An Integrated Approach to Understanding the Physical and Chemical Characteristics of Great Salt Lake

A Cooperative Study between Utah Department of Natural Resources, Division of Wildlife Resources and U.S. Geological Survey

USGS

Primary Objectives

- Define the physical constraints, circulation, and mixing rates of Great Salt Lake
- Determine the nutrient (nitrogen and phosphorus species) budget
- Quantify the occurrence and distribution of anthropogenic heavy metals, trace elements, and synthetic organic compounds

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Conceptual Approach

- Long term program, 5-10 years
- Annual plan of study with defined products
- Critical unknowns addressed in stepwise fashion: each year builds upon knowledge gained previously
- Review by GSL Ecosystem Program and Technical Advisory Group

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Great Salt Lake Bathymetry

- Describe methods and challenges
- Data coverage
- Specific features seen during data acquisition (Raw data)
- Bathymetry of South Arm of Great Salt Lake
- Other studies / data collected

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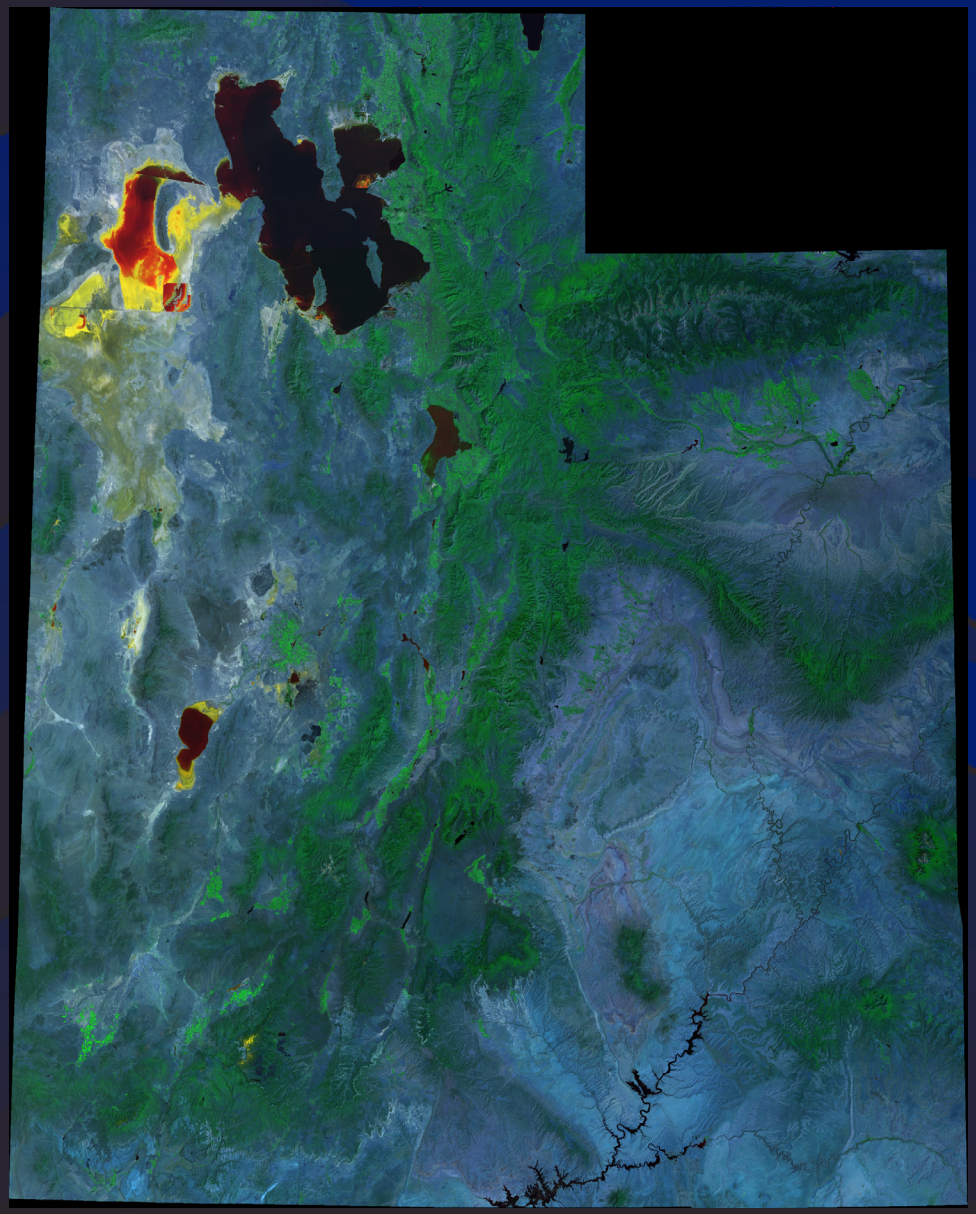

Great Salt Lake Satellite Image

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Great Salt Lake Now

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Great Salt Lake Causeway

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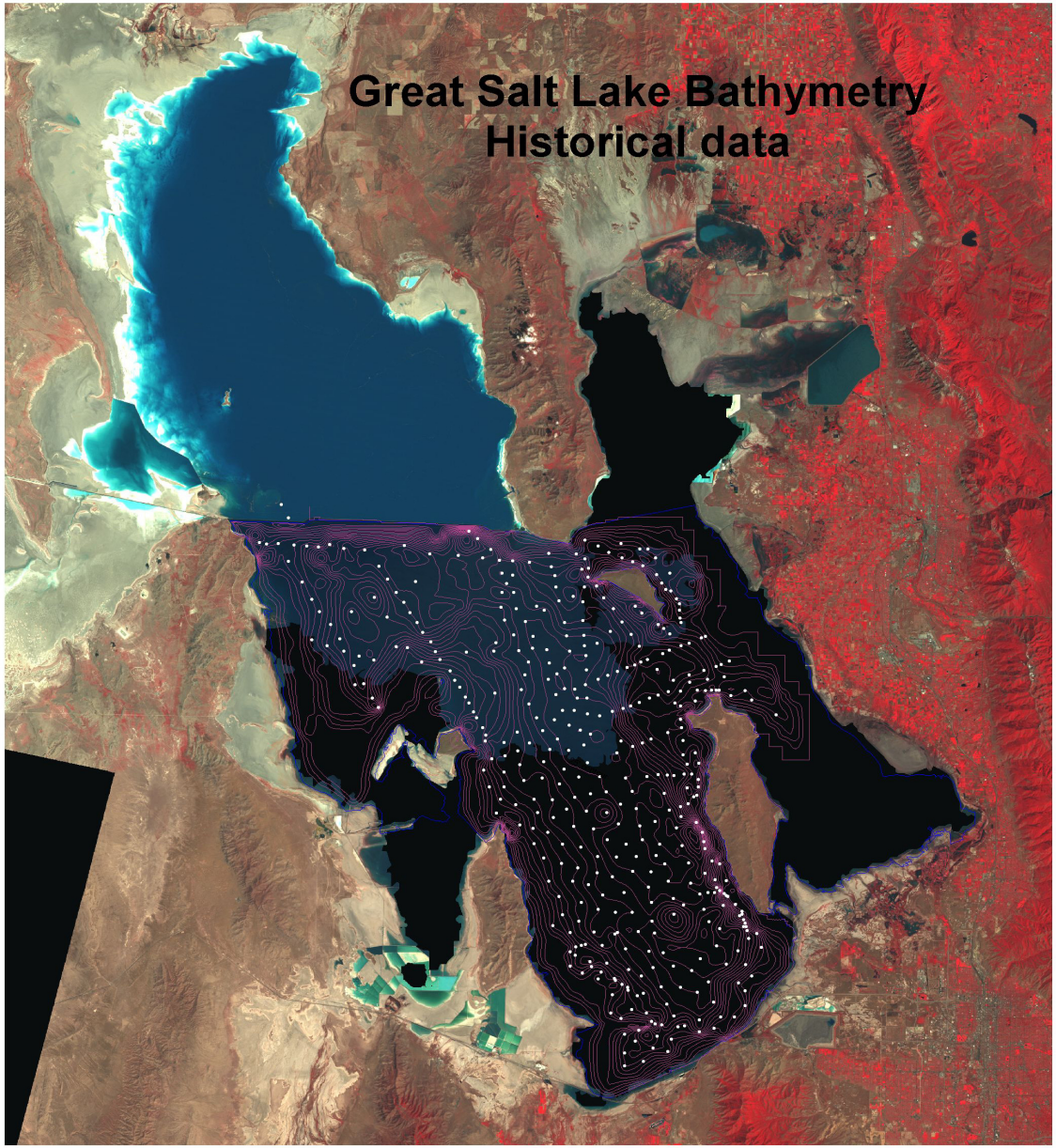
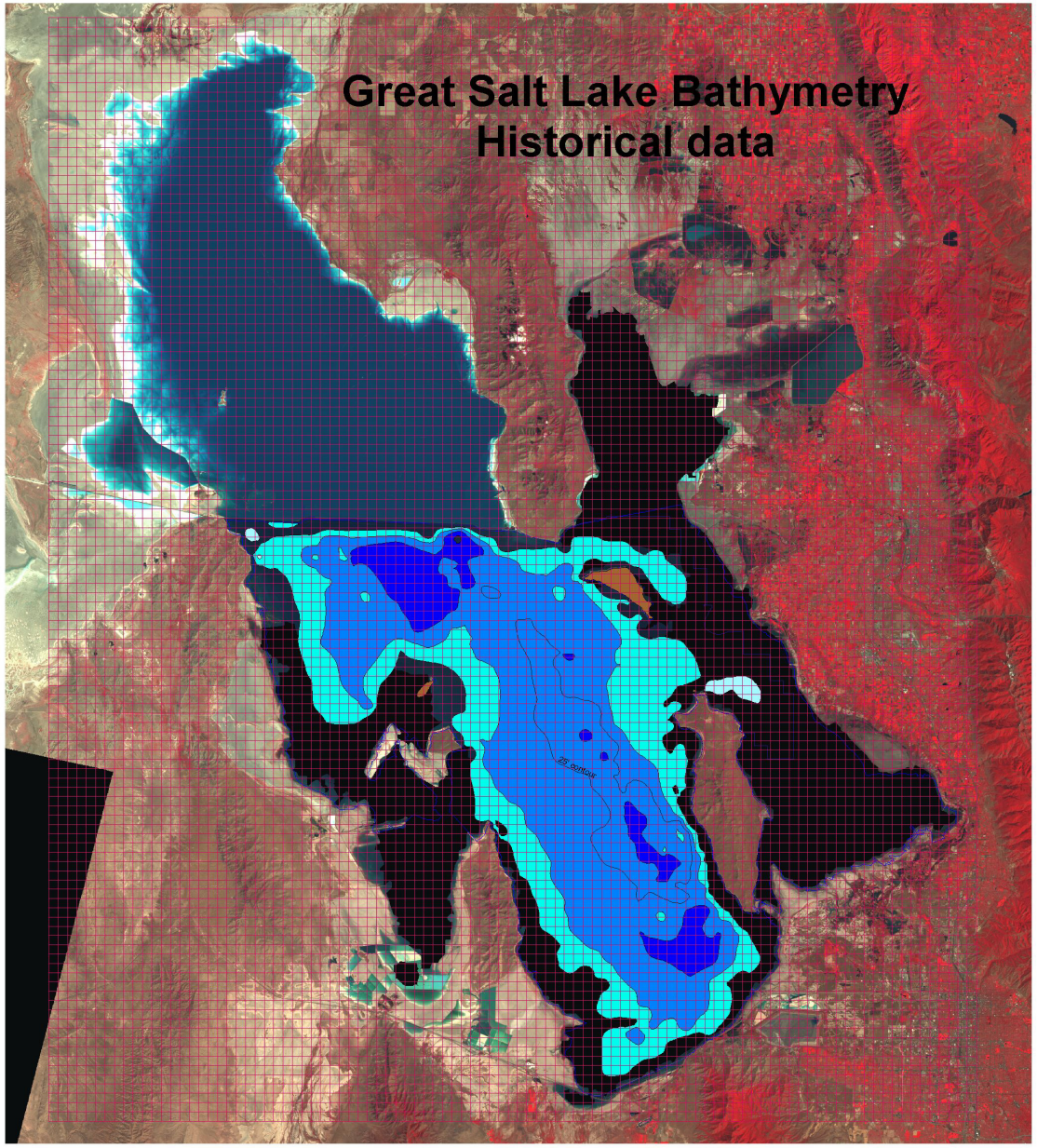

Great Salt Lake Bathymetry
Historical data
3 0 3 6 9 12 15 18 21 24 27 30 Miles

USGS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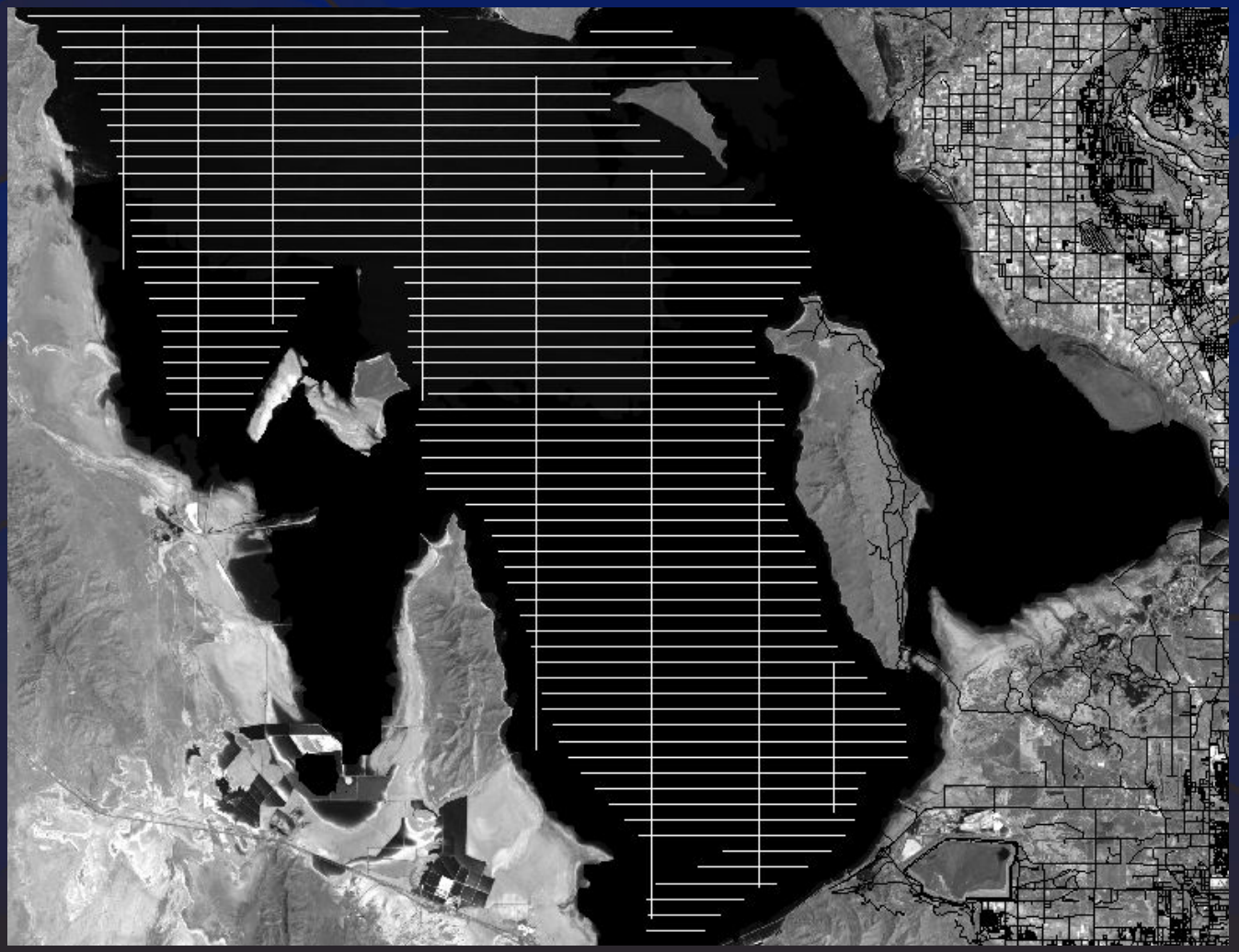
USGS

Great Salt Lake Bathymetry



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Great Salt Lake Bathymetry

- Physical Parameters of the lake/water
  - High density brine (9-26+ percent NaCl)
    - High sound velocities
    - High coefficient of friction
    - Electrically conductive
  - Shallow Water
    - Access limitations
    - Short timing intervals
    - “Surf’s up”

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Great Salt Lake Bathymetry

- Equipment Issues
  - Not designed for GSL Conditions
    - Shallow/high speed depths
    - High density water (physical issues)
    - Speed of sound corrections
    - Needed to keep it as simple as possible (corrosion problem)

USGS

Great Salt Lake Bathymetry

- Equipment Solutions
  - Navigation
    - Hypack Lite
  - Depth
    - Reson single channel
    - Narrow Beam, High Resolution Transducer
      - 2.8 degree beam
  - Position
    - RTDGPS
      - MS132 w/ OMNISTAR correction
      - <1m Real-time
  - Industrial SVS

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Global Positioning System

USGS

Transducer

USGS

Depth Finder

USGS

Helm

USGS

Great Salt Lake Bathymetry

- Acquisition parameters
  - Less than 6 inches of chop
  - No observable swell on paper record
  - Depth greater than 0.7 meters
    - Safety
    - Timing problems
  - No rain/heavy precipitation
    - Generator
  - SVS profiles (intermittent)

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Great Salt Lake Bathymetry

- Elevation data at and higher than 4193 from aerial/satellite photography/quad maps
- Elevation data below 4193 from point soundings
- Current technology provides continuous elevation cross-sections

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Data Properties

- 1850 km of data
- 2,500,000 original points
- 2,040,000 after cleanup
- 400,000 after filter and average

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Great Salt Lake Bathymetry

- Data products
  - Bathymetric map of South part of Great Salt Lake
  - Bottom materials available (map?)
  - Structures (faults, mounds, etc.) map
    - Assists in U. of U. work
  - Area/Volume/Elevation table
  - Digital data for future use
    - Visualization/modeling/circulation control/etc.

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Data availability

- Paper copy of bathymetric map
- Raw data will be available digitally
- Map and Factsheet will be available digitally
- C-Map contacted… pending

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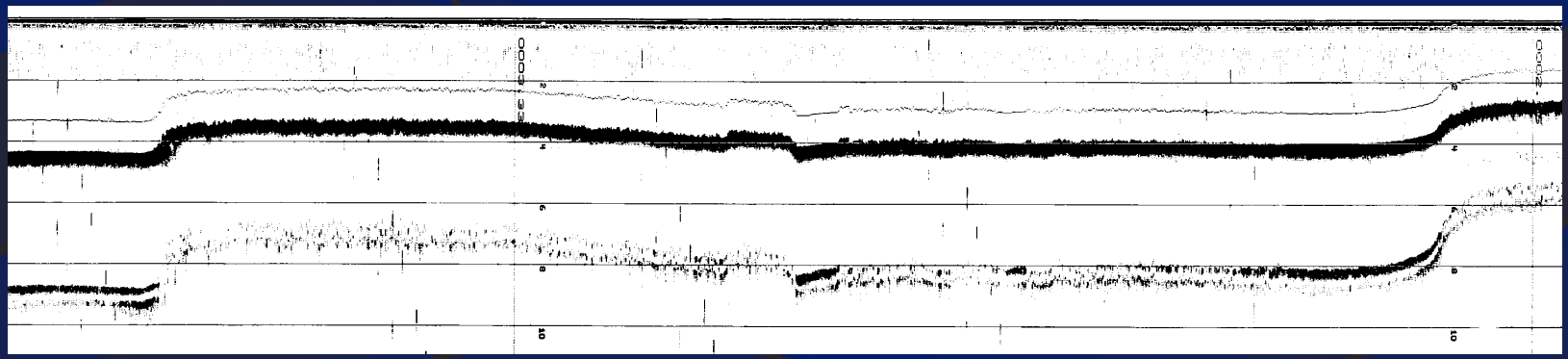
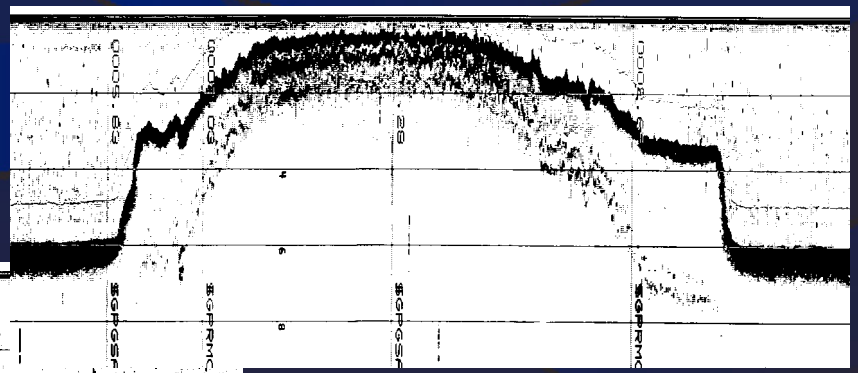
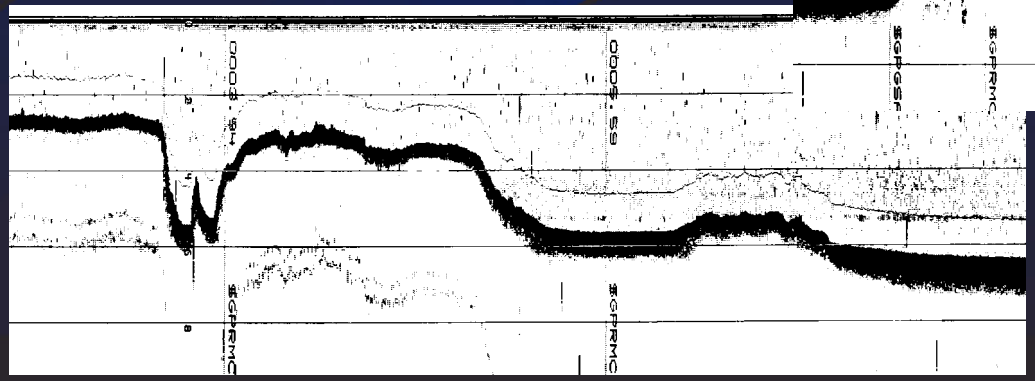
Great Salt Lake Analog Data







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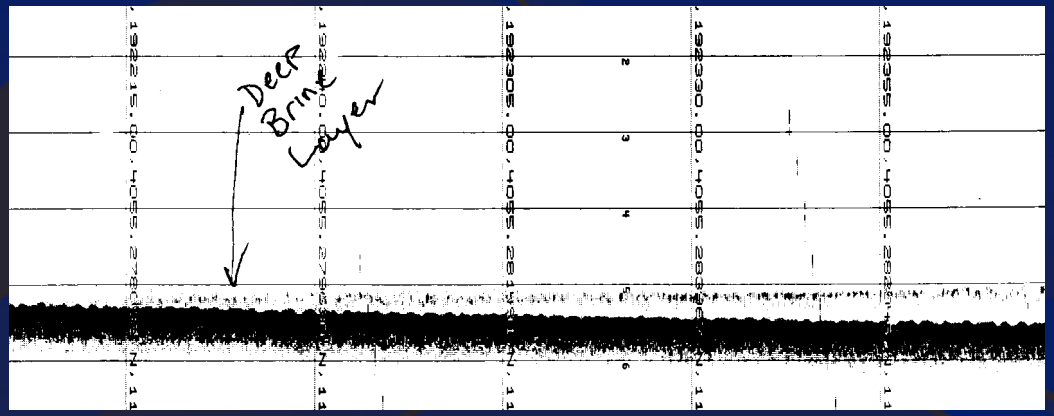
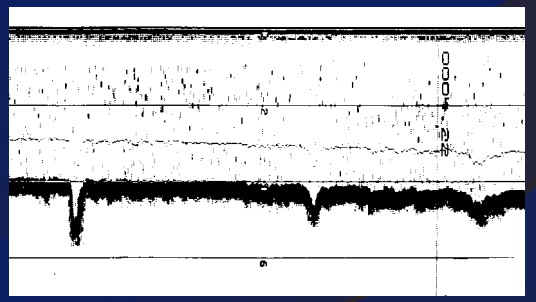
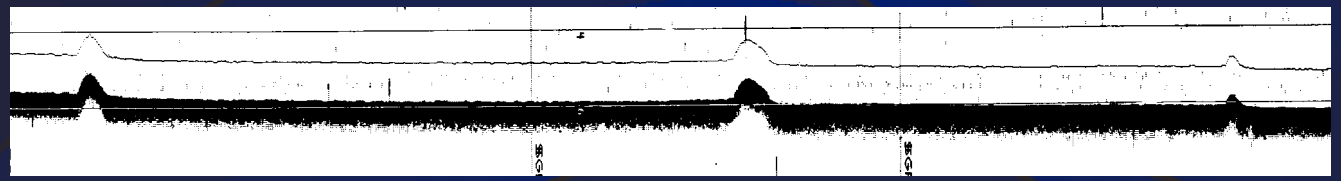
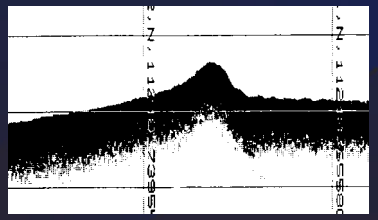
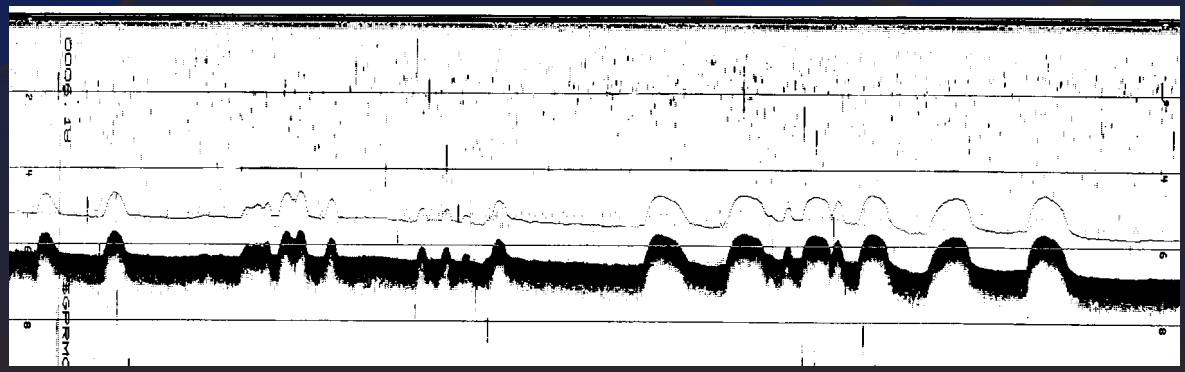
Great Salt Lake Analog Data











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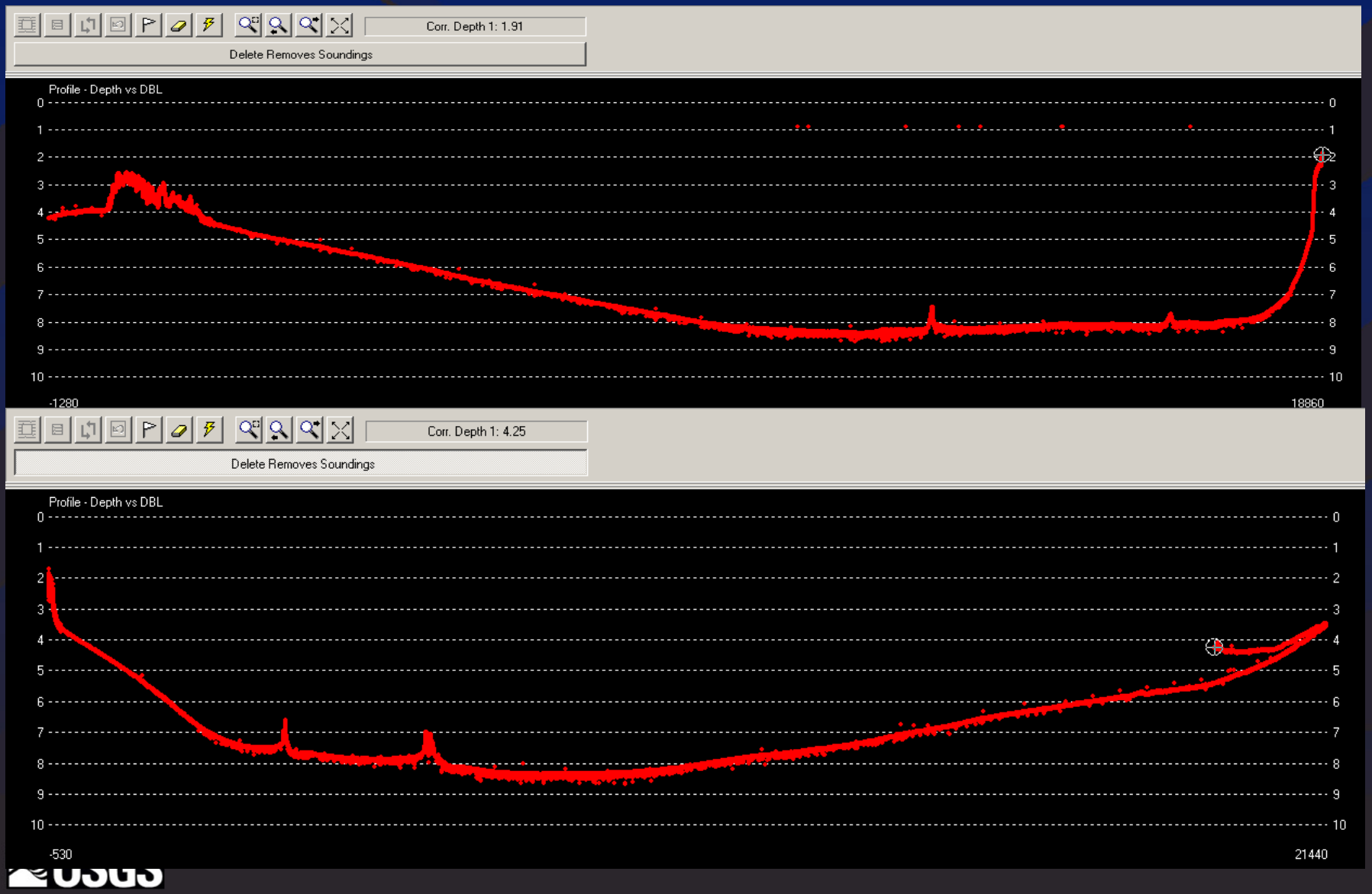
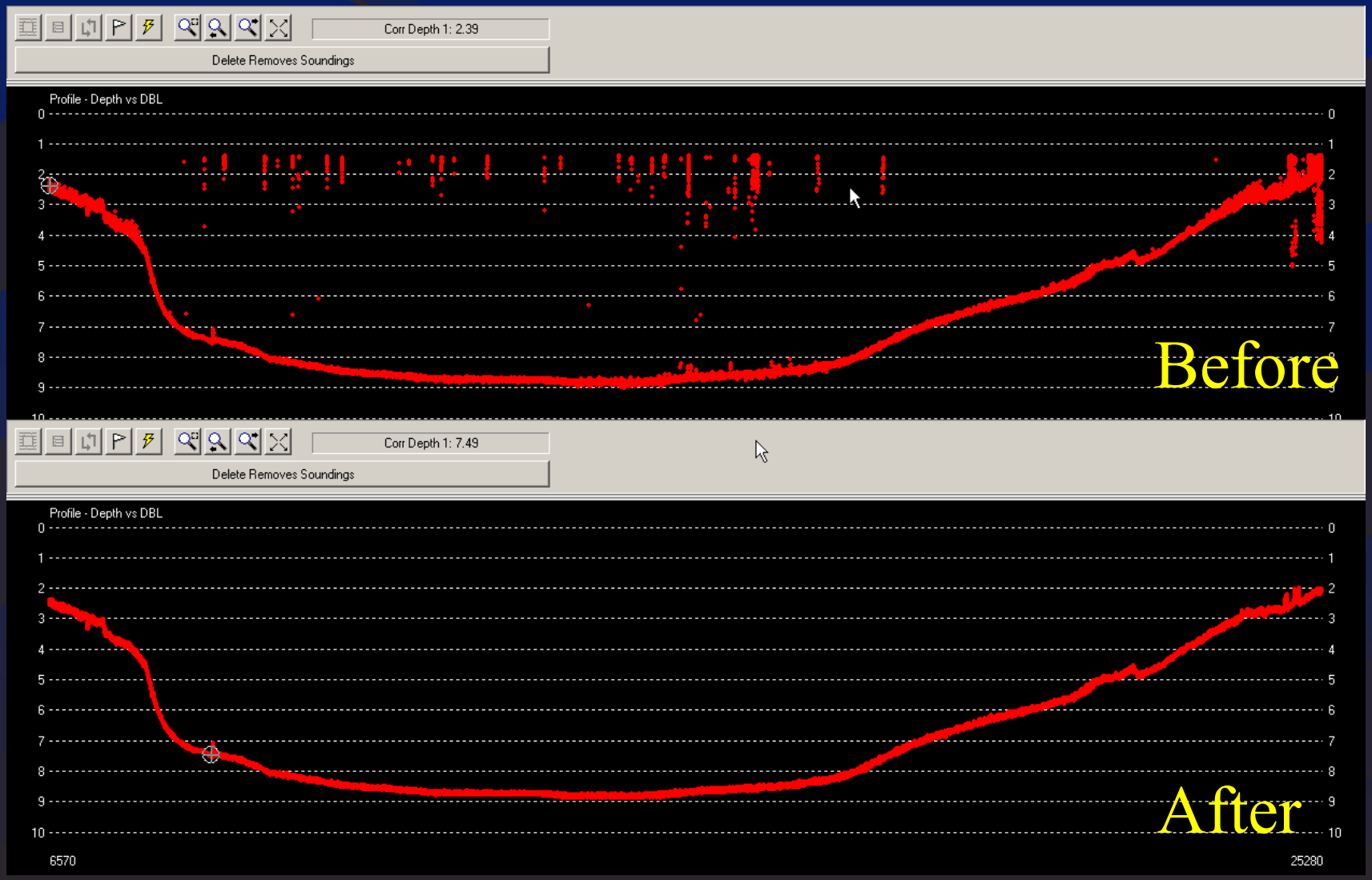
Original GSL Digital Data



Data Processing



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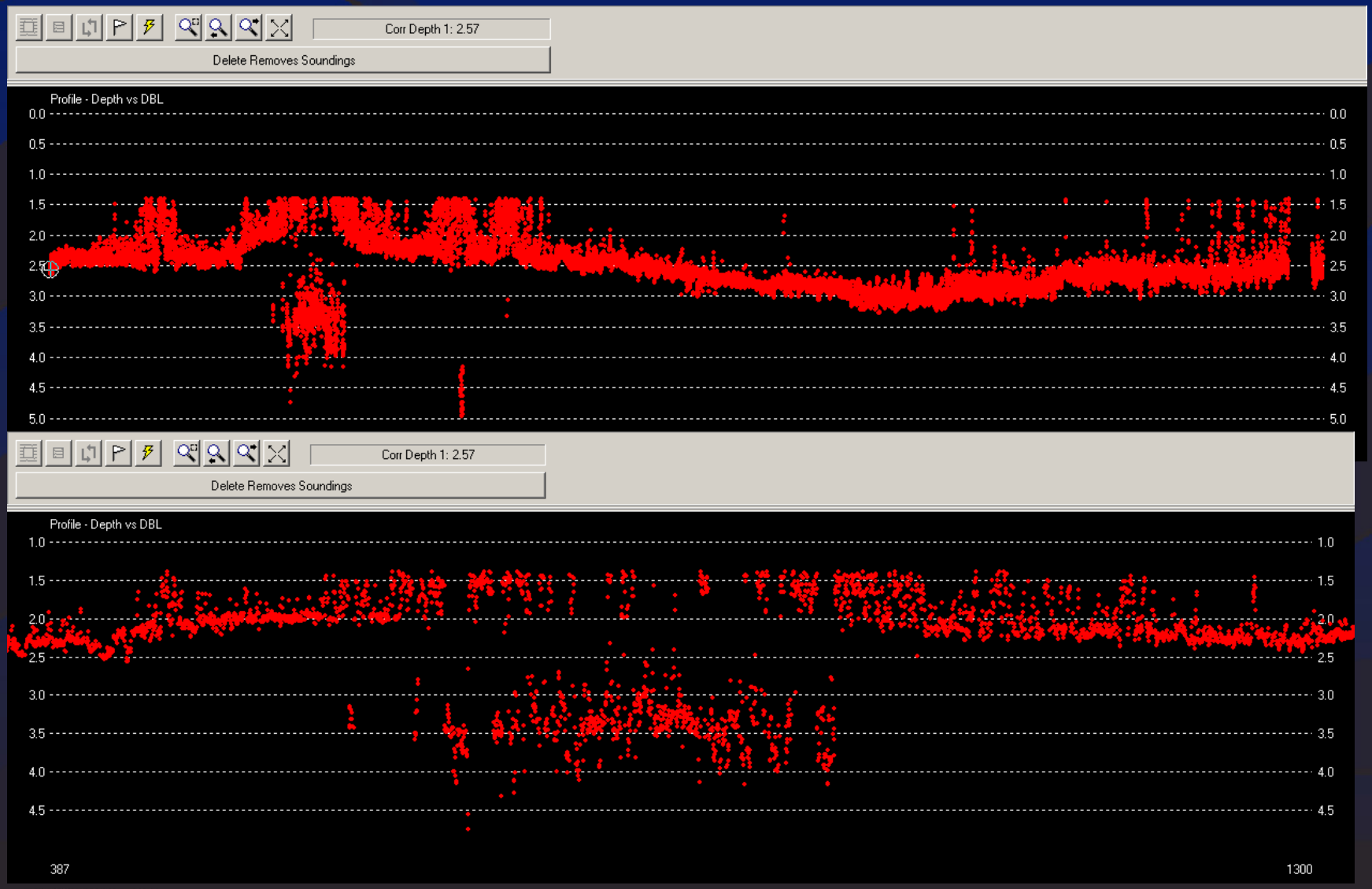
“Multiples”



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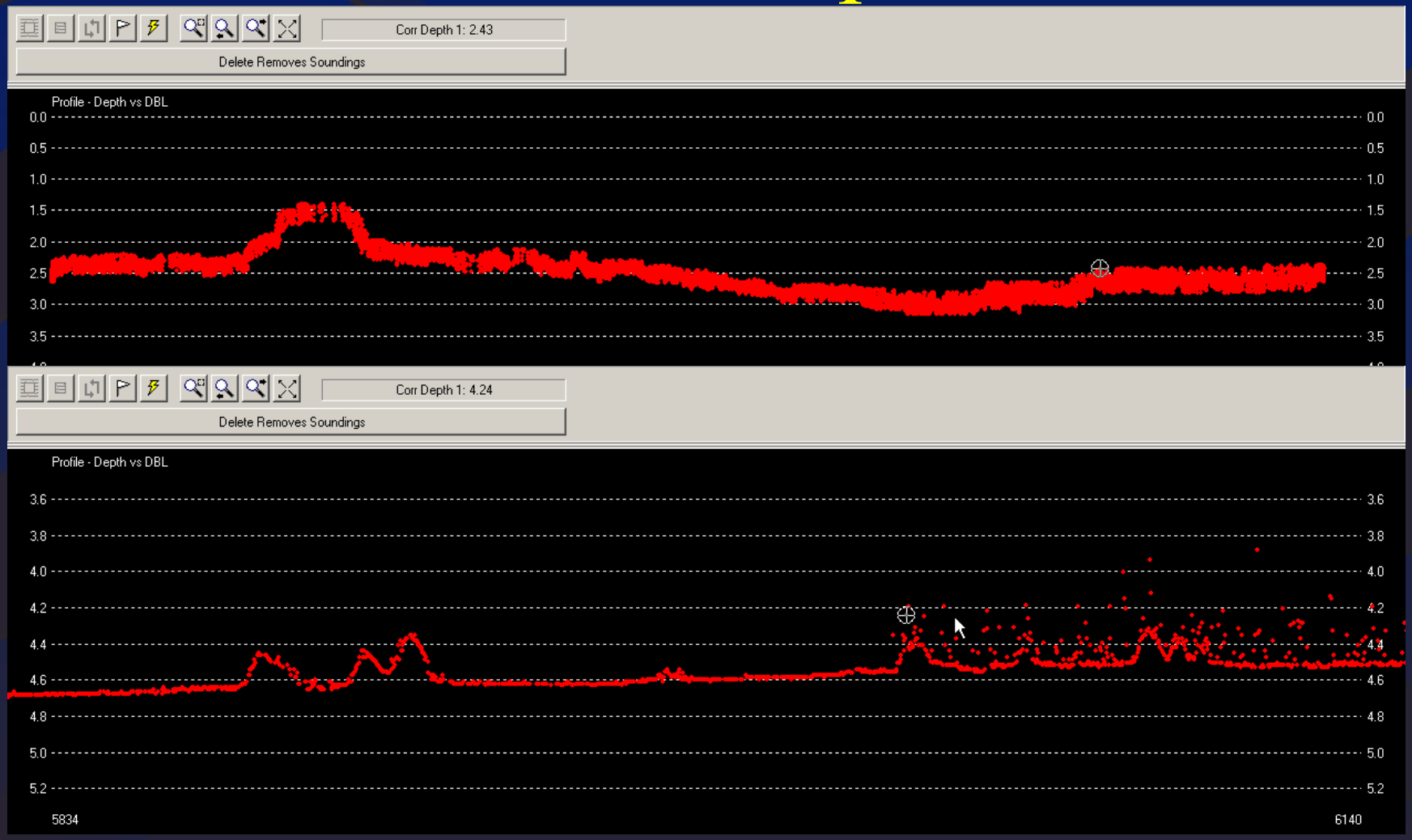
Line Examples



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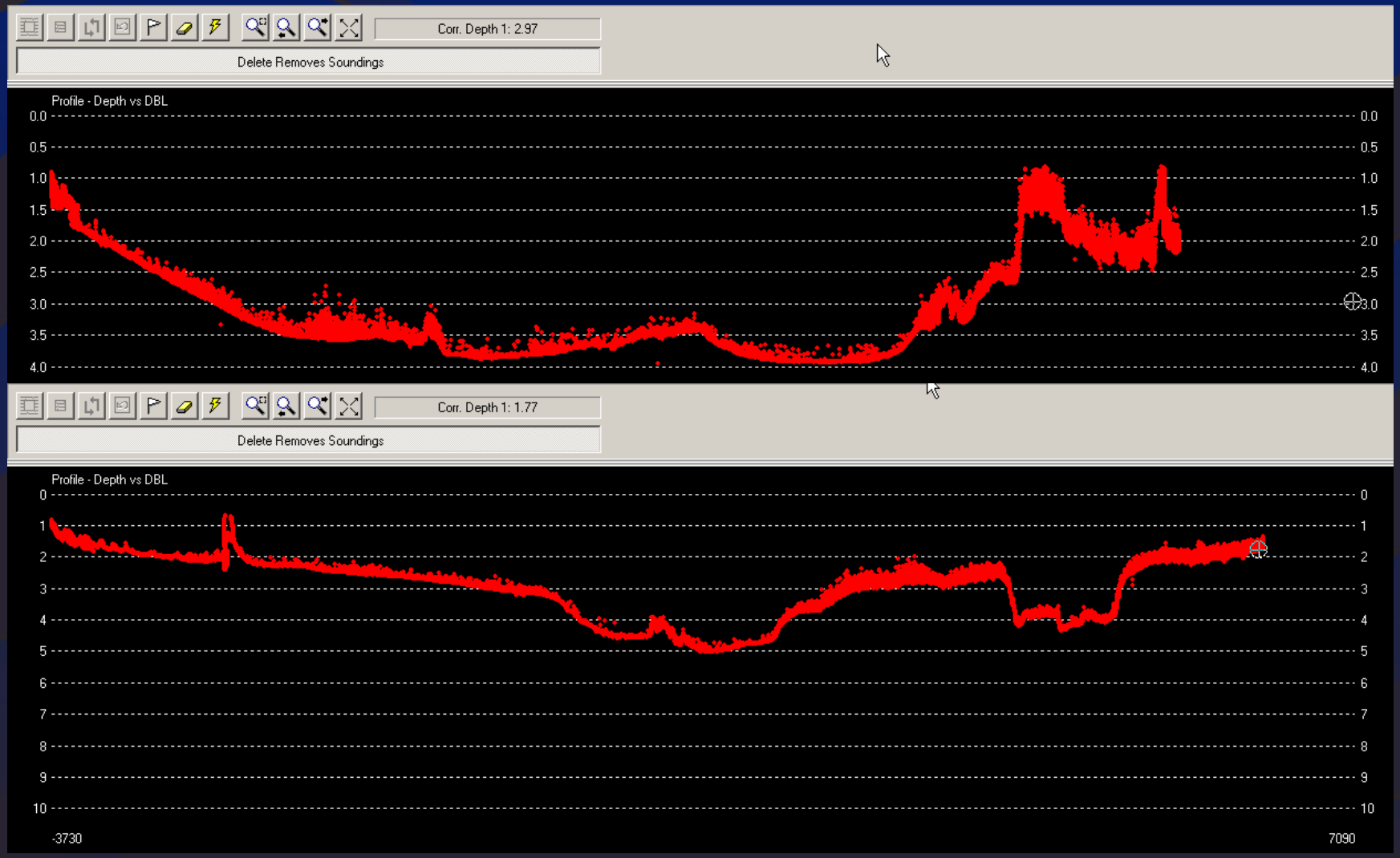
Lines 3 and 5



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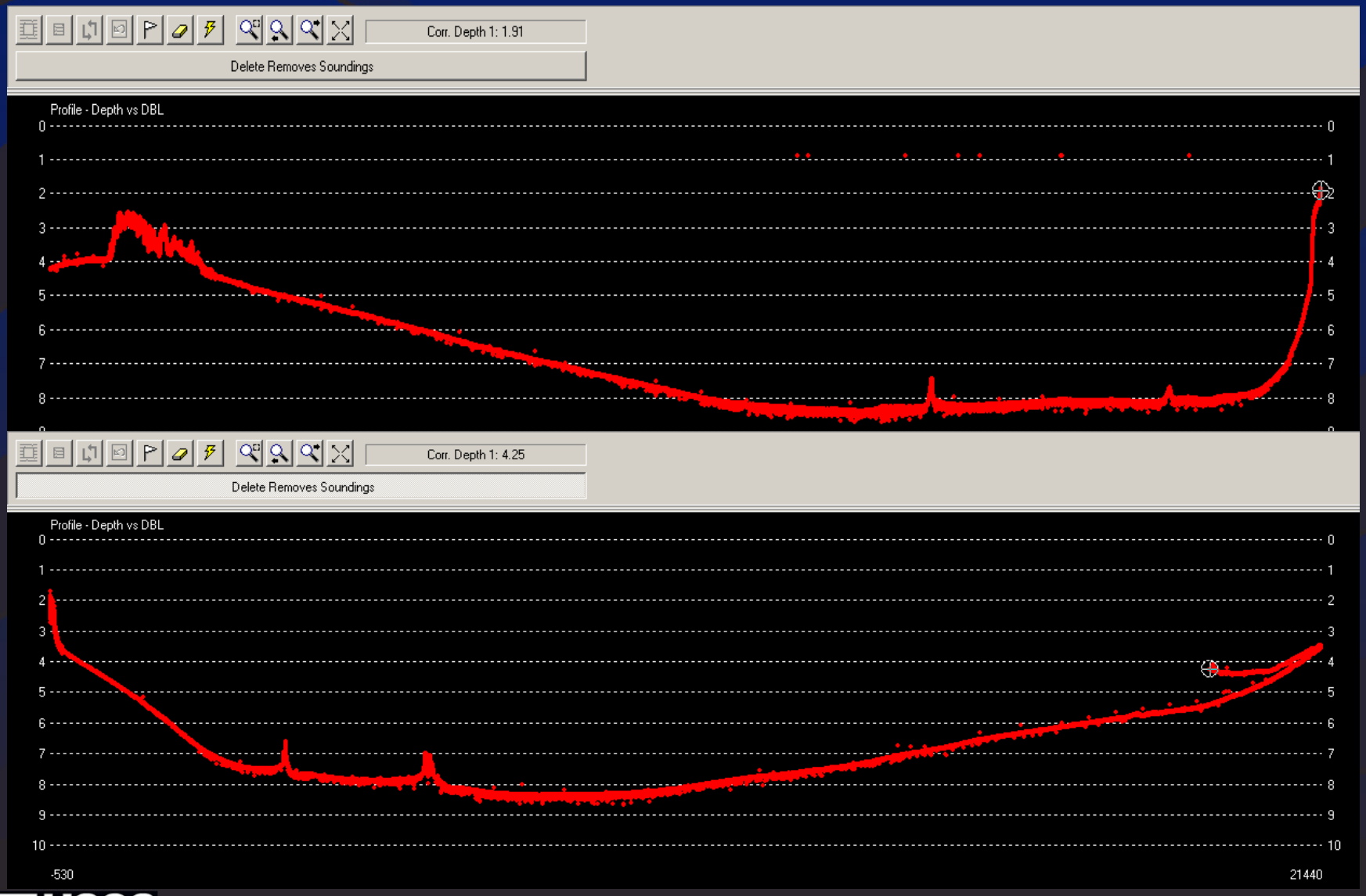
Line 27 and 32



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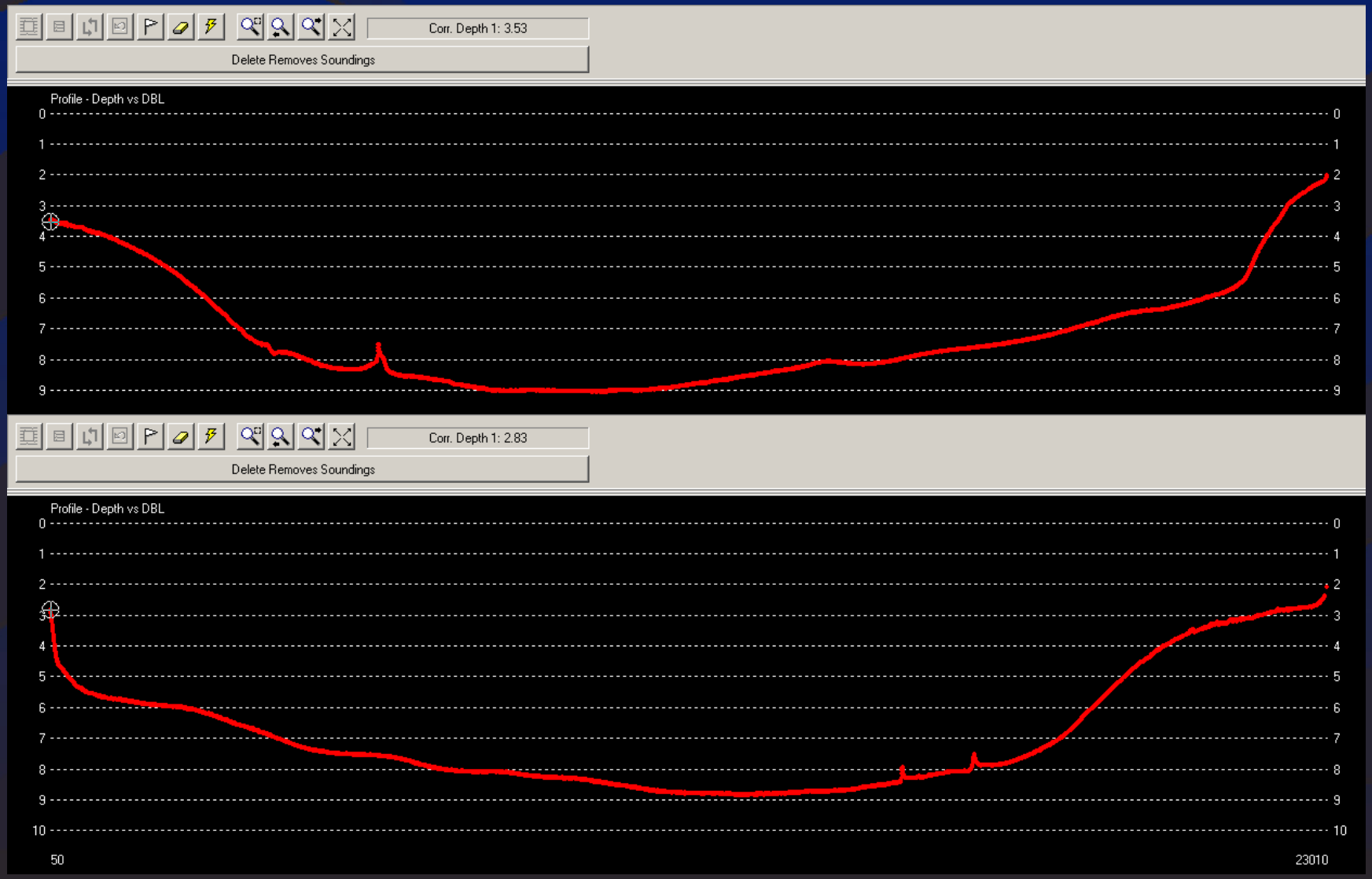
Lines 34 and 36



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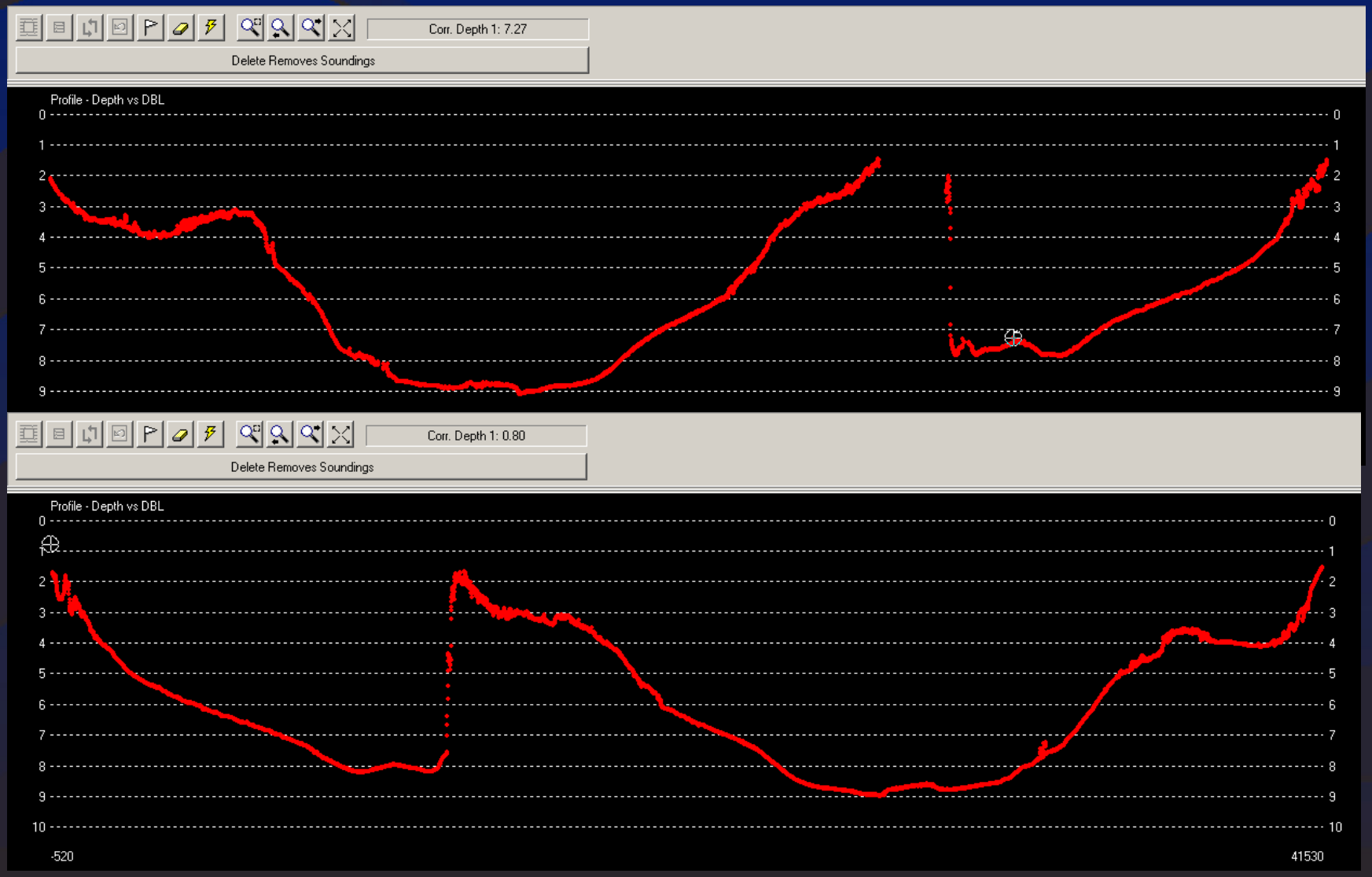
Lines 54 and 55



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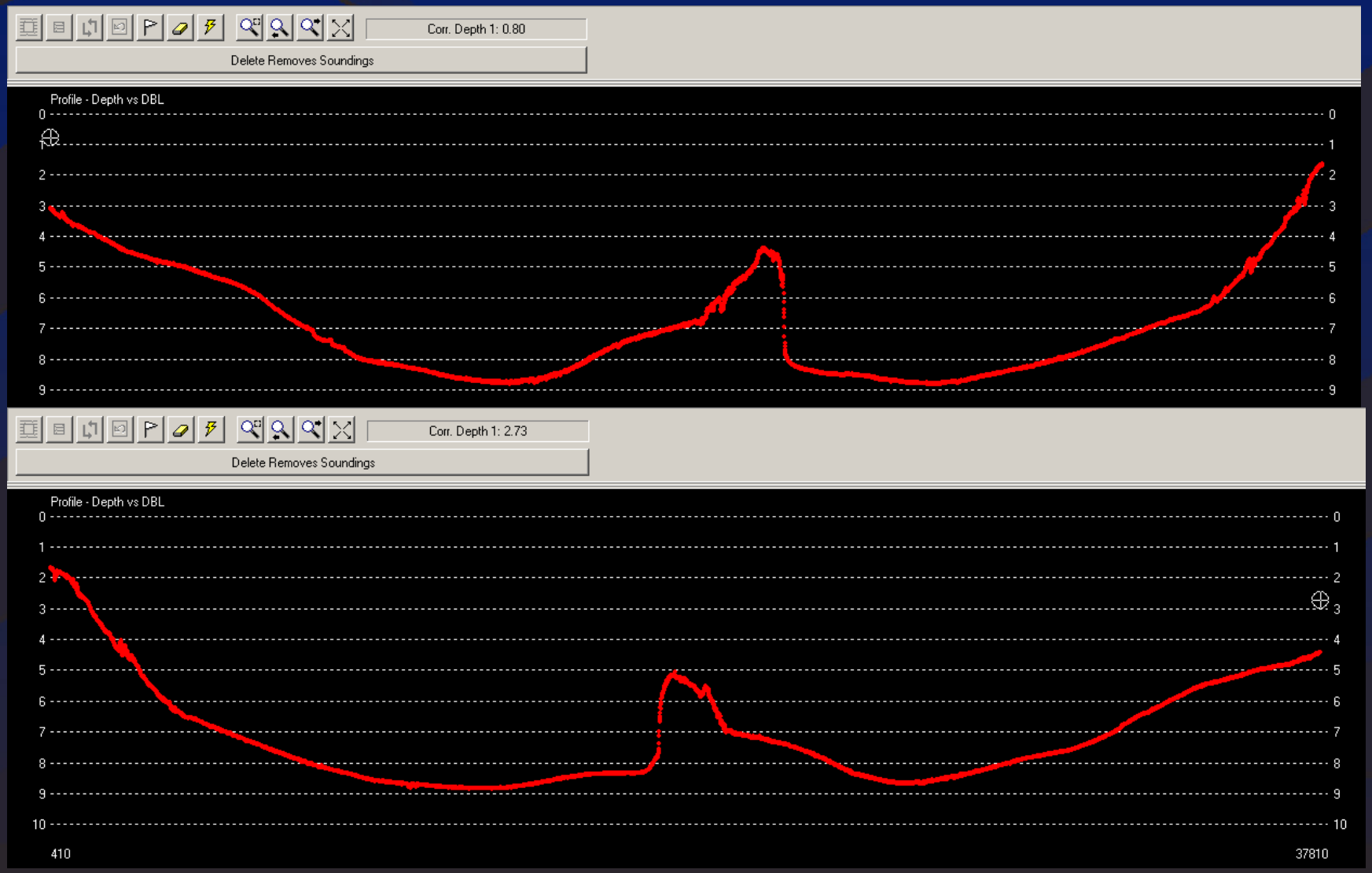

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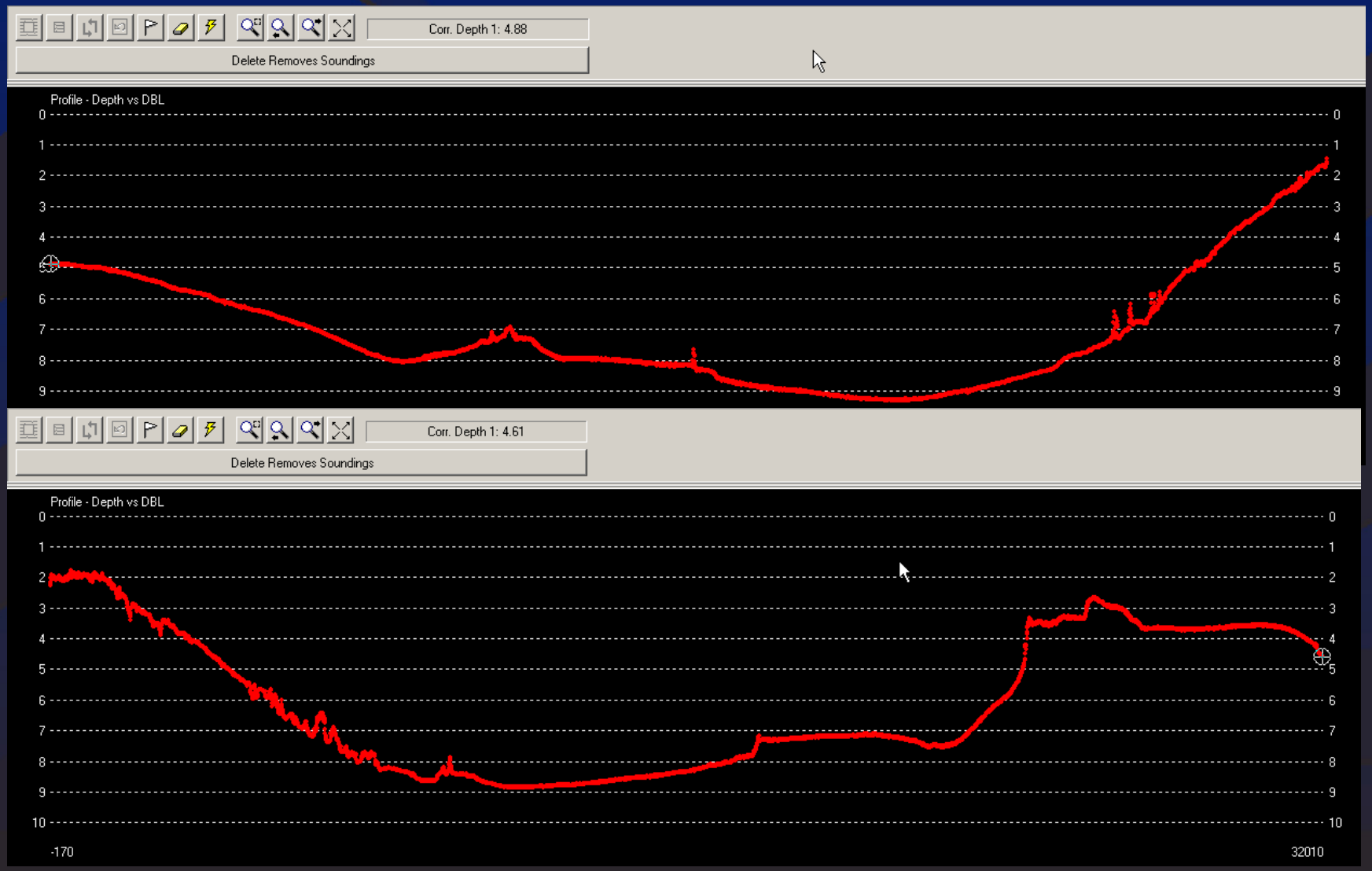

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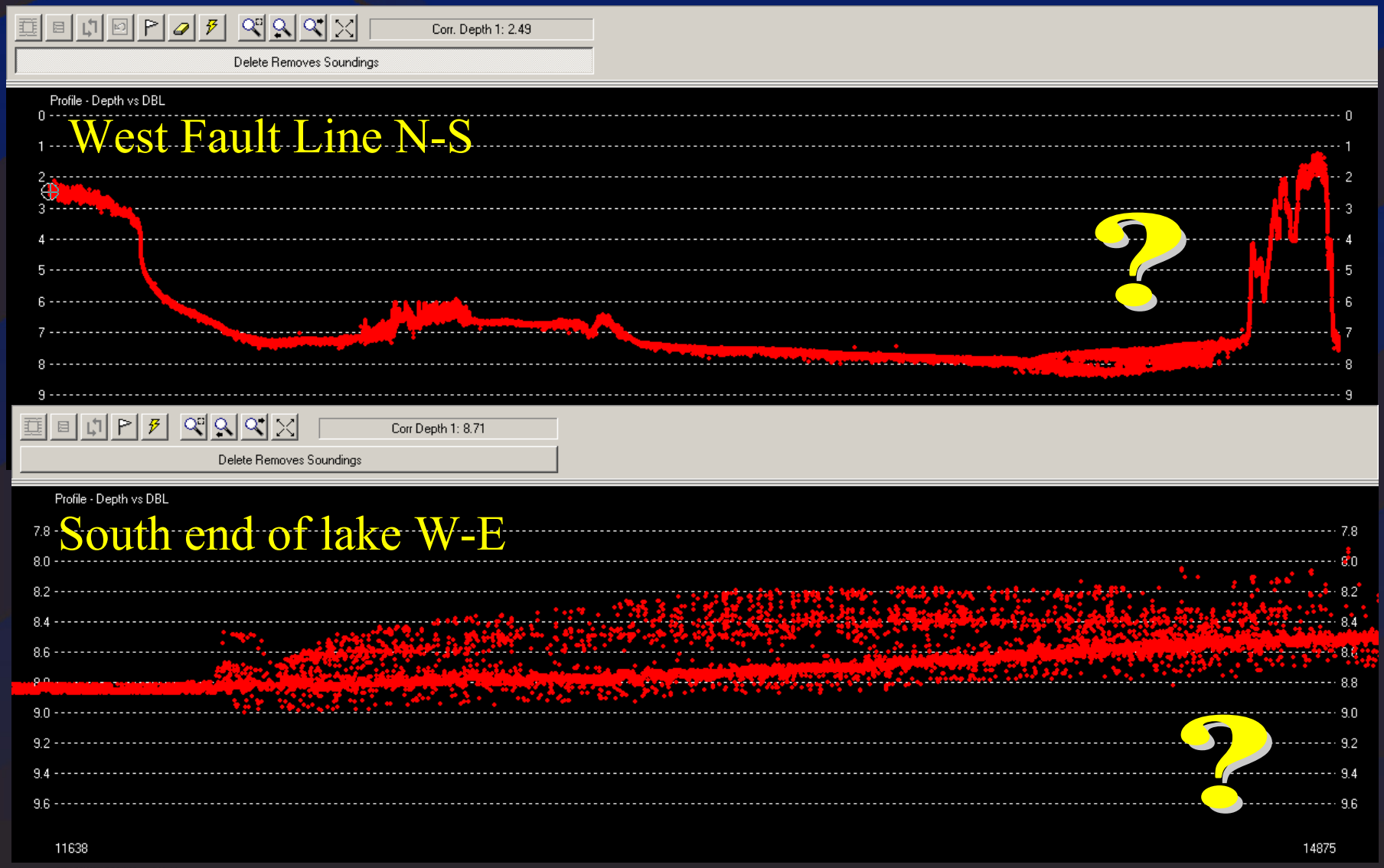
Unknowns?



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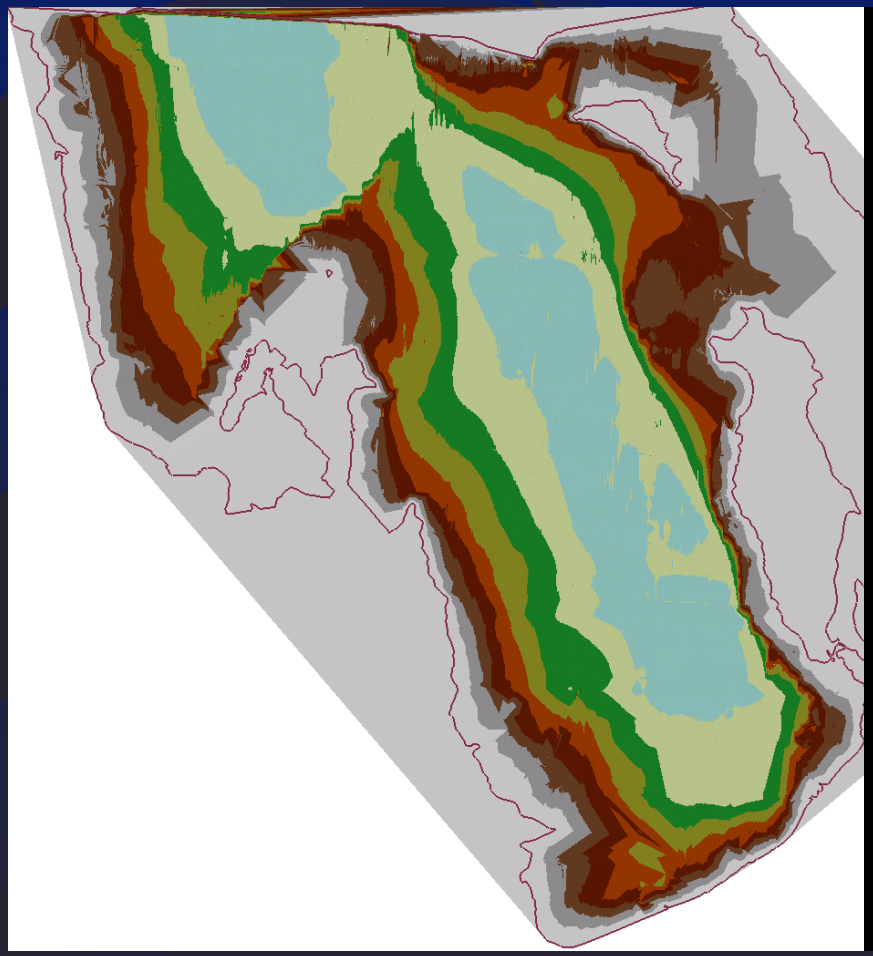
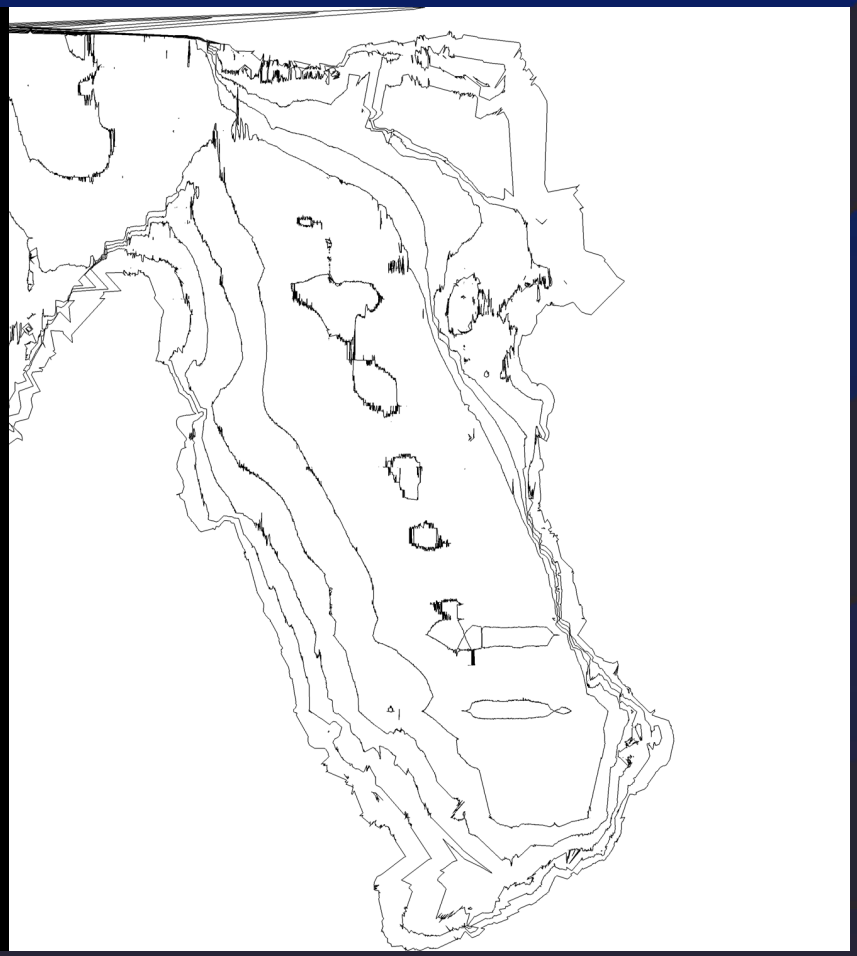
“Raw” Bathymetric Map





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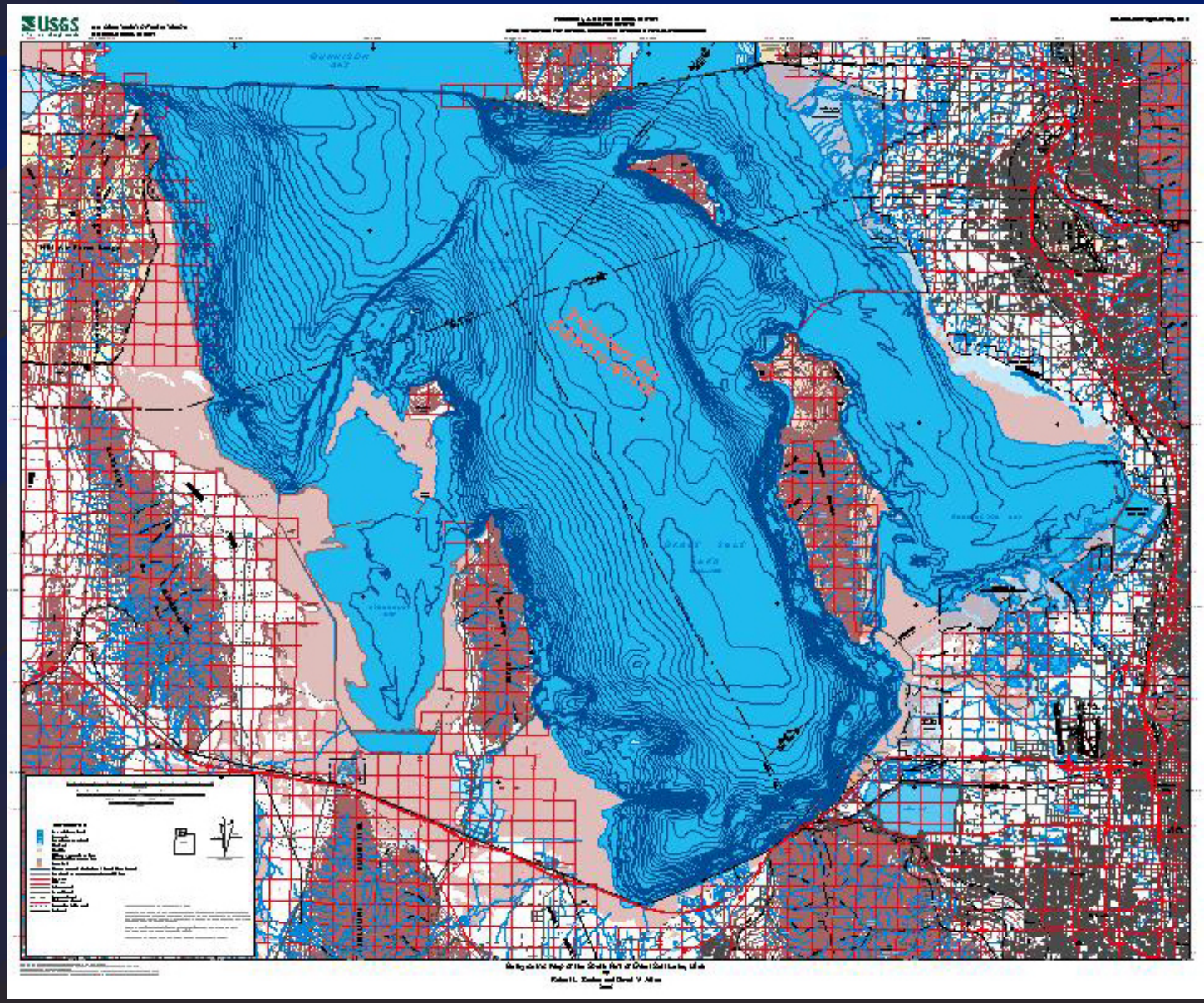

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Location of seismic lines

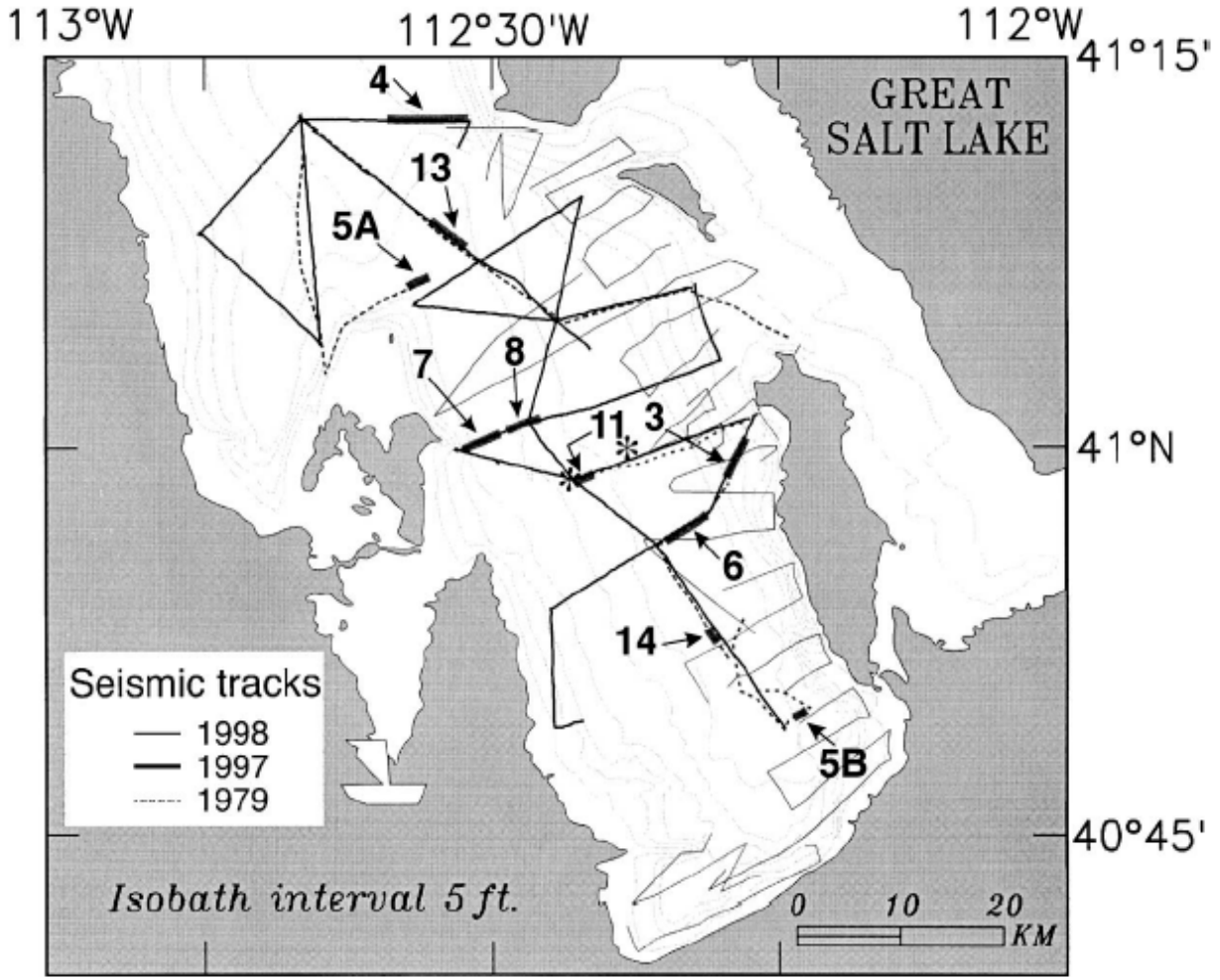

Fig. 2. Map showing the location of seismic survey track lines from 1979 (K.R. Kelts, unpublished data), 1997 (Colman and Kelts, 1997), and 1998 (Dinter and Pechmann, 1999a,b). Seismic profiles shown in this paper are identified by figure number, arrow, and thick segment of track line. Asterisks mark the location of the two cores (core C to the west and core 96-6 to the east) discussed in the text.

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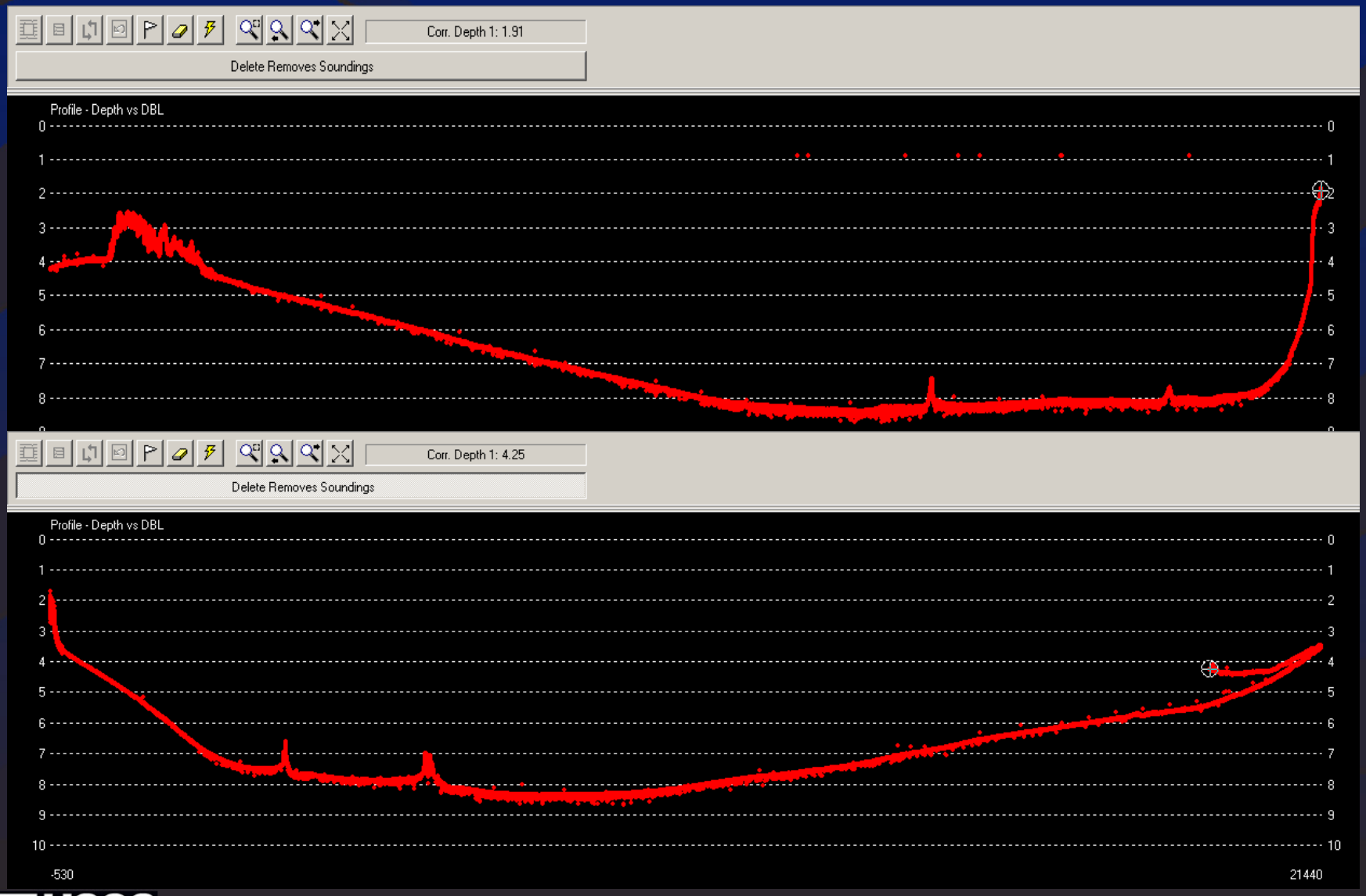
Line 27 and 32



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“Bioherm” mounds

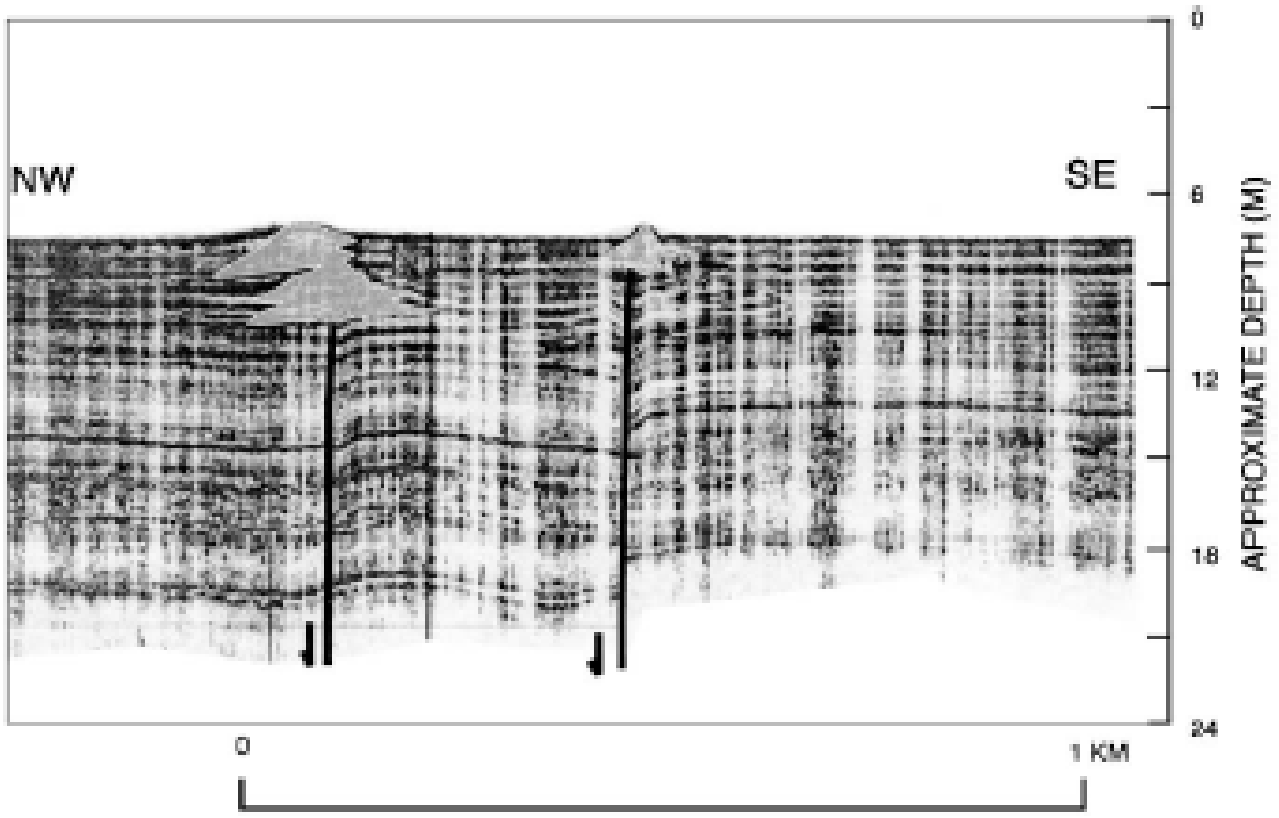

Fig. 14. Seismic-reflection profiles (7 kHz) showing inferred bioherm mounds (shaded) atop fault planes. Location shown in Fig. 2

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Great Salt Lake SideScan

Side-scan sonar test…

Interested in what the bottom looked like in “rough” areas

Woods Hole Oceanographic Institute

1200 kHz fish

No cost except fuel

Effects of brine layer unknown

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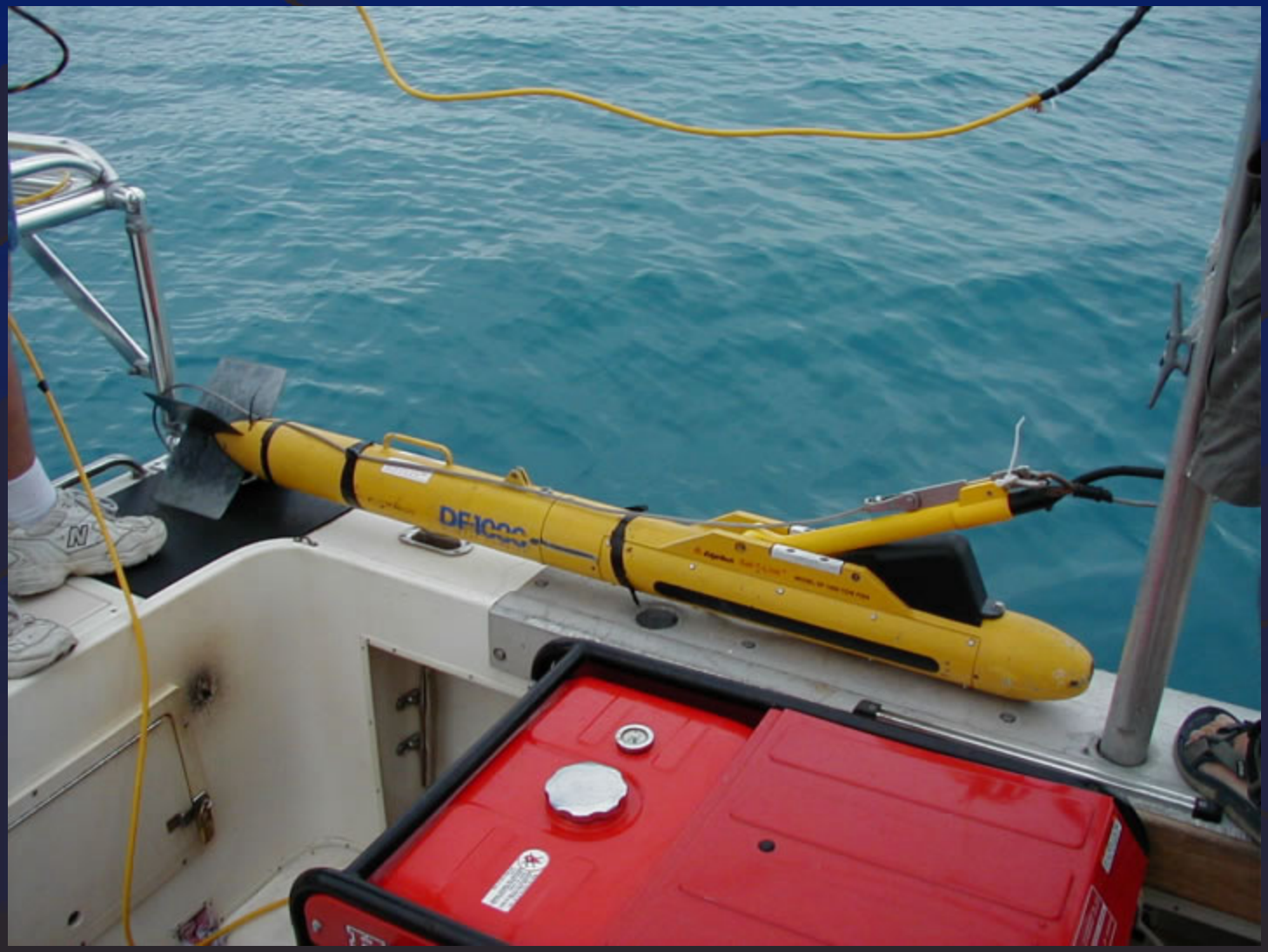
Side-Scan Sonar



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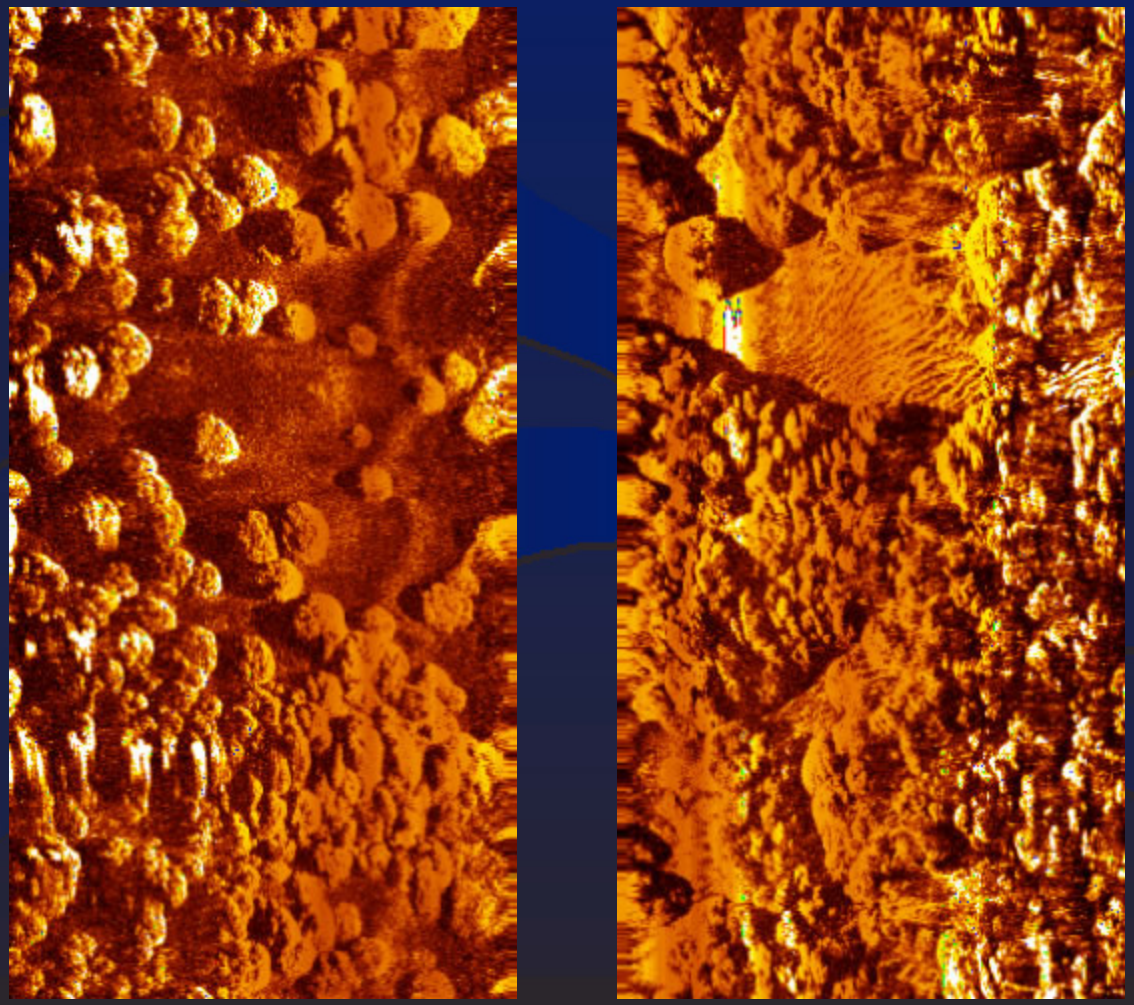
Great Salt Lake Sidescan



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Gaps in the Data

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