

GEOLOGIC MAP OF THE HILLSBOROUGH 7.5-MINUTE QUADRANGLE, ORANGE COUNTY, NORTH CAROLINA

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DESCRIPTION OF MAP UNITS

All pre-Mesozoic rocks of the Hillsborough quadrangle have been metamorphosed to at least the chlorite zone of the greenschist metamorphism. Many of the rocks display a weak to 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 nonchemical data when whole-rock geochemical data is available. Past workers in the Hillsborough quadrangle (Butler, 1964; Allen and Wilson, 1968; Sykes, 1976; Black, 1977; Allen and Newton, 1983) have used various nomenclature systems for the igneous rocks. The raw data of these earlier workers was recalculated and plotted on ternary diagrams and classified based on IUGS nomenclature. Pyroclastic rock terminology follows that of Fisher and Schminke (1984).

SEDIMENTARY UNITS

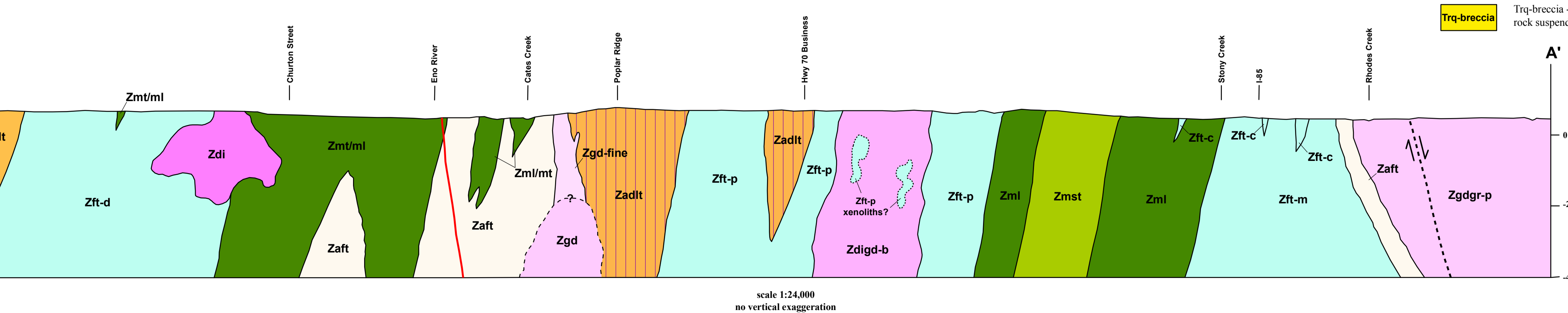
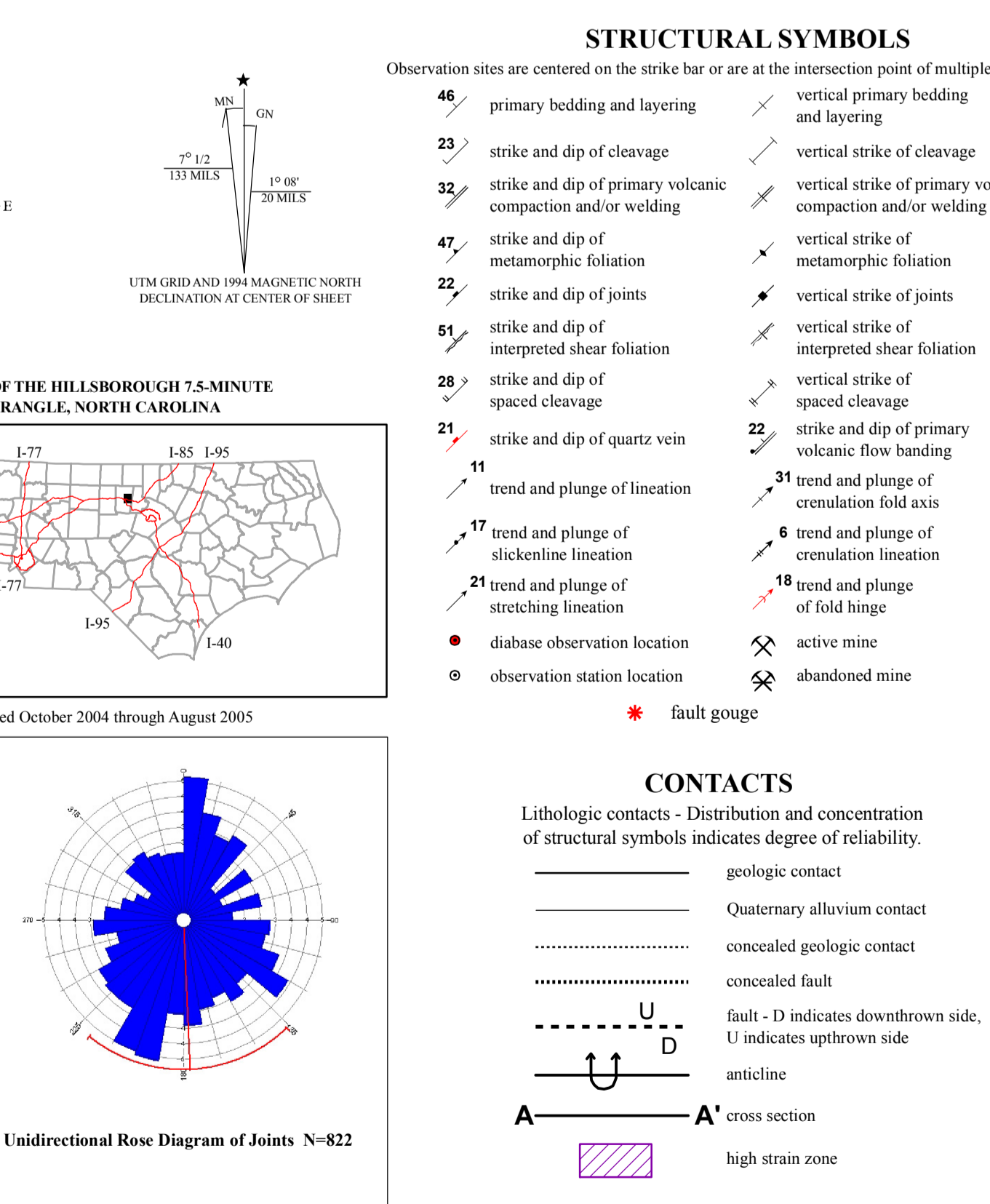
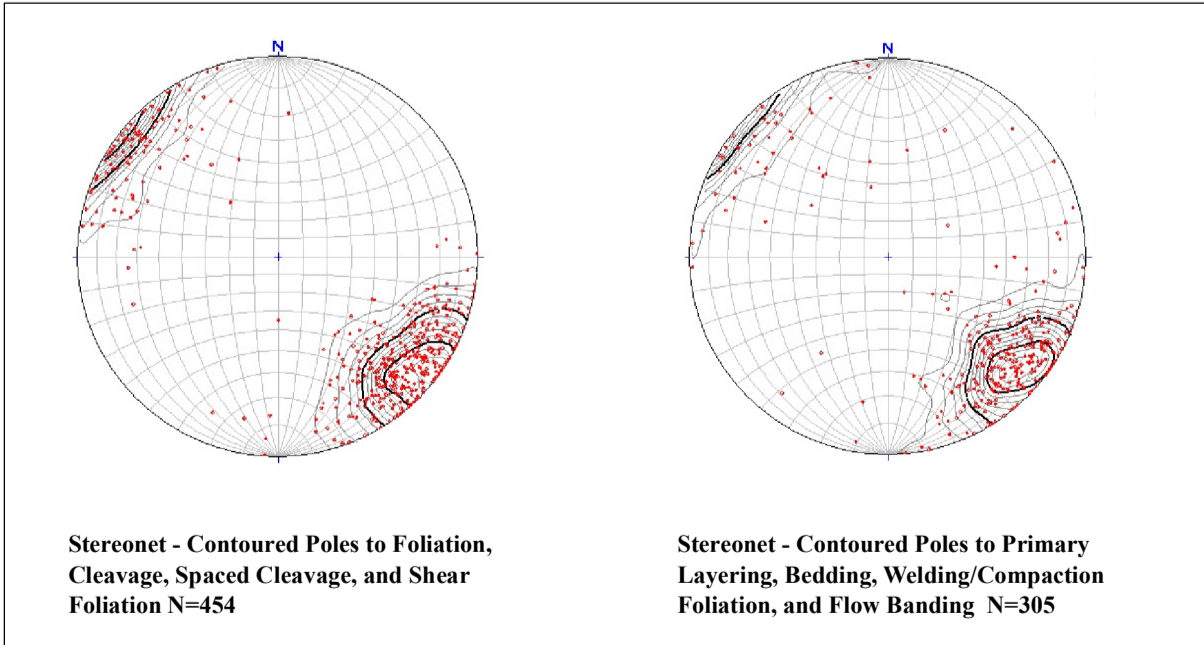
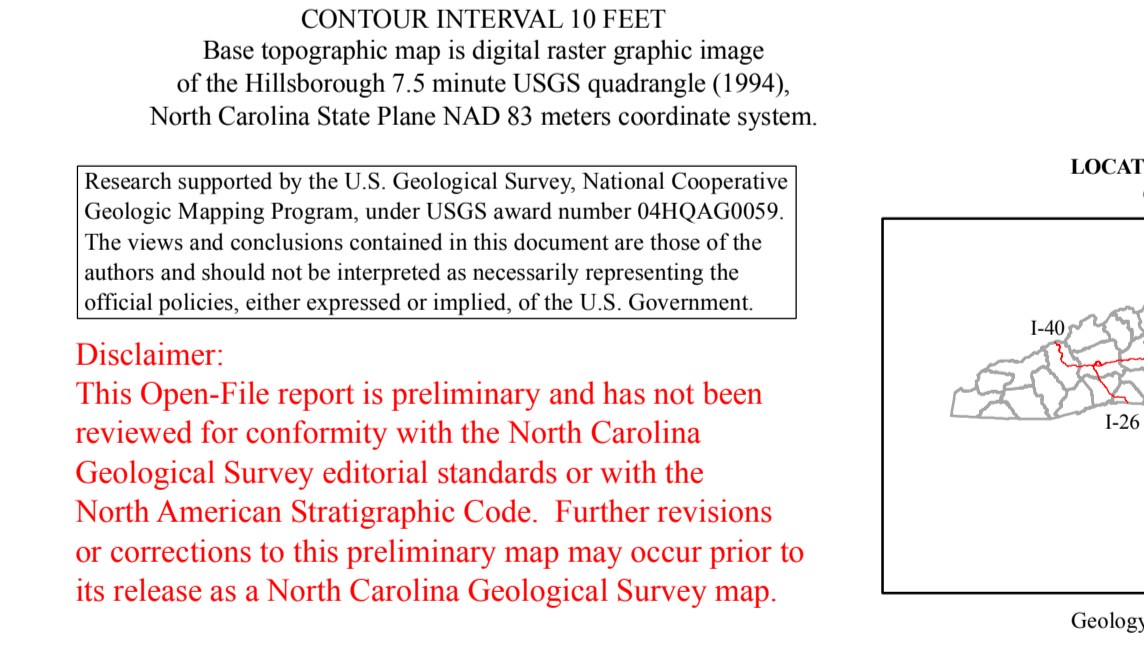
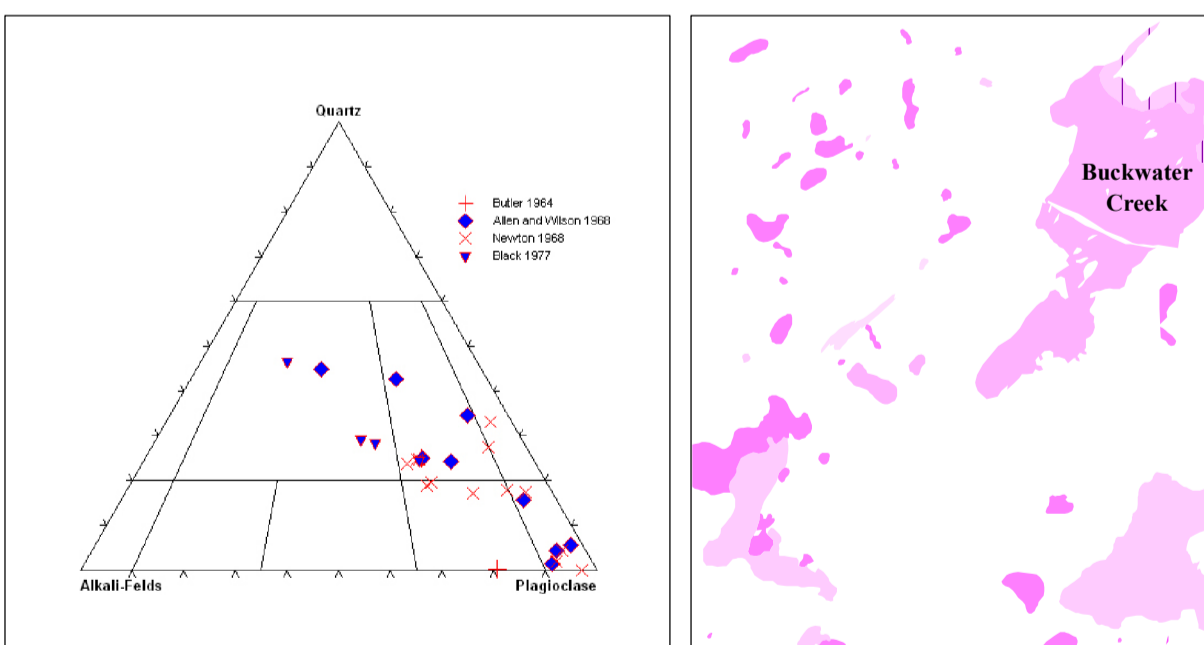
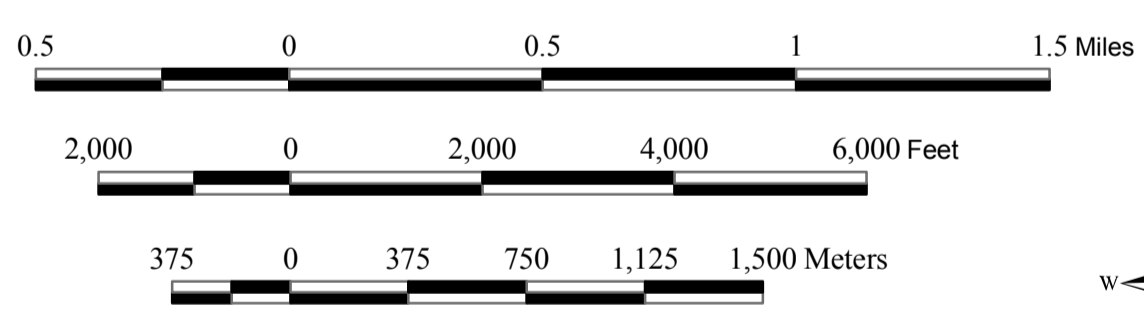
- Qal** - Alluvium: Unconsolidated clay, silt, sand and gravel to cobble-sized clasts, subrounded to angular, deposited in drainages.
- Qcv** - Colluvium: Accumulations of angular cobbles and boulders.

INTRUSIVE AND META-INTRUSIVE UNITS

- Jd** - Olivine diabase: Black to greenish-black, fine- to medium-grained, dense; consists primarily of plagioclase, augite, and olivine. Occurs as dikes up to 80 ft wide. Diabase typically occurs as spheroidally weathered boulders with a grayish-brown weathering rind. Red station location indicates outcrop or boulders of diabase.
- Zgd** - Granodiorite: Exhibits a variety of colors and textures ranging from grayish-white, fine- to medium-grained hornblende granodiorite; pinkish-white, medium-grained hornblende granodiorite; and gray, fine-grained granodiorite.
- Zgd-fine** - Fine-grained granodiorite: Light-gray to green, ranges from equigranular very fine-grained granodiorite to very fine-grained porphyritic granodiorite with plagioclase phenocrysts (1 mm to 4 mm). Black colored amphibole, when visible, occurs as phenocrysts (<1 mm to 1 mm) and as intergrowths with plagioclase; amphibole intergrowths distinguish rock from fine-grained tuffs.
- Zgddi-b** - Granodiorite and diorite: Composite pluton of dominantly medium-grained, hornblende granodiorite; lesser amounts of medium-grained hornblende diorite, fine-grained granodiorite, and diorite. Unit contains abundant xenoliths of volcanic rock and enclaves(?) of fine-grained granodiorite to diorite.
- Zgddi-g** - Diorite and granodiorite: Composite pluton of dominantly medium-grained hornblende diorite; lesser amounts of medium-grained hornblende granodiorite, fine-grained granodiorite, porphyritic diorite with plagioclase phenocrysts; minor amounts of porphyritic granodiorite with plagioclase phenocrysts, porphyritic granodiorite with potassium feldspar phenocrysts, and gabbro(?) of fine-grained granodiorite to diorite.
- Zgd-porphyritic** - Porphyritic granodiorite: Greenish-gray with a pinkish-luc, amphibole-bearing, porphyritic granodiorite with plagioclase phenocrysts. Plagioclase phenocrysts are green from saussurization and range from 2 to 8 mm in a matrix of very fine-grained quartz and alkali-feldspar. Weathered surfaces exhibit a distinct strongly porphyritic texture. Porphyritic rhyolite of Newton (1983).
- Zgdr-p** - Granodiorite and granite of Piney Mountain Creek area: Composite pluton of dominantly medium-grained hornblende granodiorite with lesser amounts of medium-grained hornblende granite.
- Zgr-di** - Granite to diorite: Composite pluton exhibiting a variety of rock types ranging from granite to diorite. Lithologies include grayish pink, medium- to coarse-grained granite; pinkish-white, medium-grained hornblende granodiorite; and dark-gray, fine- to coarse-grained diorite.
- Zdi** - Diorite: Greenish-gray to gray, medium-grained, equigranular, hornblende diorite. Major minerals include plagioclase and hornblende. Greenish-white plagioclase crystals compose up to 50% of the rock and are typically sericitized and saussuritized.
- Zdigd** - Diorite and granodiorite: Small plutonic bodies of dominantly medium-grained hornblende diorite with lesser amounts of medium-grained hornblende granodiorite.
- Zgb** - Gabbro: Fine-grained pyroxene gabbro dike.

METAVOLCANIC UNITS

- Zeip** - Mixed epiclastic-pyroclastics: Grayish-green to greenish-gray, tuffaceous, sandstones, siltstones and minor phyllite. The siltstones typically are weakly phyllitic. Unit contains lesser amounts of coarse tuff and lapilli tuff.
- Zat** - Altered tuffs: Very light-gray, light-greenish-gray to white, with red and yellow mottling; altered, felsic tuffs. Alteration of felsic tuffs has produced sericite-quartz phyllite, pods of pyrophyllite, and quartz + pyrophyllite rock; all with common <1 mm to 2 mm diameter cubic pyrite aggregates and goethite-lined molds of pyrite crystals. Fine-grained porphyroclasts of chlorite (<1 mm) and apatite (<1 mm) are present in some pyrophyllite-bearing rocks. Relict lithic clasts and kaolinitized felsic crystal shards are visible in some outcrops. Relict structures are obliterated in heavily altered rocks. Mapped area contains boulders, up to several feet in diameter, and outcrops of massive milky quartz and quartzite-like rock. Oconee Mountain contains abundant white, beige, to reddish and tan; massive, sugary to porcellaneous, very fine- to medium-grained quartzite-like rock. Quartzite-like rock is often mixed with micaceous sericite phyllite. The micaceous sericite phyllite gives the otherwise massive quartzite-like rock a foliation.
- 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 <1 mm up to 1 m diameter. Unit is interpreted as a resedimented syn-eruptive volcaniclastic deposit in which texturally unmodified volcaniclastic debris was entrained; texturally more mature accidental clasts are incorporated into a rapidly resedimented package of sediment. May be replaced via submarine mass flows, subaerial landslides and/or lahars. Outcrop in Few's Ford area of Eno River State Park has been interpreted as a lahar deposit (Allen and Wilson, 1968 and Rochester, 1978).
- Zfi** - Felsic tuffs: Gray-green to green, massive to foliated coarse tuff and lapilli tuff. Locally plagioclase crystal-fragment-rich coarse tuffs are present.
- Zfi-m** - Felsic tuffs west of Mt. Herman Church: Grayish-green to greenish-gray, massive to foliated, thin to thickly layered fine to coarse tuff with lesser amounts of lapilli tuff. 1-5% accessory sulfide minerals commonly present. Outcrops and boulders typically display a white weathering rind.
- Zfi-c** - Felsic tuffs of the Coile quarry area: Greenish-gray, massive to strongly foliated, dense, plagioclase crystal-fragment-rich coarse tuff. 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.
- Zfi-f** - Felsic tuffs of the Few's Ford area: Dominantly light-green to dark-green, massive to weakly foliated coarse tuffs. Interlayered with light-gray to gray, massive to weakly foliated lapilli tuff, a distinctive purple-colored coarse tuff; polymict conglomerate (Zfi-cong), and dark-gray to black, cryptocrystalline lava similar in appearance to the lavas present in the Zaldit unit. 1-5% accessory sulfide minerals commonly present.
- Zfi-cong** - Conglomerate interlayered in felsic tuffs of Few's Ford area (Zfi-f): Conglomerate composed of subrounded to rounded, polymictic clasts (up to 4 cm). Clast types include granodiorite and diorite; black, porphyritic lava with plagioclase phenocrysts; and fine to coarse tuff.
- Zfi-p** - Felsic tuffs west of Piney Grove: Dominantly gray to green-gray, massive to weakly foliated; layered in places coarse tuff with lesser amounts of lapilli tuff. Minor interlayers of volcaniclastic sandstone and thinly bedded (possibly burrowed?) silty siltstone are present. 1-5% accessory sulfide minerals commonly present especially near contact zone with the Backwater Creek pluton.
- Zfi-t** - Felsic tuffs east of Temple of Truth Church: Green to gray-green, massive to weakly foliated, layered in places coarse tuff with lesser amounts of lapilli tuff. Plagioclase crystal fragments compose 1-5% of typical sample.
- Zfi-s** - Felsic tuffs of the St. Mary's Church area: Gray-green to gray, massive to weakly foliated coarse tuff with lesser amounts of lapilli tuff. Minor interlayers of volcaniclastic sandstone and thinly bedded (possibly burrowed?) silty siltstone are present. 1-5% accessory sulfide minerals commonly present especially near contact zone with the Backwater Creek pluton.
- Zfi-b** - Felsic tuffs of the Blackwood area: Green-gray to gray coarse tuff and lapilli tuff. Plagioclase crystals and crystal fragments are common. Lithic clast types include dark-gray to black, magnetic, 1 to 70 mm, cryptocrystalline lava, or clasts of porphyritic lava with plagioclase phenocrysts. Porphyritic clasts are identical to the porphyritic phases of unit Zaldit. Outcrops and thin sections show a prominent welding and/or compaction foliation with flame-shaped clasts. Outcrops typically occur as very resistant fin-like outcrops.
- Zfi-g** - Felsic tuffs of the Governor Burke's Grave area: Dominantly gray, greenish-gray, grayish-green; massive to strongly foliated, fine to coarse tuff and lapilli tuff. Plagioclase crystal fragment-rich coarse tuff and lithic lapilli tuff are common. Minor interlayers of strongly foliated muscovite sericite phyllite, welded/compacted lapilli tuffs with glassy eye-shaped quartz, and altered tuffs. Map scale interlayers of apparent epiclastic rocks (Zeip) are present in unit.
- Zfi-d** - Felsic tuffs of the Duke quarry area: Unit consists of massive to strongly foliated, greenish-gray to grayish-green, coarse plagioclase crystal tuff; light-green, welded, lapilli-bearing, plagioclase + quartz crystal tuff; greenish-gray to grayish-green, matrix supported lithic tuff; and gray microcrystalline ash tuff with pyrite. Minor lithologies include interlayers of amygdaloidal basalt, fine-grained mafic tuffs that have been altered to epidote/chlorite, and epiclastic rocks.
- Zfi-purple** - Purple felsic tuffs: Light-purplish-gray, reddish-light-purple, and gray; slaty cleavage parallel to bedding; matrix supported; polymictic lapilli tuff and tuff breccias. Lithic clast types include angular, sericite-rich flattened parallel to the foliation; quartz-crystal tuff; and slaty argillites. Lithic clast types include: angular, sericite-rich flattened parallel to the foliation; black, subangular to subrounded, porphyritic lava with plagioclase phenocrysts; and green, subangular, mafic tuff and/or lava. Plagioclase occurs in traces to minor amounts as angular fragments of crystals up to 3 mm in size. Welded phases of this unit contain flattened relict pumice fragments that are now altered to chert-like quartz.
- Zgft1** - Gray felsic tuff of the Cates Creek area: Gray to dark-gray, massive to foliated fine to coarse tuff. Rare plagioclase crystal fragments are present. 1-5% accessory sulfide minerals commonly present. Rock is relatively featureless.
- Zgft2** - Gray felsic tuffs of the upper Little Creek area: Gray to light-greenish-gray; massive to foliated fine tuff. 1-5% accessory sulfide minerals commonly present.
- Zq** - Quartz bodies: White, beige, red, and tan; sugary to porcellaneous; very fine- to medium-grained quartzite-like rock. Outcrops are usually massive. Quartzite-like rock is occasionally mixed with sericite and/or pyrophyllite. The addition of sericite and/or pyrophyllite gives the otherwise massive quartzite-like rock a foliation. Pyrite is present as cubic crystals and embay 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.
- Zdit** - Dacitic lavas and tuffs: Distinctive dark-gray to black; siliceous, cryptocrystalline lava, porphyritic lava with plagioclase phenocrysts, and flow banded dacitic tuff; 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 coherent magma that were extrusive or very shallow intrusions associated with dacitic and andesitic domes. Tuff interlayers are interpreted as episodic pyroclastic flow deposits and air fall tuffs generated during eruption of domes.
- Zdit-purple** - Dacitic lavas with distinctive purple color: Reddish-light-purple to lilac-colored, massive, microcrystalline to cryptocrystalline; porphyritic dacitic lava with plagioclase phenocrysts.
- Zaldit** - Andesitic to dacitic lavas and tuffs of Poplar Ridge area: Distinctive black; siliceous, massive, cryptocrystalline lava, porphyritic lava with plagioclase phenocrysts (up to 4 mm), and flow banded lava with local amygdaloids. Interlayered with the lavas are gray to black; welded and non-welded, coarse tuff, lapilli tuff, and tuff breccia. Tuffs range from massive to strongly welded tuff with flame-shaped clasts up to 15 cm. Clast types include black cryptocrystalline lava and porphyritic lava with plagioclase phenocrysts. The lavas and tuffs are very resistant to weathering and typically have a whitish-gray weathering rind. Differentiation between lava and massive tuff is difficult in hand sample in most cases. The lavas are interpreted to have coherent magma that were extrusive or very shallow intrusions associated with dacitic and andesitic domes. Tuffs are interpreted as episodic pyroclastic flow deposits and air fall tuffs generated during eruption of domes.
- Zml** - Mafic lavas: Green, gray-green, black; amygdaloidal basalt, porphyritic basalt with plagioclase phenocrysts, and microcrystalline basalt. Interlayered with coarse plagioclase crystal tuff and coarse amphibole crystal tuff. Basalts are interpreted to be lava flows or shallow intrusions. The tuffs are fine-grained and contain plagioclase crystal fragments, commonly altered to epidote, and amphibole crystals as 1-2 mm prismatic crystal fragments.
- Zml-c** - Mafic lava of the Currie Hill area: Distinctive, very dark-gray to black; very fine-grained, magnetic, mafic lava(?). In this section the rock is composed of a very fine matrix of plagioclase laths and apparent relict amphiboles in-filled with epidote and quartz.
- Zmlmt** - Mafic lava and tuffs: Dominantly very dark-gray, greenish-gray, black; massive; andesitic to basaltic; microcrystalline lava, amygdaloidal lava, and porphyritic lava with plagioclase phenocrysts. This unit contains minor plagioclase crystal-fragment coarse tuffs and amphibole crystal-fragment coarse tuffs. Interpreted pillow structures are present in some mafic lavas.
- Zmlml** - Mafic tuffs and lavas: Dominantly dark-green, greenish-gray, grayish-green; massive to foliated, fine and coarse tuffs of andesitic(?) to basaltic(?) composition. Unit includes crystal-free, fine tuffs; matrix supported, plagioclase- and amphibole-crystal-fragment coarse tuff; and crystal-lithic lapilli tuffs. Clasts are subangular (up to 5 m) and dark green. Minor thin mafic lava flows with relict amygdaloids and interpreted pillow structures are present in unit.
- Trq-breccia** - Quartz breccia: White, massive to brecciated, vuggy quartz. Typically contains angular clasts of altered volcanic rock suspended in a quartz matrix. Some zones exhibit a lacey pattern of intersecting quartz veins with a matrix of altered wall rock.



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