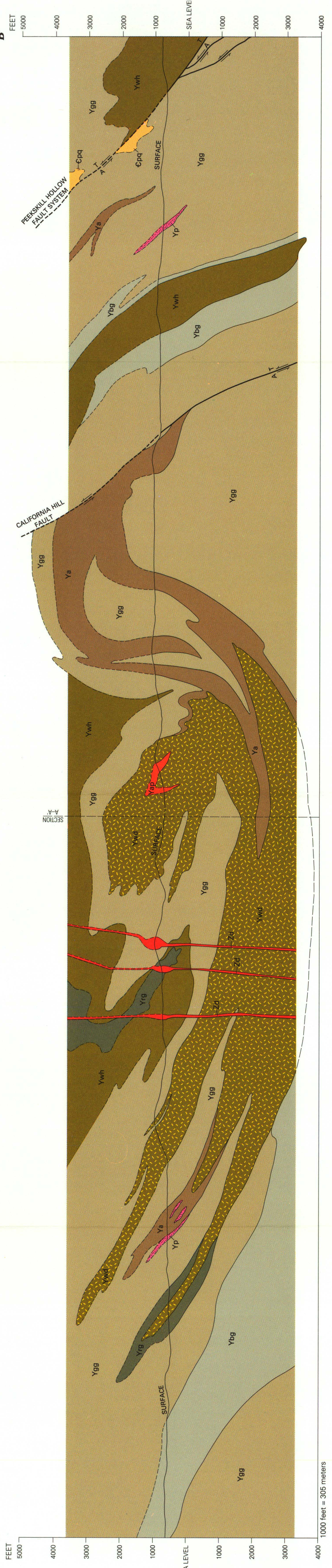
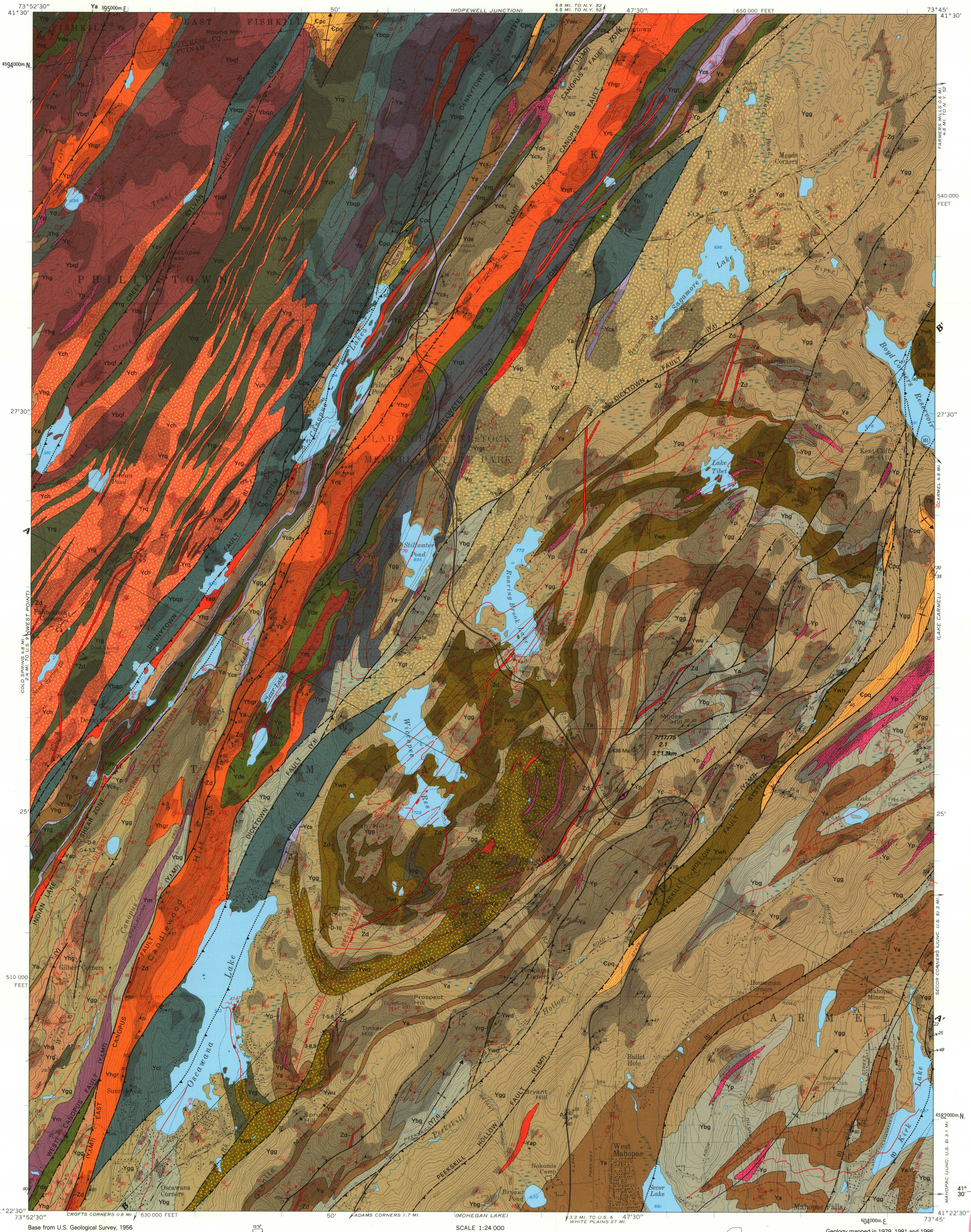




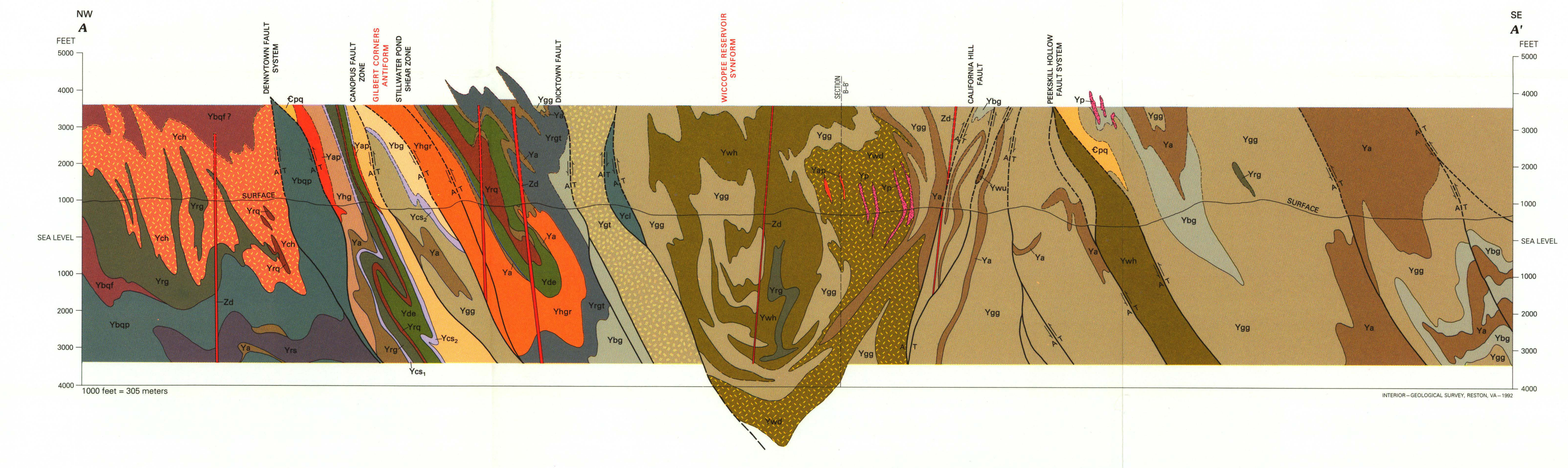
Base from U.S. Geological Survey, 1956
10,000-foot grid ticks based on New York coordinate system, east zone
1,000-meter Universal Transverse Mercator grid ticks, zone 18, shown in blue

APPROXIMATE MEAN DECLINATION, 1992 (TRUE NORTH, MAGNETIC NORTH, 13½°)

SCALE 1:24 000
1 ½ 0 1 MILE
1 .5 0 1 KILOMETER
CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

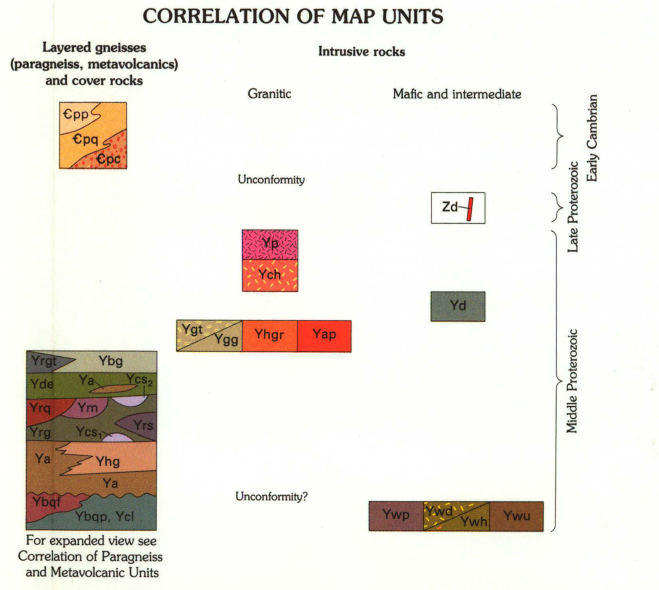
NEW YORK
QUADRANGLE LOCATION

Geology mapped in 1979, 1981 and 1986



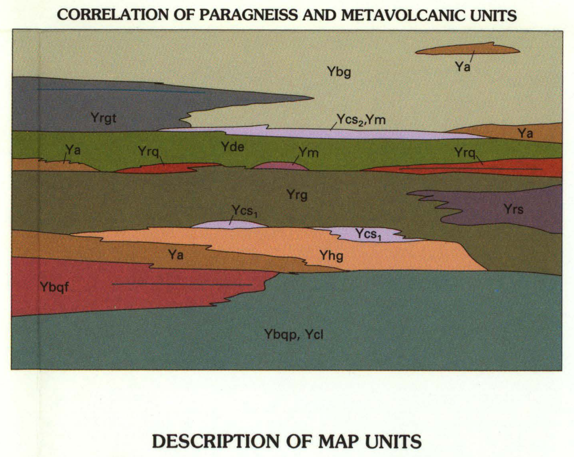
INTERIOR—GEOLOGICAL SURVEY, RESTON, VA—1992

CORRELATION OF MAP UNITS



For expanded view see Correlation of Paragneiss and Metavolcanic Units

CORRELATION OF PARAGNEISS AND METAVOLCANIC UNITS



DESCRIPTION OF MAP UNITS

(Major minerals listed in order of increasing abundance)

COVER ROCKS

Poughquag Quartzite (Early Cambrian)

Ꞓpp Phyllitic quartzite and metaquartzite—Light-orangish-gray- to tan-weathering, phyllitic quartzite interbedded with thinly laminated gray metaquartzite. Beds about a meter thick. Unit forms uppermost part of Poughquag Quartzite exposed within quadrangle but probably underlies main mass of quartzite typical of Poughquag exposed north of quadrangle

Ꞓpq Metaquartzite—Gray- to white-weathering, vitreous, massive or well-bedded metaquartzite. Includes beds of gray metaquartzite containing abundant white, quartz-filled worm tubes. Characteristic of entire formation exposed north of quadrangle

Ꞓpc Metaconglomerate—Orangish-tan- to gray-weathering, magnetite-rich, muscovitic, quartz-pebble and quartz-cobble metaconglomerate. Forms basal unit unconformably overlying Middle Proterozoic gneiss in exposures in northwestern part of map, where it contains fragments of reddish jasper

INTRUSIVE ROCKS

Zd **Metadiabase dike (Late Proterozoic)**—Light-greenish-gray-weathering, dark-green-spotted, foliated metadiabase dikes, locally coarse grained in the interior and fine grained at margins. Thicknesses from 0.5 to 10 m. Includes local relict rose-tinted clinopyroxene largely altered to chlorite, biotite, or actinolite; however, plagioclase is thoroughly altered to mixtures of muscovite-epidote-albite. Abundant skeletal ilmeno-magnetite present in most samples. Grade of metamorphism in dikes increases east-southeastward across map, where darker green biotite- and hornblende-rich dikes occur

Yp **Pegmatite (Middle Proterozoic)**—White to pinkish-white, biotite-hornblende-pegmatite in dikes, sills, and irregular masses

Ych **Canada Hill Granite (Middle Proterozoic)**—Bluish-gray to resinous-weathering, non- to weakly foliated biotite-microcline-plagioclase granite and pegmatite in irregular merging masses of dikes and sills surrounding or enclosing abundant enclaves of rusty sillimanite-biotite-quartz paragneiss and other units

Yd **Hornblende ferrodiorite (Middle Proterozoic)**—Medium-gray, green- or dark-green-spotted, coarsely porphyritic to coarse-grained, hypidiomorphic granular, hornblende-augite-sodic plagioclase, iron-oxide and apatite-rich ferrodiorite and ferromonzonite. Individual rectangular plagioclase phenocrysts up to 0.7 cm locally define a flow structure

Yhgr **Hornblende-biotite granite gneiss at Candlewood Hill (Middle Proterozoic)**—Pale-pinkish-gray- to white-weathering, green hornblende-biotite-microcline-mesoperthite granite and gneissic granite, characterized by strong foliations and well-developed hornblende or biotite lineation in gneissic layering. Exposed principally on Candlewood Hill. Exposure of similar hornblende granite gneiss in northwestern corner of map is similar to correlative Storm King Granite on Breakneck Hill in adjacent West Point quadrangle

Yap **Aplite (Middle Proterozoic)**—White-weathering, fine-grained, strongly foliated microcline-plagioclase aplitic gneiss contains less than 5 percent mafic minerals. Located near hornblende- or diopside-rich, calc-silicate rocks and their contact with biotite or hornblende granites

Ygg / **Ygt** **Reservoir Gneiss (Middle Proterozoic) Granitic Gneiss**—White-weathering biotite granite gneiss, deformed biotite granite, and migmatitic, biotitic, two-feldspar, granitic gneiss, locally showing intrusive contacts against mafic rocks but having indefinite and complexly mixed relations (migmatitic) and indefinite contacts with other felsic units. The contact between biotite-quartz-plagioclase gneiss (Ycl) and the Reservoir Gneiss in the central part of the quadrangle is marked by a garnet-rich leucogneiss (Ygt) that is gradational into potassium-feldspar-rich Ygg

Wiccopee pluton (Middle Proterozoic)

Ywd Metagabbro—Dark-gray, white-speckled, strongly foliated, coarse-knotted-textured, hornblende-biotite-textured, hornblende-biotite-plagioclase metagabbro consisting of greater than 70 percent hornblende and biotite. Has distinct but poorly developed igneous texture defined by relict plagioclase crystals in stellate forms up to 3 cm long

Ywh Medium-light-gray-weathering, warty-textured, equigranular hornblende-plagioclase, diorite gneiss

Ywp Dark-gray to black altered pyroxenite containing hornblende, plagioclase phlogopite, and (or) olivine

Ywu Light-greenish- to dark-gray serpentinite and serpentinized forsterite rock

LAYERED GNEISSES (PARAGNEISS AND METAVOLCANIC ROCKS)

Ybg **Biotite-quartz-plagioclase gneiss (Middle Proterozoic)**—Largely light- to medium-gray, nonrusty-weathering, fine-grained, well-layered, biotite-quartz-plagioclase gneiss, containing minor layers of amphibolite and quartz-rich gneiss

Yrgt **Garnet-magnetic-biotite-quartz-feldspar gneiss (Middle Proterozoic)**—Light-gray- to brownish-rusty-gray-weathering, finely foliated, well-layered to massive, magnetite-biotite-quartz-microcline-plagioclase gneiss, locally containing abundant red-brown garnet. Microcline content is as much as 30 percent in more massive and leucocratic varieties

Ycs **Calc-silicate gneiss and granofels (Middle Proterozoic)**—Includes any mixture of the following rock types: dark-green to black, coarsely knotted hornblende-diopside rocks; pale, leek-green, diopside-rich calc-silicate rock; tremolite-actinolite-calcite schist; punky-weathering, deeply pitted, phlogopite-calcite-graphite marble; rusty-weathering, sulphide-stained, hornblende-diopside rock. Two units of calc-silicate rock (Ycs_1 and Ycs_2) mapped locally in belt just east of Dennytown fault system

Ym **Marble (Middle Proterozoic)**—Includes various types. White, dull-gray to blue-gray, coarse-grained, calcite marble and brownish, punky-weathering, and deeply pitted phlogopite-plagioclase-diopside marble. Includes highly strained varieties of light- to dark-gray, fine-grained, finely flow banded dolomite-calcite marble in which disrupted rounded fragments of diopside, hornblende, or epidote form knots from 1 mm to 0.3 m in diameter

Yde **Diopside-epidote-quartz gneiss (Middle Proterozoic)**—Pale-green- to pinkish-gray-green-weathering, well-layered, quartz-ribbed diopside-epidote-microcline-quartz gneiss containing local distinct quartz- or diopside-rich layers 1 to 2 cm wide

Yrg **Rusty magnetite-garnet-quartz-biotite paragneiss (Middle Proterozoic)**—Dark-rusty-brown- to dark-gray-rusty-brown-weathering, biotite-rich sillimanite-quartz schist or gneiss, commonly containing layers of magnetite-rich quartzite or ribbony stringers of pale-blue quartz interbedded with rusty weathering biotite-quartz-plagioclase gneiss. Locally, quartz-rich layers contain abundant small, 1-mm scattered lavender garnets

Yrq **Quartzite**—Steely-gray vitreous weathering, graphite-magnetite quartzite, sillimanite quartzite, or garnet quartzite (Yrq) in beds up to 0.5 m thick, but commonly laminated or crudely layered (several centimeters)

Yrs **Sillimanite-biotite-quartz schist**—Light-gray, lustrous sillimanite-biotite-quartz schist (Yrs) marked by pods or lenticular masses containing bundles of coarse sillimanite needles oriented parallel to axes of folds in regional YF_2 foliation

Ya **Amphibolite (Middle Proterozoic)**—Contains several varieties of hornblende-rich plagioclase rocks that occur throughout paragneiss column including dark-green to black, well-foliated, hornblende-rich (>70 percent hornblende) quartz-plagioclase amphibolite commonly associated with calc-silicate rock; medium-dark-green, equigranular hornblende (50–70 percent), plagioclase (30–50 percent) gneiss consisting of indefinite layers of more hornblende-rich rock

Yhg **Diopside-hornblende-plagioclase gneiss (Middle Proterozoic)**—Medium-gray-green-weathering, well-layered gneiss or granofels, containing 1 to 2 cm, widely dispersed, equant grains of dark-colored diopside, mantled by dark-green hornblende. Overall unit is well layered and grades into darker colored amphibolite through an increase in amphibolite layers

Ybqf **Biotite-quartz-feldspar gneiss (Middle Proterozoic)**—Dark- to medium-dark-gray, nonrusty-weathering, well-layered, biotite-rich, quartz-microcline-plagioclase gneiss. Bands of biotite-magnetite rock in layers up to 20 cm thick or zones rich in disseminated magnetite

Ycl **Cat Hill Gneiss (Middle Proterozoic)**—White to bluish-gray, light-gray- to chalky-white-weathering, indistinctly layered, biotite-quartz-oligoclase gneiss and granofels containing minor layers of amphibolite and scattered deep-red-brown garnet

Ybqp **Biotite-quartz-plagioclase leucogneiss (Middle Proterozoic)**—White to light-greenish-gray, light-orangish-tan- to gray-weathering, strongly foliated, massive to indistinctly layered, biotite-quartz-oligoclase gneiss or granofels, having a greasy luster; contains scattered indistinct pods of amphibolite

EXPLANATION OF MAP SYMBOLS

Contact—Dashed where approximately located, dotted where concealed beneath water

Thrust fault or ductile shear zone—Dashed where approximately located. Sawteeth on upper plate. Relative movement shown on cross section by arrow and by A, away from observer; T, toward observer. Age or ages of movement shown by (Y) Middle Proterozoic, (t) Taconic, and (M) Mesozoic.

FOLDS

(Approximate axial trace and dip direction of axial surface. Classified by age of formation)

Middle Proterozoic folds

YF_1—Trace of axial surface, location and dip of axial surface conjectural

YF_2—Trace and dip direction (shown by position of bar) of axial surface, arrows show general plunge direction of fold axis

YF_3—Axial trace and dip direction (shown by position of bar) of axial surface, arrows show general plunge direction of fold axis

Paleozoic folds

Axial trace of syncline or synform. Arrow shows plunge direction

Axial trace of antiform. Arrow shows plunge direction

PLANAR FEATURES

(May be combined with linear feature or with planar features. Two planar features intersect at point of observation)

85 **Strike and dip of bedding**

25 **Strike and dip of foliation in Paleozoic rocks**

Strike and dip of mylonitic foliation spatially associated with faults or ductile shear zones of Paleozoic age (black) or Proterozoic (red)

76 Inclined

Vertical

Strike and dip of Middle Proterozoic foliation or schistosity in Middle Proterozoic rocks

26 Inclined

Vertical

Strike and dip of Middle Proterozoic parallel foliation and compositional layering gneissosity

20 Inclined

Vertical

Strike and dip of Middle Proterozoic axial surface of minor fold of gneissosity in Middle Proterozoic rocks

30 YF_1—Highly contorted axial surface

22 YF_2—Inclined

YF_2—Vertical

83 YF_3—Inclined

YF_3—Vertical

70 **General trend and dip of highly folded or plicated gneissosity in Middle Proterozoic rocks**—Folding may be Proterozoic or Paleozoic age

83 **Strike and dip of axial surface of Paleozoic fold associated with faults or ductile shear zones**

Strike and dip of brittle fracture or minor fault of Paleozoic or Mesozoic age—Arrows show sense of horizontal slip; U (up), D (down) show sides that move relatively up and down, where known

U 40 D Inclined

U D Vertical

LINEAR FEATURES

(May be combined with planar features)

30 **Bearing and plunge of fold axis of YF_2 generation fold**

40 **Bearing and plunge of fold axis of YF_3 generation fold**—Arrow shows sense of rotation of asymmetrical fold where known

25 **Bearing and plunge of minor fold in mylonitic gneiss associated with Paleozoic fault or ductile shear zone**—Arrow shows sense of rotation of asymmetrical fold where known

si 15 **Bearing and plunge of mineral lineation or rodding of Middle Proterozoic YF_2 age**—Sillimanite, si; other lineation defined by oriented hornblende, hb, and (or) biotite

q 20 **Bearing and plunge of quartz rodding, q, or mullion structure in Paleozoic mylonite**—Shown only in combination with symbol for Paleozoic mylonite

25 **Bearing and plunge of slickensides developed on brittle fault or fracture of Paleozoic or Mesozoic age**—Shown only with brittle fracture symbol

OTHER FEATURES

Magnetite-rich zone

Approximate area of abundant outcrop examined in this study

7-5,6 **Approximate location of sample for chemical analysis**—Number refers to table number and sample (for example, 2–1 reads as table 2, sample 1 in text)

L **K-Ar or $^{40}Ar/^{39}Ar$ sample site discussed in text**—L, Long and Kulp (1962); D, Dallmeyer and Sutter (1976)

436 Ma **$^{40}Ar/^{39}Ar$ biotite sample site with date**

Abandoned mine

Location of earthquake epicenter—Length of bars indicates approximate horizontal error; date, magnitude, and approximate depth are given. Data from Regional Seismicity Bulletin of the Lamont-Doherty Regional Observatory

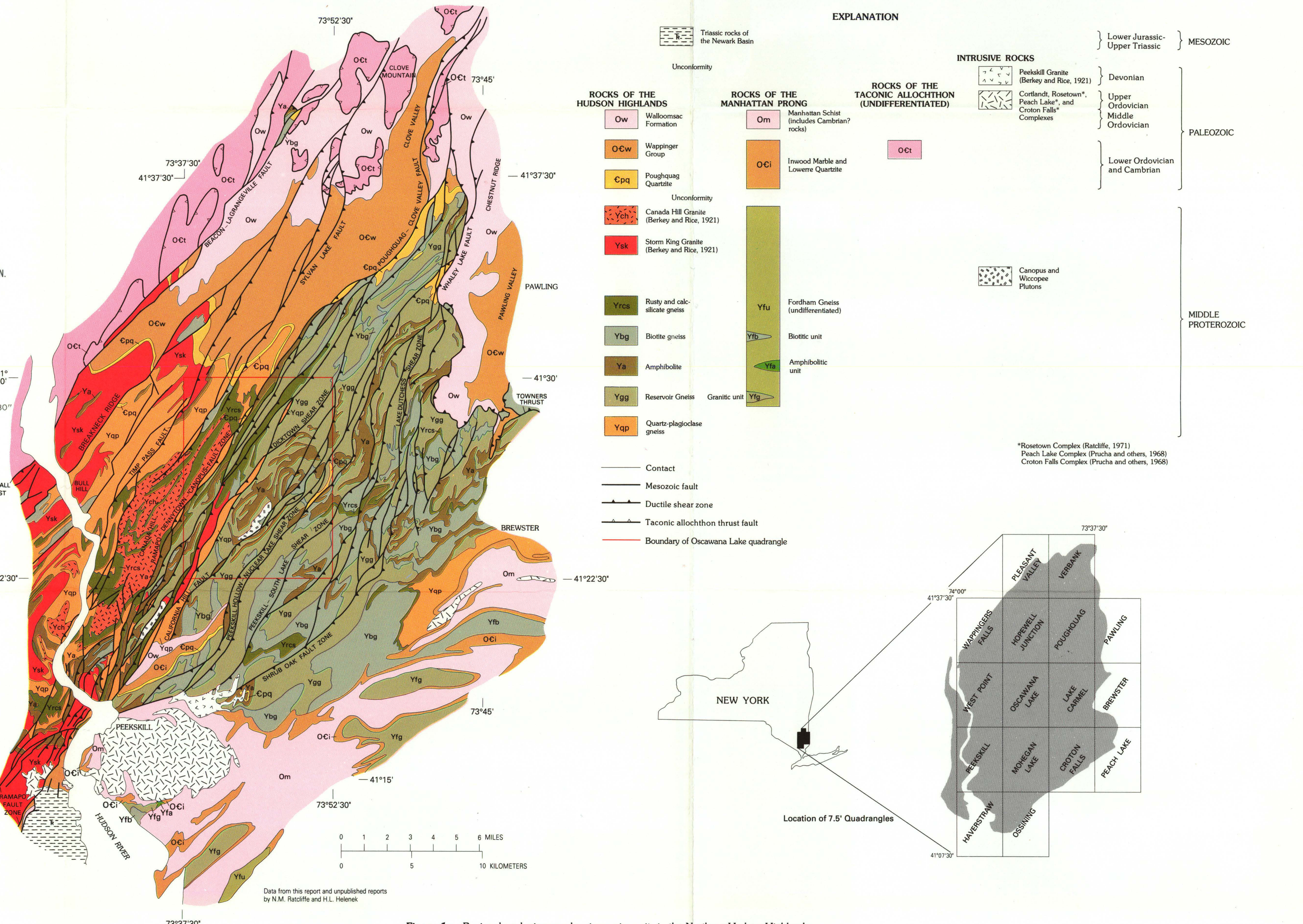


Figure 1.—Regional geologic map showing major units in the Northern Hudson Highlands.

BEDROCK GEOLOGY AND SEISMOTECTONICS OF THE OSCAWANA LAKE QUADRANGLE, NEW YORK

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