BOEM San Resources Meeting, 7 December 2017

Texas Offshore Sediments: Geophysical Workflows, Data Recovery, and Process Model for Sand Resource Evaluation

A UTIG/BOEM Cooperative Project

UTIG Team:

John A. Goff, Sean Gulick, Gail Christeson, Principal Investigators

Steffen Saustrup, Lisa Gahagan, Marcy Davis, Technical Support

John Swartz, PhD Student

Cole Speed, Post-Undergraduate Student

Key Goals

- **Where are the sands?**
  - Recognition and prediction
- **Develop marine geologic and geophysical best practices**
- **A conceptual model of regional stratigraphy**
  - What was deposited where, and why?

Four components of the cooperative with strong relevance to data archiving, collecting, and workflow development:

1) *Formulate a chirp seismic reflection data processing workflow*
   - Utilize UTIG's strong experience in chirp processing to codify "best practices"
   - Develop a suite of software utilities that can be utilized by non-experts
   - Apply processing tools to archival and newly-acquired data

2) *Rescue "legacy" seismic and core data*
   - Convert geophysical files from recoverable tape storage to SEGY
   - Scan paper records to SEGY digital storage
   - Determine core locations and geologic findings

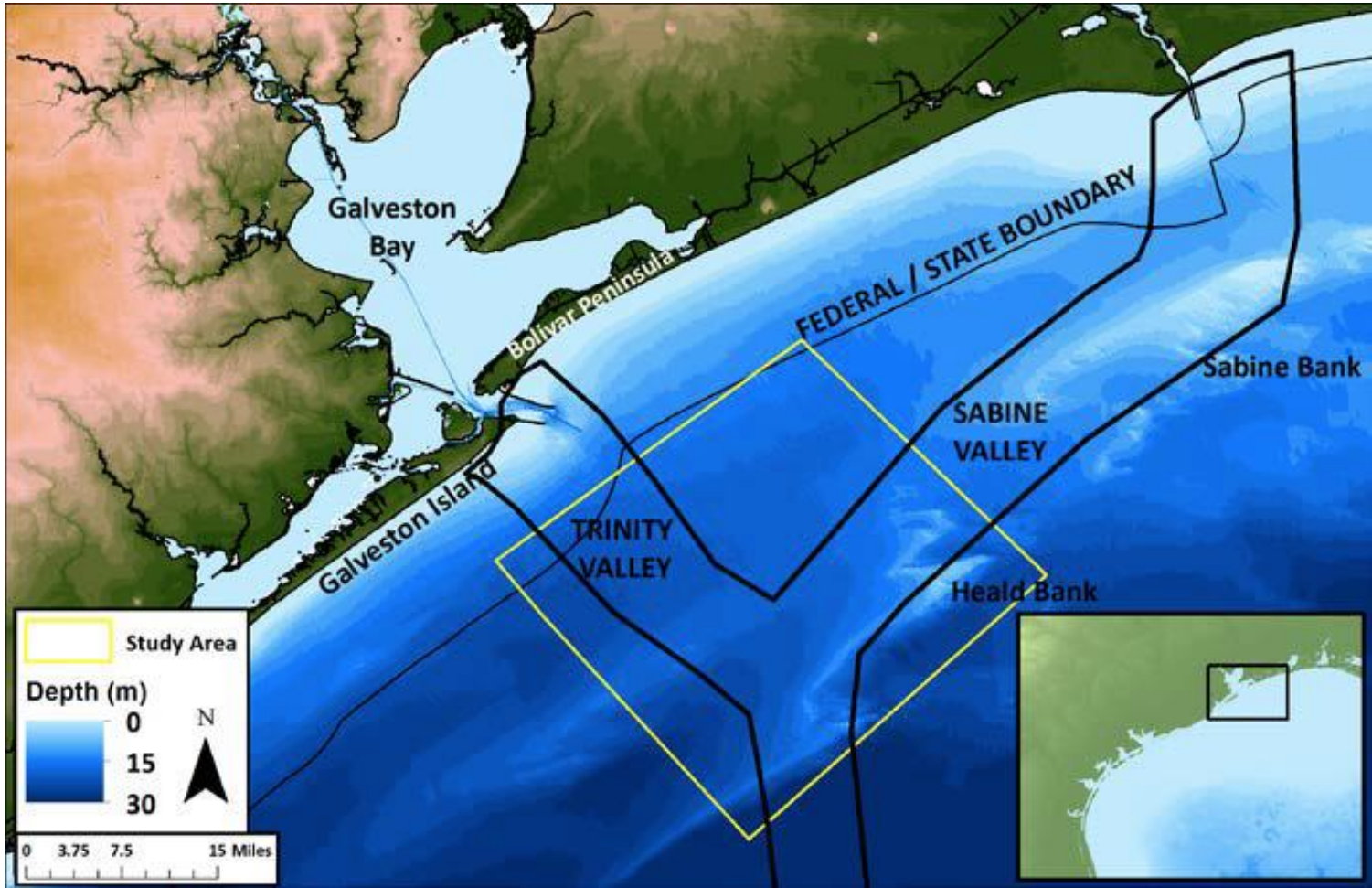
3) *Leverage UT's Marine Geology and Geophysics field course*
   - Yearly data collection opportunities
   - Student training in near-surface surveying and sampling methods/interpretation

4) The Trinity River Paleovalley Project – "TRiPP"

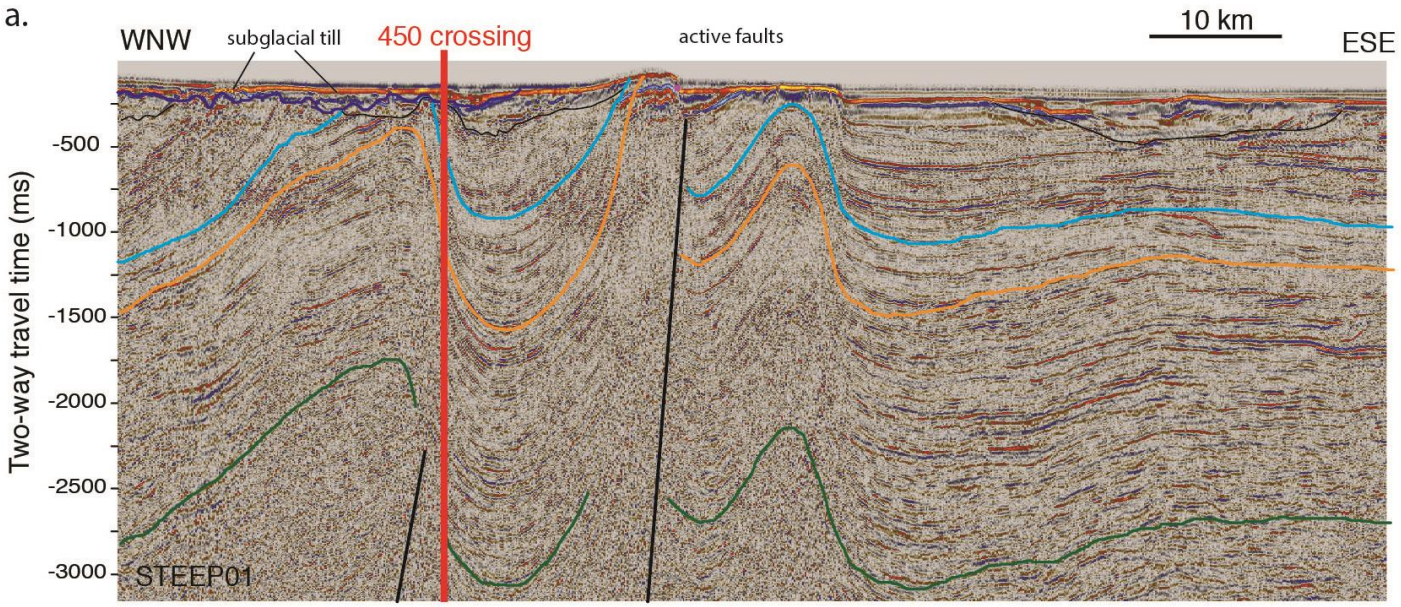
Objective: Document and characterize potential sand resources within a buried offshore paleovalley- the Trinity River system

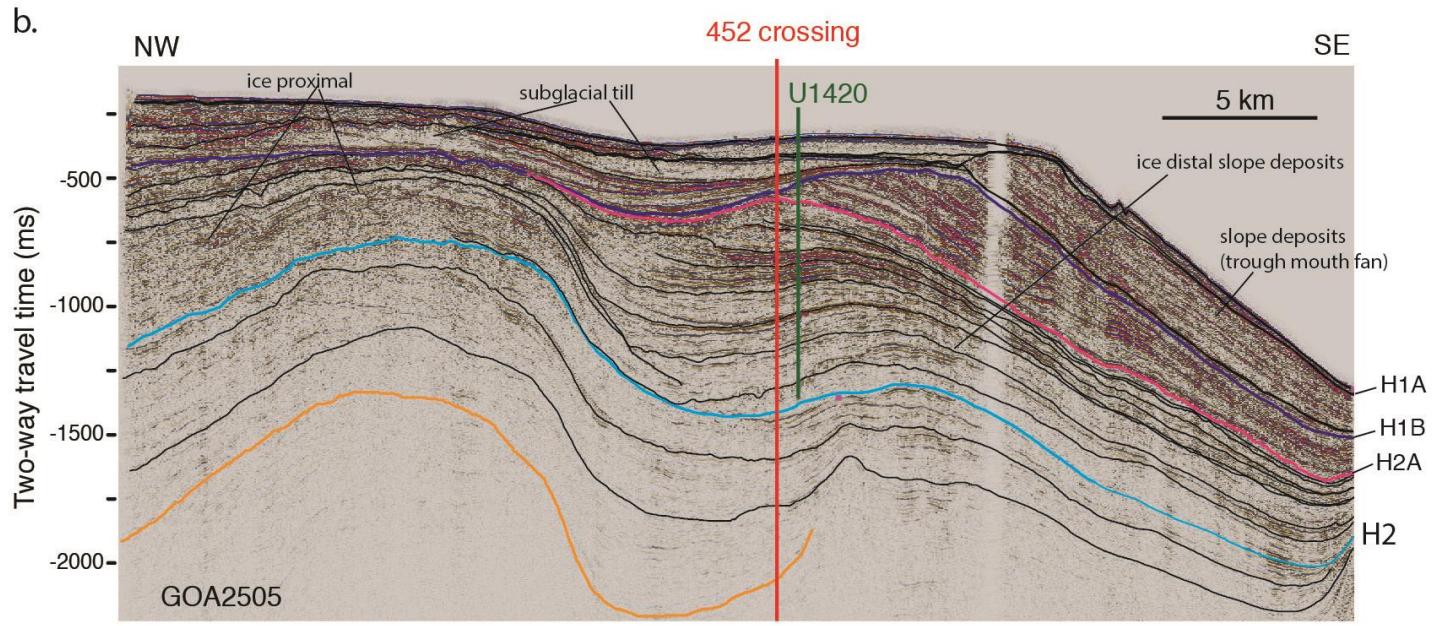
Tasks:

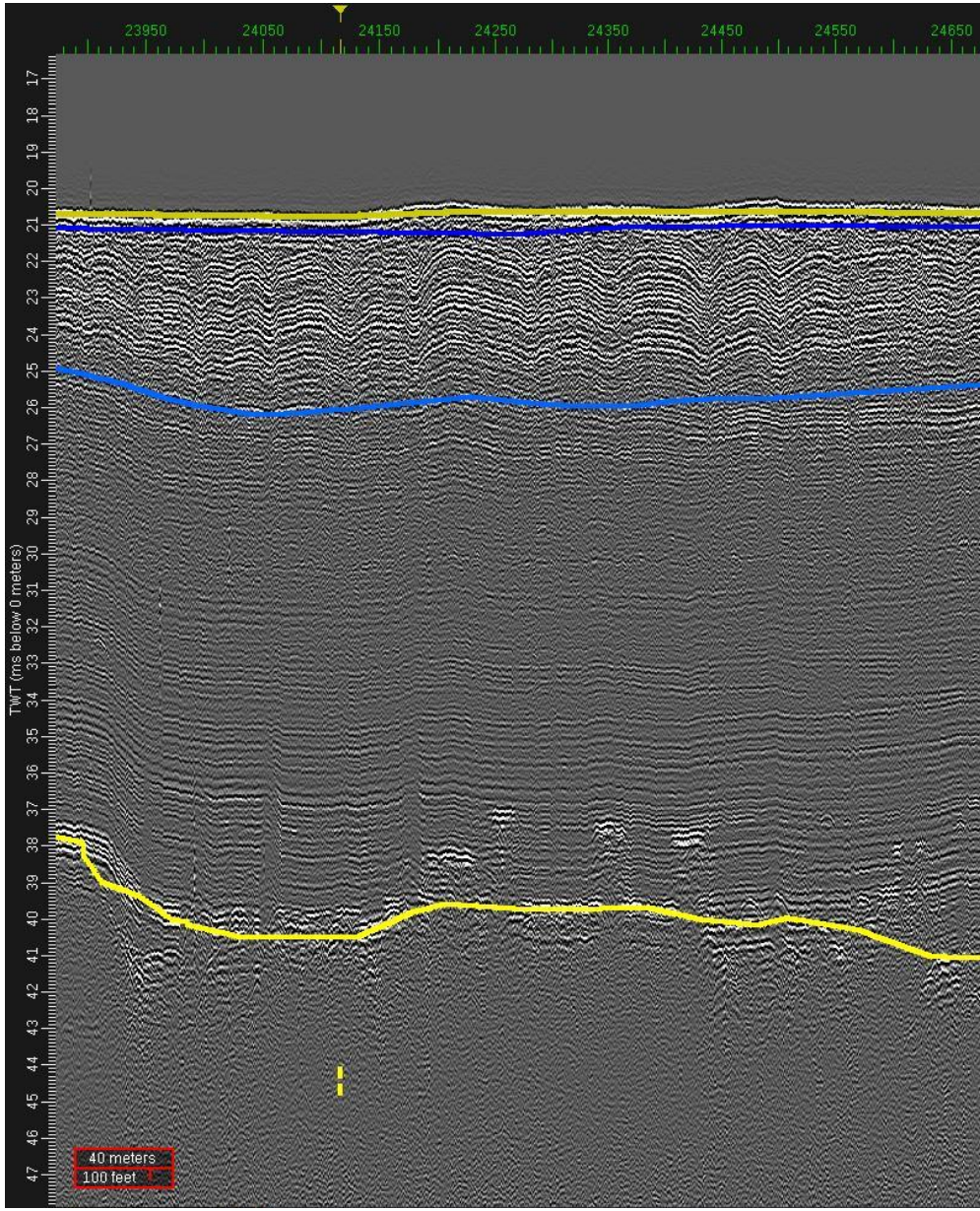
- Develop ArcGIS data base and compile pertinent peer-review and non-peer-review literature
- Deploy MG&G field course to study area for next two field seasons
- Conduct an additional survey during Spring of 2018
- Research will be a focus of John Swartz's PhD dissertation



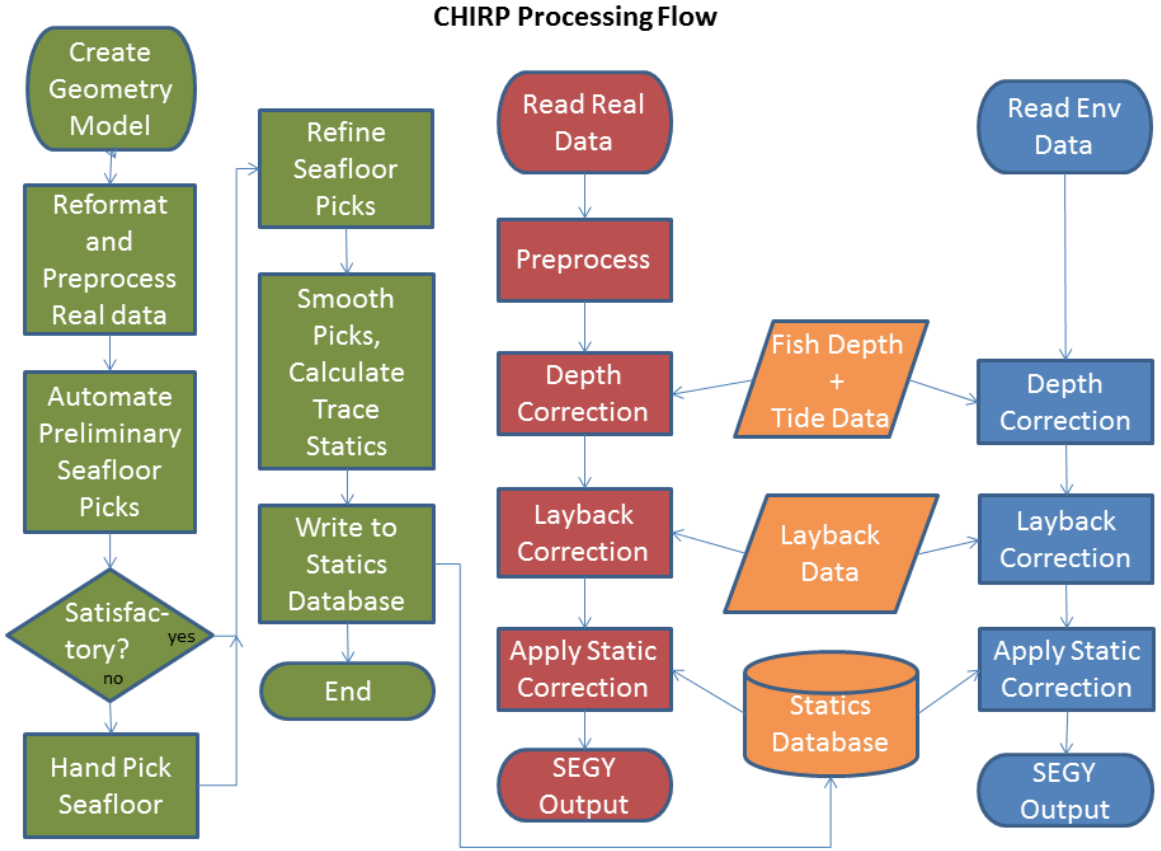
Right data for the job

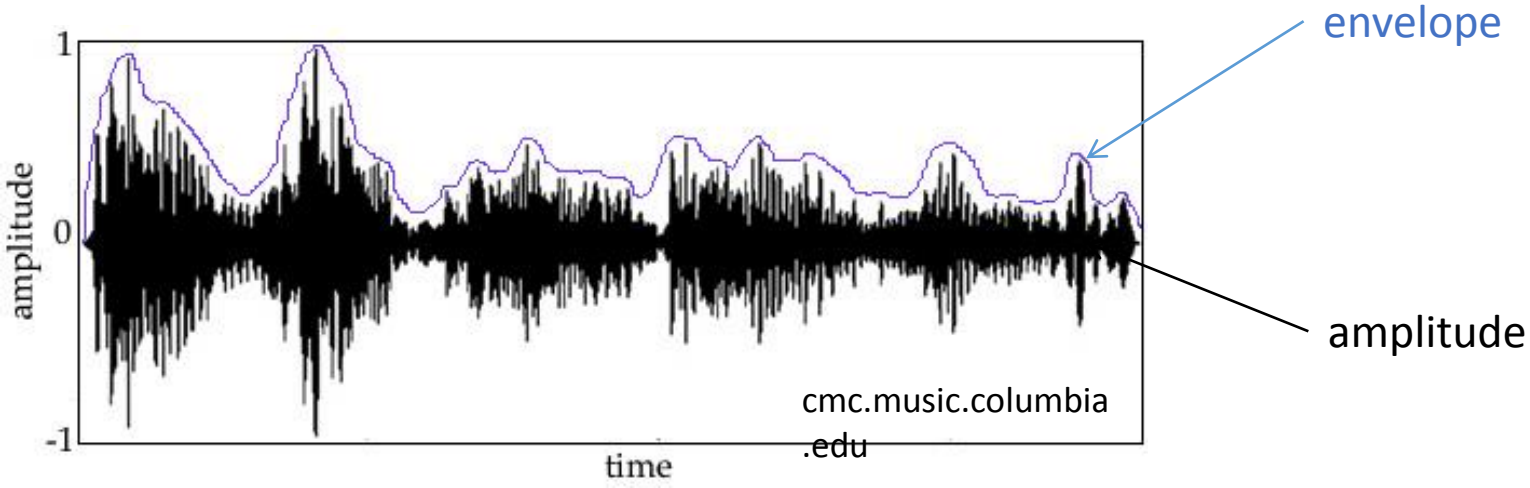






Workflow and Data Examples in Chirp Processing

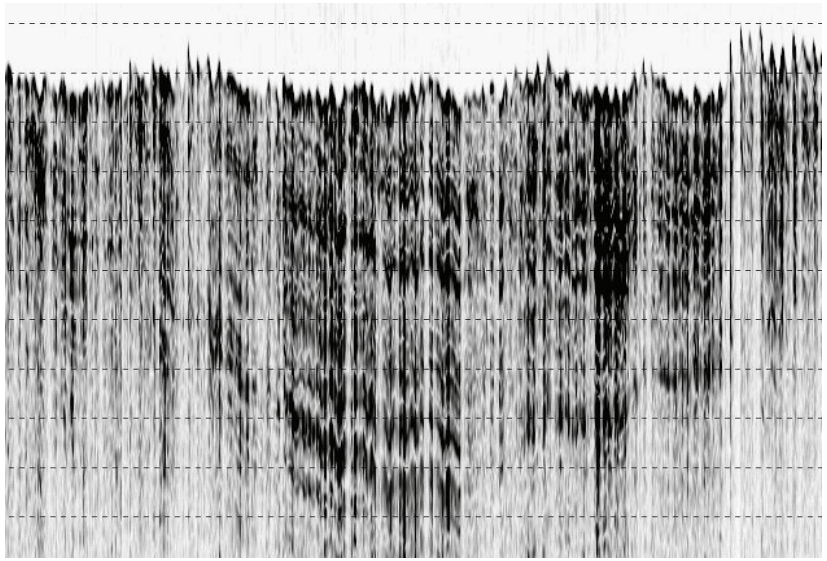


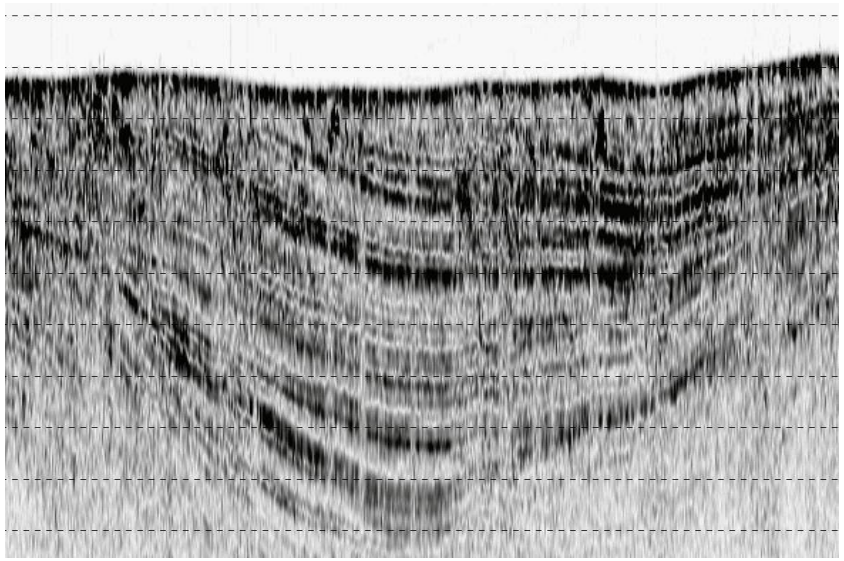


Unprocessed

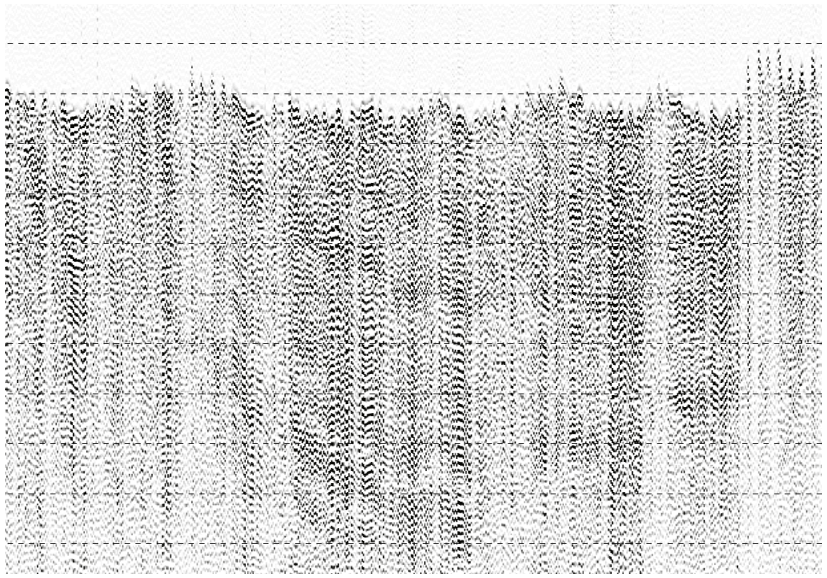
Processed

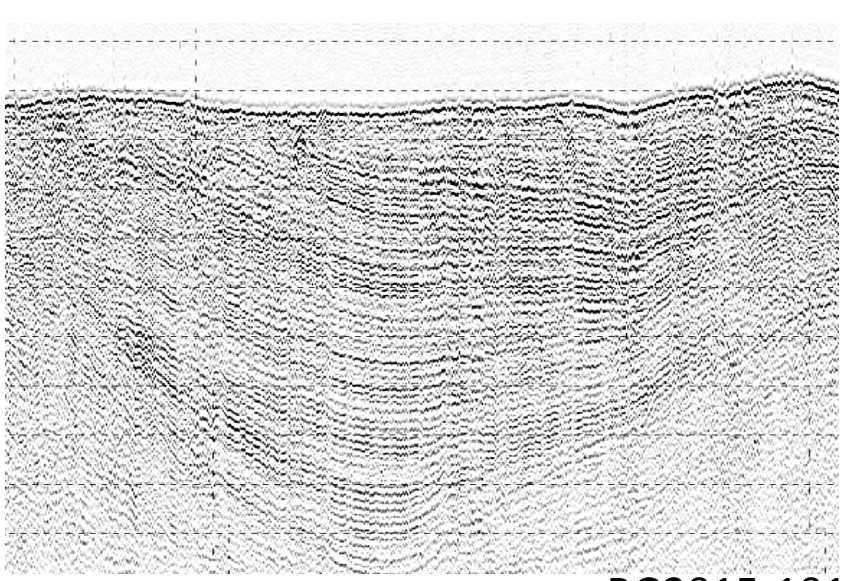
Envelope Data





Full Waveform Data

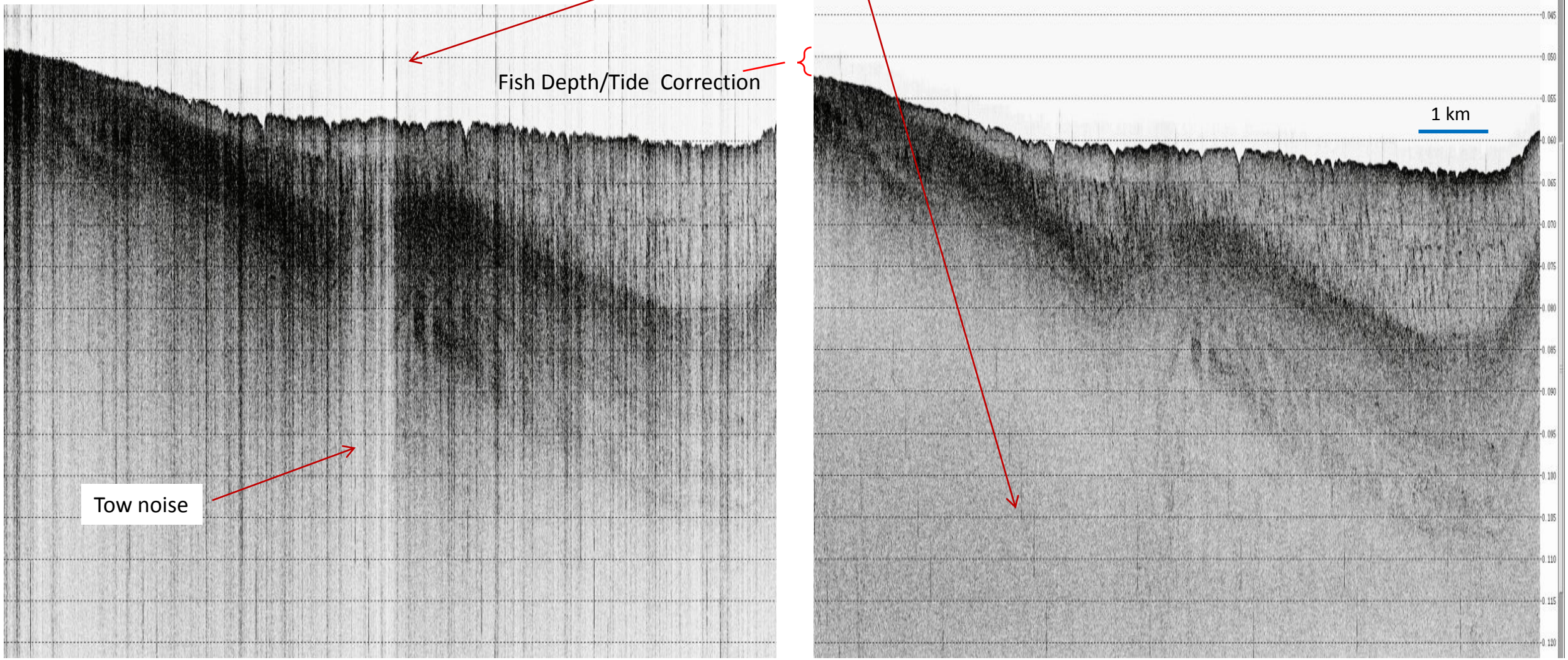




RG2015-101

Raw Envelope

Processed Envelope



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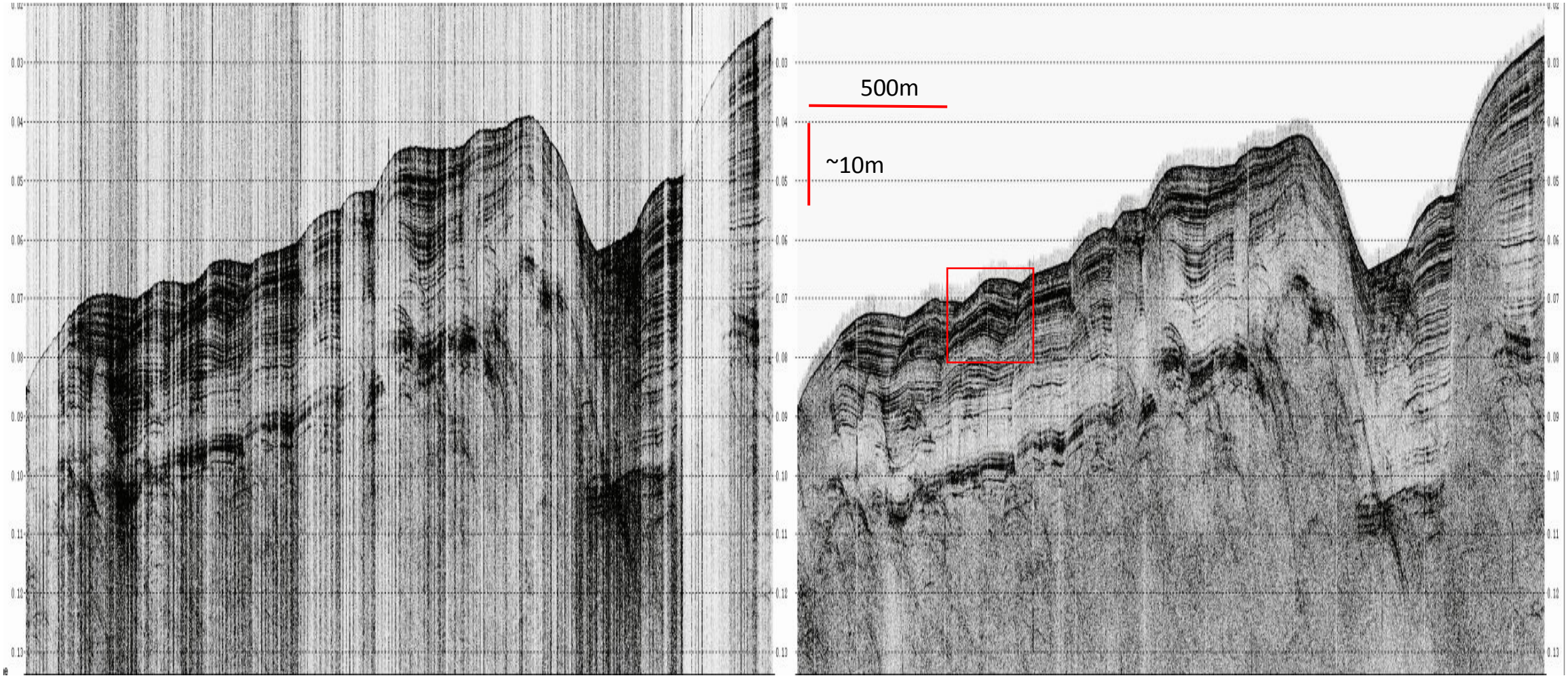
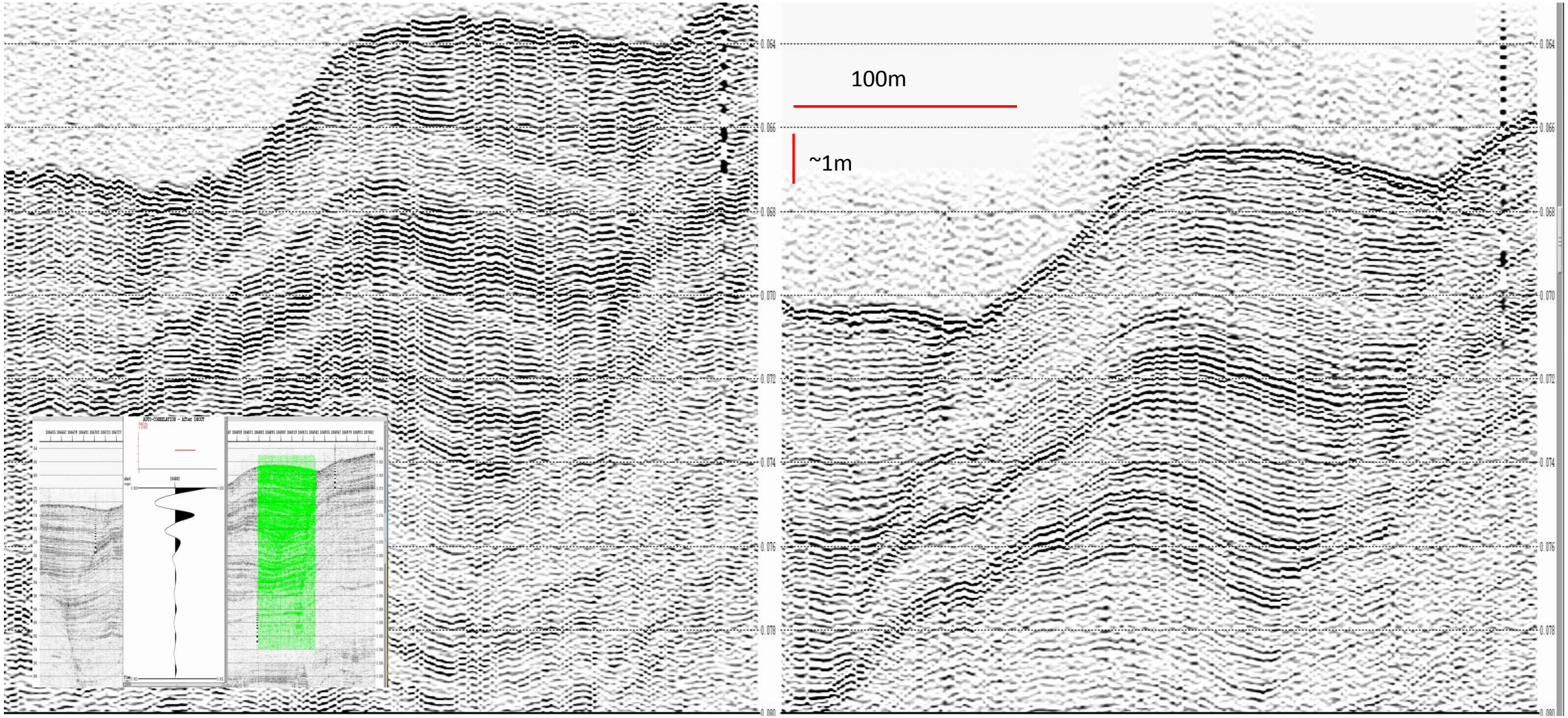
Processed Envelope



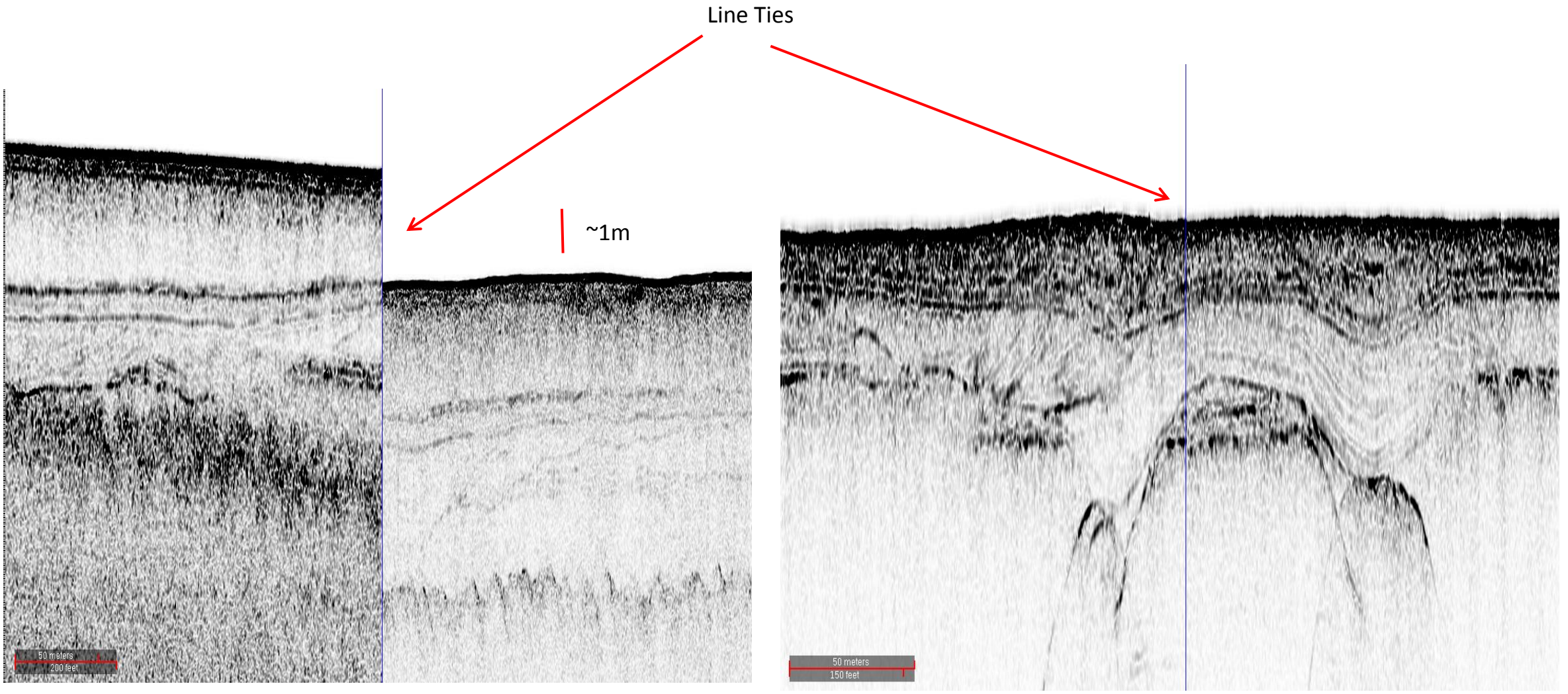
RG2015_103

Deconvolution as a Means to Increase Temporal Resolution



RG2015_103

Fish Depth, Tide, and Layback Corrections to Improve Line Ties



Uncorrected

Corrected

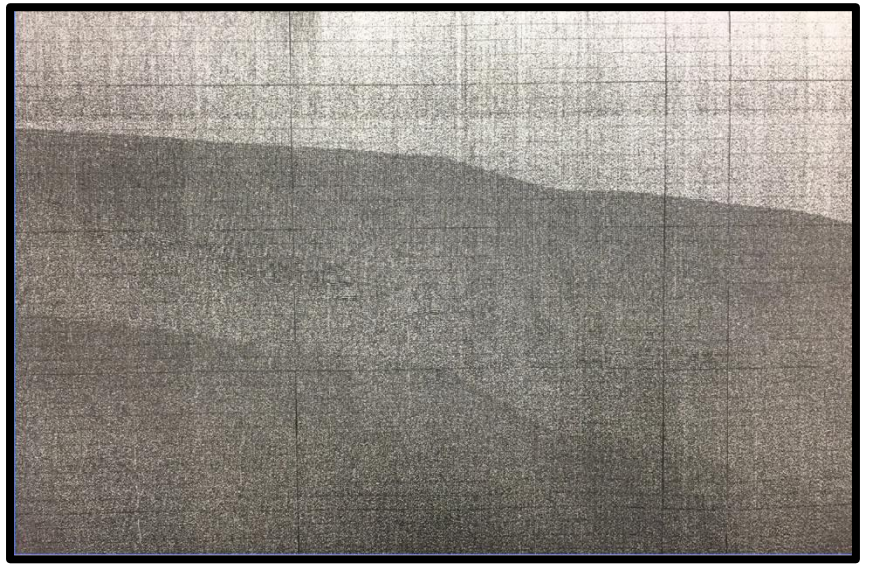
Legacy geophysical data recovery and archiving

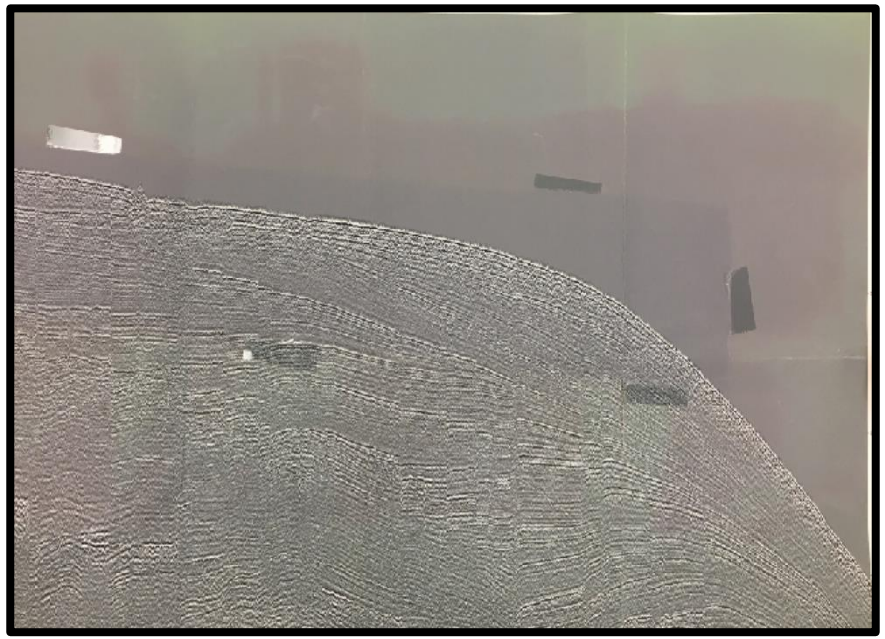
Objective: Locate, obtain, and digitize geophysical data collected by Rice University over the Texas shelf

Ideal

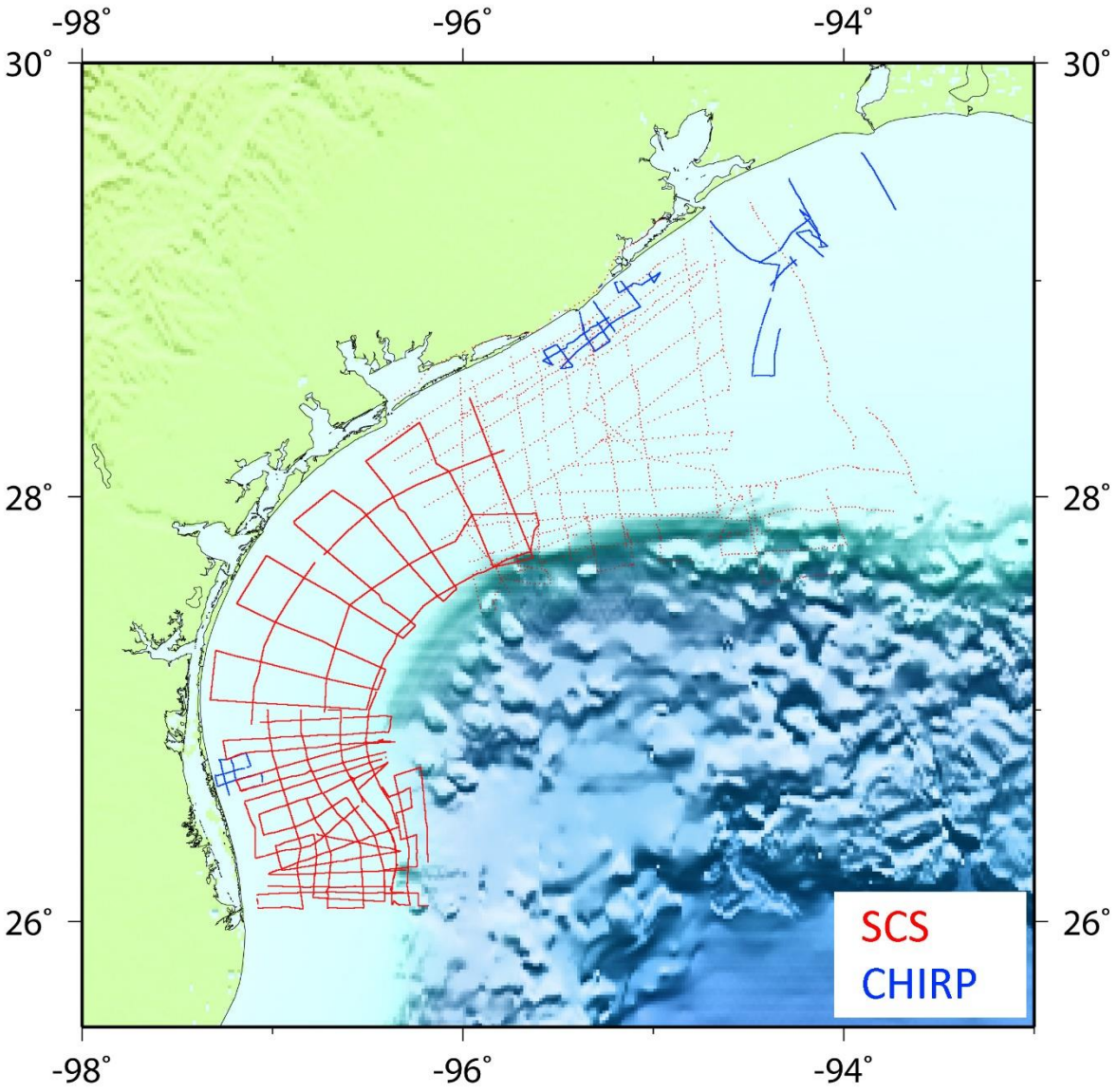
Digital .segy files
Landmark data backups (tapes?)
Landmark flat files
Paper printouts of processed data
Paper traces

Recovery possible





Seismic Data Recovered as of 2017-12-04

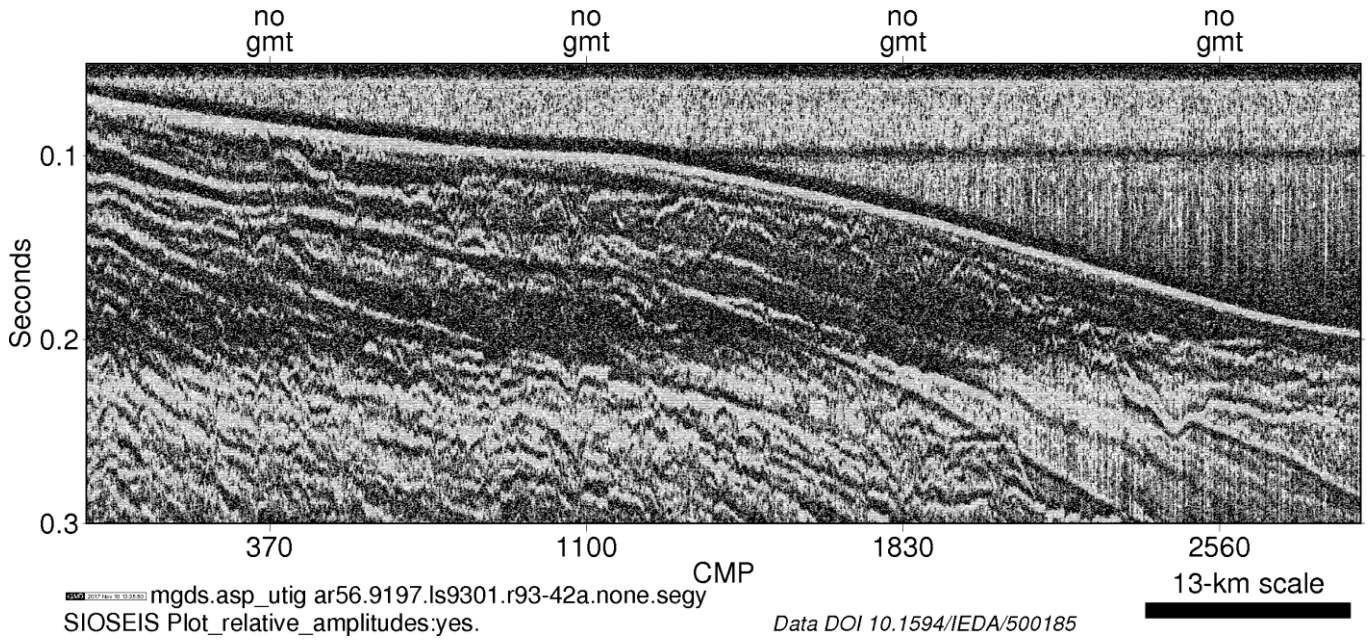


242 Single-channel SEG-Y files

128 CHIRP SEG-Y files

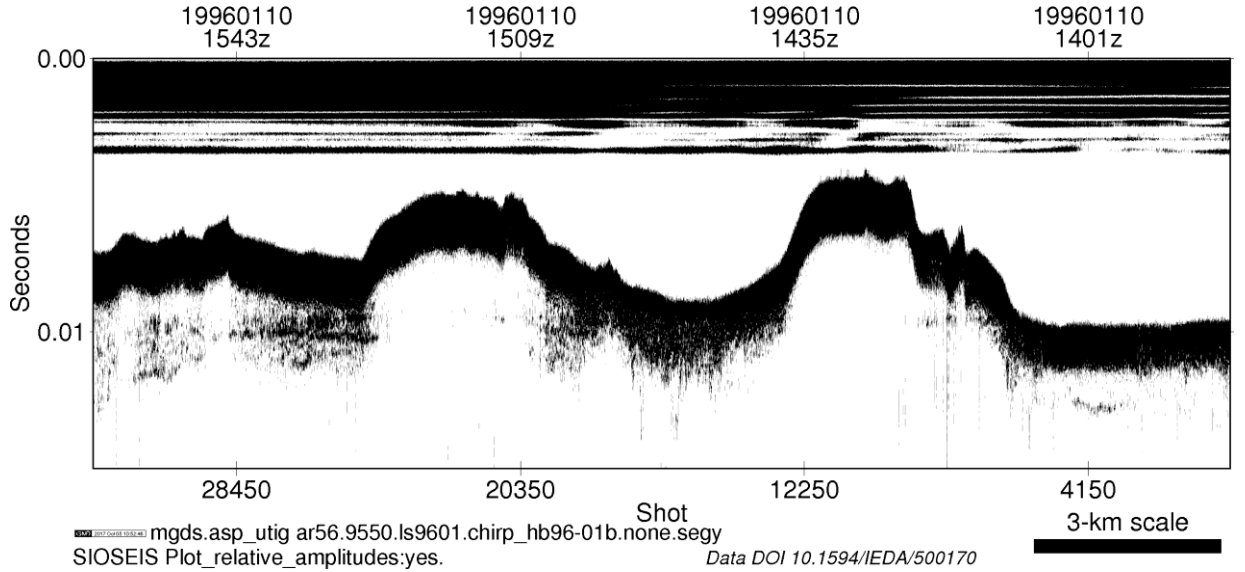
UTIG Academic Seismic Portal

http://www-udc.ig.utexas.edu/sdc/

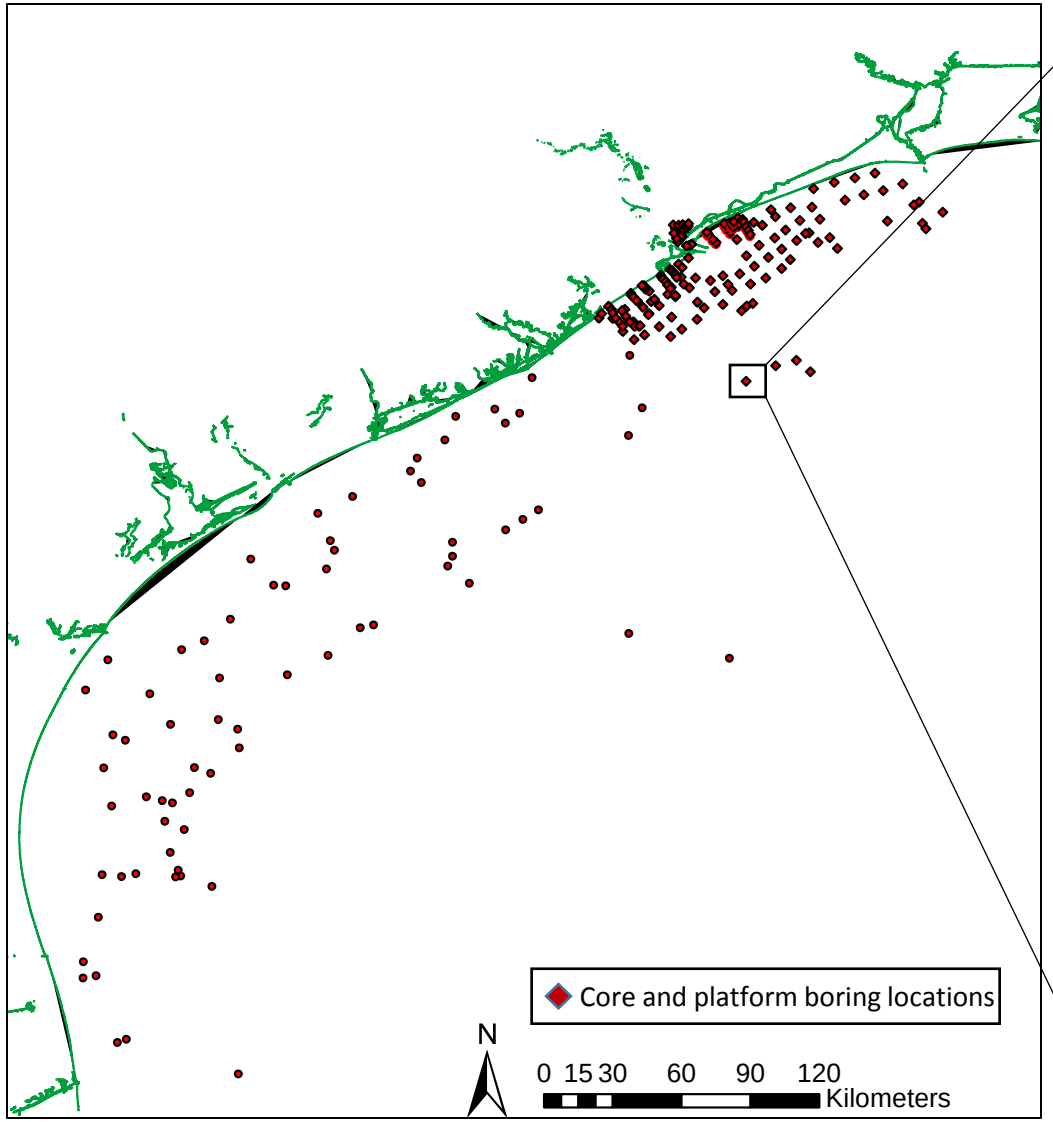


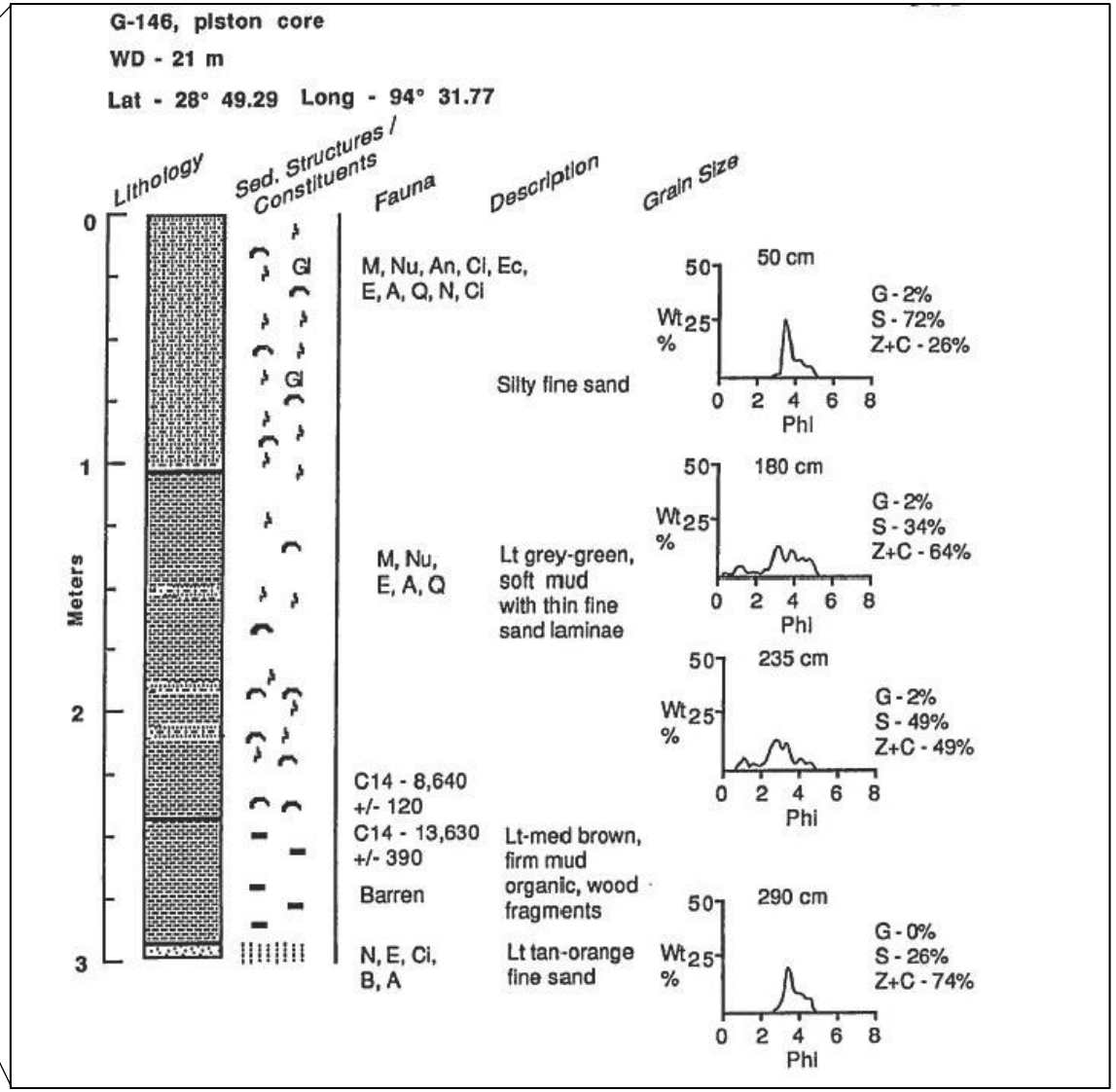
Single channel seismic data

CHIRP seismic data



Cores and Platform Borings





- Locations and data from ~230 core and platform borings across the Gulf of Mexico from published and unpublished data.
- Continuing to add new cores/borings to database

University of Texas Marine Geology & Geophysical Field Course

Phase 1

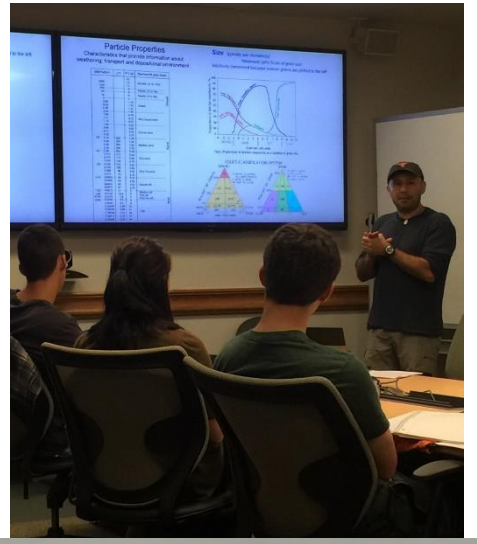
- Classroom lectures on the theoretical basis for research methodologies
- Labs on methods for seismic and geological data collection and seismic software processing packages

Phase 2

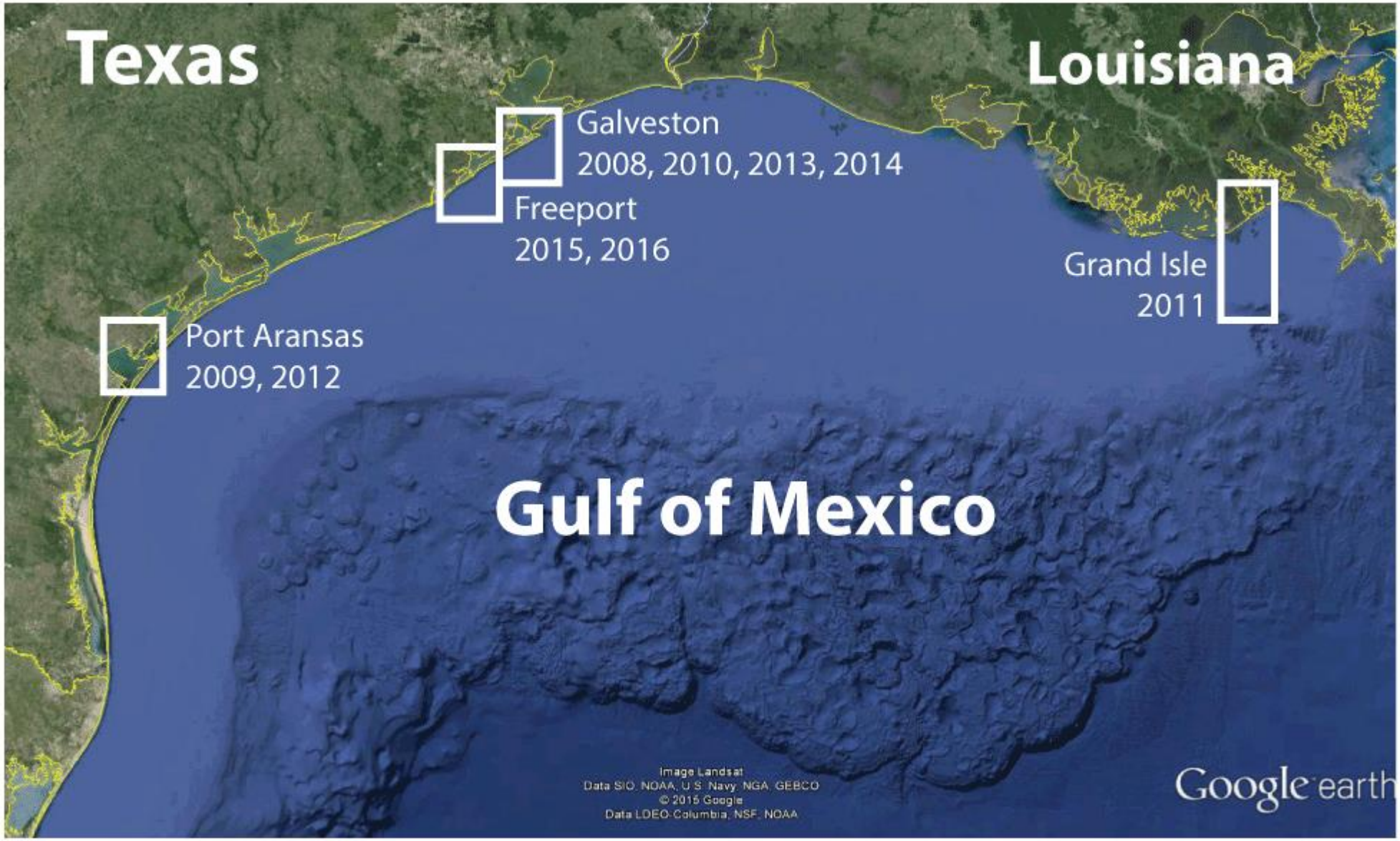
- One full week of field work in the Gulf of Mexico and continental shelf
- Use a large hired research vessel and smaller UT-owned coastal vessel.
- Each day one team remains in the shore lab to process data

Phase 3

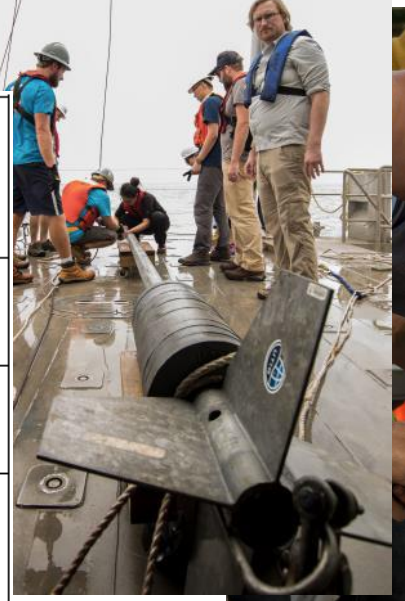
- Team-based data analysis and interpretation
- Additional lectures on data analysis, interpretation, and visualization take place
- Capstone Group Presentations



Yearly opportunity for data collection on western GOM coast



Welcome to the 2017 MG&G Field Class Presentation Day



TEAM 1	Woong Mo Koo, Conrad Suen, Naoma McCall, Emily Peacock, Sima Daneshvar	The influence of barrier islands on tidal deltas and bedforms: A case study on the effect of Galveston Island on the Bolivar Roads
TEAM 2	Will Pinkston, Pauline Tolentino, Dominik Kardell, Kelsey Roll	Valley geometry and facies analysis of the paleo Trinity River valley, offshore Galveston, TX
TEAM 3	Tianyi Sun, Caleb Melancon, Kelly Olsen, Zongpeng Chen	Multiple generations of flood-tidal delta during the formation fo the barrier islands in Galveston Bay
TEAM 4	Allison Lawman, Elizabeth Menezes, Brandon Shuck, Cody Meyer	Late Quaternary evolution of the Trinity River incised valley

Trinity River Paleovalley Project (TRiPP)

Objective:

-Find and delineate significant sand bodies located in the East Texas inner continental shelf stratigraphy

How:

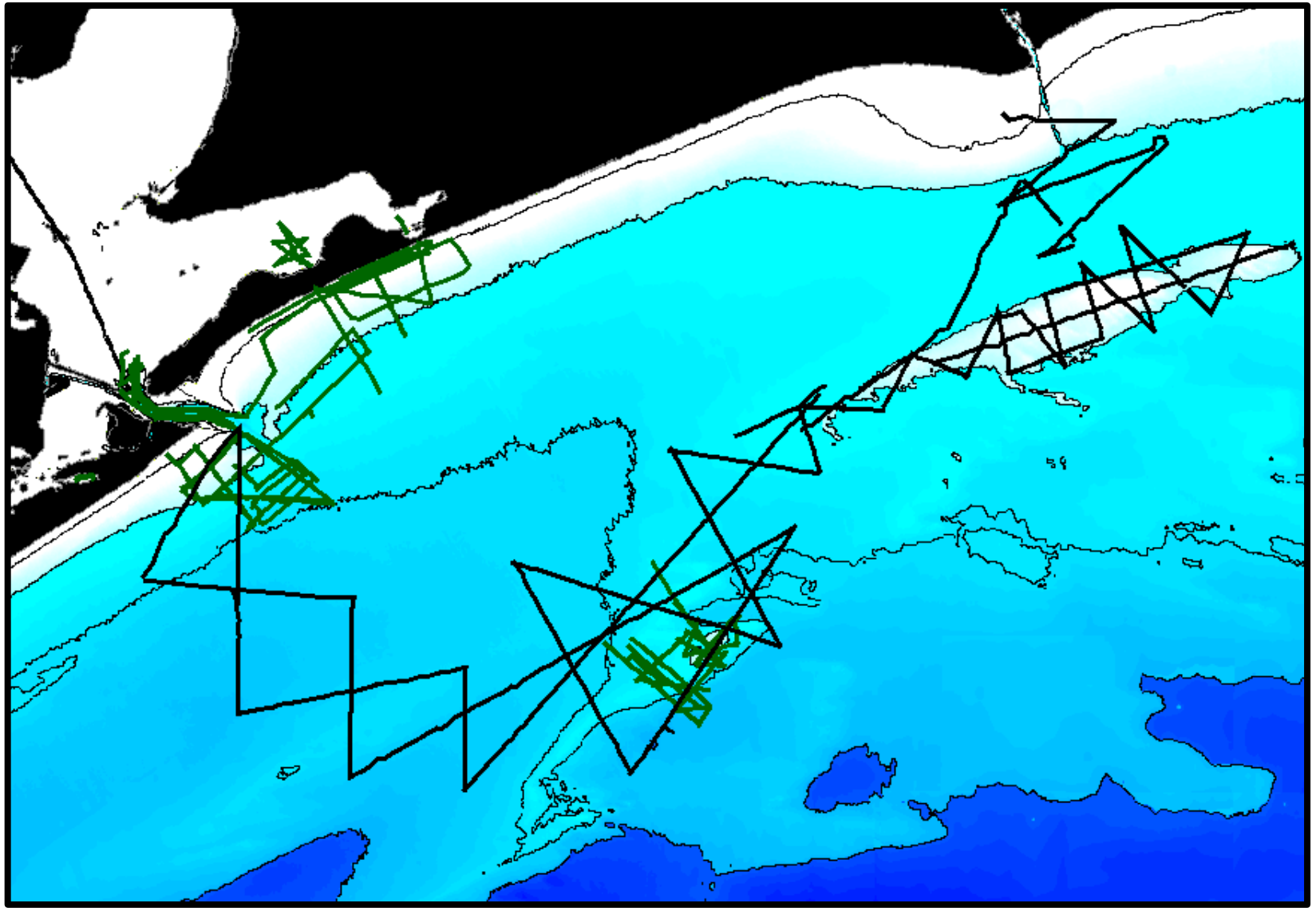
-High-density geophysical surveying and sediment coring

Outcomes:

-Case study of utility of chirp processing tool

-Delineation of sand resources in study area and identification of key data gaps

-Model for recent evolution of the East Texas inner continental shelf and Trinity River paleo-valley system, and creation of standardized best-practices/nomenclature for fluvial shelf stratigraphy

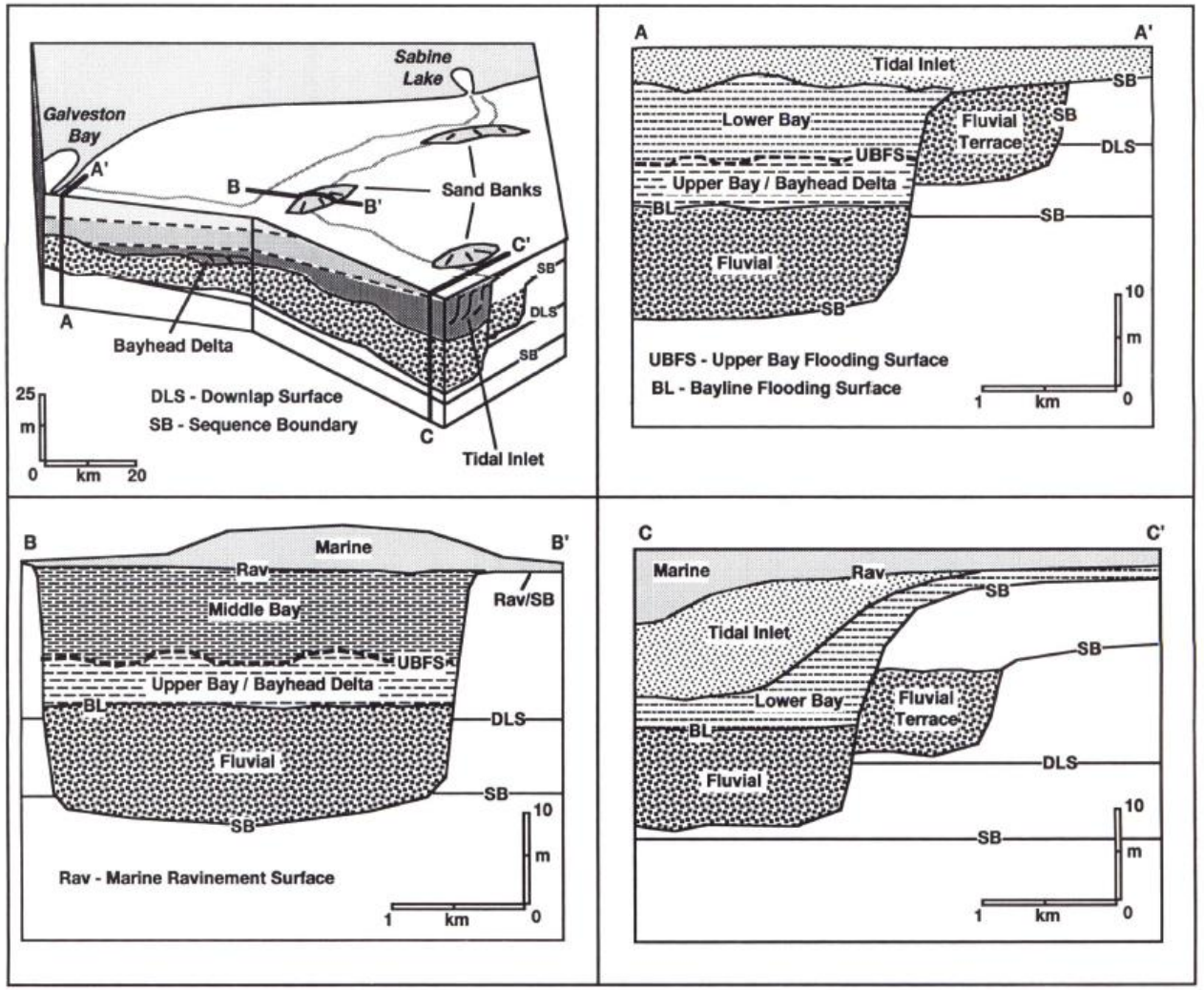


How do incised valley systems evolve?

Necessary to understand distribution of beach compatible sand resources

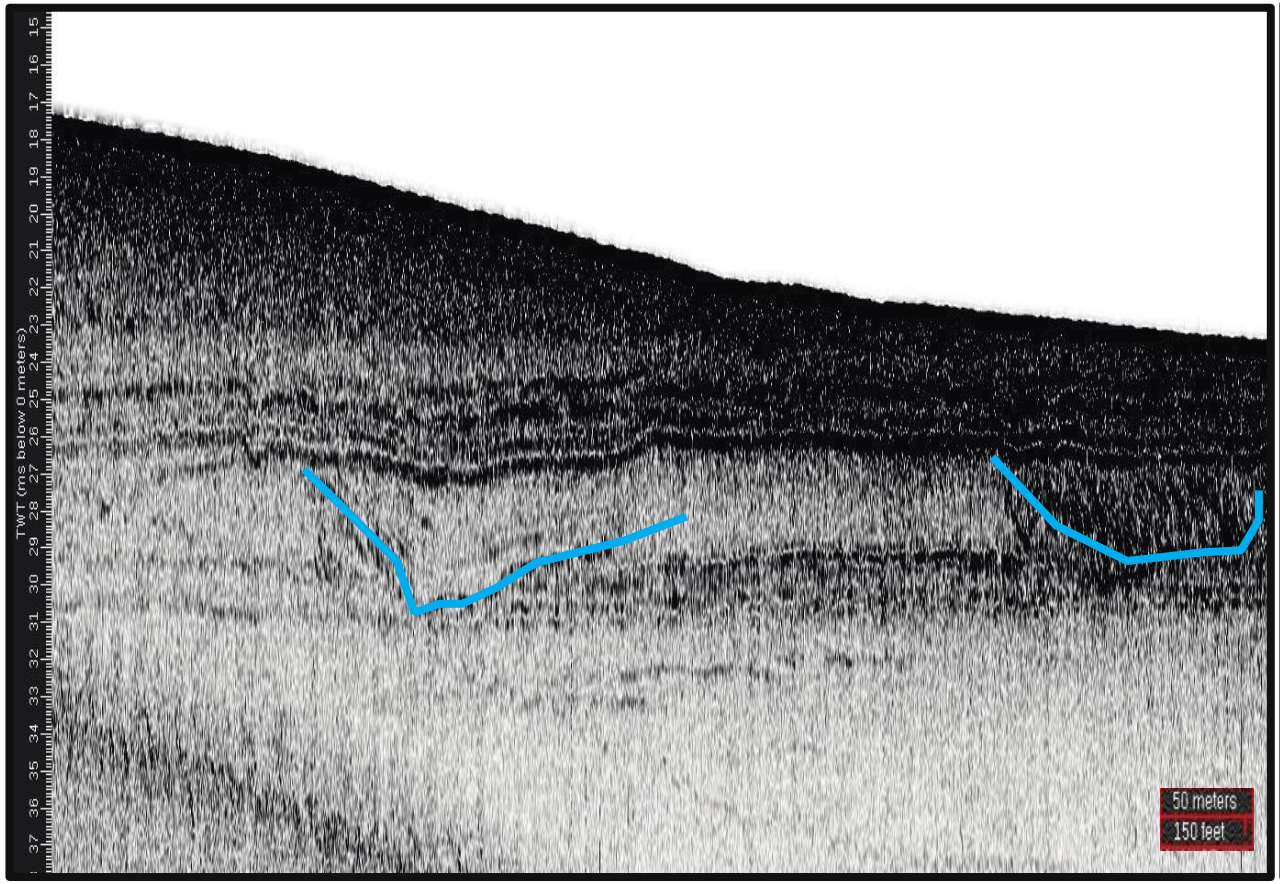
Are previous models of incised valley development not sufficiently detailed to account for observed variability?

What is the necessary survey design needed to capture this complexity and identify significant resource potential

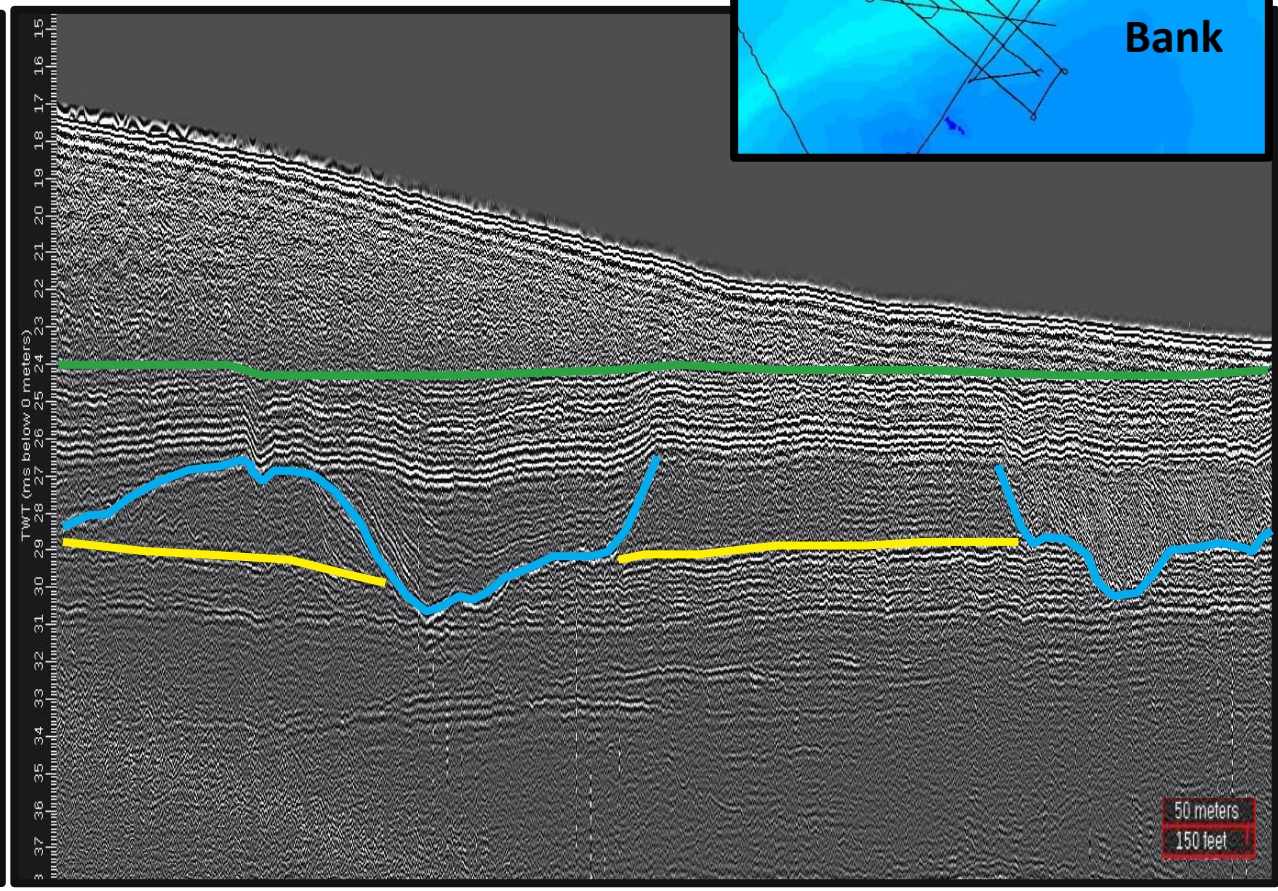


Thomas and Anderson, 1994

Identification of sands requires new approach

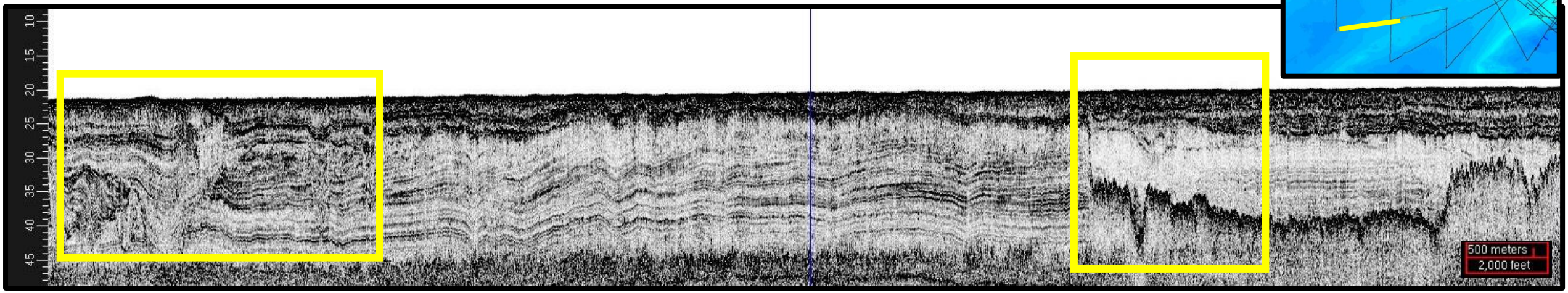


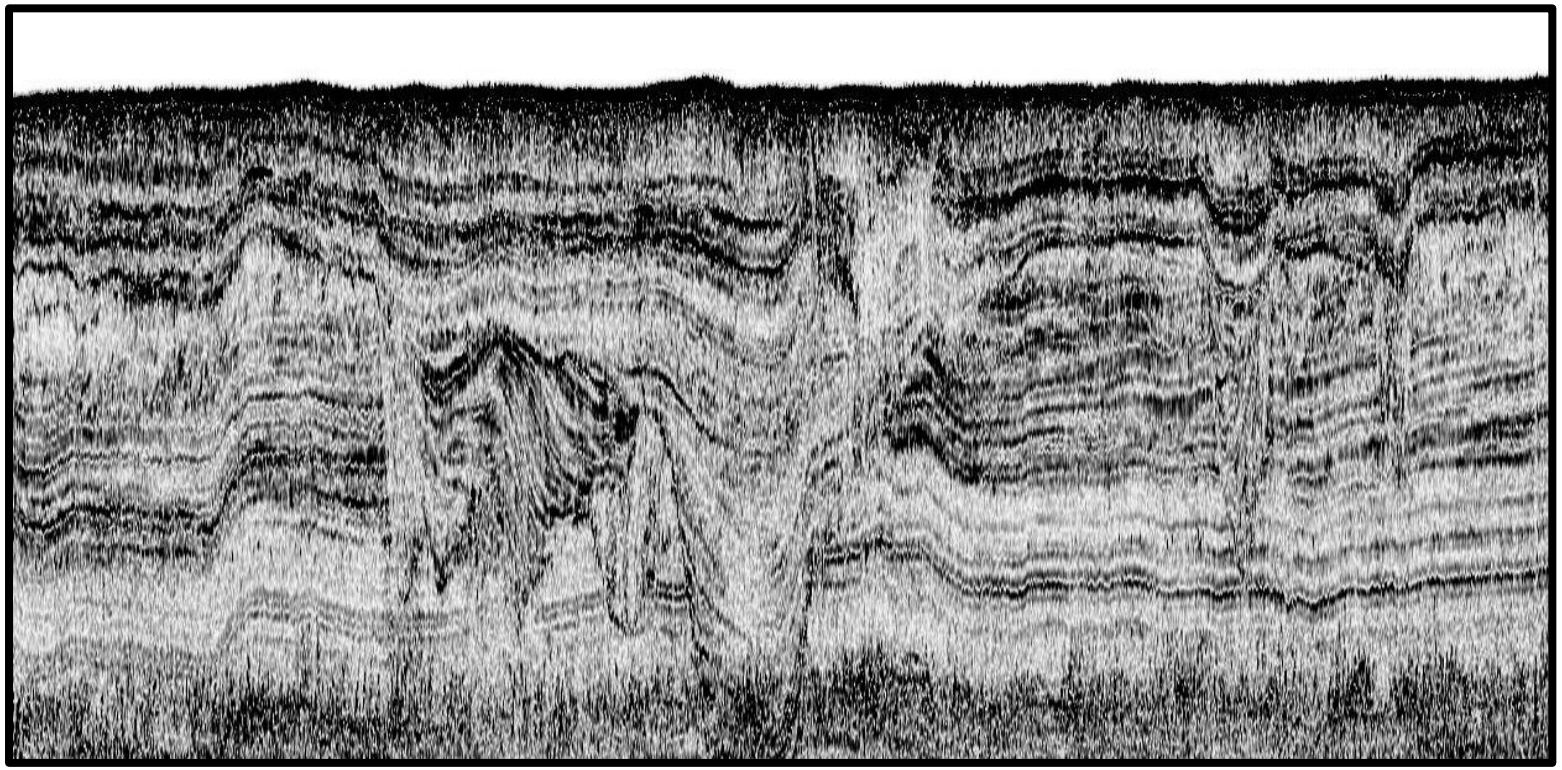
Envelope chirp with heave correction

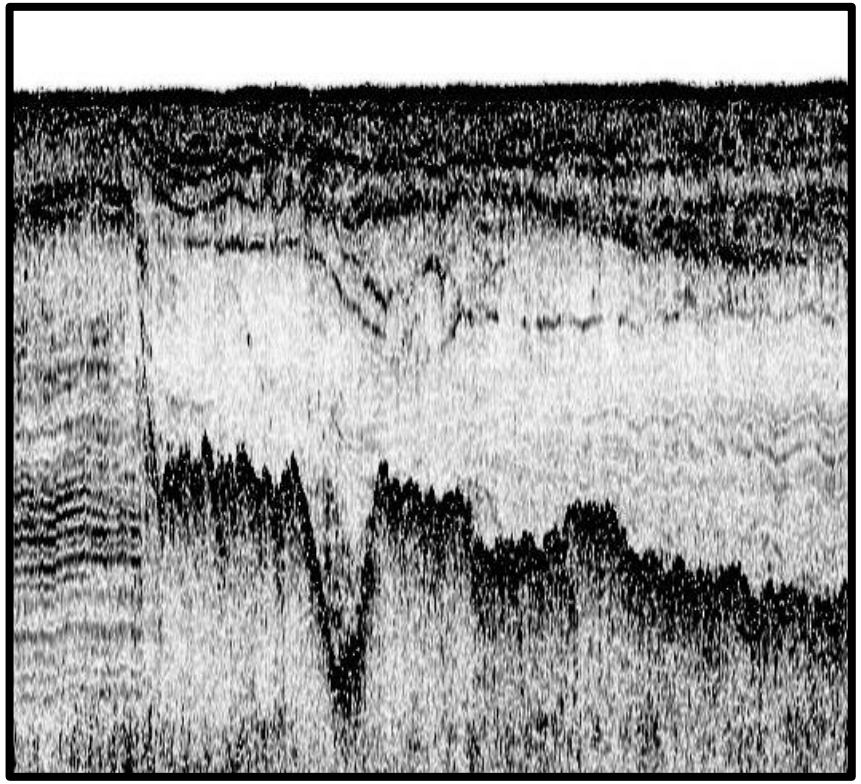


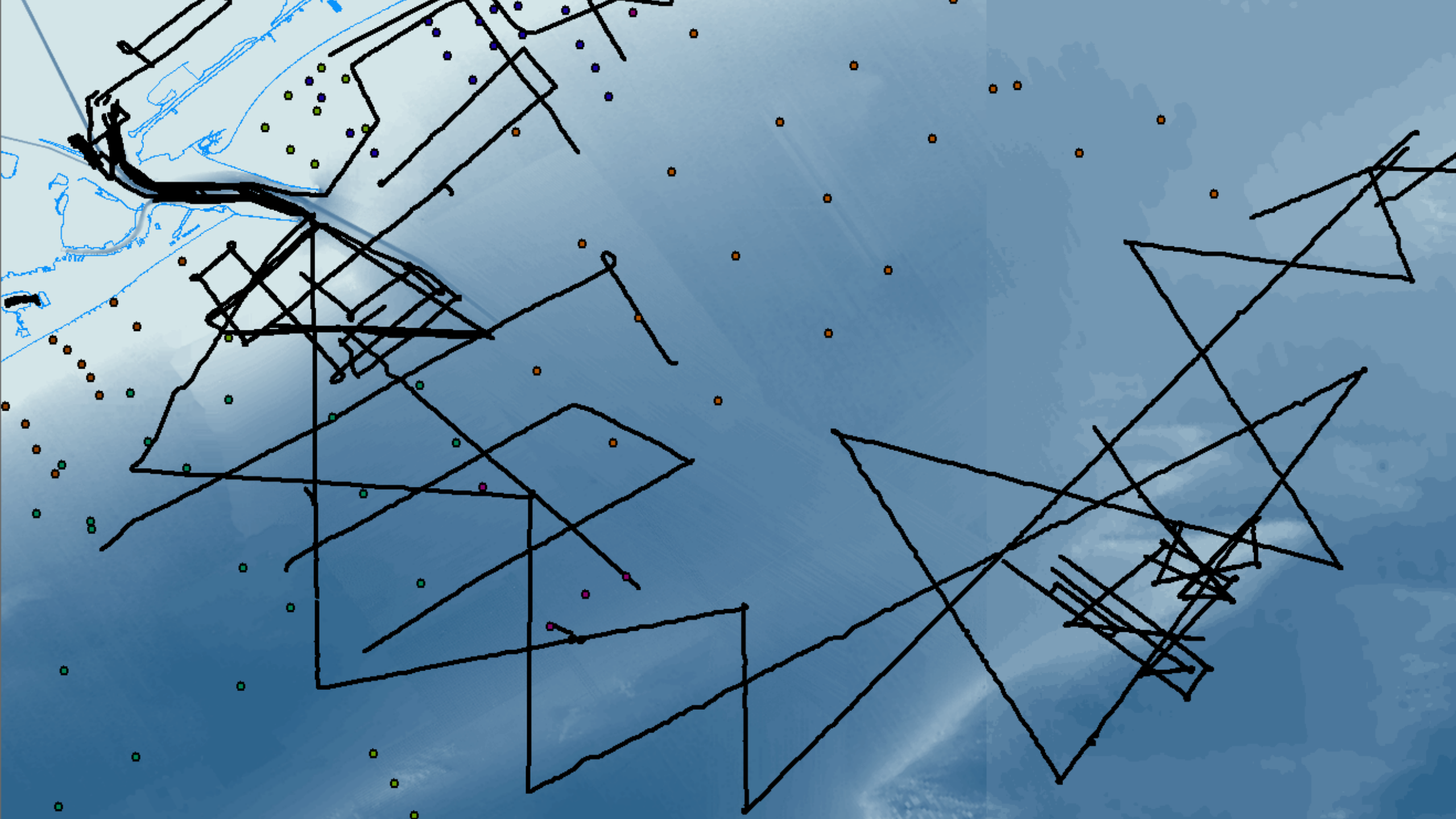
Full-waveform chirp with prototype processing workflow applied

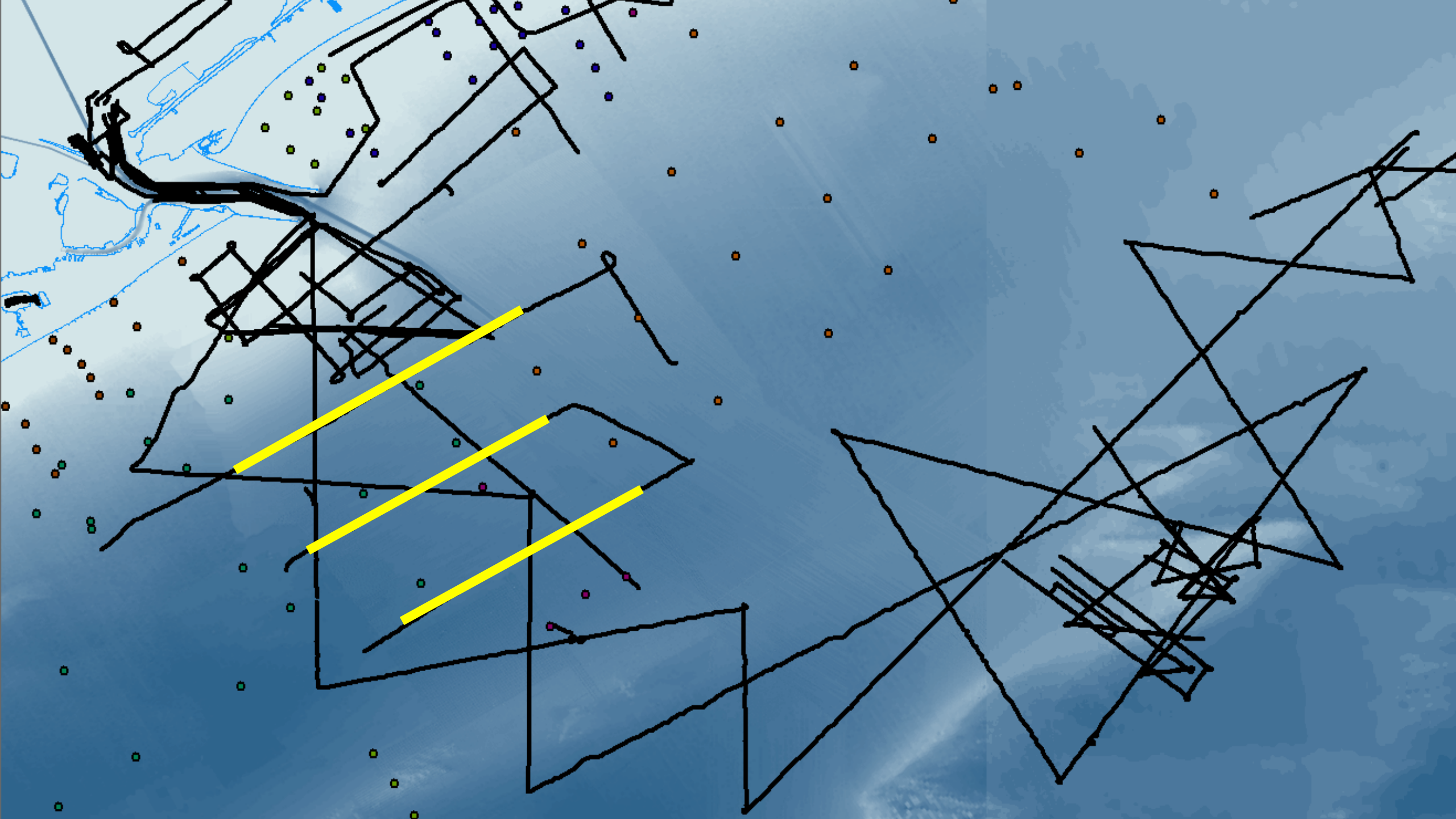
Trinity incised valley system

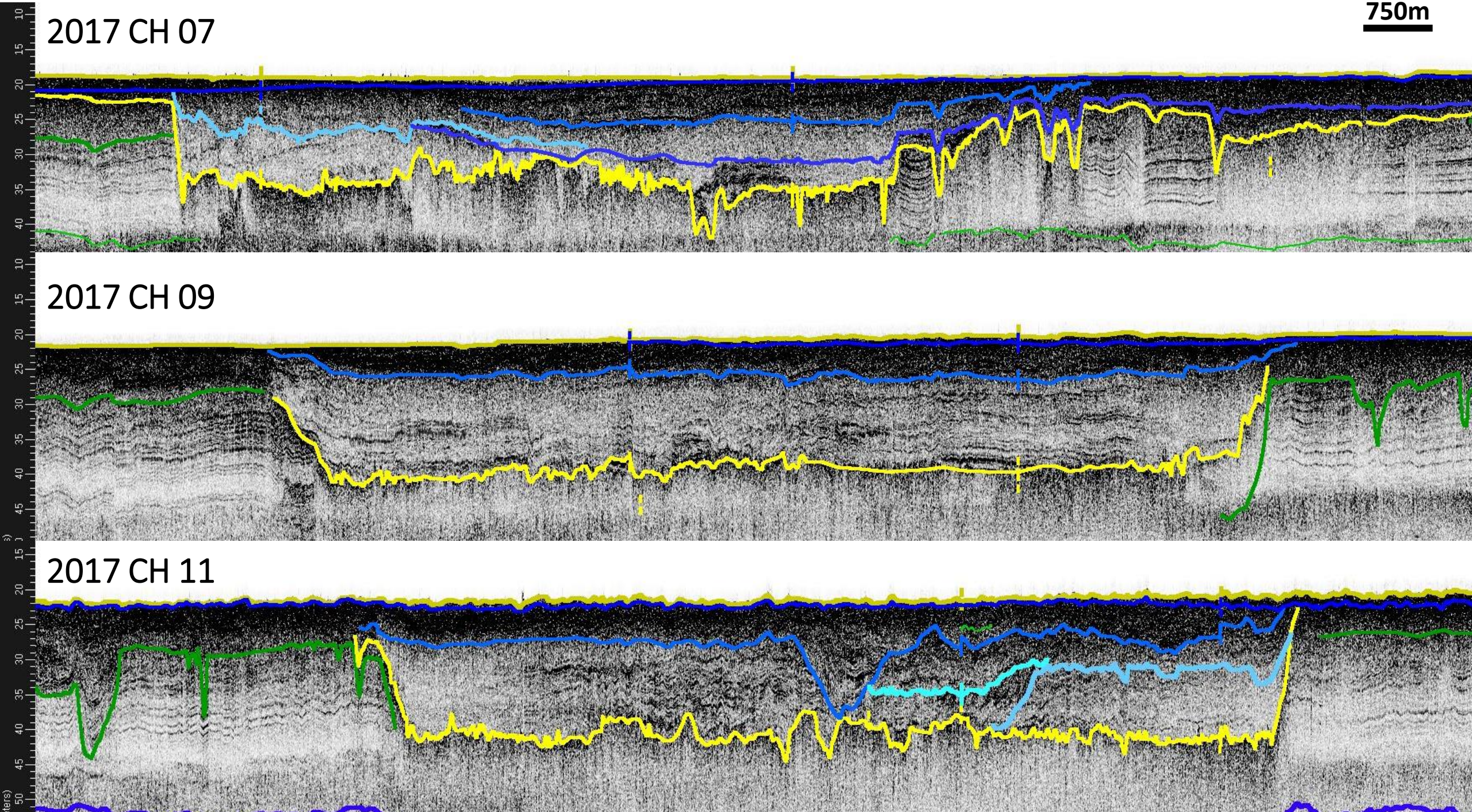


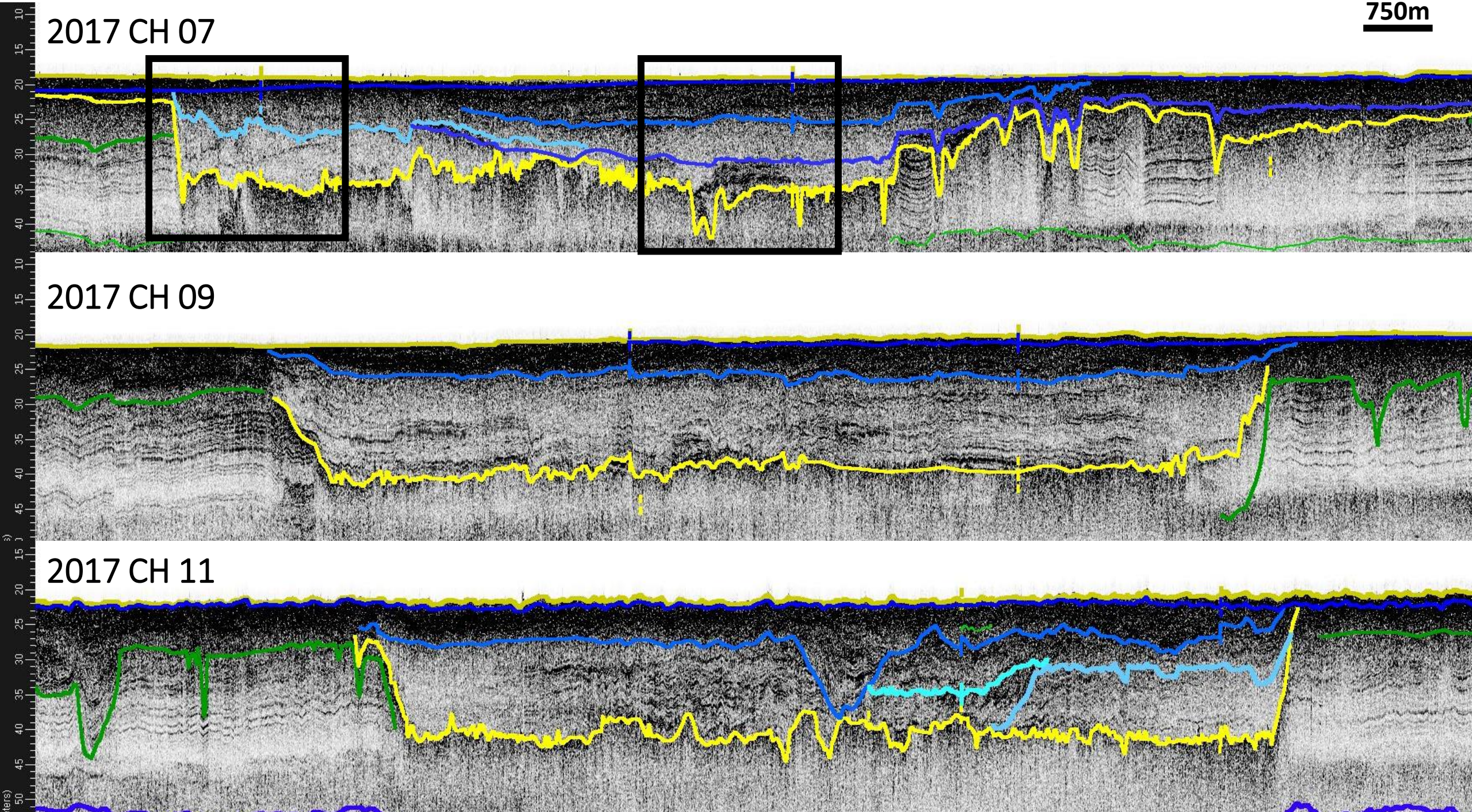


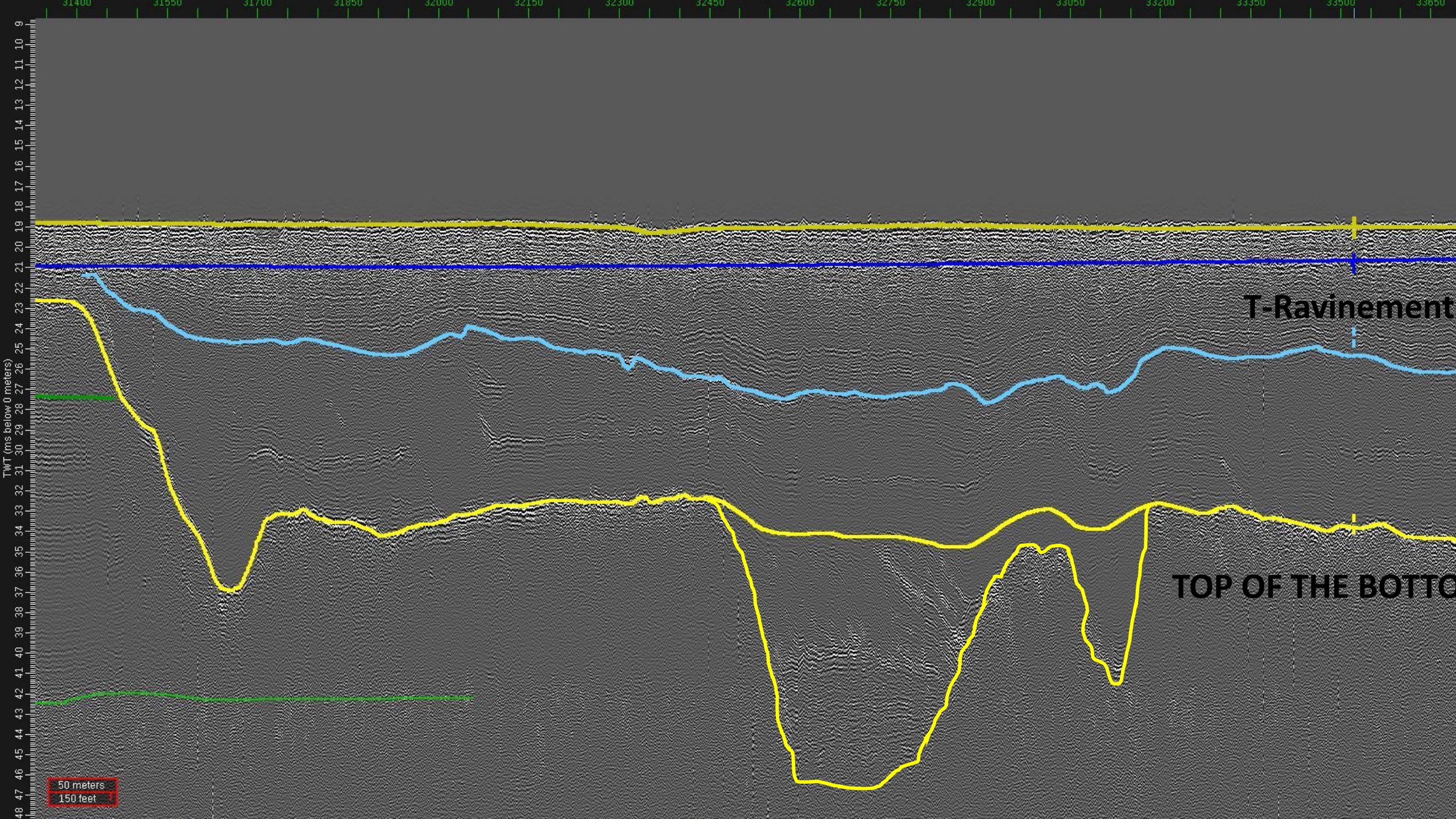


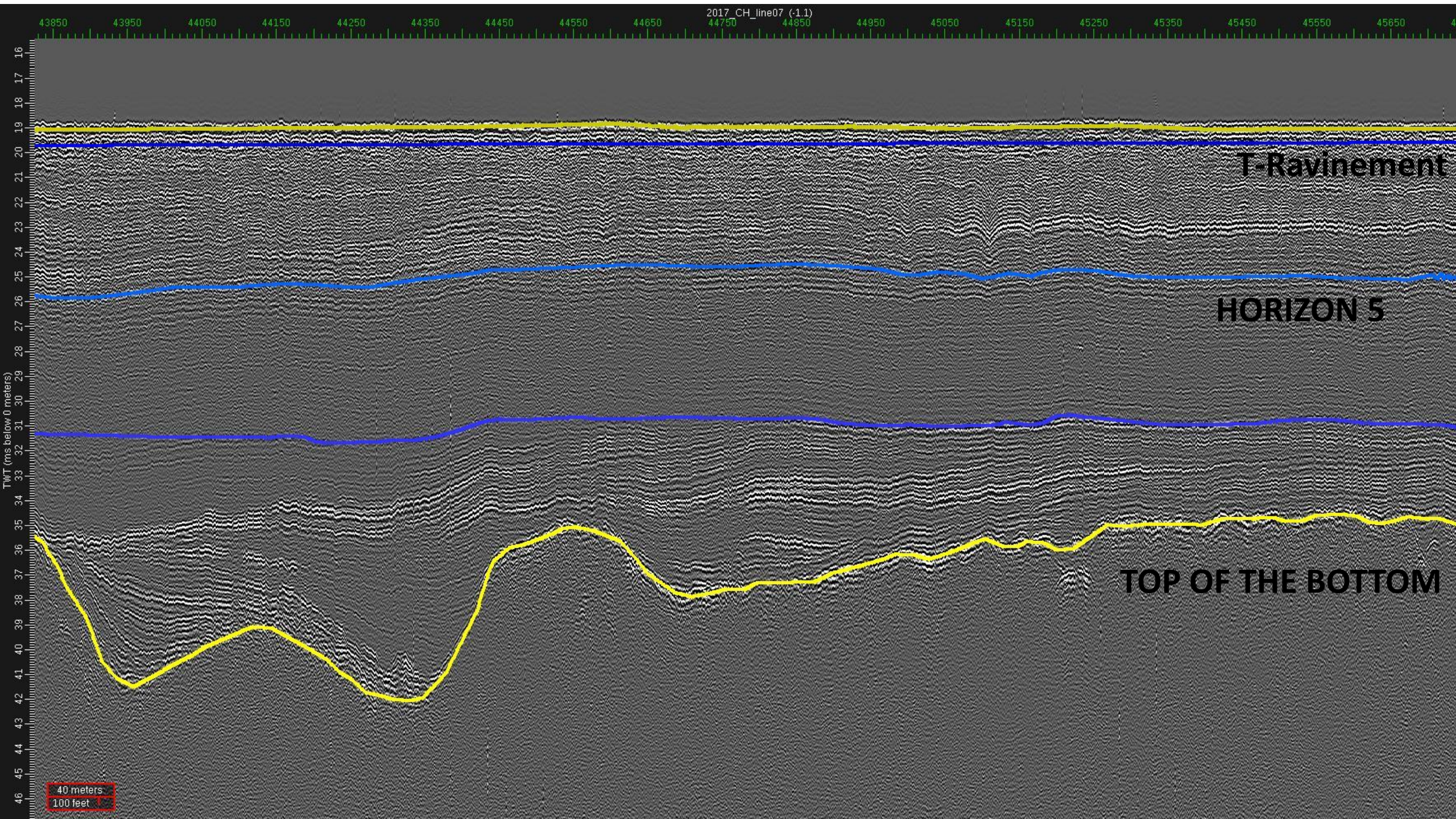


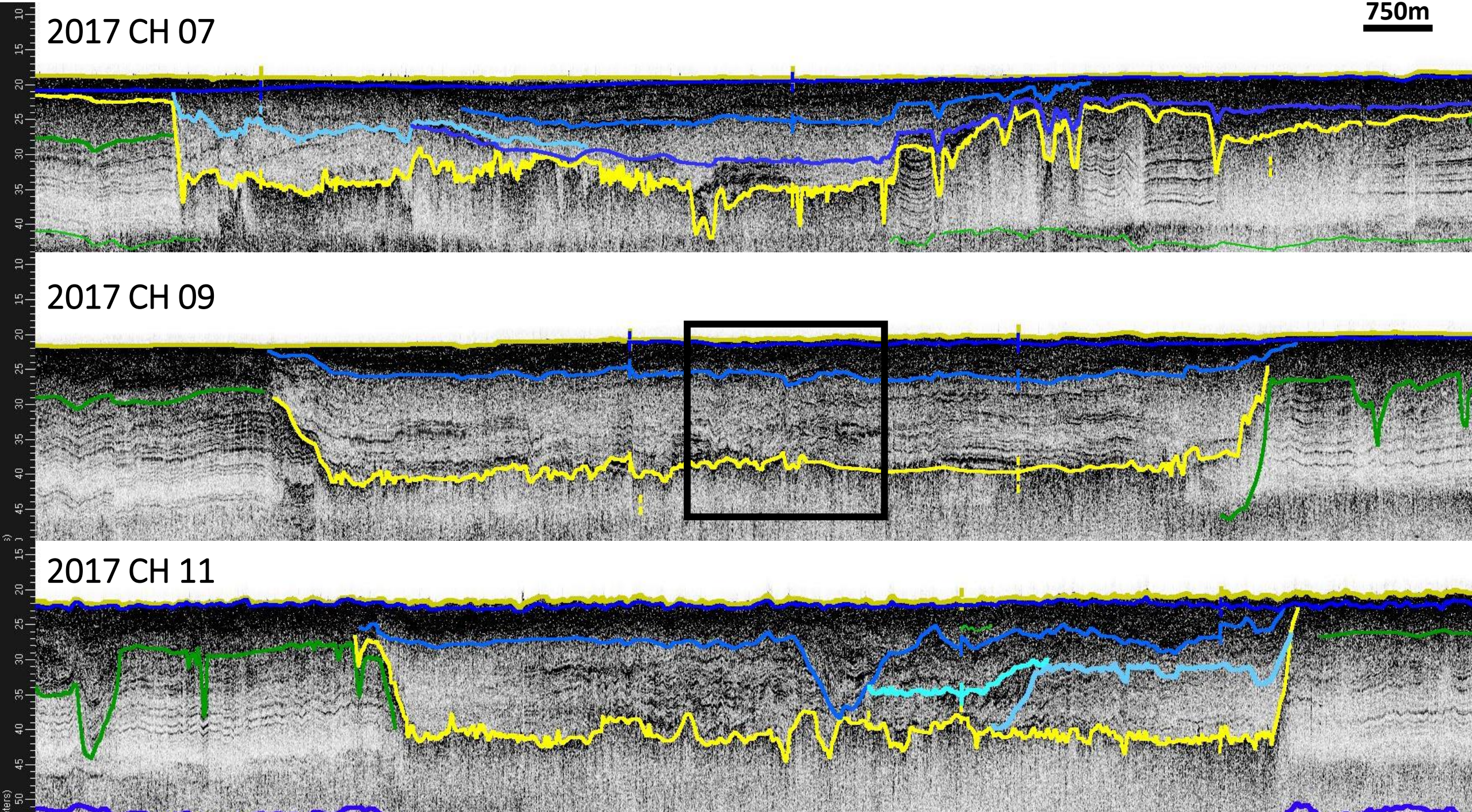


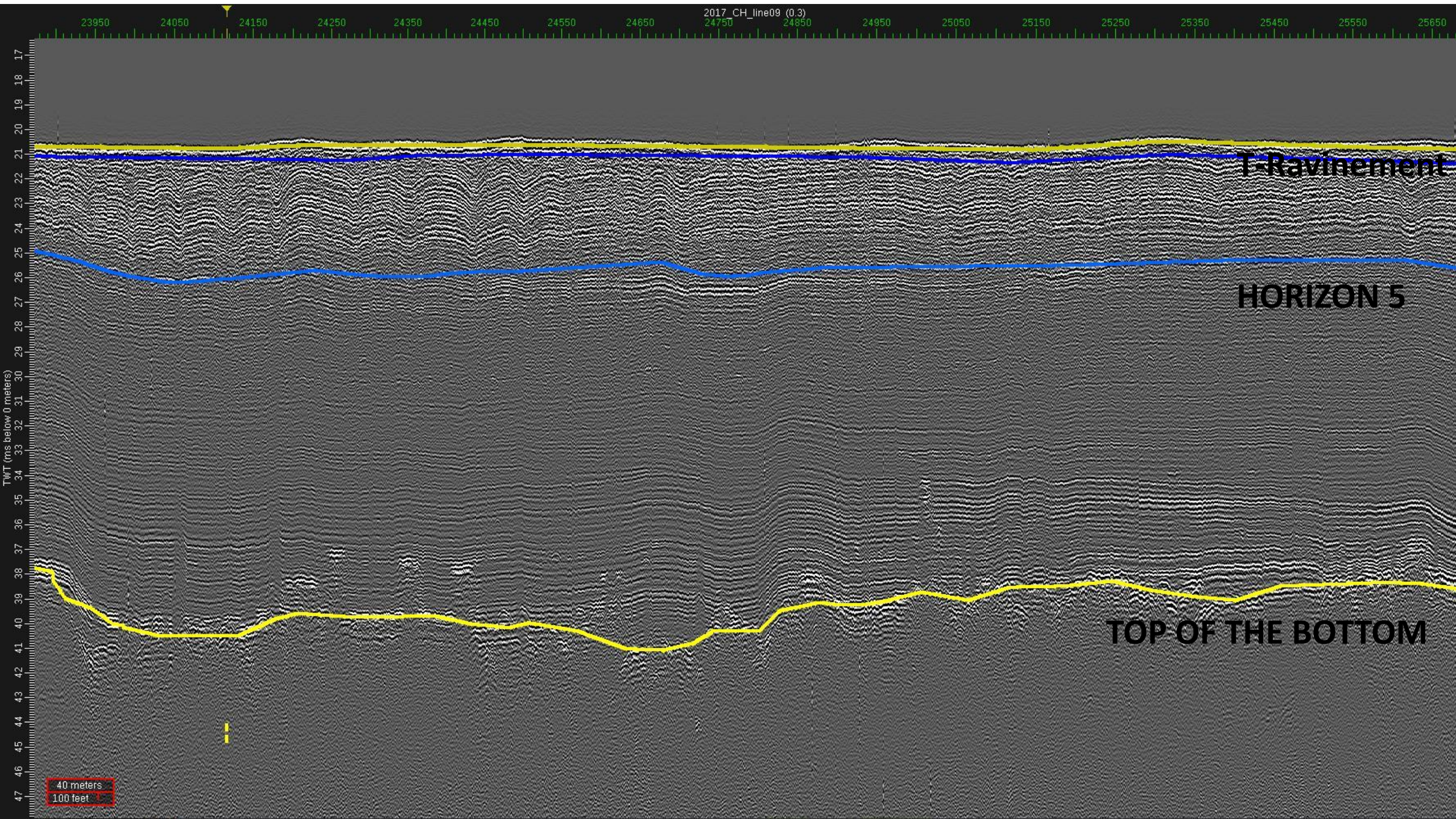

2017 CH 07
750m
2017 CH 09
2017 CH 11

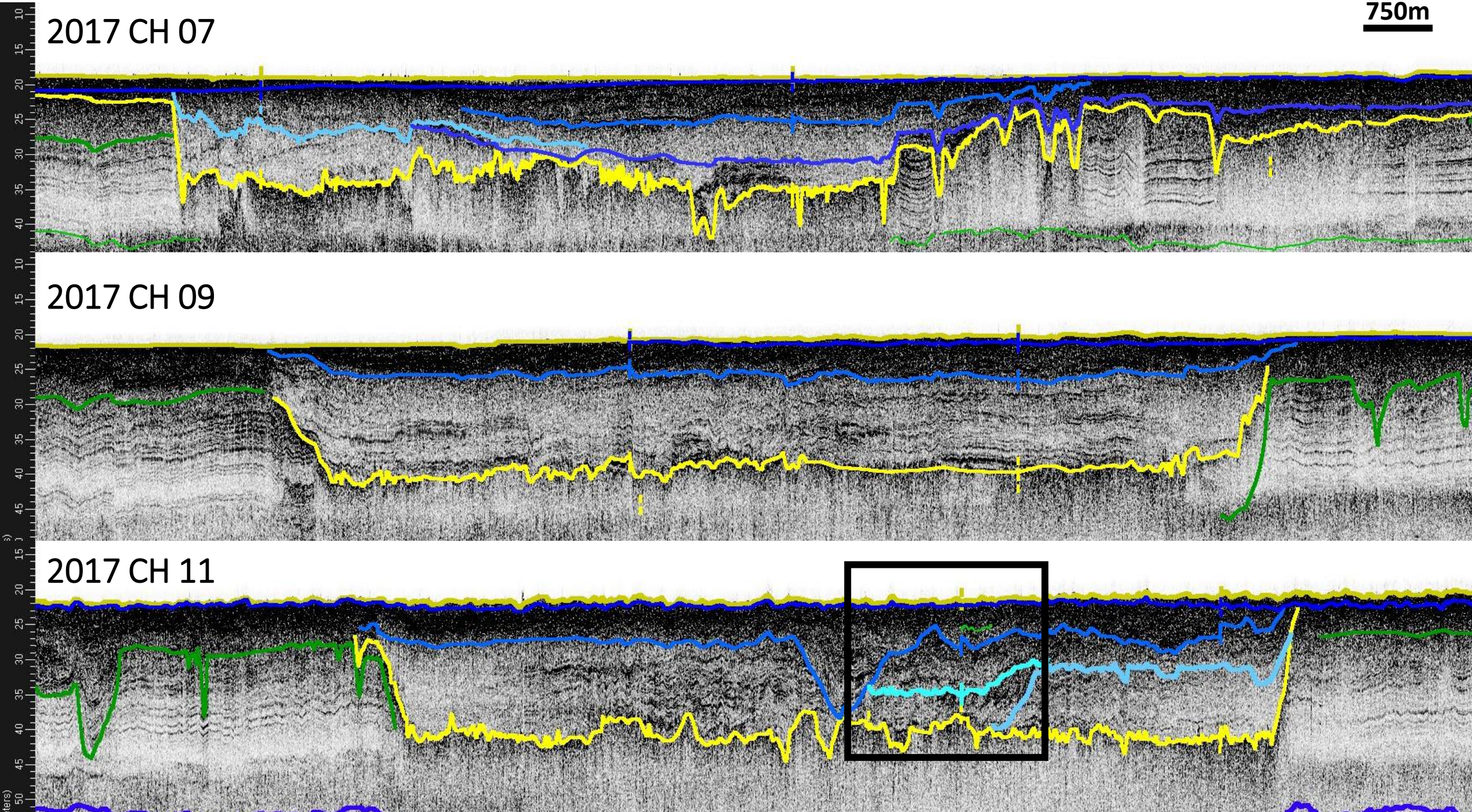

2017 CH 07
750m
2017 CH 09
2017 CH 11

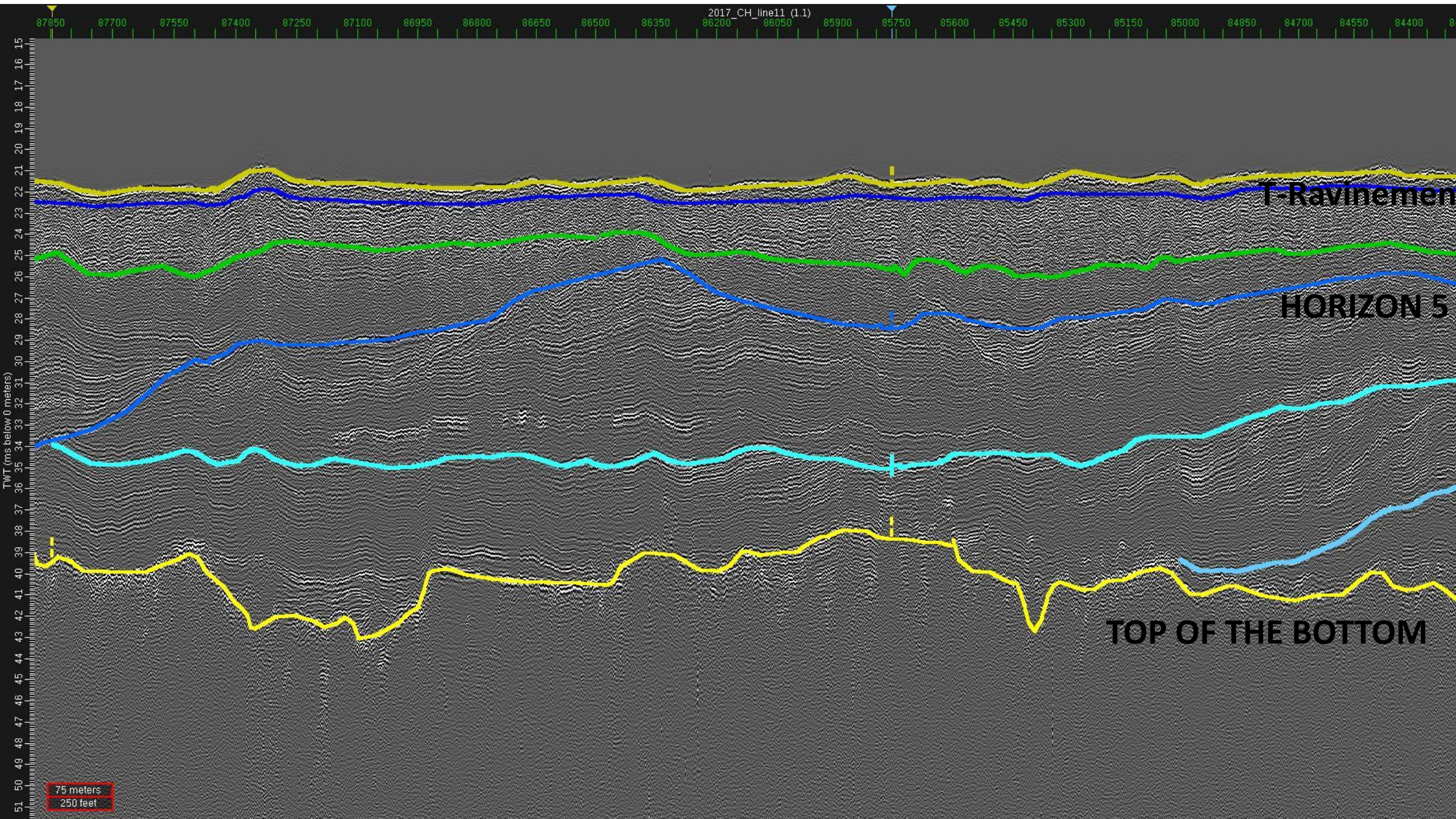

T-Ravinement
TOP OF THE BOTTO
TWT (ms below 0 meters)
50 meters
150 feet


2017_CH_line07 (-1.1)
43850
43950
44050
44150
44250
44350
44450
44550
44650
44750
44850
44950
45050
45150
45250
45350
45450
45550
45650
TWT (ms below 0 meters)
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
T-Ravinement
HORIZON 5
TOP OF THE BOTTOM
40 meters
100 feet

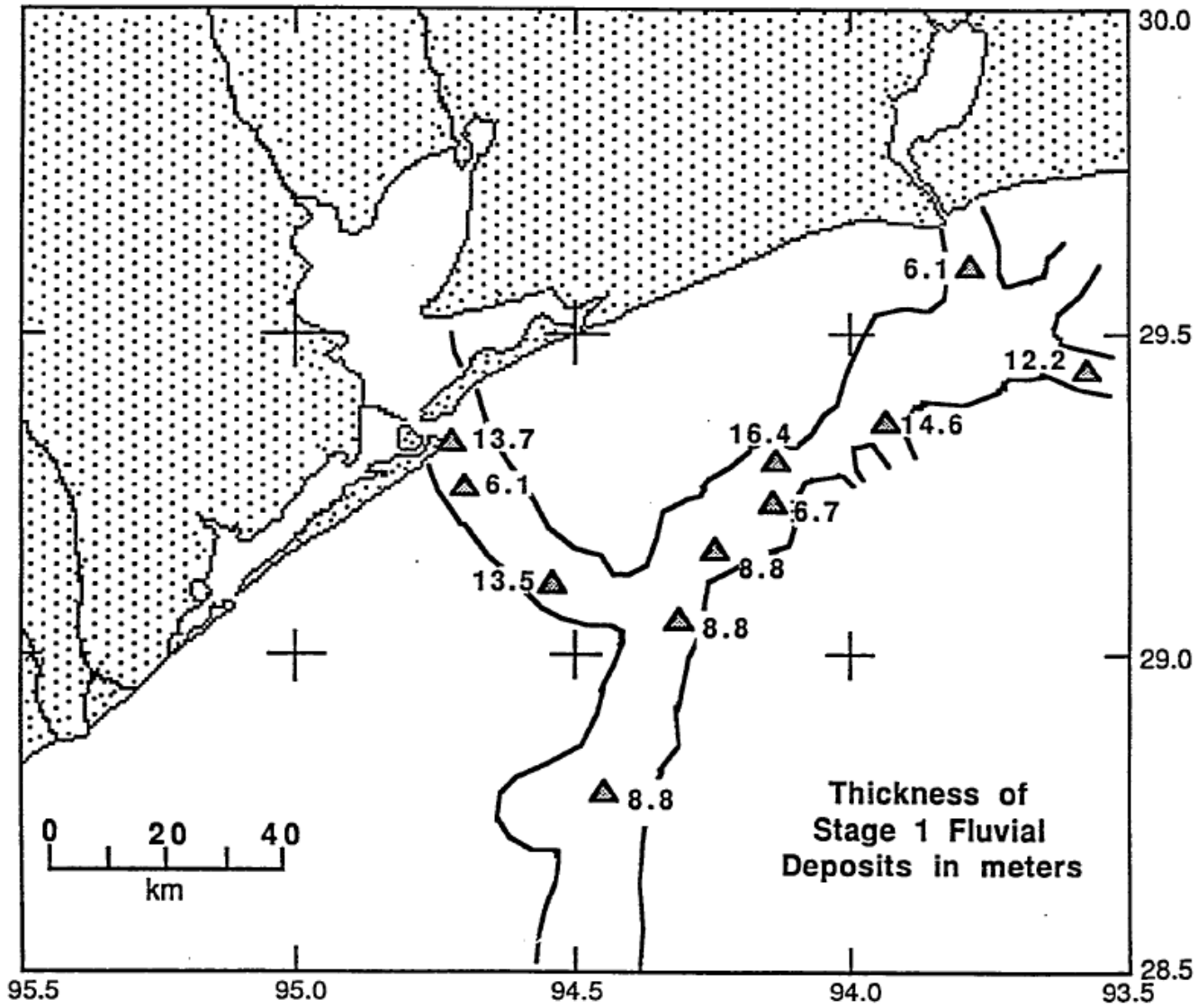

2017 CH 07
750m
2017 CH 09
2017 CH 11


2017_CH_line09 (0.3)
23950
24050
24150
24250
24350
24450
24550
24650
24750
24850
24950
25050
25150
25250
25350
25450
25550
25650
TWT (ms below 0 meters)
T-Ravinement
HORIZON 5
TOP OF THE BOTTOM
40 meters
100 feet


750m
2017 CH 07
2017 CH 09
2017 CH 11

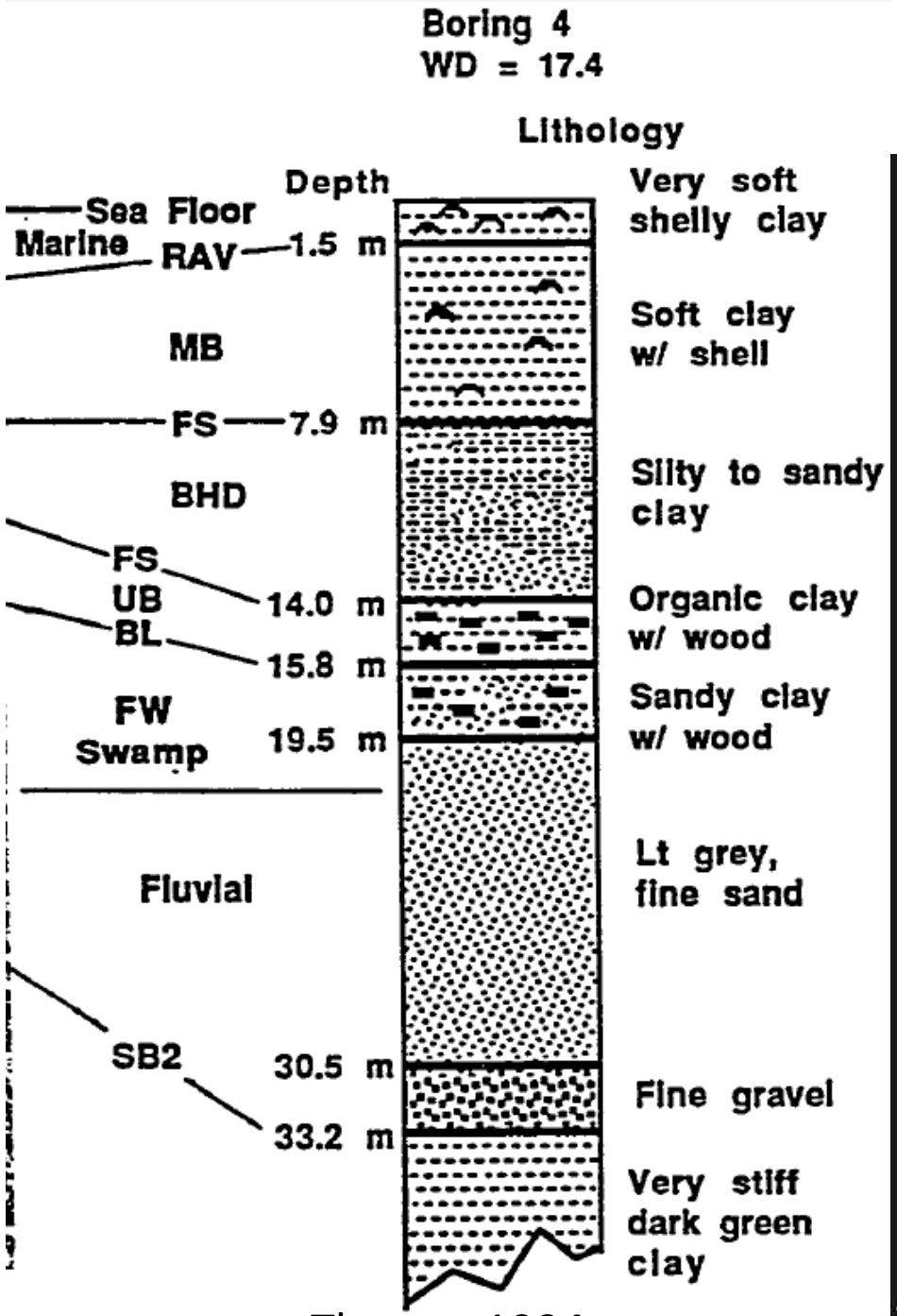

2017_CH_line11 (1.1)
87850 87700 87550 87400 87250 87100 86950 86800 86650 86500 86350 86200 86050 85900 85750 85600 85450 85300 85150 85000 84850 84700 84550 84400
TWT (ms below 0 meters)
T-Ravinemen
HORIZON 5
TOP OF THE BOTTOM
75 meters
250 feet

Platform boring lithologies

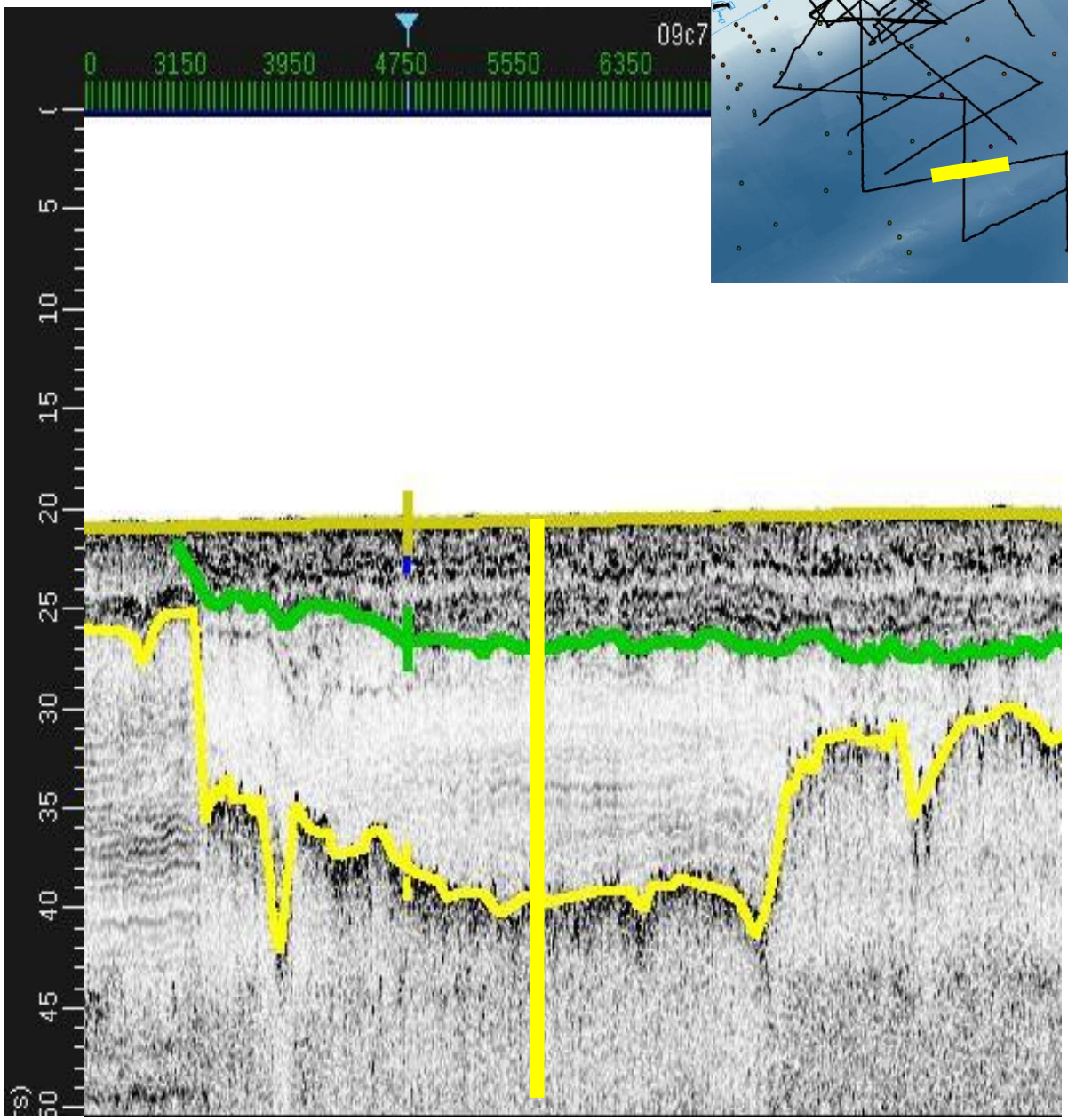


Thomas 1994

- **Identify thick amalgamated fine-medium grain sand at base of valley**
- **Related to our top of the bottom?**
  - **Probably**


Boring 4
WD = 17.4
Lithology
Depth
Sea Floor
Marine
RAV
1.5 m
MB
FS
7.9 m
BHD
FS
UB
14.0 m
BL
15.8 m
FW
Swamp
19.5 m
Fluvial
SB2
30.5 m
33.2 m
Very soft shelly clay
Soft clay w/ shell
Silty to sandy clay
Organic clay w/ wood
Sandy clay w/ wood
Lt grey, fine sand
Fine gravel
Very stiff dark green clay

Thomas 1994


09c7
0
3150
3950
4750
5550
6350
5
10
15
20
25
30
35
40
45

Key observations thus far

- **Identification of sand resources require state of the art high-resolution geophysical imaging with ground truth from cores**
- **Sand resources appear present in past fluvial settings and in remobilized sand (e.g. banks)**
- **A systems approach required to understand source to sink and our work shows greater complexity than previously suggested**
  - Preliminary results show fluvial systems identifiable in chirp data and with “valley scale” mapping the accessible portions can be identified