

Canada GEOTRACES 2012-2013

- Many manuscript published already from the 2009 Geotraces cruise in the Beaufort Sea
- GEOTRACES_CCAR proposal funded: Biogeochemical and tracer study of a rapidly changing Arctic Ocean.
R. Francois plus 20 others (~\$5,000,000 for 5 years)
2 cruises in the Arctic in 2015.
- The renewal of the Line P iron program
collaboration UBC (Vancouver) UVic (Victoria) & DFO (Sydney).
3cruises a year (February, May and August)

University of British Columbia

Workshop, May 2 - 4, 2012

- 40 university & government scientists (Canada, US, UK, Germany, Sweden and Russia)
- to plan the details of a pan-Arctic international GEOTRACES field campaign in 2015 involving 7 different countries
- study the crucial connection between the Pacific and Atlantic Ocean through the Canadian Arctic Archipelago

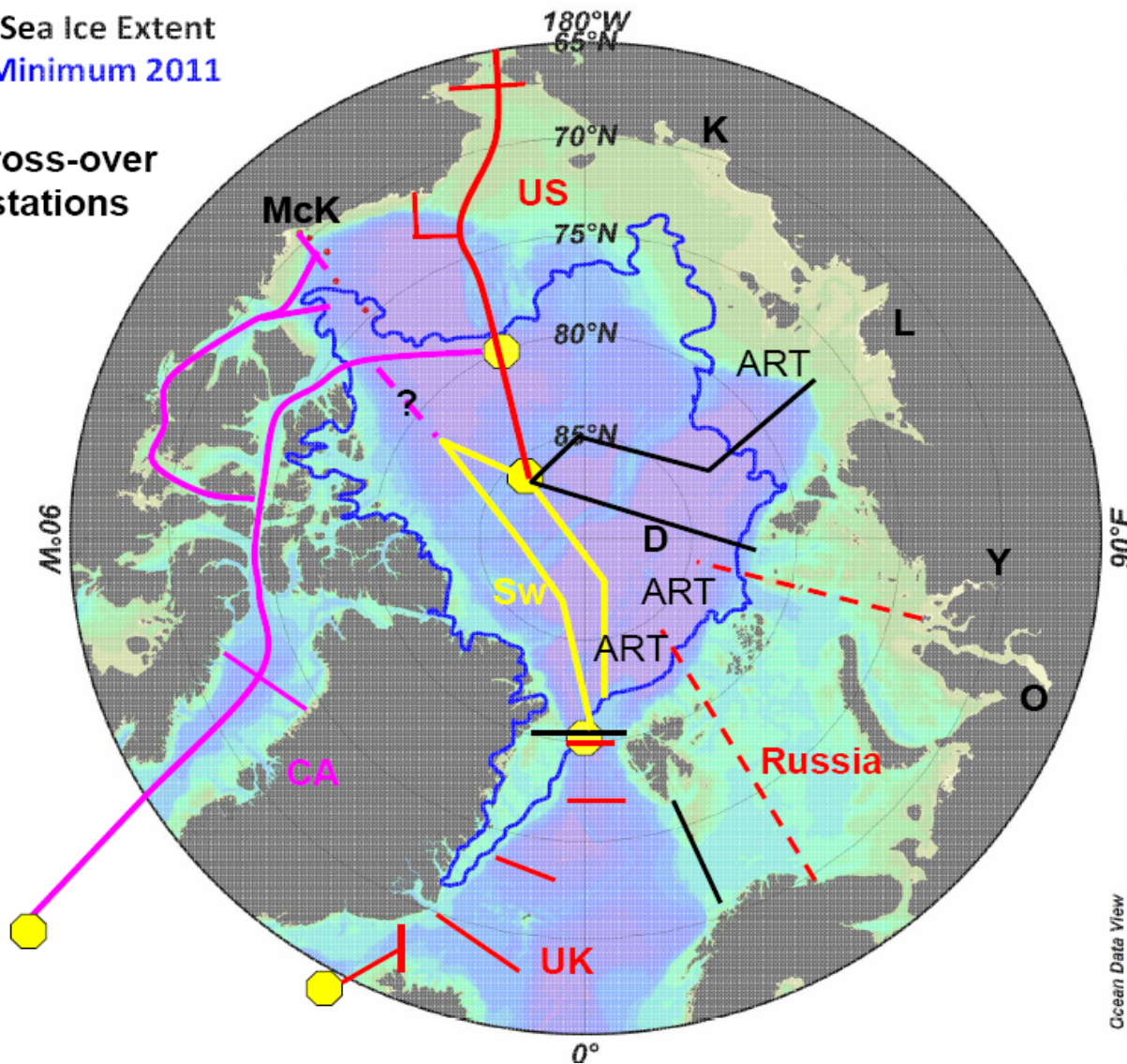
Canadian Arctic GEOTRACES_CCAR
Francois + 20 others + 6 DFO
collaborators

**Biogeochemical & tracer study
of a rapidly changing
Arctic Ocean**

Proposed 2015 international Arctic GEOTRACES program.
RED (US, UK, Russia), **MAGENTA** (Canada), **YELLOW** (Sweden),
and **BLACK** (Germany).

AMSR-E Sea Ice Extent
-- Sept Minimum 2011

● Cross-over
stations



2 cruises planned, back to back summer/fall 2015:

aboard R.V. Amundsen, ~ 9 weeks, ~ starts
late July)

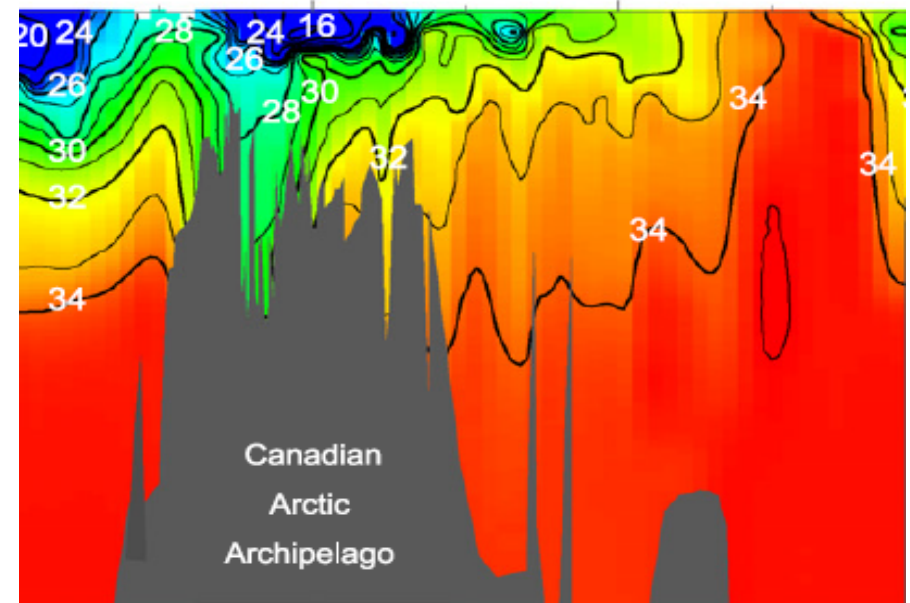
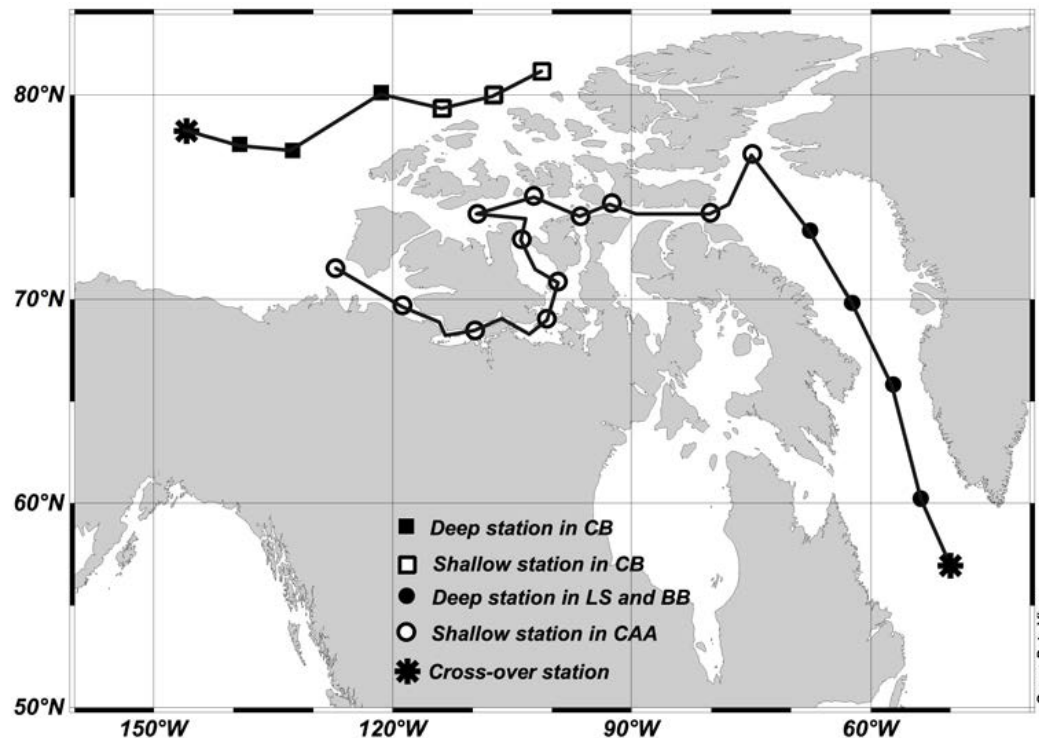
- Labrador Sea - CAA cruise (32 berths, 6 weeks) (in collaboration w/ DFO C3O Program)
- Canada Basin (in collaboration Arctic Net Program) (10 berths, 3 weeks)

The multi-disciplinary CAA project augments the core GEOTRACES measurements by:

- (1) developing novel water & circulation tracers to monitor future circulation changes in the CAA,
- (2) assessing the effect of ocean acidification on metal speciation, bioavailability and toxicity
- (3) documenting the effect of TEs on primary and secondary production & trace gas emissions in the CAA, and
- (4) integrating physical, biological and chemical parameters into a numerical model (NEMO+PISCES, Bopp et al., 2005) to predict changes in circulation & productivity in the CAA, their consequences in the N. Atlantic, and globally

TEIs measured at

- 5 deep stations in the Canada Basin (2 coincide with the JOIS moorings location)
- 12 shallow stations in the CAA,
- 6 deep stations in Baffin Bay and the Labrador Sea (one station coinciding with station BRAVO)



Diamonds: shallow stat.; Circles: deep stat.; Stars: deep cross-over intercalibration

5 THEMES

Theme 1. Water mass structure and circulation

Theme 2. Essential and Toxic Elements

Theme 3. Nutrient distributions, biological production, carbon sequestration and climate-active gas fluxes

Theme 4. Biological and chemical consequences of ocean acidification

Theme 5. Synthesis and modeling (S. Allen, UBC; P. Myers, U. Alberta; N. Steiner, CCCMA)

THEME 1

Water mass structure and circulation

GEOTRACES core measurements in red

Hydrography (DFO, ArcticNet)

^{230}Th , ^{231}Pa (R. Francois; UBC)

^{129}I & ^{137}Cs (J. N. Smith; BIO)

Nd isotopes (C. Holmden, U. Saskatchewan; R. Francois, UBC)

Pb isotopes (K. Orians; UBC & B. Bergquist, U. of T.)

Cr isotopes (C. Holmden, U. Saskatchewan)

$\delta^{18}\text{O}_{\text{H}_2\text{O}}$ $\delta^{13}\text{C}_{\text{DIC}}$ and Ba (A. Mucci, McGill; Thomas, Dalhousie)

ALK, (Mucci, McGill)

trace elements with strong Atlantic-Pacific gradients
(Cd, Ag)

cDOM (C. Geguen; U. Trent)

THEME 2

Essential and Toxic Elements

Fe, Zn, Cu, Cd (J. Cullen, Uvic)

Pb, Hg, MeHg (F. Wang; U. Manitoba)

Cr (C. Holmden, U. Saskatchewan)

Al, Mn (K. Orians, UBC)

Pb isotopes (K. Orians; UBC & B. Bergquist, U. of T.)

Nd isotopes (C. Holmden, U. Saskatchewan; R.
Francois, UBC)

Ra isotopes (H. Thomas, Dalhousie U.)

Organic complexation (A. Ross, IOS/Uvic)

THEME 3

Nutrient distributions, biological production, carbon sequestration and climate-active gas fluxes

- $p\text{CO}_2$, CH_4 , DMS, N_2O , O_2/Ar (Tortell, UBC; Thomas, Dal)
- triple O isotopes (R. Hamme, U. Vic.)
- DIC, ALK, pH, **d^{13}C -DIC** (A. Mucci, McGill)
- ^{234}Th (L. Miller; IOS; DFO)
- macronutrients & relevant stable isotopes
(**d^{15}N -nitrate**, M. Kienast; Dalhousie U;
Silicon isotopes, D. Varela; U. Vic)
- **Fe isotopes** (Bergquist; U. Toronto)
- phytoplankton pigments (Maldonado, UBC)
- $\text{N}_2/\text{Ar}/\text{Kr}/\text{Xe}$ (R. Hamme; U. Vic)

THEME 4

Biological and chemical consequences of ocean acidification

pH, ALK, DIC, trace elements and isotopes,
Underway surface sampling & depth profiles
Manipulation experiments

- Biota-trace element interactions (Maldonado, UBC):
 - Trace metal quotas of size-fractionated particles
 - Rates of trace metal uptake (^{14}C , ^{55}Fe)
- Primary production (Tortell/Maldonado/Varela):
 - (^{13}C , ^{15}N , O_2/Ar), Si uptake, C:N:Si uptake ratios
- Phytoplankton biomass & sps composition (Maldonado, UBC):
 - Microscopy, HPLC pigments, flow cytometry
- Photosynthetic competence (Maldonado, UBC)
- Bacterial productivity (R.Rivkin, Memorial Univ.)

BioGEOTRACES

- Proteomics, genomics (Maldonado, UBC; Rivkin, Memorial)
- Trace metals in size-fractionated particles (Maldonado, UBC)

- Dissolved trace metal concentrations: Fe, Al, Mn, Cu, Zn, Cd, Pb, THg (MeHg), Ag, Ba, Cr,
- Dissolved ^{129}I , ^{230}Th , ^{231}Pa , ^{234}Th concentration
- Radiogenic Pb and Nd isotopes
- N stable isotopes in nitrate, $\delta^{18}\text{O}$, Si isotopes
- Carbon stable isotopes in DIC
- Marine particles (R. Francois, UBC)
- Aerosols (B. Bergquist; U. Toronto)
- Ra, Fe, and Cr isotopes
- $p\text{CO}_2$, CH_4 , DMS, N_2O , O_2/Ar , triple O isotopes, DIC, ALK, pH
- N_2 , Ar, Kr, Xe, N_2/Ar , triple O isotopes