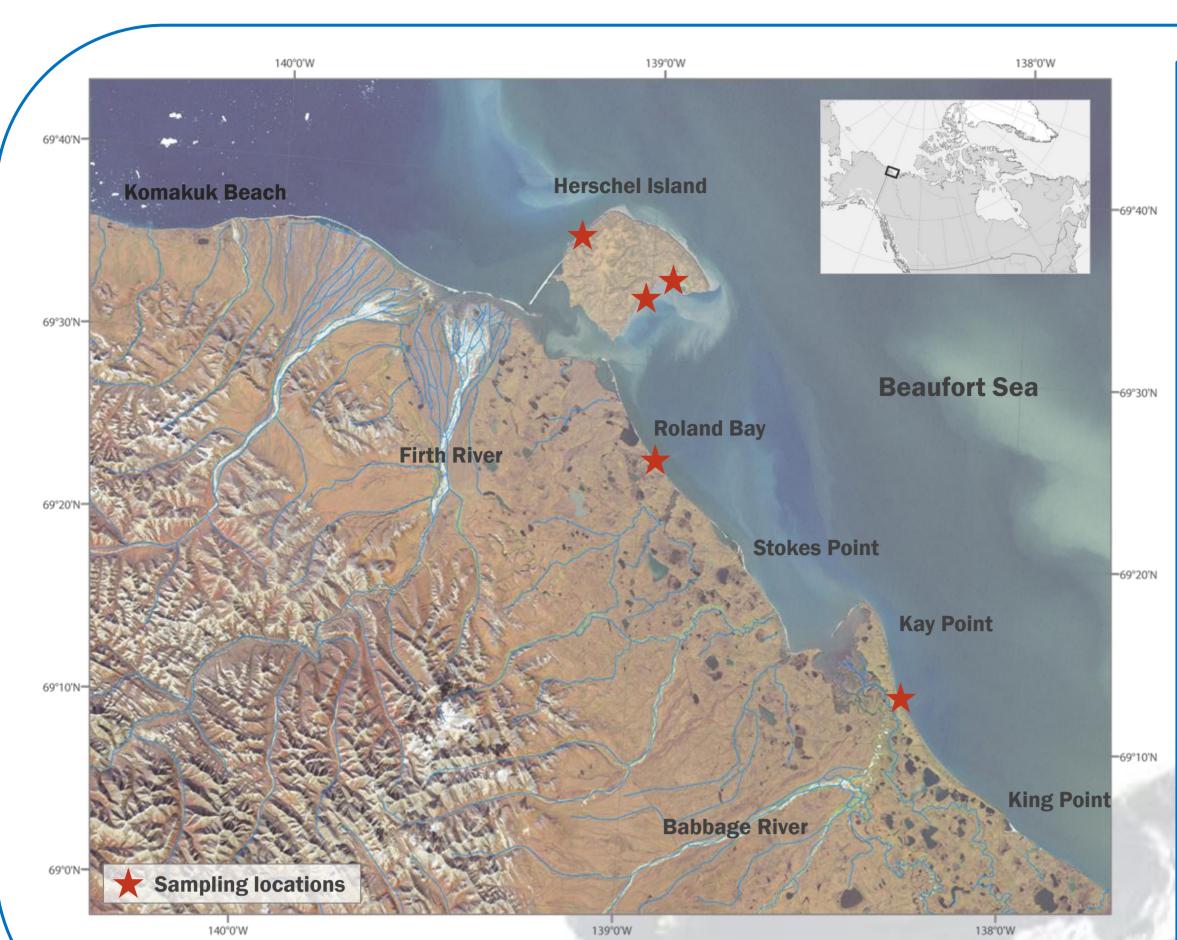
Release of dissolved organic carbon by coastal erosion in the southern Canadian Beaufort Sea - First results of a Master project

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Study area: Sampling locations at Herschel Island and the Yukon Coastal Plain, northwest of the Mackenzie Delta, Yukon Territories, Canada.

Aims & Objectives

- Carbon released by coastal erosion largely focus on particulate organic carbon (POC)
- Dissolved organic carbon (DOC) concentrations in ground ice are not properly investigated
- DOC could play a substantial role in the Arctic carbon cycle as ground ice is present nearly everywhere along the arctic coast
- It can make up to 90% of the coastal bluffs and can erode at rates up to 10m/yr

Research questions

- How much DOC is stored in massive ground ice and ice wedges?
- How much DOC from massive ground ice and ice wedges could be released (DOC flux) into the Beaufort Sea using coastal erosion rates and ground ice contents?
- What role does the DOC play in the arctic carbon budget and the food web in the near-shore zone?



Transport of eroded sediments into the coastal zone at the northeastern part of Herschel Island.

Sampling, Processing and Data analysis

Sampling

42 samples of massive ground ice and ice wedges were obtained with a chainsaw, hammer and chisel at six field sites and were stored at -20°C before further processing.

Processing

- Samples were cut in a band saw cold lab at -15°C
- Removement of contaminated margins
- Subsamples were melted and used for determining pH, electrical conductivity and DOC
- DOC analysis with 0.7µm syringe glass fiber filters

Data used

Couture, N. (2010): Fluxes of soil organic carbon from eroding permafrost coasts, Canadian Beaufort Sea.

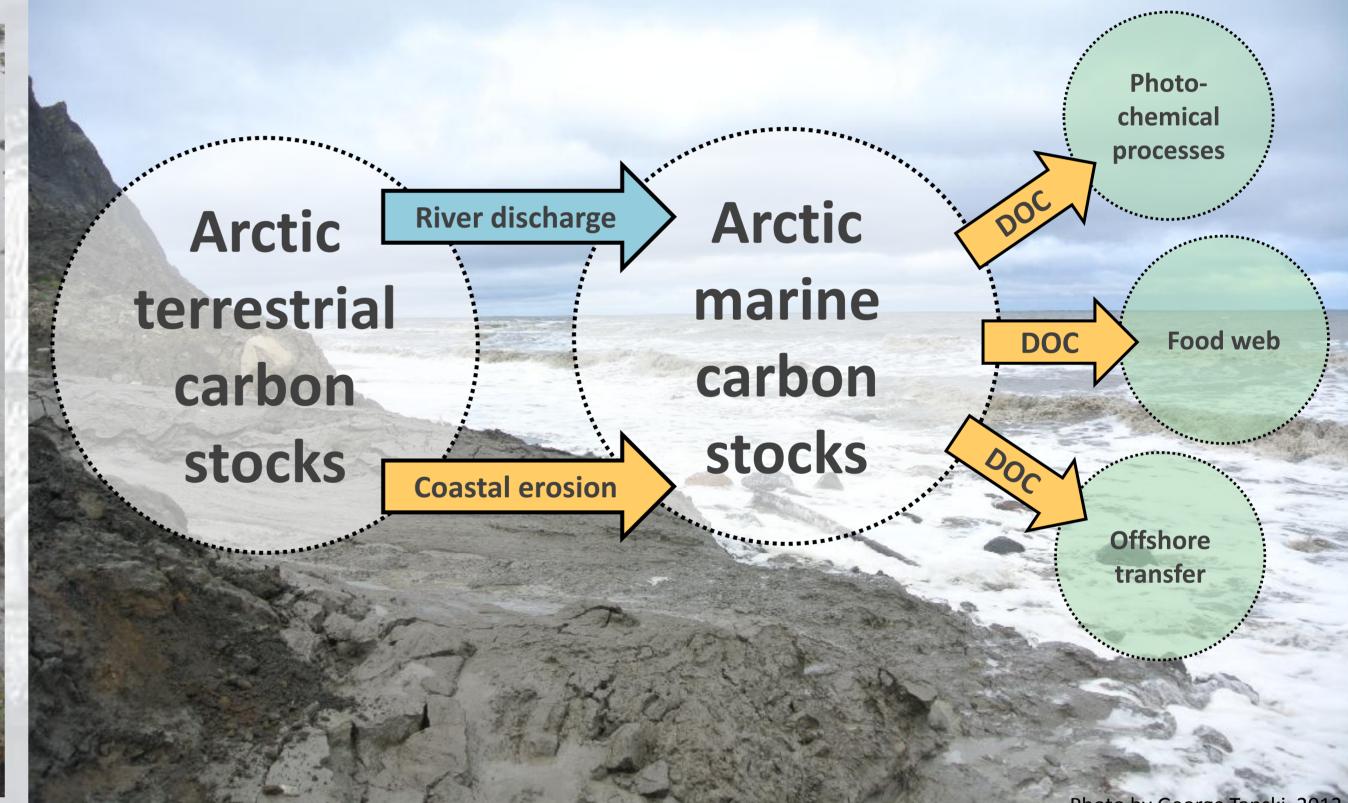
Lantuit et al. (2012): The Arctic Coastal Dynamics database. A new classification scheme and statistics on arctic permafrost coastlines.

Lantutit et al. (2009): Towards a calculation of organic carbon release from erosion of Arctic coasts using non-fractal coastline datasets.

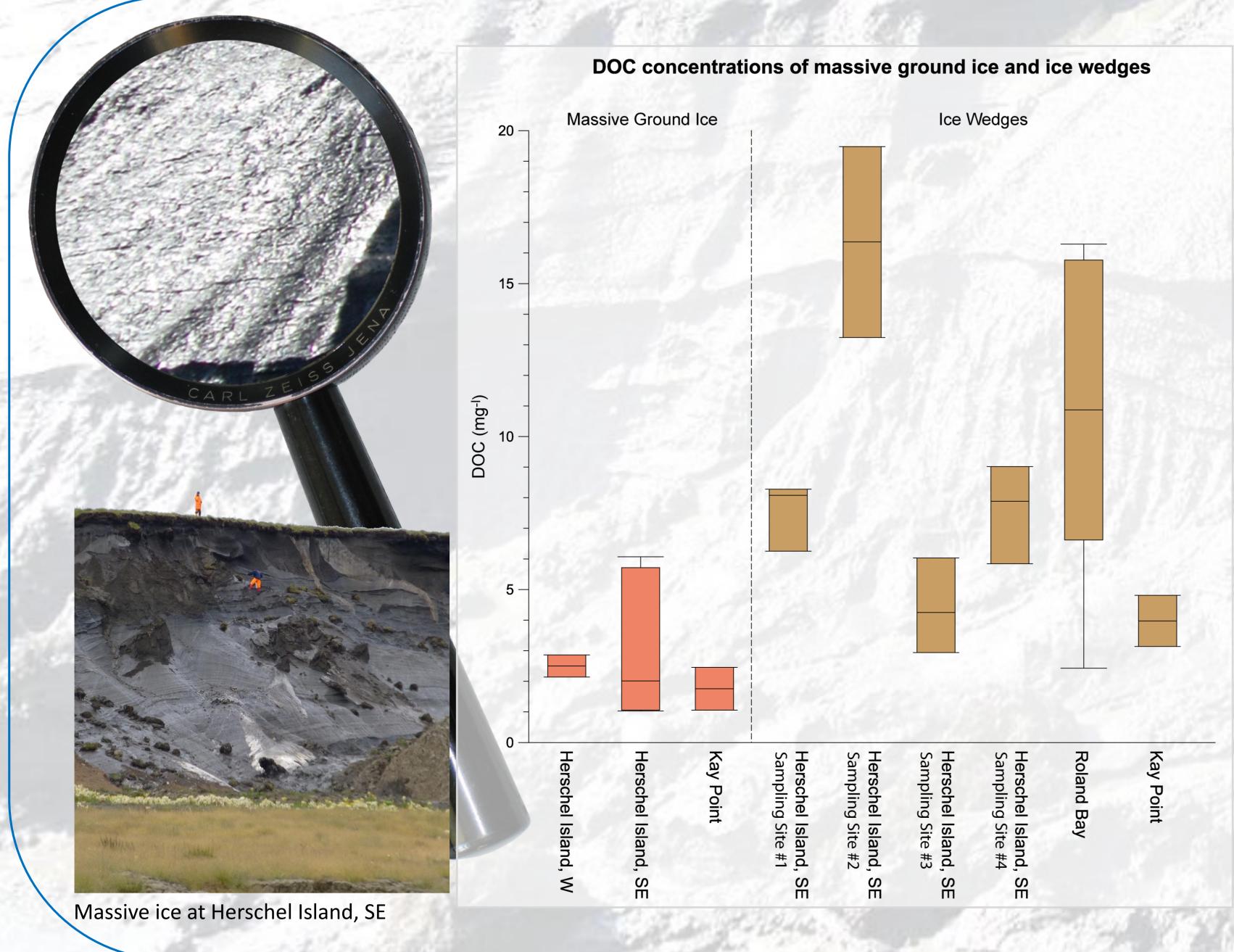
Lantuit & Pollard (2008): Fifty years of coastal erosion and retrogressive thaw slump activity on Herschel Island, southern Beaufort Sea, Yukon Territory, Canada.



Sampling of massive ground ice at the southeast side of Herschel Island with chainsaw, hammer and chisel.



Scheme of possible pathways of DOC from the terrestrial into the marine environment (background: a mudflow from a retrogressive thaw slump entering the Beaufort Sea).



Author	Year	Source	DOC conc.
Fritz et al.	2011	Massive ice	2.7 mg ^{-l}
Fritz et al.	2011	Ice Wedges	11.5 mg ^{-l}
Douglas et al.	2011	Thermokarst cave ice (upper part)	8.7 mg ^{-l}
Douglas et al.	2011	Thermokarst cave ice (lower part)	613.6 mg ^{-l}
Spitzy & Leenheer	1991	Total Canadian Arctic Rivers	5.2 mg ^{-l}

Comparison of DOC concentrations between different ground ice forms an river discharge.

Results and Outlook

DOC fluxes could be of major importance for the arctic carbon budget with regard to:

- ground ice contents along the Yukon Coastal Plain which make up on average 46% of the upper permafrost (Couture 2010)
- coastal erosion rates of 0.45m/yr from 1970 to 2000 (Lantuit & Pollard 2008)
- unknown spatial distribution and depth of ground ice bodies

Remaining tasks and questions

- Calculations of DOC fluxes and upscaling
 - Sediment/Ice content of samples and correlation with DOC concentrations
- Fate of the terrestrial dissolved organic carbon in the marine environement

Couture, N. (2010): Fluxes of Soil Organic Carbon from eroding permafrost coasts, Canadian Beaufort Sea. (Unpublished) Douglas, T. A., Fortier, D., Shur, Y. L., Kanevskiy, M. Z., Gou, L., Cai, Y. & Bray, T. (2011): Biogeochemical an Geocryological Characteristics of Wedge an Thermokarst Cave Ice in the CRREL Permafrost Tunnel, Alaska. In: Permafrost an Periglacial Processes, 22: 120-128 Fritz, M., Lantuit, H., Meyer, H., Opel, T., Couture, N. J., Pollard, W.H.: Dissolved Organic Carbon (DOC) in Ground Ice: Is It Significant? In: Hinckel, K. (es.): Tenth International Conference on Permafrost, 25-29 June 2012, Salekhard, Russia, Vol. 4: 159-160 Lantuit, H., Overduin, P. P., Couture, N., Wetterich, S., Are, F., Atkinson, D., Brown, J., Cherkashov, G., Drozdov, D., Forbes, D., Graves-Gaylord, A., Grigoriev, M.,

Hubberten, H. W., Jordan, J., Jorgenson, T., Ødegård, R. S., Ogorodov, S., Pollard, W., Rachold, V., Sedenko, S., Solomon, S., Steenhuisen, F., Streletskaya, I. and Vasiliev, A.

(2012): The Arctic Coastal Dynamics database. A new classification scheme and statistics on arctic permafrost coastlines. In: Estuaries and Coasts, 35: 383-400 Lantuit, H., Rachold, V., Pollard, W. H., Steenhuisen, F., Ødegård, R. and Hubberten, H. W. (2009): Towards a calculation of organic carbon release from erosion of Arctic coasts using non-fractal coastline datasets. In: Marine Geology, 257: 1-10 Lantuit, H. and Pollard, W. H. (2008): Fifty years of coastal erosion and retrogressive thaw slump activity on Herschel Island, southern Beaufort Sea, Yukon Territory, Canada.

Spitzy, A. & Leenheer, J. (1991): DOC in rivers. In: Degens, E. T., Kempe, S. & Richey, J. E. (eds.): Biogeochemistry of Major World Rivers. SCOPE 42, Wiley, Chichester

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