

DELAWARE GEOLOGICAL SURVEY
Robert R. Jordan, State Geologist

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DATA REPORT ON ROCK CORES FROM RED MILL ROAD, HARMONY
ROAD, PRICES CORNER, AND NEWPORT, DELAWARE

by

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INTRODUCTION

The Delaware Piedmont is underlain by metamorphosed sedimentary and igneous rocks of Middle Proterozoic to Paleozoic age. The rocks have been studied for many years, but because of poor exposure, high-grade metamorphism, and intense deformation, it has been difficult to identify units, understand their stratigraphic relationships to one another, and determine their origin and history; however, northern Delaware occupies a critical position in the central Appalachian Piedmont, and understanding its geology is key to understanding the geology of this region.

Existing geologic maps of the Delaware Piedmont were compiled by Woodruff and Thompson (1972, 1975). A new mapping project of the Delaware Piedmont that will incorporate new data acquired since the 1970s is now in progress. This data report is the result of work on 54 rock cores housed in the DGS Core and Sample Library. The cores are from engineering test borings taken by the Delaware Department of Transportation (DelDOT) for road construction projects.

The cores chosen for study are from four sites in the Wilmington Complex, a unit identified by Ward (1957). At most coring sites, saprolite and a thin cover of Coastal Plain sediments overlie the crystalline rocks. The data are presented for lithologic description only and will be used in identifying mappable lithologic units within the Delaware Piedmont.

This report organizes the geologic information obtained from these cores to make it easily accessible. Because of the rapid population growth in the city of Wilmington and its suburbs, there is continuously less access to rocks in the field. We expect that the DGS Core Library will become increasingly important as a repository for information on Delaware's crystalline bedrock.

DATA COLLECTION METHODS

Interpretation of Coastal Plain Units

Where available, drillers' log data were obtained from DelDOT for each site and are identified by boring contract numbers and years given in Table 1. Red Mill Road is the only site without log data. The drillers' log data were interpreted to distinguish between fill, alluvium, Columbia Formation, Potomac Formation, and saprolite. Other DGS well control was used to identify and trace the Columbia and Potomac formations in the subsurface to each site. These units, although not cored, are shown on the lithologic diagrams.

Table 1. DelDOT project contract number and date.

SITE NAME	DeIDOT BORING CONTRACT NUMBER	YEAR OF PROJECT
Harmony Road	69-08-002	1969
Prices Corner	70-02-008	1970
Newport/Rt 141	71-02-007	1971

Explanation of Figures, Lithologic Diagrams, and Tables

Figure 1 shows the locations of the core sites. Figures 2, 4, 7, and 9 give core locations at each site. The figures following each site map are lithologic diagrams showing Coastal Plain units and Piedmont lithologies identified by a color or pattern. The diagrams are schematic and horizontal distances are not to scale. Piedmont lithologies were described from thin sections taken from the rock cores. Samples taken for thin section are indicated by a DGS sample number. Where there are two thin sections taken from the same core, the sample numbers are supplemented with the borehole depth of the sample because DGS sample numbers are for the entire length of core. Petrographic data sheets are taken from the DGS thin section data base and are included after each lithologic diagram. Table 2 summarizes petrographic data obtained from the various Piedmont lithologies.

Explanation of Petrographic Data Sheets

The DGSID is the DGS identification number for the borehole. SAMPLE NO. refers to specific rock core that was sampled for thin section. The thin section bears both the DGSID and sample number for identification. QUAD refers to the U. S. Geological Survey 7.5-minute topographic quadrangle map on which the borehole is located. FIELD NO. is the local identification number and usually contains the DelDOT boring number for the borehole. DATE ENTERED is the date the thin section was described. LOCATION refers to the coring site and borehole depth of sample that was taken for thin section. Borehole depth is also converted to elevation above sea level (ASL) or below sea level (BSL). ROCK UNIT indicates the Woodruff and Thompson (1972, 1975) map unit to which these rocks are currently assigned. LITHOLOGY is defined and named by modal mineralogical composition and mesoscopic structure visible in the cores according to the scheme outlined by Blucher and Frey (1994). Point count information is given to validate modal percentages. A "Y" in the ORIENTED SEC. category indicates an oriented thin section. Similarly a "Y" in the STAINED category indicates the staining method used, if any, on the section. An "x" in the MODE (%) column indicates the presence of the mineral. General observations about the core are noted under COMMENTS. FABRIC AND TEXTURES record petrographic observations regarding crystal growth, crystal boundary relationships, and mineral orientation.

Piedmont lithologies

Metamorphic grade in these rocks is very high. The mineralogy indicates metamorphism took place at temperatures and pressures well within the upper amphibolite to granulite facies. Retrograde metamorphism is minor, and in most cases the mineral phases appear to be in equilibrium.

Biotite Gneiss

Mineralogically, the biotite gneisses are composed of plagioclase, quartz, biotite, and iron oxides. Garnet, sillimanite, and orthoclase in various combinations are also present in the samples. Accessory minerals are zircon, sphene, and apatite. Some of the plagioclase grains are antiperthitic.

Megascopically there are two varieties of biotite gneiss, (1) a coarse-grained variety with flaser texture in which the biotite defines a strong foliation, and (2) a fine-grained variety, a granofels, with small shredded grains of biotite in random arrangement. The coarse-grained variety usually contains garnet, sillimanite, and orthoclase; however, these minerals may also be present in small amounts in the fine-grained lithology. Contacts between the coarse and fine-grained phases are always sharp and may have large elongated poikiloblastic garnets concentrated along them.

Felsic Gneiss

Felsic gneisses are medium-grained, light-colored rocks containing primarily quartz and plagioclase with less than 10% biotite, hornblende, or orthopyroxene. Usually, hornblende is a dark-green variety and biotite is red-brown in transmitted light. Clinozoisite/epidote, apatite, zircon, garnet, sphene, muscovite, sillimanite, and opaques are accessories. The hornblende and biotite may be oriented to define a weak foliation, but in many of the gneisses these minerals are not aligned.

Locally, the felsic gneisses contain segregations of quartz and plagioclase with a single magnetite grain in the core. The magnetite grains range in size from 2 to 4 mm, and the plagioclase-quartz mantles range from 5 to 8 mm. Almost without exception the magnetite core is centered within the mantle and looks like an "eye," thus, segregations have often been referred to as "bright eyes."

Mafic Gneiss

There are two types of mafic gneisses, (1) fine to coarse-grained amphibolites and (2) two-pyroxene gneisses similar to those described by Ward (1959). All of the amphibolites consist of sub-equal amounts of plagioclase and hornblende with or without minor quartz. Accessory minerals are limited to clinozoisite/epidote, zircons, sphene, and opaques. The hornblende is usually aligned and defines a weak foliation; however, in the coarser-grained

Sample No.	DGSID	Bore Hole Depth in ft	Elevation ASL, BSL	Location	Pla	Qtz	Opx	Cpx	Hbl	Bio	Opa	Orth	Mic	Sil	Gar	Mus	Clz	other
MAFIC GNEISS																		
Amphibolite																		
24768	Cc13-05	66	26	Prices Corner	45	11			38		6							
24765	Cc23-12	78	1	Prices Corner	19	6	1	5	65		3						1	
24770	Cc13-07	58	66	Prices Corner	41	4		x	54		1							
24864	Cc34-45	82	-92	Newport	32	12			25									31
24860	Cc34-41	84	-82	Newport	46	3	2		47	1	1							
23327	Cb43-22	41	-3	Red Mill Road	51				49									
24880	Cb43-23	53	17	Red Mill Road	38	7		24	29		x						2	
Two Pyroxene Gneiss																		
24767	Cc23-14	85	-2	Prices Corner	59	8	9	18		1	5						x	
24880	Cb43-23	37	32	Red Mill Rd	59	4	18	13			6							
BIOTITE GNEISS																		
24774	Cc13-11	51	78	Prices Corner	24	30				36	4			x	6			
24897	Cc13-18	73	52	Prices Corner	30	37				29	x			x	4			
24772	Cc13-09	38	89	Prices Corner	45	31				20	x	4			x			x
24771	Cc13-08	49	75	Prices Corner	41	29				23	x	5		1	1			
24895	Cc13-16	45	85	Prices Corner	29	32				38	x	x		1	x			
24896	Cc13-17	66	58	Prices Corner	38	38				22	1			x	1			

Table 2. Summary of Piedmont lithologies and petrographic data.

Sample No.	DGSID	Bore Hole Depth in ft	Elevation ASL, BSL	Location	Pla	Qtz	Opx	Cpx	Hbl	Bio	Opa	Orth	Mic	Sil	Gar	Mus	Clz	other
FELSIC GNEISS																		
Orthopyroxene-bearing felsic gneiss																		
24769	Cc13-06	51	46	Prices Corner	61	23	11			1	4							
24774	Cc13-11	47	82	Prices Corner	49	26	19		x	1	5							
24864	Cc34-45	87	-97	Newport	51	37	9				3							
24872	Cc34-53	73	-57	Newport	51	43	4				2							
24865	Cc34-46	89	-99	Newport	52	45	2			x	1							
Biotite-bearing felsic gneiss																		
23333	Cb44-25	38	14	Harmony Rd	46	47				4	1				x	2		
24769	Cc13-06	78	19	Prices Corner	34	54				12	x						x	
Hornblende-bearing felsic gneiss																		
23326	Cb43-21	54	-22	Red Mill Rd	38	55			3	x	3						1	
23345	Cb44-34	20	8	Harmony Rd	54	40			2	1	2				1		x	
23336	Cb44-29	42	-13	Harmony Rd	52	29			14	1	1				3			

KEY TO ABBREVIATIONS

ASL-Above Sea Level	BSL-Below Sea Level
Pla-plagioclase	Qtz-quartz
Bio-biotite	Opa-opaques
Gar-garnet	Mus-muscovite
	Clz-clinozoisite
	Cpx-clinopyroxene
	Mic-microcline
	Sil-sillimanite
	Hbl-hornblende

Table 2. Summary of Piedmont lithologies and petrographic data (Continued).

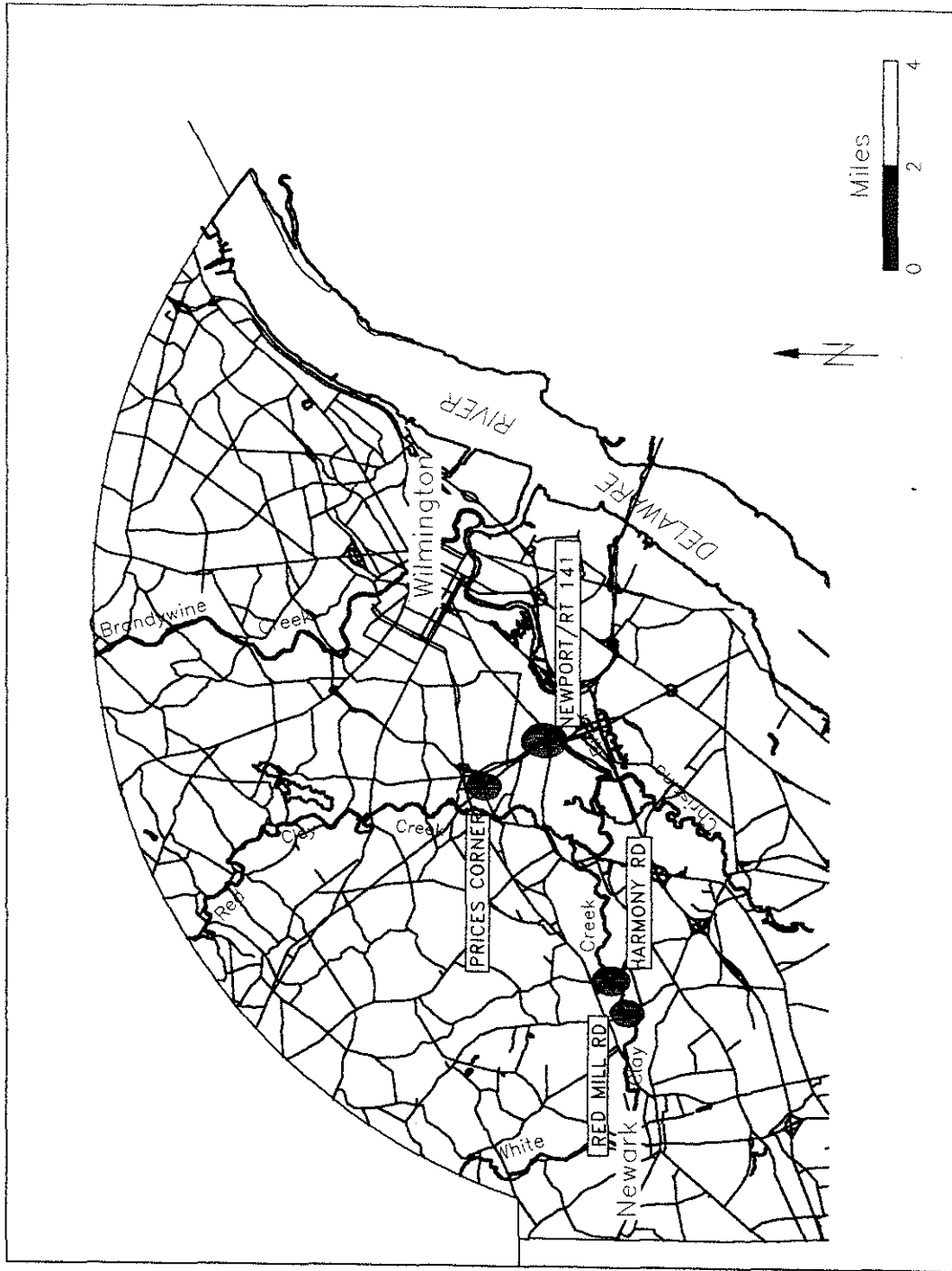


Figure 1. Map showing generalized locations of core sites.

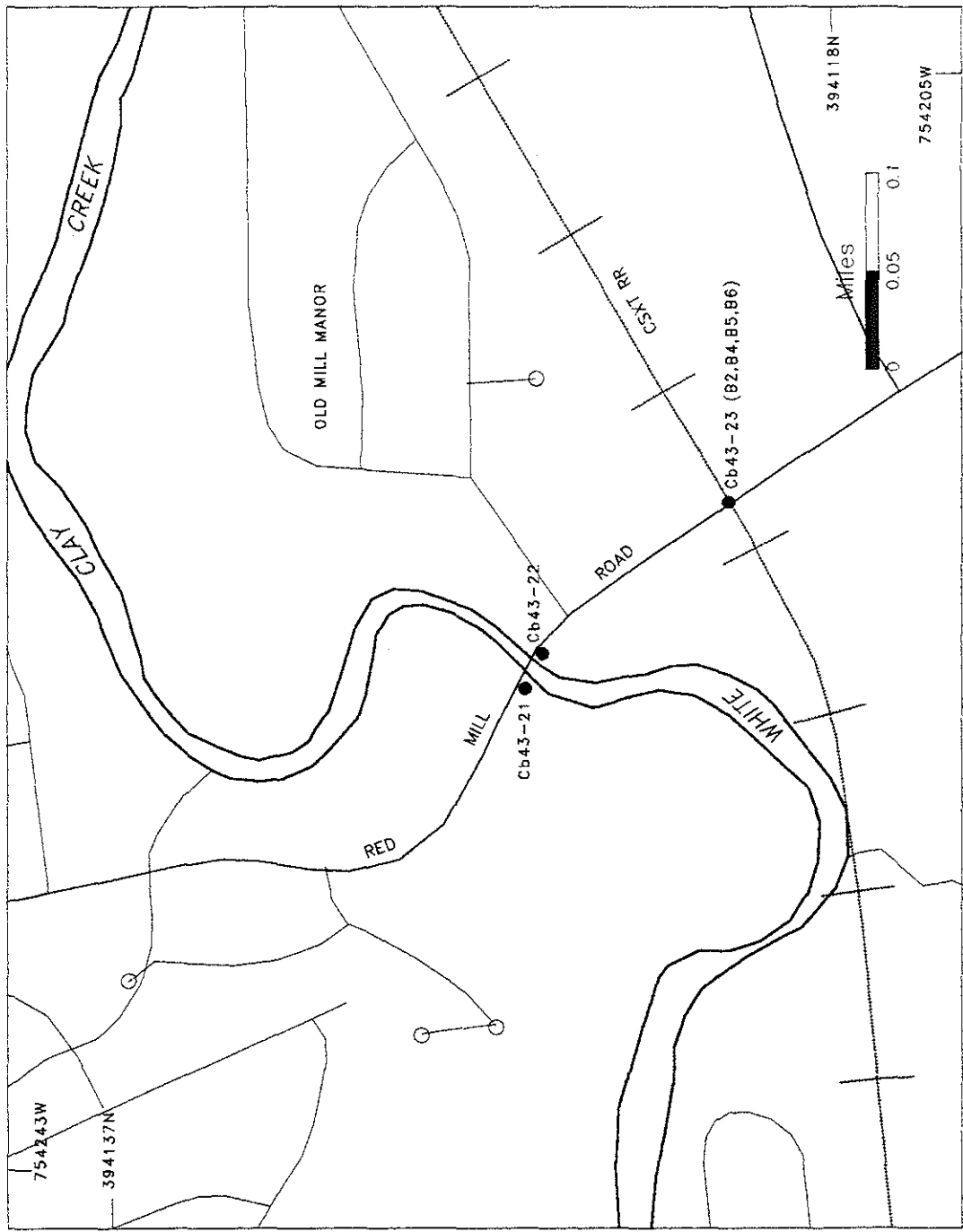
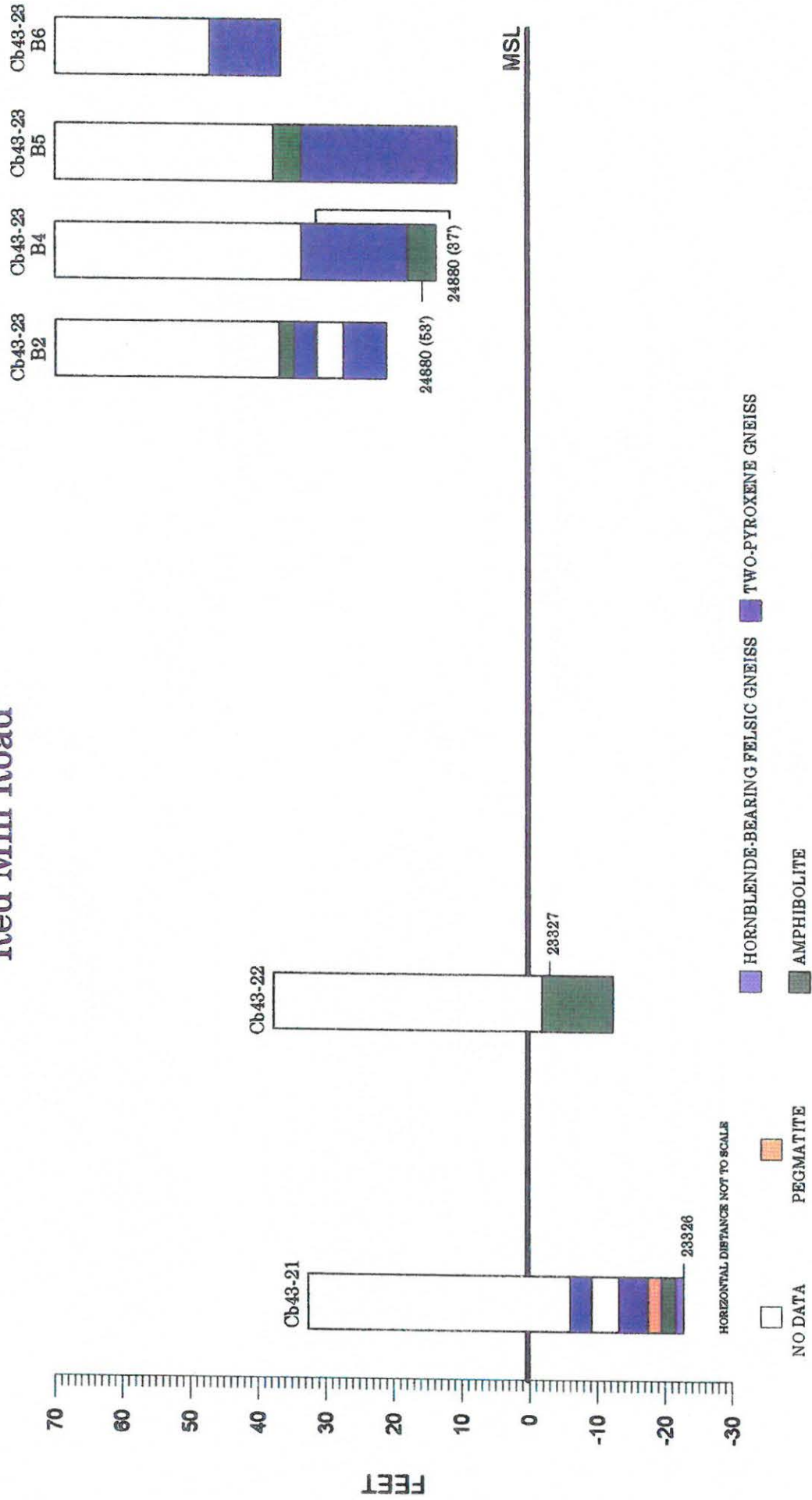


Figure 2. Red Mill Road core locations.

Red Mill Road



DGS ID: Cb43-21 SAMPLE NO.: 23326 QUAD: NEE

FIELD NO.: No.7 DATE ENTERED: 8-9-94

LOCATION: Red Mill Rd. - core, 54' (-22' BSL)

ROCK UNIT: Wilmington Complex ORIENTED SEC.:

STAINED: K-feldspar: Plagioclase: Calcite: Cordierite:

LITHOLOGY: Hornblende-bearing felsic gneiss

MAJOR MINERALS	MODE (%)	ACCESSORY MINERALS
plagioclase	38.5	apatite
quartz	54.6	zircon
opaqes	3.0	
hornblende	3.2	
clinozoisite	0.7	RETROGRADE MINERALS
biotite	x	

NUMBER OF POINTS COUNTED: 800

COMMENTS

Not much evidence for deformation, small grains, recrystallized without deformation, mostly granoblastic texture with large poikiloblastic hornblende.

Note-hornblende grains resemble poikiloblastic orthopyroxene in Wilmington Complex.

FABRIC AND TEXTURES

Plagioclase:	Anhedral (xenoblastic) grains with sharp albite twinning and some grains bear inclusions (slightly poikiloblastic)
Quartz:	Not much undulatory extinction; few subgrain boundaries anhedral (xenoblastic)
Clinozoisite:	Few high relief grains; anomalous interference colors
Hornblende:	Mafics are hornblende; large poikiloblastic grains; pleochroic in shades of green
Opagues:	Grow over plagioclase and quartz boundaries; large grains are anhedral
Biotite:	Nucleated on opagues; minor mineral, just a few grains

DGS ID: Cb43-22 SAMPLE NO.: 23327 QUAD: NEE

FIELD NO.: No. 5 DATE ENTERED: 8-9-94

LOCATION: Red Mill Rd. - core, 41' (-3' BSL)

ROCK UNIT: Wilmington Complex ORIENTED SEC.:

STAINED: K-feldspar: Plagioclase: Calcite: Cordierite:

LITHOLOGY: Amphibolite

MAJOR MINERALS	MODE (%)	ACCESSORY MINERALS
plagioclase	51.0	
hornblende	49.0	
		RETROGRADE MINERALS

NUMBER OF POINTS COUNTED: 500

COMMENTS

This rock contains no quartz or opaques. The fabric is variable, in one domain the mafics are aligned and elongated to define a weak foliation, in other domains there is no foliation. Grain size is variable.

FABRIC AND TEXTURES

Plagioclase: Equidimensional, xenoblastic, sharp twinning
Hornblende: Pale blue-green with high birefringence

DGS ID: Cb43-23 SAMPLE NO.: 24880 QUAD: NEE

FIELD NO.: B4 DATE ENTERED: 8-9-94

LOCATION: Red Mill Rd. - core, (mafic) 37' (32' ASL)

ROCK UNIT: Wilmington Complex ORIENTED SEC.:

STAINED: K-feldspar: Plagioclase: Calcite: Cordierite:

LITHOLOGY: Two-pyroxene gneiss

MAJOR MINERALS	MODE (%)	ACCESSORY MINERALS
plagioclase	59.5	zircon
quartz	3.7	apatite
orthopyroxene	18.5	sphene
clinopyroxene	12.6	
opaques	5.7	RETROGRADE MINERALS
		Retrograded to green mineral around some opaques and pyroxenes

NUMBER OF POINTS COUNTED: 600

COMMENTS

Plagioclase twinning is extremely deformed. The textures of both plagioclase and quartz grains indicate strong deformation, but no foliation.

FABRIC AND TEXTURES

Plagioclase:	Xenoblastic, odd shaped grains with partial twinning; undulatory extinction, and some inclusions
Quartz:	Undulatory extinction, small subgrain boundaries, and no inclusions (except opaques which grow over all grain boundaries)
Clinopyroxene:	Pleochroism is pale green to gray; intergrown with xenoblastic orthopyroxenes
Orthopyroxene:	Pleochroism is light green to pale pink; xenoblastic grains (modal count distinguished orthopyroxene and clinopyroxene by birefringence only)
OPAQUES:	Surround grains of pyroxene; grown over grain boundaries

DGS ID: Cb43-23

SAMPLE NO.: 24880

QUAD: NEE

FIELD NO.: B4

DATE ENTERED: 5/1/95

LOCATION: Red Mill Rd. - core, 53' (17' ASL)

ROCK UNIT: Wilmington Complex

ORIENTED SEC.:

STAINED: K-feldspar:

Plagioclase:

Calcite:

Cordierite:

LITHOLOGY: Amphibolite

MAJOR MINERALS

MODE (%)

ACCESSORY MINERALS

quartz

7.0

plagioclase

38.2

hornblende

29.4

clinopyroxene

23.6

clinozoisite

1.8

opaques

x

RETROGRADE MINERALS

NUMBER OF POINTS COUNTED: 500

COMMENTS

Unaligned large poikiloblastic grains of clinopyroxene and hornblende are present in a fine-grained matrix of plagioclase and quartz. All grain boundaries are sharp and clean.

FABRIC AND TEXTURES

Quartz:

Small xenoblastic grains; undulatory extinction

Plagioclase:

Small xenoblastic grains; triple junctions between plagioclase grains; deformation twinning

Hornblende:

Blue green xenoblastic grains; no elongation or orientation; weakly pleochroic blue green to light green

Clinopyroxene:

Large poikiloblastic grains with many inclusions of plagioclase hornblende and quartz; pleochroic pale green to colorless

Clinozoisite:

Long needles and blades

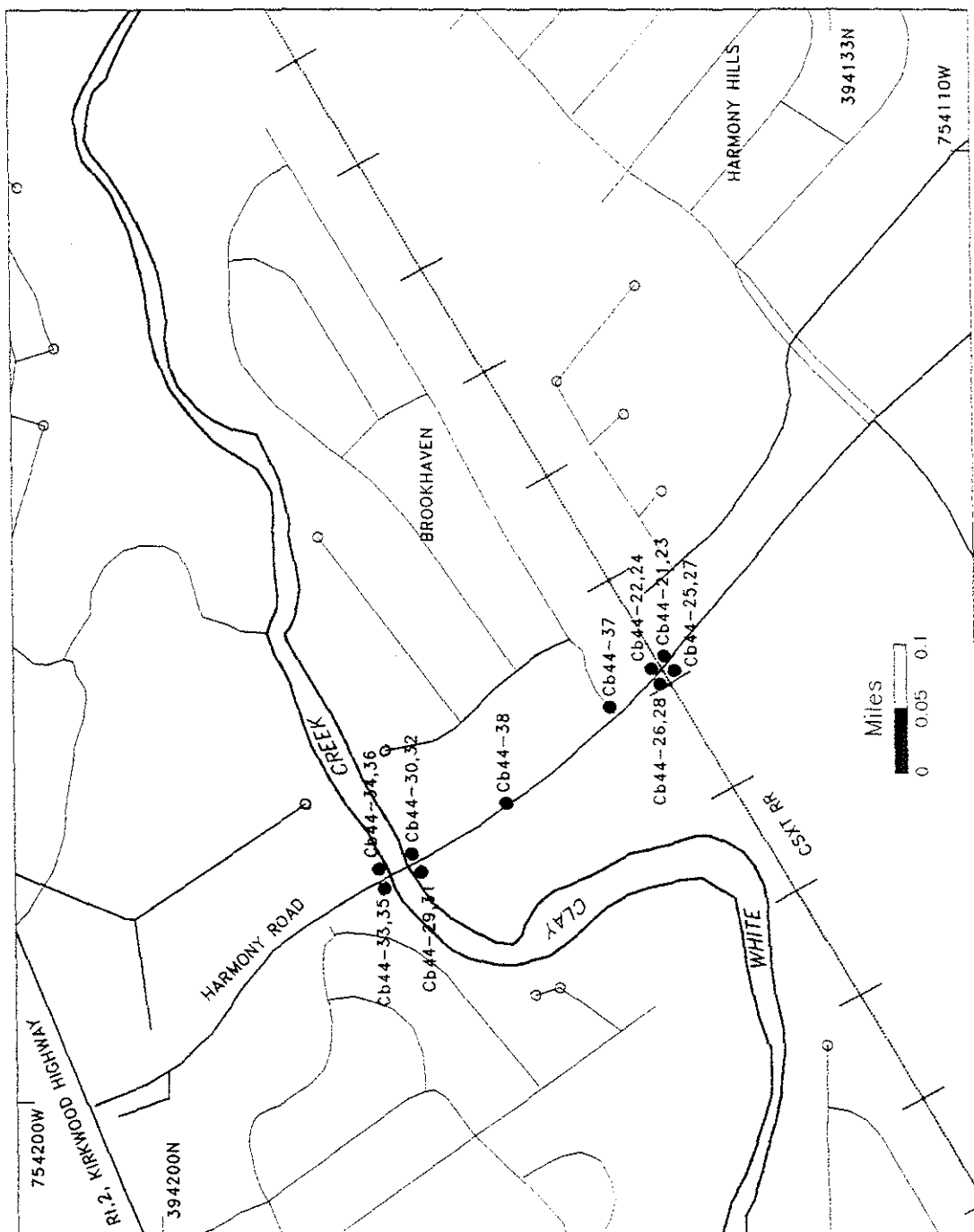


Figure 4. Harmony Road core locations.

Harmony Road Northeast

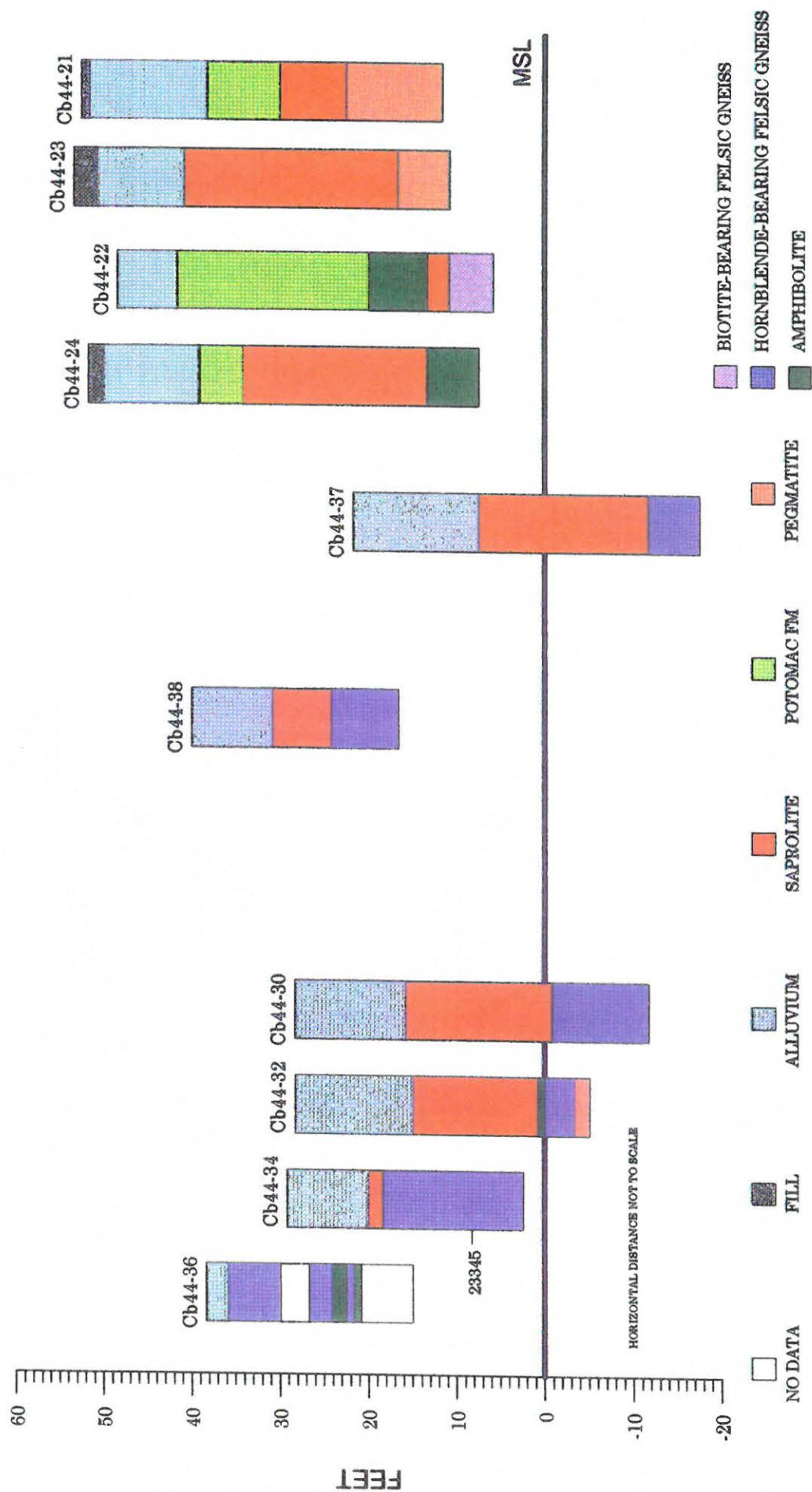


Figure 5. Harmony Road northeast lithologic diagram.

Harmony Road Southwest

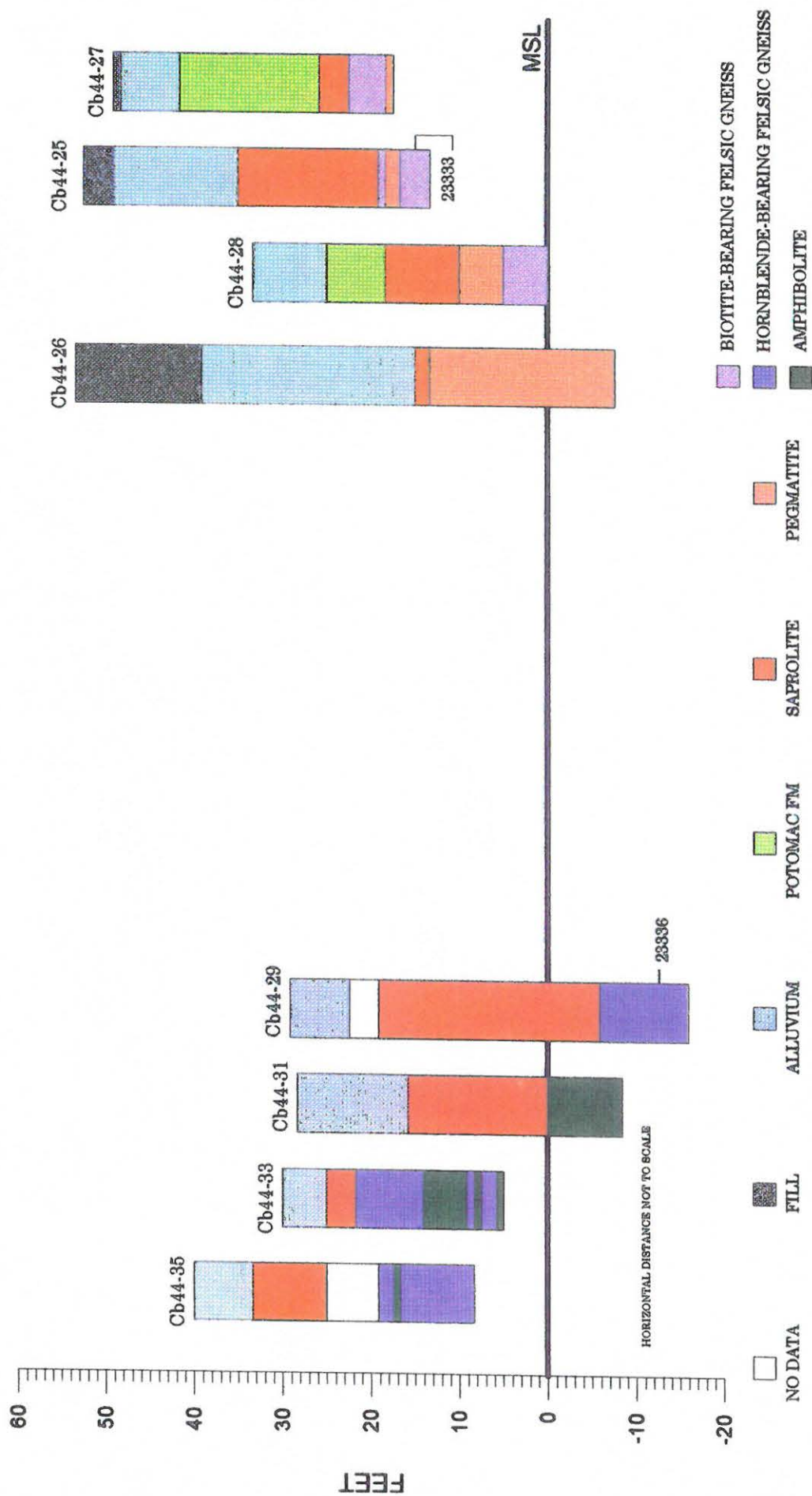


Figure 6. Harmony Road southwest lithologic diagram.

DGS ID: Cb44-25

SAMPLE NO.: 23333

QUAD: NEE

FIELD NO.: B-2-5

DATE ENTERED: 8-7-94

LOCATION: Harmony Rd. - core, 38' (14' ASL)

ROCK UNIT: Wilmington Complex

ORIENTED SEC.:

STAINED: K-feldspar:

Plagioclase:

Calcite:

Cordierite:

LITHOLOGY: Biotite-bearing felsic gneiss

MAJOR MINERALS

MODE (%)

ACCESSORY MINERALS

plagioclase

46.6

zircon

quartz

46.7

biotite

3.6

muscovite

2.1

opaques

1.0

garnet

x

RETROGRADE MINERALS

Some deuteric alteration of plagioclase; one grain of hornblende-green pleochroism, with biotite

NUMBER OF POINTS COUNTED: 700

COMMENTS

Medium grain size, heteroblastic, very weak foliation defined by biotite.

FABRIC AND TEXTURES

Plagioclase: Anhedral (xenoblastic) shapes, with irregular boundaries and weak partial twinning; some large poikiloblastic grains

Quartz: Subgrain boundaries; undulatory extinction and some granulation along grain boundaries

Hornblende: Only one grain; pleochroism in shades of green

Muscovite: Small laths intergrown with biotite

Biotite: Pleochroic dark brown to tan; alignment of laths defines a weak foliation

Opales: Large, irregular shaped grains

Garnet: Small, idioblastic to subidioblastic

DGS ID: Cb44-29 SAMPLE NO.: 23336 QUAD: NEE

FIELD NO.: B-3-1 DATE ENTERED: 8-9-94

LOCATION: Harmony Rd. - core, 42' (-13' BSL)

ROCK UNIT: Wilmington Complex ORIENTED SEC.:

STAINED: K-feldspar: Y Plagioclase: Calcite:
Cordierite:

LITHOLOGY: Hornblende-bearing felsic gneiss

MAJOR MINERALS	MODE (%)	ACCESSORY MINERALS
plagioclase	52.3	
quartz	28.5	
garnet	3.2	
hornblende	14.2	
biotite	0.5	RETROGRADE MINERALS
opaques	1.3	
		Some deuteric alteration of plagioclase: Anthophyllite

NUMBER OF POINTS COUNTED: 600

COMMENTS

A thin vein of anthophyllite runs across the slide. The mafic minerals are in elongated clumps that define a weak foliation

FABRIC AND TEXTURES

Plagioclase:	Xenoblastic; some grains are elongated parallel to the foliation; weak, partial twinning; fractured grains show deuteric alteration
Quartz:	Some undulatory extinction; grain size is variable
Garnet:	Small, rounded, subidioblastic grains with no inclusions; size varies from very small to 0.2mm
Hornblende:	Pleochroism from dark green to light brown; elongated grains are parallel to the foliation
Opagues:	Blocky grains; grow over other grain boundaries

DGS ID: Cb44-34

SAMPLE NO.: 23345

QUAD: NEE

FIELD NO.: B-3-6

DATE ENTERED: 8-9-94

LOCATION: Harmony Rd. - core, 20' (8' ASL)

ROCK UNIT: Wilmington Complex

ORIENTED SEC.:

STAINED: K-feldspar:

Plagioclase:

Calcite:

Cordierite:

LITHOLOGY: Hornblende-bearing felsic gneiss

MAJOR MINERALS

MODE (%)

ACCESSORY MINERALS

plagioclase

53.7

apatite

quartz

40.5

garnet

0.7

biotite

0.7

hornblende

2.1

RETROGRADE MINERALS

opaques

2.3

clinozoisite

x

NUMBER OF POINTS COUNTED: 800

COMMENTS

This rock is unfoliated. The grains are heteroblastic.

FABRIC AND TEXTURES

Plagioclase:

Sharply twinned, clear, xenoblastic grains

Quartz:

Undulatory extinction; xenoblastic grains with lobate boundaries; some very large quartz grains

Garnet:

Very small idioblastic grains

Hornblende:

Xenoblastic; pleochroism is dark green to light green-brown

Opakes:

Blocky grains with biotite along edges

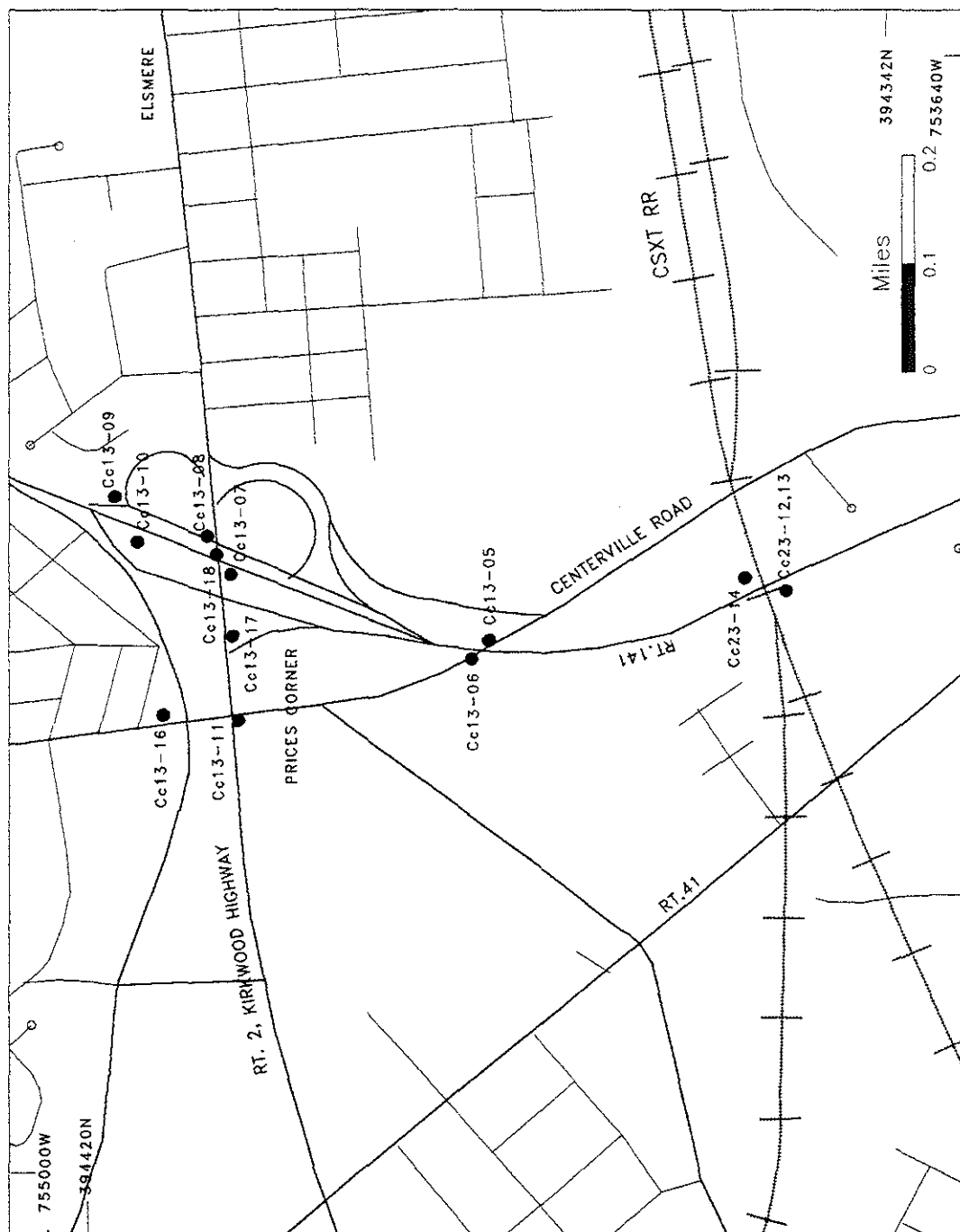


Figure 7. Prices Corner core locations.

Prices Corner Rt. 141 Interchange

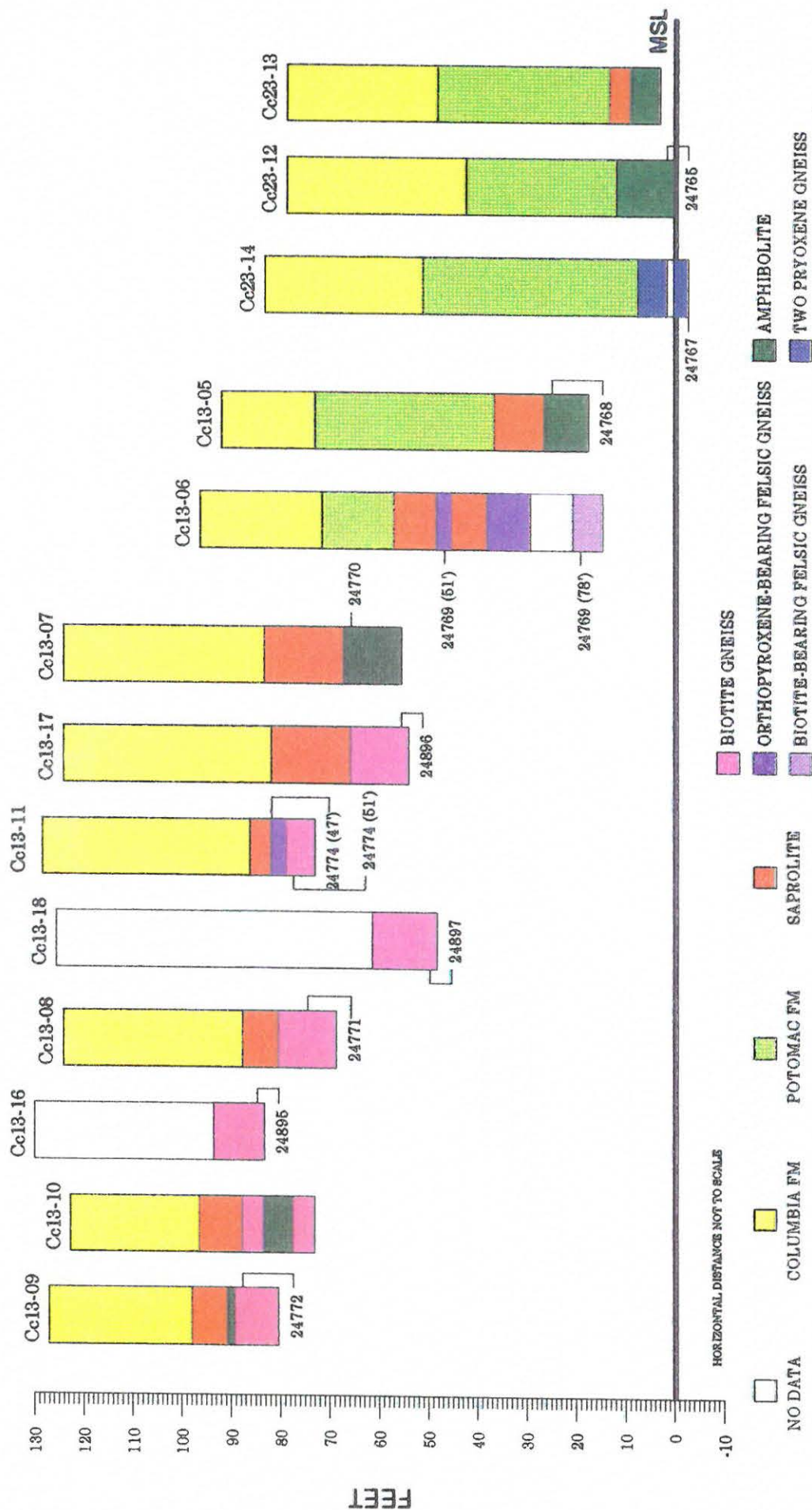


Figure 8. Prices Corner lithologic diagram.

DGS ID: Cc13-05

SAMPLE NO.: 24768

QUAD: WIS

FIELD NO.: S-6-10

DATE ENTERED: 3/3/93

LOCATION: SE of Prices Corner - core, 66' (26' ASL)

ROCK UNIT: Wilmington Complex

ORIENTED SEC.:

STAINED: K-feldspar: Y

Plagioclase:

Calcite:

Cordierite:

LITHOLOGY: Amphibolite

MAJOR MINERALS

MODE (%)

ACCESSORY MINERALS

hornblende

38.0

plagioclase

45.0

opaques

6.0

quartz

11.0

RETROGRADE MINERALS

NUMBER OF POINTS COUNTED: 300

COMMENTS

The core is composed of felsic gneiss with bright eyes and interlayered coarse and fine-grained amphibolites. This section was cut from a fine-grained amphibolite.

FABRIC AND TEXTURES

Plagioclase:

Partial twinning, mostly albite twins; xenoblastic grains

Hornblende:

Pleochroism is grey-green to pale yellow-green (pleochroism is pronounced but colors are pale) some grains contain a few round inclusions of quartz; elongated grains of hornblende define a weak foliation

Opagues:

Irregular shapes and various sizes; largest opaque grains do not grow over other grains and are surrounded by plagioclase (bright eyes?); all opaque grains look the same in reflected light; rock is not magnetic when tested with magnet

DGS ID: Cc13-06 SAMPLE NO.: 24769 QUAD: WIS

FIELD NO.: S-6-17 DATE ENTERED: 3/3/93

LOCATION: Prices Corner - core, 51' (46' ASL)

ROCK UNIT: Wilmington Complex ORIENTED SEC.:

STAINED: K-feldspar: Y Plagioclase: Calcite: Cordierite:

LITHOLOGY: Orthopyroxene-bearing felsic gneiss

MAJOR MINERALS	MODE (%)	ACCESSORY MINERALS
quartz	23.0	apatite
plagioclase	61.0	zircon
orthopyroxene	11.0	
biotite	1.0	
opaques	4.0	
		RETROGRADE MINERALS
		Minor alteration of pyroxene to pale blue-green amphibole

NUMBER OF POINTS COUNTED: 300

COMMENTS

The grain boundaries are sharp and clean. The rock is magnetic and non-foliated with a few bright eyes.

FABRIC AND TEXTURES

Plagioclase:	Equant, xenoblastic grains with partial twinning; some grains are modestly poikiloblastic with rounded inclusions; 120 degree triple junctions common
Quartz:	Prominent undulatory extinction; subgrain boundaries and minor granulation at grain boundaries
Biotite:	Pleochroism is brown to red-brown
Orthopyroxene:	Xenoblastic grains; pleochroic pink to very pale green, some square grains
Opagues:	Large grains are surrounded by plagioclase and quartz (bright eyes?); small opaques usually within pyroxene grains

DGS ID: Cc13-06

SAMPLE NO.: 24769

QUAD: WIS

FIELD NO.: S-6-17

DATE ENTERED: 3-3-93

LOCATION: Prices Corner - core, 78' (19'ASL, SE of the fall line)

ROCK UNIT: Wilmington Complex

ORIENTED SEC.:

STAINED: K-feldspar: Y

Plagioclase:

Calcite:

Cordierite:

LITHOLOGY: Biotite-bearing felsic gneiss

MAJOR MINERALS**MODE (%)****ACCESSORY MINERALS**

quartz

53.6

zircon

plagioclase

34.0

apatite

biotite

12.4

opaques

x

clinozoisite

x

RETROGRADE MINERALS

Chlorite from biotite

Anthophyllite as vein filling

NUMBER OF POINTS COUNTED: 300

COMMENTS

This weakly magnetic gneiss is interlayered with non-magnetic amphibolites. The contacts between the lithologies are sharp and dip at 45 degrees. The felsic gneiss has no lineation or foliation. A part of this thin section is severely weathered.

FABRIC AND TEXTURES

Plagioclase:	Twinning is on the albite and pericline laws; grains are fractured and in some cases the boundaries are deuterically altered to a mica or clay mineral; weathering is pronounced in one part of the slide
Quartz:	Weak undulatory extinction; large subgrains; several very large grains
Biotite:	No orientation or alignment of grains; pleochroism is light brown to red-brown; minor retrograding to chlorite slight retrograding to light green
Opaques:	All opaques are dark red in reflected light; probably hematite
Anthophyllite:	Colorless with low birefringence; occurs only as a vein filling; vein is edged with biotite

DGS ID: Cc13-07 SAMPLE NO.: 24770 QUAD: WIS

FIELD NO.: S-8-2 DATE ENTERED: 5/1/95

LOCATION: Prices Corner - core, 58' (66'ASL)

ROCK UNIT: Wilmington Complex ORIENTED SEC.:

STAINED: K-feldspar: Plagioclase: Calcite: Cordierite:

LITHOLOGY: Amphibolite

MAJOR MINERALS	MODE (%)	ACCESSORY MINERALS
quartz	3.8	apatite
plagioclase	41.2	zircon
hornblende	54.0	
clinopyroxene	0.3	RETROGRADE MINERALS
opaques	0.7	

NUMBER OF POINTS COUNTED: 500

COMMENTS

Arrangement of the grains is random. There is no preferred orientation or alignment. Hornblende grains are usually large and poikiloblastic.

FABRIC AND TEXTURES

Quartz:	Xenoblastic rounded grains; size variable; little undulatory extinction; some grains contain tiny blocky inclusions in the core
Plagioclase:	Small, xenoblastic, equant grains; some triple junctions; prominent twinning on albite and percline laws
Hornblende:	Xenoblastic; large poikiloblastic grains with round inclusions of plagioclase; pleochroic olive green to light tan; a few grains with wormy intergrowths of quartz
Clinopyroxene:	Irregular shaped poikiloblastic grains with round inclusions of plagioclase and quartz; pleochroic pale green to colorless
Opauques:	Small grains along hornblende grain boundaries

DGS ID: Cc13-08

SAMPLE NO.: 24771

QUAD: KES

FIELD NO.: S-9-11

DATE ENTERED: 10/1/92

LOCATION: Prices Corner - core, 49' (75' ASL)

ROCK UNIT: Wilmington Complex

ORIENTED SEC.:

STAINED: K-feldspar: Y

Plagioclase:

Calcite:

Cordierite:

LITHOLOGY: Biotite gneiss

MAJOR MINERALSMODE (%)ACCESSORY MINERALS

quartz

29.0

zircon/halos

plagioclase

41.0

sphene, apatite

biotite

23.0

orthoclase

5.0

sillimanite

1.0

RETROGRADE MINERALS

garnet

1.0

opaques

x

Minor retrograde of biotite to
opaques + chlorite

NUMBER OF POINTS COUNTED: 300

COMMENTS

The biotite gneiss is coarse-grained with flaser texture. The biotite laths define a strong foliation.

FABRIC AND TEXTURES

Plagioclase:	Equant xenoblastic grains; partial twinning on albite and pericline laws; several antiperthitic grains with small square patches of orthoclase clustered in center of grains.
Orthoclase:	Unfractured and untwinned xenoblastic grains
Quartz:	Undulatory extinction; lobate subgrain boundaries
Biotite:	Pleochroic brown to very dark brown; preferred orientation; biotite laths define a foliation that is folded
Sillimanite:	Bundles of sillimanite needles and blades clustered inside quartz grains
Garnet:	Lavender colored, poikiloblastic grains with large inclusions of quartz, plagioclase, and biotite; grains are highly fractured
Opques:	Irregular grains usually with biotite

DGS ID: Cc13-09 SAMPLE NO.: 24772 QUAD: KES

FIELD NO.: S-10-1 DATE ENTERED: 10/1/92

LOCATION: Prices Corner - core, 38' (89' ASL)

ROCK UNIT: Wilmington Complex ORIENTED SEC.:

STAINED: K-feldspar: Y Plagioclase: Calcite: Cordierite:

LITHOLOGY: Biotite gneiss

MAJOR MINERALS	MODE (%)	ACCESSORY MINERALS
quartz	31.0	zircon
plagioclase	45.0	sphene
biotite	20.0	apatite
orthoclase	4.0	
myrmekites	x	RETROGRADE MINERALS
garnet	x	
opaques	x	

NUMBER OF POINTS COUNTED: 300

COMMENTS

The biotite gneiss is coarse-grained with flaser texture. The biotite laths define a strong foliation.

FABRIC AND TEXTURES

Plagioclase:	Equant xenoblastic grains; partial twinning; 120 degree triple junctions; round inclusions of quartz; rare antiperthite
Quartz:	Undulatory extinction; lobate subgrain boundaries; minor granulation
Orthoclase:	Unfractured, untwinned; tiny rings of orthoclase around edges of plagioclase grains
Biotite:	Pleochroism is light brown to very dark brown; laths are aligned and have a preferred orientation
Apatite:	Round grains with very low birefringence
Opakes:	Small irregularly shaped grains

DGS ID: Cc13-11

SAMPLE NO.: 24774

QUAD: WIS

FIELD NO.: S-7-4

DATE ENTERED: 3/3/93

LOCATION: Prices Corner - core, 47'(82' ASL)

ROCK UNIT: Wilmington Complex

ORIENTED SEC.:

STAINED: K-feldspar: Y

Plagioclase:

Calcite:

Cordierite:

LITHOLOGY: Orthopyroxene-bearing felsic gneiss

MAJOR MINERALSMODE (%)ACCESSORY MINERALS

quartz

26.0

plagioclase

49.0

orthopyroxene

19.0

opaques

5.0

biotite

1.0

hornblende

x

RETROGRADE MINERALS

NUMBER OF POINTS COUNTED: 200

COMMENTS

The rock is strongly magnetic and nonfoliated with bright eyes. There is one domain in this slide where the orthopyroxene has been replaced by hornblende, changing the assemblage to plagioclase, quartz, and hornblende.

FABRIC AND TEXTURES

Plagioclase:	Equant xenoblastic grains; partial twinning; some grains are poikiloblastic and contain round inclusions of quartz and plagioclase
Quartz:	Undulatory extinction, subgrain boundaries
Orthopyroxene:	Pleochroism is pale pink to light green; minor retrograding to green hornblende
Opagues:	Irregular grains grow over other grain boundaries; minor retrograding to a light green mineral; large opaque surrounded by plagioclase (bright eye)
Hornblende:	Elongated, xenoblastic grains; pleochroism is pale yellow green to pale gray green

DGS ID: Cc13-11

SAMPLE NO.: 24774

QUAD: WIS

FIELD NO.: S-7-4

DATE ENTERED: 3/3/93

LOCATION: Prices Corner - core, 51'(78' ASL)

ROCK UNIT: Wilmington Complex

ORIENTED SEC.:

STAINED: K-feldspar: Y

Plagioclase: Calcite:

Cordierite:

LITHOLOGY: Biotite gneiss

MAJOR MINERALSMODE (%)ACCESSORY MINERALS

quartz

30.0

zircon with halos

plagioclase

24.0

sphene

biotite

36.0

monzanite(?)

garnet

6.0

opaques

4.0

RETROGRADE MINERALS

sillimanite mats

x

Deuteric alteration of plagioclase

NUMBER OF POINTS COUNTED: 300

COMMENTS

This rock core has layers of coarse and fine-grained biotite gneiss. The mineralogy of the layers is similar; however the contact between the layers is sharp. The foliation is strong in the coarse-grained layers where it is defined by the alignment of the biotite laths and elongated segregations of quartz. The fine-grained foliation is very weak.

FABRIC AND TEXTURES

Plagioclase:	Equant xenoblastic grains; weak partial twins; slight deuteric alteration
Quartz:	Undulatory extinction, abundant small subgrain boundaries, lobate edges; granulation at grain boundaries
Biotite:	Grain size is variable; ragged laths are generally aligned to define a foliation; no preferred orientation; pleochroism light brown to slightly red-brown
Garnet:	Xenoblastic to subidioblastic, medium size (1mm), grains; inclusions of biotite, quartz, plagioclase, and opaques clustered in the center of the grains; garnets are concentrated in coarse-grained layer
Opagues:	Two different opaque minerals; one has an irregular shape, but is sliver under reflected light

DGS ID: Cc13-16

SAMPLE NO.: 24895

QUAD: KES

FIELD NO.: R-22

DATE ENTERED: 10/1/92

LOCATION: Prices Corner, Centerville Rd - core, 45' (85' ASL)

ROCK UNIT: Wilmington Complex

ORIENTED SEC.:

STAINED: K-feldspar: Y

Plagioclase:

Calcite:

Cordierite:

LITHOLOGY: Biotite gneiss

MAJOR MINERALSMODE (%)ACCESSORY MINERALS

quartz

32.0

zircon

plagioclase

29.0

sphene

biotite

38.0

apatite

sillimanite

1.0

opaques

x

RETROGRADE MINERALS

garnet

x

orthoclase

x

NUMBER OF POINTS COUNTED: 100

COMMENTS

The biotite gneiss is coarse-grained with flaser texture. The biotite laths define a strong foliation.

FABRIC AND TEXTURES

Plagioclase:	Equant xenoblastic grains; 120 degree triple junctions; weak partial twinning; rare antiperthite
Quartz:	Undulatory extinction; subgrains with lobate boundaries
Biotite:	Pleochroism light brown to very dark brown; laths define a foliation that is folded into small scale folds; no preferred orientation
Sillimanite:	Bundles of sillimanite needles, blades, and large prisms clustered with biotite
Garnets:	Xenoblastic to subidioblastic grains; poikiloblastic with large inclusions; many fractured and broken grains
Opagues:	Irregular shapes; two different opaques; in reflected light, one is dark and the other is silver

DGS ID: Cc13-17

SAMPLE NO.: 24896

QUAD: WIS

FIELD NO.: S-8-1

DATE ENTERED: 3/3/93

LOCATION: Prices Corner - core, 66' (58' ASL)

ROCK UNIT: Wilmington Complex

ORIENTED SEC.:

STAINED: K-feldspar: Y

Plagioclase:

Calcite:

Cordierite:

LITHOLOGY: Biotite gneiss

MAJOR MINERALS

MODE (%)

ACCESSORY MINERALS

quartz

38.0

zircon, apatite

plagioclase

38.0

monzanite halos in biotite, colorless to yellow

biotite

22.0

garnet

1.0

opaques

1.0

RETROGRADE MINERALS

sillimanite mats

x

Pale green mineral with opaques

NUMBER OF POINTS COUNTED: 400

COMMENTS

The rock in this core is a fine-grained dark biotite gneiss with biotite grains aligned vertically.

FABRIC AND TEXTURES

Plagioclase:	Equant xenoblastic grains, partial twinning, round inclusions of quartz and plagioclase
Quartz:	Undulatory extinction; large subgrain boundaries with lobate edges
Biotite:	Pleochroism is light brown to dark brown; laths have a preferred orientation and are aligned to define the foliation
Garnet:	Tiny xenoblastic to subidioblastic garnets grow over other grain boundaries; some with small inclusions of opaques; one garnet is elongated in the foliation
Opagues:	Irregular shapes; two different opaques; in reflected light, one is dark and the other is silver

DGS ID: Cc13-18

SAMPLE NO.: 24897

QUAD: WIS

FIELD NO.: S-8-2

DATE ENTERED: 3/3/93

LOCATION: Prices Corner - core, 73' (52' ASL)

ROCK UNIT: Wilmington Complex

ORIENTED SEC.:

STAINED: K-feldspar: Y

Plagioclase:

Calcite:

Cordierite:

LITHOLOGY: Biotite gneiss

MAJOR MINERALSMODE (%)ACCESSORY MINERALS

plagioclase

30.0

zircon

quartz

37.0

biotite

29.0

garnet

4.0

opaques

x

RETROGRADE MINERALS

sillimanite mats

x

Pale green retrograde mineral with opaques

NUMBER OF POINTS COUNTED: 200

COMMENTS

This rock core has layers of coarse and fine-grained biotite gneiss. The mineralogy of the layers is similar; however the contact dips at 45 degrees and is sharp. Garnets are concentrated at the contact. A strong foliation in the coarse-grained layer is defined by alignment of biotite laths and elongated segregations of quartz. Foliation weak in fine layer.

FABRIC AND TEXTURES

Plagioclase:	Equant and elongated grains with partial twinning on albite and pericline laws
Quartz:	Undulatory extinction; lobate subgrain boundaries
Biotite:	Pleochroism light-brown to red-brown; laths define a strong foliation in the coarse layer and are randomly arranged in the fine layer
Opaques:	Two different opaques; in reflected light one variety is dark and the other is silver
Garnets:	Large elongated poikiloblastic garnets are concentrated at boundary between the dark-colored fine-grained gneiss and the light-colored coarse-grained gneiss; tiny idioblastic garnets also occur in the coarse-grained layer
Zircons:	More abundant in light, coarse-grained layer

DGS ID: Cc23-12 SAMPLE NO.: 24765 QUAD: WIS

FIELD NO.: S-4-3 DATE ENTERED: 5/1/95

LOCATION: Prices Corner - core, 78' (1' ASL)

ROCK UNIT: Wilmington Complex ORIENTED SEC.:

STAINED: K-feldspar: Plagioclase: Calcite: Cordierite:

LITHOLOGY: Amphibolite

MAJOR MINERALS	MODE (%)	ACCESSORY MINERALS
quartz	5.82	apatite
plagioclase	19.0	
orthopyroxene	0.8	
clinopyroxene	5.4	RETROGRADE MINERALS
hornblende	65.4	
opaques	2.6	Tiny grains of epidote/clinozoisite
epidote/clinozoisite	1.0	along contacts between hornblende and plagioclase

NUMBER OF POINTS COUNTED: 500

COMMENTS

Quartz and pyroxene were concentrated in specific domains. Rock is medium- to coarse-grained with no foliation.

FABRIC AND TEXTURES

Quartz:	Xenoblastic; weak undulatory extinction
Plagioclase:	Xenoblastic; sharp triple junctions between plagioclase grains; deformation in twinning
Pyroxene:	Poikiloblastic; pleochroism is flesh to pale green
Hornblende:	Unaligned xenoblastic grains; equant shape; pleochroic olive green to tan
Opagues:	Small grains crystallized along hornblende cleavages and grain boundaries

DGS ID: Cc23-14

SAMPLE NO.: 24767

QUAD: WIS

FIELD NO.: S-5-5

DATE ENTERED: 3-3-93

LOCATION: SE of Prices Corner - core, 85' (-2 BSL)

ROCK UNIT: Wilmington Complex

ORIENTED SEC.:

STAINED: K-feldspar: Y

Plagioclase:

Calcite:

Cordierite:

LITHOLOGY: Two-pyroxene gneiss

MAJOR MINERALSMODE (%)ACCESSORY MINERALS

quartz
 plagioclase
 orthopyroxene
 clinopyroxene
 biotite
 opaques
 clinozoisite

7.5
 59.2
 9.5
 17.8
 0.6
 5.4
 x

apatite, zircon
 green spinel

RETROGRADE MINERALS

Light green alteration product of
 orthopyroxene

NUMBER OF POINTS COUNTED: 600

COMMENTS

The rock in this core is strongly magnetic. Grain size varies from coarse to fine, always with very sharp grain boundaries.

FABRIC AND TEXTURES

Plagioclase: Unfractured, unweathered, equant xenoblastic grains; partial twinning; 120 degree triple junctions between grains of plagioclase
 Quartz: Some undulatory extinction, but not in all grains; subgrain boundaries with lobate edges
 Orthopyroxene: Pleochroism is pronounced very light green to pale pink
 Opaques: Black in reflected light; tiny opaque grains with orthopyroxene

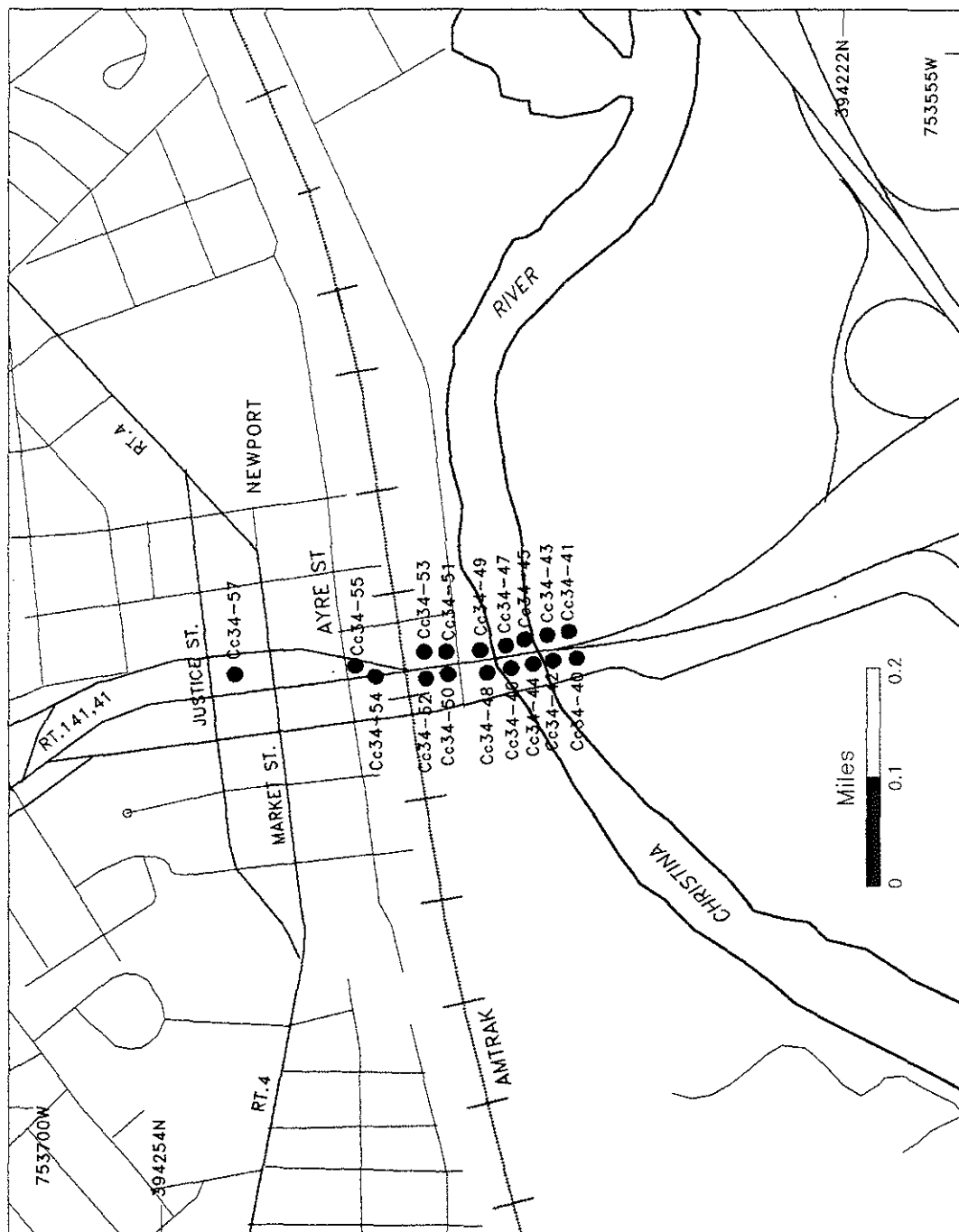


Figure 9. Newport/Rt. 141 core locations.

Newport - Rt. 141 over Christina River, North-Bound Lanes

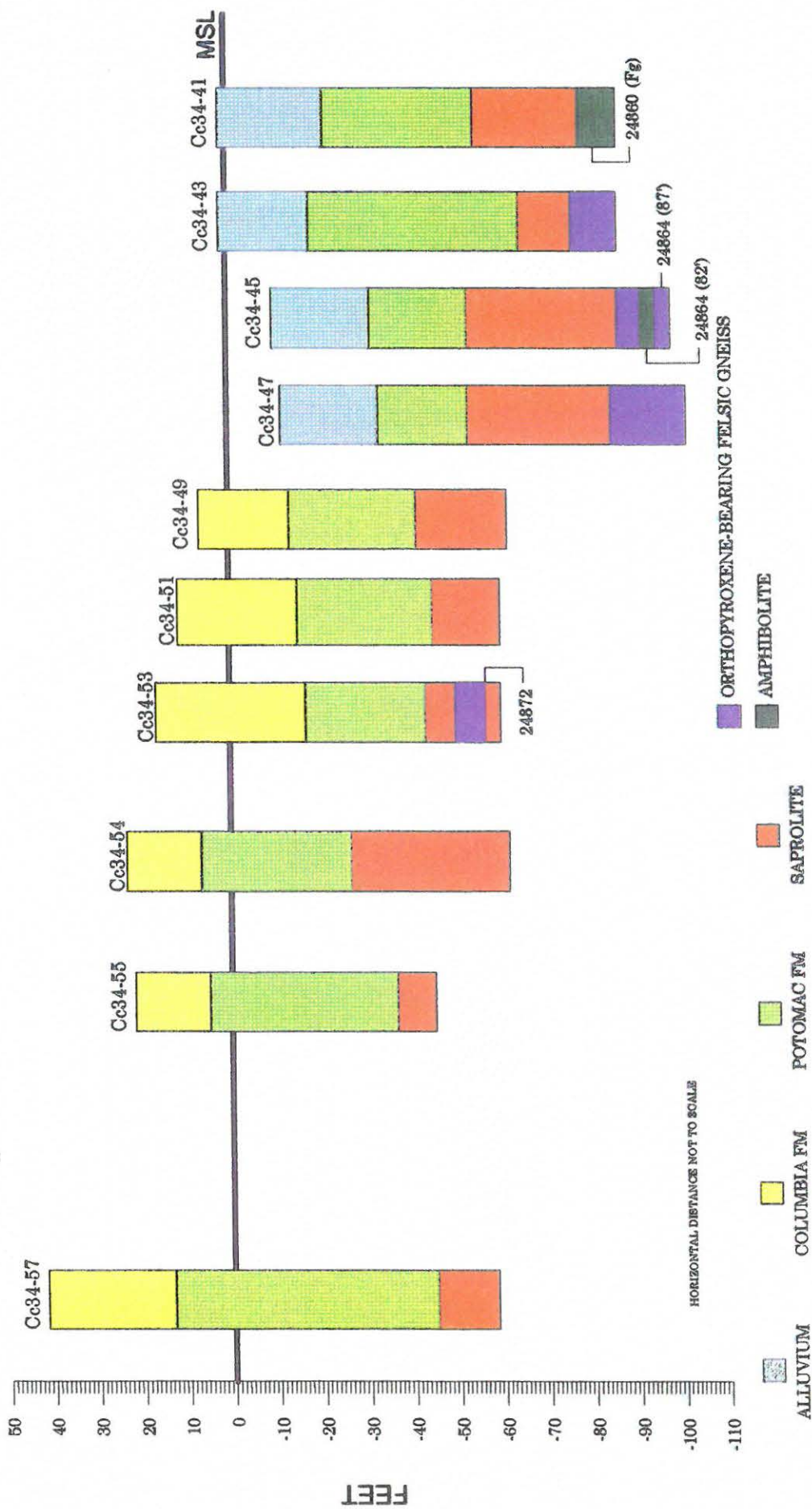


Figure 10. Newport/Rt. 141 north-bound lanes lithologic diagram.

Newport - Rt. 141 over Christina River, South-Bound Lanes

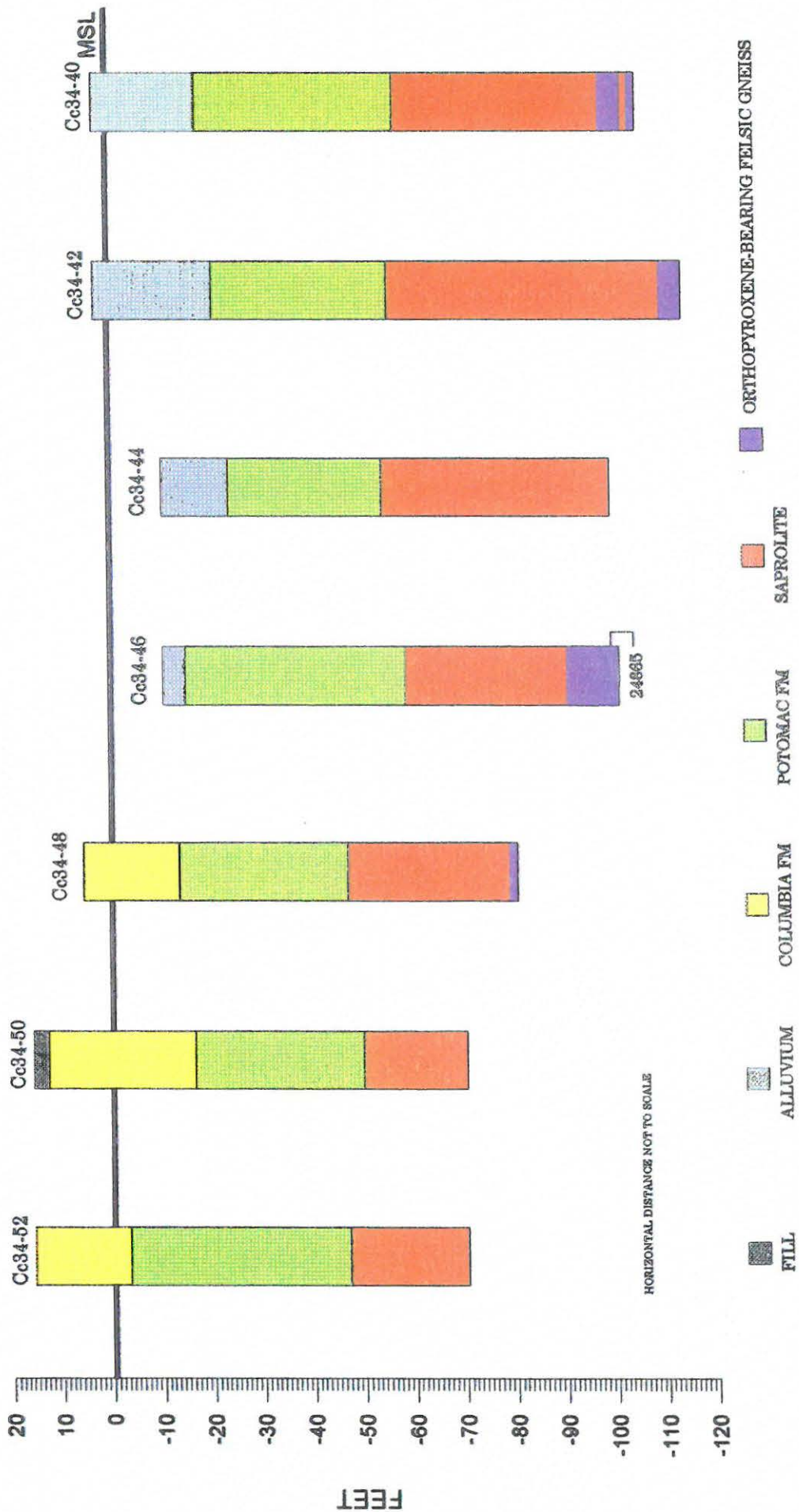


Figure 11. Newport/Rt. 141 south-bound lanes lithologic diagram.

DGS ID: Cc34-41

SAMPLE NO.: 24860

QUAD: WIS

FIELD NO.: S-2

DATE ENTERED: 10-5-93

LOCATION: Newport - core, 84' (-82 BSL)

ROCK UNIT: Wilmington Complex

ORIENTED SEC.:

STAINED: K-feldspar: Y

Plagioclase:

Calcite:

Cordierite:

LITHOLOGY: Amphibolite

MAJOR MINERALS

MODE (%)

ACCESSORY MINERALS

hornblende
plagioclase
quartz
orthopyroxene
opaques
biotite

47.2
46.0
3.3
2.0
0.4
1.1

apatite

RETROGRADE MINERALS

Biotite appears to be a retrograde product of orthopyroxene

NUMBER OF POINTS COUNTED: 700

COMMENTS

This rock may be a metagabbro. Evidence to suggest a gabbro is (1) no foliation and (2) relic orthopyroxene grains.

FABRIC AND TEXTURES

Plagioclase:	Partial (deformation) twinning; grains are rounded but xenoblastic
Hornblende:	Anhedral grains are elongated to define a weak foliation; pleochroism is yellow-green to pale green; some grains have cores rich in rectangular opaques; some grain boundaries with quartz or plagioclase are lined with opaques
Quartz:	Undulatory extinction; small grains
Orthopyroxene:	Weak pleochroism that is pale green to very light pink; the pyroxene grains are replaced in part by biotite
Opagues:	Irregular grains; dark in reflected light

DGS ID: Cc34-45

SAMPLE NO.: 24864

QUAD: WIS

FIELD NO.: S-6

DATE ENTERED: 10-3-93

LOCATION: Newport - core, 82' (-92' BSL)

ROCK UNIT: Wilmington complex

ORIENTED SEC.:

STAINED: K-feldspar: Y

Plagioclase:

Calcite:

Cordierite:

LITHOLOGY: Amphibolite

MAJOR MINERALS

MODE (%)

ACCESSORY MINERALS

quartz
plagioclase
hornblende
brown grains

11.8
31.6
25.5
31.1

zircon

RETROGRADE MINERALS

Hornblende retrograded to
brown-black weathered grains

NUMBER OF POINTS COUNTED: 200

COMMENTS

This rock is fine-grained and foliated and contains severely weathered hornblende.

FABRIC AND TEXTURES

Plagioclase: Sharp, xenoblastic grains with simple albite and pericline twinning;
many grains are poikiloblastic with round inclusions of hornblende
Quartz: Xenoblastic with undulatory extinction
Hornblende: Pleochroic in shades of green, pale green to gray-green; some
elongation of grains; much of the hornblende is altered to a dark brown
clay mineral

DGS ID: Cc34-45

SAMPLE NO.: 24864

QUAD: WIS

FIELD NO.: S-6

DATE ENTERED: 10-3-93

LOCATION: Newport - core, 87' (-97' BSL)

ROCK UNIT: Wilmington complex

ORIENTED SEC.:

STAINED: K-feldspar: Y

Plagioclase:

Calcite:

Cordierite:

LITHOLOGY: Orthopyroxene-bearing felsic gneiss

MAJOR MINERALS

MODE (%)

ACCESSORY MINERALS

quartz
plagioclase
orthopyroxene
opaques

36.9
50.8
9.5
2.8

apatite

RETROGRADE MINERALS

Minor retrograding of
orthopyroxene to biotite

NUMBER OF POINTS COUNTED: 500

COMMENTS

This rock is a quartz-rich rock with granoblastic textures. The pyroxene occurs as large poikiloblastic grains.

FABRIC AND TEXTURES

Plagioclase: Equant xenoblastic grains with little twinning
Quartz: Xenoblastic grains with undulatory extinction
Orthopyroxene: Large poikiloblastic grains with inclusions of quartz, plagioclase, and opaques; weak pleochroism is pale green to light pink
Opaques: Irregularly shaped grains

DGS ID: Cc34-46 SAMPLE NO.: 24865 QUAD: WIS

FIELD NO.: S-7 DATE ENTERED: 10-3-93

LOCATION: Newport - core, 89' (-99 BSL)

ROCK UNIT: Wilmington Complex ORIENTED SEC.:

STAINED: K-feldspar: Plagioclase: Calcite: Cordierite:

LITHOLOGY: Orthopyroxene-bearing felsic gneiss

MAJOR MINERALS	MODE (%)	ACCESSORY MINERALS
quartz	45.5	sphene
plagioclase	51.5	zircon
orthopyroxene	1.8	
opaques	1.2	
biotite	x	
		RETROGRADE MINERALS

NUMBER OF POINTS COUNTED: 600

COMMENTS

A light colored rock with granoblastic textures. The pyroxene grains are clumped together with opaque minerals. These clumps are probably the remains of large poikiloblastic orthopyroxene grains.

FABRIC AND TEXTURES

Plagioclase:	Equant xenoblastic grains with weak partial twinning; 120 degree triple junctions are common
Quartz:	Xenoblastic grains with undulatory extinction; minor subgrains with lobate grain boundaries
Orthopyroxene:	Very weak pleochroism
Opakes:	Irregularly shaped grains; two varieties, one is dark and the other is silver in reflected light; the two varieties often occur in the same grain

DGS ID: Cc34-53 SAMPLE NO.: 24872 QUAD: WIS

FIELD NO.: S-17-U DATE ENTERED: 10-3-93

LOCATION: Newport - core, 73' (-57 BSL)

ROCK UNIT: Wilmington Complex ORIENTED SEC.:

STAINED: K-feldspar: Y Plagioclase: Calcite: Cordierite:

LITHOLOGY: Orthopyroxene-bearing felsic gneiss

MAJOR MINERALS	MODE (%)	ACCESSORY MINERALS
quartz	43.6	
plagioclase	51.0	
orthopyroxene	3.7	
opaques	1.7	

RETROGRADE MINERALS

Orthopyroxene is weathered to a brown micaceous mineral

NUMBER OF POINTS COUNTED: 300

COMMENTS

A light-colored rock with granoblastic textures.

FABRIC AND TEXTURES

Plagioclase:	Xenoblastic grains that are mostly untwinned; 120 degree triple junctions between plagioclase grains
Quartz:	Xenoblastic grains with undulatory extinction; some lobate grain boundaries
Orthopyroxene:	Very weak pleochroism that is pale green to hint of pink; grains are very small and arranged randomly throughout the rock; many grains are weathered to a brown micaceous mineral
Opagues:	Small irregular grains; dark in reflected light