TRIP A4

THE LATE GLACIAL ORIGIN OF THE CLINTON COUNTY FLATROCKS

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INTRODUCTION

The Clinton County Flat Rocks comprise a discontinuous, 5-kilometer wide belt of bare sandstone areas that extend approximately 30 km southeastward into the Champlain Valley from Covey Hill, near Hemmingford, Quebec (Figure 1). Created by catastrophic floods from the drainage of glacial Lake Iroquois and younger post-Iroquois proglacial lakes in the St. Lawrence Lowland more than 12,000 years ago (Denny, 1974; Clark and Karrow, 1984; Pair et al., 1988), the exposed sandstone today provides a nutrient-poor, drought-prone habitat that is often covered by jack pine (*Pinus banksiana*) barrens. The relatively low-diversity jack pine community is maintained by fire, which has an important role in ecosystem regeneration.

We will examine the deglacial events leading to the origin of the Flat Rocks by following the path of late glacial meltwater drainage from the divide between the St. Lawrence and Champlain drainage basins. We will also address on-going efforts to understand the linkages between the hydrogeology and ecology of the jack pine barrens and document the recent history of anthropogenic development in the Flat Rocks region. The trip will feature a visit to several sites in the southeastern portion of Altona Flat Rock on property owned by the William H. Miner Agricultural Institute. The area contains the remains of the "Million-Dollar Dam", part of a failed hydroelectric project begun by William Miner in 1910. Additional stops will examine the deposits and landforms that record deglacial events leading to the catastrophic drainage of Lake Iroquois and subsequent formation of the Flat Rocks. The text of this field guide is an expanded version of a previous field guide (Franzi and Adams, 1993) that was concerned exclusively with the geology and ecology of Altona Flat Rock.

GEOLOGICAL SETTING

The Clinton County Flat Rocks lie in the upper reaches of the English, Chazy, and Little Chazy river drainage basins in the northwestern Champlain Lowland, New York (Figure 1). The bare rock areas are entirely underlain by flat-lying Potsdam Sandstone (Cambrian) that ranges from cross-laminated, orange-pink to pale red, very coarse to medium-grained arkose with quartzitic green shale and conglomeratic interbeds to pinkish gray to very pale orange, well sorted, fine to medium-grained quartz sandstone (Fisher, 1968).

The large areas of exposed sandstone were created more than 12,000 years before present by the erosional effects of ice-marginal streams related to catastrophic drainage of glacial Lake Iroquois and younger post-Iroquois lakes (Woodworth, 1905a, 1905b; Coleman, 1937; Denny, 1974; Clark and Karrow, 1984; Pair et al., 1988). Lake Iroquois occupied the Ontario Lowland and drained eastward across an outlet threshold near Rome in the western Mohawk Lowland (Coleman, 1937). Lake Iroquois expanded northeastward into the St. Lawrence Lowland during deglaciation between the Adirondack Uplands to the south and the waning Laurentide Ice Sheet margin to the north. The former water level probably stood at a present elevation between 329 and 332 meters a.s.l. (above sea level) near Covey Hill, Quebec (Figure 1) (Denny, 1974; Clark and Karrow, 1984; Pair et al., 1988).

Northward recession of the ice front into Chateaugay region diverted glacial meltwater westward along the ice margin and created the well-developed Chateaugay Channels (MacClintock and Stewart, 1965). Drainage through the channels emptied sequentially into the northeastwardly expanding Lake Iroquois as ice recession continued. Westward drainage ended when the ice front in the Champlain Lowland receded from the vicinity of the Ellenburg Moraine. Subsequently, eastward drainage of Lake Iroquois began as lower outlets were exhumed along the drainage divide between the Champlain and St. Lawrence drainage systems southwest of Covey Hill. The initial drainage may have occurred through a channel approximately 1 km north of Clinton Mills that was controlled by a threshold between 329 and 332 meters a.s.l. (Clark and Karrow, 1984). The falling levels of proglacial lakes in the St. Lawrence and Ontario lowlands temporarily stabilized at the glacial Lake Frontenac level (Clark and Karrow, 1984; Pair et al., 1988) as the ice margin receded northward and the col at The Gulf (308-311 meters a.s.l.) was uncovered. Outflow from these lakes was directed southeastward along the ice margin where it crossed the English, North Branch and Great Chazy watersheds before eventually emptying into Lake Fort Ann which occupied the Champlain Lowland at an elevation between 225 and 228 meters a.s.l. (Denny, 1974). The outflow streams stripped large areas of their surficial cover and cut deep bedrock channels and plunge pools (e.g. The Gulf (MacClintock and Terasme, 1960) and the Dead Sea (Woodworth, 1905a; Denny, 1974)) (Figure 1) into the Potsdam Sandstone. The most intense scour (e.g. Stafford Rock, Blackman Rock, and Altona Flat Rock) generally occurred on major watershed divides. Cobblestone Hill (Figures 1) is an accumulation of bouldery debris washed from the exposed rock areas by glacial lake outflow floods (Woodworth, 1905a; Denny, 1974).

The scour of the areas southeast of the St. Lawrence-Champlain divide continued as ice recession caused the drainage of Lake Frontenac around the northern flank of Covey Hill. Denny (1974) suggested that the ice margin may have oscillated in the area around Covey Hill causing the lakes in the eastern St. Lawrence Lowland to refill and empty several times. The lake-drainage episodes ended when the ice front receded from the northern flank of Covey Hill for the last time and the proglacial lake in the St. Lawrence Lowland was lowered to the level of Lake Fort Ann in the Champlain Lowland (Pair, et. al., 1988).

ALTONA FLAT ROCK

Physiography

Altona Flat Rock, with an area of approximately 32 km^2, is the largest of the Clinton County Flat Rocks (Figure 1). The exposed rock surface slopes north and east from an elevation of more than 300 meters a.s.l. (above sea level) to below 200 meters a.s.l. where it passes beneath surficial deposits in the Champlain Lowland (Denny, 1974). The sloping surface is broken into a series of stair-like bedrock treads separated by risers that range from a few decimeters to tens of meters in height (Figure 2). The tread surfaces have little local relief except near stream channels and risers. The eroded edges of truncated trough cross-beds, ripple marks, and solution pits are common minor surface features. Shoreline deposits from the highstand of glacial Lake Vermont (Fort Ann Stage) (Chapman, 1937; Denny, 1970, 1974) lap onto the northern and eastern margins of Flat Rock.

The central portion of Altona Flat Rock is drained by Cold Brook, a principal headwater tributary of the Little Chazy River that originates near the Dead Sea (Figure 1). Cold Brook is an underfit stream that occupies a bedrock channel that may locally be more than 200 meters wide and 25 meters deep. The greatest channel incision generally occurs where the stream cuts across prominent southeast-facing bedrock risers. The generally southeastward drainage of Cold Brook is characterized by a subtle rectangular channel pattern that is probably related to bedrock fracture patterns.

Cobblestone Hill forms a conspicuous, elongate ridge on the northern flank of Cold Brook at the southeastern margin of Flat Rock. The ridge is more than 15 meters high, 500 m wide, and 2.5 kilometers long and is composed of angular boulders, almost exclusively Potsdam Sandstone, that range from 0.5 to 3 meters in diameter. The average size of surface boulders decreases to the southeast. Boulder and gravel terraces on the northeast flank of Cobblestone Hill represent beach ridges formed in Lake Vermont (Woodworth, 1905a; Chapman, 1937; Denny, 1974).

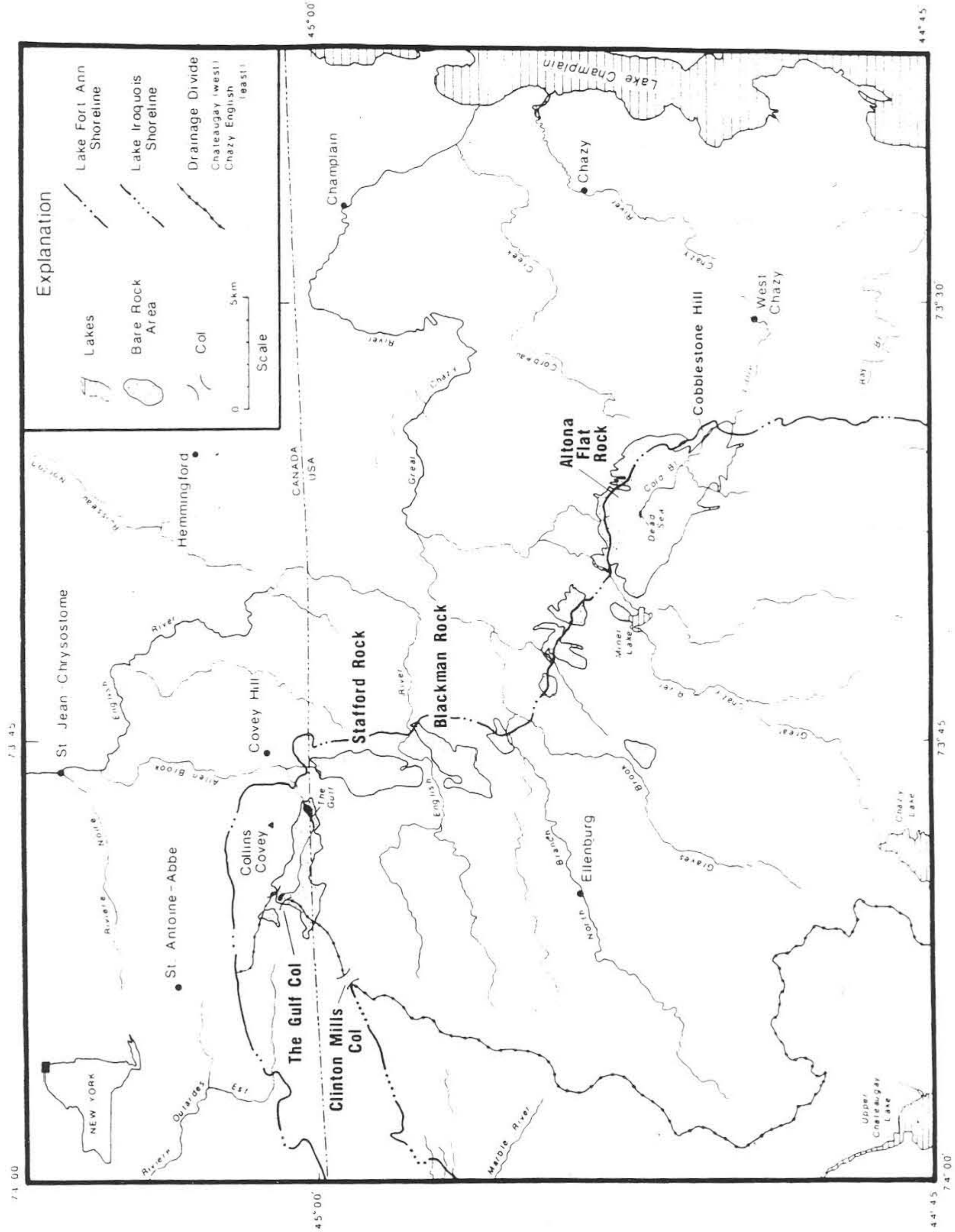

Figure 1. Location map showing the principal bare rock areas east of the divide between the Chateaugay (west) and Chazy and English (east) river watersheds in northeastern New York and adjacent parts of Canada (from Woodworth, 1905a; Denny, 1974; LaSalle, 1985).

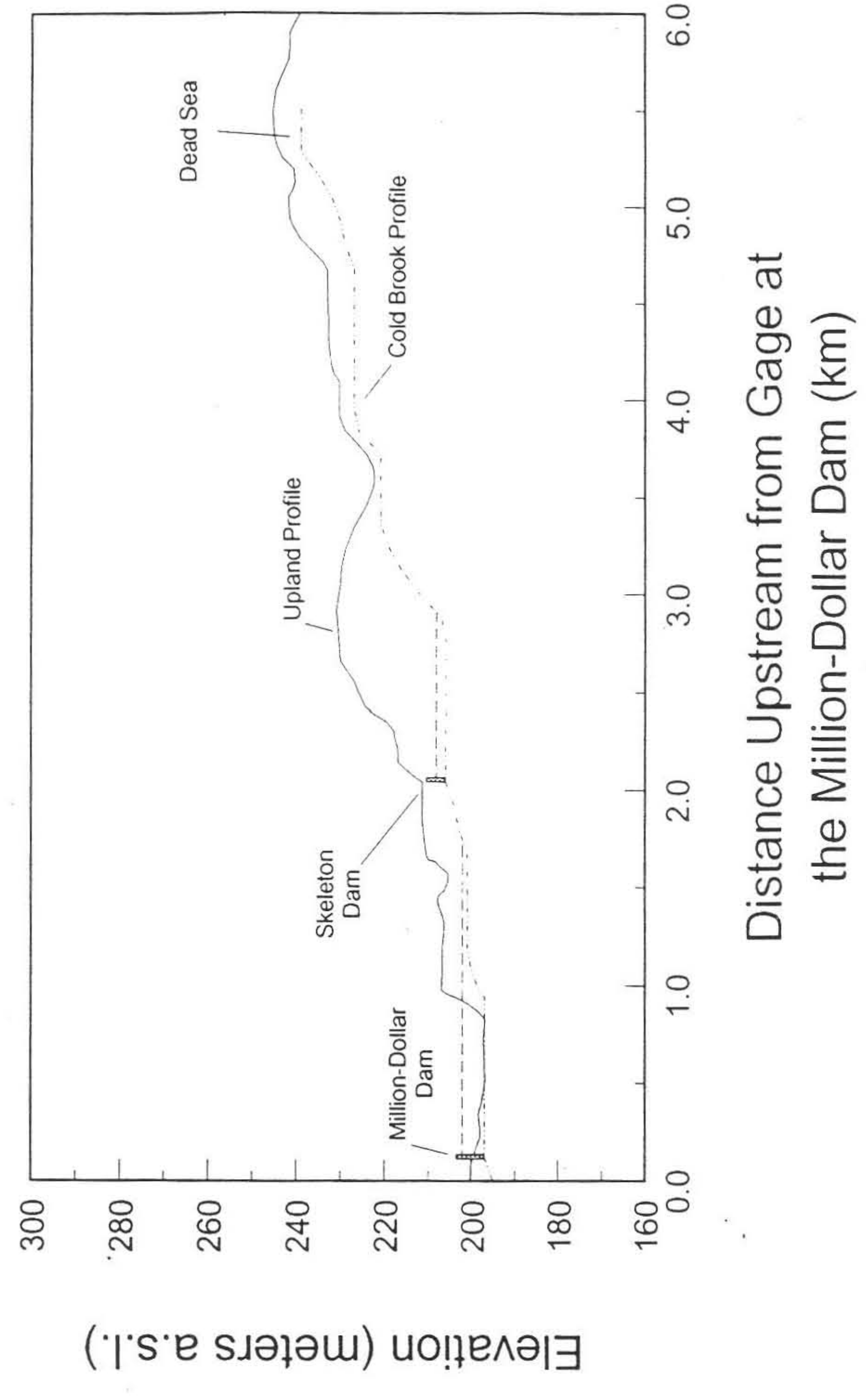

Figure 2. Topographic profile of Cold Brook and adjacent uplands on Altona Flat Rock showing the location of the Million-Dollar and Skeleton Dams and the approximate design pool elevations of their respective reservoirs. The upland profile represents the maximum land surface elevation within 0.5 kilometers of a line oriented N40^{0}W through the Cold Brook Valley.

Figure 3. Photograph of "typical" jack pine barrens on Altona Flat Rock.

Jack pine is a relatively short-lived (<150 years), shade-intolerant, boreal species that has maintained a relic community at Altona Flat Rock because of its adaptations to fire and ability to survive in an area with thin (or absent), nutrient-poor soils (Figure 3). The Altona Flat Rock pine barrens is near the southern limit of the present natural range of jack pine (Burns and Honkala, 1990; Harlow, et al., 1991).

The relatively low species diversity in the barrens reflects low seasonal water availability and the thin, nutrient-poor soils on Flat Rock. The barrens consists essentially of a single tree species, jack pine, with virtually no subcanopy or understory trees. The understory shrubs are predominantly lowbush blueberry (_Vaccinium angustifolium_), black huckleberry (_Gaylussacia baccata_), black chokeberry (_Pyrus melanocarpa_), sweetfern (_Comptonia peregrina_), and sheep laurel (_Kalmia angustifolia_). Ground cover is primarily reindeer lichen (_Cladonia rangiferina_), haircap moss (_Polytrichum commune_), bracken fern (_Pteridium aquilinum_), and _Sphagnum spp_. (Stergas and Adams, 1989).

Jack pine requires periodic crown fires for successful regeneration to occur (Ahlgren and Ahlgren, 1960; Cayford, 1971; Rowe and Scotter, 1973; Cayford and McRae, 1983; Rouse, 1986). Fire releases seeds from serotinous cones stored in the jack pine canopy, prepares a nutrient-rich ash seedbed, and reduces competition for the young seedlings. Since this barrens is a fire-dependent ecosystem, fire exclusion will ultimately cause the local extinction of jack

(Gaylussacia baccata), black chokeberry (Pyrus melanocarpa), sweetfern (Comptonia peregrina), and sheep laurel (Kalmia angustifolia). Ground cover is primarily reindeer lichen (Cladonia rangiferina), haircap moss (Polytrichum commune), bracken fern (Pteridium aquilinum), and Sphagnum spp. (Stergas and Adams, 1989).

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The combined effects of anomalously high summer air temperature, low seasonal water availability, and flammable foliage produce a fire-prone environment for which the pine barrens community is well adapted. Mean annual precipitation from meteorological records for a 27-year period between July, 1963 to August, 1992 at the Miner Institute in Chazy, New York is approximately 80 cm. Mean monthly air temperature ranges from -11°C in January to 20°C in July (Stergas and Adams, 1989). Summer air temperature in bare rock areas, however, may be as much as 16°C higher than in the surrounding areas, and midday temperatures commonly exceed 38°C (Woehr, 1980). Preliminary data from observation wells on Flat Rock indicate that, in many places, the water table lies well below the depth of root penetration.

There have been four stand-replacing wildfires at Flat Rock during this century (1919, 1940, 1957 and 1965). The oldest jack pine stand at Flat Rock (ca. 73 years) is beginning to show signs of decline. Nearly 40 percent of the trees in this stand (1919 burn area) are dead (Hawver, 1992). The accumulation of dead tree biomass increases the probability of another fire in this stand. A fire management plan, that includes both planned-ignition and natural-ignition fires, is needed for the entire barrens.

The Flat Rock Hydroelectric Project

In the summer of 1910, William Miner, ignoring the advice of his engineers, began construction of a hydroelectric dam and generating station on southeastern margin of Altona Flat Rock (Gooley, 1980). By the time of its completion in March, 1913, the concrete dam, known locally as the "Million-Dollar Dam", had a maximum height of over 10 meters and stretched more than 700 meters across the Cold Brook valley (Figures 4 and 5). The design capacity of the reservoir was more than 3.5 million cubic meters. A second dam, the Skeleton Dam (Gooley, 1980), was constructed upstream to provide supplemental flow to the main impoundment.

The dam and generating station were completed in 1913 but it took almost two years to fill the reservoir to near capacity. The inadequate flow of Cold Brook and ground water seepage through Cobblestone Hill, which formed the eastern flank of the reservoir, proved to be major design flaws. At one point, seepage beneath the dam was so great that it caused severe damage at the Stephen LaPierre residence, approximately 600 meters east of the dam (Gooley, 1980). A 10 to 15 cm layer of concrete grout was spread over more than 100,000 m^2 along the southwestern flank of Cobblestone Hill to mitigate the seepage loss (Figures 4 and 6). A deep trench was excavated at the base of Cobblestone Hill behind the dam for the purpose of pouring a grout curtain to the underlying sandstone and thereby, presumably, sealing the northeastern flank of the reservoir. The grouting effort was partially successful and the power generating plant began operation on January 21, 1915, more than four years from the beginning of the project (Gooley, 1980). The power plant produced electricity intermittently for seven years before mechanical problems forced the abandonment of the project.

SUMMARY

The Clinton County Flat Rocks illustrate the impact of glacial and post-glacial processes on landscape development and contemporary ecosystem-level processes. The region contains a unique record of meltwater drainage related to the retreat of the Laurentide Ice Sheet. The Flat Rocks sandstone pavement, created by erosion associated with late glacial lake-outflow floods, provides an environment characterized by extreme deficiencies in nutrients and soil moisture. Jack pine and its associated heath plants are among the few native species that can survive in this hostile setting. The combined effects of the harsh physical environment and its associated vegetation create an ecosystem that is adapted to and maintained by periodic fire. A fire-management program, based upon a detailed study of ecosystem dynamics and function, is needed if the uniqueness of the Flat Rock jack pine barrens is to be preserved.

ACKNOWLEDGMENTS

The authors would like to acknowledge the Center for Earth and Environmental Science and the Applied Environmental Science Program at SUNY Plattsburgh and the W.H. Miner Agricultural Research Institute for their support of our research and instructional efforts at Flat Rock. Jamie Shanley, Jon Denner (U.S. Geological Survey, Montpelier, Vermont) and Marc Hult (U.S. Geological Survey, Bloomington, Minnesota) provided valuable technical assistance for the installation of the monitoring well network and the stream gaging station. Special thanks are also extended to Michael Parsons of Michael Parsons Well Drilling Company, who generously donated drilling services for well installation. Finally, we would like to thank our students Neil Gifford, Kortney Brewster, and Chris Lassell who have enthusiastically helped with equipment installation and monitoring during the early stages of our project.

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ROAD LOG

The road log begins at the Hudson Hall parking lot on the SUNY Plattsburgh campus, Plattsburgh, New York. Road log distances are presented in English units. All other measurement are in SI units.

Persons using this log in the future should be aware that the Altona Flat Rock field trip stops are located on private property that is owned and patrolled by the William H. Miner Agricultural Institute. A permit must be obtained from the Miner Institute to access this property.

Cumulative mileage	Miles from last point	Route description
Start		Assemble in the Hudson Hall parking lot on the SUNY parking area, turn right at entrance, and proceed northwestward on Broad St.
0.1	0.1	Traffic light, continue northwestward on Broad St.
0.2	0.1	Traffic light, continue northwestward on Broad St.
0.4	0.2	Traffic light at the corner of Broad and Cornelia (US Route 3) streets. Bear left onto Cornelia St. and proceed westward through the next two traffic lights.
1.1	0.7	Junction I-87 North. Turn right onto entrance and proceed northward to Interchange 40 in Beekmantown.
8.1	7.0	Exit ramp at Interchange 40 (Spellman Road). Exit right and proceed to Spellman Road.
8.3	0.2	Intersection of Northway exit ramp and Spellman Road. Turn left and proceed west to Beekmantown Corners.
11.0	2.7	Intersection of Spellman Road and U.S. Route 22. Turn right and proceed north on U.S. Route 22.
14.4	3.4	Intersection of U.S. Route 22, N.Y. Route 348, and West Church Street in West Chazy. Turn left and proceed west on West Church Street.
15.1	0.7	Intersection of West Church Street, Parker Road, and O'Neil Road. Bear left then right to remain on West Church Street.
15.9	0.8	Intersection of West Church Street and Barnaby Road. Turn right and proceed north on Barnaby Road.

16.9	1.0	Barnaby Road changes to a gravel surface at the farm just north of Slosson Road intersection.
17.9	1.0	STOP 1.

STOP 1. LAKE FORT ANN BEACH RIDGES.

Park at the gate at the entrance of the Miner Institute property and continue northward on foot along Barnaby Road approximately 100 meters (320 ft). Turn left into woods and proceed west for 150 to 200 meters (500-750 ft) up the eastern flank of Cobblestone Hill. The beach ridges occur at elevations between 175 and 205 meters (580 and 670 ft) above sea level (Denny, 1974).

The beach ridges on Cobblestone Hill were first described by Woodworth (1905a) and later by Denny (1974). The beaches consist predominantly of moderately rounded to well rounded, pebble to cobble gravel that is deposited in multiple, elongate, low-relief ridges that extend along the northern and eastern flanks of Cobblestone Hill between 175 and 205 meters a.s.l. (Figure 7). Individual deposits are typically as much as 1 meter high and 30 meters wide, and often extend laterally for more than 400 meters (Denny, 1974). The gravel is almost exclusively composed of Potsdam Sandstone that was presumably derived from the alluvial cobble to boulder gravel that composes Cobblestone Hill.

Return to the vehicles at the gate after the discussion at this stop.

17.9		Proceed through the entrance gate. Low roadside excavations approximately 75 meters (250 ft) west of the gate expose the cobble gravel that comprises the Lake Fort Ann beach ridges. Near the crest of the ridge the angular, 0.3 to 1.2 meter (1 to 4 ft) diameter boulders that comprise the core of Cobblestone Hill can be observed at the surface. The remains of the "Million-Dollar Dam" can be seen on the right just southwest of the hill crest.
18.2	0.3	STOP 2.

STOP 2. THE "MILLION-DOLLAR DAM".

The "Million-Dollar Dam" and hydroelectric generation plant was completed on 11 March, 1913 and operated intermittently from 21 January, 1915 until its closure in 1922. A large hole was blasted in the dam shortly after William Miner's death in 1930 to permit Cold Brook to drain freely through the former reservoir. The Flat Rock sandstone pavement is exposed southwest of Cold Brook. The change from mixed deciduous, primarily oak, forest on Cobblestone Hill to jack pine barrens on Flat Rock is characteristically sharp at this location.

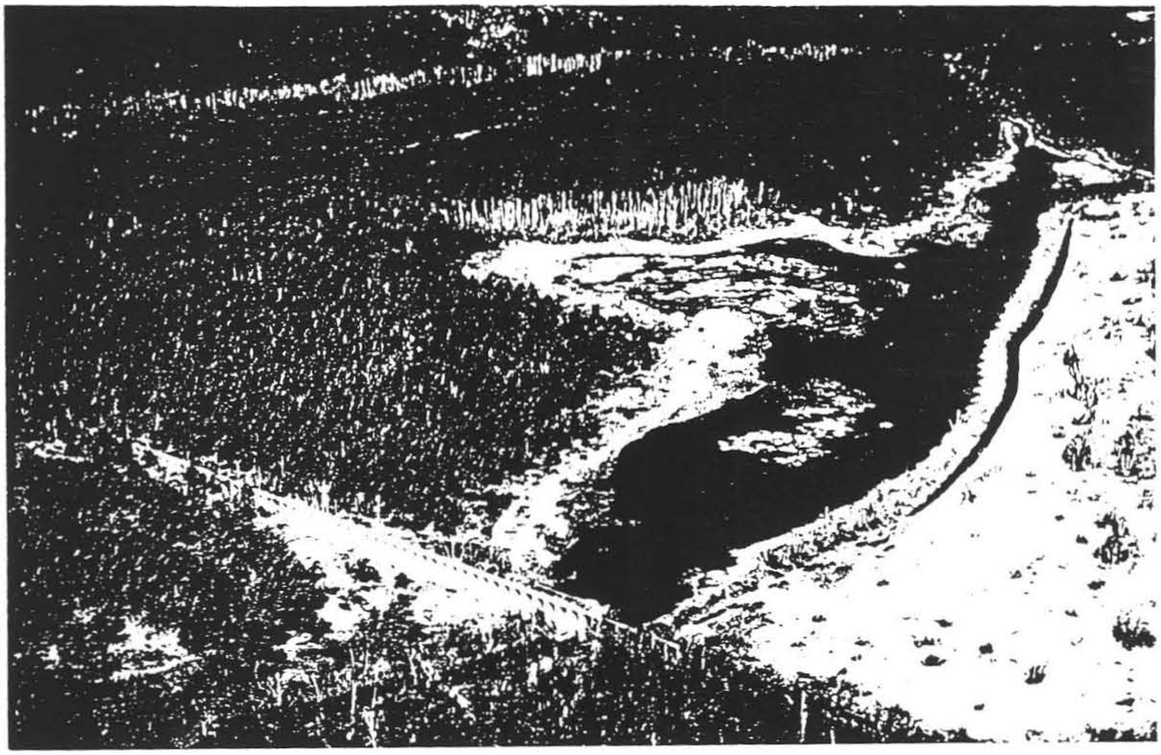

Figure 4. Oblique aerial photograph showing the Million-Dollar Dam and the northwestern flank of Cobblestone Hill (lower right) where it was covered with a concrete veneer to reduce seepage from the former reservoir. The grout-curtain trench can be seen on the right side of the photo.

Figure 5. The Million-Dollar Dam looking northwest from the reservoir outlet.

Figure 6. The Scarpit.

establish an instrumented field station for undergraduate research and instruction in geology and environmental science at the Miner Dam site. A monitoring-well network, consisting of nine wells ranging in depth from 10 to 25 meters, was completed in May, 1992 between the northeastern portion of the former Million-Dollar dam reservoir and the Skeleton Dam (Figure 7). Water-level measurements were begun in late July, 1992 (Figure 8). Future plans include the installation of a weather station, an inflow stream gaging station, and expansion of the monitoring-well network. The field station will provide an important linkage between traditional and applied educational opportunities that addresses some of the unique geological and ecological aspects of the Flat Rock region.

Return to the vechicles following the discussions at this stop and proceed eastward toward Cobblestone Hill. Turn left onto a small road near the crest of the hill that leads northwestward along the flank of the former reservoir.

18.4 0.2 STOP 3.

STOP 3. "THE SCARPIT".

The "scarpit" is the local name given to the desolate landscape created by efforts to grout the porous boulder gravel slope of Cobblestone Hill (Figures 6 and 7). The surface consists

18.4	0.2	STOP 3.

STOP 3. "THE SCARPIT".

The "scarpit" is the local name given to the desolate landscape created by efforts to grout the porous boulder gravel slope of Cobblestone Hill (Figures 6 and 7). The surface consists of a thin (1.2 to 2.5 cm) layer of cement that was poured and raked between large boulders composed predominantly of Potsdam Sandstone. The trench that was dug for the grout curtain (Figure 4) can be observed approximately 100 meters west of the concrete road that parallels the former shoreline of the reservoir.

Return to the vehicles following the discussions at this stop and proceed northwestward on the concrete road.

18.9	0.5	The first of nine observation wells drilled in May 1992 can be observed to the left near the treeline at the edge of the grout surface. The wooded area beyond the well is part of minor southeast-facing bedrock riser. The slope of Cobblestone Hill steepens and the boulder size increases to the northwest.
19.4	0.5	The concrete road ends and the access road bears sharply northeast and continues on the bedrock surface through the jack pine barrens.
19.5	0.1	The road crosses a surface-water supported wetland. The road bed is deeply rutted where it crosses a wetland that contains 0.2 to 1.0 meters of organic soil. Observation wells located approximately 50 meters northeast and 70 meters southwest of the wetland indicate that the water table is usually more than 7.5 meters below the surface.
19.7	0.2	The road crosses a small channel that contains a large wetland. A concrete wall on the left (south) side of the road was constructed to prevent water impounded behind the "Million-Dollar Dam" to escape northward through this channel. The access road forks immediately west of the channel. The right fork leads to an abandoned fire tower on the top of Pine Ridge. Bear left and proceed southward.
19.9	0.2	STOP 4.

STOP 4. THE "SKELETON DAM".

The partially completed "Skeleton Dam" was designed to augment flow to the reservoir impounded behind the "Million-Dollar Dam" (Figure 7). The dam impounds "Chasm Lake"

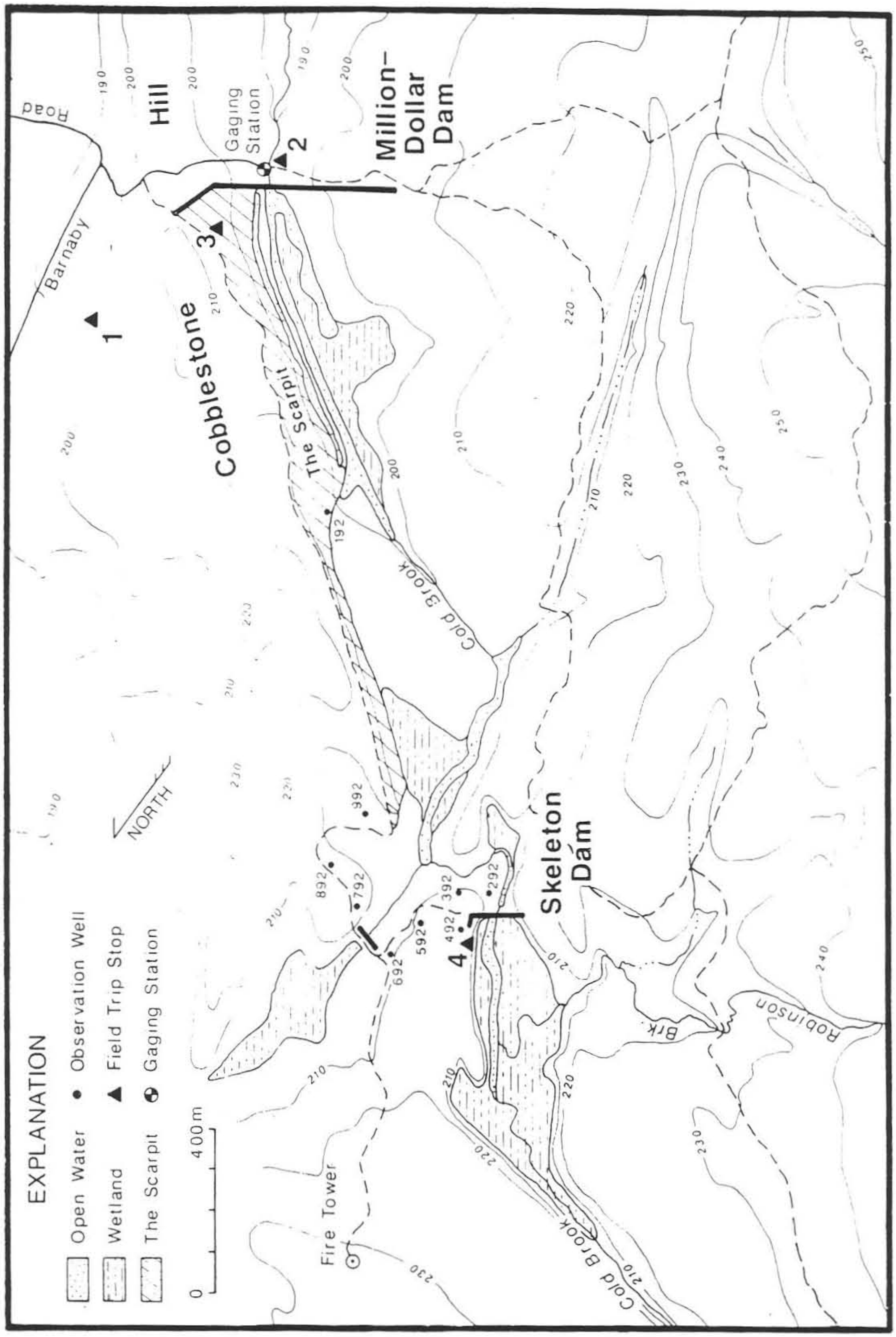

Figure 7. Topographic map of the southeastern portion of Altona Flat Rock showing locations referred to in text. (Topographic base from West Chazy Quadrangle, U.S. Geological Survey 7.5-Minute Series)

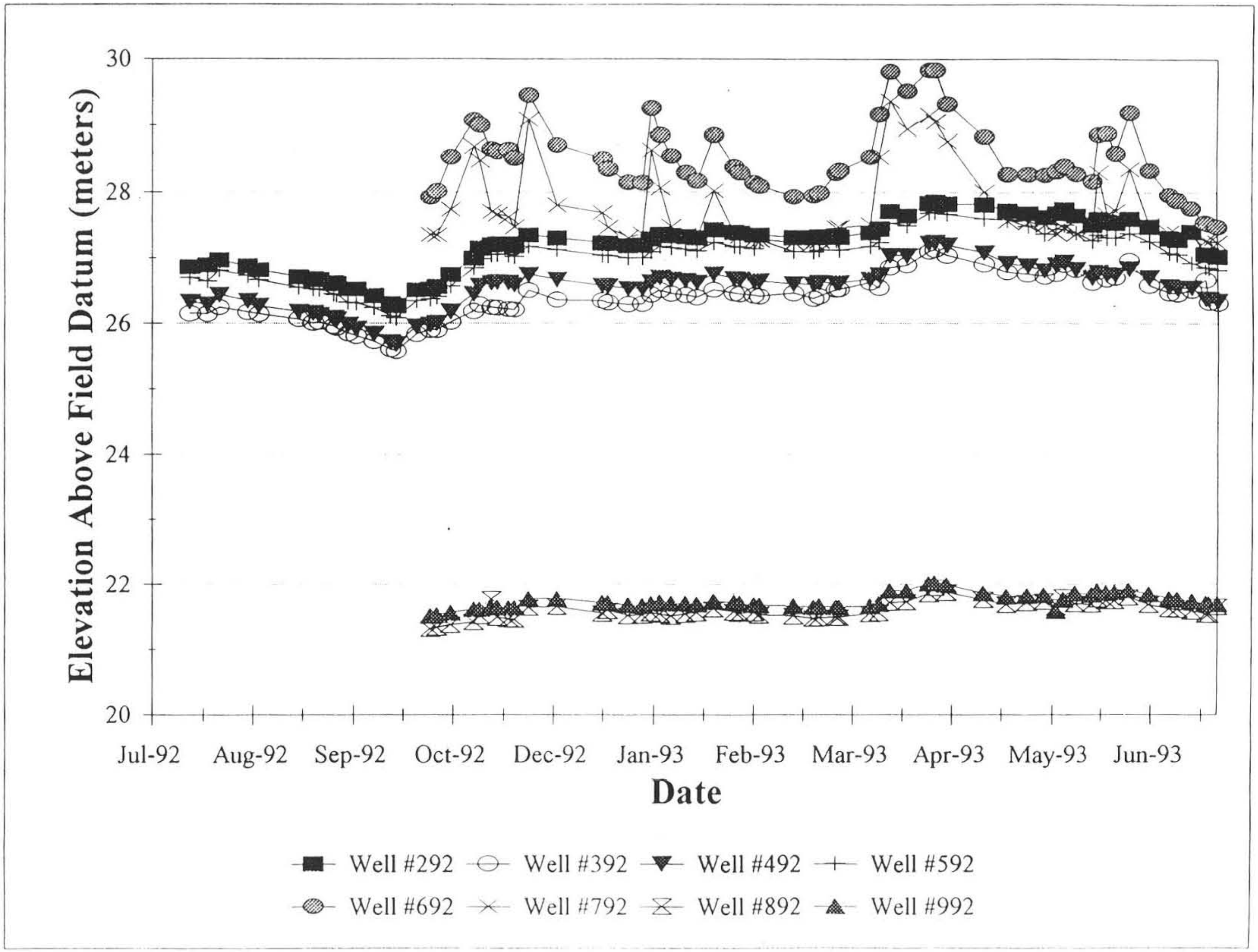

Figure 8. Hydrographs for monitoring wells near the Skeleton Dam.

(Gooley, 1980), presumably named for the deep gorge cut into a prominent sandstone riser at its northwestern edge.

The water level of Chasm Lake dropped more than 2 meters below the spillway of the Skeleton Dam during the summers of 1991 and 1992. What little surface flow reached the basin during the summer months was lost by evaporation and ground-water seepage from the basin. Water level measurements from nearby observation wells since late July, 1992 indicate that steep, eastwardly directed hydraulic gradients exist at the southeastern flank of Chasm Lake, providing support for the hypothesis that some water is being lost from the reservoir by groundwater seepage.

Return to vehicles after the discussion at this stop and follow the rod log in reverse order to the gate at the entrance of the W.H. Miner Institute Property on Barnaby Road.

21.7	1.8	Miner Institute gate on Barnaby Road. Proceed south on Barnaby Road to the West Church Street intersection.
23.7	2.0	Intersection of Barnaby Road and West Church Street. Proceed west on West Church Street.
23.8	0.1	West Church Street forks, bear left (southwest) onto Recore Road.
26.0	2.2	Intersection of Recore Road and Old Military Turnpike. Turn right onto Old Military Turnpike and proceed northwestward toward Ellenburg.
37.1	11.1	Blinking light at the Intersection of Old Military Turnpike and Plank Road. Turn right onto Plank Road and proceed northward.
37.8	0.7	STOP 5.

STOP 5. THE ELLENBURG MORAINE.

The gravel pit at this stop is excavated into the eastern (ice-proximal) side of the moraine. The pit contains approximately 10 to 12 meters of interbedded sand, gravel and diamicton that overlies Potsdam Sandstone. Bedset thickness generally ranges from about a decimeter to just over a meter. The maximum elevation of the upper surface of the moraine at this location ranges between 290 and 297 meters a.s.l..

Return to vehicles after the discussion at this stop and continue northward on Plank Road.

38.8	1.0	Intersection of Plank Road and U.S. Route 11. Turn left onto Route 11 and proceed westward to Ellenburg Depot.
39.2	0.4	Turn left and proceed southward on lake road.

39.7	0.5	STOP 5a.

STOP 5a. THE ELLENBURG MORAINE.

The exposure at this location is on the west (ice-distal) side of the moraine. The exposure contains approximately 10 to 12 meters of interbedded fine to medium sand with minor gravel and silt interbeds. Bedsets range from a centimeter to a few decimeters thick and are commonly horizontally laminated or ripple-cross laminated. Thin silt or silty fine sand deposits occur locally as draped laminae. Ripple azimuths and the gentle dip of the strata indicate a westerly paleocurrent. The moraine deposits were probably deposited in a proglacial lake west of the moraine in the upper North Branch valley. A small sandplain at an elevation of about 290 meters a.s.l. at Ellenburg may represent a delta that was built by the North Branch into the western end of the proglacial lake.

Return to the vehicles after the discussions at this site and return to Ellenburg Depot.

40.2	0.5	Intersection of lake road and U.S. Route 11. Turn left onto Route 11 and proceed westward to Chateaugay.
47.0	6.8	Route 11 crosses the Chazy-Chateaugay drainage divide. The most easterly of the Chateaugay Channels can be seen adjacent to and crossing the road over the next few miles.
55.2	8.2	Intersection of U.S. Route 11 and State Route 374. Turn left and proceed south on Route 374.
56.3	1.1	STOP 7. Turn right into Chateaugay Park.

STOP 7. DISCUSSION OF THE CHATEAUGAY CHANNEL SYSTEM.

Return to the vehicles after the discussions at this stop and continue southward on Route 374.

56.5	0.2	Turn right onto Pulpmill Road.
57.3	0.8	Cross the Chateaugay River and bear left along the river. The Chateaugay channels are on the right.
58.3	1.0	Turn right onto Hartnett Road and proceed west .4 miles.
62.3	4.0	STOP 8

STOP 8. CHATEAUGAY CHANNELS.

This stop is alongside one of a series of underfit stream channels referred to as the Chateaugay Channels by MacClintock and Stewart (1965). These channels are eroded in till and bedrock and trend east-west across the low relief of the south slope of the St. Lawrence Valley. The channels are present from elevations of about 400 m (1300') to 315 m (1040') and are graded to the west.

MacClintock and Stewart (1965), Denny (1974), and Clark and Street (1984) concluded that the channels were eroded along a retreating ice front and emptied into Lake Iroquois to the west. These channels do appear to be graded to the highest level of Lake Iroquois in the vicinity of Malone (Pair and Rodrigues, 1993).

Discussion at this stop will focus on the channel morphology, nature of the ice-marginal drainage, and the possible duration of the drainage events.

Return to vehicles and continue westward on Hartnett Road.

61.3	3.0	Turn right onto Montgomery Road and proceed north.
61.7	0.4	Bear left towards the village of Burke.
62.4	0.7	Village of Burke. Continue north towards Burke Center.
63.6	1.2	Turn left onto Route 11 towards Malone.
71.7	8.1	Cross the Salmon River in downtown Malone.
72.1	0.4	Follow signs to Route 11B. Turn left and proceed south.
72.3	0.2	Bear left (west) on stay on 11B.
88.7	16.4	Village of Dickinson. 11B passes through morainal topography identified as the Fort Covington Moraine by MacClintock and Stewart (1965).
91.9	3.2	Turn left onto Savage Road.
94.1	2.2	Turn right onto Ploof Road.
95.7	1.6	STOP 9

STOP 9. THE ST. REGIS ESKER- FAN COMPLEX AND NICHOLVILLE CHANNELS.

This stop will illustrate the sequence of deglacial landforms characteristic of ice margins in this part of the St. Lawrence Lowland. Moraines and an esker-fan complex in the St. Regis River valley indicate that a lobate ice margin extended southward and ended in a local proglacial lake. The esker ridge attached to the subaqueous fan complex is 80 to 90 feet high and extends northward 2 miles. Esker-fan complexes are present in many of the north-south valleys along the northwestern flank of the Adirondacks. Moraines in the region were attributed by MacClintock and Stewart (1965) to their Fort Covington readvance. They suggested that this ice advance was equivalent to the Port Huron stade. Our studies suggest that the ice margin here is probably recessional in nature and post-dates the Port Huron stade.

Continued ice retreat along the Adirondack flank uncovered the north end of the St. Regis River valley and the water level of the local proglacial lake dropped. Northwest of St. Regis Falls at Nicholville, the ice margin was still grounded and a series of progressively lower ice-marginal channels (from 1050-950') carried drainage westward and emptied into Lake Iroquois. We are standing in the bottom of one of these channels. Subsequently, a northward-flowing stream constructed the Iroquois delta at Nicholville.

Discussion at this stop will center around the time-transgressive nature of ice retreat, the proglacial water bodies in this region, and the morphology of the characteristic landforms. Return to vehicles and continue west on Ploof Road.

95.8	0.1	Turn left (south) onto Fisk Road.
96.0	0.2	Turn left onto Port Kent Road and proceed across the sand plain of the Iroquois delta towards Nicholville.
96.2	0.2	Turn left back onto 11B and proceed west towards Potsdam.
112.8	16.6	Potsdam. Follow signs through town for Route 11.
121.8	9.0	Outskirts of Canton. Best Western/University Inn on left.
122.3	0.5	Romoda Drive entrance to St. Lawrence University.

END OF ROAD LOG

A4