

Downscaling capacity estimates from a regional to a site scale – Case study in the South Eastern US



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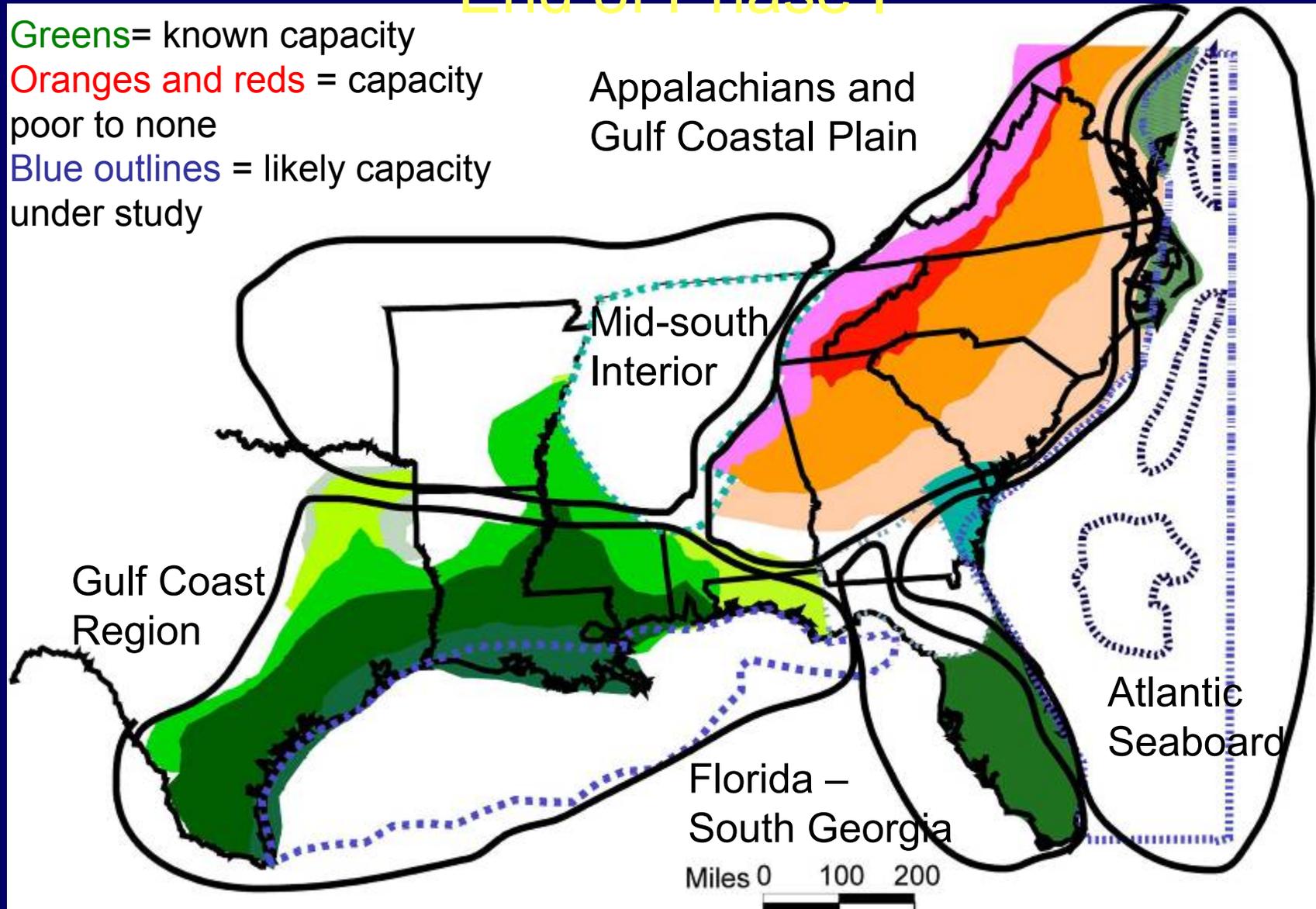
Status of Regional Capacity Assessment at End of Phase I

Greens= known capacity

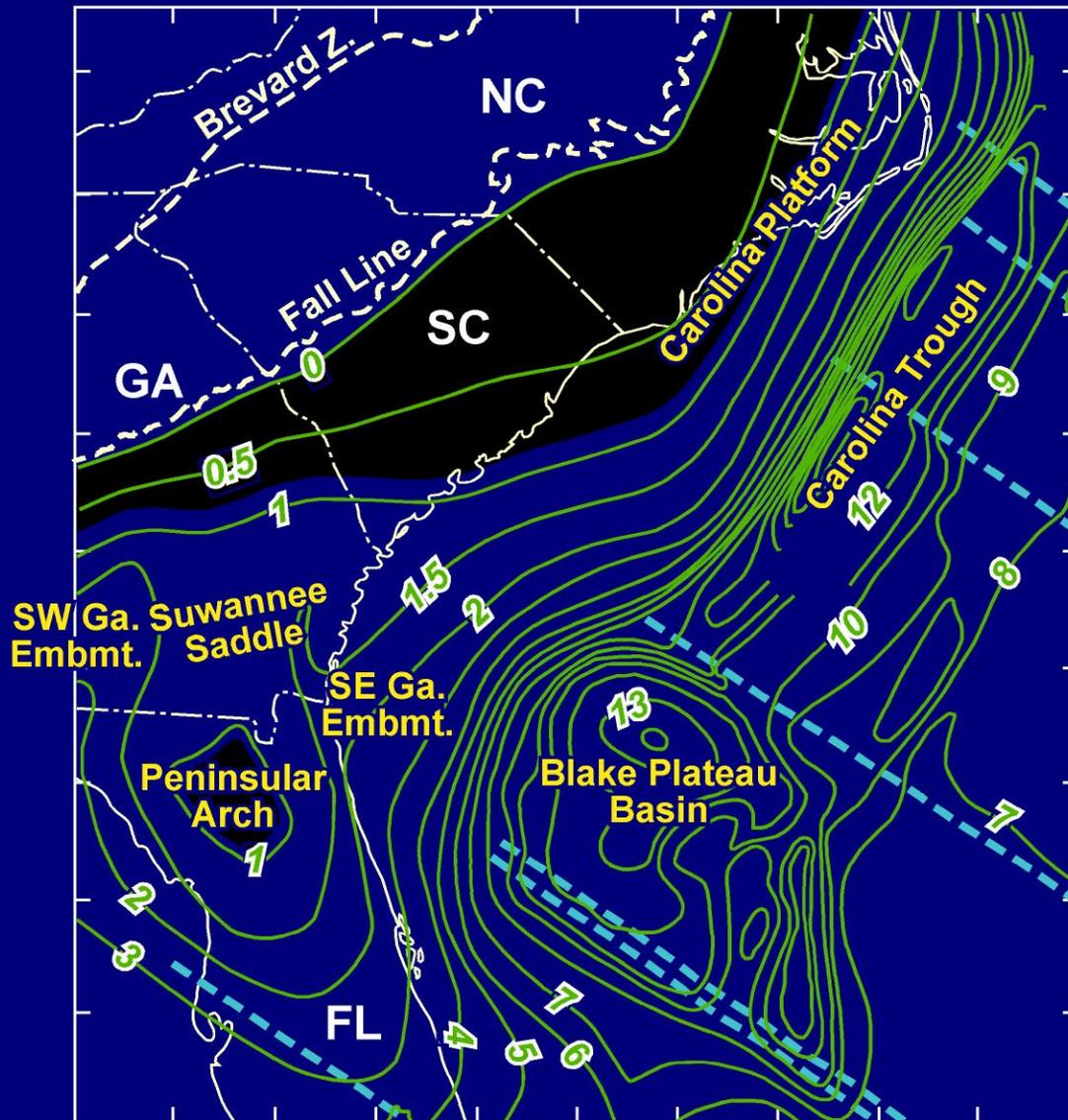
Oranges and reds = capacity poor to none

Blue outlines = likely capacity under study

Appalachians and Gulf Coastal Plain

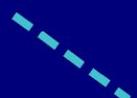


POST-RIFT STRUCTURE, SOUTHEASTERN U.S.



Major Structures and Depth to Postrift Unconformity

Green lines depict the thickness of Mesozoic and Cenozoic clastic, carbonate, and evaporite strata

-  Insufficient thickness for CO₂ storage
-  Depth to postrift unconformity (km)
-  Major fault zones

modified from Dillon and Popenoe (1988)

EXPLANATION

Estimated transmissivity of Potomac aquifer based on aquifer tests, geology, and simulation, in feet squared per day



1,000

5,000

10,000

20,000

No data

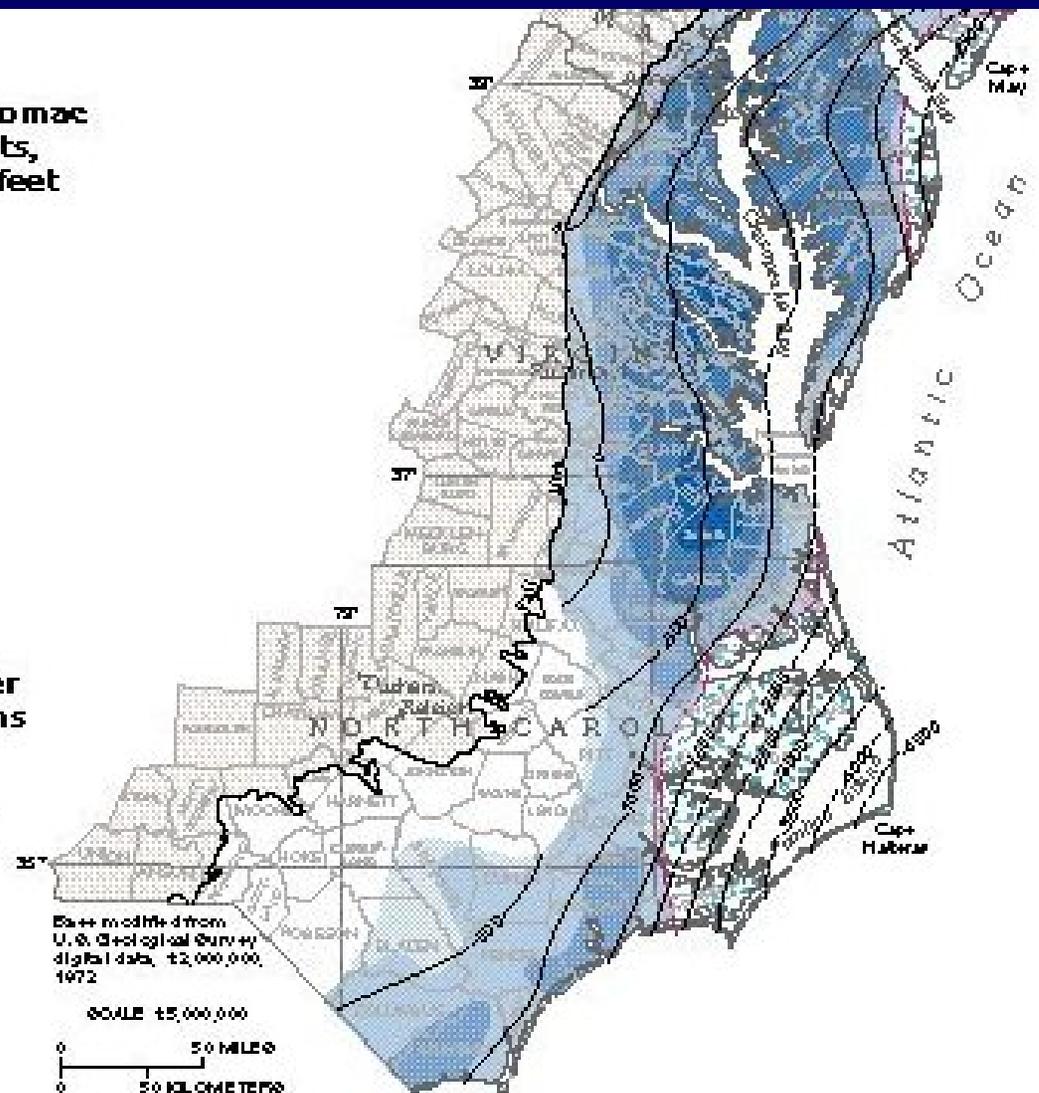


Potomac aquifer absent

Approximate updip limit of water containing 10,000 milligrams per liter dissolved chloride

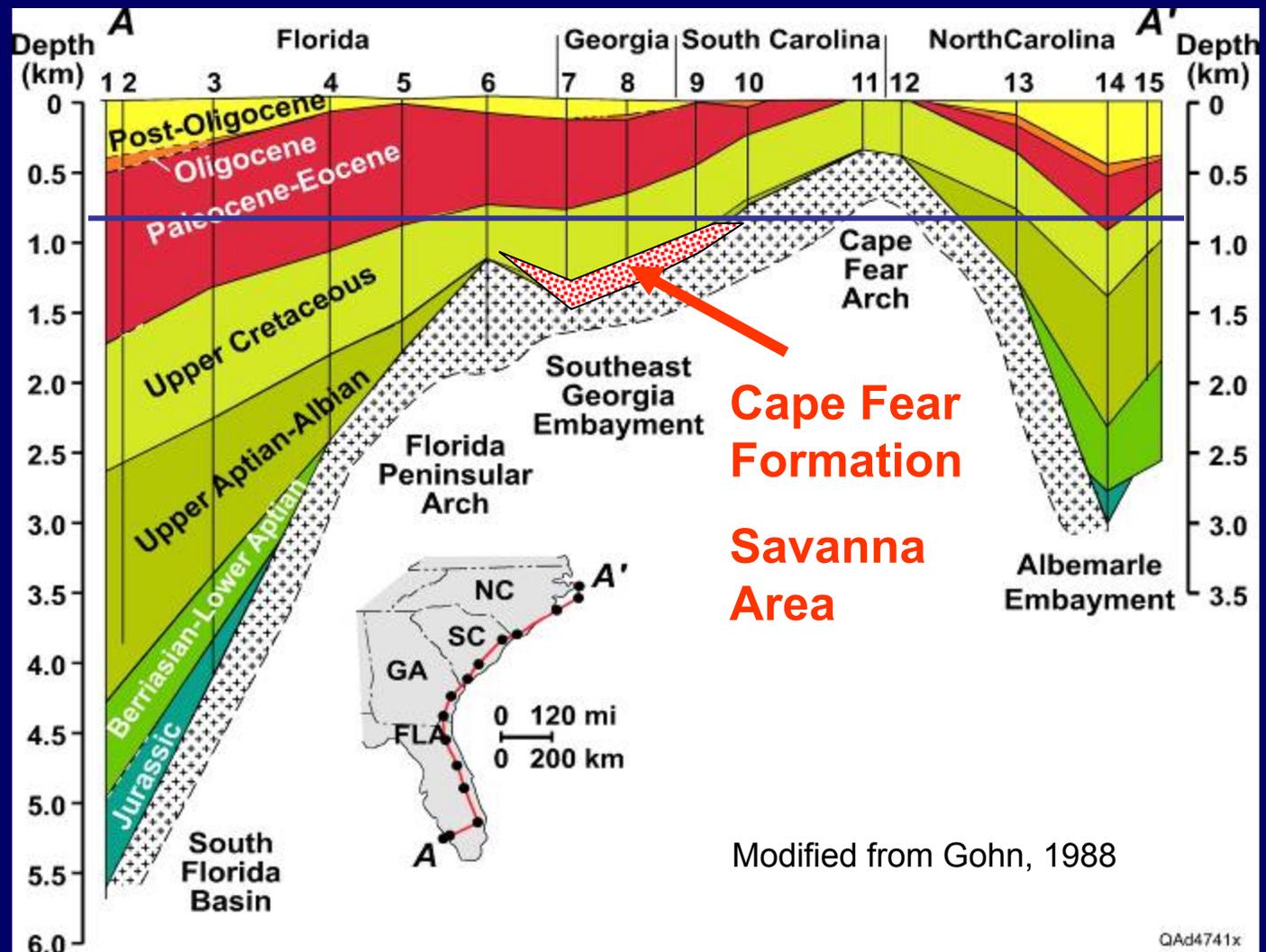
-500

Top-of-aquifer contour— Shows altitude of top of Potomac aquifer. Dashed where approximately located. Contour interval 500 feet. Datum is sea level

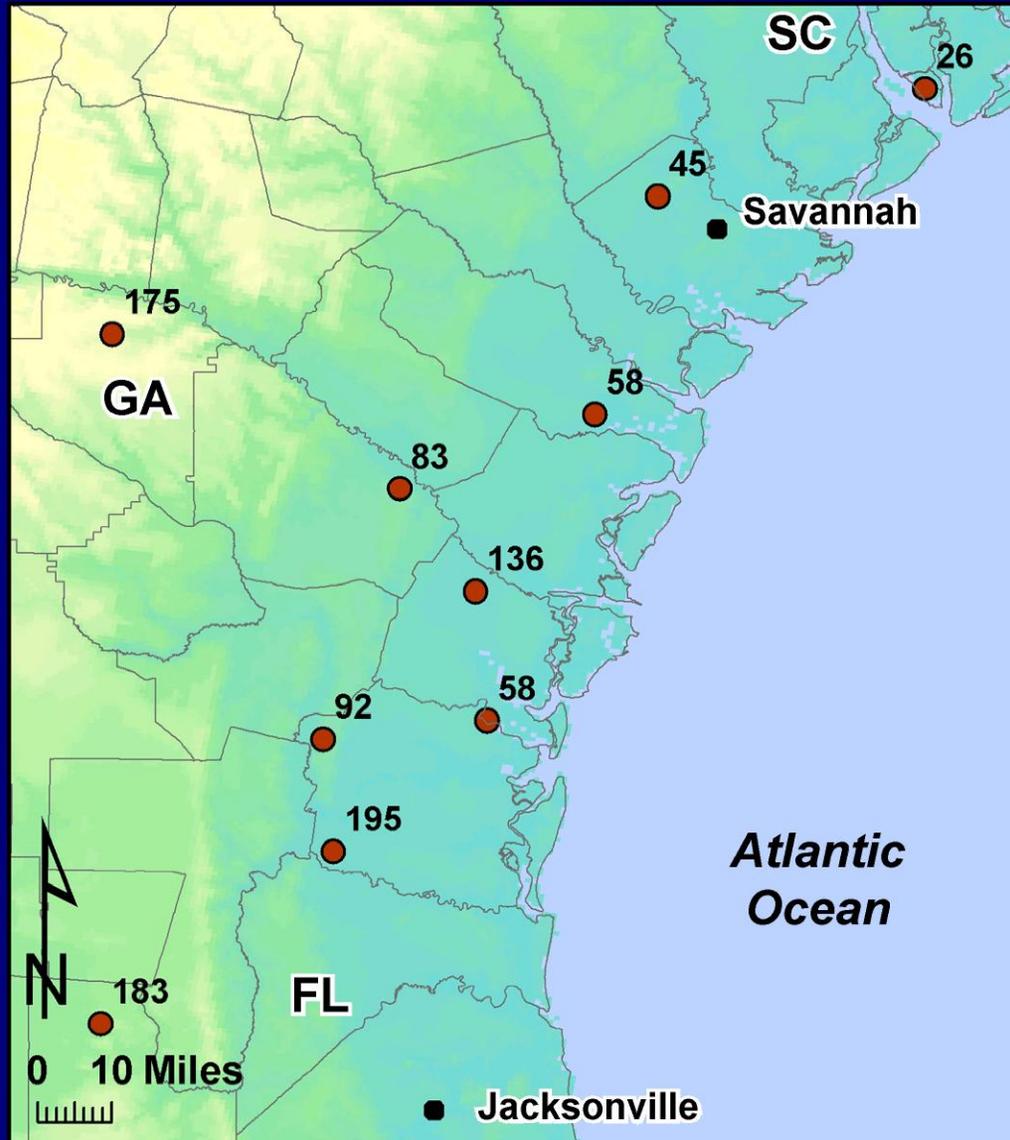


Capacity along the Eastern Seaboard – Savanna Area

Minimum
Depth 800 m



THICKNESS OF K5/K6 UNIT, GEORGIA

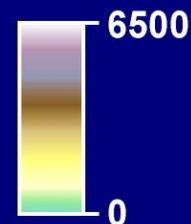


The upper Cretaceous K5/K6 unit of Gohn and others (1980) is a coarse-grained siliciclastic deposit that becomes more carbonate-rich toward Florida.

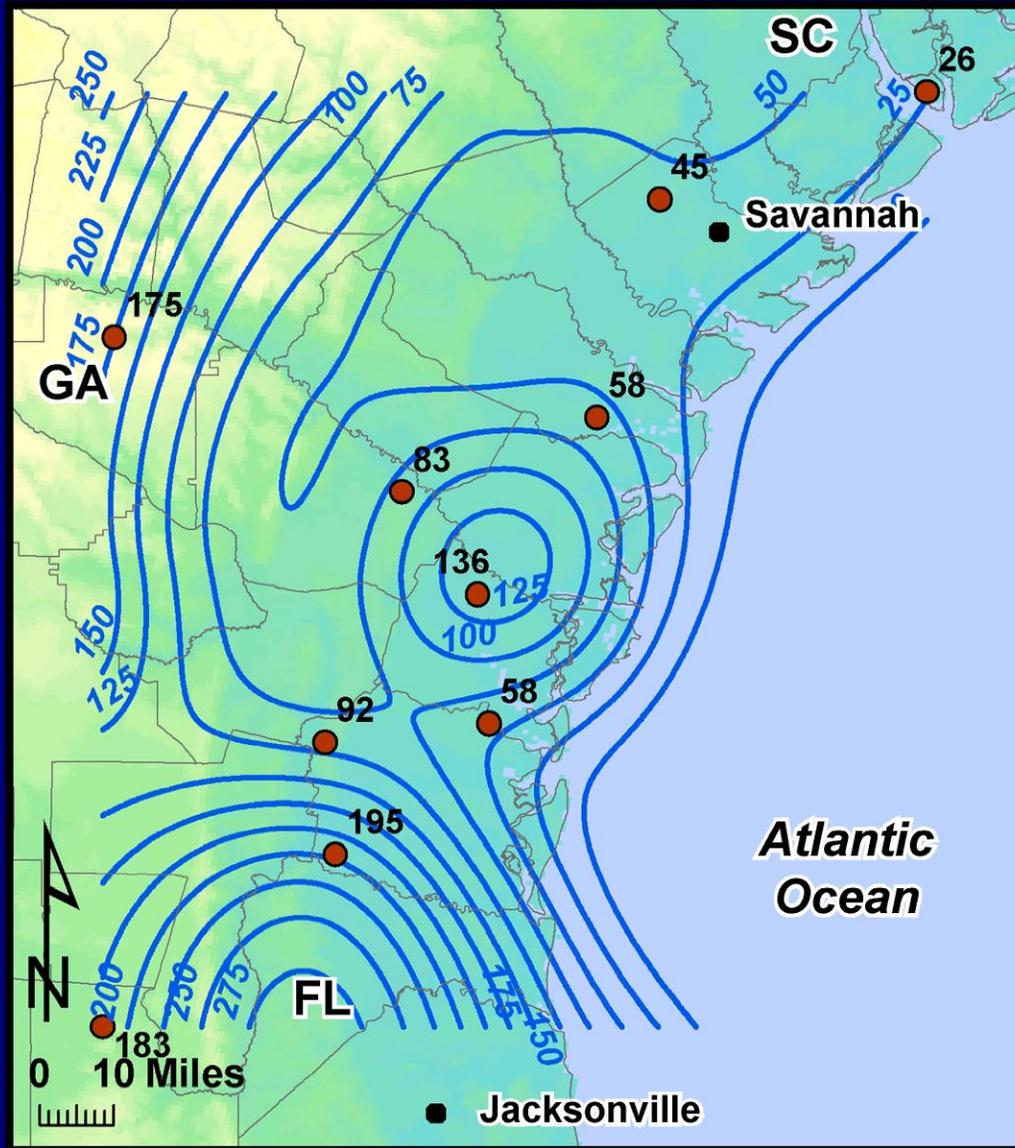
Thickness of this deposit is estimated from geophysical logs in wells drilled during hydrocarbon exploration.

● Well location and K5/K6 thickness (ft); data from Gohn and others (1980)

Elevation (ft)



CONTOURED THICKNESS OF K5/K6 UNIT (SPLINE)



Automated approaches to contouring K5/K6 thickness without geologic knowledge (kriging and spline-based) produce divergent depositional trends.

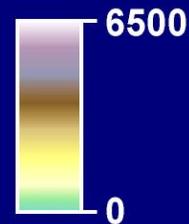


Contoured thickness (ft) of Cretaceous K5/K6 unit

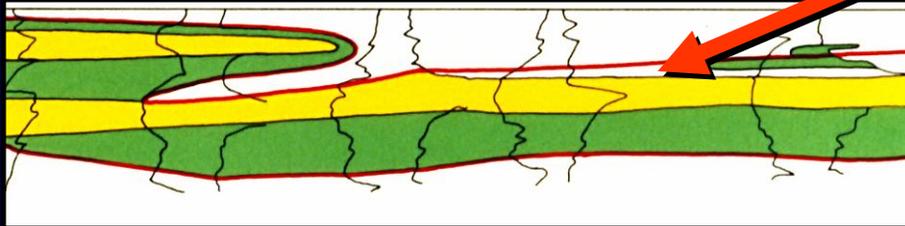
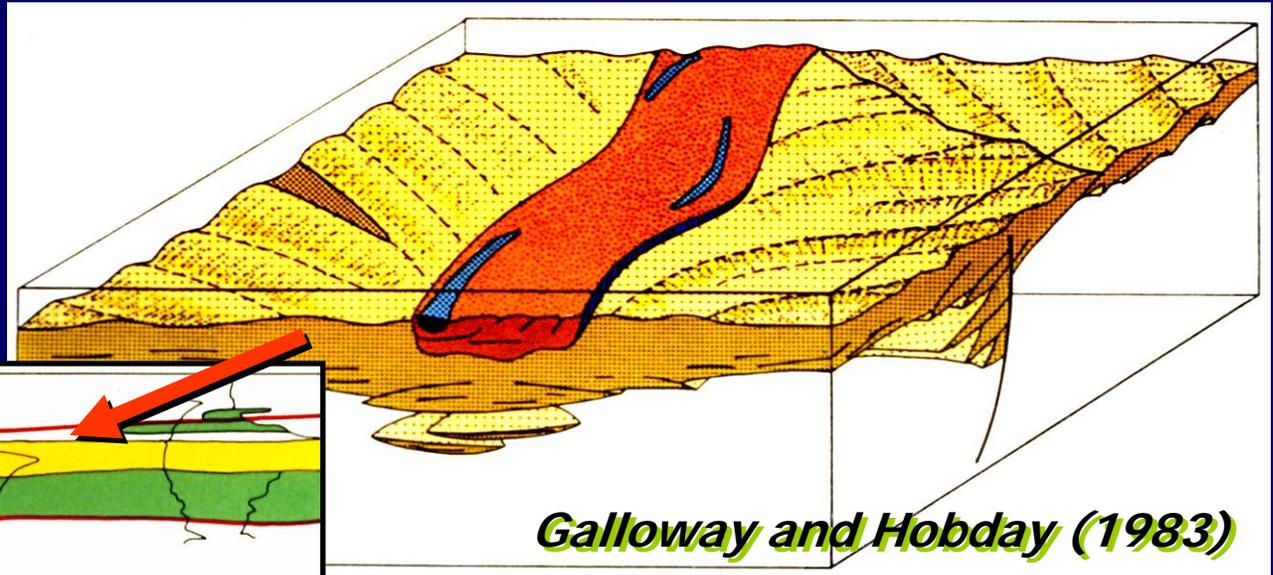


Well location and K5/K6 thickness (ft); data from Gohn and others (1980)

Elevation (ft)

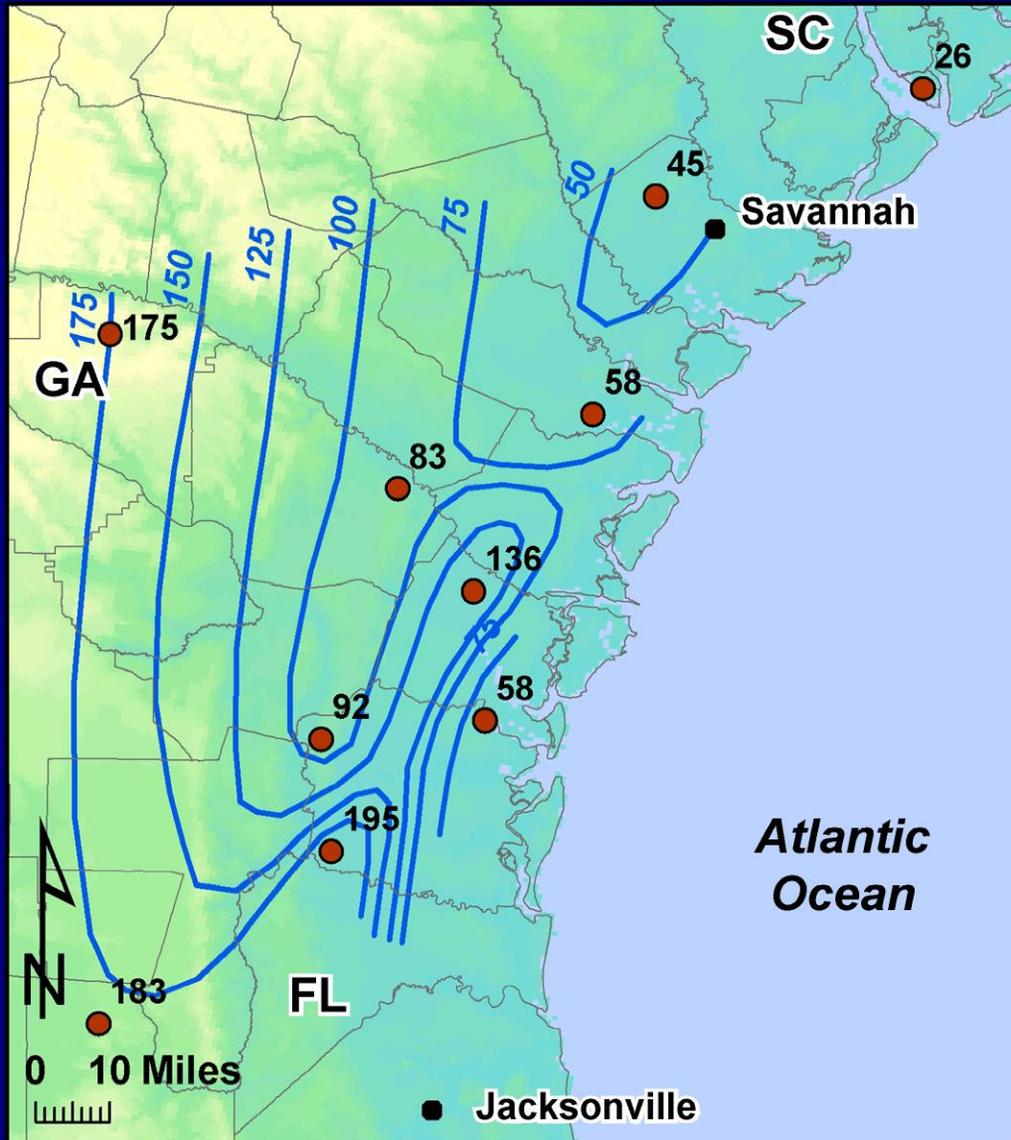


Shoreface Systems



*Sundays River Estuary
South Africa*

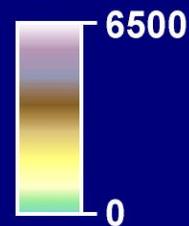
GEOCONTOURED THICKNESS OF K5/K6 UNIT



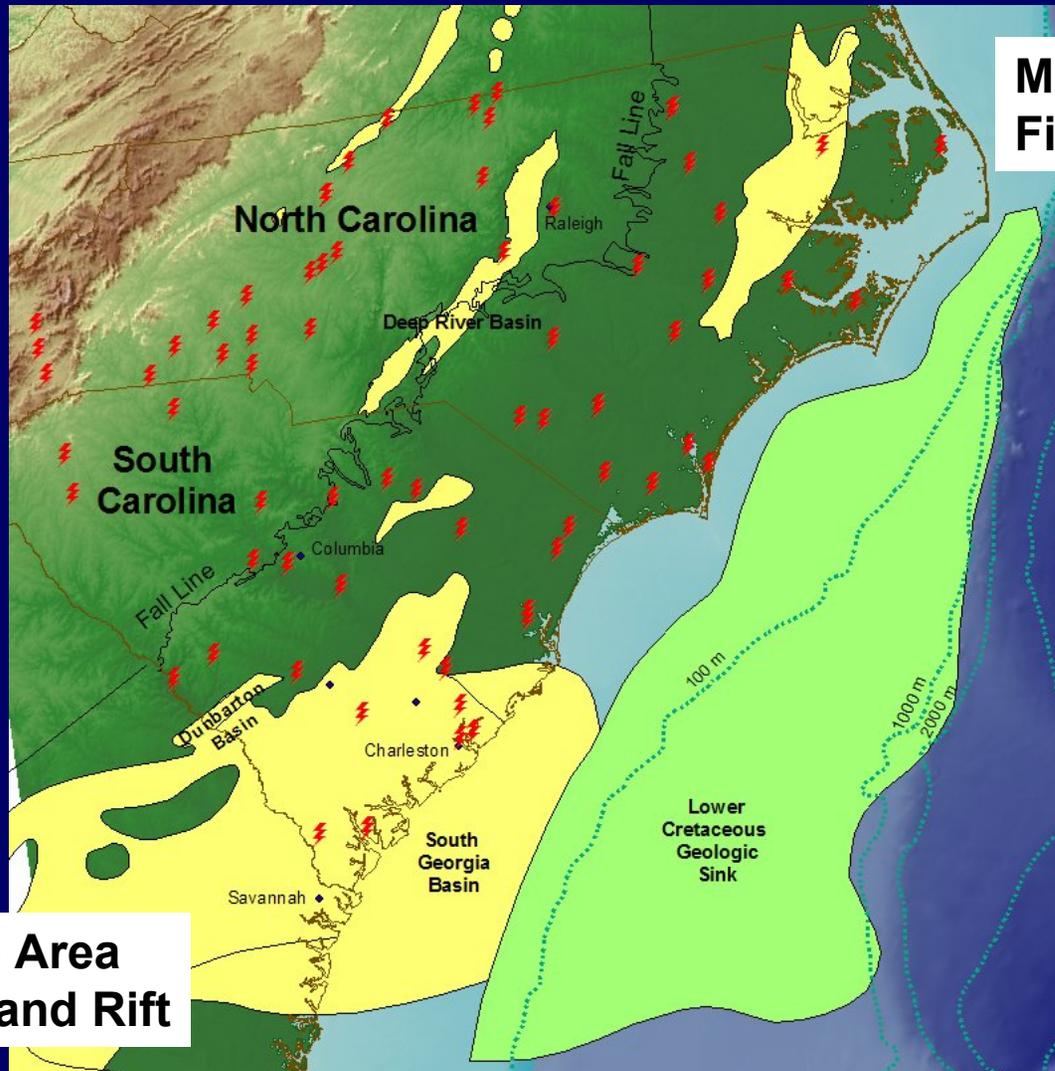
Manual contouring guided by well data and geologic knowledge of the area produces trends that help interpret the likely depositional environment and consequently better predict suitability for CO₂ sequestration.

● Well location and K5/K6 thickness (ft); data from Gohn and others (1980)

Elevation (ft)



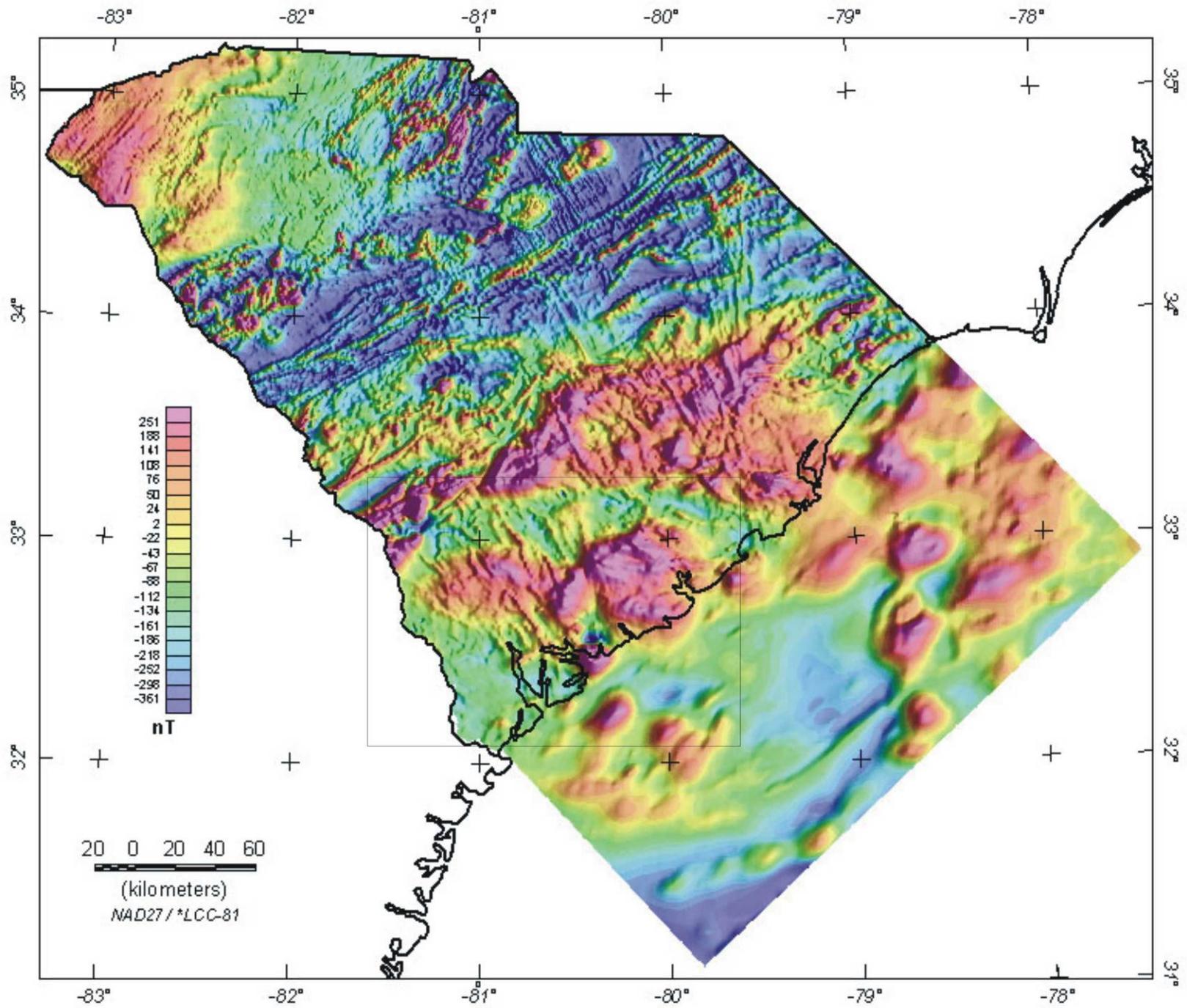
Mesozoic Rift Grabens



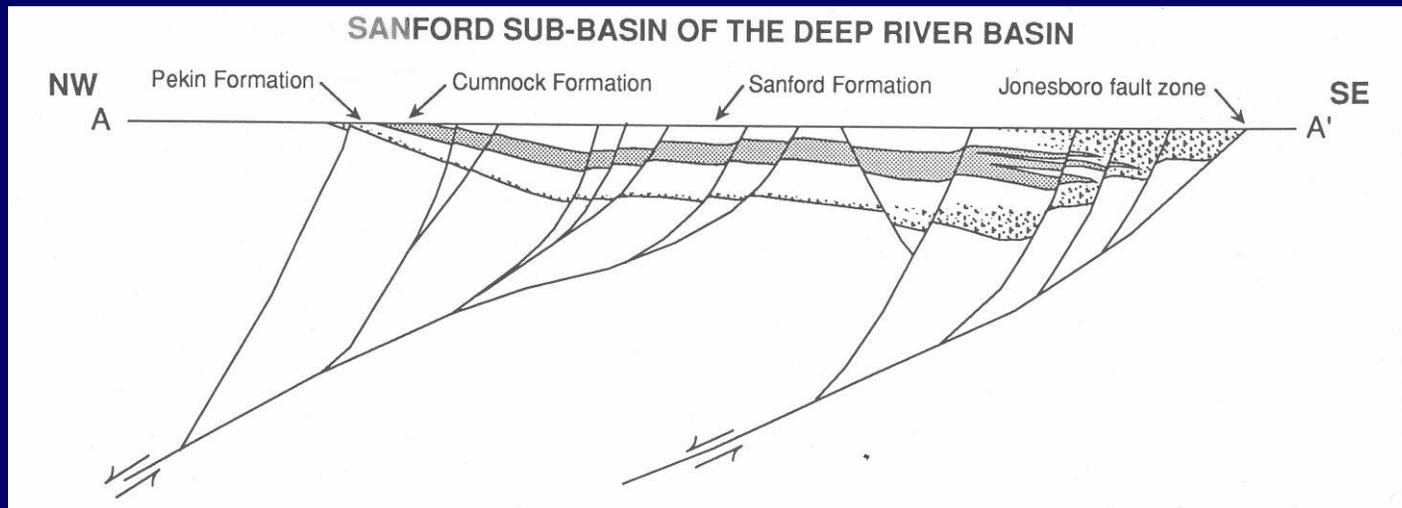
**Mesozoic Rift
Fills**

**Savanna Area
Tertiary and Rift**

 **Power Plants**



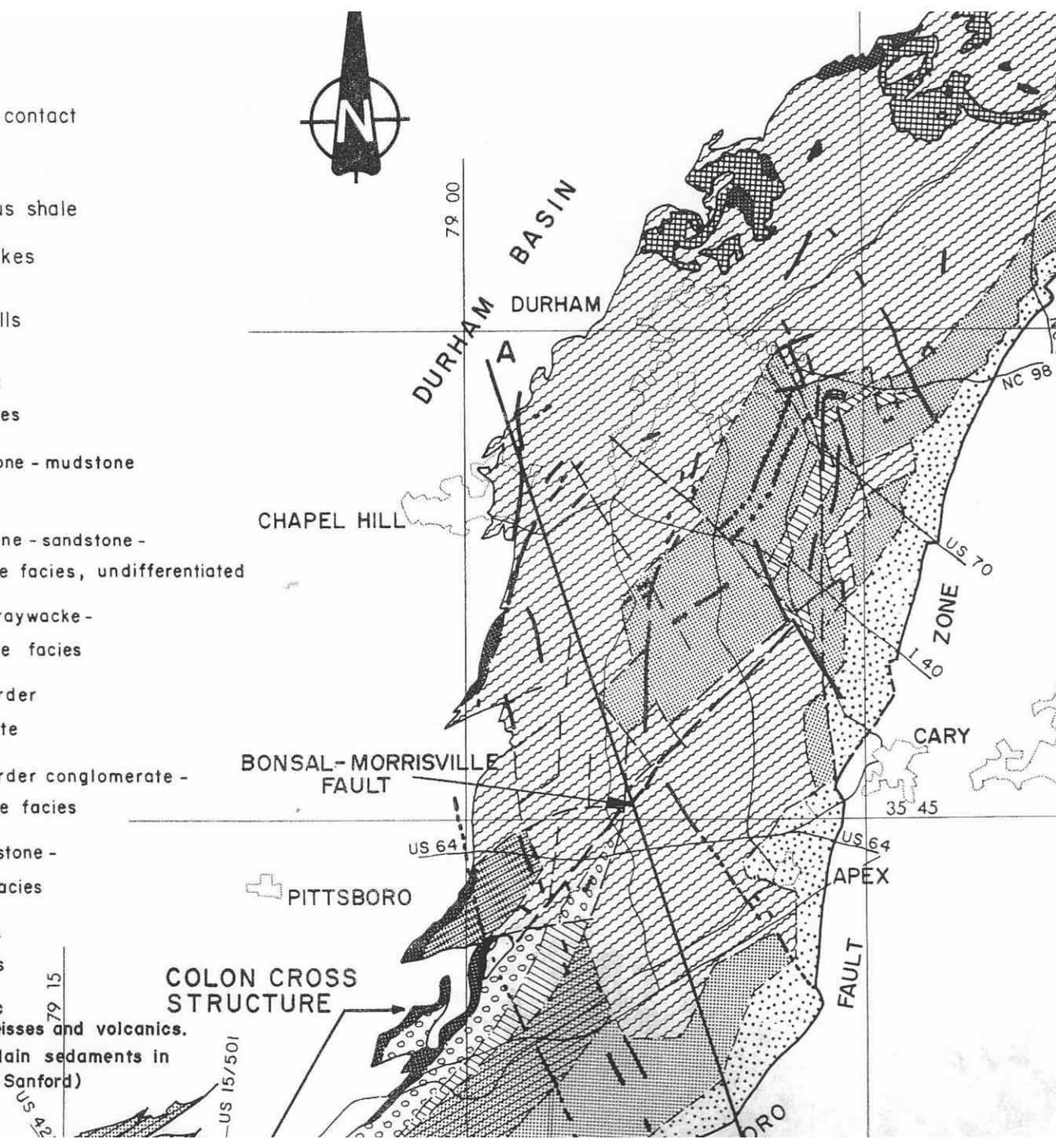
Exposed Mesozoic Graben



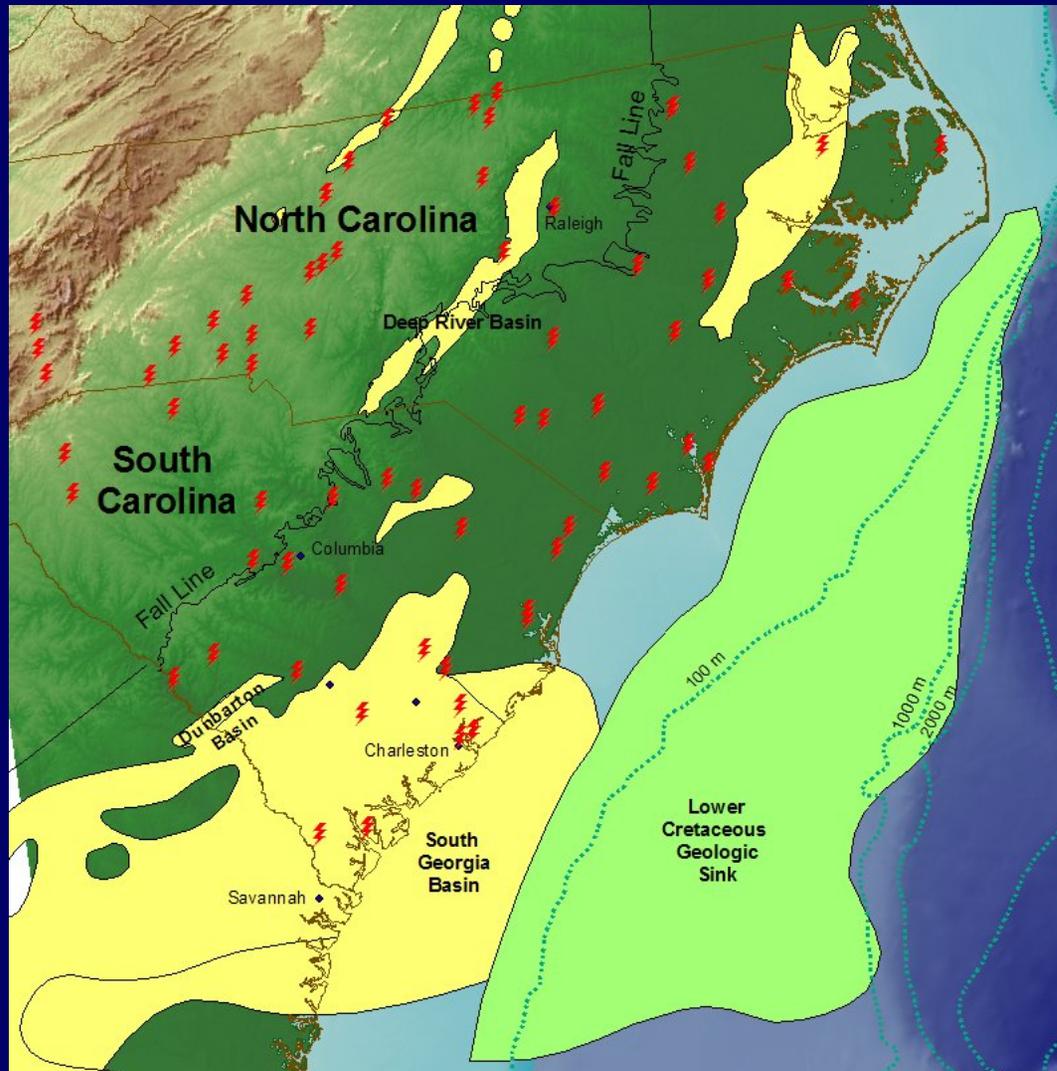
-  Mostly fluvial, red and brown clastic rocks
-  Lacustrine gray and black fine-grained clastic rocks
-  Red, brown, and gray conglomerate and sandstone
-  Major normal faults

LEGEND

- Formation contact
- - - Faults
- Fossiliferous shale
- Diabase dikes
- ▣ Diabase sills
- ▨ Tan arkosic fluvial facies
- ▩ Red sandstone - mudstone facies
- ▧ Red mudstone - sandstone - conglomerate facies, undifferentiated
- ▦ Argillite - graywacke - conglomerate facies
- Western border conglomerate
- ▤ Eastern border conglomerate - fanglomerate facies
- ▨ Chert - limestone - mudstone facies
- Coal - black shale facies
- Pre-Triassic granites, gneisses and volcanics. (Coastal Plain sediments in vicinity of Sanford)

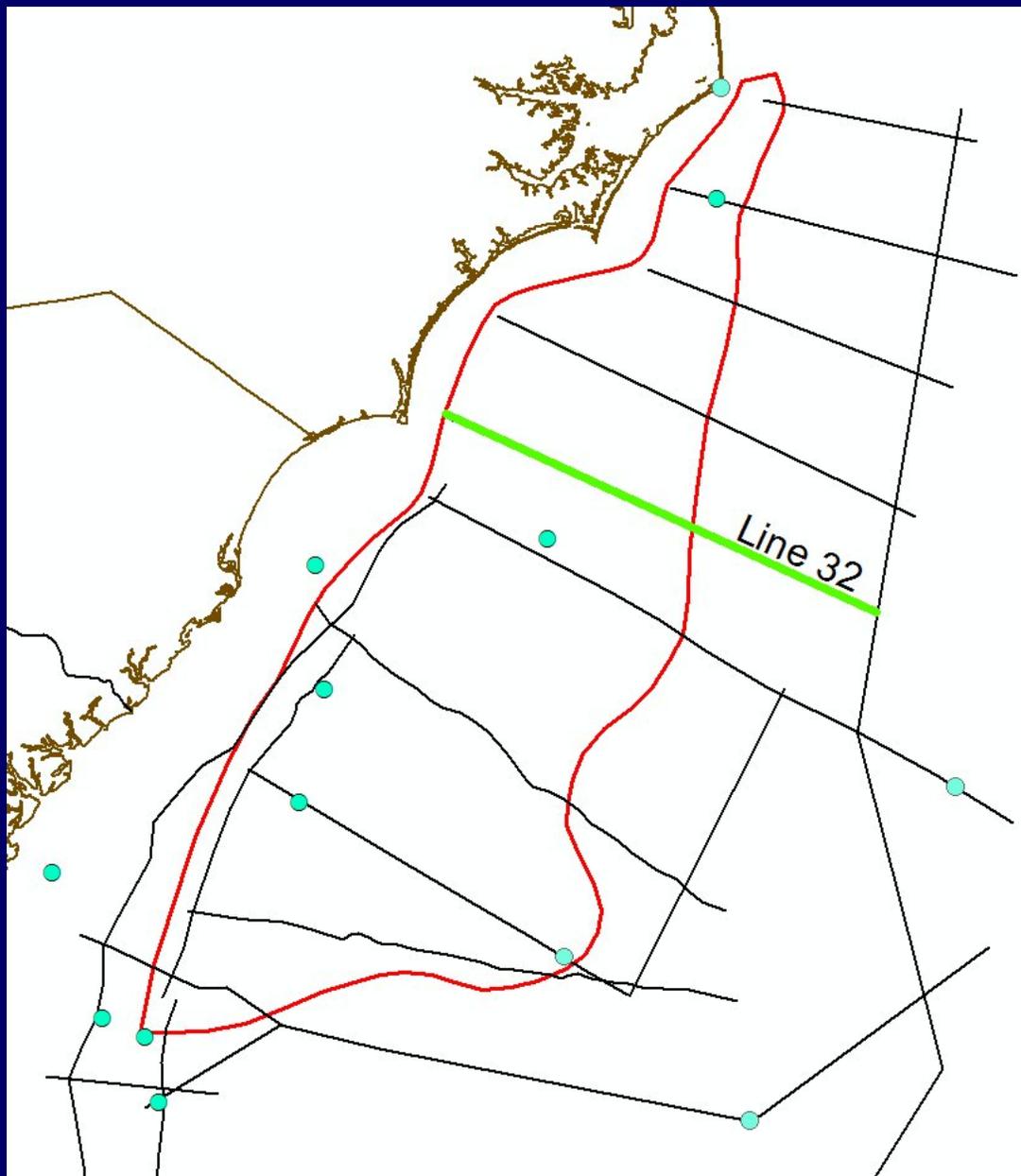


Atlantic Offshore Wedge

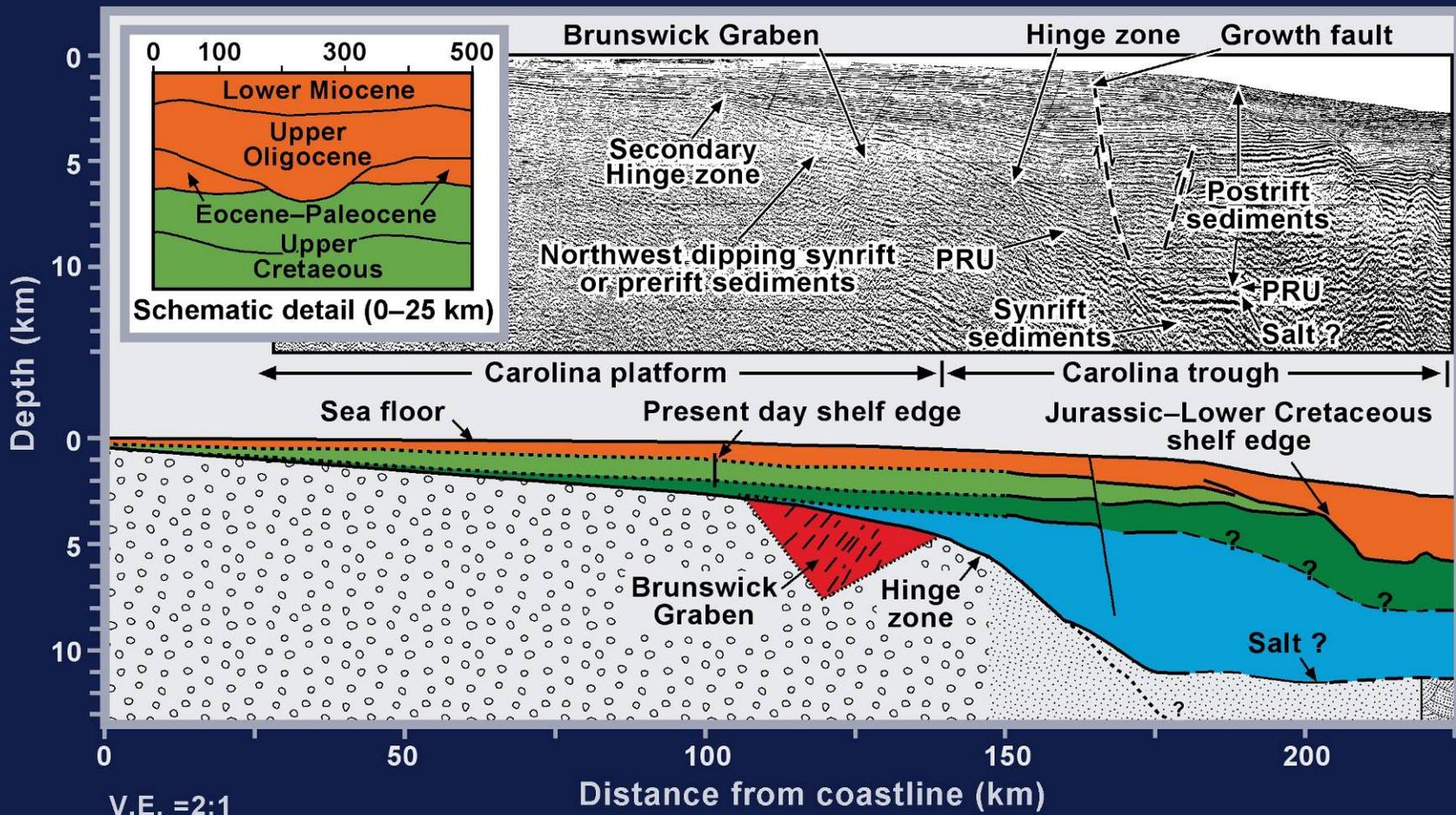


Atlantic
Offshore
Wedge

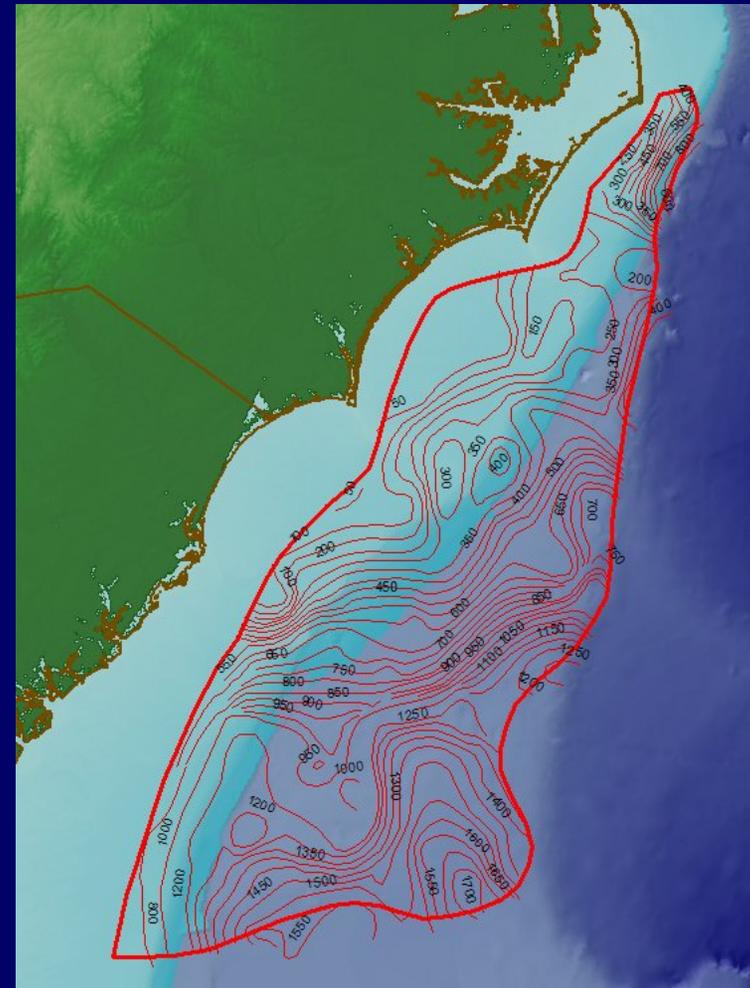
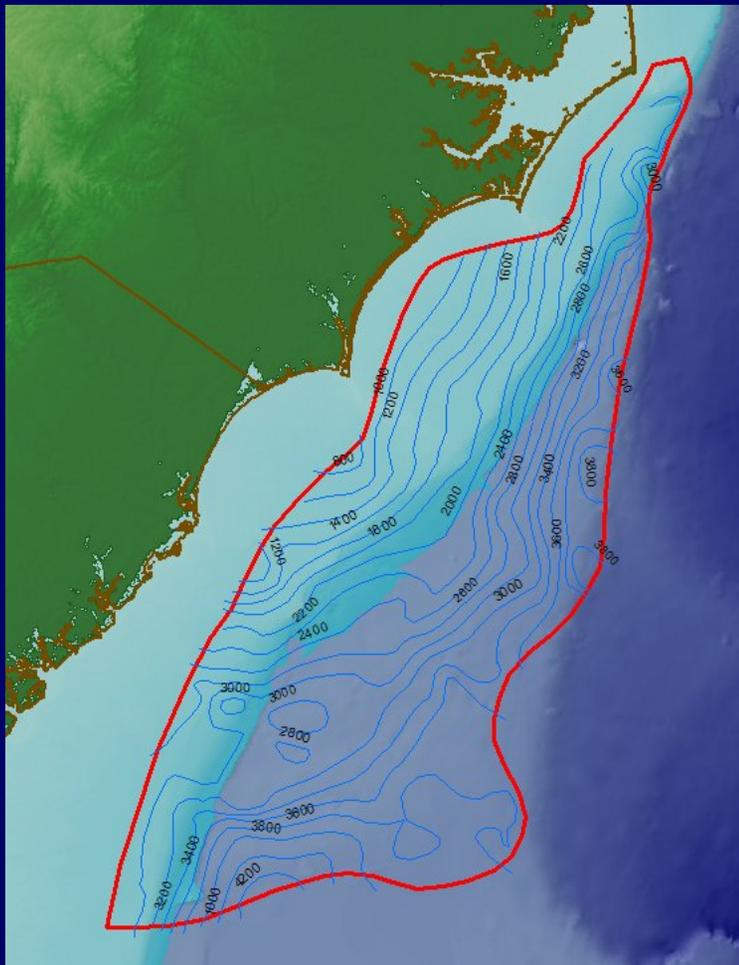
 Power Plants



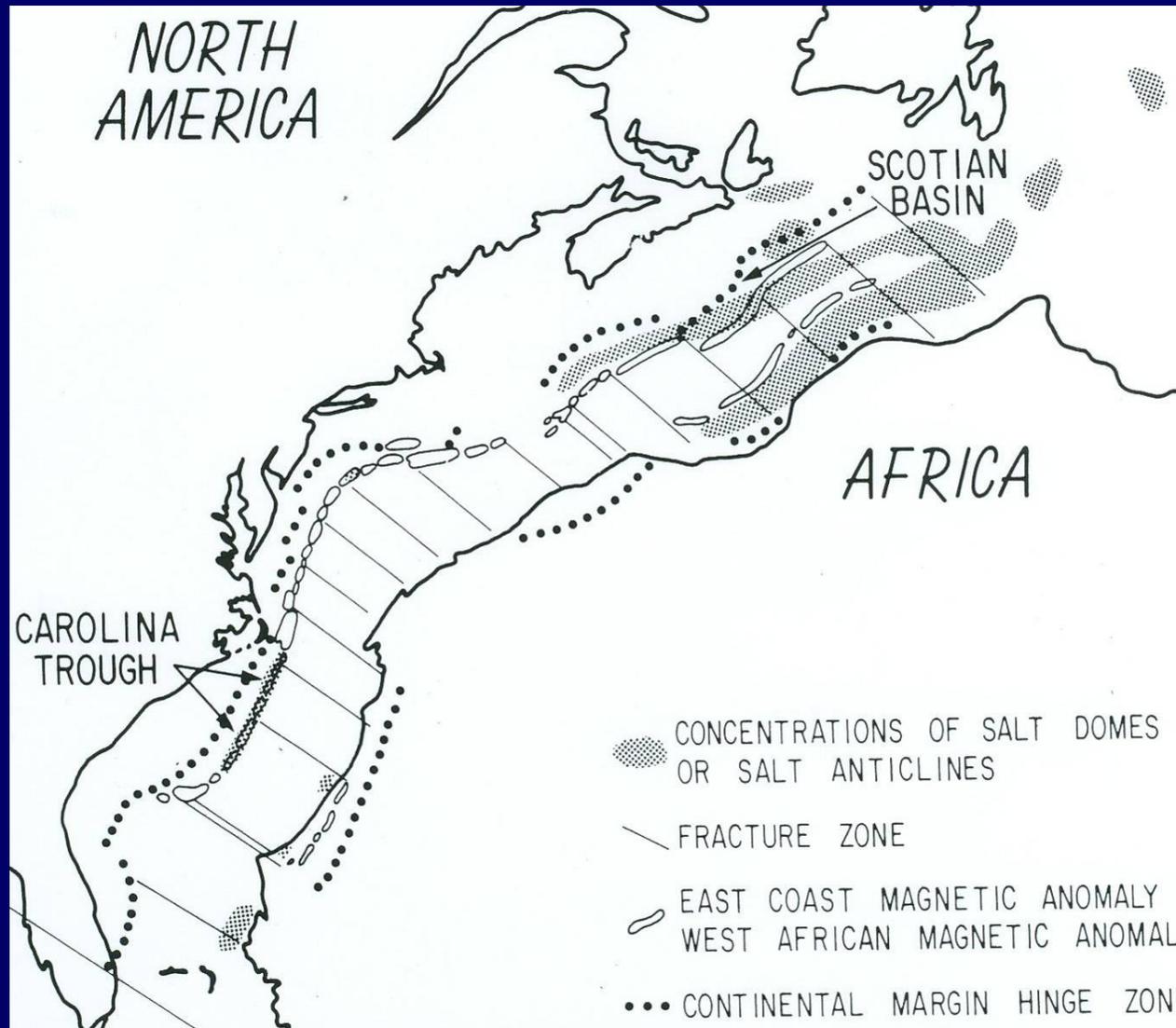
- Offshore_Cores
- Seismic Lines



Depth and thickness from Seismic



Prospective analog – equivalent oil producing basins – information on injectivity

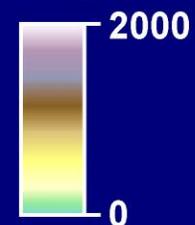


REGIONAL CO₂ SEQUESTRATION CANDIDATES



 Oil field area (active and inactive); from Lloyd (1997)

Elevation (ft)

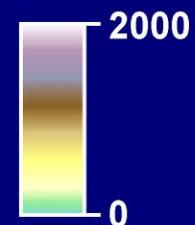


REGIONAL CO₂ SEQUESTRATION CANDIDATES



 Oil field area (active and inactive); from Lloyd (1997)

Elevation (ft)



ELEVATION AT BASE OF FLORIDAN AQUIFER



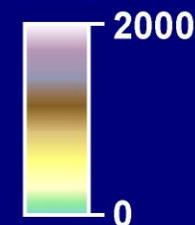
 Oil field area (active and inactive); from Lloyd (1997)

The Floridan aquifer is a major ground-water resource in Florida and Georgia.

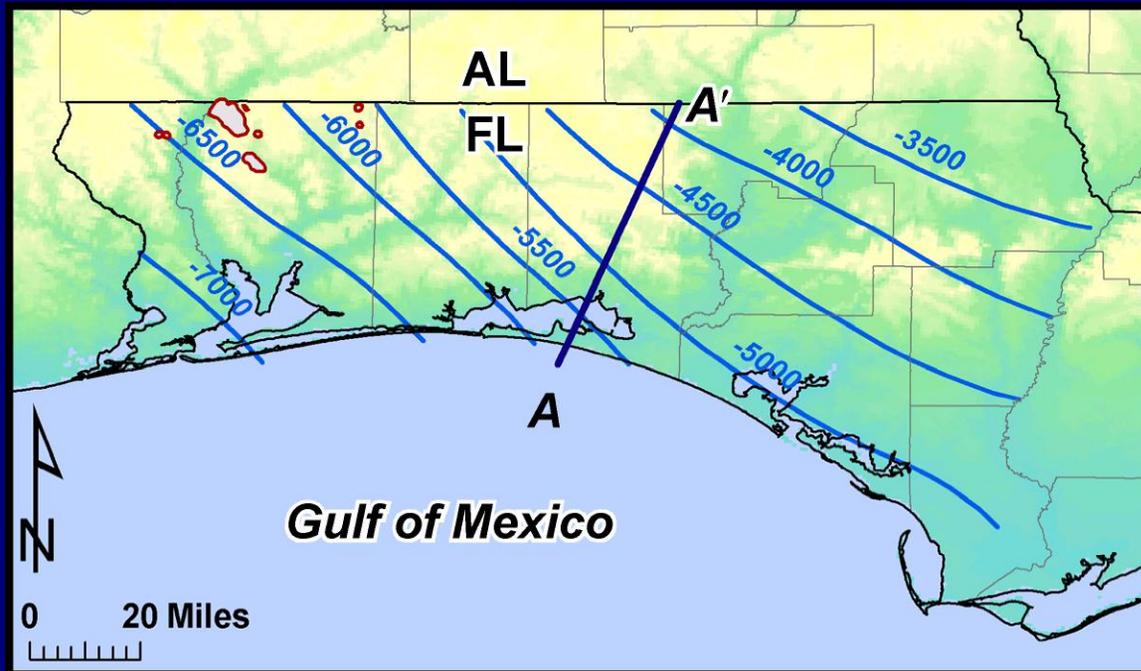
Strata above the base of the Floridan aquifer are unsuitable for CO₂ injection and sequestration.

 Elevation (ft) at the base of the Floridan aquifer; data from Miller (1985)

Elevation (ft)



TOP OF CRETACEOUS “INJECTION” SAND, NW FL.



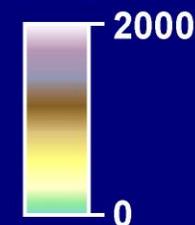
 Oil field area (active and inactive); from Lloyd (1997)

The upper Cretaceous “injection” sand (Miller, 1979) is a coarse-grained, highly permeable siliciclastic deposit about 100 ft thick that becomes less permeable toward the east.

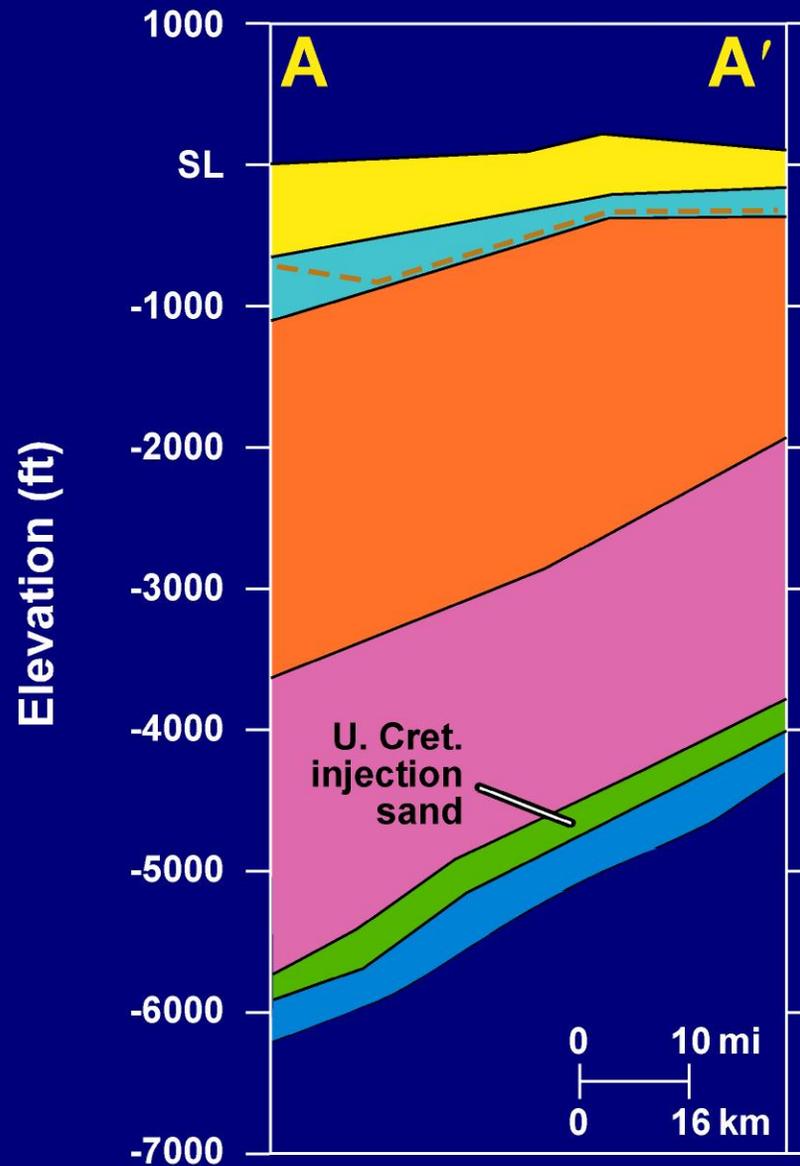
This unit is used for brine municipal waste disposal. In NW Florida, it occurs at depths great enough to be a candidate for hosting CO₂.

 Elevation (ft) at the top of the Cretaceous sand; data from Miller (1979)

Elevation (ft)



CROSS SECTION A - A', FLORIDA PANHANDLE

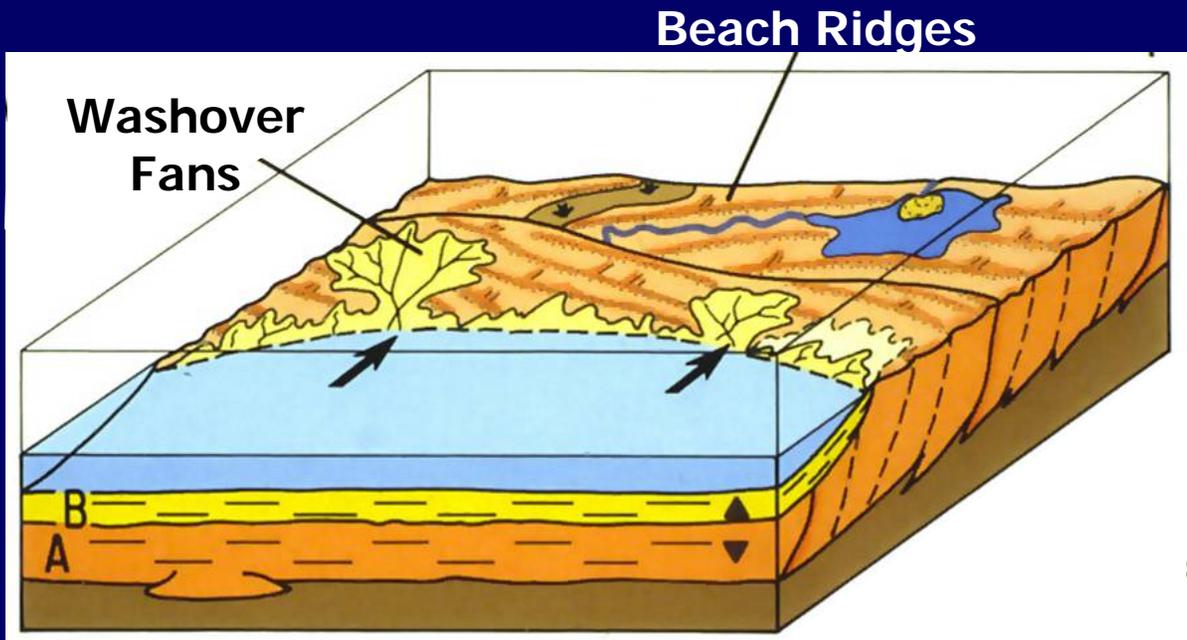


The upper Cretaceous “injection” sand is a regionally extensive coarse-to-medium sand interpreted to be capable of receiving brine or liquid waste at rates near 1 Mgal/day. It is ~100 ft thick, partly cemented, and interbedded with shale.

-  Sand and clay (post-Eocene)
-  Limestone (Eocene)
-  Shale and clay (Paleocene, Eocene)
-  Chalk and shale (U. Cret.)
-  Med. to coarse sand, partly cemented, interbedded with shale (U. Cret.)
-  Shale and sand (L. Cret.)
-  Base of TDS < 10,000 mg/L

Modified from Miller (1979)

Transgressive Shoreline Systems



*Washover Fans
North Carolina*

Conclusions

- Geologic inference is a powerful tool for identifying potential sequestration targets in areas of low data density
- Four prospective areas under investigation in the Southeastern US
 - Cretaceous shore-parallel sandstones Georgia
 - Mesozoic rift basins entire Eastern seaboard
 - Offshore Atlantic Cretaceous
 - Cretaceous sheet sands, Florida Panhandle