-2,000

### Prepared in cooperation with the U.S. GEOLOGICAL SURVEY NATIONAL GEOLOGIC MAPPING PROGRAM

INTRODUCTION

The Wawayanda and Pine Island quadrangles are located in northeastern Sussex and

Paleozoic rocks in the map area range in age from Cambrian through Devonian and are

Formations of Cambrian and Ordovician age of the Kittatinny Valley sequence include the

Mesoproterozoic rocks

Mesoproterozoic rocks consist of an assemblage of granites, gneisses, and marble. Most

The oldest Mesoproterozoic rocks in the area consist of the Losee Suite and a thick assemblage

Granite and related rocks of the Byram and Lake Hopatcong Intrusive Suites, that together

The youngest Mesoproterozoic rocks are postorogenic potassic granites and granite pegmatites

Paleozoic bedding

Proterozoic foliation

Crystallization foliation, formed by the parallel alignment of mineral grains in the Mesoproterozoic

Folds in the Lower Paleozoic rocks were formed during the Taconian and Alleghanian orogenies

Folds that deform Mesoproterozoic rocks originated during the Ottawan phase of the Grenville

The structural geology of the bedrock units is dominated by northeast-trending faults that deform

Most faults exhibit brittle deformation features that include brecciation, recrystallization, and low-

The Glenwood fault extends through the center of Pochuck Mountain where it is bounded by

The East fault borders the west side of Vernon Valley where Mesoproterozoic rocks on the

The Vernon fault extends along the west side of Wawayanda Mountain where it is bounded by

Aesoproterozoic rocks along most of its length almost to Pine Island, and from there, by Paleozoic rocl

Bedding in the Middle Paleozoic rocks is fairly uniform and strikes northeast from N.12°E. to

The DeKay fault extends along the western base of Wawayanda Mountain west to Vernon where it appears to be cut off by the Vernon fault. It is bounded by Mesoproterozoic rocks at its southern end and by Lower Paleozoic rocks at its northern end which are offset. The fault strikes N.40°E. and dips about 80° northwest. The latest movement appears to have been normal. The fault exhibits brittle deformation The Highland Lake fault extends through the western part of Wawayanda Mountain where it is

bounded by Mesoproterozoic rocks. To the south it merges with, or is cut off by, the Vernon fault. To the north its extent is unknown beyond the area of Highland Lake. The fault strikes N.20°E. to N.40°E. and dips about 75° southeast. The latest movement appears to have been normal. The fault exhibits brittle

The Wawayanda Lake fault extends through the central part of Wawayanda Mountain where it is bounded by Mesoproterozoic rocks. The fault bifurcates east of Highland Lake, and the main segment extends northeastward through Wawayanda Lake. To the north the presence of both fault segments is unknown, however the main segment does not seem to offset the Lower Paleozoic rocks. The fault strikes N.15°E.to N.35°E. and dips about 75° southeast. The latest movement appears to have been normal. The fault exhibits brittle deformation features.

The Laurel Pond fault extends along the east side of Wawayanda Mountain where it is bounded by Mesoproterozoic rocks. The strike is somewhat varied and ranges from N.40°E. to N.70°E. The dip is about 50° northwest. The latest movement appears to have been normal. The fault exhibits brittle The Reservoir fault extends from New York State southwest to Schooleys Mountain (Drake and

others, 1996). In the map area the fault places Paleozoic rocks on the hanging wall against Mesoproterozoic rocks on the footwall, but to the south it is bounded by Mesoproterozoic rocks on both sides. The fault strikes N.30°E. and dips 80° northwest to vertically. It has undergone multiple reactivations dating from the Proterozoic that reflect a complex deformation history involving normal, right-lateral strike slip, and reverse movement, with the latest movement having been normal. The fault exhibits ductile deformation features that are overprinted by brittle features. Timing of fault movement based on 40Ar/39Ar isotope analysis yielded disturbed spectra, indicating resetting of amphiboles at about 722 Ma, and biotite inclusions in amphibole at about 322 Ma (Price, 2005), likely due to the effects of hydrothermal fluid movement along the fault. Mesoproterozoic and Paleozoic rocks are also deformed by small faults that strike northeast or northwest. These faults range from a few inches to a few feet wide and are of short length. They are characterized mainly by brittle deformation features.

Joints are a common feature in the Paleozoic and Mesoproterozoic rocks. They are best developed in massive rocks such as Paleozoic limestone, dolomite, and sandstone, and in Mesoproterozoic granite and some gneiss. Joints are characteristically planar, moderately well formed, moderately to widely spaced, and moderately to steeply dipping. Their surfaces are typically unmineralized, except near faults, and are smooth or less commonly, slightly irregular. Joints vary in their spacing from one foot to tens of feet apart. Those formed close to faults are spaced two feet or less apart. Joint data for the Middle Paleozoic rocks are shown on the map of Herman and Mitchell (1991) and are not shown here. Joints in the Lower Paleozoic rocks form two populations that have average

The dominant joints in Mesoproterozoic rocks are nearly perpendicular to the strike of crystallization foliation, a consistent feature observed throughout the Highlands (Volkert, 1996). Therefore, the strike of joints is somewhat varied because of folding of the rocks. In the Wawayanda quadrangle the dominant joints strike N.67°W. on average (fig. 5) and dip 18° to 90° mainly southwest at an average of 70°. In the Pine Island quadrangle principal joint sets were measured that strike northwest at an average of N.70°W. and northeast at an average of N.20°E. (fig. 6). Northwest-striking joints dip nearly equally southwest and northeast and northeast-striking joints dip mainly southeast. The dip of all joints ranges from 56° to 90°

strikes of N.65°W. and N.40°E. (fig. 4). Northwest-striking joints dip mainly southwest, whereas the

northeast-striking joints dip mainly southeast. The dip of all joints ranges from 44° to 90° and averages

# ECONOMIC RESOURCES

Mesoproterozoic rocks in the map area host economic deposits of iron ore (magnetite) that were mined predominantly during the 19th century. Detailed descriptions of most of the mines are given in Bayley (1910). Mount Eve Granite was formerly quarried at several locations on Mount Adam and Mount Eve for use as dimension stone. Marble was quarried for agricultural use as fertilizer east of Pochuck Mountain and south of Pine Island, and dolomite was quarried in Orange County, N.Y. Deposits of sand and gravel and peat were formerly worked in the area and organic-rich "black dirt" in the area of Pochuck Creek currently supports robust agricultural activity.

# **EXPLANATION OF MAP SYMBOLS**

----- Contact - Dotted where concealed Faults - Dotted where concealed. Queried where uncertain

Normal fault - U, upthrown side; D, downthrown side

# Reverse fault - U, upthrown side; D, downthrown side

Folds in Proterozoic rocks showing trace of axial surface, direction and dip of limbs, and direction of plunge.

— → Antiform

Overturned antiform

Overturned synform

— ← → 20 Minor asymmetric fold

Folds in Paleozoic rocks showing trace of axial surface, direction and dip of limbs, and direction of plunge. Folds are in bedding.

PLANAR FEATURES

Strike and dip of crystallization foliation \_\_\_ Inclined

Vertical

Strike and dip of mylonitic foliation

Strike and dip of beds - Ball indicates top of beds known from sedimentary structures

Inclined

Strike and dip of spaced cleavage in Paleozoic rocks

→ 30 Bearing and plunge of mineral lineation in Proterozoic rocks

→ 20 Bearing and plunge of interesection of bedding and cleavage in Paleozoic rocks

OTHER FEATURES

Yps Ybs Ylb

SEA LEVEL

-1,000

-2,000

Abandoned quarry

Abandoned magnetite mine

### **DESCRIPTION OF MAP UNITS** GREEN POND MOUNTAIN REGION

Skunnemunk Conglomerate (Middle Devonian) (Darton, 1894) – Grayish-purple to grayish-red, thin- to very thick bedded, locally cross-bedded, polymictic conglomerate and sandstone containing clasts of white vein quartz, red and green quartzite and sandstone, red and gray chert, and red shale; interbedded with medium-gray, thin-bedded sandstone and greenish-gray and grayish-red, mud-cracked shale. Conglomerate and sandstone matrix is primary hematite and microcrystalline quartz. Conglomerate cobbles are as much as 6.5 in. long, and average cobble size is larger in upper part of unit. Lower contact is conformable and gradational as defined by Kümmel and Weller (1902). Unit is about 3,000 ft thick.

Bellvale Sandstone (Middle Devonian) (Bellvale Flags of Darton, 1894; Willard, 1937) – Upper beds are grayish-red to grayish-purple sandstone containing quartz pebbles as large as 1 in. in diameter. Lower beds are light-olive-gray to yellowish-gray- and greenish-blackweathering, medium-gray to medium-bluish-gray, very thin to very thick-bedded siltstone and sandstone, crossbedded, graded, and interbedded with black to dark-gray shale. Sandstone more common in upper beds and is finer downward. Lower contact conformable with the Cornwall Shale and placed where beds are thicker and volume of shale and siltstone is about equal. Unit is 1,750 to 2,000 ft. thick.

Cornwall Shale (Middle Devonian) (Hartnagel, 1907) – Black to dark-gray, very thin to thick-bedded, fossiliferous shale, interbedded with medium-gray and light-olive-gray to yellowish-gray, laminated to very thin-bedded siltstone that is more abundant in upper part. Lower contact with Kanouse Sandstone probably conformable. Unit is about 950 ft. thick.

Kanouse Sandstone, Esopus Formation, and Connelly Conglomerate, undivided (Lower Formation)

> Kanouse Sandstone (Kümmel, 1908) – Medium-gray, light-brown, and grayish-red, fine to coarse-grained, thin to thick-bedded sandstone and pebble conglomerate. Basal conglomerate is interbedded with siltstone and contains well-sorted, subangular to subrounded, gray and white quartz pebbles less than 0.4 in. long. Lower contact with Esopus Formation gradational. Unit is about 46 ft. thick.

Esopus Formation (Vanuxem, 1842; Boucot, 1959) - Light to dark-gray, laminated to thinbedded siltstone interbedded with dark-gray to black mudstone, dusky-blue sandstone and siltstone, and yellowish-gray, fossiliferous siltstone and sandstone. Lower contact probably conformable with Connelly Conglomerate. Unit is about 180 ft. thick.

Connelly Conglomerate (Chadwick, 1908) – Grayish-orange-weathering, very light-gray to yellowish-gray, thin-bedded quartz-pebble conglomerate. Quartz pebbles are subrounded to well rounded, well sorted, and as much as 0.8 in. long. Unit is about 36 ft. thick.

# Sbp Berkshire Valley and Poxino Island Formations, undivided (Upper Silurian)

Berkshire Valley Formation (Barnett, 1970) - Yellowish-gray-weathering, medium-gray to pinkish-gray, very thin to thin-bedded fossiliferous limestone interbedded with gray to greenish-gray calcareous siltstone and silty dolomite, medium-gray to light-gray dolomite conglomerate, and grayish-black thinly laminated shale. Lower contact conformable with Poxino Island Formation. Unit ranges in thickness from 90 to 125 ft.

Poxino Island Formation (White, 1882; Barnett, 1970) - Very thin to medium-bedded sequence of medium-gray, greenish-gray, or yellowish-gray, mud-cracked dolomite; light-green, pitted, medium-grained calcareous sandstone, siltstone, and edgewise conglomerate containing gray dolomite; and quartz-pebble conglomerate containing angular to subangular pebbles as much as 0.8 in. long. Interbedded grayish-green shale at lower contact is transitional into underlying Longwood Shale. Unit ranges in thickness from 160

Longwood Shale (Upper and Middle Silurian) (Darton, 1894) – Dark reddish-brown, thin to very thick-bedded shale interbedded with cross-bedded, very dark-red, very thin to thin-bedded sandstone and siltstone. Lower contact conformable with Green Pond Conglomerate. Unit is about 330 ft. thick.

Green Pond Conglomerate (Middle and Lower Silurian) (Rogers, 1836) – Medium to coarse-grained quartz-pebble conglomerate, quartzitic arkose and orthoquartzite, and thin to thick-bedded reddish-brown siltstone. Grades downward into less abundant gray, very dark red, or grayish-purple, medium to coarse-grained, thin- to very thick-bedded pebble to cobble-conglomerate containing clasts of red shale, siltstone, sandstone, and chert; yellowish-gray sandstone and chert; dark-gray shale and chert; and white, gray, and pink milky quartz. Quartz cobbles are as much as 4 in. long. Unconformably overlies, or is in fault contact with, Mesoproterozoic rocks. Unit is about 1,000 ft. thick.

# KITTATINNY VALLEY SEQUENCE

Epler Formation (Lower Ordovican and Upper Cambrian) (Hobson, 1957) – Upper part is light-olive to dark-gray, fine to medium-grained, thin to thick-bedded, locally laminated dolomite. Middle part is olive-gray, light-brown, or dark-yellowish-orange-weathering, dark-gray, aphanitic to fine-grained, laminated to medium-bedded dolomite, and light-gray to light-bluish-gray-weathering, medium-dark to dark-gray, fine-grained, thin to medium-bedded limestone, that is characterized by mottling and reticulate dolomite and light-olive-gray to grayish-orange-weathering, medium-gray dolomitic shale laminae surrounding the limestone lenses. Limestone grades laterally and down section into medium-gray, fine-grained dolomite. Lower part is medium-light to dark-gray, aphanitic to medium-grained, laminated to medium-bedded dolomite. Contains lenses of white and dark-gray chert. Lower contact is placed at the transition from a massive laminated, very fine-grained, dark-gray dolomite to the underlying massive light-gray, medium to coarse-grained pitted dolomite that occurs about 50 to 75 feet above a thinly interbedded sequence of medium-grained dolomite and as many as seven, thin, black, convex-upward chert layers. Unit contains conodonts of Cordylodus lindstomi to Rossodus manitouensis zones of the North American Midcontinent Province as used by Sweet and Bergstrom (1986). Unit is approximately 420 ft. thick.

Rickenbach Dolomite (Upper Cambrian) (Hobson, 1957) - Upper part is medium to dark-gray, fine to coarse-grained, medium to thick-bedded dolomite, locally fetid, mottled, weathered surface. Contains pods and lenses of dark-gray to black chert near the upper contact. Lower part is medium to dark-gray, fine to medium-grained, thin to medium-bedded dolomite. Floating quartz sand grains and quartz-sand stringers occur in the basal part of unit. Lenses of light-gray, coarse to very-coarse-grained dolomite locally occur throughout the unit. Lower contact placed at top of distinctive medium-gray quartzite. Contains conodonts of Cordylodus proavus to Cordylodus lindstomi zones of North American Midcontinent Province, as used by Sweet and Bergstrom (1986). Unit is as much as 200 ft. thick.

Allentown Dolomite (Upper Cambrian) (Wherry, 1909) - Upper sequence is light to medium-gray-weathering, medium-light to medium-dark-gray, fine to medium-grained, locally coarse-grained, medium to very-thick-bedded dolomite; local shaly dolomite near the bottom. Floating quartz sand and two intervals of medium-light to very-light-gray, medium-grained, thin-bedded quartzite and discontinuous dark-gray chert lenses occur directly below upper contact. Lower sequence is medium to very-light-gray-weathering, light to medium-dark-gray, fine to medium-grained, thin to medium-bedded dolomite and shaly dolomite. Weathered exposures characterized by alternating light- and dark-gray beds. Ripple marks, ooids, algal stromatolites, cross-beds, edgewise conglomerate, mud cracks, and paleosol zones occur throughout but are more abundant in the lower sequence. Unit grades down into the Leithsville Formation. Elsewhere, contains a trilobite fauna of Dresbachian (early Late Cambrian) age (Weller, 1903; Howell, 1945). Unit is approximately 1,800 ft. thick.

Leithsville Formation (Middle and Lower Cambrian) (Wherry, 1909) - Upper sequence, seldom exposed, is mottled, medium-light to medium-dark-gray-weathering, medium to medium-dark-gray, fine to medium-grained, medium to thick-bedded dolomite, locally pitted and friable. Middle sequence is grayish-orange, light to dark-gray, grayish-red, or lightgreenish to dark-greenish-gray-weathering, fine-grained, thin to medium-bedded dolomite, argillaceous dolomite, dolomitic shale, quartz sandstone, siltstone and shale. Lower sequence is medium-light to medium-gray-weathering, medium-gray, fine to medium-grained, thin to medium-bedded dolomite. Quartz-sand lenses occur near lower gradational contact with Hardyston Quartzite. Archaeocyathids of Early Cambrian age were found in the formation in Franklin, New Jersey, suggesting an intraformational disconformity between Middle and Early Cambrian strata (Palmer and Rozanov, 1967). Unit also contains Hyolithellus micans (Offield, 1967; Markewicz, 1968). Thickness is approximately 600 ft.

Hardyston Quartzite (Lower Cambrian) (Wolff and Brooks, 1898) – Medium to light-gray, fine to coarse-grained, medium to thick-bedded quartzite, arkosic sandstone and dolomitic sandstone. Elsewhere, contains Scolithus linearis(?) and fragments of the trilobite Olenellus thompsoni of Early Cambrian age (Nason, 1891; Weller, 1903). Thickness is as much as 40

# **NEW JERSEY HIGHLANDS**

or light-pinkish-gray, medium to coarse-grained, massive, unfoliated granite composed principally of microcline microperthite, quartz, oligoclase, horblende, and biotite. Locally contains xenoliths of foliated country rock. Includes bodies of pegmatite too small to show on map.

### Vernon Supersuite (Volkert and Drake, 1998)

Hornblende granite (Mesoproterozoic) – Pinkish-gray or buff-weathering, pinkish-white or light pinkish-gray, medium to coarse-grained, foliated granite and sparse granite gneiss composed principally of microcline microperthite, quartz, oligoclase, hornblende, and magnetite. Some variants are quartz syenite or quartz monzonite. Locally contains clinopyroxene where in contact with rocks of the Lake Hopatcong Intrusive Suite. Includes small bodies of pegmatite too small to show on map.

Hornblende monzonite (Mesoproterozoic) – Tan or buff-weathering, pinkish-gray or greenish-gray, medium to coarse-grained, foliated monzonite and, less commonly, quartz monzonite composed of microcline microperthite, oligoclase, hornblende, and magnetite. Locally contains quartz. Sparse to moderate amounts of clinopyroxene may be present where in contact with rocks of the Lake Hopatcong Intrusive Suite.

### Lake Hopatcong Intrusive Suite (Drake and Volkert, 1991)

**Pyroxene granite (Mesoproterozoic)** – Light gray, buff, or white-weathering, greenish-gray, medium to coarse-grained, massive, foliated granite composed of mesoperthite to microantiperthite, quartz, oligoclase, and clinopyroxene. Commonly contains titanite, magnetite, apatite, and pyrite. Sparse to moderate amounts of hornblende may be present where in contact with rocks of the Byram Intrusive Suite. Includes small bodies of pegmatite too small to show on map.

Pyroxene alaskite (Mesoproterozoic) – Light-gray or tan-weathering, greenish-buff or light pinkish-gray, medium to coarse-grained, massive, foliated granite composed of mesoperthite to microantiperthite, oligoclase, and quartz. Commonly contains clinopyroxene, titanite and magnetite. Occurs in a pair of bodies east of Highland Lake.

**Pyroxene monzonite (Mesoproterozoic)** – Gray, buff, or tan-weathering, greenish-gray, medium to coarse-grained, massive, foliated rock composed of mesoperthite to microantiperthite, oligoclase, clinopyroxene, titanite and magnetite. Locally contains hornblende where in

### Back-Arc Supracrustal Rocks

Potassic feldspar gneiss (Mesoproterozoic) – Light-gray or pinkish-buff-weathering, pinkish-white or light pinkish-gray, fine to medium-grained, moderately foliated gneiss and less abundant granofels composed of quartz, microcline microperthite, and varied amounts of biotite, garnet, sillimanite, and magnetite. Locally contains thin, sparsely garnetiferous quartzite layers. Exposed sporadically throughout the map area, but is most abundant in the vicinity of Highland Lake.

Microcline gneiss (Mesoproterozoic) – Tan or pale pinkish-white-weathering, light-gray of microcline microperthite, quartz, and oligoclase. Common accessory minerals include biotite, garnet, sillimanite, and magnetite. Unit is well exposed in the northwest part of the

weathering, gray, tan, or greenish-gray, medium to coarse-grained, moderately layered and foliated gneiss containing microcline microperthite, oligoclase, quartz, and biotite. of Upper Greenwood Lake.

pinkish-white or pinkish-gray, fine to medium-grained, moderately well layered and foliated gneiss composed of microcline, quartz, oligoclase, and hornblende. Locally contains garnet, magnetite, and biotite. Unit occurs throughout the map area.

weathering, white, pale-pinkish-white, or light-gray, fine to medium-grained, moderately foliated gneiss composed of quartz, microcline, oligoclase, clinopyroxene, and trace amounts of epidote, biotite, titanite, and opaque minerals. Commonly contains thin layers of amphibolite. Unit is present throughout the map area, but is most abundant south and east of Wawayanda

Pyroxene gneiss (Mesoproterozoic) – White or tan-weathering, greenish-gray, mediumfine to medium-grained, layered and foliated gneiss containing oligoclase and clinopyroxene. Quartz content is highly varied. Contains sparse amounts of epidote, titanite, scapolite, or calcite. Commonly interlayered with pyroxene amphibolite or marble. Unit is abundantly exposed throughout the map area.

Marble (Mesoproterozoic) – White or light-gray-weathering, white, grayish-white, or less commonly pinkish-orange, fine to coarse-grained, calcitic to locally dolomitic marble with accessory graphite, phlogopite, chondrodite, and clinopyroxene. Contains pods and lenses of clinopyroxene-garnet skarn, hornblende skarn, and clinopyroxene-rich rock. Divided by Hague and others (1956) into a lower Franklin marble (Yff) and an upper Wildcat marble (Yfw) separated by a layered sequence of gneiss. Locally contains relict karst features in the form of bedrock pinnacles and solution joints and openings. Unit is best exposed in the northwestern part of the map area in Vernon Valley.

volcanic rocks with microcline gneiss.

Quartz-oligoclase gneiss (Mesoproterozoic) – White-weathering, light greenish-gray, andesine, quartz, and local hornblende, biotite, and clinopyroxene. Commonly contains thin, conformable layers of amphibolite. Best exposed north and west of Canistear Reservoir.

Hornblende-quartz-oligoclase gneiss (Mesoproterozoic) – White-weathering, light

near Canistear Reservoir, in the southwestern part of the map area.

County, New York.

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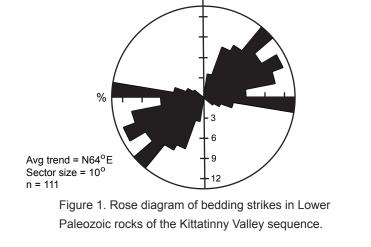
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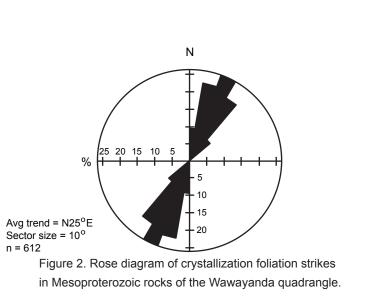


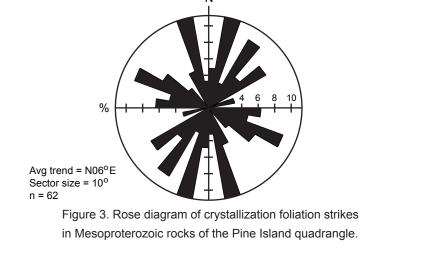
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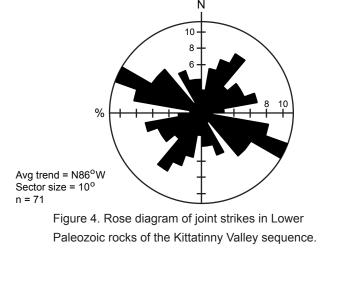
BEDROCK GEOLOGIC MAP OF THE WAWAYANDA QUADRANGLE

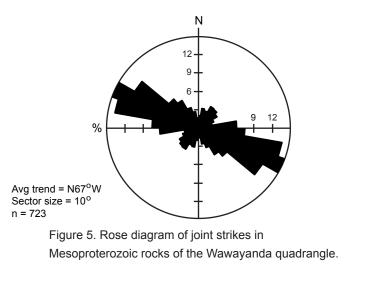
SUSSEX AND PASSAIC COUNTIES, NEW JERSEY AND ORANGE COUNTY, NEW YORK

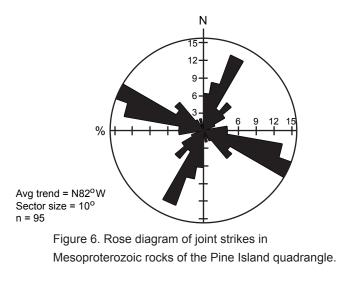
AND NEW JERSEY PART OF THE PINE ISLAND QUADRANGLE

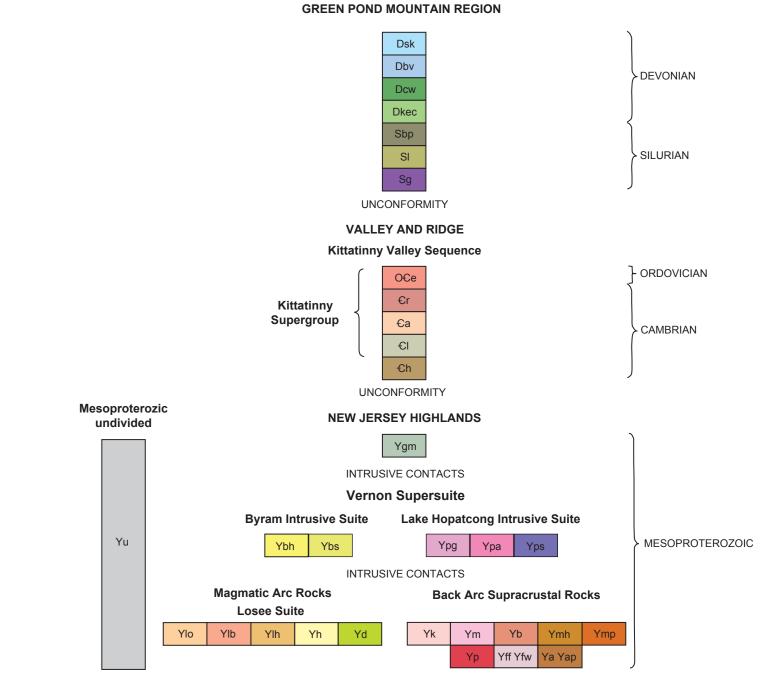












CORRELATION OF MAP UNITS

Mount Eve Granite (Mesoproterozoic) – Pinkish-gray or buff-weathering ,pinkish-white

# Byram Intrusive Suite (Drake and others, 1991b)

contact with rocks of the Byram Intrusive Suite. Crops east and west of the Vernon fault.

or pinkish-gray, fine to medium-grained, layered and foliated rock composed principally Biotite-quartz-feldspar gneiss (Mesoproterozoic) - Gray-weathering, locally rusty-

Locally contains garnet, sillimanite, graphite, and opaque minerals. Commonly contains thin layers of quartzite that may contain graphite and biotite. Unit is most abundant north Hornblende-quartz-feldspar gneiss (Mesoproterozoic) – Pinkish-gray or buff- weathering,

Clinopyroxene-quartz-feldspar gneiss (Mesoproterozoic) – Pinkish-gray or pinkish-buff-

Amphibolite (Mesoproterozoic) – Grayish-black, medium-fine to medium-grained, foliated rock composed of hornblende and andesine. Some amphibolite also contains abundant clinopyroxene (Yap). Unit is associated with most Mesoproterozoic rocks in the map area. Amphibolite associated with the Losee Suite is metavolcanic in origin, and that associated with supracrustal rocks may be metavolcanic or metasedimentary in origin. All types are shown undifferentiated on the map. Unit is best exposed on Pochuck Mountain. It locally contains relict pillow structures (Hague and others, 1956) and forms a bimodal sequence of

Losee Metamorphic Suite (Drake, 1984; Volkert and Drake 1999) medium to coarse-grained, moderately layered to foliated gneiss composed of oligoclase or

Biotite-quartz-oligoclase gneiss (Mesoproterozoic) – White or light-gray-weathering, medium-gray or greenish-gray, medium to coarse-grained, layered and foliated gneiss composed of oligoclase or andesine, quartz, and biotite. Some outcrops contain garnet or hornblende. Locally interlayered with amphibolite. Best exposed in the eastern part of the

greenish-gray, medium to coarse-grained, foliated gneiss containing oligoclase or andesine,

quartz, hornblende, and magnetite. Crops out in one small body southwest of Highland Lake. Hypersthene-quartz-plagioclase gneiss (Mesoproterozoic) – Gray or tan-weathering, greenish-gray or greenish-brown, medium-grained, layered and foliated gneiss composed of andesine or oligoclase, quartz, clinopyroxene, hornblende, and hypersthene. Contains thin, conformable layers of amphibolite and mafic-rich quartz-plagioclase gneiss. Crops out

**Diorite (Mesoproterozoic)** – Gray or tan-weathering, greenish-gray or greenish-brown, medium to coarse-grained, massive, foliated rock containing andesine or oligoclase, clinopyroxene, hornblende, and hypersthene. Commonly contains thin mafic layers or schlieren having the composition of amphibolite. Crops out in one small body in Orange

Undifferentiated rocks (Mesoproterozoic) – Shown in cross section only.