DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF LAND RESOURCES
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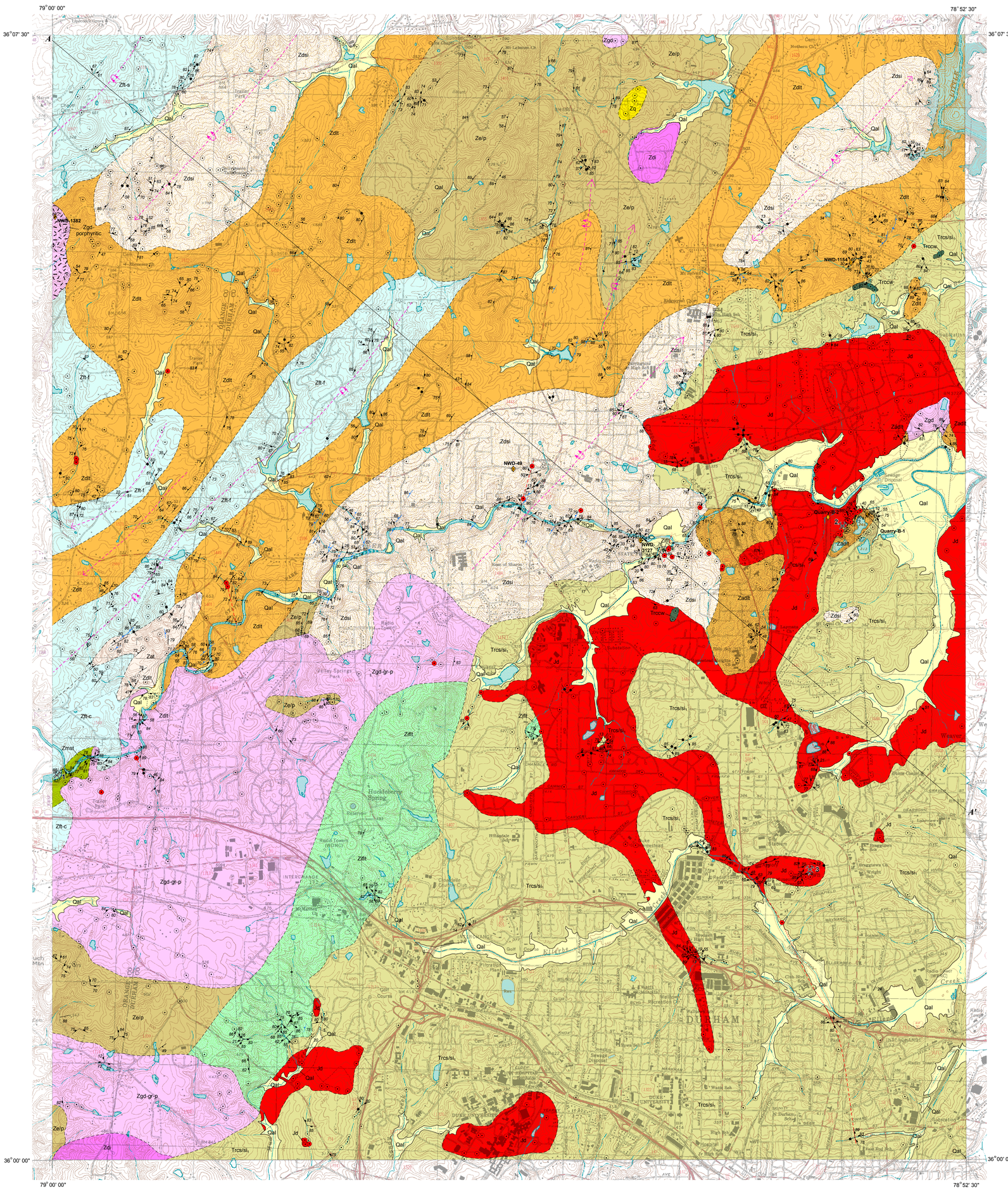
NORTH CAROLINA GEOLOGICAL SURVEY
OPEN FILE REPORT 2004-03a Revision - 01 (2010)



MN GN
8 1/2° 151 MILS
1° 13' 22 MILS
UTM GRID AND 2003 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

MAP LOCATION

SCALE 1:24 000

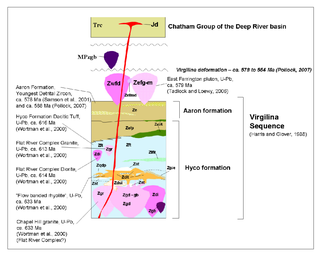
1 0.5 0 1 Miles
1,000 500 0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 Feet
1 0.5 0 1 Kilometers

CONTOUR INTERVAL 10 FEET

Base topographic map is a digital raster graphic image of the Northwest Durham 7.5-minute quadrangle (1993), North Carolina State Plane NAD 83 meters coordinate system.

Geology mapped from August 2002 through September 2003 by Philips, Witanachchi, Ward and Clark. Additional field work, data collection and interpretation by Bradley and Bechtel in 2005 through 2009.

PLEASE NOTE: This map replaces the Northwest Durham quadrangle portion of NCGS Open-File Report 2004-03 (Phillips et al., 2004).



Schematic representation of relationships of geologic units in the Orange and Durham counties, NC area. Includes geologic units from the Chapel Hill, White Cross, Efland, Farrington, Caldwell and Cedar Grove geologic maps. Not all units represented in the Northwest Durham quadrangle.

Description of Map Units

All pre-Mesozoic rocks of the Northwest Durham quadrangle have been metamorphosed to at least the chlorite zone of the greenschist metamorphic facies. Many of the rocks display a weak or strong metamorphic foliation. Although subjected to metamorphism, the rocks retain relict igneous, pyroclastic, and sedimentary textures and structures that allow for the identification of protolith rocks. As such, the prefix "meta" is not included in the nomenclature of the pre-Mesozoic rocks described in the quadrangle.

The nomenclature of the International Union of Geological Sciences subcommission on igneous and volcanic rocks (IUGS) after Streckeisen (1973 and 1979) is used in classification and naming of the units. The classification and naming of the rocks is based on relict igneous textures, modal mineral assemblages, or normalized mineral assemblages when whole-rock geochemical data is available. Pyroclastic rock terminology follows that of Fisher and Schminke (1984).

Sedimentary Units

Qal - alluvium: Unconsolidated clay, silt, sand and gravel to cobble-sized clasts, subrounded to angular, deposited in drainages.

Trcs/si$_1$ - Chatham Group Lithofacies Association I: Pinkish-gray, light-gray, and light-tan; fine- to coarse-grained, micaceous, slightly clayey, moderately poor to moderately well sorted, subangular to subrounded arkose and lithic arkose; maroon, very silty, micaeous, moderately well sorted, fine-grained sandstone; and maroon, massive, and thickly laminated, bioturbated, micaceous to very micaceous, siltstone and mudstone. Muscovite flakes up to 3 mm diameter are common especially in the siltstone. Fine-grained flakes of biotite in the arkose and lithic arkose is a distinctive accessory. Randomly oriented and vertical, cylindrical structures often filled with pale-green, fine-grained, quartz sandstone are interpreted as burrows. Bedding, when observed, is parallel to slightly wavy, occurring as thick laminations to thinly bedded (0.5 cm to 5 cm). These rocks are assigned to the Lithofacies Association I of Hoffman and Gallagher, 1989 and Watson, 1998. The clastic rocks of Lithofacies Association I are interpreted to have been deposited in a braided stream fluvial system.

Trccw - Chatham Group western border conglomerates: Reddish-brown to dark brown, matrix to clast supported, pebble to cobble conglomerate; clasts are subrounded to rounded consisting of primarily of quartz and foliated and unfoliated felsic volcanic rocks; matrix consists of coarse- to very coarse-sand.

Intrusive and Meta-Intrusive Units

Jd - Diabase: Black to greenish-black, melanocratic, fine- to medium-grained, dense, consists primarily of plagioclase, augite, and may contain olivine. Occurs as sills and dikes up to 100 ft wide. Locally gabbroic in sills. Typically occurs as dense, spheriodally weathered boulders with a grayish-brown weathering rind. Red station location indicates outcrop or boulders of diabase. Whole rock geochemistry data for several samples in the Durham area are presented in Gottfried et. al. (1991) and Brown et. al. (1985).

Zgd-gr-p – Granodiorite to granite of Piney Mountain Creek area:: Composite pluton of dominantly medium-grained hornblende granodiorite with lesser amounts of medium-grained hornblende granite. Typically contains dark green to black less than 1 mm to 4 mm clots of actinolitic (?) amphibole and chlorite masses. Locally contains pinkish-hued feldspars.

Zgd – Granodiorite: Leucocratic to mesocratic, fine- to medium-grained, equigranular to porphyritic granodiorite. May contain quartz diorite and diorite. Typically contains dark green to black less than 1 mm to 4 mm clots of actinolitic (?) amphibole and chlorite masses. Locally contains pinkish-hued feldspars. Plagioclase grains are often sericitized and saussuritized and may exhibit a greenish color.

Zgd-porphyritic - Porphyritic granodiorite: Greenish-gray with a pinkish-hue; amphibole-bearing; porphyritic granodiorite with plagioclase phenocrysts. Plagioclase phenocrysts are green from saussuritization and range from 2 to 8 mm in a matrix of very fine-grained quartz and alkali-feldspar. Weathered surface exhibit a distinct strongly porphyritic texture. Porphyritic rhyolite of the Buckwater Creek Pluton of Newton (1983).

Zdsi – Dacitic shallow intrusive: Gray-green, light green to green; plagioclase porphyritic dacite with a granular-textured groundmass to very fine-grained granodiorite (with intrusive texture visible with 7x hand lens). Contains lesser amounts of fine- to medium grained granodiorite. Fine to medium grained diorite locally present. Plagioclase phenocrysts typically range from 1 mm to 4 mm. Black colored amphibole, when visible, occurs as phenocrysts (less than 1 mm to 1 mm) and as intergrowths with plagioclase. Amphibole intergrowths distinguish rock from fine-grained tuffs. Enclaves of dark gray, plagioclase porphyritic dacite are common and at times give rock a psuedo-clastic appearance. Locally xenoliths of tuffs are present. Generally equivalent to Unit B of Wright (1974).

Zdi – Diorite: Greenish-gray to gray, fine- to medium-grained, hornblende diorite. Major minerals include plagioclase and hornblende. Plagioclase crystals are typically sericitized and saussuritized. Hornblende is typically altered to chlorite and actinolite masses. May be foliated.

Metavolcanic Units

Zq – Quartz bodies: White, beige, red, and tan; sugary to porcelaneous; very fine- to medium-grained massive quart rock to quartzite-like rock. Outcrops are usually massive. Quartzite-like rock is occasionally mixed with sericite and/or pyrophyllite. The addition of sericite and/or pryophyllite gives the otherwise massive quartzite-like rock a foliation. Pyrite is present as cubic crystals and empty cubic molds of crystals (up to 12 mm). Map areas contain boulders (up to several feet in diameter) and outcrops of white colored massive quartz.

Ze/p - Mixed epiclastic-pyroclastic rocks: Green, grayish-green to greenish-gray; siltstones, tuffaceous sandstones, conglomeratic sandstones and conglomerate. Minor phyllite. The siltstones typically are weakly phyllitic. Contains lesser amounts of fine to coarse tuff and lapilli tuff. Silicified and/or sericitized altered rock similar to Zat unit are present near contacts with other units. Minor andesitic to basaltic lavas and tuffs.

Zifft – Intermediate to felsic lavas and tuffs with epiclastics: Green-gray to green; weakly foliated to well foliated, dacitic to andesitic volcaniclastic pyroclastic and sedimentary rocks interpreted as tuffs, reworked tuffs and volcanic sandstones to siltstones interlayed with dacitic to andesitic lavas.

Zmst – Matrix supported tuffs: Green-gray to green; weakly foliated to well foliated; matrix supported; polymictic; lapilli tuffs and tuff breccias. Angular to sub-rounded, lithic fragments range from less than 1 mm up to 0.5 m diameter. Unit is interpreted as a resedimented syn-eruptive volcaniclastic deposit in which texturally unmodified volcaniclastic debris and entrained texturally more mature accidental clasts are incorporated into a rapidly resedimented package of sediment. May be emplaced via submarine mass flows, subaerial landslides and/or lahars.

Zft-f – Felsic tuffs of the Few's Ford area: Dominantly light-green to dark-green; massive to weakly foliated tuffs. Interlayered with light-gray to gray; massive to weakly foliated lapilli tuff; a distinctive purple-colored coarse tuff and dark-gray to black, andesitic to dacitic cryptocrystalline lava similar in appearance to the lavas present in the Zadlt unit in the Hillsborough quadrangle (Bradley et al, 2005). 1-5% accessory sulfide minerals commonly present.

Zft-c – Felsic tuffs of the Coile quarry area: Greenish-gray; massive to strongly foliated; dense; plagioclase crystal-fragment-rich coarse tuffs. Strong foliation is interpreted to be result of primary volcanic welding and/or compaction. 1-5% accessory sulfide minerals commonly present. Outcrops and boulders typically display a white weathering rind.

Zft-s – Felsic tuffs of the St. Mary's Church area: Grayish- green to greenish-gray, silvery-gray, and gray, massive to foliated, volcaniclastic pyroclastic rocks consisting of fine- to coarse tuffs, lapilli tuffs and minor welded tuffs. Layering ranges from massive to thinly bedded. Contains lesser amounts of volcaniclastic sedimentary rocks consisting of volcanic sandstones, and greywackes with minor siltstones and phyllite. Minor andesitic to basaltic lavas and tuffs. Distinctive plagioclase + quartz crystal tuff present in unit in higher stratigraphic zones near the Ze/p unit.

Zat – Altered tuffs: Very light-gray, light-greenish-gray to white, mottled red and yellow, altered tuffs. Alteration of felsic tuffs have produced sericite-quartz phyllite, pods of pyrophyllite, and quartz + pyrophyllite rock; all with common less than 1 mm to 2 mm diameter cubic pyrite aggregates and goethite-lined molds of pyrite crystals. Relict lithic clasts and kaolinitized feldspar crystal shards are visible in some outcrops. Relict structures are obliterated in heavily altered rocks.

Zdlt - Dacitic lavas and tuffs: Distinctive dark-gray to black; siliceous; cryptocrystalline lava, porphyritic lava with plagioclase phenocrysts, and flow banded dacitic lavas. Interlayered with gray to black; welded and non-welded coarse tuff and lapilli tuff. Tuffs often contain black-colored fiamme, up to 10 cm, interpreted as flattened pumice. Clast types include black cryptocrystalline lava and porphyritic lava with plagioclase phenocrysts. Differentiation between lavas and massive tuffs is difficult in hand sample in most cases. The lavas are interpreted to have been coherent magma that were extrusive or very shallow intrusions associated with dacite domes. Tuff interlayers are interpreted as episodic pyroclastic flow deposits and air fall tuffs generated during eruption of domes. Includes portions of Wright (1974) unit C and Cp.

Zadlt – Andesitic to dacitic lavas and tuffs: Distinctive black to dark gray; porphyritic lava with plagioclase phenocrysts (up to 4 mm), and flow banded lava with local amygdules. Interlayed with the lavas are gray to black; welded and non-welded; coarse tuff, lapilli tuff, and tuff breccia. Lavas with relict hyaloclastic texture and amygdules are well exposed in the former Nello Teer Quarry south of the Eno River.

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EXPLANATION OF MAP SYMBOLS

CONTACTS

Lithologic contacts - distribution and concentration of station locations and structural symbols indicates degree of reliability.

- inferred geologic contact
- concealed geologic contact
- diabase dike trend
- in cross section, fold form lines
- A — A' cross section line
- observation station location
- diabase station location
- NWD-49 geochemical sample location
- inferred fold hinge of plunging overturned anticline, dotted where concealed
- inferred fold hinge of plunging overturned syncline, dotted where concealed
- inferred fold hinge of doubly plunging overturned anticline, dotted where concealed
- in cross section, inferred fold axis

PLANAR FEATURES

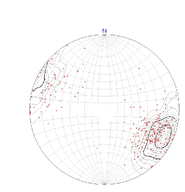
Observation sites are centered on the strike bar or are at the intersection point of multiple symbols. Planar feature symbols may be combined with linear features.

- 14 strike and dip of primary bedding and layering
- 65 strike and dip of overturned primary bedding and layering
- 79 strike and dip of primary volcanic compaction and/or welding foliation
- 64 strike and dip of foliation
- strike and dip of vertical foliation
- 65 strike and dip of cleavage
- strike and dip of vertical cleavage
- 77 strike and dip of high strain foliation
- strike and dip of vertical high strain foliation
- 62 strike and dip of joint
- strike and dip of vertical joint
- horizontal joint
- 70 strike and dip of slicken plane

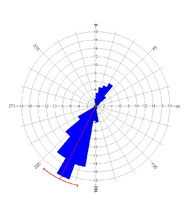
LINEAR FEATURE

- 55 trend of plunge of slicken line

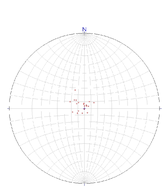
inactive quarry and abandoned quarries
1 - Abandoned quarry on Eno River State Park property. Known as Coile Quarry or Eno Quarry.
2 - Inactive former Nello Teer Quarry
3 - Abandoned quarry on Museum of Life and Sciences property - Location of mafic rock standard DNC-1 (Flanagan, 1984). Known as Braggtown Quarry.



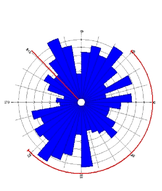
Schmidt Equal Area Stereogram Data of Contoured Poles to Foliation and Cleavage Contour Interval = 1 N = 282



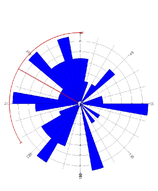
Unidirectional Rose Diagram of Foliations and Cleavage N = 282



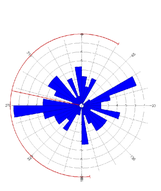
Schmidt Equal Area Stereogram Data of Poles to Bedding of Triassic Sediments N = 20



Unidirectional Rose Diagram of Joints for Carolina Terrane Crystalline Rock Types N = 437



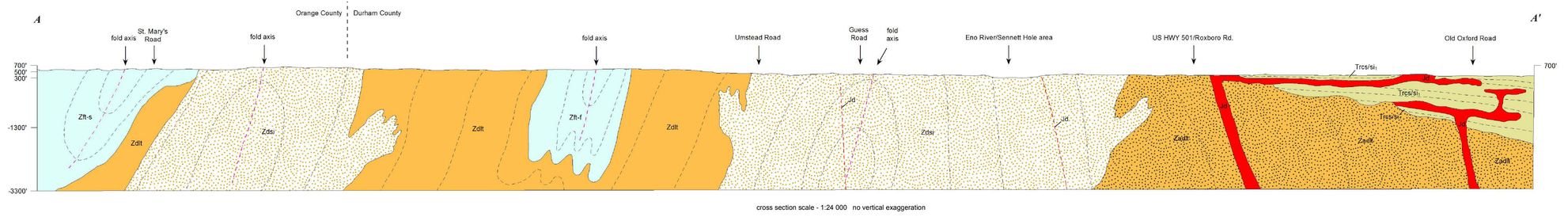
Unidirectional Rose Diagram of Joints for Triassic Sediments Only (Trcs) N = 46



Unidirectional Rose Diagram of Joints for Diabase Only (Jd) N = 92

			OXIDES IN PERCENT												SELECTED ELEMENTS IN PPM											
SAMPLE ID	Rock Type	Map Unit	SiO2	Al2O3	CaO	MgO	Na2O	K2O	Fe2O3	MnO	TiO2	P2O5	Cr2O3	LOI	Sum	Ba	Ce	Co	Cu	Nd	Ni	Sm	Sr	Ta	Y	Zn	Zr
NWD-49	plagioclase porphyritic dacite	Zdsi	67.38	15.87	2.66	0.94	4.74	2.84	3.58	0.07	0.43	0.1	0.05	1.35	100.2	928	57	7.7	16	23.5	14	4	446.8	<0.5	14.4	60	207.4
NWD-1154	plagioclase porphyritic dacite	Zdlt	67.94	15.7	1.53	0.9	6.31	2.53	3.67	0.08	0.46	0.11	0.04	0.75	100.2	921.9	55.7	7.4	7	23	12	3.9	327	<0.5	14.2	62	209.8
NWD-1382	plagioclase porphyritic granodiorite	Zgd-porphyritic	69.99	13.79	3.19	0.27	4.29	2.51	2.66	0.08	0.27	0.05	0.04	3.2	100.5	1171.4	56.7	3.8	10	21.6	9	3.7	114.2	<0.5	15.7	48	223
NWD-3127	basaltic dike intruding Zdsi unit	Zdsi	44.4	15.6	9.22	8.19	2.48	0.17	14.3	0.25	1.52	0.07	0.04	3.05	99.3	160	6.7	56.7	148	3	167	3.2	253	<0.5	26	NA	64
Quarry-B-1 (58)	andesitic lava	Zadlt	56.6	17.5	3.35	1.39	1.93	1.58	8.22	0.09	1.19	0.05	<0.01	5.95	97.9	NA	29.4	19	41	14.9	14	3.8	NA	0.8	21.1	NA	133
Quarry-B-1 (60)	andesitic lava	Zadlt	56.1	17	3.8	0.91	6.19	0.44	8.88	0.07	1.21	0.08	<0.01	4.05	98.7	NA	36.2	14.2	22	21.3	<5	5.1	NA	0.6	22.3	NA	105
Quarry-B-1 (70)	andesitic lava	Zadlt	54.7	16	6.8	3.4	3.9	0.8	8.84	0.19	1.16	0.29	<0.01	2.1	98.1	NA	26.5	19.5	33	18.6	12	4.8	NA	0.5	28	NA	109
Quarry-B-1 (90)	dacitic lava	Zadlt	62.9	15.2	5.09	1.54	5.64	0.58	5.34	0.11	0.79	0.23	<0.01	1.5	98.9	NA	32.5	9.5	32	21.4	5	5.4	NA	<0.5	30.9	NA	148
Quarry-B-2 (100)	diabase	Jd	47.2	18.4	10.7	10.7	1.95	0.22	9.51	0.14	0.46	0.06	0.04	0.05	99.4	NA	7.5	54.9	119	4.8	276	1.4	NA	0.6	15.4	NA	30.6

Geochemical analyses completed by SGS Minerals, Toronto, Canada for major and trace elements. Whole-rock analyses by method codes XRF103 (NWD-1154, NWD-1382 and NWD-49), XRF78V (NWD-3127), XRF76Z (quarry samples) for major oxides and IMS95A (all samples).
Analyses from quarry samples provided by CDM. Samples collected from two borings. Number in parentheses indicate depth of sample in boring.
NA = No sample analysis
PPM = parts per million
LOI = loss on ignition



cross section scale - 1:24 000 no vertical exaggeration

GEOLOGIC MAP OF THE NORTHWEST DURHAM 7.5-MINUTE QUADRANGLE, DURHAM AND ORANGE COUNTIES, NORTH CAROLINA

By Philip J. Bradley, Cindy M. Phillips, Randy Bechtel, Channa Witanachchi, Amy N. Ward and Timothy W. Clark

Digital representation by Michael A. Medina, Philip J. Bradley and Cindy M. Phillips

2004

Scan with smartphone for link to GeoPDF of map. Third party App required.