2012 *COAST* survey MGL1212

Cascadia Open-Access Seismic Transect

off Grays Harbor Washington

R/V *Langseth* cruise MGL1212

Astoria, Oregon - Astoria, Oregon

July 12-24, 2012

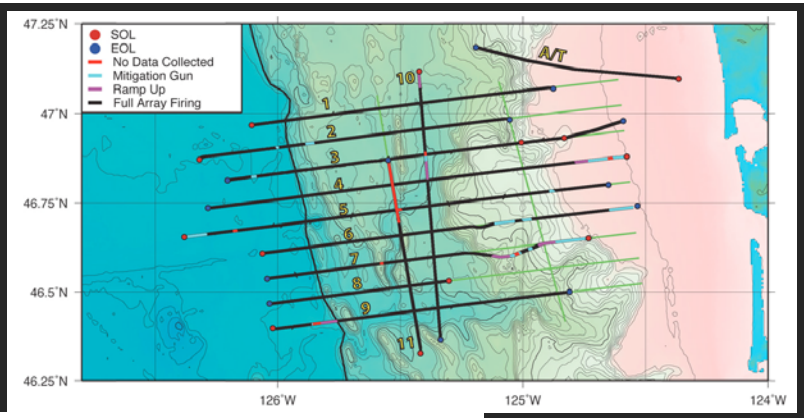
Vital Statistics:

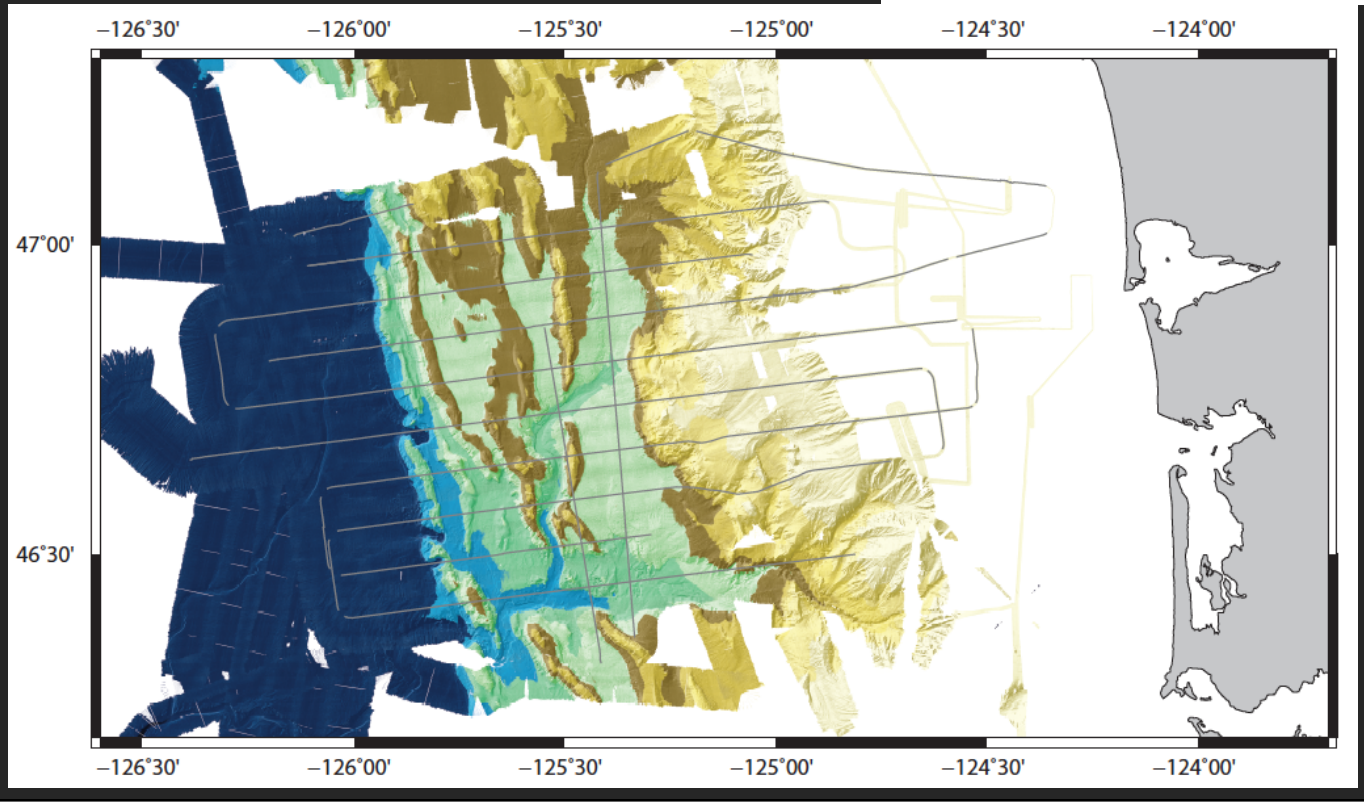
- ~1100 km MCS data acquired
- Full coverage multibeam bathymetry in deeper water (>2 km)
- Gravity, magnetic data acquired
- No 3.5 kHz data (mech failure)

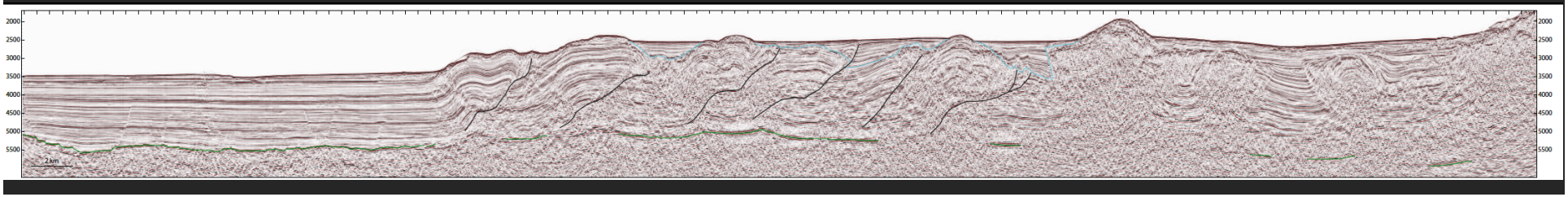
Seismic Acquisition:

- 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)

- Ten (ish…) lines collected over 12 days
- Single 8 km streamer for MCS
- Multibeam bathymetry & backscatter, gravity
- Collected as a “community survey” or open access project







Ongoing work on COAST survey data

S. Holbrook, H. Tobin, K. Keranen, S. Webb, E. Everson, W. Fortin, D. Peterson (MGG)

Time and Depth imaging, Structural intepretation, and Velocity inversion

P Johnson & M. Salmi (MGG)

Thermal Modeling and Heat Flow of the Washington Margin

- COAST BSR analysis and seafloor imagery

J. Caplan-Auerbach & A. Ypma

- Gravity modeling

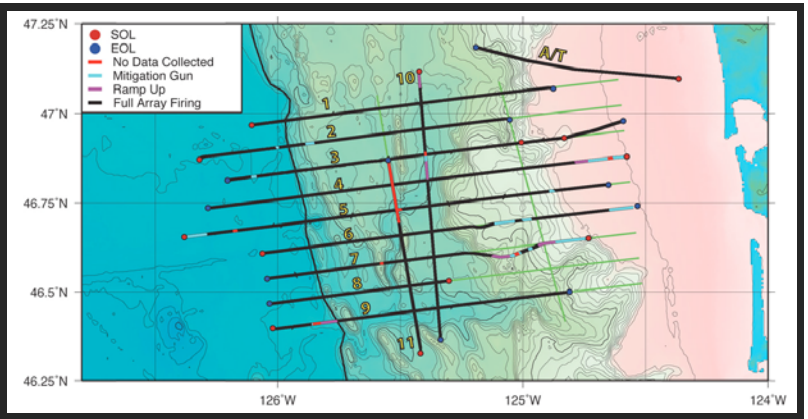
C. Goldfinger & J. Beeson

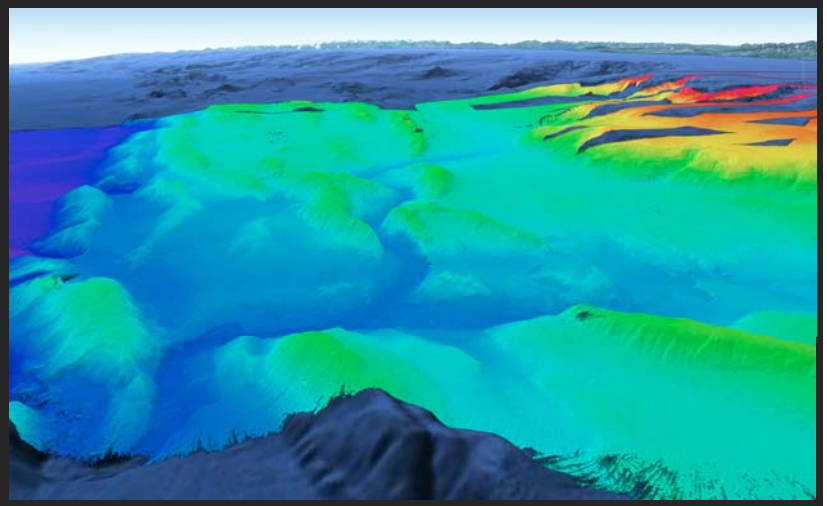
- Surface slope failures from multibeam imagery

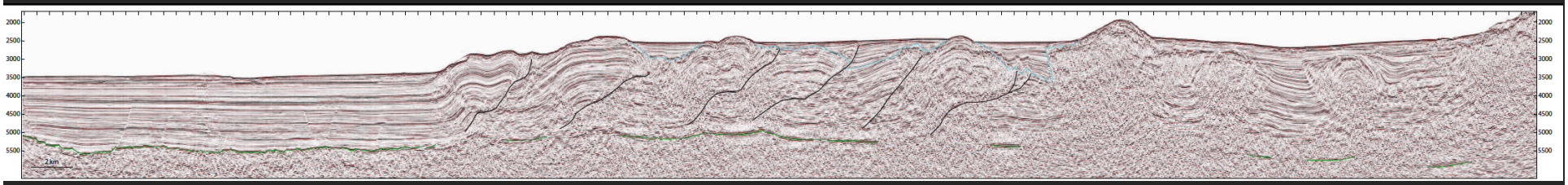
- COAST Survey imaged offshore central WA in high resolution: central portion of margin where wedge is very low taper, landward-vergent thrusting

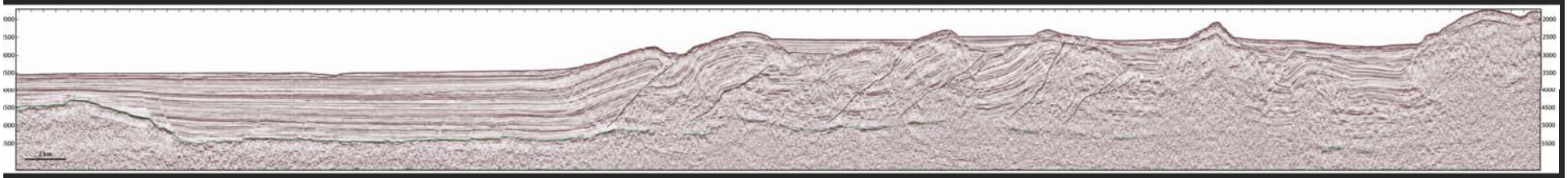
- Shallow sedimentation into (interconnected) super-wedge basins suppresses deformation, supports build-out of landward vergent zone

- Top of lower plate basement imaged; no strong decollement reflection in sediments observed in most areas; varying position of detachment level

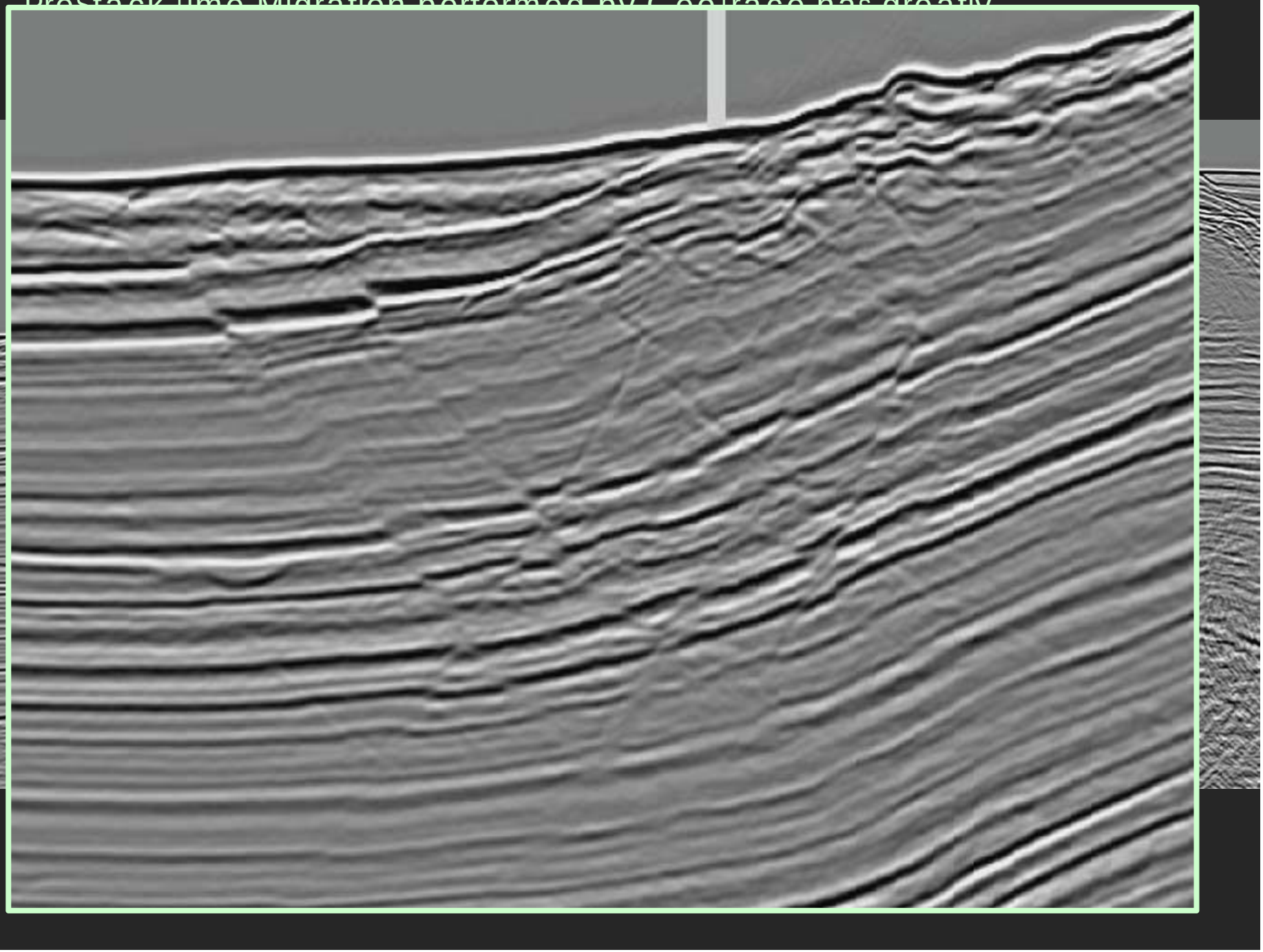


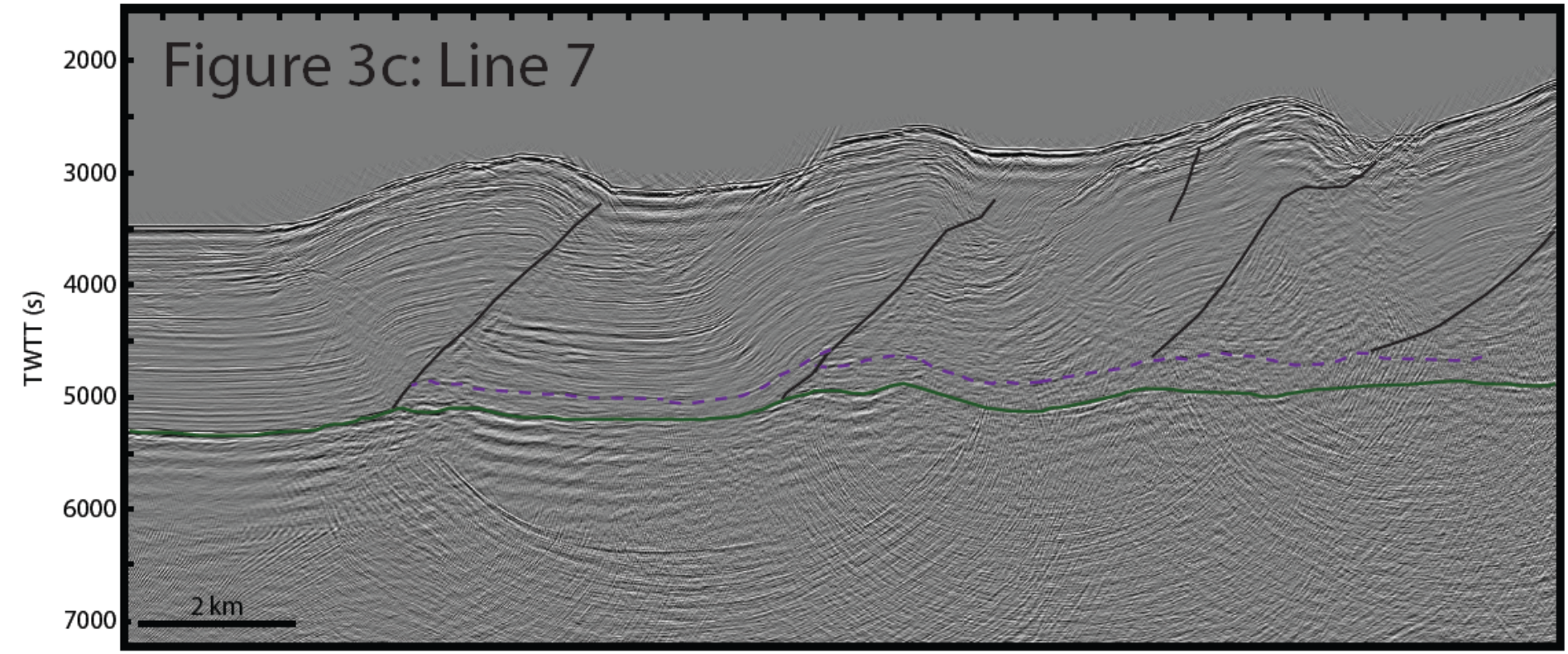




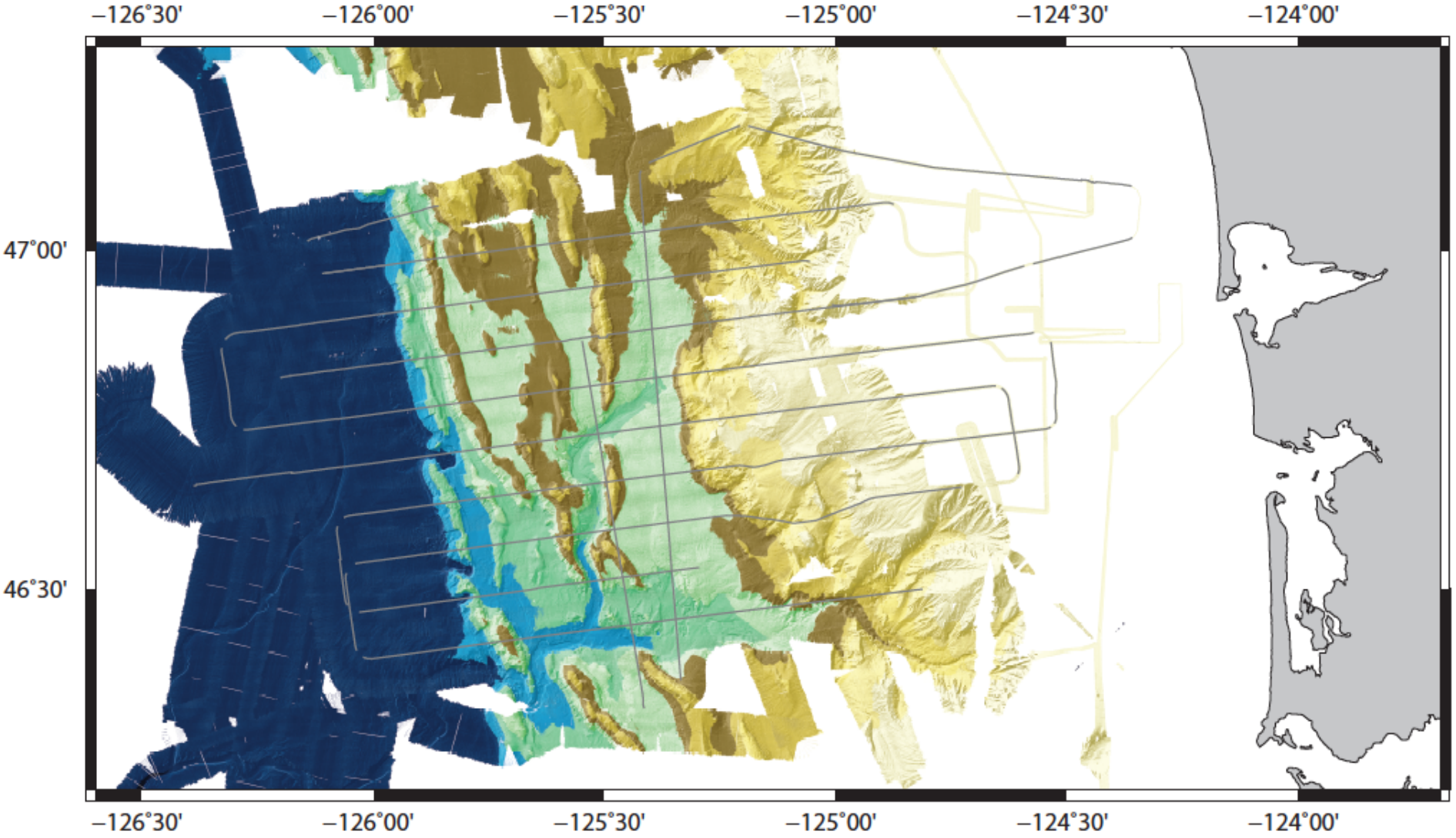


PreStack Time Migration performed by GeoTrace has greatly





Webb, Tobin, et al. work in progress



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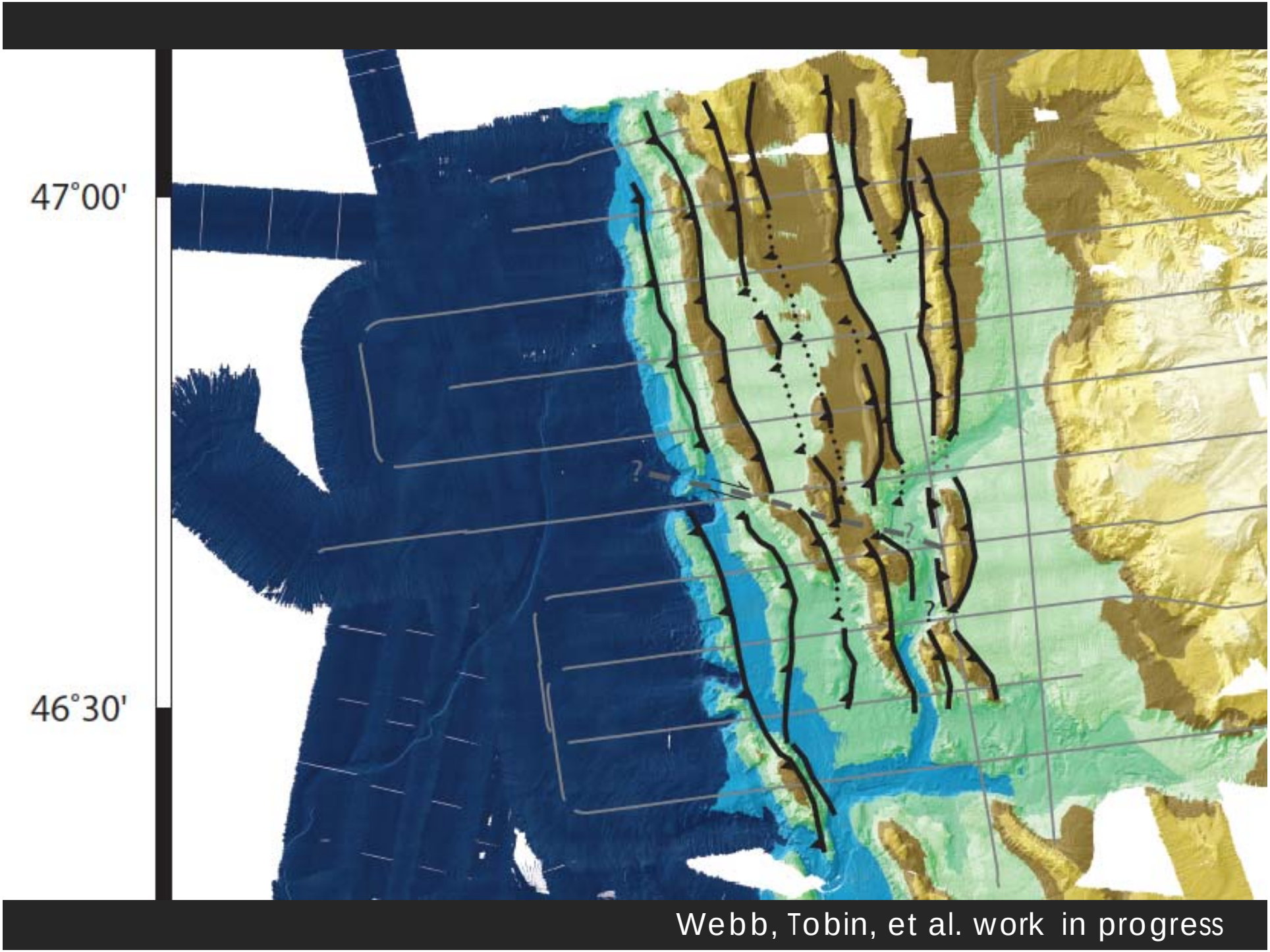
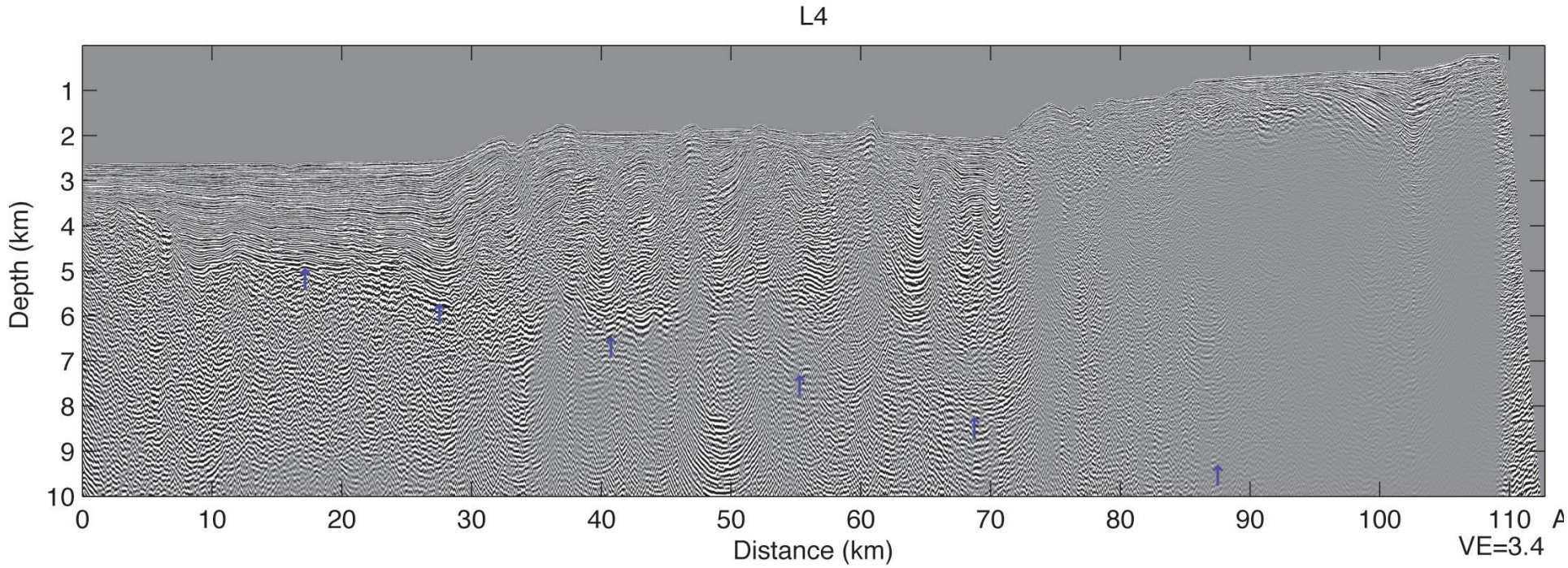
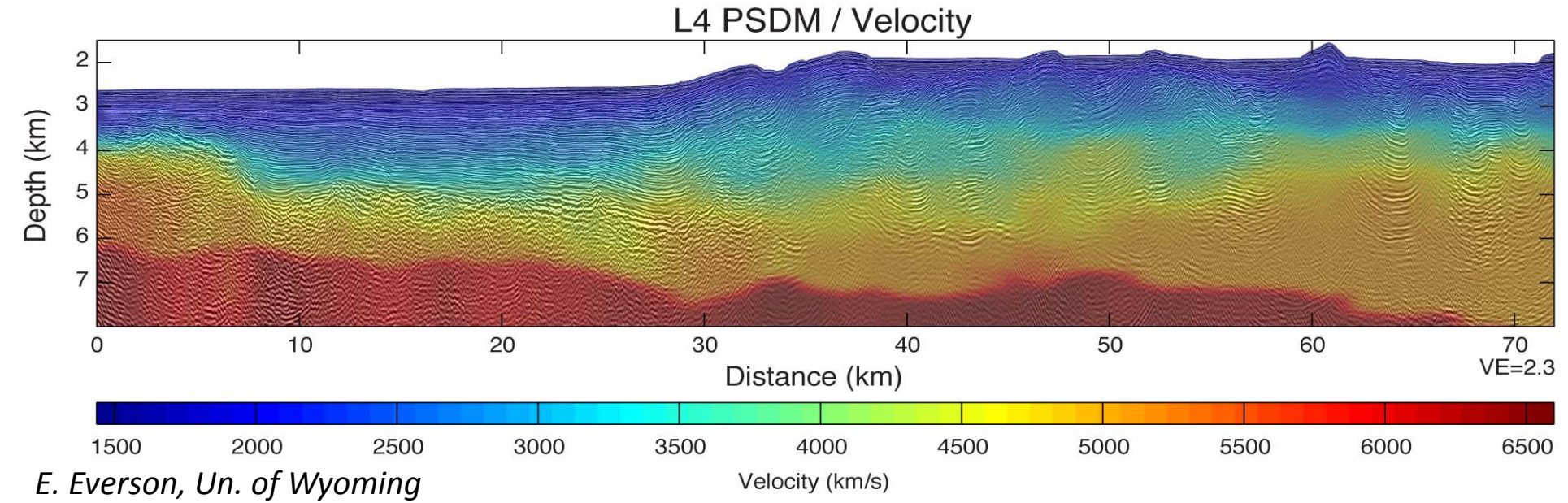
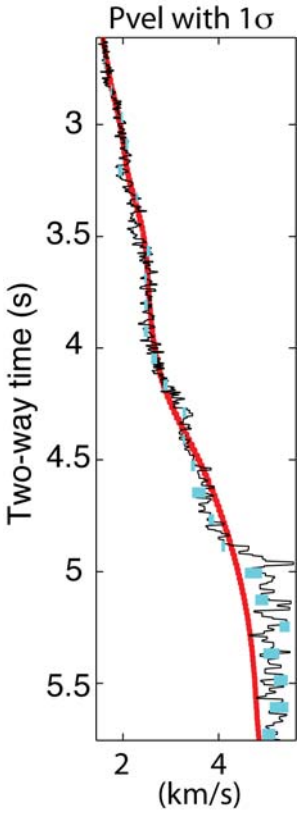

47°00'
46°30'
Webb, Tobin, et al. work in progress



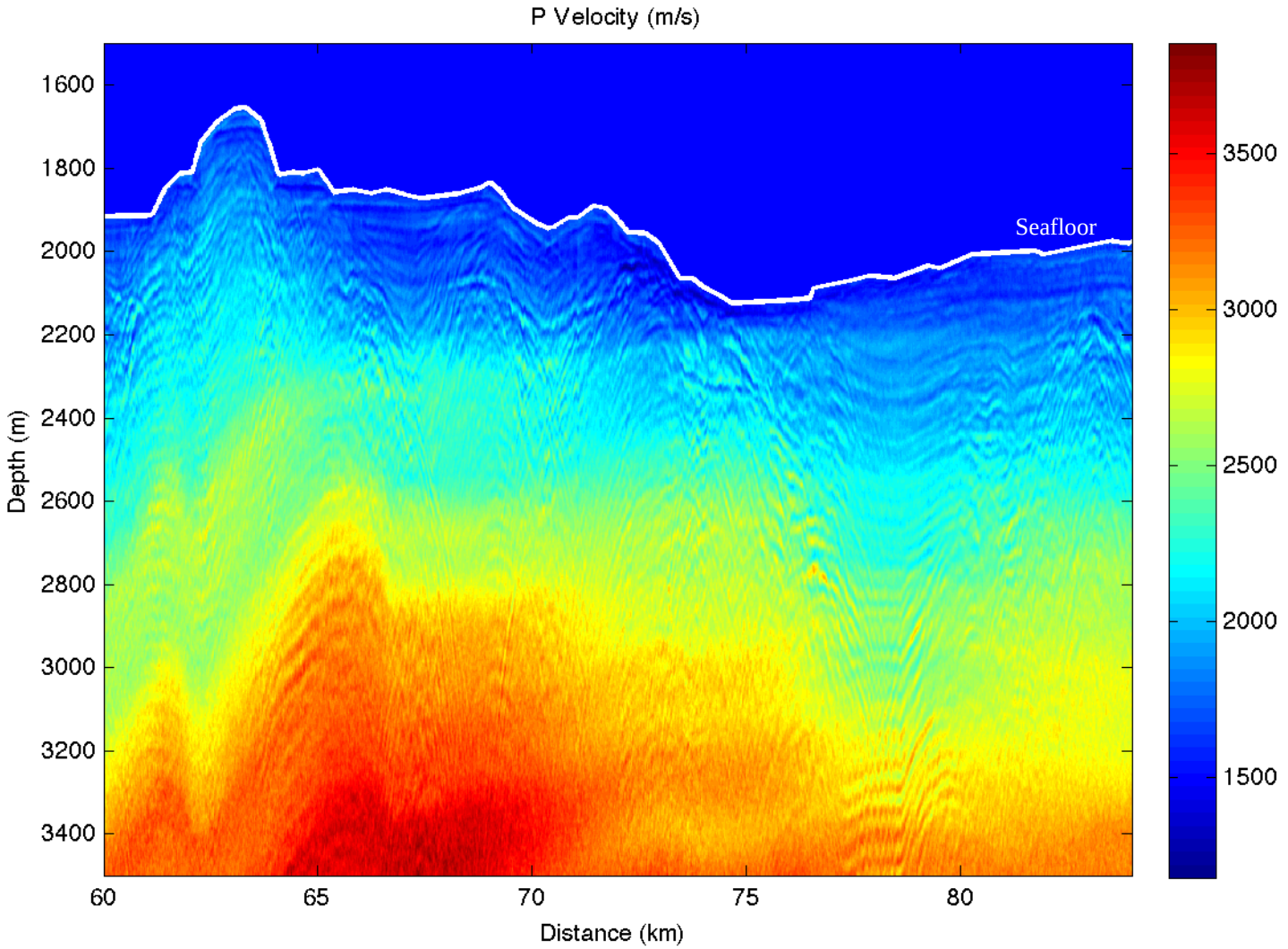


E. Everson, Un. of Wyoming

COAST velocity inversion: Fortin et al., Un. of Wyoming



Initial model (red)
Inverted model (black)
1-sigma error (cyan)

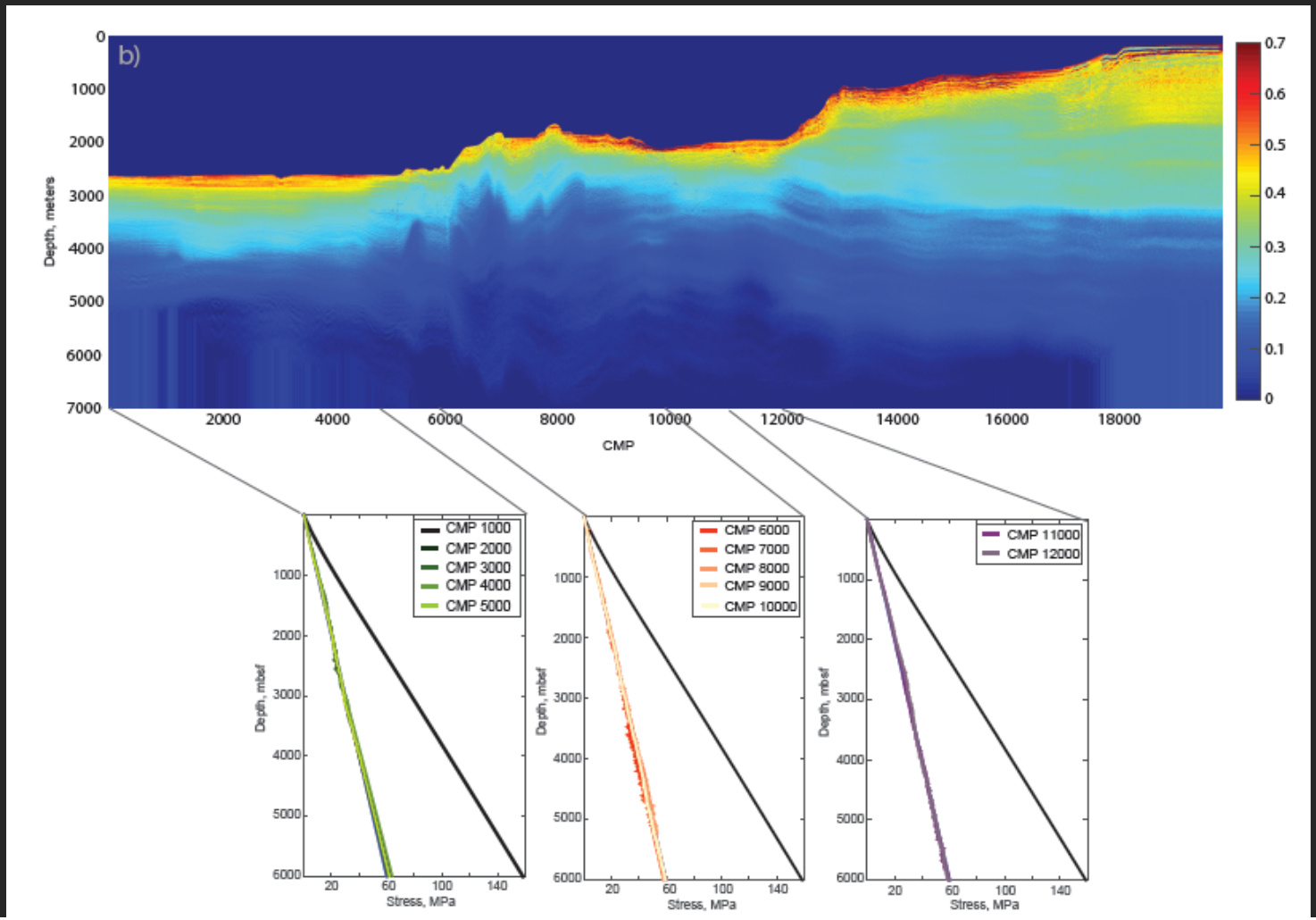


Selection from final inverted velocity model. Notice the capture of stratigraphy and lower velocities at ~78 km in a region of undeformed sediments.

Fortin et al., in prep.

Porosity model and calculated porosity anomalies (or lack thereof)

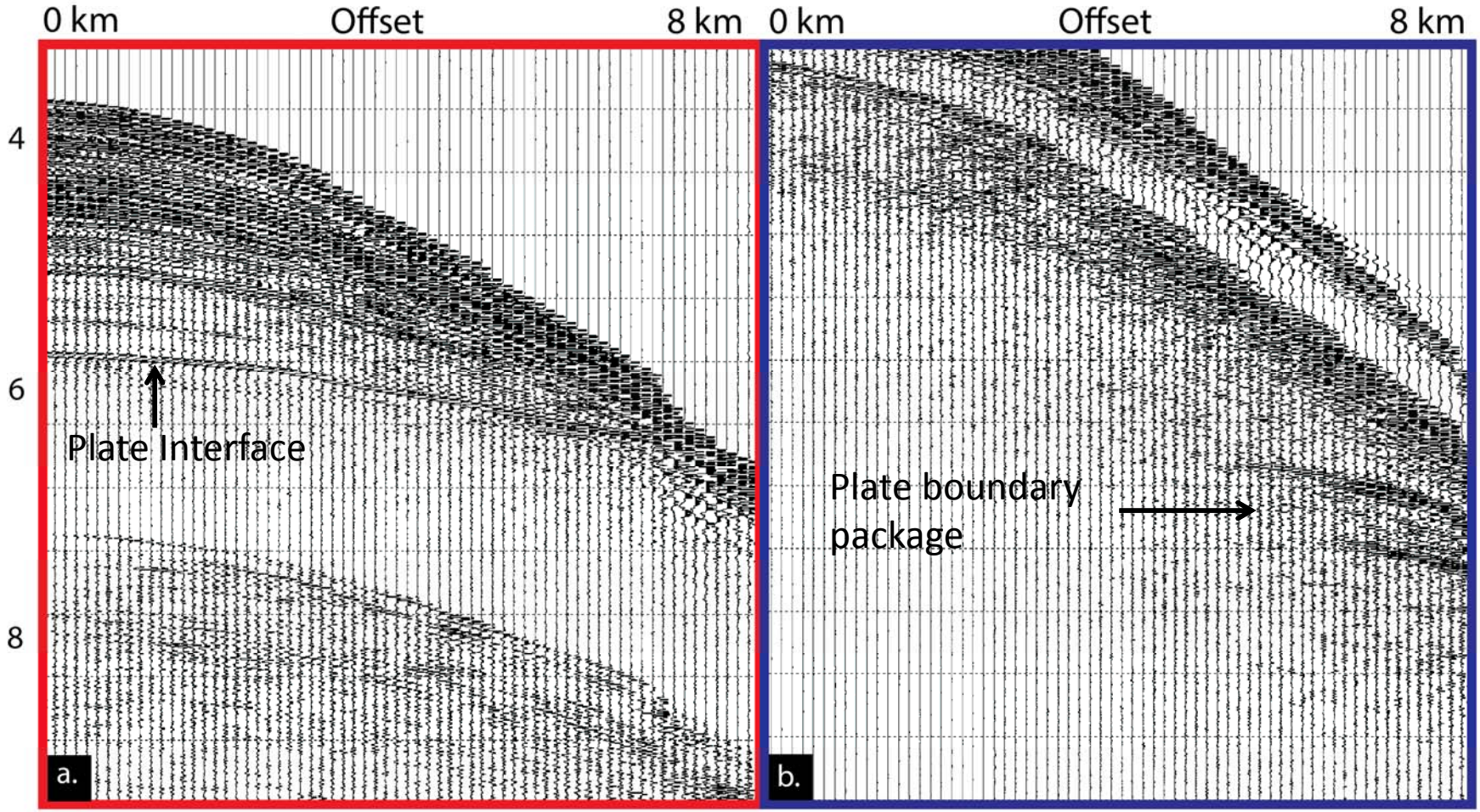
- Porosity from inverted velocity (PSDM preliminary values give similar result)
- If we assume a normal consoidation in the Cascadia basin, then no anomalously high porosity is detected in wedge – i.e., no evidence for overpressure anywhere



Webb, Tobin, et al. work in progress

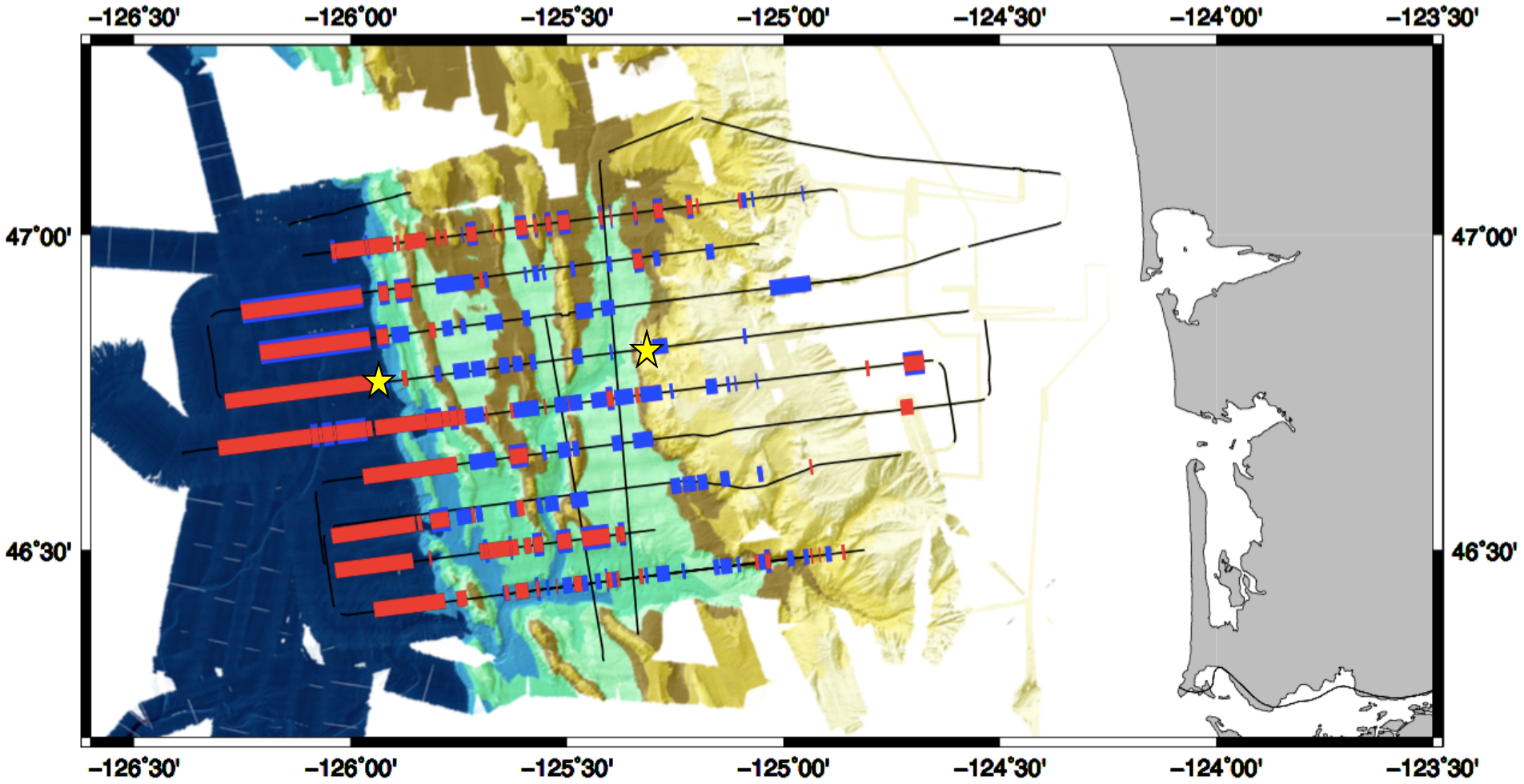
- Velocity work so far (sNMO analysis, preliminary PSDM, waveform inversion) all work indicates unusually high *Vp* in base of outer wedge at ~ 4000 m/s
- No basal LVZ detected (so far) – maybe in landward portions via Cornell group work
- Wedge taper of 3˚
- *Strong wedge over extremely weak base promotes potential for rupture propagation to the tip of the wedge?*

Deep Energy in CDP gathers



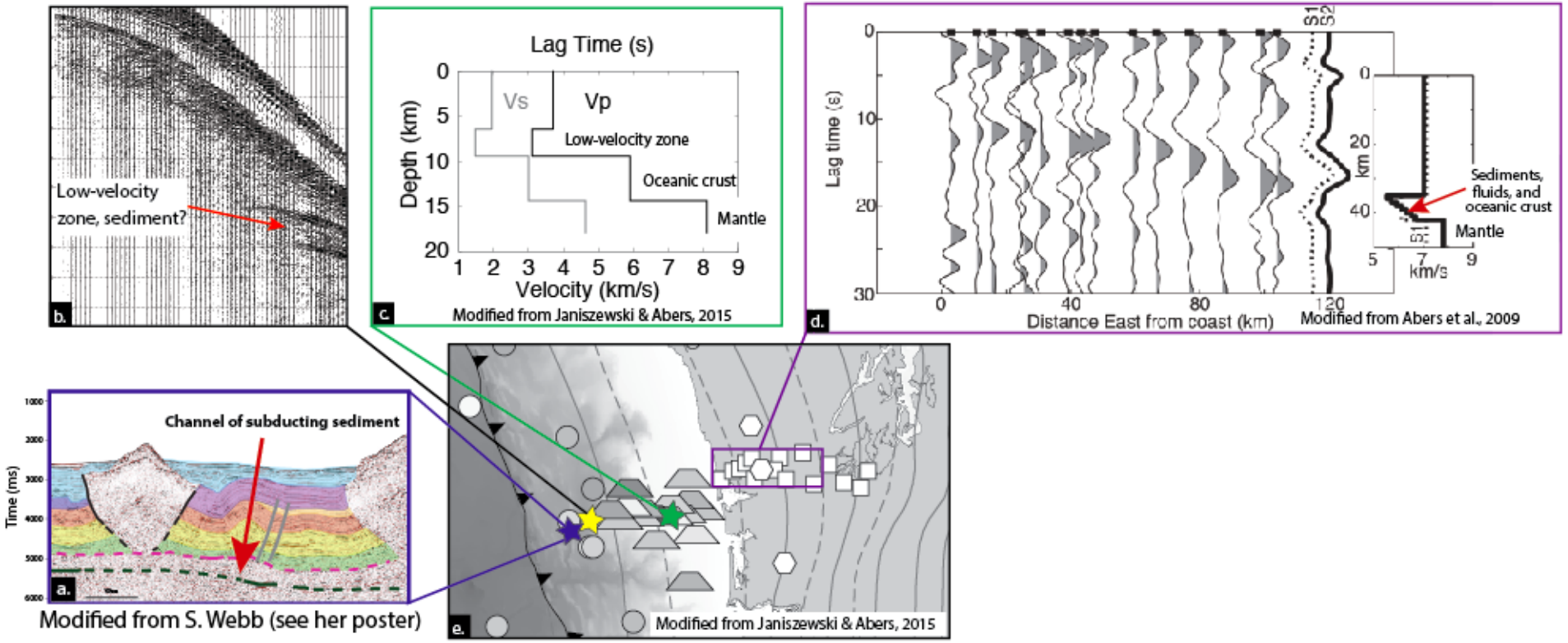
Peterson, Keranen, et al.,work in progress

Mapping Deep Energy in CDP gathers



Peterson, Keranen, et al.,work in progress

Possible correlation landward

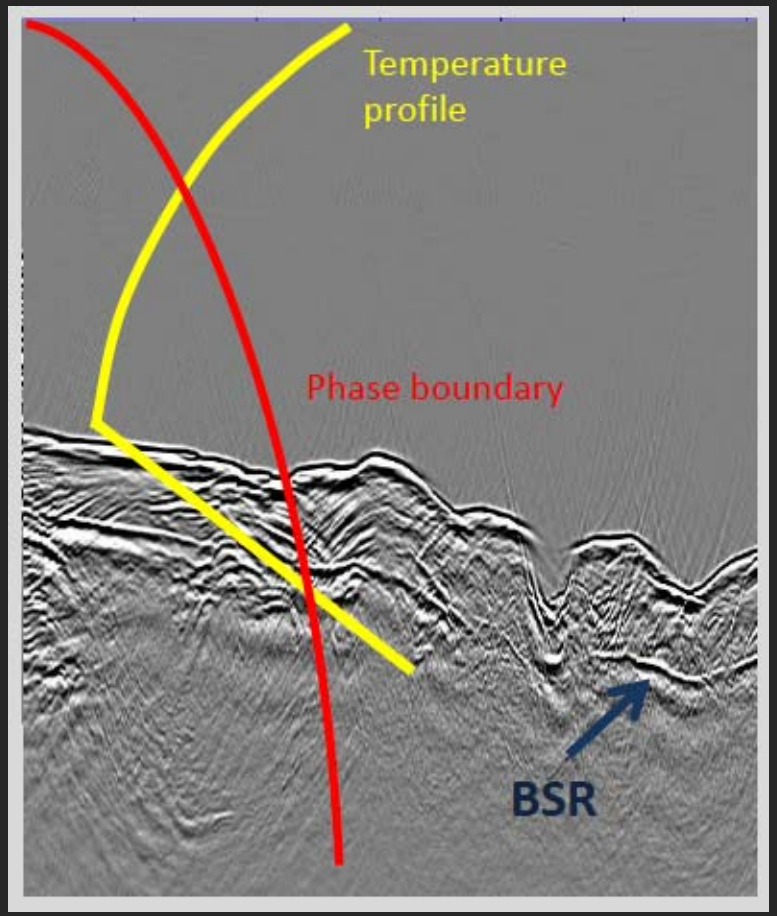


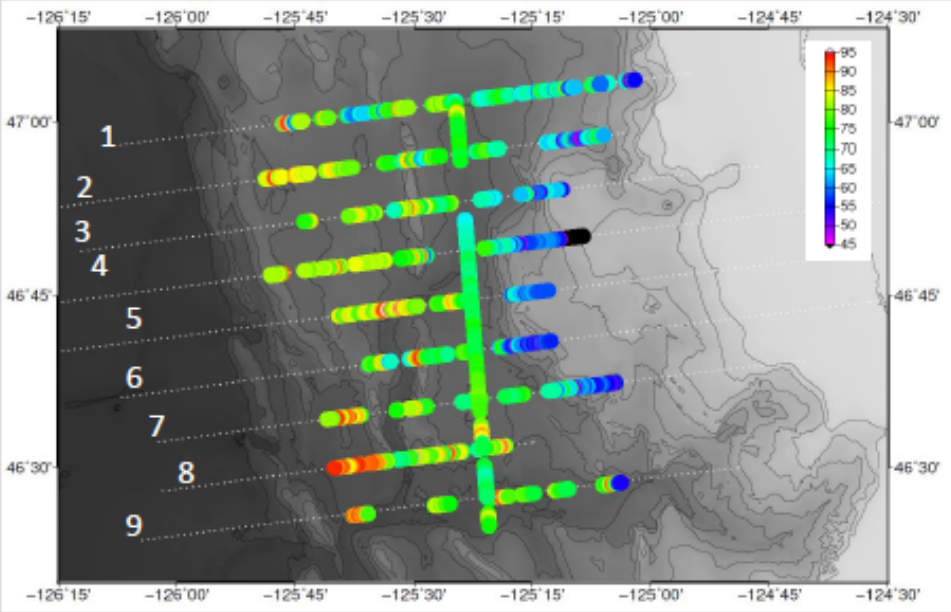
Peterson, Keranen, et al.,work in progress

Heat Flow Study: Salmi, Harris, Johnson, Solomon (Un. Washington & OSU)

Poster T21D-2870 Tuesday morning

Probe and BSR-inferred thermal gradients to estimate heat flow and temperature at the plate interface





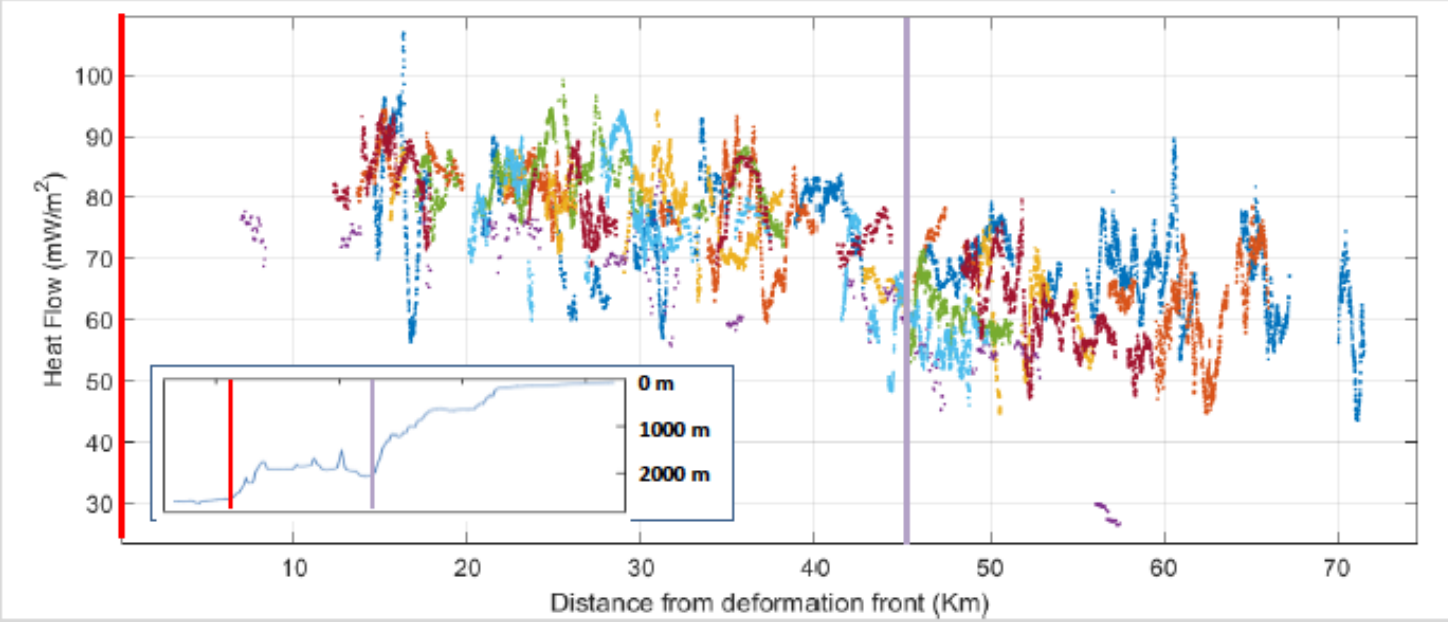
Above: 2012 Langseth MCS profile lines and BSR heat flow

BSR based heat flow measurements along 9 perpendicular and 1 parallel R/V Langseth MCS lines:

- BSR Heat flow varies from
  21 to 118 mW/m^2
- General decrease in heat flow from deformation front landward from ~80 mW/m^2 to 60 W/m^2

Source of Scatter in BSR Heat flow:

- N-S margin variations along margin, e.g. large scale bathymetric changes
- Internal fluid circulation along faults or diffuse flow through accretionary material

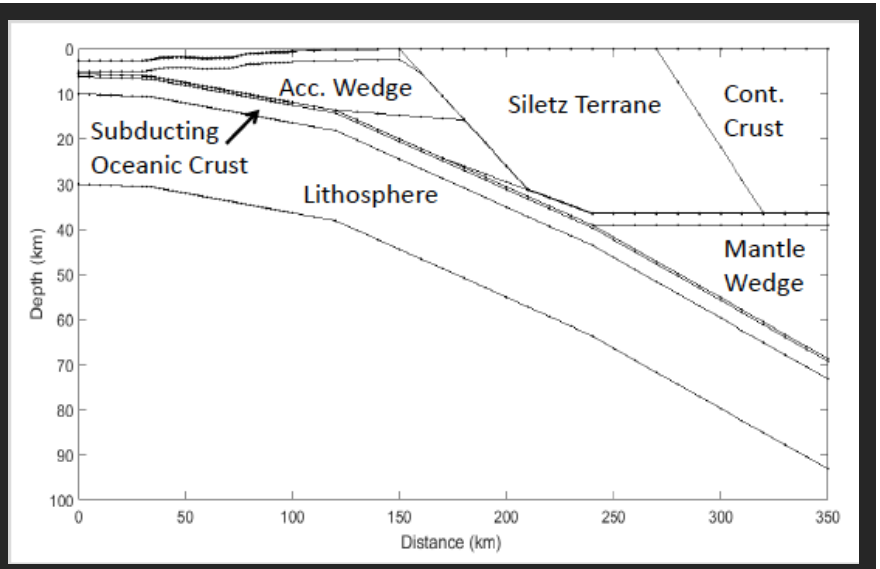


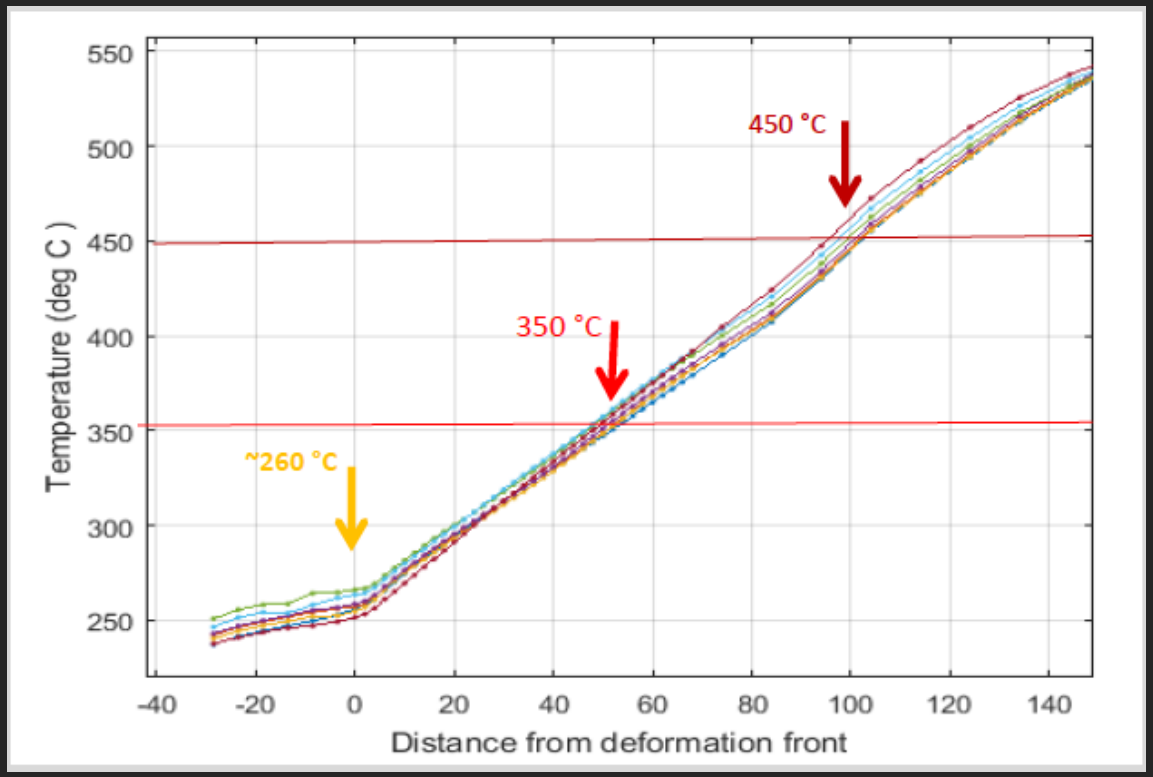
Compilation of BSR heat flow of all lines , referenced to the deformation (trench) front. Each line has a different colo . Insert is the corresponding bathymetric profile along line 4

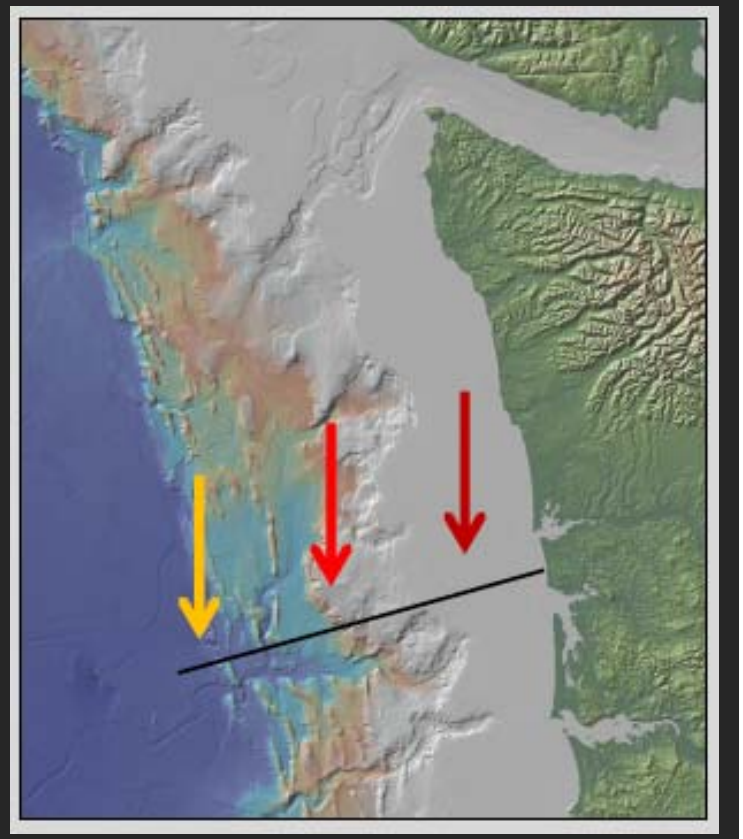
Modeled temperature at the plate interface

260 C right at the deformation front!
350 C under lower slope
450 C under shelf

Canonical seismogenic locking zone is ~100 C to 350 - 450 C

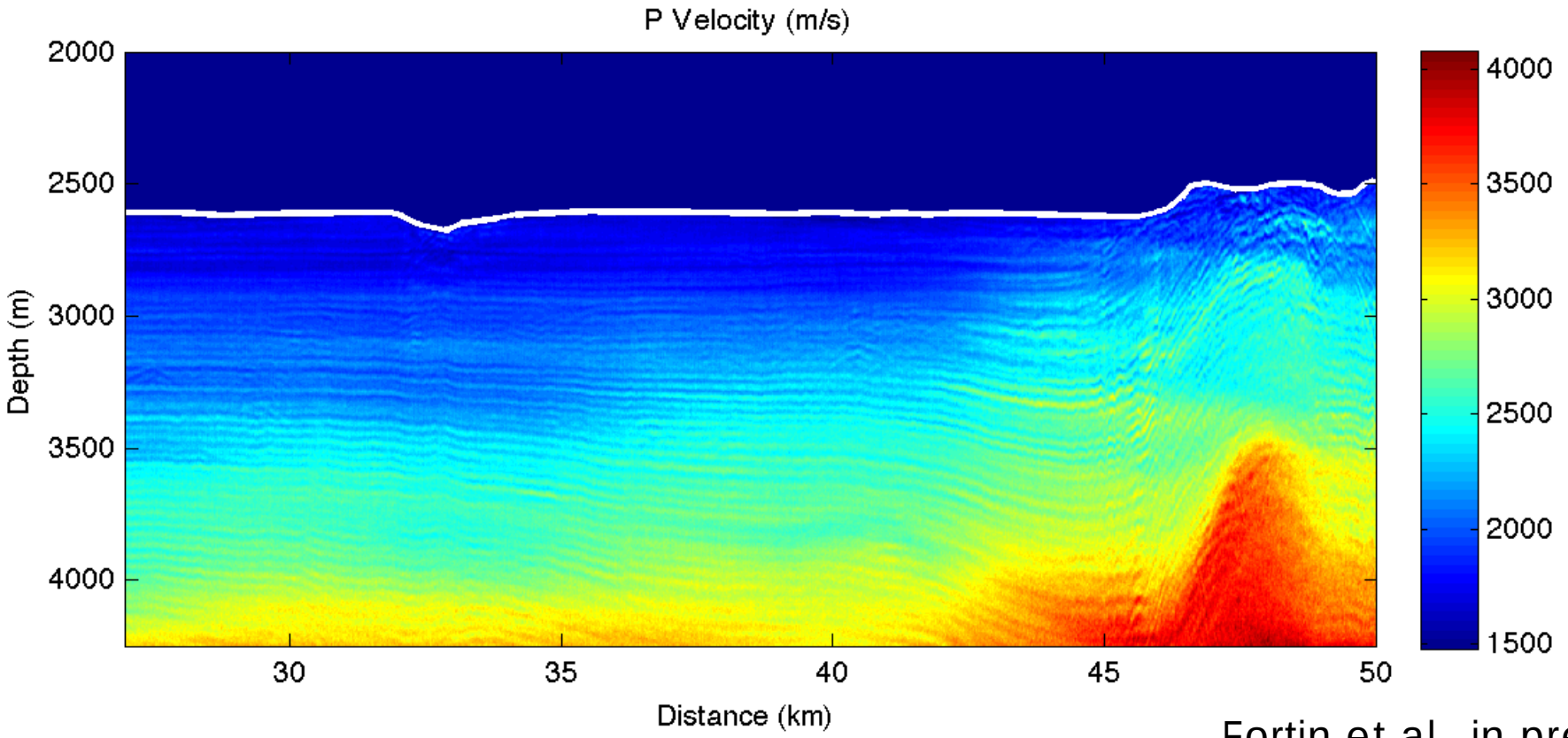




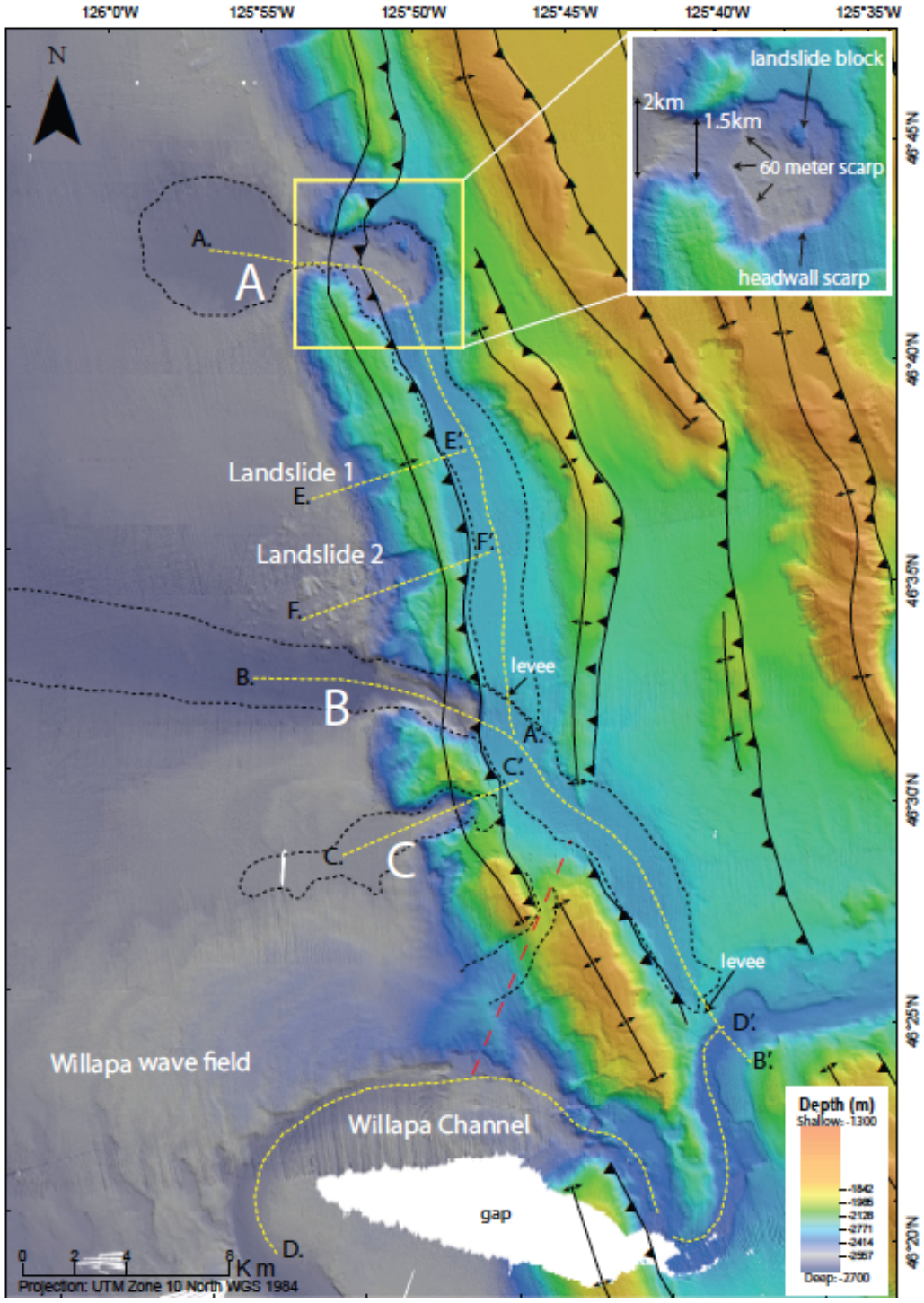


Full waveform pre-stack velocity inversions:

- Lateral velocity increase near deformation front
- No evidence for deep sediment low velocity zone



Fortin et al., in prep

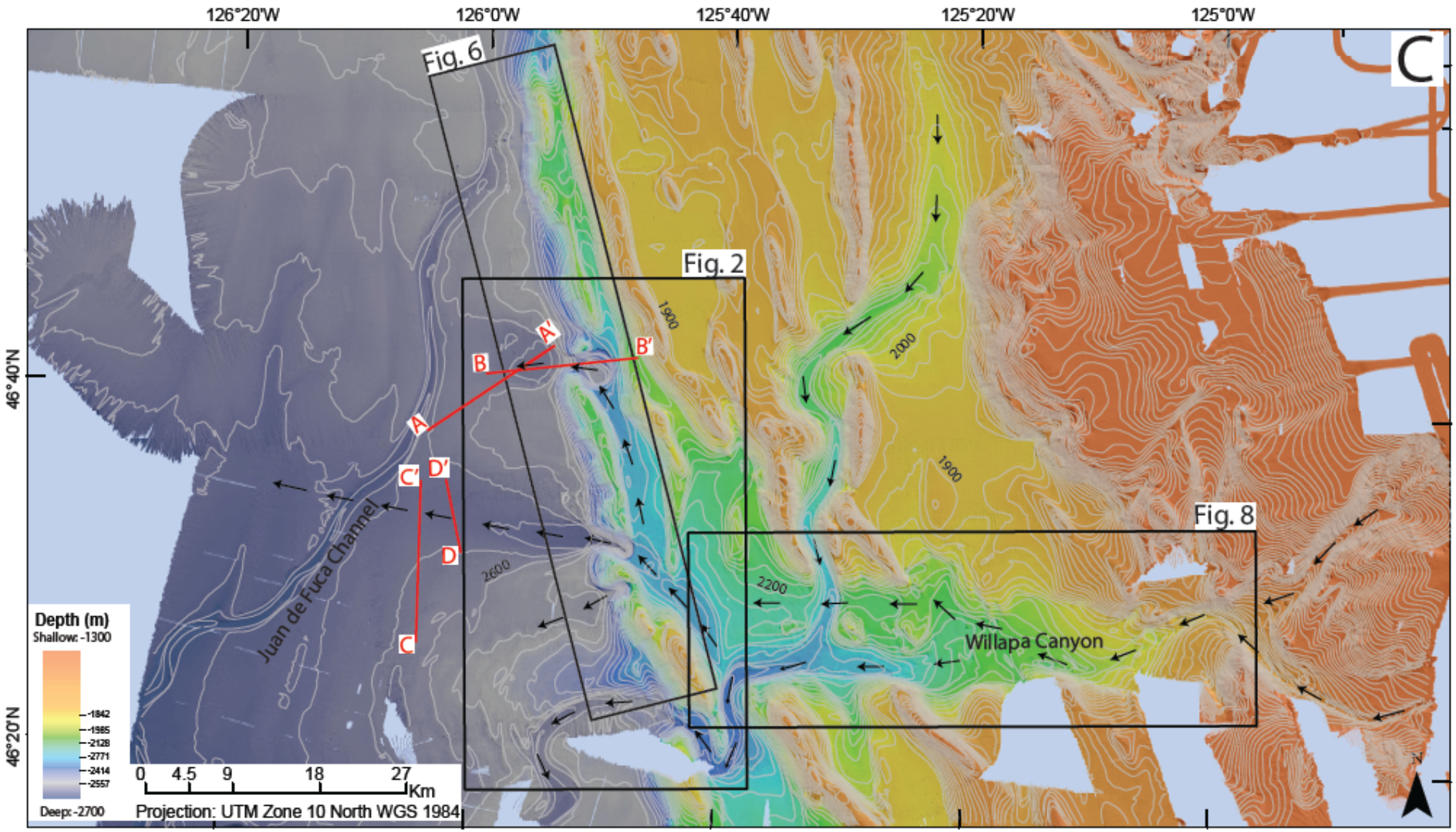


Using multibeam bathymetry to map surface morphology of channels and surface failure features

Found evidence they interpret as radical erosion events associated with massive turbidity currents

Likley timing is end-Pleistocene – they argue these are Missoula flood related.

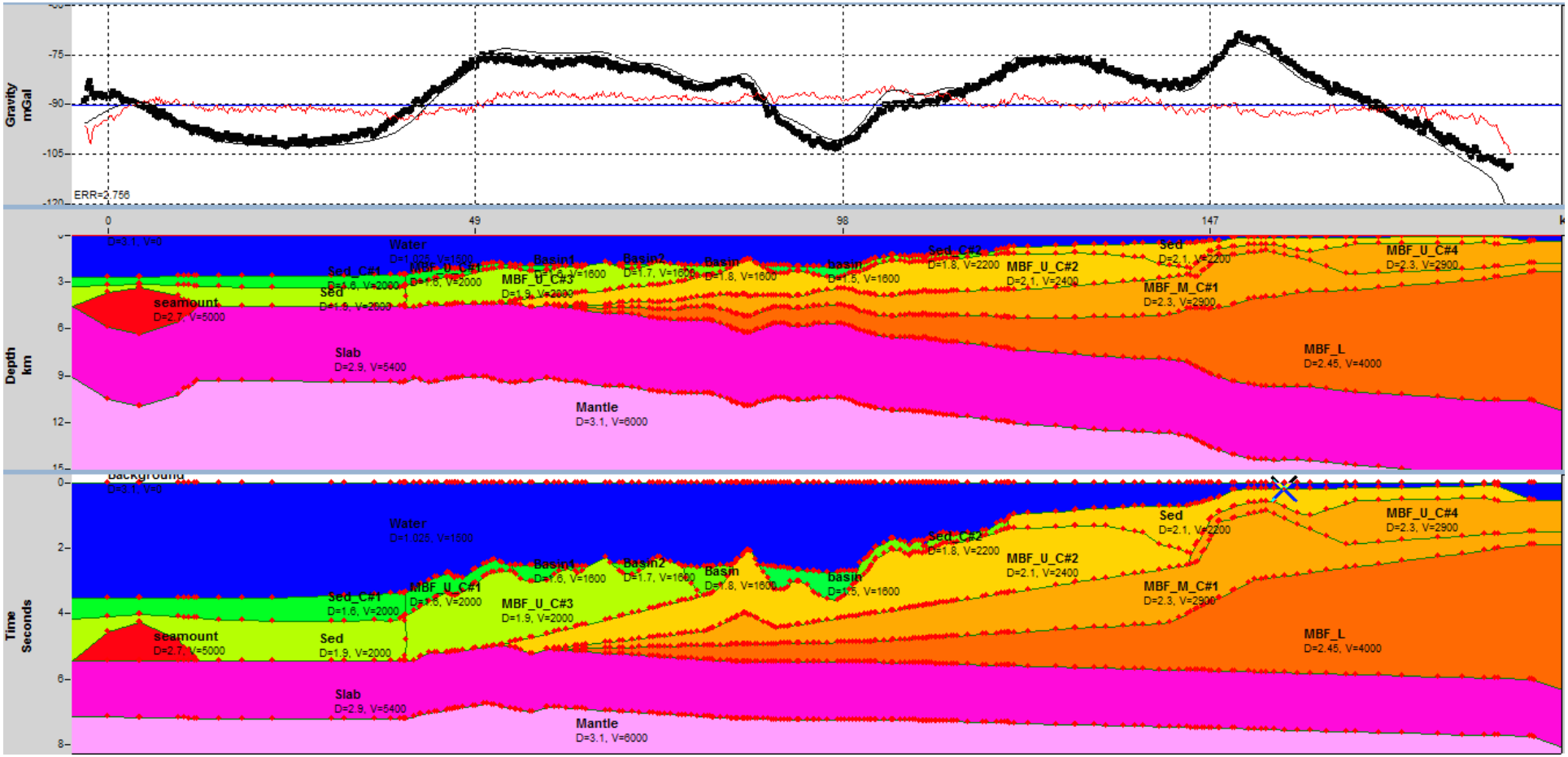
Beeson, Goldfinger, Fortin, ms. in prep



Beeson, Goldfinger, Fortin, ms. In prep

Gravity modeling

Line 4



Work in progress by *Anton Ypma & Jackie Caplan-Auerbach*

COAST: Now and future

Cornell and Wisconsin

- More detailed structural and stratigraphic analysis of outer wedge and wedge-top basins
- Analysis of plate boundary reflector via large-offset arrivals
- PSDM processing for better depth and velocity model

Washington & Oregon State

- Improvements to thermal models

Western Washington

- Ongoing gravity modeling