

ARTICLES

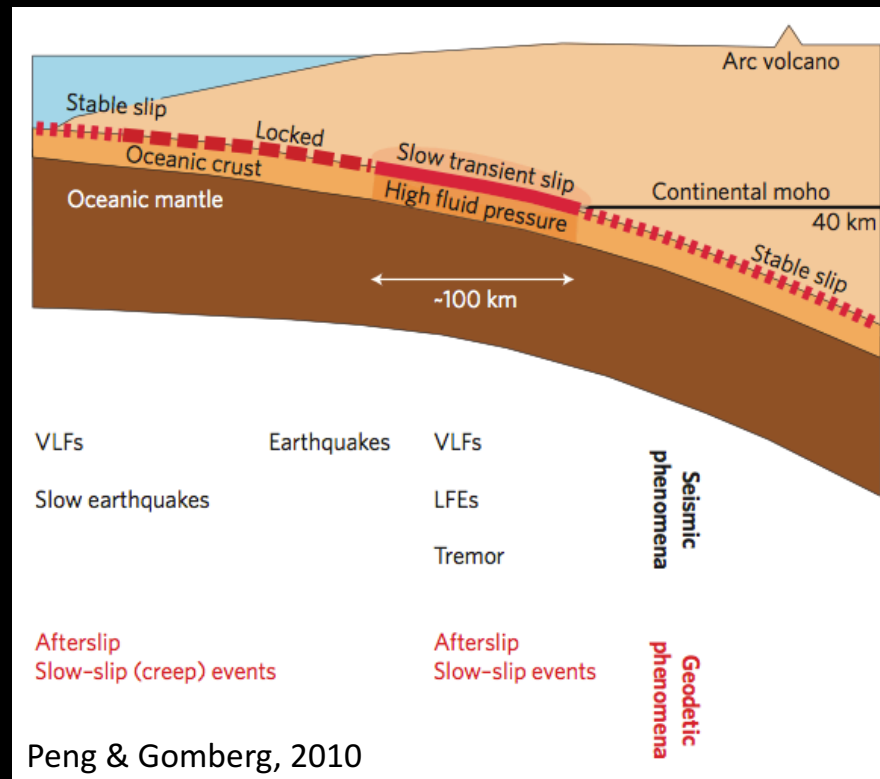
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nature
geoscience

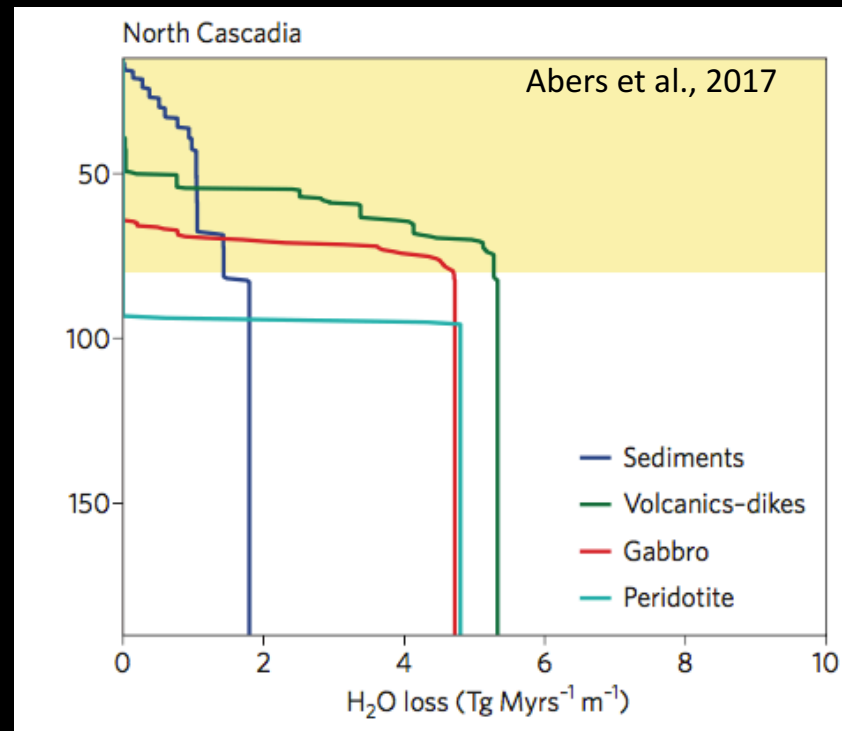
Dry Juan de Fuca slab revealed by quantification of water entering Cascadia subduction zone

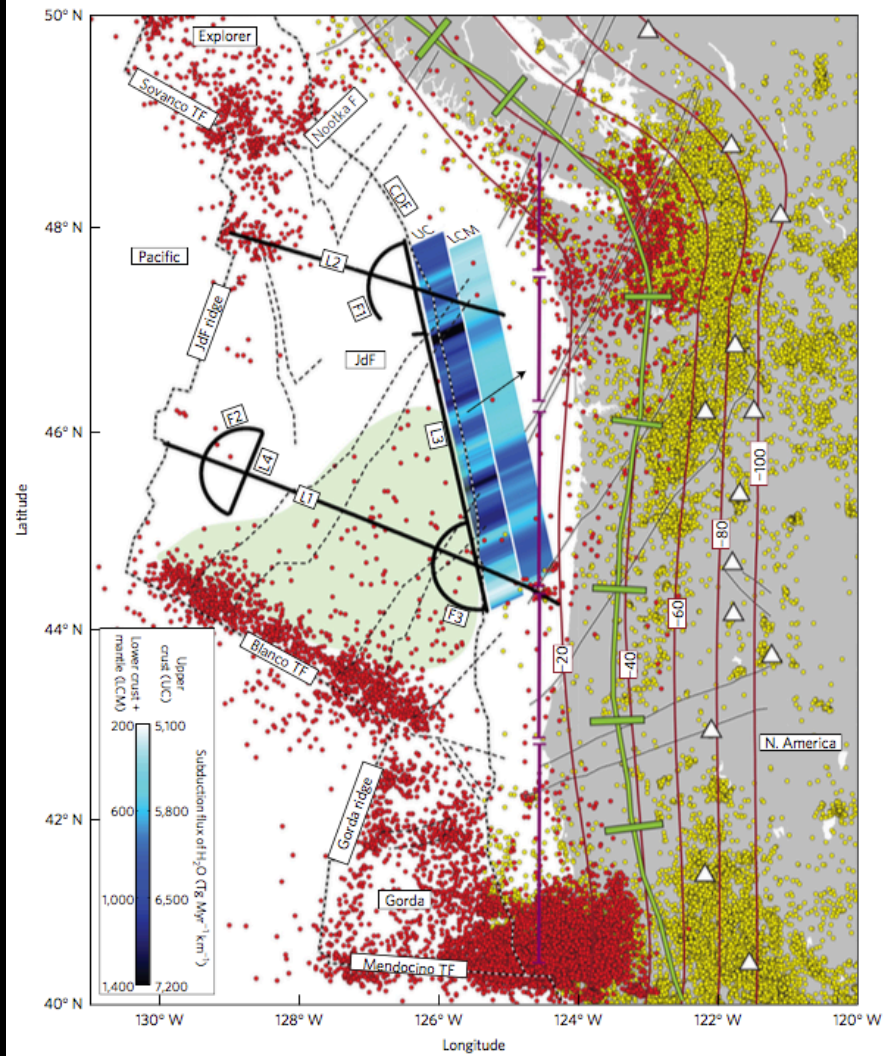
J. P. Canales^{1*}, S. M. Carbotte², M. R. Nedimović³ and H. Carton^{2,4}

Why we care about water

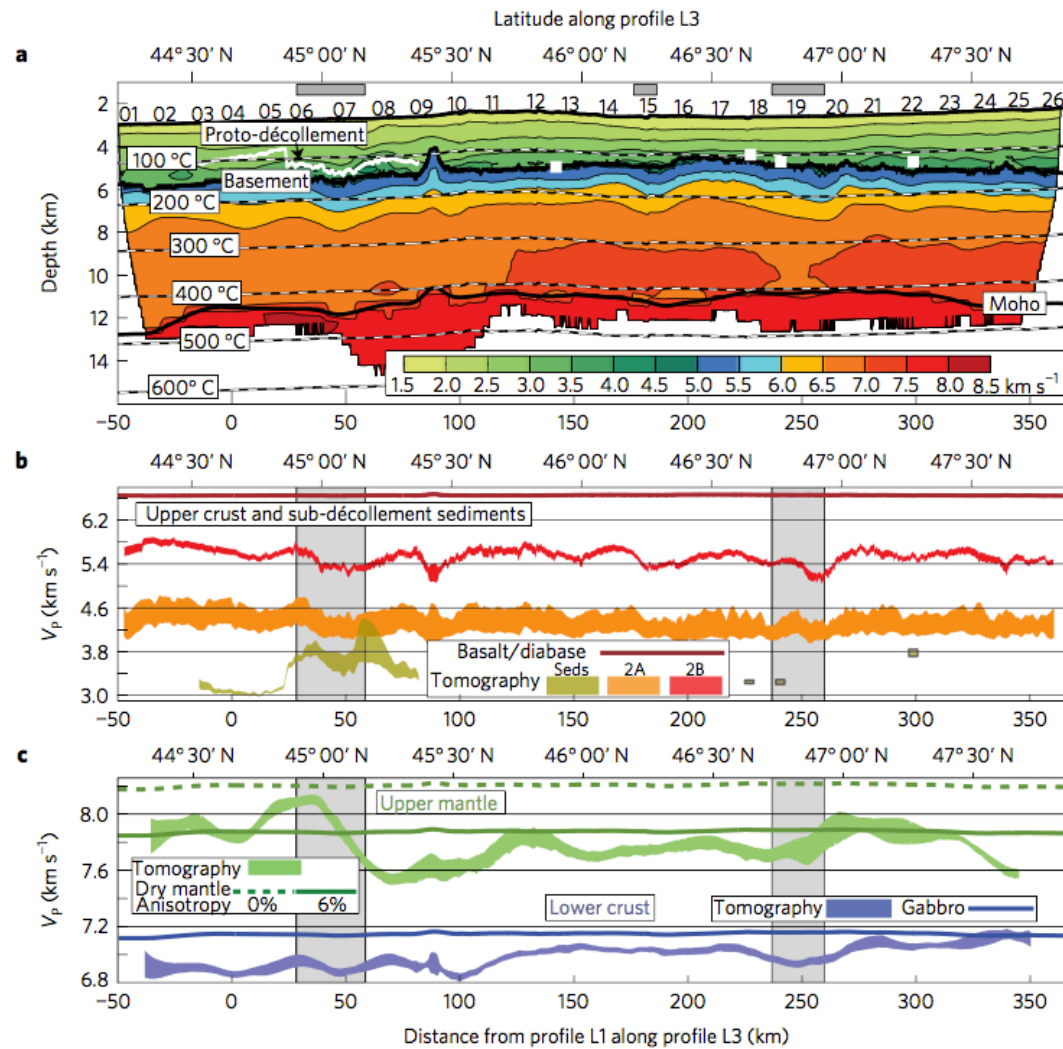


Why we care about water





Canales et al., 2017



Canales et al., 2017

Water Estimation

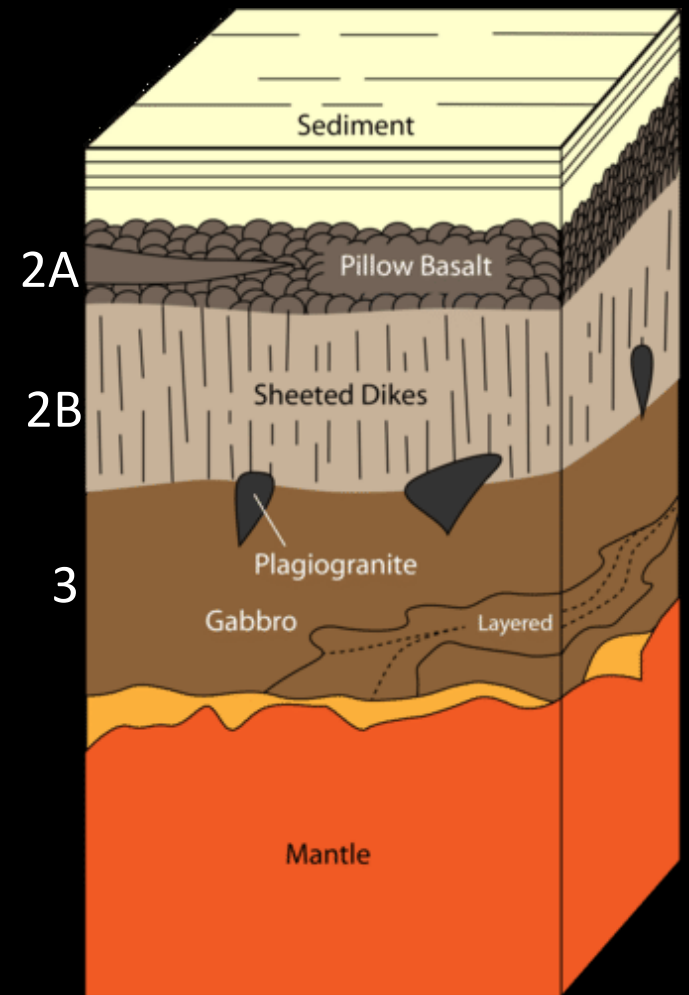
Effective medium theory = fancy averaging

Given a particular layer and a...

- velocity perturbation
- porosity
- aspect ratio
- temperature
- alteration mineral assemblage

Estimate (pore volume fraction)

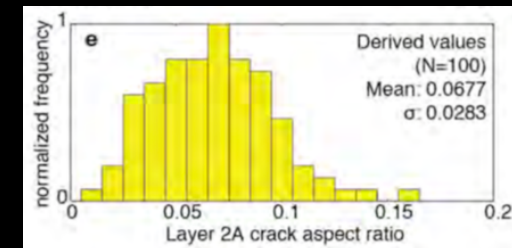
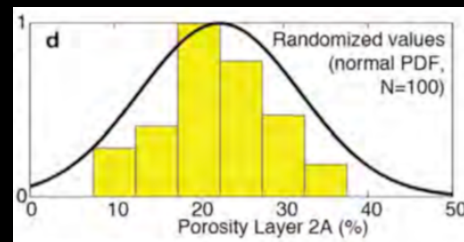
- H₂O-free
- H₂O⁺



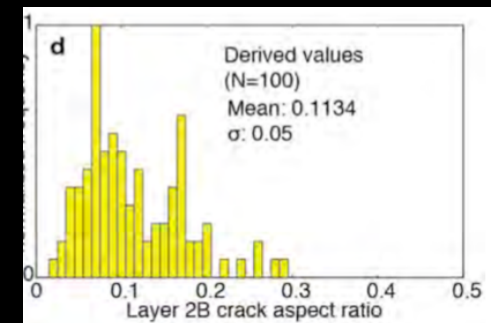
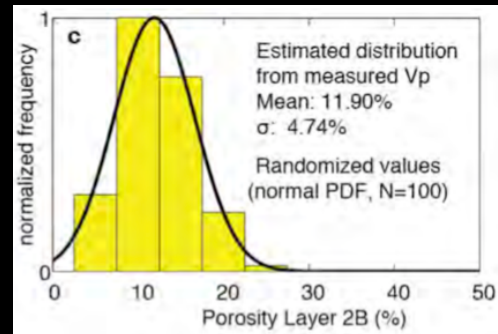
Upper Crust

Layer	Max porosity	Aspect ratio
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Extrusives



Dikes

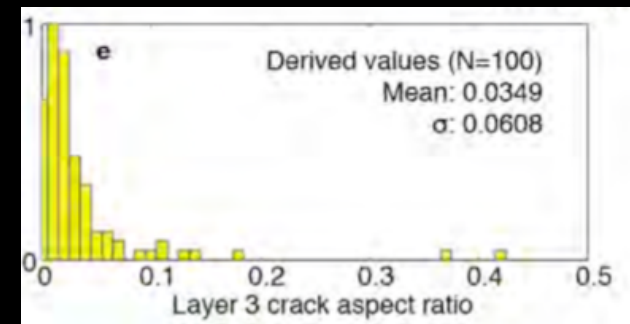
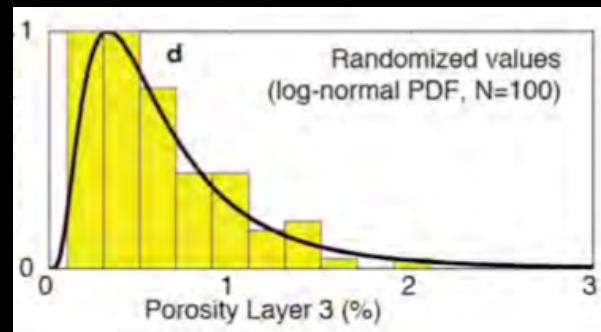


*All water in sediments assumed free in pore space

Lower crust/mantle

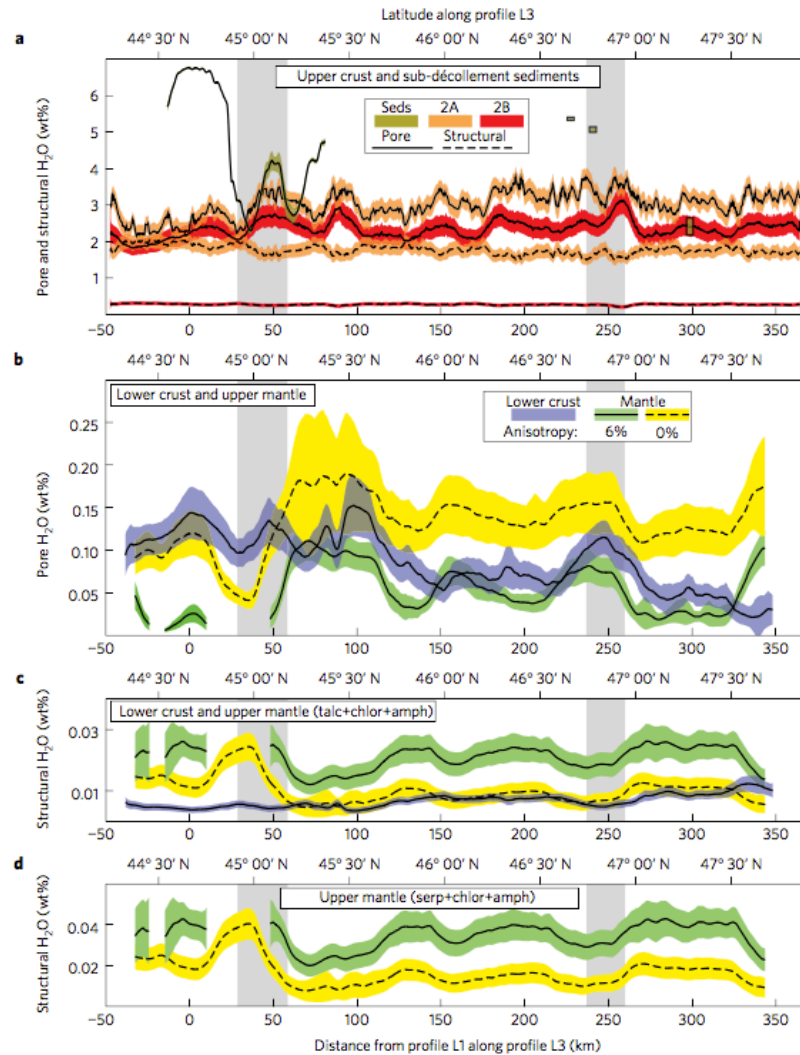
Layer	Max porosity	Aspect ratio
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Gabbro

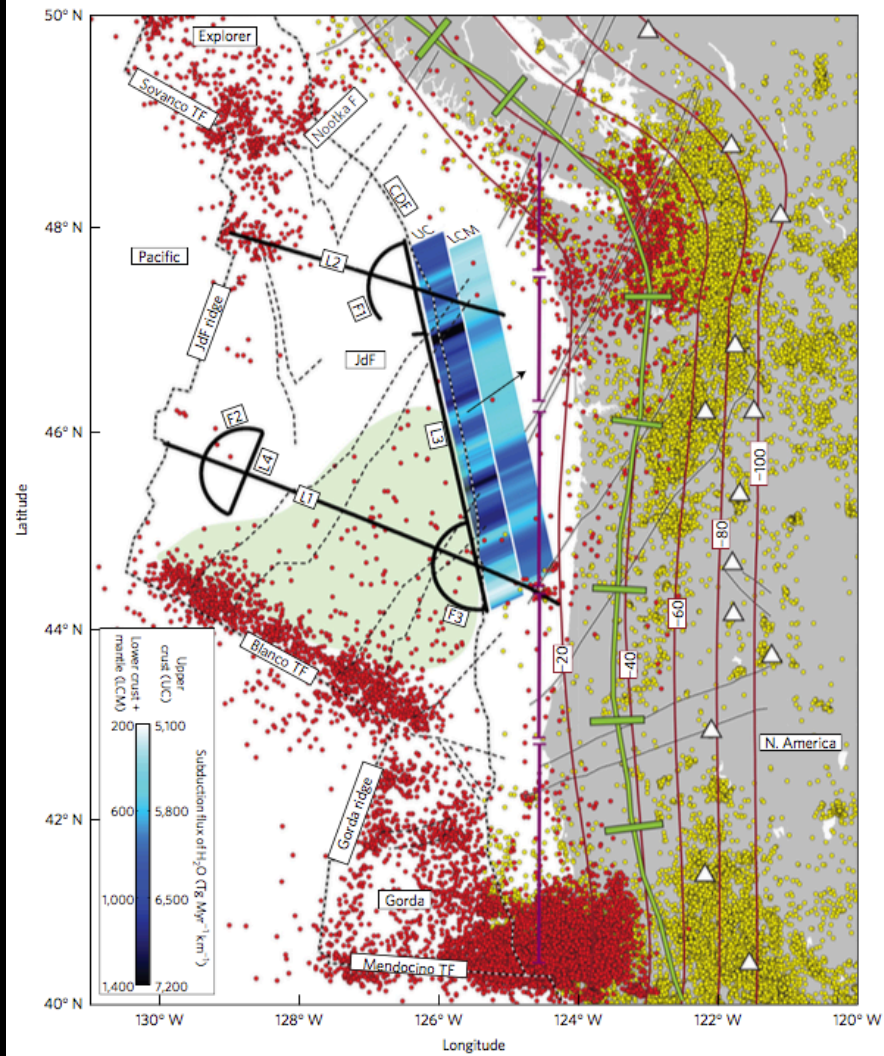


Mantle

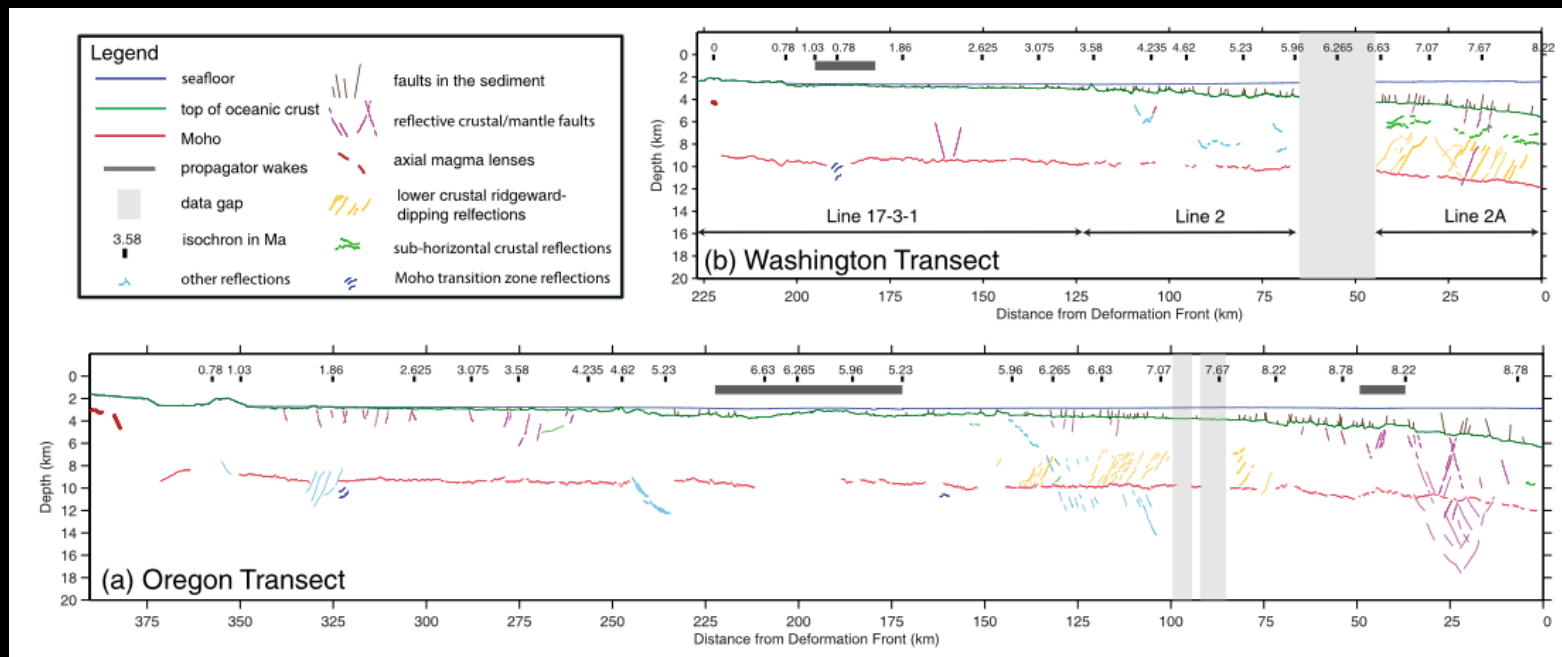




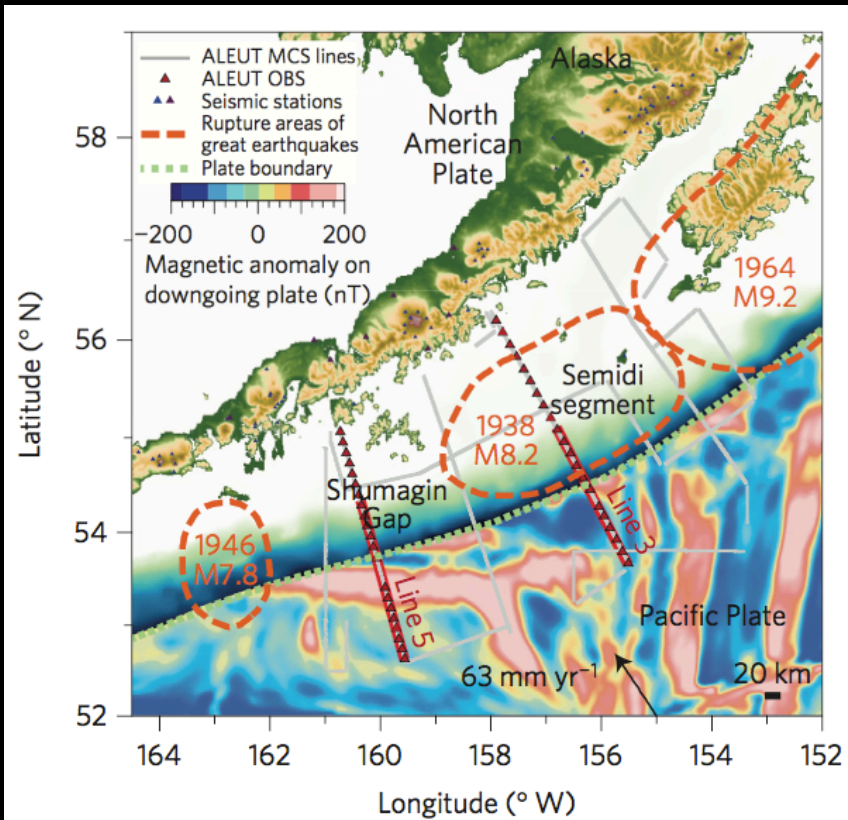
Canales et al., 2017



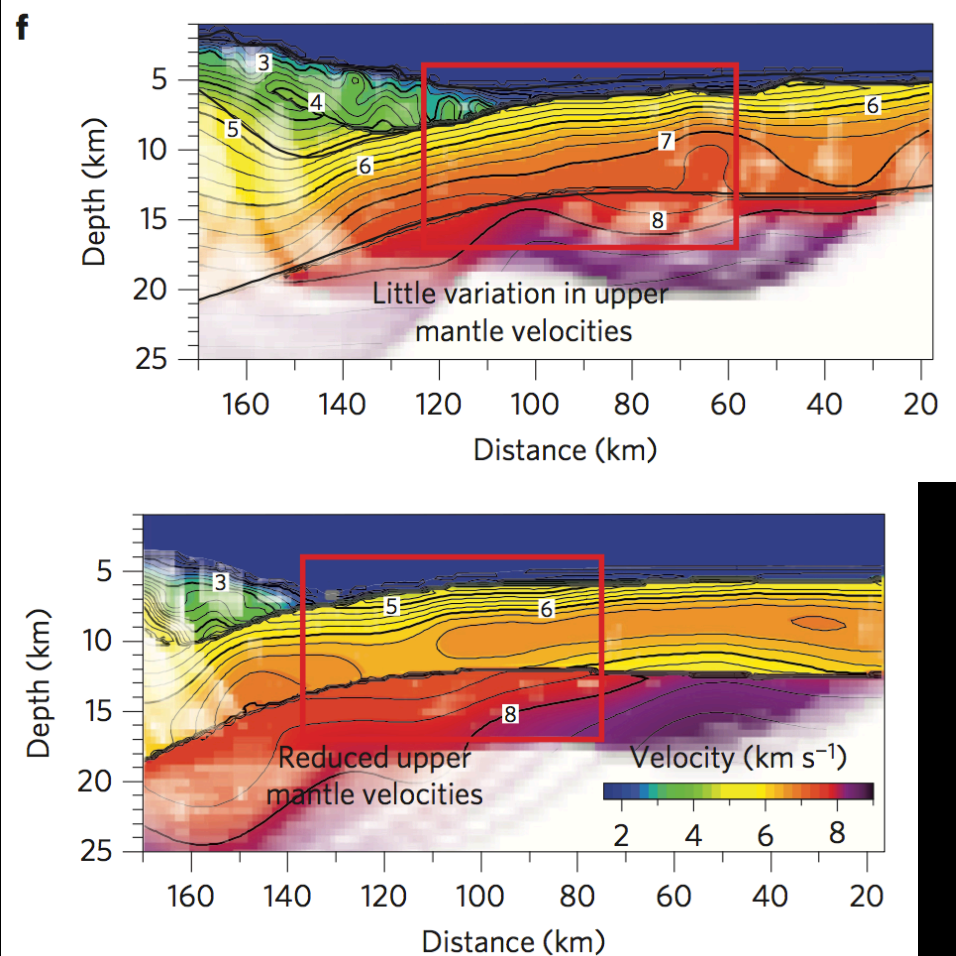
Canales et al., 2017



Han et al., 2016



Shillington et al., 2015



Upper Crust: 5,200 - 7,400 Tg Myr⁻¹ km⁻¹

OR

1 – 1.5 Lake Michigans Myr⁻¹ km⁻¹

Modeled H₂O Flux: 7,700 – 19,900 Tg Myr⁻¹ km⁻¹ [van Keken et al. 2011]

- 1) Upper crust is source for fluid-mediated tremor
- 2) Lack of intra-slab seismicity
- 2) Decompression melting and not hydrous melting generate Cascade arc magmas