VERMONT GEOLOGICAL SURVEY

GEOLOGIC MAP OF VERMONT

PLUTONIC ROCKS

(Including a few dike rocks and volcanic rocks.)

PERMIAN OR TRIASSIC

Upper Permian, or Lower or Middle Triassic — White Mountain plutonic-volcanic series

- Bostonite — *Many small laccoliths and lamprophyre dikes do not show.*
- Biotite and hornblende granites
- Hornblende, biotite, quartz and augite syenites
- Nepheline syenite and pulaskite
- Hornblende-biotite diorite; gabbro
- Essexite
- Volcanic breccia, felsitic tuff, and flows

DEVONIAN

Middle (?) Devonian — New Hampshire plutonic series

- Bethlehem gneiss — *Two-mica granodiorite gneiss.*
- Undifferentiated granitic rocks — *Small dikes and sills do not show.*
- Metadiorite — *Dikes and sills of metagabbro, metadiabase and, meta-andesite, too small to show, are chiefly in the Missisquoi, Athol, and Orfordville formations.*
- Biotite quartz diorite gneiss

ORDOVICIAN

Upper Ordovician — Highgate Springs (?) plutonic series

- Undifferentiated granitic rocks
- Ultramafic rocks — *ub, dunite, peridotite, and serpentinite. us, serpentinite, carbonate rock, talc-carbonate rock and steatite. un, undifferentiated ultramafic rocks.*

PRECAMBRIAN

Upper (?) Precambrian

- Stamford gneiss — *Granitic biotite gneiss with megacrysts of microcline.*
- Undifferentiated gneissic biotite granite, quartz monzonite, and granodiorite

Contact

Local horizon showing structure

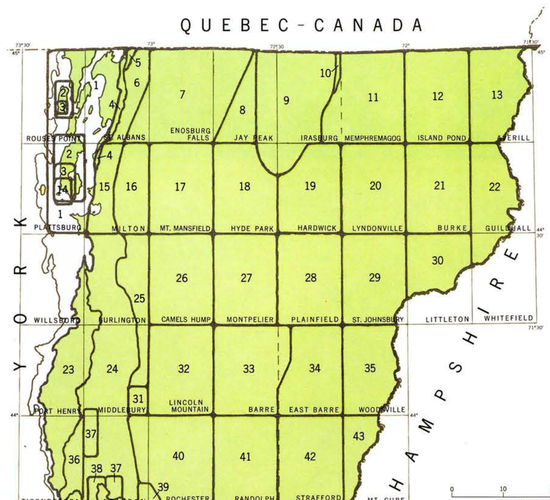
Thrust fault — *Location of thrust indicated by structural criteria; sawteeth on upper plate.*

Thrust fault — *Exact location uncertain in places; shown by stratigraphic and paleontologic evidence; sawteeth on upper plate.*

Reverse fault — *Dashed where inferred, bar on upthrown side.*

Normal Fault — *Dashed where inferred, bar and ball on downthrown side.*

QUEBEC - CANADA



EDITING

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General: M. P. Billings

0 10 20 30 40 50 miles
SCALE

INDEX MAP OF VERMONT

Shows quadrangle grid, sources of primary geologic information, and (on inset map) areas of regional geologic studies and of editorial responsibility.

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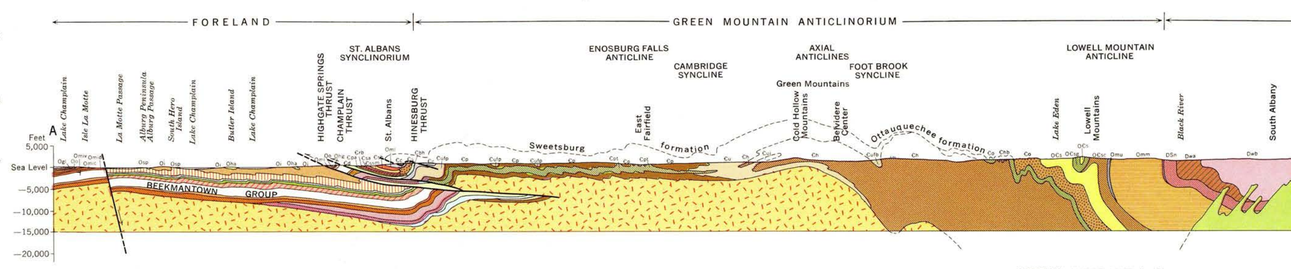
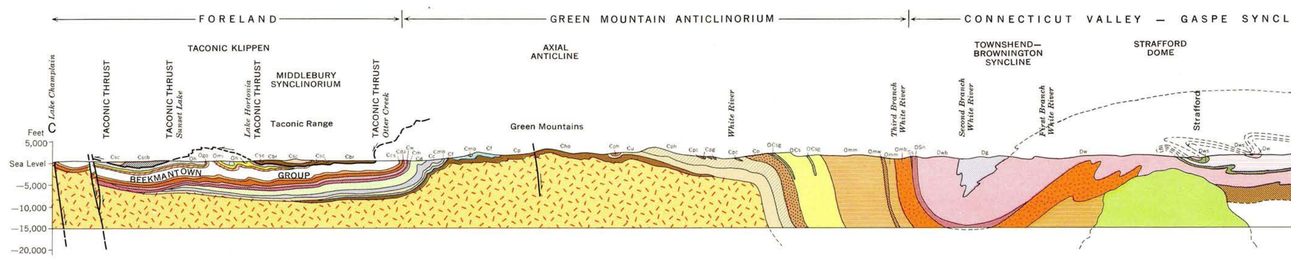


SECTION ALONG LINE A—A'



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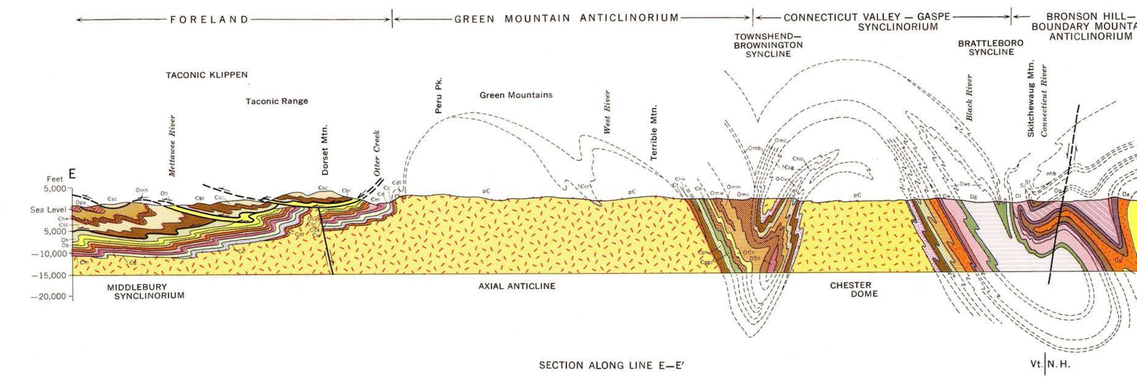

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Williams & Heintz Map Corporation Washington 27, D. C.

EXPLANATION

EASTERN VERMONT

DEVONIAN — Lower Devonian

Dwb Dws Dw Dwc Dwa Dgh Dga Dg Dgm

Waits River formation

Gray quartzose and micaceous crystalline limestone weathered to distinctive brown earthy crust; interbedded and intergradational with gray quartz-muscovite phyllite or schist. Where more metamorphosed the limestones contain actinolite, hornblende, zoisite, diopside, wollastonite, and garnet, and the phyllite and schist, biotite, garnet, and locally andalusite, kyanite or sillimanite.

Dws, *Standing Pond volcanic member: amphibolite, garnet amphibolite, coarse garnet schist with fasciculite hornblende, and hornblende maculite; contains pillow lavas near St. Johnsbury and passes eastward into actinolitic greenstone and greenstone south of Windsor.*

Dwc, *Crow Hill member: tough gray quartzite near St. Johnsbury is distinctive; similar rock (not shown on map) occurs at several other places.*

Dwb, *Barton River member: interbedded siliceous crystalline limestone and sericite-quartz-chlorite phyllite in northern Vermont; diopsidic limestone and cordierite hornfels at contacts with granitic dikes and sills.*

Dwa, *Ayers Cliff limestone member: siliceous crystalline limestone containing thin beds of slate and phyllite north of the Lamoille River.*

Gile Mountain formation

Gray quartz-muscovite phyllite or schist, interbedded and intergradational with gray micaceous quartzite (graywacke northeast of Nulhegan River), calcareous mica schist, and, locally, quartzose and micaceous crystalline limestone like that of the Waits River formation. The phyllite and schist commonly contain porphyroblasts of biotite, garnet, or staurolite, and locally kyanite, andalusite, or sillimanite.

Dgh, *Hall Stream member: highly feldspathic grit, probably volcanic; feldspathic chlorite-ankerite schist and amphibolite; all northeast of Nulhegan River.*

Dga, *amphibolite: hornblende-quartz-biotite-chlorite rock.*

Dgm, *Meetinghouse slate member: chiefly gray slate or phyllite characterized by beds of gray schistose quartzite ¼ inch to 3 inches thick.*

Dl

Littleton formation

Gray slate and phyllite containing interbeds of gray schistose quartzite ¼ inch to 6 inches thick. West of Guildhall are lustrous, light to dark gray biotite-garnet phyllite and schist, some slate, and subordinate quartzite and impure quartzite. South of Bellows Falls gray phyllite passes eastward into gray mica schist containing porphyroblasts of biotite, garnet, and staurolite.

SILURIAN — Middle and Upper Silurian

DSn

Northfield formation

Dark gray to black quartz-sericite slate or phyllite with fairly widely-spaced interbeds a few inches thick of siltstone and silty crystalline limestone like that of the Waits River formation; calcareous slate north of Lamoille River; phyllite passes into gray quartz-sericite schist containing abundant porphyroblasts of biotite and garnet in southern Vermont.

Sf

Fitch formation

NORTHEASTERN VERMONT

Bluish-gray, white-weathered, sandy limestone.

SOUTHEASTERN VERMONT

Quartz-plagioclase-biotite granulite; actinolite-diopside granulite; impure limestone and dolomite; mica schist; the carbonate-rich beds are typically an inch or two thick and segmented so as to give the weathered outcrop a characteristic pitted appearance.

Lower Silurian

Ss

Shaw Mountain formation

NORTHERN VERMONT

Chiefly tan to brown weathered quartzose limestone and calcareous quartzite characterized by specks of limonite after ankerite; locally underlain by quartz conglomerate and overlain by blue fossiliferous crystalline limestone; greenstone and quartz-sericite schist.

SOUTHERN VERMONT

Quartzite, quartz conglomerate, cummingtonite schist, amphibolite, and quartz-sericite schist with prophyroblasts of biotite and garnet.

Sc

Clough formation

NORTHEASTERN VERMONT

Boulders, cobbles, pebbles and angular fragments of quartzite, micaceous quartzite, and gray mica schist in matrix of dark gray quartz-mica schist or quartzite; schist commonly contains porphyroblasts of biotite, less commonly garnet.

SOUTHEASTERN VERMONT

Quartzite, quartz-conglomerate, and mica schist; lenses of fossiliferous calcareous quartzite in upper part.

UNCONFORMITY

UNCONFORMITY

TACONIC RANGE

Middle Ordovician

Opt

Pawlet formation

Silver gray to jet black, locally carbonaceous and pyritiferous, micaceous silty slate; interbedded, at intervals of a few inches to tens of feet, by beds of dark gray rusty weathered graywacke a few inches to 6 feet thick. The graywacke contains subangular grains of quartz, and less abundant feldspar and slate fragments, in a gray argillaceous matrix that is locally calcareous.

UNCONFORMITY

Lower Ordovician

Omh

Mount Hamilton formation

White weathered black, gray, green, purple, and red hard slates, some interbedded with thin cherty appearing quartzites and ribbon limestones a few inches apart; smooth, soft, red slate; beds of ankeritic quartzite a few inches to several feet thick, locally containing layers of edgewise conglomerate; and a polymict limestone conglomerate. Lithic features vary laterally and are in many places indistinguishable from those of the underlying Hatch Hill and West Castleton formations.

Upper Cambrian — Middle Cambrian

Chw

Hatch Hill and West Castleton formations, undifferentiated

The Hatch Hill, a relatively thin formation that succeeds the West Castleton, is characterized by rusty and spongy weathered gray calcareous quartzite traversed by numerous white-quartz veins. The West Castleton is a gray to black, siliceous, carbonaceous, and pyritiferous slate containing paper-thin white sandy laminae. Black slates are common to both formations. A blue-gray weathered black limestone is near the base of the West Castleton in a few places.

Lower Cambrian

Csc Cscz Cscb

St. Catherine formation

Purple, gray-green, and variegated slate and phyllite containing minor interbeds of white to green quartzite; locally albitic. Purple and green chloritoid-bearing slate and phyllite is within dashed line in northern Taconic Range, but not separated farther south.

Cscb, *Bomoseen graywacke member: green to olive-colored arkose and graywacke that weathers pale red to white; contains visible flakes of mica and rock fragments.*

Cscz, *Zion Hill quartzite member: white weathered green, vitreous chloritic quartzite and graywacke spotted with limonite.*

Cbr Cbrc

Brezee formation

Dark gray to black phyllite with beds of blue-gray marble, dark gray dolomite, sandy dolomite, and dolomitic sandstone, in upper part; beds of massive quartzite as much as 20 feet thick occur, and in places contain pebbles of blue quartz. Phyllites are locally highly albitic.

Cbrc, *quartzose green phyllite.*

PROFOUND UNCONFORMITY

Precambrian

pCgn

Gneiss, quartzite, calc-silicate granulite

CHAMPLAIN AND VERMONT VALLEYS

Trenton group

Oha

Hathaway formation

Gray to black argillite and bedded radiolarian chert, with included blocks and fragments of chert, limestone, dolomite, sandstone and graywacke.

Oi

Iberville formation

Noncalcareous black shale interbedded with occasional dolomite beds and in the lower part with calcareous shale.

Osp

Stony Point formation

Predominantly calcareous black shale that grades upward into argillaceous limestone and rare dolomite beds, in northwestern Vermont.

Och

Cumberland Head formation

Interbedded calcareous black shale and fine-grained homogeneous, dark-gray limestone; shown only in Grand Isle county where it is thick enough and well enough exposed to map.

Ogs Ogl

Glens Falls formation

Thin bedded, dark blue-gray, rather coarsely granular and highly fossiliferous limestone.

Ogs, *Shoreham member: interbedded limestone and shale, contains Cryptolithus tesselatus and Prasopora orientalis.*

Ogl, *Larrabee member: thin-bedded shaly limestone.*

Oh

Hortonville formation

Black, carbonaceous and pyritic slate and phyllite, locally sandy; brown weathered limy beds are common near base. Occurs east of Highgate Springs, Champlain, and Orwell thrusts.

Ohg

Hortonville, or Cumberland Head, and Glens Falls formations, undifferentiated

Hortonville or Cumberland Head is combined with Glens Falls where the boundary with the Glens Falls is widely covered by surficial deposits, also where the Cumberland Head thins.

Oml

Morses Line formation

Calcareous and non-calcareous slate; local lenses of thin-bedded limestone, limestone conglomerate, and dolomite; in St. Albans synclinorium.

Black River group

Oor Oo

Orwell limestone, and Isle La Motte and Lowville limestones

Smooth ledged, sublithographic and lithographic, dove-gray weathered limestone commonly cut by veins of white calcite; beds filled with fossil shell fragments are characteristic. The Lowville is a thin, undifferentiated unit near the base of the Orwell that is characteristically ashen gray and contains abundant Phytopsis tubulosum. The Isle La Motte is about the equivalent of the Orwell in areas west of Champlain thrust, on Isle La Motte and near South Hero, Highgate, Swanton, and St. Albans; it is locally underlain by the Lowville, which is too thin to show on the map.

Oor, *Root Pond quartzite member: massive quartz sandstone, near Benson and West Haven, that overlies Orwell limestone.*

Ogo

Glens Falls and Orwell limestones, undifferentiated

Combined where deformation has made the thin bedded Glens Falls indistinguishable from the thick bedded Orwell; from West Rutland south may contain rocks as low as the Middlebury.

UNCONFORMITY

Chazy group

Omiv Omic Omid Omi

Middlebury and Chazy limestones; undifferentiated Youngman and Carman formations

Dark blue-gray, somewhat nodular and granular limestone with buff dolomite and shaly interbeds a fraction of an inch thick and 2 to 4 inches apart. The Middlebury, which is east of Champlain and Orwell thrusts, and the Youngman, which is east of Highgate Springs thrust, are, due partly to deformation, more slaty in appearance than the Chazy, which is west of the major thrusts. The Carman is a quartz sandstone with shaly partings that underlies the Youngman. The Chazy contains three members.

Omiv, *Valcour member: dark gray calcarenite succeeded by medium to light gray, buff-weathered silty, partly coquinal limestone.*

Omic, *Crown Point member: massive, characterized by abundant Maclurites magnus.*

Omid, *Day Point member: calcareous quartz sandstone, and calcarenite; orange-weathered dolomitic siltstones are common in eastern areas.*

UNCONFORMITY

Beekmantown group

Ocbr Ocbe Ocw Ocb

Chipman, Bridport, and Beldens formations; Providence Island dolomite

The Chipman formation in west-central Vermont includes four members:

Ocbr, *Bridport dolomite member: buff to brown weathered, sharply defined and laterally persistent beds chiefly of medium bedded to massive, scored dolomite; variously designated Bridport formation and Providence Island dolomite in northwestern Vermont.*

Ocbe, *Beldens member: interbedded buff to brown heavily scored dolomite and white to blue-gray marble and limestone; designated Beldens formation east of Highgate Springs thrust.*

Ocw, *Weybridge member: gray limestone with thin interbeds of sandy limestone ½ to 2 inches thick and 1 to 4 inches apart.*

Ocb, *Burchards member: blue-gray limestone with irregular spots of light buff dolomite that give weathered surface a mottled appearance.*

Obb Ob

Bascom formation, and undifferentiated Luke Hill, Naylor Ledge and Hastings Creek limestones

Interbedded dolomite, limestone or marble, calcareous sandstone, quartzite, and limestone breccia; irregular dolomitic layers, thin sandy laminae, and slaty or phyllitic partings characterize limestone and marble of lower, middle, and upper parts of the Bascom, respectively; south of West Rutland it includes some of Chipman formation. The combined Luke Hill, Naylor Ledge, and Hastings Creek, east of Philipsburg thrust, are stratigraphically equivalent to the Bascom.

Obb, *Brownell Mountain phyllite member: calcareous phyllite in upper part of the Bascom formation of east limb of Hinesburg synclinorium.*

Oc

Cutting dolomite, and undifferentiated Morgan Corner and Wallace Creek formations

Typical Cutting is a massive, gray weathered, nondescript dolomite with a finely laminated calcareous sandstone at base. The combined Morgan Corner and Wallace Creek formations, east of Philipsburg thrust, are stratigraphically equivalent to the Cutting.

Ohi

Highgate formation

Banded blue limestone and calcareous slate; local lenses of limestone conglomerate; on west limb of St. Albans synclinorium.

Os

Shelburne, Whitehall, and Strites Pond formations

The Shelburne is chiefly a white marble or gray limestone characterized by raised reticulate lines of gray dolomite on the weathered surface; includes Sutherland Falls marble, intermediate dolomite and Columbian marble of the marble quarries. Interbedded massive dolomite increases westward and predominates in the Whitehall formation, west of Champlain and Orwell thrusts. The Strites Pond, which is identical to the Shelburne, is east of Philipsburg thrust.

Upper Cambrian

Ccs

Clarendon Springs, Ticonderoga, and Rock River dolomites; Gorge formation

Fairly uniform, massive, smooth weathered gray dolomite characterized by numerous geodes and knots of white quartz; quartz sandstone and irregular masses of chert are near the top. Called the Ticonderoga west of Orwell and Champlain thrusts and the Rock River east of Philipsburg thrust. The Gorge is a partly conglomeratic facies on west limb of the St. Albans synclinorium.

Csh Csr Cssm Csa Cs

Sweetsburg formation

Black, carbonaceous, well-cleaved slate with characteristic thin (1-5mm) whitish silty bedding laminae; in St. Albans and Hinesburg synclinoria and Cambridge syncline.

Csh, *Hungerford slate member: black slate.*

Csr, *Rockledge conglomerate member: phenoclasts chiefly of biohermal limestone in a matrix of gray limestone containing frosted quartz sand grains.*

Cssm, *Skeels Corners slate and Mill River conglomerate members undifferentiated: black slate; local dolomite, sandstone, dolomite conglomerate, limestone bioherms, limestone, and calcareous shale. The Mill River is a basal limestone conglomerate.*

Csa, *St. Albans slate member: black, gray-black, or tan micaceous slate.*

Middle Cambrian

Cda

Danby and Potsdam formations

The Danby is comprised of interbedded quartzite and dolomite; white quartzite beds, more than a foot thick, separated by 10 to 12 feet of dolomite in eastern areas, increase westward to continuous sections of white to pink weathered, massively bedded Potsdam quartzite, west of Orwell thrust.

Csb

Saxe Brook dolomite

Sandy gray dolomite, sandstone containing dolomitic cement, and pure dolomite; on west limb of St. Albans synclinorium.

Crb

Rugg Brook formation

Sandy gray dolomite, dolomite conglomerate, and interbeds of gray-weathered sandstone, in St. Albans and Middlebury synclinoria.

UNCONFORMITY

Lower Cambrian

Cw

Winooski dolomite

Buff-weathered, pink, buff, and gray dolomite; beds 4 inches to 1 foot thick separated by thin, protruding, red, pink, green, and black siliceous partings.

Cbh

Bridgeman Hill formation

Undifferentiated dolomite, slate, and conglomerate, on east limb of St. Albans synclinorium, about equivalent to Dunham, Parker, Rugg Brook, and Saxe Brook formations.

Cpa

Parker slate

Gray to black micaceous shale and slate, includes dolomite, sandstone, and quartzite lenses; chiefly on west limb of St. Albans synclinorium.

Cm

Monkton quartzite

Distinctively red quartzite interbedded with lesser buff and white quartzite and relatively thick sections of dolomite like that of the Winooski; the quartzites thin to the east, and they become gray and phyllitic to the east and south.

Cd

Dunham dolomite

Buff-weathered siliceous dolomite, pink and cream mottled or buff to gray on fresh surface; lower part is massive and upper part is sandy and resembles the Winooski dolomite.

Cc

Cheshire quartzite

Very massive, white to faintly pink or buff vitreous quartzite near the top in west-central and southwestern Vermont; predominantly a less massive appearing mottled gray, somewhat phyllitic quartzite; dolomitic sandstone and conglomerate near the base of the formation in west-central Vermont apparently grades southward into the Dalton formation.

Cdt

Dalton formation

Schistose quartzite containing pebbles of feldspar and blue quartz; impure dolomite containing pebbles of quartz and feldspar occurs locally; conglomerate common near base. Occurs in southwestern Vermont.

Cmo

Moosalamoo phyllite

Gray to black sericite-quartz phyllite; sericite-quartz-chlorite phyllite occurs locally.

Cf

Forestdale marble

Buff to rusty-weathered white, buff, and pink and white mottled dolomite containing local interbeds of dolomitic sandstone, gray-green phyllitic quartzite, and crossbedded sandy dolomite.

GREEN MOUNTAINS

Omcr Omco Omhb Omm Omb Omc Omw Omu

Missisquoi formation

NORTHERN VERMONT

Omcr, *Cram Hill member: pale greenish-gray to black phyllite grades locally into gray to black slate; felsic to mafic volcanic rocks.*

Omhb, *Harlow Bridge quartzite member: buff to pale-green quartzite with interbeds of quartz-sericite-chlorite phyllite.*

Omco, *Coburn Hill volcanic member: actinolite-epidote-chlorite-albite greenstone and hornblende-albite-epidote amphibolite; includes pillow lavas.*

Omc, *carbonaceous phyllite and slate, black to light gray (where extensive enough to show on map).*

Omu, *Umbrella Hill member: quartz and slate pebble, phyllitic conglomerate with interbeds of slate and phyllite—chiefly quartz-sericite-magnetite-chloritoid rocks.*

SOUTHERN VERMONT

Omc, *Rusty weathering carbonaceous mica schist, quartzite and micaceous quartzite.*

Omb, *Barnard volcanic member: fine- to medium-grained biotite gneiss, hornblende gneiss, and amphibolite.*

Omw, *Whetstone Hill member: carbonaceous black to light gray phyllite and schist containing porphyroblasts of biotite and garnet; beds of gray micaceous quartzite, fine-grained biotite gneiss and amphibolite.*

NORTHERN AND SOUTHERN VERMONT

Omm, *Moretown member: quartzite and quartz-plagioclase granulite, in layers ⅛ to several inches thick, separated by "pinstripe" partings that contain muscovite, chlorite, epidote, biotite, and locally garnet; also greenish quartz-sericite-chlorite phyllite and schist, and minor carbonaceous phyllite. Schist and phyllite commonly contain biotite and garnet porphyroblasts in southern Vermont.*

LOCAL UNCONFORMITY

Oos Oo Oop

Orfordville formation

Carbonaceous phyllite; minor quartzite.

Oos, *Sunday Mountain volcanics: greenstone, chloritic schist, felsite, and quartz-feldspar-sericite schist.*

Oop, *Post Pond volcanics: greenstone and green chloritic schist commonly interbedded with schistose felsite and quartz-feldspar-sericite schist; also fine-grained chloritic and biotitic gneiss; all west of Ammonoosuc fault; mainly amphibolite east of the Ammonoosuc fault.*

ORDOVICIAN

Op Opv

Partridge formation

NORTHEASTERN VERMONT

Dull gray to sooty black carbonaceous slate and phyllite; mostly fissile, but locally massive and tough. Contains a few beds of both schistose and massive soda-rhyolite tuff (not shown on map).

SOUTHEASTERN VERMONT

Rusty weathering carbonaceous mica schist locally containing porphyroblasts of biotite, garnet, or staurolite.

Opv, *volcanics: fine-grained biotite gneiss and amphibolite.*

Oa

Ammonoosuc volcanics

NORTHEASTERN VERMONT

Soda-rhyolite tuff, breccia, and flows.

SOUTHEASTERN VERMONT

Fine-grained chlorite and biotite gneiss and greenstone in areas north of Bellows Falls, biotite gneiss and amphibolite south of Bellows Falls.

Oal

Albee formation

Massive, gray, white-weathered quartzite and feldspathic quartzite interbedded with greenish-gray slate, phyllite, feldspathic phyllite and quartzose argillaceous phyllite. Micaceous quartzite, quartz-mica schist, mica schist, and hornfels containing porphyroblasts of biotite, garnet, staurolite, and sillimanite in the vicinity of granitic plutons. Soda-rhyolite tuff occurs locally. Micaceous quartzite characterized by thin, schistose "pinstripe" partings is common in many areas.

OCsc OCsg OCs

Stowe formation

Quartz-sericite (muscovite-paragonite)-chlorite phyllite and schist; porphyroblasts of albite, garnet, chloritoid, or kyanite are common locally; includes phyllitic graywacke north of Lamoille River. Schist contains abundant segregations of granular white quartz.

OCsc, *carbonaceous schist and phyllite north of Lamoille River; occurs in several small areas to the south, not shown on map.*

OCsg, *greenstone and amphibolite; epidote-albite-chlorite rocks contain actinolite and hornblende where more metamorphosed.*

Co Cog

Ottauquechee formation

Black carbonaceous phyllite or schist containing interbeds of massive quartzite commonly criss-crossed by veins of white quartz; quartzite is dark gray and carbonaceous, light gray, or white; also includes light green quartz-sericite-chlorite phyllite or schist and sericitic quartzite; beds of phyllitic graywacke and feldspar granule conglomerate are north of Lamoille River. Schist contains abundant porphyroblasts of garnet and biotite from Ludlow south.

Cog, *greenstone and amphibolite.*

CAMBRIAN

OCu

Pinney Hollow, Ottauquechee, and Stowe formations, undifferentiated

Includes quartz-muscovite-garnet-chlorite-biotite schist, rusty carbonaceous schist, amphibolite, and schistose quartzite; schist locally contains prophyroblasts of staurolite and kyanite; on flanks of Chester and Athens domes.

CAMBRIAN (?)

Camels Hump group

Cug Cuj Cuc Cufp Cu Cph Cpgc Cpc Cuw, Cuf Cuw, Cub Cufb Cua Chb Chg Ch Chop Chd Cpt Cup Cp Cho Chog Ct

NORTHERN AND CENTRAL VERMONT

Underhill formation Cu

Silvery, gray-green, quartz-sericite-albite-chlorite-biotite schist containing abundant lenticular segregations of granular white quartz; locally quartz-sericite-albite-chlorite phyllite; porphyroblasts of albite, garnet, and magnetite are common and locally very abundant in gneissic facies in axial anticlines of the Green Mountain anticlinorium.

Cufp, *Fairfield Pond member: greenish quartzitic schist (quartz-sericite-albite-chlorite-biotite); sericite-quartz-chlorite phyllite, locally purple or red, common in lower part.*

Cug, *greenstone: varied composition including albite-chlorite-epidote-calcite and sericite-magnetite-chlorite-clinozoisite rocks.*

Cuc, *carbonaceous quartz-sericite-albite-chlorite schist and phyllite.*

Cuw, *White Brook member: chiefly brown-weathered whitish, tan and gray sandy dolomite, locally only a hematitic zone; includes carbonaceous crystalline limestone in Cambridge syncline.*

Cuf, *Forestdale member: buff to rusty weathered sandy dolomite and limestone.*

Cuj, *Jay Peak member: pale, silver-green, quartz-sericite-chlorite-albite schist, locally quartzitic.*

Cufb, *Foot Brook member: sericite (muscovite-paragonite)-quartz-chlorite-chloritoid schist; minor carbonaceous interbeds.*

Cua, *Mount Abraham schist member: light gray sericite (muscovite-paragonite)-quartz-chloritoid rock with silvery sheen; porphyroblasts of magnetite are common and porphyroblasts of chlorite, chloritoid, garnet, and kyanite occur locally.*

Cub, *Battell member: carbonaceous sericite-quartz-albite-chlorite schist and schistose quartzite, also carbonaceous and noncarbonaceous limestone; quartz-sericite-chlorite-albite schist.*

Cup, *Peaked Mountain member, greenstone.*

Pinnacle formation Cp

Schistose graywacke, gray to buff, commonly striped, quartz-albite-sericite-biotite-chlorite rock predominates; quartz-cobble and boulder conglomerate is common, chiefly near base.

Cpt, *Tibbit Hill volcanic member: albite-actinolite-chlorite-epidote greenstone; locally pillowed and vesicular.*

Hazens Notch formation Ch

Interbedded carbonaceous and noncarbonaceous quartz-sericite-albite-chlorite schist; grades to quartzite and gneiss.

Chb, *Belvidere Mountain amphibolite member: coarse- to fine-grained hornblende-epidote-albite rock; grades to epidote-chlorite-actinolite-albite greenstone where less metamorphosed.*

Chm, *sericite-quartz-chlorite-albite-magnetite schist, near Hyde Park.*

Chg, *chiefly albite-actinolite-chlorite-epidote greenstone; locally hornblende-epidote-chlorite-albite amphibolite.*

SOUTHERN AND CENTRAL VERMONT

Pinney Hollow formation Cph

Pale green quartz-sericite (muscovite-paragonite)-chlorite phyllite and schist with abundant magnetite, chloritoid phyllite and schist, and quartz-sericite-albite-chlorite schist, and rare beds of carbonaceous and quartz-sericite-chlorite schist; garnet porphyroblasts common south of Ottauquechee River.

Cpgc, *Chester amphibolite member: thin-layered, ligniform amphibolite and hornblende schist; includes actinolitic greenstone and greenstone north of Windham.*

Cpg, *greenstone and actinolitic greenstone.*

Cpc, *carbonaceous phyllite and schist.*

Hoosac formation Cho

Quartz-sericite-albite-biotite-chlorite schist characterized by albite porphyroblasts—biotite and garnet porphyroblasts common southward; locally carbonaceous.

Chop, *Plymouth member: quartzite, schistose quartzite, dolomitic quartzite; carbonaceous phyllite; buff to dark gray dolomite with partings locally of carbonaceous phyllite; quartz-sericite-chlorite-albite schist; carbonaceous albite schist.*

Cht, *Turkey Mountain member: amphibolite and actinolitic greenstone characterized by oval, ⅛ to ¾ inch spots, chiefly of epidote.*

Chog, *amphibolite and actinolitic greenstone.*

Tyson formation Ct

Feldspathic quartz-mica schist containing biotite, chlorite, and carbonate; many beds contain pebbles of quartz and feldspar; cobble or boulder conglomerate commonly at base; thin beds of quartzite, carbonaceous phyllite, and schistose dolomite in upper part, overlain at top by massive buff dolomite as much as 30 feet thick.

UNCONFORMITY

?Ccg ?Ccr ?Ccm

Cavendish formation

(May in large part correlate with Tyson formation, or may be older; in northernmost area, possibly age equivalent of rocks elsewhere included in Mount Holly complex.)

?Ccr, *Readsboro member: quartz-muscovite schist containing biotite or chlorite and characterized by conspicuous porphyroblasts of sodic plagioclase; less commonly quartz-muscovite-paragonite schist containing chlorite, garnet, or chloritoid, or, in Chester dome, quartz-muscovite-paragonite schist containing garnet, staurolite, and locally kyanite (Gassetts schist).*

?Ccg, *Bull Hill gneiss: quartz-plagioclase-microline-biotite gneiss characterized in many areas by augen of microcline as much as 2 inches long; fine- to medium-grained quartz-plagioclase-biotite or biotite-muscovite gneiss.*

?Ccm, *buff dolomite; minor white to pink calcite marble; actinolitic and diopsidic marbles and beds of actinolite diopside granulite common in Chester dome.*

PROFOUND UNCONFORMITY

PRECAMBRIAN

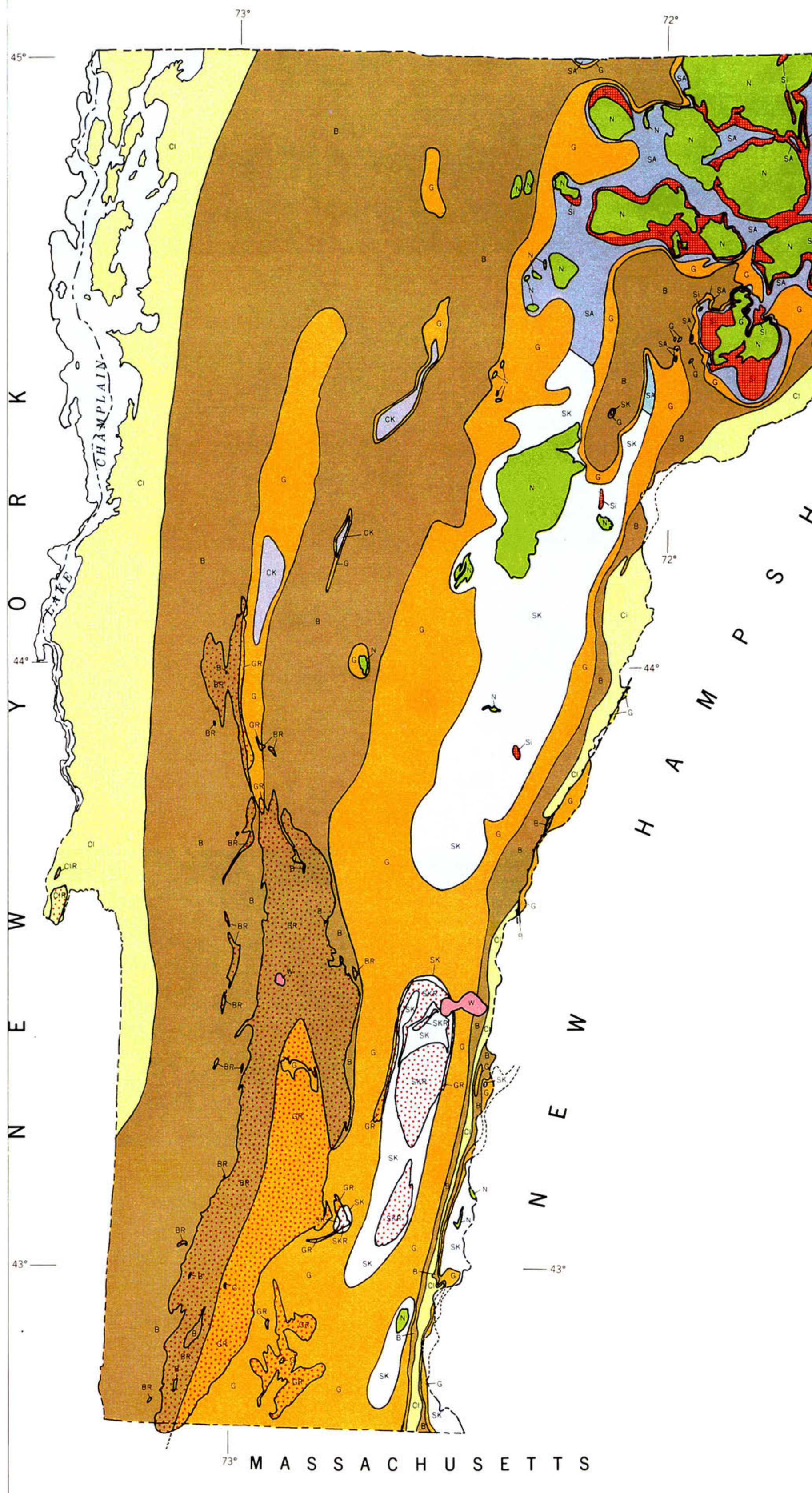
pCsq pCm pC

Mount Holly complex

Mainly fine- to medium-grained biotitic gneiss, locally muscovitic, and in western areas chloritic; massive and granitoid in some localities, fine-grained or schistose and compositionally layered in others; also abundant amphibolite and hornblende gneiss, and minor beds of mica schist, quartzite and calc-silicate granulite; includes numerous small bodies of pegmatite and gneissoid granitic rock.

pCsq, *quartzite, locally in massive beds as much as 30 feet thick, micaceous quartzite, and quartz-mica schist that commonly contains garnet or pseudomorphs (largely chlorite) after garnet; schists are locally rusty weathered and contain conspicuous flakes of graphite; also includes amphibolite and minor hornblende gneiss, biotite gneiss, and pegmatite.*

pCm, *calcite and dolomite marbles, locally coarse grained; commonly contain phlogopite, actinolite, and diopside, and are interbedded with medium- to coarse-grained calc-silicate granulite; includes minor amounts of other types of Precambrian rock.*



METAMORPHIC MAP of VERMONT

0 10 20 30
Scale of miles

METAMORPHIC ZONES

EXPLANATION

Post Metamorphic Faults

W — White Mountain Plutonic Series
Typically surrounded by a zone several hundred yards wide of flinty andalusite-cordierite or sillimanite-bearing hornfels. These aureoles are distinctly younger than the regional metamorphism.

N — New Hampshire Plutonic Series
Most bodies emplaced during the regional metamorphism or shortly thereafter. Sillimanite and locally cordierite occur near many contacts in northern part of state in zones too narrow to show on map.

Si — Sillimanite Zone
Marked by first appearance of sillimanite in rocks of appropriate composition.

SA — Staurolite-Andalusite Zone
Marked by first appearance of staurolite or andalusite in pelitic schists. Some kyanite occurs in southwest part of this zone.

SK SKR — Staurolite-Kyanite Zone
Marked by first appearance of staurolite or kyanite in pelitic schists. Carbonate rocks commonly contain diopside.

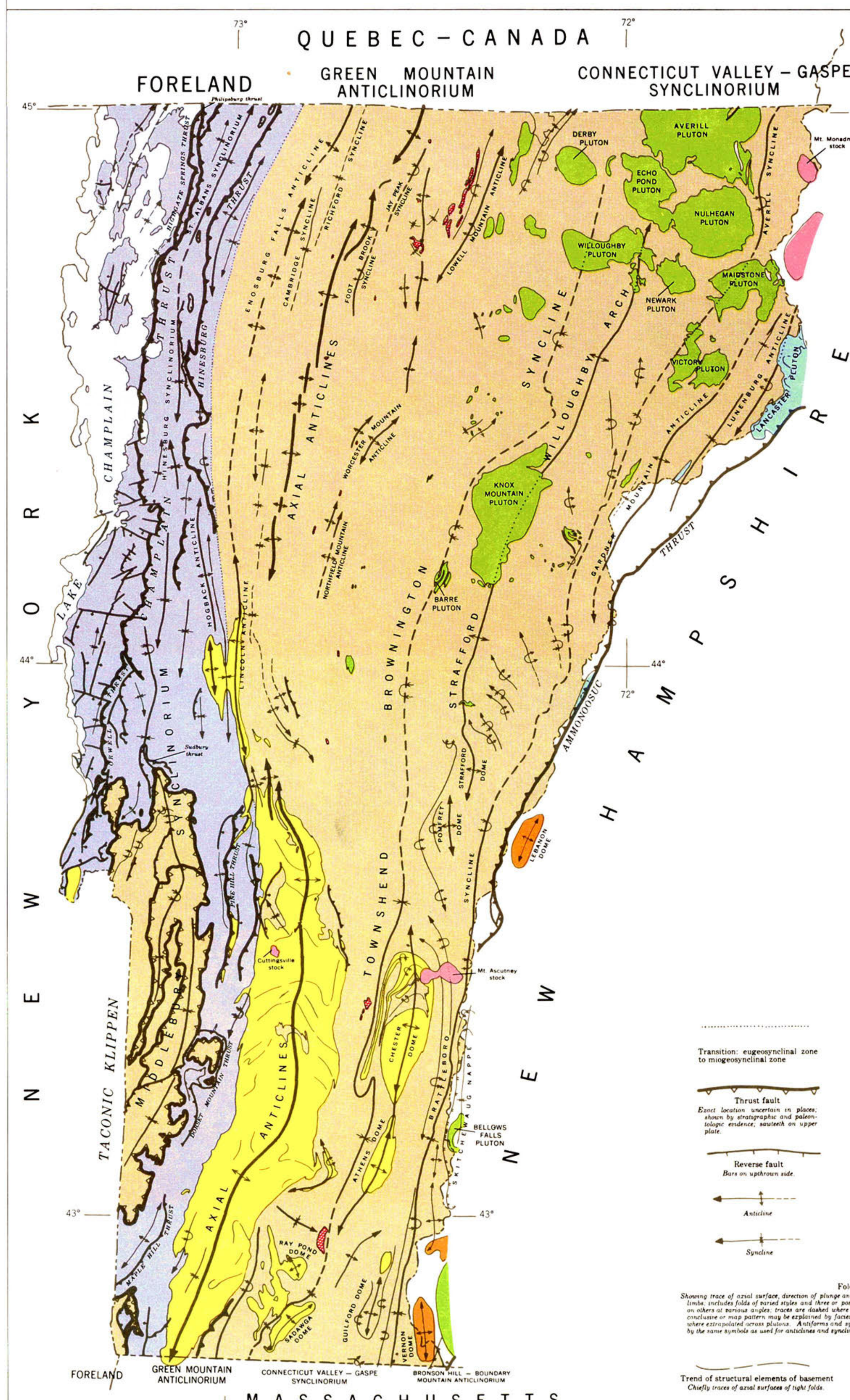
CK — Chloritoid-Kyanite Zone
Characterized by the assemblage chloritoid-kyanite in northern Green Mountains. Staurolite is absent.

G GR — Garnet Zone
Marked by the first appearance of almandite garnet in pelitic schists. Mafic rocks commonly contain a dark green amphibole.

B BR — Biotite Zone
Marked by approximate first appearance of biotite in rocks with a low alumina-alkali ratio or of chloritoid in rocks, mainly pelitic phyllites, with a high alumina-alkali ratio. Mafic rocks mainly greenstone schists, though locally containing an actinolitic amphibole. Carbonate rocks may contain talc or phlogopite and locally tremolite or zoisite.

Cl ClR — Chlorite Zone
Rocks showing evidence of considerable recrystallization but containing few minerals not found in sedimentary rocks. Stilpnomelane is reported locally in schistose greywackes.

Polymetamorphic areas
Mainly rocks metamorphosed before the Cambrian to probable sillimanite zone or higher, then later subjected to a lower-grade Paleozoic metamorphism. Grade of Paleozoic metamorphism indicated by color beneath stipple, and by letters preceding "R" in letter symbol.



TECTONIC MAP of VERMONT

0 10 20 30
Scale of miles

EXPLANATION

White Mountain plutonic-volcanic series

New Hampshire plutonic series

Oliverian plutonic series

Highlandcroft plutonic series

Ultramafic rocks

Miogeosynclinal rocks

Eugeosynclinal rocks

Basement

Transition: eugeosynclinal zone to miogeosynclinal zone

Unit boundary

Thrust fault
Exact location uncertain in places; shown by stratigraphic and paleontologic evidence; sawteeth on upper plate.

Thrust fault
Location indicated by structural criteria; sawteeth on upper plate.

Reverse fault
Bars on upthrown side.

Normal fault
Bar and ball on downthrown side.

Anticline

Overturned anticline

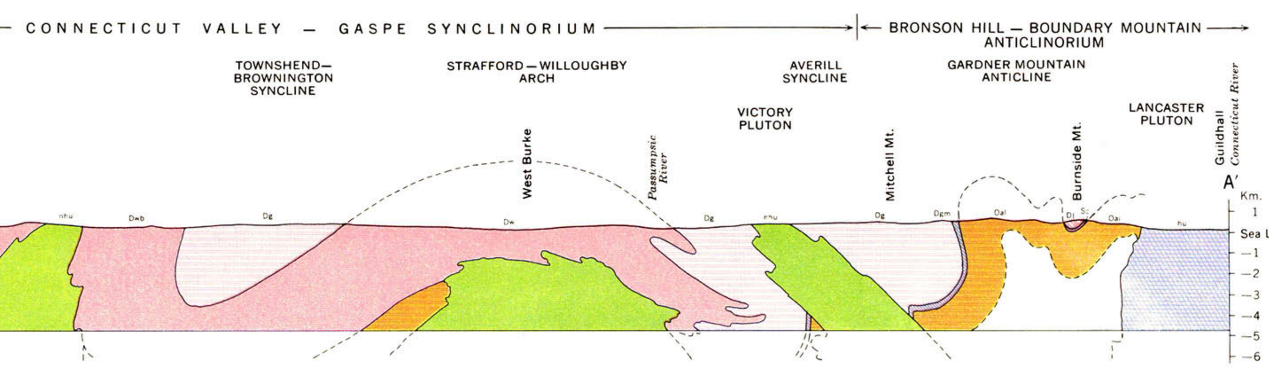
Syncline

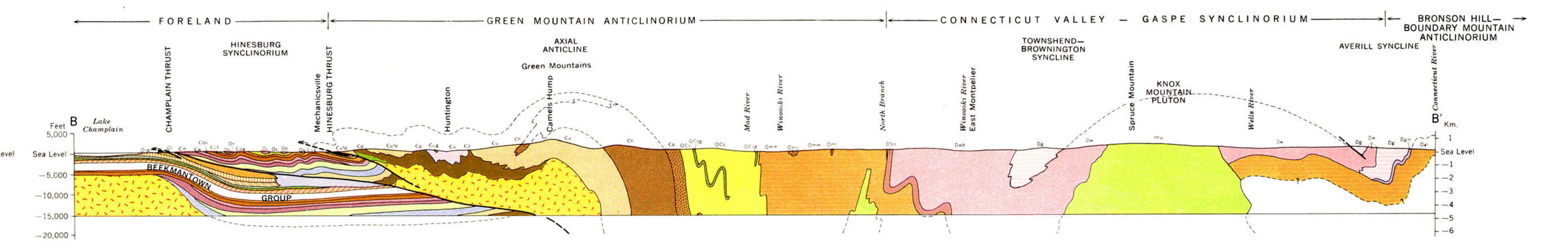
Overturned syncline

Folds
Showing trace of axial surface, direction of plunge and approximate bearing of axis, and direction of dip of limbs. Includes folds of varied styles and three or possibly more regimes, some of which are superimposed on others at various angles; traces are dashed where structural and stratigraphic evidence for folds is inconclusive or map pattern may be explained by facies distribution as well as by folding; traces are dotted where extrapolated across plutons. Antiforms and synforms on the flanks of domes and arches are shown by the same symbols as used for anticlines and synclines, respectively.

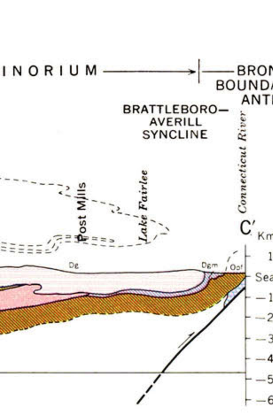
Trend of structural elements of basement
Chiefly traces of axial surfaces of tight folds.

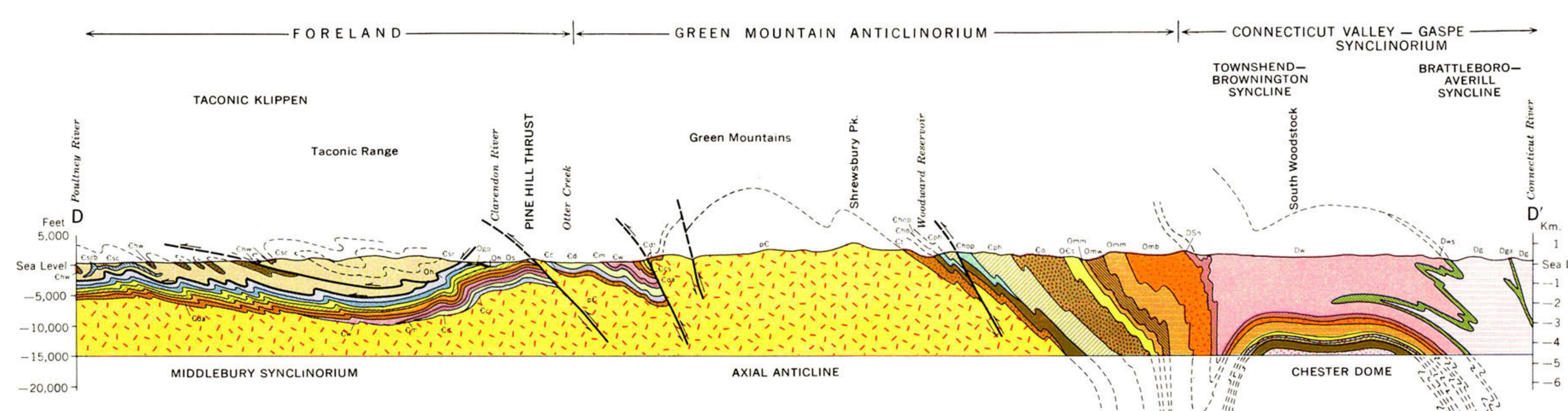
Axial trace of recumbent fold or nappe
Bars point into inverted limb.





SECTION ALONG LINE B—B′





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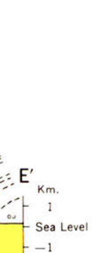

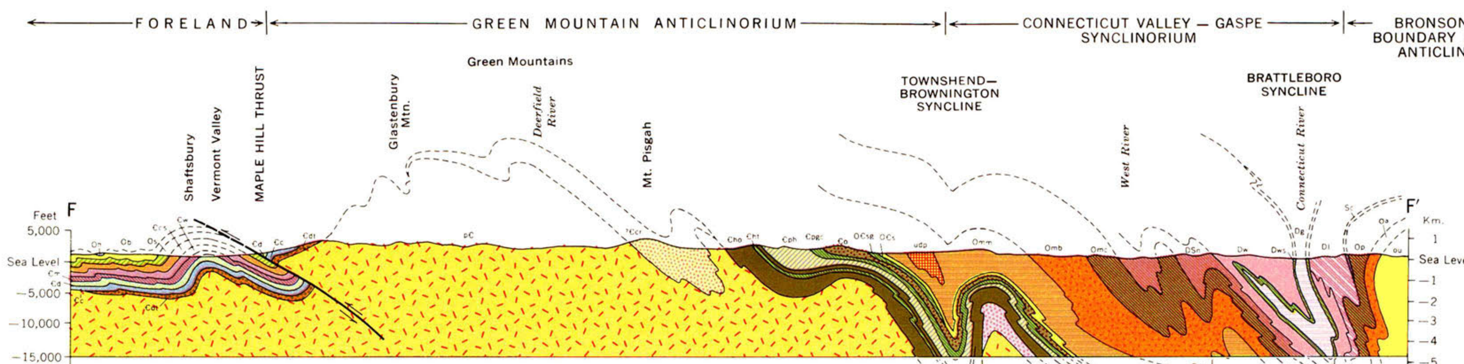

SECTION ALONG LINE F—F′

Vt. | N.H.

CENTENNIAL

GEOLOGIC MAP OF VERMONT

Compiled and Edited under the Direction of
Charles G. Doll, State Geologist

by

Charles G. Doll, Vermont Geological Survey — Wallace M. Cady, U.S. Geological Survey
James B. Thompson, Jr. and Marland P. Billings, Harvard University

Scale 1:250,000

5 0 5 10 15 Miles

Contour interval 100 feet
Datum is mean sea level

1961

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STATE OF VERMONT

Topographic base compiled from Army Map Service 1:250,000 scale map sheets. Corrections and additional topographic features, Vermont Highway Department, Planning Division.