## Bristol Rodgers Bedrock Compilation Sheet 2 (paper)

Map

## NOTICE!

Bedrock quadrangle 1:24,000 scale compilation sheets for the Bedrock Geological Map of Connecticut, John Rodgers, 1985, Connecticut Geological and Natural History Survey, Department of Environmental Protection, Hartford, Connecticut, in Cooperation with the U.S. Geological Survey, 1:125,000 scale, 2 sheets. [minimum 116 paper quad compilations with mylar overlays constituting the master file set for geologic lines and units compiled to the State map, some quads have multiple sheets depicting iterations of mapping]. Compilations drafted by Nancy Davis, Craig Dietsch, and Nat Gibbons under the direction of John Rodgers.

Geologic unit designation table translates earlier map unit nomenclature to the units ultimately used in the State publication.

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## SURFICIAL GEOLOGY OF THE BRISTOL QUADRANGLE, CONNECTICUT

Howard E. Simpson

Bristol quadrangle constitutes an area of about 55 square miles. It is named for the town of Bristol, which ies about 15 miles west-southwest result of stream action and in part pit about half a mile southeast of ture and texture and their relation of the capital city of Hartford. The eastern one-third of the quadhuman activity. rangle lies in the Connecticut Valley owland: the remainder is in the Western Highland. The two areas are topographically distinct and are separated by a prominent scarp that rends southward between Bristol and East Bristol. The lowland is gently to moderately rolling. Local relief generally is less than 50 feet, out rarely it is as much as 100 feet. n contrast, the highland is moder- largely of nonstratified material are ately to strongly rolling; local relief called morainal drift, deposits of commonly is from 100 to 150 feet, stratified debris laid down on or out, along the scarp just west of the against the ice are called ice-contact ake, the relief is about 600 feet. The position, form, and orientation of the principal topographic features are controlled by the lithology and structure of the bedrock. The scarp between the lowland and highland, as well as many of the hills that dot the highland surface, was formed largely by faulting and subsequent erosion of bedrock. The lowland is underlain by sedimentary strata of riassic age that dip from 10° to 20° progressively lower channels contain eastward. These rocks are chiefly red sandstone and conglomerate and esser quantities of red siltstone and tion of the drift is reflected in its shale. The highland is underlain by color. Material derived from sedischist and gneiss believed to have mentary rocks in the Connecticut from detrital sediments of early pale reddish brown1, whereas matealeozoic age (Rodgers, Gates, and rial derived from crystalline rocks Rosenfeld, 1959, p. 13-14). Foliation of the Western Highland is light to of the metamorphic rocks shows that pale yellowish gray when unweath-

Bristol quadrangle is moderately well drained by many small streams Except along the Pequabuck River. the narrow uneven valley floors are swampy. About three-fourths of the quadrangle drains, chiefly by way of e Pequabuck River, into the Farmngton River, which flows just beyond the northeast corner of the Quinnipiac River drain the southeastern part of the area, and the extreme southwestern part drains oward the distant Naugatuck River. Swampy depressions and ponds are numerous, but the ponds are either wholly artificial or their level has been raised by the construction of dams. Subsurface drainage throughout he quadrangle is generally fair to good: it is poor only where the surace is underlain by compact, nearly urvey and the U.S. Geological urvey. Geology was plotted in the ield on a topographic base map at 24,000 scale; plotting was facilitated by the use of aerial photographs at scales of about 1:28,000 and 1:20,000. The map and report are based on examination of all available natural and artificial exposures, and records in files of the eological Survey, and City Engi eer of Bristol. Where information as much as 5 feet in depth were dug In general, the map represents the geology from 1 to 2 feet beneath he surface, thereby eliminating a hin, patchy mantle of windblown ilt and sand, disturbed soil, thin swamp deposits, and thin deposits o artificial fill. Geology within urban Bristol is heavily obscured by ouildings and artificial filling and grading, but faint geomorphic expression of the original deposits The towns of Farmington and lainville also have been mapped or a water-resources study by A. D. andall, U.S. Geological Survey. He and I have compared field maps and liscussed mutual problems. SURFICIAL STRATIGRAPHY The surficial geology includes all deposits that have accumulated during or since the Great Ice Age, r Pleistocene epoch. These deposits are in part of glacial and in part of postglacial, or Recent age. Al re unconsolidated and rest on bedock of pre-Pleistocene age. During the Pleistocene epoch, a succession of continental glaciers dvanced southward across much of At least the last of these glacial f readvances, or substages, sepaated by warmer intervals. The glaciers eroded the land as hey advanced and scoured a smooth. irregular bedrock surface. The principal evidence of this erosion is glacial deposits, or drift. Evidence of the earlier glaciers was destroyed or covered by later glaciers, and in is quadrangle only the deposits and atures of the last advance in the what distinctive gneissic lithology ristol area are recognizable. that were observed within a mile of two south of the Pequabuck River more than 1,000 feet thick. The probably came from gneiss that outresence of striations and till atop crops along and just north of that ohnnycake Mountain show the river. Similarly, pegmatite boulders surface of the ice was higher than are most numerous along the scarp hat crest; meanwhile, the base of where numerous lenses of pegmatite the ice was lower than the present crop out, and boulders of a distinct surface of the valley-train deposit tive pale conglomerate generally lie in the lowland. Thus the thickness no more than 2 or 3 miles south of the ice was greater than the uthwest of their source between ,000 feet of relief that now exists. Hurley Hill and Mine Mountain. Rock and earth debris held in the A less common constituent of base of the moving ice was the

principal agent of abrasion. With

t the glacier scoured from initial

that now characterize bedrock out-

crops in the highland. Exposed

gneissic rocks preserve their

the schistose rock weathers rapidly,

its glaciated surface either is de-

stroyed or only the general form

remains with the foliation deeply

etched. Erosion by plucking pieces

of rock from their original positions

oy overriding ice was a major cause

of the steep southern and western

ations, or scratches, made by ice

dragging a rock fragment across a

moothly abraded surface are rare.

ney indicate the general direction

slopes of many hills. Glacial stri-

braded surfaces well but, because

During and since the wasting of across, and commonly lack distinc- proceeded chiefly by stagnation. the north and northwest. Thus the he last glacier, nonglacial deposits tive topographic form. They are Ice-contact stratified deposits kame plain originally may have been have accumulated on and adjacent most common on the lower flanks of to the glacial deposits. These non- hills and ridges. One such deposit glacial deposits are predominantly a is well exposed in a small, shallow form, and partly by internal strucglacial erosion separated them. a result of wind, gravity, and South Mountain.

Most of the transported debris was deposited within a few miles of its source. Much was laid down directly by the ice as nonstratified drift, but part, washed and reworked was deposited by meltwater as stratified drift. Deposits composed stratified drift, and deposits laid down beyond the ice margin are The manner in which the glacier advanced and wasted away is inits deposits, for during deglaciation, meltwater deposited debris in a succession of channels both within and beyond the ice margin. Surface gradients of these deposits commonly permit correlation, and progressively younger deposits. Streets.

The source and general composi peen altered in Late Ordovician time Valley Lowland is moderate red to ICE-CONTACT STRATIFIED DEPOSITS Bristol occupies a structural dome, ered and pale yellowish orange when now eroded to form a topographic weathered. Intermediate colors result from mixing. Drift characterized by construccalled moraine. Only ground rangle and the region. moraine is mapped. The absence of ristol quadrangle. -A mantle of mostly nonstratified reflects the form of the underlying melting of the adjacent ice. bedrock surface. The deposits Exposures show that all or nearly l ridges and hills contain bedrock cores mantled by ground moraine. Even knolls that superficially esemble hills of compact till are such knoll on the south flank of melting ice. round moraine is till, locally called rdpan." The till is a nonsorted and poorly stratified deposit composed of glacial debris ranging from ay-size particles to large boulders. lost of the till is compact, firm, and noderately permeable, but the upper to 4 feet is commonly somewhat oose and highly permeable. The loose till is believed to be the result of frost and root heave, but in part t may be ablation till, that is, glacial ebris let down onto the ground rom the surface of the melting ice. The till varies in its composition The average grain size of the matrix liffers locally with the differing proportions of clay, silt, and sand that compose it. Till in the lowland s somewhat sandy, and generally is moderately stony. In contrast, till on the highland is somewhat finer grained and not as stony. Most stones in the till are less than 2 feet 2 to 6 feet in diameter are common. Boulders 6 to 12 feet in diameter are rare, and mostly lie on or near the scarp that separates the highland from the lowland. Till that was derived mostly from schist contains much partly ground mica, which gives the till a loose, fluffy feel and a glittery appearance. Such till is dely distributed on the highland The lithology of the till indicates that the material was carried only a nort distance from its source. Thus on Redstone Hill, till with a very sandy matrix overlies coarse sand stone and conglomerate. Similarly on the highland, till with a finer grained matrix blankets rock con caining large quantities of easily

ground moraine is ablation till, a

poorly sorted debris that locally

shows a little crude stratification

This kind of debris was observed in

nantle much of the south wall of

ne topographic basin in which the

ity lies. In one house excavation.

ne material ranged from coarse

nighly micaceous, sandy till to

oulders 2 feet in diameter with

oids as much as a few inches across

A rarely observed component o

ne ground moraine is stratified

lrift. It consists of lenses of sand

and gravel enclosed in the till as well

is small deposits that lie on the till

irface. The lenses generally are

o 2 feet thick and a few are several

eet across. Most are crudely strat-

ified and poorly sorted. Deposits

between the stones.

laciation, and, together with the than 10 feet thick and several yards

the south part of Bristol and may

common, to more than 15 feet in found, and, as a result, classification ness of about 15 feet, and a maximum of about 100 feet is known on the crest of Chippen Hill. In the lowland, the ground moraine is generally less than 25 feet thick, and just east of the intersection on reported three-fourths of a mile south of that intersection. Good exposures of compact till excellent exposure of compact, variety of ice-contact stratified

are uncommon. Till mantling the foundation excavations, but is poorly exposed in most road cuts. An road cut about 3 miles northwest of Glacial debris laid down by meltwater on or against the ice forms a deposits. These deposits are distinguished from outwash by evidence that they were adjacent to ice during at least part of their accumulation. Several kinds of ice-contact stratified deposits are differentiated on the map, partly because they differ tional topography generally unre- somewhat in economic importance lated to the underlying bedrock and partly because they are espesurface and composed of unstratified cially significant in interpreting the material deposited by glacial ice, is geologic history of both the quad-The ice-contact deposits are comridgelike end moraines suggests posed principally of moderately to that during deglaciation there was well stratified, moderately to well no margin of active, flowing ice in sorted, highly permeable sand and gravel. In addition, they share, to Ground-moraine deposits (Qgm). a greater or lesser degree, certain characteristics that are indicative of drift that is variable in thickness ice-contact origin. These include and has a more or less undulatory internal variation in color; unpresurface of low relief is generally dictably abrupt changes in grain mapped as ground moraine. In this size, thickness, and lateral extent of uadrangle the ground moraine is so beds; flowtill; and various structural about 100 feet. thin that it rarely shows topographic and topographic features. Some of expression of its own, and merely these result from collapse caused by therefore, were mapped on their rial corresponds to the colors of the of Bensted Corner. Augering south most numerous in terraces built part of a detailed study of rock and lithologic nature and inferred man-source rocks. Most of the deposits of the Plainville-Farmington town principally by meltwater streams material, but, along the lowland near is chiefly red fine- to coarse-grained the scarp, some contain both light- sand and fine gravel which locally and red-colored debris, either as is inferred to be as much as 40 feet good examples. separate beds or as a mixture. thick. The present relief of this part Deposits composed wholly of red of the deposit probably is caused by nferred to contain cores, because debris are rare; an example is he knolls are either randomly the kame-terrace deposit along the 💹 inal deposit before collapse as it lay sive lowering of a marginal spilly riented or alined with the local east flank of Redstone Hill. The rend of bedrock structure and color variations suggest changes in copography rather than with the the meltwater drainage pattern, irection of glacial flow. In one commonly on the surface of the Chippen Hill the bedrock core is Abrupt changes and great differences in grain size, horizontal extent, The principal component of the and thickness of beds are normal in of the material ranges from fine and nonstratified to poorly sorted sand to medium gravel; coarse, cobbly or bouldery gravel is rare. Scattered boulders nevertheless can occur in any of the deposits, but are uncommon in beds of sand. Some oulders are more than 3 feet in diameter, but a few are as much as 8 feet. Boulders probably are more numerous in kames and ice-channel fillings than in kame-plain or kameare from a few feet to many yards across; in general, great lateral extent for a bed is more likely in only one good exposure in a foundakame plains or kame terraces than in kames or ice-channel fillings. Because a bed may thicken from a few inches to several feet in a horizontal distance of only a few feet. prediction of bed thicknesses in the various kinds of deposits is tains a few cobbles and very few Flowtill is a common component boulders. It resembles ablation of the ice-contact stratified deposits, moraine but is mapped as collapsed and is believed to have formed by stratified drift because of its sorting. flowing or slumping of more or less Kame deposits (Qk).—Knolls or saturated debris from the glacier short ridges of stratified drift that surface (see Hartshorn, 1958). common feature of flowtill is small once occupied openings in the ice or were deposited against its margin voids, particularly on the underside of stones. In this quadrangle, flow- are mapped as kame deposits. Good exposures of these features are few; till is distinguished by voids and however, auger holes show that greater compactness and firmness nearly all of the deposits consist of from ordinary till which it strongly light-colored fine- to coarse-grained resembles. The flowtill apparently sand and fine to medium gravel that is composed wholly of red debris. is moderately well to well sorted and his characteristic may be genetmoderately well stratified. ically related to the greater clay Four kames from 1 to 2 miles content of debris derived from the lowland bedrock than of debris south of East Bristol are arbitrarily differentiated from collapsed drift derived from the highland bedrock. Lenses of flowtill as much as 5 feet thick and several yards across are exposed in nearly every gravel pit kames are somewhat older than the coarse sand and gravel. surrounding drift. lverized mica. Stones of some lenses of flowtill lie on such deposits, Kame-plain deposits (Qkp). but most are interlayered with them. A broad, thick lens of flowtill is well stratified drift that were more or and built by meltwater streams that exposed in a pit about half a mile east of Lake Compounce.

Structural features, chiefly caused

and displaced bedding. Gravel pits

commonly expose beds that lie at

angles steeper than the angle of

that stand on edge between more

gently dipping strata of differing

Vertical displacement of strata

Topographic features, in part

caused by collapse, include kettles,

knoll-like form, and hummocky

angular ground plan, ridgelike or

iscrete ice blocks that were sur-

aults may total a few feet.

beds show crude loops or whorls. the quadrangle.

drift. The ground plan, form of the little fine gravel.

ounded or covered by stratified posed mostly of sand and a very pattern of the deposit, its nearly

deposit, and marginal topography The large flat-topped deposit of crossbedding indicate that this

of Whigville is mapped as a kame stream flowing southwest.

all indicate the former position of gravel and sand half a mile south channel filling was deposited by a

The ice-contact stratified deposits plain because of ice-channel fillings A mile west of Lake Como, severa

are the best indicators of the man-associated with it, its poor sorting ice-channel fillings associated with

ner in which the last glacier wasted and stratification, its nearly level a kame-plain deposit are more or

away. The kinds of deposits, their crest, and the angularity of its less separated by kettles. Gravel cations, characteristics, and rela- western margin. The altitude of pits show that the fillings consist

seem distinct and simple for they are a part of and continuous with those classified chiefly by topographic terraces before late-glacial and post-Kame-terrace deposits (Qkt). to other topographic features. Map- Stratified sand and gravel laid down The average thickness of the ping of the deposits however is by meltwater in a temporary valle ground moraine is believed to be commonly difficult because the de- between ice and an adjacent hill continuous with well-formed kame Kame terraces differ in form, and few have an ideal long or cross

about 10 feet. In general, thick-posits are actually complex members slope, and which remained as a ternesses range from less than 5 feet at of an interrelated and somewhat race when the ice melted, are and near the crests of hills and gradational series. Simple deposits mapped as kame-terrace deposit ridges where bedrock exposures are that fit the definitions are rarely Parts of some deposits, although draws and valleys. On the highland, of the deposits is commonly arbiterraces, accumulated on the ice and well logs commonly indicate a thicka deposit was laid down directly hillside as the ice melted. Thes on the ice. Owing to irregularities deposits commonly form a thir of the glacier surface and to differ- patchy mantle that is terracelik ences in thickness of drift on it, the only locally. Two deposits, one at external form of the original dethe maximum known is about 35 feet posit may have been destroyed or No. 1, the other at Whigville, are it may have assumed a resemblance mapped as kame terraces but are Stafford Avenue and Stevens Road, to a variety of the simple forms as bedrock benches mantled by sand the ice melted. In the Bristol quad- and gravel of irregular thickness and 3 miles northeast of Bristol. A possible thickness of 55 feet is the ice melted. In the Bristol quadant gravel of irregular kame-terrace origin. are classified so as to best express geologic history. The ice-contact deposits mapped include collapsed profile. An excellent example of stratified drift, kame deposits, kame terrace lies on the south wall lowland is well exposed in house-kame-plain deposits, kame-terrace of the Pequabuck River valley west deposits, ice-channel fillings, and of Bristol. This deposit displays a undifferentiated deposits. classic terrace form, boulder; Collapsed stratified drift (Ocd). composition, characteristic stratif unweathered highland till is in a Broad sheets of sand and gravel cation and sorting, and topographi believed to have been deposited on position. Many terraces are irreg Bristol, 1,000 feet north of the inter- the surface of stagnant ice or to ular, stepped, or sloping in cross section of Perkins and Peacedale have surrounded or enclosed disprofile because the rate of ice wastcrete stagnant ice blocks, and that age varied or because the material collapsed or were let down as the was deposited on ice that subseice melted, are mapped as collapsed quently melted. The series of terstratified drift. Collapsed material races along Whigville Brook was that is clearly part of an otherwise probably caused by intermittent nearly undisturbed ice-contact de- wastage of the ice, and a thin patch mantle of debris that lies north of some deposits, is not included in Peacedale Street probably accumulated on ice that subsequently The largest area of collapsed drift lies just west of Redstone Hill and Most of the kame-terrace deposit consists of many knolls and ridges are composed of light-colored sand eparated by low areas that hold and gravel. In general, the amount in swamp deposits. From the vicinity of East Bristol southward, it is absent in the highland ar he knolls become progressively attains a maximum at the south end broader, flatter, and lower in altiof the terrace on the east flank of tude. The deposit consists predom-Redstone Hill. Little red materia inantly of well-sorted, well-stratiis found north of the Pequabucl fied, medium- to coarse-grained sand River. In the longer terraces, the average grain size appears to decrease downstream. Crossbedding indicates that the direction of melwater flow was generally south-Stones more than 4 inches i of the deposit are composed of red diameter make up a very small

and fine to medium gravel. Stones are generally less than 2 inches in diameter, but boulders as much as 2 feet in diameter are common. Larger boulders are rare. Most of the material is light colored, but some parts debris. Moderate quantities of flowpercentage of kame-terrace depostill are present. The maximum thickits. Cobbles and boulders are absen ness of the deposit is estimated to be from even large exposures in some deposits, but because such stones A smaller area of unexposed col- are scattered about the surface of lapsed drift lies along the eastern all terraces they must be present. The color of the ice-contact mate-boundary of the quadrangle south Cobbles and boulders seem to be flowing along the ice margin: kame terraces flanking Lake Como and the southern end of Chippen Hill are differences of thickness of the origcity of Bristol represent the progre on the irregular surface of the ice. eastward from Bristol basin. T North of the town boundary, ter- highest and oldest remnant is at 500 racelike topography suggests a to 520 feet altitude. The second kame-terrace deposit, but foundakame terrace is less obvious, bu tion excavations exposed a bedrock forms a slight flattening of the slo bench covered by from 2 to 13 feet at 460 feet altitude. At about 376 of collapsed drift. The drift mantle feet altitude, an exposure of 12 fee here is locally very cobbly and boul- of sand and gravel in an indistinc ce-contact stratified deposits. Most dery, and large voids between stones nose at the bend in East Road sugare only partly filled by finer gests a third and still younger position of the spillway. Becau Collapsed stratified drift in the the altitude of this deposit is similar orthern part of the deposit at to that of the east part of the kame terrace south of Federal Hill School bles ground moraine but is somethe two probably formed at about what different lithologically. The the same time, and when the crest material is a semicompact, red. of adjacent hills were free of ice poorly sorted, crudely stratified, Just south of the Pequabuck Rive slightly porous sandy matrix enclosa still lower deposit at 280 to 320 fee ing a little fine to medium gravel altitude may represent the youngest with a few cobbles. Toward the northeast, the matrix becomes finer A descending sequence of kam grained and more till-like. Based on terrace deposits occupies a broad meltwater channel that extend tion excavation, the material is across the quadrangle from th Farmington River (just north o because of its porosity, sorting, and stratification. Southward, the de-Como to East Bristol, and southwar posit surface is more undulatory, and the material consists of loose, light-colored, fine- to coarse-grained sand and medium gravel that con-

into the adjacent Southington qua rangle. Terraces at 310 feet altitud near Lake Garda are apparentl correlative with terraces at 290 fee altitude at Stevens Street, 270 fee altitude west of Stafford School 50 feet altitude by Malone Por and 230 feet east of Lake Cor pounce. The kame terrace at 2 feet altitude on the northeast flan of Redstone Hill may be related to a later course of this meltwater The best example of a kame terrace deposit of collapse origin hat part of the Chippen Hill terrac that extends northward about three fourths of a mile from Peacedal Street. In this area, the deposilacks terrace form and is an irre ular mantle of low relief. deposit is locally more than 5 fee thick, but is absent in places. It is that surrounds them because their composed of very poorly sorted higher altitudes suggest that the poorly stratified to unstratified gate deposits of stratified drift Nearly flat-topped accumulations of generally of sinuous, ridgelike form less surrounded by ice at the time of flowed in channels, crevasses, or deposition are mapped as kame-plain tunnels in the ice, are mapped as deposits. They accumulated in ice-channel fillings. Both eskers y collapse, include tilted, contorted, larger ice-free areas than did kame and crevasse fillings, which are deposits, and lack the characteristic difficult or impossible to differ topographic form of kame deltas. entiate, are thus included in the unit Although kame plains in the Bristol Ice-channel fillings are compose natural repose, and, in rare cases, area were deposited mostly by of very light colored material that streams, locally exposed deltaic ranges from sand to boulder gravel structure shows that parts of some They resemble other ice-contact deposits were laid down in ponded meltwater deposits, but are more attenuated or collapsed with the water; an example was exposed in poorly sorted and stratified, some resulting depression filled by subse- a large sand pit north of Terryville what coarser, and contain more Avenue at the western boundary of boulders. An ice-channel filling about 2 Most of the kame-plain deposits miles long extends from the north along small faults is general. It consist of poorly to moderately well ern boundary of the quadrangle past ranges from a fraction of an inch sorted light-colored sand to coarse Lakes Garda and Como to the south to several inches and in a series of gravel. Cobble gravel is found in end of Mine Mountain. In gravel small deposits about a mile east of pits near Monce Pond and Lake Forestville and in the large kame Como, coarse poorly sorted and plain south of Bristol Reservoir No Deposits between Redstone Hill lenses of flowtill. Boulders are and Compounce Mountain contain common, and locally, as at Monce marginal topography. Kettles are moderate quantities of medium Pond, they are very numerous and epressions that mark the site of gravel. The kame plain northwest generally 3 to 6 feet in diameter of Bristol Reservoir No. 1 is com- The sinuous, braided, branchin

level crest, and the attitude of crud

lenses of flowtill. The relation of lain suggests that they originated in crevasses that radiated from an some draws. ice-free area in which the kame plain accumulated. idifferentiated stratified drift in categories of the contemporary, nternal structure indicating an origin very different from that suggested by their topographic form. ch deposits are mapped as undifferentiated stratified drift. The present form of these deposits is largely caused by collapse and postglacial erosion. Most are small, topographically low, and lack natural exposures. Their signifiically is small.

OUTWASH Outwash is generally better sorted and better stratified than icecontact deposits and changes in grain size, continuity, and lithology are less extreme and less abrupt. Boulders are rare, and probably were transported by floating ice. In this quadrangle outwash deposits are classified as valley trains, terrace alluvium, and alluvial-fan ville station. Valley-train deposits (Qvt).—The Swamp deposits (Qs).—Muck and outwash laid down by a meltwater peat constitute the swamp deposits. stream in a proglacial valley is The muck consists chiefly of silt, mapped as a valley-train deposit. Clay, and very fine grained sand hese deposits partly fill their intermixed with locally differing valleys from wall to wall and form quantities of thoroughly decomposed nearly flat floors that slope down- plant material; the peat consists stream; they lack scattered kettles almost entirely of only partly and other features characteristic of decomposed plant material. Swamp contact deposits. Upstream deposits are generally underlain by eposits correlated with these valley- beds of well-stratified, well-sorted, train deposits are mapped as kame- medium- to fine-grained sand and terrace deposits. silt, are more than 3 feet thick in The valley-train deposits consist places, and locally are inferred to lie of light-colored well-sorted and upon till. Locally, however, the stratified silt and sand that contains swamp deposits rest directly upon considerable mica. Augering inditill. A mixture of muck with a little and west of this hill kame-plain cates that most of the deposits peaty material generally mantles contain a little fine gravel and the floors of the larger draws. A exceed 5 feet in thickness. swamp deposit is rarely more than The valley-train deposit near the 2½ feet deep, but only deposits southeast corner of the quadrangle known to be at least 18 inches thick is part of a deposit that covers much in places are mapped. Many of the f western New Britain quadrangle. depressions now occupied by artifi-In Bristol quadrangle the deposit cial ponds were once swamps. Artificial fill (af).-Deposits emamounts of fine to medium gravel trash, or graded fills. Earth fills great deposits was unable to escape and gravelly sand; locally this is monly of till from ground moraine. probably passed westward through capped by as much as 1 foot of wind- Trash fills are earth fills intermixed a gap (a mile west of Pequabuck

coarse-grained sand and small Augering indicates that sand of unknown thickness is overlain by 1 to 3 feet of fine to medium gravel Gravelly sand that forms low allutities of wood, waste metal, and adjacent Thomaston quadrangle. vial terraces of small areal extent other refuse. The possibility exists es north of Forestville. The terthat trash fills may be covered by a races probably represent remnants few feet of earth, and so may have altitude half a mile south of the of dissected late-glacial valley been mapped inadvertently as earth northeast portal of the Terryville Alluvial-fan deposits (Qf).—Sedimaterials have been scraped into ment deposited by a stream in a fanbelow-grade depressions are mapped large alluvial fan built by the 5 feet of artificial fill are mapped. 660 feet, such as the kame terrace abuck River where it exits from the highland is composed and commercial construction are buck River west of Bristol, were almost wholly of light-colored out- excluded, as are parking lots and built at this time by meltwater that wash that ranges from medium sand playgrounds in urban areas. Earth followed this channel southwestto coarse gravel. Coarse material is most common near the fan's apex; near the margin, kettles, flowtill. and collapsed bedding indicate adja- are less than 10 feet thick. cent ice during deposition. Expo sures are limited to the walls of the equabuck River channel and to scattered outcrops near the fan's Three small alluvial fans composed of stratified drift eroded from adjacent kame-terrace deposits by small streams during late-glacial and postglacial time are arbitrarily included n this unit owing to the similarity f their lithology and form to the arge fan above. They are composed light-colored material that ranges

fills. Areas where above-grade

Only areas underlain by more than

ills are generally less than 10 feet

PLEISTOCENE AND POST-

PLEISTOCENE HISTORY

At the beginning of the Pleisto-

cene epoch, or Great Ice Age, the

landscape in the vicinity of Bristol

was very much like that of today.

Hills and ridges were slightly higher

and their profiles more angular,

Irainage was better integrated, and

valleys were narrower, more V-

shaped, and deeper. The terrain was mantled by a thick residual soil. he present topography of the bedom silt to very coarse grained sand, and probably contains a little cipal river in the quadrangle pro ine to medium gravel. ably followed the course of the present Pequabuck River, and joined POSTGLACIAL DEPOSITS the preglacial Farmington River Deposits that have accumulated somewhere east of the quadrangle hiefly since deglaciation are conboundary. One tributary of th sidered to be postglacial in age, Pequabuck may have followed the even though deposition began while course of the present Copper Mine stagnant ice still occupied some Brook and its principal tributaries; depressions. In this quadrangle, another may have extended from the eolian deposits, swamp deposits, present headwaters of Polkville talus, alluvium, and artificial fill are Brook to the lower course of Birge considered to be postglacial, but only artificial fill is wholly modern. During the Pleistocene epoch an Accumulation of the older units has alternately cooler and warmer ontinued into the present. climate caused a succession of conti Eolian deposits.—Windblown silt nental glaciers to cross the Bristol and sand compose the eolian quadrangle. The successive ice deposits. Because the accumulations sheets stripped away the soil mantle, are thin, patchy, and lack characteristic form they are not mapped. The material is derived from the larger areas of stratified drift, and is generally found on, or south and east deposits are thin, they are eroded from the steeper slopes. Basal contacts are gradational, and much upslope, mostly by slope wash. The windblown silt, or loess, is sorted, unstratified, and lacks interleposits. It is most easily recognized where it overlies till, but even here recognition is difficult because of intermixing and the thinness of the intermixed layer. This layer is

lowered hills and ridges, smoothed their profiles, and disrupted and partly reorganized the drainage Replenishment of the last glacier of, a source area. Because the slowed as the climate became warmer, and flow eventually ceased. The stagnant ice sheet began to thin. crevasses appeared, and the rate of if not all of a deposit is intermixed melting—and also the amount of with underlying material owing to debris deposited by the meltwater root and frost heave and plowing, or increased. Deglaciation by stagnawith material carried in from tion had begun, and was uninterrupted by rejuvenation of ice movelight brown owing to oxidation, well Crevasses on the ice surface flowing meltwater, which deposited widened, lengthened, and deepened some horizontally bedded finenal structure. Loess may lie on any until when the ice had thinned to less grained sand and silt in ice-dammed kind of glacial deposit, but was than 200 to 250 feet thick, the larger not recognized on postglacial crevasses probably penetrated to the ground surface. Intersecting crevasses caused discrete masses of ice. Some of these masses were large and remained for a relatively long time in areas that were then and are now topographic depressions; other from the basin along parts of Polkas much as 10 to 15 inches in thickness. Typical loess locally mantles masses were surrounded or covered the western flanks of Redstone and by debris and on melting caused Bristol basin, but was diverted east-Campground Hills. kettles. Potholes and other openings ward when ice in the Polkville Brook The eolian sand is mostly fine to formed in the ice and increased in gap west of Edgewood melted to an medium grained and includes some size; in some of these meltwater finer material. It is pale grayish orange owing to oxidation, lacks where, it escaped between the ice margin and an adjacent hillside, in and is well sorted. The sand, which places entering small temporar is as much as 18 inches thick, generponds or passing over spillways of ally mantles the stratified drift from bedrock or till. In these openings well exposed, a broad tongue of ice which it was derived, but locally it and channels, the meltwater depos- continued to cover the lowland. This extends a short distance farther ited stratified material that in some tongue may have continued to places extended out onto the ice flow briefly, but, as it thinned, flow south and east. A good exposure is in a small pit near ponds south of surface. As the ice continued to ceased, fractures enlarged, and a Copper Mine Road and east of melt, those deposits against or on stagnant, crevassed terminal zone Plainville Avenue. the ice collapsed. Alluvium (Qal).—Sediments The ice-contact stratified deposits nected ice masses. Further thinning mapped as alluvium were deposited show that the glacier melted downy postglacial streams. The material ward as well as northward. This northward extension to protrude, deposits in Bristol and New Britain is light colored, well rounded, and exposed the highland first, leaving splitting the tongue. As on the ranges from silt to coarse gravel; a great tongue of ice in the lowland highland, meltwater used and then sequence is dependent primarily on generally it is moderately well strat- and residual masses of ice along the abandoned a succession of channels. comparison of radiocarbon age ified and moderately well sorted. valley of the Pequabuck River and Melting eventually permitted the determinations. A determination t may contain a little humus, and in the basin now occupied by the city drainage to reoccupy modified of 10,700±300 radiocarbon-years age ders, show that the last glacier | 1 Color terminology (Goddard, 1948) refers to | 1 Color terminology (Goddard, 1948) refers channels reveal that deglaciation that of adjacent kame terraces to stratified and sorted sand and fine unmapped swamp deposits. Allulowland tongue of ice was lowered doned higher deposits and channels postglacial gravel in New Britain sota: Science, v. 125, p. 1038-1039.

to bouldery gravel that enclose vium lies along the principal stream by wastage, Redstone Hill and its as a record of a shifting temporary quadrangle (see Flint, 1956, p. 276) channels, and minor amounts that counterparts north of the Pequadrainage pattern. the channel fillings to the kame contain some colluvium and are too buck appeared through the ice. The Deposits west of Redstone Hill 11,404±350 radiocarbon years was small to map cover the floors of absence of comparable deposits at were among the first to accumulate. obtained for 5 samples of wood from similar altitudes in the topographic-Alluvium in the Pequabuck River ally lower area east of Redstone Hill valley is mostly a flood-stage suggests that the meltwater channel River, was still blocked by ice, meltdeposit. It consists of sand and area west of Redstone Hill became water escaped southward along the years for 2 samples of wood from Qu).—Not all deposits can be placed coarse gravel along the stream free of ice first. Similarly, the west side of that ridge. As the eposits of stratified drift lack a much as 8 feet in diameter, are Pequabuck River was more free of existed on the highland. Augering shows that alluvium HIGHLAND DEGLACIATION along Copper Mine Brook and its principal tributaries grades from sand and gravel headward to sand tain or possibly Johnnycake

channel and sand mantling the deposits and their continuity suggest wasting ice became pitted and Appleton, Wis. (Libby, 1954, p. 137) conventional classification. Some flood plain. Boulders, some as that the lowland area south of the crevassed the water partly filled the and a date of 10,676±750 radiocarbon depressions with stratified drift years for wood from sediments distinctive topographic form, or have numerous near bedrock outcrops. ice than the area to the north. A forming kames and ice-channel deposited near Kimberly, Wis., in a Thickness of the deposit is believed comparable situation probably deposits. Further melting made proglacial lake dammed by the larger openings in which kame plains receding Valders glacier (Libby, accumulated, and caused collapse of 1952, p. 678-679). ice-contact deposits. Melting of the In the highland area, South Mounlast remaining ice blocks caused Creeks was believed to represent the additional collapse and left depresdownstream. The broader parts of Mountain appeared first through sions like those occupied by Malone this deposit are more than 3 feet the thinning ice, and other highland Pond and Lake Compounce. thick, and the entire deposit is hills soon followed. At first, much North of Bristol quadrangle, ice the peat has been correlated inferred to overlie outwash from of the meltwater ran off across the blocked the Farmington River valley cance both historically and econom- which it is distinguished with diffice, but as more of the highland was so that its drainage was diverted Leighton, 1957; and Wright, 1957) exposed, the flow of meltwater was southward at Unionville. Owing to Talus.—Very coarse fragmental influenced more strongly by the ice in the Lake Garda-Lake Como Mankato substage and the Valders rock, or talus, along the foot of some terrain and flowed in channels area, the water flowed southeast substage of Thwaites (1943). steep bedrock slopes is not mapped across the newly exposed ground. toward Bensted Corner, then southbecause of its thin, patchy occur- The first meltwater deposits in the west to Forestville and south past rence. It is composed of large frost- quadrangle probably were small riven slabs and blocks from 8 to 12 accumulations of sand and gravel on permitted the stream to abandon recovered was deposited at the lower this course for a lower route along feet long and 2 to 4 feet thick that the ground moraine and along chanre derived from underlying bedrock. nels on the highland south of the the east edge of Mine Mountain to The lake was trapped behind a dam The slabs are irregular in form, but Pequabuck River. As wastage Edgewood and southward. At that time ice in the area east of glacier that covered the two quadgenerally have two approximately continued and the surface of the ice Edgewood was still more or less rangles. The radiocarbon dates parallel surfaces. A typical deposit lowered further, these channels were continuous with ice in the small suggest the lake used the spillway lies about 1,000 feet south of Terry- abandoned and lower channels Whigville basin, and was less during the Valders glaciation o occupied. When flow across the crevassed than either that ice or the Thwaites (1943), and the lake is highland was no longer possible, still lower channels developed between Construction of the alluvial fan at preceding interstadial represented the glacier and the protruding hills, East Bristol started after meltwater by the peat near Two Creeks. A and these filled with kame-terrace from Bristol basin began to escape the lake was younger than the deposits. Eventually the drainage through the Pequabuck River gap glacial deposits which caused it, the returned to valleys of the preglacial south of Hurley Hill and while the rainage pattern. Meltwater cascading from stag-Farmington River was diverted the peat at Two Creeks. On this southward. Growth of the fan basis, glacial deposits in Bristol and nant ice that still occupied the squeezed the stream against the low New Britain quadrangles are tentaequabuck River valley and Bristol till-mantled hill north of East tively considered to be Mankato in basin built the first major deposits Bristol, kept the flow there to a age. f sand and gravel in the quadrangle. minimum, and probably forced much he highest of these, and probably e earliest, lies between 650 and 700 feet in altitude, and surrounds the southern end of Chippen Hill. South tion of the fan, some scattered deposits and other landforms also were deposited at similar altitudes at about the same time. Locally, the adjacent ice was mantled by stratified drift that formed an extension of such deposits. As the ice melted the mantle collapsed and formed the great area of irregular topography along the east flank of Chippen Hill. placed by man are mapped as earth, The meltwater that built these predominate and are composed most eastward because ice filled Bristol

While the gap north of Redstone a peat bog near Two Creeks, Wis.

In addition, there are an average

Valders till of Thwaites (1943) near

Previously the peat near Tw

of the midwest sequence. Recen

(Flint, 1957, tables 20-B and 23-B

with the interstadial between th

The wood from New Britain quad-

The gravel from which the wood was

rangle may be of Two Creeks age.

end of a spillway from a glacial lake

of glacial drift built by the last

assumed to have filled during th

deposits are inferred to be older that

Sand, gravel, and till are the only

material is weaker, softer, le

where compaction is necessary. It

distance commonly involve

Although till is widely available

fill, probably because of its high

crushing is rare because little

observed is exposed in two pits on

the east flank of Chippen Hill abou

a mile north of Peacedale Street

Boulders as much as 6 feet in

diameter are common, and stones

deposit. The deposit probably does

Sand for bituminous aggrega-

of the highland scarp, and may be

Riprap is available in moderat

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\_\_\_\_1957, Glacial and Pleisto

screening at gravel pits, and in sma

ice-channel deposits.

ll slopes, but in general there has quantities as boulders from pits in

larger than 2 inches in diameter

Hill, now occupied by the Pequabuck

of it to adopt a more easterly course through Forestville. During deposiremnants of ice remained in and economic surficial deposits in the near its margin. The diverted quadrangle. These materials are Farmington River, together with widely available and provide good meltwater from Bristol basin and aggregate for some purposes and the ice remnants in the fan margin, good artificial fill. The best availlowed south, west of Redstone Hill. able aggregate for concrete and When ice in the Farmington River asphalt is basalt, which is crushed at valley melted sufficiently, the river quarries in the New Britain quadreturned to its original course where rangle. it constructed kame terraces at Light-colored sand and gravel ar about 260 feet altitude in New produced from pits in and adjacent Britain quadrangle (Simpson, 1959). to the highland. This material is ce in the area west of Campground preferred for nearly all engineering Hill melted mainly after the redi- use over the less abundant by commonly of sand and gravel from basin and the Connecticut Valley version of the Farmington. In locally more accessible reddishglaciofluvial deposits, and less com- Lowland. Therefore the meltwater melting, the ice left some collapsed brown sand and gravel available in drift, but much of it was covered by the lowland. The reddish-brown subsequent alluvium. or interlayered with differing quan-village) at 660-foot altitude in the Ice that dammed the Pequabuck equidimensional, darker colored, and River gap between Campground and less well sorted than light-colored The ice continued to melt and alluvial fan at East Bristol; it also is, nevertheless, rarely used because melted at the time of, or shortly of the smaller quantities locally nnel in the town of Plymouth. before, the return of the Farmington available and the greater hauling The spillway is clearly marked by a River to its original course. When valley-train deposit. Kame-terrace the ice dam in the Pequabuck River and kame-plain deposits with sur gap melted, south-flowing drainage it very rarely is used for artificial faces at altitudes of about 625 to was diverted eastward through the gap and the long-used course west Foundation fills around private along the south side of the Pequa-Redstone Hill was abandoned. After flowing through the gap, the water turned south along the east flank of Redstone Hill where. together with meltwater from the thick, but some are as much as 50 Subsequently additional melting adjacent ice, it built a kame terrace feet thick. Trash and graded fills opened a still lower escape route at about 250 feet altitude. The eastward from the Bristol basin. water then escaped southward down his ice-marginal channel lay at 500 to 520 feet altitude across the base plains and possibly the collapsed of the ridge that extends northeastdrift northeast of the gap were built constitute a large part of the ward from Castle Rock. As ic at about this time. filling the basin continued to melt. The last glacial deposit in the not extend southward, but much of the water was able to spill eastward quadrangle was the broad valley the flat area immediately to the across the ridge at progressively train that accumulated in the Quin- north may be underlain by similar lower altitudes. The lowest remnant nipiac River lowland while ice material. In general, coarse grave of this spillway is at 370 feet altiremained in the Farmington River is most likely in ice-channel fillings, tude. The east part of the kame lowland several miles north less so in kame-terrace deposits, and terrace south of Federal Hill School Simpson, 1959). No proof of the least likely in kame-plain and valleyprobably formed at about the same outhington Glacial Lake of Lougee The crests of Federal Hil (1938, p. 38-46 and pl. XII) was Hurley Hill, and the next hill north recognized in the quadrangle. Drill- water filtration, molding, and other were by now free of ice. ing logs in the town of Plainville small-demand uses is available in o When the stagnant ice melted to record fine-grained sediments be- near the quadrangle. It is in altitude somewhat less than 365 neath the valley train but these may byproduct of gravel pits just eas eet, drainage shifted northward to or may not be glaciolacustrine. After the ice disappeared, the available from kame terrace uck River. Beyond the gap the accumulation of talus, swamp flanking Chippen Hill. discharge began construction of the eposits, alluvium, and eolian mateadjacent large alluvial fan, and from ial began and has continued locally. quantities as cobbles separated by there flowed south through the low ostglacial erosion has gullied a few

area just west of Redstone Hill.

small terrace deposit at 280 to 32

feet altitude immediately west of

the gap is the lowest feature related

to this stage of drainage develop-

Eventually the drainage attained

a still lower altitude at about 265

feet. Bristol basin was now wholl

free of ice, and the young Pequabuc

position of its preglacial equivalen

ceased while the river flowed at this

instruction of the alluvial fa-

ltitude, and on further lowering of

ne channel to its present altitude

of 261 feet during postglacial time,

ne river began dissection of the fan.

accumulation of ice-contact strati-

Whigville Brook valley sporadically

eceded southeast; and southeast-

kame terraces. The large complex

deposit south of Whigville was built

more or less simultaneously within

crevassed mass of ice that occupied

the small topographic basin. Some

of the meltwater spilled southward

ville and Birge Brook valleys into

altitude somewhat less than 385

Although the highland now was

LOWLAND DEGLACIATION

ment and suggests that Bristol basin

was by then nearly free of ice.

There are no deposits of valual channels. Since the last glacier, the most obvious changes have been the metals or fuels in the surficia levelopment of a soil profile, and the deposits. growth of vegetation, on practically ll surficial deposits. Except for essentially as it did when the last ice similar to those of the same kinds sheet disappeared. deposits in the adjacent New Britain quadrangle. The subsurface drain CORRELATION OF THE age, ease of excavation, slone GLACIAL DEPOSITS stability, susceptibility to from heaving, amount of compressibilit There is no direct evidence to and expansion, and usefulness for determine the age of the glacial base course and subgrade are deposits. The best indirect evidence generalized in a table in the report is the correlation of these deposits on that quadrangle (Simpson, 1959). with those in the adjacent Nev In south-central Burlington town, Britain quadrangle for which a single radiocarbon date suggests a fied deposits took place at about the late Wisconsin age. The correlation Flint, R. F., 1956, New radiocarbon, same time that the large kame is based on the apparent age equivdates and late Pleistocene stratig terrace flanking Chippen Hill was alency of the ground moraine exposed both east and west of the Farmington-Quinnipiac valley-train unmodified by erosion, by the weak ponds, helped build a succession of ness of soil development, and by the similarity to other deposits in southern New England also believed to be of late Wisconsin age. In the upper Mississippi River Valley, the Wisconsin stage has been subdivided and the substages named his sequence is popular as a basis of

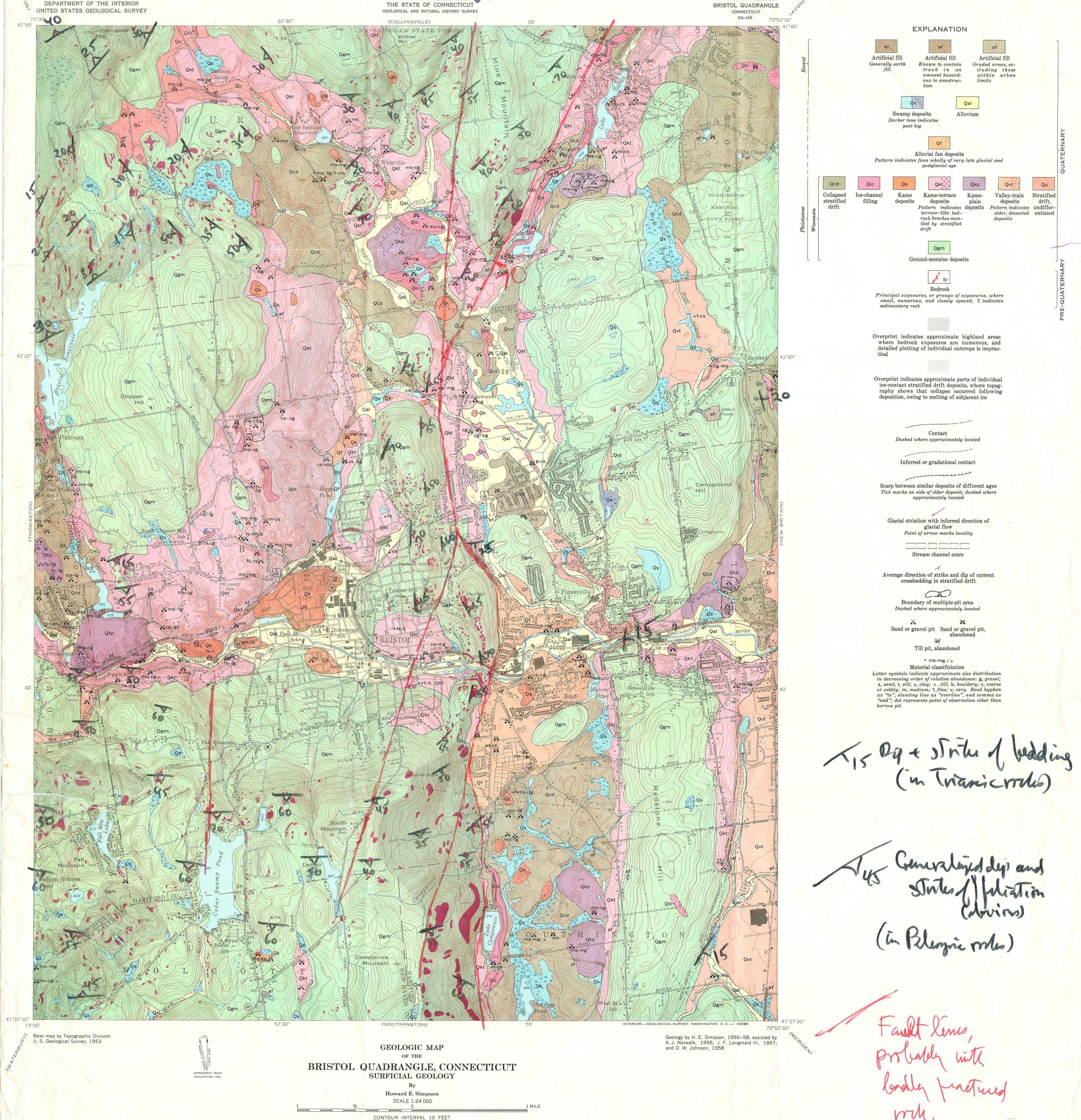
summarized below.

een little modification of drainage

ddard, E. N., and others, 194 Hartshorn, J. H., 1958, Flowtill i outheastern Massachusetts: Ge Soc. America Bull., v. 69, p. 477-48. Leighton, M. M., 1957, Radiocarbon dates of Mankato drift in Minn sota: Science, v. 125, p. 1037-1038 ibby, W. F., 1952, Chicago radio carbon dates III: Science, v. 116, \_\_1954, Chicago radiocarbon questionable. In the New Britain dates IV: Science, v. 119, p. 135quadrangle, I concluded that the deposits of the last glacier are of Lougee, R. J., 1938, Physiography of late Wisconsin age, and tentatively the Quinnipiac-Farmington lov correlated them with those of the land in Connecticut: Colby College Cary substage in the midwest Mon. 7, 64 p. (Simpson, 1959). Information now Rodgers, John, Gates, R. M., and suggests that the deposits in Bristol Rosenfeld, J. L., 1959, Explanaand New Britain quadrangles may tory text for preliminary geologic be tentatively correlated with the map of Connecticut, 1956; Connect-Mankato substage, the substage cut Geol. Nat. History Survey next younger than the Cary of the Bull. 84, 64 p. midwest sequence. The evidence is Simpson, H. E., 1959, Surficial geology of New Britain quadrangle Connecticut: U. S. Geol. Survey Tentative correlation of glacial quadrangles with the midwestern Geol. Soc. America Bull., v. 54,

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SURFICIAL GEOLOGY



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