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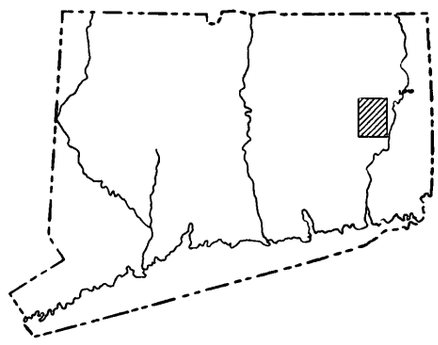
GEOLOGIC QUADRANGLE MAPS OF THE UNITED STATES

GEOLOGIC MAP OF THE SCOTLAND QUADRANGLE CONNECTICUT

By
H. Roberta Dixon
and
Charles E. Shaw, Jr.



QUADRANGLE LOCATION

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TO ACCOMPANY MAP GQ-392

GEOLOGY OF THE SCOTLAND QUADRANGLE, CONNECTICUT

By

H. Roberta Dixon and Charles E. Shaw, Jr.

INTRODUCTION

Brief descriptions of the Scotland Schist and the Canterbury Gneiss are given below, as the type areas for these units are in the Scotland quadrangle. Descriptions of the Tatnic Hill Formation in the Norwich quadrangle are given by Snyder (1961) and by Dixon (1964), and of the Hebron Formation in the Norwich quadrangle and the Fitchville quadrangle by Snyder (1964).

BEDROCK GEOLOGY

Scotland Schist.—The name Scotland Schist was used by Gregory (*in* Rice and Gregory, 1906, p. 141) for a coarse muscovite schist that "covers the town of Scotland." He gives no type locality for the schist and the only outcrop he cites (a railroad cut east of Pautipaug Hill) is well within the Yantic Member of the Tatnic Hill Formation. The most complete section of the Scotland Schist in the town of Scotland is in a series of road cuts and bluffs on the north bank of the Shetucket River where there is approximately 4,000 feet of discontinuous exposure. The basal horizon, as seen just west of Merrick Brook, consists of about 5 feet of alternating fine-grained, granular quartz-oligoclase- to andesine biotite schist and well-foliated quartz-muscovite-biotite schist, produced from interbedded impure sands and shales. Individual beds range in thickness from an inch to about a foot, the quartzose beds in general being thicker and more abundant than the micaceous ones. This basal horizon is repeated by folding at least twice within the eastern 2,000 feet of these exposures. Along strike the basal horizon appears to thicken and thin, and to the south may grade into the pure white quartzite that separates the Hebron Formation from the Scotland Schist in parts of the Fitchville quadrangle (Snyder, 1964). To the north, this horizon ranges from about 2 feet to 20 feet in thickness. Within the basal zone are local thin bands, rarely more than an inch thick, of calc-silicate granulite.

The bulk of the Scotland Schist is dominantly a muscovite schist with well-developed foliation and indistinct bedding. On the weathered surface it is murky gray with streaks of rusty or yellowish iron stain, and on fresh surfaces it is silver to steel gray. It contains numerous yellow-stained quartz pods, averaging an inch in thickness and 6 inches in length. The most prominent mineral is muscovite in coarse-grained plates that are commonly crinkled and form a distinct lineation. The main constituents of the schist are fine-grained quartz and biotite, and coarse-grained muscovite, and minor constituents are garnet, staurolite, oligoclase, and kyanite. Accessory minerals are tourmaline, apatite, zircon, and opaque minerals. Relatively fine grained (a few millimeters) red garnet and brown staurolite, and locally tourmaline, are visible on the weathered surface. Kyanite is present only locally in the southern half of the quadrangle, but on Pudding Hill it commonly accompanies staurolite in minor amounts. Foye (1949, p. 78) reported andalusite from the Scotland Schist above the power plant on the north side of the Shetucket River, but examination of his thin sections showed that the mineral reported as andalusite is staurolite.

An impure, fine-grained, buff quartzite occurs about 1,500 feet above the westernmost repetition of the basal horizon. The quartzite is 10 to 20 feet thick and is commonly folded into small, overturned folds. It can be traced from the north side of the Shetucket River, northeast for about 2,000 feet, where it bends north and may lens out. A similar quartzite can be traced for about 2,500 feet in the bluffs south of the Shetucket River. The north end of this layer apparently bends eastward and may connect with a similar, east striking quartzite in the Willimantic quadrangle (Snyder, 1964). The quartzites on either side of the river are apparently at the same stratigraphic horizon, separated by a fault.

The western belt of Scotland Schist apparently forms a thin veneer over the Hebron Formation. A sample from a depth of 175 feet from a water well on Brooklyn Road is from the Hebron Formation. The rocks in this belt are poorly exposed, but most outcrops are granular quartz-oligoclase-biotite schists, similar to those of the basal part of the eastern belt. The bedding and foliation within this belt dip gently toward the center of the belt, indicating a shallow structural basin.

Canterbury Gneiss.—Gregory (*in* Rice and Gregory, 1906, p. 142) used the name Canterbury Granite-Gneiss for a large body of injected muscovite-biotite granite gneiss, but no type locations were cited. The best exposures of the gneiss in the town of Canterbury are east of Brooklyn Road, one-half to three-quarters of a mile north of Westminster Hill. A better exposure of relatively fresh gneiss is in an old quarry in the town of Scotland north of the road between Hanover Road and Fort Ned Pond. Snyder (1961) changed the name of the unit to Canterbury Gneiss, and described the rock as "a uniform medium-grained quartz monzonitic gneiss." In the Scotland quadrangle the gneiss ranges in composition from quartz diorite to quartz monzonite, and the most common rock is granodiorite. The gneiss is porphyritic, with phenocrysts of oligoclase and microcline as much as one-half inch long. The rock is relatively uniform in appearance throughout the body, though locally it is fine grained near the contact with the Hebron Formation. Subparallel alinement of biotite flakes gives the rock a weak foliation

that in general is parallel to the regional foliation in the surrounding rocks. A strong lineation is reflected in the stretching out of small biotite clusters and of quartz and feldspar grains. Muscovite rarely forms more than 1 percent of the rock in the main body of gneiss, but is relatively abundant in the small disconnected arm of Canterbury Gneiss east of Cory Brook. The muscovite gneiss is, in general, finer grained and more strongly foliated than the gneiss in the main body, but to the south and east it grades into pegmatite.

The Canterbury Gneiss is a large tabular body mostly within the Hebron Formation, but locally cuts across it into the Tatnic Hill Formation. It extends westward beneath the Hebron Formation and the Scotland Schist and is exposed again in the northwest corner of the quadrangle, reappears on the surface where it was previously mapped as Eastward Gneiss (Rice and Gregory, 1906; Rodgers and others, 1959).

SURFICIAL GEOLOGY

Surficial mapping, which was carried out in connection with hydrologic studies in the Shetucket River basin, was mostly detailed in the valley areas where permeable deposits of stratified drift are thickest and most extensive. A reconnaissance survey was made in the upland areas where the surficial deposits consist chiefly of till. Small bodies of stratified drift in the uplands may have been overlooked.

GLACIAL DEPOSITS

Till

Unsorted rock debris deposited directly by glacier ice covers most of the upland areas in the Scotland quadrangle, and, although not indicated by a separate color pattern, is the principal surficial deposit in areas where the bedrock geology alone is shown. The till is characterized by lack of conspicuous sorting or stratification. The matrix is generally light gray in color and sandy in texture. In uncrushed samples of till, aggregates of light-gray sand a few millimeters in diameter are interlocked with similar aggregates of darker gray silt and clay. When this structure is destroyed by excavation, the till may resemble poorly sorted water-laid sand. The till contains only a small percentage of stones where observed in several small cuts; however, large angular boulders are common on the land surface. Several conspicuous accumulations of boulders are indicated on the map, but no systematic effort has been made to map boulder concentrations throughout the area. Fissility is strongly developed in the till in some exposures.

Over much of the quadrangle the till is thin and its topographic expression reflects that of the underlying bedrock. In the area northwest of Scotland and around Westminster Hill in Canterbury, where wells have penetrated 45 feet or more of till, the till is sufficiently thick to have constructional topography of its own and may be termed ground moraine. Northwest of Scotland the till locally forms drumlins.

Sand and gravel deposits

Sand and gravel deposited by streams of glacial melt water occur in the larger and some of the smaller valleys in the quadrangle. These deposits are divided into three units on the basis of materials composing them: stratified sand usually containing beds of well sorted fine to coarse gravel, Qsg; stratified sand with minor amounts of gravel and capped by bouldery gravel, Qgs; and deposits that consist chiefly of bouldery gravel, Qg. All three units may occur in deposits of a single age and all gradations exist between them.

Sand and gravel deposits along the Shetucket River.—Sand and gravel deposits along the Shetucket River occur at two levels, one at about 190 feet (Qsg_1, Qg_1) and one at about 110 feet (Qg_2) in altitude. The higher and older terrace slopes gently to the southeast along the main valley and to the southwest along the narrow valley west of Pautipaug Hill. Well-bedded medium to coarse yellow sand interbedded with gravel is capped by well-bedded and well-sorted medium to coarse gravel in pits south of the dam on the Shetucket River and east of the river east of Pautipaug Hill. The 190-foot terrace is similar in topographic form and altitude to deltas in the Willimantic quadrangle to the west, and may also be deltaic. West of Pautipaug Hill only bouldery gravel is exposed. Pebbles of red arkose that were derived from rocks of Triassic age, the nearest outcrops of which lie 25 miles due west of the western border of the Scotland quadrangle, are abundant in the higher Shetucket River terraces.

The lower and younger terrace (Qg_2) stands only 10 feet above the present floodplain of the Shetucket River and may be subject to occasional flooding. The presence of kettles and an exposure of cobble gravel in a railroad cut near the west end of the terrace suggest that glaciofluvial gravels underlie the terrace. Concentrations of boulders near the southeast end of the terrace, however, could be a lag deposit formed by action of the present river. Most probably this terrace has a compound history, but because the materials are similar to gravels mapped elsewhere as Qg, this designation is used here.

Sand and gravel deposits along Merrick Brook.—Three levels of sand and gravel deposits occur in the valley of Merrick Brook. In the highest and oldest of these (Qg_1), bouldery gravel overlies stratified sand in pits near Cemetery Road. The next lower and younger deposit (Qsg_2) consists of interbedded fine to medium sand and medium to coarse gravel, with a cap of well-sorted pebble gravel 2 to 5 feet thick. Bouldery gravel (Qg_2) on grade with this terrace occurs in the northern two-thirds of Merrick Brook and along part of Beaver Brook, and appears to grade into well sorted gravel and sand (Qsg_2) in the southern reaches of Merrick Brook. Late, low-lying sand terraces (Qsg_3) occur just north of the gap leading to the Shetucket River. The exposure of bedrock in this gap and in the bed of Merrick Brook suggests that the thickness of the sand and gravel deposits is about equal to the height of the terrace above the valley floor.

Sand and gravel deposits in the Little River valley.—Glaciofluvial deposits of three ages are recognized in the Little River valley also. The southernmost and oldest of these (Qg_1) consists chiefly of bouldery, indistinctly stratified gravel with fine sand to small pebbles in the matrix and with local lenses of well-sorted sand. Thick local deposits of sand (Qgs_1) are indicated on the map. In the north half of the valley (Qgs_2), deposits of stratified sand containing scattered layers of gravel are everywhere overlain by bouldery gravel that averages 2 to 3 feet thick, but locally is as much as 15 feet thick. Near Fort Ned Pond the gravel cap is locally replaced by unstratified material (flowtill) that probably flowed off adjacent ice and that grades valleyward into stratified gravel and sand. A few late low-lying terraces

(Qsg_3) south of Howard Valley are underlain by sand. An exposure of bedrock in the Little River just upstream from the Hannance Road bridge, and several well records, suggest that the thickness of the deposits north of Hanover is not much greater than their local relief above the valley floor. However, south of Hanover, borings in the floodplain of the Little River penetrated as much as 50 feet of alluvium, sand, and gravel.

POSTGLACIAL DEPOSITS

Eolian deposits.—A thin cover of yellowish-brown windblown silt and sand blankets the Scotland quadrangle, as it does much of southern New England. Because it may overlie any older deposit, it is not mapped.

Alluvium.—Alluvium (Qal) is material underlying the surfaces of modern floodplains and low terraces. In general it consists of fine sand and silt mixed with a variable amount of organic matter, but locally (Qab) gravel and even boulders may occur. The bouldery alluvium is generally associated with an abrupt local increase in the gradient of the depositing stream, as in the area east of Hanover in the Little River valley.

Swamp deposits.—Muck and peat are presently accumulating in the numerous swamps in the quadrangle, some within areas mapped as alluvium.

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