# Preliminary geologic map of the Becket quadrangle, Berkshire, Hampshire, and Hampden Counties, Massachusetts

by

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# Explanation

## Surficial Deposits

Modern deposits of silt and sand have accumulated behind man-made impoundments on Rudd Pond Brook at an elevation of 1500 feet and on Coles Brook above an elevation of 1480 feet.

Swamp deposits of Holocene age are shown only by the standard topographic map symbol for swamps.

Holocene alluvium, consisting of silt, sand, and gravel is present in Geer and Factory Brooks in the northeast corner of the quadrangle, in the Westfield River southeast of Washington, in Yokum and Rudd Pond Brooks in the west central part of the quadrangle, and in Walker Brook east of Bonny Rigg Corner.

Pleistocene water-laid ice-contact stratified sand and gravel are present as kames and kame terraces at the following localities; just northwest and southwest of Bonny Rigg Corners; east of Bonny Rigg Hill Road at the south quadrangle boundary; the large knob south of Quarry Road at the south quadrangle boundary; northwest of the unnamed brook draining into Cushman Brook near Quarry Road; west of Blandford Brook in the southeast corner of the quadrangle. The ridge east of the unnamed brook which drains southeast to Wards Pond in the southwest corner of the quadrangle is interpreted to be an esker.

Pleistocene till covers much of the quadrangle with a mantle ranging in thickness from zero to as much as 60 m. Bedrock exposures are most common on south and east slopes with till ranging in thickness from zero to 10 m. North to northwest trending elongate hills are largely

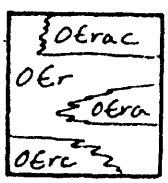
Pleistocene and Holocene

erosional features, the orientation being structurally controlled by the bedrock. However, in the southern half of the quadrangle, many hills and southeast trending ridges are either entirely till or rock cored drumlins.

Note: There is a rather unusual occurrence of giant potholes extending from an elevation of about 1000 feet to the ridge at 1250 feet on the brook draining north into the Westfield River at the east edge of the quadrangle. Their presence must date from a period when ice cover was thinning over the area at the end of the Pleistocene and sub-ice drainage was significant. The largest pot hole is about 12 m across.

Note: About a half square mile east and south of Washington is underlain by saprolite which ranges in thickness from zero to 10 m.

Unconformity

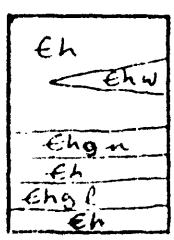



Rowe Schist

OGr, fine-to medium-grained, light green to silvery, quartz-muscovite-chlorite schist, commonly with garnet, shinozoisite, oligoclase, magnetite, and biotite; abundant quartz lenses and ribbons throughout. Well developed schistosity composed of muscovite and chlorite. Locally there are 2 nearly parallel schistosities which give rise to an anastomosing foliation. Weathers dull gray. Abundant thin beds of light to dark green to black non-rusty weathering metavolcanic rocks, composed of hornblende or actinolite (needly), oligoclase, epidote, quartz, chlorite,

Lower to Upper Cambrian and Lower Ordovician(?)

sphene, and opaque minerals. These rocks compose about 5 percent of 0Gr. Locally they are sufficiently thick (up to 50 m) to map separately (0Gra). 0Gra is predominatly dark green to black fine-to-medium-grained hornblende-plagicoclase-chlorite-epidote-quartz-sphene-ilmenite gneiss, commonly laced with discontinuous quartz-epidote layers. 0Grac, Chester Amphibolite Member (Hatch and others, 1966), fin- to medium-grained hornblende-plagioclase-quartz-epidote gneiss with accessory sphene, chlorite, and ilmenite generally massive and well foliated. 0Grc, includes phyllite, quartzite, and sandy well bedded schist, all of which are graphitic and locally pyrrhotitiferous and thus they display sulfidic weathering. The phyllite is composed of quartz, plagioclase, muscovite, chlorite and/or biotite, garnet, and opaque minerals. Quartzite is very well bedded with beds ranging from a few mm to as much as 8 cm. Muscovite, biotite and garnet are the only important accessory minerals. The schist is well bedded in beds up to 5 cm thick. It is composed of quartz, plagioclase, muscovite, biotite, and locally abundant 1 to 2 mm garnets. The contact of 0Grc with 0Gr is sharp, generally with a thin transition zone caused by interbedding and gradation. The total thickness ranges from 1,300 to 2,000 m with individual members thickening and thinning along strike.




Hoosac Formation

Eh, medium - to coarse-grained, gray, brown, or green quartz-plagioclase-

and plagioclase-quartz-muscovite-biotite schist with accessory chlorite, BB shot garnet and clinozoisite. Plagioclase porphyroblasts commonly form conspicuous gray or white spots up to 1 cm in diameter on outcrops. Predominantly non-rusty weathering but locally weathers rusty-brown. Garnet-bearing schist generally is somewhat rusty weathering. Bedding ranges from massive 1 to 2 m thick beds to thin flaggy beds, the latter most commonly below Ehg. Bedding (?) is most commonly indicated by discontinuous quartz lenses and ribbons, up to 2 m long and several cm thick. Very rare graded beds, as thick as 5 cm, are present in about the middle of the formation. Very minor quartz-pebble conglomeratic schist is present east of Glendale Brook, 700 m above the base of the Hoosac. No conglomerate is present at the base of the formation. Rare beds up to 5 m thick of non-rusty weathering hornblende-plagioclase-quartz gneiss with accessory garnet, epidote, sphene, and biotite are distributed throughout Eh but constitute only 2 to 3 percent of the unit. The contact with OErc is transitional over an interval of about 50 m with both gradation of mineralogy and interbedding of rusty Hoosac-like schists and better bedded rusty and graphitic sandy schists of the OErc. The contact with the Precambrian rocks is razor sharp with no gradation between the two rocks. However, Hoosac lithologies (including Eh, Ehgl and Ehgu) are interlayered with Precambrian rocks. This interlayering increases southward and involves more of the Hoosac stratigraphy. Within the Precambrian terrane quartz-plagioclase muscovite-biotite schist with rare microcline and garnet is present in thin septa bounded by Precambrian gneisses. The westernmost septum extends 4 km north into the Peru quadrangle and has been traced southward nearly to Jacobs

Ladder Road. The septum parallel to Factory Brook is not exposed but has been intersected in 2 widely separated localities by drilling. The easternmost Hoosac septum extending from Middlefield to the south quadrangle boundary is poorly documented in terms of continuity. The schist in these septa ranges from zero to 15 m thick. The Precambrian rocks in contact with the schist are structurally conformable to the trend of the septa, conformity having resulted from strong refolding and cataclasis of the gneisses. Rarely blocks of gneiss are isolated within the schist or the septum is split along strike into 2 parallel septa.

These bands of schist, although not physically continuous with (except for those adjacent to the main body of Hoosac, and not traceable into the main body of the Hoosac (€h) are equated with the €h and interpreted to be schist caught along north-trending faults which root in the Hoosac.

€hw, coarse-grained, non-rusty to slightly rusty weathering quartz-plagioclase-garnet-staurolite-muscovite-biotite schist with rare kyanite or very rare sillimanite. Garnets are commonly 1 to 2 cm in diameter and swell and cross cut the schistosity. This member has been traced from just south of Middlefield south to the quadrangle boundary. It is well exposed on Walnut Hill, north of the Westfield River. The thickness varies from zero to 50 m. The contact with €h is sharp.

€hgu, coarse-grained, well banded schist which weathers to an orange and black striped rock. The orange layers, up to 2 cm thick, are granular, weather rusty, and are rich in quartz. The black layers, up to 4 cm thick, are nearly void of quartz, are highly graphitic, and contain in addition to muscovite, large concentrations of garnet, staurolite, and

kyanite. The contacts with Ch are sharp. The thickness of this unit ranges from about 50 to 100 m. The unit is well exposed west of the Middlefield school.

Ghgl, coarse-grained, massive, rusty-weathering quartz-muscovite-plagioclase-garnet-biotite-staurolite-kyanite schist with garnets as large as 2 cm. Quartz lenses and ribbons are abundant and give outcrops a ribbed appearance. The contacts with Ch and pC are sharp. The thickness of this unit ranges from about 50 to 100 m. It is well exposed at Middlefield.

?pCcbl

Coles Brook Limestone

Medium- to coarse-grained calcite marble with accessory plagioclase, quartz, diopside, tremolite, and chondrodite, and secondary or retrograde chlorite, serpentine, and talc. Weathered surfaces are generally buff but locally reddish-brown bands are formed from the weathering of ankeritic calcite and pyrrhotite. The Coles Brook Limestone crops out in 3 parallel, north-trending bands in the eastern part of the Precambrian terrane. None of the bands extend north or south of the quadrangle boundary. The westernmost band is first detected 600 m north of Town Hill Road in the Factory Brook valley. There detailed drilling reveals 4 separate bands ranging from about 8 to 35 m thick. Southward to the Westfield River, only one layer is exposed. At the river, 2 layers are present, 8 and 20 m thick. Southward to the Westfield River, only one layer is exposed. At the river, 2 layers

are present, 8 and 20 m thick. Southward to Wade Inn Road, only one layer is present; at Jacobs Ladder Road, 2 layers are present. The middle band is only exposed in 2 localities, both south of Hopkins Lane. The easternmost band is exposed for only 300 m along strike. Septa of Hoosac schist (Ch) are spatially associated with the Coles Brook limestone, locally lying to the west or east of it and rarely interlayered with it (north of Town Hill Road). These relationships suggest that the Coles Brook Limestone is present along north-trending faults. This suggests that the Coles Brook, which at least tectonically crosscuts other Precambrian lithologic boundaries, may be Paleozoic in age, representing miogeosynclinal rocks or a facies of the Hoosac not represented further east in the Hoosac.

Unconformity?

Precambrian or Lower Cambrian

?pCs

Medium- to coarse-grained quartz-microcline-plagioclase-biotite spangly, non-rusty weathering schist with accessory muscovite (locally abundant), epidote, and magnetite. The quartz, microcline, and plagioclase are mortared. Muscovite and magnetite crosscut this mortared texture and yield a schistosity. Exposed only in a narrow fault-bounded band at the north end of the quadrangle. The band extends 1,500 m into the Peru quadrangle. The thickness of this unit ranges from zero to about 150 m.

pCb

Banded Gneisses

Generally non-rusty weathering, fine- to coarse-grained quartz-plagioclase-microcline-biotite gneiss. Layering ranges from 1 cm to 1 m and is evidenced by variation in the quartz:feldspar ratio and most commonly by concentrations of biotite. Accessory minerals may include clinozoisite or epidote, garnet, zircon, tourmaline, magnetite, muscovite, and hornblende. Generally the dominant foliation is parallel to compositional banding. Locally this compositional banding is cut by a later cleavage or slip cleavage. Where this is intense, the early foliation is transposed into a new orientation and the older foliation is obliterated. This younger foliation is cataclastic, marked by crushed quartz and feldspar strung out in trains and realignment of biotite and neocrystallization of muscovite. Other lithologies include minor amounts of pEw, pEs, and pEt which are not separable on this scale. They constitute about 5 percent of pCb. The stratigraphic relationship between pCb and other and other Precambrian units is not known.

pEw | pEwa | pEwc | pEwg | pEwr

Washington Gneiss

Highly varied unit. pEwa, medium- to coarse-grained hornblende-plagioclase-quartz-epidote-garnet gneiss with accessory sphene and opaque minerals. Non-rusty weathering and black. Quite massive. Mapped only at the

northwest corner of the quadrangle. pЄwc, calc-silicate gneisses including: feldspar-quartz-actinolite-garnet non-rusty weathering fine-grained well banded gneiss, locally calcareous, locally with diopside; rusty to sulfidic weathering quartz-feldspar-muscovite-biotite-pyrrhotite-graphite schist. Mapped only in the northwest part of the quadrangle. pЄwg, the most characteristic unit within the Washington is an orange-brown-rusty weathering massive to well layered quartz-feldspar-biotite-graphite-pyrrhotite gneiss or schist with accessory garnet and spangly muscovite. Schistose varieties are more massive. Gneissic varieties are commonly weathered to a ribbed surface. Granules of quartz are commonly milky white to light blue. All gradations occur between these 2 lithologies and well- but irregularly-bedded quartz-feldspar-garnet-biotite quartzite, commonly frosty blue or white weathering. Garnet is locally retrograded to chlorite or biotite. Quartzite forms about 20 percent of pЄwg and is distributed throughout the formation. It is particularly abundant between Leonhardt and Tyne Roads and between Plumb Road and Palmer Brook. pЄwm, coarse-grained calcite marble, with abundant tremolite, diopside, microcline, and graphite. Occurs just east of McNerney Road, southwest of Becket and on the west side of West Hill. The maximum thickness is about 20 m. Locally, within the members, different lithologies may be present, the member taking its name from the dominant lithology. Locally, non-rusty to slightly rusty well banded quartz-plagioclase-microcline-biotite gneiss are abundant, especially in the eastern areas of pЄwg.

The thickness of the entire formation is difficult to estimate because of recumbent folding and thrust faulting but is probably in excess of

400 m.

pЄt

Tyingham Gneiss

Chalky to light tan or gray weathering, plagioclase-microcline-quartz gneiss. Ferrohastingsite, garnet, and biotite are important accessory minerals in the southwestern part of the quadrangle. Ferrohastingsite is partially replaced by garnet and biotite to the north. Trace minerals include sphene, apatite, and euhedral zircon. The fabric ranges from weakly foliated (coarsest-grained), to well foliated in one direction, to strongly penciled due to two intersecting penetrative foliations (finest-grained). The latter is commonly associated with a cataclastic texture. In the southwest part of the quadrangle, some outcrops have 3 distinct foliations, the mineralogy of all being the same, with garnet porphyroblasts crosscutting the latest foliation. Northward, all minerals except magnetite are reoriented or cataclased. Locally, compositional banding is present, most commonly evidenced by layers 1 to 5 cm thick rich (up to 5 percent) in garnet. Isolated outcrops of pЄt are present in all Precambrian units but are not separately mapped.

Note: Foliated to non-foliated gray quartz-microcline-plagioclase-biotite fine-grained granite occurs in numerous isolated outcrops (bodies?) to small to map separately. They are restricted to the pЄb. Coarse-grained white to pink foliated pegmatite is common in the southeastern part of the quadrangle within the pЄb.

Note: pЄl (Lee Gneiss) is presumed to underlie the extreme southwest corner

of the Becket quadrangle but is not exposed. This relationship is suggested by reconnaissance to the west by this writer and mapping in progress by N. M. Ratcliffe.

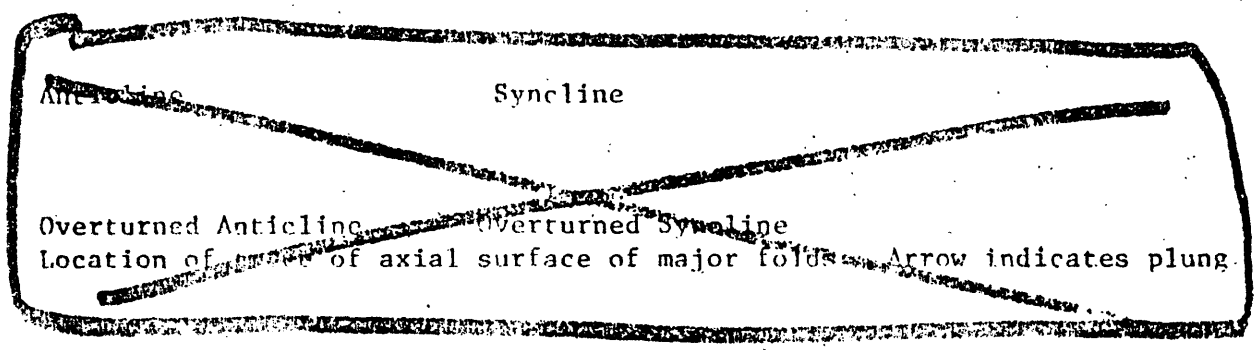
# Symbols Used

Bedrock outcrops examined in field

Contact

Thrust fault
Teeth on upper plate

Sillimanite isograd
Ticks on high intensity side




Planar Features

(Where 2 structural symbols are combined, their intersection is the point of observation.)

horizontal inclined vertical
Strike and dip of beds, tops unknown.

horizontal inclined vertical
Strike and dip of axial plane schistosity or penetrative schistosity of unknown origin.

horizontal inclined vertical horizontal inclined vertical
Probably parallel to bedding Transposed from original oventation
Strike and dip of compositional banding in Precambrian rocks

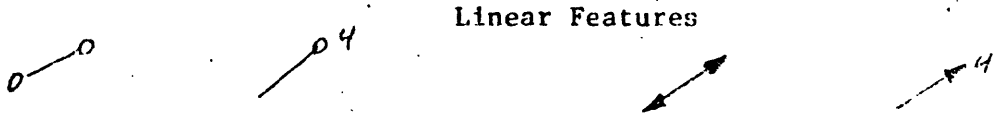
horizontal inclined vertical
Strike and dip of cleavage

inclined vertical inclined vertical
widely spaced closely spaced
Strike and dip of shears developed in Precambrian rocks

inclined vertical inclined vertical
tight fold open fold
Strike and dip of axial planes

right-handed left-handed symmetrical (open) symmetrical (tight)
Shear sense of folds

## Linear Features



horizontal inclined
Generally open folds which fold compositional banding or schistosity

horizontal inclined
Generally tight folds which have an associated axial plane foliation. May or may not fold an earlier foliation.

## Direction and plunge of fold axes

Schistosity 1 - Shistosity 2
Compositional banding - Schistosity
Cleavage - Schistosity
Pencils

Bedding - Schistosity

Direction and plunge of lineations caused by intersecting planar features

mineral lineation

Rodding

Glacial grove or striation

Prospect pit; M = marble, G = granite

Gravel pit

Selected

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