Geologic Characterization of the South Georgia Rift Basin for Source Proximal CO_2 Storage

DE-FE0001965

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U.S. Department of Energy
National Energy Technology Laboratory
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Developing the Technologies and Building the Infrastructure for CO_2 Storage
August 21-23, 2012

Presentation Outline

- Project goals and benefits
- Overview of the geologic evolution of the South Georgia Rift basin
- Results of deep characterization boring – Rizer #1
- Assimilation of borehole data and seismic data
- Summary

Benefit to the Program

Program Goals:

- Develop technologies that will support industries' ability to predict CO_2 storage capacity in geologic formations to within ±30 percent.
- Develop technologies to demonstrate that 99 percent of injected CO_2 remains in the injection zones.
- Conduct field tests through 2030 to support the development of BPMs for site selection, characterization, site operations, and closure practices.

Benefits Statement:

Our research is evaluating the feasibility of CO_2 storage in the Jurassic/Triassic strata of the buried South Georgia Rift basin and providing all data and analyses associated with this evaluation to the NATCARB database. This is the first characterization effort in a relatively unexplored basin that may have tremendous potential for storing large quantities of CO_2.

Project Overview: Goals and Objectives

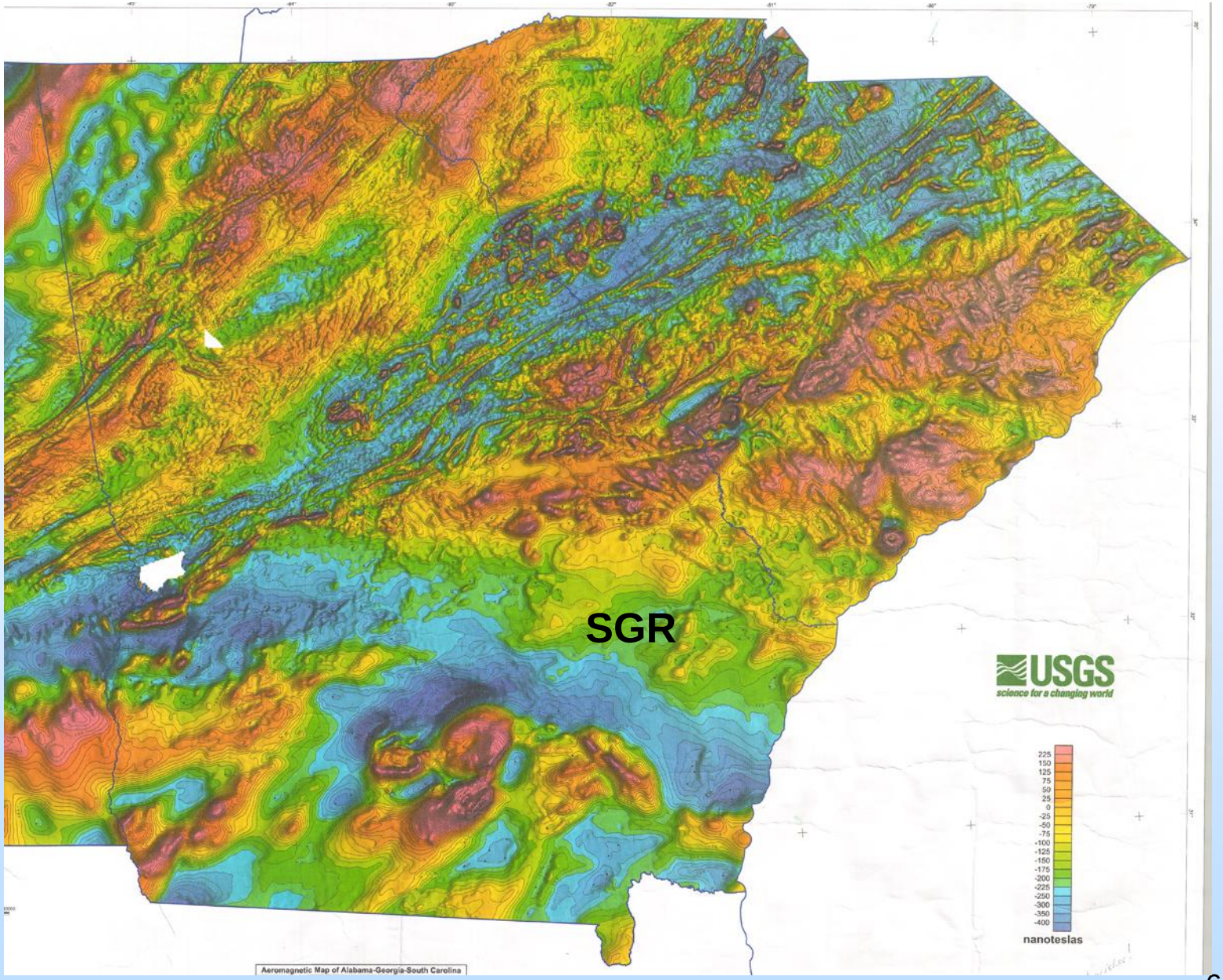
Our project objectives address the fundamental program goal of site characterization of promising geologic formations for CO_2 storage. Specifically, characterization of the South Georgia Rift (SGR) basin is answering the following questions:

- Are there porous horizons with the potential to store at least 30M tonnes of CO_2
- Are the trapping reservoirs structurally competent enough to prevent injected CO_2 from migrating upward into the Coastal Plain aquifers
- Are the physical and chemical properties of the possible porous horizons conducive for CO_2 injection and long-term storage

Success Criteria (activities completed):

- Assimilation of existing data and information pertaining to SGR geology
- 240 km 2D reflection seismic acquired; 3D seismic acquired at test borehole site
- Characterization borehole drilled, cored, and logged
- 3D numerical simulation of CO_2 injection scenarios

Technical Status
Geologic Evolution of the South Georgia Rift basin


SGR
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science for a changing world
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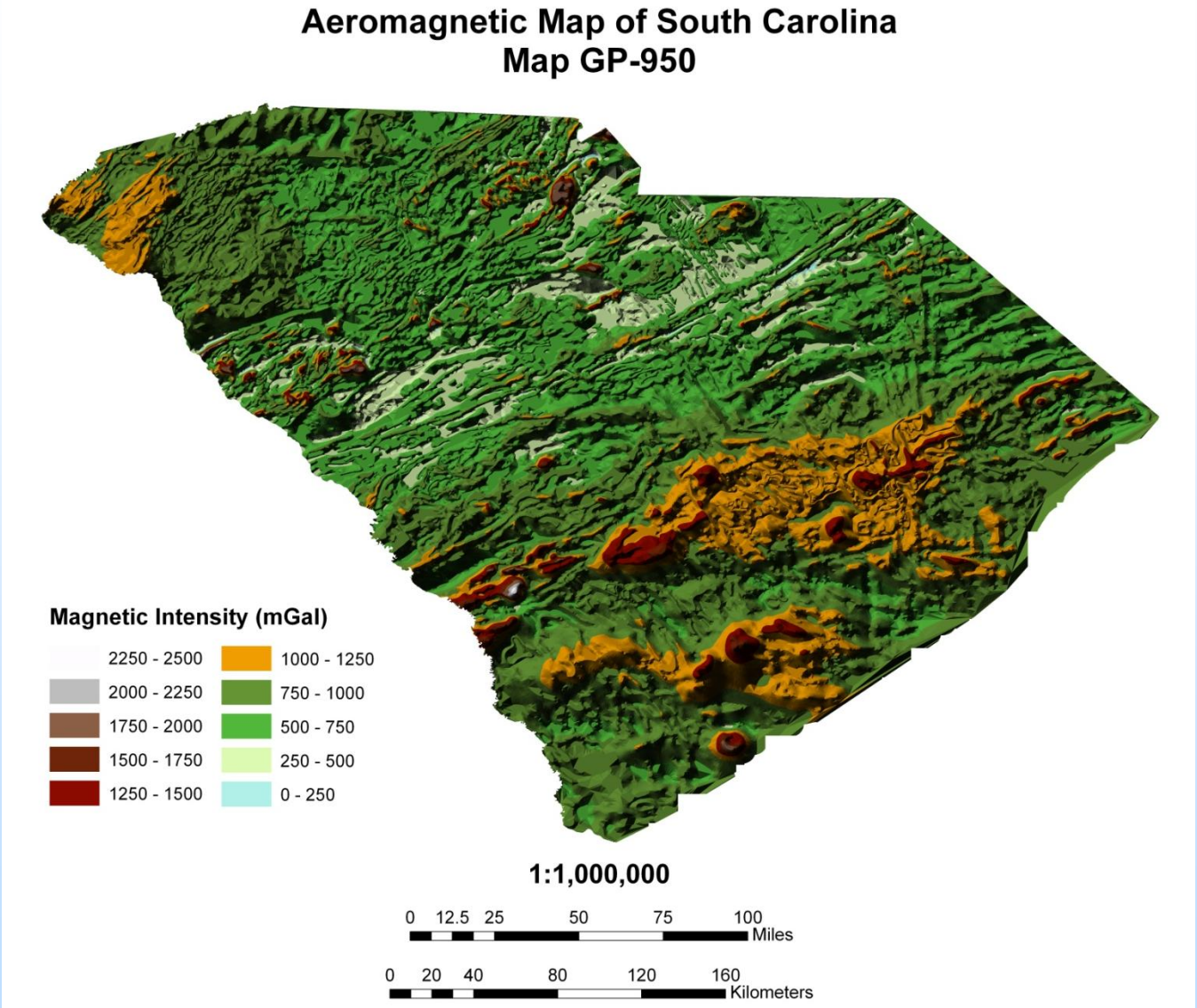
nanoteslas
Aeromagnetic Map of Alabama-Georgia-South Carolina


Aeromagnetic Map of South Carolina
Map GP-950
Magnetic Intensity (mGal)
2250 - 2500
2000 - 2250
1750 - 2000
1500 - 1750
1250 - 1500
1000 - 1250
750 - 1000
500 - 750
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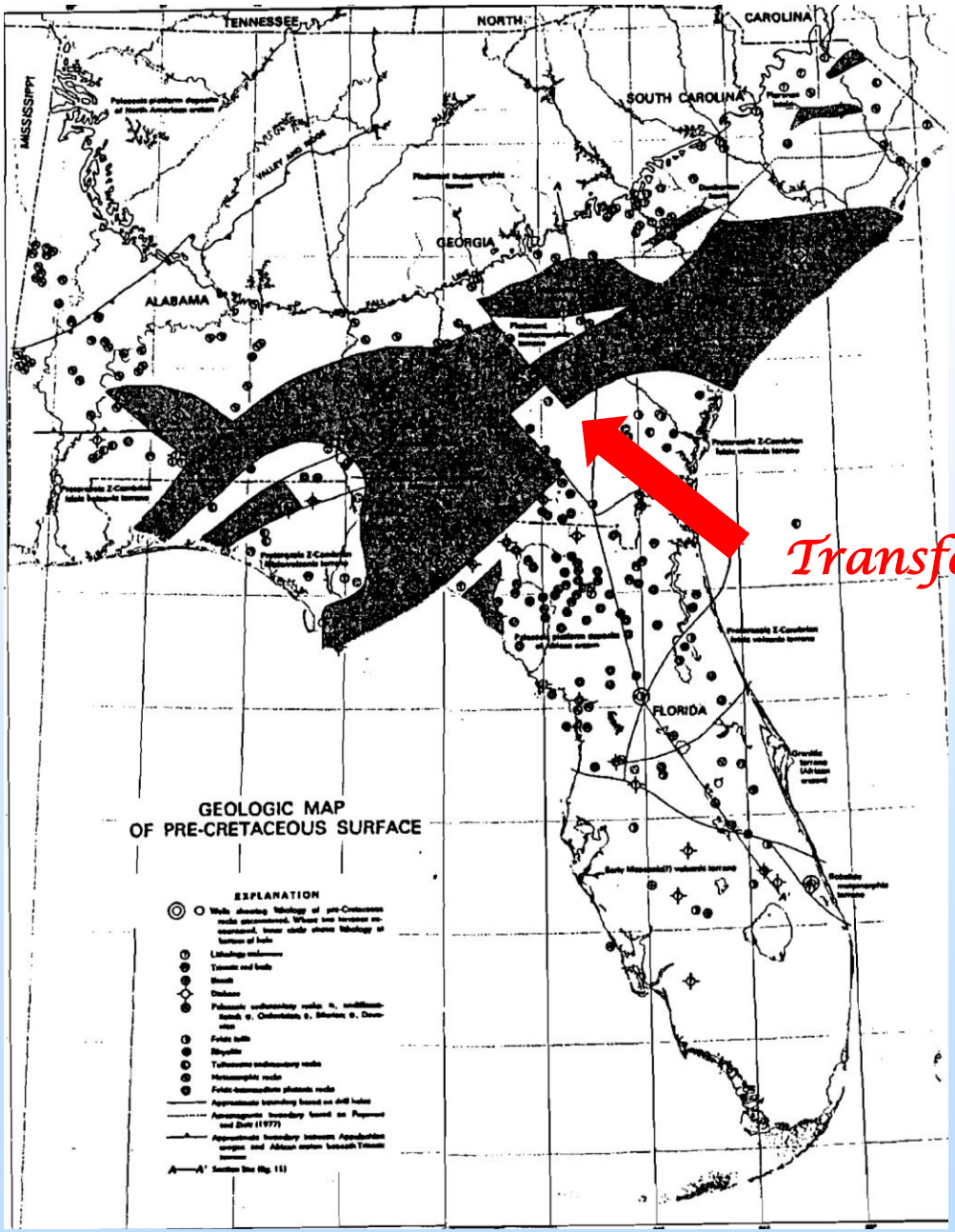
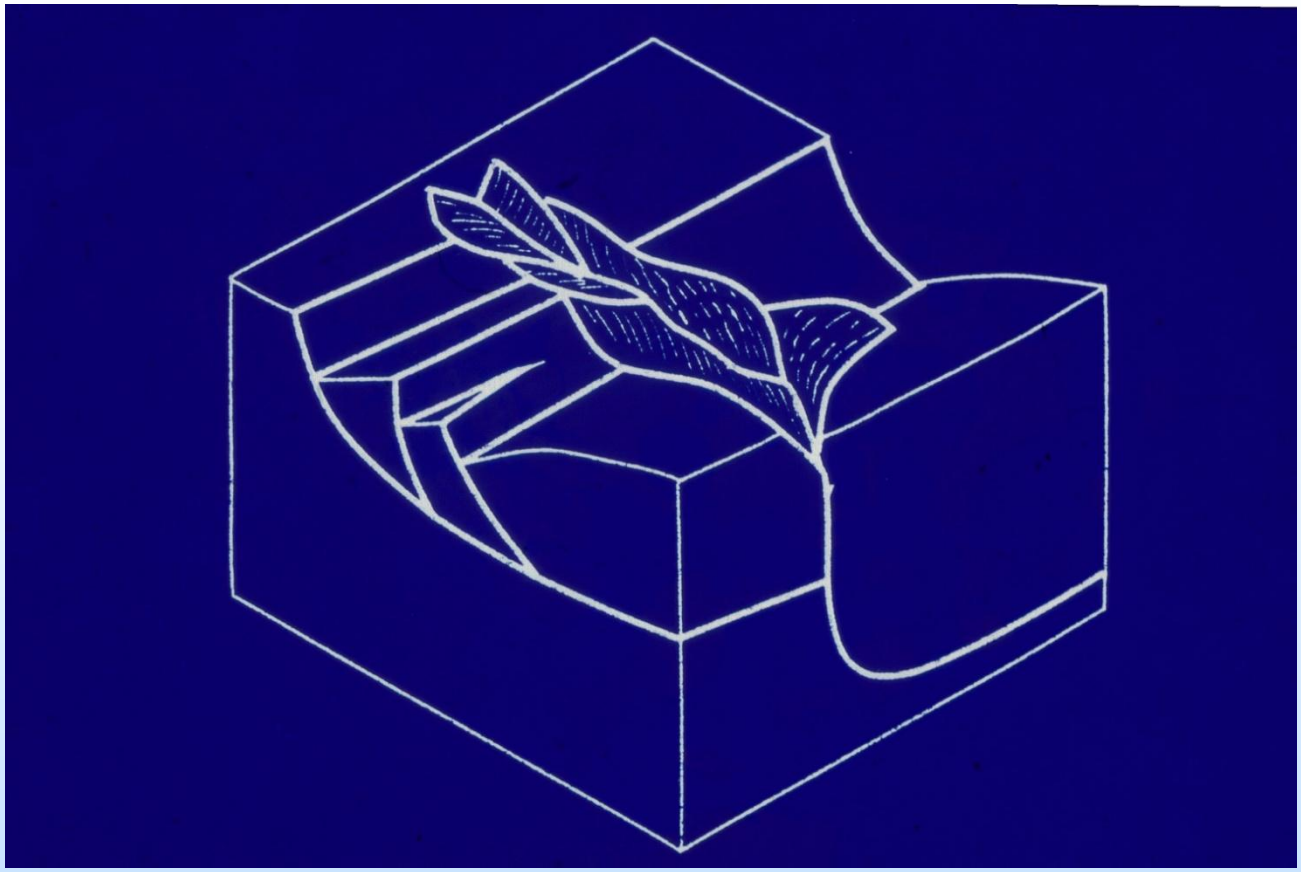
Kilometers

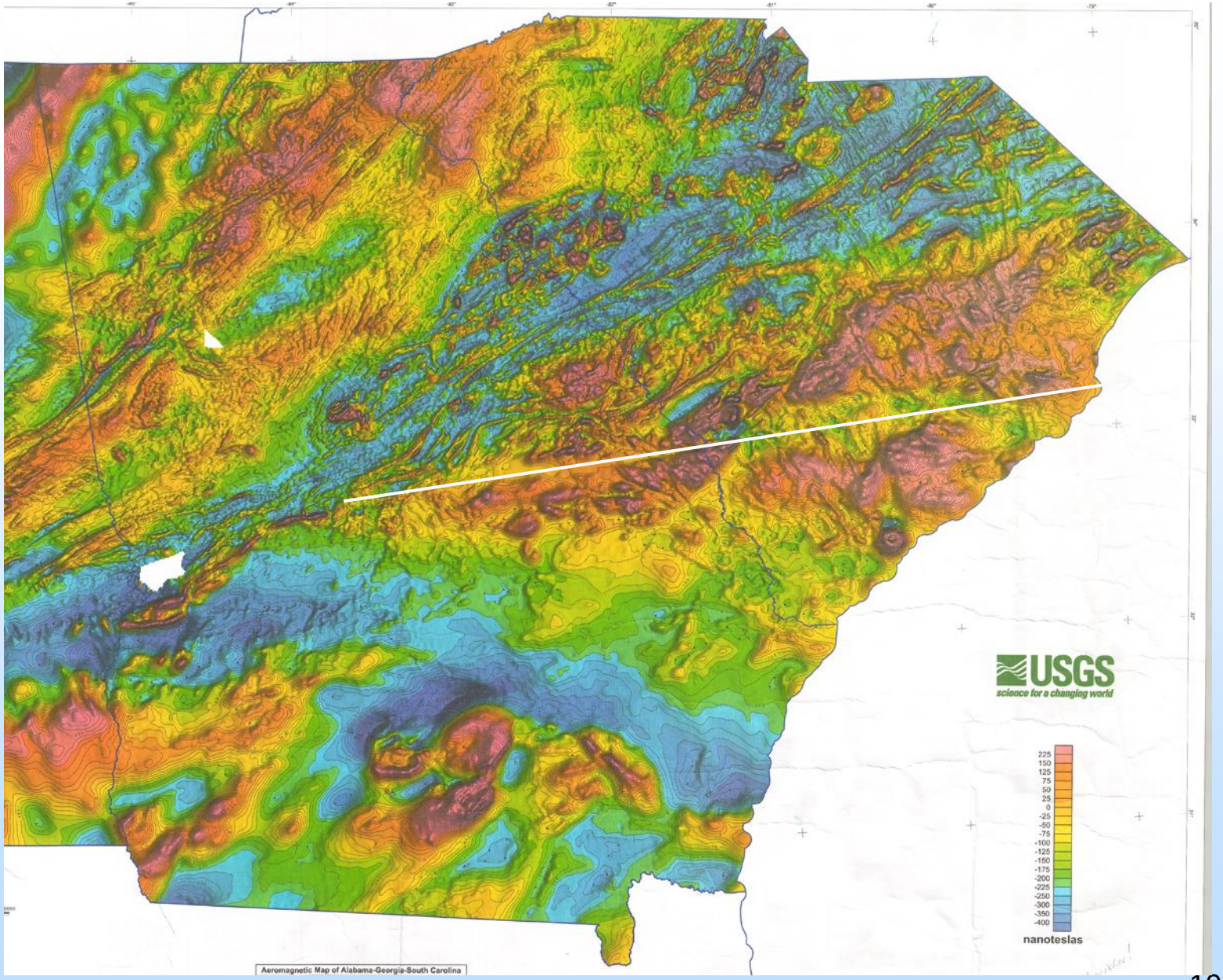


Transfer fault

T.M. Chowns



Compartmentalized Basin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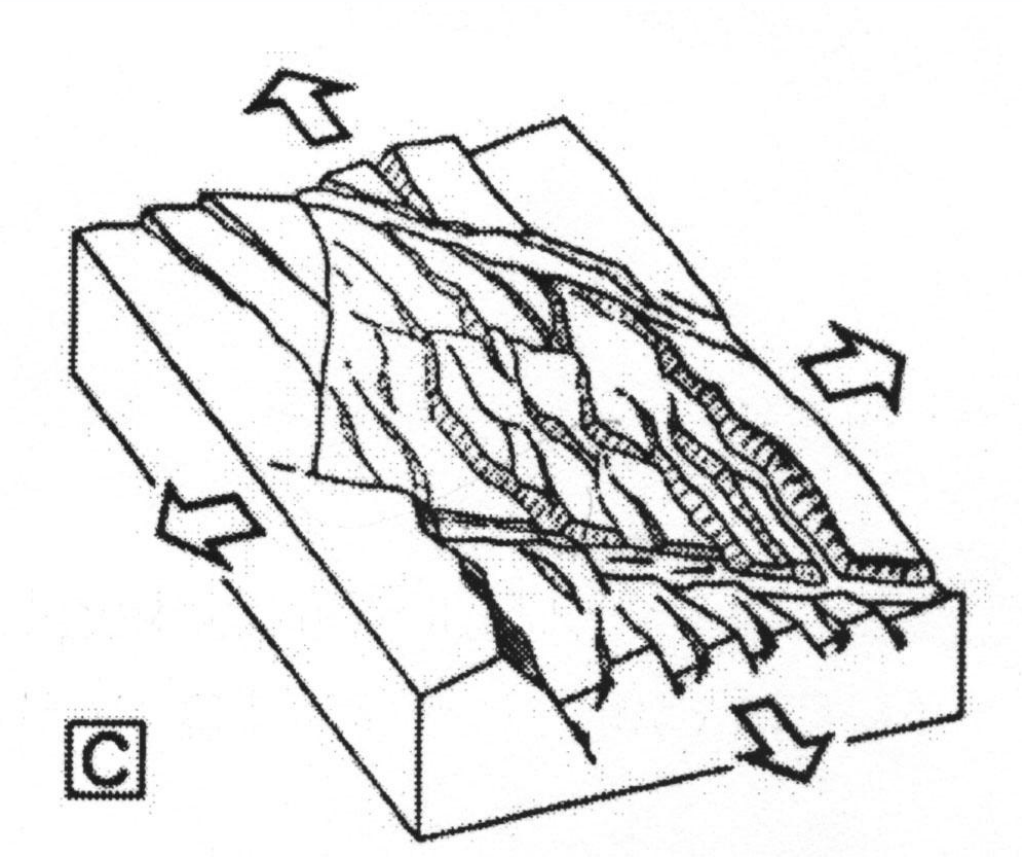
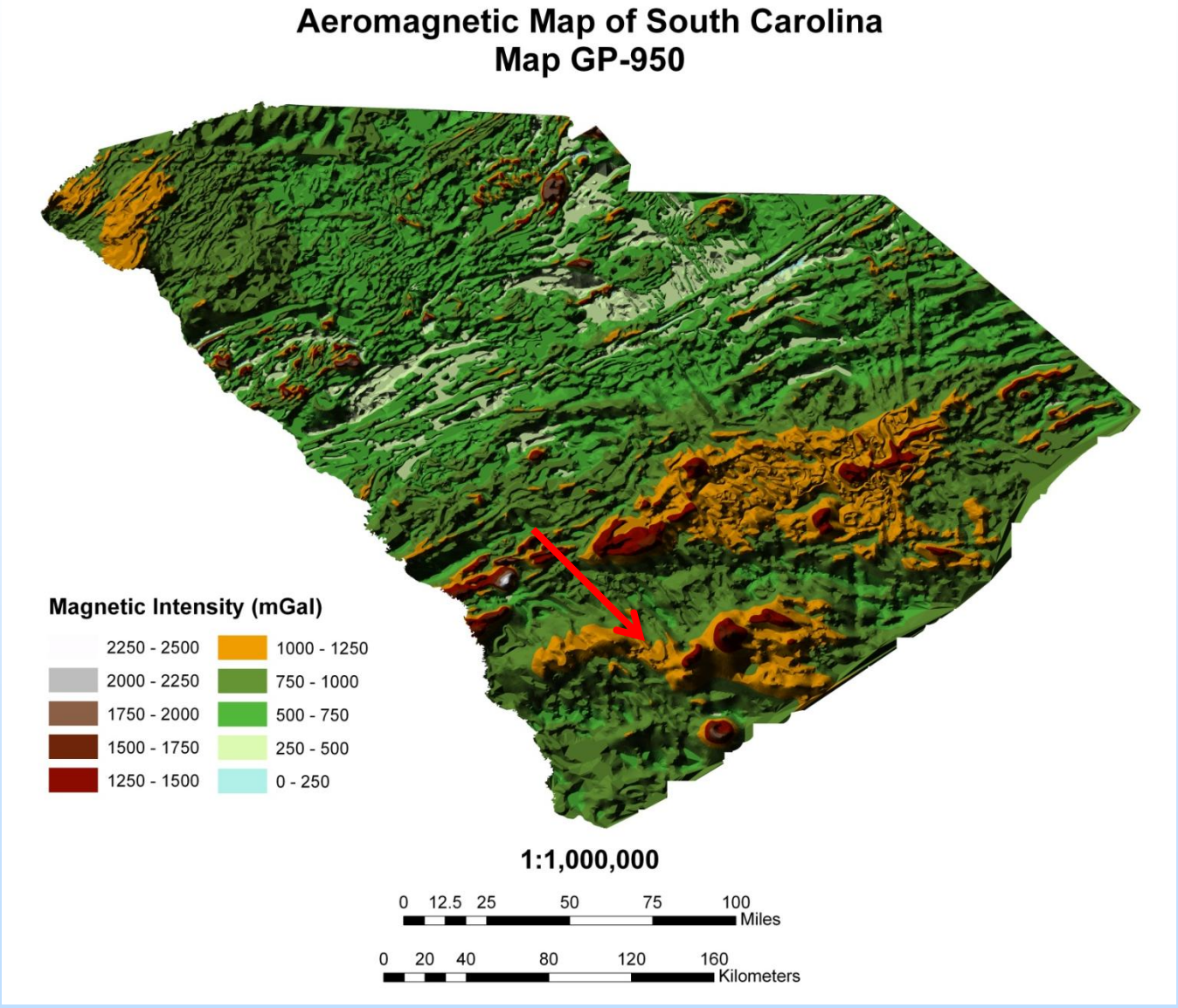
Aeromagnetic Map of Alabama-Georgia-South Carolina



Further complexity as a result of pre-existing weakness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1750 - 2000
1500 - 1750
1250 - 1500
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500 - 750
250 - 500
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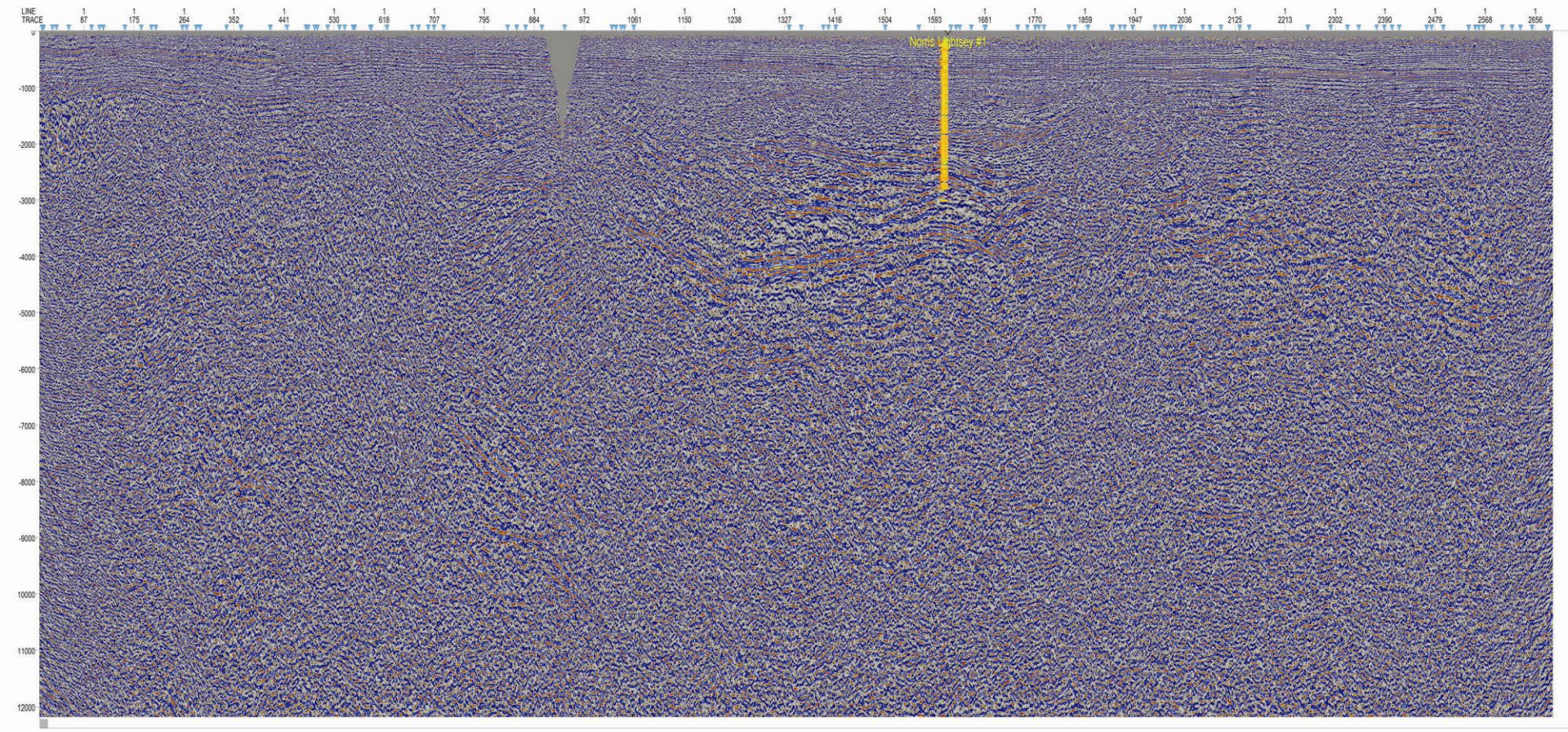
Miles
0 20 40 80 120 160
Kilometers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Norris Lightsey #1
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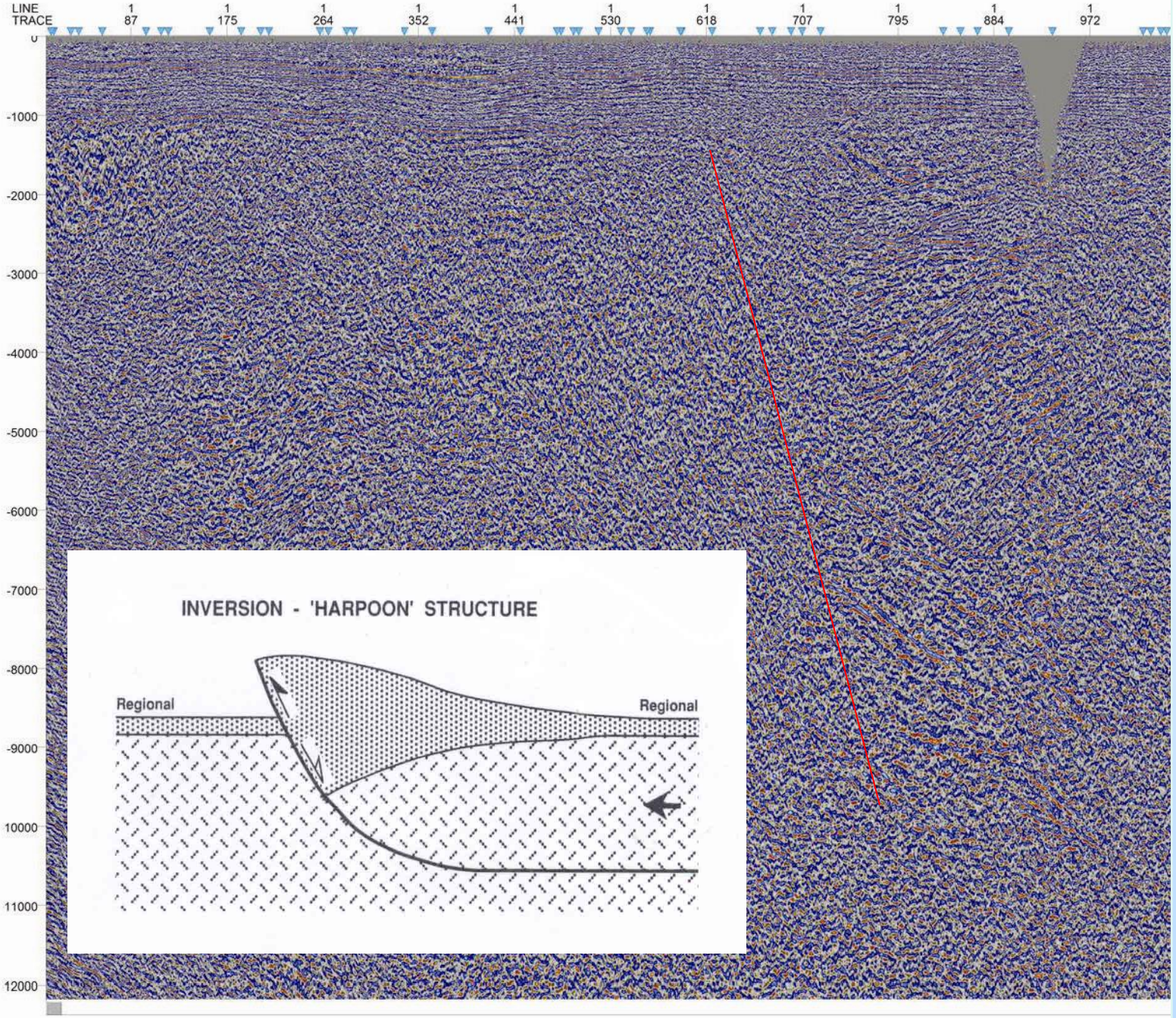
-7000
-8000
-9000
10000
11000
12000

SCCO2-1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972
0
-1000
-2000
-3000
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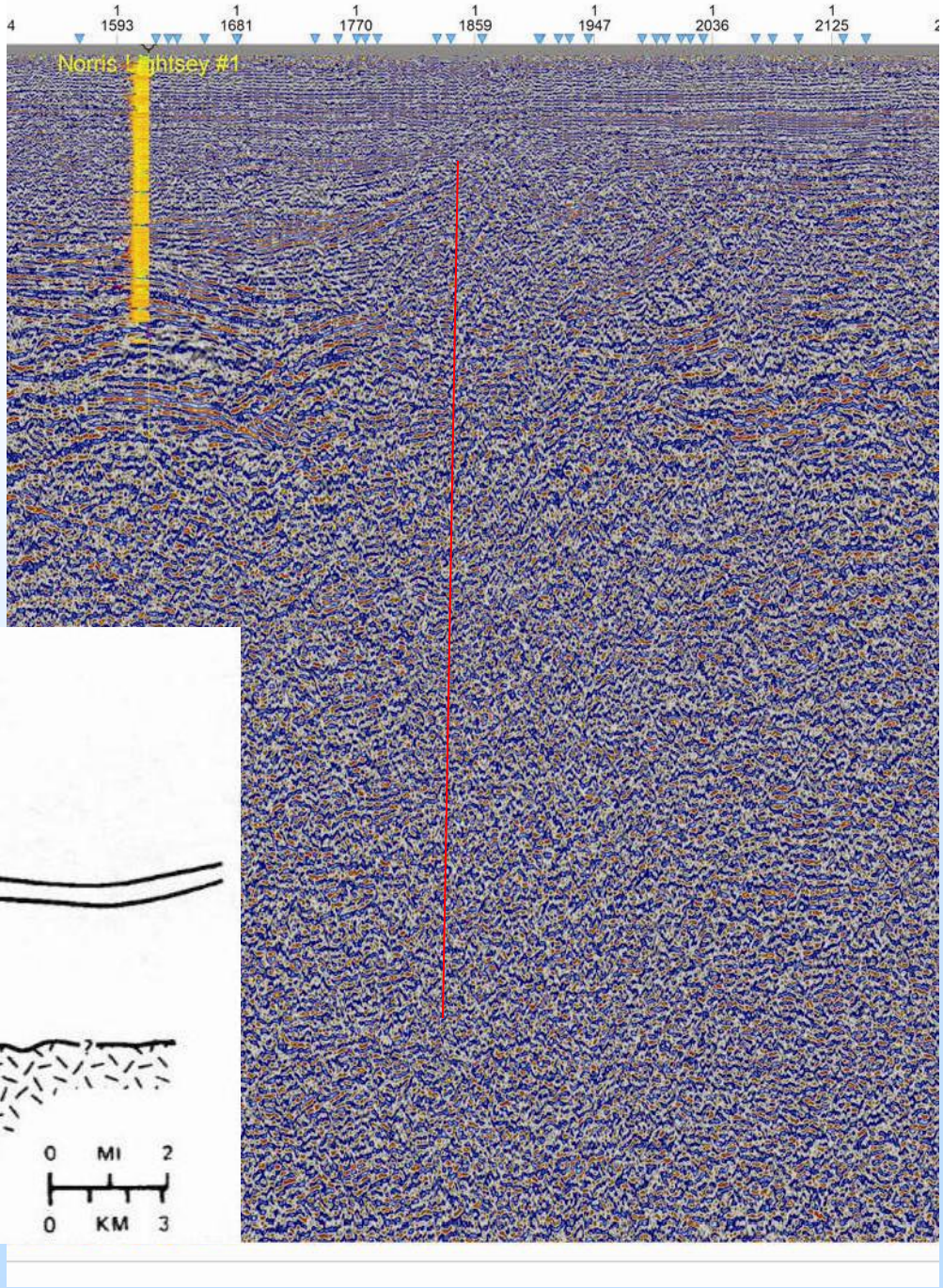
INVERSION - 'HARPOON' STRUCTURE
Regional
Regional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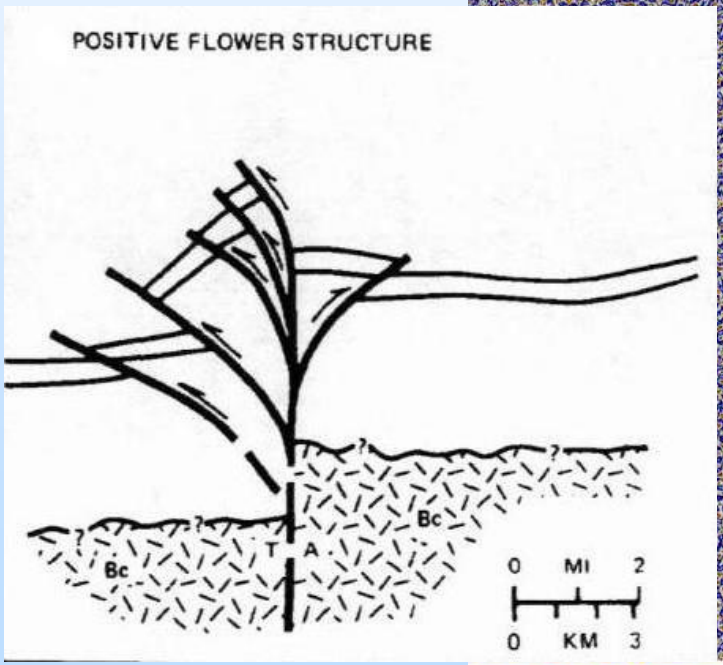
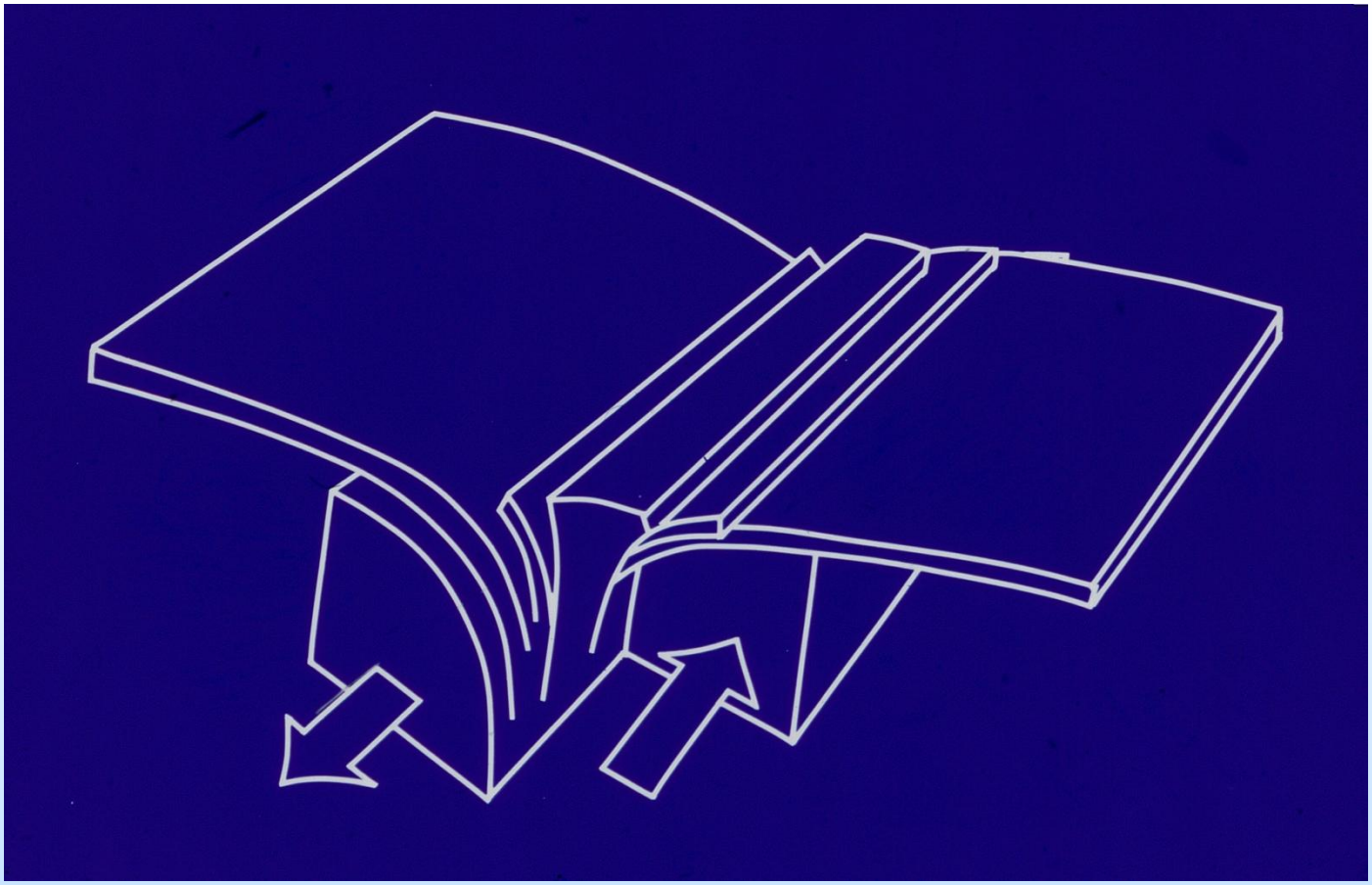
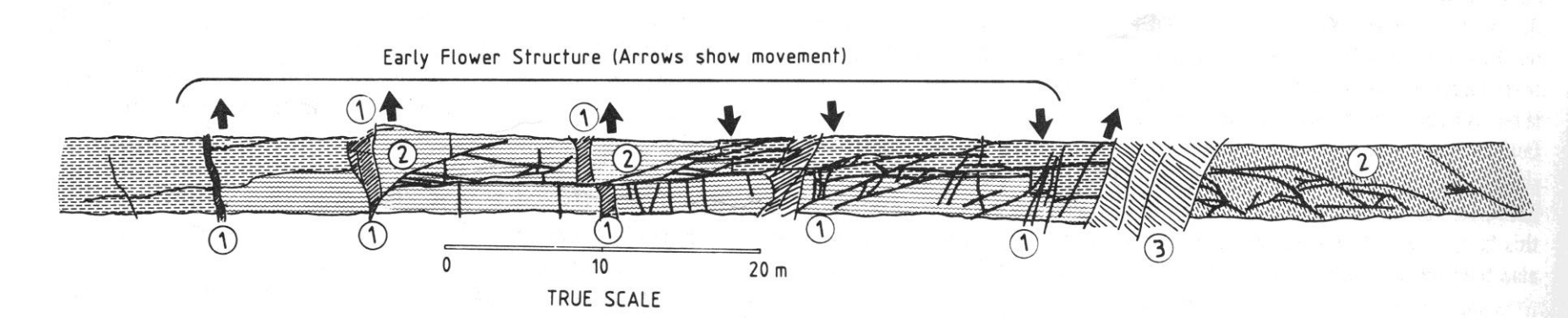
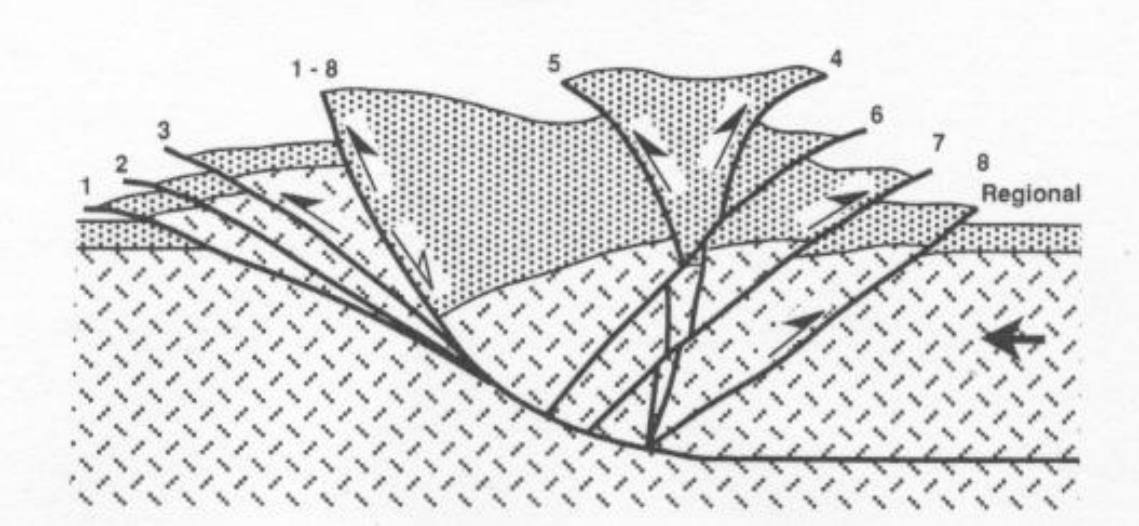
Norris Lightsey #1


POSITIVE FLOWER STRUCTURE
Bc
Bc
A
0 MI 2
0 KM 3

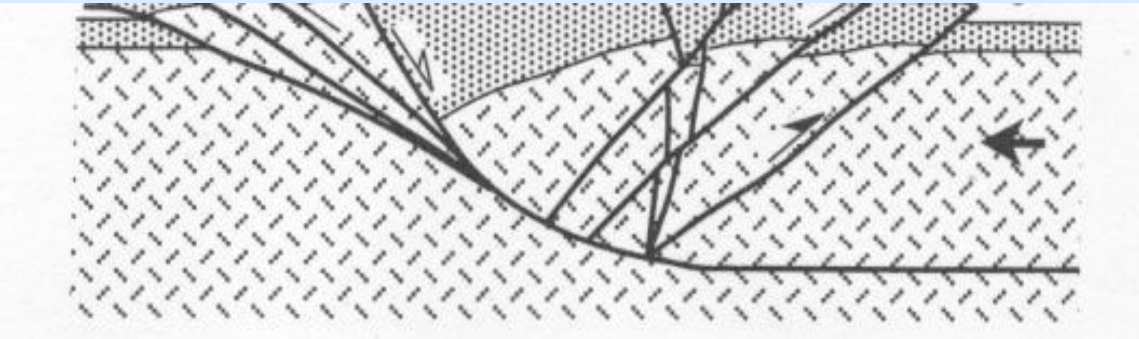




Oblique thrust splays related to partitioned deformation Sweetwater fault zone, Sweetwater Mine, MO



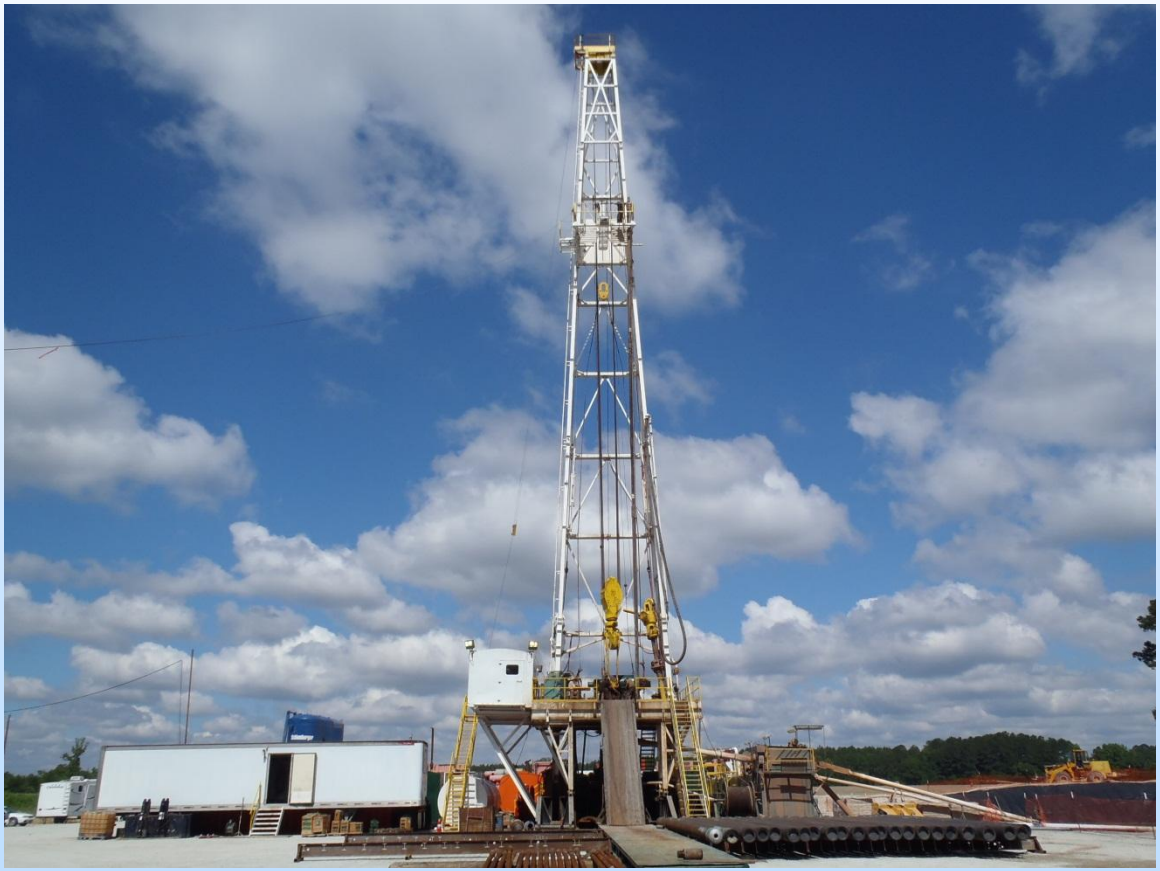
Inversion produces a complex, superimposed structural style



After erosion, half-gaben seems to be best interpretation

Technical Status

RIZER # 1 Test Boring



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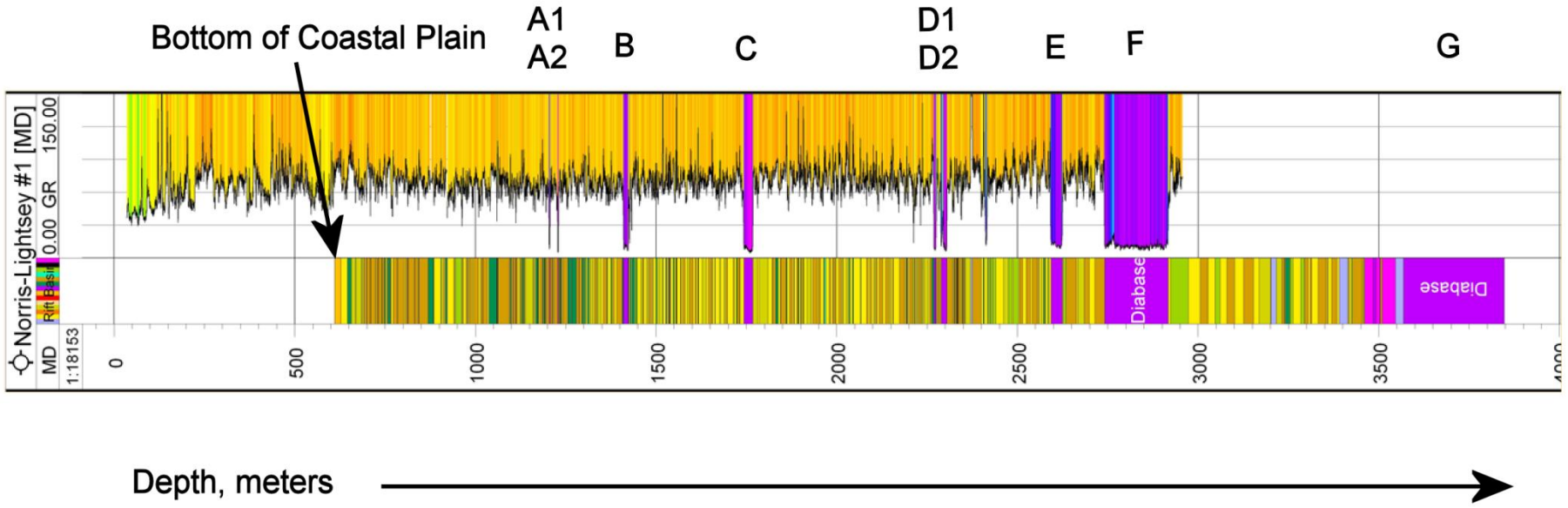

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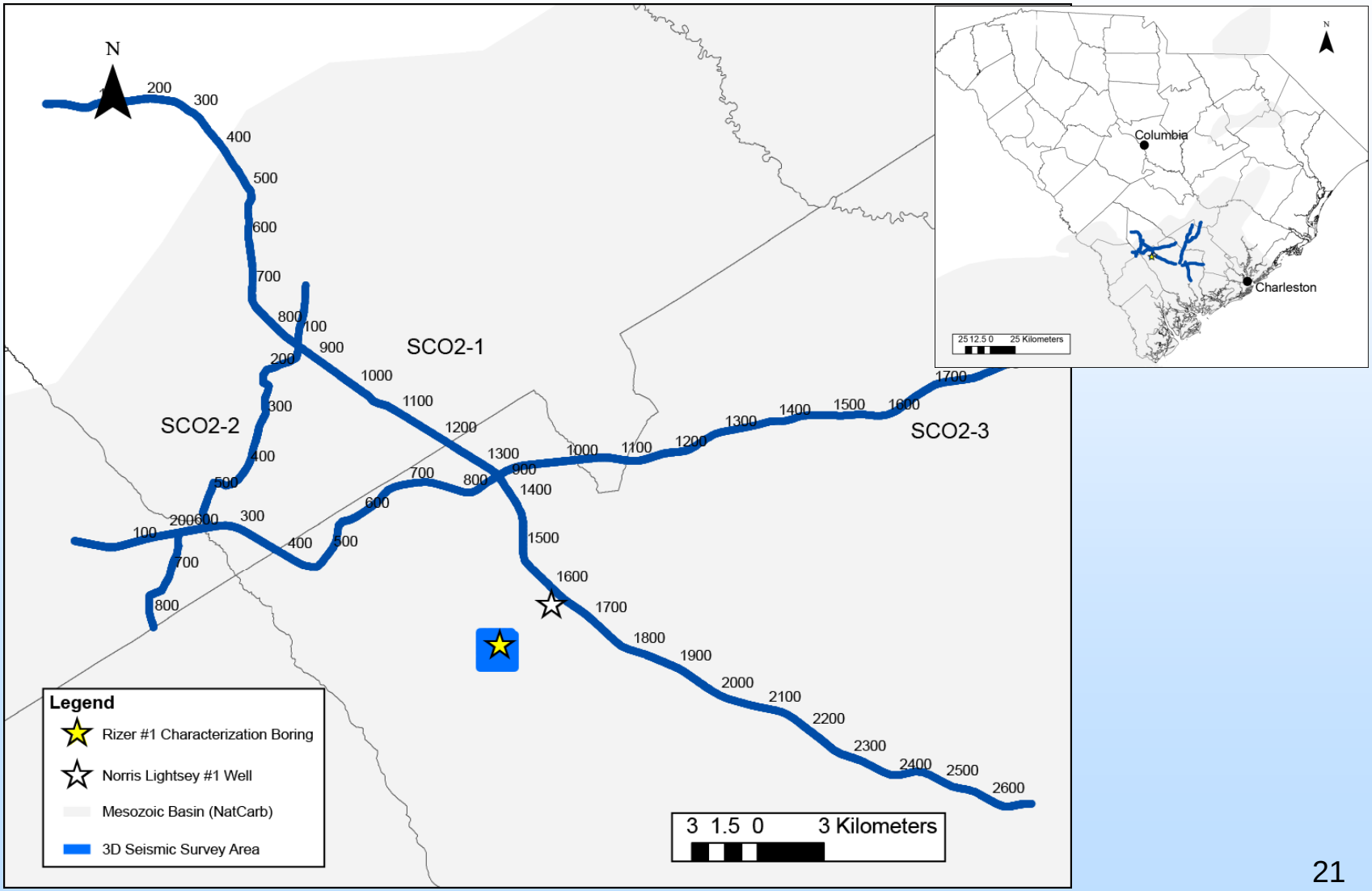
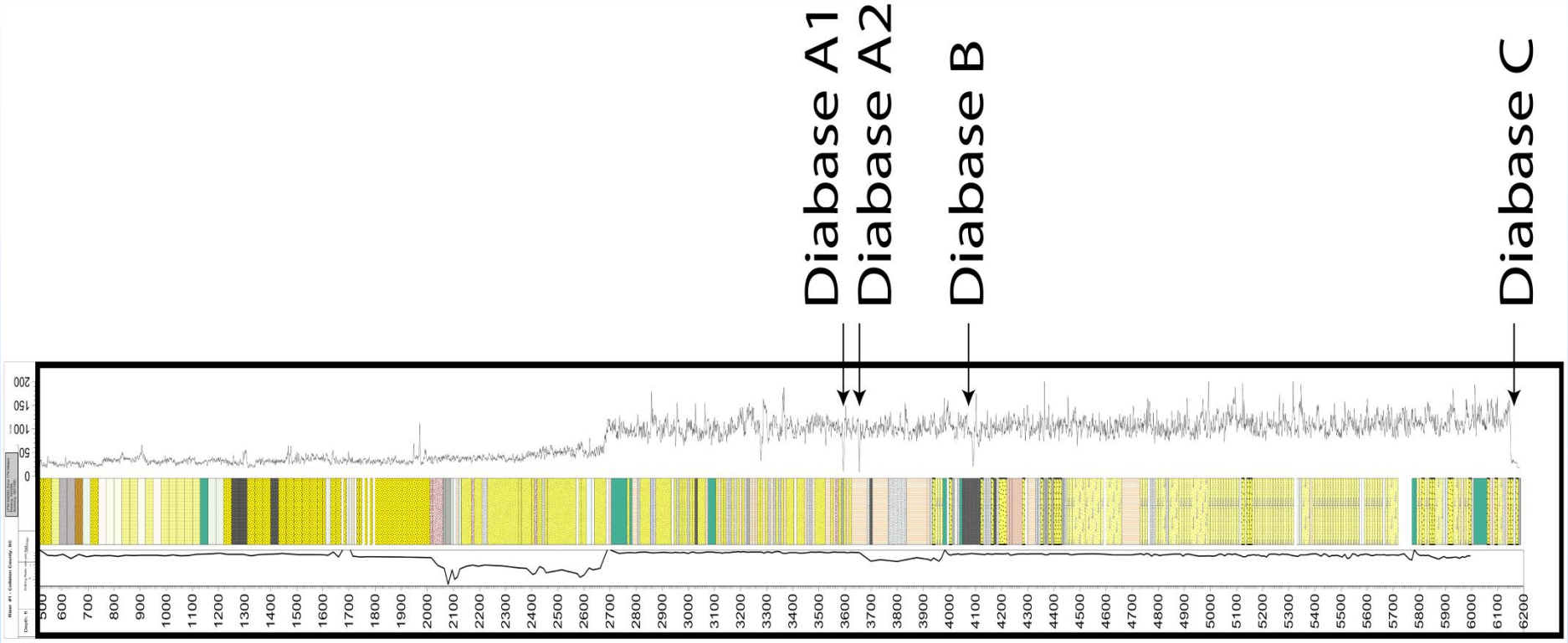
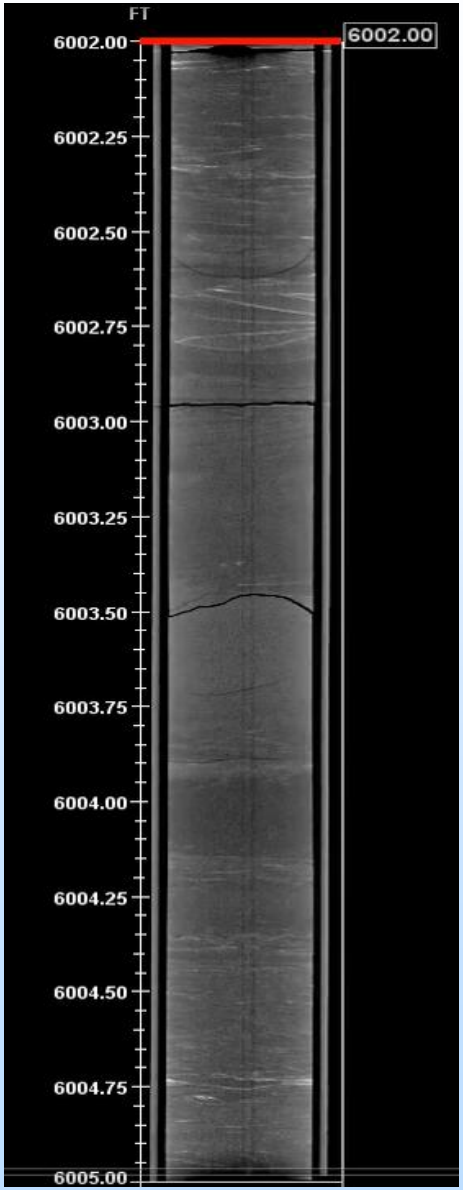


Rizer #1 Test Boring
TD 6200 Ft (1890 m)



Rizer # 1 Core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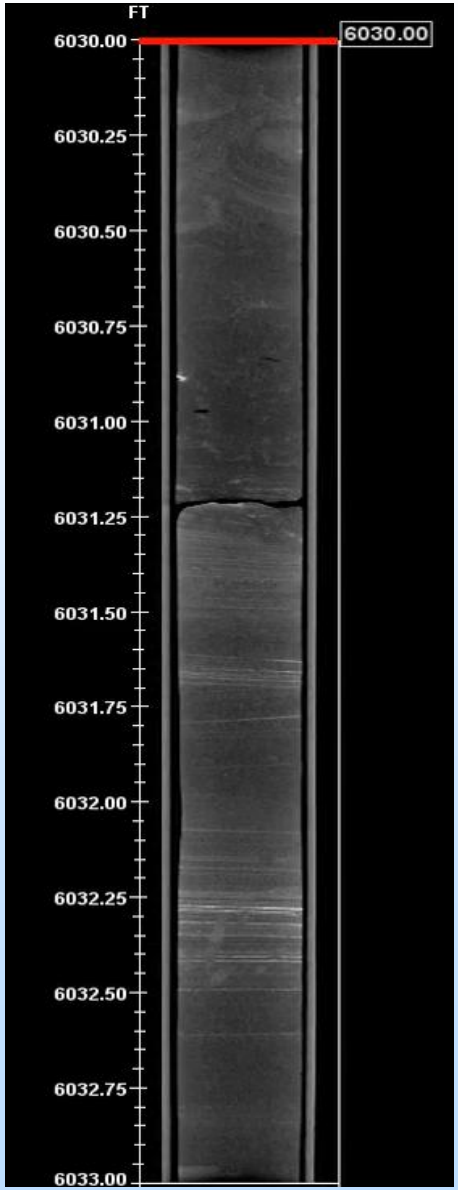
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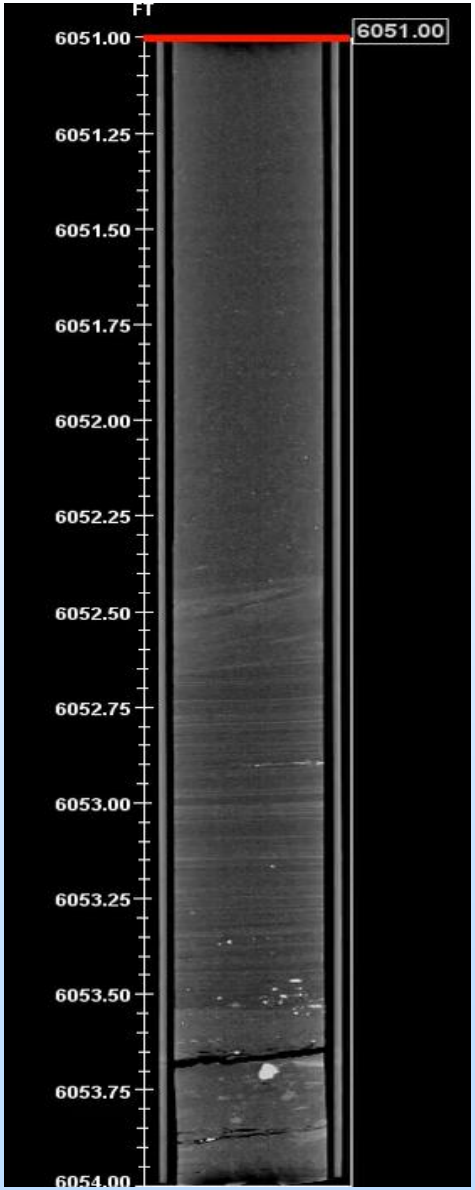
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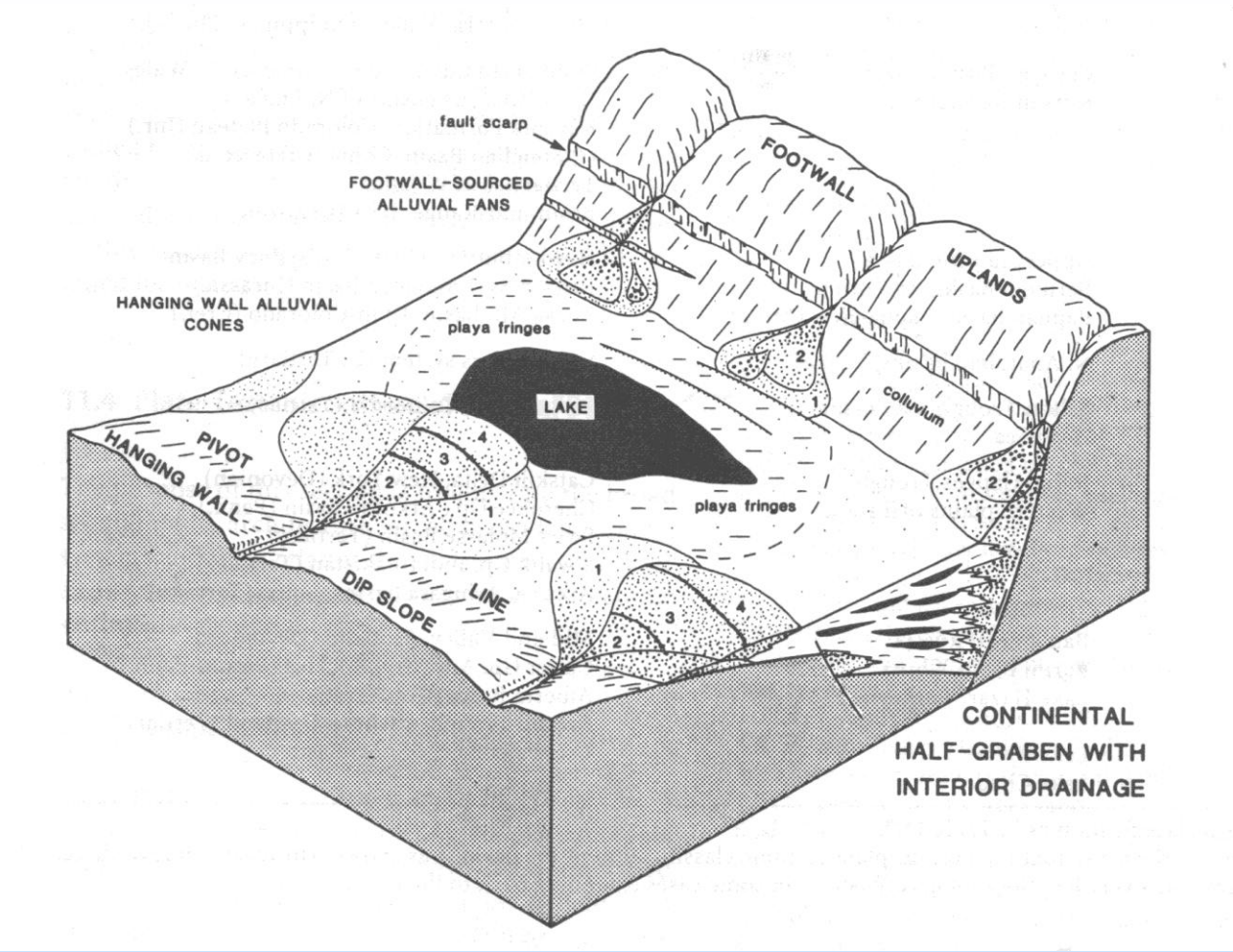

Half-graben with Interior Drainage

Accomplishments to Date

- Suitable infrastructure and subaward arrangements established
- Existing data pertaining to SGR obtained, assimilated, and integrated
- Site characterization field investigations completed
  - 240 km 2D seismic acquired
  - 3D seismic acquired over characterization borehole site
  - Characterization borehole drilled, cored, and wireline logged
- Detailed integration of geologic information almost completed and preliminary 3D geologic model developed
- 3D numerical modeling of CO_2 injection initiated

Summary

Key Findings:

- SGR appears to be capable of storing large quantities of CO_2 in compartmentalized, stacked storage reservoirs
- Both stratigraphic and structural seals are present to contain the injected CO_2

Lessons Learned:

- Geologic characterization in a “frontier” area has many logistic and scientific challenges not encountered in well-studied areas
  - Lack of data
  - Land access
  - Uncertainty/risk associated with field characterization
  - Lack of industry experience

Future Plans:

- Integrate laboratory results into assessment of SGR
- Complete Best Management Practices manual

DOE/NETL Acknowledgment:

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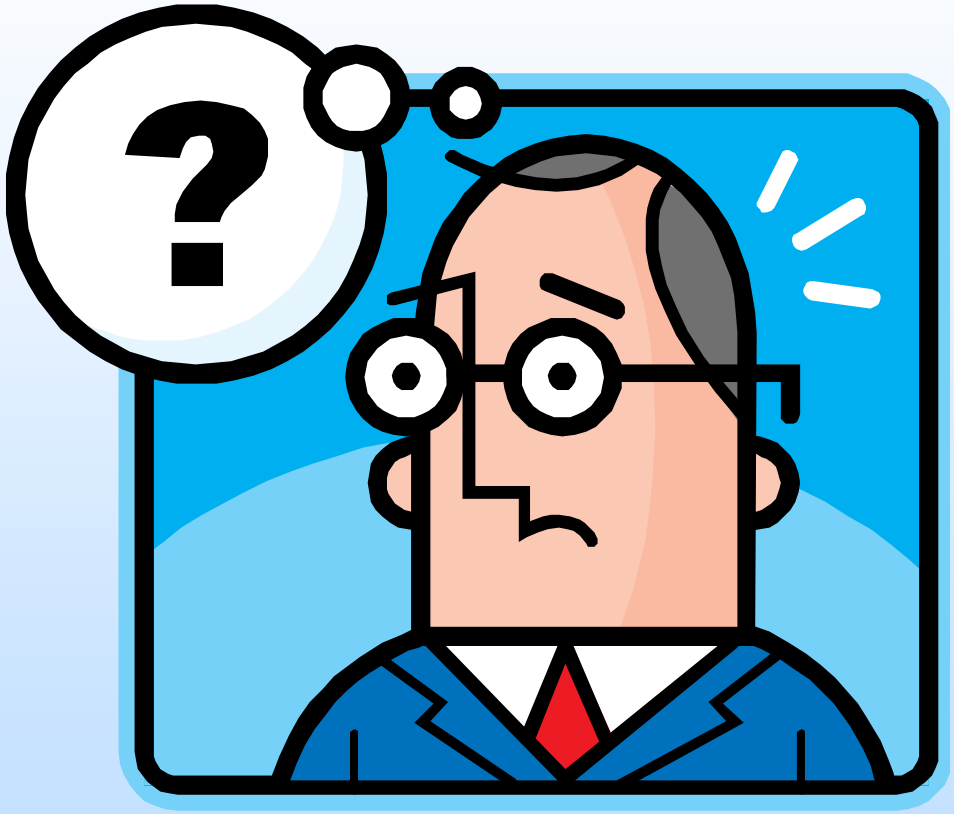
DOE/NETL Disclaimer:

Questions



Appendix

Organization Chart

Lead organization – project mgmt., geologic characterization, injection simulation

Geologic overview of SGR

Geologic interpretation, field support, core repository

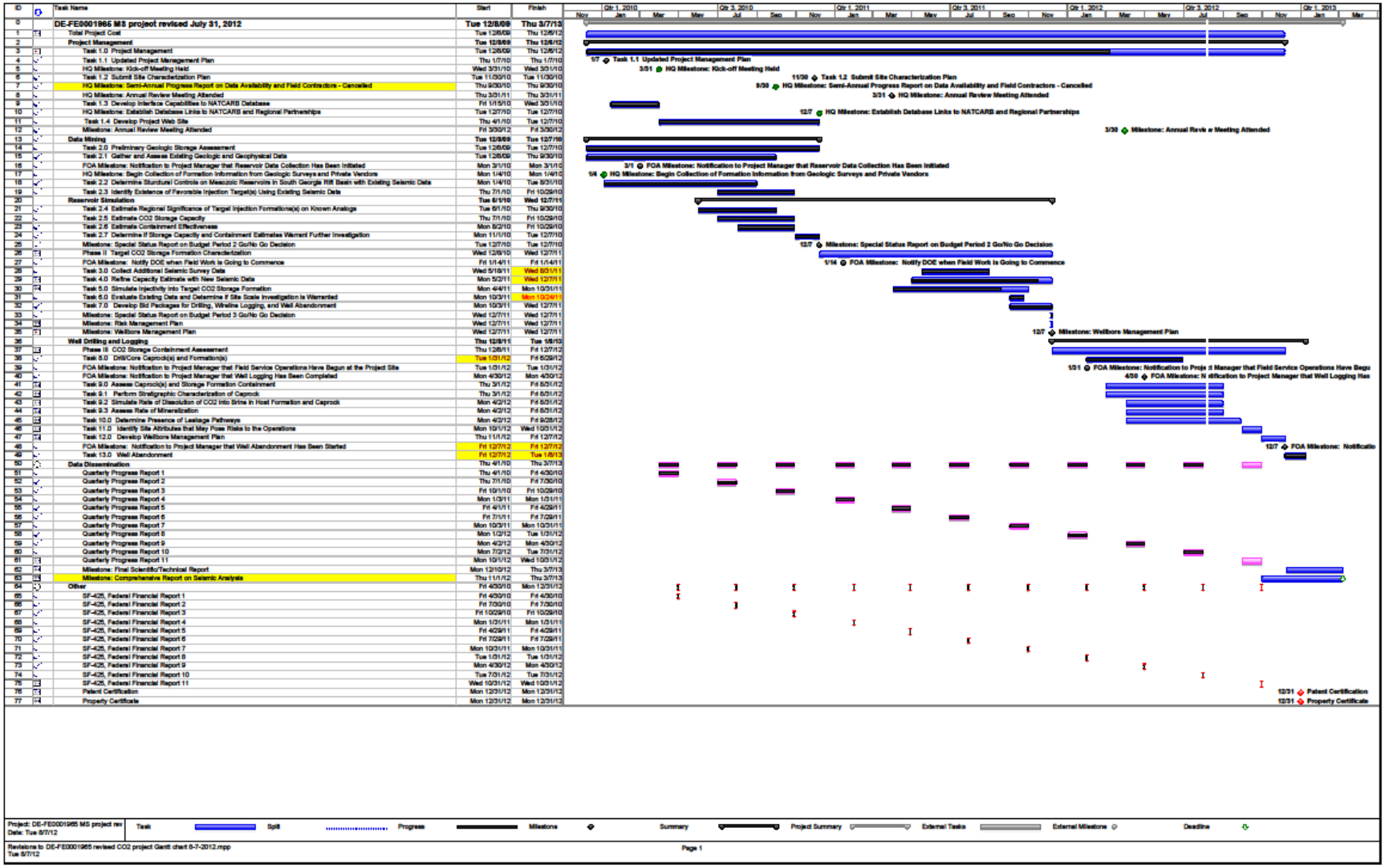
Project mgmt. support, review of findings

2D and 3D seismic acquisition

Routine core analysis, special core analysis

Characterization borehole mgmt., drilling, coring, wireline logging

Gantt Chart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Thu 3/7/13
Project: DE-FE0001985 MS project rev
Date: Tue 8/7/12
Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline
Revisions to DE-FE0001985 revised CO2 project Gantt chart 8-7-2012.mpp
Tue 8/7/12
Page 1

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