DISCUSSION

This report consists of three maps showing recent geologic mapping within the City of New York and some adjacent parts of the State of New Jersey. The mapped area includes all of New York County and parts of Kings and Queens Counties, New York, and parts of Bergen and Hudson Counties, New Jersey. Sheet 1 shows the general geology and geologic profiles; sheets 2 and 3 show specific engineering geologic data.

All available and accessible rock outcrops within the field area were examined during the course of study. Some structural measurements shown on these maps and used in geologic interpretation were taken in excavations and tunnels no longer accessible.

The informal members of the Manhattan Schist follow the usage of Hall (1968); for those of the Fordham Gneiss see Baskerville (1989). The Newark Basin rocks have been deposited unconformably on generally downfaulted Paleozoic and Late Proterozoic rocks (see Lyttle and Epstein, 1987).

These maps basically consider bedrock; detailed engineering characteristics of surficial materials in the map area are not presented in this format. A general discussion of the surficial materials will be found in the text of these maps on sheet 3.

DESCRIPTION OF MAP UNITS

Newark Basin Rocks

NOTE: The lithologic descriptions of the Newark Basin rocks follow the usage and nomenclature of Lyttle and Epstein (1987) and Puffer (1989)

Jd Palisades Diabase (Lower Jurassic) - Dark-gray to black, fine- to coarse-grained (very fine to fine-grained near chilled borders) diabase composed largely of calcic plagioclase and augite. Shales and siltstones surrounding the diabase have been thermally metamorphosed to a purplish-red, light-gray, and dark gray, indurated, brittle, and fine-grained hornfels containing plagioclase,sericite,biotite, cordierite, epidote, chlorite, magnetite,hornblende, pyroxene, tourmaline, nepheline, cancrinite, and zeolite in a zone averaging about 610 m (2,000 ft) wide. The width of this zone depends on the thickness of the diabase, its topographic expression, and its inclination. The sill is as thick as 520 m (1,700 ft)

JTrp Passaic Formation of Olsen (1980) (Lower Jurassic and Upper Triassic) Predominantly grayish-red to reddish-brown, evenly to irregularly bedded, thin- to thick-bedded shale; siltstone; very fine to coarse-grained sandstone; and red-matrix conglomerate. Generally coarser in the northeastern half of the basin in New Jersey. Mud cracks, ripple marks, and crossbeds are common. Dinosaur footprints, burrows, and plant impressions are present. Lies conformably on the Lockatong Formation

Trl Lockatong Formation (Upper Triassic) - Predominantly laminated to thick-bedded, gray and black siltstone and shale; rich in fossils, including plants, reptiles, fish, and diagnostic spores and pollen. Unit composed of alternating detrital and chemical lacustrine cycles. Detrital cycles: lower part laminated, medium-dark-gray to black, calcareous, pyritic siltstone and shale overlain by platy to massive, disrupted (mud cracked and burrowed), dark-gray, calcareous siltstone; ripple-bedded siltstone; and fine-grained sandstone. More common in the lower Lockatong. Averages about 5.2 m (17.1 ft) in thickness. Chemical cycles: Lower part platy, medium-dark-gray to black, dolomitic siltstone and marlstone with shrinkage cracks and lenses of pyritic limestone, overlain by massive, gray or red, analcime-and carbonate-rich, disrupted siltstone. Average thickness about 3.2 m (10.5 ft). The contact with the underlying Stockton Formation is conformable

Trs Stockton Formation (Upper Triassic) - Light- to medium-gray and light-yellowish-gray to pale-reddish-brown,thin- to thick-bedded, fine- to coarse-grained sandstone, arkose and arkosic conglomerate with pebbles of quartz, quartzite, feldspar, shale, limestone, and metamorphic rocks, locally more than 8 cm (3 in) long; grayish-red to moderate-reddish-brown, and light- to medium-gray siltstone and shale,bioturbated by roots and burrows; and grayish-red to reddish-brown, thin- to thick-bedded, very fine to medium-grained, arkosic sandstone, generally fining upward with abrupt lateral lithic changes. The sedimentary structures in these rocks include channels, ripple marks, mud cracks, crossbeds, pinch-and-swell structures, and minor burrows. Purplish siltstone near the middle and top. This unit has a conglomeratic basal portion resting unconformably on the Paleozoic and Late Proterozoic rocks

Paleozoic and Late Proterozoic Rocks

NOTE: The rank order of the minerals usage in these descriptions is after Winkler (1979)

AUTOCHTHONOUS UNITS

Oma Manhattan Schist, member A - Fissile, fine- to medium-grained, gray, plagioclase-garnet-muscovite-biotite-quartz schist. This unit overlies the Inwood Marble unconformably

O€i Inwood Marble - Composed of (1) coarse-grained white calcitic dolomite marble; (2) alternating medium-grained blue-gray, and white fine-grained calcite and dolomite marble; (3) white and blue-gray, predominantly fine-grained calcite marble with scattered dolomite and phlogopite crystals; and (4) fine-grained white dolomite marble with subordinate calcite and minor phlogopite. This unit overlies the Fordham Gneiss unconformably

Yfc Fordham Gneiss, member C - Fine-grained, medium-gray, quartz-biotite-plagioclase-muscovite schist interlayered with gray biotite-muscovite-quartz granofels. The two units of Fordham Gneiss are in normal conformable stratigraphic contact with each other

Yfb Fordham Gneiss, member B - Complex black and white banded gneiss. The black bands consist of quartz-plagioclase-biotite and the white bands garnet-quartz-plagioclase-muscovite-microcline. The unit contains quartz-feldspar veins; boudinage structures with almandine and grossular garnet, quartz, and biotite; and coarse siliceous dolomite

ALLOCHTHONOUS UNITS

€mc Manhattan Schist, member C - Medium- to coarse-grained gray, layered sillimamite-muscovite-biotite-kyanite and tourmaline-garnet-plagioclase-biotite-quartz schist and gneiss with black amphibolite layers. A major thrust fault separates the Manhattan C from the underlying Manhattan A

Os Serpentinite - Ranges in color from a very dark green through green to a light-green. The darker variety generally has magnetic properties, containing iron, chromite, actinolite, and traces of olivine. The lighter variety is generally the weathered near-surface art of the mass and contains alteration minerals such as magnesite, talc, and varieties of asbestos. The serpentinite may be massive or highly fractured. The serpentinite appears to be intrusive into and is everywhere associated with the surrounding Hartland schists. This intrusive relationship probably occurred prior to thrusting

O€h Hartland Formation - Composed of: (1) Gray and gray-weathering, fine-grained quartz-feldspar kyanite granulite with minor biotite and garnet; (2) Fine- to course-grained, gray- to tan-weathering, quartzofeldspathic, muscovite-biotite-garnet schist; the muscovite flakes are commonly large and may give outcrops a "spangled" or shiny metallic look; some outcrops will display knotty kyanite surfaces; (3) Dark greenish-black quartz-biotite-hornblende amphibolite, weathers black or rusty along fractures. These units are interbedded with each other; the schist and granulite units often displaying magnetic properties The Hartland Formation is in conformable contact with the Ravenswood Granodiorite. Both the Hartland and Ravenswood are in thrust contact with the underlying autochthonous units and the allochthonous Manhattan C

O€r Ravenswood Granodiorite - Gray to dark-gray sillimanite-garnet pink microcline-plagioclase biotite-muscovite-quartz and/or biotite-hornblende-orthoclase granodiorite and banded gneiss

INTRUSIVES

am Amphibolite - Black and dark-greenish-black, quartz-magnetite-biotite-plagioclase-hornblende amphibolite

g Granite pegmatite or granitoid - grayish-white to white, medium- to coarse-grained, biotite-muscovite-microcline-quartz granite and megacrystic pegmatite

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EXPLANATION OF MAP SYMBOLS

Contact - Dashed where approximately located; dotted where under water except solid where located under water by test borings and tunnel data; queried where uncertain underground

Fault, showing dip - Dashed where approximately located; dotted where under water; D, downthrown side, U, upthrown side - Arrows show relative horizontal movement; in section: a - movement away from observer, t - movement toward observer

Thrust fault - Sawteeth on upper plate; dotted under water

Coincident thrust faults - Cameron's Line/Inwood Hill [Hartland Formation overlies Manhattan Schist, member C separated by Cameron's Line; base of member C is Inwood Hill thrust]

Antiform - Shows trace of axial surface and direction of plunge, where known. May be overturned. Dashed where approximately located; dotted where under water

Synform - Shows trace of axial surface and direction of plunge, where known. May be overturned. Dashed where approximately located; dotted where under water

Uncertain axial trace

Strike and dip of axial surface of folds; arrow shows bearing and plunge of axis

Anticline or antiform, minor - Shows bearing of plunge

Syncline or Synform, minor - Shows bearing of plunge

Minor fold deforming earlier foliation

Strike and dip of foliation (open symbols are at tunnel level):

- Inclined
- Vertical
- Horizontal

Strike and dip of joints:

- Inclined
- Vertical
- Horizontal

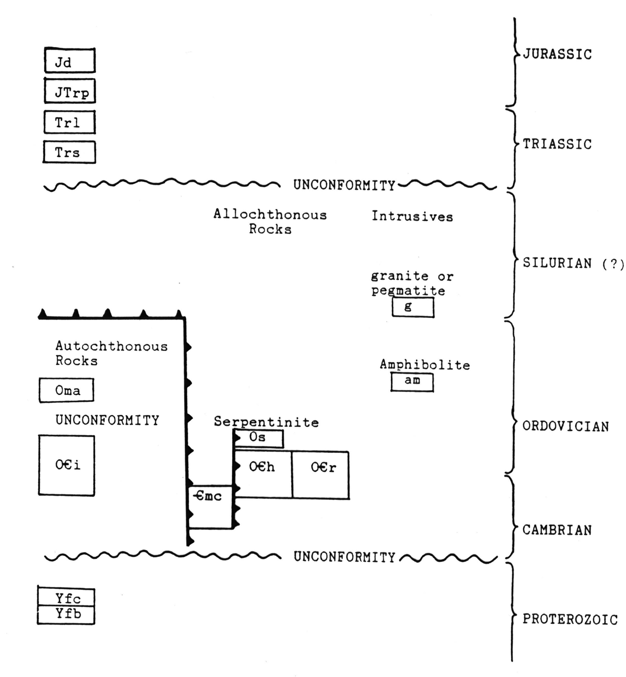
Bearing and plunge of lineation - may be combined with foliation symbol

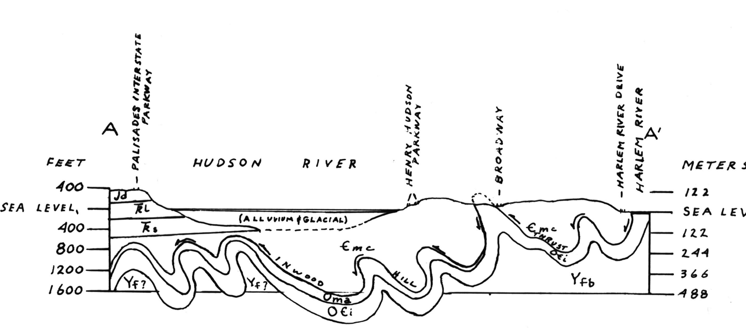
Bearing of glacial groove or striation - Point of observation at tip of arrow

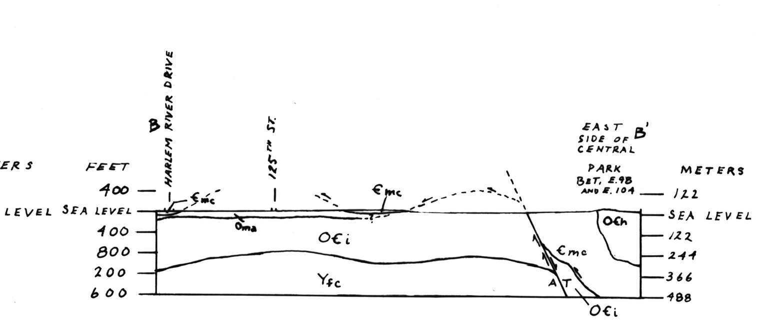
Locations of borings used to define stratigraphic contact

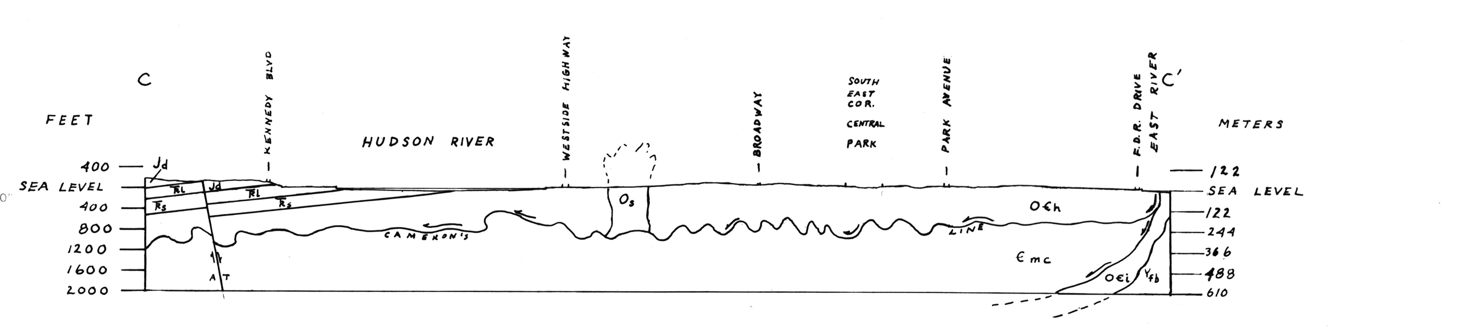
Tunnel or other subsurface engineering structure used to locate stratigraphic contacts - Water tunnels average 168 m (550 ft) below sea level; Utility tunnels 30-60 m (200 ft) below sea level. Contacts at tunnel level are projected up dip to the surface

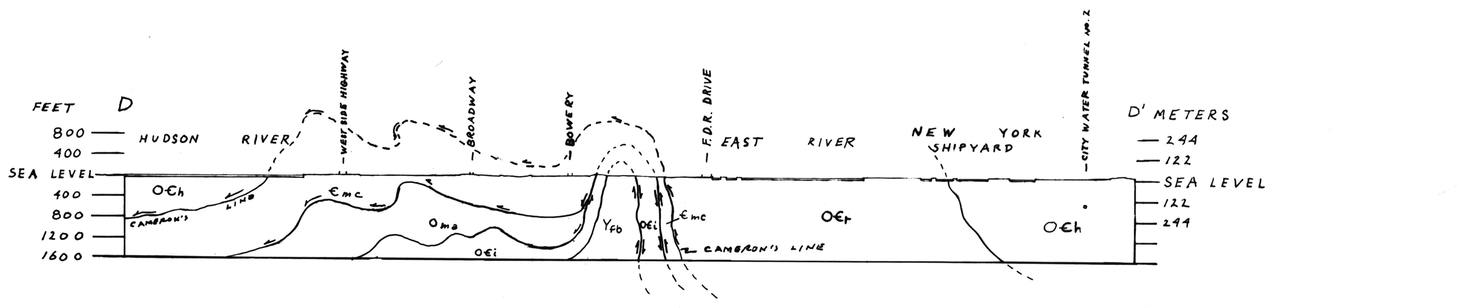
CORRELATION OF MAP UNITS











This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature.

Base from U.S. Geological Survey
Brooklyn, 1966 (photorevised 1976),
Central Park, 1966 (photorevised 1979),
Jersey City, Weehawken, 1967, Yonkers, 1966
(photorevised 1979)

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Geology Mapped by Charles A. Baskerville
1981-1987. Assisted by J.A. Harris, 1981-1983;
Fernando Martinez, G.R. Roberts, 1981;
Fernando Martinez, R.L. Vincent 1982.

SHEET 1 - GEOLOGIC MAP

BEDROCK AND ENGINEERING GEOLOGIC MAPS OF NEW YORK COUNTY AND PARTS OF KINGS AND QUEENS COUNTIES, NEW YORK, AND PARTS OF BERGEN AND HUDSON COUNTIES, NEW JERSEY

By Charles A. Baskerville

1990