Late Pleistocene History of South-Central Onondaga County

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INTRODUCTION

Central New York State offers much for the glacial geomorphologist including examples of both erosional and depositional features associated with the continental ice sheet. Within south-central Onondaga County many of these morphological as well as associated stratigraphic units can be seen. Some pose intriguing problems relating to the chronology of events leading to their birth and subsequent survival. The scope of previous work ranges from broad regional approaches to localized detailed analyses and has been reported in numerous publications and theses (e.g., Blagbrough, 1961; Brainerd, 1922; Durham, 1958; Fairchild, 1899a, 1899b, 1905, 1907, 1909, 1932; Grasso, 1970; Kirkland, 1970; Krall, 1966; Muller, 1964; von Engeln, 1921, 1961). The purpose of this report is to furnish the reader with a short and generalized account of late Pleistocene history of southern Onondaga County. This is supplemented with Figure 1, which depicts approximate terminal zones associated with post-Olean glacial advances.

REGIONAL SETTING

The area is underlain by lower Devonian sediments comprised primarily of shales. These strata, which dip gently to the south, create east-west-trending cuesta-form morphology. Examination of the present topography suggests a pre-glacial drainage system. The dendritic nature of the over-deepened valleys implies ancestral dip slope control with obsequent streams originating at the margin of the escarpment and flowing into the Ontario Basin. It is believed generally that the steeper gradient provided by this latter orientation created excessive headward erosion and subsequent capture of the resequent streams. The barbed juncture between Cedarvale and Onondaga Valleys tends to support this hypothesis. It is however difficult to believe that the secondary drainage patterns represent a preglacial influence. Even though several streams, such as the one at Vesper, join the major valleys acutely, their headwaters and initial courses parallel the ice flow in the area. Much debate has taken place as to the effect of the numerous glacial advances upon the preexisting drainage pattern. Durham (1954) believed that three preglacial erosion surfaces can be ascertained, whereas Clayton (1965) stated that the existing topography is "independent" of the preglacial drainage pattern. Most investigators have chosen to compromise and follow the theory of polycyclic origin as proposed by Coates (1966).

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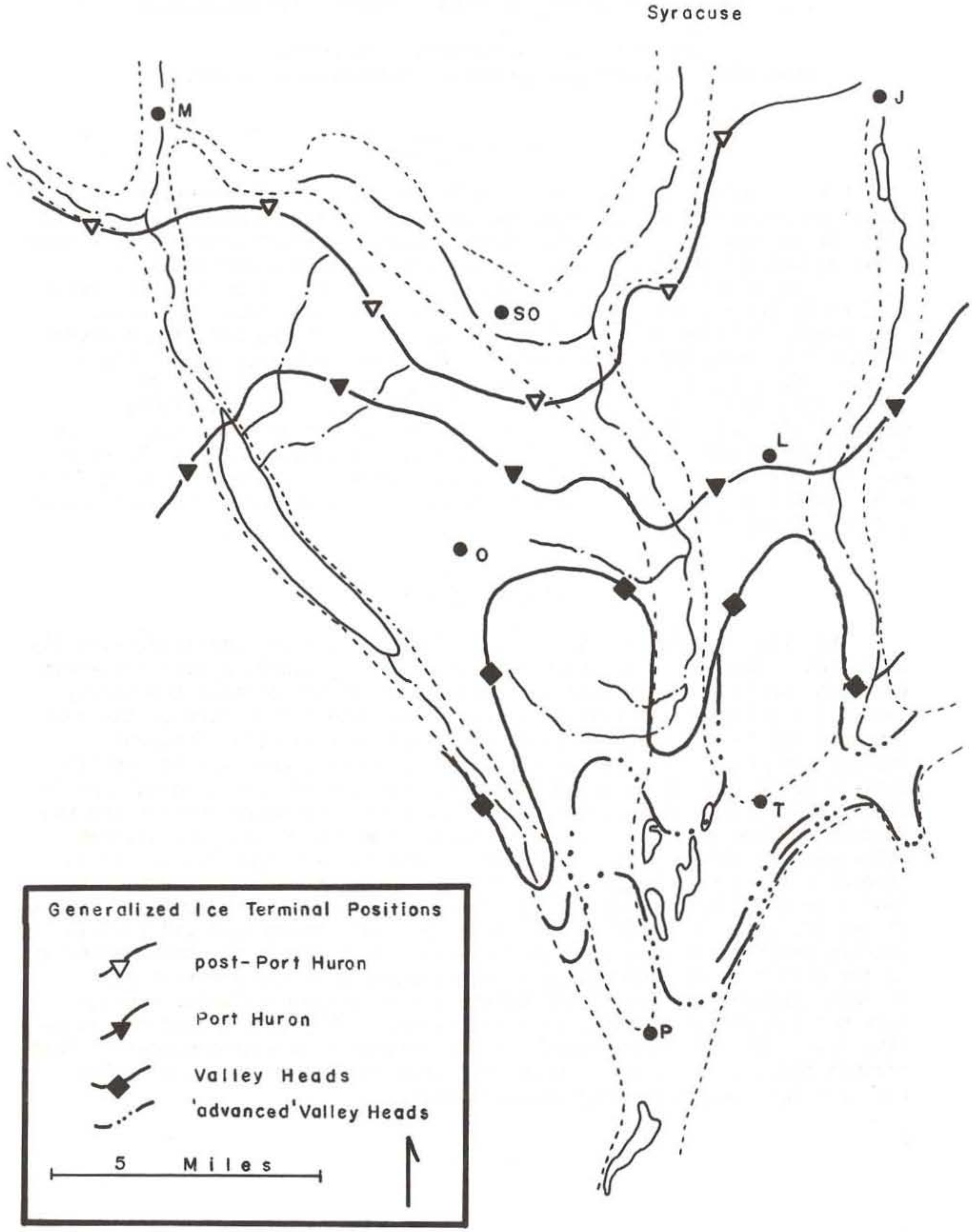

Figure 1. Generalized ice terminal positions.

WISCONSINAN GLACIATION

Much controversy has taken place about the subdivision of Wisconsinan drift in central New York State (e.g., MacClintock and Apfel, 1944; Muller, 1965). However, the classification suggested by Moss and Ritter (1962) is agreed on generally at this time. They proposed an Olean Substage followed by a Valley Heads substage, based upon both morphology and textural studies. No known occurrence of the former drift has been reported in Onondaga County, north of Tully.

Although it is agreed generally that there was a reorientation of ice flow from south-southwest (Olean) to southeast (Valley Heads) (Connally, 1960; Holmes, 1939; Kirkland, 1968), the amount of recession as well as subsequent readvance between these substages is in question. Kirkland (1968) suggested that Valley Heads glaciation represented a relatively limited retreat and rejuvination due to a westerly shift in source area.

For many years the drift barrier located at Tully was considered the terminus for the Valley Heads glaciation. This primarily was based on morphology as well as the fact that it formed the drainage divide between the St. Lawrence and the Susquehanna Rivers (von Engeln, 1921). This type of drift barrier occurs in all through valleys of the region. The upland counterparts of these positions, however, are difficult to trace and in many localities are nonexistent. Kirkland (1970) suggested that Valley Heads ice never covered the uplands surrounding the town of Vesper. Muller (1966) referred to an "advanced" Valley Heads position. This was based upon the location of lateral moraines in addition to well-developed kettle lakes within the outwash plain. These latter features (such as the Tully Lakes) not only suggest a retreat from an "advanced" position but also show close association with the previously mentioned drift barrier. If these features were not contemporaneous with the "Tully Moraine," they would have been filled by outwash and lost their well-defined morphologies. Durham (1954) demonstrated that the "valley stopper" is bedrock controlled with a relatively sharp drop of 800 ft in the bedrock floor near Route NY80. This feature easily could account for a relatively rapid retreat from the "advanced" position and the major standstill at the drift barrier.

With the recession of the ice sheet from the Valley Heads Moraine, the meltwater was unable to escape laterally due to the topographic controls created by the valley walls. Northward escape was blocked by the ice barrier. Thus the elevation of the imponded waters was regulated initially by the height of the moraines.

As the glacial margin retreated, cols of lower elevation were uncovered by the ice, allowing the isolated valley lakes to merge. Many of these marginal meltwater channels, some of which may have been initiated subglacially (Sissons, 1960) were reexcavated. This form of multicyclic usage has been demonstrated by previous workers (Hand and Muller, 1972). The original birth of these cross channels is unknown. For a more detailed description of the channels south of Syracuse, the reader is referred to Hand (1978, pers. comm.).

The ice withdrew to a position north of Cedarvale Valley. During this time the proglacial lakes became the site for deposition of an ubiquitous varved red clay and gray silt. Whether free drainage was initiated at this point is speculative. Krall (1966) suggested this was possible based upon work done in the Camillus Channel. It is known that Smoky Hollow was open because the laminated lake sediments are encountered within the channel.

The ice sheet then readvanced (tentatively correlated to Port Huron) to a position approximately 4 mi south of Cedarvale. This location is based primarily upon exposures of contorted varved red clay and gray silt overlain by lodgment till near Marietta and Cardiff. In addition to this, two subsurface exploration programs undertaken for the dam at Otisco Lake revealed soil profiles suggesting a morainal position. It is believed that both the activity of the ice sheet and its length of time at this position were less than for the western New York counterpart. This is based on the lack of constructional topography and may reflect the effect of distance from the source area or its location in regards to maximum ice flow. Associated with this advance was the formation of the upper levels of the Amber Delta.

Northward retreat of the ice to some unknown position north of the plateau created a second succession of valley occupied lakes. Cross channels were reexcavated and eventual free-eastward drainage along the front of the escarpment took place.

The final glaciation of the area, (here referred to simply as "post-Port Huron") occurred when the ice advanced to a position along the southern edge of Cedarvale Valley. With the exception of a large drift barrier south of Marcellus, the terminal position is marked only by small discontinuous moraines. The valley plug south of Marcellus has been correlated to the Skaneateles-Auburn-Waterloo morainal belt by many previous investigators. This advance initiated Lake Warren II at an approximate elevation of 970 ft. It was in this lake that the lower levels of Amber Delta were formed, being supplied by the rejuvenated Joshua and Navarino Channels.

With the final recession of the ice came the third succession of descending lakes. These have been documented by several writers including Blagbrough (1951), Hand and Muller (1972), and Krall (1966). Previous investigators (Fairchild, 1899; Grasso, 1970; Thrivikramaji, 1976) attempted to correlate the "delta" remnants in Cedarvale and Onondaga Valleys with the descending lake levels and corresponding channel thresholds. Krall (1966) suggested that these deposits reflect ascending lake levels. However, present investigations revealed several anomalous features such as kamic topography, variations in texture and lithology, as well as forset beds dipping in opposing directions. These factors suggest a more complex origin than previously thought. An adequate model of this phase of deglaciation is unknown and should be the focus of future work.

Nearly fifty years ago, H.L. Fairchild, after proposing his model, reflected upon the complexity of this region in the following manner:

"In the translation of the commingled glacial records in the Syracuse-Oneida district, the Syracuse geologists have an exceedingly difficult, yet exciting task."

H.L. Fairchild, 1932; p. 654.

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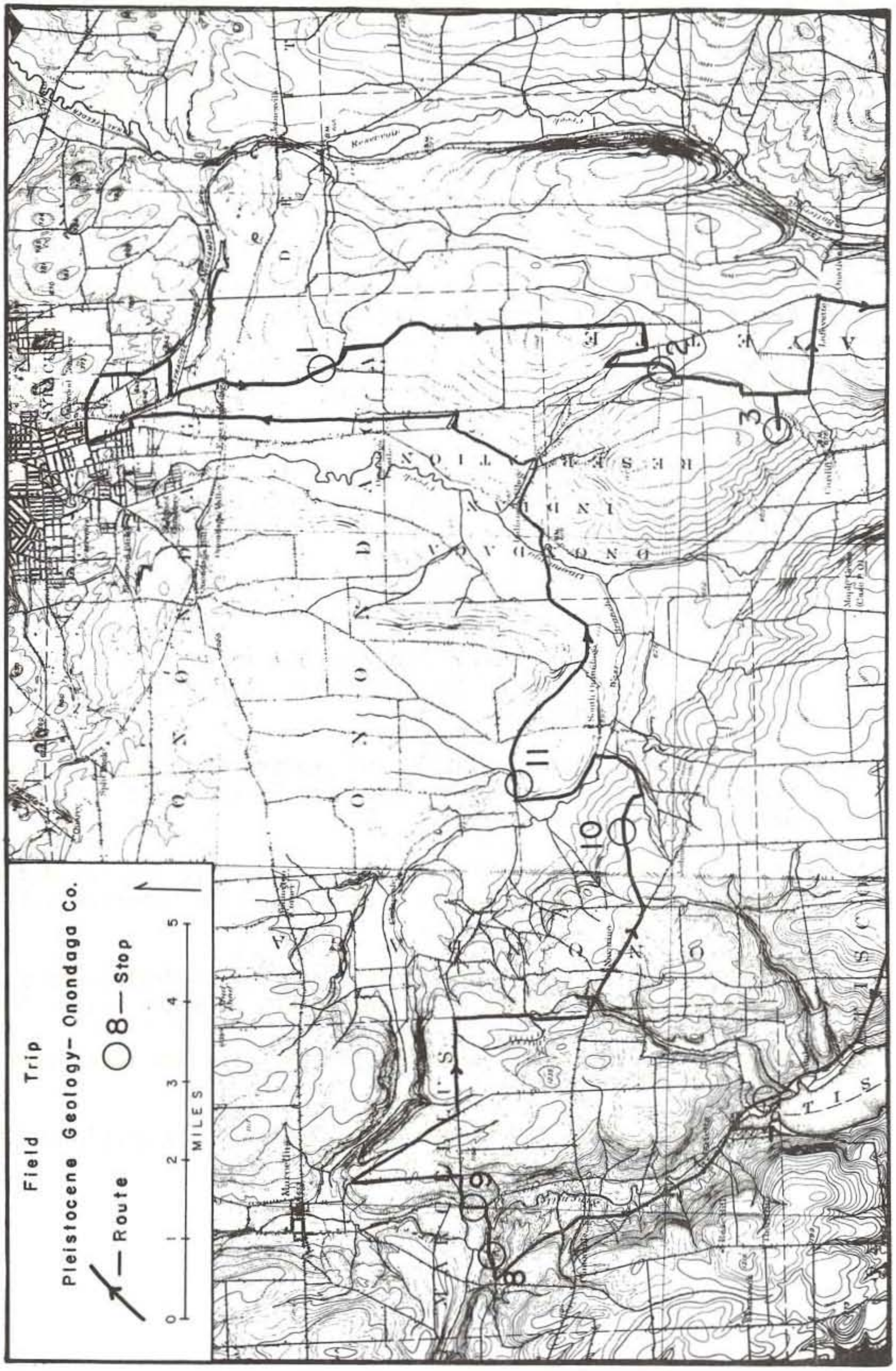
Field Trip
Pleistocene Geology- Onondaga Co.
Route
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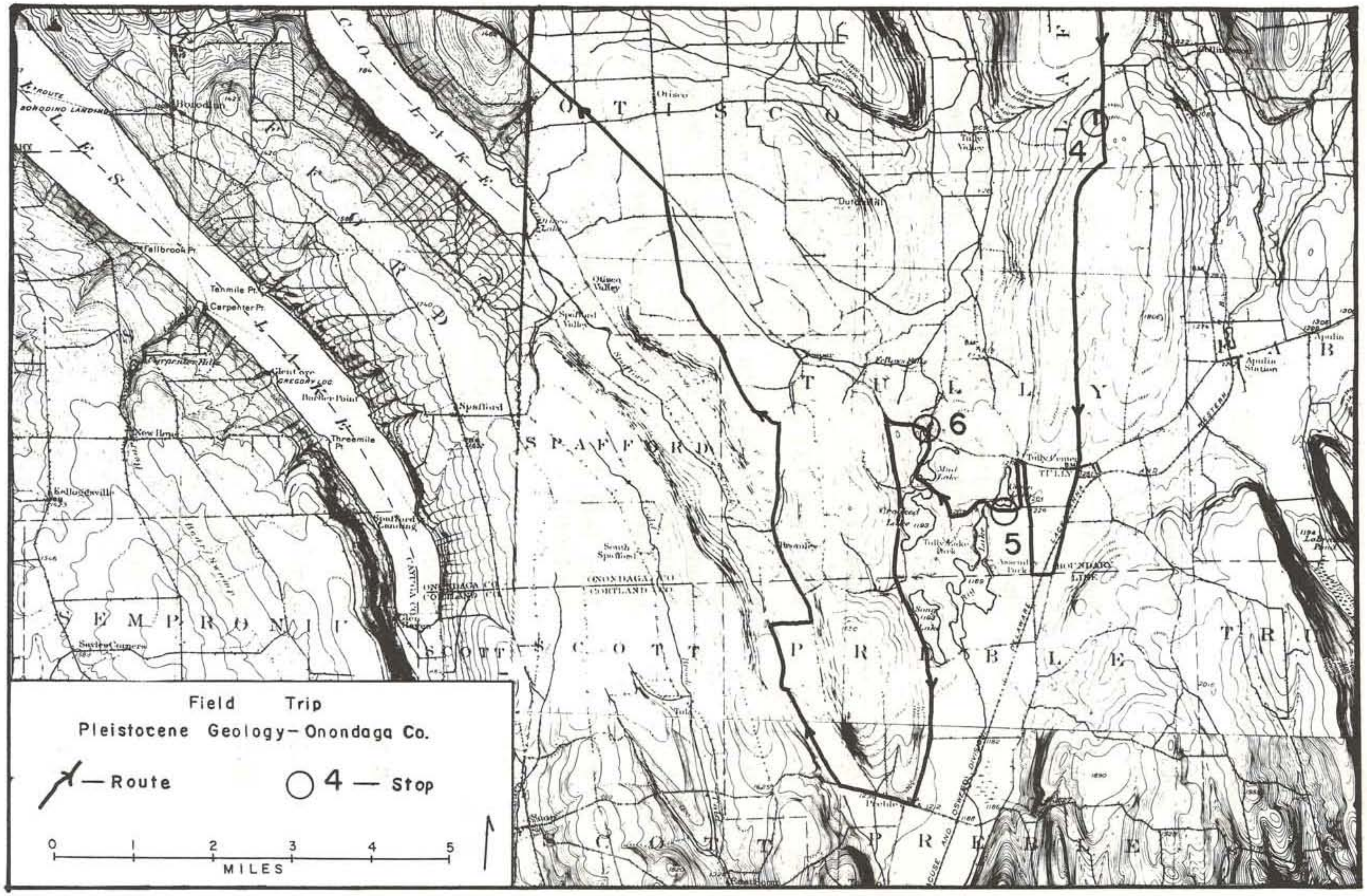
MILES



Proposed Route and Referenced Stops for Field Trip

ROAD LOG: PLEISTOCENE GEOLOGY OF SOUTH-CENTRAL ONONDAGA CO.

Total Miles	Miles from last point	Route Description
0.0	0.0	Assembly Point: Parking lot - Manley Field House, Syracuse University
		Departure Time: 8:00 A.M. Sharp! Travel by bus!
		Note: This log is a comprehensive view of the region. Therefore the percentage of material covered will differ depending upon mode of travel, number of people, interest, and weather.
0.0	0.4	Turn left (S) onto Comstock Ave.
0.9	1.3	Stay left (S) onto Jamesville Ave.
1.3	0.4	Turn right (W) onto Ainsley Drive - look southeast and observe a steepwalled, flatbottomed channel. This is Rock Cut, one of several major meltwater channels which controlled the eastward escape of imponded glacial waters.
1.7	0.4	Turn left (S) onto Brighton Ave. at 't' intersection.
1.8	0.1	Corner of Rock Cut Rd. & Brighton Ave. To the left (E) is the channel - elev. 550 ft. To the right (W) is Onondaga Trough, elev. of valley floor is approximately 415 ft.
2.1	0.3	Outcropping of Elmwood Formation; a portion of the scarp developed on Manlius Group.
2.4	0.3	Cross Rt. NY173, continue on LaFayette Rd.
3.3	0.9	On right (W) SUNY - College of Environmental Science & Forestry - Experimental Station. On left (E) LaFayette Golf Course located at base of drumlinoid composed of bedrock with thin veneer of lodgment till. This is typical of upland streamlined features of this region.
3.7	0.4	STOP 1: ENTRANCE - SMOKY HOLLOW MELTWATER CHANNEL

Total Miles	Miles from last point	Route Description
		Discussion of character of channel and relationship to Onondaga Trough History, including preview of broad deltas visible in valley to southwest.
4.3	0.6	Turn right (S) on Dave Tilden Rd. Cross ancillary channel developed during initial stages of Smokey Hollow. Elevation of bedrock at junction of this channel and Smokey Hollow is approximately 780 (a depth of 50 ft)
4.8	0.5	Turn left (SE) on Sentinel Hieghts Rd. Borings at this intersection encountered 24 ft of sand and gravel overlying 17 ft of till. No bedrock was encountered.
5.0	0.2	Note the water tanks positioned on subdued kamic topography; adjacent uplands to south are bedrock controlled.
8.1	3.1	Turn right (W) at base of steep hill on unnamed road. LaFayette Senior High School on left (S).
8.4	0.3	Turn right (N) on Route US11.
8.8	0.4	Turn left (SW) on Webb Rd.
9.4	0.6	Cross under Route I81; note coarseness of till. Road on right leads to LaFayette Landfill approximately 1/2 mi to north. It is located in deltaic sediments deposited in a lowering proglacial lake (elevation 1040±)
9.6	0.2	STOP 2: STREAM CUT - KENNEDY CREEK
		On right (W), across stream is bouldery till overlying light brown sands. Beneath this is a red-gray silty clay.
9.8	0.2	Close-up of bouldery till in roadcut.
10.6	0.8	Take right (W) at 't' intersection.
10.8	0.2	Enter small meltwater channel.
11.0	0.2	Take right (W) on Amdon Rd.
11.2	0.3	Reenter meltwater channel.
11.5	0.3	STOP 3: OVERVIEW OF TULLY MORAINE

Total Miles	Miles from last point	Route Description
		Discussion of its development as well as other prominent glacial features.
		Turn Around
12.0	0.5	Turn right (S) on Webb Rd.
12.5	0.5	Turn left (E) on Route US20.
13.4	0.9	Cross Route I81.
13.6	0.2	Turn right (S) on Route US11.
14.3	0.7	Note cemetary on right (W) and gravel pit on left (E). These are located on a zone of drift tentatively correlated to the Port Huron advance.
15.3	10.	Stay left onto Tully Rd.
15.7	0.4	Turn right (W) on Maple Grove
15.9	0.2	Turn left at 't' intersection and proceed to end of road.
		STOP 4: OVERVIEW OF RATTLESNAKE GULF
		Discussion of its development and its relationship to the deglaciation of Tully Valley.
		Turn around, return to Tully Rd. and take a right (S).
16.5	0.6	Start of constructional topography of Valley Heads Moraine (proximal end)
18.5	2.0	Leave morainal topography and reenter streamline topography.
20.5	2.0	Stoplight in village of Tully; continue south along Route US11. This gradually sloping surface to the south is the outwash plain formed by Valley Heads Ice.
21.1	0.6	Cross railroad tracks. The rolling hills on left (E) are lateral moraines associated with the "advanced" Valley Heads Ice. The tree line emphasizes the break between the moraine and the bedrock escarpment.

Total Miles	Miles from last point	Route Description
21.9	0.8	Turn right on Marybelle Rd.
22.1	0.2	Turn right (N) on Route NY281. Note the gradual change into a zone of pitted outwash.
23.5	1.4	Turn left (W) at light onto Route NY80.
23.6	0.1	Turn left (S) and proceed parallel to Route I81.
24.4	0.8	STOP 5: GRAVEL PIT SOUTH OF GREEN LAKE Examination of features and materials of pitted outwash plain.
25.2	0.8	Turn right (N) on Gatehouse Rd.
25.8	0.6	Stay right (N) on Gatehouse Rd. Note the procession from outwash to pitted outwash to kame and kettle topography as the "moraine" is approached.
26.6	0.8	Cross Route NY80.
26.7	0.1	STOP 6: ALLIED CHEMICAL CORPORATION GRAVEL PITS Discussion as to mode of origin of the "moraine". Continue west on Route NY80.
27.3	0.6	Turn left (S) on Song Mountain Rd. Note bedrock outcrop on right side of road and deep valley fill on left.
27.7	0.4	On left (E) kame field grades into kame terrace. This is believed to reflect one of the positions for the "advanced" Valley Heads Ice.
28.4	0.7	On right (W), small remnants of lateral moraine.
29.4	1.0	Cross Lake Rd. Lateral moraine is on right and continues down valley. A portion of it has been cut for a parking lot for Song Mountain Ski Resort. Farther south the moraine becomes partially buried by colluvium.
31.3	1.9	Last vestige of lateral moraine as it dips

Total Miles	Miles from last point	Route Description
		under road and into outwash.
31.5	0.2	Cross Currie Rd. Note that slope changes from dipping south to north. This represents the distal edge of a fan built from Otisco Valley and lies above the Tully Valley outwash.
31.9	0.4	Leave Song Lake Rd. and proceed south on Route NY281.
32.3	0.4	Preble - turn right (W) on Preble Rd. On left is von Engeln's (1961) classic example of a truncated spur.
32.8	0.5	Stay left at 'y' intersection. Descent from the terrace cut into outwash gravels. These were deposited by meltwaters from Valley Heads Ice in Otisco Valley.
33.3	0.5	Turn right (N) on W. Bennett Hollow Rd.
34.1	0.8	Note: Scarp of outflow channel on right (E); on left (W) two borrow pits which are remnants of the dissected plain. Above these are vestiges of a lateral moraine deposited during "advanced" stage.
34.7	0.6	Stay left at 'y' intersection.
34.8	0.1	Stay right at 'y' intersection.
35.6	0.8	Turn right (E) on Williams Rd.
36.0	0.4	To south is a partial ridge across the valley. It merges with the "advanced" stage lateral moraine on east wall and can be traced northward past Gulf Rd.
36.1	0.1	Turn left (N) on Otosco Valley Rd.
36.8	0.7	On right is a second "advanced" lateral moraine.
37.1	0.3	Turn right (N) on Strong Rd. This is the proximal edge of the Valley Heads "moraine". On the west wall, remnants of a nearly horizontal lateral moraine can be seen. The valley drops over 500 ft to Otisco Lake. Strong Rd. follows the moraine onto the uplands.

Total Miles	Miles from last point	Route Description
38.3	1.2	Turn left (N) on Loomis Hill Rd.
41.0	2.7	Cross high-level meltwater channel which carried water into Otisco Valley.
41.5	0.5	Turn left (NW) on Oak Hill Rd.
42.7	0.2	Cross Otisco Rd.
45.3	2.6	Cross Patterson Rd.
46.1	0.8	Turn right (N) on Otisco Valley Rd.
47.7	1.6	STOP 7: AMBER DELTA
		Discussion of its character and mode of origin.
48.5	0.8	Stay right on Route NY174. The hummocky terrain is a result of a complex relationship between kames, delta and eroded lake clays. Borings taken at the dam suggest a terminal ice position. This is correlated tentatively with the Port Huron advance.
50.5	2.0	Cross Route US20. The red clays exposed in the slump occur throughout this portion of the valley and create many slope stability problems.
		Continue along road and observe clay mounds and "moraine" to north.
51.8	1.3	Turn right (E) on Masters Rd. Observe the kamic topography and morainal features on left (N).
52.4	0.6	STOP 8: SAND PIT - MASTERS RD.
		Consideration of the nature and history of the deposit.
		Continue east along Masters Rd.
52.6	0.2	Turn left (N) on Route NY174.
52.8	0.2	STOP 9: OVERVIEW OF GUPPY GULF AND BISHOP HILL DELTA
		Further discussion of deglaciation history of the area.
52.9	0.1	Turn right (E) on Seal Rd. The road cuts

Total Miles	Miles from last point	Route Description
		through the moraine near the base of the hill and then transects a delta built into the proglacial lake imponded south of the moraine.
53.3	0.4	Turn left on Rockwell Rd. Proceeding north, three well-developed minor meltwater channels are traversed. Water flowed from east to west and deposited the above mentioned deltaic sediments.
54.6	1.3	Turn right (SE) on Slate Hill Rd.
56.1	1.5	Turn left (E) on Seal Rd. Borings and wells in this upland region generally encountered over 50 ft of till overlying a thick layer of sand and gravel.
57.4	1.3	Turn right on Town Line Rd.
58.2	0.8	Intersection with Collins Rd. Note kamic topography on side hill to southeast. This is associated with small morainal belt which is believed related to a post-Port Huron readvance. The valley in the foreground is the northern extension of the Navarino Meltwater channel which supplied sediments to Amber Delta.
		Continue south along Town Line Rd. paralleling the channel.
59.1	0.9	Turn left (E) on Route US20.
59.4	0.3	Navarino Channel.
60.7	1.3	Stay left (NE) on Bailer Rd.
61.5	0.8	On left (N) is portion of morainal belt mentioned above (mile 59.2) with small meltwater channel formed between drift and uplands.
61.9	0.4	STOP 10: OVERVIEW OF CEDARVALE DELTAS
		Discussion of large-scale morphological features and generalized history of deglaciation.
62.5	0.6	Turn left on Hogsback Rd.
62.8	0.3	On left is cobble-boulder delta remnant at elevation 640 ft.

Total Miles	Miles from last point	Route Description
63.0	0.2	Turn left (N) on Red Mill Rd.
63.3	0.3	Turn left (NW) on Cedarvale Rd. The scarp to the right is a result of erosion through the deltaic deposits and into the till.
64.6	1.3	Turn right (E) on Tanner Rd.
64.9	0.3	STOP 11: D.W. WINKLEMAN PIT
		Examination of a nearly complete late Pleistocene stratigraphic section and discussion about mode of origin for the deltas.
66.8	1.9	Contorted varved red silts and clays exposed in stream bank to left (N).
67.0	0.2	Stay left on Route NY80. Road continues along 600 ft terrace.
68.1	1.1	Turn right (E) on Indian Village Rd.
69.0	0.9	Turn left (N) on Route US11.
69.2	0.4	Turn right (E) on Websters Rd.
69.6	0.4	Stay left. Note Onondaga Limestone outcropping. This forms a ledge along the east wall of the valley.
69.8	0.2	Stay left on Quarry Road.
70.4	0.6	On left (W) is large sand and gravel pit excavated into kame terraces. To the right (E) is a thin veneer of sand and gravel over the limestone ledge.
71.1	0.7	Turn right (S) on Route US11.
71.2	0.1	Turn left (N) on Route I81.
73.6	2.4	Note broad bedrock flexures related to the stresses imposed during the Appalachian Orogeny (Chute, 1964).
75.1	1.5	Exit on Brighton Ave., left at stop sign and turn right (N) at second stop light (Route US11).
76.0	0.9	Parking Lot Manley Field House.