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Use of high resolution bathymetry and backscatter for mapping depositional environments on the New Hampshire continental shelf

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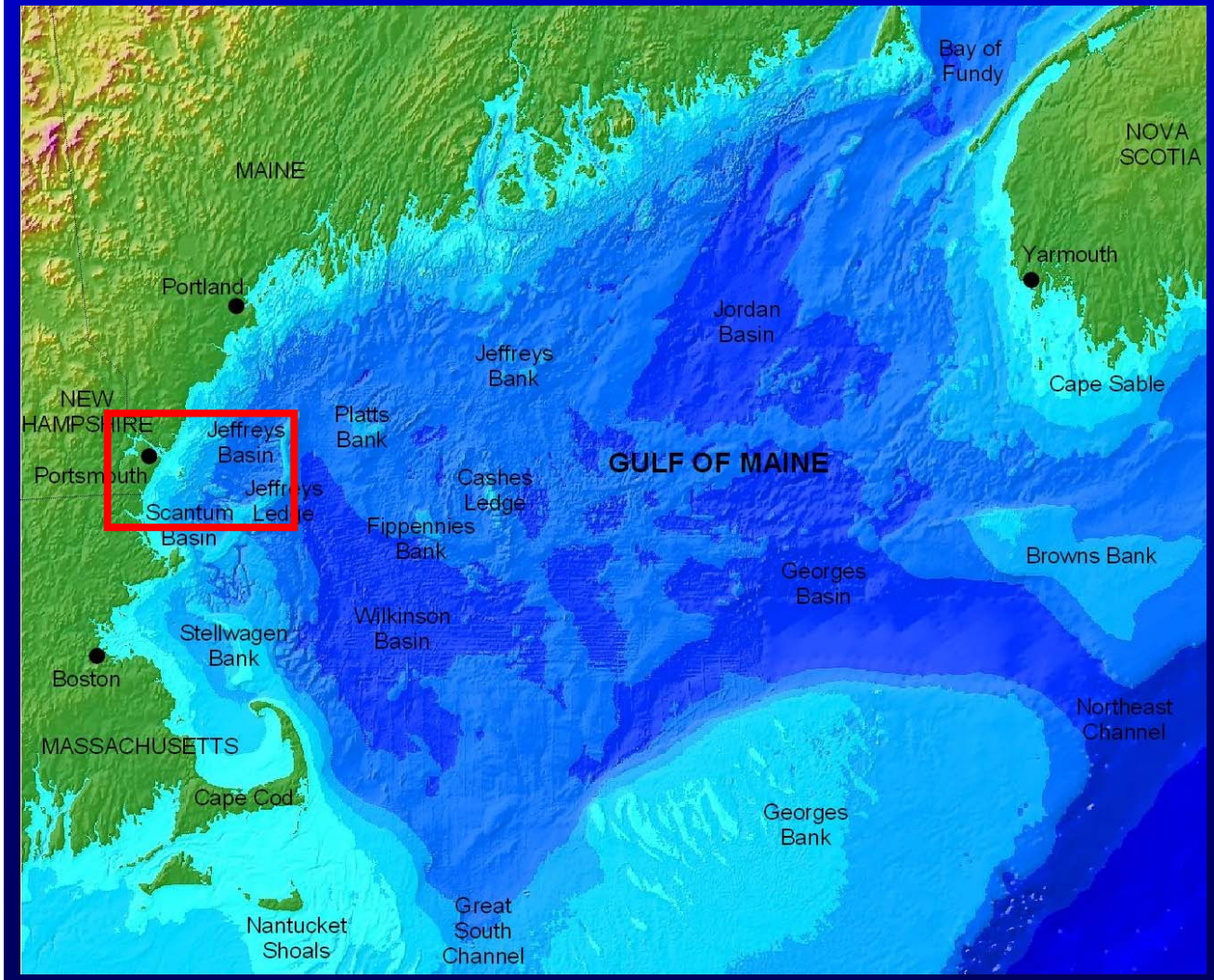
Use of High Resolution Bathymetry and Backscatter for Mapping Depositional Environments on the New Hampshire Continental Shelf



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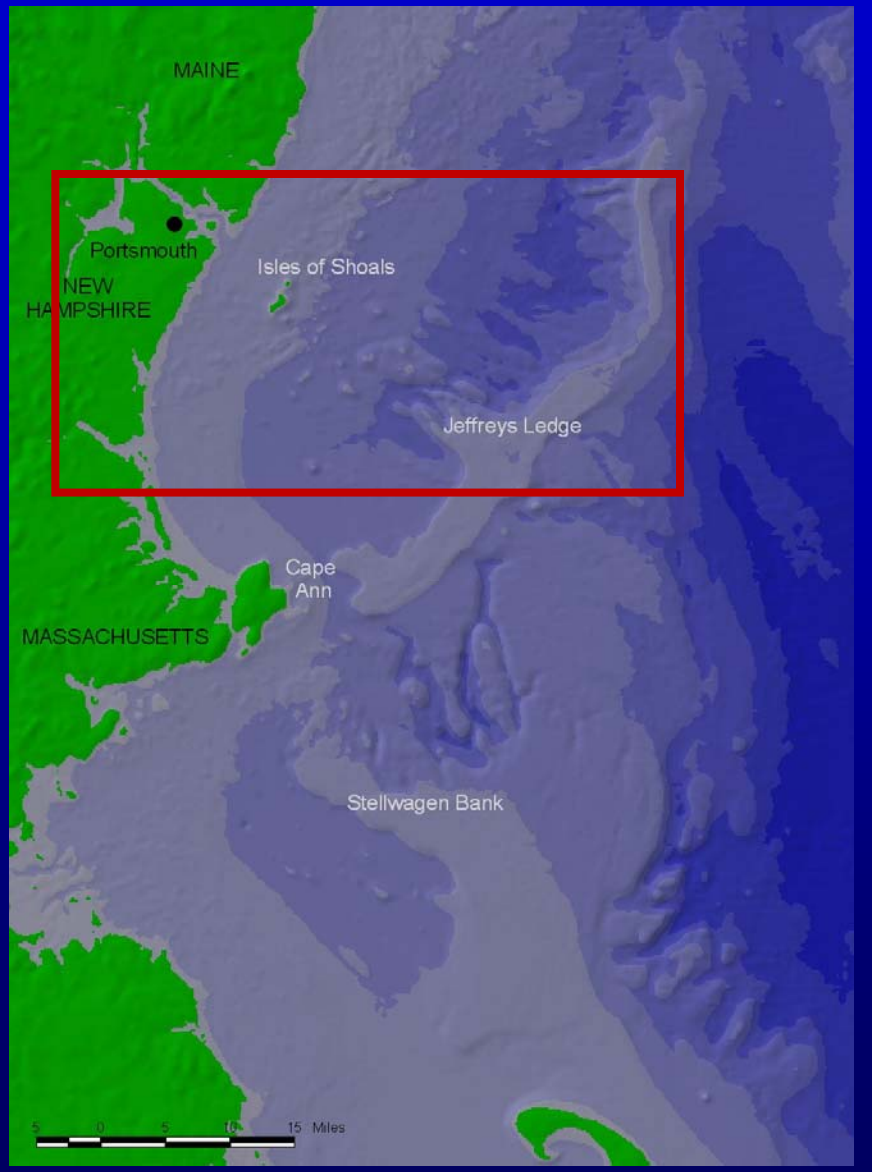
Overarching Goals of Research Program

- Further the Understanding of the Geology of Western Gulf of Maine
  - Quaternary Geology
  - Depositional Environments
  - Controlling Processes
- Further the Understanding of the Relationship Between Seafloor Geology and Habitats
- Delineate and Verify Sand and Gravel Resources on the NH Shelf
  - Partnering with NHGS and BOEM
- Develop Sand Resource Needs Assessment of the New Hampshire Coast
  - Partnering with NHGS and BOEM
- Improve Bottom Characterization Ability

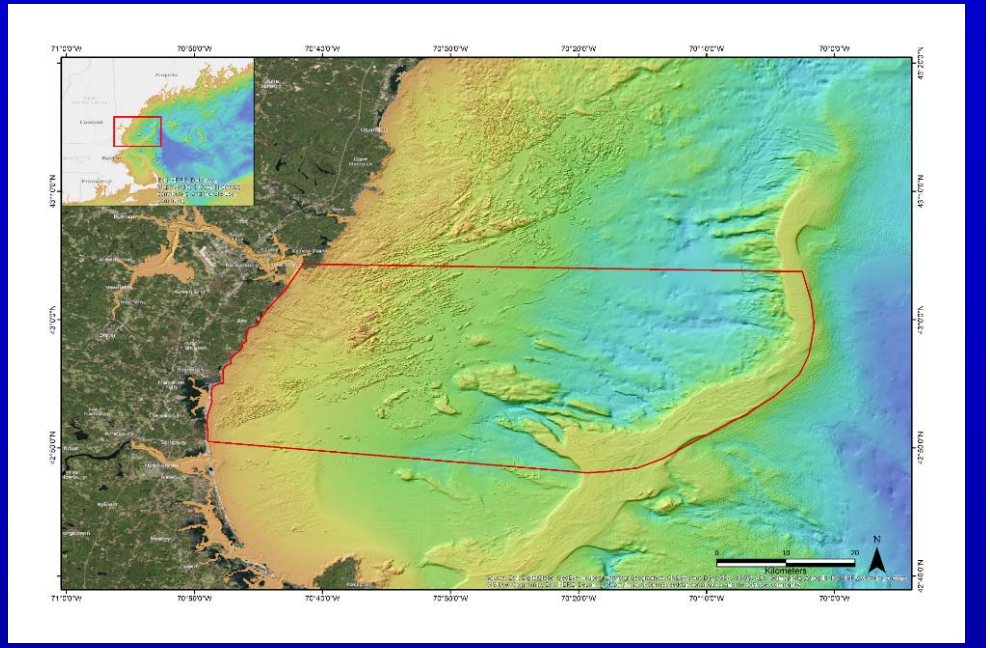


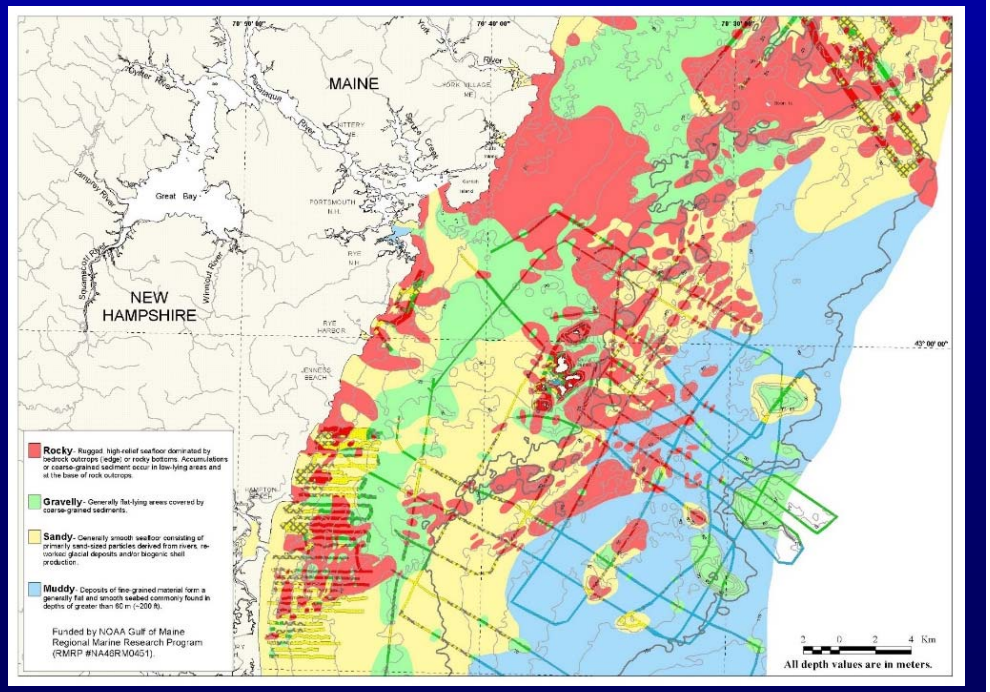
Rational for Sand and Gravel Studies

- Due to Climate Change Many Coastal Areas Will Be Exposed to Increased Coastal Flooding and Erosion
  - Need to Increase Coastal Resiliency
- A Likely Management Strategy will be to Maintain the Beaches as long as Possible by Sand Nourishment
- Therefore, Need to Identify Sources of Sand Now
  - For Immediate Use in Some Locations
  - For Future Use in Others (i.e., New Hampshire)

Our Approach

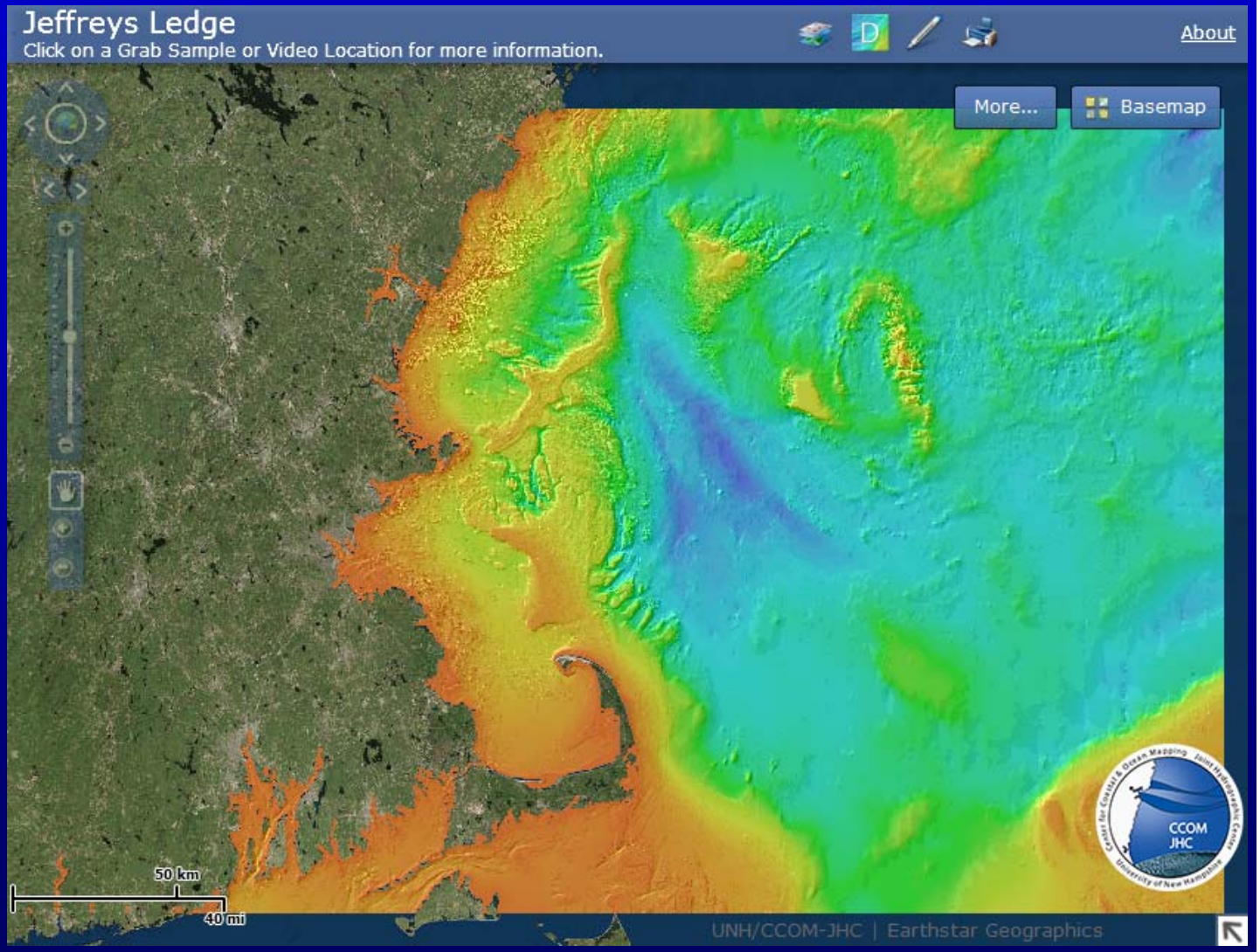
- Develop High Resolution Bathymetric and Backscatter Maps of the NH and Vicinity Shelf
- Locate and Verify Previously Mapped Sand and Gravel Deposits on NH Shelf
  - Location
  - Thickness
- Merge the Database To Develop Seafloor Geology Maps
    - Surficial Sediments
    - Morphology
    - Sand Deposits





High Resolution Bathymetric Maps

- Shows Bathymetry at the 4 to 8 m Gridding
- New Bathymetry Added as it Becomes Available
- Backscatter Added as it Becomes Available
- Can Serve as Base for Other Data Sets (Jeffreys Ledge)
- Available via CCOM/JHC Web Site



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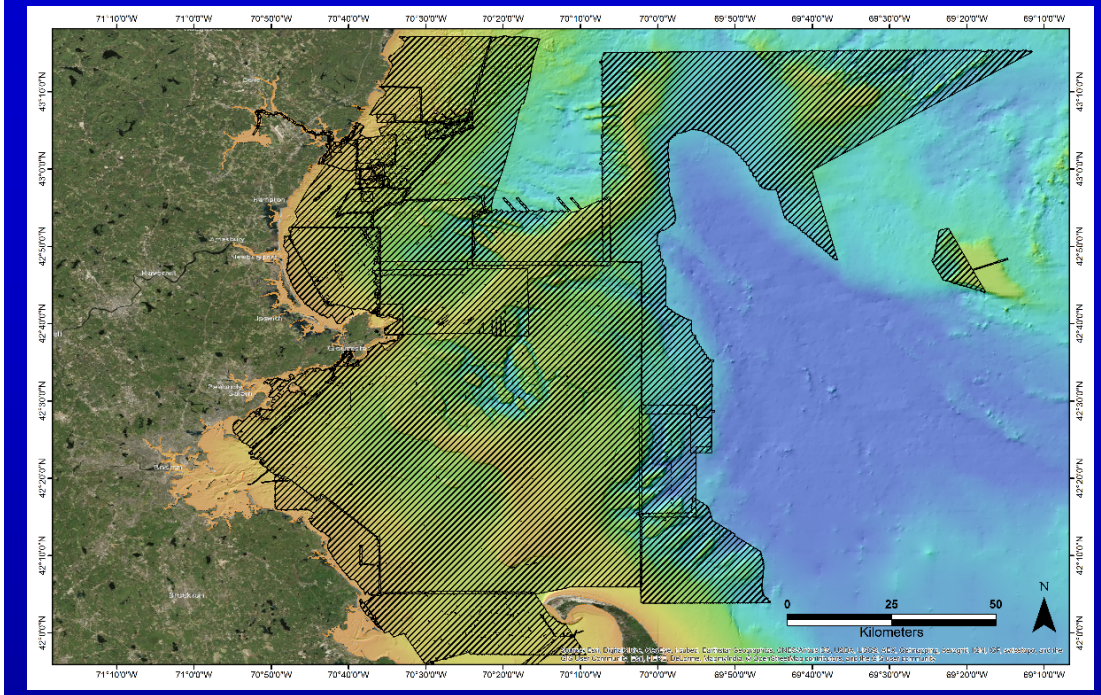
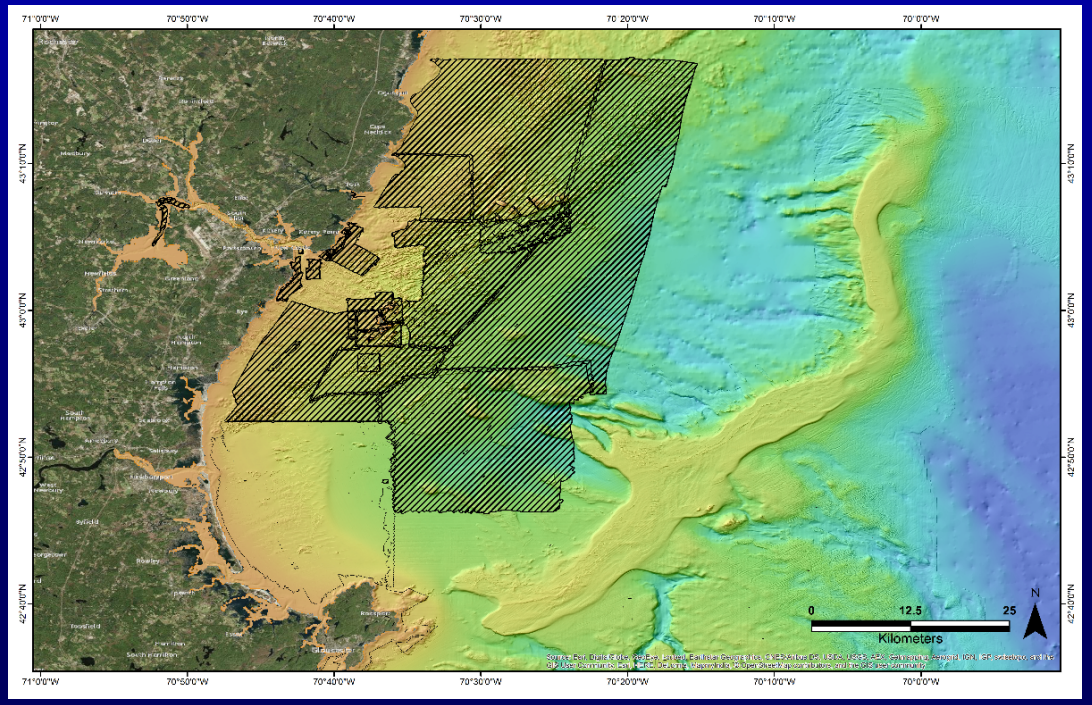


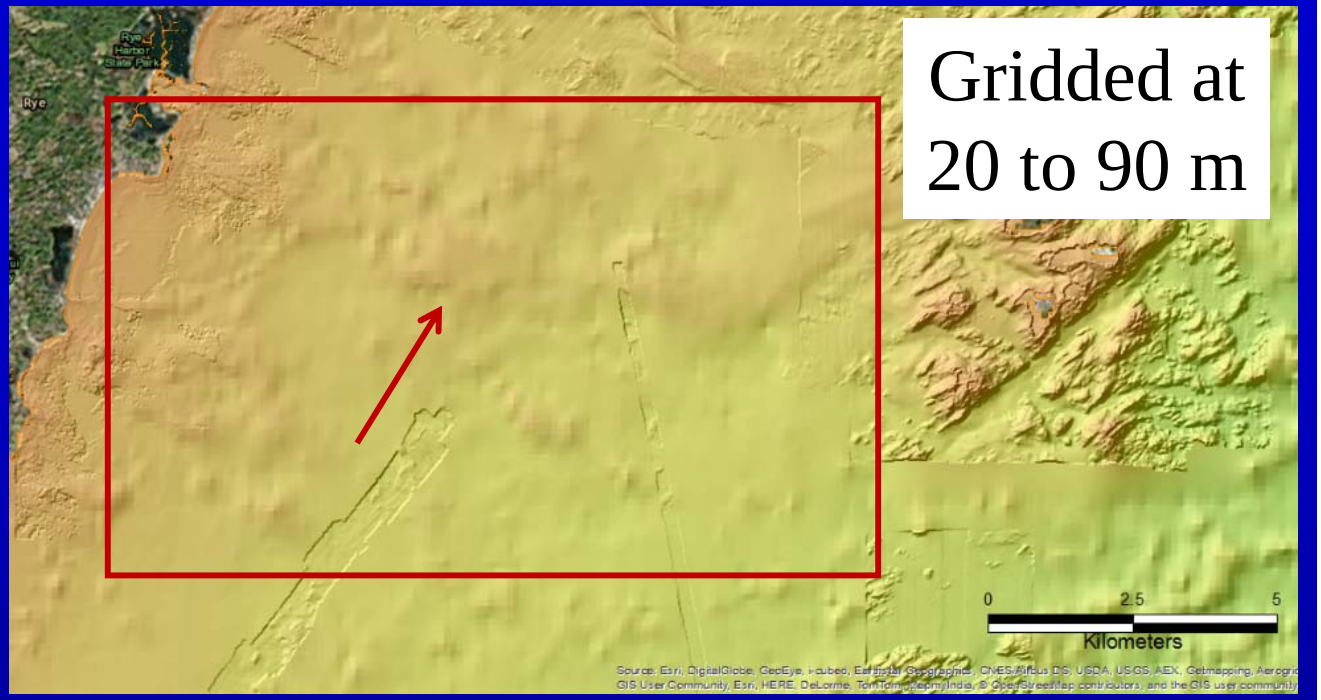
Multibeam Echosounder Surveys Incorporated into WGOM Synthesis (to Date)

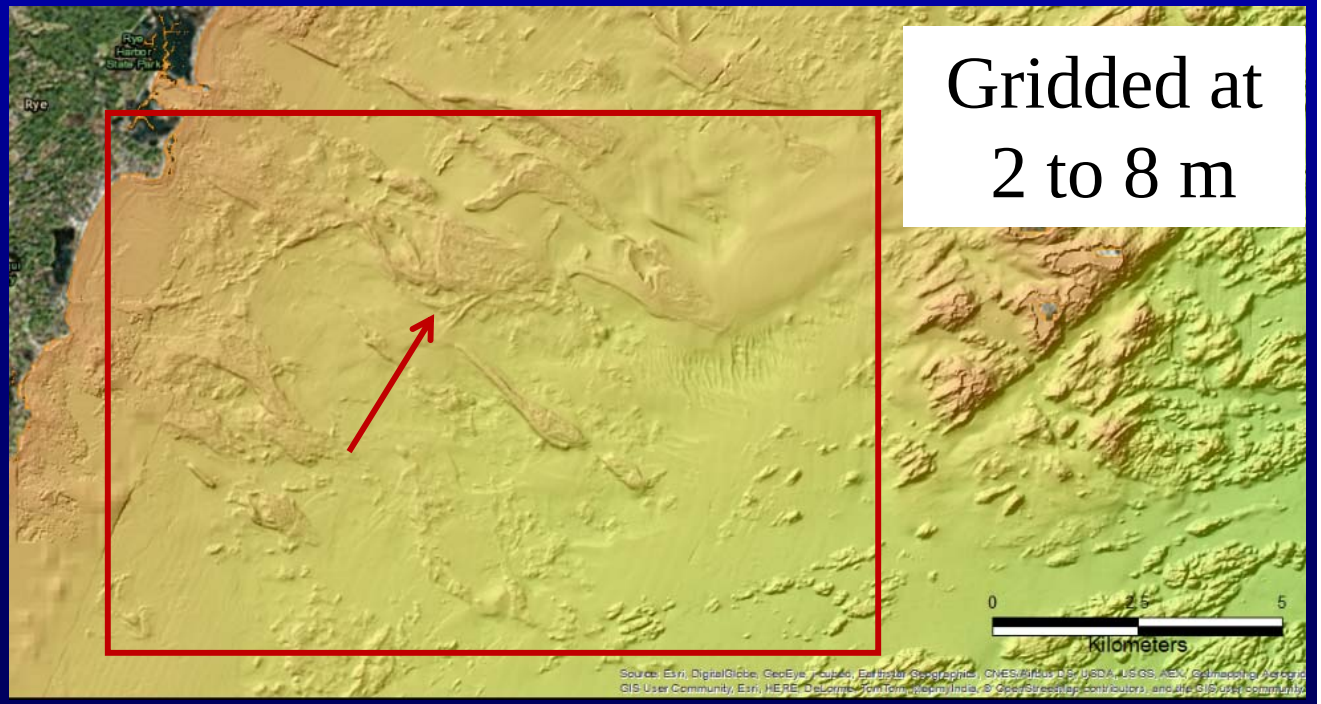
MBES Bathymetric Database

Backscatter Database Recently Obtained and Processing Initiated

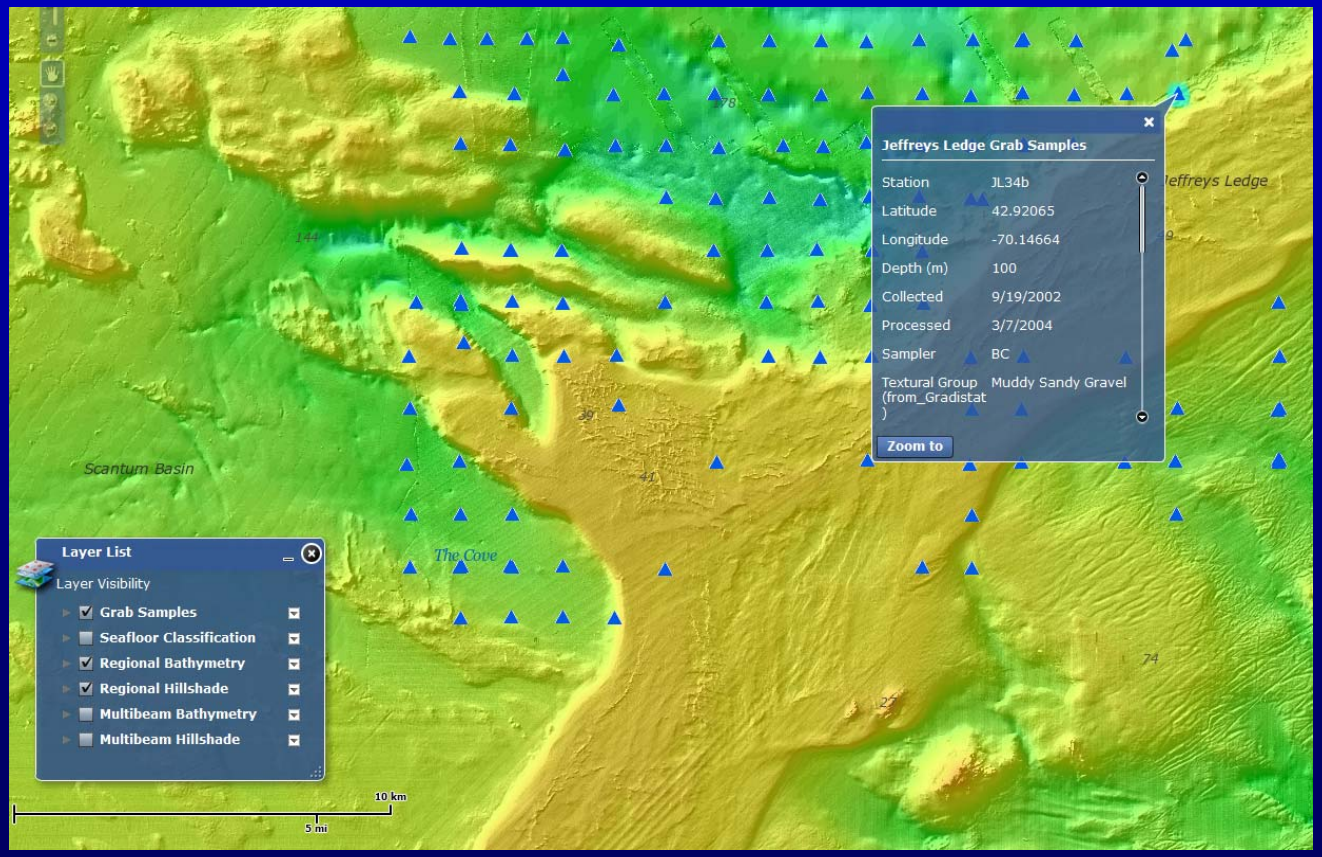


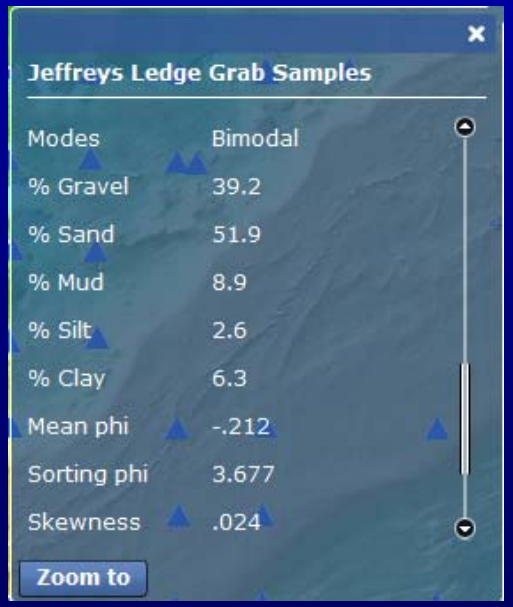
Value of MBES Bathymetry



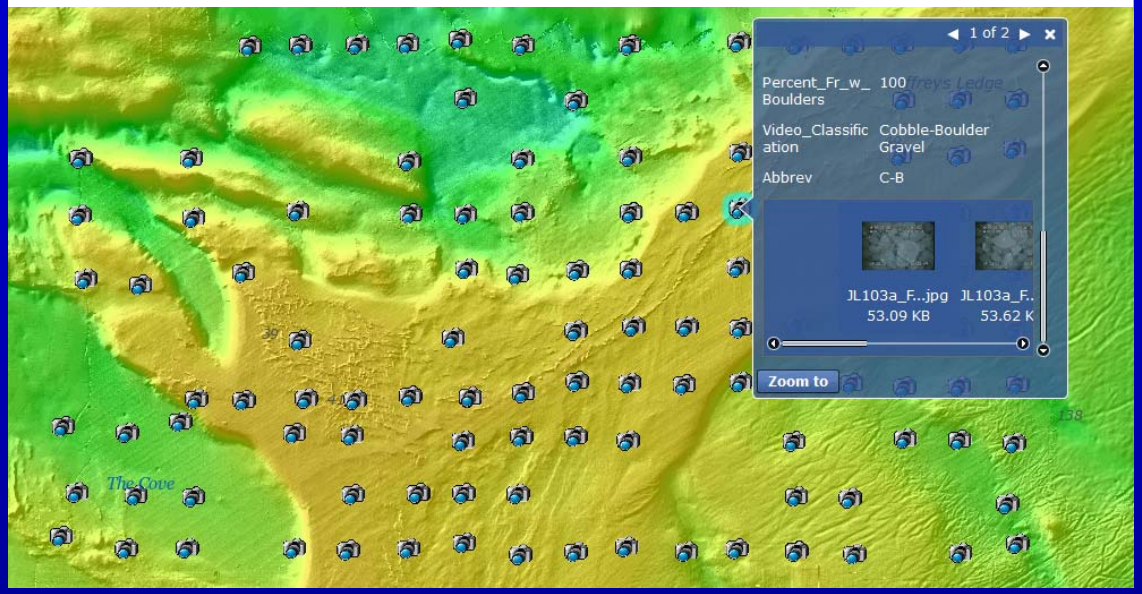


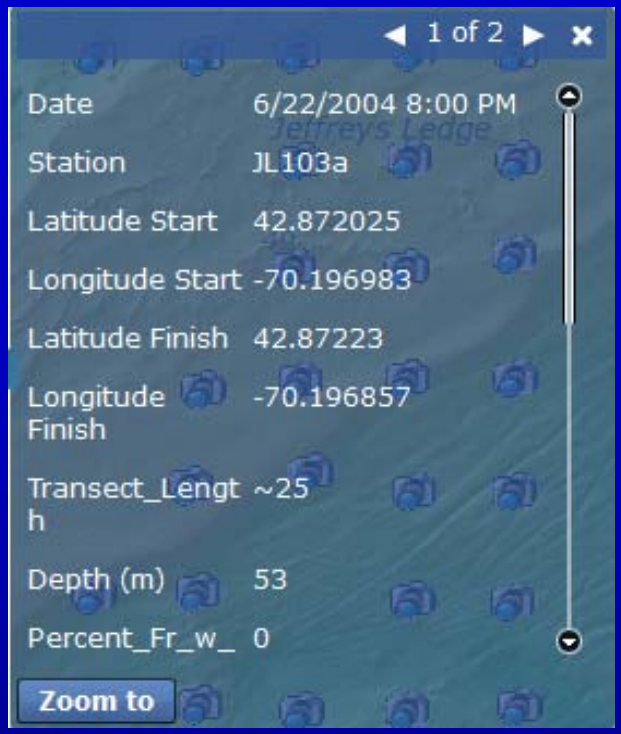
Other Databases Included With Bathymetric Maps: (Jeffreys Ledge Sediments)





Jeffreys Ledge Images





Mapping Sand Bodies: Merging High Resolution MBES with 1980's Seismics

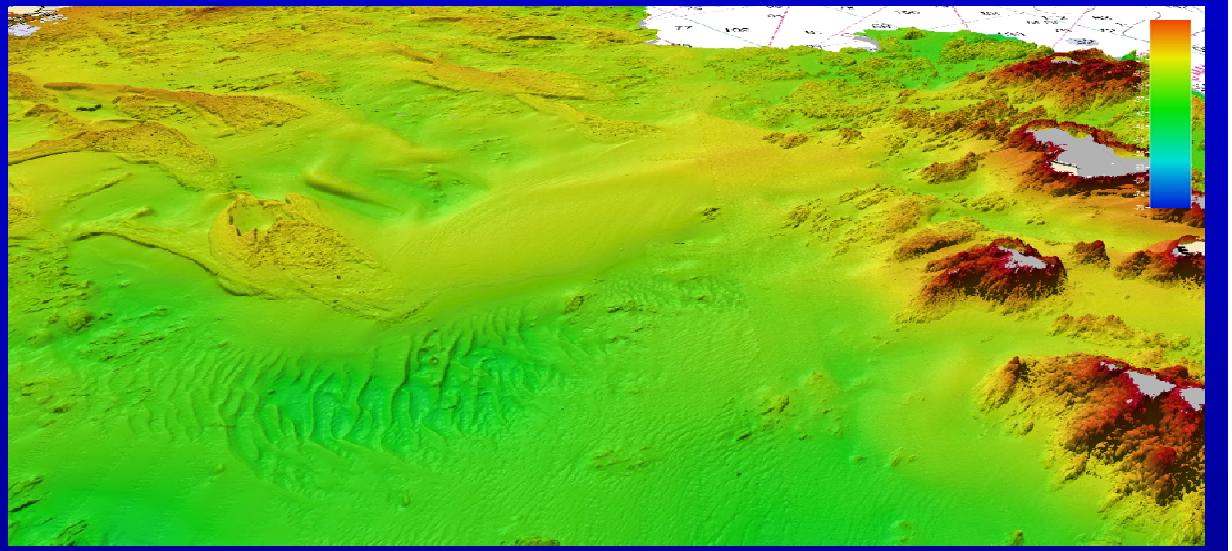
Archived Subbottom Seismics Records from Birch and others (1981, 1982, 1985)

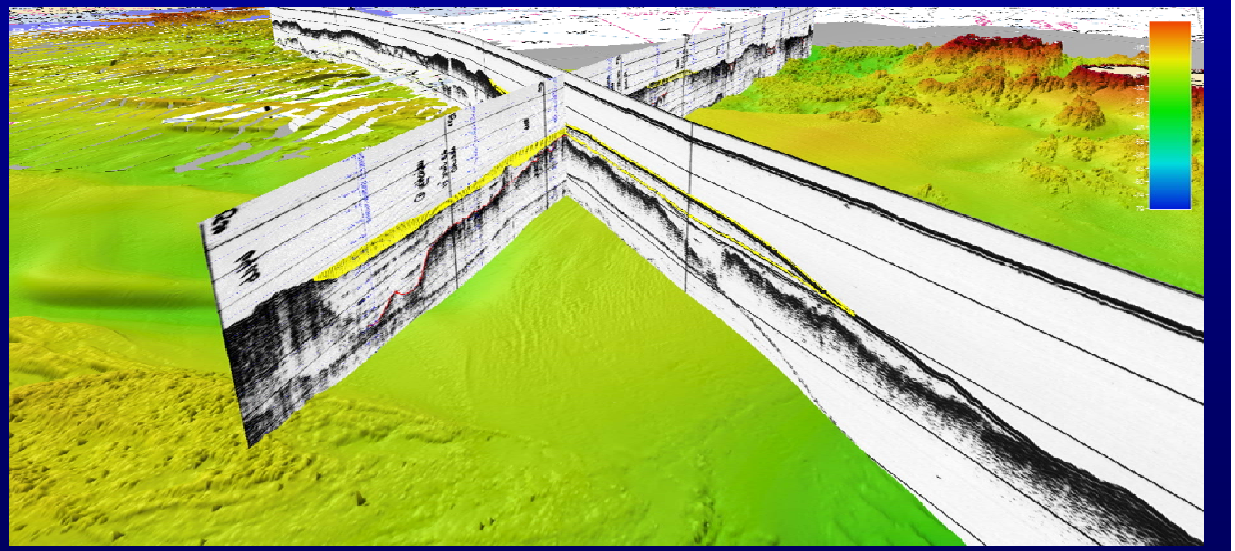
Converted to Digital Records

Digital Files Analyzed in SonarWIZ and Displayed in Fledermaus and ArcGIS

Seismics Merged With New Seafloor Maps to Achieve the Best Possible Positioning

Sand Body Thicknesses Extracted and Contoured to Form Isopach Maps





Conversion of Analog Seismic Records to Digital (SEG-Y)

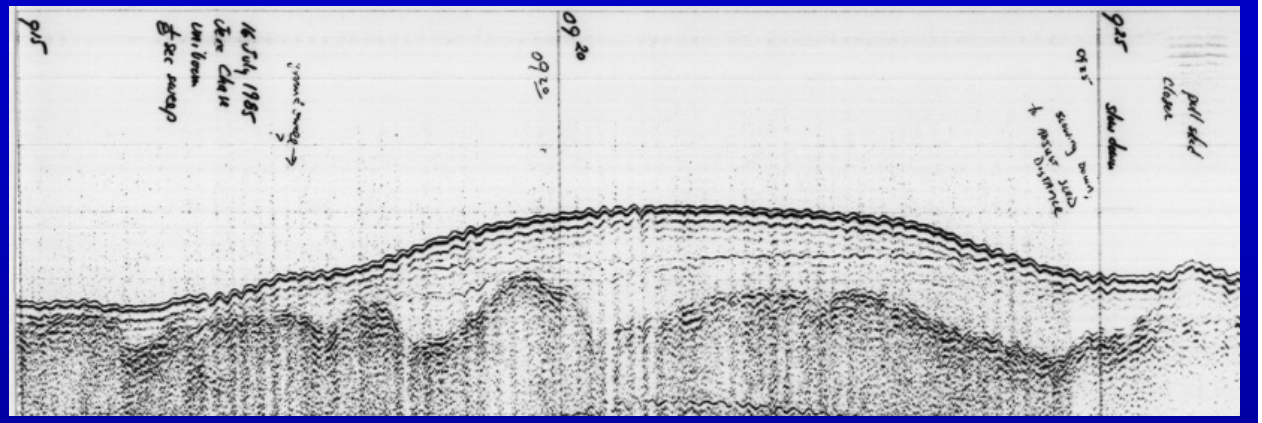
Original Analog Records Scanned and TIFF Files Created

Tiff Files Brought Into "ImageToSegy" Software

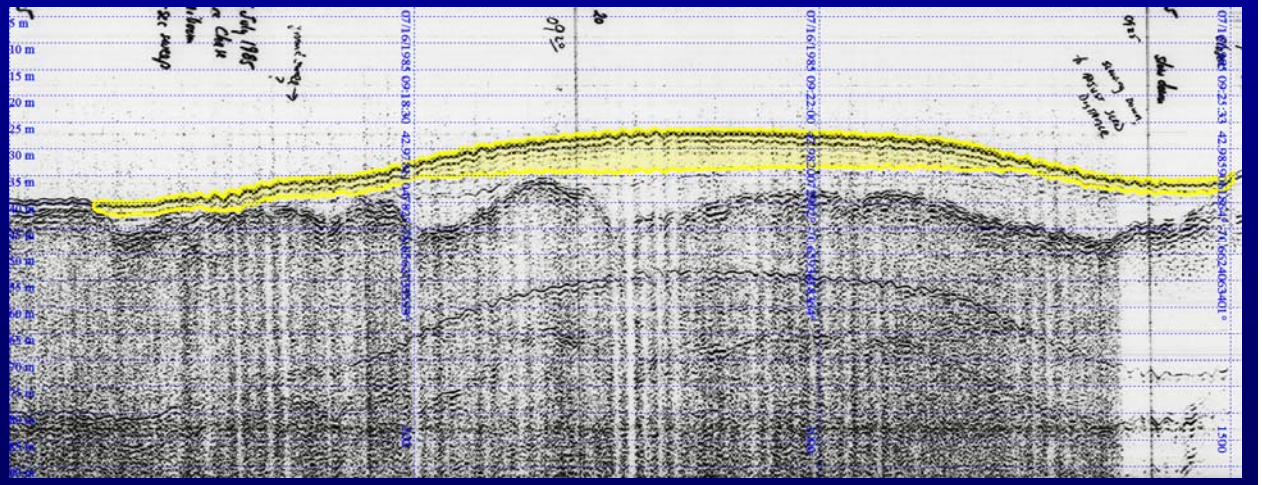
Navigation Points and Depth Information Added (Date, Time, Sweep Rate)

Output is Standard SEG-Y File

Challenge is Positioning: Need to Determine Horizontal Uncertainty

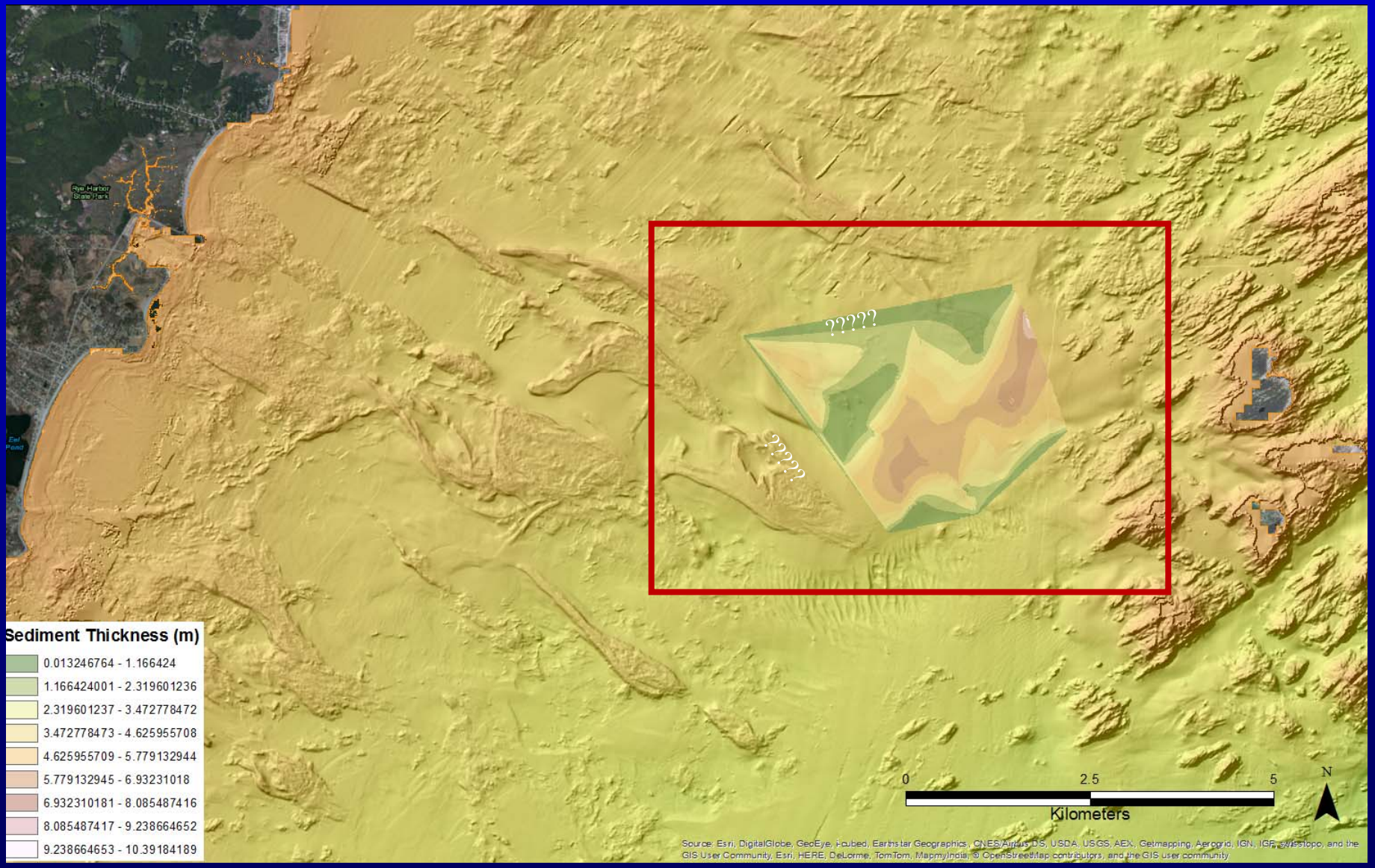


Analog Subbottom Seismic Record

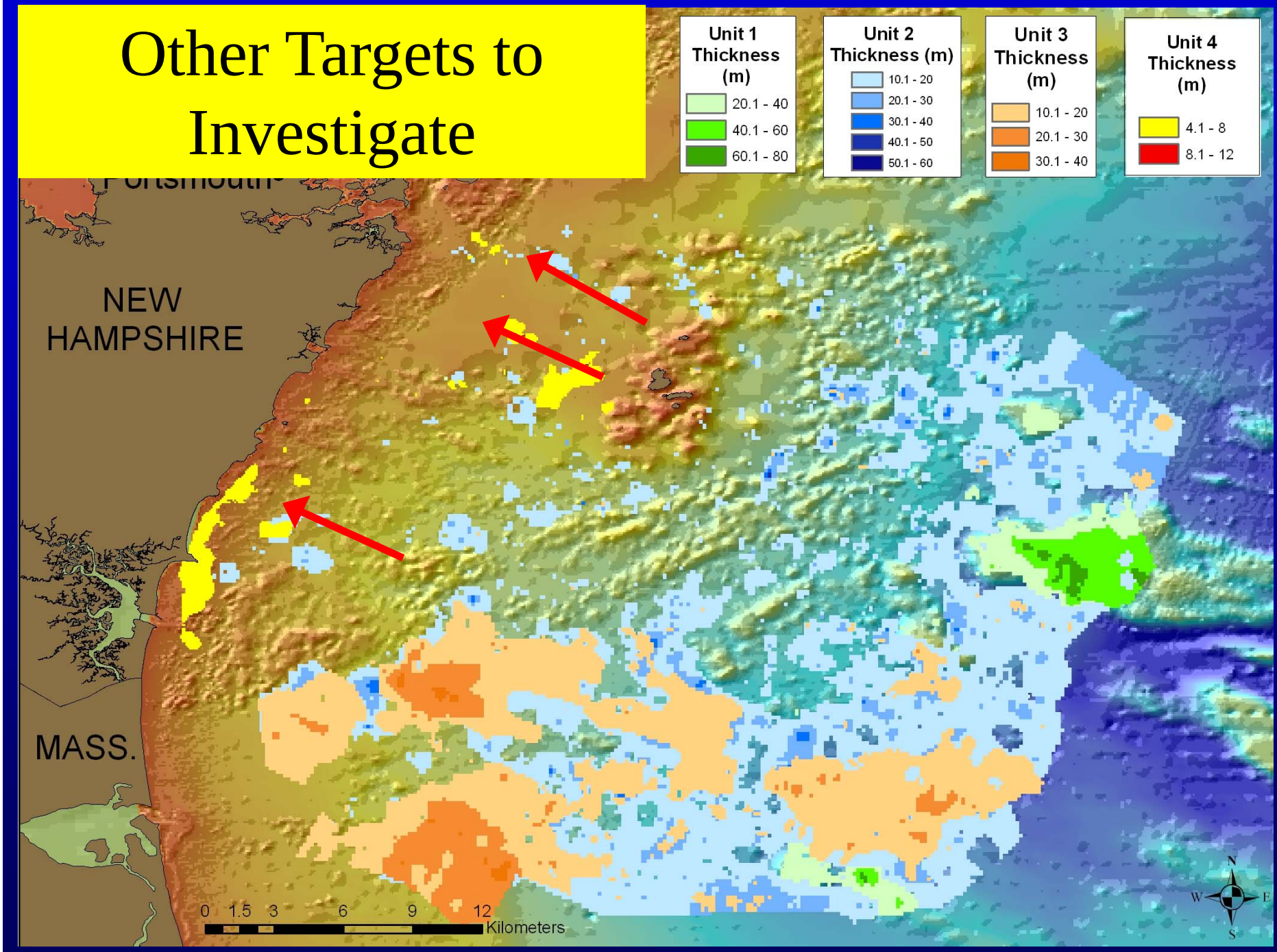


Analog Record Converted to Digital

Northern Sand Body Isopach Map



Other Targets to Investigate



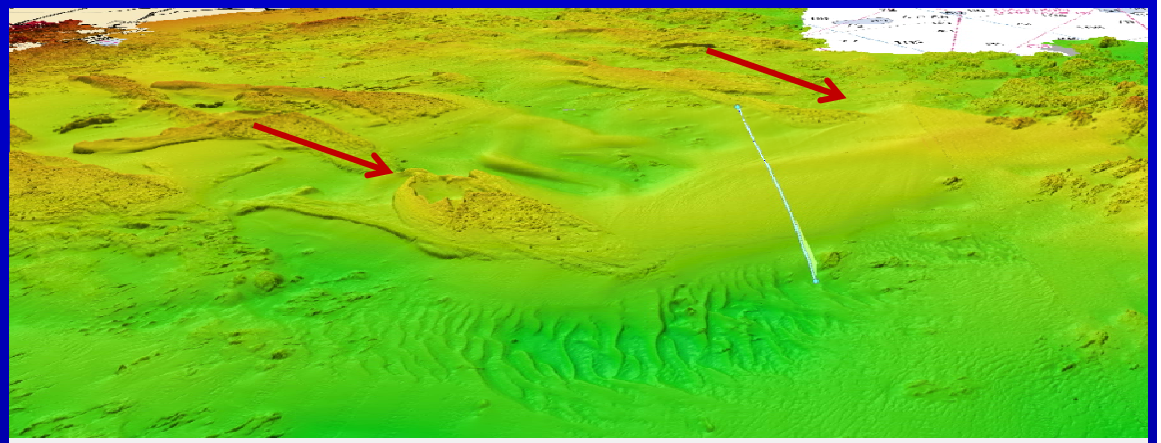
Potential Origin of Northern Sand Body

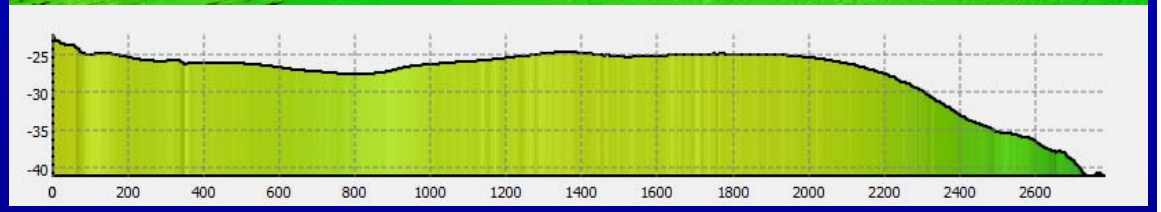
Extends ~2.5 km Between Two Eroded Drumlins (Hypothesis)

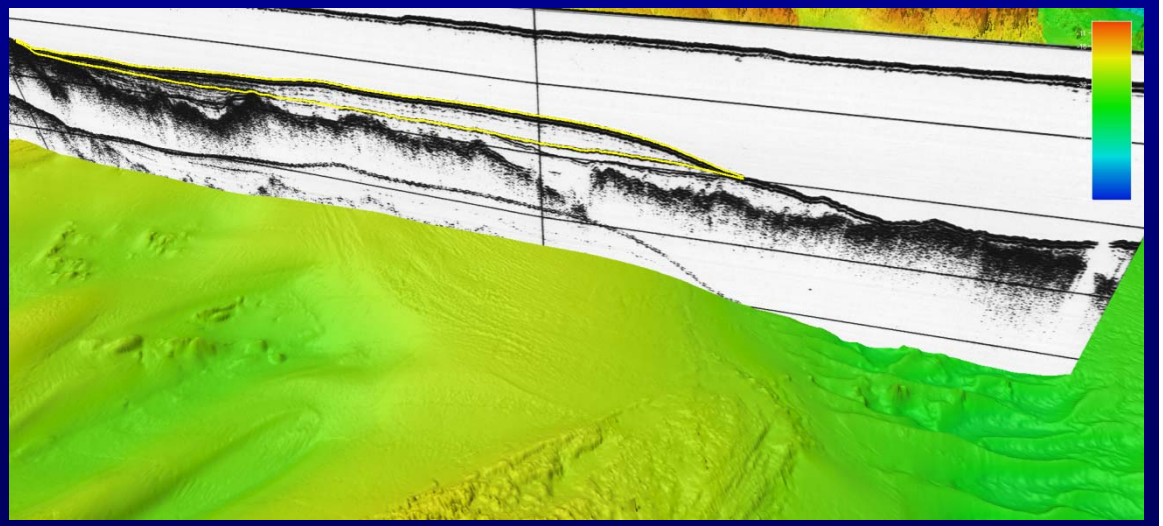
Up to 15 m Vertical Relief of Entire Feature

Sand Confined to Upper 6 to 10 m (Needs to Be Verified with Subbottom Seismic Survey and VC)

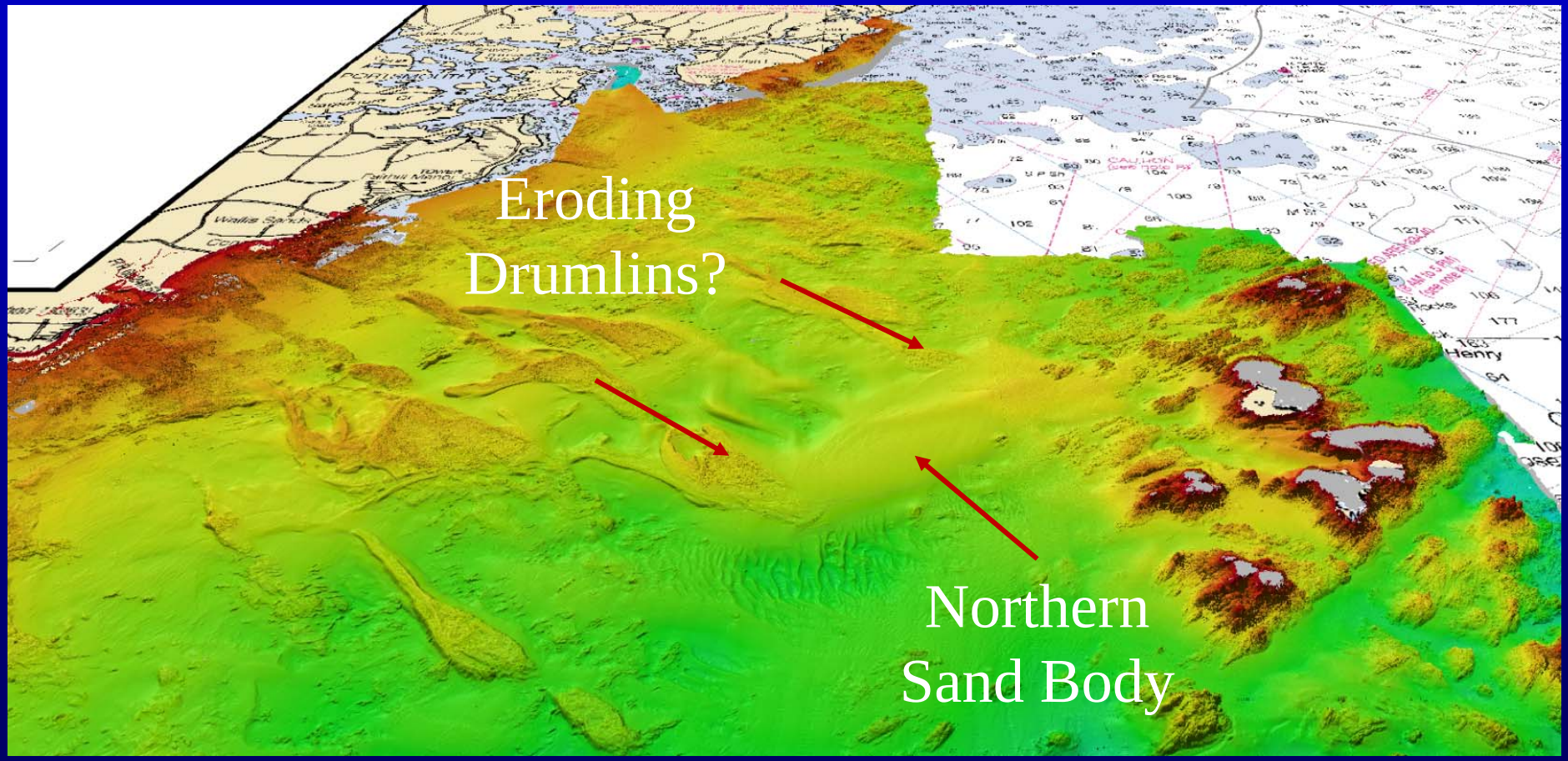
Drumlins or Other Glacial Features are Possible Source of Sand and Gravel

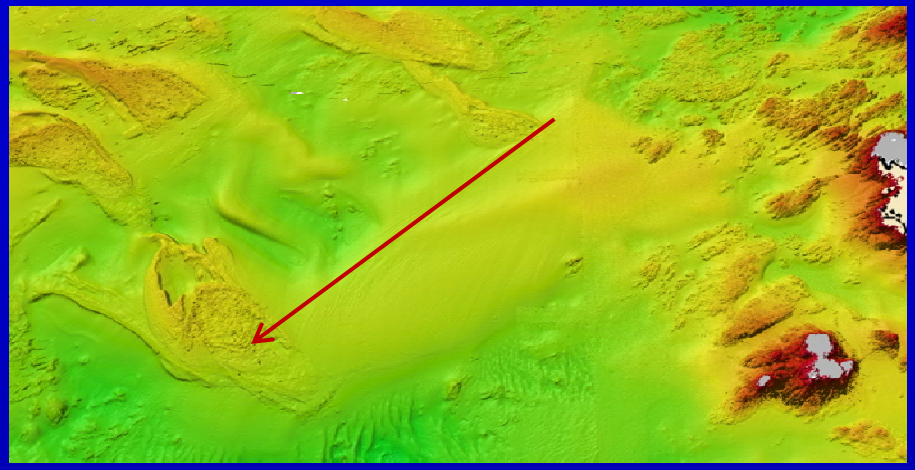




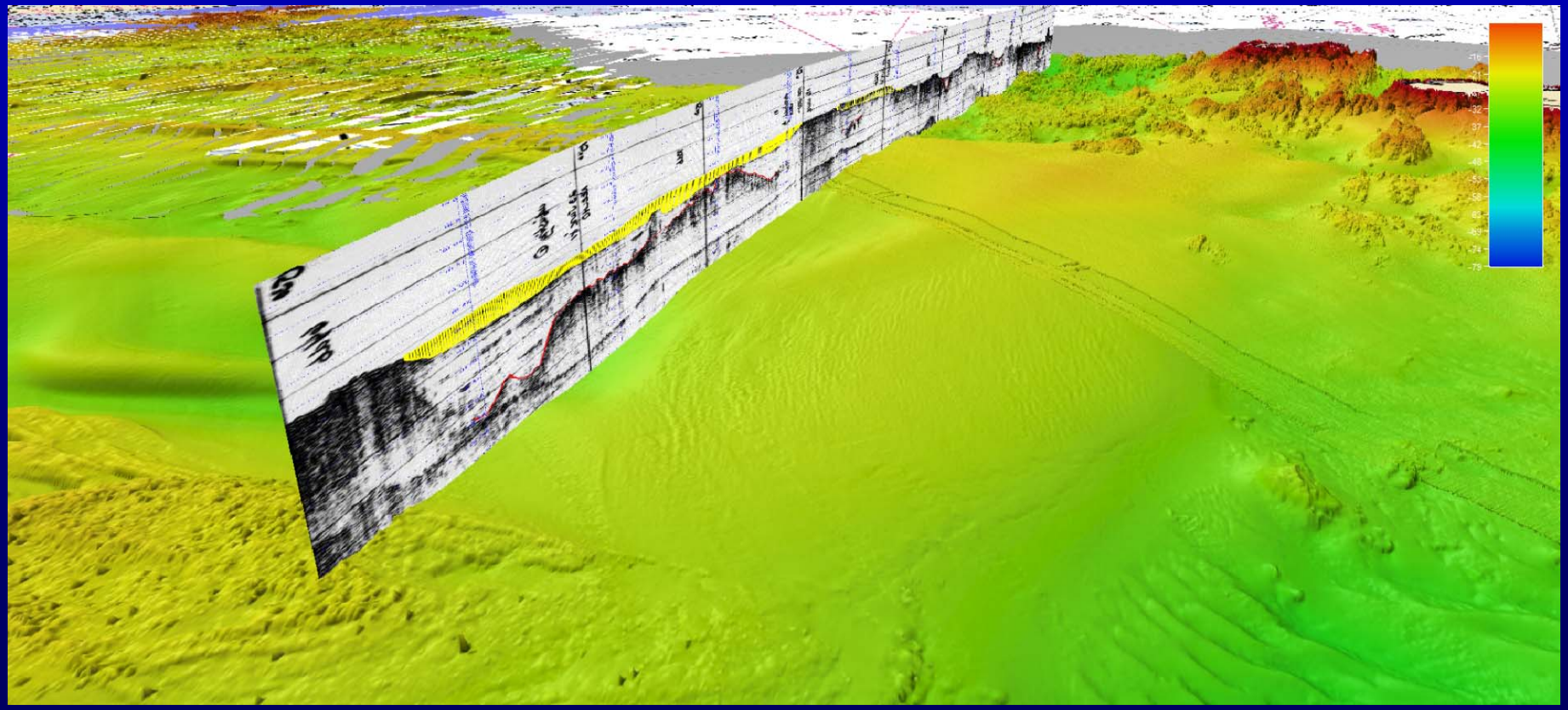


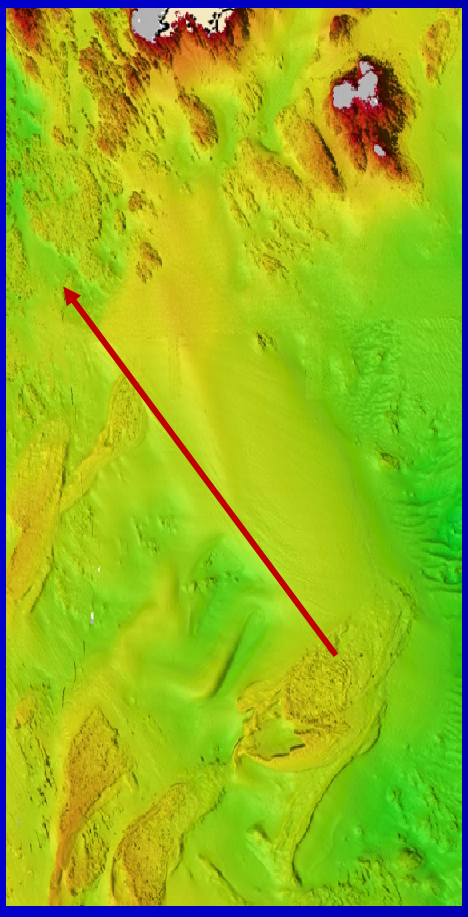
Relationship Between Northern Sand Body and Eroded Drumlins

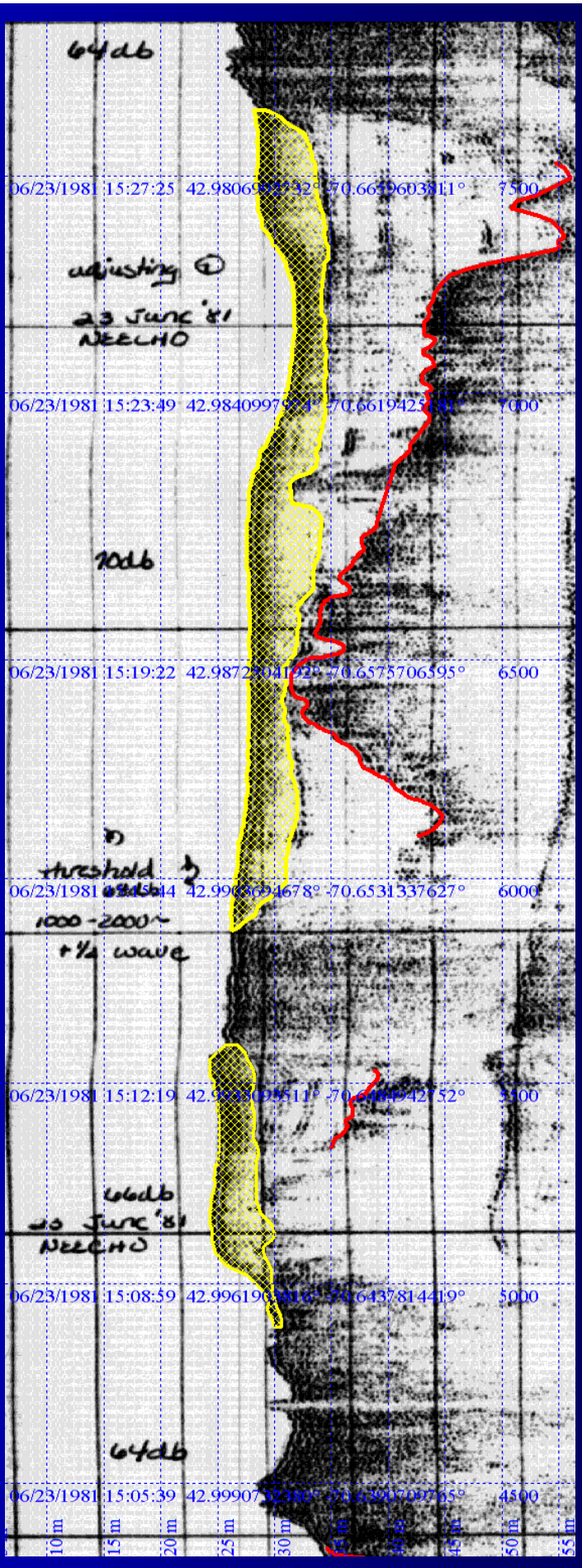




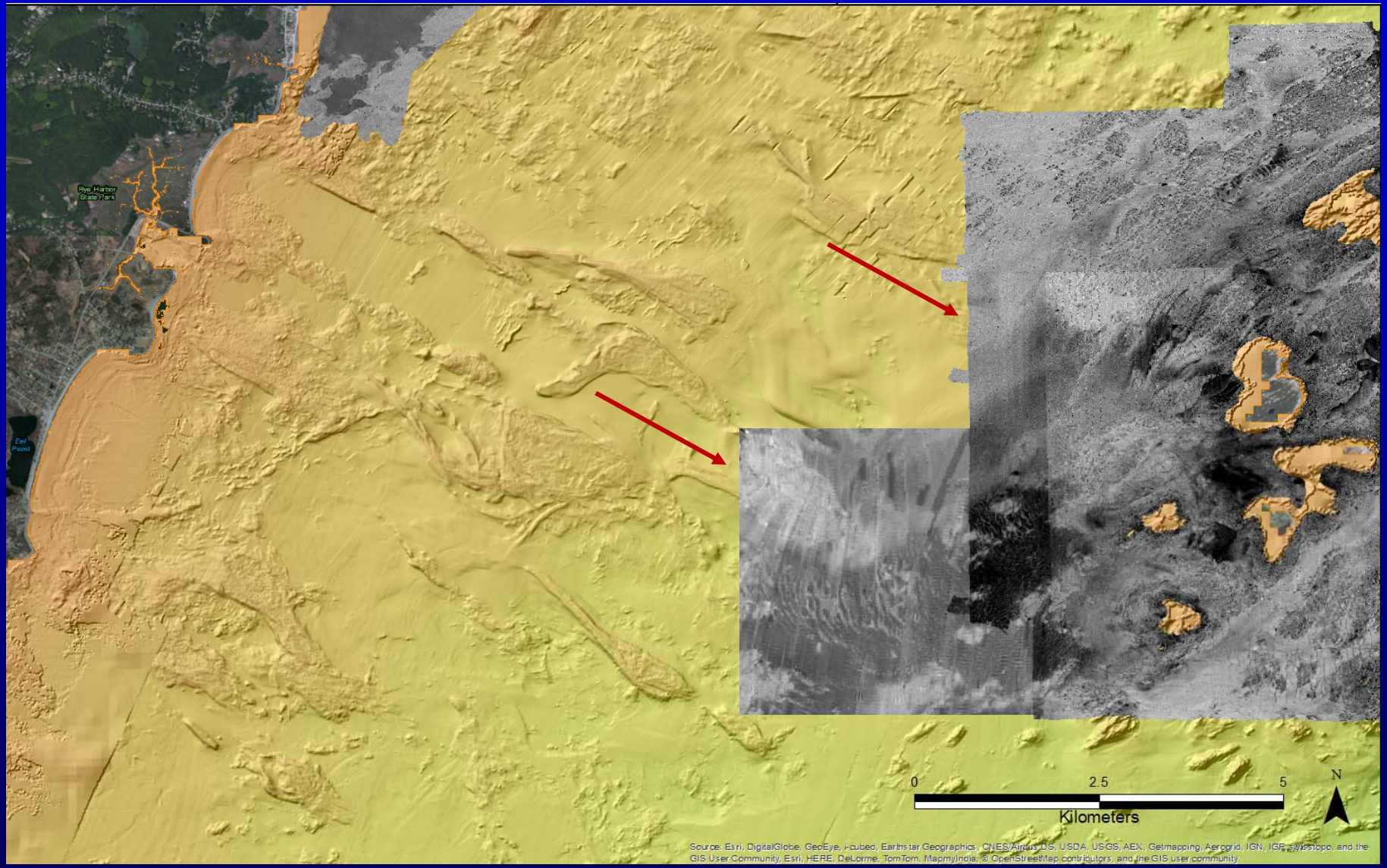
Relationship Between Northern Sand Body and Eroded Drumlins



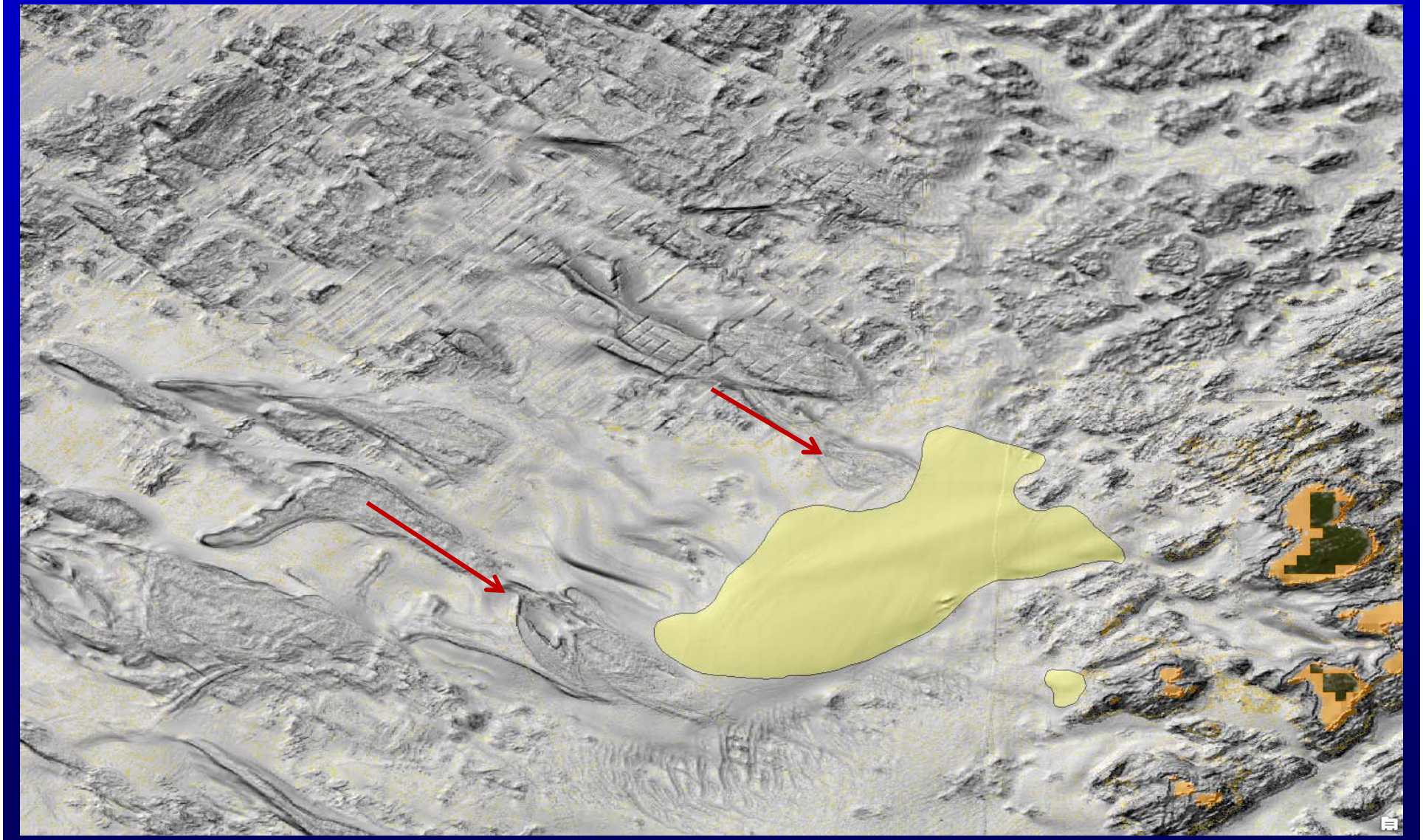



64db
06/23/1981 15:27:25 42.98069[illegible] -70.6632603811° 7500
adjusting ①
23 June '81
NEECHO
06/23/1981 15:23:49 42.9840997[illegible] -70.6619425[illegible]° 7000
10db
06/23/1981 15:19:22 42.9872304[illegible] -70.6575706595° 6500
threshold
06/23/1981 15:14:44 42.9903694678° -70.6531337627° 6000
1000-2000~
+½ wave
06/23/1981 15:12:19 42.[illegible] -70.[illegible]° 5500
66db
23 June '81
NEECHO
06/23/1981 15:08:59 42.996190[illegible] -70.643781441[illegible]° 5000
64db
06/23/1981 15:05:39 42.99907[illegible] -70.639[illegible]° 4500
10 m
15 m
20 m
25 m
30 m
35 m
40 m
45 m
50 m
55 m

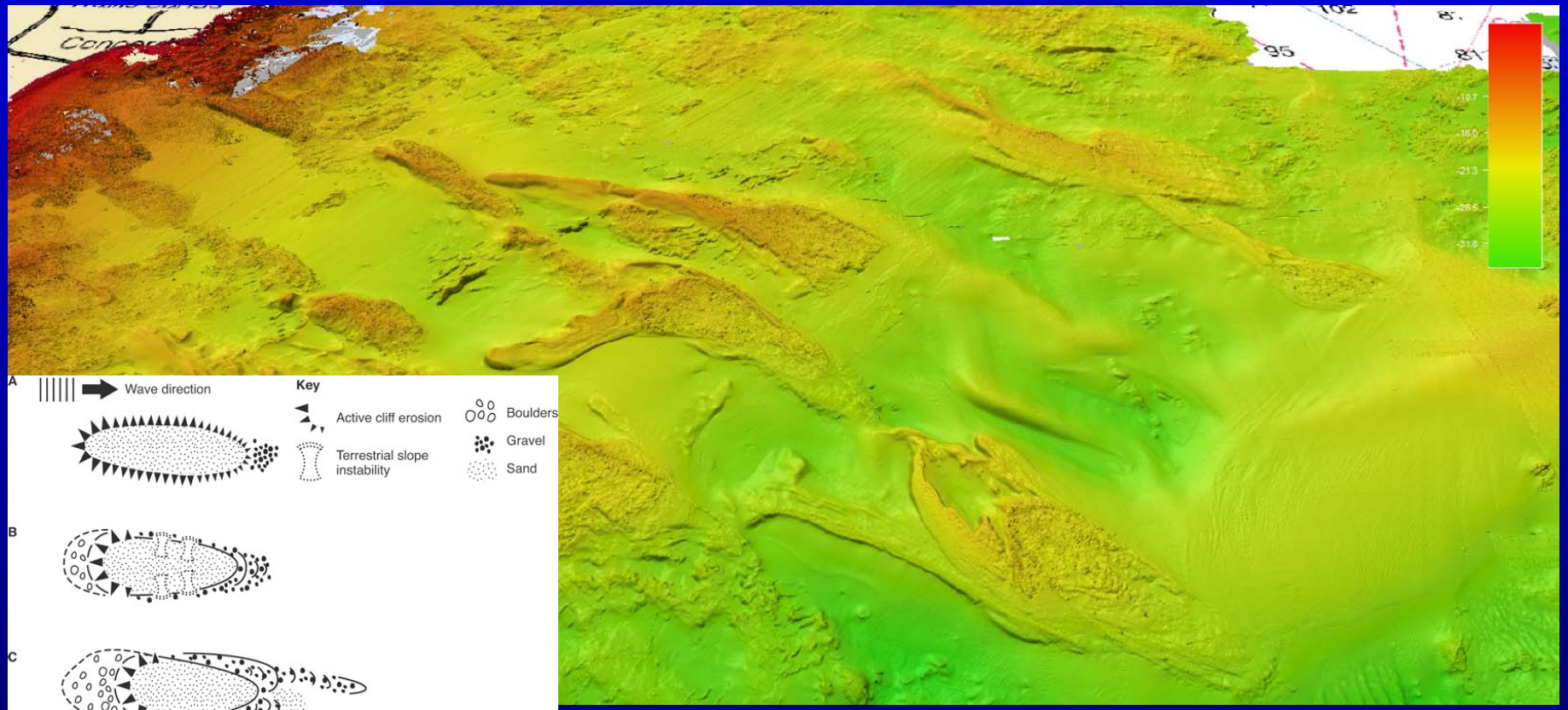
Composition of Glacial Features Based On Backscatter



Composition of Glacial Features Based On Texture



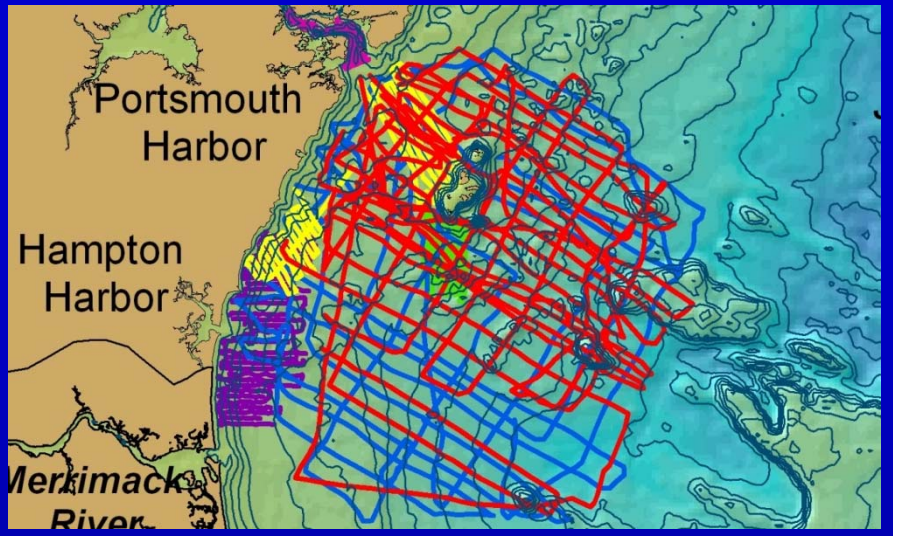
Model for Eroded Drumlins and Sand and Gravel Deposits (Carter and Orford 1988)

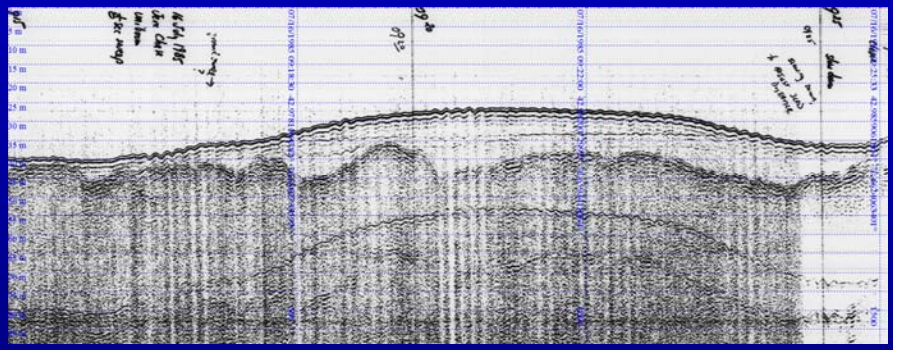


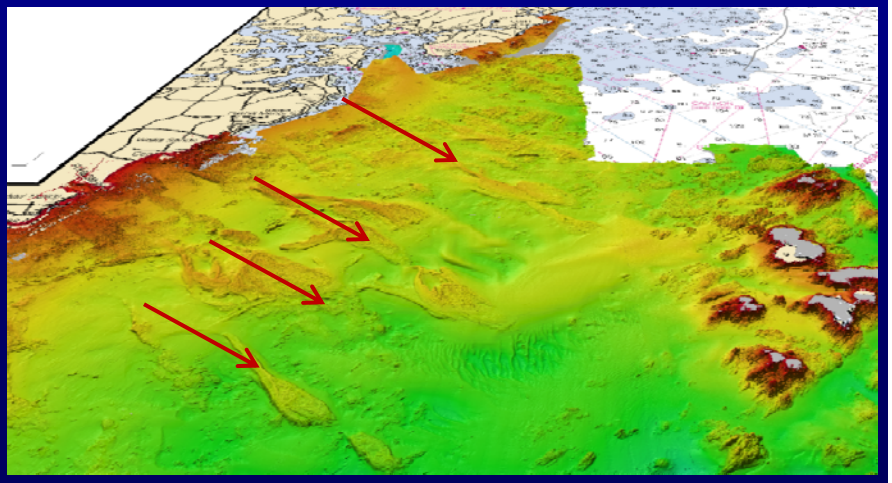
Carter and Orford. 1988. Model for Erosion of Drumlin and Beach Ridge Formation (figure reproduced in Masselink, Hughes and Knight. 2011. Introduction to Coastal Processes and Geomorphology, 2nd edition. Hodder Education. Figure 11.6

Summary

- Mapping of Sand Bodies from Early Surveys Enhanced by Conversion to Digital Format
- And Merging with MBES Bathymetry and Backscatter
- However, Comparisons with High Resolution MBES Indicates Positioning Uncertainty Needs to be Better Understood
- Origin of Sand and Gravel Features on NH Shelf at Least Related to:
  - Erosion of Glacial Features
    - Drumlins
  - Marine Processes
  - Sea Level Changes
    - Transgression







Acknowledgements

- BOEM, Marine Minerals Program
  - **BOEM, NHGS and UNH Cooperative Agreement**
- New Hampshire Geological Survey
- UNH/NOAA Joint Hydrographic Center (Award NA10NOS4000073)
- NOS for Supplying Bathymetry and Backscatter
  - Castle Parker
  - LTJG David Rodziewicz
  - LTCD Mathew Jaskoski
- Erin Nagel