

## Trip B-3

### SILURIAN AND DEVONIAN EURYPTERID HORIZONS IN UPSTATE NEW YORK

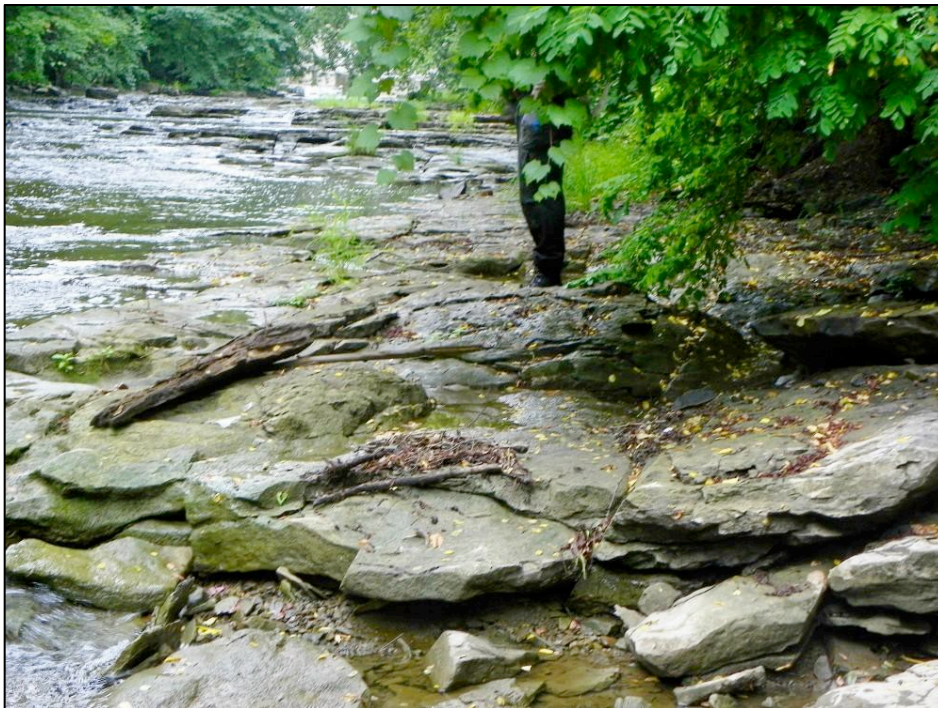
SAMUEL J. CIURCA, JR. (paleoresearch at yahoo.com) Rochester, New York

The upper Salina Group consists of a minimum of 70 feet of argillaceous beds (Camillus Formation) that weather rather rapidly. Most beds are mudstones or dolomitic mudstone and shale. The succeeding Bertie Group begins with the deposition of hypersaline „algal” mounds and a eurypterid fauna – the Fort Hill Waterlime (see Ciurca, 1973, 1990). Overlying this is the Oatka Shale – dolomitic mudstone with no fossils currently known.

The initiation of Bertie Group sedimentation with a unit of eurypterid-bearing, stromatolitic waterlime set the stage for deposition of overlying units all, in one way or another, deposited during a regime of extensive microbialite sedimentation in the Late Silurian. This, and the numerous eurypterid faunas, typifies the Bertie Group sequence across upstate New York and southwestern Ontario, Canada.

Ciurca (1990), in a redefinition of the Bertie Group, added similar lithologic units that occur above the Akron- Cobleskill to the Group (e.g. Moran Corner Waterlime) considering them part of depositional cycles occurring as the result of the shifting of paleoenvironments to and fro during the close of the Late Silurian of the region. We may never know if latest Silurian strata occur in New York as many of the distinguishing zonal fossils may never be found within our sequences. In the meantime, it has been continuously suggested that *Eurypterus* characterizes the Late Silurian and that *Erieopterus* characterizes our Early Devonian (at least in the northeast U.S. and Ontario, Canada). The earliest invasion of the Helderbergian transgression may have removed our latest Late Silurian sediments. See Ciurca 1990, Fig. 5, Distribution of Eurypterid-bearing Waterlimes.

Except for the '*Eurypterus*' *pittsfordensis*, found at the base of the Salina Group, true *Eurypterus* are found throughout the Bertie Group and readily distinguish the beds from units such as the Early Devonian Manlius Group or somewhat equivalent beds (Honeoye Falls Dolostone or the Clanbrassil Formation of southwestern Ontario, Canada) – these are replete with the eurypterid, *Erieopterus*.



**Figure 1** Algal mounds (microbialites) in the Fort Hill Waterlime at the base of the Oatka Formation downstream from the NY 96 bridge over Flint Creek, Phelps, N.Y. The dam/falls can be seen in the background. The mounds rest on a layer of dolostone bearing abundant evidence of hypersalinity (e.g. salt hoppers).

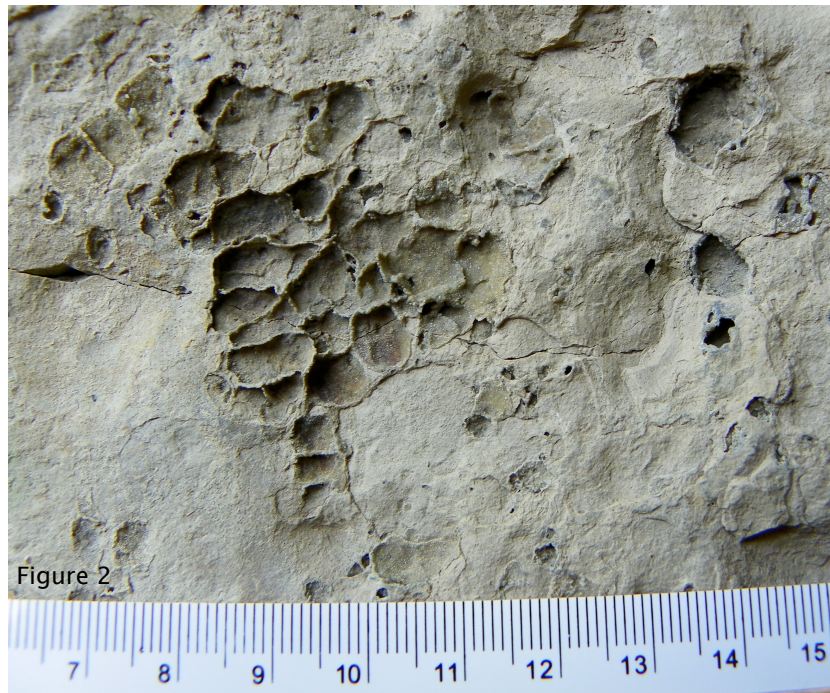
STRATIGRAPHY

Selected Strata and Localities

**Fiddlers Green Formation, Litchfield Town Hall**

The Fiddlers Green Formation is exposed in a roadcut opposite the Litchfield Town Hall, Litchfield, New York. Two members are exposed, the Phelps Waterlime constitutes the upper portion and the rest is Victor Dolostone. Hundreds of specimens of eurypterid remains (and associated fauna) were obtained by this author and over the years (since the 1960s) fossil collectors have found many more.

The Phelps Waterlime here is about 1.5 m thick, gray in color but much darker when fresh. It breaks with conchoidal fracture and is characterized at this site with a zone (~0.25 m thick) of stromatolites and mudcracks at the top. Recently, interesting features have been observed in the uppermost transition to the overlying Forge Hollow Formation (shaly, platy dolostone near the contact with the Phelps). These include “boxwork” (Figure 2 – note optical illusion) and small-scale mudcracks associated with algal mats at the top of the stromatolite beds. (Figure3).





The boxwork occurs on the underside of the rock and, presumably, represents the structures left by the removal of gypsum nodules. To the west, the Forge Hollow Fm. contains thick beds of gypsum that were formally extensively quarried (Syracuse area and Cayuga Lake region). Mudcracks are a common structure at the top of the Phelps Waterlime, but at this site they are intimately meshed with the stromatolite beds. The small-scale mudcracks illustrated above are associated with algal mudflats that were present just prior to deposition of the Forge Hollow Fm. They have also been observed at Flint Creek at Phelps, N.Y. but there are overlain by the Ellicott Creek Breccia.

**Cobleskill Formation**

While the Cobleskill Formation in its limestone facies (type section westward to Cayuga Lake) is replete with a Silurian marine fauna (see Berdan 1972 and Stock 1979, for example, for faunal listings), the unit is much more complicated in structure and distribution than generally realized (Cieurca 2005). Eurypterids occur below (Williamsville-Oxbow), within and above most facies across upstate New York.

Of particular interest to this author is the occurrence of eurypterids above the main portions of the Martisco Reef Complex (MRC) (Cieurca 2003, 2005) from Rock Cut Gorge westward to Auburn. *Eurypterus* sp. (*dekayi*- type), a dolichopterid, ostracods, brachiopods and a single conulariid have been retrieved thus far from a thin zone above the reef. Within the fossil-bearing bed, about 0.25 m thick, salt hoppers occur indicating still another eurypterid bed that formed under hypersaline conditions. Salt hopper structures are particularly abundant in some of the eurypterid-bearing waterlimes in New York and Ontario, Canada.

Recently, another small structure (Figure 4) has been located north of the MRC and is interpreted to be another example of a highly dolomitized patch reef (North Reef). Silicified stromatoporoids occur here also.



Figure 4 North Reef – Note massive bedding, apex, and wedging. Rock above reef is slightly cherty and is mostly of stromatolitic origin and overlain by more typical Chrysler Formation.

Eurypterid remains are not easy to extract from the waterlime in the sequence. However, many specimens have been obtained through persistent search. Figure 5 shows the characteristic eurypterid found in this zone.

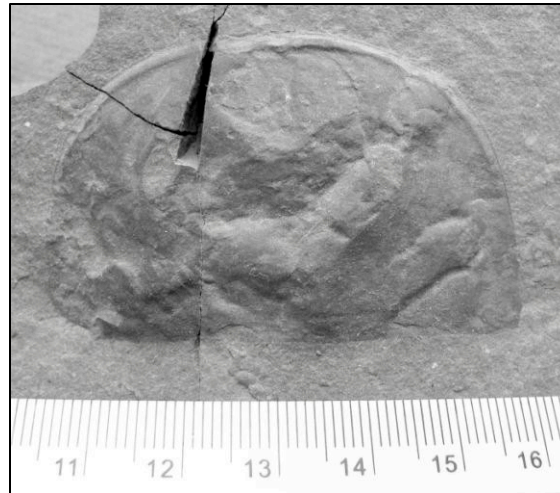


Figure 5 Wide eurypterid carapace of the *Eurypterus dekayi* type. Species is undetermined. Note small ostracods and trace fossil.

At Owasco Outlet, Auburn, New York a different “Cobleskill” Limestone is present with a eurypterid horizon slightly older than that of the MRC. This is treated below as the “Canoga Waterlime” – still another eurypterid-bearing unit within the Late Silurian of New York. New York probably has more eurypterid horizons than any place in the world (for now).

#### **Canoga Waterlime (new)**

Immediately overlying the Cobleskill Limestone at Auburn, New York are about 2 m of thin- to thick-bedded, fine-grained dolostone (waterlime). Owasco Outlet is the suggested type section of the Canoga Waterlime. Thus far, the unit is limited in occurrence to northern Auburn, Cayuga Lake and west to Seneca Falls.

At Owasco Outlet, the Canoga Waterlime bears a *Eurypterus* fauna with small leperditiid ostracods. Windrows, consisting of very finely-comminuted carbonaceous material, have been observed and stylolites are common.

How this dolomitic unit has gone unnoticed for so long is perplexing. In 1909, D. Dana Luther noted that waterlime occurred above the stromatoporoid-bearing Cobleskill Ls. at the old McQuan’s Quarry south of Seneca Falls and even noted the occurrence of eurypterid fragments:

“Overlying the stromatopora layer in the McQuan quarry there is a bed of dark somewhat shaly magnesian limestone 9 feet thick, some parts of which are dolomitic. It is the only exposure on this quadrangle (Geneva-Ovid) of the Rondout waterlime, a formation 40 feet thick in the eastern part of the state...” and “segments of *Eurypterus* have been found 2 or 3 feet below the top of the bed.”

The region about Auburn and Seneca Falls is anomalous (herein the ASF Anomaly). Normally, the Canoga Waterlime (occurring above the Cobleskill limestone facies as it does) would be considered part of the Chrysler Formation. However the „other“ Cobleskill Fm. occurs higher in the section (see discussion of Cobleskill Formation).

Correlation of the Canoga Waterlime with other eurypterid-bearing units is not currently possible as it is sandwiched between the two „Cobleskill“ units mentioned above. The contact with overlying units has not been precisely observed, but a hard, argillaceous (presumably dolomitic) unnamed unit does occur slightly above.



Luther's observation over a hundred years ago was keen. The unit he observed is the Canoga Waterlime as defined above and we now finally know more about the eurypterid fauna characteristic of the unit, i.e. *Eurypterus* sp. (Figures 6 and 7).

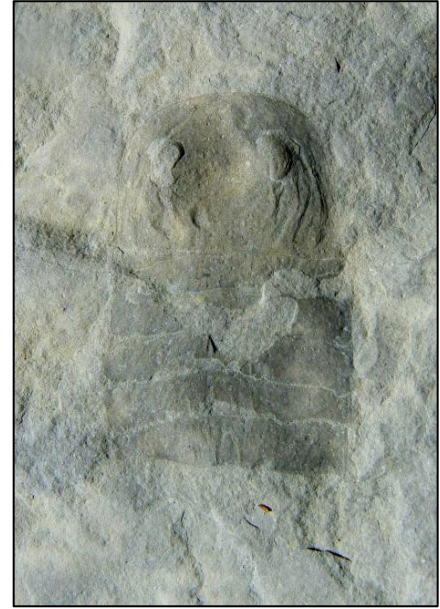


Figure 6 (left) and Figure 7 (right): Somewhat thick beds of the Canoga Waterlime (~2 m thick). Below this are beds of Cobleskill Limestone. The eurypterid found in the Canoga Waterlime is a type of *Eurypterus* sp. and detailed comparisons with eurypterids in other horizons have not been made.

#### **Flint Creek (Phelps) and Mud Creek (East Victor)**

A comparison of sections shows stromatolite layers of the Phelps Member at Flint Creek grading into typical eurypterid-bearing waterlime facies. The mudcracks at the top of the Phelps Waterlime appear to grade into a stromatolitic facies bearing occasional desiccation features among algal clasts (this situation also occurs over 100 miles to the east at Litchfield Town Hall – see STOP 1). At Mud Creek, East Victor, New York, the

mudcracked beds are at least 0.35 m thick, more typical of the distribution of this marker horizon east to Passage Gulf. At Mud Creek, the mudcracks appear beneath the Ellicott Creek Breccia (ECB), but to the west disappear either due to unconformity, or more likely by grading into a zone of stromatolite mounds of the ECB or the underlying (upper) Victor Dolostone.

At the Neid Road Quarry, northeast of LeRoy, such stromatolite mounds are common and eurypterids are found between and above the mounds in hypersaline settings (salt hoppers are found that are up to a foot on a side). See Ciurca 2005, Nudds and Selden 2008 for illustrations.

A peculiar feature at Mud Creek is worth noting. The “topographic waterlime” (so characteristic of the upper ECB in Canada – Figure 8) is present, presumably only as large clasts (Figure 9) as if most of the unit had been removed before deposition of the overlying Scajaquada Fm. The ECB at Mud Creek is rubbly-looking and heavily brecciated. It is believed to represent part of a widespread Late Silurian paleoseismic event, attesting to a violent origin. Clasts (within the breccia) are often vertical to the bedding. Topographic waterlime is so unusual that it can be recognized even as pieces.



Figure 8 Topographic Waterlime: Part of a large block from the topmost stromatolite zone of the Ellicott Creek Breccia Member, Fiddlers Green Formation at Fort Erie, Ontario, Canada (RQS quarry). The specimen is wet to bring out details of this highly unusual type of eurypterid-bearing waterlime. The microbialite mounds in this area are measured in meters. Note incipient brecciation.





Figure 9 Ellicott Creek Breccia (Fiddlers Green Formation) at Mud Creek, East Victor, New York. Note the very large clast of topographic waterlime to the right of the hammer.



Figure 10 Chunk of Ellicott Creek Breccia with large clast of “algal” topographic waterlime in center. Note the clast is perpendicular to the bedding – Flint Creek at Phelps, New York.

At Flint Creek, the Ellicott Creek Breccia is exposed for an unusually long section of the creek from south of the William Street Bridge to the north sections where it is seen in the wall of the exposures leading to the dam at NY 96. Various other lithologies are represented in the clasts including what looks like black shale – provenance unknown.



At the type section, at Ellicott Creek in Williamsville, the ECB is a tripartite unit with stromatolites concentrated in the middle and is about 2.5 m thick. The *Eurypterus remipes* Fauna is present and occurs throughout the distribution of the unit. Other than eurypterids, fossils are rare except for ostracods and occasional cephalopods. Salt hopper structures are relatively common at many sites. See Figure 85 in Nudds and Selden 2008 for a color photograph.

**Chittenango Falls, New York**

The Silurian rocks exposed on the east side of NY 13, south of the falls, present an unusually thick section of dolomitic strata („Cobleskill”, Chrysler) with overlying Helderbergian limestones. See Rickard, 1962 for detailed stratigraphy.

Massive, fine-grained dolostone constitutes most of the “Cobleskill” at the base of the cliff. Rare stromatoporoids have been observed and fragmentary eurypterid remains, some unusually large pieces.

For many years, Celestite crystals and associated minerals were eagerly sought after by collectors (Ciarca 1962). The source was the Chrysler Fm. which appears in the cliff above the “Cobleskill” as a series of thin- to medium-bedded dolostones often with mudcracked surfaces. The crystals line prolific vugs and even the mudcracks. Fossils are not common, but *Erieopterus* occurs in beds within the upper half of the Chrysler Fm. (above the Celestite beds). The Silurian-Devonian boundary is placed approximately at the base of a thick waterlime (Figure 10). The (time) interval between deposition of the “Cobleskill” here and the appearance of the *Erieopterus* Fauna represents long emergence to the atmosphere with multiple layers of sun-baked sediments in what must have been a playa-like setting.



Figure 11 Chittenango Falls NY 13 Section: Massive beds at base are „Cobleskill” Formation with Chrysler dolostones above. Dark patches (excavations) are where collectors obtained Celestite crystals over the years. Arrow marks approximate position of the Silurian-Devonian boundary.

The section at Chittenango Falls lacks the tripartite division seen at Clockville that has a limestone unit



in the middle with abundant, though poorly preserved fossils. At Clockville, though, a large *Eurypterus* is present in the upper third associated with brachiopods. How these sections are related to the Martisco Reef Complex to the west is not understood. What is evident, however, is the continuous shift in paleoenvironments as Late Silurian sedimentation occurred throughout the region, layer-cake in presentation but much more complex in realization. Traced eastward, the „Cobleskill“ becomes interbedded with fascinating eurypterid beds in limestone and dolomitic facies that are most unusual and little-understood. Though they all contain Bertie-type eurypterid faunas, the faunas are still little-studied compared to the marine biota. Collections of some of the material obtained thus far are in the research collections of the Peabody Museum of Natural History in New Haven, Connecticut.

#### CONCLUDING OBSERVATIONS

It would appear that many factors contributed to the deposition of Bertie Group sediments. These include proximity to a northern/eastern shoreline, degree of carbonate buildups (e.g. stromatoporoids) and restriction that allowed for the formation of hypersaline lagoons (what I call, alglagoons) over most of the region. It is assumed here that restriction was caused not only by biostromes and localized patch reefs, but also by great expanses of microbialites formed in shallow waters of Late Silurian bays/seas. Further, carbonate shoals contributed to restriction due to great piles of shell material (e.g. *Whitfieldella*) along with the microbialite mounds. Cross-bedding observed in such units as the Victor Dolostone demonstrates active currents (not a static environment) in which shell debris is piled up into „dunes“ that form shoals that finally become micritized and blended into the surrounding sediment.



Figure 12 Victor Dolostone, Marcellus Falls, N.Y. Crinkled stromatolitic beds with low amplitude stylolites (irregular black lines) with abundant micritized *Whitfieldella* (brachiopods) and cross-bedding and microbreccia.

All of these factors must have influenced salinity in what are interpreted as near-shore lagoons for there we find salt hopper structures in great abundance associated with prolific fragmentary eurypterid remains and other biota transported into them during episodes of storm activity (tempestites).

What has recently been made clear to this author is that the more one looks at the Bertie Group, with its multiplicity of eurypterid horizons, the more various morphotypes of microbialites become evident – a fertile area for study. The Late Silurian, at least in upstate New York and Ontario, Canada, was a strange place.

#### ACKNOWLEDGMENTS

Mark Wade was invaluable in the field as we reinvestigated some of the important exposures of several of the Bertie Group units with special emphasis on the Phelps Waterlime and the Ellicott Creek Breccia. Many new observations were made and some of these will be the subject of future publication.



**ROAD LOG FOR SILURIAN-DEVONIAN EURYPTERID-HORIZONS, UPSTATE NEW YORK**

CUMULATIVE MILEAGE	MILES FROM LAST POINT	ROUTE DESCRIPTION
0.0	0.0	Exit 30 Toll booth, NYST I-90 at Herkimer
0.1	0.1	Turn left, Follow NY-28 south through Mohawk to Illion
0.7	0.6	NY-28 (continue through town, W. Main St.
1.5	0.8	Entering Illion
2.2	0.7	Remington Arms Factory on left
2.5	0.3	Turn left (head south NY-51)
4.0	1.5	Entering Illion Gorge (Steele Creek) ENTERING
	ORDOVICIAN	TIME ZONE
5.7	1.7	Town of Litchfield
6.1	0.4	ENTERING SILURIAN TIME ZONE
8.1	2.0	Vernon Red Shale
8.9	0.8	Syracuse Formation on left (above creek)
10.2	1.3	Cedarville
10.6	0.4	Turn right at stop sign, follow Cedarville Road
11.3	2.0	STOP 1 Litchfield Town Hall (on right)

**STOP 1. EXPOSURES: THE VICTOR AND PHELPS MEMBERS, FIDDLERS GREEN FORMATION**

The type section of the Fiddlers Green Fm. is along Butternut Creek, north of Jamesville, N.Y., where the upper beds form the top of a waterfall. While the rock there is much darker in appearance, the divisions seen here are recognizable there. At the type section there is an upper, very fine-grained dolostone (Phelps Waterlime) with eurypterids and salt hoppers and below, massive beds of the Victor Dolostone

When I first discovered this locality in the 1960s, I called it Con Loc 1 (or Cieurca Locality 56) as we were trying to keep a hoard of collectors from visiting the site in the early years. The site was glacially polished and striated and quite resistant to intrusion, but with weathering and working it slowly over several years, it produced a large number of eurypterid specimens and associated fauna. After a brief interval of several years, when the site was mostly covered with locally-collected drainage ditch material, the site became popular with eurypterid collectors who continued to excavate the rock layers to the state the exposure is today. The research collection I made over the years is available for study at the Peabody Museum of Natural History in New Haven, Connecticut.

Return to the New York State Thruway, I-90 and head west to the Canastota Exit (Exit 34).

69.4	43.0	Toll booth – Canastota.
69.6	0.2	Turn right on NY 13 and stop at McDonalds.
69.7	0.1	Leave McDonalds, turn right and follow NY-13 south.
70.3	0.6	Erie Canal Museum on right.
71.0	0.7	NY-5, continue south on Oxbow Road.
72.9	1.9	Cotton Road, Clockville (continue south).
73.7	0.8	STOP 2 Roadcut on east side of Oxbow Road (pull into parking area).

**STOP 2. EXPOSURES: LATE SILURIAN AND EARLY DEVONIAN STRATA (CLOCKVILLE)**

This is an important section, stratigraphically. Rickard (1962) gives a detailed description of the exposed strata. At the base is the uppermost Fiddlers Green Formation (Bertie Group) with eurypterids and salt hoppers. Overlying strata include the Forge Hollow, 'Cobleskill,' Chrysler, Thacher and part of the Olney Formations. At least four eurypterid horizons are present in the section. The Silurian/Devonian boundary occurs within the Chrysler Fm. here. At Chittenango Falls, portions of the Chrysler Fm. are rich in horizons of Celestite – a strontium mineral (STOP 3).

Return north to NY 5 and turn left following NY 5 to Chittenango.

76.4	2.7	NY-5 (head west to Chittenango).
82.4	6.0	NY-13 Chittenango, follow NY-13 south.
87.4	5.0	Parking area on right, opposite large cliff face (STOP 3, see Figure 11).

**STOP 3. EXPOSURES: LATE SILURIAN AND EARLY DEVONIAN STRATA (Celestite locality)**

For many years, this was a famous mineral collecting locality (mostly Celestite and Calcite). See text for a description of the stratigraphy. Note the massive beds at the base of the cliff – these are the dolomitic facies of the ‘Cobleskill’ Formation. Slightly farther up the road is Chittenango Falls State Park with one of the most beautiful cascading-type waterfalls. Trails take you to the bottom and are well worth seeing. A side canyon just to the north shows what appears to be large ‘algal’ reefs in the Thacher Fm.

87.4	5.0	Turn around and head back to NY-5.
96.9	9.5	Fayetteville (continue west on NY-5).
99.5	2.6	Turn right, I-481 (ramp) and head north to I-690.
101.0	1.5	Exit 4 to I-690.
111.0	10.0	Exit 6 to I-695 south.
113.2	2.2	Right lane for Camillus west, NY-5 (to Auburn).
114.1	0.9	NY-5 west.
117.1	1.0	Exit to NY-5 (Camillus, Warners).
117.4	0.3	Turn left, head to Camillus.
118.1	0.7	Turn right, village of Camillus.
118.2	0.1	Turn left, NY-174, head south through a beautiful valley.
121.4	3.2	Marcellus Falls.
121.9	0.5	STOP 4 Park at Marcellus Paper Company.

**STOP 4. MARTISCO REEF COMPLEX – ‘COBLESKILL’ FORMATION**

This is one of the most unusual facies variations of the ‘Cobleskill’ Formation. Sedimentary structures here are interpreted to be part of a highly dolomitized reef complex with silicified fossils, wedging of beds, unusual black chert deposits and succeeding stromatolite beds with breccia and eurypterids. See Ciuca 2005 and <http://eurypterids.net/MartiscoReefComplex.html> for additional comments. Note: Parts of the overlying Chrysler Fm. are well-displayed here.

One other stop is suggested for those interested on this field trip. From this site, take the road back to NY-5 and head west through Auburn and continue to Waterloo, New York. Turn right on NY-96 and head for Phelps where a bridge right in the village goes over Flint Creek (see text). Looking north from the bridge is the Oatka Shale, a rare outcropping. Looking south, below the dam, is lowermost Fiddlers Green Fm. and above the dam is upper Fiddlers Green Fm. including a suggested paleoseismitic represented by the Ellicott Creek Breccia. We can collect samples of this for those interested. Many eurypterid specimens have been retrieved from the Phelps Waterline of this area. Another interesting feature of this locality is the four foot bed of sandstone at the Silurian/Devonian unconformity (just below the Onondaga Limestone).

**END OF FIELD TRIP**

Note: From Phelps, there are many routes heading to the NYS Thruway or directly to Rochester.



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