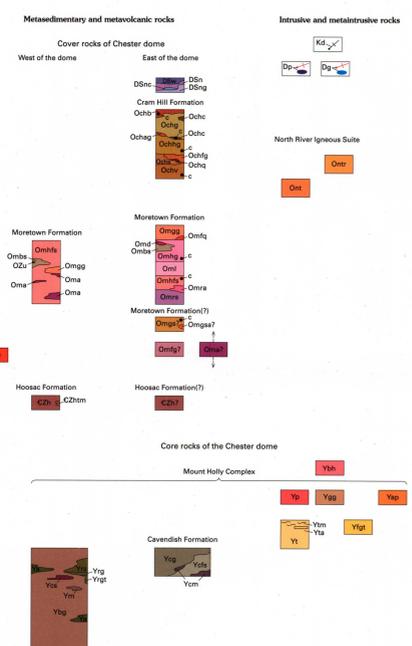


CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS
(Major minerals listed in order of increasing abundance)

- INTRUSIVE ROCKS OF COVER AND CORE OF CHESTER DOME**
 - Mafic dikes (Cretaceous)**—Nodded, blocky jointed, medium- to fine-grained calcic or diabasic dikes, shown by marked only; one in roadcut at Gassetts, one 0.8 km southeast of Peckville.
 - Pegmatite (Devonian)**—Massive, nonfoliated to foliated, muscovite-biotite pegmatite. May be shown by symbol only.
 - Granite (Devonian)**—Massive to weakly foliated muscovite-biotite-microcline-plagioclase-quartz granite to granodiorite dikes and sills that crosscut highly foliated country rocks. May be shown by symbol only.
- COVER SEQUENCE ROCKS OF THE CHESTER DOME**
 - Metasedimentary Rocks**
 - Waits River Formation (Lower Devonian and Silurian)**—Dark-gray to black, fine-grained, lustrous, carbonaceous schist, and dark-blue, gray to dark-purplish-brown weathering limestone, and quartz-rich, limy schist. Poorly exposed and distinguished from underlying Northfield Formation (D5a) by abundance of pinkish-weathering limestone and schist.
 - Northfield Formation (Lower Devonian and Silurian)**
 - Schist member**—Dark-gray to black, fine-grained, carbonaceous muscovite-biotite-plagioclase-quartz schist or phyllite marked by conspicuous small garnets 1 to 2 mm in diameter that form small bumps on foliation surfaces. Garnets commonly partially to completely replaced by white plagioclase or by chlorite.
 - Calc-silicate member**—Light gray-green to gray-weathering, medium-grained zoisite-magnetite-epidote-calcite-garnet schist. Locally occurs associated with D5w near base of unit.
 - Grit member**—Medium- to dark-gray to steel-gray-weathering biotite-plagioclase-quartz granodiorite, impure quartzite, and minor quartz pebble conglomerate. Occurs near base of unit. Interbedded with layers of schist or phyllite. Thickness variable from 0 to 10 m.
 - Cram Hill Formation (Ordovician)**—Dot and c indicates cotecite in all units.
 - Black quartz-phyllite and ironstone member**—Dark-gray to dull-black-weathering, very fine grained, siliceous phyllite and phyllitic metaconglomerate. Forms thin beds of splintery, highly fractured rock. Contains beds of pale-gray-green to steel-gray-weathering, siliceous, concretionary magnetite-plagioclase-quartz quartzite as much as 3 m in thickness and discontinuous beds of very rusty, impure magnetite quartzite and pebbly layers of cotecite 1 to 2 m thick.
 - Greenstone member**—Medium-green to gray-green, highly foliated hornblende-plagioclase-greenschist member marked by distinctive irregular clots, or isolated patches of more plagioclase-rich rock as much as 3 m in length as in a more uniform amphibolite matrix. Grades into zones of highly anastomosing greenschist; one prominent zone near base, recognized as Oshs, contains lens of half-gray to orange-gray-weathering dolomite, quartzite, and quartz. Unit interpreted as basaltic to andesitic tuff breccia and volcanoclastic rock.
 - Quartzite and cotecite member**—Discontinuous beds and zones of gray to light-gray-weathering quartzite, quartz-pebble conglomerate, and well-bedded, feldspathic granodiorite and cotecite. Thickness as much as 2 m, but commonly 0.5 to 1 m in thickness where interbedded in Oshs or Oshs at or near their mutual contact.
 - Hornblende-plagioclase-quartz granodiorite member**—Light gray-weathering, medium- to coarse-grained hornblende-biotite-hornblende-plagioclase-quartz granodiorite. Marked by abundant sprays of large hornblende schists as much as 5 cm in length. Interbedded with layers of biotite, amphibolite and hornblende-garnet amphibolite. Contains numerous inclusions of coarse-grained plagioclase in granodiorite distinguishes this unit from similar hornblende facies schist member (Oms) of Moretown Formation. Unit is combined and perhaps identical to Marlboro unit of Armstrong (1994) of Cram Hill Formation.
 - Feldspathic granodiorite member**—Medium- to dark-gray, well-bedded biotite-quartz-plagioclase granodiorite, biotite schist, and minor amphibolite and hornblende facies schist. Unit gradational with Oshs through interbedding.
 - Papery thin schist and phyllite member**—Pale-gray-brown to whitish-tan-weathering, fine-grained biotite-garnet-muscovite schist and carbonaceous phyllite. Contains beds rich in tiny 1- to 2-mm-diameter garnets that are similar to garnet-rich phyllites of the Northfield Formation (D5a). Grades laterally into a darker gray to slightly rusty-weathering siliceous phyllite as schist that contains discontinuous layers of steel-gray quartzite. Closely resembles phyllite and schist in the Whetstone Hill member of the Missisquoi Formation of Dill and others (1961). Locally contains a distinctive steel-gray to yellowish-weathering quartzite and quartz-pebble conglomerate as much as 2 m thick (D5w) that closely resembles conglomerate unit (D5w) in the upper part of the Cram Hill Formation. Unit is transitional downwards into Oshs.
 - Felsic and mafic volcanoclastic member**—Heterogeneous unit consisting of light-gray-weathering, well-layered, felsic biotite-hornblende-quartz plagioclase gneiss closely interlayered with darker gray-green hornblende-biotite-plagioclase amphibolite and hornblende-plagioclase granodiorite and gneiss. Proportion of felsic to mafic layers varies greatly and thickness of mafic layers, which are generally subordinate, ranges from one to several meters. Rusty-weathering biotite-muscovite-quartz schist, feldspathic granodiorite, and layers of cotecite present throughout indicate collection of volcanoclastic rocks and interbedded metasediment; for this reason, unit is interpreted as member of Cram Hill Formation. Contact relations with underlying units uncertain; may disconformably overlie both units of Moretown Formation and metaconglomerate (D5w) of North River Igneous Suite.
 - Moretown Formation (Ordovician)**
 - Garnet schist and granodiorite**—Light-gray to gray-green-weathering garnet-biotite-chlorite-muscovite-quartz schist and schistose biotite-garnet-plagioclase-quartz granodiorite. Contains thin layers of rusty-weathering, siliceous magnetite-plagioclase-quartz quartzite (Omg) near base.
 - Hornblende-plagioclase dioritic amphibolite**—Medium-grained, black and white-spotted, dioritic-appearing amphibolite consisting of substantial amount of hornblende and plagioclase. Has coarse grained diabasic texture resembling that of Moretown Formation. Probably either a dike or relict of intermediate volcanoclastic rock.
 - Hornblende granodiorite and schist**—Light-gray-green, lustrous chlorite-biotite-muscovite-quartz schist containing abundant layers of dark-gray garnet-hornblende-quartz granodiorite and quartzite. Granodiorite layers contain abundant facies of hornblende or layers of hornblende-plagioclase granodiorite 1 to 5 cm thick. Where hornblende facies and granodiorite layers predominate, unit grades into Omg.
- INTRUSIVE AND META-INTRUSIVE ROCKS**
 - North River Igneous Suite (Ordovician)**
 - Trondhjemite gneiss**—Principally light-gray to gray-green-weathering, lustrous chlorite-biotite-muscovite-quartz schist and light-gray-weathering, feldspathic granodiorite interbedded on a scale of 10 cm. Locally contains coarse-grained garnet schist and widespread thin beds as much as 10 cm thick of prismatic chlorite-muscovite-plagioclase-quartz schist and granodiorite identical to Oms. Beds of cotecite 1-2 cm thick identified by dot, leader and in one of highly foliated forms of Moretown Formation along western border of the map, 1 km north of Whitmore Brook, where unit contains small blocks of late (D5a) 10 cm to 1 m in size, although similar, need not be correlative.
 - Moretown Formation (Ordovician)**—Refers to units near base of cover sequence east of dome that may be broadly correlative with Oms and west of dome, west of dome, Oms? Oms? and Omg? are mapped as members of Rowe Schist in adjacent Saxtons River quadrangle (Ratliffe and Armstrong, in press).
 - Green schist and granodiorite**—Principally light-green to pale-green, lustrous chlorite-biotite-muscovite-quartz schist and light-gray-weathering, feldspathic granodiorite interbedded on a scale of 10 cm. Locally contains coarse-grained garnet schist and widespread thin beds as much as 10 cm thick of prismatic chlorite-muscovite-plagioclase-quartz schist and granodiorite identical to Oms. Beds of cotecite 1-2 cm thick identified by dot, leader and in one of highly foliated forms of Moretown Formation along western border of the map, 1 km north of Whitmore Brook, where unit contains small blocks of late (D5a) 10 cm to 1 m in size, although similar, need not be correlative.
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 - Mount Holly Complex (Middle Proterozoic)**
 - Feldspathic granodiorite**—Medium- to dark-gray muscovite-biotite-quartz-plagioclase granodiorite and schist, locally bedded on a scale of 2 to 4 cm or prismatic and marked by distinctive porphyroblasts of cross-foliated biotite.
 - Amphibolite**—Dark-green, highly foliated epidote-biotite-hornblende and hornblende-plagioclase amphibolite. Varies from highly foliated and podded with epidote to a more granular rock consisting of approximately 70 percent hornblende and 30 percent plagioclase. Unit is in fault contact with Middle Proterozoic rocks at its base and is bedded with and gradational upwards into Oms?
 - Hoesac Formation (Late Proterozoic and Cambrian)**—Light-gray to medium-dark, biotite-rich plagioclase-quartz granodiorite and gray, fine-grained, shaly biotite schist containing layers of hornblende amphibolite west of Chester dome. East of Chester dome, a very narrow belt of similar plagioclase-rich granodiorite and interbedded amphibolite occurs beneath Oms?, near contact with Bull Hill Gneiss (Yrs) and hornblende-quartz-plagioclase gneiss (Yrs). Base of unit is mylonitic and fault contact is down at last recognizable outcrop of porphyroblastic gneiss within mylonite. Excellent outcrop showing tectonic laminae in plagioclase-rich granodiorite from Yrs are exposed in bed of Williams River, 2 km south of quadrangle border on strike with projected contact between D5h and Yrs; these exposures suggest that at or part of the rocks mapped east of dome is Hoesac Formation? and along this fault may have been derived from Middle Proterozoic basement by mylonitization.
- CORE ROCKS OF THE CHESTER DOME**
 - Bull Hill Gneiss (Cardinal Brook Intrusive Suite) (Middle Proterozoic)**—Light-pinkish gray to gray, coarse-grained to medium-grained, mylonitic biotite-plagioclase-microcline augen gneiss, distinguished by distinctive, partially recrystallized augen of microcline set in a much finer grained biotite and epidote mylonitic matrix. Where less deformed, contains rectangular to oval relict phenocrysts of microcline that make up more than 50 percent of the rock. This coarse relict texture may be seen in exposures on west slopes of Broad Hill. Continuous with type area of Bull Hill Gneiss exposed 12 km south in Saxtons River quadrangle. Mylonitic augen gneiss is well exposed in outcrop just west of State Route 11 in Spryfield, near eastern margin of map, and along complex fault system on western limb of Chester dome. Narrow, 200-m-wide belt west of Gassetts is highly mylonitic and may be deformed pegmatite (Yp) or granite gneiss (Ygs) of Mount Holly Complex rather than Bull Hill Gneiss; correlation of this belt with that Bull Hill Gneiss is uncertain. Unit is intrusive into rocks of Mount Holly Complex over broad areas south of quadrangle, but here is confined to eastern and western margins of core of Chester dome.
 - Mount Holly Complex (Middle Proterozoic)**
 - Pegmatite**—Light-gray to pinkish-gray, well-foliated, highly deformed biotite-muscovite-microcline schist commonly altered to chlorite, epidote, albite, and sericite. Contains large plates of feldspar and local diopside crystals as long as 30 cm. Forms small 1- to 2-m-thick pods to masses as small as 1 m long. Most abundant in or near rusty-weathering schist and quartzite units (Yrs, Yrs, and Yrs) in Caledonide quadrangle on Hawks Mountain.
 - Aplite and aplitic gneiss**—Light-gray to white, highly foliated biotite aplite and aplitic gneiss. Forms pods and stringers in Bailey Mills Tonalite Gneiss and in Caledonide quadrangle on Hawks Mountain.
 - Granitic and migmatitic gneiss**—Light-gray to pinkish-tan-weathering, fine-grained, irregularly to well-foliated biotite-quartz-microcline-plagioclase gneiss. Commonly has distinct layers or augen of microcline and intergranular plagioclase as much as 2 cm in diameter. Unit resembles Yrs but contains abundant, thin (1-2 mm) grains of microcline and plagioclase. Locally includes white-weathering, quartzite, and quartz-pebble conglomerate. Accessory metamorphic muscovite and coarse epidote common. Fine-grained varieties may contain abundant scattered magnetite. Unit interpreted as original feldspathic volcanic rock migmatized during Middle Proterozoic. May correlate with Ygs unit of Mount Holly Complex as mapped in Mount Holly area (Ratliffe, 1992).
 - Felschville Gneiss**—Light-gray to whitish-gray-weathering, medium- to coarse-grained magnetite-biotite-microcline-quartz-plagioclase gneiss. Has distinct layers near contacts with adjacent units but is massive elsewhere. Large, conspicuous augen of well-twinned plagioclase, as much as 1 cm in diameter, are common, whereas matrix foliation is less than 1 mm in diameter and consists of sparse amounts of microcline to as much as 25 percent. Overall composition is granodioritic to trondhjemite. Unit is intrusive into all units of Mount Holly Complex. Locally includes white-weathering, quartzite, and quartz-pebble conglomerate, and only trace amounts of microcline, contain porphyroblasts of more biotite gneiss and amphibolite and is commonly associated with contact zones of Yrs against calc-silicate gneiss (Yrs), amphibolite (Yrs), or marbles (Yrs) associated with Caledonide quadrangle on Hawks Mountain and on Pine Hill. Both Yrs and Yrs are tectonic variants of Yrs and are shown only by an overprint pattern.
 - Baileys Mills Tonalite Gneiss**—Light-gray to whitish-gray-weathering, medium-grained biotite-quartz-plagioclase gneiss, bedded with coarse biotite. Has distinctive microcline, igneous texture in less deformed rocks. Rock closely resembles tonalitic and trondhjemite gneisses within core of Green Mountain mass dated at 1.3 Ga (Ratliffe and others, 1992). Contains numerous inclusions of coarse-grained amphibolite mapped as Yrs that may be, in part, conmagmatic dikes of metagabbro. Grades into lighter gray, more kaesobitic biotite-trondhjemite gneiss.
 - Augen gneiss and mylonitic facies of the Baileys Mills Tonalite Gneiss**—Very well foliated, mylonitic, biotite gneiss (Yrs) containing garnet-hornblende eyes of plagioclase as much as 5 mm long set in a mylonitic, biotite-rich matrix, gradually grades into mylonite gneiss or schist (Yrs) that may be equivalent to much of the dark, biotite feldspathic schist in feldspathic member (Yrs) of Caledonide quadrangle on Hawks Mountain and on Pine Hill. Both Yrs and Yrs are tectonic variants of Yrs and are shown only by an overprint pattern.
- LAYERED PARAGNETITE AND METAVOLCANIC(?) ROCKS**
 - Caledonide Formation (Middle Proterozoic)**
 - Gassetts Schist Member**—Yellowish-green to gray-green, rusty-weathering, lustrous, chlorite-biotite-muscovite (paragneiss)-quartz-plagioclase schist containing large garnets and marked by large irregular, gray, dots, and patches of iron-rich chlorite and large, irregular, shredded plates of muscovite. May contain large conspicuous grains of black staurolite as much as 4 cm long and smaller (1 cm) grains of finely blue gray kyanite. Deep-reddish-brown garnet, as much as 2 cm in diameter, commonly is highly altered to chlorite, whereas small (2-3 mm) garnets in matrix are unaltered. Grades into gray-green, more feldspathic schist lacking abundant silty muscovite but still containing small garnets and abundant gray, dots, and patches of chlorite. This variant is mapped within Yrs.
 - Feldspathic schist or granodiorite member**—Either a light to medium-dark-gray, rusty-weathering, white-weathering, biotite-quartz-plagioclase schist or a biotite-rich porphyroblastic schist having isolated augen of plagioclase, as much as 1 cm in diameter, set in a phyllitic matrix of biotite, muscovite, epidote, and quartz. Later variety is widely distributed on Hawks Mountain and on Pine Hill in adjacent Caledonide quadrangle. Contact with underlying tonalite and trondhjemite gneisses (Yrs) is interpreted as original feldspathic schist, originally intrusive contact. On eastern side of Duttonville Gull, occurs at or near contact with paragneiss or intrusive units of Mount Holly Complex. Marble member—Consists of a variety of marbles closely associated with calc-silicate gneiss or beds of actinolitic quartzite including whitish-gray-weathering, medium- to coarse-grained, phlogopite-calcite-dolomite and quartziferous marble; greenish, actinolitic, dioritic marble and yellow-gray-weathering, fine-grained, highly foliated phlogopite-talc(?) tremolite-dolomite marble. Various varieties of marble were quarried 0.7 km east of Peckville at northern border of map. Foliated variety occurs as 0.5-m-thick lens at contact between Yrs and Yrs in large roadcuts 1 km east of Gassetts, where noted by leader and Yrs symbol without any color designation.
 - Other layered rocks**
 - Biotite-quartz-plagioclase gneiss**—Heterogeneous assemblage of dark to medium-gray, rusty-weathering, quartz-rich, biotite gneiss, all characterized by having abundant plagioclase and epidote and little or no microcline. Distinctive rock types include light-gray-weathering, magnetite-muscovite-biotite-plagioclase-quartz schist containing thin layers of hornblende-spotted gneiss; very dark gray, biotite-rich plagioclase-quartz gneiss commonly associated with epidote quartzite and medium to dark gray, white-weathering biotite-quartz gneiss. Muscovite is common accessory in most rocks and small garnet may be present as well. Biotite-quartz-plagioclase gneiss unit contains numerous layers of other distinctive rocks interlayered throughout, where thick enough, these units (listed below) are mapped separately.
 - Amphibolite**—Dark-green to dark-gray-weathering, light to coarse-grained biotite-hornblende and hornblende-garnet-plagioclase amphibolite. Commonly associated with Yrs or Yrs.
 - Feldspathic granodiorite**—Medium- to dark-gray muscovite-biotite-quartz-plagioclase granodiorite and schist, locally bedded on a scale of 2 to 4 cm or prismatic and marked by distinctive porphyroblasts of cross-foliated biotite.
 - Amphibolite**—Dark-green, highly foliated epidote-biotite-hornblende and hornblende-plagioclase amphibolite. Varies from highly foliated and podded with epidote to a more granular rock consisting of approximately 70 percent hornblende and 30 percent plagioclase. Unit is in fault contact with Middle Proterozoic rocks at its base and is bedded with and gradational upwards into Oms?
 - Hoesac Formation (Late Proterozoic and Cambrian)**—Light-gray to medium-dark, biotite-rich plagioclase-quartz granodiorite and gray, fine-grained, shaly biotite schist containing layers of hornblende amphibolite west of Chester dome. East of Chester dome, a very narrow belt of similar plagioclase-rich granodiorite and interbedded amphibolite occurs beneath Oms?, near contact with Bull Hill Gneiss (Yrs) and hornblende-quartz-plagioclase gneiss (Yrs). Base of unit is mylonitic and fault contact is down at last recognizable outcrop of porphyroblastic gneiss within mylonite. Excellent outcrop showing tectonic laminae in plagioclase-rich granodiorite from Yrs are exposed in bed of Williams River, 2 km south of quadrangle border on strike with projected contact between D5h and Yrs; these exposures suggest that at or part of the rocks mapped east of dome is Hoesac Formation? and along this fault may have been derived from Middle Proterozoic basement by mylonitization.
- North River Igneous Suite (Ordovician)**
 - Trondhjemite gneiss**—Principally light-gray to gray-green-weathering, lustrous chlorite-biotite-muscovite-quartz schist and light-gray-weathering, feldspathic granodiorite interbedded on a scale of 10 cm. Locally contains coarse-grained garnet schist and widespread thin beds as much as 10 cm thick of prismatic chlorite-muscovite-plagioclase-quartz schist and granodiorite identical to Oms. Beds of cotecite 1-2 cm thick identified by dot, leader and in one of highly foliated forms of Moretown Formation along western border of the map, 1 km north of Whitmore Brook, where unit contains small blocks of late (D5a) 10 cm to 1 m in size, although similar, need not be correlative.
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 - Green schist and granodiorite**—Principally light-green to pale-green, lustrous chlorite-biotite-muscovite-quartz schist and light-gray-weathering, feldspathic granodiorite interbedded on a scale of 10 cm. Locally contains coarse-grained garnet schist and widespread thin beds as much as 10 cm thick of prismatic chlorite-muscovite-plagioclase-quartz schist and granodiorite identical to Oms. Beds of cotecite 1-2 cm thick identified by dot, leader and in one of highly foliated forms of Moretown Formation along western border of the map, 1 km north of Whitmore Brook, where unit contains small blocks of late (D5a) 10 cm to 1 m in size, although similar, need not be correlative.
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EXPLANATION OF MAP SYMBOLS

- Contact—Dashed where concealed by water. Accuracy indicated by outcrop locations and distribution and concentration of structural symbols.
- Thrust fault—Teeth on upper plate; dotted where concealed by water. Accuracy indicated by outcrop locations and distribution and concentration of structural symbols.
- Mylonite zone
- FOLDS
 - (Arrows trace of major folds; dots show approximate direction of plunge where known. Relative age identified by color and subscript; the greater the subscript number, the younger the fold)
 - Upright anticline
 - F₁ antiform
 - F₂ antiform
 - F₃ antiform
 - F₄ antiform
 - Inclined
 - F₁ antiform
 - F₂ antiform
 - Acclinal fold—Both shows dip direction of axial surface. Arrow shows approximate plunge direction where known. Generation shown by subscript where known.
 - Inclined
 - F₁ antiform
 - F₂ antiform
 - Tectonic fold—Both shows dip direction of axial surface. Arrow shows approximate plunge direction where known.
 - F₁ inclined
 - Middle Proterozoic fold—Approximate axial trace only; dip of axial surface uncertain.
 - (May be combined, joined at observation)
 - Strike and dip of compositional layering or geometry of probable Middle Proterozoic age
 - Inclined
 - Vertical
 - Strike and dip of Paleozoic foliation or schistosity (Taconian) or foliation of uncertain age (possibly Acadian) in pre-Silurian rocks
 - Inclined
 - Vertical
 - Strike and dip of mylonitic foliation spatially associated with thrust faults or ductile deformation areas of Paleozoic (Acadian, Taconian); second-generation foliation commonly developed in zones of highly plicated schistosity
 - Inclined
 - Vertical
 - General strike and dip of highly plicated foliation or schistosity
 - Inclined
 - Vertical
 - Strike and dip of foliation and parallel bedding in Silurian or younger rocks, the first Acadian foliation
 - Inclined
 - Vertical
 - Strike and dip of Acadian crenulation cleavage not distinguished by relative age
 - Inclined
 - Vertical
 - Strike and dip of Acadian schistosity developed in Silurian or younger rocks
 - Inclined
 - Vertical
 - Strike and dip of axial surface of Taconian(?) minor fold of second (F₂) generation—Commonly associated with thrust faults and zones of mylonitization. Where shown, arrow indicates direction and amount of plunge of fold axis.
 - Inclined—Where shown, open semicircular arrow shows rotation sense of asymmetric fold as viewed down plunge. Where brackets having two senses of rotation are shown on the same axial surface, the brackets of the two plunge directions approximate the azimuth of the slip direction of the fold.
 - Strike and dip of axial surface of Acadian minor fold—Where shown, closed arrow shows direction and amount of plunge of fold axis. Open semicircular arrow shows sense and amount of asymmetric minor fold viewed down plunge. Double-plunge arrows indicate nonplunging fold.
 - Inclined
 - Strike and dip of dikes—Dike to a narrow map to map at site. D₁ Devonian granite; D₂ Devonian pegmatite (in red); K₁ Cretaceous (in black).
 - Inclined
 - Vertical
- LINEAR FEATURES
 - (Combined with linear structure)
 - Bearing and plunge of prominent nullion structure, linear structure, or quartz rodding in mylonitic rocks—Indicates transport direction; arrow shows sense of rotation of minor folds.
- OTHER FEATURES
 - Quartz—q, soapstone, g, granite, m, marble, f, feldspar; i, talc
 - Actinolite
 - Biotite
 - Location of chemically analyzed sample in table 1 (in pamphlet)
 - Area of outcrop examined in this study

BEDROCK GEOLOGIC MAP OF THE CHESTER QUADRANGLE, WINDSOR COUNTY, VERMONT

By
Nicholas M. Ratcliffe
2000