77-523

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN FILE MAP 77-523
DRAKE AND FROELICH—BEDROCK MAP,
FAIRFAX CO., VIRGINIA

INTRODUCTION

The generalized rock-type or lithologic map separates the firm consolidated bedrock that underlies most of Fairfax County into thirteen (13) major rock types; each type groups rock units with grossly similar physical characteristics. Although crystalline bedrock underlies the Coastal Plain deposits of Eastern Fairfax County, it was not subdivided on this map. The only available information is based on interpretations from a few widely scattered deep drill holes and aeromagnetic and gravity surveys. Three sedimentary and ten (10) crystalline rocks on the Explanation are arranged in order from softest, best bedded, most foliated and readily splittable - to hardest, most massive, and least readily splittable.

The western part of the County is underlain by sedimentary rocks (formed by accumulation of sediment in water) consisting of layers or beds of siltstone, sandstone, shale and conglomerate. The sedimentary rocks are grouped into three principal rock types (units S1, S2, S3). Bedding symbols on these map units indicate the trend (strike) and inclination (dip) of the rock layers, and joint (planar cracks or partings that abruptly interrupt the physical continuity of a rock mass) symbols indicate where and how beds are disrupted. The layers strike northerly and dip generally 5° to 25° to the west. Standard symbols for joints and bedding appear on the map and in the Explanation.

Block diagram showing strike (s) and dip (d) of inclined bedding in sedimentary rocks (S1, S2, S3), strike and dip of vertical (X) and inclined (B) foliation (B0) in metamorphic rocks, strike and dip of vertical (A) and inclined (A80) joints. Note local shear zones along contact between units B and C of contrasting competence, cluster of fan joints at apex of fold, and regional metamorphic foliation cross-cutting original bedding of folded unit C.

Some layers of siltstone and shale are calcareous near the surface, others are pitted and leached to depths exceeding 20 feet (6 m), and calcareous below, and some beds are non-calcareous throughout. Unit S3 is mainly unconsolidated gravel and sand at the surface, but increases in compaction and hardness with increased depth. Fresh rock outcrops are most abundant along stream valleys. Extensive upland areas are mantled by a thin residuum of partly decayed rock usually less than 10 feet (3 m) thick, commonly with less than 3 feet (1.0 m) of soil at the surface.

Most of the central part of the County is underlain by belts of metamorphic rock (crystalline rocks formed in the solid state in response to great heat, deep burial and such extreme pressure that the original texture was profoundly altered). The metamorphic rocks were originally either sedimentary or igneous rocks (formed by solidification from a molten or partially molten state). The complex pattern of distribution of the units is a result of isoclinal folding and refolding, further complicated by regional over-thrust faulting. Most of the metamorphic rocks are foliated, cleaved or layered, with platy minerals such as mica and chlorite so oriented that the rocks split most readily in the direction of principal foliation, cleavage or layering. Joints are abundant and oriented parallel, perpendicular, and at angles to the foliation, and commonly dip steeply. Fresh hard metamorphic bedrock outcrops are chiefly restricted to stream valleys, although some ledges of unusually resistant units (H - K) crop out on uplands; however, most of the rolling interstream uplands (on units A, B, C, D, and F) are mantled by a blanket of decayed rock (saprolite) as much as 140 feet (50 m) thick, with a few feet (1-2 m) of residual soil at the surface.

Both metamorphic and sedimentary bedrock are locally cut by diabase (unit J), a dark-colored crystalline igneous rock that occurs as dikes (narrow elongate bodies with nearly vertical walls) or much larger spoon-shaped, tabular intrusive bodies. A zone of hard, brittle hornfels (unit E) as much as a half-mile wide surrounds the larger diabase bodies. It was formed by thermal metamorphism of former sedimentary rocks that were intruded by the adjacent diabase.

Possible Uses of the Map

The map can be used to delineate areas of rock with similar physical properties, such as those described in Table 1. It can be used in conjunction with the Mineral Resources map (Froelich, 1976) to delineate the general distribution of bedrock types formerly quarried in the County. It can be used with the Thickness of Overburden map (in prep.) and the Mineral Resources map to define shallow favorable bedrock areas that pose few constraints to siting new quarries. The map can be used with the Drainage Basin map (Mohler, 1977) to calculate the surface area of selected rock types in any basin. The map can be used with the soils survey (Porter and others, 1963) and the Surface Materials map (in prep.) to delineate areas of similar saprolite; such areas should show comparable rates of infiltration, percolation, absorption, and shrink-swell potential in areas of similar topography.

Sources of geologic data used to compile this map appear in the list of selected references, but most of the Piedmont data are based on recent geologic mapping (Drake, A. A., in prep.). Table 1 lists geologic names, selected characteristics and engineering properties of the major rock types. More detailed engineering aspects are treated specifically in the relevant references.

SCALE 1:48 000

1 0 1 2 3 4 5 6 KILOMETERS

1 0 1 2 3 MILES

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

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EXPLANATION

Predominant consolidated rock types, in order of increasing hardness and decreasing ease of excavation and rippability. Main rock name in upper case letters; b - bedded rocks; f - foliated rocks; l - layered rocks; m - massive rocks.

MAP UNITS

SEDIMENTARY ROCKS

S1 — b — SILTSTONE, shale, and sandstone - Interbedded, red to brown, ferruginous, micaceous, commonly calcareous; siltstone, red to purplish-brown, feldspathic; shale, dark red, fissile, silty, locally green gray; minor thin beds of light gray to red brown arkosic sandstone. Unit is jointed, readily eroded, forms gently rolling lowlands mantled by thin residuum and soil except where fresh rock exposed on road cuts or steep-sided streams; as much as 3500 ft (1000 m) thick.

S2 — b — SANDSTONE and siltstone - Interbedded gray, pink and reddish-brown arkosic, micaceous sandstone and purplish-brown sandy siltstone; minor amounts of silty, sandy shale and quartz pebble conglomerate; unit is jointed but mostly resistant to erosion, forming gently rolling uplands and steep bluffs locally; residuum and soil are thin and sandy; as much as 4000 ft (1200 m) thick.

S3 — b-m — CONGLOMERATE, sandstone and siltstone - pebble, cobble and boulder conglomerate and angular rock fragments in friable poorly sorted silty sand matrix interbedded with arkosic coarse to fine-grained red brown arkosic sand and purplish-brown sandy siltstone. Coarse fragments mainly quartz, quartzite and schist; unit as much as 600 ft (180 m) thick but locally absent.

CRYSTALLINE ROCKS

A — f-b — PHYLLITE, metasiltstone and slate - light to dark grey, lustrous, sericitic, quartzose and feldspathic; commonly cut by veinlets of quartz; with at least one prominent cleavage or foliation; low metamorphic grade. Phyllite partly schistose with fine mica and chlorite imparting surface sheen to folia; interbedded with metasiltstone that commonly shows graded bedding, and both are isoclinally folded. Slate is dark gray, in part carbonaceous with graded beds of quartzose siltstone and sandstone; limited to southeast part of county. Unit contains considerable amounts of altered volcanic tuff; joints common parallel to cleavage and foliation and irregular cross joints and fan joints common at fold culminations. Phyllite and metasiltstone weather to saprolite of irregular thickness on which is developed a thin channery soil with abundant angular rock chips; slate commonly overlain by very thin, clay-rich saprolite and soil. Unit forms irregular rolling uplands.

B — f — SCHIST, metagraywacke, gneiss, phyllite and phyllonite - The schist is commonly a foliated silvery gray pelitic rock consisting mostly of aligned plates of mica and chlorite, with abundant fine quartz and feldspar grains and accessory minerals such as garnet, sillimanite, staurolite, andalusite and kyanite. The change from garnet to andalusite reflects increasing metamorphic grade from west to east across the county; however, in many areas high grade rocks have been retrograded. The schist is rhythmically interbedded with more quartzose units of coarser grain size. Multiple cross-cutting foliations are the dominant planar elements, and the unit has been intensely refolded and faulted. The faulted rocks are commonly recrystallized and healed; jointing is irregular and locally intense at the apex of folds, and small scale sheared zones are common at contacts between rock units of contrasting competency and at the crest of tight folds. The unit weathers to a thick micaceous saprolite and soil; it forms rolling uplands and steep walled valleys.

C — f-l-b — METAGRAYWACKE, interbedded with quartzite, schist, and granofels - The metagraywacke is light to medium gray, fine to medium-grained quartzo-feldspathic rock that in part is well bedded, graded and laminated. Unit commonly has at least two foliations, is isoclinally folded, and prominently jointed. Unit weathers to moderately thick silty sandy saprolite and soil and forms rolling uplands, ridges and steep bluffs.

D — layered to nearly massive gray rock composed mainly of quartz, feldspar, mica and chlorite; it is characterized by the presence of a variety of exotic rock fragments ranging in size from sand to giant blocks. The unit commonly has two steeply inclined foliations, is locally faulted and sheared, and is prominently jointed, with steeply dipping intersecting sets spaced 1 feet (1 m) or more apart. It commonly weathers to thick, silty saprolite with thick micaceous silty soils on rolling uplands; locally, fresh nearly massive gneiss pinnacles jut through the soil cover.

E — b-l — HORNFELS - The hornfels is a unit of thermally metamorphosed Triassic sedimentary rocks surrounding diabase intrusive bodies. Original red-brown siltstones and shales are bleached to various shades of light gray, commonly spotted, and baked to great toughness with new minerals such as epidote, cordierite and metallic minerals. Bedding is moderately well preserved, and intersecting joints and fractures commonly break the rock into polygonal blocks and platy fragments. Residual overburden is generally thin, soils are thin and gravelly, and the unit commonly forms uplands topographically higher than the adjacent diabase.

F — m-l — GRANITOID ROCKS, gneissic granite, adamellite, granodiorite, quartz diorite, tonalite, aplite, alaskite, pegmatite, - Granitoid rocks are banded to massive, fine, medium and coarse crystalline rocsalcs composed mainly of quartz, feldspar and mica. - Rock contains abundant inclusions especially near intrusive contacts with other rocks and in most areas has two foliations. In some of the border areas the granitoid rock is crushed and intensely foliated. Intersecting joint sets are prominent and commonly split the rock into large polygonal blocks meters across. Granitoid rocks form gently rolling uplands and steep sided valleys with uplands weathered to thick, well drained silty and sandy saprolite capped by thick soils.

G — m-f — MAFIC ROCKS, amphibolite, gabbro, chloritic green-schist, greenstone, lamprophyre, etc. Mafic rocks form a complex sequence (associated with ultramafic rocks) which includes massive, layered and schistose rocks rich in magnesium and iron and low in feldspar and quartz. Joints are closely spaced, intersecting and dip steeply. Unit G generally forms irregular upland topography with weathered bedrock near the surface, thin to moderately thick saprolite, and shallow, clay-rich, poorly drained soils.

H — uf — ULTRAMAFIC ROCKS, serpentinite, talc-chlorite schist, chlorite-amphibole-epidote schist. Dominantly massive to foliated serpentinite, a dark green dense rock usually formed by hydraus alteration of crystalline rocks rich in magnesium and iron. Whereas the interior core of the larger bodies is layered or nearly massive, hard and tough, the borders of the larger bodies and most of the thin elongate bodies are polyfoliated and sheared and broken by intersecting zones of weak, friable, slippery material. Intersecting joint and fracture systems are common and break the unit into blocks less than 3 feet (1 m) in diameter. Unit H forms rocky uplands with very thin saprolite and shallow, clay-rich, poorly drained soils.

J — m — DIABASE - Intrusive linear dikes and sill-like bodies; hard, dense, dark gray to black, interlocking crystalline mosaic of feldspar and pyroxene. Unit is massive to blocky; prominently jointed with 3 to 10 feet (1-3 m) spacing. Overlain by reddish to yellowish brown and gray clay-rich residuum as much as 35 feet thick (10 m), connonly surrounding spheroidally weathered core stones of fresh rock. Unit forms irregular upland topography, locally of lower relief than adjacent hornfels baked zone.

K — m — QUARTZ BODIES, veins, dikes and pods - Quartz is a white, very hard, brittle mineral that fills fractures in the softer schist, gneiss, phyllite or granite. Some quartz masses are shattered by fractures, whereas others are massive bodies with widely spaced joints. Quartz does not weather readily, and fresh blocks commonly occur at the surface in the cores of linear hills and ridges.

SYMBOLS

CONTACT BETWEEN ROCK UNITS, APPROXIMATELY LOCATED—Dashed where gradational or inferred

TREND OF FAULT, FRACTURE, OR LINEAMENT, APPROXIMATELY LOCATED—Dashed where concealed or inferred

DIRECTION (STRIKE) AND INCLINATION (DIP) OF BEDDING IN SEDIMENTARY ROCKS

STRIKE AND DIP OF DOMINANT FOLIATION
Inclined
Vertical

STRIKE AND DIP OF JOINTS (PLANAR CRACKS OR PARTINGS)
Inclined
Vertical

TABLE 1 - SELECTED PROPERTIES OF ROCK UNITS IN FAIRFAX COUNTY, VIRGINIA

(Based in part on tables in John D. Fehr (unpublished geologic, hydrologic and engineering conditions in Fairfax County, Virginia, Northeastern, D.C. to Boston, Massachusetts: Bedrock Geology, 1967, U.S. Geol. Survey Misc. Geol. Inv. Map I-514-A)

Map Unit and Rock Type	Principal Rock Types and Their Characteristics (Composition, Color, Structure, Hardness of Component Rocks)	Structure and Planar Elements (Strike/Dip)	Residual Soil Material	Maximum Dry Density, lbs/ft³	Relative Infiltration[1]	Unconfined Compressive Strength[2]	Slope[3] Stability	Tunnel Excavation Characteristics[4] Overbreak[5]	Rock Load[6]	Surface Excavation[7]	Remarks
SILTSTONE S1	Siltstone, shale & sandstone (Triassic Lowland Deposits, Bull Run Shale, Bull Run Siltstone (S1,SM? f-l)	Beds 1 to medium-bedded, 3 in. to 3 ft. (8 cm to 1 m) thick; with cross-bedding, ripple marks, mud cracks, load casts, beds of siltstone and shale.	0-10' (0-3 m) Clayey silt, Clayey gravel (GC, SC)	150-160	6-7	Very low to low	Very low to low				Stable map slopes in dry, broken-earth; bedding controls overall topography. Dip between 5 and 25 degrees to west. Joints control steep slopes. Partings and fissility control gentle slopes.
SANDSTONE S2	Sandstone (Triassic Lowland Deposits, Balls Bluff Siltstone (SM f-l) and siltstone (SM f-l) Manassas Sandstone (SW f-l) Arcola Mbr. (SCH f-l)	Beds 1 to medium-bedded (3 in. to 3 ft.) (8 cm to 1 m) with cross-bedding (planar, lenticular), ripple marks, mud cracks, load casts, beds of siltstone and shale.	0-10' (0-3 m) Clayey silt, Clayey gravel (GC, SC)	130-145	5-6	Medium to high	Low	Probable slight to moderate, depending on orientation of joints in relation to direction of sloping beds.	Large differences in physical properties between interbedded sandstone and siltstone and sandstone because cementing has varying amounts.	Moderate, may require blasting.	Complementary map subunit to S1. Dip usually gentler and map pattern considerably wider; especially in joints and bedding plane controlled slopes. Forms ridges and cliffs. Fairly blasting rock classes. Sandstone is light gray to reddish brown, fine to coarse grained, with thin to thick beds of siltstone, quartz, Balls Bluff Siltstone, 1100 Manassas Mbr. with silica and ferruginous cement.
CONGLOMERATE S-3	Conglomerate (Gravels, sandstone and shale, pebbles, cobbles, silts), Bull Run Shale, Bull Run Siltstone Balls Bluff Siltstone Manassas Sandstone	Thinly bedded (1/2 in. to 1 ft.) (1 cm to 30 cm) with cross-bedding, lenticular, channel, ripple marks, mud cracks and other features of sedimentary deposition.	0-10' (0-3 m) Clayey silt, Clayey gravel (GC, SC) Poorly graded sand (SP)	130-150	5-6	Low to high	Low	Probable moderate to large depending on orientation of tunnel in relation to inclined bedding and amount of overbreak.	Large differences in physical properties between interbedded conglomerate beds may cause machine boring problems.	Moderate to severe; may require blasting.	Conglomerate and shale report in S1, dip is usually faulted to depth of 10-15 ft. and is highly permeable. Unit is a source of potable, unimpaired and seasonal ground water.
PHYLLITE A	Phyllite, metasiltstone, schistose phyllite, metagraywacke, slate (Peters Creek Schist, Wissahickon Schist, Piedmont Road Fm)	Foliated to fissile, locally bedded, locally schistose (1 in. to 1 ft.) (3 cm to 30 cm) thick, with cleavage and abundant planar elements. Fissile, platy, slaty cleavage (1 in. to 3 ft.) (3 cm to 1 m) thick.	0-100' (0-30 m) Clayey silt, Clayey gravel (ML, MH, GC, SC)	160-175	3-4	Very low (fissile) to low (foliated)	Low to high	Probable dependent on orientation of tunnel in relation to foliation, joints and shear zones that commonly form potential failure surfaces. Overbreak commonly large perpendicular to foliation.	Machine boring slowed by interbedded hard and soft rock. Sudden inflow of water. Softing overbreak.	Moderate to severe; requires blasting.	Cleavage and foliation planes commonly reinforced by quartz veins. Cleavage and foliation planes weather white. Young ridges and valleys topography.
SCHIST B	Schist, schist, mica schist, quartz-feldspar-mica schist, muscovite-biotite schist, biotite schist, chlorite schist, Wissahickon Schist, Piedmont Road Fm)	Metamorphic foliation is commonly inclined (dip 10 to 90 degrees) with cross-bedding, lenticular, channel, ripple marks, mud cracks and other features of sedimentary deposition. Joints commonly parallel foliation, cleavage, and bedding planes, and also oblique to foliation (cross-jointed blocks).	0-100' (0-30 m) Clayey silt, Clayey gravel (ML, MH, GC, SC) Micaceous saprolite and soil	155-170	3-4	Low to medium	Low to medium	Highly dependent on orientation of tunnel in relation to foliation, joints and shear zones. Overbreak commonly large perpendicular to foliation.	Machine boring slowed by interbedded hard and soft rock. Sudden inflow of water. Softing overbreak.	Moderate to severe; heavy blasting.	Shear zones of variable thickness and lower parts of valley sides commonly contain thick micaceous saprolite and soil. Unit is a source of potable water. Poor to fair stability on cut slopes. Foliation planes commonly weather white. Outcrops rock class and of streets of Fairfax. Commonly forms linear ridges.
METACONGLOMERATE C	Impure saprolite, metaconglomerate, metagraywacke, Wissahickon Schist, Piedmont Road Fm)	Thick to thin-bedded, commonly massive, with cross-bedding, load bedding and foliation moderate to well developed. Joints and fractures locally abundant. Foliation joints about 1 ft. (0.3 m) apart, locally closely spaced, commonly parallel to foliation. Locally sheared shear contacts with schist.	0-100' (0-30 m) Clayey silt, Clayey gravel (ML, MH, GC, SC) Micaceous thick saprolite and soil	150-170	3-5	Medium to high	High to medium	Probable dependent on orientation of tunnel in relation to foliation and shear zones. Overbreak commonly large perpendicular to foliation, since rock is fractured into blocks. Joints commonly parallel foliation, cross jointed blocks.	Machine boring slowed by interbedded hard and soft rock. Sudden inflow of water. Softing overbreak.	Difficult; requires blasting.	Massive zones may be highly sheared, possibly faulted. Foliation planes commonly weather white. Joints commonly parallel foliation. Poor to fair stability on cut slopes. Poor foundation conditions for heavy structures. Forms linear ridges.
SERPENTINITE H	Serpentinite, soapstone, massive, schistose, talc-chlorite schist, chlorite-amphibole-epidote schist, Peters Creek Schist, Wissahickon Schist, Piedmont Road Fm)	Massive to well foliated, commonly sheared and broken by intersecting zones of weak, friable, slippery material. Joints and fractures abundant. Foliation joints commonly 1 ft. (0.3 m) or more apart, locally closely spaced. Joints commonly parallel foliation, cross jointed blocks. Locally sheared shear contacts with schist.	0-100' (0-30 m) Clayey silt, Clayey gravel (ML, MH, GC, SC) Micaceous thick saprolite and soil	160-175	3-5	Medium to high	High to medium	Probable dependent on orientation of tunnel in relation to foliation and shear zones. Overbreak commonly large perpendicular to foliation, since rock is fractured into blocks. Joints commonly parallel foliation, cross jointed blocks.	Machine boring slowed by interbedded hard and soft rock. Sudden inflow of water. Softing overbreak.	Difficult; requires blasting.	Massive zones may be highly sheared, possibly faulted. Foliation planes commonly weather white. Joints commonly parallel foliation. Poor to fair stability on cut slopes. Poor foundation conditions for heavy structures. Forms linear ridges.
HORNFELS E	Hornfels, metasiltstone, metashale, metasandstone, Triassic Lowland Deposits, Bull Run Shale, Bull Run Siltstone, Manassas Sandstone, Balls Bluff Siltstone, Arcola Mbr.	Massive to faulted, rather thick-bedded (1 ft. to 3 ft.) (30 cm to 1 m) with cross-bedding, ripple marks, mud cracks, load casts, beds of siltstone and shale. Joints 1000 feet (1500 m) apart, commonly parallel foliation, locally widely spaced. Commonly with prominent joints parallel bedding, and several vertical and other intersecting sets closely spaced.	0-100' (0-30 m) Clayey silt, Clayey gravel (ML, MH, GC, SC) Micaceous saprolite and soil	160-175	2-5	Medium to very high	Low to medium	Probable slight to moderate, depending on orientation of tunnel in relation to foliation and shear zones. Overbreak commonly large perpendicular to foliation.	Machine boring slowed by interbedded hard and soft rock. Sudden inflow of water. Softing overbreak.	Moderate to difficult; requires blasting.	Rock locally in high state of compression; pushing and squeezing ground noted. Very high inflow rates into underground openings. Open joints and fractures filled with saltpetre, carbonate, silicate and hornfels.
DIABASE J	Fine-grained, intermediate and coarse-grained, dark-gray to black, crystalline igneous rock (Gabbro, Diabase)	Massive to jointed, commonly with columnar jointing, locally with platy jointing (1 in. to 3 ft.) (3 cm to 1 m) plates. Also blocky, spheroidal weathering. Joints usually not closely spaced, usually slightly jointed	0-35' (0-10 m) Clayey silt, Clayey gravel (ML, MH, GC, SC) Micaceous clayey saprolite and soil	165-175	2-5	Moderately high to very high	Low to high	Commonly high to unusual overbreak depending on intensity and orientation of joints in relation to direction of excavation; decreasing in the whole rock is massive.	Possibility of high rates of inflow and spalling at depth. Machine boring slowed by hard rock. Can cause large amount of overbreak.	Moderately difficult; requires blasting.	Moderately difficult to work, commonly absolute, usually discolored. Moderately weathered. Commonly forms nearly flat upland surfaces.
GRANITOID ROCKS F	Granitic, adamellitic, granodioritic, and quartz diorite gneiss, tonalite, trondhjemite, alaskite, aplite, pegmatite, quartzite, quartz veins	Massive to faulted, rather thick-bedded (1 ft. to 3 ft.) (30 cm to 1 m) with cross-bedding, ripple marks, mud cracks, load casts, beds of siltstone and shale. Joints 1000 feet (1500 m) apart, commonly parallel foliation, locally widely spaced. Commonly with prominent joints parallel bedding, and several vertical and other intersecting sets closely spaced.	0-100' (0-30 m) Clayey silt, Clayey gravel (ML, MH, GC, SC) Micaceous clayey saprolite and soil	160-175	2-5	Medium to very high	Low to medium	Probable slight to moderate, depending on orientation of tunnel in relation to foliation and shear zones. Overbreak commonly large perpendicular to foliation, since rock is fractured into blocks. Joints commonly parallel foliation, cross jointed blocks.	Machine boring slowed by interbedded hard and soft rock. Sudden inflow of water. Softing overbreak.	Moderate to difficult; requires blasting.	Rock locally in high state of compression; pushing and squeezing ground noted. Very high inflow rates into underground openings. Open joints and fractures filled with saltpetre, carbonate, silicate and hornfels.
GRAB C	Gray gabbro, metagabbro and related rocks, commonly with chloritic and epidotic alteration (Peters Creek Schist, Wissahickon Schist, Piedmont Road Fm)	Massive to banded and well-foliated, commonly with cross-bedding, ripple marks, mud cracks, load casts, beds of siltstone and shale. Joints 1000 feet (1500 m) apart, commonly parallel foliation, locally widely spaced. Commonly with prominent joints parallel bedding, and several vertical and other intersecting sets closely spaced.	0-100' (0-30 m) Clayey silt, Clayey gravel (ML, MH, GC, SC) Micaceous clayey saprolite and soil	165-175	2-5	Medium to very high	Low to medium	Probable slight to moderate, depending on orientation of tunnel in relation to foliation and shear zones. Overbreak commonly large perpendicular to foliation, since rock is fractured into blocks. Joints commonly parallel foliation, cross jointed blocks.	Machine boring slowed by interbedded hard and soft rock. Sudden inflow of water. Softing overbreak.	Moderate to difficult; requires blasting.	Rock locally in high state of compression; pushing and squeezing ground noted. Very high inflow rates into underground openings. Open joints and fractures filled with saltpetre, carbonate, silicate and hornfels.
GRANITOID ROCKS F	Granitic, adamellitic, granodioritic, and quartz diorite gneiss, tonalite, trondhjemite, alaskite, aplite, pegmatite, quartzite, quartz veins	Massive to faulted, rather thick-bedded (1 ft. to 3 ft.) (30 cm to 1 m) with cross-bedding, ripple marks, mud cracks, load casts, beds of siltstone and shale. Joints 1000 feet (1500 m) apart, commonly parallel foliation, locally widely spaced. Commonly with prominent joints parallel bedding, and several vertical and other intersecting sets closely spaced.	0-100' (0-30 m) Clayey silt, Clayey gravel (ML, MH, GC, SC) Micaceous clayey saprolite and soil	160-175	2-5	Medium to very high	Low to medium	Probable slight to moderate, depending on orientation of tunnel in relation to foliation and shear zones. Overbreak commonly large perpendicular to foliation, since rock is fractured into blocks. Joints commonly parallel foliation, cross jointed blocks.	Machine boring slowed by interbedded hard and soft rock. Sudden inflow of water. Softing overbreak.	Moderate to difficult; requires blasting.	Rock locally in high state of compression; pushing and squeezing ground noted. Very high inflow rates into underground openings. Open joints and fractures filled with saltpetre, carbonate, silicate and hornfels.
ULTRAMAFIC ROCKS H	Serpentinite (peridotite, soapstone, talc-chlorite schist, gabbro, etc.	Massive to locally foliated, commonly sheared and broken by intersecting zones of weak, friable, slippery material. Joints and fractures abundant. Foliation joints commonly 1 ft. (0.3 m) or more apart, locally closely spaced. Joints commonly parallel foliation, cross jointed blocks. Locally sheared shear contacts with schist.	0-10' (0-3 m) Clayey silt, Clayey gravel (ML, MH, GC, SC) Micaceous clayey saprolite and soil	170-185	2-5	Very low (sheared) to very high (massive)	Very low (sheared) to very high	Moderate to large depending on orientation of tunnel in relation to foliation and to intensity of joints; presence of sheared zones may be disrupting to the whole machine.	Machine boring slowed by interbedded hard and soft rock. Sudden inflow of water. Softing overbreak.	Difficult; requires blasting.	Exceedingly difficult to work. Swelling and squeezing ground noted at shear zones. May act as barrier to ground water and results diffusion of water. Shear zones may be source of water. Joints and fractures filled with saltpetre, carbonate, silicate and hornfels or locally weathered. Commonly forms linear ridges.
DIABASE J	Intrusive igneous dikes and sill-like bodies; hard, dense, dark gray to black, interlocking crystalline mosaic of feldspar and pyroxene. Locally porphyritic, with large crystals of pyroxene, quartz.	Massive to blocky; dikes, commonly prominently jointed with 3 to 10 feet (1-3 m) spacing. Overlain by reddish to yellowish brown and gray clay-rich residuum as much as 35 feet thick (10 m), commonly surrounding spheroidally weathered core stones of fresh rock.	0-35' (0-10 m) Clayey silt, Clayey gravel (ML, MH, GC, SC) Micaceous clayey saprolite and soil	165-180	2-5	Medium to very high	High	Probably moderate to large depending on orientation of joints, fractures and shear zones in relation to direction of excavation; decreasing in massive rock.	Machine boring slowed by massive rock and tight rock. Rock bolts commonly shattered and sloughed when bolts driven. Can cause large amount of overbreak.	Difficult; requires blasting.	Rock locally in high states of stress. Fresh rock and sheared zones may be source of water. Commonly forms linear ridges. Exceedingly difficult to work. Swelling and squeezing ground noted at shear zones.
QUARTZ BODIES K	Quartz veins, dikes, pods	Massive and shattered by fracture and by foliation	0-2' (0-.6m) Clayey silt, Clayey gravel (ML, MH, GC, SC)	N/A	1-2	Very low to low	Very low to low	Loosely held in shattered zones	Loose when rock bolts and bursting machine may be difficult to control.	Difficult; requires blasting.	Exceedingly difficult (0-10 ft) work where not shattered by fracture. Undermined - as much as 25 ft. min. Commonly forms linear ridges.

[1] Infiltration Rate: Very High — 10 inches per hour; High — 5 to 10 inches per hour; Moderate — 2.5 to 5 inches per hour; Low — 1 to 2.5 inches per hour; Very Low — less than 1 inch per hour.

Common conditions: Dry — soil contains less than 3% moisture; Moist — soil contains 3 to 10% moisture; Wet — soil contains more than 10% moisture.

[2] Unconfined Compressive Strength (psi): Very High — 40,000 to 80,000; High — 20,000 to 40,000; Medium — 10,000 to 20,000; Low — 5,000 to 10,000; Very Low — 1,000 to 5,000.

Common conditions: Dry — soil contains less than 3% moisture; Moist — soil contains 3 to 10% moisture; Wet — soil contains more than 10% moisture.

[3] Slope Stability: Range of Stable Gradients of Foundation Soils: Very High — 45 to 90°; High — 30 to 45°; Medium — 20 to 30°; Low — 10 to 20°; Very Low — 0 to 10°.

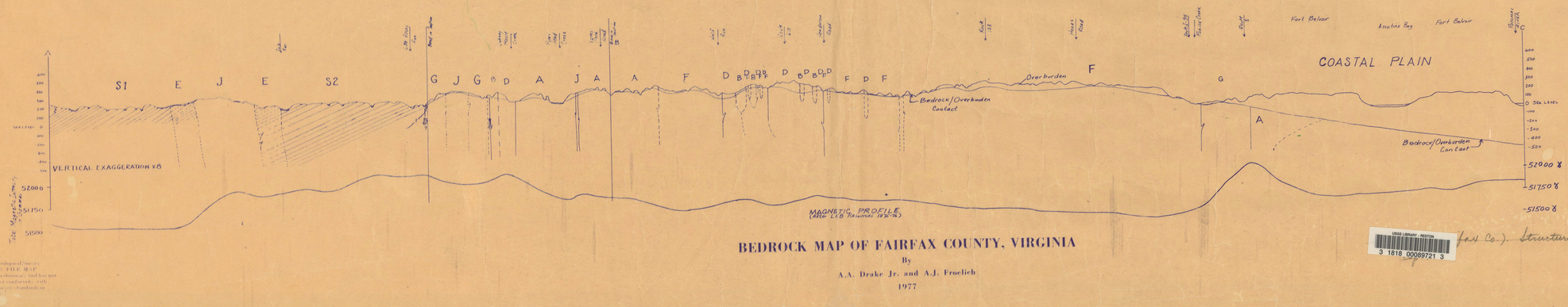
[4] Tunnel Excavation Characteristics:

[5] Overbreak — In tunnelling, excess quantity of rock already excavated beyond settlement previously fixed for the supports or the finished permanent tunnel lining.

[6] Rock Load — In tunnelling, the rock mass which tends to drop out of the roof, requiring temporary support.

[7] Excavation Characteristics — Where practically, should not remove rock units requiring blasting in similar manner as encountered in Washington, D.C. area Marine Terrace Units T1, T2, T3, T4 and T5 and Piedmont Residuum (Fehr, 1967, Table 1).

U.S. Geological Survey
OPEN FILE MAP
This report is preliminary and has not been edited for conformity with Geological Survey standards or nomenclature.



BEDROCK MAP OF FAIRFAX COUNTY, VIRGINIA

By

A.A. Drake Jr. and A.J. Froelich

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