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SURFICIAL GEOLOGY OF THE WINNISQUAM LAKE QUADRANGLE, BELKNAP COUNTY, NEW HAMPSHIRE

By

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2001

DESCRIPTION OF MAPPED UNITS

NOTE: Correlation between isolated deposits and map units is tentative.

A discontinuous thin layer of windblown sand and silt less than 1 ft (1\3 m) thick is irregularly disbursed in the quadrangle, but has not been mapped. It overlies and is mixed with the older surficial deposits.

al — ALLUVIUM (HOLOCENE)—Mostly pebble to boulder gravel with some sand, silt , and muck in flood plains along present streams and brooks. Estimated to be as much as 10 ft (3m) thick. In places grades into, and is indistinguishable from swamp deposits (s)

s — FRESHWATER SWAMP DEPOSITS (HOLOCENE)—Muck, peat, silt, and sand in poorly drained areas. Estimated to be 1 to 15 feet (0.5-5 m) thick. In places gradational into alluvium (al)

STRATIFIED GLACIAL SAND AND GRAVEL DEPOSITS (PLEISTOCENE)—Interlayered sand and gravel deposits are irregularly disbursed throughout the quadrangle. The sand deposits range from fine to coarse-grained, are well to poorly sorted and locally include thin layers of silt and clay; gravel layers are mostly poorly sorted and include pebble, cobble and boulder gravels. The thickness of individual deposits varies widely throughout the quadrangle. The sands and gravels were deposited in streams graded to glacial lakes, as delta deposits formed at the heads of glacial lakes and as fine grained silt and clay in glacial lake bottoms

UNCORRELATED GLACIOLACUSTRINE AND GLACIOFLUVIAL DEPOSITS (PLEISTOCENE)

wi — Wickwas Lake deposits-- Sand and gravel deposits, as much as to 28 ft. (8 m) thick, underlie the area surrounding Wickwas Lake west of Meredith Center. The sand is fine-to medium-grained, well stratified and widely disbursed; thin layers of mostly pebble and cobble gravels although present are not widely distributed. These relatively thin deposits were graded to a small glacial lake whose level was controlled by a till deposits across a south trending valley east of Meredith Center

pe — Pemigewasset Lake deposits--Sratified glacial deposits as much as 36 ft (11m) thick underlies the area around Pemigewasset Lake in the northwest part of the quadrangle. These deposits, which consist mostly of interbedded layers of fine-to medium-grained sand, also include some beds of pebble and cobble gravels. These sand and gravel deposits form the southern extension of the sands and gravels underlying an adjoining area to the north in the Holderness quadrangle. These sands and gravels were graded to a small glacial lake whose level was controlled by a dam of till across a westerly trending valley north of the quadrangle

bb — Bagoon Brook deposits--Interbedded glacial sand deposits, up to 22ft. (6.5m) thick, underlies the northwest corner of the quadrangle. These are the eastern extension of more widespread sand and gravel deposits underlying the Bagoon Brook valley in the adjoining Bristol Quadrangle

nh — New Hampton deposits--Deposits of sand and gravel estimated to be as much as 42 ft. (13m) thick underlie the area just east of Spectacle Pond in the northwest part of the quadrangle along the west border. The thick deposits of sand are well layered and range from fine-to medium-grained. The gravels are believed to represent top set beds in a deltaic sequence. These deposits form the eastern extension of thicker more widespread sand and gravel deposits underlying a large area east and southeast of New Hampton in the Bristol Quadrangle

e

Eskers--These deposits are present as small linear ridges of mixed fluvial sand and gravel, generally poorly sorted although some exposures display some sorting. The sand is coarse-to medium-grained and the associated gravels include well rounded cobbles, boulders , and pebbles. The eskers have variable trends from northeast to northwest, generally do not exceed .3 mi. (.5 km) in length, and are commonly associated with kame and kettle topography. A custer of eskers is located in the southwestern part of the quadrangle

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Uncorrelated sand and gravel deposits--Several isolated and widely scattered sand or sand and gravel deposits are exposed within areas underlain by till. These sand and sand and gravel deposits are less than .2mi (.3km) in their longest dimension. The sand is mostly thickly layered and fine-to medium-grained and the gravel deposits are mostly pebble to cobble gravels with some thin interbedded coarse sand beds. It is estimated that the thickness of these deposits ranges from 25 ft (4.5 m) to 40 ft (12m) thick.

GLACIOLACUSTRINE AND GLACIOFLUVIAL DEPOSITS (PLEISTOCENE) ASSOCIATED WITH SALMON BROOK AND HERMIT LAKE

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Hermit Lake deposits--Stratified surficial deposits include those laid down in glacial streams, deltas, and glacial lakes. Cobble, pebble, and boulder gravels and sand deposits are widely dispersed. Most of the area north of Hermit lake is underlain by gravel deposits with some minor interlayers of coarse-grained sand. Thicker layers of fine-to medium-grained sand, locally interlayered with thin silt beds are present farther south around Hermit Lake. The thickness of these gravel and sand deposits varies but is estimated to be as much as 46 ft (14 m) thick. They were deposited in, or graded to a small glacial lake whose level was temporarily controlled by an ice dam across the valley at North Samborntan. Hermit lake is drained southward into Salmon Brook a tributary of the Winnisquam River

hts

Upper Salmon Brook stage--South of North Sambornton the upper Salmon Brook valley is underlain by cobble, pebble, and boulder gravels and coarse-to fine-grained sand layers. These deposits are as much as 31 ft (9m) thick and were laid down in and graded to a glacial lake whose level was controlled by an ice and till dam in Cawley Pond

sb

Salmon Brook stage--The Salmon Brook valley west and northwest of Gaza is underlain by stratified gravel and sand deposits. The gravels, which characteristically contain more cobbles and boulders than pebbles, commonly contain some thin layers of coarse sand. In places thick layers of fine-to medium-grained sand is present. The Salmon Book stage deposits are estimated to be as much as 63 ft (19 m) thick. These gravel and sand deposits were graded to a glacial lake whose level was controlled by a bedrock dam across Salmon Brook in the southwestern part of the map.

sbl

Lower Salmon Brook stage--The deposits of this stage, which is located in the southwestern part of the map area, represent the northern extension of sand and gravel deposits underlying parts of the adjoining Northfield and Franklin Quadrangles to the south and southwest. Thick beds of fine-to medium-grained sand, interbedded with thinner beds of silt and rarely clay, are widespread and probably represent lake bottom deposits. The gravels, which include cobbles, pebbles and rare boulders and associated thin layers of coarse sand, are believed to represent deltaic deposits. Together these surficial deposits, which are as much as 260 ft (79 m) thick, were graded to a glacial lake whose level was controlled by a spillway in the Franklin Quadrangle

GLACIOLACUSTRINE AND GLACIOFLUVIAL DEPOSITS (PLEISTOCENE) ASSOCIATED WITH WINNISQUAM LAKE

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Swains Pond deposits--Sand and gravel deposits associated with Swains Pond are in the north east part of the quadrangle near the northern end of Winnisquam Lake. The gravels with some minor thin layers of coarse sand were deposited in a delta at the head of the sequence and the finer-grained and thicker beds of sand were deposited in the glacial lake that occupied the Winnisquam Lake valley. These deposits are as much as 38 ft (11.5 m) thick and they were graded to a large glacial lake whose level was controlled by an outlet in the adjoining Northfield quadrangle to the south

bl

Black Brook deposits--Sand and gravel deposits underlie the Black Brook valley that is on the west side of Winnisquam Lake approximately 3 miles north of Winnisquam. Like the Swains Pond deposits the gravels and sands underlying Black Brook valley are also deltaic and glacial lake deposits that are estimated to be as much as 37 ft (11 m) thick

ws — Winnisquam deposits--Fine-to medium-grained, thickly layered sand underlies the Winnisquam area in the southeastern part of the quadrangle. These deposits, estimated to be at least 32 ft (10 m) thick, were graded to the glacial lake that occupied the Winnisquam Lake valley

TILL(PLEISTOCENE)

t — Till--Till was deposited directly by glacial ice and ranges from those deposits with a compact clay rich matrix that are mostly an olive gray color to those that are less compact and have a sandy matrix with an olive greenish color. Commonly the more compact till is locally rust colored due to oxidation. Most of the till is a stony non-sorted to poorly sorted unconsolidated assemblage of clay, silt, sand, pebbles, cobles, and boulders (diamicton). Locally lenses of sand and gravel are present.. The proportions of silt, clay, and sand in the matrices of tills varies widely; where the proportion of clay is high the till is characteristically poorly drained, whereas tills with a higher percent of sand in the matrix are moderately well drained. The matrix contains a variety angular rock fragments that range from pebble to cobble size; boulders commonly are seen at the surface. Some areas, especially along the shores of Winnisquam Lake (see map), are underlain by a till with a sandy matrix and contain concentrations of fairly large boulders. The origin of these boulder concentrations is uncertain. They may be the result of ablation of the sandy till or part of a moraine deposited during a slight readvance of the glacier. Thompson and others (1999) attributed somewhat similar boulder concentrations in the Bethlehem area as a moraine. Drumlins, streamlined hills of till which were shaped by moving ice, are present in different parts of the map area. The drumlins are outlined on the map and appear to be in those areas underlain by the compact clay rich olive gray till.

af afg — ARTIFICIAL CUT AND FILL—Manmade. Composition varies from natural sand and gravel to quarry wastes. Some artificial fill areas are to small to show at the map scale. Graded areas (afg) include some cut and fill. Depth of cuts and thickness of fill are variable.

BEDROCK EXPOSURES—Individual outcrops not shown completely. Solid pattern is individual outcrop; ruled pattern indicates areas of abundant exposure and areas where surficial deposits are generally less than 10 ft (3m) thick.

Contact

Approximate position of stagnant ice position during deposition of mapped sequence.

Long axis of drumlin—Generally parallel to inferred direction of ice movement.

Glacial grooves and striations—Number is degrees east (e) or west (w) of south, observations at the tip of arrow.

Temporary melt-water channel

Boulder debris accumulations

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

3ps / 17s — g, gravel; b, boulder; c, cobble; p, pebble; s, sand (as separate beds, not including sand in matrix of gravel); F fine sand; S, silt; cl, clay; t, till

20(650) — WELL-HOLE 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. Number is depth to bedrock in feet. Elevation of bedrock above mean sea level is shown in parentheses. Information from New Hampshire Department of Environmental Services, Water Resources Division.

TEXTURE OF STRATIFIED DEPOSITS—Indicated to a depth of 3 ft (1m)

Mostly pebble to boulder gravel

Mixed sand and gravel

Sand with minor pebble gravel, fine sand, and silt

Pit in surficial maaterials

BEDROCK EXPOSURES--Individual outcrops not shown completely. Solid pattern is individual outcrop; ruled pattern indicates abundant exposure and areas where surficial deposits are generally less than 10 ft (3 m) thick.

REFERENCES

Thompson, W. B., Fowler, B.K. Flanagan, and Dorion, C.C., 1999, Deglaciation of the northwestern White Mountains, New Hampshire, in Thompson, W. B., Fowler, B.K., and Davis, P. J., eds., Late Quaternary history of the White Mountains, New Hampshire and adjacent southeastern Quebec: Deographic physique et Quaternaire, v. 53, no. 1.