Surficial Geologic Map of the New Hampshire Part of the Hartland and North Harland 7.5-Minute Quadrangles, Vermont—New Hampshire

By

Carol T. Hildreth

2010

Correlation of Map Units

- Qw
- Qaf
- Qe
- Qst
- Qbb
- Qbh
- Qhl
- Qghh
- Qhs
- Qbg1
- Qbg2
- Qbg3
- Qbg4
- Qmlb
- Qmlg
- Qt

Holocene

Late Wisconsinan

Pleistocene

Quaternary
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Description of Map Units

A thin, discontinuous layer of windblown sand and silt, generally mixed with underlying glacial deposits by frost action and bioturbation, is present near the ground surface over much of the area but is not shown.

af ARTIFICIAL FILL—Manmade. Material varies from natural sand and gravel to quarry waste to sanitary landfill, includes highway and railroad embankments and dredge spoil areas. This material is mapped only where it can be identified using topographic contour lines or where actually observed. Minor artificial fill is present in virtually all developed areas and bridge abutments throughout the quadrangle. Thickness of fill varies.

Qal STREAM ALLUVIUM (HOLOCENE)—Sand, silt, gravel and muck in floodplains along present rivers and streams. As much as 3 m (10 ft) thick. Extent of alluvium indicates most areas flooded in the past that may be subject to future flooding. In places the unit is indistinguishable from, grades into, or is interbedded with wetland deposits (Qw).

Qw WETLAND DEPOSITS (HOLOCENE)—Muck, peat, silt and sand deposited in poorly drained areas. Generally 0.5 to 3 m (1 to 10 ft) thick. In places the unit is indistinguishable from, grades into, or is interbedded with Stream Alluvium (Qal deposits).

Qe EOLIAN DEPOSITS (HOLOCENE AND LATE PLEISTOCENE)—Sand and silt. Consists of windblown materials, some of which are dune-shaped, deposited on hillsides by winds that scoured Glacial Lake Hitchcock bottom deposits after the lake drained. Thickness is highly variable; 0.5 to 3 meters (1 to 10 feet) thick.

Qst STREAM TERRACE DEPOSITS (HOLOCENE AND LATE PLEISTOCENE)—Sand, silt, gravel, and occasional muck on terraces cut into glacial deposits in major stream valleys. These terraces formed in part during late-glacial time as the streams cut down their channels through local base level deposits following the retreat of the ice sheet, and the base level of the Connecticut River, to which they ultimately drain, also dropped after the draining of Glacial Lake Hitchcock. In some places, erosional scarps are present and mapped in this unit: in which case, several terrace levels may be represented by this unit but are not mapped separately because they are very narrow and sparse. In places, these deposits may be thin or missing on the present terrace surface, in which case the terrace is directly underlain by the material that was eroded out to form the terrace. From 0 to 5 m (0 to 15 ft) thick.
GLACIOFLUVIAL AND GLACIOLACUSTRINE DEPOSITS (PLEISTOCENE)

GLACIAL-LAKE HITCHCOCK DEPOSITS (PLEISTOCENE)—Sand, gravel, silt and clay deposited by glacial meltwaters in contact with or beyond adjacent ice as kame-delta, shore, nearshore, glaciofluvial outwash, and bottom-set beds of Glacial Lake Hitchcock (GLH), whose level was controlled by a glacial drift dam at Rocky Hill, Connecticut, and a spillway at New Britain, Connecticut. Glacial Lake Hitchcock occupied the Connecticut Valley for several thousand years between around 15,000-16,000 years ago and perhaps about 12,000-11,000 years ago. The front of the Late-Wisconsinan ice sheet may have still been in contact with the lake near its northern end near Burke, Vt., when the Rocky Hill drift dam failed and the lake drained. Unit Qhl consists mostly of bottom-set beds, mostly silt and clay varves (rhythmic couplets generally less than an inch [2.5 cm] thick) whose overall thickness is as much as 76 meters [250 ft] (Campbell and Hartshorn, 1980). Units Qhls (near Saint Gaudens Road) and Qhgh (near Hell Hollow and Mill Village) consist of kame-delta, fan and glaciofluvial outwash deposits built into and graded to the lake. A topset-foreset (t-f) contact elevation of a GLH “stable phase” delta at Etna in the Enfield quadrangle northeast of this area was measured at 197.5 meters (657 ft) by Koteff and Larsen (1989), and based on their measurements of t-f contacts throughout the valley, they calculated the water plane rises up to the N.21° W., in the amount of 0.9 m/km (4.74 ft/mi) graded to the “stable phase” 25 m (82 ft) New Britain, CT, spillway level. This water plane tilt was created by post-glacial uplift. In addition, several “Post-stable Phase” deltas have been identified in the valley, including a 172-meter (565-ft) delta surface in the Sand Hill section of Hanover, NH, near Storrs Road. The water level(s) associated with units Qhls and Qhgh in this area have not been determined due to lack of exposure of t-f contacts in them. Unit Qhgsf is an esker (termed the Connecticut Valley Esker) that was deposited by meltwater in a tunnel within the glacier and beneath the level of GLH, so that Qhgsf was subsequently buried by draped GLH lake-bottom silt and clay deposits (Qhl) several meters or more thick. Unit Qhgsf is viewed directly only where the downcutting Connecticut River (or its tributaries) or gravel pit excavations have exposed it, but its presence beneath the surface can be interpreted by topographic ridges, as indicated on the Vermont side of the river here. Unit Qhgsf consists of subaqueous fan deposits laid down by meltwater into GLH at the mouth of the Qhgsf tunnel into GLH, also subsequently covered by draped GLH lake-bottom silt and clay deposits several meters or more thick, thus Qhgsf deposits are also only viewed directly where exposed by the downcutting Connecticut River or its tributaries or by gravel pit excavations.

Qhl Silt, fine sand and clay lake-bottom and nearshore deposits; as much as 76 meters (250 ft) thick.

Qhgh Sand, silt, and gravel in kame-delta, shore, nearshore, and outwash deposits; as much as 30 meters (100 ft) thick.

Qhls Sand, silt, and gravel in kame-delta, shore, nearshore, and outwash deposits; as much as 30 meters (100 ft) thick.

Qhgsfe Sand and gravel esker deposits draped by 1-6 meters (3-20 ft) of silt, clay, and fine sand lake-bottom deposits. Esker is as much as 30 meters (100 feet) thick.

Qhgsf Sand, fine sand, and gravel subaqueous fan deposits draped by 1-6 meters (3-20 ft) of silt, clay, and fine sand lake-bottom deposits. Subaqueous fan deposits are as much as 15 meters (50 feet) thick.

GLACIAL LAKE BLOW-ME-DOWN BROOK DEPOSITS (PLEISTOCENE)—Sand, gravel, silt and clay deposited by glacial meltwaters in contact with or beyond adjacent ice as kame-delta, shore, nearshore, glaciofluvial outwash, and bottom-set beds of Glacial Lake Blow-Me-Down Brook (GLMBDB), whose level was first controlled by a 940+ foot (287+ meter) elevation threshold in the hills SSW of Cornish Flat; GLMBDB meltwaters flowed thence down Mill River into GLH. As the ice front receded northward, GLMBDB found a lower outlet toward GLH through till deposits blocking the northern end of its valley (near the intersection of Farm and Columbus-Jordan Roads); which outlet was eventually cut down to a level that drained GLMBDB completely. It appears that before this new outlet for GLMBDB was eroded very much, it may have shared, for a relatively short time, the same water plane with Glacial Lake Meriden (GLM), to the north, but as GLMBDB threshold lowered below about 840 ft [256 m], GLM developed a threshold in the headwaters of Penniman Brook around that elevation. Unit Qblb consists of lake-bottom sand, silt, and clay deposits. Units Qbg1-4 are interpreted to be successively younger kame-delta, fan and glaciofluvial outwash deposits built into and graded to the lake as the ice front receded northward up the valley.
Qblb  Silt, fine sand and clay lake-bottom and nearshore deposits; as much as 9 meters (30 ft) thick.

Qbg4  Sand, silt, and gravel in kame-delta, shore, nearshore, and outwash deposits; as much as 6 meters (20 ft) thick.

Qbg3  Sand, silt, and gravel in kame-delta, shore, nearshore, and outwash deposits; as much as 6 meters (20 ft) thick.

Qbg2  Sand, silt, and gravel in kame-delta, shore, nearshore, and outwash deposits; as much as 6 meters (20 ft) thick.

Qbg1  Sand, silt, and gravel in kame-delta, shore, nearshore, and outwash deposits; as much as 6 meters (20 ft) thick.

GLACIAL LAKE MERIDEN DEPOSITS (PLEISTOCENE)—Sand, gravel, silt and clay deposited by glacial meltwaters in contact with or beyond adjacent ice as delta, shore, nearshore, glaciofluvial outwash, and bottom-set beds of Glacial Lake Meriden (GLM), which initially probably shared the GLBMDB waterplane until that lake’s threshold was cut down below about 840 ft (256 m) elevation and GLM established its own threshold at the drainage divide between Penniman and Bloods Brooks at between 840-860 ft (256-262 m) elevation. Unit Qmlb consists of lake-bottom sand, silt, and clay deposits. Unit Qmlg consists of kame-delta, fan and glaciofluvial outwash deposits built into and graded to the lake. GLM existed because the ice front blocked drainage northward down Bloods Brook valley, but as the ice front melted northward, meltwaters found lower outlets, and GLM drained completely into the Unit Qbh system.

Qmlb  Silt, fine sand and clay lake-bottom and nearshore deposits; as much as 9 meters (30 ft) thick.

Qmlg  Sand, silt, and gravel in kame-delta, shore, nearshore, and outwash deposits; as much as 6 meters (20 ft) thick.

Qph  ICE-CONTACT GLACIOFLUVIAL AND GLACIOLACUSTRINE DEPOSITS GRADED TO A GAP BETWEEN PROSPECT AND HOME HILLS (PLEISTOCENE)—Sand, silt, and gravel deposited between the adjacent ice front and the 680-700 foot (207-213 meter) elevation gap. As much as 40 feet (12 meters) thick.

Qbh  GLACIOFLUVIAL AND GLACIOLACUSTRINE DEPOSITS OF BLOODS, HUBBARD, HILLIARD AND BEAVER BROOKS (PLEISTOCENE)—Sand, silt, gravel deposited by meltwater streams originating in the hills in the northeast edge of the map area, flowing down the Hubbard Brook valley, thence flowing SW toward the headwaters of Hilliard, while adjacent ice blocked drainage down Bloods Brook, where some ponding occurred. In the Hilliard Brook headwaters, meltwaters then turned westward down the headwaters of Beaver Brook via Mud Pond and Puckerpod Swamp to eventually enter GLH. However, before taking the Beaver Brook route entirely, it appears that in the early stages of this drainage history, after passing through the Mud Pond area, Qbh meltwaters took a southerly course through Cooney Hollow, thence to GLH in the Plainfield area via the Shipman Brook drainage. Thickness is variable; as much as 20 feet, (6 meters).

Qbb  GLACIOFLUVIAL DEPOSITS OF BLOODS BROOK (LATE PLEISTOCENE)—Sand, silt, gravel and occasional muck on deposited on terraces cut into glacial deposits in Bloods Brook valley. These terraces formed during late-glacial time as Bloods Brook cut down its channel to enter GLH, following the retreat of the ice sheet northward up its valley and the base level of the Connecticut River valley also dropped after the draining of Glacial Lake Hitchcock. These deposits probably represent the lower levels (“Post-Stable Stage”) of GLH to the Lily Pond Stage. In places, these deposits may be thin or missing on the present terrace surface, in which case the terrace is directly underlain by the material that was eroded out to form the terrace. From 0 to 5 m (0 to 15 ft) thick.

Qt  TILL (PLEISTOCENE)—Light- to dark-gray, nonsorted to poorly sorted mixture of clay, silt, sand, pebbles, cobbles and boulders; a predominantly sandy diamicton containing some gravel and sand. Varying proportions of silt and sand form the matrix, which ranges from loose to compact and contains a variety of irregularly shaped rock fragments, most of which are less than 4 inches (10 cm) long. Moar of the uplands in the quadrangle are mantled by till deposited directly by the ice sheet. Generally underlies most other deposits. Thickness varies and generally is less than 6 m (20 ft) but is probably more than 30 m (100 ft) under some drumlins and streamlined hills. Denny (1958,
p. 76-77) described sandy and compact till in the valley of Stoney Brook, near the south edge of the adjacent Enfield map.

Bedrock Exposures. Not all individual outcrops are shown on the map. Solid dots indicate individual outcrops; ruled pattern indicates area of abundant exposures and areas where surficial deposits are generally less than 3 meters (10 feet) thick. Mapped in part from aerial photographs, soil surveys (Homer, 1999; Simmons and others, 1949), and previous geologic and materials maps (Denny, 1958; and Lyons, 1949).

Glacial striation – Point of observation is either at point of arrow or at dot at center of arrow. Line show ice-flow direction inferred from striations on bedrock, Number is azimuth (in degrees) of flow direction.

Direction of meltwater or meteoric water flow over outwash, alluvium or till deposit.

Meltwater threshold of glacial deposits; arrow shows direction of drainage. Elevation range given in feet.

Contact – Boundary between units, approximately located.

Esker ridge crest—Chevrons point in inferred direction of meltwater flow.

MATERIALS OBSERVATIONS—Surficial materials in exposures, well holes and test holes. Letters indicate texture in decreasing order of abundance. Number indicates thickness in feet.

g = gravel,  b = boulder,  c = cobble,  p = pebble

s = sand (as separate beds; not including sand as matrix of gravel)

F = very fine sand,  L = silt,  Y = clay,  t = till,  st = sandy till

B = bedrock,  R = refusal

WELL- AND TEST-HOLE DATA—Approximately located from New Hampshire Department of Environmental Services, Water Resource Division, Concord, N.H

Well or test hole reported as ending in bedrock or refusal. Number is reported depth to bedrock.
TEXTURE OF STRATIFIED DEPOSITS—Indicated to a depth of at least ½ meter (~1.5 feet).

- Pebble to boulder gravel
- Mixed sand and gravel
- Sand
- Sand, fine sand, silt and clay
- Borrow pit
- Borrow pit, abandoned
- Quarry

REFERENCES


Rhythmical graded beds in subaqueous fan deposits (Qhgsf), laid down beneath Glacial Lake Hitchcock beyond the mouth of the ice tunnel in which the associated nearby Connecticut Valley Esker formed. Each graded bed consists of a lower cross-bedded sand section (light-colored that grades upward to a darker silty section. Beds dip gently southward into the pit face. These units probably record daily pulses of sedimentation. The very uppermost thin silty layers are lake-bottom deposits draped over the fan deposits after the ice front retreated north of the area. Graded beds here are as much as 3 feet (1 meter) thick. Hartland Quad.