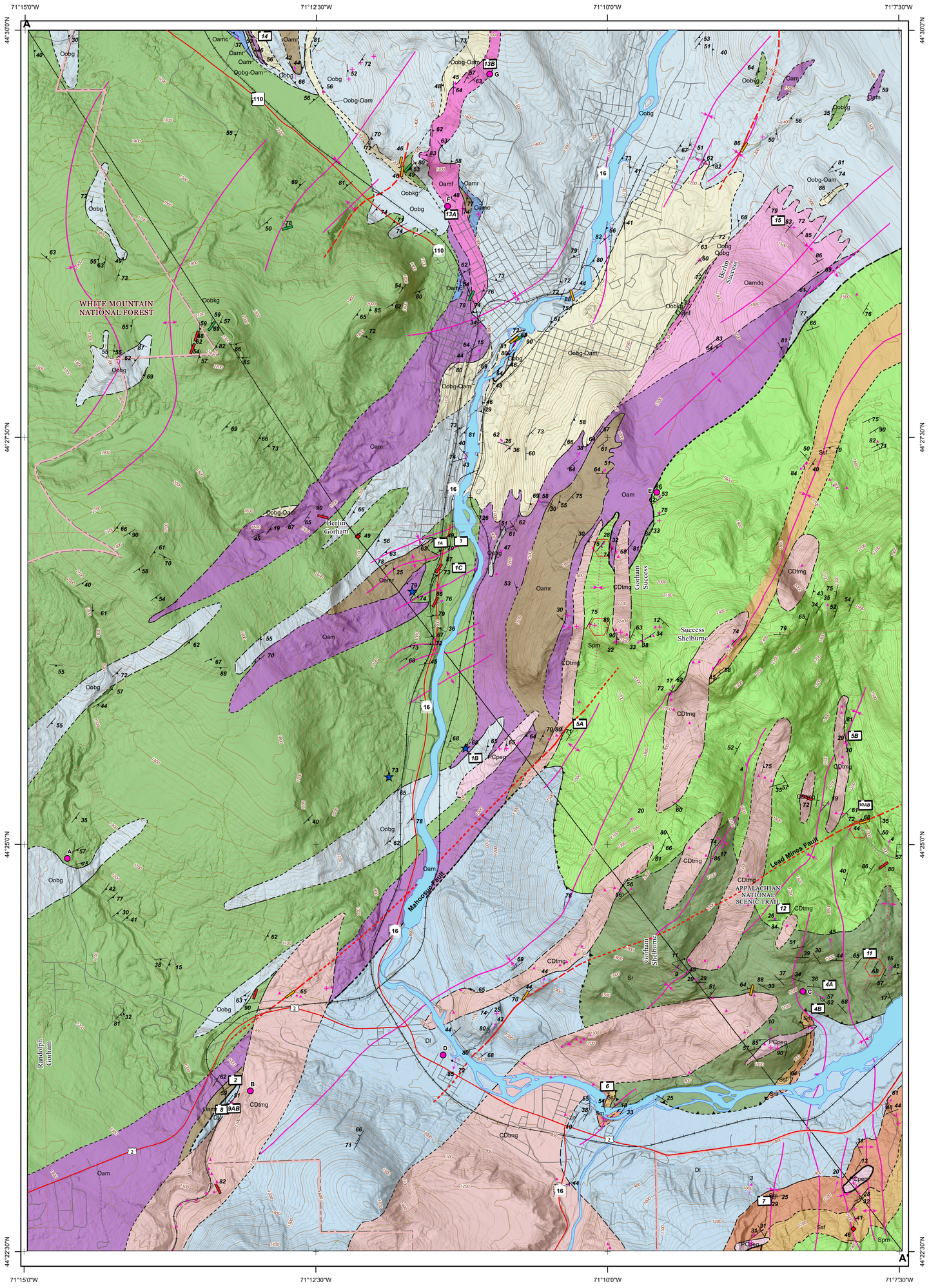
Bedrock Geologic Map of the Berlin 7.5' Quadrangle, New Hampshire, 2021



Scale 1:24,000

0 0.25 0.5 1 Kilometers

0 1,000 2,000 4,000 Feet

0 0.25 0.5 1 Miles

UTM GRID AND 2014 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

Topographic basemap from the USGS 1998 North Grantham 7.5' quadrangle
Data in Coordinate System North American Datum 1983 New Hampshire State Plane Feet, Projection in UTM Zone 19N. Contour Interval 40 ft

Hillshade produced from high resolution (1 meter) LiDAR data

DESCRIPTION OF MAP UNITS

PCpeg — Permian to Carboniferous Pegmatite. Coarse-grained whitish pegmatite with crystals up to 10 cm in dimension. Mineralogy: ksp, qz, plag, musc, +/- bio, +/- tour, +/- gar.

CDtmg — Carboniferous-Devonian Two Mica Granite. Medium-grained whitish granite with distinct flecks of black biotite and clear muscovite and common pegmatite associated with it. Mineralogy: ksp, qz, plag, musc, bio.

Dl — Littleton Formation. Well bedded and foliated dark gray coarse schists and light gray fine quartzites of varying thicknesses, with rare garnet coticule, graded bedding, and coarse muscovite pseudomorphing andalusite and sillimanite. Mineralogy: schist: musc, bio, qz, sill, plag, gar; quartzite: qz, plag, musc, bio.

Sm — Madrid Formation. Fine-grained granoblastic medium gray to purple, sometimes calc-silicate bearing granofels with interlayered darker, more bio-rich granofels, both generally lacking a strong foliation. Mineralogy: qz, plag, bio, +/- actin, +/- gar.

Ssf — Smalls Falls Formation. Well foliated, interbedded schists and less common quartzites, both weathering to a deep rusty red-brown. Graded bedding is not seen and layering thickness is generally on the cm-scale. Mineralogy: musc, bio, qz, sill, plag, pyrr (pyrrhotite).

Spm — Perry Mountain Formation. Light gray quartzites with interbedded less abundant dark gray schists. Bedding thickness is variable from cm-scale to 10-20 cm. Graded bedding is present, rare garnet coticule, and common coarse muscovite pseudomorphing andalusite and sillimanite. Mineralogy: quartzite: qz, plag, musc, bio; schist: musc, bio, qz, sill, plag, gar.

Sr — Rangeley Formation. Slightly rusty red-brown weathering, well foliated, interbedded, dark gray schists and light gray quartzites. Oval, calc-silicate granofels pods, 10-30 cm in length are infrequently seen. Layering ranges from cm-scale to 10-20 cm wide beds. Some graded bedding is seen. Mineralogy: schist: musc, bio, qz, sill, plag, gar; quartzite: qz, plag, musc, bio; calc-silicate pods: qz, plag, bio, gross, diop.

Oobg — Oliverian Biotite Monzogranite. Fine to medium-grained gray granite gneiss, commonly with a foliation. Mineralogy: qz, plag, ksp, bio

Oobg-Oam — Oliverian Biotite Monzogranite with xenoliths of Oam Ammonoosuc Volcanics ranging in size from a few cm to up to 10 m in length. Mineralogy: Oobg: qz, plag, ksp, bio; Oam: hbl, plag, qz, bio.

Oobkg — Oliverian Biotite K-Feldspar Monzogranite. Medium to coarse-grained pink granite gneiss, commonly with a strong foliation. Mineralogy: ksp, plag, qz, bio, musc.

Oamr — Ammonoosuc Volcanics Rusty Granofels. Rusty brown weathering , fine-grained, massive granofels that has a weak foliation and some horizons of more foliated rusty gneiss. Mineralogy: plag, qz, sulfides, bio, +/- hbl.

Oam — Ammonoosuc Volcanics. Dark green to black medium to coarse-grained amphibolite and minor biotite schist both with strong foliation. Mineralogy: hbl, plag, qz, bio.

Oamc — Ammonoosuc Volcanics Conglomerate facies. Dark green to black medium to coarse-grained amphibolite and minor biotite schist both with strong foliation with rounded, elongated clasts of felsic material. Mineralogy: matrix: hbl, plag, qz, bio; clasts: plag, qz, bio, +/- hbl

Oamdq — Ammonoosuc Volcanics dark quartzite-granofels facies. Dark gray, granular, bedded quartzite or granofels with abundant magnetite, and amphibole. Mineralogy: bio, hbl, mag, plag, qz.

Oamf — Ammonoosuc Volcanics felsic meta-tuff facies. Light gray to white, fine-grained massive metavolcanic with subordinate micaceous quartzite and rusty gneiss. Mineralogy: meta-tuff: plag, qz, bio; quartzite: qz, musc, plag.

EXPLANATION OF MAP SYMBOLS

- Geochronology sample site keyed to Table 1 below and described in companion report
- Photo locality, keyed to map locality and described in companion report
- Mafic dike outcrop location
- Pegmatite outcrop
- Two mica granite outcrop
- Mylonite. Region of mylonitic fabrics, mostly S-C foliations and sigma porphyroclasts. Most show reverse slip kinematics
- Mafic dike strike and dip. 10cm to 2 m wide mafic, basalt/diabase dikes of Jurassic (?) age
- Felsic dike strike and dip. 10cm to 2 m wide felsic, rhyolite/andesite dikes of Jurassic (?) age
- Strike and dip of silicified zone vein. Massive white quartz deposit with parallel quartz veins, some with Pb, Zn, Ag mineralization
- Region where bedding, So, is not parallel to foliation, S1, in an F1 hinge region
- Strike and dip of inclined bedding with topping direction unknown, nearly always parallel to early foliation
- Strike and dip of inclined upright bedding, nearly always parallel to early foliation
- Strike and dip of inclined inverted bedding, nearly always parallel to early foliation
- Strike and dip of inclined dome foliation. In mylonite this records the C fabric orientation

Folds

- D5 anticline axial trace
- D5 syncline axial trace
- D5 overturned anticline axial trace
- D2 nappe-stage anticline axial trace
- D2 nappe-stage syncline axial trace
- D5 fold trend and plunge

Contacts

- Inferred
- Approximate
- Accurate

Late normal fault defined by silicified zones

- Inferred
- Approximate
- Accurate

Mahoosuc Fault

- Inferred
- Approximate
- Accurate

Stevens Point thrust fault

- Inferred
- Approximate
- Accurate

Basemap features

- Lidar Contours (20-foot intervals)
- Stream

Roads and railroads

- 2 US Route
- 116 State Route
- Local Road
- Not Maintained
- Railroad

Interpretive Cross Section A - A' (No Vertical Exaggeration)

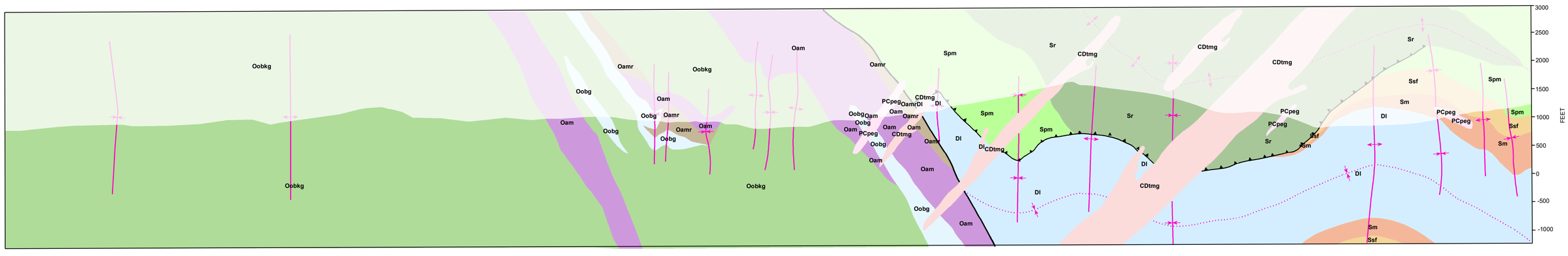


TABLE 1. SUMMARY OF SAMPLE LOCATIONS AND GEOCHRONOLOGY

	Sample number	Unit	Location Lat (°N)	Location Long (°W)	Age (Ma)†
	(Meta)Igneous rocks Crystallization Age				
B	CDtmg 214 BN	Muscovite-biotite granite	44.390471°	71.220044°	347 ± 3
A	Oobkg 273 BN	Oliverian bio-ksp granite gneiss	44.414676°	71.242397°	445 ± 3
F	Oamf 109 BN	Ammonoosuc Volcs. felsic metatuff	44.482612°	71.188656°	451 ± 2
	(Meta)Sedimentary rocks Maximum Depositional Age				
D	Dl 008 BN	Littleton Formation	44.394311°	71.188879°	444 ± 3
E	Spm 167 BN	Perry Mountain Formation	44.452693°	71.159655°	424 ± 5
C	Sr 105 BN	Rangeley Formation	44.399768°	71.133315°	420 ± 2
G	Oamq 155 BN	micaceous quartzite, Ammonoosuc Volcs.	44.496180°	71.185379°	460 ± 3

BRIEF BEDROCK GEOLOGIC HISTORY OF THE BERLIN 7.5' QUADRANGLE, NH

The bedrock geology of the Berlin, NH 7.5' quadrangle lies along the boundary between the Bronson Hill Belt and the Central Maine Belt. The geology consists of the Ordovician Oliverian Jefferson Batholith and Ammonoosuc Volcanics of the Bronson Hill Belt, the Silurian Rangeley, Perry Mountain, Smalls Falls Formations and Devonian Littleton Formation of the Central Maine Belt, and intrusions of Devonian-Carboniferous two mica granites. The Bronson Hill Belt units of the Ammonoosuc Volcanics (Oam, Oamr, Oamc, and Oamf) and Oliverian Jefferson Batholith (Oobg, Oobg_Oam, and Oobkg) were erupted and intruded in the Ordovician, circa 440-460 Ma, in a volcanic arc setting during the Taconic and Salinic Orogenies. A period of Silurian and Devonian marine sedimentation in the Central Maine Belt followed in an active tectonic setting, probably a forearc basin. Deposition occurred over and along the southeast flank of the Oliverian granites, and is recorded by the Rangeley, Perry Mountain, Smalls Falls, Madrid, and Littleton Formations. All of the above rocks in both the Bronson Hill and Central Maine Belts were subsequently deformed and metamorphosed. D1 pre-metamorphic faulting along the Mahoosuc fault juxtaposed the Bronson Hill and Central Maine Belts. D2 nappe-stage folding was followed by D3 faulting along the Stevens Point Thrust in the early Devonian Acadian orogeny. D4 doming of the Oliverian Dome and D5 folding of the units likely occurred in the Late Acadian or Neoacadian Orogeny, sometime before the end of the Devonian period. Intrusion of the Carboniferous-Devonian two mica granites and associated pegmatites crystallized around 350 Ma and were likely derived from partial melts of thickened Appalachian crust. D6 shearing and mylonitization of the Bronson Hill units may have occurred in the Carboniferous to Permian Alleghenian orogeny. Episodes of pegmatite intrusion likely continued from the Carboniferous into the Permian, though radiometric ages are few. D7 late brittle normal faults, as marked by mineralized silicified zones, likely developed during the early stages of rifting of Pangea in the Triassic. Lastly, late mafic and felsic dikes probably developed under tensile stresses in the Jurassic as rifting continued. For a more detailed description of the bedrock geology and geochronology, please see the accompanying companion report to this map.

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Companion documents can be found at https://www.des.nh.gov/land/geology

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