IODP Proposal Cover Sheet

004 - Pre-LEAP

N. Atlantic Stratigraphic Integration

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Title	SIGNALS: Stratigraphic InteGration of North Atlantic Legacy Sites
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Keywords	lateMiocene-Quaternary paleoclimate
Area	North Atlantic

Proponent Information

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Abstract

The North Atlantic is one of the most climatically variable and sensitive regions in the oceans as it is prone to mode jumps in the Atlantic Meridional Ocean Circulation (AMOC). Its proximity to the North American, Greenland, and European ice sheets make it particularly susceptible to ice discharge and associated freshwater forcing. On millennial timescales, the North Atlantic experiences abrupt climate change with global implications, while on orbital time scales, variations in surface heat transport and the depth of penetration of North Atlantic Deep Water play a fundamental role in northern hemisphere ice sheet stability and in ocean-atmosphere exchanges of CO2 in the late Pliocene and Pleistocene.

ODP/IODP expeditions to the North Atlantic recovered continuous, high-resolution sequences in many locations to study the variability of the climate system during the late Miocene–Quaternary. The array of cores from these North Atlantic legacy sites provides a particularly favorable target for stratigraphic and paleoclimatic integration and synthesis. Advantages include good spatial and depth coverage, generally good carbonate preservation, and proximity to ice core and speleothem records of climate change in the northern hemisphere. Many of the legacy sites have been studied individually but few have been correlated and integrated across the entire North Atlantic.

We propose such a targeted effort with a legacy project called SIGNALS: Stratigraphic InteGration of North Atlantic Legacy Sites. SIGNALS will complete proxy data sets and integrate North Atlantic ODP/IODP legacy sites into a common chronostratigraphic framework. The overall goal is to correlate proxy data across the North Atlantic at both orbital and sub-Milankovitch time scales and compare these signals with other records from across the globe.

We will promote the application of new automated signal correlation methods and machine learning algorithms and incorporate them into user-friendly software packages, which will be used to train a new generation of early career scientists in modern stratigraphy and paleoclimatology. Existing composite sections will be reviewed and assessed and new composite sections for integrated stratigraphy will be constructed by XRF scanning. Climate variability will be placed in a robust orbitally-tuned framework for the last ~6 Ma.

The SIGNALS proponents bring expertise in stratigraphic alignment, the study of millennial and orbital-scale climate change, stable isotope stratigraphy, sediment radio-isotope tracers, paleoecology and sediment provenance. Unified stratigraphic control developed in this project will provide the basis for new proxy data generation and synthesis by members of the scientific ocean drilling community.

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Scientific Objectives

SIGNALS will construct a robust 4-dimensional stratigraphic framework for the evaluation of proxy data of surface and deep ocean properties, arrayed spatially in the North Atlantic to capture major features of changes in circulation, heat and carbon transport, and ecological assemblages, with the axis of time as the 4th dimension. We will integrate these into addressing long-standing questions in paleoclimate:

- how did the earth move from the warmer late Miocene into the Pleistocene world of large ice age cycles?
- did the resumption of Mediterranean Outflow Water at the Miocene/Pliocene boundary affect heat transport and deep-water formation in the North Atlantic?
- how does global temperature and ice volume influence millennial climate variability as seen in marine records?
- Do changes in orbital forcing and glacial boundary conditions affect the character of millennial climate variability (MCV) and, in turn, how does MCV interact with orbital geometry?
- What was the role of the North Atlantic in triggering or amplifying these climatic changes?

To answer these questions, SIGNALS will develop an accurate, consistent stratigraphic framework across North Atlantic legacy sites. Existing composite sections will be reviewed and assessed and new composite sections for integrated stratigraphy will be constructed by XRF scanning. New approaches to stratigraphic alignment and orbital tuning challenge will be developed and tested . Working groups will utilize the stratigraphic framework to conduct new proxy investigations to target the questions posed above. The unified stratigraphic control will provide the basis for new proxy data generation and synthesis by members of the SIGNALS project.

Have you contacted appropriate IODP Curator(s) to discuss sampling needs and core facility access

yes