PALEOECOLOGY AND STRATIGRAPHY OF THE ORDOVICIAN BLACK RIVER GROUP LIMESTONES: CENTRAL MOHAWK VALLEY

by

Barry Cameron
Department of Geology
Boston University
Boston, MA 02215

and

Rami A. Kamal
Geology Department
Texas A & M University
College Station, TX 77843

INTRODUCTION

Introduction

For over 150 years the Ordovician rocks of the Mohawk Valley have been under study. Some of the leading geologists and paleontologists of the 19th and 20th centuries studied the limestones, shales, and fossils of the Medial Ordovician Black River and Trenton groups in the Black River, West Canada Creek, and Mohawk River valleys (see Kay, 1937, for historical review). As a result, these rocks have become well-known as part of the Medial Ordovician standard reference section of North America.

The purposes of this field trip focusing on the limestones of the Black River Group of southern Herkimer County, New York, are to:

1) Demonstrate the stratigraphic succession and its lateral variations.
2) Discuss and evaluate the age relationships and time correlations of the various formations by
   a) Examining the diverse faunas and
   b) Demonstrating the lateral continuity of major lithic and biologic characteristics.
3) Examine and evaluate the criteria for determining the extent and significance of the disconformity along the Black River-Trenton boundary.
4) Examine and evaluate the criteria for determining the environments of deposition and paleogeography.

This field trip guide will summarize some of the previous work on the Black River Group in the Little Falls and Utica 15' quadrangles of Herkimer County and incorporate new data supporting reinterpretations of the stratigraphy in this area. The order of localities has been chosen as conveniently as possible for economy of travel along a southeast to northwest traverse.

Geologic setting

The Little Falls and Utica quadrangles are located along the southwestern margin of the Adirondack Mountains and include part of southern Herkimer County (Fig. 1). Good exposures of Medial Ordovician limestones are to be found along the Mohawk River, West Canada Creek, and East Canada Creek valleys and those of their tributaries (Fig. 1). Many small abandoned limestone quarries in both quadrangles contain exposures of the Black River-Trenton boundary.

Lower Paleozoic strata dip gently to the southwest from the Pre-Cambrian on the northeastern part of the Little Falls Quadrangle (Cushing, 1905), and Precambrian inliers occur at Middleville and Little Falls (Cushing, 1905; Young, 1943; Kay, 1953). The Late Cambrian Little Falls Dolomite underlies the Ordovician rocks and overlies the Precambrian basement complex. A few northeast-southwest trending normal faults cut Paleozoic and Precambrian rocks, e. g., near Little Falls and Dolgeville (Cushing, 1905; Kay, 1937).

BLACK RIVER GROUP: BACKGROUND

Rock units

Vanuxem (1842) was the first to use the name Black River for some of the limestones of Medial Ordovician age. The Black River Group has its type area in the Black River Valley in northwestern New York State. Although not originally, it is now composed of four formations: Selby, Watertown, Lowville, and Pamelia formations (Cameron and Mangion, 1977) (Fig. 2). The group occurs in the Champlain Valley, Mohawk Valley and extends northwestward to the shores of Lake Ontario beyond Watertown, Jefferson County, and thence westward into Ontario, Canada. It is also exposed in the Ottawa Valley and St. Lawrence Lowland of Ontario and Quebec (Kay, 1942; Wilson, 1946).

The Watertown and Pamelia were both thought to disappear somewhere south of Boonville, Lewis County; however, Cameron and Mangion (1977) have extended the Watertown southeasterward to the Newport area for what was previously considered to be Rockland (Kay, 1953; Cameron, 1969). The Watertown Limestone is the Youngest unit of the Black River Group in the field trip area (Central Mohawk Valley) and ranges from zero to seven feet thick (Fig. 2). The name Watertown was used by Cameron (1968) and Kay (1968) to replace the original name, Chaumont Formation, which Kay (1929) first applied as a time-stratigraphic term. The Pamelia Formation is the oldest unit and averages about 150 feet thick in northwestern New York. It is a dolostone that nonconformably overlies the Precambrian basement complex or the Cambrian Potsdam Sandstone in northwestern New York.

The middle formation of the group, the Lowville Limestone, which

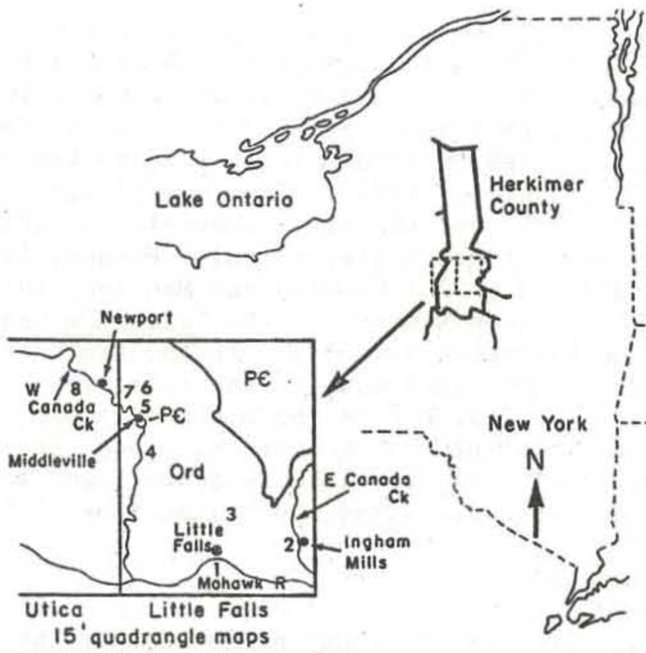


Fig. 1. Partial map of New York State with index maps showing location of quadrangles and field trip stops (numbers).

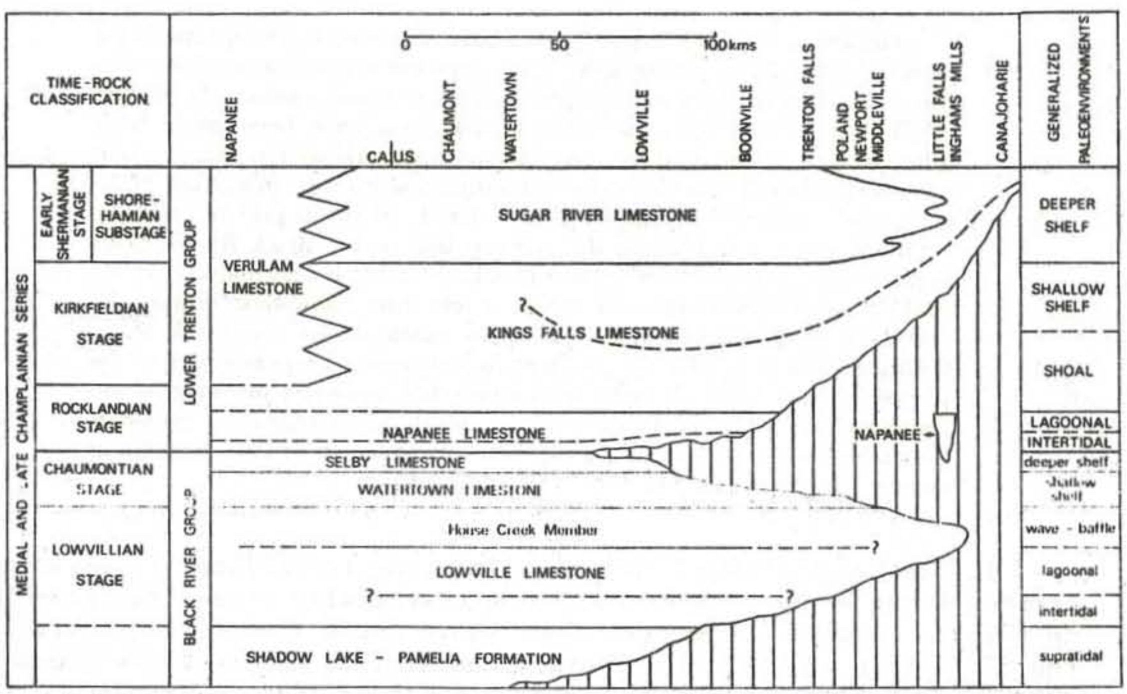


Fig. 2. Generalized correlation chart of Black River and lower Trenton groups from the central Mohawk River Valley in New York to southeastern Ontario. The width of each unit approximates relative thickness which is an estimate of time. Generalized paleoenvironmental framework is shown in the right hand column. Note the ambiguous and problematic portrayal of the Black River Group in the southeast, i. e., central Mohawk River Valley (From Cameron and Mangion, 1977, p. 489).

averages about sixty feet thick, was, prior to 1899, known as the "Birdseye Limestone." Clarke and Schubert (1899) called it the Lowville Formation for exposures in and around the town of Lowville, Lewis County, New York. However, they also referred to it as a stage or time-rock unit which has resulted in terminological confusion (Kay, 1968; Cameron, 1969; Cameron and Mangion, 1977). The "Lowvillian" stage is ambiguous outside its type area, and the term "Lowville" is still the most widely used term for the rock-stratigraphic unit (Fisher, 1962, in press; Walker, 1973; Rickard, 1973; Cameron and Mangion, 1977). Walker (1973) proposed the House Creek Member for the Tetraduim-bearing upper Lowville limestones of northwestern New York. In the field trip area the Lowville Limestone comprises most of the relatively thin (26 to 37 feet) Black River Group, and it has not been formally subdivided into members. However, at least two informal members have been described (Kay, 1953; Cameron, 1969; Kamal, 1977): a lower buff-colored, sandy and dolomitic limestone and an upper dove-gray, pure limestone.

Correlation Problem

Some controversy exists today as to whether the rock units of the Black River Group and Trenton Group in New York and Ontario are time-stratigraphic, i. e., the same age throughout their geographic distribution. This problem was summarized by Cameron and Mangion, (1977, p. 488) as follows:

> Walker (1973) and Barnes (1967) have reviewed three current hypotheses of Black River stratigraphy. The argument revolves around whether the formations are time-stratigraphic or facies of one another. As Walker (1973) has pointed out, the various viewpoints have been made from different spatial orientations: one follows the trend of the outcrop belt whereas the others show hypothetical onshore-offshore relationships. However, when the paleogeography is considered, all the hypotheses may be regarded as correct. That is, the outcrop belt in the Black River Valley more or less parallels the ancient strandline, and it is reasonable that the contacts of the formations are more or less time lines. Furthermore, by following Walther's Rule, all the facies exhibited by the Black River Group should be laterally equivalent in a direction perpendicular to the paleoshoreline. Unfortunately, the outcrop belt geometry precludes showing this relationship. Walker (1973) has also shown stratigraphic evidence, a metabentonite, that confirms the near synchroneity of the formational contacts in part of northwestern New York.

In northwestern New York, the limestone formations of the lower Trenton Group are also believed to be essentially time-stratigraphic in nature. However, they have been shown to be time-transgressive in the field trip area in the central Mohawk River Valley where the paleoshoreline is eastward along the north-south trending Adirondack Arch near Canajoharie, New York (Fisher, 1962, in press; Kay, 1968; Cameron, 1972, 1973; Mangion, 1972; Cameron, Mangion, and Titus, 1972; Mangion and Cameron, 1973; Titus, 1973, 1974; Titus and Cameron, 1976; Cameron and Mangion, 1977). The Black River Group in this area, on the other hand, appears to be time-stratigraphic, indicating that its local paleoshoreline is northward towards the Adirondack Dome.

Environmental Framework

The environmental stratigraphy and paleoecology of the Black River Group in northwestern New York has received much attention in recent years (e. g., Textoris, 1968; Walker and Laporte, 1970; Walker, 1972, 1973; Cameron and Mangion, 1977). "In the type area of northwestern New York it represents a somewhat restricted (Walker and Laporte, 1970) submergent cycle with (1) supratidal dolomitic mud flats of the Pamelia at the base, (2) intertidal lagoonal, and wave-baffle limestone facies of the Lowville in the middle, (3) level bottom, subtidal, pelletal limestones of the Watertown..." (Cameron and Mangion, 1977, p. 495) representing relatively deeper, though still shallow, water deposits, and (4) slightly deeper subtidal, more argillaceous, Selby limestones at the top. "The shoaling conditions in the uppermost Selby are consistent with the shoaling conditions of the middle Bobcaygeon of south-central Ontario (Liberty, 1969), the apparent diastem between the Selby and Napanee of southeastern Ontario and northwestern New York, and the widening bite of the Black River-Trenton unconformity along the western and southern Adirondack border (Fig. 2)" (Cameron and Mangion, 1977, p. 497).

Black River-Trenton Unconformity

The lower Trenton limestones of central and northwestern New York represent a transgressive sequence in which a late-Medial Ordovician sea transgressed the western Adirondack Dome from west to east according to the northwest-southeast outcrop belt. One result is a disconformity between the Black River Group below and the Trenton Group above in central New York that narrows to a diastem in northwestern New York (Fig. 2).

Evidence for this transgression and unconformity can be found in the litho- and biostratigraphic relationships of the upper Black River-lower Trenton formations. The northern basal Napanee Limestone pinches out southward before reaching the field trip area where the lower Trenton formation is the Kings Falls Limestone (Fig. 2). West of the Adirondacks in the Black River Valley, the Selby Limestone at the top of the Black River Group (Fig. 2; Cameron and Mangion, 1977) pinches out southward while the underlying Watertown Limestone decreases in thickness. The latter also pinches out still farther south in the Mohawk River Valley (Fig. 2).

The age of the base of the Kings Falls becomes progressively younger to the southeast because its basal Rocklandian-aged beds disappear (Titus and Cameron, 1976), indicating that the lower Kings Falls in central New York is Kirkfieldian in age (Fig. 2). Conglomeratic beds also sporadically occur at its base, such as at Inghams Mills (Stop #2). In addition, the Kings Falls decreases in thickness eastward to disappearance east of Canajoharie (Park and Fisher, 1969).

In the area of Middleville, a thin metabentonite layer (an altered volcanic ash) in the lower Kings Falls occurs progressively lower in the section towards the southeast, being at nine feet at Buttermilk Creek (Stop #6), seven feet a quarter mile south at City Brook (Stop #5), two feet three miles farther southeast at Stop #4 and at Stoney Creek

(Kay, 1953), and absent farther east. If this persistent clay represents a synchronous time surface at each of these localities, then the base of the Kings Falls is onlapping the top of the Black River Group and becoming younger eastward (Fig. 3).

Other indications for an early Trentonian transgression come from paleoenvironmental evidence. For example, the lower Trenton Group represents another submergence event with progressively deeper water formations upwards in the section (Titus and Cameron, 1976; Cameron and Mangion, 1977) (Fig. 2).

BLACK RIVER GROUP: HERKIMER COUNTY

Lithologies

The Watertown and Lowville Limestone formations of the central Mohawk River Valley are composed of a complex of ten interbedded and somewhat gradational lithologies, seven of which are volumetrically important (Fig. 3) (Kamal, 1977). The three minor lithologies are (1) a thin metabentonite composed of cream-colored clay resulting from alteration of volcanic ash, (2) medium gray clay seams, and (3) thin calcareous shales.

The seven major lithologies and some of their variations are described below:

Lithology 1: Medium- to thick-bedded, massive, very light to light gray weathering, medium gray, quartzose, pelletiferous, dolomitic, calcarenitic limestone. This lithology characterizes the lower member of the Lowville Limestone.

Lithology 2: Thin- to medium bedded, yellowish gray weathering, medium gray, wavy, mudcracked, dolomitic, extensively stylolitized, laminated micrite; ostracodes rare. A variation is a pelletiferous micrite.

Lithology 3: Medium- to thick-bedded, light gray weathering, medium to dark gray, vertically burrowed, mudcracked, stylolitized biomicrite; ostracodes rare to common.

Lithology 4: Thin-bedded, yellowish gray weathering, medium gray intrasparite; ostracodes common. When the ostracodes and other ofssils are common, the lithology is an intrabiosparite.

Lithology 5: Thin- to medium-bedded, pale yellowish gray weathering, dark gray micrite. These micrites grade into biomicrites, micrites with a minor sparry fraction, or a combination of all three. This lithology is very mottled. The mottling is thought to be the result of horizontal burrow-reworking.

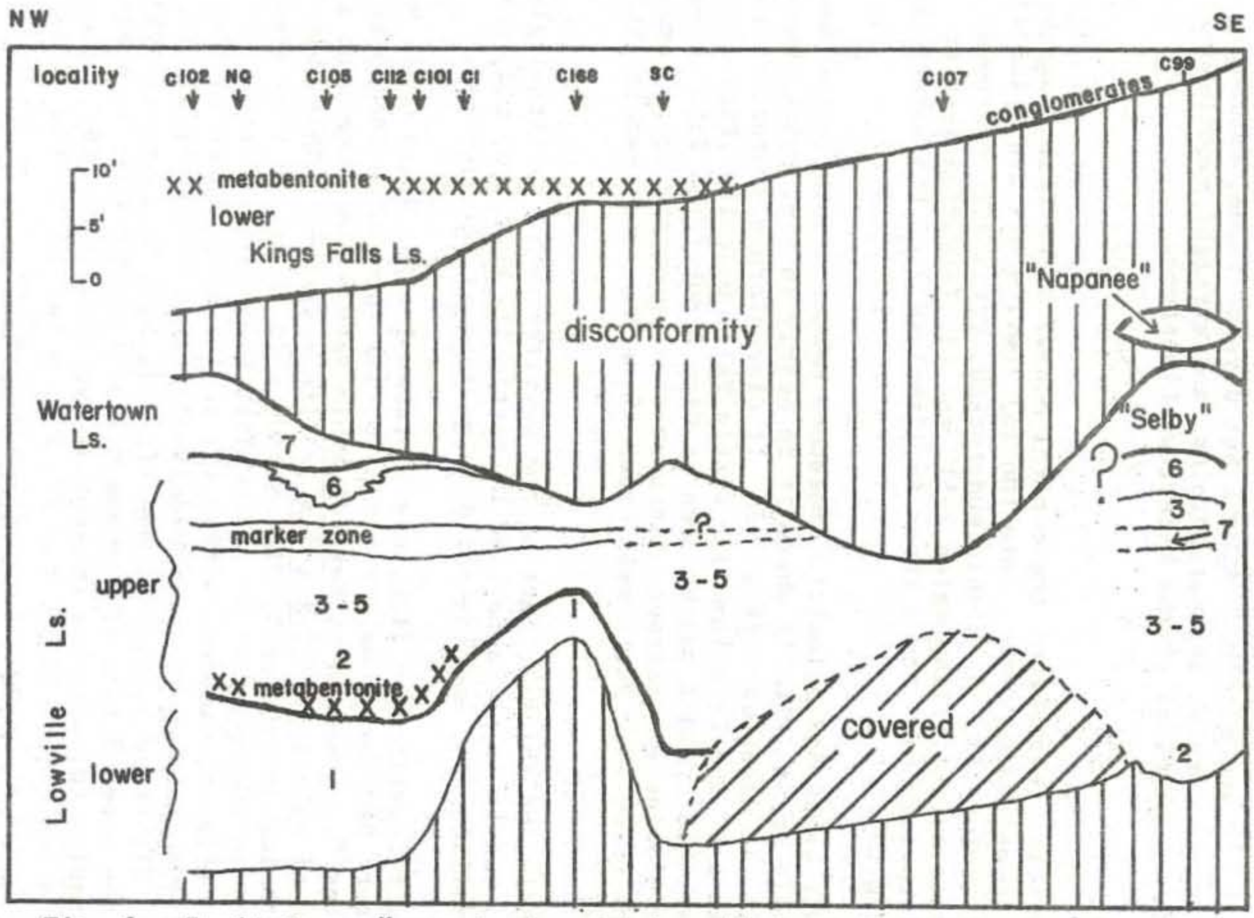


Fig. 3. Preliminary "correlation-thickness" chart for the Black River and lower Trenton groups in the central Mohawk River Valley. Thicknesses are shown along with disconformities (vertical lines). Horizontal time lines are assumed to be the upper metabentonite and the argillaceous marker zone; the lower metabentonite would also be a horizontal line on a true correlation chart. See Figure 5 for a guide to symbols and abbreviations. Numbers refer to lithologies described in text.

Lithology 6: Thin- to medium-bedded, yellowish gray weathering, medium gray, bioclastic limestone. This Tetradium (tabulate coral)-bearing lithology ranges from a biomicrite (or fossiliferous micrite) to a biosparite.

Lithology 7: Thick ledged, cherty, lumpy and wavy bedded, thoroughly horizontally burrow-reworked biomicrite, pelmicrite, and micrite. Sparse but diverse fauna, including corals, stromatoporoids, and straight nautiloids. Typical of the Watertown Limestone.

Stratigraphy

The Lowville Limestone of the central Mohawk River Valley can be subdivided, in ascending order, into the (1) lower sandy and dolomitic limestone (lithology 1), (2) middle mudcracked, vertically burrowed, dove-gray calcilutite (lithologies 2-5), and (3) Tetradium-bearing limestone (lithology 6). Above these is lithology 7 of the Watertown Limestone (Fig. 3).

The lower sandy and dolomitic limestone member occurs in the Newport and Middleville areas (Fig. 1) where it is nearly 16 feet thick, but east of Middleville it disappears (Fig. 5). It disconformably overlies the sandy dolomites of the Late Cambrian Little Falls Dolomite (Fig. 5). The relief at this contact can be seen at City Brook (Stop #5). A metabentonite or prominent reentrant occurs at the top of the lower member at City Brook (Stop #5), Buttermilk Creek (Stop #6), and Newport (Stop #8) (Fig. 5).

The middle and thickest part of the Lowville contains lithologies 2 through 5, but it is characterized by vertically burrowed, mudcracked, sparsely fossiliferous, and laminated (algal? mats) calcilutites.

The upper Lowville, or lithology 6, resembles the House Creek Member of northwestern New York. Walker (1973, p. 11) introduced the House Creek as being "...composed of Tetradium bioclastic limestone with a central zone of colonies of Tetradium in life position." This thin bioclastic facies is apparently discontinuous in the field trip area, occurring (1) in the upper 2' 4" at locality C105 to the north at Diamond Hill (Fig. 5; Cameron, 1969), (2) in the upper three to five inches in the south Newport-north Middleville area (localities C112, C112A, C101, C1; Stops 5, 6, & 7; see Figs. 1, 5, & 8; Cameron, 1969), and (3) in the upper 8 feet at Inghams Mills (locality C99; Stop #2). Upright Tetradium colonies are present at two localities (C99, Stop #2, Fig. 8 of Cameron, 1969; C112, Stop #7, Fig. 8 herein). This facies is apparently absent at Newport (Stop #8) and at exposures in Poland, the next town to the north.

Correlation

The nearshore carbonate lithologies of the Lowville Limestone are complexly interbedded. This interbedding is indicative of "yo yo oscillation" (Friedman, 1975) across the shoreline, such as in sabkhas. Such interbedding makes correlation very difficult. Furthermore, much of the strata was deposited in local areas (lenses) and, as such, may not be directly correlative with strata of the same lithology at a geographic distance. Lithological similarity has remained, therefore, the major method of correlation, using marker beds, metabentonites and geometric relationships.

Correlation of the lower strata of the formation was done through recognizing the lower sandy and dolomitic member (lithology 1). In three of the sections (Stops 5, 6, & 8), the member is topped by a two to four inch metabentonite or a reentrant whose unique position favors its acceptance as a suitable time line (Fig. 5).

A marker zone of thin, shaly and argillaceous limestone about two or more feet thick near the top of the Lowville stands out physically with a definite lumpy weathering appearance. It is traceable among eight of the sections and serves as a correlatable horizon for the upper part of the Lowville (Fig. 5).

The marker zone, the metabentonite and the Tetradium-bearing bioclastic facies appear progressively higher in the sections eastward. This and the fact that the Watertown Limestone above the Lowville pinches out eastward (Cameron, 1969; Cameron and Mangion, 1977) indicates that (1) the top of the Lowville Limestone is older eastward and (2) the unconformity of the Lowville Limestone with the overlying Trenton Group is larger eastward. Inghams Mills (Stop #2) appears to be an exception because a nearly complete section is preserved locally (Fig. 3).

Paleoshoreline

A time-stratigraphic relationship is postulated in the east-west direction for the Lowville in the study area (Fig. 3). Because the transgressive sequence does not cross time-lines, the outcrop in central New York is postulated to have been parallel to a paleoshoreline to the north. Walker (1973) concludes that the Lowville Limestone in northwestern New York is time-stratigraphic in the north-south direction parallel to the outcrop belt, but postulates a time-transgressive relationship in an east-west direction at right angles to the outcrop belt. In central New York, on the other hand, such a time-transgressive model would be in a north-south direction. Most likely, the paleoshoreline was north-south along the western side of the Adirondacks and east-west along the southwestern side of the Adirondacks. Connecting these two areas suggests a paleoshoreline that may have encircled an Ordovician low lying landmass - Adirondackia of Kay (1937).

Paleoenvironments

Seven nearshore to offshore carbonate environments of depostion are recognized in the transgressive Black River Group as inferred from lithofacies distributions. Although the seven lithofacies occur most often in pure form, they are best considered as ideal end members. Lateral gradations occur between some of them and vertical gradations are common. The environments of depostion of these lithofacies are inferred on the basis of lithology, textural features, sedimentary structures and paleontologic considerations (Kamal, 1976, 1977) (Fig. 4).

Supratidal environments (lithology 2) are characterized by nonfossiliferous, layered, mudcracked, dolomitic, pelletal dismicrites and dolomitic quartzose calcarenites (lithology 1).

High intertidal environments (mostly lithologies 3 and 4 and some 2) are characterized by vertically burrowed, well-bedded, mudcracked, pelletal, laminated (algal?) biomicrites and biopelmicrites. Intrasparites are common. Fossil debris, mainly large leperditid ostracodes are rare to common.

Low intertidal environments (some of lithologies 3, 5, & 6) are characterized by sparsely fossiliferous, poorly bedded, laminated (algal?) micrites. This facies is readily recognized by combinations of mottling, vertical burrows, and pelloids.

Shallow subtidal or lagoonal environments (mostly lithology 5) are characterized by sparsely to commonly fossiliferous and horizontal burrow-reworked micrites. Fossils range from a few ostracodes to skeletal debris mainly containing snails, trilobie fragments, coral fragments and cryptostome ectoprocts.

Shoal environments (lithology 6), or wave-baffles of Walker (1973), are composed chiefly of biomicrites and, occasionally, biosparites. The tabulate coral Tetradium celluloseum in life position (Fig. 8 herein; Cameron, 1969, Fig. 8, p. 15-16), is common in this facies (Stops 2, 6, & 7).

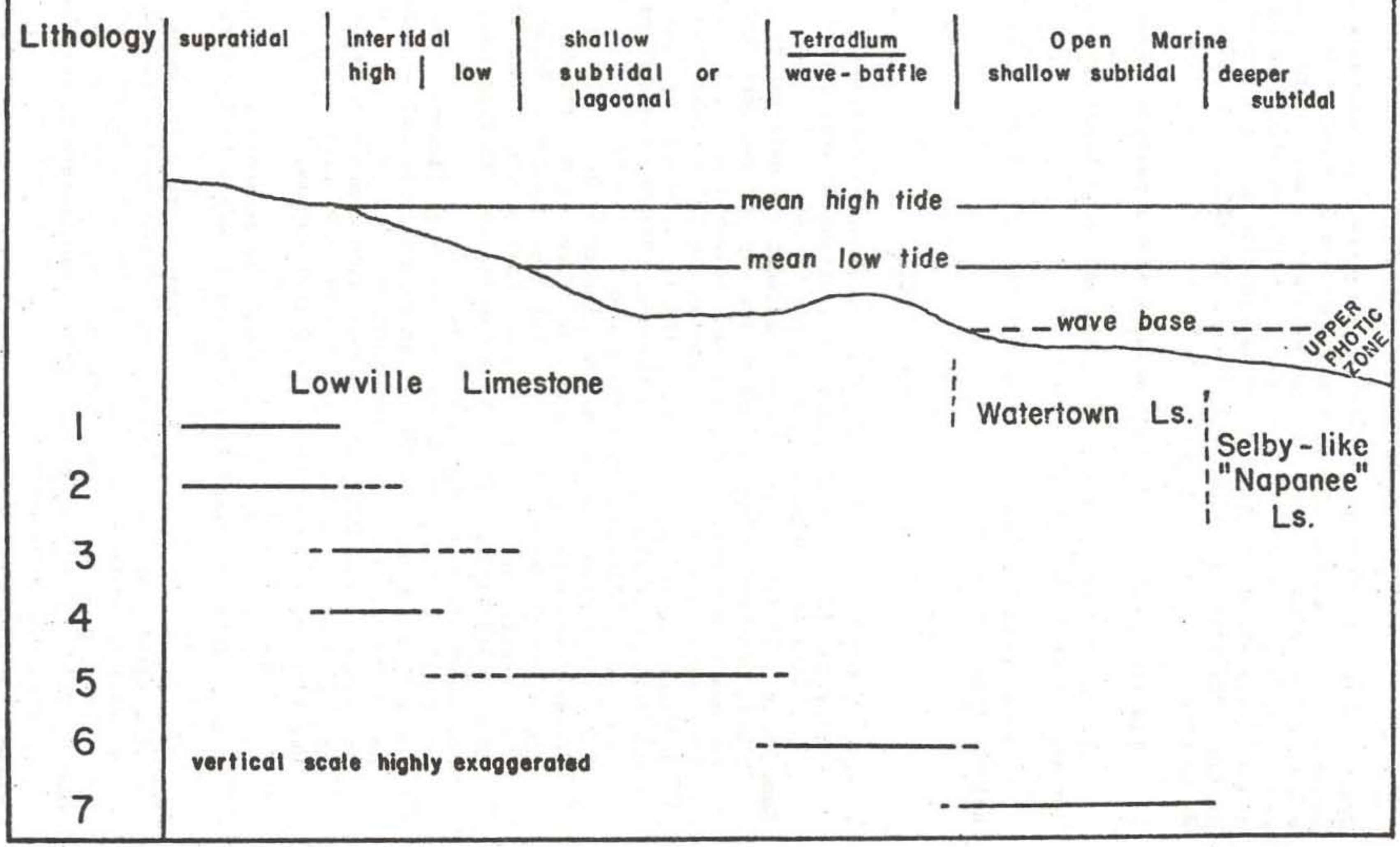
Open marine, shallow "level-bottom" environments are characterized by thorough horizontal burrow-reworking, obscured bedding, and diverse and abundant fossils. This facies is represented by the Watertown Limestone. The major fossils include tabulate and rugose cup corals, normal salinity requiring ectoprocts, brachiopods, and echinoderms, and mollusks, such as nautiloids, snails, and clams. Uncommon calcareous algae, micrite envelopes of possible endolithic (shell-boring) algal origin, and algal(?) borings indicate deposition within the photic zone, while the burrow-reworking indicates depths below wave-base (e. g., 10 meters or more).

Deeper subtidal environments are represented by the shaly, very fossiliferous, Selby-like lower "Napanee" at Inghams Mills (Stop #2). This was probably deposited in still deeper water than the Watertown (lithology 6), but rare micrite envelopes indicate depths still within the photic zone.

ACKNOWLEDGMENTS

Much of the paleoenvironmental and stratigraphic work was supported by the Division of Earth Sciences, National Science Foundation, NSF

Fig. 4. Litholgic-Environmental Model for the Black River Group



Grant GA-23740 to Cameron. Preliminary biostratigraphic work was supported by a research grant from the Graduate School of Boston University (GRS-GL200) to Cameron. The preliminary work on the use of endolithic algae (shell - borings) and micrite envelopes as paleodepth indicators was supported by the Division of Earth Sciences, National Science Foundation, NSF Grant EAR76-84233 to S. Golubic and B. Cameron.

This field guide includes some work from a masters thesis by R. Kamal.

Dr. Robert Titus, Stephen Mangion, and Renya Kamal are each thanked for assistance in the field.

Diane Grenda, China Ayer, Randi Blattberg, and Dr. J. Richard Jones helped prepare this manuscript.

REFERENCES CITED

Barnes, C. R., 1967, Stratigraphy and sedimentary environments of some Wilderness (Ordovician) limestones, Ottawa Valley, Ontario: Canadian Jour. Earth Sci., v. 4, p. 209-244.

Cameron, B., 1968, Stratigraphy and sedimentary environments of lower Trentonian Series (middle Ordovician) in northwestern New York and southeastern Ontario: Ph.D. diss., Columbia Univ., New York, p. 271.

____1969, Stratigraphy of upper Bolarian and lower Trentonian limestones: Herkimer County, <u>in</u> Bird, J. M. (Ed.), Guidebook for field trips in New York, Massachusetts, and Vermont, 1969 New England Intercoll. Geol. Conf., Albany, New York, p. 16-1 to 16-29.

____1972, Stratigraphy of the marine limestones and shales of the Ordovician Trenton Group in central New York: <u>in</u> McLelland, J. (Ed.), Field Trip Guidebook, New York State Geol. Assoc., Colgate Univ. 23 p.

____1973, Epeiric sea transgression and bank models for the Trenton Group (Middle Ordovician) of New York: Abstracts with Programs, Geol. Soc. America, v. 5, no. 1, p. 145.

____and Kamal, R. A., 1976, Comparison and significance of vertical sedimentary structures in Ordovician carbonate shoreline deposits: Abstracts with Programs, Geol. Soc. America, v. 8, p. 9-10.

____and Mangion, S., 1977, Depositional environments and revised stratigraphy along the medial Ordovician Black River-Trenton boundary in New York and Ontario: Abstracts with Programs, Geol. Soc. America, v. 9, no. 3, p. 250.

____and Mangion, S., 1977, Depositional environments and revised stratigraphy along the Black River-Trenton boundary in New York and Ontario: Amer. Jour. Sci., v. 277, p. 486-502.

____Mangion, S. and Titus, R., 1972, Sedimentary environments and biostratigraphy of the transgressive early Trentonian sea (Medial Ordovician) in central and northwestern New York, <u>in</u> McLelland, J. (Ed.), Field Trip Guidebook, New York State Geol. Assoc., Colgate Univ., 39 p.

Clarke, J. M. and Schuchert, C., 1899, Nomenclature of the New York Series of geologic formations: Science, v. 10, p. 874-878.

Craig, L. C., 1941, Lower Mohawkian stratigraphy of central New York State: Masters thesis, Columbia Univ., New York.

Cushing, H. P., 1905, Geology of the vicinity of Little Falls, Herkimer County: New York State Mus. Bull. 77, 95 p.

Fisher, D. W., 1962, Correlation of the Ordovician rocks in New York State: New York State Mus. and Science Service, Geological Survey, Map and Chart Ser., no. 3.

____1977, in press, Correlation of the middle and upper Ordovician rocks in New York State: New York State Mus. and Sci. Service, Geological Survey, Map and Chart Ser., no. 25.

Friedman, G. M., 1975, The making and unmaking of limestones or the downs and ups of porosity: Jour. Sed. Petrology, v. 45, p. 379-398.

Kamal, R. A., 1976, Gull River Limestone - Transgressive sequence of supratidal to subtidal and shoal deposits in medial Ordovician of central New York: Amer. Assoc. Petroleum Geologists Bull., v. 60, p. 685-686.

____1977, Interpretive Stratigraphy of the Lowville Limestone (Medial Ordovician) of Central New York: Masters thesis, Boston Univ., 84 p.

Kay, G. M., 1929, Stratigraphy of the Decorah Formation: Jour. Geology, v. 37, p. 639-671.

____1937, Stratigraphy of the Trenton Group: Geol. Soc. America, Bull., v. 48, p 233-302.

____1942, Ottawa-Bonnechere Graben and Lake Ontario Homocline: Geol. Soc. America, Bull., v. 53, p 585-646, 7 pls., 7 figs.

____1943, Mohawkian Series on West Canada Creek, New York: Amer. Jour. Sci., v. 241, p. 597-606.

____1953, Geology of the Utica Quadrangle, New York: New York State Mus. Bull. 347, p. 1-126.

____1968, Ordovician formations in northwestern New York: Naturaliste Canadien, v. 95, p. 1373-1378.

Liberty, B. A., 1969, Paleozoic geology of the Lake Simcoe area, Ontario: Canada Geol. Survey Mem 355, 201 p.

Mangion, S., and Cameron, B., 1973, Early Trentonian transgressing sea: Environmental stratigraphy of its final phase in central and northwestern New York: Abstracts with Programs, Geol. Soc. America, v. 5, no. 2, p. 193.

Park, R. A., and Fisher, D. W., 1969, Paleoecology and stratigraphy of Ordovician carbonates, Mohawk Valley, New York, in Bird, J. M. (Ed.), Guidebook for field trips in New York, Massachusetts, and Vermont, 1969 New England Intercoll. Geol. Conf., Albany, New York, p. 14-1 to 14-16.

Rickard, L. V., 1973, Stratigraphy and structure of the subsurface Cambrian and Ordovician Carbonates of New York: New York State Mus. and Science Service, Map and Chart Ser., no. 18.

Textoris, D. A., 1968, Petrology of supratidal, intertidal, and shallow subtidal carbonates, Black River Group, middle Ordovician, New York, U. S. A.: XXIII Internat. Geological Congress, v. 8, p. 227-248.

Titus, R., 1973, Fossil assemblages and paleoecology of the Kings Falls and Sugar River limestones (Medial Ordovician, Northwestern New York

State: Abstracts with Programs, Geol. Soc. America, v. 5, no. 2, p. 228-229.

____1974, Fossil communities and paleoecology of the Medial Ordovician Kings Falls and Sugar River limestones (Trenton Group) of northwestern and central New York: Ph.D. diss., Boston Univ., 249 p.

____and Cameron, B., 1976, Fossil communities of the lower Trenton Group (Middle Ordovician) of central and northwestern New York: Jour. Paleontology, v. 50, p. 1209-1225.

Vanuxem, L., 1842, Geology of New York, part III, White and Visscher, Albany, New York, p. 306.

Walker, K. R., 1972, Community ecology of the Middle Ordovician Black River Group of New York State: Geol. Soc. America Bull., v. 83, p. 2499-2524.

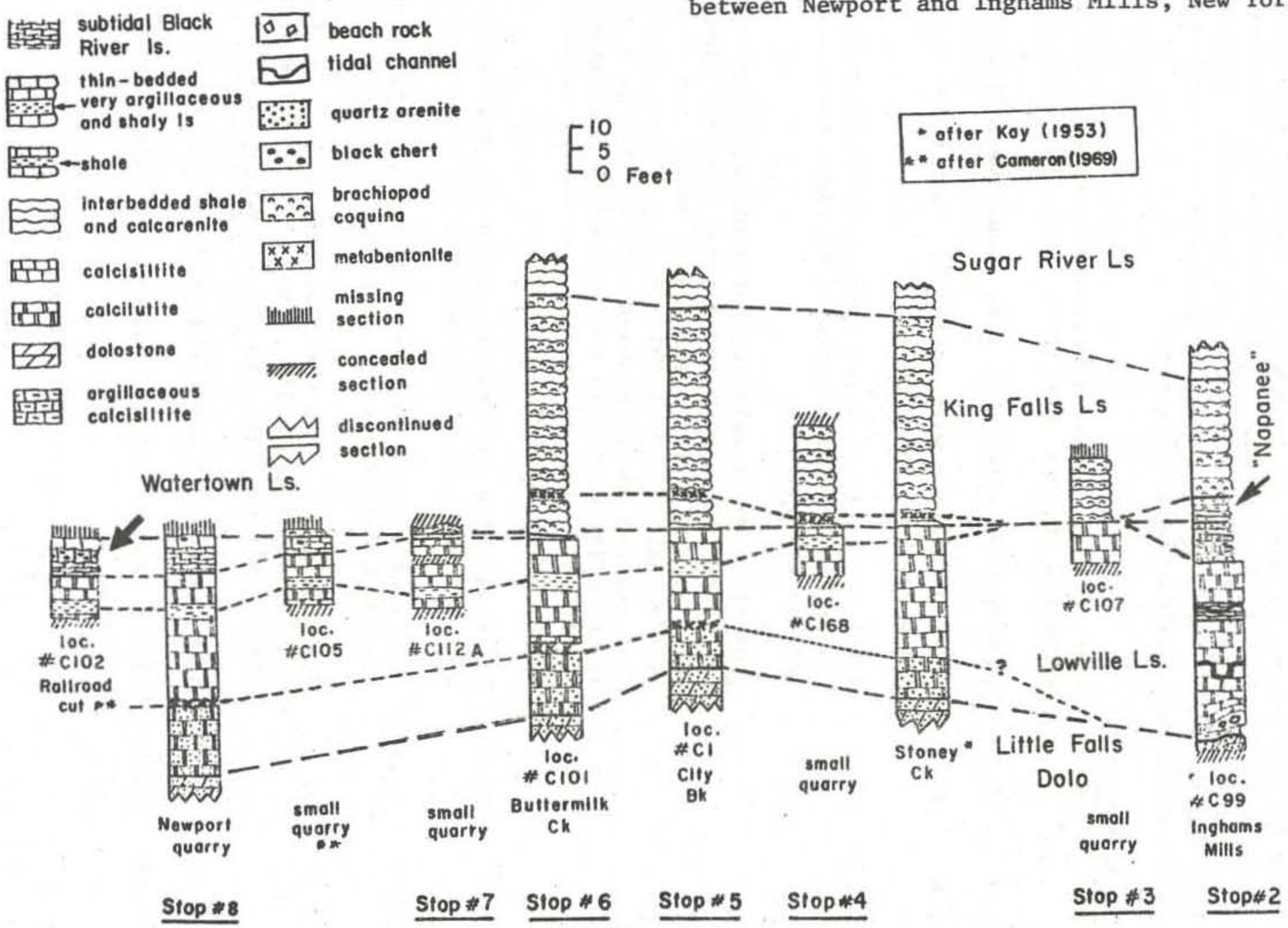
____1973, Stratigraphy and environmental sedimentology of the Middle Ordovician Black River Group in the type area - New York State: New York State Mus. and Science Service Bull. 419, 43 p.

____and Laporte, L. F., 1970, Congruent fossil communities from Ordovician and Devonian carbonates of New York: Jour. Paleontology, v. 44, p. 928-944.

Wilson, A. E. ,1946, Geology of the Ottawa-St. Lawrence Lowland, Ontario and Quebec: Geol. Surv. Canada, Mem. 241, 65 p. & maps.

Young, F. P., 1943, Black River stratigraphy and faunas: Amer. Jour. Sci., v. 241, p. 141-166 & 209-240.

Fig. 5. Measured sections of the Black River Group between Newport and Inghams Mills, New York.



Mileage Log

This mileage log is designed to start in Richfield Springs at the intersection of Routes 20 and 167. From Oneonta, take Route 205 north to Route 80, drive east on Route 80 to Route 28, and then take Route 28 north to Richfield Springs. As you intersect Route 20, from Route 28, turn right (east) onto Route 20. Go 0.4 mile to traffic light where a left (north) turn starts this road log on Route 167. A road sign at this intersection says "Little Falls 17 miles."

*In Mi	**Cu Mi	
0.00	0.00	Traffic light at intersection of Routes 20 and 169 in Richfield Springs, New York. Go north on Route 167.
9.9	9.9	Intersection with Route 168. Continue north on Route 167.
5.6	15.5	"T"-intersection with Route 5S. Turn right (east) onto Route 5S and drive uphill.
0.8	16.3	Small vegetation covered outcrop of Trenton limestones (upper Kings Falls Limestone) on right side of road. Park on the shoulder.
		Stop #1: While watching for traffic, cross highway to the small clearing and descend the bank along the small stream at the right (east) end of the clearing. (The stream is not visible until you enter the brush.) Cross stream and walk about 100 feet to the near end of the cliff where 2.5 feet of medium dove gray Lowville Limestone is exposed beneath the coarse, cross-laminated, shelly lower Kings Falls Limestone.
0.0	16.3	While watching for traffic, carefully make a "U"-turn and head west, downhill, on Route 5S.
0.85	17.15	Intersection with Route 167 north. Turn right and head towards Little Falls.
0.05	17.2	Outcrops of the late Cambrian Little Falls Dolomite on both sides of Route 167. This unit directly underlies the Black River Group in this area.
0.25	17.45	More outcrops of the Little Falls Dolomite on the right.
1.45	18.9	Cliffs of Little Falls Dolomite, a thick formation, on the right.
0.1	19.0	Bridge crossing Mohawk River Canal.

*In Mi = Incremental Mileage
**Cu Mi = Cumulative Mileage

0.05	19.05	Bridge crossing Mohawk River.
0.1	19.15	Stop sign. Continue straight after checking for traffic.
0.05	19.2	Stop sign at "T"-intersection. Turn right and stay in right lane.
0.1	19.3	Stop sign. Turn right and get into the left (turning) lane.
0.05	19.35	"T"-intersection with Route 5, a divided highway. Turn left onto Route 5 and head east.
0.45	19.8	Traffic light at intersection with Route 169. Proceed straight on combined Routes 5 and 167.
0.2	20.0	Precambrian gneiss on both sides of highway. This unit underlies the Late Cambrian Little Falls Dolomite in this area.
0.3	20.3	Get into left lane in preparation for a left turn.
0.1	20.4	Blinking yellow traffic light. Turn left onto Route 167 north.
0.9	21.3	Turn right into scenic view parking area.
0.1	21.4	North end of parking lot by sign explaining this historic part of New York. A nice view of the Mohawk River Valley to the east can be seen from this upthrown side of the Little Falls Fault (Cushing, 1905, p. 38).
0.2	21.6	Outcrop of Little Falls Dolomite on left side of road.
1.45	23.05	Proceed straight ahead, leaving Route 167. Pass Exxon Station on your left. Now on Dockey Road.
0.15	23.2	Intersection with Bidleman Road. Proceed straight ahead.
0.4	23.6	"Y"-intersection after small bridge. Bear left onto Inghams Mills Road.
0.75	24.35	Intersection with Snells Bush Road (once East Creek Road). Continue straight on Inghams Mills Road.
0.75	25.1	After driving down hill, continue straight onto dirt road (a dead end sign marks it). (Do not turn right and go onto the large bridge over East Canada Creek.) Note: Poor roadside exposures of Rocklandian and Kirkfieldian (lower Trentonian) limestones and shales to the left. If the power company (Niagara-Mohawk) does not permit trespassing, park and walk across the large bridge. Descend the left (upstream) side to the large limestone exposures at the inside of the meander to see all but the base and top of the Lowville Limestone. The 4 foot thick, burrow-reworked, Watertown-like, subtidal facies caps the exposure.

0.05	25.15	Turn right and cross small wooden bridge.
0.04	25.19	After crossing wooden bridge, take right fork in dirt road.
0.02	25.21	Turn left in front of building.
0.02	25.23	Turn left back onto dirt road.
0.05	25.28	Park on grass along right side of dirt road.

Stop #2. Inghams Mills (locality #C99):

Walk to the right, through the grass, and proceed to the right of the tall chain-link fence, walking beneath the powerline tower. At the stone wall along the edge of the field, bear left and walk along the fence. (CAUTION: Poison ivy often grows in abundance along this path.) Opposite the brick building, turn right and proceed very carefully over the boulders and across the creek towards the base of the outcrop. The boulders you will have to walk over to get to this exposure are sometimes unstable and move when stepped on. Some are sharp and dangerous.

Four formations of Medial Ordovician age are excellently exposed along with the top of the Late Cambrian Little Falls Dolomite(?) below the dam on East Canada Creek. Lithologies, unusual sedimentary structures, fossils, formation boundaries, and disconformities can be carefully examined.

Little Falls Dolomite(?). Only 2 feet of the Late Cambrian Little Falls Dolomite are exposed at the base of the exposure. This unit is represented by relatively thick-bedded, light to medium brown weathering, quartz arenitic, pyrite-bearing dolostone with thin interbedded shale layers.

Lowville Limestone. About 29.5 to 30 feet of Lowville Limestone are excellently exposed with a thick dove gray shaly limestone at the base. The lowest 2 to 3 feet exhibit a slump and boulder beachrock (Figs. 5-6) containing limestone blocks up to 2.5 feet in diameter, that probably formed as a result of instability over the irregular depositional surface of the Little Falls Dolomite. This might be a channel margin slump, e. g., bank collapse deposit.

The next 16.5 feet contain horizontally laminated (algal?), dove gray calcilutites with abundant vertical burrows (Phytopsis), a few ostracodes. and frequent stylolites. Frequent mudcracks confirm an intertidal origin. A tidal channel (Figs. 5,7) is wholly exposed on the west side of the outcrop (old stream channel).

Fig. 6. Beach-rock at base of Lowville Limestone at Inghams Mills (locality C99; Stop #2). Hammer is scale.

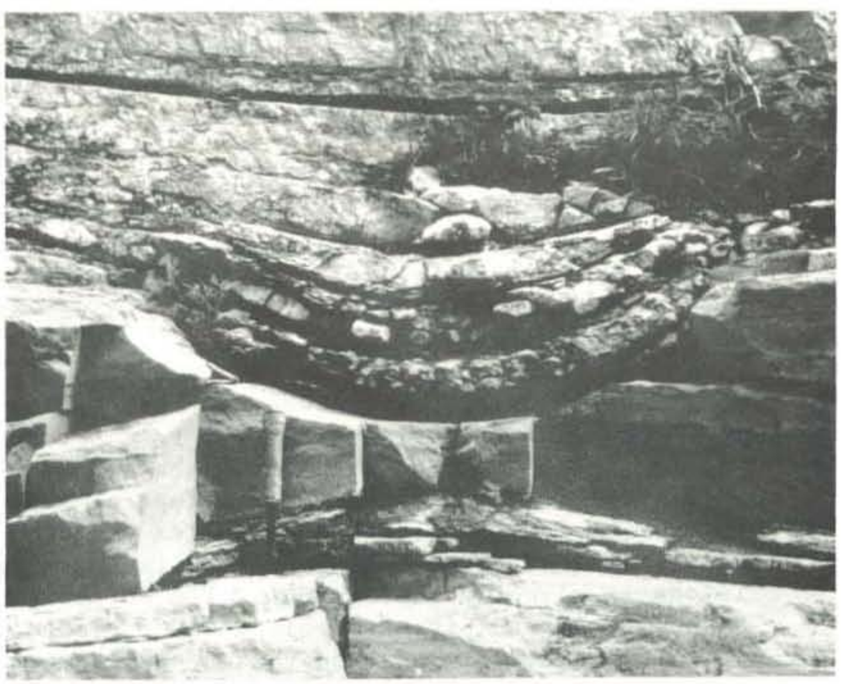


Fig. 7. Tidal channel cutting intertidal lithologies in the middle Lowville Limestone at Inghams Mills (locality C99; Stop #2). Hammer is scale.

Between 16.5 and 21.5 feet an apparently subtidal, irregularly burrowed, essentially non-laminated, massively bedded, dark gray to black calcisiltite zone contains Foerstephyllum halli, Lambeophyllum profundum, Hormotoma, Loxoplocus, Isotelus, cryptostome bryozoa, straight nautiloids, and pelmatozoan debris. This resembles the subtidal Watertown Limestone to the northwest.

Immediately above these deeper water sediments, the intertidal facies begins to reappear. This is a vertically burrowed, horizontally laminated (algal?), limestone intraclast-bearing, fossiliferous calcilutite and calcisiltite zone. Fossils from this interval include Tetradium cellulosum, Eoleperditia fabulites, Lambeophyllum profundum, Isotelus, cryptostome bryozoa, and pelmatozoan fragments. Near the base of this zone a sediment-filled tidal meander(?) or channel (Cameron, 1969, see Fig. 7) up to 7 feet wide and 2 feet deep is excellently exposed in 2 faces of the outcrop. Note the structure and composition of the sediments filling it.

At about 27 feet, a 9 inch thick calcilutite bed contains scores of whole Tetradium cellulosum colonies in life position that cover 50% to 90% of the bed which contains a thin veneer of limestone pebble conglomerate. One can readily see how the fine-grained sediment was trapped in and around these delicately branching tabulate corals. This is also equivalent to Walker's (1973) wave-baffle lithology and it resembles his House Creek Member of the Lowville Limestone in northwestern New York (Fig. 8; see Fig. 8 of Cameron, 1969).

The top of the Lowville Limestone is riddled with burrows (dominantly vertical) partially filled with the black lustrous carbonaceous mineral anthraxolite. Several inches of irregular relief over the top of this bed may mark a disconformity between the Black River Group and the Trenton Group.

Trenton Group. The lowest 13 feet of the Trenton(?) limestones can be divided into 7.5 feet of chocolate brown weathering interbedded calcareous shales and argillaceous calcisiltites at the base and 5.5 feet of medium gray weathering interbedded thinner shales and less argillaceous calcisiltites above. The contact between these 2 subdivisions is slightly gradational. The surfaces of the limestone layers exhibit extremely well-developed loading casts. In addition, the lower subdivision contains an unusually well-developed and fully exposed intraformational fold similar to those described by Chenowith (1952) from the Sugar River Limestone in northwestern New York. Fossils are common. The fauna of the lower 7.5 feet is that of the uppermost Black River Group, i. e., the Selby Limestone of northwestern New York (Cameron and Mangion, 1977), while the fauna of the upper 5.5 feet resembles that of the lower Trentonian Napanee Limestone. Overlying these limestones is the 38 foot thick Kings Falls Limestone with basal conglomerates.

0.0	25.28	Drive straight ahead on the dirt road.
0.02	25.3	Turn left onto dirt road leading from power plant.
0.05	25.35	Bear right, crossing small wooden bridge. Then, bear left.
0.05	25.4	Intersection with Inghams Mills Road. Proceed straight, uphill. (Do not turn left and cross bridge.)
0.8	26.2	Intersection with Snells Bush Road. Turn right.
2.15	28.35	Intersection with Route 167. Turn right onto Route 167, heading north.
0.4	28.75	Turn left onto Bronner Road.
0.65	29.4	Intersection with Murphy Road. Continue straight on Bronner Road.
0.6	30.0	Bear right where Bronner Road turns right (intersection with Davis Road).
0.2	30.2	"Y"-intersection. Bear left, continuing on Bronner Road.
1.25	31.45	Park on right side of road.

Stop #3. Small quarry (locality #C107):

Walk into small old quarry about 100 feet into field from right side of road.

The Black River-Trenton boundary is well-exposed along the contact between 8 feet of upper Lowville Limestone and 13 feet of lower Kings Falls Limestone. The very shaly lowest 13 feet of Trenton(?) limestones seen at Stop #2 is absent and pebbles of the Lowville Limestone can be seen in the lowest few inches of the Kings Falls. There is little relief along this contact to suggest a disconformity.

The thickest section of the Lowville occurs at the axis of the fold at the far end of the quarry. Shales are rare. Fossils are uncommon but include Isotelus, Eoleperditia fabulites, small ostracodes, Liospira, and cryptostome bryozoa. Tetradium cellulosum is absent.

The very fossiliferous Kings Falls Limestone exhibits the somewhat typical cyclic nature of burrowed finer-grained calcarenites and calcisiltites alternating with cross-laminated, coarse-grained calcarenites and coquinites.

0.0	31.45	Proceed straight ahead (west).
0.15	31.6	Intersection with Burrell Road. Turn left (south).
0.1	31.7	Exposures of Shorehamian limestones (Trenton Group) on both sides of Burrell Road.
0.2	31.9	Intersection with Yellow Church Road. Turn right (west) onto Yellow Church Road.
0.7	32.6	Intersection with Route 170. Proceed straight ahead. Yellow Church Road changes name to Top Notch Road.
0.7	33.3	Intersection with dirt road. Bear right, continuing on paved road.
0.45	33.75	Intersection. Continue straight ahead.
1.05	34.8	Intersection with Cole Road. Continue straight ahead. Top Notch Road changes name to Rockwell Road.
0.75	35.55	Acute angle intersection with Route 169. Proceed north on Route 169.
4.6	40.15	Crossing Stoney Creek in a relatively narrow stream valley.
0.6	40.75	Park on right side of road by entrance to quarry uphill from small creek and outcrop of Little Falls Dolomite.

Stop #4. Small quarry (locality #C168):

Walk along dirt road into small old quarry (now a private dump about 100 feet into woods from right side of road (Route 169)).

At this stop, we shall (1) examine metabentonites at the base of the Kings Falls Limestone and (2) reexamine the Black River-Trenton boundary between the upper Lowville and lower Kings Falls limestones. The top of the Lowville has 1 to 2 inches of relief, possibly due to scouring since bedding laminae are truncated. The shaly and argillaceous limestone interval between 2 and 3 feet appears to form a marker zone that can be traced from here northwestward to Newport. *Tetradium* is absent. The 4.5 foot sandy lower member can be seen in the lower quarry. The Lowville is about 11.5 feet thick at this locality.

The fossiliferous Kings Falls contains cream-colored, sticky, 2 to 3 inch thick metabentonites at 12 and 29 inches. A similar 2 inch thick clay has been reported at 2 feet from Stony Creek one-half mile to the southeast (Craig, 1941; Kay, 1943, 1953). We shall evaluate the significance of these clays for time-correlation at the next stop.

0.0	40.75	Proceed downhill (north), continuing on Route 169.
1.05	41.8	Stop light. Downtown Middleville. Proceed straight ahead onto Route 28 North.
0.7	42.5	Quarry on right is in Little Falls Dolomite.
1.1	43.6	Turn right onto paved road. Drive straight uphill (not a hard right turn).
0.25	43.85	"Y"-intersection. Bear left, going downhill, onto Old City Road.
0.15	44.0	Park on either side of road before bridge over City Brook.

Stop #5. City Brook (locality #C1):

Walk onto bridge and look upstream towards the falls. This outcrop has been CLOSED to trespassers, but we can look and talk here.

The characteristics of the Lowville and lower Trenton limestones will be compared with those at previous stops. The Lowville Limestone lies disconformably on the quartz arenite-rich Late Cambrian Little Falls Dolomite below the bridge. The lower falls is supported by the upper Lowville Limestone, and the upper falls (Craig, 1941, Fig. 5; Kay, 1953, Fig. 11) is supported by the middle Kings Falls Limestone.

Lowville Limestone. The lower 7 feet are tan weathering, gray, quartz arenite-rich, ostracode-bearing, impure, thick-bedded, medium-textured, dolomitic, argillaceous limestones interbedded with a few calcareous shales up to 3 inches thick. Vertical burrows are abundant. A 3 inch thick metabentonite occurs at 6' 9" (Kay, 1943, 1953). Kay (1953) correlated this with a prominant reetrant at the top of this lower member at Newport Quarry (Stop #8, Fig. 5).

The upper 19.5 feet of the Lowville is composed of relatively pure, light gray weathering, dove gray, conchoidally fracturing calcilutite (sublithographic) and some calcisiltites. Stylolites are abundant from 11 to 16 feet. Thin shales are frequent between 13 and 16 feet, at the 18th foot, and especially between 19.5 and 21.5 feet where the limestones are very argillaceous (argillaceous marker horizon). Vertical burrows (Phytopsis) are abundant between 11 and 16 feet and in the top foot. Mudcracks occur above and below the 25th foot. An intertidal origin seems probable for these limestones. Tetradium is extremely rare in the upper few feet.

Kings Falls Limestone. Sediment from a coquinal calcarenite bed at the base of the Kings Falls fills some of the burrows in the highly burrow-reworked calcilutite bed at the top of the Lowville. The Kings Falls is characterized by coquinal calcarenites, as at previous localities. Cross-laminated and pararippled beds are frequent.

At 7 feet a deep reentrant marks where a metabentonite is weathering out. Less than a mile north, at Buttermilk Creek (Stop #6), this clay is 9 feet above the base of the Kings Falls (Kay, 1953). If this altered volcanic ash near the base of the Kings Falls between Stony Creek and Buttermilk Creek is part of a single bed, then it represents a synchronous time surface indicating that this formation is onlapping the Lowville eastward. Therefore, the base of the Kings Falls becomes progressively younger eastward, increasing the gap in time marked by the Black River-Trenton boundary in that direction (Fig. 3).

0.0	44.0	Proceed straight ahead, crossing bridge.
0.05	44.05	(Herkimer diamonds are common in the Little Falls Dolomite downhill to the left.)
0.5	44.55	Turn sharp, acute, right onto White Creek Road.
0.4	44.95	Buttermilk Creek. Carefully park on the shoulder. Do not block the driveway.

Stop #6. Buttermilk Creek (locality #C101):

Descend to the creek from the bridge and walk upstream. The Little Falls Dolomite comprises the streambed at the bridge. As you walk upstream, you will walk through the Lowville Limestone and eventually reach the Trenton limestones (Kings Falls).

The lower sandy member (11-12 feet) of the Lowville can be seen roughly between 2 broad flat areas in the streambed. The 23-24 foot thick upper Lowville is fully exposed as you walk further upstream. The argillaceous marker horizon (about 2 feet thick) occurs 6 feet below the top. From 2 to 5 inches below the top there are pieces of the colonial tabulate coral Tetradium. Beneath the Tetradium, vertically burrowed calcilutites dominate down to the marker horizon. The uppermost 1 to 2 inches contain a strophomenid-rich layer resembling the top of the Watertown Limestone at the next stop (Stop #7).

The Kings Falls Limestone, disconformably overlying the Lowville, is shelly, shaly, pararippled, cross-laminated, and sheet-laminated. A metabentonite, reviewed at City Brook (Stop #5), occurs at 9 feet above the base. The Trenton Group at this outcrop is described in more detail by Cameron, Mangion and Titus (1972).

0.0 44.95 Continue north on White Creek Road.

0.3 45.25 Intersection with Elm Tree Road. Turn right.

0.05 45.3 Barbed wire gate to "car graveyard." Park on shoulder of road.

Stop #7. Small hillside quarry exposures (locality #C112A):

Open gate, go through, CLOSE GATE, and walk uphill to last major exposure in field (about 100 feet from road). Return to cars by way of gate. Be sure it is closed when you leave.

The Watertown burrow-reworked lithology first appears as about a 1 foot thick, but recognizable, lithology at this locality. It can be distinguished from the subjacent vertically burrowed calcilutites of the Lowville and the superjacent calcarenites of the Kings Falls. Large tabulate corals (Foerstephyllum halli) and rugose solitary corals are present, as in some exposures farther northwest, but black chert is absent here. Only the 2 inch thick strophomenid brachiopod-rich bed at this locality is represented at Buttermilk Creek less than a half mile south.

Whole Tetradium cellulosum colonies can be found in the uppermost five inches of the Lowville whose argillaceous limestone marker bed is exposed 6 feet below the top. Between the Tetradium and the marker zone, vertically burrowed calcilutites predominate, as at Buttermilk Creek (Stop #6). This upper Tetradium horizon resembles the upper Tetradium beds at Inghams Mills (Stop #2) and Walker's (1973) House Creek Member of the Lowville of northwestern New York.

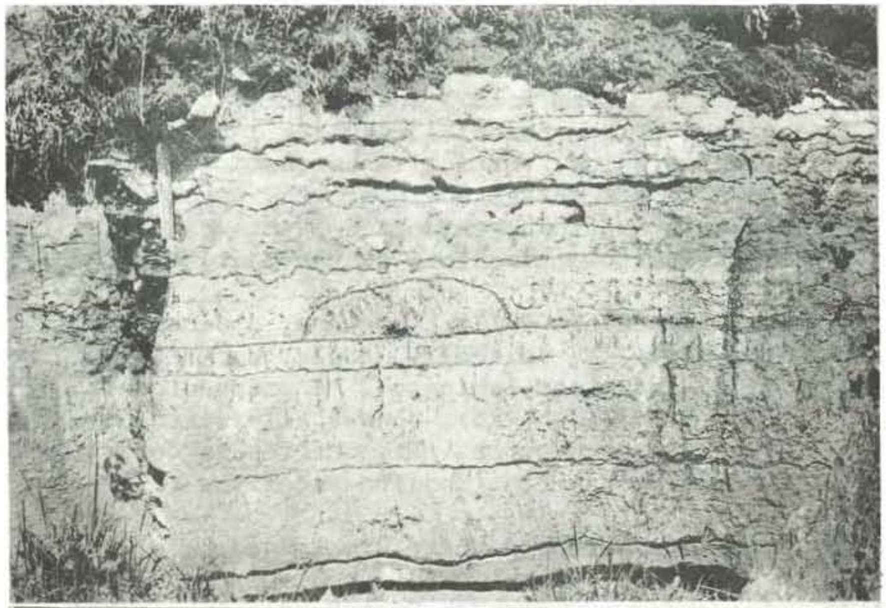


Fig. 8. Tetradium in life position (outlined) in lithology 6 (outlined) at the top of the Lowville Limestone, at locality C112 (Stop #7) in southern Newport. The thin Watertown Limestone is above lithology 6. Six inch ruler is scale.

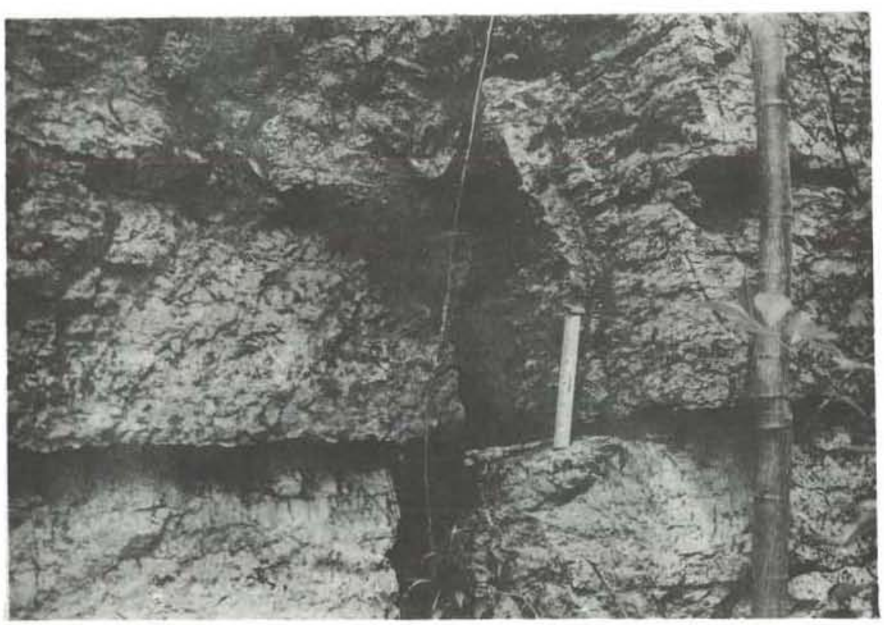


Fig. 9. Highly burrow-reworked, subtidal Watertown Limestone (lithology 7) above vertically burrowed, intertidal Lowville Limestone at Diamond Hill (locality C105, Fig. 5). Six inch ruler at contact is scale.

0.0	45.3	Continue on Elm Tree Road (uphill).
0.1	45.4	Turn left into driveway in order to turn around and proceed back to White Creek Road.
0.2	45.6	"T"-intersection with Elm Tree Road. Turn left.
0.7	46.3	Intersection with Old City Road on left. Continue on White Creek Road.
0.65	46.95	"T"-intersection with Route 28. West Canada Valley Central Junior-Senior High School across the road. Turn right (north) towards Newport.
2.05	49.0	Flashing yellow traffic light in Newport. Turn left onto Bridge Street (=Old State Road).
0.15	49.15	Crossing bridge over West Canada Creek.
0.1	49.25	"T"-intersection with West Street (=Newport Road). Turn right (north).
0.75	50.0	Turn right into gravel road leading to a large, old quarry. Park in front of the gate, but do not block the entrance for trucks.

Stop #8. Northwest Newport Quarry (locality NPQ):

Walk about 150 feet along the gravel road and then descend the grassed slope to the upper quarry where the Watertown Limestone caps the quarry wall which is composed mostly of Lowville Limestone. The top of the quarry here is beginning to collapse, so stay well clear of the edge. Enter at your own risk. After examining the top of the Watertown, continue to descend the grassed slope (overgrown old road) to the quarry floor. Bear left to examine fallen blocks of the Watertown and upper Lowville. Bear right all around a promentory to the southeast part of the quarry where the lower and middle Lowville can be examined safely in the quarry wall. Climb up over the rubble to the gravel road to return to the cars.

The lower dolomitic and sandy member of the Lowville is about 15.5 feet thick. Its contact with the upper 21.5 feet is gradational. The 2 foot thick argillaceous marker horizon occurs about 6 feet below the Watertown Limestone. Tetradium have not been found in the upper Lowville here. The top of the Little Falls Dolomite presumably forms the quarry floor.

The Watertown Limestone is highly burrow-reworked, black chert-bearing and fossiliferous. The fauna is diverse but hard to collect. Corals are common as well as brachiopods and mollusks.

The contact with the Kings Falls Limestone is exposed in a quarry southwest of Newport (Kay, 1953), but not here.

0.0	50.0	Turn around in quarry driveway and head back to Newport.
0.75	50.75	Turn left (west) onto Bridge Street.
0.2	50.95	Flashing red traffic light at "T"-intersection with Route 28 (Main Street of Newport). Turn right (south) onto Route 28 South.
2.05	53.0	Passing school on right.
2.35	55.35	Traffic light. Downtown Middleville. Turn right and cross bridge over West Canada Creek, thus continuing on Route 28 South.
0.2	55.55	Bear left at fork in road, continuing south on Route 28.
8.15	63.7	Turn right (west) onto Route 5 (Routes 5 and 28 combine here for a short distance). Proceed into Herkimer.
0.7	64.4	Stop light. Intersection of Routes 28 and 5. Turn left (south) onto Route 28 South.
0.2	64.6	Stop light. Turn right, continuing south on Route 28.
0.25	64.85	Entrance to New York Thruway. Those returning to Oneonta, New York, continue south on Route 28 and retrace your way back (see beginning of road log).

- END OF TRIP -