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.
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

All ridges:
- 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

Example: 3D studies at Atlantis Bank, SWIR:
- 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).