Assessment of Geological Storage Capacity of the Southeastern U.S. for CO_2 in Brines and Economic Use for EOR

GCCC Digital Publication Series #06-03

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Keywords:
CO_2 Storage Capacity- Brine, CO_2 Storage Capacity- Eastern Seaboard, CO_2 Storage Capacity- Offshore, CO_2 Storage Capacity- CO_2 EOR, CO_2 EOR-Economics

Cited as:
Hovorka, S.D., Holtz, M.H., Smyth, R.C., Núñez López, V., Kim, E., Breton, C.L., Scanlon, B.R., Reedy, R.C., Paine, J., Tinker, S., and Duncan, I., Assessment of geological storage capacity of the southeastern U.S. for CO_2 in brines and economic use for EOR: presented at SECARB Industry Briefing, Atlanta, Georgia, January 18–19, 2006. GCCC Digital Publication Series #06-03.

Assessment of Geological Storage Capacity of the Southeastern US for CO_2 in Brines and Economic Use for EOR

Prepared by the Gulf Coast Carbon Center at the Bureau of Economic Geology

The University of Texas at Austin

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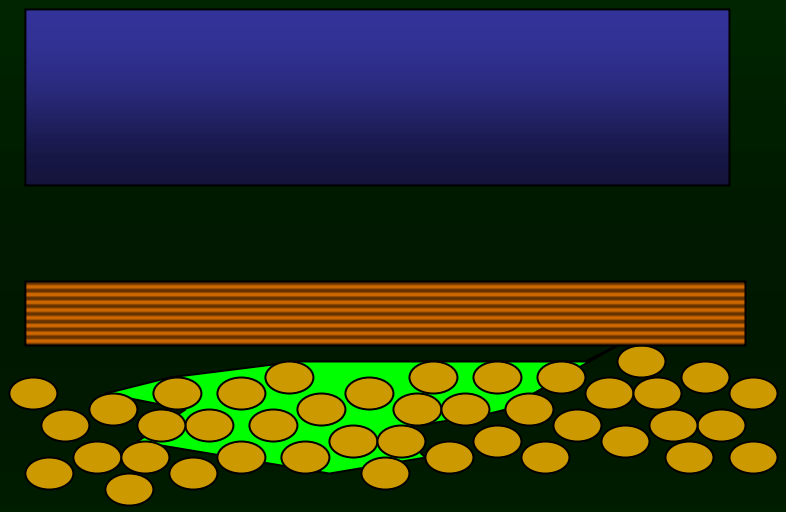
Prepared for Southeast Regional Carbon Sequestration Partnership Phase I, led by the Southern States Energy Board

1/19/2006, Atlanta Georgia

Assessing Storage Capacity In Brine



Identify a porous and permeable rock volume in the subsurface

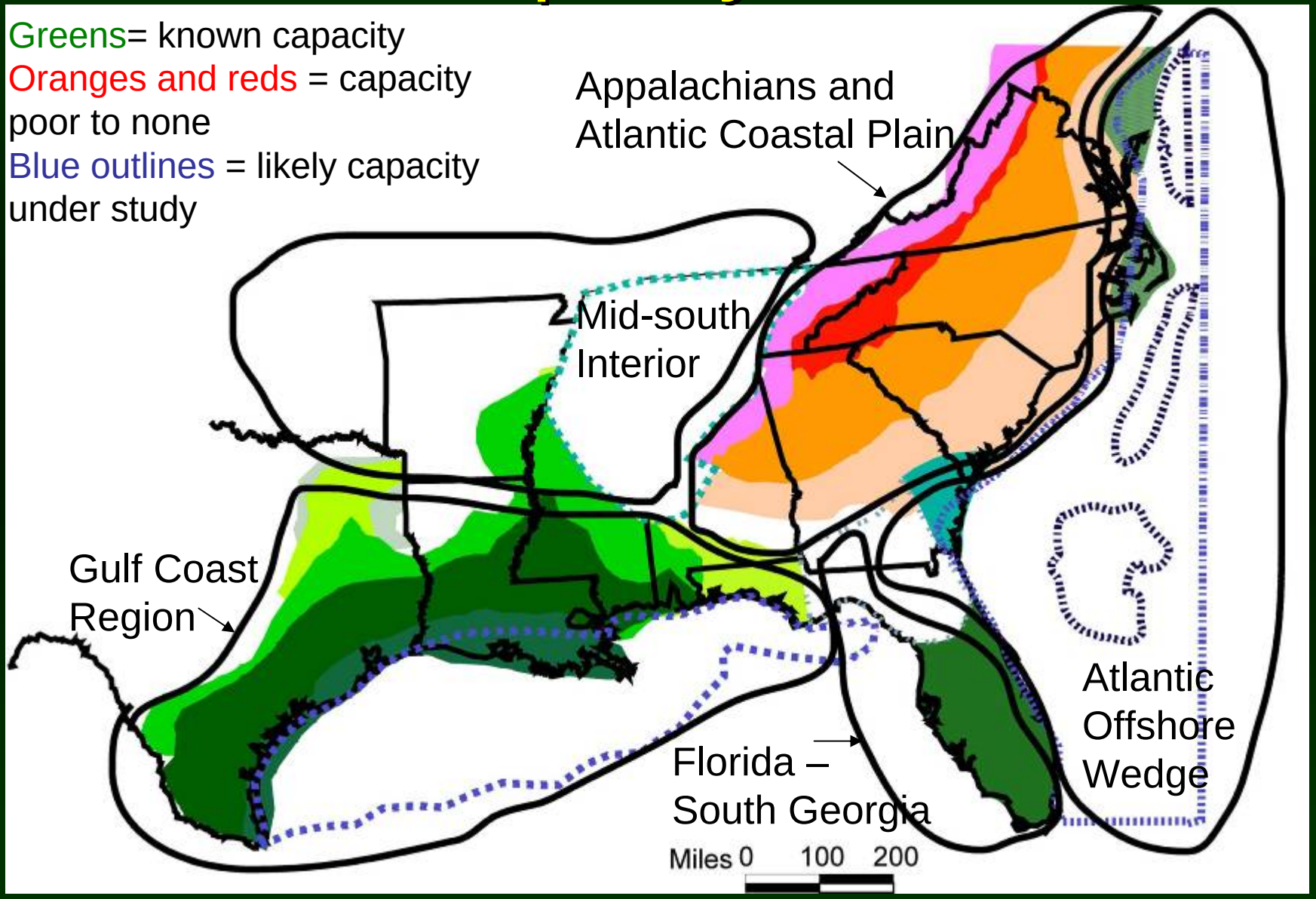
…That is below underground sources of drinking water

…and isolated from them and from escape to the atmosphere by one or more seals

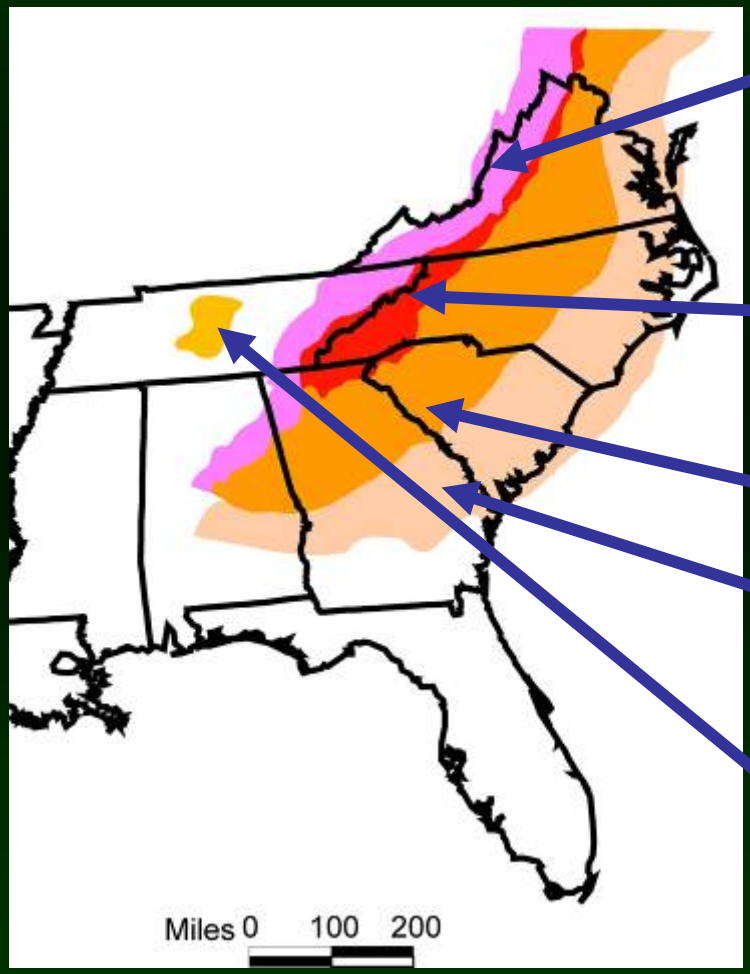
… and collect data on areal extent, thickness, CO_2 density porosity, and permeability that permit simple estimates of storage capacity for CO_2

If preceding steps are favorable, proceed to additional steps, including matching to sources, estimating cost, permanence, and risk/uncertainly

Status of Capacity Assessment



Appalachians and Atlantic Coastal Plain

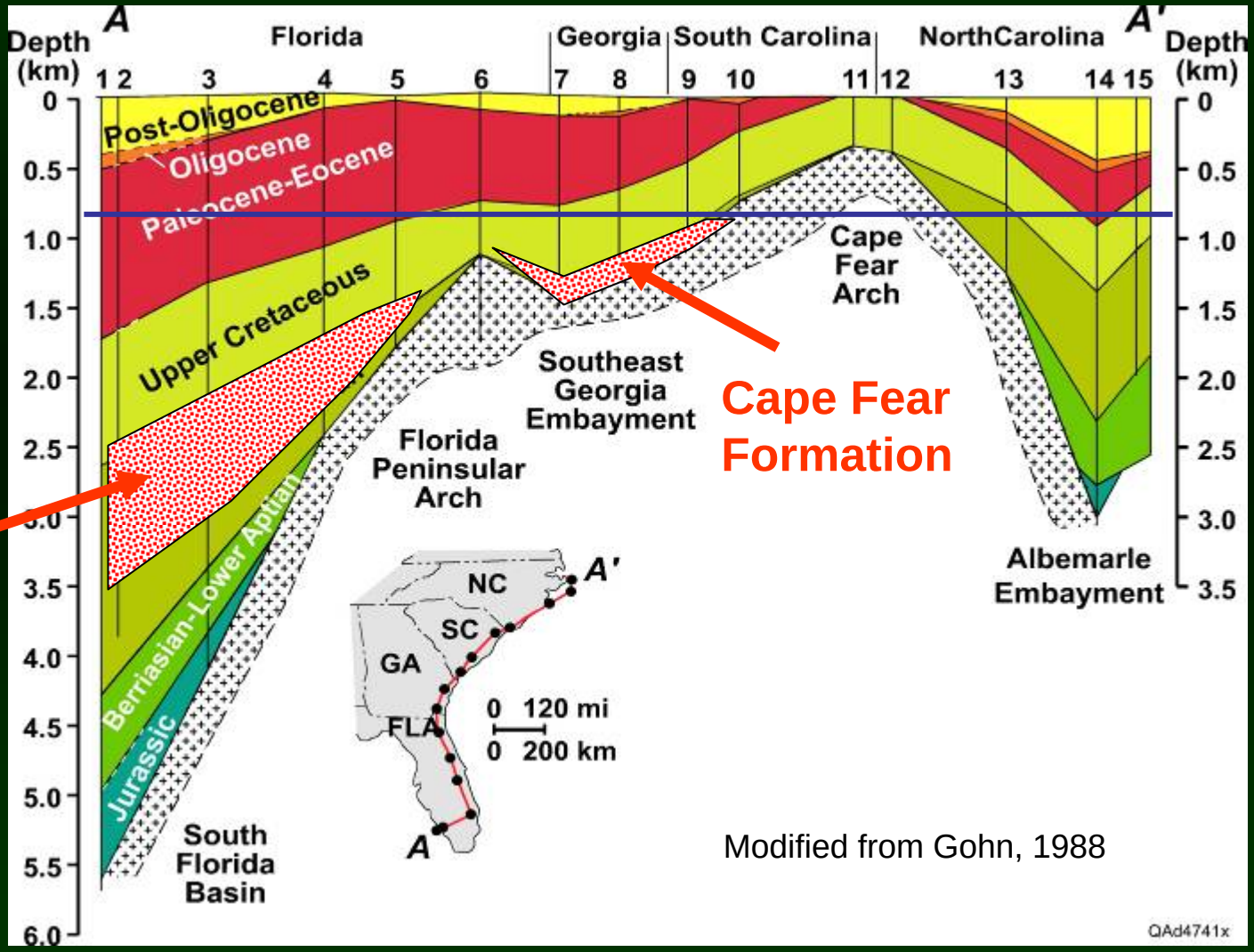


- Valley and Ridge – complex, likely local capacity
- Blue Ridge – no capacity
- Piedmont – no capacity
- Atlantic coastal plain – capacity only near coast
- Nashville dome – poor to no capacity

Capacity along the Eastern Seaboard

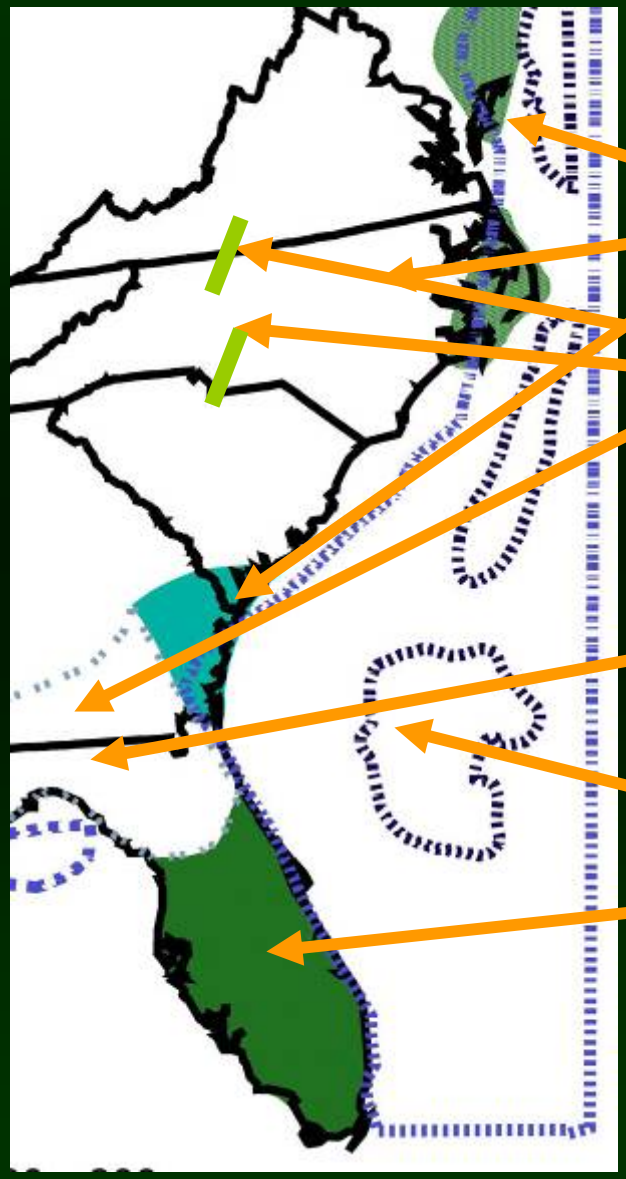
Minimum Depth 800 m

Cedar Keys/ Lawson & other carbonates



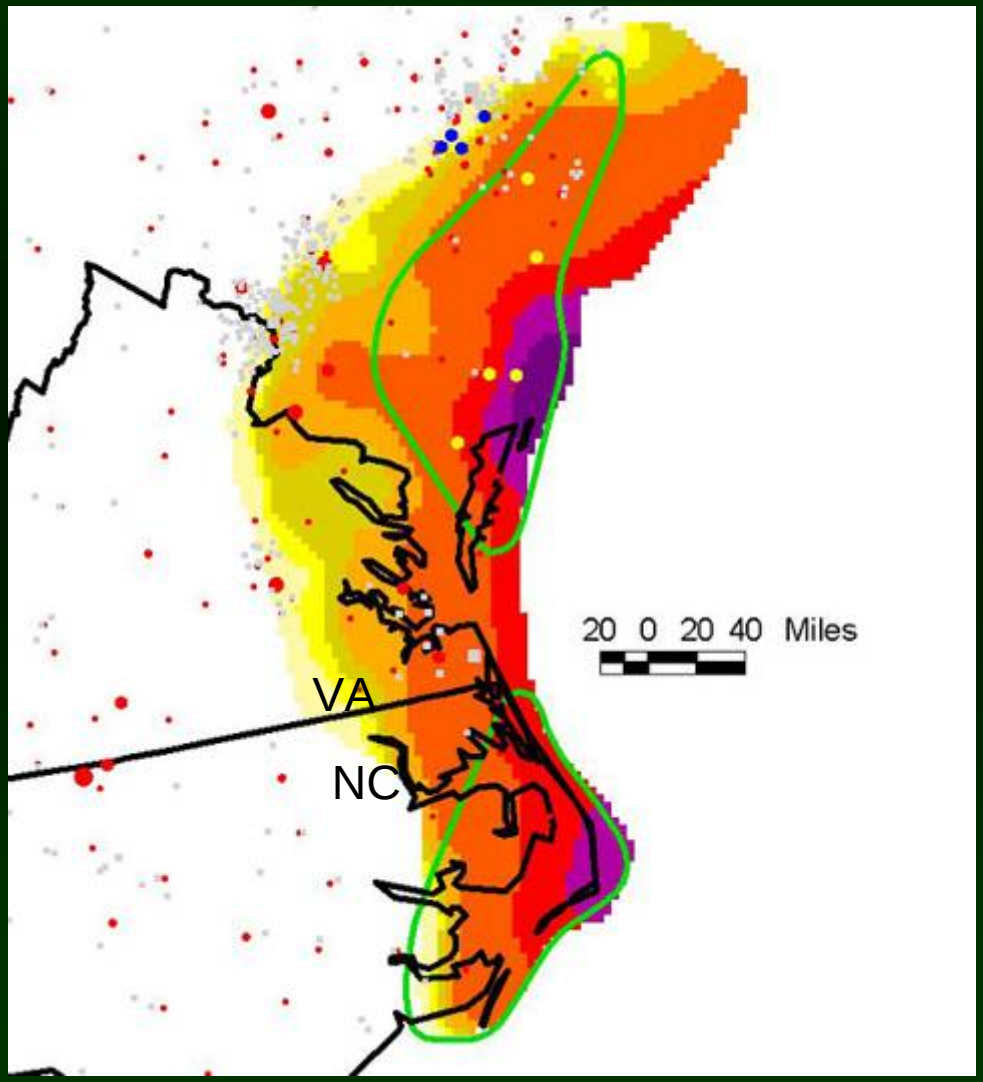
Modified from Gohn, 1988

Brine Storage Capacity for Eastern SE US



- Cretaceous of the Atlantic Coastal margin
- Mesozoic Rift Basins
- North Florida - south Georgia Cretaceous and Mesozoic Rift Basins
- Offshore Atlantic wedge
- Southern Florida
- West of Appalachians

Detail study eastern seaboard options: lower Potomac Formation Thickness and Salinity



These trends encourage us to explore for geologic storage options on the continental shelf of the eastern US.

Formation thickness (m)

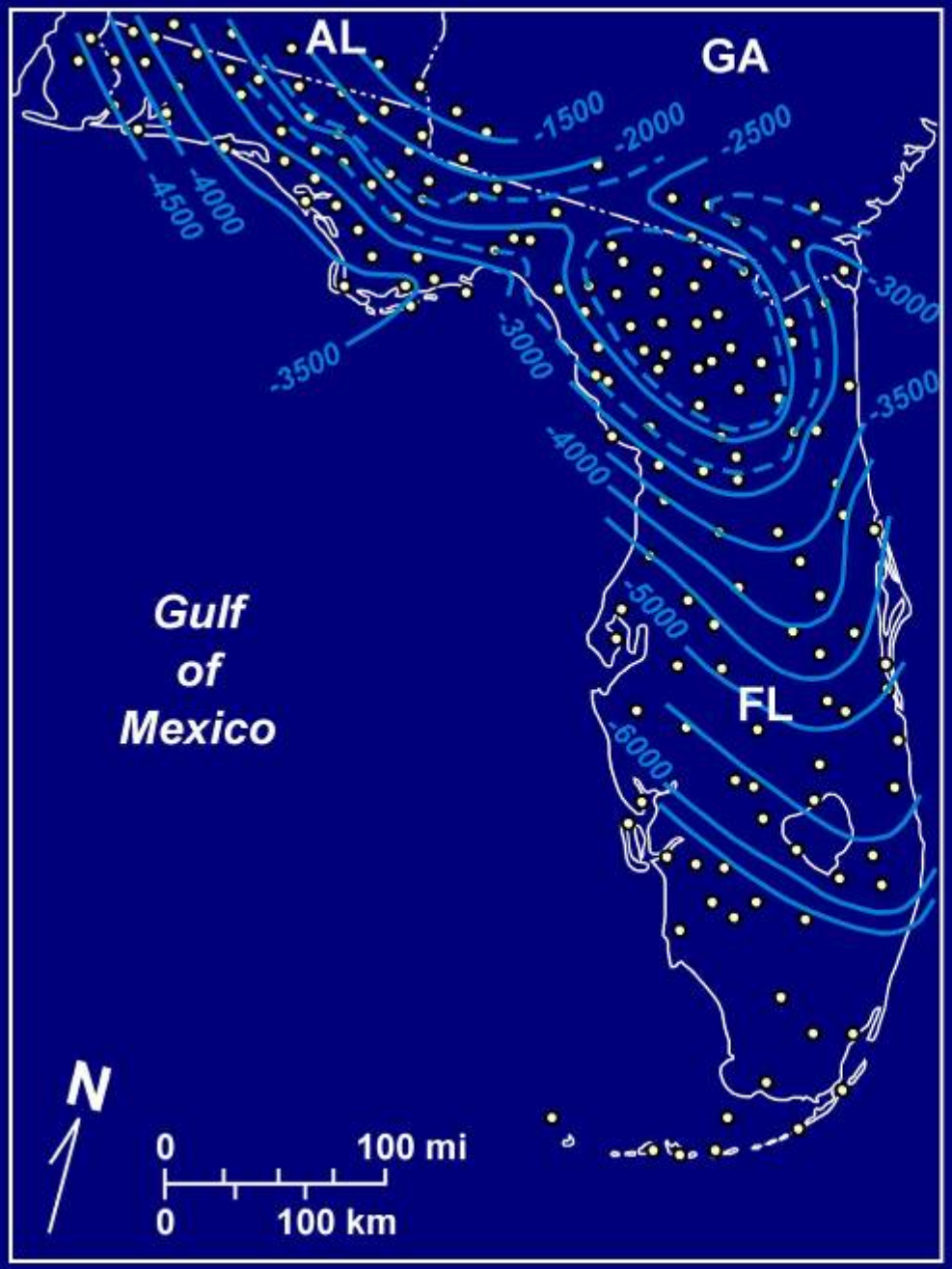
- 1000-750
- 750-500
- 500-200
- 200-100
- 100-50
- 50-10
- <10

Power plant

Adequate depth

Fresh

Saline



TOP "TAYLOR KICK" U. CRETACEOUS

Thin, low-resistivity shale

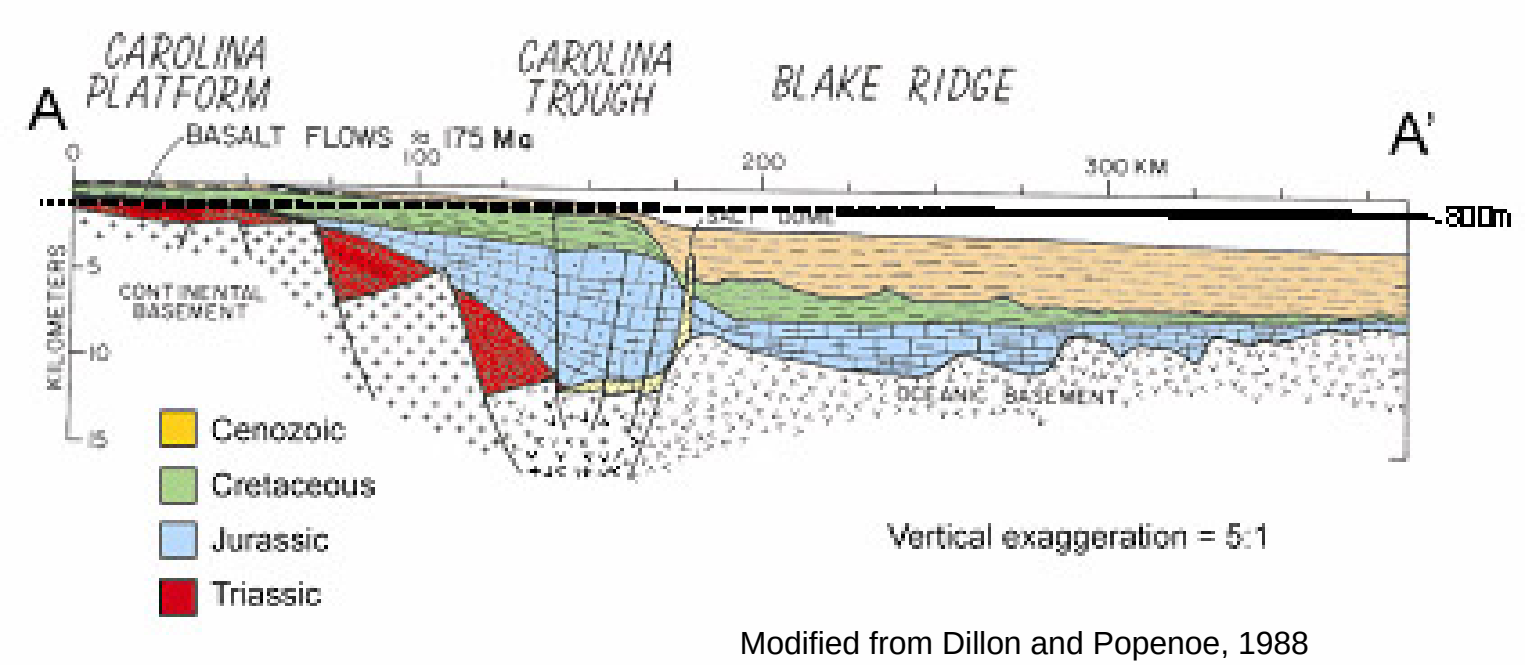
Possible regional seal on Cretaceous carbonates and evaporites

Elevation contour (ft)

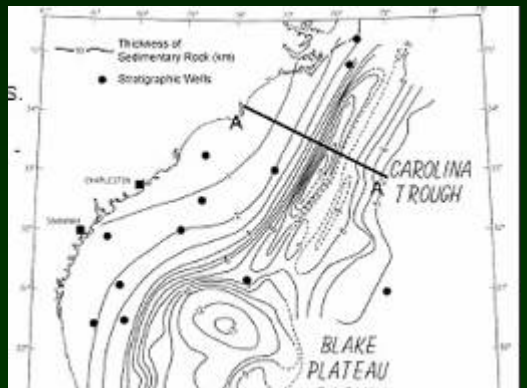
Well

adapted from Chen (1965)

Significant Capacity Offshore Atlantic Wedge

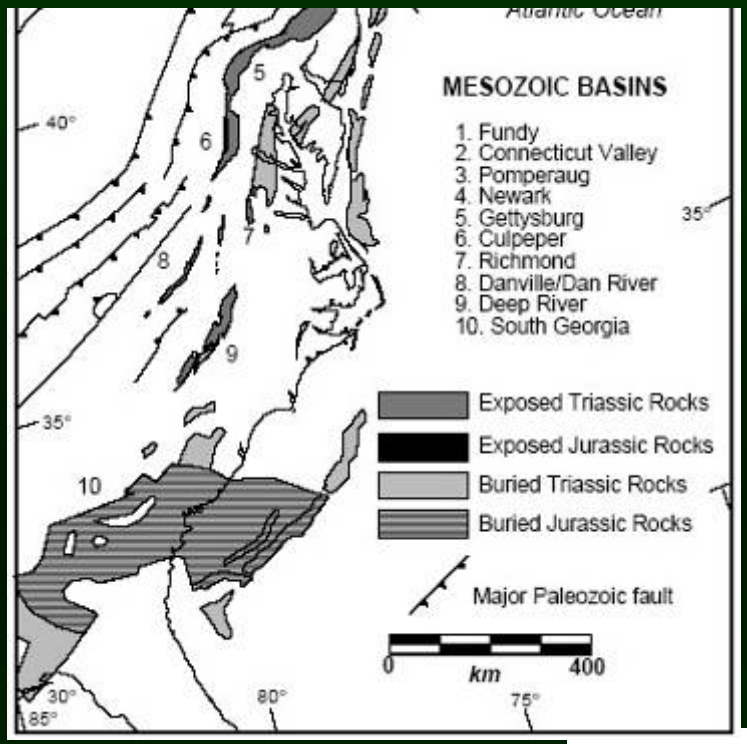


Modified from Dillon and Popenoe, 1988



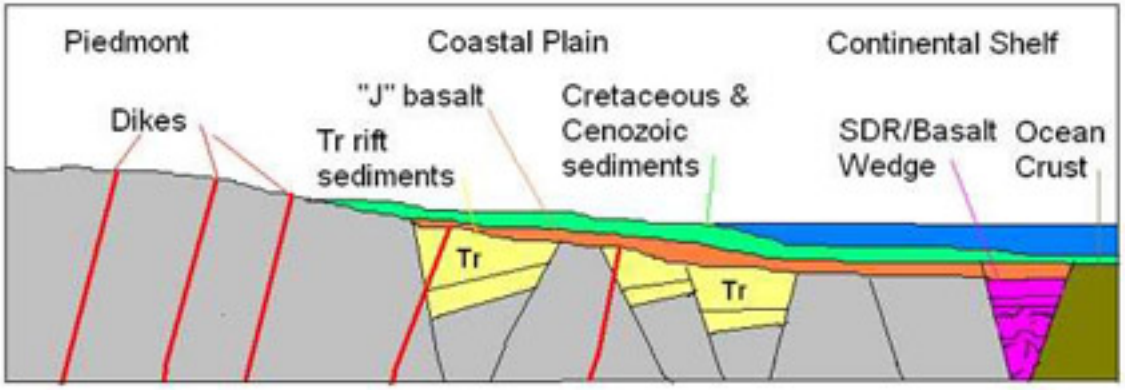
Subsea geologic storage in thick sediments
[n.b. not “ocean storage”= in ocean water
Large volumes known from sparse core and seismic surveys
Feasibility, cost, and legal/treaty issues to be surveyed

Mesozoic Rift Basins



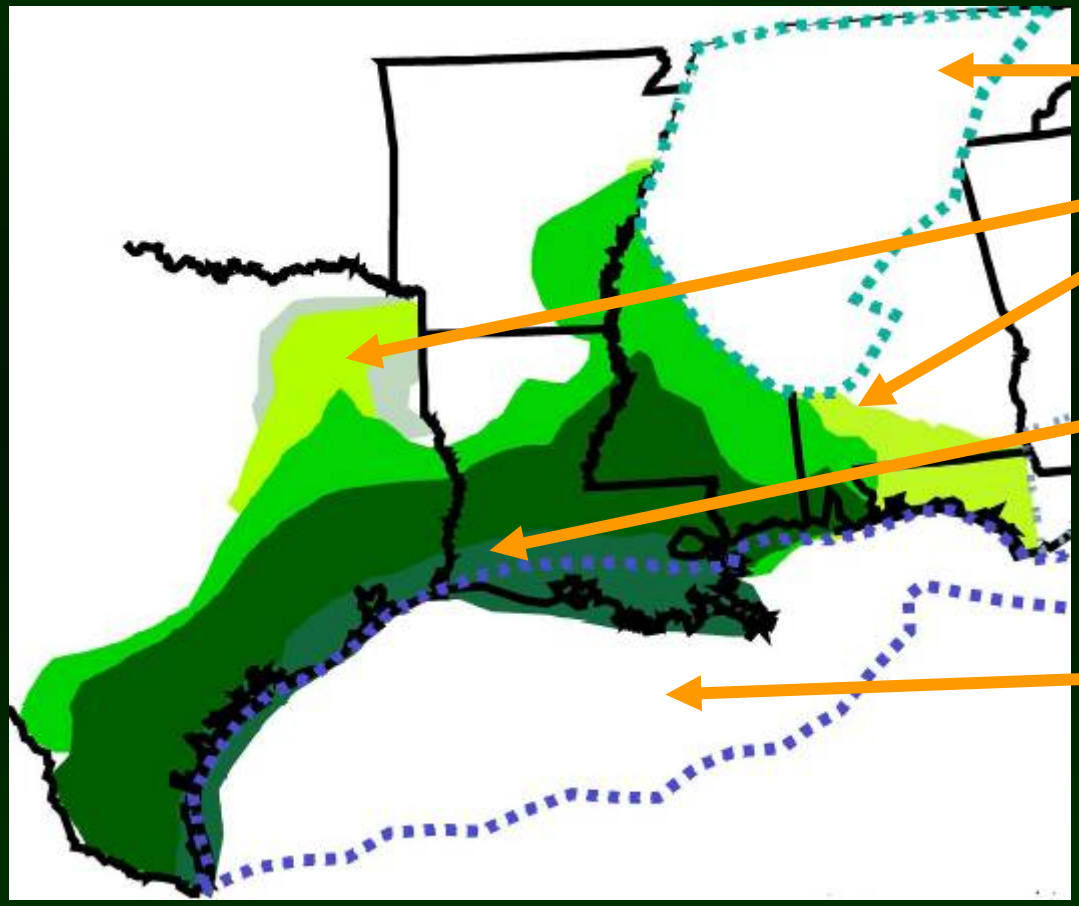
- Dan River, Deep River, and South Georgia Rift are mostly buried, complex blocks of heterogeneous sediment and basalts, depths in the range of 2 km, with variable permeability and porosity

From Schlische, 1995 and McHone 2006



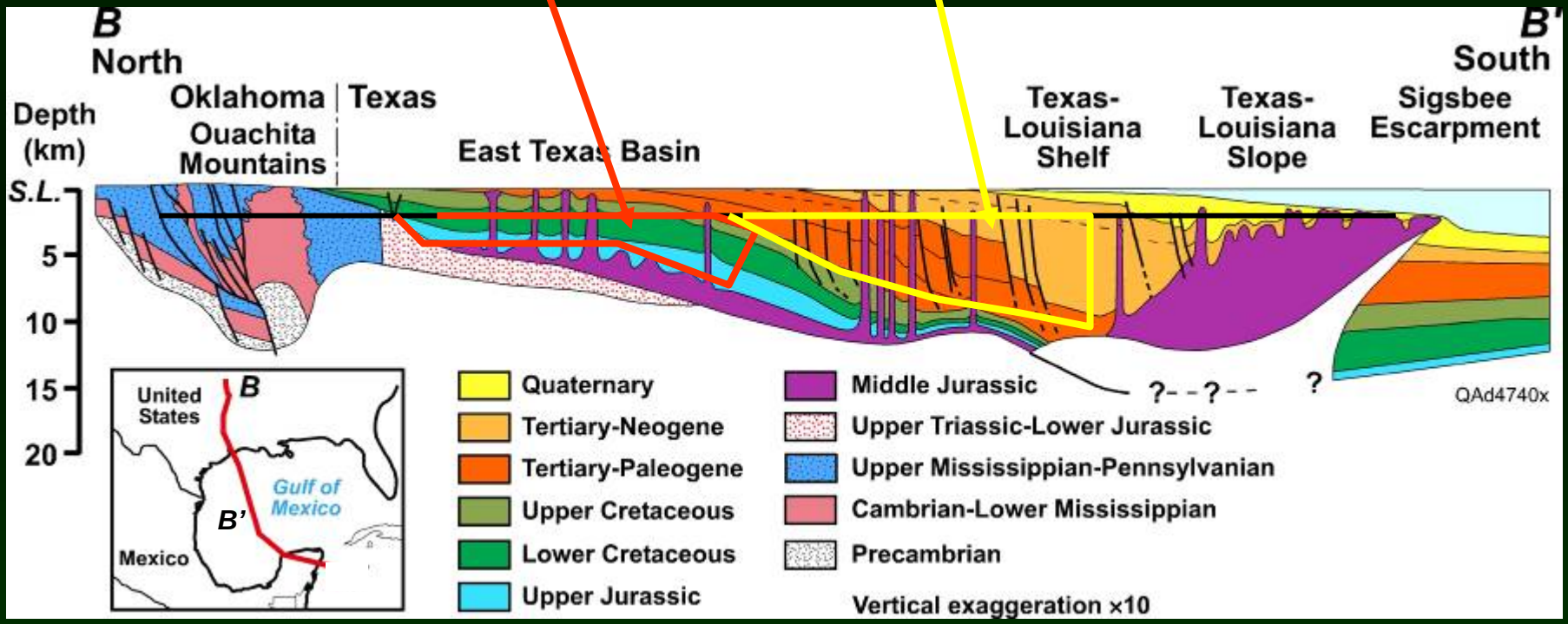
Cross section of the southeastern USA rift zone (South Georgia rift)

Brine Storage Capacity for Western SE US



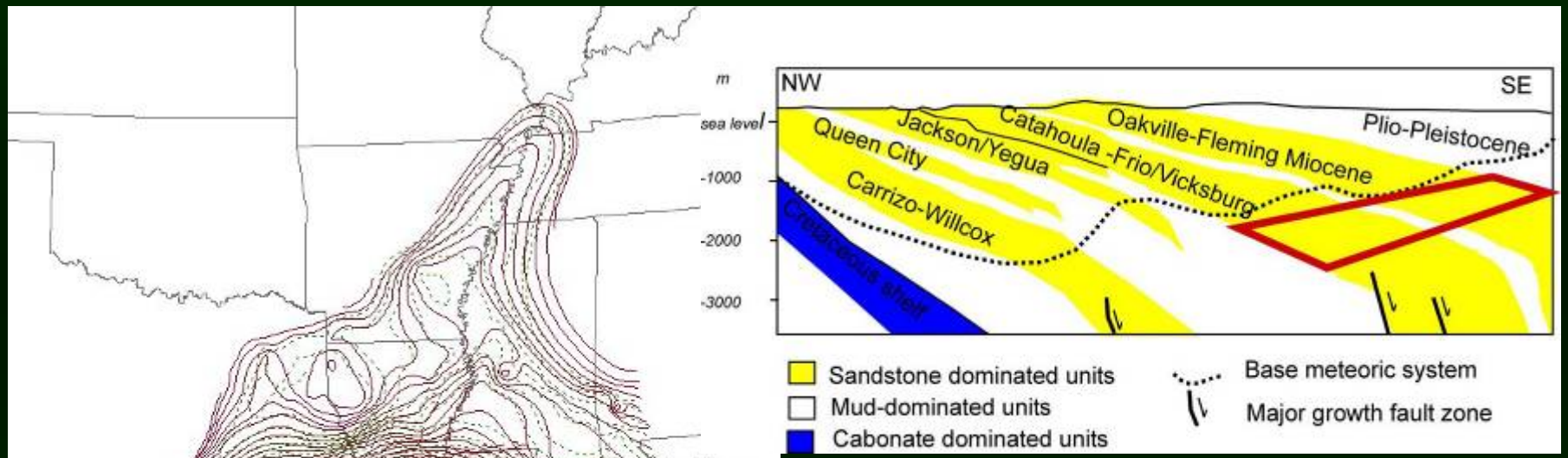
- Mid South interior
- Cretaceous wedge
- Tertiary Gulf Coast Wedge
- Gulf Coast offshore

Gulf Coast Storage



Modified from: (1) Arbenz, 1988, Plate 11, cross section D-D' and (2) Salvador, 1991, Plate 6, cross section B-B'

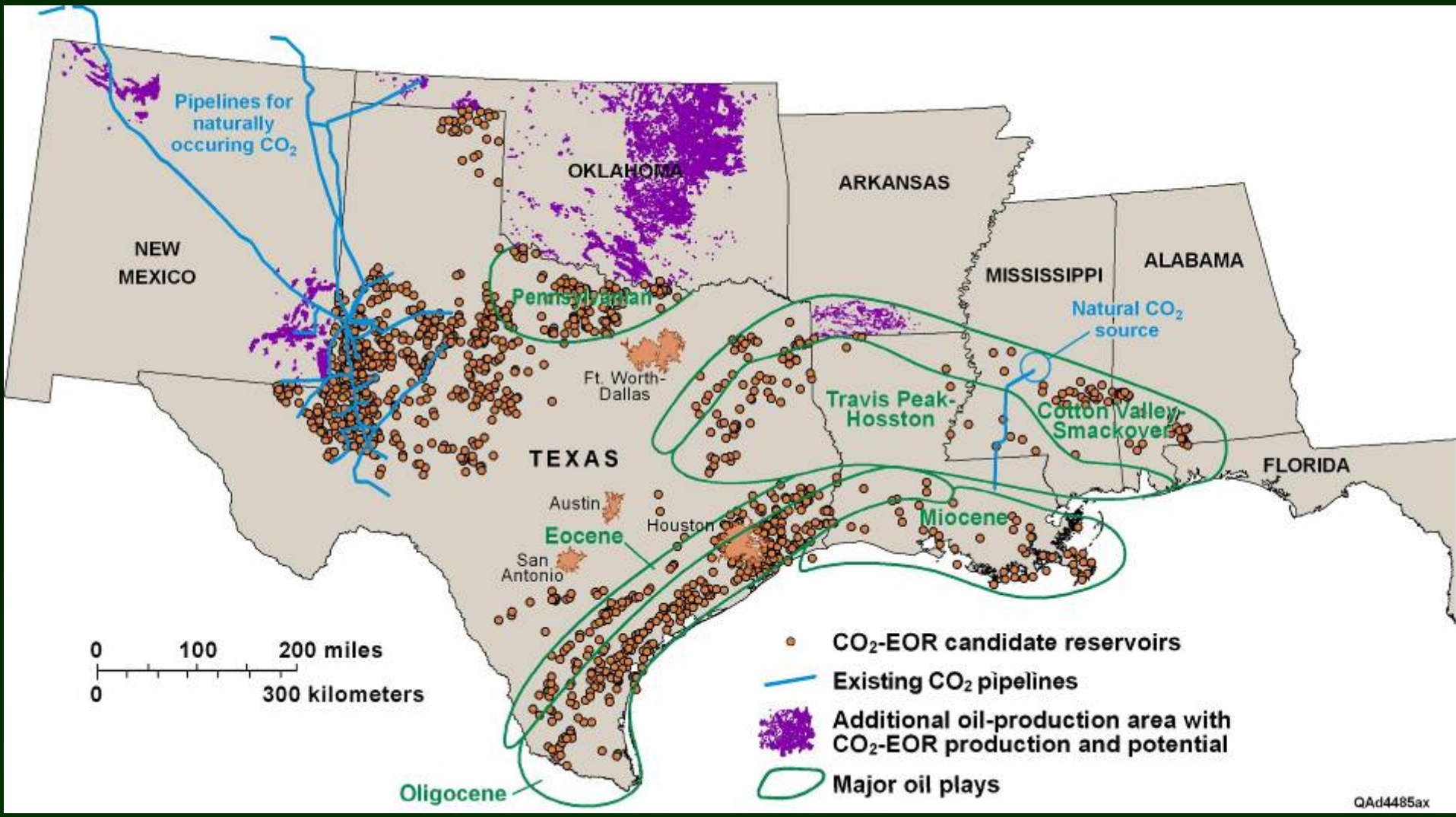
Gulf Coast Wedge



Very large capacity in numerous high injectivity sandstones, clay seals, fault bounded compartments, exceptionally well known.

One of many detailed regional data sets

CO_2-EOR Candidate Reservoirs – Key Element in the Gulf Coast



Gulf Coast Carbon Center (GCCC)

Gulf Coast Carbon Center

Mission: ***A global leadership position in economic implementation of large scale greenhouse gas sequestration.***

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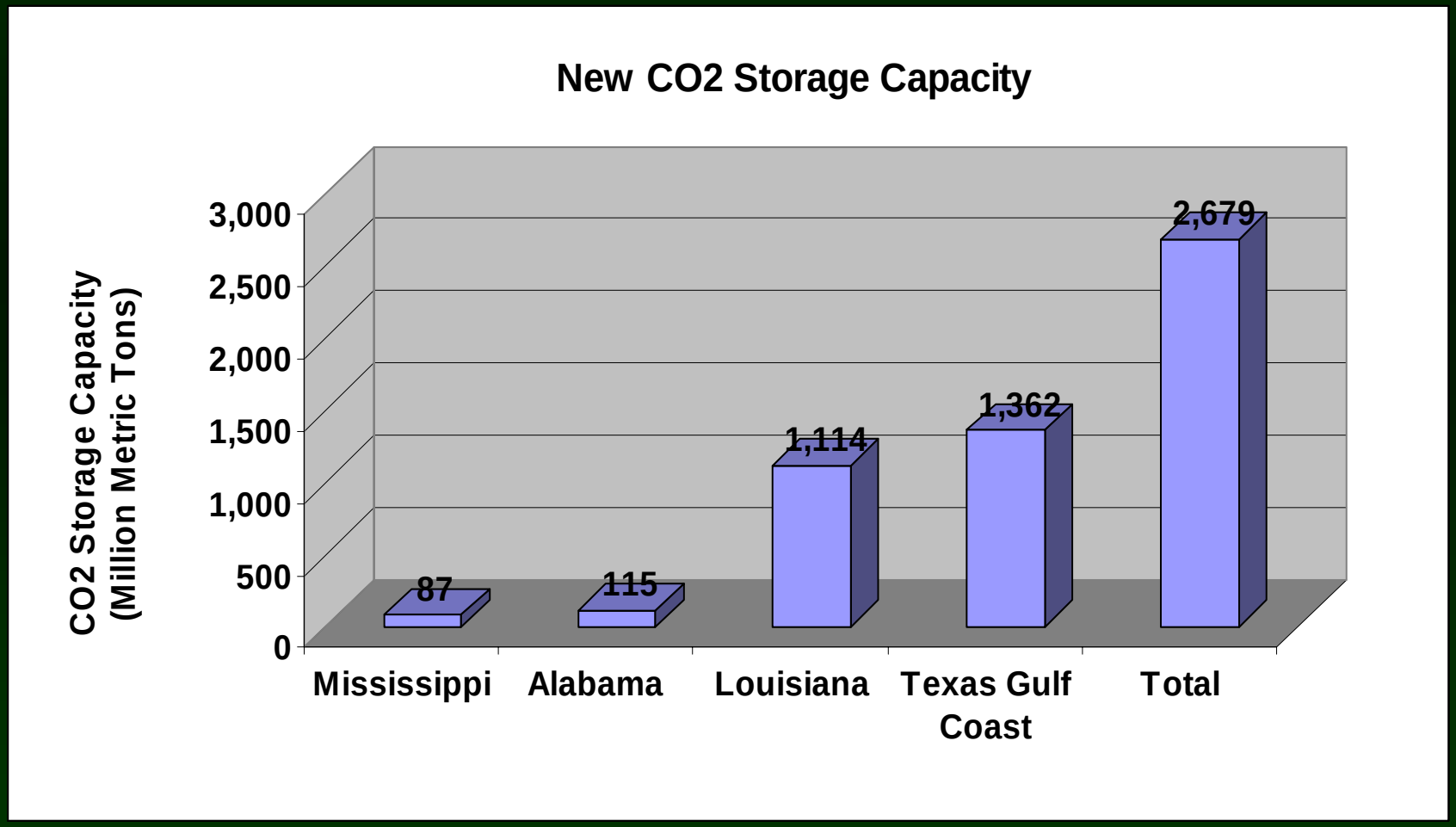
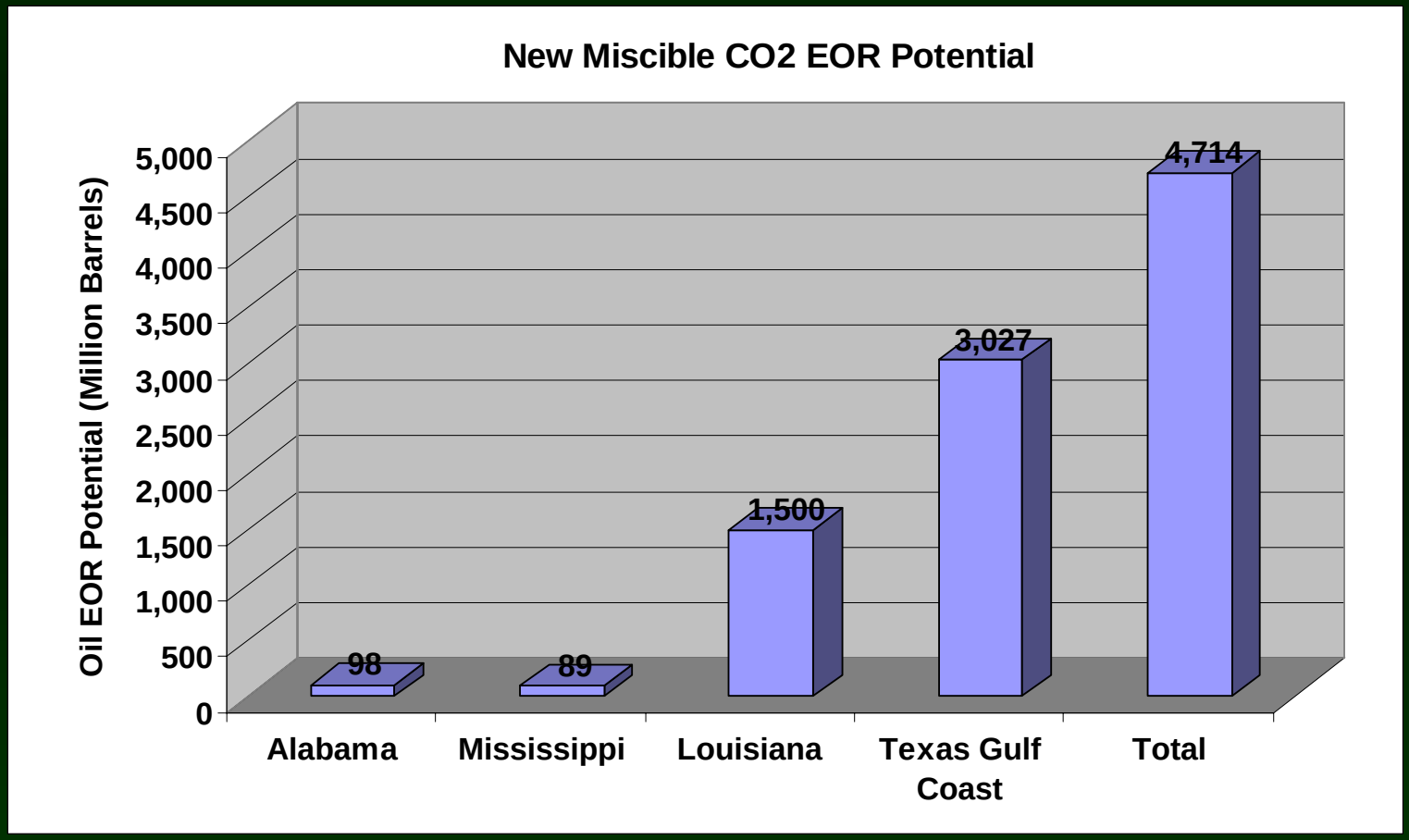
Storage Capacity associated with CO_2 EOR



Looking at Miscible EOR from a Production Standpoint



Mark Holtz, GCCC

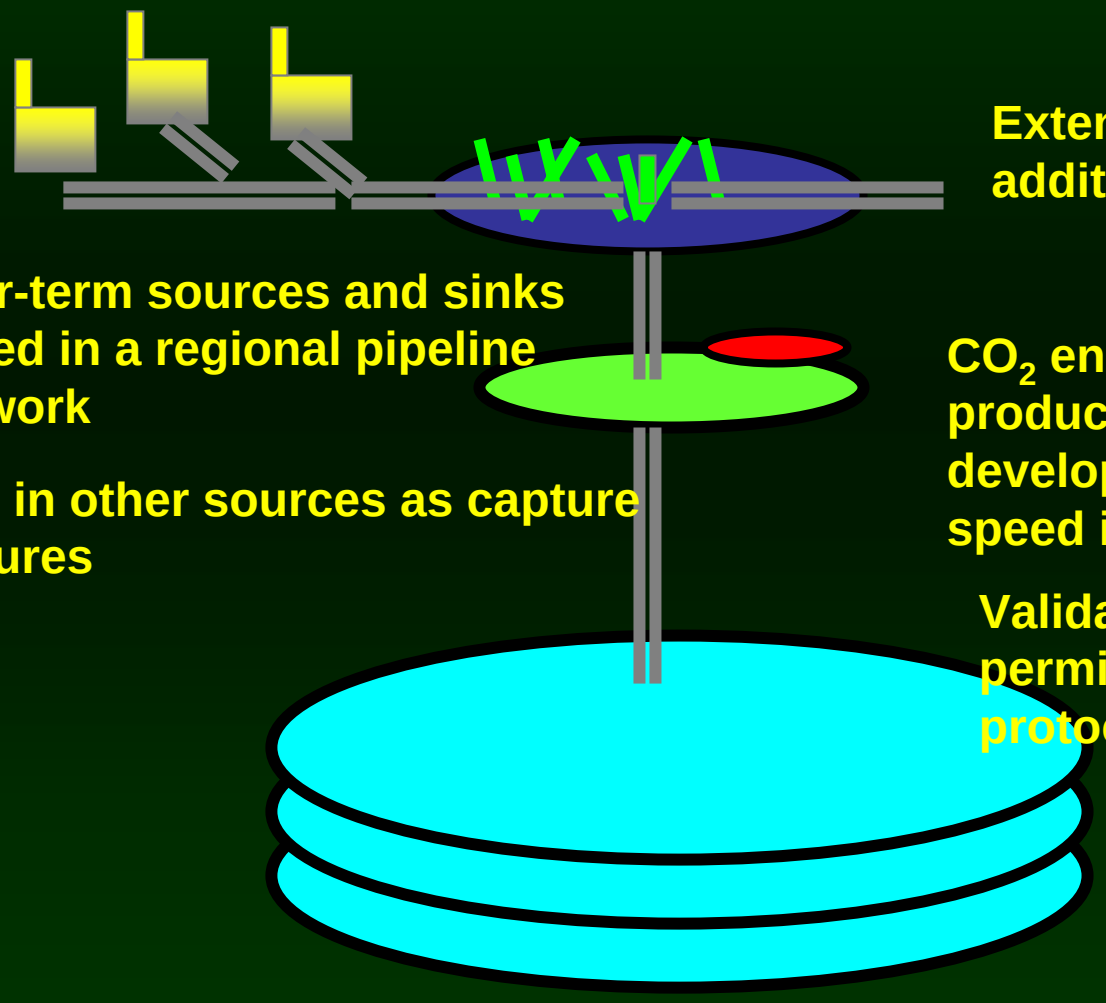
CO_2 EOR Is not "The Answer" …

- Volume of CO_2 that could be sold for EOR is large but inadequate to solve the GHG issue
- CO_2 EOR is useful only in areas oil production, and is most useful only in certain reservoirs with lighter oil, moderate depth, unitized, with reasonable sweep efficiency.

…but CO_2 EOR is a great beginning

- Economic or near economic in current market, depending on cost of CO_2
- Acceptable to public
- Other major benefits (domestic energy production, taxes, employment)
- Build infrastructure that can be used long term for large volume CO_2 disposal = stacked storage

Model for Stacked Storage in the Gulf Coast



Extend pipeline system to additional stacked storage

Near-term sources and sinks linked in a regional pipeline network

Add in other sources as capture matures

CO_2 enhanced oil and gas production to offset development cost and speed implementation

Validation of adequacy of permitting and monitoring protocols

Very large volume storage in stacked brine formations beneath reservoir footprints