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Bedrock Geologic Map of the Jefferson, New Hampshire 7.5' Quadrangle, NH

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Jefferson Quadrangle, New Hampshire - Bedrock Geology

Bedrock mapping by:

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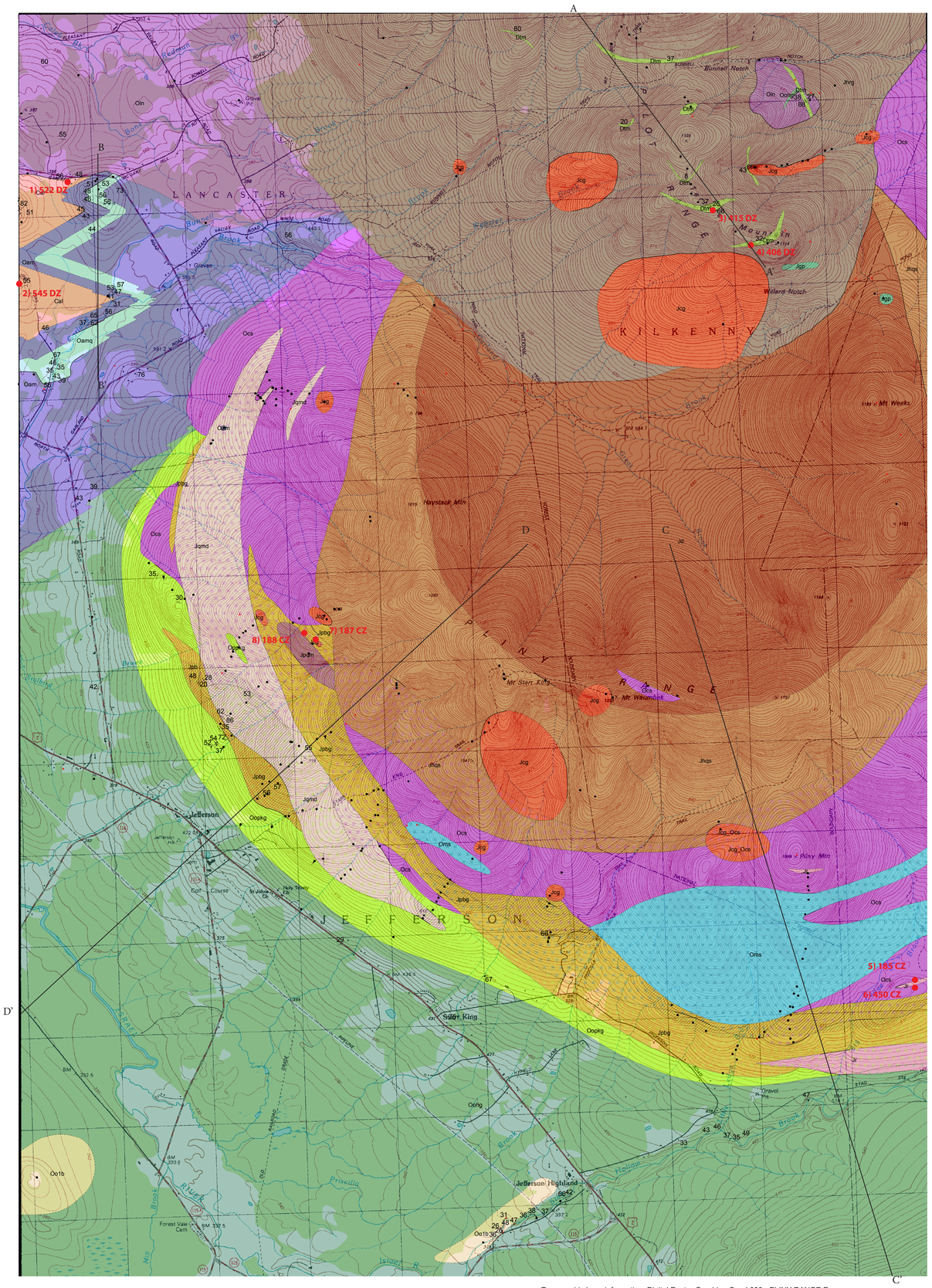


Topographic base information: Digital Raster Graphic - Quad 038 - PLINY RANGE E, NH, from Complex Systems Research Center, University of New Hampshire, 1998. Geospatial information: NH State Plane Coordinate System 1983 using North American Datum of 1983. Contour interval is 6 meters.

Scale 1:24,000

0 0.5 1 2 3 4 5 Miles

0 0.5 1 2 3 4 5 Kilometers

MN 17

N

BEDROCK GEOLOGIC HISTORY OF THE JEFFERSON QUADRANGLE

The Jefferson 7.5' minute quadrangle is located in Coos County, New Hampshire, and includes the towns of Jefferson and Lancaster. The bedrock geology of the quadrangle was last mapped at a scale of 1:62,500 by Chapman (1942) and Billings et al. (1979), and the contacts mapped then were used in the most recent state bedrock map (Lyons et al., 1997). The purpose of this project was to produce an updated, detailed bedrock map and cross sections at a scale of 1:24,000 to better define the history and patterns of the igneous and metasedimentary rocks in the region.

From oldest to youngest the new mapping has identified the following units: 1) Cambrian Albee Formation (new detrital zircon minimum ages of 522 ± 4 Ma and 545 ± 17 Ma); 2) Ordovician Ammonoosuc Volcanics; 3) a variety of foliated intrusive rocks of the Ordovician Oliverian Dome; 4) unfoliated Ordovician Lost Nation Pluton; 5) unfoliated Ordovician syenite (new zircon crystallization age of 450 ± 3 Ma); 6) Devonian roof pendants on Terrace Mountain that are possibly the Tarratine Formation of Western Maine (new detrital zircon minimum ages of 406 ± 11 Ma and 415 ± 17 Ma); and 7) Jurassic Pliny Complex stocks and cone sheets, from oldest to youngest, a) diorite; b) porphyritic quartz monzodiorite; c) hornblende quartz syenite; d) quartz monzodiorite; e) hastingite-riebeckite granite; f) granite porphyry; g) pink biotite granite (new zircon crystallization age of 188.3 ± 1.0 Ma); h) Jurassic Conway granite (new zircon crystallization age of 187.3 ± 1.1 Ma); and i) flow banded and spherulitic rhyolite (new zircon age of 184.9 ± 2.3 Ma).

Based on their age difference of at least 50 million years and stark contrast in deformation style we speculate that the Albee Formation and overlying Ammonoosuc are in unconformable contact along the Early Ordovician Penobscot unconformity. The Albee Formation is multiply deformed showing classic pin-striping and transposition while the Ammonoosuc Volcanics show primary features in the form of lapilli and interbedded mafic and felsic units and only a single phase of folding. This latter deformation defines a series of NE plunging, map-scale, reclined folds of Acadian or Taconian age. The diapiric doming of the Oliverian Jefferson Dome in the Neoacadian in turn deformed these fabrics. The Ordovician Lost Nation Pluton and syenite are metamorphosed but only weakly deformed.

The Jurassic Pliny Caldera Complex represents a series of near contemporaneous igneous stocks and cone sheets with three main phases of caldera development. The first is the intrusion of cone sheets of diorite, porphyritic quartz monzonite, and hornblende quartz syenite. These developed synchronously with, or slightly after, the deflection of Oliverian Dome foliations along a caldera-bounding fault. The second phase of caldera development is the intrusion of two more inward dipping cone sheets of commingled quartz monzodiorite and pink biotite granite. These sheets may have intruded somewhat passively as xenoliths of Ordovician gneisses and syenites within them were only slightly deflected. The last phase of caldera development is the intrusion of near circular stocks of hastingite-reibeckite granite and Conway Granite and ultimately the extrusion or shallow intrusions of the rhyolites.

We do not support the existence of the Ammonoosuc Fault in the Jefferson 7.5' minute quadrangle as proposed by Chapman (1942) and Billings et al. (1979). This is based on the new extensions of the Albee Formation across the proposed fault, the lack of any silicified zones or zones of crenulation in both the Ordovician and Jurassic rocks, and the existence of a chilled intrusive contact, without fault disruption, between the complex mafic intrusive rocks of the Lost Nation Pluton and older rocks.

Photo Gallery

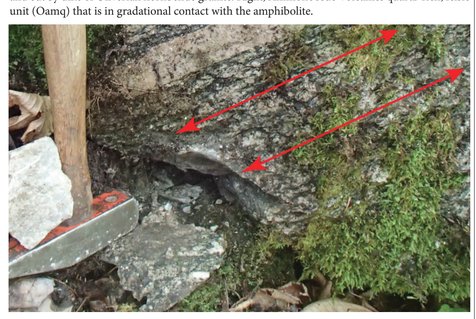
Albee Formation (Cal): Pin-striped, transposed, quartz-rich metasedimentary rock that is complexly folded and metamorphosed. Garland Brook.

Terrace Mountain Formation (Dtm): Left, roof pendants of Dtm composed of thinly laminated quartz-rich layers with some possible cross bedding. Right, Terrace Mountain Formation (Dtm) sandwiching a sill of hastingite-riebekite granite (Jhrg). Both images from Terrace Mountain.

Left, hastingite-riebekite granite (Jhrg) Terrace Mountain, field of view about 5 cm across. Right, Conway Granite (Jcg), boots for scale.

Left, Ammonoosuc Volcanics amphibolite (Oam) with possible lapilli fragments below sharpie and cut by dike of Oliverian hornbende granite. Right, Ammonoosuc Volcanics quartz-rich, felsic unit (Oamq) that is in gradational contact with the amphibolite.

Pink biotite granite (Jpbg) commingling with dark quartz monzodiorite (Jqmd), Starr King region.



Oliverian porphyritic k-spar gneiss (Oopkg) cut by a vein of pink bitite granite (Jpbg). Foliation indicated by red arrows.

Rhyolite (Jr) showing flow banding, near Pliny Mountain.

Left, hornblende quartz syenite (Jhqs). Right, diorite (Jd).

Coarse syenite (Ocs).

Lost Nation Pluton (Oln) cut by thin veins of possibly pink biotite granite (Jpbg).

EXPLANATION OF UNITS

EXTRUSIVE ROCKS

Jurassic

Jr, Jefferson Rhyolite. Very fine grained rock, generally orange to pink in color, with characteristic mm-scale flow banding and spherulitic texture. Often occurs in narrow 1 m wide dikes.

INTRUSIVE ROCKS

Jurassic

Jcg, Conway Granite. Coarse-grained pink granite. Mineralogy: ksp+plag+quartz+bio.

Jgp, Granite Porphyry. Fine grained dikes and irregular lenses of pink porphyry

Jhrg, Hastingsite-Riebeckite Granite. Medium grained with interlocking crystalline texture. Mineralogy: ksp, plag, qtz, bio

Jpbg, Pink Biotite Granite. Medium to fine grained pink granite. Mineralogy: ksp, plag, qtz, bio.

Jqmd, Quartz Monzodiorite. Medium to coarse grained dark gray monzodiorite. Mineralogy: plag, hbl, bio, mag, qtz.

Jhqs, Hornblende Quartz Syenite. Medium grained quartz syenite. Mineralogy: ksp, hbl, bio, qtz.

Jpqm, Porphyritic Quartz Monzonite. Medium grained pink to gray foliated monzonite with large pink phenocrysts. Mineralogy: plag, hbl, bio, mag.

Jd, Diorite. Medium dark gray diorite, Mineralogy: plag, hbl, bio, mag.

Ordovician

Oln, Lost Nation Pluton. Typically a greenish, coarse-grained meta-gabbro or meta-diorite, lacking a foliation. Chills against the Albee Formation.

Oms, Medium Syenite. Medium grained syenite with weak to no foliation. Mineralogy: ksp, plag, hbl.

Ocs, Coarse Syenite. Coarse grained syenite with large k-feldspar phenocrysts, exhibiting weak to no foliation. Mineralogy: ksp, plag, hbl.

STRATIFIED ROCKS

Devonian

Dtm, Terrace Mountain Formation. Gray to tan thinly interbedded cm-scale quartzite. Likely correlative to the Tarratine Formation Misery Quartzite Member.

Ordovician

Oopkg,K-feldspar rich orthogneiss. Hornblende gneiss with large pink k-feldspar phenocrysts, often exhibits strong foliation, Mineralogy: ksp, plag, qtz, hbl, mag.

Oohg, hornblende granite of the Oliverian Jefferson Dome. Coarse-grained white granite, often exhibits strong foliation and rarely porphyritic. Mineralogy: ksp, plag, hbl, variable bio.

Oo1b, biotite granite of the Oliverian Jefferson Dome. Medium-grained pink granite, often exhibits strong foliation, rarely porphyritic. Mineralogy: ksp, plag, qtz, bio.

Oam, Ammonoosuc Volcanics. Dark green to black, massive, foliated amphibolite composed of hbl+bio+plg+ qtz+sph. Some preserved lapilli textures

Oamq, Ammonoosuc Volcanics Quartzite Member. Light gray to white quartz-rich unit with rare schistose horizons

Cambrian

Cal, Albee Formation. Thin, cm-scale, pin-striped quartz-rich layered metasedimentary rock often transposed and multiply deformed and metamorphosed

EXPLANATION OF SYMBOLS

- Diabase dike
- Foliation
- Bedding
- Fold Hinge Line
- Float of >3m diameter angular blocks
- Outcrop
- Overturned anticline
- 3) 415 DZ Geochronology sample, age in Ma

EXPLANATION OF LINES

- Contact - accurate
- Contact - inferred
- Contact - approximate
- Shatter Zone - areas where abundant Ordovician and Silurian xenoliths are present within Jurassic cone sheets.
- Xenolith Zone - areas where abundant xenoliths of either Ocs, Oms, or Oliverian Jefferson Dome units (symbolized by unit color).

Geochronology

1) 522 DZ Detrital Zircon age Cal, Albee Formation, Tug Mountain. Mean age of eight youngest zircons 522 ± 4 Ma. Other peaks 530, 575, 610, 650, 950, 1400, 1650, and 2050 (Ma)

2) 545 DZ Detrital Zircon age Cal, Albee Formation, Tug Mountain. Mean age of eight youngest zircons 545 ± 17 Ma. Other peaks 5560, 630, 770, 950, 1200, 1500, 1700, 1850, and 2600 (Ma)

3) 415 DZ Detrital Zircon age Dtm, Terrace Mountain Formation, Terrace Mountain. Mean age of eight youngest zircons 415 ± 17 Ma. Other peaks 460, 630, 950, 1150, 1550, 1750, and 2600 (Ma)

4) 406 DZ Detrital Zircon age Dtm, Terrace Mountain Formation, Terrace Mountain. Mean age of eight youngest zircons 406 ± 11 Ma. Other peaks 415, 460, 650, 1050, 1500, and 1750 (Ma)

5) 185 CZ Crystallization Zircon age Jr, rhyolite, near Pliny Mountain, 184.9 ± 2.3 Ma

6) 450 CZ Crystallization Zircon age Ocs, coarse syenite, near Pliny Mountain, 450 ± 3 Ma

7) 187 CZ Crystallization Zircon age Jcg, Conway Granite, near Waumbek Mountain, 187.3 ± 1.1 Ma

8) 188 CZ Crystallization Zircon age Jpbg, pink biotite granite, near Waumbek Mountain, 188.3 ± 1.0 Ma

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INTERPRETIVE CROSS SECTIONS - NO VERTICAL EXAGGERATION