

# Mobilization and methylation: coastal erosion

## sets mercury in motion

### along the Yukon coast, Canada

Thawing permafrost causes the destabilization of Arctic unlithified coasts. Coastal erosion rates at the Yukon coast reach up to  $22 \text{ m yr}^{-1}$  (Obu et al. 2017).

Mercury (Hg) is a neurotoxic element. Long-range atmospheric transport northwards combined with geological sources and slow decomposition rates resulted in its accumulation in permafrost where it has been safely locked away until now (Schuster et al. 2018).

#### Methodology

Sample terrestrial and marine sediments

Measure Hg and MeHg concentrations

Train and apply a random forest model to fill Hg data gaps

Consider ground ice content and sum up for total stock

Combine with erosion rates for total flux

Evaluate concentrations in marine sediment samples for Hg fate

Hg stock:  
**381,080 kg**  
(271,540 to 501,930 kg)

According to this stock estimate and given its small area, the Yukon coast stores more Hg than the average permafrost area.

Hg flux from coastal erosion:  
**113 kg yr<sup>-1</sup>** (87 to 163 kg yr<sup>-1</sup>)

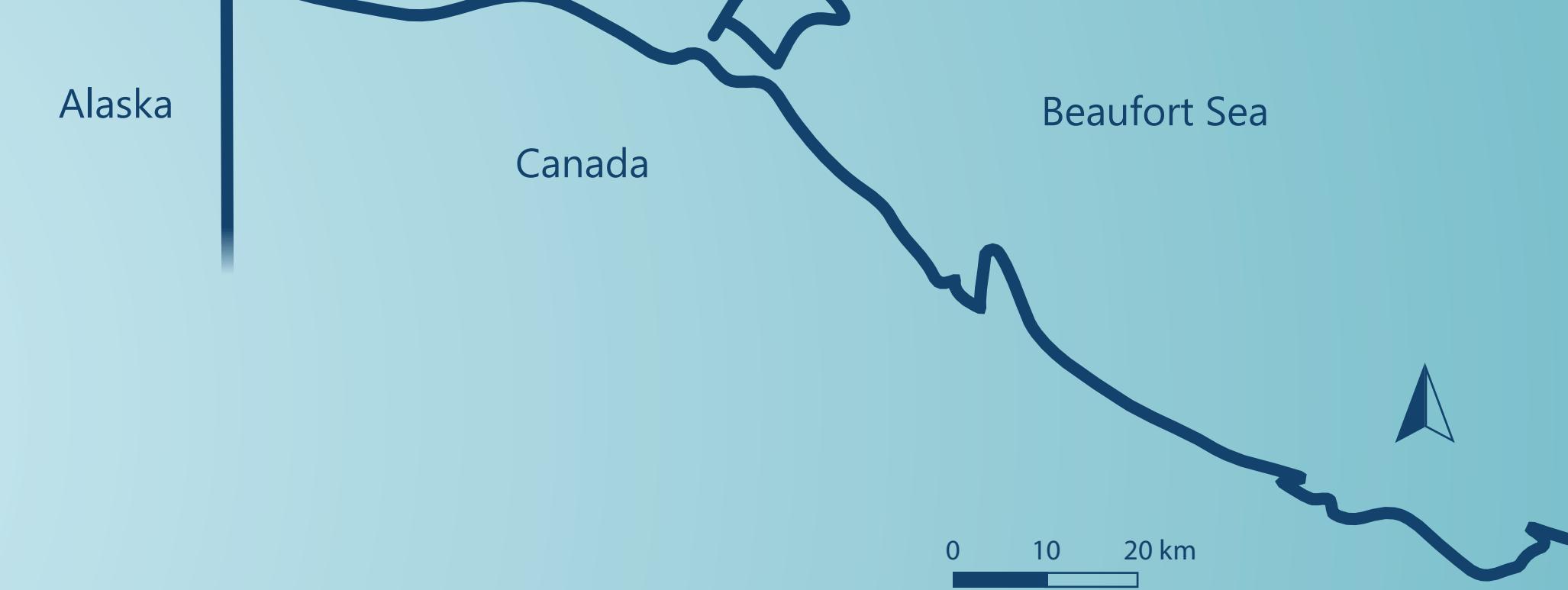
This flux estimate is consistent with the sediment contribution from coastal erosion of the Yukon coast to the Arctic Ocean.

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Methylmercury (MeHg) is a highly toxic form of Hg that bioaccumulates along the food chain, posing elevated risks to top predators and Arctic Indigenous Peoples who count on traditional hunting and fishing (AMAP 2021).



Hg fate:  
transport,  
transformation,  
gas exchange

#### Terrestrial vs. marine

Hg and MeHg concentrations were lower in marine than in terrestrial sediments.

	terrestrial	marine
Hg	$74.52 \pm 29.91$ , n = 158	$52.04 \pm 27.93$ , n = 87
MeHg	$0.29 \pm 0.25$ , n = 52	$0.21 \pm 0.08$ , n = 24

Table 1: Measured Hg and MeHg concentrations (mean  $\pm$  standard deviation) in  $\mu\text{g kg}^{-1}$ .

Sources of uncertainties in stock and flux estimates include:

- limited amount and resolution of model predictors
- small sample and training data set

... and not all of the released Hg may just be buried in marine sediments.

some Hg evades back into the atmosphere

some Hg can be methylated to highly toxic MeHg

some MeHg enters the food web through uptake by phytoplankton

The actual pathway determines the risk associated with mobilized Hg.

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