North Carolina Department of Environmental Quality
Policy and Innovation Group

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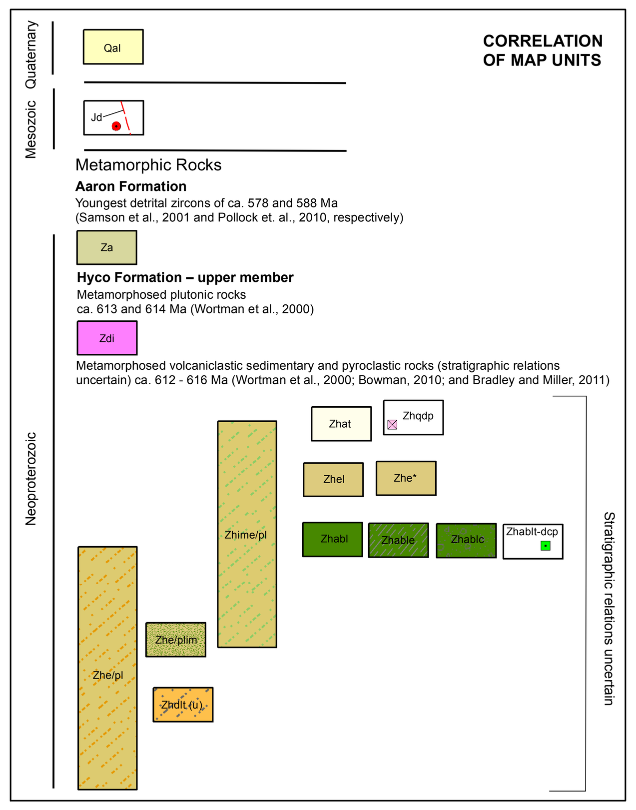
This Geologic map was funded in part by the USGS National Cooperative Geologic Mapping Program

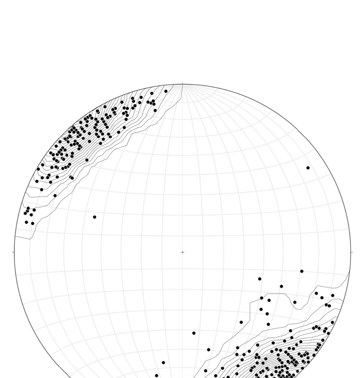
North Carolina Geological Survey
Open File Report 2017-07

CORRELATION OF MAP UNITS

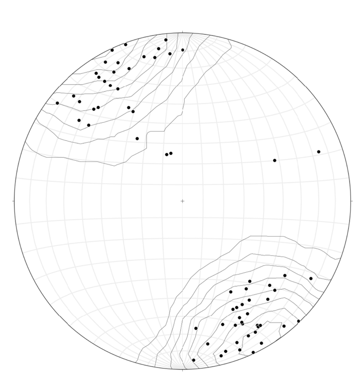


Equal-Area Schmidt Net Projections and Rose Diagram

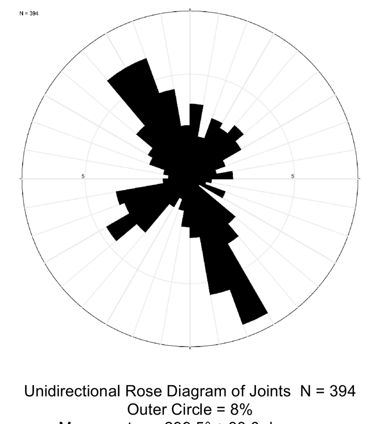
Plots and calculations created using Stereonet v. 8.6.0 based on Allmendinger et al. (2013) and Cardozo and Allmendinger (2013).



Equal Area Schmidt Net Projection of Contoured Poles to Foliation and Cleavage
Contour Interval = 2 sigma N =389



Equal Area Schmidt Net Projection of Contoured Poles to Primary Bedding, Layering, and Welding Compaction/Foliation
Contour Interval = 2 sigma N = 67



Unidirectional Rose Diagram of Joints N = 394
Outer Circle = 8%
Mean vector = 299.5° ± 33.0 degrees
Max value = 7.4% between 151° and 160°

INTRODUCTION

The Siler City 7.5-minute Quadrangle lies in the east central portion of the North Carolina Piedmont. The Rocky River crosses the northeastern corner of the quadrangle and the Town of Siler City (population approximately 8,200) occupies the northwest portion of the quadrangle. The quadrangle is crossed by northwest-southeast US Highway 421, and by east-west US Highway 64.

The Rocky River primarily controls the drainage in the quadrangle; named tributaries include: Meadow Creek, Loves Creek, Welch Branch, Tick Creek, Evans Creek and Sandy Branch. On the western side of the quadrangle, the Deep River controls the drainage with named tributaries of Little Brush, Blood Run and other unnamed tributaries. The drainage divide is locally controlled by a ridge that marks a major geologic contact (Hyco and Aaron Formations contact) in the quadrangle. Natural exposures of crystalline rocks occur mainly along these and numerous unnamed creeks. Rock exposure at road cuts, ridges, resistant finned-shaped outcrops and pavement outcrops occur locally outside of drainages. The elevations in the map area range from about 760 feet above sea level along Fire Tower Road (on the ridge that defines the drainage divide between the Rocky and Deep Rivers) in the western portions of the quadrangle southwest of the Siler City town limits, to less than 430 feet along Tick Creek at the eastern edge of the quadrangle.

Geologic Background and Past Work

Pre-Mesozoic crystalline rocks in the Siler City Quadrangle are part of the redefined Hyco Arc (Hibbard et al., 2013) within the Neoproterozoic to Cambrian Carolina terrane (Hibbard et al., 2002; and Hibbard et al., 2006). In the region of the map area, the Carolina terrane can be separated into two lithotectonic units: 1) the Hyco Arc and 2) the Aaron Formation of the redefined Virgilina sequence (Hibbard et al., 2013). The Hyco Arc consists of the Hyco Formation which include ca. 612 to 633 Ma (Wortman et al., 2000; Bowman, 2010; Bradley and Miller, 2011) metamorphosed layered volcaniclastic rocks and plutonic rocks. Available age dates (Wortman et al., 2000; Bradley and Miller, 2011) indicate the Hyco Formation may be divided into lower (ca. 630 Ma) and upper (ca. 615 Ma) members (informal) with an apparent intervening hiatus of magmatism. In northeastern Chatham County, Hyco Formation units are intruded by the ca. 579 Ma (Tadlock and Loewy, 2006) East Farrington pluton and associated West Farrington pluton. The Aaron Formation consists of metamorphosed layered volcaniclastic rocks with youngest detrital zircons of ca. 578 and 588 Ma (Samson et al., 2001 and Pollock, 2010, respectively).

The Hyco Arc and Aaron Formation lithologies were folded and subjected to low grade metamorphism during the ca. 578 to 554 Ma (Pollock, 2007; Pollock et al., 2010) Virgilina deformation (Glover and Sinha, 1973; Harris and Glover, 1985; Harris and Glover, 1988; and Hibbard and Samson, 1995). In the map area, original layering of Hyco and Aaron Formation lithologies are interpreted to range from shallowly to steeply dipping due to open to isoclinal folds that are locally overturned.

Map units of metavolcanic and metavolcaniclastic rocks include various lithologies that when grouped together are interpreted to indicate general environments of deposition. The dacitic lavas and tuffs unit is interpreted to represent dacitic domes and proximal pyroclastics. The andesitic to basaltic lavas (with tuffs or conglomerates) units are interpreted to represent eruption of intermediate to mafic lava flows and associated pyroclastic and/or epiclastic deposits. The epiclastic/pyroclastic units are interpreted to represent deposition from the erosion of dormant and active volcanic highlands. Some of the metavolcaniclastic units within the map area display lithologic relationships similar to dated units present in northern Orange and Durham Counties. Due to these similarities, the metavolcanic and metavolcaniclastic units have been tentatively separated into upper and lower portions of the Hyco Formation; geochronologic data in the map area is needed to confirm this interpretation. A review of the regional lithologies is summarized in Bradley (2013).

The map area is located immediately north of the study area of Green et al. (1982), Abdelzahir (1978), and Green (1977). Their studies documented the presence of an overlapping series of metavolcanic and metavolcaniclastic lithologies sourced from distinct areas.

Abundant evidence of brittle faulting at the outcrop scale and large-scale lineaments (as interpreted from hillshade LiDAR data) are present in the map area. The brittle faulting and lineaments are interpreted to be associated with Mesozoic extension. The Colon cross-structure (Reinemund, 1955), located to the southeast of the study area, is a constriction zone in the Deep River Mesozoic basin and is characterized by crystalline rocks overprinted by complex brittle faulting. Dikes of Jurassic aged diabase intrude the crystalline rocks of the map area. Quaternary aged alluvium is present in most major drainages.

Mineral Resources

There are no active mining activities currently in the quadrangle. An abandoned quarry utilized for gravel is present in the northeast corner of the quadrangle. An abandoned quarry utilized for crushed stone is present along the east-central edge of the quadrangle. One historic small flagstone quarry was identified.

Two historic mine locations are present: 1) the Gilmore-Hart Copper Mine and 2) Ore Hill Iron Mine. The Gilmore-Hart is described as a consisting of two holes with one hole having been worked for copper in the 1860's(?) (Carpenter, 1976). The Ore Hill Iron Mine, located southwest of Mount Vernon Springs, was an important local source for iron ore during the Revolutionary and Civil Wars. Ore Hill is described in several historic publications from the North Carolina Geological Survey including Nitze (1893 a and b) and Kerr and Hanna (1888). The Nitze (1893a) publication includes a detail map of the site depicting locations of excavations and the location of the furnace. Carpenter (1976) provides a brief summary of the Ore Hill iron mine and former workings. According to Carpenter (1976), "This mine was worked primarily during the Revolutionary and Civil Wars. The Sapona Iron Company operated a small charcoal furnace here during the Civil War and the North Carolina Steel and Iron Company took out 700 tons during prospecting, apparently around 1890. There was some production in 1903. Numerous openings were made on the property. Opening No. 1 was 40 feet deep with drifts in several directions; opening No. 2 was 80 feet deep with one short drift; the Whim shaft was 90 feet deep, and four other openings were 85, 10, 4 and 12- feet in depth."

Description of Map Units

All pre-Mesozoic rocks in the map area 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. Jurassic diabase dikes are unmetamorphosed.

A preliminary review of the area geology is provided in Bradley (2013). Unit descriptions common to Hanna et al. (2015) and Hanna et al. (2014) from the Siler City NE and Silk Hope geologic maps, respectively, were used for conformity with on strike units in neighboring quadrangles. Unit descriptions and stratigraphic correlations were maintained from adjacent mapping in Orange County (Bradley et al., 2016). The nomenclature of the International Union of Geological Sciences subcommission on igneous and volcanic rocks (IUGS) after Le Maitre (2002) 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 — **Qal – Alluvium:** Unconsolidated poorly sorted and stratified deposits of angular to subrounded clay, silt, sand and gravel- to boulder-sized clasts, in stream drainages. May include point bars, terraces and natural levees along larger stream floodplains. Structural measurements depicted on the map within Qal represent outcrops of crystalline rock inliers surrounded by alluvium.

Intrusive and Metaintrusive Units

Jd — **Jd – Diabase:** Black to greenish-black, fine- to medium-grained, dense, consists primarily of plagioclase, augite and may contain olivine. Occurs as dikes up to 100 ft wide. Diabase typically occurs as spheriodally weathered boulders with a grayish-brown weathering rind. Red station location indicates outcrop or boulders of diabase.

MPzgb — **MPzgb – Gabbro:** Melanocratic (CI greater than 50), fine-grained gabbro. Distinctive brown weathering. Occurs as a small map scale body in the adjacent Crutchfield Crossroads Quadrangle that is closely associated with a diabase dike. In the Siler City Quadrangle occurs as isolated boulders along the trend of a diabase dike. Appears unmetamorphosed. Purple station locations indicate outcrop or boulders of MPzgb.

Zdi — **Zdi – Diorite:** Mesocratic (CI~50), greenish-gray to grayish-green, fine- to medium-grained, metamorphosed, hypidiomorphic granular diorite. Major minerals include plagioclase and amphibole. Plagioclase crystals are typically sericitized and saussuritized. Amphiboles are typically altered to chlorite and actinolite masses. Gabbro intermingled locally.

Metavolcanic and Metavolcaniclastic Units

Aaron Formation

Za — **Za – Aaron Formation:** Distinctive metasedimentary package that ranges from fine-grained siltstones to coarse-grained sandstones, pebbly sandstones and conglomerates. Siltstones are similar in appearance to Hyco Formation lithologies. The sandstones, pebbly sandstones and conglomerates (classified as litharenite, feldspathic litharenite and lithic feldsarenite by Harris (1984)) are distinctive and commonly contain rounded to subrounded clasts of quartz ranging from sand- to gravel-sized. In the sandstones, feldspar is the most prominent mineral grain; quartz varies from sparse to abundant in hand sample. Lithic clasts are typically prominent and range from sand- to gravel-size. Harris (1984), performed a detailed sedimentary study of the Aaron Formation to the immediate west of the map area. Harris (1984) interpreted the Aaron Formation to have been deposited by turbidity currents in a retrogradational submarine fan setting. Pollock (2010) interprets an approximate 35 million year unconformity between the Aaron and underlying Hyco Formation. This interpretation is based in part on detrital zircon age date data from an Aaron conglomerate sample collected in the nearby Liberty Quadrangle.

Hyco Formation – Upper Portion

Zhat — **Zhat – Altered tuffs:** Very light gray to light greenish gray (whitish in areas) with red and yellow mottling, altered volcaniclastic rocks. Alteration consists of silicified, sericitized and pyrophyllitized rock. Sericite phyllite, pods of pyrophyllite, and quartz + phyrophyllite rock all with less than 1 mm to 2 mm diameter weathered sulfides are common. Relict lithic clasts and kaolinitized feldspar crystal shards are visible in some exposures. Relict structures are obliterated in heavily altered rocks. Map area contains boulders (up to several feet in diameter) and outcrop of massive milky quartz and quartz + sericite rock. Chloritoid and staurolite present locally.

Zhqdp — **Zhqdp - Quartz dacite porphyry:** Porphyritic with aphanitic groundmass and sub- to euhedral phenocrysts (2-6 mm) of white to salmon plagioclase and gray to dark gray (beta-) quartz; phenocrysts typically constitute 20 to 25% of the rock. May locally have fine-grained intrusive texture. Interpreted as either lava flows or shallow intrusives possibly associated with domes. Present locally, mainly in southern portion of quadrangle. Similar to quartz dacite porphyry unit within the Bynum Quadrangle (Bradley et al., 2013). Present as isolated outcrops or boulders as designated by pink-colored station locations.

Zhe* — **Zhe* - Epiclastic rocks of the Southern Chatham County area:** Grayish-green to green, locally with distinctive reddish-gray or maroon to lavender coloration, siltstones, sandstones, conglomeratic sandstone, and conglomeratic siltstone (greywacke). Siltstones are locally phyllitic. Siltstones typically display bedding ranging from mm-scale up to 10 cm, bedding layers traceable for several feet locally, may exhibit soft sediment deformation. Locally tuffaceous with a relict vitric texture. Locally contain interbedded intermediate to mafic lavas. Conglomerates and conglomeratic sandstones typically contain rounded to angular clasts. Deposition interpreted as distal from volcanic center. May be correlative to Green et al. (1982) unit B – Felsic Graywacke Unit.

Zhel — **Zhel - Epiclastic rocks and lavas:** Metamorphosed conglomerate, conglomeratic sandstone, sandstone, siltstone and mudstone. Siltstones and mudstones typically display bedding ranging from mm-scale up to 10 cm, bedding layers traceable for several feet locally, may exhibit soft sediment deformation. Locally tuffaceous with a relict vitric texture. Locally contain interbedded dacitic to basaltic lavas. Conglomerates and conglomeratic sandstones typically contain subrounded to angular clasts of dacite in a clastic matrix. Deposition interpreted as distal from volcanic center, in deep water (?), and via turbidite flows.

Zhe/plim — **Zhe/plim - Mixed epiclastic-pyroclastic rocks with interlayered intermediate to basaltic lavas:** Grayish-green to greenish-gray, locally with distinctive reddish-gray or maroon to lavender coloration; metamorphosed: conglomerate, conglomeratic sandstone, sandstone, siltstone, mudstone, and felsic fine- to coarse tuff and lapilli tuff. Siltstones are locally phyllitic. Locally contain interbedded andesitic to basaltic lavas identical to Zhabl unit. Silicified and/or sericitized altered rock are locally present. Interpreted to be in gradational contact with unit Zhe/pl and identified by increase in intermediate to mafic lavas and decrease and/or absence of dacites.

Zhime/pl — **Zhime/pl - Mixed intermediate to mafic epiclastic-pyroclastic rocks with interlayered intermediate to mafic lavas:** Grayish-green to green, locally with distinctive reddish-gray or maroon to lavender coloration; metamorphosed: conglomerate, conglomeratic sandstone, sandstone, siltstone and mudstone. Lithologies are locally bedded; locally tuffaceous with a cryptocrystalline-like groundmass. Siltstones are locally phyllitic. Locally contain interbedded intermediate to mafic lavas identical to Zhabl, Zhable, and Zhablc units. Contains lesser amounts of fine- to coarse tuff and lapilli tuff with a cryptocrystalline-like groundmass. Pyroclastics, lavas, and epiclastics are mainly intermediate to mafic in composition. Minor dacitic lavas and tuffs present. Silicified and/or sericitized altered rock are locally present. Conglomerates and conglomeratic sandstones typically contain subrounded to angular clasts of andesite and basalt in a clastic matrix. Generally interpreted to have been deposited proximal to active intermediate to mafic composition volcanic centers and/or record the erosion of proximal intermediate to mafic composition volcanic centers after cessation of active volcanism.

Zhe/pl — **Zhe/pl - Mixed epiclastic-pyroclastic rocks with interlayered dacitic lavas:** Grayish-green to greenish-gray, locally with distinctive reddish-gray or maroon to lavender coloration; metamorphosed: conglomerate, conglomeratic sandstone, sandstone, siltstone and mudstone. Lithologies are locally bedded; locally tuffaceous with a cryptocrystalline-like groundmass. Siltstones are locally phyllitic. Locally contain interbedded dacitic lavas identical to Zhdlt unit. Contains lesser amounts of fine- to coarse tuff and lapilli tuff with a cryptocrystalline-like groundmass. Pyroclastics, lavas, and epiclastics are mainly felsic in composition. Minor andesitic to basaltic lavas and tuffs present. Silicified and/or sericitized altered rock are locally present and increase in occurrence toward the north. Conglomerates and conglomeratic sandstones typically contain subrounded to angular clasts of dacite in a clastic matrix. Fine- to medium-grained diorite is locally present. Portions of the Zhe/pl unit are interpreted to have been deposited proximal to active volcanic centers represented by the Zhdlt unit but are also interpreted to record the erosion of proximal volcanic centers after cessation of active volcanism.

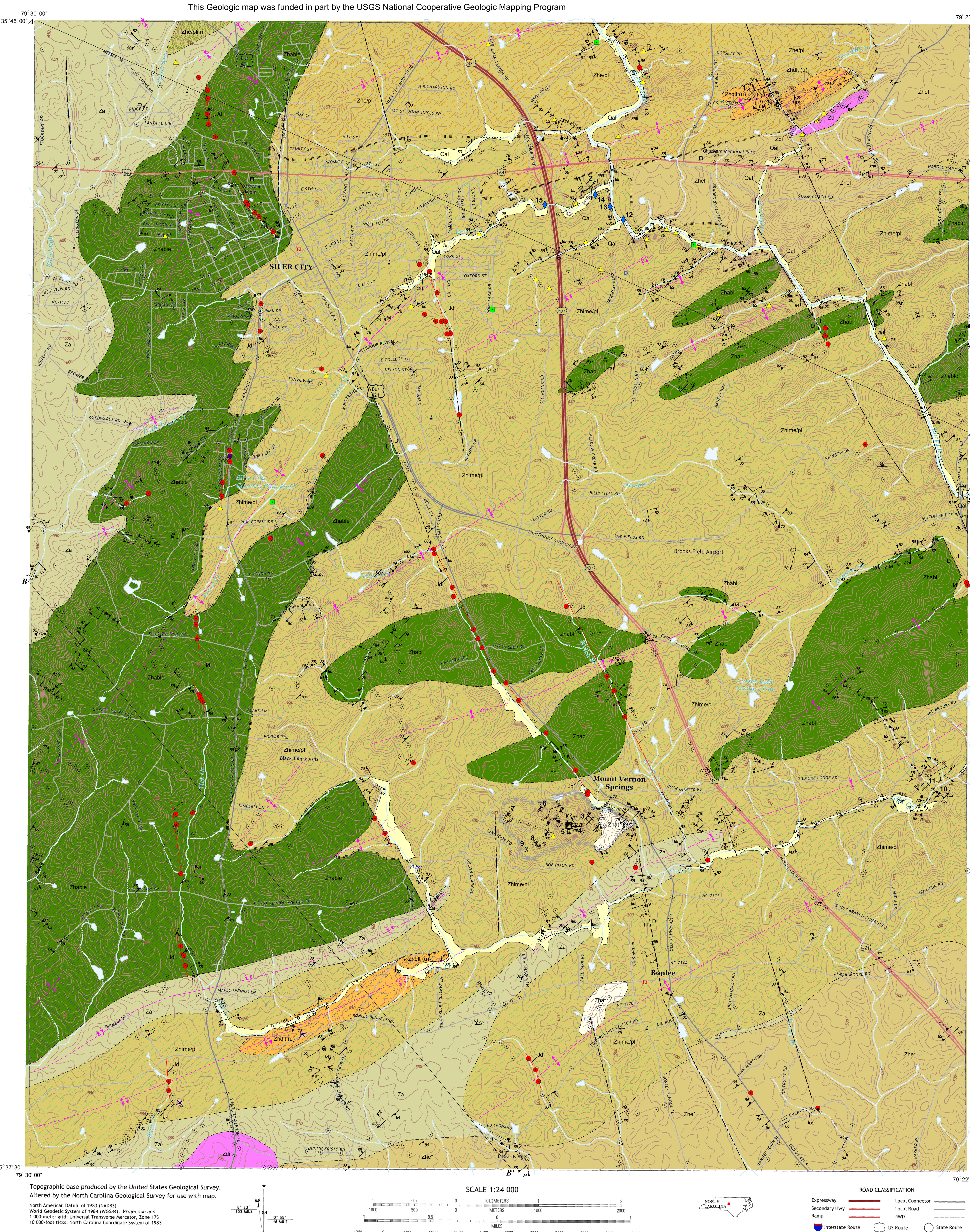
Zhdlt (u) — **Zhdlt (u) – Dacitic lavas and tuffs of the upper portion of the Hyco Formation:** Greenish-gray to dark gray, siliceous, metamorphosed: aphanitic dacite, porphyritic dacite with plagioclase phenocrysts, and flow banded dacite. Dacite with hyaloclastic textures are common. Welded and non-welded tuffs associated with the lavas include: greenish-gray to grayish-green, fine tuff, coarse plagioclase crystal tuff and lapilli tuff. Locally, interlayers of immature conglomerate and conglomeratic sandstone with abundant dacite clasts are present. The dacites are interpreted to have been coherent extrusives or very shallow intrusions associated with dome formation. The tuffs are interpreted as episodic pyroclastic flow deposits, air fall tuffs or reworked tuffs generated during formation of dacite domes. The unit occurs as map scale pods surrounded by clastic rocks of Zhe/pl unit. Wortman et al. (2000) reports an age of 615.7+3.7/-1.9 Ma U-Pb zircon date for a dacitic tuff from the unit in the Rougemont quadrangle.

Zhabl — **Zhabl - Andesitic to basaltic lavas:** Green, gray-green, gray, dark gray and black; typically unfoliated, amygdaloidal, plagioclase porphyritic, amphibole/pyroxene porphyritic and aphanitic; metamorphosed: andesitic to basaltic lavas and shallow intrusions. Hyaloclastic texture is common and imparts a fragmental texture on some outcrops and float boulders. Conglomeratic rocks consisting of angular clasts of andesite and/or basalt occur locally and are interpreted as resedimented hyaloclastite.

Zhable — **Zhable – Andesitic to basaltic lavas with interlayered epiclastic rocks:** Light green, gray-green, gray, and dark gray; typically unfoliated, amygdaloidal, plagioclase porphyritic, amphibole/pyroxene porphyritic and aphanitic; metamorphosed: andesitic to basaltic lavas and shallow intrusions. Hyaloclastic texture is common and imparts a fragmental texture on some outcrops and float boulders. Contains lesser amounts of grayish-green, light green, and light gray to white; metamorphosed conglomerate, conglomeratic sandstone, sandstone, siltstone and mudstone.

Zhablc — **Zhablc - Andesitic to basaltic lavas and conglomerate:** Green, gray-green, gray, dark gray and black; typically unfoliated, amygdaloidal, plagioclase porphyritic, amphibole/pyroxene porphyritic and aphanitic; metamorphosed: andesitic to basaltic lavas and shallow intrusions. Hyaloclastic texture is common and imparts a fragmental texture on some outcrops and float boulders. Interlayers of conglomeratic rocks consisting of angular clasts of andesite and/or basalt are common and are interpreted as resedimented hyaloclastite. Locally interlayered with pyroclastic rocks and meta-sediments identical to the Zhime/pl units.

Zhablt-dcp — **Zhablt-dcp – Andesite to basalt porphyry of the Dry Creek area:** Distinctive, green to dark green, metamorphosed andesite porphyry with aphanitic groundmass and euhedral phenocrysts (up to 10 mm) of greenish-white plagioclase; phenocrysts typically constitute 20 to 50% of the rock; local alignment of plagioclase; lesser pyroxene/amphibole phenocrysts. Green to dark green basalt porphyry with abundant pyroxene (altered to amphibole) phenocrysts with minor plagioclase phenocrysts. Andesite and basalt porphyries locally amygdaloidal (up to 2 cm), amygdules in filling include calcite, quartz, chlorite, and epidote. Same as Dry Creek Porphyry complex of Hauck (1977). Present as isolated outcrops or boulders as designated by green station locations.



Topographic base produced by the United States Geological Survey.
Altered by the North Carolina Geological Survey for use with map.

North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid: Universal Transverse Mercator, Zone 17S
10 000-foot ticks: North Carolina Coordinate System of 1983

Imagery....NAIP, May 2012
Roads....©2006-2012 TomTom
Names....GNIS, 2012
Hydrography....National Hydrography Dataset, 2012
Contours....National Elevation Dataset, 2008
Boundaries....Census, IBWC, IBC, USGS, 1972 - 2012

Base map is from USGS 2013 GeoPDF of the Siler City 7.5-minute quadrangle. Air photo, map collar and select features removed. Bounds of GeoPDF based on 7.5-minute grid projection in UTM 17S; North American Datum of 1983 (NAD83).

8° 33′ 152 MILS
0° 55′ 16 MILS
UTM GRID AND 2013 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000-m Square ID
PV
Grid Zone Designation
17S

SCALE 1:24 000

KILOMETERS · METERS · MILES · FEET

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.11

NORTH CAROLINA

QUADRANGLE LOCATION

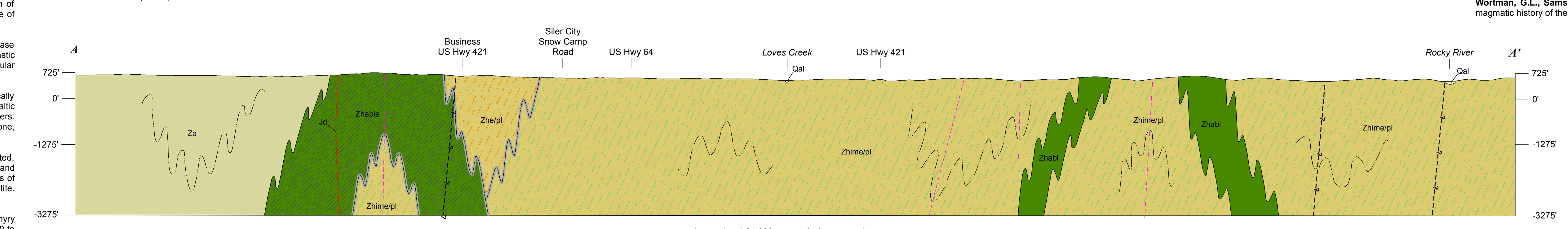
Liberty	Crutchfield Crossroads	Silk Hope
Coleridge	Siler City	Siler City NE
Bennett	Bear Creek	Goldston

ADJOINING 7.5' QUADRANGLES

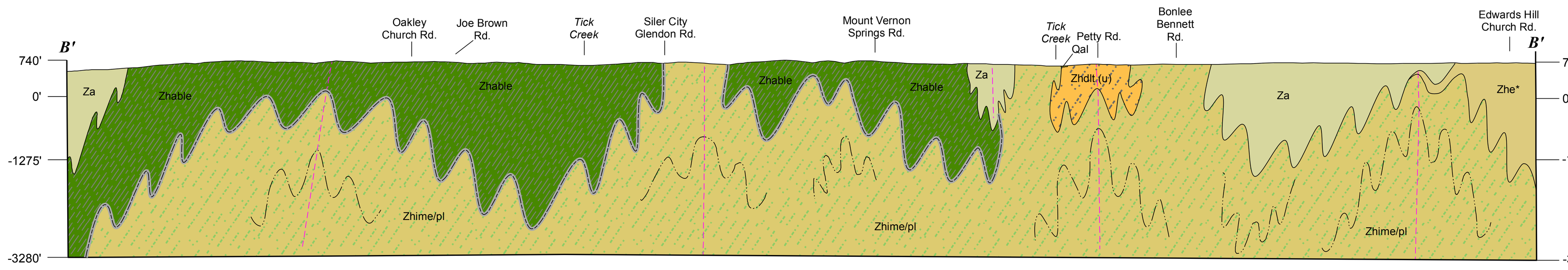
ROAD CLASSIFICATION

Expressway · Local Connector
Secondary Hwy · Local Road
Ramp · 4WD
Interstate Route · US Route · State Route

SILER CITY, NC



cross section scale - 1:24 000 no vertical exaggeration



Geologic Map of the Siler City 7.5-minute Quadrangle, Chatham County, North Carolina

By Philip J. Bradley, Brandon T. Peach and Heather D. Hanna

Map preparation, digital cartography and editing by
Michael A. Medina, Heather D. Hanna and Philip J. Bradley
2017

Supersedes Open-file Report 2016-08

This is an Open File Map. It has been reviewed internally for conformity with North Carolina Geological Survey mapping standards and with the North American Stratigraphic Code. Further revisions or corrections to this Open File map may occur.

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Environmental Quality

GEOLOGICAL SURVEY N.C. 1823

EXPLANATION OF MAP SYMBOLS

CONTACTS, FAULTS, AND OTHER FEATURES

- inferred contact
- concealed contact
- gradational contact - inferred
- inferred brittle fault; dotted where concealed; D indicates downthrown side, U indicates upthrown side
- quaternary alluvium contact
- linear geomorphic feature interpreted from hillshade LiDAR - origin uncertain
- A — A' cross section
- interpreted fold hinge of anticline; question mark where existence is questionable; dotted where concealed
- interpreted fold hinge of syncline; question mark where existence is questionable; dotted where concealed
- interpreted fold hinge of overturned anticline
- interpreted fold hinge of overturned syncline
- inferred diabase dike; dotted where concealed
- zone of alteration associated with the Ore Hill Mine area

IN CROSS SECTIONS

- inferred contact
- inferred gradational contact
- interpretive fold form lines
- brittle fault, identity or existence questioned, inferred from LiDAR lineament
- inferred fold axis
- diabase dike - inferred

PLANAR AND LINEAR FEATURES

- 74 strike and dip of primary bedding and/or layering
- 60, 70 strike and dip of primary bedding and/or layering (multiple observations at one location)
- 66 strike and dip of overturned bedding
- 70 strike and dip of overturned bedding (multiple observations at one location)
- 78 strike and dip of primary volcanic compaction and/or welding foliation
- 69 strike and dip of inclined regional foliation
- 81, 84 strike and dip of inclined regional foliation (multiple observations at one location)
- 77 strike and dip of cleavage
- 75, 84 strike and dip of cleavage (multiple observations at one location)
- 71 strike and dip of inclined joint surface
- strike of vertical joint surface
- 78, 82 strike and dip of inclined joint surface (multiple observations at one location)
- strike of vertical joint surface (multiple observations at one location)
- 56 clast lineation

PROSPECTS AND QUARRIES

X prospect (pit or small open cut)
6 mine workings approximate location - abandoned
7 mine workings approximate location - abandoned
8 mine workings - abandoned
9 mine workings approximate location - abandoned

quarry or mine - abandoned
1 quarry (crushed stone) - abandoned
2 quarry (flagstone) - abandoned
3 Ore Hill Mine area (Iron) - abandoned (Carpenter, 1976)
10 Gilmore-Hart mine (Cooper) - abandoned (Carpenter, 1976)
11 quarry (crushed stone) - abandoned

mine shaft - abandoned
5 shaft (Whim?) - abandoned

4 - trenches - abandoned

FBL geochemical sample location
12 FBL035 lithic sample of Steponaitis et al. (2006)
13 FBL036 lithic sample of Steponaitis et al. (2006)
14 FBL037 lithic sample of Steponaitis et al. (2006)
15 FBL038 lithic sample of Steponaitis et al. (2006)

OTHER FEATURES

- observation station location
- indicates location of quartz dacite porphyry boulders or outcrop
- indicates location of vuggy quartz or sliceous breccia float
- diabase station location
- indicates location of Zhablt-dcp boulders or outcrop
- indicates location of MPzgb boulders or outcrop
- Mt. Vernon Springs spring location

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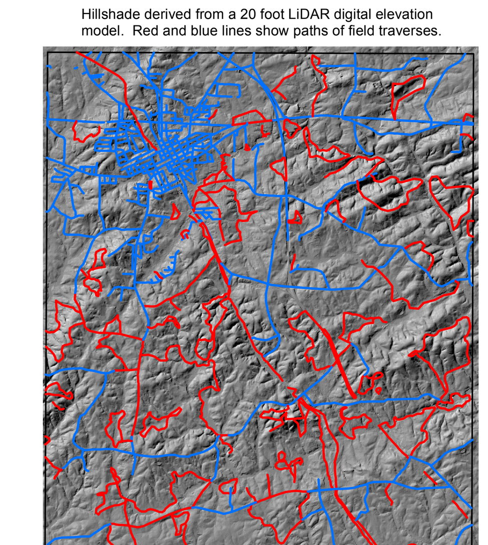
TRAVERSE MAP

Hillshade derived from a 20 foot LiDAR digital elevation model. Red and blue lines show paths of field traverses.



by car
by foot