Surficial Geology of the
Danbury quadrangle, Conn.
Woodrow Thompson
Feb., 1975

INTRODUCTION

The Danbury quadrangle is located in southwestern Connecticut, near the New York border. Precambrian crystalline rocks form a highland in the western third of the quadrangle. The remainder is underlain by Paleozoic igneous, metasedimentary, and metavolcanic rocks. The bedrock geology of the quadrangle has been mapped by Clarke (1958).

The topography of the Danbury quadrangle is very hilly. It is rough where controlled by bedrock outcrops, but many hills are smoothed by glacial till. The Still River drains most of the map area. It originates in the southwest corner of the quadrangle and flows north to join the Housatonic River in the New Milford quadrangle. A short segment of the Housatonic is included in the northeast corner of the Danbury quadrangle. Other major water bodies in the quadrangle are Lake Candlewood and Margerie Lake, which are impounded by dams.

GLACIAL AND POSTGLACIAL DEPOSITS

Till

There are two types of till in the quadrangle. They are here called the "upper till" and "lower till" because of their stratigraphic relationship to each other. The moist color of the upper till varies from light olive-brown through olive to light olive-gray (2.5Y 5/4 - 5Y 5/3 - 5Y 6/2). Near-surface oxidation has occurred at some localities, but the till is mostly unoxidized. It has a friable, sandy texture; and it contains many stones of pebble to boulder size. Basal and ablation facies are locally distinguishable in the upper till. The ablation facies is very loose and contains lenses of washed sediment. The basal facies is compact and commonly contains inclusions of lower till. The upper and lower tills are thoroughly mixed in some places.

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The lower till occurs as a thick deposit on most of the drumlins in the quadrangle. Its moist color ranges from olive-brown through olive to dark olive-gray (2.5Y 4/4 - 5Y 4/3 - 5Y 3/2). The lower till is more compact and finer-grained than the upper till. It is generally oxidized and has a platy structure that is caused by closely spaced sub-horizontal joints. A single excavation revealed carbonate-rich lower till that was structureless and unoxidized below a depth of about 10 feet.

Few localities show the two tills in superposition. The best two-till exposure in the Danbury quadrangle is in New Fairfield. It is located on the hill east of the village and just west of Disbrow Pond.

Glacial meltwater deposits

Meltwater deposits in the Danbury quadrangle have been subdivided into chronologic units. In general these units are morphologic sequences as described by Koteff (1974). Their deposition was controlled by successively lower meltwater spillways as the Late Wisconsinan glacier retreated from the area. Included here are both glacial stream deposits and sediments deposited in or graded to proglacial lakes. Some of the map units (such as Qk and Qkb) are subdivisions of fluvial-lacustrine sequences, and have been classified according to whether they were deposited on a lake bottom or in meltwater streams that fed the lake. Other map units (such as Qsr and Qpb_2) probably include several poorly defined sequences that were graded to a common lake level.

<u>Glacial stream deposits.</u> - Meltwater streams deposited sand, gravel, and silt during the deglaciation of the Danbury quadrangle. These sediments commonly occur as kame deposits and exhibit the poor sorting and collapsed bedding that are typical of ice-contact meltwater deposits. The map units distinguished here are Qgb, Qgs, and Qgp_{1-3}. Unit Qgb is an ice-contact

deposit that was graded to a bedrock threshold near the northern border of the Bethel quadrangle. The Saugatuck unit (Qgs) occurs as scattered kames and ice-channel fillings. They were graded to the divide between the Still and Saugatuck River basins, which is also located in the northern part of the Bethel quadrangle. Glacial stream sediments in the vicinity of Pond Brook have been divided into three units: Qgp_1, Qgp_2, and Qgp_3. The first two units were deposited directly into the head of the Pond Brook valley, near the east border of the quadrangle. Their elevation difference is due to the thinning and retreat of the stagnant ice margin in this area. Deposition of unit Qgp_3 was controlled by the divide between Pond Brook and the Still River.

Glacial lake deposits. - Glacial Lake Danbury was named by Hokans (1952), though its existence had been previously suggested by Harvey (1920). The lake occupied most of the lowland area that is now drained by the Still River. Deposits from two of its stages occur in the Danbury quadrangle. They are the Saugatuck River stage, which drained southward across the Saugatuck divide, and the Pond Brook stage, which was controlled by the Pond Brook divide. The inferred shorelines of these lake levels are shown on the map. The glaciofluvial units included here are Qsr, Qsr_{1-2}, and Qpb_{1-2}. Field evidence shows that they were deposited in an ice-contact environment by meltwater streams that entered the lake from the north, east, and west. The only well-exposed glacial lake delta in the quadrangle is in unit Qsr, in the Germantown district of Danbury. The contact between the topset and foreset beds is at an altitude of about 440 feet. This was presumably the local surface altitude of glacial Lake Danbury during the Saugatuck River stage. Other probable deltas are indicated on the map, although their internal structure is not exposed or has been obscured. Units Qsrb and Qpbb are lake bottom deposits of sand, silt, and clay. Rhythmic bedding is locally well developed and probably represents seasonal deposition. The hillside deposits of Qpbb near the north border of the quadrangle are probably just a thin veneer over the underlying till.

Glacial Lake Kenosia was located in the Mill Plain Swamp basin, in the southwest corner of the quadrangle. The lake drained eastward across a till upland and into glacial Lake Danbury. Outwash that was graded to this lake (unit Qk) forms the gently sloping surface at Mill Plain Cemetery. Unit Qk may be traced westward into the Brewster quadrangle as a series of successively higher kame terraces. Unit Qkb was deposited on the lake bottom.

A third glacial lake is believed to have existed in the Lake Candlewood valley. Present day Lake Candlewood is artificial and was created by damming the north-flowing Rocky River. The former drainage divide between the Rocky and Still River basins was very near the south end of the modern lake. It was apparent to Harvey (1920) that a proglacial lake occupied the Rocky River basin as it was deglaciated. She described well logs from the Rocky River valley that the present investigator interprets as recording lake bottom sediments. Although the area is now flooded, patches of sand and gravel occur as scattered islands and peninsulas that stand 10 feet or less above lake level. Most of these deposits were probably graded to glacial Lake Candlewood, and they are designated as unit Qc.

Undifferentiated deposits. - Unit Qgu includes water laid deposits of uncertain age and origin. In some cases they may be unmodified patches of glaciofluvial or glaciolacustrine sediments. Alternately, they may be recent stream alluvium, or glacial meltwater deposits that have been reshaped by subsequent erosion.

Stream terrace deposits

A stream terrace unit (Qst) occurs along much of the Still River. Its surface lies 10 to 30 feet above the modern flood plain. In a few places there are two terrace levels that are sufficiently distinct to be shown on the map. The Still River formed these terraces when it flowed at higher levels than at present. The unit is entirely depositional in some places, while elsewhere the terraces have been cut into older glacial stream or lake sediments. Exposures south of Brookfield show 4 to 8 feet of sand and pebble gravel overlying silty bottom deposits of glacial Lake Danbury. Cross-bedding in the sand and gravel indicates a northward flow direction for the currents that deposited the terrace alluvium.

Alluvium and swamp deposits

Recent alluvium (unit Qal) underlies the flood plain of the Still River and also occurs along a few of the smaller streams. Flooding is frequent along the Still River and occasionally covers the lowest stream terrace surfaces between Danbury and Brookfield. Greatly increased construction activity in recent years has caused a large reduction in flood plain and infiltration areas in the vicinity of Danbury. It is probable that this situation has increased the frequency and magnitude of flooding in the Still River valley.

Swamp deposits (unit Qs) are most extensive in the southern part of the Still River basin, where they overlie glacial lake bottom sediments. Smaller swamps occupy poorly drained areas in the upland region.

GLACIAL AND POSTGLACIAL HISTORY

Studies of the two tills have shown that the lower till was deposited by an earlier glaciation than the upper till (Pessl and Schafer, 1968). The age of the lower till is uncertain, but regional studies suggest that it is probably of Early Wisconsinan (Altonian) age. The upper till was deposited by the Late Wisconsinan (Woodfordian) glaciation. The orientations of both bedrock striations and the long axes of drumlins indicate an ice advance direction of 150 to 175 degrees in the Danbury quadrangle.

Debris from shear planes in the active ice was the probable source of most meltwater deposits during the final deglaciation of southern New England (Koteff, 1974). The active ice in the Danbury quadrangle was fringed by a stagnant zone in which ice-channel fillings developed. Meltwater emerged from the stagnant zone and deposited both glacial stream and glacial lake sediments. The meltwater stream sediments were usually deposited in contact with residual ice masses, and the ice-contact heads of such deposits mark successive positions of the retreating stagnant ice margin (indicated on the map).

Meltwater drainage was ultimately across the divide between the Still and Saugatuck Rivers when the ice margin was in the southern third of the Danbury quadrangle. The elevation of this spillway is approximately 410 feet. Unit Qgb is the oldest meltwater deposit. It was formed when the ice began to retreat from the southeast corner of the quadrangle. Meltwater graded the Qgb deposit to a local bedrock spillway just south of the quadrangle border. Further ice retreat resulted in the deposition of unit Qgs in the vicinity of Limekiln and Sympaug Brooks. The Qgs deposits were graded directly to the Saugatuck divide.

The Saugatuck River stage of glacial Lake Danbury commenced when the stagnant ice zone was receding from the southern end of the Still River basin. The lake level was controlled by the Saugatuck divide; and units Qsr, Qsr_{1-2}, and Qsrb were deposited during this period in the lake's history. Lake bottom sand deposits (unit Qsrb) accumulated in pockets among stagnant ice blocks and now stand above the valley floor at elevations of 360 to 400 feet. An example is seen north of the sewage treatment plant in the Beaverbrook district of Danbury. Subsequent lake bottom deposits accumulated at lower levels.

The glaciofluvial deposits that were graded to the Saugatuck River stage lake level have been subdivided into two units (Qsr_1 and Qsr_2) in the eastern part of the quadrangle. These deposits were built from successive ice margin positions that are indicated by their heads of outwash. The positions of ice-contact sequence heads suggest that unit Qgp_1 in the Pond Brook valley was deposited contemporaneously with unit Qsr_1. Units Qgp_2 and Qsr_2 are similarly correlated.

Local ice margin positions have been shown for the undifferentiated Saugatuck River stage deposits (Qsr) in the Danbury area, but their correlation with units Qsr_1 and Qsr_2 is uncertain. Ice retreat in the Mill Plain Swamp area resulted in the deposition of Qsr stream sediments, followed by the opening of glacial Lake Kenosia. Accumulation of Qkb sediments began at this time. The youngest Qsr deposits were formed when the ice margin stood at what is now the south end of Lake Candlewood. A large quantity of sand and gravel was graded to glacial Lake Danbury from this position, including the Germantown delta. Qkb deposits continued to build up in late Qsr time; and meltwater streams graded unit Qk to glacial Lake Kenosia as the ice locally retreated toward the New York border. Stagnant ice is believed to have blocked the Still River valley southeast of Beaver Brook Mountain throughout Qsr time. Otherwise glacial Lake Danbury would have fallen to the level of the Pond Brook stage.

Unit Qgp_3 was deposited as the ice margin withdrew from the divide between the Still River and Pond Brook. This divide was the base level to which the glacial stream sediments of unit Qgp_3 were graded. Then the ice in the Still River valley thinned to the point where glacial Lake Danbury escaped across the divide and fell to the level of the Pond Brook stage. The elevation of the Pond Brook spillway is approximately 380 feet. The ice margin was close to the south end of the Candlewood valley during the earliest part of the Pond Brook stage. Sand and gravel from this part of the ice margin (unit Qpb_1) was graded to glacial Lake Danbury, and fine-grained sediments were deposited on the lake bottom (unit Qpbb).

Further ice retreat uncovered the Rocky River valley, and glacial Lake Candlewood was established. The elevation of the spillway at the divide between the Still and Rocky River basins was about 430 feet. Water from this lake drained across the Qpb_1 deposits and probably carved the erosional scarp northwest of Great Plain School. Unit Qc was graded to glacial Lake Candlewood as the ice retreated from the northern part of the Danbury quadrangle.

Along with unit Qc, the Brookfield area Qpb_2 and Qpbb deposits are the youngest correlated meltwater deposits in the quadrangle. Fine-grained lake bottom sediments of unit Qpbb were deposited in the central and eastern parts of the Still River valley. They have since been locally concealed at the surface by stream terrace and flood plain alluvium. The Qpb_2 deposits lie along the west side of the Still valley near Brookfield. These kame deposits are problematical because they seem too low to have been graded to the Pond Brook stage lake level. The only lower outlet from the valley is where the Still River enters the Housatonic in the New Milford quadrangle. A northward meltwater drainage to this point could not have occurred because the ice margin blocked the valley north of Brookfield. There is no topographic expression of meltwater flow direction in the kames. However, there are several deposits with undisturbed bedding in which there was unequivocal southward flow. Some of the coarse ice-contact gravels may have been deposited as ice-channel fillings in the glacial stagnation zone. An example is the gravel ridge in the pit complex west of Brookfield village. Other Qpb_2 deposits are sand hills that may be small kame deltas. One such deposit is the partially excavated hill just north of the power line and west of the village. The remainder of the Qpb_2 kames are sand and gravel deposits that are commonly slumped and faulted. They may have been dumped into local meltwater pools in the stagnant ice; or the ice margin may have retreated so rapidly that they were not built up to grade with the lake surface. In either case, an unstable glacial stream environment was soon followed by deposition of undisturbed lake bottom sediments. Exposures west of Brookfield show that flat lacustrine silt beds were laid down above greatly deformed lacustrine sand beds, which in turn had been deposited on coarse glacial stream sediments.

The third and fourth levels of glacial Lake Danbury developed after the ice front had retreated to the New Milford quadrangle. Lake water continued to occupy the northern part of the Still River valley, but sedimentation was negligible within the map area. As glacial Lake Danbury withdrew from the valley, the modern Still River developed on the former lake bed. Bedrock contours near Brookfield village show that the river was probably diverted from a preglacial course that lay along the west side of the valley. The abandoned channel had been blocked by mounds of sand and gravel (unit Qpb_2). In late glacial and early postglacial time the Still River reworked the glacial deposits in the valley and formed the terraces that stand above the present flood plain. At the same time, the postglacial Rocky River was establishing its northward course after ice retreat from the New Milford area had caused the emptying of glacial Lake Candlewood. A thin layer of eolian sand and silt was laid down soon after deglaciation and before the development of a vegetation cover. Eolian sediment locally reaches thicknesses of 2 to 4 feet in valley areas.

The most recent units in the quadrangle are swamp deposits and flood plain alluvium. These sediments are accumulating at the present time.

Postglacial uplift has reduced the gradient of the Still River. The stream now has an intricate meander pattern along parts of its course. Soil forming processes are developing podzolic soils on both glacial and postglacial deposits. Mechanical weathering is causing the accumulation of talus along the bottoms of cliffs, but this processs is probably slower now than in late glacial time.

ECONOMIC GEOLOGY

Sand and gravel deposits are the most valuable surficial materials in the quadrangle. They are being worked at the present time, and many of them have already been depleted. Important deposits are located in the valleys of the Still River and its tributaries. Smaller deposits occur in the upland areas, as in the northeast and southeast corners of the quadrangle. The exploitation of remaining sand and gravel deposits is complicated by geologic and geographic factors. Sediment textures in the glacial stream units may change rapidly in both horizontal and vertical directions. Gravel lenses are apt to pinch out unexpectedly in ice-contact units. A few deposits remain untouched. However, they are commonly small, or their removal is prevented by existing land use patterns.

Coarse-grained stratified drift deposits are the most productive aquifers in the Danbury quadrangle. Well yields of up to 500 gallons per minute were reported by Melvin (1970), though most were less than 300 GPM. The ground water resources of the area have been described in detail by Cervione, Mazzaferro, and Melvin (1972).

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SURFICIAL GEOLOGIC QUADRANGLE MAP

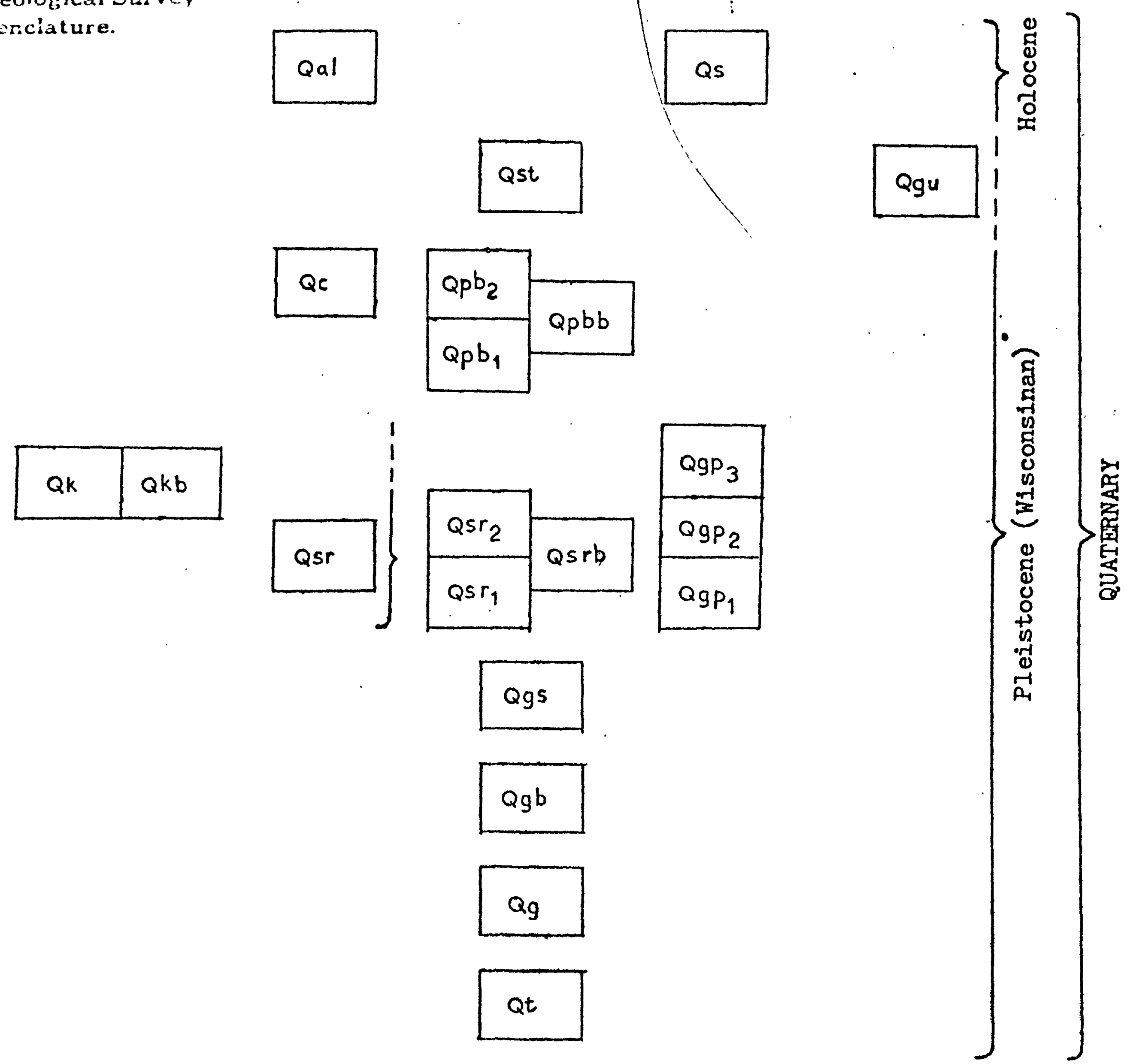
DANBURY QUADRANGLE

CONNECTICUT

Woodrow Thompson

1975

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Qal — ALLUVIUM - Sand, silt, and gravel deposited on flood plains by modern streams. Still River alluvium generally consists of 5-10 ft. of gray sand and silt. Deposits along upland brooks are mostly gravel

Qs — SWAMP DEPOSITS - Peat, silt, and sand in poorly drained areas. Thickness is typically less than 15 ft.

Qst — STREAM TERRACE DEPOSITS - Sand, gravel, and silt on terraces cut into glacial lake or glacial stream deposits. Formed in part during late glacial time. Average less than 10 ft. thick

Qgu — UNDIFFERENTIATED DEPOSITS - Sand, gravel, and silt of uncertain age and origin. May be glacial or postglacial

Qc — GLACIAL LAKE CANDLEWOOD DEPOSITS - Sand and gravel deposited in or graded to glacial Lake Candlewood. Concealed in large part by modern Lake Candlewood. Water level of glacial lake controlled by spillway at former divide between Rocky and Still River basins, near south end of present lake

Qk, Qkb — GLACIAL LAKE KENOSIA DEPOSITS

Qk, sand, gravel, and silt. Kame terrace deposits laid down by meltwater streams that entered lake from the west. Average over 50 ft. thick. Lake level controlled by spillway east of Mill Plain Swamp

Qkb, silt, sand, and clay. Deposited on lake bottom. Thickness generally exceeds 40 ft. and is locally as much as 100 ft.

Qpb_2, Qpb_1, Qpbb — GLACIAL LAKE DANBURY DEPOSITS

Sand, gravel, and silt laid down by meltwater streams that entered lake, and lake bottom deposits of sand, silt, and clay. Lake bottom sediments in Danbury area are commonly over 50 ft. thick and exceed 100 ft. in places. Average thickness is less than 50 ft. in Brookfield area

Qpb_1 and Qpb_2, Pond Brook stage deposits. Lake level controlled by spillway at divide between Still River and Pond Brook, near east border of the quadrangle. Qpb_1 is older

Qpbb, Pond Brook stage lake bottom deposits

65s
active

6p/st
inactive

Till or sand and gravel pit -- Extent of large pits shown by hachures. Letter symbols indicate materials in decreasing order of abundance: cl, clay; st, silt; s, sand; ps, pebbly sand; p, pebble gravel; c, cobble gravel; b, boulder gravel; f, flowtill. Superposed symbols indicate superposition of materials. Numbers are thicknesses in feet.

active

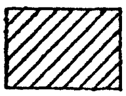
inactive

Quarry

BT 27
well

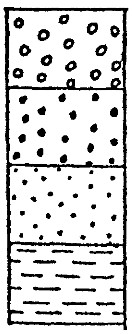
DY 35
test hole

Location of logged well or test hole. Numbers assigned by Melvin (1970)



Graded area where topography has been modified by construction equipment

The following overprint patterns indicate the first material of substantial thickness (greater than 3 ft.) encountered beneath the soil in areas of fluvial deposits:



g = 100 percent gravel to 50 percent gravel/50 percent sand

sg = 50 percent gravel/50 percent sand to 25 percent gravel/75 percent sand

s = 25 percent gravel/75 percent sand through 100 percent sand to 50 percent sand/50 percent fine particles (very fine sand, silt, clay)

c = Greater than 50 percent fine particles

Qsr_2 | Qsr_1 | Qsr | Qsrb

Qsr, Qsr_1, and Qsr_2, Saugatuck River stage deposits. Lake level controlled by spillway at divide between Still and Saugatuck River basins, south of the quadrangle. Where numbered, Qsr_1 is older
Qsrb, Saugatuck River stage lake bottom deposits

Qgp_3 | Qgp_2 | Qgp_1

GLACIAL STREAM DEPOSITS - Sand, gravel, and silt deposited by meltwater streams that flowed southeast into the Pond Brook valley (Newtown quadrangle). Qgp_1 is oldest

Qgs

GLACIAL STREAM DEPOSITS - Sand, gravel, and silt deposited by meltwater streams that flowed south into the Saugatuck River valley (Bethel quadrangle)

Qgb

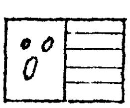
GLACIAL STREAM DEPOSITS - Gravel and sand deposited by meltwater streams controlled by spillway just south of the quadrangle

Qg

UNCORRELATED GLACIAL STREAM DEPOSITS - Sand and gravel. Chronologic position not assigned

Qt

TILL - Poorly sorted rock debris deposited by glacial ice. Derived from crystalline rocks. May be very carbonate-rich where derived from marble. Includes two types, which are rarely seen in superposition. Upper till is light olive-brown to light olive-gray, friable, and very stony. Typically contains 60-80 percent sand in matrix and may have small bodies of washed sand, gravel, and silt. Probably averages about 10 ft. thick. Lower till is olive-brown to dark olive-gray, very compact, and generally contains 40-60 percent sand. Commonly has deep oxidation, jointing, and iron oxide staining on surfaces of joints and stones. Thickness is generally greater than 40 ft. and locally exceeds 100 ft. t, exposure of upper till. T, exposure of lower till. Subscripts: a, ablation facies; b, basal facies; m, locality where lower till is intermixed with upper till



BEDROCK EXPOSURES - Ruled pattern indicates areas of closely spaced outcrops where surficial deposits are thin. Mapped in part from aerial photographs

af | aft

ARTIFICIAL FILL
af, obtained from till, sand and gravel, or bedrock
aft, dump material. Contains considerable trash

——— – – Contact - Dashed where approximately located

Scarp separating adjacent surfaces within same map unit -- Hachures on downslope side. Dashed where approximately located

—150— Bedrock contour -- Shows approximate altitude of bedrock surface. Contour interval is 50 feet. Datum is mean sea level. Contours omitted in upland areas

Drumlin -- Symbol shows direction of long axis. Composed mostly or entirely of till

22E → Glacial striation -- Point of observation at tip of arrow. Number is in degrees east or west of south

+I Glacial boulder -- Glacially transported boulder with maximum diameter greater than 4 ft.: Y, "younger granite"; B, Brookfield Plutonic Series; I, Inwood marble; D, Danbury Augen Granite; A, hornblende gneiss and amphibolite; G, gneissic granite and trondhjemite. All lithologic names are those of Clarke (1958)

Area of numerous large till boulders

440 → Dip direction of delta foreset beds -- Number is altitude in feet of topset-foreset contact(where known)

⟶ Dip direction of fluvial cross-bedding

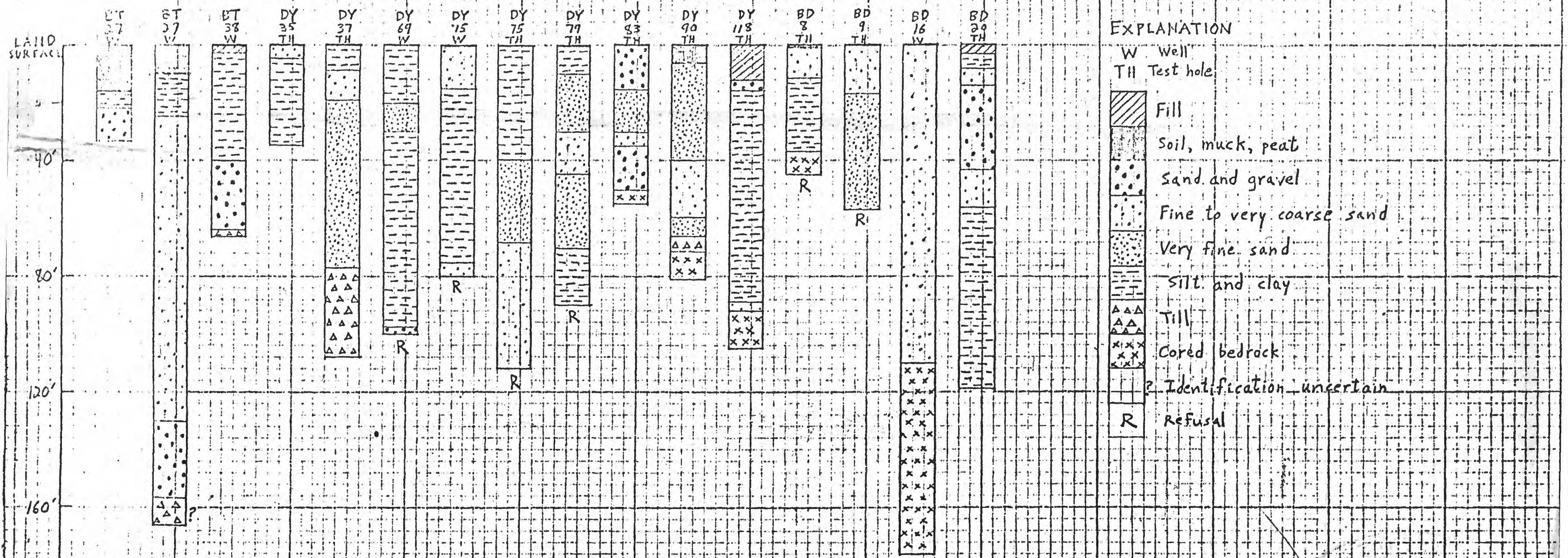
>>>> Crest of esker or other ice-channel filling

kt Morphology -- Letter symbols indicate examples of glaciofluvial land forms: k, kame; kt, kame terrace; kd, kame delta

Danbury

Danbury Quadrangle, Connecticut

Woodrow Thompson - 1975



LOGS OF SELECTED WELLS AND TEST HOLES

(numbers are those assigned by R. [illegible] [illegible], 1970)

Connecticut (Danbury quad.) Surficial 1:24,000. 1975
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