

# iSAS/IODP Proposal Cover Sheet

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Title:	Paleoceanographic and Tectonic Evolution of the Central Arctic Ocean		
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Keywords: (5 or less)	Arctic Ocean, Paleoceanography, Tectonics, Lomonosov Ridge	Area:	Lomonosov Ridge

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Permission to post abstract on iSAS Web site: ☐ Yes

Abstract: (400 words or less)

Five sites are proposed to be drilled on the ridge crest of the Lomonosov Ridge in the central Arctic Ocean. The sites are distributed between 88°N and 81°N in water depths ranging between 800 and 1415 m, and are all located in international waters. The ridge was rifted from the Kara/Barents Sea shelves during early Paleogene time and subsequently subsided to its present water depth. Since that time sediments of biogenic, eolian and ice-rafted origin have accumulated on the ridge crest. In our primary target area between 87°N and 88°N these sediments are about 450 m thick, indicating an average rate of sedimentation of ~10 m/m.y. throughout the course of the Cenozoic. Sampling of these sediments would provide an unprecedented and unique opportunity to acquire a first-order knowledge about the paleoceanographic history of the central Arctic Ocean. Sampling of the underlying bedrock provides a similarly unique opportunity to decipher the tectonic history of the Lomonosov Ridge and the formation of the Eurasian Basin.

The proposed program epitomizes both the spirit and the science of the new Integrated Ocean Drilling Program, calling upon the creative use of mission specific platforms and directly addressing a number of the key scientific questions raised in the IODP Initial Science Plan.

Amongst scientific issues relating to "Environmental Change, Processes and Effects" are:

- the long-term (50 Ma) climate history of the central Arctic Ocean, and its role in Earth's transition from one extreme (Paleogene greenhouse lacking glaciation) to another (Neogene icehouse with bipolar glaciation)
- the shorter-term (Neogene) climate history, connecting the Neogene history of the Arctic Ocean to that of the North Atlantic Ocean at sub-millennial scale resolution
- Scientific issues relating to "Solid Earth Cycles and Geodynamics" are:
- the composition and origin of the pre-Cenozoic bedrock underlying the sediment drape
- the rifting and subsidence history of the Lomonosov Ridge

Five sites distributed over six degrees of latitude are proposed, partly with overlapping goals, which will make the drilling expedition less vulnerable to severe local ice conditions. The major goals of this proposal can be achieved by completing one site to 450 mbsf. Should ice conditions at this site be prohibited, a suite of sites from other areas along the Lomonosov Ridge corridor can be drilled to achieve the proposed science.

### Scientific Objectives: (250 words or less)

There are two major objectives: understanding the paleoceanographic history and the tectonic evolution of the central Arctic Ocean. The history of Arctic paleoceanography is so poorly known that we can look at the recovery of any material as a true exploration that will, by definition, increase our knowledge and understanding of this critical region. Specific paleoceanographic objectives are to:

- understand the history of ice rafting;
- study local versus regional ice-sheet development
- determine the density structure of Arctic Ocean surface waters, the nature of North Atlantic conveyor and onset of Northern Hemisphere glaciation
- determine the timing and consequences of the opening of the Bering Strait
- study the land-sea links and the response of Arctic to Pliocene warm events
- investigate the development of deep Fram Strait and deep water exchange between Arctic and GIN seas/world ocean
- determine the history of biogenic sedimentation.

The tectonic objectives are focused on Ridge evolution. If proven to be a continental fragment, it represents truly unique global information on the relative strength of continental and oceanic lithosphere. Specific tectonic objectives for drilling on the Lomonosov Ridge are:

- to investigate the nature and origin of the Lomonosov Ridge by sampling the oldest rocks below the regional unconformity in order to establish the pre-Cenozoic environmental setting of the ridge
- to study the history of rifting and the timing of tectonic events that affected the ridge.

### Proposed Sites:

Site Name	Position	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
Primary LORI-013A	87 39.45N, 144 37.80E	1070	450	30	480	paleoceanography & tectonic
LORI-06A	81 28.54, 140 50.71	802	400	0	400	paleoceanography (Neogene)
LORI-04A	85 23.28, 150 20.62	794	90	110	200	tectonic
LORI-05A	83 58.90, 147 25.02	982	400	0	400	paleoceanographic
LORI-10A	86 24.89, 147 15.56	1132	400	0	400	paleoceanographic
Alternate LORI-08A	87 53.99, 138 38.60	1124	450	0	450	paleoceanographic
LORI-14A	87 37.55, 147 14.65	1415	90	110	200	tectonic
LORI-12A	82 04.30, 142 02.58	1392	400	0	400	paleoceanographic (Neogene)