
Seabed morphology, geologic framework, and paleoceanography of the NW Passage

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Thirty kHz multibeam echosounder and 3.5 kHz sub-bottom profiler data were continuously collected as CCGS Amundsen transited the NW Passage during the 2004 and 2005 ArcticNet field programs. These 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 palaeoceanographic history of the NW Passage over the past 20 000 years. The known, but very patchy, geologic framework of the seabed of the NW Passage inter-channels consists of bedrock base overlain by discontinuous glacial till. Thin glaciomarine sediments drape the till and/or bedrock. Discontinuous localized accumulations of Holocene sediment infill depressions with thickness varying from <1 to 10 m. Geophysical data collected on the Amundsen has significantly extended this stratigraphy to new areas not previously surveyed. Sediment coring of this sequence of sediments at key sites identified on sub-bottom profiles will define the geological framework of the inter-channel areas. Sediment core sampling is currently focused on the localized thick Holocene deposits to determine the waxing and waning of the sea-ice regime over the past 10 000 years. To date, seven piston cores ranging in length from 1.3 to 7.0 m have been acquired for palaeoceanographic reconstructions. The first piston core to be analyzed was collected in Lancaster Sound during 2004. Initial results indicate the core successfully penetrated about 5.3 m of undisturbed Holocene sediment covering the last 10,700 – 10,500 cal years BP; confirming the interpretation of the geophysical data.

Regional geological mapping of the NW Passage to locate Holocene sediment depocentres has resulted in the identification of a variety of geomorphic features on the seabed that shed light on glacial and recent processes responsible for shaping the morphology of the NW Passage. In 2004 and 2005, streamlined linear fluting features were mapped in about 400m water depth in Amundsen Gulf. These features are on strike with similar terrestrial features on Victoria Island to the east. Ice scours with irregular paths are observed seaward of the

flutes which may have been formed by icebergs calving from the glacier front. These ice scours are in 410m water depth and are not explained by the present day ice dynamics in the region. Other flutings were also observed in Dolphin and Union Strait, Lancaster Sound, Viscount-Melville Sound, and smaller scale flutings were observed in Pond Inlet and Eclipse Sound. Processes responsible for the generation of these features include glacial ice streaming and/or high velocity subglacial meltwater discharge.

A 16 × 5 km area of Lancaster Sound in approximately 860m water depth mapped in 1978 by side scan sonar was remapped in 2005 with the multibeam echosounder. The seabed is dominated by ice scours trending to the east. Preliminary interpretation of this area suggests that there are no new scours or other seabed features that have formed over the past 27 years.