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TRIP 5

GLACIAL GEOLOGY OF THE SCHOHARIE VALLEY

by

Robert G. LaFleur

Rensselaer Polytechnic Institute

INTRODUCTION

Recent mapping, literature, and field trips through the Hudson-Champlain Lowland [LaFleur 1961, 1965, 1965b, 1965c, 1968, Schock 1963, Connally and Sirkin 1967, 1969, and Wagner 1969] have provided detailed analyses and interpretations of a variety of glacial deposits and have reevaluated the series of proglacial lakes which accompanied wasting Late Wisconsin ice. Readvances of ice in the southern Hudson and southern Champlain Valleys have been proposed by Connally (1968) and Connally and Sirkin (1969).

The Hudson Valley meltwaters seem to have always had exit to the south away from the receding ice, a situation which produced a rather consistent pattern of outwashing ice-contact, fluvial, and lacustrine deposition into Lakes Albany and Vermont, the levels of which were progressively lowered as crustal uplift proceded.

The Schoharie Valley was, however, a container of a slightly different character, draining northward toward the ice instead of away from it, having several sharply defined notches along its southern divide through which glacial drainage spilled, and also having along the northeastern divide several shallow cols through which reinvasions of Hudson Valley ice passed. These features made the Schoharie Basin extremely sensitive both to major ice advance and to more subtle action of wasting and readvancing ice, and permitted the accumulation in deep, sheltered valleys of a more complete Pleistocene record than has been previously seen in eastern New York.

Among the intriguing problems in understanding the deglacial history of the region are the determination of routes for exiting meltwaters issuing directly from wasting and readvancing ice, and confirmation of the presence of lakes standing behind spillways as postulated by earlier workers. Also more than 400 water well logs have been recently obtained from drillers who have worked in and near the Schoharie Basin, and many of these logs suggest earlier glaciations in eastern New York. The subsurface data have made it abundantly clear that the complete Pleistocene record will not be determined through surficial mapping alone. As is usually the case with drillers' logs this information is oversimplified, and variable in its detail and reliability, but it provides the only means of access to the older glacial deposits which rarely outcrop. The last major glaciation, of probable Cary age, was an overwhelming one, and subdued the record of any prior glacial episodes with a thick blanket of till, drumlins, and lacustrines.

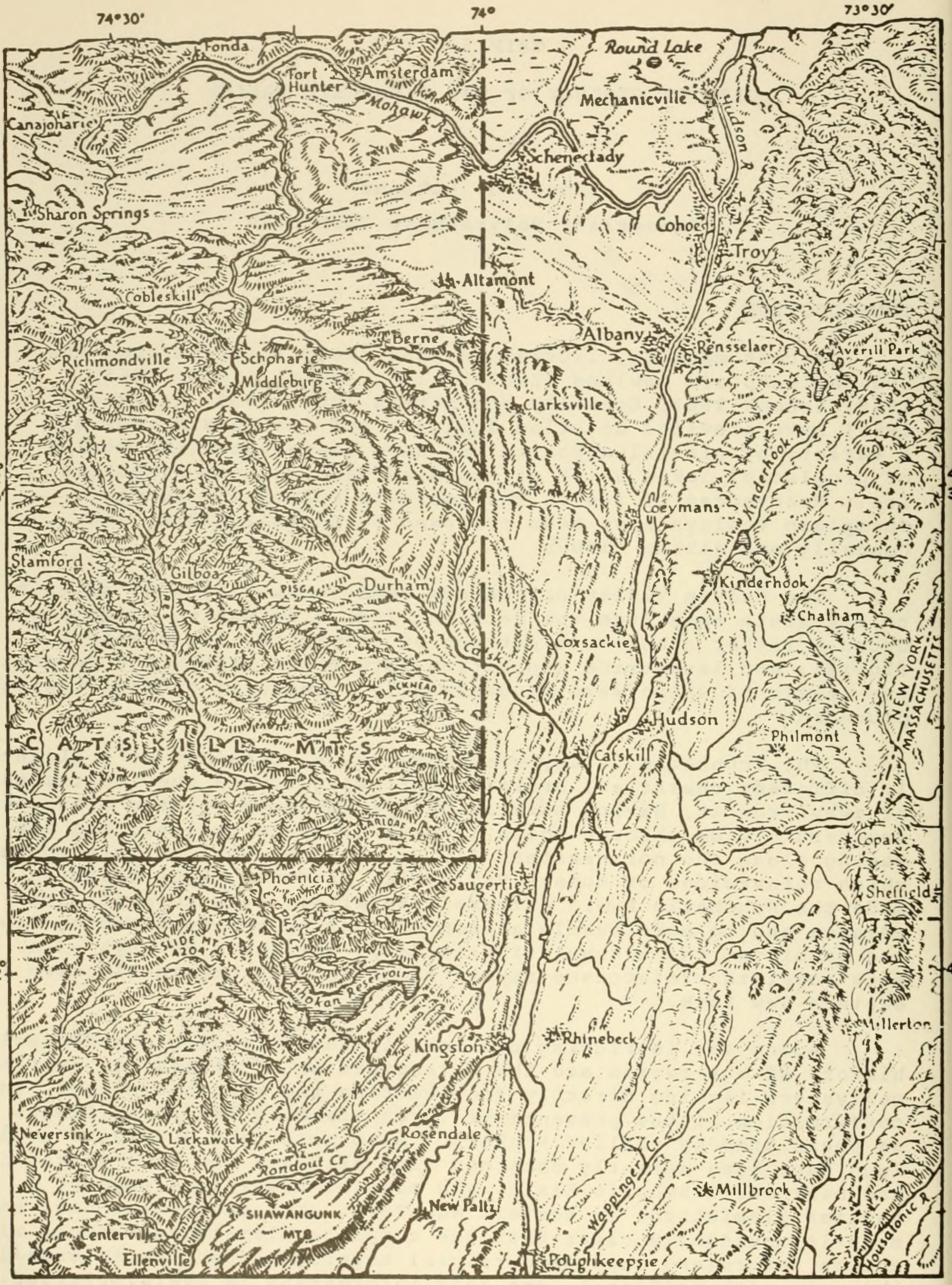


FIGURE 1. Physiographic diagram of Catskills and Hudson Valley showing area of Figure 3. (After Berkey, 1933)

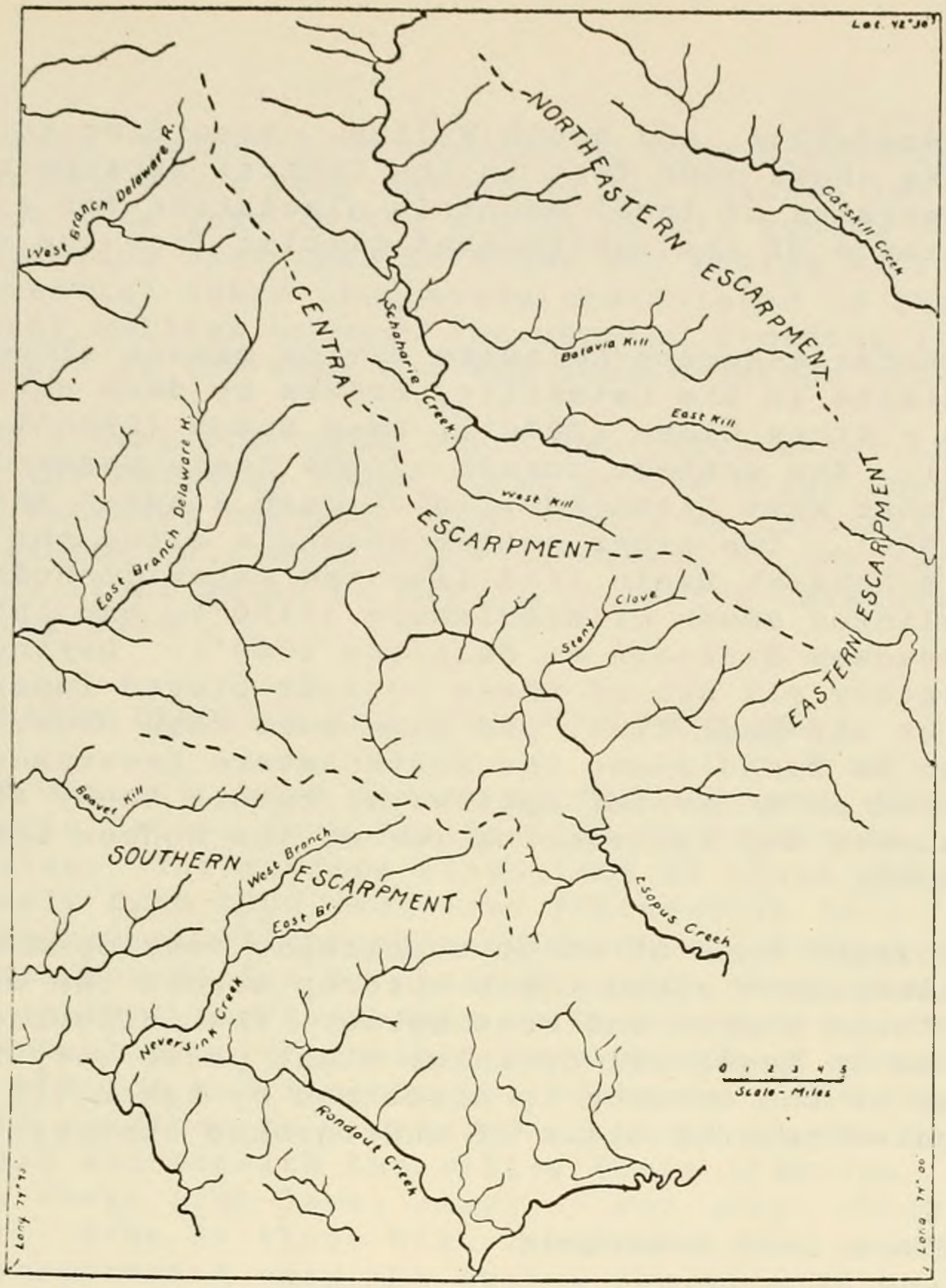


FIGURE 2. Drainage of Catskills, with escarpment terminology of Rich (1935)

SCHOHARIE BASIN PHYSIOGRAPHY

Schoharie Creek above Breakabeen and its tributaries drain an area about 15 miles wide and 40 miles long, situated between two northwestward-trending escarpments developed on gently dipping Devonian clastics. (See Fig. 2.) The Central Escarpment extends from Kaaters Kill and Platte Kill Cloves northwestward through Hunter Mountain, West Kill Mountain, Vly Mountain, Irish Mountain, and the Moresville Range to a point between Stamford and Jefferson where it loses its prominence. This ridge forms the divide between the Schoharie and the Delaware-Susquehanna drainage. The Northeastern Escarpment forms the Schoharie-Catskill divide and extends from North Lake near Haines Falls northwestward through the Blackhead Mountains, Mount Zoar, Mount Hayden, and High Knob toward Broome Center. A topographically reduced extension of the Northeastern Escarpment can be projected across the Schoharie Valley to

Summit, Richmondville, and South Valley. According to Rich (1935), the high peaks above 3000 feet in the Central Escarpment formed loci for dispersion of local mountain glaciation for a time during the disappearance of the continental glacier from the upper Schoharie Basin.

The Schoharie-Hudson-Delaware divide passes along some of the highest mountains in the Catskills, broken by deep notches at only three points - Stony Clove (2070'), Deep Notch (1900'), and Grand Gorge (1570'). The western corner of the basin passes into the Susquehanna near West Richmondville through a notch and outlet channel at 1500'. Two other outlet channels along the eastern edge of the Schoharie Basin lead into the Catskill-Hudson drainage at Franklinton south of Middleburg (1180'), and into the Normanskill-Hudson drainage at Delanson (840'). During the glacial deglacial history all six of these outlets played important roles, but not all at the same time, and some more than once. Several cols may also be found along the Northeastern Escarpment, but none of these served as meltwater spillways; rather their function was to provide access for readvancing ice of the Hudson Lobe into the Schoharie Basin.

An important area of karst topography developed in the Helderberg limestones along their outcrop across the middle of the Basin between Sharon and West Berne. The influence of the cavern systems on deglacial drainage might prove very significant. The hydrology of the terrane is described by Baker (in preparation) who investigated several miles of underground chambers.

EARLY CONCEPTS - LAKE SCHOHARIE

Papers by Brigham (1908), (1929), Fairchild (1912), and Rich (1935), describe the glacial history of the upper and lower reaches of the Schoharie. Brigham (1929), and Rich mapped northward from the Catskills through most of the Gilboa quadrangle and Brigham included the lower Schoharie in part of his Fonda and Amsterdam sheets.

Much of the earlier Pleistocene literature concerned itself with areas where various glacial lake waters collected, and citations of cols which controlled their levels. The Schoharie Basin was no exception. Brigham (1908), first appreciated the presence of glacial and post-glacial lake water standing in the Schoharie Valley and gave these lake bodies that name. His post-glacial lake extended up the Cobles Kill and main Schoharie valleys and was dammed by a morainal plug at the northern end between Burtonsville and Esperance. The water level was set at 700 feet. Brigham's glacial Lake Schoharie was postulated as an ice-margin body draining through cols in the southern divide.

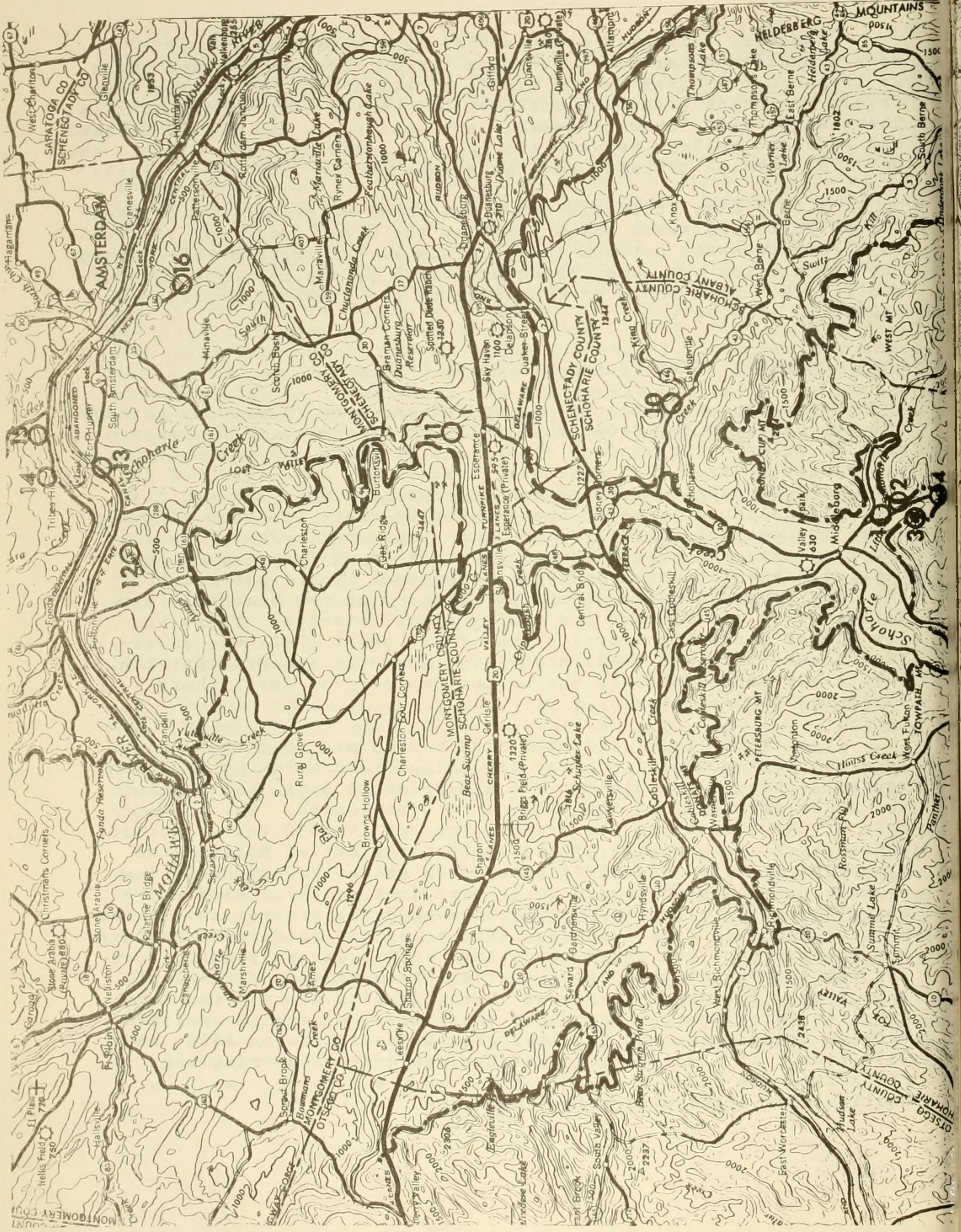
However, Fairchild's concept of Lake Schoharie was of a more expansive water body extending far outside the present basin. He included this lake in the middle of his system of falling water levels beginning with Lake Herkimer and ending with Lake Amsterdam. These sequential lakes presumably accumulated in the Mohawk Lowland and adjacent valleys between two opposed receding lobes of ice, the Ontarian lobe on the west and the Mohawk-Hudson lobe on the east.

Rich's Lake Schoharie was a two-phase water body which overflowed to the Delaware Basin first at the Grand Gorge col at 1620'-1570' and extended between these levels as far north as Middleburg. The Franklinton col, upon being uncovered by the receding ice controlled the final phase of discharge to the Catskill Basin at an elevation of 1180'.

LAKE SCHOHARIE DEPOSITS AND ATTENDING PROBLEMS

Large discontinuous masses of red and gray clay occur through the Schoharie Valley from Prattsville to Esperance, a distance of some 30 miles. The surface elevations of these clay deposits drop progressively from 1300 feet near Prattsville to a level of 650 feet at Esperance. Although considerable gullying has modified the original boundaries of these deposits there are many places where ice contact surfaces seem to be preserved. There are also several exposures which exhibit deformation of the clay by contact with the ice and also by ice override. The great bulk of the clay is confined to dissected terraces at the base of steep valley walls and beneath the valley floor alluvium. There are few places where high-level clays of any great thickness or extent occur. Even in these high-level cases it appears that the thin clays represent only the bottom deposits of small short-lived ice-border lakes.

Fairchild (1912), and Rich (1935), presumed that these clays were the bottom deposits of an expanding Grand Gorge Lake, which had exit through the divide into the Delaware Basin at a point two miles southwest of the village of Grand Gorge. The present base of the channel at the Grand Gorge col is 1570 feet. According to Rich, downcutting of the Grand Gorge outlet between the elevation of 1620' and 1570' took place while the Schoharie ice block was wasting northward to a point just south of Middleburg. When the receding ice supposedly uncovered the present col at the head of the Cats Kill drainage, at a point now between Middleburg and Franklinton, the Grand Gorge Lake waters abruptly fell, downcutting the Franklinton "till plug" at the divide to a level of 1180 feet. This explanation of the history of Grand Gorge Lake requires first that a reasonably continuous water body existed between Grand Gorge and Middleburg at a level between 1620 and 1570 feet. It also assumes that the valley-choking plug near Franklinton is older than the outlet at Grand Gorge. Serious difficulties arise with this hypothesis.


AMSTERDAM
MOHAWK
RIVER
Schoharie
Creek
SARATOGA CO
SCHENECTADY CO
MONTGOMERY CO
SCHENECTADY CO
SCHENECTADY COUNTY
SCHOHARIE COUNTY
SCHOHARIE COUNTY
ALBANY COUNTY
MONTGOMERY COUNTY
SCHOHARIE COUNTY
MONTGOMERY CO
OTSEGO CO
HELDERBERG
MOUNTAINS
Duanesburg
Esperance
Charleston
Sharon
Cobleskill
Middleburg
Richmondville
Schoharie
Amsterdam
South Amsterdam
Fonda
Canajoharie
Palatine Bridge
Fort Plain
Sharon Springs
Carlisle
Central Bridge
Knox
Berne
East Berne
Altamont
Rotterdam Junction
Mariaville Lake
Featherstonhaugh Lake
Duane Lake
Thompsons Lake
Warner Lake
Summit Lake
Schuyler Lake
Bear Swamp
PETERSBURG MT
WEST MT
Briggs Field (Private)
Esperance (Private)
Sky Haven
Delanson
Quaker Street
Sloansville
Gallupville
Sidney Corners
Hyndsville
Seward
Gardnersville
Lawyersville
Ames
Marshville
Stone Arabia
Christmans Corners
Rural Grove
Browns Hollow
Charleston Four Corners
Oak Ridge
Burtonsville
Glen
Auriesville
Minaville
Scotch Bush
Rynex Corners
Mariaville
Pattersonville
Cranesville
Hagaman
Glenville
West Charlton
Tribes Hill
Fultonville
Randall
Yatesville Creek
Cobleskill Creek
Fox Creek
Switz
West Berne
Valley
Warnerville
East Cobleskill
West Richmondville
Summit
Hallsville
Nelliston
St Johnsville
Eagleville
East Worcester
Hudson Lake
West Fulton
Fulton
Breakabeen

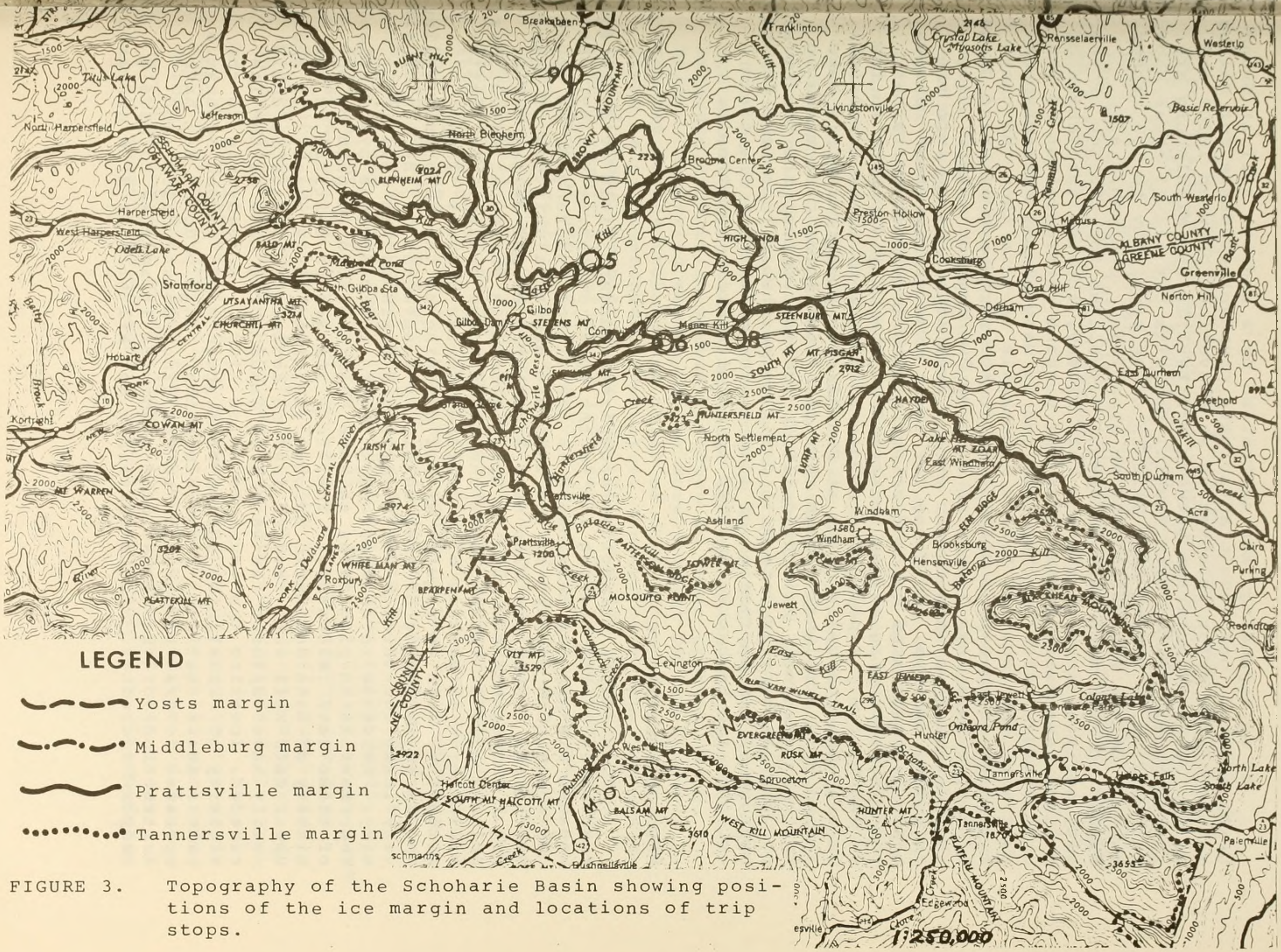


FIGURE 3. Topography of the Schoharie Basin showing positions of the ice margin and locations of trip stops.

If an expanding lake controlled by a bedrock sill at Grand Gorge existed, one should anticipate abundant evidence for deltas in all of the major tributaries at elevations between 1620' and 1570'. Side tributaries between Prattsville and Middleburg are indeed partly filled with fluvial deposits but all of these show indications of having been laid in close proximity to ice rather than as deltas extending into an open lake. One would also expect to find more uniform summit elevations for the top of the clay surface, such as that of Lake Albany, through the length of a large lake basin rather than the present configuration of the clay surface which is step-like and in many places reflects contact with the ice. If Rich's hypothesis is true then the clays two miles southwest of Middleburg at the north end of Grand Gorge Lake must have been deposited in over 800 feet of water. Clays should have also extended in such a deep lake well up into the tributary valleys. Evidence for their presence in these valleys again is associated quite distinctly with ice blockage rather than as continuing masses connected to the clay deposits in the valley bottom. Finally the sudden onslaught of Grand Gorge Lake waters upon the valley plug at Franklinton would certainly have caused more erosional damage than the Franklinton plug seems to have experienced. Fairchild (1912), considered that the Franklinton channel carried Cats Kill drainage northward into Lake Schohar because of his impression of slight erosion there. The field evidence can be better applied to an alternative hypothesis.

MULTIPLE GLACIATION

Rich (1935), correctly recognized abundant field evidence for readvances of the wasting ice in the upper Schoharie Valley, but because his mapping terminated in the Gilboa quadrangle, he could not apply this concept to the complete deglacial history of Lake Schoharie. There are also many kame terraces and deltas which occur throughout much of the upper Schoharie Valley at elevations below the 1570' threshold of the Grand Gorge outlet. At Prattsville thick lacustrine clay overlies coarse gravel. These situations seem to require either draining of the Schoharie Valley and later impounding of lake waters by readvances of the ice, or else very leaky ice through which northward drainage was relatively easy. Evidence to date strongly favors the readvance hypothesis. The Franklinton plug seems to have been emplaced in part by one of these late readvances. Therefore its age is critical to the history of Lake Schoharie through the Grand Gorge phase. If the upper Cats Kill were free of ice and sediment blockage it could easily have captured the waters of Grand Gorge Lake as the ice receded, lowering the level to below 1100'. A readvance to the vicinity of Franklinton and to Breakabeen would impond Schoharie waters again abut at a lower elevation. This process may have operated several times prior to the final construction (and destruction) of the Franklinton plug, for it appears to have a compound character. It is certainly not all till as Rich assumed.

Four positions of the ice margin are recognized as significant in the deglacial history of the Schoharie Valley. See Figure 3. It is probable that all four represent terminal positions of the ice during readvances which occurred during Late Cary(?) deglaciation. These readvances are particularly important to the lake history which heretofore has been treated as a simple recessional sequence.

Tannersville Margin

The oldest readvance is represented by the ice margin which extends along the edge of the Central Escarpment. The leading edge of this advancing ice lobe moved eastward in the Hunter-Tannersville area where it apparently collided with a lobe of Hudson ice advancing up the Kaaters Kill Clove at Haines Falls. In several water well logs between Hunter and Tannersville an upper till some 15 to 30 feet thick can be recognized overlying a much thicker section of lacustrine sediments. A basal till lies directly beneath the lacustrines on top of bedrock. The age and character of the basal till are unknown. Small tongues of this advancing lobe extended into the cols at Stony Clove, Deep Notch and Grand Gorge, and ice scour and meltwater drainage through these cols served to excavate them to an elevation close to their present thresholds. Lingering masses of ice were present in the upper reaches of the tributaries south of each clove, for the outwash there is of ice-contact character. Recession of the ice block toward Hunter permitted the Red Kill to build a small delta with a summit elevation of 1890 feet. The present threshold elevation of Stony Clove is 2070 feet. The bottom of Stony Clove appears to have been elevated by landslide debris accumulation. Even if one allows for a 200 foot thickness of such a debris fill, it does not seem likely that a glacial lake at the elevation of the delta summit would have drained southward through Stony Clove. Ice-contact deposits lying between 1800 and 2000 feet occur one-half mile south of Devil's Tombstone (Stony Clove). Dissection of these ice-contact deposits is minor, easily accomplished by the steep tributary streams of upper Stony Clove Creek, several of which have built small, steep alluvial fans into the valley. There is little to suggest erosion here by lake spillway waters of any lengthy duration. At Haines Falls, the low point in the Kaaters Kill-Schoharie divide lies presently at 1940 feet with no indication there of an outlet channel draining eastward into the Kaaters Kill.

The Tannersville ice was apparently drained to the west through Grand Gorge (1620'+) at a time when ice still protruded through that col. This condition would allow deltas and kame terraces inferior to the Stony Clove (2070') and Deep Notch (1900') thresholds to form. Ice-contact deposits at Grand Gorge are missing, suggesting free drainage into the Delaware. This ice mass downwasted with abundant recessional deposits having decreasing elevations to the west. Left behind were detached ice blocks which served as local drainage controls for kame terraces and deltas lying between 1600 and 1400 feet in the valleys of the Schoharie and Batavia Kill. Minor readvances of the ice are indicated at Mosquito Point and Lexington where deformed sand and clay are overridden by till. How much of the Schoharie was deglaciated during this time is not presently known. Gravel underlying Lake Schoharie clay at Prattsville might suggest a free drainage northward perhaps with exit at the Franklinton col at an elevation of about 1100 feet.

Prattsville Margin

A second readvance of the Schoharie Lobe is proposed to have extended south to near Prattsville, with side lobes reaching to Grand Gorge and into the valleys of the Manor Kill and Platter Kill. Restoration of Lake Schoharie took place during this readvance where clays north of Prattsville with a summit of 1400 feet were deposited in lake water with at least this level. Build-up of the Hudson Lobe simutaneously sent tongues of active ice through the larger cols along the Northeast Escarpment. Two of these tongues at Broome Center and between High Knob and Steenberg Mt. (Stop 7) served to supply meltwater for extentive outwash and delta systems in the upper Platter Kill and Manor Kill valleys. A small lake formed between Manorkill and Conesville where a delta complex was built into each end. (Stops 6 and 8) Recession of this margin down the Platter Kill Valley produced a series of progressively lowered outwash and delta deposits between the Broome Center col and Gilboa (Stop 5). The upper Platter Kill and Manor Kill valleys record active ice thrusting over the divide from the east in the form of convex-westward moraine loops, mapped by Rich (1935). The contemporanity of these lobes with ice lying in the Gilboa-Conesville area is indicated by the abundance of coarse gravel and sand laid against ice (Stop 5) which fills the upper reaches of each valley. These deposits are too extensive to have formed by normal processes of precipitation and erosion, and must have been transported by actively moving meltwater. The Grand Gorge col served as an exit for this glacial drainage with deltas in the Manor Kill and Platter Kill between 1580' and 1620' suggesting the final stage in the downcutting of the Grand Gorge col. In the western Schoharie Basin presently drained by the Cobles Kill, the ice margin at this time rested against the extension of the Northeast Escarpment from Summit through the West Richmondville col and then into South Valley and Cherry Valley. Stages in the recession of the Schoharie Lobe are indicated by the ice-contact clay deposits lying in the valley bottom between Gilboa and Breakabeen (Stop 9). When the Hudson lobe had deteriorated so as to no longer contribute meltwater to the 1940-foot outlet channel west of Broome Center, a series of progressively lower kame deltas and eskers were formed in the Keyser Kill Valley. These range in summit elevation from slightly under 1900 feet down to 1400 feet. A sag south of the summit of Brown Mountain permitted meltwater to issue across the divide there and form a small delta at 1620 feet overlooking the Schoharie Valley at North Blenheim. Rich (1935) considered this delta to reflect the northernmost extension of his Lake Schoharie comparable in elevation to a 1620 foot temporary sill at the Grand Gorge col. The present writer prefers to substitute stagnating ice for much of the Lake Schoharie waters at this time, with the drainage from the Conesville-Manor Kill area, the Platter Kill and from the Keyser Kill extending over ice to exit for a time at Grand Gorge. Deterioration of the ice from this margin might expose again the col at Franklinton which could serve upon deglaciation of much of the upper Cats Kill to drain Lake Schoharie waters, but at a time while ice still lingered as detached blocks in the area between Breakabeen and Gilboa. Recession of this ice margin took place to at least the latitude of Middleburg in order to permit the accumulation of red clays in a lake between Middleburg and the Franklinton outlet. Deglaciation of the Cobles Kill Basin also permitted lacustrine conditions to develop in the basin now occupied by West Creek, a tributary to the Cobles Kill, between Seward and Hyndsville.

Middleburg Margin

A third readvance of Schoharie ice permitted the construction at the limit of the advance of the major portion of the Franklinton morainal plug (Stop 2) in addition to other end morainal features in the valleys of Little Schoharie Creek at Huntersland, the main Schoharie near Breakabeen, and the Cobles Kill near Richmondville. The lacustrines near Hyndsville were overridden with thin clay-rich till overlying clay with a terminus for the advance suggested by the valley-choking moraine west of Seward at the foot of the escarpment. In the easternmost Schoharie Basin at the head of Swiss Kill a kame moraine near Rensselaerville may correlate with this advance. Remnants of ice probably occupied parts of the upper Cats Kill establishing local lacustrine conditions adequate to maintain a kame delta at the Franklinton moraine with an elevation of 1280 feet (Stop 3). Recession of the ice from the moraine (Stop 1), and deterioration of the ice blocks in the Cats Kill permitted the final downcutting phase of the Franklinton col (Stop 4) with a threshold at present lying at 1180'. Ice override in the tributary valleys northeast of Peterburg Mountain is indicated by thin till overlying sand, clay and older till in well records. In the Cobles Kill Valley slight smoothing of kame terraces with occasional veneers of thin till are found southeast of the Cobles Kill between Mineral Springs and Richmondville. Inwash ice-contact deposits of gravel are found which correlate at near 1000 feet with recession of the ice from the Middleburg area and esker-like masses of clay south of Vroman's Nose suggest the lingering of ice in the valley bottom after some drainage of the lake waters from the 1180' outlet at Franklinton. If the clays south of Vroman's Nose with a summit elevation of 800 feet date from the time of outlet of Lake Schoharie at 1180' at Franklinton then a water depth of something under 400 feet would have been present at the time of their accumulation. This is a more desirable alternative to the 800-foot depth required by Rich's hypothesis. The compound character of the Franklinton morainal plug (gravel and clay overlying till) and the availability of a deglaciated Cats Kill Valley provides an alternative to the concept of large lake bodies which are required to overflow at high levels through the southern divide. It is clear that a single recessional deglaciation of an ice margin is inadequate to explain the complicated subsurface stratigraphy and the requirements of drainage of Lake Schoharie during the deglacial episode.

The recession of the Middleburg ice was accompanied by falling Lake Schoharie waters, but the point of exit from the Schoharie Basin for these waters is not clear. Upon exposure of the Helderberg limestone karst terrane leakage possibly took place through underground cavern systems. Another possibility might involve an exposure of an outlet near Delanson permitting overflow for a while at near 800 feet. Water well records for the Cobles Kill Valley in the vicinity of Howe Caverns suggest that the lower Cobles Kill was always occupied by either ice or lake water. Minor recessional ice-contact features are also found on the uplands east of Schoharie where several small esker segments trend down the hillslopes.

Yosts Margin

A final readvance of the Mohawk Lobe involved the lower Schoharie Basin, where a valley-choking moraine is now located just east of the junction of Fox and Schoharie Creeks. In the lower Cobles Kill Valley above Central Bridge a similar valley choking morainal system defended a small lake in which clays accumulated to 750 feet. Similar small, local lakes appear to have been imponded along the escarpment overlooking the lower Schoharie between Esperance and Glen. Yatsevitch (1969) has referred to a readvance through the Mohawk which terminated at the Noses on the Mohawk River. This readvance produced till which overlies stratified sand and gravel at Tribes Hill (Stop 15), and also produced an end moraine system running north and south along the Noses Escarpment. He calls this the Yosts Readvance. If earlier Lake Schoharie waters ever exited from the basin at Delanson, the record of these spillways was obliterated by this final readvance, unless the now-beheaded Bozen Kill at Duane records this earlier exit. A slight recession permitted the development of two outlet channels, which have been previously referred to as the Delanson outlet or the Delanson River (Fairchild, 1912). More complete stagnation of this final ice mass exposed the till and bedrock sill for the final controls of Lake Schoharie at Esperance (Stop 11). Recession through the lower Schoharie has left a somewhat fragmented record of kame terraces and gravel outwash systems between Burtonsville and Fort Hunter.

LAKE AMSTERDAM Final disappearance of ice from the Mohawk permitted the development of Lake Amsterdam with a water elevation of 420 to 450 feet. In its early stages Lake Amsterdam was blocked on the east by a narrow ice lobe as evidenced by concordant summits of deltas at Cranesville and Hoffmans. Final disappearance of the ice appears to have exposed a sill developed on till and limestone at Cranesville along the Cranesville fault. The duration of Lake Amsterdam with this spillway is not known but meltwaters from Port Huron ice in the western Mohawk or Lake Iroquois discharge may have finally destroyed the sill.

Stages in the downcutting of the Esperance sill for the final stage of Lake Schoharie are indicated by a series of terraces one-half mile north of Esperance. The upper, oldest sill level is indicated by a terrace at 680', which stands at the narrowest part of the present Schoharie gorge (Stop 11). Successively lower terraces are found at 640', 620', with modern terrace remnants at 580' and 560'. The northern limit of Lake Schoharie clays is found immediately south of the sill, with summit elevations near 650 feet. Clearly the sills at Esperance served to retain Lake Schoharie waters after the disappearance of ice from the lower Schoharie Valley, and it is probable that Lakes Schoharie and Amsterdam were in part contemporaneous.

OLDER GLACIATIONS

Several of the trip stops are at localities where till is found overlying stratified sediments. In these cases the occurrence can perhaps be best explained by minor readvances of Late Cary(?) ice which left a relatively thin record of its activity.

Several dozen water well logs obtained throughout the Schoharie Basin also show good evidence for multiple glaciation and in some logs the till portions each exceed 50-100 feet in thickness. Of particular interest are the well records from two thick-drift areas, one of which extends along Route 20 between Esperance and Sloansville, diagrammed in Figure 4. The second area extends from Central Bridge to Cobleskill and reflects a similar valley history. In many of the wells shown

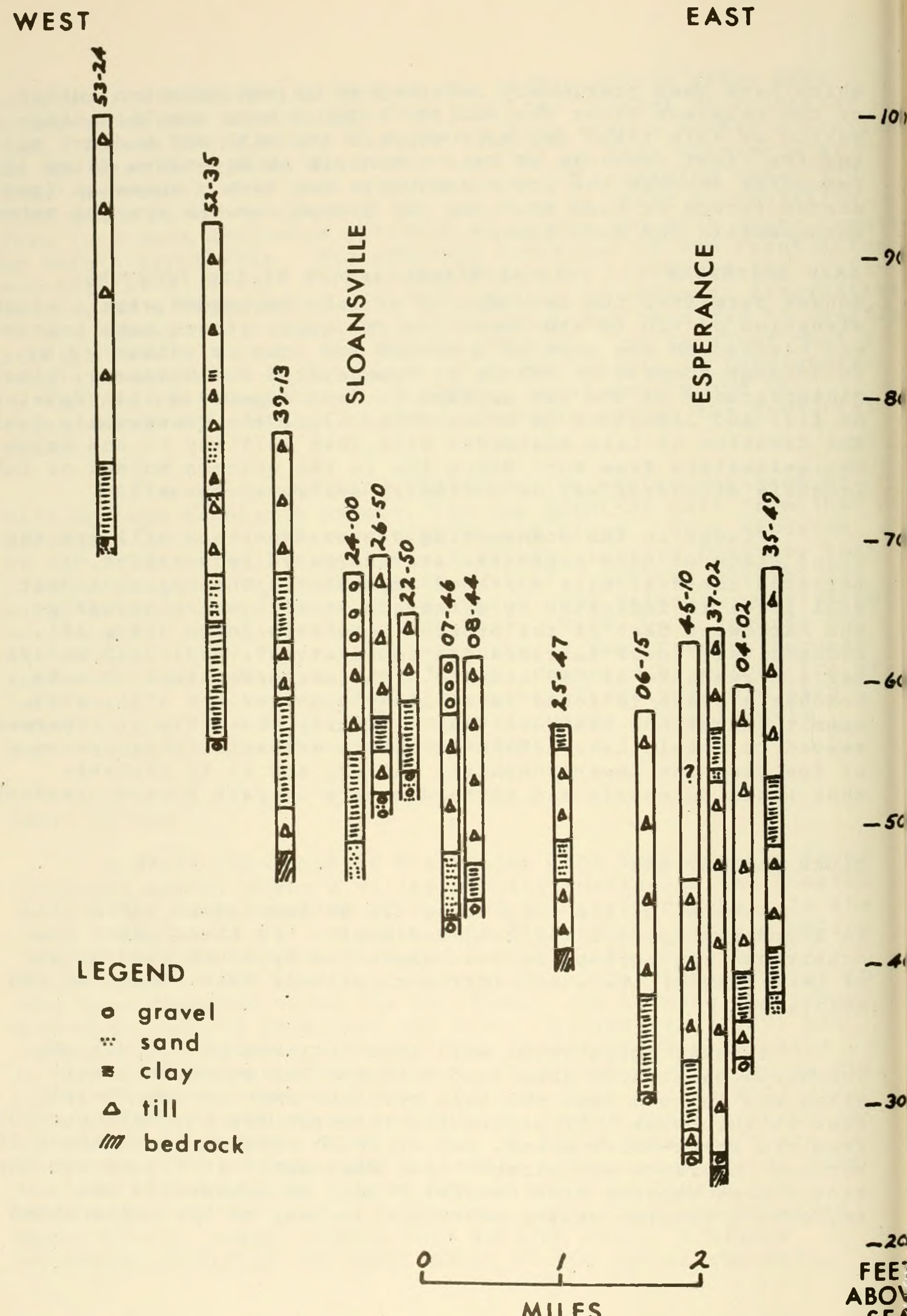


FIGURE 4. Water well logs indicating multiple glaciation in the Sloansville-Esperance area (Esperance quadrangle).

on Figure 4, the drift thickness exceeds 300 feet and in one, three glacial-deglacial cycles are represented. Well 39-13 shows three tills separated by two clay intervals. At least two cycles are indicated in several of the others.

The most important concern in correlating these records is in assigning correctly an age for the upper till. It is not clear at this writing whether the upper till represents all Late Wisconsin glaciation in this area deposited by ice which overtopped the Catskills , or whether it includes or is composed completely of till of some of the later readvances.

At Tahawas in the eastern Adirondacks, Muller (1965) and Craft (1969) have described a multiple till section which includes wood-bearing sediment with a radiocarbon date of > 40,000 years. If the upper till in these wells and at Tahawas represents the last major glaciation in southeastern New York, then a more ancient age for much of the drift in the Schoharie Basin is indicated.

GLACIAL HISTORY

Extinction of Lake Amsterdam. Mohawk delta at 340' into Lake Albany

Port Huron advance in western Mohawk Basin

Lake Amsterdam

Esperance sills

Delanson channels

Yosts Readvance

Franklinton channel

Middleburg Readvance

Grand Gorge outlet

Prattsville Readvance

Deglaciation of High Catskills: local alpine glaciers

Tannersville Readvance

Deglaciation, unknown extent

Main Cary (?) or older (?) advance, overtopping Catskills

Deglaciation with clay and sand deposition in lakes. (Pre-Cary (?) age). Free drainage of basin to Mohawk and Hudson?

Glaciation with deposition of lacustrine clay in lakes blocked by advancing ice. Override and till deposition. Extent and age of glaciation unknown.

Deposition of black sand (Braymanville aquifer) in Cobles Kill Valley

Preglacial northward drainage of Schoharie Valley, course between village of Schoharie and the Mohawk lying about a mile east of the present course.

SELECTED EXPOSURES
and
TRIP STOPS

Stop 1 Middleburg quad. 42 35 06 N 74 19 05 W 740' el. Small pit in esker segment behind gas station on Rt. 145 one mile southeast of Middleburg. Exposes 1-3' pebble gravel, overlying 15' sand with deformed red clay beds, overlying faulted and collapsed pebble sand. Formed upon withdrawal of ice margin from Franklinton morainal plug. Good view of plug to south and of ice-scoured Vroman's Nose and of alluvial fan of Little Schoharie Creek to west.

Stop 2 Middleburg quad. 42 34 29 N 74 18 36 W 970' el. Small exposure of till with subrounded boulders of local siltstone and a few clumps of red clay in matrix of red clay. May be till formed by Middleburg readvance over lacustrine sediments. Smooth slopes leading up to Franklinton plug, and ice-contact clays visible to south.

Stop 3 Middleburg quad. 42 33 27 N 74 18 55 W 1260' el. Lobate kame delta atop Franklinton moraine. Pit exposes boulder gravel with south dip. Abundance of subrounded local lithologies with few carbonates. May represent early exit of waters to Cats Kill while receding ice choked the valley, or may represent terminus of Middleburg readvance over dead ice and lacustrines in main Schoharie Valley to north. This deposit is graded to 1240' terrace remnants along Rt. 145 one mile north of Franklinton.

Stop 4 Middleburg quad. 42 32 50 N 74 18 08 W 1230' el. View of Franklinton outlet channel at 1180' and upper 1230' outwash terrace remnant at the present Schoharie-Cats Kill divide. For a mile to the south, small fans choke the channel and a swamp has formed.

Stop 5 Gilboa quad. 42 25 04 N 74 24 54 W 1620' el. Pit 2 miles NE of Gilboa exposes over 30' of well-rounded, SW-dipping lobate cobble gravel and sand laid against ice on downstream side. Supply of outwash was from ice lobe extending into head of Platter Kill Valley at Broome Ctr. 2 miles to the NE. Normal faults on SW end of pit. This locality is cited by Rich (1935) as evidence for upper 1620' phase of Lake Schoharie, with spillway at Grand Gorge.

Stop 6 Livingstonville quad. 42 22 51 N 74 21 41 W 1560' el. Conesville choker moraine. View to east toward Manor Kill and Steenburg Mt. col through which ice readvanced westward. Pit at 1560' exposes east-dipping pebble gravel and sand. Small lake basin lies to east.

Stop 7 Livingstonville quad. 42 23 43 N 74 18 55 W 1500' el. Morainal loop terrane NE of Manor Kill.

Stop 8 Livingstonville quad. 42 23 12 N 74 19 30 W 1500' el. Manor Kill delta. Pit exposes lobate pebble gravel and sand, dipping west; derived from ice projecting through Steenburg Mt. col.

Stop 9 Breakabeen quad. 42 30 23 N 74 25 23 W 750' el. Roadcut one mile south of Breakabeen on Rt. 30 in deformed interbedded red and gray clay. Southern end of a two-mile-long mass of kame-terrace clay.

Stop 10 Gallupville quad. 42 40 26 N 74 14 55 W 760' el. Pit along Rt. 43 one mile west of Gallupville exposes 10 feet of oxidized till overlying 20'+ of tightly cemented kame terrace cobble gravel.

Stop 11 Esperance quad. 42 46 28 N 74 15 25 W 680' el. Terrace remnant at 680' one mile north of Esperance represents highest Esperance sill for late Lake Schoharie. View to east of narrowest part of Schoharie gorge, cut in till. Between this point and Esperance, road drops over lower terraces lying at 670', 640', 620', and 580'.

Stop 12 Tribes Hill quad. 42 55 15 N 74 19 45 W 420' el. Landslide into Auriesville Creek one mile southwest of Auriesville exposes in the slide scar 2-3' silt and pebble gravel overlying 20' varved brown clay overlying 12' compact calcareous dark gray till. Base of till rests on a few inches of exposed yellow sand and pebble gravel.

Stop 13 Tribes Hill quad. 42 56 14 N 74 16 45 W 280' el. A 20-foot stream bank cut at Rt. 5S bridge over Schoharie Creek exposes (poorly at this writing) cobble gravel and sand overlying dark gray compact till, overlying interbedded till and mess-bedded sand and clay in 2-3" beds.

Stop 14 Tribes Hill quad 42 57 25 N 74 16 33 W 340' el. Roadcut along new Rt. 5 one-half mile east of Tribes Hill exposes 15-20' dark gray till overlying 15' rhythmic sand and dark gray clay over mess-bedded clay and clean sand. A few stones are found in the clay which at the base of the section rests on limestone with S75W striations.

Stop 15 Tribes Hill quad 42 57 50 N 74 15 12 W 500' el. Sand pit one mile northwest Ft. Johnson exposes 10-15' light brown till overlying 45'+ quartz sand with some indurated layers. One of the type exposures of till assigned to the Yosts readvance. Hill in which pit is dug resembles a drumlin nearly a mile long, oriented east-west.

Stop 16 Amsterdam quad. 42 53 45 N 74 09 59 W 620' el. Roadcut where Rt. 160 crosses Terwilleger Creek, exposes 10' brown till oxidized to base, and leached 3 ', overlying one foot of irregular 1-2" beds of gray till and sand, overlying one foot of sand and thin silt beds, overlying 40'+ gray unweathered till. Resembles the exposure at Stop 13.

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