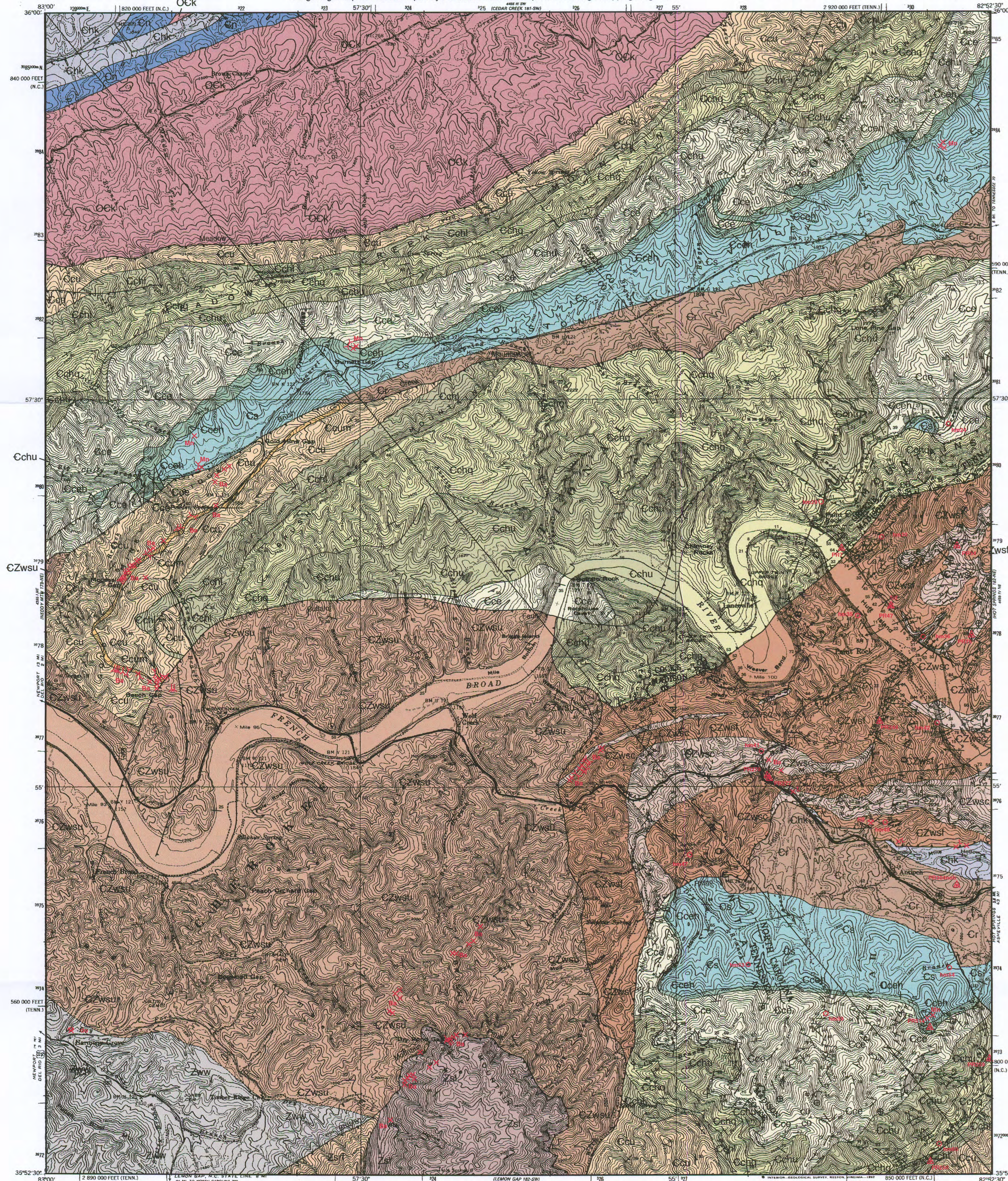


BEDROCK GEOLOGIC MAP OF THE PAINT ROCK 7.5-MINUTE QUADRANGLE, NORTH CAROLINA AND TENNESSEE

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF LAND RESOURCES

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NORTH CAROLINA GEOLOGICAL SURVEY
OPEN FILE REPORT 2004-04 REVISED 2006



MAP UNITS

METASEDIMENTARY SEQUENCE

- OCK** Knox Group
- En** Nolichucky Shale
- Chk** Honaker Dolomite
- Cr** Rome Formation
- Cs** Shady Formation
- Cchh** Helenmode Member
- Cce** Erwin Formation
- Cchu** Upper Shale Member
- Cchq** Middle Quartzite Member
- Cchl** Lower Shale Member
- Ccu** Unicoi Formation
- Ccum** Moccasin Gap Member
- CZwsu** Undivided
- CZwsc** Fine-grained
- CZwsc** Coarse-grained
- Zww** Wilhite Formation
- Zsrl** Roaring Fork Sandstone
- Zsl** Longarm Quartzite

STRUCTURAL FEATURES

CONTACTS

- Thrust Fault (with upper plate)
- High-Angle or Tear Fault (with lower plate)
- Stratigraphic Contact

STRIKE AND DIP OF PLANAR FEATURES

- Bedding
- Overturned Bedding
- Vertical Bedding
- Horizontal Bedding
- Brecciated Surface
- Joint
- Vertical Joint
- Staly Cleavage
- Vertical Staly Cleavage

BEARING AND PLUNGE OF LINEAR FEATURES

- Minor Fold Axis
- Licetion
- Axis of Crenulation Cleavage

AXES OF MAP SCALE FOLDS

- Open Anticline
- Open Syncline

MINERAL RESOURCES

- Occurrence
- Prospect
- Adit
- Trench
- Abandoned mine or quarry
- Mine or quarry
- Borrow pit
- Commodity Letter
- Lineate
- Barite
- Dolomite
- Manganese
- Fill material

DESCRIPTION OF MAP UNITS¹

METASEDIMENTARY SEQUENCE
KNOX GROUP (OCK) - Massive to medium-bedded, dark, bluish-gray limestone and sandstone with local beds of ribboned dolomite, flat pebble conglomerate and chert.

NOLICHUCKY SHALE² (En) - Gray to bluish gray calcareous shale and shaly limestone divided into four members. Ribboned limestone with dolomite, greenish gray siltstone and shaly limestone, limestone with siltstone and dolomite, dark green siltstone.

HONAKER DOLOMITE³ (Chk) - Onel (1950) considers limestone along Shick-Creek with the Honaker Dolomite of Campbell (1897) in northeastern Tennessee and western Virginia. In the Hot Springs window, the unit is dominantly limestone, which is light gray to dark gray to locally dusky blue when fresh, weathers grayish yellow to moderate yellowish brown; fine-grained, finely laminated to thin bedded to massive, argillaceous. Chert, which is light gray to black, subvertical to wavy, and concretionally bedded, is locally common and a key to identification of this unit in the field.

ROME FORMATION⁴ (Cr) - A heterogeneous unit consisting of siltstone, shaly siltstone, and argillaceous shale, with subordinate fine-grained sandstone, dolomite shale, and shaly dolomite. Classic rock types are characteristically moderate red, dusky red, moderate brown, and light olive brown; very fine- to fine-grained; laminated to thin bedded; micaceous. Primary structures such as depositional laminae, graded bedding, ripple laminations, and mud cracks are typical. Locally ribbonbed dolomite, light gray to light bluish gray, fine-grained; medium- to thick-bedded; and is especially abundant in the upper part of the formation.

SHADY DOLOMITE⁵ (Cs) - Several distinctive dolomite rock types comprise this unit. Most of the dolomite is light bluish gray to medium bluish gray, fine- to medium-grained, laminated to thin bedded to thick bedded. Ribbons and stringers of coarse-grained crystalline secondary dolomite is locally common. Some dolomite is white to bluish white to very light gray to grayish pink to yellowish gray, fine- to medium-grained, massive. Ribbon-banded dolomite is common in some areas, and consists of fine, alternating layers of light bluish gray and medium bluish gray dolomite. Darker layers are slightly finer grained than the lighter layers and contain more organic matter. Nearly all of the lighter layers of the ribbon-banded dolomite have been converted to coarsely crystalline secondary dolomite. Limestone is a subordinate rock type locally. Baker (1966) describes dark, thin- to medium bedded, sulfatic siltstone occurring locally in the lower part of the unit. Moderate to severe mudstone and argillaceous occur locally in all rock types of the Shady Dolomite, and in the overlying residual clay.

HELENMODE MEMBER⁶ (Cchh) - This unit is characterized by siltstone, shale, and a few interbeds of sandstone. Shale and siltstone are moderate red to very dark red purple, locally mottled with dusky gray glauconitic layers, finely laminated to thin bedded; calcareous; sulfatic. Sandstone is fine- to medium-grained, thin bedded; calcareous to dolomitically cemented; weathers to pale yellowish orange clay and argillaceous sand; which is stained black and dark reddish brown with manganese and iron oxides. Sample consists of 25% quartz, 20% plagioclase, 10% potassium feldspar, 6% chlorite, 3% muscovite, 1% hornblende, and 1% black opaque.

ERWIN FORMATION⁷ (Cce) - Quartzite to feldspathic sandstone with interbeds of siltstone, shale, siltstone and minor shale. Quartzite - white; fine- to medium-grained, locally conglomeratic; thin- to thick bedded; consists of quartz, sericite, potassium feldspar, plagioclase, and traces of apatite, zircon, epidote group minerals, and sphene. Onel (1950) reports that the quartzite is lens-shaped, which is dusky blue to very dusky purple. The color resulting from finely disseminated hematite in the cementing material, as well as from the decomposition of glauconite. Feldspathic sandstone - very pink orange to yellowish orange, fine- to medium-grained, thin- to thick bedded; consists of quartz, potassium feldspar, plagioclase, and traces of apatite, zircon, epidote group minerals and sphene. Siltstone and shale - grayish olive green to dusky green, locally stained dark reddish brown from iron-oxides; quartz, feldspar, sericite, black opaque, and other trace minerals.

UNICOI FORMATION⁸ (Ccu) - An interbedded succession of quartz pebble conglomerate, quartzite, feldspathic sandstone, and minor siltstone. Conglomerate - bluish white to very light gray, locally weathers dusky red due to iron staining; coarse- to very coarse-grained; medium- to thick bedded; graded bedding is common; consists of quartz, potassium feldspar, plagioclase, sericite, ilmenite and other black opaque minerals, and traces of chlorite, tourmaline, zircon, sphene, and carbonate; traces of barite and garnet also occur as detrital grains. Clasts consist of rounded quartz pebbles, angular feldspar granules, and lithic fragments (dominantly siltstone); the matrix is medium- to coarse-grained, feldspathic and locally sulfatic. Quartzite - grayish green to yellow green to white, medium-grained, thin- to thick bedded; characteristically devoid of primary sedimentary structures; feldspathic sandstone - very pale orange to pale yellowish orange, medium- to coarse-grained; thin- to thick bedded. Sandstone - grayish olive green to fine-grained; thin bedded, micaceous.

MOCASIN GAP MEMBER⁹ (Ccum) - Quartzite to feldspathic sandstone interbedded with the Unicoi Formation - very light gray to yellowish gray; medium- to coarse-grained, poorly sorted; thin bedded; characteristically devoid of primary sedimentary structures; feldspathic sandstone - very pale orange to pale yellowish orange, medium- to coarse-grained; thin- to thick bedded. Sandstone - grayish olive green to fine-grained; thin bedded, micaceous.

WALDEN CREEK GROUP
FINE-GRAINED UNIT (CZwsc) - Metasilicate to metashale with minor interlayers of feldspathic sandstone, quartzite, metagranulite and metapelite. Metasilicate to shale - grayish olive green to medium gray, weathers light brown to moderate brown; fine-grained; thin bedded; locally laminated or cross-bedded; highly indurated; consists of 55-65% chlorite, 10-20% sericite, trace-30% potassium and plagioclase feldspar, 5-15% quartz, 2-3% black opaque, trace-2% barite, and a trace of hornblende. Feldspathic sandstone - medium light gray to greenish gray, fine- to medium-grained; moderately well sorted; medium bedded; sample consists of 65% quartz, 6% plagioclase feldspar, 5% sericite, 4% chlorite, 2% potassium feldspar, and traces of black opaque and hornblende. Metagranulite - light gray to pinkish gray, coarse-grained; medium- to thick bedded; sample consists of 60% quartz, 20% calcite, 15% plagioclase and 5% sericite, 2% potassium feldspar, and traces of chlorite and black opaque. Metapelite - brownish gray to very dusky red on weathered surfaces; fine- to medium-grained; poorly sorted; thin- to thick bedded; silt laminae are locally present; consists of quartz, potassium feldspar, plagioclase, sericite, and black and red opaque minerals.

GRANULE METAGROUNDED UNIT (CZwsu) - Granule metagranulite and quartzite with interbedded metasilicate, shale, and minor pebble conglomerate. Conglomerate unit, only slightly indurated. Granule metagranulite - yellowish gray to grayish yellow, locally bedded; coarse- to very coarse-grained; consists of angular quartz and feldspar granules and lithic fragments (dominantly siltstone and metapelite) in a feldspathic matrix. Quartzite - medium light gray to medium gray, medium- to coarse-grained; medium- to coarse-grained; locally conglomeratic; poorly sorted; medium- to thick bedded; cross-bedded and graded bedding are common; sample consists of 65-68% quartz, 10-14% sericite, 1-2% black opaque, and trace-2% red opaque.

UNDIVIDED (CZwsc) - Interbedded siltstone, feldspathic sandstone, quartzite and granule conglomerate with minor pebble conglomerate. Not mapped in detail.

WILHITE FORMATION (Zww)
 Varied unit not subdivided on this map. Consists of metasilicate, feldspathic siltstone, sandstone, phyllite and limestone. Metasilicate - olive gray to greenish black, fine-grained; laminated to well bedded, rhythmic banding is locally distinct; locally calcareous and sulfatic; feldspathic siltstone - light brownish gray to greenish black, fine-grained; thin bedded; limestone - bluish white to light gray, fine-grained to coarsely crystalline, argillaceous; thin- to medium bedded; interbedded with siltstone and sandy siltstone.

ROARING FORK SANDSTONE (Zsrl) - A variably interbedded sequence of metasilicate, metagranulite, metapelite, and shale. Metasilicate - light bluish gray to dark greenish gray, fine- to coarse-grained siltstone, but ranging to fine-grained sandstone; consists of potassium feldspar, quartz, plagioclase, chlorite, sericite, and minor apatite, zircon, and sphene. Metagranulite - bluish gray to light brownish gray, medium- to coarse-grained; well sorted; bedding ranges from several decimeters to about one meter thick; locally graded and cross-bedded; consists of quartz, potassium feldspar, plagioclase, sericite, chlorite, minor opaque, zircon, and sphene. Shale - grayish brown to grayish black, laminated.

LONGARM QUARTZITE (Zsl) - Dominantly meta-arkose and metagranulite, with subordinate metapelite, metasilicate and shale. Meta-arkose and metagranulite - pinkish gray to grayish pink, mottled with white to very light gray quartz and grayish pink to grayish orange pink feldspar granules; coarse- to very coarse-grained, locally pebbly; thin bedded, graded and cross-bedded; consists of quartz, potassium feldspar, plagioclase, sericite, barite, and traces of zircon, sphene, epidote, and opaque minerals. Interbedded throughout the sequence is dark greenish gray metagranulite, grayish olive metasilicate, and grayish black to brownish black shale.

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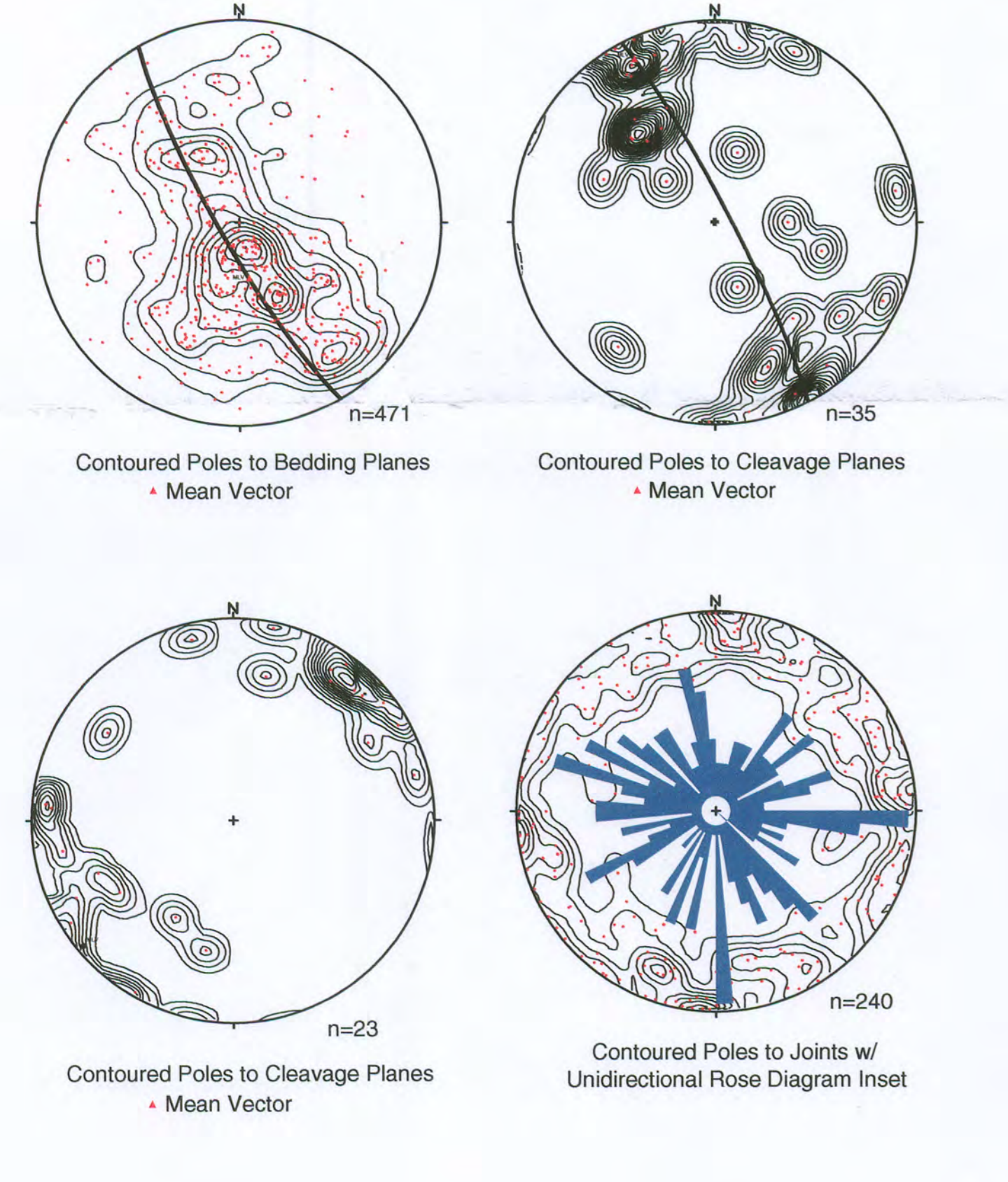
2004

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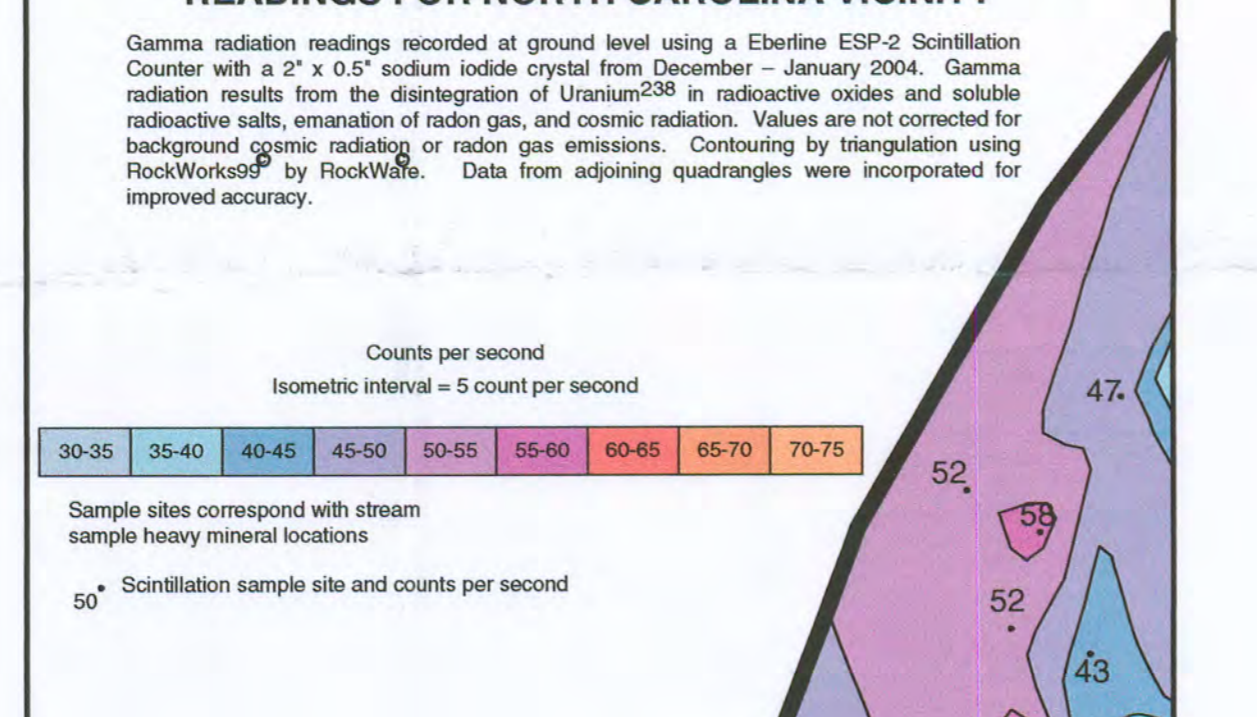
QUADRANGLE LOCATION



SCHMIDT EQUAL AREA STEREONET DATA



SKETCH MAP SHOWING CONTOURED SCINTILLATION READINGS FOR NORTH CAROLINA VICINITY



STREAM SEDIMENT HEAVY MINERAL ANALYSIS

Stream sediment heavy mineral analysis was conducted in January 2004 to aid geologic mapping, better define conditions of metamorphism, and inventory minerals of potential economic significance. Procedure: In the field, approximately 150 g of stream sediment material is removed to approximately 200 g of heavy mineral concentrate at each sample locality (collected in the morning at the sample site). In the laboratory, concentrate is washed and passed through heavy liquid separation using bromoform, and separated with short- and long-wave ultraviolet illumination using an Ultraviolet Fluorescence Analyzer (UVFL) and a Mineralogical Lamp. Magnetite is removed with a hand magnet. A sample split is placed in a standard 27x6 mm glass slide and approximately 200 grains are identified and counted with the aid of a petrographic microscope and a 167 inch of reticulation oil. Results of stream sediment heavy mineral analysis are tabulated below.

SAMPLE	NC COORDINATES (State Plane NAD 83 in feet)	MAP UNIT	DRAINAGE ¹	%HM IN SAMPLE ²	PERCENT HEAVY MINERALS IN SAMPLE ³																
					Mg	Ca	Fe	Zn	Sp	Il	St	Tr	Ust	Sr	Hb	Bl	Ky				
PR-514	801.097N 849.507E	feldspathic sandstone	Chk	0.17	0.10	17.18	0.00	1.66	0.41	3.31	0.00	0.00	5.38	62.11	9.11	0.00	0.00	0.00	0.00	0.41	0.41
PR-514	801.097N 849.507E	feldspathic sandstone	Chk	0.14	19.01	0.00	0.00	0.00	2.43	0.40	0.40	4.05	64.79	8.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR-259	796.706N 849.320E	quartzite	Cchh	0.01	35.33	0.67	1.33	0.07	3.00	2.00	1.00	4.00	8.67	0.67	0.67	0.00	0.00	0.00	0.00	0.00	0.00
PR-250	816.342N 849.718E	quartzite	Cchh	0.02	7.50	0.25	2.32	2.78	0.00	0.00	6.48	27.36	40.81	0.00	0.93	0.93	0.00	0.00	0.00	0.00	0.00
PR-250	816.342N 849.718E	quartzite	Cchh	0.02	16.73	0.83	0.83	0.83	7.49	0.42	2.50	2.91	44.96	12.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR-250	816.342N 849.718E	quartzite	Cchh	0.02	13.46	0.00	1.30	0.87	2.60	0.67	0.43	1.73	61.01	17.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PR-250	816.342N 849.718E	quartzite	Cchh	0.16	16.73	0.83	0.83	0.83	7.49	0.42	2.50	2.91	44.96	12.91	0.00	0.00	0.00	0.00	0.00	0.00	
PR-250	816.342N 849.718E	quartzite	Cchh	0.11	17.30	0.00	0.41	2.88	0.01	0.41	2.48	55.78	18.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
PR-250	816.342N 849.718E	quartzite	Cchh	0.07	15.91	0.42	1.68	0.84	0.00	0.00	5.08	56.92	18.08	0.42	0.64	0.00	0.00	0.00	0.00	0.00	
PR-250	816.342N 849.718E	quartzite	Cchh	0.37	11.58	0.00	0.44	0.44	0.44	0.44	0.31	27.67	38.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
PR-250	816.342N 849.718E	quartzite	Cchh	0.40	5.26	0.00	0.00	1.89	1.89	0.00	0.00	9.47	43.11	37.89	0.00	0.00	0.00	0.00	0.00	0.00	
PR-250	816.342N 849.718E	quartzite	Cchh	0.28	8.86	0.00	0.00	0.01	0.91	0.00	0.00	14.11	29.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
PR-250	816.342N 849.718E	quartzite	Cchh	0.23	15.21	0.00	0.85	0.42	1.27	0.42	0.00	2.97	44.38	30.52	0.85	0.00	0.00	0.00	0.00	0.00	

WHOLE ROCK ICP ANALYSIS¹ OF SELECTED SAMPLES

SAMPLE ²	COORDINATES	ROCK TYPE	MAP UNIT	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	Na ₂ O	K ₂ O	TiO ₂	P ₂ O ₅	MnO	Cr ₂ O ₃	Ba	Cu	Zn	Ni	Co	Sr	Zr	Ce	Y	Nb	Sr	La	LOI	SUM
PR-514	801.097N 849.507E	sandstone	Chk	90.09	0.18	0.05	0.04	0.07	0.04	<0.02	<0.01	0.06	0.03	0.002	1.94	20.70	35.20	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	144.9999
PR-47	817.622N 848.638E	serpentine siltstone	Cchh	81.87	7.82	2.11	0.22	0.12	0.19	4.83	0.58	0.40	<0.01	0.004	7.94	<20	<20	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	177.100
PR-277	811.028N 843.618E	granite conglomerate	CZwsc	90.30	3.75	2.36	0.51	0.13	0.15	1.59	0.15	<0.01	0.001	0.001	284	<20	<20	<20	<20	<20	<10	<10	<10	<10	<10	<10	<10	208.49
PR-250	796.706N 849.320E	quartzite	Cchh	96.74	0.81	0.12	0.05	0.10	0.03	0.21	0.23	0.09	0.001	0.001	1.66	<20	<20	<20	<20	<20	<10	<10	<10	<10	<10	<10	<10	188.215
PR-250	796.706N 849.320E	feldspathic siltstone	Chk	65.68	12.73	9.28	1.96	0.36	0.81	2.88	0.93	0.21	0.17	0.009	399	64	37	22	<20	<20	<10	<10	<10	<10	<10	<10	<10	488.939
PR-34	819.882N 851.307E	feldspathic quartzite	CZwsc	95.20	1.54	1.34	0.06	0.03	0.04	0.43	0.17	0.01	0.001	<0.001	1685	<20	<20	<20	<10	<10	<10	<10	<10	<10	<10	<10	<10	100.11
PR-47	817.622N 848.638E	serpentine siltstone	CZwsc	58.39	17.68	10.37	2.16	0.39	1.77	2.27	1.19	0.17	0.003	0.001	245	<45	104	53	<20	<10	<10	<10	<10	<10	<10	<10	<10	46.9927
PR-277	811.028N 843.618E	granite conglomerate	CZwsc	73.00	4.87	4.56	2.36	4.98	1.39	1.19	0.15	0.19	0.002	0.002	274	<20	<20	<20	<20	<20	<10	<10	<10	<10	<10	<10	<10	208.49
PR-278	811.028N 843.618E	sandstone	CZwsc	94.57	3.10	2.54	0.32	0.03	0.24	0.05	<0.01	<0.001	<0.001	<0.001	36	<42	<20	<20	<20	<20	<10	<10	<10	<10	<10	<10	<10	100.11
PR-25	816.371N 851.783E	granite conglomerate	CZwsc	83.39	2.54	1.98	0.09	0.02	0.04	0.64	0.16																	