
Fundian Valley
Bay of Fundy
Beaufort Valley
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US Dept of State Geographer
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649 mi
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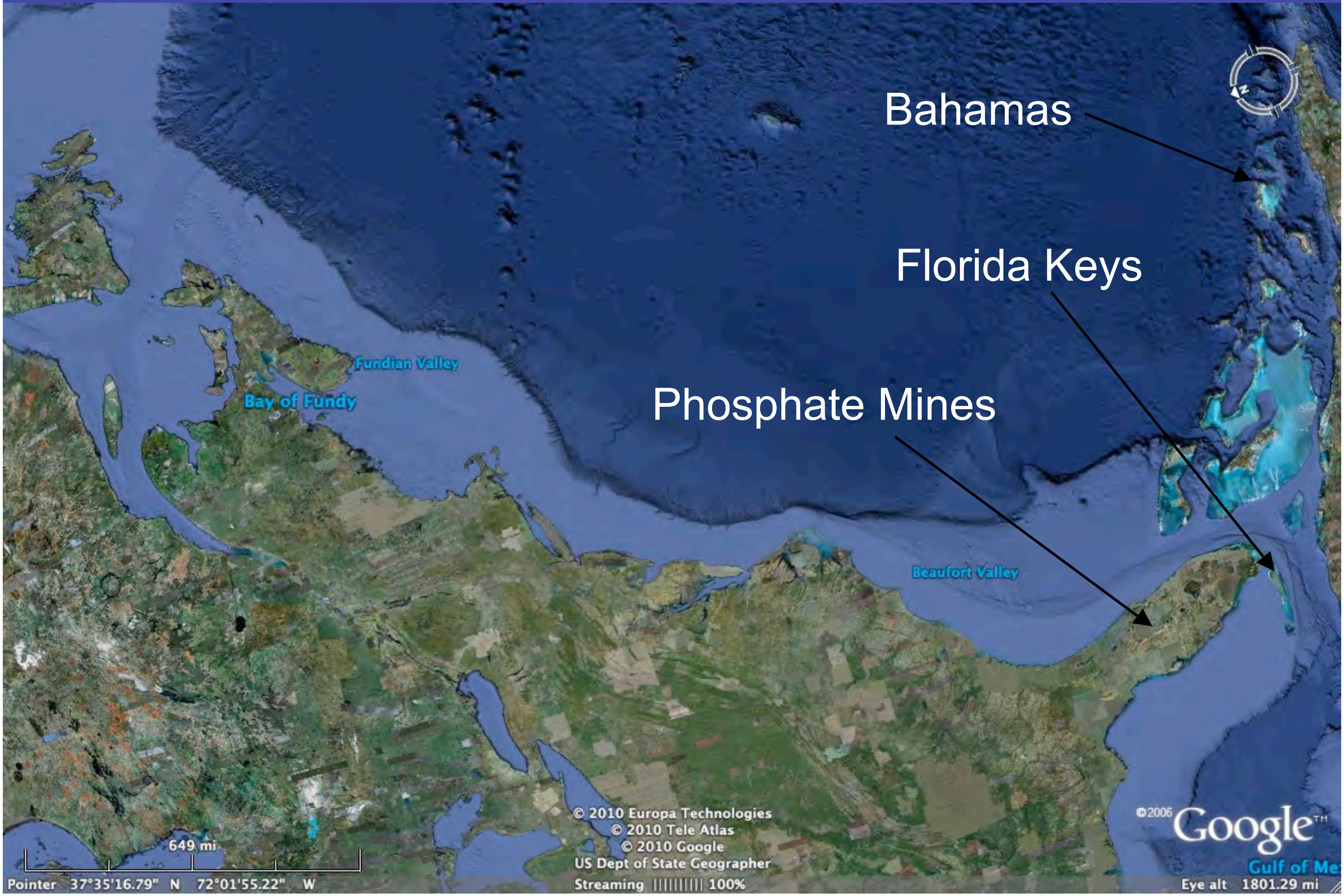
Eye alt 1801.29 mi


Bahamas
Florida Keys
Phosphate Mines
Fundian Valley
Bay of Fundy
Beaufort Valley
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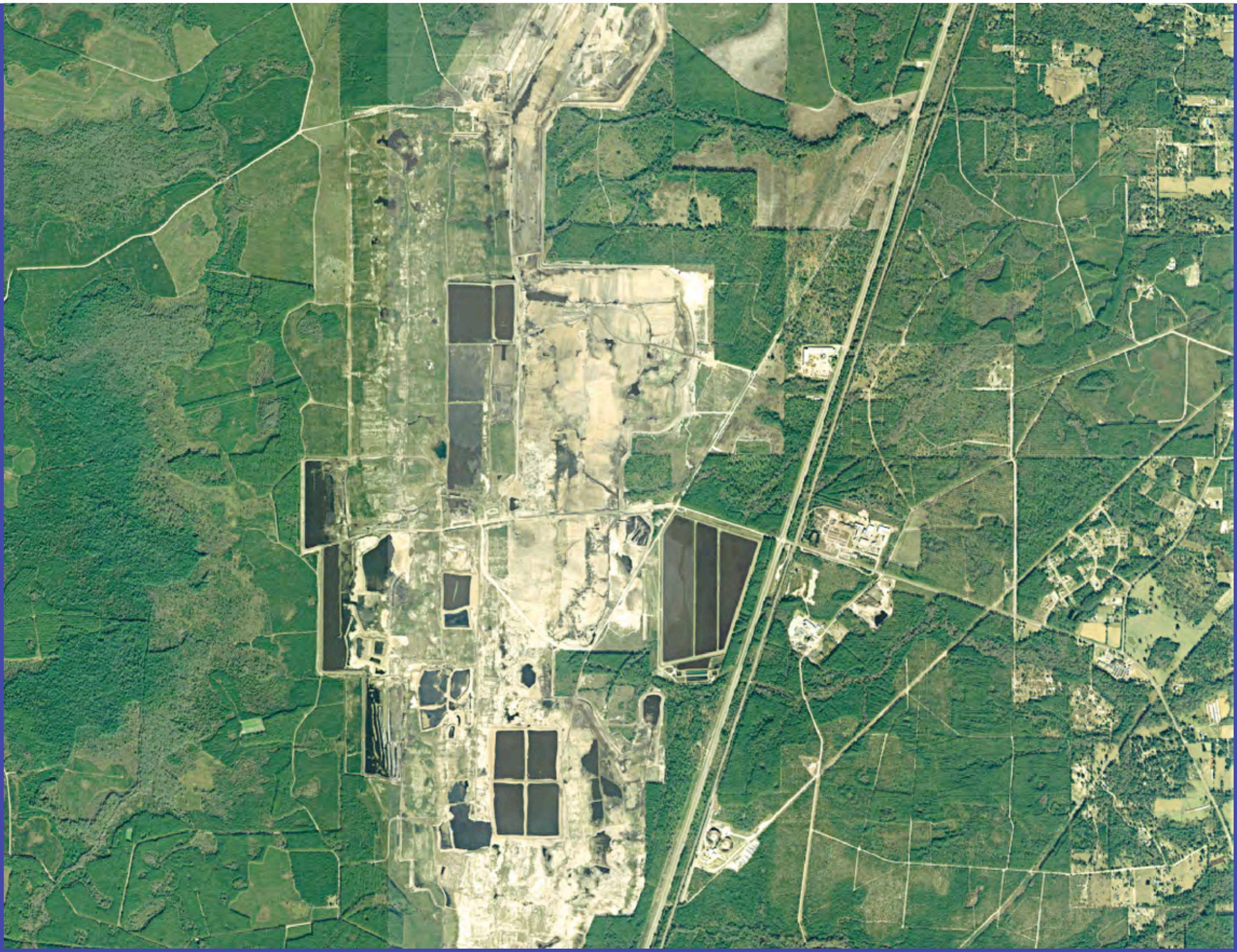


Central Florida: Phosphate mine in Miocene sediments: Why?


Key West FL: Quaternary carbonate bank


South Florida, Bahamas Bank, and Cuba

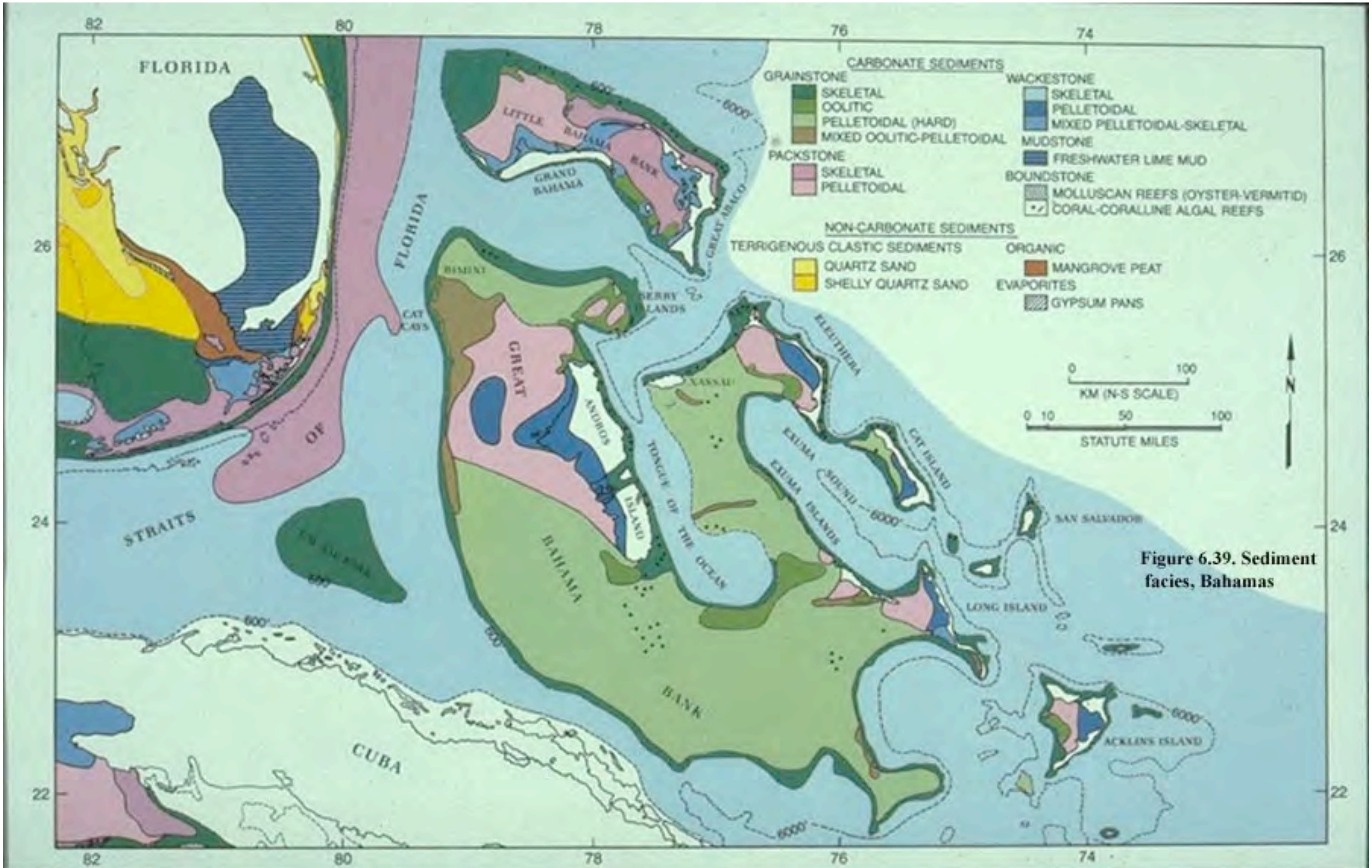



**Figure 6.39. Sediment facies, Bahamas**

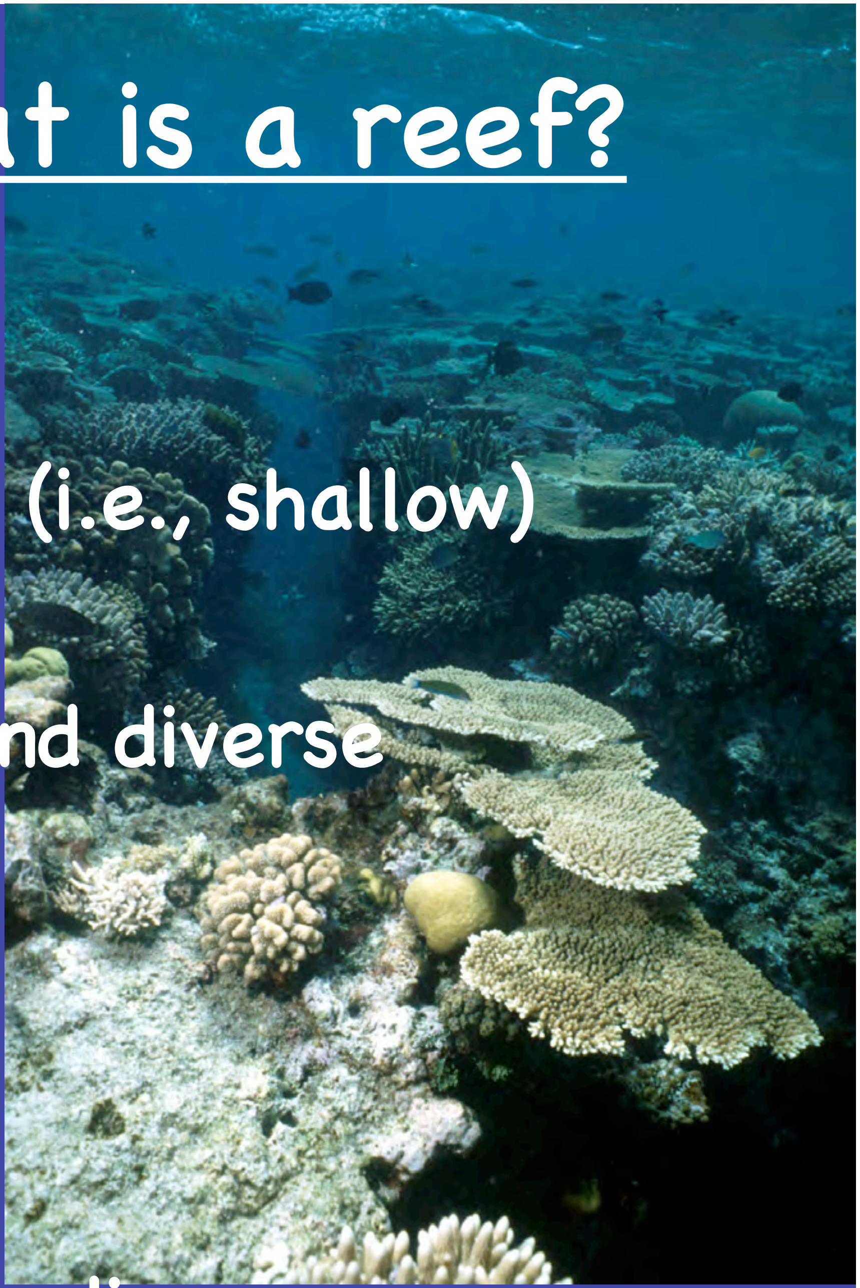
Digression: Coral Reef Geology

# What is a Reef ?

Digression courtesy of Wilson Ramirez

# Perspective....what is a reef?

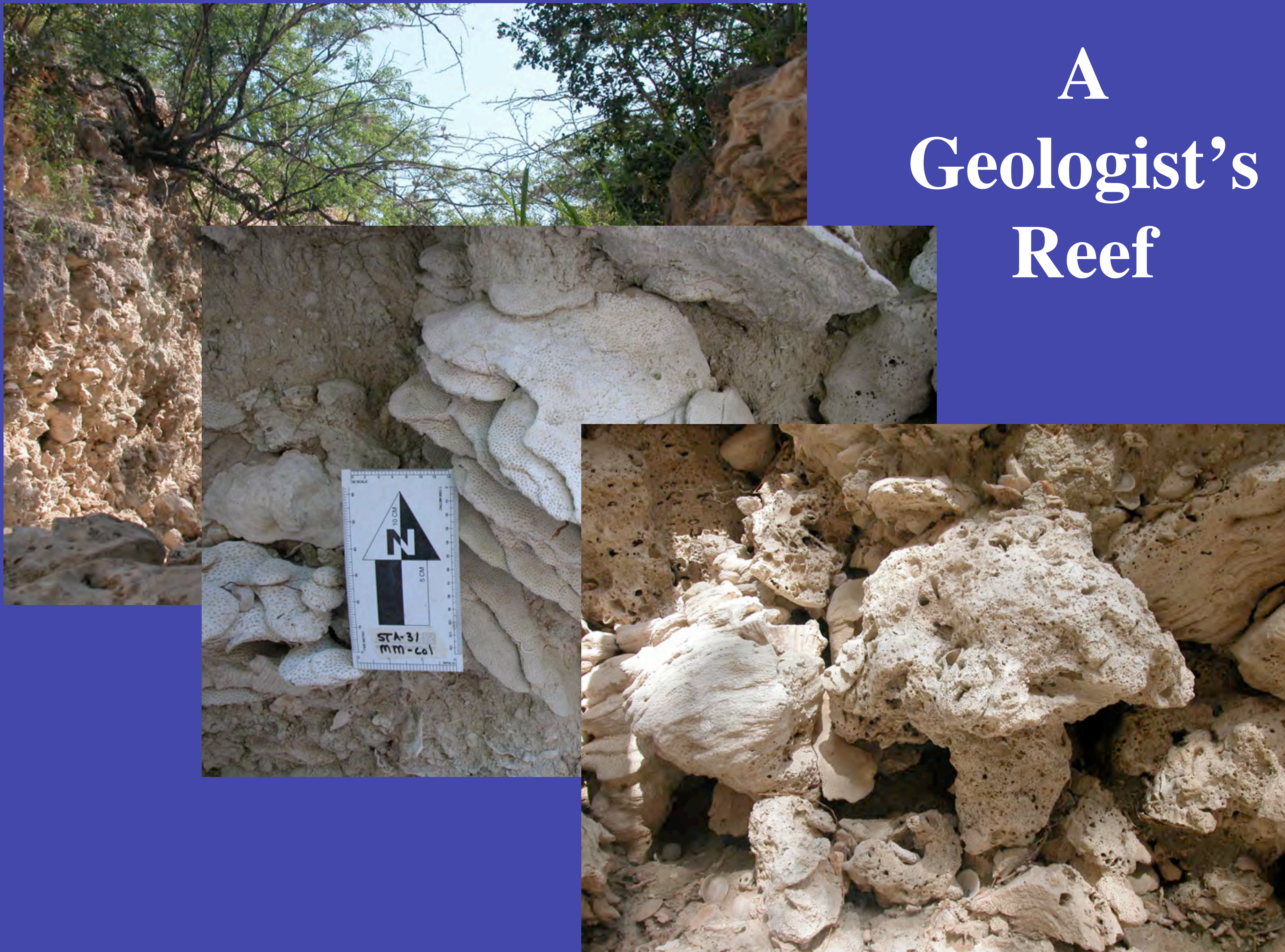
- Mariners
  - Can I hit my keel on it (i.e., shallow)
- Biologists
  - Biologically abundant and diverse assemblage
- Geologists
  - Biologically built
  - Wave resistant
  - Stands above its surroundings




Canning Basin, Australia
(Devonian)


Isla de Mona, Puerto Rico


# A Geologist's Reef



# Reef Definition

"the vast majority of of ancient reef deposits are comprised not of in-place, interlocking framework, but rather are loose assemblages with reef-building organisms 'floating' in a matrix of reef-derived debris"

**Hubbard (1997, p. 43)**

# Reef Definition

## Stanley (2001)

**“Growth of biological framework on modern shallow reefs is rapid….”**

**“…it is counterbalanced by highly destructive (recycling) processes…”**

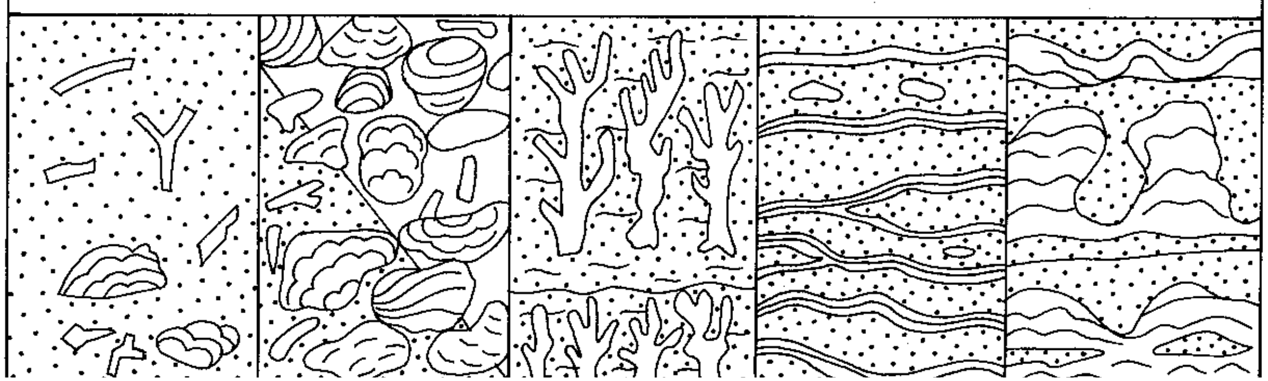
# “Reef” definition

- Constructed of material of **biological origin**
- Rigid structure, owing to either interlocked and **in place framework elements or of re-worked framework** elements bound together by secondary encrustation or cementation
- Stands **topographically above** the surrounding seascape and, therefore, exerts at least local control on oceanographic processes
- The majority of the framework elements were **formed in an environment similar** to the one in which they were ultimately **deposited**

**Fig. 4.94** *Textural classification of reef limestones. Based on Embry & Klovan (1971) and James (1984b).*

*Tucker & Wright*

| Allochthonous | | Autochthonous | | |
|---|---|---|---|---|
| Original components not organically bound during deposition | | Original components organically bound during deposition | | |
| >10% grains>2mm | | | | |
| Matrix supported | Supported by >2mm component | By organisms which act as baffles | By organisms which encrust and bind | By organisms which build a rigid framework |
| **Floatstone** | **Rudstone** | **Bafflestone** | **Bindstone** | **Framestone** |

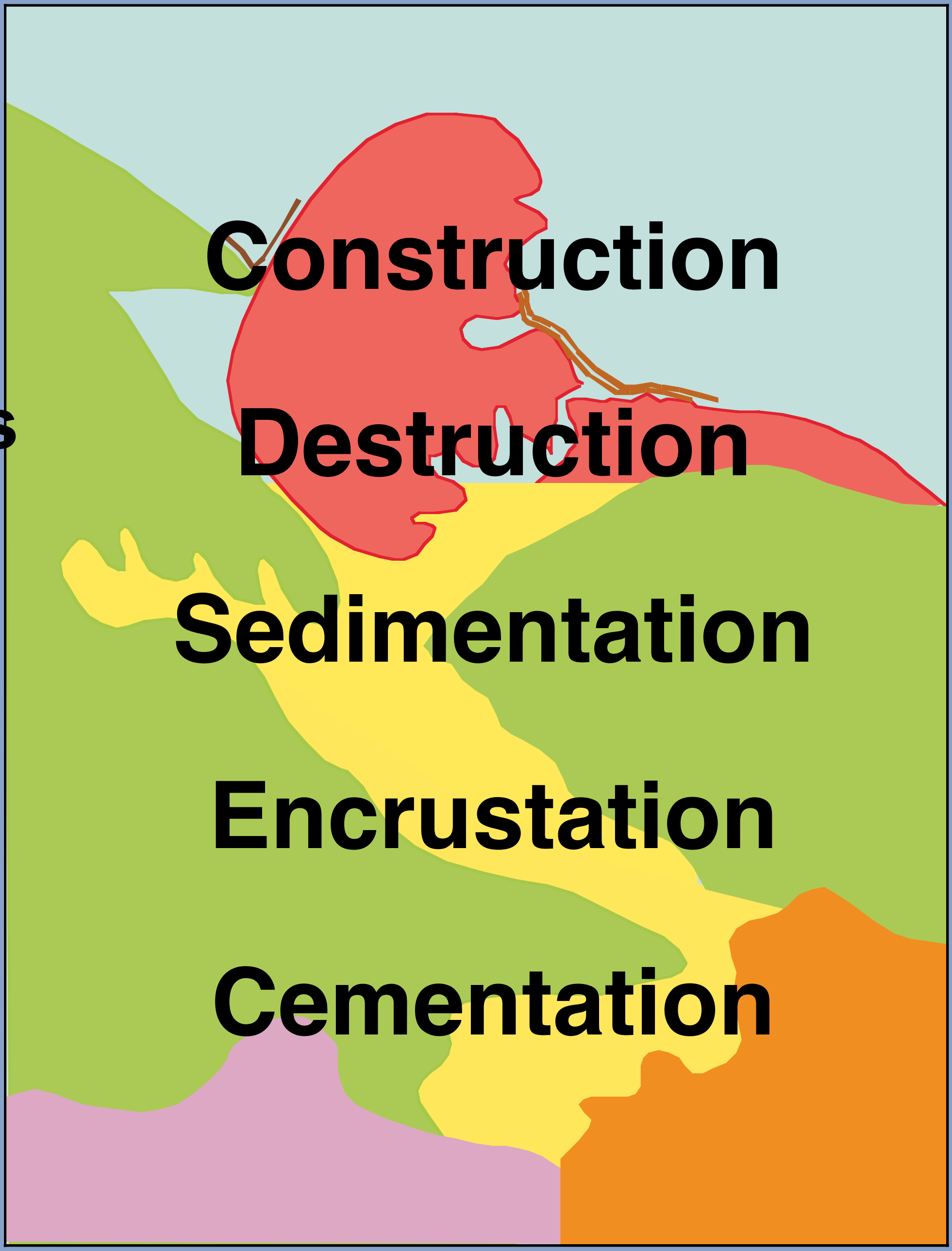


# A Geologic Reef

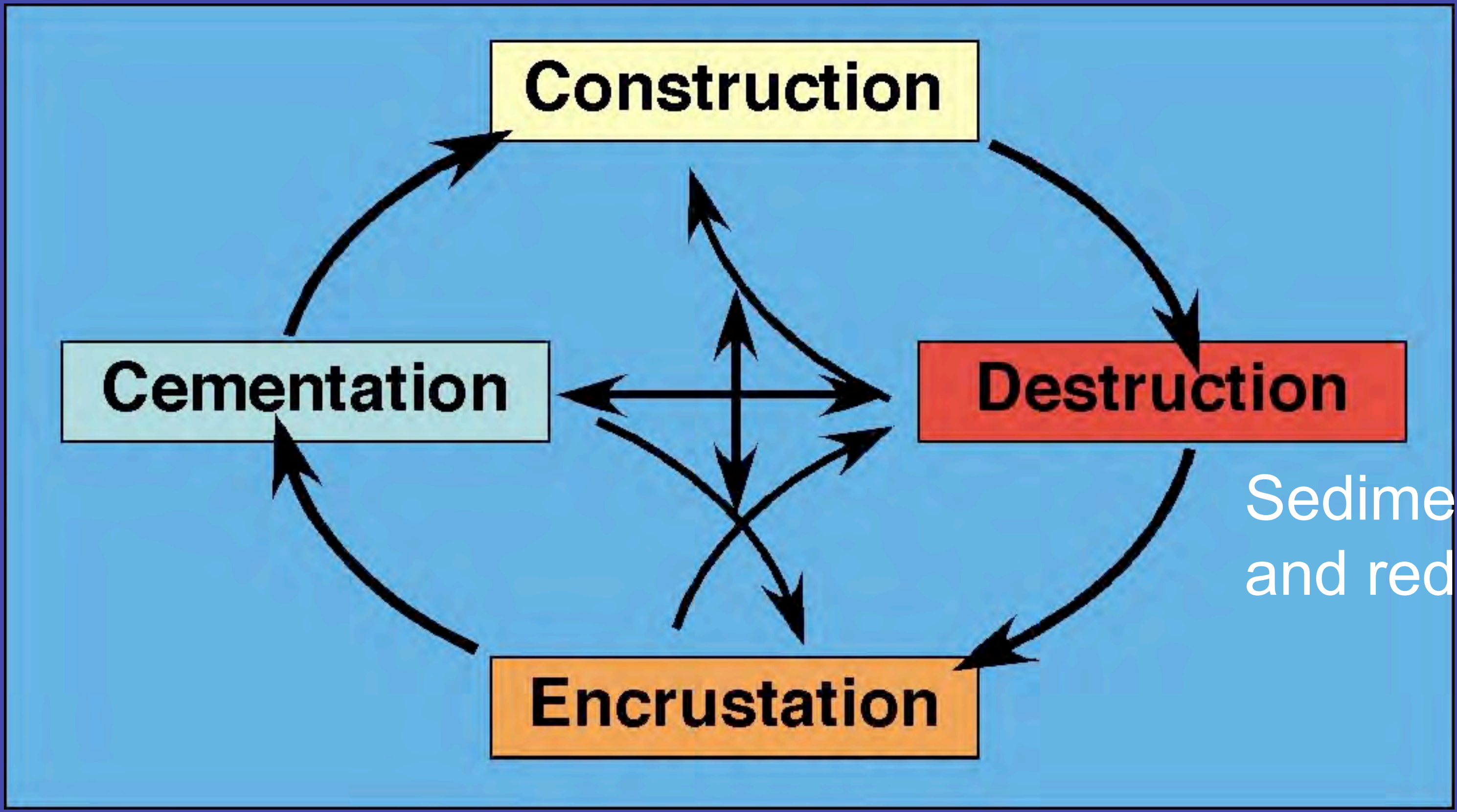
- Rigid, & wave resistant
- Elevated - affect local oceanography
- Near sea level?

# How do we get rigid, elevated structures?

- Construction
  - Corals
  - Other calcifiers
- Destruction
  - Fish
  - Urchins
  - Borers
- Encrustation
- Cementation

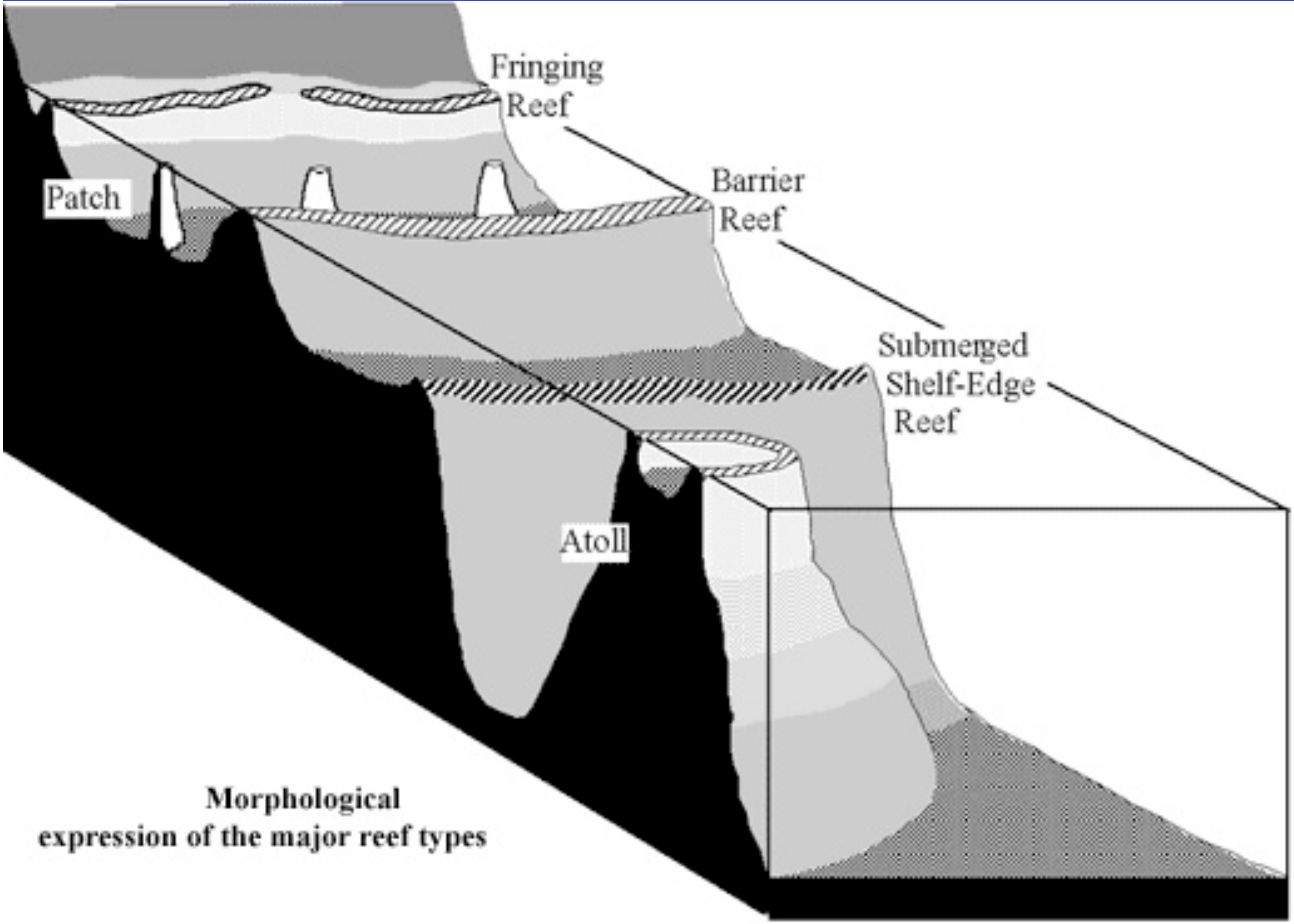


# Corals Grow
# Reefs Accrete (or build)




Sediment production
and redistribution

. . . End Digression




**Morphological expression of the major reef types**

Bahamas Platform:

Carbonate beaches
And shelf

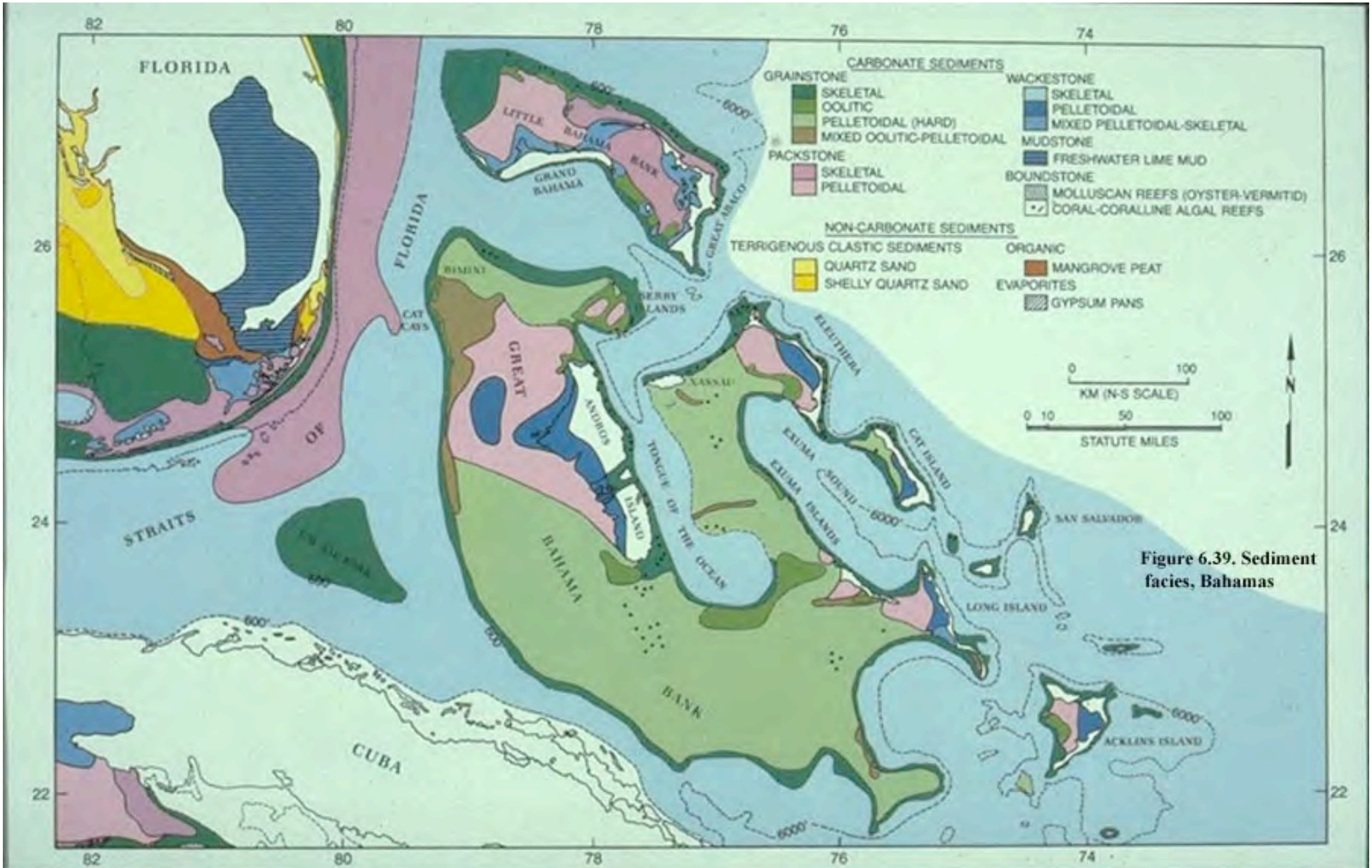
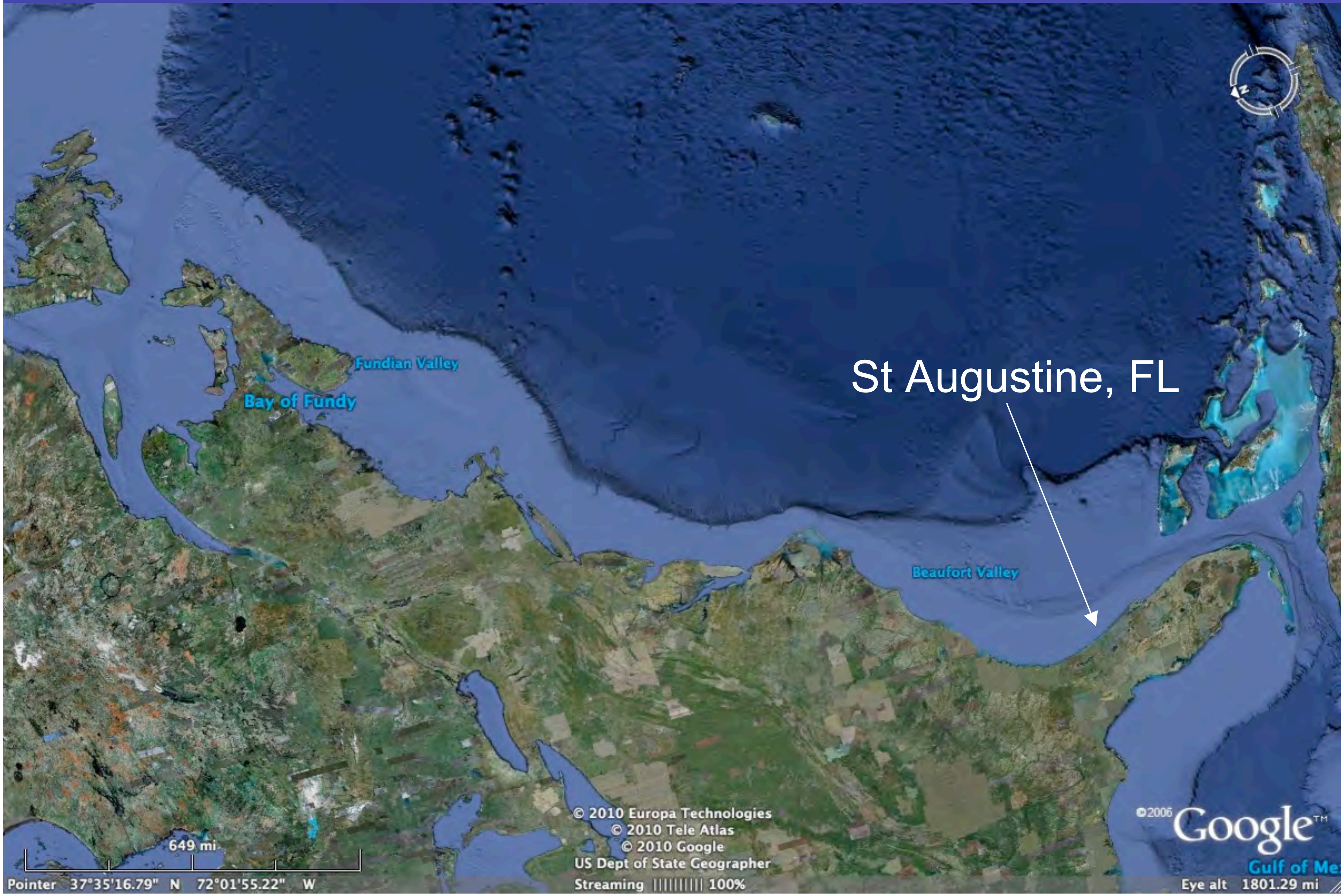



Figure 6.39. Sediment facies, Bahamas


St Augustine, FL
Fundian Valley
Bay of Fundy
Beaufort Valley
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649 mi
Pointer 37°35'16.79" N 72°01'55.22" W
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Eye alt 1801.29 mi


St Augustine, FL
Cape Fear Terrace
Beaufort Valley
Bethel Shoal
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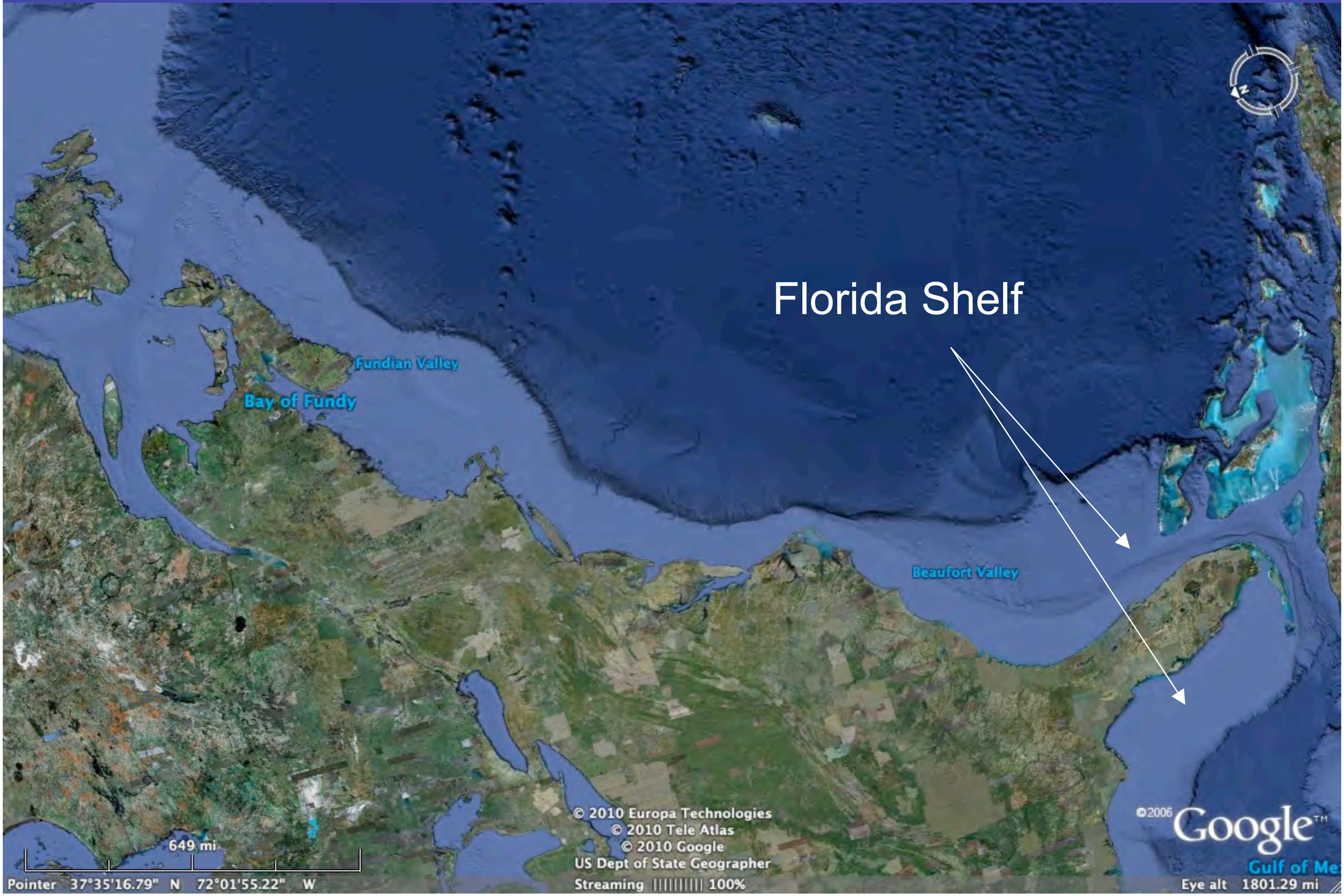
US Dept of State Geographer
218 mi
Pointer 30°58'34.49" N 79°59'17.20" W
Streaming 100%
©2006 Google
Eye alt 707.15 mi


St Augustine, FL: quartz sand beaches and shelf: Why?



Florida Shelf
Fundian Valley
Bay of Fundy
Beaufort Valley
649 mi
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Pointer 37°35'16.79" N 72°01'55.22" W
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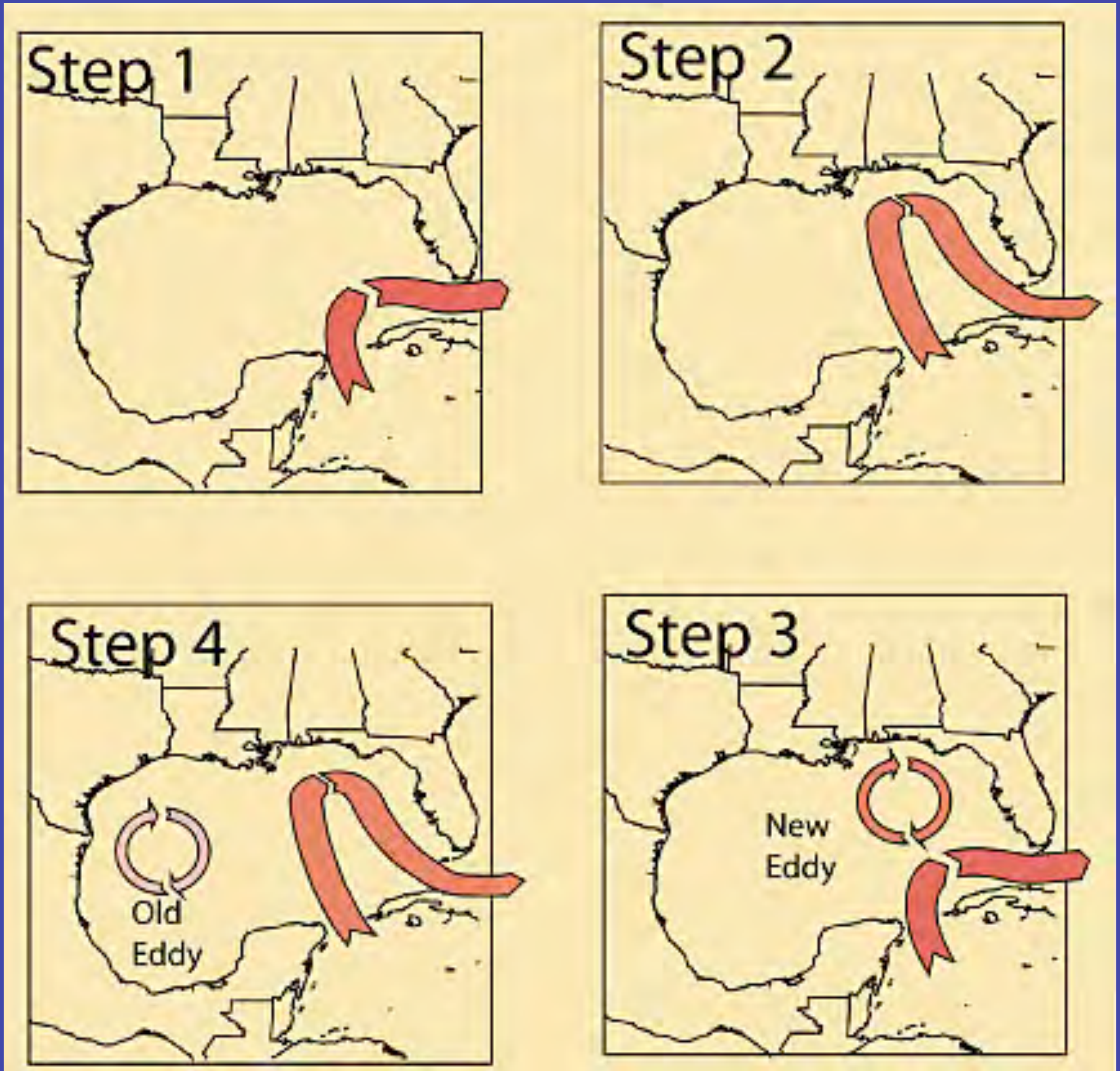
Eye alt 1801.29 mi

# Gulf of Mexico Loop Current: an intermittent feature



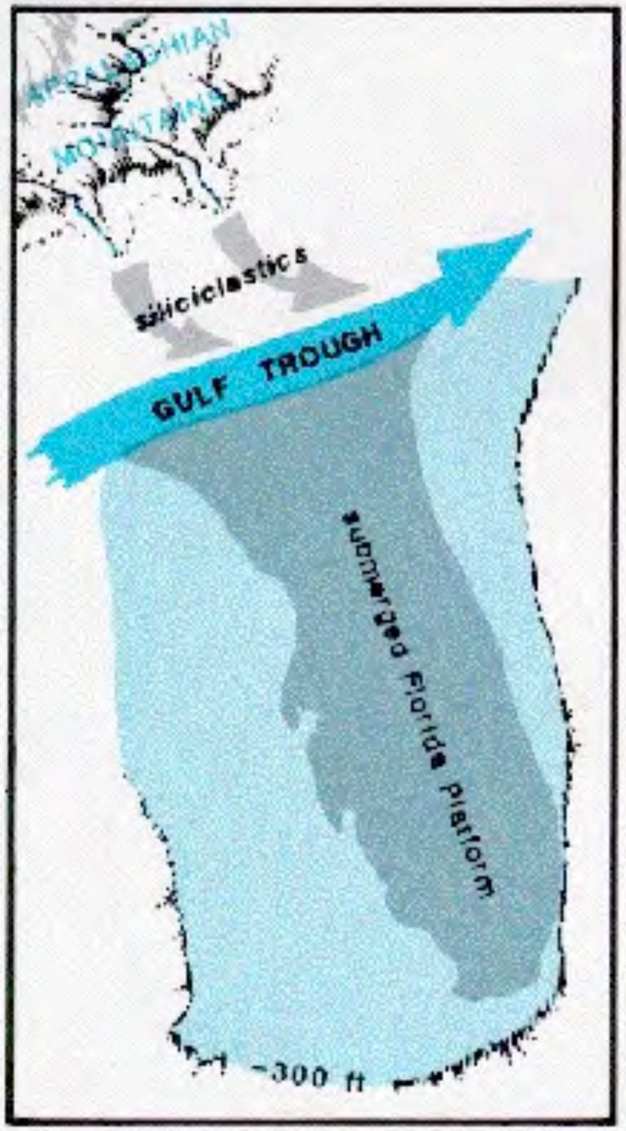



Figure 12. Through Oligocene time the Florida Platform was a shallow, marine limestone bank environment. Currents through the Gulf Trough diverted sands, silts and clays that were eroding off the Appalachian Mountains to the north.

Oligocene

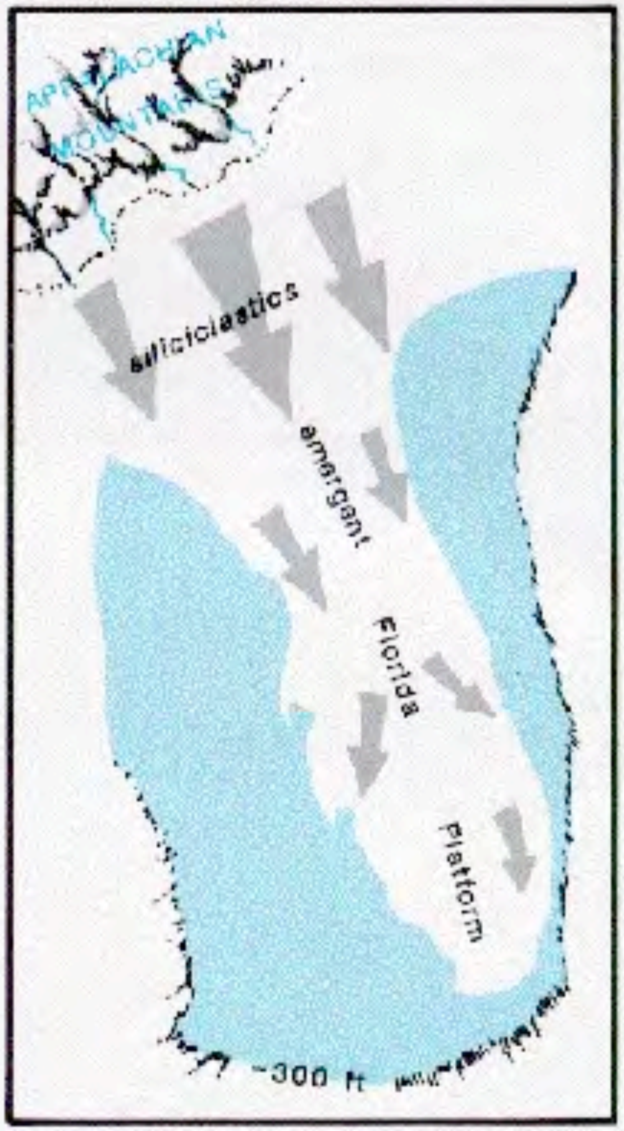



Figure 13. Siliciclastic sediments had filled the Gulf Trough by Miocene time and encroached down the peninsula, covering the limestone environments.

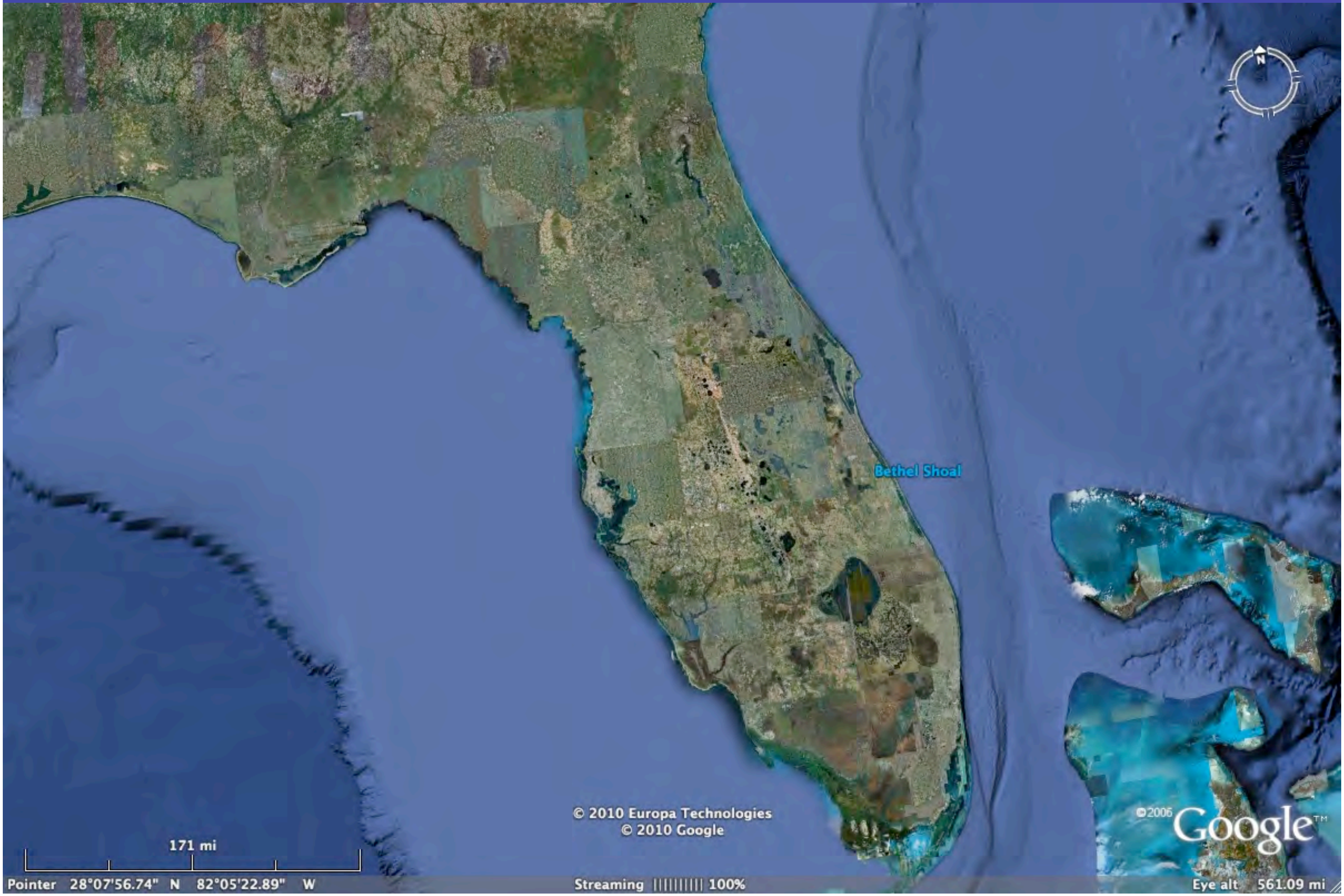
Miocene

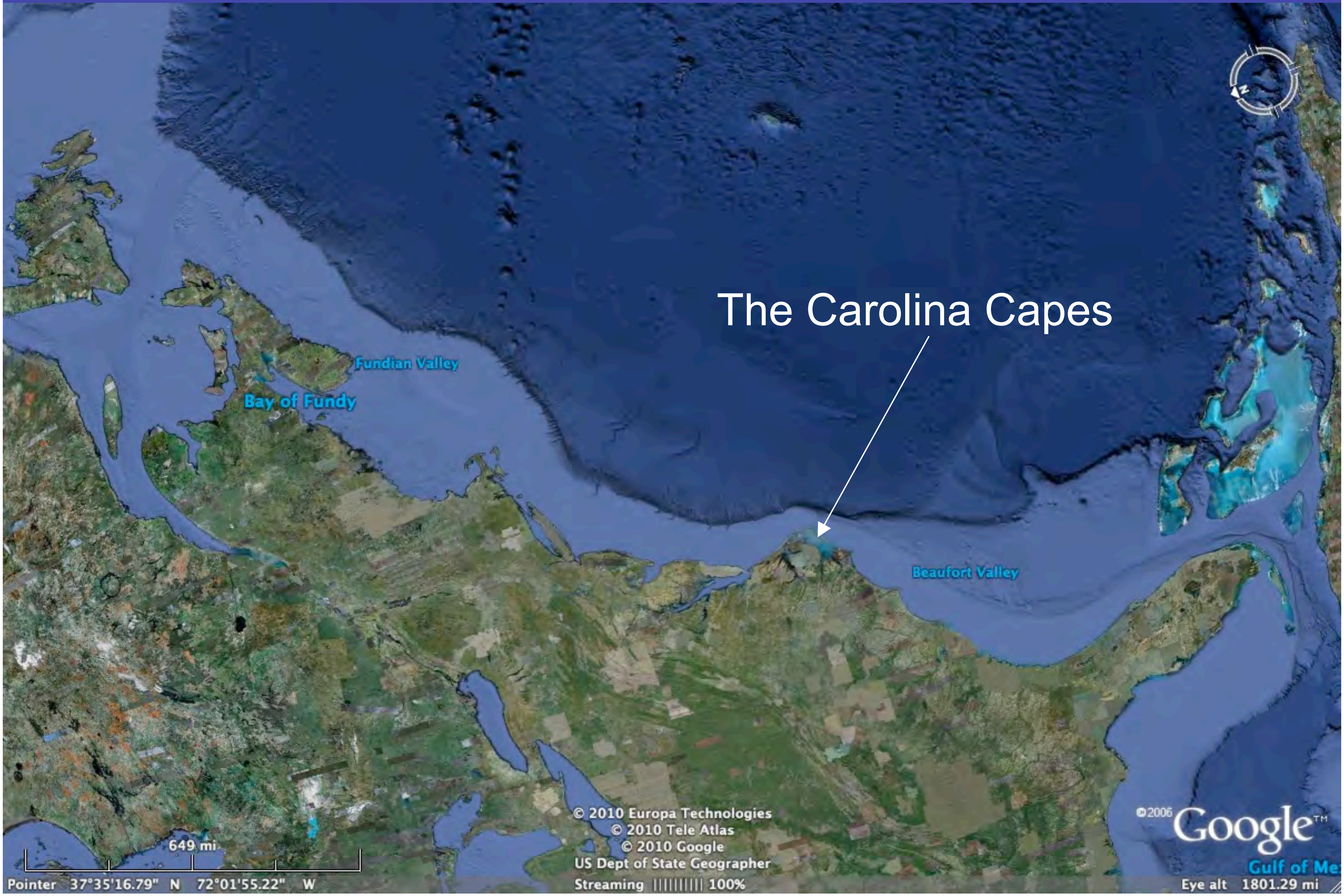
Florida Phosphate Deposits:

Two stages:
Oligocene upwelling

Miocene reworking

# Florida today: Quartz versus Calcite Beaches & Dunes




The Carolina Capes
Fundian Valley
Bay of Fundy
Beaufort Valley
649 mi
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Pointer 37°35'16.79" N 72°01'55.22" W
Streaming |||||||||| 100%
Eye alt 1801.29 mi

Cape Fear NC: Quaternary


Cape Hatteras, North Carolina


Diamond Shoals
6.63 mi
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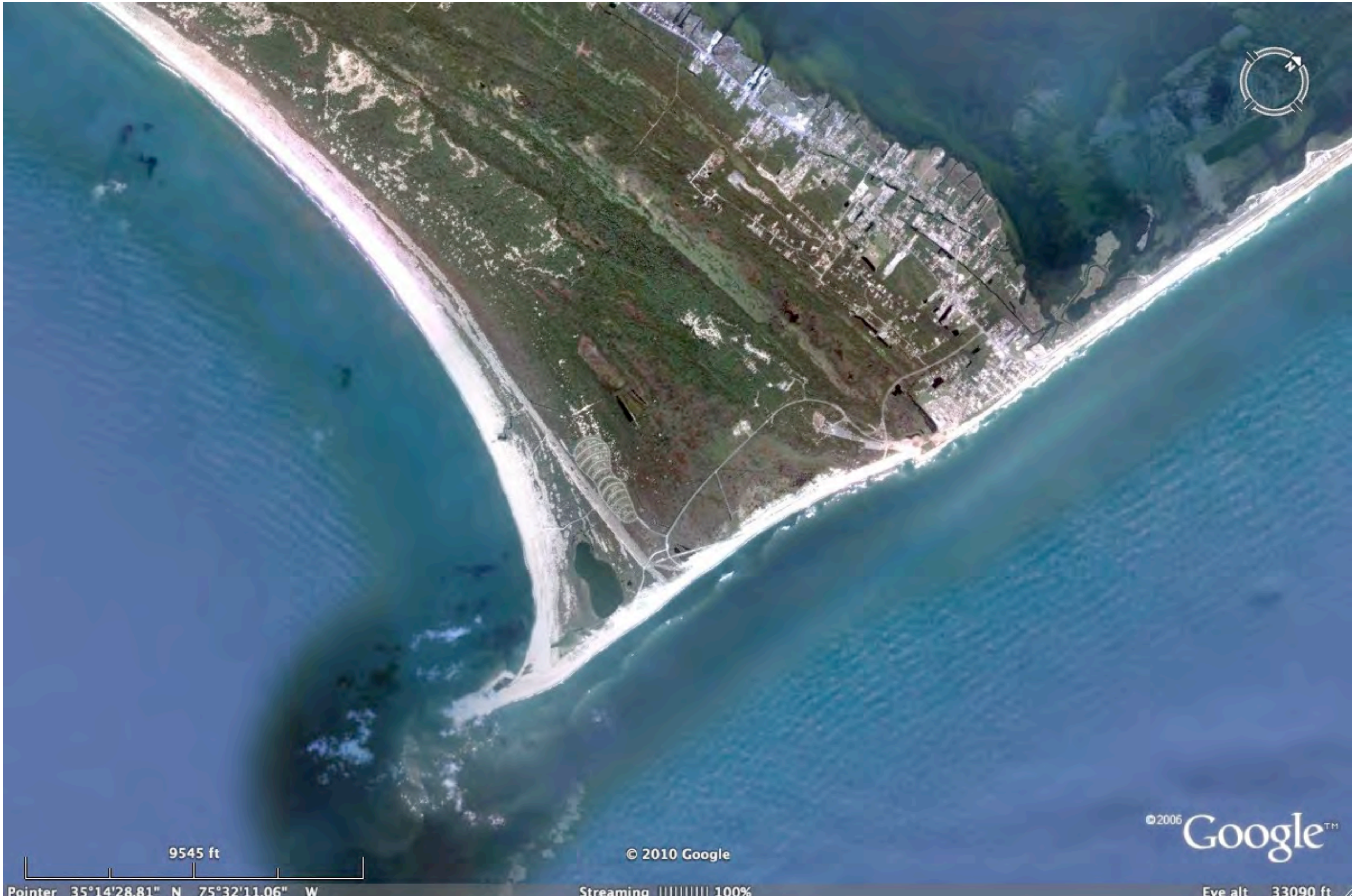
Pointer 35°15'55.26" N 75°31'15.41" W
Streaming |||||||||| 100%
Eye alt 22.93 mi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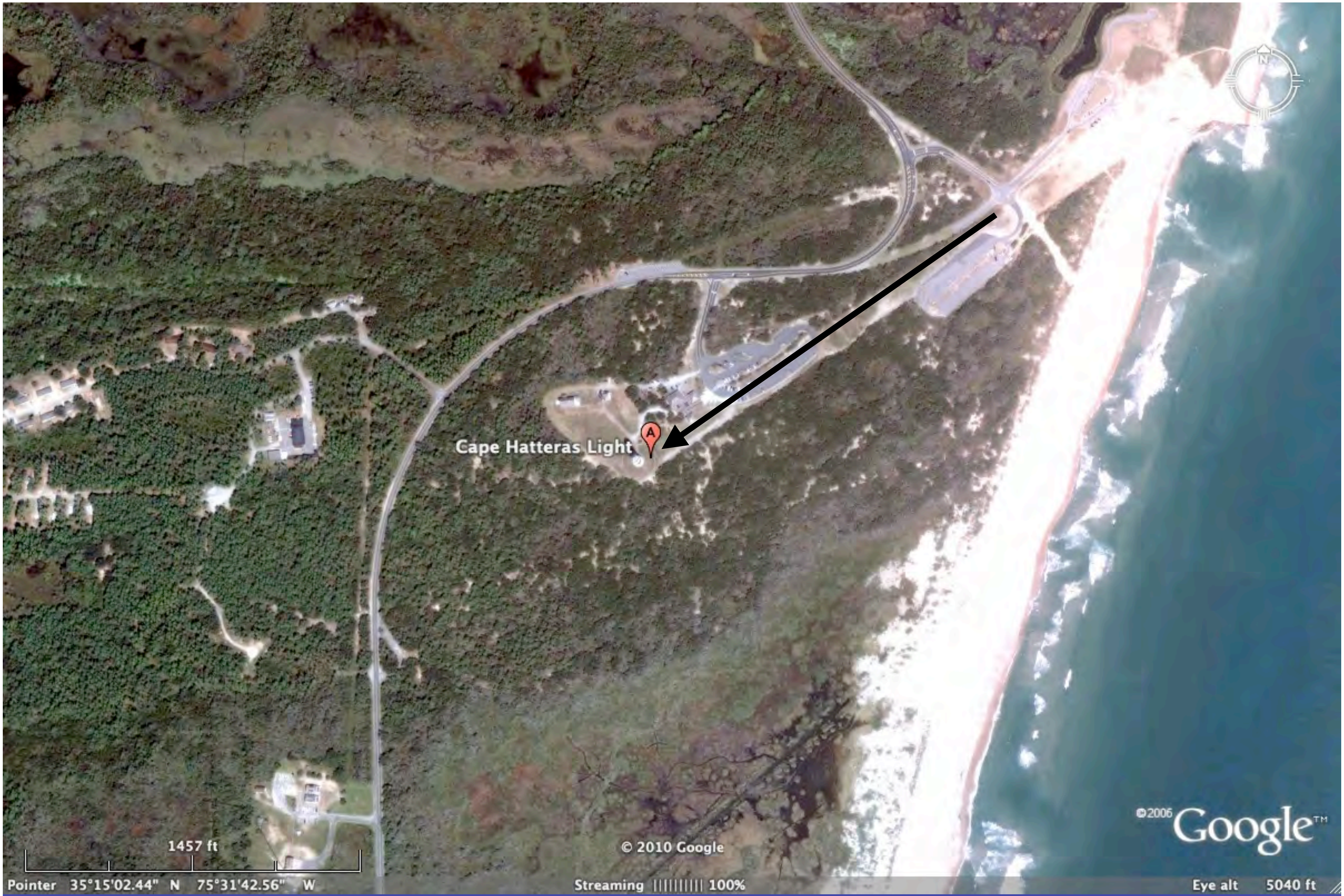


Cape Hatteras Light 1806 and 2000


Chesapeake Bay
Fundian Valley
Bay of Fundy
Beaufort Valley
649 mi
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Pointer 37°35'16.79" N 72°01'55.22" W
Streaming |||||||||| 100%
Eye alt 1801.29 mi

Newport News, VA: 35 My impact crater under Quaternary

Delmarva Peninsula: Quaternary flooding of Pleistocene valleys

Fall Line

Washington DC: U Cretaceous overlies Camb-Ordovician

Atlantic City NJ: Quaternary overlying Cenozoic sediments

The Piedmont at New York: glacial deposits on Paleozoic

The Piedmont at Boston Harbor: glacial deposits on Paleozoic

# Sediment thickness and depth to basement in Western North Atlantic Ocean Basin

Tucholke et al 1982

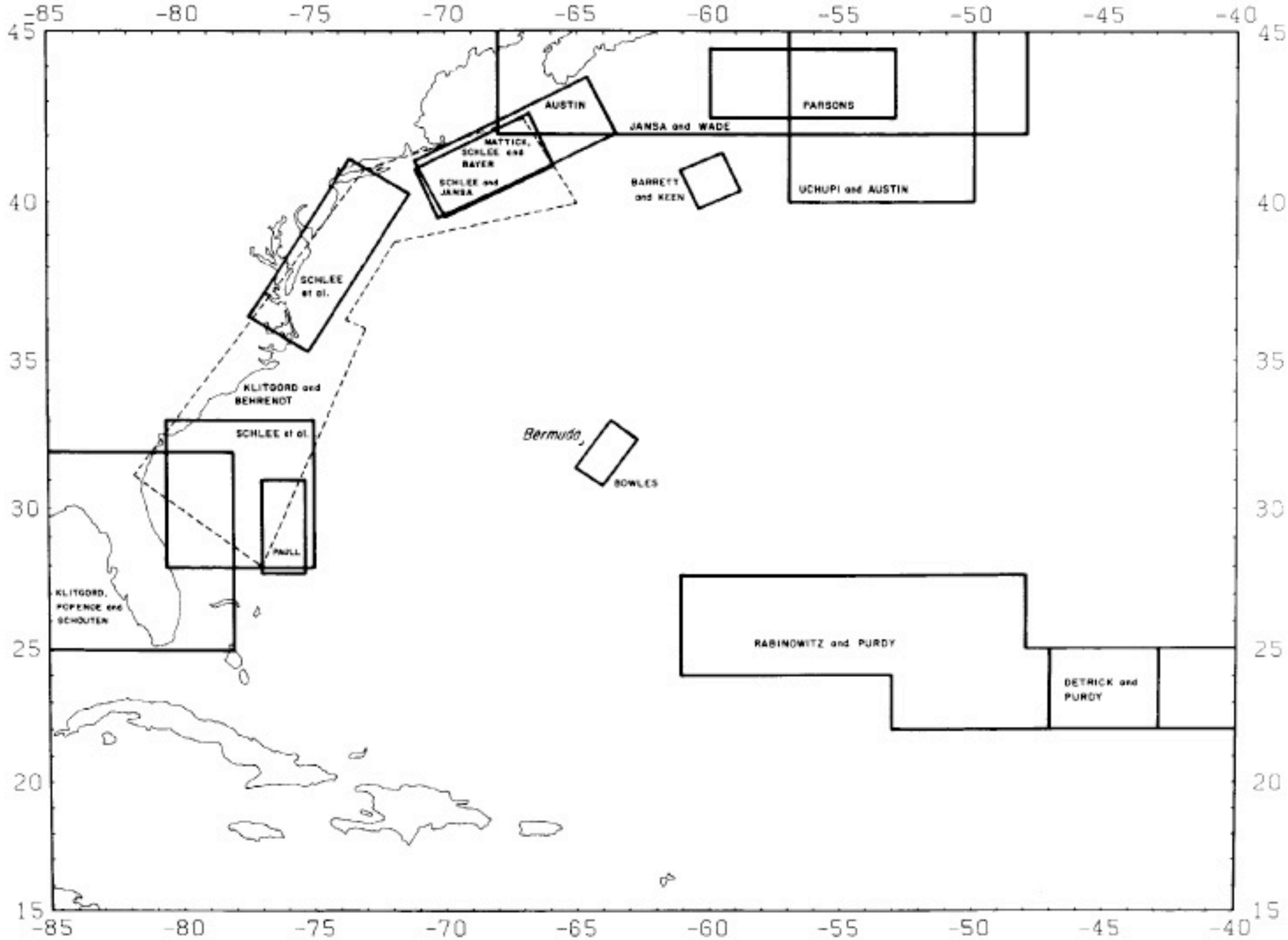



**FIG. 5—Sources of existing maps that were modified or used directly in this compilation. Contours from magnetic depth-to-basement estimates (Klitgord and Behrendt, 1979) are depicted on our maps as long dashed lines.**

# PDF: existing maps used in compilation

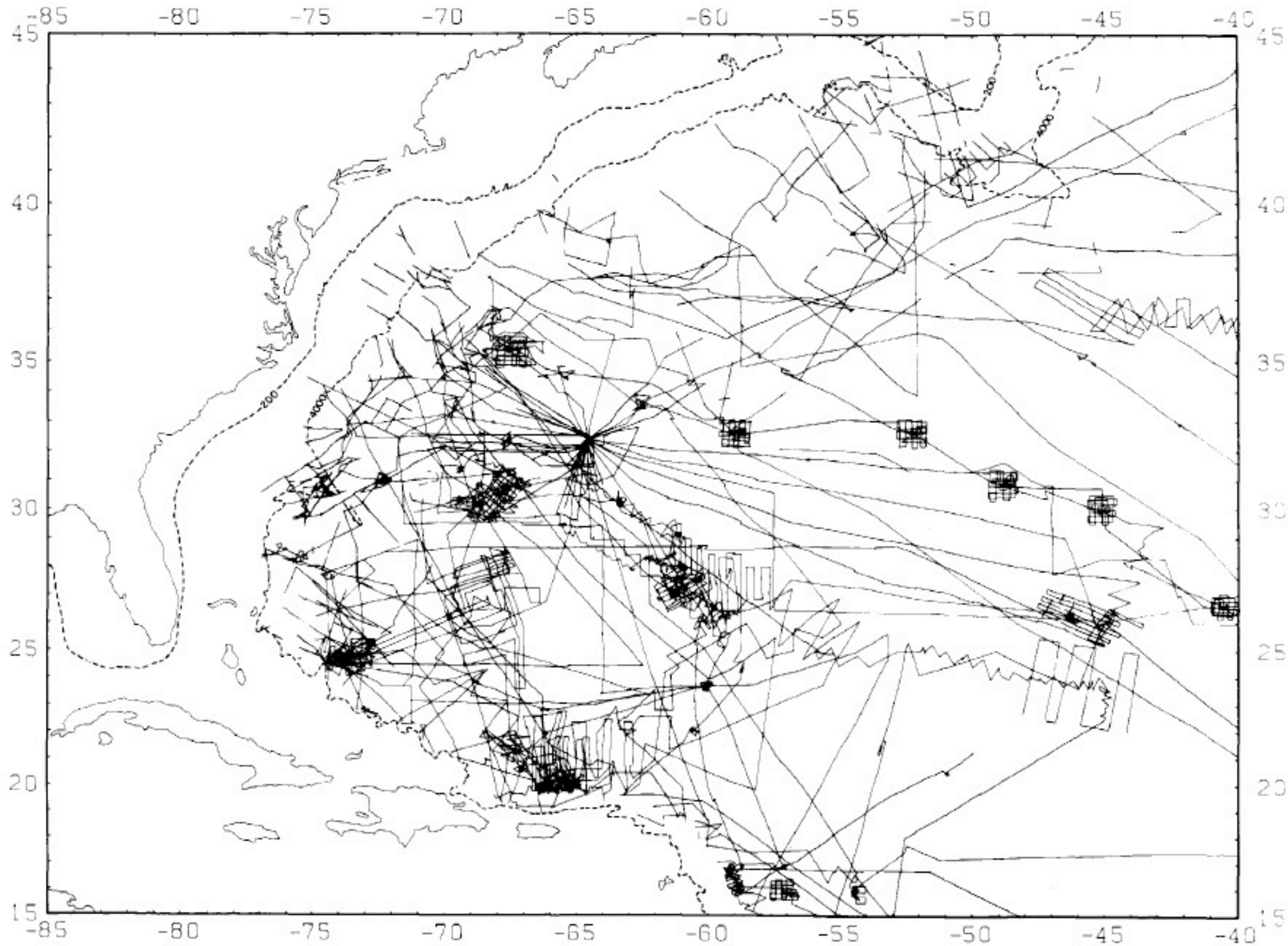



FIG. 1—Single-channel and multichannel seismic reflection tracks used to map sediment thickness and depth to basement. Reference isobaths (dashed lines) are in meters.

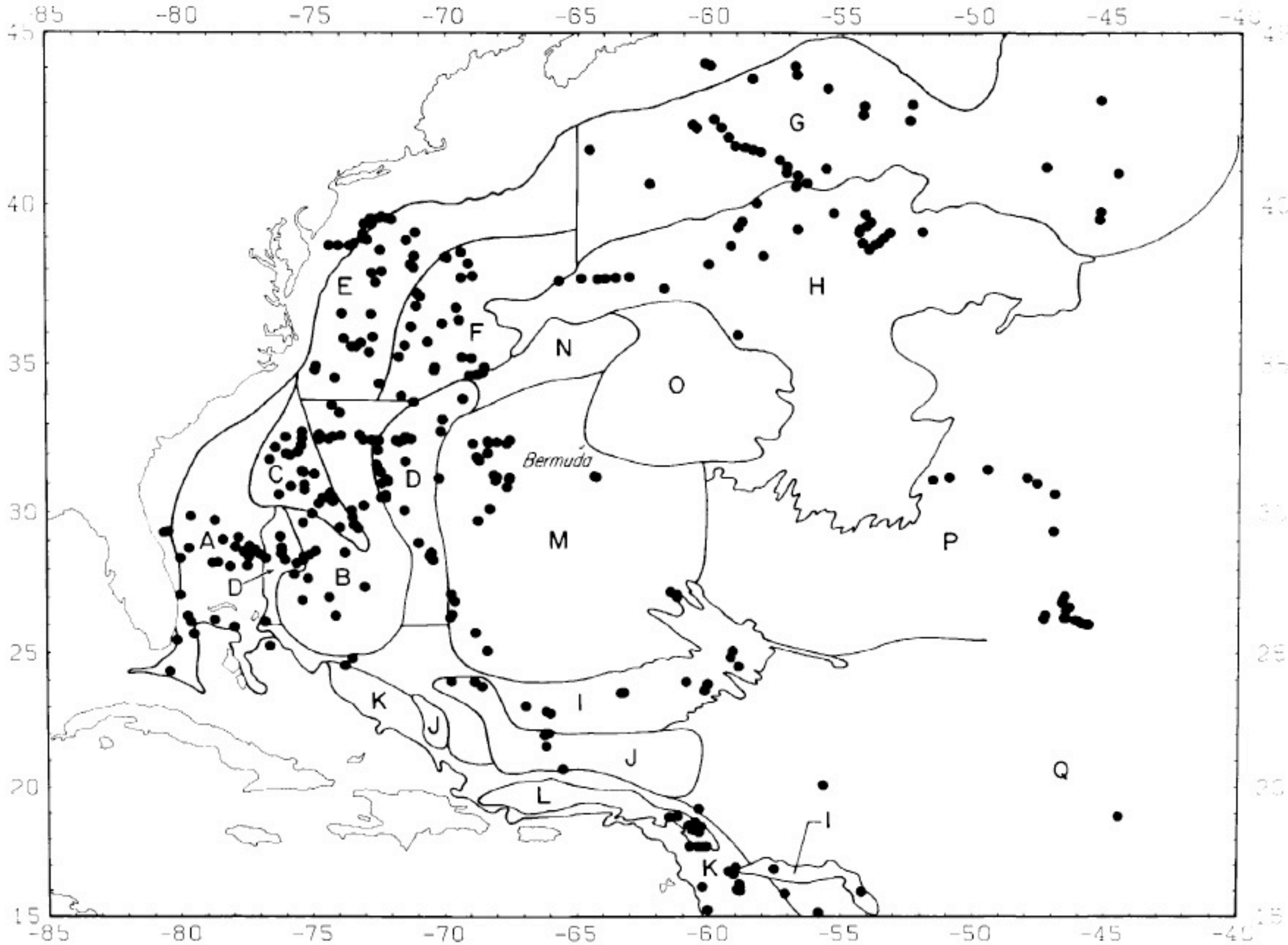



**FIG. 2—Locations of sonobuoy stations (dots) and areas of velocity regression equations listed in Table 1.**

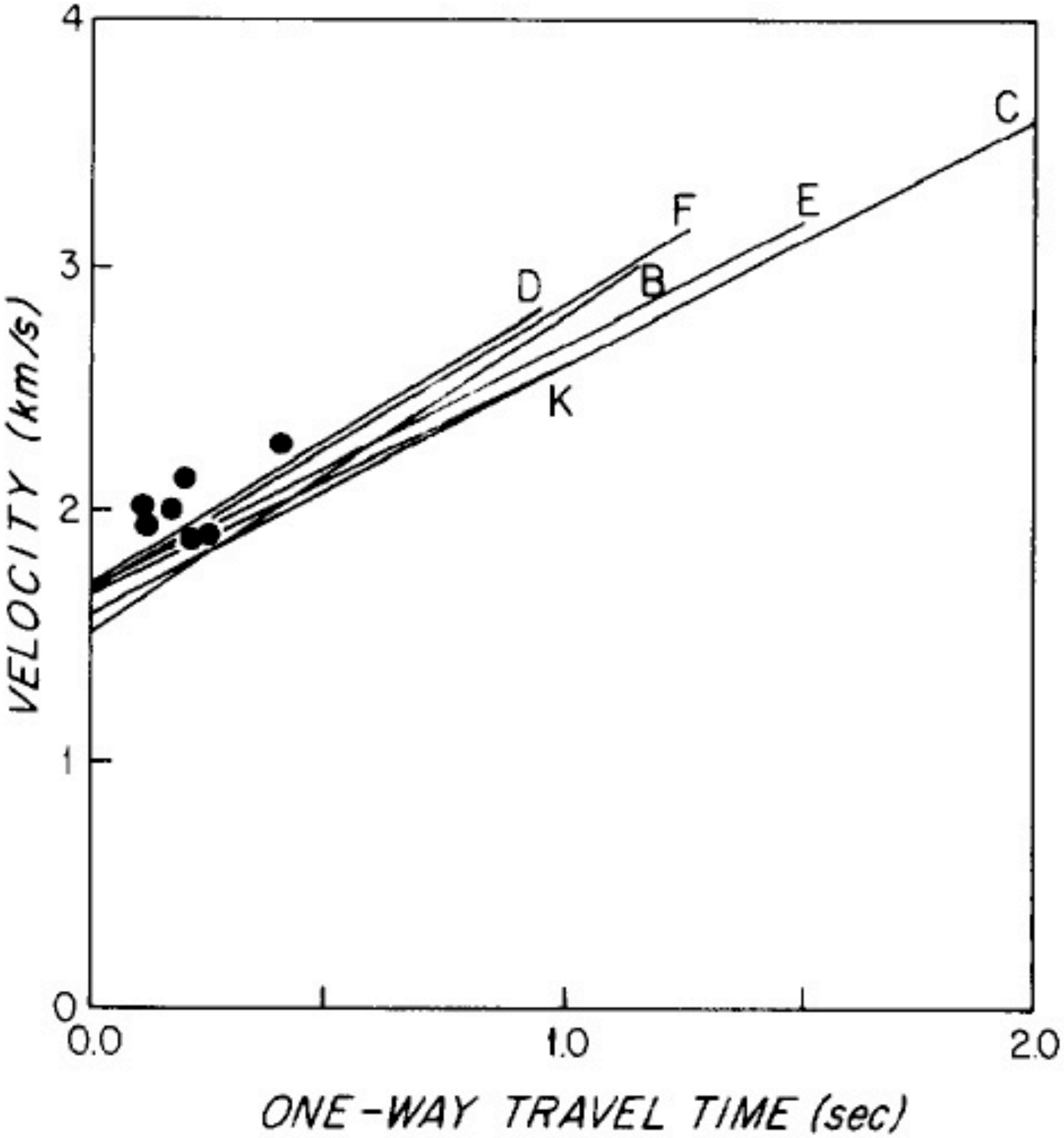



**FIG. 3—Velocity regression lines for areas in Table 1 and on Figure 2. Dots are averages for entire sediment column where low data density or thin sediments precluded derivation of a regression line (after Houtz, 1980).**

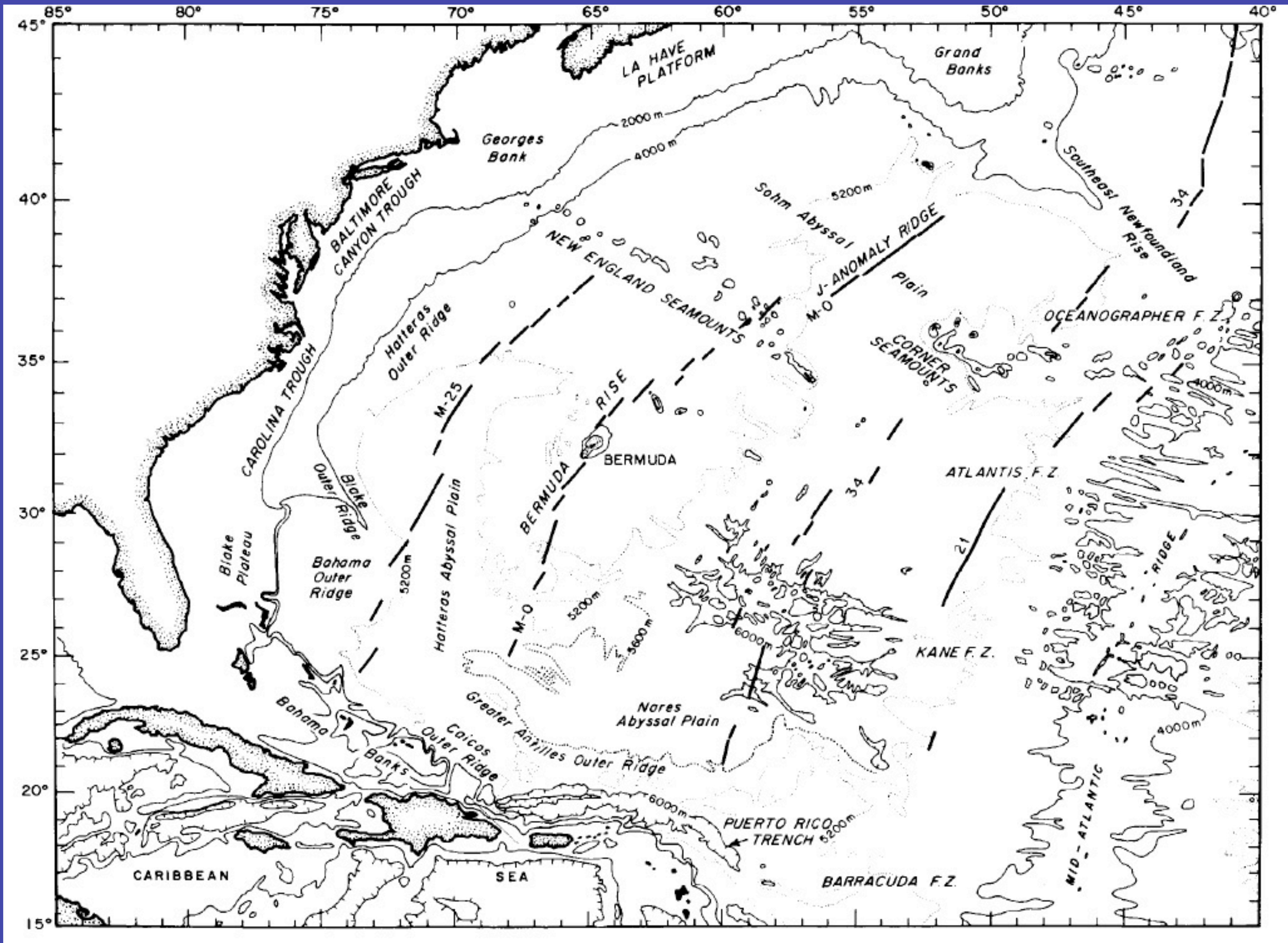



**FIG. 6**—Geographic location of sedimentary and basement structural features and magnetic anomalies discussed in text. Isobaths are in meters.

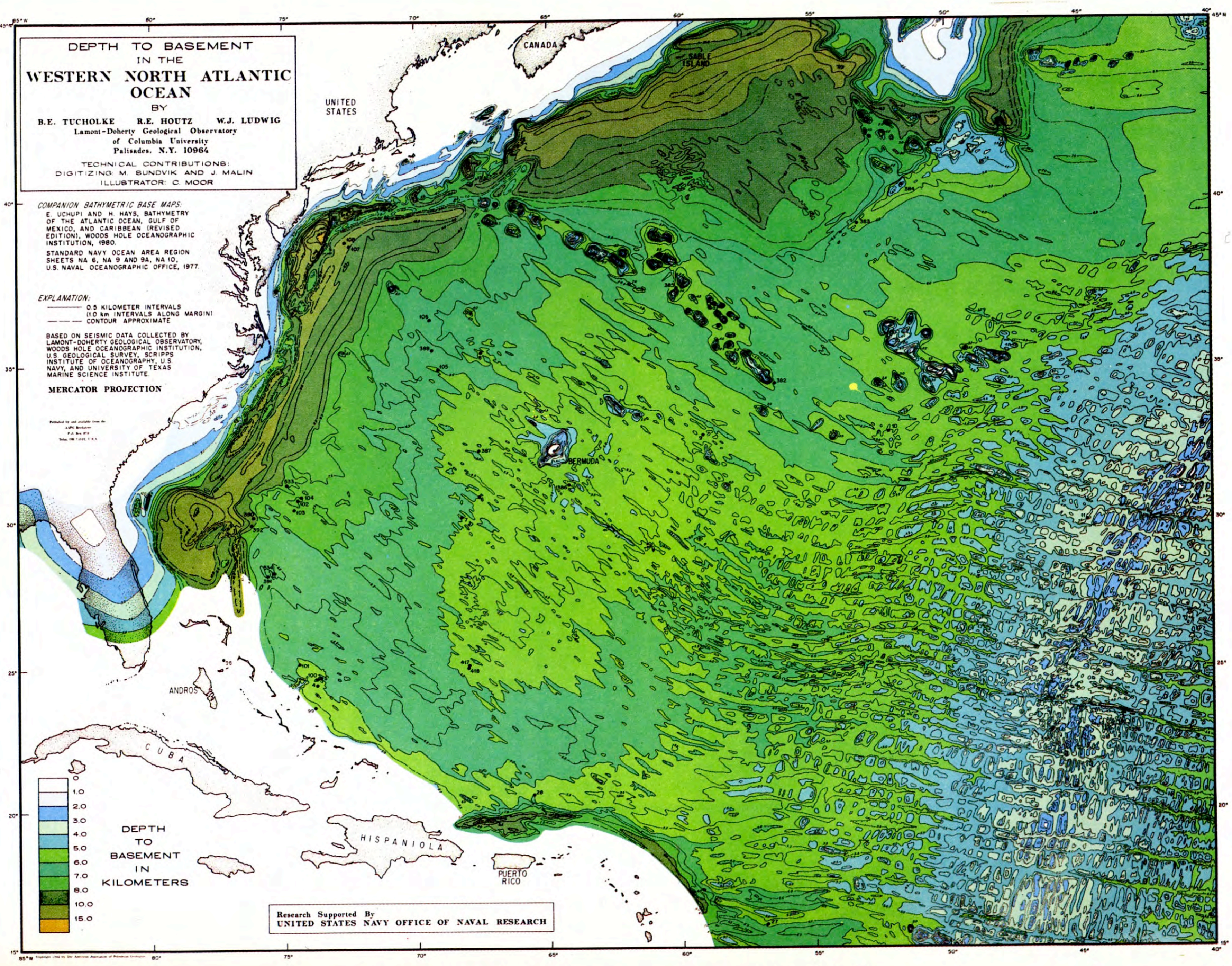



FIG. 7—Map of depth to basement in kilometers below sea level.

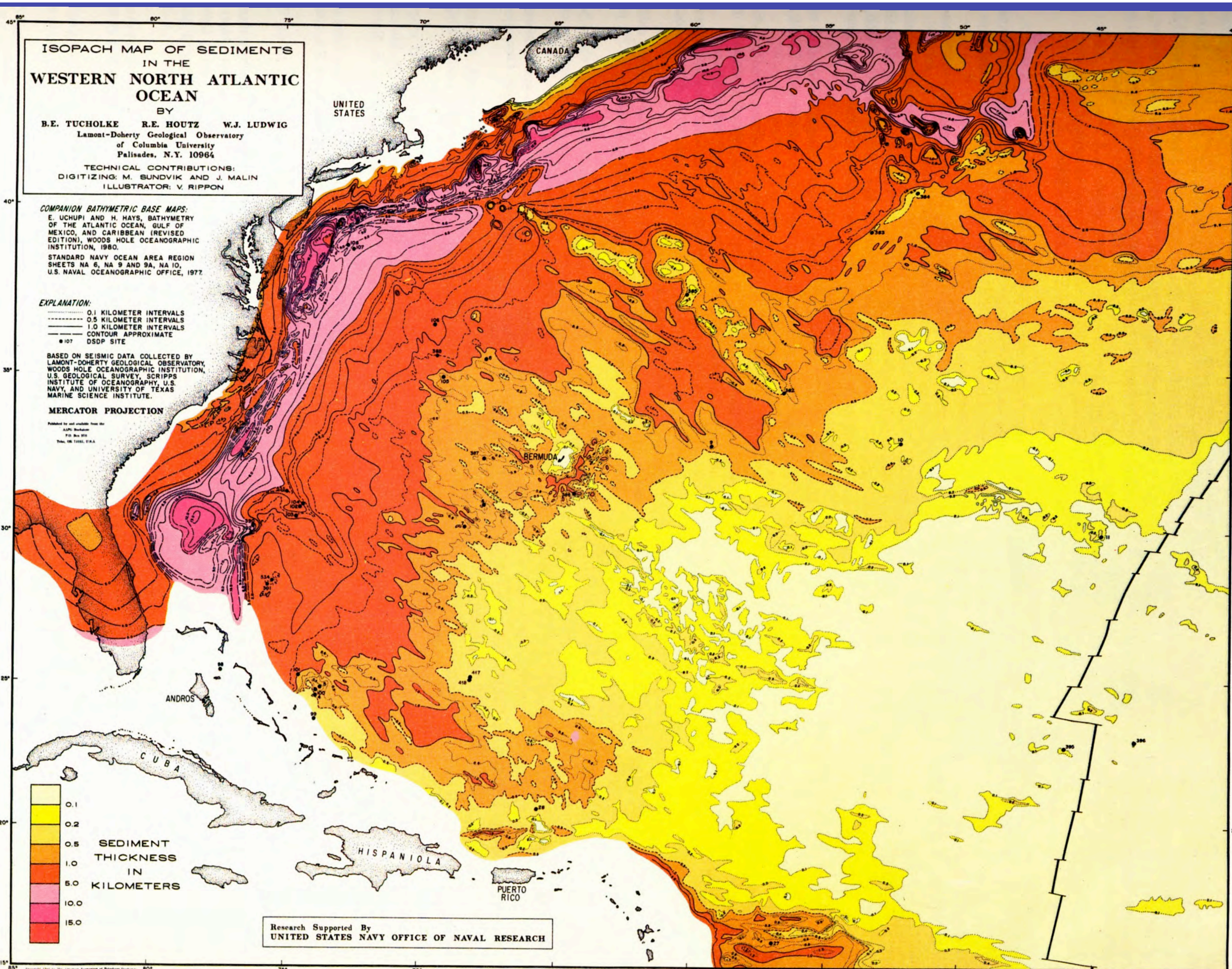



FIG. 8—Map of sediment thickness in kilometers.

# Conclusions

- Fracture Zone fabric or strips between mid-ocean ridge and continent margin
- Change in FZ and sea floor spreading in early Eocene
- 25% of map has less than 100 m seds
- Thin seds due to “mid-gyre surface water”; lack of river input; young crust
- Thicker deep water deposits due to deep water currents, present and past
- ECMA ridge and basin with ?15 km seds

# Broad-terrane Jurassic flood basalts across Northeastern America

McHone 1996


Palisades Sill, New Jersey

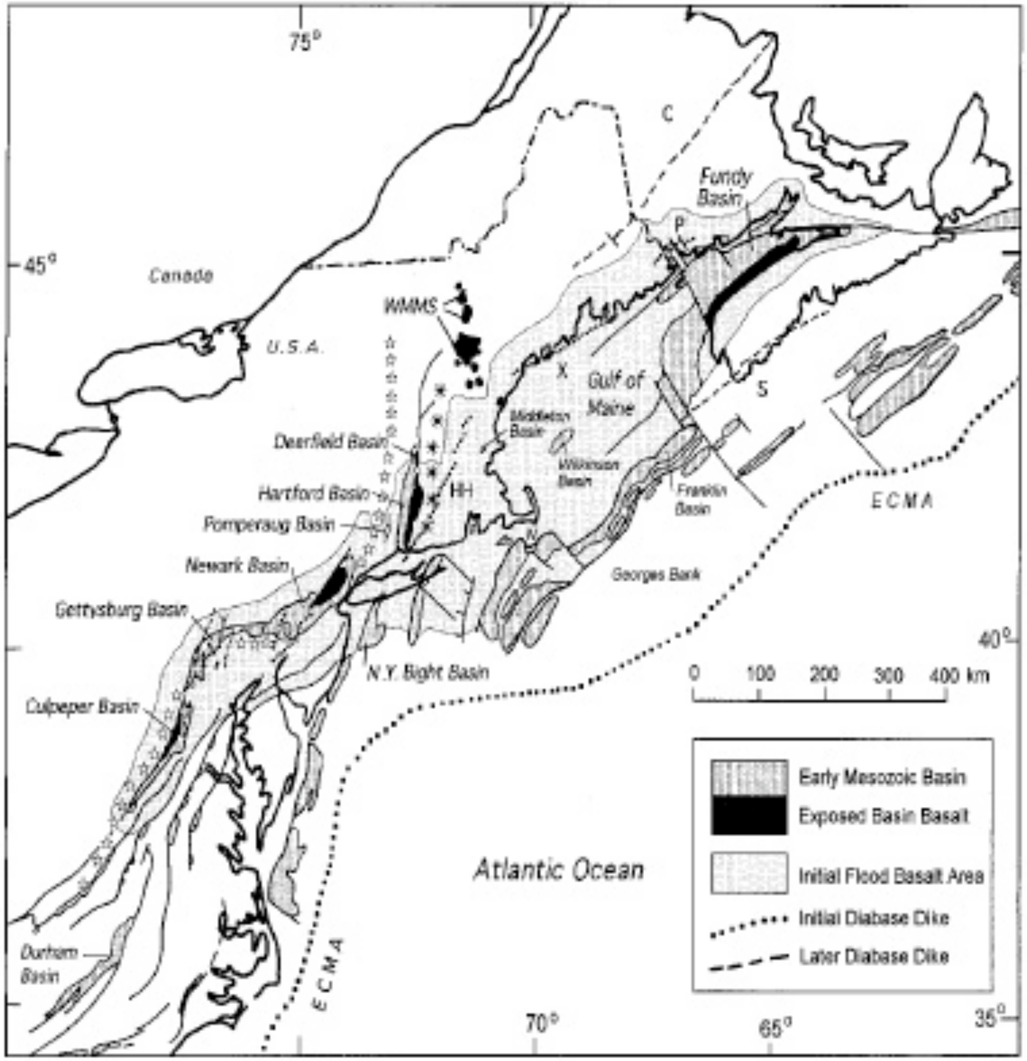



**Figure 1. Mesozoic basins and rift features of northeastern North America, including proposed initial Early Jurassic flood basalt province. Basins are essentially as shown by Manspeizer (1988). Other labels (text references): S = Shelburne dike; C = Caraquet dike; X = Christmas Cove dike; HH = Higganum-Holden dike; P = Passamaquoddy Bay dike; N = Nantucket Island and adjacent Nantucket basin; ECMA = east coast magnetic high; WMMS = White Mountains magma series plutons; stars mark trend of Appalachian gravity gradient; asterisks mark Bronson Hills terrane.**

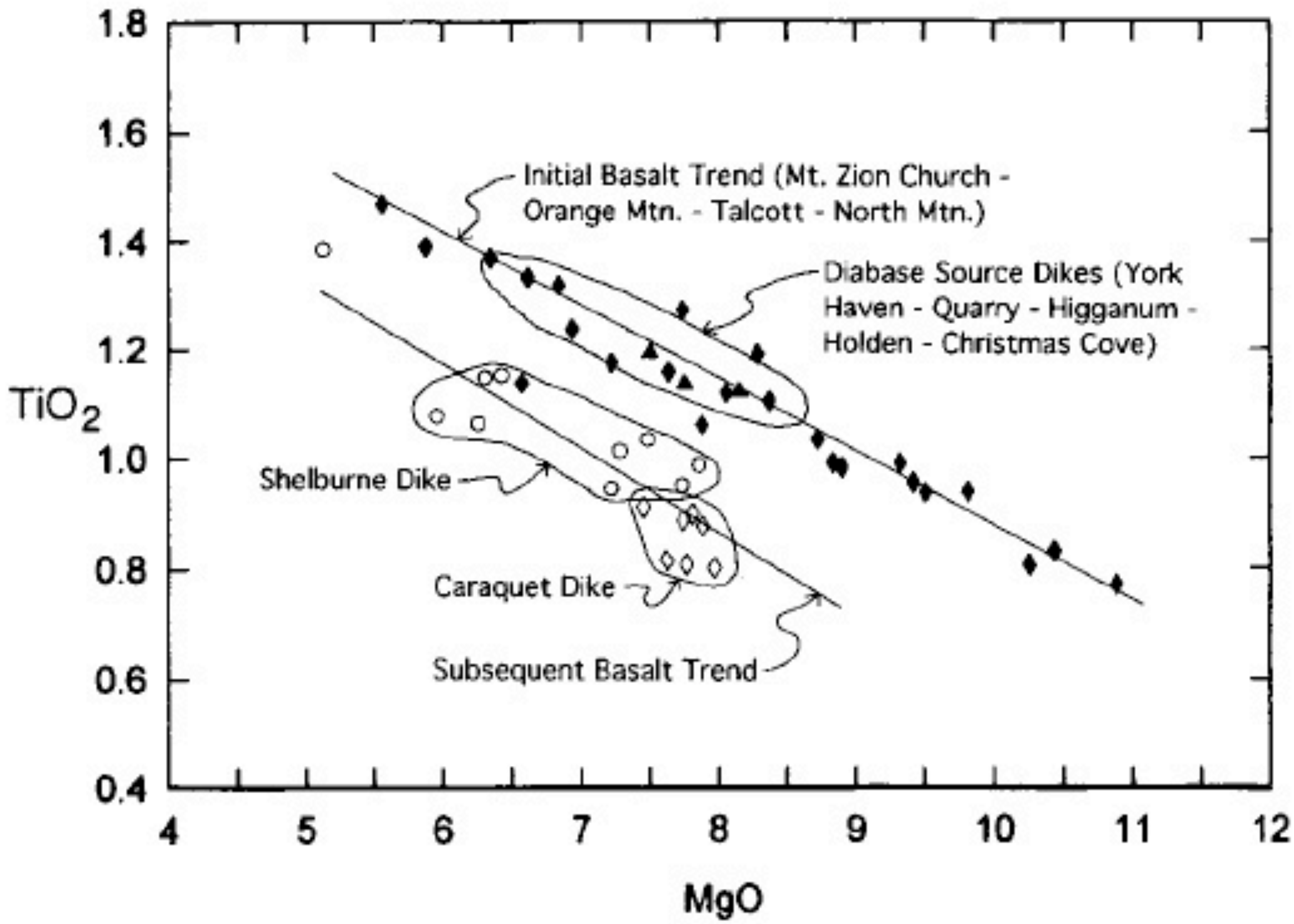



**Figure 2. $TiO_2$-MgO plot for initial and subsequent Early Jurassic diabase dikes and basalts in eastern North America (other basalts are not shown). Solid triangles represent new analyses of Christmas Cove dike. Solid diamonds represent North Mountain basalt analyses from Dostal and Greenough (1992). Other sources: Smith et al. (1975); Papezik and Barr (1981); Greenough and Papezik (1986); Philpotts and Martello (1986); Puffer (1992).**

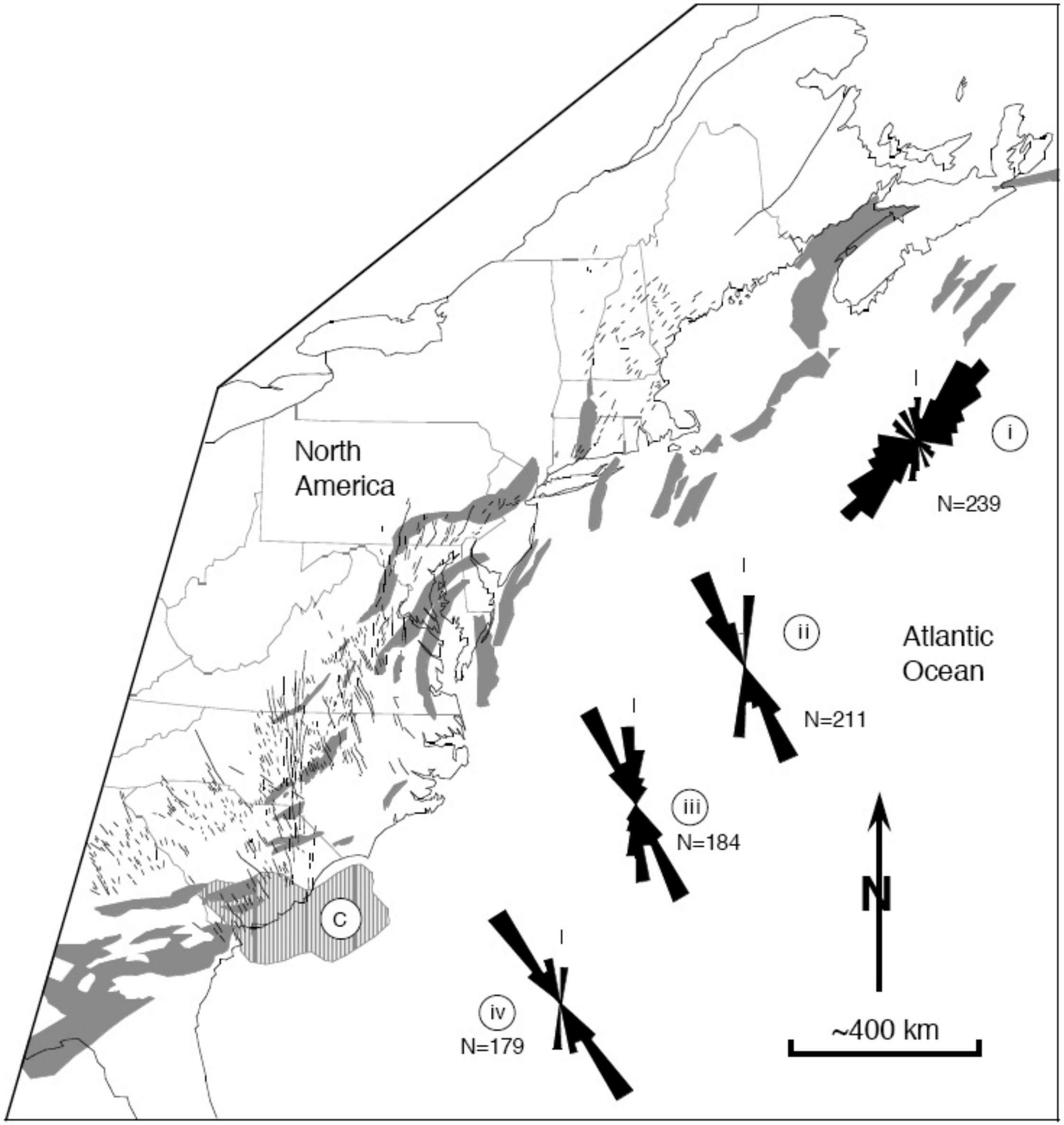


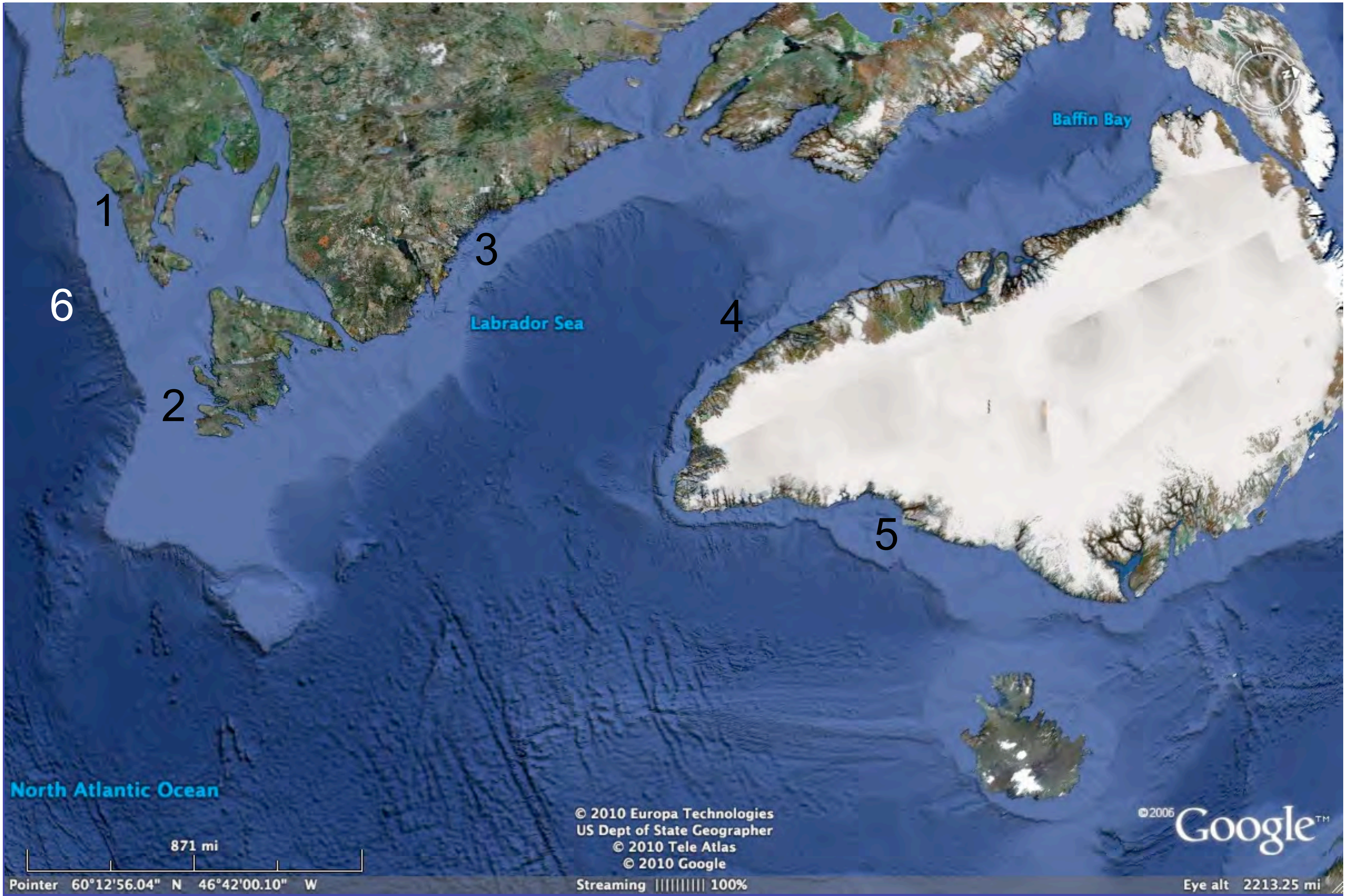

**Figure 6.** Early Jurassic-age diabase dikes (thin black lines) in eastern North America. Rift basins are stippled. C = possible extent of Clubhouse Crossroads Basalt [*Oh et al.*, 1995]. Rosettes indicate dike orientations (small tick marks indicate north) for the following regions: (i) Maritime Canada, New England, and New Jersey; (ii) Pennsylvania, Maryland and Virginia; (iii) North Carolina; (iv) South Carolina and Georgia. Modified from *McHone* [1988].

Schlishe et al 2002: Triassic Basins and CAMP dikes

# Conclusions

- Eastern North America underlain by Mesozoic rift basins
- Dikes, sills, and lava flows show very similar basalt chemistry and age (202-200 My)
- Extent of basalt flows is inferred from distribution of dikes
- Central Atlantic Magmatic Province inferred to represent a major flood basalt province
- Sea floor spreading in the Mid-Atlantic began 185-175 My from vents east of the CAMP

# North Atlantic Basin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Baffin Bay
6
Labrador Sea
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North Atlantic Ocean
871 mi
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Streaming |||||||||| 100%
Eye alt 2213.25 mi


Gulf of St Lawrence
Rose Blanche Bank
Bay of Fundy
Tusket Basin
Fundian Valley
Newfoundland
Nova Scotia
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© 2010 Google
251 mi
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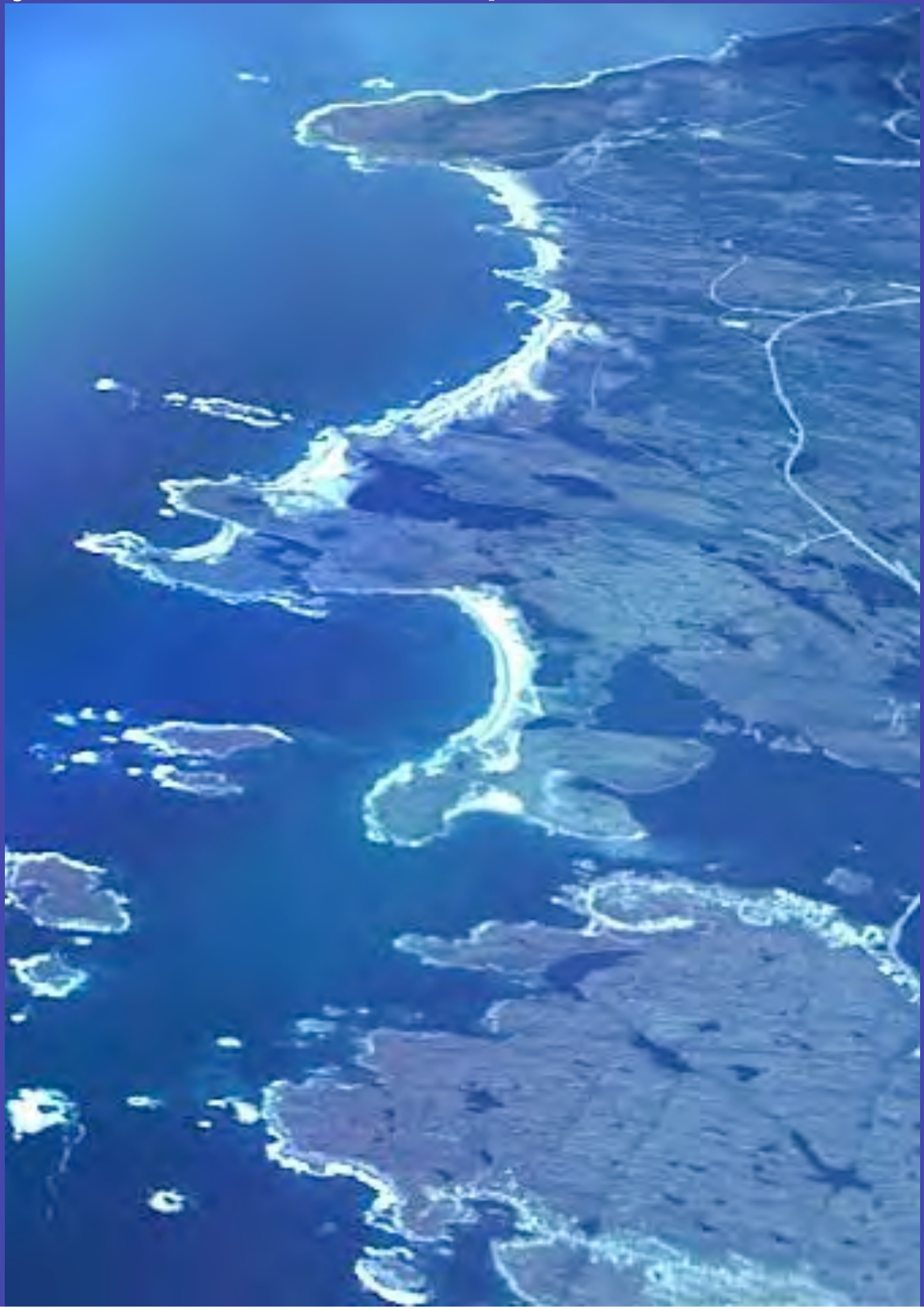
Eye alt 803.31 mi

# Cape Ray, Porte aux Basques, Newfoundland



The Long Range Escarpment, Newfoundland

Gros Morne NP, Newfoundland

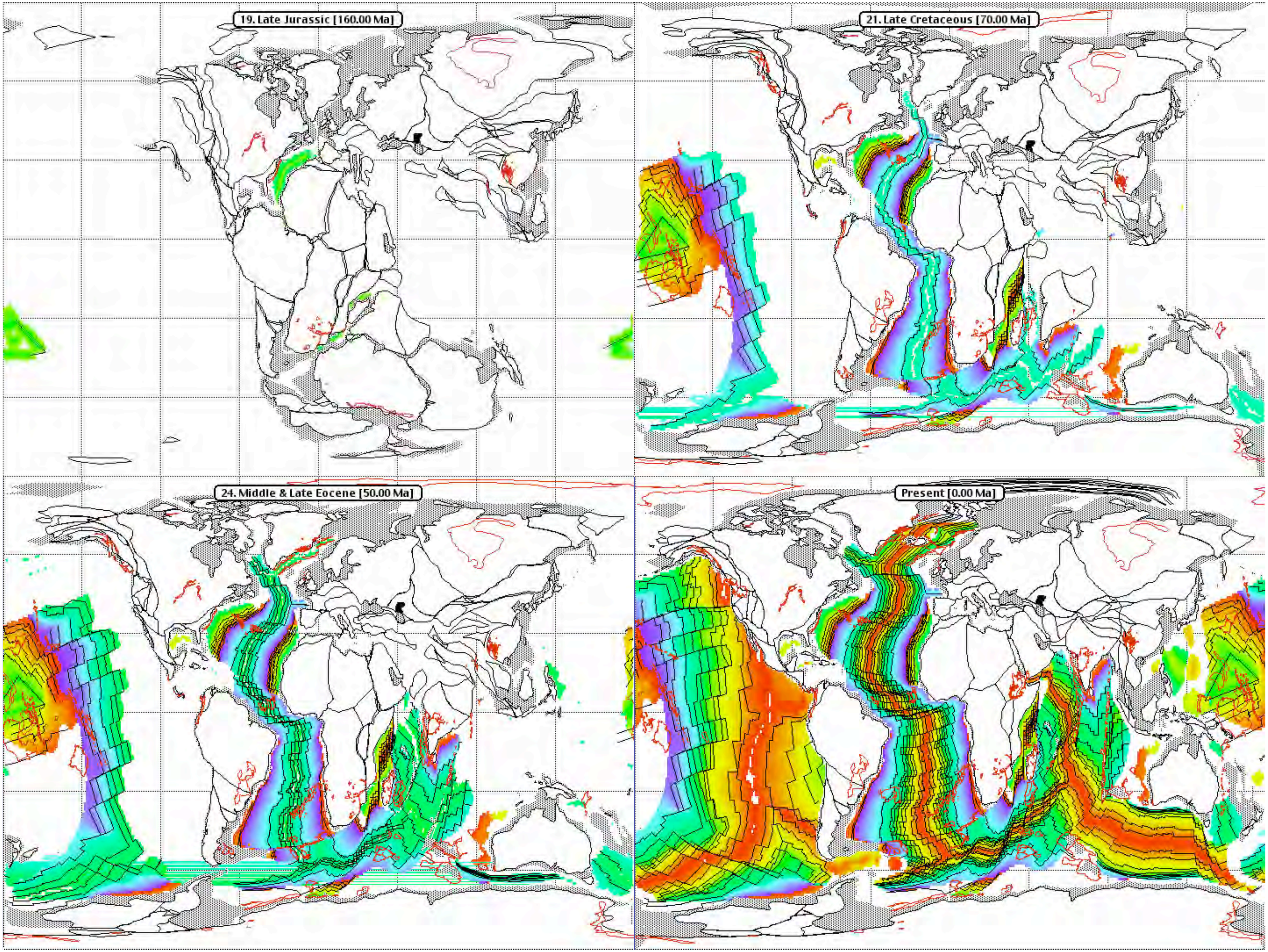
Cape Breton, Nova Scotia

# Torngutfjord, Labrador

Nuuk Fjord, Southwest Greenland


Nuuk, Greenland


East Greenland, north of Scorsbysund


19. Late Jurassic [160.00 Ma]
21. Late Cretaceous [70.00 Ma]
24. Middle & Late Eocene [50.00 Ma]
Present [0.00 Ma]

# Tucholke and Fry 1985

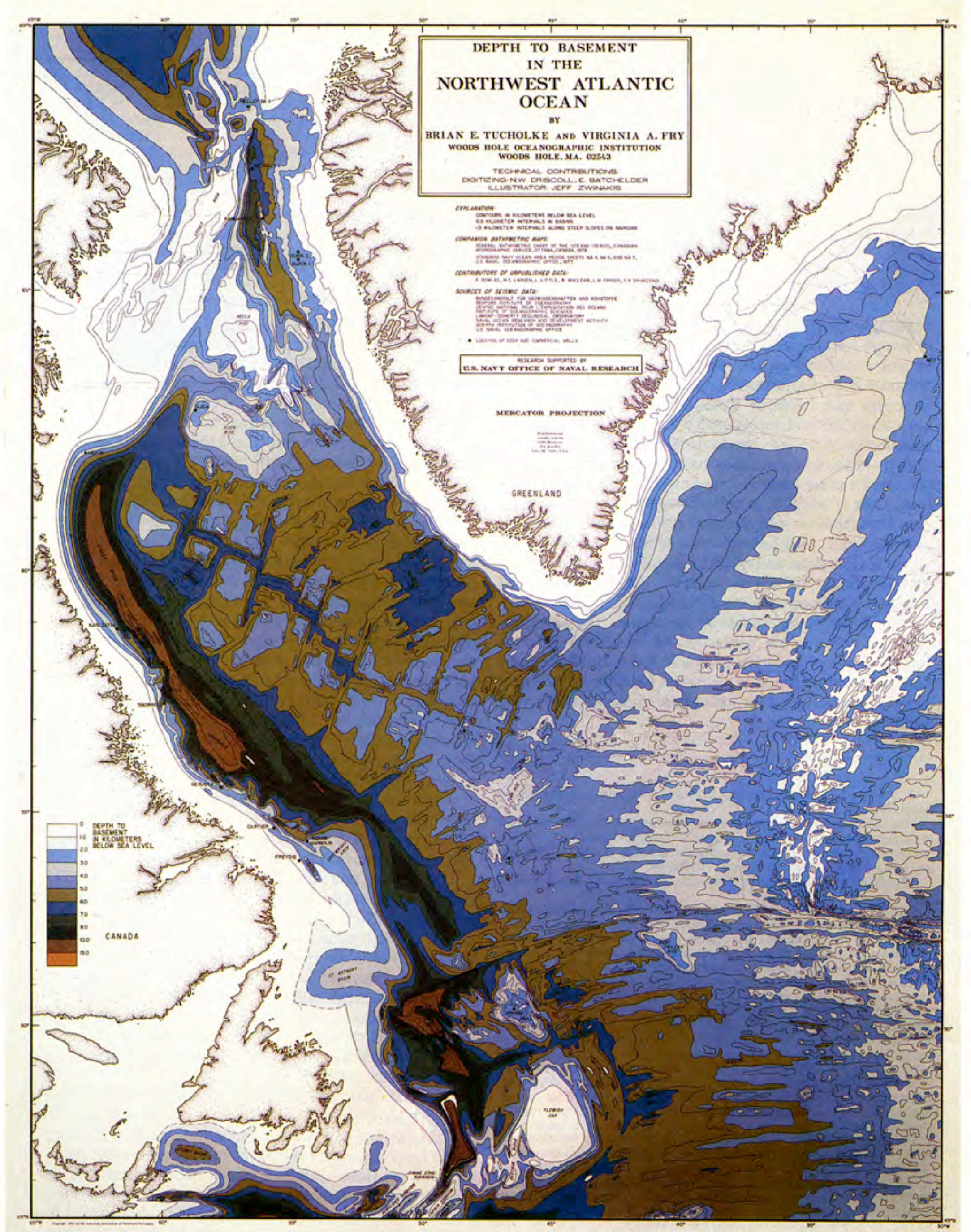



**Figure 1—Depth to basement, in kilometers below sea level, in northwest Atlantic Ocean. Locations of DSDP and commercial wells summarized in Figure 5 are shown. Track control is indicated by fine dotted lines. St. Anthony and Sydney basins and two small basins near Newfoundland are principally Paleozoic features (Wade et al., 1977); they are enclosed by dashed contours.**

# Tucholke and Fry 1985

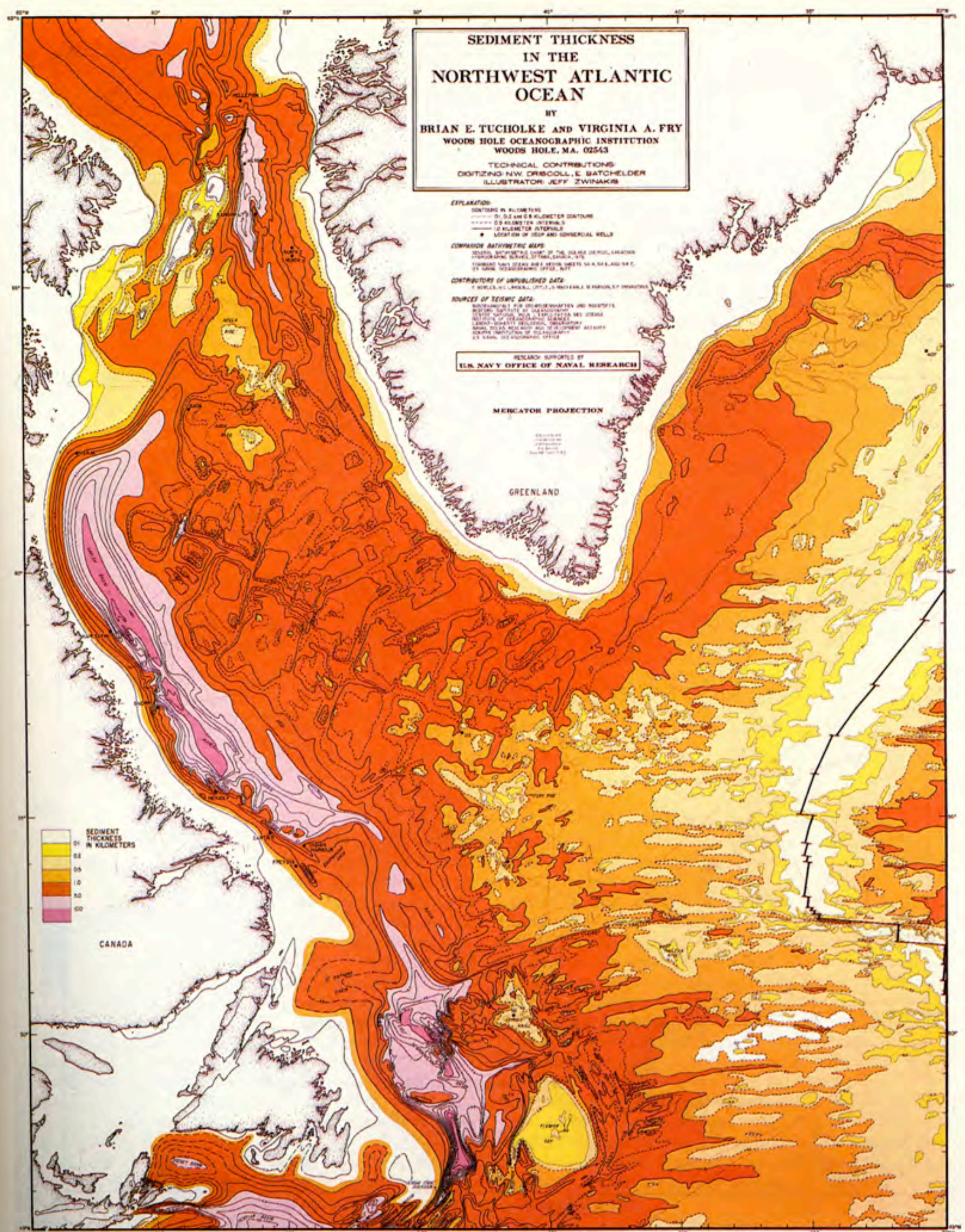



**Figure 2—Sediment thickness, in kilometers, in northwest Atlantic Ocean. Locations of DSDP and commercial wells summarized in Figure 5 are shown. Track control is indicated by fine dotted lines. St. Anthony and Sydney basins and two small basins near Newfoundland are principally Paleozoic features (Wade et al, 1977); they are enclosed by dashed contours. Line of zero sediment thickness along continental margins is approximate; several tens to hundreds of meters of sediment may locally be present shoreward of this line.**