Trip B-4

EURYPTERIDS AND FACIES CHANGES WITHIN SILURIAN/DEVONIAN 'EURYPTERID BEDS' OF NEW YORK STATE

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Perhaps nowhere else in the world are eurypterids found in the abundance they are within the Silurodevonian strata of New York State. More importantly, little-understood cyclic sequences, mostly within an evaporite basin, preserved a multitude of distinctive eurypterid faunas. Many of these are currently known, and several now known, need to be better understood. This is especially true of Akron-Cobleskill horizons (see Ciurca 1978, 1994) that are providing abundant remains of successor faunas to those of the well-known Bertie faunas, viz. *Eurypterus remipes* (older) and *Eurypterus lacustris* Faunas.

The purpose of this paper is to comment on Bertie Group and overlying Akron-Cobleskill occurrences – their distribution geographically and stratigraphically of microbialites and eurypterids – and suggest that much more research is required if we are to truly understand the paleoenvironment not only of the sedimentary rocks in which we find specimens, but the environment in which the animals actually lived. The association of many of the eurypterid horizons with stromatolites/thrombolites is particularly emphasized. This is an exciting new area of observation and research.

The evolution of fish, and other organisms, has taught us that given enough time, many animals evolve to occupy disparate environments within the marine realm and often within the fresh water realm (rivers and lakes). Many authors have already suggested that the various eurypterid morphologies we encounter can be attributed to their existence in a variety of environments. Yet, it has proved difficult to provide specific environments for specific eurypterids – especially faunas that contain a great variety of species (forms) co-mingled like those of the Bertie Group assemblages.

The discovery of numerous post Akron-Cobleskill eurypterid horizons (Ciurca 1973, 1994) and horizons within the Cobleskill Limestone (itself) of eastern New York suggested lithologically and faunally that the Bertie Group needed redefinition. Redefinition was proposed previously (Ciurca 1980) and provided for practical recognition of the Silurian-Devonian boundary across New York State from Albany westward to Buffalo and into the Niagara Peninsula of Ontario, Canada based upon the abrupt appearance of *Erieopterus*.

In addition, examination of the typical Bertie Group lithologies and faunas can help us look for and understand newly discovered eurypterid horizons. An example of this, discussed below, is the occurrence of numerous stromatolite horizons within most sequences (See section on Microbialites within the Bertie Group).

The eurypterid-bearing horizons mostly begin in basal Salina Group units that are more argillaceous than Bertie Group (and higher) horizons. While not much is known about facies relationships within these lower horizons (e.g. Pittsford and other members of the Vernon Formation), some observations have been made (Ciurca in NYSGA 1990). Of course, during the deposition of the Salina sequence, the thick redbeds of the Vernon-Bloomsburg to the south and east were important to the paleoenvironmental setting in which we find the eurypterids. To the west of the basin were the 'Niagaran' reefs, some of which are believed to have continued growth into late Salina and Bertie time.

All of the Late Silurian and Early Devonian eurypterid 'deposits' indicate formation in shallow water and most are associated with features of desiccation represented by the numerous (cyclical) horizons bearing mudcracks, occasional ripple marks, rip-up clasts and probable strandline deposits. Uniquely, the Yale Peabody Museum ory is now the repository of a great collection of the sedimentary structures and sedimentological features, including a suite of associated lithological samples personally observed and collected over a period of about 40 years.

AKRON-COBLESKILL (*EURYPTERUS*) FACIES CHANGES

The type Cobleskill Limestone occurs in eastern New York while the type Akron Dolostone occurs in western New York. Between the two regions, important and little-understood facies changes take place. These changes are important to understand if we wish to gain insight into the evolution of *Eurypterus* and associated fauna. Part of the problem exists because various authors have interpreted, especially the Cobleskill Limestone, differently. The limestone is not one continuous bed or lithology. Westward from the type section, the interval is replaced by numerous *Eurypterus*-bearing beds that are useful in delineating the Silurian-Devonian boundary in the northeastern United States. Above these lateral and vertical changes, *Erieopterus* makes its appearance during the Helderbergian Transgression.

If anything characterizes the Cobleskill Limestone, it is its brachiopod fauna. While associated forms including horn corals, stromatoporoids, favositids and cephalopods are often important and typically marine forms; the brachiopods cross facies and are even associated with *Eurypterus* in some areas. The abundance of *Eurypterus* and associated eurypterids within post-Bertie units has generally gone unrecognized for over 100 years.

Until a redefinition of the eurypterid-bearing Akron/Cobleskill suite of litho- and biofacies is completed, it is difficult to discuss thoroughly the distribution of the eurypterid faunas, the emphasis of this work on a complete survey of the distribution of eurypterid faunas above the faunas of the Bertie Group. However, several observations can be recorded. The Moran Corner Waterlime (Ciurca 1973, 1994) is currently one of the most important of the post-Akron/Cobleskill units only because so much material has been recovered already and most eurypterid types have been recognized, viz. *Eurypterus* (2 species), *Acutiramus*, *Dolichopterus* (probably 2 species of dolichopterids) and an associated fauna not unlike that of typical Bertie Group associations

Figure 1 - Stromatoporoid biostrome, generally regarded as Cobleskill Limestone, within Owasco Outlet near Auburn, New York. Unnamed overlying beds are rich in eurypterid remains and may represent a channel through the Akron-Cobleskill sequence in this area. Presumably, the stromatoporoid beds are the same as those found on Frontenac Island in Cayuga Lake where the Cobleskill fauna is well known and consists of many types of brachiopods, rugose and colonial corals, pelecypods and cephalopods.

The critical area, probably more central in the basin, is Auburn-Syracuse. *Eurypterus* occurs above stromatoporoid biostromes that would be interpreted, as Cobleskill Limestone and that are also present on Frontenac Island in Cayuga Lake. Above this is a sequence with still other *Eurypterus*-bearing units including a brachiopod fauna that would also be interpreted as "Cobleskill," but which is a chert-bearing dolostone. It is possible that at least one of these *Eurypterus*-bearing units represents a large channel cutting through the complex of Akron/Cobleskill sediments in a relatively north-south orientation. Stromatoporoids extend westward at least to the Honeoye Falls area and corals to Buffalo and Fort Erie, Ontario, Canada. The zonal brachiopod *Eccentricosta jerseyensis*, occurs sporadically throughout the extent of this complex of post-Bertie units but also occurs within the (Bertie) Williamsville Formation in western New York and Ontario, Canada.

It is likely that the *Eurypterus lacustris* Biofacies developed behind Akron/Cobleskill deposition of stromatoporoid biostromes and probably small patch reefs. There is a distinct change in fauna within the Williamsville Waterlime itself as we go from central to western New York. The west is dominated by the *Eurypterus lacustris* Fauna, and the east by the *Paracarcinosma scorpionis* Fauna (presumably a deeper water regime). At the same time, the ubiquitous *Lingula* seems to disappear almost completely in the Fort Erie, Ontario region.

MARTISCO REEF COMPLEX

A road cut near Marcellus Falls, New York, exposes massive beds of cherty dolostone that are termed "Cobleskill Formation" in the literature. However, lithologically there is no similarity between the beds exposed here and the type Cobleskill Limestone of eastern New York. Additionally, near the top of the beds exposed at Marcellus falls, and just below the overlying Chrysler Formation, occurs a small patch reef. This reef and the associated cherty dolostone are referred to as the "Martisco Reef Complex." (from an Abstract presented before the Rochester Academy of Science Fall Paper Session at the Rochester Institute of Technology, Rochester, New York, November 15, 2003).

Irregular bedding and stylolitic contacts characterize the massive reef beds exposed here. Fossils are difficult to extract and identify due to recrystallization. However, silicified stromatoporoids preserved here provide evidence as to the nature of the mound occurring near the top of this exposure. Brecciation is prominent in certain beds and indicates the high-energy environment in which these beds formed.

The Martisco Reef Complex is capped by stromatolites and a bed of brecciated dolostone. An important eurypterid bed occurs near the top. The basal beds are not obvious at this site, but a nearby ravine reveals the expected Williamsville (or Oxbow) Formation with *Lingula* as seen at many outcrops of the unit.

A similar complex occurs in the Rock Cut Gorge near Syracuse and is herein termed the Rock Cut Bioherm. The sequence is nearly the same as that at Marcellus Falls, but the dark chert is less prominent. Large ostracods, a conulariid, and eurypterid remains have been observed above the irregular biohermal beds.

MICROBIALITES (STROMATOLITES & THROMBOLITES) WITHIN THE BERTIE GROUP

Stromatolites form extensive biostromes in some sections. Within the Bertie Group, occurrences have been uncovered from the highly eurypterid-bearing localities at Litchfield (CIURCA Locality 56) and Passage Gulf (CIURCA 57) westward into Ontario, Canada. They are common structures in many eurypterid horizons and it has taken many years to recognize just how widely distributed they are. Current research at one site, the Neid Road Quarry northeast of LeRoy, New York, has revealed 'sheets' of stromatolite mounds packed within a bed of waterlime in the upper Fiddlers Green Formation (i.e. the Ellicott Creek Breccia).

Figure 2 - A portion of the 'Martisco Reef Complex' at Marcellus Falls. Note white mineralized zones associated with silicified stromatoporoids and irregular bedding. Bands of dark chert overly the reef.

There are a variety of morphotypes recognized within the organosedimentary structures referred to here as simply stromatolites. Recently, a large ramus of the giant pterygotid, *Pterygotus cobbi*, was recovered from the waterlime just above a bed of stromatolite mounds at the Neid Road Quarry in 2005. Thus far, four eurypterid species have been observed within this sequence of uppermost Fiddlers Green Formation in this region. The most common feature observed within the strata here are bedding planes replete with what appear to be countless ripped up 'algal' clasts. This is part of the *Eurypterus remipes* Biofacies occurring across New York State.

Stromatolitic structures have now been observed within the Fiddlers Green Formation from the Niagara Peninsula of Ontario, Canada eastward all the way to the *Eurypterus remipes* localities at Litchfield and Passage Gulf in eastern New York. Enormous thrombolites occur within the Victor Member in Ontario, Canada.

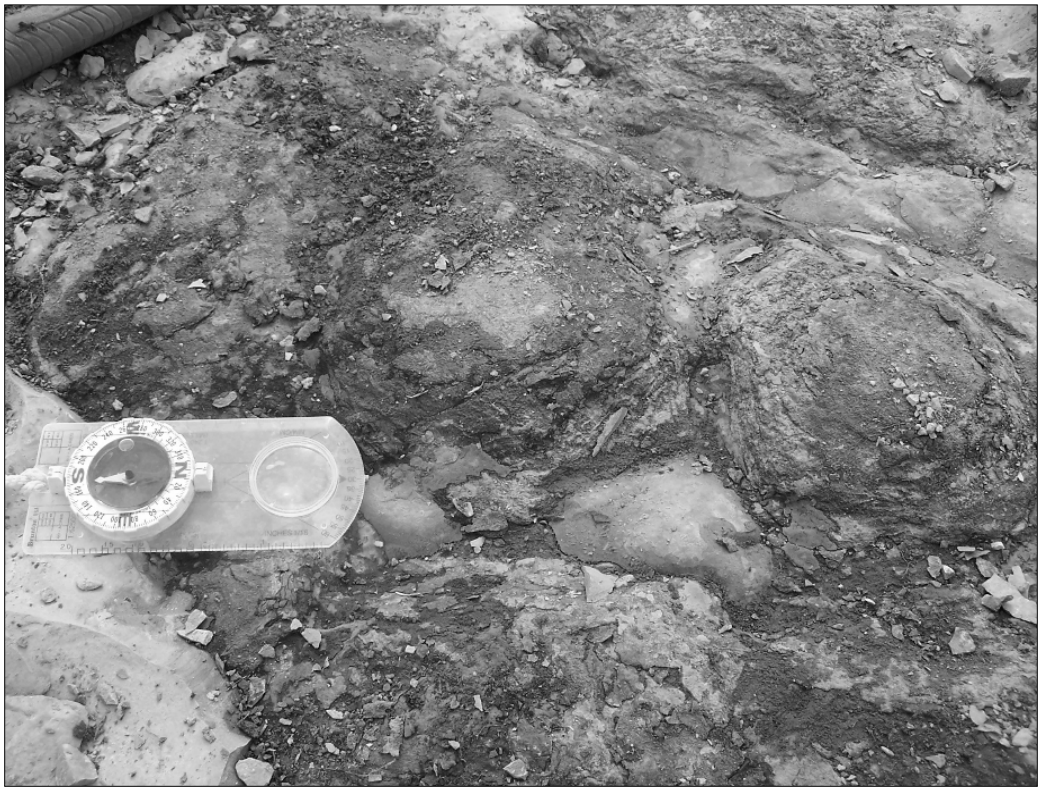

Figure 3 - Stromatolite mounds at the Neid Road Quarry. The intermound areas are light-colored, eurypterid-bearing waterlimes typical of the Bertie Group. Black (presumably carbonaceous) material easily weathers off the surface of the mounds. Excavation is a work in progress.

Figure 4 - "*Pterygotus cobbi*" – Part of a very large ramus (about 20 cm) found just above a bed of stromatolite mounds at the Neid Road Quarry northeast of LeRoy, New York in the Summer of 2005. This must have been one hell-of-a pterygotid. The sediments around are replete with unusually large salt hoppers.

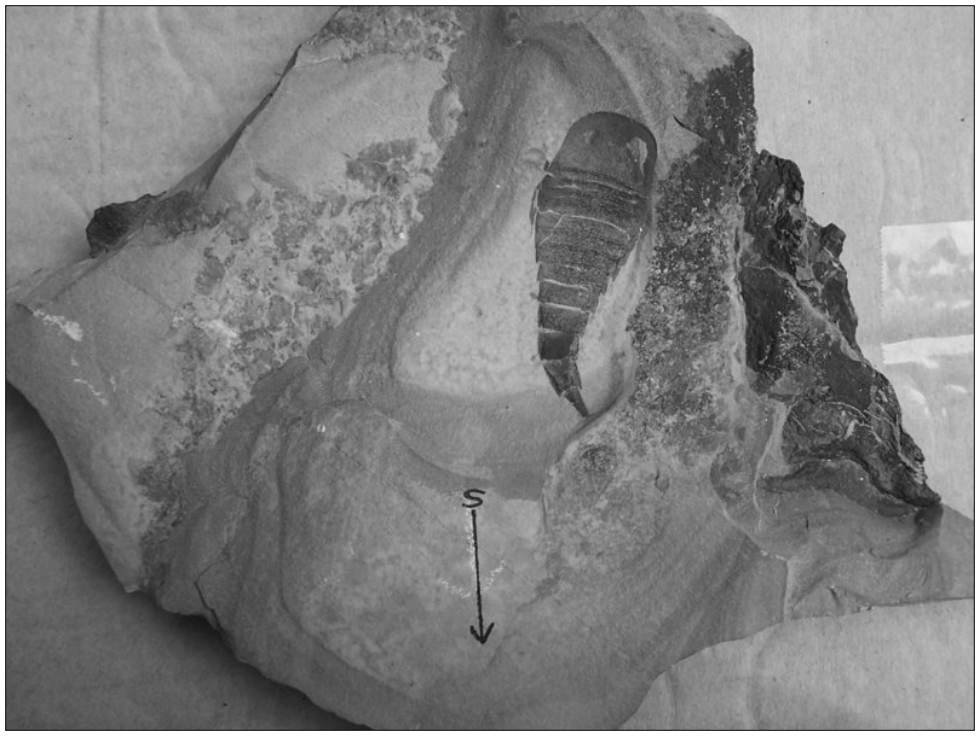

Figure 5 - '*Eurypterus' laculatus*, preserved in the waterlimes of the Ellicott Creek Breccia, Fiddlers Green Formation, Bertie Group. This specimen was retrieved from intermound waterlime at the Neid Road Quarry. See Ciurca (1973) for a description of the quarry. Specimen now in the Yale Peabody Museum collections.

ROAD LOG FOR MICROBIALITE-BEARING EURYPTERID SITES
SILURIAN AND DEVONIAN OF UPSTATE NEW YORK
Part 1

CUMULATIVE MILES FROM	MILEAGE LAST POINT	ROUTE DESCRIPTION
0.0	0.0	Exit 30 Toll booth, NYST I-90 at Herkimer
0.1	0.1	Turn left at intersection. Follow NY 28 south through Mohawk to Illion
0.7	0.6	NY 28 (continue straight 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 (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
10.2	1.3	Cedarville
10.6	0.4	Turn right at stop sign onto Cedarville Road
11.3	0.7	Early Devonian limestones on left
13.3	2.0	STOP 1 at Litchfield Town Hall (on right)

STOP 1: EXPOSURES OF THE LATE SILURIAN FIDDLERS GREEN FORMATION

Approximately the upper half of the Fiddlers Green Fm. (Bertie Group) is exposed along the road directly opposite the Litchfield Town Hall (Ciurca Locality 56, Cedarville at Jerusalem Hill Roads). In 1966, the exposure was a glacially polished surface on the Phelps Waterlime Member and very resistant to excavation. However, during this and many subsequent years, hundreds of specimens of eurypterids and associated fauna were obtained from this relatively small outcrop. This material is now in the Yale Peabody Museum in New Haven, Connecticut. The eurypterid-bearing units here are the Phelps Waterlime at the top of the exposure and the underlying finely-crystalline Victor Member. *Eurypterus remipes* is the common element of the eurypterid fauna here and has drawn collectors from all over to this area trying to find one.

13.3		Turn back on Cedarville Rd. to NY-51. Turn left and head back through the gorge to Illion.
24.2	10.9	Turn right (Clark St., McDonald's on right). Continue towards I-90.
25.0	0.8	Village of Mohawk.
25.5	0.5	NY-28 (continue forward).
26.4	0.9	POW/MIA Remembrance Bridge. Follow sign to I-90. Head west on Thruway to Canastota 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 at road cut on east side of Oxbow Road – Oxbow Falls on right.

STOP 2: EXPOSURES OF THE LATE SILURIAN AND EARLY DEVONIAN STRATA

Stratigraphically, this is an important section. At the base is the uppermost Fiddlers Green Fm. (Bertie Group) with eurypterids and salt hoppers. Overlying strata include the Forge Hollow, Cobleskill, Chrysler, Thacher and part of the Olney Formations. There are at least three eurypterid horizons present in the section. The Silurian/Devonian boundary lies within the lower part of the Chrysler Fm. here – this lower portion is rich in strontium (celestite) at Chittenango Falls. This section, again, exhibits the importance of microbialites in sections preserving eurypterid remains. In the upper portions of this section, within the 'Thacher' here, are more than two thick beds (more than 2.5 m) of stromatolites (including digitate forms) and thrombolites intimately associated with the Early Devonian eurypterid, *Erieopterus*.

73.7		Turn back to NY-5.
76.9	3.2	NY-5, Village of Canastota. Continue north to I-90.
78.2	1.3	Thruway toll booth (end of Part 1).

Part 2

0.0	0.0	Start at Exit 34A toll booth (from the east) to I-481. Follow I-481 south towards Jamesville.
6.6	6.6	Jamesville exit (follow road towards Jamesville).
7.5	0.9	Turn right (Jamesville Toll Road).
8.2	0.7	STOP 3 near road cut in Late Silurian dolostones.

STOP 3: ROCK CUT BIOHERM (NEW NAME)

This road cut exposes what is here interpreted as another example of a patch reef within the Akron/Cobleskill sequence like that proposed for the Marcellus Falls area (Martisco Reef Complex). Above the sequence here is the lower portion of the overlying Crysler Formation. While chert is a minor

component there, as compared to the Marcellus Falls exposures, it allows for a direct correlation with the units exposed at Marcellus Falls. Both localities record the same post-Bertie eurypterid facies.

		Continue forward to Brighton Avenue, turn left up the hill
10.7	2.5	Turn right on NY-173, down the hill.
11.4	0.7	US-11 (continue west on NY-173.
13.3	1.9	NY-175, NY-173, etc. Follow NY-175 west towards Marcellus.
21.4	8.1	NY-174 (continue into Marcellus village).
21.8	0.4	Turn right (follow NY-174 north).
23.0	1.2	STOP 4 at the Martisco Reef Complex and associated facies.

STOP 4: MARTISCO REEF COMPLEX, MARCELLUS FALLS, AND OVERLYING CHRYSLER FORMATION

Interpreted herein (and associated website) to be a Late Silurian patch reef associated with the Akron/Cobleskill sedimentation in upstate New York in this area, and eastward to the Rock Cut Gorge and also westward to the Auburn area. Eurypterid paleoenvironments can only legitimately be interpreted if we take into account the known distribution of stromatoporoids biohermal and biostromal deposits and understand the impact of the variety of morphotypes exhibited within the Bertie Group (and overlying sequences) of microbialites as we come to recognize them within the eurypterid-bearing Late Silurian and Early Devonian sequences.

The most notable feature here is the dark chert facies which is seen to laterally replace the reef but also overlies what looks like the core of the reef – a highly dolomitized massive section with vugs, dolomite crystals, and silicified stromatoporoids. This lithology resembles parts of the Lockport Dolostone of western New York.

		Continue north on NY-174 (winding road)
23.6	0.6	Ninemile Creek Fishing Area on right
26.3	2.7	Entering Camillus
26.8	0.5	NY-5 (turn left and head for Auburn)
42.0	15.2	Entering City of Auburn, continue west on NY-5
45.5	3.5	NY-326
46.0	0.5	Turn right on Clark St. (bear right), note shopping mall
46.4	0.4	Turn left on Beech Tree Rd. (head north)
46.9	0.5	Turn right on Canoga Road
47.4	0.5	STOP 5 at Owasco Outlet and Cobleskill (stromatoporoidal) Limestone

STOP 5: EXPOSURES OF THE COBLESKILL LIMESTONE STROMATOPOROID BIOSTROME

The intimate contact of an eurypterid horizon with deeper water facies is illustrated at this site. This may represent an extreme regression as eurypterid beds lie upon a massive stromatoporoid biostrome. And to complicate matters more, there are higher *Eurypterus*-bearing, pre-*Erieopterus*, units preserved upstream. This is the most complex area of eurypterid stratigraphy in upstate New York and is especially important because the units are all post-Bertie Group, i.e. post *Eurypterus lacustris* Biofacies. Thus, there are numerous eurypterid horizons exposed in the Owasco Outlet and we need to know why they are preserved here and how this important section relates to those to the west, south and east.

		Leave parking lot and head back to NY-5.
47.9	0.5	Turn left (onto Beech Tree Road).
48.4	0.5	Turn right on Clark St. to NY-5 and US-20. Head west to get to the New York State Thruway.
56.3	7.9	NY-90, continue west across Montezuma National Wildlife Refuge
58.3	2.0	Bear right onto NY-318 to NYST (I-90).
69.3	11.0	Entrance to the NYST, I-90.
		END OF TRIP.

ACKNOWLEDGEMENTS

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