TRANSITIONAL SEDIMENTARY FACIES OF THE CATSKILL DELTAIC SYSTEM IN EASTERN NEW YORK STATE

by

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INTRODUCTION

One of the greatest thicknesses of Devonian rocks on the North American continent is at the northeastern end of the Allegheny Synclinorium in east-central Pennsylvania and southeastern New York. The sequence crops out along a north-facing escarpment extending from Lake Erie to the Catskill Mountains, a distance of some 300 miles. The escarpment continues south along the west side of the Hudson Valley into the Valley and Ridge physiographic province of the Appalachian highlands. The New York sequence is accepted as the standard for the Devonian System of North America. In the Catskills, although the top has been eroded, the Devonian is some 10,000 feet thick. It thins to about 2500 feet at the western edge of New York State and also thins toward the southwest. In northeastern New York Devonian rocks have been removed by erosion. In New York State the Devonian sequence was only slightly affected by the Appalachian Revolution; it was deformed into gently undulant folds. More intense tectonic forces to the southwest in Pennsylvania folded the same strata into elongate, plunging anticlines and synclines.

The upper Middle Devonian and Upper Devonian of eastern New York and Pennsylvania consist of a thick wedge of continental rocks that have a progradational relationship to marine formations farther west. These rocks have a deltaic character.

The deltaic wedge is composed of detritus derived from a source area east of the present-day Catskill Mountains which was being elevated by the first pulses of the Acadian Orogeny. At the base of the clastics is an interval of some 2500 feet of fossiliferous sandstones and shales (Hamilton Group) which thins toward the west and southwest. Penetrating eastward from the marine basin into the upper Hamilton clastics are two thin fossiliferous limestone beds (Centerfield and Portland Point) which were deposited during the time that the source terrain was in the beginning stages of uplift. The Tully Limestone, a transgressive carbonate tongue at the base of the Upper Devonian, represents the last significant limestone deposition in the New York Devonian prior to the overwhelming of the marine basin by clastic influx.

After deposition of the Tully, uplift apparently accelerated and continued on a large scale into the Mississippian. A thick wedge of clastic continental sediment (Catskill lithofacies) was deposited at the margin of the basin. The red and green-gray sandstones, shales, and conglomerates of this wedge interfinger westward with littoral and shallow marine (Chemung lithofacies) sandstones and shales. These grade into dark-colored shales and siltstones

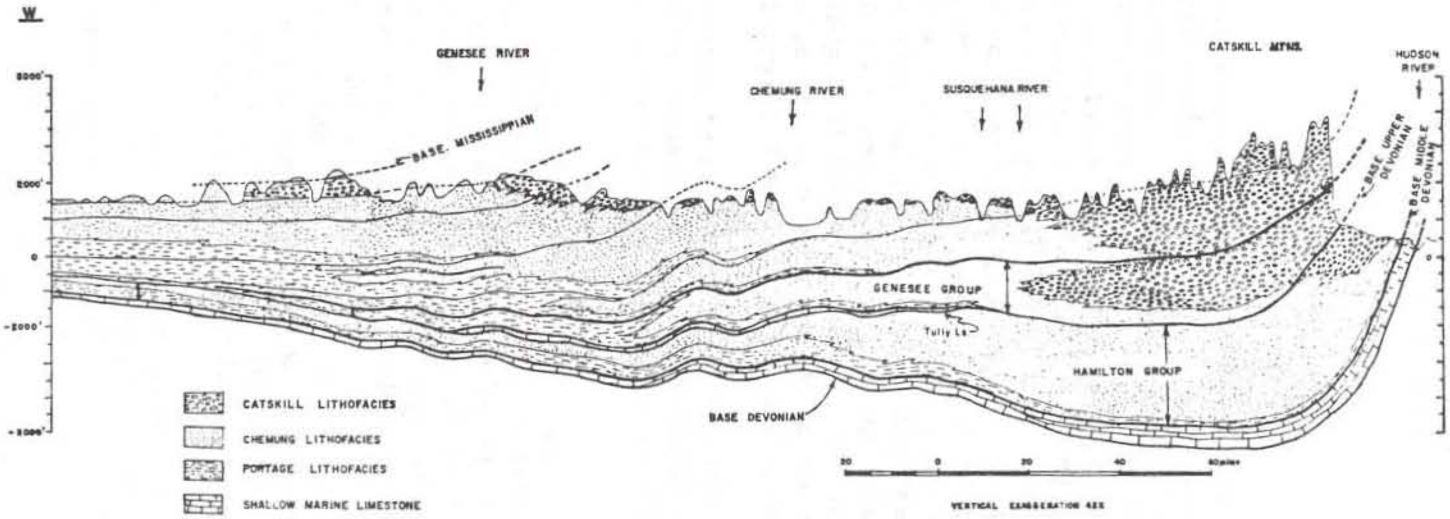

Fig. C-1. Cross-section of Devonian System Along New York - Pennsylvania Border (After Broughton, et al, 1966)

(Portage lithofacies) farther west that are of deeper marine origin. The irregular, interfingering contact between the continental beds and the marine formations rises stratigraphically towards the west and the continental beds consequently have the appearance of over-riding the marine strata. This prograding relationship, the result of displacement of the late Devonian sea by the expanding clastic wedge, is shown in the cross-section along the N. Y. - Pa. border (Fig. C-1). Dunbar and Rodgers (1957, p. 137-140) give a concise description of the New York Middle and Upper Devonian from the point of view of the facies concept. A correlation chart by Rickard (1964) shows the relationship of the depositional phases of the Devonian rocks in New York State.

Within the Tully Limestone and its eastern clastic correlatives are rocks that are representative of the spectrum of sedimentary environments that comprised the Catskill deltaic system during early Late Devonian Time. These were studied (Fig. C-2) in order to develop associations of criteria that will permit recognition of sedimentary environment elsewhere in the Catskill complex.

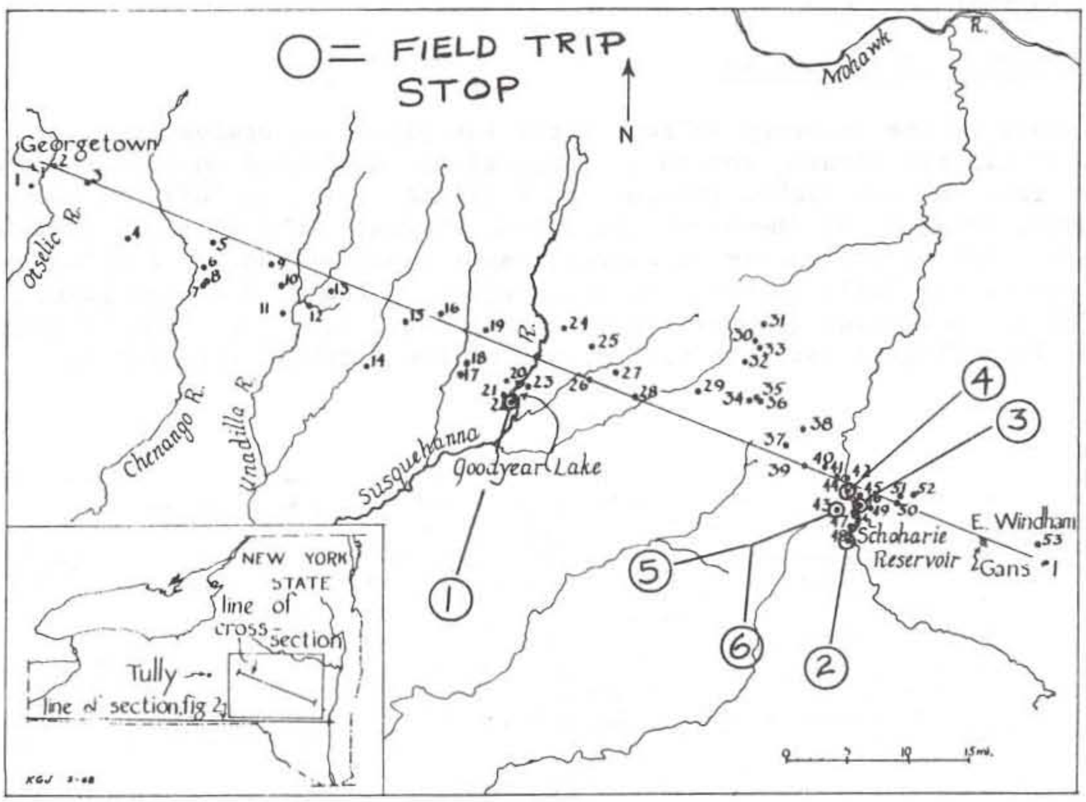

Fig. C-2. Measured Section Locations and Line of Cross-section for Figs. C-4, C-5, C-6.

GENERAL STRATIGRAPHY
TULLY LIMESTONE AND EASTERN CLASTIC CORRELATIVES

Tully Limestone

The name Tully Limestone was applied by Vanuxem (1838) to a series of beds which are well exposed in central New York in the vicinity of the village of Tully. The Tully, composed mostly of gray calcilutite with subordinate bio-calcarenite, constitutes an excellent stratigraphic marker which varies in thickness from 3 to 48 feet in central New York.

The Tully is subdivided, from the oldest to youngest, into the Tinkers Falls, Apulia, and West Brook members (Cooper and Williams, 1935). The guide fossil Hypothyridina venustula characterizes the Apulia Member and the fimbriata biozone is included in the West Brook Member. Both of these zones, which extend into the western part of the Tully clastic correlatives, provide stratigraphic control which was essential for study of the pattern of depositional facies. As defined by Trainer (1932, p. 8), the Tully includes all beds between the Geneseo Shale and the uppermost shale in the Moscow Formation. The Tully interval thickens eastward but the limestone beds become thinner, and east of the Chenango Valley are replaced by terrigenous rocks (New Lisbon and Laurens) (Fig. C-3).

Tully Eastern Correlatives

East of the Chenango Valley, where the limestone grades into very fine-grained clastic strata, the Tully interval is subdivided on a biostratigraphic basis into the New Lisbon (Cooper and Williams, 1935, p. 809) and Laurens (Cooper, 1934, p. 5) "Members" (Fig. C-3). Farther east in the clastic wedge, suitable biologic elements for stratigraphic subdivision are lacking, and that portion of the Tully interval in this region is included in the lower part of the Gilboa Formation (Cooper and Williams, 1935, p. 818). The Gilboa Formation interfingers eastward with strata of the Catskill lithofacies.

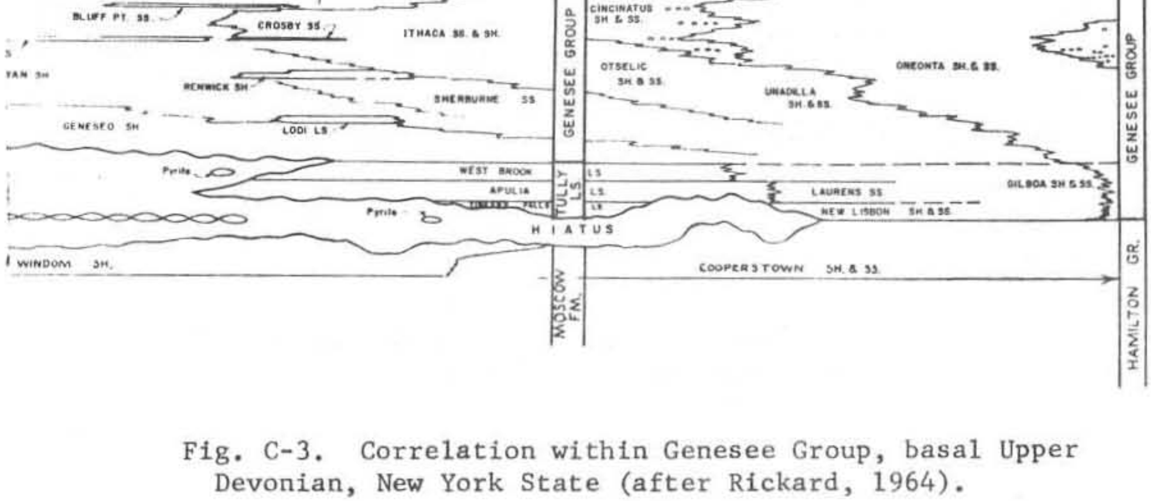

Fig. C-3. Correlation within Genesee Group, basal Upper Devonian, New York State (after Rickard, 1964).

LITHOSOMES
TULLY AND ASSOCIATED STRATA

The Tully Limestone and associated starta are subdivided into four lithosomes (Fig. C-4). Lithosome A is the thinned eastward extension into the study area of the Tully Limestone. The unit consists of argillaceous calcilutite and sandy biocalcarenite. Lithosome B, which lies directly above Lithosome A and is co-extensive with the tongue shaped eastern extension of the Geneseo Shale, consists of very dark fissile shale grading eastward into shaly siltstone. Lithosome C forms a massive clastic wedge which in cross-sectional view envelops Lithosomes A and B. It is comprised of interlensing gray siltstone and slightly lighter gray, very fine-grained sandstone which contains flow-rolls, trace fossils, coquinite lenses and, at the eastern margin of the lithosome, fossil seed-ferns. Lithosome D consists of red and green siltstone and mudstone with interbeds of gray, fine to medium-grained, texturally very immature sandstone.

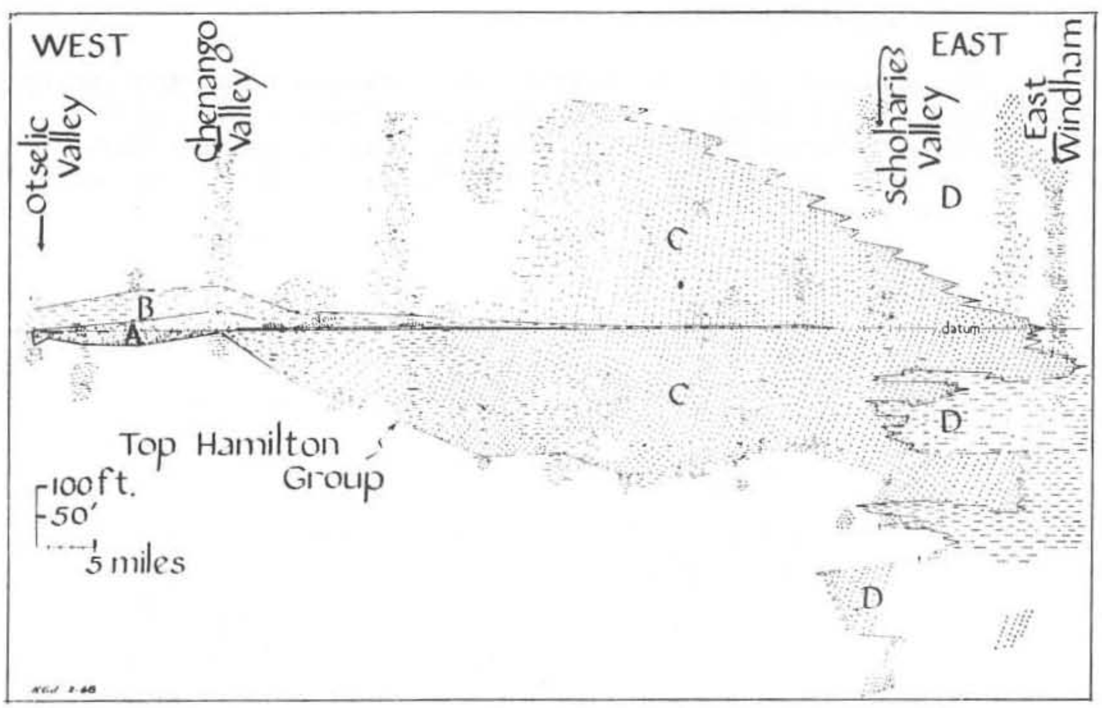

Fig. C-4. Cross-section, Lithosomes in Tully Clastic Correlatives

SEDIMENTARY FACIES OF TULLY INTERVAL

The environmental spectrum of the Tully interval includes alluvial plain, tidal and sub-tidal facies each of which can be further subdivided on the basis of multiple recognition criteria such as sedimentary structures, lithology, geometric relationships of rock units and character of biologic content. Rocks of alluvial derivation are well exposed in the eastern part of the study area. Sandstone bodies of alluvial channel origin truncate underlying beds, contain basal shale-pebble lag-concentrates, are well cross-bedded, are texturally very immature and invariably display a "fining-upwards". The alluvial strata of overbank origin are horizontally laminated, red and green siltstones which locally include large very highly organic lenses and beds representing a marsh environment. At the distal margin of the alluvial plain, just below the Tully interval, a swamp environment is represented at the three levels of the Gilboa seedferns.

Sedimentation that resulted in strata of tidal origin within the Tully interval was of the Wadden-type. The tidal flat facies consists of gray, very finely cross-laminated muddy siltstone and very fine-grained sandstone, which contain allochthonous brachiopods and locally well-developed mud-cracks. Sedimentary structures of the tidal channel facies are essentially identical to those of the alluvial channel facies, but can be distinguished by the unique character of the basal lag-concentrate, which contains very abundant allochthonous brachiopod shells.

Within the strata of sub-tidal derivation a nearshore, predominantly sandstone, facies and an offshore, predominantly siltstone, facies are recognized. Well developed trends of change in texture, general biologic character and type and scale of sedimentary and biologic structures are present in the sub-tidal strata.

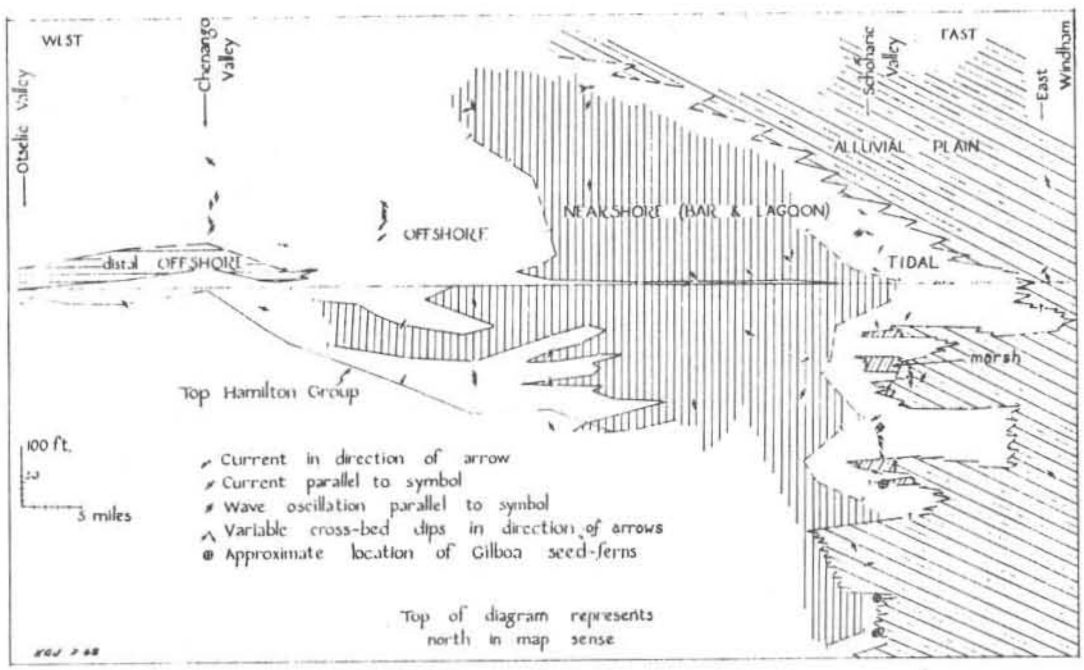

Fig. C-5. Cross-section, Sedimentary Facies in Tully Clastic Correlatives

The purpose of this trip is to study the characteristics of rocks within the Tully clastic correlatives that appear to have evolved in shallow nearshore, tidal and distal alluvial plain sedimentary environments. Those interested in the Tully Limestone are referred to a recent comprehensive report by Heckel (1966) dealing with the stratigraphy and sedimentology of the limestone facies in Central New York.

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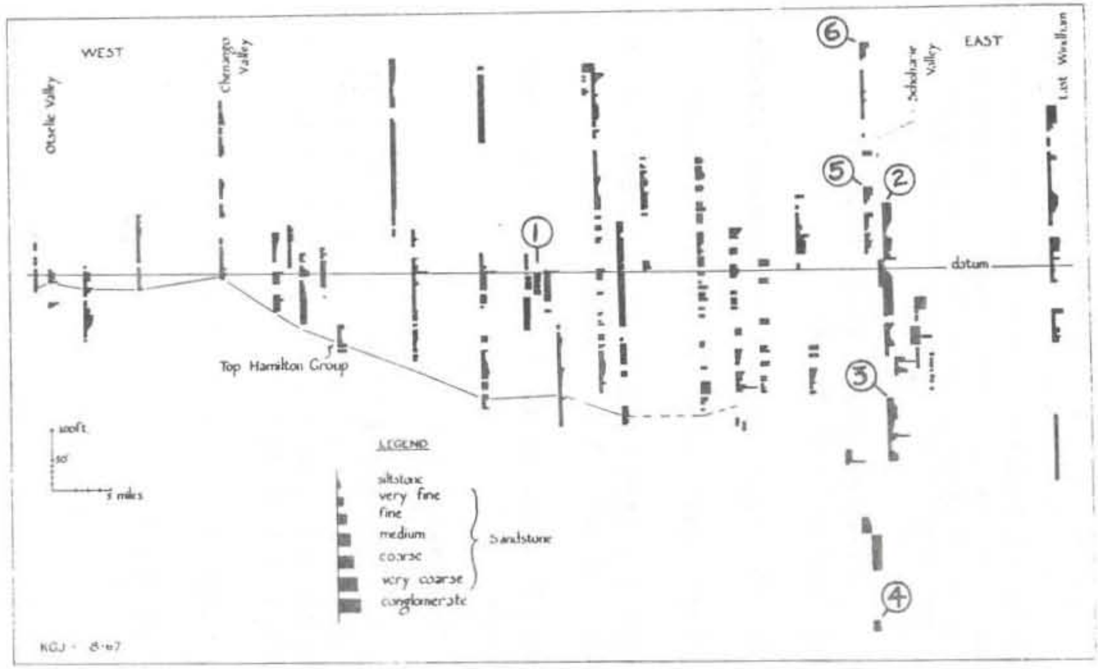

Fig. C-6. Cross-section, Tully Limestone and associated rocks, east-central New York State showing mean grain-size. Note increasing grain-size of sandstones eastward between Chenango Valley and Schoharie Valley. <u>CIRCLED NUMBERS INDICATE FIELD TRIP STOPS</u>.

TRIP C: TRANSITIONAL SEDIMENTARY FACIES OF THE CATSKILL DELTAIC SYSTEM IN EASTERN NEW YORK STATE

Kenneth G. Johnson

Total Miles	Miles from last point	Route description
		Assembly point: Parking lot, Holiday Inn, Cortland
		Departure: 8:15 A.M. Sharp!
	→	Proceed south via Interstate 81 to Route 41. Take Route 41 east through McGraw, to Route 26 in the Otselic River Valley. Turn north on Route 26 and proceed to Route 23. Turn east on Route 23. Junction of Routes 26 and 23 is considered zero point for this road log.
2.8	2.8	On right (S) swamp which forms headwaters of south flowing Genegantslet Creek.
6.5	3.7	On left (N) large outcrop of Chemung Lithofacies.
14.6	8.1	Cross Canasawacta Creek in South Plymouth
16.9	2.3	On right (S) large gravel pit in glacio-fluvial sedimentary deposit.
18.6	1.7	In Norwich cross Route 12 and continue east on Route 23.
19.2	0.6	Cross Chenango River
23.0	3.8	Road cut in Catskill Lithofacies. On left (N) excellent example of alluvial channel facies (cross-bedded, gray, graywacke) resting on over-bank facies (red shale).
27.1	4.1	Cross Route 8 and continue east on Route 23.
27.2	0.1	Cross Unadilla River
34.6	7.4	Descend river terraces.
35.2	0.6	Center of Morris. Note stone buildings constructed of Chemung lithofacies flagstone.
36.3	1.1	On left large gravel pit in glacio-fluvial deposit.
40.1	3.8	West Laurens.
45.2	5.1	West Oneonta.
46.1	0.9	Ahead on left large gravel pit in Kame deposit.

Total Miles	Miles from last point	Route description
47.6	1.5	Junction of Routes 23 and 205. Continue east on Route 23.
48.6	1.0	Oneonta. Junction Routes 23 and 7.
49.6	1.0	On left in used car lot adjacent to Nick's Diner horizontal, very thin bedded Chemung lithofacies containing abundant spiriferid brachiopods.
		Proceed through Oneonta on Route 7.
52.6	3.0	On right view of glacial deposits in mouth of Charlotte Valley.
54.5	1.9	On right across valley very large gravel pit in Kame terrace.
55.9	1.4	Junction Routes 7 and 28. Turn left (N) onto Route 28.
56.3	0.4	On right power station at Goodyear Lake Dam. On left extensive outcrop.
		STOP 1 (Indicated as Section 22 on Fig. C-2 and as (1) on Fig. C-6.) This outcrop contains as example of the flow-rolls which are locally common in Lithosome C. The flow-rolls occur as beds of internally distrubed structure underlain and overlain by horizontal, well-bedded strata. Within the flow-roll beds are nodule-shaped, concentrically laminated masses of medium gray, very fine-grained sandstone enclosed in slightly darker colored siltstone. The laminar structure is due to concentric, extremely thin, dark laminae composed largely of very fine plant fragments. The enclosing siltstone commonly has a diapiric relationship to adjacent pillows. This outcrop is at the distal edge of the nearshore (bar and lagoon) facies.
		Return to Route 7.
57.4	0.7	Junction Routes 28 and 7. Turn right (W) on Route 7.
60.0	2.6	At drive-in theatre turn left onto County Route 47.

Total Miles	Miles from last point	Route description
60.5	0.5	Cross creek.
61.7	1.2	Kame and Kettle topography.
		Road designation changes to Delaware County Route 11.
63.6	1.9	Junction Routes 11 and 23. Turn left (E) on Route 23.
63.8	0.2	Passing through Kame and Kettle topography.
65.7	1.9	Davenport Center.
67.8	2.1	On left well defined river terrace.
68.5	0.7	On right outcrop of dark Gilboa Formation shale.
70.0	1.5	Davenport.
73.6	3.6	Traffic light in center of Stamford.
81.1	7.5	Grand Gorge.
81.6	0.5	Junction of Routes 23 and 30. Continue east on Route 23.
84.6	3.0	On right power sub-station. Park and walk down unsurfaced road across from power station.
		STOP 2 - Hardenburgh Falls (Indicated as Section 48 on Fig. C-2 and as (2) on Fig. C-6.) The beds here are medium gray and olive gray, trough cross-bedded, fine to medium-grained, graywacke and medium gray, shaly siltstone of Lithosome C. Pebble and coquinoid conglomerate lenses, rich in plant fragments, are common. The strata are interpreted as being of tidal channel and tidal flat origin.
		Continue east on Route 23.
85.0	0.4	Kame (?) topography.
85.5	0.5	Prattsville.
86.2	0.7	Cross Schoharie Creek. Take sharp left (N) onto County Route 11.
88.3	2.1	On right sandstone ledges of Catskill lithofacies (Lithosome D).
89.9	1.6	On right more sandstone ledges of Catskill lithofacies.

Total Miles	Miles from last point	Route description
90.9	1.0	Park on left side of road just before crossing bridge over Manor Kill.
		STOP 3 (Indicated as Section 46 on Fig. C-2 and as ③ on Fig. C-6.) The beds exposed in the Manor Kill Gorge are within the upper part of the Hamilton Group. Those in the lower part of the section, adjacent to the Schoharie Reservoir, are trough cross-bedded, burrowed, medium-grained sandstone of Lithosome C assigned to the tidal channel facies. Some of these sandstones are rich in plant material and in a few places during low water stages of the reservoir fossil seed-fern stumps may be seen. The remainder of the section upstream consists of interbedded red and green shales, dark gray shales and medium gray, shallowly cross-bedded, fine-grained sandstone; interpreted, respectively, as distal alluvial plain, tidal flat and tidal channel facies. Walk down path on left (W) side of road to east bank of reservoir at mouth of Manor Kill to observe cross-bedded, burrowed sandstone.
		Continue across Manor Kill bridge and bear left.
91.9	1.0	On right Gilboa-Conesville Central School.
92.2	0.3	On left Gilboa Dam constructed mainly of tidal channel (and bar?) sandstone of Lithosome C.
		Continue down hill bearing left (on surfaced road). Cross bridge over Schoharie Creek about 0.5 mile north of Gilboa Dam.
92.9	0.7	On left, at west end of bridge. STOP 4 Display of Gilboa seed-ferns taken from quarry (abandoned) a short distance back in woods. (Lower few feet of quarry is designated as Section 44 on Fig. C-2 and as ④ on Fig. C-6.) Over 200 such seed-fern stumps were taken from this quarry. They apparently represent a distal alluvial plain or tidal swamp which was buried by shifting tidal channel sands.
		Continue west to Route 30.
94.0	1.1	Turn left (S) on Route 30.

Total Miles	Miles from last point	Route description
95.0	1.0	Park on right side of road opposite outcrops near base of steep hill.

STOP 5

(Basal part of section which is designated Section 43 on Fig. C-2. Designated (5) on Fig. C-6.) Outcrop consists of medium gray and olive gray, tabular and trough cross-bedded, fine to medium-grained, immature graywacke. The sandstone contains well-developed lag accumulations of large spiriferid brachiopods and a few large burrow structures. The sandstone is interpreted to represent a tidal channel deposit.

Continue up the hill (S) on Route 30.

95.3	0.3	Park on right opposite red beds.

STOP 6

(Upper part of section which is designated 43 on Fig. C-2. Designated (6) on Fig. C-6.) Outcrop consists of grayish red, highly micaceous siltstone and silty, very fine-grained sandstone of the overbank alluvial facies (Lithosome D). Dark greenish gray mottles are common in these beds.

Resting in channel contact on the red beds is well cross-bedded, apparently unfossiliferous, medium gray, very fine-grained sandstone and olive-gray, fine-grained sandstone. Within this 30 foot sandstone interval is a well-developed compound channel that migrates to the right (SW) upward in the section.

Proceed south towards Grand Gorge on Route 30.

96.0	0.7	In distance ahead note accordant summits which are typical of this part of the Catskill Mountains.
96.9	0.9	Junction of Routes 30 and 23 in Grand Gorge. Turn right (W) on Route 23.

Return to Cortland via Routes 23, 26, 41 and 81.