Texas Offshore Sediment Resources Inventory: Development and Application of Geophysical Processing Workflows for Sand Resource Evaluation

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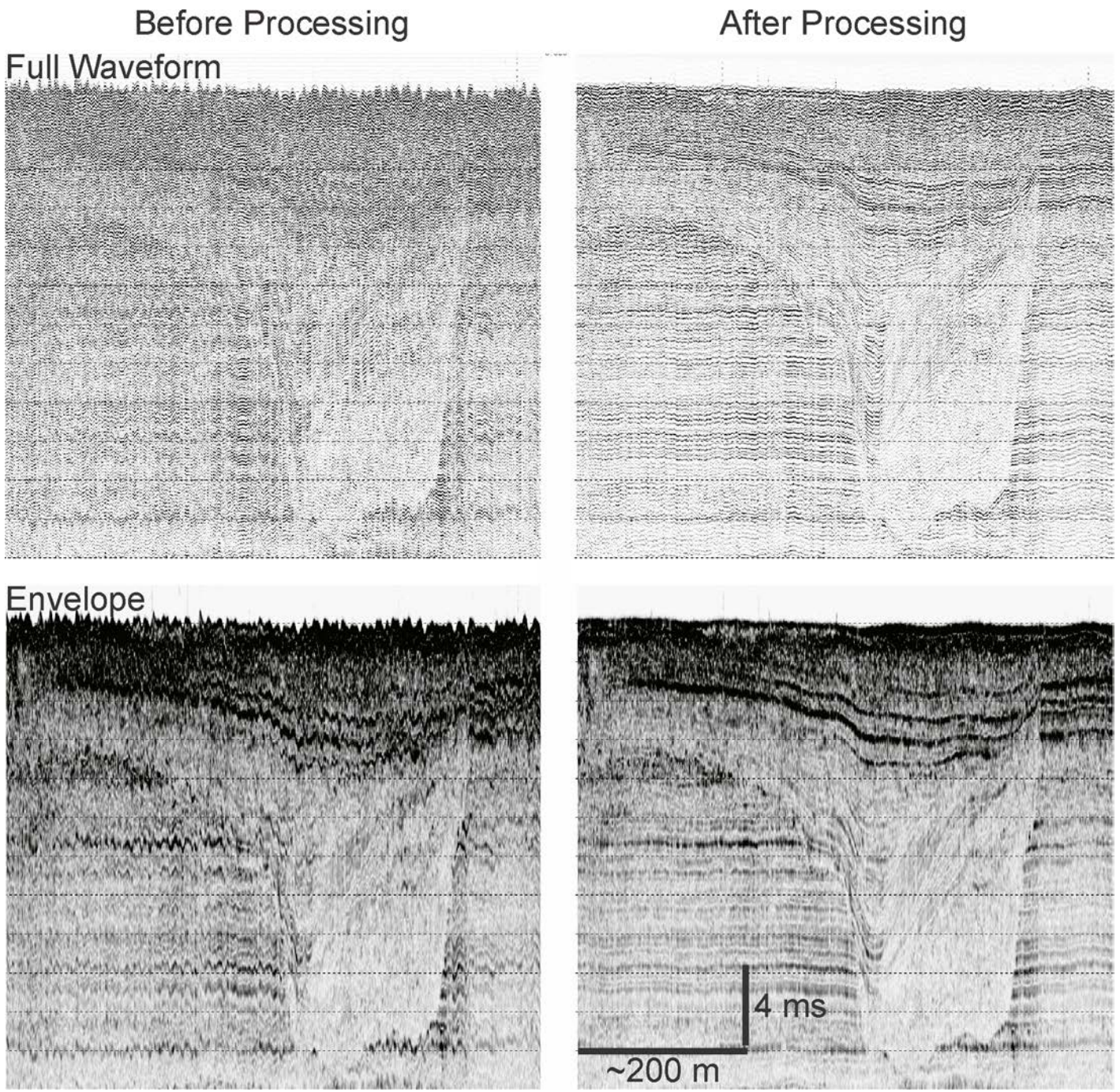
University of Texas at Austin

UTIG

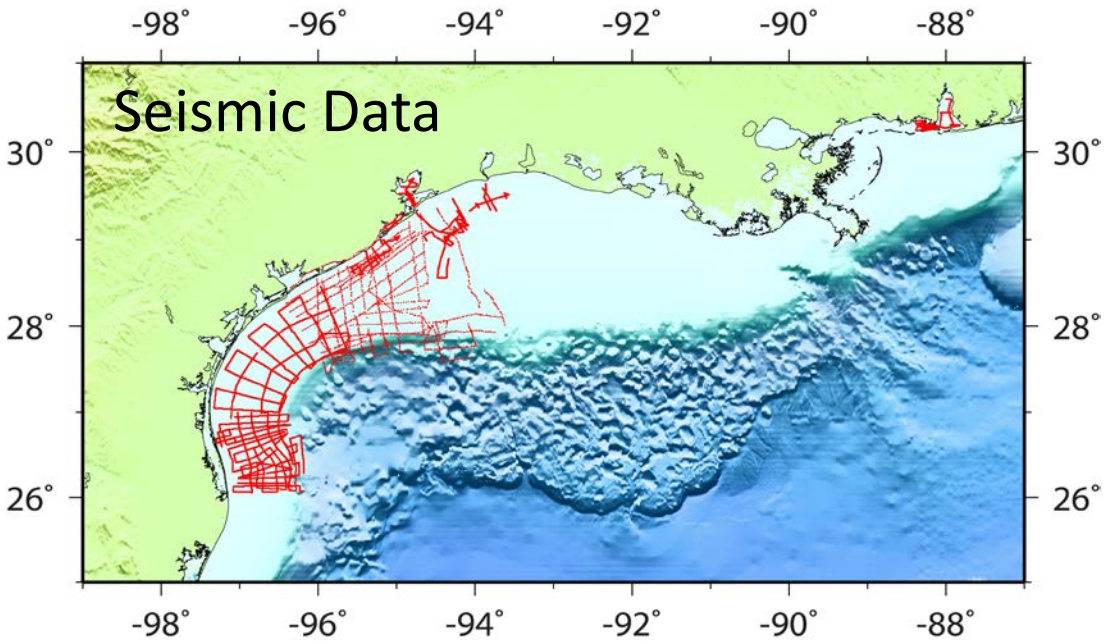
TEXAS Geosciences
The University of Texas at Austin
Jackson School of Geosciences

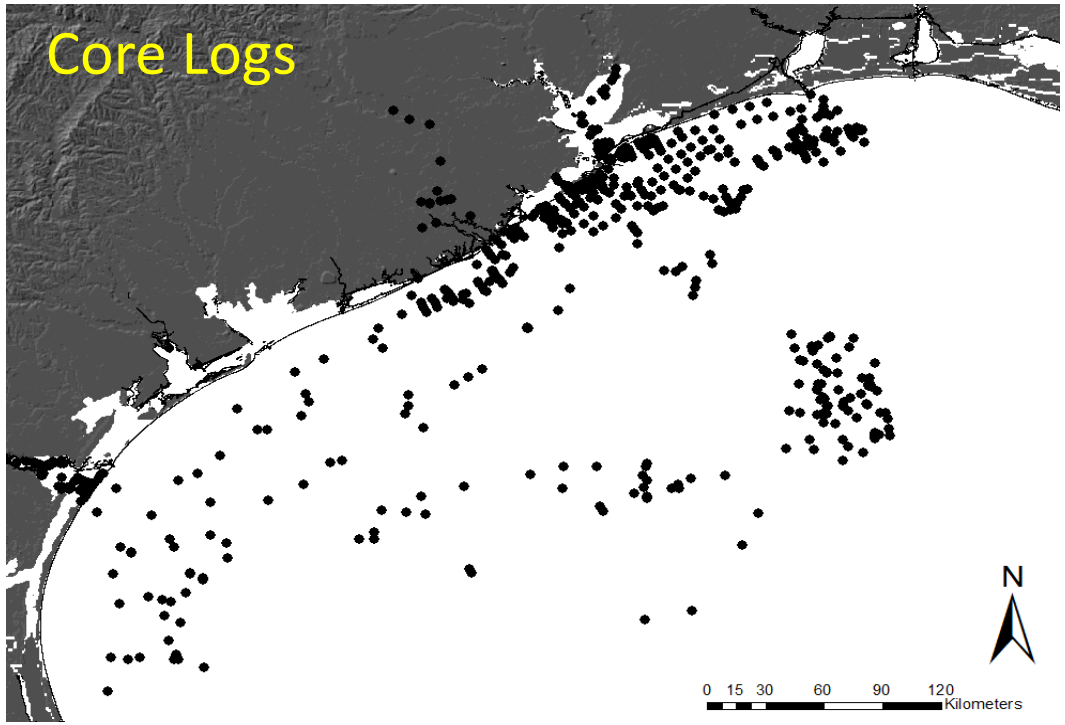
1. Streamline chirp data processing, and write white paper on best practices in processing and acquisition



2. “Rescue” archival data and build Texas Shelf database

John Anderson (Rice Univ) Holdings





3. Integrate research with educational mission

2017 and 2018 Marine Geology and Geophysics Field Classes

4. Trinity River Paleovalley Project (TRiPP)

Objective:

-Find and delineate significant subsurface sand bodies located on the East Texas shelf

How:

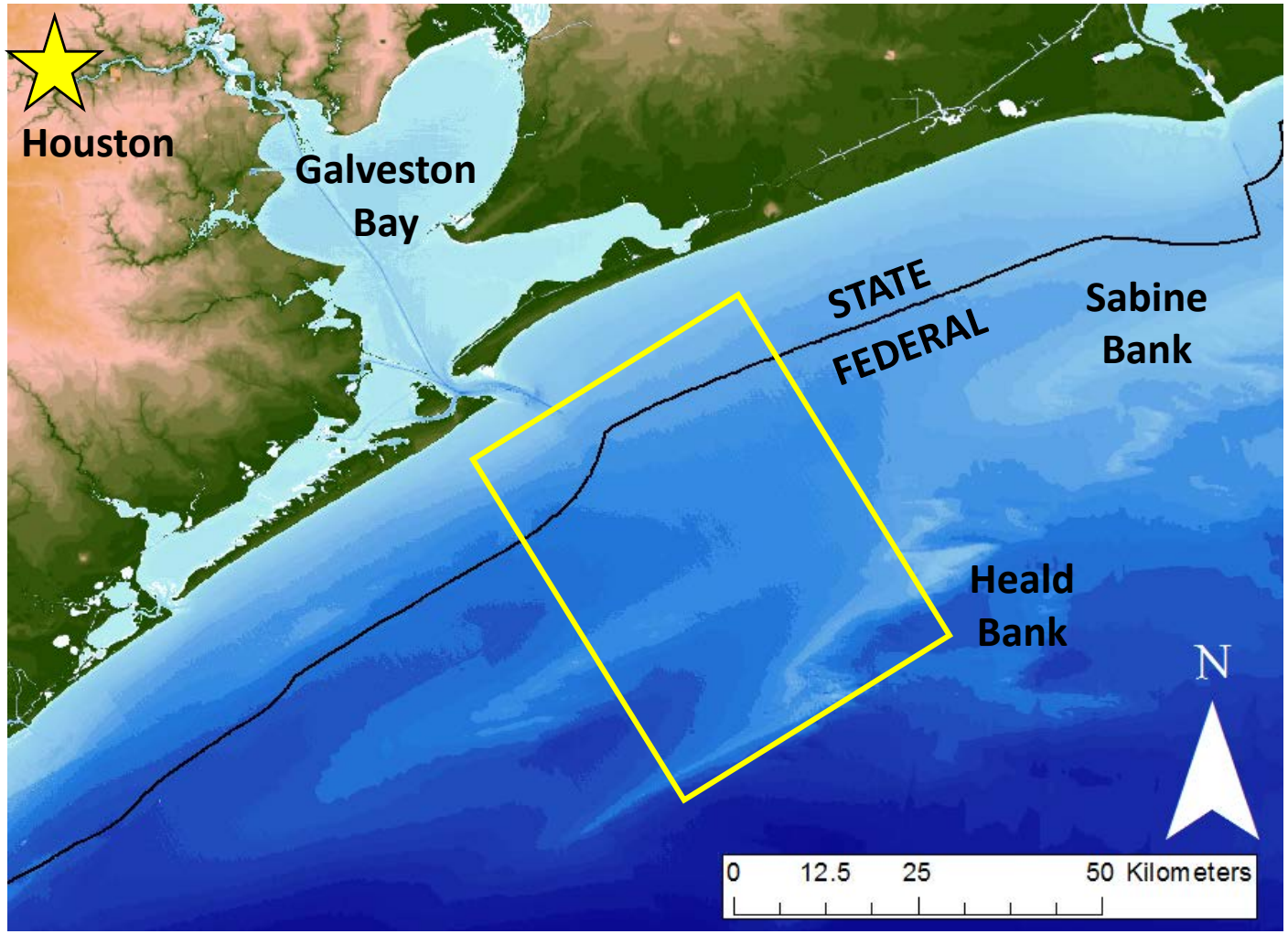
-High-density geophysical surveys (250m spacing)
-Legacy academic and industry surveys
-Sediment coring and paleo-environment analysis

Outcomes:

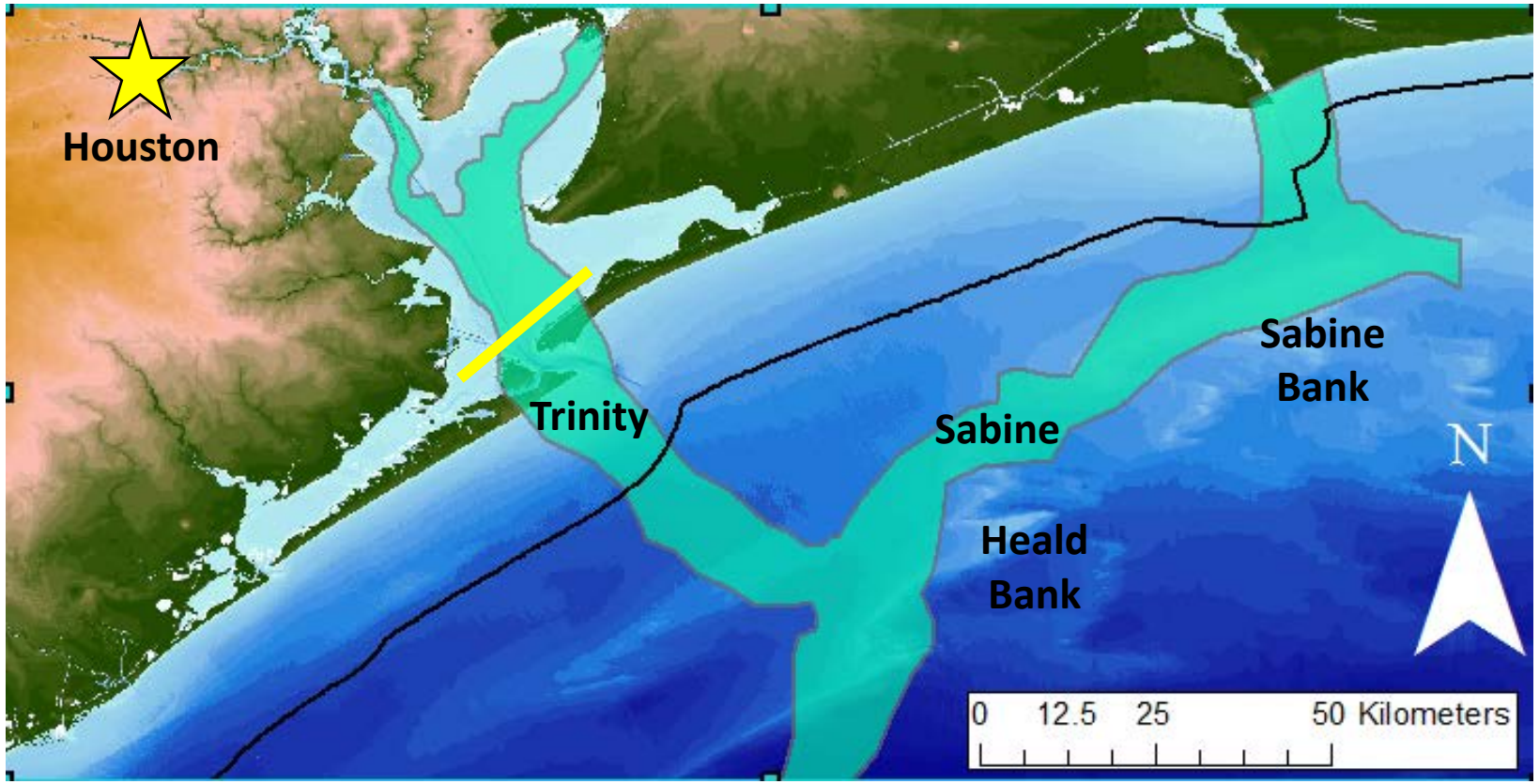
-Case study of utility of chirp processing tool

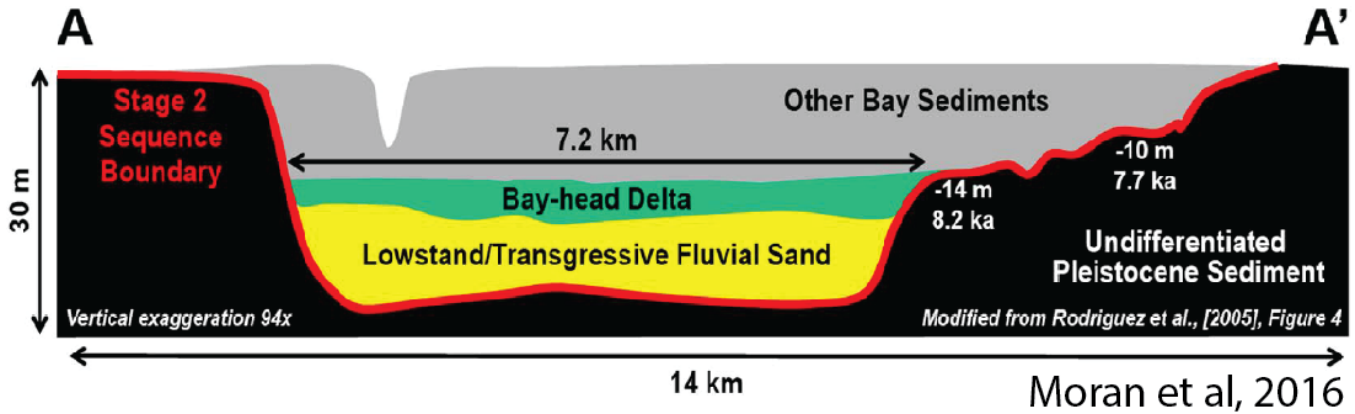
-Delineation of sand resources in study area and identification of key data gaps

-Model for recent evolution of the East Texas shelf and Trinity River system



Trinity River Paleo-valley





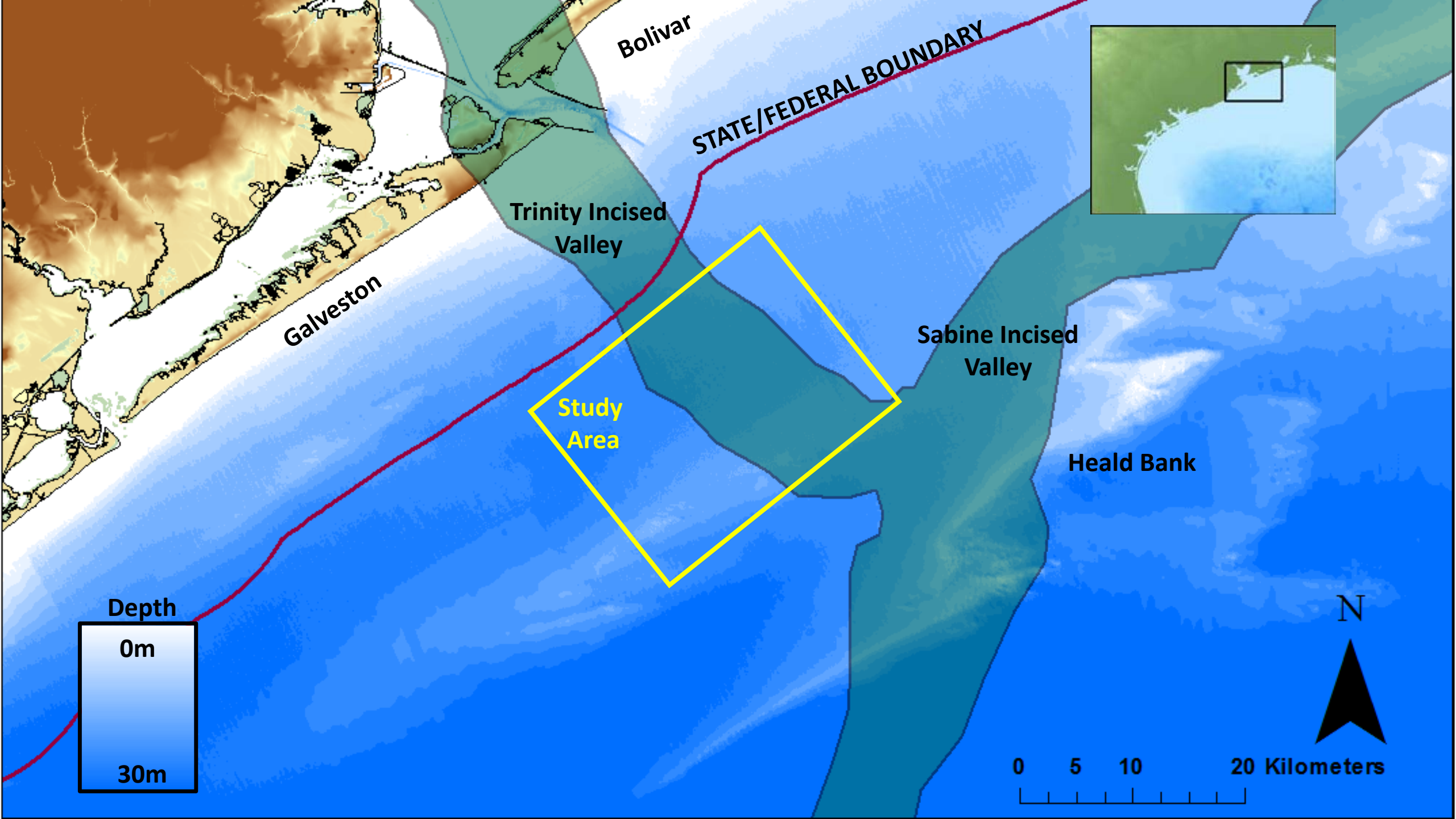
Moran et al, 2016

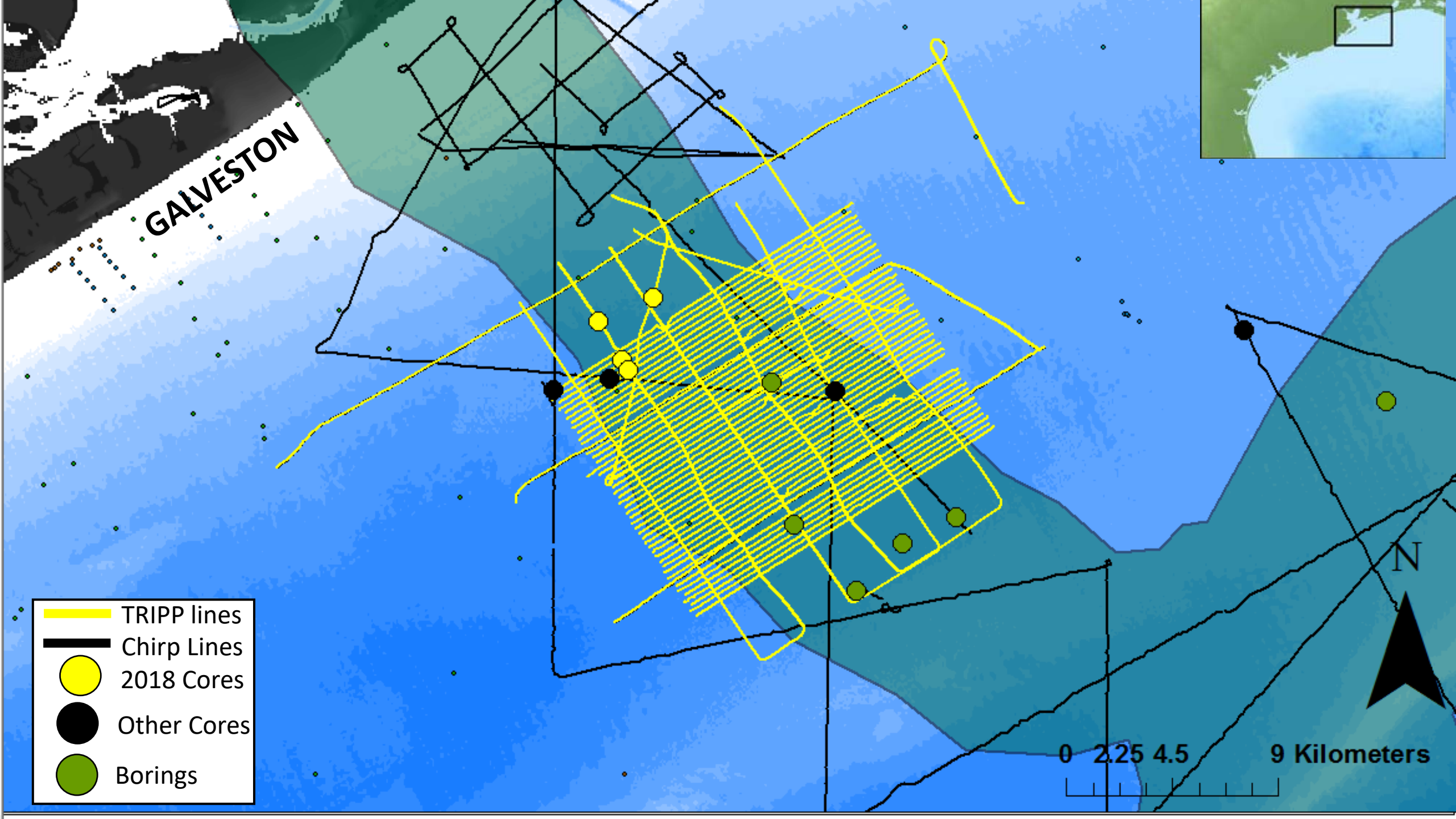
Extent of valley geometry fairly well constrained

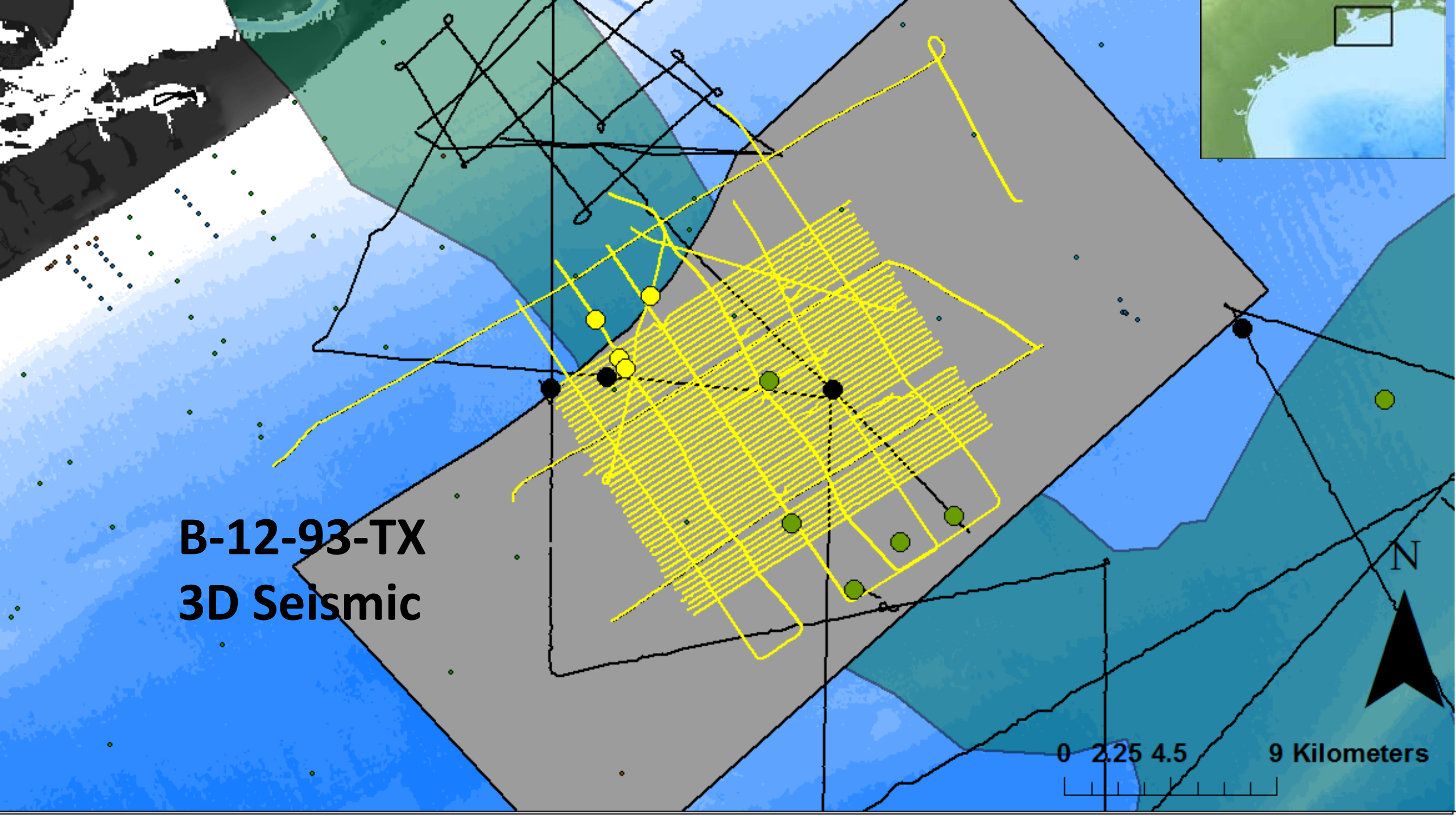
But what actually makes up a valley?

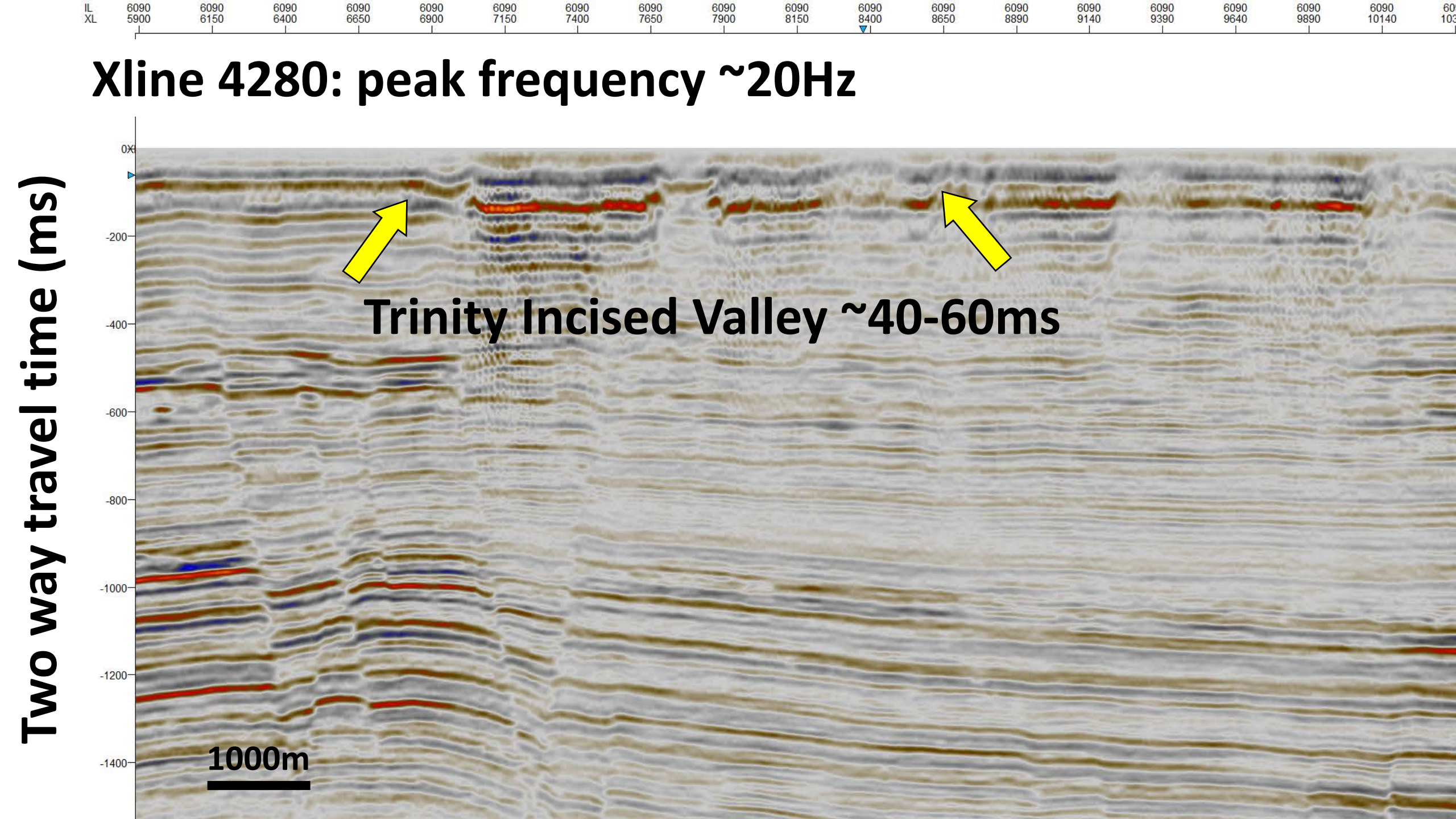
Internal stratigraphic architecture?

How do coastal rivers respond to transgression and how does the shelf evolve?

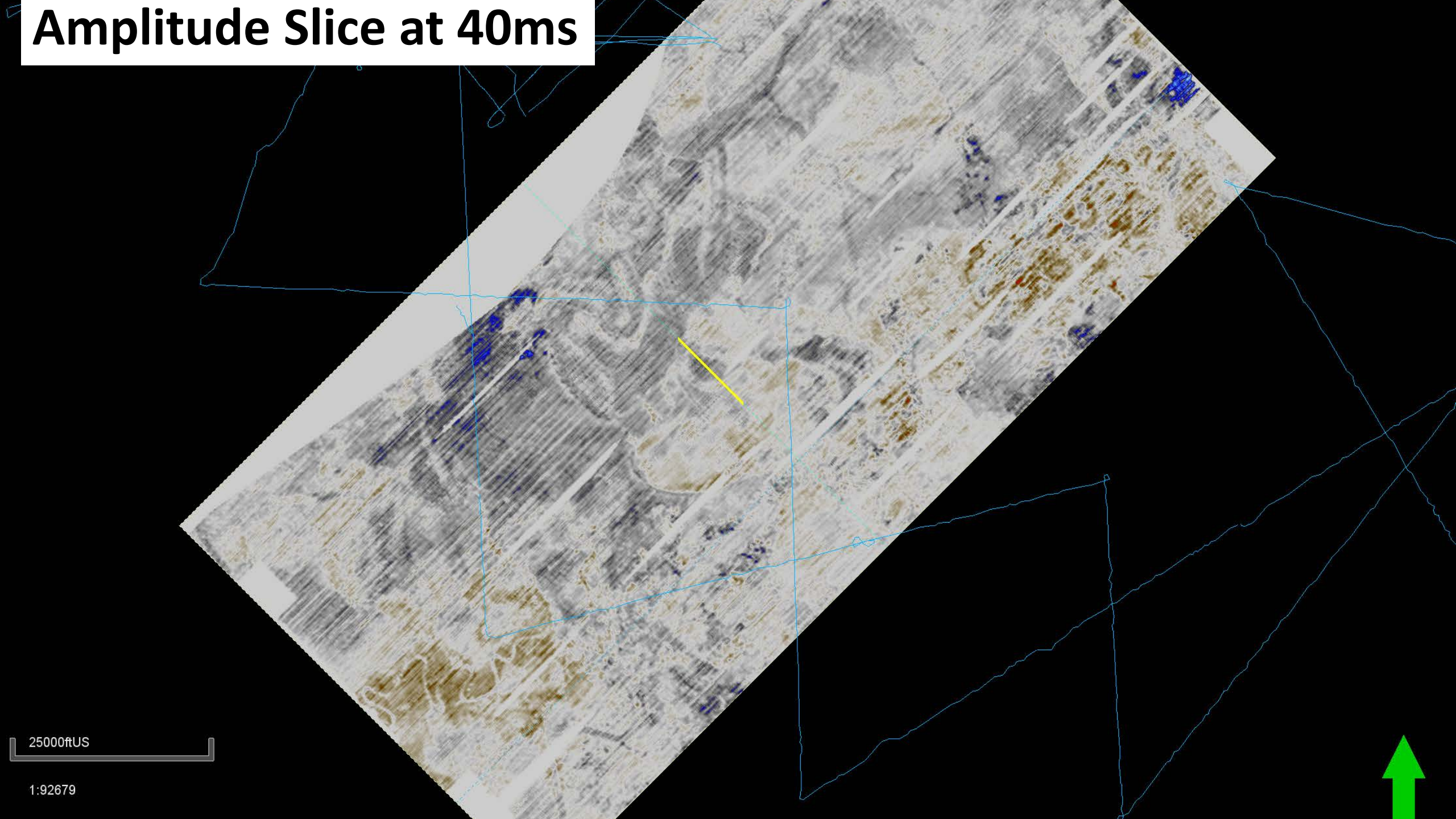

Bolivar
STATE/FEDERAL BOUNDARY
Trinity Incised Valley
Galveston
Sabine Incised Valley
Study Area
Heald Bank
Depth
0m
30m
N
0 5 10 20 Kilometers


GALVESTON
TRIPP lines
Chirp Lines
2018 Cores
Other Cores
Borings
N
0 2.25 4.5
9 Kilometers

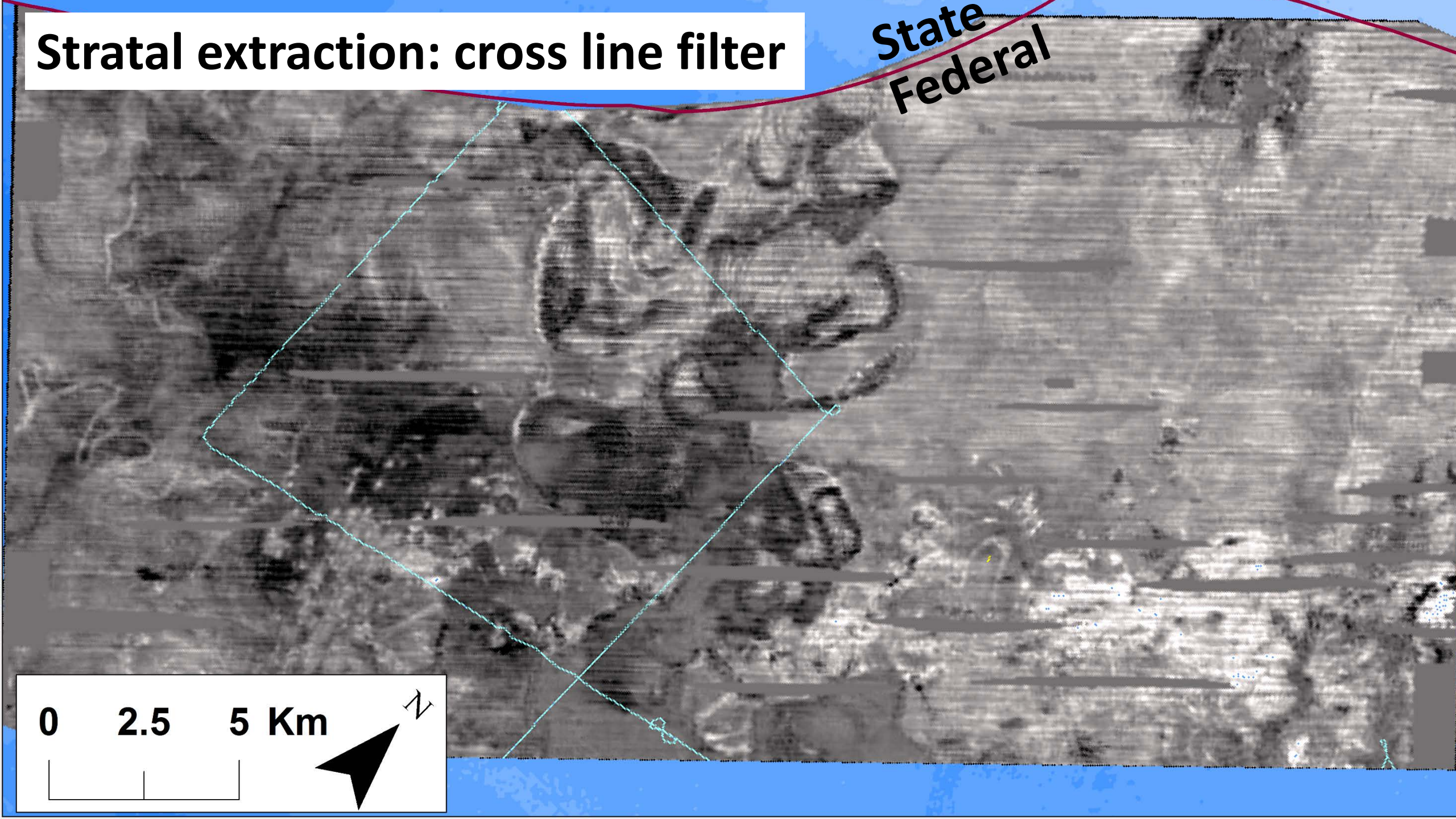

B-12-93-TX
3D Seismic
N
0 2.25 4.5
9 Kilometers

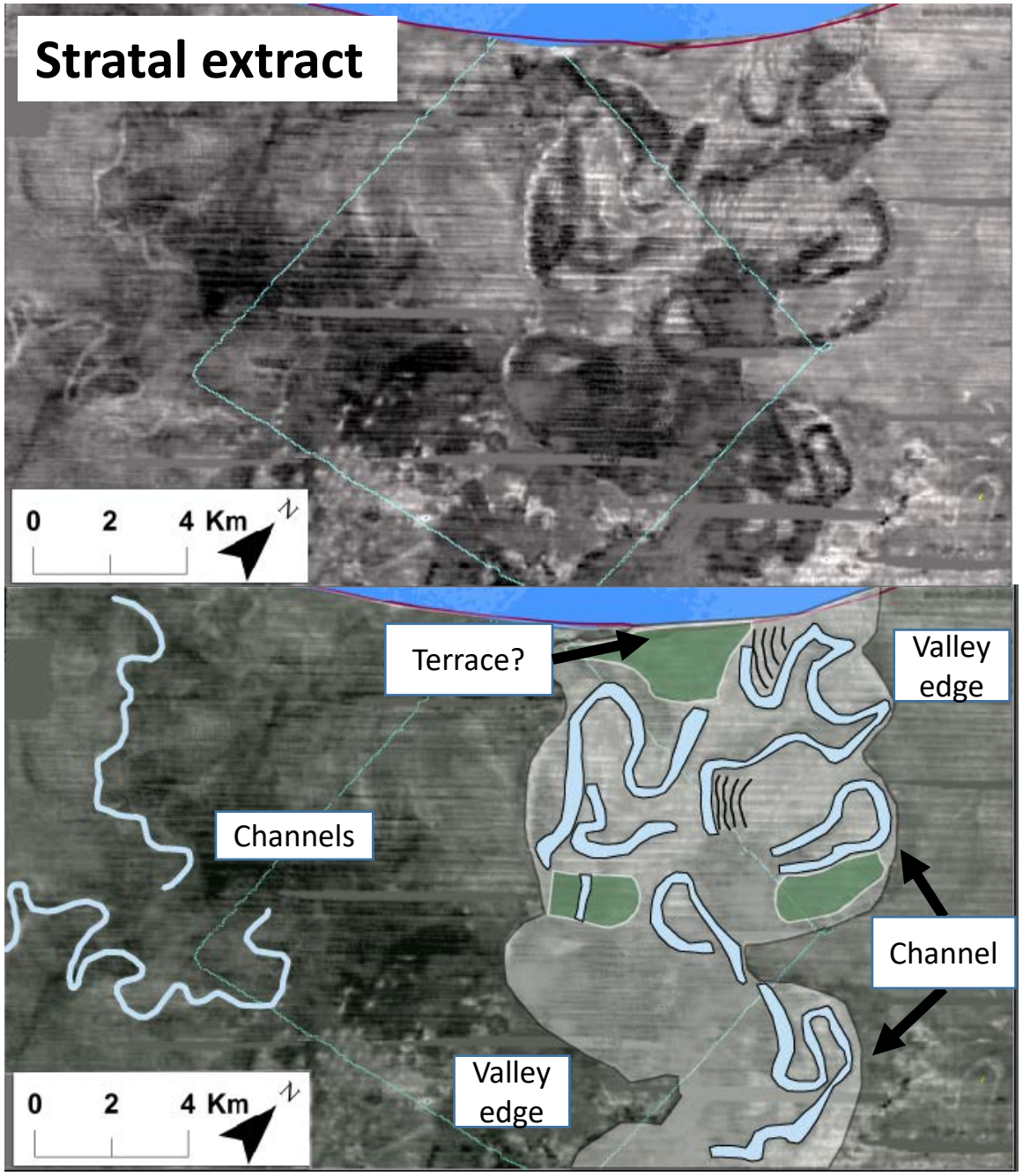

IL 6090 6090 6090 6090 6090 6090 6090 6090 6090 6090 6090 6090 6090 6090 6090 6090 6090 6090
XL 5900 6150 6400 6650 6900 7150 7400 7650 7900 8150 8400 8650 8890 9140 9390 9640 9890 10140
Xline 4280: peak frequency ~20Hz
Two way travel time (ms)
0
-200
-400
-600
-800
-1000
-1200
-1400
Trinity Incised Valley ~40-60ms
1000m

Amplitude Slice at 40ms

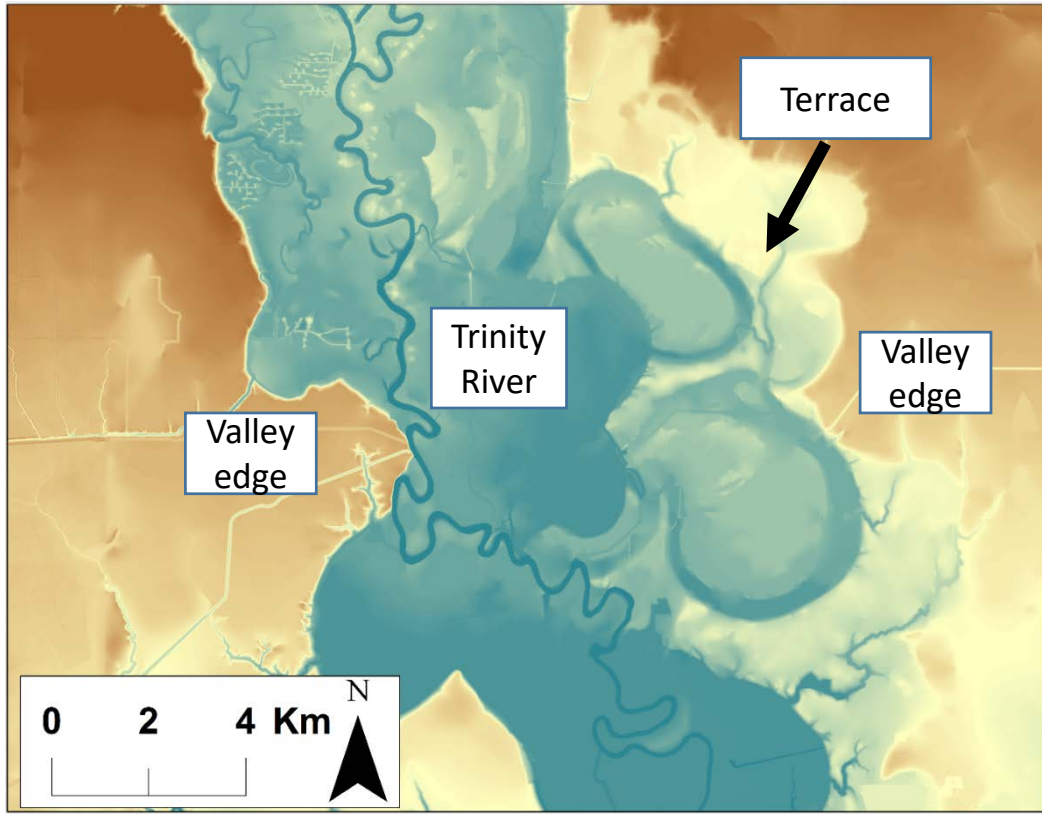


Stratal extraction: cross line filter

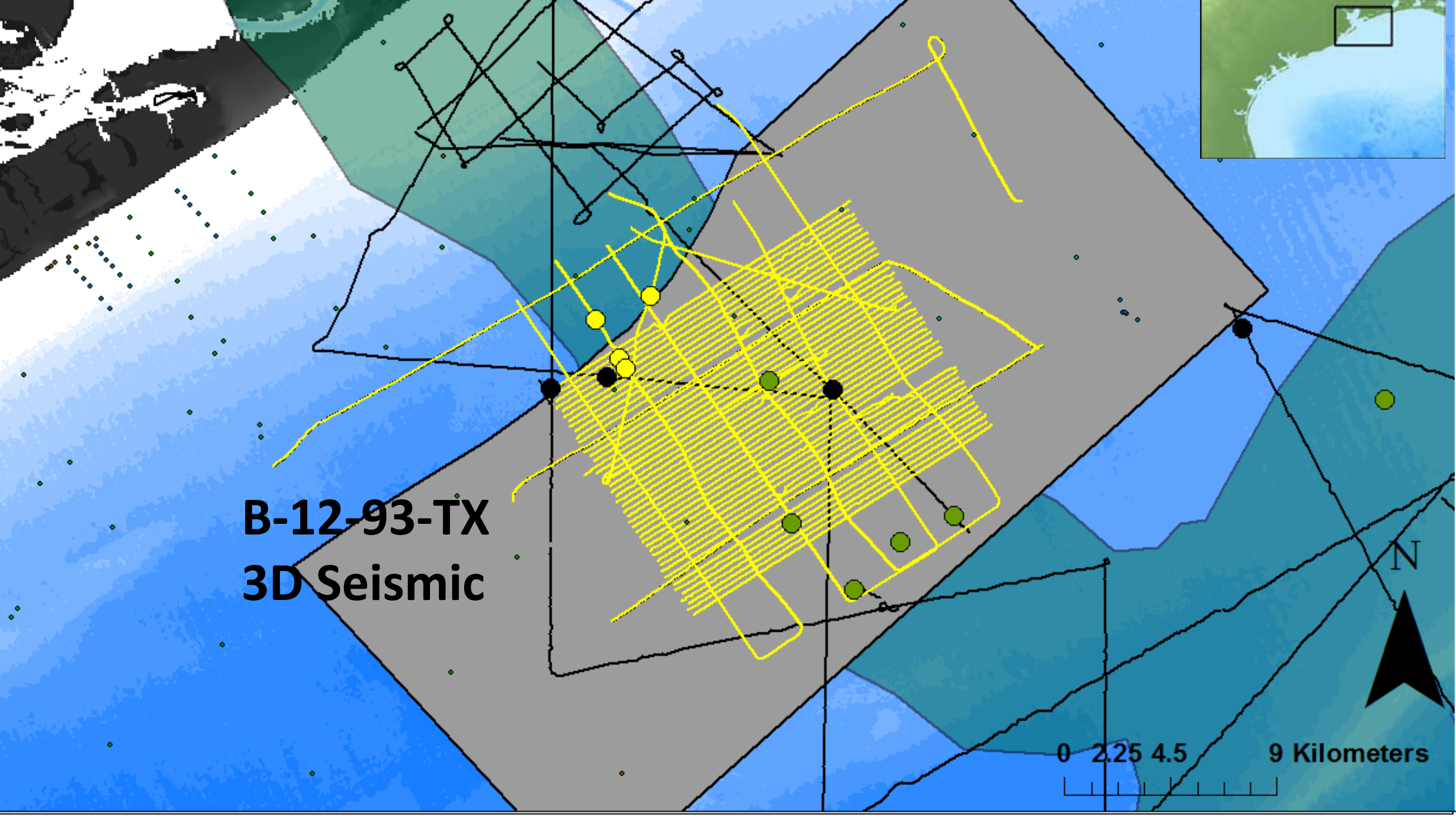


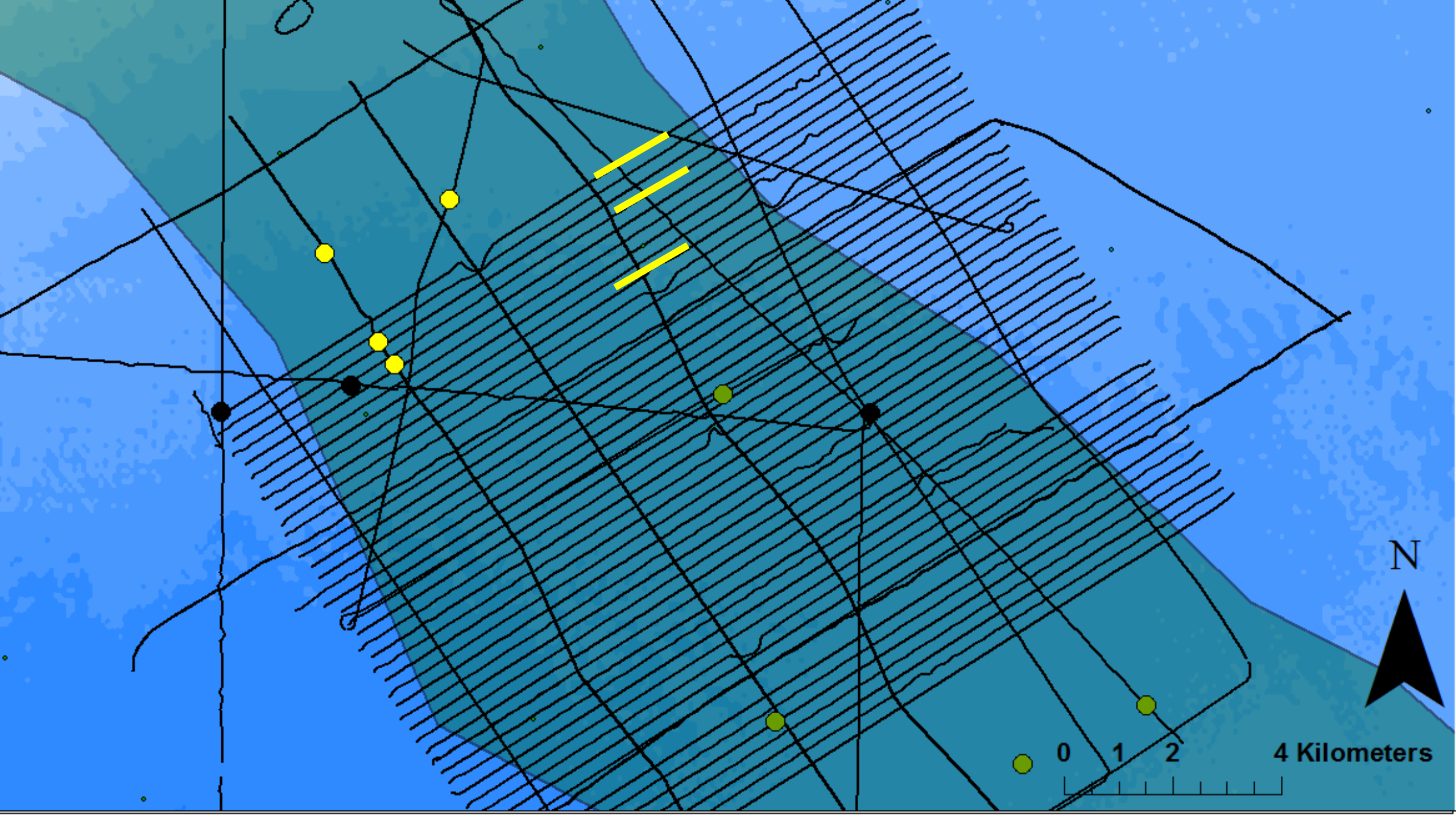


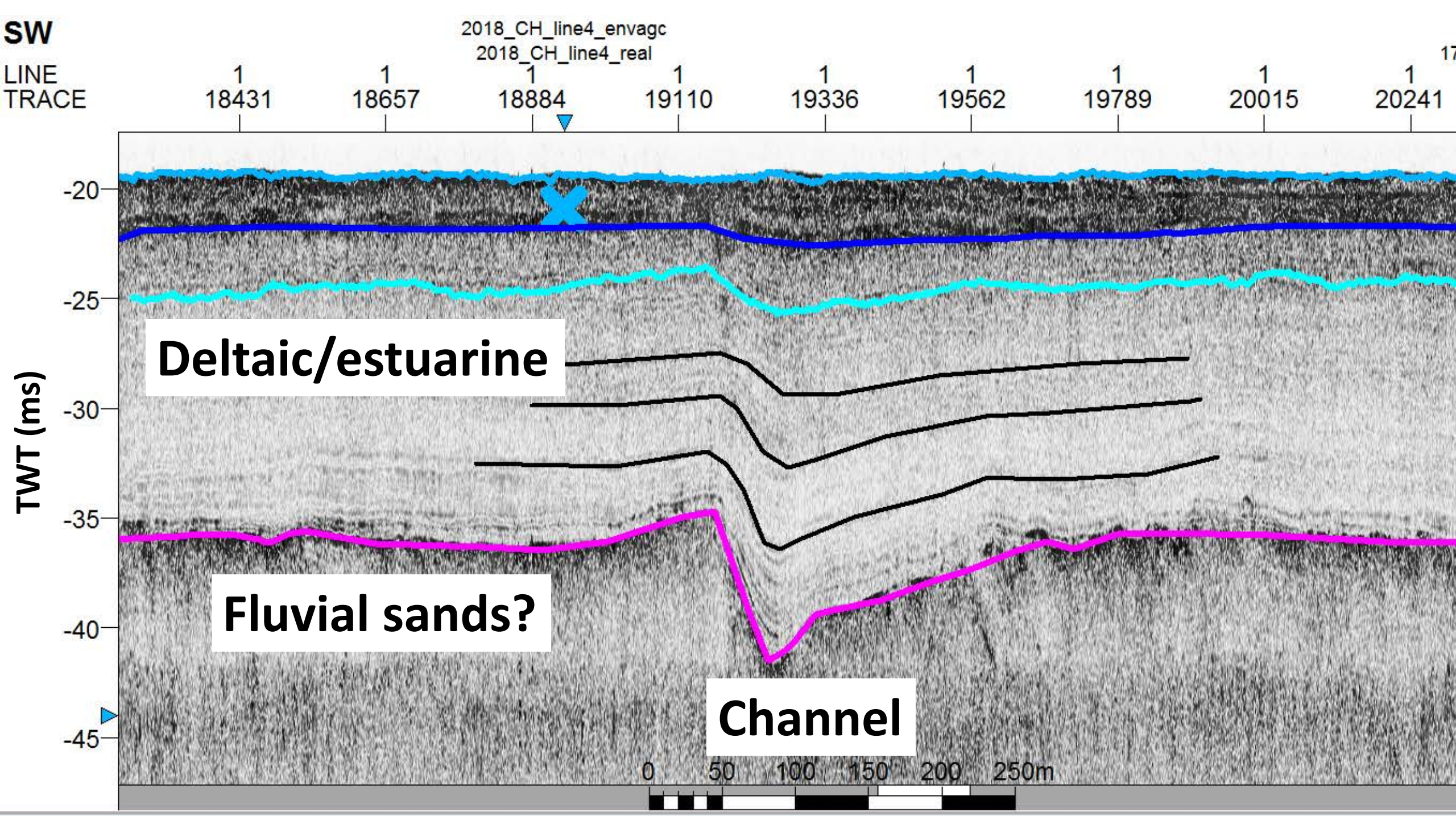
Modern Trinity valley

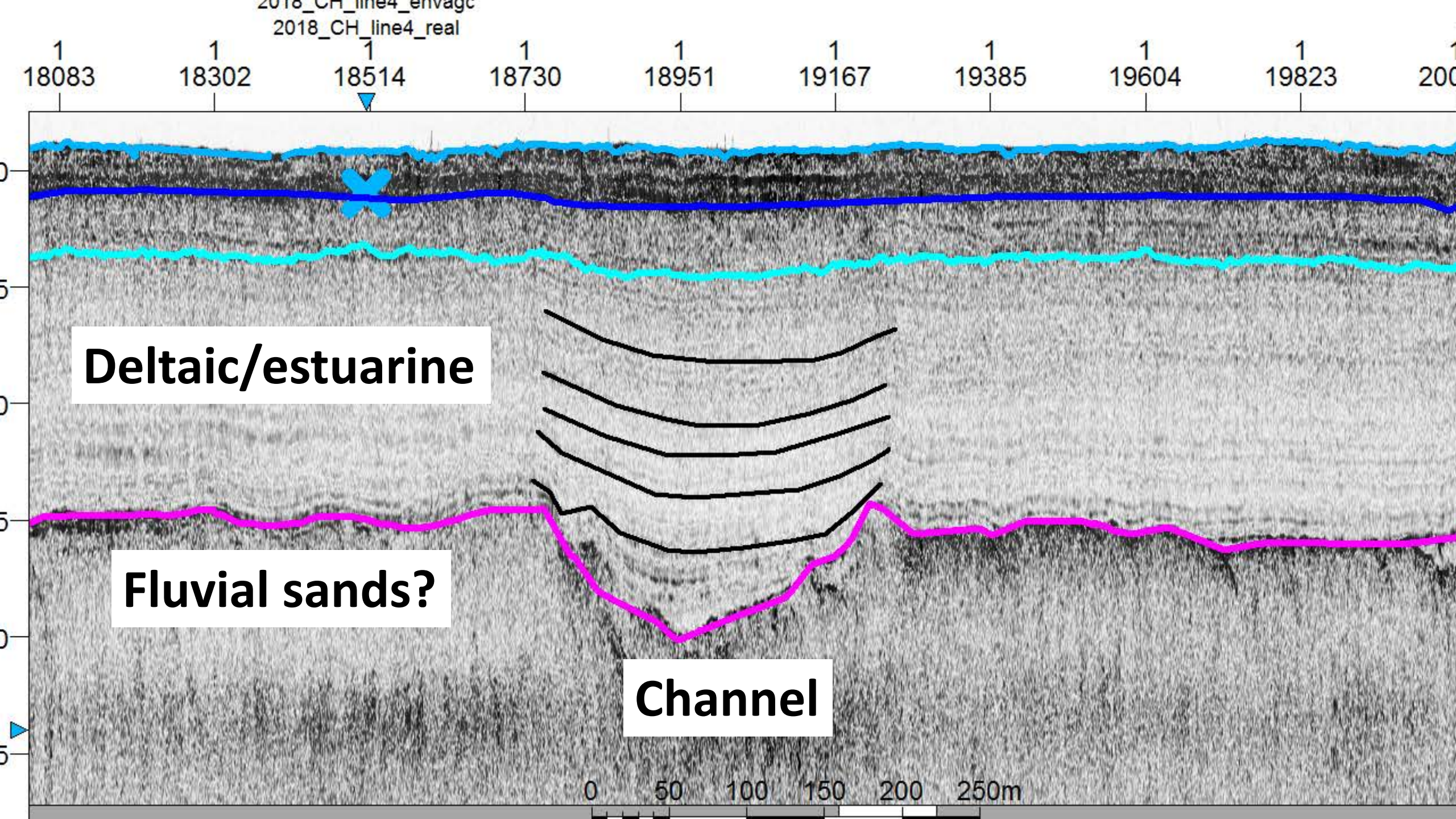


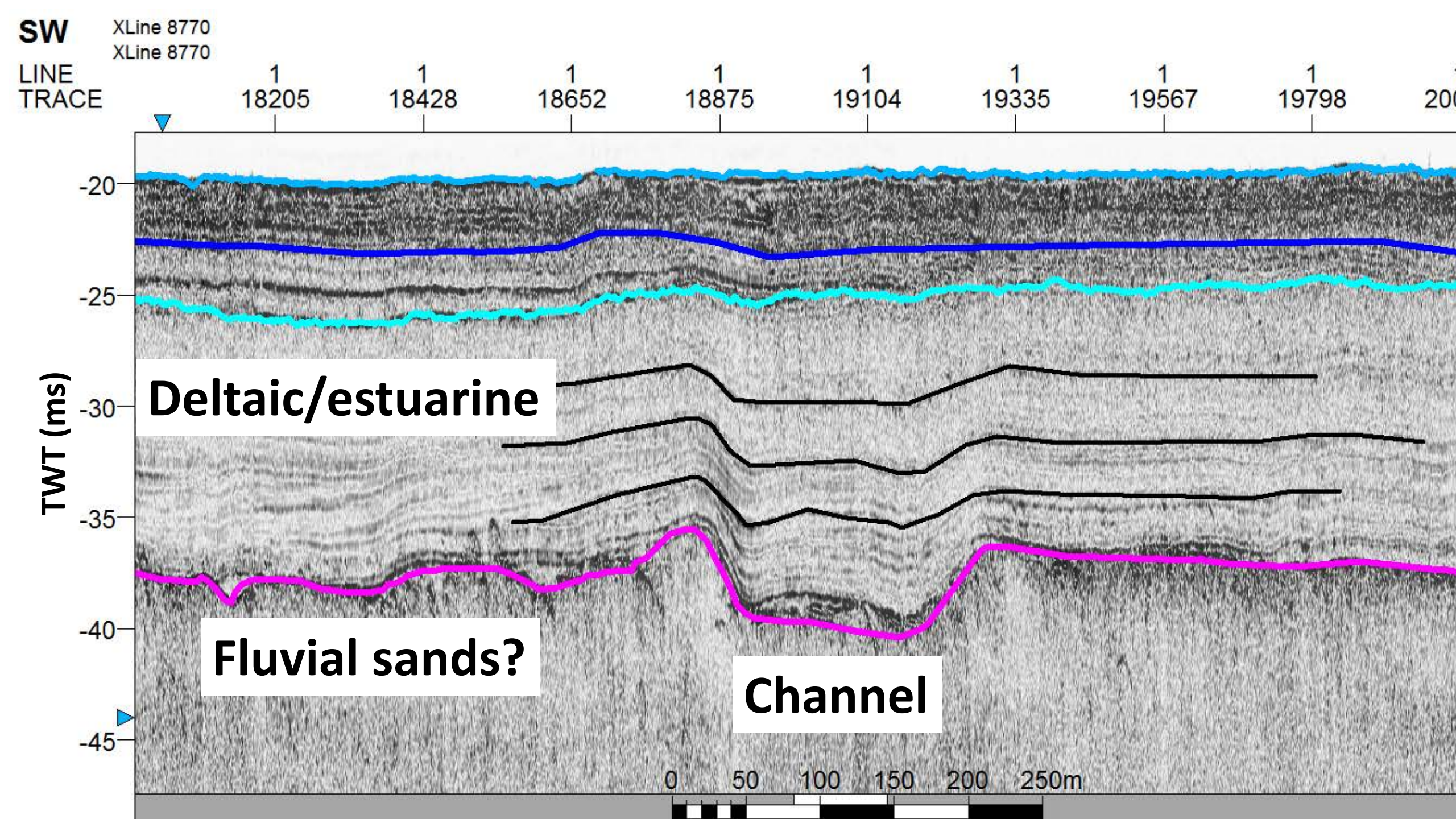
- 3D seismic images geomorphic forms similar to modern terrestrial valley
- Significant shallow fluvial stratigraphy outside of the valley
- Limited detail of internal stratigraphy (what actually makes up these beautiful images?)


B-12-93-TX
3D Seismic
N
0 2.25 4.5
9 Kilometers

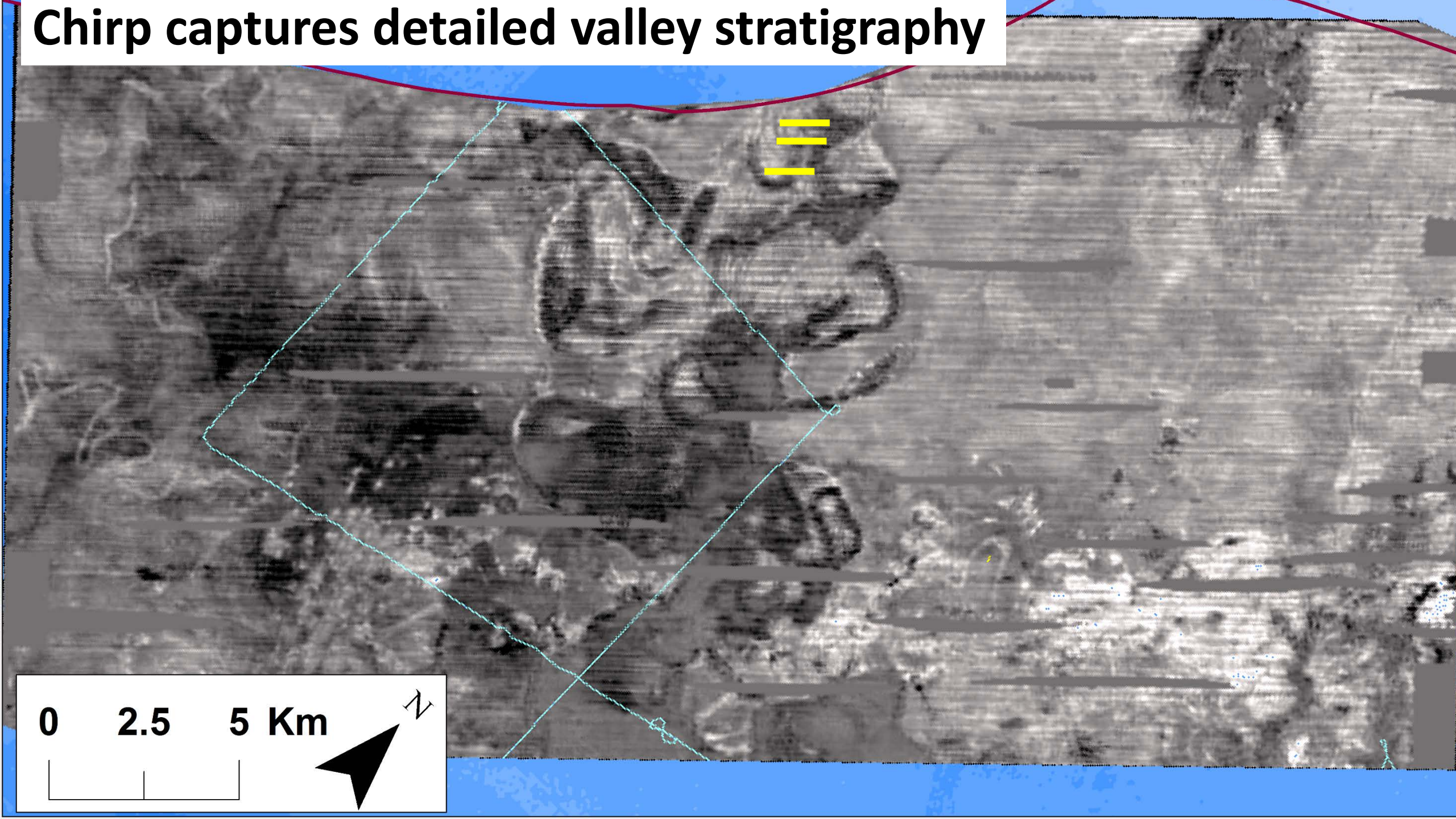

N
0
1
2
4 Kilometers

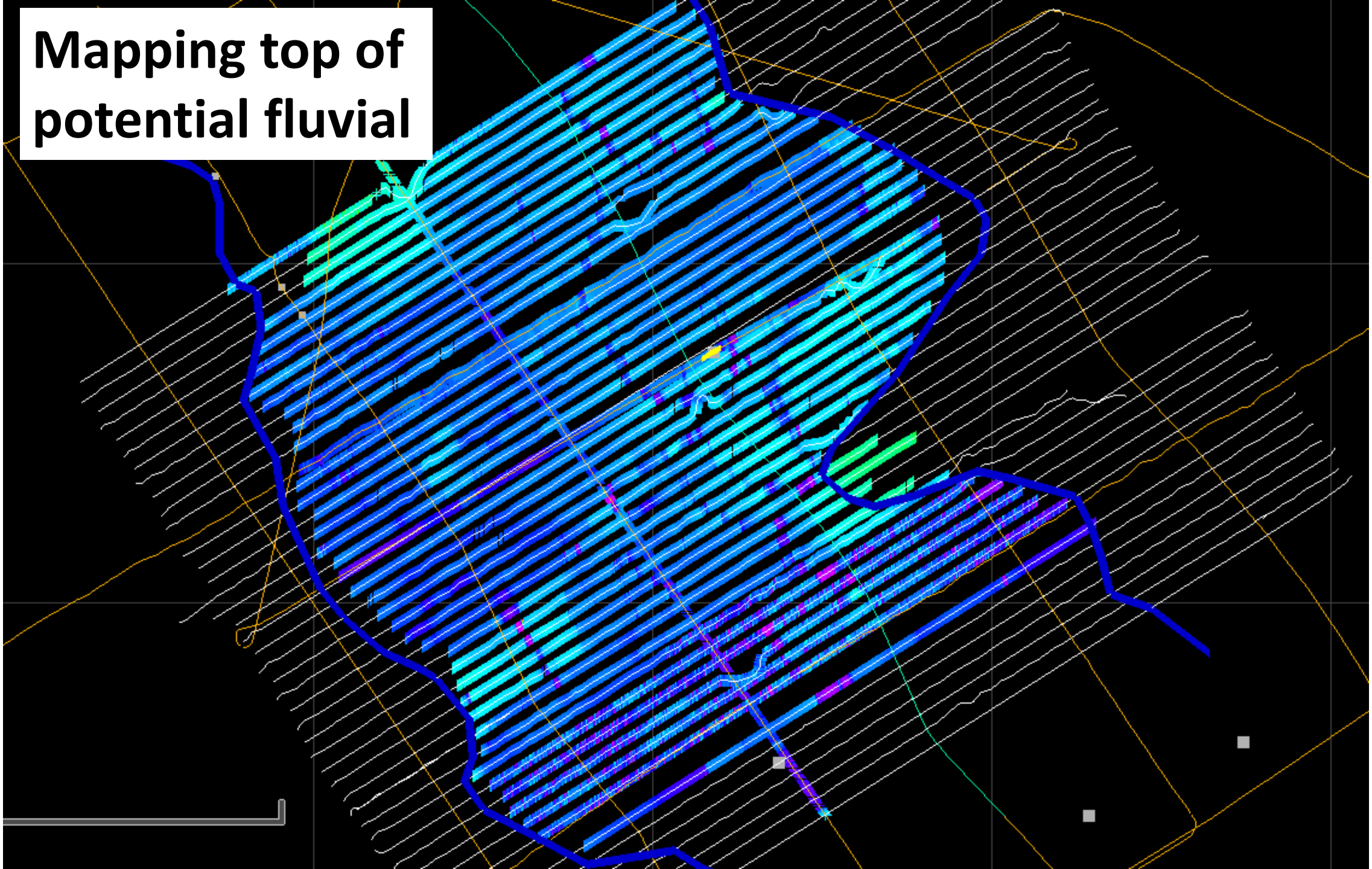

SW
2018_CH_line4_envagc
2018_CH_line4_real
LINE
TRACE
1 18431
1 18657
1 18884
1 19110
1 19336
1 19562
1 19789
1 20015
1 20241
-20
-25
-30
-35
-40
-45
TWT (ms)
Deltaic/estuarine
Fluvial sands?
Channel
0
50
100
150
200
250m

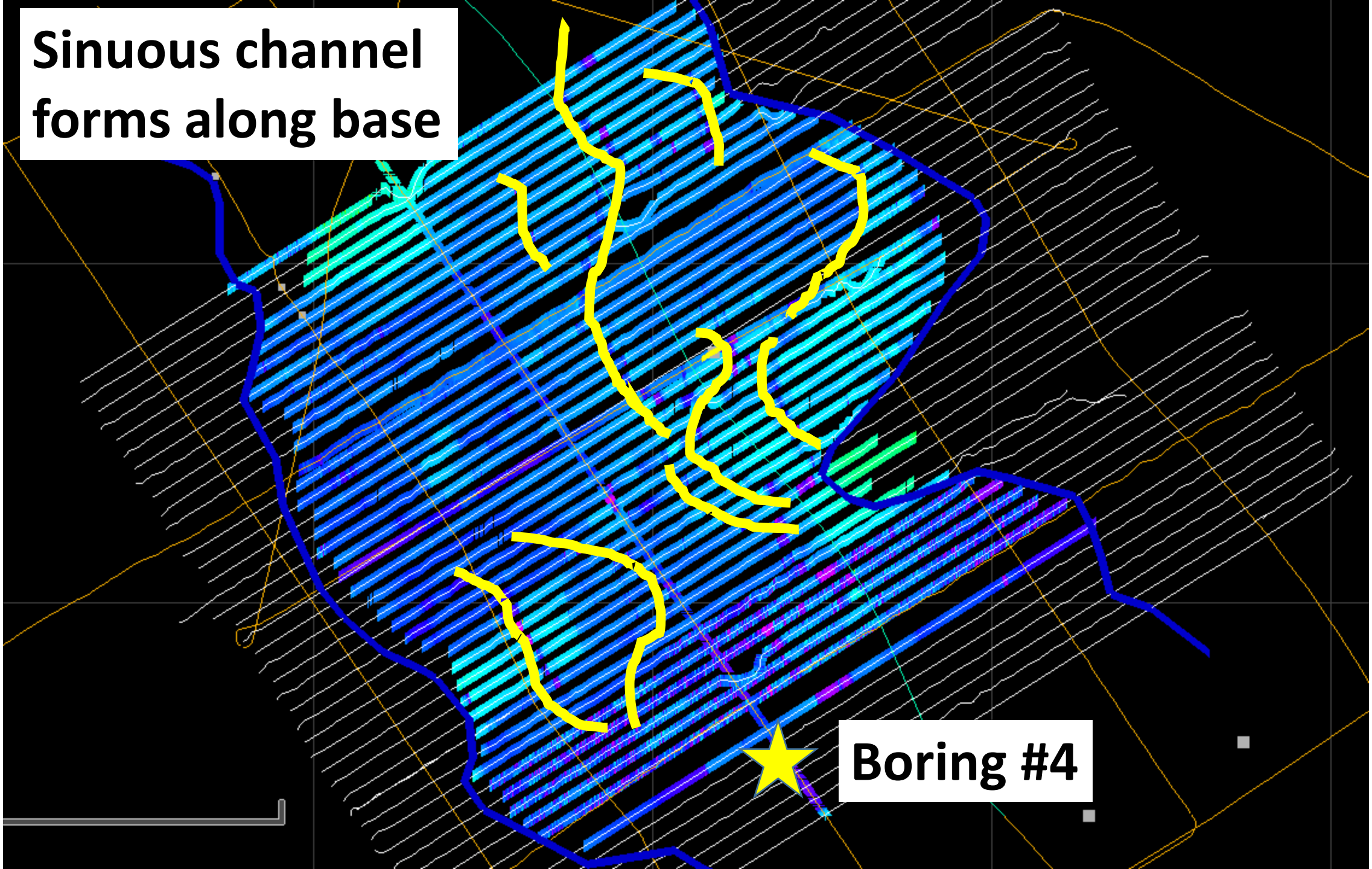

2018_CH_line4_envagc
2018_CH_line4_real
1 18083
1 18302
1 18514
1 18730
1 18951
1 19167
1 19385
1 19604
1 19823
Deltaic/estuarine
Fluvial sands?
Channel
0 50 100 150 200 250m

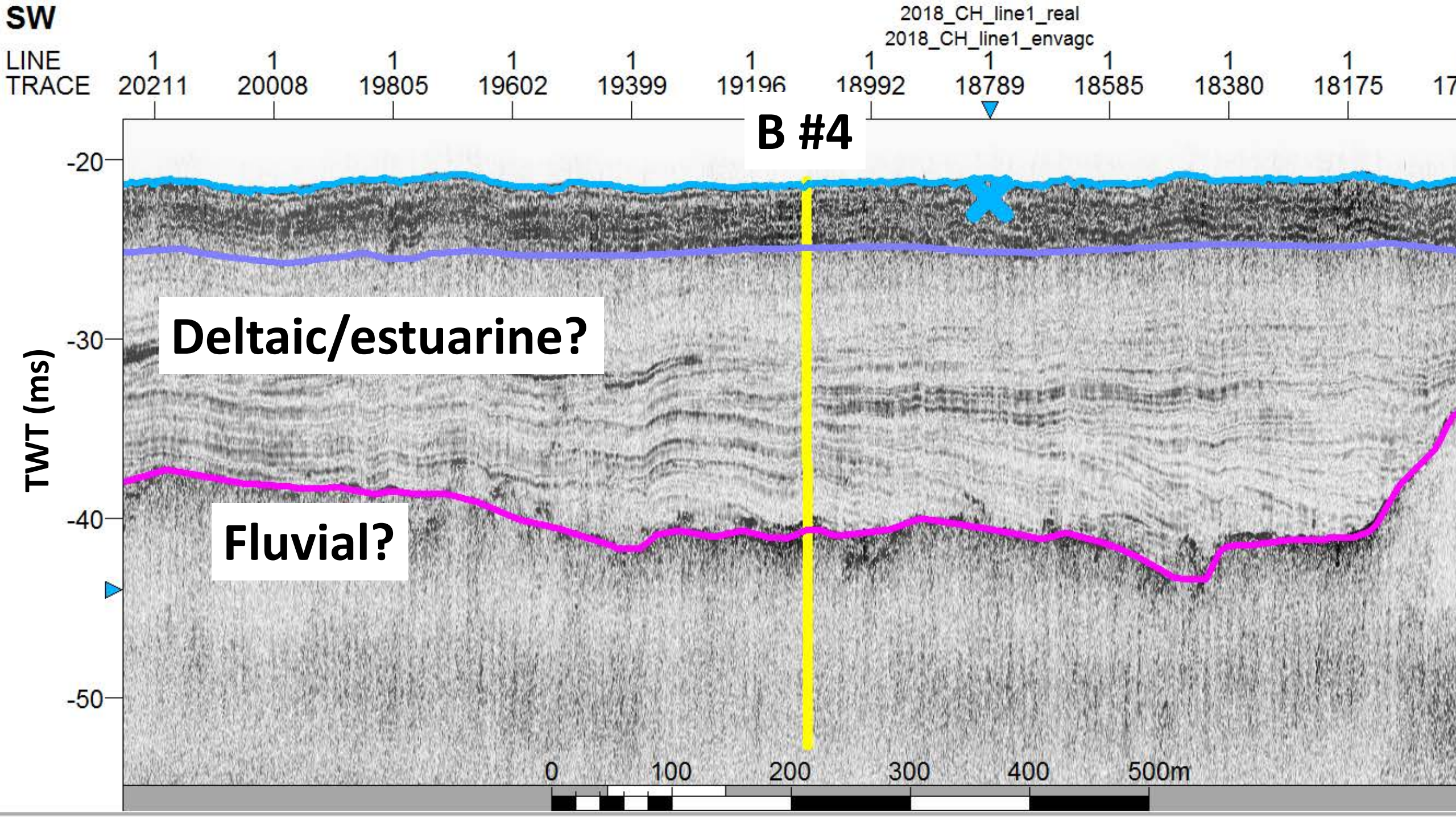

SW
XLine 8770
XLine 8770
LINE
TRACE
1
18205
1
18428
1
18652
1
18875
1
19104
1
19335
1
19567
1
19798
-20
-25
-30
-35
-40
-45
TWT (ms)
Deltaic/estuarine
Fluvial sands?
Channel
0
50
100
150
200
250m

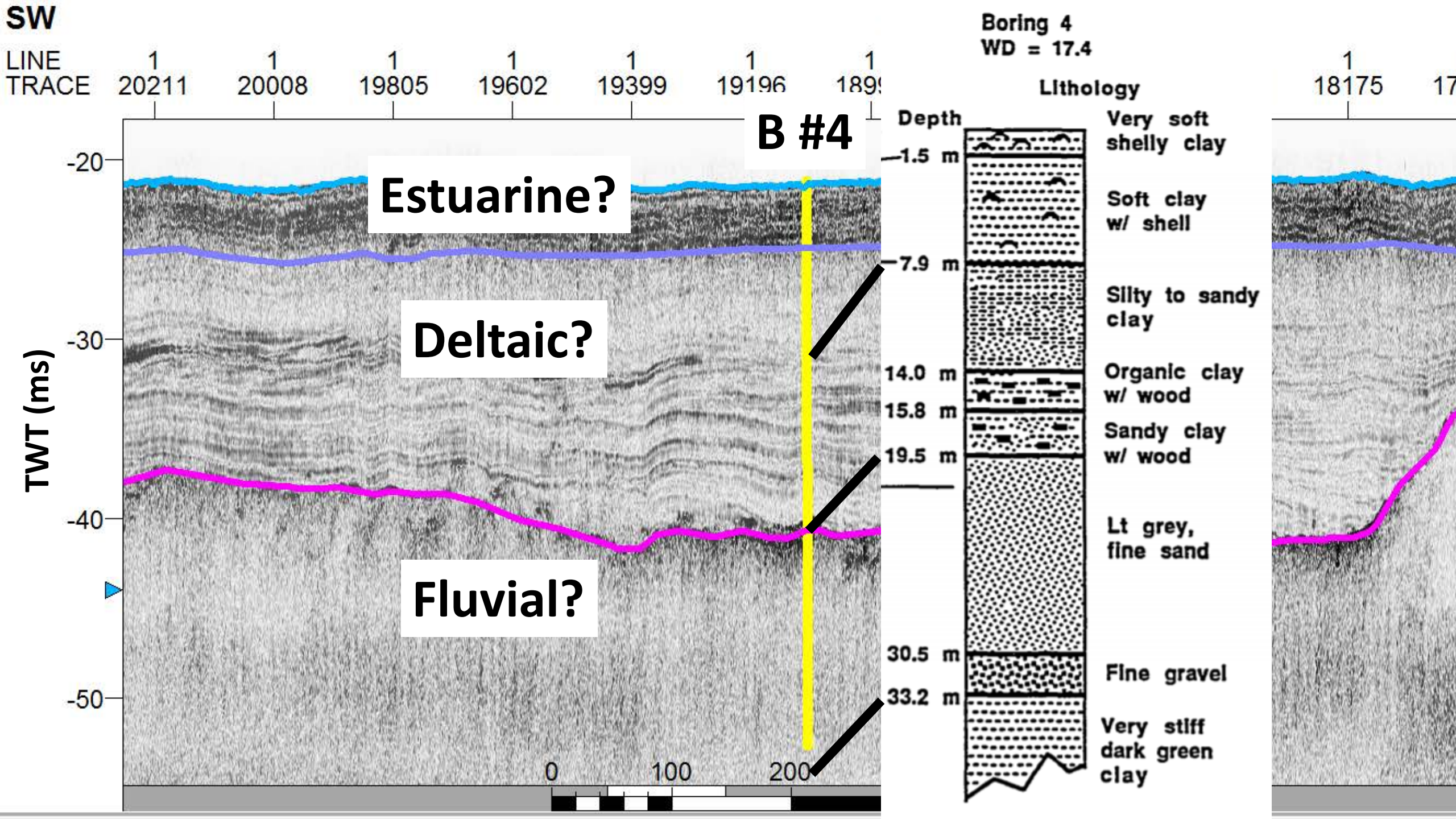
Chirp captures detailed valley stratigraphy

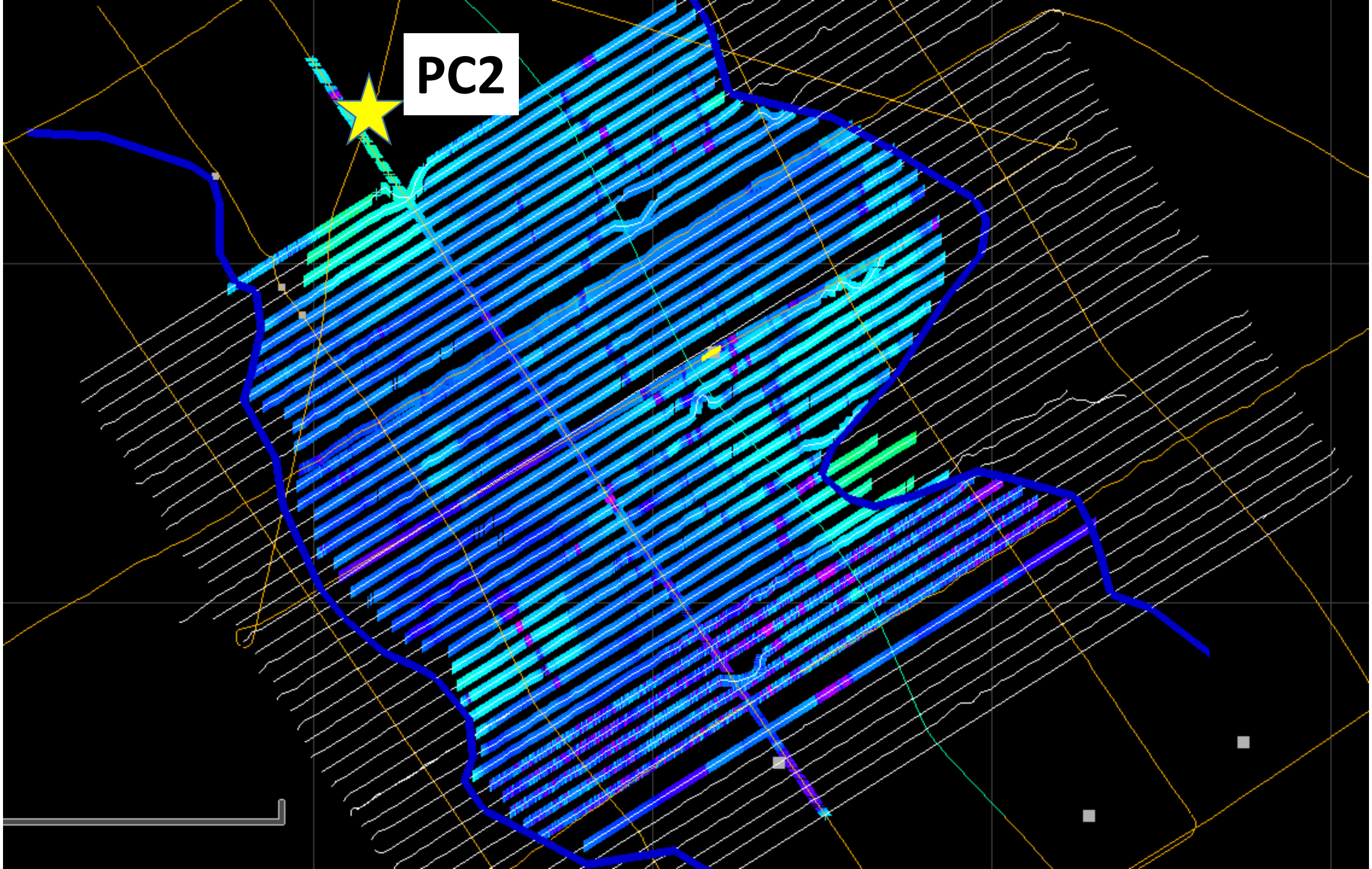



Mapping top of potential fluvial

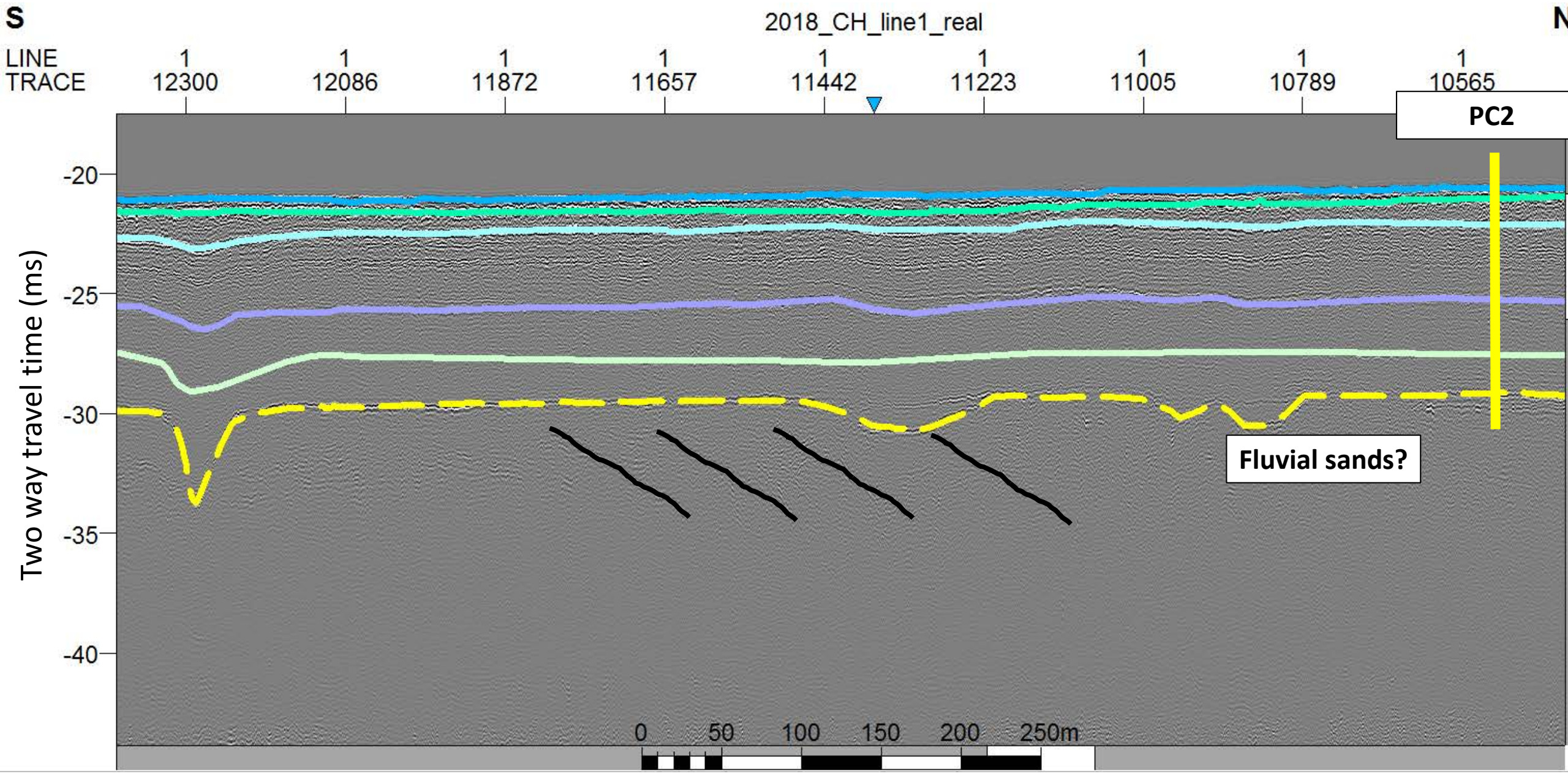

Sinuous channel forms along base
Boring #4


SW
2018_CH_line1_real
2018_CH_line1_envagc
LINE 1 1 1 1 1 1 1 1 1 1 1
TRACE 20211 20008 19805 19602 19399 19196 18992 18789 18585 18380 18175 17
B #4
-20
-30
-40
-50
TWT (ms)
Deltaic/estuarine?
Fluvial?
0 100 200 300 400 500m

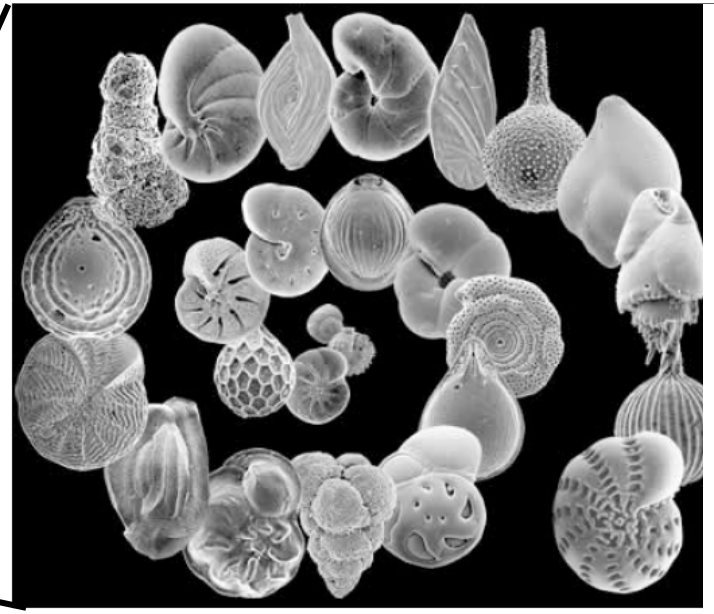

SW
LINE
TRACE
1 20211
1 20008
1 19805
1 19602
1 19399
1 19196
1 18175
B #4
Estuarine?
Deltaic?
Fluvial?
TWT (ms)
-20
-30
-40
-50
0
100
200
Boring 4
WD = 17.4
Lithology
Depth
1.5 m
7.9 m
14.0 m
15.8 m
19.5 m
30.5 m
33.2 m
Very soft shelly clay
Soft clay w/ shell
Silty to sandy clay
Organic clay w/ wood
Sandy clay w/ wood
Lt grey, fine sand
Fine gravel
Very stiff dark green clay

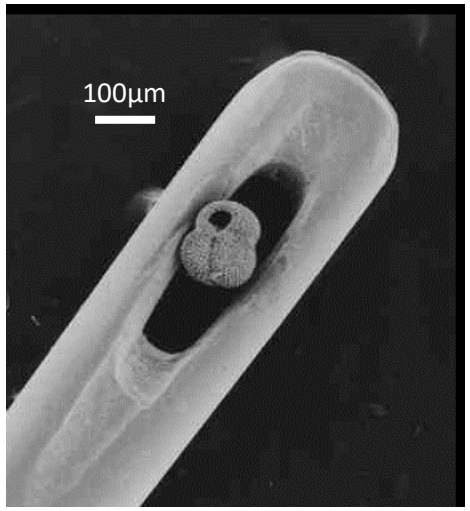

PC2

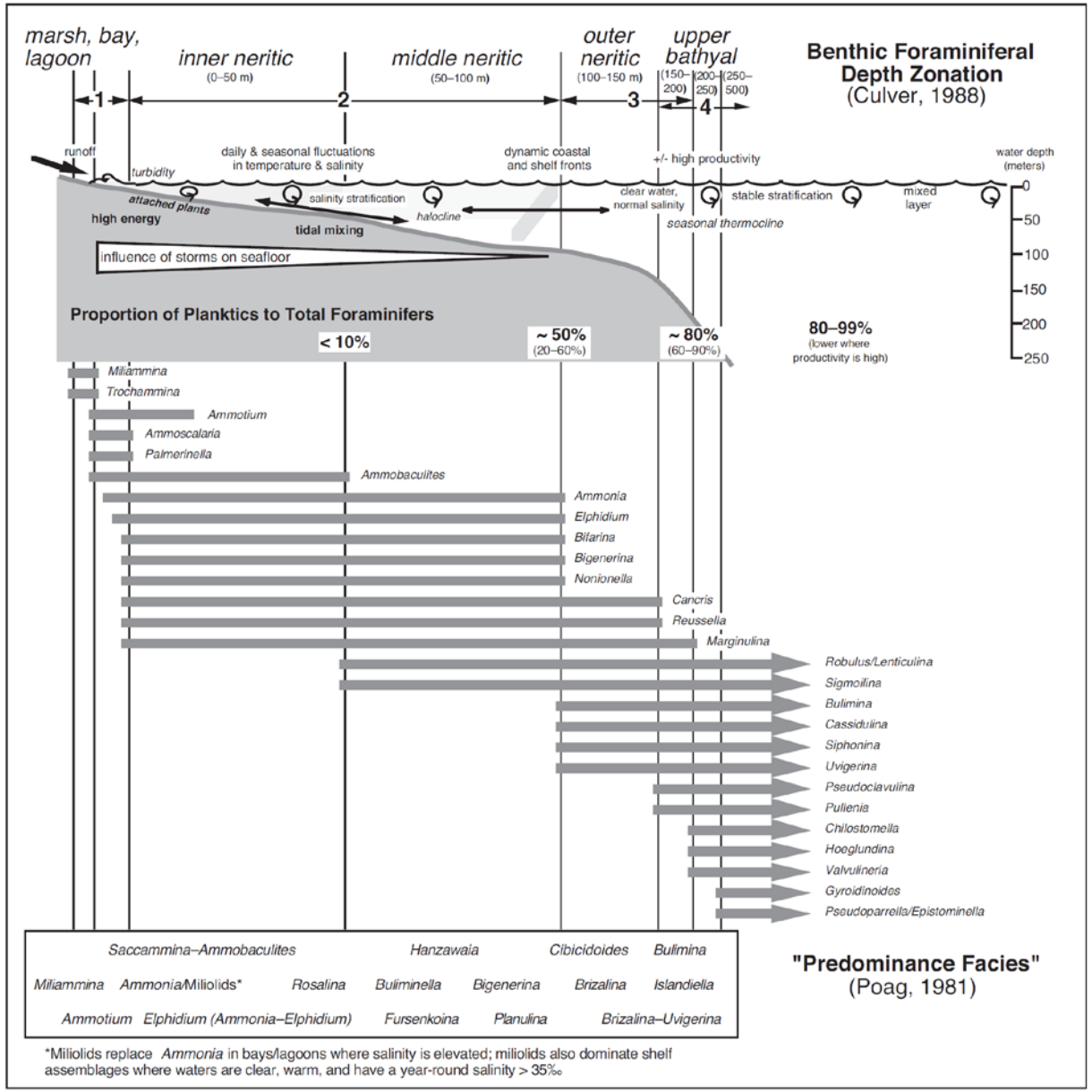
2018 CH Line 10 Real



Foraminifera Provide a Tool to Determine Depositional Environment

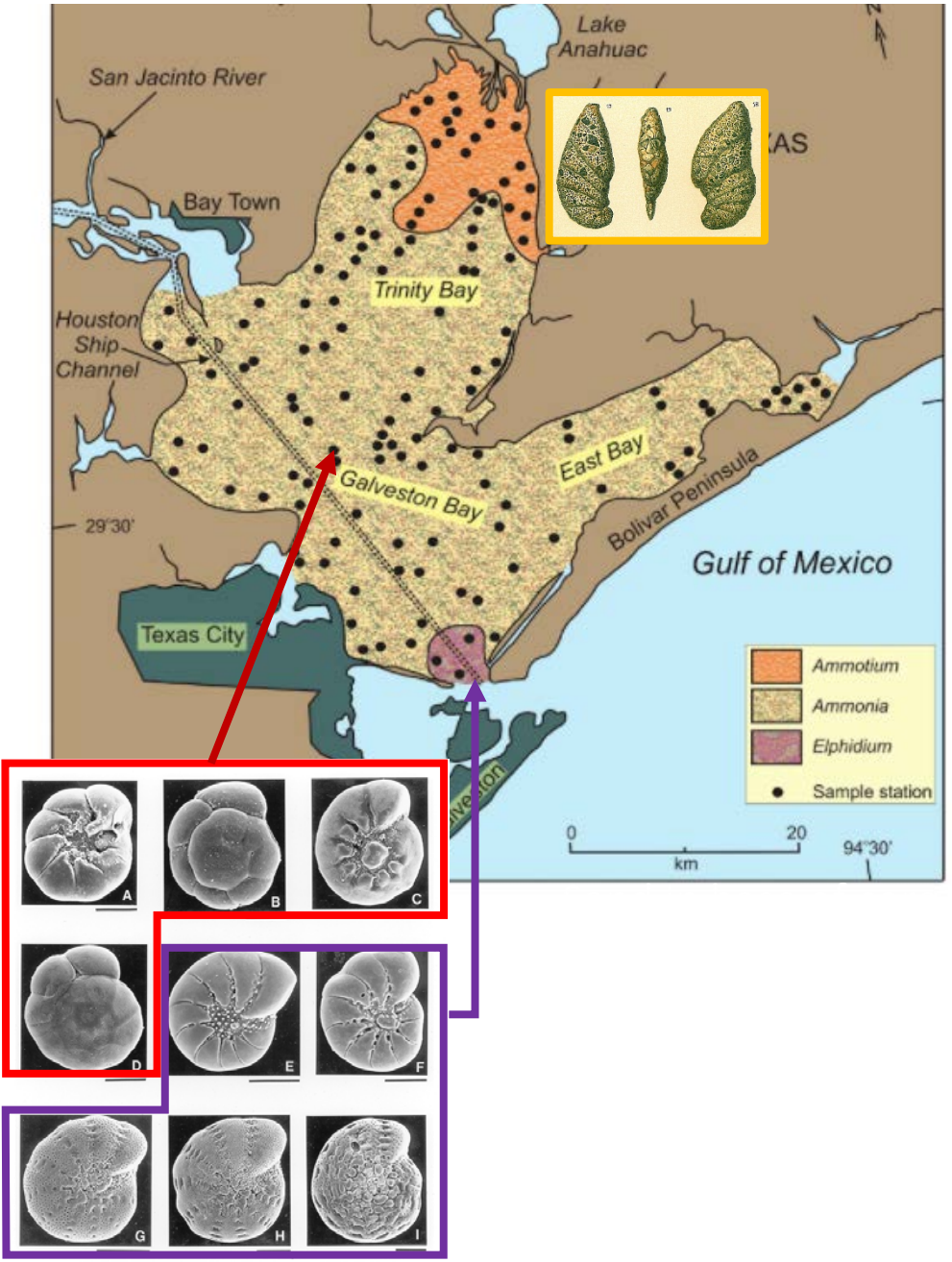




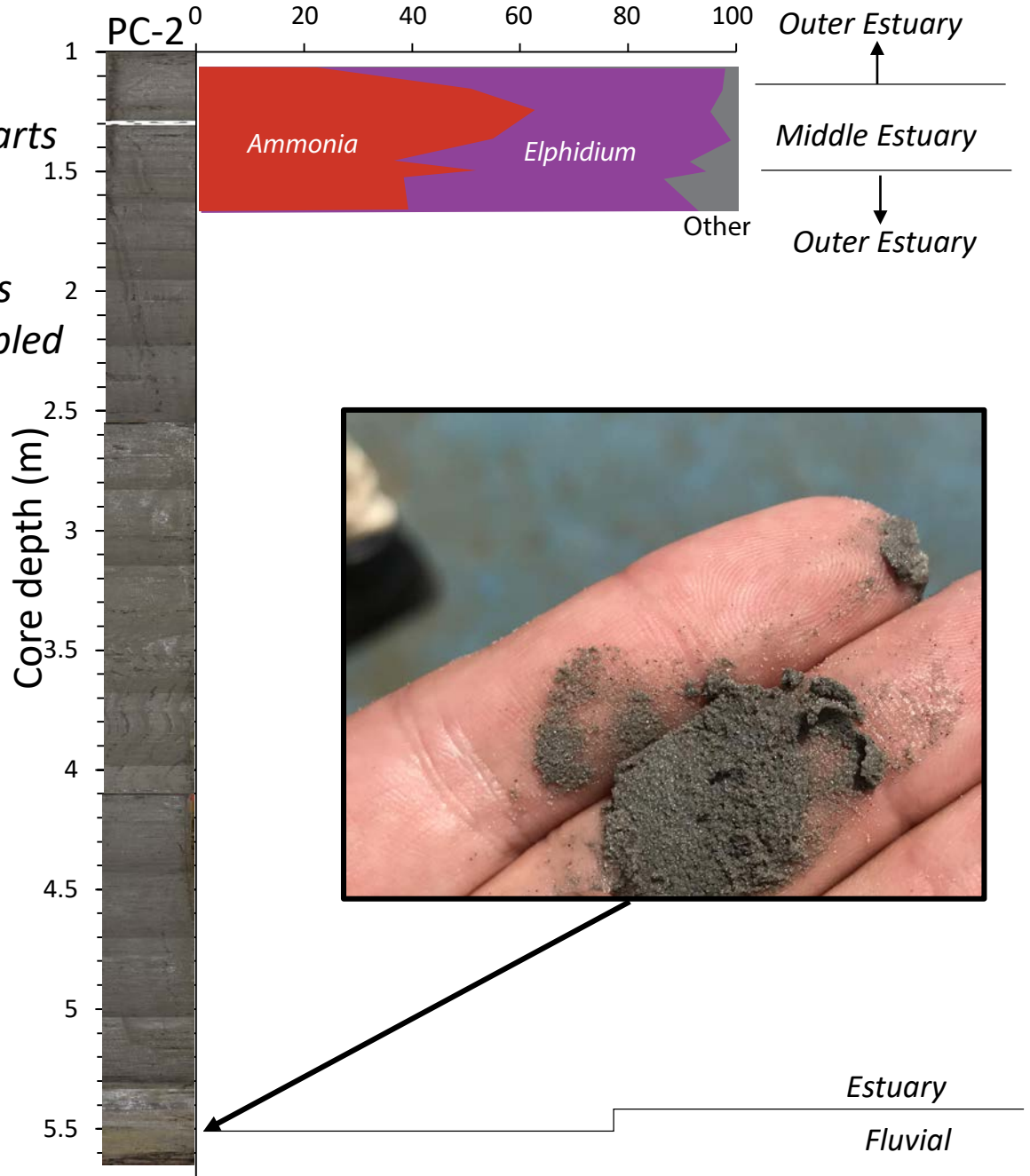


Leckie and Olson, 2003

Foraminifera Show the Fluvial-Estuarine-Open Marine Transitions



Note that core starts at 1 m depth; the upper 1 m is a soupy mess and was not sampled



Future work

- Continued core and geophysical analysis
- C14 dating of core material
- Coring cruise scheduled for this summer (2 days with core and additional geophysics)
- Low frequency (airgun/streamer or boomer) data to image thickness of the fluvial layer
- What’s going on with the other Texas fluvial systems?