

MMS

Resource Methodology Offshore North Carolina

Dave Marin

*Regional Supervisor
U.S. Dept. of the Interior
Minerals Management Service
Gulf of Mexico Region*

Raleigh, NC
April 15, 2009

MMS

MMS Definitions

(without technical jargon)

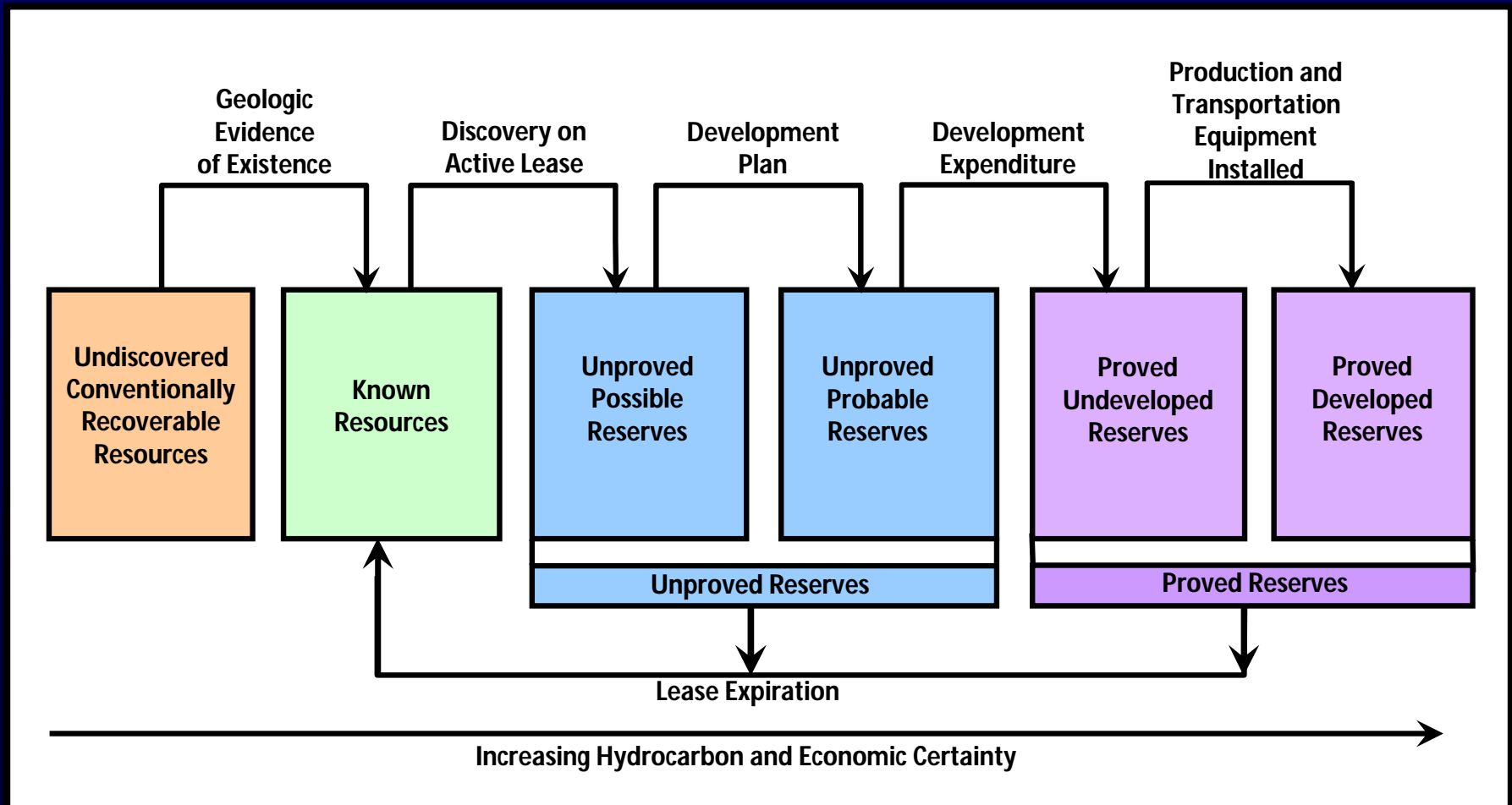
❖ Resources

- ❖ Hydrocarbon (oil and/or gas) volumes that we think might be there

❖ Reserves

- ❖ Hydrocarbon (oil and/or gas) volumes that we have a high degree of confidence are there
 - ✦ Subject to SEC definitions

MMS Gulf of Mexico & Atlantic Reserve Classification Procedure*



* currently in use

MMS

Assessment of Undiscovered Oil & Gas Resources

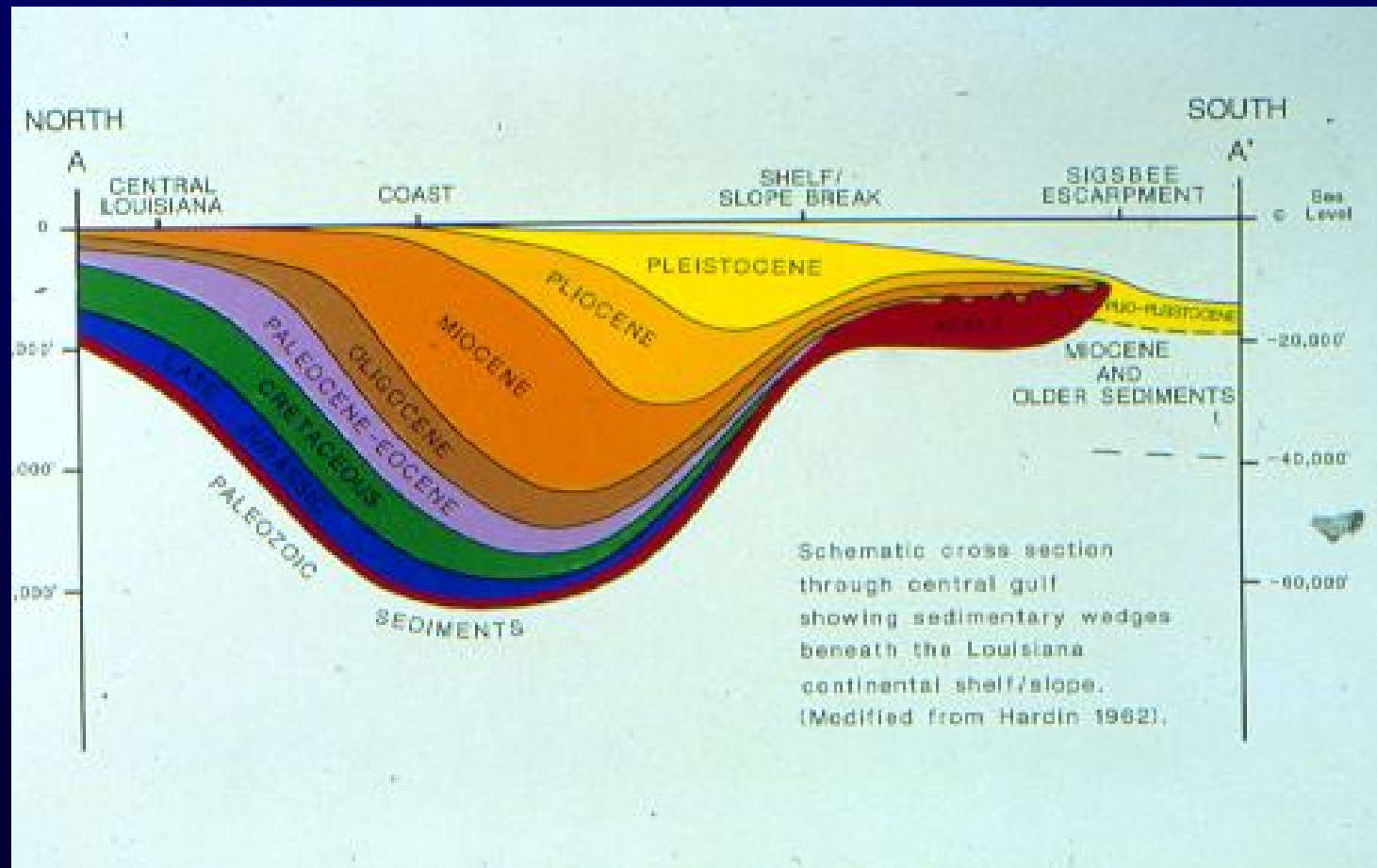
- ❖ Aids development of appropriate Government policy (such as MMS' 5-Year Leasing Program, Energy Policy)
- ❖ Provides resource estimates used for environmental and socioeconomic studies (EIS)
- ❖ Provides an independent estimate of the Nation's remaining resources for use by Government, industry, academia and the public.

Evaluating the Resource Potential of a Basin

❖ Geologic Basin (or Basin)

- ❖ Depressed and geographically confined area of the earth's crust in which sediments accumulated and hydrocarbons may have formed
- ❖ Necessary steps to assess/inventory resources
 - Identify sedimentary basin
 - Determine sedimentary thickness
 - Identify major structural elements
 - Identify reservoir and source rocks
 - Identify migration pathways
 - Assess geologic risk & rank undeveloped acreage

Example Cross-Section Showing Sedimentary Thickness of a Basin



US Atlantic Plays Identified Using

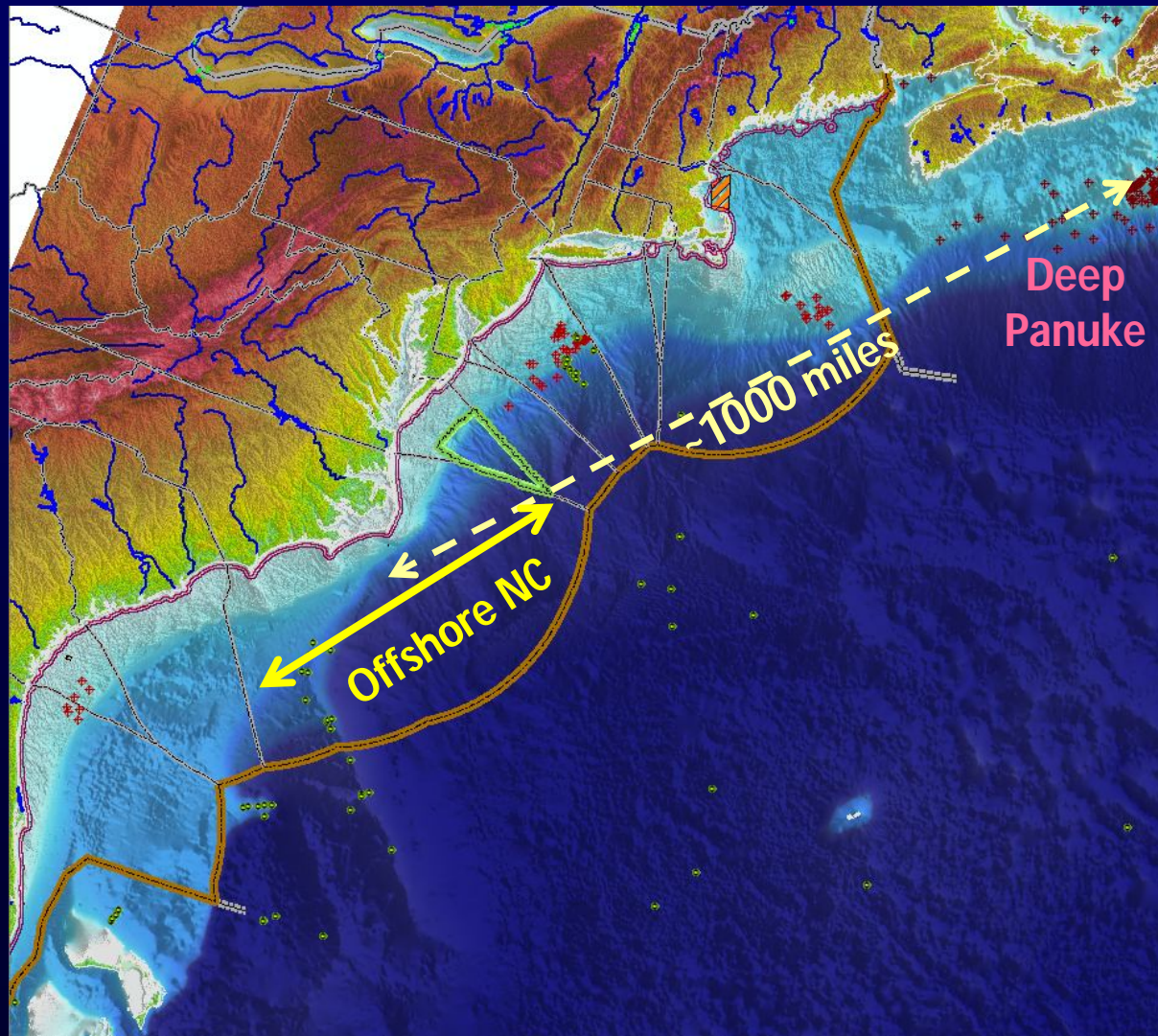
- ❖ Other oil & gas plays and fields
 - ◆ Selected based on experience of MMS geologists / geophysicists / engineers
 - ◆ With similar structural setting, geologic age, lithology
 - ◆ From US or international oil & gas producing areas using MMS or other data sources



MMS

Nova Scotia – North Carolina

Offshore Central Atlantic Analog Connection



Nova Scotia – North Carolina

- ❖ Why is something ~1000 miles away of interest?
 - ❖ Because Deep Panuke, a discovery on the “carbonate margin”, represents the most recent discovery in an area of the Atlantic margin where oil and gas exploration and production are on-going
 - ❖ It provides a reasonable analog for one of the potential oil & gas plays offshore North Carolina

Nova Scotia – Deep Panuke

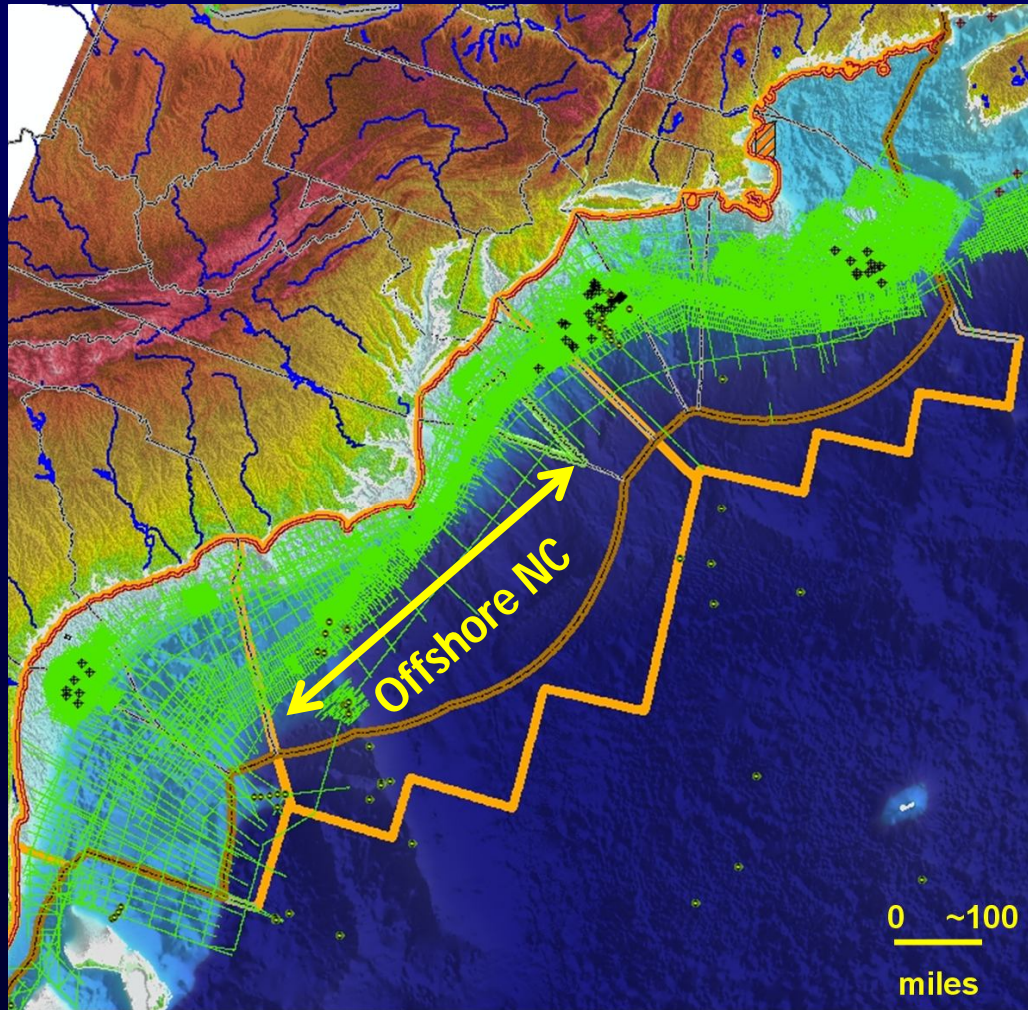
- ❖ 1999 EnCana carbonate margin discovery
- ❖ Water depth – ~150 feet
- ❖ Net pay 33 – 330 feet
- ❖ Test rates (5 wells) – av. >50 MMCFG/D
- ❖ Delineated by 12 wells
- ❖ Field – potentially 12 mi. long
- ❖ *Only ~1 mi. wide on average*

North Carolina Offshore Exploration

❖ Data

- ❖ Extensive historical seismic & well data base
- ❖ Substantial knowledge of the region from Nova Scotia to the Bahamas and across the Atlantic to Northwest Africa

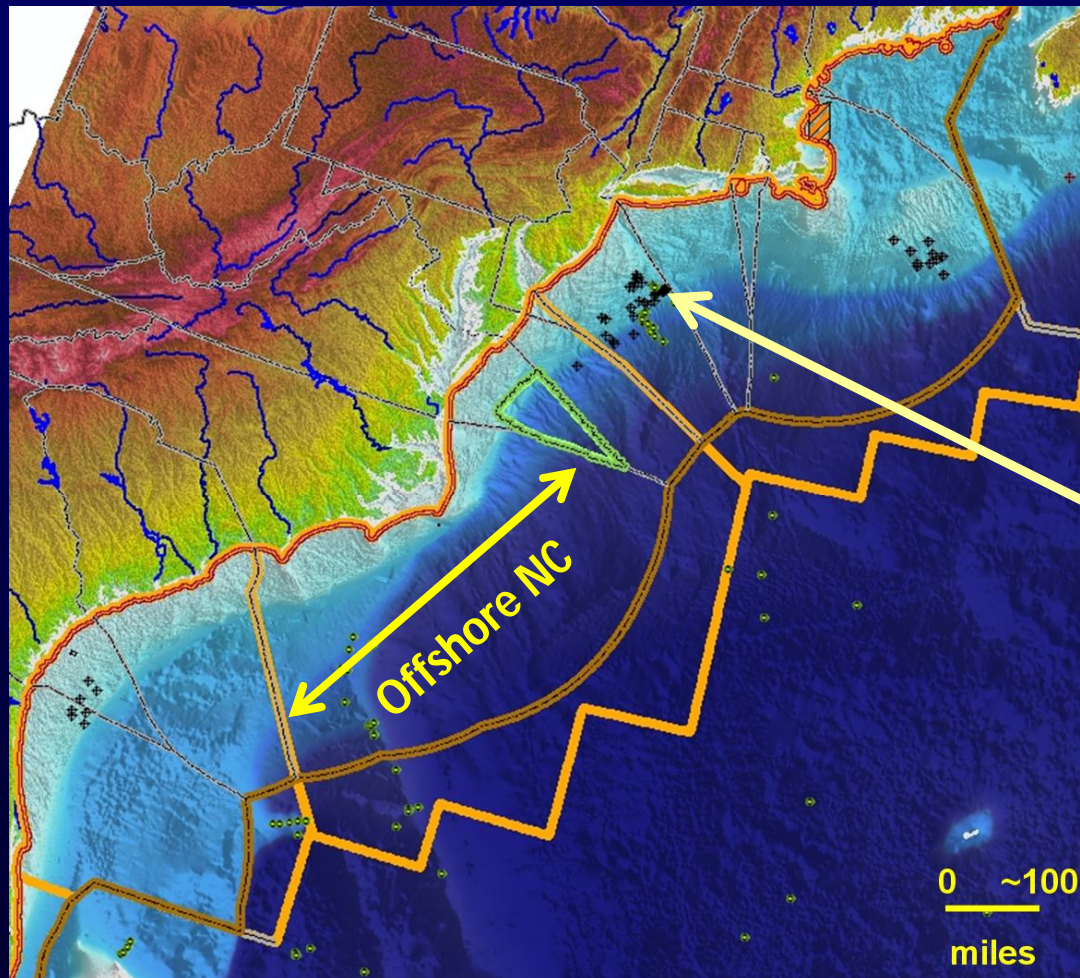
U.S. Central Atlantic Margin Seismic



- ❖ Seismic 1966 – 1988
- ❖ AAPG & OCS Rpt MMS 2002-079
 - ◇ ~239,000 line miles
 - ◇ MMS vectorized & migrated (if needed) seismic data base
 - ~147,000 line mi. (~60%)

U.S. Central Atlantic Margin

Leasing & Drilling



- ❖ 9 lease sales (1976 – 1983)
 - ◆ 433 leases / 2,466,678 ac
 - ◆ \$2,841,887,349 (DOD)
 - ◆ \$1,152 (DOD) PAB
- ❖ 51 Wells
 - ◆ 5 COST (1975 – 1979)
 - ◆ 46 Industry (1978 – 1984)
 - ◆ 39 Industry NFWs
- ❖ 1 discovery – Hudson Canyon (HC) 598 Area
 - ◆ 4-block area
 - ▲ All 8 wells – gas shows
 - ▲ 5 DSTd gas
 - ◆ Est. risked rec. *RESOURCES*
Range ~85 – ~254 BCFGE
ML ~170 BCFGE

North Carolina Offshore Exploration

❖ Seismic Data

- ❖ Acquired / processed mid 1960's – late 1980's
- ❖ New data (preferably long cable, high frequency 3D) would help better evaluate area
- ❖ Timing of new data acquisition – uncertain

❖ Leasing

- ❖ Blocks leased

❖ Drilling

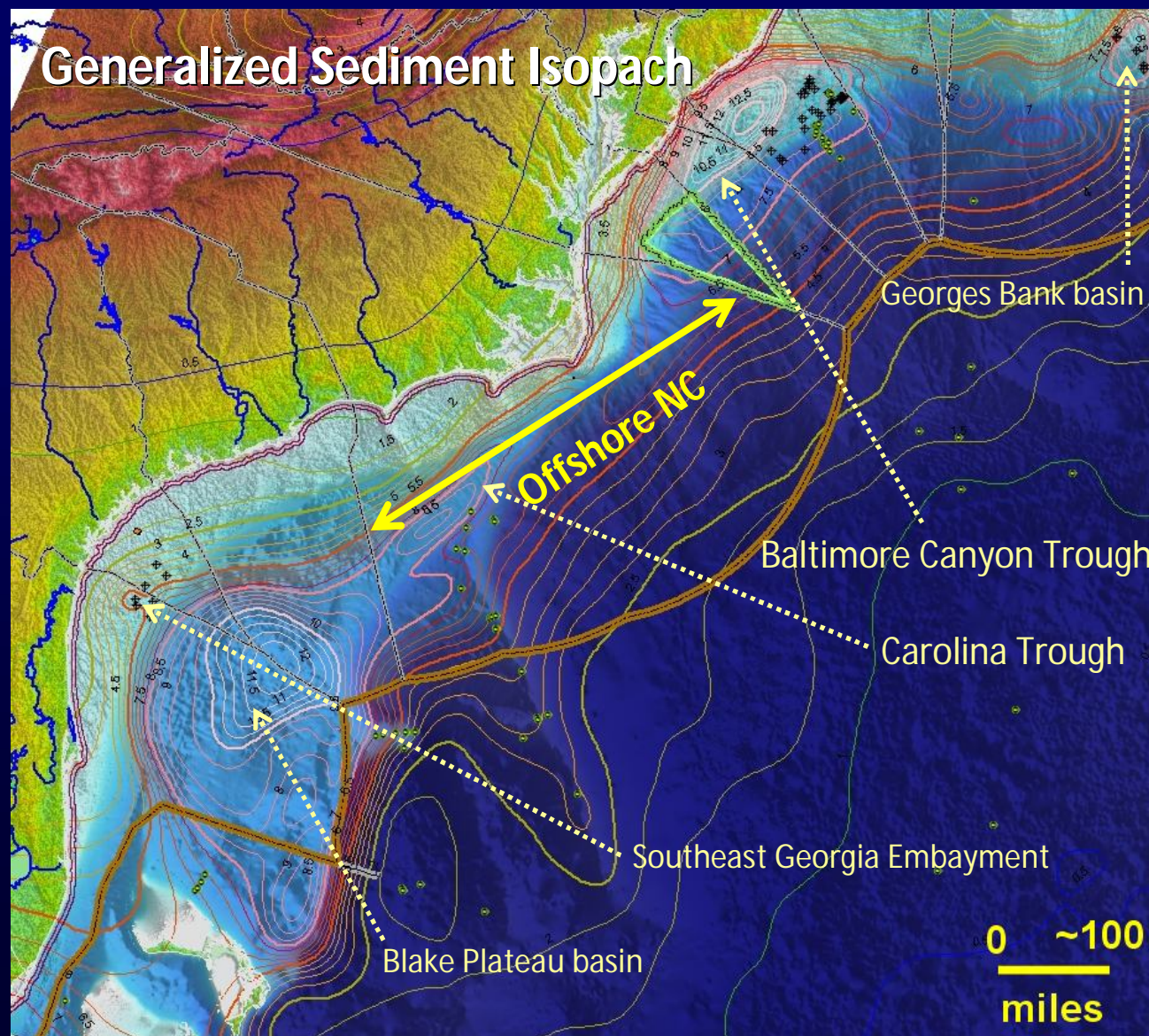
- ❖ None
- ❖ Various reasons

North Carolina Offshore Exploration

❖ So what is there to look for?

- ❖ Drilling to the north was generally unsuccessful
 - ✦ 1 ? commercial discovery
- ❖ Offshore North Carolina
 - ✦ Carbonate margin & Carolina Trough Salt Basin
undrilled
- ❖ New concepts & analogs applied

U.S. Central Atlantic Margin Basins



North Carolina Offshore Nearshore Shelf

❖ Observations

❖ Limited prospectivity

- ✦ Structural closures – very low-relief
- ✦ Mature source rocks unknown – existence ?
- ✦ Reservoir quality unknown

However,

- Sandstone – probably poor
(based on drilling to the north)
- Carbonates – probably adequate
(based on drilling to the north)

North Carolina Offshore

Carolina Trough Salt Basin

❖ Observations

❖ More prospective

- ✦ Updip (more distal shelf/slope)
 - Marginal fault belt play
- ✦ Downdip (deeper water)
 - Salt structure play
 - Analogous structures on the conjugate African margin in Mauritania are productive

❖ Undrilled ∴ high risk

- ✦ Source rocks unknown – but can be speculated
- ✦ Reservoir rocks unknown

North Carolina Offshore Carbonate Margin

❖ Observations

- ❖ Possibly prospective based on Deep Panuke analog
- ❖ Undrilled \therefore high risk
 - ✦ Mature source rock unknown – but can be speculated (based on various indirect lines of evidence)
 - ✦ Reservoir unknown – but can be speculated (based on drilling to the north and Deep Panuke analog)

North Carolina Offshore

2006 Resource Estimate

UTRR	Oil	Gas
	(Bbbbls)	(TCFG)
Atlantic	3.82	36.99
Mid-Atlantic	1.50	15.13

UERR @ \$46/bbl & \$6.96/mcfg

Atlantic	2.23	13.70
Mid-Atlantic	.81	5.12

North Carolina Offshore Resource Summary

- ❖ Geologically – Risk varies with play
- ❖ Moderate – High Potential

Thank you