Mapping in the Arctic Ocean in Support of a Potential U.S. Extended Continental Shelf

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Potential U.S. ECS in the Arctic
THE CONVENTION ON THE LAW OF THE SEA
ARTICLE 76 of UNCLOS

Six hundred and seventeen words that redefine the "continental shelf" of a coastal state and provide a mechanism for the state to extend its sovereign rights over the resources of the "seabed and subsoil" of the continental shelf.
To establish an extended continental shelf a coastal state must demonstrate that region is “natural prolongation” of continental landmass - limits are then determined by

- depth and shape of the seafloor (FOS and 2500m contour)
- the thickness of the underlying sediments (1% line)
- distances from the territorial sea baselines (350 nm line)

Need to map the seafloor
**Formulae Lines:**

- **Foot of Slope + 60 nmi** - bathy
- **Gardiner line** - sediment thickness less than 1% of distance back to FOS - seismic and bathy

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Determining the Outer Limit of the Continental Shelf
Cutoff Lines:

- **2500 m contour + 100 nmi** - **bathy**
- **350 nmi from baseline** - **distance**
UNH CCOM-JHC U.S. Law-of-the-Sea Bathymetric Mapping to Date

- Gulf of Alaska: 2005
- Gulf of Mexico: 2007
- Kingman Reef, Palmyra Atoll: Soon

> 1,060,000 km²
Arctic is unique as an ocean basin in that >52% is made up of shelf (geologic)
Five nations having potential extended shelves

From Ron McNab
5.10B. Bathymetry from IBCAO in detailed area ARC, drawn bathymetric profiles, and possible locations of the FOS. Labeled profile is shown in figure 5.11. Note that the orange line, which represents the 2500 m + 100 nm, makes use of the 2500 m contour of the Alpha-Mendelev Ridge as well as the Canadian shelf.
Chukchi Region and Barrow Margin

Chukchi plateau

Barrow margin

2003 & 2004
2007 & 2008
Arctic - Chukchi Plateau mapping
USCGC Healy

Seabeam 2112 - 12 kHz, 121-2° receive beams
bathymetry & acoustic backscatter
Knudsen 320BR 3.5-kHz chirp profiler

UNH: bathymetry, backscatter & 3.5-kHz processing at sea
Arctic Mapping

cruise statistics

operations.......................... 65 days
transits.............................. 24 days

average speed (in ice)........... 4 kts

average sea-ice state............. 9/10

tracklines......................... ~24,300 km

Area mapped...................... ~135,000 km²
Healy 03-02
~3000 km of multibeam sonar bathymetry
1-11 Sept 03
8/10 ice
typical ice conditions
2003
8/10 “cheesy” ice
Redefinition of the 2500 m contour
Healy Seamount
looking S, ve=6x

3100 m high, summit at 900 m water depth
45 km long x 15 km wide
Healy Seamount Survey
HEALY 2004 - Plan
Radarsat ice coverage for 10 October 2004. Image processed at either ASF, Qinetic or CDPF. © CSA2004
How do we map in this?

Photo from M. Jakobsson
HEALY 04-05 TRACK
6-26 Oct. 2004
6700 line km
“Ratchet Surveying”
“Pirouette Surveying”
Barrow margin looking SE, ve=10x

mapped 2500-m isobath

ridges <300 m high, ~100 km long

erosion

2500 m
HEALY 07-03
Plan

Depart Barrow:
17 Aug. 07
Return Barrow
15 Sept. 07
mapping the 2500-m isobath & foot of the slope
perspective view looking SW

Healy 03-02, 04-05, 07-03

2007 results

Where we thought FOS was

Where we now think it is
Where we thought Foot of Slope was

Where we now believe it is
Pt Barrow

Arctic surveys

scours & bedforms

Barrow margin

Pt Barrow

0 500 km
λ = ~2 km
H = ~10 m

3 to 5 m deep

ice grooves

central Chukchi Plateau

-380 m

-470 m

bedforms

λ = ~2 km
H = ~10 m
central Chukchi Plateau pockmarks

200-m diameter
20-m deep

VE = 10x
looking SW
HEALY 0806 and LOUIS St. LAURENT WORK
www.ccom.unh.edu

Center for Coastal & Ocean Mapping
Joint Hydrographic Center


ALSO available through NGDC and LDEO GeoMapApp

Today at CCOM is: Tuesday - January 10, 2006

The documentary of the Sumatra Earthquake and Tsunami Offshore Survey (SEATOS 2005) will be on the Discovery channel 1/12 and 1/23/06.


As Polar Ice Turns to Water, Dreams of Treasure Abound - 10/10/05 N.Y. Times

Lost City Expedition - to study the hydrothermal vent field, located in the middle of the Atlantic. July 2003.

The Center for Coastal and Ocean Mapping (CCOM) Joint Hydrographic Center (JHC) is a recently established University of New Hampshire program aimed at creating a national center for expertise in ocean mapping and hydrographic sciences. Guided by a Memorandum of Understanding with the National Oceanic and Atmospheric Administration (NOAA), the JHC operates in partnership with NOAA's National Ocean Service. The C-COM is a University center that expands the scope of interaction and cooperation with the private sector, other government agencies and universities. In addition to NOAA support, C-COM currently has projects underway funded by the US Geological Survey, the Office of Naval Research, the Naval Research Lab, DARPA, NSF and several private sector partners. The centers focus their activities on two major tasks, an educational task, aimed at creating a learning center that will promote and foster the education of a new generation of hydrographers and ocean mapping scientists, and a research task aimed at developing and evaluating a wide range of state-of-the-art hydrographic and ocean mapping technologies and applications.

The Center's graduate degree program in ocean mapping has been awarded Category A Recognition by the International Federation of Surveys/International Hydrographic Organization/International.
~6% of the Arctic Ocean has been mapped with multibeam. There is much much more to discover!!!