MARINER

Mid-Atlantic Ridge INtegrated Experiments at Rainbow

***R/V Marcus G. Langseth* MGL1305**
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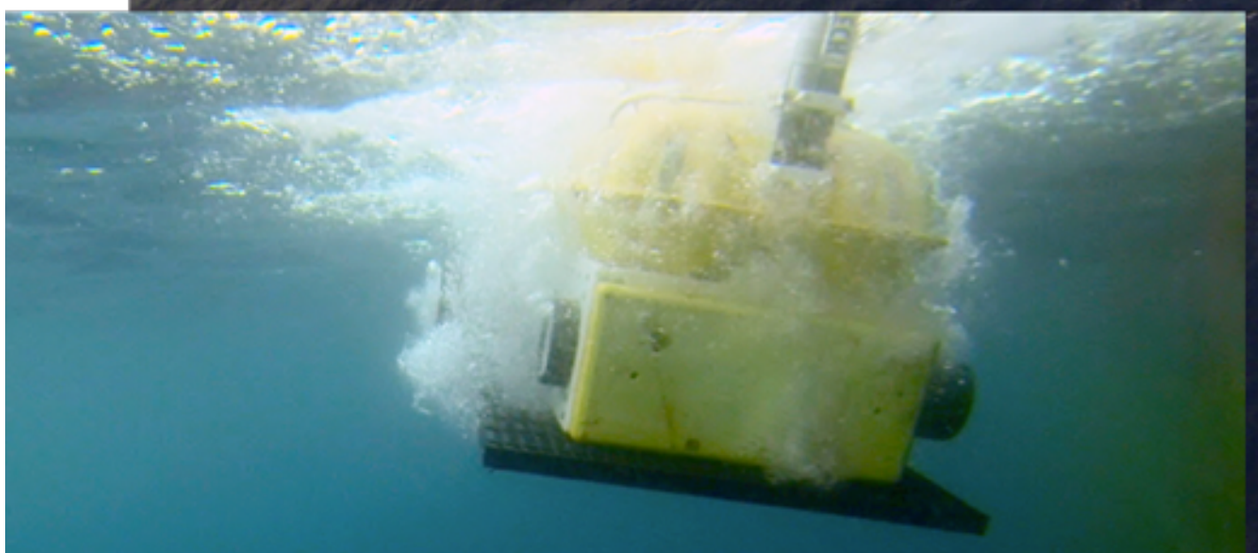
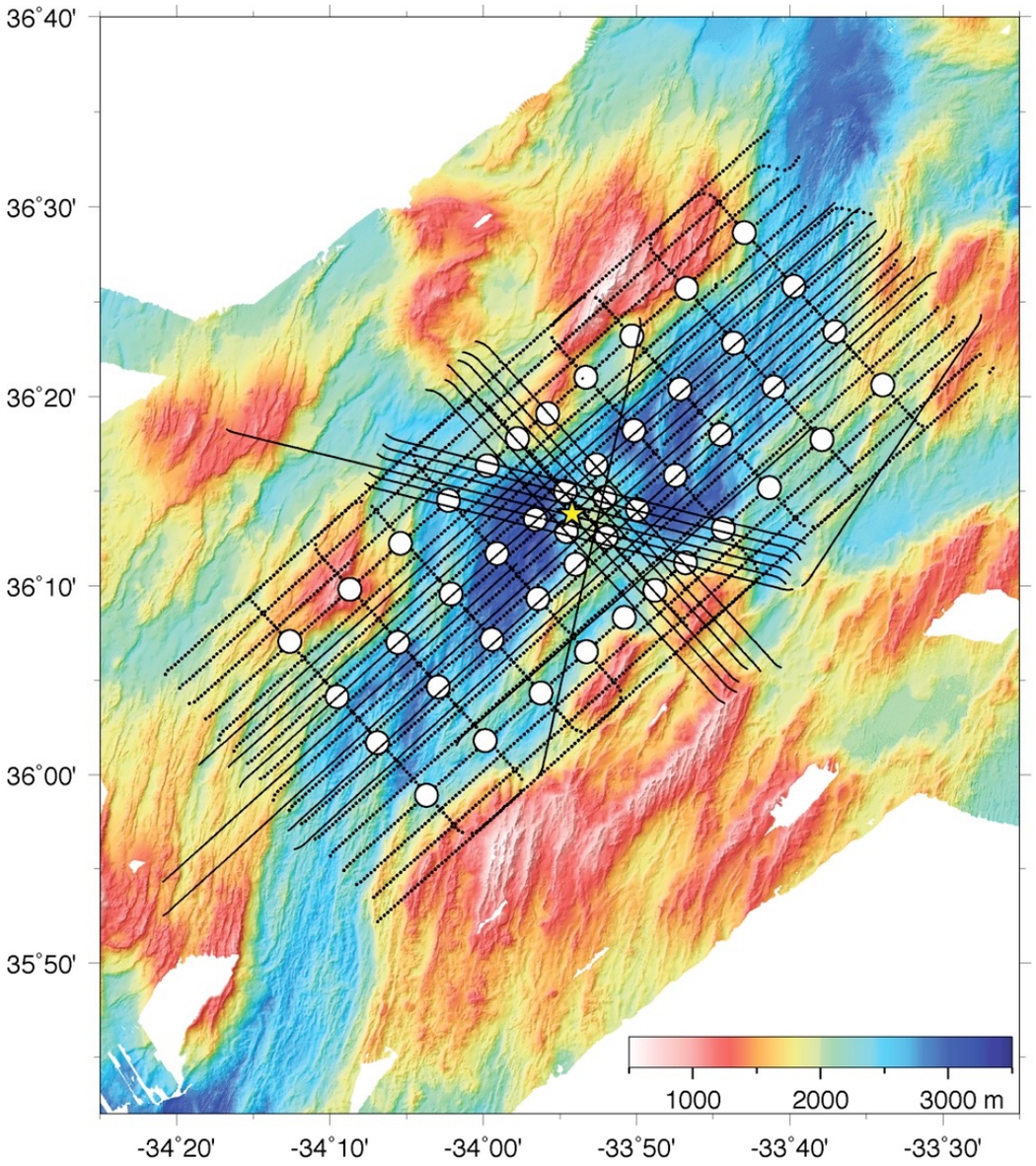
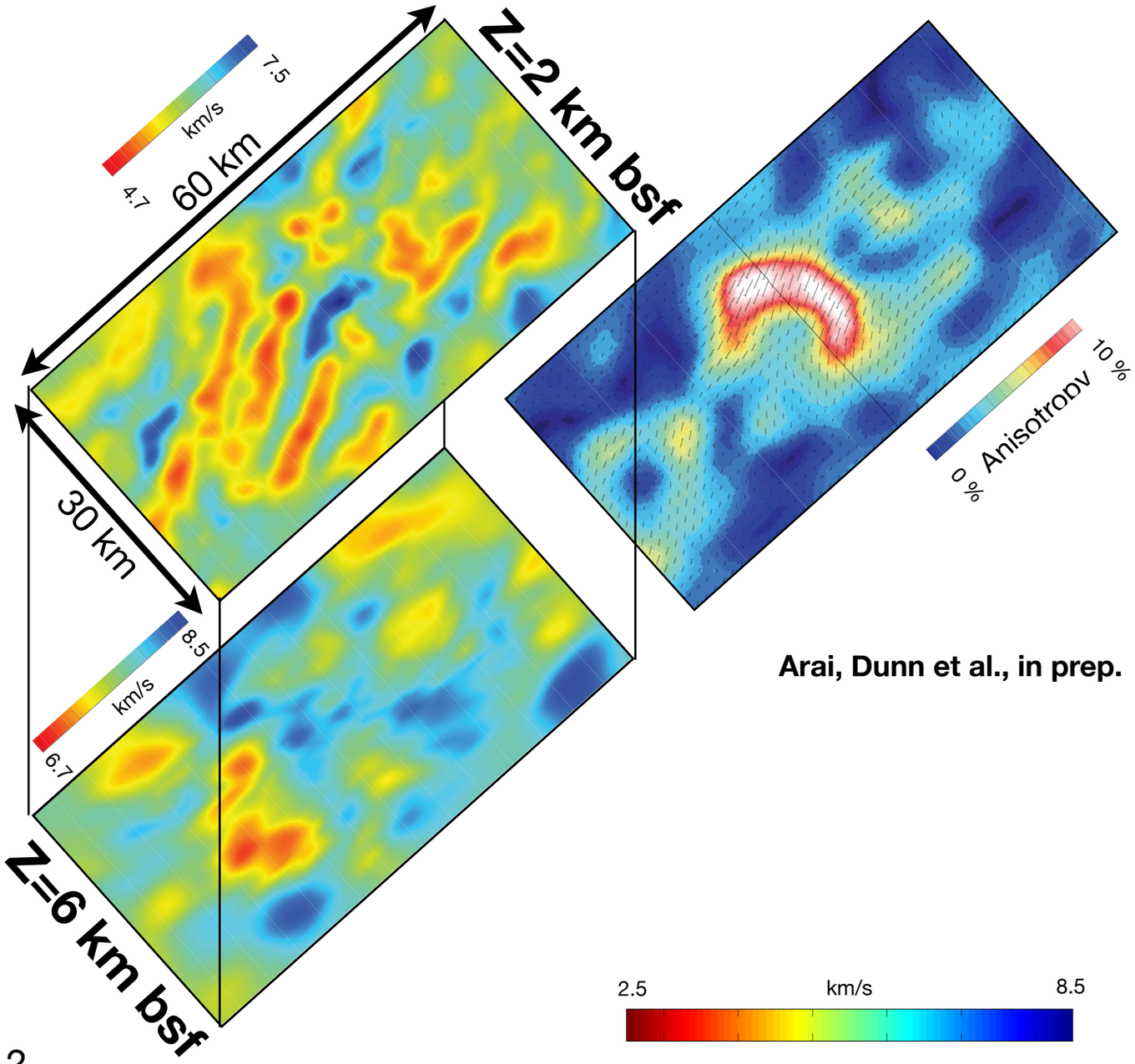
What are the relationships between magmatism, faulting, substrate lithology, and hydrothermal circulation in an ultramafic setting?

- 3D active-source OBS seismic tomography (46 OBSs, ~30km x 80km)
- Long-streamer (8 km) 2D multichannel seismic profiling
- Network of 15 OBSs for 9-month passive monitoring
- Multibeam bathymetry and backscatter echosounding
- Gravity and magnetics

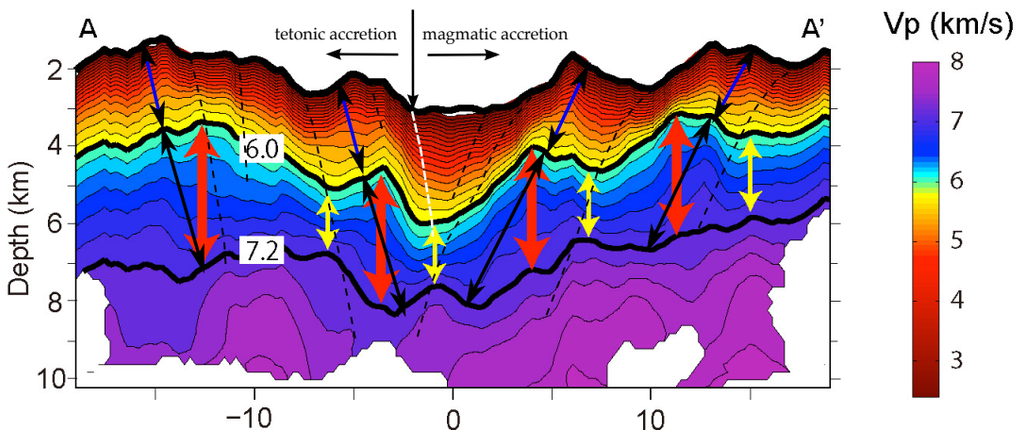


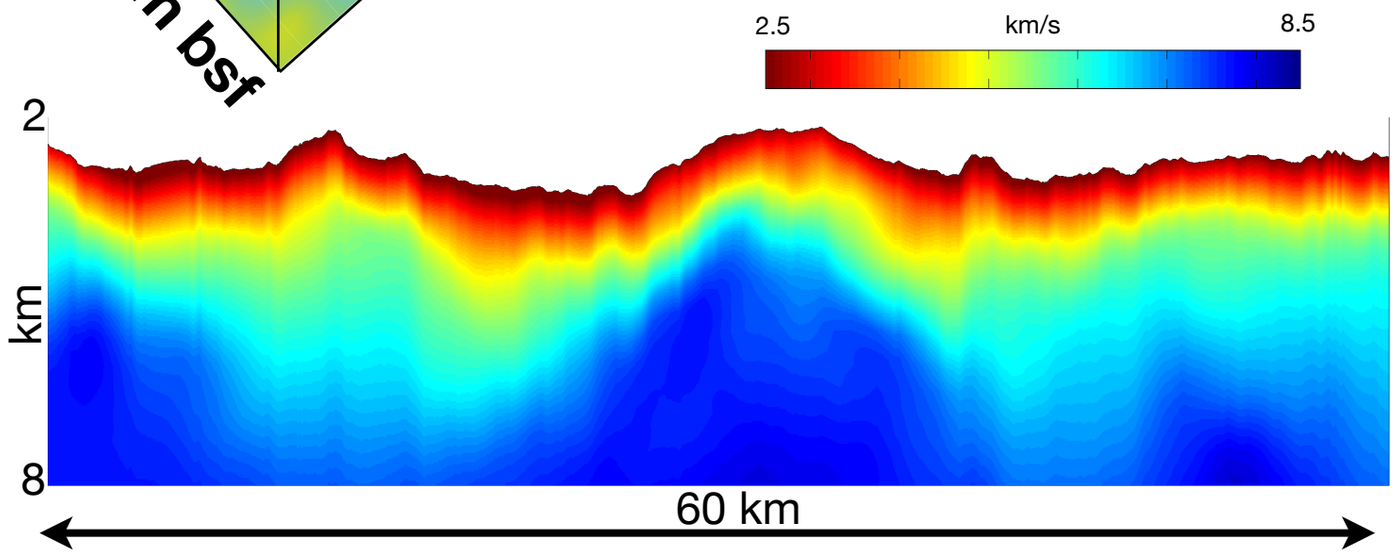
3D OBS Tomography and 2D MCS

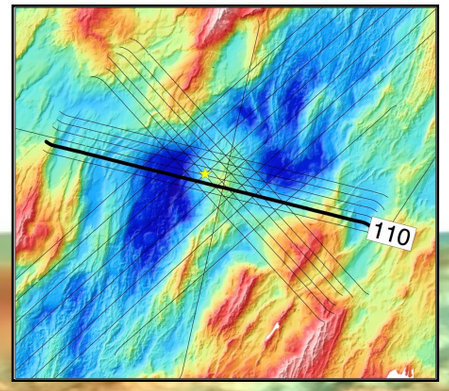




Arai, Dunn et al., in prep.







500 1000 1500 2000 2500 3000 m

2 km

4 km

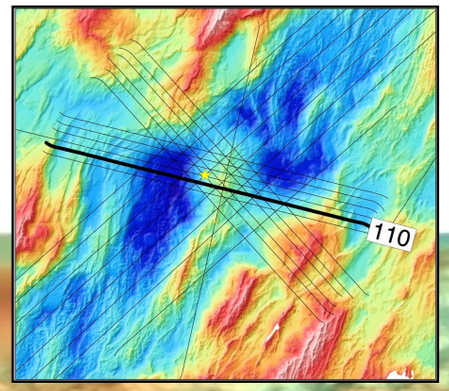
6 km

8 km

10 km

-1.0 -0.8 -0.6 -0.4 -0.2 0.0 0.2 0.4 0.6 0.8 1.0 km/s

Canales et al., in prep.



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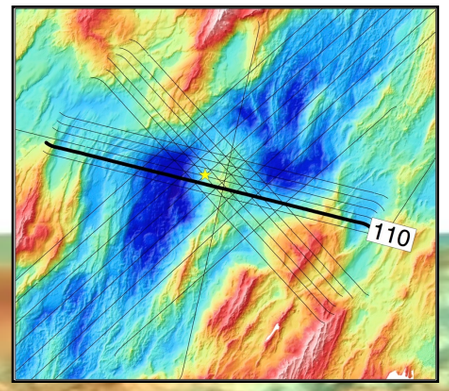

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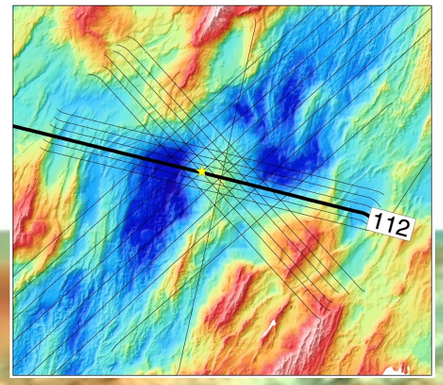

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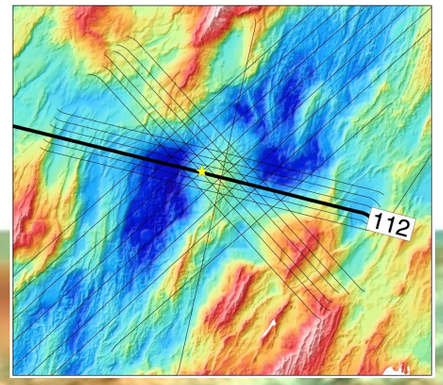
Canales et al., in prep.



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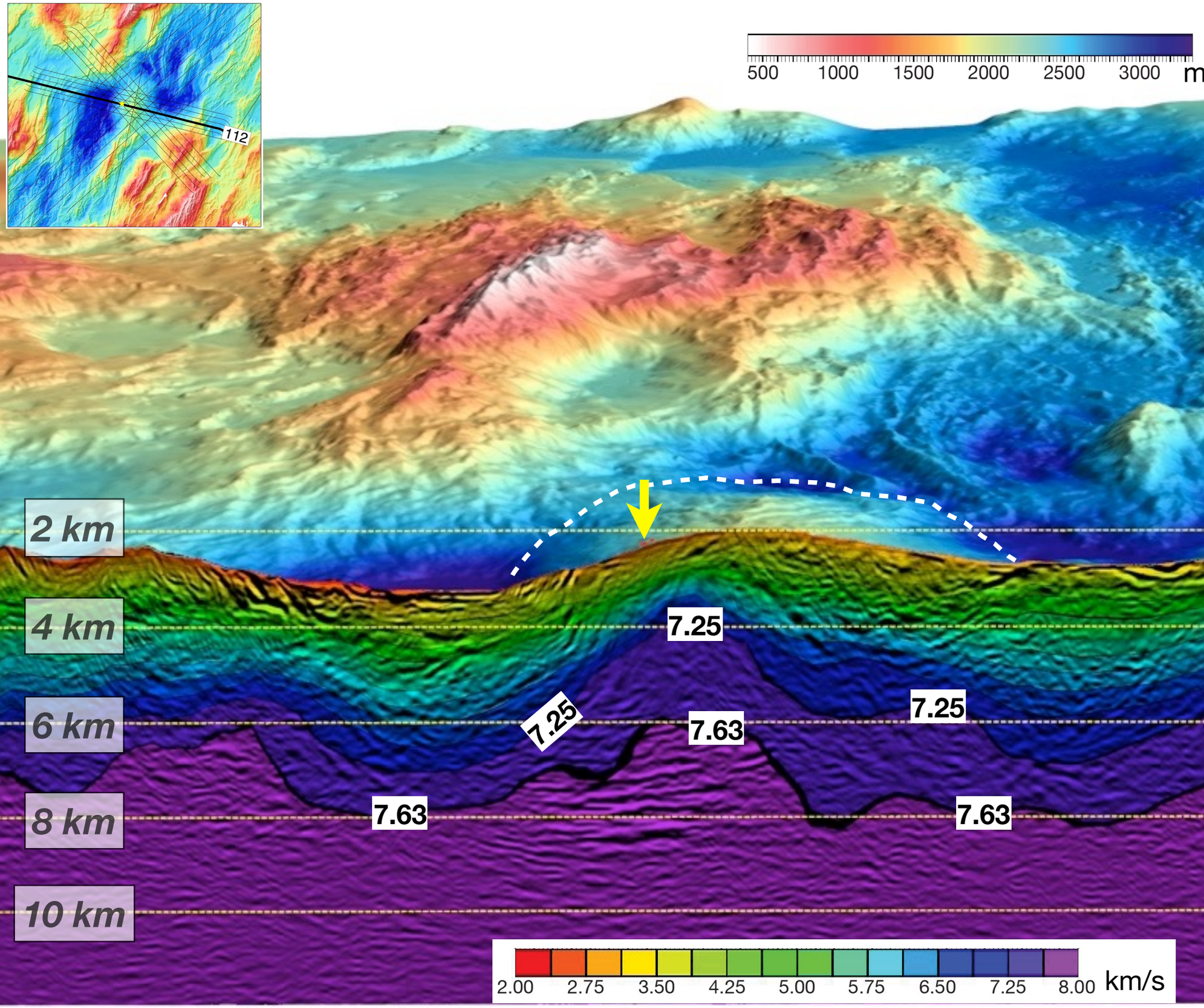
Canales et al., in prep.

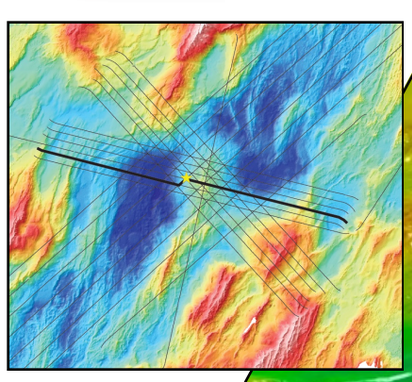


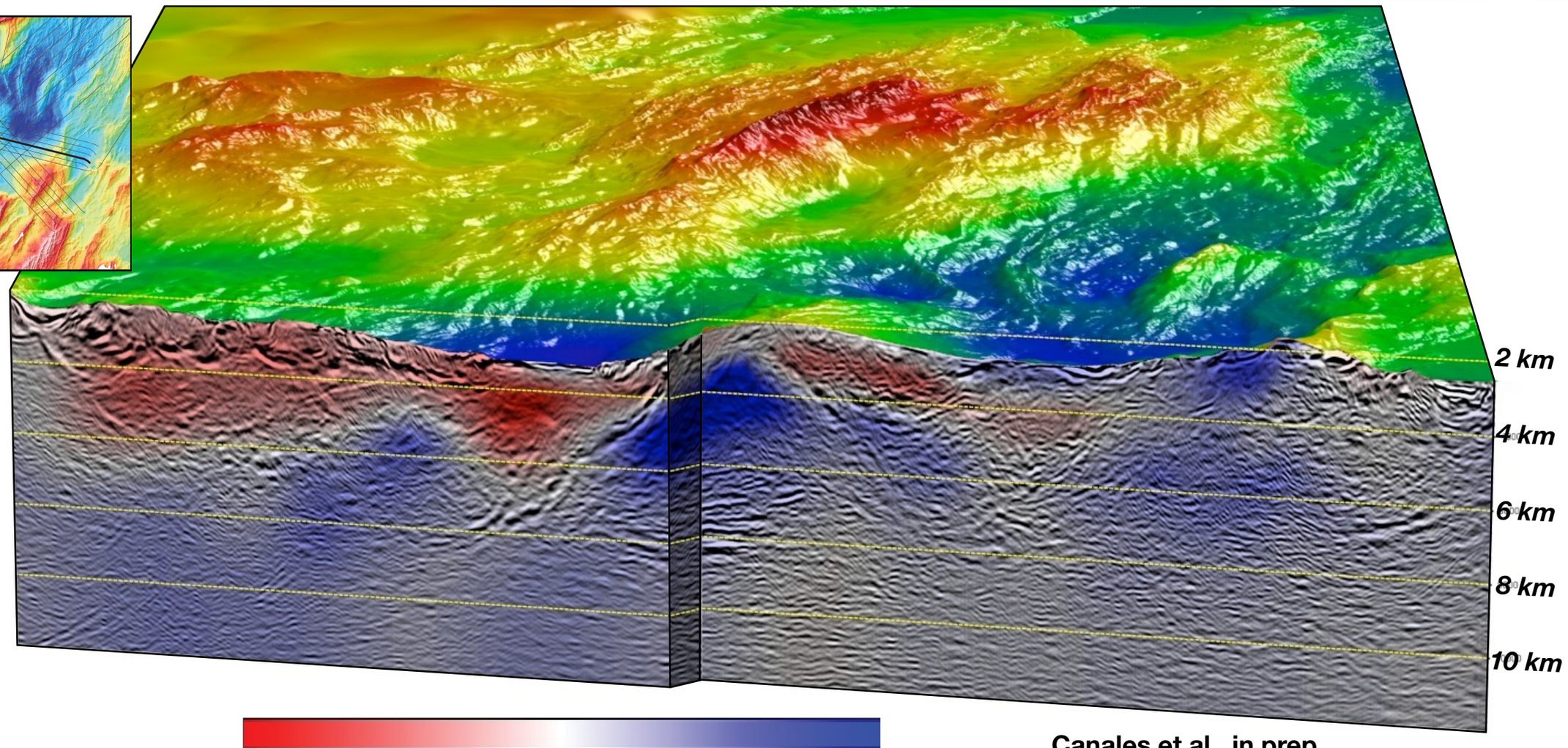
Canales et al., in prep.

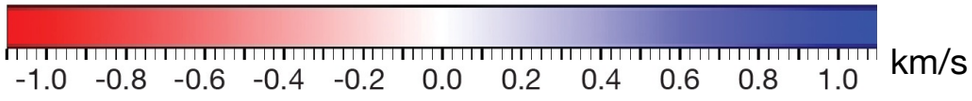
➡ **Long-streamer** (8 km in this study but optimally longer) **MCS** reflection **combined with** wide-angle **OBS data** is the only approach to **obtain accurate images** of subsurface structures **in complex tectonic settings**.

➡ **Long-offset** (>50 km) **OBS recordings** for crustal/mantle tomography **and deep MCS** reflection **imaging require a powerful tuned** seismic **source**.

➡ **RV Langseth** provides a **single research platform** for acquiring **high-quality** coincident **OBS/MCS data** (and other underway geophysical datasets).







Canales et al., in prep.

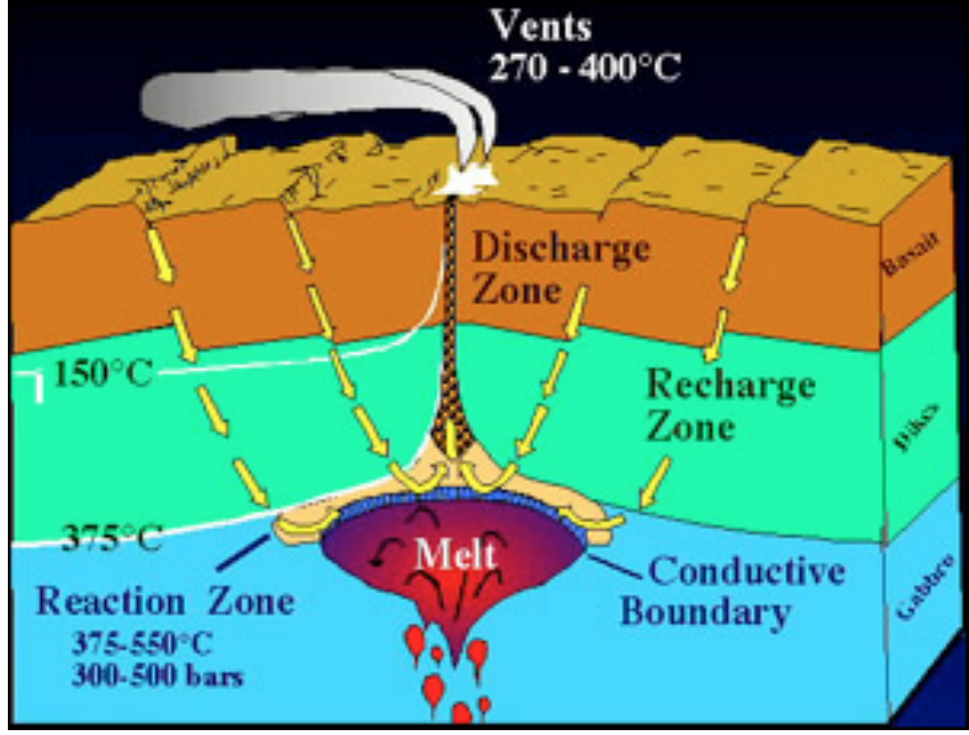
Thoughts on future MOR Studies

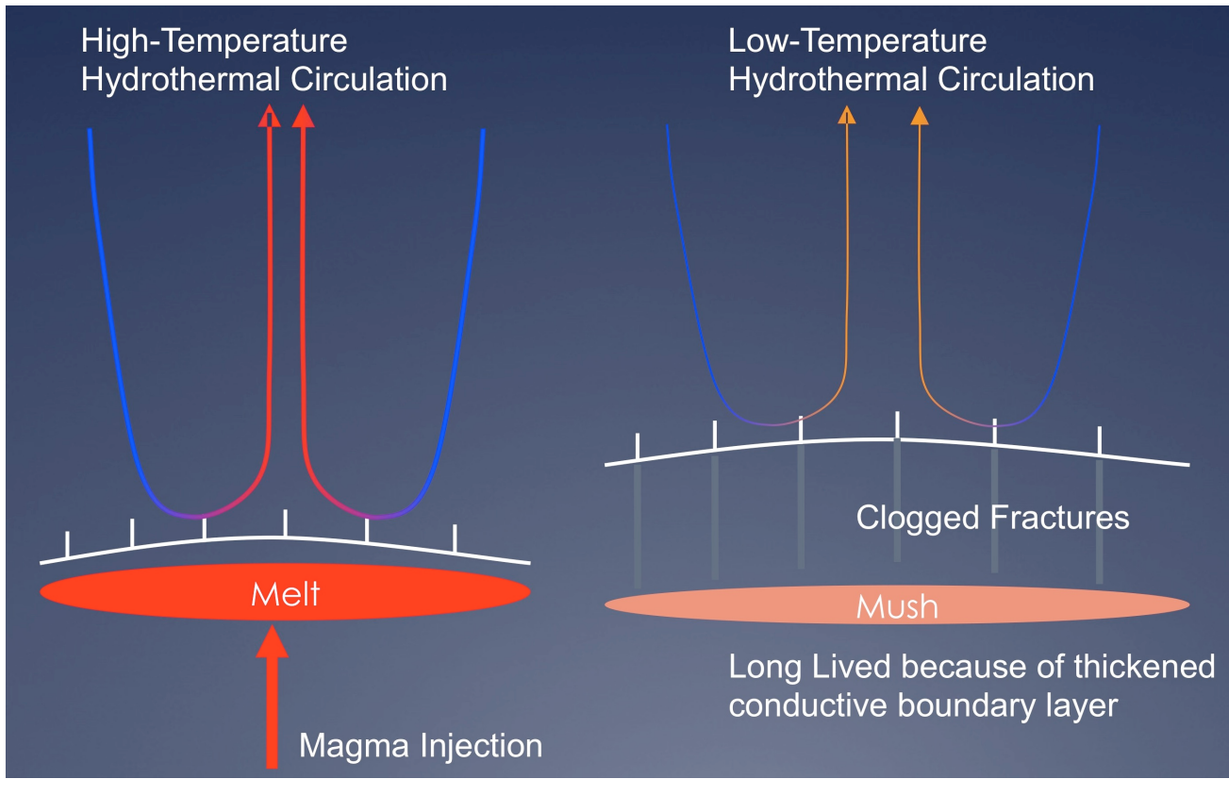
<u>All ridges:</u>

Long-streamer studies of ridge axis hydrothermal circulation.

-FWI of upper 1-2 km to characterize both magmatic heat source and crustal lid above that hosts fluid flow.

Long-streamer studies of ridge flank hydrothermal flow and crustal aging.

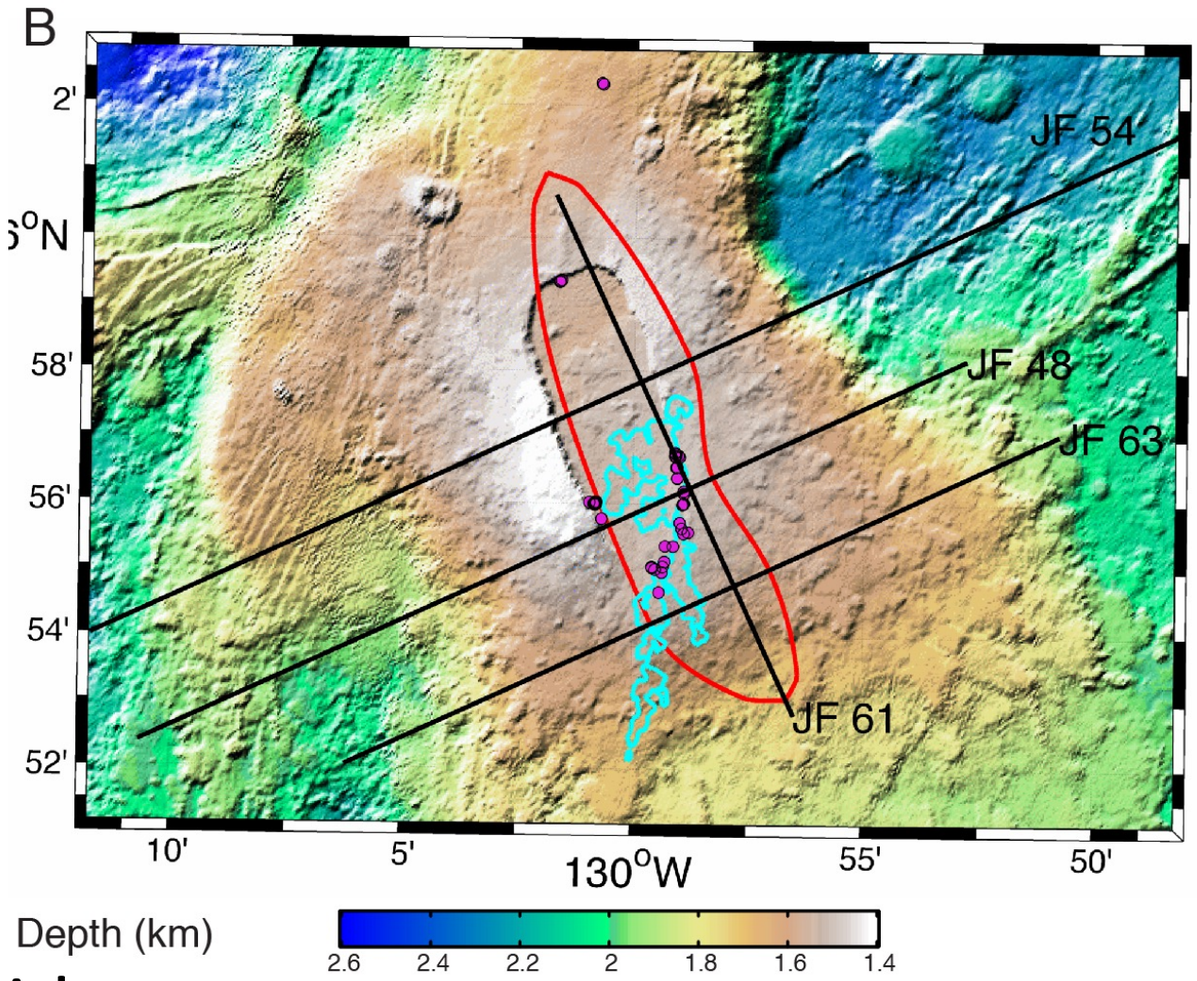




Community Experiments:

3D imaging of magma reservoir and crustal lid beneath Axial Seamount to support OOI-planned 30 years of monitoring studies of hydrothermal flow and volcanism.

-largest magma reservoir imaged to date at MOR.



Fast and intermediate spreading ridges:

Comparative 3D studies of ridge segmentation and axial lens complex.

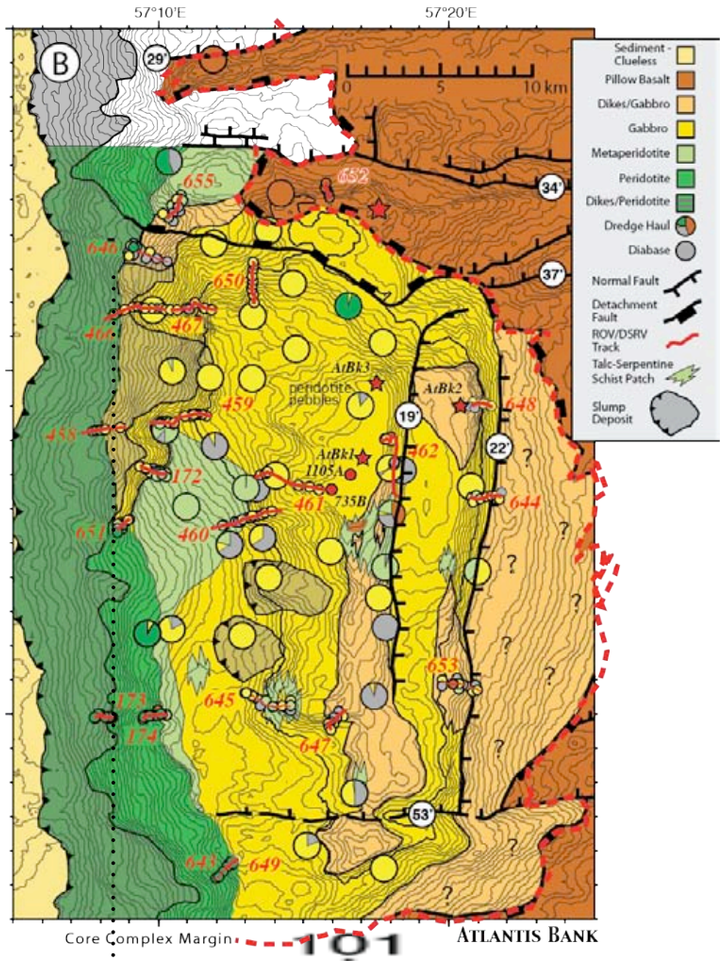
4D studies of magma flow within axial magma reservoirs - temporal and spatial scales of magma recharge.

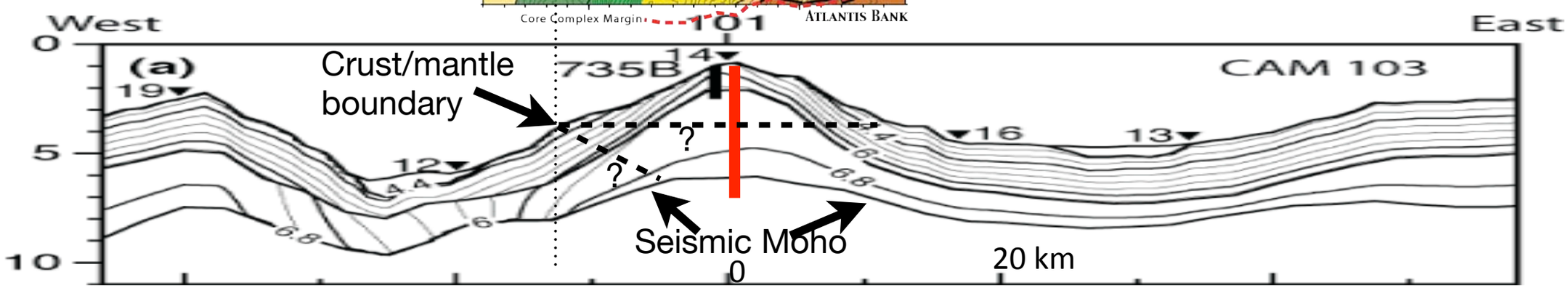
3D studies of slow and ultraslow-spread lithosphere:

- structural heterogeneity;
- geological nature of the seismic Moho;
- mantle exposures;
- high-methane, high-hydrogen hydrothermal fluid flow

<u>Example: 3D studies at Atlantis Bank, SWIR:</u>

- Drilling through the Moho is proceeding in 2 phases (Leg 1, Nov 30, 2015-Jan 31, 2016, 1300 m; Leg 2, 3000 m; Leg 3, 6000 m) to test the hypothesis that the Moho is a serpentinization front.





- Modern, high-quality 3D seismic surveys are needed to complement and expand the drilling results (currently only low-res 2D OBS data are available).