

# Investigation of the mound at the bottom of Lulu Lake



David Hart  
Carolyn Streiff

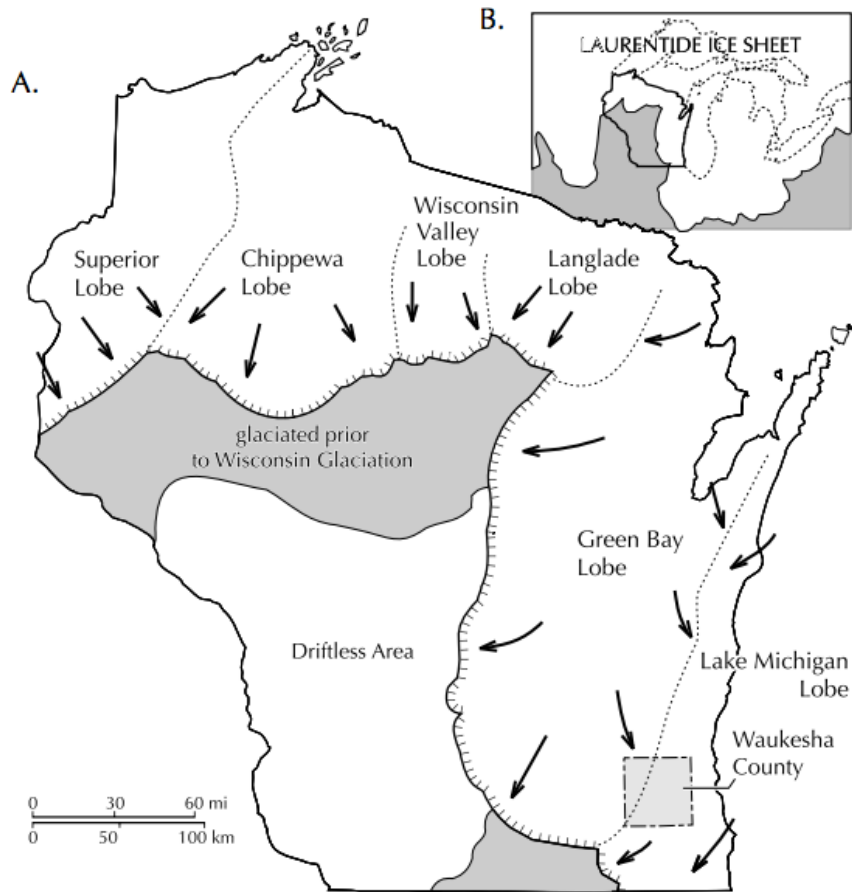
**UW**  
**Extension**  
Wisconsin Geological and Natural History Survey

Sarah Gatzke  
Jerry Ziegler



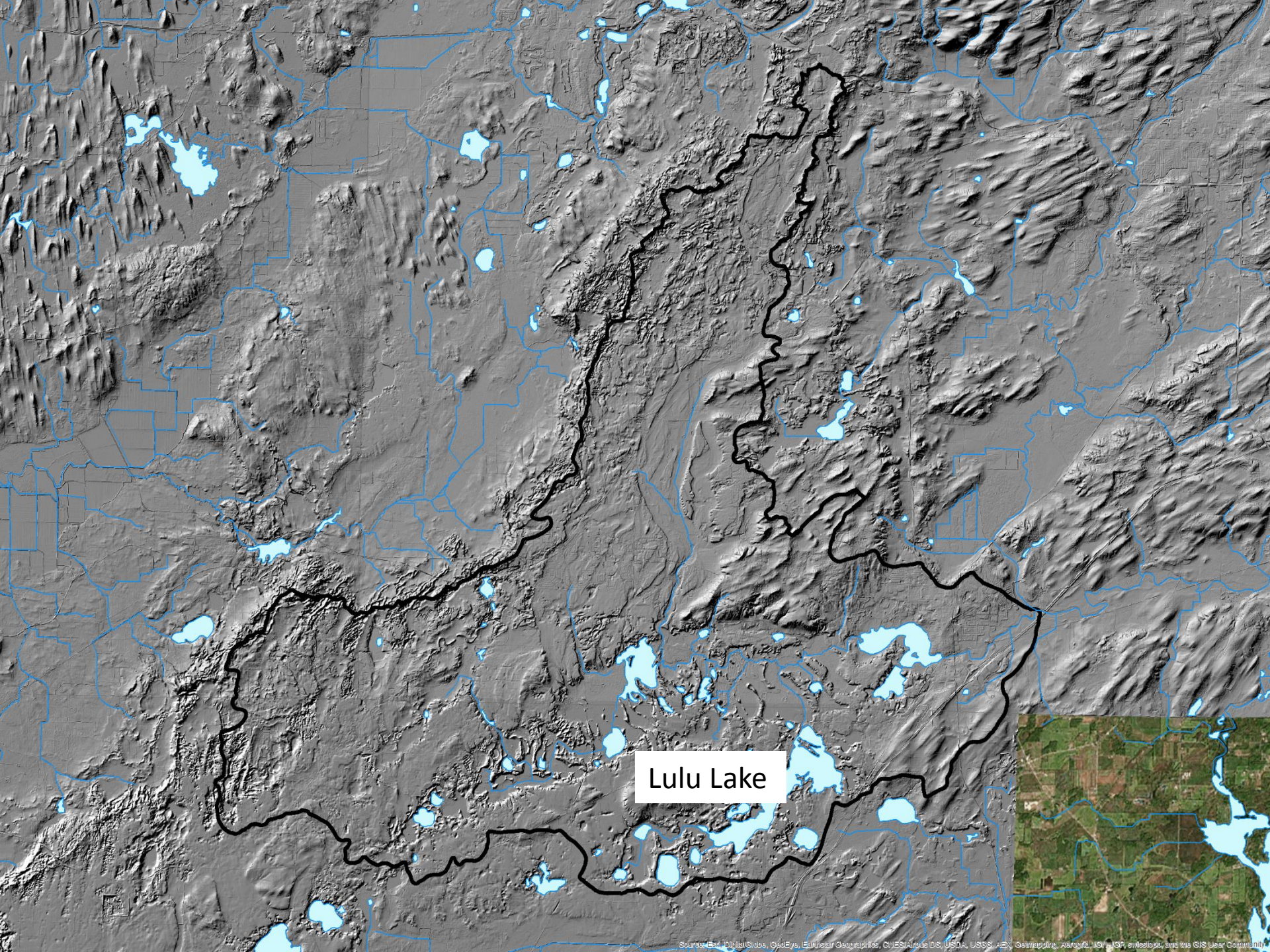
The Nature  
Conservancy  
Protecting nature. Preserving life.™

# Geologic Setting - Kettle Moraine

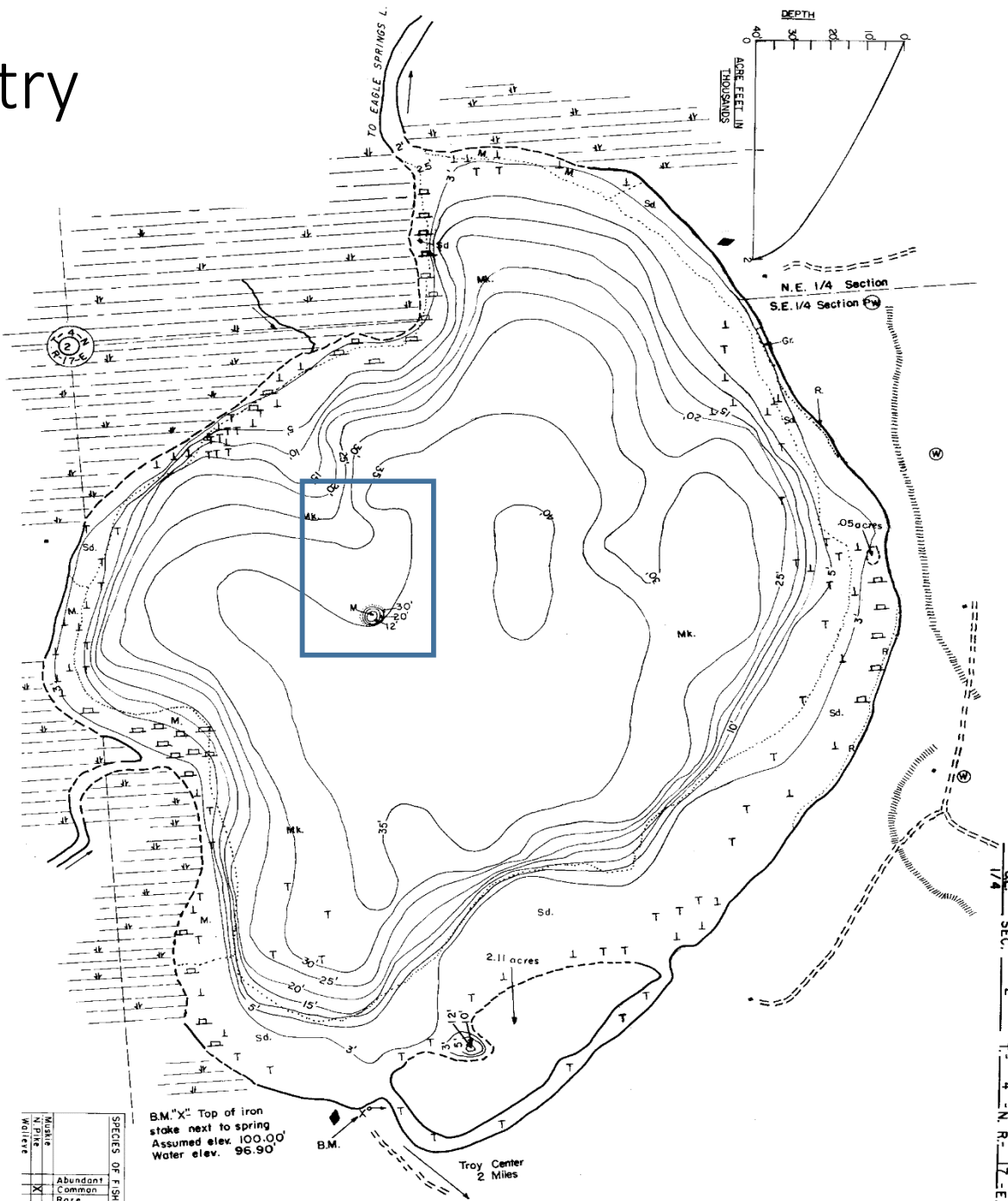


Clayton 2001

Figure 1. Location of Waukesha County in Wisconsin (A) in relation to the Laurentide Ice Sheet (B) and its lobes during the last part of the Wisconsin Glaciation. Hachures indicate the edge of the ice sheet; arrows indicate direction of ice flow.



Lulu Lake



MAPPED JULY 1967

WATER ELEV. 96.90'

LAKE BOTTOM SYMBOLS

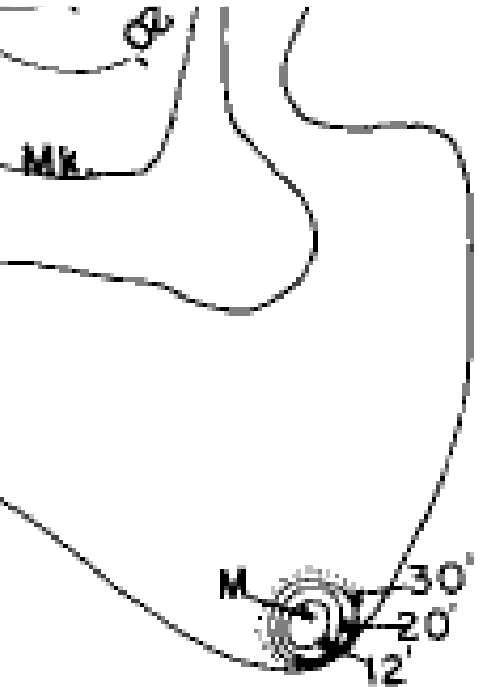
P, Pearl  
Mk, Muck  
C, Clay  
M, Mott  
Sd, Sand  
St, Silt

G, Gravel  
R, Rubble  
B, Bedrock  
T, Submerged veg  
L, Emergent veget  
F, Flooding

SPECIES OF FISH

Species	Abundant	Common	Rare
Muskie			
N. Pike	X		
Wolffeye			

# Lulu Lake Bathymetry



# Hypotheses

- Anthropogenic
  - Lulu Lake was used to supply ice for cooling. Mound is pile of equipment, waste, or building materials left over from that operation.
  - Gangster activity left pile.
- Geologic
  - Tufa Mound - Precipitating calcite from groundwater formed mount
  - Kame – Glacial sediment fill into void in stagnant ice.



<https://i2.wp.com/mywalworthcounty.com/wp-content/uploads/2013/07/ETT-72417-Lulu-Lake-Ice-House1.jpg>

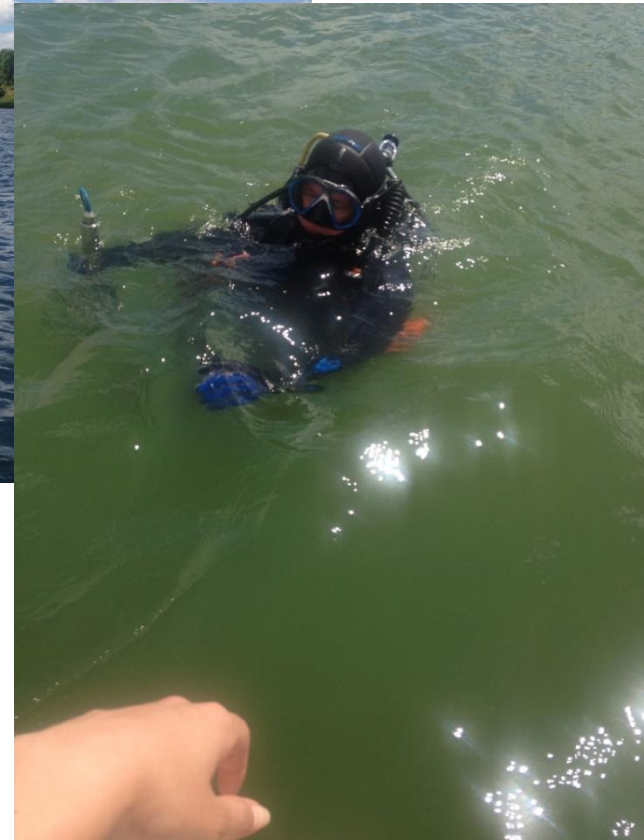


<https://pubs.usgs.gov/circ/2004/1267/pdf/Tufas%20of%20Pyramid%20Lake.pdf>



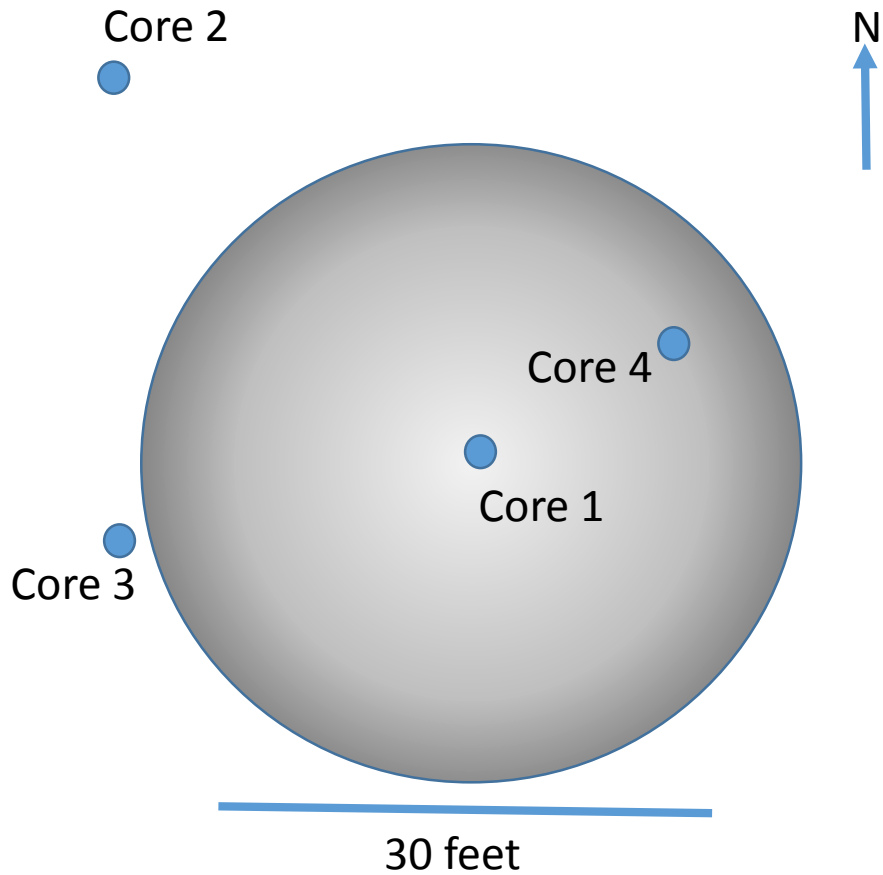
[Geology of Ice Age National Scientific Reserve of Wisconsin ...](#)

# Scuba Sediment and Water Samples



Thanks Manta Divers

# Four sediment cores collected

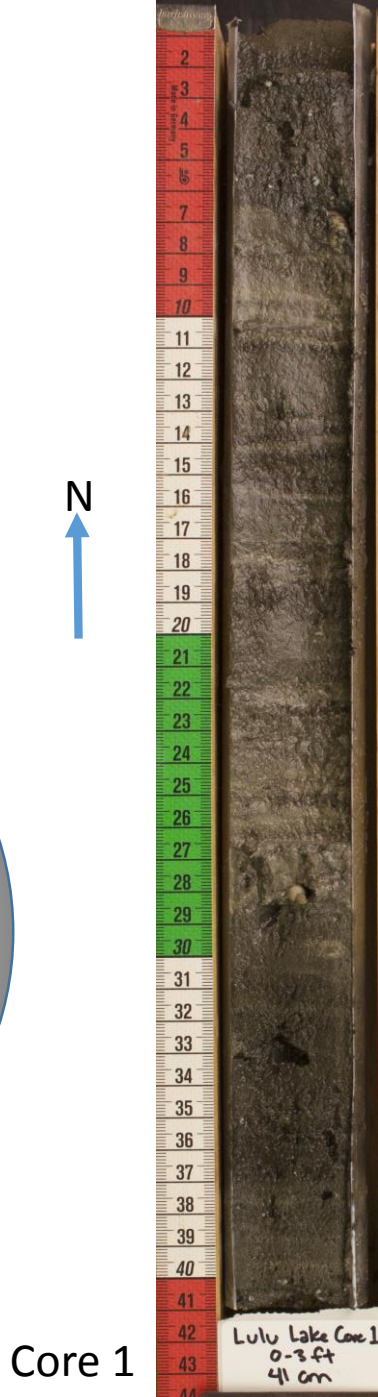
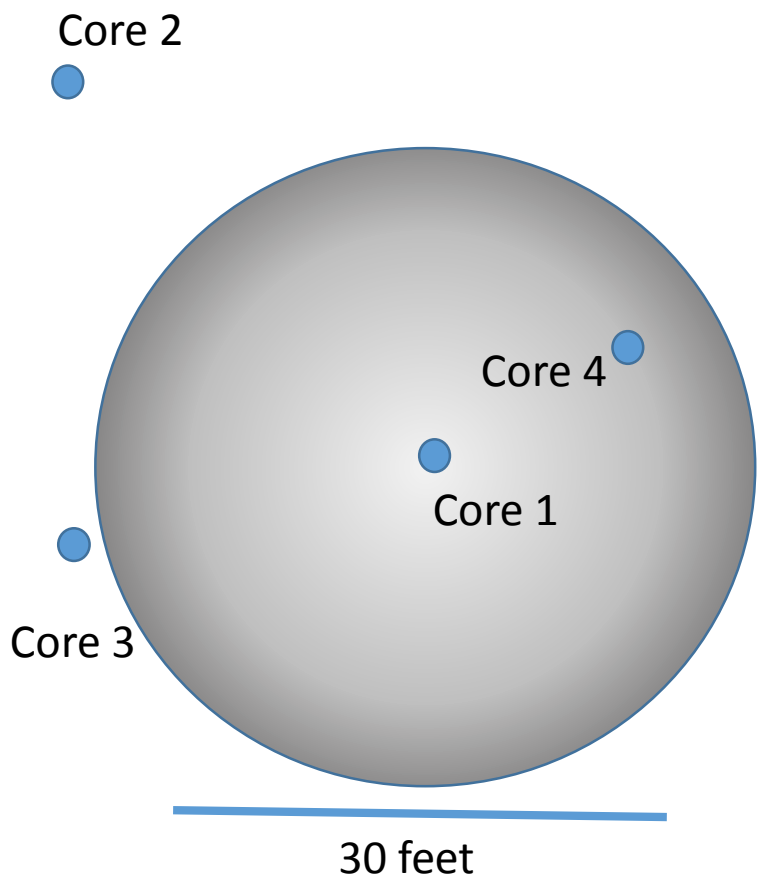


- All Cores: - Only soft sediment encountered during collection (3-foot length)  
- No evidence of sands, gravel, rocks or very large objects.

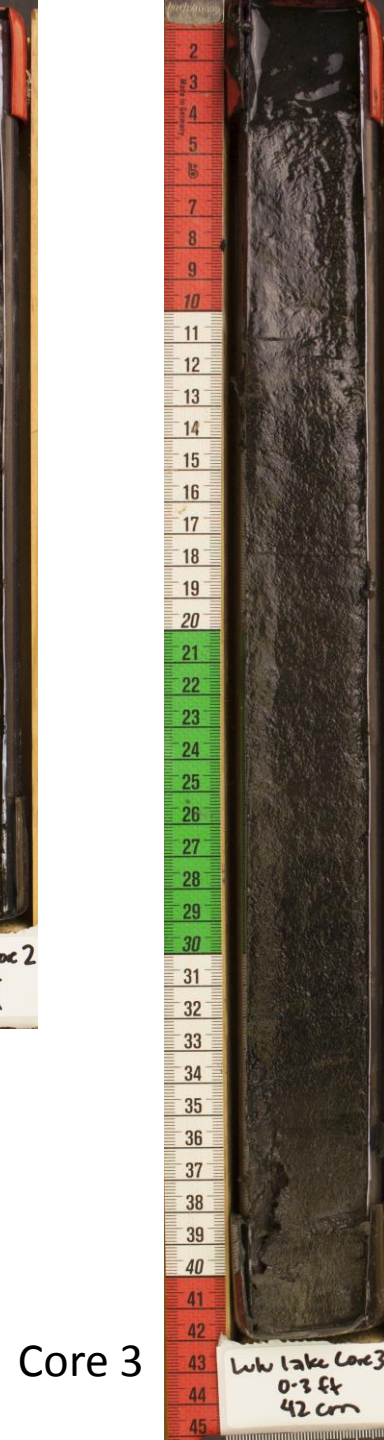




# Core images



Core 2



Core 3

# Core 1 - Mound

- Lighter colored laminated zones alternating with darker more massive zones.
- Large gastropods at boundaries
- Small gastropods at top

Core 1



# Core 1 - Mound

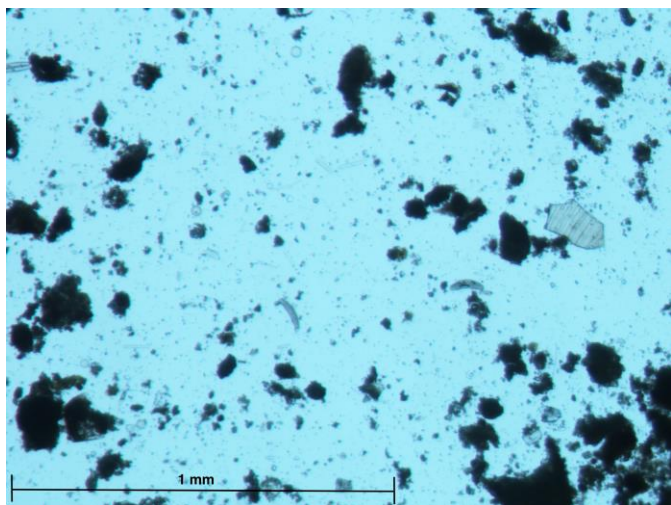


Core 1



# Core 2 Lake Sediment

- Massive
- All dark organics



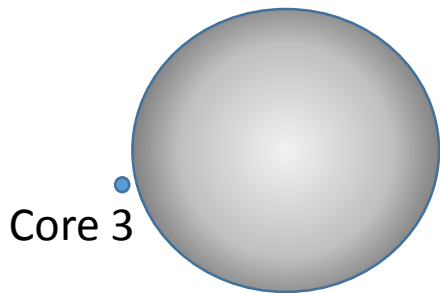
Lulu Lake Core 2  
0-3 ft  
29 cm

Core 2

# Core 3

## Lake Sediment near mound base

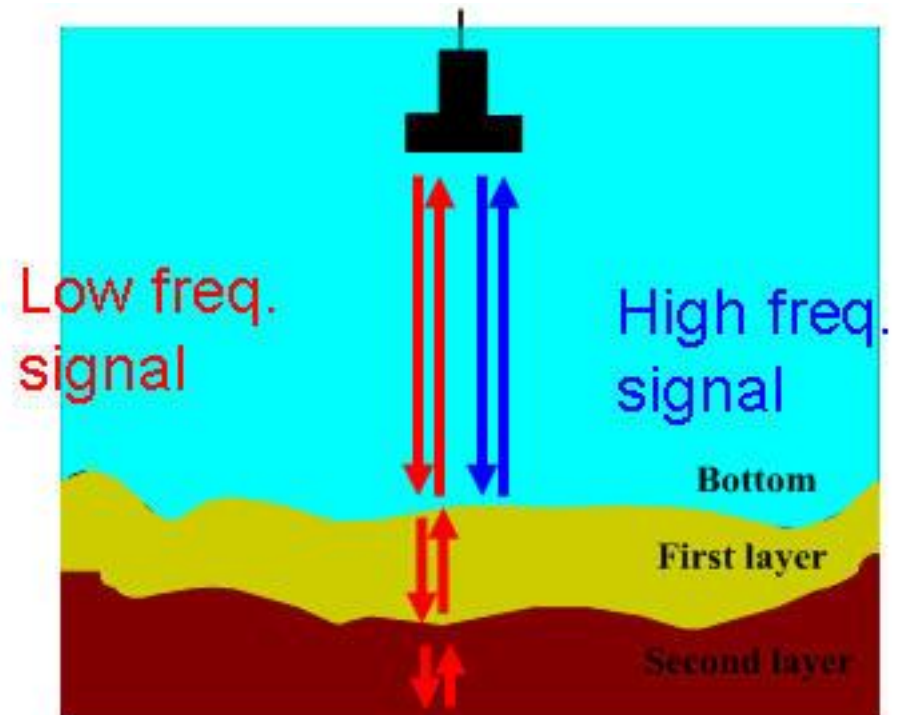
- Massive
- Mostly dark organics
- Some gray clays and silts near base



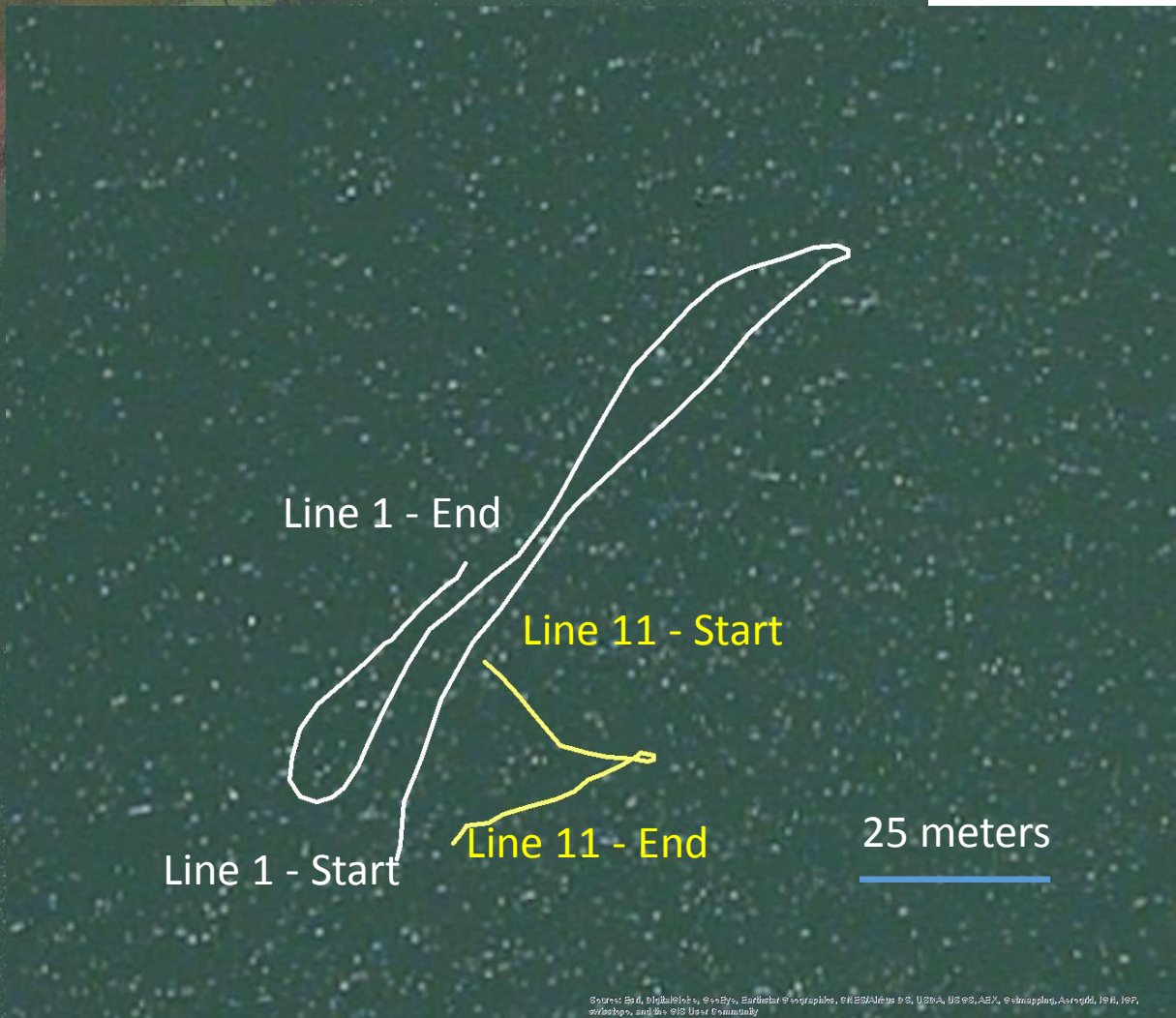
Core 3

# Sub-bottom profiler survey

Provides image into sediment



[http://homepages.cae.wisc.edu/~chinwu/CEE618\\_Exploration\\_of\\_Great\\_Lakes/Students/Kevin\\_Craig/Methodology\\_1.htm](http://homepages.cae.wisc.edu/~chinwu/CEE618_Exploration_of_Great_Lakes/Students/Kevin_Craig/Methodology_1.htm)



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroX, Swmap, AeroGRID, IGN, IGP, swisstopo, and the GIS User Community

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surface

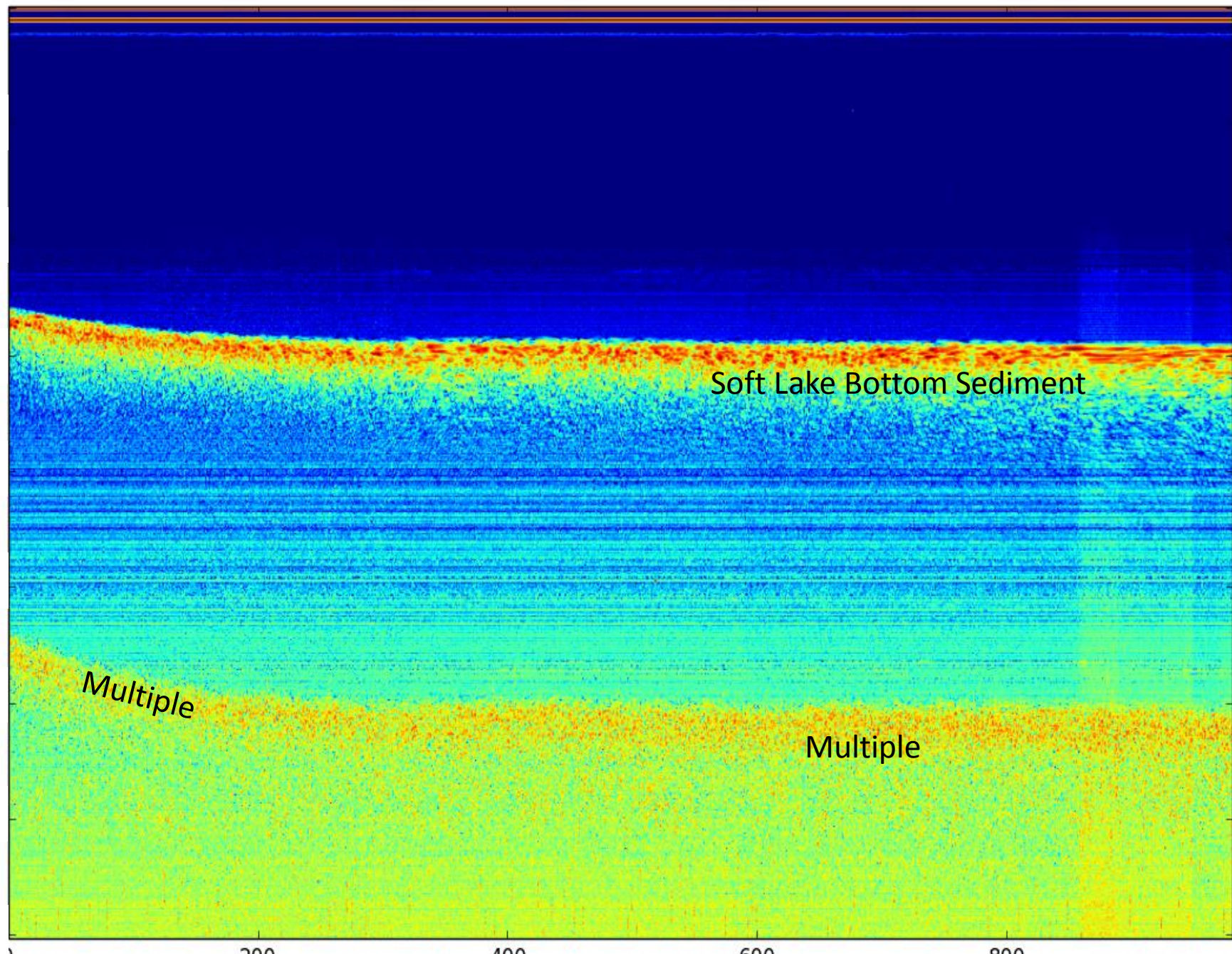
10  
20  
30  
40  
50  
60  
70  
80

Depth (ft)

Soft Lake Bottom Sediment

Multiple

Multiple





surface

10

20

30

40

50

60

70

80

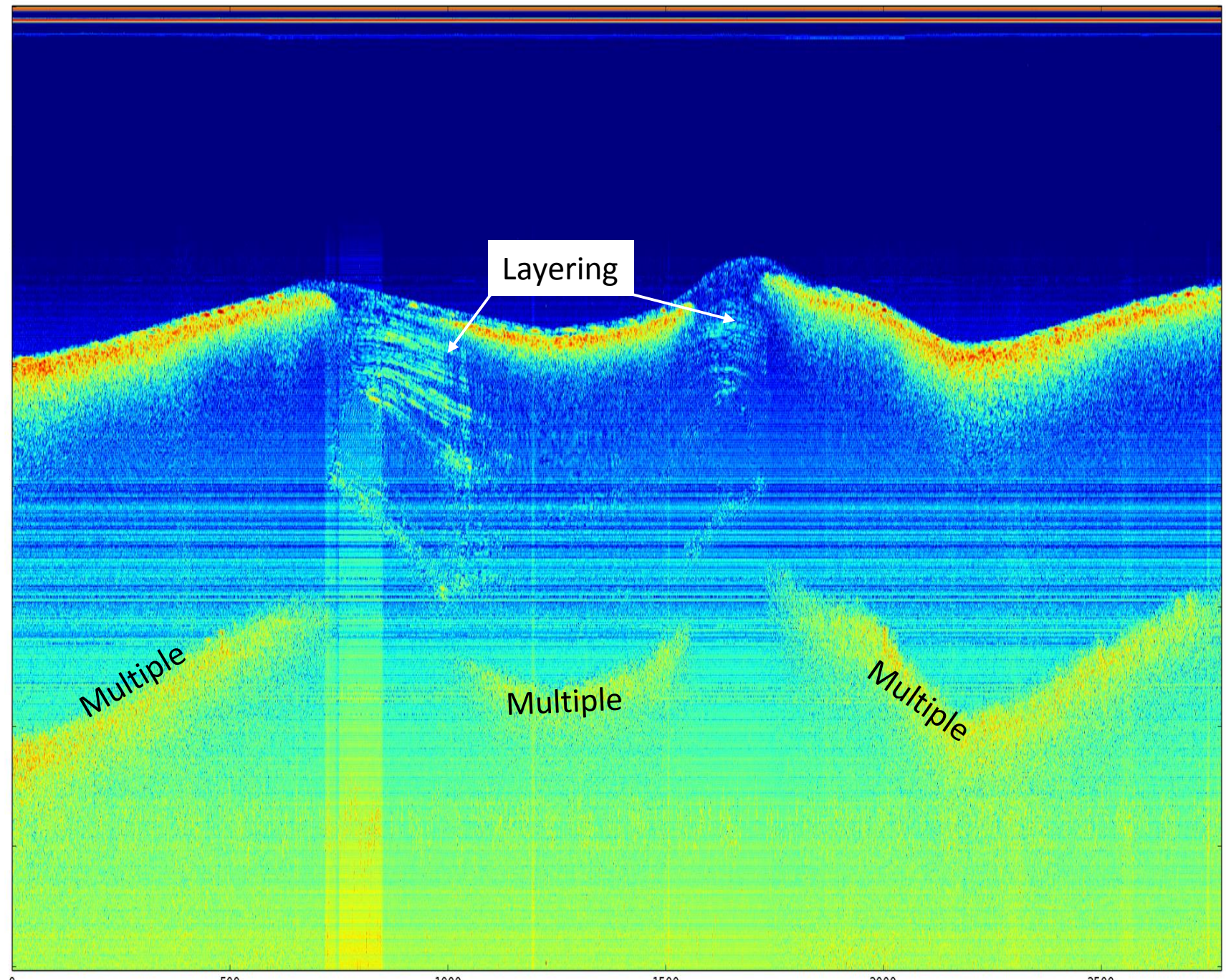
Depth (ft)

Layering

Multiple

Multiple

Multiple



# Video of Discharge



## Hamm's Beer Can from Video

- This can design dates from the late 60s to early 70s.
- Indication of sedimentation rate.



# Conclusions

- Tufu mound seems most likely explanation
  - No refusal with scuba core collection
    - Implies lack of refuse or coarse materials
  - Sub-bottom profiler shows either layering or no structure to 20 feet below the bottom surface.
    - Implies lack of refuse or coarse materials
    - No indication of kame materials.
  - Discharge, while faint and small, would indicate groundwater.
- Issue - Need to get groundwater discharge to the middle of the lake
  - Implies preferential pathway
    - Bedrock estimated to be >150 feet at Lulu Lake (Passive Seismic and nearby well construction reports)
    - Gravel deposit
    - Small kame sits above lake sediment seal allowing discharge.
- Interest – If a Tufa mound, then
  - implies lots of stability in this basin.
  - Might be useful as a climate record (see Swanson, Muldoon, Polyak, and Yemane 2014)
  - Needs a more focused study