DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF LAND RESOURCES
JAMES D. SIMONS, DIRECTOR AND STATE GEOLOGIST

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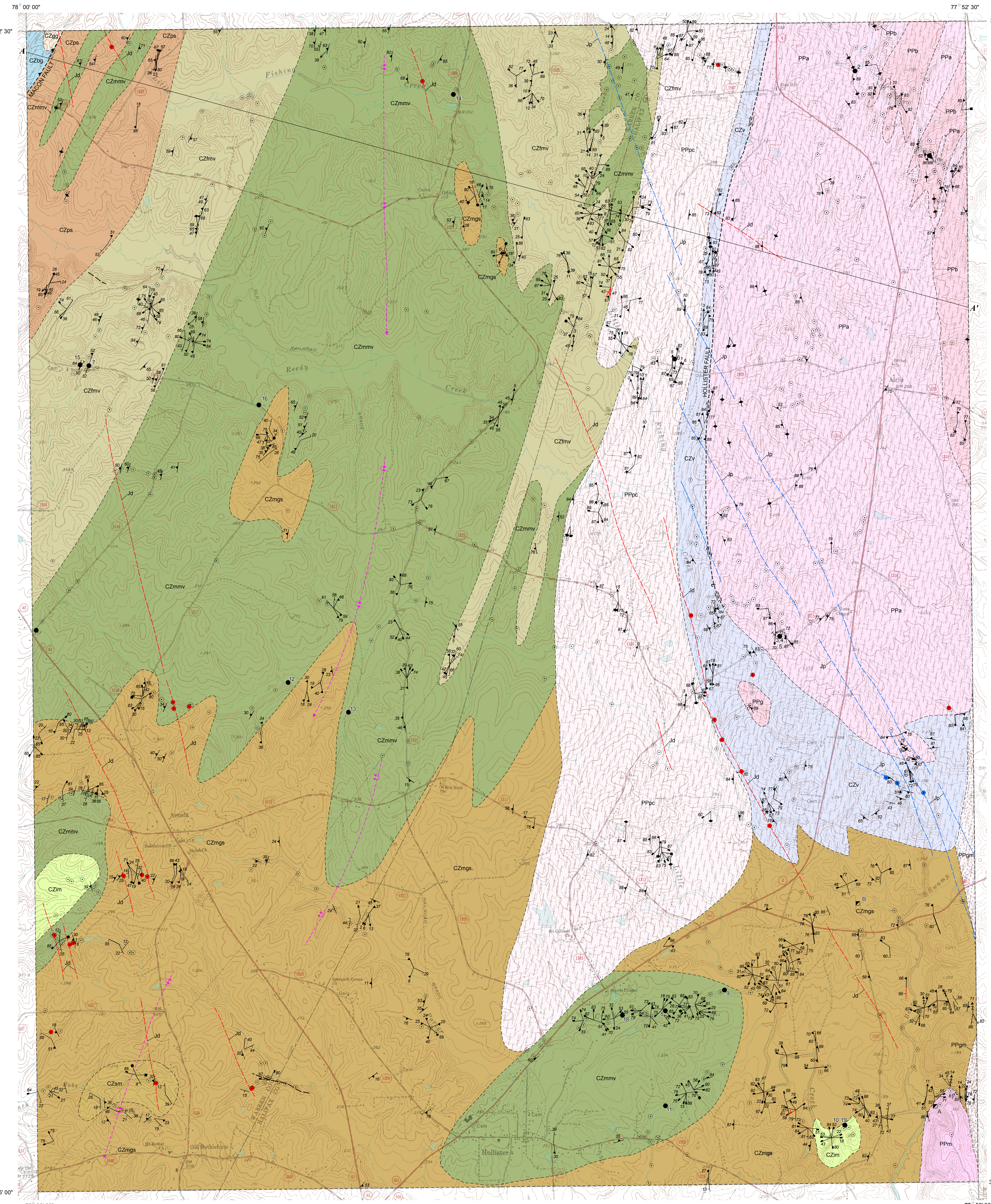
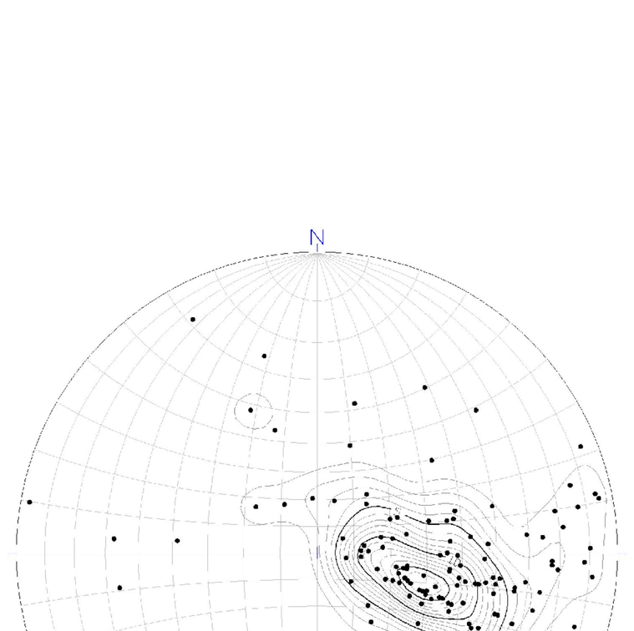
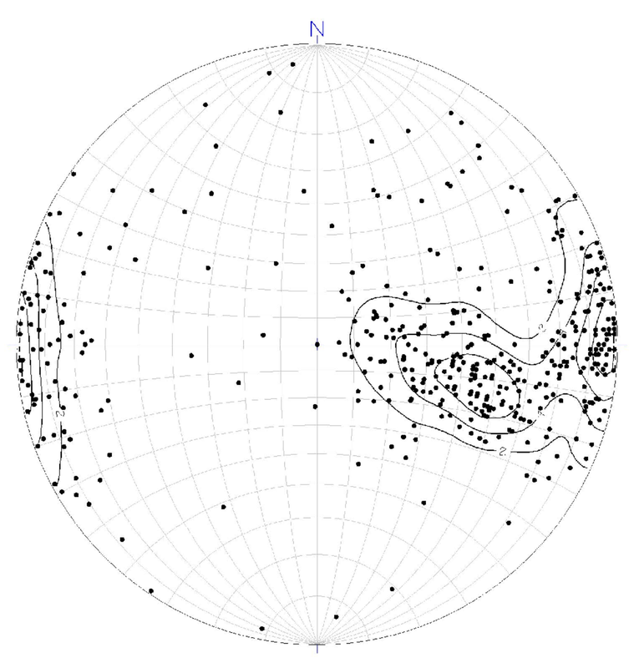
NORTH CAROLINA GEOLOGICAL SURVEY
OPEN FILE REPORT 2011-03

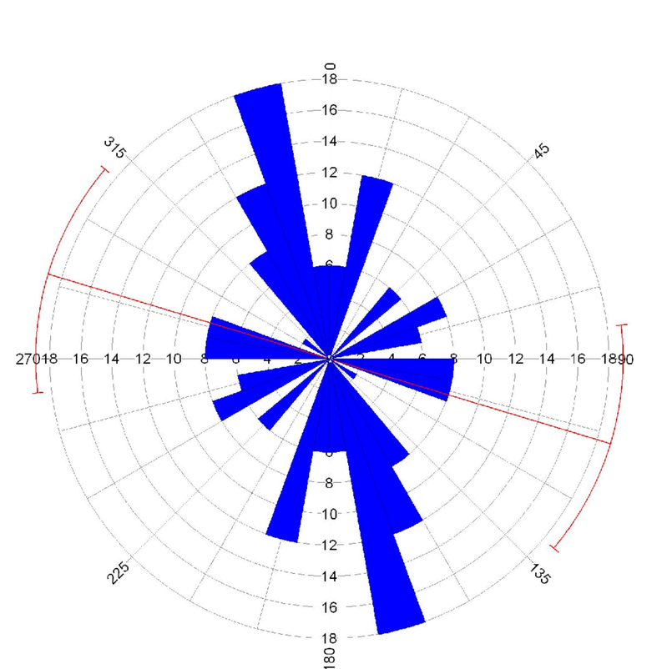




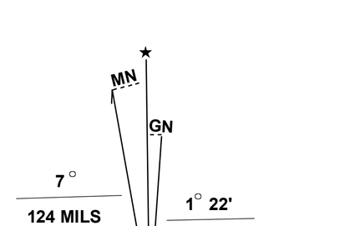
Equal Area Schmidt Net Projection of Poles to Primary Layering and Bedding.
Contour Interval = 1 N = 243



Equal Area Schmidt Net Projection of
Contoured Poles to Foliation.
Contour Interval = 2 N = 428



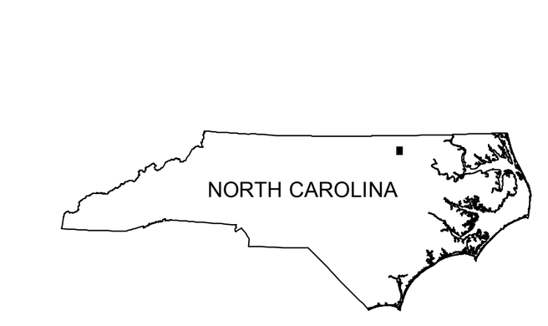
Unidirectional Rose Diagram of Joints. N = 50
Outer Circle = 18%
Mean direction = 287



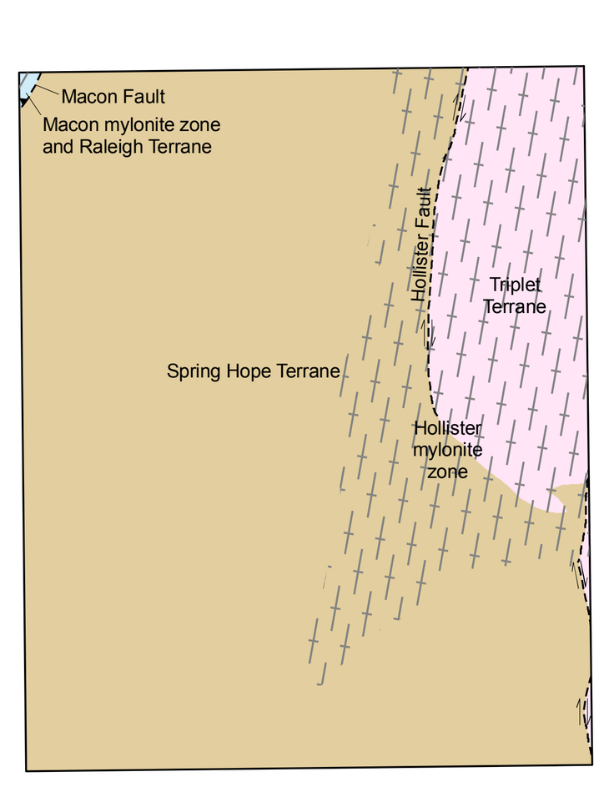
UTM GRID AND 1987 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

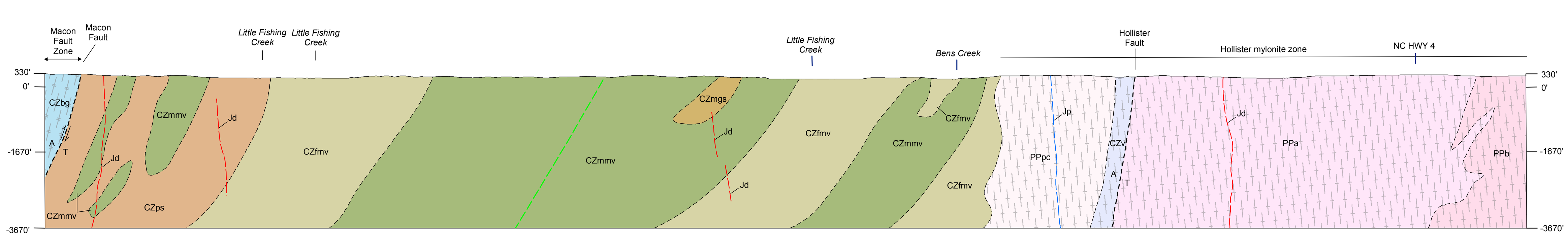
CONTOUR INTERVAL 10 FEET



MAP LOCATION



MAJOR GEOLOGIC FEATURES



cross section scale: 1:24 000 elevation in feet no vertical exaggeration

WHOLE ROCK CHEMISTRY OF SELECTED SAMPLES

OXIDES IN WEIGHT PERCENT / TRACE ELEMENTS IN PARTS PER MILLION

sample	geochem ID	rock type	map unit	source	SiO2	TiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	P2O5	L.O.I.	Total	Rb	Sr	Y	Zr	Nb	Ba
HRB84	1	qtz monzonite	PPb	B;U	62.44	0.83	17.04	6.40	0.11	1.81	4.56	3.67	3.73	0.55	nd	101.12	132	356	25	319	20	2011
HRB95	2	monzogranite	PPa	B;U	68.20	0.51	16.08	2.96	0.03	1.30	2.12	3.79	4.86	0.35	0.44	100.61	177	429	28	377	17	2237
HRB 2	3	leucogranite	PPa	B;U	74.38	0.04	13.33	0.64	0.07	0.26	0.52	3.65	4.20	0.02	0.43	97.51	295	77	56	66	33	164
PHQP	4	leucogranite	PPa	U	74.55	0.06	12.34	0.42	0.04	0.05	0.73	4.26	4.53	0.04	nd	97.02	286	74	88	64	31	nd
PHQG	5	leucogranite	PPa	U; S	74.02	0.19	13.98	1.13	0.10	0.27	1.11	3.53	4.79	0.07	nd	99.19	319	106	78	152	36	nd
HRB40	6	monzogranite	PPpc	B;U	70.03	0.28	15.49	1.71	0.03	0.80	1.54	4.39	3.50	0.10	1.26	99.10	128	723	15	188	10	nd
WRBSL	7	metarhyodacite	CZfmv	S	75.90	0.28	10.50	2.73	0.02	tr	0.24	4.10	4.34	0.05	nd	98.16	130	86	50	365	25	nd
HRB241a	8	metabasalt	CZmmv	B	50.98	0.78	16.81	11.24	0.24	11.75	7.49	2.02	0.08	0.05	nd	101.44	nd	138	31	49	6	nd
HRB244	9	metabasalt	CZmmv	B	57.61	1.55	14.51	13.08	0.23	4.14	7.48	1.44	0.06	0.29	nd	100.39	nd	228	41	112	9	nd
HRB255	10	metabasalt	CZim	B	55.50	1.56	14.81	13.92	0.28	3.66	5.32	3.26	0.30	0.21	nd	98.82	nd	282	36	101	9	nd
HRB260	11	metabasalt	CZmmv	B	50.43	1.16	15.03	14.29	0.31	9.40	4.66	2.80	0.26	0.10	nd	98.44	nd	41	30	64	2.4	nd
WRB328	12	amphibolite	CZmmv	B	56.79	1.58	14.23	13.64	0.21	3.55	6.89	2.74	0.40	0.36	nd	100.39	nd	218	41	86	10	nd
WRB333	13	amphibolite	CZmmv	B	51.16	1.27	14.32	14.50	0.26	5.22	9.69	0.98	0.29	0.21	nd	97.90	nd	141	32	82	8	nd
HESK2	14	amphibolite	CZmmv	B	53.00	1.22	14.81	12.63	0.21	4.74	9.68	1.76	0.34	0.21	1.44	100.04	nd	101	34	78	5	nd
WRB21A	15	amphibolite	CZfmv	B	49.13	0.47	15.96	9.72	0.15	8.75	12.41	0.65	0.12	0.07	0.84	98.27	nd	107	25	30	4	nd
WRB24	16	amphibolite	CZmmv	B	49.63	0.48	16.05	10.59	0.18	9.14	12.32	0.39	0.10	0.06	1.02	99.96	nd	91	23	22	2	nd
WRB181	17	amphibolite	CZmmv	B	49.39	0.87	15.15	11.19	0.19	6.35	12.14	0.26	0.13	0.14	1.22	97.03	nd	117	30	70	2	nd
HRB237	18	metagabbro	CZmmv	B	48.88	0.61	15.78	8.72	0.19	9.00	13.06	2.22	0.19	0.08	nd	98.73	nd	nd	nd	nd	nd	nd
HRB256	19	metadiorite	Czim	B	55.80	0.79	14.42	13.41	0.24	4.40	5.02	2.67	0.58	0.32	1.72	99.37	nd	nd	nd	nd	nd	nd

Analyses by X-ray fluorescence spectrometry; North Carolina State University
Total Fe as Fe2O3; tr=trace; nd=not determined
L.O.I. = percent weight loss on ignition
source: B= Boltin (1985); S= Stoddard and others (1987); U= unpublished data

BEDROCK GEOLOGIC MAP OF THE HOLLISTER 7.5-MINUTE QUADRANGLE, HALIFAX AND WARREN COUNTIES, NORTH CAROLINA

By Paul E. Sacks, William R. Boltin and Edward F. Stoddard

Digital representation by Michael A. Medina, Heather D. Hanna and Philip J. Bradley

2011

INTRODUCTION

The Hollister 7.5-minute quadrangle lies in the northeastern Piedmont of North Carolina, along the Warren-Halifax County line, which runs NNE and splits the quad in half. Three state highways cut across the quadrangle: NC Highway 4 runs north to south between Littleton and Rocky Mount, NC 43 west to east between Liberia (Warren County) and New Bern (Craven County), and NC 561 west to east between Louisburg and Ahoskie. There are no incorporated towns within the quadrangle; the largest community, Hollister, which is located at the southern edge of the quadrangle in southwestern Halifax County, has a post office and an elementary school. Many of the residents in the area have Native American heritage. The Haliwa-Saponi Tribal School, a charter school, is located at the southwestern edge of the quadrangle in a small Warren County community called Old Bethlehem. Other communities include Airlie (Halifax County), and Odell and Arcola (Warren County). Arcola is the site of a large lumber mill. Medoc Mountain State Park is located at the southeastern corner of the quadrangle, on a ridge that was the site of a former vineyard.

Little Fishing Creek traverses the entire quadrangle from northwest to southeast, emptying into Fishing Creek to the south. Tributaries to Little Fishing Creek include Reedy Creek, Bens Creek, Porter Creek, Butterwood Creek and Bear Swamp. Bobs Branch flows west from the southwestern part of the quad, emptying into Fishing Creek in the Inez quad to the west. Total relief in the quadrangle is about 220 feet, with a high around 360 feet above sea level near the west edge of the quad north of Arcola, along CR 1514, while the low point is just less than 140 feet above sea level where Little Fishing Creek exits the southeast corner of the quad in Medoc Mountain State Park. An abandoned crushed stone quarry, known as the Alston Quarry, is located south of Airlie, about 0.25 mi west of CR 1315. Two Mo-Cu prospects lie in the southeast part of the quad, the Ellis prospect north of NC 561, and the Boy Scout-Jones prospect at Medoc Mountain.

GEOLOGICAL FRAMEWORK

Three major groups of rocks underlie the quadrangle. They include late Proterozoic to Cambrian metamorphic rocks of the Raleigh terrane, present only in the extreme northwest corner of the quadrangle. Proterozoic to Cambrian metamorphic rocks of the Spring Hope terrane underlie the greatest portion of the quadrangle. In addition, the eastern third of the quadrangle contains portions of several late Paleozoic granitoid plutons. Two major late Paleozoic faults also lie within the quadrangle. The Macon fault separates the Raleigh terrane from the Spring Hope terrane. The Hollister fault, which separates the Spring Hope terrane from the Triplet terrane, tracks through younger granitic rocks in the eastern part of the quadrangle. Metamorphic rocks of the Triplet terrane occur east of the Hollister Quadrangle in the Aurelian Springs Quadrangle. Rocks of the Raleigh terrane, poorly exposed in the Hollister Quadrangle, consist of gneisses and schists, and are interpreted as an infrastructural component of a Neoproterozoic volcanic arc (Hibbard and others, 2002). The suprastructural Spring Hope terrane comprises metasedimentary and metavolcanic rocks. The Raleigh terrane comprises amphibolite-grade metamorphic rocks, while rocks of the Spring Hope terrane in the Hollister quad have been subjected to a range of metamorphic conditions, from mid-greenschist to mid-amphibolite facies, as well as hornfels facies in contact aureoles adjacent to, and as enclaves within granite plutons (Boltin, 1985; Boltin and Stoddard, 1987).

Late Paleozoic granitic rocks in the quadrangle range from medium-grained and equigranular to strongly megacrystic, and from undeformed to strongly deformed rocks including ribbon mylonites. Nearly all of the granitic rocks are divided into four separate plutons: Butterwood Creek, Airlie, Panacea Springs, and Medoc Mountain. The Butterwood Creek and Airlie plutons intrude metamorphic rocks of the Triplet terrane, while the other two intrude the Spring Hope terrane. Fullagar and Butler (1979) reported an Rb/Sr age of 301+/- 6 Ma for the Medoc Mountain pluton, while Russell and others (1985) reported an Rb/Sr age of 292 +/- 31 Ma for the Butterwood Creek pluton. Despite the fact that subsequent mapping indicates that some of the samples analyzed in their Butterwood Creek study are actually from the Panacea Springs pluton, a late Paleozoic (Alleghanian) age is likely for all four granitic plutons in the Hollister Quadrangle.

Intrusive rocks of Jurassic age cut the older rocks of the quadrangle. These are of two types: olivine diabase and rhyolite porphyry. Both types occur as NNW-trending, steeply dipping dikes; the porphyries comprise a swarm of dikes in the eastern half of the quadrangle. The unusual rhyolite porphyry has been dated at 196 – 200 Ma by several methods (Stoddard and others, 1986; Ganguli and others, 1995). In the northeastern corner of the quadrangle along NC Highway 4, sedimentary deposits of the Atlantic Coastal Plain underlie a high flat area; they are not shown on the geologic map.

PREVIOUS WORK

Previous geologic investigations pertinent to the Hollister quadrangle include several regional and reconnaissance studies. Parker (1968) defined the structural framework of the region. McDaniel (1980) mapped a multi-county region, including Warren County, at a scale of 1:100,000. Farrar (1985a, b) mapped the entire eastern Piedmont of North Carolina, defined map units for the region, and proposed a model for the tectonic evolution of the region.
In a more detailed study, Boltin (1985) produced a geologic map of the Hollister quadrangle and described a strong metamorphic gradient across the quadrangle (Boltin and Stoddard, 1987); this map updates and adds detail to the earlier map. Immediately to the north, the Littleton quadrangle has now been mapped (Stoddard and others, 2011). Stoddard and others (2009) mapped a four-quad area to the immediate southwest of the Hollister quadrangle. Mapping by Sacks (1999 and unpublished manuscript map), in his study of the Hollister fault zone, constitutes the eastern portion of the geologic map and served as an impetus for this study.

Other research pertinent to the geology of the Hollister quadrangle includes a study of the Halifax County complex just to the southeast (Kite, 1982; Kite and Stoddard, 1984), investigations of Mesozoic dikes (Delorey, 1983; Stoddard and others, 1986; Stoddard, 1992).
In a study addressing the Medoc Mountain granite pluton and related mineralization Harvey (1974) examined rock cores, thin sections, and polished surfaces taken from ten drill holes ranging up to 702 feet deep. The Medoc Mountain granite is not well exposed at the surface. Analyses of garnet from the Airlie granite exposed in the Alston quarry are included in a study by Miller and Stoddard (1981). One published field trip guide includes stops within the Hollister quadrangle (Stoddard and others, 1987).

DESCRIPTION OF MAP UNITS

INTRUSIVE UNITS

Jp – rhyolite porphyry: Dark gray to black, strongly porphyritic dike rocks containing phenocrysts of alkali feldspar (sanidine-anorthoclase) and quartz, and locally microphenocrysts of Fe-Ti oxide minerals, ferropigeonite, and amphibole. Commonly with ovoid, locally aligned amygdules of calcite, silica, or a green swelling clay mineral. Occurs in steeply dipping, NNW-trending dikes that correlate with linear magnetic highs. Weathers spheroidally. Blue dots indicate outcrops or float occurrences.

Jd – diabase: Fine to medium-grained, dark gray to black, equigranular to locally plagioclase porphyritic diabase, typically olivine-bearing. Commonly weathers to tan-gray, spheroidal boulders and cobbles. Occurs in vertical to steeply dipping dikes. The traces of the larger dikes correlate with and may be partly inferred on the basis of linear magnetic highs. In the Hollister quad, nearly all diabase dikes trend NW to NNW. Red dots indicate outcrops or float occurrences.

PPpc – Panacea Springs granite: Medium-gray, coarse-grained, porphyritic, foliated biotite granite, composed of plagioclase, microcline, quartz, biotite, opaque minerals, and minor white mica; locally contains microcline phenocrysts as long as 3 cm. Locally mylonitic along eastern margin (Sacks, 1996c). Apparently sampled in the Littleton quad and analyzed by Vynhal and McSween (1990) as their "deformed Butterwood Creek" granite. A mylonitic sample of PPpc was analyzed by Boltin (1985) and falls in the monzogranite compositional range (see table, sample HRB40).

Ppa – Airlie granite: Light gray or beige, fine- to medium-grained, dominantly equigranular biotite, muscovite, muscovite-biotite, and muscovite-biotite-garnet monzogranite and leucomonzogranite. Generally massive, but locally weakly to moderately foliated. Mylonitic along western margin (Sacks, 1999). Cuts and locally contains enclaves of megacrystic Butterwood Creek granite. Whole-rock chemical analyses show weakly to strongly peraluminous composition for Airlie samples (see geochemical table, analyses HRB2, HRB95, PHQP, and PHQG). Sample locations are shown on the geologic map. HRB-2 and other samples collected from the abandoned Alston Quarry are leucogranitoid rocks. Garnets from these rocks are spessartine-almandine solutions (average mole % 46.9 alm, 48.3 sps, 2.7 pyr, 2.1 grs); white mica ("muscovite") inferred to be magmatic is phengitic, containing 4.5 – 5.5 wt % FeO; 0.47-0.71 wt% TiO2, and 0.76-1.46 wt% MgO). The mineral analyses are unpublished, but fall in the range described by Miller and Stoddard (1981) and Miller and others (1981). According to Boltin (1985, Table 7), plagioclase from biotite monzogranite (HRB 95) is oligoclase An21-25, while plagioclase from leucomonzogranite (HRB 2) is albite to oligoclase (An9-14).

PPb – Butterwood Creek granite: Medium gray to tan, megacrystic biotite +/- hornblende monzogranite or quartz monzonite with accessory titanite. Generally massive, locally with a weak magmatic alignment of K-feldspar megacrysts. Plagioclase analyzed by Boltin (1985, Table 7, HRB 74) is in the andesine range (An 31-38). At its western and northwestern margin, where it is intruded by granite of the Airlie pluton within the Hollister fault zone, the Butterwood Creek granite carries a strong deformational fabric. There, megacrysts are strongly aligned, quartz ribbons are developed, and the foliation is composite with both a mylonitic foliation defined by aligned feldspars, biotite and quartz ribbons, and shearbands that offset the main foliation in a dextral sense (Sacks, 1999). Sampled were collected and studied from the Aurelian Springs quad by Vynhal and McSween (1990) as their "undeformed Butterwood Creek granite." A single whole-rock chemical analysis of Butterwood Creek granite is shown in the chemical table (HRB84), and yields norms falling in the quartz monzonite field. Grundy (1983) analyzed samples of Butterwood Creek granitoids from the Thelma quadrangle.

PPm – Medoc Mountain granite: Pink, medium- to coarse-grained biotite syenogranite and leucogranite, with accessory epidote or allanite; altered portions carry white mica, chlorite, fluorite, and carbonate minerals. Sulfide mineralization characterized by pyrite, chalcopyrite, and molybdenite (description adapted from Harvey, 1974).

PPg – unnamed granite: Medium-gray, medium-grained biotite and muscovite-biotite granite and leucogranite.

PPgm – mylonitic granite: Medium-gray, medium- to fine-grained biotite and muscovite-biotite granite in the Hollister fault zone; locally contains feldspar porphyroclasts as long as 1-2 cm; variably mylonitic or gneissic; commonly lineated (Sacks, 1996d).

METAMORPHIC ROCKS OF THE SPRING HOPE TERRANE

Note: order of listed units does not imply stratigraphic sequence.

Czim – intermediate-mafic metaplutonic rocks: Dark green to greenish-black, medium- to coarse-grained weakly foliated to massive metagabbro or metadiorite consisting of amphibole, plagioclase, and clinopyroxene, with local quartz and epidote; and tan to brownish medium-grained weakly to non-foliated metadiorite containing plagioclase, biotite, quartz, and local epidote or clinozoisite. Displays probable relict plutonic texture. Chemical analyses of one sample each of metadiorite and metagabbro are shown in the table.

CZmmv – mafic metavolcanic rocks: Green to dark green, fine to medium grained, weakly to moderately foliated amphibolite, amphibole gneiss, greenstone, phyllite, and quartz-epidote rock containing various mixtures of hornblende, plagioclase, epidote/clinozoisite, quartz, chlorite, and opaque minerals. In the southeastern Hollister quad, includes metabasalt having obvious relict primary igneous textures including plagioclase phenocrysts and randomly oriented groundmass laths, as well as amygdules filled with calcite, epidote-clinozoisite, or quartz (Boltin, 1985). Boltin (1985) also describes a hyaloclastite breccia. Chemical analyses of metabasalt and amphibolite are shown in the table. Amphibolite analyses suggest either ocean-floor or volcanic-arc affinities (Boltin, 1985) while the metabasalts are interpreted to be low-K abyssal tholeiites that underwent spilitization and low-grade metamorphism (Boltin, 1985). Boltin and Stoddard (1987) suggest that these rocks belong to the same low-K tholeiitic suite as do rocks of the Halifax complex to the south (Kite and Stoddard, 1984), and that they represent a more distal position relative to the volcanic source.

CZfmv – felsic metavolcanic rocks: Light grayish-tan, fine-grained, layered felsic gneiss composed primarily of plagioclase, quartz, and microcline, with minor or accessory biotite, garnet, amphibole, epidote, white mica and opaque minerals. Typically contains significant magnetite. Rare relict phenocrysts of sodic plagioclase and/or quartz are locally present. Rock is distinctively hornfelsic in contact aureoles and where occurring as enclaves within granite plutons. Common metamorphic minerals, especially in hornfels zone, include Ca-amphibole, Mn-Fe garnet, and magnetite; these minerals may occur in clusters, suggesting they are pseudomorphous after mafic phenocrysts or possibly amygdules. Interpreted to be pyroclastic or lava in origin. Includes Bens Creek leucogneiss of Farrar (1985a,b) and quartzite of McDaniel (1980); also believed to be correlative with "dacitic bluestone" mapped to the southwest (Stoddard, 1993; Stoddard and others, 2009). Major-element chemical data (chemical table, specimen WRB-SL) from a low roadcut in the northwestern Hollister quad indicate that the rock has a rhyodacitic protolith. The unit includes dacitic to rhyolitic rocks based on analyzed samples from elsewhere (Stoddard, 1993; Stoddard and others, 2011).

CZmgs – metagraywacke and metasiltstone: Light greenish to medium-brown or gray, fine- to medium-grained metagraywacke; fine, typically phyllitic, slaty or fissile metasiltstone. Consists of quartz, plagioclase, white mica, biotite, epidote and opaque minerals. Locally displays relict clastic texture and sedimentary bedding or laminae, commonly with a tectonic cleavage at an angle. May weather into thin slabs. Includes minor metavolcanic rocks including felsic varieties with possible phenocrysts of plagioclase and quartz, and chlorite-actinolite phyllite likely derived from a mafic protolith. Includes minor metamudstone, and rare pebbly metagraywacke and metaconglomerate in the southeastern Hollister Quadrangle.

CZps – muscovite-garnet schist: Silver to gray white mica schist and phyllite commonly containing porphyroblasts of staurolite and garnet. May also contain quartz, chlorite, biotite, tourmaline, sodic plagioclase, and opaque minerals. Rock is typically well crenulated, with crenulation cleavage overprinting the schistosity. Unit also includes rare interlayers of fine-grained micaceous quartzite; one quartzite specimen contains biotite, muscovite, chloritoid, staurolite, garnet and opaque minerals.

CZv – metavolcanic rocks undivided: Mixed fine- to medium-grained metavolcanic rocks of felsic, mafic, or intermediate composition, together with volcaniclastic metasedimentary rocks. Includes phyllite, schist, gneiss, greenstone, amphibolite and metagraywacke.

CZsm: - metamudstone: Light tan to medium-brown massive to laminated metamudstone, locally phyllitic. Includes minor metasiltstone. Locally carries cleavage at angle to bedding.

Zone of high strain overprint of Hollister fault zone

METAMORPHIC ROCKS OF THE RALEIGH TERRANE

Note: order of listed units does not imply stratigraphic sequence.

CZbg – biotite gneiss: Predominantly interlayered medium-gray to greenish-gray, fine to medium-grained biotite gneiss and grayish-tan muscovite-biotite gneiss composed of plagioclase, quartz, biotite, white mica, and local garnet. Interlayered with dark grayish-green to greenish-black, medium-grained amphibole and amphibole-biotite gneiss composed of plagioclase and amphibole, and local biotite, quartz, clinopyroxene, magnetite and/or epidote. Also contains minor interlayers of muscovite schist.

CZgg – granitic gneiss: Light tan, light gray, and light brown, fine- to medium-grained quartzofeldspathic gneiss and foliated metagranitoid, consisting of quartz, sodic plagioclase, microcline, white mica, and locally biotite. May show retrograde effects including chlorite and sericite.

Zone of high strain overprint of Macon fault zone

ACKNOWLEDGMENTS

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

CONTACTS, FOLDS AND OTHER FEATURES

Lithologic contacts - Distribution and concentration of structural symbols indicates degree of reliability.

Base topographic map is a digital raster graphic image of the Hollister 7.5-minute quadrangle (1973), Lambert Conformal Conic projection.

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The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

Disclaimer:
This Open-File report is preliminary and has been reviewed internally for conformity with the North Carolina Geological Survey editorial standards. Further revisions or corrections to this preliminary map may occur.

- contact - location inferred
- brittle fault
- thrust fault - location inferred, sawtooth on upthrown side
- strike-slip fault - location inferred; ? indicates existence questionable; in cross section: T- towards observer, A - away from observer
- in cross section, inferred axial trace of fold
- inferred fold hinge of anticline
- inferred fold hinge of syncline
- inferred fold hinge of overturned anticline
- inferred fold hinge of plunging overturned syncline
- A — A' cross section line
- 39 strike and dip of inclined primary bedding (Includes banding, layering and So for Spring Hope metasedimentary rocks)
- 43 / 34 strike and dip of inclined primary bedding (multiple observations at one locality)
- 50 strike and dip of compositional layering in leucogneiss and other high grade rocks
- 57 / 77 strike and dip of compositional layering in leucogneiss and other high grade rocks (multiple observations at one locality)
- 62 strike and dip of inclined regional foliation (Includes mylonitic foliation of Sacks (1996c))
- 58 / 72 strike and dip of inclined regional foliation (multiple observations at one locality)
- horizontal regional foliation
- strike of vertical regional foliation (includes mylonitic foliation of Sacks (1996c))
- strike of vertical regional foliation (multiple observations at one locality)
- 60 strike and dip of inclined mylonitic foliation
- 83 / 85 strike and dip of inclined normal slip crenulation or shear band (multiple observations at one locality)
- strike of vertical normal slip crenulation or shear band
- 64 strike and dip of cleavage (Includes S2 for Spring Hope metasedimentary rocks)
- 40 / 61 strike and dip of cleavage (multiple observations at one locality)
- 60 strike and dip of inclined joint surface
- 45 / 75 strike and dip of inclined joint surface (multiple observations at one locality)
- strike of vertical joint surface (multiple observations at one locality)
- 47 strike and dip of inclined quartz vein
- 80 strike and dip of inclined mesoscale fault
- 82 / 84 Strike and dip of axial surface of mesoscale fold (multiple observations at one locality)
- 70 strike and dip of slickenside
- 28 bearing and plunge of mesoscale fold hinge
- 14 bearing and plunge of lineation
- bearing of horizontal lineation
- 70 bearing and plunge of slickenline
- observation station location
- abandoned quarry
- abandoned prospect: A - Boy Scout-Jones molybdenum prospect; B - R.A. Ellis molybdenum prospect
- 14 geochemical sample ID