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INTRODUCTION AND PREVIOUS MAPPING

The Ingleside 7.5-minute quadrangle occurs primarily in northernmost Franklin County, North Carolina, between the towns of Lenoir and Henderson. The northeastern corner of the quad is in Vance County. US Highway 401/NC Highway 39 enters the quad from the south, splits at the crossroads of Ingleside, with US 401 continuing NNE toward Warrington and NC 39 NNW toward Henderson. NC Highway 501 traverses the extreme southeastern corner of the quad, running between Lenoir and Centerville. Aside from Ingleside itself, the quad contains the communities of Epson (Vance County) and Kearney, Rocky Ford and Moulton (Franklin County), but no incorporated towns.

The Tar River cuts across the southwestern portion of the quad, draining toward the southeast. A large portion of the quad is deeply dissected by south-flowing tributaries that empty into the Tar River. These are Gills Little Mill Creek, Faves Creek, Lynch Creek, Tooles Creek, Giles Creek, Bear Swamp Creek, and Fox Creek. Sandy Creek cuts across the extreme northeastern corner of the quad, and the northeastern quarter of the quad is drained by Flatrock Creek and Devils Cradle Creek, themselves tributaries to Sandy Creek. The western portion of the quad features unusually rugged topography for this part of the eastern Piedmont, with local relief of up to 150 feet. Total relief in the quad is just over 300 feet, with elevations above sea level ranging from about 400 feet just northwest of Epson to approximately 187 feet where the Tar River leaves the southern edge of the quad.

The Ingleside quadrangle is dominantly underlain by granitoid rocks belonging to the late Paleozoic (Alleganians) Roanokeville batholith. The granites are intrusive into gneisses and schists of the Raleigh terrane, interpreted as an infrastructure complex of a Neoproterozoic volcanic arc (Hibbard and others, 2002). Just to the east of the map area, in the Gold Sand quad (Fuemmeler, 2004; Stoddard and others, 2009) the Macon fault separates the Raleigh terrane from the suprastructural Spring Hope terrane to the east. In addition, Jurassic dikes of olivine diabase are common in the area, most striking north-northeast, as are linear zones of felsic rocks, mostly northeast-southwest, which are thought to represent brittle faulting of Mesozoic age (cf. Heffner and others, 1998).

Prior to this investigation, little geologic mapping had been undertaken in the quadrangle, although it has been included in a number of regional and reconnaissance studies. Parker (1968) defined the structural framework of the region. McDaniel (1980) mapped a multi-county region, including Franklin and Vance Counties, at a scale of 1:100,000. Farrar (1985a, b) mapped the entire eastern Piedmont of North Carolina, defined map units in the region, and made a model for the tectonic evolution of the region. As part of regional geologic mapping of the Roanokeville batholith, He (Speer, 1994) also presented a map showing some granitoid plutons of the batholith, and describing some of their constituent facies. Sacks (1996a, b, c) mapped a strip of four 7.5-minute quadrangles along the Virginia-North Carolina border, along strike to the north-northeast.

Adjacent to the field area, 1:24,000-scale mapping has been done for the Gold Sand quadrangle to the east (Fuemmeler, 2004; Stoddard and others, 2009), for the Kintell quadrangle to the west (Stoddard and others, 2003), and for the Lenoir quad to the south (Heffner and others, 2010).

DESCRIPTION OF MAP UNITS

HYDROTHERMAL UNITS

- gr1 - quartz rock and quartz breccia:** Sizeable accumulations of massive, milky quartz, commonly with vuggy crystals of clear, milky, or smoky quartz ranging from 1 mm to 5 cm. Locally brecciated and silicified granitoid rock having networks of thin quartz veins. Likely the result of quartz mineralization along brittle fracture zones or faults. Probable fault-surface features, including slickensides, observed locally in the field. The basis of such quartz occurrences, several fault segments are inferred and depicted on the map as linear quartz breccia zones with trends typically E-W to NE-SW. At one location (N1470) an in situ surface fault zone (N11E and dip 72°) and another (N11E and dip 191, 22), and a third (N11E and dip 191, 22) are shown. The Tar River fault zone in the southwestern corner of the quad, striking NNE. An excellent exposure of grs, along an E-W fault segment, holds up an isolated hill due west of Moulton (station IN1890). The trace of another E-W fault, located due west of Ingleside, is well exposed at station IN1822. At one location (N1822) these two trend intersect at a diabase dike, with no effect on the dike's orientation, and though brecciated granitoid rock is present, no diabase is brecciated. This fault is inferred to pre-date the dike intrusion. Because the opposite relationship has been documented in the Middleburg quad to the northwest, it appears that diabase intrusion and brittle faulting in the eastern Piedmont were more or less contemporaneous in the Jurassic. On the map, yellow diamonds not associated with mapped faults indicate isolated outcrops or major fault occurrences of grs.

INTRUSIVE UNITS

- di - diabase:** Fine to medium-grained, equigranular to locally plagioclase porphyritic diabase, typically olivine-bearing. Commonly weathers to black to tan-gray, spherical boulders and cobbles. Occurs in vertical to steeply dipping dikes. The trace of the larger dikes correlate with and may be part of the same magmatic high. In the Gold Sand quad, nearly all diabase dikes trend NNW to NNW, one dike in the northwest corner of the quad trends N06E. Red dots indicate isolated outcrops or float occurrences.

Granitoid rocks of the Roanokeville batholith

The Roanokeville batholith is a large, composite granitoid intrusive complex in the Piedmont of North Carolina. It is elongate parallel to the typical north-northeast regional strike, and generally lies along the axial trace of the Wake - Warren anticlinorium, which passes approximately through the center of the Ingleside quad. Field evidence indicates that the Roanokeville plutons intruded during or after the peak of regional metamorphism, and very limited radiometric age dates indicate that they crystallized and cooled during the Pennsylvanian and Permian periods (Fullagar and Butler, 1979; Horton and Stern, 1994; Schneider and Samson, 2001). Previous studies dealing with the Roanokeville batholith in the area covered by this map include those by Parker (1968), Becker and Farrar (1977), Farrar (1985a, b), Speer (1994), Speer and others (1994), and Speer and Leff (1997).

Granitoid rocks of the Roanokeville batholith underlie most of the Ingleside quad, except for its eastern edge, and the northeastern quarter of the quad, where gneisses and schists of the Raleigh terrane occur. Leucogranite occurs as mapped bodies (PPgr) and as unmapped smaller pods in the metamorphic terrane, especially associated with sillimanite-muscovite schist (CZsm).

The leucogranite and five other granitoid facies are mapped in the Ingleside quadrangle, as detailed below. The dominant facies, PPgr, underlies most of the map. Granitic pegmatite bodies are associated with all of the mapped granitoids.

- PPgr - granitoid facies g:** Fine to medium-grained, non-porphyratic, locally foliated muscovite +/- garnet +/- biotite leucogranite. C1 less than 5. Occurs primarily in the eastern Ingleside quadrangle and the northeastern Lenoir quadrangle, as well as the adjacent Gold Sand and Justice quadrangles. Typically intermingled with CZsm south of Moulton.
- PPgr - granitoid facies h:** Medium-grained, generally equigranular pink, orange or buff biotite +/- muscovite leucogranite and granite, locally with garnet. C1 - 2 - 8. Occurs in the east-central portion of the Ingleside quad in the upper tributary of Bear Swamp Creek drainage basin, associated with and contains xenoliths of gneiss and schist just south of Ingleside. Commonly cut by pegmatite dikes locally having smoky quartz. Intrudes and contains anastomosing of fine-to-medium grained biotite granite PPgr at stations IN1818-1823.
- PPgr - granitoid facies i:** Fine to coarse-grained, but primarily medium-grained equigranular to moderately porphyritic (very rarely megacrystic), rarely foliated, pink or salmon and white biotite monzogranite. Commonly has an almost isotropic fabric with well formed alkali feldspar and plagioclase grains. C1 - 5 - 12. Contains common biotite and local biotite-cristallite clots. Pegmatite dikes and pods are extremely common, locally, isolated xenocrysts of alkali feldspar 1 - 4 cm in length also occur. Unit also contains relatively common xenoliths of Raleigh terrane country rocks. Less commonly contains anastomosing of fine grained orthogneiss or tonalite and may display igneous layering between biotite-rich and biotite-poor phases. Weathered surfaces are commonly mottled, friable and/or cavernous. Chemical analysis from station O1-LR61-F from the west-central Lenoir quad has 70.5 wt percent SiO₂, normative Q:An of 28:29:43 and normative Q:An of 28:16:56, with normative An 32.6%.
- PPgr - granitoid facies j:** Fine-grained to medium-grained white, light gray, or tan, equigranular to weakly porphyritic biotite +/- muscovite granite, locally with pink alkali feldspar. C1 - 5 - 12. Locally contains alkali feldspar xenocrysts up to 8 mm in length, but does not contain sillimanite or xenoliths and contains fewer pegmatite dikes than most other granitoid phases. Extends from north-central Lenoir quad into south-central Ingleside quad, cut by isograntic east of SR 1227 (Beasley Road) at station IN1818-19. Also mapped in a separate pod in the southwestern part of the quad north of the Tar River (N 2442).
- PPgr - granitoid facies k:** Heterogeneous granitoid unit consisting of streaky, gneissic, or layered biotite granitoid and biotite granitoid facies. Includes granite, leucogranite, and granodiorite and their gneissic counterparts. Generally medium grained but ranges from fine to coarse. Locally has alkali feldspar xenocrysts up to 3 cm. Locally exhibits strong compositional banding, elsewhere vague phase layering, banding of darker phases, biotite schlieren, or xenoliths of biotite gneiss. Additionally may contain feldspar or biotite foliation. Planar fabric elements may be contorted and possibly transposed. Pegmatite and apfite dikes are abundant and locally deformed. Occurs in northwestern and southwestern Ingleside quad. Always appears to be associated with gneiss of the Roanokeville main phase PPgr. Well-exposed at station IN2536, in an east-flowing tributary to Lynch Creek just north of a sharp bend in SR 1003 (Bemis Road), and in a large pavement exposure (station N2363) along upper Lynch Creek west of its confluence with Gills Little Mill Creek in the northwestern Ingleside quad.
- PPgr - granitoid facies l:** Medium grained (typically 3 - 5 mm), hydromorphic granular to weakly porphyritic biotite granodiorite. Contains titanite, apatite and opaque minerals. C1 - 15 - 20. Occurs in three small mapped pods in west-central Ingleside quad. Chemical analysis from station O1-ING-02 shows 61 wt% SiO₂ and normative Q:An of 28:16:56, with normative An 32.6%.

METAMORPHIC ROCKS OF THE RALEIGH TERRANE

In the Ingleside quad, metamorphic rocks of the Raleigh terrane include biotite gneiss and schist (CZbg), felsic gneiss, hornblende gneiss (CZhg), and sillimanite-muscovite schist (CZsm). The CZsm extends eastward into the Gold Sand quad system, it is inferred to be the upper dipping sequence of units (Stoddard and others, 2009), and biotite gneiss (CZbg) lies to the east, presumably beneath the schist. In the east-central part of the Ingleside quad, foliations depart drastically from the typical NS or NNE trends of the region, locally striking roughly east-west and dipping gently or moderately northward. Furthermore, in the central and western portions of the quad, large mapped bodies of CZbg, CZsm, and perhaps CZhg, plus smaller xenoliths (depicted on the map by point symbols within mapped granitoid rocks) suggest a geostratigraphy of Raleigh terrane country rocks within the batholith. Taken together, these observations suggest the presence of a right-shear, complex but locally north-plunging fold of metamorphic rocks, having an axial trace trending south-southwest. The axial trace of the Wake-Warren anticlinorium is inferred to lie to the west of the system, running through the Ingleside quad.

- CZsm - muscovite-biotite sillimanite schist:** Wash green to gray to golden or white, fine to coarse-grained, moderately to well foliated muscovite schist. Locally may be strongly and chaotically crystallized and/or rusty or maroon weathering. Locally carries sillimanite, kyanite, garnet, pyrite and/or very rare staurolite. Includes quartz-muscovite schist and poorly foliated maroon-weathering muscovite schist, as well as local kyanite-quartz rock or sillimanite-quartz rock. Commonly associated with pegmatite and/or leucogranite. Occurs in abundance north and northwest of Moulton, between SR 1002 (Trinity Church Rd) and SR 1413 (Gaston Rd) and in the northeastern corner of the map in the Sandy Creek drainage. Just northeast of Ingleside, two separate pods of CZsm, surrounded by granitoid rocks, are also mapped.
- CZhg - biotite gneiss and schist:** Medium to dark gray, fine to medium grained, moderately to well foliated biotite-quartz-plagioclase +/- alkali feldspar gneiss and schist. Varies from non-banded biotite granitoid gneiss to variably banded biotite gneiss and biotite schist. Rarely includes zones of hornblende-biotite schist, hornblende-biotite gneiss with or without biotite and/or muscovite. Locally carries garnet, epidote, or albite minerals. Locally associated with dikes and/or sills of pegmatite and/or leucogranite, and/or sillimanite within granitoid bodies. Excellent exposures in east-flowing tributary of Devil's Cradle Creek in the east-central part of the quad, east of Highway 401 (station IN1935-1948), and in the headwaters of Fox Creek south of Moulton. Other good examples may be found in the headwaters of Giles Creek, just north of Ingleside, between US Highway 401 and NC Highway 39. An excellent exposure of banded biotite gneiss in contact with granite lies along Flatrock Creek about 100 meters south of SR 1404 (Lake View Rd.) west of Kearney.
- CZbg - felsic gneiss:** Light tan to pinkish gray, fine to medium grained, well foliated, massive to foliated, quartz-plagioclase-K-feldspar-muscovite-biotite orthogneiss. Mapped as a single pod surrounded by CZhg in the southeastern corner of the quad. Similar (unmapped) lithologies occur rarely within CZhg.
- CZhg - hornblende gneiss:** Dark gray to black, medium grained, poorly to moderately foliated hornblende-plagioclase gneiss and amphibolite. May contain biotite or epidote. Where biotite content is high may be somewhat schistose. Occurs in the western half of the quad as xenoliths within granitoid bodies. The larger bodies are mapped as pods while the smaller xenoliths are indicated by point symbols within granitoid rock.

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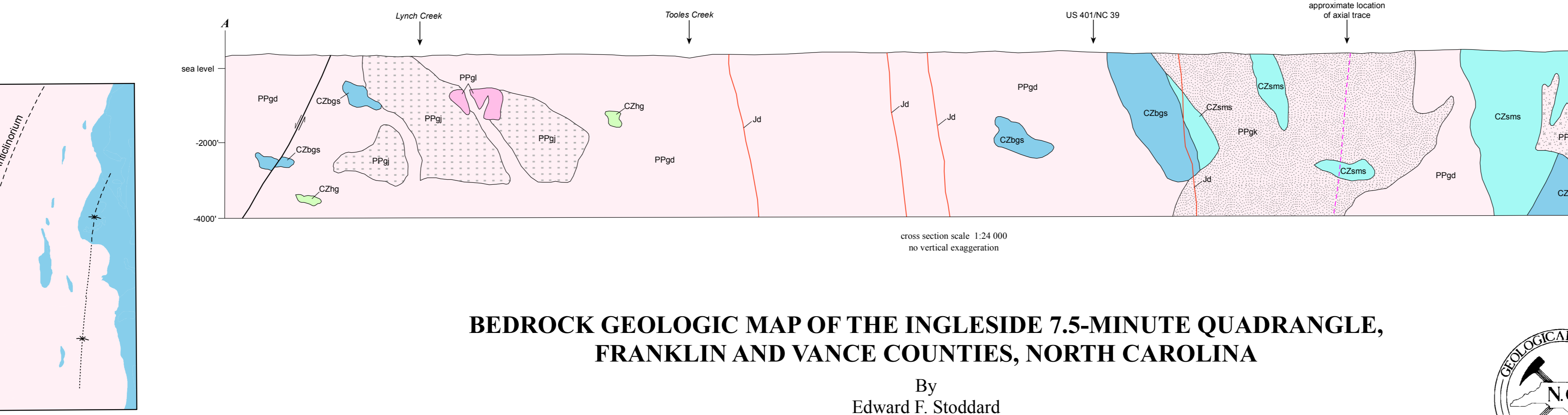
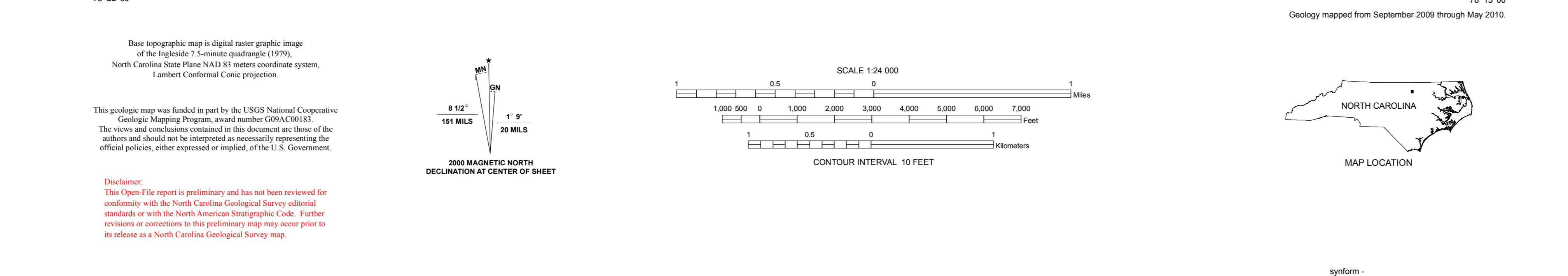
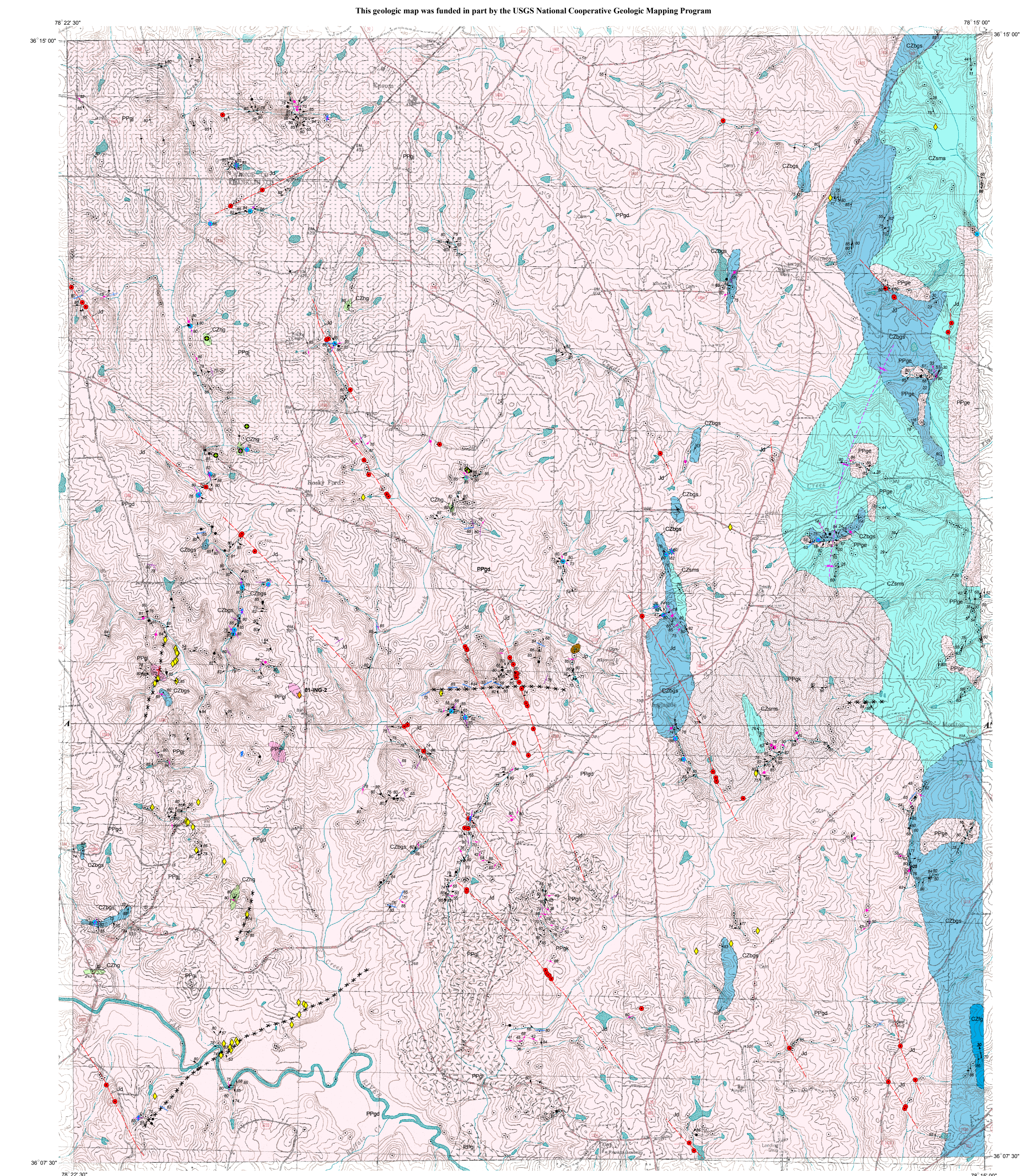
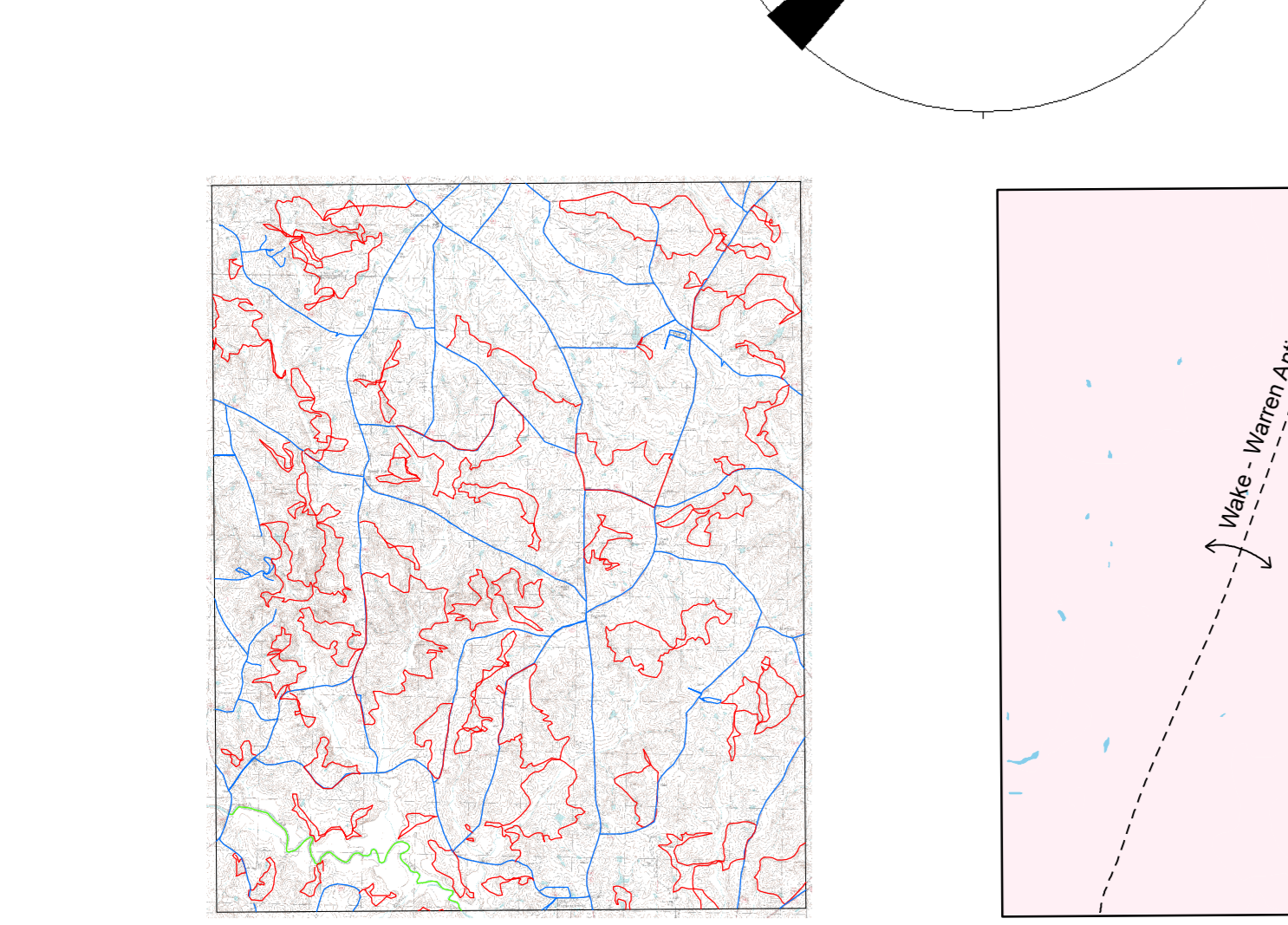
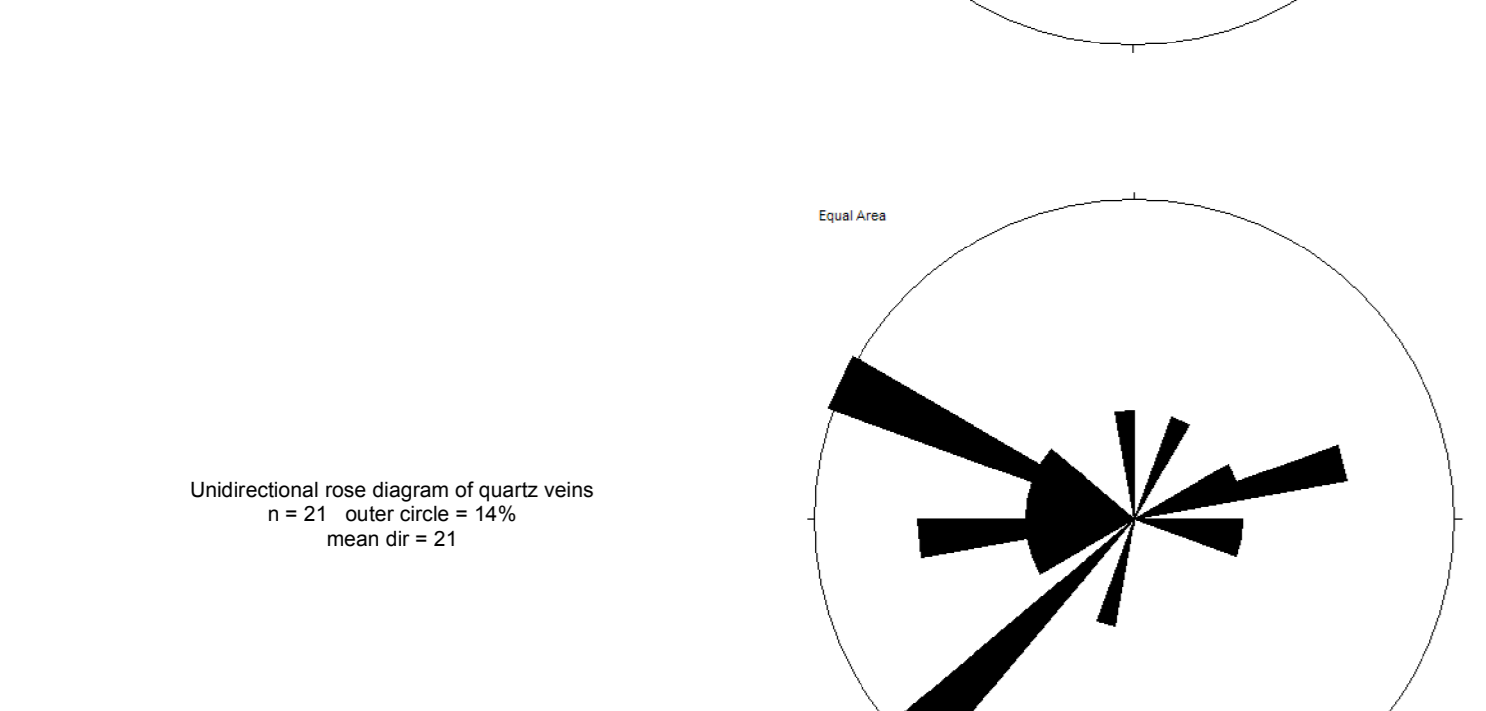
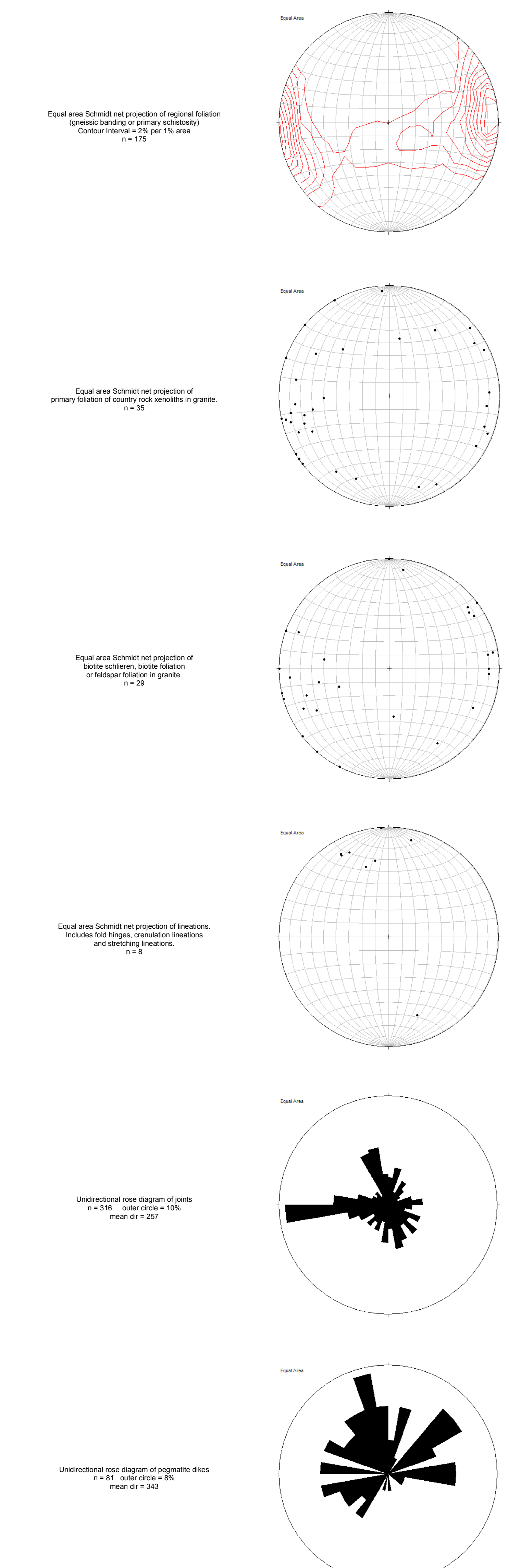
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BEDROCK GEOLOGIC MAP OF THE INGLESIDE 7.5-MINUTE QUADRANGLE, FRANKLIN AND VANCE COUNTIES, NORTH CAROLINA

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2010



EXPLANATION OF MAP SYMBOLS

CONTACTS

- Lithologic contacts - Distribution and concentration of structural symbols indicates degree of reliability.
- inferred geologic contact
- quartz breccia zone - location inferred
- diabase dike - location inferred
- axial trace of synform - location inferred
- cross section line

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.

- strike and dip of regional foliation
- strike of vertical regional foliation
- strike and dip of cleavage
- strike and dip of foliation of schist
- strike of vertical biotite schlieren in granite
- strike and dip of primary igneous planar features
- strike of vertical joint
- strike of vertical primary igneous planar features
- strike and dip of brittle fault
- strike of vertical biotite schlieren in granite
- strike of vertical quartz vein
- strike of vertical quartz vein
- strike and dip of pegmatite or apfite dike
- strike of vertical pegmatite or apfite dike

OTHER FEATURES

- biotite gneiss xenolith with granite
- biotite hornblende gneiss xenolith with granite
- biotite schist xenolith with granite
- hornblende gneiss xenolith with granite
- schistose biotite gneiss with granite
- biotite schist xenolith with granite
- diabase station location
- observation station location
- geochronological sample location



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