TRIP C

GLACIAL LAKE SEQUENCES IN THE EASTERN MOHAWK-NORTHERN HUDSON REGION

by

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INTRODUCTION

The Mohawk-Hudson Lowland has long been a subject area for historical syntheses dealing with various aspects of Wisconsin deglaciation. Following the original investigations of Peet (1904) and Woodworth (1905), considerable attention was focused here, and much of it led to controversy. Of particular interest were the demonstration of post-glacial crustal uplift of eastern North America, the character of the deflection, and its influence on drainage evolution.

Concerning the manner of ice disappearance, two schools of thought developed, each attempting to relate topographic and field evidence to its favored mechanism of ice withdrawal.

Fairchild (1912) emphasized receding, well-defined ice margins defending sequential glacial lakes, and proposed, in chronological order, Lakes Herkimer, Schoharie, and Amsterdam for the Mohawk Lowland and adjacent side valleys. Following the original definition by Woodworth (1905), he continued the concept of a northward-expanding Lake Albany in the Hudson Lowland. In 1918 Fairchild abandoned usage of Lake Albany in favor of a marine strait connecting the Atlantic Ocean at New York City with the St. Lawrence Lowland. Stoller (1918), after mapping the Cohoes quadrangle (1918), rejected this concept, as did others who followed.

Cook (1924) (1930) proposed that the ice overlying eastern New York was thicker than elsewhere and therefore in stagnation

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lingered both in Hudson Lowland valleys and on uplands for the duration of the glacial lakes. Brigham (1929, p. 72-82) lent support to this hypothesis from his study of the Mohawk Lowland. Actually the Fairchild and Cook-Brigham viewpoints need not be mutually exclusive and there is some evidence in support of each. In essence the argument involved the degree to which lake waters were free of ice, and whether wasting upland ice maintained a discernable sequential series of ice margins.

ICE FLOW AND DRIFT BORDER

Ice-molded topography indicating diverging (Cary) ice flow was observed by Rich (1914), Brigham, and Cook (1930) in the Berne quadrangle. The E-W trend of drumlins produced by the Mohawk lobe is in sharp contrast to the S 10 E trend of Hudson lobe flow indicated by drumlins east of the Hudson River in the Troy quadrangle. In the Mohawk Lowland, westward ice flow is topographically indicated as far as western Herkimer County where the Mohawk and Ontarian lobes joined (Brigham, 1929). In the Hudson Lowland, the southern limit (Valley Heads equivalent) has been placed at the Hudson Highlands by Flint (1953) and by MacClintock (1954), but at Long Island (Harbor Hill moraine) by Denny (1956). The younger Catskill drift border of Rich (1935) is acceptable as Valley Heads equivalent. The area covered by Figures 1-6 is well within the Valley Heads border and the deposits throughout indicate only one cycle of glacial advance and stagnation.

DEGLACIATION

The (Cary) deglaciation of the Mohawk Lowland, according to Fairchild, was accomplished by nearly simultaneous recession of the Mohawk block eastward, and the Ontarian block westward. In the uncovered valley areas between the blocks, lake waters supposedly replaced the ice. Lake levels were controlled in early, high-level phases by spillways connecting southward with the Chenango, Susquehana, and Catskill watersheds, and in later phases by spillways and channels leading southeastward along the Helderberg escarpment as the Hudson ice block deteriorated. There is little alternative to the requirement of southward overflow for these glacial drainages but the degree of replacement of ice by open lake waters in upland areas requires further investigation.

The "overthickened stagnant ice" concept of Cook is pertinent here and the reader is referred to the original paper (1924) for details. Cook was impressed, in the Berne quadrangle particularly (1930), for the lack of evidence of water-worked deposits marking, even occasionally, a well-defined, "withdrawing" ice margin. He was also encouraged, by examination of the depressions now occupied by Round and Saratoga Lakes, to promote Woodworth's (1905) and Stoller's (1918) concept of an ice-choked Hudson Lowland through the close of Lake Albany. He further suggested the deltas of the Hoosic River and Batten Kill were laid as kame terraces against ice, rather than into open lake water. [For a discussion of the sedimentary evolution of kame terraces in the Connecticut and Hudson Lowlands the reader is referred to Jahns and Willard (1942) and to LaFleur (1961b, 1963, 1965a).]

The evidence to date indicates a single episode of ice stagnation, with frequent lacustrine accompaniment, through the area north of the Catskills and throughout the easternmost Mohawk and northern Hudson Lowlands, which involved eventually both Lake Albany and Lake Vermont. On the basis of this hypothesis, Figures 1-6 have been drawn to summarize the literature and some recent work by the writer.

LAKE CHRONOLOGY

In the northern Catskills, Grand Gorge Lake (1640' maximum) spilled southwestward through Grand Gorge until the ice margin receded 18 miles northward to Middleburg and uncovered the col at the head of the present Catskill Valley near Franklinton. At this point the Grand Gorge Lake waters were lowered to 1200' and diverted into the Franklinton channel (Rich, 1935). After the ice margin receded northward an additional 12 miles, defending expanding Lake Schoharie, the east-facing outlet at Delanson was made available, and lake levels fell to about 860'. Figure 1 illustrates this lake phase.

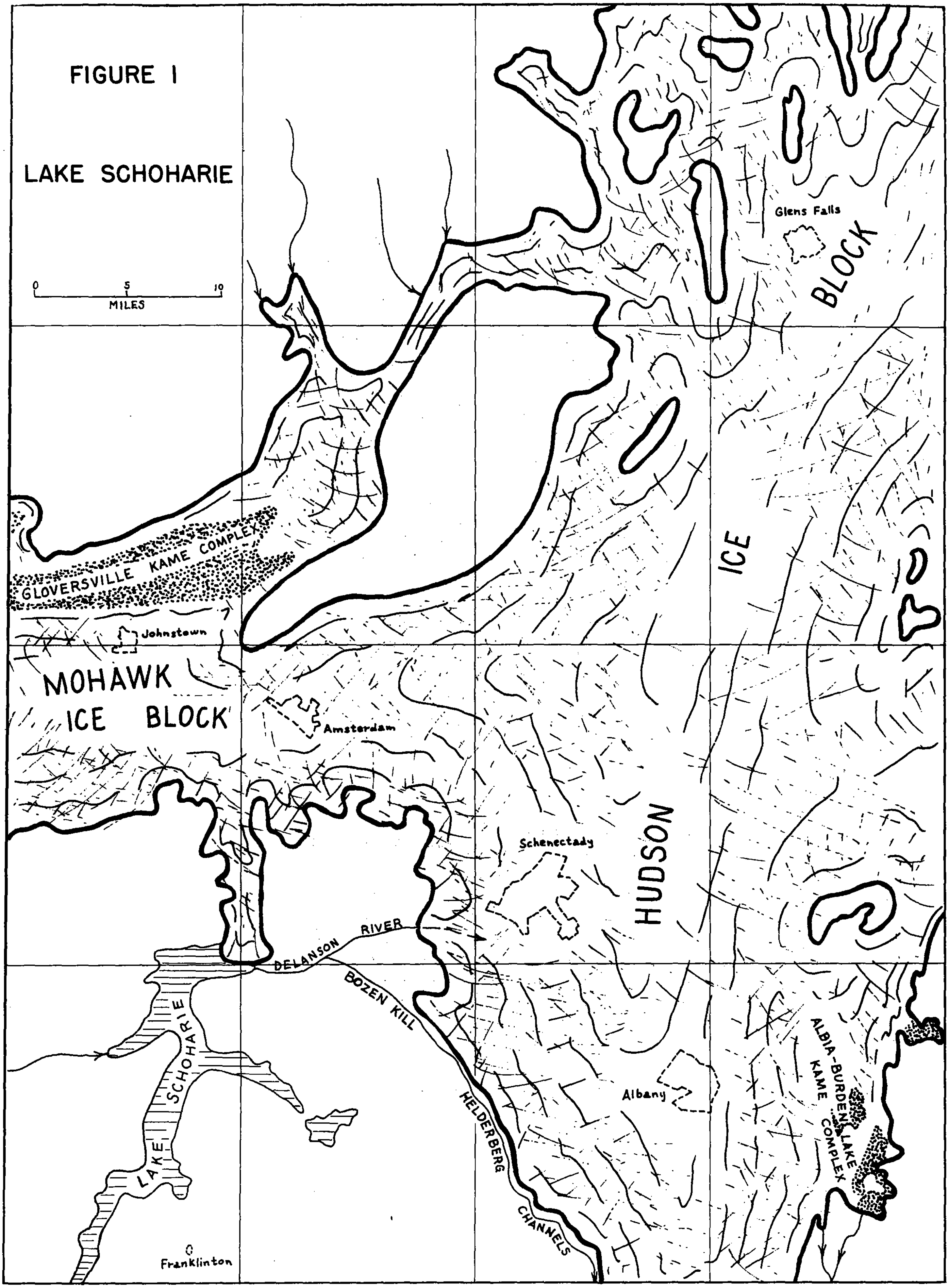


FIGURE I
LAKE SCHOHARIE
0
5
10
MILES
Glens Falls
BLOCK
ICE
HUDSON
GLOVERSVILLE KAME COMPLEX
Johnstown
MOHAWK
ICE BLOCK
Amsterdam
Schenectady
RIVER
DELANSON
BOZEN KILL
HELDERBERG
CHANNELS
LAKE SCHOHARIE
Albany
ALBIA-BURDEN LAKE
KAME COMPLEX
Franklinton

The validity or extent of Lake Herkimer has not been evaluated in the eastern Mohawk region but it must have been equivalent to part of the Grand Gorge-Schoharie lake sequence. West of this area, in Herkimer County, spillways at 1360' and 1220' are cited by Fairchild as controls for Herkimer lake waters at Summit Lake north of Springfield Center and at Cedarville, respectively.

Lake Schoharie

The clays of the Schoharie Valley imply the existence of lacustrine conditions there and Fairchild proposed Lake Schoharie, with overflow to the east at Delanson at an elevation of about 860'. Figure 1 shows the ice dam at the northern end of Schoharie Valley, which required eastward flow initially through the valley now more completely dissected by the Bozen Kill and southward along the face of the Helderberg escarpment. Upon slight recession of the ice northward, the Delanson River (Fairchild, 1912) became established. The underfit headwaters of the Normans Kill now occupy the large Delanson outlet.

The kame complex at 900' to 1200' mapped by Brigham (1929) near Gloversville probably dates in part from this episode and reflects continuity of the Mohawk and Hudson ice blocks through the Sacandaga Valley.

East of the present Hudson River in the Troy quadrangle, southward drainage between the ice and the edge of the Rensselaer Plateau became established as the ice thinned and exposed the plateau as a broad nunatak. Some early elements of the Albia-Burden Lake kame complex with summits at about 800' may date from this episode (LaFleur, 1965a). The Hudson ice block extended perhaps as far south as the village of Catskill, precluding Lake Albany waters from the central Hudson region.

Early Lake Amsterdam and Lake Sacandaga

After recession of the Mohawk ice block to the north end of the Schoharie Valley near Minaville, 860' Lake Schoharie was lowered. This new Lake Amsterdam, beginning with a level of about

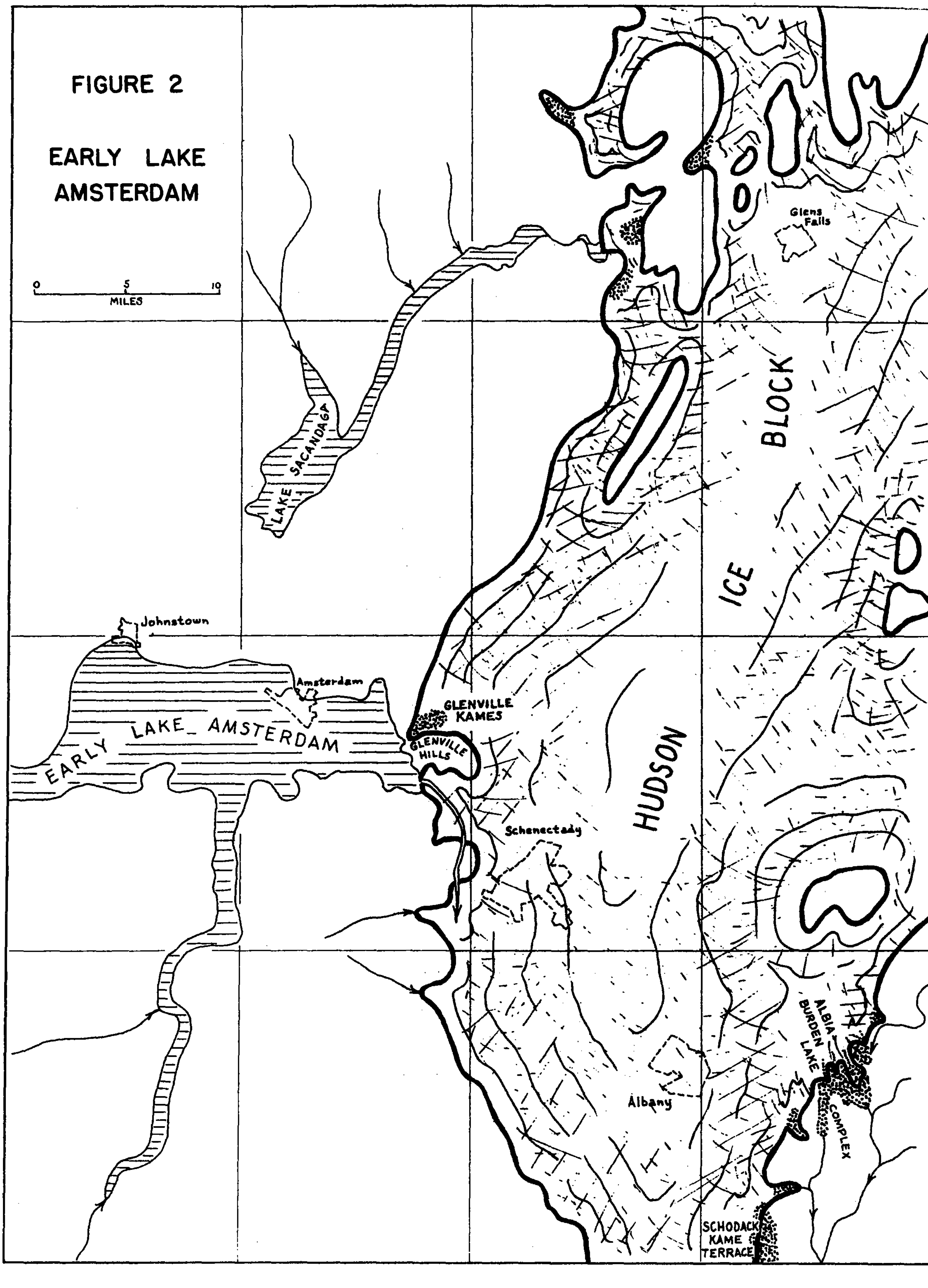


FIGURE 2
EARLY LAKE AMSTERDAM
0 5 10
MILES
LAKE SACANDAGA
Glens Falls
Johnstown
Amsterdam
EARLY LAKE AMSTERDAM
GLENVILLE KAMES
GLENVILLE HILLS
Schenectady
HUDSON ICE BLOCK
ALBIA BURDEN LAKE
COMPLEX
Albany
SCHODACK KAME TERRACE

700' drained eastward through the Mohawk Valley as downwasting progressed through the site of the present gorge of the Mohawk at Rotterdam Junction. See Figure 2. A well-defined channel 2 miles due south of Wyatts indicates one of the south-leading outlets.

One need not presume the Mohawk Valley was thoroughly deglaciated by this time. Lake Amsterdam may actually have been in part a stagnant ice block segregated from the Hudson block by the bedrock promontory hills overlooking Glenville and Rotterdam Junction. But how slowly or erratically the ice may have downwasted locally, the drainage sequence remains largely the same - imponded Mohawk waters find lower and lower outlets as the Hudson ice block thins.

Deglaciation and imponding of the Sacandaga Valley produced Lake Sacandaga, standing near 760', confined on the south by the Gloversville kame complex and on the northeast by ice or drift near Luzerne. Construction in 1930 of the Conklingville dam and filling of the Sacandaga Reservoir as a flood control for the modern Sacandaga and Hudson Rivers has restored this former glacial lake.

The duration of Lake Sacandaga is unknown, but the relatively slight incision of bottom sediments by the modern Sacandaga River and the rock canyon constriction at Conklingville suggest a relatively long life. A temporal lake condition is suggested into modern times by the (pre-reservoir) flood-plain character of the Sacandaga Vly, west of Northampton.

In the Troy quadrangle, the Albia-Burden Lake complex continued to accumulate and the Schodack kame terrace also developed alongside the Hudson ice block.

Later Lake Amsterdam

Prominent deltas and terraces near 420' along the present Mohawk River record the lowest level of falling Amsterdam waters, by that time restricted to a narrow valley not more than a mile

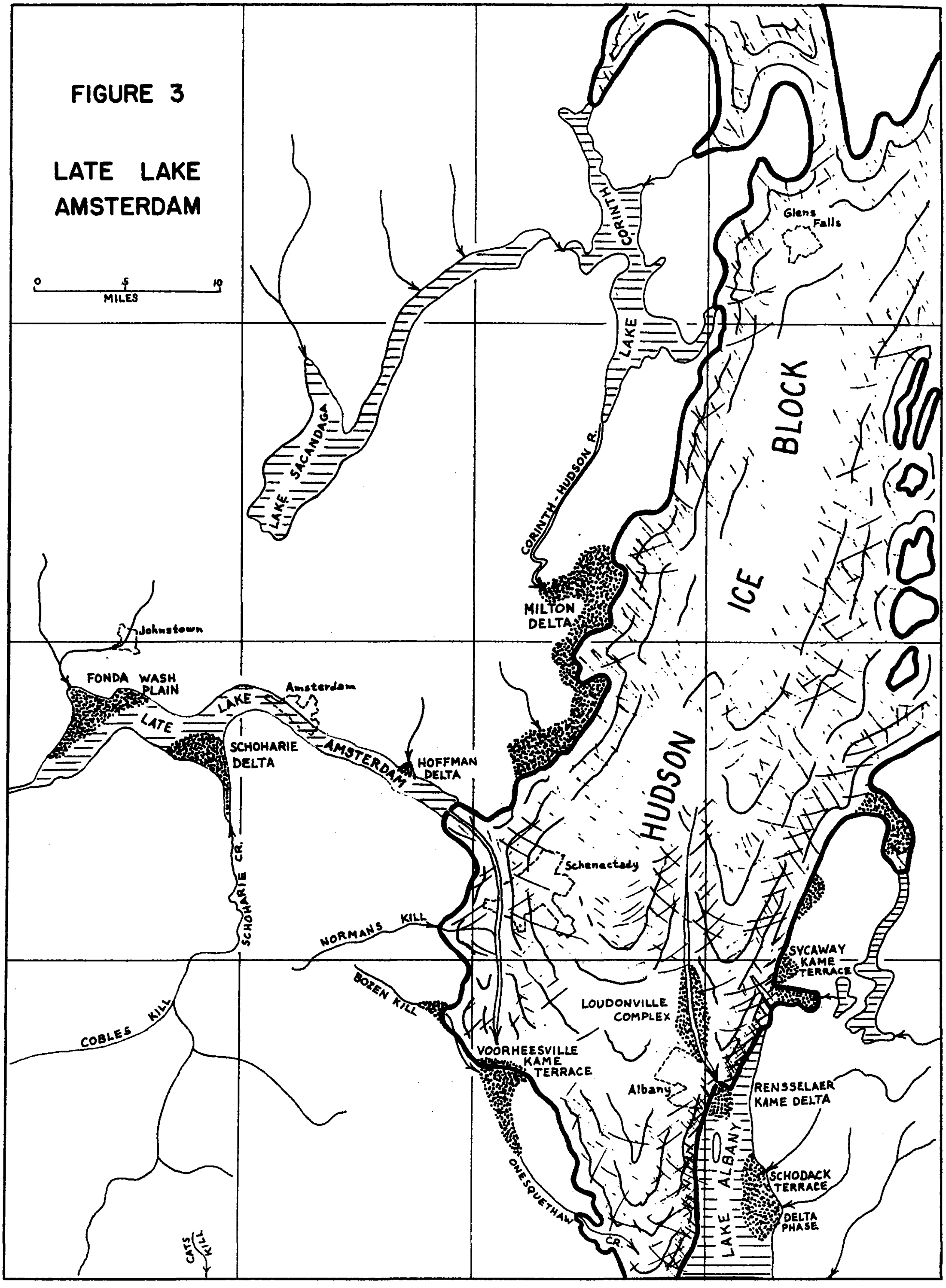


FIGURE 3
LATE LAKE AMSTERDAM
0 5 10
MILES
Glens Falls
CORINTH
LAKE
LAKE SACANDAGA
CORINTH-HUDSON R.
BLOCK
ICE
HUDSON
MILTON DELTA
Johnstown
FONDA WASH PLAIN
LATE LAKE AMSTERDAM
Amsterdam
SCHOHARIE DELTA
HOFFMAN DELTA
SCHOHARIE CR.
Schenectady
NORMANS KILL
BOZEN KILL
COBLES KILL
LOUDONVILLE COMPLEX
SYCAWAY KAME TERRACE
VOORHEESVILLE KAME TERRACE
Albany
RENSSELAER KAME DELTA
LAKE ALBANY
SCHODACK TERRACE
DELTA PHASE
ONESQUETHAW CR.
CATS KILL

or two across. See Figure 3. The Fonda wash plain, the Schoharie delta, the smaller deltas at Hoffmans and Cranesville record this level. Lake Sacandaga at 760' - 740' continued to be drained northeastward by a short Sacandaga River.

The first of several diagrams by Chadwick (1928) appears to correlate with late Lake Amsterdam. Lake Corinth filled the lower, eastern valley of the Sacandaga and, imponded by the ice at Palmertown Mt., found exit southward through the Corinth-Hudson River. The 420' Milton delta is the terminus of this system against the Hudson ice block.

The Voorheesville kame terrace appears to lie in the path of escaping Lake Amsterdam waters, which ultimately found their way through the Onesquethaw Valley into Lake Albany, south of the map area. The Loudonville complex similarly lies immediately upstream from the kame delta at Rensselaer in the path of drainage derived from the Hudson ice block. These drainage systems built at an ice margin of slightly later time the esker and kame complex at Mohawk View (SE corner of Schenectady 15' quadrangle), and the Guilderland kame terrace (Voorheesville 7.5' quadrangle).

On the Cohoes and Troy quadrangles, the ice margin bordered the 400' kame terraces at Spiegletown and Sycaway, with the kame delta at Rensselaer indicating the ice margin defending 350' Lake Albany. The Albia-Burden Lake kame complex had been completed and (Lake Albany) lacustrine conditions spread northward through the Capital District area. For local details see LaFleur (1961b) (1965a).

Mohawk Delta and 350' - 330' Lake Albany

As the wasting Hudson block cleared the eastern end of the Mohawk Valley at Schenectady, the westward enlargement of Lake Albany began to receive a large delta of Fairchild's Glaciomohawk River. See Figure 4. Although the delta appears to have been built largely into open water, at some localities southwest of Albany the more distal, deeper water sands were laid down apparently

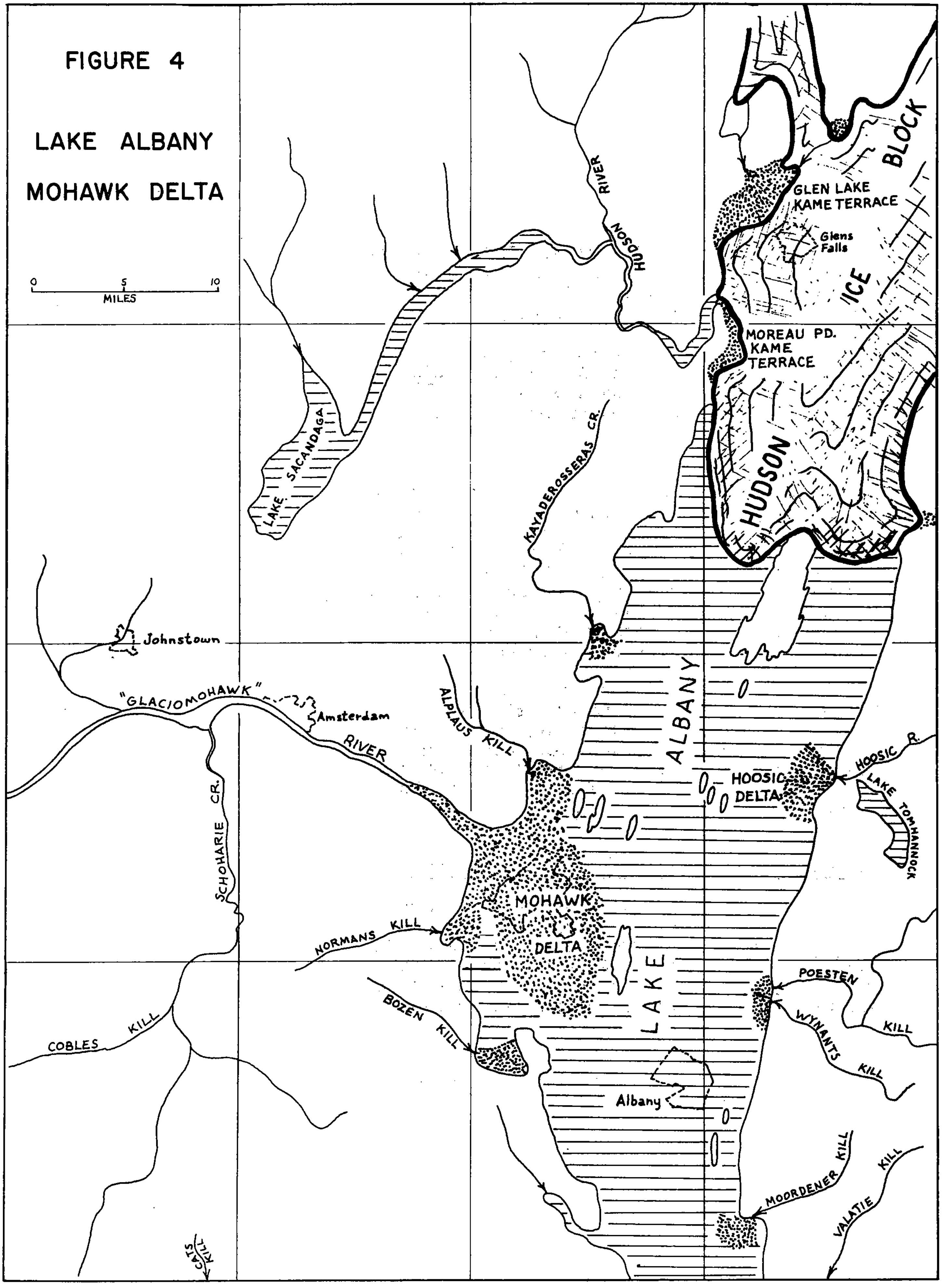


FIGURE 4

LAKE ALBANY

MOHAWK DELTA

in the presence of sunken dirty ice. Severe deformation structures are found in sand hills resembling dunes along the present Normans Kill about 200' above present sea level. The dune origin of other sand hills west of Albany may also be suspect. Chadwick (1928) implied the existence of buried ice beneath the "Malta Lake" sand plain of the same age in Saratoga County.

Along the eastern shore, Lake Albany received delta sands from the Moordener Kill, Wynants Kill and Hoosic River and a prominent beach began to form. The 380' kame terrace of the Batten Kill appears to correlate with the 360' Hoosic delta, as other more extensive Batten Kill deltas are inferior to the Hoosic delta summit. Chadwick's diagram of the ice margin of this episode includes the Glen Lake and Moreau Pond kame terraces. The latter is the sedimentary product of the early post-glacial Hudson River, which at this time drained a dwindling Lake Corinth eastward.

Quaker Springs Lake Vermont and 300' - 240' Lake Albany

Upon lowering of Lake Albany level from 350' to about 300', the Mohawk was forced to turn northward at Alplaus and cut a series of channels, the earliest of which is indicated on Figure 5. Throughout the Hudson Lowland, earlier, higher deltas and kame terraces were similarly incised during this episode with a particularly complete record of falling lake levels indicated by the terraces in the Hoosic delta. (Woodworth, 1905), (Stoller, 1918).

The Hudson River continued its delta building at lower levels at Glens Falls, as did the Batten Kill and other streams along the eastern shore. Lake Bolton, predecessor to Lake George, occupied that basin (Chadwick, 1928). The Iromohawk River of Fairchild supposedly drained Lake Iroquois through large outlet channels, well shown on the Schenectady quadrangle, into a dwindling Lake Albany. The Ballston-Mourning Kill channel appears to be the earliest, followed shortly by the Ballston-Drummond Creek channel.

(If the disturbed clays northeast of Hudson Falls are the result of an ice readvance in early "Quaker Springs" time (or before) into lake waters of the northernmost Hudson Lowland, there would be no incompatibility with the later lake history. Chadwick (1928) placed a buried ice block east of Hudson Falls at this time, but did not relate it to a readvance.)

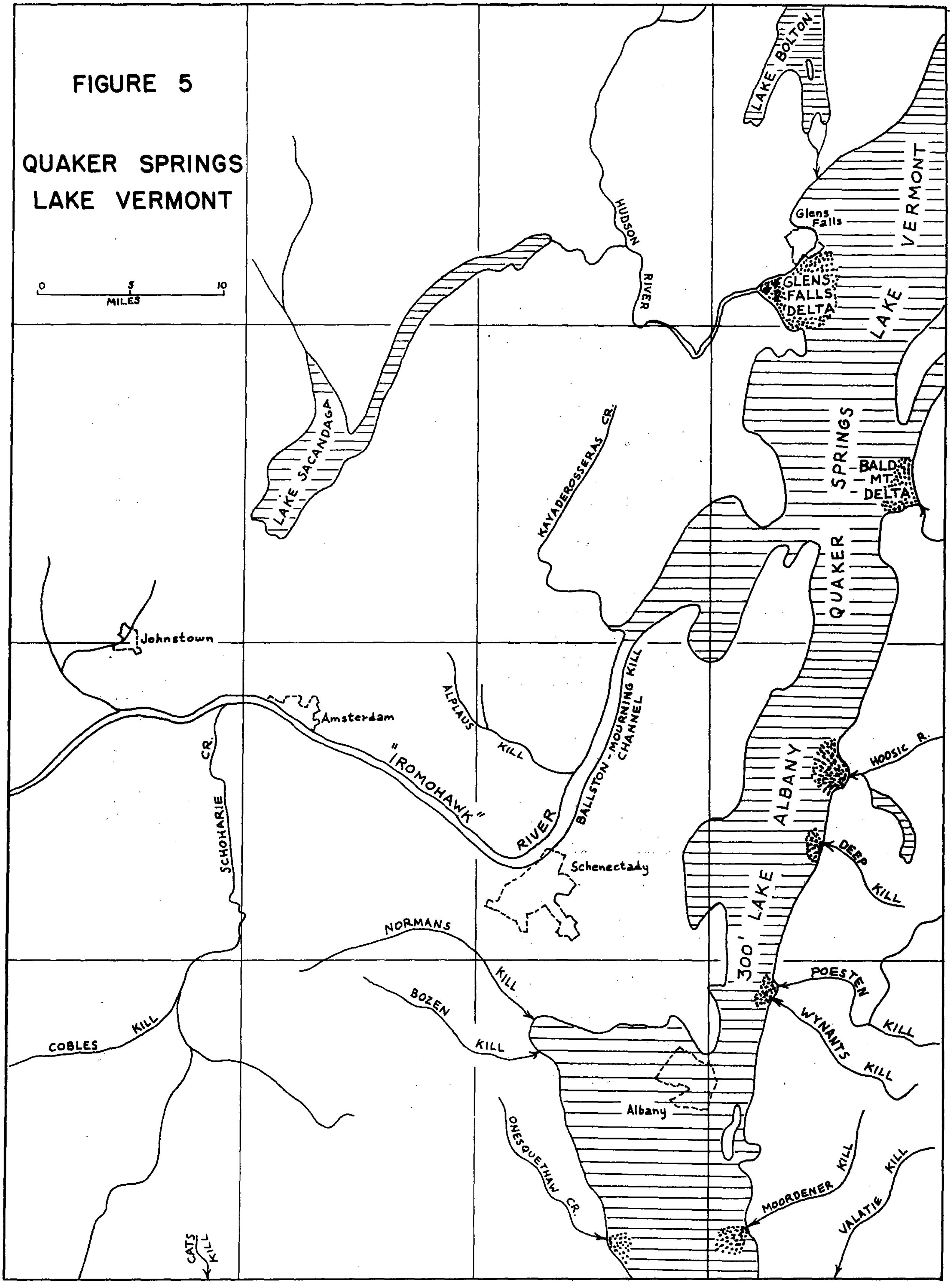


FIGURE 5

QUAKER SPRINGS
LAKE VERMONT

Coveville Lake Vermont and 190' Lake Albany

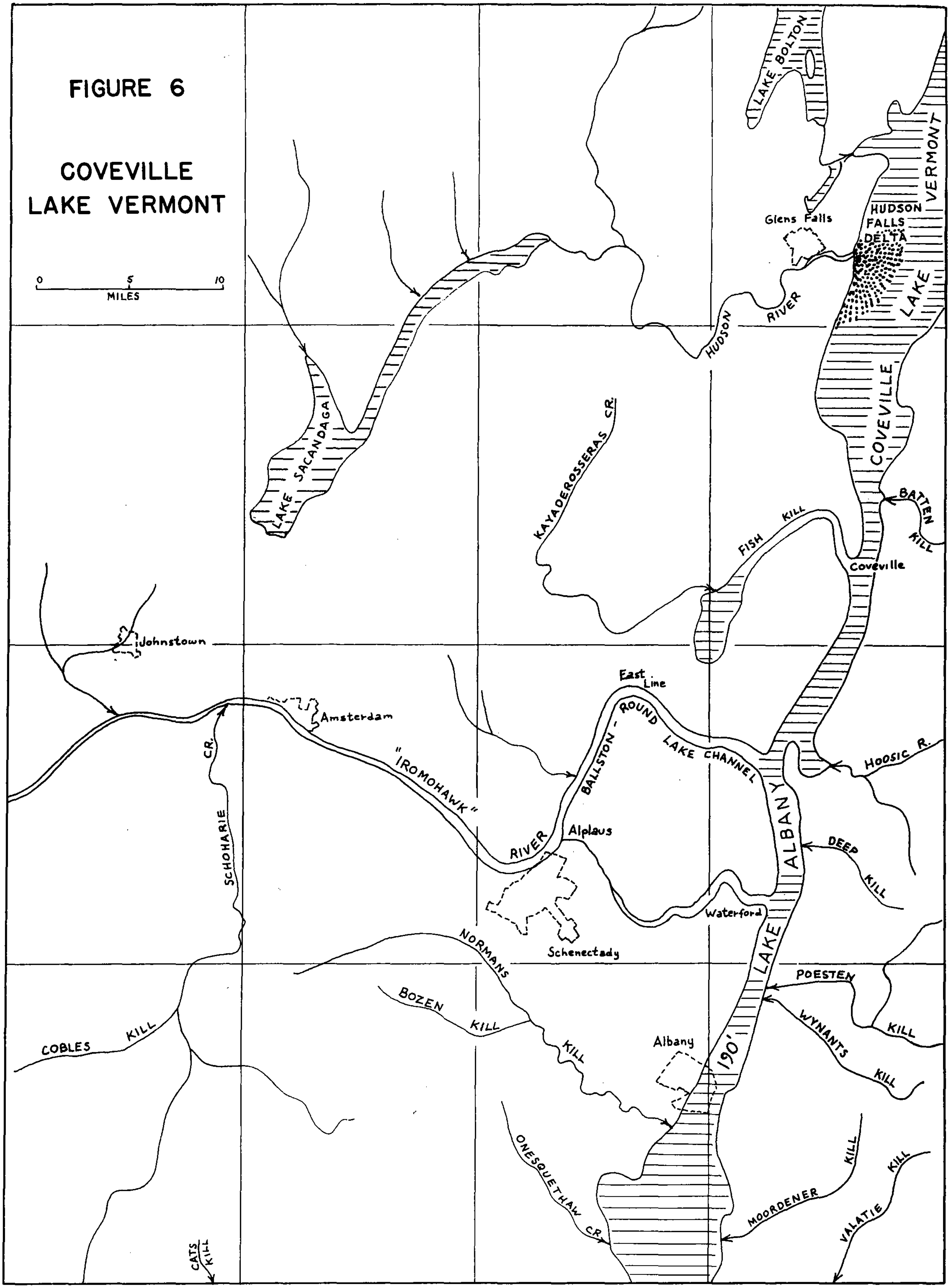
A time of stability of falling water levels is indicated by the terraces along the Hudson at about 200' south of Schuylerville and by the 240' delta of the Hudson River at Hudson Falls (Chadwick, 1928). This Vermont lake phase is represented south of Schuylerville by a greatly reduced "Lake Albany" which is by this time only a broad river. See Figure 6. The tributary Iromohawk occupied both the Round Lake channel and the Alplaus-to-Waterford channel (now the present Mohawk course) as indicated by the terrace at 190' at Mechanicville and also by scour of clays to that level at Waterford (Schock, 1963). The Kayaderosseras-Fish Kill system entered the lake at Coveville and continued to fall over the rock sill at that point until the system was captured by the short tributary to the Hudson at Victory Mills. All of the Mohawk was eventually captured at Alplaus upon erosion there of a rock sill and the river presently enters the Hudson at Cohoes. Ballston, Saratoga, and Round Lakes now occupy parts of the abandoned Mohawk channels.

The origin of the basin of Round Lake and the reason for its position in the middle of an outlet channel remain enigmatic. The elbow of capture at East Line is also curious, considering the then-existing well-developed Ballston-Drummond channel. The thaw of a buried ice block at Round Lake combined with headward erosion westward from the basin so produced might have provided a mechanism for capture of a well-established channel. One must also take into account the lessening of channel gradient in the north direction caused by progressing crustal uplift. (The reader is referred to Chadwick (p. 917, 1928) for discussion of the "wave of uplift" and other hypotheses, and to LaFleur (1965a) for a comparison of Lake Albany and Lake Vermont data which indicate crustal uplift.)

Fort Ann Lake Vermont (not illustrated) then drained through the present Hudson Valley, confined to approximately the present strath of the Hudson River. Its record in the Capital District is insignificant in comparison to earlier lake phases.

FIGURE 6

COVEVILLE LAKE VERMONT



PROBLEMS IN CORRELATION OF THE LATER LAKES

Previous Work

By careful study of spatial relationships between features which indicate temporary base levels, such as beaches, deltas, kame terraces, and the drainage systems necessary for their formation, one can arrive at a meaningful grouping of successive ice-contact and proglacial lake deposits. The first such attempt was made by Chadwick (1928) who diagrammed a sequence of ice margins defending expanding Lake Albany in the area between Saratoga and Glens Falls. Chadwick distinguished younger Lake Vermont from Lake Albany and restricted the former, largely on geographical grounds, to the Hudson Lowland north of Schuylerville. Through reference to the supposed southern spillway for Lake Vermont into a drained Lake Albany basin at Coveville, he continued to promote the Coveville phase originally named by Woodworth (1905). Chadwick also cited the pot-holed sill in the Precambrian rocks at Fort Ann as a Lake Vermont outlet to be preferred to the Fort Edward channels. From this reference Chapman (1937) coined the final Fort Ann phase of Lake Vermont.

At Quaker Springs, a location on the Schuylerville quadrangle 2 miles southwest of Coveville, Woodworth (1905) recognized a temporary lake level at about 300' above present sea level, inferior by 50' to the Lake Albany maximum. He applied this name to the earliest phase of Lake Vermont. The Quaker Springs phase was totally ignored by Chadwick (1928) and was not given regional significance in the Champlain Valley by Chapman (1937). Rather the evidence for its existence there was attributed to the effects of local, high-level lakes. Stewart (1961) revived usage of the name Quaker Springs as the earliest phase of the Lake Vermont succession, followed by the inferior Coveville and Fort Ann phases.

Current Concepts

Much of the difficulty in relating Lake Albany to Lake Vermont is nomenclatural. "Quaker Springs", however valid its application might be to Champlain Lowland history, is clearly in the middle of the classical Lake Albany sequence of falling lake levels and geographically is well south of and topographically superior to the "outlet" at Coveville.

Still to be evaluated is the postulated readvance of ice to Glens Falls and the degree of Late Cary deglaciation (if any) in the Champlain Lowland, between the time of Lakes Albany and Vermont. Flint (1953) suggested that the evidence of Mankato ice override west of Glens Falls might be obscured by the later development of the Glens Falls delta of the Hudson. But Chadwick had assigned, in a reasonable way, most of that delta to the latest phase of Lake Albany, as receding ice cleared the Hudson Lowland at Palmertown Mountain for influx of Sacandaga-Hudson drainage. Chadwick accepted an orderly succession of ice-margin and lacustrine deposits dating from Lake Albany through Lake Vermont. His hypothesis has not been contradicted by recent mapping in the Troy area (LaFleur, 1965a). There is so far no evidence to suggest a draining of the Mohawk-Hudson Lowland following Lake Albany and later filling by Lake Vermont waters.

Coveville Outlet

The word "Coveville" has unfortunately been applied erroneously to identify a spillway which never controlled a lake level, in contradiction to traceable superior and inferior terraces north and south of Schuylerville along the present Hudson. But the name has been firmly entrenched in the literature and its removal is not suggested here - rather the relation of the spillway to Mohawk and Kayaderosseras-Fish Kill drainage is to be emphasized.

The writer (1965a) has drawn some conclusions regarding the partial synonomy of Lakes Albany and Vermont. Figures 5 and 6 indicate the proposed relationships between early Vermont phases and late Albany phases.

SELECTED EXPOSURES

See Figure 7 for numbered locations.

1. Long, narrow drumlins with east-west trend, 2 miles west of Mariaville Lake. (Duanesburg 7.5 min. quad.)

2. Flaggy boulders of Schenectady Formation predominate drift north of Duanesburg; well exposed along Duanesburg Churches Rd. Excellent view of drumlin terrane north from Highland Park Rd.

3. Overlook of Duanesburg channel (of Delanson River) at Duane, Rt. 7 one mile south of Duanesburg.

4. Drumlins north of Rt. 20, 1 1/2 miles east of Duanesburg. Roadcut exposes till. Good view north across Normans Kill Valley.

5. Overlook of lower Mohawk Valley from hill one mile northwest of Rotterdam; 350' terrace remnant of Mohawk delta; river gravels; islands in the Mohawk River at Scotia.

6. Outlet channel of Early Lake Amsterdam now occupied by NYS Thruway; 1/2 miles west of exposure no. 5.

7. Delta in Late Lake Amsterdam at Hoffmans; Wolf Hollow gorge of Chaughtanoonda Creek has formed along the Hoffmans Fault, accentuating a striking topographic lineament traceable for 3 miles to the north. (Pattersonville 7.5 min. quad.)

8. Glenville kames along the West Glenville Rd.; suggesting the location of the ice margin which defended Early Lake Amsterdam.

9. View from Potter Rd., one mile north of Glenville, south to rock benches of the Glenville Hills.

10. View from Ostrander Rd., one mile east of Guilderland Ctr., southwest to Helderberg escarpments. (Voorheesville 7.5 min. quad.)

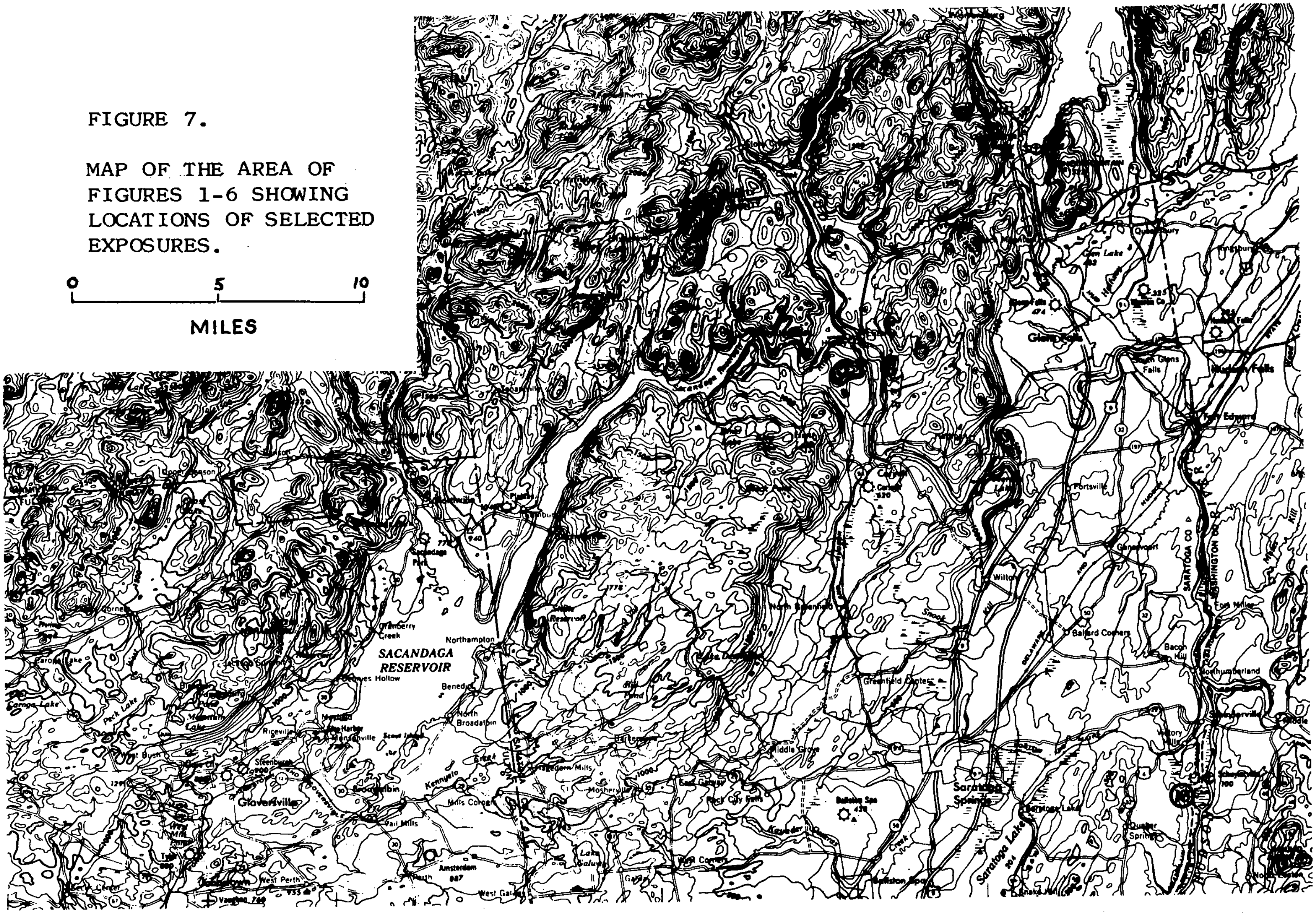
11. Along Grant Hill Rd., one mile southeast of exposure no. 10; dissection of the south (lee) side of a drumlin by the Normans Kill exposes 100 feet of bouldery till.

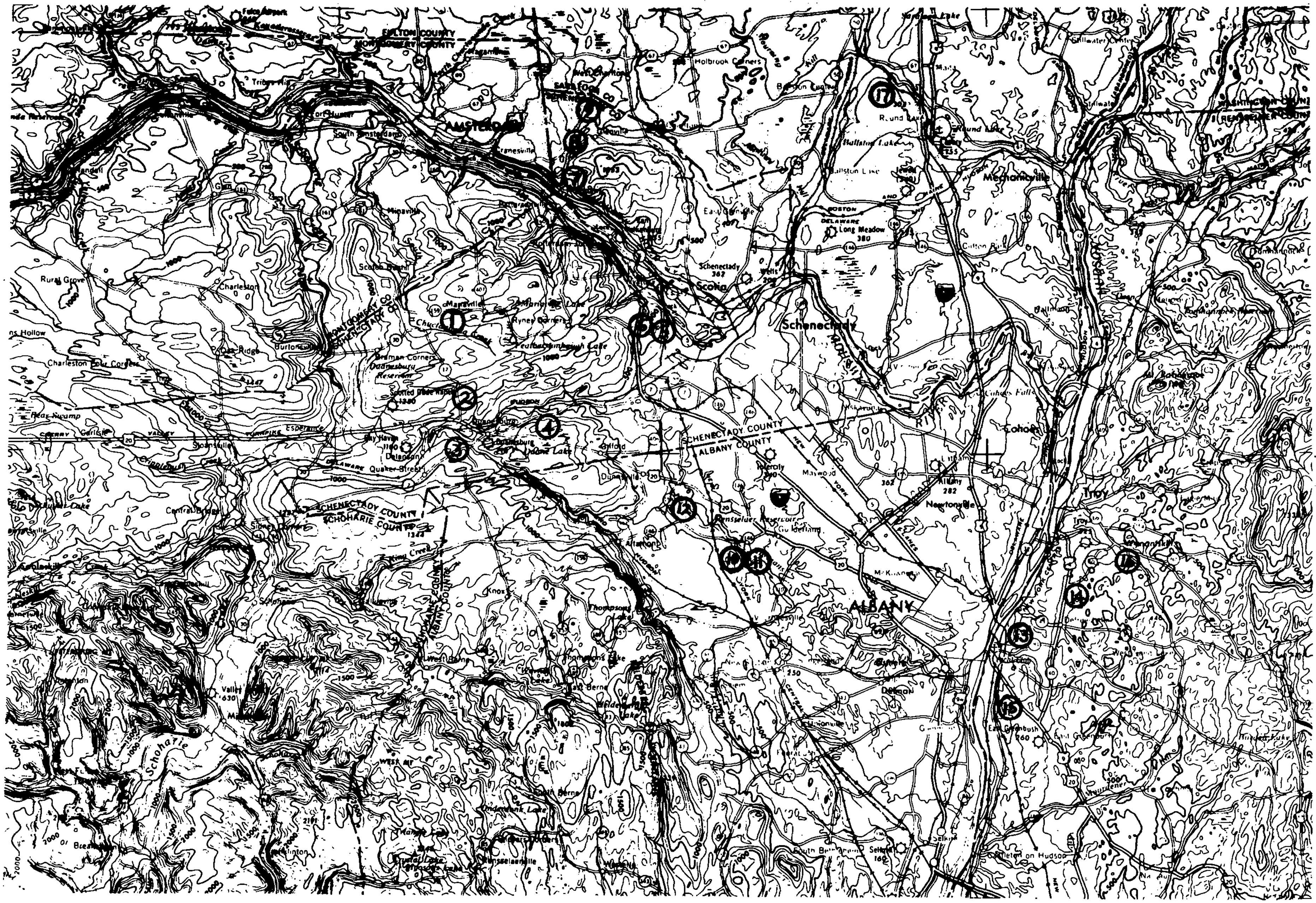
FIGURE 7.

MAP OF THE AREA OF FIGURES 1-6 SHOWING LOCATIONS OF SELECTED EXPOSURES.

0 5 10

MILES





ALBANY
Schenectady
SCHENECTADY COUNTY
ALBANY COUNTY
SCHOHARIE COUNTY
Troy
Cohoes
Mechanicville
Long Meadow
Charleston
Knox
Delmar
Scotia

12. Guilderland kame terrace along southwest shore of the Watervliet Reservoir (Voorheesville 7.5 min. quad). Several gravel pits expose southwest-dipping gravels and sands; also isolated pockets of rhythmic clays. A solitary kame is located at the intersection of Routes 158 and 146. The Lake Albany 330' beach has modified the northeast (ice-contact) side of the kame terrace.

13. Rensselaer (Lake Albany) kame delta, east of city limits of Rensselaer. Turbidite sands in delta bottomset beds; graded bedding, sole markings. (Troy South 7.5 min. quad.)

14. Lake Albany beach ridge with gravel pit excavation; one mile north of Defreestville on Bloominggrove Rd. (Troy South 7.5 min. quad.)

15. Teller Hill promontory, one-half mile west of Sherwood Park (E. Greenbush 7.5 min. quad.) Panorama of Hudson Valley, the Hampton Park kame delta, and the Hudson flood plain.

16. Eskers of the Albia-Burden Lake complex, exposed in several large gravel pits on Route 66 east of Wynantskill. (Averill Park 7.5 min. quad.)

17. Panorama from East Line Rd., 3 miles north of Jonesville (Round Lake 7.5 min. quad.); Ballston outlet channel capture at East Line; Round Lake depression and channel, Malta sand plain. Round Lake channel also shown where it is crossed by the Northway one mile east of exposure no. 17.

18. Coveville outlet and plunge pool three miles south of Schuylerville on west side of Hudson River. (Schuylerville 15 min. quad.)

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