TRIP B-5

PLEISTOCENE HISTORY OF THE MILLBROOK, NEW YORK REGION

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Location, Physiography, Relief and Drainage

The Millbrook, New York quadrangle is centrally located in Dutchess County, New York, mid-way between the Hudson River and the State of Connecticut (to the east) and New York City and Albany (to the north). The topography of the southern half of the quadrangle is generally hilly with areas of low relief between the hills. These areas appear to be lake plains of ice-marginal lakes formed during the retreat of the continental ice sheet from the Mid-Hudson Valley. Subsequent erosion of the lacustrine deposits has formed flood plains and terraces. The lowest elevation, about three hundred feet above sea level, occurs on the western border of the map area in the flood plain of the east branch of Wappingers Creek. A series of progressively higher rock ridges trending northeast-southwest traverse the quadrangle. The highest elevation, Tower Hill, rises to 1323 feet. The valleys between these ridges are probably pre-glacial in origin but at present are partially filled with glacial deposits. The larger valleys have terraces along the sides.

The area is drained by tributaries of three major creeks. Tributaries of Wappingers Creek on the west and Fishkill Creek on the south, flow into the parent streams and then into the Hudson River. The extreme eastern part of the area is drained by unnamed tributaries of the Ten Mile River, which flows into the Housatonic River in Connecticut. These tributaries originate in elevated bogs and small kettle ponds and lakes.

Geology

The bedrock in the map area varies in age and composition. It consists mostly of folded metamorphosed sediments. The largest area, in the center of the map, is underlain by Ordovician Walloomsac Formation, a mixture of phyllite, schist and metagraywacke. Overlying the Walloomsac in the western and eastern parts of the map area are older Cambrian formations, the Everett Schists in the east and the Everett Schists and the Nassau shales and quartzites in the west. There is a small limestone area in the center of the map and a small area of sedimentary rocks in the extreme northeast corner. Both of these are obscured by glacial and recent deposits. The topography may or may not be structurally related. The relation between the drainage pattern and the nature of the bedrock is not understood. (See map overlay #2)

Evidence of Glaciation

Ice first advancing over the area probably removed a layer of bedrock-derived soil and mixed it with rocks plucked from the bedrock and rocks carried by the ice from the north. This formed the till that seems to blanket most of the area. Typically, the higher, steeper hills are covered with thin till, the lower, less steep hills with thick till. The valleys are partly filled with stratified drift. Evidence of recessional or terminal moraines was not observed.

In the western portion of the map area, glacial striae appear confined to newly exposed rock surfaces and to surfaces of low inclination. These occur mostly on phyllites. The striae indicate that the ice last moved into the area from the northwest from 340°. (See map overlay #1) One groove in the center of the map area and one in the eastern part indicated the same direction but for the most part the rocks in the east were highly weathered and did not exhibit striae. Freshly exposed bedrock, however, was not observed.

Glacial deposits of the following types have been identified in the map area.

Till Thick till has been deposited over the less steep hills. Extensive areas of these rolling hills make up much of the farmland in the area. The till is stony as is the soil developed on it. There are many walls, buildings and piles of stone. These stones vary in size from large cobbles to small boulders. They may have come from lag concentrates resulting from post-glacial sheet-wash of the till. These lag concentrates were probably removed from the fields by the first farmers when they cleared the land for cultivation.

Thin till covers most of the steeper hillsides and some of the hilltops. The bedrock on the higher hills is often exposed or covered with bedrock-derived soil or post-glacial origin.

Deltas, Kettles and Kames

Extensive deltaic deposits occur in several places and at several elevations in the map area. (See map overlay #1) Foreset beds in materials ranging from silts to large cobbles exist at the eastern edges of what were probably once ice-marginal lakes. It is assumed that topset beds of varying thickness overlay these foreset beds in most areas. Where the foreset beds are presently exposed, the topset beds and their soil profiles have been removed as a result of sand and gravel pit operations. In most areas the foreset beds are inclined to a maximum of 30°, generally to the west. In the valley east of the "Hogback" in the northeastern portion of the map, they dip more gently, about 5°, and are extensively cross-bedded. At Glacial Lake Littlerest (See map overlay #1) the formation of large kettles, up to fifty feet deep, may have disturbed the original bedding, making it impossible to distinguish between topset and foreset beds. It is inferred

that some of the original beds were deposited against and between large ice blocks. When the ice melted, the bedding collapsed, extensively altering its original position.

Kettles occur in the lake plains of Glacial Lake Littlerest and Glacial Lake Washington but not in the lake plain of Glacial Lake Mabbettsville. It is inferred that these kettles were formed when ice blocks became separated from the retreating ice front and were buried in sediments. When the ice melted kettles remained. Some of these kettles form lakes and ponds, most are dry. They range in depth from a few feet to more than fifty feet. Many are too small to appear on the topographic map; they are more extensively distributed than appears on the topographic map of map overlay #1, but are generally associated with the kettles that do appear on the maps.

A few kames occur on the lake plains. These are generally located marginal on the plains.

In several areas bogs have developed in what were probably shallow glacial lakes. When the ice dams confining pro-glacial lakes melted, these lakes were dammed by residual topography.

Recapitulation of Ice Retreat

Ice retreat westward across the map area is indicated by three major and two minor lake plains. These are inferred from relatively large areas of relatively low relief underlain by deltaic and lacustrine deposits. The major levels occur at 440, 740 and 900 feet. The minor levels occur at 650 and 830 feet.

As the ice sheet began to thin, the high hills, up to 1300 feet, in the eastern part of the map area became exposed and ice probably rose to not more than 1200 feet in the west. The ice front was trapped against the higher eastern topography and forward motion was prevented. The edge of the ice then appears to have formed a dam to the west which trapped melt-water against the hills in the east, forming a lake in a one-sided valley, Glacial Lake Littlerest, with a minimum delta top level at 900 feet. (See map overlay #1 and topographic map) Large ice blocks seem to have become separated from a stagnating ice front and were probably buried in sediments. When the ice blocks melted, they left large kettles. The source of the sediments was probably the till on the hills to the north, east and south, not the base or the top of the ice to the west. The drainage of this lake appears to be eastward through Mutton Hollow into the Housatonic River drainage system.

When the ice sheet thinned to less than 1150 feet and/or the ice front retreated west, melt-water was apparently ponded against the hills west of Lake Littlerest and east of the present South Mabbettsville Road. A narrow lake formed here

extended into the valley east of the Hogback. The minimum delta top level of this lake occurs at about 830 feet. The presence of this lake is evidenced by deltaic deposits and kettles along the western slope of this hill. The bottom of the valley east of the Hogback is filled with cross-bedded, gently dipping deltaic deposits. A bog was formed at the lake bottom level, which persists. The deltas occur at several levels in these valleys, indicating that the lake level was not constant. Drainage from this lake was probably to the northeast into the Housatonic drainage system.

The next large lake plain occurs southwest of Mabbettsville at 740 feet. This large lake, Glacial Lake Mabbettsville, has deltaic deposits on the north and east but the hills on the south and west are covered with till over which a layer of clay has been deposited. This lake seems to have been dammed by a relatively small ice plug as it has few of the features usually associated with ice margins. The dam may have been located across Mill Brook northeast of the present village of Millbrook. Ice marginal features associated with this plug were possibly eroded away. The drainage of this lake was probably to the west into the Wappingers Creek drainage system, possibly under the ice in the deep channel that drains the area today. (1) When the lake drained, the part north of Daheim Road on North Mabbettsville Road remained dammed and subsequently evolved into a bog, which persists.

The lake bottom level then lowered to 650 feet where it remained until Mill Brook found what was probably its preglacial channel, cut deep into bedrock, at the northwest edge of the village of Millbrook. This channel was the site of the mills that were the reason for the settlement of the village and from which the creek and the village got their name.

The ice sheet probably continued melting until the ice surface sank to about 740 feet or less to the west. At this time another lake with a delta ((1) It is possible that drainage from this lake followed a channel between the ice and the 740 foot level on the hills east of the village of Millbrook into the drainage system of Fishkill Creek to the south.) top level at 440 feet elevation, Glacial Lake Washington, was formed between the higher ground on the east and the ice on the west. This lake occupied a large area at the west side of the quadrangle and backed up into the valleys to the north, east and south. Stagnant ice was left in the valleys and sediments were washed in around the remnants. When the ice melted many kettles remained. These kettles are concentrated in three areas and scattered elsewhere. Several kames appear along the margins of the lake plain. The presence of this large lake is inferred because of the extensive deltaic deposits found at this level. These deposits consist largely of foreset beds dipping 30^{o} west, overlain by topset beds. Erosion has removed much of the former lake bottom, leaving terraces cut into the deposits on all sides. Some of the remaining sediments are being removed by sand and gravel companies.

As the ice melted off the hills, a ground moraine, the till that exists on them today was left. A soil profile redeveloped and along with the lake plains and the valleys, the hills became reforested and remained so until the arrival of man. Indian artifacts have been found in the western portion of the map area and recently bones believed to be Indian were discovered here.

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Quaternary Geology and Related Topograph, Southern Half, Millbrook Quadrangle, Dutchess County, New York

Unpublished excerpt from the program of the
First Annual New Paltz Science Student Paper Presentation
May 12, 1973 State University College at New Paltz, N. Y.

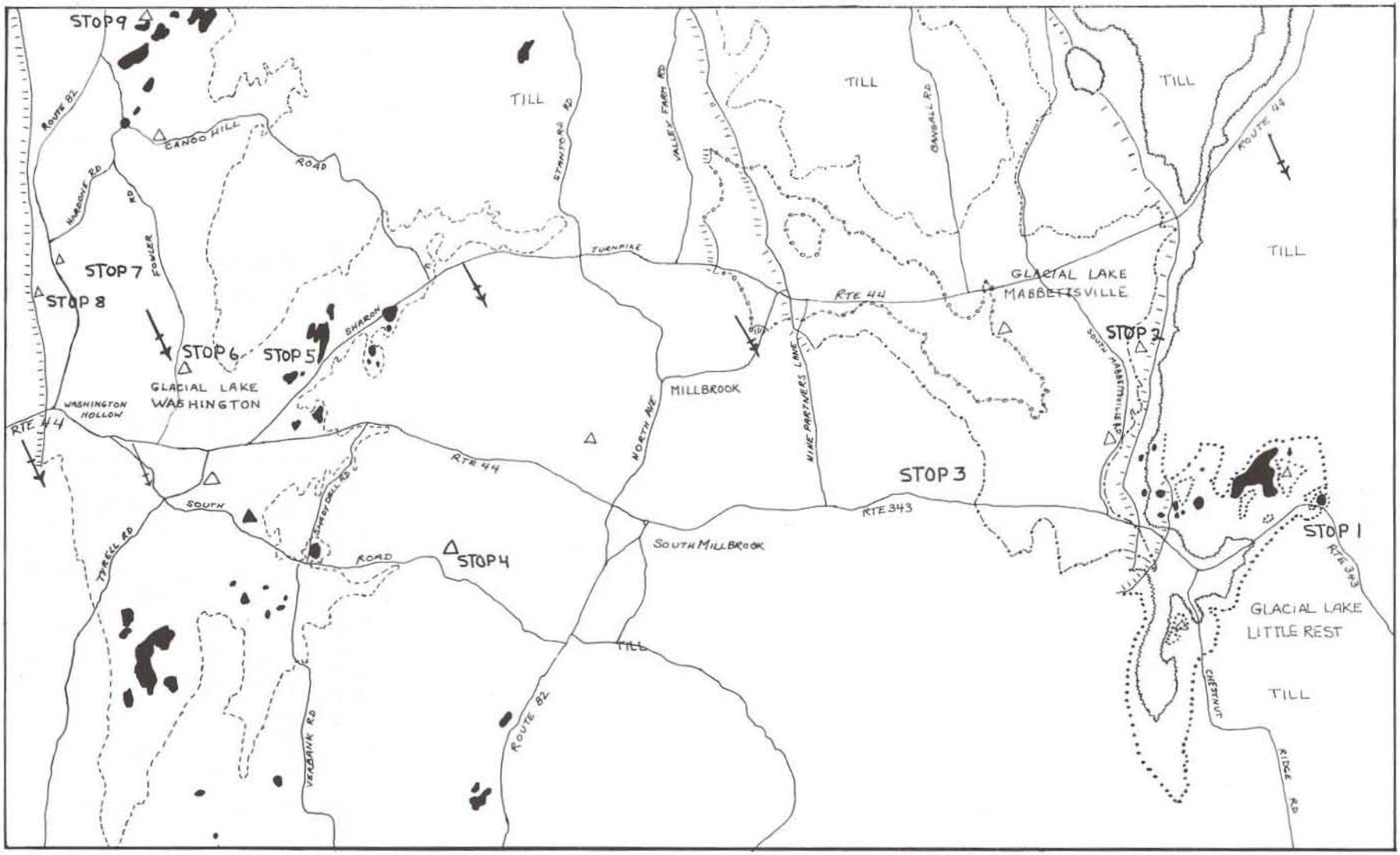
ROAD LOG FIELD TRIP B-5
Leader: David J. Murray

Total Miles	Miles from Last Stop	
0.0	0.0	Assembly Point - Vassar College student parking lot at the corner of Raymond Avenue and Route 376. Departure time: 8:30 a.m. Leave parking lot and turn right (north) on Raymond Avenue.
1.0	1.0	Turn right on Main Street (Route 44).
1.3	1.3	Bear left on Route 44 at Route 44 and Route 55 intersection.
6.8	6.8	Pass through village of Pleasant Valley. Cross Wappingers Creek. This creek provides drainage from field trip area.
12.6	12.6	Pass Dutchess County Farm and Home Center. This site is on the east side of former Glacial Lake Washington.
14.7	14.7	Proceed directly east on Route 343 from Route 44 straight through traffic light. Pass Bennett College.
14.9	14.9	Traffic Rotary with monument. Continue east on Route 343.
		STOP 1 (One hour) Time: 9:05 a.m.
18.4	18.4	Town of Washington Disposal Area. Sanitary Landfill. This is the highest level of the field trip area. Look for massive kettle holes and distorted bedding, due to slumping as buried ice blocks melted. Top elevation 900 feet. Time: 10:05 a.m.
18.4	0.0	Leave Town of Washington Disposal Area. Turn right and proceed west on Route 343.
19.2	0.8	Turn right on Little Rest Road. Proceed north.
20.1	0.9	Turn right on Sutton Road.
20.2	1.0	Dirt Road to Left beyond first House to abandoned gravel pit.
		STOP 2 (15 minutes) Time: 10:15 a.m. Deltaic deposit consisting of foreset and topset beds dipping west indicating source of sediments from east into Glacial Lake Mabbettsville. Time: 10:30 a.m. Leave Stop 2. Return to Little Rest Road.

Total Miles	Miles from Last Stop	
20.5	0.0	Turn left on Little Rest Road. Head south.
21.3	0.8	Turn right on Route 343 (west).
		STOP 3 (30 minutes) Time: 10:35 a.m.
22.5	1.2	Pull into Dutchess Day School Driveway on right. Observe lake plain and lake terrace indicating Glacial Lake Mabbettsville. Time: 11:05 a.m.
22.5	0.0	Leave Dutchess School. Proceed west on Route 343 to Route 44.
26.0	3.5	Go straight ahead on Route 44.
27.3	4.8	Turn left on Shady Dell Road.
27.8	5.3	Note kame and kettle topography on right in field next to swimming pool.
28.2	5.7	Turn right on South Road and proceed west.
28.7	6.2	Turn right into dirt road past white house on right.
		STOP 4 (45 minutes) Time: 11:15 a.m. Large gravel pit. The sand and gravel from this pit is used "as is" as a high grade bank run gravel. It is quite well sorted and fairly free of silt and clay sized particles. Foreset and topset beds visible in this massive deltaic deposit in Glacial Lake Washington. Leave Stop 4. Time: 12:00 noon.
28.7	0.0	Proceed west on South Road.
29.4	0.7	Turn right on Tyrrel Road.
29.6	0.9	Abandoned gravel pit on right.
29.8	1.1	Turn left on Route 44. Turn right on Fowler Road past Cottonwood Inn.
30.3	1.6	Arrive Cary Arboretum Headquarters. Time: 12:10 p.m. Lunch Stop. The Cary Arboretum of the New York Botanical Garden is a 2000 acre tract of land devoted to botanical research, applied environmental science, and education about plants. It was established in 1971 with a grant of land and funds from the Mary Flagler Cary Charitable Trust on an estate owned by the late Mrs. Cary. Time: 1:00 p.m.
30.3	0.0	Leave lunch area. Proceed east on Cary Internal Road to construction site at
31.4	1.4	new headquarters building.

Total Miles	Miles from Last Stop	
		STOP 5 (30 minutes) Time: 1:05 p.m. Level ground underlaid with deep gravel; bedding almost horizontal. Look for fairly well sorted gravels and stagnant ice features. Time: 1:35 p.m.
31.4	0.0	Leave Stop 5. Return west on Cary Internal Road.
32.2	0.8	STOP 6 (10 minutes) Time: 1:40 p.m. Level field is a delta surface at 440 feet elevation. Soil on left side of road is dramatically different from soil on right side of road. Time: 1:50 p.m.
32.2	0.0	Leave Stop 6. Proceed west on Internal Road.
32.5	0.3	Cross Fowler Road.
32.9	0.4	Bear right across Glacial Lake Washington plain.
		STOP 7 (15 minutes) Time: 1:55 p.m.
33.8	0.9	Stop at bridge across Wappingers Creek. Inferred history of Glacial Lake Washington will be discussed. Time: 2.10 p.m.
33.8	0.0	Leave Stop 7.
34.2	0.4	Cross Route 82. Proceed west around greenhouses.
34.4	0.6	Turn right at lathe house to gravel pit.
34.6	0.8	STOP 8 (15 minutes) Time: 2:15 p.m. Gravel pit is an exposure of poorly sorted outwash overlaid with ground moraine on western margin of Glacial Lake Washington. Time: 2:30 p.m.
34.6	0.0	Leave Stop 8. Return to Route 82.
35.0	0.4	Turn left on Route 82 (north).
35.1	0.5	On right side of Route 82 at this point a deltaic deposit was removed for road building material. Bones thought to be those of Indians were found here in 1973 but have not yet been authenticated.
36.3	1.7	Turn right onto Canoe Hill Road.
36.5	1.9	Turn left at Route 82 Sand and Gravel Co. pit.

Total Miles	Miles from Last Stop	
		STOP 9 (One hour) Time: 2:40 p.m. This large gravel pit operated by the Route 82 Sand and Gravel Company has a variety of features that will be discussed here. Time: 3:40 p.m.
36.5	0.0	Leave Stop 9. Return to Route 82.
36.7	0.2	Turn left on Route 82 (south).
38.7	2.2	Turn right on Route 44.
50.9	12.5	Continue straight ahead through Pleasant Valley on Route 44 to Main Street.
51.2	12.8	Turn left off Main Street onto Raymond Ave.
52.2	13.8	Return to Assembly Point.



B-5-10

DRAWN FROM U.S. GEOLOGICAL SURVEY MAP
BY
DAVID J. MURRAY

N
MN GN

GLACIAL MAP
SOUTH HALF MILLBROOK
(DUTCHESS COUNTY) N.Y QUADRANGLE

SCALE
1 0 1 MILE

LEGEND
△ DELTAIC DEPOSITS
KETTLES
INFERRED ICE FRONT
GLACIAL LAKE MARGINS
···· 900 FEET ELEVATION
830 " "
740 " "
650 " "
440 " "
ICE DIRECTION

TRIP B-5

- Photograph (Scale 1:130,000) of northern portion of western Dutchess County taken from a U-2 aircraft at an elevation of 20 kilometers (12 miles); resolution of photo is 10 meters. Note especially the NNE alignment of water bodies (black) in the Milan Window, the fold patterns on the west side of the Hudson River in the Quassaic Quartzite, and the topographic break between the Van Buren Slide on the east and the deformed rocks to the west. Wappinger Creek follows this linear for much of its course; Stissing Mountain is in the upper right-hand corner.

Flown April, 1973.