



# MINERALOGICAL, PHYSICAL AND CHEMICAL PROPERTIES OF ARCTIC LAKE SEDIMENTS

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Natural Resources  
Canada

Ressources naturelles  
Canada

Canada

# Study Sites

## Existing Study Sites

(Natural Archives Reliability)

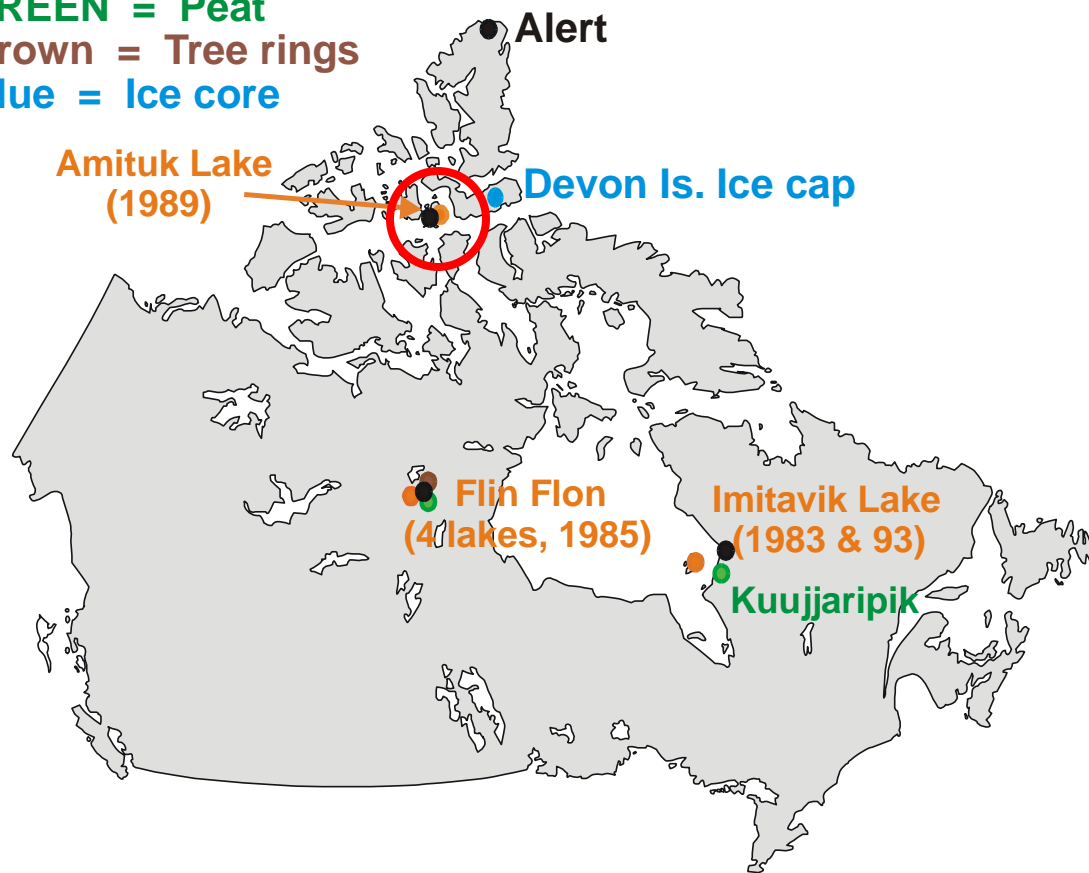
Black = Instrumented Record

Orange = Lake sediment

GREEN = Peat

Brown = Tree rings

Blue = Ice core

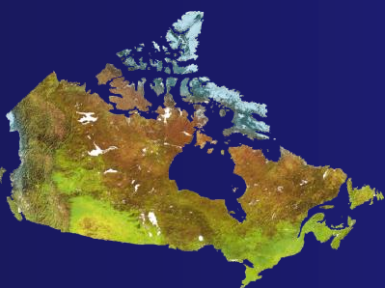




# Source “Apportionment” of Metals

- Several approaches are involved
  - mass balance calculations based on known industrial outputs
  - isotopic labels
  - identification of natural “background”
  - using natural archives as proxy records
- Importance
  - regulation of industrial emissions
  - transboundary issues





# Testing the Validity of the Sedimentary “Record”

- Does the vertical distribution of metals in lake sediments represent:
  - chronological metal loading?
  - diagenetic remobilization?
  - something else?





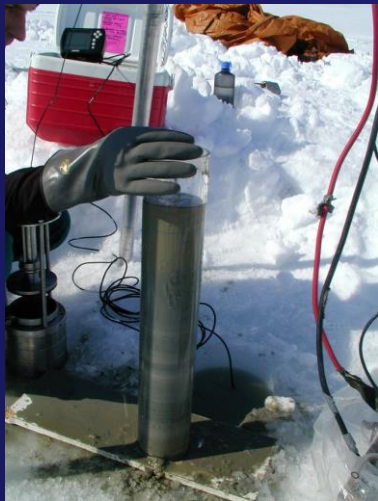
# Approach

- Examine sediments for physical and diagenetic changes
- Determine major and trace mineral content; examine flux of Hg and other elements in relation to bulk physical properties
- Revisit lakes studied >1 decade ago to track changes in the vertical distribution of metals
  - Partners: DFO, Can Museum of Nature, U of Penn, Hudson Bay Mining & Smelting Co. (now HudBay Minerals. Inc.)



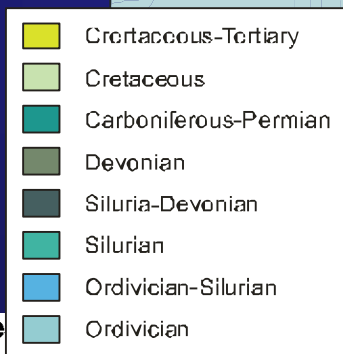
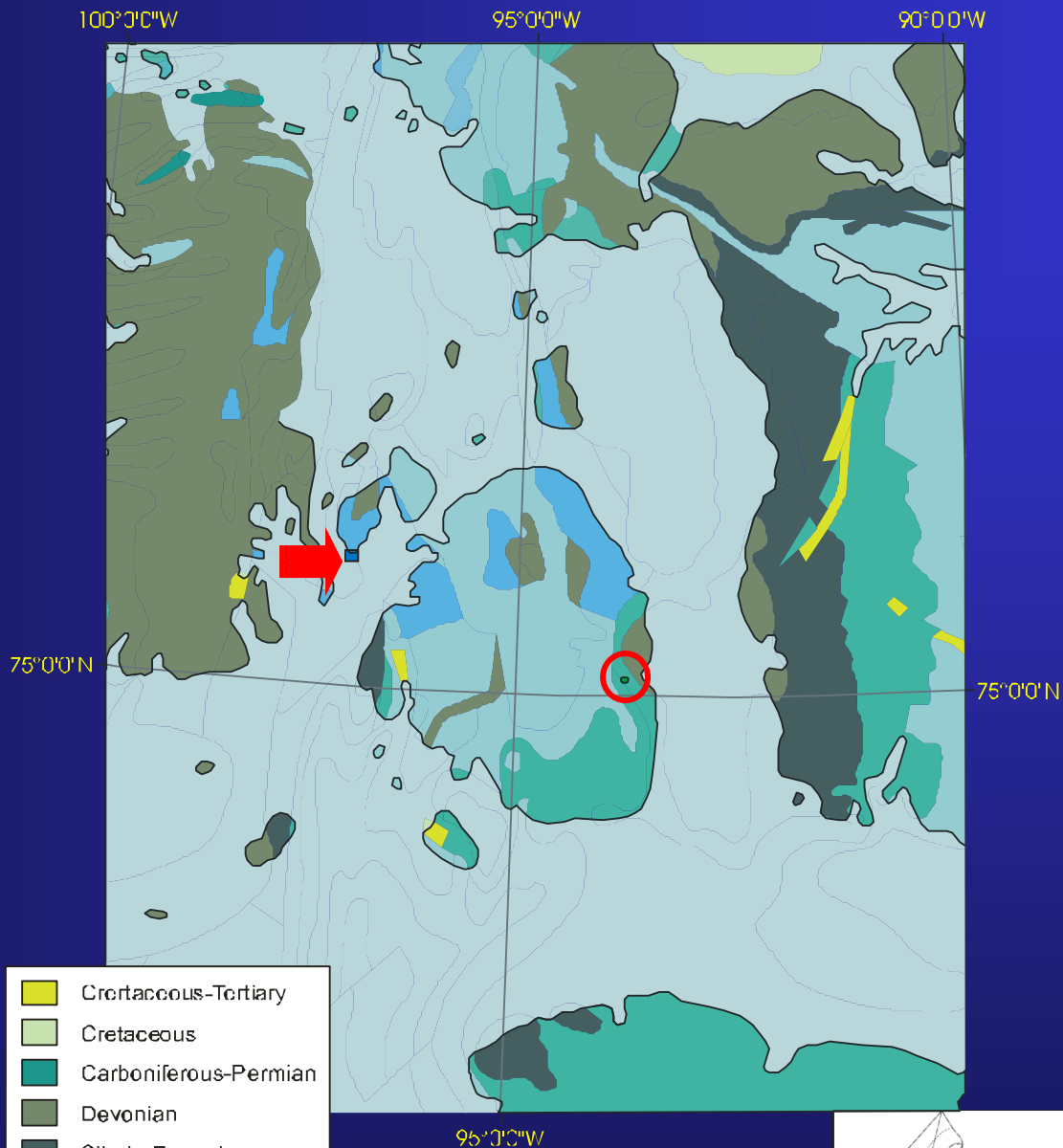
# Sediment Influences

- Texture, bulk properties and chemical composition are affected by mineralogy, depositional and post-depositional processes (diagenesis)
  - Diagenesis may include
    - changes in mineralogy and formation of authigenic minerals
    - evidence of physical compaction
    - mass balance changes of non-industrial elements such as REEs, alkali earth metals, etc.





# Amituk Lake Cornwallis Island





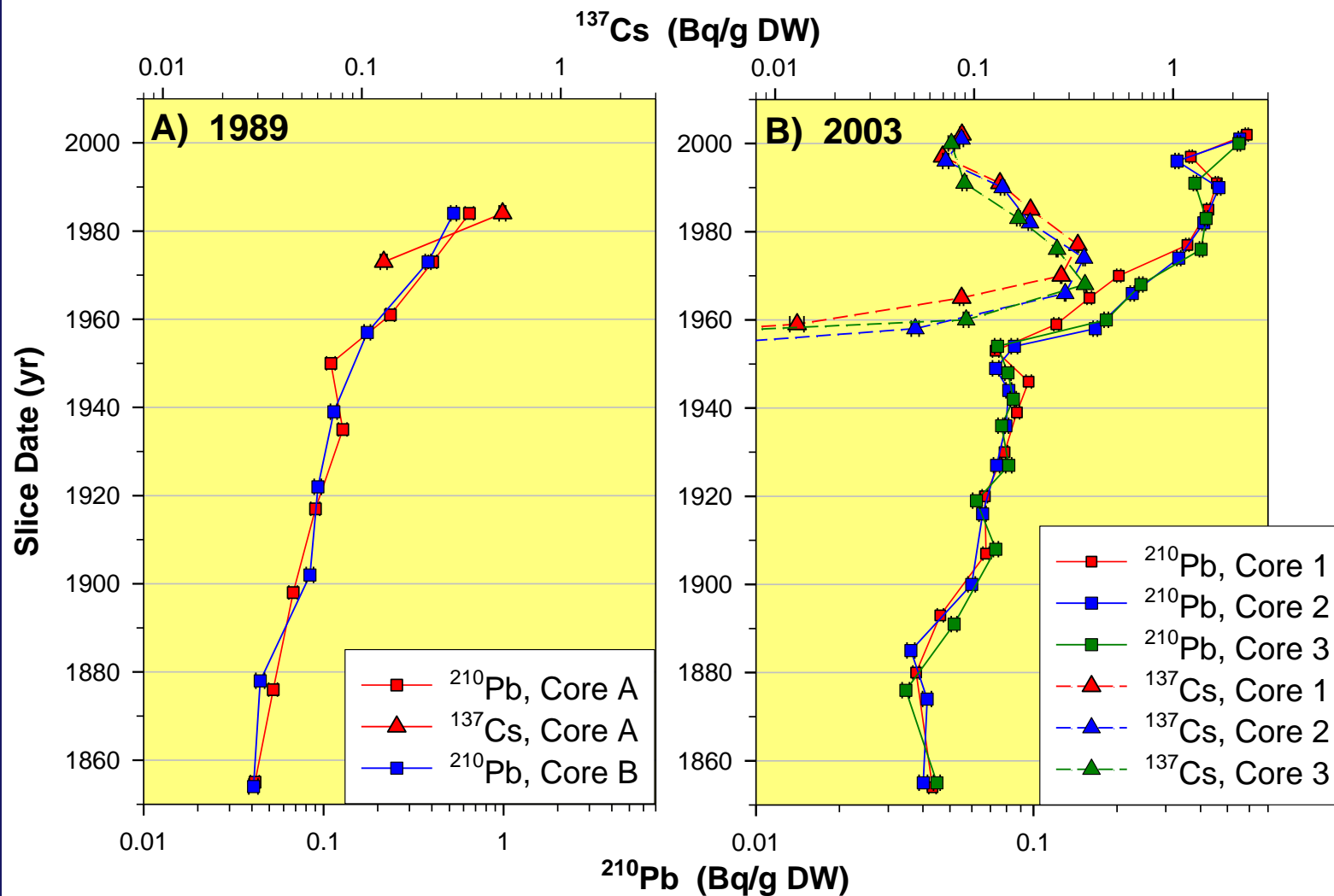


# Cornwallis Island, 2003



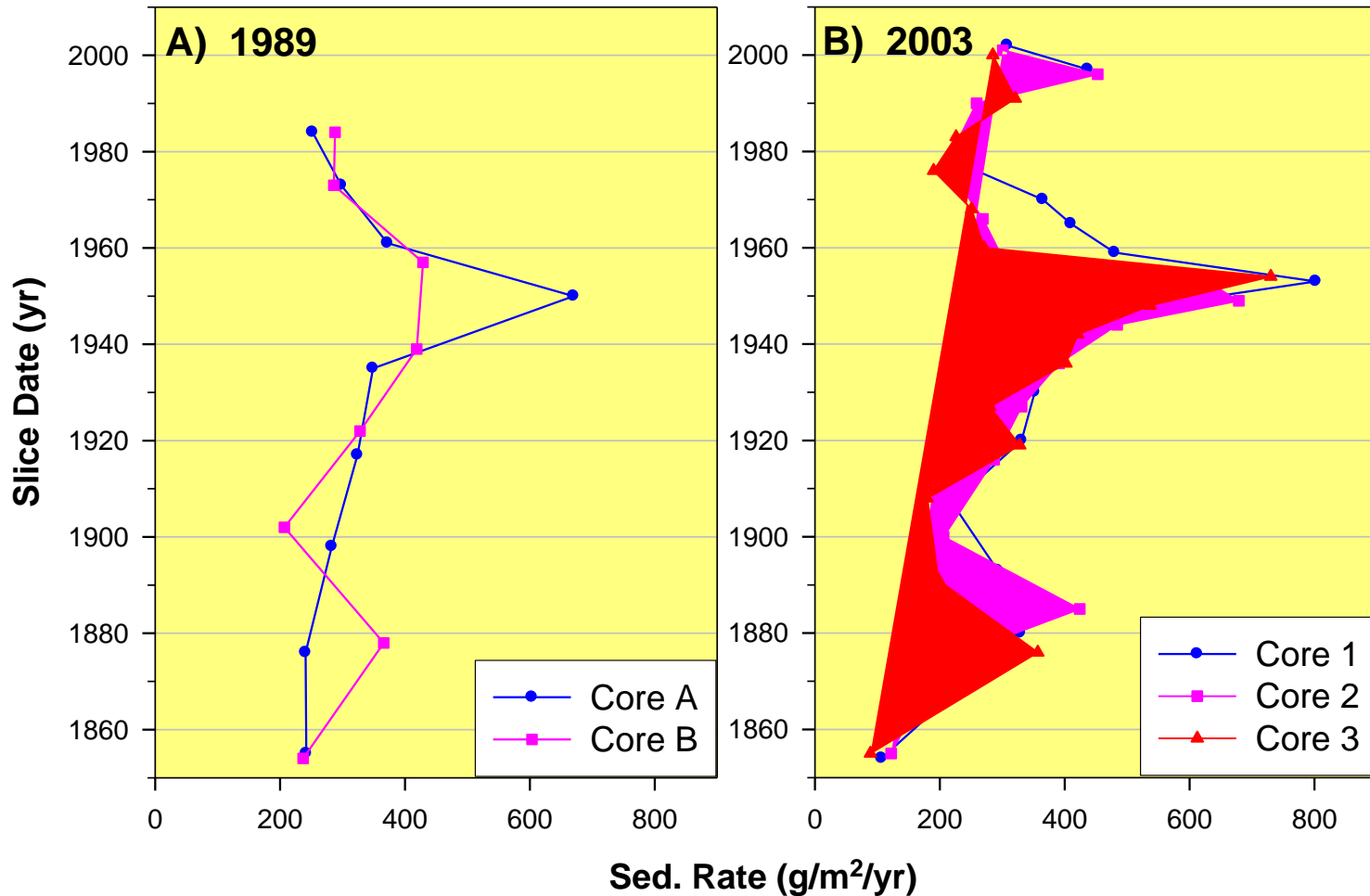


# Amituk Lake, $^{210}\text{Pb}$ and $^{137}\text{Cs}$ dating



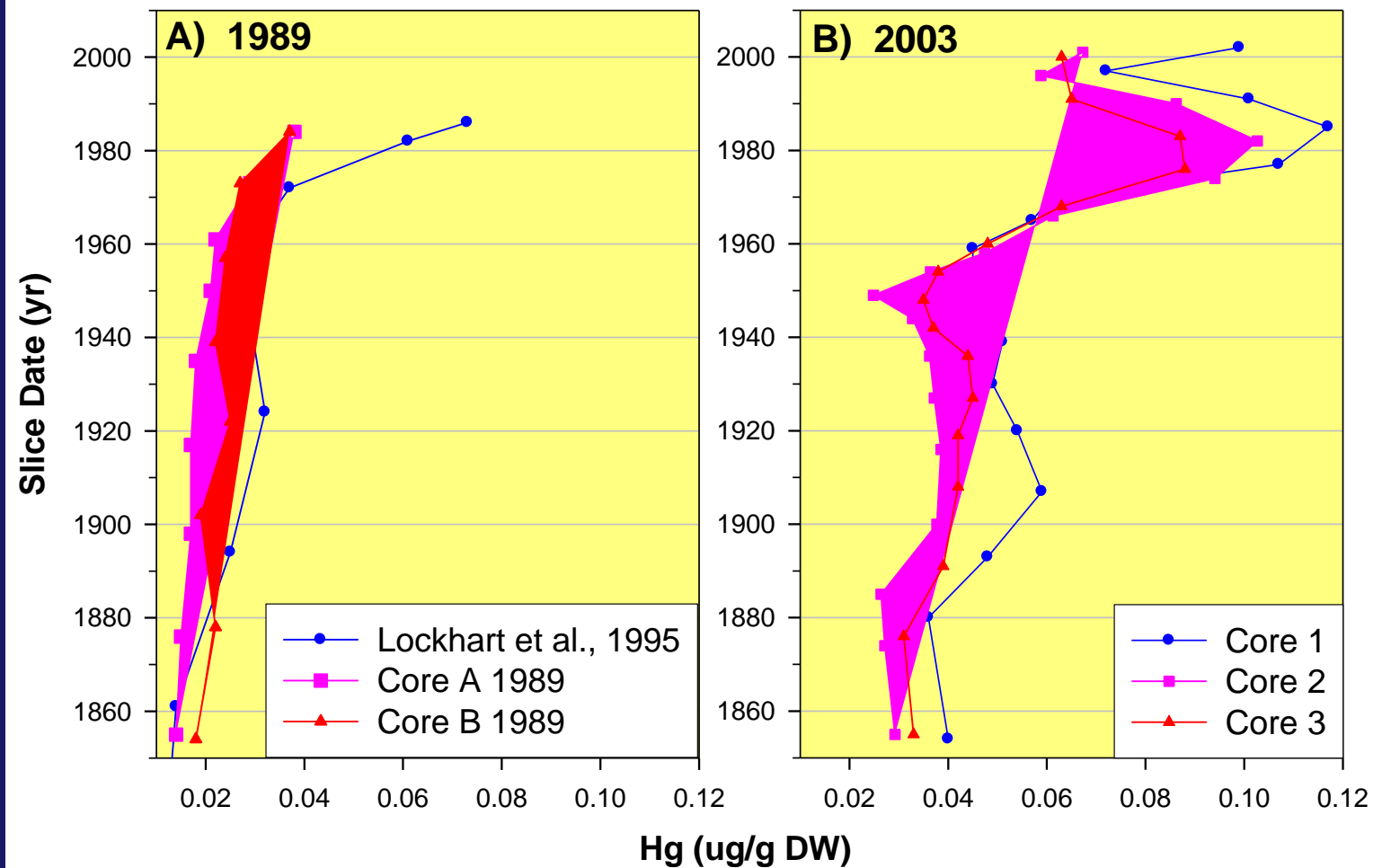
# Amituk Lake, Sedimentation Rate

(based on  $^{210}\text{Pb}$  CRS model)

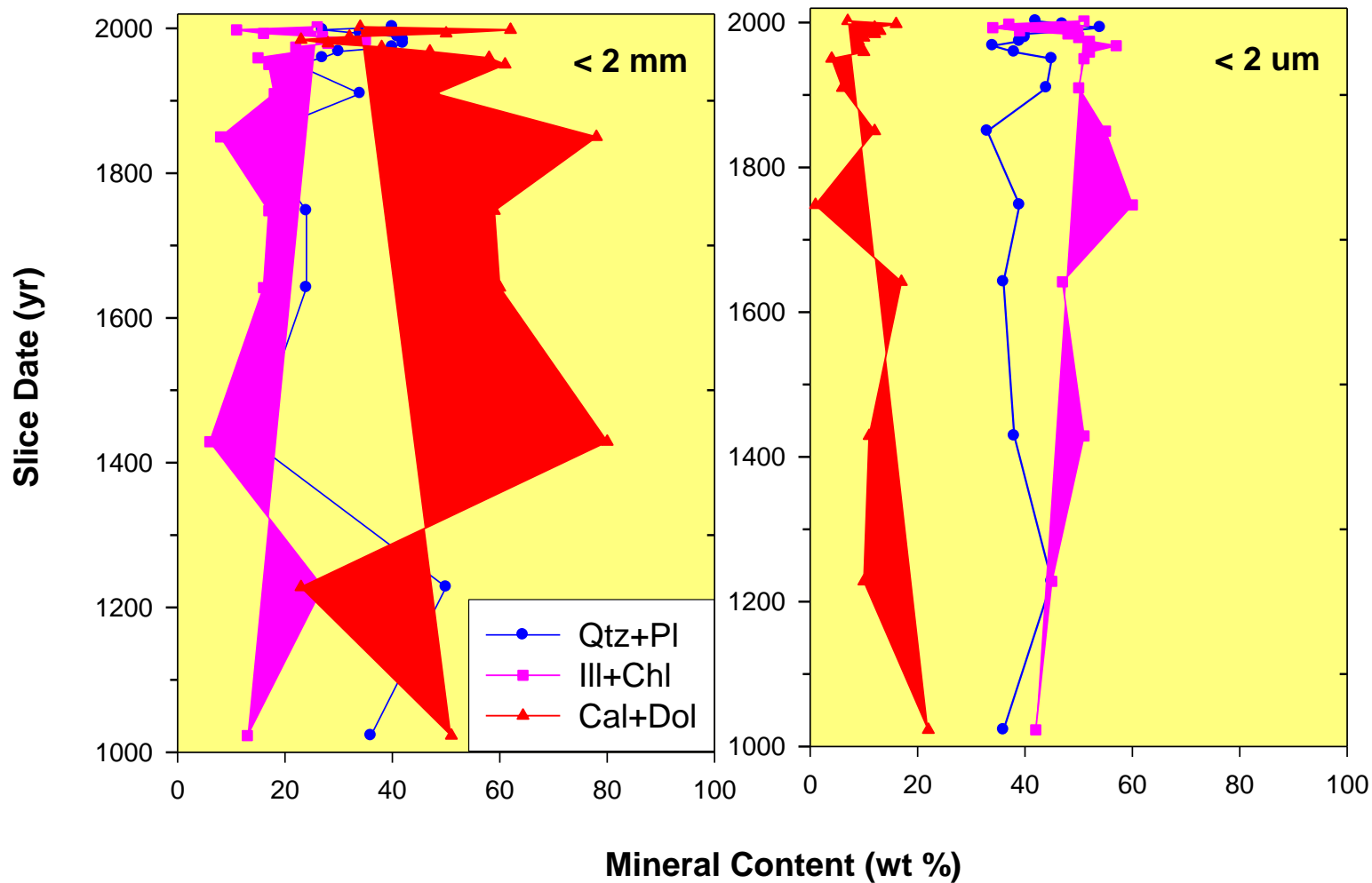




# Amituk Lake, Hg Concentrations

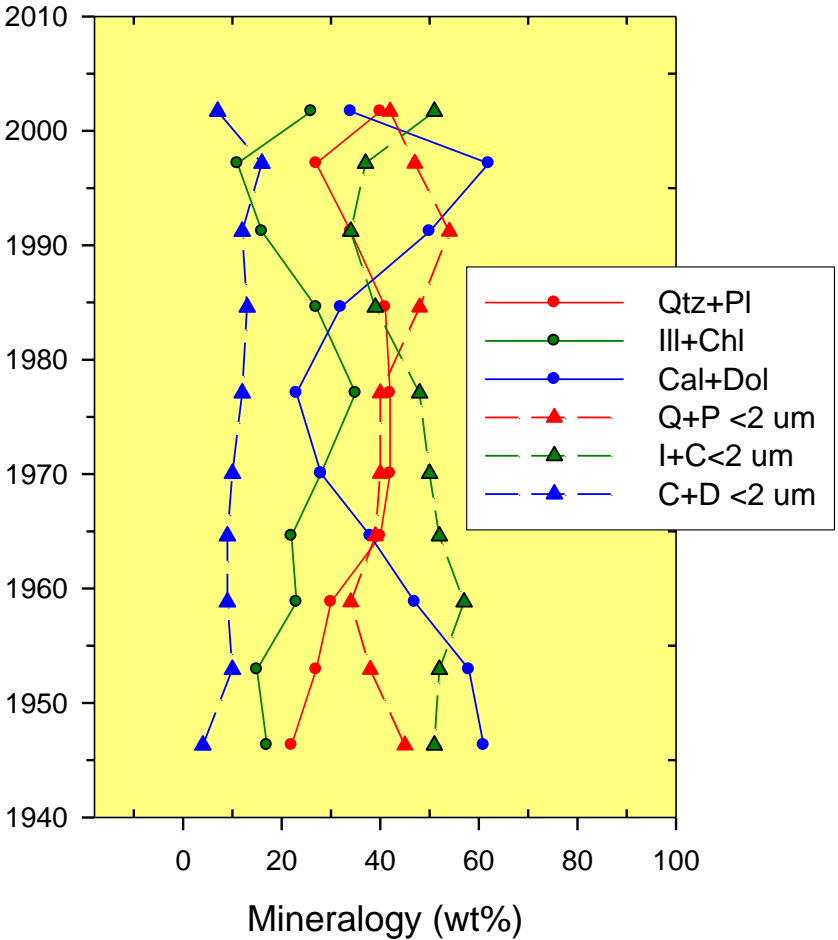
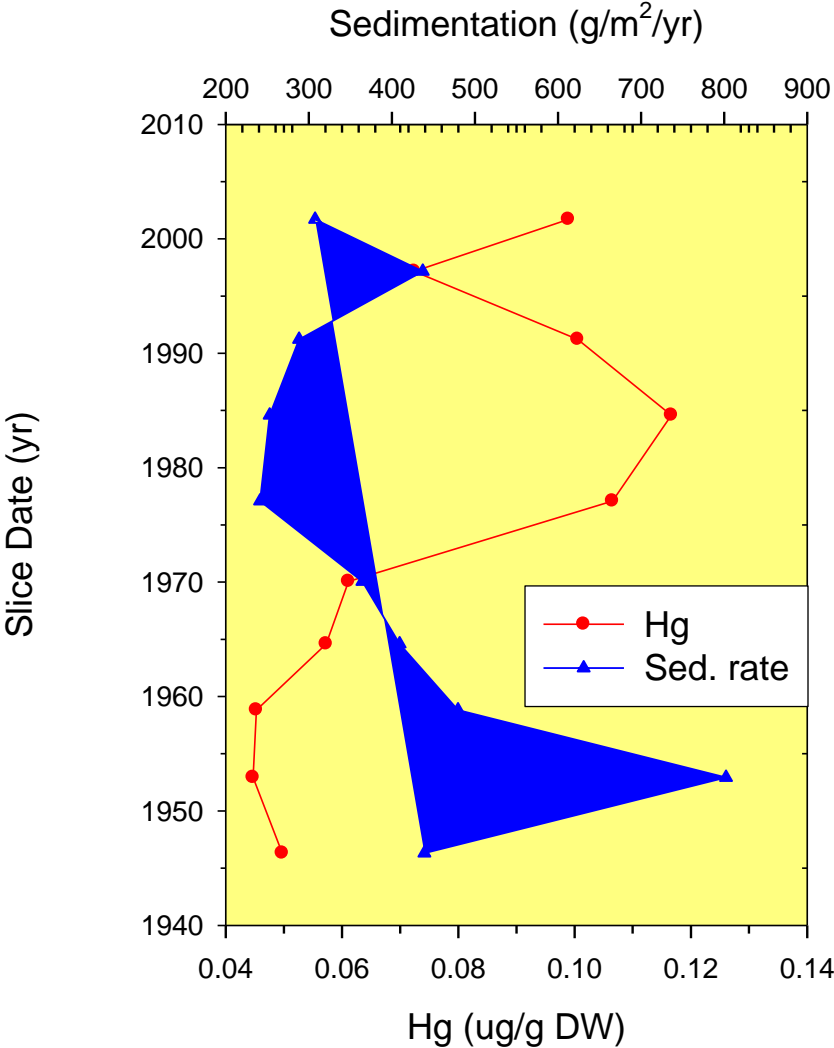


## Amituk Lake Mineralogy



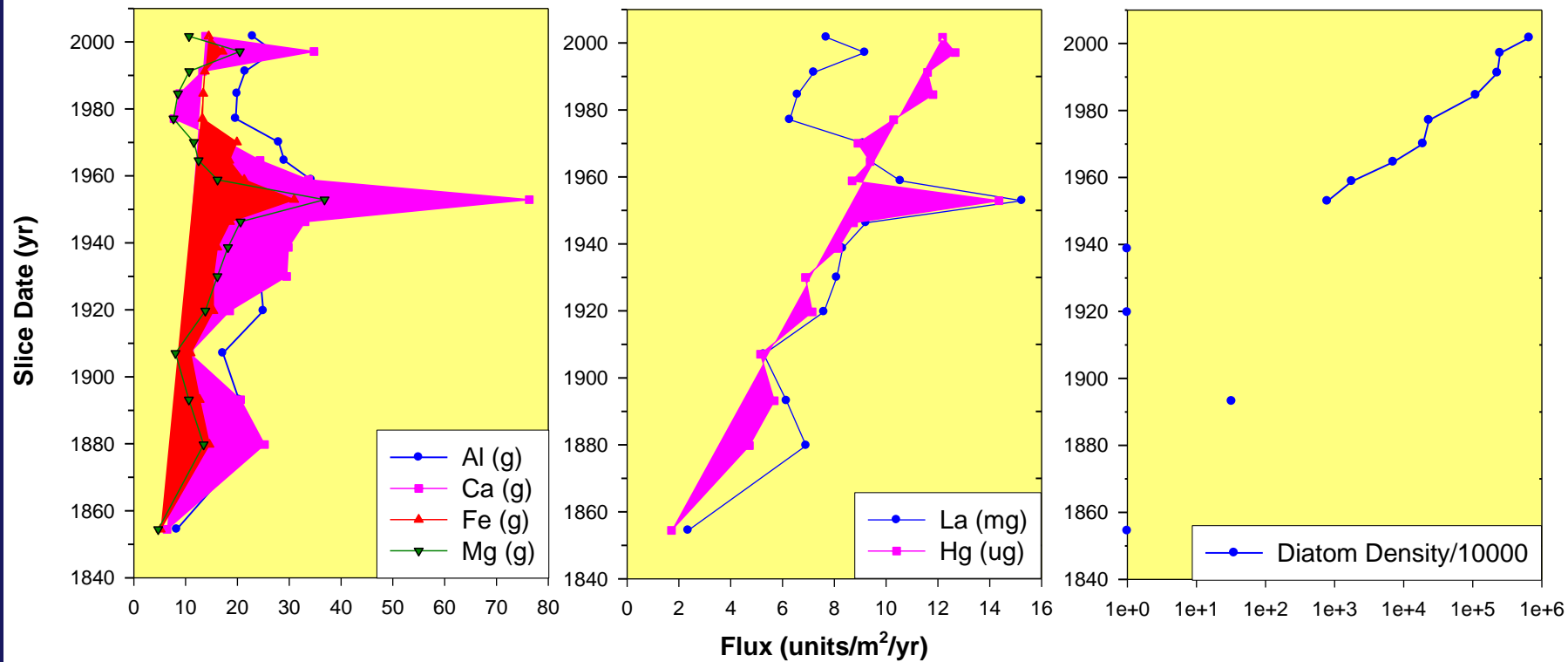


# Amituk Lake





## Amituk Lake 2003 Flux Profiles



# Study Sites

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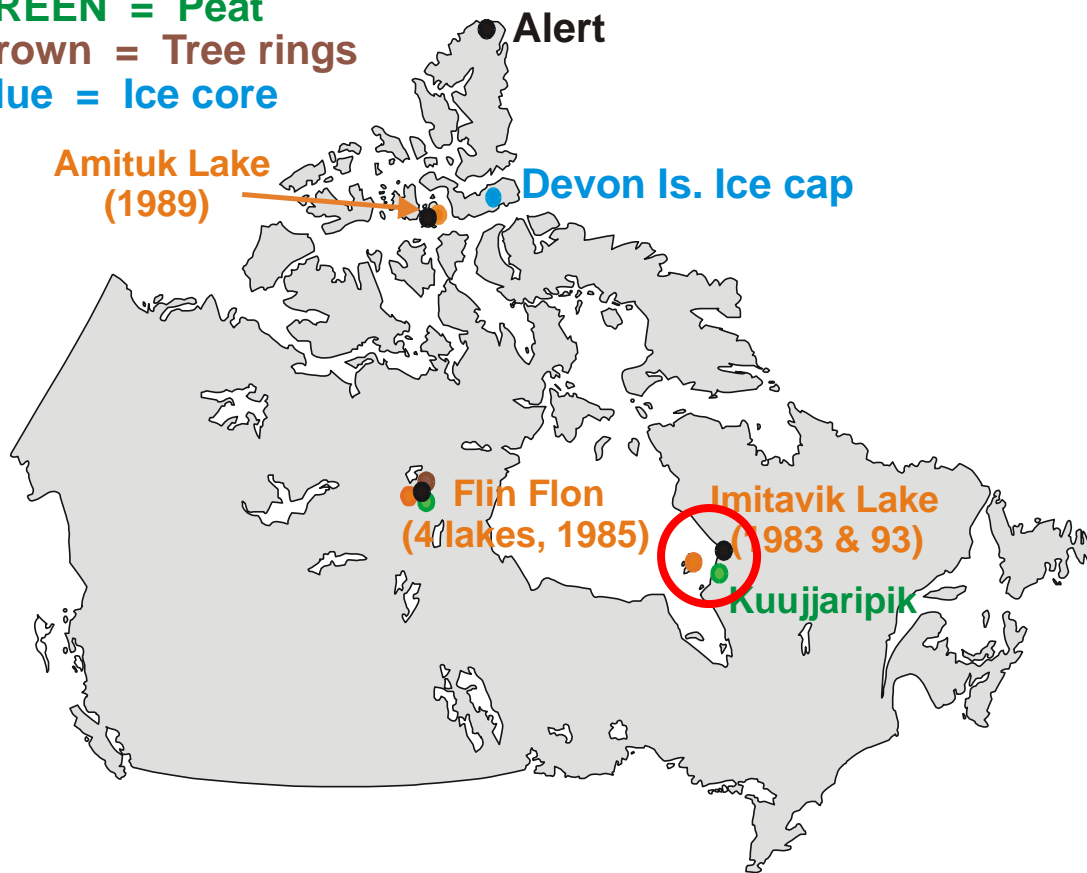
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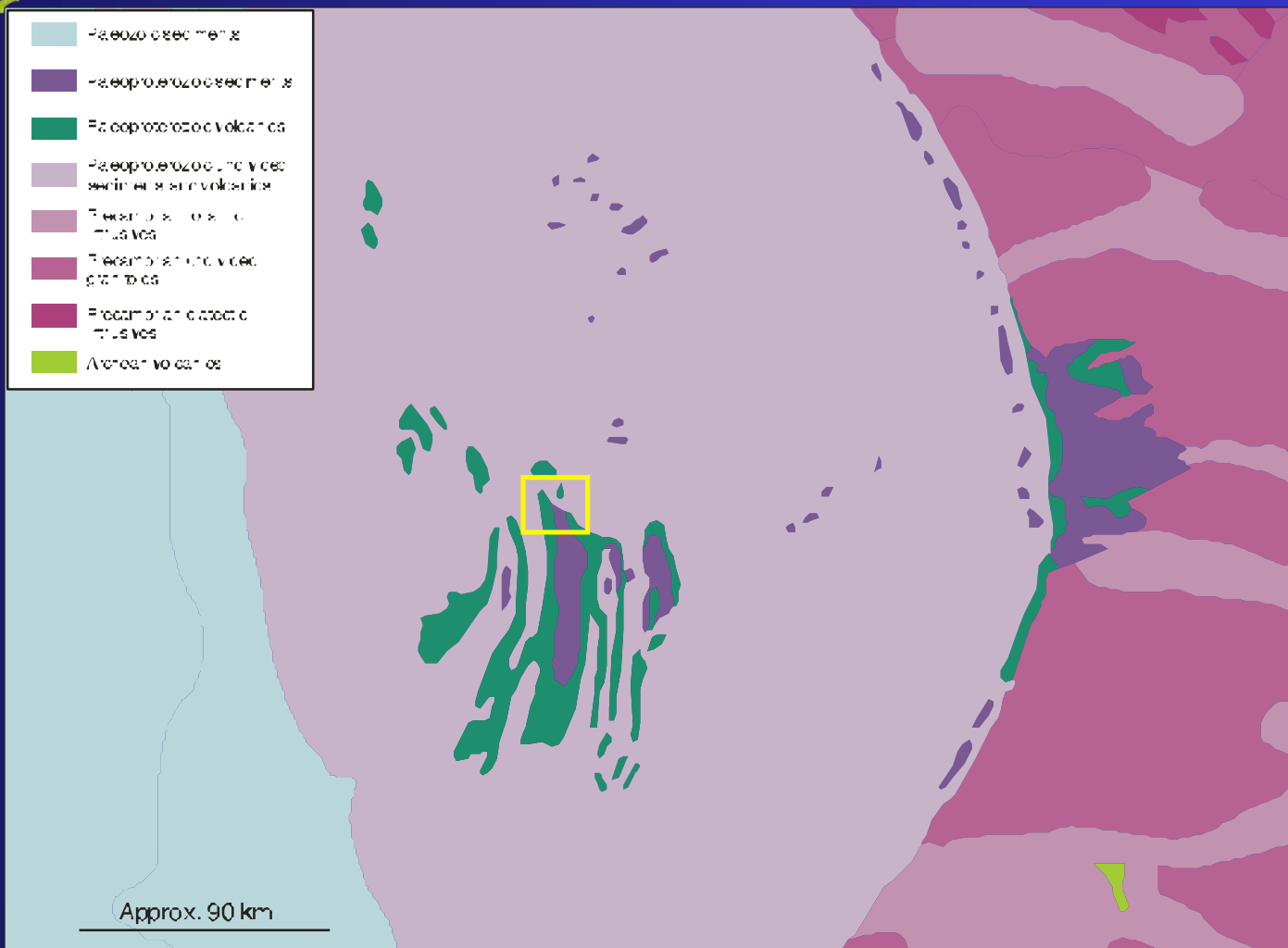
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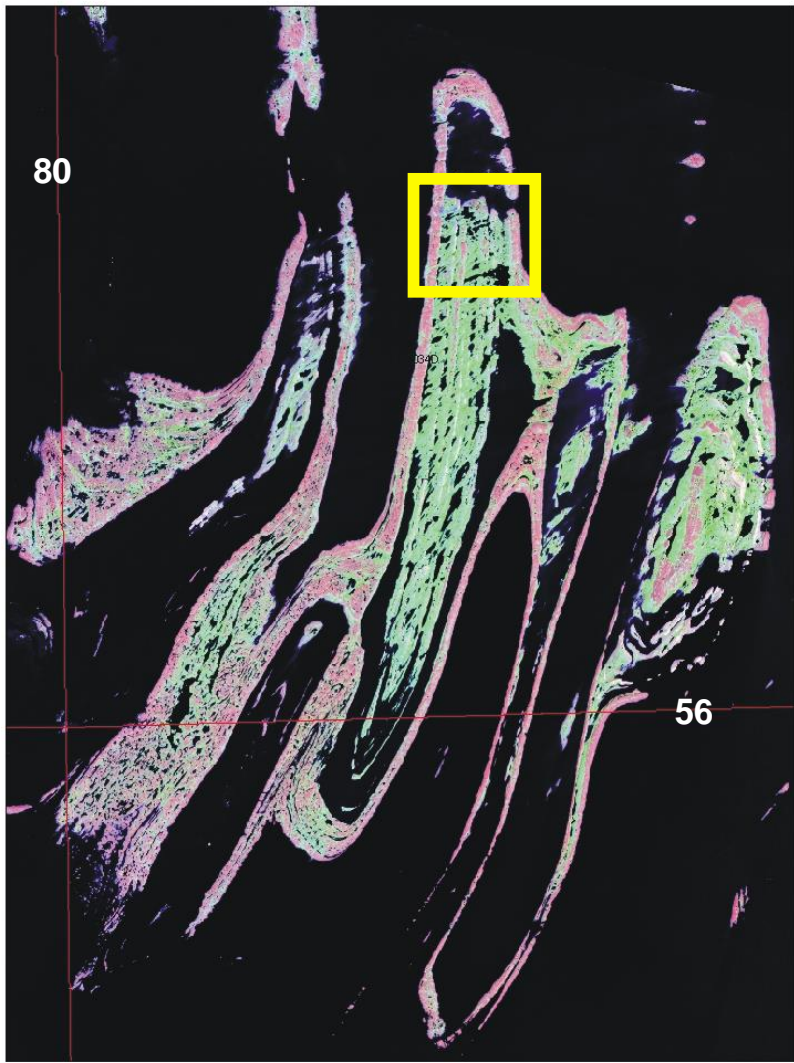


# Geology of the Belcher Islands



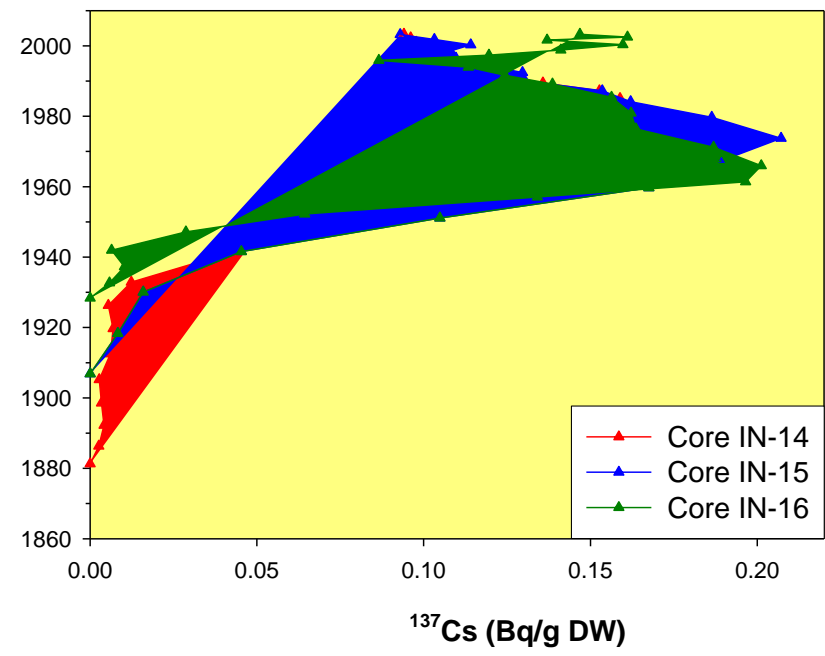
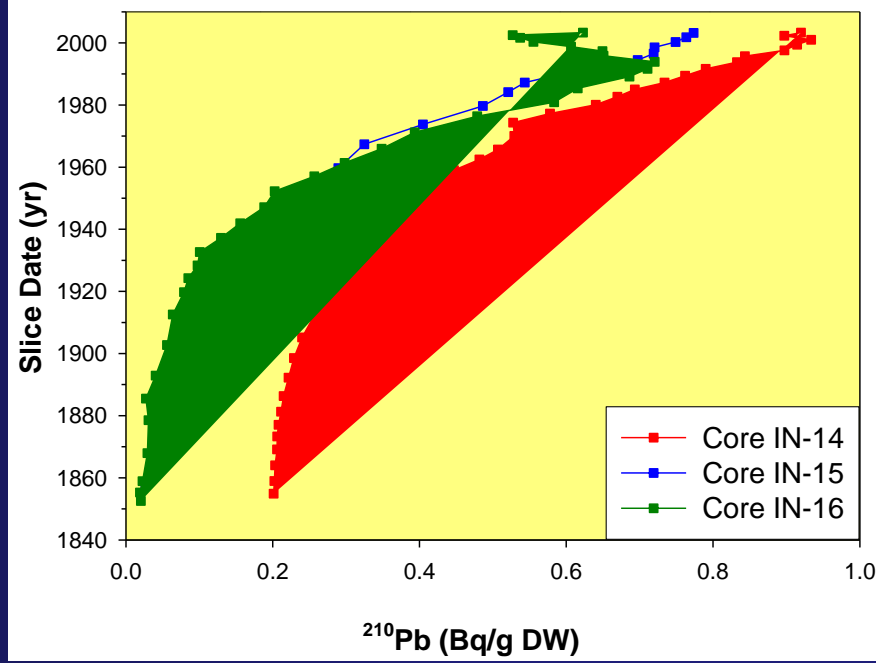


# Satellite View Belcher Islands



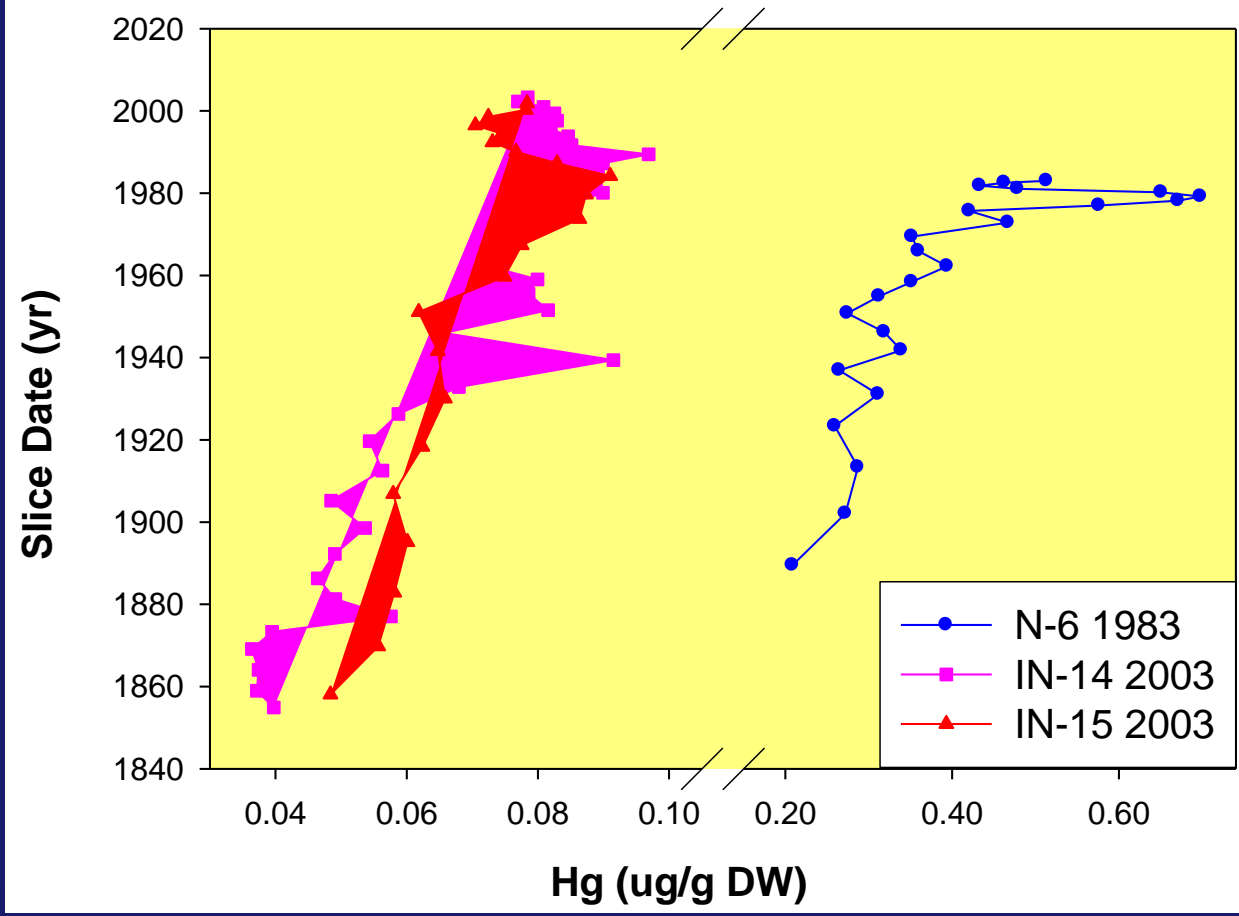


Imitavik Lake,  $^{210}\text{Pb}$  and  $^{137}\text{Cs}$  Dating





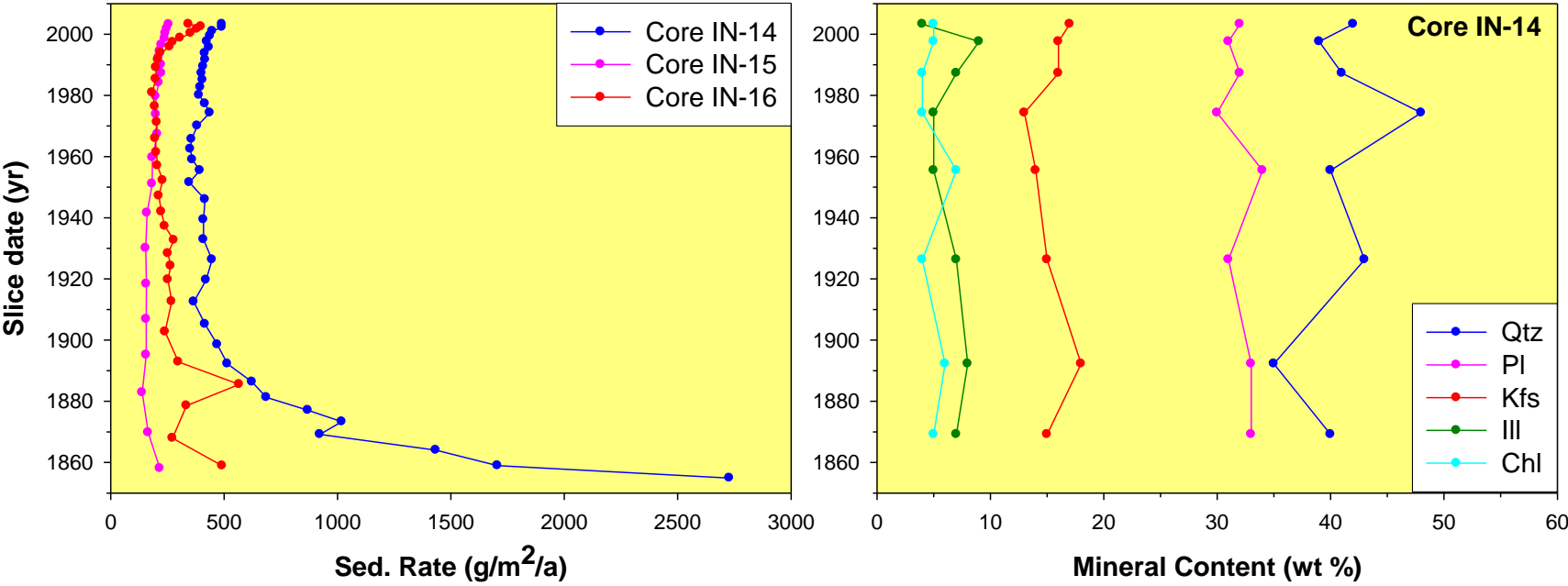
# Imitavik Lake, Hg Concentrations



Note: N-6 samples re-analysed

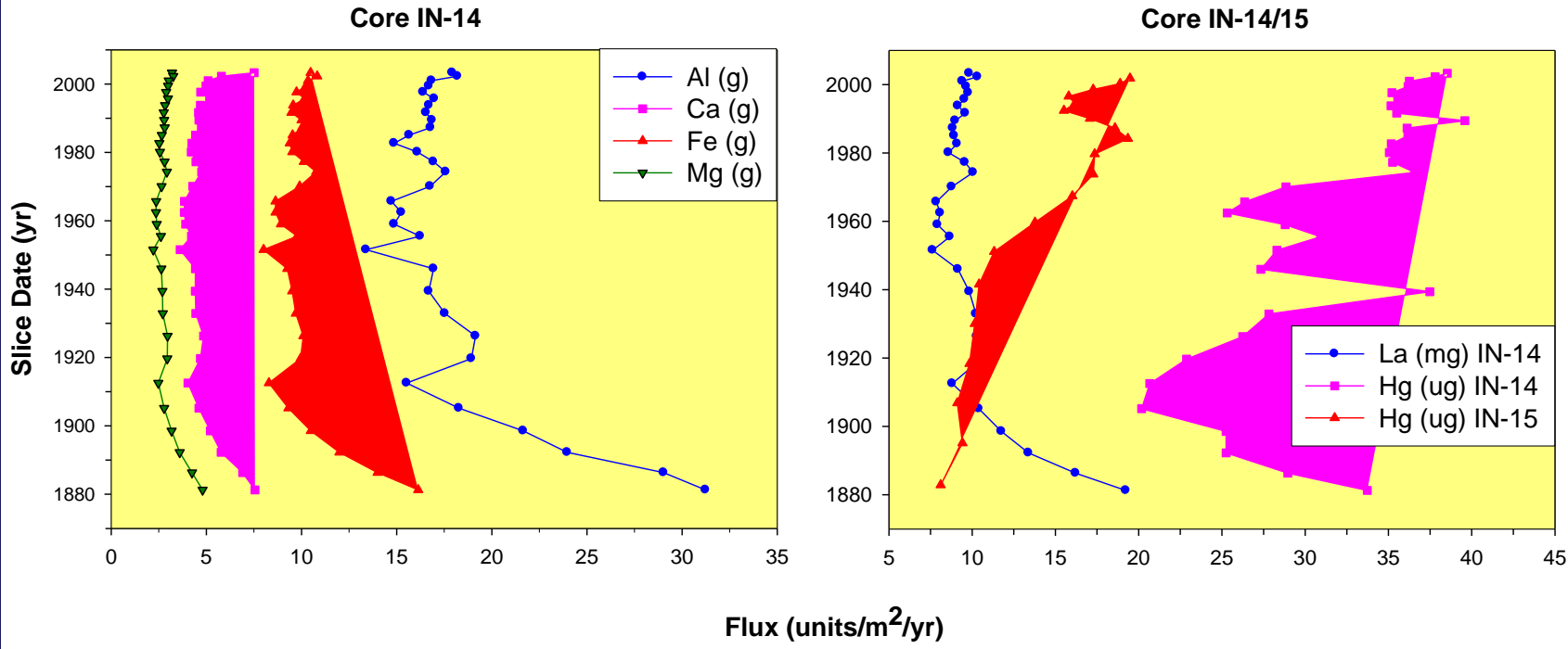


Imitavik Lake



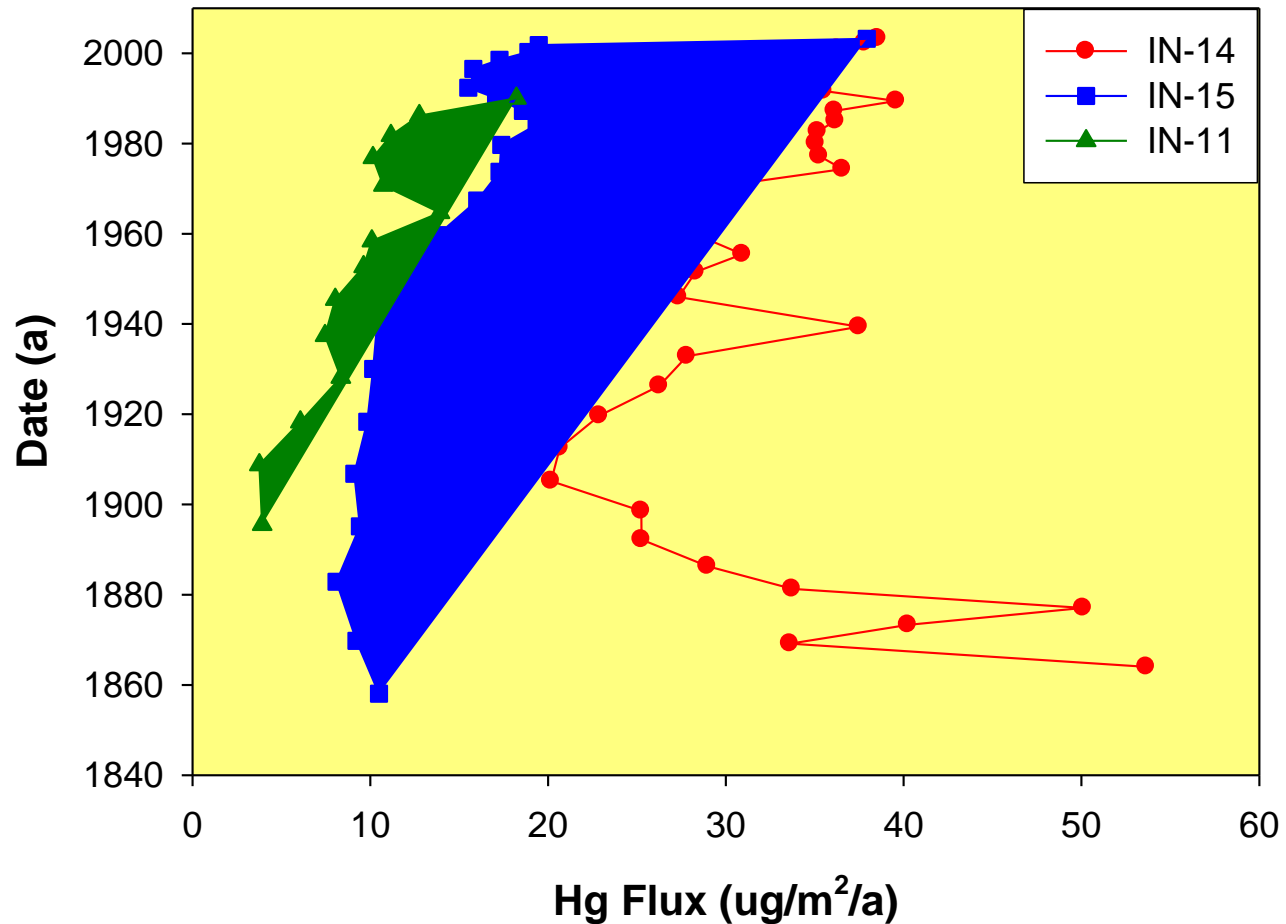


Imitavik Lake 2003 Flux Profiles





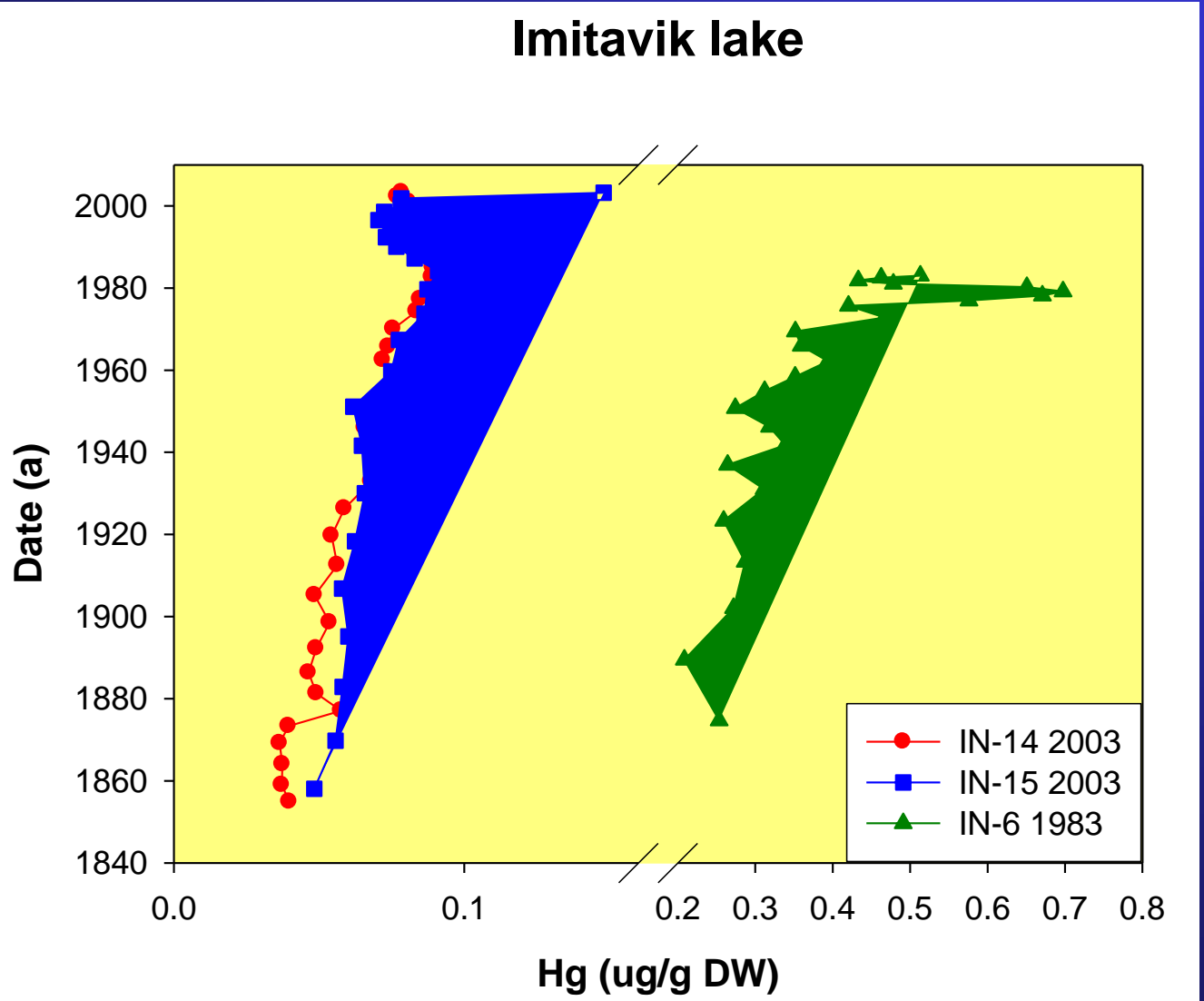
# Imtavik Lake







# Imitavik lake





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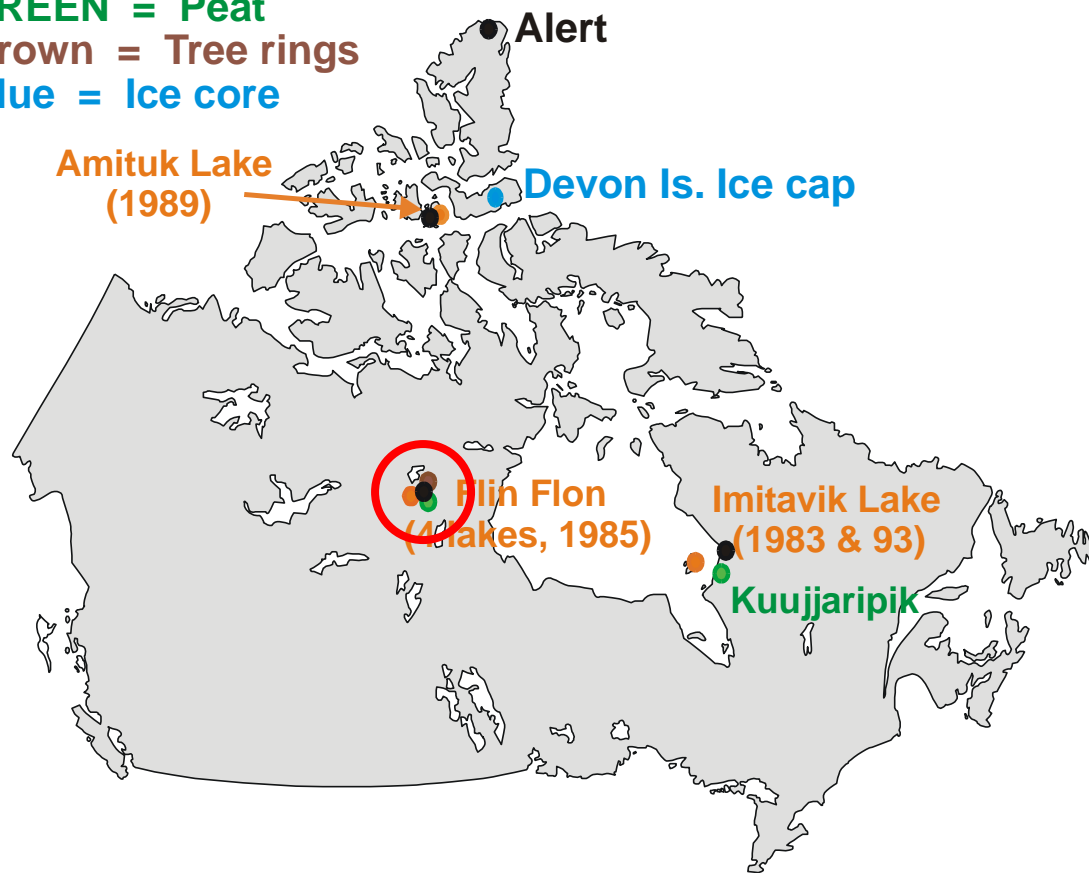
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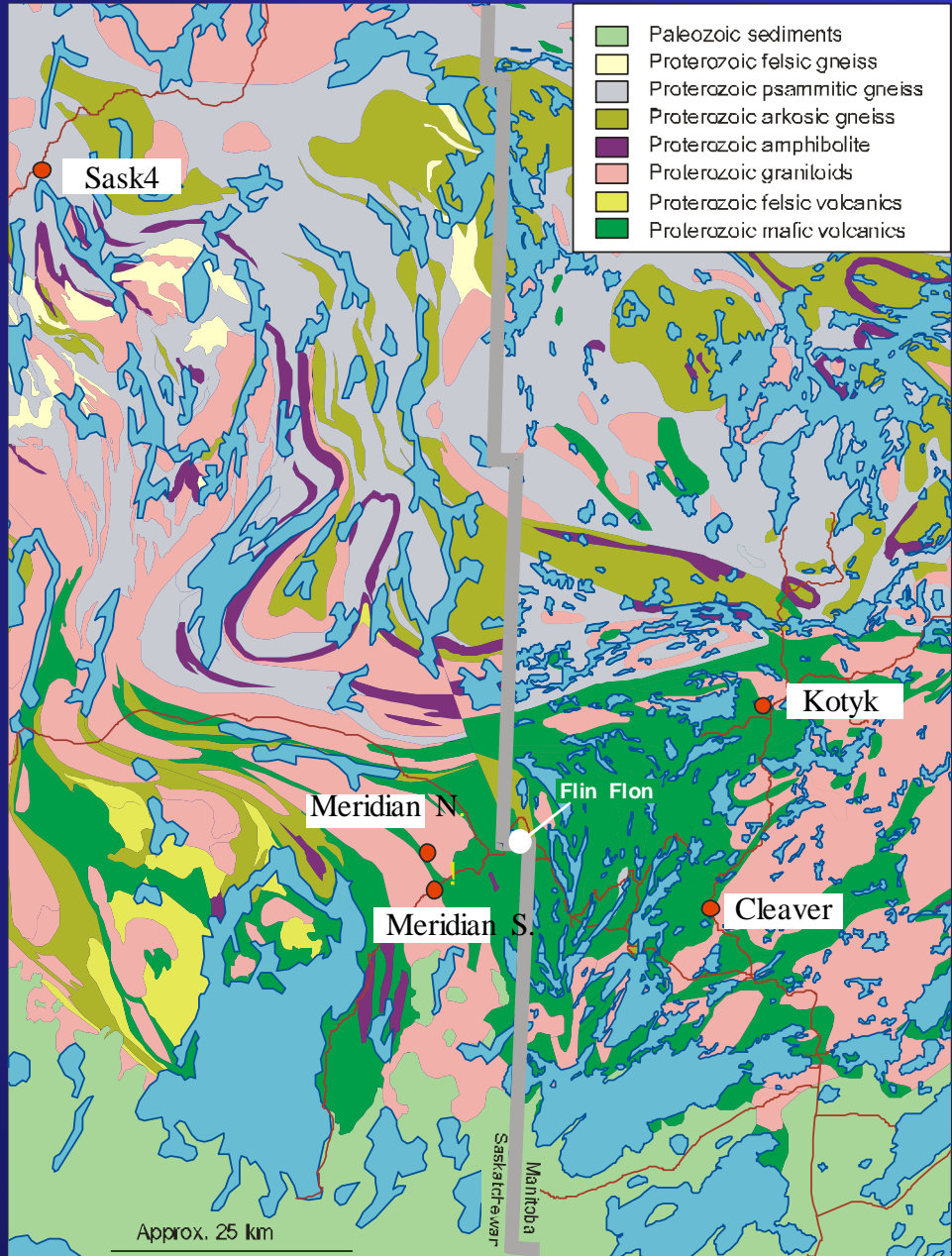
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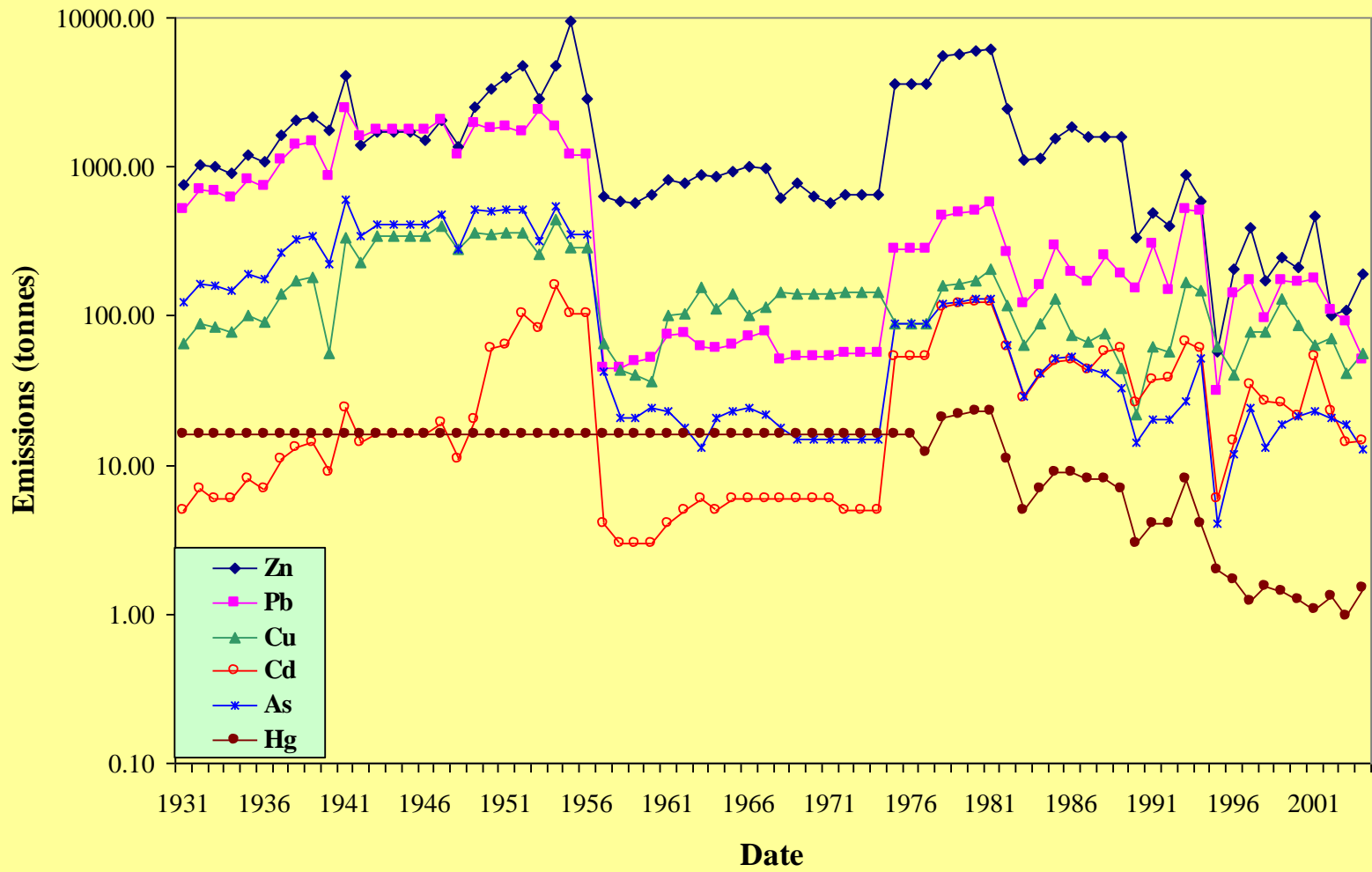


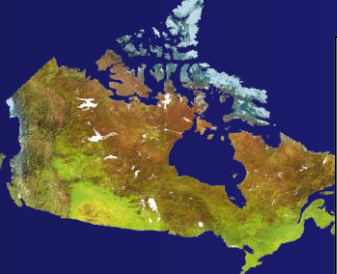


# Geology Flin Flon

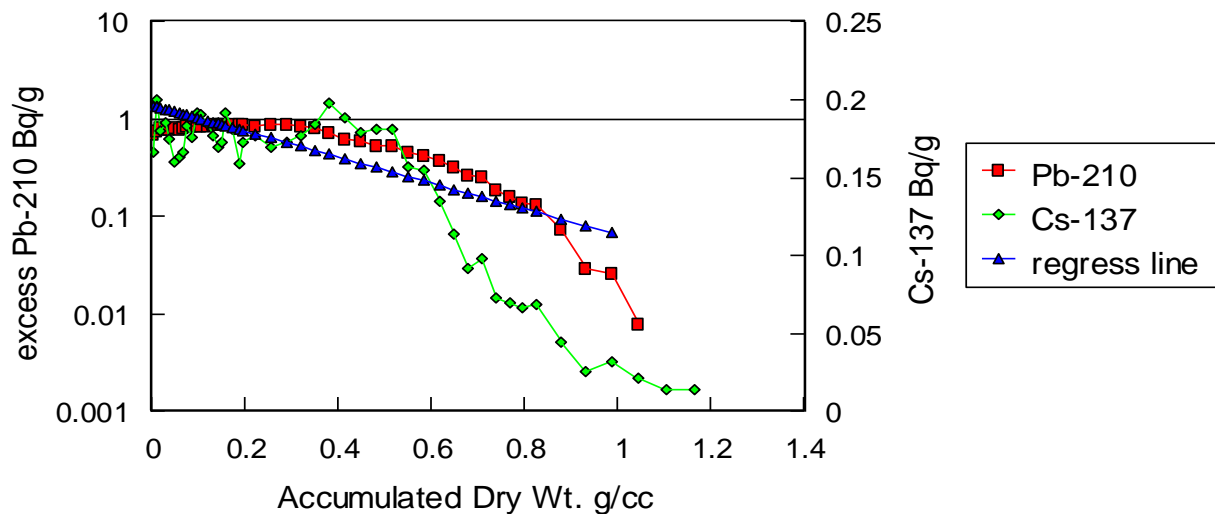


## Flin Flon Emissions 1931-2003

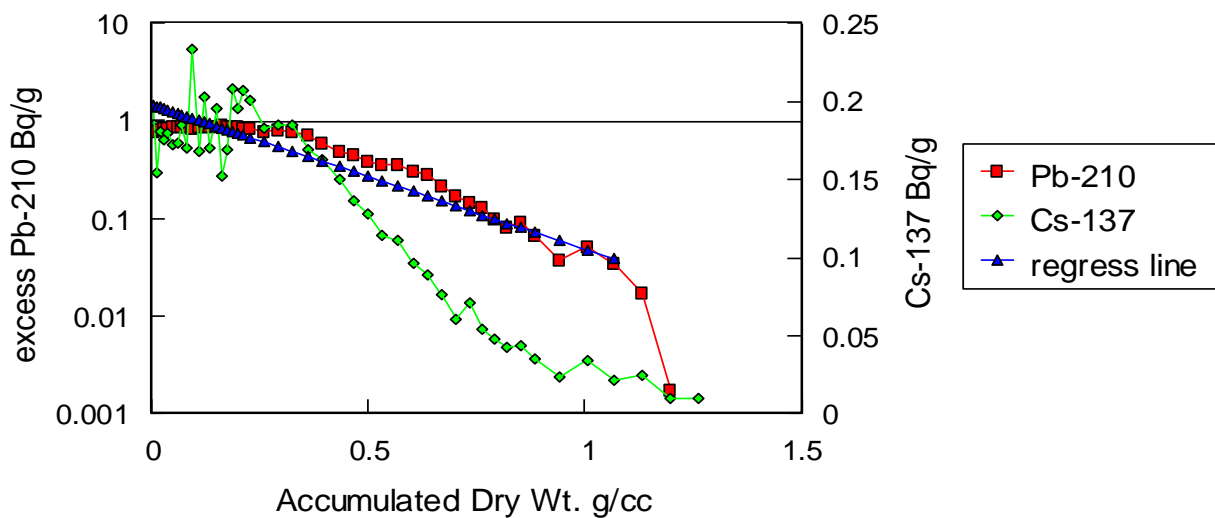




## KOTYK #1, AUG.2004

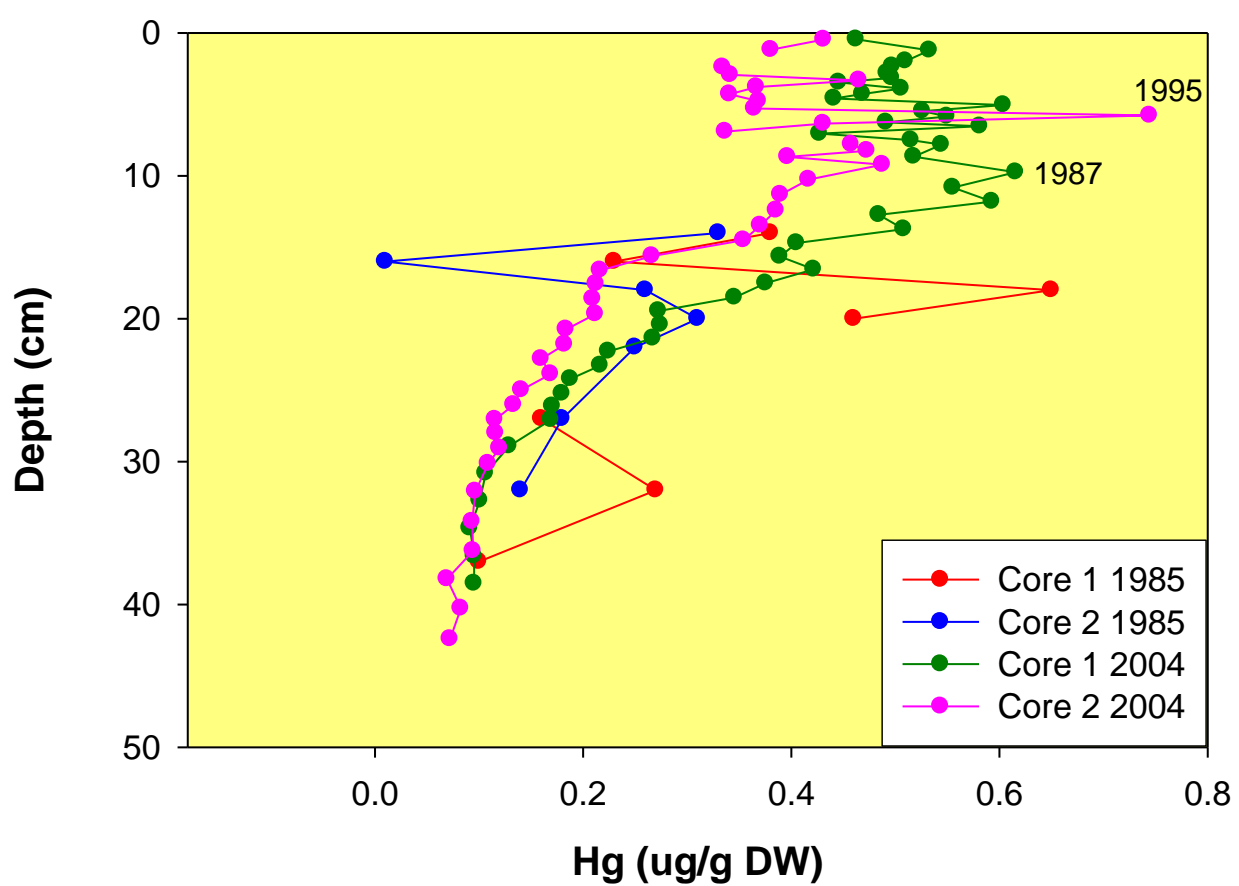


## KOTYK #2, Aug.2004



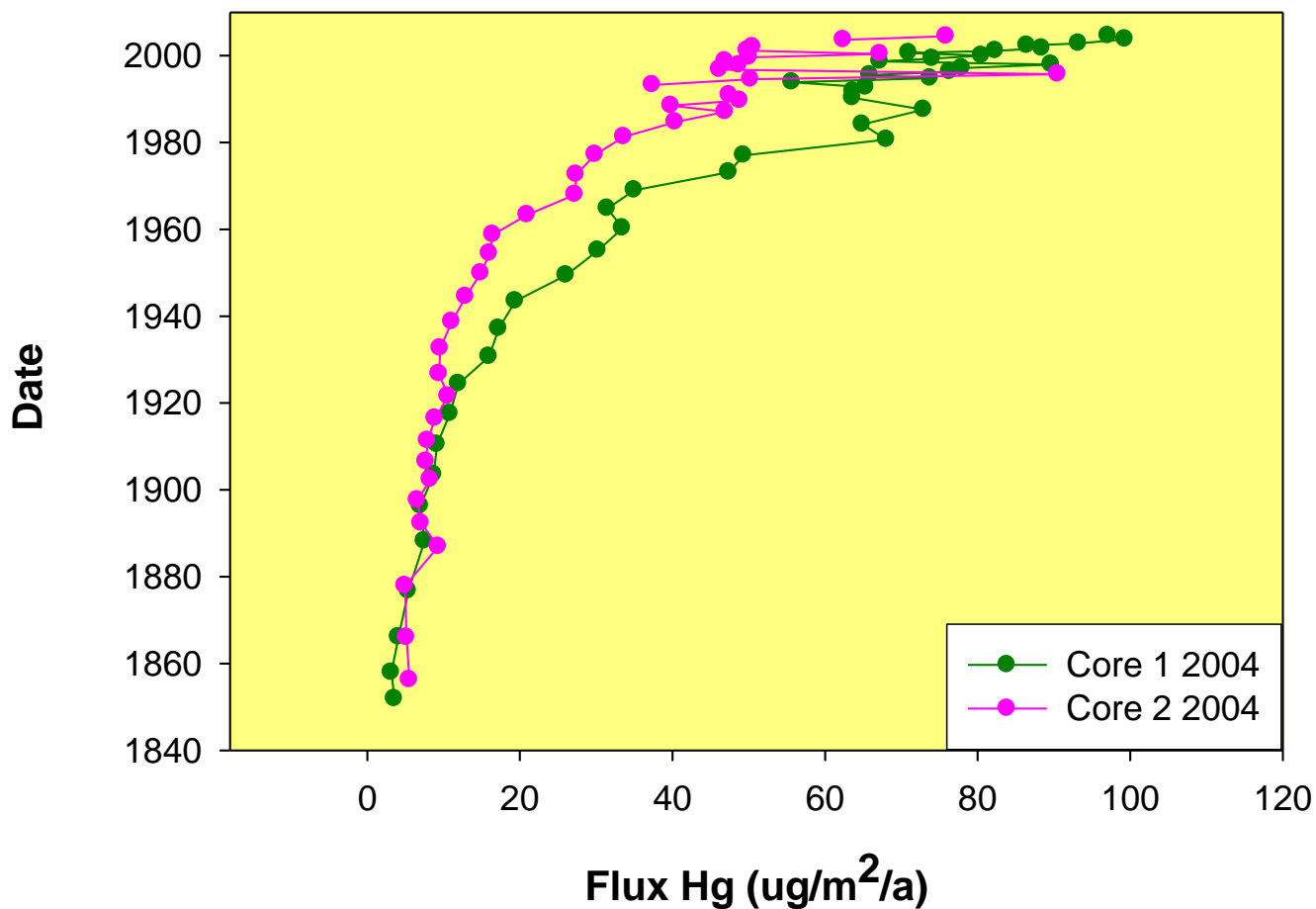


# Kotyk Lake





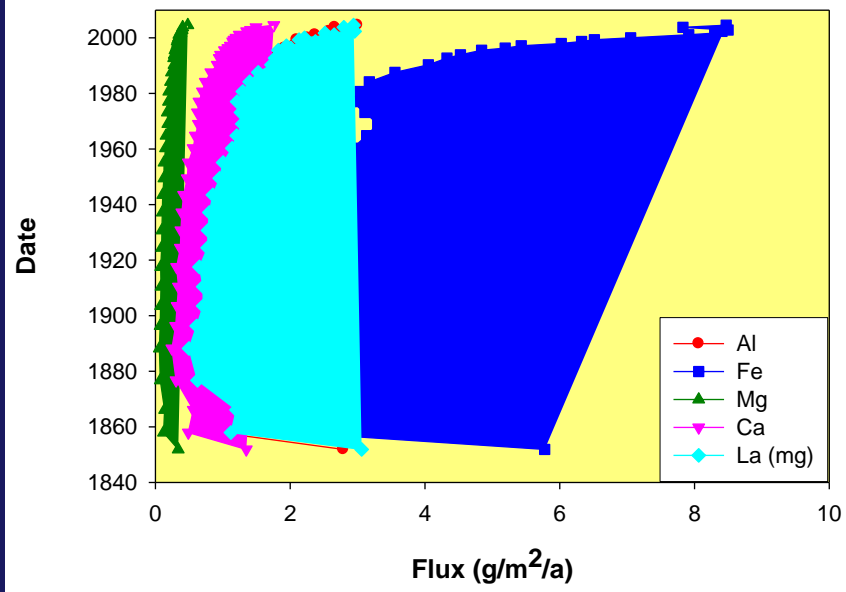
# Kotyk Lake



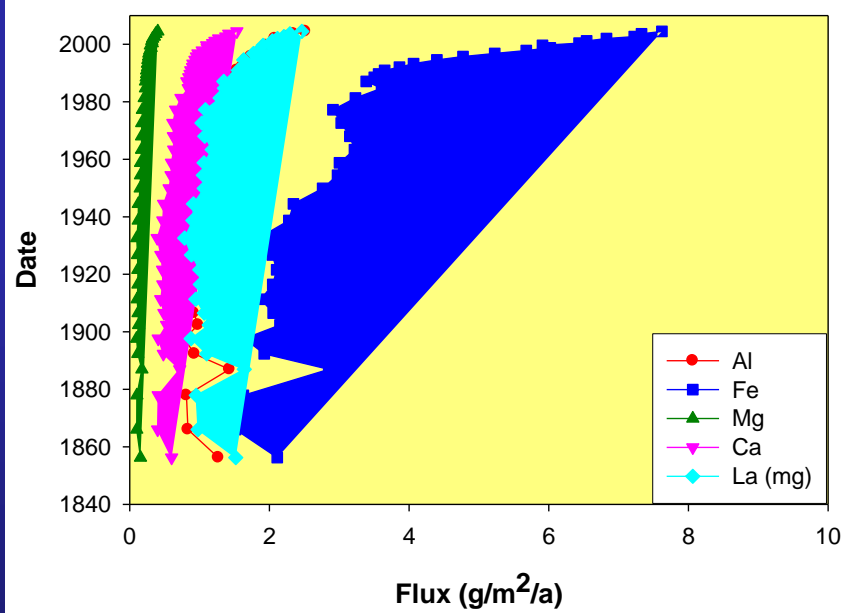




Kotyk Lake- Core 1

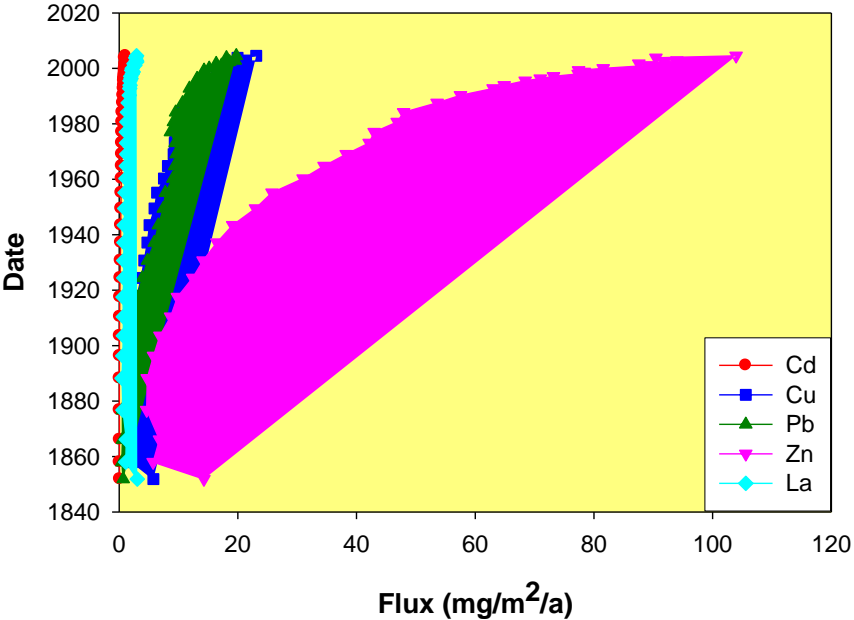


Kotyk Lake Core 2

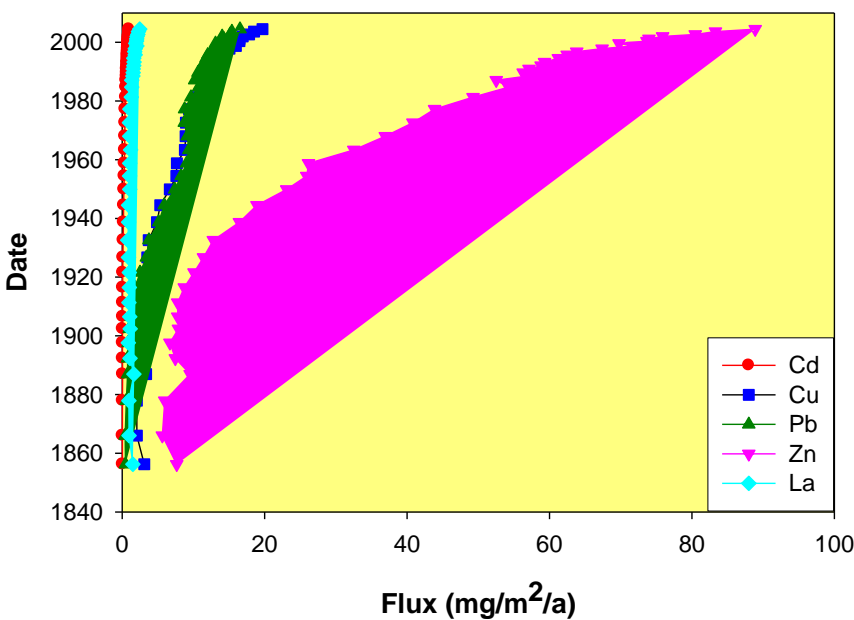




Kotyk Lake Core 1

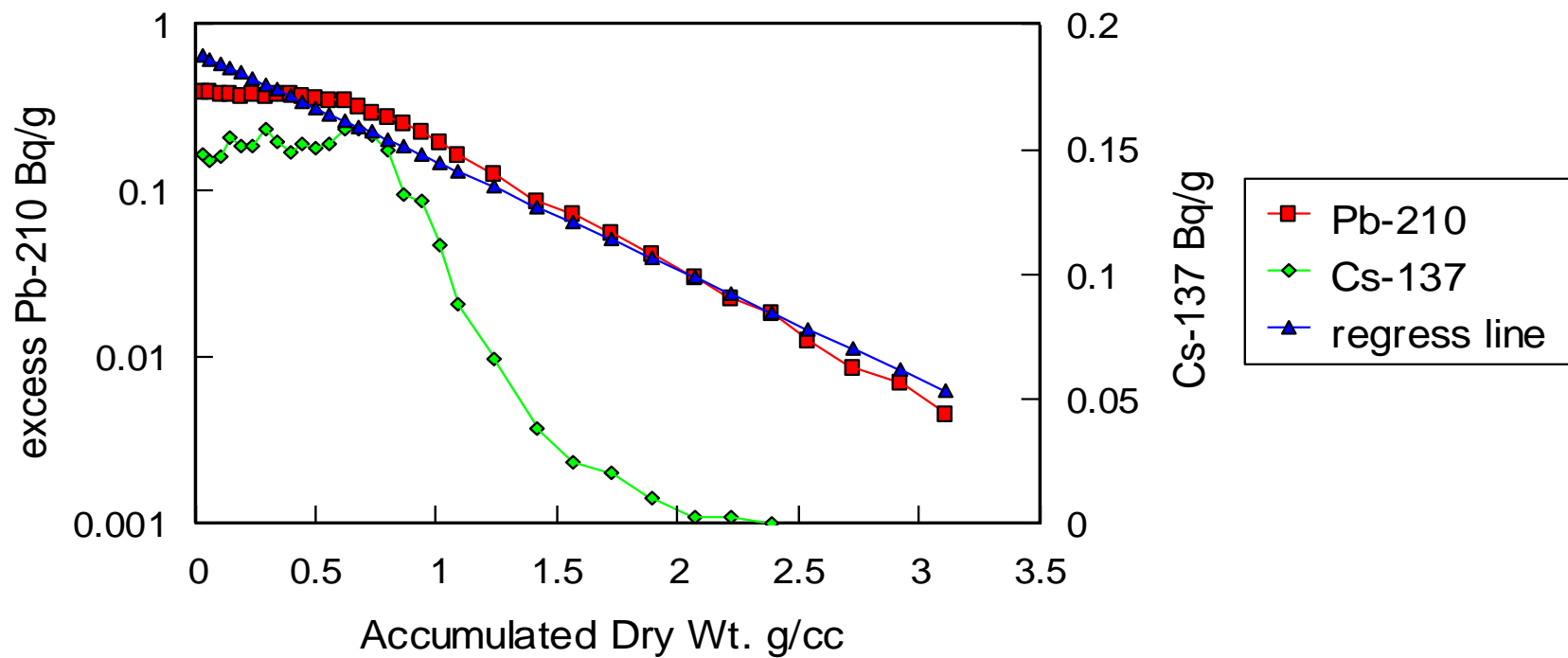


Kotyk Lake Core 2



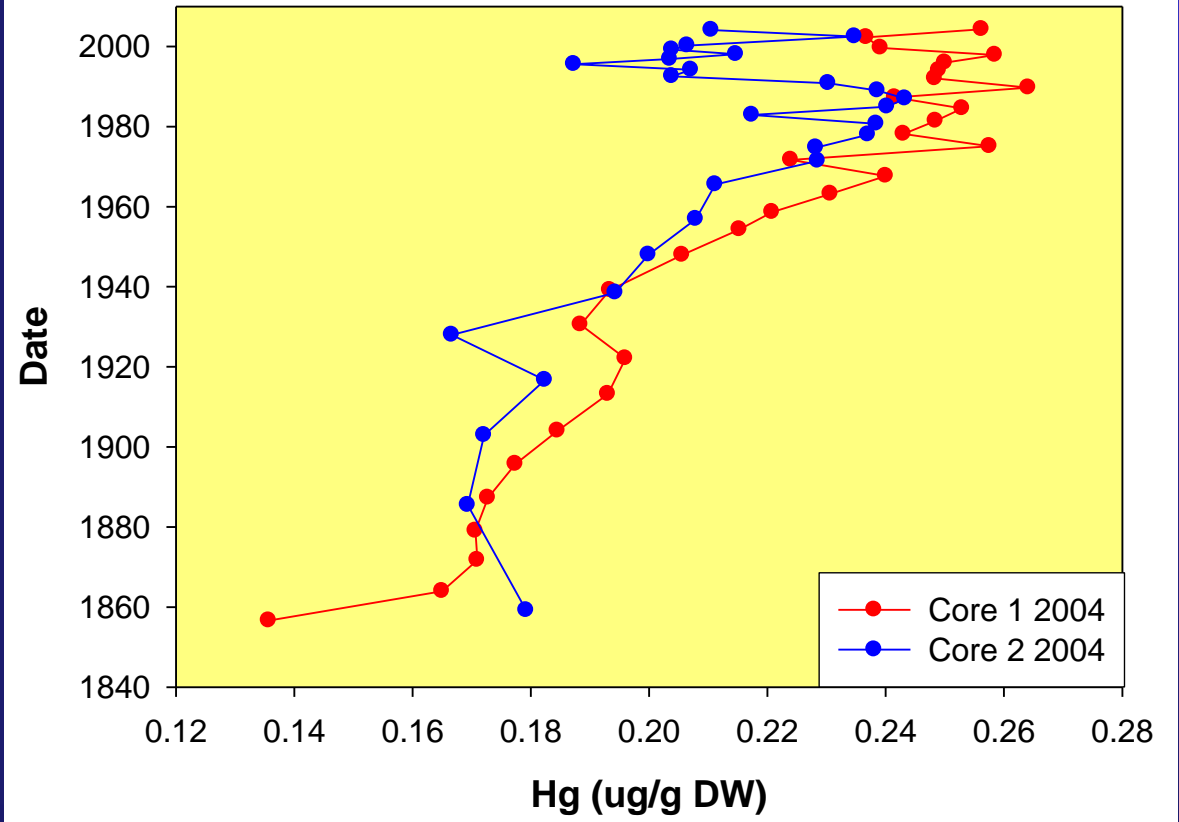


## Sask4 #1, Aug. 2004



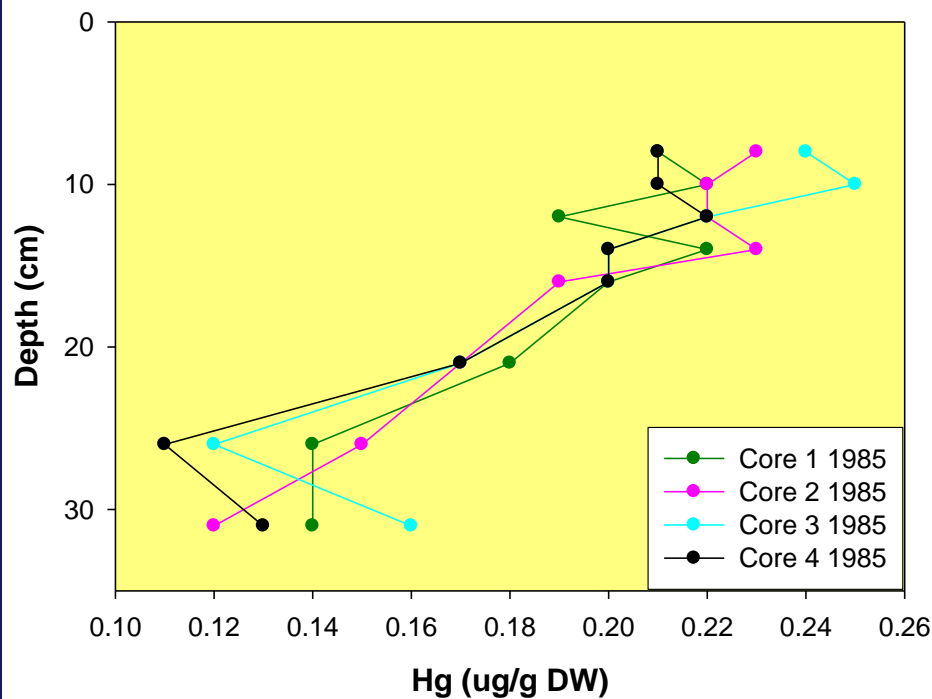


# Sask4 Lake

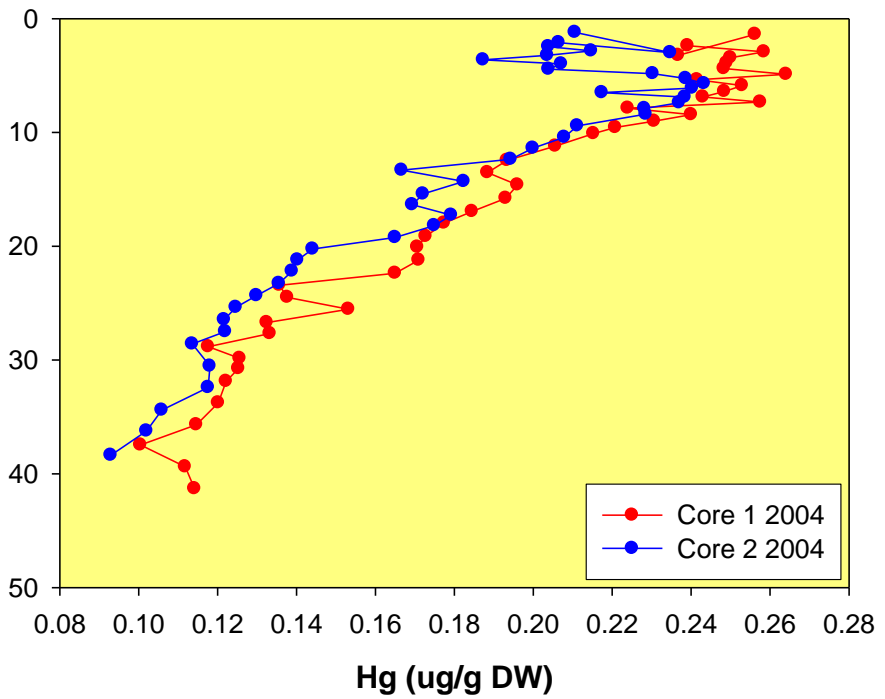




**Sask4 1985 Data**



**Sask4 Lake**





# Next Steps

- Amituk Lake & Imitavik Lake
  - Complete comparative analysis of data from Amituk and Imitavik lakes with other sites in this region, especially Lake DV-09
- Flin Flon Lakes
  - Carry out similar analysis of data through comparison with earlier investigations/results at the same sites, especially Meridian and Cleaver lakes when results are available
- Complete inter-comparisons of various media with respect to source apportionment
  - including sediments, peat, trees, ice, and country foods

