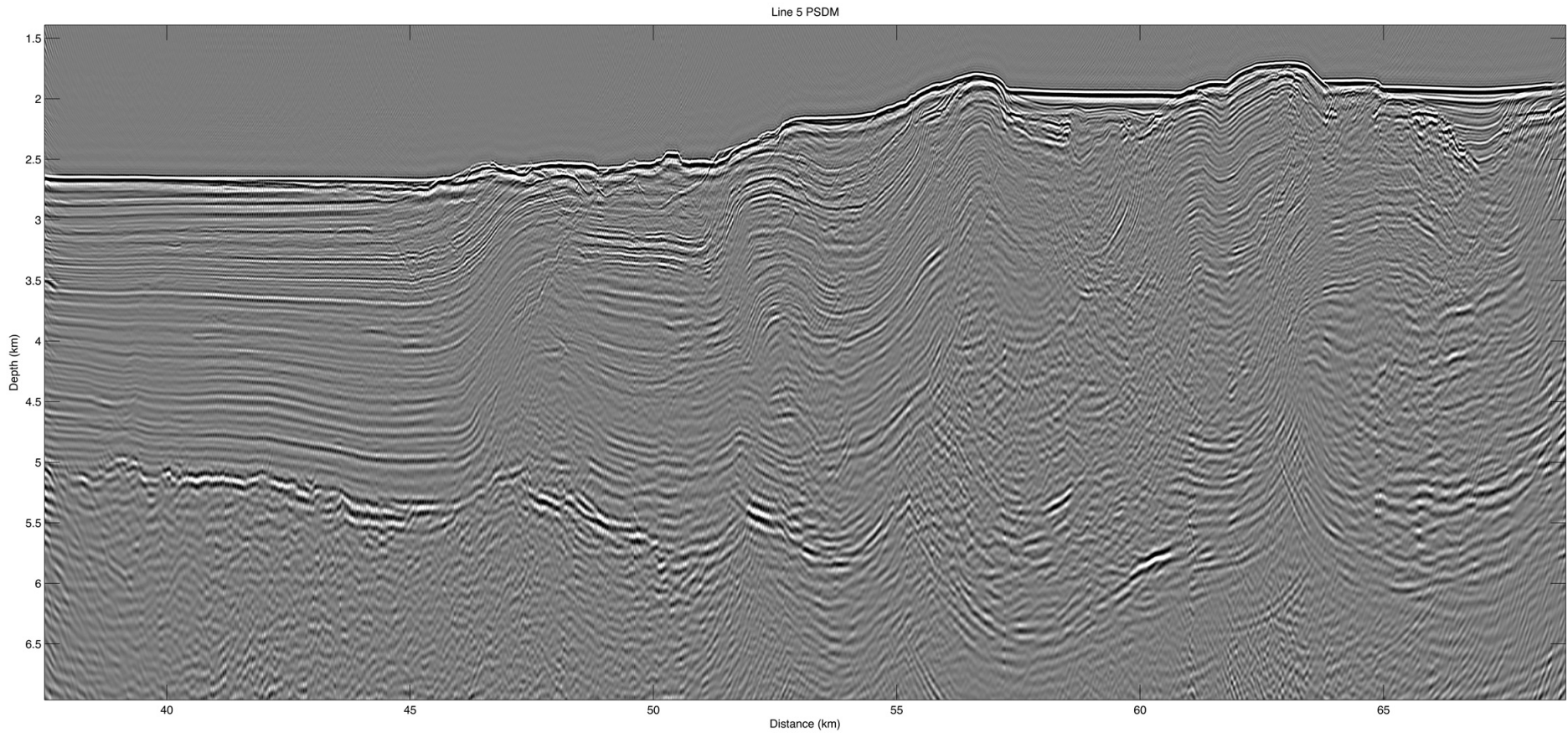
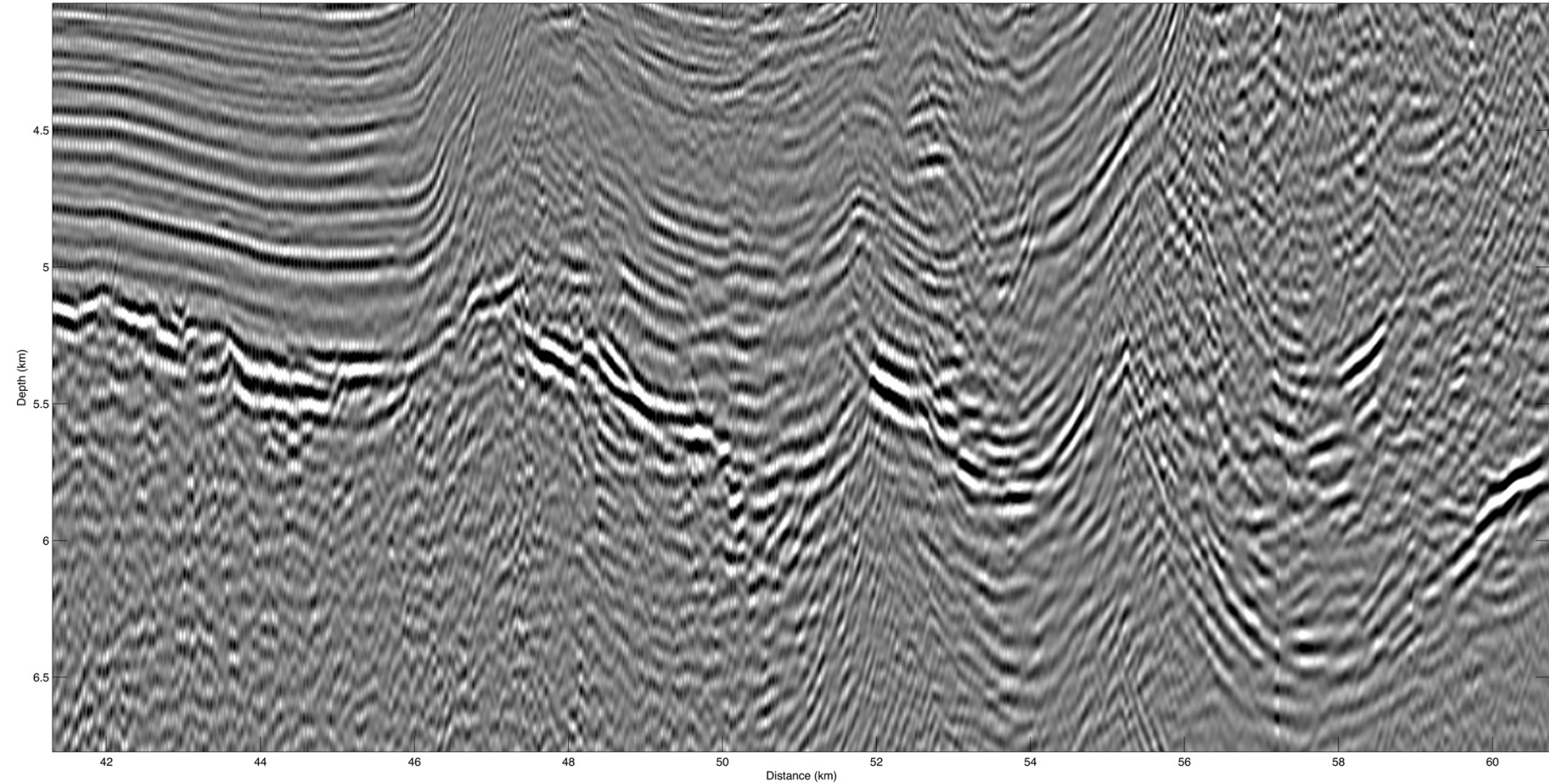


Plate Boundary Structure

Line 5 PSDM



The top of oceanic crust appears to be deforming with overlying accretionary wedge.

Plate Boundary Structure

Line 4 PSDM

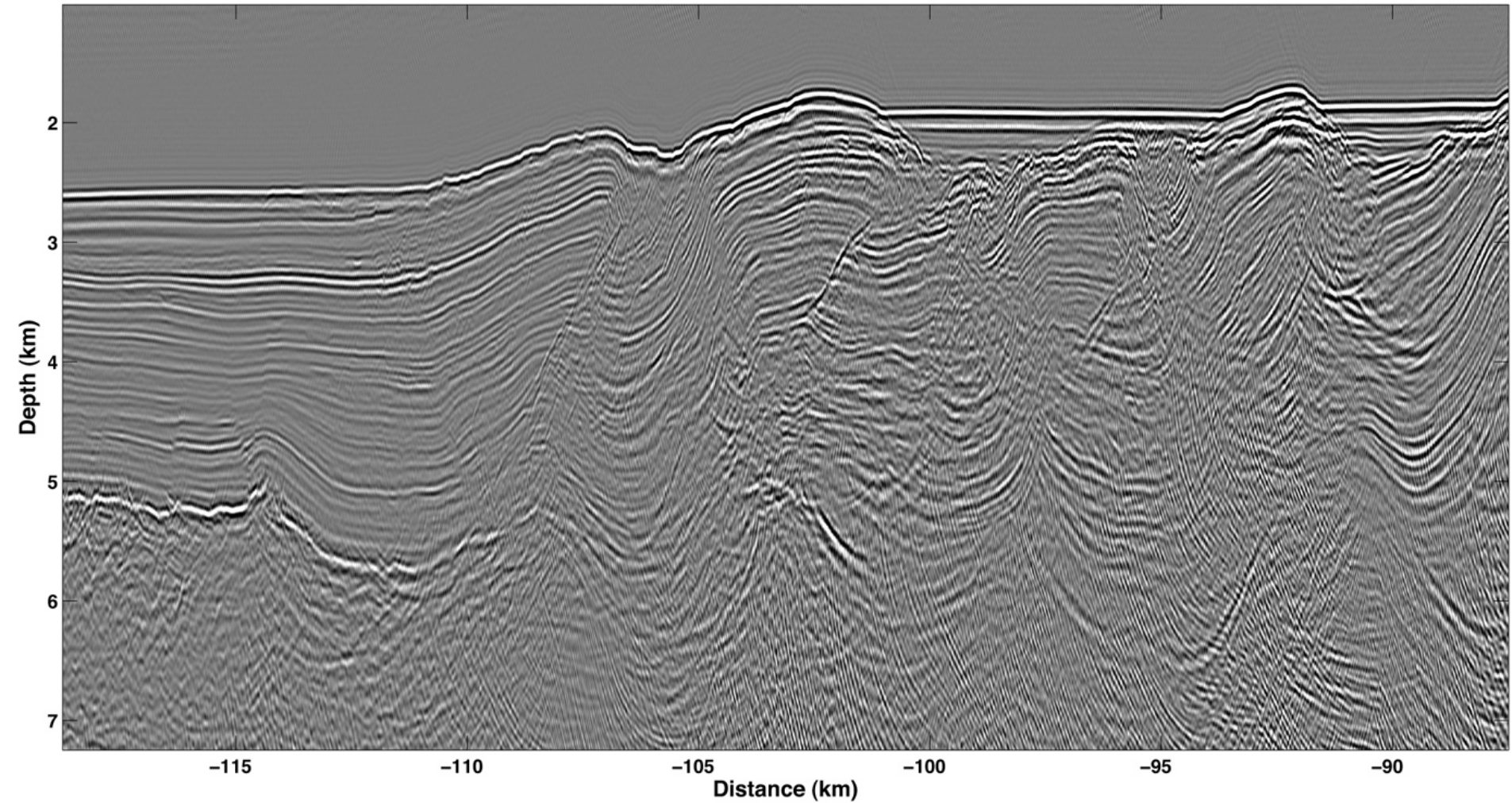


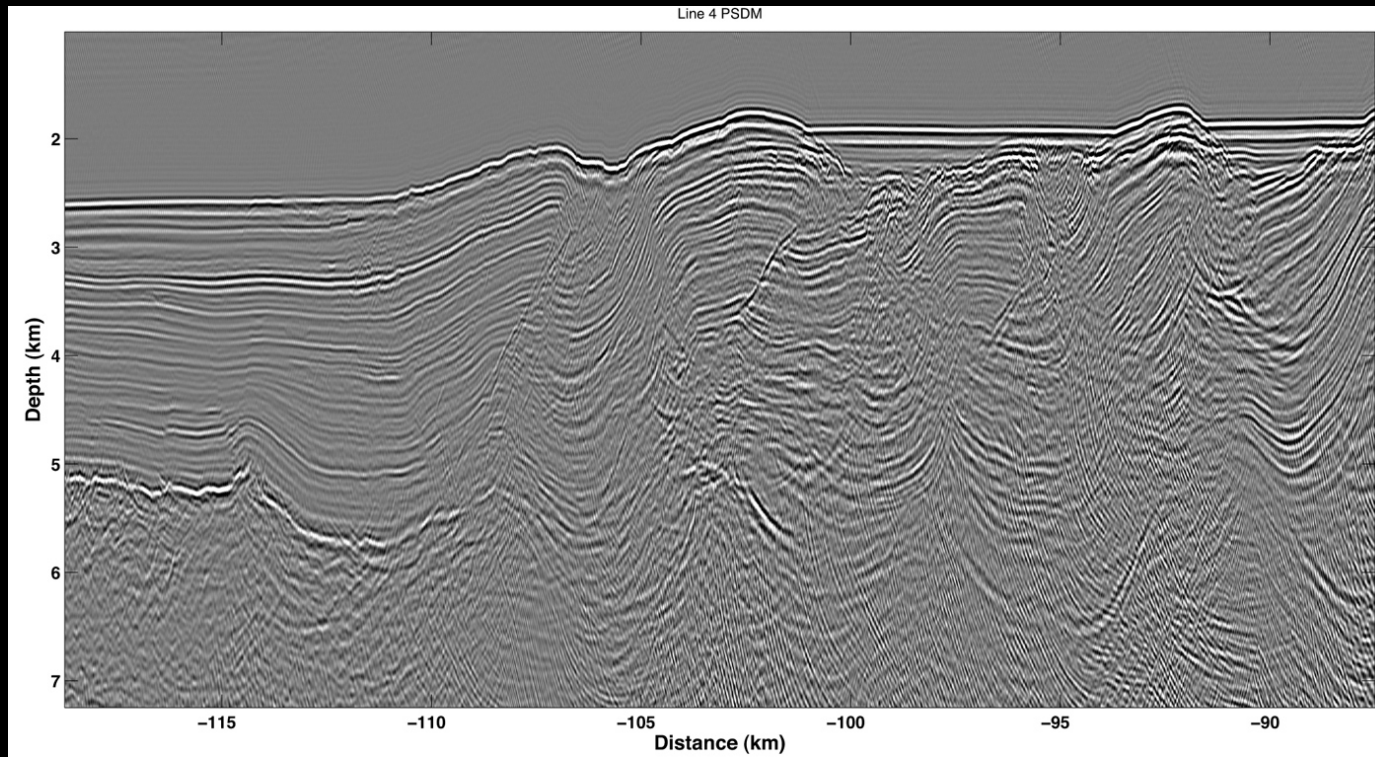
Plate Boundary Structure

Requirements for landward vergence:

1. Low basal shear stress (Byrne et al., 1993)
2. Landward-dipping décollement (MacKay et al., 1995)
3. Strong wedge, relative to weaker décollement (MacKay et al., 1995)

Paradox (?):

How can low basal shear stress be achieved, if the décollement is not in the sediments?

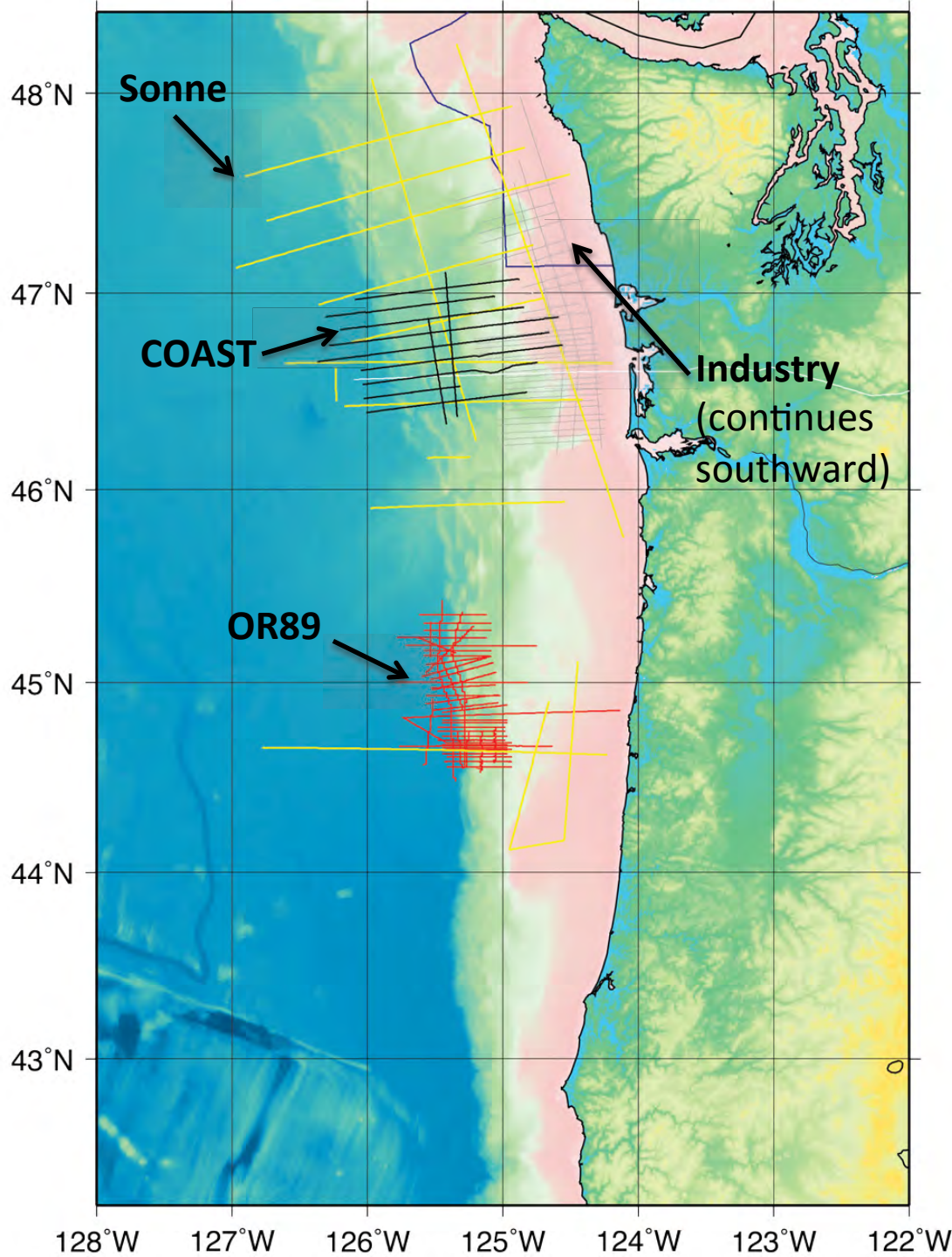


What Next?

Existing MCS Data

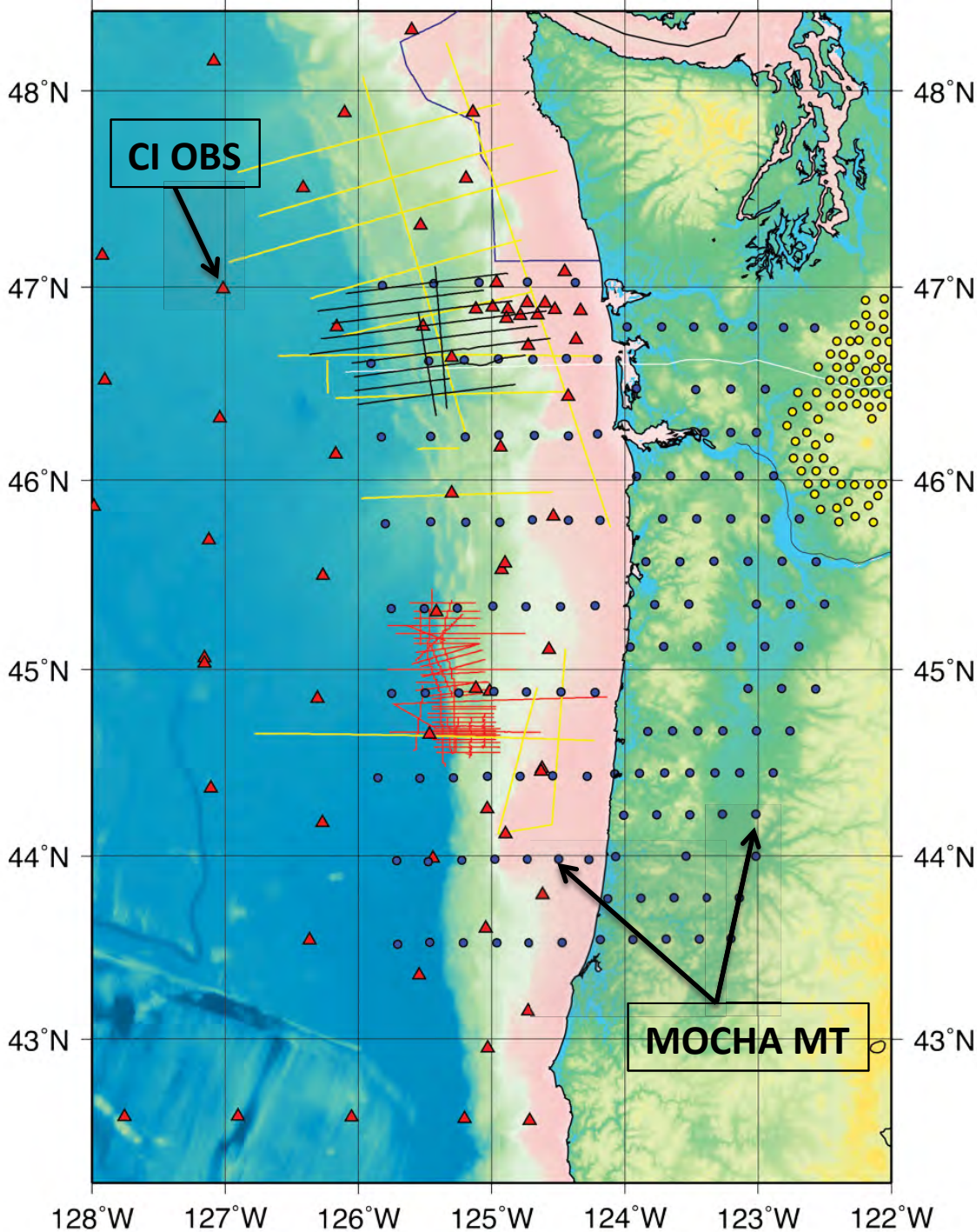
Four main data sets:

- Sonne cruise (ORWELL)
- OR89 site survey data
- Industry data on shelf (USGS data base)
- COAST (2012)



Other Major Offshore Cascadia Datasets

- Cascadia Initiative OBS data
- MOCHA magnetotelluric survey (funded; Schultz)



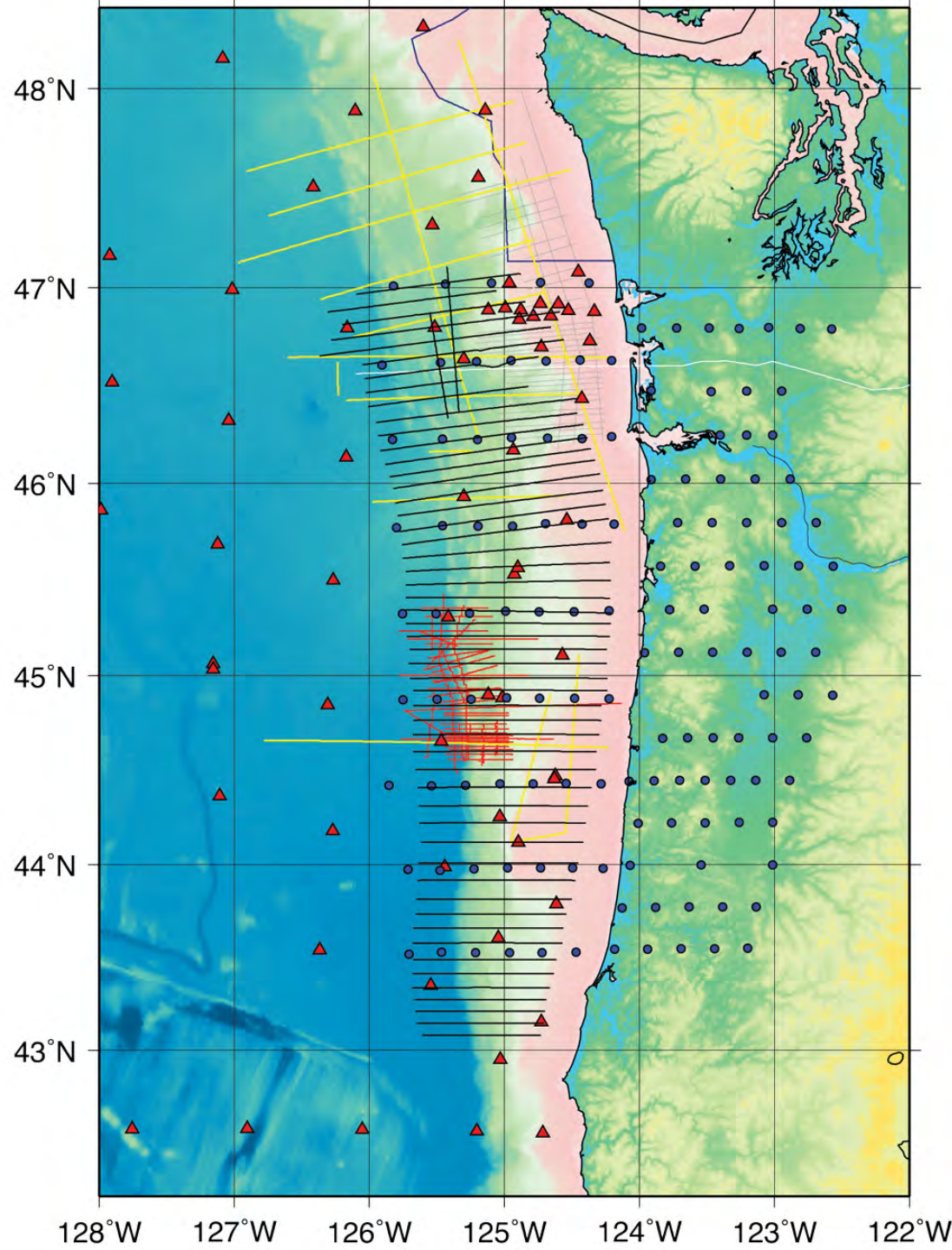
Notional Open-Access 2D Survey ("COAST 2")

Rationale:

- Characterize offshore region over 400-km-long region
- Coverage commensurate with Cascadia Initiative and MOCHA study areas
- Ancillary OBS & onshore-offshore data highly desirable during shooting
 - Characterize crustal structure in much of Cascadia study area
 - Context for seismicity, ETS, SSE detected by TA and CI datasets

Survey Plan:

- Single 40-day leg of Langseth for airgun/MCS shooting
- Second ship for OBS deployments

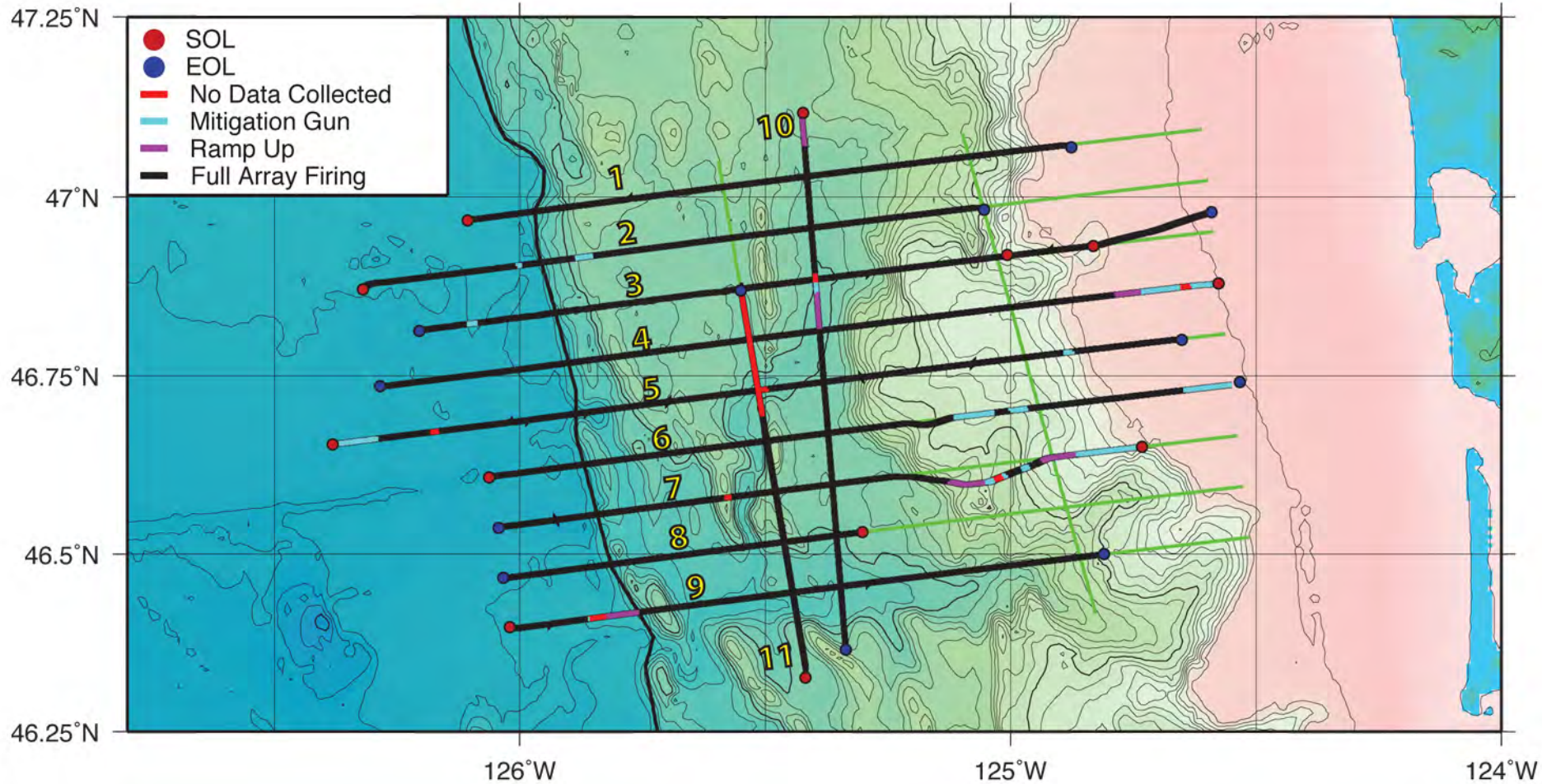


Thank You

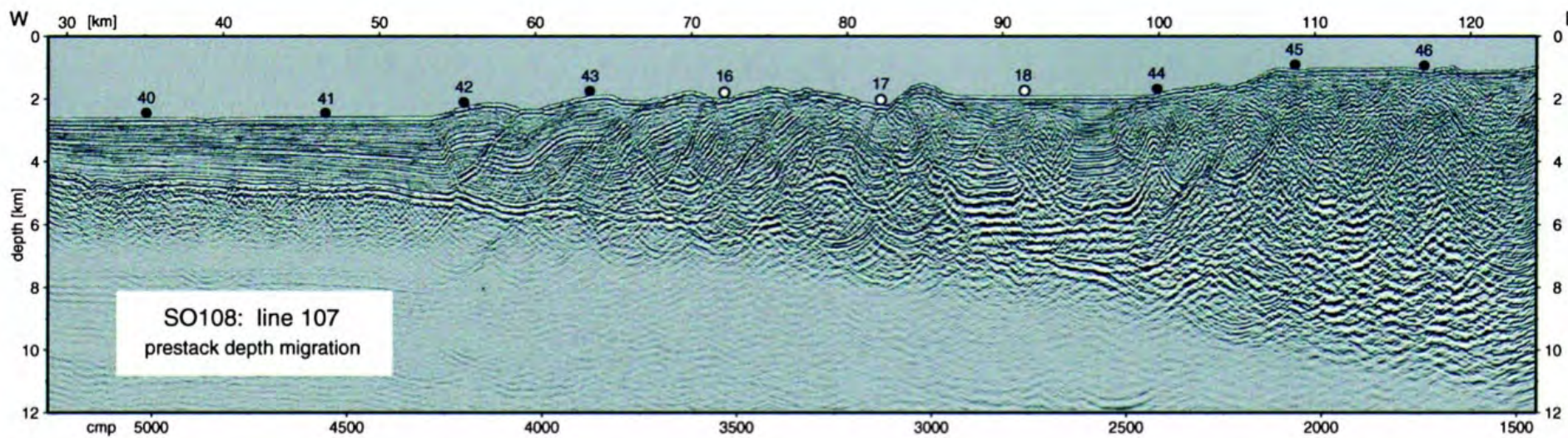


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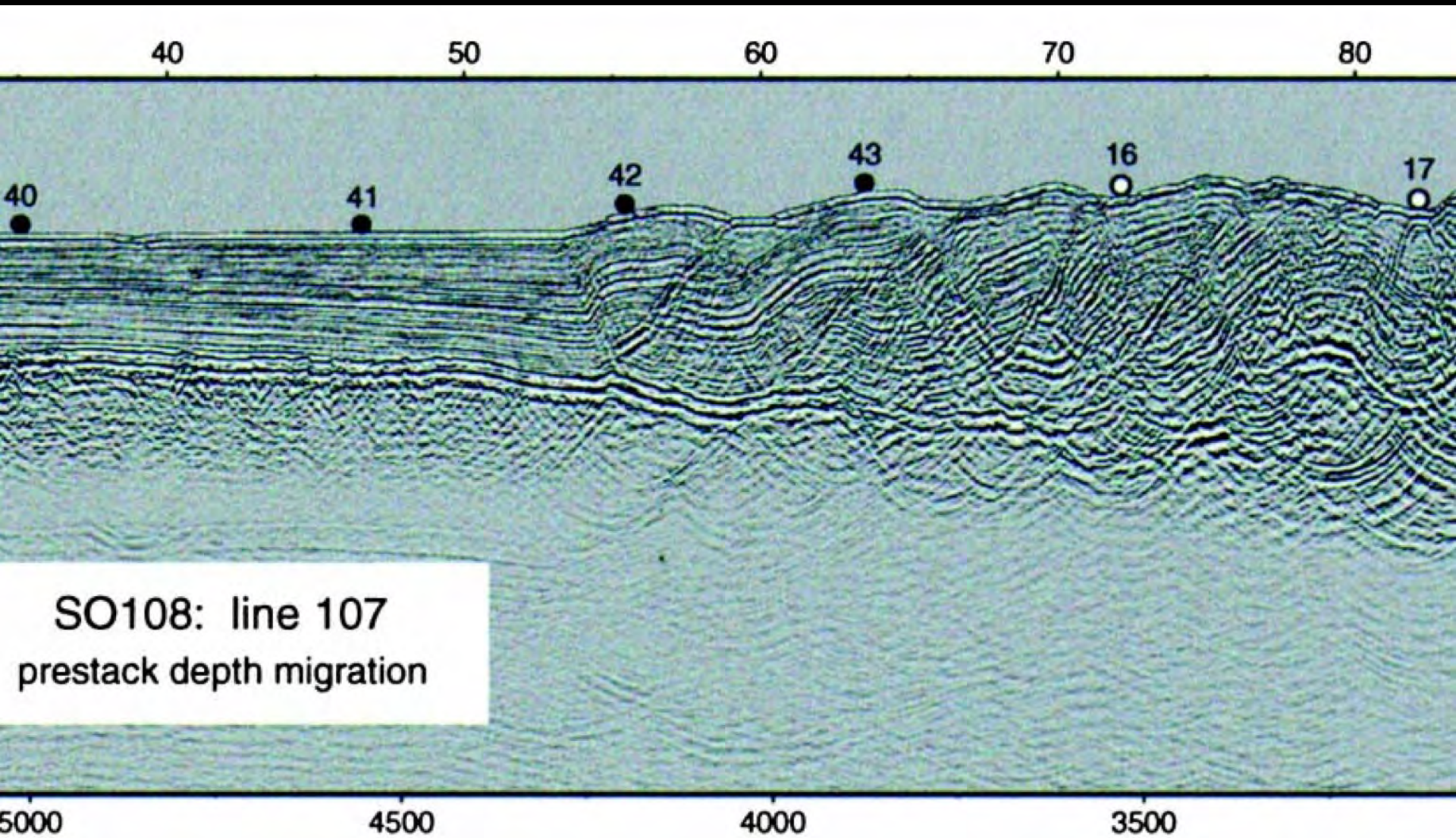
Challenges: The Usual Suspects



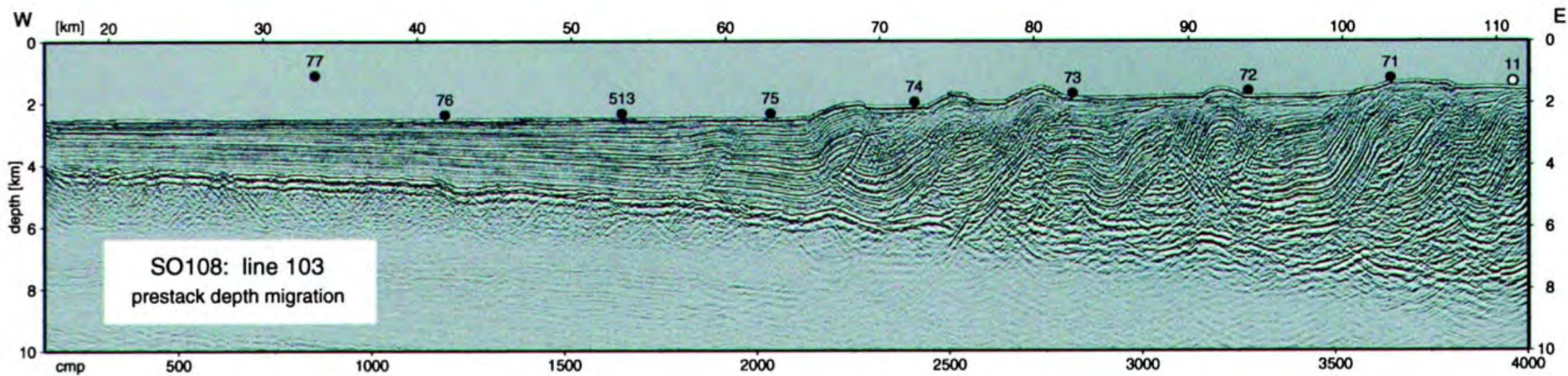
ORWELL Line 107 PSDM



ORWELL Line 107 PSDM – zoom



ORWELL Line 103 PSDM



ORWELL Line 103 PSDM - zoom

