

IODP Proposal Cover Sheet

Northwest Atlantic Cenozoic

851 - Pre

Title	Cenozoic Evolution of the North Atlanticthe Western Atlantic Latitudinal Transect.		
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Abstract

We propose a latitudinal transect of 4 sites from 32°N to 52°N in the western North Atlantic to study the Cenozoic evolution of the North Atlantic subtropical and subpolar Gyres. We will splice continuous records from multiple holes at each site to form Milankovitch-resolving sediment records. We will focus on the pre-5 Ma record to at least the Middle Eocene climate Optimum (MECO). Sampling sediments older than MECO depends on whether chert layers are encountered. Objectives are to understand how the North Atlantic has responded to Eocene warmth and to cooling at the Eocene-Oligocene boundary. We will study how Miocene closure of both the Tethys and Central American Seaways affected circulation in the North Atlantic, and how changing tectonics and greenhouse gas levels affected the initiation and development of North Atlantic Deep Water (NADW). We will also evaluate how changes in deep circulation in the North Atlantic have affected sediment carbonate storage and the global carbon cycle.

The records will enable researchers to discern the impact of orbital solar insolation fluctuations upon initiation of major climate changes and how the sensitivity to orbital forcing changes under different climate states. The studies on the sediment material will reveal how elevated greenhouse gas levels and tectonics affect the feedbacks of the North Atlantic to the global climate system. An ancillary objective is to better intercalibrate the paleomagnetic time scale, biostratigraphy, and regional North Atlantic climate events. Drillsites will also provide sediments for continued reconnaissance of porewater geochemistry and deep biosphere microbial diversity.

Sea surface temperature gradients and other surface water properties will be monitored along 32°N to 52°N transect through time. Benthic records from the sites will monitor access by Antarctic-derived bottom waters versus NADW and will document the initiation of northern source water flow. Stable carbon and oxygen time series, as well as other tracer records, will be used to evaluate water exchange and sources. The sites are located on the western edge of the Mid-Atlantic Ridge above the level of turbidite deposition and will avoid erosional intervals found under high current regimes along the North American margin. Coupled with drilling at the Newfoundland margin, it should be possible to determine both the timing and strength of NADW production through time.

Scientific Objectives

Specific objectives for drilling are:

1. Resolve changes in North Atlantic climate at orbital-scale to determine climate sensitivity under different global climates, to improve age models, and to determine the interaction between orbitally-driven solar insolation variability and longer term climate change.
2. Make a record of the evolution of North Atlantic SST, nutrient, and productivity gradients over Paleogene and Neogene
3. Identify the change in SST gradient as NADW formation occurs
4. Identify when NADW formation occurs by changes in bottom water temperature, stable isotope, tracer concentrations, and nutrient concentrations.
5. Identify changes in carbonate preservation and carbon cycle through Paleogene and Neogene resulting from changes in Antarctic Bottom Water penetration to compare with the Pacific carbonate record.
6. Identify effects of the closing of Central American and Tethys Seaways upon SST, nutrients, and deepwater gradients.
7. Intercalibration of paleomagnetic and biostratigraphic time scales.
8. Identification of sedimentation events in the North Atlantic
9. Reconnaissance of microbial diversity in the pelagic North Atlantic sediment column.

Non-standard measurements technology needed to achieve the proposed scientific objectives.

none

Proposed Sites

Site Name	Position (Lat, Lon)	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
WATL-5A	53.148, -41.537	3456	691	1	692	Alternate to WATL-4A; Cenozoic evolution of surface and deep water properties in the subarctic North Atlantic; continuous sediment section
WATL-4A	51.971, -40.003	2805	614	1	615	Cenozoic evolution of surface and deep waters in North Atlantic subarctic gyre; continuous sediment record
WATL-3A	43.721, -37.342	3946	609	1	610	Cenozoic evolution of surface and deep water properties near boundary of Atlantic subarctic and subtropical gyres; continuous sediment record
WATL-2A	38.286, -38.374	3903	590	1	591	Site 2 in latitudinal transect; Cenozoic surface and deep water evolution near north boundary of Atlantic subtropical gyre; continuous sediment record
WATL-1A	33.867, -48.904	4736	515	1	516	subtropical gyre site for latitudinal transect--Cenozoic evolution of surface and deep water, continuous sediment record.