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Surficial materials data and Quaternary geologic history of the Broad Brook quadrangle, Connecticut

(To be used with Geologic Quadrangle Map GQ-434)

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Introduction

The Broad Brook quadrangle is entirely within the Connecticut Valley lowland and is underlain by reddish-brown and gray arkosic mudstone, siltstone, shale, sandstone, and conglomerate. The formation is the (Portland arkose) (₮p) of Triassic age (Krynine, 1950). These rocks are veneered with unconsolidated Pleistocene and Holocene deposits which were mostly derived from Portland arkose. The area is midway between Hartford, Connecticut and Springfield, Massachusetts. This open-file text should be read with GQ-434 (Colton, 1965) and I-401 (Cushman and Colton, 1963).

Previous mapping of the surficial deposits was of a reconnaissance nature or is incomplete because only certain areas or materials were considered. Soils investigations were made by Dorsey and Bonsteel (1899) and by other members of the Department of Agriculture. A glacial map of Connecticut was published by Flint (1930) at a scale of 1:125,000. A general discussion of the geology of the area is by Cushman (1960). A general report (Cushman, 1964), on ground water resources, which included the Broad Brook quadrangle was made as part of a state-wide groundwater study.

The author is indebted to Philip Keen, Virgil MacGuire, Craig Belcher, and others of the Foundations Section of the Connecticut State Highway Department for records of hundreds of borings made along the Hartford-Springfield Expressway. The consulting firm of Hayden, Harding, and Buchanan of Boston made a geologic cross section (C-C') along the expressway north and east of its intersection with U.S. Route 5.

The highest part of the quadrangle is about 350 feet above sea level and is at the east central edge of the quadrangle near the Hartford-Tolland County line. The lowest point is less than 10 feet above sea level along the Connecticut River in the southwest corner of the quadrangle. Local relief is as much as 180 feet along the Connecticut River and generally more than 50 feet but as much as 150 feet along the Scantic River.

Surficial deposits

The geologic map (Colton, 1965) shows the surficial deposits as if the upper few feet had been removed thereby eliminating a thin veneer of soil, decaying humus, and windblown silt. Thin swamp deposits and minor artificial fills also have not been mapped.

Most of the deposits are the result of glacial action; others were formed in postglacial time. The oldest glacial deposit is reddish brown till (Qt) (a mixture of clay- to boulder-sized particles). Locally, the upper part of this till contains large lenses of reddish-brown varved clay. Overlying the till is stratified drift (Qcd, Qgf, Qo - all reddish-brown silt, sand and gravel) and, locally, flowtill (Hartshorn, 1958). Lake deposits (Ql) of varved clay and silt overlie the stratified drift and till; they grade upward into silt and sand. The lake deposits interfinger with reddish-brown ice-contact stratified drift, beach deposits (Qb), and light yellowish-gray deltaic deposits (Qgf) derived from the highlands east of the quadrangle. Elsewhere, the lake deposits are overlain by younger outwash (Qo). Swamp deposits (Qs) and sand dunes (Qsd) are scattered throughout the quadrangle; a thin blanket of windblown silt and sand (not mapped) covers most of the quadrangle. Terrace deposits (Qst) are along the valleys of the Connecticut and Scantic Rivers; the youngest deposits in the stream valleys are alluvium (Qal). Man has made extensive artificial fills (af) along railroads, highways, and in dams. The composition, origin, distribution, and engineering properties of these deposits are summarized in the tabular text.

Geologic history of the surficial deposits

No preglacial surficial deposits were discovered during the mapping of the quadrangle. Probably all post-Triassic sediments and unconsolidated preglacial deposits were removed during Pleistocene glaciations. Consequently, no record remains of the 25 million years of Jurassic time, the 55 million years of Cretaceous time, and the 70 million years that elapsed during Tertiary time. The preglacial land surface and present topography generally conformed to the bedrock surface (see Cushman and Colton, 1963). Cushman (1960, p. 105, plate 2) found a 2 mile-wide trough in the bedrock surface which trends north-south through the quadrangle just west of the center of the quadrangle; bedrock is locally more than 100 feet below sealevel. This buried bedrock trough may be part of a preglacial drainage system which was probably deepened by glacial scouring. The bedrock surface is more than 250 feet above sealevel along the eastern edge of the quadrangle (Cushman and Colton, 1963).

Scattered over the quadrangle, but most abundant on the high ridges and in the gravel deposits in the eastern part of the area, are boulders of igneous and metamorphic rocks that are quite different from the underlying reddish-brown Triassic rocks. These boulders are called erratics and were brought into the area by glacial ice. A few of the boulders are several feet in diameter. Grooves and scratches cut in the bedrock by stones held in the basal part of the moving ice were noted only along Stoughton Brook.

Evidence in the Broad Brook quadrangle indicates that the glacier which covered the quadrangle was at least 400 feet thick because it left erratics at altitudes exceeding 300 feet and scoured the bedrock to depths exceeding 100 feet below sealevel. Evidence from other areas in Connecticut suggests that at least 2500 feet of ice once covered the area (Flint, 1930, p. 44). One and possibly more glaciations affected the area. The principal direction of movement of the ice across the area was from north to south, as shown by the orientation of the long axes of drumlins (streamlined hills of till or other glacial drift). The till was moulded or eroded by the ice passing over it and the resultant drumlin form indicates the direction of major ice movement. Most drumlins have rounded upstream ends and long tapering downstreamends. Examples of drumlins are: 1 mile southeast of Broad Brook; 1 mile north of Melrose; 0.5 mile northeast of Melrose; 1 mile southeast of Scitico, and 1 mile west of Thompsonville. Most of the hills just east of the Connecticut River are rock-cored drumlins with only a thin veneer of till. An exception is the drumlin 1 mile south of Warehouse Point. Nearly all of the drumlin was removed and used as fill in the adjacent Hartford-Springfield Expressway (I-91). The drumlin consisted of tough, reddish-brown, stony till that contained many large reddish-brown blocks of contorted varved clay as much as 10 feet in diameter and a few feet thick. This unusual till suggests that the ice overrode the varved clay and incorporated it into the till. Another exception is the small drumlin which has a crescent-shaped exposure of till in the southwest part of the quadrangle near the mouth of Namerick and Stoughton Brooks; its core of varved clay is exposed.

Evidence of only the last few glacial events was found during the mapping of the area. Late Wisconsin glaciation ended when a climatic change favored the melting of ice rather than its accumulation; northward retreat of the ice front resulted. As the ice wasted, the first areas to become ice-free were the highlands to the east and then the crests of the highest drumlins in the southern part of the quadrangle. They probably were nunataks or islands in a sea of ice. Ice-marginal channels were cut into the glacial deposits and bedrock in a few places in the eastern part of the quadrangle. Deposits of ice-contact stratified drift were deposited against, around, in, under, and on the stagnant ice, and outwash was deposited south of the ice and between the ice and the highland along the eastern part of the quadrangle.

Southward drainage of the Connecticut Valley was temporarily blocked by a morainal ridge left by the glacier near Rocky Hill, about 16 miles south of the area (Flint, 1933, p. 978). A large lake (Lake Hartford of Flint, 1947, p. 139 and Lake Hitchock of Lougee, 1939) rose to an altitude exceeding 170 feet in the quadrangle as evidenced by beach deposits such as on the southwest end of the drumlin just east of King's Corner. The shoreline of this glacial lake was tilted upward to the north by slow crustal rebound after the ice had melted so that the former shoreline of the lake is now about 210 feet (from evidence in other quadrangles) above sea level at the north end of the quadrangle or 30 to 35 feet higher than at the south end.

The beach deposits (Qb) on the southwest sides of the drumlins interfinger with varved silt and clay lake deposits (Ql) which were laid down in glacial lakes. Antevs (1928) studied the varves in this general area and considered them to be annual deposits. The sequence of varves is very thick over the buried bedrock channel trending north-south through the center of the quadrangle. Well logs indicate varved clay is as much as 150 feet thick locally. Exposures of varved clay along the west side of the Scantic River near the southern edge of the quadrangle reveal thicknesses exceeding 60 feet. There are about 30 varves per foot suggesting that if the varves are annual, the lake existed at least 1800 years. The varved sediments interfinger with Scantic River deltaic deposits (Qgf) near Hazardville.

A readvance of the ice front may have occurred before the barrier at Rocky Hill was breached and the lake drained, because till and ice-contact stratified drift occur above the lake deposits in a few places and many exposures reveal a thin layer of pebbly, deformed varved (till equivalent) clay at the top of the varved clay lake sequence (till equivalent; Simpson, 1959). How far south the ice advanced is not known; the ridge of collapsed ice-contact stratified drift, which trends northeast just north of Windsorville may mark the limit of this readvance. This northeast trending ridge 0.3 mile north of Windsorville may only be a moraine which marks a temporary stillstand of the retreating ice front. However, coarse gravel and till overlie outwash exposed in pits a few hundred feet north of the moraine and also suggest a local readvance.

The extensive deposits of reddish-brown sand and gravel (Qcd) east of the Scantic River were formed as the ice stagnated and melted. Ice-marginal channels and the general shape and location of the Scantic River indicate the river now occupies the last in a series of ice-marginal channels. The present course of the river is, with only a few exceptions, the western limit of ice-contact stratified drift and separates a plain west of the river, having an average altitude of 110 feet, from a hummocky collapsed area to the east whose average altitude is 60 feet higher. Ice must have formed the west wall of the glacial Scantic River and ice-contact stratified drift formed the east wall. The extensive deposits of reddish-brown ice-contact stratified drift east of the Scantic River still show characteristic forms which were built against, on, or under the ice. Several eskers (long snake-like ridges of sand and gravel) were formed. One is 0.5 mile north of Sadds Mill; another is 0.3 mile east of the Wallop School; and a third is 0.5 mile north of Scitico. Many kames (hills of sand and gravel built against or in the ice) are in the area extending north from Windsorville to Hazardville. One kame 0.4 mile north of Scitico and just north of Terry Brook has been removed for fill; it had a cap of flowtill (Hartshorn, 1958) about 5 feet thick. Several other kames occur within a mile west and north of Sadds Mill.

While stagnant ice still remained in the Connecticut River Valley northwest of the Scantic River, meltwater probably cut down through the central part of the lobe of ice and cut a channel into the glacial deposits and the high bedrock ridge northwest of what is now King's Corner. After the stagnant ice melted away, the ancestral Connecticut River was unable to reoccupy its old channel in the center of the quadrangle because it had cut too deeply into the bedrock high along the west edge of the quadrangle. High terrace remnants (Qrt) at altitudes exceeding 120 feet in Enfield west of U.S Route 5 and along U.S. Route 5 indicate that at the time of their deposition ice must have filled the lower area to the east at least as far as the Scantic River.

In postglacial time, the Connecticut and Scantic Rivers cut down through glacial deposits and bedrock more than 100 feet. As they did so, some of the eroded materials were left as terrace remnants (Qst) along the valley walls.

Swamp deposits (Qs) began forming in ice block holes as soon as the ice melted. Sand Dunes (Qsd) formed on much of the plain between the Connecticut and Scantic Rivers; few formed along the east side of the Scantic River. Locally, it appears that the Scantic River eroded some of them and the river was flowing at altitudes of 100 feet near the southern edge of the quadrangle and 130 feet near Hazardville. Presumably, the numerous long narrow southeast-trending dunes were formed by strong northwesterly winds before vegetation was able to cover the deglaciated area. Both swamp deposits and sand dunes have continued to form on river terraces and floodplains. Many swamps have formed in depressions among dunes.

A blanket of windblown silt which began to accumulate when the sand dunes were formed covers most of the surficial deposits except modern alluvium. Ventifacts (pebbles and cobbles polished by windblown sand) occur in this blanket. Recent undercutting of varved clay and other deposits by streams has caused small landslides (Qld) in several areas. Alluvium (Qal) was deposited within the last few thousand years on the floodplains of the Connecticut and Scantic Rivers. Recently man has moved large volumes of earth to create artificial fills in expressways, roads and railroads.

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