Geology of Lynchburg - Otter River Area, Virginia

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EXPLANATION

STRATIGRAPHY

(within formations no time sequence implied by position of map unit)

Jurassic diabasic dike

Jd — Fine grained diabasic gabbro

Pegmatite, Ordovician ?

p — Pegmatite: quartz ± albite ± K-feldspar ± muscovite ± biotite

Evington Group, Cambrian (?)

ϵe — Mica schist-phyllite: locally graphitic, bedding-parallel sandy laminations common; quartz + muscovite ± albite ± chlorite ± biotite ± garnet ± graphite

ϵeq — Quartz arenite: thick to massive bedded; quartz (75-95%) + plagioclase + biotite + muscovite ± magnetite ± titanite

Catoctin Formation, Late Precambrian or Cambrian

$p\epsilon-\epsilon c$ — Catoctin greenstone-greenschist : massive to bedded; albite+ chlorite + actinolite + epidote+ opaque ± quartz ± titanite ± biotite; albite phenocrysts common, locally with amphibole / pyroxene phenocrysts; mostly lavas, some pyroclastics (laminated with 3-5% biotite) in the Altavista dome area

$p\epsilon-\epsilon cs$ — Catoctin fine grained meta sandstone - mica schist: occurs as greenish to gray, thin bedded intercalations in the greenstones; quartz + plagioclase + muscovite + biotite + opaque ± chlorite ± garnet ± apatite ± graphite

Lynchburg Group, Late Precambrian

$p\epsilon l_3$ — Lynchburg III: fine grained meta-arenite and mica schist; thin to medium bedded, graded bedding and bedding-parallel laminations are common; commonly comprises the middle to upper part of upward-fining sequences; quartz + plagioclase + muscovite + biotite + opaque ± K-feldspar ± garnet ± epidote ± titanite ± apatite

$p\epsilon l_{3\,s}$ — Lynchburg III: coarse-grained to gravel-bearing feldspathic meta-arenite; thin to thick bedded, some beds are graded; commonly comprises the lower parts of upward- fining sequences; similar in composition to $p\epsilon l_3$ but more feldspathic; gravel fraction is mainly quartz and plagioclase, some perthite and granitic rock fragments also occur

$p\epsilon l_2$ — Lynchburg II: graphitic schist and meta-arenite; mostly thin to medium bedded, locally thick bedded to massive; bedding-parallel laminations and graded bedding are common; arenites are mostly fine-grained and locally medium-coarse grained in the lower part of a bed / sequence; quartz + plagioclase + muscovite + biotite + graphite ± garnet ± epidote ± magnetite ± titanite ± apatite ± calcite ± K-feldspar

$p\epsilon l_{2\,s}$ — Lynchburg II: coarse grained to gravel-bearing meta-feldspathic arenite; light gray to gray, thick bedded to massive; mostly are lens- shaped and occur as basal parts of upward-fining sequences / beds; graded bedding and scoured basal contacts are common; quartz + plagioclase + biotite + muscovite ± graphite ± garnet ± epidote ± magnetite ± titanite ± apatite ± K-feldspar; graphite if present occurs as small graphitic schist chips

$p\epsilon l_1$ — Lynchburg I: meta-arkose; light gray to gray, mostly medium to coarse grained, with minor muddy to gravel-bearing sandstone end members; commonly thick bedded to massive, moderately sorted to well sorted; graded bedding and bedding-parallel laminations are quite common, locally cross bedded; quartz + plagioclase + biotite ± muscovite ± epidote ± garnet ± magnetite ± titanite ± apatite ± K-feldspar; a few layers of volcanic-epiclastic (mafic and felsic) rocks also occur

$p\epsilon l_{1\,c}$ — Lynchburg I: metaconglomeratic arkose and metaconglomerate; thick bedded to massive, normal graded bedding is common, locally with reversed grading; some grade laterally and upwards into Lynchbyrg I meta-arkose; gravel-pebble sized clasts (15-35%) are made up of quartz, perthite, plagioclase and locally felsite; the matrix has quartz + plagioclase + perthite + biotite ± muscovite ± epidote ± garnet ± magnetite ± titanite ± apatite ± K-feldspar;

Moneta Formation, Late Precambrian

$p\epsilon_{mf}$ — Moneta felsite (meta- volcanic to subvolcanic rocks): fine to very fine grained, massive to layered, relict phenocrysts of quartz, plagioclase and K-feldspar are present; quartz + plagioclase + K-feldspar + biotite ± muscovite ± garnet ± magnetite ± apatite ± perthite ± fluorite; some (subvolcanic) bodies show clearly intrusive contacts , whereas others (volcanic) are interlayered with volcaniclastic - epiclastic rocks

$p\epsilon_{mm}$ — Moneta mafic meta- volcanic to subvolcanic rocks (amphibolites): dark gray to dark brown, fine to medium grained, layered to massive, some show clearly intrusive contacts with Moneta felsites, others are laminated and interlayered with, or grade into, Moneta volcaniclastics; hornblende + plagioclase + magnetite + titanite ± quartz ± biotite; m: observed mafics; m-u: observed mafic to ultramafics

$p\epsilon_{ms}$ — Moneta meta-arkosic sandtones: with minor (≤ 30%) interbedded metavolcanics and minor thin-bedded biotite schist; the meta-arkosic sandstone is light gray, thin to thick bedded, fine to coarse grained, locally gravel-bearing, bedding-parallel laminations are common; quartz + plagioclase + perthite + biotite ± garnet ± epidote ± titanite ± hornblende ± magnetite ± apatite

$p\epsilon_{mvs}$ — Moneta volcanic, volcanic -epiclastic and epiclastic rocks: felsic and mafic metavolcanics ($p\epsilon_{mf}$ and $p\epsilon_{mm}$) to meta-volcaniclastic rocks interbedded with nearly equal amounts of meta-arkosic sandstone ($p\epsilon_{ms}$) to conglomerate ($p\epsilon_{mc}$); both mafic and felsic volcaniclastic rocks exist, differ from their volcanic equivalents only in being well layered / laminated and contain more quartz and micas

$p\epsilon_{mv}$ — Moneta volcanics: thin bedded mafic and felsic metavolcanics-subvolcanics ($p\epsilon_{mf}$ and $p\epsilon_{mm}$) alternating, with ≤ 30% of meta-arkosic sandstones ($p\epsilon_{ms}$)

$p\epsilon_{mc}$ — Moneta conglomerates: light gray, thick bedded to massive, poorly sorted; clasts of pebble to boulder size are made of quartz, feldspars and basement augen gneiss; the coarse sand to mud matrix is arkosic in composition

$p\epsilon_{mgr}$ — Moneta granite in the basement: massive, fine-medium grained, show clearly intrusive contacts with basement gneiss; quartz + plagioclase + k-feldspar + perthite + biotite ± muscovite ± magnetite ± apatite

Grenville Basement, Precambrian

$p\epsilon_g$ — Grenvillian gneiss: light gray to light brown, medium to coarse grained, massive, predominentally biotite augen gneiss with quartz + plagioclase + perthite + biotite + epidote + titanite ± garnet ± magnetite; also in the basement are minor amounts (≤ 5%) of quartz-biotite amphibolite schist, calcite-biotite schist, epidote-biotite schist and metagranite.

$p\epsilon_{m-u}$ — Precambrian meta- mafic to ultramafic rocks: greenish to brown, massive or schistose, fine to medium grained, locally coarse grained, the mafics are mostly amphibolite, relict gabbroic texture common, with hornblende + plagioclase + opaque ± epidote ± titanite; the ultramafics are either schist with serpentine + talc + chlorite + actinolite + opaque ± plagioclase, or hornblendite with >85% of hornblende plus minor plagioclase and opaque; most of the ultramafics grade into mafic rocks on an outcrop scale or regionally along strike. m: observed mafic; u: observed ultramafic; m-u: observed mafic and ultramafic.

STRUCTURE

67 — S_0, strike and dip of compositional layering (shown only where *not* parallel S_1)

64 — S_1, strike and dip of schistosity, inclined, vertical (same as S_0 unless S_0 is given)

46 — S_2, strike and dip of crenulation cleavage or crenulation micro-fold axial plane

23 — S_1 / S_2, trend and plunge of crenulation micro-fold axis or intersection lineation

45 — Mineral lineation, trend and plunge

F1 — F_1, trend and plunge of meso- to macroscopic folds

F2 — F_2, trend and plunge of meso- to macroscopic folds

F3 — F_3, trend and plunge of macroscopic folds

macroscopic faults; macroscopic faults with shear sense observed

mylonite zone

63 — Geologic contacts; defined where structure measurments are given, approximate for the other parts.**

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1. Because the massive nature of the pegmatite, only a few structure measurements were obtained. The extensions of the pegmatite bodies are based on actual outcrop patterns as well as topography (they form elongated hills).

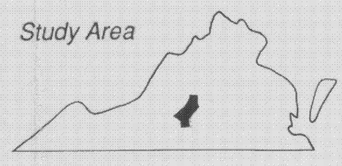
2. Open-ended rock units within the map area are those that are thinner (usually less than 50 meters) and whose extension could not be projected accurately based on current data. These units include Moneta granite in the basement, some of the volcanics and conglomerates in the Moneta Formation, and several post Grenville mafic-ultramafic bodies in the Lynchburg group. On the other hand, the thicker units are believed to have a relatively constant extension, and thus are connected even if the the outcrop found may be as far as 2 or 3 miles apart along strike.

3. Because Moneta felsites in the basement are clearly intrusive, they are labled as $p\epsilon_{mgr}$ rather than $p\epsilon_{mf}$ which contains both intrusive (subvolcanic) and extrusive (lava and pyroclastic).

4. More rock units are recognized where detailed mapping was done, whereas more heterogeneous units are labled in between. A typical example is the Moneta formarion. Many rock units such as $p\epsilon_{mf}$, $p\epsilon_{mm}$, $p\epsilon_{ms}$ and $p\epsilon_{mc}$ are mapped where detailed work is done, while a more common symble $p\epsilon_{mvs}$ which include all of the above units, is used in between areas.

5. Lithologic and thickness variations along strike are called to the reader's attention. Both the Moneta and the Lynchburg are thicker in the Otter River area than those of in the Lynchburg area. There are more sedimentary components in the Moneta Formation of the Otter River area than in the Lynchburg area. Because of the lower metamorphic grade, primary sedimentary structures are better preserved in the Lynchburg area than in the Otter River area; whereas significant amounts of pegmatite only occur in the Otter River - Altavista area.

6. Similar lithological and thickness variations are also observed perpendicular to strike. The Lynchburg Group is much thinner in the Altavista Dome area than in the Lynchburg - Otter River area. The Lynchburg rocks in the Altavista Dome contain only a few post-Grenville mafic-ultramafic bodies; while those in the Otter River - Lynchburg area have large amount of post-Grenville mafic-ultramafic bodies.



Quadrangle locations