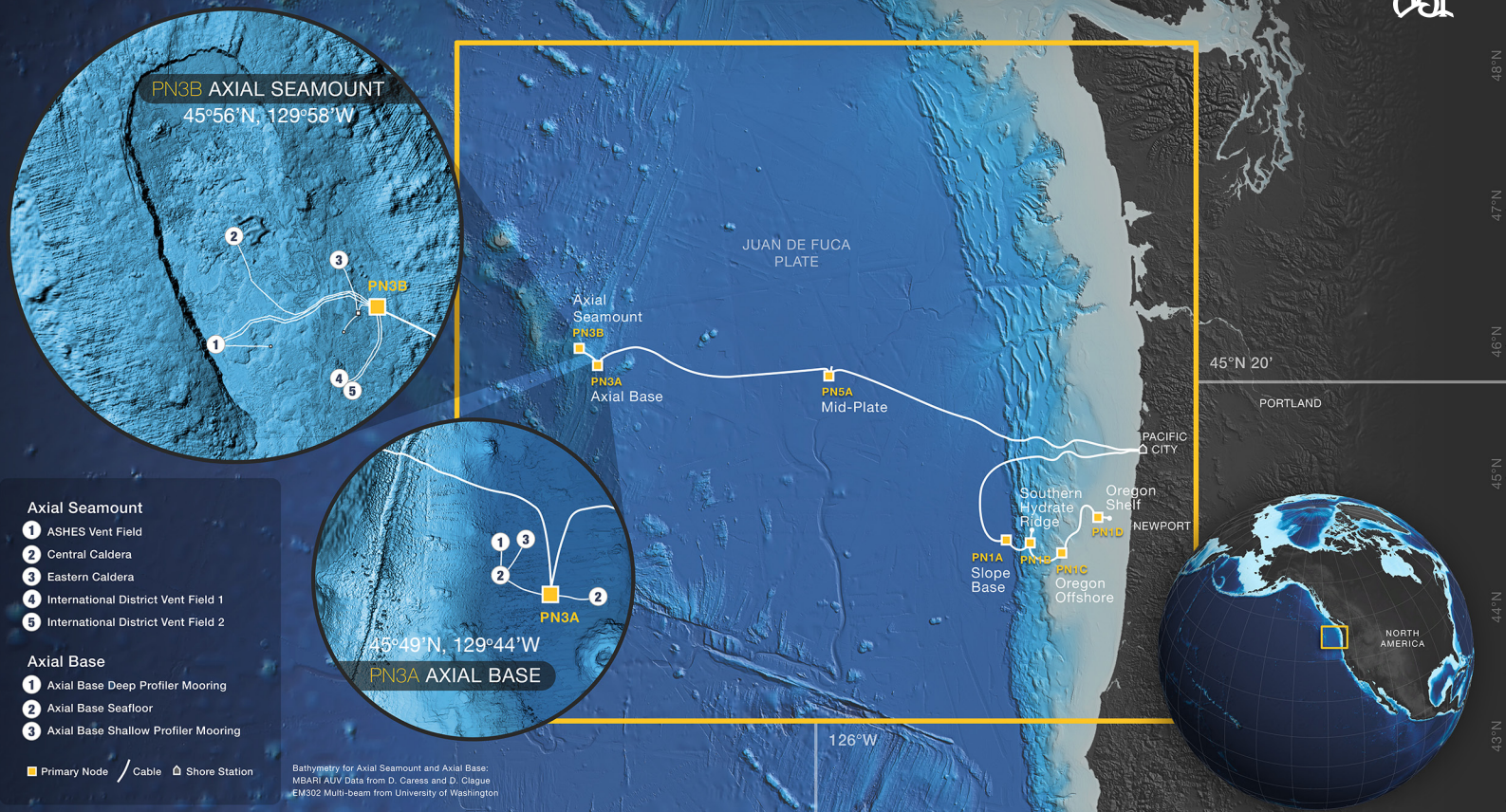


CABLED AXIAL SEAMOUNT ARRAY



Scientific Motivation

The Axial Seamount portion of the Cabled Array focuses on blue water environments >500 km offshore (Axial Base) and the Juan de Fuca mid-ocean ridge spreading center (Axial Caldera). Additional instrumentation has been added to the Cabled Array through NSF PI funding.

Axial Base is in an open-ocean environment that permits collection of data linking ocean dynamics, climate, and ecosystem response from basin to regional scales. Here, large-scale currents (North Pacific/California Currents, and the subpolar gyre) interact, transporting heat, salt, oxygen, biota, and other crucial elements of the region's ecosystem.

Axial Caldera, the summit of the seamount, hosts the most advanced underwater volcanic observatory in the world ocean. Using data from this site, scientists examine formation and alteration of oceanic crust, the relationships between seismic activity, volcanic eruptions, and fluid flow in diffuse and black smoker sites, and how changes in fluid temperature and chemistry impact microbial and macrofaunal communities.

Design

The Cabled Array spans coastal to blue-water environments and includes electro-optical submarine cables that provide high-power, bandwidth, and two-way real-time communication to seafloor and water column instrumentation. Within the Axial Seamount Array, infrastructure is located in the active caldera of Axial Seamount and at its base.

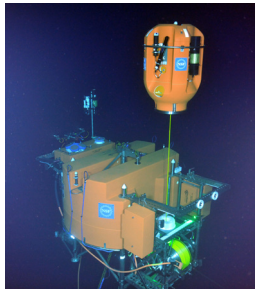
Five Medium-Power Junction Boxes are located on the Axial Caldera site. Several contain geophysical instruments (seismometers, hydrophones) paired with pressure-tilt devices to monitor volcanic inflation and deflation. Hydrothermal vents are examined using an HD camera, a myriad of sensors to examine vent fluid and volatile chemistry (including a mass spectrometer), a microbial DNA sensor, and a 3D thermister array.

At Axial Base, observations are made from the seafloor to near the sea surface using instrumented junction boxes paired with a Cabled Deep Profiler Mooring and a Cabled Shallow Profiler Mooring with an instrumented science pod that rises from 200 m to just below the surface.

All infrastructure is connected to the cable for power, communication and real-time data flow.

The OOI Cabled Array spans the Juan de Fuca Plate in the Northeast Pacific; its observations allow for the in-depth study of volcanic activity, methane seeps, hydrothermal vents, and submarine earthquakes, as well as biological, chemical, and physical processes in the overlying water column.

Cabled Axial Seamount Array Platforms & Instruments



International District Vent Field 1

Instrument	Data Products
Digital Still Camera	Still Image
Particulate DNA Sampler	Microbial DNA
Hydrothermal Vent Fluid In-situ Chemistry	H ⁺ & H ₂ S Concentration, pH, Vent Fluid Temperature
Hydrothermal Vent Fluid Temperature & Resistivity	Chloride Concentration, Oxidation-Reduction Potential, Water Temperature
Hydrothermal Vent Fluid Interactive Sampler	Water Temperature, Vent Fluid Samples for Laboratory Chemical Analysis
Mass Spectrometer	Hydrothermal Vent Volatile Chemistry

International District Vent Field 2

Instrument	Data Products
Seafloor Pressure and Tilt	Bottom Pressure, Uplift & Deflation, Tilt
Short-period Seismometer	Ground Motion
3-D Single Point Velocity Meter	Turbulent Point Water Velocity

Central & Eastern Caldera

Instrument	Data Products
Low Freq. Hydrophone	Acoustic Pressure Waves
Seafloor Pressure and Tilt	Bottom Pressure, Uplift & Deflation, Tilt
Broadband & Short-period Seismometers	Ground Motion

ASHES Vent Field

Instrument	Data Products
HD Video Camera	HD Video
Osmosis-Based Water Sampler	Physical Fluid Samples for Diffuse Fluid Chemistry
Diffuse Vent Fluid 3-D Temperature Array	Diffuse Vent Fluid Temperature
Short-period Seismometers	Ground Motion

Cabled Shallow Profiler Mooring

Instrument	Data Products
CTDs	Salinity, Temperature, Depth, Density
Digital Still Camera	Still Image
Dissolved Oxygen	Dissolved Oxygen Concentration
2- & 3-Wavelength Fluorometers	Chlorophyll, CDOM, Optical Backscatter
Broadband Hydrophone	Acoustic Pressure Waves & Frequency
Spectral Irradiance	Downwelling Irradiance
Nitrate	Nitrate Concentration
PAR	Photosynthetically Active Radiation
Seawater pCO ₂	Partial Pressure of CO ₂
Seawater pH	pH
Spectrophotometer	Optical Absorption & Attenuation
ADCPs	Water Velocity Profile
Single Point Velocity Meter	Mean Point Water Velocity

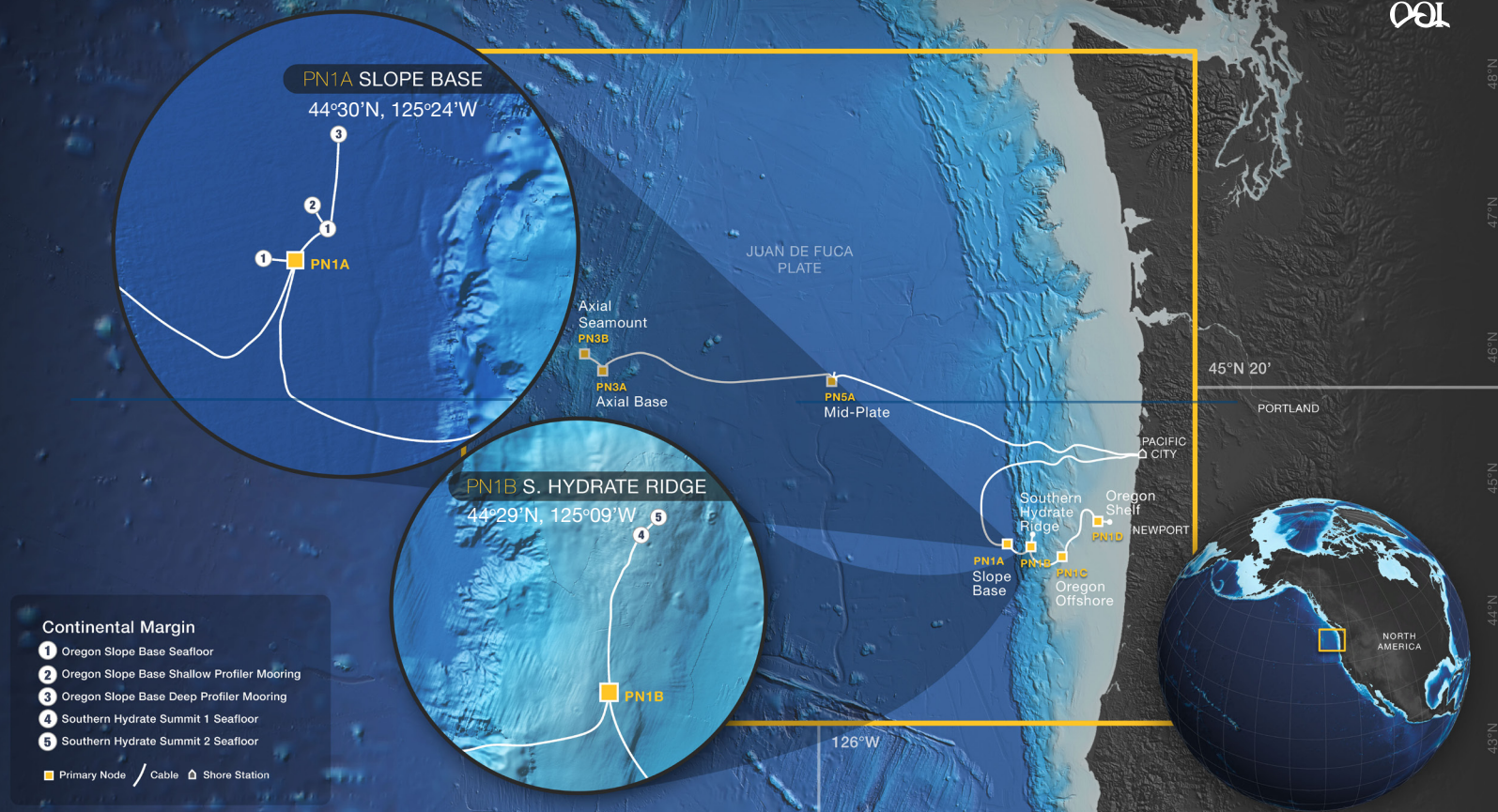
Cabled Deep Profiler Mooring

Instrument	Data Products
CTD	Salinity, Temperature, Depth, Density
Dissolved Oxygen	Dissolved Oxygen Concentration
2-Wavelength & CDOM Fluorometers	Chlorophyll, CDOM, Optical Backscatter
Spectrophotometer	Optical Absorption & Attenuation
3-D Single Point Velocity Meter	Turbulent Point Water Velocity

Axial Base Junction Boxes

Instrument	Data Products
CTD	Salinity, Temperature, Depth, Density
Dissolved Oxygen	Dissolved Oxygen Concentration
Broadband & Low-Freq. Hydrophones	Acoustic Pressure Waves and Frequency
Tidal Seafloor Pressure	Seafloor Pressure
Broadband Seismometer	Ground Motion
Spectrophotometer	Optical Absorption & Attenuation
Horizontal Electric Field, Pressure and Inverted Echo Sounder (HPIES)	Vertically Averaged Horizontal Water Velocity, Water Column Heat Content, Bottom Pressure
ADCP	Water Velocity Profile
3-D Single Point Velocity Meter	Turbulent Point Water Velocity

CABLED CONTINENTAL MARGIN ARRAY



Scientific Motivation

The Continental Margin portion of the Cabled Array focuses on observations of biogeochemical and physical oceanographic processes, coastal ecosystems, and methane seeps west of Newport, Oregon and the Cascadia subduction zone.

Geophysical observations at the Slope Base detect seismic and tsunami events associated with earthquakes along the Cascadia subduction zone and far field. This site also contains seafloor infrastructure and moorings with instrumented profilers designed to observe the deeper portions of the California Current as well as biogeochemical processes in the overlying water column including ocean acidification.

Southern Hydrate Ridge is located in a region of buried deposits of methane hydrates and, more rarely, hydrates exposed on the seafloor. Methane-rich fluids and bubble plumes emitted from these seeps support dense benthic microbial communities and may provide a carbon source for the upper water column. As a potent greenhouse gas, it is also important to quantify methane released into the atmosphere.

Design

The Cabled spans coastal to blue-water environments and includes electro-optical submarine cables that provide high power, bandwidth, and two-way real-time communication to seafloor and water column instrumentation.

Within the Continental Margin Array, infrastructure is located just off the continental slope near the Cascadia subduction zone, on the continental slope at Southern Hydrate Ridge (an area with methane hydrates), and then connects further up the slope to the Endurance Array Oregon Line at the Offshore, and Shelf sites.

Three Junction Boxes are located at the Southern Hydrate Ridge site containing geophysical instruments (seismometers & hydrophones) as well as sensors to image and measure the rising plumes, the flow of fluid into and out of the seafloor, and fluid chemistry. At the Slope Base, observations are made from the seafloor to near the sea surface using a junction boxes hosting geophysical instruments and those focused on water column processes. These are paired with a Cabled Deep Profiler Mooring and a Cabled Shallow Profiler Mooring. All instrumentation is connected to the cable for power and communication. All infrastructure is connected to the cable for power, communication and real-time data flow.

The OOI Cabled Array spans the Juan de Fuca Plate in the Northeast Pacific; its observations allow for the in-depth study of volcanic activity, methane seeps, hydrothermal vents, and submarine earthquakes, as well as biological, chemical, and physical processes in the overlying water column.

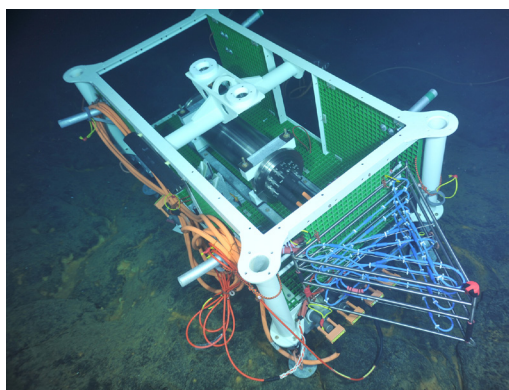
Cabled Continental Margin Array Platforms & Instruments

Southern Hydrate Summit 1

Instrument	Data Products
Low Freq. Hydrophone	Acoustic Pressure Waves
Tidal Seafloor Pressure	Seafloor Pressure
Broadband & Short-period Seismometers	Ground Motion
3-D Single Point Velocity Meter	Turbulent Point Water Velocity

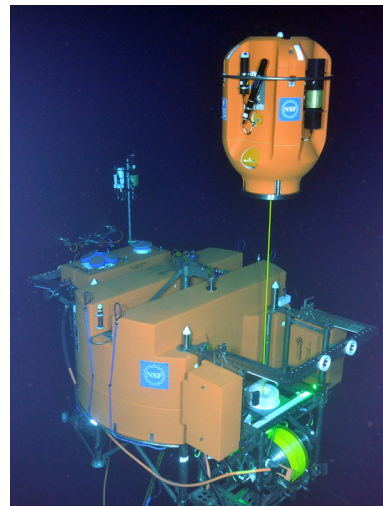
Southern Hydrate Summit 2

Instrument	Data Products
Benthic Fluid Flow	Benthic Flow Rates
Digital Still Camera	Still Image
Osmosis-Based Seep Fluid Sampler	Physical Fluid Sample for Seep Fluid Chemistry
Mass Spectrometer	Methane Seep Volatile Chemistry
ADCP	Water Velocity Profile



Oregon Slope Base Junction Boxes

Instrument	Data Products
CTD	Salinity, Temperature, Depth, Density
Dissolved Oxygen	Dissolved Oxygen Concentration
Broadband & Low Freq. Hydrophones	Acoustic Pressure Waves and Frequency
Tidal Seafloor Pressure	Seafloor Pressure
Broadband Seismometer	Ground Motion
Spectrophotometer	Optical Absorption & Attenuation
Horizontal Electric Field, Pressure and Inverted Echo Sounder (HPIES)	Vertically Averaged Horizontal Water Velocity, Water Column Heat Content, Bottom Pressure
ADCP	Water Velocity Profile
3-D Single Point Velocity Meter	Turbulent Point Water Velocity



Cabled Shallow Profiler Mooring

Instrument	Data Products
CTDs	Salinity, Temperature, Depth, Density
Digital Still Camera	Still Image
Dissolved Oxygen	Dissolved Oxygen Concentration
2- & 3-Wavelength Fluorometers	Chlorophyll, CDOM, Optical Backscatter
Broadband Hydrophone	Acoustic Pressure Waves & Frequency
Spectral Irradiance	Downwelling Irradiance
Nitrate	Nitrate Concentration
PAR	Photosynthetically Active Radiation
Seawater pCO ₂	Partial Pressure of CO ₂
Seawater pH	pH
Spectrophotometer	Optical Absorption & Attenuation
ADCPs	Water Velocity Profile
Single Point Velocity Meter	Mean Point Water Velocity

Cabled Deep Profiler Mooring

Instrument	Data Products
CTD	Salinity, Temperature, Depth, Density
Dissolved Oxygen	Dissolved Oxygen Concentration
2-Wavelength & CDOM Fluorometers	Chlorophyll, CDOM, Optical Backscatter
Spectrophotometer	Optical Absorption & Attenuation
3-D Single Point Velocity Meter	Turbulent Point Water Velocity