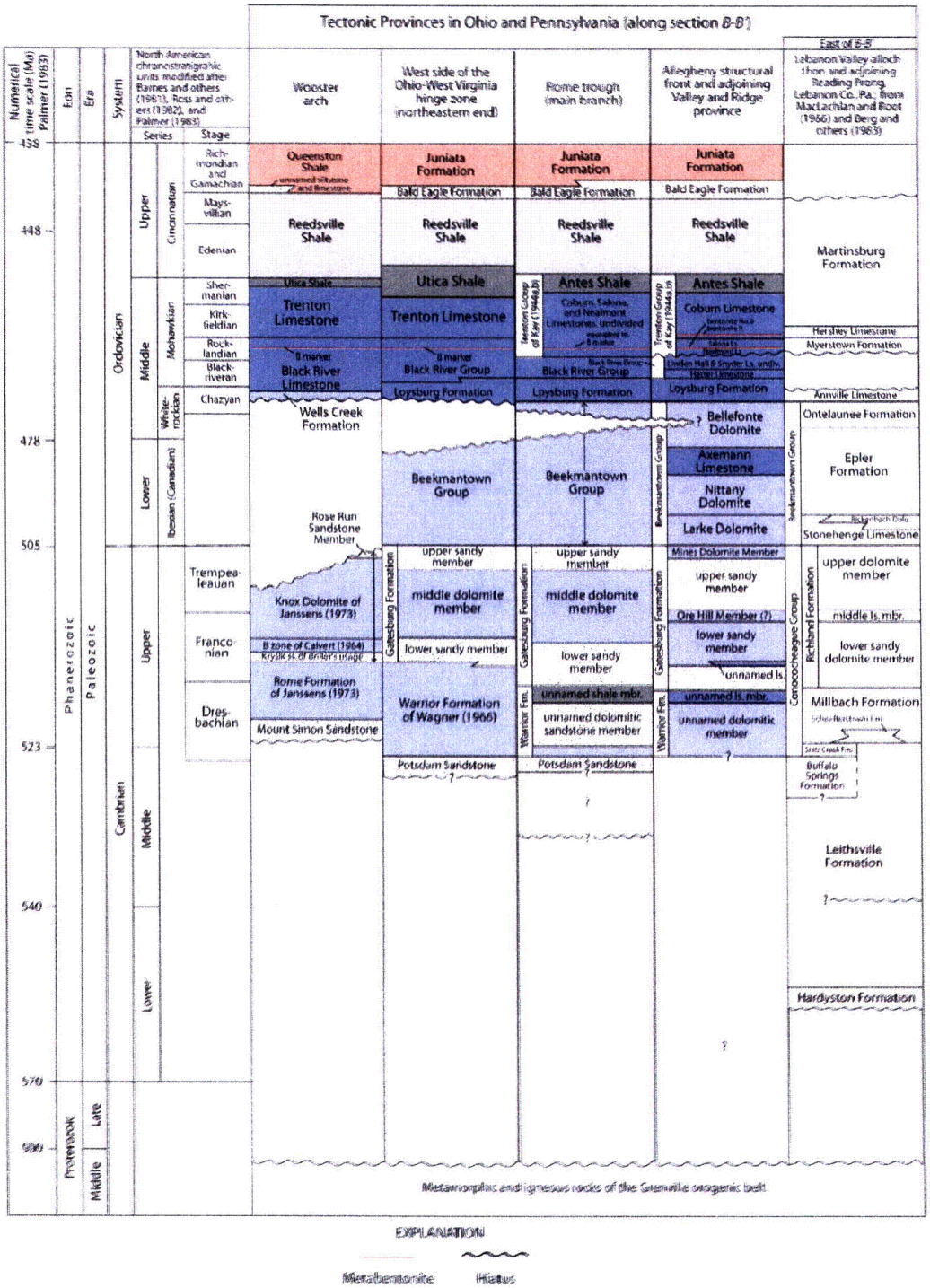
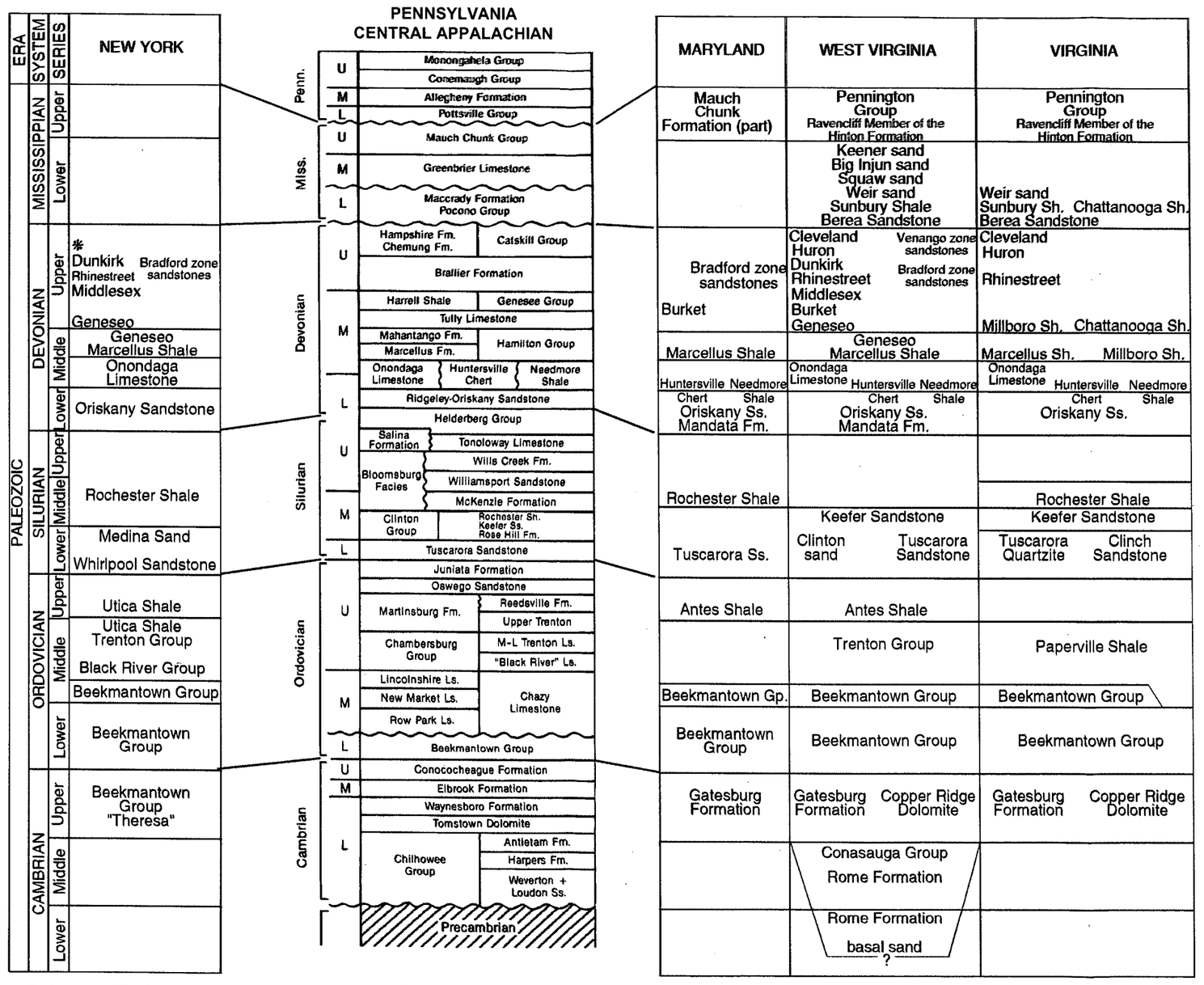
Figure 2.5-13 Stratigraphic Correlation Chart of Appalachian Basin



REFERENCE:
- Crangle Jr. 2002.

Figure 2.5-13a Regional Generalized Composite Stratigraphic Column

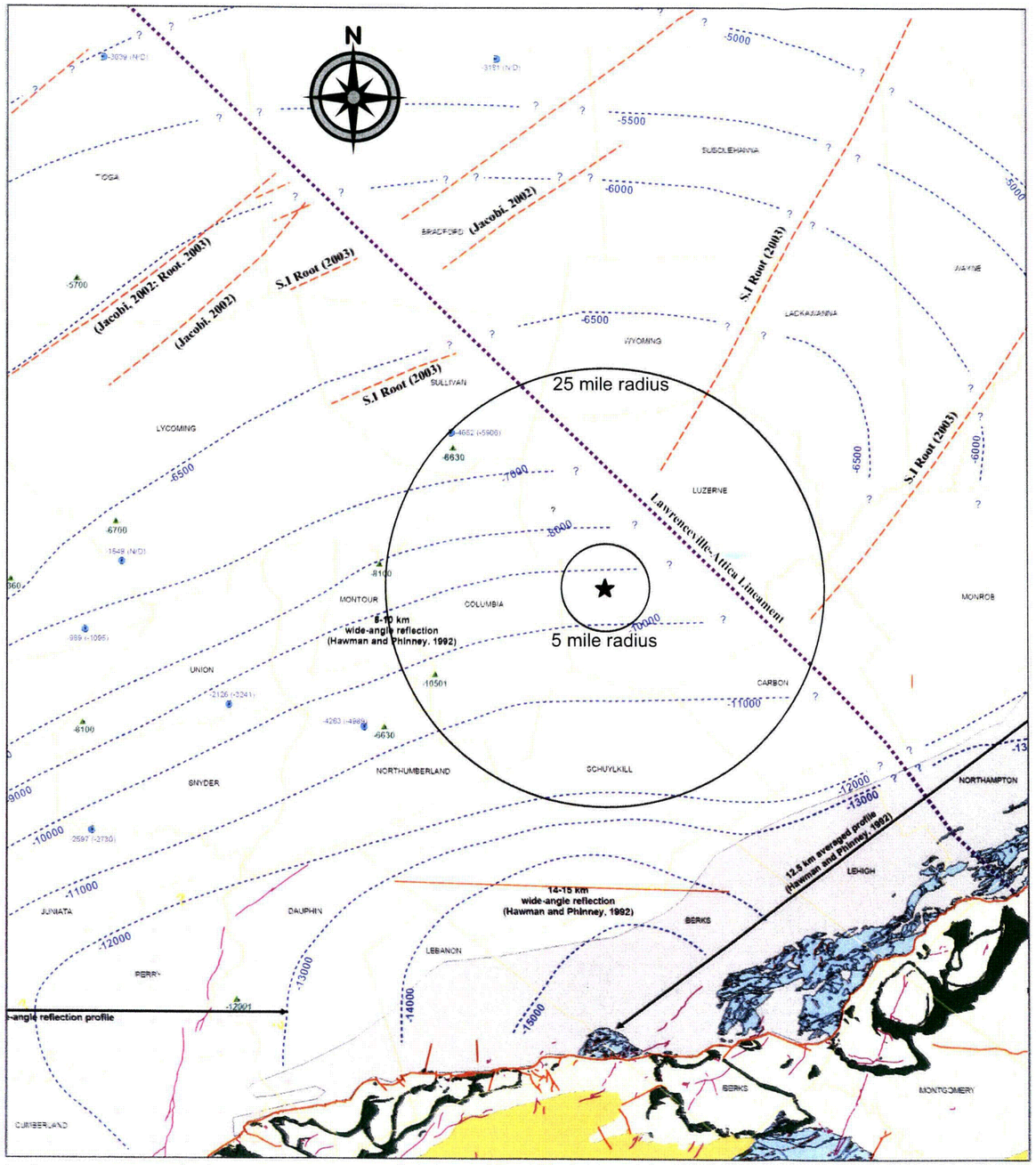


Reference: Ryder, 1995

Reference:` Mitra, 1988

Reference: Ryder, 1995

Figure 2.5-14 Precambrian Basement Map of Appalachian Basin 25 mile (40 km) and 5 mile (8 km) Radii



Reference:
Modified from Gold, 2005

Note: Contours are in meters

Appalachian Basin (structure contours of Precambrian surface, 500 m interval)

- Paleozoic sedimentary rocks (undifferentiated)

Piedmont Physiographic Province (no contours shown)

- Tertiary and Cretaceous cover rocks
- Mesozoic cover rocks, with diabase sheets (dark green)
- Cambro-Ordovician sedimentary rocks; highly deformed, with nappes
- Lower Paleozoic metasediments
- Lower Paleozoic crystalline and metamorphic rocks
- Precambrian metavolcanic rocks (Catoctin), exposed/potential area coverage
- Precambrian crystalline and metamorphic rocks

SYMBOLS LEGEND

Pennsylvania database

- Fault (tab indicates dip direction)
- Fault, inferred
- Fault, mapped
- Seismic fault (barb indicates inferred dip direction)
- Lineament
- -6000 Basement contours; depth in meters bellow sea level
- Structural trough, inferred
- S Structural arch, inferred
- -1811 (-2086) Deep drill hole in Paleozoic cover rocks; bottom elevation of hole in meters below sea level (estimated depth to basement)
- N/D or N/A Elevation not determined or not available
- -5150 Seismic depth in meters
- -7550 Seismic depth in meters
- Oriskany absent
- Jurassic diabase dike
- Jurassic Kimberlite dike
- Lower Paleozoic granitic pegmatite dike
- PreCambrian metadiabase dike

West Virginia database

- Normal fault; tab on downthrown side
- Thrust fault; barbs on upthrown side
- (-22000) - -6706 Basement contours; depth in feet and meters below sea level

Ohio database

- -1632 Drill hole, depth in meters below sea level
- Fault, inferred
- (-5600) - -1881 Basement contours; depth in feet and meters

New York database

- Fault

0 5 10 20 30 40 50 km

0 5 10 20 30 mi

Figure 2.5-15 Regional Tectonic Features

LEGEND

- ★ Center Point of Proposed Bell Bend NPP (BBNPP)
- City
- NPP Reactor 200-mile (322 km) Radius
- Basin
- State Boundary

Earthquakes by Magnitude, m_b (USGS, 2007)

- 3.0 - 3.9
- 4.0 - 4.9
- 5.0 - 5.9
- 6.0 - 6.9
- 7.0 - 7.9

Tectonic Features

1. Moodus Seismic Zone
2. Lackawanna Synclinorium
3. Dobbs Ferry Fault Zone
4. Mosholu Fault
5. New York Bight Fault
6. Kingston Fault
7. Cacoosing Valley Earthquake
8. Lancaster Seismic Zone
9. New Castle County Faults
10. Yellow Breeches Fault
11. Martic Fault
12. Pleasant Valley - Huntingdon Valley Fault
13. Plummers Island Fault
14. Light Street Fault
15. Ramapo Fault
16. Everona Fault
17. Transylvania Fault System
18. Stafford Fault System
19. Brandywine Fault
20. Clarendon-Linden Fault Zone
21. Clinton-Newbury Liquefaction
22. East Border Fault
23. Offset Glaciated Surfaces
24. Furlong-Flemington Fault System
25. Upper Marlboro Faults
26. Fall Lines
27. Hudson River Valley Trend
28. New York-Alabama Lineament
29. Tyrone-Mt. Union Lineament
30. Pittsburgh-Washington Lineament
31. Bristol Block Geopotential Trends
32. Berwick Fault
35. Anthracite Region
36. St. Lawrence Valley Rift
37. Charlevoix - La Malbaie
38. Lebanon - Pennsylvania Geopotential Trend
39. Pennsylvania Aulacogen
40. Adirondack Uplift
41. Latitude 40° N Fault Zone
44. Valley and Ridge Fold and Thrust Zone
45. Mohawk River Trend
46. Attica, NY Intersection Feature
47. New Jersey Isostatic Gravity Saddle
48. Broadtop Synclinorium
49. Sweet Arrow Fault
50. Chestnut Ridge Anticlinorium
51. Reading Prong
52. Peekskill - Stamford Seismic Boundary

REFERENCES:
- EPRI, 1986.
- ESRI, 2007.
- Harrison, 2004.
- Hibbard, 2006.
- Jacobsen, 1974.
- King, 1978.
- National Atlas, 2008.
- Rogers, 1984.
- Senior, 2006.
- Shumaker, 2002.
- Sykes, 2008.
- Weems, 1998.
- Wheeler, 2006.
- Wood, 1960.

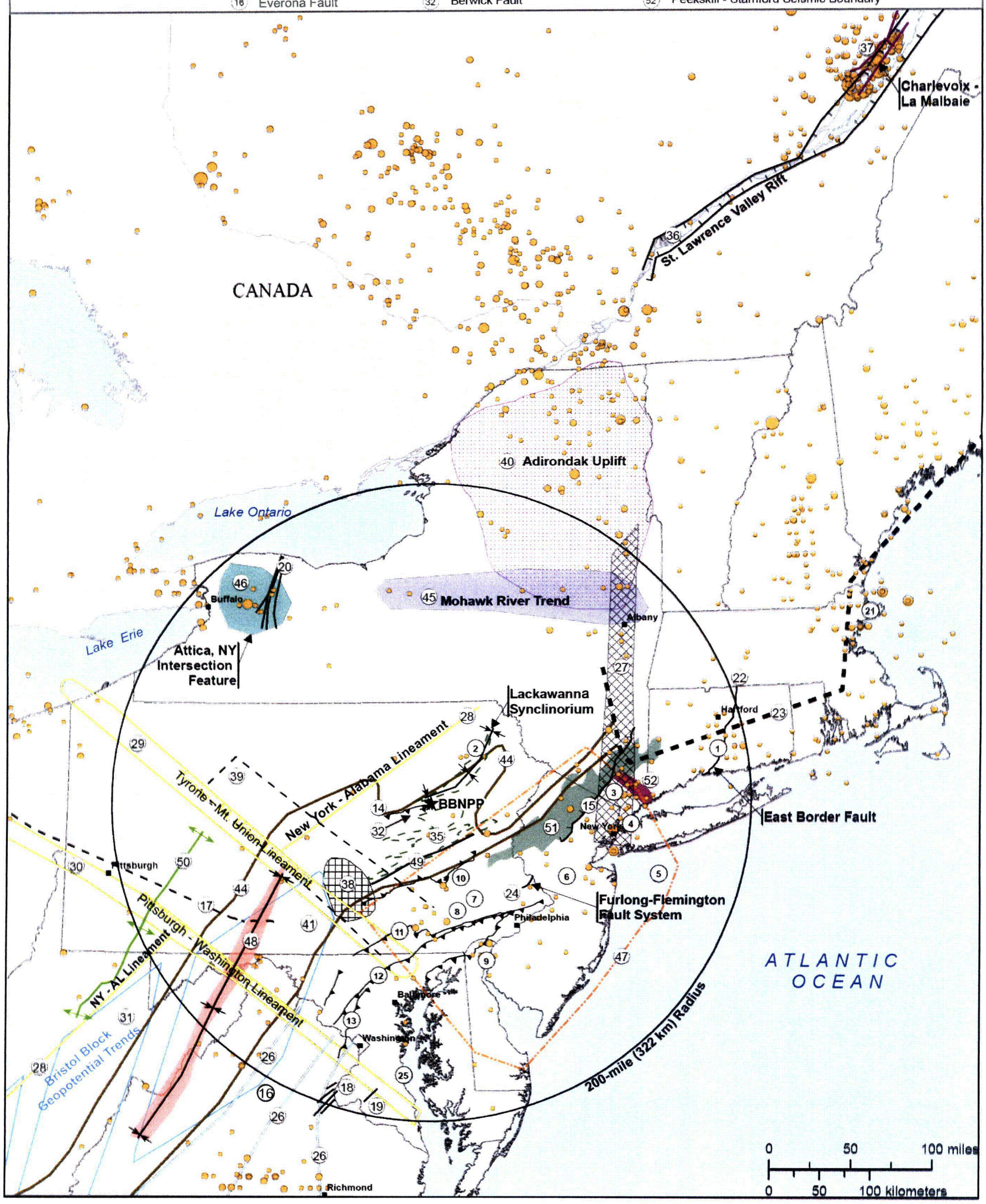
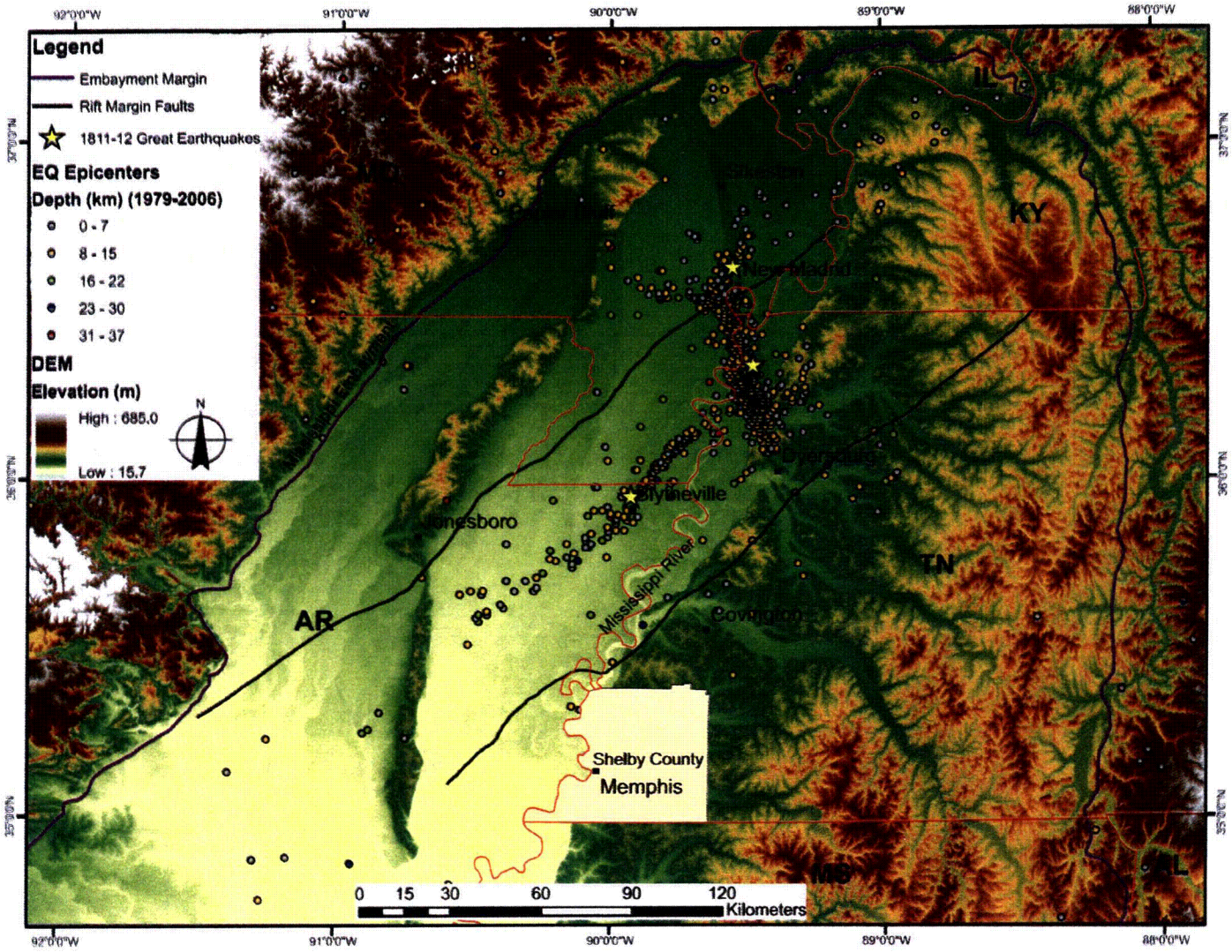
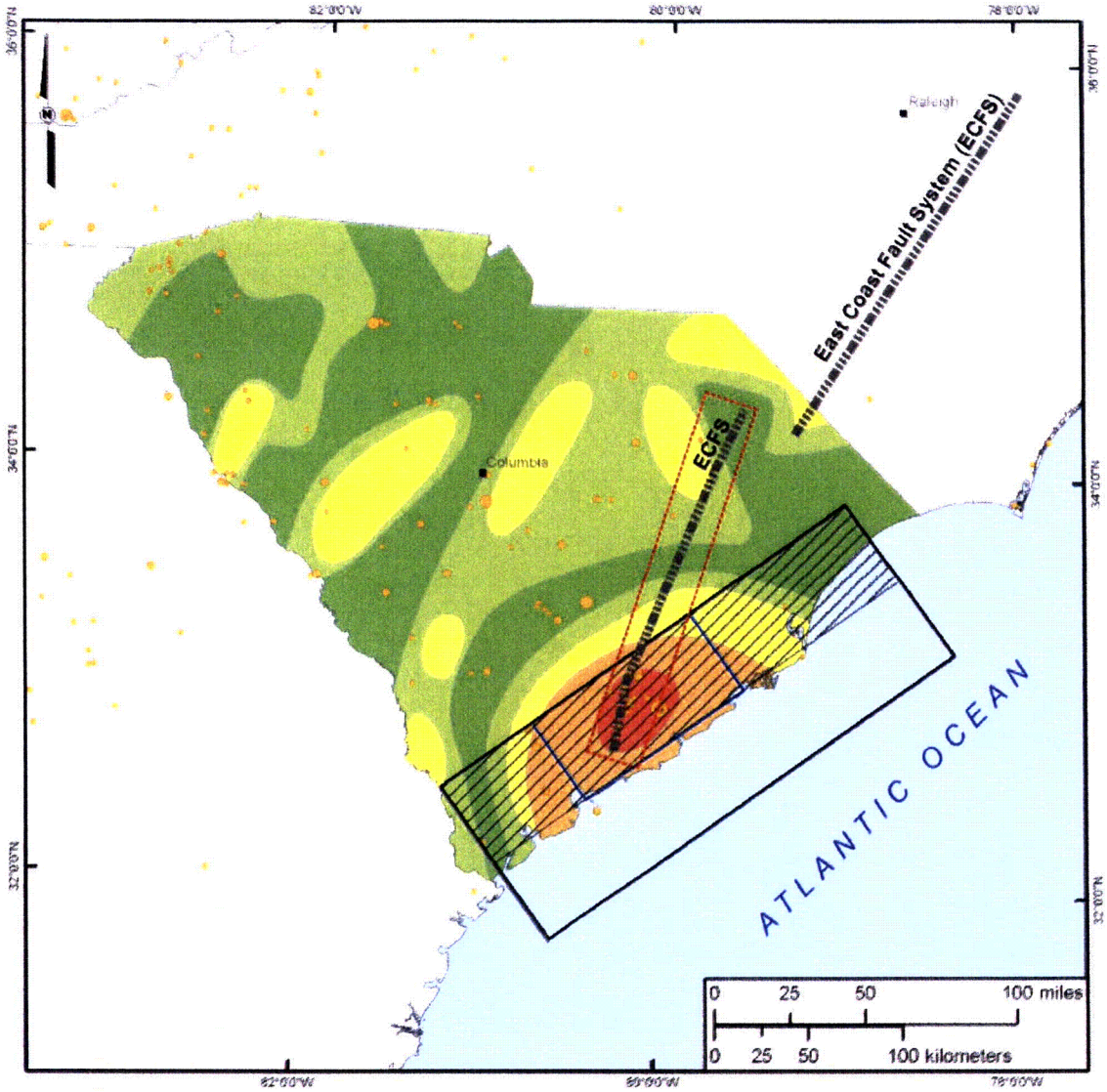


Figure 2.5-15a New Madrid Seismic Zone with Microearthquake Activity (1979-2006)



Reference: Csontos, 2008

Figure 2.5-15b Updated Charleston Seismic Zone (UCSS) Map



LEGEND

- City
- State/Province Boundary
- Postulated East Coast Fault System (Marple 2000)

Earthquakes by Magnitude, mb (USGS 2001 Catalog)

- 3.0 - 3.9
- 4.0 - 4.9
- 5.0 - 5.9
- 6.0 - 6.9
- 7.0 - 7.9

Updated Charleston Seismic Zones (UCSS)

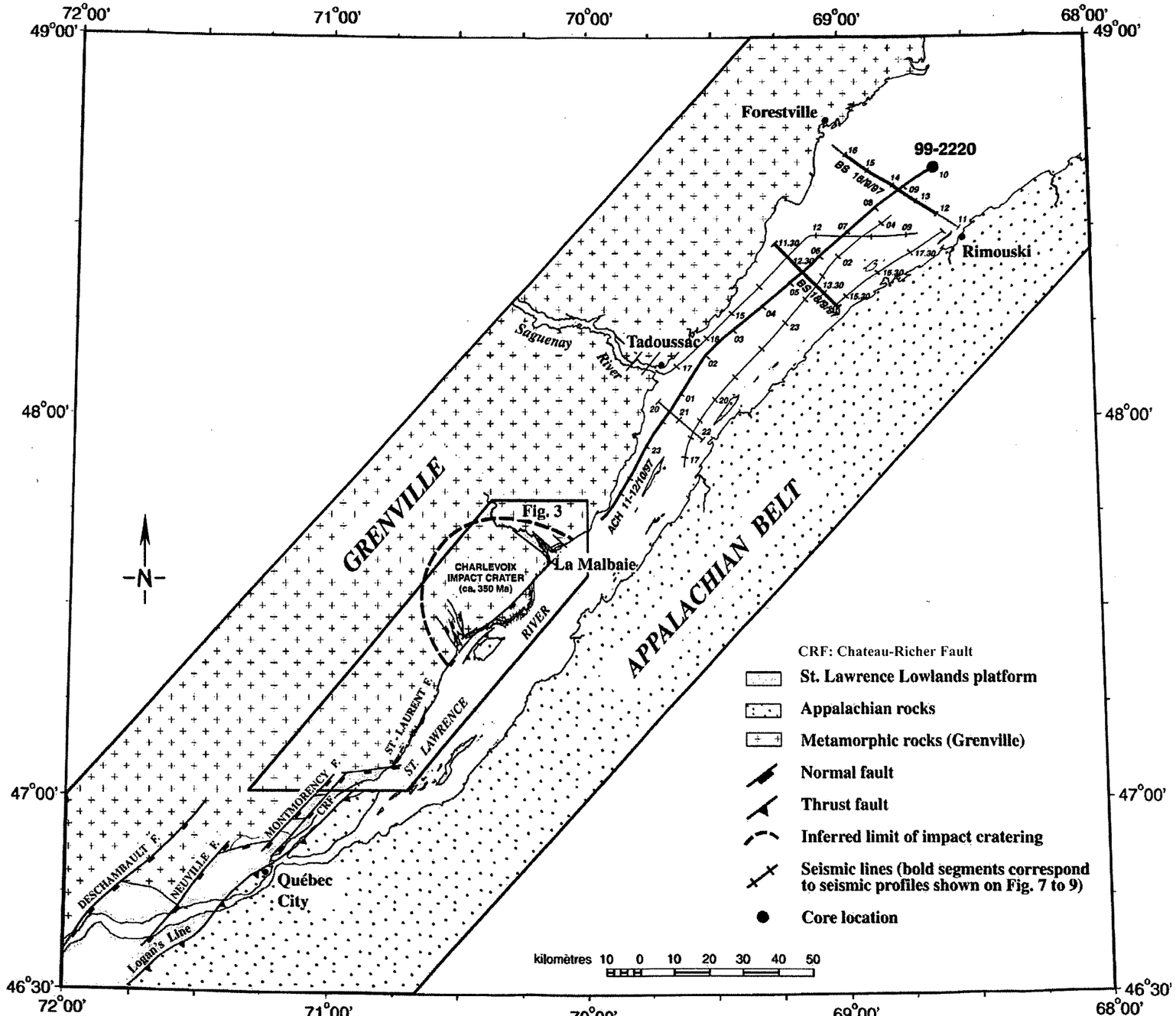
- A
- B
- B'
- C

1886 Charleston Isoseismals (Bollinger, 1977)

- VI
- VII
- VIII
- IX
- X

REFERENCES:
- ESRI, StreetMap Pro [CD-ROM]. City and State/Province Boundary

Figure 2.5-15c Geological Map of the St. Lawrence Rift System Between Quebec City and the St. Lawrence Estuary



Reference: Tremblay, 2003

Figure 2.5-15d Regional Tectonic Basins with Gravity and Magnetic Anomalies

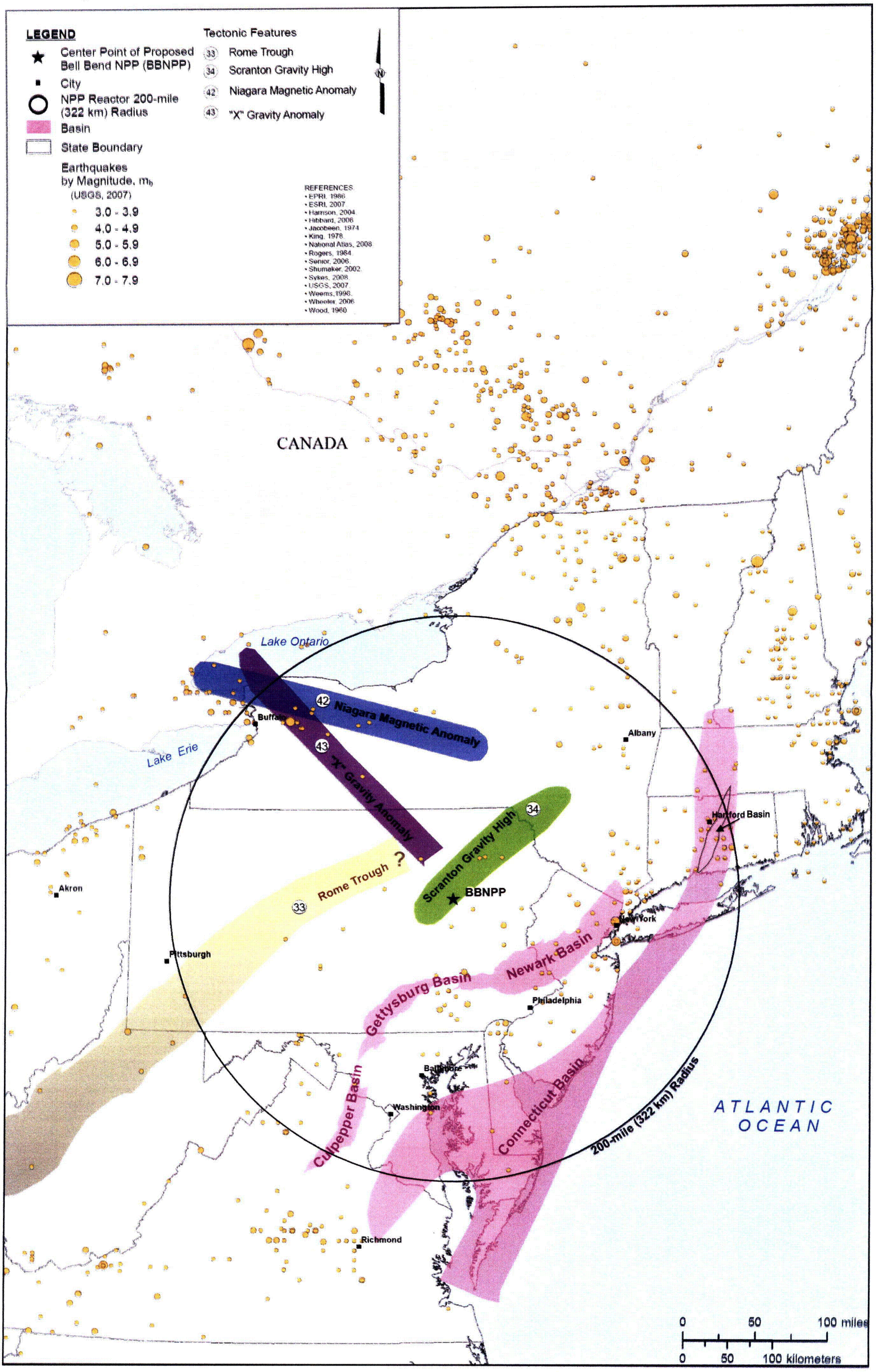
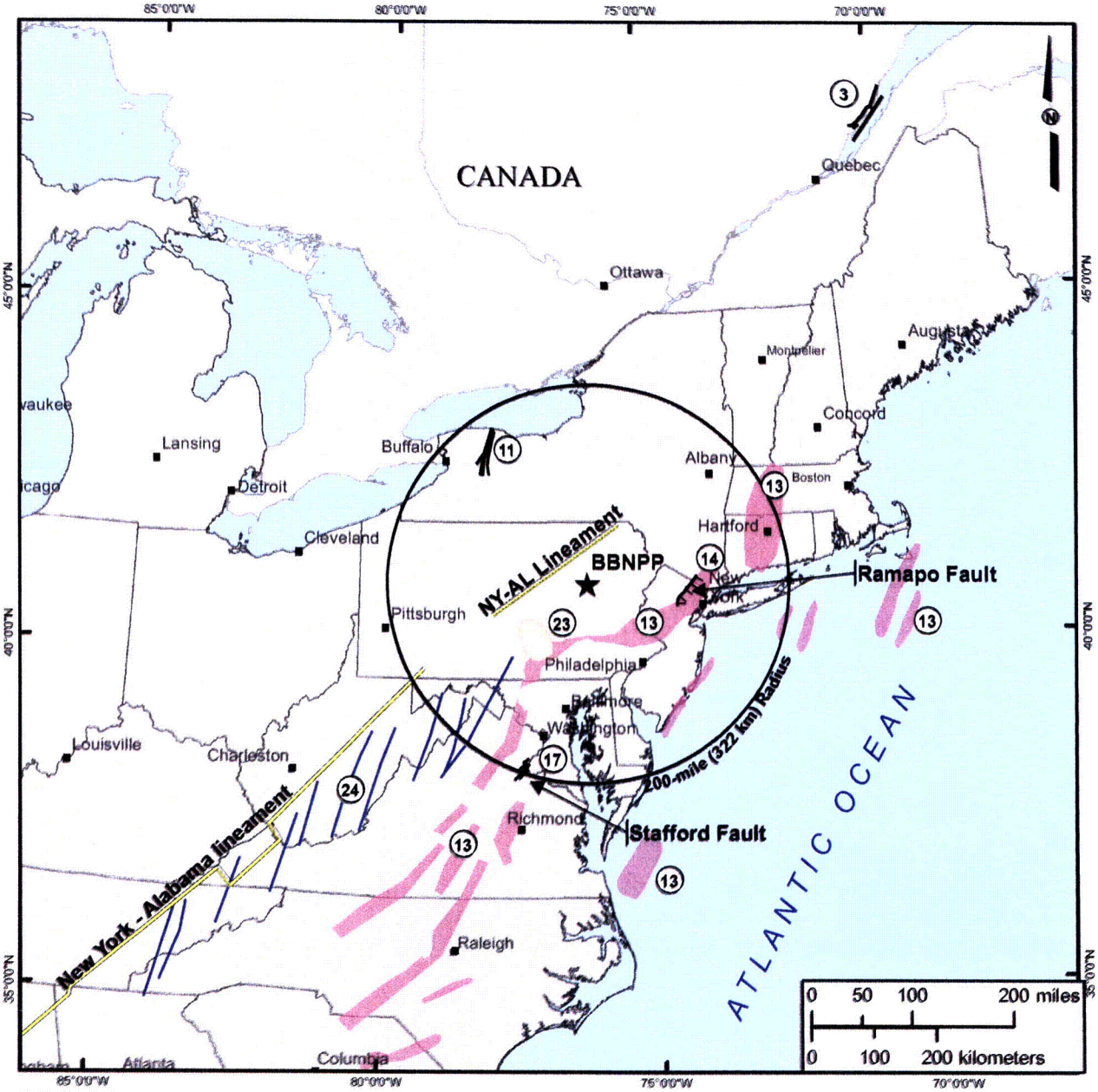


Figure 2.5-16 Tectonic Interpretations by Bechtel Group



LEGEND

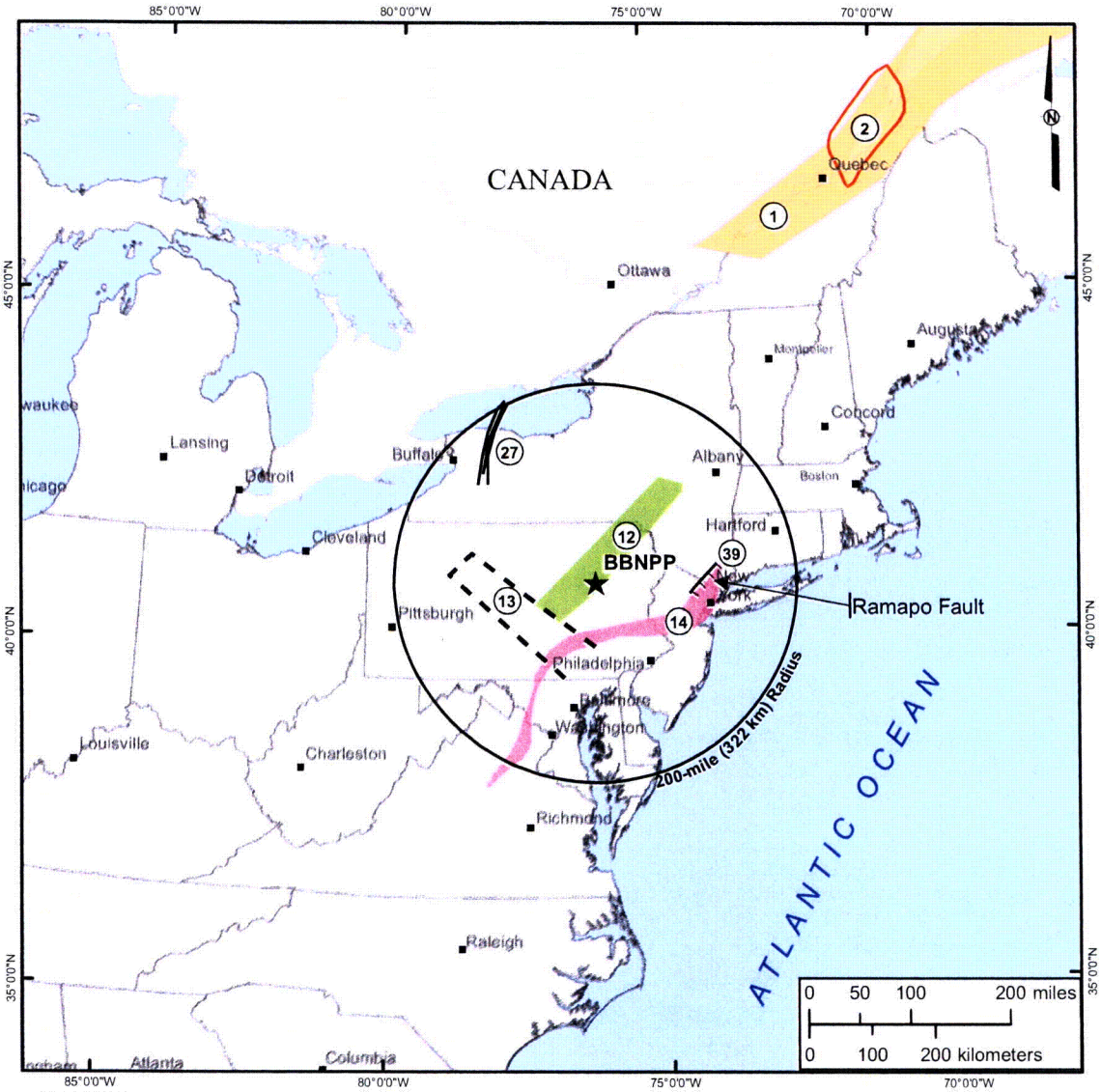
- ★ Center Point of Proposed Bell Bend NPP (BBNPP)
- ▪ City
- ○ NPP Reactor 200-mile (322 km) Radius
- ▭ State/Province Boundary

Bechtel Group Tectonic Interpretation

- (3) Charlevoix - La Malbaie
- (11) Clarendon - Linden Fault
- (13) Eastern Mesozoic Basins
- (14) Ramapo Fault
- (17) Stafford Fault
- (23) Lebanon - Pennsylvania Geopotential Trend
- (24) Bristol Block Geopotential Trends
- New York - Alabama Lineament

REFERENCES:
- ESRI, 2007.
- EPRI Volume IX: Bechtel Group, 1986.

Figure 2.5-16a Tectonic Interpretations by Dames and Moore



LEGEND

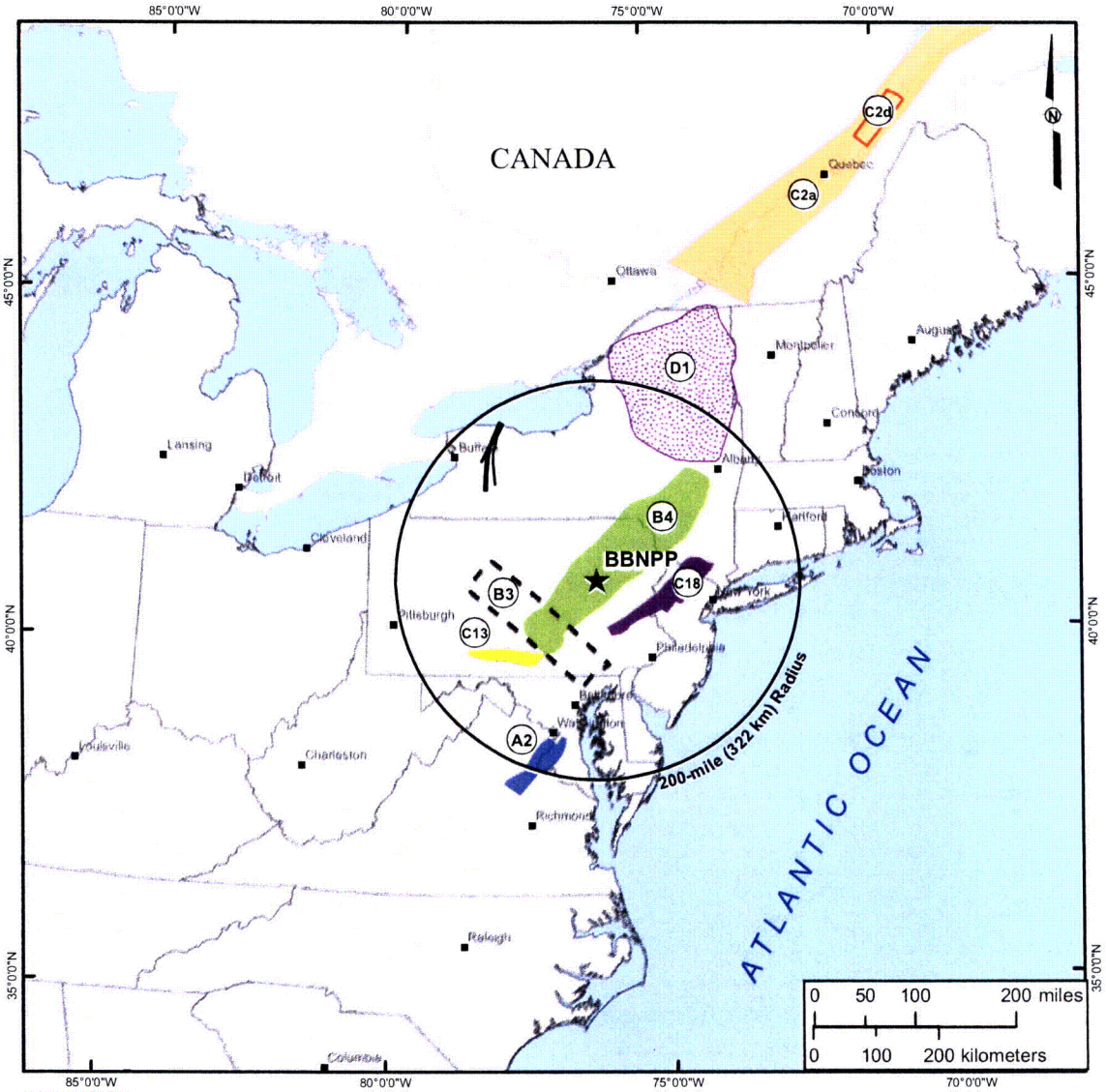
- ★ Center Point of Proposed Bell Bend NPP (BBNPP)
- ▪ City
- ○ NPP Reactor 200-mile (322 km) Radius
- ▭ State/Province Boundary

Dames and Moore Tectonic Interpretation

1. St. Lawrence Valley Rift
2. La Malbaie/Charlevoix Zone
12. Scranton Gravity Anomaly
13. Pennsylvania Aulacogen
14. Newark - Gettysburg Basin
27. Clarendon - Linden Fault Zone
39. Ramapo Fault

REFERENCES:
- ESRI, 2007.
- EPRI Volume VI: Dames and Moore, 1986.

Figure 2.5-16b Tectonic Interpretations by Law Engineering



LEGEND

- ★ Center Point of Proposed Bell Bend NPP (BBNPP)
- ▪ City
- ○ NPP Reactor 200-mile (322 km) Radius
- ▭ State/Province Boundary

Law Engineering Tectonic Interpretation

Regional Features

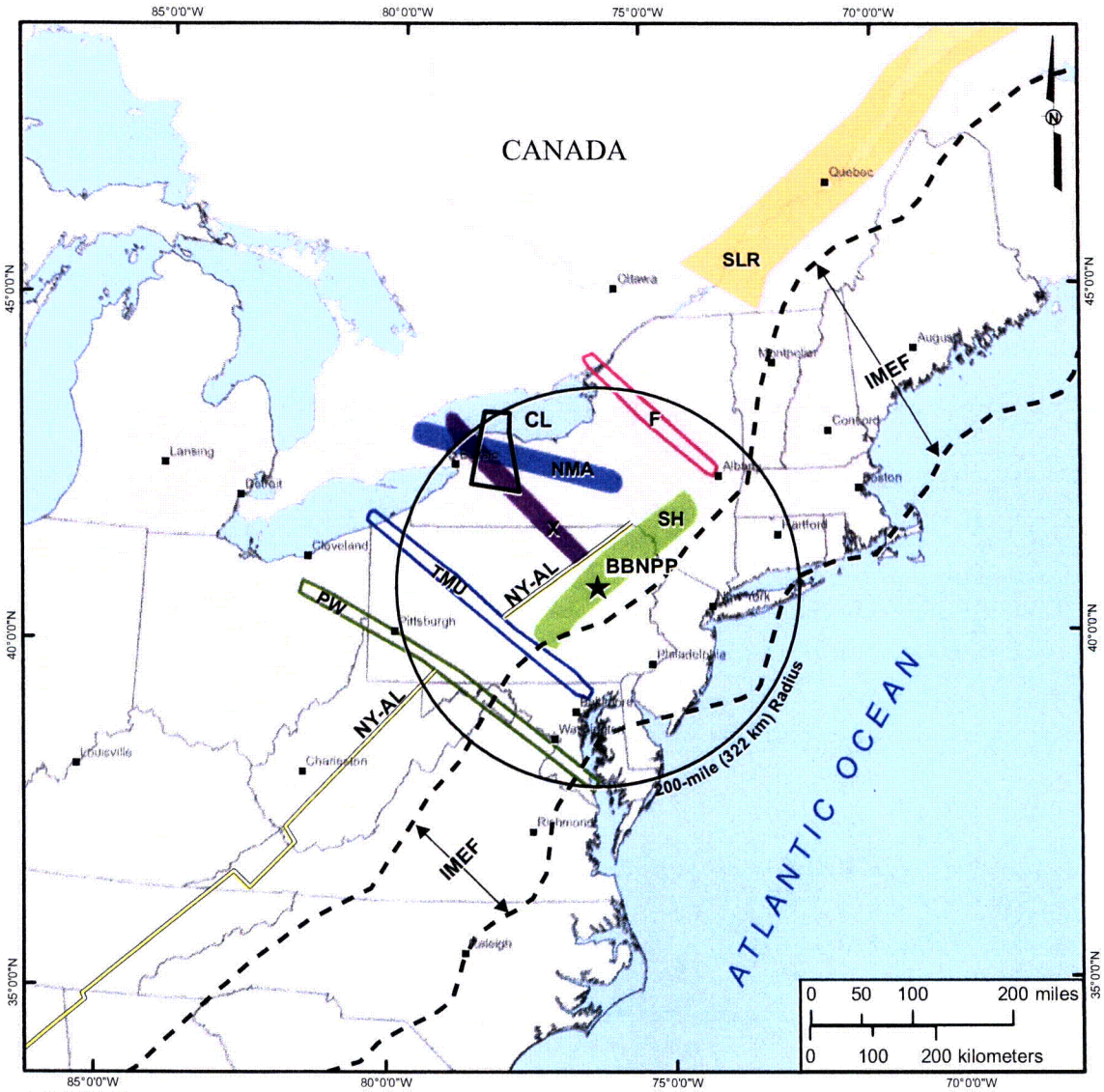
- (B3) Pennsylvania Aulacogen (EOCAMBRIAN RIFTS)
- (B4) Scranton Gravity High (EOCAMBRIAN RIFTS)
- (C2a) St Lawrence Valley Rift (ST. LAWRENCE RIFT SYSTEM)
- (C2d) Charlevoix - La Malbaie Area (ST. LAWRENCE RIFT SYSTEM)
- (D1) Adirondacks (MESOZOIC RIFTS)

Faults and Shear Zones

- (A2) Stafford - Brandywine Fault Zone
- (C14) Clarendon - Linden Structure
- (C13) Latitude 40° N Fault Zone
- (C18) Ramapo Fault

REFERENCES:
- ESRI, 2007.
- EPRI Volume VII: Law Engineering, 1986.

Figure 2.5-16c Tectonic Interpretations by Rondout Associates



LEGEND

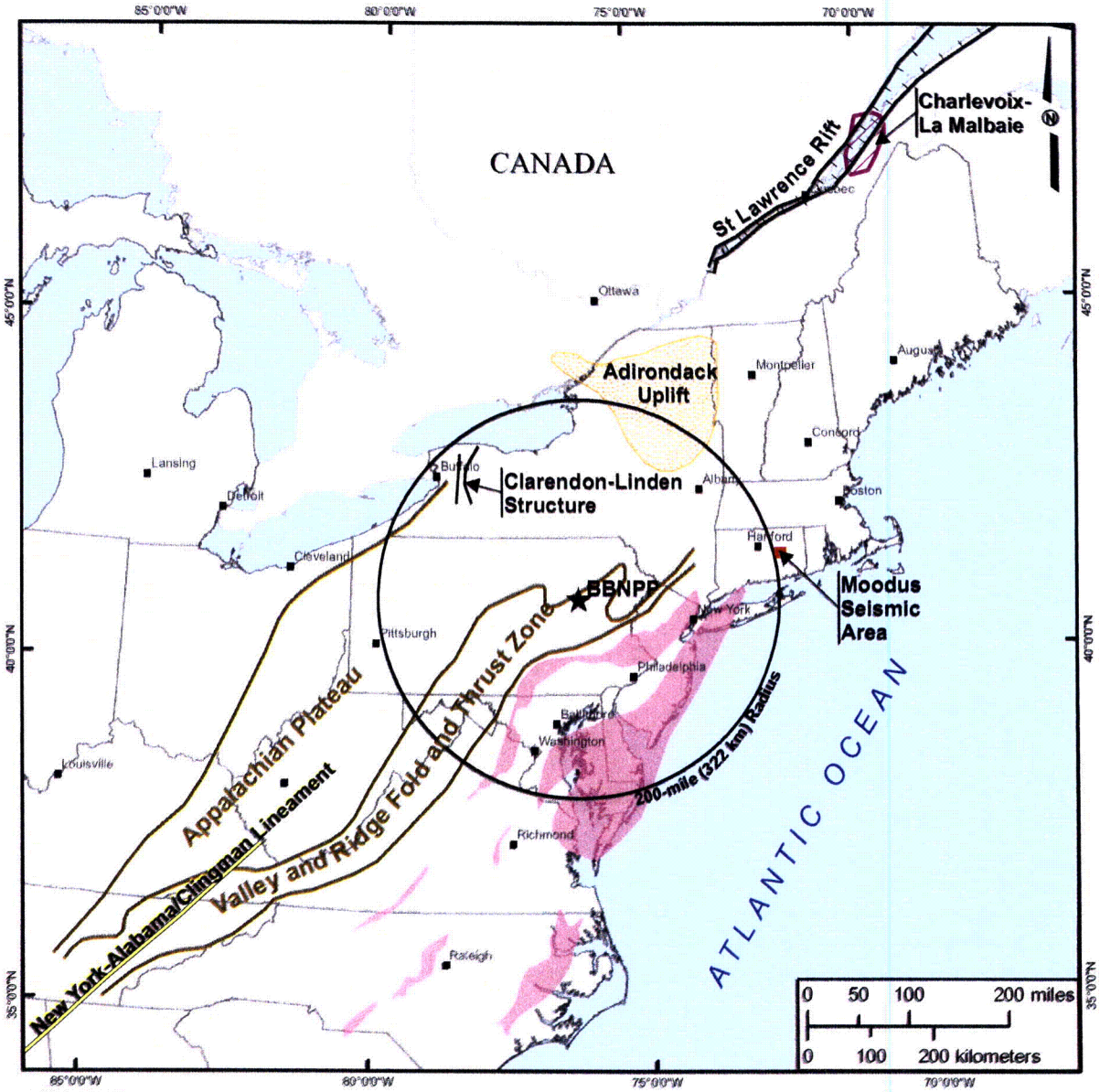
- ★ Center Point of Proposed Bell Bend NPP (BBNPP)
- ▪ City
- ○ NPP Reactor 200-mile (322 km) Radius
- ▭ State/Province Boundary

Rondout Associates Tectonic Interpretations

CL	Clarendon-Linden
F	Gravity Lineament
IMEF	Inboard Mesozoic Extentional Fault Realm
NMA	Niagara Magnetic Anomaly
NY-AL	New York - Alabama Lineament
PW	Pittsburgh - Washington Lineament
SH	Scranton Gravity HIgh
SLR	St. Lawrence Rift
TMU	Tyrone - Mt. Union Lineament
X	Gravity Anomaly

REFERENCES:
- ESRI, 2007.
- EPRI Volume X: Rondout Associates, 1986.

Figure 2.5-16d Tectonic Interpretations by Weston Geophysical



LEGEND

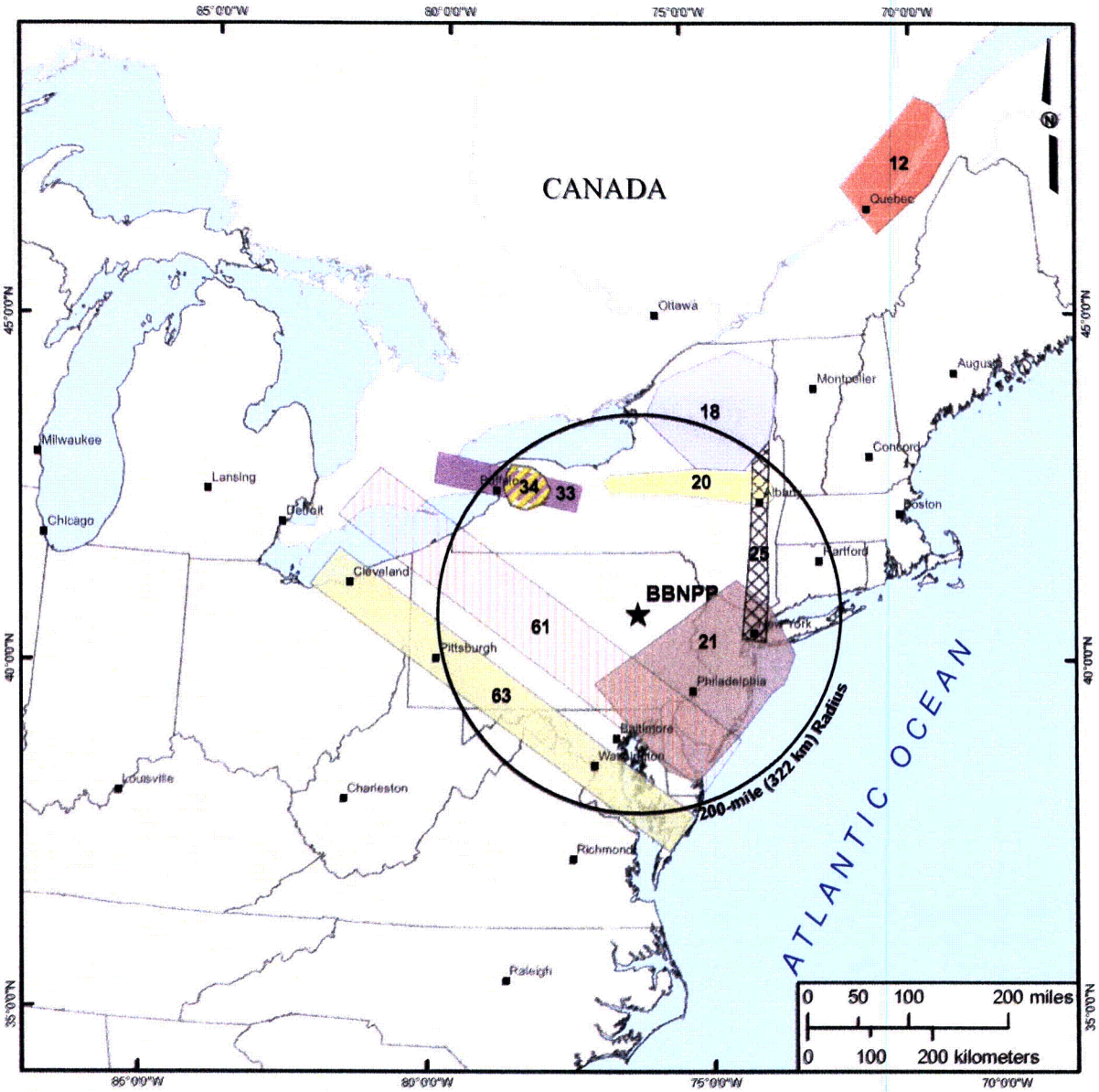
- ★ Center Point of Proposed Bell Bend NPP (BBNPP)
- ▪ City
- ○ NPP Reactor 200-mile (322 km) Radius

Weston Geophysical Tectonic Features

- Adirondack Uplift
- Charlevoix - La Malbaie
- Clarendon - Linden Structure
- N.Y. - Alabama/Clingman Lineaments
- St. Lawrence Rift
- Appalachian Plateau
- Valley and Ridge Fold and Thrust Zone
- Moodus Seismic Area
- Zone of Mesozoic Basins

REFERENCES:
- ESRI, 2007.
- EPRI Volume V: Weston Geophysical, 1986.

Figure 2.5-16e Tectonic Interpretations by Woodward-Clyde Consultants



LEGEND

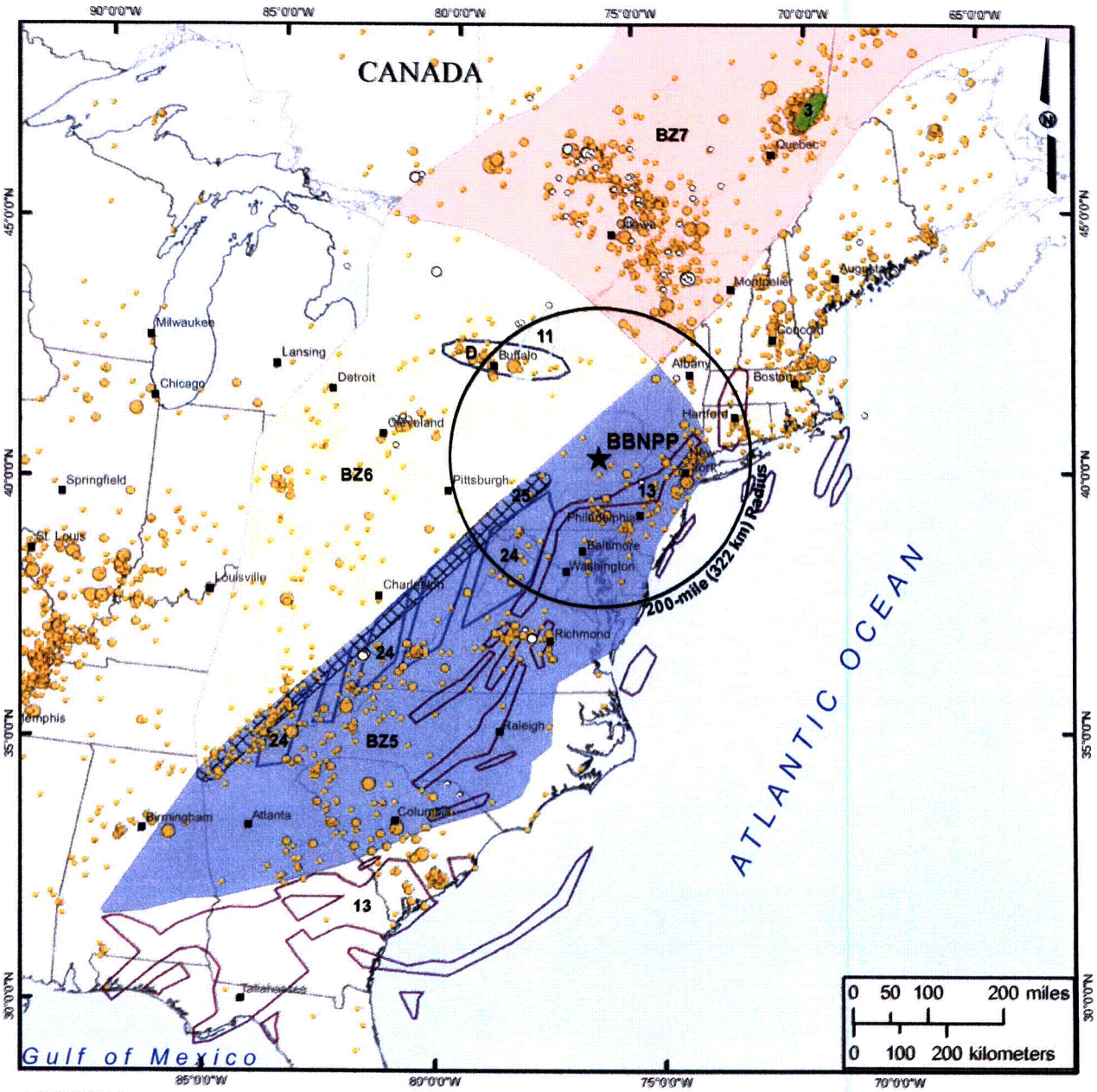
- ★ Center Point of Proposed Bell Bend NPP (BBNPP)
- ▪ City
- ○ NPP Reactor 200-mile (322 km) Radius

Woodward-Clyde Tectonic Interpretations

18	Adirondack Uplift
20	Mohawk River Trend
21	NJ Isostatic Gravity Saddle
25	Hudson River Valley Trend
33	Western NY - Southern Ontario Trend
34	Attica, NY Intersection Feature
63	Pittsburgh-Washington Lineament
12	Charlevoix - La Malbaie Structure
61	Tyrone - Mt. Union Lineament

REFERENCES:
- ESRI, 2007.
- EPRI Volume VIII: Woodward-Clyde Consultants, 1986.

Figure 2.5-16f Bechtel Group EPRI Source Zones



LEGEND

- ★ Center Point of Proposed Bell Bend NPP (BBNPP)
- ▪ City
- ○ NPP Reactor 200-mile (322 km) Radius

Earthquakes by Magnitude, mb (SEE NOTE)

USGS 2001	USGS 2002 to 2007
3.0 - 3.9	3.0 - 3.9
4.0 - 4.9	4.0 - 4.9
5.0 - 5.9	5.0 - 5.9
6.0 - 6.9	
7.0 - 7.9	

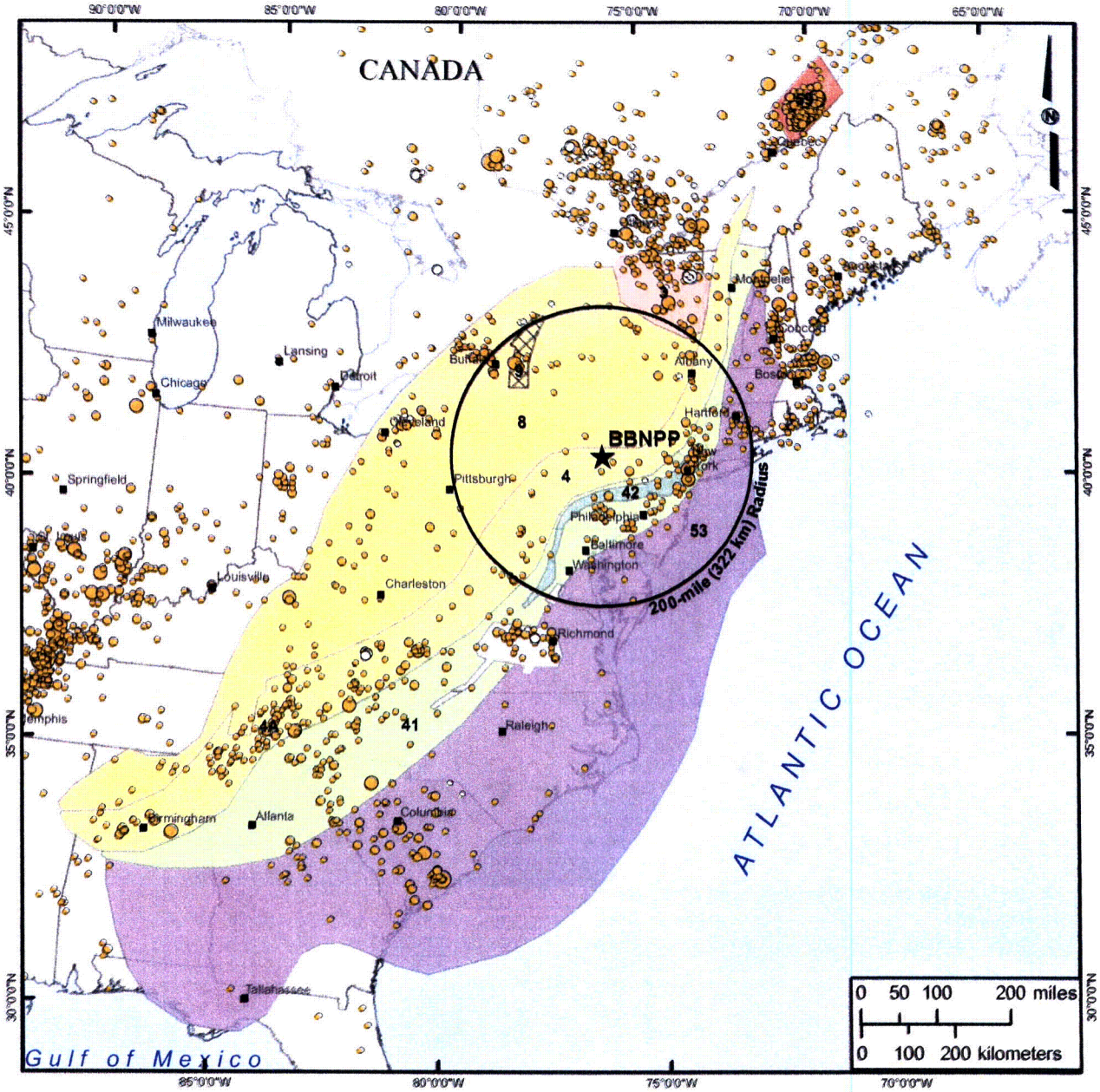
NOTE: The 2002 to 2007 seismicity shown in 500-mile (805 km) radius.

Bechtel Group Sources contributing to 99% of BBNPP Site Hazard

- 3 La Malbaie
- 11 Clarendon-Linden
- 13 Mesozoic Basins
- 24 Bristol Block
- 25 NY-AL Lineament
- BZ5 Southern Appalachians Background
- BZ6 Southern Eastern Craton Background
- BZ7 Northern Eastern Craton Background
- D Niagara Area

REFERENCES:
- ESRI, 2007.
- USGS 2007.
- ANSS, 2007.
- EPRI Volume IX: Bechtel Group, 1986.

Figure 2.5-16g Dames & Moore EPRI Source Zones



LEGEND

★ Center Point of Proposed Bell Bend NPP (BBNPP)

▪ City

○ NPP Reactor 200-mile (322 km) Radius

Earthquakes by Magnitude, mb (SEE NOTE)

USGS 2001	USGS 2002 to 2007
3.0 - 3.9	3.0 - 3.9
4.0 - 4.9	4.0 - 4.9
5.0 - 5.9	5.0 - 5.9
6.0 - 6.9	
7.0 - 7.9	

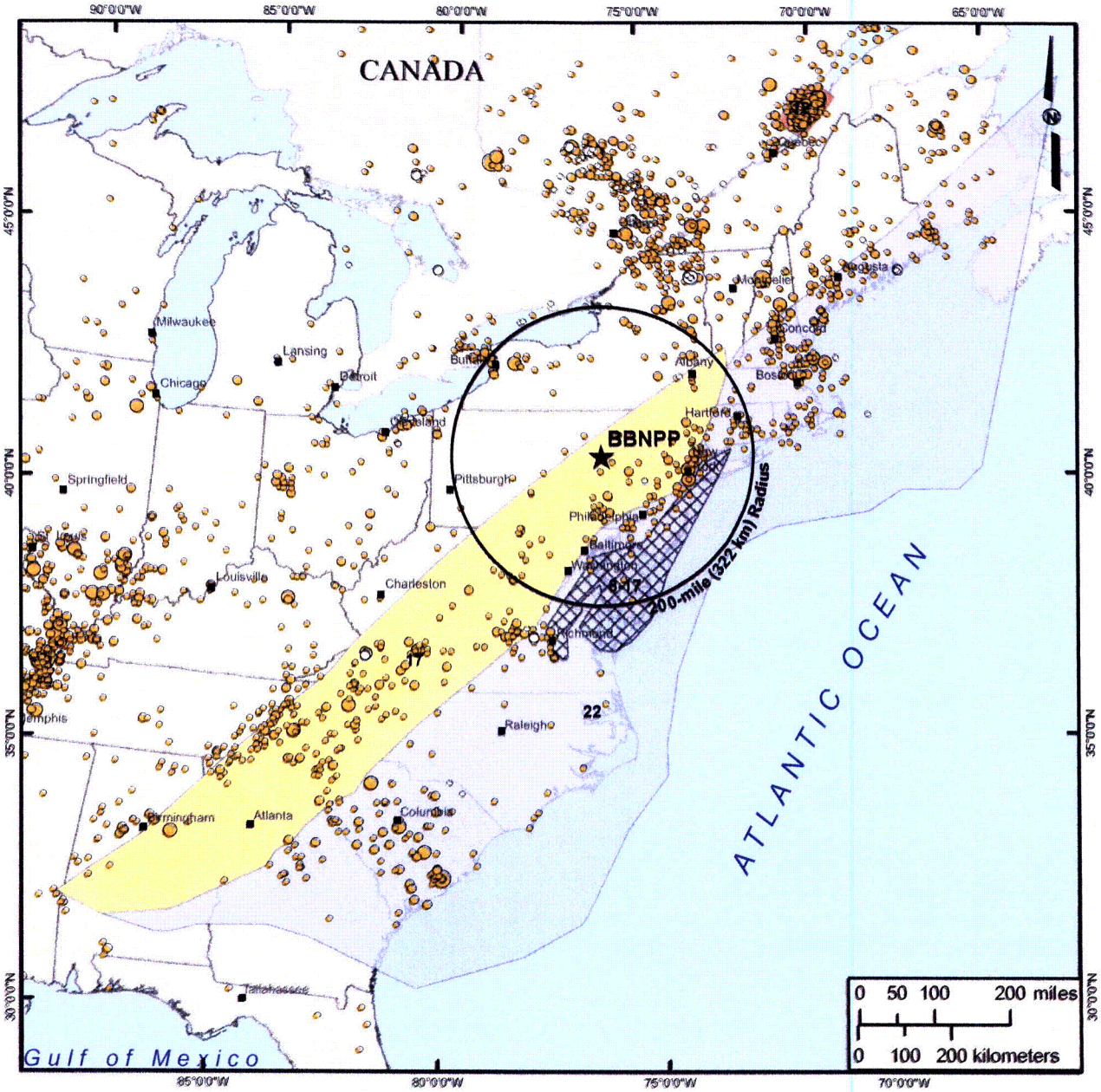
NOTE: The 2002 to 2007 seismicity shown in 500-mile (805 km) radius.

Dames and Moore Sources contributing to 99% of BBNPP Site Hazard

- 3 Adirondacks Zone
- 4 Paleozoic Fold Belts
- 8 Eastern Marginal Basin
- Clarendon-Linden Zone
- 41 Southern Cratonic Margin (default)
- 42 Newark-Gettysburg Basin
- 53 Southern Appalachian Mobile Belt (default)
- 59 La Malbaie/Charlevoix Zone

REFERENCES:
- ESRI, 2007.
- USGS 2007.
- ANSS, 2007.
- EPRI Volume VI: Dames and Moore, 1986.

Figure 2.5-16h Law Engineering EPRI Source Zones



LEGEND

- ★ Center Point of Proposed Bell Bend NPP (BBNPP)
- ▪ City
- ○ NPP Reactor 200-mile (322 km) Radius

Law Engineering Sources contributing to 99% of BBNPP Site Hazard

- 2-12 Buried East Coast Mesozoic Basins
- 17 Eastern Basements
- 22 Reactivated Eastern Seaboard Normal Faults
- 12 Charlevoix Seismic Zone

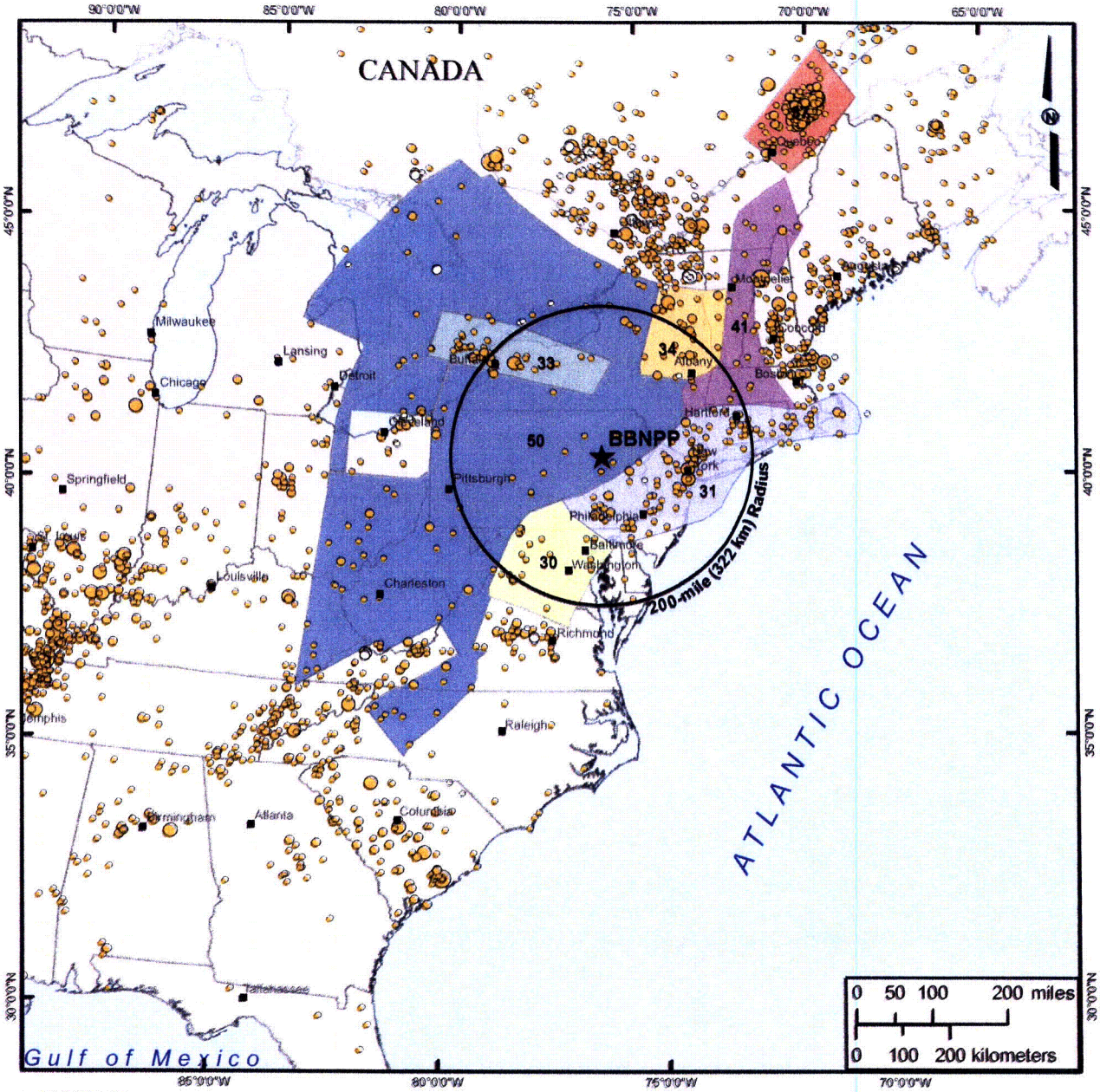
REFERENCES:
- ESRI, 2007.
- USGS 2007.
- ANSS, 2007.
- EPRI Volume VII: Law Engineering, 1986.

Earthquakes by Magnitude, mb (SEE NOTE)

USGS 2001	USGS 2002 to 2007
3.0 - 3.9	3.0 - 3.9
4.0 - 4.9	4.0 - 4.9
5.0 - 5.9	5.0 - 5.9
6.0 - 6.9	
7.0 - 7.9	

NOTE: The 2002 to 2007 seismicity shown in 500-mile (805 km) radius.

Figure 2.5-16i Rondout Associates EPRI Source Zones



LEGEND

★ Center Point of Proposed Bell Bend NPP (BBNPP)

▪ City

○ NPP Reactor 200-mile (322 km) Radius

Earthquakes by Magnitude, mb (SEE NOTE)

USGS 2001	USGS 2002 to 2007
3.0 - 3.9	3.0 - 3.9
4.0 - 4.9	4.0 - 4.9
5.0 - 5.9	5.0 - 5.9
6.0 - 6.9	
7.0 - 7.9	

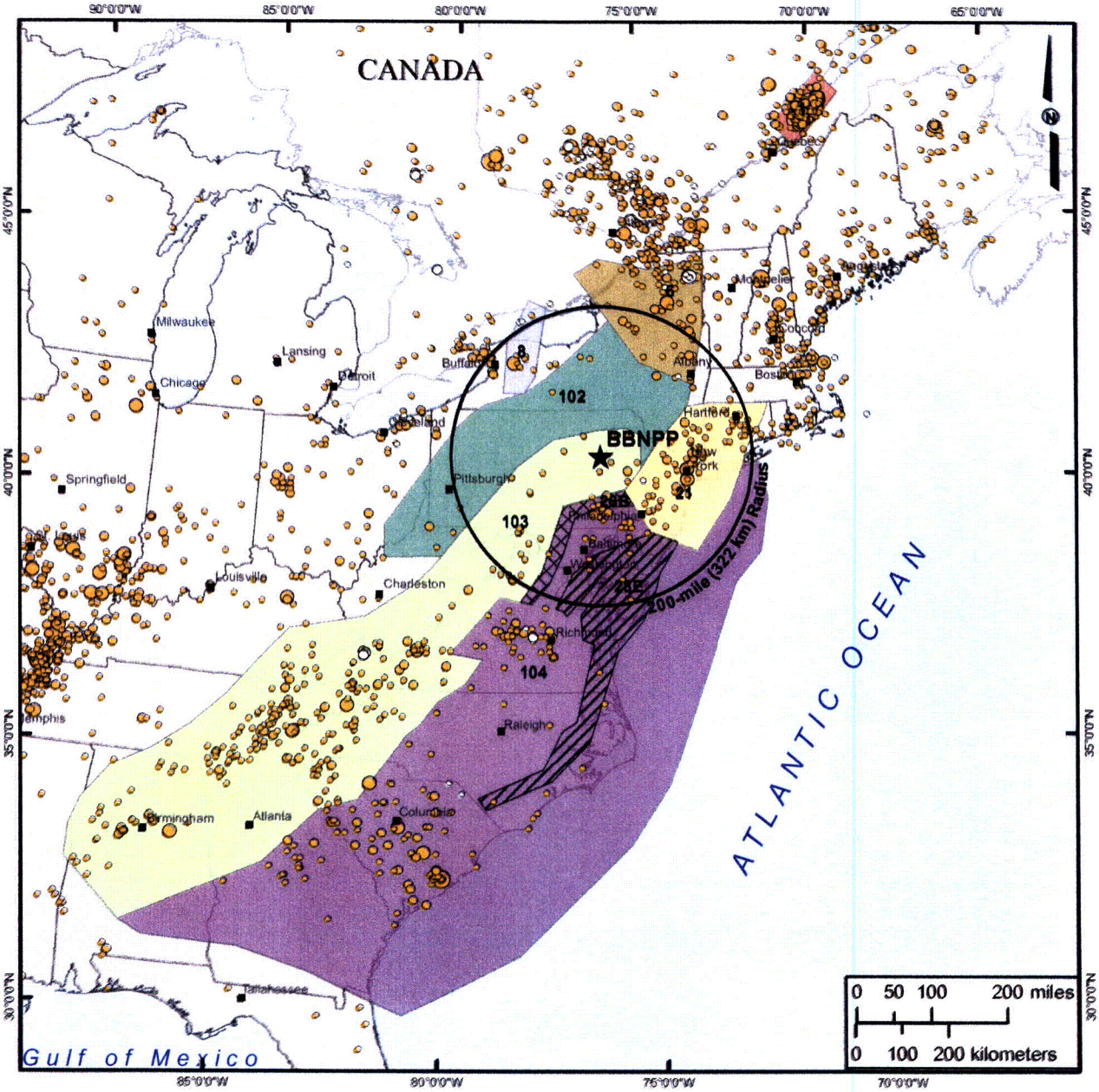
NOTE: The 2002 to 2007 seismicity shown in 500-mile (805 km) radius.

Rondout Associates Sources contributing to 99% of BBNPP Site Hazard

- 30 Shenandoah
- 31 Quakers
- 33 Niagara
- 34 Nessmuk
- 37 La Malbaie (Charlevoix) Seismic Zone
- 41 Vermont
- 50 Grenville (Background)

REFERENCES:
- ESRI, 2007.
- USGS 2007.
- ANSS, 2007.
- EPRI Volume X: Rondout Associates, 1986.

Figure 2.5-16j Weston Geophysical EPRI Source Zones



LEGEND

- ★ Center Point of Proposed Bell Bend NPP (BBNPP)
- ▪ City
- ○ NPP Reactor 200-mile (322 km) Radius

Earthquakes by Magnitude, mb (SEE NOTE)

USGS 2001	USGS 2002 to 2007
3.0 - 3.9	3.0 - 3.9
4.0 - 4.9	4.0 - 4.9
5.0 - 5.9	5.0 - 5.9
6.0 - 6.9	
7.0 - 7.9	

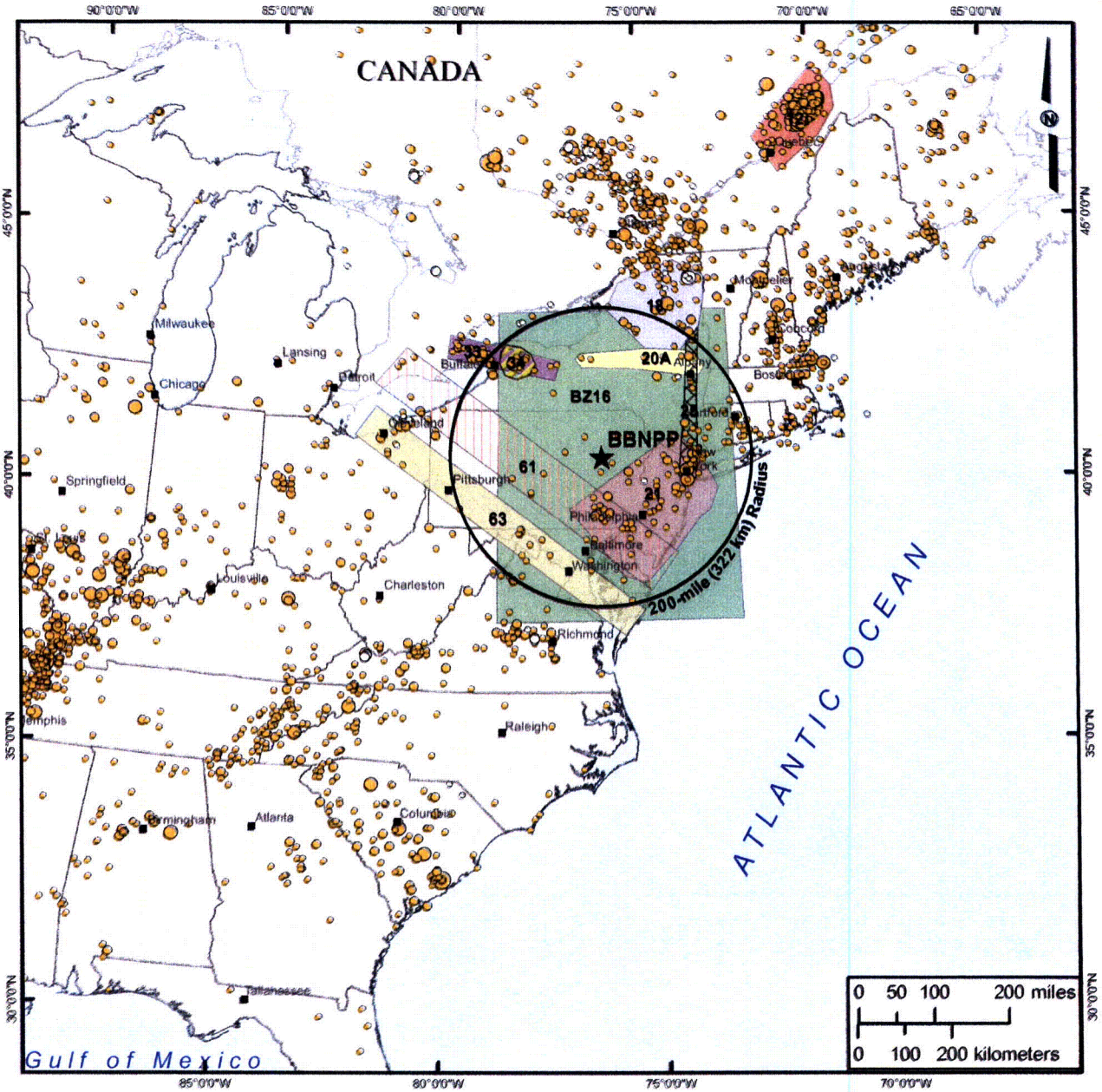
NOTE: The 2002 to 2007 seismicity shown in 500-mile (805 km) radius.

Weston Geophysical Sources contributing to 99% of BBNPP Site Hazard

- 1 Charlevoix - La Malbaie Seismic Zone
- 6 Adirondack Mountains
- 8 Clarendon-Linden
- 21 New York Nexus
- 265 Zone of Mesozoic Basin
- 262 Zone of Mesozoic Basin
- 102 Appalachian Plateau Background
- 103 Southern Appalachian Background
- 104 Southern Coastal Plain Background

REFERENCES:
- ESRI, 2007.
- USGS 2007.
- ANSS, 2007.
- EPRI Volume V: Weston Geophysical, 1986.

Figure 2.5-16k Woodward-Clyde Consultants EPRI Source Zones



LEGEND

- ★ Center Point of Proposed Bell Bend NPP (BBNPP)
- ■ City
- ○ NPP Reactor 200-mile (322 km) Radius

Earthquakes by Magnitude, mb (SEE NOTE)

USGS 2001	USGS 2002 to 2007
3.0 - 3.9	3.0 - 3.9
4.0 - 4.9	4.0 - 4.9
5.0 - 5.9	5.0 - 5.9
6.0 - 6.9	
7.0 - 7.9	

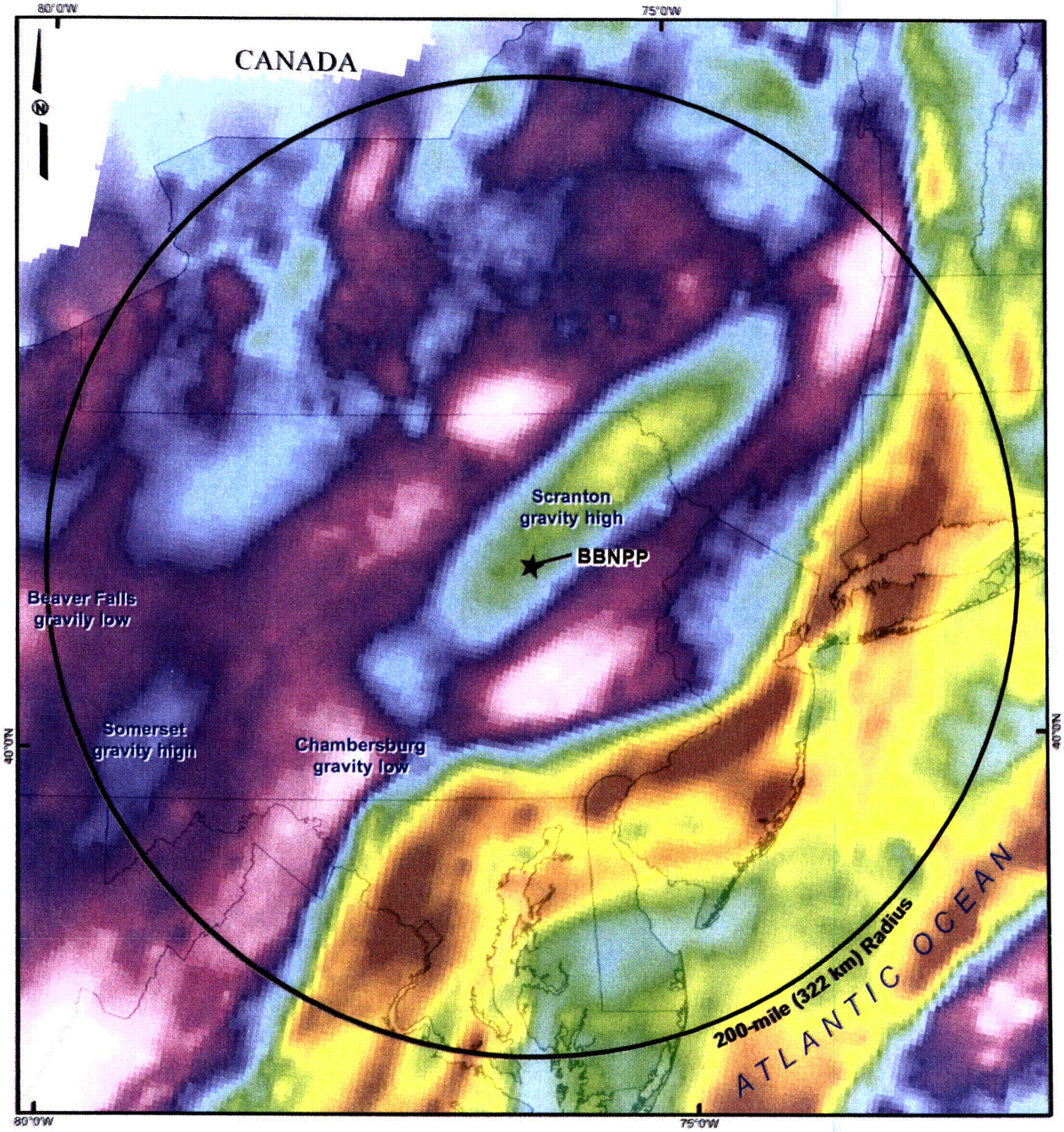
NOTE: The 2002 to 2007 seismicity shown in 500-mile (805 km) radius.

Woodward-Clyde Sources contributing to 99% of BBNPP Site Hazard

- 18 Adirondack Uplift
- 20A Mohawk River Trend
- 21 NJ Isostatic Gravity Saddle
- 26 Hudson River Valley Trend
- 33 W. NY-S Ontario Trend
- 34 Attica, NY Intersection
- 63 Pittsburgh - Washington Lineament
- BZ16 Susquehanna Background
- 12 Charlevoix Seismic Zone
- 61 Tyrone - Mt. Union Lineament

REFERENCES:
- ESRI, 2007.
- USGS 2007.
- ANSS, 2007.
- EPRI Volume VIII: Woodward-Clyde Consultants, 1986.

Figure 2.5-17 Regional Bouguer Gravity Anomaly Map



LEGEND

★ Center Point of Proposed Bell Bend NPP (BBNPP)

○ NPP Reactor 200-mile (322 km) Radius

Gravity Anomaly

0 — 95 mgals

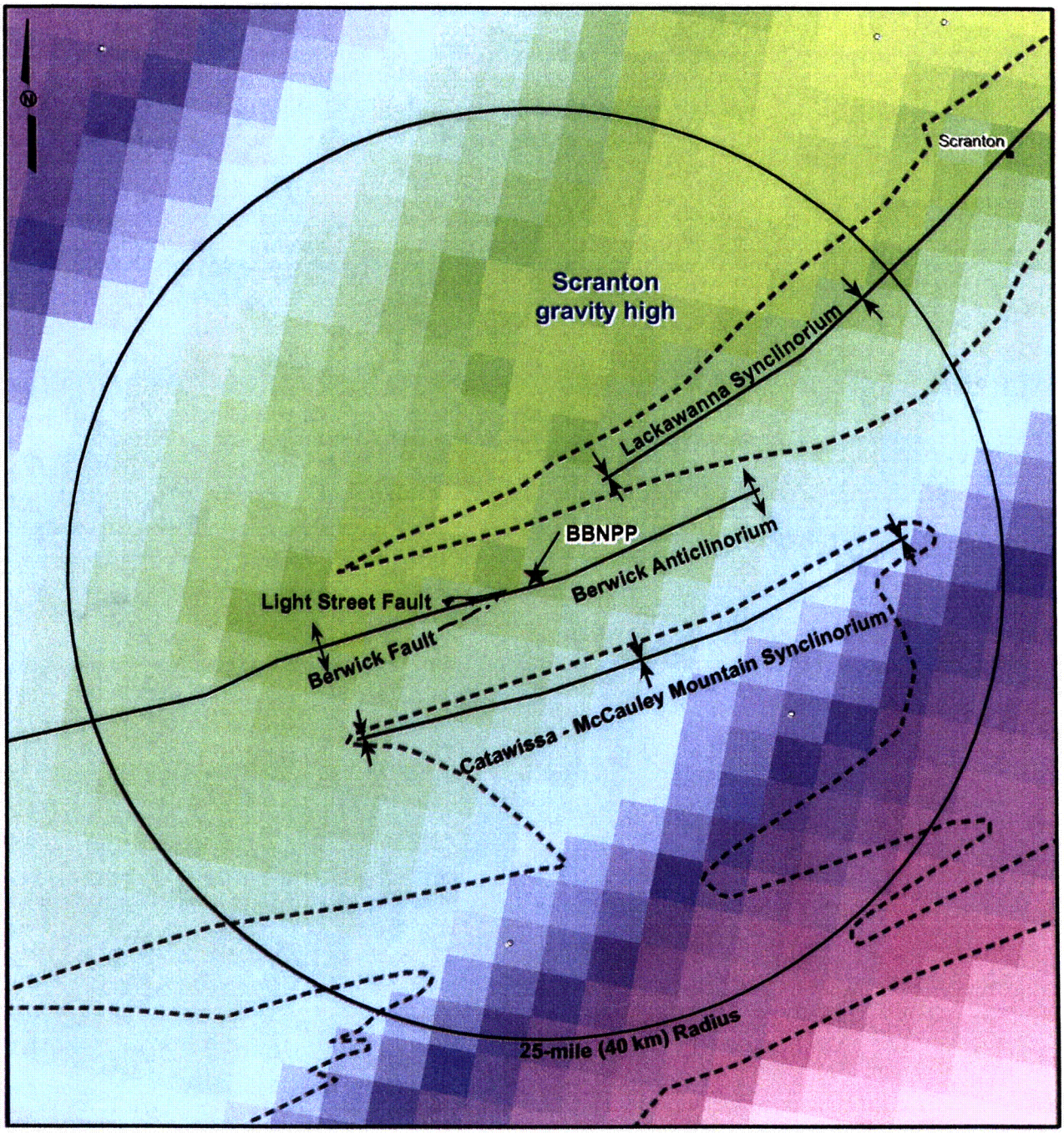
-340 mgals

0 25 50 100 miles

0 25 50 100 kilometers

REFERENCE:
- Kucks, 1999.

Figure 2.5-17a Site Vicinity Bouguer Gravity Anomaly Map



LEGEND

★ Center Point of Proposed Bell Bend NPP (BBNPP)

O NPP Reactor 25-mile (40 km) Radius

— — Anthracite Region

Earthquakes by Magnitude, m_b

- 3.0 - 3.9
- 4.0 - 4.9
- 5.0 - 5.9

Gravity Anomaly

0 95 mgals

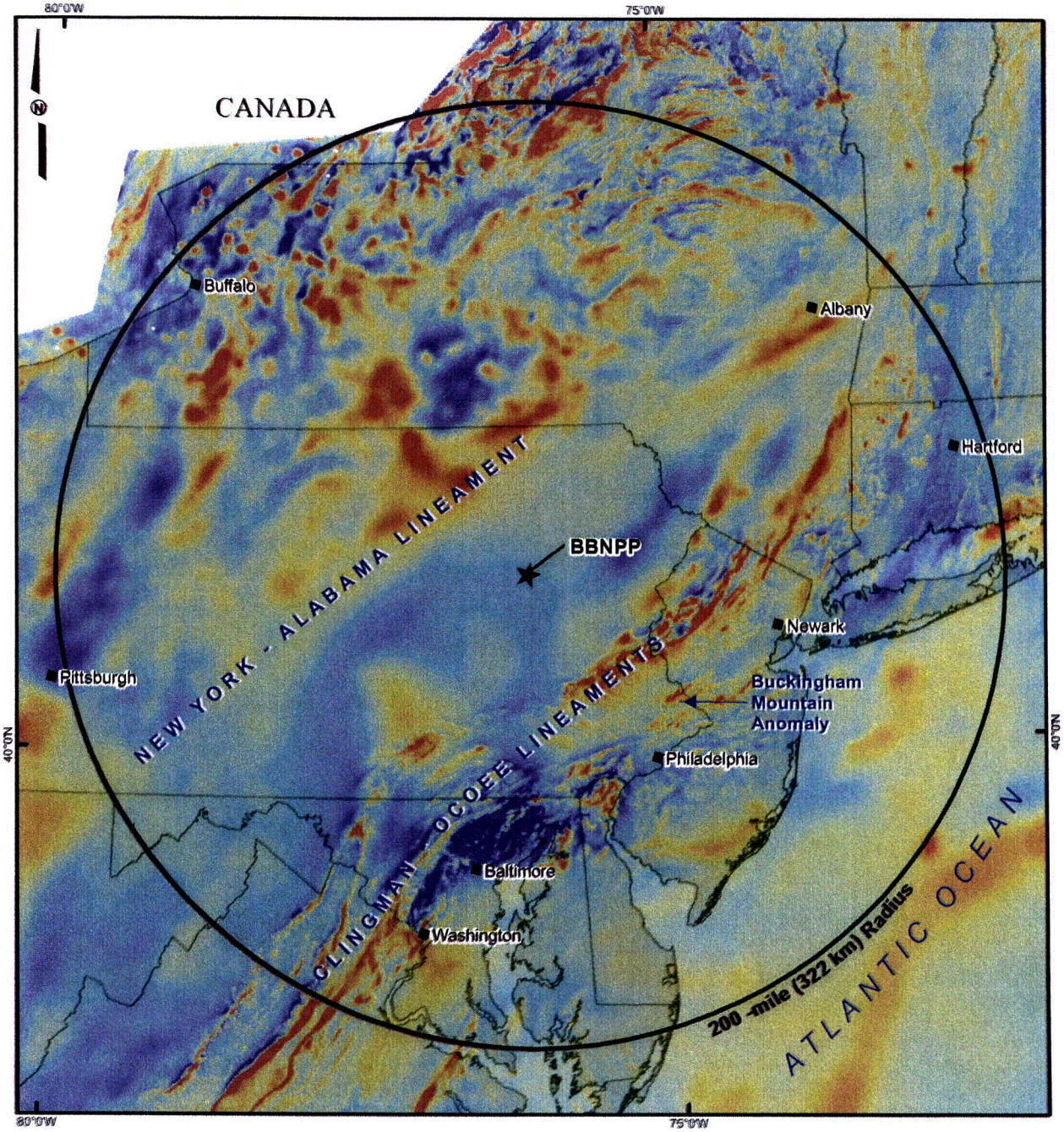
-340 mgals

0 2.5 5 10 miles

0 2.5 5 10 kilometers

REFERENCE:
- Kucks, 1999.
- Harrison, 2004.
- USGS, 2007.

Figure 2.5-18 Regional Magnetic Anomaly Map



LEGEND

★ Center Point of Proposed Bell Bend NPP (BBNPP)

○ NPP Reactor 200-mile (322 km) Radius

Aeromagnetics

8215 nanoteslas

0

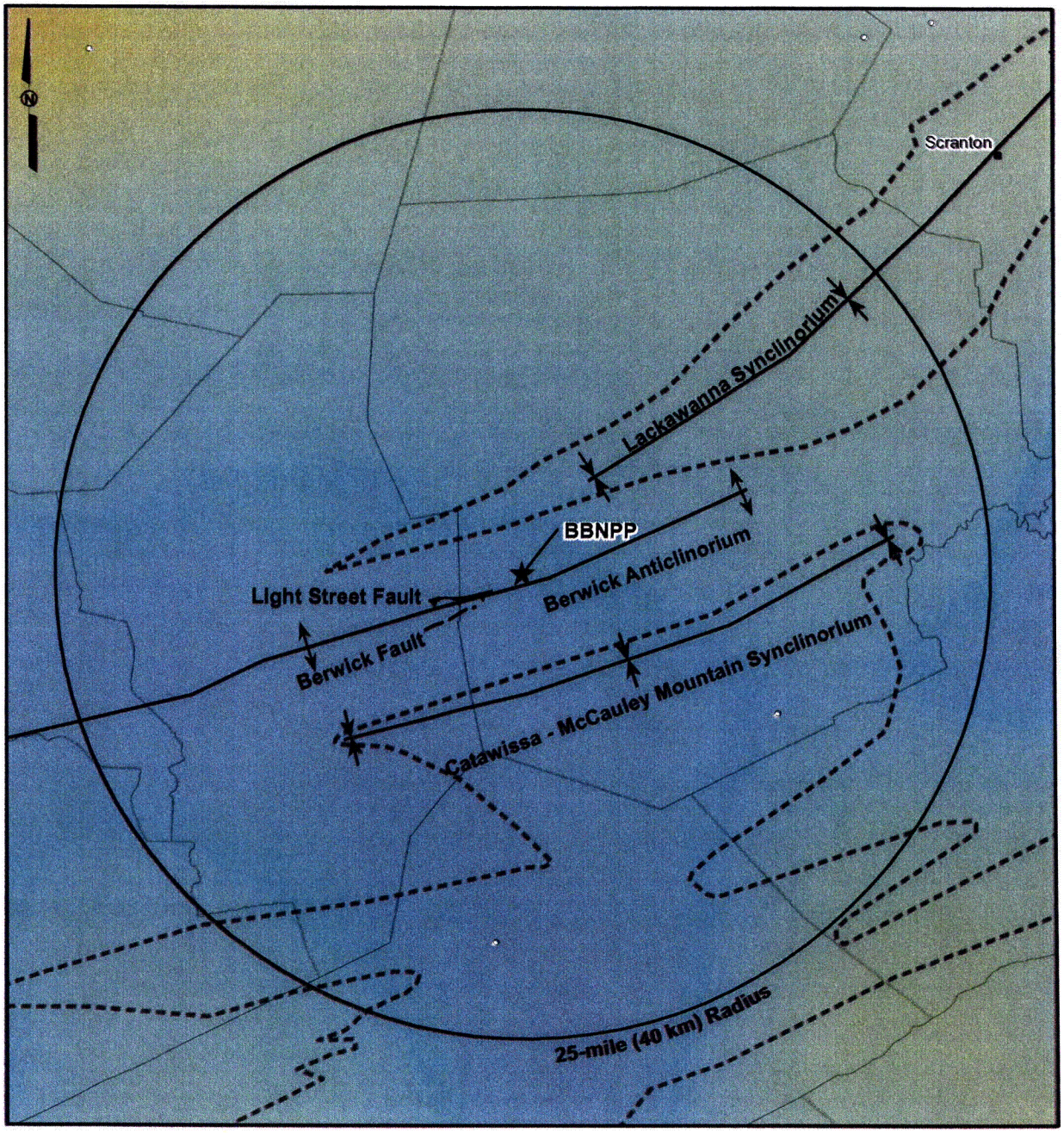
-1730 nanoteslas

0 25 50 100 miles

0 25 50 100 kilometers

REFERENCE:
- Bankey, 2002.

Figure 2.5-18a Site Vicinity Magnetic Anomaly Map



LEGEND

- ★ Center Point of Proposed Bell Bend NPP (BBNPP)
- ○ NPP Reactor 25-mile (40 km) Radius
- — — Anthracite Region

Earthquakes by Magnitude, m_b

- 3.0 - 3.9
- 4.0 - 4.9
- 5.0 - 5.9

Aeromagnetics

8215 nanoteslas

0

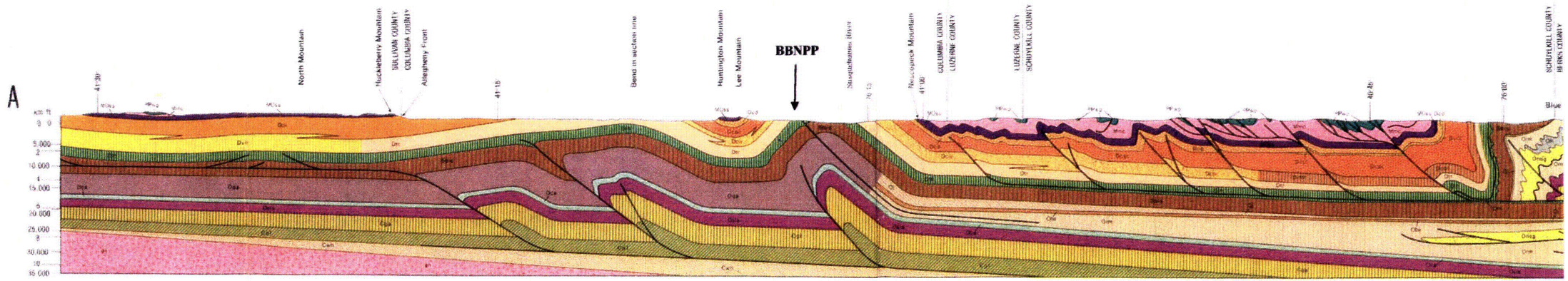
-1730 nanoteslas

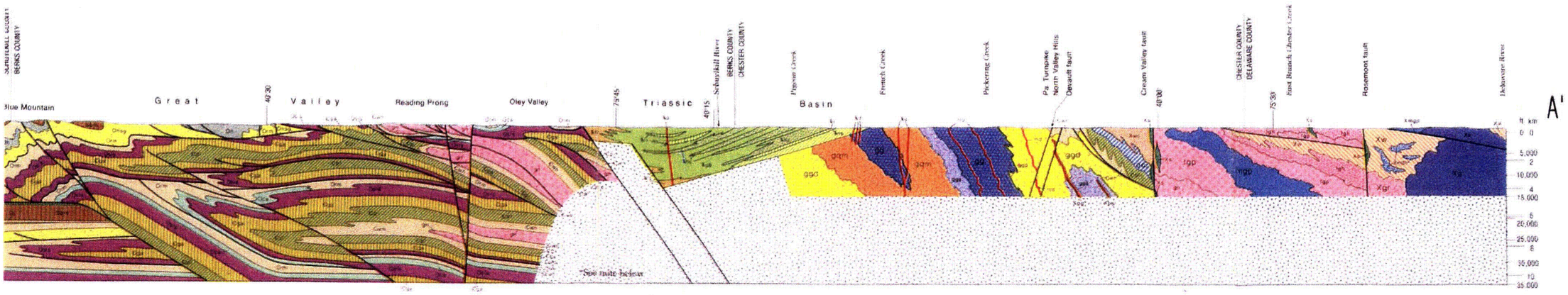
0 2.5 5 10 miles

0 2.5 5 10 kilometers

REFERENCE:
- Bankey, 2002.
- Harrison, 2004.
- USGS, 2007.

Figure 2.5-19 Regional Cross Section





NOTES:

-BBNPP approximate location is extrapolated and is not the true geological location of Bell Bend NPP.

-Refer to Figure 2.5-5 for Cross Section A-A' location.

-Refer to subsequent figure for Cross Section A-A' descriptions.

REFERENCE:

King, 1974.

Figure 2.5-20 Stratigraphic Description for Regional Cross Section

TRIASSIC

- DIABASE
- LIMESTONE FANGLOMERATE
- QUARTZ FANGLOMERATE
- GETTYSBURG, HAMMER CREEK, AND BRUNSWICK FORMATIONS, UNDIVIDED
- HEIDLERSBURG MEMBER OF GETTYSBURG FORMATION
- LOCKATONG FORMATION
- HAMMER CREEK CONGLOMERATE
  Also includes some conglomerate in Gettysburg Formation.
- NEW OXFORD AND STOCKTON FORMATIONS, UNDIVIDED
- NEW OXFORD CONGLOMERATE

PERMIAN AND PENNSYLVANIAN

- WAYNESBURG FORMATION, MONONGAHELA GROUP, CONEMAUGH GROUP, ALLEGHENY GROUP, AND POTTSVILLE GROUP, UNDIVIDED (western Pennsylvania); LLEWELLYN FORMATION AND POTTSVILLE GROUP, UNDIVIDED (eastern Pennsylvania)

MISSISSIPPIAN

- MAUCH CHUNK FORMATION

MISSISSIPPIAN AND DEVONIAN

- Same as MDss (described below), but also includes MAUCH CHUNK FORMATION
- SHENANGO FORMATION, CUYAHOGA GROUP, BEREA OR CORRY SANDSTONE, BEDFORD SHALE, CUSSEWAGO SANDSTONE, AND RICEVILLE FORMATION OR OSWAYO FORMATION, UNDIVIDED (northwestern Pennsylvania); BURGOON SANDSTONE AND HUNTLEY MOUNTAIN FORMATION OR ROCKWELL FORMATION, UNDIVIDED (northern and western Pennsylvania); POCONO AND SPECHTY KOPF FORMATIONS, UNDIVIDED (eastern Pennsylvania)

DEVONIAN

UPPER

- CATSKILL FORMATION
- DUNCANNON MEMBER OF CATSKILL FORMATION
- CLARKS FERRY MEMBER OF CATSKILL FORMATION
- SHERMAN CREEK MEMBER OF CATSKILL FORMATION
- IRISH VALLEY MEMBER OF CATSKILL FORMATION
- BEAVERDAM RUN, WALCKSVILLE, AND TOWAMENSING MEMBERS OF CATSKILL FORMATION, UNDIVIDED
- TRIMMERS ROCK FORMATION
  Includes Harrell Formation in part of section A-A'.
- VENANGO GROUP, CHADAKOIN FORMATION, GIRARD SHALE, NORTHEAST SHALE, SHUMLA SILTSTONE, WESTFIELD SHALE, LAONA SILTSTONE, PERRYSBURG FORMATION, JAVA FORMATION, WEST FALLS FORMATION, SONYEA FORMATION, AND GENESEE FORMATION, UNDIVIDED (northwestern Pennsylvania); VENANGO GROUP, CHADAKOIN FORMATION, BRADFORD GROUP, ELK GROUP, BRALLIER FORMATION, AND HARRELL FORMATION, UNDIVIDED (western Pennsylvania); LOCK HAVEN, FOREKNOBS, SCHERR, BRALLIER, AND HARRELL FORMATIONS, UNDIVIDED (Valley and Ridge province; northern Pennsylvania)
  Also includes equivalents of Ohio Shale, Chagrin Formation, and Huron Shale in parts of westernmost Pennsylvania.

MIDDLE AND LOWER

- TULLY LIMESTONE, HAMILTON GROUP, ONONDAGA FORMATION, BOIS BLANC FORMATION, ORISKANY SANDSTONE, AND MANLIUS FORMATION, UNDIVIDED (northwestern Pennsylvania); HAMILTON GROUP, ONONDAGA FORMATION, OLD PORT FORMATION, AND UPPER PART OF KEYSER FORMATION, UNDIVIDED (western Pennsylvania; Valley and Ridge province); MAHANTANGO FORMATION, MARCELLUS FORMATION, BUTTERMILK FALLS LIMESTONE, PALMERTON SANDSTONE, SCHOHARIE FORMATION, ESOPUS FORMATION, RIDGELEY SANDSTONE, SHRIVER CHERT, AND HELDERBERG GROUP, UNDIVIDED (eastern Pennsylvania)

SILURIAN

- BASS ISLANDS GROUP, SALINA GROUP, LOCKPORT DOLOMITE, ROCHESTER SHALE, IRONDEQUOIT DOLOMITE, REYNALES DOLOMITE, AND MEDINA GROUP, UNDIVIDED (northwestern and western Pennsylvania); LOWER AND MIDDLE PARTS OF KEYSER FORMATION, TONOLOWAY FORMATION, WILLS CREEK FORMATION, BLOOMSBURG FORMATION, MIFFLINTOWN FORMATION, CLINTON GROUP, AND TUSCARORA FORMATION, UNDIVIDED (Valley and Ridge province); DECKER FORMATION, BOSSARDVILLE LIMESTONE, POXONO ISLAND FORMATION, BLOOMSBURG FORMATION, AND SHAWANGUNK FORMATION, UNDIVIDED (eastern Pennsylvania)

ORDOVICIAN

- QUEENSTON SHALE, JUNIATA FORMATION, BALD EAGLE FORMATION, REEDSVILLE FORMATION, AND UTICA FORMATION OR ANTES SHALE, UNDIVIDED
- JUNIATA FORMATION
- BALD EAGLE FORMATION
- REEDSVILLE FORMATION AND UTICA FORMATION OR ANTES SHALE, UNDIVIDED (western Pennsylvania; Valley and Ridge province); MARTINSBURG FORMATION (Great Valley)
- HAMBURG SEQUENCE ROCKS (phyllitic shale)
  Includes some limestone.
- HAMBURG SEQUENCE ROCKS (shale and graywacke)
- COBURN, SALONA, NEALMONT, BENNER, SNYDER, HATTER, AND LOYSBURG FORMATIONS, UNDIVIDED (western Pennsylvania; Valley and Ridge province); CHAMBERSBURG FORMATION, ST. PAUL GROUP, HERSHEY FORMATION, MYERSTOWN FORMATION, JACKSONBURG FORMATION, AND ANNVILLE FORMATION, UNDIVIDED (Great Valley)
- SHADOW LAKE, BELLEFONTE, AXEMANN, NITTANY, AND STONEHENGE/LARKE FORMATIONS, UNDIVIDED (western Pennsylvania; Valley and Ridge province); PINESBURG STATION, ROCKDALE RUN, STONEHENGE, AND STOUFFERSTOWN FORMATIONS (BEEKMANTOWN GROUP), UNDIVIDED (Cumberland Valley sequence); ONTELAUNEE, EPLER, RICHENBACH, AND STONEHENGE FORMATIONS (BEEKMANTOWN GROUP), UNDIVIDED (Lebanon and Lehigh Valley sequences; northern Piedmont)

ORDOVICIAN AND CAMBRIAN

- CONESTOGA FORMATION

CAMBRIAN

- GATESBURG FORMATION AND UPPER PART OF WARRIOR FORMATION, UNDIVIDED (western Pennsylvania; Valley and Ridge province); SHADYGROVE FORMATION, ZULLINGER FORMATION, AND UPPER PART OF ELBROOK FORMATION, UNDIVIDED (Cumberland Valley sequence); RICHLAND, MILLBACH, SCHAEFFERSTOWN, AND SNITZ CREEK FORMATIONS, UNDIVIDED (Lebanon Valley sequence); ALLENTOWN FORMATION (Lehigh Valley sequence)
- GATESBURG, WARRIOR, PLEASANT HILL, POTSDAM, ELBROOK, AND WAYNESBORO FORMATIONS, UNDIVIDED
  Also includes lateral equivalents of Tomstown Formation and Chilhowee Group (if present).
- POTSDAM FORMATION (western Pennsylvania); MIDDLE AND LOWER PARTS OF ELBROOK FORMATION, LOWER PART OF WARRIOR FORMATION, AND PLEASANT HILL FORMATION, UNDIVIDED (Valley and Ridge province); BUFFALO SPRINGS AND ZOOKS CORNER FORMATIONS, UNDIVIDED (Lebanon Valley sequence); LEITHSVILLE FORMATION (Lehigh Valley sequence)
- WAYNESBORO, TOMSTOWN, ANTIETAM, HARPERS, AND WEVERTON FORMATIONS, UNDIVIDED (south-central Pennsylvania); LEDGER, KINZERS, VINTAGE, ANTIETAM, HARPERS, CHICKIES, AND HARDYSTON FORMATIONS, UNDIVIDED (Lebanon Valley and Lehigh Valley sequences; northern Piedmont)

PRECAMBRIAN

- METAVOLCANIC ROCKS
  Includes metabasalt, metarhyolite, and greenstone schist.
- METADIABASE
- QUARTZ MONZONITE AND QUARTZ MONZONITE GNEISS
- GRANODIORITE AND GRANODIORITE GNEISS
- GABBROIC GNEISS AND GABBRO
- GRAPHITIC GNEISS
- FELSIC GNEISS, HORNBLENDE-BEARING
- FELSIC GNEISS, PYROXENE-BEARING
- HORNBLENDE GNEISS
- MAFIC GNEISS, PYROXENE-BEARING
- GRANITIC GNEISS
  Includes all Precambrian and undifferentiated basement crystalline rocks (igneous or metamorphic).

PROBABLY LOWER PALEOZOIC

- PEGMATITE
- ANORTHOSITE
- GRANITIC GNEISS AND GRANITE
- MAFIC GNEISS, HORNBLENDE-BEARING
- MAFIC GNEISS, PYROXENE-BEARING
- SERPENTINITE
- PEACH BOTTOM SLATE AND CARDIFF CONGLOMERATE, UNDIVIDED
- PETERS CREEK SCHIST
- WISSAHICKON FORMATION, ALBITE-CHLORITE SCHIST
- WISSAHICKON FORMATION, OLIGOCLASE-MICA SCHIST
- COCKEYSVILLE MARBLE
- SETTERS QUARTZITE

- INSUFFICIENT DATA FOR INTERPRETATION

*Note: Decollement surfaces may extend under the Pennsylvania Piedmont, based on seismic research in the southern Appalachians and in Quebec, but no data are presently available to extend this structural interpretation into Pennsylvania.

REFERENCE:
King, 1974.

Figure 2.5-21 Site Specific Stratigraphic Column

Era	Period	Epoch	Age (Ma)	Unit	Thickness (ft)
Cenozoic	Quaternary	Holocene	0.01	**Stratified Drift**	38.5
		Pleistocene	1.8		
Paleozoic	Devonian	Upper	360	**Harrell Formation**	150
		Middle	370	Hamilton Group: **Mahantango Formation**	1,500
				Hamilton Group: **Marcellus Formation**	350
				Onondaga Formation	175
		Lower	391	**Old Port Formation**	100-150
	Silurian	Upper	417	**Keyser Formation**	125
				Tonoloway Formation	100
				Wills Creek Formation	750
		Lower	423	**Bloomsburg Formation**	464
				Mifflintown Formation	336
				Keefer Formation	670-1,070
				Rose Hill Formation	
				Tuscarora Formation	400-700
	Ordovician	Upper	443	**Juniata Formation**	600-1,125
				Bald Eagle Formation	700-1,313
				Reedsville Formation	600-1,800
		Middle	458	**Trenton Group** Antes Shale Coburn Limestone Salona Limestone	842
				Black River Group	632
				Loysburg Formation	263-475
		Lower	470	**Beekmantown Group** Bellefonte Dolomite Axemann Limestone Nittany Dolomite Stonehenge Formation	3,159-4,200
	Cambrian	Upper	490	**Gatesburg Formation**	1,211
		Middle	510	**Warrior Formation**	400-1,340
				Pleasant Hill Formation	NOT REPORTED
		Lower	520	**Waynesboro Formation**	1,000+
Neo-Proterozoic	Ediacaran		543	Metamorphic/Igneous	

REFERENCES:
- Crangle, 2002
- Gold, 2003
- Inmers, 1978
- Kauffman, 1999
- Laughrey, 1999
- McElroy, 2007
- Thompson, 1999

Figure 2.5-22 {Deleted}

Figure 2.5-23 Bedrock Geologic Map Berwick Quadrangle

LEGEND:

★ Center Point of Proposed Bell Bend NPP (BBNPP)

○ BBNPP Reactor 0.6-mile (1 km) Radius

A — A' Cross Section

WOOD-FORDIAN OUTWASH	MAUCH CHUNK FORMATION	POCONO FORMATION	SPECHTY KOPF FORMATION	CATSKILL FORMATION				
				DUNCANNON MEMBER	SHERMAN CREEK MEMBER	IRISH VALLEY MEMBER	TRIMMERS ROCK FORMATION	HARRELL FORMATION
Qwo	Mmc	Mp	MDisk	Dcd	Dcs	Dci	Dtr	Dh

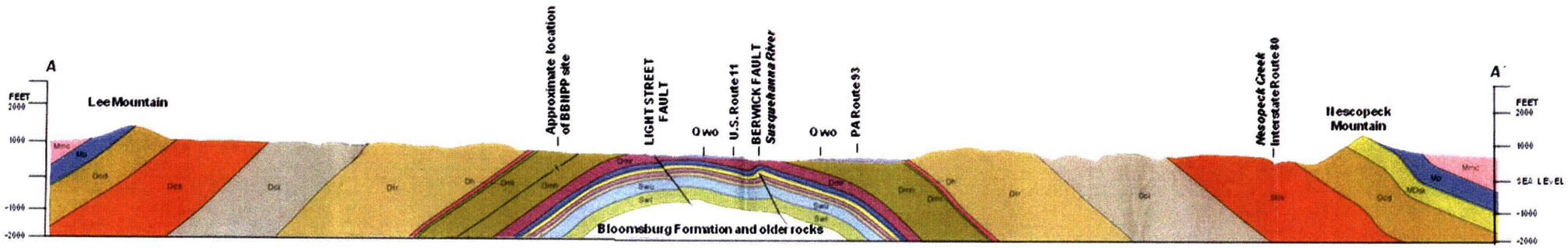
MANHATTAN FORMATION							WILLS CREEK FORMATION	
TULLY MEMBER		MANDELLUS FORMATION	ONONDAGA FORMATION	OLD PORT FORMATION	KEYSER FORMATION	TONOLOWAY FORMATION	UPPER MEMBER	
Dmh		Dmr	Don	Do	DSk	Sto	SWU	LOWER MEMBER Swl

NOTE: See Figure 2.5-23a for Cross Section.

REFERENCE:
- Inners, 1978.
- Harrison, 2004.

Figure 2.5-23a Cross Section of Berwick Anticlinorium - Bedrock Geology of Berwick Quadrangle

CROSS SECTION



Location Map of Cross Section

Legend

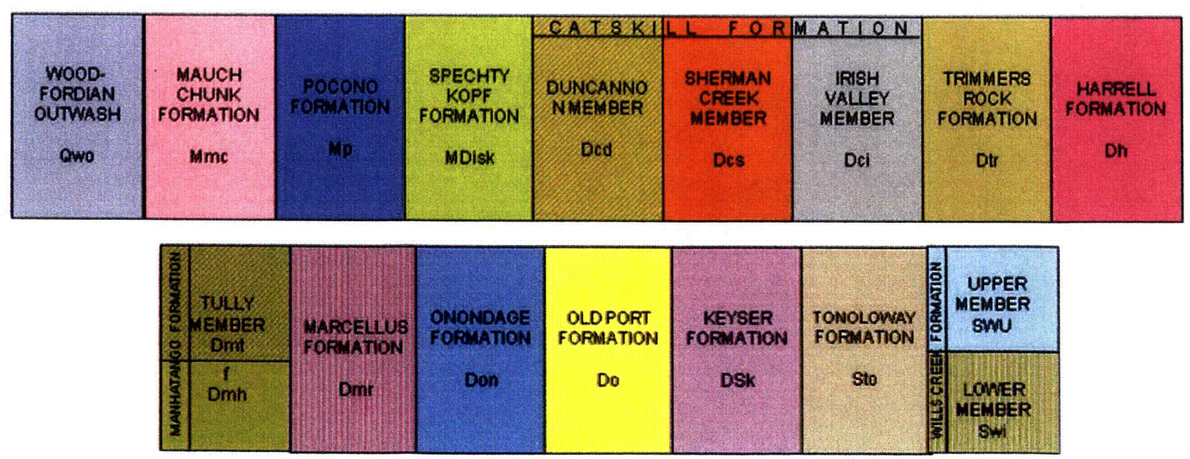


Figure 2.5-24 Surficial Geologic Site Map 0.6 Mile (1 km)

LEGEND:

☆ Proposed Center Point of Bell Bend NPP (BBNPP)

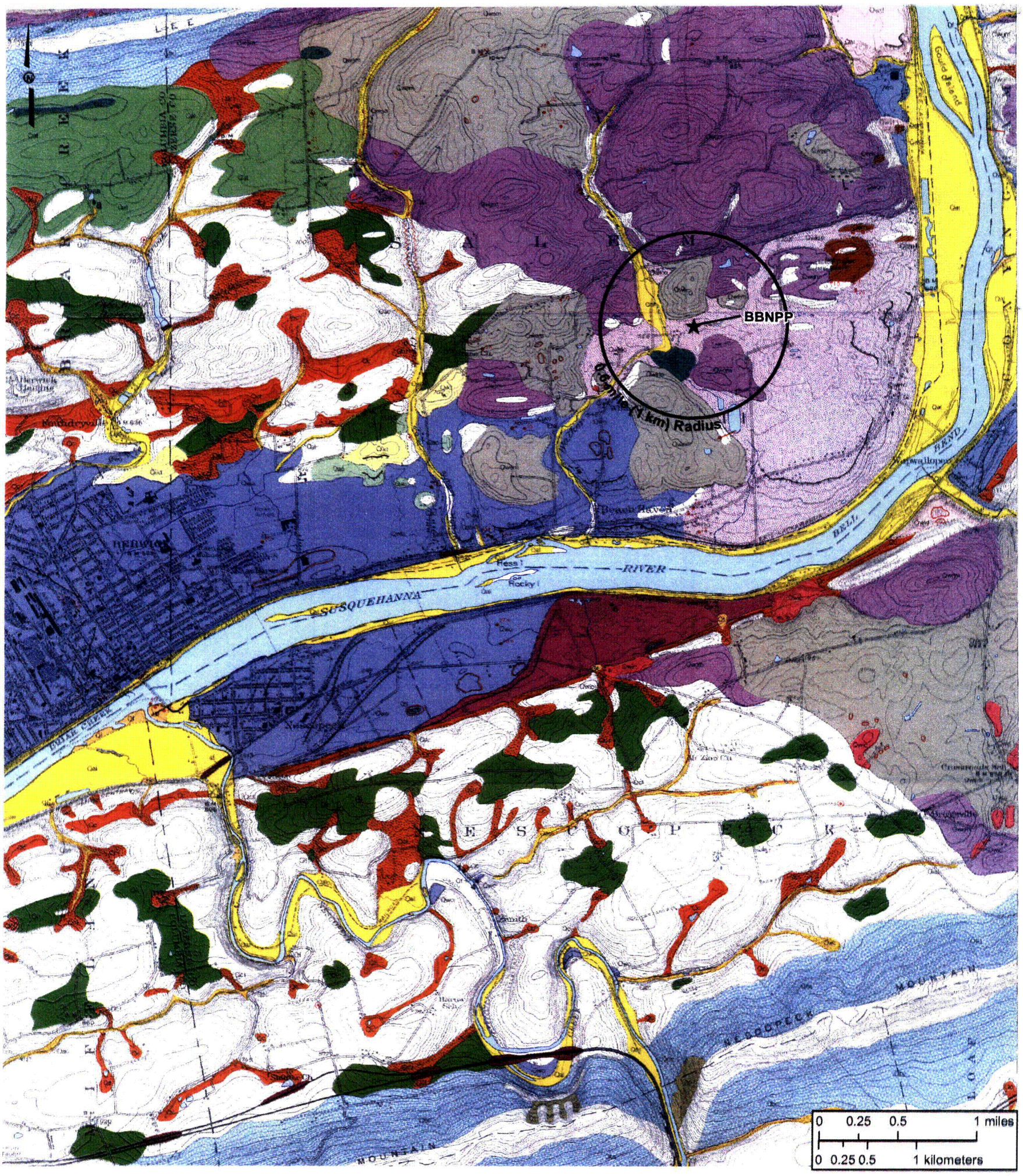
◯ NPP Reactor 0.6-mile (1 km) Radius

ARTIFICIAL FILL af	ALLUVIUM Qal	ALLUVIAL FAN Qf	ALLUVIUM AND WOOD-FORDIAN OUTWASH, UNDIVIDED Qwoa	SWAMP DEPOSIT Qs	ALLUVIUM AND COLLUVIUM UNDIVIDED Qac	COLLUVIUM Qc	COLLUVIUM AND TILL, UNDIVIDED Qct	EOLIAN MANTLE Qem	TALUS Qt	BOULDER COLLUVIUM Qbc

WOOD-FORDIAN OUTWASH Qwo	WOOD-FORDIAN KAME TERRACE Qwkt	WOOD-FORDIAN KAME TERRACE AND OUTWASH, UNDIVIDED Qwkto	WOOD-FORDIAN FRONTAL KAME Qwfk	WOOD-FORDIAN ICE-CONTACT STRATIFIED DRIFT Qwic	WOOD-FORDIAN GROUND MORAINE Qwgm	WOOD-FORDIAN END MORAINE Qwem	ALTONIAN OUTWASH Qao	ALTONIAN TILL Qat	ILLINOIAN KAME TERRACE Qikt	ILLINOIAN TILL Qit

REFERENCE:
• Inners, 1978.

Figure 2.5-25 Surficial Sediments Description



LEGEND:

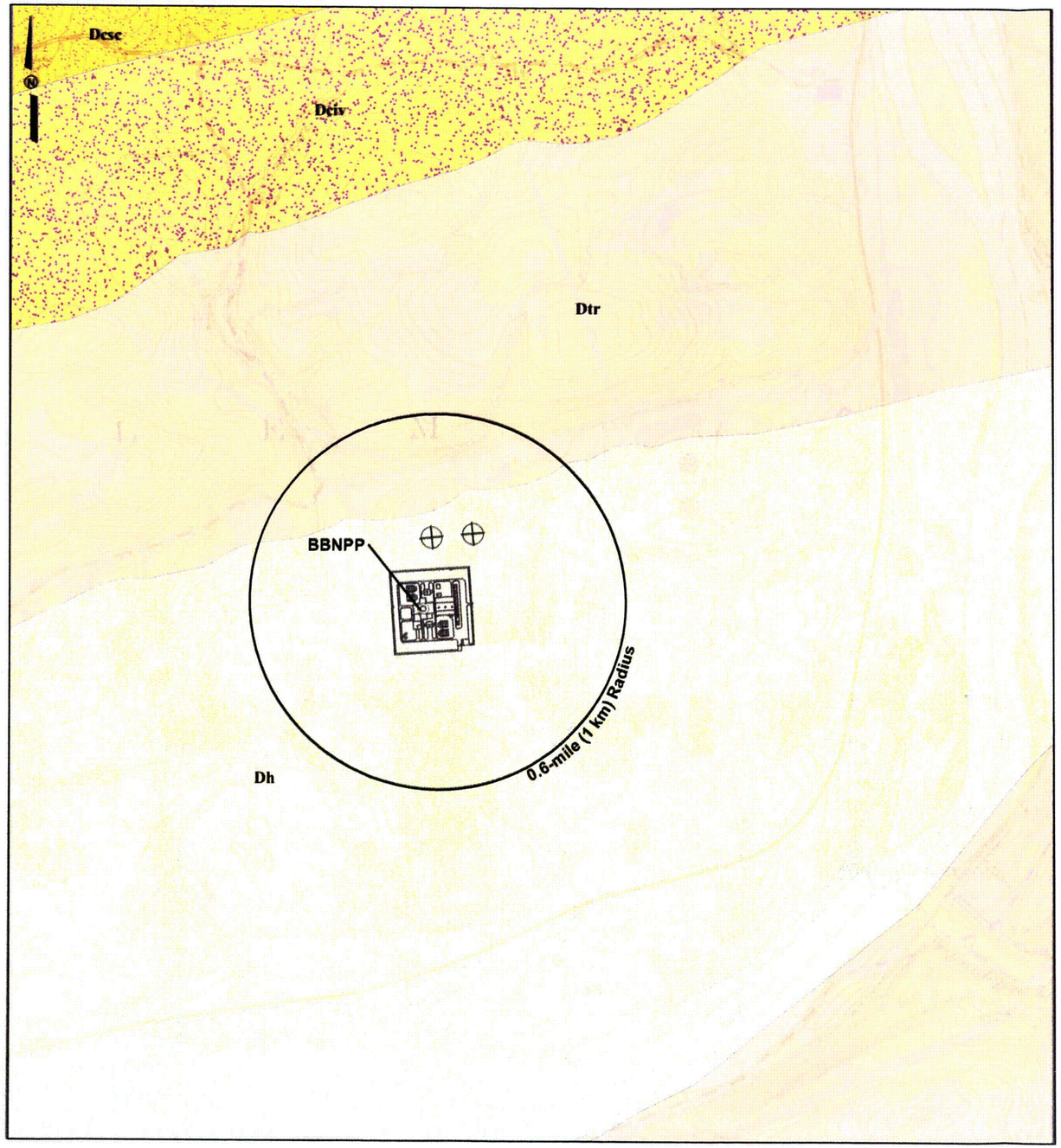
★ Proposed Center Point of Bell Bend NPP (BBNPP)

○ NPP Reactor 0.6-mile (1 km) Radius

ARTIFICIAL FILL af	ALLUVIUM Qal	ALLUVIAL FAN Qf	ALLUVIUM AND WOODFORDIAN OUTWASH, UNDIVIDED Qwoa	SWAMP DEPOSIT Qs	ALLUVIUM AND COLLUVIUM UNDIVIDED Qac	COLLUVIUM Qc	COLLUVIUM AND TILL, UNDIVIDED Qct	EOLIAN MANTLE Qem	TALUS Qt	BOULDER COLLUVIUM Qbc
WOOD-FORDIAN OUTWASH Qwo	WOOD-FORDIAN KAME TERRACE Qwkt	WOOD-FORDIAN KAME TERRACE AND OUTWASH, UNDIVIDED Qwkto	WOOD-FORDIAN FRONTAL KAME Qwfk	WOOD-FORDIAN ICE-CONTACT STRATIFIED DRIFT Qwic	WOOD-FORDIAN GROUND MORAINE Qwgm	WOOD-FORDIAN END MORAINE Qwem	ALTONIAN OUTWASH Qao	ALTONIAN TILL Qat	ILLINOIAN KAME TERRACE Qikt	ILLINOIAN TILL Qit

REFERENCE:
• Inners, 1978.

Figure 2.5-26 Site Area Geologic Map 0.6-mile (1 km) Radius



LEGEND

Unit Descriptions

Pennsylvanian

- Pl — Llewellyn Formation
- Pp — Pottsville Formation

Mississippian

- Mmc — Mauch Chunk Formation
- Mb — Burgoon Sandstone
- Mp — Pocono Formation
- MDhm — Huntley Mountain Formation
- MDsk — Spechty Kopf Formation

Devonian

- Dck — Catskill Formation

Catskill Formation Members:

- Dcb — Buddys Run Member
- Dcd — Duncannon Member
- Dccf — Clarks Ferry Member
- Dcsc — Sherman Creek Member
- Dcbs — Berry Run & Sawmill Run Members, undivided
- Dcp — Packerton Member
- Dclr — Long Run Member
- Dciv — Irish Valley Member
- Dtr — Trimmers Rock Formation
- Dh — Hamilton Group
- Doo — Onondaga & Old Port Formations, undivided
- DSkt — Keyser & Tonoloway Formations, undivided

Silurian

- Swc — Wills Creek Formation
- Sbm — Bloomsburg & Mifflintown Formations, undivided
- Sc — Clinton Group

---- Fault - Inferred

—— Fault

★ Center Point of Proposed Bell Bend NPP (BBNPP)

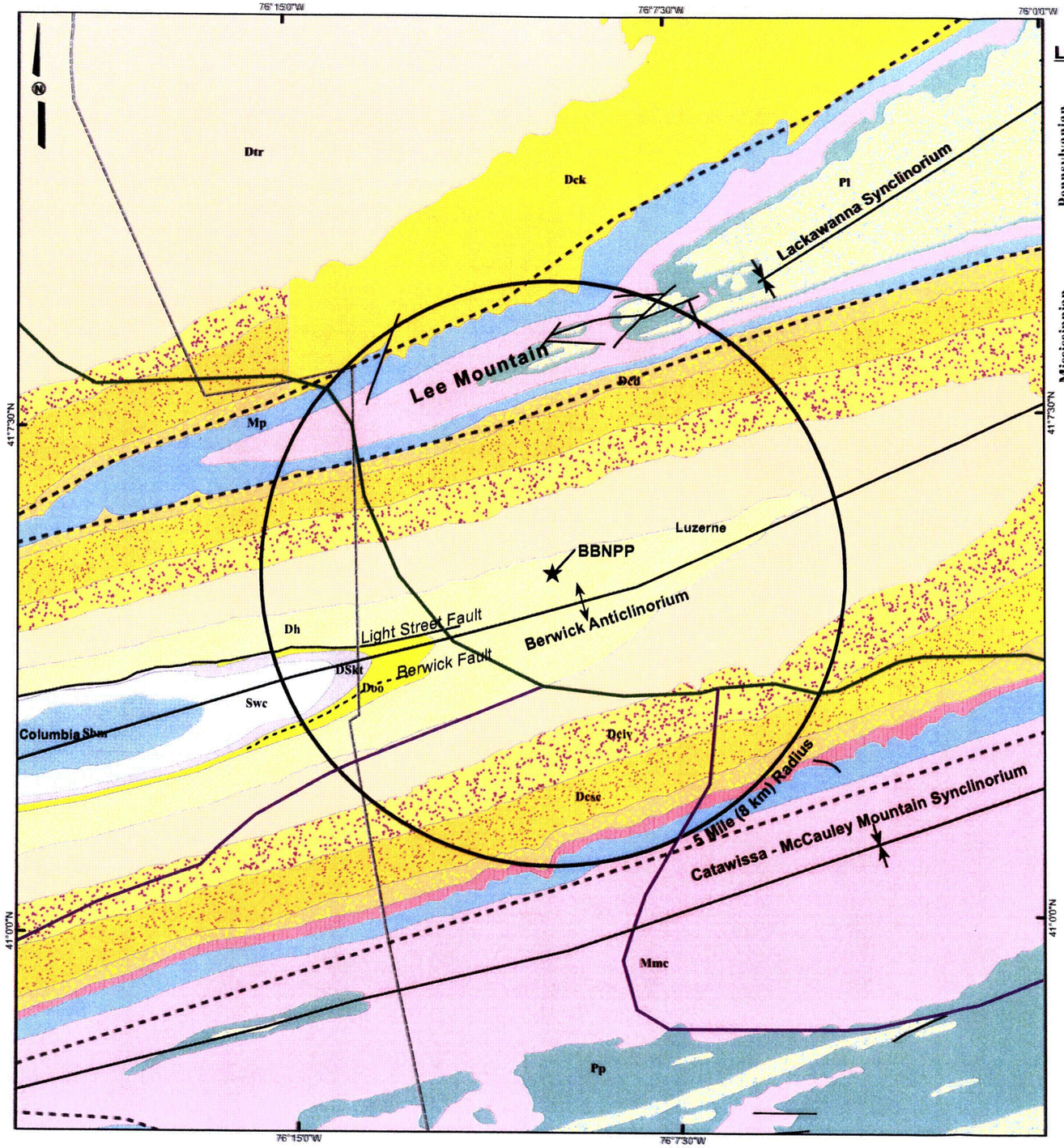
○ NPP Reactor 0.6-mile (1 km) Radius

0 0.25 0.5 1 miles

0 0.5 1 kilometers

REFERENCES:
- sk-12198-004-001, 2008.
- Berg, 1980.
- King, 1974.
- USGS, 1989.
- ESRI, 2007.

Figure 2.5-27 Site Area Geologic Map 5-mile (8km) Radius



LEGEND

Unit Descriptions

Pennsylvanian

- Pl — Llewellyn Formation
- Pp — Pottsville Formation

Mississippian

- Mmc — Mauch Chunk Formation
- Mb — Burgoon Sandstone
- Mp — Pocono Formation
- MDhm — Huntley Mountain Formation
- MDsk — Spechty Kopf Formation

Devonian

- Dck — Catskill Formation

Catskill Formation Members:

- Dcb — Buddys Run Member
- Dcd — Duncannon Member
- Dccf — Clarks Ferry Member
- Dcsc — Sherman Creek Member
- Dcbs — Berry Run & Sawmill Run Members, undivided
- Dcp — Packerton Member
- Dclr — Long Run Member
- Dclv — Irish Valley Member
- Dtr — Trimmers Rock Formation
- Dh — Hamilton Group
- Doo — Onondaga & Old Port Formations, undivided
- DSkt — Keyser & Tonoloway Formations, undivided

Silurian

- Swc — Wills Creek Formation
- Sbm — Bloomsburg & Mifflintown Formations, undivided
- Sc — Clinton Group

- Fault - Inferred
- Fault
- Pre-Wisconsinan Glacial Limit
- Wisconsinan Glacial Limit
- Anthracite Region
- ★ Center Point of Proposed Bell Bend NPP (BBNPP)
- ○ NPP Reactor 5-mile (8 km) Radius
- County Line

0 0.5 1 2 miles

0 1 2 kilometers

REFERENCES:
- Berg, 1980.
- Harrison, 2004.
- King, 1974.
- ESRI, 2007.