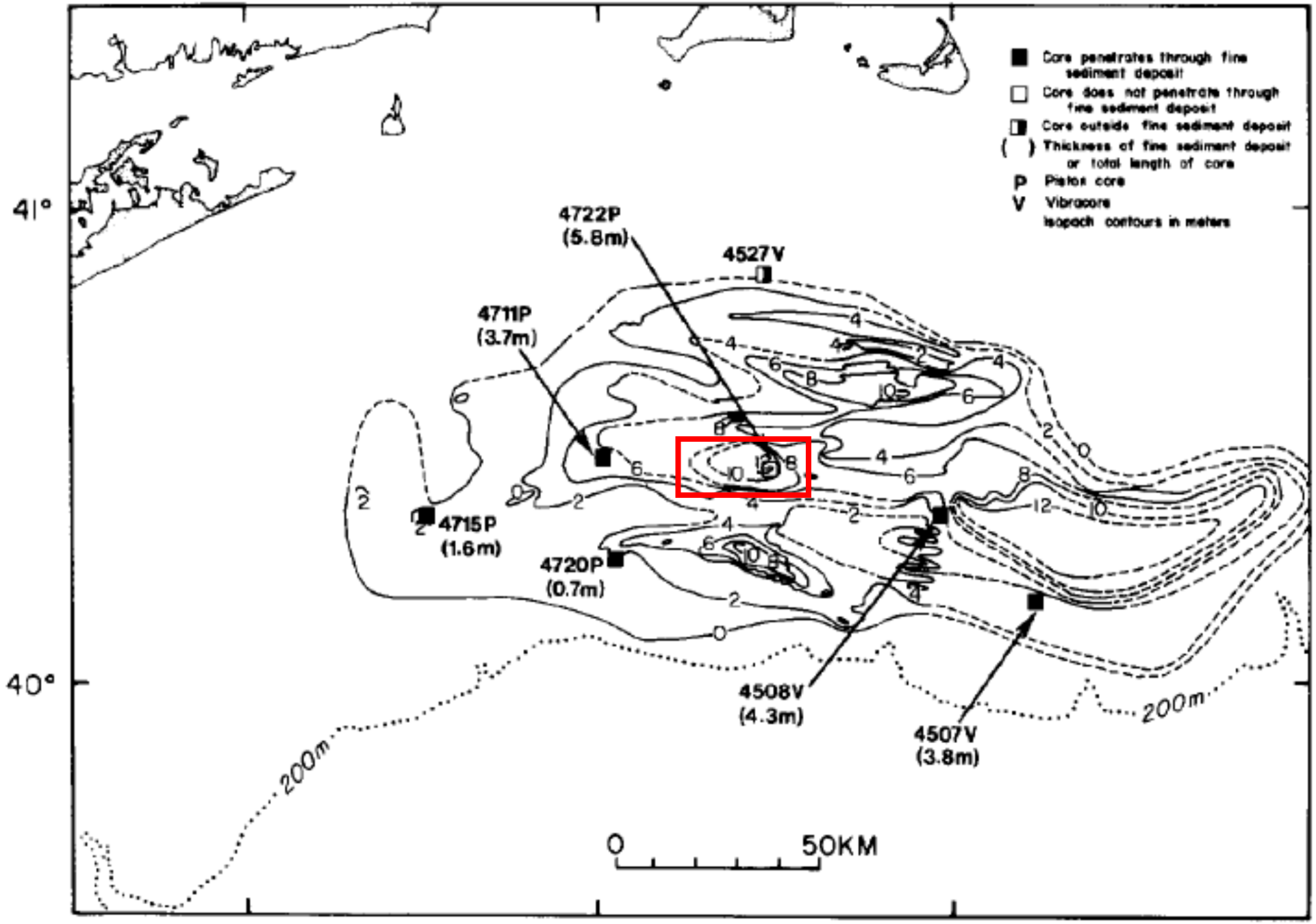
CHIRP Acoustic Reflection Survey Within the New England Mud Patch

R/V Sharp, Cruise DK10-15, Leg 1
22 July 2015 - 2 August 2015

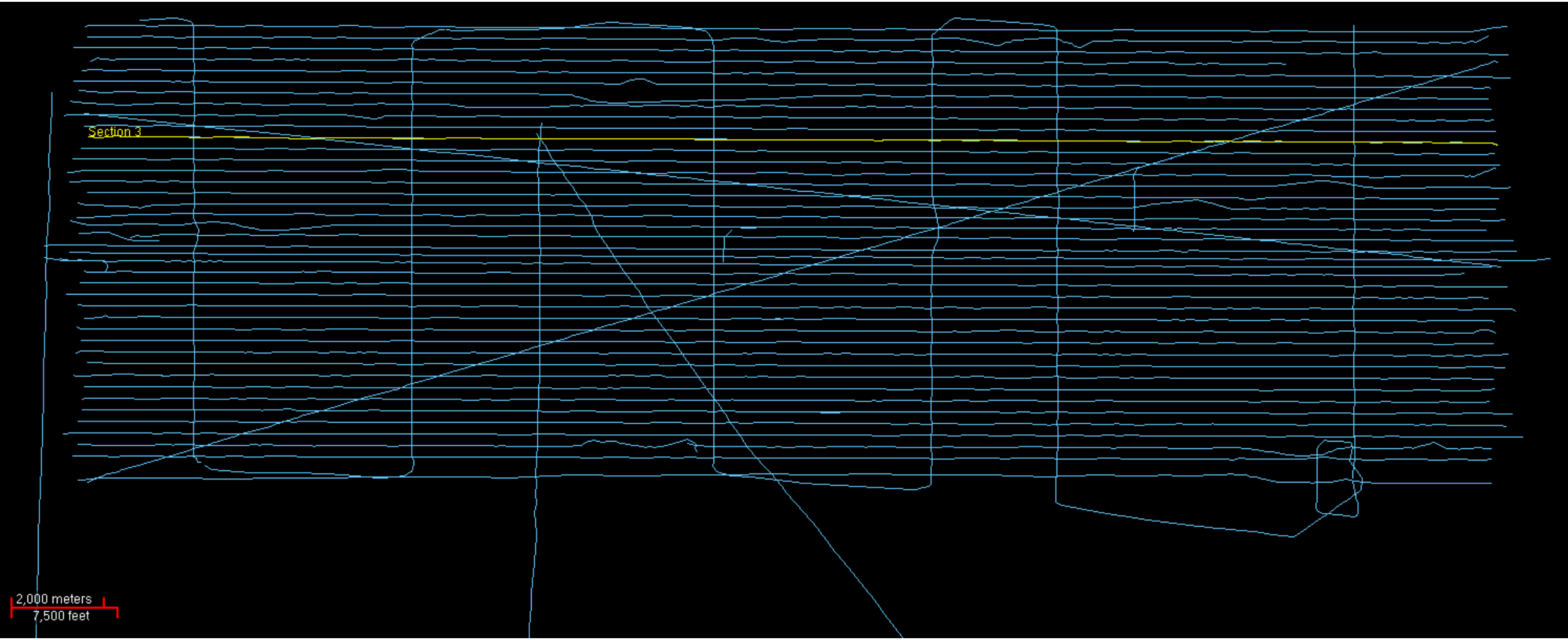
PI: John Goff
University of Texas Institute for Geophysics



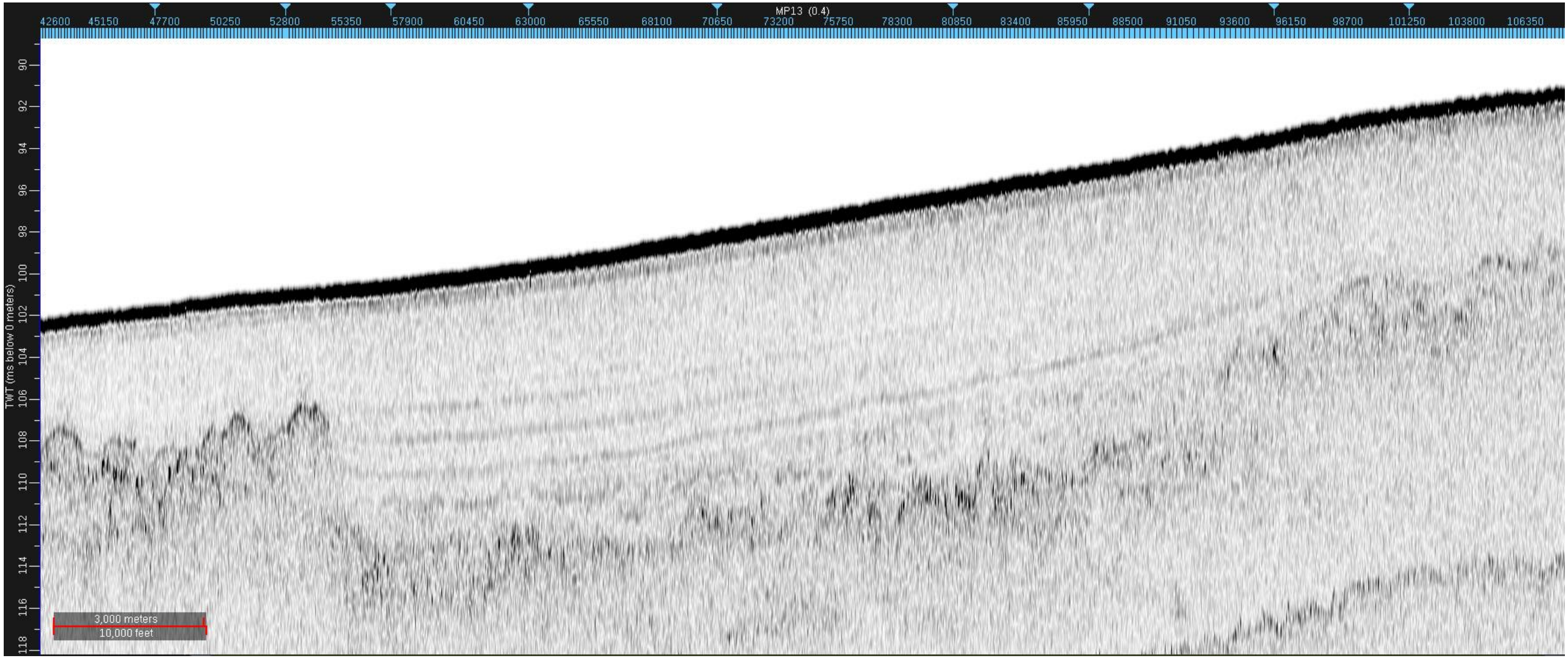
Twichell et al., 1981

CHIRP Data Examples and Reflector Interpretations

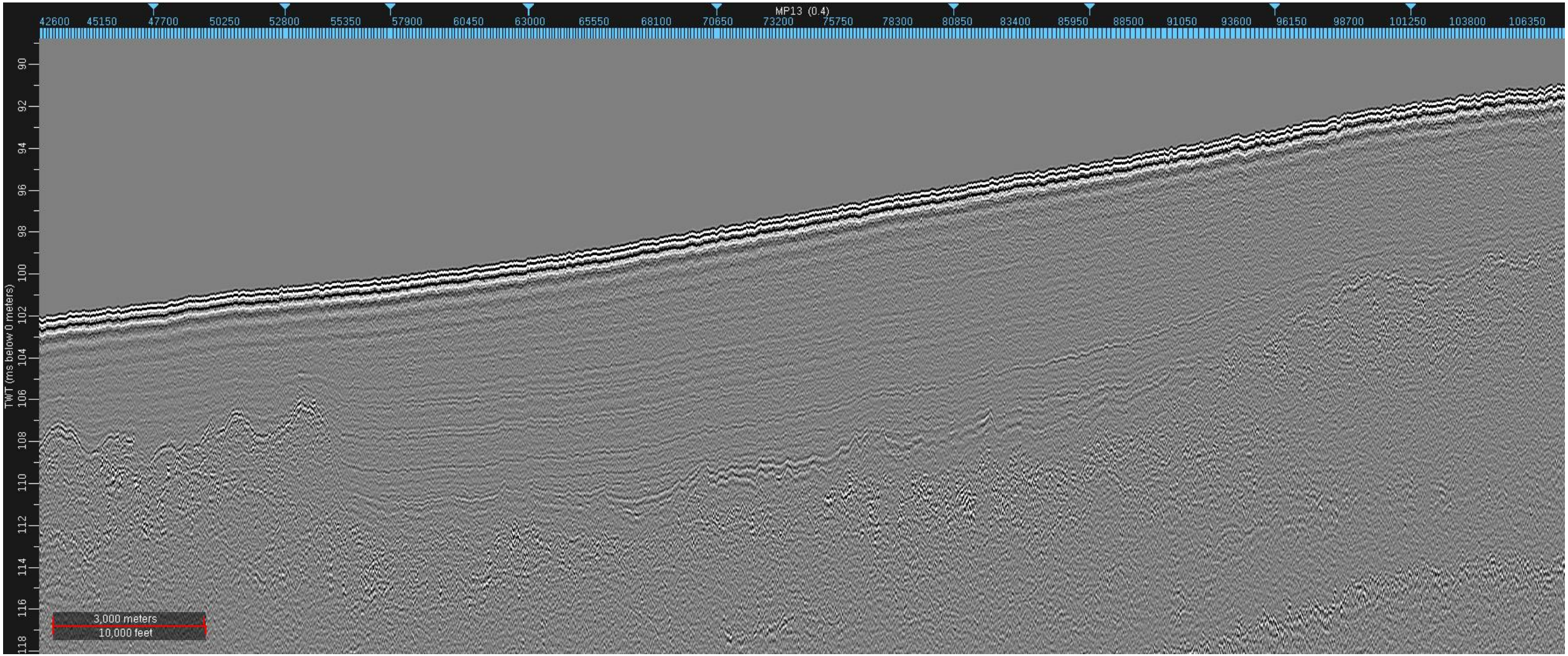
Line mp13 trackline



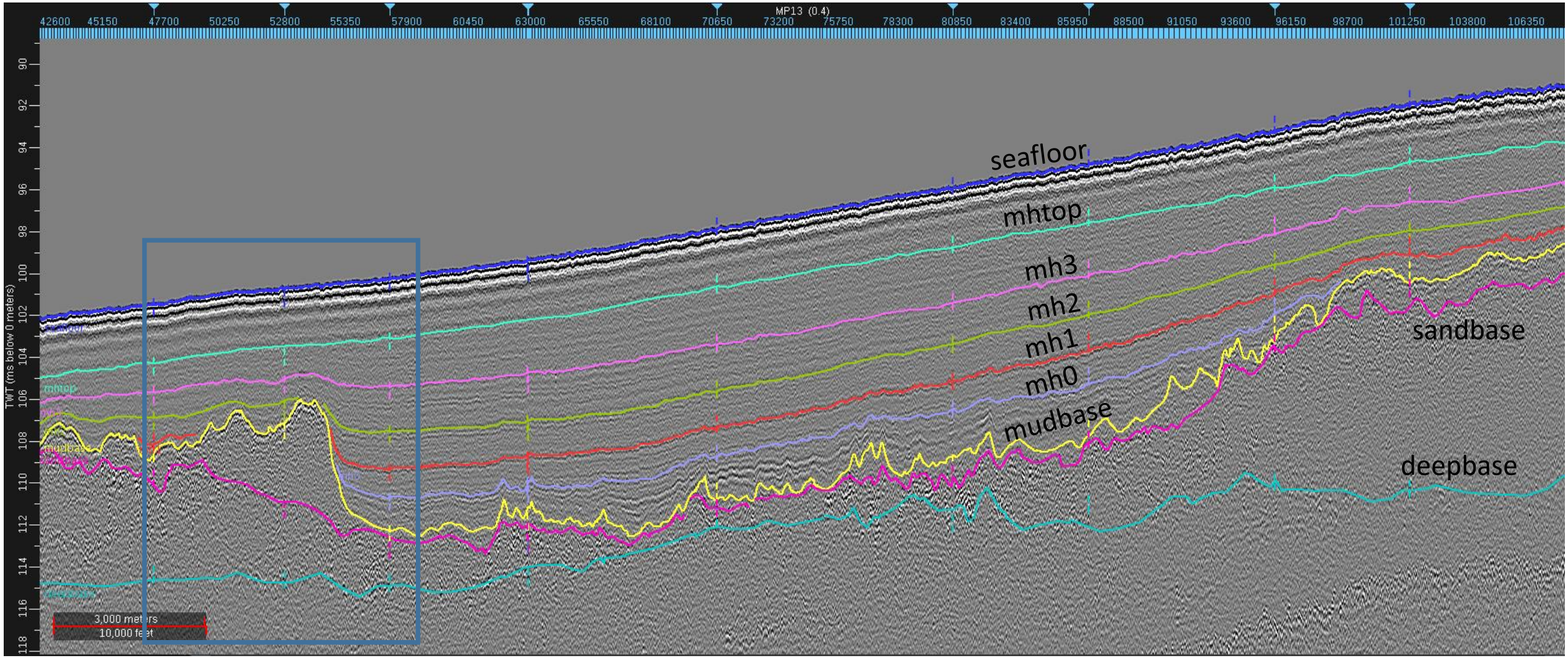
Line mp13, envelope record



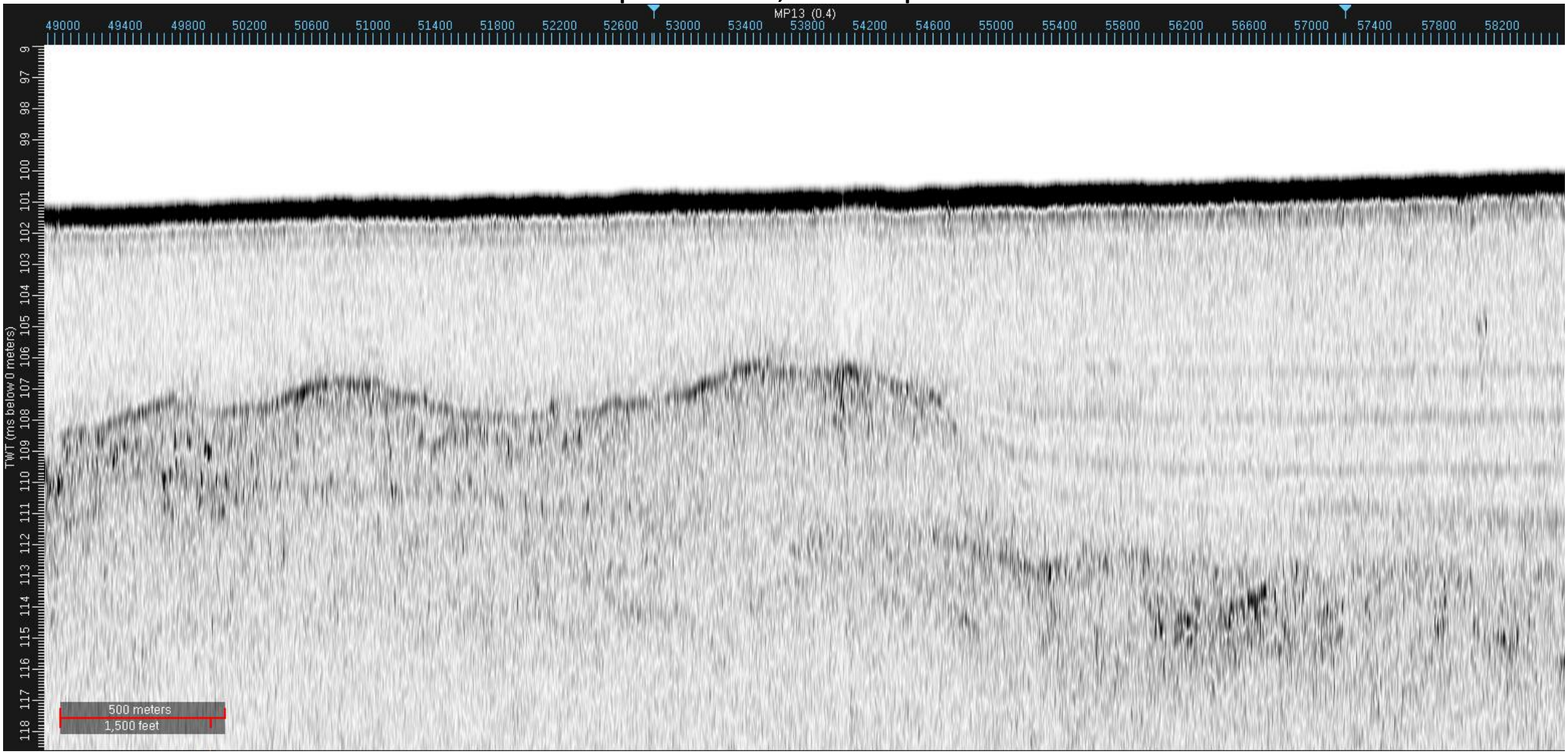
Line mp13, waveform record



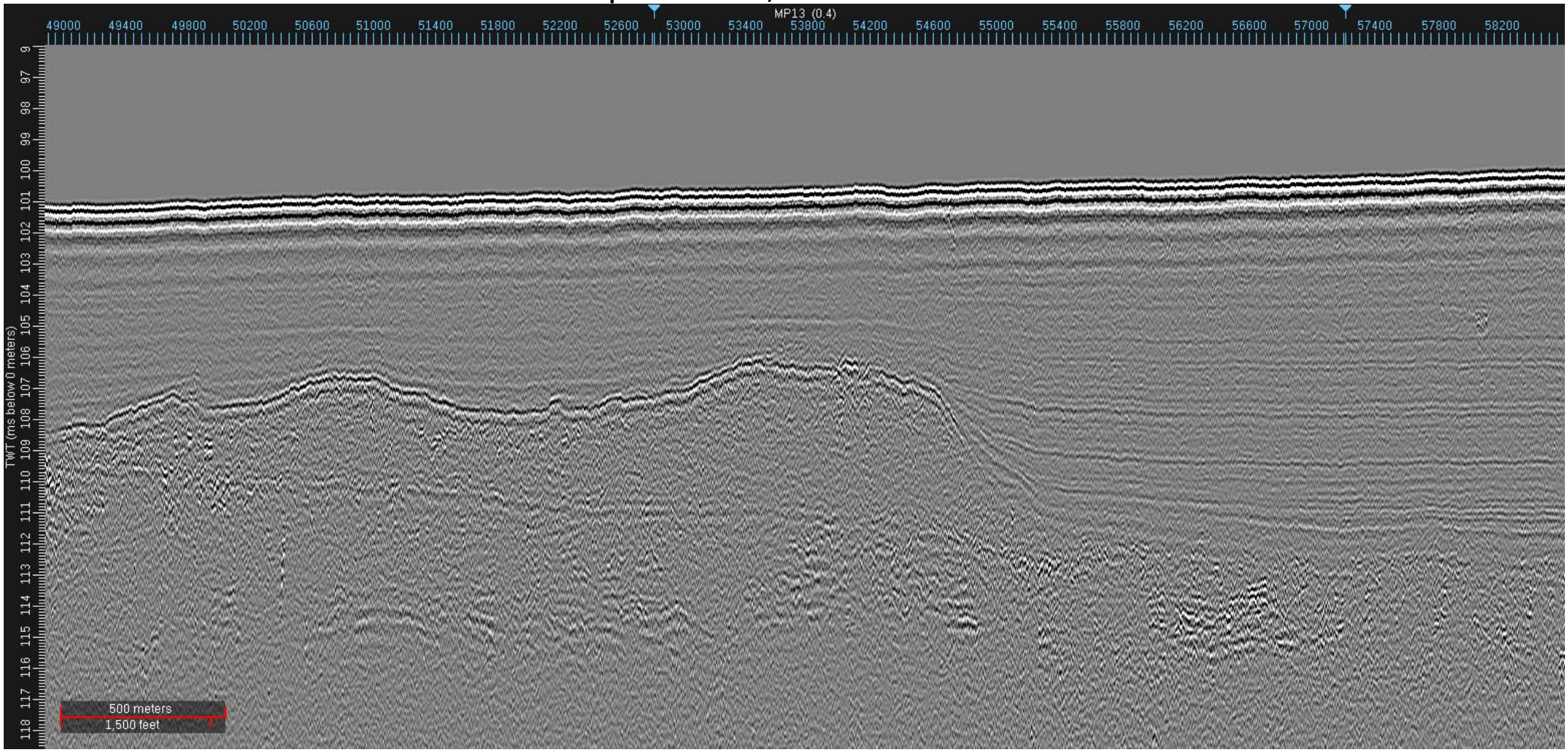
Line mp13, Interpreted



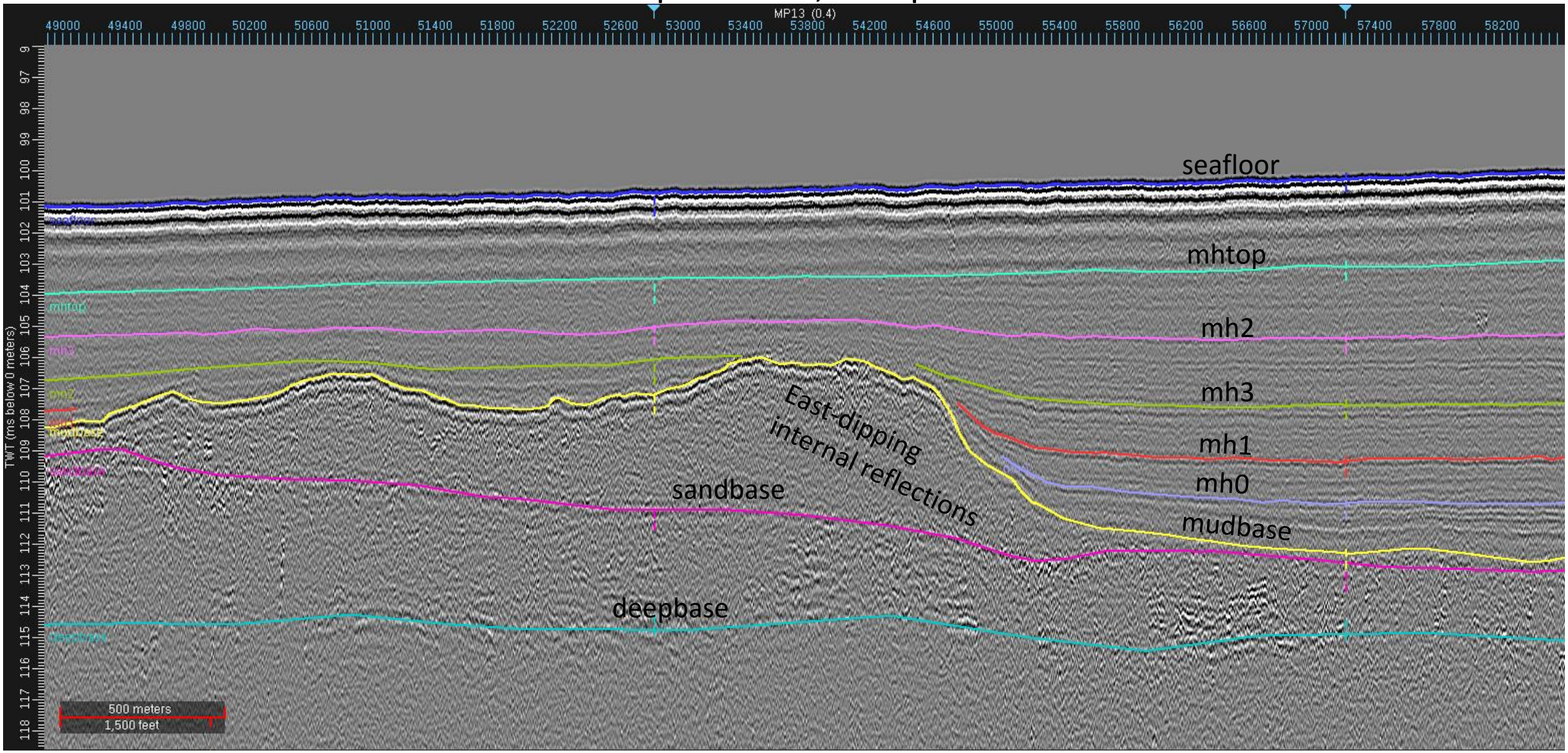
Line mp13 detail, envelope record



Line mp13 detail, waveform record

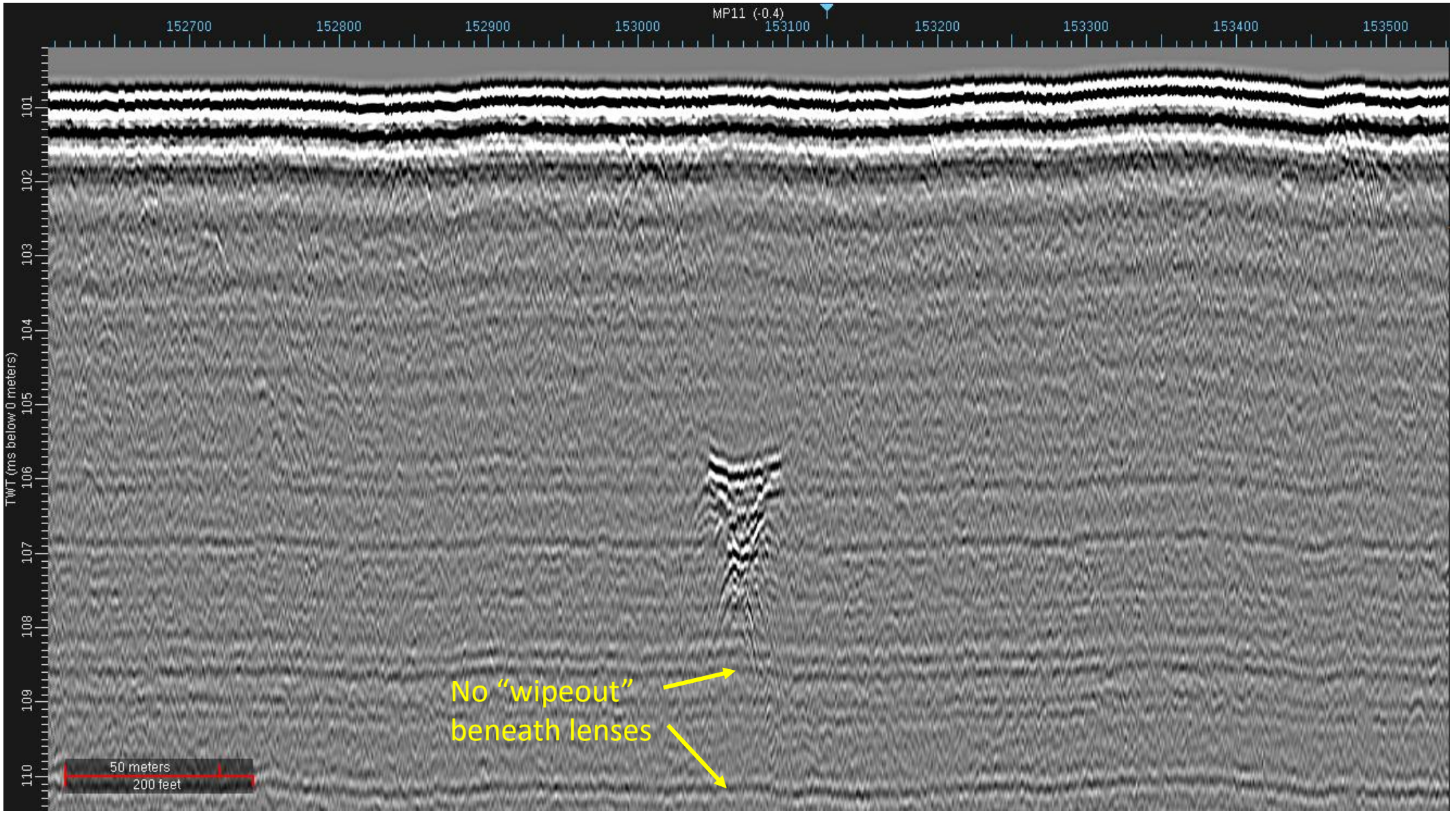


Line mp13 detail, interpreted

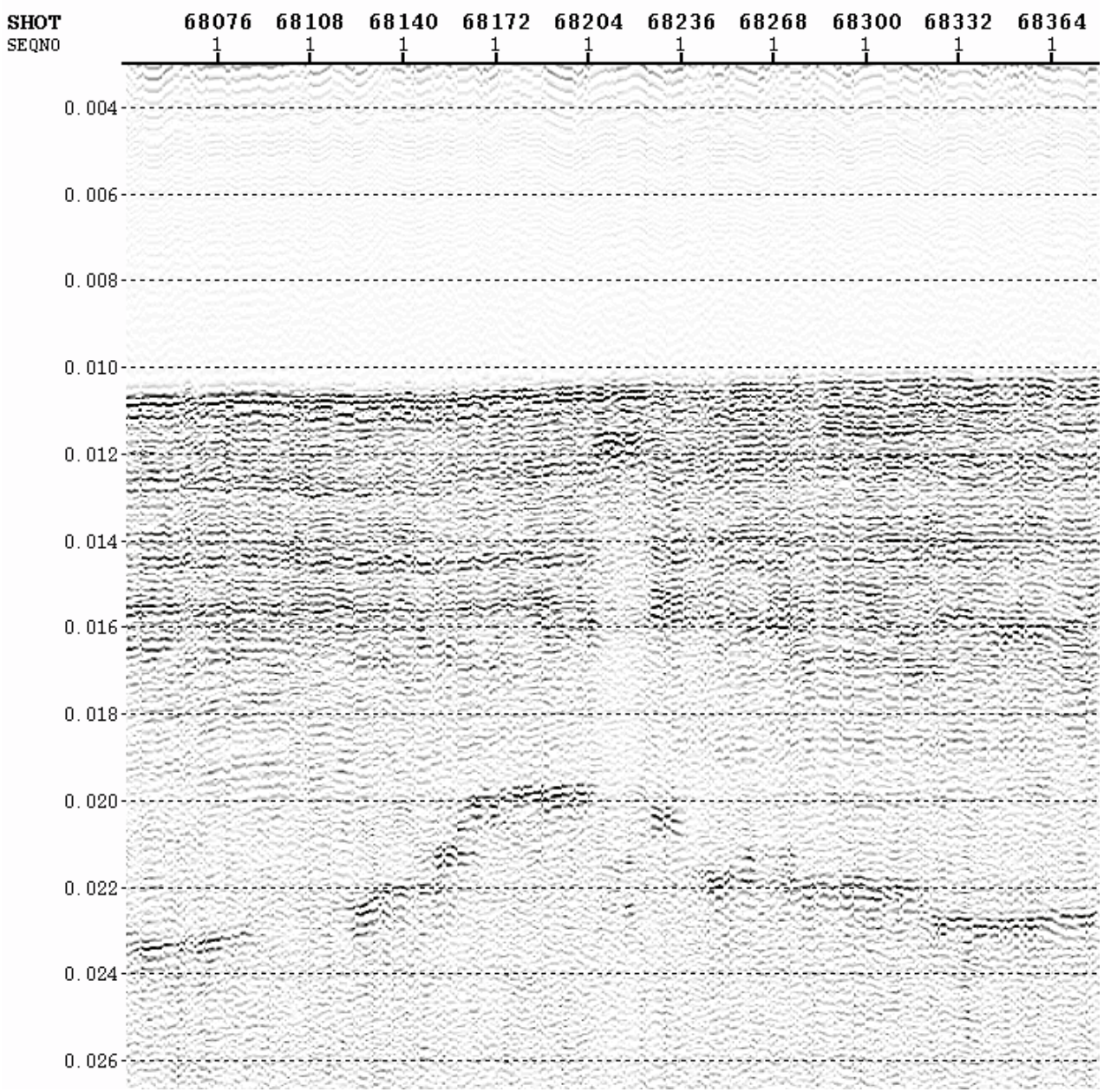


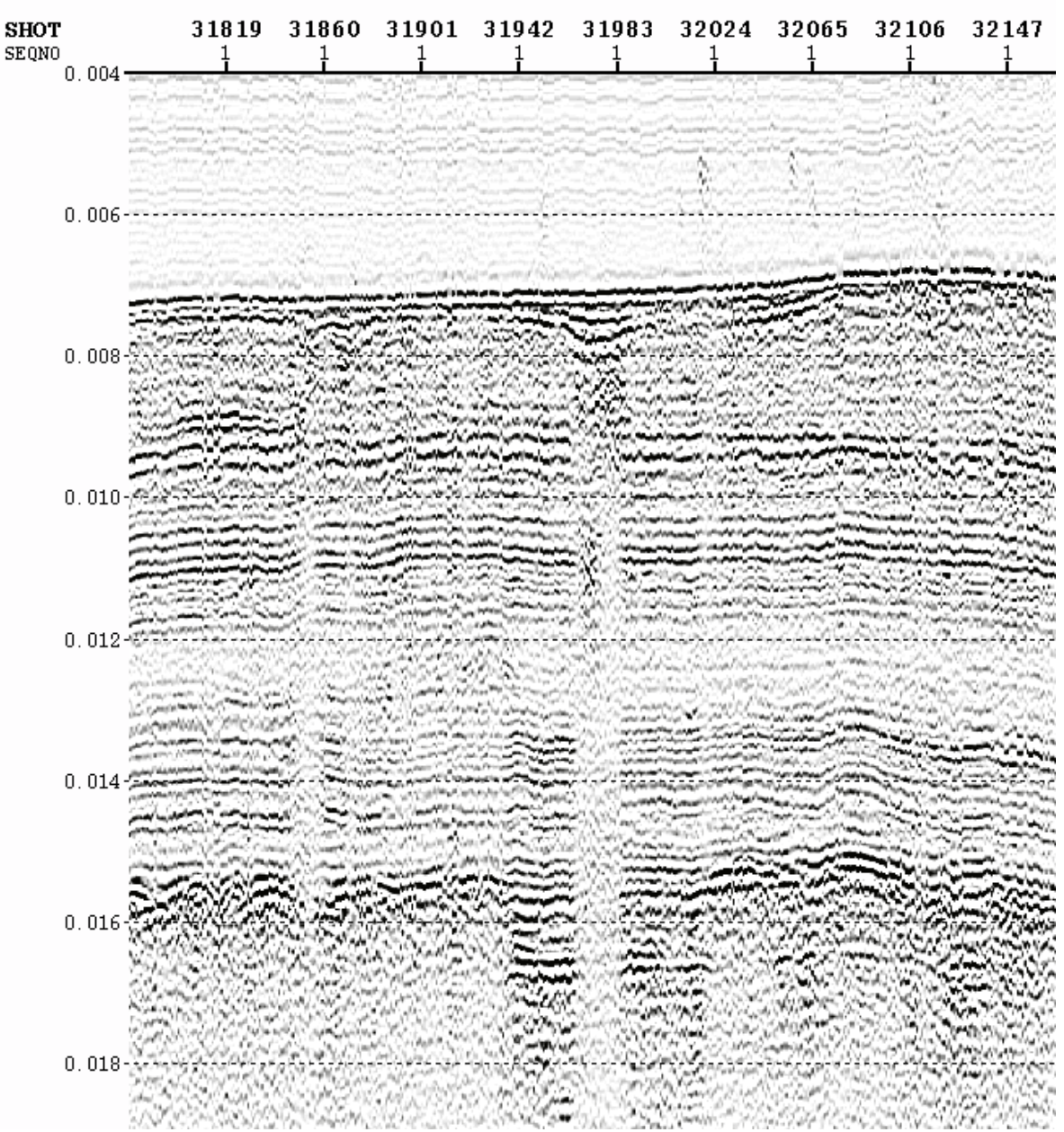
Bright Lenses

Line mp11



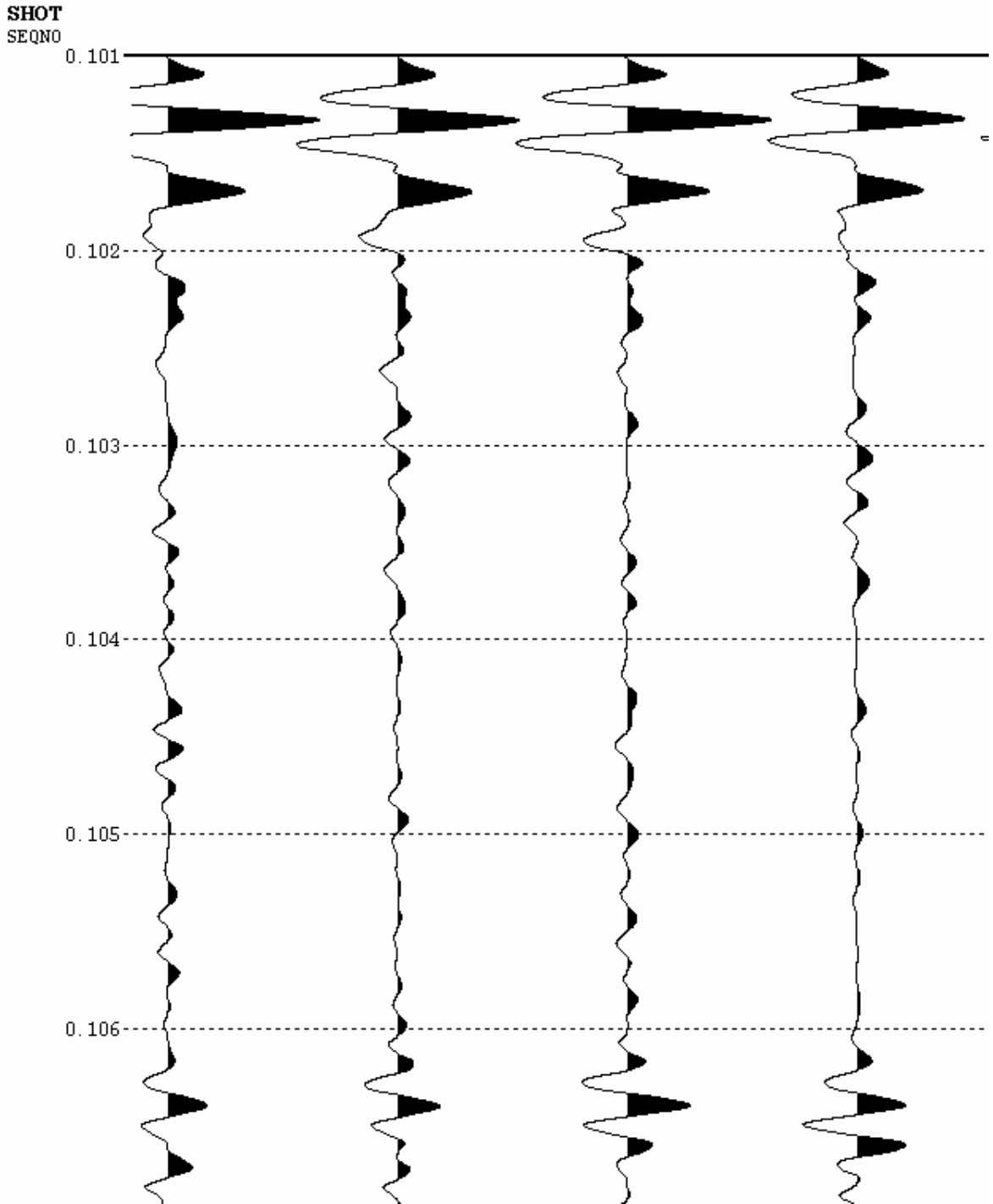
Gas wipeouts – Grand Isle, LA





Bright lenses are positive impedance contrasts with no evidence of wipeout below. They are therefore neither gas nor fluid inclusions.

Best guess is that they are isolated shell or sand bodies.

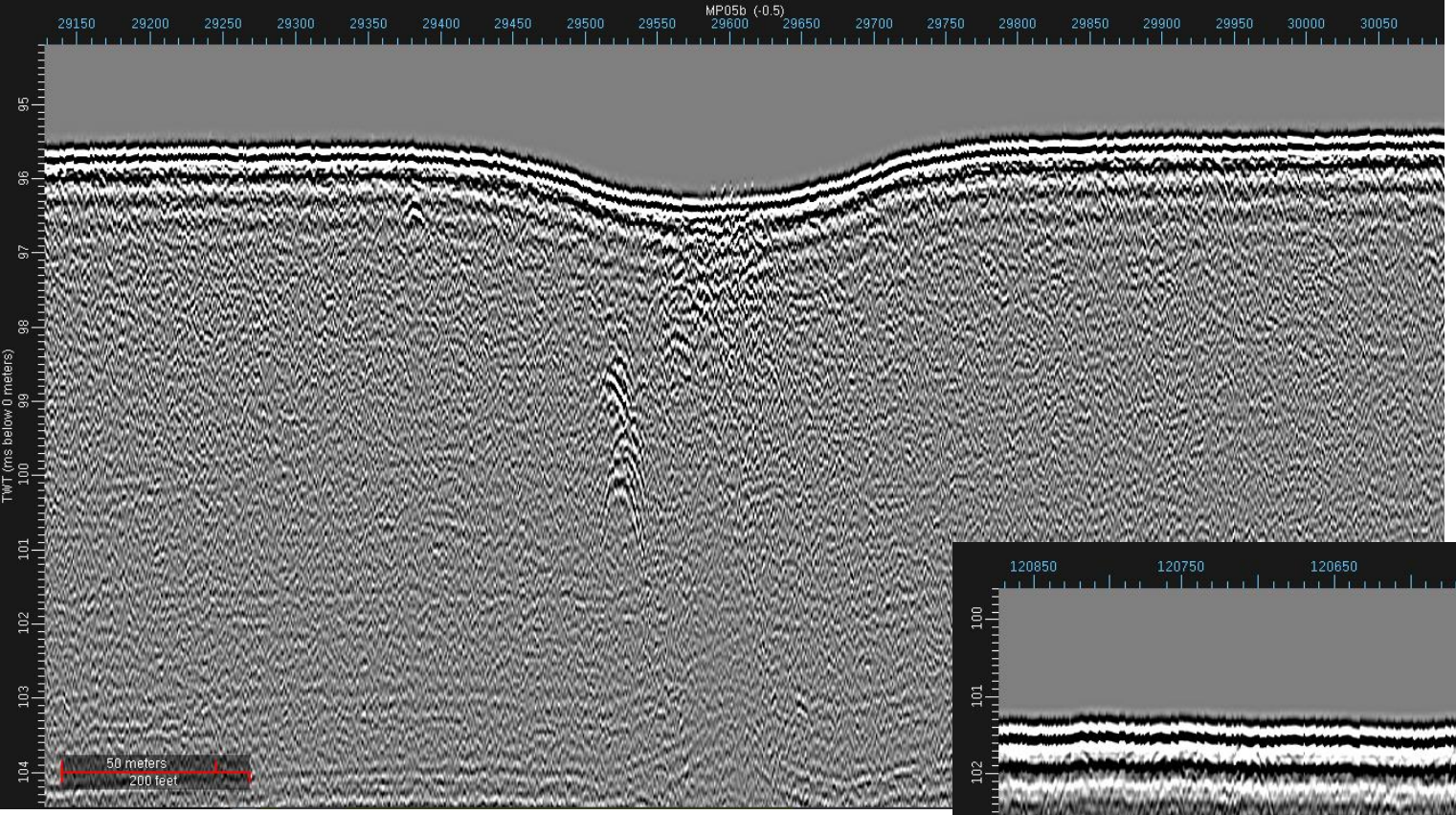


Seafloor

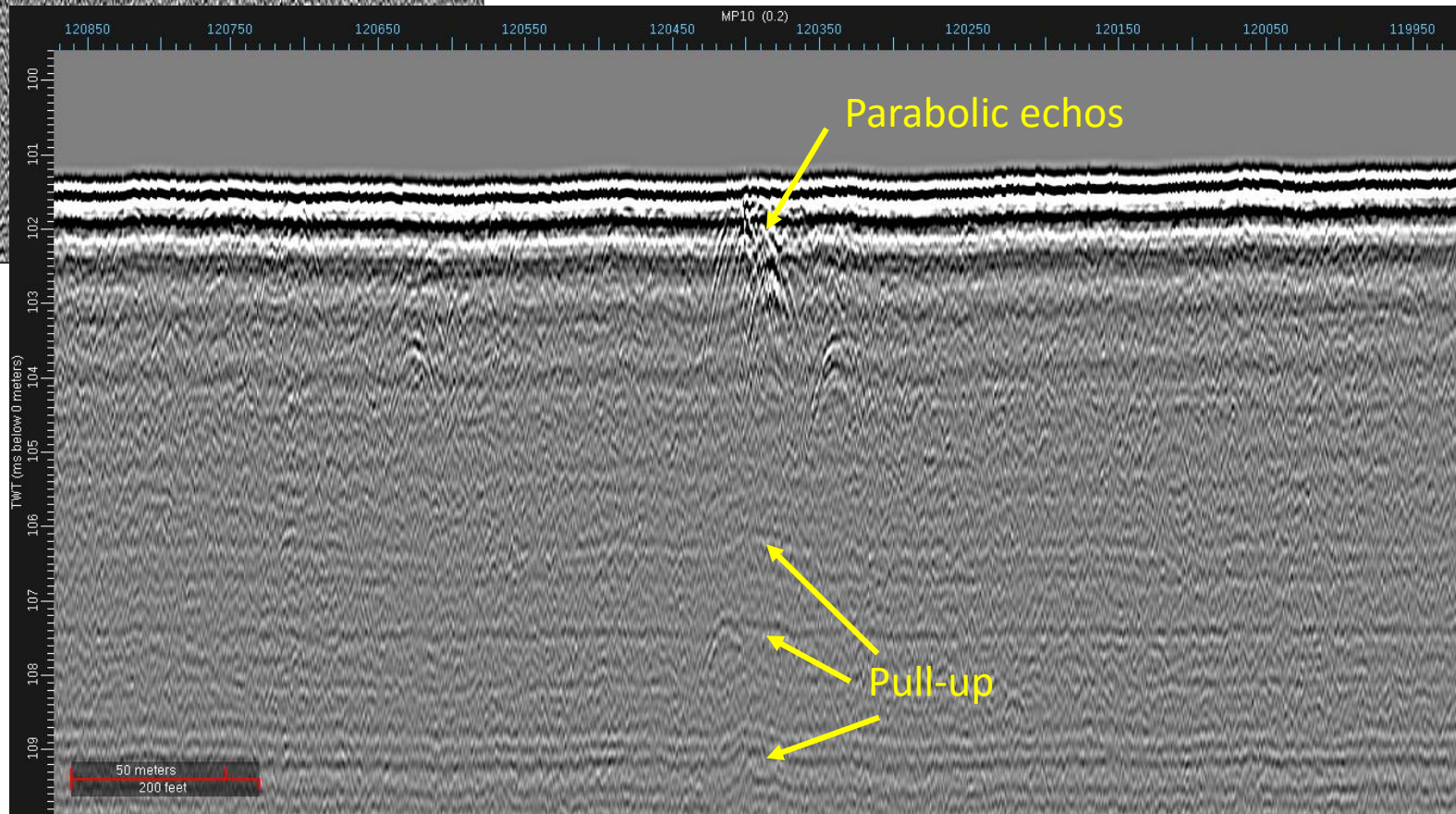
Top of bright lens

Seafloor Depressions

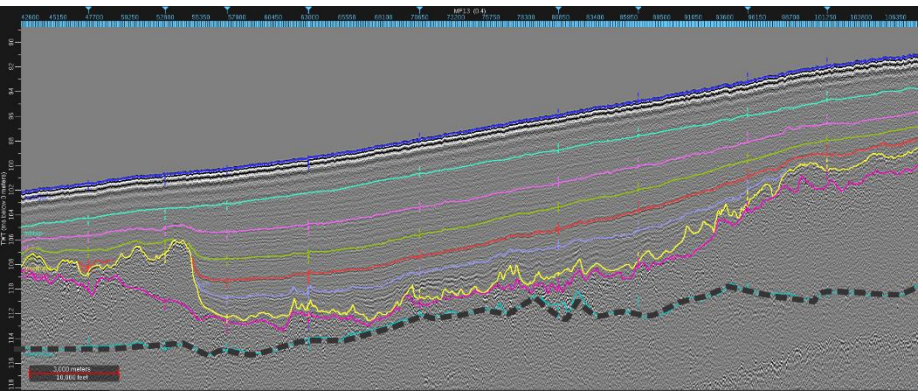
Line mp05b: Large seafloor depression (only one this big)

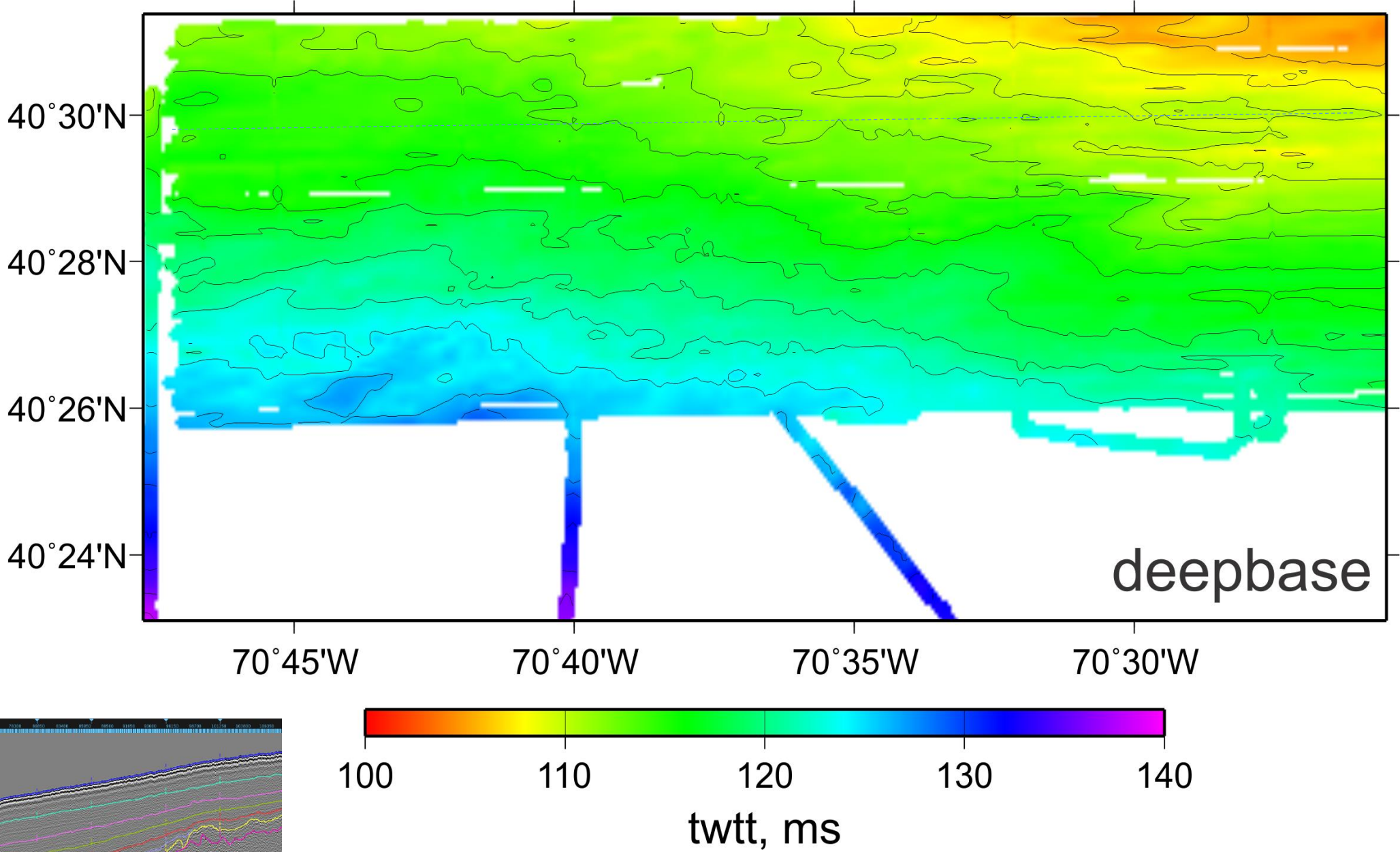


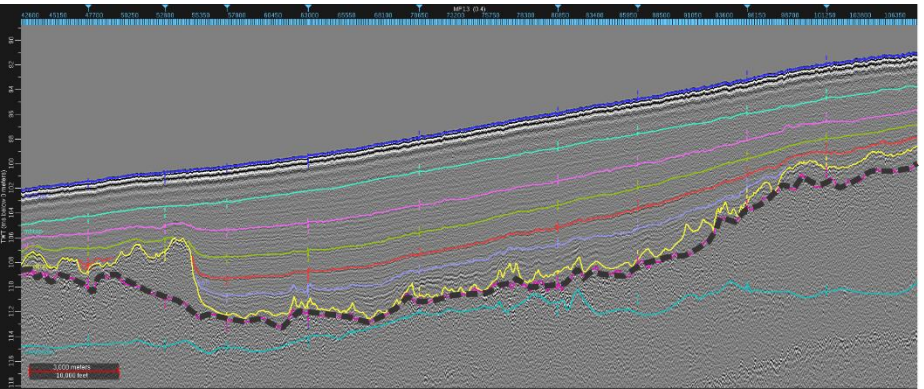
Line mp10: typical small seafloor depression, observed by “pull-up” of subsurface horizons after heave filtering has been applied, as well as parabolic echos at seafloor, indicative of something hard within.

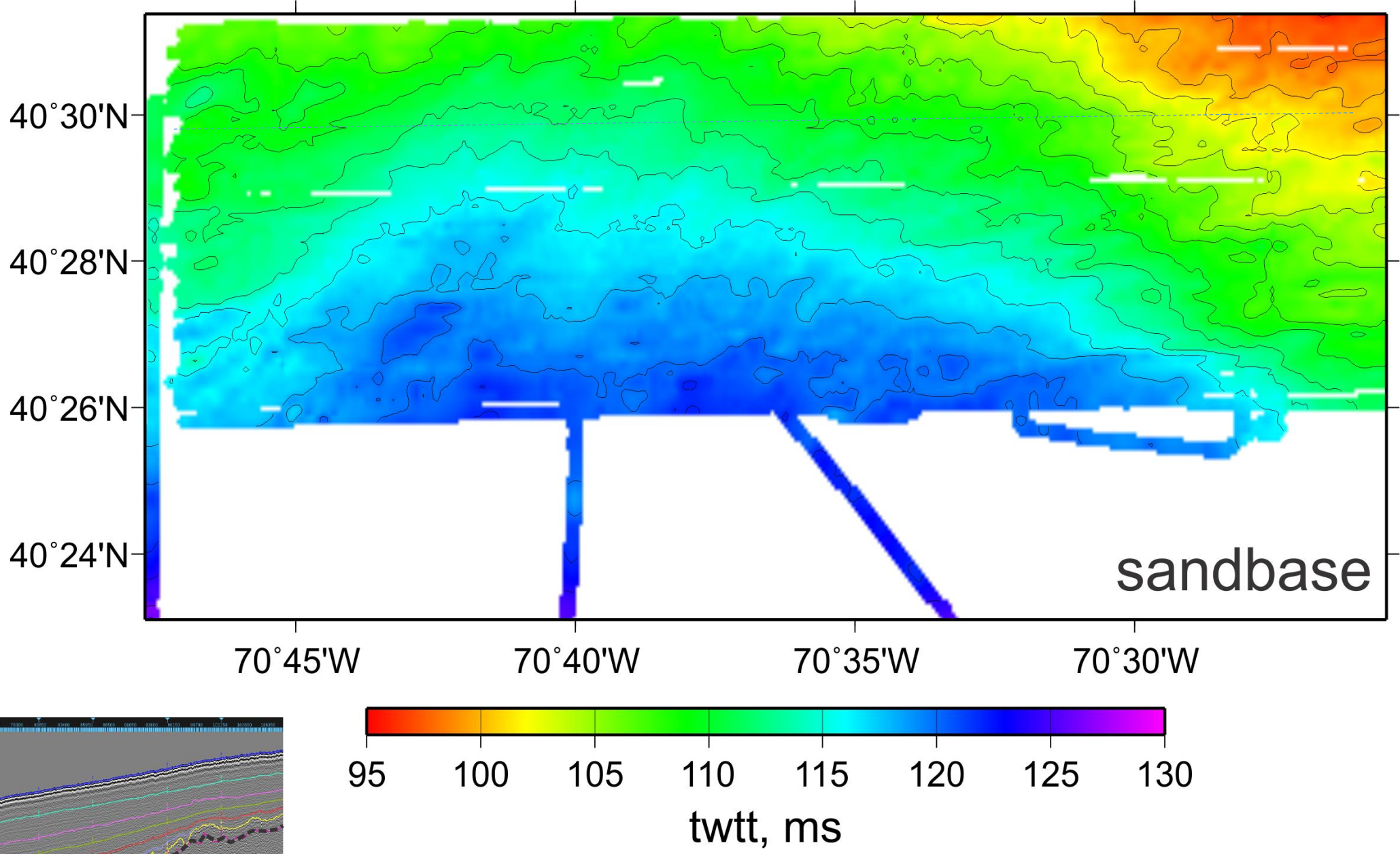


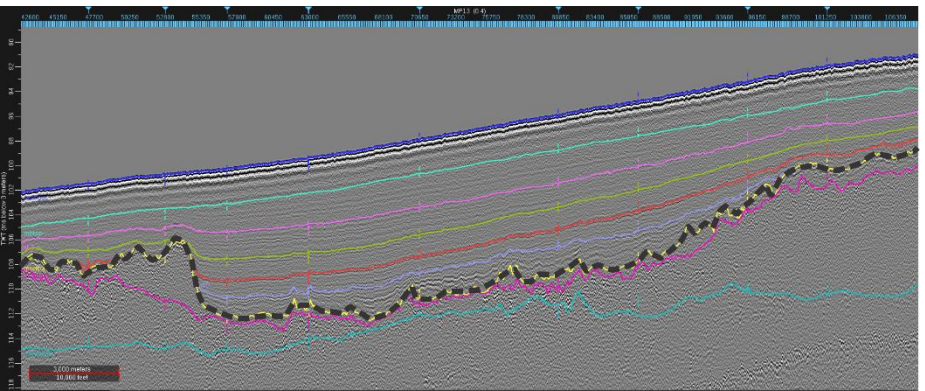
Structure Maps of Interpreted Horizons

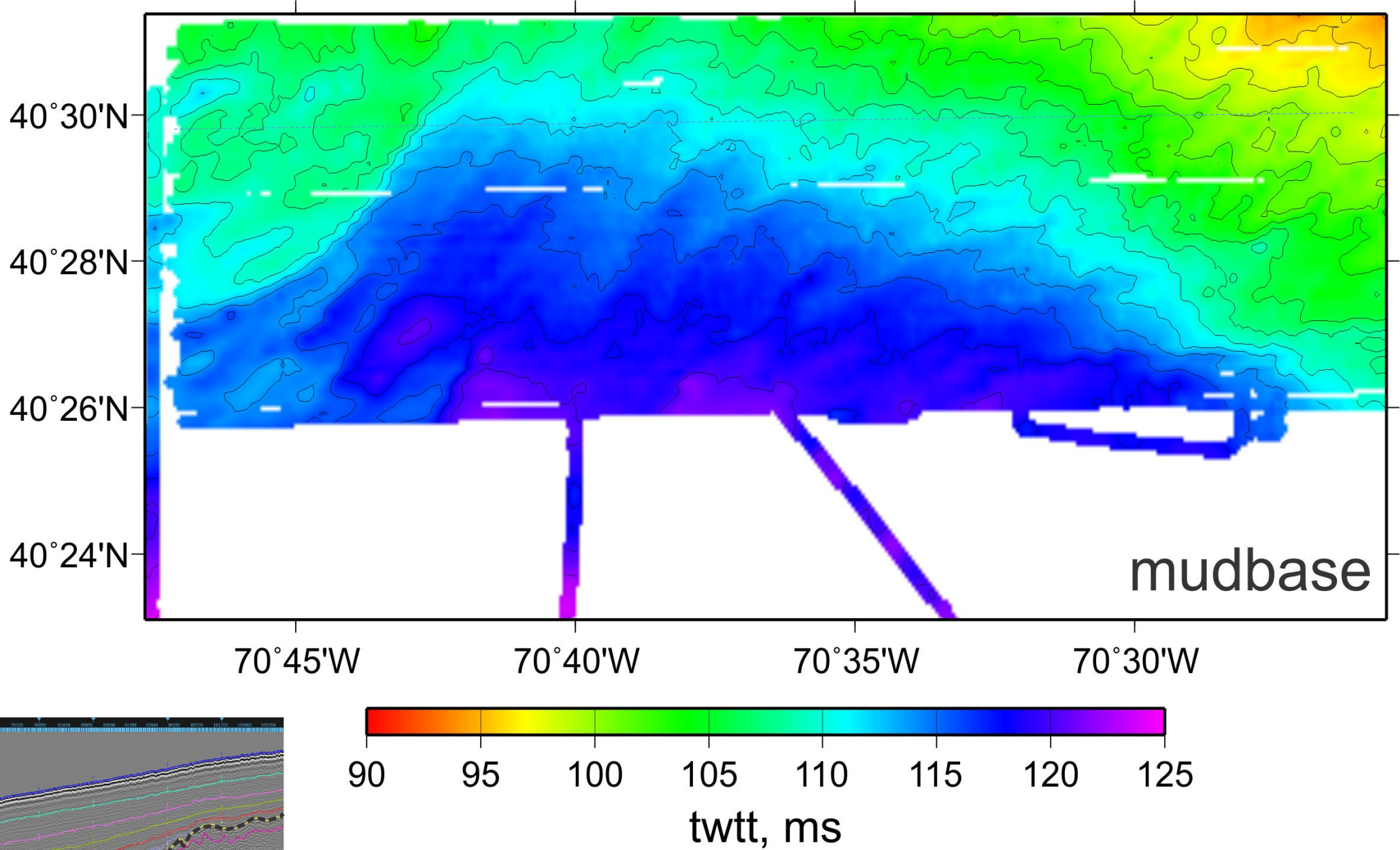



40˚30'N
40˚28'N
40˚26'N
40˚24'N
70˚45'W
70˚40'W
70˚35'W
70˚30'W
deepbase
100
110
120
130
140
twtt, ms

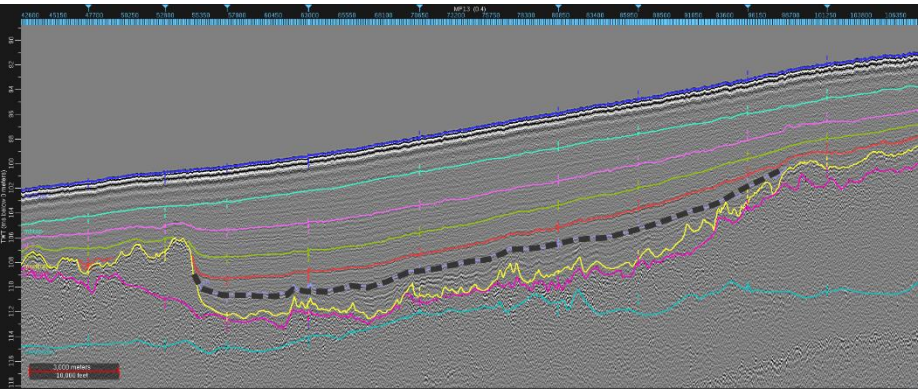


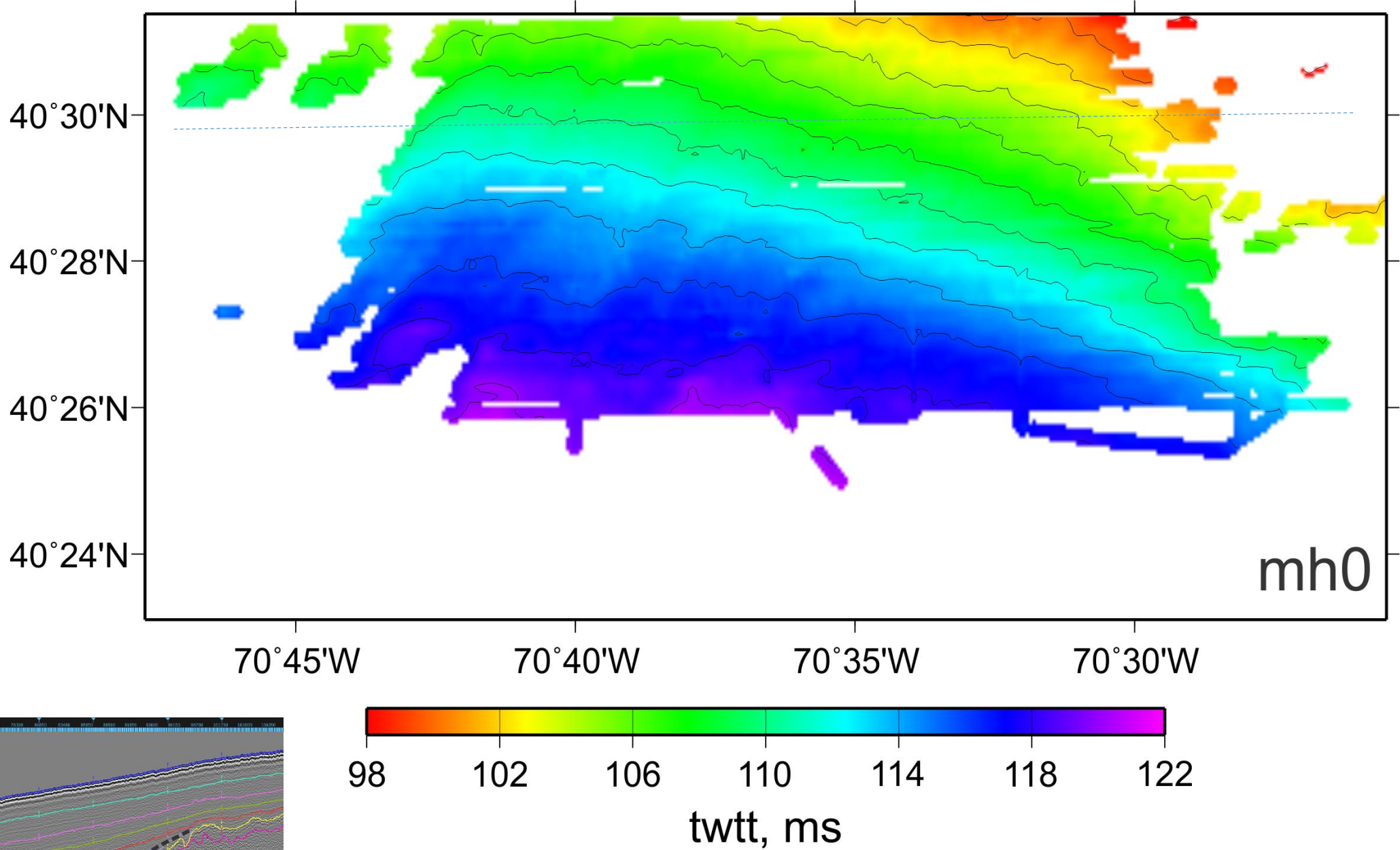

40˚30'N
40˚28'N
40˚26'N
40˚24'N
70˚45'W
70˚40'W
70˚35'W
70˚30'W
sandbase
95
100
105
110
115
120
125
130
twtt, ms



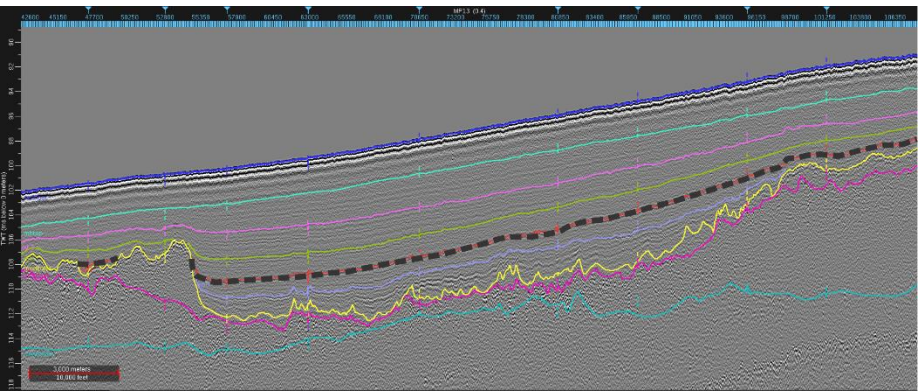

40˚30'N
40˚28'N
40˚26'N
40˚24'N
70˚45'W
70˚40'W
70˚35'W
70˚30'W
mudbase

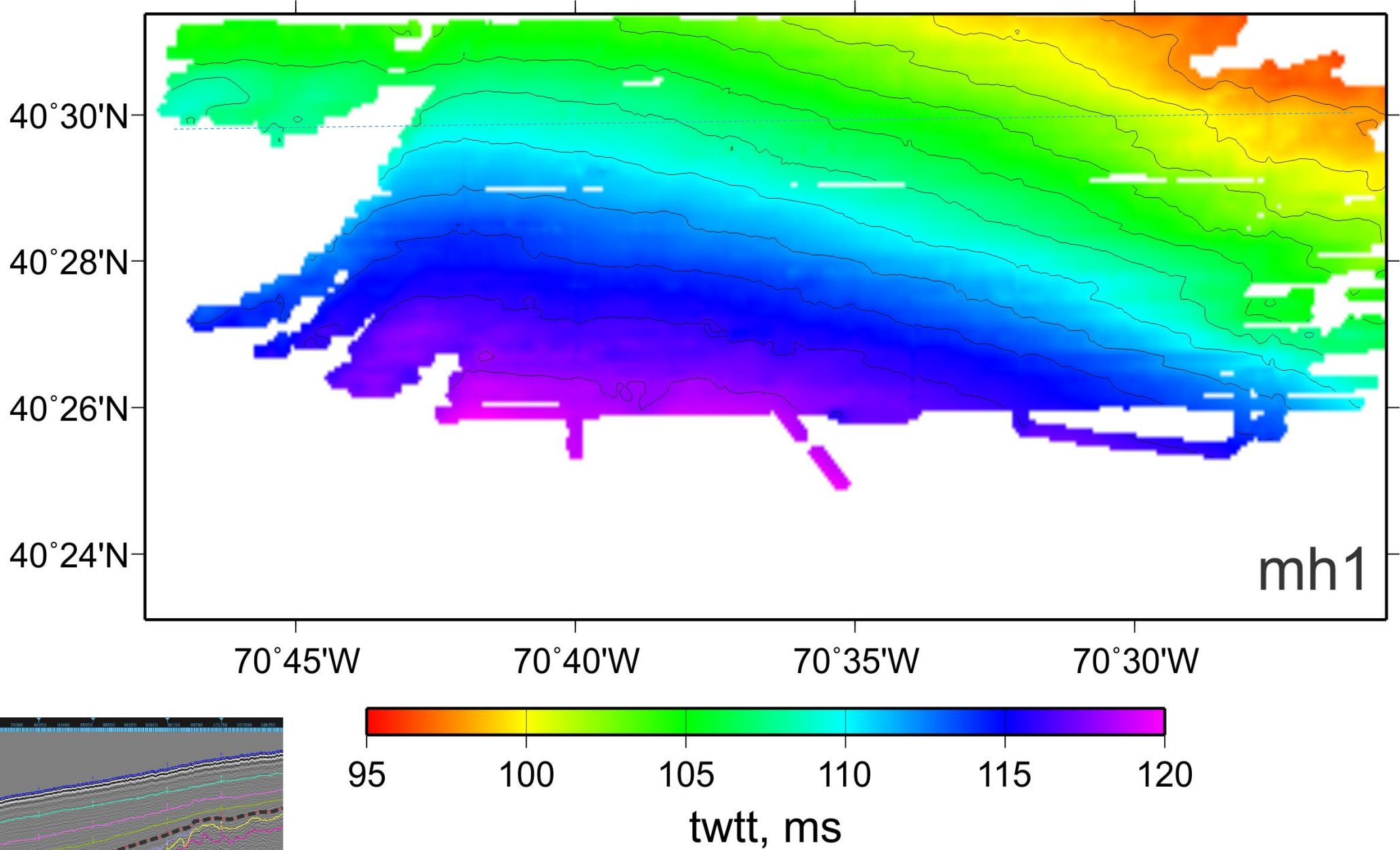
90
95
100
105
110
115
120
125
twtt, ms



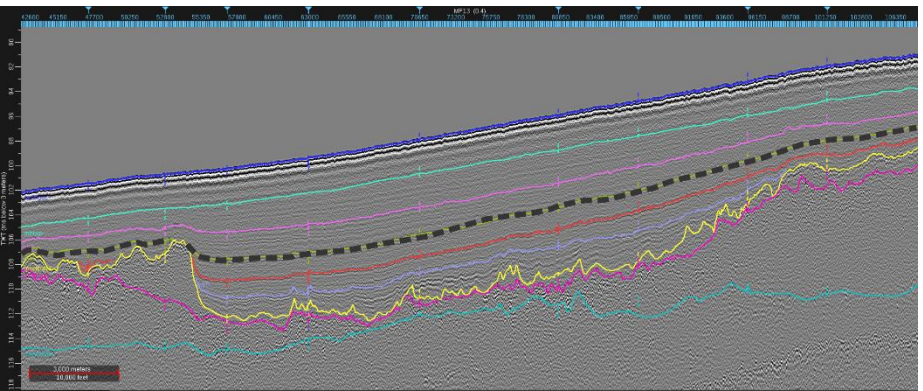

40˚30'N
40˚28'N
40˚26'N
40˚24'N
70˚45'W
70˚40'W
70˚35'W
70˚30'W
mh0

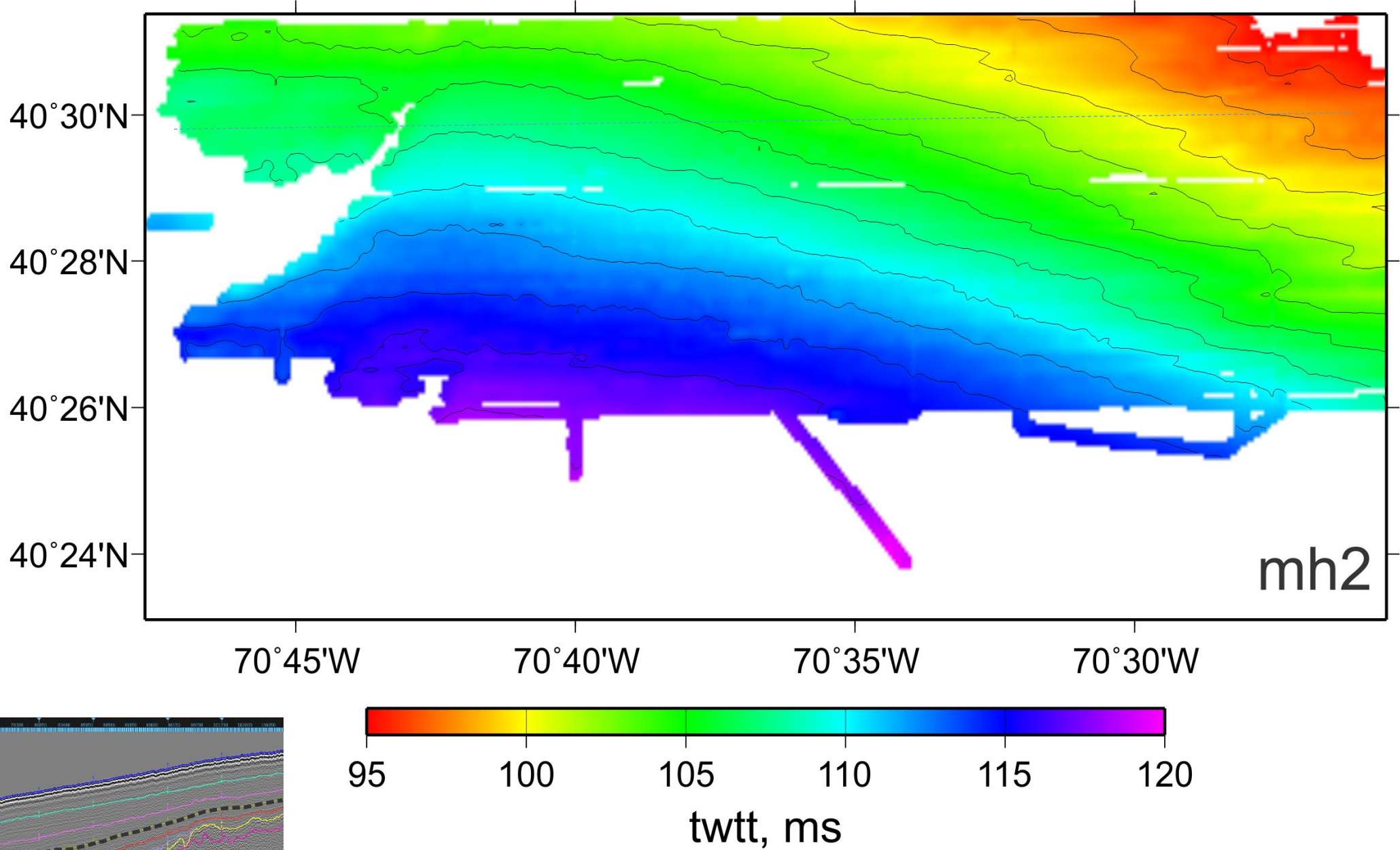
98
102
106
110
114
118
122
twtt, ms

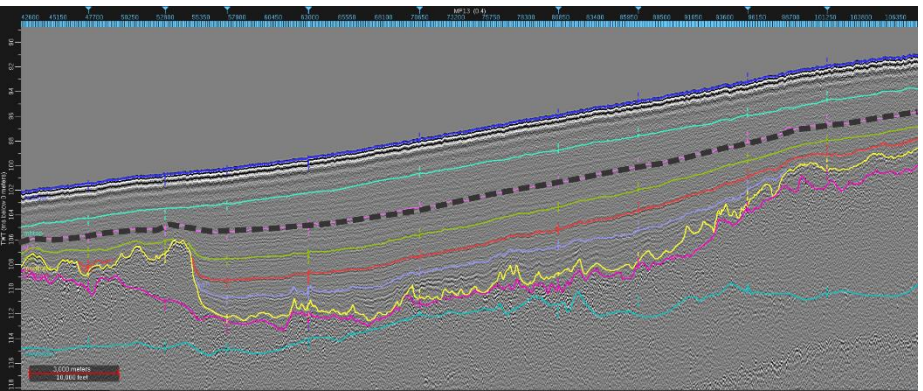


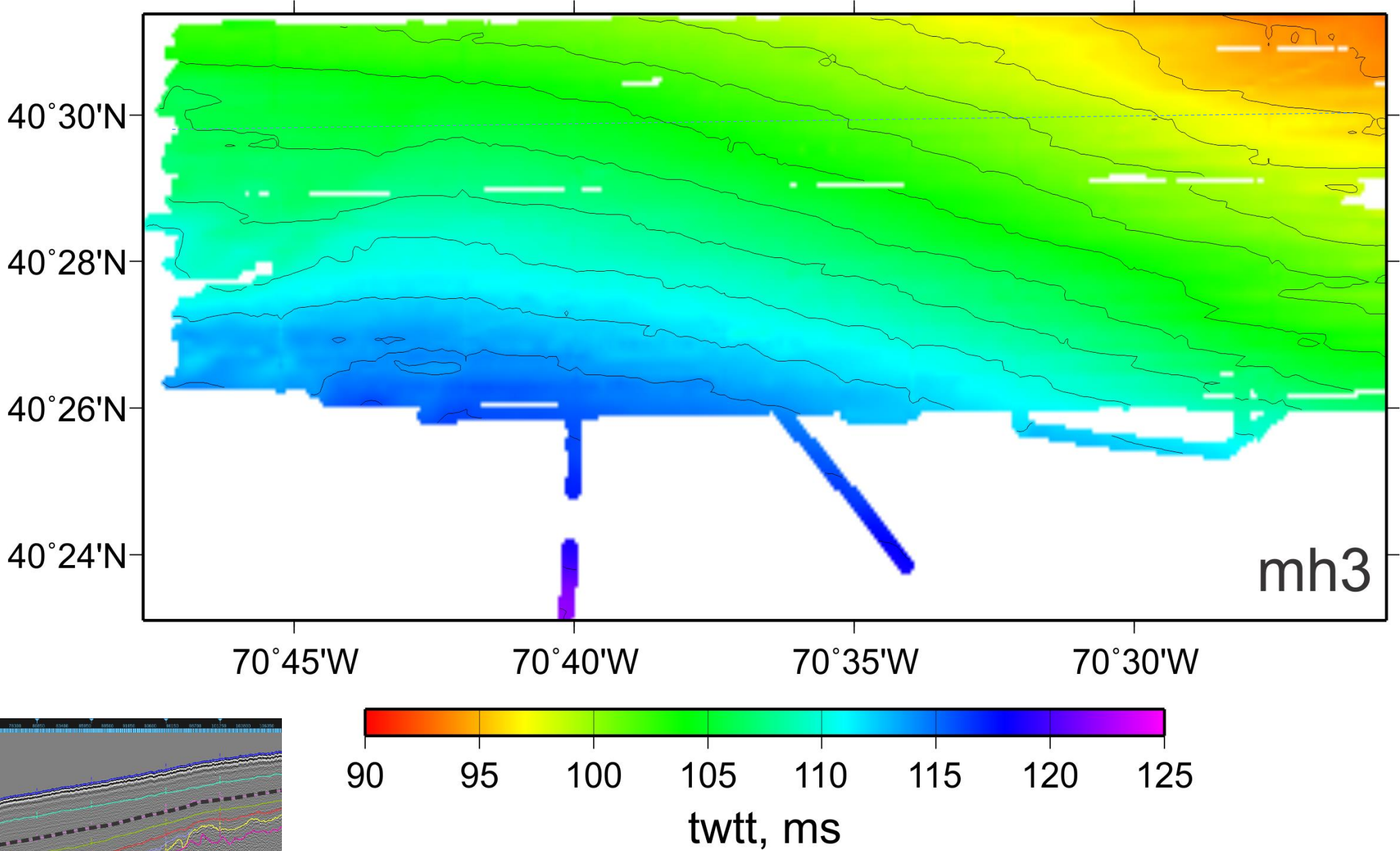

40°30'N
40°28'N
40°26'N
40°24'N
70°45'W
70°40'W
70°35'W
70°30'W
mh1

95
100
105
110
115
120
twtt, ms

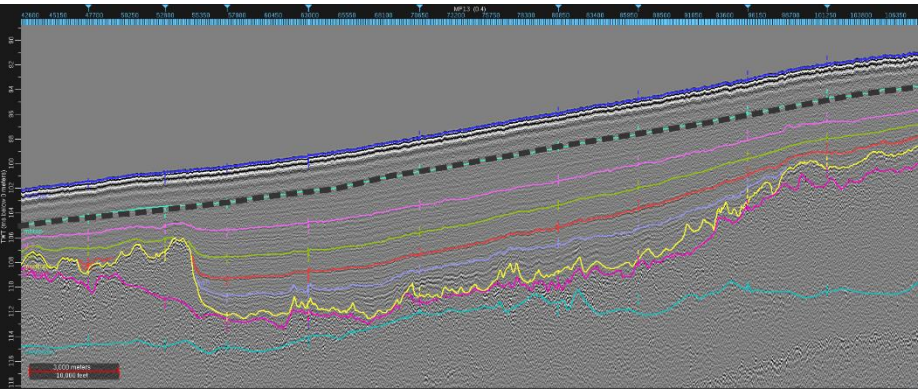


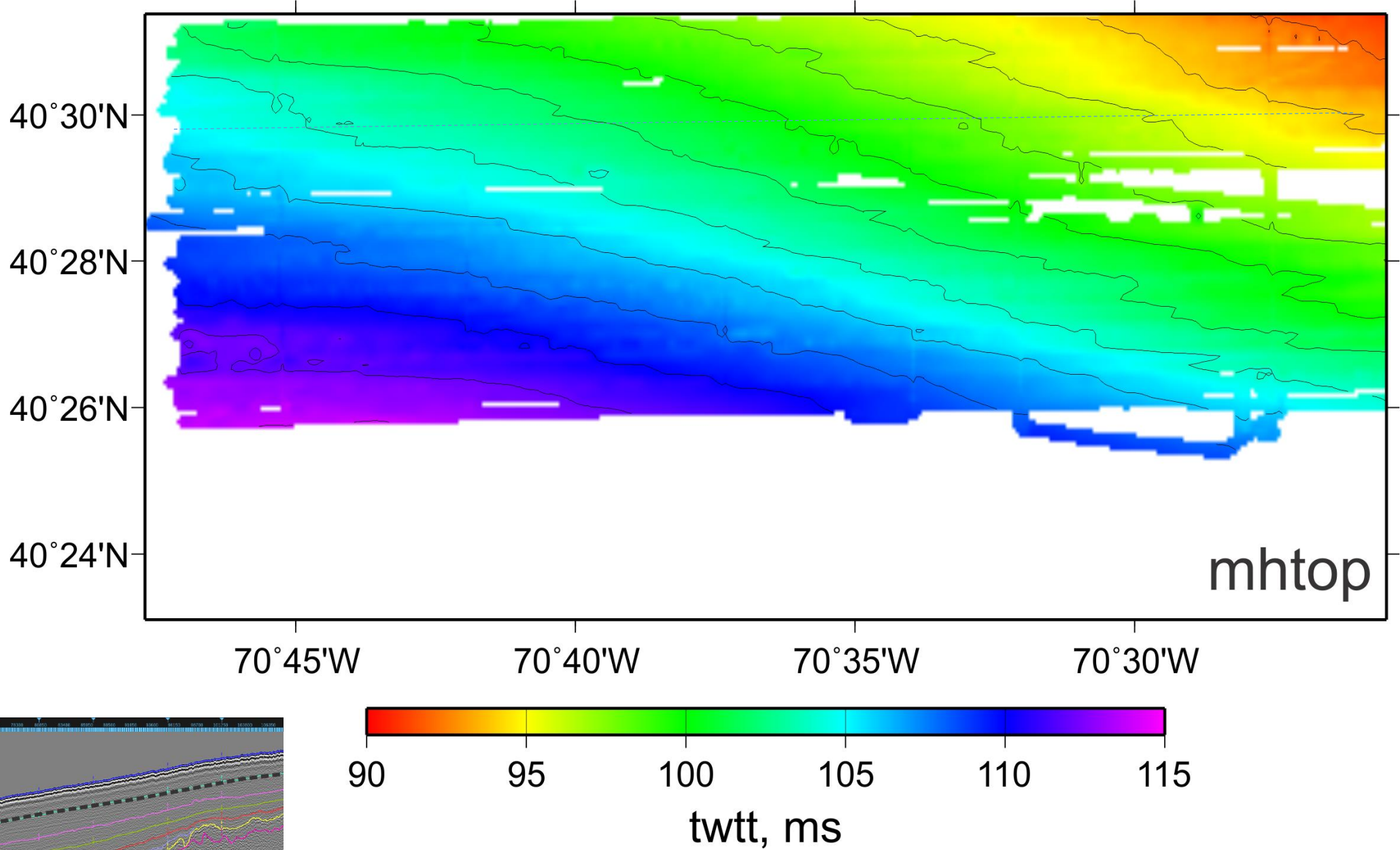

40°30'N
40°28'N
40°26'N
40°24'N
70°45'W
70°40'W
70°35'W
70°30'W
mh2
95
100
105
110
115
120
twtt, ms



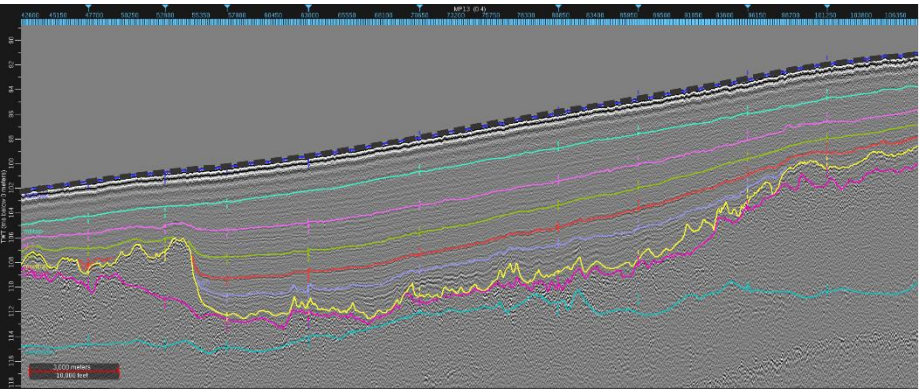

40°30'N
40°28'N
40°26'N
40°24'N
70°45'W
70°40'W
70°35'W
70°30'W
mh3

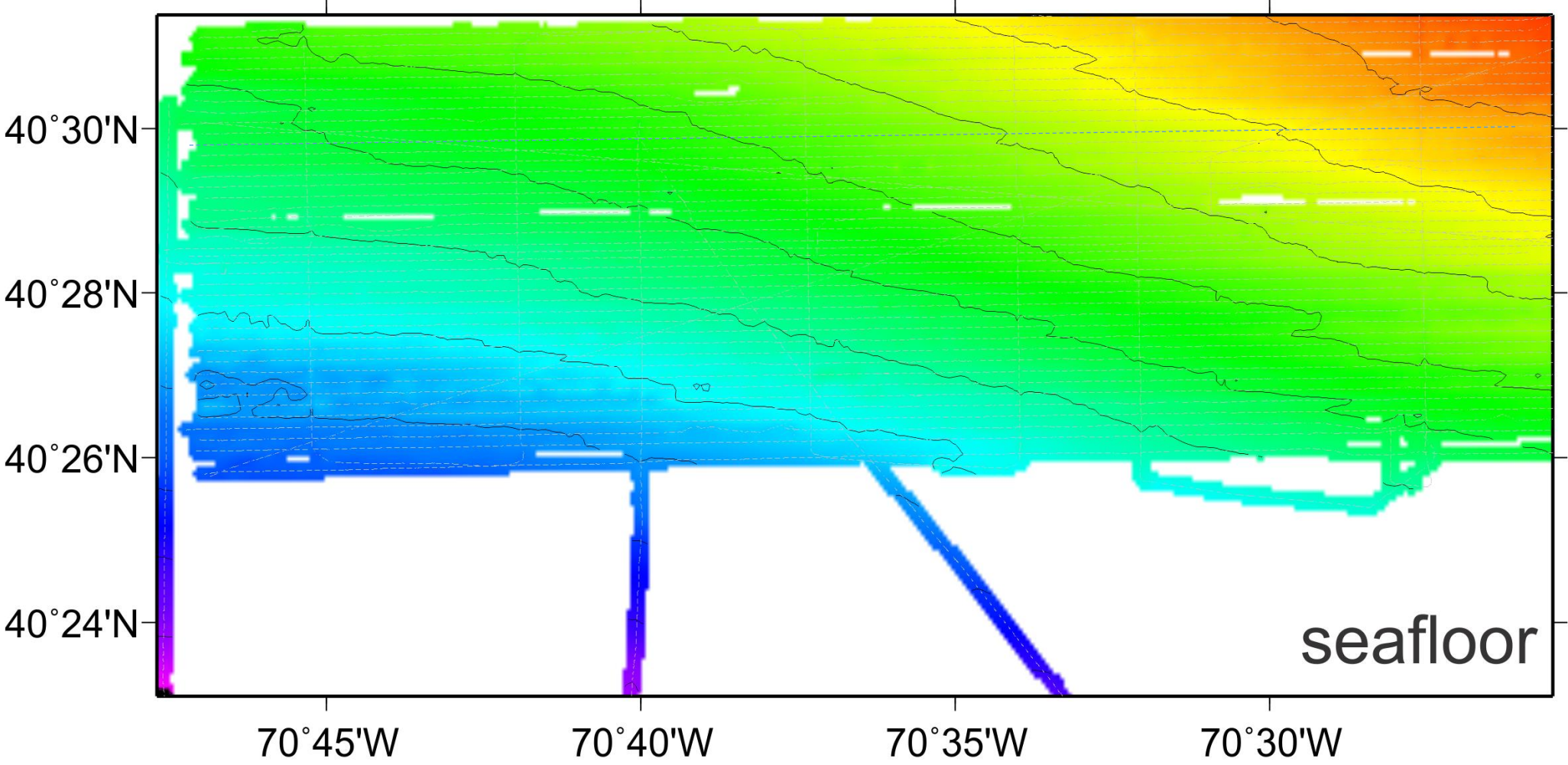
90
95
100
105
110
115
120
125
twtt, ms

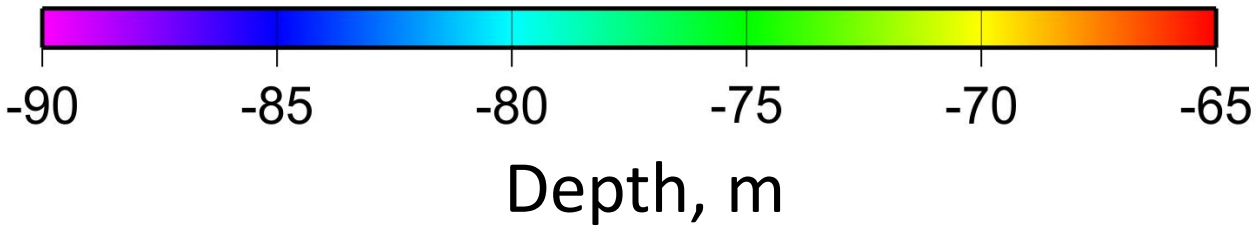



40˚30'N
40˚28'N
40˚26'N
40˚24'N
70˚45'W
70˚40'W
70˚35'W
70˚30'W
mhtop

90
95
100
105
110
115
twtt, ms




40˚30'N
40˚28'N
40˚26'N
40˚24'N
seafloor
70˚45'W
70˚40'W
70˚35'W
70˚30'W

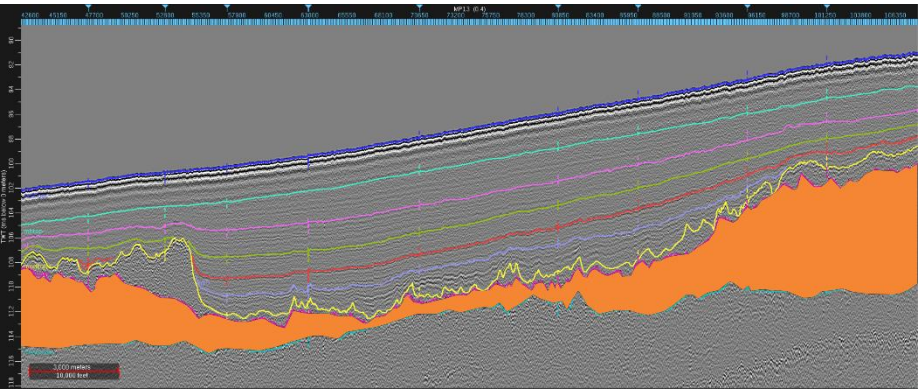

-90
-85
-80
-75
-70
-65
Depth, m

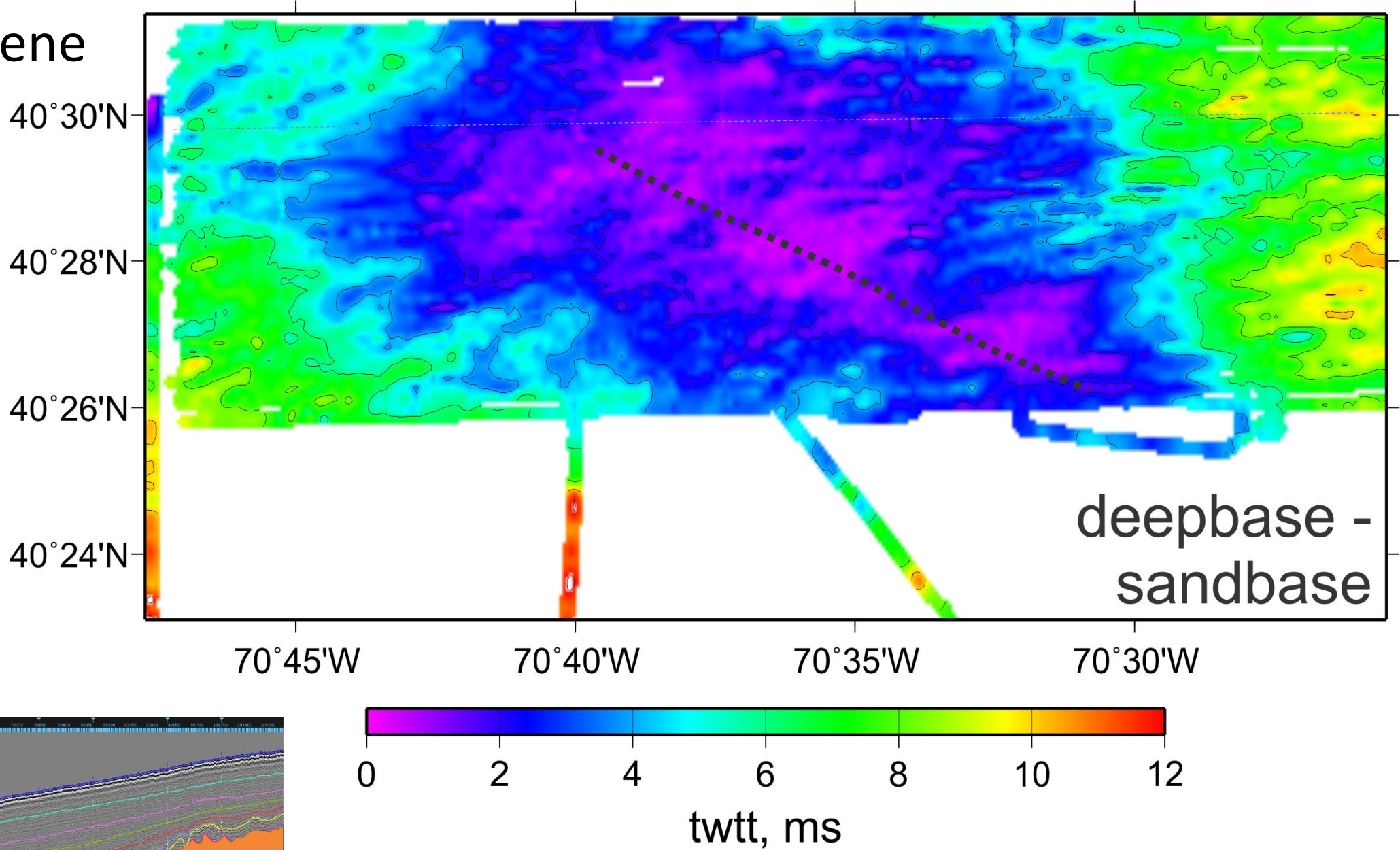
Isopach Maps of Interpreted Units

Basal Pleistocene Unit

This isopach defines the “accommodation space” in older, presumably Pleistocene sediments, that was filled first by marine sands and then by muds to form the mud pond.

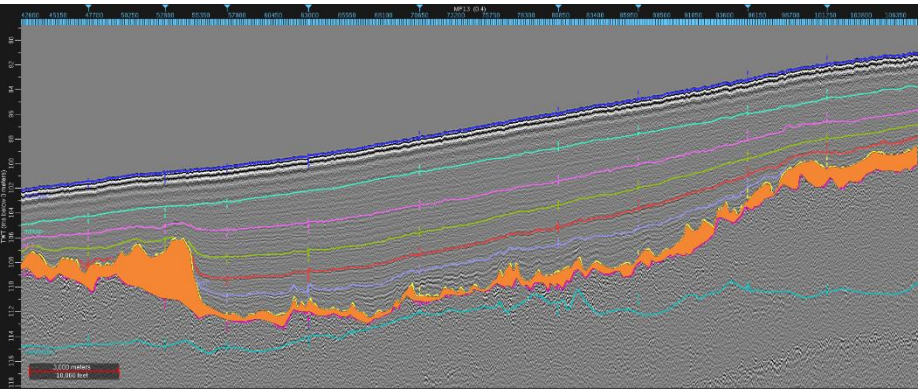
The dashed line is approximately the axis of the accommodation space, to be referenced in later images.

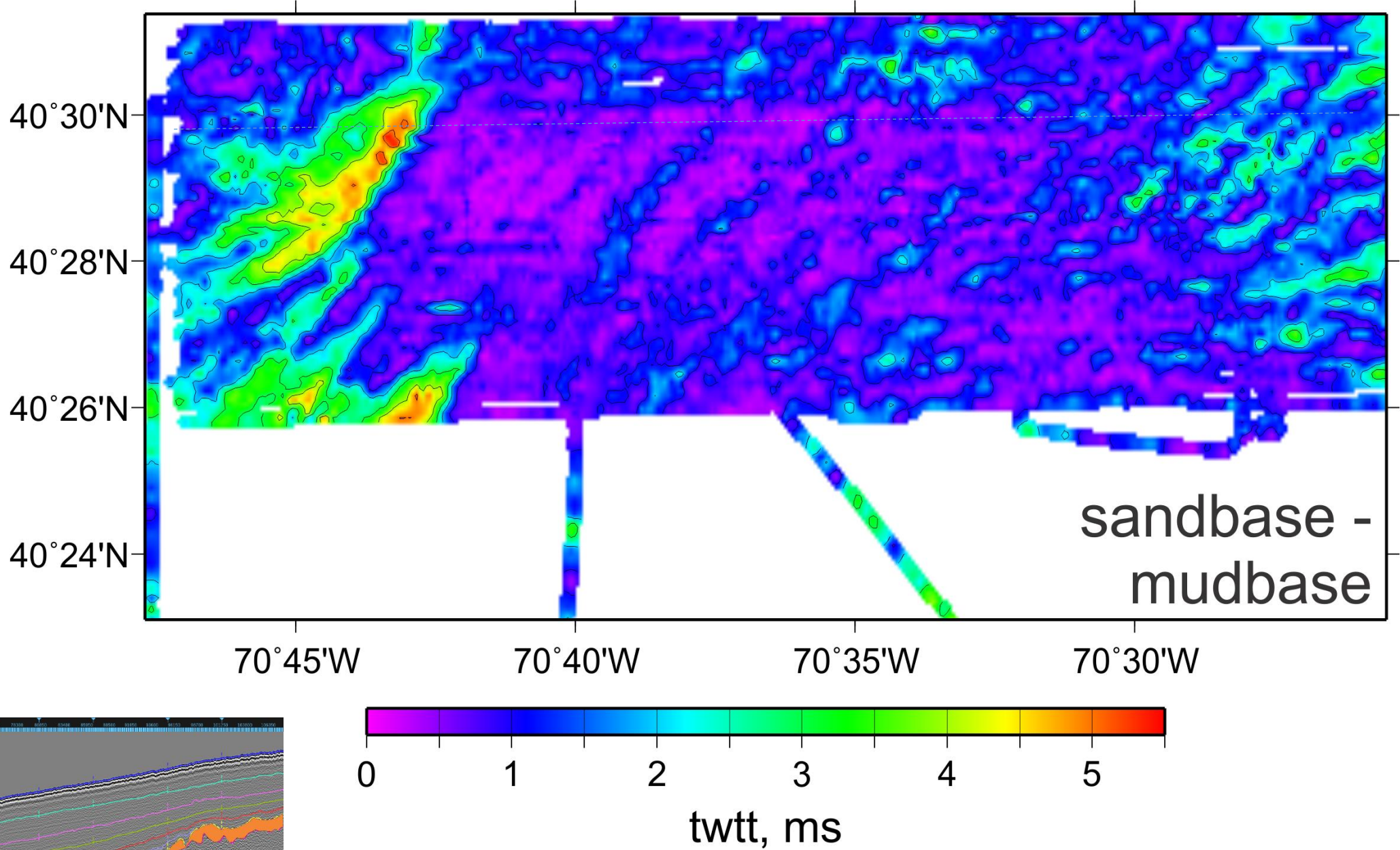




Marine Sand Unit

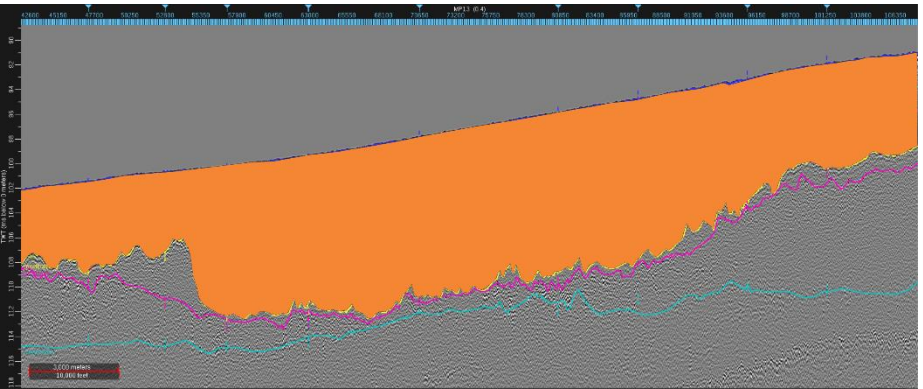
Marine sands are organized into oblique sand ridge morphology, with a west-to-east transport direction based on (1) east-dipping internal reflections (see earlier), (2) angle of obliquity, (3) asymmetry, and (4) primary accumulation on west side of accommodation space.

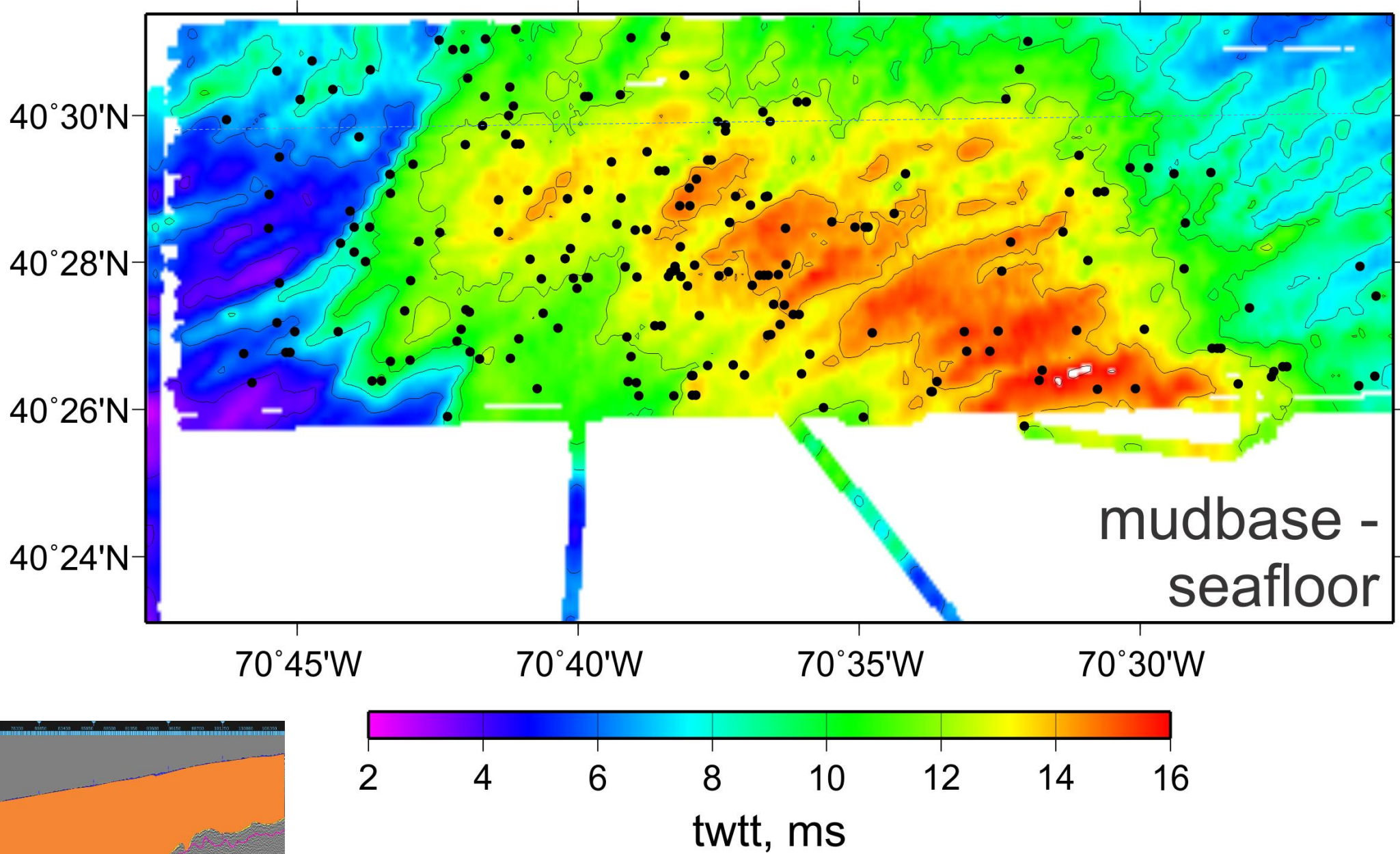




Full Mud Thickness

Dots indicate "bright lenses" within the mud

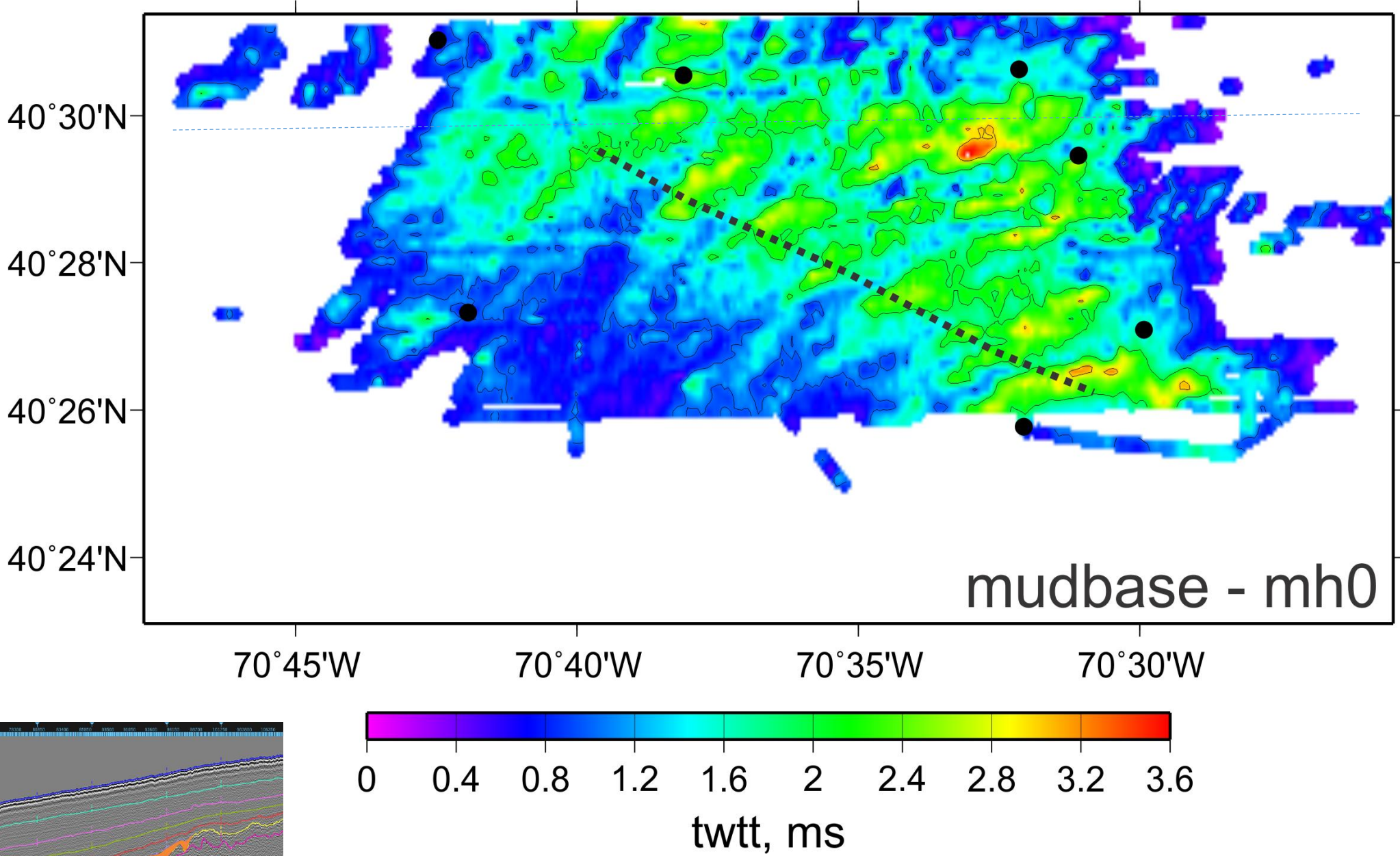


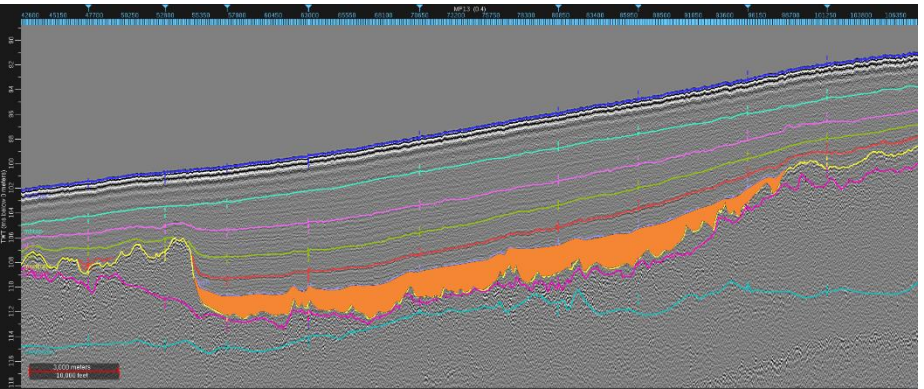


First Mud Unit

Dots indicate “bright lenses” in unit

Note thickest accumulation to NE of axis of accommodation space

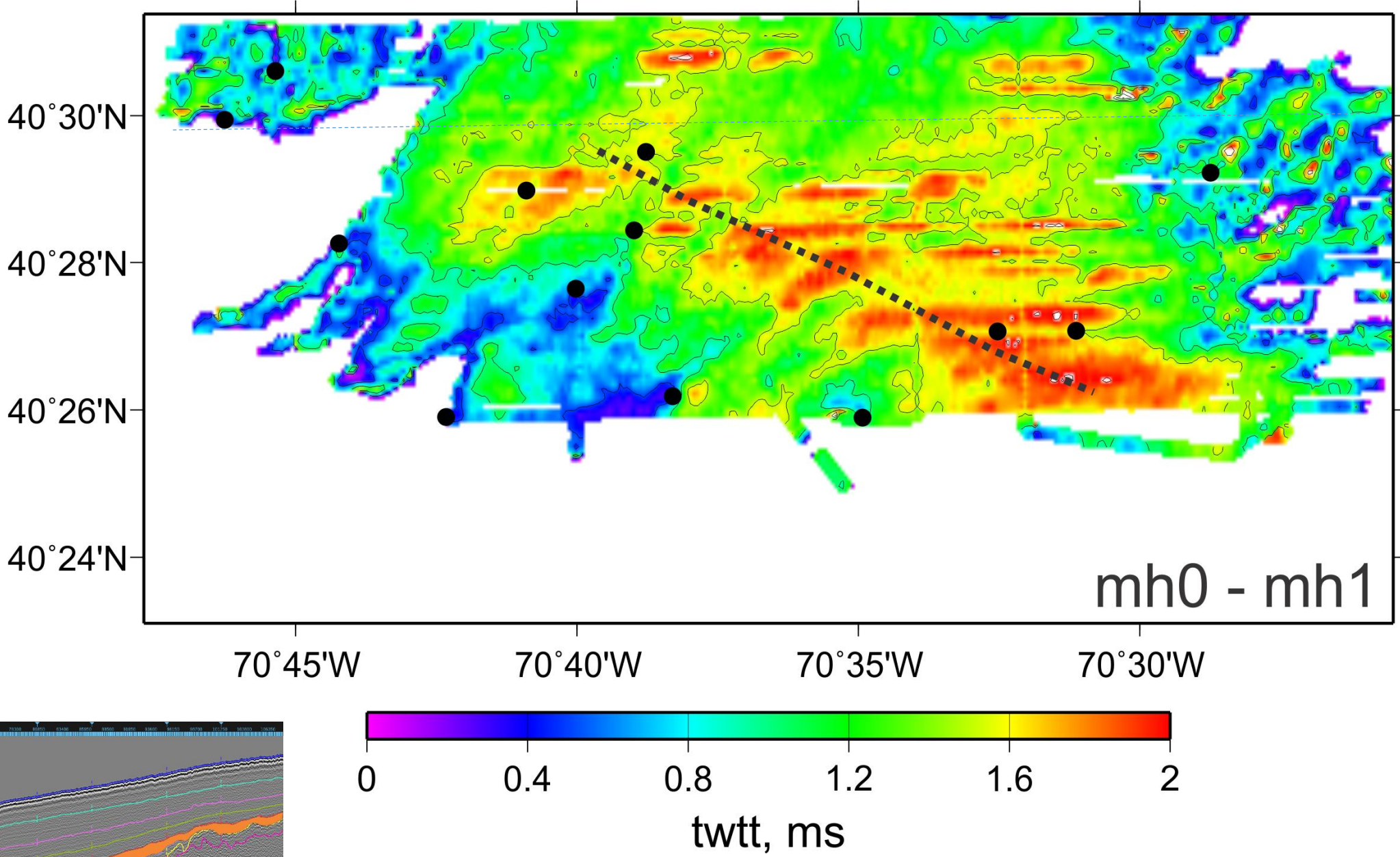


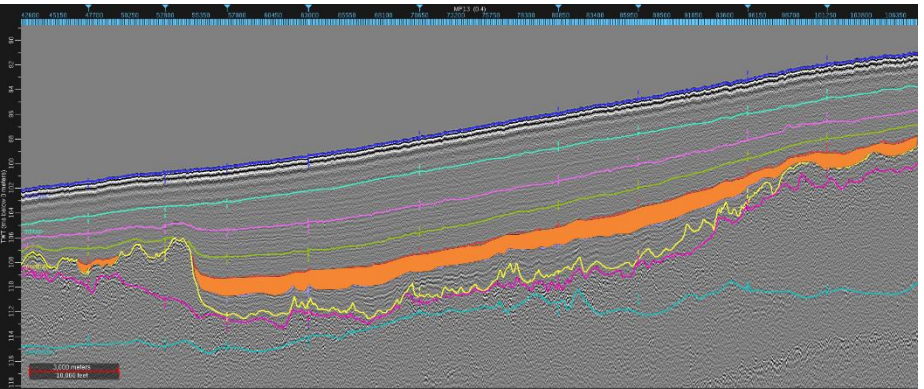


Second Mud Unit

Dots indicate “bright lenses” in unit

Note thickest accumulation along axis of accommodation space

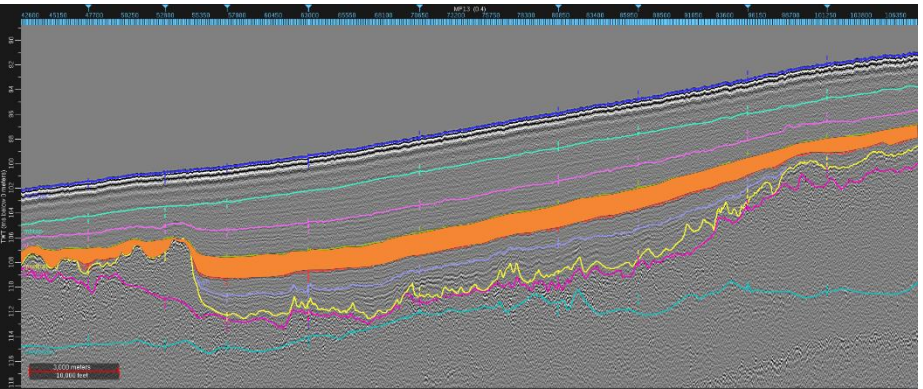


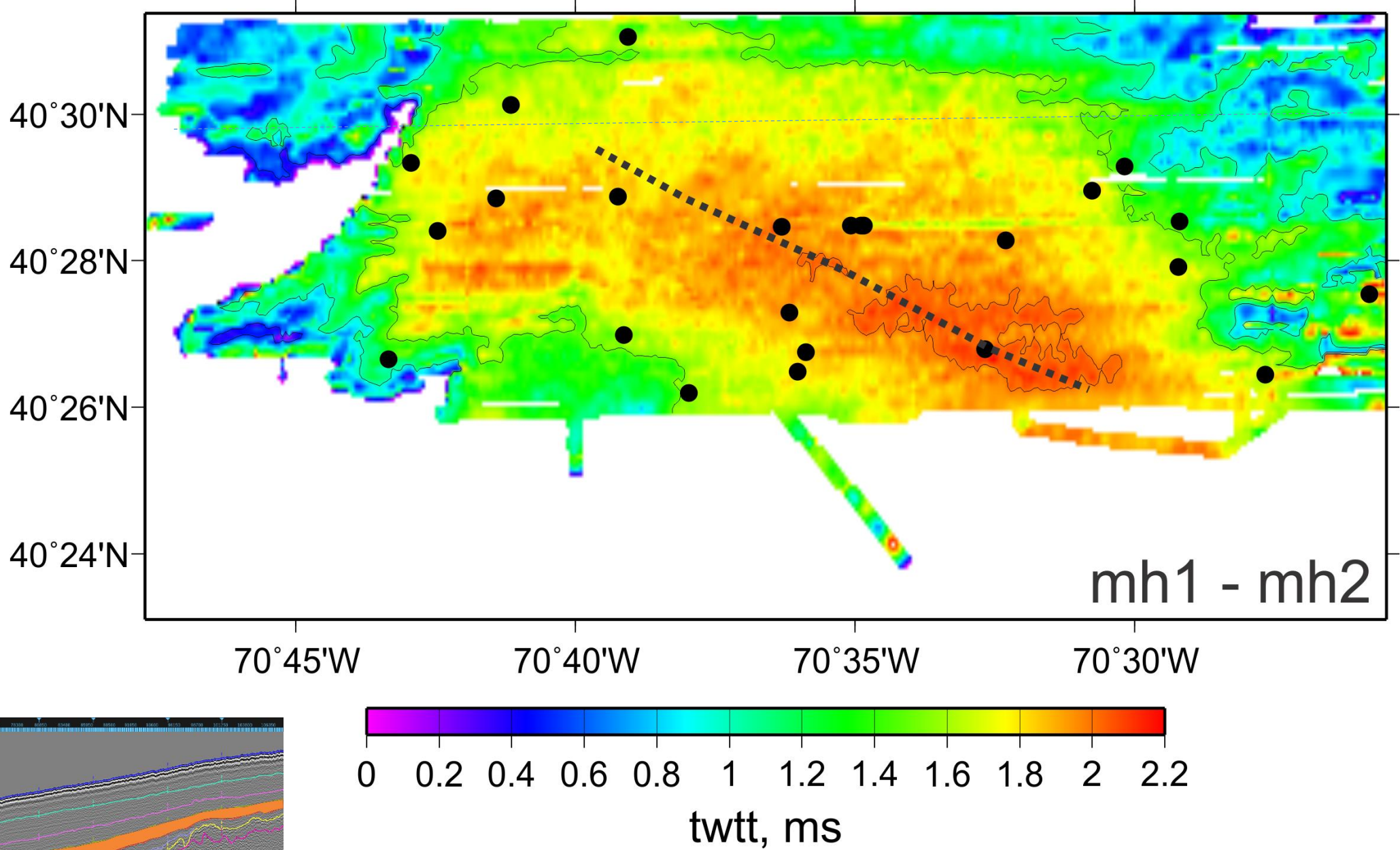


Third Mud Unit

Dots indicate “bright lenses” in unit

Note thickest accumulation along axis of accommodation space

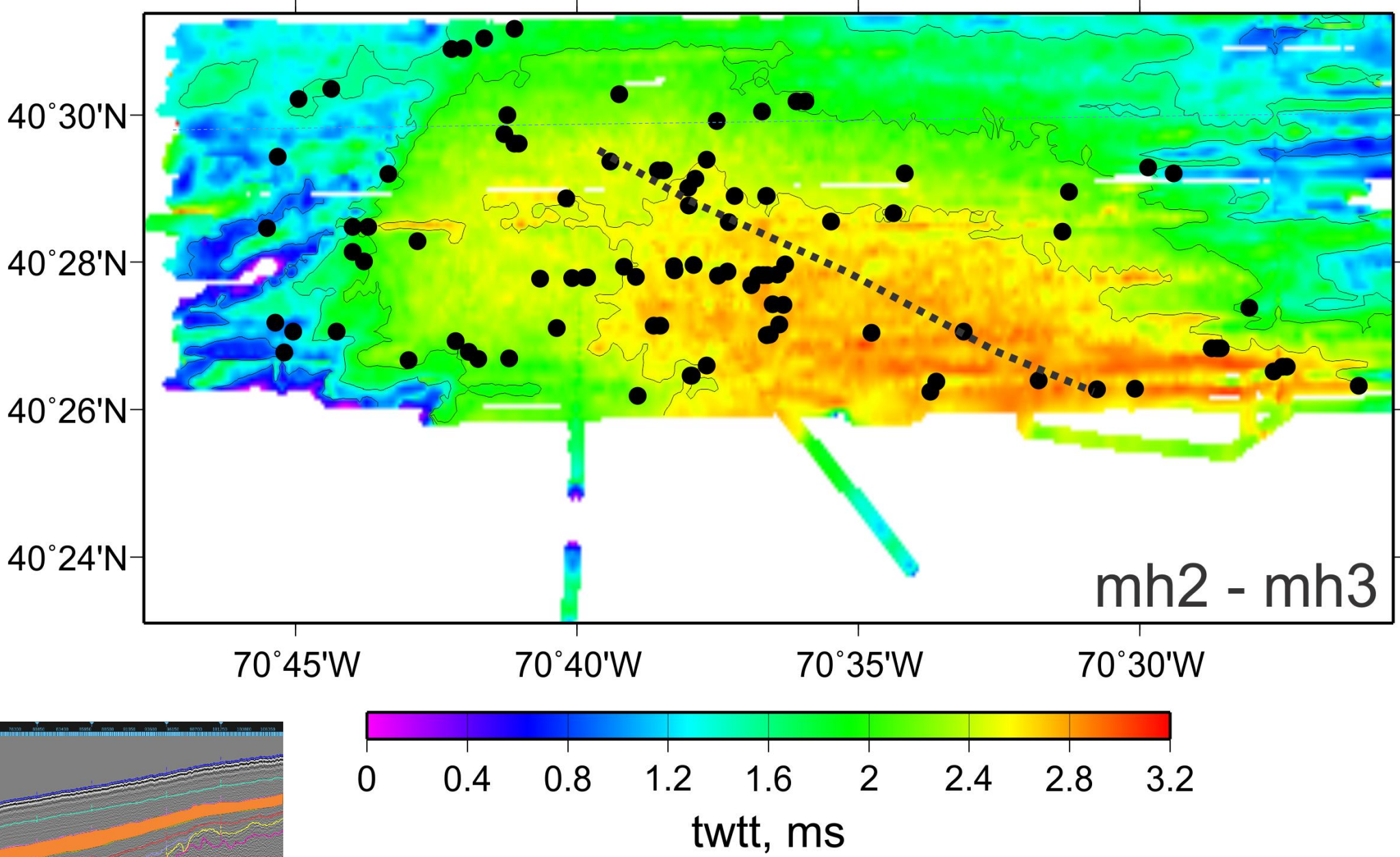


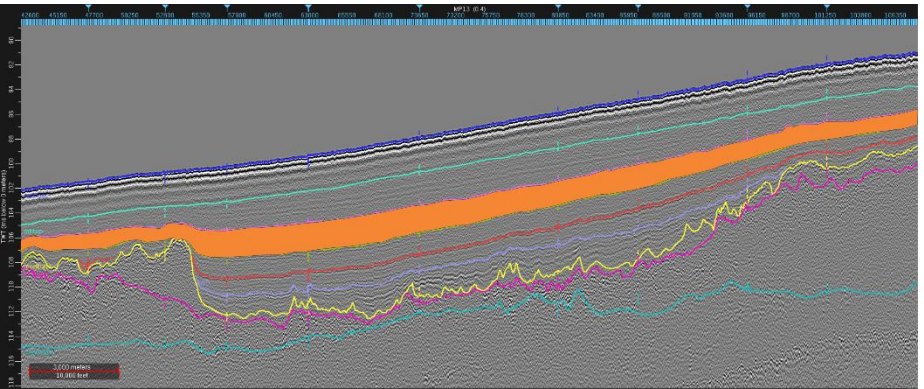


Fourth Mud Unit

Dots indicate “bright lenses” in unit

Note thickest accumulation to SW of axis of accommodation space

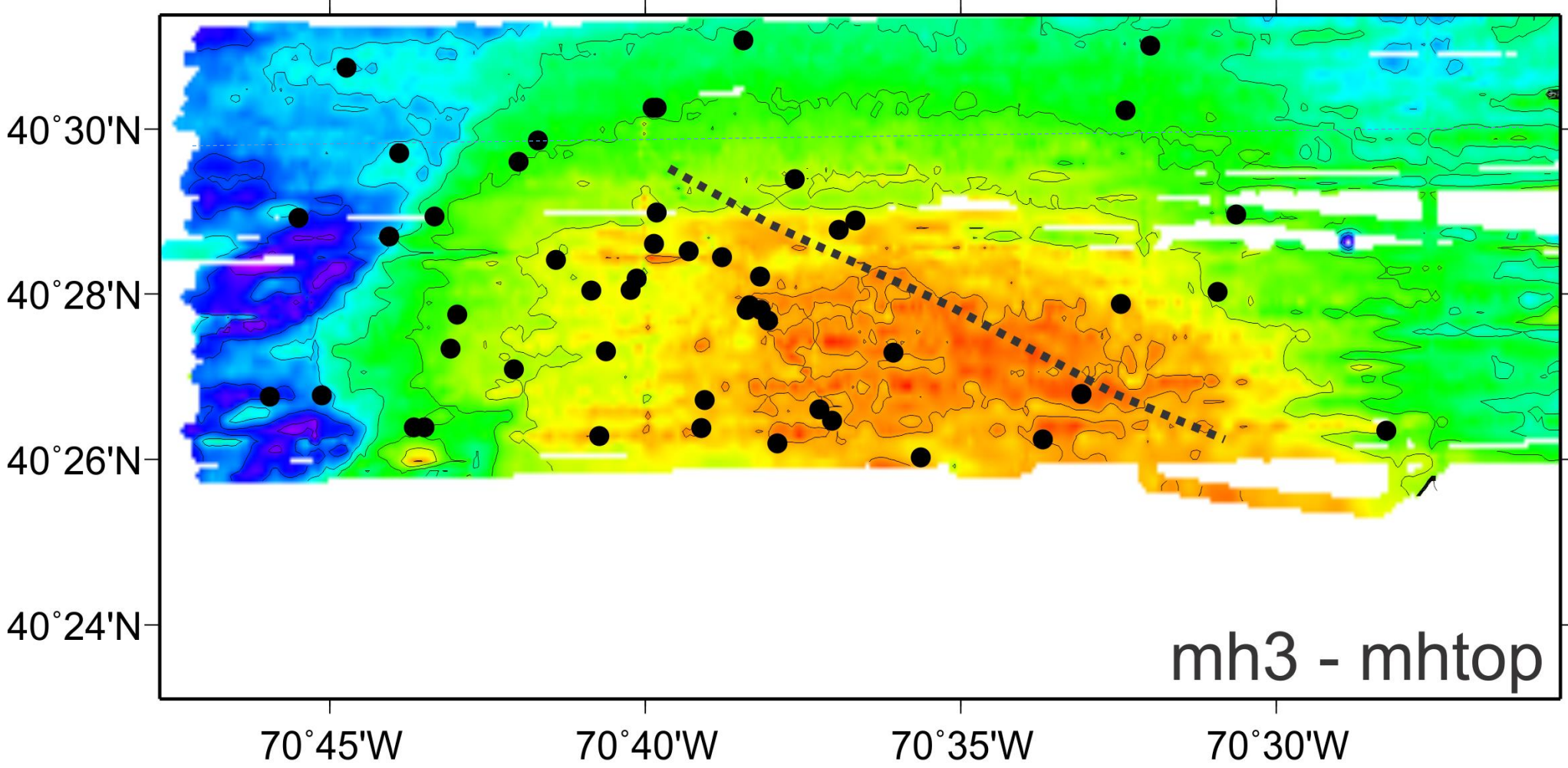


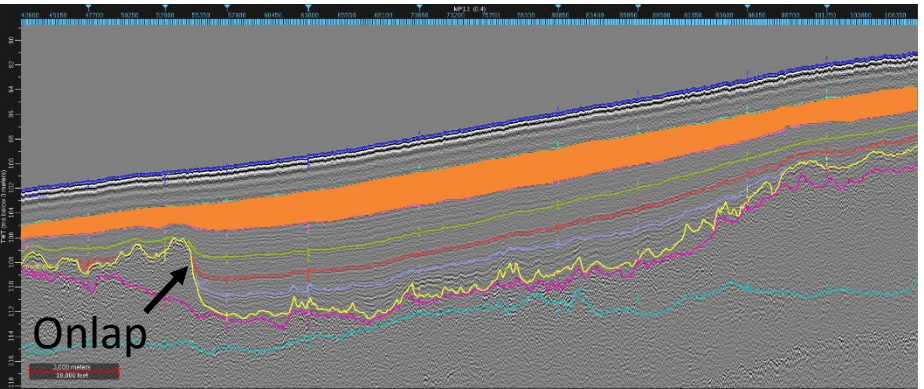


Fifth Mud Unit

Dots indicate “bright lenses” in unit

Note thickest accumulation to SW of axis of accommodation space



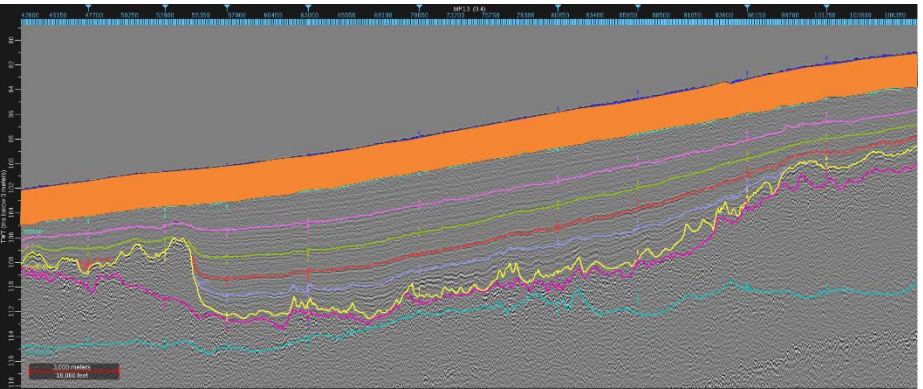


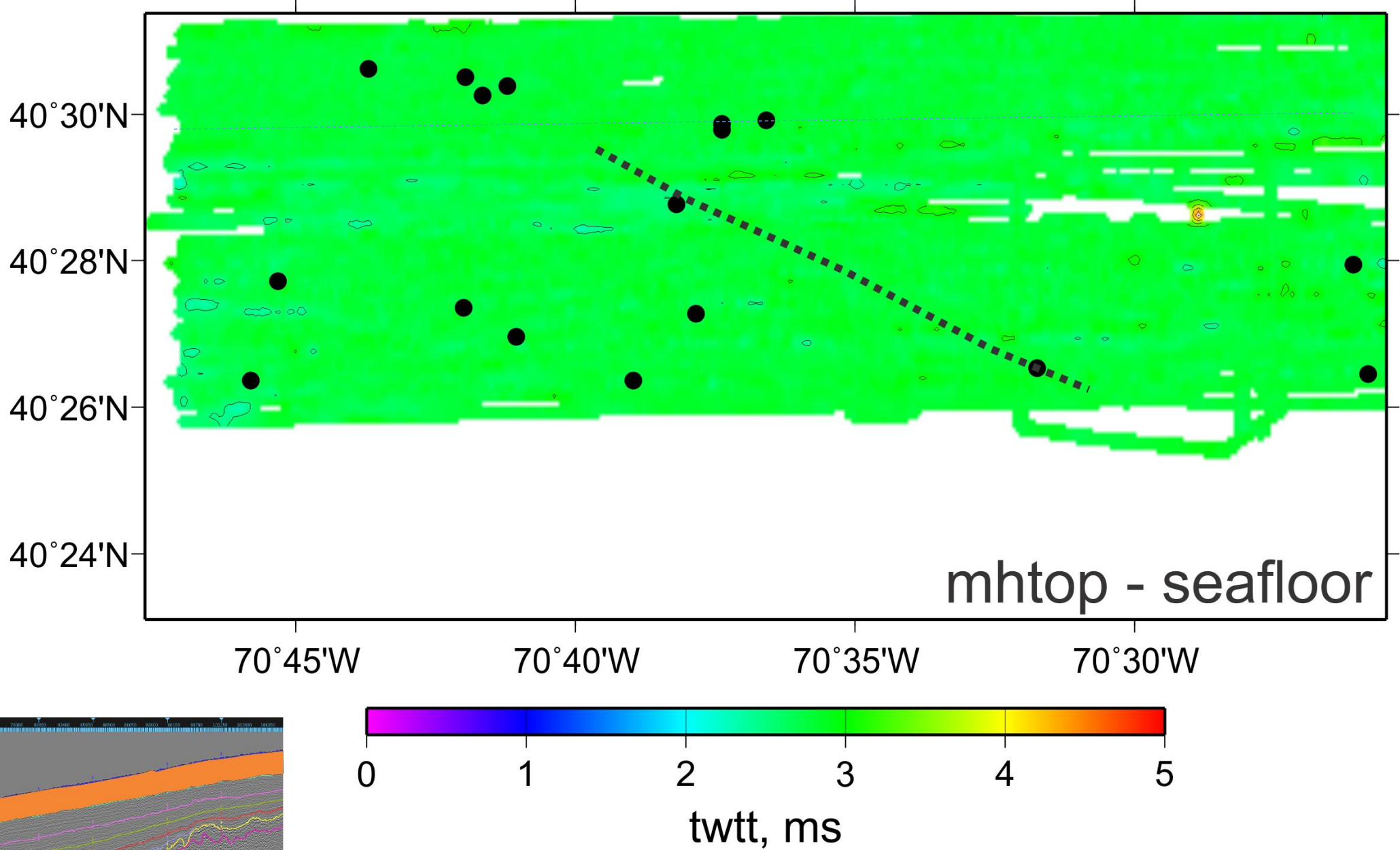
Westward progradation of mud units, and onlap onto western flank, indicate that mud was deposited in an westward transport regime. So the mud-to-sand transition coincided by a major change in sediment transport direction.

Most Recent Mud Unit

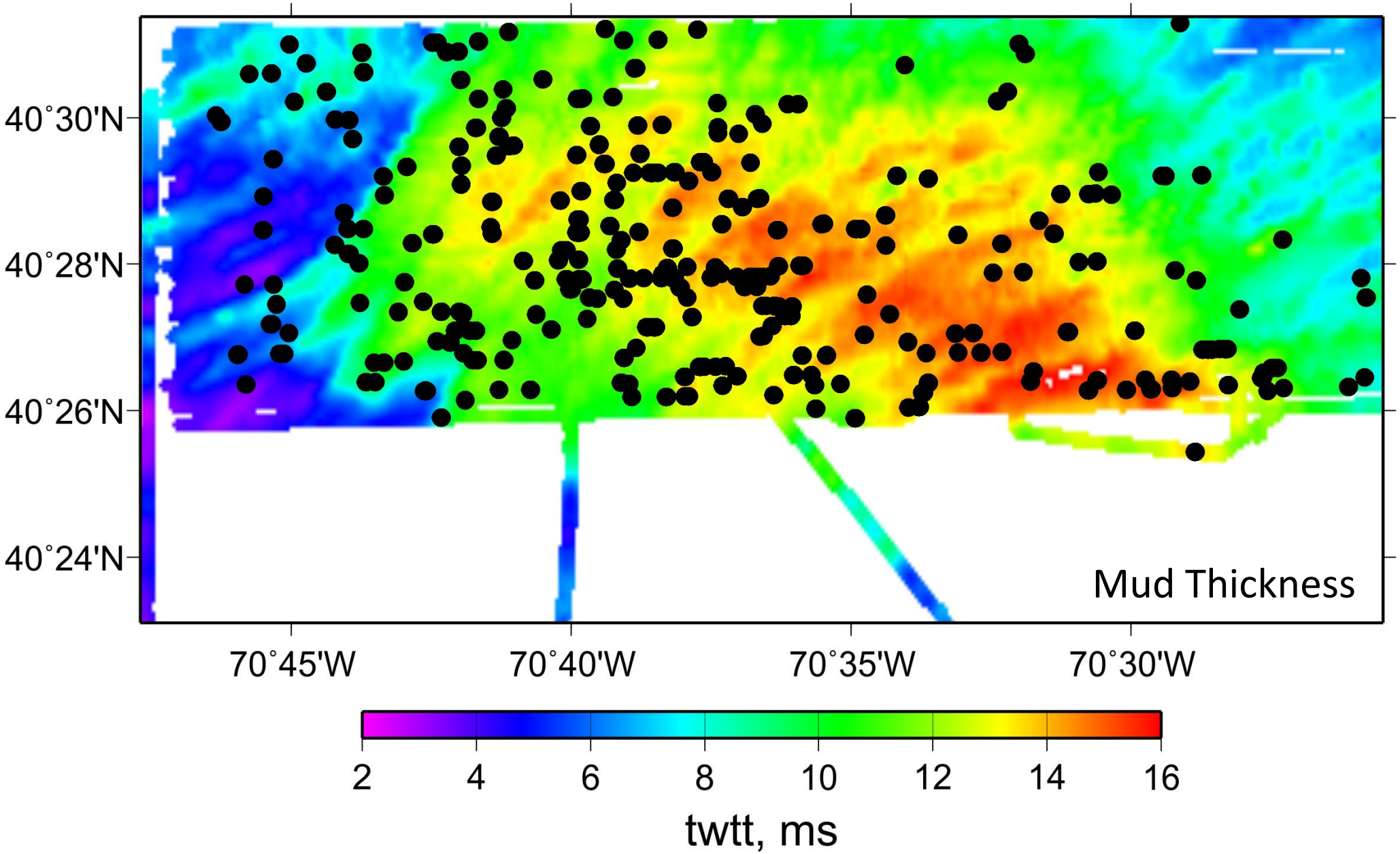
Dots indicate “bright lenses” in unit

Note uniform accumulation

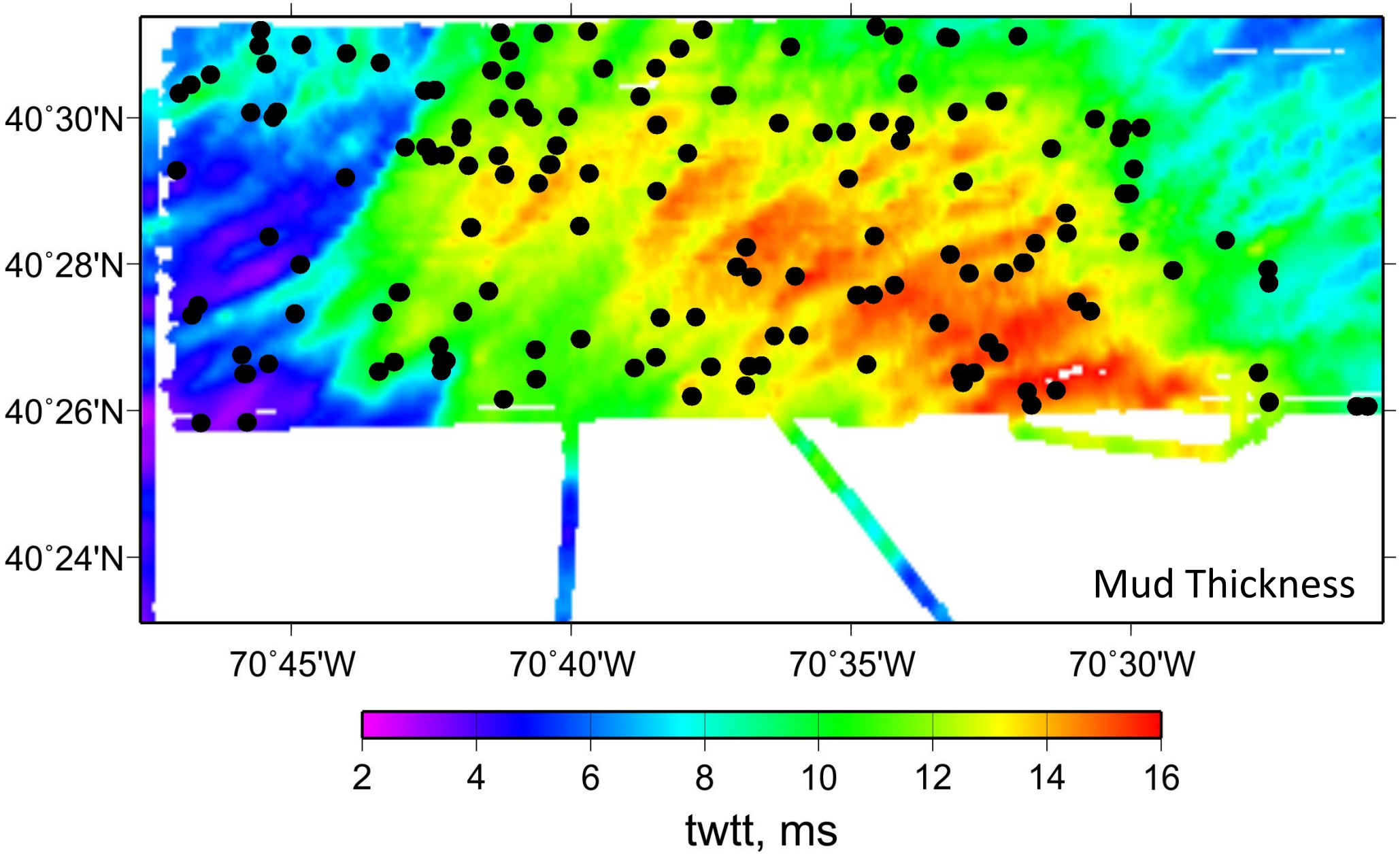




Bright Lenses



Seafloor Depressions



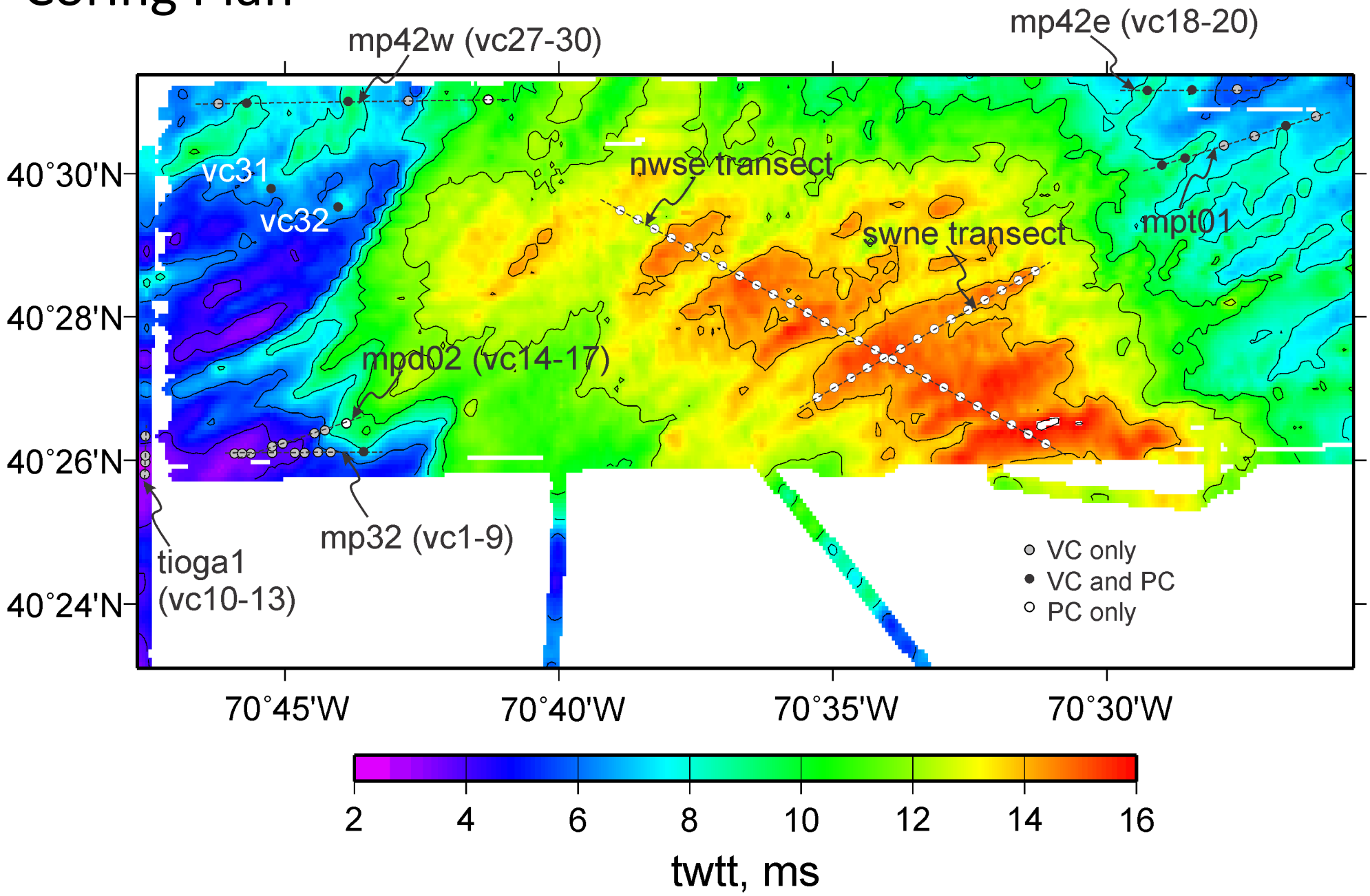
Bright lenses and seafloor depressions may be related. They are similar in size (~20-50 m typically), shape (most bright lenses are, like depressions, concave-up), and distribution (more common where mud is thicker). It can be hypothesized that bright lenses were seafloor depressions that were subsequently buried. If such depressions are created by fluid seeps, the hard material within could be mollusk accumulations or perhaps sand that has percolated up from below the mud.

Vibracoring Within the New England Mud Patch

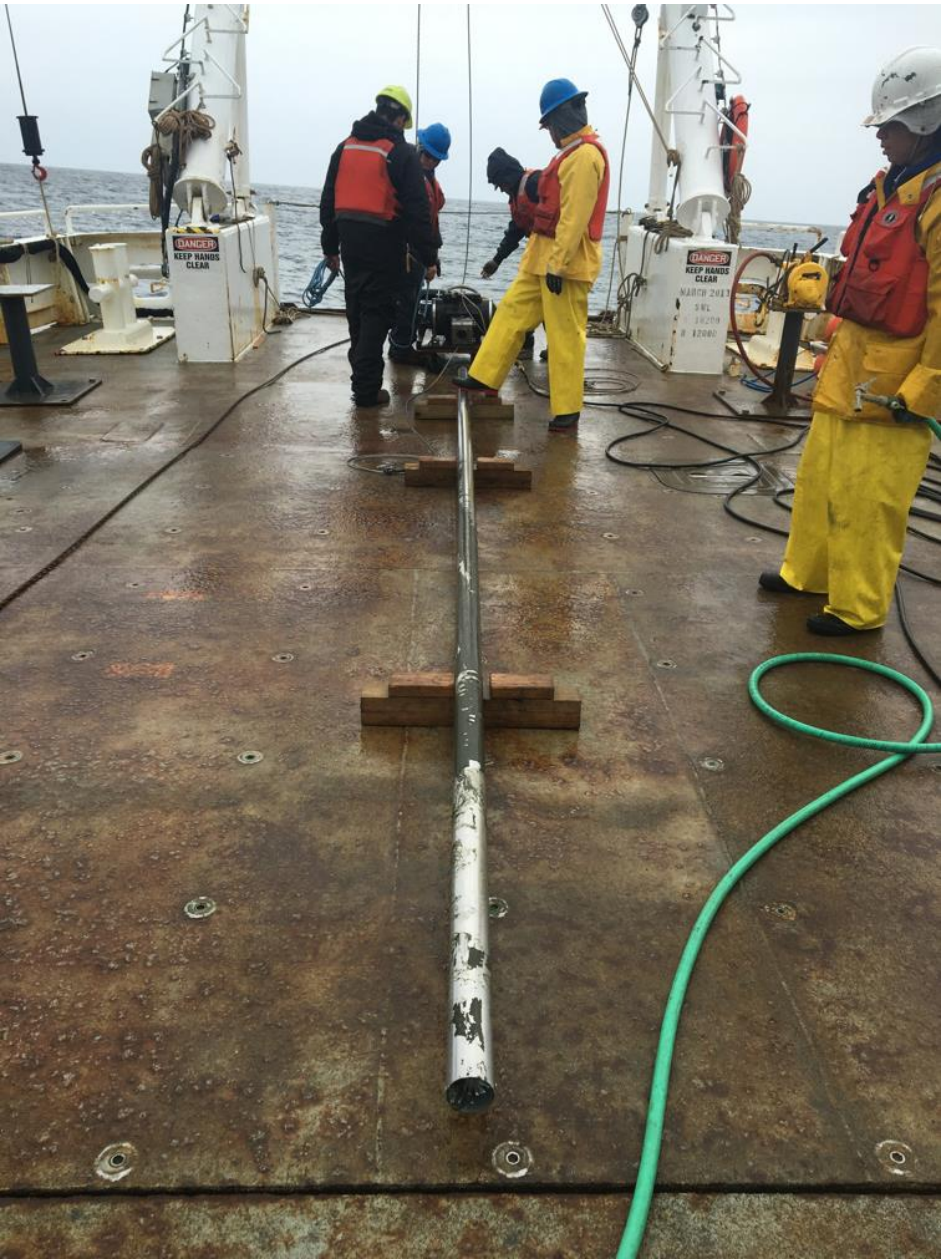
R/V Endeavor, Cruise EN577, Leg 2
26 April 2016 - 2 May 2016

PI: John Goff
University of Texas Institute for Geophysics

EN577 Coring Plan

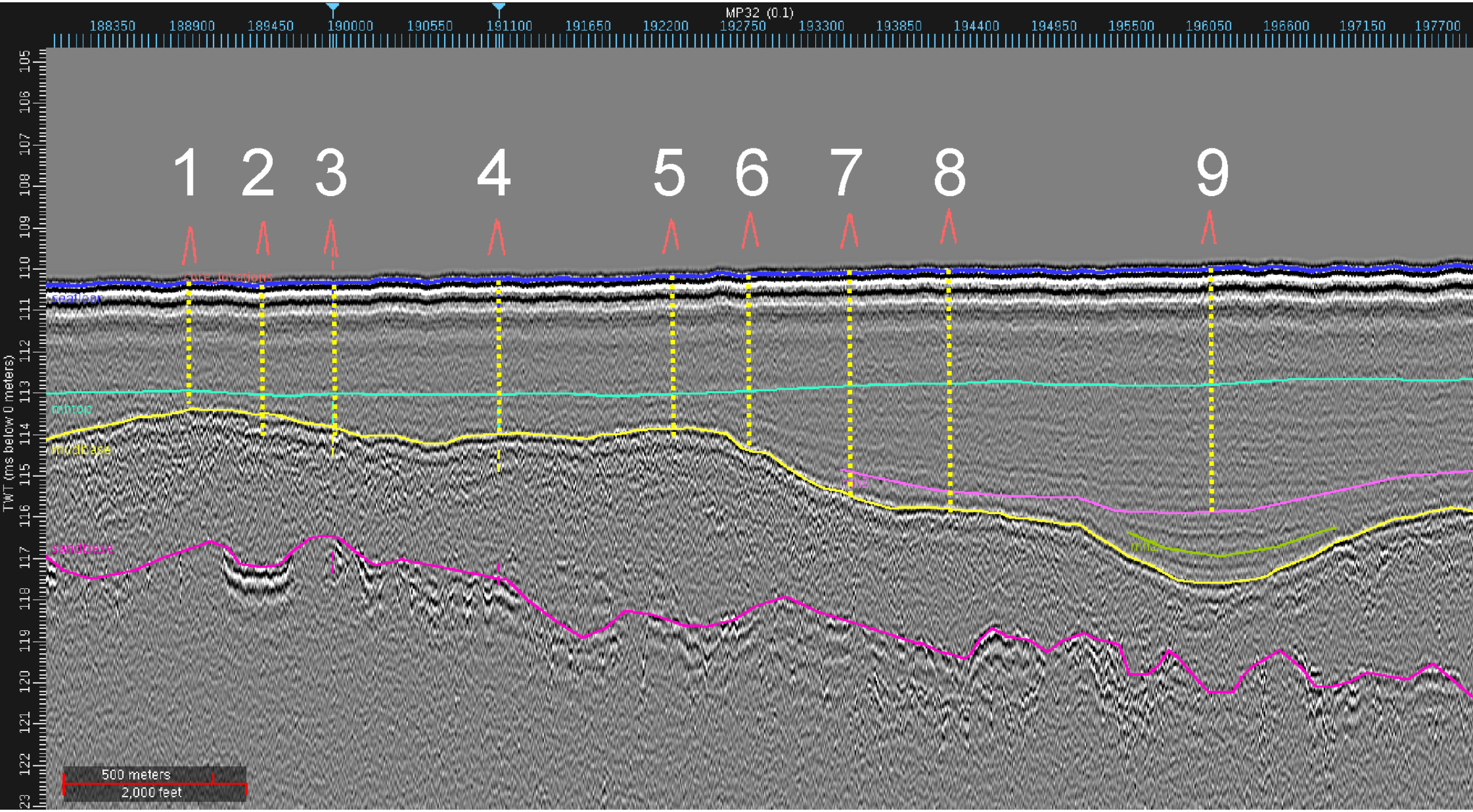


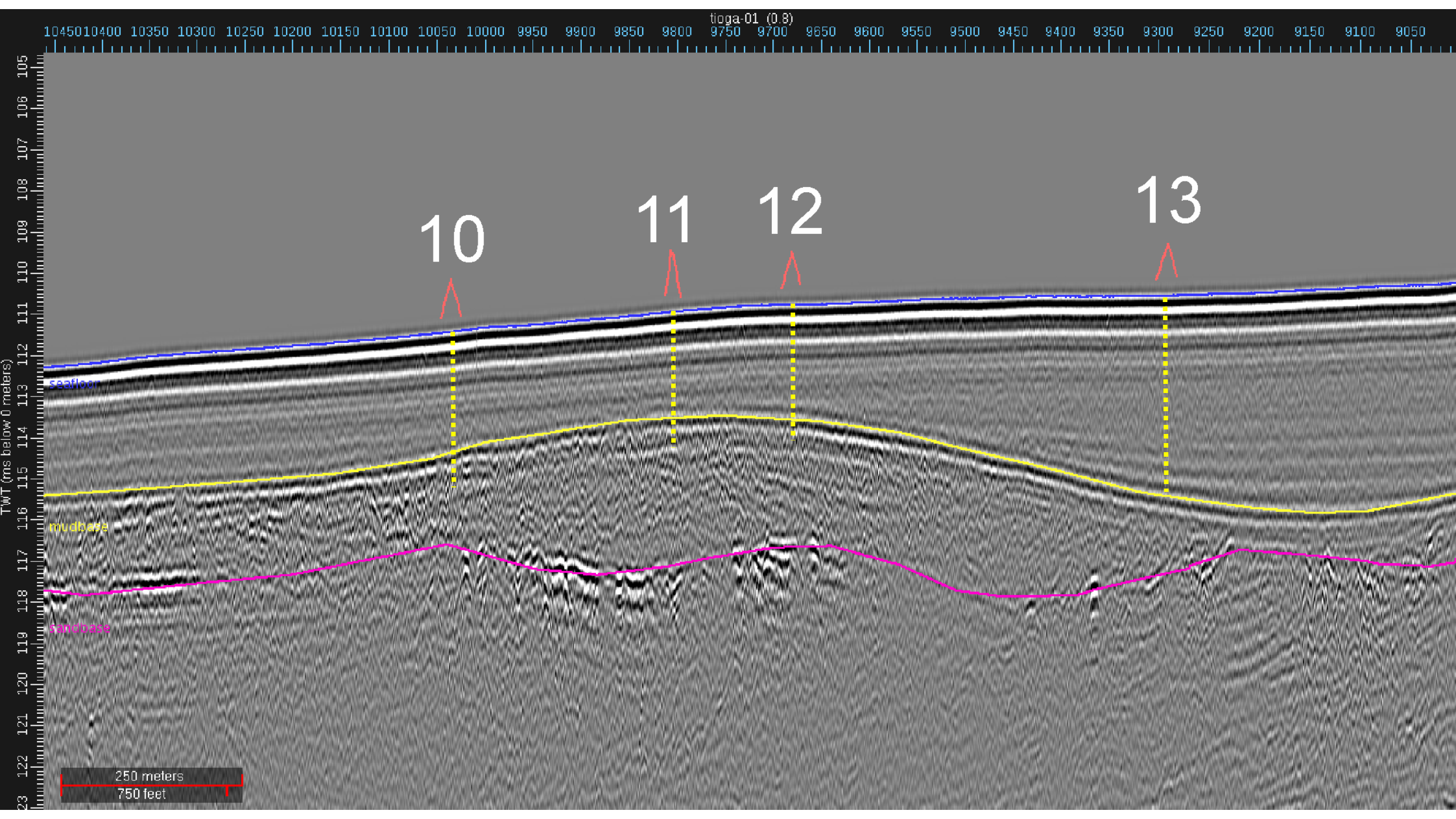
Penetration vs. Recovery

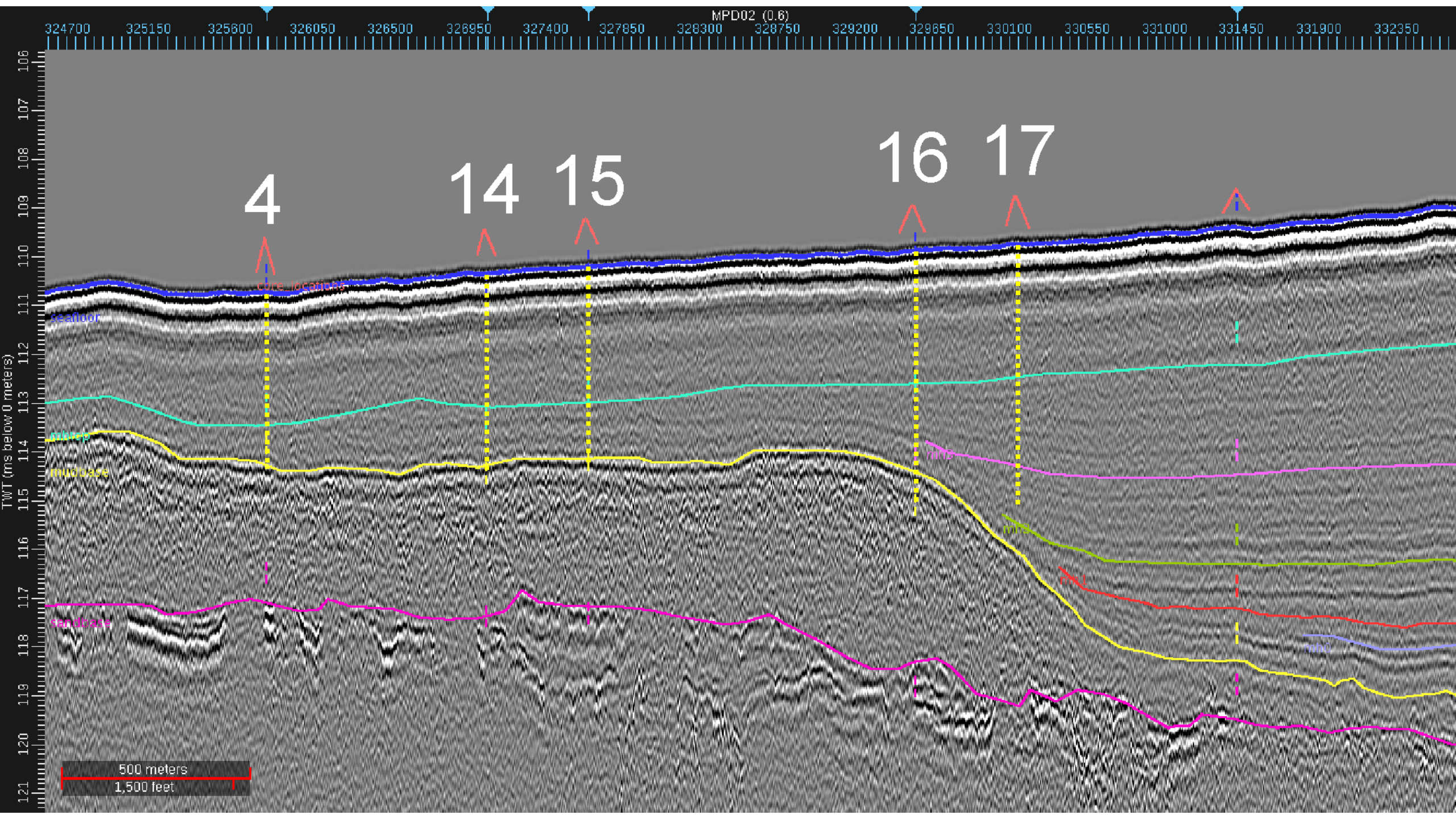


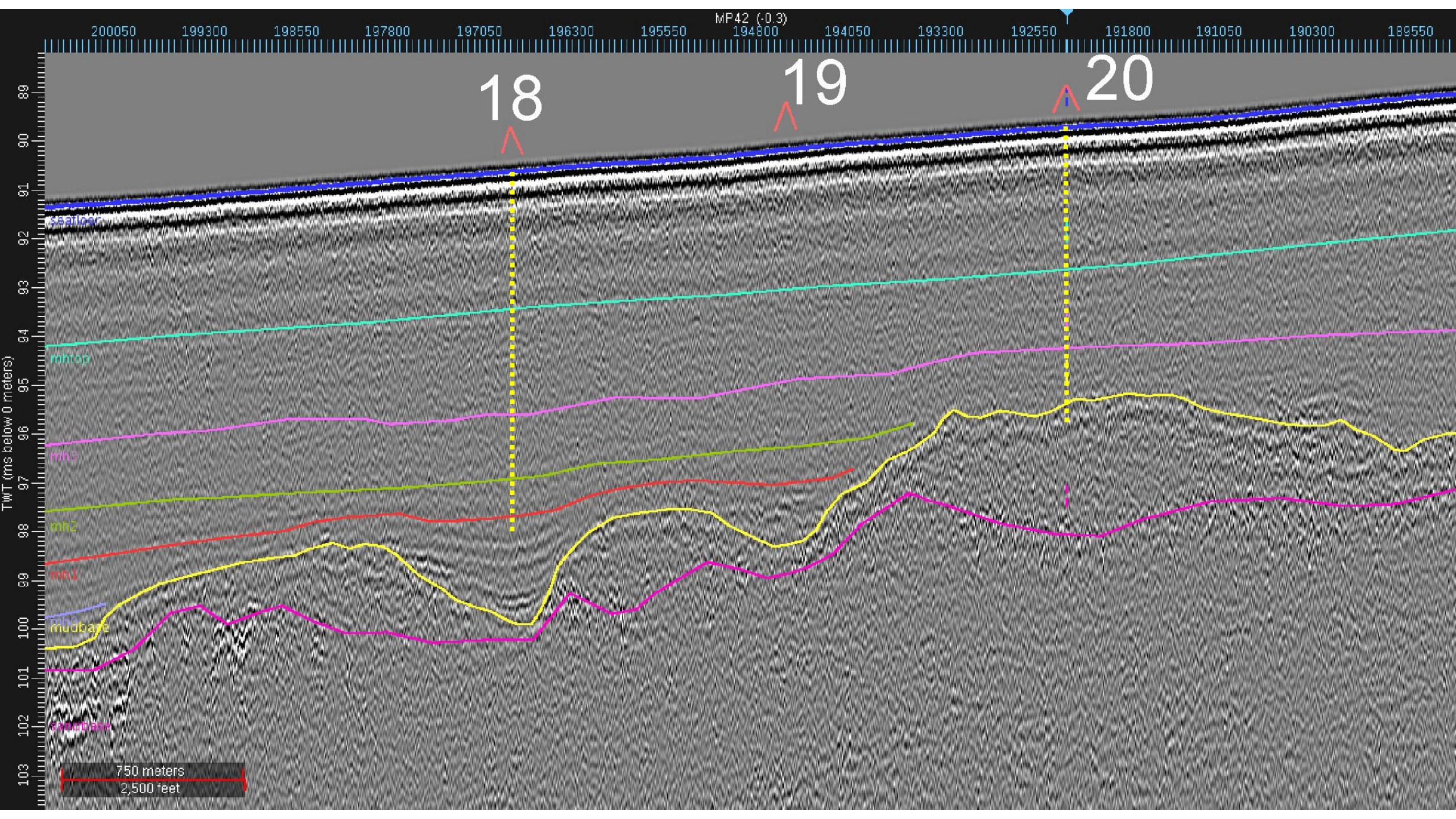
Where possible with either vibration chafing (above) or mud on exterior of barrel (left), we were able to document that penetration depth exceeded recovery length by 0.5-1.3 m – this discrepancy generally increased with the thickness of the mud penetrated. We therefore did not achieve full recovery within mud; i.e., some fraction of the mud penetrated was pushed around the barrel (pile-driving) rather than entered. We suspect that the tightness of our core catcher may be partly responsible.

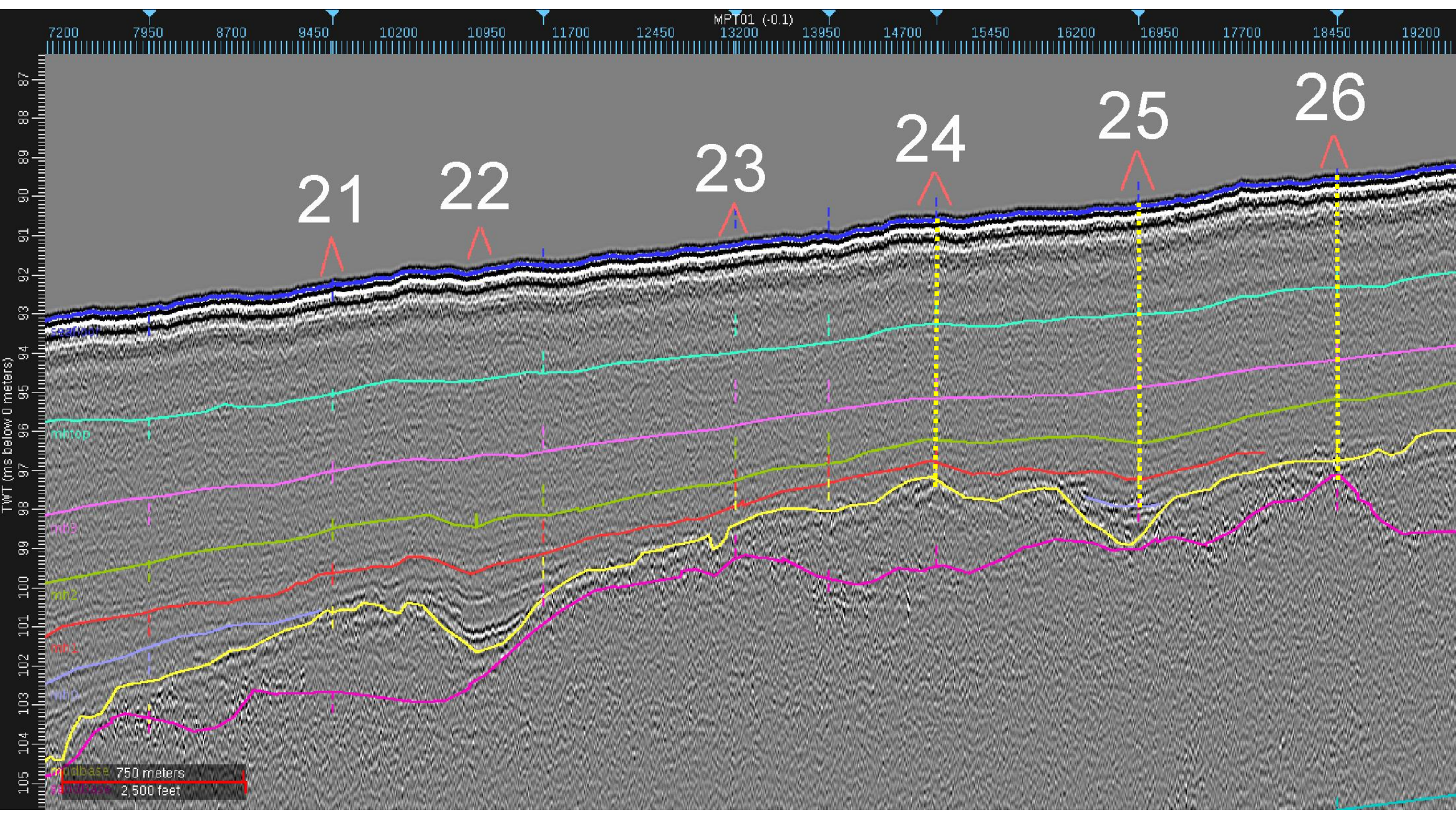
Vibracore Locations and Estimated Penetration Depths (1500 m/s conversion) of Successful Cores

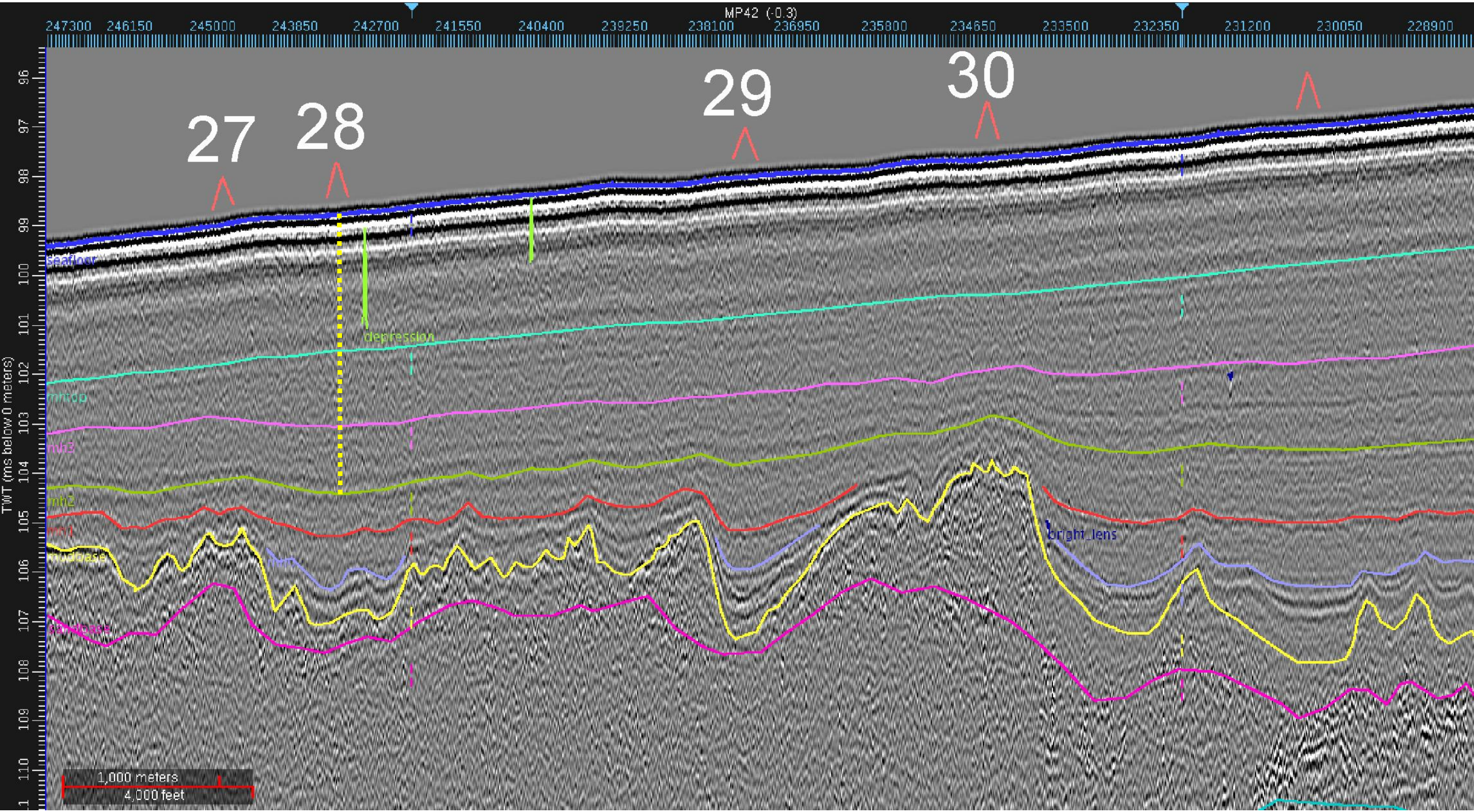

MP32 (0.1)
188350
188900
189450
190000
190550
191100
191650
192200
192750
193300
193850
194400
194950
195500
196050
196600
197150
197700
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
TWT (ms below 0 meters)
1
2
3
4
5
6
7
8
9
core locations
seafloor
mtop
mudbase
mh2
mh1
sandbase
500 meters
2,000 feet


tioga-01 (0.8)
10
11
12
13
seafloor
mudbase
sandbase
TWT (ms below 0 meters)
250 meters
750 feet


MPD02 (0.6)
324700
325150
325600
326050
326500
326950
327400
327850
328300
328750
329200
329650
330100
330550
331000
331450
331900
332350
TWT (ms below 0 meters)
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
4
14
15
16
17
core location
seafloor
mid-cap
mud-base
sand-base
500 meters
1,500 feet


MP42 (-0.3)
200050
199300
198550
197800
197050
196300
195550
194800
194050
193300
192550
191800
191050
190300
189550
18
19
20
seafloor
mhtop
mh3
mh2
mh1
mudbase
sandbase
TWT (ms below 0 meters)
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
750 meters
2,500 feet


MPT01 (-0.1)
7200
7950
8700
9450
10200
10950
11700
12450
13200
13950
14700
15450
16200
16950
17700
18450
19200
TWT (ms below 0 meters)
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
21
22
23
24
25
26
seafloor
mktop
mt3
mt2
mt1
mb1
750 meters
2,500 feet


MP42 (-0.3)
247300 246150 245000 243850 242700 241550 240400 239250 238100 236950 235800 234650 233500 232350 231200 230050 228900
27
28
29
30
seafloor
depression
mh1op
mh3
mh2
mh1
mudbase
bright_lens
TWT (ms below 0 meters)
96 97 98 99 100 101 102 103 104 105 106 107 108 109 110
1,000 meters
4,000 feet