Physical Sedimentology

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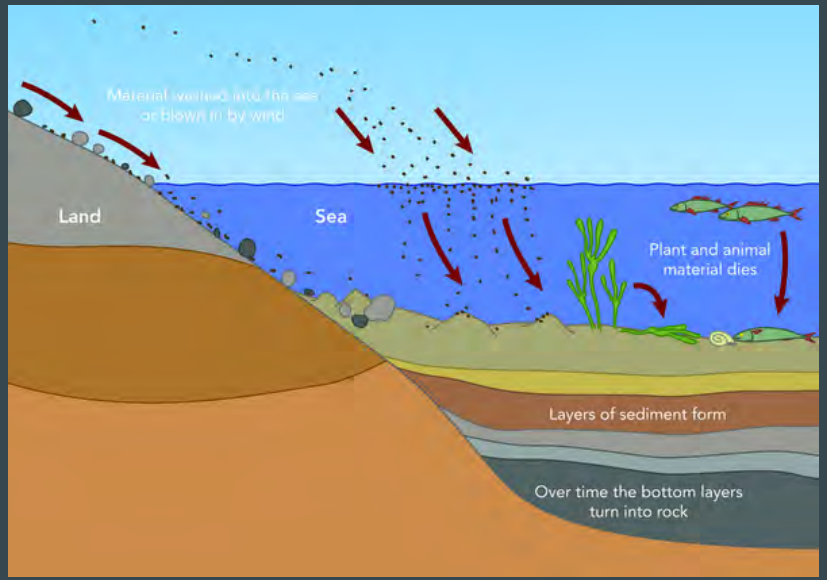
Background

Sedimentology: the study of sedimentary rocks/sediment and the processes by which they are formed

Physical sedimentology group:
Support project with dating information

Objective:

1. Collect 3 cores
2. Perform sediment age determination
3. Calculate sedimentation rates

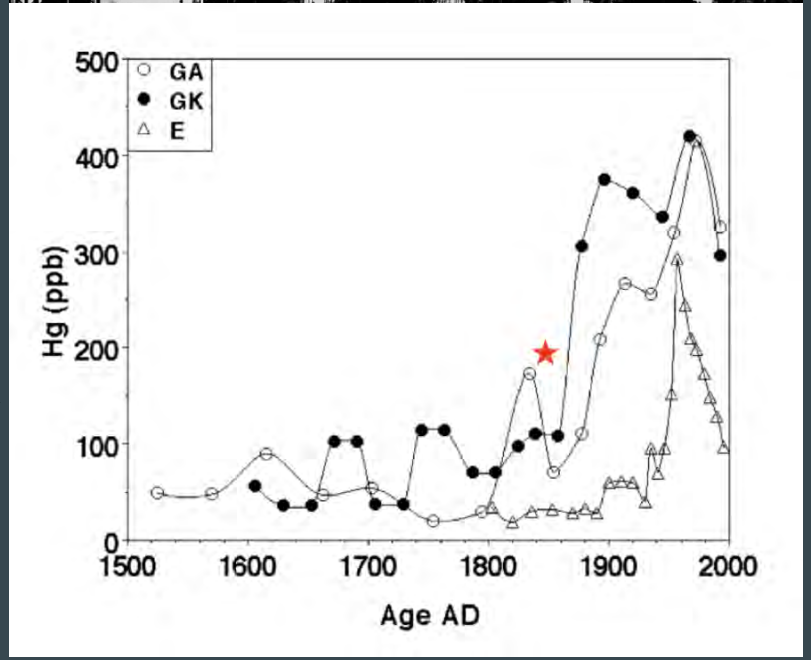


Law of Superposition

I. Age Determination

Mercury (Hg)

- Released into the environment following periods of high industrial activity
- Signal preserved in lake sediment provides a record of anthropogenic activity
- *Mercury contamination chronologies from CT wetlands and Long Island Sound sediments* (Varekamp et al., 2003)
- Alternative method: radiometric dating (210Pb)



I. Age Determination

Steps:

1. Using previously published profiles (Varekamp et al., 2003)
2. We can measure Hg along a core
3. Locate depth(s) with peak Hg and match to literature trends/ages
4. Develop relative ages for remaining sediment

II. Sedimentation Rates

Two methods:

- Linear sedimentation rate (LSR)

$$LSR = \frac{depth\ \sim 1850\ (cm)}{2017 - 1850\ (yr)}$$

- Mass accumulation rate (MAR)
  - Measure of accumulated sediment within an area over time

$$MAR = \frac{cumulative\ mass\ up\ to\ \sim 1850\ (g/cm^2)}{2017 - 1850\ (yr)}$$

$$Bulk\ density = \frac{mass\ dry\ sediment\ (g)}{volume\ wet\ sediment\ (cm^3)}$$

Methods

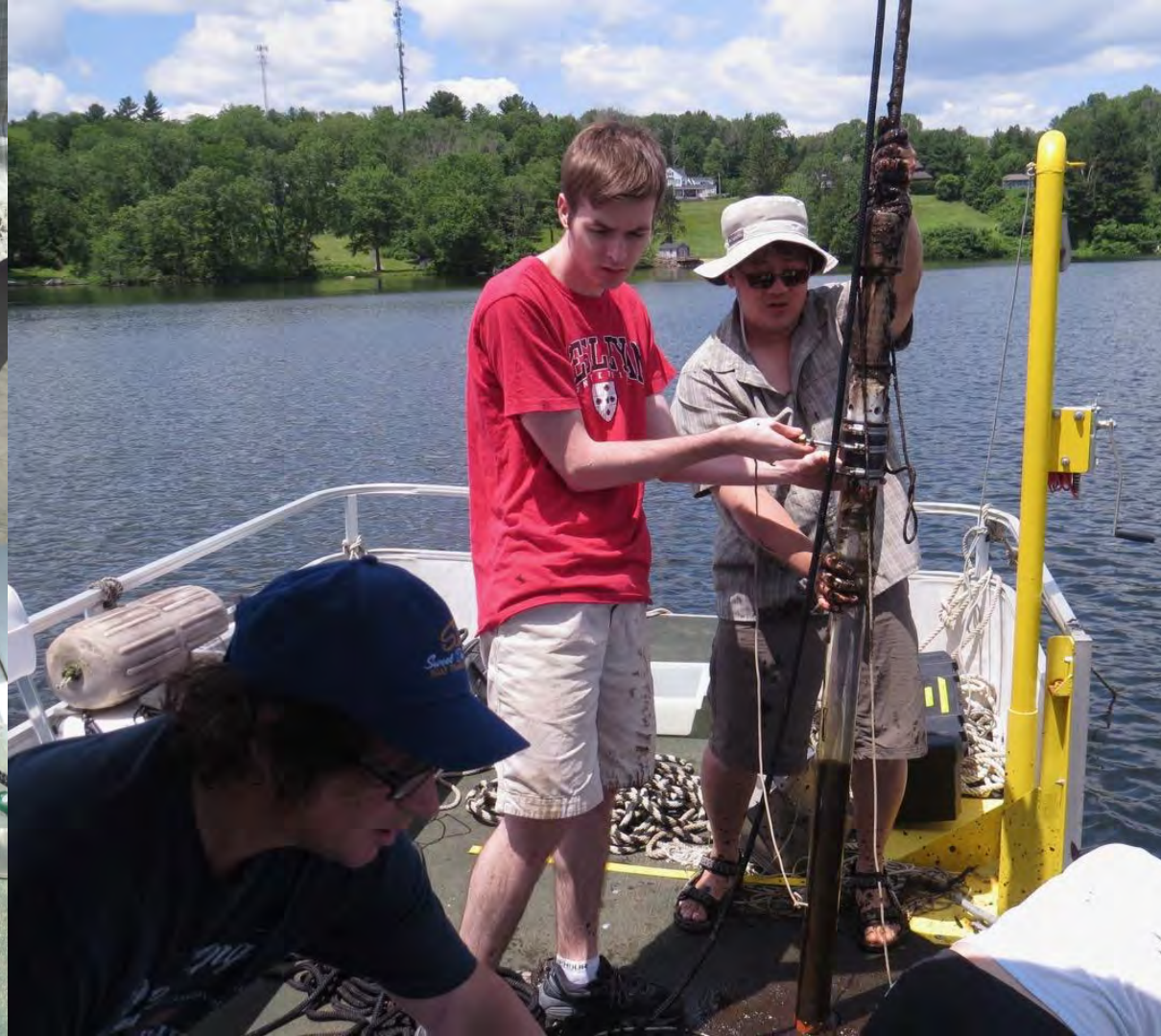
Field work:

- Collect cores
  - Percussion core
  - Freeze core

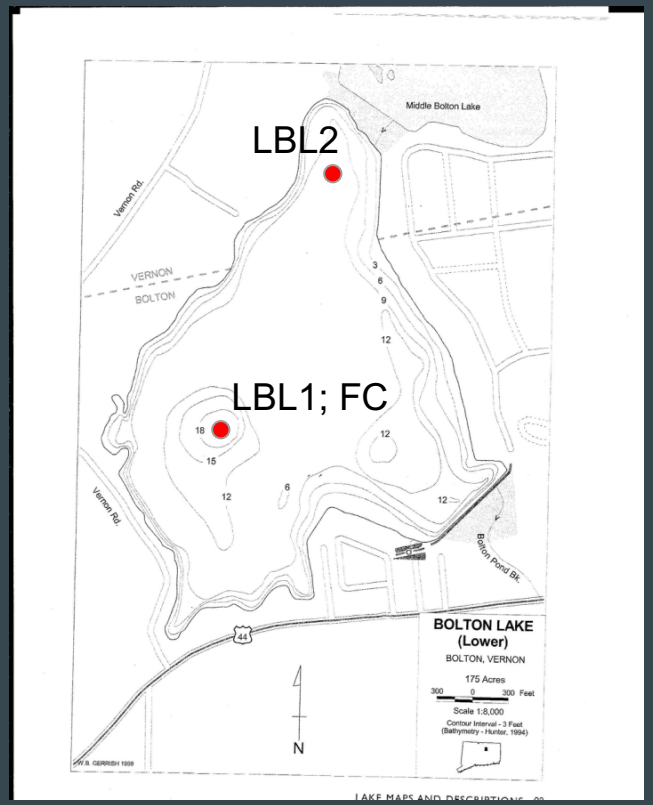
Lab work:

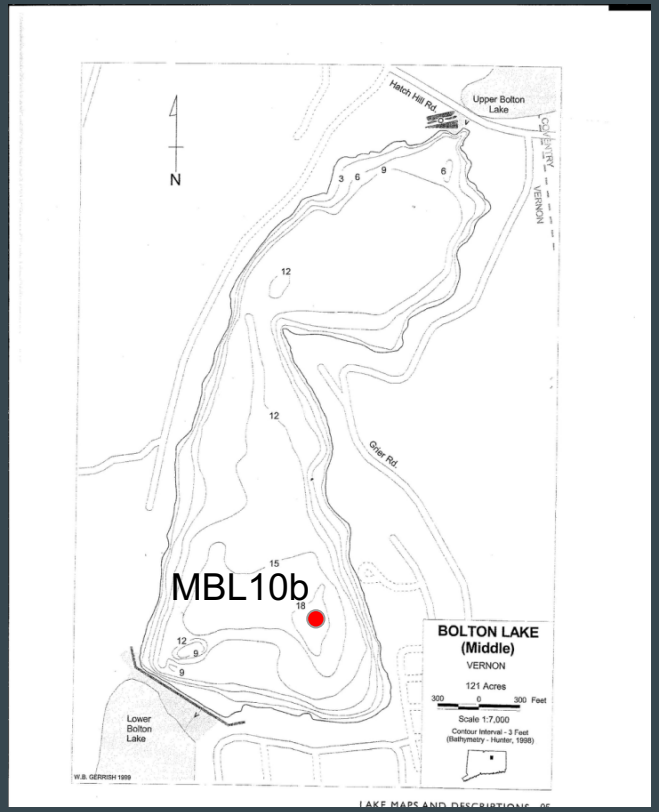
- Homogenize and crush samples
- Mercury analysis
- Bulk density analysis (centrifuge; note volume; dry; note weight dry sed)


06/28/2017



Sample Locations



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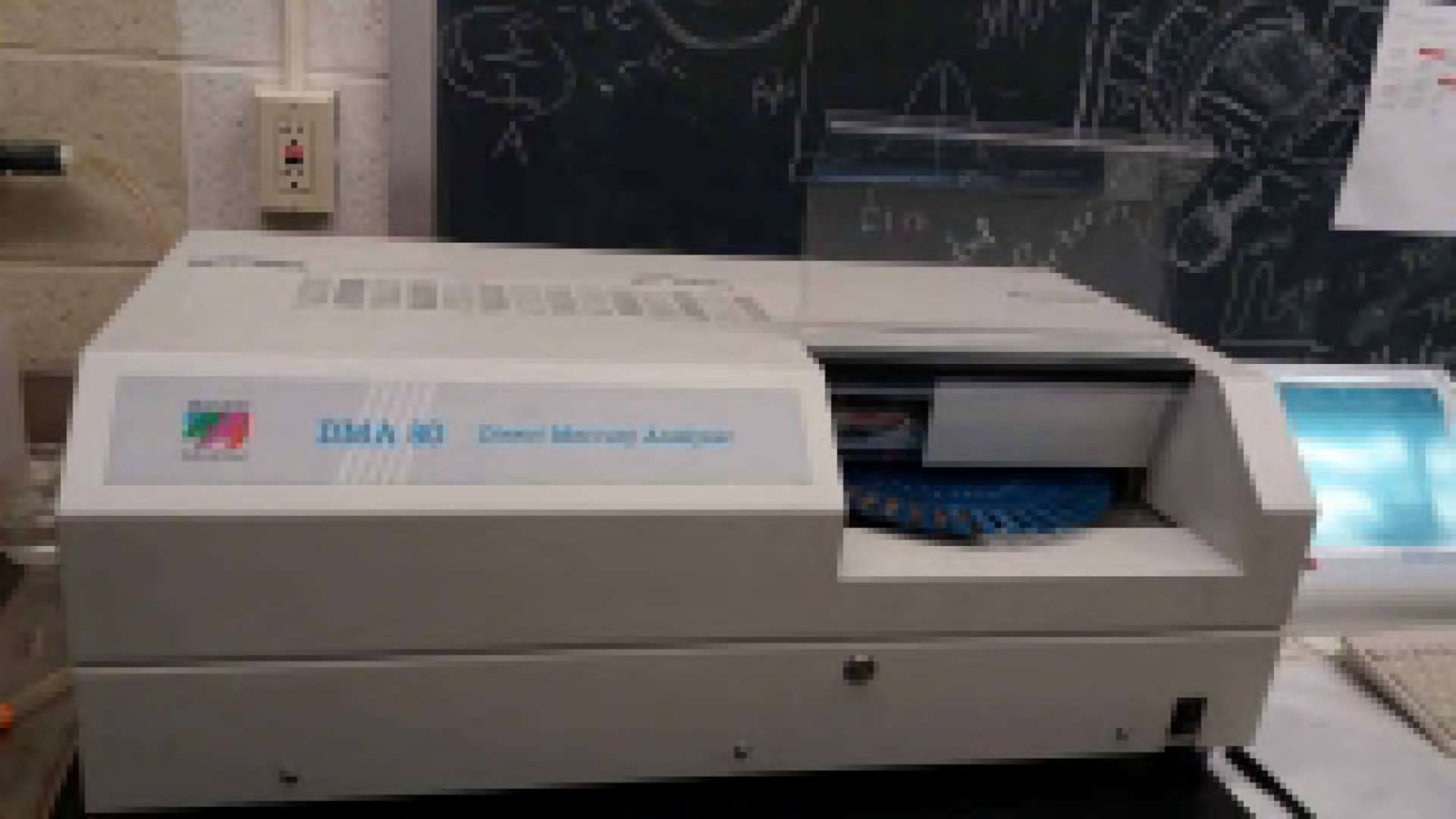
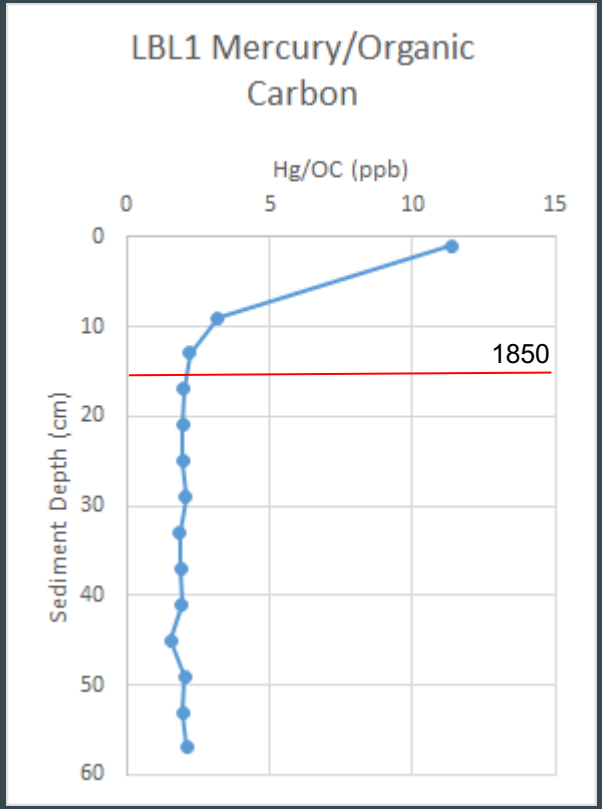
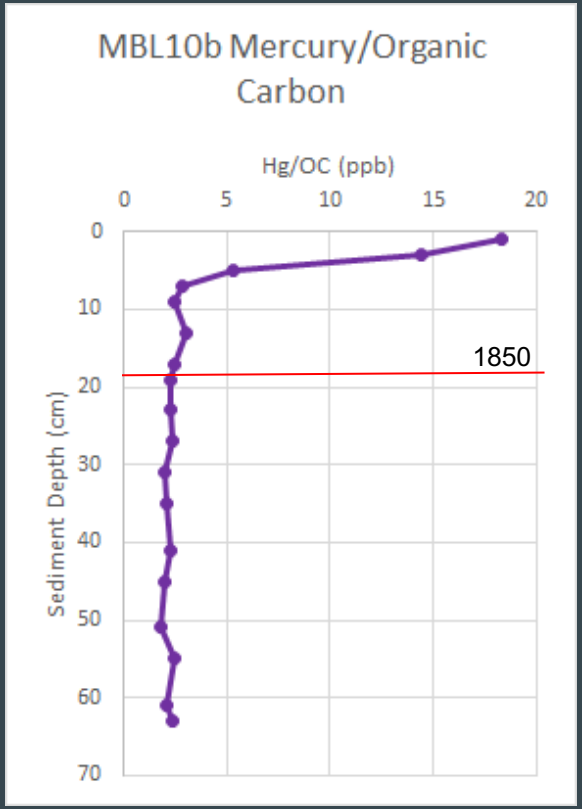
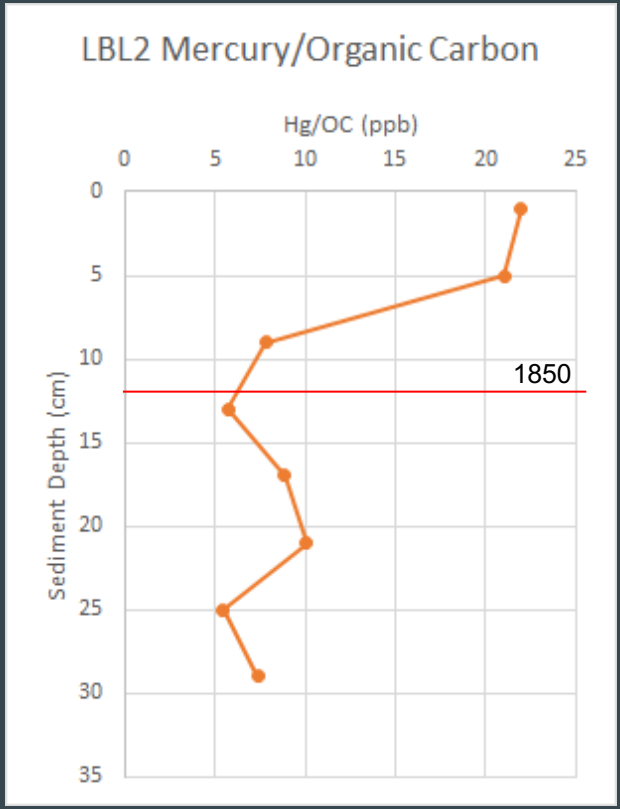

DMA 80
Direct Mercury Analyzer



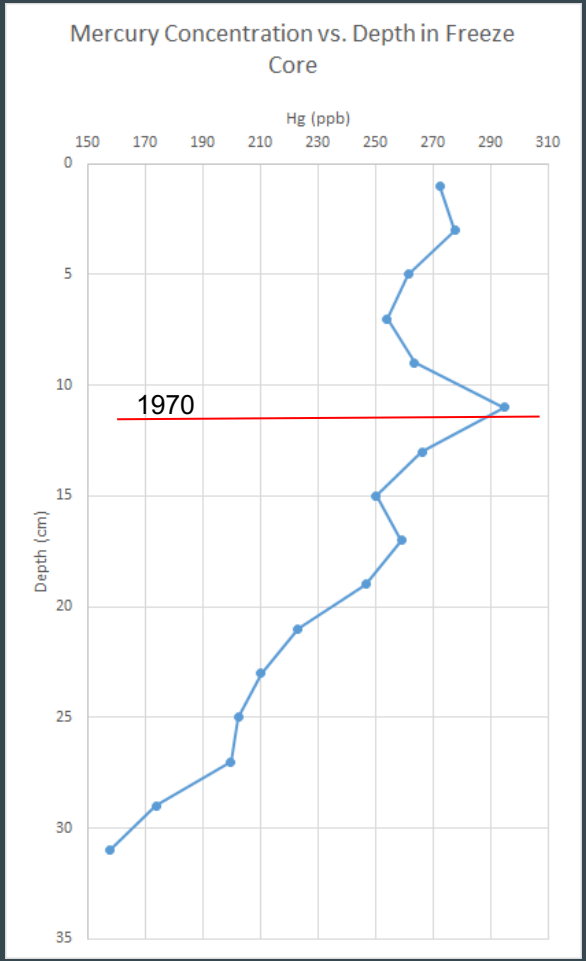


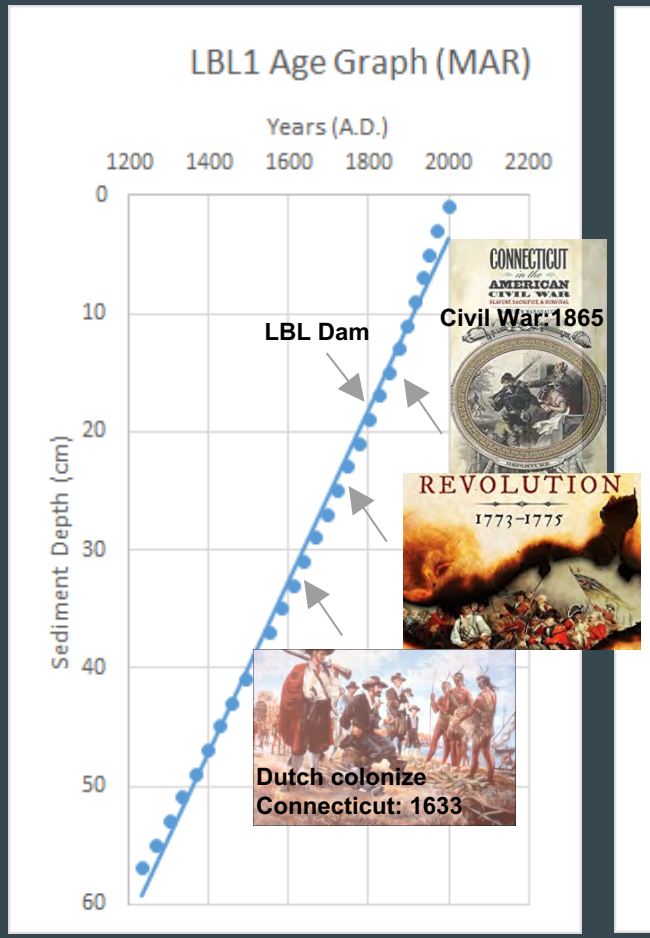


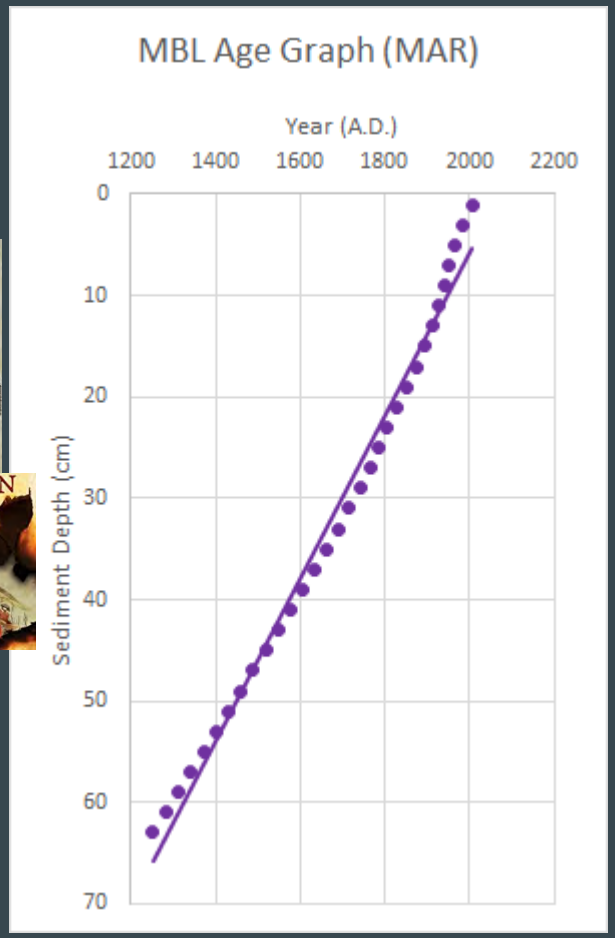
LSR: 0.090 cm/year
MAR: 4.86 mg/cm2/year
22.64mg/cm2/year

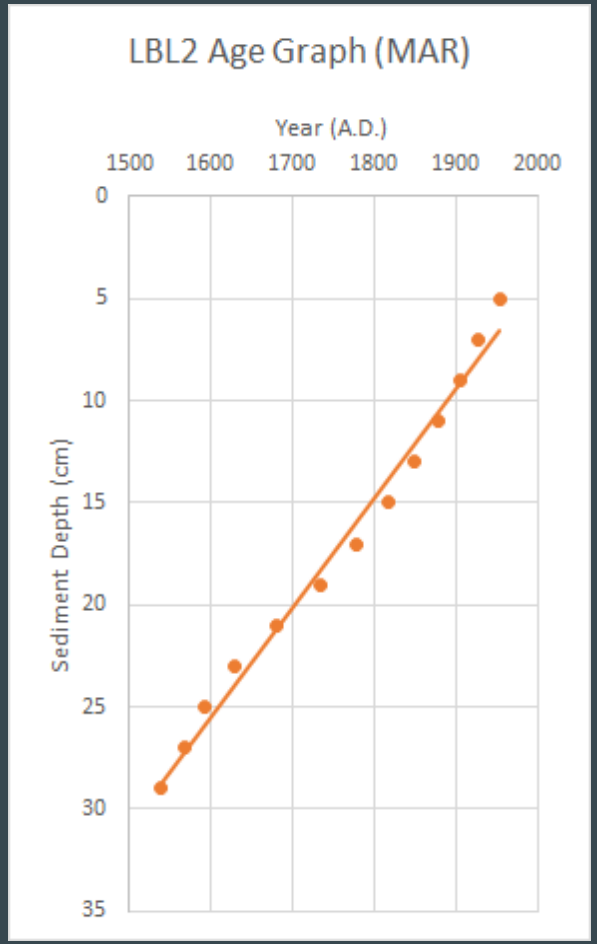
0.114cm/year
7.29mg/cm2/year

0.078cm/year

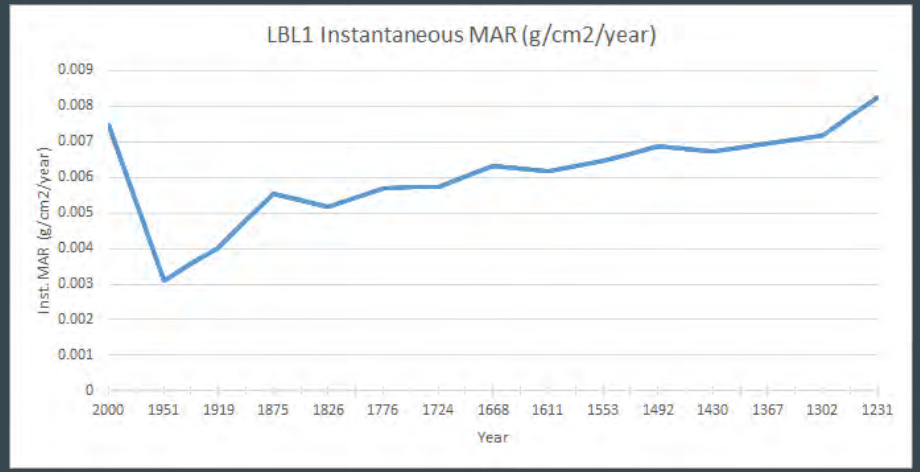

Mercury Concentration vs. Depth in Freeze Core
Hg (ppb)
150
170
190
210
230
250
270
290
310
Depth (cm)
0
5
10
15
20
25
30
35
1970

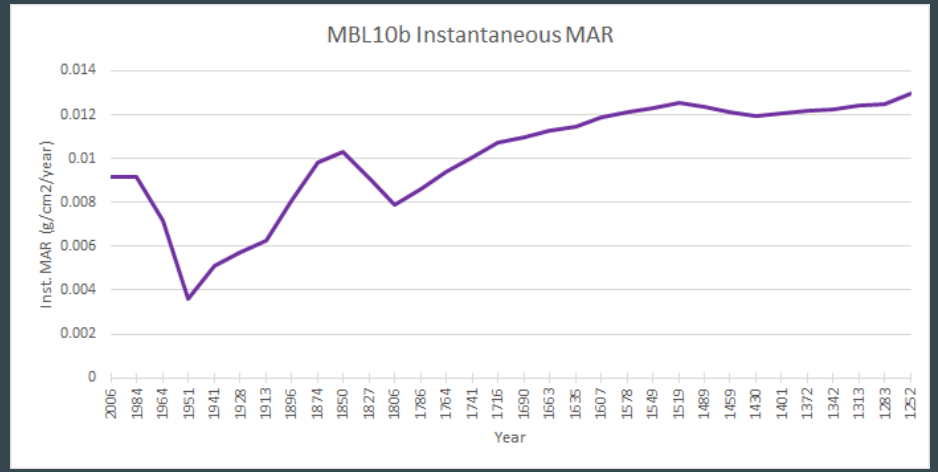

LBL1 Age Graph (MAR)
Years (A.D.)
1200
1400
1600
1800
2000
2200
Sediment Depth (cm)
0
10
20
30
40
50
60
LBL Dam
Civil War:1865
CONNECTICUT in the AMERICAN CIVIL WAR
REVOLUTION
1773–1775
Dutch colonize Connecticut: 1633

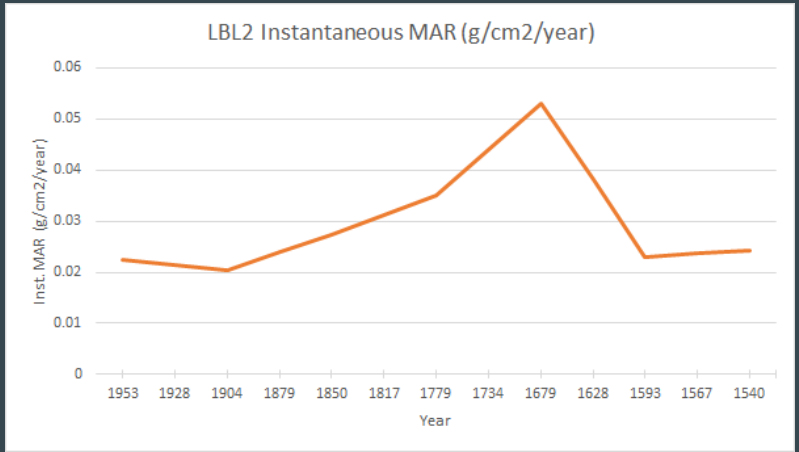

MBL Age Graph (MAR)
Year (A.D.)
1200
1400
1600
1800
2000
2200
Sediment Depth (cm)
0
10
20
30
40
50
60
70


LBL2 Age Graph (MAR)
Year (A.D.)
1500
1600
1700
1800
1900
2000
Sediment Depth (cm)
0
5
10
15
20
25
30
35

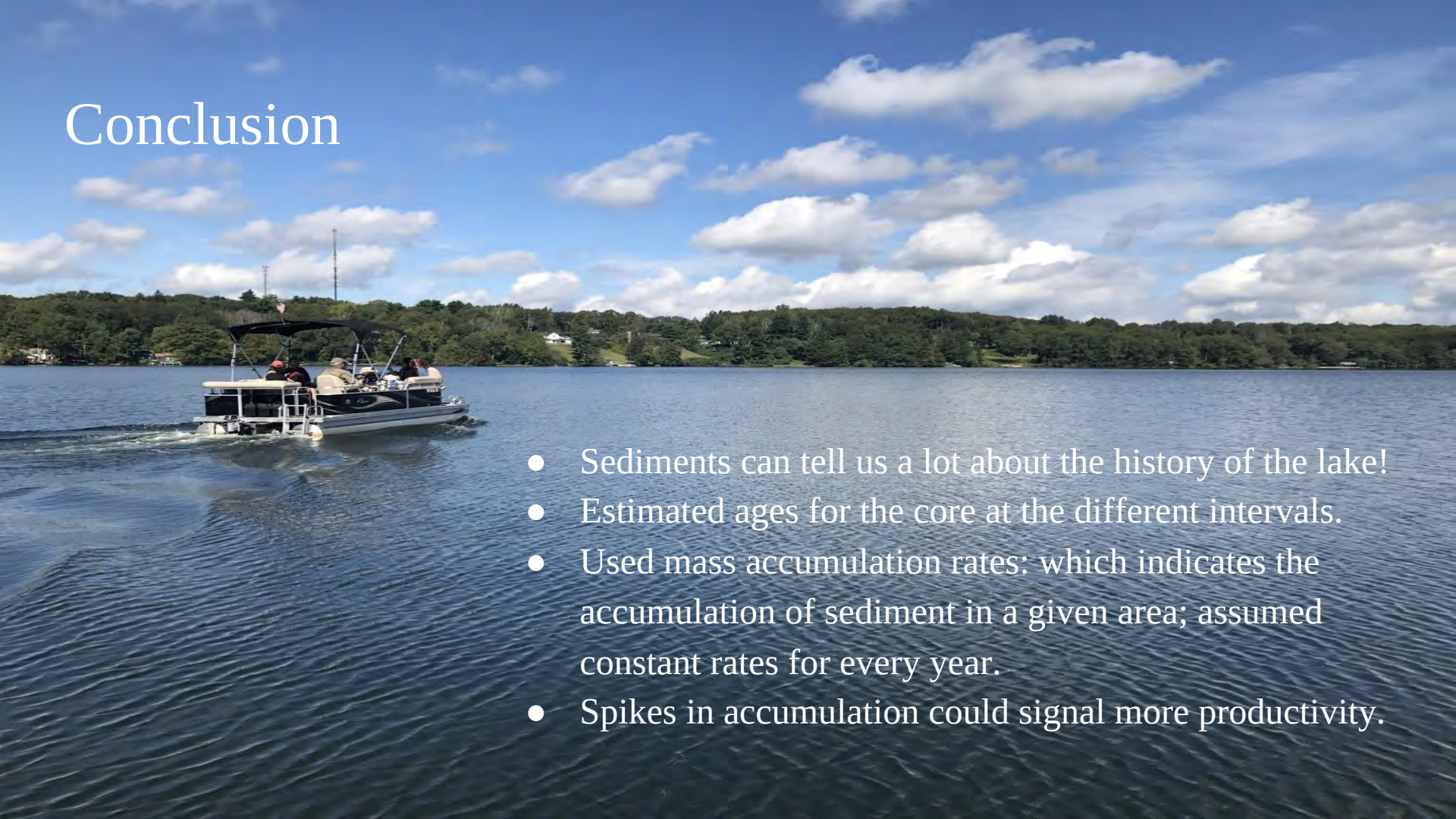
Instantaneous MAR Graphs







Conclusion



- Sediments can tell us a lot about the history of the lake!
- Estimated ages for the core at the different intervals.
- Used mass accumulation rates: which indicates the accumulation of sediment in a given area; assumed constant rates for every year.
- Spikes in accumulation could signal more productivity.

References / Acknowledgements

Varekamp, J., Kreulen, ten Brink, B.M., and Mecray, E. (2003) Mercury contamination chronologies from Connecticut wetlands and Long Island Sound sediments. Environmental Geology 43, 268-282.

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