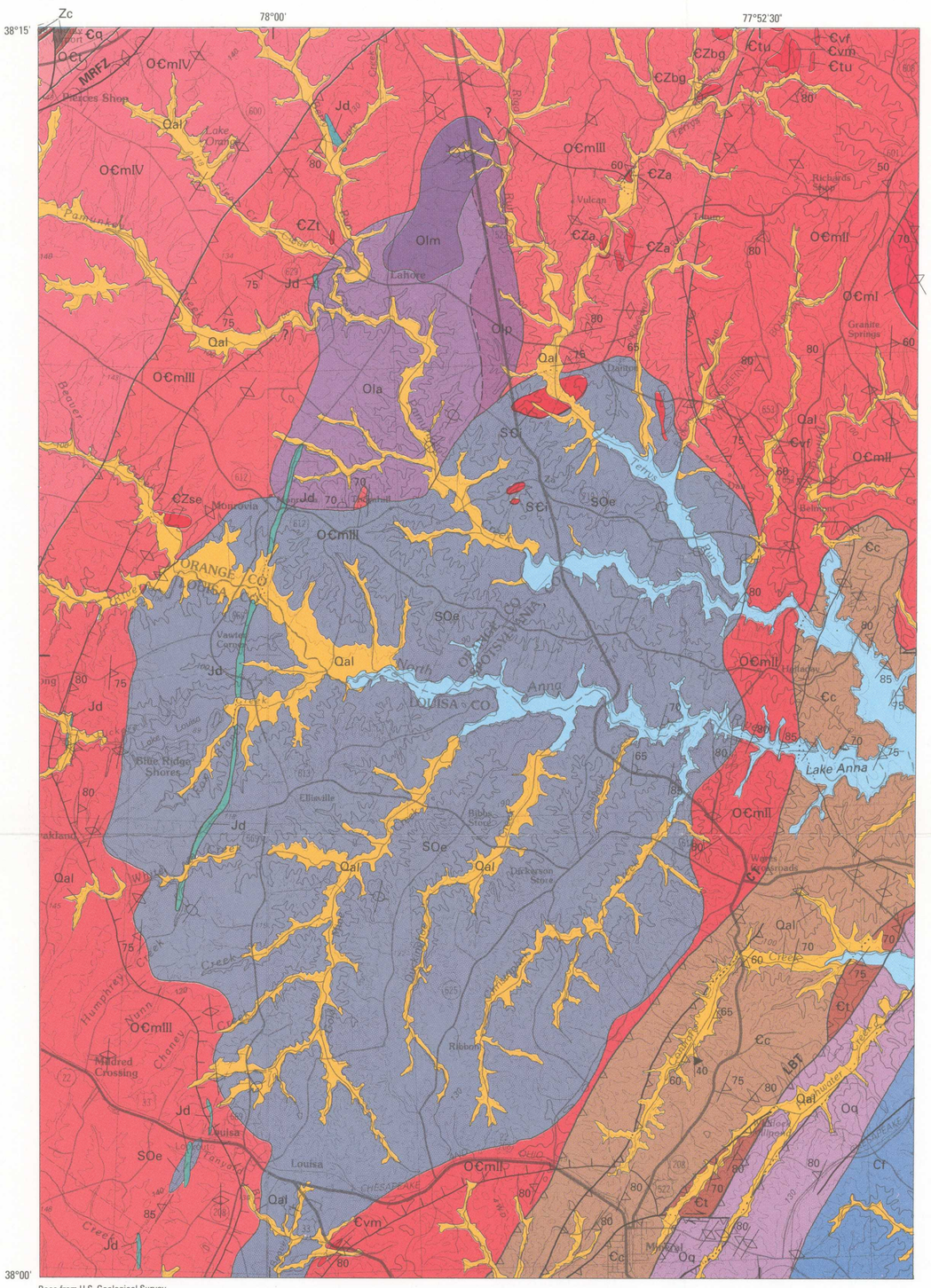
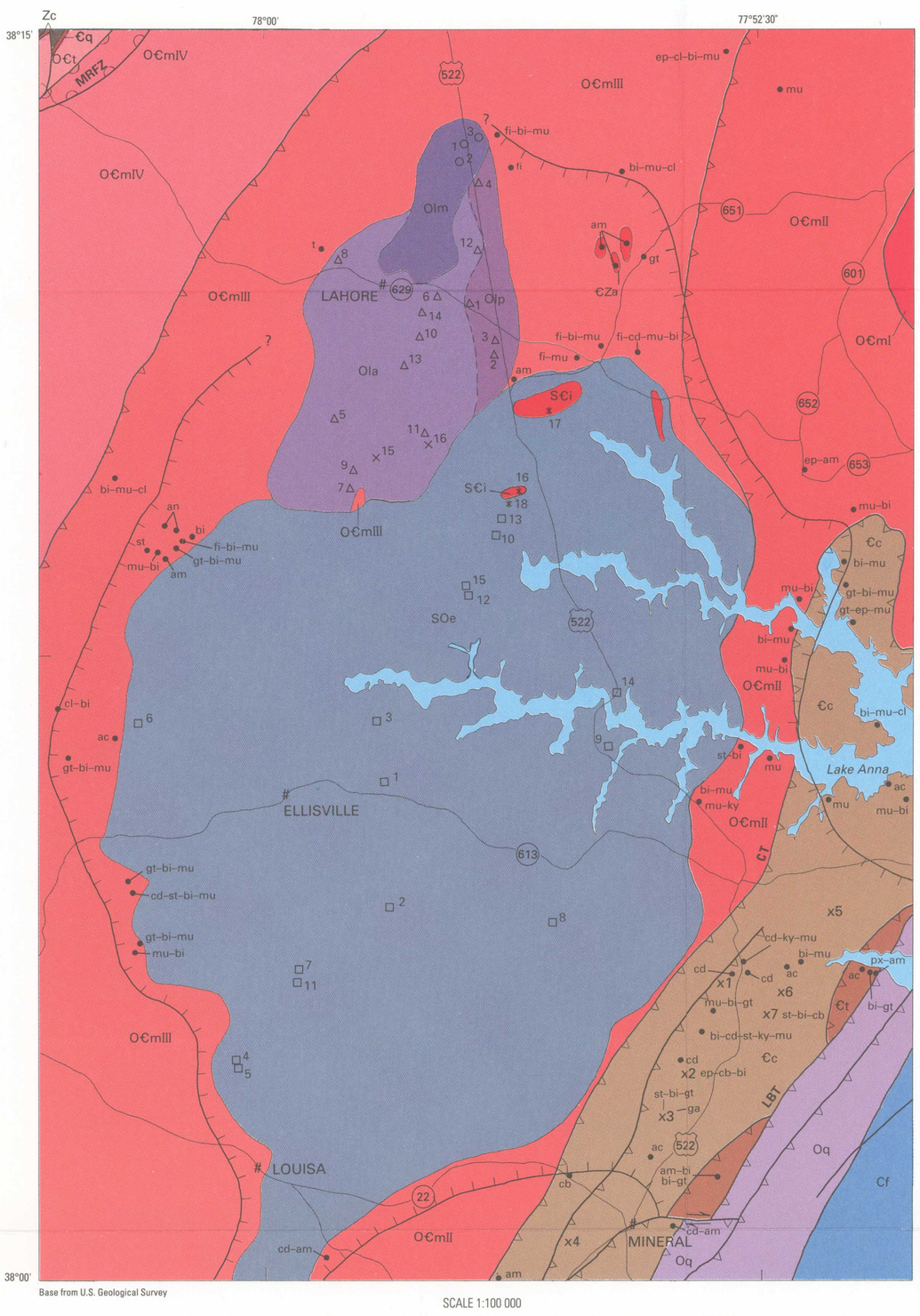


A—Geologic map of the Lahore Complex-Ellisville pluton area, central Virginia Piedmont



Lahore pluton
- ○ Mafic pluton
- × Dikes of Lahore pluton

Ellisville pluton
- □ Granodiorites
- * Intrusions or inclusions

Other
- + Olistoliths

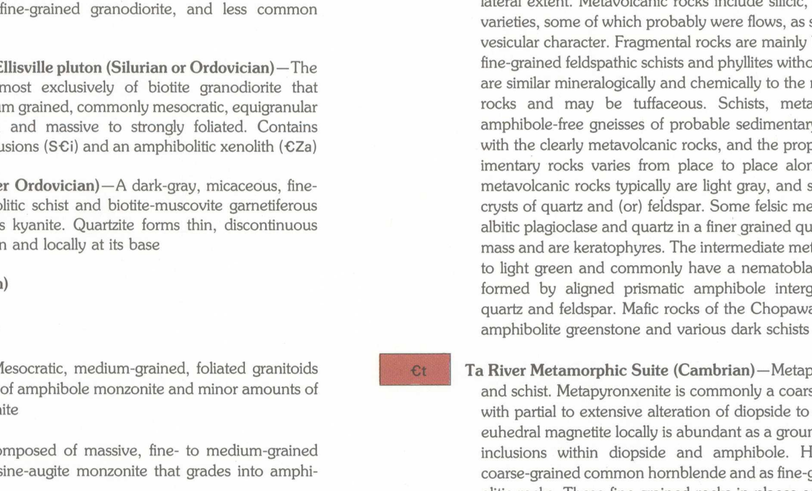
Inactive mines
- x1 Sulfur mine
- x2 Boyd Smith
- x3 Arminius
- x4 Julia
- x5 Allah Cooper
- x6 East Sulfur
- x7 Cofer

Mineral abbreviations

ac	actinolite	fi	fibrolite
am	amphibole	ga	gahnite
an	antigorite	gt	garnet
bi	biotite	ky	kyanite
cb	carbonate	mu	muscovite
cl	chlorite	px	pyoxene
cd	chloritoid	st	staurolite
ep	epidote		

B—Simplified geologic map showing location of samples, inactive mines of the Mineral district, and the distribution of minerals formed through contact metamorphism within the thermal aureole of the Lahore and Ellisville plutons

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Qal — **Alluvium (Quaternary)**—Sand, gravel, silt, and clay; brown to gray and gray green. In stream channels and flood plains. Grades into colluvium along margins of some streams. Locally may include swamp deposits

Jd — **Diabase dikes (Jurassic?)**—Crystalline, medium- to fine-grained, dark-gray to black, generally intergranular to ophitic textured basaltic rocks. Predominantly bytownite-augite diabases with opaques and locally minor biotite as common accessory. Less common diabase contains fayalitic olivine with bytownite more calcic than the plagioclase in olivine-free diabase. Dikes are Mesozoic, probably Jurassic

Cf — **Falmouth Intrusive Suite (Carboniferous)**—Fine-grained monzogranite and pegmatitic granite, fine-grained granodiorite, and less common tonalite

SOe — **Biotite granodiorite of the Ellisville pluton (Silurian or Ordovician)**—The Ellisville is composed almost exclusively of biotite granodiorite that typically is coarse to medium grained, commonly mesocratic, equigranular to porphyritic in texture, and massive to strongly foliated. Contains granitoid intrusions or inclusions (S€i) and an amphibolitic xenolith (€Za)

Oq — **Quantico Formation (Upper Ordovician)**—A dark-gray, micaceous, fine- to medium-grained staurolitic schist and biotite-muscovite garnetiferous schist that locally contains kyanite. Quartzite forms thin, discontinuous lenses within the formation and locally at its base

Lahore Complex (Ordovician)

Rocks of the Lahore pluton

Ola — Amphibole monzonite—Mesocratic, medium-grained, foliated granitoids composed predominantly of amphibole monzonite and minor amounts of amphibole quartz monzonite

Olp — Pyroxene monzonite—Composed of massive, fine- to medium-grained melanocratic biotite-andesine-augite monzonite that grades into amphibole monzonite

Olm — Rocks of the mafic pluton—A composite mass that contains partially serpentinized pyroxenite consisting of well-formed diopside that is rimmed by antigorite as well as amphiboles; diopside metapyroxenite present as a medium-grained rock with cores of diopside replaced by tremolite on margins

O€t — **True Blue Formation of Pavlides (1990) (Ordovician and (or) Cambrian)**—Consists primarily of calcareous and noncalcareous slate and siltstone and lesser amounts of argillite

Mine Run Complex (Ordovician and (or) Cambrian)—The four thrust slices that compose the Mine Run Complex are numbered from east to west as I through IV. In general, the matrix rocks of these four melange zones in fresh outcrop are various shades of gray or green, and many of the matrix rocks are metagraywackes

O€mlV — Melange zone IV—Fine-grained, gray-green to green metavolcanic phyllites are intercalated with metavolcaniclastic phyllites and other metasedimentary rocks. These metavolcanic and intercalated metasedimentary rocks pass gradationally across strike to the west into mostly fine grained metasandstone and metasiltstone. Melange zone IV locally contains pebble-sized exotic material

O€mlII — Melange zone III—Phyllite and schist are the matrix lithologies of this melange zone. One of its major features is the abundance of euhedral magnetite. This magnetite invariably truncates or crosscuts rock foliation and is believed to be a late metamorphic mineral. Many of the matrix rocks are highly deformed on a mesoscopic and microscopic scale. Polydeformation of the matrix phyllites and schist is evident from the folding of early foliation. Amphibolitic rock (€Za) is a common type of exotic block north and south of the map area; biotite gneiss (€Zbg) and serpentinite (€Zse) are present locally. Massive, as well as foliated, talc (€Zt) forms sparse exotic blocks. Many blocks are composite and are composed of various amounts of combinations of serpentinite, amphibolite, talc, or mafic rocks

O€mlI — Melange zone II—A thrust slice with felsic (€vf) and mafic (€vm) metavolcanic blocks similar to those in the Chopawamsic Formation (€c) and with granitoid blocks (€tu). The matrix of melange zone II consists of schist or phyllite that is deformed more complexly than the matrix rocks of melange zone I and that generally have crenulation cleavage

O€ml — Melange zone I—The matrix rocks of this melange zone are fine-grained schist and phyllite locally enclosing coarse-grained metasandstone beds. Exotic blocks do not occur in this unit within the map area or within the map area of plate 1 but are present immediately to the north and south

€q — **Quartzite-siltstone-granule conglomerate (Cambrian)**—Siliclastic metasedimentary rocks that form discontinuous lenses unconformably above the Catoctin Formation (Zc). Some of the metasiltstones and fine-grained quartzites show crossbedding and channel structures. Other quartzites have well-rounded quartz grains

€c — **Chopawamsic Formation (Cambrian)**—Consists of lenses and tongues of metavolcanic and metasedimentary rocks and lacks single units with great lateral extent. Metavolcanic rocks include silicic, intermediate, and mafic varieties, some of which probably were flows, as suggested by their highly vesicular character. Fragmental rocks are mainly breccias and tuffs. Many fine-grained feldspathic schists and phyllites without identifiable fragments are similar mineralogically and chemically to the more distinctive volcanic rocks and may be tuffaceous. Schists, meta-arenites, and, locally, amphibole-free gneisses of probable sedimentary origin are interlayered with the clearly metavolcanic rocks, and the proportion of such metasedimentary rocks varies from place to place along the formation. Silicic metavolcanic rocks typically are light gray, and some have small phenocrysts of quartz and (or) feldspar. Some felsic metavolcanic rocks contain albitic plagioclase and quartz in a finer grained quartzofeldspathic groundmass and are keratophyres. The intermediate metavolcanic rocks are dark to light green and commonly have a nematoblastic groundmass texture formed by aligned prismatic amphibole intergrown with fine-grained quartz and feldspar. Mafic rocks of the Chopawamsic Formation include amphibolite greenstone and various dark schists

€t — **Ta River Metamorphic Suite (Cambrian)**—Metapyroxenite, hornblendite, and schist. Metapyronxenite is commonly a coarse-grained diopsidic rock with partial to extensive alteration of diopside to amphibole. Anhedral to euhedral magnetite locally is abundant as a groundmass accessory and as inclusions within diopside and amphibole. Hornblendite consists of coarse-grained common hornblende and as fine-grained, foliated amphibolitic rocks. These fine-grained rocks in places consist of an amphibolitic groundmass with small porphyroblasts of euhedral amphibole locally altered to chlorite and glomeroporphyritic plagioclase. Grandular to subhedral titanite and granular epidote-zoisite are groundmass constituents as well as inclusions in amphibolite. Schist is generally composed of garnet enclosed in a fine- to medium-grained matrix of quartz and aligned brown biotite, some of which occurs as coarser grained metacrysts

Zc — **Catoctin Formation (Late Proterozoic)**—Greenstone, green phyllitic tuff, and greenschist-facies fragmental rocks (brecciated pillows?)

EXPLANATION OF MAP SYMBOLS

Contact — Dashed where gradational

Fault

Thrust fault — Sawteeth on upper plate. Arrows show direction of possible late strike-slip movement. CT, Chopawamsic thrust fault; LBT, Long Branch thrust fault

Limits of Mountain Run Fault Zone (MRFZ)

Limits of thermal aureole around Ellisville and Lahore plutons

Flow foliation
- 85 Inclined
- Vertical

Regional tectonic foliation
- 75 Inclined
- Vertical

Crenulation foliation
- 40 Inclined

Map units		Text table numbers	Lithology	Samples: Sample number	Field number	Chemical analysis	U/Pb zircon	Rb/Sr whole rock	$^{40}Ar/^{39}Ar$ Amphibole	$^{40}Ar/^{39}Ar$ Biotite	$^{40}Ar/^{39}Ar$ Microcline	$^{40}Ar/^{39}Ar$ amphibole isochrons
Lahore Complex	Lahore pluton	3	Pyroxene monzonite	1	P–78–53	X						
				2	P–81–10A	X						
				3	P–81–10	X	--------	X				
				4	P–80–48	X						
			Amphibole monzonite	5	P–80–66	X						
				6	P–80–68	X						
				7	P–81–12	X	--------	X	X	X		
				8	P–81–14	X	--------	X		X		
				9	P–81–13	X						
				10	P–80–70	X						
				11	P–81–11	X	X	X				
				12	P–78–52	X	X					
				13	P–80–72	X						
				14	P–81–15	X	--------	X	X			X
			Dikes	15	P–80–74A	X						
				16	P–80–75	X						
	Mafic pluton	6	Meta-pyroxenite	1	P–80–86	X						
				2	P–80–84	X						
				3	P–80–92	X						
Ellisville pluton		4	Granodiorite	1	P–80–38	X	--------	X				
				2	P–80–20	X						
				3	P–80–24	X						
				4	P–80–33	X	--------	X				
				5	P–80–32	X	X					
				6	P–80–26	X						
				7	P–80–37	X	--------	X		X	X	
				8	P–25	X	X					
				9	P–80–9	X						
				10	P–80–41	X	----------		X	X	X	
				11	P–80–36	X	X	X				
				12	P–80–39	X	--------	X				
				13	P–80–42	X	--------	X	X	X	X	X
				14	P–80–8	X						
				15	P–80–40	X	X	X				
	Inclusions/ Intrusions		Tonalite	16	P–80–44	X						
			Monzodiorite	17	P–80–45	X						
			Diorite	18	P–80–43	X						
Olistoliths			greenschist	1	P–80–48B	X	----------	X	----------			X
			greenschist	2	P–80–46C	X	----------	X				
			greenschist[1]		P–78–22[1]	X	----------	X				
			greenschist[2]		P–78–6[2]	X	----------	X				

[1] Located in the Mine Run Quadrangle N40°45'E, 15.02 km from the northeast corner (lat 38°15'N, long 77°52'30"W) of the Lahore quadrangle, Virginia.
[2] Located in the Mine Run Quadrangle N36°00'E, 8.42 km from the northeast corner (lat 38°15'N, long 77°52'30"W) of the Lahore quadrangle, Virginia.

Pavlides, Louis, Arth, J.G., Sutter, J.F., Stern, T.W., and Cortesini, Henry, Jr., 1994, Early Paleozoic alkalic and calc-alkalic plutonism and associated contact metamorphism, central Virginia Piedmont: U.S. Geological Survey Professional Paper 1529

GEOLOGIC MAP *(A)* AND SAMPLE LOCATION AND METAMORPHIC MINERAL ASSEMBLAGE MAP *(B)* OF THE LAHORE COMPLEX-ELLISVILLE PLUTON AREA

By
Louis Pavlides, J.G. Arth, J.F. Sutter,
T.W. Stern, and Henry Cortesini, Jr.

1994