Marcus Langseth Science Oversight Committee

- Streamer Replacement
- 2015 Langseth Schedule
- Membership

Nathan Bangs, UT-Austin
MLSOC Interim Chair

Seismic Streamer/Recording System Replacement

Current system

- In 2D mode: 8,000 m streamer
- In 3D mode: 4 x 6,000 m streamers
- On the verge of complete failure
  - Streamer is a decades old design and is now noisy and unreliable
  - Streamer cannot be repaired and is obsolete. All known spares have been acquired
  - Recording/navigation uses four different operating systems on outdated computers (‘90s vintage running MS-DOS)

The new Sercel streamer

- Seal 408 Recorder/navigation system and streamer
  - Streamer configurations
    - 2D: 15,000 m long streamers
    - 3D: 4 x 6,000 m long streamers

The new Sercel streamer

- Reliability: Less down time, currently manufactured and supported, streamers repairable and upgradable, compatible with updated computer interfaces.
- Larger dynamic range during recording
- Shorter sample rates for recording higher frequencies and improving resolution
- Shorter deployment times
- Less drag and less fuel to operate

The new Sercel streamer

– Costs:

Two options

- Recording/navigation system and 24,000 m streamer
  $2.7 million

- Recording/navigation system and 18,000 m streamer
  $1.62 million
  Additional streamer sections can be readily leased as needed

2015 Langseth Schedule

April 9 – May 5 27 days	Mid-Atlantic Extended Continental Shelf	USGS	Hutchinson
June 1 – July 6 36 days	New Jersey 3D	NSF	Mountain
July 31- August 28 29 days	ECS Atlantic Mapping	NOAA	Gardner
Sept. 1 – Sept. 12 12 days	Freshwater seeps NE US margin	NSF	Key
Oct. 14 – Nov. 4 22 days	Santorini OBS survey (western Mediterranean)	NSF	Hooft
Dec. 12 – Dec. 31 20 days	S. Atlantic seismic imaging	NSF	Reece

Total

NOAA	31
NSF	169 (30 days pending)
USGS	28
	228

Membership

Nathan Bangs (Interim Chair, MLSOC)	UT Austin	02/10 to 02/16
Suzanne Carbotte (MLSOC, ex-officio)	LDEO	10/10 to 10/15
Debbie Hutchinson	USGS	03/12 to 03/18
William Lang	Independent Consultant	03/12 to 03/18
Paul Ljunggren| (ex-officio RVOC Rep)	LDEO	10/05
Beatrice Magnani	SMU	11/14 to 11/17
Gregory Mountain	Rutgers U.	10/14 to 10/17
Clare Reimers (Chair, FIC) | (ex-officio FIC Rep, MLSOC)	OSU	10/09 to 10/15
Jeff Rupert (ex-officio RVTEC Rep)	LDEO	07/10
Dale Sawyer	Rice University	03/12 to 03/18
David W. Scholl	USGS	02/10 to 02/16
Alexander (Sandy) Shor (ex-officio, MLSOC Liaison, FIC)	U Hawaii	02/10 to 02/16
Maurice Tivey	WHOI	03/12 to 03/15
Maya Tolstoy (ex-officio)	LDEO	10/05

Membership Issues

- Chair
- Replacements for one member: Maurice Tivey

Regional Framework Plan

The framework is designed to:

- Provide guidance about when to submit proposals for work in a particular area
- Encourage investigators (both US and potential international teams) with new ideas for work along the path to submit a proposal for work that could mesh geographically (modest transit) with the framework path
- Provide rotating access to all regions of scientific interest within a timeframe of several years

Regional Framework Plan

- Equitorial-South Atlantic
  2016
- Southeastern Pacific
  2017
- Southwestern Pacific
  2018
- Indian Ocean
  2019
- North Pacific

Overview of MLSOC response to the Sea Change Report

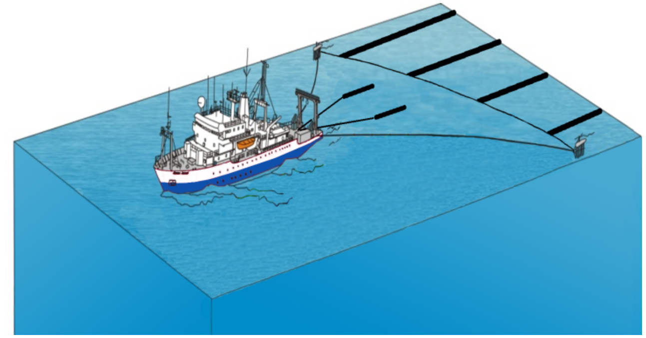
MLSOC response is directed at the suggestion of immediate layup of the Langseth

Nathan Bangs
University of Texas
Senior Research Scientist, Institute for Geophysics
MLSOC Interim Chair

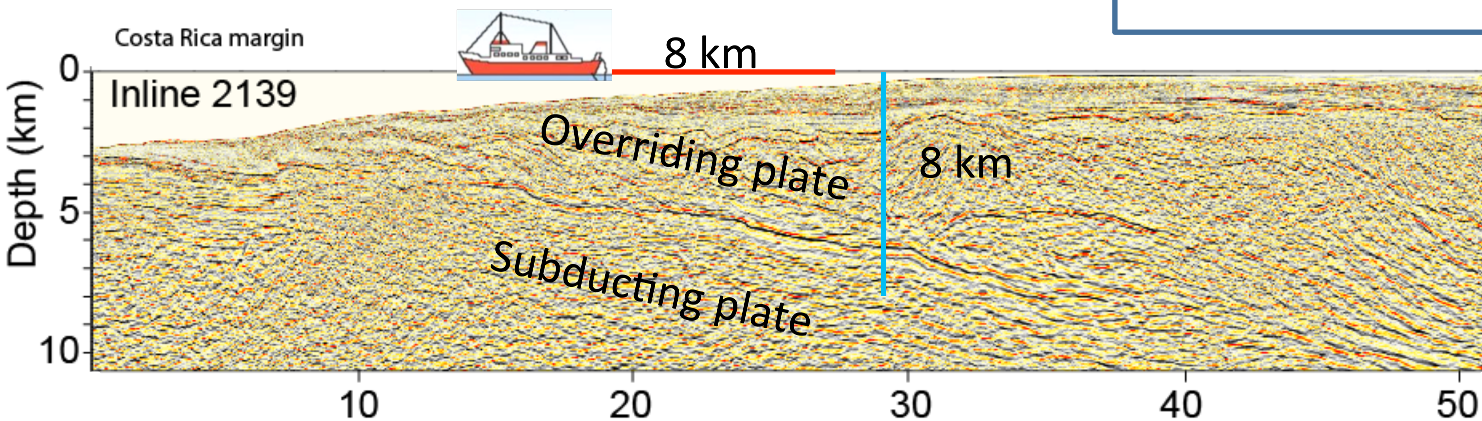
Unique Capabilities of Langseth

Langseth is unique in the academic world because of her dedicated high-resolution, high-quality source and long source-receiver 2D (up to 8 km currently and potentially longer with streamer acquisition) 2D and 3D capabilities.

3D seismic acquisition

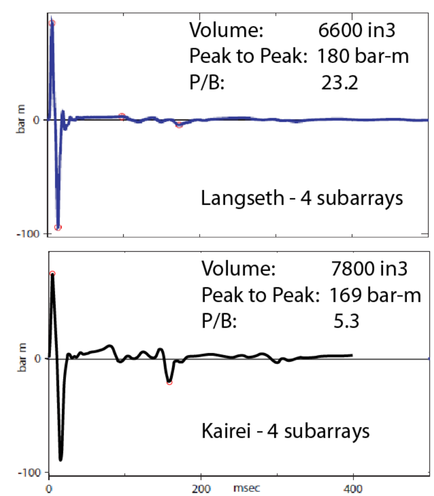


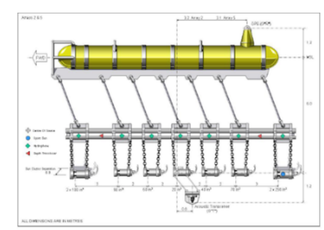
Crustal scale 2D seismic acquisition



Laying up Langseth would not simply eliminate the ability to acquiring 3D seismic data, but it would eliminate our ability to conduct 2D and severely impact wide-angle refraction with OBS View of the Langseth as more than just 3D, it is 2D and source for OBS; critical for characterizing subseafloor structure.

High-quality seismic source for reflection and OBS refraction





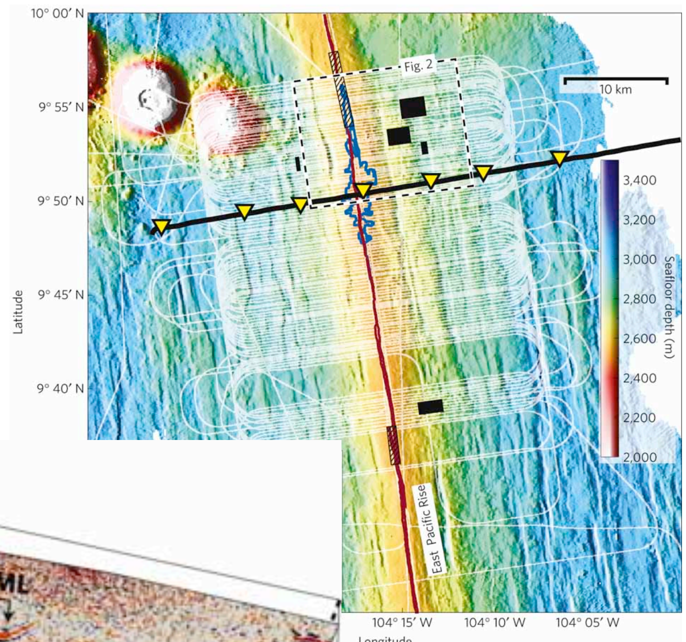
Sub seafloor imaging is essential for addressing four of the eight science questions identified in the Sea Change Report

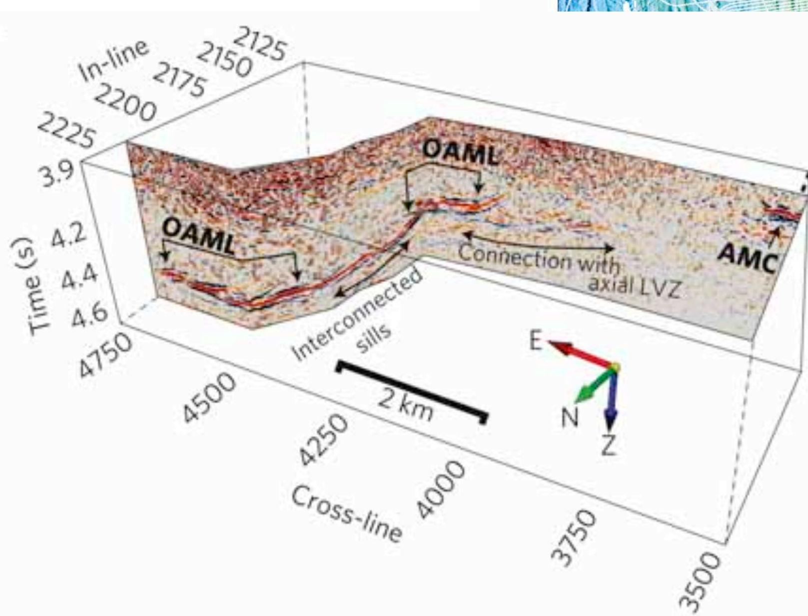
- 1. **What are the rates, mechanisms, impacts, and geographic variability of sea level change?**
- 2. **How are the coastal and estuarine ocean and their ecosystems influenced by the global hydrologic cycle, land use, and upwelling from the deep ocean?**
- 3. **How have ocean biogeochemical and physical processes contributed to today's climate and its variability, and how will this system change over the next century?**
- 4. **What is the role of biodiversity in the resilience of marine ecosystems and how will it be affected by natural and anthropogenic changes?**
- 5. **How different will marine food webs be at mid-century? In the next 100 years?**
- 6. **What are the processes that control the formation and evolution of ocean basins?**
- 7. **How can risk be better characterized and the ability to forecast geohazards like mega-earthquakes, tsunamis, undersea landslides, and volcanic eruptions be improved?**
- 8. **What is the geophysical, chemical, and biological character of the subseafloor environment and how does it affect global elemental cycles and understanding of the origin and evolution of life?**

Question # 6: **What are the processes that control the formation and evolution of ocean basins?**

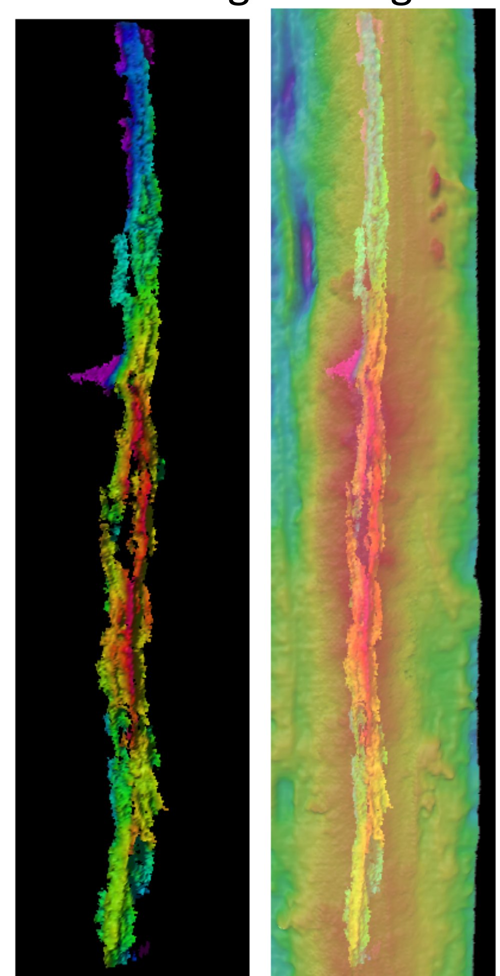
East Pacific Rise 3D survey of a mid-ocean ridge system

3D, Off axis magma migration



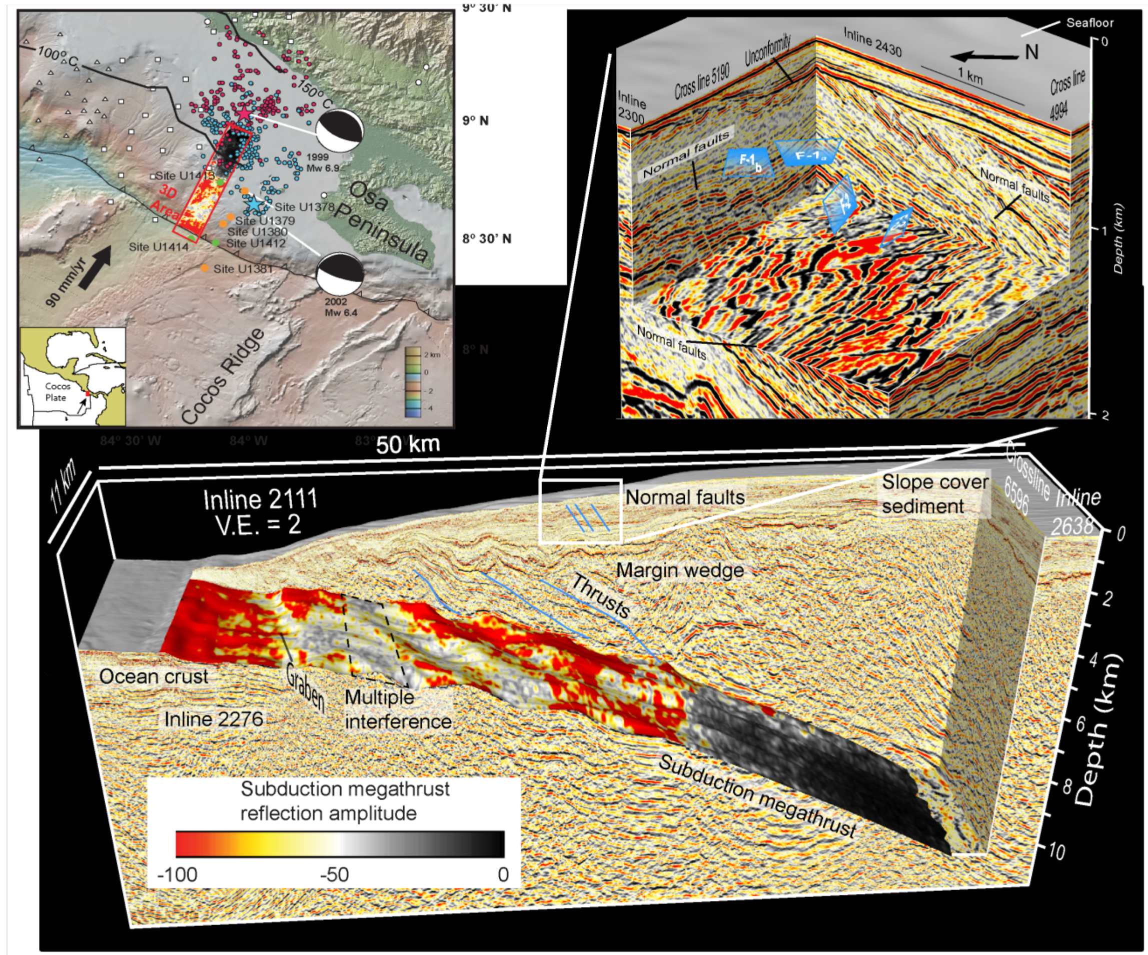


Multiple vertically stacked magma chambers along the ridge axis



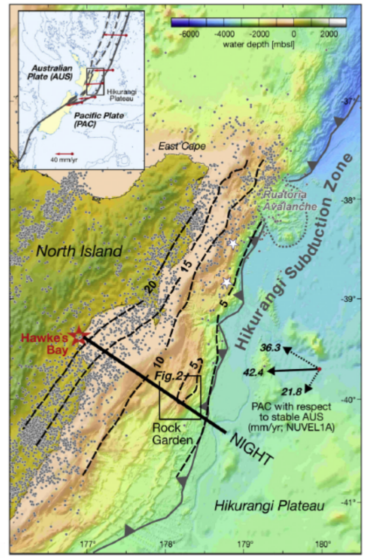
Question # 7: **How can risk be better characterized and the ability to forecast geohazards like mega-earthquakes, tsunamis, undersea landslides, and volcanic eruptions be improved?**

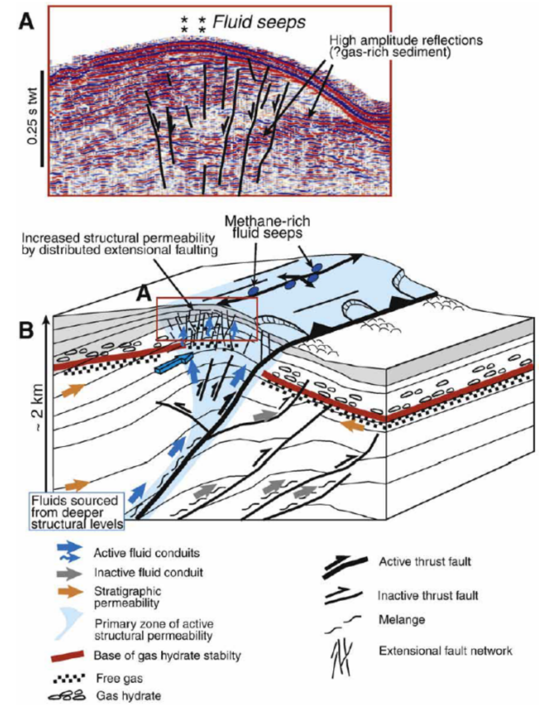
Costa Rica 3D survey of a subduction megathrust

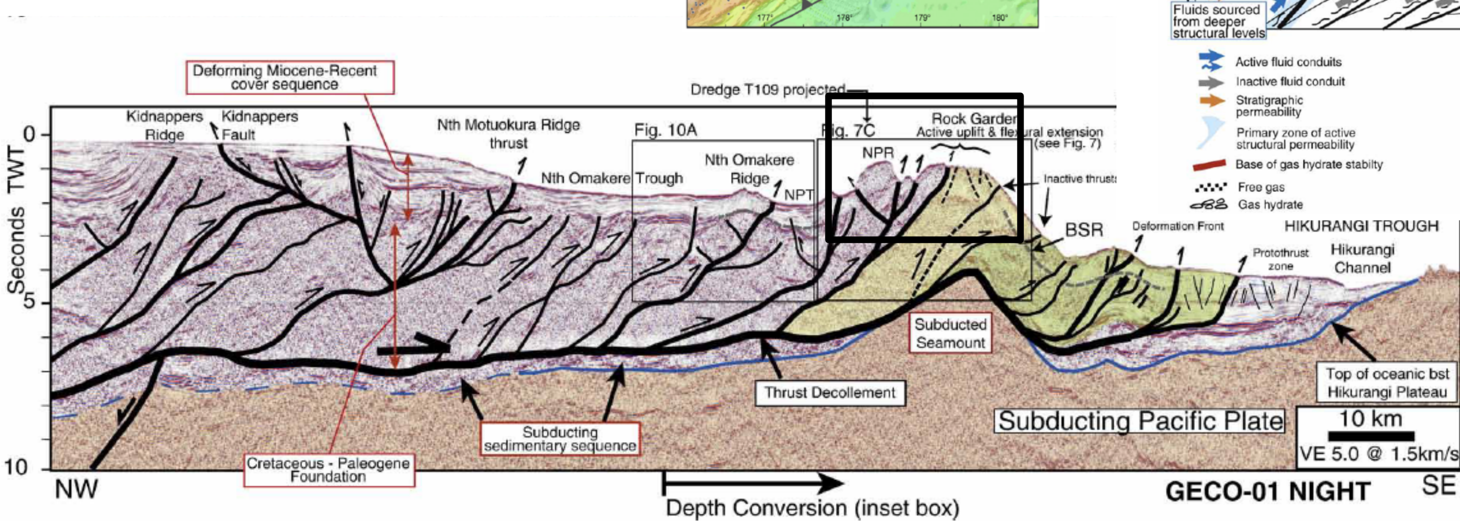


Question # 8: **What is the geophysical, chemical, and biological character of the subseafloor environment and how does it affect global elemental cycles and understanding of the origin and evolution of life?**

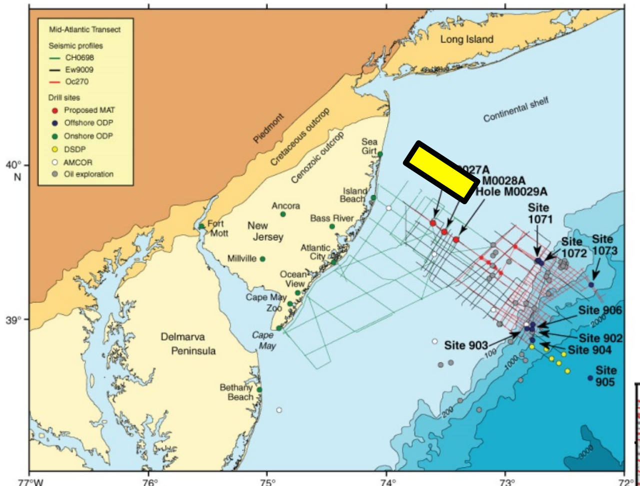
Deeply sourced fluid migration along the Hikurangi margin



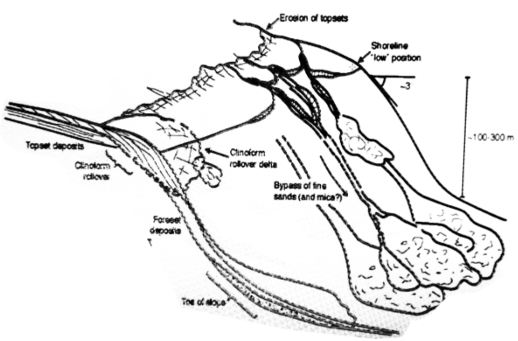


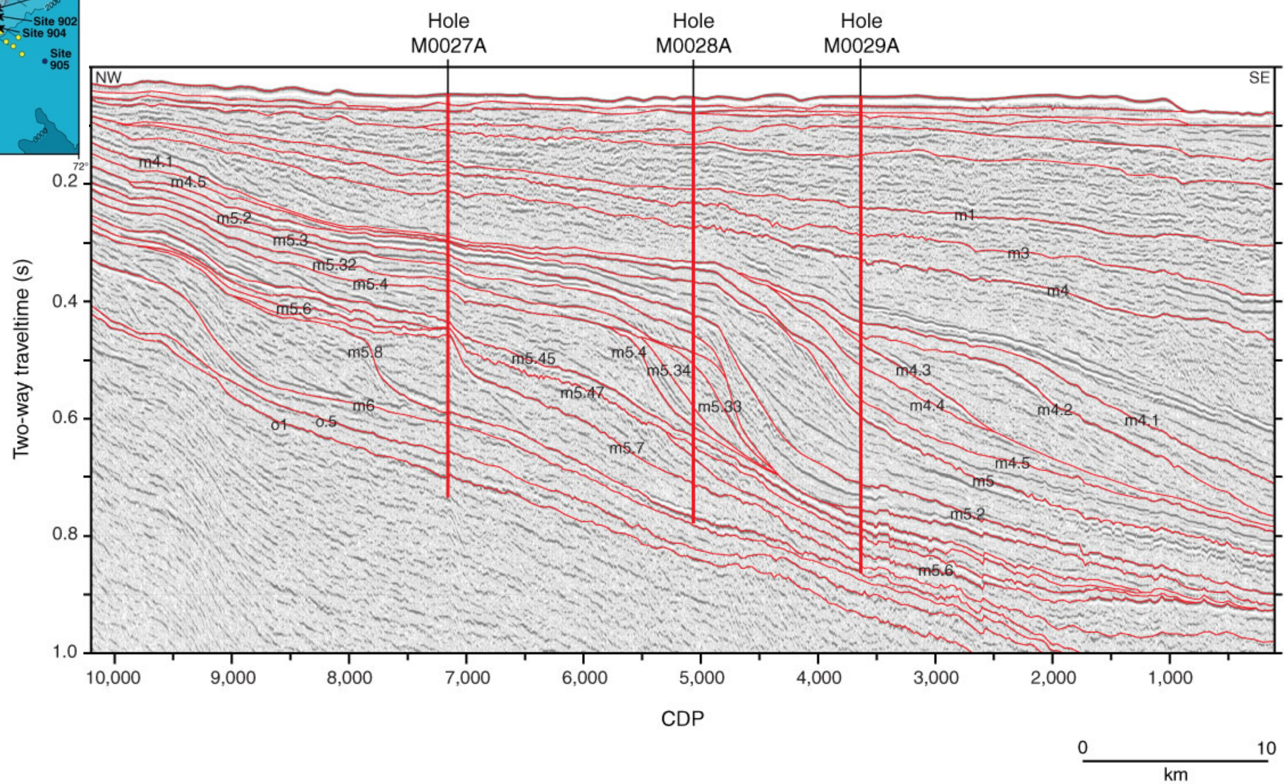


Question #1: **What are the rates, mechanisms, impacts, and geographic variability of sea level change?**



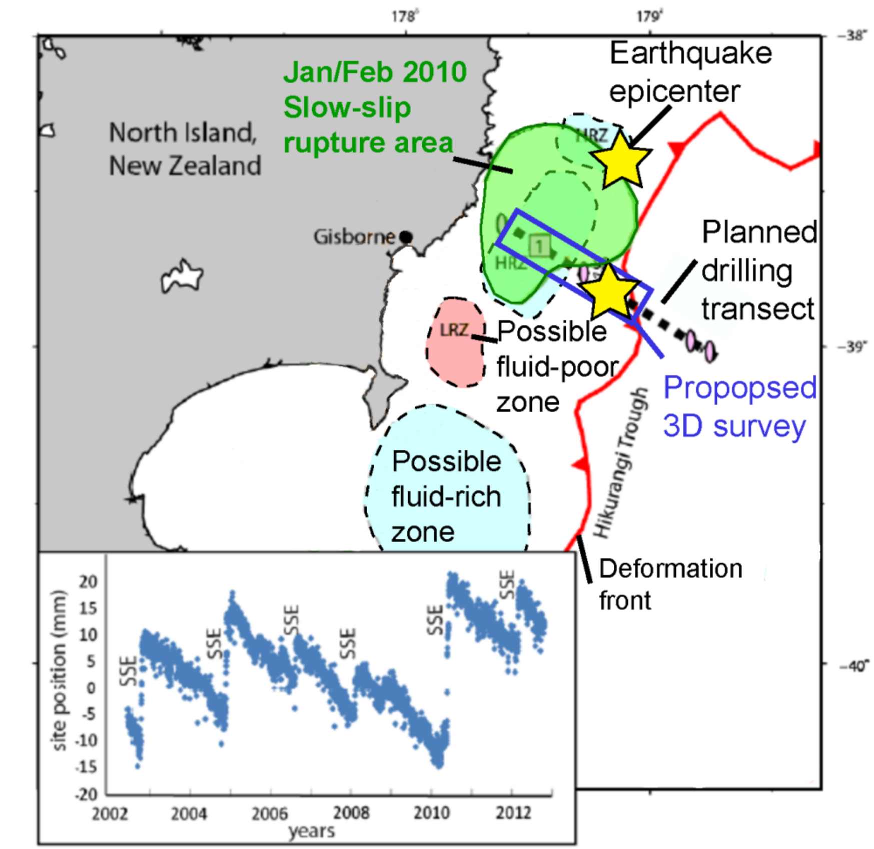
New Jersey 3D (acquisition summer '15) will examine magnitude and timing of sea-level changes based on sediment depositional systems

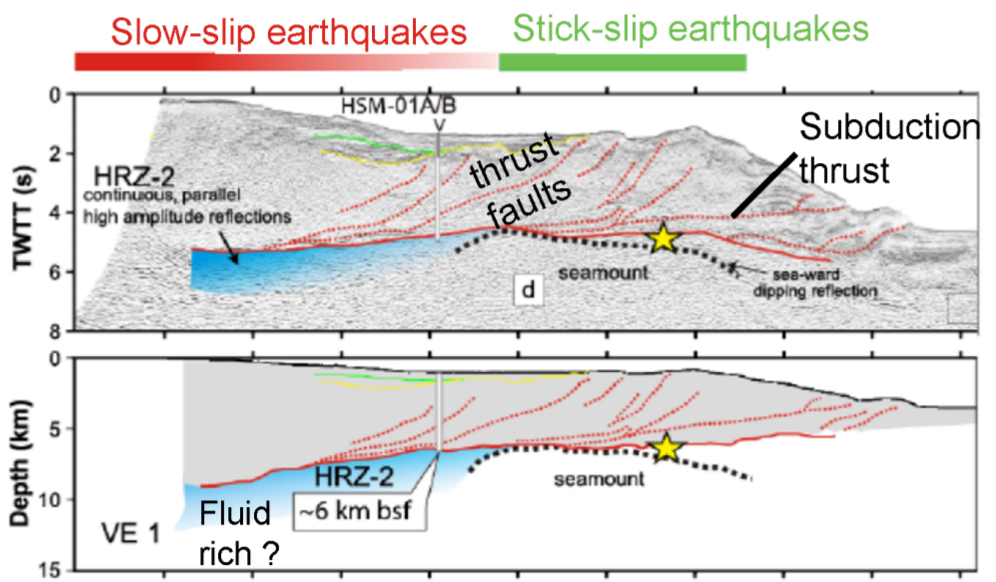




Proposed science for the future –

Hikurangi 3D seismic imaging to investigate slow-slip earthquakes





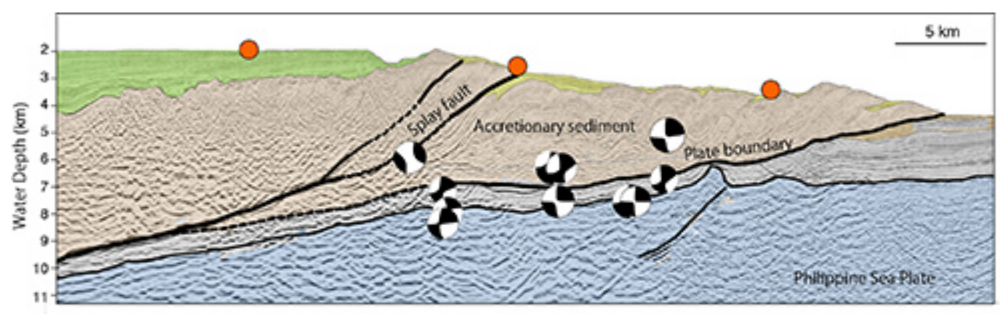
Langseth provides an essential framework for other studies with tremendous value added, especially IODP

– Site location and well planning – site surveys are cost effective for maximizing drilling science

– Regional characterization enables interpretation beyond the borehole and puts drilling results into a regional structural, physical property and tectonic context.

– Required for safety and pollution prevention, crossing 2D lines for riserless; 3D for riser drilling

– Provides structural and tectonic framework for geophysical and geological studies to context, such as sub seafloor vent systems and seafloor heat flow, earthquake hypocenters, gas hydrates and gas migration, ...

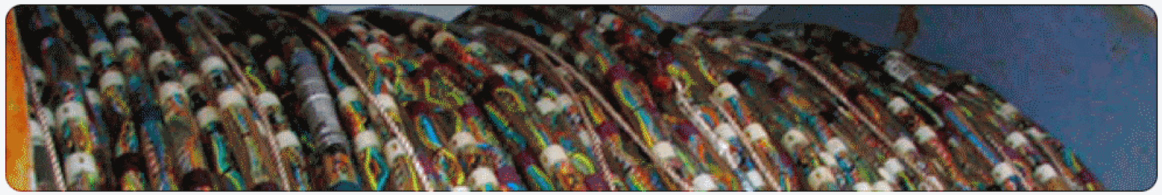


Alternatives to a dedicated system, such as Langseth, are limiting

- **Commercial contractors:**
  - Costs
  - Limited locations of operation
  - Limited student participation and training at sea

- **Portable systems:**
  - Portable systems currently operating have ~3 km long streamers (French system is up to 6 km, but with limitations…)
  - Sources are poorer (weaker signal with more artifacts)
  - More time for rigging up and testing.
  - Short-offset streamers (< 6-8 km) are inadequate for crustal scale imaging, and limited data quality improvements by stacking, filtering, and multiple elimination.
  - A 3 km, low-resolution source is equivalent to systems used on the Conrad up until the late 1990's, and were limiting in their ability to produce high-quality data and address the science at that time. These limitations were the motivation for acquiring Ewing, and eventually Langseth.

The new Sercel streamer and its impact on future science



- A larger variety of streamer configurations with greater source-receiver offset:
  - Longer offsets (up to 15 km for 2D) for deeper penetration and more opportunities with data processing for improved imaging quality at all depths.
  - Longer offsets for reliable velocities (1:1 for reliable velocities from reflections; possible analysis of refracted arrivals)
  - Longer streamers for 3D (up to 12 km with 2 x 12 km) for limited deep 3D imaging
- Reliability: Less down time, currently manufactured and supported, streamers repairable and upgradable, compatible with updated computer interfaces.
- Larger dynamic range during recording
- Shorter sample rates for recording higher frequencies and improving resolution
- Shorter deployment times
- Less drag and less fuel to operate

A 15 km streamer along the Sumatra Margin

Costa Rica margin