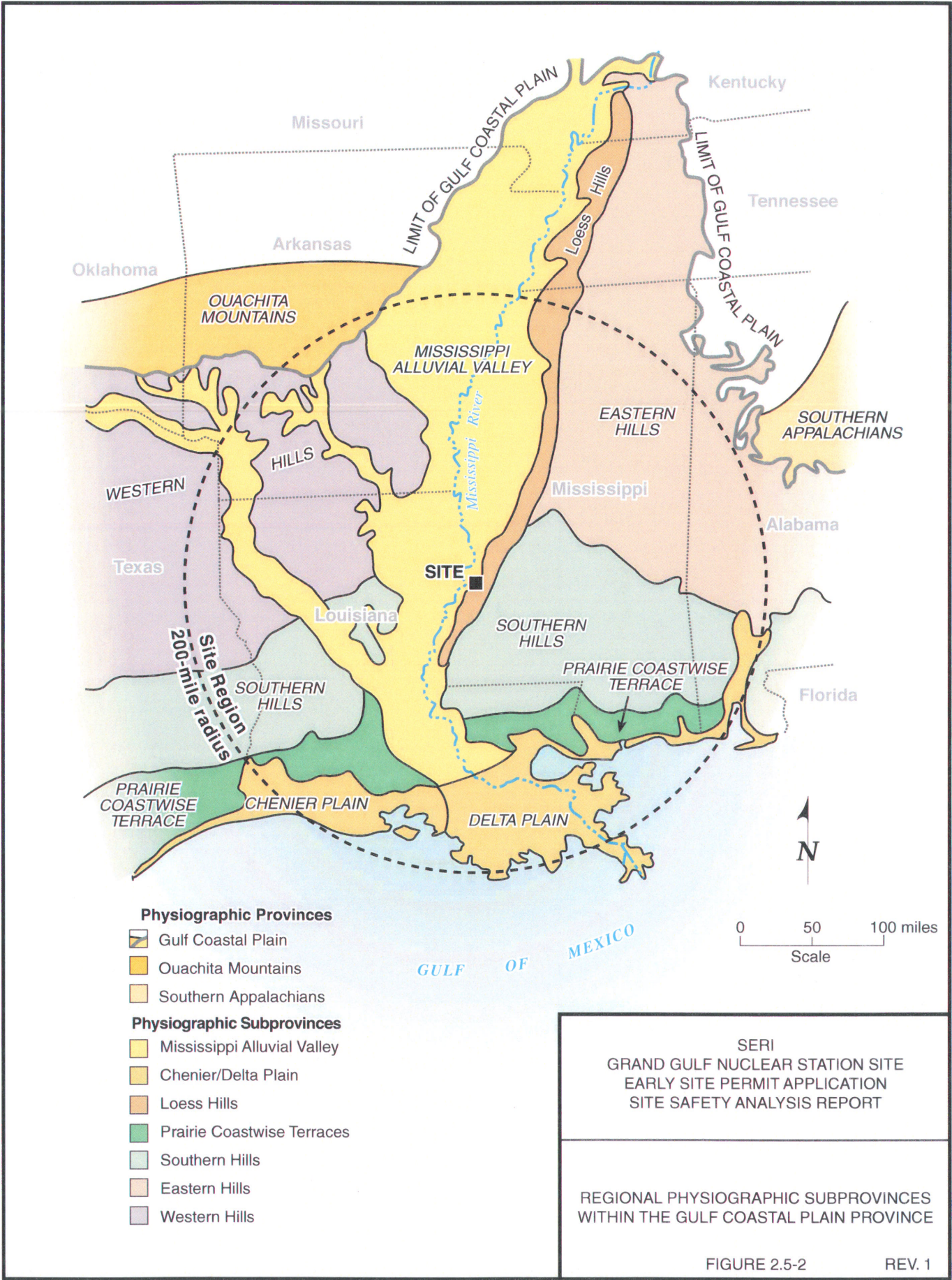


- Explanation**
- Grand Gulf Site
 - Major city
 - Major river
 - Interstate highway
 - State boundary

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 EARLY SITE PERMIT APPLICATION
 SITE SAFETY ANALYSIS REPORT

DEFINITION OF SITE INVESTIGATION AREAS

FIGURE 2.5-1 REV. 1

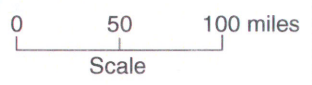


Physiographic Provinces

- Gulf Coastal Plain
- Ouachita Mountains
- Southern Appalachians

Physiographic Subprovinces

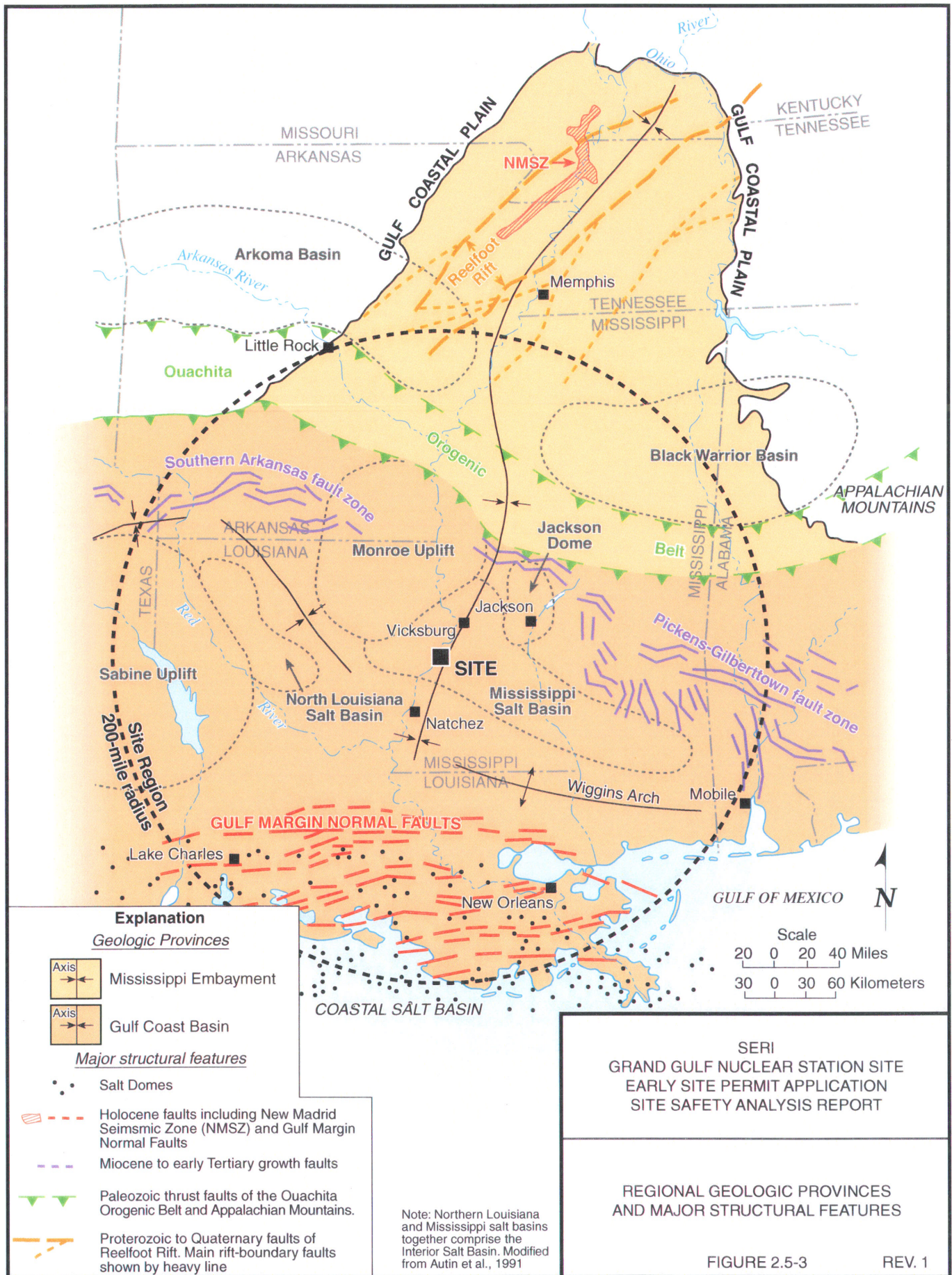
- Mississippi Alluvial Valley
- Chenier/Delta Plain
- Loess Hills
- Prairie Coastwise Terraces
- Southern Hills
- Eastern Hills
- Western Hills



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REGIONAL PHYSIOGRAPHIC SUBPROVINCES
 WITHIN THE GULF COASTAL PLAIN PROVINCE

FIGURE 2.5-2 REV. 1

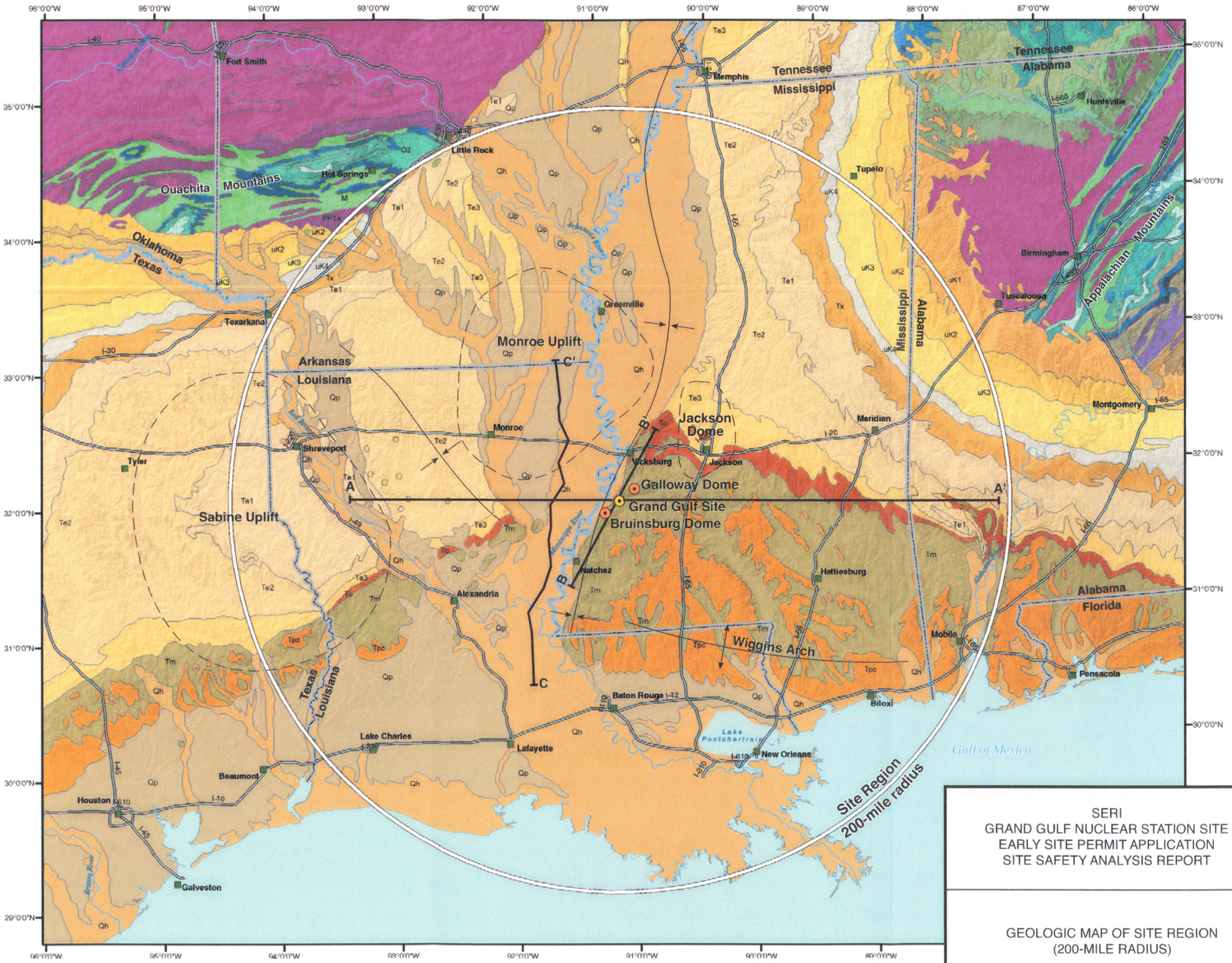
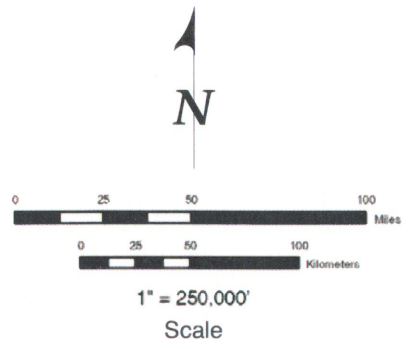


- Explanation**
- Salt dome
 - Grand Gulf Site
 - Major city
 - Major river
 - Interstate highway
 - State boundary
 - ↕ Syncline
 - ↕ Anticline
 - A A' Cross section

Map units are described on Figure 2.5-4b

Geology from Schruben, P.G., Arndt, R.E., Bawiec, W.J., digital representation of King, P.B., and Beikman, H.M., 1974, Geology of the conterminous United States at 1:2,500,000 scale, Digital Data Series II, release 2.











Cross-sections are plotted to show respective locations only. Cross-sections A and B are from Reference 16. Cross-section C is from Louisiana Geological Survey (1984).



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GEOLOGIC MAP OF SITE REGION
(200-MILE RADIUS)

Explanation

	Qh, Holocene; includes loess, alluvial, deltaic, beach, backswamp, and Mississippi River meander belt deposits.
	Qp, Pleistocene; includes loess, terrace, Praire Complex, Intermediate Complex, Upland Complex (Lafayette and Citronelle gravels), and Deweyville Terrace deposits.
	Tpc, Pliocene; Upland Complex (Lafayette and Citronelle gravels).
	Tm, Miocene; includes Catahoula, Pascagoula, Hattiesburg, and Flemming Formations.
	To, Oligocene; includes Forest Hill formation and Vicksburg Group (Bucatanna, Byram Marl, Glendon Limestone, and Mint Springs formations).
	Te3, Eocene; Jackson Group (Yazoo Clay and Moody's Branch formations).
	Te2, Eocene; Claiborne Group (undifferentiated).
	Te1, Eocene; Wilcox Group.
	Tx, Paleocene; Midway Group (Porters Creek Clay and Clayton formation).
	Uk4, Upper Cretaceous; Navarro Group, Arkadelphia Marl, and Nacatoch Sand.
	Uk3, Upper Cretaceous; Taylor Group, and Selma Group
	Uk2, Upper Cretaceous; Austin and Eagle Ford Groups, Tuscaloosa Formation, and Eutaw Formation.
	Uk1, Upper Cretaceous; undifferentiated.
	Ki, Cretaceous; intrusive rocks.
	PP1a, Pennsylvanian; undifferentiated.
	M, Mississippian; undifferentiated.
	DS, Devonian and Silurian; undifferentiated.

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GEOLOGIC MAP UNIT DESCRIPTIONS
 FOR GEOLOGIC MAP OF SITE REGION

Explanation

- Grand Gulf Site
- Major city
- Major river
- State boundary

Fault Zones

- Quaternary/Holocene
- Possible Quaternary
- Miocene
- Cretaceous
- Mississippian/Pennsylvanian
- Proterozoic
- Undifferentiated
- likely Paleozoic in North
- likely Miocene-Pliocene in South


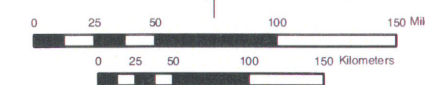
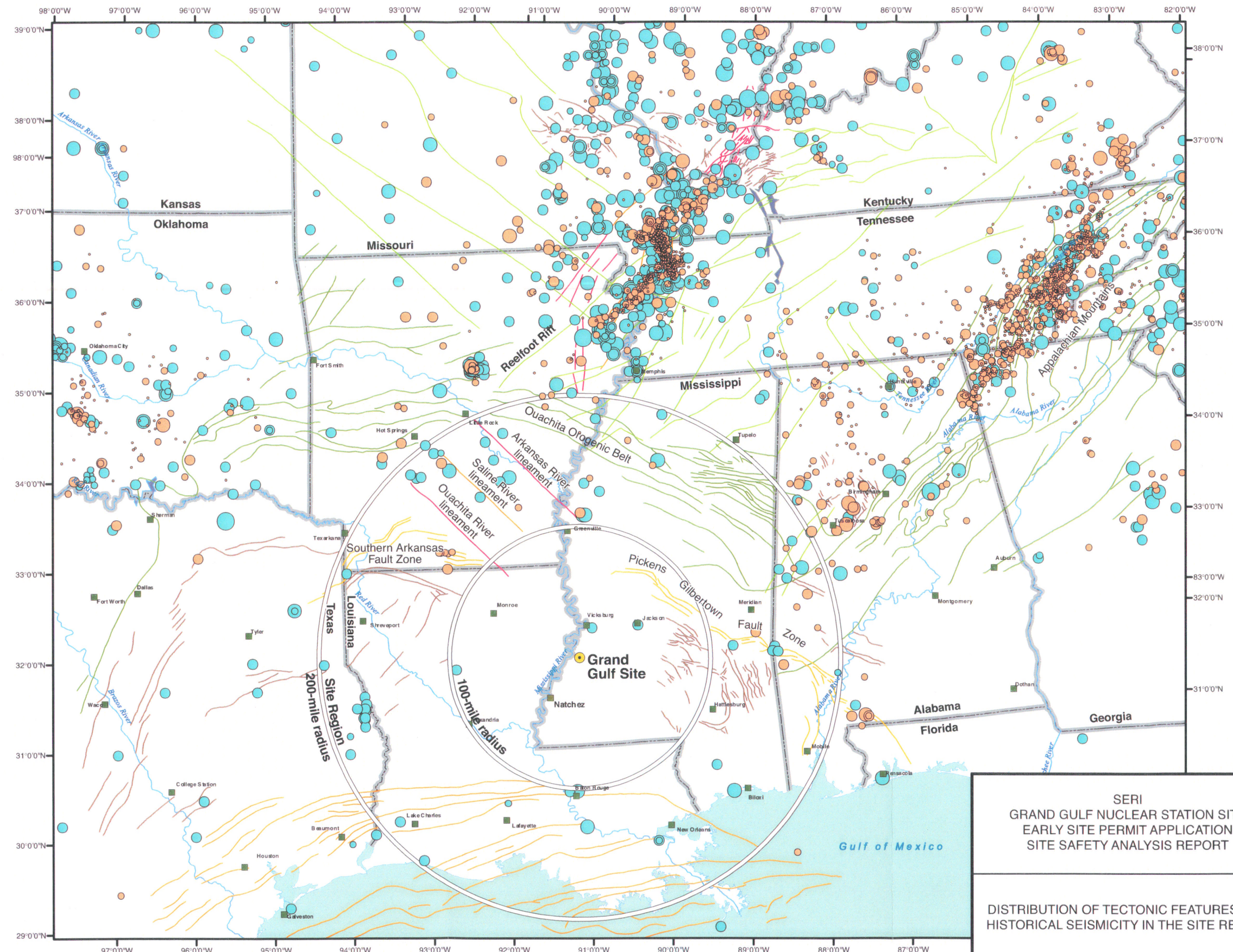
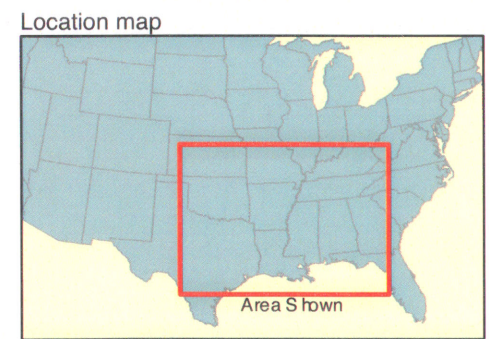
Seismic Activity (1627 - 1984)
Magnitude (Mb)

- 0.00 - 1.99
- 2.00 - 2.99
- 3.00 - 3.99
- 4.00 - 4.99
- 5.00 - 7.99

Seismic Activity (1985 - 2004)
Magnitude (Mb)

- 0.00 - 1.99
- 2.00 - 2.99
- 3.00 - 3.99
- 4.00 - 4.99
- 5.00 - 7.99

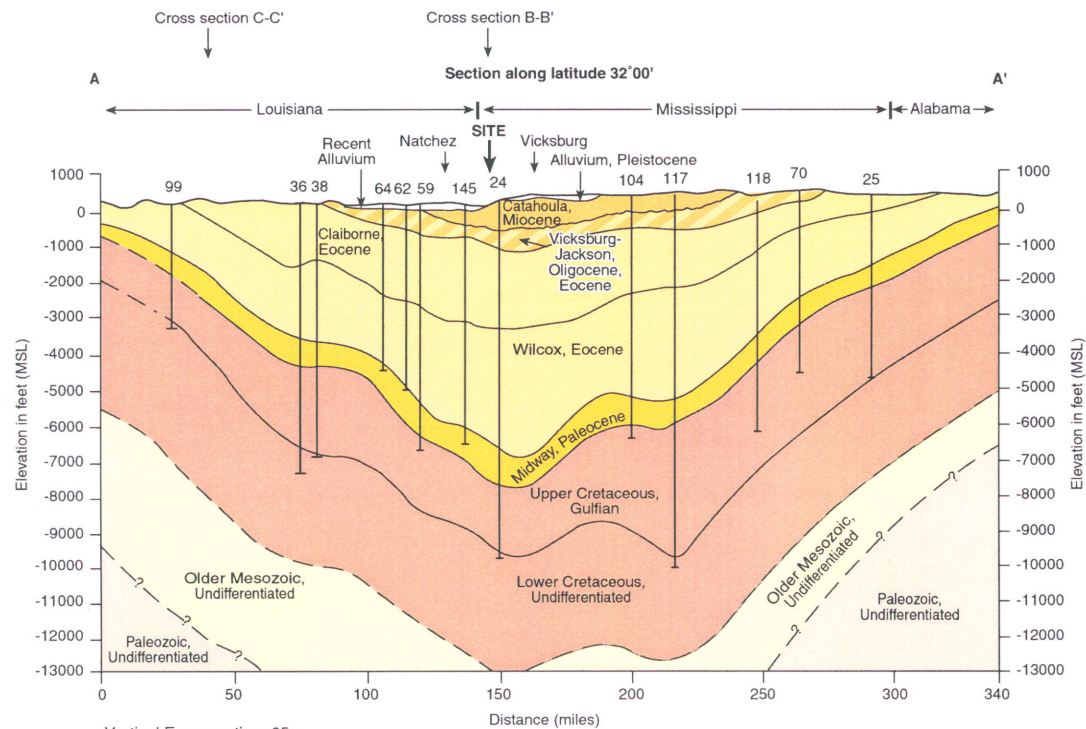
Pre-1985 seismicity from EPRI (1986) catalog and post-1984 seismicity from ANSS-CNSS (2004) composite catalog.

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DISTRIBUTION OF TECTONIC FEATURES AND
 HISTORICAL SEISMICITY IN THE SITE REGION

FIGURE 2.5-5 REV. 1



Vertical Exaggeration=65x

Explanation

Geology

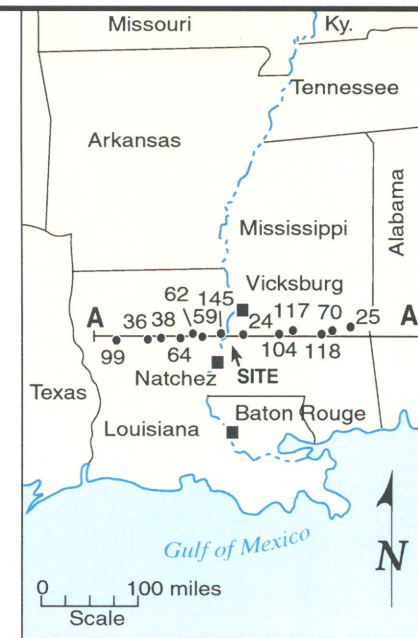
- Recent Alluvium
- M Miocene
- O/E Oligocene/Eocene
- E Eocene
- P Paleocene
- K Cretaceous
- J Older Mesozoic
- ? Paleozoic undifferentiated

Symbols

- 99 ↓ Previous boring
- Geologic contact
- - - Inferred geologic contact
- ? - Queried geologic contact
- Unconformity

References: Fisk, H.N., 1944, Geological investigations of the lower Mississippi River, Mississippi River Commission, Vicksburg Mississippi.

From Figure 2.5-19 of Ref. 16.



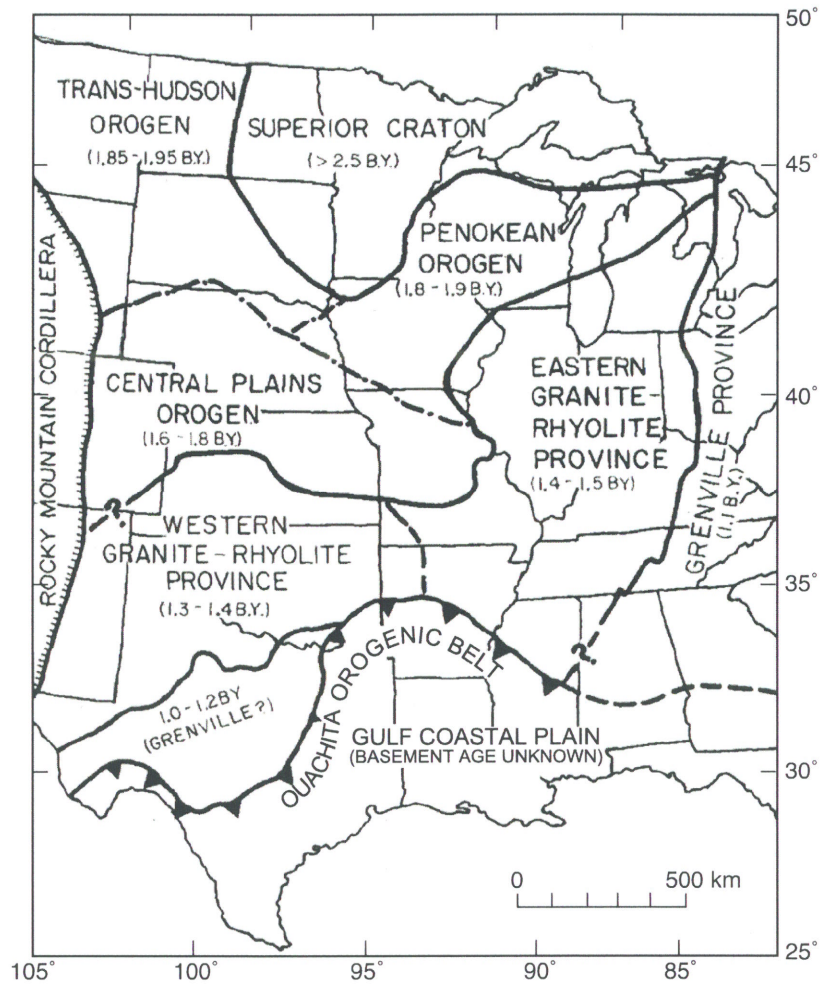
Location Map

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GEOLOGIC SECTION A-A' OF SITE REGION

FIGURE 2.5-6

REV. 1

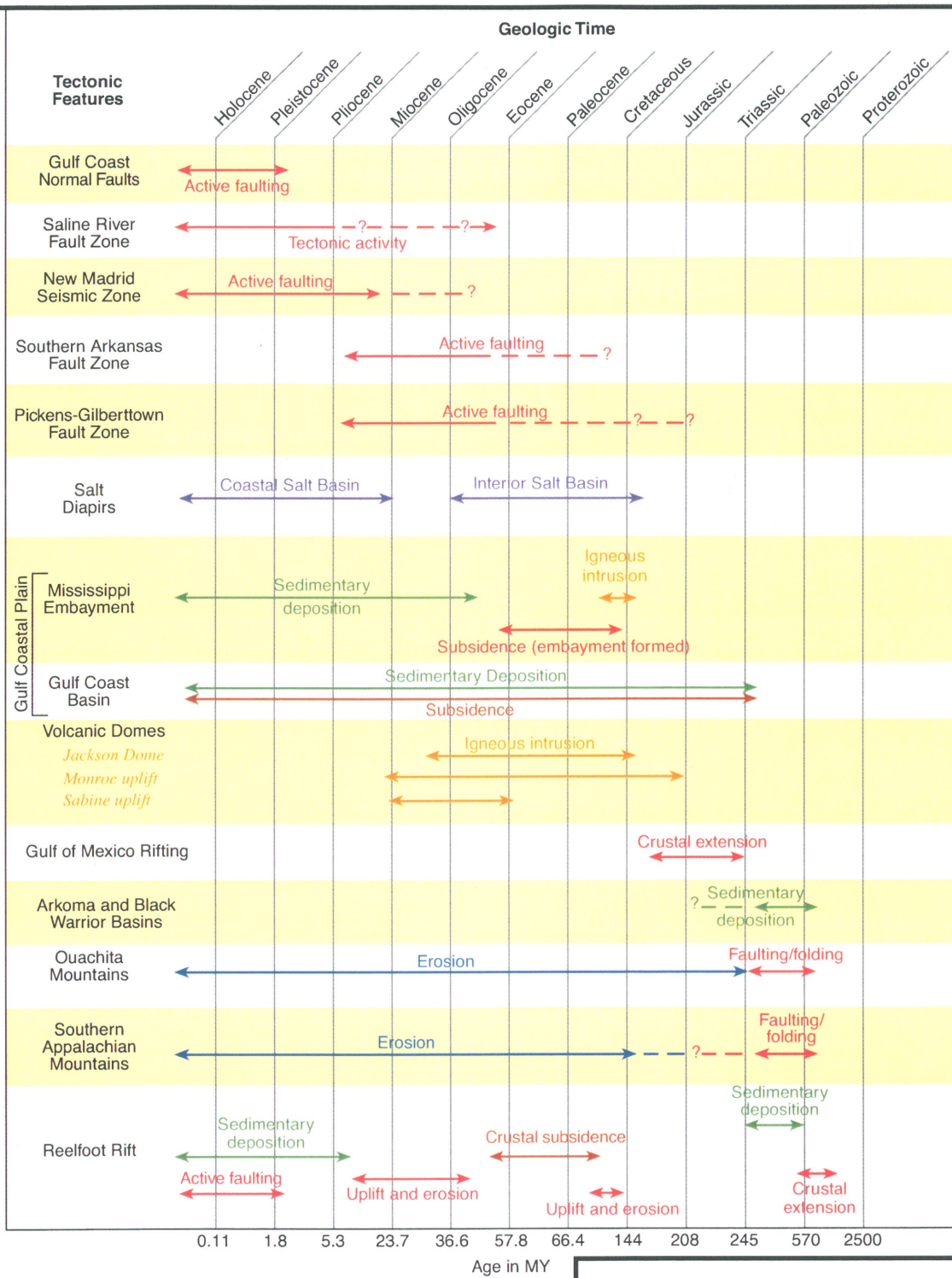


Age subdivisions of crust in the central U.S. The ages apply to the crystalline basement that is covered by Paleozoic strata over most of the region north of the Ouachita Orogenic Belt and are derived mainly from U-Pb dates on zircon from drill hole samples.

Modified from Johnston and Nava, 1990.

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MAJOR CRATONIC FEATURES OF
 CENTRAL UNITED STATES



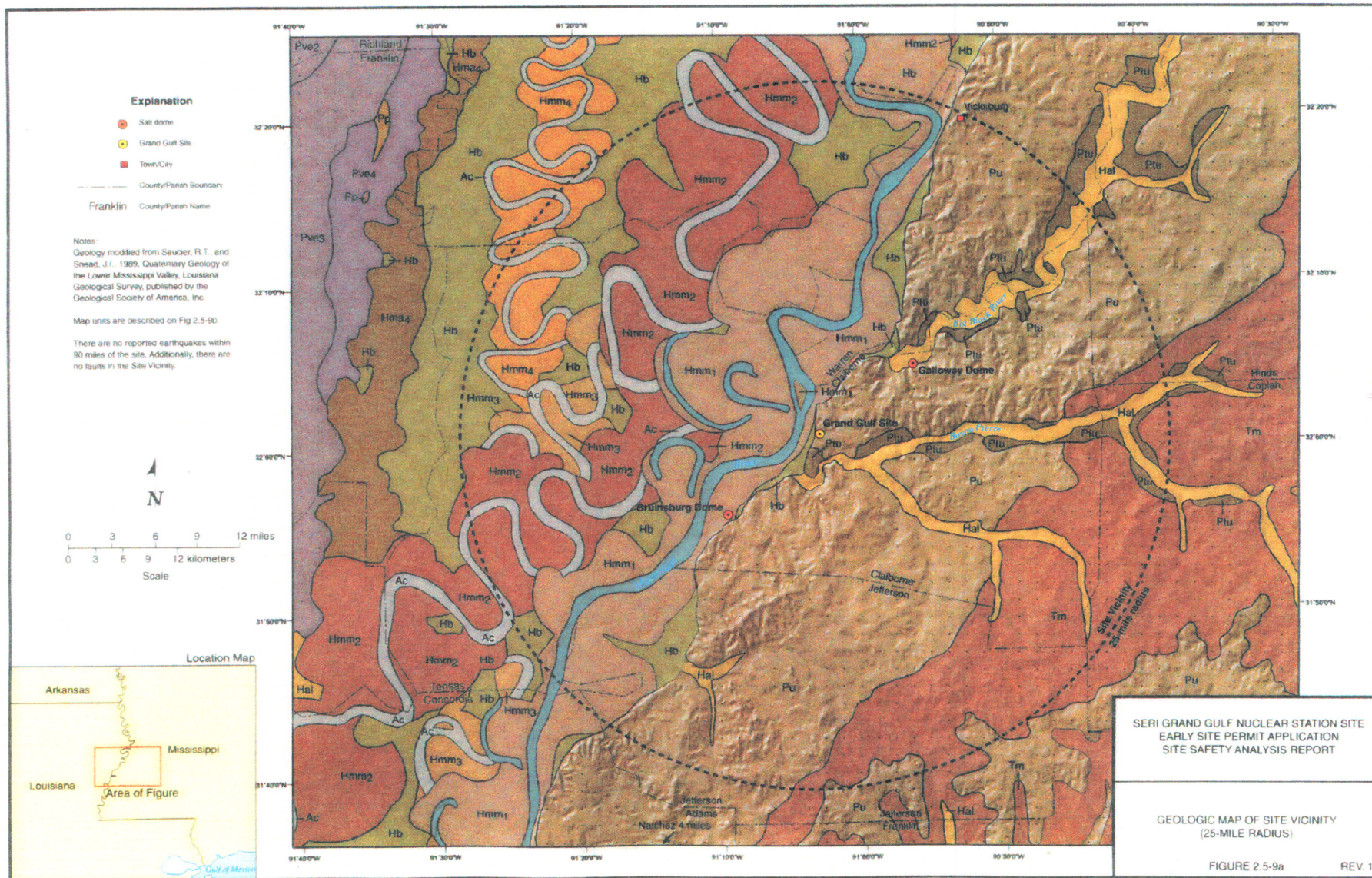
- Explanation**
- Sedimentary deposition
 - Tectonic activity
 - Erosion
 - Salt migration
 - Igneous intrusion
 - Crustal subsidence

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GENERALIZED SEQUENCE OF MAJOR
 GEOLOGIC EVENTS IN REGION

FIGURE 2.5-8

REV. 1



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 SITE SAFETY ANALYSIS REPORT

GEOLOGIC MAP OF SITE VICINITY
 (25-MILE RADIUS)

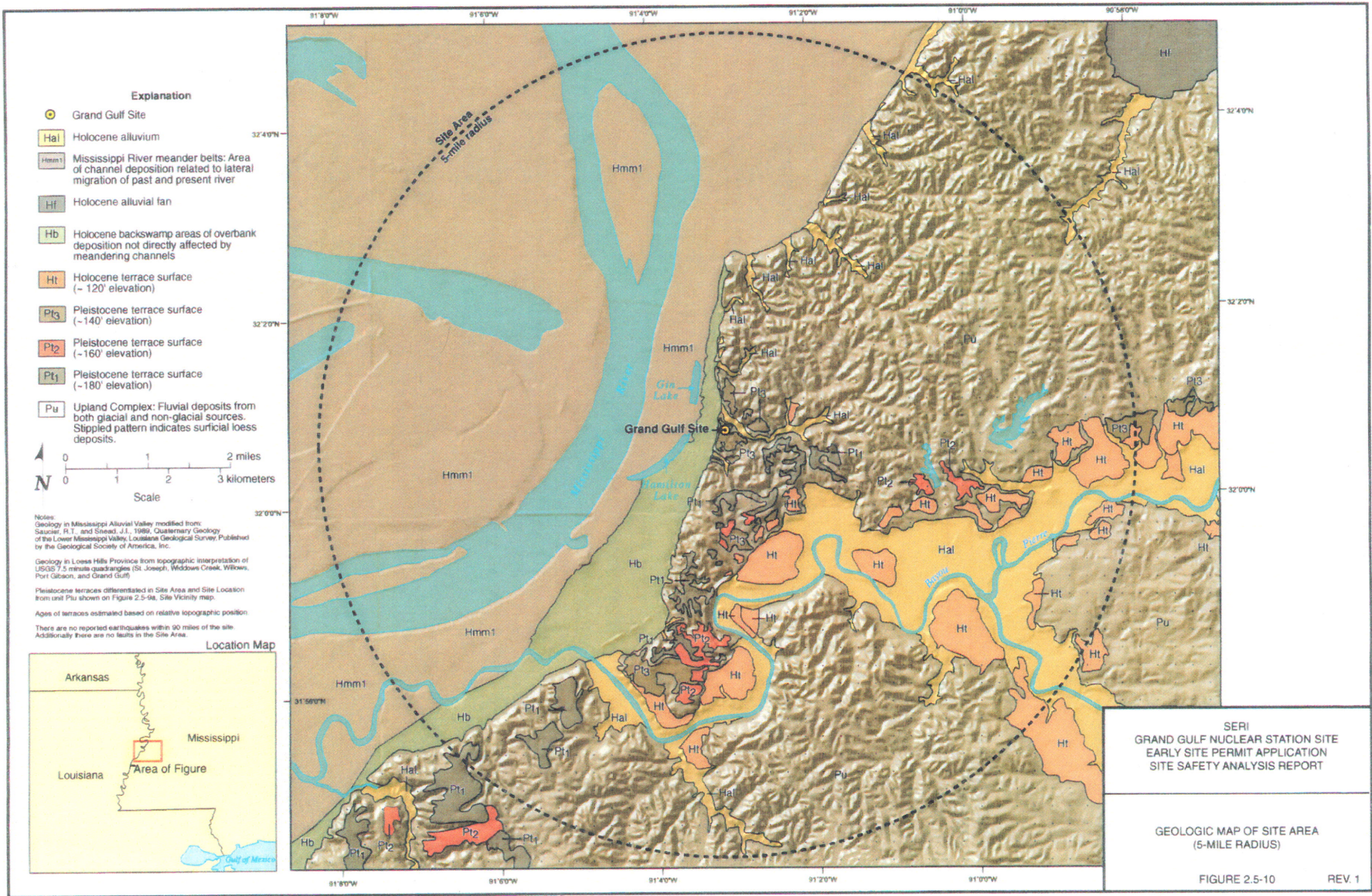
**Geologic
Map Units**

Descriptions

Hal	Alluvium: Undifferentiated on smaller streams.
Hmm1	Mississippi River meander belts: Areas of channel deposition related to lateral migration of past and present river. Final course positions are indicated but abandoned channels (cutoffs) are not delineated.
Hmm2	
Hmm3	
Hmm4	
Ac	Abandoned river course: Last course within each meander belt.
Hma4	Arkansas River meander belts: Areas of channel deposition related to lateral migration of past Arkansas River courses.
Hb	Backswamp: Areas of overbank deposition not directly affected by meandering channels.
Pve ₂₋₄	Valley train of early Wisconsin glaciation: Terraced outwash deposits of braided streams; five levels are recognized. Stippled pattern indicates surficial loess deposits.
Pp	Prairie Complex: A diverse depositional sequence of the Mississippi River, its tributaries, and costal plain streams; includes terraces, fluvial (meander belt and braided stream), colluvial, estuarine, deltaic, and marine units deposited over a considerable part of the late Pleistocene (Wisconsin to Sangamon); three levels are recognized but not mapped.
Pt _u	Pleistocene Terrace: Undifferentiated, probably Prairie Complex (Pp) stippled pattern indicates surficial loess deposits.
Pu	Upland complex: Fluvial deposits from both glacial and non-glacial sources. Stippled pattern indicates surficial loess deposits.
Tm	Tertiary and older formations: Undifferentiated. Stippled pattern indicates surficial loess deposits.

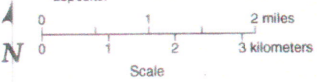
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GEOLOGIC MAP UNIT DESCRIPTIONS
FOR GEOLOGIC MAP OF SITE VICINITY



Explanation

- Grand Gulf Site
- Hal Holocene alluvium
- Hm Mississippi River meander belts: Area of channel deposition related to lateral migration of past and present river
- Hf Holocene alluvial fan
- Hb Holocene backswamp areas of overbank deposition not directly affected by meandering channels
- Ht Holocene terrace surface (~120' elevation)
- Pt3 Pleistocene terrace surface (~140' elevation)
- Pt2 Pleistocene terrace surface (~160' elevation)
- Pt1 Pleistocene terrace surface (~180' elevation)
- Pu Upland Complex: Fluvial deposits from both glacial and non-glacial sources. Stippled pattern indicates surficial loss deposits.



Notes:
 Geology in Mississippi Alluvial Valley modified from: Saucier, R.T. and Shead, J.L., 1989, Quaternary Geology of the Lower Mississippi Valley, Louisiana Geological Survey. Published by the Geological Society of America, Inc.
 Geology in Loess Hills Province from topographic interpretation of USGS 7.5 minute quadrangles (St. Joseph, Widows Creek, Wilcox, Port Gibson, and Grand Gulf).
 Pleistocene terraces differentiated in Site Area and Site Location from unit Pu shown on Figure 2.5-9a, Site Vicinity map.
 Ages of terraces estimated based on relative topographic position.
 There are no reported earthquakes within 50 miles of the site. Additionally there are no faults in the Site Area.

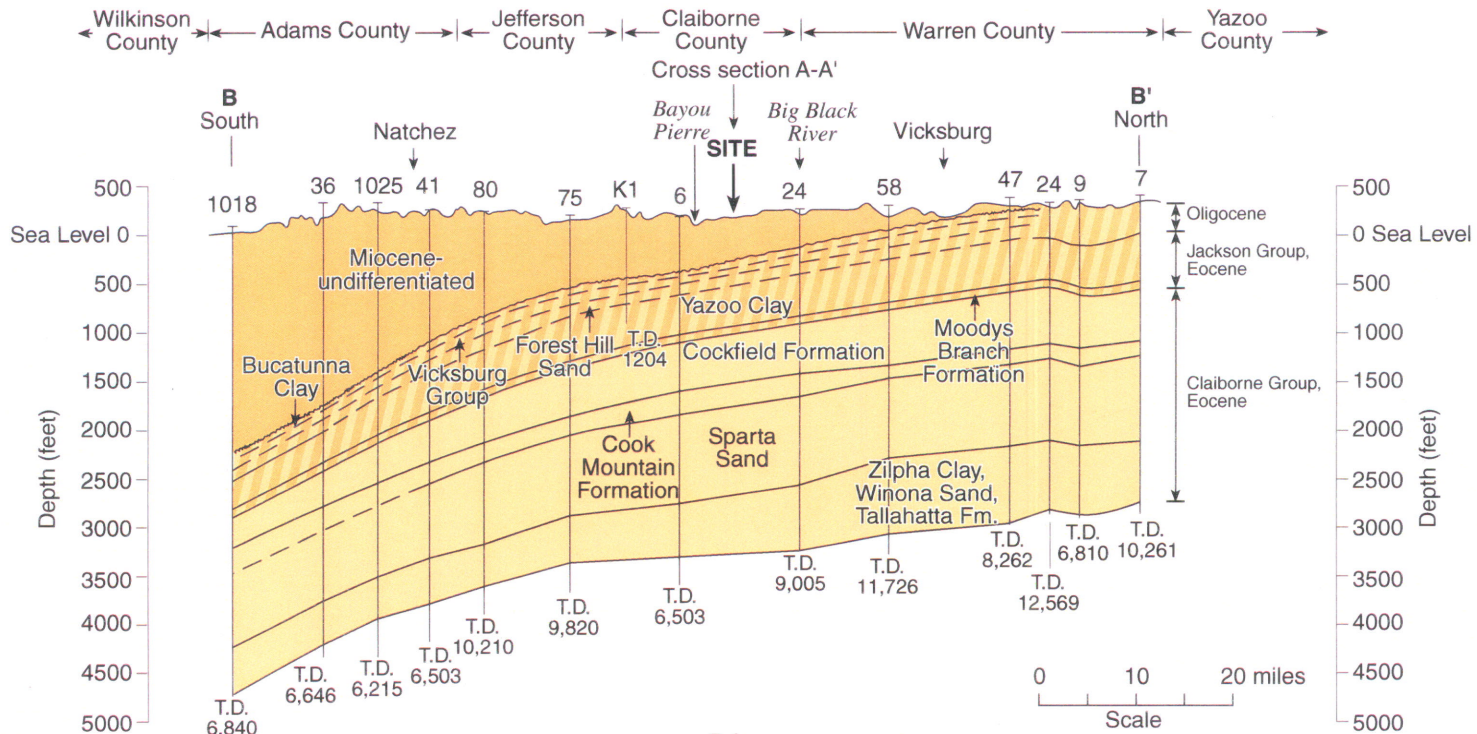
Location Map



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GEOLOGIC MAP OF SITE AREA
 (5-MILE RADIUS)

FIGURE 2.5-10 REV. 1



Vertical exaggeration=52.5x

Reference
Callahan, J.A., Skelton, J., Everett, D.R., Harvey, E.J., water Resources of Adams, Claiborne, Jefferson, and Warren Counties, Mississippi, Water Resources Bulletin, 63-1, 1963.

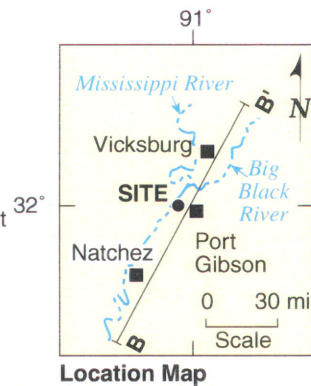
From Figure 2.5-35 of Ref 16.

Key to Electric Logs

- 1018 Serio-Punches Oil Co., No. 1 Booze-Fort
- 36 Callon and Tischener, No. 1 Gousett
- 1025 Duncan-Taylor and Schumacher, No. 1-A Stanton
- 41 S.C. and J.S. Callon, No. 1 Abbott
- 80 Ohio Oil Co., No. 1 Hardtimes Plantation
- 75 Union Oil Co., of California, No. 1 Wagner
- K1 Alcorn College, test hole
- 6 Serio, Justiss-Mears and Clements, No. 1 Wilson
- 24 Danciger Oil and Refining Co., No 1 Taylor
- 58 Union Producing Co., No. 1 Harlin
- 47 Magnolia Petroleum Co., No. 1 Field Estate
- 24 California Co., No.1S-1 Anderson-Tully
- 9 Roy Lee, Trustee, No. 1 Anderson-Tully
- 7 D.T. Dougherty, No. 1 Hintson

Explanation

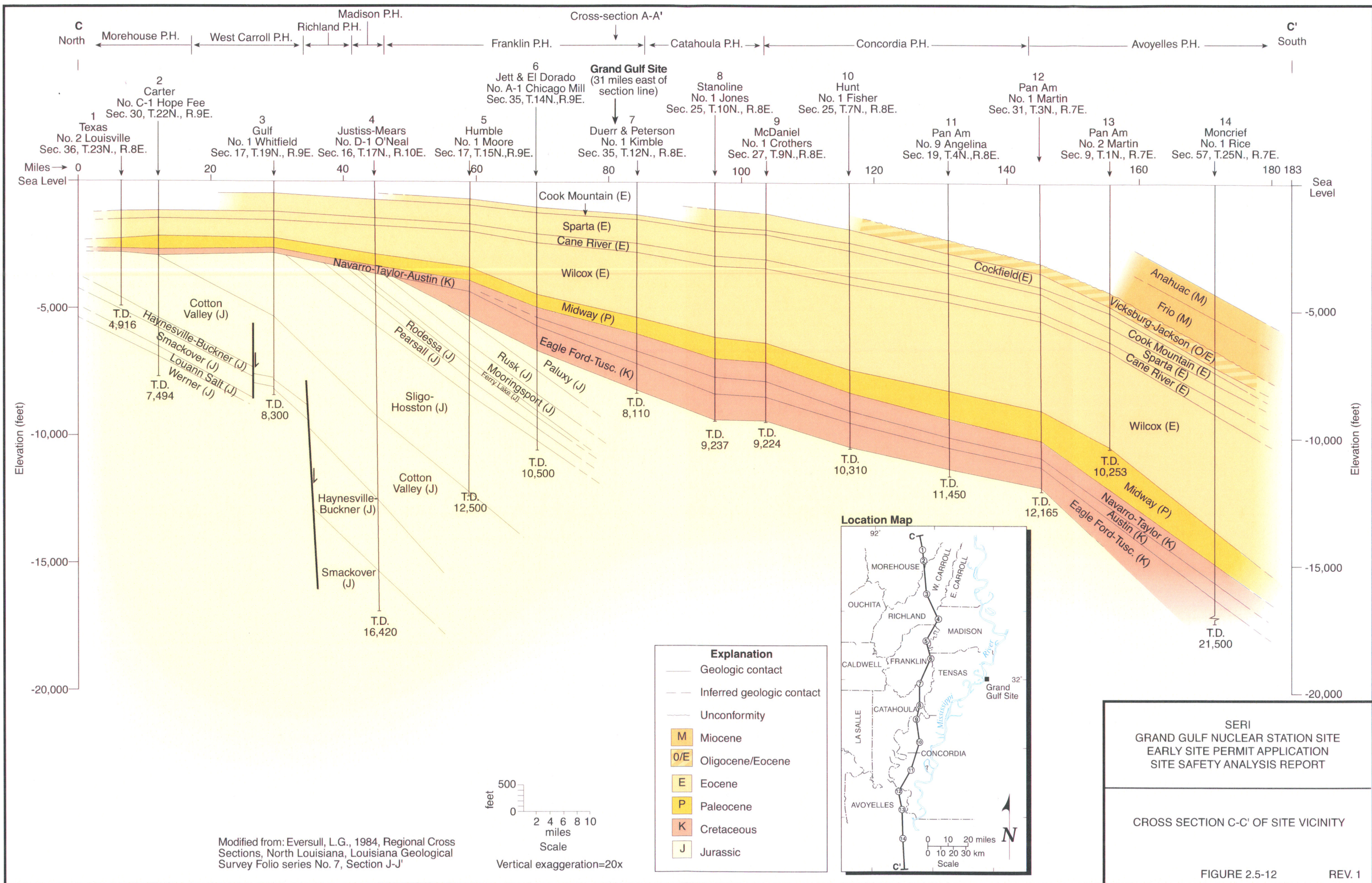
- Symbols*
- 36 ↑ Previous boring
 - Geologic contact
 - ~ Unconformity
 - - - Inferred geologic contact
- Geology*
- M Miocene
 - O/E Oligocene/Eocene
 - E Eocene



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CROSS SECTION B-B' OF SITE VICINITY

FIGURE 2.5-11 REV. 1



Modified from: Eversull, L.G., 1984, Regional Cross Sections, North Louisiana, Louisiana Geological Survey Folio series No. 7, Section J-J'

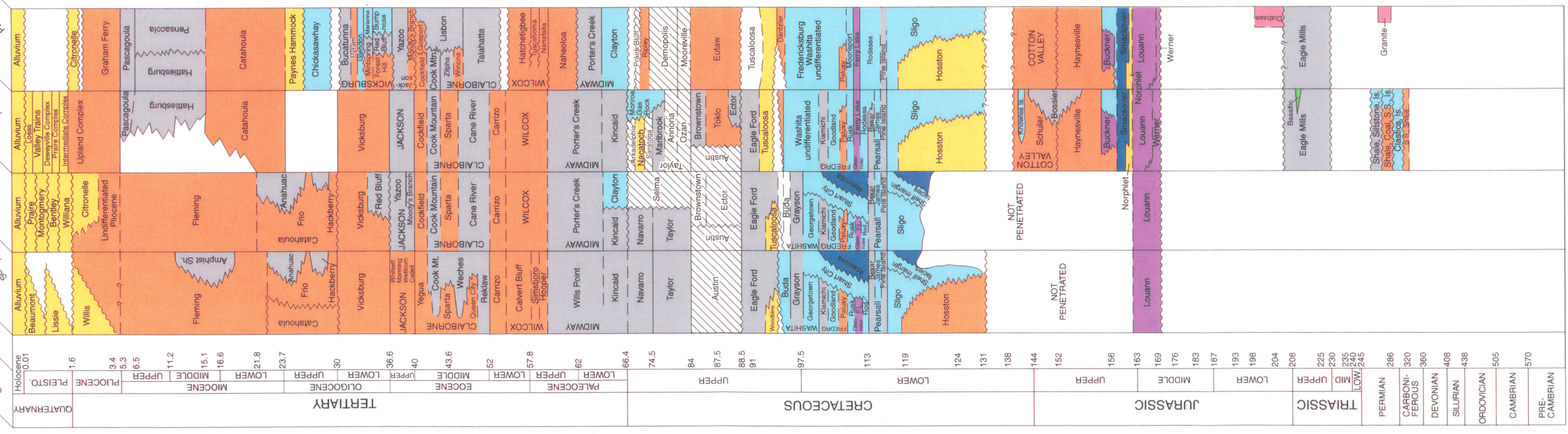
CHRONOSTRATIGRAPHIC UNITS SCALE (M)

1-SOUTHEAST TEXAS AND OFFSHORE

2-SOUTH LOUISIANA OFFSHORE

3-SOUTH ARKANSAS, NORTH LOUISIANA, AND MISSISSIPPI

4-SOUTHEAST MISSISSIPPI, FLORIDA PANHANDLE, AND OFFSHORE



Explanation

Dominant lithology

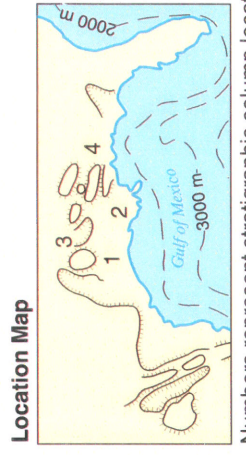
- Predominantly sandstone
- Shale, mudstone, siltstone
- Interbedded sandstone, siltstone, and shale
- Platform and platform-margin carbonates (grain carbonates and reefs)
- Chalk
- Evaporites
- Basinal carbonates, calcic shale, and shale
- Volcanic rocks
- Intrusive-igneous rocks
- Haitus

Contacts

- Conformable
- Unconformable
- Uncertain
- Precise age unknown

FREDRG Fredricksburg
 F.L. Ferrylake
 R.O.D. Rodessa
 ls Limestone
 ss Sandstone
 sh Shale

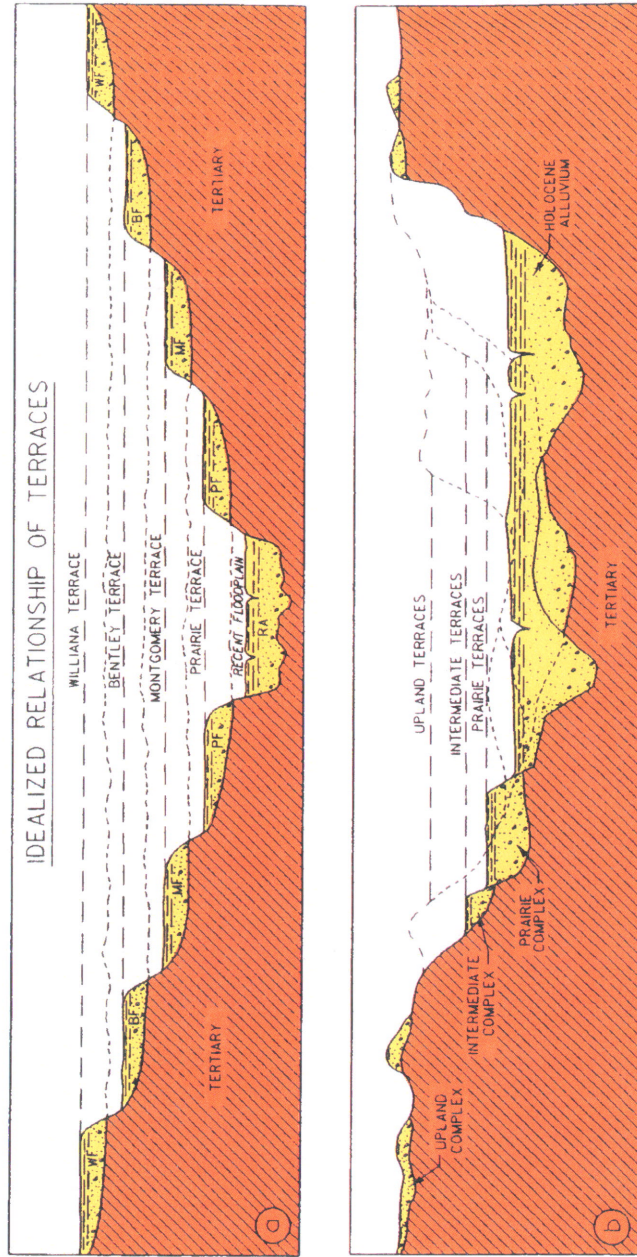
Note: Columns showing several laterally-grading units represent, whenever possible, transition from basin margin on the left to basin center on the right.
 From Salvador and Muñeton, 1991



Numbers represent stratigraphic column location

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STRATIGRAPHIC COLUMN FOR
 THE GULF COAST BASIN



Idealized cross section of the southern Mississippi Alluvial Valley comparing: (a) relationships of terraces from Fisk (1944); and (b) relationships of terraces from Autin et al. (1991).

From Autin et al., 1991 and Saucier, 1994.

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COMPARISON OF TERRACE MODELS
 ALONG THE MISSISSIPPI ALLUVIAL VALLEY

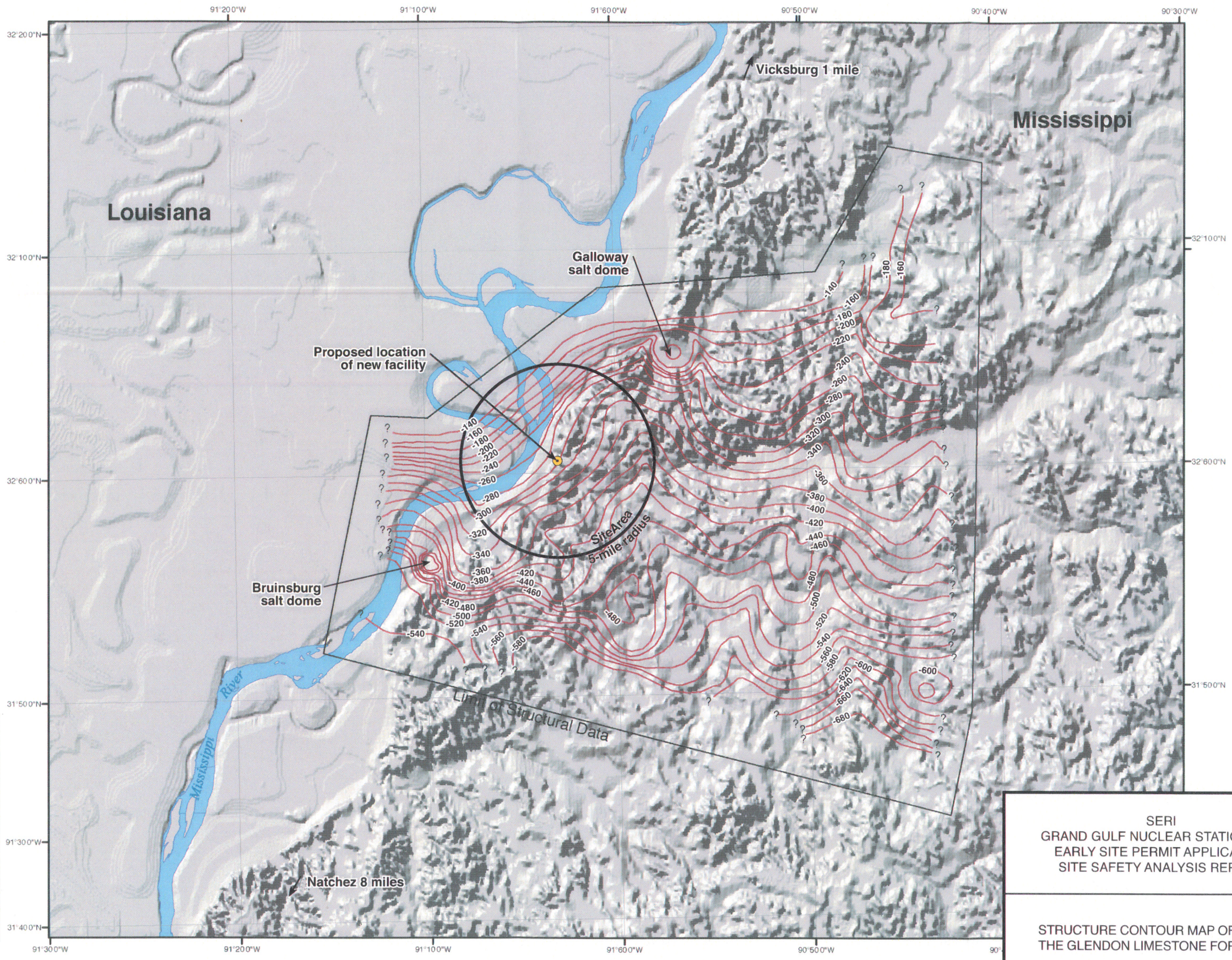
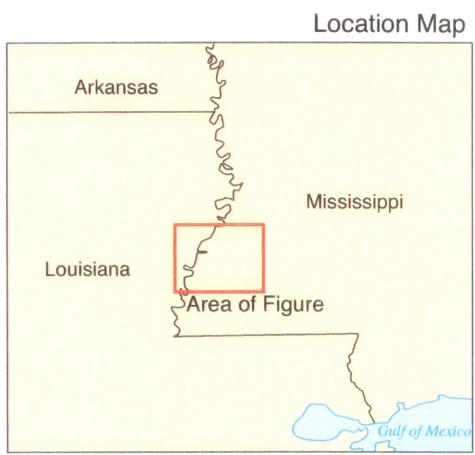
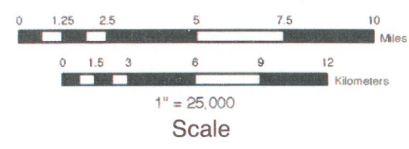
FIGURE 2.5-14

REV. 1

Explanation

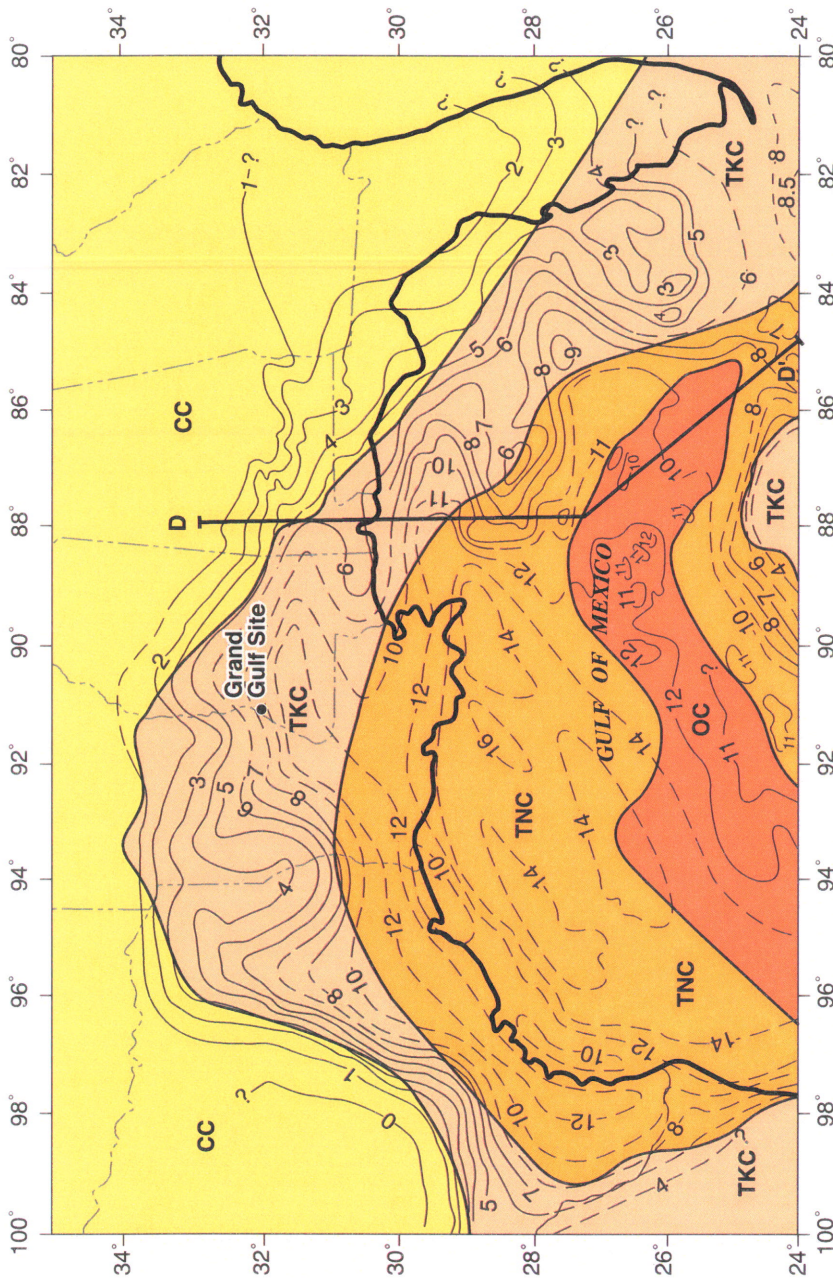
- Grand Gulf Site
- Contour of top of Glendon Limestone; contour interval = 20 feet

Data source: Figure 2.5-32 of Ref 16.



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STRUCTURE CONTOUR MAP OF TOP OF
 THE GLENDON LIMESTONE FORMATION



- Explanation**
- Continental crust
 - Thick transitional crust
 - Thin transitional crust
 - Oceanic crust

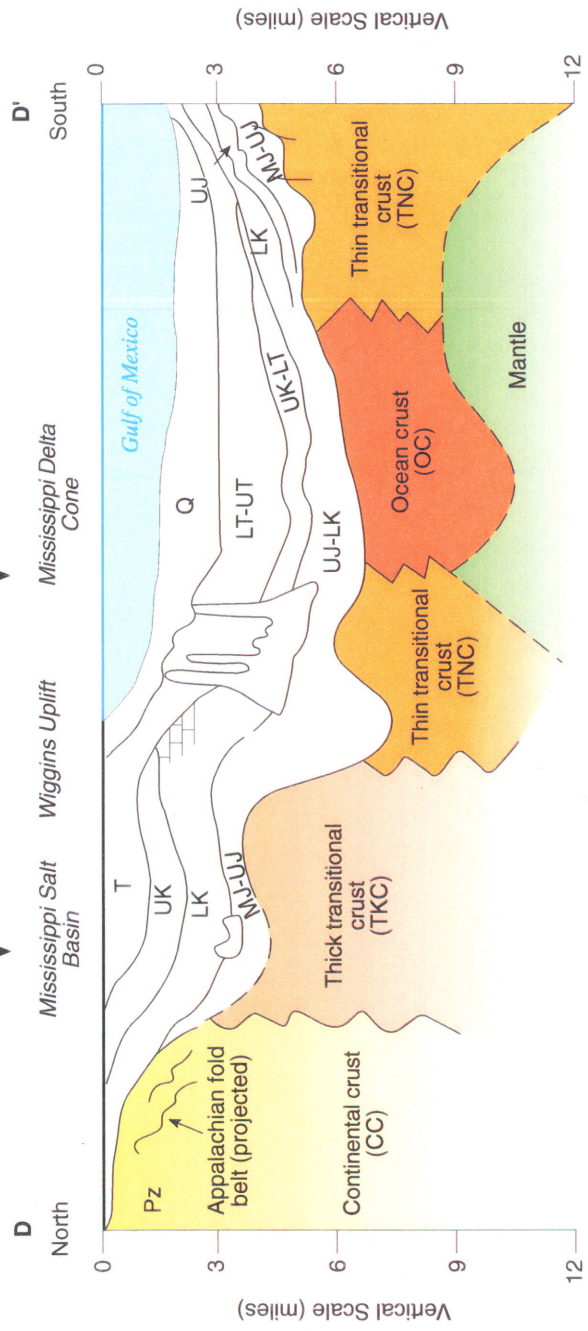
Note: to convert depths from kilometers to miles, multiply depth shown by 0.6.
 Modified from Sawyer et al., 1991

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DEPTH TO BASEMENT AND CRUSTAL
 TYPES, GULF COAST BASIN

FIGURE 2.5-16a REV. 1

Grand Gulf Site
(projected)



Explanation

- Q Quaternary
- T Tertiary
- UT Upper Tertiary
- LT Lower Tertiary
- UK Upper Cretaceous
- LK Lower Cretaceous
- UJ Upper Jurassic
- MJ Middle Jurassic
- PZ Paleozoic



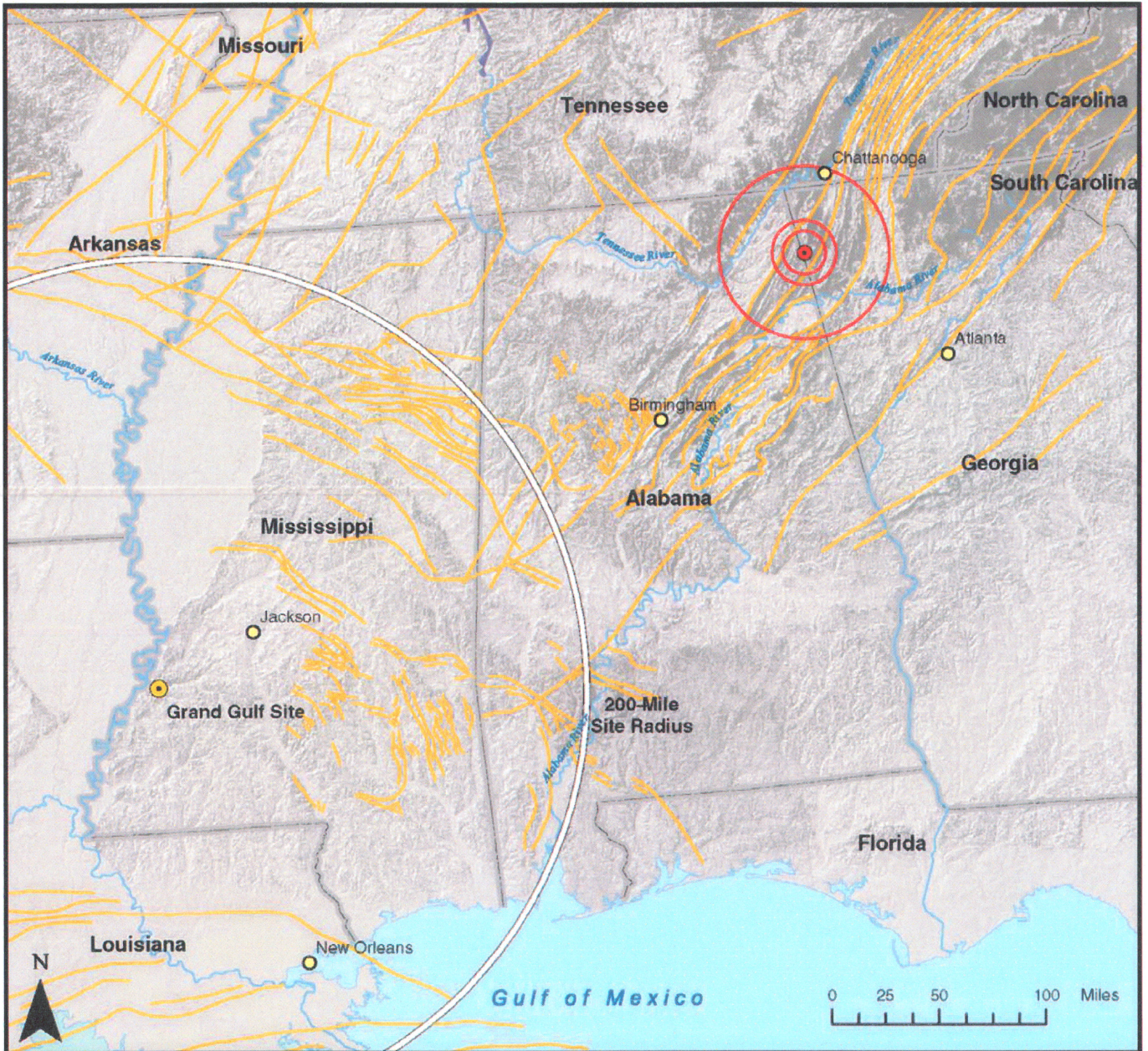
Note:
Modified from Sawyer et al., 1991
Depth to basement beneath Grand Gulf Site Location
is 5.4 miles (9.0km)




See Figure 2.5-16a for cross-section location

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GEOLOGIC SECTION D-D'

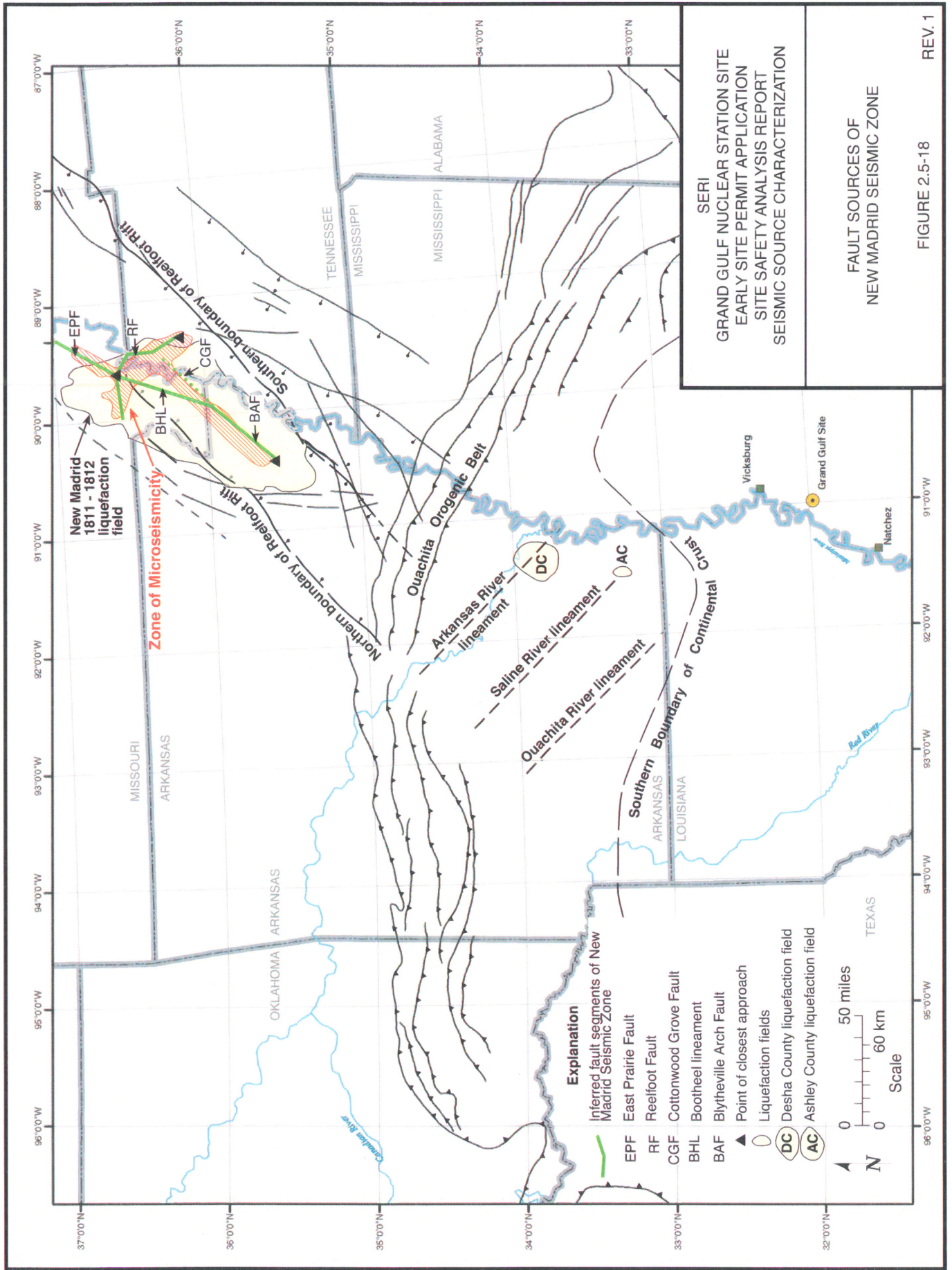
FIGURE 2.5-16b
REV. 1



Explanation	
	Faults
	Cities
	Fort Payne Alabama earthquake, Tuesday April 29, 2003, 08:59:36. Magnitude = Mw = 4.9. Depth = 5 km. Location 34.55N, 85.50W.

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MAP SHOWING LOCATION OF
 FORT PAYNE, ALABAMA
 EARTHQUAKE, APRIL 29, 2003



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 EARLY SITE PERMIT APPLICATION
 SITE SAFETY ANALYSIS REPORT
 SEISMIC SOURCE CHARACTERIZATION

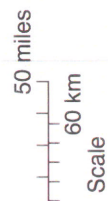
FAULT SOURCES OF
 NEW MADRID SEISMIC ZONE

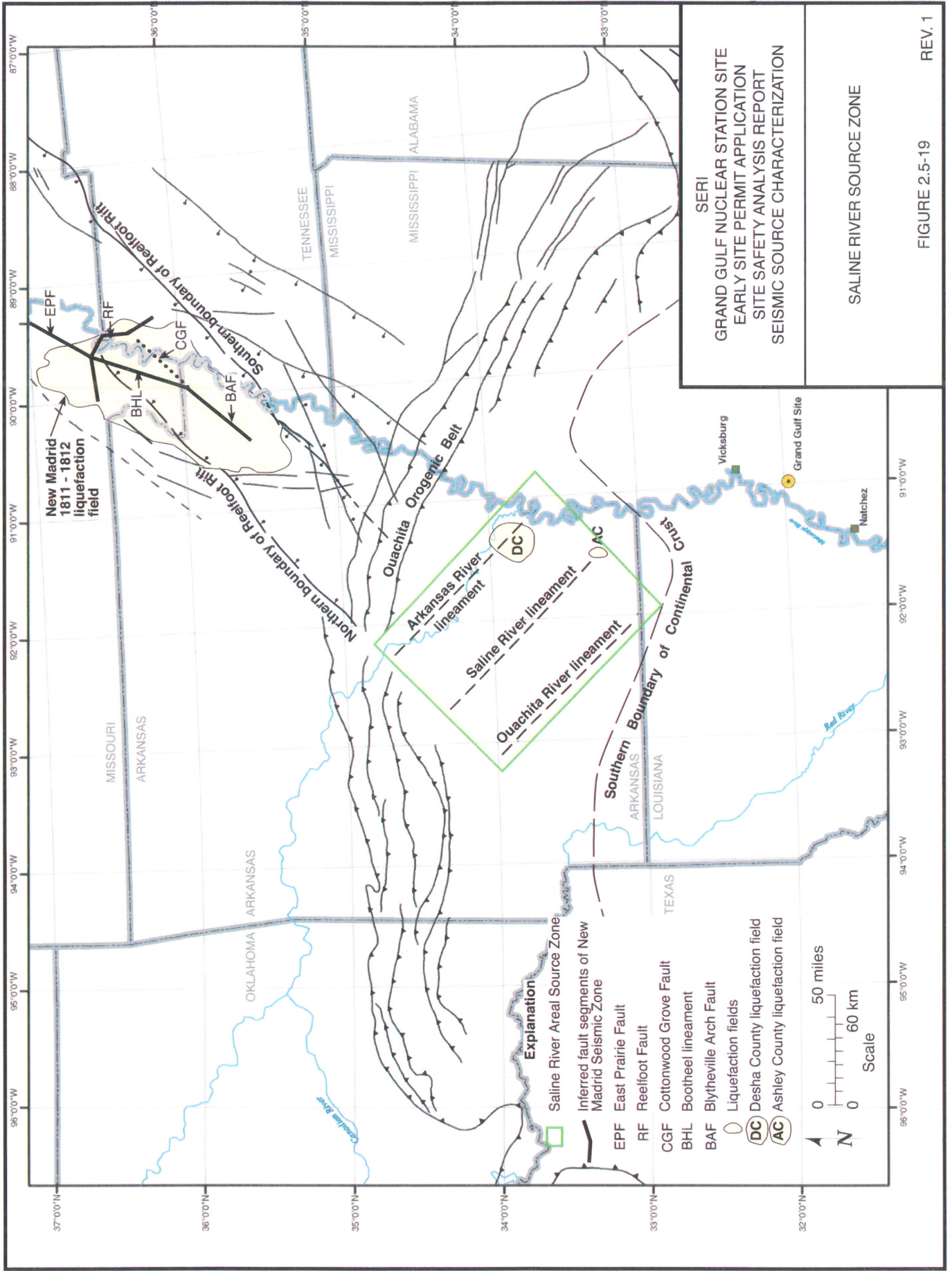
FIGURE 2.5-18

REV. 1

Explanation

- Inferred fault segments of New Madrid Seismic Zone
- East Prairie Fault (EPF)
- Reelfoot Fault (RF)
- Cottonwood Grove Fault (CGF)
- Bootheel lineament (BHL)
- Blytheville Arch Fault (BAF)
- Point of closest approach (▲)
- Liquefaction fields (○)
- Desha County liquefaction field (DC)
- Ashley County liquefaction field (AC)

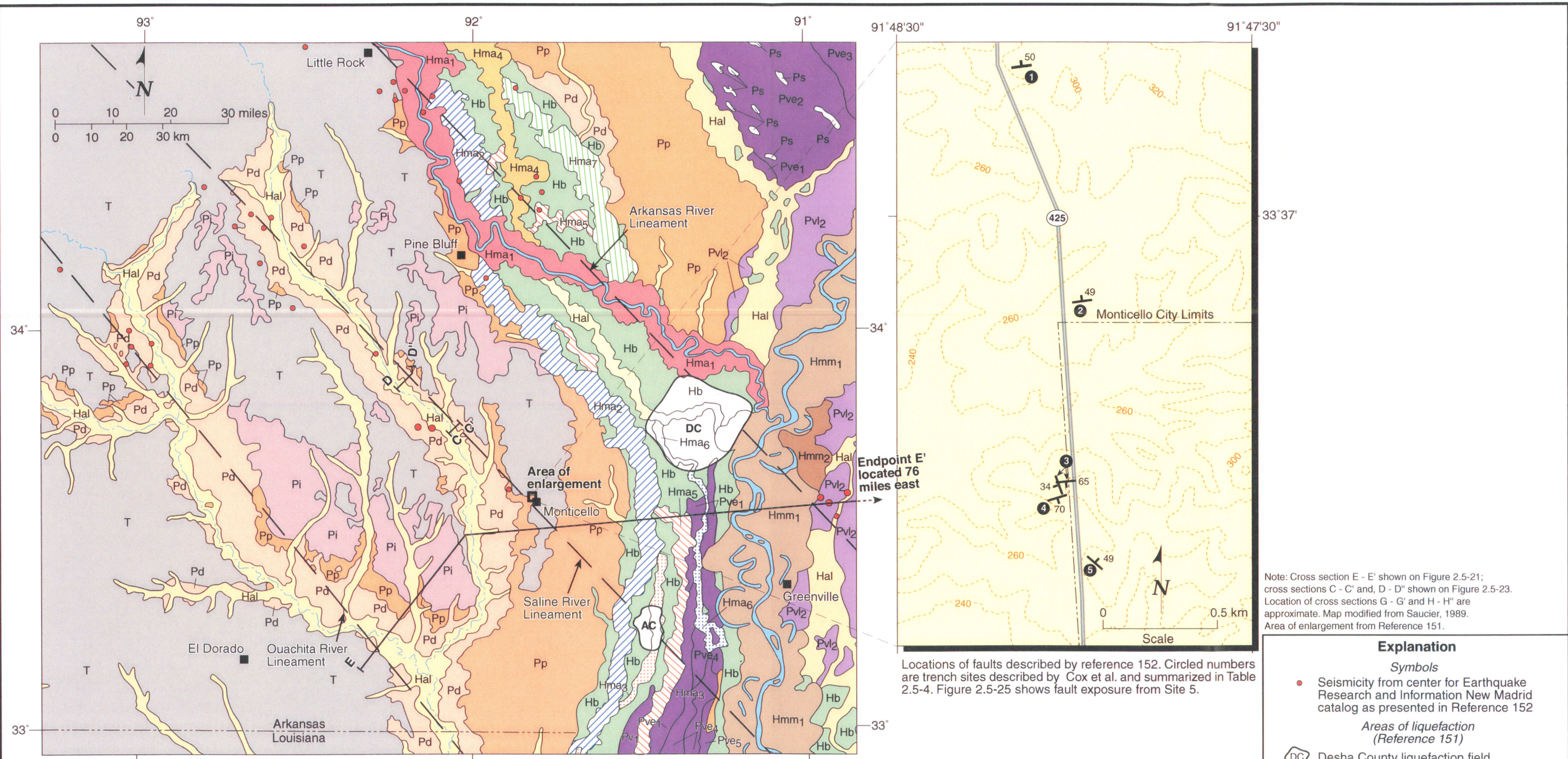




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 SITE SAFETY ANALYSIS REPORT
 SEISMIC SOURCE CHARACTERIZATION

SALINE RIVER SOURCE ZONE

FIGURE 2.5-19



Note: Cross section E - E' shown on Figure 2.5-21; cross sections C - C' and D - D' shown on Figure 2.5-23. Location of cross sections G - G' and H - H' are approximate. Map modified from Saucier, 1989. Area of enlargement from Reference 151.

Locations of faults described by reference 152. Circled numbers are trench sites described by Cox et al. and summarized in Table 2.5-4. Figure 2.5-25 shows fault exposure from Site 5.

Explanation

Symbols

- Seismicity from center for Earthquake Research and Information New Madrid catalog as presented in Reference 152

Areas of liquefaction (Reference 151)

- DC Desha County liquefaction field
- AC Ashley County liquefaction field

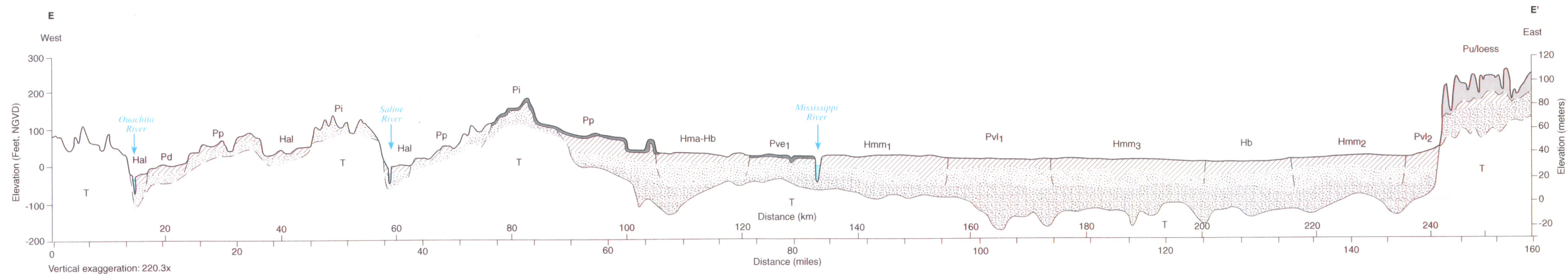
Explanation
Geologic Units

- Hal Alluvium: Undifferentiated in smaller streams.
- Hb Backswamp: Areas of overbank deposition not directly affected by meandering channels.
- Hmm_(1,2) Mississippi River meander belts: Areas of channel deposition related to lateral migration of past and present river. Final course positions are indicated, but abandoned channels (cutoffs) are not delineated.
- Hma₍₁₋₇₎ Arkansas River meander belts: Areas of channel deposition related to lateral migration of past Arkansas River courses.
- Pve₍₁₋₃₎ Valley train of early Wisconsin glaciation: Terraced outwash deposits of braided streams; five levels are recognized. Stippled pattern indicates surficial loess deposits.
- Pp Prairie Complex: A diverse depositional sequence of the Mississippi River, its tributaries, and coastal plain streams; includes terraces, fluvial (meander belt and braided stream), colluvial, estuarine, deltaic, and marine units deposited over a considerable part of the late Pleistocene (Wisconsin to Sangamon); three levels are recognized, but not mapped.
- T Tertiary and older formations: Undifferentiated. Stippled pattern indicates surficial loess deposits.
- Pv₁₂ Pleistocene valley train deposits of late Wisconsin age.
- Pd Pleistocene Deweyville complex terraces
- Pi Pleistocene intermediate complex terraces
- 49 Strike and dip of fault plane observed in trenches of Reference 152

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GEOLOGIC MAP IN VICINITY OF SALINE RIVER
SHOWING SEISMICITY,
LIQUEFACTION, AND FAULTS

FIGURE 2.5-20 REV. 1

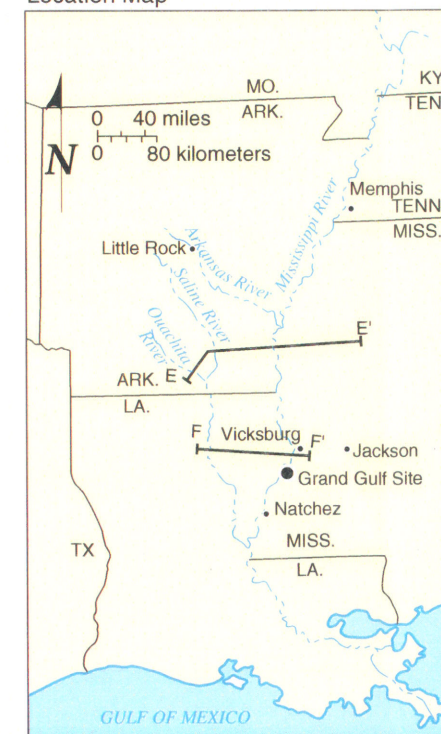


Explanation

- | | | | |
|--|------------------|----------|--|
| | Loess veneer | Hal | Holocene alluvium undifferentiated |
| | Loess | Hmm(1-3) | Holocene Mississippi River meander belt |
| | Clay and silt | Hma | Holocene Arkansas River meander belt |
| | Sand | Hb | Holocene backswamp |
| | Sand and gravel | Pd | Pleistocene Deweyville Complex |
| | Tertiary | Pvl(1-2) | Pleistocene Valley train of late Wisconsin age |
| | Geologic contact | Pp | Pleistocene Praire Complex |
| | NGVD | Pi | Pleistocene Intermediate Complex |
| | | Pu | Pleistocene Upland Complex |
| | | T | Tertiary undifferentiated |

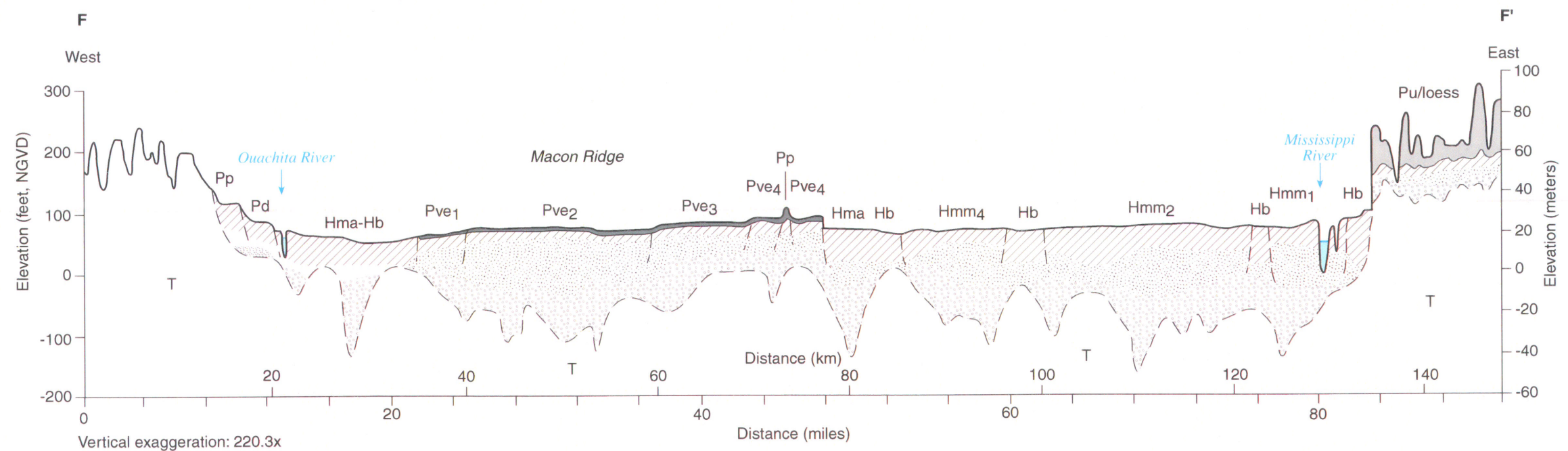
Note:
 From Saucier, 1991, Quaternary Nonglacial
 Geology: Conterminous United States, The
 Geology of North America, Vol. K-2, Geological
 Society of America, Plate 7, Lower Mississippi
 Valley cross section D-D'.

Location Map











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CROSS SECTION E - E'



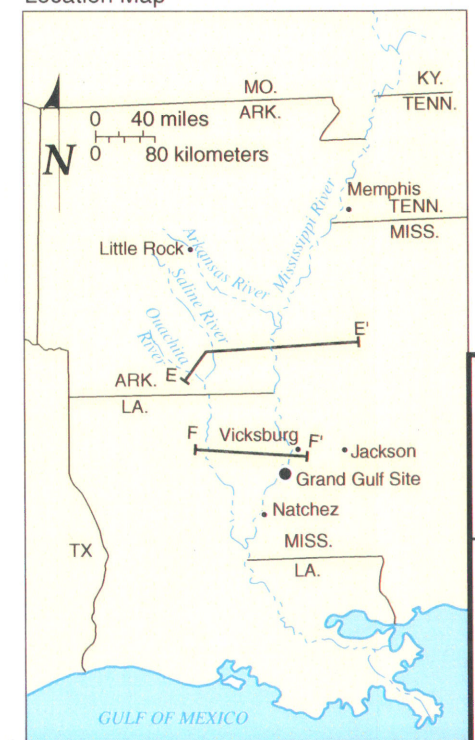
Explanation

- | | | | |
|---|------------------|------------|---|
|  | Loess veneer | Hmm(1,2,4) | Holocene Mississippi River meander belt |
|  | Loess | Hma | Holocene Arkansas River meander belt |
|  | Clay and silt | Hb | Holocene backswamp |
|  | Sand | Pd | Pleistocene Dewyeville Complex |
|  | Sand and gravel | Pve(1-4) | Pleistocene Valley train of early Wisconsin age |
|  | Tertiary | Pp | Pleistocene Praire Complex |
|  | Geologic contact | Pu | Pleistocene Upland Complex |
|  | NGVD | T | Tertiary undifferentiated |

Notes:
 Ouachita River now occupies the Holocene Arkansas River meander belt. The Arkansas River changed its course through avulsion in late Holocene time.

From Saucier, 1991, Quaternary Nonglacial Geology: Conterminous United States, The Geology of North America, Vol. K-2, Geological Society of America, Plate 7, Lower Mississippi Valley cross section E-E'.

Location Map



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CROSS SECTION F - F'