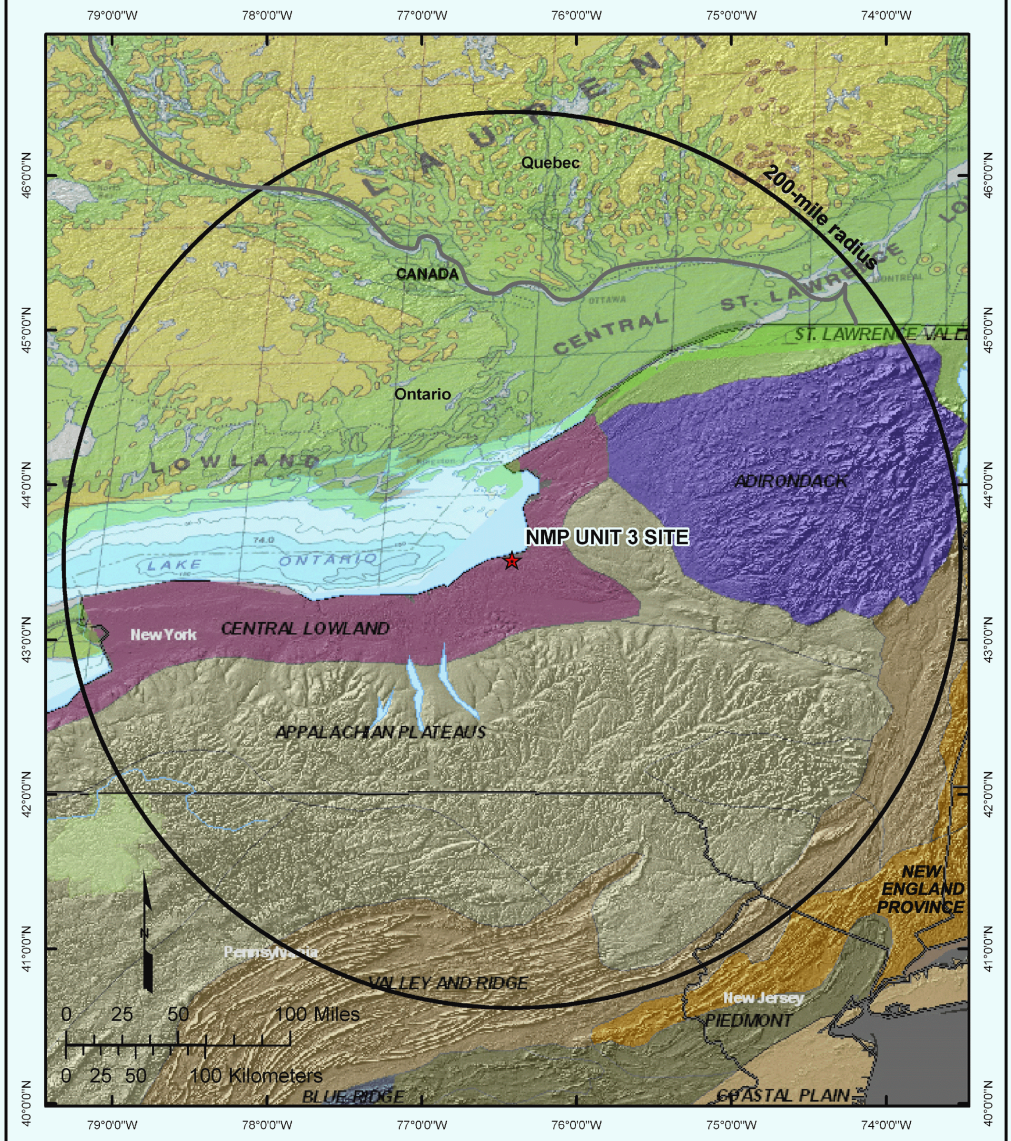
Figure 2.5-3—{Map of Physiographic Provinces}

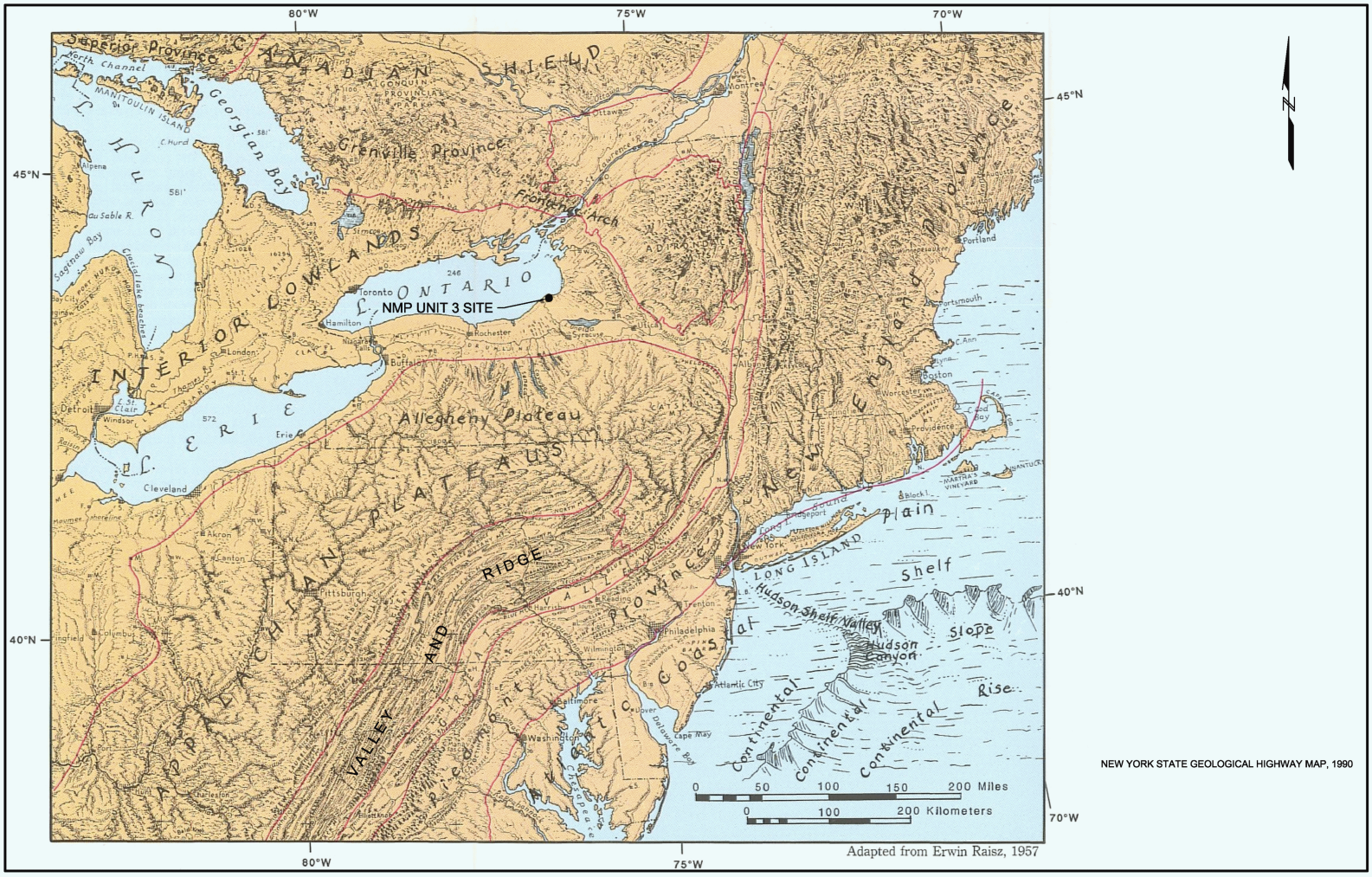


US: Fenneman and Johnson, 1946
Canada: Geological Survey of Canada,
Surveys and Mapping Branch, 1975.

M:\DRAFTING\2007\072230 Borealis\FSAR Figures\072230 -fsar - 46 - Physiographic Provinces

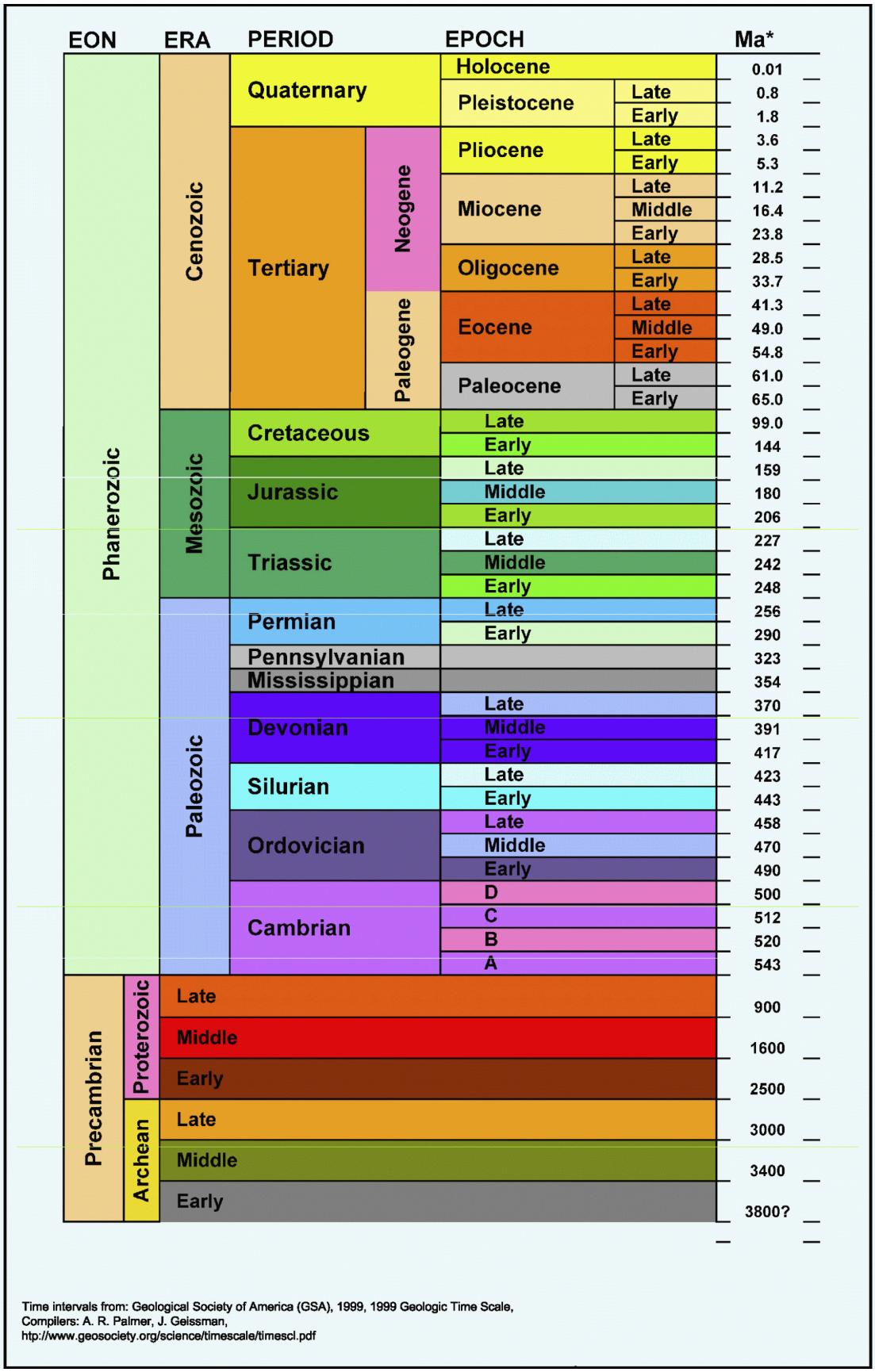
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-4—{Physiographic Map of New York and Surrounding Areas}



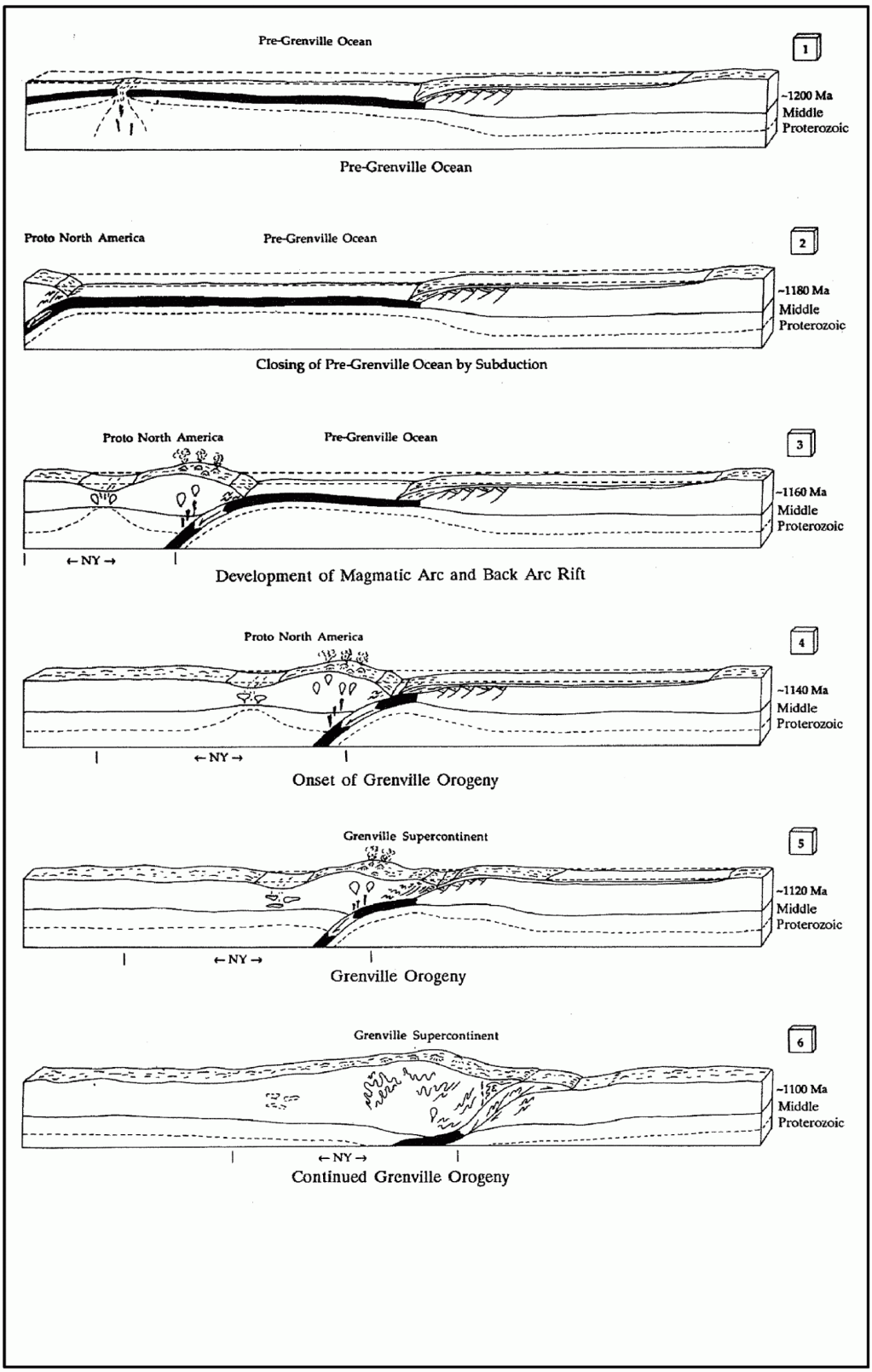
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-5—{Geologic Time Scale}



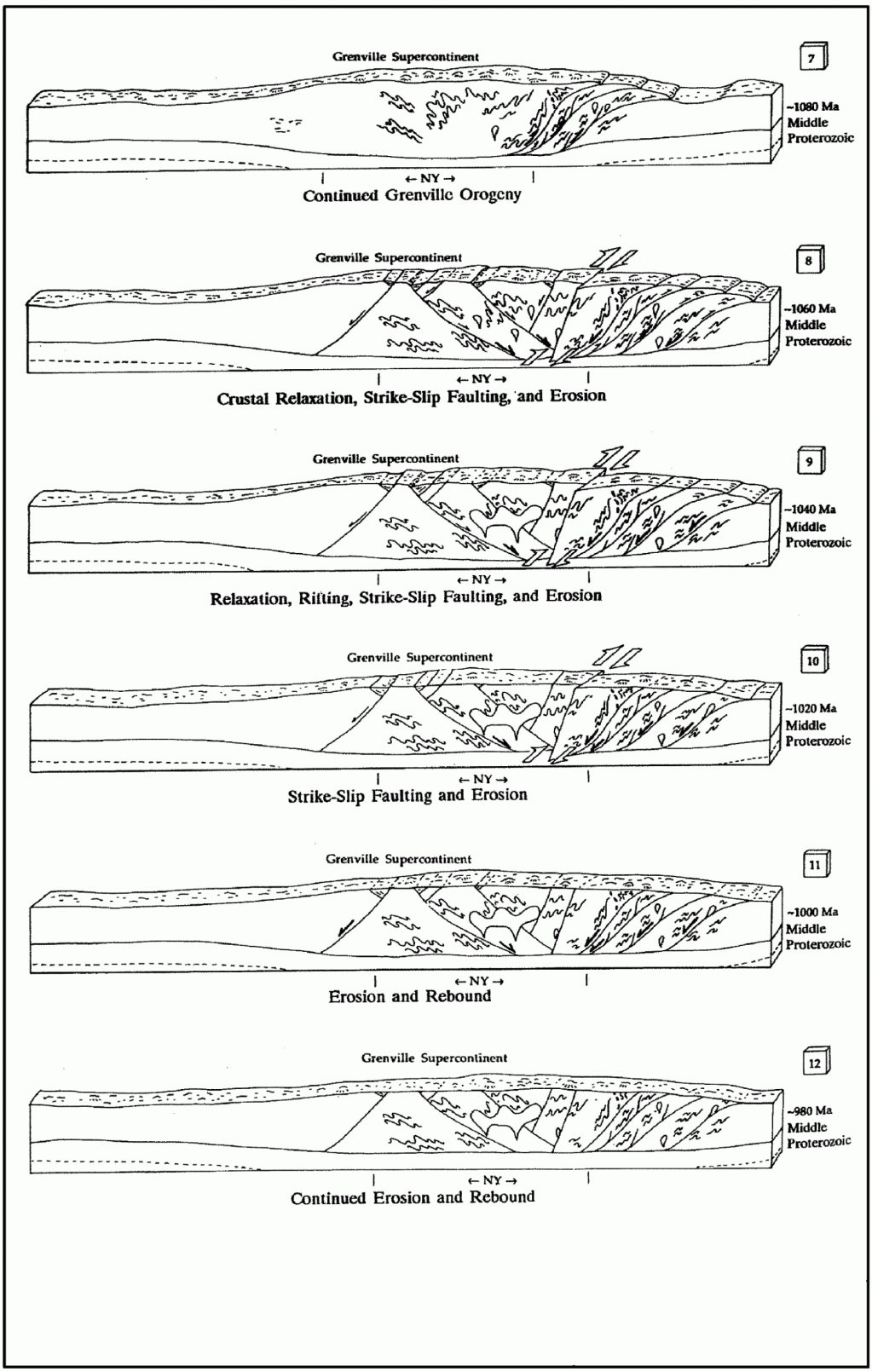
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-6—{Evolution of New York and Eastern America A}



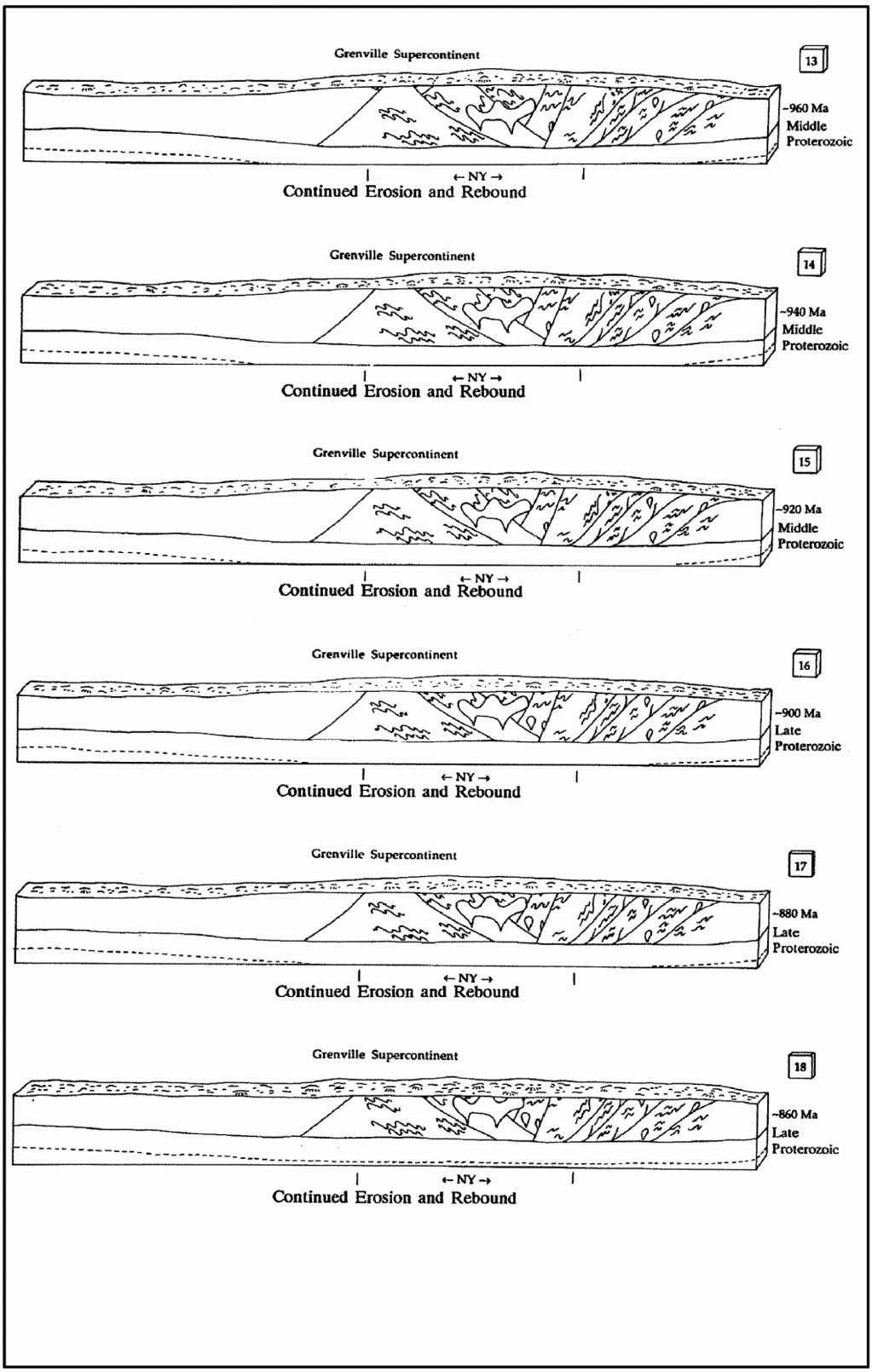
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-7—{Evolution of New York and Eastern America B}



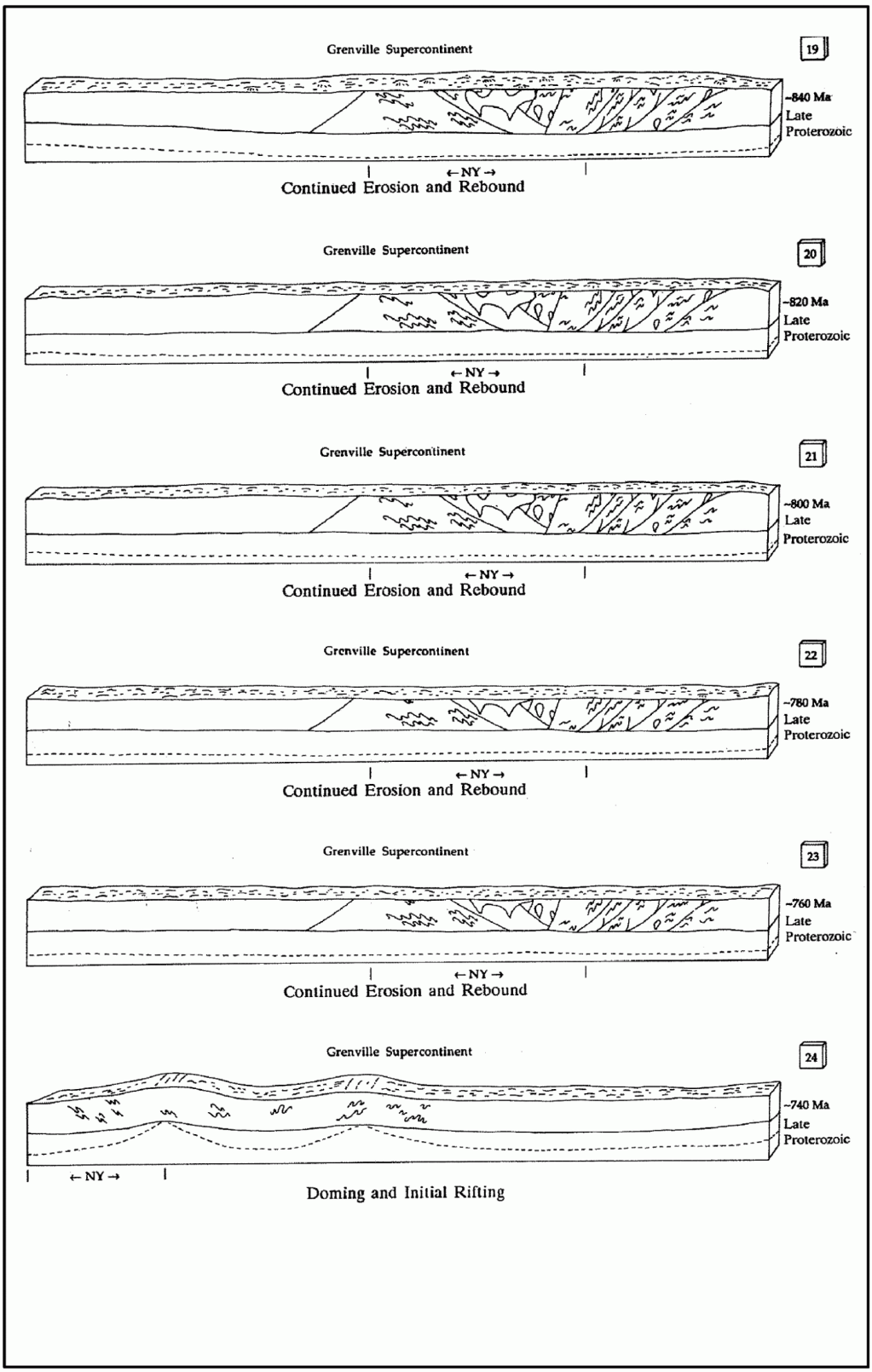
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-8—{Evolution of New York and Eastern America C}



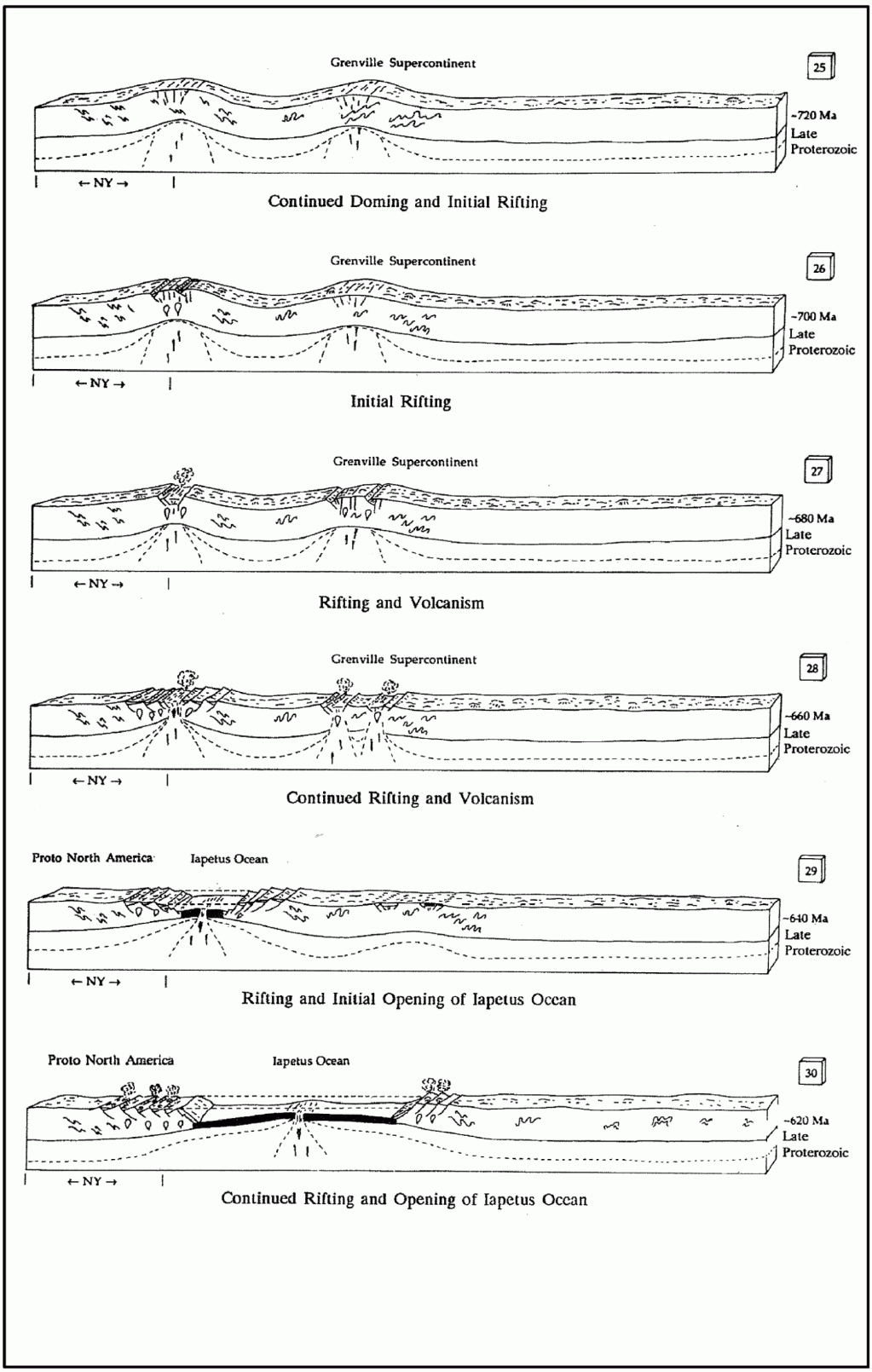
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-9—{Evolution of New York and Eastern America D}



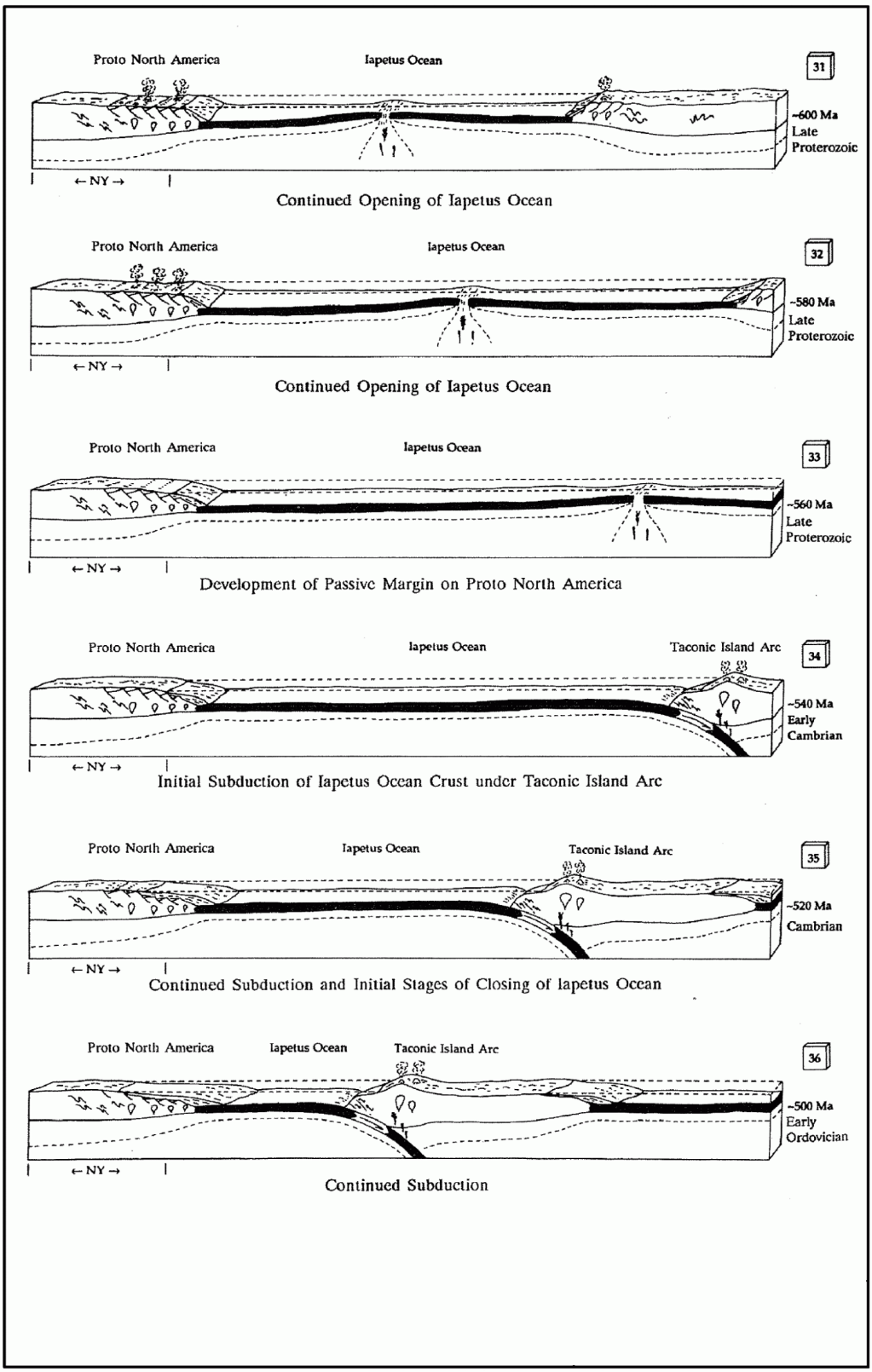
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-10—{Evolution of New York and Eastern America E}



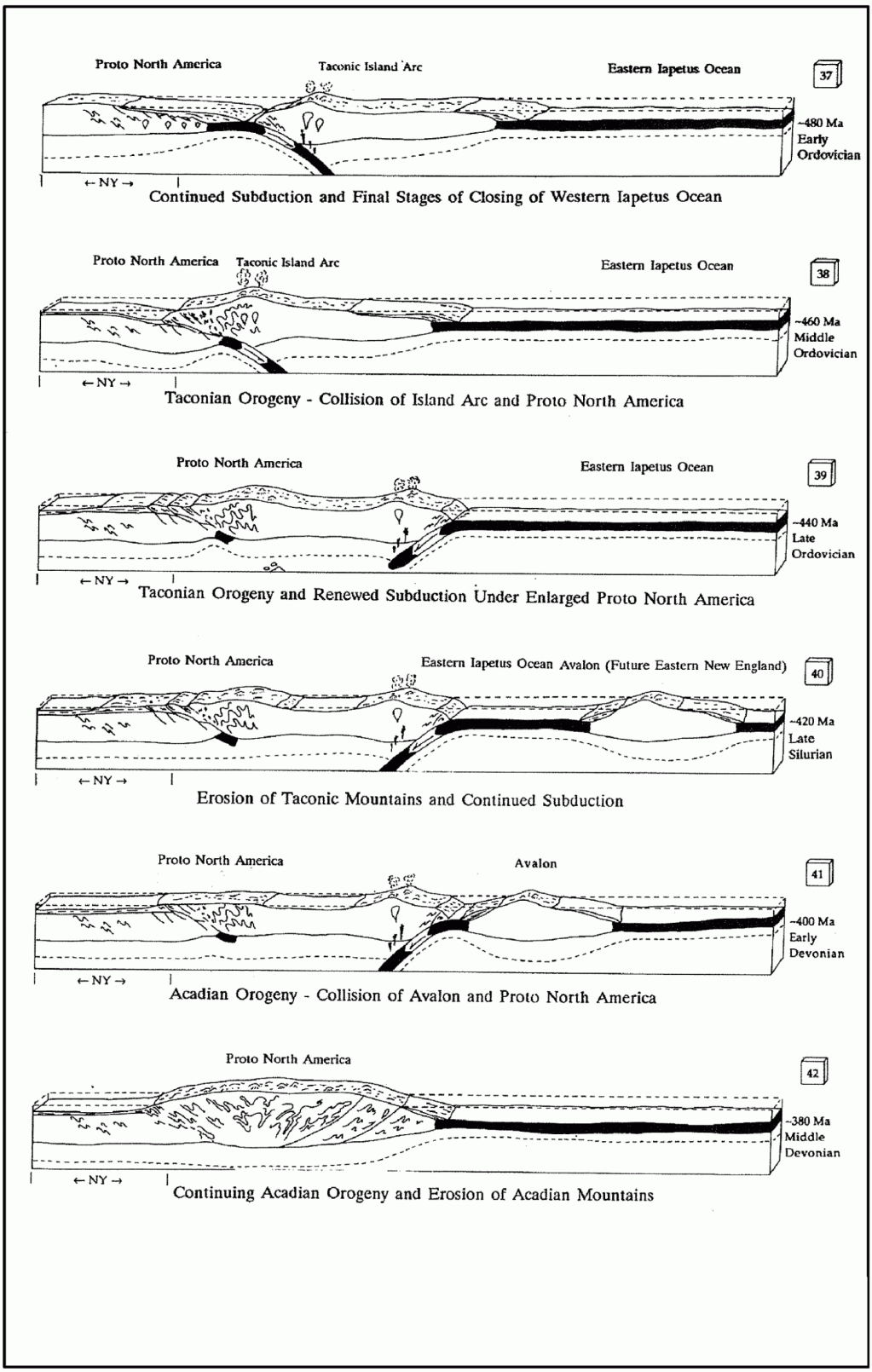
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-11—{Evolution of New York and Eastern America F}



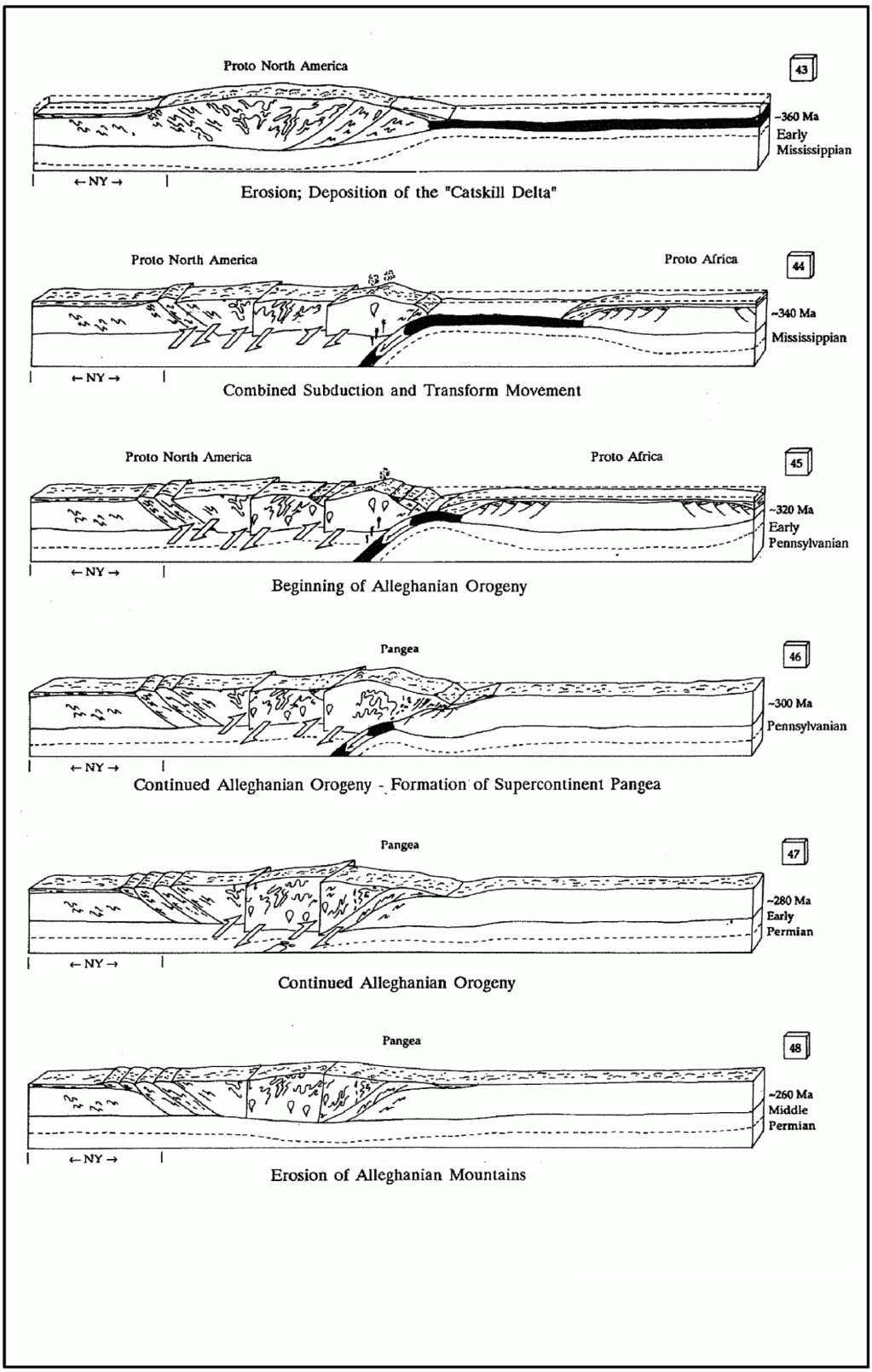
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-12—{Evolution of New York and Eastern America G}



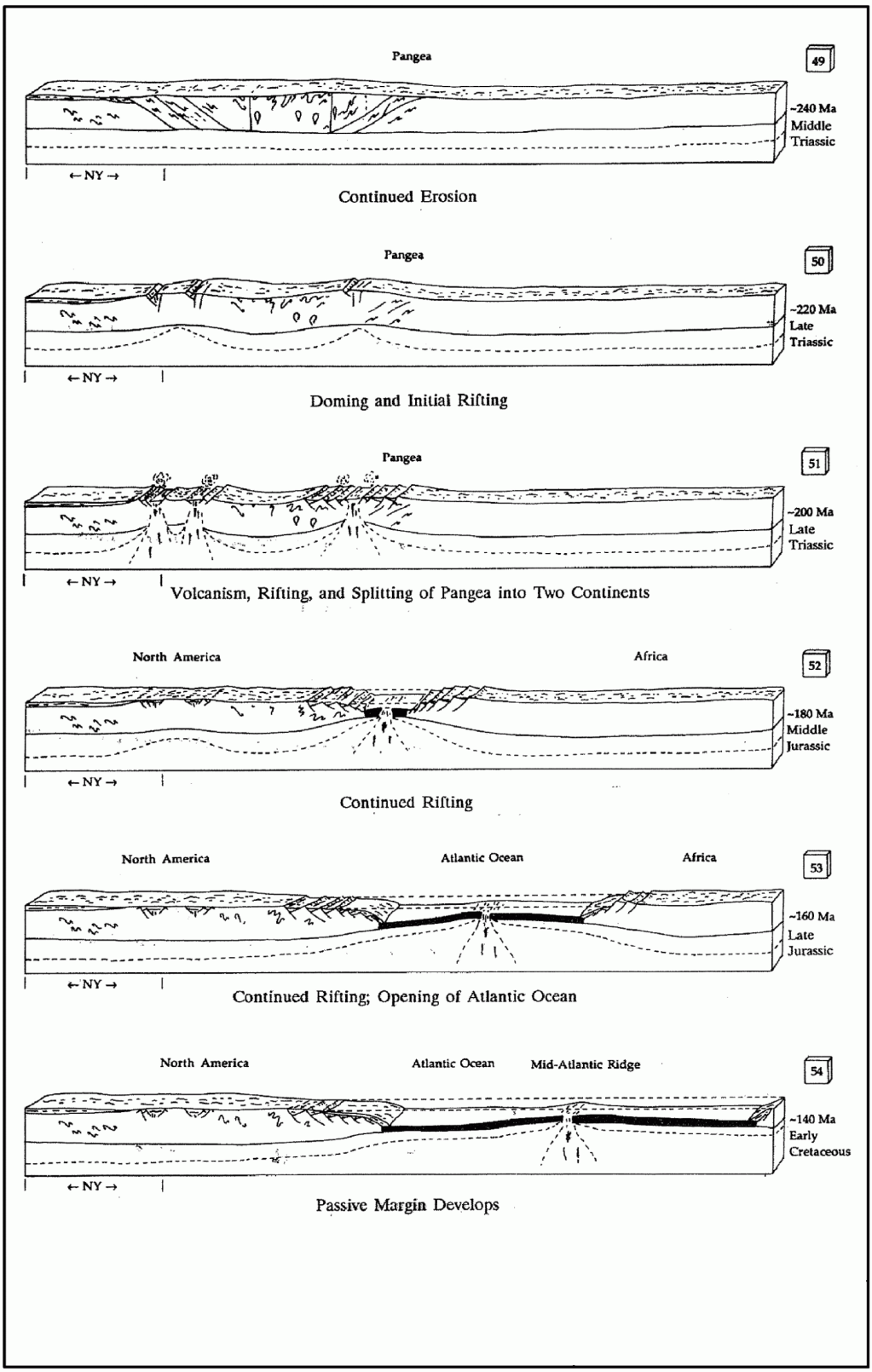
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-13—{Evolution of New York and Eastern America H}



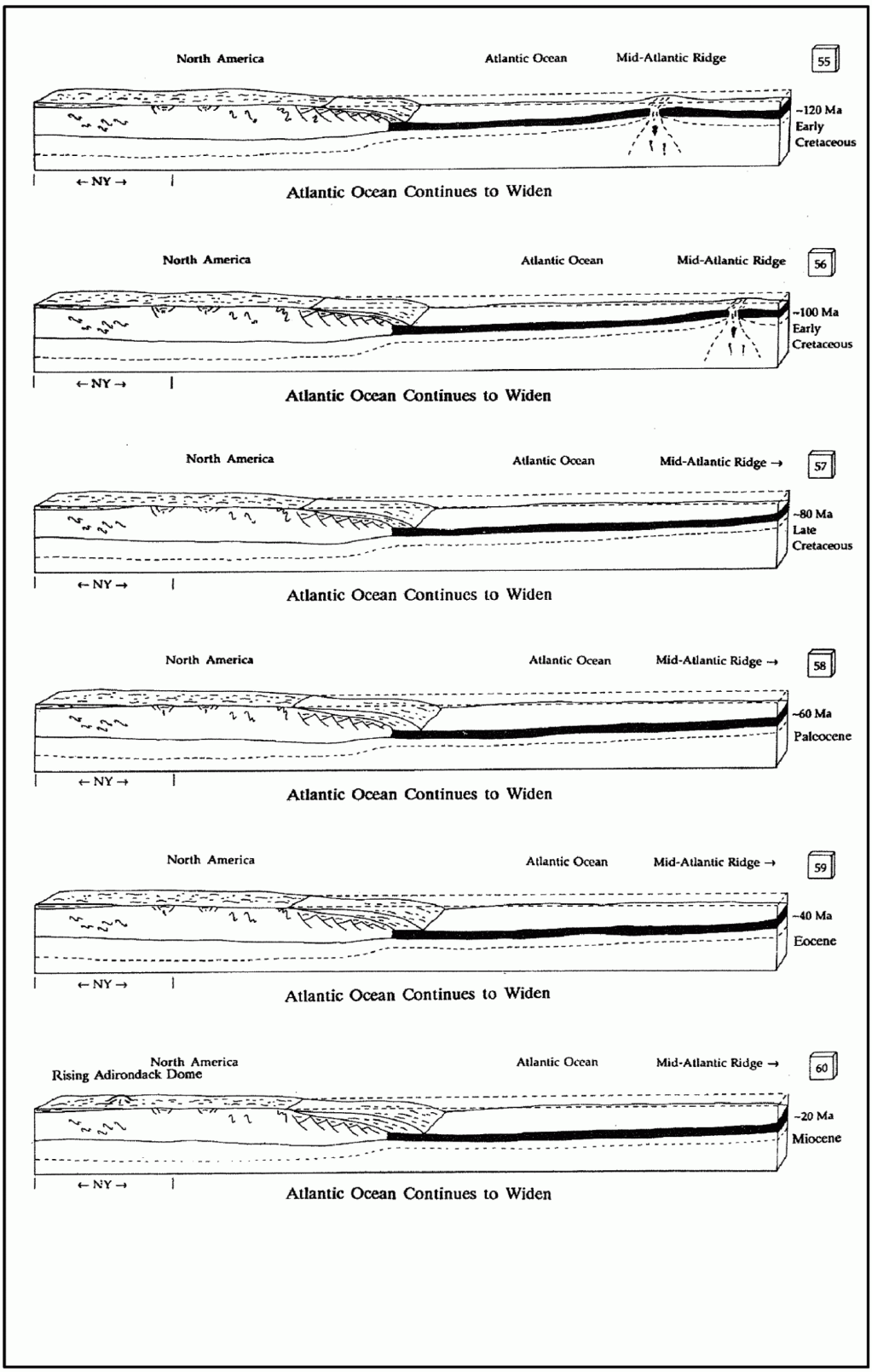
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-14—{Evolution of New York and Eastern America I }



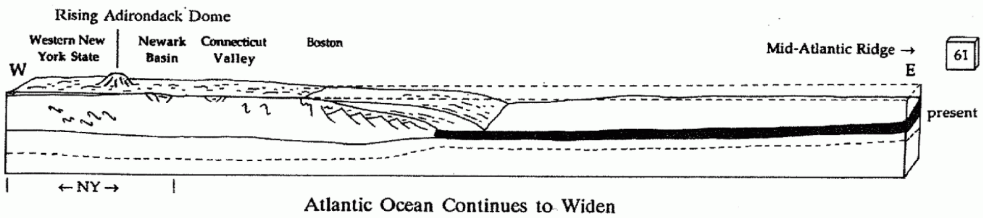
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-15—{Evolution of New York and Eastern America J}



© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-16—{Evolution of New York and Eastern America K}



These 61 three-dimensional diagrams, drawn by Professor Barbara Tewksbury, illustrate, in a very general way, the plate tectonic history of eastern North America. The time covered is from 1.2 billion years ago to the present. See Chapter 3 for more information.

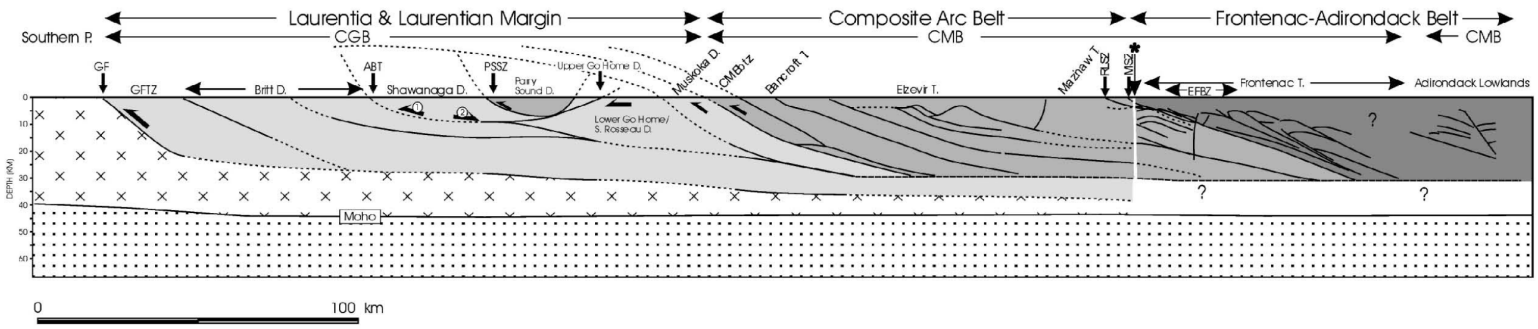
In each drawing, the uppermost dashed line shows sea level. The lower dashed line is within the mantle and marks the base of the lithosphere. Beneath it is the asthenosphere, on which the plates of the lithosphere glide. Black represents oceanic crust. Within the continental crust, curved lines represent folds and straight lines represent faults. Arrows show relative movement along some faults. The "tear drop" shapes that appear in many of the diagrams represent intruding magma.

Notice that the New York State area of each diagram is indicated by *NY* beneath it. The abbreviation *Ma* stands for "million years ago." For example, the notation *~1100 Ma* is translated as "approximately 1100 million years ago" or "approximately 1.1 billion years ago."

© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-17—{Crustal-Scale Cross Section of Grenville Orogen in Southern Ontario and Western Quebec}

Fig. 3. Interpretational cross-section from Fig. 2. Abbreviations are the same as in Fig. 1.

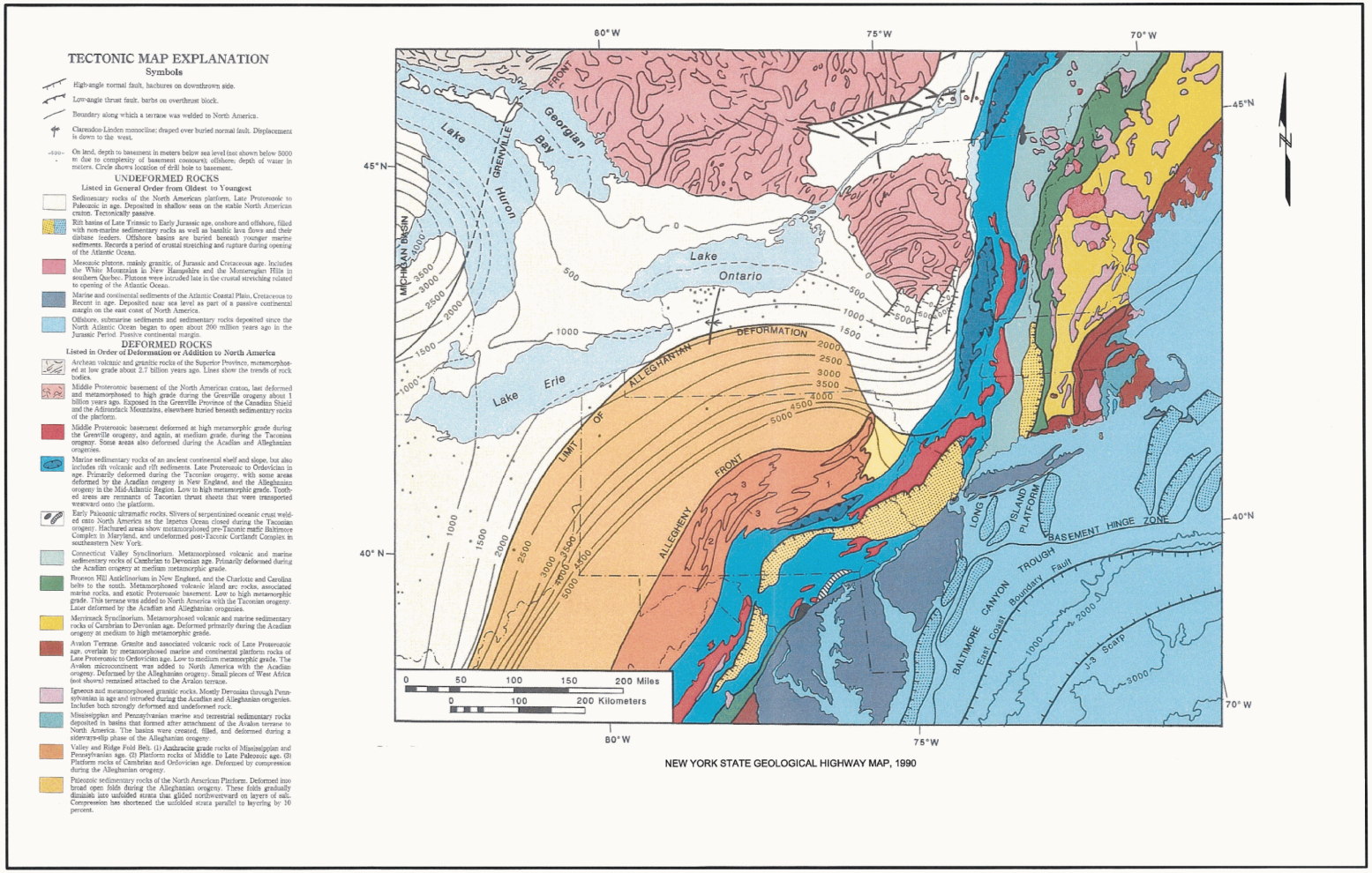


ABT, Allochthon Boundary Thrust; AH, Adirondack Highlands; AL, Adirondack Lowlands; Al, Algonquin domain; Ba, Bancroft terrane; Br, Britt domain; CGB, Central Gneiss Belt; CMB, Central Metasedimentary Belt; CMBbtz, Central Metasedimentary Belt boundary thrust zone; EFBZ, Elzevir–Frontenac boundary zone; El, Elzevir terrane; Fr, Frontenac terrane; GH, Go Home domain; GF, Grenville Front; GFTZ, Grenville Front Tectonic Zone; Ma, Mazinaw terrane; MSZ, Maberly shear zone; Mu, Muskoka domain; PS, Parry Sound domain; PSSZ, Parry Sound shear zone; RLSZ, Robertson Lake shear zone; Ro, Rousseau domain; Sh, Shawanaga domain; SL, Sharbot Lake domain; SSZ, Shawanaga shear zone.

SOURCE:
"A SEISMIC-BASED CROSS-SECTION OF THE GRENVILLE OROGEN IN SOUTHERN ONTARIO AND WESTERN QUEBEC" BY D.J. WHITE, D.A. FORSYTH, I. ASUDEH, S.D. CARR, H. WU, R.M. EASTON, AND R.F. MEREU, 2000.

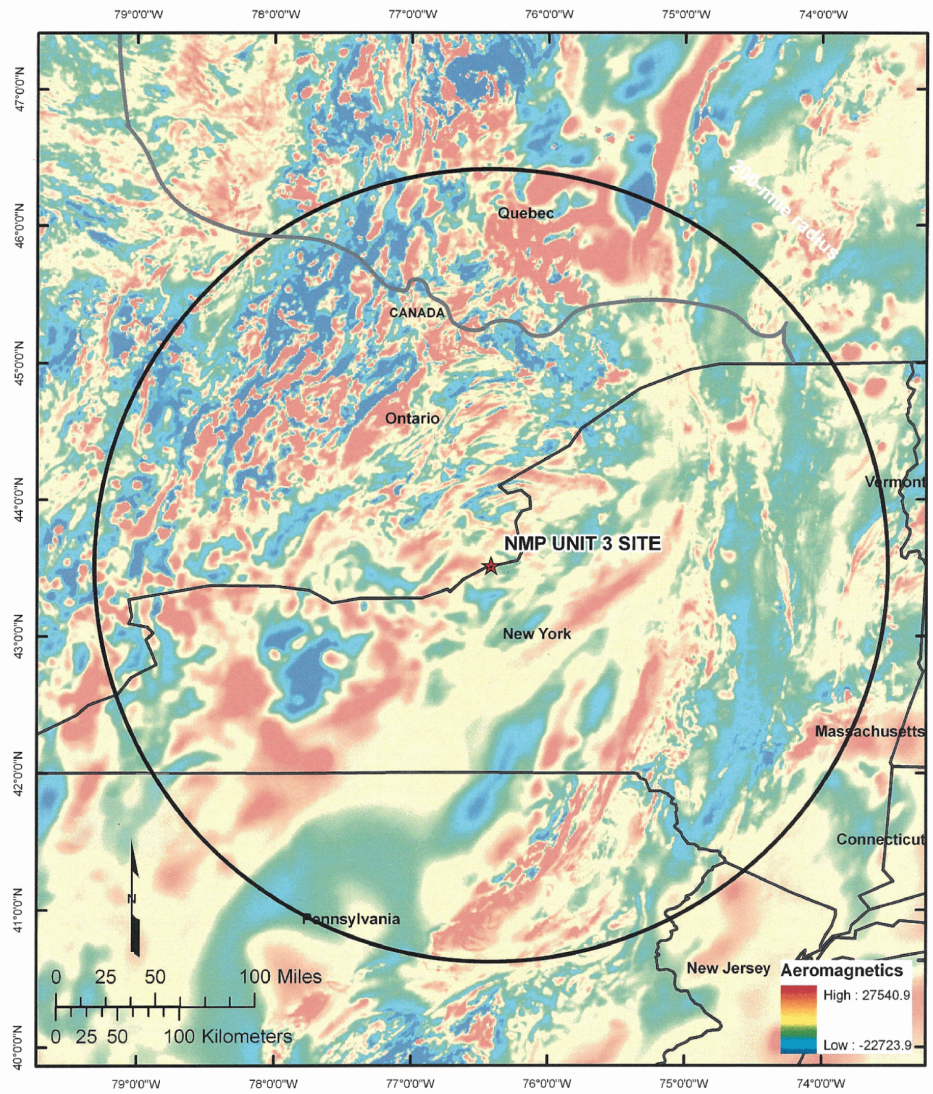
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-18—{Tectonic Map of New York and Surrounding Areas}



© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

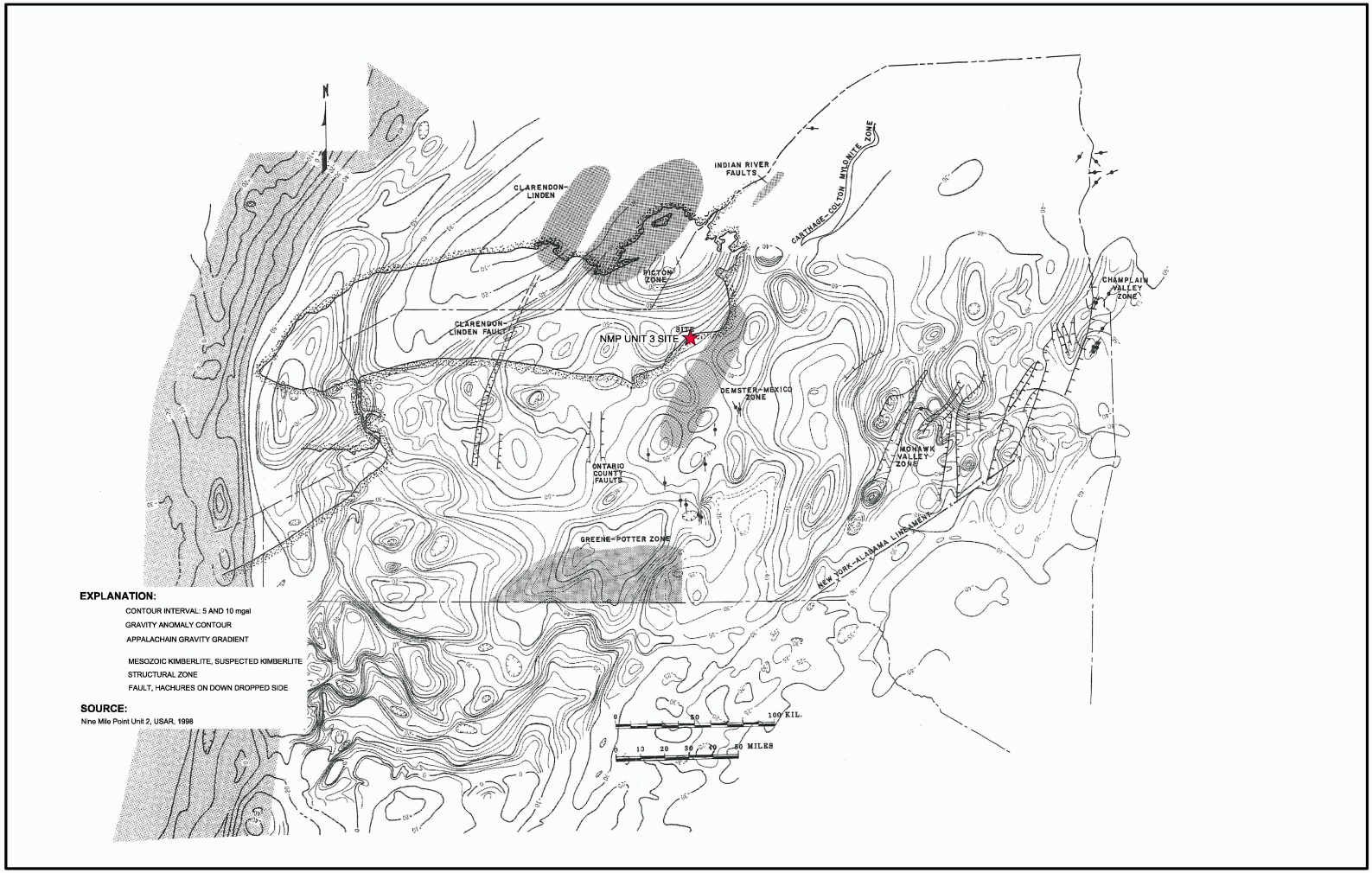
Figure 2.5-19—{Regional Magnetic Anomaly Map}



U.S. Geological Survey - Aeromagnetic data from Bankey et. al. (2002)

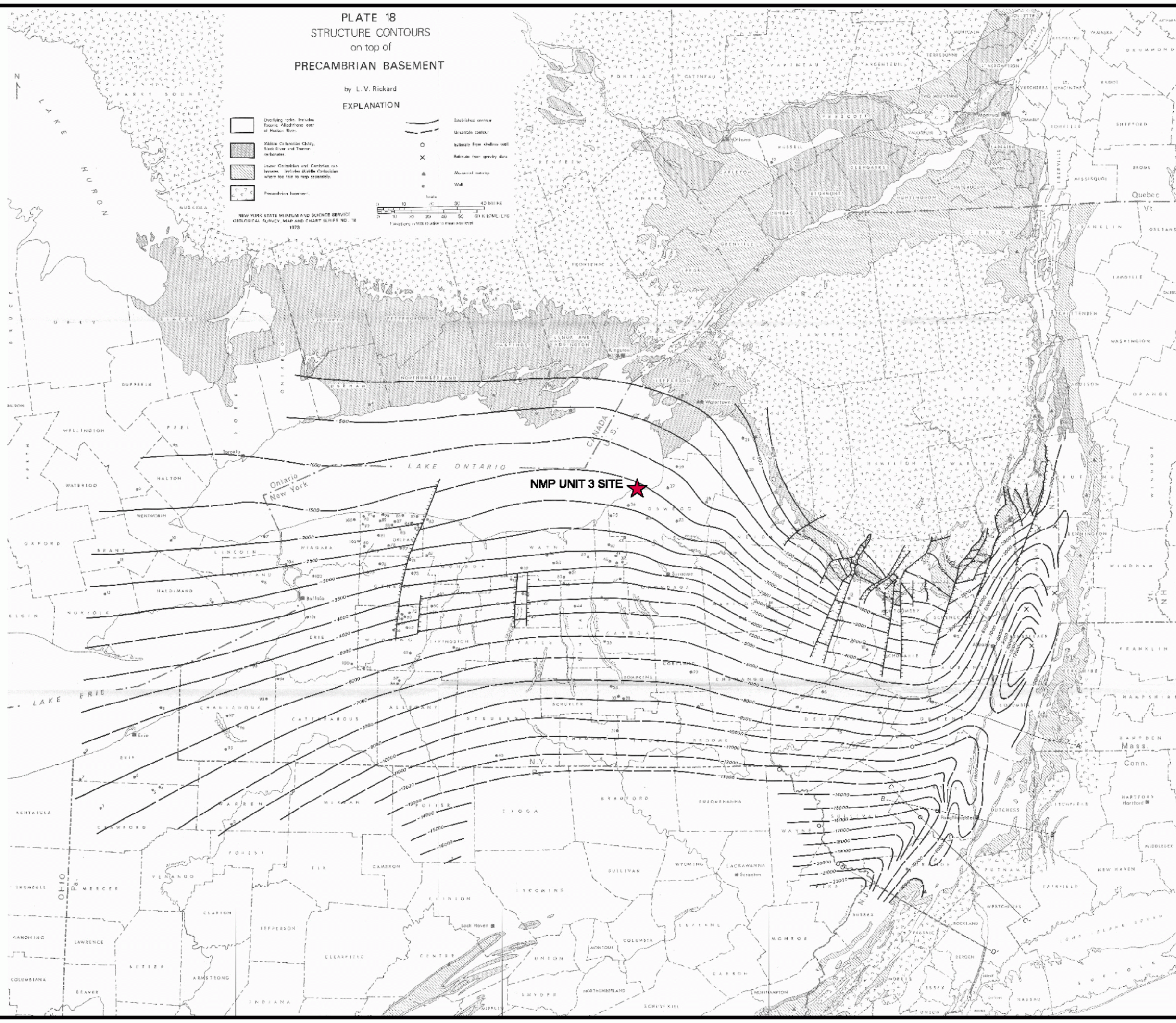
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-20—{Simple Bouguer Gravity Map of New York}



© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-21—{Structure Contours on Top of Precambrian Basement}

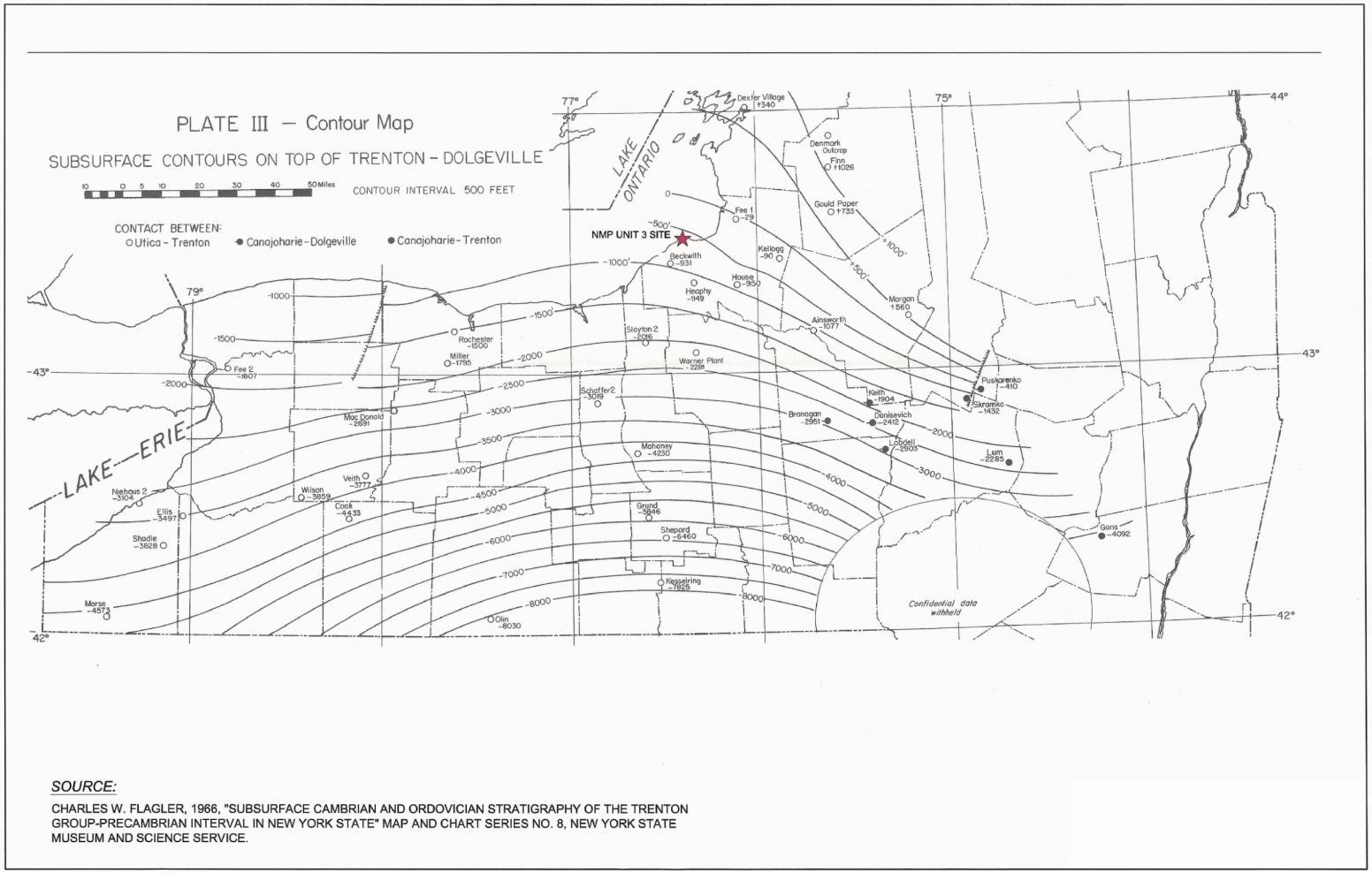


SOURCE:

LAWRENCE V. RICKARD, 1973, "STRATIGRAPHY AND STRUCTURE OF THE SUBSURFACE CAMBRIAN AND ORDOVICIAN CARBONATES OF NEW YORK" NEW YORK STATE MUSEUM AND SCIENCE SERVICE, MAP AND CHART SERIES NUMBER 18.

© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-22—{Contour Map Subsurface Contours on Top of Trenton-Dolgeville}

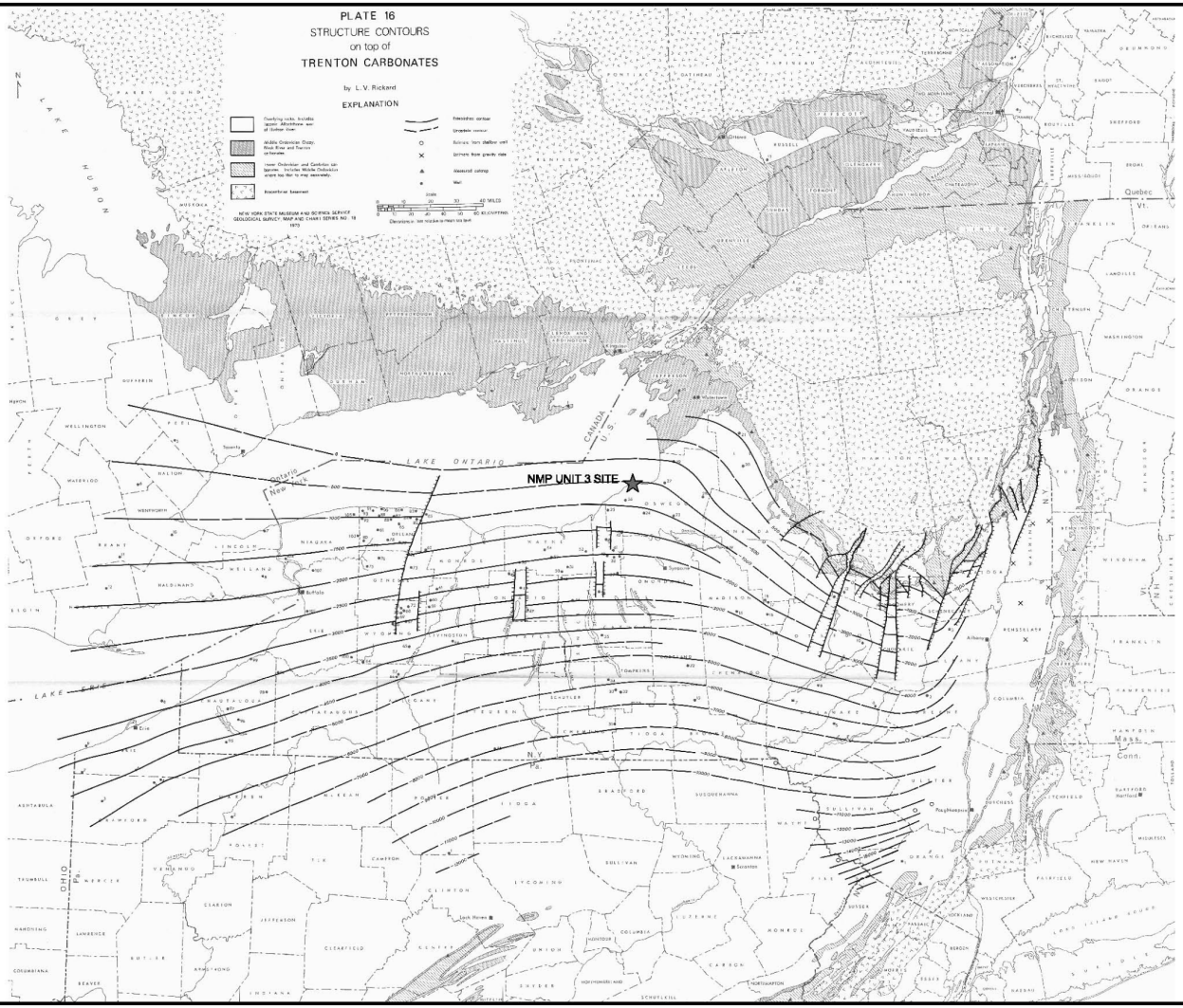


SOURCE:

CHARLES W. FLAGLER, 1966, "SUBSURFACE CAMBRIAN AND ORDOVICIAN STRATIGRAPHY OF THE TRENTON GROUP-PRECAMBRIAN INTERVAL IN NEW YORK STATE" MAP AND CHART SERIES NO. 8, NEW YORK STATE MUSEUM AND SCIENCE SERVICE.

© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-23—{Structure Contours on Top of Trenton Carbonates}

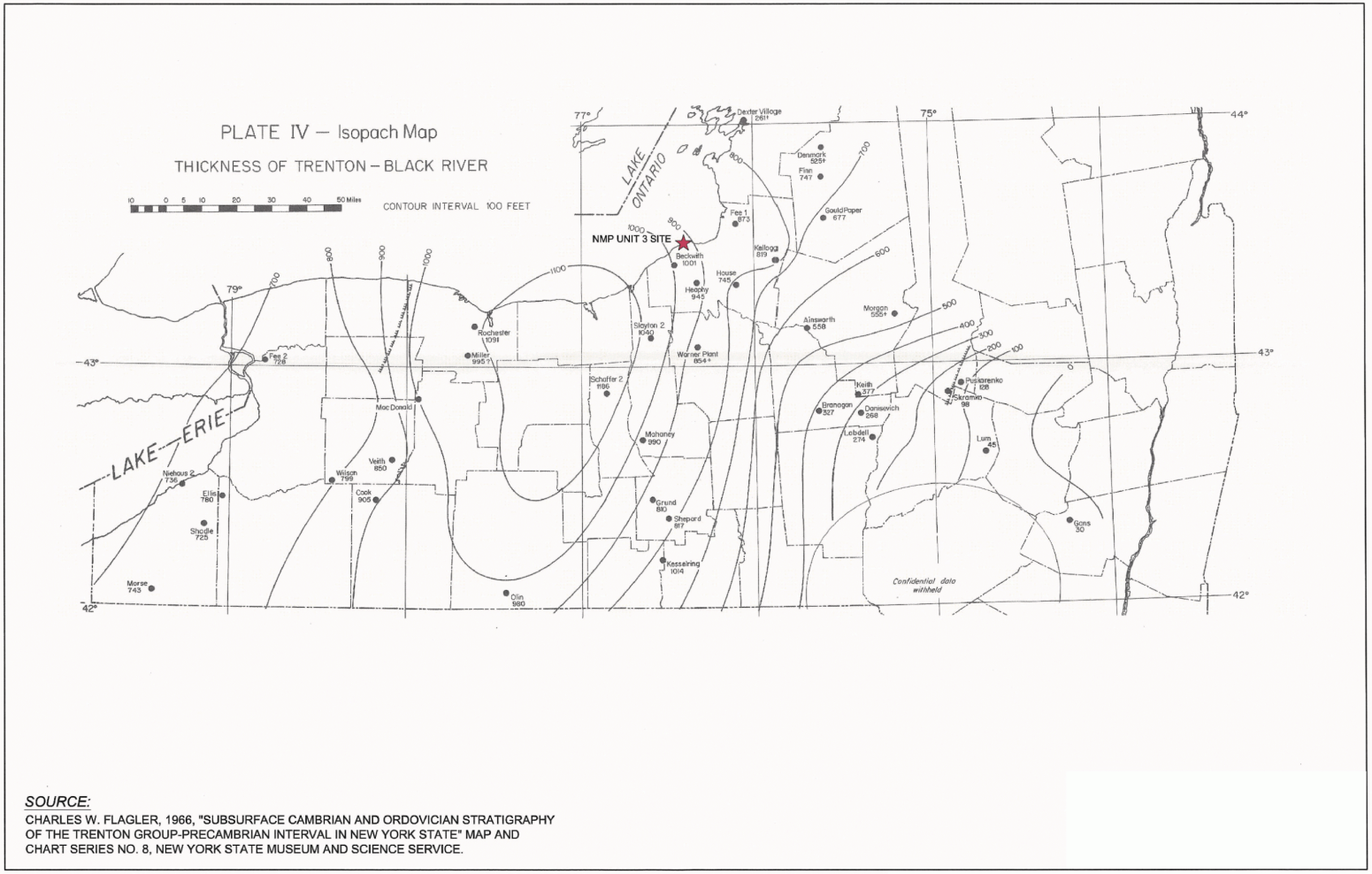


SOURCE:

LAWRENCE V. RICKARD, 1973, "STRATIGRAPHY AND STRUCTURE OF THE SUBSURFACE CAMBRIAN AND ORDOVICIAN CARBONATES OF NEW YORK" NEW YORK STATE MUSEUM AND SCIENCE SERVICE, MAP AND CHART SERIES NUMBER 18.

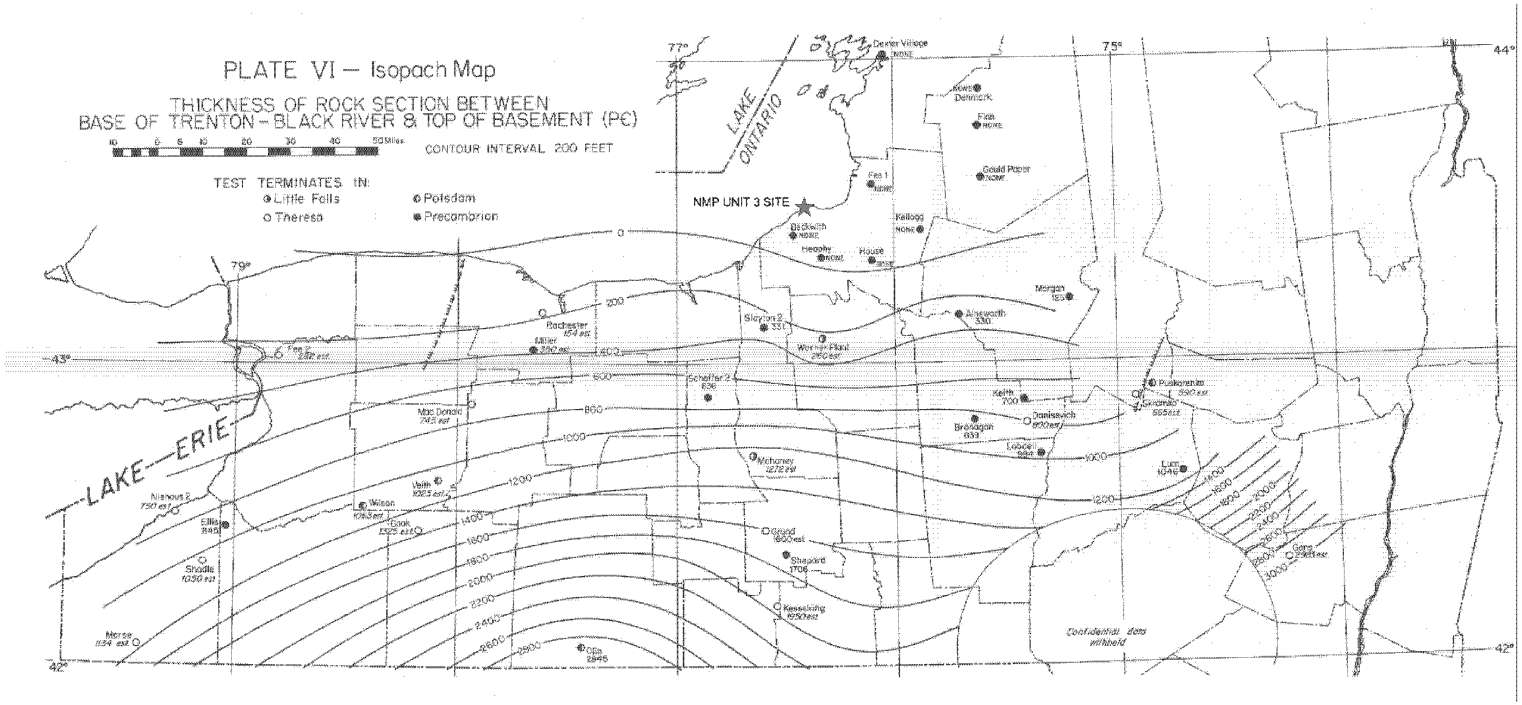
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-24—{Isopach Map Thickness of Trenton - Black River}



© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-25—{Isopach Map Thickness of Rock Section Between Trenton-Black River & Top of Basement}

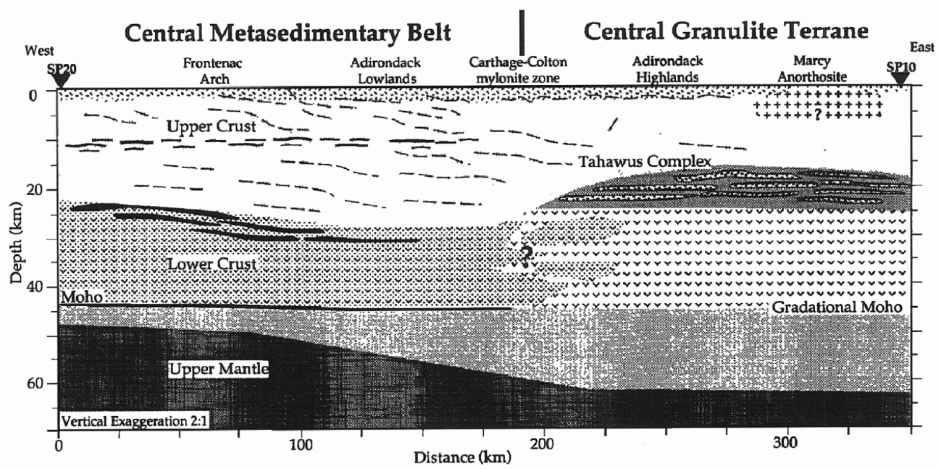


SOURCE:

CHARLES W. FLAGLER, 1966, "SUBSURFACE CAMBRIAN AND ORDOVICIAN STRATIGRAPHY OF THE TRENTON GROUP-PRECAMBRIAN INTERVAL IN NEW YORK STATE" MAP AND CHART SERIES NO. 8, NEW YORK STATE MUSEUM AND SCIENCE SERVICE.

© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-26—{Crustal-Scale Cross Section of Northern New York State and Eastern Ontario}



Lithologies

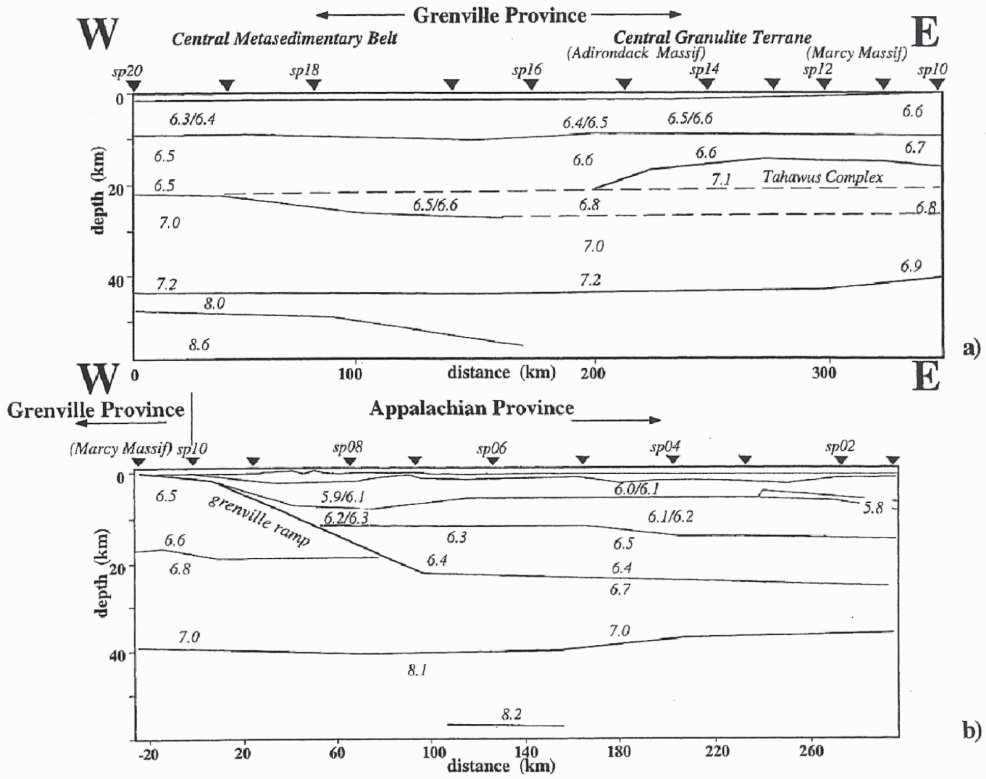
	V_p	V_s	σ
Marbles/Quartzites, Granitic Gneisses	6.1	—	—
Marcy Anorthosite	6.6	3.2[1]	0.28[1]
Quartzofeldspathic Gneissic Basement	6.5	—	0.26
Mafic Cumulates	7.1	4.0[2]	0.27
Pyroxene-Garnet Granulites	7.0	3.7[2]	0.30
Peridotite	8.0	—	—
Eclogite	8.6	—	—

Interpretive deep crustal section for the southeastern Grenville province obtained from the western portion of the Ontario–New York–New England seismic refraction/wide-angle reflection profile . The homogeneous velocity structure of the upper crust in the vicinity of the Carthage-Colton mylonite zone suggests that this boundary is a shallow feature. The Tahawus complex, a laminated domelike body in the midcrust, is interpreted as a zone of mafic cumulate sills on the basis of its high velocity (7.1 km/s) and Poisson's ratio (0.27 ± 0.02). The lower crust is characterized by a velocity of 7.0 km/s and a Poisson's ratio of 0.30 ± 0.02, indicating mafic granulites, possibly grading into eclogites in the lower portions of the crust and upper mantle. Velocity variations in the lower crust appear to signify a lateral change in composition, possible reflecting a decrease in the mafic content of the lower crust beneath the Central Granulite Terrane. The Moho is a transitional zone of interlayered mafic granulites, eclogites, and peridotites. The anomalous upper mantle layer with a velocity of 8.6 km/s is interpreted as a lens of eclogite associated with extensive underplating and fractionation of mantle-derived melts during the Grenvillian orogeny. Inferred layer compositions are illustrated with their associated compressional and shear wave velocities (V_p and V_s) and Poisson's ratio (σ), in each case the average layer velocity is allotted. The velocity suffixes refer to (1) *Hughes and Luetgert* [1991] and(2) *Owens* [1987].

SOURCE:
"CRUSTAL STRUCTURE OF THE SOUTHEASTERN GRENVILLE PROVINCE, NORTHERN NEW YORK STATE AND EASTERN ONTARIO" BY STEPHEN HUGHES AND JAMES H. LUETGERT, PUBLISHED IN THE JOURNAL OF GEOPHYSICAL RESEARCH, 1992.

© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-27—{Crustal Scale Cross Section of the Grenville and Appalachian Provinces}

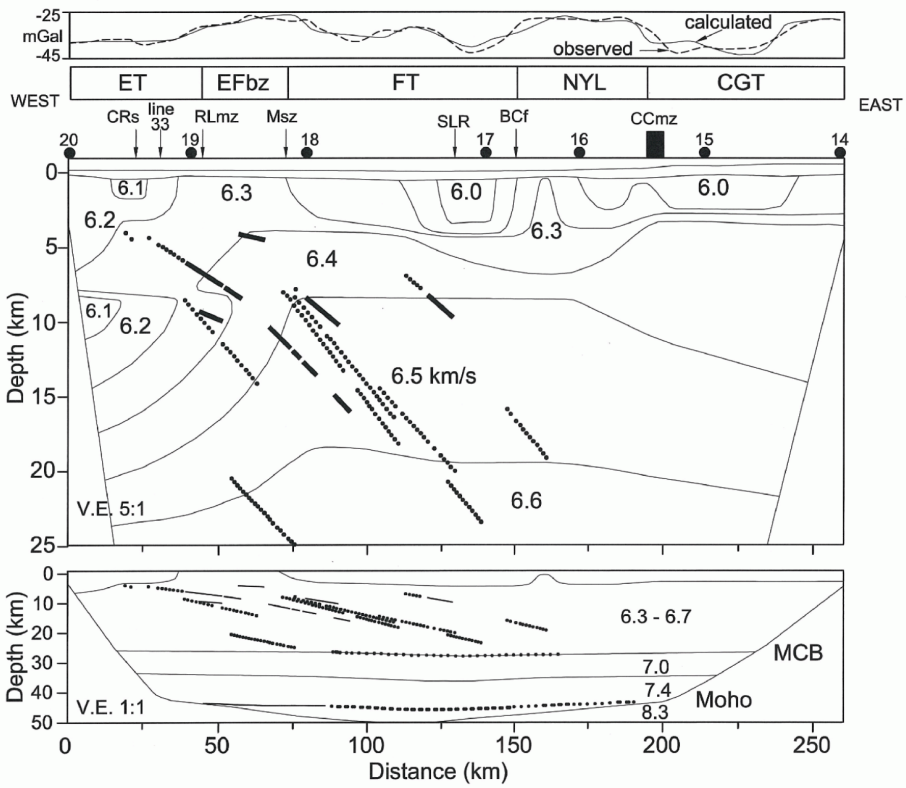


P wave velocity models as published by *Hughes and Luetgert* [1991, 1992] along the O-NYNEX profile. Two separate models have been published: (a) the first is in the Grenville Province, includes shot points 20-10 and was obtained by inversion technique; (b) the second includes shot points 11-1 in the Appalachian Province and was obtained by forward modeling.

SOURCE:
JOURNAL OF GEOPHYSICAL RESEARCH, TITLED "COMPOSITION OF THE CRUST IN THE GRENVILLE AND APPALACHAIN PROVINCES OF NORTH AMERICA INFERRED FROM Vp/Vs RATIOS" BY GEMMA MUSACCHIO, WALTER D. MOONEY, JAMED H. LUETGERT, AND NICKOLAS I. CHRISTENSEN, 1997.

© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-28—{Crustal Scale Cross Section of the Southeastern Grenville Province}

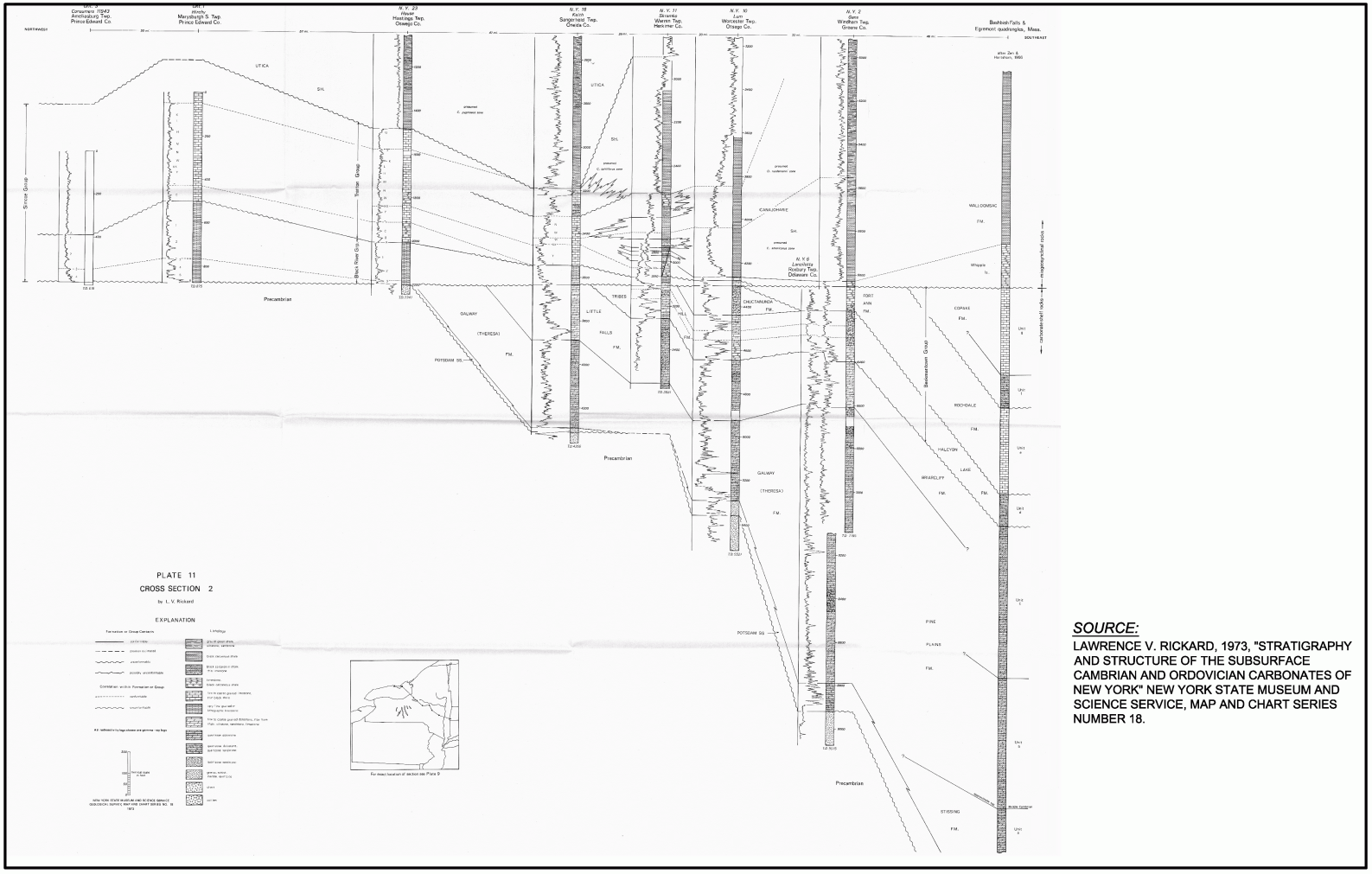


Final velocity model. Vertical exaggeration is 5:1 for upper- and mid-crustal model above and 1:1 for complete model below. Contoured velocity field is presented, omitting the perimeter not constrained by the wide-angle data. Numbers inside models indicate P-wave velocity in kilometres per second. Upper-crustal boundary at the base of the surface layer is shown in the upper model, and the mid-crustal boundary (MCB) and Moho are indicated only where imaged by PcP and PmP ray paths, respectively, in the lower model. Line style of the MCB and Moho indicates the wide-angle reflectivity factor (WARF): solid line, WARF > 1; broken line, 0.5 < WARF < 1; dotted line, WARF < 0.5. The east-dipping reflectors are indicated by the reflection points corresponding to each Pr arrival. Smoothing has been applied to the velocity field and layer boundaries to represent the lateral resolution of the wide-angle data. Shotpoint locations (●), intersection with Lithoprobe line 33, tectonic features, and comparison of observed and calculated gravity anomalies indicated above the upper model (see text for details). CGT, Central Granulite Terrane; CCmz, Carthage – Colton mylonite zone; ET, Elzevir terrane; FT, Frontenac terrane; NYL, New York Lowlands; EFbz, Elzevir – Frontenac boundary zone; CRs, Clare River structure; RLmz, Robertson Lake mylonite zone; Msz, Maberly shear zone; BCf, Black Creek fault; SLR, St. Lawrence River. (1 Gal = 1 cm/s^2)

SOURCE:
MODIFIED FROM "SEISMIC STRUCTURE OF THE CENTRAL METASEDIMENTARY BELT, SOUTHERN GRENVILLE PROVINCE" BY C.A. ZELT, D.A. FORSYTH, B. MILKEREIT, D.J. WHITE, I. ASUDEH, AND R.M. EASTON, 1993.

© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-29—{Cross Section}

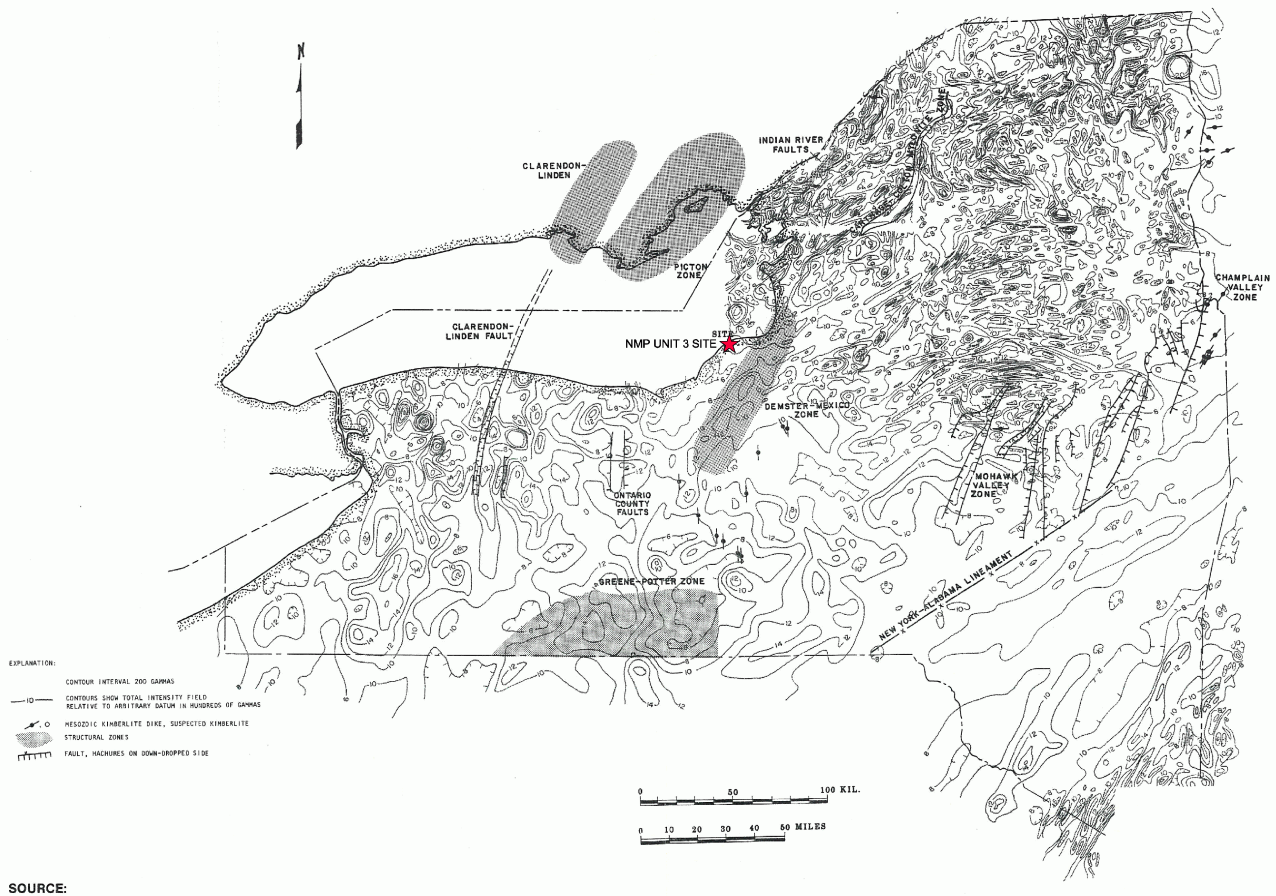


SOURCE:

LAWRENCE V. RICKARD, 1973, "STRATIGRAPHY AND STRUCTURE OF THE SUBSURFACE CAMBRIAN AND ORDOVICIAN CARBONATES OF NEW YORK" NEW YORK STATE MUSEUM AND SCIENCE SERVICE, MAP AND CHART SERIES NUMBER 18.

© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

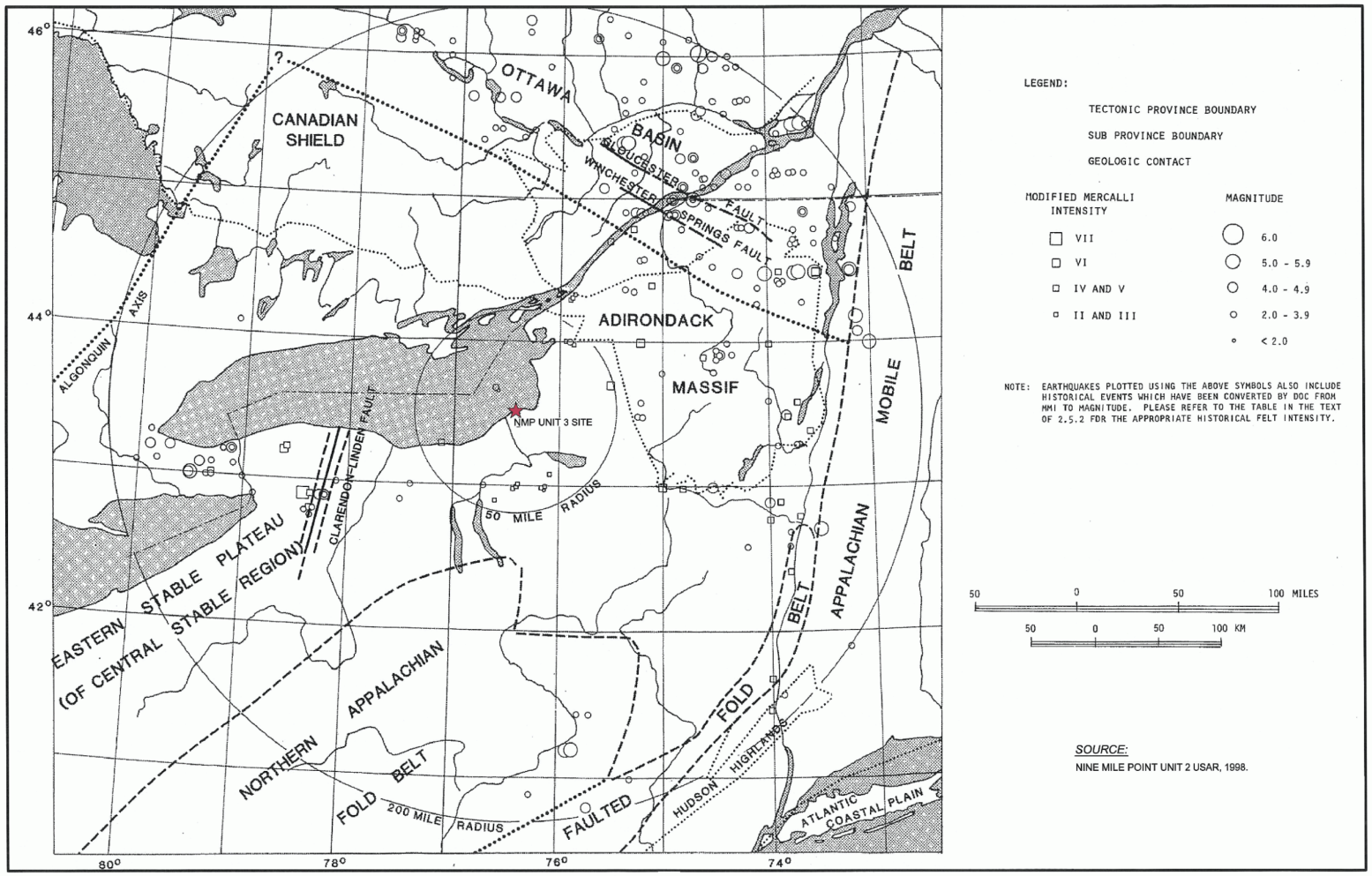
Figure 2.5-30—{Aeromagnetic Map of New York}



SOURCE:
Nine Mile Point Unit 2 USAR, 1998

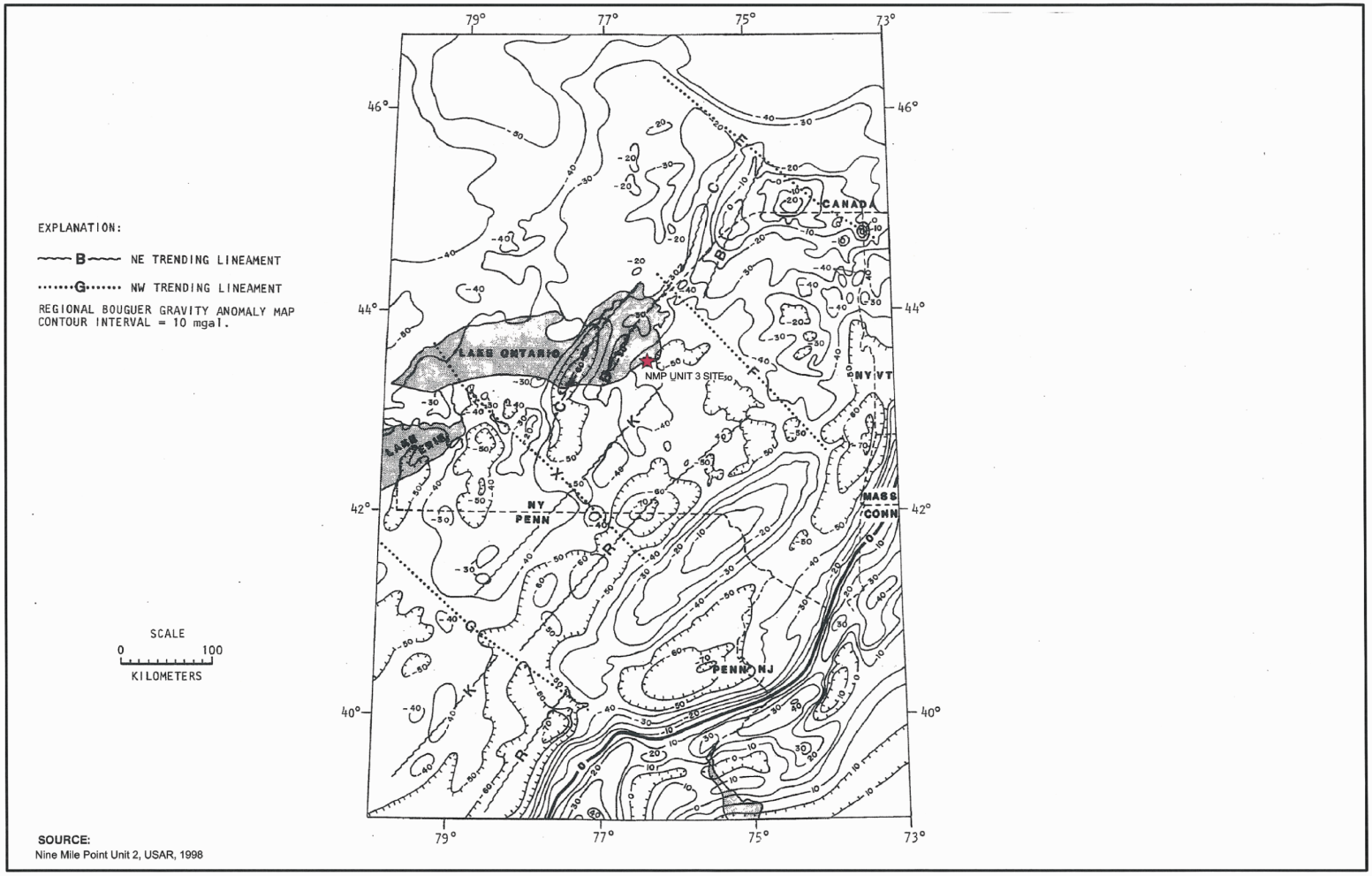
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-31—{Tectonic Provinces of Northeastern United States and Adjacent Canada Showing Historic Seismicity}



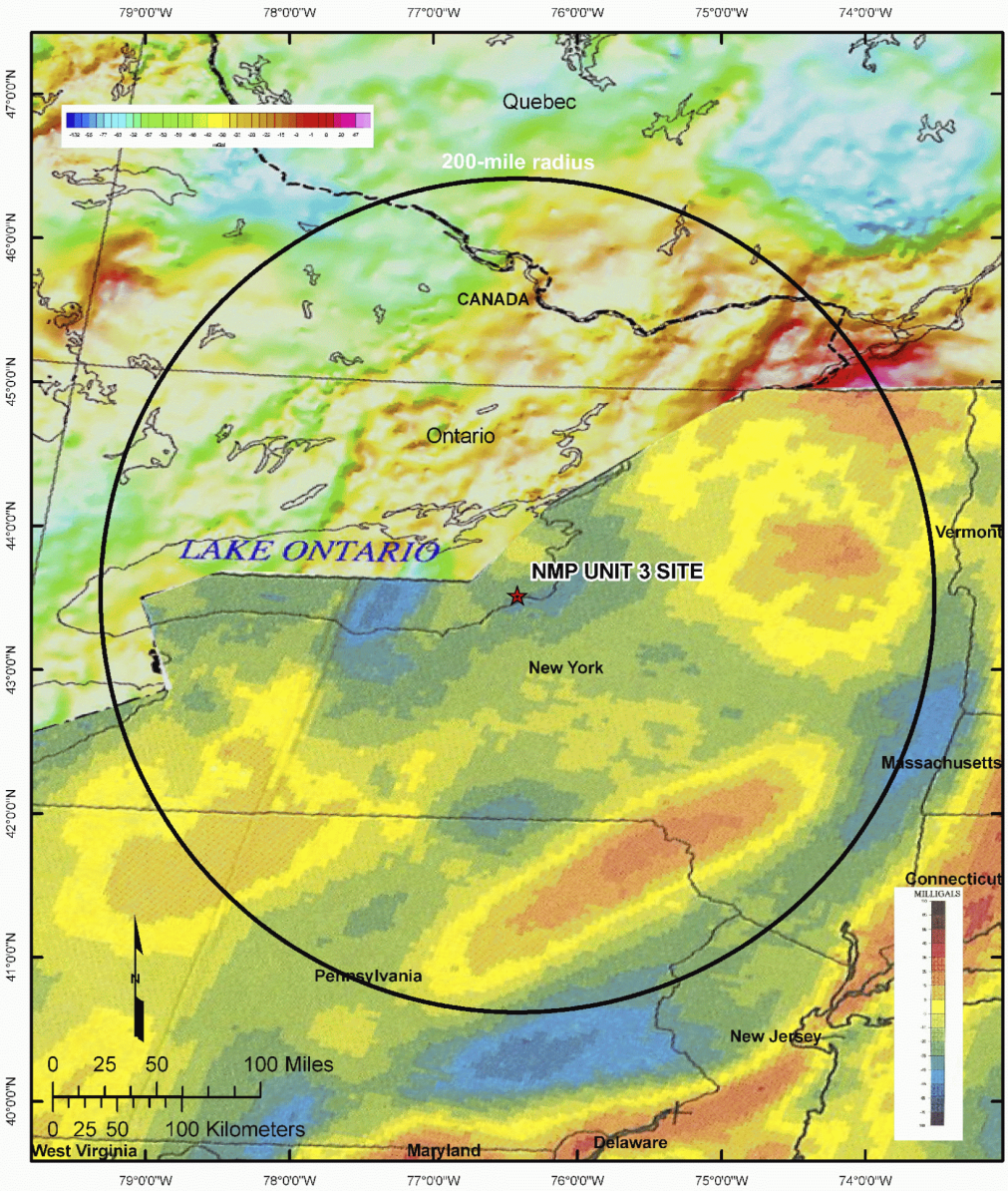
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-32—{Cross-Strike Lineaments of Pennsylvania and New York}



© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-33—{Map of Isostatic Residual Gravity}

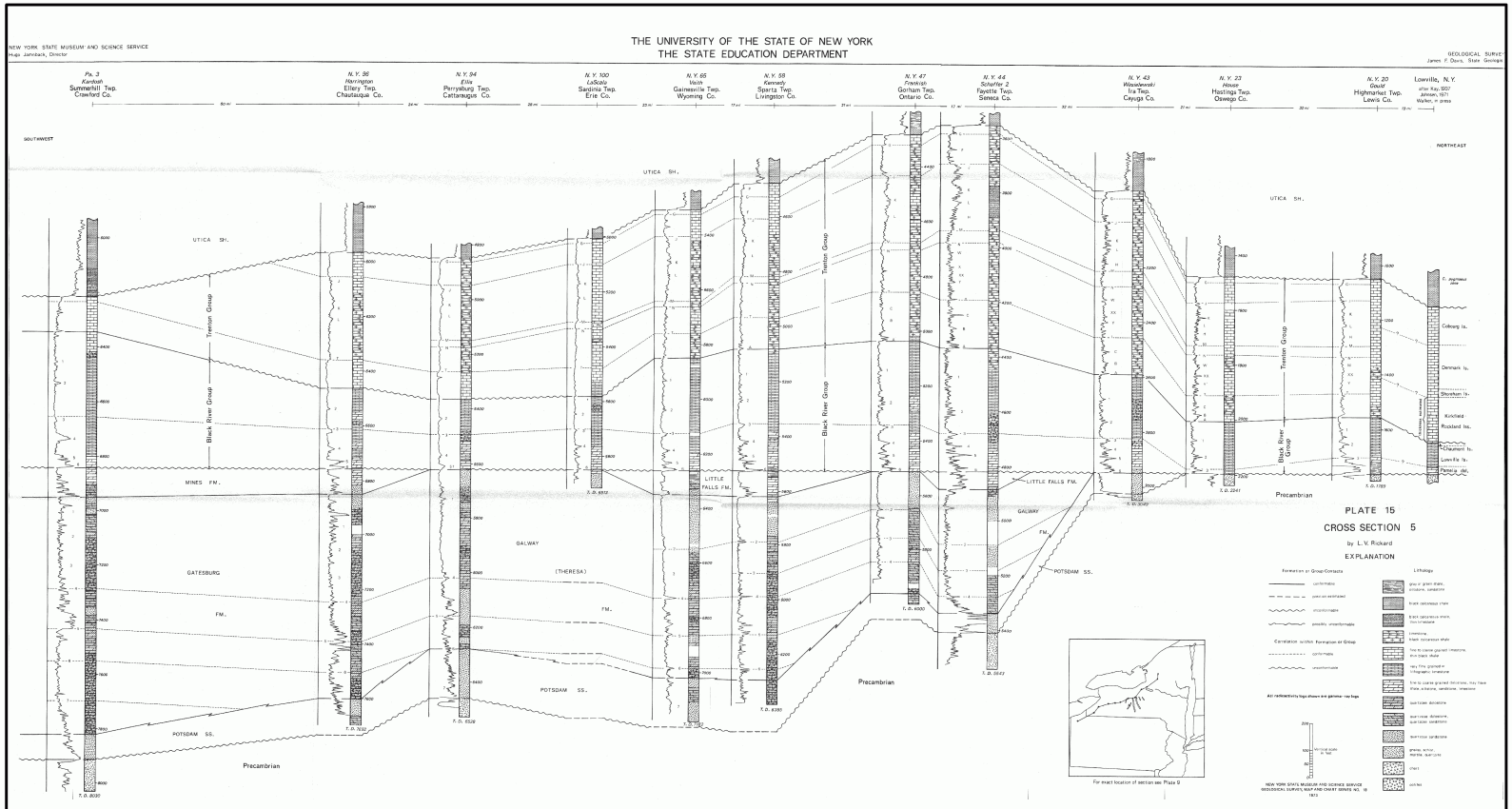


Isostatic Residual Gravity and Crustal Geology of the United States, R.C. Jachens et al. 1989.

GRAVITY ANOMALY MAP, CANADA
W.F. MILES, et al. 2000

© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

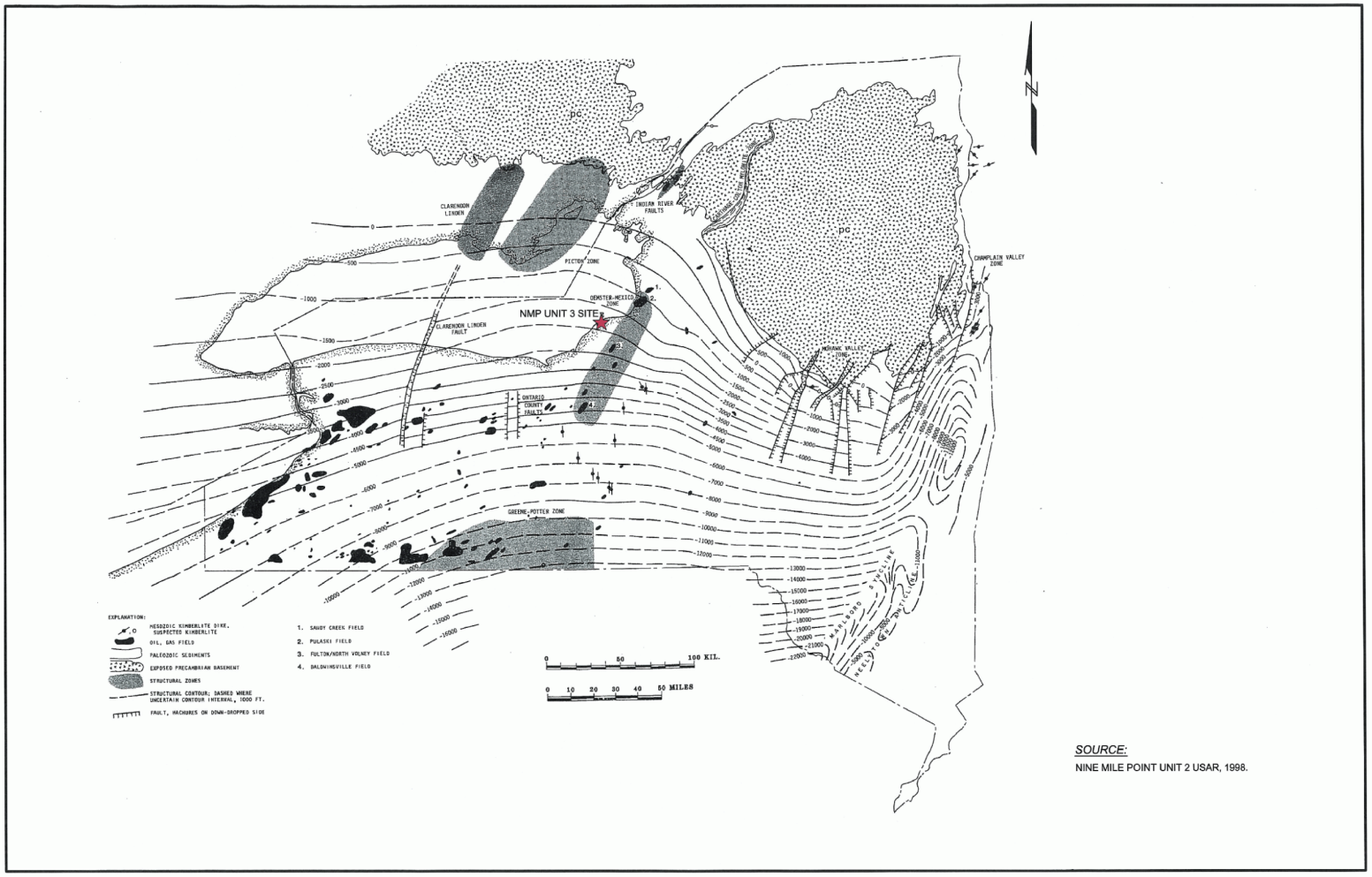
Figure 2.5-34—{Cross Section}



SOURCE:
LAWRENCE V. RICKARD, 1973, "STRATIGRAPHY AND STRUCTURE OF THE SUBSURFACE CAMBRIAN AND ORDOVICIAN CARBONATES OF NEW YORK" NEW YORK STATE MUSEUM AND SCIENCE SERVICE, MAP AND CHART SERIES NUMBER 18.

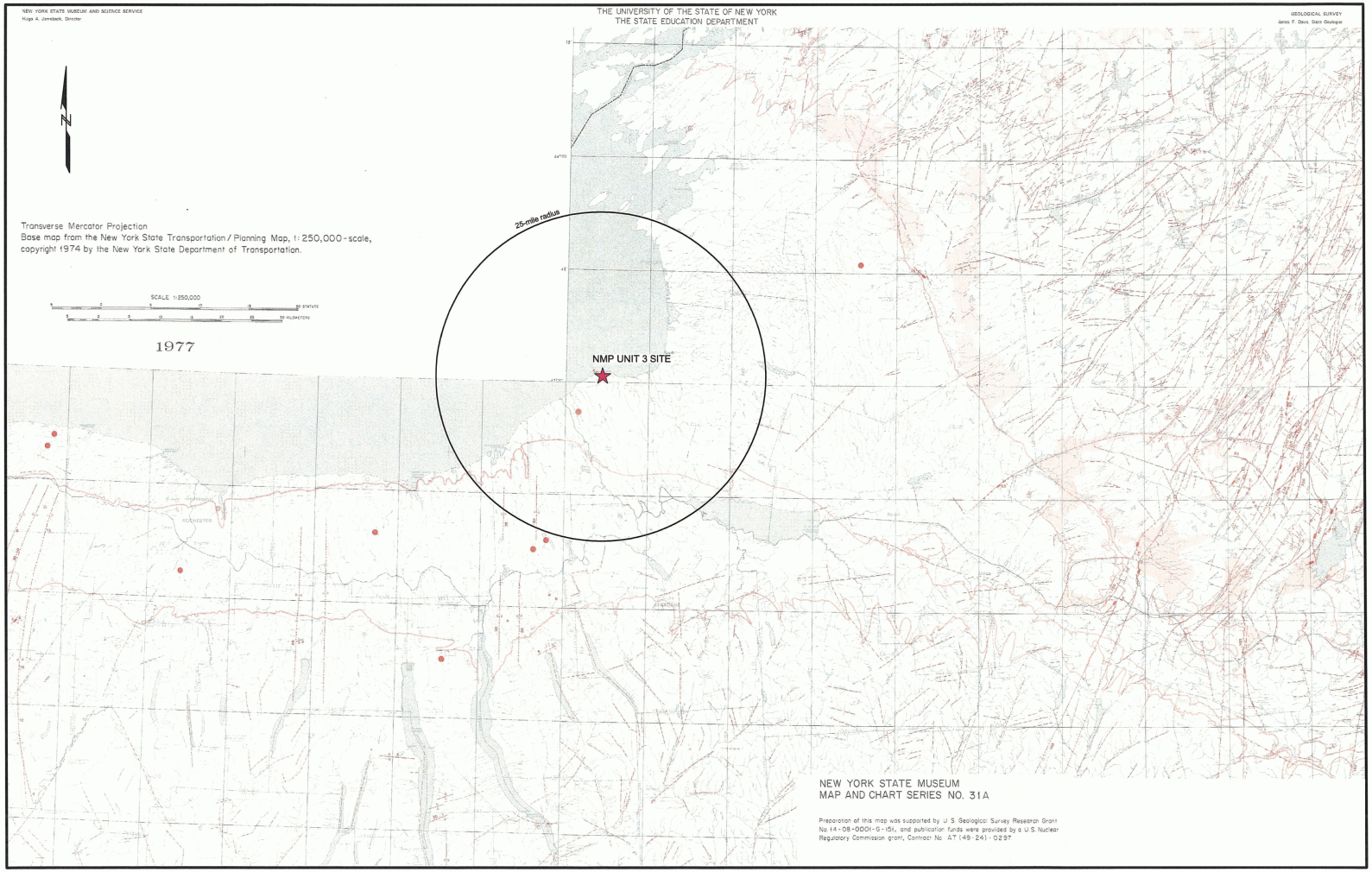
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-35—{Structure Contour Map of Precambrian Basement, N.Y.}



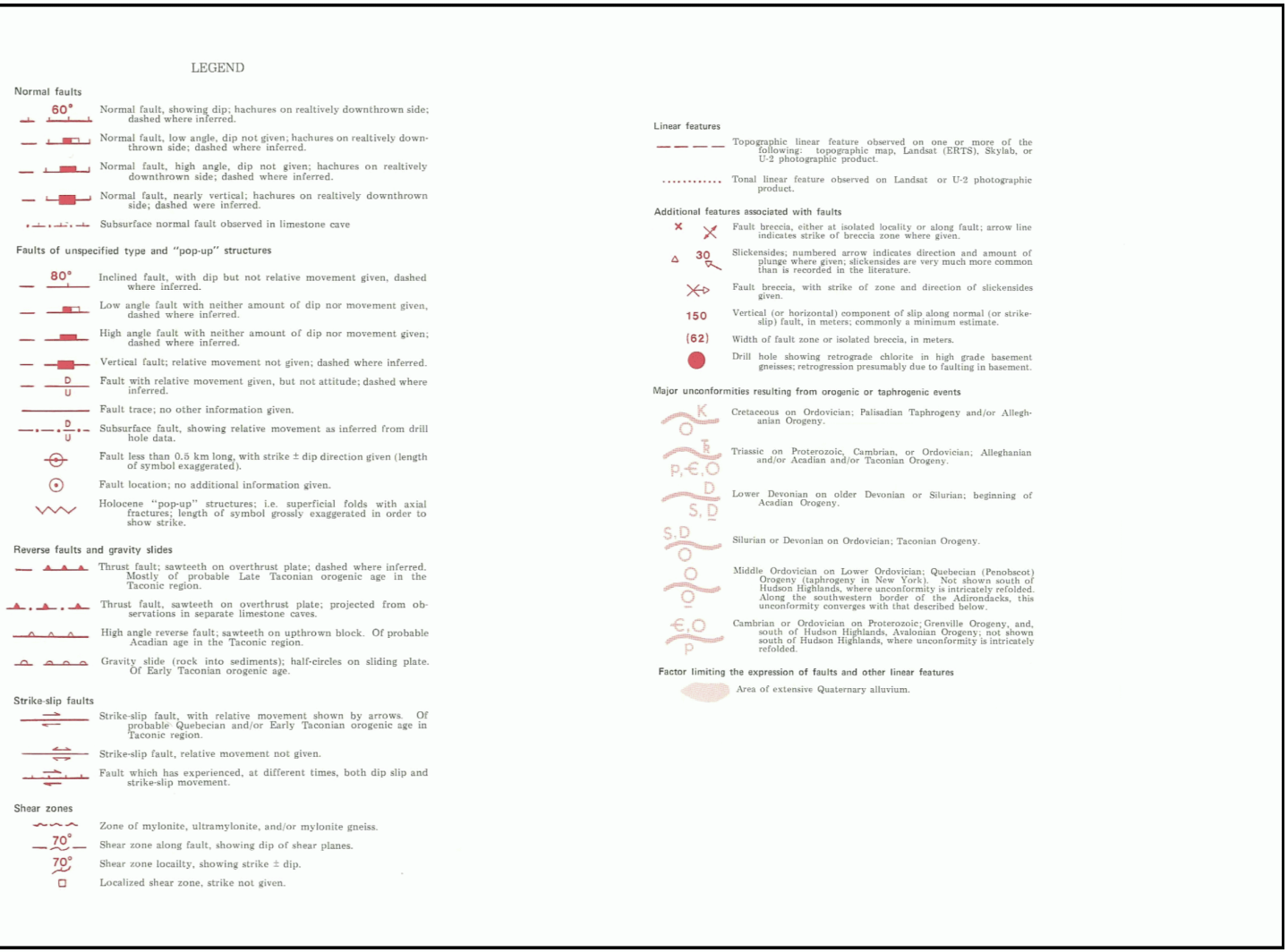
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-36—{Preliminary Brittle Structures Map of NY}



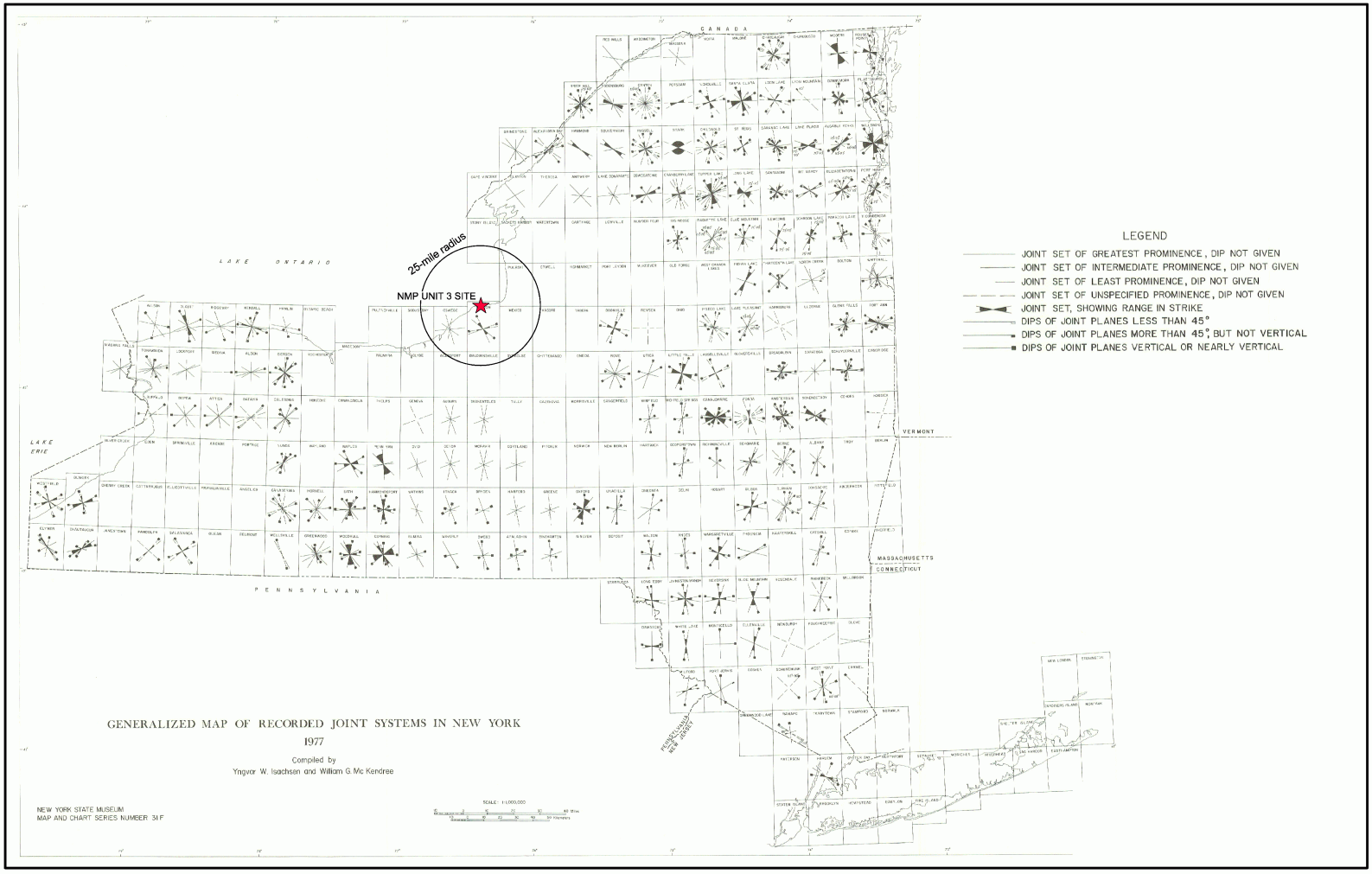
© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-37—{Preliminary Brittle Structures Map of NY - Legend}



© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED

Figure 2.5-38—{Generalized Map of Recorded Joint Systems in New York}



© 2008 UniStar Nuclear Services, LLC. All rights reserved.
COPYRIGHT PROTECTED