Carbon and Sediment
in the Nearshore of an Eroding Permafrost Coast: Herschel Island, Canada

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Introduction

Through the combination of thermal abrasion and coastal erosion, arctic coasts are highly threatened by climate change that result in extremely high rates of shoreline retreat. The eroded materials contain large fractions of organic carbon whose release in nearshore waters may affect coastal ecosystems, and possibly act as a positive feedback to ongoing climate change (Fig.1).

Arctic erosion takes two forms: 1) "normal" shoreline retreat, and 2) through thermokarst features that act as point sources of released sediments and carbon. Previous workers suggest that deposition could occur within the nearshore. Submarine permafrost degradation and sea-level rise are possibly creating accommodation space (Figs 2, 3).

Questions

This study focuses following questions:

- How is the cross-shore and longshore coastal morphology related to shoreface evolution?
- How does shoreface evolution in relate to sequestration of carbon and coastal erosion?
- What percentage of eroded sediment is buried within the near shore?
- How might the shoreface evolve given present trends of climate change and sea-level rise?
- What changes can be anticipated for sedimentary features such as Simpson Point, the site of the historic whaling settlement?

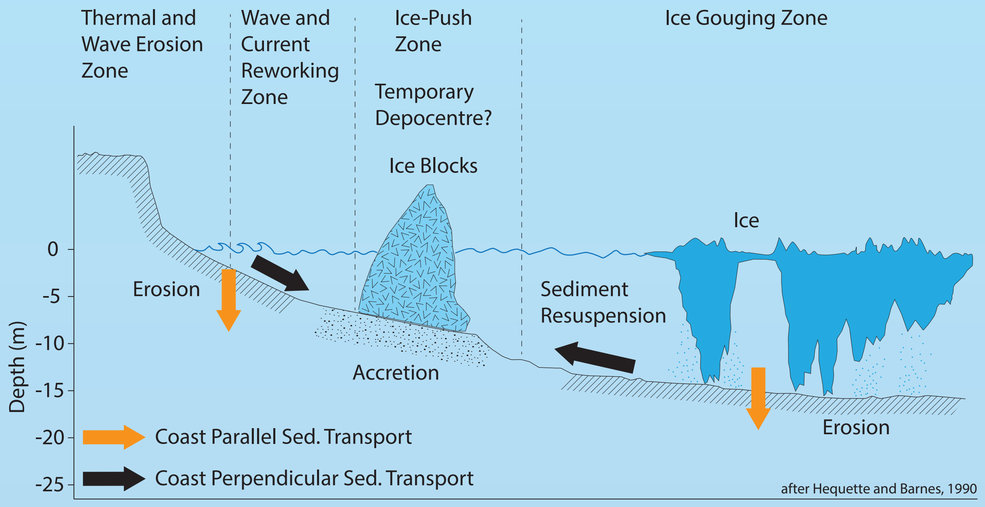


Fig. 2. Conceptual model of shoreface processes in the Canadian Beaufort Sea.

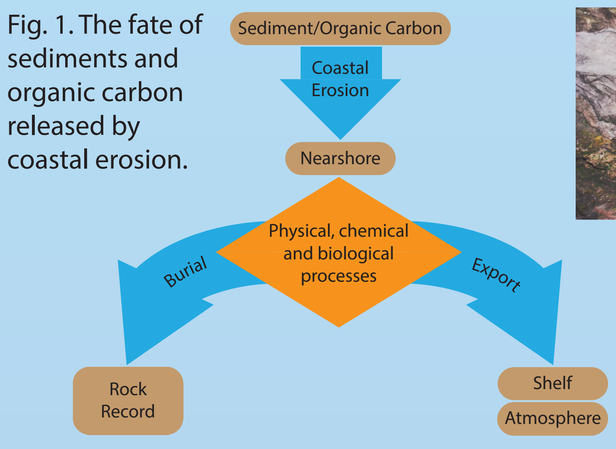


Fig. 1. The fate of sediments and organic carbon released by coastal erosion.

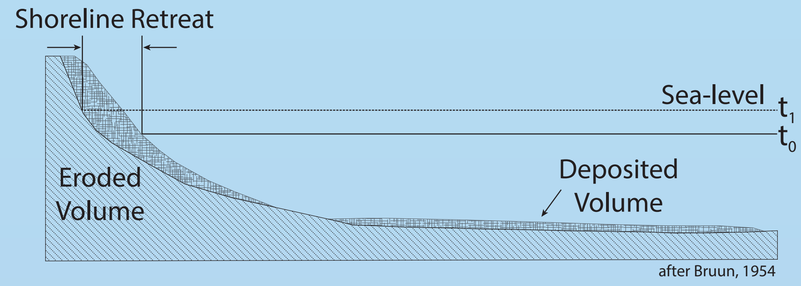


Fig. 3. Shoreline retreat resulting from sea-level rise, the Bruun rule. Note deposition on lower shoreface.

Study Area

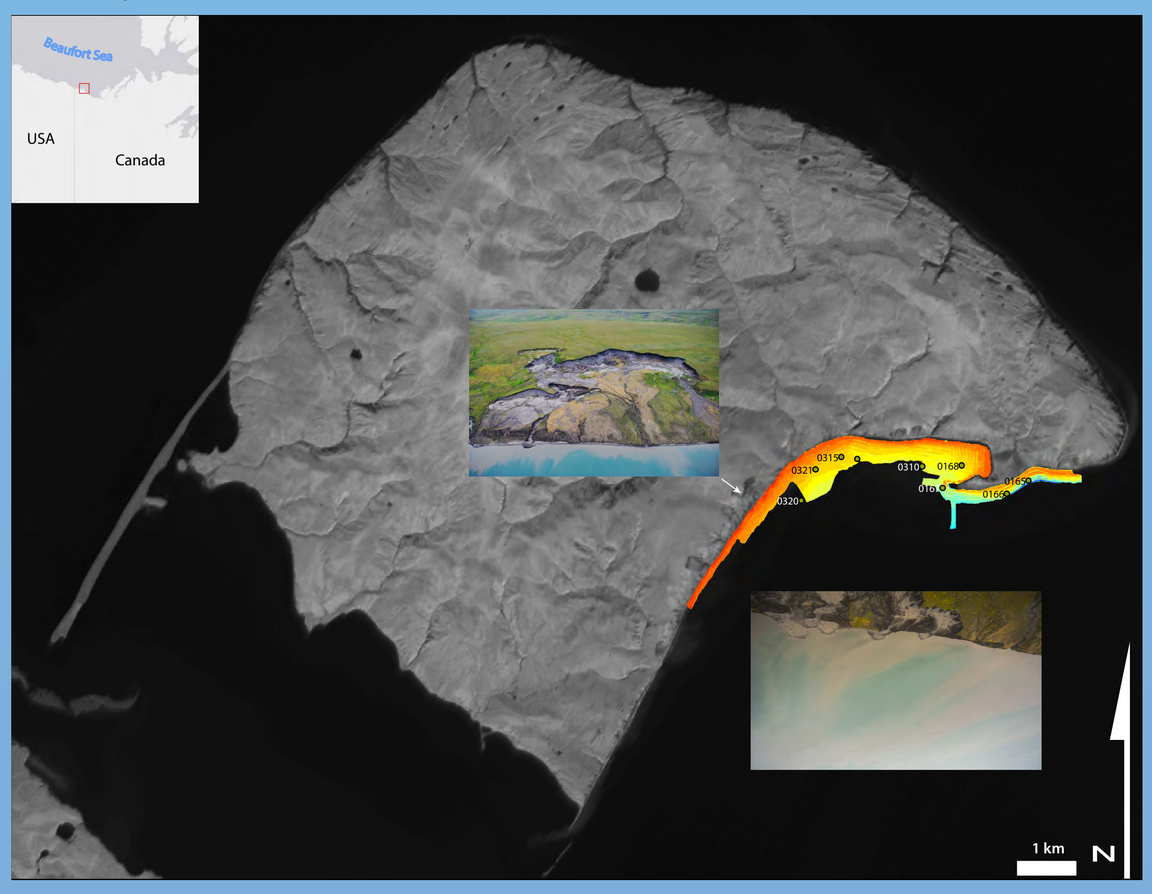


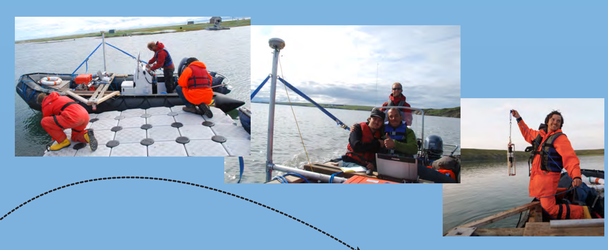
Fig. 4. Map of Herschel Island showing sidescan coverage and locations of SVP profiles.

Methods

An array of complementary geophysical and conventional geologic methods are applied in this study.

- interferometric sidescan sonar (coupled with a real-time kinematic GPS system)
- seismic sub-bottom profiler
- surface sediment samples
- sediment cores

Fig 7. The AWI RV Christine is equipped to perform sidescan and seismic surveys.



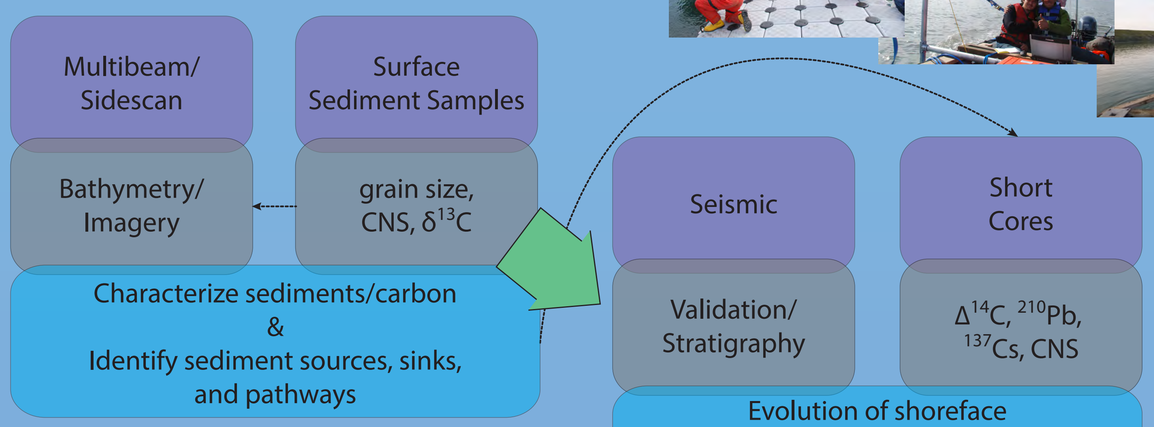


Fig. 6. Instruments and samples (purple) deliver data (grey) that answer relevant questions (blue) for the completion of study objectives.

Results (Preliminary)

The 2012 field season yielded sidescan bathymetry and surface sediment samples(Figs. 4, 8, 9). Additional sidescan-, seismic-, as well as the collection of surface grab samples and shallow cores is planned for the summer of 2013 (Fig. 9).

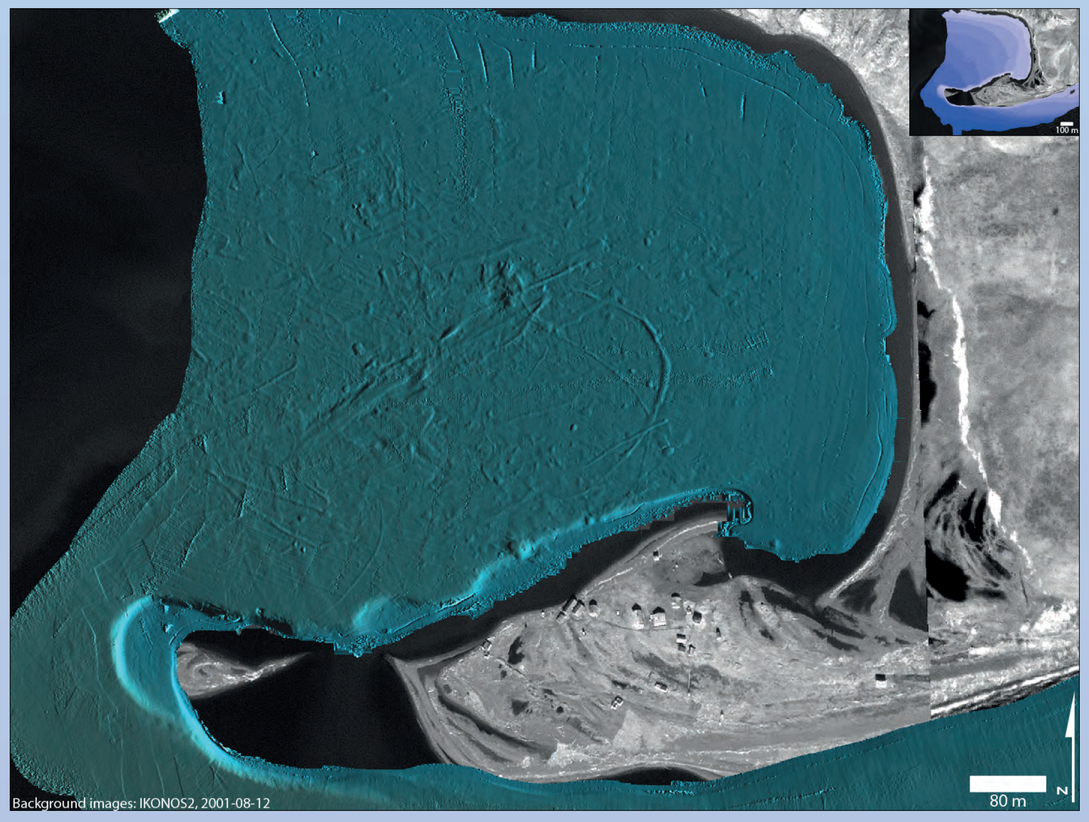


Fig. 8. Hillshade of Pauline Cove bathymetry obtained during summer 2012. The bathymetric survey of Pauline Cove has already revealed benthic features of cryogenic or anthropogenic origin that may indicate conditions favorable for deposition.

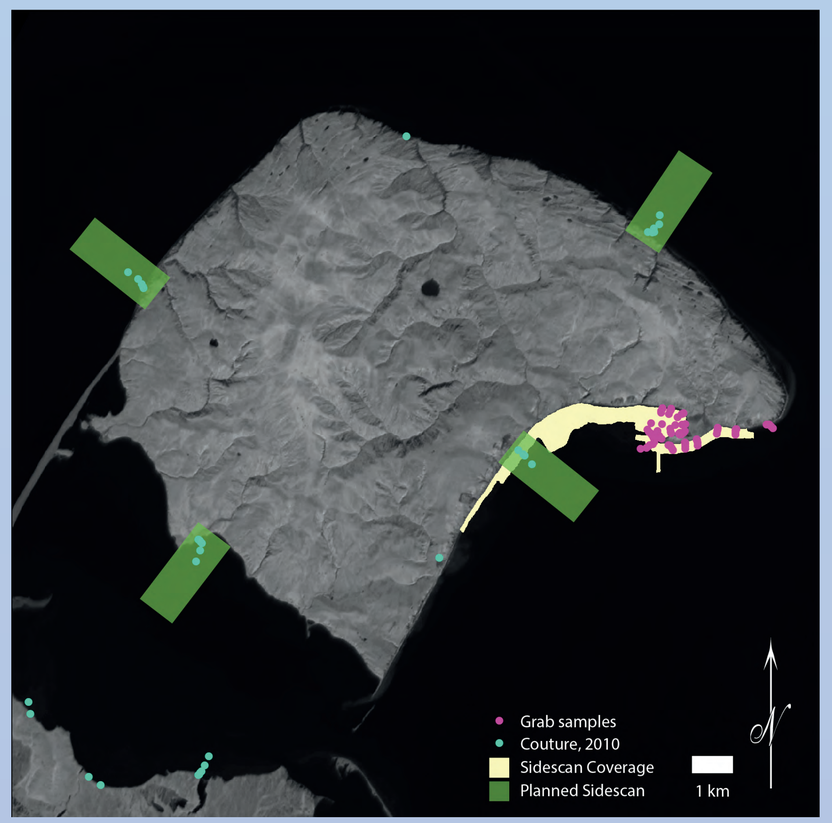


Fig. 9. Map of Herschel Island showing coverage of sidescan (yellow) and locations of surface grab samples (pink). Areas shaded in green indicate future focus locations. Cyan dots are sites of a prior study that aimed at characteriying terrestrail and marine carbon.

Have questions? Feel free to contact me!
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