

ARCTIC BASIN CHARACTERIZATION FOR UNITED NATIONS CONVENTION ON THE LAW OF THE SEA



Kyle Schultz and Dr. Leslie Sautter
Dept. of Geology and Environmental Geosciences
College of Charleston, Charleston, SC USA

Abstract

Bathymetric surveys were conducted by the University of New Hampshire in to visualize the seafloor of the Arctic Basin. The purpose of analyzing these data is to characterize the bathymetry to facilitate an accurate resolution for the UN Convention of the Law of the Sea (UNCLOS). Bathymetry can be used to reveal sections of ridge systems and other features on the seafloor to determine the continental margin to which sections of the basin belong. These decisions are crucial to identify the extent of Economic Exclusive Zones. The depth of the seafloor in this study area ranges from 1800 to 4000 meters. The shallower portion lies on the border of where a number of previous surveys have been conducted. This shallow region gradually deepens into a broad relatively flat area that contains a channel-like feature with a relief of 20 to 50 meters, and is the primary area of interest.

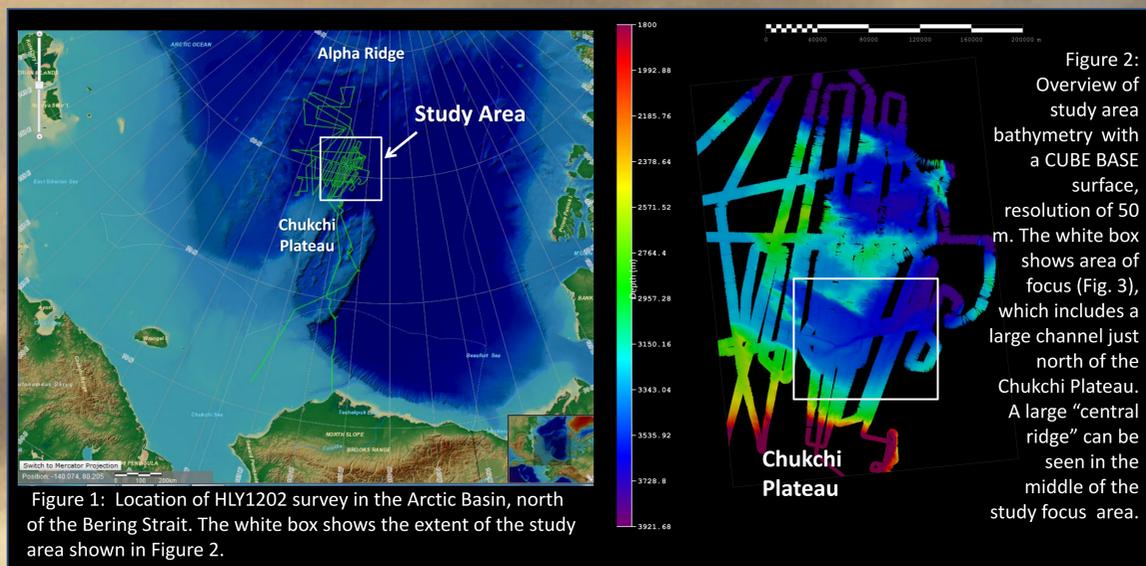


Figure 1: Location of HLY1202 survey in the Arctic Basin, north of the Bering Strait. The white box shows the extent of the study area shown in Figure 2.

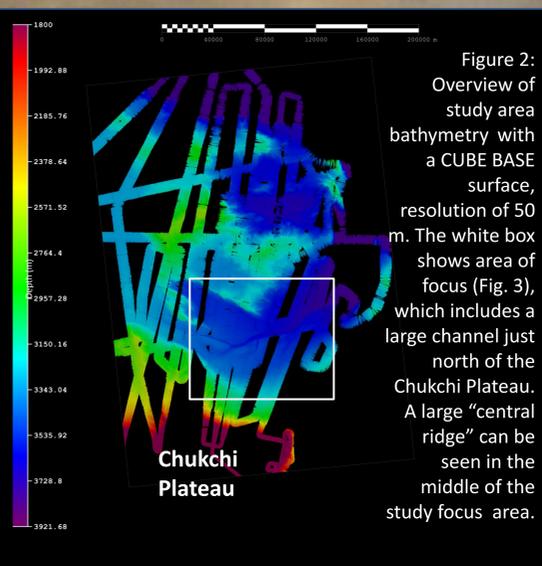


Figure 2: Overview of study area bathymetry with a CUBE BASE surface, resolution of 50 m. The white box shows area of focus (Fig. 3), which includes a large channel just north of the Chukchi Plateau. A large "central ridge" can be seen in the middle of the study focus area.

Results

- Wave features were observed (Fig. 5), located near the southeastern section of the study area bordering Chukchi Plateau. These were previously identified as mud waves (Darby 2005).
- Mud waves have a wavelength of approximately 500 m and a height of 15 m (Fig. 4).
- A large channel feature can be seen in the center of a large relatively flat area between Chukchi Plateau and the unnamed referred to here as the "central ridge system" (Figs.7, 8, 9).
- Vertical relief within the channel ranges from 20 to 50 m.
- A mostly flat, deep area to the north occurs near the border of Alpha Ridge at the northern extent of the study area (Fig. 2). Some higher areas can be observed to the northwest of the study area near Alpha Ridge.

Introduction

Data were collected by scientists from the University of New Hampshire aboard the *USCGC Healy* in a 2012 NOAA funded survey of the Arctic Basin. The study area is roughly 330 km in length and around 220 km across, and is located from 78.67° N, 161.52°W to 81.62° N, 159.45° W in the Arctic Circle. This area is just north of the Chukchi Plateau, shown on Figure 1. The scientific focus of this analysis is to characterize the bathymetry of the study area, primarily the channel-like feature it contains. The 2005 *Healy-Oden* Trans-Arctic Expedition (HOTRAX 05) discovered large mud waves near the Alpha Ridge in the northern portion of the 2012 survey. These features could be of interest if similar features are found in the study area. The current International Bathymetric Chart of the Arctic Ocean (IBCAO) has updated information from 1999 and uses a 2 x 2 km grid spacing (Jakobsson et al., 2008). Converting that grid spacing to resolution (R), where $R = 2.83 \times \text{grid spacing}$, results in a 5.66 km resolution as the standard for IBCAO charts, while the surfaces presented in this study are at a 50 m resolution giving significant improvement in visualizing features.

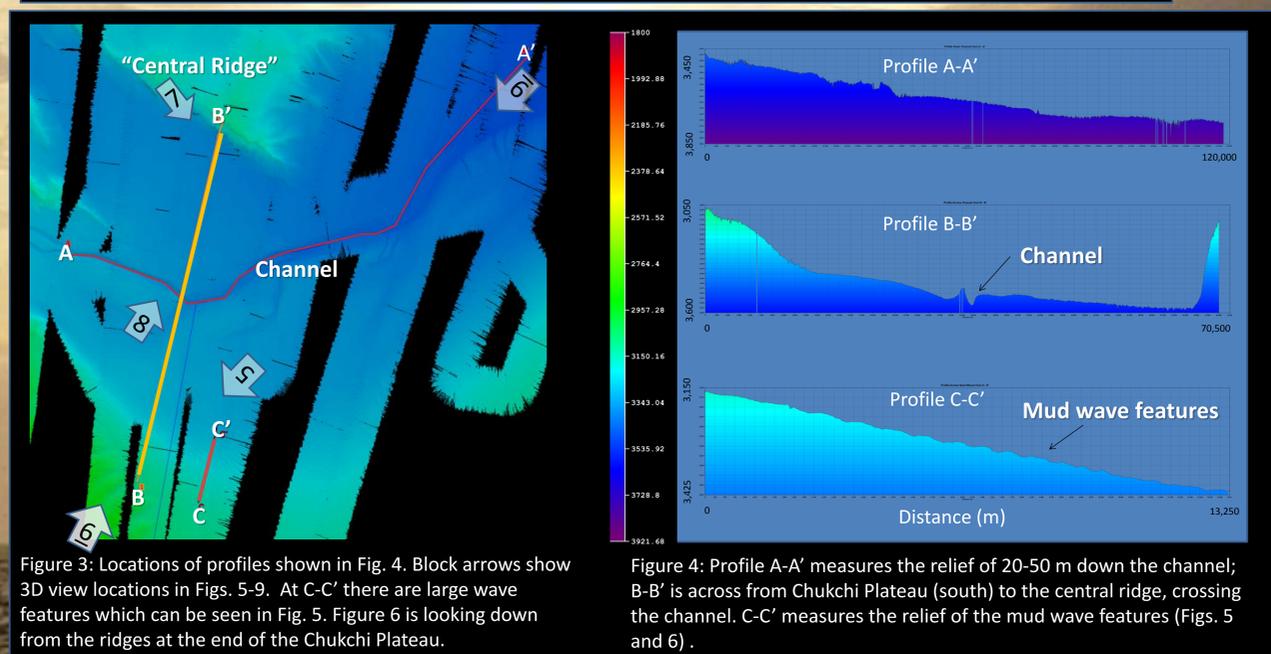


Figure 3: Locations of profiles shown in Fig. 4. Block arrows show 3D view locations in Figs. 5-9. At C-C' there are large wave features which can be seen in Fig. 5. Figure 6 is looking down from the ridges at the end of the Chukchi Plateau.

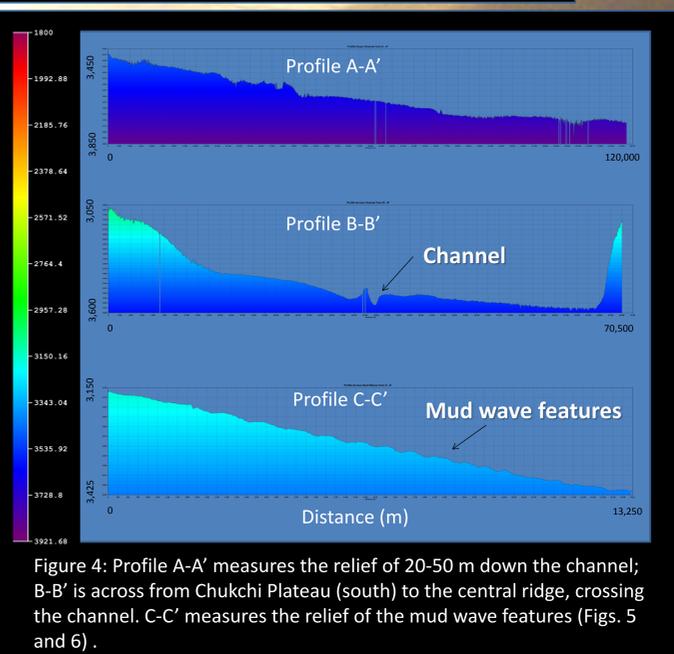


Figure 4: Profile A-A' measures the relief of 20-50 m down the channel; B-B' is across from Chukchi Plateau (south) to the central ridge, crossing the channel. C-C' measures the relief of the mud wave features (Figs. 5 and 6).

Discussion & Conclusions

- The buildup of sediment in the form of waves at the base of the rise extending from the Chukchi Plateau would imply additional sedimentation and could be the basis of extending the claim of the Economic Exclusive Zone (EEZ) according to UNCLOS article 76 (UNCLOS, 2013).
- Mud wave features found in the 2012 study area indicate related bottom currents (Darby, 2005).
- The channel is likely to be a mechanism for transporting sediment in turbidity flows. Areas of higher relief in the profile indicate possible deposition.
- The next step in exploring this area for its consideration in the UNCLOS would be to take sediment samples at the wave features near the base of Chukchi Plateau to determine the composition of the wave features and the percentage of sedimentary rock present in order to determine if it is significant for an extension of the EEZ of whichever nation owns it.

Methods

- The Coast Guard cutter *USCGC Healy* is the vessel which was used to collect the data with a Kongsberg EM-122 sonar.
- Data downloaded from NOAA NGDC website
- Cruise HLY 1202
- CARIS HIPS 8.1 used for post-processing
- Measurements of relief and profile were made for supplementing visual information.

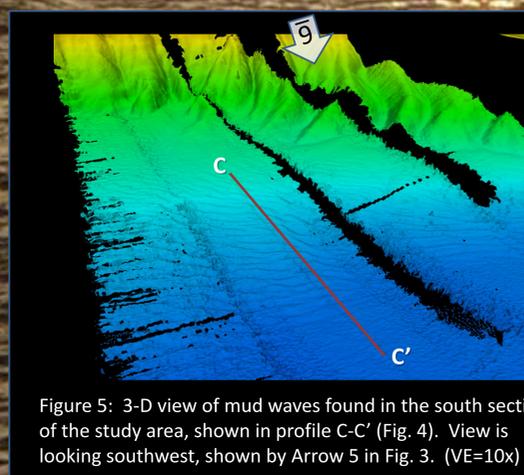


Figure 5: 3-D view of mud waves found in the south section of the study area, shown in profile C-C' (Fig. 4). View is looking southwest, shown by Arrow 5 in Fig. 3. (VE=10x)

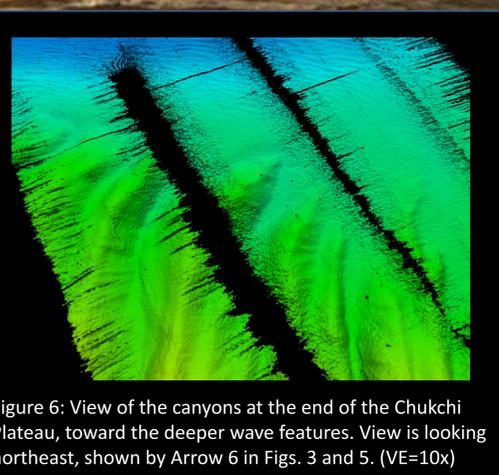


Figure 6: View of the canyons at the end of the Chukchi Plateau, toward the deeper wave features. View is looking northeast, shown by Arrow 6 in Figs. 3 and 5. (VE=10x)



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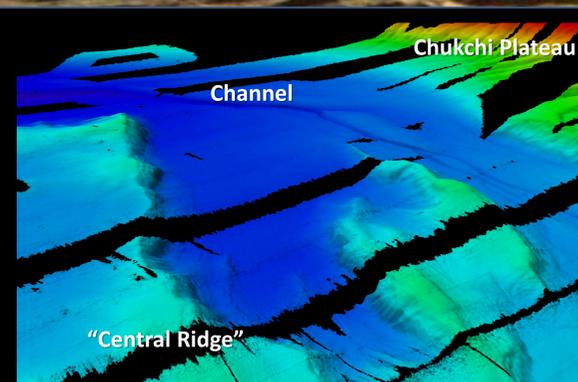
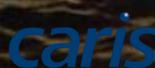


Figure 7: View looking to the southeast of the channel feature (VE=10x). The channel cuts through between Chukchi Plateau and the "Central Ridge", which has a more prominent rim, canyons at the edges, and a depression at its center.

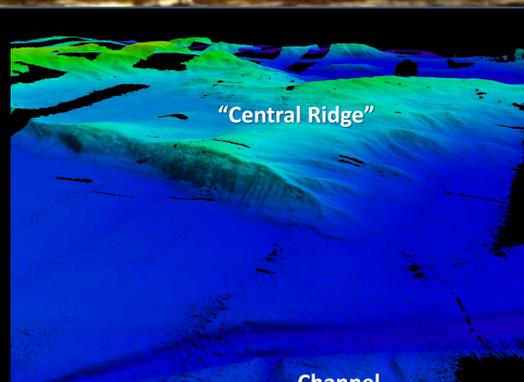


Figure 8: View looking north of the central ridge system in the center of the study area (VE=10x). The depression in the "Central Ridge" can be seen more clearly. The channel can be seen forking around an area of higher relief.

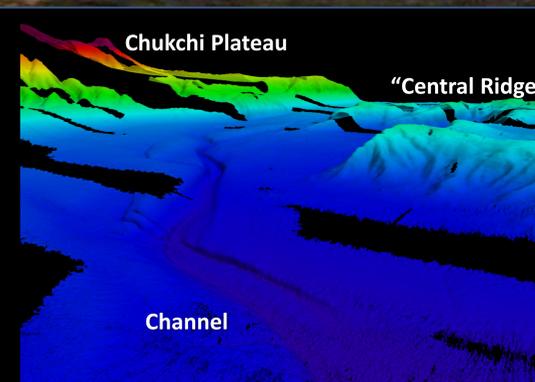


Figure 9: View looking west of the channel from its end where some depositional areas can be seen (VE=10x). The mouth of the channel appears to be fanning out.

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