IODP³ Expedition 506S – SIGNALS: Stratigraphic Integration of North Atlantic Legacy Sites

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Abstract

The North Atlantic plays a crucial role in regulating global climate due to its proximity to major ice sheets and sensitivity to changes in the Atlantic Meridional Overturning Circulation (AMOC). Over millennial and orbital timescales, the region has experienced abrupt climate shifts with significant global implications. Despite the wealth of sediment cores recovered from North Atlantic legacy sites through IODP and predecessor programs, many remain underutilized due to challenges in stratigraphic correlation and integration. The SIGNALS (Stratigraphic InteGration of North Atlantic Legacy Sites) project aims to synthesize and integrate these legacy records into a coherent, four-dimensional stratigraphic framework to provide a regional reconstruction of past climate variability on millennial to orbital timescales since the late Miocene.

SIGNALS will enhance stratigraphic correlation, refine age models, and synchronize proxy datasets for multiple legacy sites across the North Atlantic spanning a wide range of climatic and bathymetric gradients. The project will capitalize on advanced methods, including machine learning and signal correlation algorithms, to rapidly produce high-resolution data by automated processing of core images, point counting, and precise stratigraphic correlation. The SIGNALS Expedition Science Team will work collaboratively to produce training datasets to refine AI models, stratigraphic correlation methods, and age models.

SIGNALS will address methodological issues associated with estimating uncertainty in stratigraphic correlations and the limits of temporal resolution at each site given varying sedimentation rates, bioturbation, and sampling frequency. Furthermore, we will develop process models to understand how orbitally-driven climatic changes are expressed as cycles in the stratigraphic record of each site. By analyzing high-resolution geochemical and sedimentological proxies in a robust stratigraphic framework, the project will reconstruct climate evolution and ocean circulation changes across the North Atlantic since the late Miocene. The project will focus on major climatic transitions and provide robust regional paleoclimate data for numerical modeling and assimilation studies.

Beyond research advancements, SIGNALS will foster collaboration by developing user-friendly computational tools, training early-career researchers, and making data publicly accessible through open repositories. The project will contribute to other programs, such as PAGES PMIP, CVAS, TIMES, Beyond-EPICA Oldest Ice, by providing robust paleoclimatic information for assimilation and comparison. SIGNALS aligns with key objectives of the IODP 2050 Science Framework, including: Earth's Climate System, Feedbacks in the Earth System, Tipping Points in Earth History, and Global Cycles of Energy and Matter. Additionally, it addresses the themes of Technology Development and Big Data Analytics through machine learning applications and automated data collection.

To help the IODP³ Science Office provide the best possible support to scientists interested in joining this expedition, we invite potential applicants to complete our **Expression of Interest (EoI)** form.

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Submission of an expression of interest is entirely optional and does not commit you to applying. Likewise, not submitting an EoI will not affect the evaluation of any future application.

However, we strongly encourage completion — it takes **less than two minutes** and will help us support you more effectively if you decide to apply.