Possible Submarine Landslide Locations Along the Continental Slope, East of Georges Bank

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ABSTRACT

Georges Bank is geographically located near the edge of the continental shelf off the eastern coast of Massachusetts. In May 2009 scientists from the U.S. Geological Survey (USGS, Woods Hole, MA) collected multibeam sonar data from aboard the NOAA Ship RONALD H. BROWN, surveying the continental slope east of George's Bank where water depths range from 200 to 3000 m. A Seabeam 2112 12KHz swath bathymetric sonar system was used to collect the bathymetric data, which were then processed using CARIS HIPS 7.0 software.
The bathymetric image created makes it possible to view the seafloor morphology and depth relief of the continental slope east of Georges Bank. Numerous submarine canyons cut through the slope, and are areas prone to submarine landslides. The USGS scientists will use the images produced to better understand areas of potential slumping for the purpose of investigating areas prone to tsunami generation.

Background:

- USGS scientists, aided by CofC student volunteers sailed on board the NOAA Ship Ron Brown in May of 2009 for two weeks. For five days they collected multibeam data along the continental slope located east of Georges Bank (Fig 1).
- Georges Bank is a shallow submarine shoal east of Cape Cod, Massachusetts and is roughly 40,000 km², with deposition derived from the Wisconsin glaciations (Fogarty and Murawski, 1998).
- The primary water currents in this region flow north to south, originating from the Gulf of Maine. These currents often lead to strong sediment laden bottom-hugging flows – turbidity currents – that move down the continental slope. Turbidity currents erode through the terrain resulting in steep submarine canyons (Fig 2).
- Gravity-induced slumping of unstable slope walls may also lead to the creation of submarine canyons.
- The region is prone to mass wastage occurring when rock material moves down or breaks off the slope. These resulting slumps have the potential to create dangerous tsunamis displacing water (Geist, 1998), (Fig. 4.1,2,3).

Methods:

- Bathymetric data of the continental slope east of Georges Bank were acquired by the NOAA Ship RONALD BROWN (Fig1), from May 14 to May 20, 2009.
- Acquisition of the bathymetric data was done with an Elac Seabeam 2112 multibeam sonar sensor.
- CARIS HIPS 7.0 software was used to process the bathymetric data.

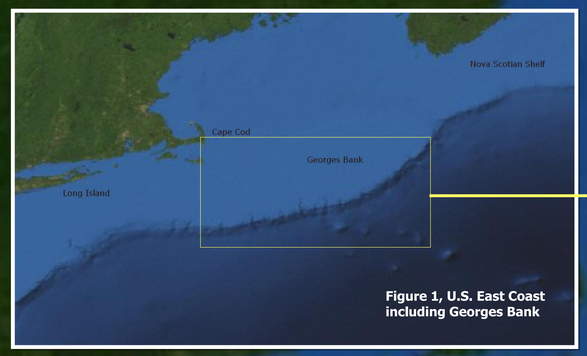


Figure 1, U.S. East Coast including Georges Bank

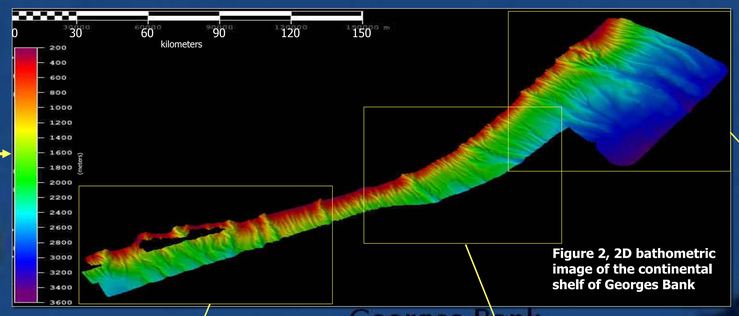


Figure 2, 2D bathometric image of the continental shelf of Georges Bank

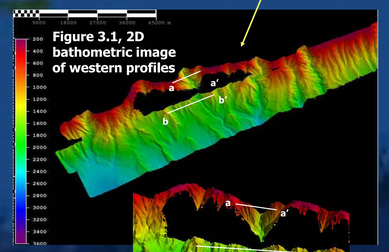


Figure 3.1, 2D bathometric image of western profiles

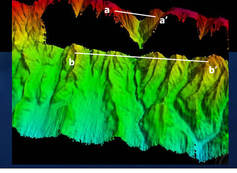


Figure 3.2, 3D image of western profiles

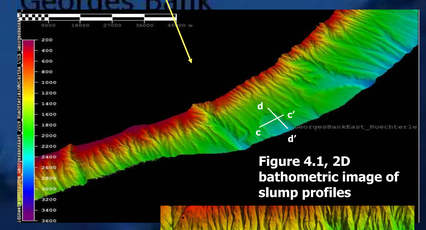


Figure 4.1, 2D bathometric image of slump profiles

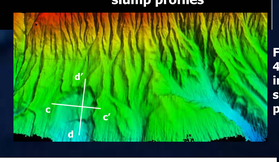


Figure 4.2, 3D image of slump profiles

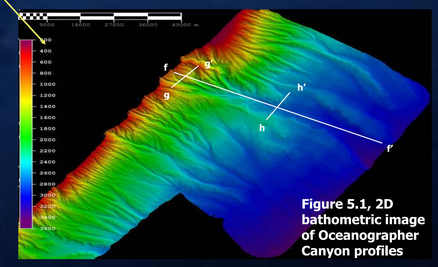


Figure 5.1, 2D bathometric image of Oceanographer Canyon profiles

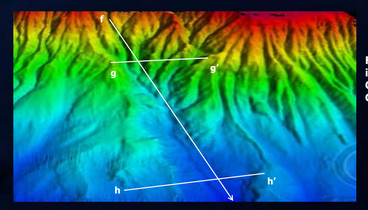
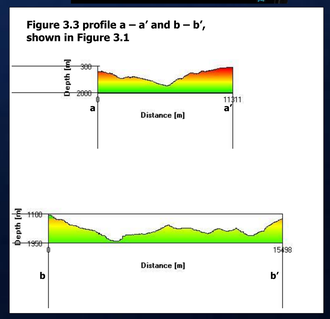
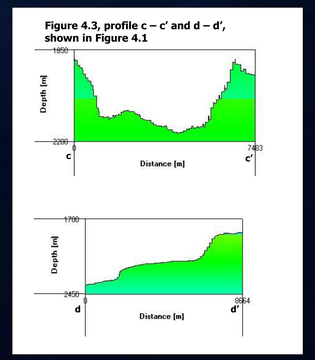
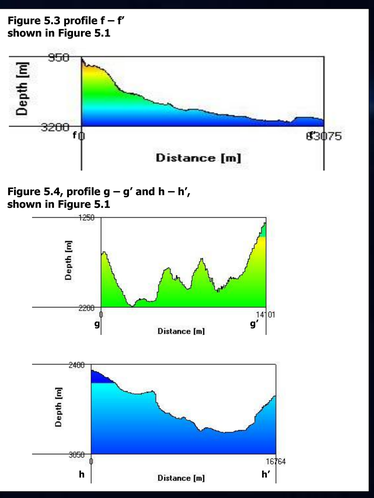


Figure 5.2, 3D image of Oceanographer Canyon profiles







NOAA Ship RONALD BROWN

Results

The bathymetric image displays the continental slope and the numerous submarine canyons that are present. In eastern most region (Fig 3.1) two profiles were created a-a'(Fig 3.3), and b-b'. The middle region of the data contained a possible slump (Fig 4.1). There were two profiles made across the possible slump, one across the slump, c-c' (Fig. 4.3) and one along the canyon axis, d-d'. The northwestern region (Fig 5.1) contains Oceanographer Canyon, the largest canyon of the data collected. Three profiles were collected over this canyon, f-f' (Fig 5.3) and g-g', h-h' (Fig 5.4) .

Discussion

The continental slope east of Georges Bank contains numerous canyons (figure 2). The depths of the canyons range from approximately 250 to 3400 meters. The largest of the canyons observed is Oceanographer Canyon. Oceanographer Canyon ranges in depth from 950 to 3200 meters within this data set (figure 5.2). Other canyons and their profiles can be seen in figures 3.1 through figures 3.3. These are small canyons and range in depth from 970 to 1700 meters in depth. Submarine slopes are generally unstable and create landslides, which often result in slumps. These slumps can create tsunamis which endanger coastal areas (Masson, et al., 2009). A large slump was identified in the middle region of the data set of the continental slope, suggesting a submarine landslide had occurred, although the timing is unknown. The slump can be seen in figures 4.1 and figure 4.2. It is important to know where slumps occur and the displacement of the slump. By knowing the location and size of slumps, it is possible to understand where tsunamis could possibly occur and affect the coast. The continental slope off of Georges Bank does not appear to have a lot of slumps; however the one that was identified is large and could have possibly created a tsunami when it occurred.

References

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Geist, E. L., 1998, Source characteristics of the July 17, 1998 Papua New Guinea tsunami: EOS, Transactions of the American Geophysical Union, v. 79 (supplement), p. 571.

Masson, D.G., Harbitz, C.B., Wynn, R.B., Pedersen, G., and Lovholt, F., 2009, Submarine landslides processes, triggers and hazard prediction: Philosophical Transactions of The Royal Society, v. 364, p. 2009-2039.

Acknowledgements

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