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Department of Natural Resources
MARYLAND GEOLOGICAL SURVEY
Emery T. Cleaves, Director

GEOLOGIC MAP OF THE LITTLESTOWN QUADRANGLE, CARROLL COUNTY, MARYLAND

by
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NOTES ON STRATIGRAPHY, STRUCTURE, AND CORRELATION

The geologic formations present in the Maryland part of the Littlestown Quadrangle lie in two separate terranes: one is composed of phyllitic bedrock that is of probable Early Paleozoic age, and the other consists of sedimentary rocks of Triassic age in the Gettysburg and Tyrone rift basins. The phyllitic rocks are part of an extensive low-grade metamorphic terrane of polydeformed sedimentary and volcanic rocks that constitutes the western Piedmont of Maryland. Most primary sedimentary structures in these metamorphic rock units have been obscured or obliterated by close folding, development of foliation, and recrystallization. To a large extent, the early-formed structures and foliation have also been destroyed or modified by later episodes of tectonism. Stratigraphic relationships and interpretation of the structure in this region are hampered by poor exposure and structural complexity, as well as by the lack of fossils.

The Gillis Group consists of an assemblage of phyllites that make up, from oldest to youngest, the Urbana, Ijamsville, and Marburg Formations. In this quadrangle, rocks mapped as the Araby Formation, defined by Reinhardt (1974) as a shale-siltstone unit along the eastern edge of the Frederick Valley in central Frederick County to the west but originally mapped by Jonas and Stose (1938) as the Antietam Formation, occur between the Ijamsville and Marburg Formations and are included in the Gillis Group. Reinhardt (1974) assigned a Lower Cambrian age to the Araby.

The Urbana Formation in Maryland is generally accepted as correlative with the Lower Cambrian(?) Harpers Formation in the Appalachian region to the west (Scotford, 1951; Thomas, 1952; Hopson, 1964). Schwab (1971) depicts the depositional environment of the shale-siltstone turbidite facies of the Harpers Formation in the Blue Ridge of Central Virginia as a deep-water marine basin marginal to the continent.

During the Early Cambrian marine transgression, erosion of the exposed surface of the Paleozoic North American continent supplied weathered and oxidized materials to this offshore marine basin (Edwards, 1986) where they were deposited as a tongue of marine redbeds (Ziegler and McKerrow, 1975). These strata are now represented by the purple, green, and tan phyllites and associated quartzites and sandy beds of the Ijamsville Formation. In the more westerly Piedmont occurrences of the Ijamsville, closer to the presumed Early Paleozoic shoreline, sandy layers are more prevalent and the quartzite beds are thicker and more numerous. Eastward across the western Piedmont, the Ijamsville Formation thins, loses its distinctive coloration, and becomes indistinguishable from the underlying Urbana and overlying Marburg. This may indicate the fingering-out of the Ijamsville redbed facies into the marine basin.

The Ijamsville overlies the Urbana Formation in the Sugarloaf Anticlinorium in southeastern Frederick County. It was correlated with the upper part of the Harpers Formation and the overlying Antietam Formation of the Appalachian region by Edwards (1986). Farther west, in the Harpers Formation on Catoctin and South Mountains, the Ijamsville lithology has not been recognized.

The Marburg Formation is a marine shale-siltstone sequence very similar in lithology to the Urbana Formation, which suggests a similar depositional environment in an offshore marine basin. Of all the phyllite units that make up the Gillis Group, a reasonable certainty of stratigraphic position exists only for the Marburg Formation. Edwards (1984) has proposed a Cambro-Ordovician age for the Marburg based on the lithologic similarity of some of its calcareous members to the Frederick Formation to the west in Frederick County, and to the Conestoga Limestone in the Piedmont of Pennsylvania. The Frederick bears a Late Cambrian fauna (Jonas and Stose, 1936; Stose and Stose, 1946; Rasetti, 1959; 1961; Reinhardt, 1974). The Conestoga has been assigned an age range from Middle(?) Cambrian to Early Ordovician(?) based on tentative identification of fossils found near York and from the eastern Chester Valley near Norristown (Stose and Jonas, 1939; Stose and Stose, 1944; Gohn, 1978). These thin limestones in the Marburg, the best developed of which is the Silver Run Limestone Member in the New Windsor (Fisher, 1978) and Union Bridge Quadrangles (Edwards, 1986), may represent tongues of the western shelf carbonates that extended eastward into the marine basin. Fisher (1978) also considered the Silver Run Limestone to be of Cambrian(?) to possibly Early Ordovician age.

In the New Windsor Quadrangle, which adjoins this quadrangle on the south, Fisher (1978) mapped the lithology that here has been called Marburg as part of his Ijamsville Formation, which he considered to be also of Cambrian(?) age, based on chemical and lithologic similarities to the Lower to Middle Cambrian Harpers, Antietam, and Araby Formations. The Ijamsville was also equated with the Wissahickon Formation of the Eastern Piedmont (Fisher, 1978; Fisher and others, 1979).

Therefore, the Gillis Group in the Littlestown Quadrangle includes units that range in age from Early Cambrian through Early Ordovician.

The structure of the phyllitic terrane consists of two westward-thrust anticlines, the Blacks Corner Anticline and the Dug Hill Anticline. These structures, the pervasive east-dipping foliation, and the metamorphism to greenschist grade, are the result of the Ordovician Taconic deformation. Near-vertical slip-cleavage in the southeastern part of the quadrangle may be due to the late Paleozoic Allegheian deformation.

The Blacks Corner Anticline consists only of its southeastern limb. The oldest rocks exposed are the Araby and Ijamsville Formations which have been thrust over Cambro-Ordovician limestones of the York-Hanover Valley in Pennsylvania. The Marburg Formation, youngest unit on the southeast flank of the Blacks Corner Anticline, has been overridden by rocks of the Dug Hill Anticline along the Deep Run Fault. In the Manchester Quadrangle to the east, conglomeratic quartzites of the Urbana Formation are exposed in the core of the Dug Hill anticline.

Superimposed on the Paleozoic bedrock formations in the western part of the quadrangle are rift basins of Late Triassic age: the Gettysburg and Tyrone Basins. These constitute a terrane of unmetamorphosed sedimentary rocks which lie unconformably on the phyllites and which dip to the west and northwest at angles ranging up to approximately 30 degrees. Both the Paleozoic metamorphic rocks and the Triassic sedimentary rocks have been cut and displaced by younger, post-depositional normal faults and were later intruded by near-vertical diabase dikes of Jurassic age.

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EXPLANATION

QUATERNARY

Qal — **ALLUVIUM** — Gray-brown to light-brown, poorly sorted, coarse to fine sand, silt, and clay with sporadic lenses of subrounded quartz cobble gravel. In places includes chips and cobbles of local bedrock. May range up to as much as 15 feet in thickness, but in areas underlain by Triassic bedrock alluvium is usually no more than 3 to 10 feet thick. In smaller tributary streams, alluvium has not been shown, but is present as a thin veneer overlying channeled bedrock.

Qt — **TERRACE GRAVEL** — Reddish-orange to light brown sandy clay with sub-rounded cobbles of quartz and local bedrock. Commonly occurs as a thin veneer, less than 10 feet thick, capping low hills, spurs, and terrace remnants adjacent to present flood plains of larger streams. Best preserved in areas underlain by Triassic bedrock.

unconformity

JURASSIC

Jd — **DIABASE** — Dark greenish-gray to black, dense, fine-grained, intrusive basalt with ophitic (diabasic) texture. Occurs in steeply dipping to vertical dikes which range between 1 and 10 feet in thickness. Weathers to orange-red clayey soil with rounded residual boulders.

intrusive igneous contact

TRIASSIC

NEWARK GROUP

Trnc Trn — **NEW OXFORD FORMATION** — Maroon to dark reddish-brown, argillaceous to silty sandstone and micaceous siltstone with subordinate interbedded silty shale and mudstone. Some reddish-gray to gray arkosic sandstone also occurs. Cross-bedding is present in some layers. Bedding in sandstones and siltstones ranges up to 1 feet in thickness and may be cut by as many as three sets of joints. Shales and mudstones are broken by closely spaced fractures that obscure bedding. Formation is best exposed in bluffs along Big Pipe Creek and in channels of minor streams. Maximum thickness of unit was determined by Stose and Stose (1946) to be about 4,500 feet in Frederick County southeast of Creagerstown, but in this quadrangle the top of the formation is not present and the section has been repeated by numerous normal faults.

Trnc — Poorly bedded, massive, grayish-white to reddish-gray conglomerate with minor amounts of interbedded reddish-brown shale and siltstone. Generally occurs at the base of the New Oxford Formation and lies unconformably upon the pre-Triassic rocks, but conglomerate layers may also occur within the lower part of the New Oxford up to 100 feet above the base. Clasts are predominantly round to subround cobbles and pebbles of vein quartz and quartzite with maximum dimension up to 8 inches embedded in a clayey, micaceous sand matrix. The conglomerate generally is loose and friable but locally has been cemented by silica. Hematite staining and cementation occur sporadically. Thickness averages 25 feet, but may be as much as approximately 100 feet in places.

unconformity

GILLIS GROUP

mfq mf mfl — **MARBURG FORMATION** — Silvery gray-tan, pale olive-tan, and waxy, pale bluish-green quartz-chlorite-muscovite phyllite with abundant thin, silty beds or laminae and thin zones of pale reddish-purple phyllite. Weathers to gray-tan chips. Locally contains limonite pseudomorphs after pyrite in cubic crystals up to 1/2 inch in size. Includes thin to thick and massive beds of quartzite and also contains a few thin zones of poorly exposed, dark gray, calcareous muscovite phyllite with thin interbeds of bluish-gray schistose limestone. Thickness not known; top of formation is not present. Unit is very similar in appearance to much of the Urbana Formation, and is distinguished primarily by the presence of the dark calcareous phyllite and thin limestone layers.

mfq — Lenses of light-gray to tan, medium-grained, thin- to medium-bedded, phyllitic quartzite and subordinate brown to black or dark greenish-gray, medium-grained, thick-bedded quartzite. Phyllitic quartzite is composed of round grains of quartz in a very fine-grained matrix of sericite and quartz. Thick-bedded quartzite is composed of round quartz grains tightly bound by fine-grained quartz and quartz cement. Thickness of individual lenses ranges up to 10 feet.

mfl — Medium to dark bluish-gray to black, thin-bedded limestone interbedded with thin layers of gray to dark gray muscovite phyllite. Contains many calcite-filled fractures and joints. Occurs as lenses or layers up to 15 feet in thickness.

EARLY CAMBRIAN TO EARLY ORDOVICIAN

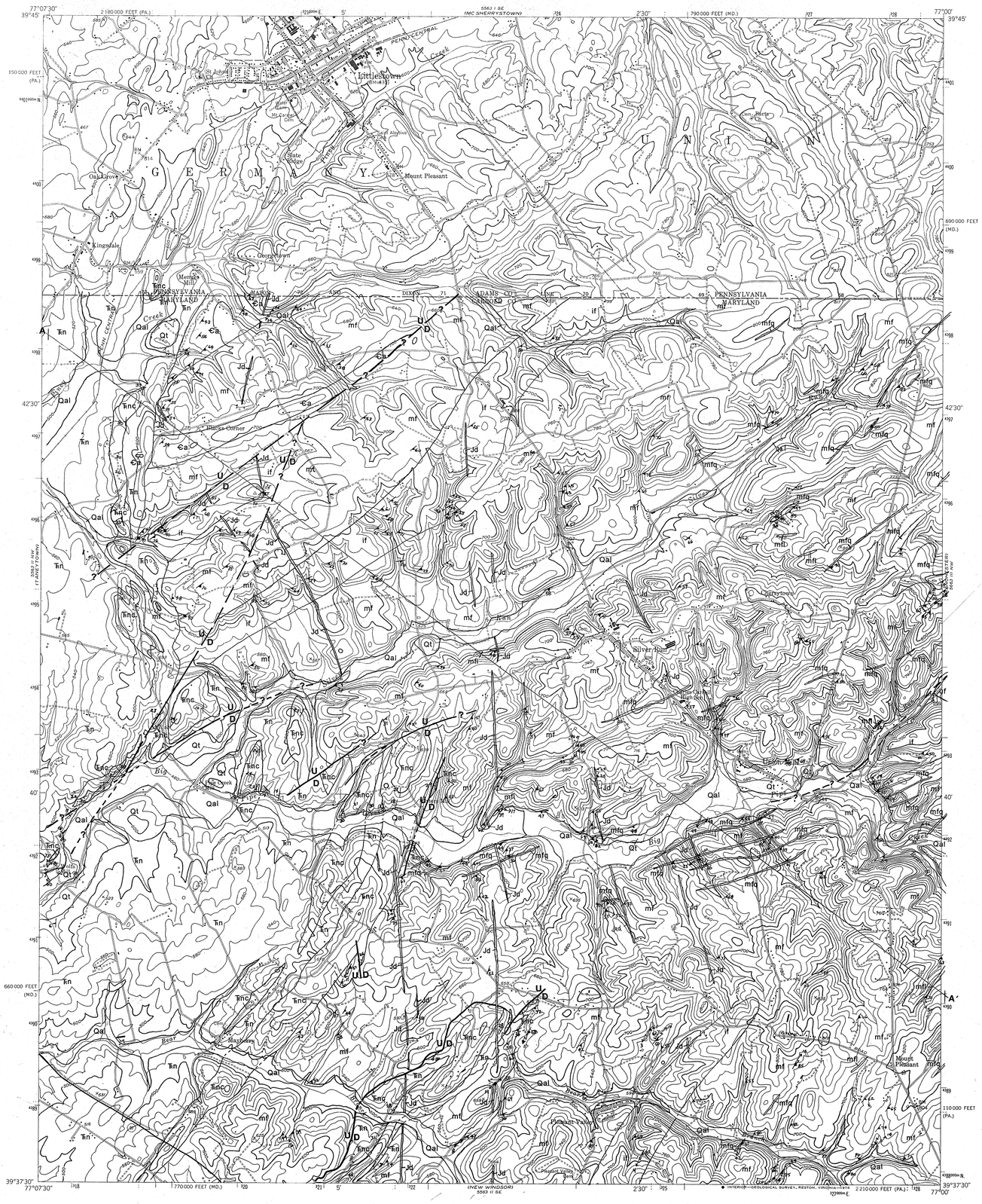
Ca — **ARABY FORMATION** — Gray to tan phyllitic siltstone and dark gray silty shale or phyllite with thin zones of dark gray to black, fine- to medium-grained quartzite or sandy phyllite. Includes some dark reddish-gray phyllite. Thickness unknown. Eastward across the quadrangle, the Araby Formation becomes thinner and more phyllitic until it can no longer be mapped separately from the Ijamsville Formation.

if — **IJAMSVILLE FORMATION** — Lustrous to dull, purple to reddish-gray hematitic muscovite phyllite interlayered with lesser amounts of tan to green chlorite-muscovite phyllite. Includes sporadic thin layers and lenses of gray, tan, and brown quartzite. Thickness unknown.

uf — **URBANA FORMATION** — Dark gray-tan to gray-green chlorite-muscovite phyllite with thin interbeds of tan silty phyllite and some thin zones of pale purple phyllite. Weathers tan to pale orange-tan. Thin layers of quartzite occur throughout the unit. Locally contains numerous limonite pseudomorphs after pyrite in cubic crystals up to 1/2 inch in size. Thickness of unit unknown. Closely resembles the Marburg Formation but contains more quartzite layers, some of which are conglomeratic, and generally is more resistant to weathering. Best distinguished from the Marburg when the two units are separated by the purplish-red phyllite of the Ijamsville Formation. Occurs in the Littlestown Quadrangle only in a small area along the eastern margin, where it extends in from the adjoining Manchester Quadrangle.

SYMBOLS

- Geologic contact — generally inferred or approximate
- Strike and dip of bedding
- Strike and dip of foliation
- Strike and dip of crenulation cleavage or slip cleavage
- Strike and dip of joints
- Plunge of minor fold axes: Dextral rotation
- Sinistral rotation
- Horizontal fold axes
- Overthrust fault teeth on upper plate
- Normal fault — **U** - upthrown side; **D** - downthrown side



Base map from U.S. Geological Survey
7½-Minute Series (Topographic)
Littlestown Quadrangle, 1953 (photorevised 1971),

Field mapping:
Triassic rocks - Glaser, 1976
Crystalline rocks - Edwards, 1983-1990
With additional data from field notes of W.P. Crowley

UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000
1 MILE
1 KILOMETRE
CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

QUADRANGLE LOCATION

Copies of this map available from
Maryland Geological Survey
2300 St. Paul Street
Baltimore, MD 21218-5210

GEOLOGIC CROSS SECTION

Horizontal scale same as map scale; no vertical exaggeration.
Dashes represent trace of main foliation
Alluvial deposits not shown