UNIVERSITY OF THE STATE OF NEW YORK
THE STATE EDUCATION DEPARTMENT

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GEOMORPHIC HISTORY OF NORTHERN NEW YORK

The Adirondack Sheet of the New York State Surficial Geologic Map includes parts of four physiographic provinces—the Ontario Lowlands, the St. Lawrence-Champlain Lowlands, the Adirondack Highlands, and the Tug Hill Plateau; the latter is an outlier of the Appalachian Uplands to the south. The Tug Hill, in the southwest portion of the sheet, is separated from the Adirondack Highlands by the Black River valley. The bedrock geology differs widely among the different provinces. Both the Ontario and the St. Lawrence-Champlain Lowlands are underlain by relatively flat-lying strata composed of Cambrian and Ordovician age sandstone, limestone, and shale. Streams that drain the north, east, and western slopes of the Adirondack Highlands flow across these lowlands and empty either into the St. Lawrence River or into Lakes Ontario or Champlain. The isolated Tug Hill Plateau has a cap of resistant Oswego sandstone that overlies a thick sequence of shale and limestone. The Adirondack Highlands are composed of a complex of erosion-resistant Precambrian metaigneous and metasedimentary rocks. In the east-central part of the province, the High Peaks region is underlain by metanorthosite, which is highly resistant to erosion. The Adirondacks are transected by long northeast-southwest lineaments that represent fracture zones or major faults. These lineaments commonly control local drainage and the distribution of some landforms. The Frontenac Arch, a low arch of Precambrian rocks bridges the area between the Adirondack Highlands and the Canadian Shield to the northwest. The outlet of Lake Ontario is through this arch at the rock threshold represented by the Thousand Islands in the St. Lawrence River.

Landscape evolution involves slow, unending processes. The imprint of past environments may be effaced so gradually that relict landforms persist to this day. Landscape features originated through differential weathering and a long complex history of erosion. The major landscape features of the Adirondack Sheet evolved initially through fluvial erosion but were modified by glacial processes during the Pleistocene Epoch, the last 1-2 million years. The main features of the preglacial landscape are the uplands, lowlands, escarpments, and saprolites. Erosion of bedrock in the Lowlands has yielded flat, tabular surfaces parallel to bedding and steep slopes or scarps along rivers and creeks. A dominantly radial drainage pattern in the Adirondack Highlands and vestiges of preglacial valleys imply minimal modification of these major landscape features by glacial erosion and deposition.

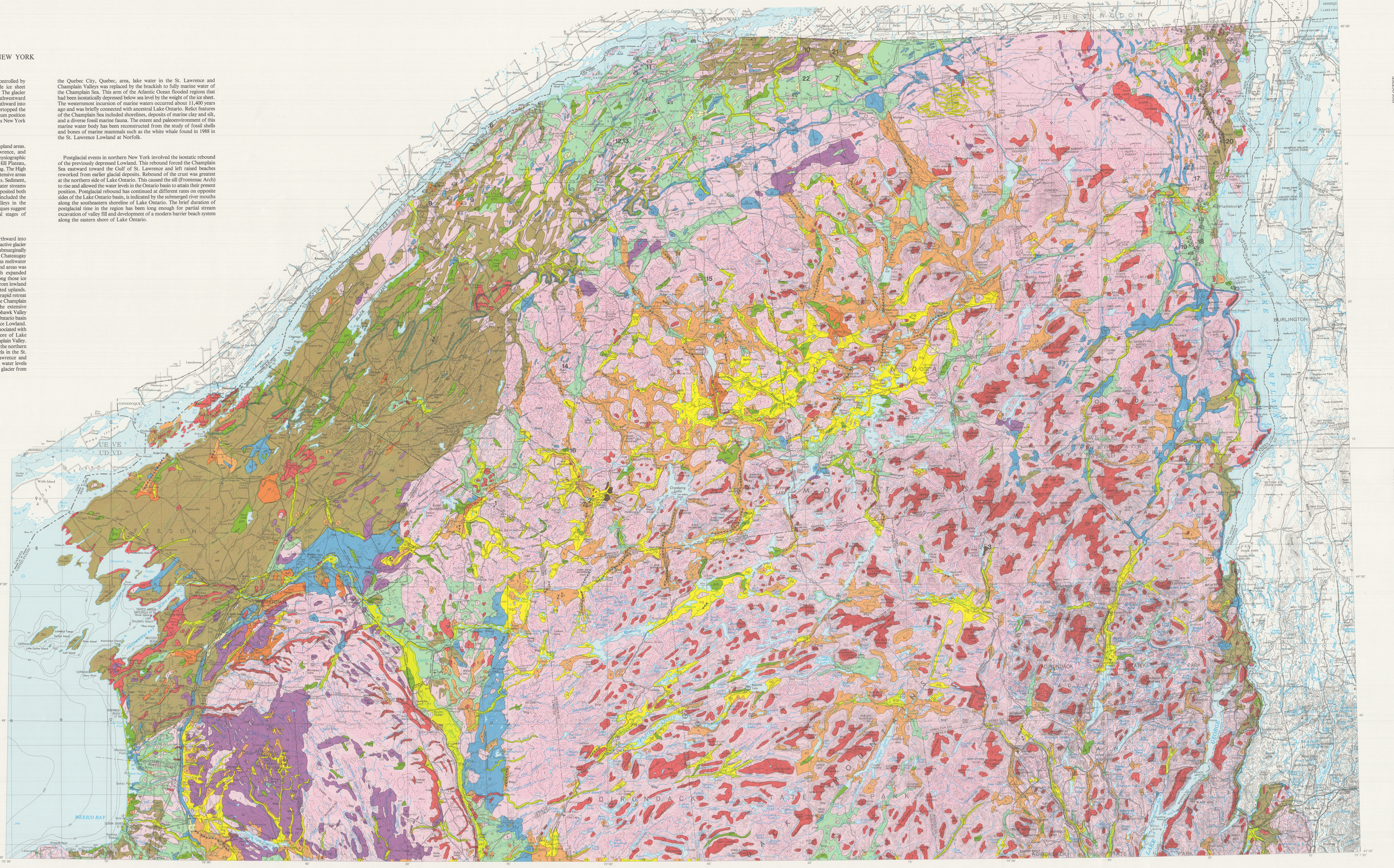
Glacial erosion associated with multiple glacial advances had the greatest effect in Lowland areas, where more easily eroded rocks are present. Repeated glacial episodes are documented by the stratigraphic record at only one location within the Adirondack Sheet. At Tahawus, in the central Adirondack Highlands, wood fragments and plant debris more than 55,000 years old are found in non-glacial lacustrine sediment preserved between two tills. The Tahawus site thus provides evidence for two episodes of glaciation in the central Adirondack Mountains punctuated by the intervening non-glacial environment. Although evidence of prior glaciation does exist, most deposits in northern New York are the product of Late Wisconsinan expansion of ice that began about 30,000 years ago.

Patterns of ice flow during that time period largely were controlled by pre-existing bedrock topography and relief. The Laurentide ice sheet expanded westward and southward into northern New York. The glacier extended into the St. Lawrence Lowlands and advanced southwestward across the Frontenac Arch into the Lake Ontario basin and southward into the Champlain Valley. Eventually the ice sheet thickened, overtopped the Adirondack Highlands and continued to advance to its maximum position on Long Island 21,750 years ago. From there it retreated across New York State.

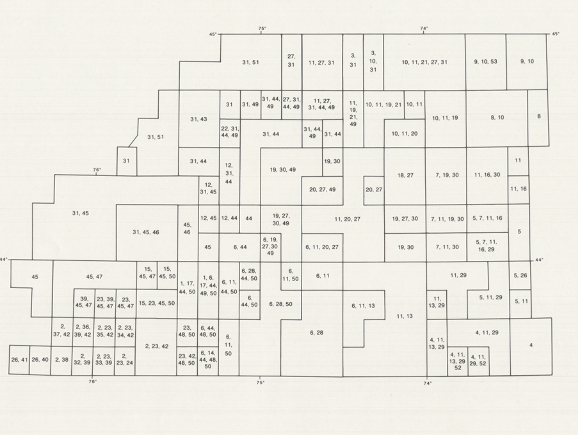
The thinning ice sheet uncovered mountain peaks and other upland areas. Major ice lobes became restricted to the Ontario, St. Lawrence, and Champlain Lowlands. Styles of deglaciation differed among physiographic regions. In mountainous regions, as well as parts of the Tug Hill Plateau, recession was characterized by thinning and regional downwasting. The High Peaks may have acted to cut off active glacier flow and leave extensive areas of remnant ice in valleys in the central and southern Adirondacks. Sediment, both outwash derived from the ice and transported by meltwater streams and inwash from meteoric drainage on ice-free uplands, was deposited both on and adjacent to masses of remnant ice. Deglaciation also included the construction of sinuous, sharp-crested eskers in many valleys in the Adirondacks. Basins in the High Peaks region that may be cirques suggest that alpine glaciers may have developed during the final stages of deglaciation.

In contrast to the High Peaks Region, glacier recession northward into the St. Lawrence-Champlain Lowlands was characterized by an active glacier ice margin that built small moraines. Meltwater drained both submarginally and across interfluves. Examples of this drainage include the Chateaugay Channels, a series of drainageways eroded into the till cover as meltwater flowed westward in ice marginal channels. Ice retreat in lowland areas was accompanied by development of ice-dammed lakes, which expanded northward with retreat of the glacier margin. Deposition along those ice borders was in deep proglacial lakes. Recession of the glacier from lowland areas ponded meltwater between the glacier and the deglaciated uplands. These lakes may have promoted calving of the ice front and a rapid retreat of the ice margin. Large glacial lakes formed in this manner in the Champlain and Black River Valleys. One of these, Lake Iroquois, the extensive predecessor to Lake Ontario, had an outlet to the east in the Mohawk Valley across the col at Rome. Continued retreat of the ice from the Ontario basin allowed Glacial Lake Iroquois to expand into the St. Lawrence Lowland. Relict strandline features and fine-grained bottom sediments associated with these regional water bodies are found along the eastern shore of Lake Ontario, along the northern Adirondack flank, and in the Champlain Valley. When the receding ice margin uncovered alternative outlets on the northern flank of the Adirondacks at Covey Hill, Lake Iroquois levels in the St. Lawrence Lowland dropped to unite waters of the St. Lawrence and Champlain Valleys. Subsequent lower, temporarily stabilized water levels have been identified in both valleys. Following recession of the glacier from the Quebec City, Quebec, area, lake water in the St. Lawrence and Champlain Valleys was replaced by the brackish to fully marine water of the Champlain Sea. This arm of the Atlantic Ocean flooded regions that had been isostatically depressed below sea level by the weight of the ice sheet. The westernmost incursion of marine waters occurred about 11,400 years ago and was briefly connected with ancestral Lake Ontario. Relict features of the Champlain Sea included shorelines, deposits of marine clay and silt, and a diverse fossil marine fauna. The extent and paleoenvironment of this marine water body has been reconstructed from the study of fossil shells and bones of marine mammals such as the white whale found in 1988 in the St. Lawrence Lowland at Norfolk.

Postglacial events in northern New York involved the isostatic rebound of the previously depressed Lowland. This rebound forced the Champlain Sea eastward toward the Gulf of St. Lawrence and left raised beaches reworked from earlier glacial deposits. Rebound of the crust was greatest at the northern side of Lake Ontario. This caused the sill (Frontenac Arch) to rise and allowed the water levels in the Ontario basin to attain their present position. Postglacial rebound has continued at different rates on opposite sides of the Lake Ontario basin, is indicated by the submerged river mouths along the southeastern shoreline of Lake Ontario. The brief duration of postglacial time in the region has been long enough for partial stream excavation of valley fill and development of a modern barrier beach system along the eastern shore of Lake Ontario.



MAP REFERENCE SOURCES



MAP REFERENCES

SURFICIAL GEOLOGIC MAP OF NEW YORK

ADIRONDACK SHEET

Compiled and Edited by Donald H. Cadwell, Donald L. Pair

1991

Preliminary compilation by Robert J. Dineen

1989

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Scale 1:250,000

RADIOCARBON DATING

A small fraction of the carbon atoms in all living matter is the radioactive isotope C^{14} (radiocarbon), which disintegrates spontaneously. Its half-life is 5570 ± 130 years. In fossil organic material, the ratio of remaining radiocarbon atoms to atoms of the stable isotopes of carbon affords a base for estimating the duration of time since the organism died.

The chronology of glacial events in New York is pegged to absolute ages by radiocarbon assays of material collected from the localities indicated by numbers on the Surficial Geologic Map and listed below. Published references to the dated materials and the localities where they were collected are also listed.

SITE	NAME TOWN	QUADRANGLE COUNTY	YEARS B.P.	LAB	REMARKS: MATERIAL, LOCATION, SIGNIFICANCE	PUBLISHED REFERENCES
1	Goose Pond Harrisville	Harrisville St. Lawrence	12,500 ± 140	GSC-4370	wood fragments in gyttja	13, 14
2	Readway Pond Star Lake	Star Lake St. Lawrence	12,640 ± 430	GX-13278	basal organic matter 7.62-7.72m, kettle lake	4
3	Sanford Pit Tahawus	Newcomb Essex	>40,000	W-1520	wood fragments and plant material in lake sand and clay, between two tills	9
			>55,000	Y-1715	wood fragments and plant material	10
4	Norfolk Norfolk	Brasher Falls St. Lawrence	10,350 ± 140	Beta-25252	purified collogen from rib of white whale *Delphinapterus leucas*	17
			10,430 ± 90	Beta-25253	*Macoma balthica* shells	17
5	Elizabethtown Elizabethtown	Elizabethtown Essex	11,280 ± 110	AA-4935	purified collogen from muskoxen vertebra (*Ovibus moschatus*)	7
			10,720 ± 80	AA-5257	humin fraction from vertebra of muskoxen *Ovibus moschatus*	7
6	Sparrowhawk Point Sparrowhawk Point	Sparrowhawk Point St. Lawrence	11,900 ± 100	GSC 3767	*Portlandia arctica* shells in massive silt and clay over rhymites.	15, 16
			11,900 ± 140	GSC 3788	*Portlandica arctica* shells in sand overlying silt and clay	15, 16
7	Westville Center Westville Center	Ft. Covington Franklin	10,630 ± 200	WAT-623	*Macoma balthica* shells in laminated sand	3,5
8	Ogdensburg Ogdensburg	Ogdensburg St. Lawrence	11,820 ± 290	WAT-1190	*Macoma balthica* shells in massive silt and clay	11, 12
9	Lisbon Lisbon	Lisbon St. Lawrence	11,300 ± 380	WAT 1361	*Macoma balthica* shells in stratified beach deposit	11, 12
10	Fort Covington Fort Covington	Fort Covington Franklin	10,340 ± 130		shells	8
11	Massena Massena	Massena St. Lawrence	12,000 ± 200		shells	8
12	Norfolk Norfolk	Norfolk St. Lawrence	11,000 ± 160		shells	8
13	Norfolk Norfolk	Norfolk St. Lawrence	11,225 ± 200		shells	8
14	Boyd Pond Degrasse	West Pierrepont St. Lawrence	11,200 ± 190	GSC-3429	base of gyttja	2
15	Clear Pond Parishville	Rainbow Falls St. Lawrence	12,000 ± 200	GSC-4498	organics at base of gyttja 9.7m depth	1
16	Dodge Pond Parishville	Rainbow Falls St. Lawrence	12,900 ± 210	GSC-4369	organics at base of gyttja	1
17	Kennon Brook West Plattsburgh	Plattsburgh Clinton	11,800 ± 150	GSC-2366	*Macoma balthica* shells in silt	6
18	Lapham Mills Lapham Mills	Plattsburgh Clinton	11,900 ± 120	GSC-2338	*Macoma balthica* shells in sand and gravel	6
19	Norco Plattsburgh	Plattsburgh Clinton	11,665 ± 175	QC-200	*Macoma balthica* shells in silt and sand	6
20	Beekmantown Beekmantown	Rouses Point Clinton	10,300 ± 180	QC-199	*Mya arenaria* shells in clay	6
21	Briggs Rd Westville	Fort Covington Franklin	10,970 ± 110	WAT-626	*Macoma balthica* shells in laminated sand	5
22	Fort Covington Center Fort Covington Center	Fort Covington Franklin	11,610 ± 210	WAT-625	*Macoma balthica* shells in laminated sand	5

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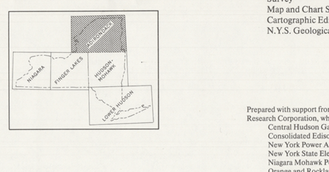
MAP SYMBOLS

Discrepancies between this map and the Finger Lakes and Hudson-Mohawk Sheets to the south reflect differences that have occurred between 1986 and 1991 in interpretation of depositional environments.



Cadwell, D. H., and others, 1991
Surficial Geologic Map of New York
New York State Museum—Geological Survey
Map and Chart Series #40.
Cartographic Editor: John B. Skiba, N.Y.S. Geological Survey

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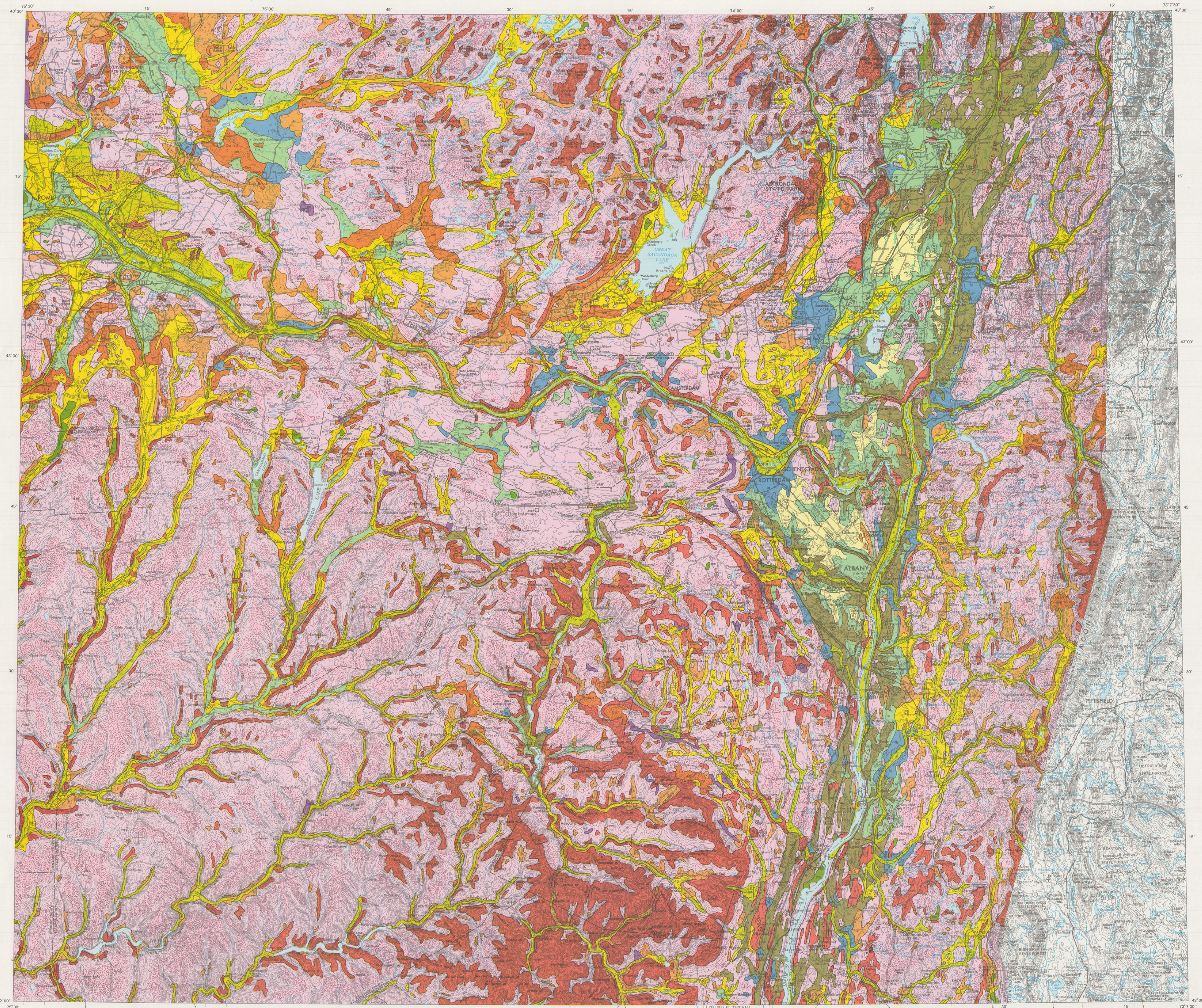

EXPLANATION

RADIOCARBON DATING

A small fraction of the carbon atoms in all living matter is made up of the radioactive isotope C^{14} (Radiocarbon) which disintegrates spontaneously with a half-life of 5570 ± 130 years. In fossil organic material the ratio of remaining radiocarbon atoms to atoms of the stable isotopes of carbon affords a base for estimating the duration of time since the organism died.

The chronology of glacial events in New York is pegged to absolute ages by radiocarbon assays of material collected from the localities that are located on the Surficial Geologic Map and listed below. Published references to the dated materials and the localities where they were collected are listed.

SITE	NAME TOWN	QUADRANGLE COUNTY	YEARS B.P.	LAB	REMARKS: MATERIAL LOCATION, SIGNIFICANCE	PUBLISHED REFERENCES
1.	Pine Log Camp Lake Luzerne	Lake Luzerne Warren	12,400 ± 200	I-3199	Wood fragment in lowest 15 cm of 810 cm core.	1.
			13,150 ± 200	I-4986	Wood fragment in lowest 3 cm of 810 cm core.	2.
2.	Eagle Hill Camp Livingston	Clermont Columbia	13,670 ± 170	SI-4082	Organic materials from swamp, at a depth of 10.25m.	3.
3.	Great Bear Swamp Westerlo	Greenville Albany	11,590 ± 265	QC-149	Organic materials from swamp, at a depth of 340 cm.	4.
			19,875 ± 980	GX-8672	Organic materials from swamp, at a depth of 420 cm.	4.
4.	Meadowdale Bog Voorheesville	Voorheesville Albany	10,485 ± 324	GX-8487	Organic materials from swamp, at a depth of 610 cm.	4.
			16,650 ± 660	GX-8488	Organic materials from swamp, at a depth of 750 cm.	4.
5.	Russ Site Unadilla	Unadilla Otsego	13,860 ± 800	DIC-750	Charcoal, at a depth of 75 cm. in silt.	5.
			11,710 ± 1300	DIC-476	Charcoal, at a depth of 170 cm. in silt.	5.

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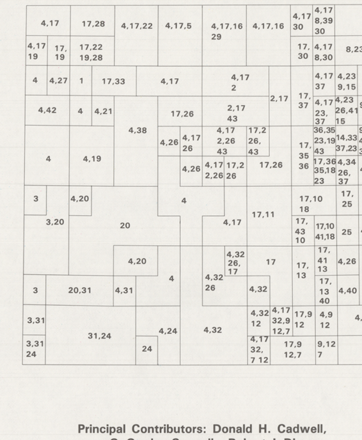
MAP SYMBOLS



GEOMORPHIC HISTORY OF EAST CENTRAL NEW YORK

The Hudson-Mohawk Sheet of the New York State Surficial Geologic Map includes parts of four physiographic provinces — the Appalachian Uplands, the Erie-Ontario and Hudson-Mohawk Lowlands, the New England Uplands, and the Adirondack Highlands. The Tug Hill Plateau, in the northwest corner of the sheet, is similar in structure and topography to the Appalachian Uplands though isolated from those uplands by the Erie-Ontario and Hudson-Mohawk Lowlands,

The bedrock geology varies widely among the different physiographic provinces. The Appalachian Uplands are underlain by Silurian and Devonian age sandstone, shale and limestone dipping gently to the southwest. The Hudson-Mohawk Lowlands are underlain by Ordovician shale, sandstone and limestone. The New England Uplands are composed of a diverse group of sedimentary rocks (shale, graywacke and limestone) and metamorphic rocks (phyllite, schist, quartzite and marble). The Adirondack Highlands contain a complex of erosion resistant metaigneous and metasedimentary rocks. These include meta-anorthosite, granite gneiss, garnet sillimanite gneiss and marble.

Major landscape features originated from the varying resistance of different rocks to chemical and mechanical disintegration. These major landscape features, products of several hundred millions of years of erosion, were profoundly modified by glacial erosion and deposition during the last 1-2 million years.

The main evidence of the years of preglacial landscape modification are the large-scale physiographic features (the upland and lowland areas), saprolites and a partially buried stream drainage network. Saprolites (deeply weathered soils) are preserved in small areas near Honnadaga Lake, Lake George, and Piseco Lake in the Adirondacks and Slide Mountain in the Catskills.

During preglacial time, a trellis drainage system existed in the Hudson-Mohawk region. The trunk stream, known as the Colonie River, drained the eastern Adirondacks, including the Lake George Basin, and flowed south through the present location of Saratoga and Round Lakes. The preglacial Mohawk River originated in the West Canada Creek valley, was confluent with the Sacandaga River at Fonda and joined the Colonie River at Ravena. This entire preglacial drainage network is buried by glacio-lacustrine deposits.

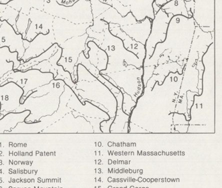
The landscapes of east-central New York have a pronounced glacial imprint. Floodplains, valley walls and the upland areas have been reshaped by erosion during the advance of the glaciers and by deposition of gravel, sand, silt and clay during retreat of the ice. However, this imprint of continental glaciation across east-central New York is not uniform. The most extensive erosion and deposition are found in the Hudson-Mohawk Lowlands and the northern and eastern parts of the Appalachian Uplands, where weaker, more easily eroded strata occur.

New York State was subjected to glacial erosion and deposition several times during the Pleistocene. Each succeeding glacial episode, however, destroyed the geologic record of the previous one. Evidence of multiple glaciation rarely is preserved. Glacial deposits found in the area covered by the Hudson-Mohawk Sheet were derived almost entirely from Late Wisconsinan glaciation, an expansion of the ice sheet that began about 30,000 years ago and culminated perhaps 20,000 years ago on Long Island.

As the Wisconsinan glacier advanced over the landscape the glacier gathered up and transported large quantities of soil and rocks. The erosive power of the advancing glacier was enhanced in valley and lowland areas oriented parallel to glacier flow where the ice was thicker and diminished in areas transverse to its flow where thinner ice prevailed. Thus, the major stream valleys in the Appalachian Uplands and the Hudson Lowlands were deeply scoured. Directional indicators of glacier flow such as rockdrumlins, drumlins, flutes and striations suggest two major ice streams — the Hudson-Champlain and the Ontario Lobes — that were deflected by the Adirondack Uplands.

After formation of the Wisconsinan Terminal Moraine on Long Island, the glacier began its retreat northward across New York State producing a series of proglacial lakes and recessional moraines. Upland regions were deglaciated before adjacent lowland areas. In eastern New York, for example, the Taconic and Catskill Mountains were exposed through the thinning ice while long tongues of glacial ice remained active within the Hudson Valley. Recessional moraines formed when the margin of the glacier remained at one position for some time, as indicated in Figure 1. The general location of these margins have been traced from the Taconic Mountains, across the Hudson Valley, through the Catskill Mountains and westward into the Appalachian Uplands. Interlobate moraines formed at Gloversville and Glens Falls at the junction of the major ice lobes in the Hudson and Mohawk Valleys with smaller ice masses from the Adirondacks. Deposits of drift in the valleys tend to be thicker (up to 100 meters) than drift in the uplands (generally less than 5 meters).

FIGURE 1
GENERALIZED ICE MARGINS



1. Rome
2. Holland Patent
3. Norway
4. Salisbury
5. Jackson Summit
6. Spruce Mountain
7. Cambridge
8. Eagle Bridge
9. Rensselaer
10. Chatham
11. Western Massachusetts
12. Delmar
13. Middleburg
14. Cassville-Cooperstown
15. Grand Gorge
16. Wagon Wheel Gap
17. Delhi
18. Sidney

As the Hudson-Champlain Glacial Lobe began to retreat, Glacial Lake Hudson formed in the lower Hudson Valley between the Terminal Moraine on Long Island and Staten Island and the margin of the retreating glacier. This lake gradually enlarged as the ice front receded northward to the Hudson Highlands. With further retreat of the ice this lake continued to enlarge throughout the mid and upper Hudson Valley where it is known as Glacial Lake Albany. Lake Albany ultimately reached a length of about 224 km (140 miles) and a width of 13-20 km (8-12 miles).

The existence of Glacial Lake Albany has been proven by a study of the materials deposited in the lake and the recognition of its shoreline features. Fine silts and clays were deposited in deep-water areas of the lake. Deltas of sand and gravel were deposited by streams entering the lake. Examples of such glacio-lacustrine deltas can be seen in Columbia County along the Kinderhook Creek; in Rensselaer County along the Hoosic River; in Washington County along the Batten Kill; and in Schenectady County along the Mohawk River at Rotterdam. The largest of these Lake Albany glacio-lacustrine complexes lies between Rotterdam and Albany where meltwater from the Erie-Ontario Lowlands and the Mohawk Valley formed the large delta in Lake Albany. The dune fields in this region formed when the delta deposits were exposed to winds during the gradual lowering of the lake level. The dam for Lake Albany remained intact for about 5000-8000 years, and when the dam failed, the lake began to drain, leaving only lacustrine deposits as evidence of its former existence.

The Wisconsinan glacier receded from New York State about 11,000 years ago. Subsequent to deglaciation the landforms of New York have been reshaped only moderately by postglacial processes, mainly along the floodplains of streams and the adjacent valley walls.

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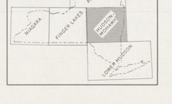
Map and Chart Series #40.



Cartographic Editor: John B. Skiba,
N.Y.S. Geological Survey

SURFICIAL GEOLOGIC MAP OF NEW YORK

HUDSON-MOHAWK SHEET

Compiled and Edited by: Donald H. Cadwell, Robert J. Dineen

1987

Prepared with support from Empire State Electric Energy Research Corporation, whose members are:
Central Hudson Gas and Electric Corporation
Consolidated Edison Co. of New York, Inc.
New York Power Authority
New York State Electric and Gas Corporation
Niagara Mohawk Power Corporation
Orange and Rockland Utilities, Inc.
Rochester Gas and Electric Corporation

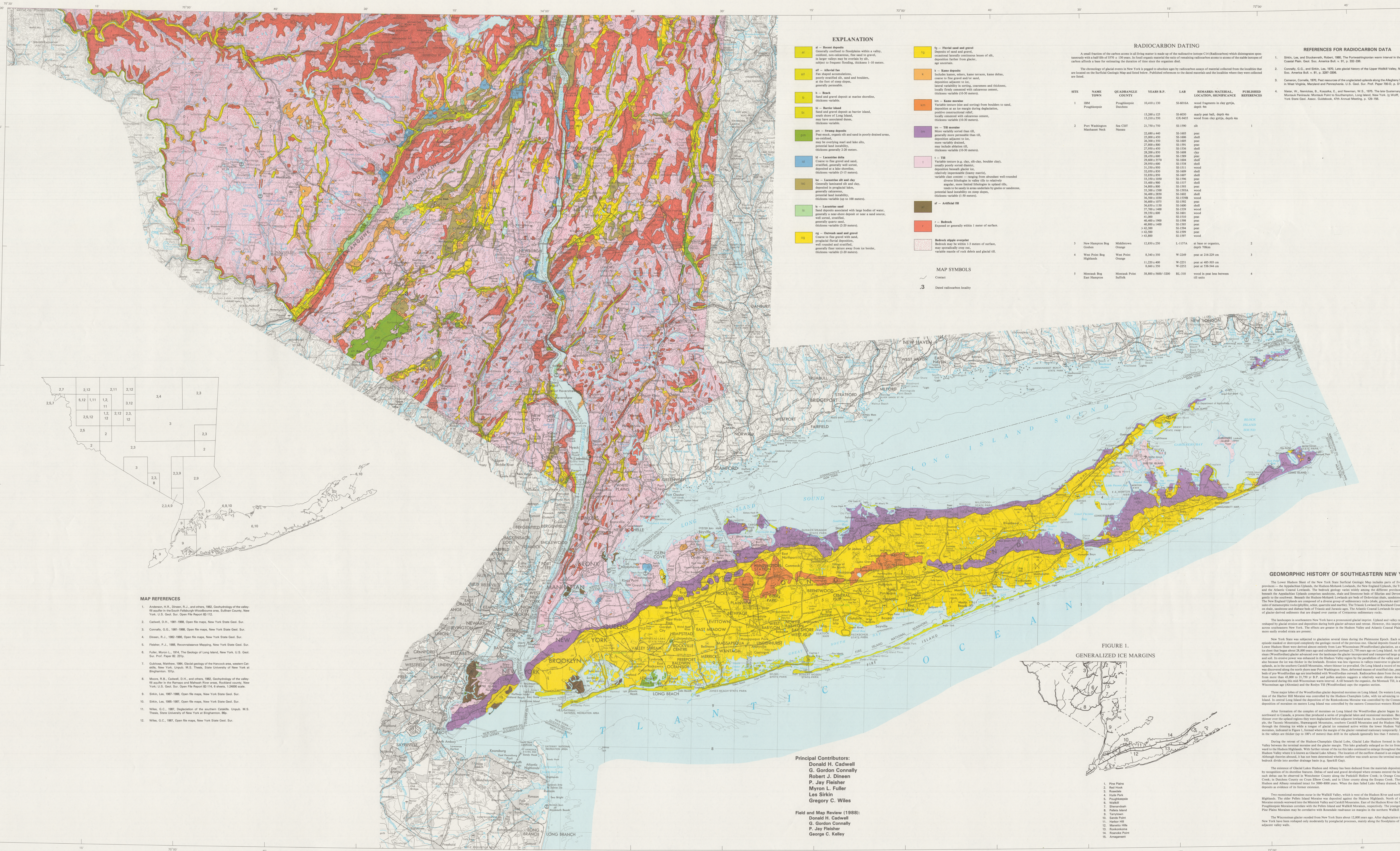
CONTOUR INTERVAL 100 FEET

Principal Contributors: Donald H. Cadwell, G. Gordon Connally, Robert J. Dineen, P. Jay Fleisher, John L. Rich

Field and Map Review (1986) by: G. Gordon Connally, P. Jay Fleisher, David A. Franzi, George C. Kelley

UNIVERSITY OF THE STATE OF NEW YORK
THE STATE EDUCATION DEPARTMENT

Robert H. Fakundiny, State Geologist



EXPLANATION

MAP SYMBOLS

Contact

.3 Dated radiocarbon locality

RADIOCARBON DATING

A small fraction of the carbon atoms in all living matter is made up of the radioactive isotope C14 (Radiocarbon) which disintegrates spontaneously with a half-life of 5570 ± 130 years. In fossil organic material the ratio of remaining radiocarbon atoms to atoms of the stable isotopes of carbon affords a base for estimating the duration of time since the organism died.

The chronology of glacial events in New York is pegged to absolute ages by radiocarbon assays of material collected from the localities that are located on the Surficial Geologic Map and listed below. Published references to the dated materials and the localities where they were collected are listed.

SITE	NAME TOWN	QUADRANGLE COUNTY	YEARS B.P.	LAB	REMARKS: MATERIAL, LOCATION, SIGNIFICANCE	PUBLISHED REFERENCES
1	IBM Poughkeepsie	Poughkeepsie Dutchess	10,410 ± 130	SI-6016A	wood fragments in clay gyttja, depth 4m	
			13,260 ± 125	SI-6030	marly peat ball, depth 4m	
			13,210 ± 550	GX-9435	wood from clay gyttja, depth 4m	
2	Port Washington Manhasset Neck	Sea Cliff Nassau	21,750 ± 750	SI-1590	silt	1
			22,680 ± 440	SI-1603	peat	
			25,000 ± 450	SI-1606	shell	
			26,300 ± 350	SI-1605	peat	
			27,800 ± 800	SI-1591	peat	
			27,950 ± 450	SI-1536	shell	
			28,200 ± 850	SI-1608	clay	
			28,450 ± 600	SI-1589	peat	
			29,600 ± 3570	SI-1604	shell	
			29,950 ± 600	SI-1538	shell	
			31,550 ± 950	SI-1511	wood	
			32,050 ± 830	SI-1609	shell	
			32,850 ± 850	SI-1607	shell	
			33,350 ± 1050	SI-1596	peat	
			33,400 ± 900	SI-1537	shell	
			34,800 ± 800	SI-1593	peat	
			35,300 ± 1500	SI-1593A	wood	
			36,400 ± 2850	SI-1602	shell	
			36,500 ± 1030	SI-1539B	wood	
			36,600 ± 1075	SI-1592	peat	
			36,650 ± 1150	SI-1600	shell	
			37,700 ± 1400	SI-1539	wood	
			39,350 ± 600	SI-1601	wood	
			41,000	SI-1510	peat	
			40,400 ± 1900	SI-1598	peat	
			40,800 ± 1400	SI-1595	peat	
			> 42,300	SI-1594	peat	
			> 42,500	SI-1599	peat	
			> 43,800	SI-1597	wood	
3	New Hampton Bog Goshen	Middletown Orange	12,850 ± 250	L-1157A	at base or organics, depth 700cm	2
4	West Point Bog Highlands	West Point Orange	8,340 ± 350	W-2249	peat at 216-229 cm	3
			11,220 ± 400	W-2251	peat at 485-503 cm	
			8,660 ± 350	W-2252	peat at 538-544 cm	
5	Montauk Bog East Hampton	Montauk Point Suffolk	38,800 ± 5600/-3200	RL-318	wood in peat lens between till units	4

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GEOMORPHIC HISTORY OF SOUTHEASTERN NEW YORK

FIGURE 1.
GENERALIZED ICE MARGINS

1. Pine Plains
2. Red Hook
3. Rosedale
4. Hyde Park
5. Poughkeepsie
6. Wallkill
7. Shenandoah
8. Pellets Island
9. Tarrytown
10. Sands Point
11. Harbor Hill
12. Manetto Hills
13. Ronkonkoma
14. Roanoke Point
15. Amagansett

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Field and Map Review (1988):
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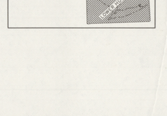

SURFICIAL GEOLOGIC MAP OF NEW YORK

LOWER HUDSON SHEET

Compiled and Edited by Donald H. Cadwell

1989

Scale 1:250,000

5 0 5 10 15 20 Statute Miles

5 0 5 10 15 20 25 30 Kilometers

5 0 5 10 15 Nautical Miles

CONTOUR INTERVAL 100 FEET

1948 MAGNETIC DECLINATION FOR THIS SHEET VARIES FROM 10°45′ WESTERLY FOR THE CENTER OF THE WEST EDGE TO 13°00′ WESTERLY FOR THE CENTER OF THE EAST EDGE. MEAN ANNUAL CHANGE IS NEGLIGIBLE.

Prepared with support from Empire State Electric Energy Research Corporation, whose members are:
Central Hudson Gas and Electric Corporation
Consolidated Edison Co. of New York Inc.
New York Power Authority
New York State Electric and Gas Corporation
Niagara Mohawk Power Corporation
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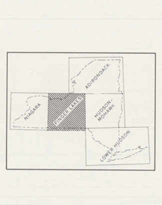

SURFICIAL GEOLOGIC MAP OF NEW YORK

FINGER LAKES SHEET

Compiled and Edited by: Ernest H. Muller, Donald H. Cadwell

Reconnaissance field review (1985) by: G. Gordon Connally, Richard A. Young

1986

Scale 1:250,000

CONTOUR INTERVAL 100 FEET

THE ISOGONIC LINES VARY FROM APPROXIMATELY 10° WEST TO 13° 30' WEST, RUNNING IN A NORTHWEST TO SOUTHEAST DIRECTION.

EXPLANATION

al - Recent deposits
Generally confined to floodplains within a valley, oxidized, non-calcareous, fine sand to gravel, in larger valleys may be overlain by silt, subject to frequent flooding, thickness 1-10 meters.

alf - alluvial fan

pm - Swamp deposits
Peat-muck, organic silt and sand in poorly drained areas, unoxidized, may be overlying marl and lake silts, potential land instability, thickness generally 2-20 meters.

d - Dunes
Fine to medium sand, well-sorted, stratified, non-calcareous, unconsolidated, generally wind-reworked lake sediments, permeable, well-drained, thickness variable (1-10 meters).

lb - Lacustrine beach
Generally well-sorted sand and gravel, stratified, permeable and well-drained, deposited at a lake shoreline, generally non-calcareous, wave-winnowed lag gravel in isolated drumlin localities, thickness variable (2-10 meters).

ld - Lacustrine delta
Coarse to fine gravel and sand, stratified, generally well-sorted, deposited at a lake shoreline, thickness variable (3-15 meters).

lsc - Lacustrine silt and clay
Generally laminated clay and silt deposited in proglacial lakes, generally calcareous, potential land instability, thickness variable (up to 50 meters).

ls - Lacustrine sand
Sand deposits associated with large bodies of water, generally a near-shore deposit or near a sand source, well-sorted, stratified, generally quartz sand, thickness variable (2-20 meters).

og - Outwash sand and gravel
Coarse to fine gravel with sand, proglacial fluvial deposition, well-rounded and stratified, generally finer texture away from ice border, thickness variable (2-20 meters).

k - Kame deposits
Includes kames, eskers, kame terraces, kame deltas, coarse to fine gravel and/or sand, deposition adjacent to ice, lateral variability in sorting, coarseness and thickness, locally firmly cemented with calcareous cement, thickness variable (10-30 meters).

km - Kame moraine
Variable texture (size and sorting) from boulders to sand, deposition at an ice margin during deglaciation, locally cemented with calcareous cement, thickness variable (10-30 meters).

tm - Till moraine
Much like till, but more variable in sorting, generally more permeable than till, deposition adjacent to ice, more variably drained, may be ablation till, thickness variable (10-30 meters).

t - Till
Variable texture (e.g. clay, silt-clay, boulder clay), usually poorly sorted diamict, deposition beneath glacier ice, generally calcareous in northern part of map, relatively impermeable (loamy matrix), variable clast content - ranging from abundant well-rounded diverse lithologies in valley tills to relatively angular, more limited lithologies in upland tills, potential land instability on steep slopes, thickness variable (1-50 meters).

r - Bedrock
Exposed or within 1 meter of surface, the following types of rock may be exposed: Paleozoic limestone, sandstone, shale.

Bedrock stipple overprint
bedrock may be within 1-3 meters of surface, may sporadically crop out, variable mantle of rock debris and glacial till.

MAP SYMBOLS

Contact

Esker

Glacial meltwater channel

2 • Dated radiocarbon locality

RADIOCARBON DATING

A small fraction of the carbon atoms in all living matter is made up of the radioactive isotope C^{14} (Radiocarbon) which disintegrates spontaneously with a half-life of 5570 ± 130 years. In fossil organic material the ratio of remaining Radiocarbon atoms to atoms of the stable isotopes of carbon affords a base for estimating the duration of time since the organism died.

The chronology of Wisconsinan glacial events in New York is pegged to absolute ages by radiocarbon assays of material collected from the localities that are located on the Surficial Geologic Map and listed below. Published references to the dated materials and the localities where they were collected are listed.

Site	Name, Town	Quadrangle, County	Years B.P.	Lab	Remarks: Material, location, significance	Published References
1.	Payne Brook Hamilton	Hamilton Madison	10,990 ± 970	GX-2717	Fragment of jawbone, from excavation in floodplain, N. side Payne Brook	1
2.	Chenango Forks Chenango Forks	Chenango Forks	16,650 ± 1800	BGS-86	Organic material from a depth of 31 feet in kettle hole bog, 5 ft above gravel	1
3.	Quaker Basin Linckaen	South Otselic Chenango	10,930 ± 150	GX-206	Organic materials from swamp at a depth of 12.5 - 13.5 ft	2, 3
			10,650 ± 300	W-1230	Organic materials from swamp at a depth of 11.0 - 12.5 ft	
			10,415 ± 145	GX-205	Organic materials from swamp at a depth of 8.75 - 9.25 ft	
4.	Fall Creek Ithaca	Ithaca East Tompkins	> 35,000	W-504	Organic debris at base of varves	4, 5, 6
			39,900	I-6046	Twigs at base of varves	
5.	Sixmile Creek Ithaca	Ithaca East Tompkins	41,900	Y-1401	Spruce knot in varves	7, 8
6.	Fernbank Covert	Ludlowville Seneca	> 50,000	Y-2431	Wood at base of gravel, 62 ft above lake	7, 8, 9
			> 52,000	Y-1404	Wood in marly sand, 47 ft above lake	
			> 54,000	Y-1403	Wood at 28 ft above lake	
7.	Colgan Farm Genoa	Genoa Cayuga	11,410 ± 410	Y-460	Spruce wood from basal clay that contained *Mammut Americanum* remains	10
8.	Great Gully Ledyard	Union Springs Cayuga	> 35,000	W-563	Twigs in 8 ft thick stratified sand between two tills	6,11
9.	Chemung River Athens, PA	Sayre, PA Bradford, PA	13,320 ± 200	Y-2619	Right innominate bone (pelvic) of *Mammut americanus,* found 3.5 m below surface of flood-plain, Chemung River	12

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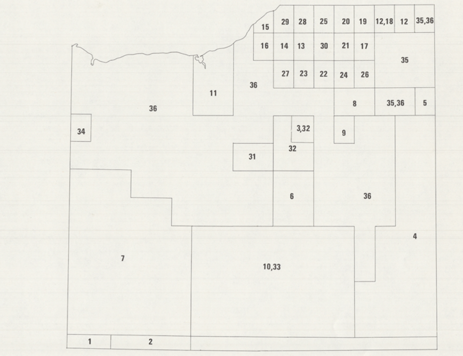

GEOMORPHIC HISTORY OF CENTRAL NEW YORK

The Finger Lakes Sheet includes part of two physiographic provinces — the Appalachian Uplands and the Erie-Ontario Lowlands. [illegible]

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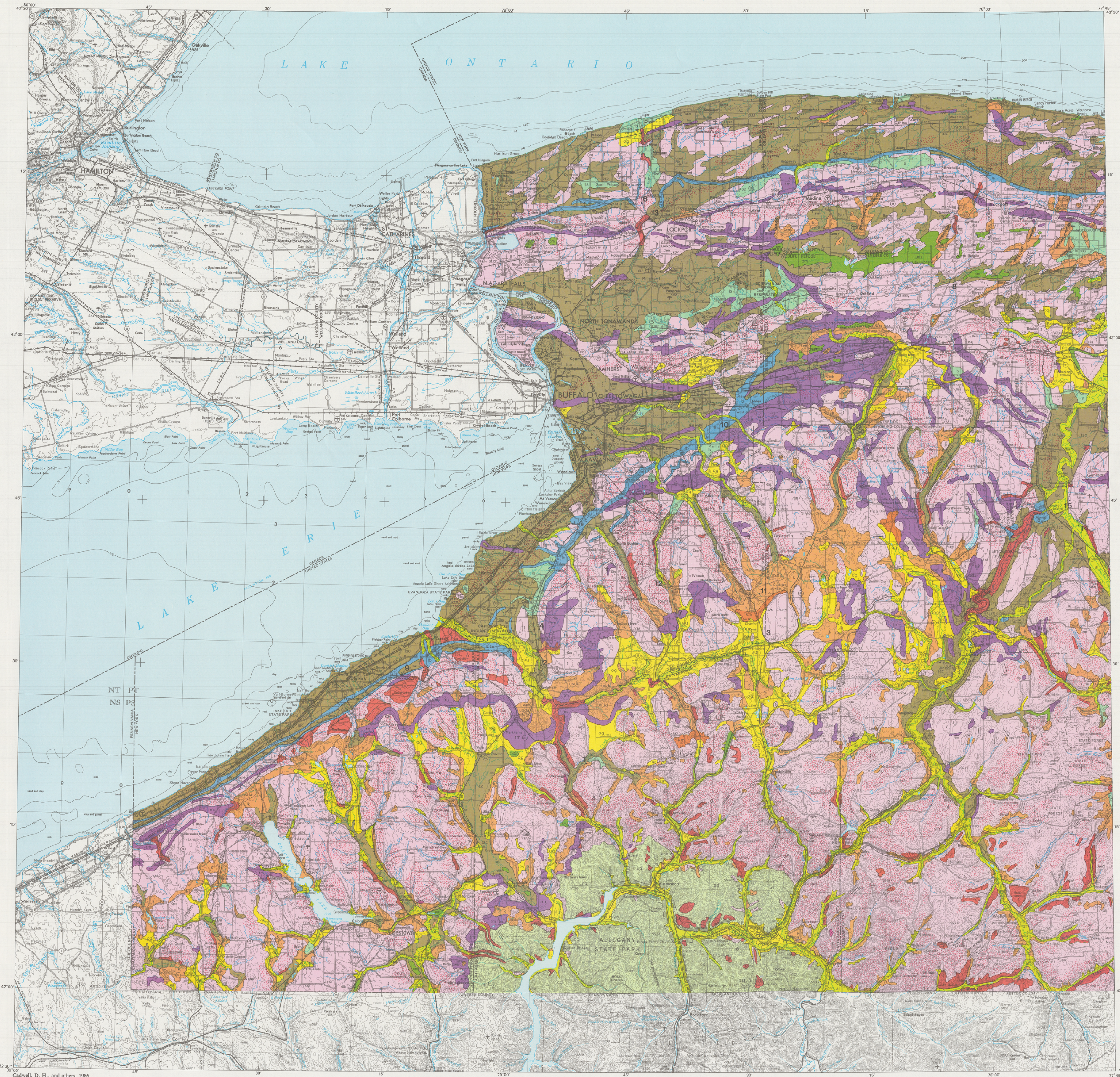


EXPLANATION

MAP SYMBOLS

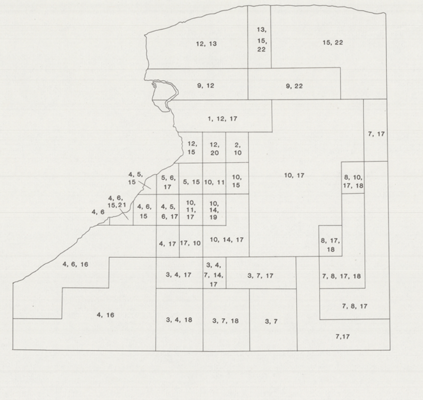
RADIOCARBON DATING

A small fraction of the carbon atoms in all living matter is made up of the radioactive isotope C^{14} (Radiocarbon) which disintegrates spontaneously with a half-life of 5570 ± 130 years. In fossil organic material the ratio of remaining radiocarbon atoms to atoms of the stable isotopes of carbon affords a base for estimating the duration of time since the organism died.

The chronology of glacial events in New York is pegged to absolute ages by radiocarbon assays of material collected from the localities that are located on the Surficial Geologic Map and listed below. Published references to the dated materials and the localities where they were collected are listed.

Site	Name, Town	Quadrangle, County	Years B.P.	Lab	Remarks: Material, Location, Significance	Published References
1	Otto Otto	Cattaraugus Cattaraugus	>35,000 >38,000	W-87 W-688	Peat near stream level S. Br. Cattaraugus Ck	19, 9
			>52,000	GrN-2565 GrN-2632	Carb. silt in gravel beneath lake clay	14, 13, 9
			63,900 ± 17,000	GrN-2634	Peat beneath gravel	14, 13, 9
2	Clear Creek Collins	Gowanda Erie	>48,400	GrN-5486	Wood in silty clay 6.5m beneath till	16, 13
3	Nichols Bk Sardinia	Arcade Erie	11,210 ± 160	I-6023	Wood in marly silt	10
			12,020 ± 300	W-507	Wood in marly silt	10, 15
			12,800 ± 200	I-5092	Wood in marly silt	10
			13,800 ± 250	I-4043	Marly detritus	3, 10
			14,000 ± 450	I-4216	Marly detritus	3, 10
4	Winter Gulf N. Collins	N. Collins Erie	12,610 ± 200	I-8022	Spruce wood 1.78m below shale shingle	3
			12,730 ± 220	I-3665	Organic detritus in gray clay	3
5	Lewiston Lewiston	Lewiston Niagara	12,080 ± 300 12,660 ± 400	W-861 W-861	Picea twigs in silty clay over till	14, 16, 17
6	Malloy Newfane	Lockport Niagara	12,100	I-838	Picea wood in lake silt	2, 12
7	Houghton Bog Springville	Concord Erie	11,880 ± 730	I-3290	Peat in kettle	11
8	Byron Byron	Byron Genesee	10,450 ± 400	W-1038	Wood directly beneath Mastodon pelvis	6, 8
9	Sheridan Forestville	Sheridan Chautauqua	9,200 ± 500	M-490	Mastodon rib in lake sand beneath 0.6m muck	4, 5
10	Marilla E. Aurora	Alden Erie	9,640 ± 250	W-199	Wood in lake clay	1, 18
11	Protection Arcade	Holland Erie	9,030 ± 150	I-3550	Peat in kettle	11
12	Colden Colden	Colden Erie	9,745	SI-1328 SI-1329	Twigs near base of lake silt, above till	7
13	The Gulf Lockport	Lockport Niagara	10,920 ± 160	I-5841	Picea wood from base of organics overlying gravel, lake clay and silt in floor of the Gulf	
14	Sonyea Groveland	Sonyea Livingston	8,050 ± 135	I-7527	Woody flotsam 4.6m below top of laminated silts and clays	20
15	Macauley Site Geneseo	Geneseo Livingston	4,745 ± 110	I-6804	Carbonized wood in silt overlying varves	20

REFERENCES FOR RADIOCARBON DATA



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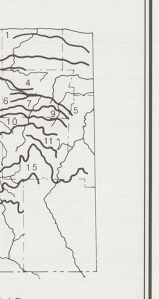
GEOMORPHIC HISTORY OF WESTERN NEW YORK

Figure 1.
GENERALIZED ICE MARGINS



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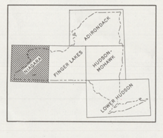

SURFICIAL GEOLOGIC MAP OF NEW YORK

NIAGARA SHEET

Compiled and Edited by Donald H. Cadwell

1988

Scale 1:250,000

CONTOUR INTERVAL 100 FEET

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