

PERMAFROST MELTING AS A POTENTIAL SOURCE OF MERCURY TO THE BEAUFORT SEA

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INTRODUCTION

- Mercury (Hg) levels in marine mammals in the Mackenzie Delta and Beaufort Sea area are high and appear to be increasing (e.g., Hg in beluga liver has increased ~4x since 1981 [1]).
- The Mackenzie Basin is experiencing some of the most dramatic climate warming anywhere [2], and is projected to be increasingly affected in the future [3].
- The southern Beaufort Sea coast is one of the most ice-rich areas in the Canadian Arctic.
- Permafrost thaw, sea level rise, changing sea ice conditions, and increased wave activity will result in accelerated rates of coastal erosion and thermokarst activity in areas of ice-rich permafrost [4].

HYPOTHESIS

- We hypothesize that the increasing permafrost thawing, increasing thermokarst, and the subsequent accelerated coastal erosion might contribute significantly to Hg in the Beaufort Sea ecosystem.

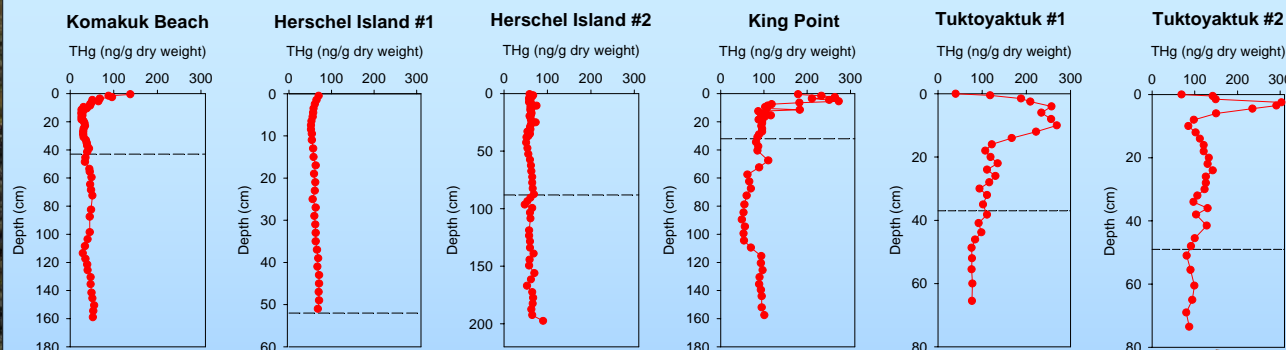
OBJECTIVES

- To profile the vertical distribution of Hg in permafrost cores in the region.
- To estimate Hg fluxes to the Beaufort Sea due to increased permafrost thawing and coastal erosion.
- To date the permafrost cores to explore the possibility of estimating atmospheric deposition of Hg over recent years.



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Vertical Distribution of Total Mercury



RESULTS

(1) Vertical Distribution of Hg

- Cores show a constant natural background of Hg between 50 and 100 ng/g dry weight.
- In all cores except Herschel Island, there is a Hg peak ~2.5-3x higher than background in the top 10 - 15 cm.
- There is no Hg trend on Herschel Island.

(2) Flux Calculations

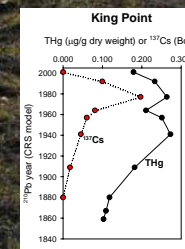
- Using existing estimates of coastal erosion along the Mackenzie Shelf (5.6 Mt ± 2.5) [6], our calculations suggest that 360 ± 160 kg of Hg enter the Beaufort Sea each year.

Hg Flux to the Beaufort Sea		
	Flux (kg)	Source
Coastal Erosion	360 ± 160	This Study
Mackenzie River	1,800 ± 600	[7]
Atmosphere*	17,000	[8]

* Flux estimate to entire high arctic ocean

(3) Permafrost Dating

- One core (King Point) was dated using ²¹⁰Pb and ¹³⁷Cs.
- Atmospheric deposition of Hg appears to have been increasing since the early 1900s and decreasing since the 1970s.



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