IODP Proposal Cover Sheet

909 - Pre

NW Greenland Glaciated Margin

Received for: 2016-10-03

Title	Evolution of the Baffin Bay–West Greenland glaciated margin: Interplay between ice sheet, oceanic, atmospheric and tectonic processes
Proponents	Paul Knutz, Anne de Vernal, Anne Jennings, Mads Huuse, John Hopper, David Mosher, Calvin Campbell
Keywords	Greenland Ice Sheet, Cenozoic, interglacials
Area	Baffin Bay

Proponent Information

Proponent	Paul Knutz
Affiliation	Geological survey of Denmark and Greenland
Country	Denmark

☑ Permission is granted to post the coversheet/site table on www.iodp.org

Abstract

Understanding the evolution of the Greenland Ice Sheet (GIS) holds the key to the origin of Northern Hemisphere glaciation, and possibly the mechanisms of the gradual amplification of glacial cycles since the late Pliocene. To address current knowledge gaps in the evolution and variability of the GIS and its role in Earths climate system we propose to drill along a transect crossing the northwest Greenland margin toward Baffin Bay. The mission strategy is to retrieve a composite stratigraphic succession along this transect representing the Late Cenozoic era from late Oligocene to Holocene. The proposed drill sites will specifically target high-accumulation-rate deposits associated with contourite drifts and potential interglacial deposits within a trough-mouth-fan system that is superbly covered by seismic data. The detailed information obtained from these paleoclimate archives will be of great value for predictive models addressing how the Greenland Ice Sheet may respond to global warming in the near future. The overall aim is to investigate the full range of forcing and feedbacks - oceanic, atmospheric, orbital, tectonic –that influence the GIS over a range of time scales, as well as conditions prevailing at the time of glacial inception and deglacial to interglacial periods. The scientific objectives of this proposal are of key significance in addressing the challenges "How do ice sheets and sea level respond to a warming climate?"and "How does Earth's climate system respond to elevated levels of atmospheric CO2?"under the Climate and Ocean Change theme of the IODP science plan.

909 - Pre

Scientific Objectives

1. When was glacial inception in North West Greenland and how has the GIS fluctuated at orbital timescales?
Obtaining a long composite sedimentary succession targeting high-accumulation-rate intervals and important seismic marker horizons across the margin will form the basis for piecing together the history and dynamic range of the northern Greenland Ice Sheet.

2. What factors controlled the warm Arctic climates prior to intensification of Northern Hemisphere glaciations and were GIS dynamics responsive to changes in pCO2?
This objective will be addressed by recovery of high-resolution records from Late Cenozoic sedimentary drifts and hemipelagic deposits likely capturing ‘warmer-than-present’ intervals, e.g. of Pliocene, middle Miocene and Oligocene age. These sediments will shed new light on the local (Baffin Bay) and global environmental conditions prior to the shelfward expansion of the GIS.

3. What is the role of the GIS in interglacial and interstadial climate variability and what were the consequences for global sea-levels?
By recovering interglacial deposits from the late and middle Pleistocene epochs we intend to gain new insights into the millennial-scale behavior of the northern GIS during deglacial and interglacial periods of extreme climate perturbations.

4. Elucidate climate-tectonic relationships during evolutionary phases of the NW GIS.
By constraining the ages and changes in depositional conditions associated with regional unconformities the proposed sites can shed light on the role of tectonic forcing and ice-tectonic interactions in the Late Cenozoic climate evolution.

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

909 - Pre

Proposed Sites (Total proposed sites: 7; pri: 7; alt: 0; N/S: 0)

Site Name	Position (Lat, Lon)	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
MB-1A (Primary)	73.0079 -63.1074	1850	430	0	430	Recover a high-resolution paleoceanographic record of a middle-late Pleistocene sediment drift system corresponding to the most recent part of the trough-mouth-fan history
MB-2A (Primary)	73.1229 -63.7638	1940	475	0	475	Recover a high-resolution paleoceanographic record of a middle-late Pleistocene sediment drift system corresponding to the most recent part of the trough-mouth-fan history
MB-3A (Primary)	73.5315 -62.3170	515	370	0	370	Recover deglacial and interglacial intervals potentially of middle Pleistocene age within top-set strata of the trough-mouth fan
MB-4A (Primary)	73.7839 -61.9155	603	260	0	260	Recover deglacial and interglacial intervals potentially of middle-early Pleistocene age within top-set strata of the trough-mouth fan
MB-5A (Primary)	74.2152 -61.1995	670	370	0	370	(1) Capture progradational deposits that may correspond to the earliest shelf-based glaciations in NW Greenland; (2) Recover a composite succession of a Neogene contourite drift that can elucidate paleoceanographic conditions prior to major Greenland Ice Sheet expansions
MB-6A (Primary)	74.1210 -60.8978	620	530	0	530	Recover a composite succession of Neogene contourite sediments that can elucidate paleoceanographic conditions prior to major Greenland Ice Sheet expansions
MB-7A (Primary)	74.5136 -60.6792	730	1210	0	1210	To recover an upper Miocene drift interval and penetrate the Middle Miocene transition with the ultimate target of reaching early Oligocene deposits. The primary scope is to elucidate past warm climates in Baffin Bay/Greenland and the response of Greenland glaciers at climate transitions.