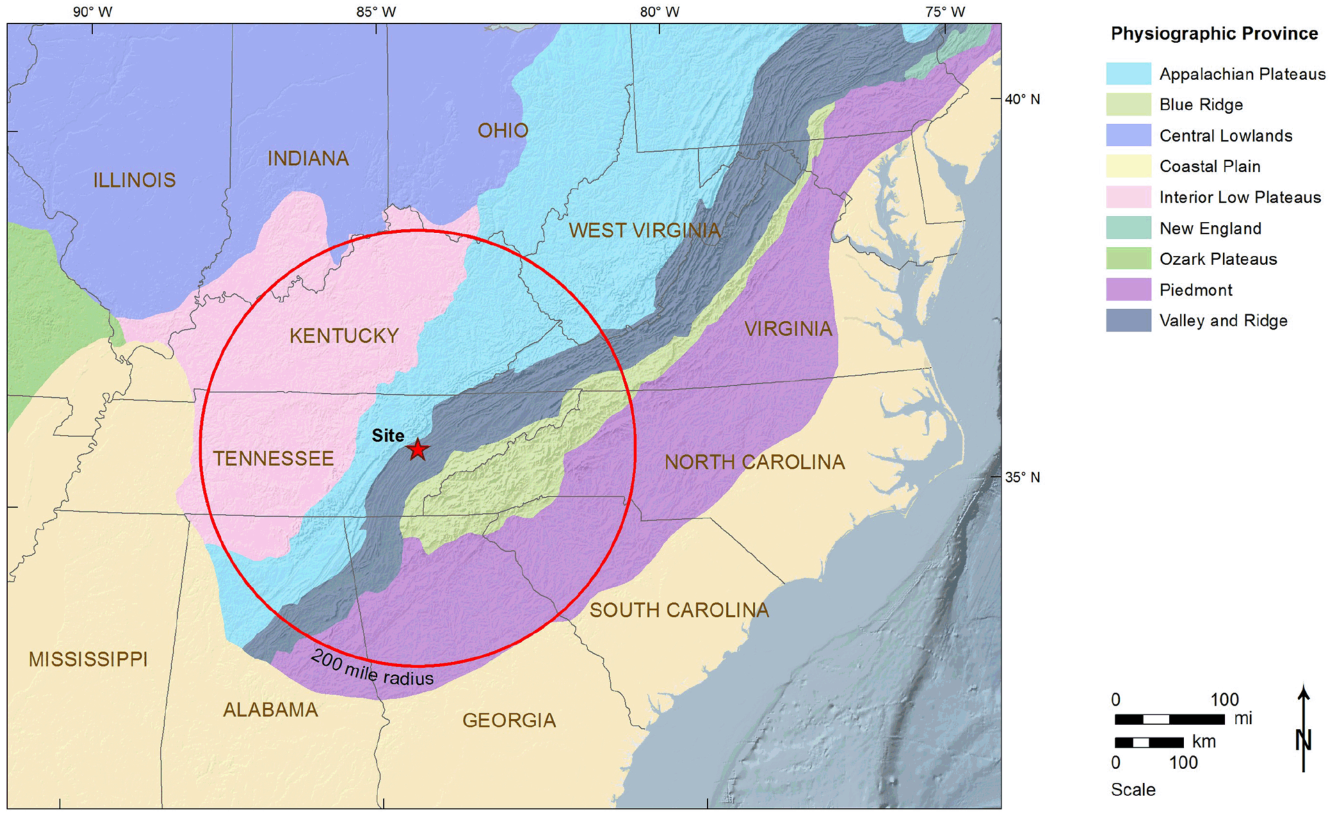
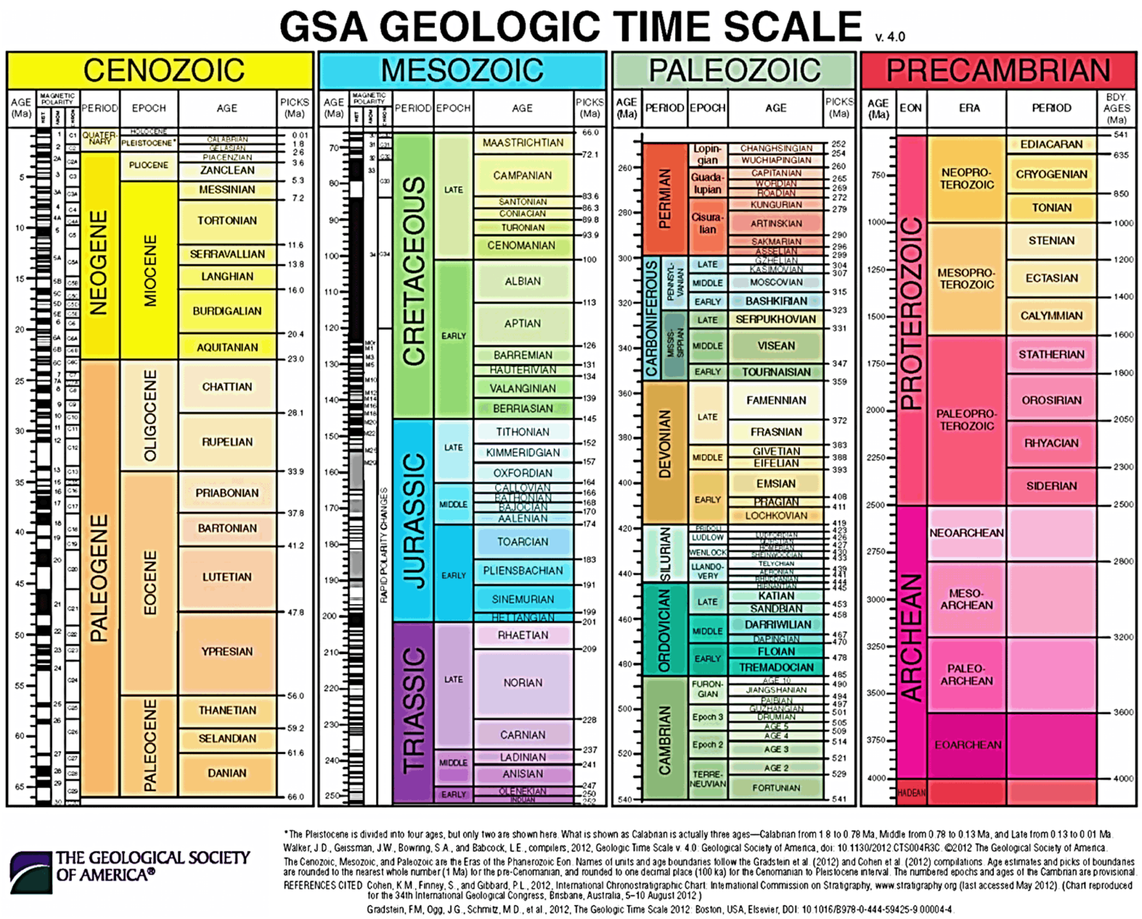
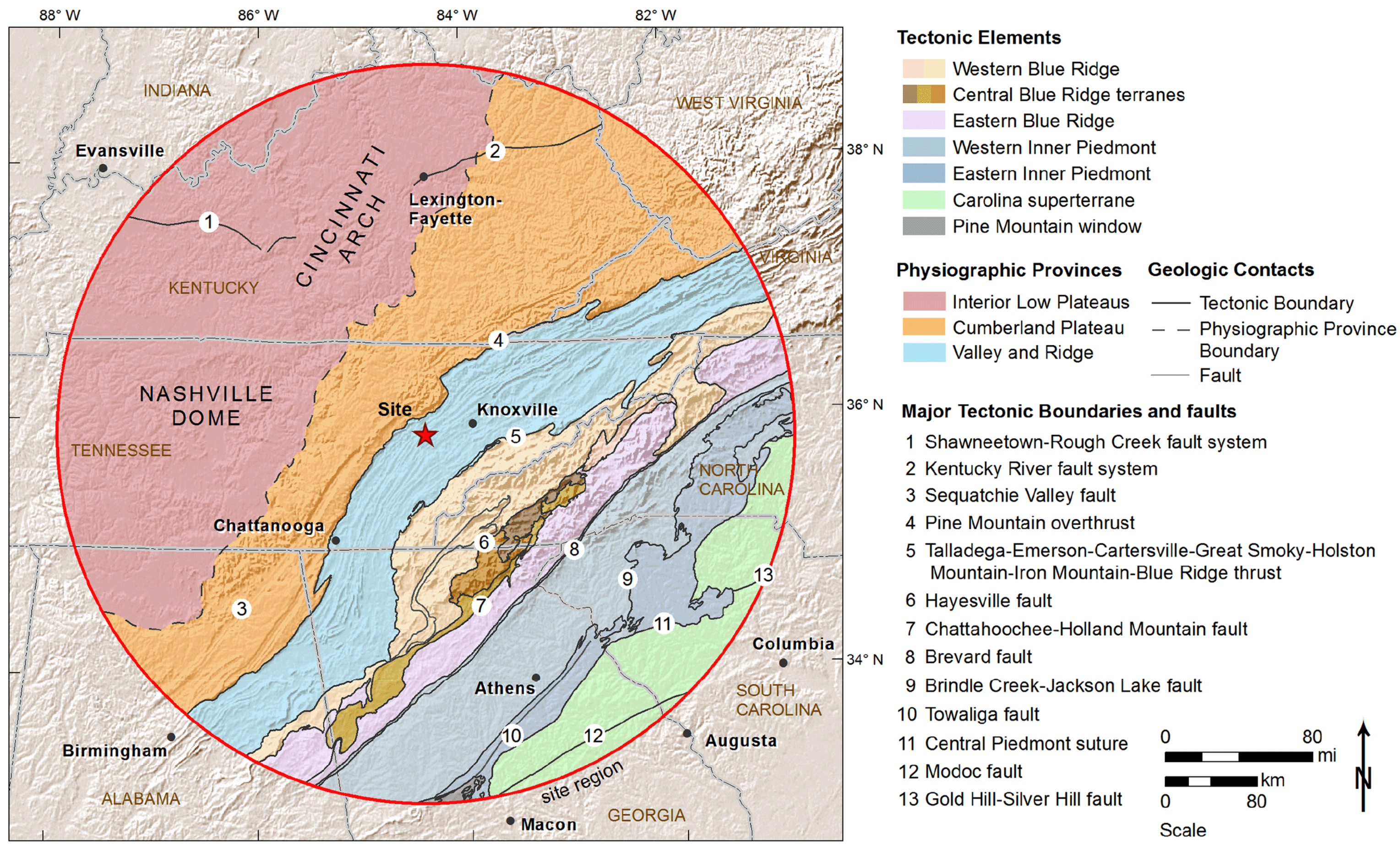


Figure 2.5.1-1. Map of Physiographic Provinces



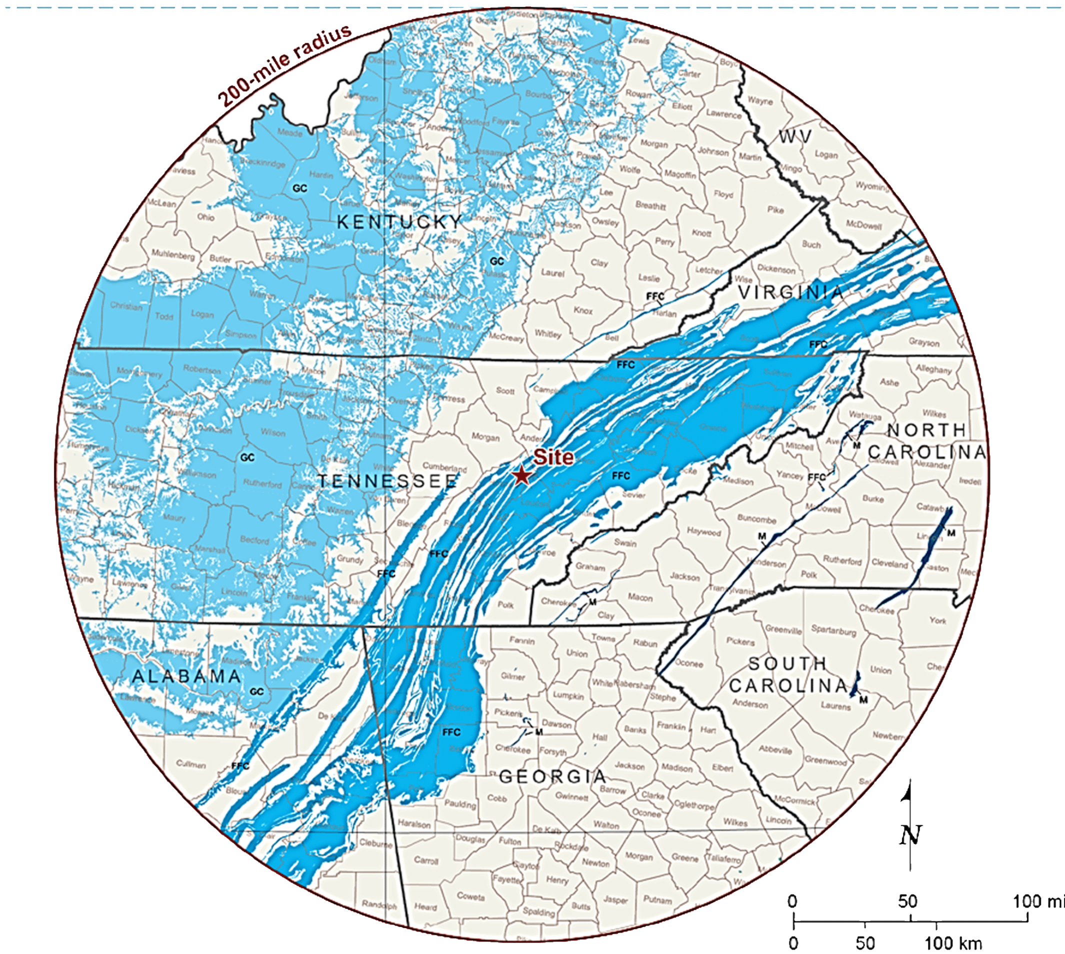
Source: Reference 2.5.1-33

Figure 2.5.1-2. Geologic Time Scale



Note: Modified from References 2.5.1-5, 2.5.1-24, and 2.5.1-34

Figure 2.5.1-3. Map of Lithotectonic Tectonic Terranes, Provinces and Major Tectonic Boundaries



Source: Modified from Reference 2.5.1-26

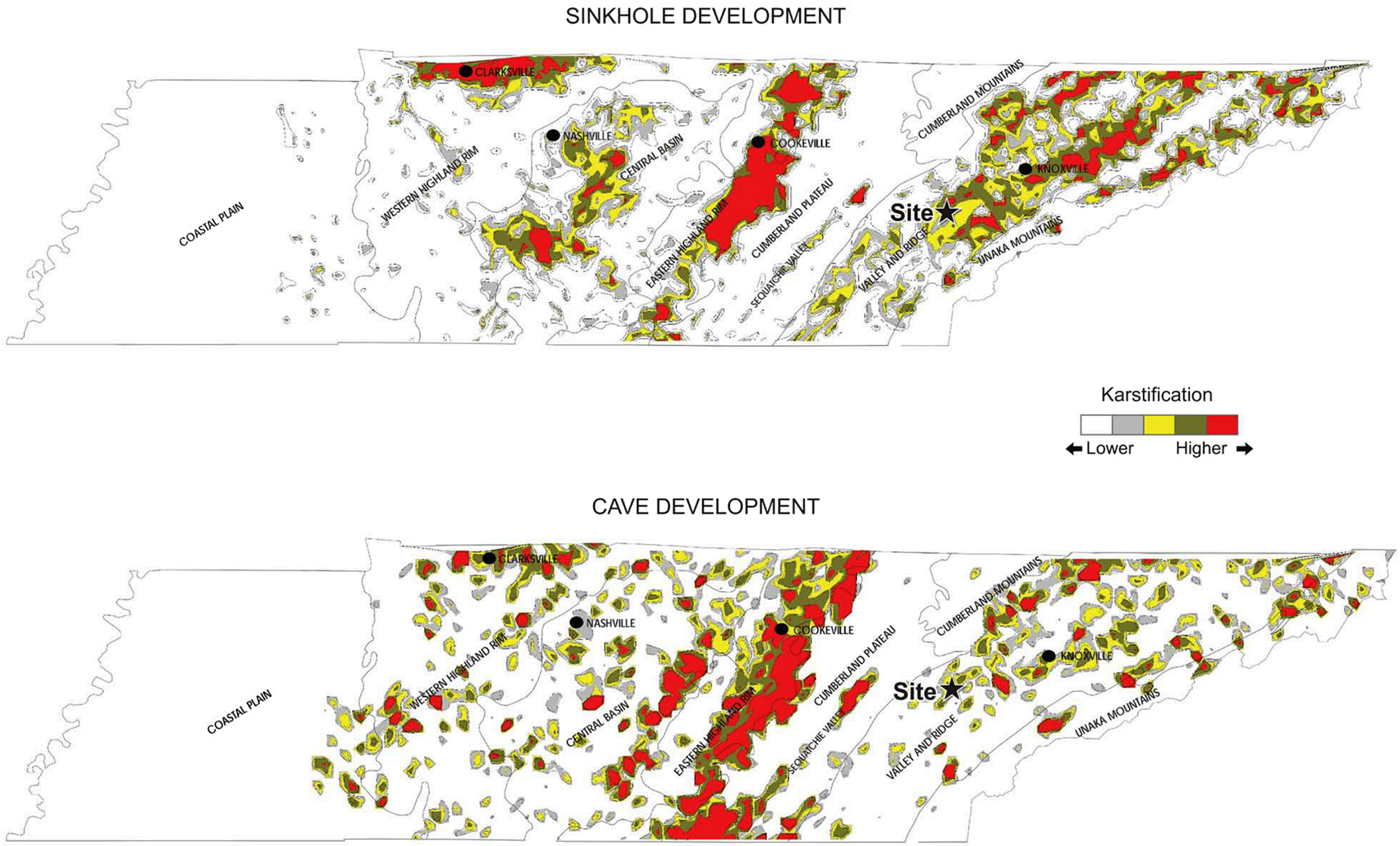
Description of Map Units

GC — Gently folded and flat-lying carbonates rocks: indurated limestone and dolomite that has not been strongly deformed. Predominantly found in interior plateaus and lowlands. Dissolution may produce solution, collapse, and cover-collapse sinkholes. Where carbonates are thick and extensive, cave systems may be long and complex. Where thin and interbedded with non-carbonates, caves are small and short. Geometry of cave passage patterns often shows stratigraphic and bedding-plane control often resulting in branchwork caves. (Reference 2.5.1-35)

FFC — Folded, faulted carbonate rocks: limestone and dolomite in areas flanking and in orogenic zones. May be intensely folded and faulted, commonly well jointed, commonly with cleavage. These rocks are located in the Valley and Ridge Province on this map and most are Paleozoic in age. Dissolution may produce solution, collapse, and cover-collapse sinkholes. Caves range from small and simple to long and complex systems. Geometry of cave passage patterns tend to show at least some structural control producing network caves. (Reference 2.5.1-35)

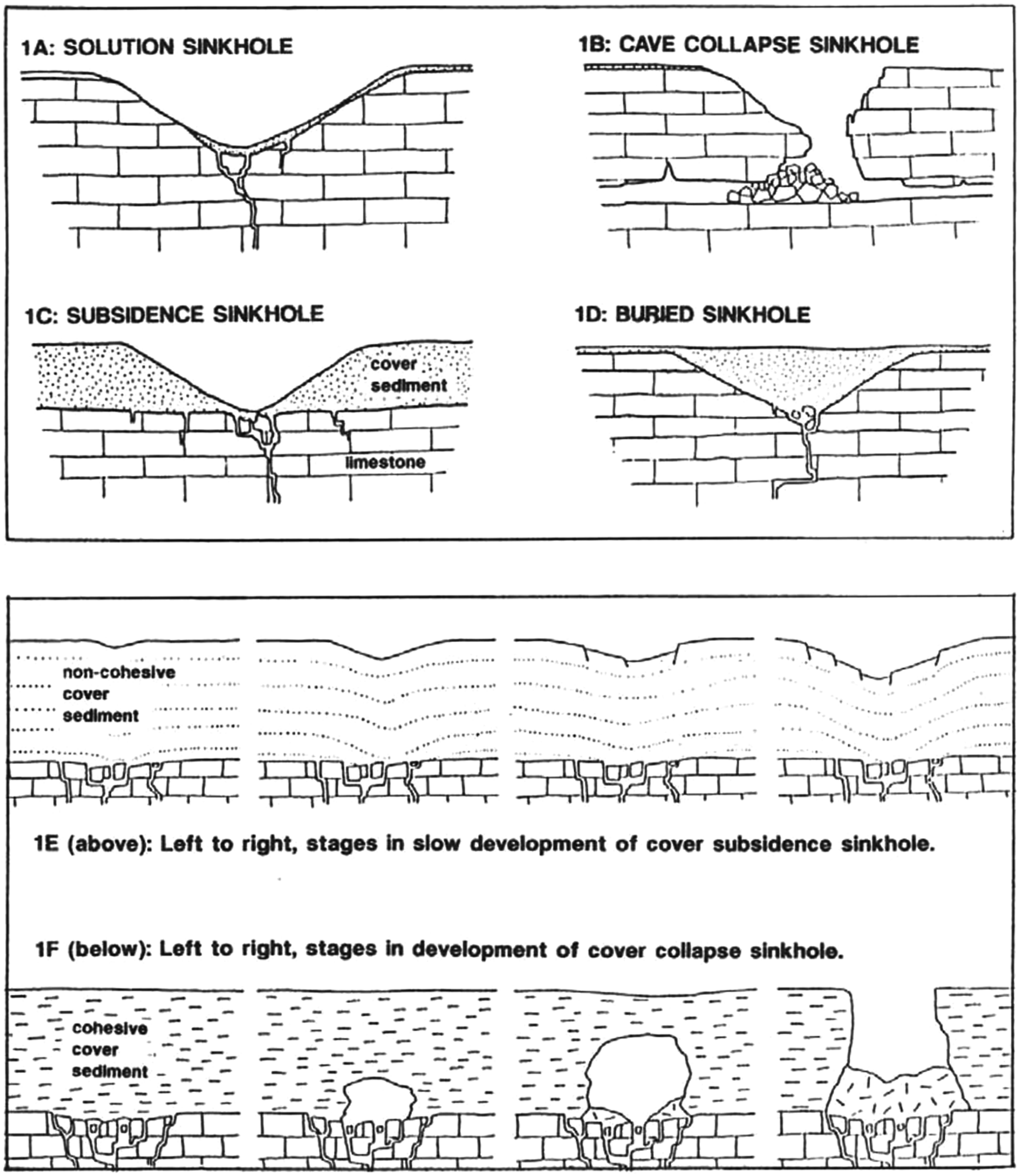
M — Marbles and metalimestones: highly deformed carbonate rocks, usually found in long, thin, linear belts or pods. Mapped areas are often exaggerated as these rocks are usually mapped with associated, non-soluble metamorphic rocks. Dissolution may result in solution, collapse, and cover-collapse sinkholes and small, short caves.

Figure 2.5.1-4. Regional Distribution of Carbonate Rocks



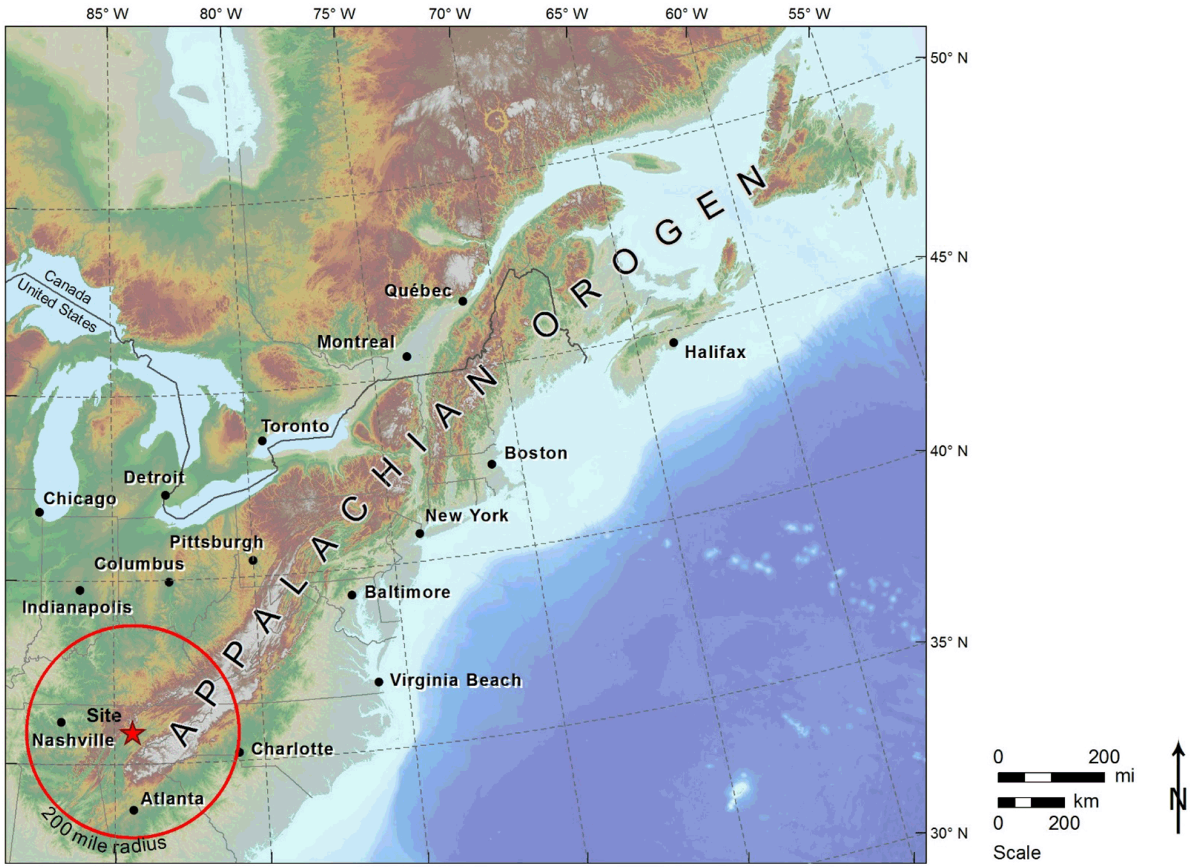
Source: Reference 2.5.1-25

Figure 2.5.1-5. Map of Sinkhole and Cave Development for the State of Tennessee



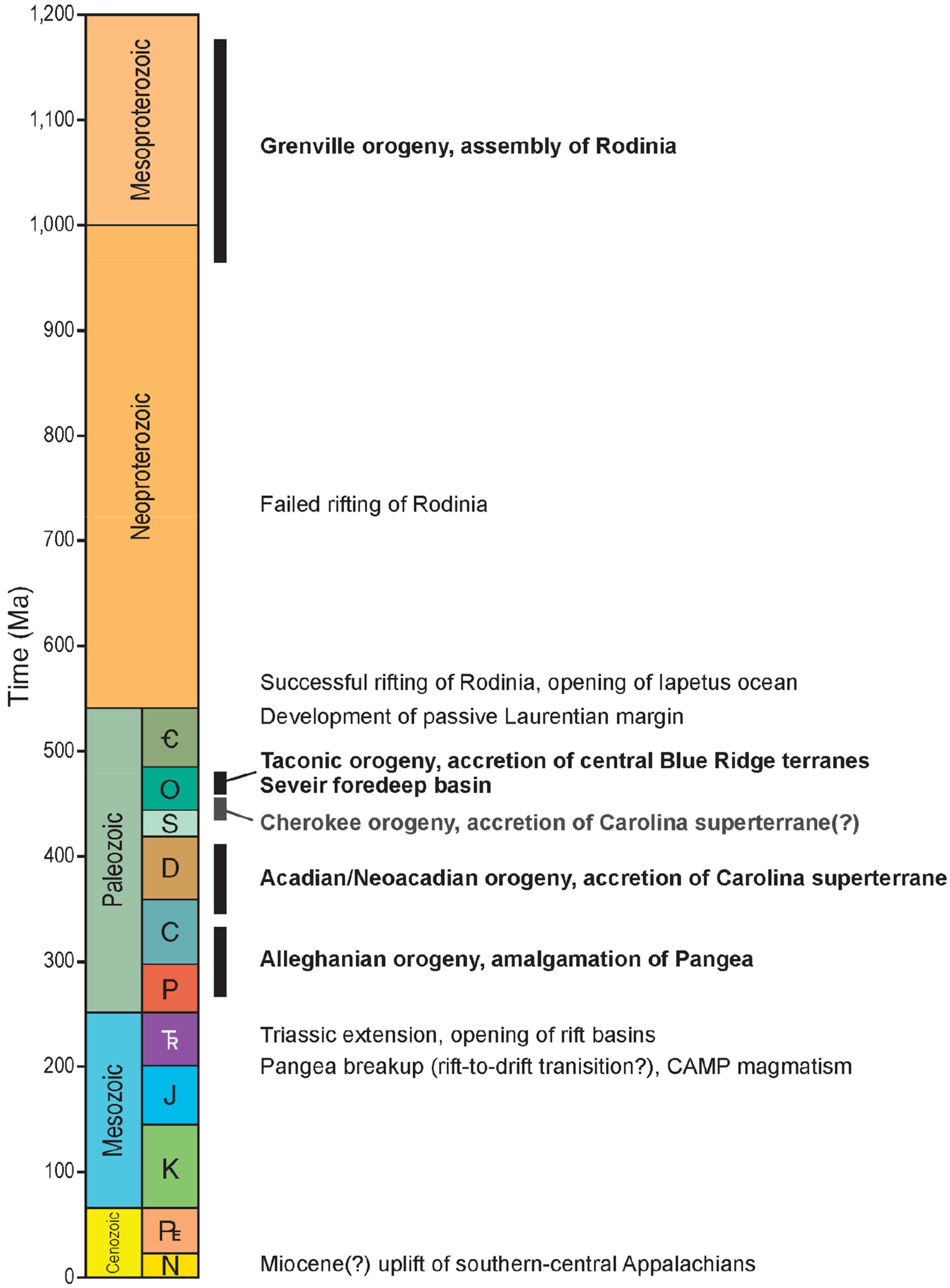
Note: Reference 2.5.1-27

Figure 2.5.1-6. Sinkhole Types



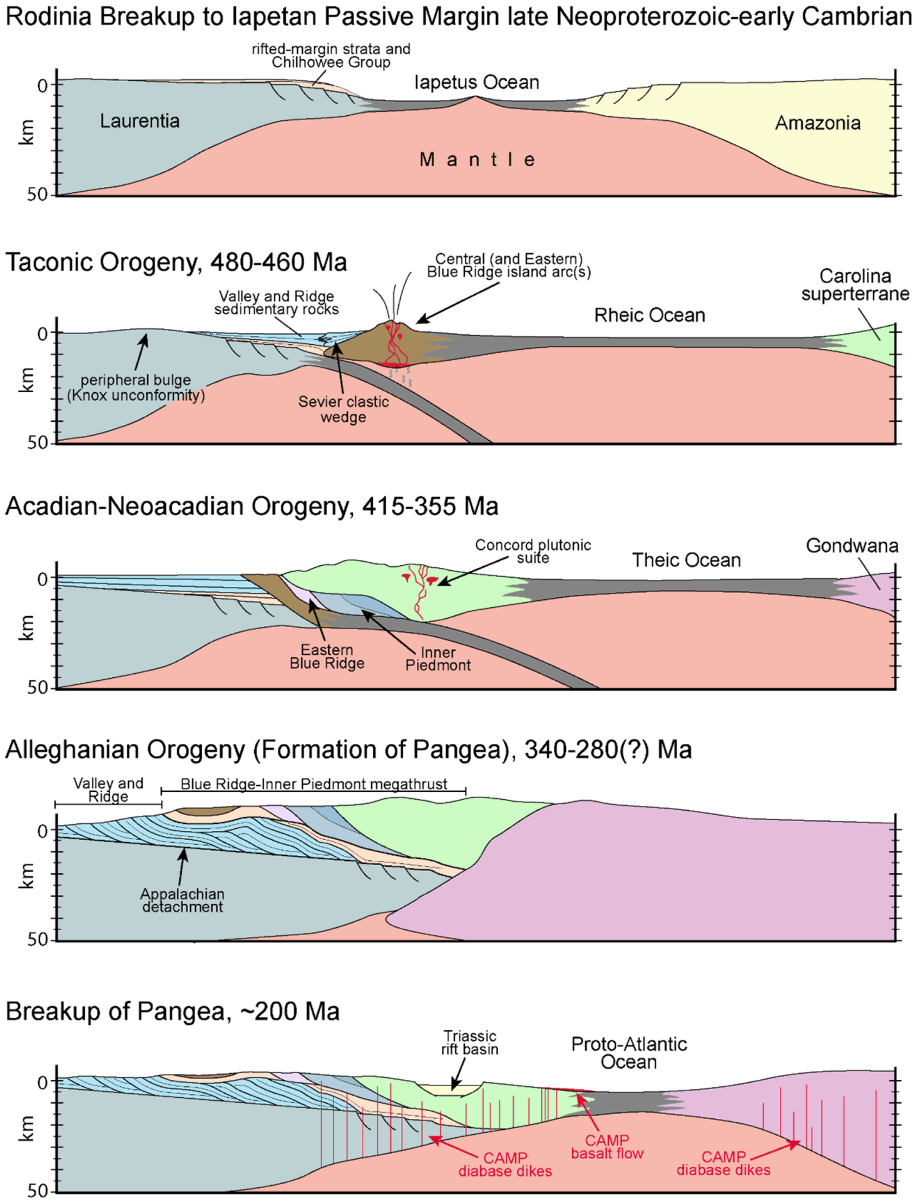
Note: Elevation and bathymetric data from Reference 2.5.1-190, Sheet A-1.

Figure 2.5.1-7. Shaded Relief Map of Eastern North America Demonstrating the Extent of the Appalachian Orogenic Belt



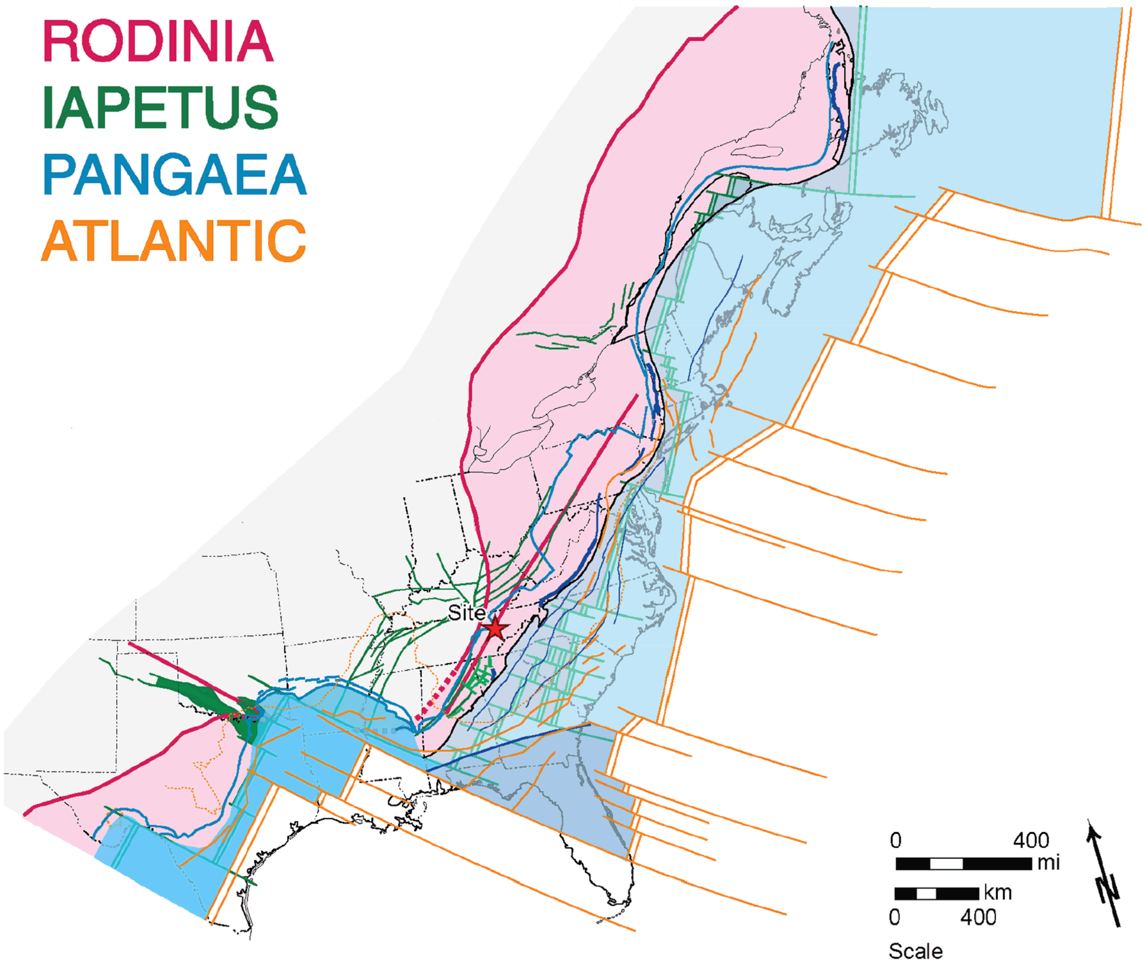
Note: Geologic time scale (Reference 2.5.1-33) with tectonic events that have affected the Appalachian orogenic belt (References 2.5.1-34 and 2.5.1-65).

Figure 2.5.1-8. Geologic Time Scale with Orogenic Events



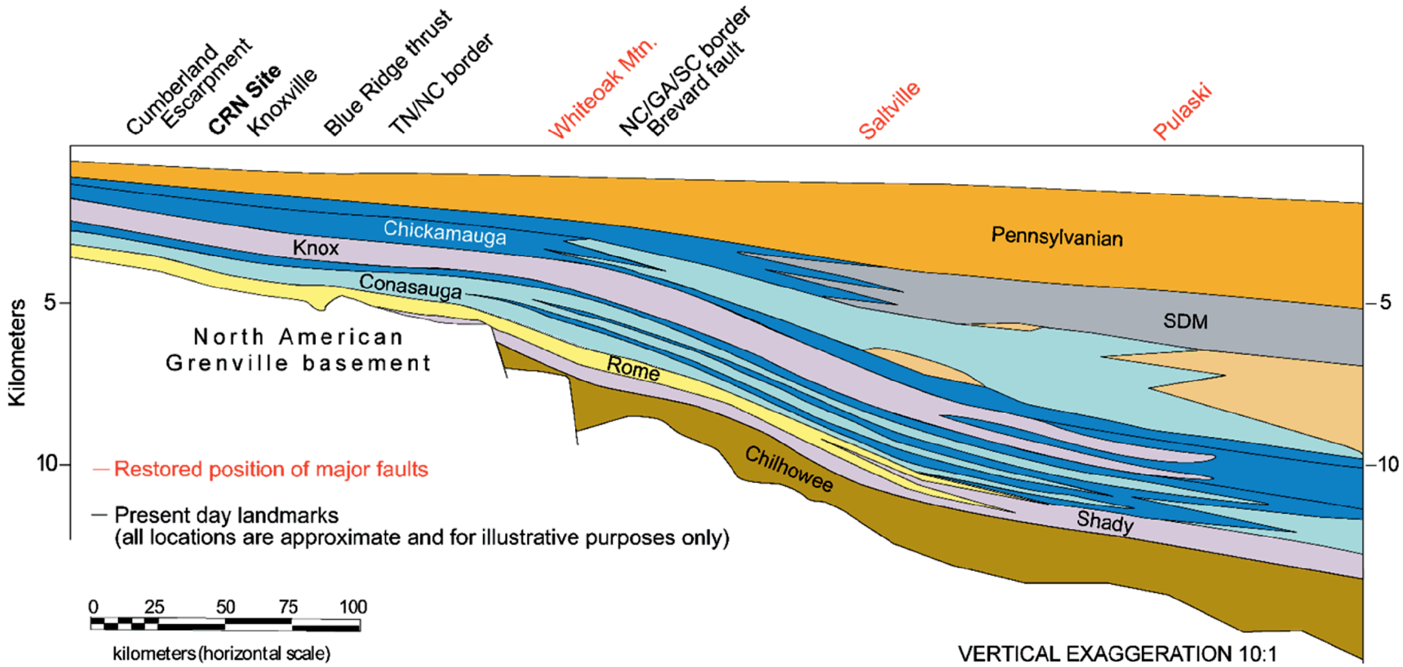
Notes:
Sequential development of the Appalachian orogen from the breakup of Rodinia to the breakup of Pangea, from Reference 2.5.1-73.
Deep crustal structure from Reference 2.5.1-277.
See Figure 2.5.1-3 for map of lithotectonic terranes.

Figure 2.5.1-9. Sequential Development of Appalachians Profiles



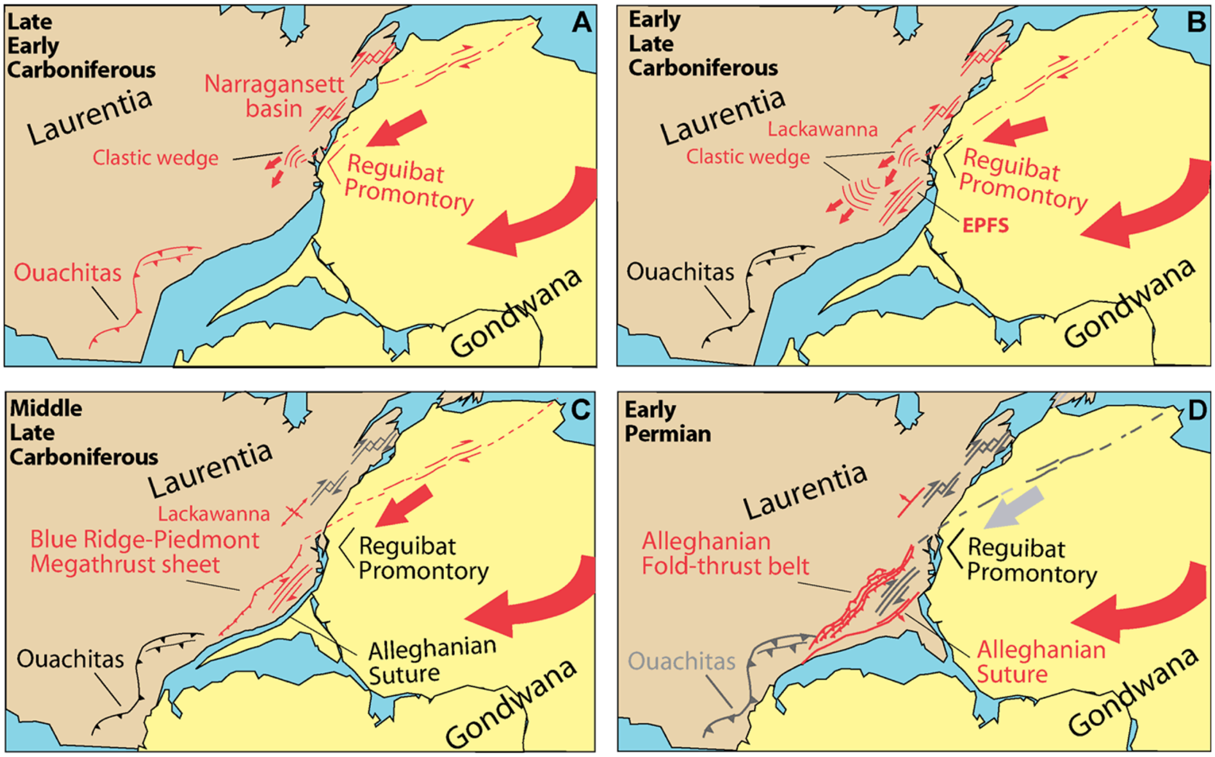
Notes:
Map of eastern North America, illustrating tectonic inheritance through the amalgamation and breakup of two supercontinents.
Features formed during the Grenville orogeny (formation of Rodinia) shown in red; those formed during the Appalachian orogenies (formation of Pangea) shown in blue.
Rifted margins that formed from supercontinent breakup are shown in green (Iapetus ocean) and orange (Atlantic Ocean).
Modified from Thomas, 2006 Reference 2.5.1-38.

Figure 2.5.1-10. North American Rifted Margin



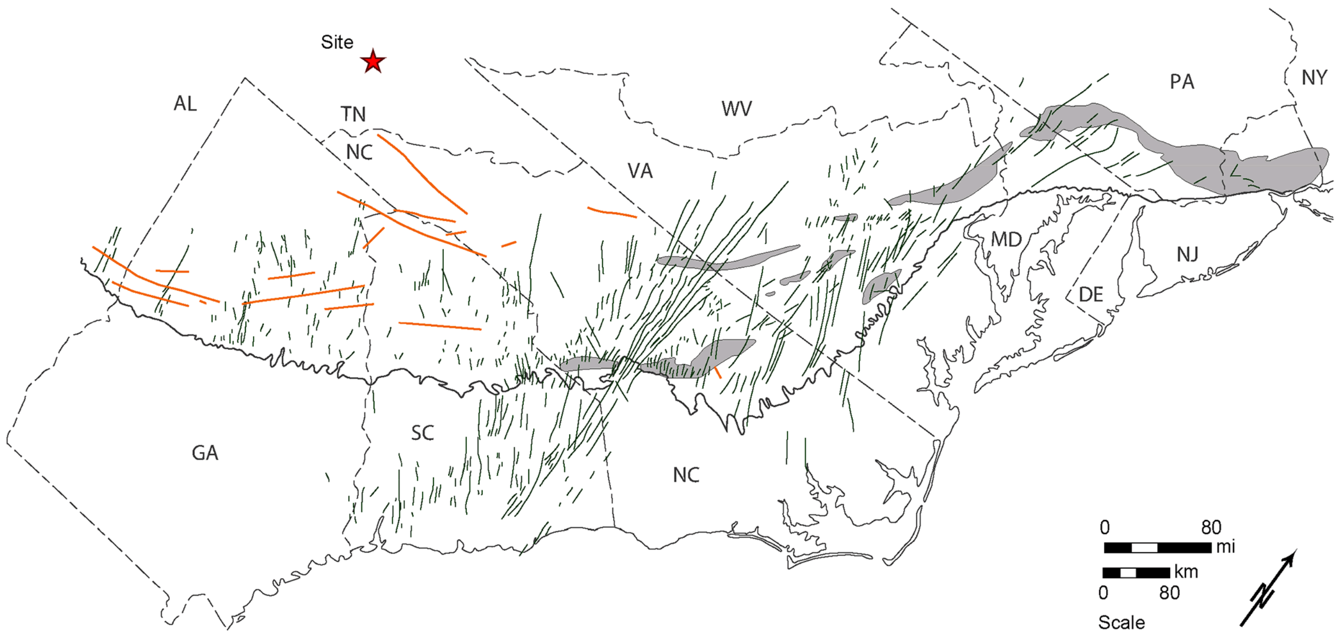
Notes:
Facies diagram of passive margin to stable shelf strata of the western Blue Ridge and Valley and Ridge (from Reference 2.5.1-13).
Units have been palinspastically restored along major Valley and Ridge thrust faults.
Blue — limestone facies; Lavender — dolomite facies; Light blue — shale facies; Beige and medium brown — coarse clastics and turbidites; Gray — siltstone facies; Light yellow — sandstone, shale, and dolomite intertidal facies.

Figure 2.5.1-11. Facies Diagram of Stable Shelf Strata



Notes:
Collision model for the Alleghanian orogeny (From Reference 2.5.1-74).
Red lines and symbols indicate the feature is active in the time interval shown.
A) Initial contact between Gondwana and Laurentia produced step-over basins in New England and deposition in the Appalachian basin.
B) Continued collision resulted in greater clastic input in the foreland, with the development of dextral strike-slip faults in the interior of the orogen.
C) Clockwise rotation of Gondwana begins to dominate the collision, resulting in a more head-on collision in the southern Appalachians.
D) Head-on collision in the southern Appalachians results in thrusting of the Blue Ridge-Piedmont megathrust sheet and foreland fold-thrust belt development.
EPFS — Eastern Piedmont Fault System.

Figure 2.5.1-12. Alleghanian Zipper Tectonics



Notes:
Distribution of Mesozoic features in the southern and central Appalachians.
Central Atlantic Magmatic Province (CAMP) diabase dikes shown as thin green lines, with silicified faults shown as heavy orange lines.
Dark shaded areas represent exposed Triassic rift basins.
From Reference 2.5.1-87.

Figure 2.5.1-13. Mesozoic Features Map

Geologic Units

Pennsylvanian Middle
- IPmu — Middle Pennsylvanian - undivided

Pennsylvanian Lower
- IPcf — Crooked Fork Group - undivided
- IPcg — Crab Orchard Mountains Group & Gizzard Group - undivided
- IPco — Crab Orchard Mountains Group - undivided
- IPg — Gizzard Group - undivided

Mississippian Upper
- Mp — Pennington Formation
- Mn — Newman Limestone

Mississippian Lower - Devonian Upper
- Mfp — Fort Payne Fm.
- MDc — Chattanooga Shale

Silurian Lower
- Sr — Rockwood Fm.

Ordovician Upper
- Os — Sequatchie Fm.
- Or — Reedsville Shale

Ordovician Middle

Chickamauga Supergroup

Nashville Group
- Ocn — Cannon Ls.
- Ocyl — Catheys and Leipers Fm. - undivided
- Oh — Hermitage Fm.

Chickamauga Group
- Och — Chickamauga group - undivided
- Omc — Moccasin Fm.
- Owi — Witten Fm.
- Obw — Bowen Fm.
- Obe — Benbolt Fm.
- Ork — Rockdell Fm.
- Ofl — Fleanor Shale
- Obl — Blackford Fm. (includes Eidsen mbr.)
- Obs — Bays formation
- Oo — Ottosee Shale
- Ocr — Chapman Ridge Sandstone
- Oho — Holston Formation
- Ole — Lenoir Ls.
- Oa — Athens Shale

Stones River Group
- Osr — Stones River Group - undivided
- Oca — Carters Ls.
- Olb — Lebanon Ls.
- Omp — Pierce Ls. and Murfreeboro Ls. - undivided
- Ops — Pong Spring Fm.
- Ord — Ridley Ls.

Ordovician Lower

Knox Group
- OꞒk — Knox Group - undivided
- Oma — Mascot Dolomite
- Ok — Kingsport Fm.
- Olv — Longview Dolomite
- Oc — Chepultepec Dolomite
- Ꞓcr — Copper Ridge Dolomite

Cambrian Middle

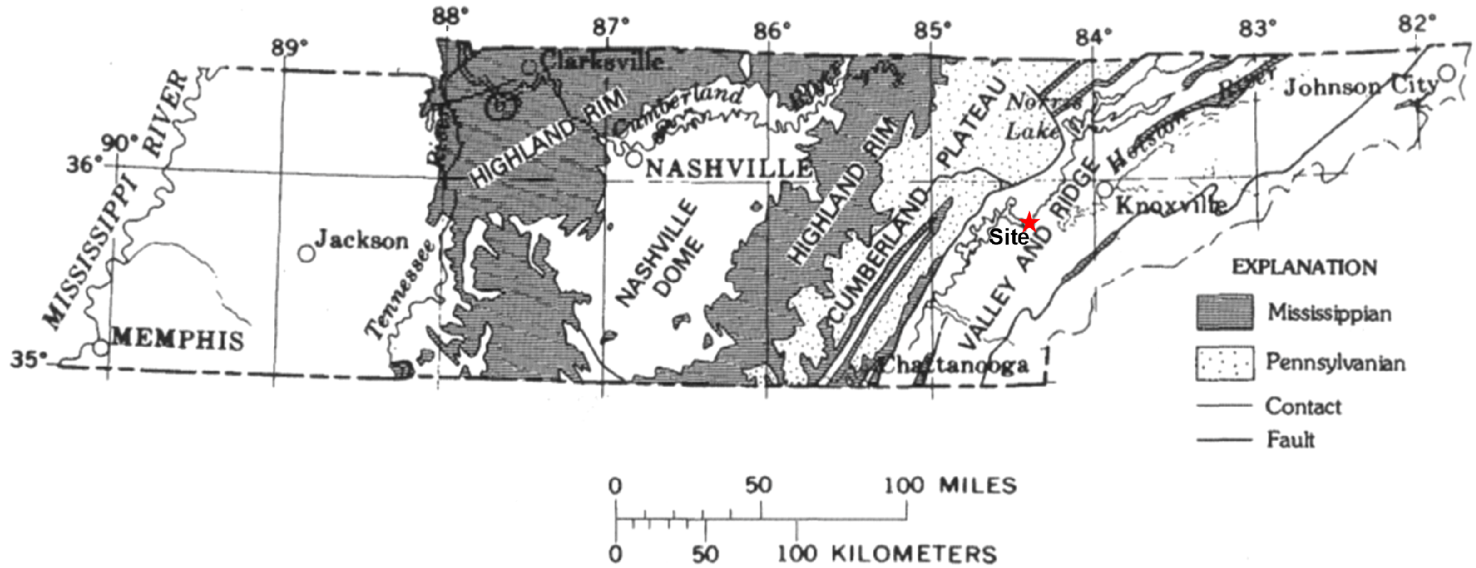
Conasauga Group
- Ꞓc — Conasauga Group - undivided
- Ꞓmn — Marynardville Ls.
- Ꞓn — Nolichucky Shale
- Ꞓdg — Dismal Gap Fm. (Maryville Ls.)
- Ꞓrg — Rogersville Shale
- Ꞓf — Friendship Fm. (Rutledge Ls.)
- Ꞓpv — Pumpkin Valley Shale

Cambrian Lower
- Ꞓr — Rome Fm. - undivided

Geologic Structures
- Syncline *dashed where approximate*
- Anticline *dashed where approximate*
- Overturned Syncline *dashed where approximate*
- Major Fault
- Minor Fault
- Contact *dashed where approximate, dotted where concealed*

Other
- Source map boundary

Figure 2.5.1-14. Site Vicinity Stratigraphic Columns



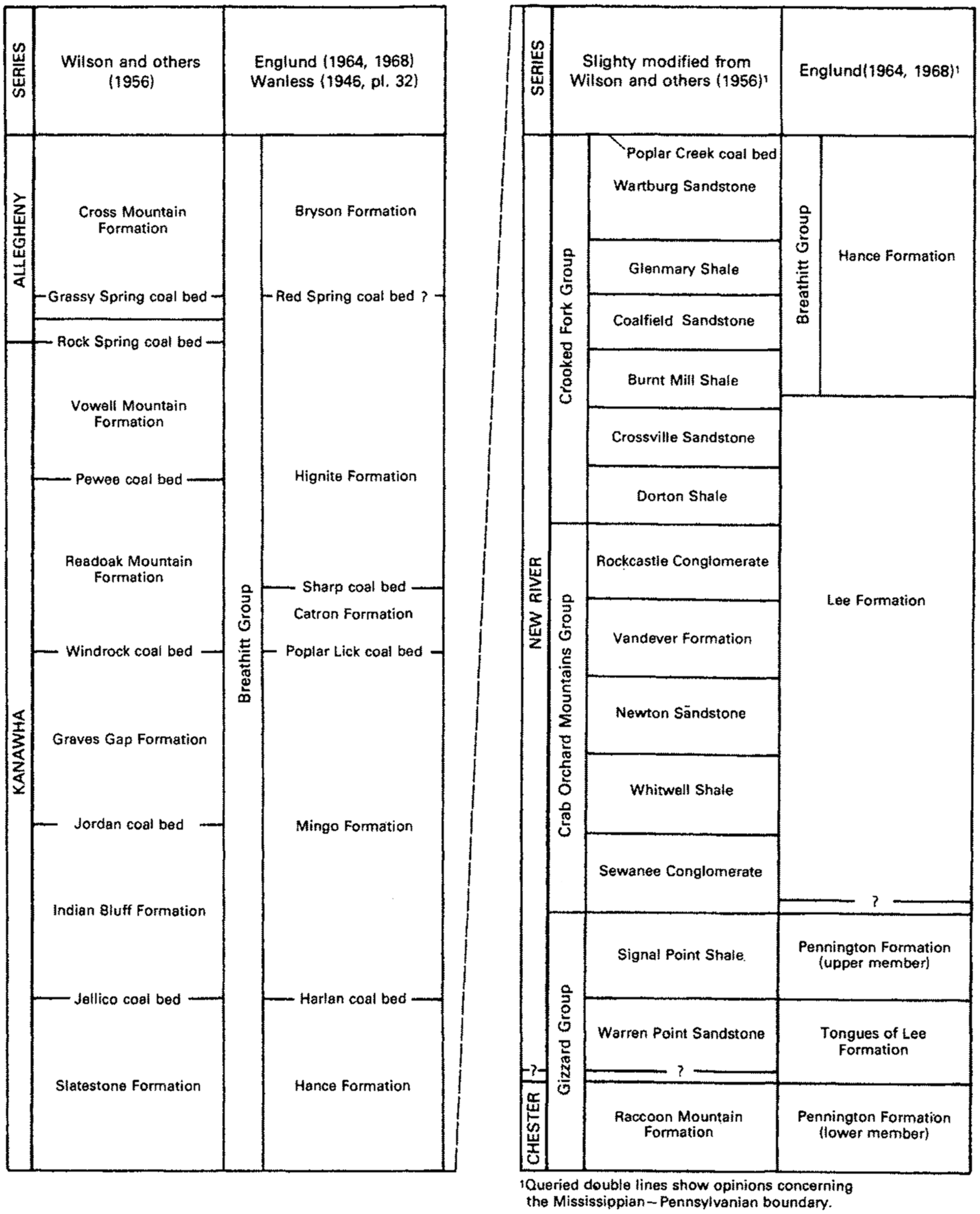
Note: After Reference 2.5.1-112

Figure 2.5.1-15. The Cumberland Plateau and Interior Low Plateaus in Tennessee

SERIES	WESTERN HIGHLAND RIM	CUMBERLAND PLATEAU AND EASTERN HIGHLAND RIM	PINE MOUNTAIN BLOCK (Englund, 1964, 1968)	NEWMAN RIDGE (Mixon and Harris, 1971)	BELT EAST OF CLINCH MOUNTAIN (Sanders, 1952, unpub. data; Hasson, 1973)	CHILHOWEE MOUNTAIN (Newman and Nelson, 1965)
CHESTERIAN		Gizzard Group (lower part)	Pennington Foramtion	Pennington Formation	Pennington Formation	
CHESTERIAN		Pennington Formation	Newman Limestone	Newman Limestone	Newman Limestone: Cove Creek Formation	
CHESTERIAN		Bangor Limestone			Newman Limestone: Fido Sandstone	
CHESTERIAN		Hartselle Sandstone			Newman Limestone: Fisher Creek Limestone	
MERAMECIAN	Ste. Genevieve Limestone	Monteagle Limestone			Newman Limestone: Gilliam Creek Limestone	
MERAMECIAN					Newman Limestone: Clifton Creek Limestone	
MERAMECIAN					Newman Limestone: Snowflake Formation	
MERAMECIAN	St. Louis Limestone	St. Louis Limestone			Newman Limestone: Laurel Branch Limestone	
MERAMECIAN	Warsaw Limestone	Warsaw Limestone			Newman Limestone: Pressmens Home Formation	Greasy Cove Formation
MERAMECIAN					Newman Limestone: Maccrady Formation	Grainger Formation
OSAGEAN	Fort Payne Formation	Fort Payne Formation	Fort Payne Chert; Grainger Formation	Grainger Formation	Grainger Formation	
KINDERHOOKIAN	Maury Shale	Maury Shale	Maury Shale	?	?	?
KINDERHOOKIAN				Chattanooga Shale (upper part)	Chattanooga Shale (upper part)	Chattanooga Shale (upper part)

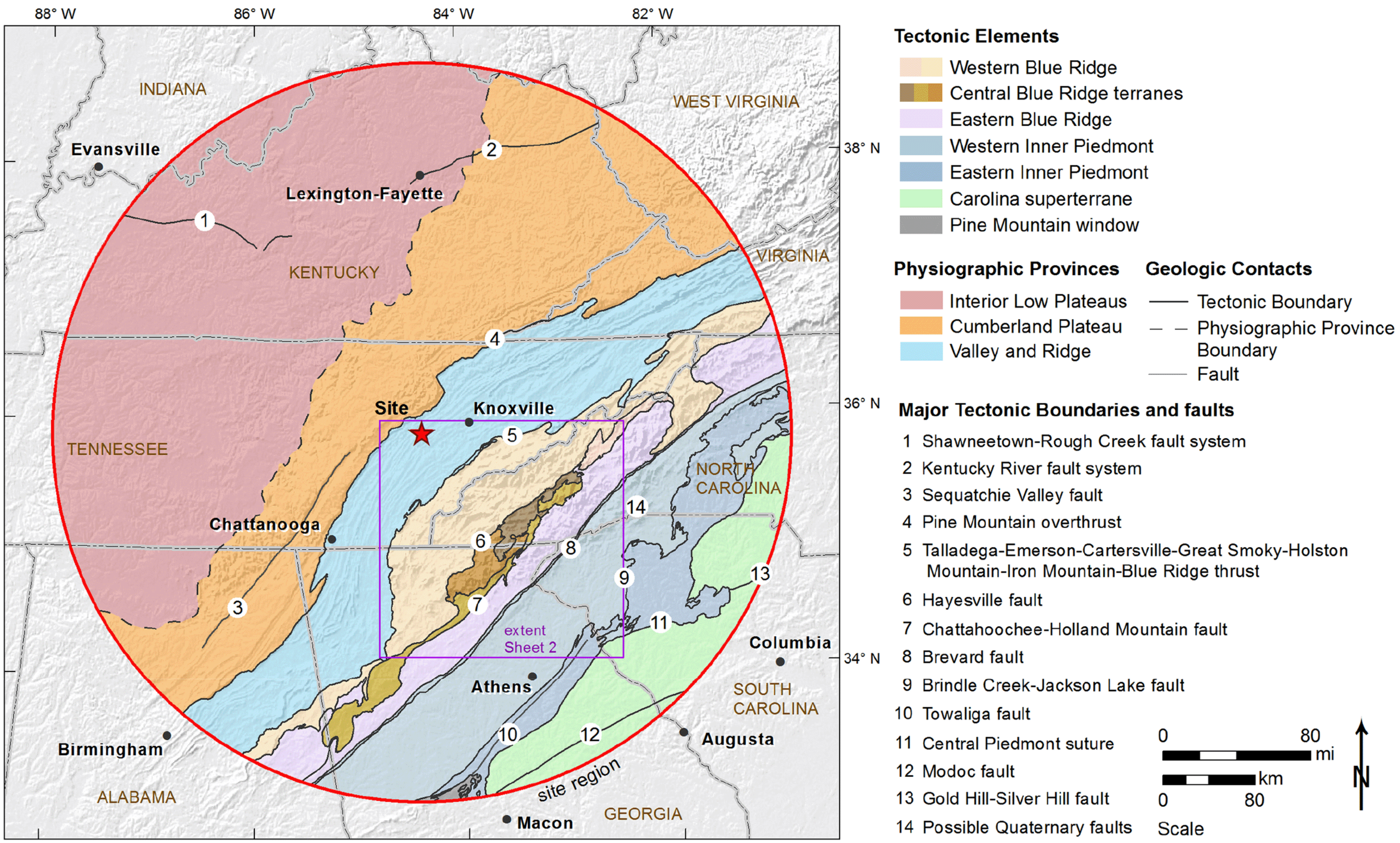
Notes:
From Reference 2.5.1-112

Figure 2.5.1-16. Mississippian Stratigraphic Units in Tennessee



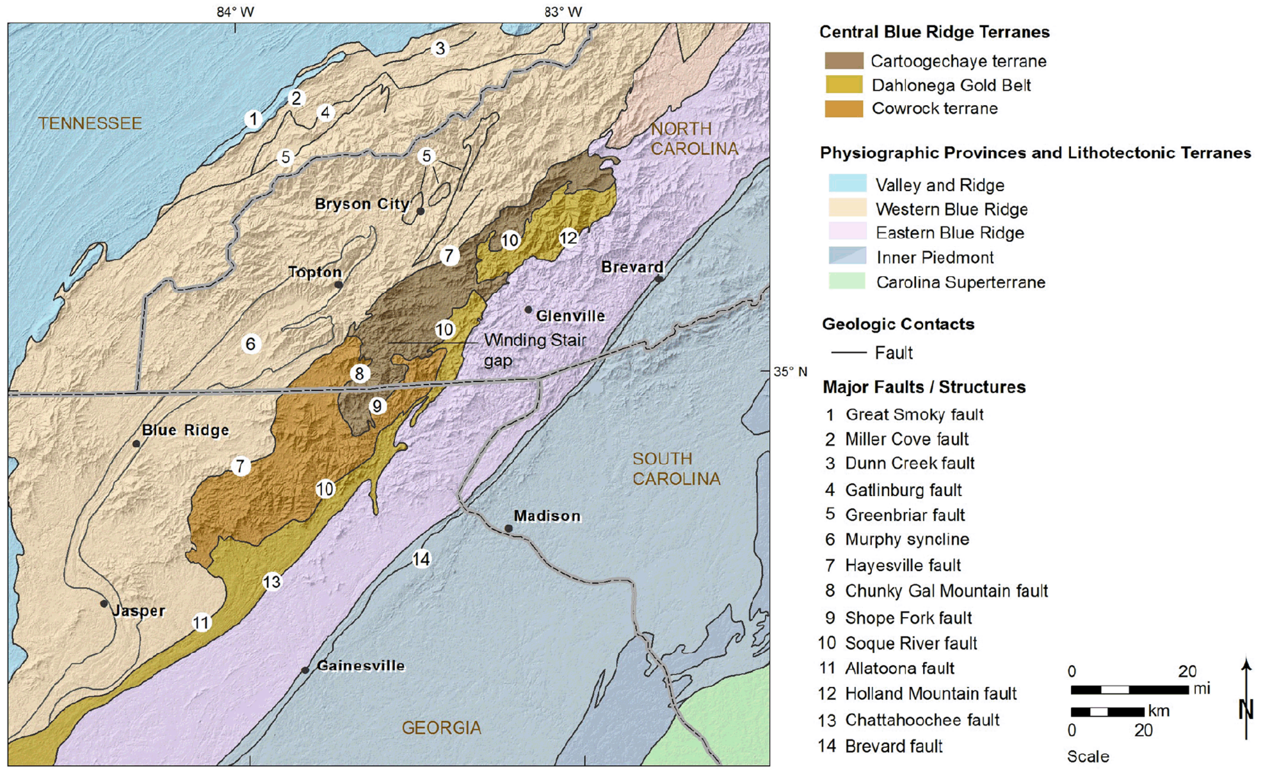
Note: Reference 2.5.1-112

Figure 2.5.1-17. Pennsylvanian System in Tennessee



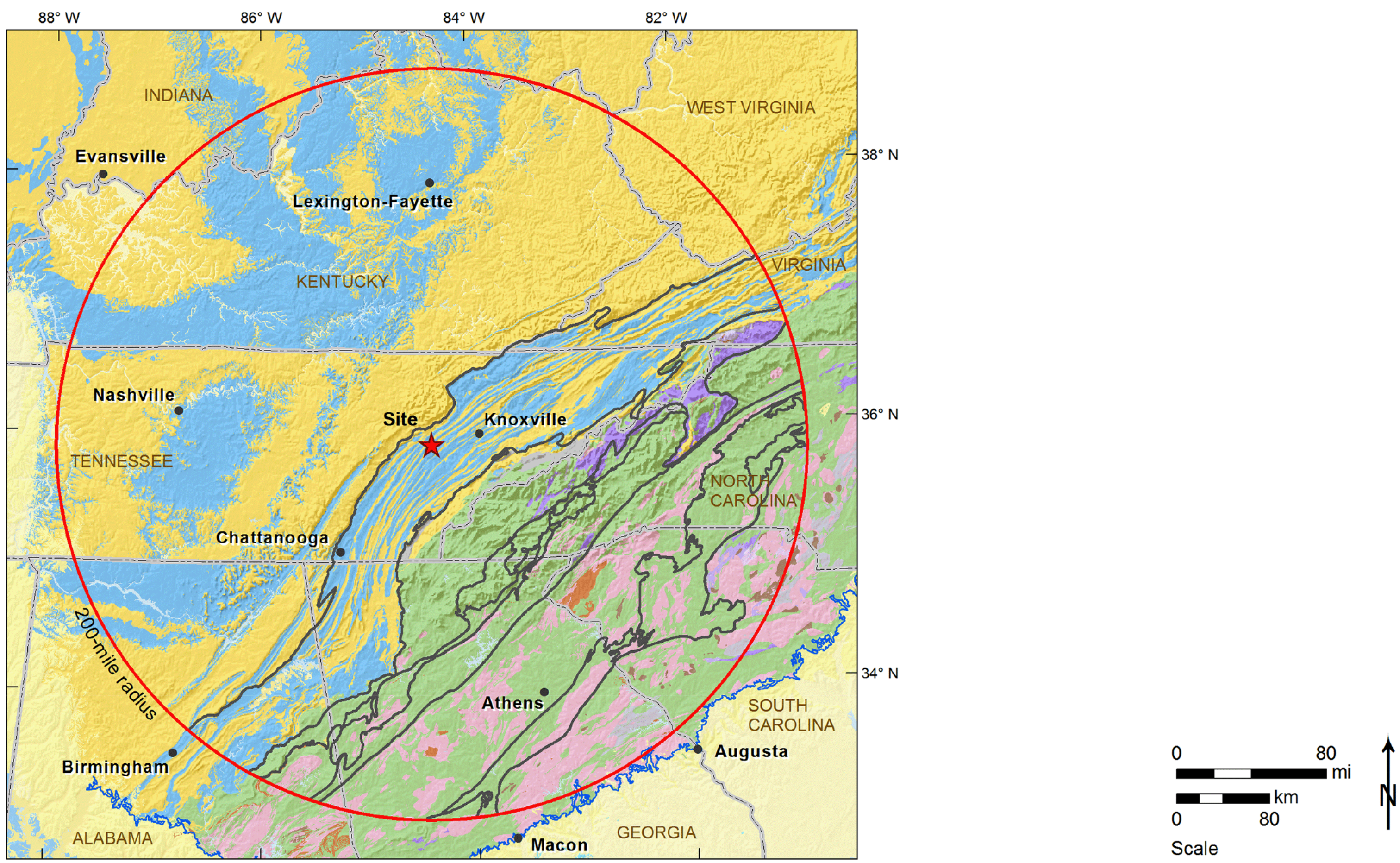
Notes:
Lithotectonic terranes, provinces, and major tectonic boundaries (after References 2.5.1-24, 2.5.1-34, and 2.5.1-137)

Figure 2.5.1-18. (Sheet 1 of 2) Lithotectonic Terrane Map



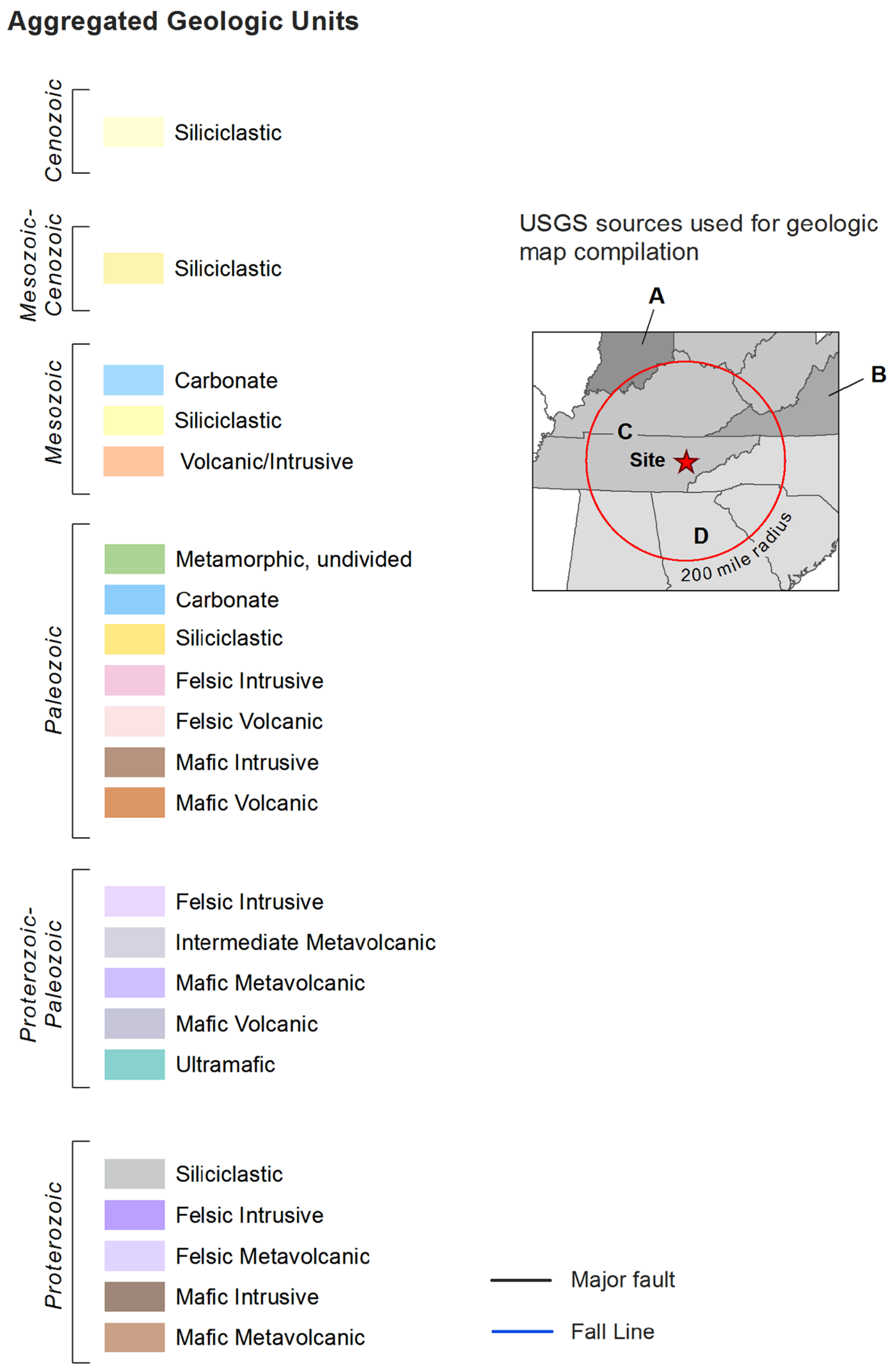
Note:
Simplified tectonic map of the Central Blue Ridge terranes.

Figure 2.5.1-18. (Sheet 2 of 2) Lithotectonic Terrane Map—Blue Ridge Zoom



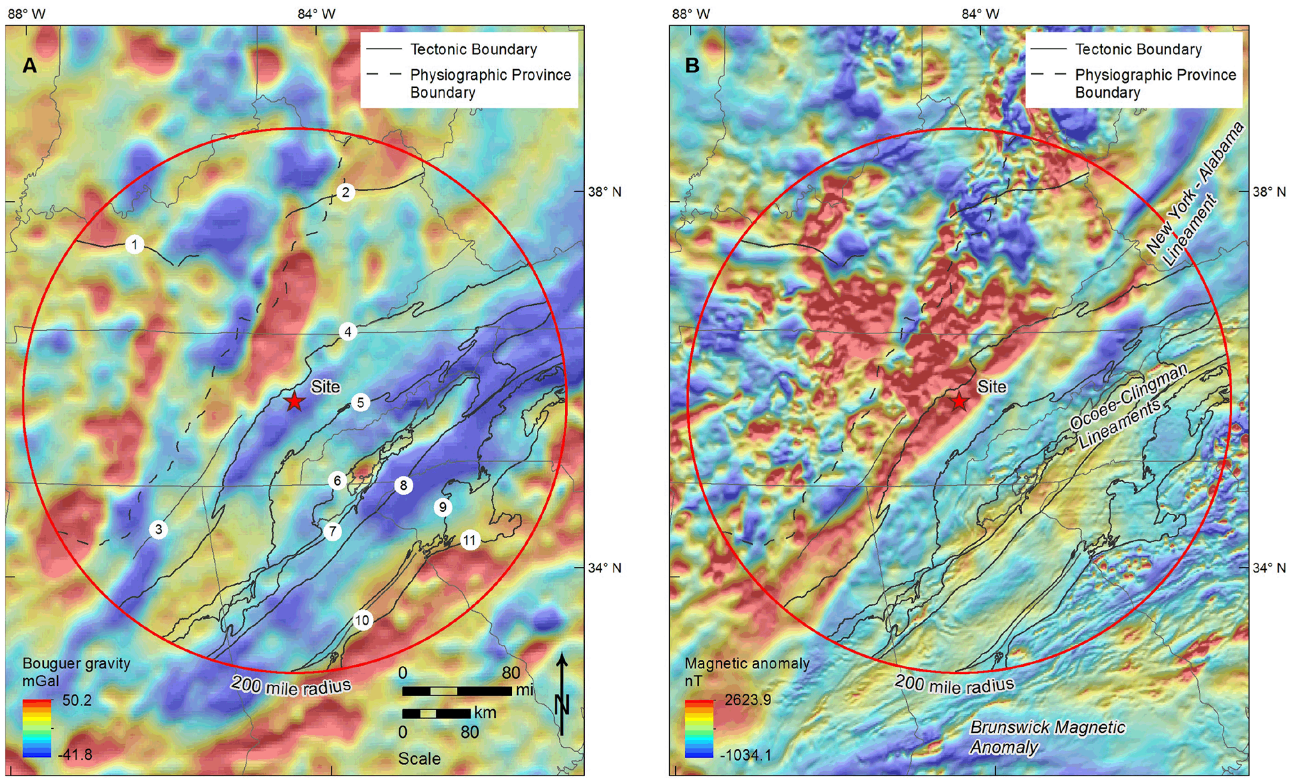
Note:
USGS sources for geologic map: A - OFR-04-1355, Reference 2.5.1-116; B - OFR-05-1325, Reference 2.5.1-115; C - OFR-05-1323, Reference 2.5.1-114; D - OFR-05-1324, Reference 2.5.1-117. Major faults from References 2.5.1-24 and 2.5.1-34. Fall Line from Reference 2.5.1-20.

Figure 2.5.1-19. (Sheet 1 of 2) Site Region Geologic Map



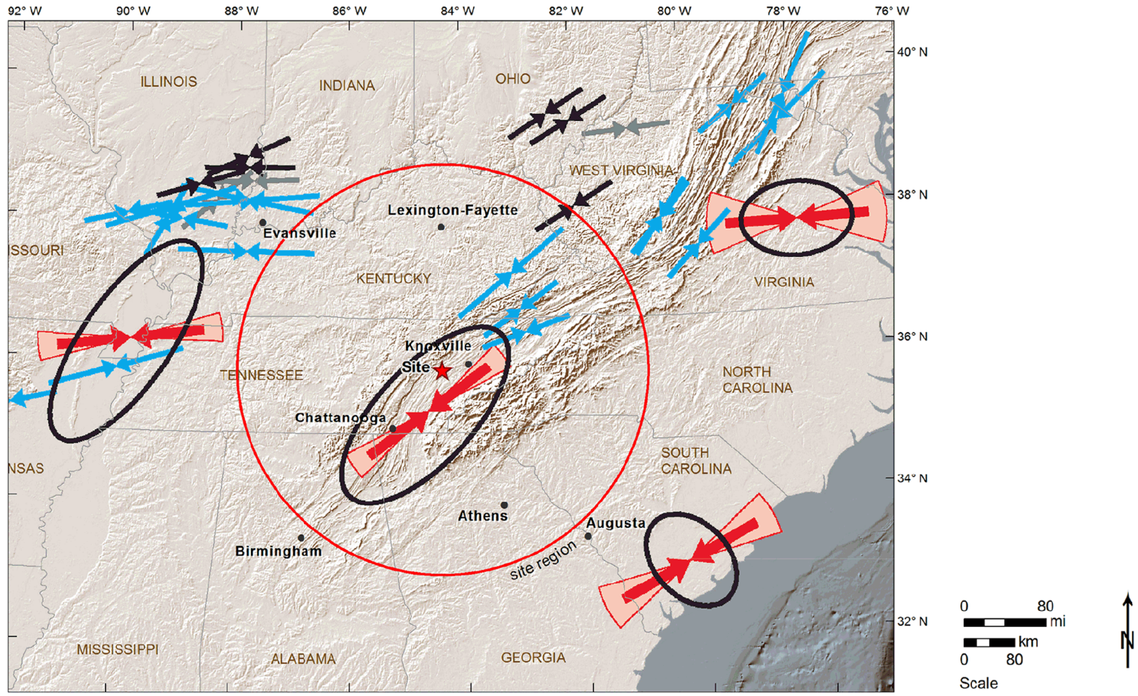
Note:
USGS sources for geologic map: A - OFR-04-1355, Reference 2.5.1-116; B - OFR-05-1325, Reference 2.5.1-115; C - OFR-05-1323, Reference 2.5.1-114; D - OFR-05-1324, Reference 2.5.1-117. Major faults from References 2.5.1-24 and 2.5.1-34. Fall Line from Reference 2.5.1-20.

Figure 2.5.1-19. (Sheet 2 of 2) Site Region Geologic Map



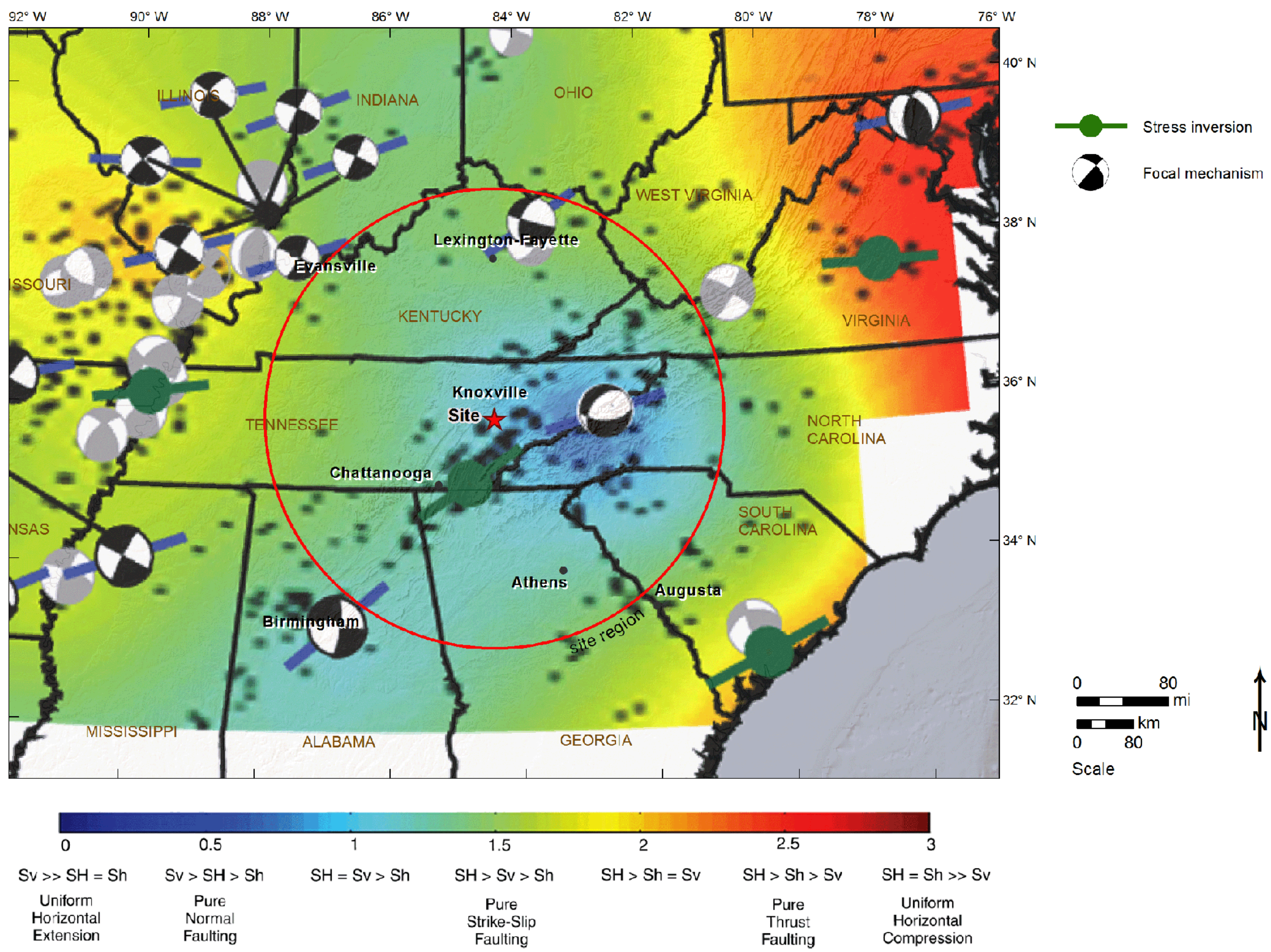
Notes:
Gravity anomaly (A) and aeromagnetic residual data (B) from CEUS SSC (Reference 2.5.1-190).
See Figure 2.5.1-18, Sheet 1 for numbered fault references.

Figure 2.5.1-20. Aeromagnetic and Gravity Maps



Notes:
Map of current stresses in the central and eastern U.S. (after Reference 2.5.1-185).
Black and gray arrows – orientation from borehole observations;
Blue arrows – borehole observations used in calculating the regional average within 250 km (155 mi) of the seismic zones (solid ellipses);
Red arrows and angular sectors – orientation from focal mechanism inversion.

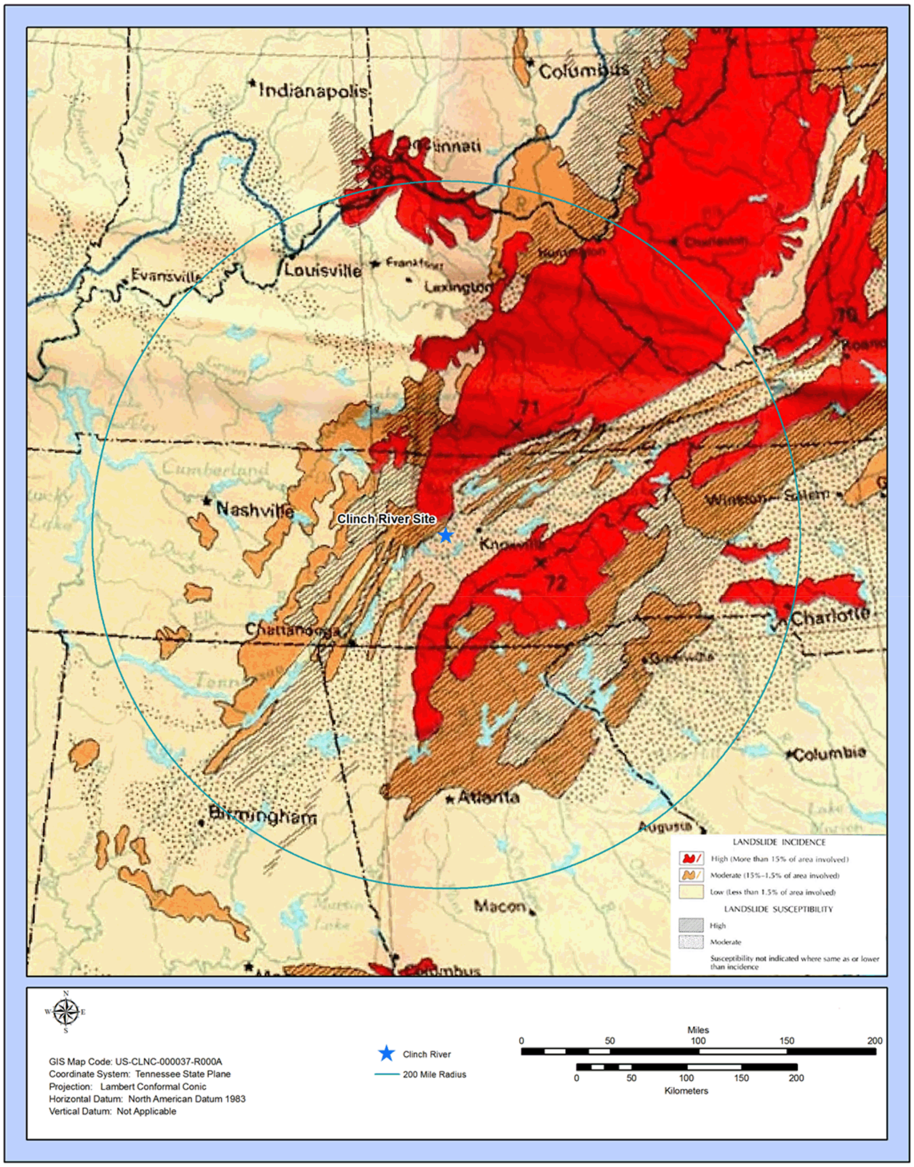
Figure 2.5.1-21. (Sheet 1 of 2) Current Compressive Stress—Eastern United States



Notes:
Gray focal mechanisms from Reference 2.5.1-183; black focal mechanisms from Reference 2.5.1-306.
SH – maximum horizontal stress; Sh – minimum horizontal stress; Sv – vertical stress.

Source: Reference 2.5.1-306

Figure 2.5.1-21. (Sheet 2 of 2) Regional Stress Map from Hurd and Zoback



Note: Modified from Reference 2.5.1-202

Figure 2.5.1-22. Landslide Hazard Map for the Clinch River Nuclear Site Region

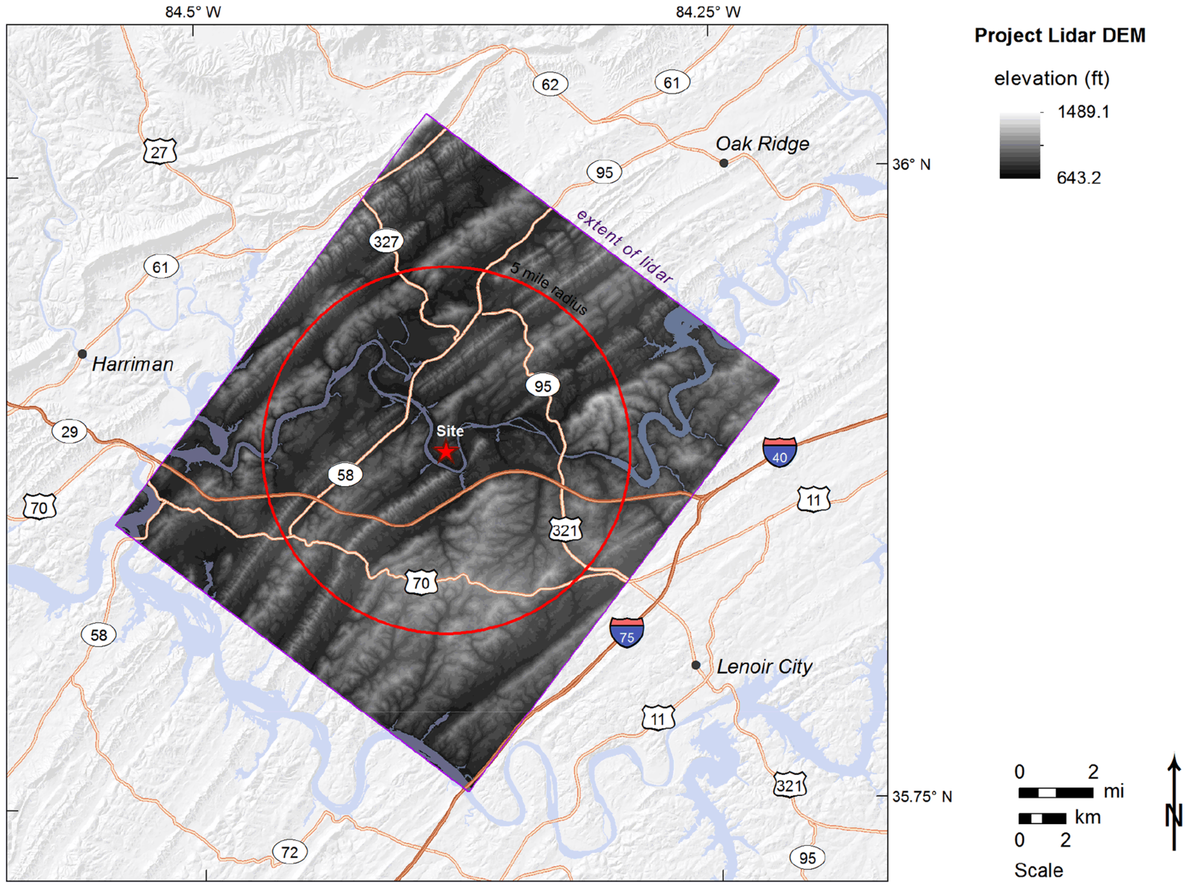
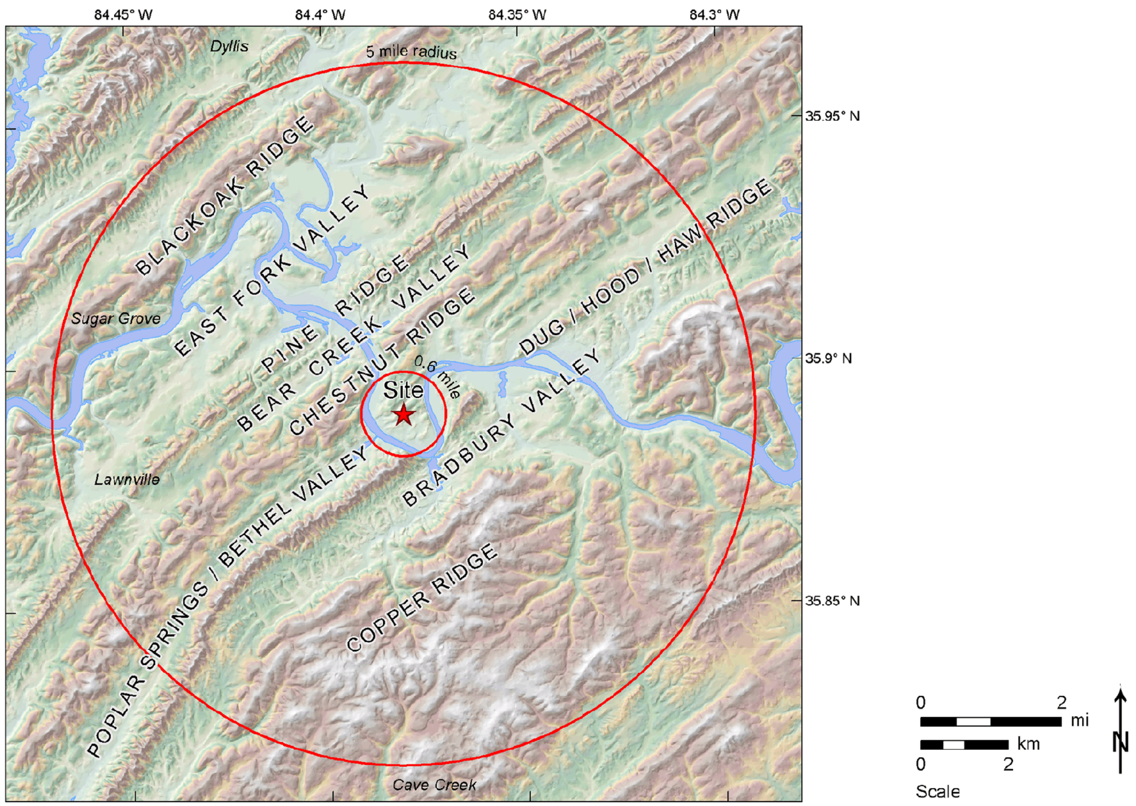


Figure 2.5.1-23. LiDAR Digital Elevation Model Coverage



Note: Local geographic nomenclature from Lemiszki (Reference 2.5.1-215)

Figure 2.5.1-24. Local Physiography with Local Nomenclature for Valleys and Ridges

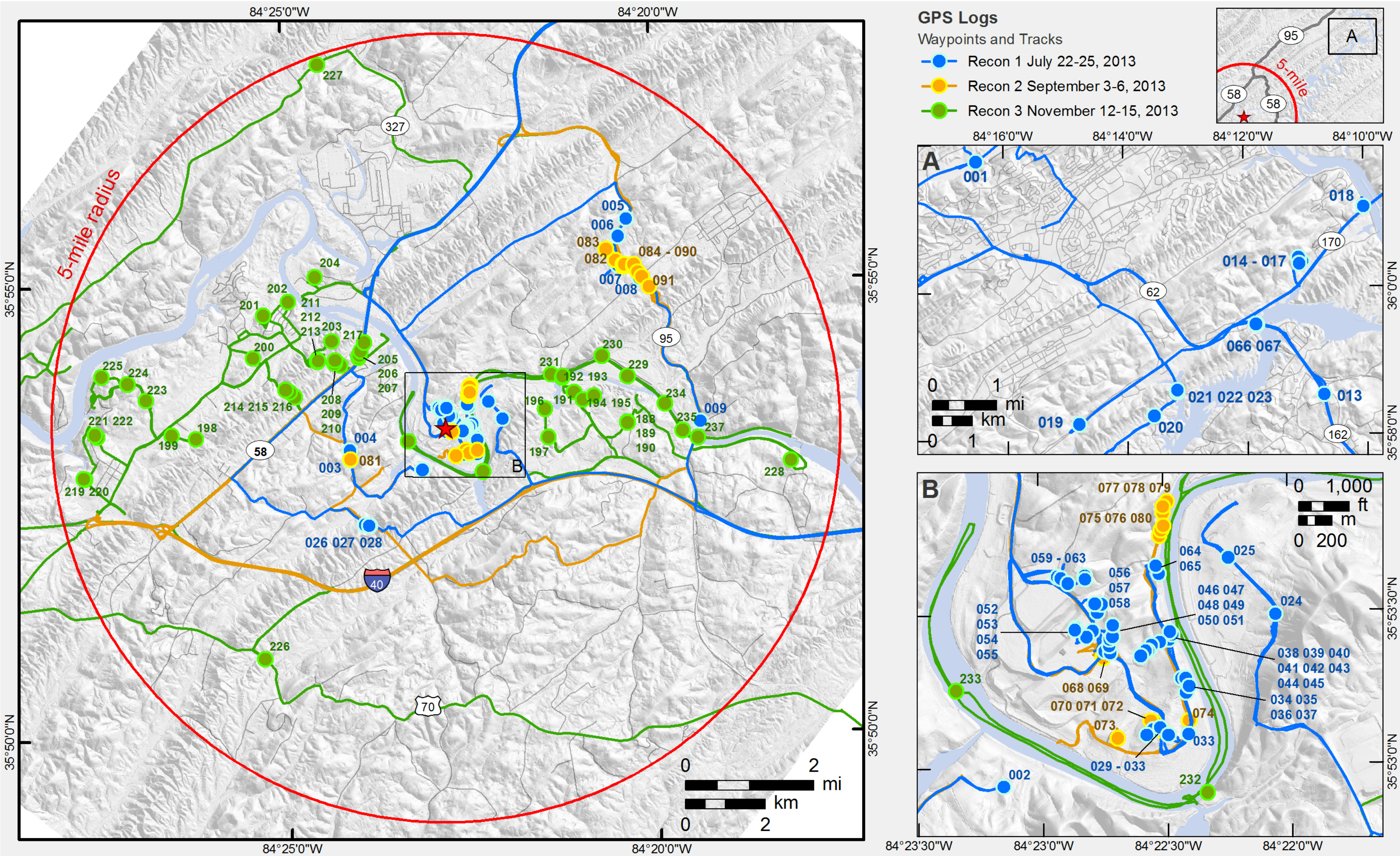


Figure 2.5.1-25. Geologic Field Reconnaissance Waypoint Locations

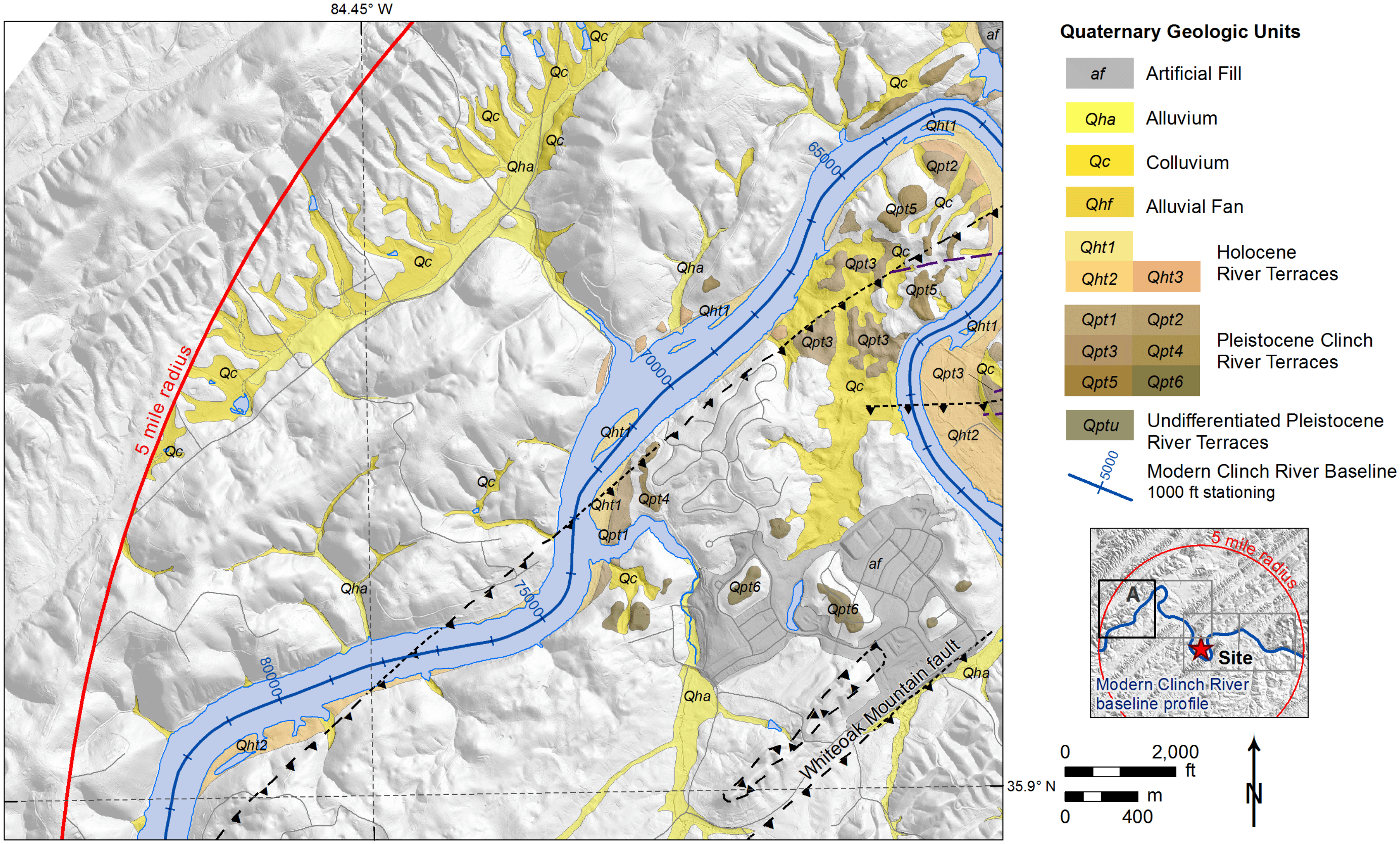


Figure 2.5.1-26. (Sheet 1 of 6) Quaternary Terrace Map Adjacent to the Clinch River Arm of the Watts Bar Reservoir Within the Clinch River Nuclear Site Area, Location A

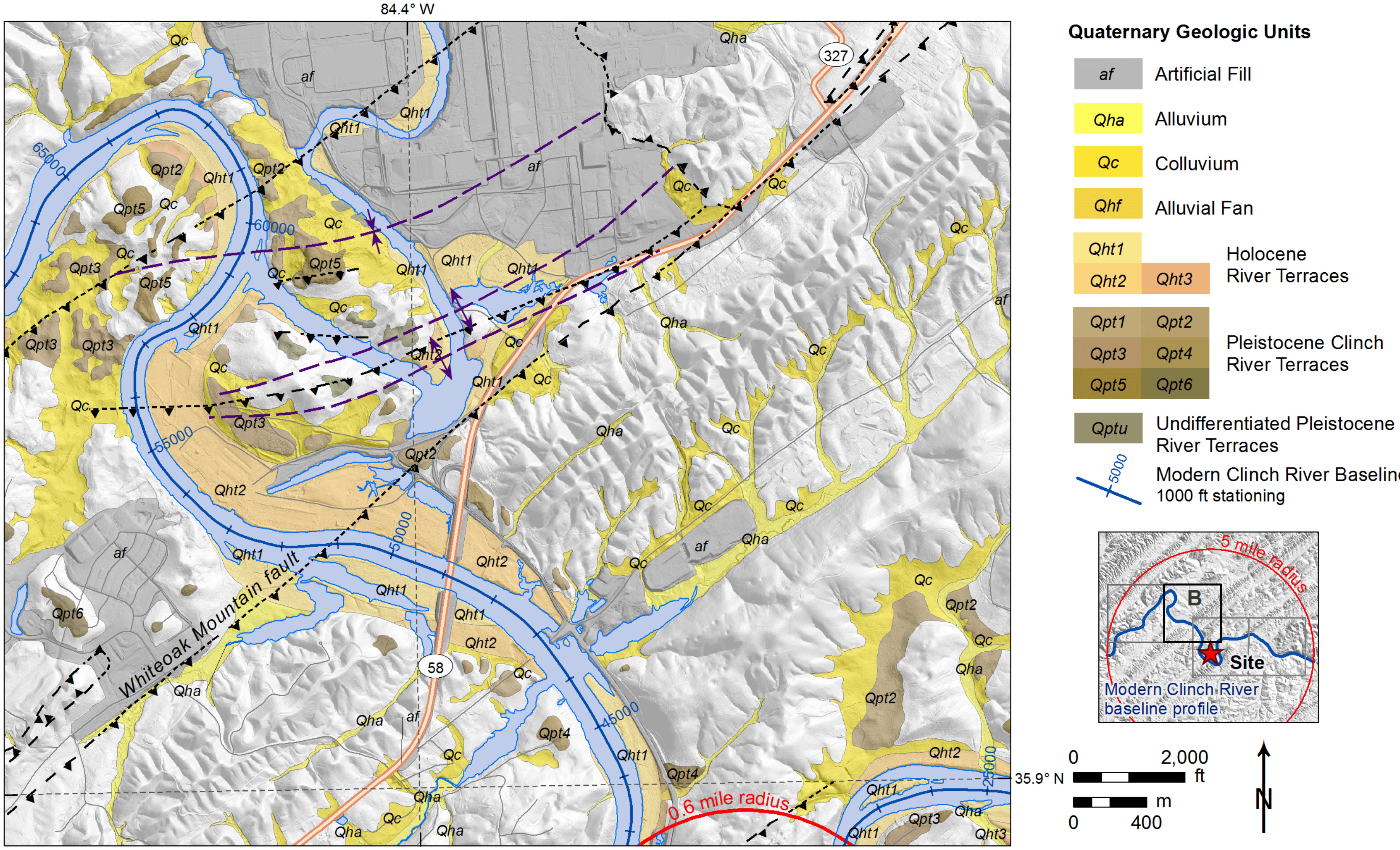


Figure 2.5.1-26. (Sheet 2 of 6) Quaternary Terrace Map Adjacent to the Clinch River Arm of the Watts Bar Reservoir Within the Clinch River Nuclear Site Area, Location B

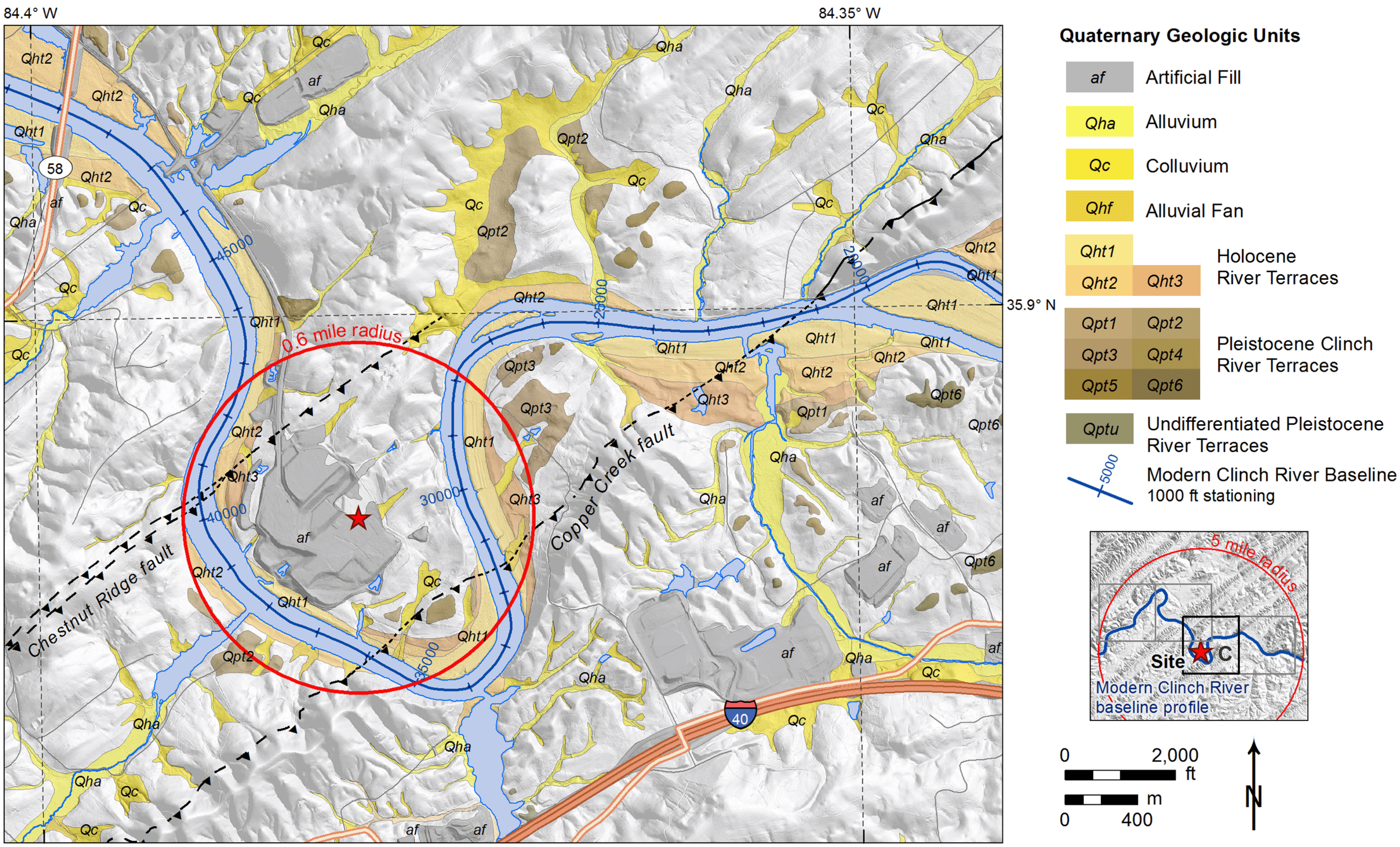


Figure 2.5.1-26. (Sheet 3 of 6) Quaternary Terrace Map Adjacent to the Clinch River Arm of the Watts Bar Reservoir Within the Clinch River Nuclear Site Area, Location C

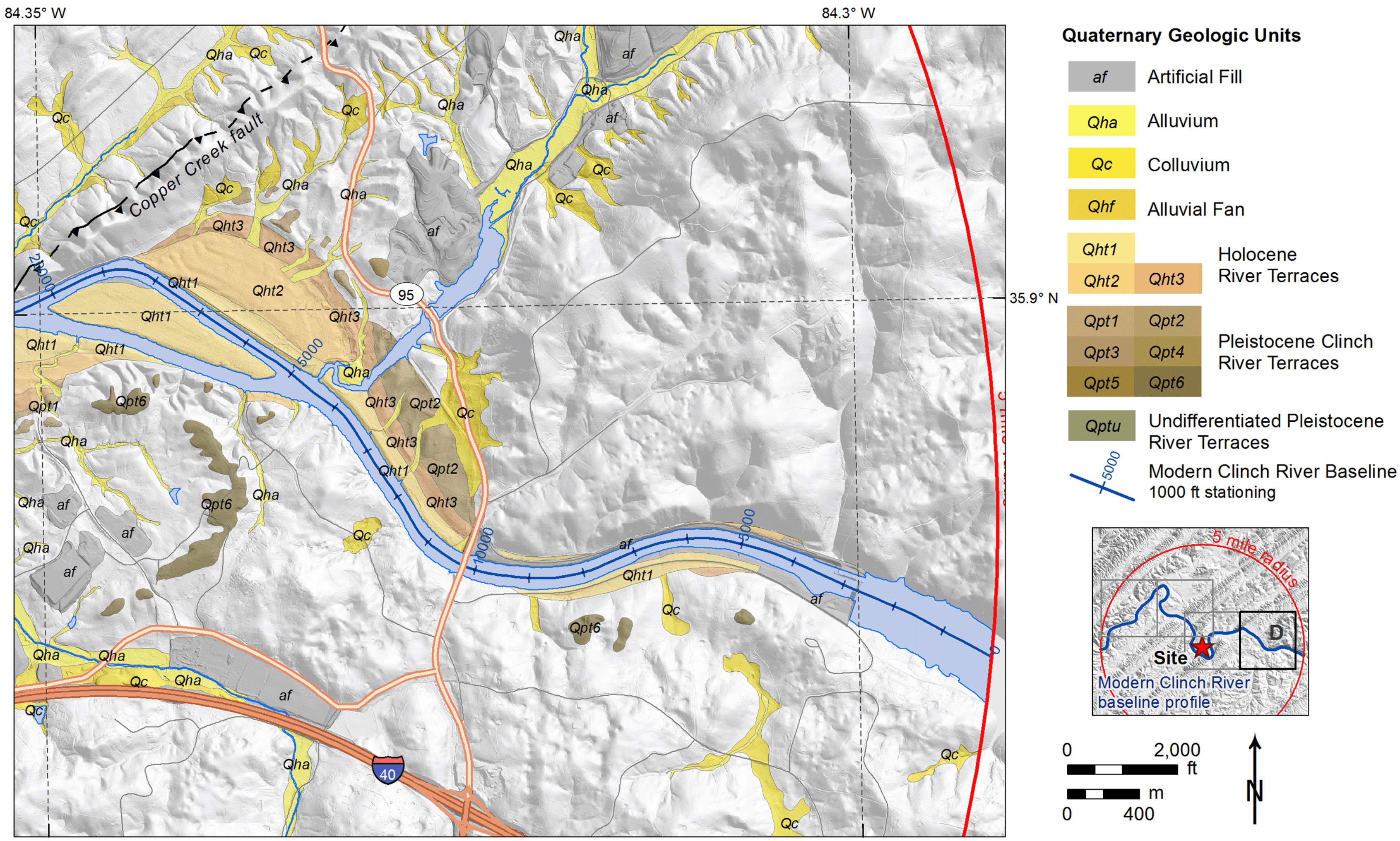
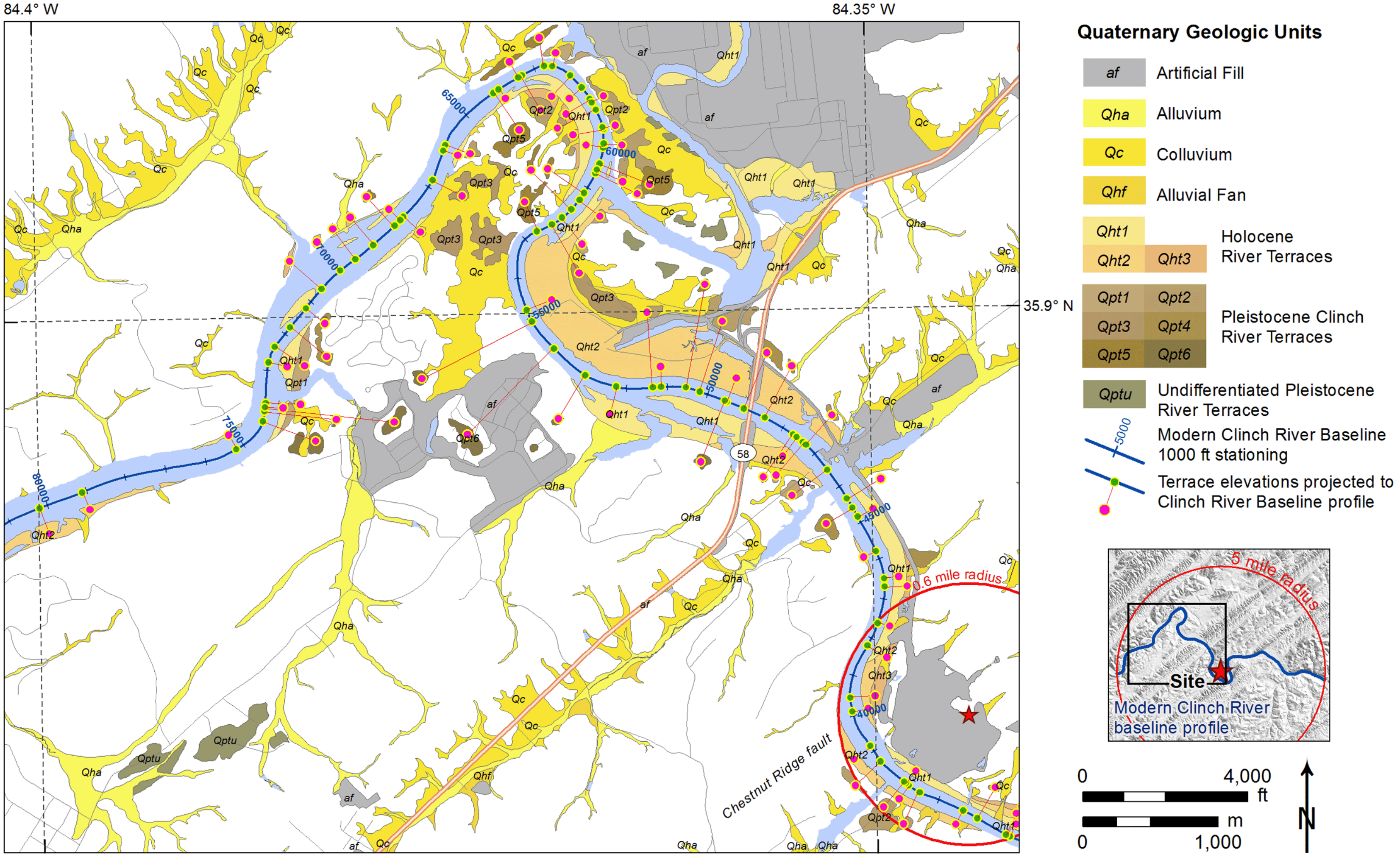
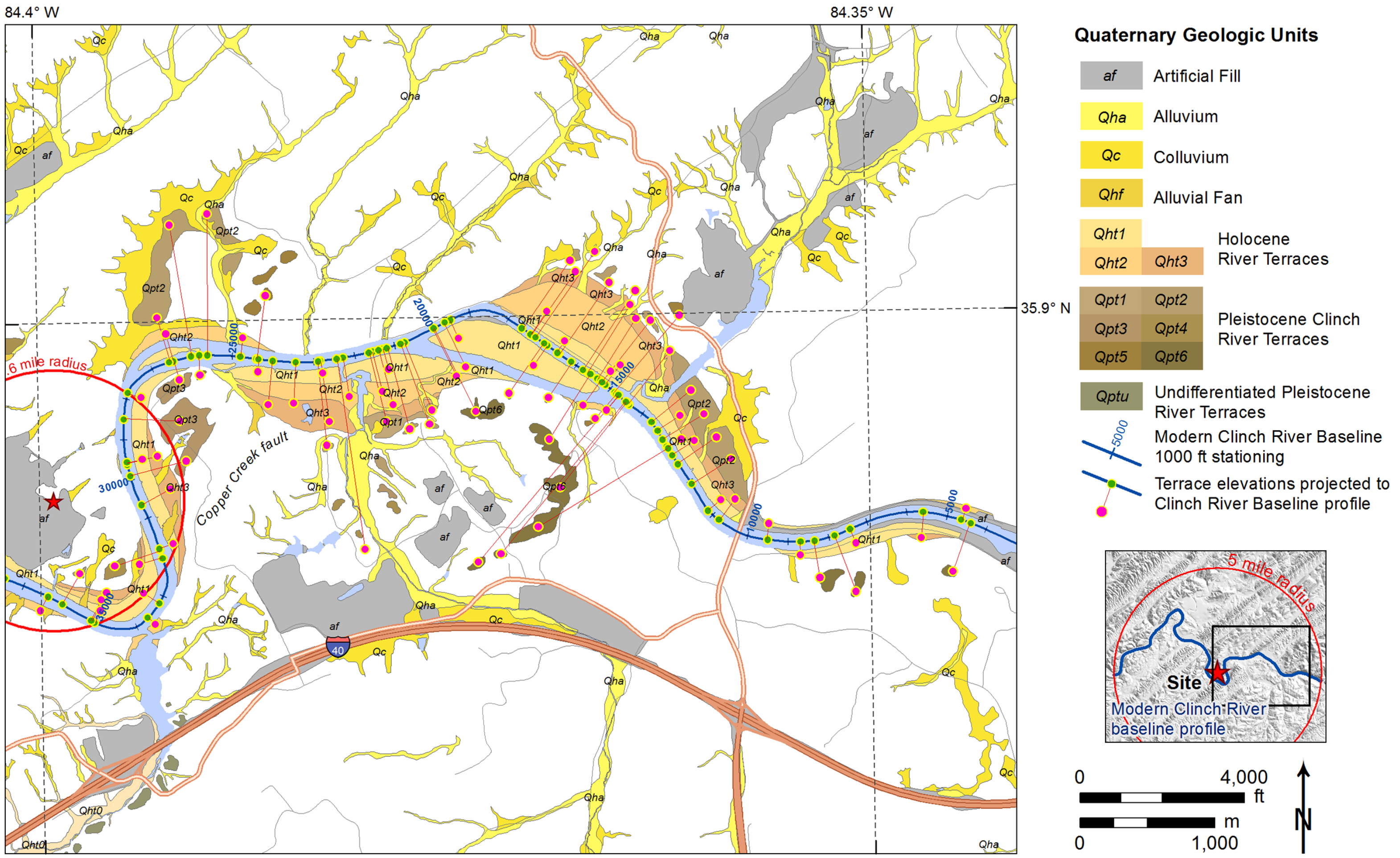


Figure 2.5.1-26. (Sheet 4 of 6) Quaternary Terrace Map Adjacent to the Clinch River Arm of the Watts Bar Reservoir Within the Clinch River Nuclear Site Area, Location D



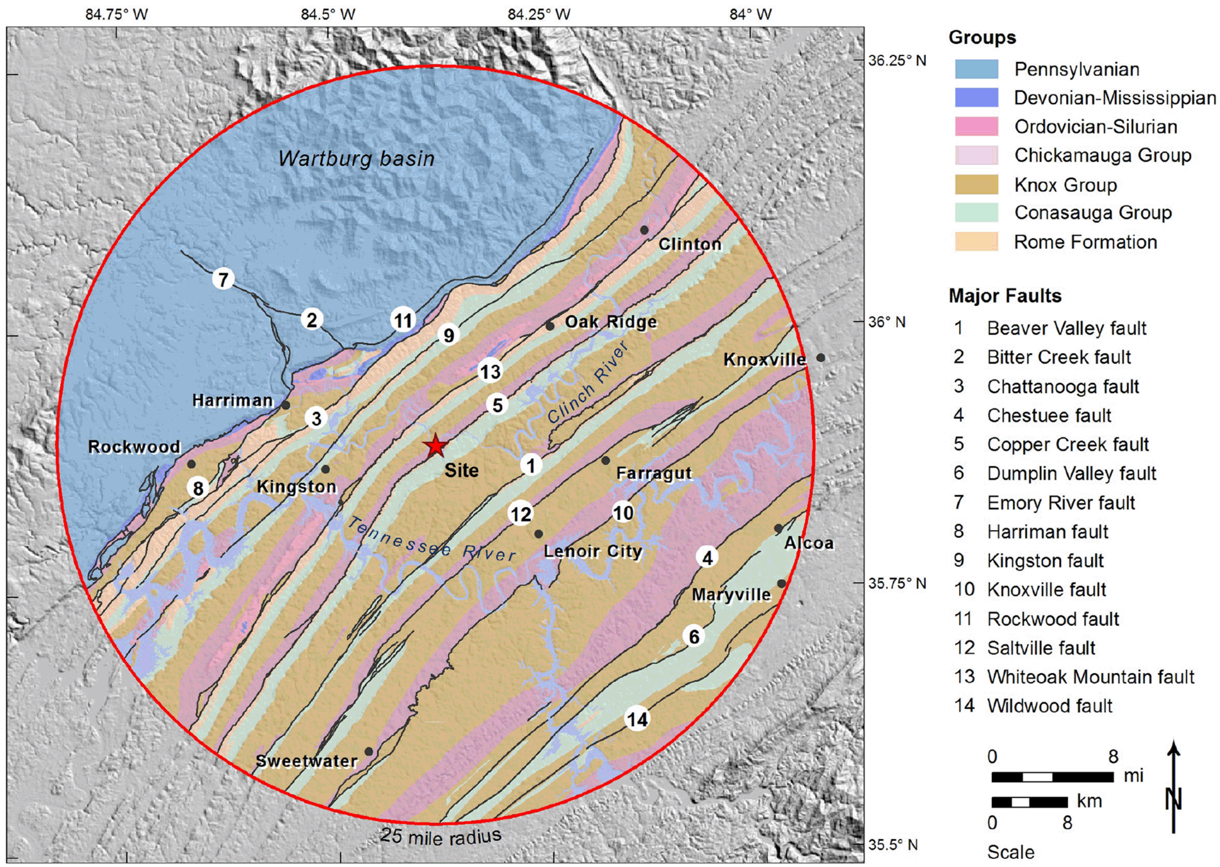
Notes:
See Figure 2.5.3-4 for Longitudinal Profiles of Quaternary Terraces along the Clinch River.

Figure 2.5.1-26. (Sheet 5 of 6) Quaternary Terrace Projections to the Clinch River for creation of Longitudinal Profile



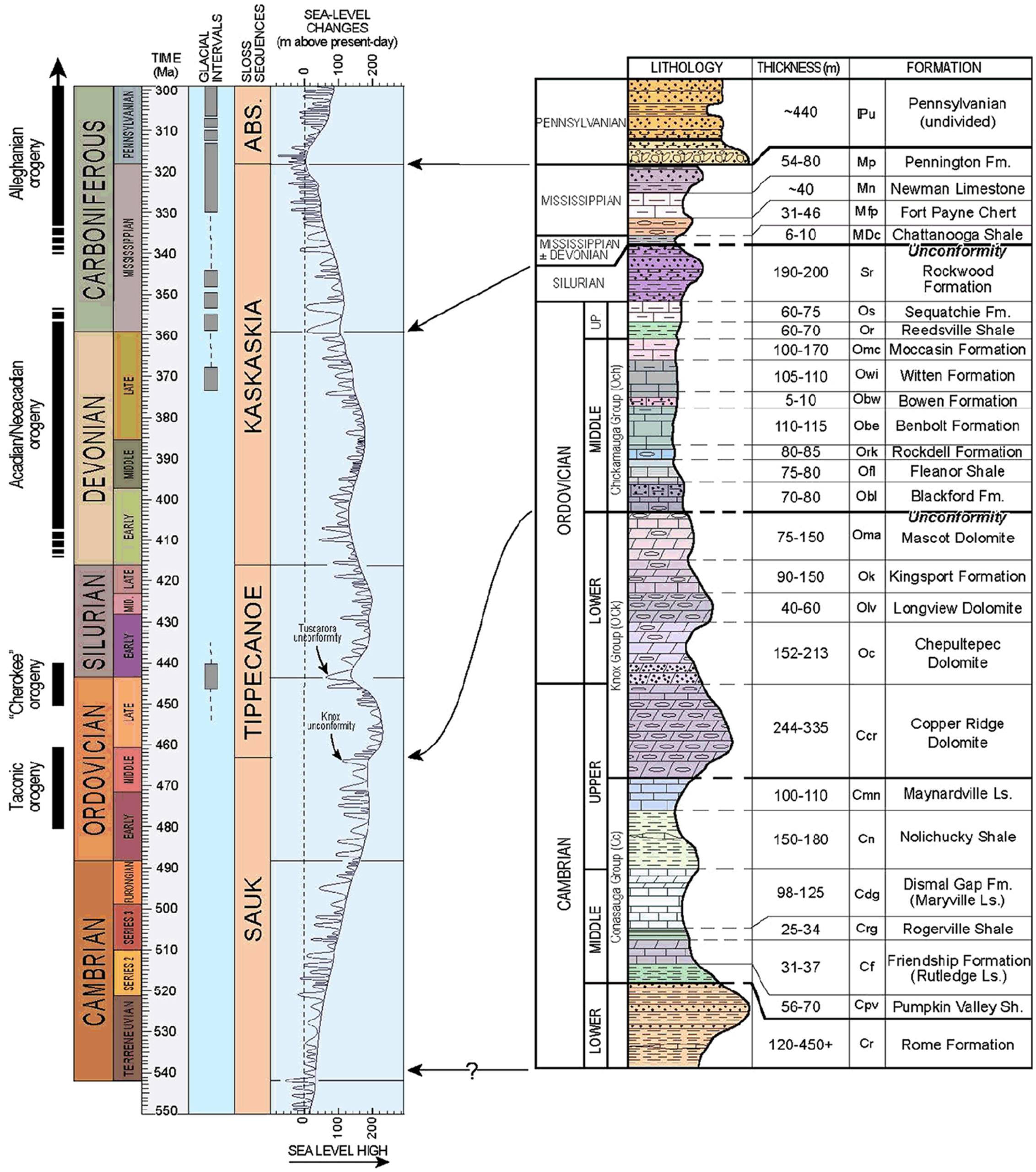
Notes:
See Figure 2.5.3-4 for Longitudinal Profiles of Quaternary Terraces along the Clinch River.

Figure 2.5.1-26. (Sheet 6 of 6) Quaternary Terrace Projections to the Clinch River for creation of Longitudinal Profile



Note: Simplified geologic map of the Clinch River Nuclear site vicinity.

Figure 2.5.1-27. Simplified Site Vicinity Geologic Map



Notes:
Generalized stratigraphic column of the geology of the CRN site vicinity (right) with Paleozoic sea level curves, Reference 2.5.1-49 cratonic sequences, glacial intervals, and tectonic events (left; modified from Reference 2.5.1-206) that correspond to the time interval represented by the stratigraphic section (modified from Reference 2.5.1-9).
ABS-Absaroka

Figure 2.5.1-28. Stratigraphic Column with Sea Level Curve

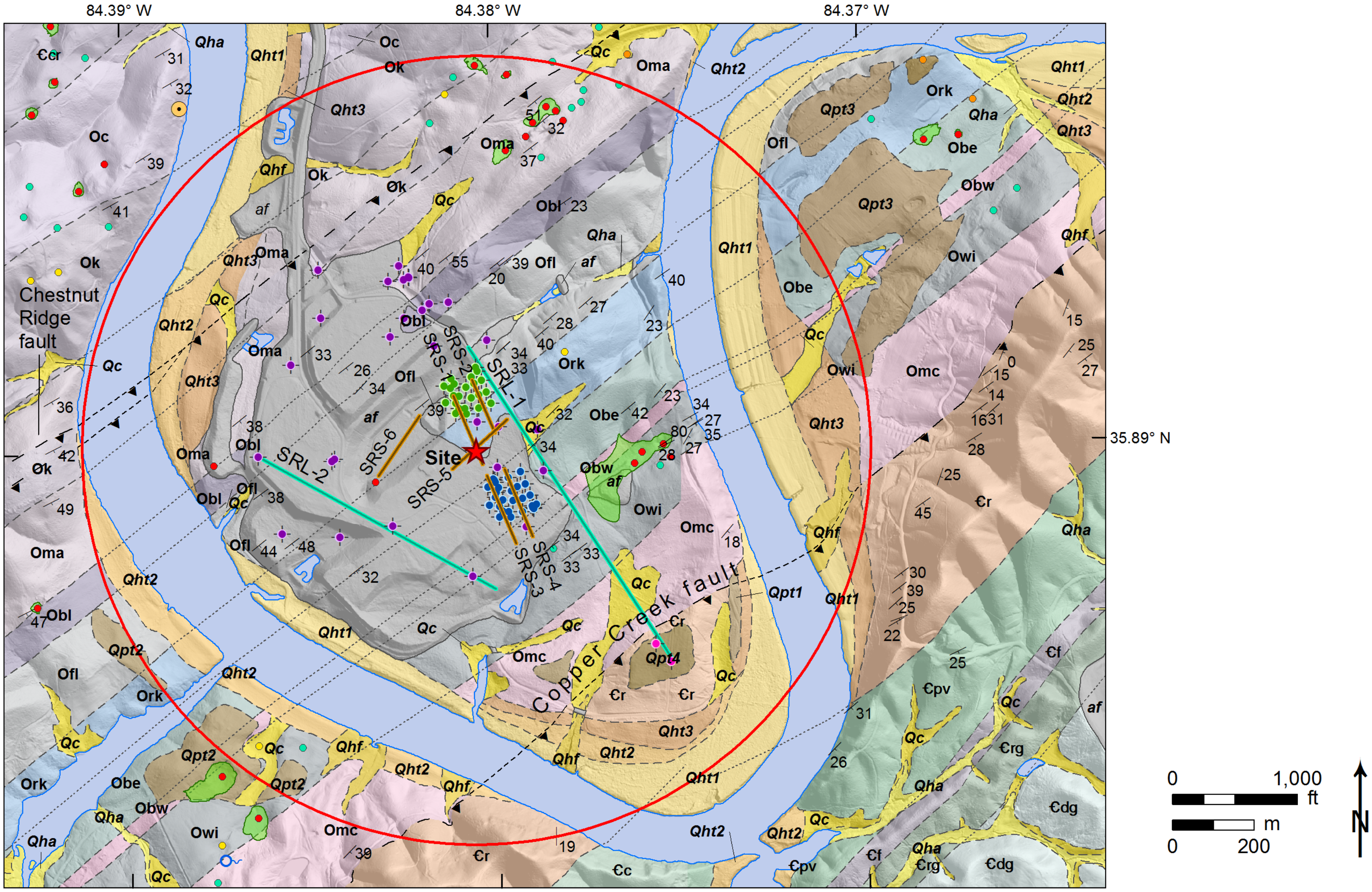


Figure 2.5.1-29. (Sheet 1 of 2) Site Location Geologic Map Showing Borings

Quaternary Units

Quaternary

- *af* Artificial Fill
- *Qha* Alluvium
- *Qc* Colluvium
- *Qhf* Alluvial Fan
- *Qht1* *Qht2* *Qht3* Holocene Clinch River Terraces
- *Qpt1* *Qpt2* *Qpt3* *Qpt4* *Qpt5* Pleistocene Clinch River Terraces

Geologic Structures

Thrust Fault
dashed where approximate, dotted where concealed

Contact
dashed where approximate, dotted where concealed

Karst Features

- Cave
- Closed depression ≥ 2 ft deep and 100 sq ft area
- Three-sided depression
- Two-sided depression
- Shallow closed depression < 2 ft deep
- Spring
- Closed depression ≥ 2 ft deep and 2000 sq ft area

Explorations

Borings

- CC Series
- MP-100 Series
- MP-200 Series
- MP-400 Series

SRL Seismic Reflection Line

SRS Seismic Refraction Line

Bedrock Units

Chickamauga Group

Middle Ordovician

- Omc — Moccasin Fm.
  siltstone with limestone interbeds
- Owi — Witten Fm.
  limestone with shale interbeds
- Obw — Bowen Fm.
  siltstone with limestone interbeds
- Obe — Benbolt Fm.
  limestone with siltstone interbeds
- Ork — Rockdell Fm.
  limestone with siltstone interbeds
- Ofl — Fleanor Shale mbr. of the Lincolnshire Fm.
  shale and siltstone with limestone
- Obl — Blackford Fm. (includes Eidsen mbr.)
  limestone and siltstone

Knox Group

Lower Ordovician

- Oma — Mascot Dolomite
  dolomite with chert, limestone and sandstone
- Ok — Kingsport Fm.
  dolomite with chert, limestone and sandstone
- Olv — Longview Dolomite
  dolomite and chert
- Oc — Chepultepec Dolomite
  dolomite with chert, limestone and sandstone

Upper Cambrian

- Ꞓcr — Copper Ridge Dolomite
  dolomite with chert, limestone and sandstone

Conasauga Group

- Ꞓc — Conasauga Group - undivided

Middle Cambrian

- Ꞓrg — Rogersville Shale
  shale with mudstone and siltstone interbeds
- Ꞓf — Friendship Fm. (Rutledge Ls.)
  limestone, dolomite, siltstone and shale
- Ꞓpv — Pumpkin Valley Shale
  shale with mudstone and siltstone interbeds

Rome Formation

Lower Cambrian

- Ꞓr — Rome Fm. - undivided
  sandstone, shale and siltstone with interbeds of dolomite

Figure 2.5.1-29. (Sheet 2 of 2) Site Location Geologic Map Showing Borings

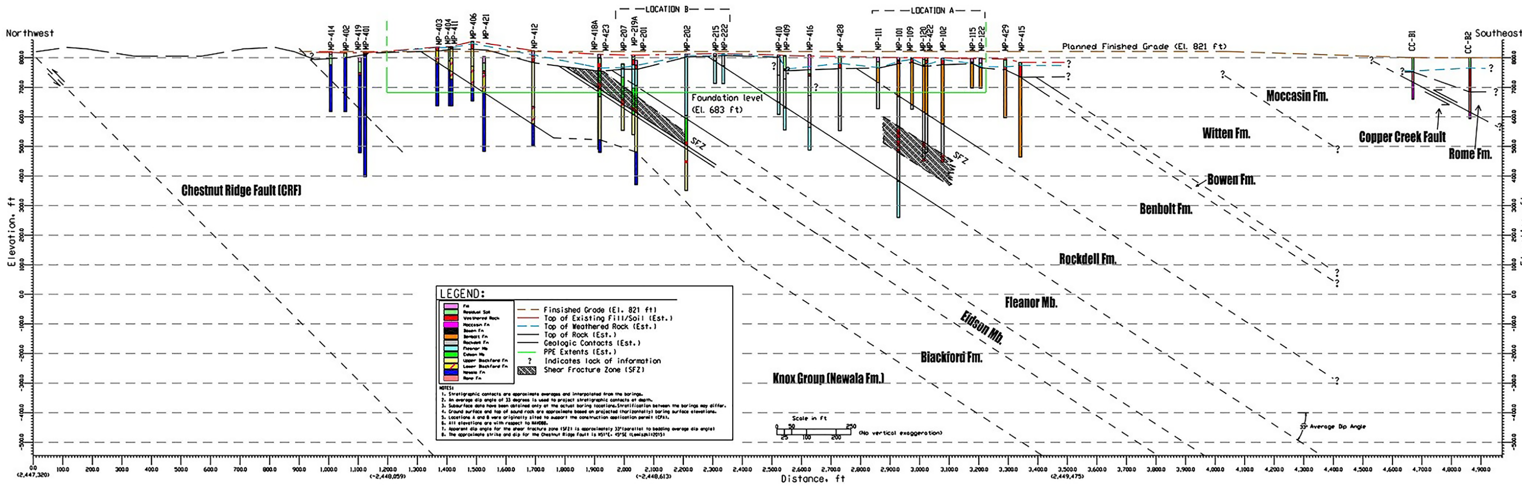


Figure 2.5.1-30. Geologic Cross-Section K–K′ of the Clinch River Nuclear Site

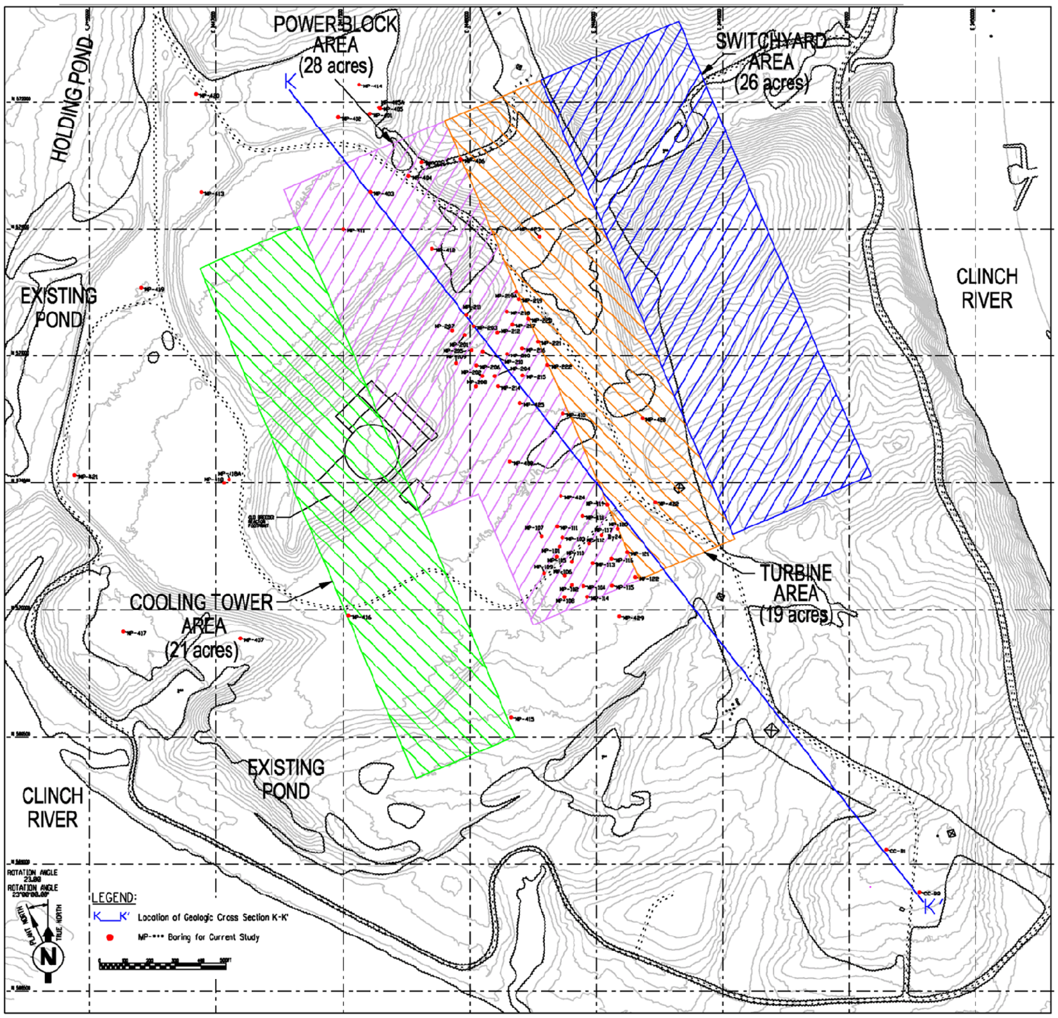
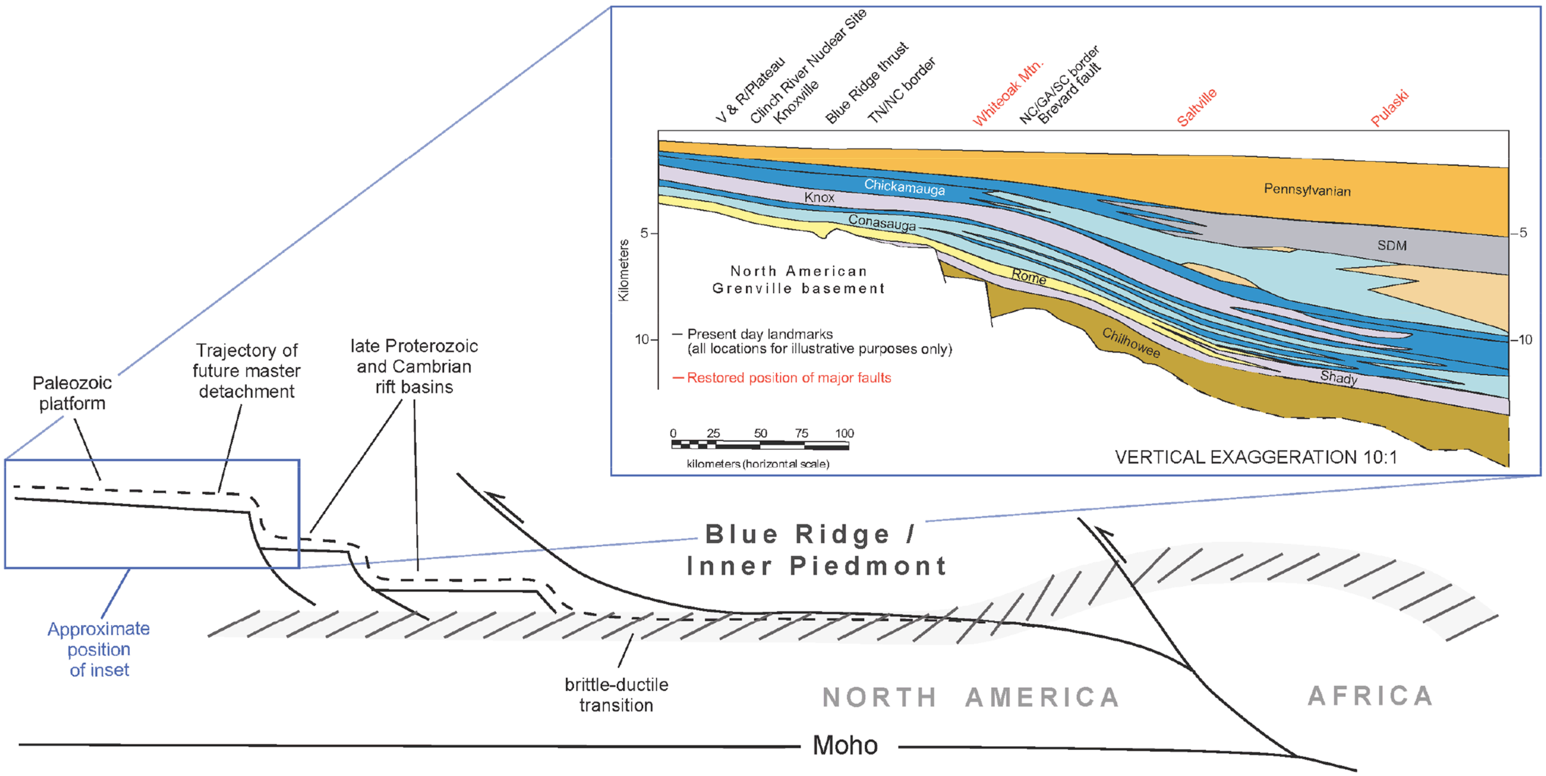
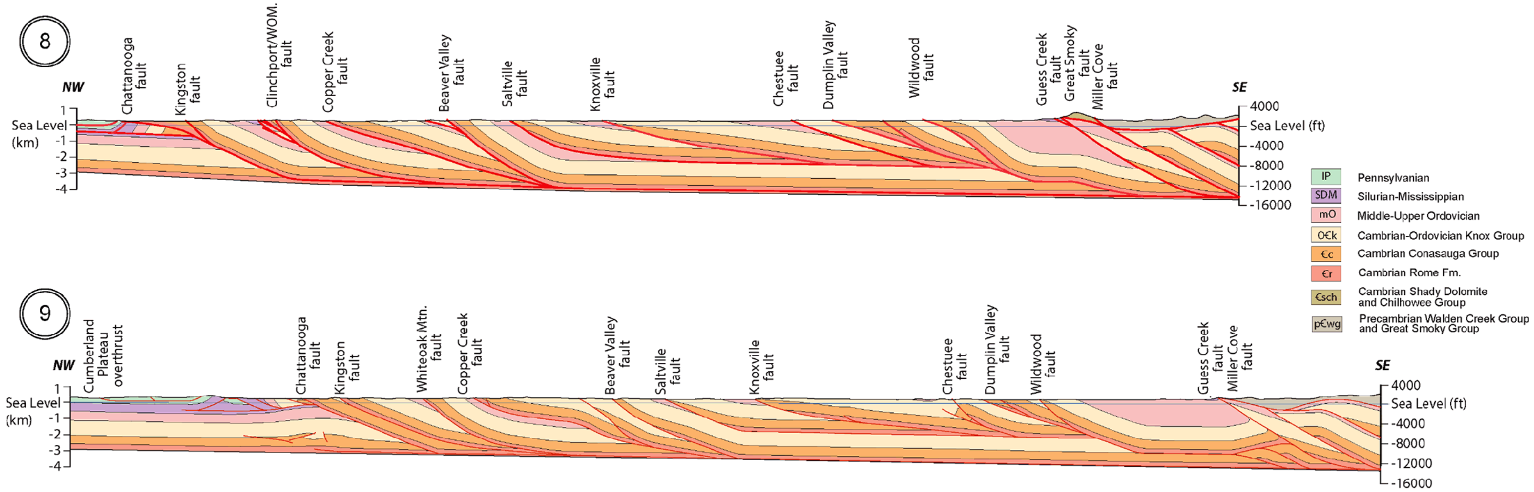


Figure 2.5.1-31. Subsurface Investigation Borehole and Geologic Cross-Section K–K′ Locations



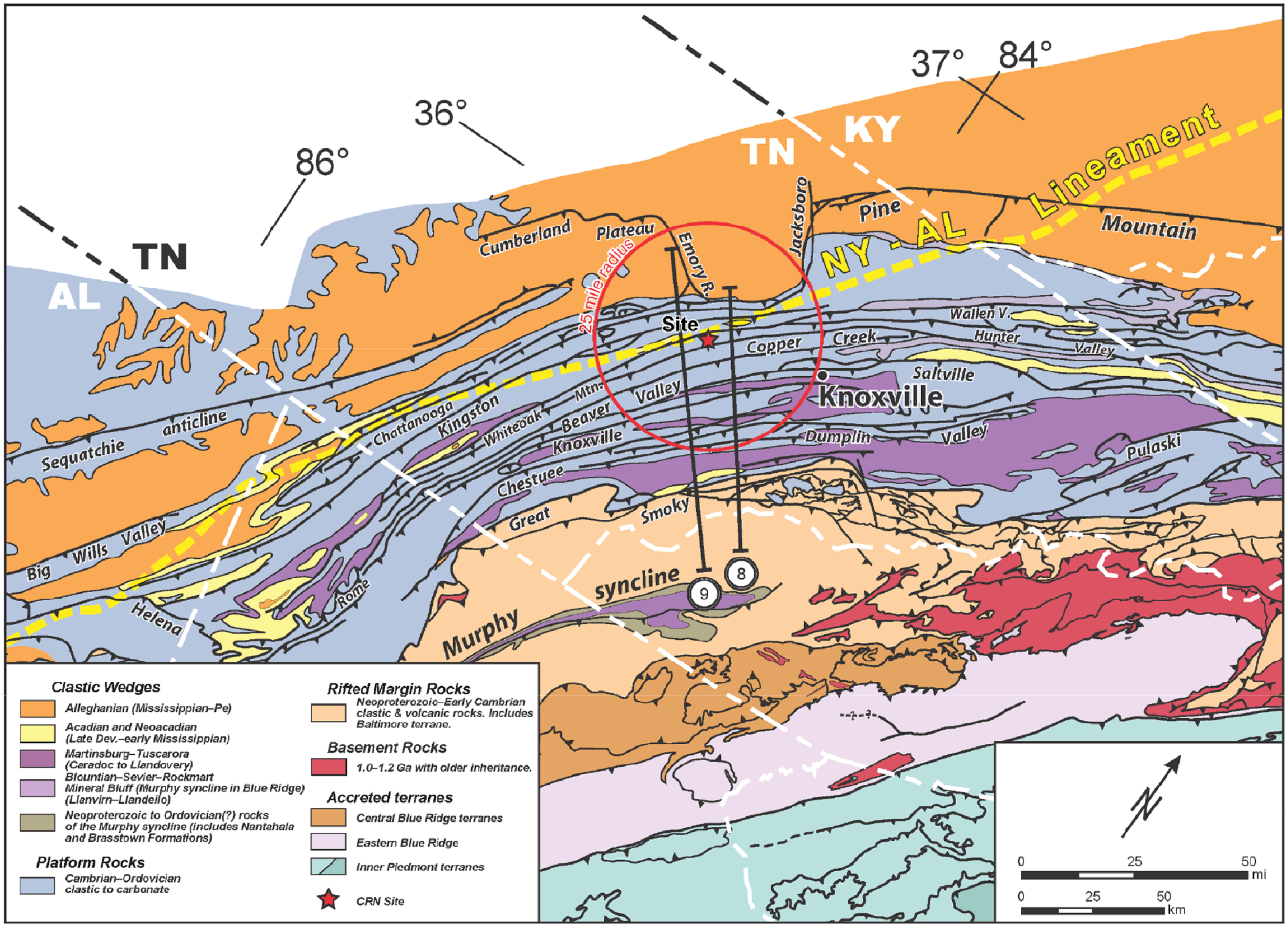
Notes:
Diagrammatic illustration of the propagation of the master Appalachian detachment (modified from Reference 2.5.1-159).
Inset shows palinspastically restored facies diagram of Neoproterozoic to late Paleozoic passive margin strata that was deposited along the Iapetan margin (modified from Reference 2.5.1-13).
Blue box indicates the approximate location of area depicted in inset.

Figure 2.5.1-32. Schematic Appalachian Detachment



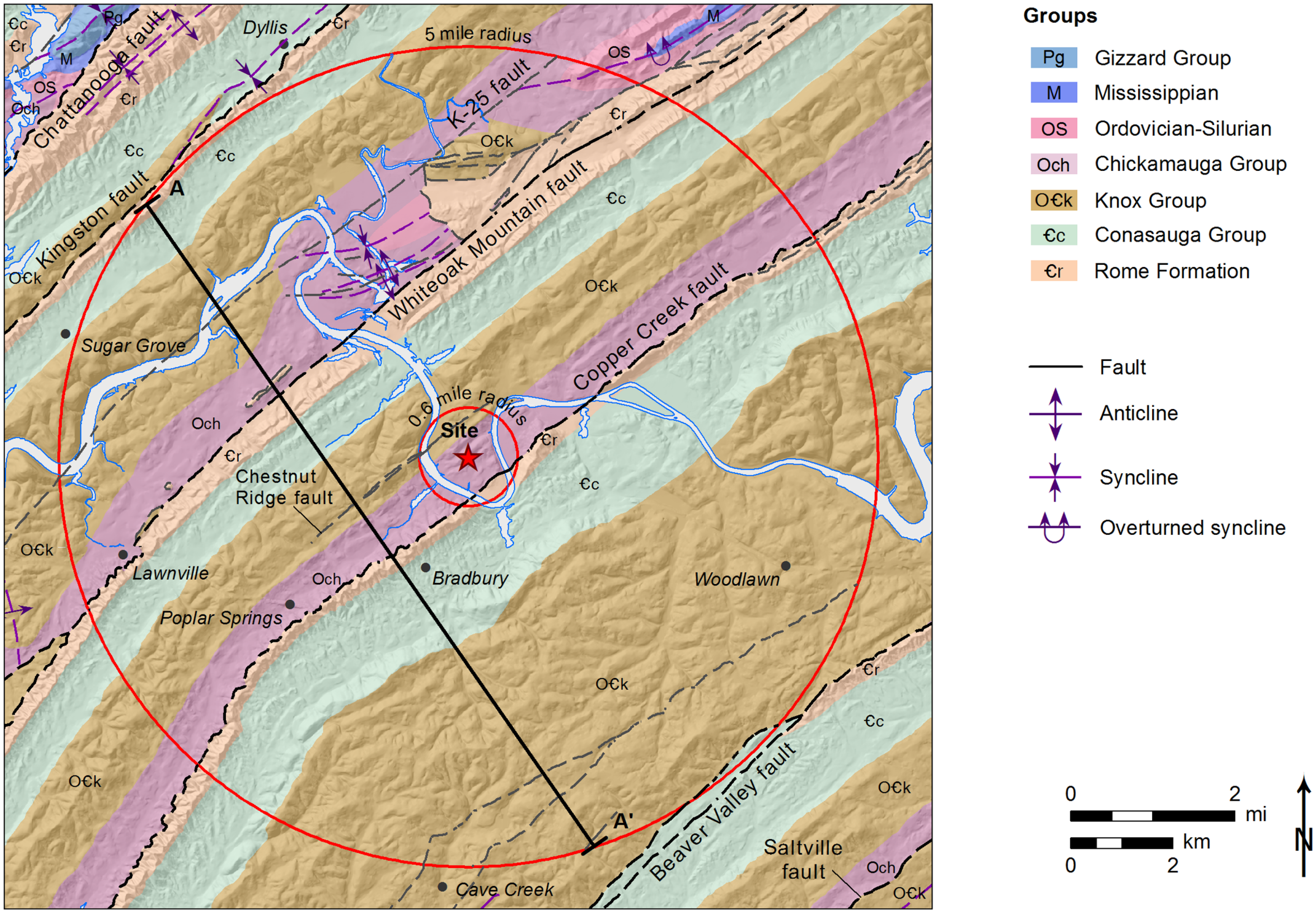
Note: Balanced cross-sections through the Valley and Ridge province from Reference 2.5.1-230 that intersect the Clinch River Nuclear site vicinity.

Figure 2.5.1-33. (Sheet 1 of 2) Tectonic Map Cross-Sections—Valley and Ridge



Notes:
Location of cross-sections shown in (A).
Tectonic map modified from Reference 2.5.1-102.

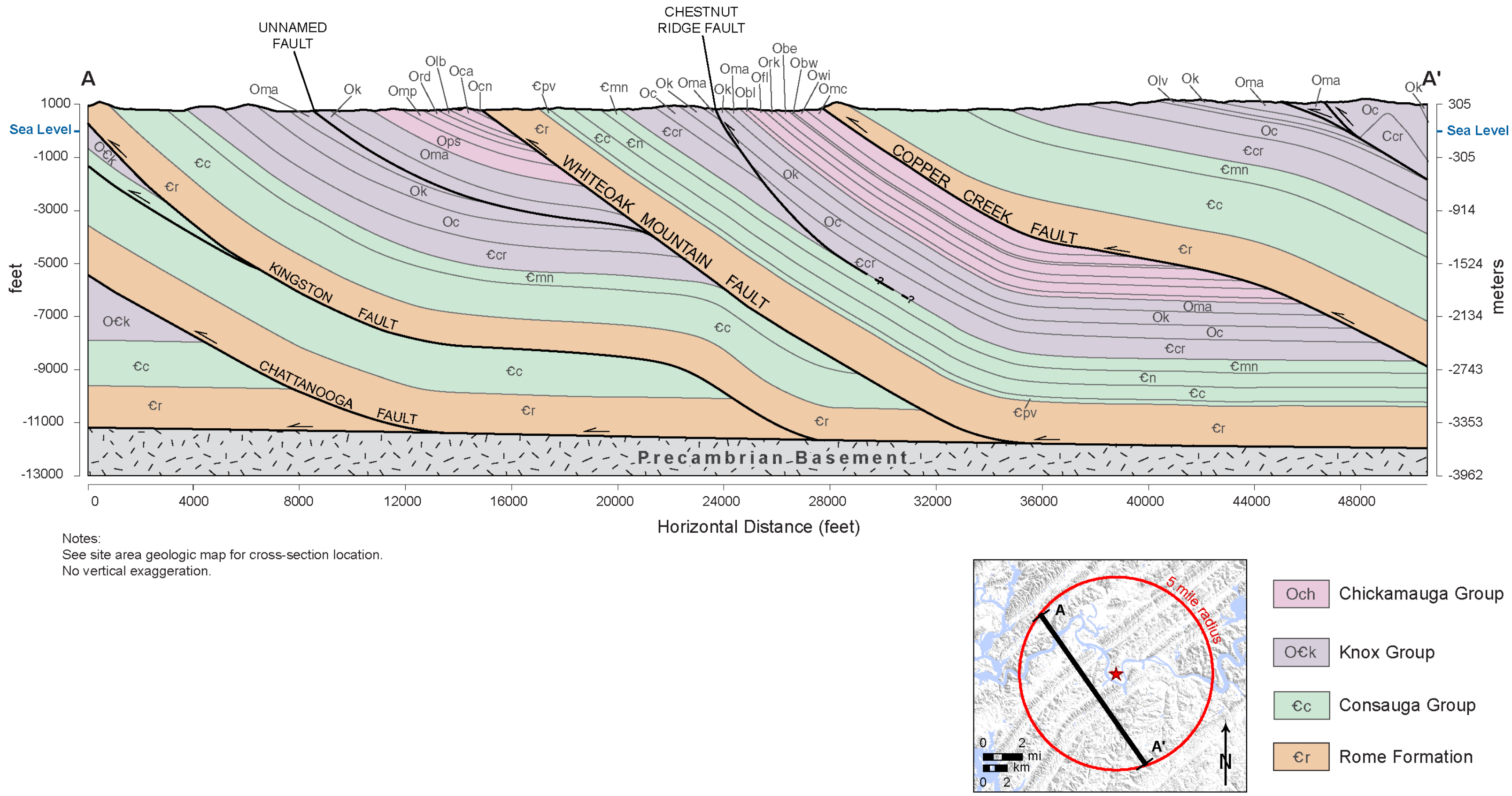
Figure 2.5.1-33. (Sheet 2 of 2) Tectonic Map Cross-Sections—Locations



Notes:

See Site Area Geologic Cross Section A-A' (Figure 2.5.1-35).
See Plate 2 in Part 8 for more detailed geologic map of the site area.

Figure 2.5.1-34. Site Area Geologic Map



Notes:
See site area geologic map for cross-section location (Figure 2.5.1-34).
No vertical exaggeration.
Geologic cross-section through the site area projected to Precambrian basement.

Figure 2.5.1-35. Site Area Geologic Cross-Section A-A’