ESS / SST

The Investigation of Seabed Geohazards in the Canadian Arctic: Assessing the Opening Northwest Passage

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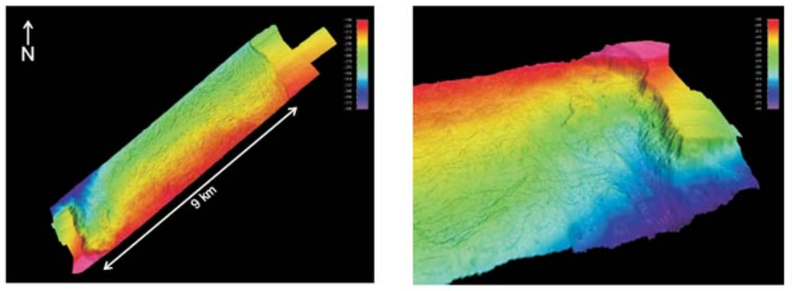
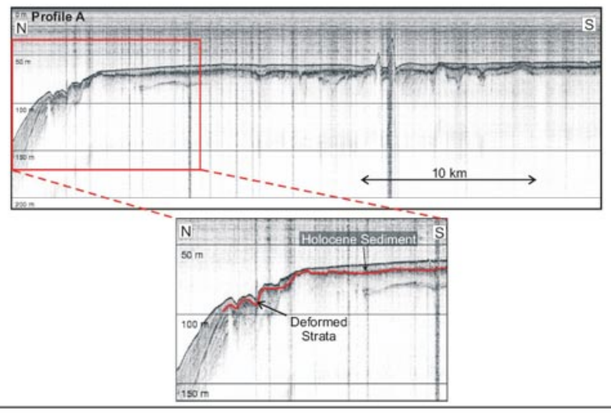
SLOPE FAILURE



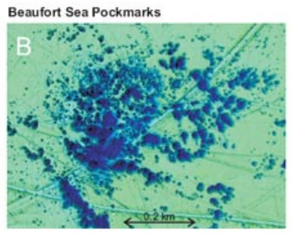
A submarine slump scar located 176km northwest of Tuktoyaktuk in 250m of water, which was originally mapped in 1981, was remapped using multibeam echosounder in 2004. The feature was not completely imaged with multibeam in 2004 however from the data acquired the slump appears to be ~9km wide and has steep sides up to 70m high.

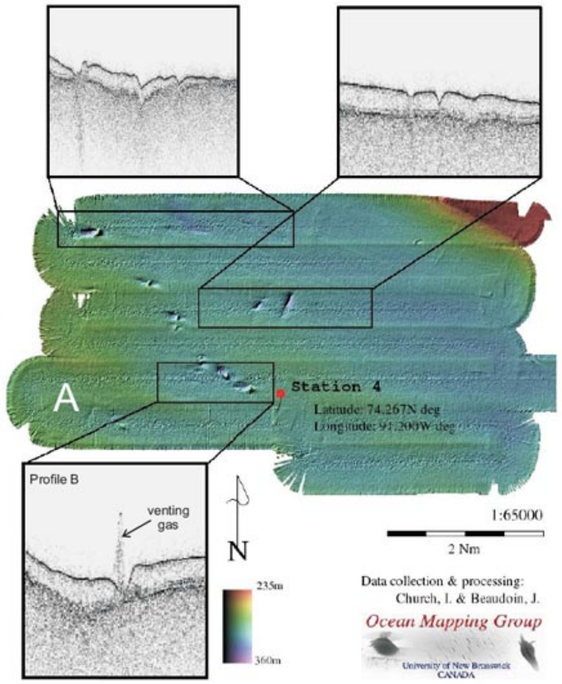
The morphology of the slump suggest that it could be a fresh feature, however sub-bottom profiles near the slump suggest that it may be 10,000 years or older. The profiles show up to 10m of undisturbed presumed Holocene sediment draped over older deformed strata (Profile A). Radiocarbon dating of undisturbed sediments near the slump scar (4.5km to the east) yields a date of 4840-4650 cal years BP at a depth of 5.5m. It is more likely that the slump was formed during the last glaciation when sea level was ~120m lower than present and sedimentation rates were higher. Both of these factors would create an environment more suited to causing slope failure.

Studying slope failure is necessary as slumps or slides would impact any nearby seabed infrastructure if one were to occur at present. Slumps can also effect the environment through the generation of tsunamis.



BARROW STRAIT POCKMARKS





Pockmarks are seabed features caused by the venting of shallow gas through the seafloor. These features have been observed and repetitively mapped for the past few years in the Beaufort Sea, but have just recently been imaged in Barrow Strait.

The Barrow Strait pockmarks (A) are ~200m wide, approximately 10-25m deep and located in 300m water depth. Profile B shows that one of these features appears to be actively venting gas. The Beaufort Sea pockmarks (B) are smaller (5-10m wide, 8-10m deep) and in shallow water (~10m water depth), but are much more concentrated then the Barrow Strait features. Repetitive mapping of the Beaufort Sea pockmarks suggests that gas is venting episodically the area.

Shallow gas research (i.e. pockmarks, mud volcanoes, etc.) is necessary because of the potential impact on pipelines, sub-seabed drilling, ice roads, etc. Pockmarks could also be an indication of oil and gas resources at depth.

LOCATION MAP

This map was generated from 2-minute Gridded Global Relief Data (ETOPO2) supplied by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Geophysical Data Center (2001). The data was then projected to the World Mercator projection for the display purposes of this poster. The horizontal datum is WGS-84, the vertical datum is Mean Sea Level, and the vertical resolution is 1m.

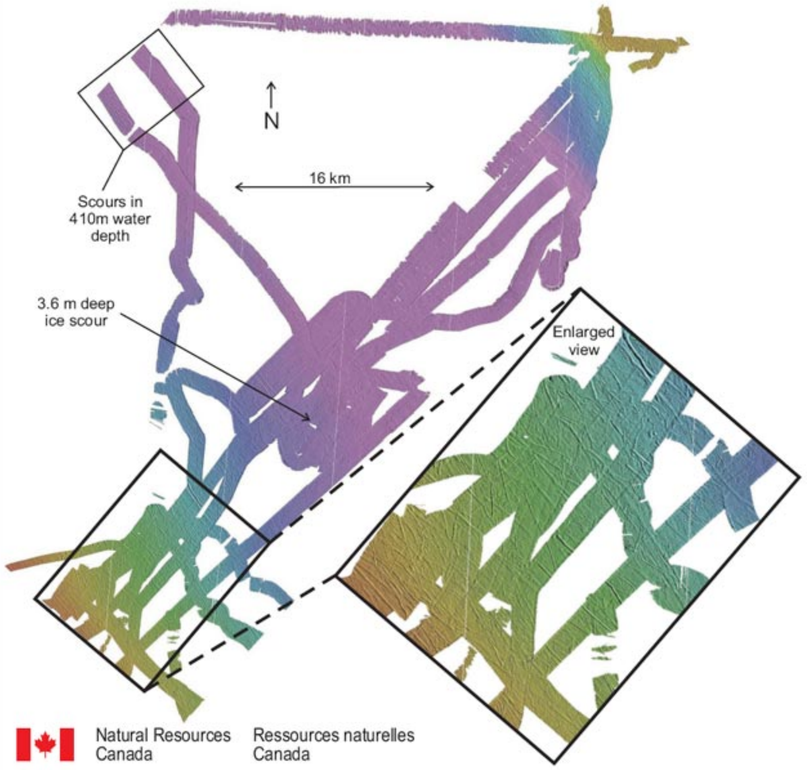
CCGS AMUNDSEN

The CCGS Amundsen is outfitted with a Kongsberg-Simrad EM300 (30 kHz) multibeam echosounder, Knudsen 320R (3.5 kHz) sub-bottom profiler, piston and box coring equipment, and a well equipped geology lab for sediment core analysis. The geophysical data in conjunction with sediment cores collected at key sites are being used to map seabed morphology, interpret the regional geologic framework and to investigate the paleoceanographic history of the Northwest Passage over the past 20,000 years to meet the objectives of project 1.6.

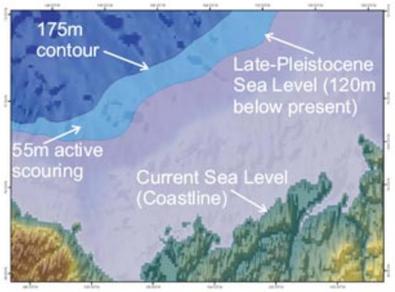
DEEP WATER ICE SCOURS

Ice Scours with irregular paths and scour depths up to 3.6m deep have been observed to water depth of 410m in Amundsen Gulf. These scours are of interest as the present day ice scour regime in the Beaufort Sea generates ice scours to water depths of only ~55m. Even during the late-Pleistocene when sea level was as much as 120m lower than at present, ice scours would have only been generated from sea ice to water depths of 175m. Ice scours in 410m water depth could have been caused by large icebergs calved from glaciers that were once present in the area or the scours could have been caused by a more extreme sea ice regime in the past.

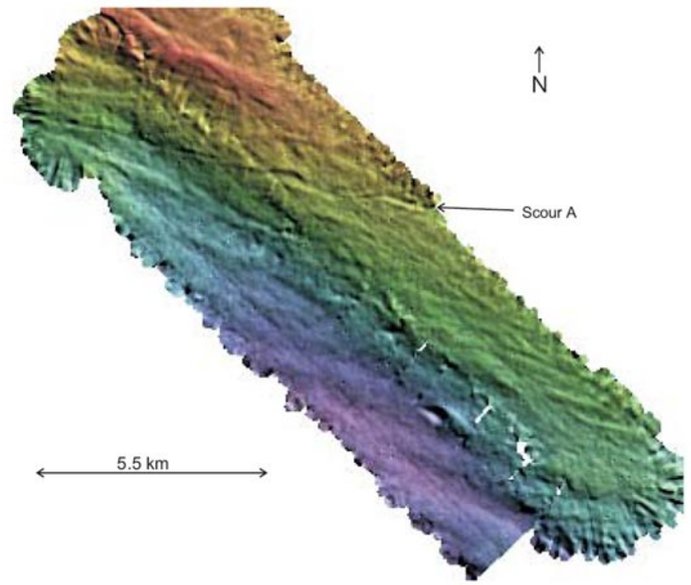
The study of these deep water scours is important in order to distinguish them from the shallow water scours that are being generated from the present sea ice conditions. The deep water scours also provide insights into past glacial ice extents and dynamics.



Beaufort Shelf Late-Pleistocene Ice Scour Limits



LANCASTER SOUND REPETITIVE MAPPING



A 20 x 8 km area of the seabed in Lancaster Sound was mapped during the 2005 ArcticNet field program using the multibeam echosounder and sub-bottom profiler onboard the CCGS Amundsen. The seabed of this area was first mapped in 1978 by side scan sonar as part of a preliminary wellsite survey. The 1978 program mapped three potential wellsites in eastern Lancaster Sound including this 16 x 5 km block northeast of Cape Liverpool, Bylot Island

Both the 2005 multibeam data and the 1978 side scan sonar data show that this area, located in approximately 890m water depth, is dominated by eastwardly trending ice scours. A preliminary comparison between the two data sets suggests that there have been no new ice scours or other seabed features that have formed over the 27 year time period.

Positioning errors inherent in the older data set from 1978 does introduce some uncertainty in the comparison with the new 2005 multibeam data, however one feature is visible in both data sets (Scour A). In the future, the 1978 side scan sonar mosaic interpretation will be digitized and georeferenced so that the two data sets can be compared more accurately in a GIS environment.

Temporal data of this type is important to determine if there are any active ice scouring or seabed processes in this area that could impact hydrocarbon development, shipping, and/or the environment.

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