Ward Hunt Island Observatory 2006

Development of Environmental Change Indicators in the Canadian High Arctic

Julie Veillette, Dermot Antoniades, Marie-Ève Garneau, Derek C.G. Muir and Warwick F. Vincent

Centre d'Études Nordiques (CEN) et département de biologie, Université Laval, Québec, Québec G1K 7P4

Quttinirpaaq National Park: Sentinel of Global Climate Change

Global climate change is predicted to occur most rapidly at high latitudes in the Northern Hemisphere[1].

The park encompasses a remarkable diversity of ecosystems. **Our work focussed on ice shelves, fjords, meromictic and epishelf lakes.**

These environments and their biological communities are likely to be sensitive indicators of environmental change[2].

In partnership with Parks Canada, we aimed to **identify the most appropriate indicators of climate change for long term monitoring in this region.**

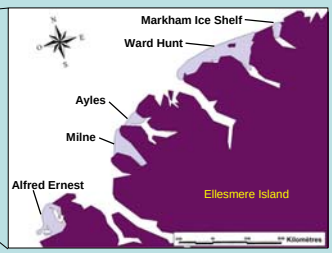
2006 Field Work

Main foci:

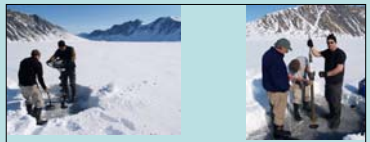
- Molecular diversity and food web of meromictic lakes
- Sedimentary profiles from lakes and fjords
- Genetic studies of the biodiversity of microbial mat communities on ice shelves

Ongoing monitoring:

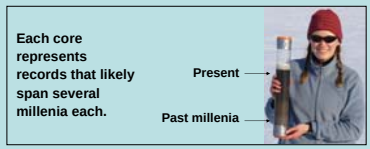
- Climate variables from automated weather stations
- Survey of coastal ice conditions
- Ablation rates on the adjacent Ward Hunt Ice Rise and Ice Shelf



Indicators of Past Climate and Glaciological History

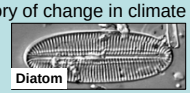

Sediment coring at Ayles Fjord

Sediment cores from fjords (Disraeli, Ayles and Markham) were retrieved.



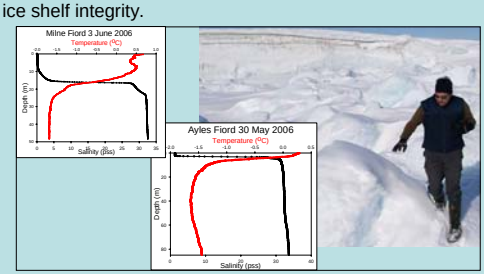
We are constructing the history of change in climate and ice shelves by:

- Analyzing microfossils;
- Geochemical signatures.


Diatom

Climate Impacts on Aquatic Ecosystem Structure

Water column profiling provided evidence of major changes in the vertical structure of lakes and fjords that depend on ice shelf integrity.



The results show the loss of the epishelf lake in Ayles Fjord due to the break-up of the Ayles Ice Shelf in 2005. Epishelf lakes are unique ecosystems under threat from climate warming[3].

Microbial Diversity of Meromictic Lakes and Ice Shelves

Microbial communities play a key role in nutrient recycling and carbon fluxes[4].

We evaluated microbial diversity using:

- Photosynthetic pigment analyses to identify algal groups and cyanobacteria;
- Molecular analyses to assess the microbial genetic diversity.

Our HPLC analyses show that Lake A contained a wide variety of phototrophic pigments varying with the physico-chemical gradients down the water column.


Water sampling


Microbial mats


Cyanobacteria

Perfluorinated Contaminants (PFCs)

- Used in a multitude of consumer and industrial products
- Ubiquitous global environmental contaminants
- PFOS, a predominant compound, already detected at some arctic sites at concentrations comparable to PCBs
- Persistant, bioaccumulative and some precursors prone to atmospheric transport
- Detected in the top predators in the Arctic up to 76°N[5].

Are PFCs present at 83°N?

Preliminary results indicate detectable concentrations in the surface waters and sediments of perennially ice-covered meromictic Lake A.

Surface concentrations of PFCs in sediments (ng g-1) and water (ng L-1) from lakes A and C1. (— : below detection)

		PFOS	PFOA	C9	C10	C11	C12	10 :2 PFUA
Lake A	Sediments	—	0.004	0.013	—	0.011	0.014	0.0462
	Water	0.43	—		0.052	0.138	0.094	—
Lake C1	Water	0.05	—	0.524	0.043	0.023	—	—

Acknowledgements

Financial support:

Logistics support:

Science support:

D. Sarrazin, E. Bottos , J. Tomkins, J. Pouliot, M.-J. Martineau, J. Small

References

1. ACIA (2005) Arctic Climate Impact Assessment. Cambridge University Press. **2. Vincent et al.** (2004) Break-up and climate change at Canada's northern coast, Quttinirpaaq National Park. Meridion Spring/Summer p.1-6. **3. Mueller et al.** (2003) Break-up of the largest Arctic ice shelf and associated loss of an epishelf lake. Geophys. Res. Lett. 30 (20): 2031. **4. Kirchman** (2000) Microbial ecology of the oceans. Wiley-Liss, New York. **5. Martin et al.** (2004) Identification of long-chain perfluorinated acids in biota from the canadian Arctic. Environ. Sci. Technol. 38: 373-380.