

# BEDROCK GEOLOGIC MAP OF THE ASHEVILLE 7.5-MINUTE QUADRANGLE, NORTH CAROLINA

BY  
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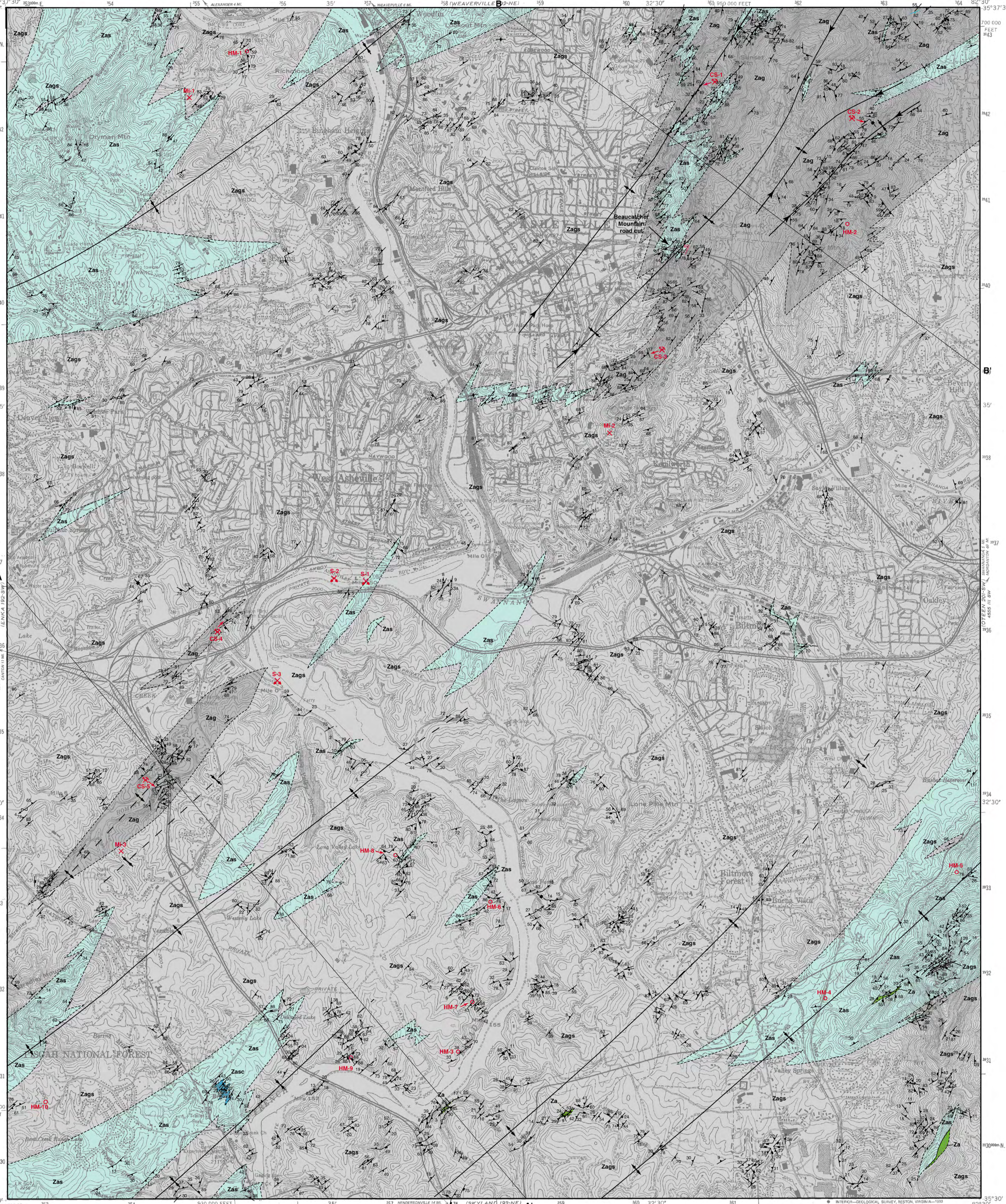
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## MAP UNITS

- ASHE METAMORPHIC SUITE**
- Zags Schistose Metagraywacke
  - Zag Metagraywacke
  - Zas Silimanite-Garnet-Chlorite-Mica Schist
  - Za Amphibolite
  - Zasc Chloritoid-Garnet-Chlorite-Quartz-Muscovite Schist

## STRUCTURAL FEATURES

- CONTACT**
- Stratigraphic Contact
- STRIKE AND DIP OF PLANAR FEATURES**
- Foliation
  - Vertical foliation
  - Joint
  - Vertical joint
  - Shear zone
- BEARING AND PLUNGE OF LINEAR FEATURES**
- Fold axis
  - Horizontal fold axis
  - Vertical fold axis
  - Mineral lineation
- MAP SCALE STRUCTURAL FEATURES**
- Axis of map-scale synform inferred
  - Axis of map-scale antiform inferred

## DESCRIPTION OF MAP UNITS

**ASHE METAMORPHIC SUITE** The Ashe Metamorphic Suite is predominantly Schistose Metagraywacke (Zags), less abundant Metagraywacke (Zag) and Garnet-Mica Schist (Zas), and minor Amphibolite (Za) and Chloritoid-Garnet-Chlorite-Quartz-Muscovite Schist (Zasc). Garnet, Granofels, Garnet-Biotite, Actinolite Schist, and Amphibole-Biotite Granofels are widely scattered in non-mappable amounts. The gneiss of the Ashe Metamorphic Suite is a mafic rock or a sedimentary derivative of a mafic igneous rock, and the calc-silicate rocks (Garnet Granofels, Garnet-Biotite Schist, Actinolite Schist, and Amphibole-Biotite Granofels) originated from sedimentary derivatives of mafic rocks. The sequence in the Asheville 7.5-minute quadrangle is composed dominantly of continentally derived clastic sediments with minor amounts of interlayered volcanics. Deposition occurred in a marine basin. The Ashe Metamorphic Suite has been metamorphosed to sillimanite grade, amphibolite facies. Muscovite porphyroblasts (51 cm) are abundant regardless of rock type in varying amounts throughout the quadrangle.

**Schistose Metagraywacke (Zags)** is light to medium gray, nonfoliated to weakly foliated, fine to medium grained, granoblastic to lepidoblastic, layering ranges from centimeters to several meters. Consists of 35-58% quartz, 20-41% plagioclase, 2-15% K-feldspar, 10-20% biotite, 0-10% muscovite, 0-5% amphibole, widespread traces of zircon, and occasional traces of apatite, calcite, rutile, ilmenite, pyrrhotite, pyrite, and chalcocopyrite.

**Metagraywacke (Zag)** is light to dark gray, nonfoliated to strongly foliated, fine to medium grained, granoblastic to lepidoblastic, layering ranges from centimeters to several meters. Consists of 20-70% quartz, 10-50% plagioclase, 0-20% K-feldspar, 10-20% biotite, 0-7% amphibole, 0-5% muscovite, traces to locally minor epidote, clinzoisite, kyanite, sillimanite, staurolite, and traces of cummingtonite, zircon, apatite, calcite, rutile, ilmenite, magnetite, pyrrhotite, pyrite, and chalcocopyrite.

**Garnet-Mica Schist (Zas)** is dark, silvery bluish to greenish gray, strongly foliated, fine to medium grained, lepidoblastic, layering in meters. Consists of varying amounts of mica, with 5-60% muscovite, variable but persistent (1-30%) chlorite and (0-30%) biotite, highly variable (0-65%) quartz, (0-65%) plagioclase, and (0-35%) amphibole. Widespread traces of sillimanite, and rare traces of clinzoisite, zircon, ilmenite, magnetite, pyrrhotite, pyrite, and chalcocopyrite.

**Amphibolite (Za)** is black to mottled black and white, weakly foliated, fine to coarse-grained, hydroblastic, some fine-grained amphibolites contain hornblende in the main rock matrix as well as porphyroblasts (2 mm). Consists of 50-70% hornblende and 25-50% plagioclase, 0-5% biotite, and traces of chlorite, zircon, apatite, calcite, rutile, ilmenite, magnetite, hematite, pyrrhotite, chalcocopyrite, and pentlandite (always as inclusions in pyrrhotite). Occurs most often as small rectangular fragments a few meters in outcrop dimension. One 30-meter-thick conformable layer occurs in the central-east end of the Beaucatcher Mountain road cut. Protholite is mafic rock consisting of derivatives of a mafic rock.

**Chloritoid-Garnet-Chlorite-Quartz-Muscovite Schist (Zasc)** is mottled silvery white to silvery medium gray, strongly foliated, fine to medium grained, in meters-thick layers. Consists of 40-70% muscovite, 5-20% quartz, 10-15% chlorite, 10-15% amphibole as porphyroblasts (51 mm), and 0-10% chloritoid as porphyroblasts (2 mm).

## DESCRIPTION OF OTHER ROCK TYPES

The following rock types also occur on the Asheville 7.5-minute quadrangle, but individual bodies are too small and discontinuous to be shown at this scale.

**PALEOZOIC INTRUSIVES**

**Pegmatite** is mottled white to very light gray, nonfoliated, very coarse grained, and lenticular to tabular, thickness ranges from centimeters to meters. Consists primarily of plagioclase and quartz with minor microcline, muscovite, biotite, and garnet. Pegmatites typically cross-cut foliation of other rock units. Not found in mappable units.

**Trochilite** is very light gray to nearly white, fine to medium grained, granoblastic. Thickness ranges from centimeters to meters. Consists of 50-70% plagioclase, 20-40% quartz, 2% biotite, 0-10% muscovite, and traces of K-feldspar, chlorite, and zircon. Trochilites typically cross-cut foliation of other rock units. Not found in mappable units.

**METAMORPHIC ROCKS**

**Garnet Granofels** is mottled pink and white and non-foliated. **Garnet-Biotite Schist** is mottled pink and brown and strongly foliated. These two rock types are members of the same unit that are distinguished by increasing amounts of biotite from granofels to schist. They may be interlayered or graded between the two and members. Thickness of layering is in decimeters to meters. Consists of 30-50% plagioclase, 20-40% amphibole, 2-10% sillimanite, 2-5% biotite, 0-10% K-feldspar, 0-1% each kyanite, muscovite, staurolite, and pyrrhotite, and traces of zircon, apatite, calcite, rutile, ilmenite, chalcocopyrite, and pentlandite. The largest layer in outcrop reaches 30 meters thick at the northwest end of the Beaucatcher Mountain road cut.

**Actinolite Schist** is mottled dark green and white, moderately to strongly foliated, xenoblastic to hydroblastic, layering 4 meters. Consists primarily of actinolite-rich (90%) and actinolite-poor quartzofeldspathic sublayers < 1 centimeter thick, with 20-40% quartz, 0-30% K-feldspar (microcline), 3-10% plagioclase, 2-5% biotite, 0-1% staurolite, and traces of apatite, calcite, and pyrite. Not exposed in mappable units. One 4-meter-thick layer occurs at the west end of the Beaucatcher Mountain road cut on 1-240.

**Amphibole-Biotite Granofels** is mottled medium-dark gray, granoblastic to weakly foliated, xenoblastic to hydroblastic, layering in meters. One sample from the Beaucatcher Mountain road cut contained 74% plagioclase, 10% chlorite, 5% biotite, 5% hornblende, 5% cummingtonite, and traces of apatite, calcite, ilmenite, hematite, goethite, pyrrhotite, chalcocopyrite, and pentlandite.

## MINERAL RESOURCES

### PROSPECTS, QUARRIES, AND SAND RESOURCES

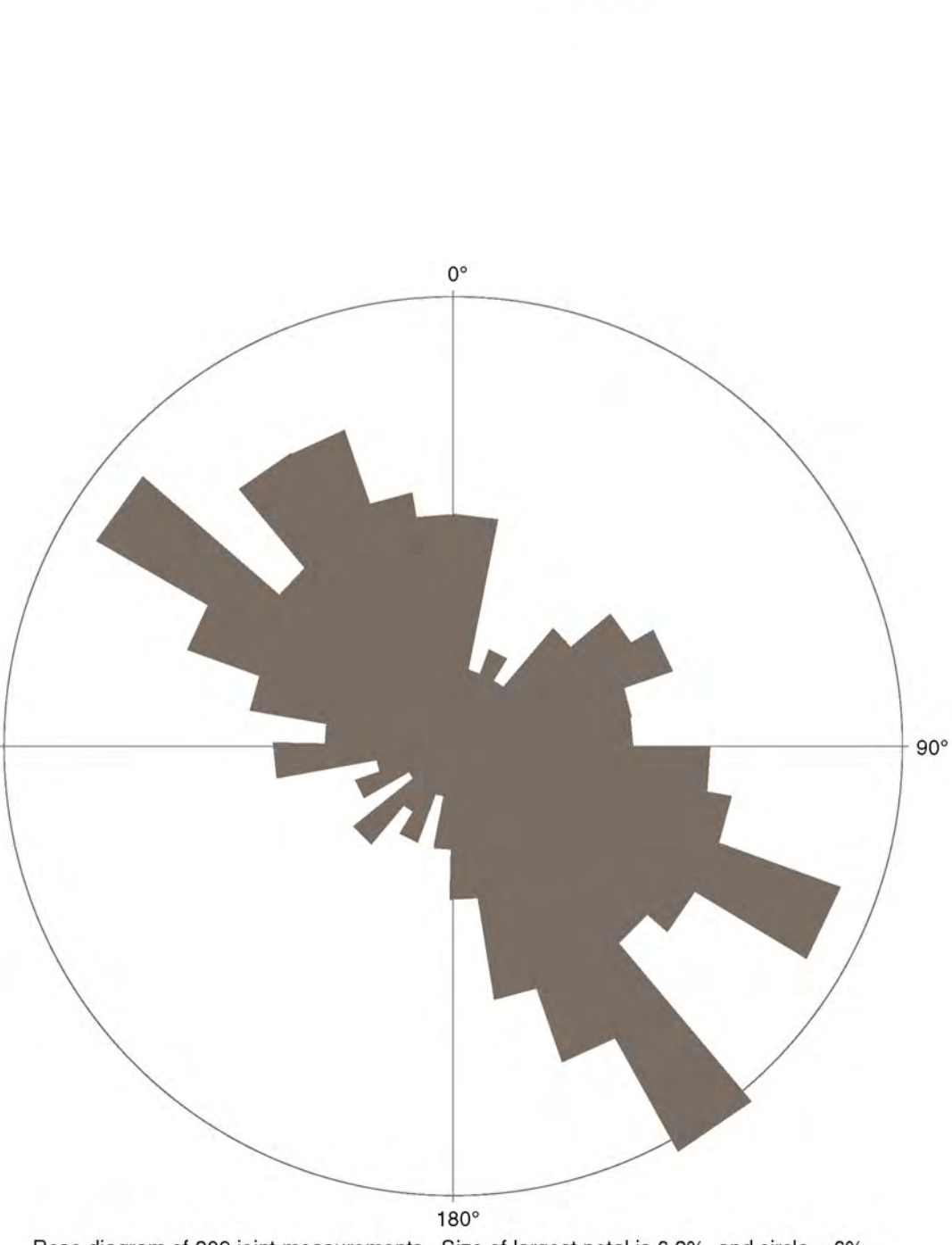
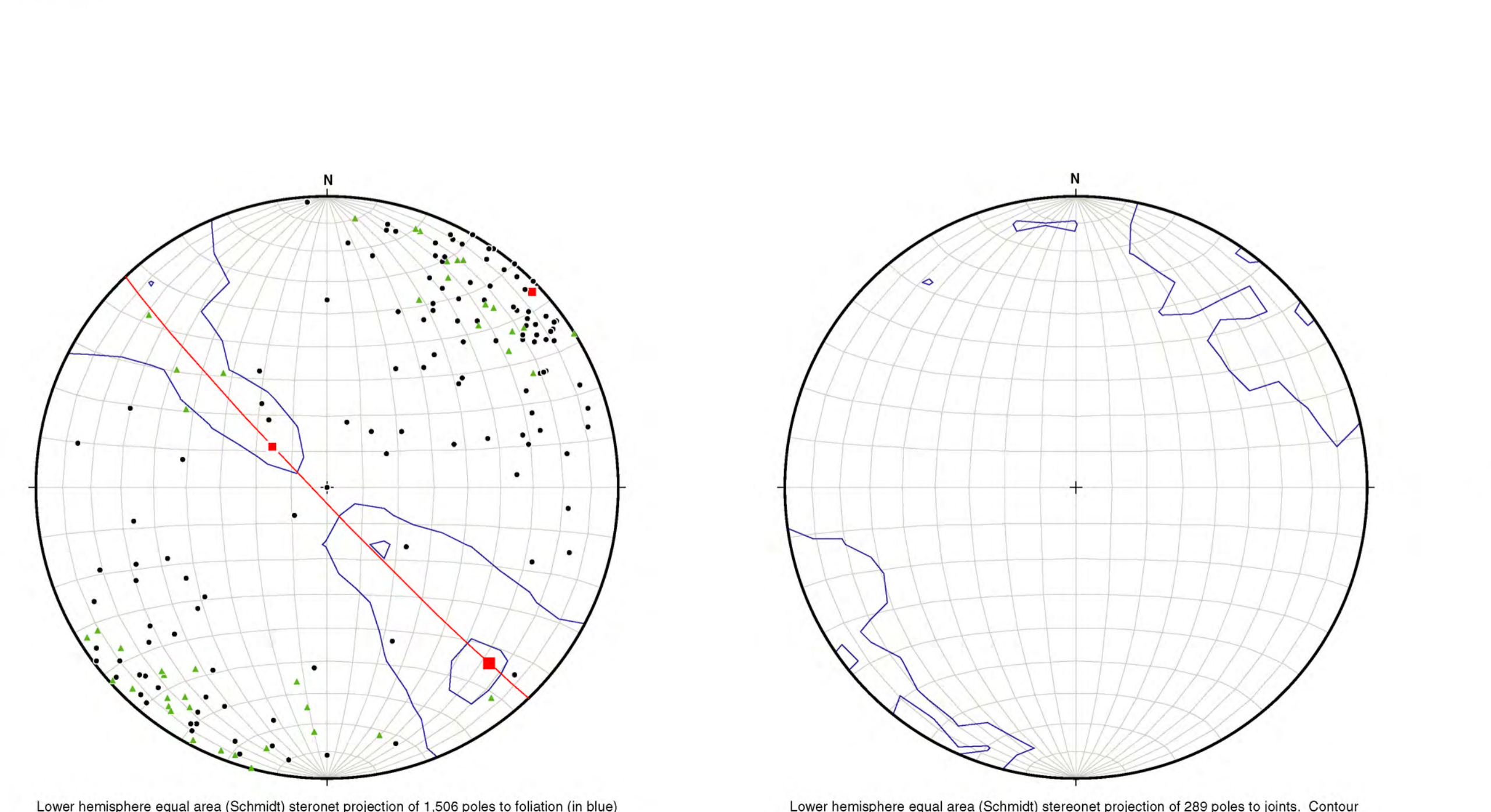
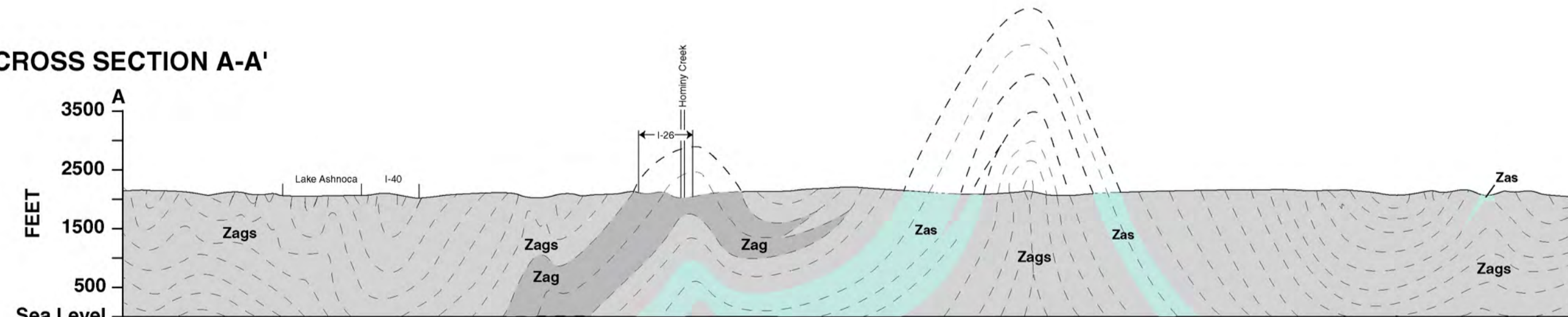
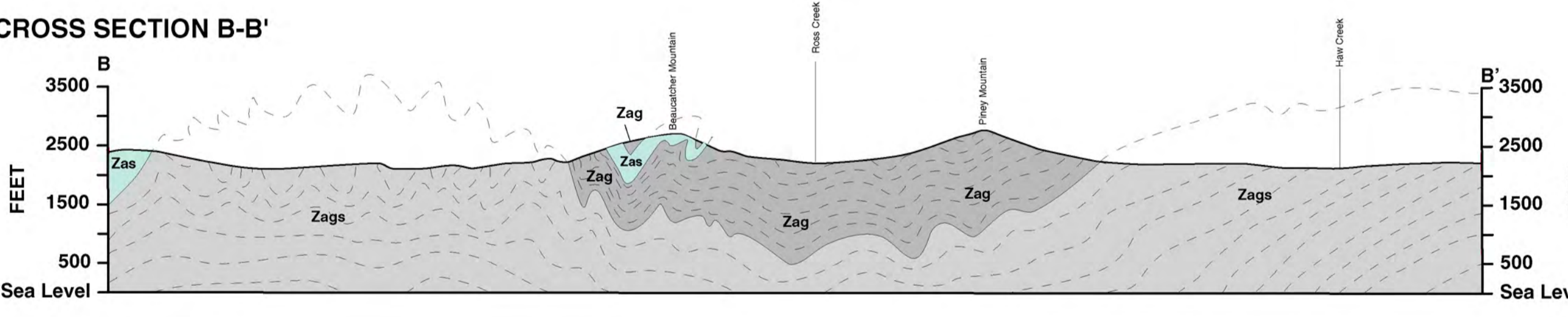
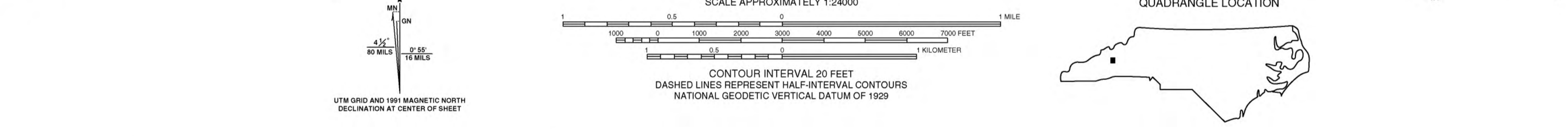
| Number | Description                    | Latitude; Longitude (decimal degrees) | NC COORDINATES (State Plane, NAD 83 meters) |
|--------|--------------------------------|---------------------------------------|---|
| MI-1   | Etzel Rice mica prospect       | 35.61568 N; 82.50157 W                | 212,288N; 285,423E                          |
| MI-2   | H.D. McDowell mica prospect    | 35.59047 N; 82.54747 W                | 208,811N; 288,181E                          |
| MI-3   | Lora Lee Mathews mica prospect | 35.59687 N; 82.61023 W                | 204,160N; 282,320E                          |
| CS-1   | Unnamed stone quarry           | 35.61663 N; 82.53545 W                | 212,781N; 289,414E                          |
| CS-2   | Unnamed stone quarry           | 35.61335 N; 82.51448 W                | 212,350N; 291,298E                          |
| CS-3   | Unnamed stone quarry           | 35.58872 N; 82.54250 W                | 209,710N; 288,664E                          |
| CS-4   | Unnamed stone quarry           | 35.59071 N; 82.59702 W                | 209,811N; 293,915E                          |
| CS-5   | Pond Road crushed stone quarry | 35.54322 N; 82.65653 W                | 204,871N; 282,763E                          |
| S-1    | Harrin's Sand Company dredge   | 35.56487 N; 82.57882 W                | 207,183N; 285,279E                          |
| S-2    | Harrin's Sand Company dredge   | 35.56491 N; 82.58247 W                | 207,207N; 284,949E                          |
| S-3    | Harrin's Sand Company dredge   | 35.5407 N; 82.59002 W                 | 206,023N; 284,212E                          |

### STREAM SEDIMENT HEAVY MINERAL ANALYSIS

Approximately 14 kg of stream sediment was panned to approximately 300 g of heavy mineral concentrate, which was further separated with tetrahydrofuran. At least 200 grains were identified with a petrographic microscope and refraction of n=1.47.

| SAMPLE# | LATITUDE; LONGITUDE (decimal degrees) | NC COORDINATES (State Plane, NAD 83 meters) | MAP UNITS | % HM IN DRAINED <sup>1</sup> SAMPLE <sup>2</sup> | PERCENT HEAVY MINERALS IN SAMPLE <sup>4</sup> |      |      |      |      |      |     |     |     |      |     |
|---------|---------------------------------------|---|-----------|--|---|------|------|------|------|------|-----|-----|-----|------|-----|
|         |                                       |   |           |  | Mag   | Op   | Gt   | Hbl  | Zr   | Ep   | Sil | Rt  | Ky  | St   | Ti  |
| HM-1    | 35.62073 N; 82.59408 W                | 213,427N; 284,121E                          | Zag, Zas  | tr   | 9.4   | 26.3 | 3.3  | 14.1 | 10.3 | 12.2 | 0.0 | 2.3 | 4.7 | 17.4 | 0.0 |
| HM-2    | 35.60247 N; 82.51682 W                | 211,152N; 291,044E                          | Zag       | tr   | 7.0   | 22.2 | 26.4 | 21.7 | 5.2  | 3.8  | 1.4 | 0.0 | 3.3 | 9.0  | 0.0 |
| HM-3    | 35.51642 N; 82.56692 W                | 201,862N; 286,198E                          | Zag       | tr   | 33.0  | 15.4 | 14.4 | 6.5  | 18.1 | 0.8  | 0.0 | 0.9 | 0.6 | 2.5  | 0.0 |
| HM-4    | 35.52108 N; 82.51963 W                | 202,137N; 290,466E                          | Zas       | 0.04   | 21.9  | 30.6 | 20.3 | 13.8 | 7.9  | 2.1  | 1.4 | 0.0 | 1.0 | 1.0  | 0.0 |
| HM-5    | 35.53452 N; 82.50300 W                | 203,574N; 292,029E                          | Zas       | tr   | 70.6  | 1.6  | 14.3 | 3.1  | 5.2  | 1.6  | 0.4 | 0.0 | 0.1 | 2.8  | 0.3 |
| HM-6    | 35.53100 N; 82.55002 W                | 203,390N; 286,575E                          | Zag, Zas  | 0.04   | 18.4  | 20.9 | 17.3 | 7.2  | 19.3 | 5.6  | 0.4 | 1.6 | 3.6 | 0.0  |     |
| HM-7    | 35.52078 N; 82.56493 W                | 202,250N; 288,362E                          | Zag       | 0.08   | 9.5   | 33.9 | 18.7 | 3.9  | 11.3 | 11.7 | 9.1 | 0.0 | 0.0 | 1.7  | 0.0 |
| HM-8    | 35.59613 N; 82.57493 W                | 203,985N; 285,517E                          | Zag       | 0.05   | 16.8  | 30.3 | 16.1 | 8.1  | 20.6 | 2.0  | 4.0 | 0.0 | 0.0 | 1.8  | 0.4 |
| HM-9    | 35.51487 N; 82.58980 W                | 201,647N; 284,900E                          | Zag       | 0.61   | 3.1   | 34.9 | 21.2 | 15.1 | 11.6 | 6.1  | 3.5 | 0.0 | 1.0 | 3.0  | 1.0 |
| HM-10   | 35.51043 N; 82.62042 W                | 201,288N; 281,291E                          | Zag, Zas  | 0.01   | 29.3  | 20.5 | 39.9 | 0.0  | 2.3  | 2.7  | 0.0 | 0.0 | 0.0 | 5.3  | 0.0 |

<sup>1</sup> Sample numbers correspond to heavy mineral sample locations shown on geologic map.  
<sup>2</sup> Map units contributing to the drainage basin, listed in ascending order of map area.  
<sup>3</sup> Weight percent heavy minerals in stream sediment sample.  
<sup>4</sup> Weight percent of heavy minerals. Magnetite, Op, includes other than magnetite in heavy minerals. Epidote, clinzoisite, Epidote-Biotite, chloritoid, Staurolite, Rutile, Kyanite, Pyrrhotite, Chalcocopyrite, Pentlandite, Monazite was not observed but is expected to occur in Ashe heavy mineral samples.



Lower hemisphere equal area (Schmid) stereonet projection of 1,506 poles to foliation (in blue) and cylindrical best fit and pole (in red). Contour interval = 2.00°/1% area. Black dots represent 132 fold axes, and green triangles represent 49 mineral lineations.  
Lower hemisphere equal area (Schmid) stereonet projection of 289 poles to joints. Contour interval = 2.00°/1% area.  
Rose diagram of 289 joint measurements. Size of largest petal is 6.2%, and circle = 6%.