Trip B

A COMPARISON OF ENVIRONMENTS

by

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The Middle Devonian Hamilton Group in the Genesee Valley

The Devonian System of New York State varies from carbonates at the bottom (Helderbergian and Ulsterian Series) to coarse continental clastics at the top (Chautauquan Series) and represents a westward migrating deltaic complex built during Middle and Late Devonian time, (Rickard, 1964).

This deltaic complex, the Catskill Delta, is today represented by a wedge of sedimentary rock that thickens and coarsens eastward toward the Hudson River. These rocks are highly fossiliferous and structurally simple, thereby, lending themselves to detailed faunal, stratigraphic and paleoecologic studies.

Since the Middle and Upper Devonian of New York represents a deltaic complex, at any instant in time during the Devonian there existed a series of transitional environments aligned approximately parallel to the old shoreline from west to east or offshore deep water to onshore shallow water. These contemporaneous environments are not only transitional with one another laterally, but they also succeed each other vertically since the delta prograded westward across New York State. Each environment is today characterized by its own distinctive rock type and fossil assemblage. For example, the fine shale deposits of the Middle Devonian in the west (Lake Erie) gradually coarsen to siltstones and sandstones eastward (Catskills). The fine shales of the Middle Devonian on Lake Erie are in turn succeeded by the coarser siltstones and sandstones of the Upper Devonian.

The purpose of this field trip will be to sample and contrast several offshore Devonian biotopes representing two major environments; a poorly oxygenated phase of dark shales ("Cleveland" facies), and an oxygenated environment of soft calcareous blue-gray shales and limestones ("Moscow" facies).

Stratigraphy

The units to be examined belong to the upper part of the Middle Devonian Hamilton Group and the lower part of the overlying Upper Devonian Genesee Group. A table of these units is illustrated on the following page (* = units to be examined).

The Geneseo and Ledyard black shales and the Leicester Pyrite are representatives of the "Cleveland" phase, while the other members represent the "Moscow". Although the Geneseo is younger than the Ledyard it more or less resembles the Ledyard because the Geneseo represents a recurrence of the "Cleveland" phase in New York State at the beginning of the Late Devonian. Oscillations of the strand line are responsible for numerous recurrences of environments throughout Middle and Late Devonian time in New York; the Ledyard and Geneseo is just one example.

AGE	GROUP	FORMATION	MEMBER	APPROXIMATE THICKNESS IN FEET
Late Devonian		Other Upper Devonian Units		
	Genesee	West River Shale		65
		Genundewa Limestone		6
		Penn Yann Shale		30
		Geneseo Black Shale*		50
		Leicester Pyrite*		0-.2
Middle Devonian	Hamilton	Moscow	Windom Shale*	50
			Kashong Shale*	80
			Menteth Limestone*	1
		Ludlowville	Deep Run Shale*	7
			Tichenor Limestone*	2
			Wanakah Shale*	46
			Ledyard Shale*	57
			Centerfield Limestone*	7
		Skaneateles	Levanna Black Shale*	230
			Stafford Limestone	2
		Marcellus	Oatka Creek Black Shale	30
		Onondaga Limestone		145
		Silurian Formations		

* = units to be examined

Paleoecology

There are several parameters of extreme importance in determining ancient environments. Many more exist than will be treated in this brief discussion.

Feeding Types

The feeding types of bottom dwelling organisms (or, "how they go about making their living") are very useful in paleoecology as they reflect certain physical characteristics of the environment.

To meet the objectives of this field trip, especially the sequence at Jaycox Run (see page 10), I have chosen to subdivide and group various taxa into six major feeding groups.

Large Epifaunal Filter Feeders

This group embraces those organisms living on the substrate and deriving nourishment by straining sea water for its contained organic material and microrganisms. Since currents carry nutriments, the higher the current activity, the more food there is in suspension for filter feeders. They are found on mud, sand, and silt substrates and dominate faunal assemblages in fine to coarse grained rocks deposited in turbid water.

Included in this group are the larger articulate brachiopods, and the epibyssate bivalves (Stanley 1972), Mytilarca (Plethomytilus), Gosselettia, Cornellites, Pterinopecten, Leiropecten, Pseudaviculopecten. Crinoids and blastoids are also placed in this feeding group but it should be recognized that they may have been microphagous carnivores or both. They seem to be abundant in more facies than the typical microrganism eating coelenterates and bryozoans.

Small Epifaunal Filter Feeders

This group, though somewhat artificial includes mostly the brachiopods Ambocoelia and Chonetes. These two genera are most abundant in rocks carrying a low **diversity** fauna. As diversity increases these small filter feeders usually decline drastically. It seems to me that, at least for the Genesee Valley region, they are indicative of stressed environments of low oxygen and extremely soft mud bottoms. Their small size and shell shape (deep recurved beak of Ambocoelia and spines along the hinge of Chonetes) seem to be especially adaptive on soft mud substrates, for keeping the commissure off the bottom.

Infaunal Filter Feeders

Infaunal filter feeders are most abundant in well sorted sands and silts. The same physical requirements of currents high in organic matter apply both to large epifaunal and infaunal suspension feeders.

Included in this group are the endobyssate (Stanley, 1972) bivalves, Cypricardella, Leptodesma, Actinopteria, Ptychopteria, Goniophora, Modiomorpha, Leiopteria, Actinodesma (Glyptodesma); the inarticulate brachiopod Lingula; and the problematical fossil Taonurus probably a suspension feeding marine annelid.

According to Stanley (1972) the byssus of endobyssate bivalves anchored into the substrate, therefore, these forms live partially buried and are semi-infaunal. Endobyssate bivalves usually have at least three of the following morphological features (Stanley, 1972, pg. 181):

1) elongate shape
2) reduced lobate anterior
3) broad byssal sinus
4) absence of appreciable ventral flattening

Infaunal Deposit Feeders

Deposit feeders are those organisms which burrow into and feed directly on the soft sediment extracting the organic nutriments contained therein and disposing of the inorganic mud as waste products. They are most abundant in fine grained quiet water deposits (shale) where the mud was rich in organic matter. Deposit feeders are not abundant in coarser grained sedimentary rocks such as siltstone and sandstone because these rock types reflect environments of high current activity. The fine grained organic particles will be kept in suspension and therefore unavailable as a food source for deposit feeders.

Many worms, the nuculid bivalves _Nucula_, _Nuclites_, _Paleoneilo_, and the bivalves _Panenka_ and _Pterochaenia_ are herein labelled infaunal deposit feeders, although _Pterochaenia_ may have been epiplanktonic attaching to floating seaweed.

Vagrant Epifaunal Deposit Feeders; Scavengers; Carnivores; Herbivores

The vagrant epifaunal forms such as trilobites, snails and starfish are examples of this group. They actively move on the substrate, but some may have occasionally jumped or swam above it and occassionally burrowed into it for food and/or protection, as perhaps the trilobites _Phacops_ and _Greenops_.

The genera assigned to this feeding group may have exhibited more than one feeding type, some being deposit feeders and scavengers, or omnivores, etc. Some may have even attached themselves to crinoids like the gastropods _Platyceras_ and _Nauticonema_ (Knight _et.al_, 1960). Most other gastropods were probably deposit feeders or herbivores, but a few most certainly were borers using the radula as a drill. They are found in all sediment types but most abundantly in organic rich substrates such as dark shales and siltstones.

Microphagous Carnivores

Corals and bryozoans, the microphagous carnivores, fed mostly on smaller organisms, even perhaps microganisms. Therefore, they require well circulated water much like filter feeders; however, the water must not be heavily charged with sedimentary particles because, if sedimentation is too rapid they cannot become firmly established. In short, they are suffocated. This explains their conspicuous absence from siltstones and sandstones.

Many bryozoans are epizooites living attached to the shells of most other invertebrates. Hederella and Reptaria are examples. Some crinoids might more properly belong here than with the epifaunal filter feeders.

Habit

There are only two basic habits exhibited by marine invertebrates.

Pelagic forms are those that live free from direct dependence on the bottom and are either floaters (planktonic) or swimmers (nektonic).

Their number and size is more a reflection of physical conditions in the overlying water than on the bottom. They are most abundant in dark and black shales reflecting anaerobic conditions on the bottom thereby preventing the establishment of a well developed benthonic fauna.

The epipelagic brachiopods Leiorhynchus and Orbiculoidia (inarticulate) probably attached to floating objects, while the pteropoda Stylionia and the cephalopod Orthoceras were nektonic. Furthermore, Orthoceras and perhaps related nautiloids spent considerable time on the bottom as vagrant carnivores feeding on brachiopods or trilobites.

Benthonic organisms are those that live on the sea floor (epifaunal) and burrow into it (infaunal). Furthermore, they may be permanently attached (sessile benthonic) or highly mobile (vagrant benthonic). Feeding type and habit are closely related. For example, most carnivores, are also highly mobile and most epifaunal types are filter feeders.

Species Diversity

Species diversity is the number of different species believed to have inherited a given area of the sea floor. Diversity can be correlated with the physical environment through the use of the following principle.

Under rigorous environmental conditions such as an exceptionally soft bottom, low oxygen levels, or extremely high current activity, only a few species are adaptable and hence able to survive. However, these few species may be represented by numerous individuals as competition would be at a minimum.

An environment that can support many different species probably reflects opulent conditions of oxygen, temperature, salinity, food supply, etc., and hence many more species are able to survive.

FAUNAL ANALYSIS OF JAYCOX RUN

Jaycox Run (Stop #2) exposes a nearly complete section of the Ludlowville Formation which can be divided from oldest to youngest into the Centerfield, the Ledyard, Wanakah and Tichenor Members totalling 130 feet. The Menteth member of the Moscow Formation caps the section (Plates #1 & #2).

Methods and Acknowledgement

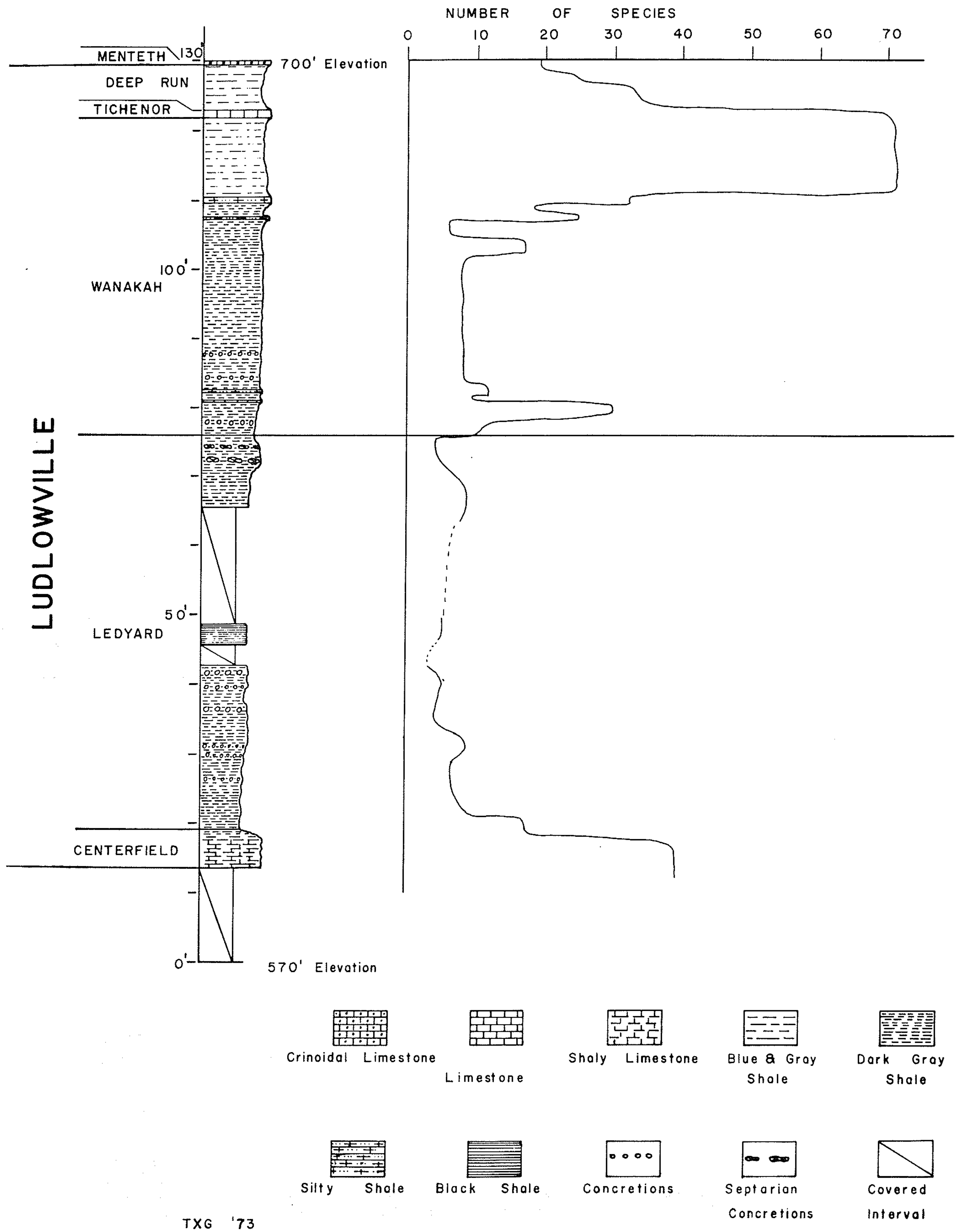
The section at Jaycox Run was measured with a hand level and folding wooden rule over a two week period. The author was assisted in the field by Richard D. Hamell who aided immensely in measuring and sampling the section, and without whose aide this project could not have been brought to a successful conclusion.

The number of species represented at each horizon were counted and identified in the field. Only those of questionable identity were collected. At each abundantly fossiliferous horizon (Zones- A, B, G, H, L, P, Q, S, T) two to four hours of sampling were consumed, (Plates #1 & #2).

The relative abundance of each species was estimated on the numbers of individuals recognized in the outcrop after a suitable period of collecting. One hour in unfossiliferous horizons and approximately two hours for fossiliferous horizons. Although this is not a statistically precise method, it is the best method to use when sampling a thick interval of strata with a limited

Plate 1

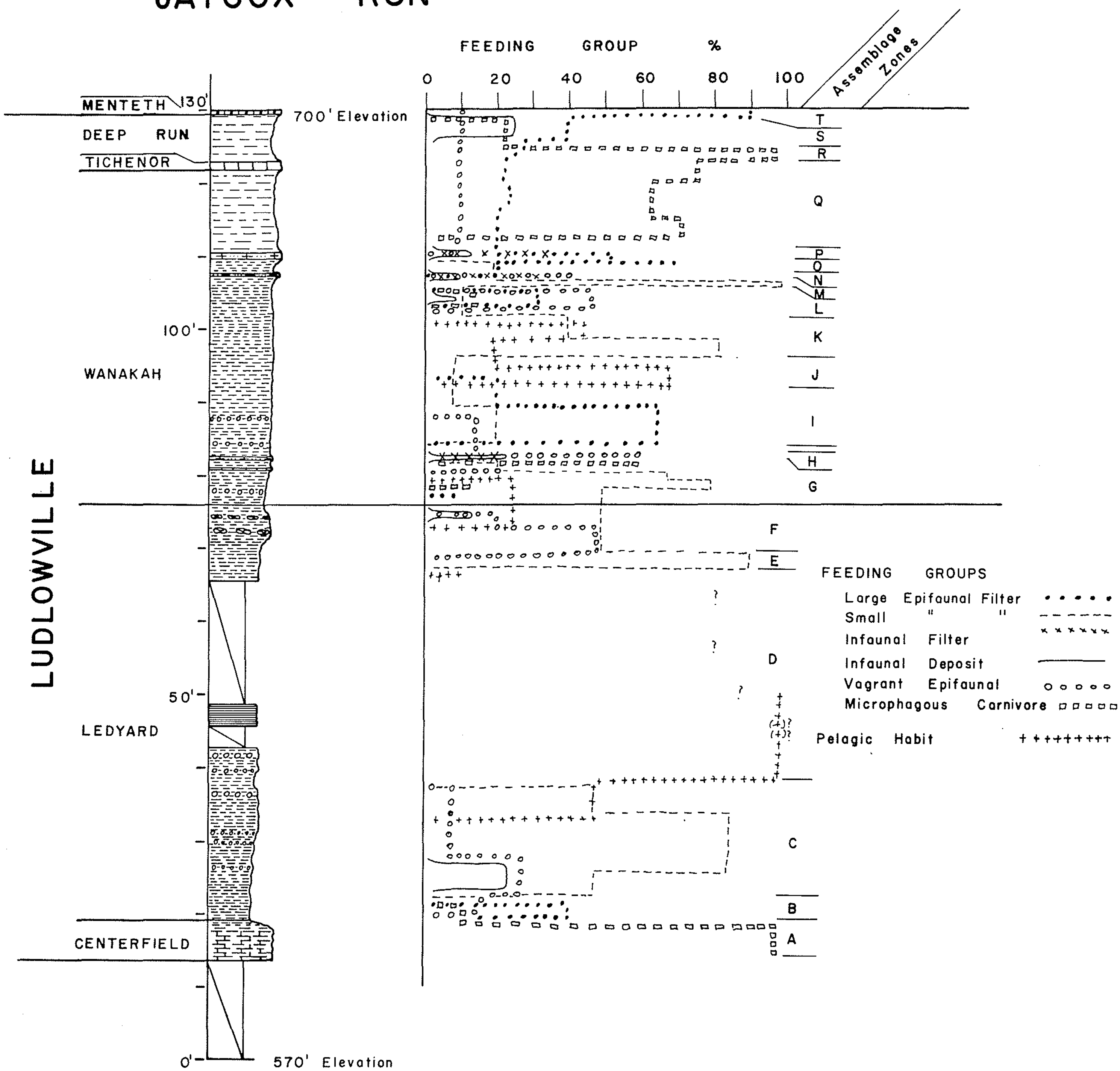
FAUNAL ANALYSIS
LUDLOWVILLE FORMATION
JAYCOX RUN

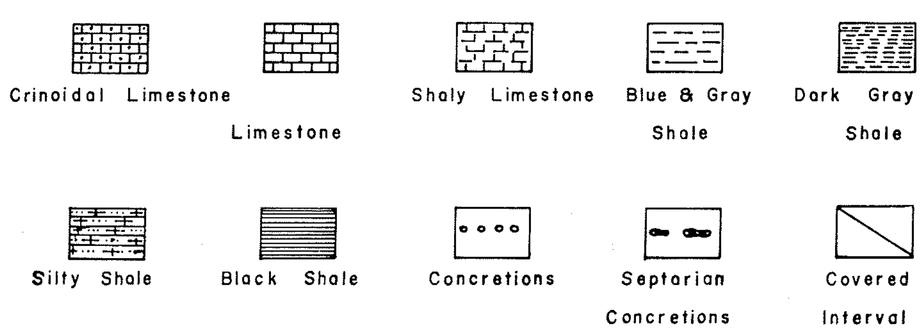


TXG '73

FAUNAL ANALYSIS
LUDLOWVILLE FORMATION
JAYCOX RUN

Plate 2





TXG '73

amount of time and where the nature of the exposure changes constantly from a bedding plane surface to a vertical face.

Individuals of a species were assigned a code number according to the table below:

Code	Number of Specimens	Mean	Descriptive Term
1	1-3	2	Very Rare
2	4-12	8	Rare
3	13-52	32	Present
4	53-204	128	Common
5	205-820	512	Abundant
6	Over 820	2048	Very Abundant

The relative abundance of each species by counting specimens can be misleading due to fragmentation (crinoid stems), shedding of exoskeletons (trilobites) and separation of valves (bivalves, brachiopods, ostracods). Crinoid stems and bryozoan colony fragments, especially fenestellids were counted numerically, therefore, the codes assigned to these groups probably are abnormally high.

The maximum number of either trilobite cephalons or pygidia were counted and thoracic segments were counted as individuals if the exhibited more than five pleura (after Bray, 1971).

The various species present at each horizon were then grouped into the feeding type and habit categories discussed above. The sum of the means of all species in any one category was then divided by the total mean of all the species for that stratigraphic interval. This results in a mean percent for each feeding type or a rough approximation of the community composition based on feeding types for each successive stratigraphic horizon. Plate #2 was then constructed utilizing these data. For example: by examining Plate #1, one can see a fossiliferous horizon in the coarse, silty shale at 110 feet. By comparing this same horizon on Plate #2, it becomes apparent that the assemblage is composed mostly of filter feeders (large epifaunal 50%, infaunal filter feeders 36%); deposit feeders (10%) and a few vagrant epifaunal forms (4%).

One more point. Implicit in all this is the assumption that the assemblages sampled represent life or near life assemblages as define by Fagerstrom (1964).

Jaycox Run Section

Centerfield Member

Seven feet of the Centerfield is poorly exposed in the stream bed and small side banks (1-2') just upstream from the old railroad tressel at the base of Jaycox Run. It is mostly a shaly limestone or very calcareous shale at the base of the exposure becoming more shaly and darker upward grading into the Ledyard above. The upper boundary is not a lithologic one but a faunal one being placed at the top of the uppermost abundantly fossiliferous zone (Zone B).

Zone A: The lower part of the exposure is composed almost entirely of microphagous carnivores of bryozoa and corals. Solitary horn corals dominate the assemblage, to the exclusion of almost all other invertebrate species except bryozoans. In this aspect it is almost a coral biostrome and closely parallels those described by Oliver (1951): Heliophyllum halli is very abundant; Amplexiphyllum hamiltoniae, Heterophrentis simplex Aulopora sp. are abundant; Favosites alpenensis is common; Favosites hamiltoniae is present. (Descriptive terms for abundance throughout the text from the table on page 11.)

The overwhelming domination of microcarnivores certainly means minimal amount of clastic influx with abundant nutrients in shallow, warm, well lighted, agitated waters. Other species are represented by relatively few individuals.

Zone B: Atrypa reticularis Zone: Influx of clastics ended the rugosan-bryozoan domination allowing for the establishment of other feeding groups. Large epifaunal filter feeders dominate this zone especially the brachiopods Atrypa reticularis, (abundant), Mucrospirifer mucrunatus (present) and Megastrophia concava (rare). Vagrant epifaunal forms are conspicuous represented mostly by Platyceras (common) and Phacops rana (present). Corals and bryozoans still survive though reduced in numbers.

Ledyard Member

The Ledyard Member is composed of approximately 57 feet of dark gray calcareous bituminous shale with some black shale interbeds. Calcareous non-septarian concretions mostly small (less than 1 foot in diameter) are abundant at certain intervals throughout the unit. Larger septarian concretions are found toward the top of the Ledyard.

Zone C: Ambocoelia-Chonetes zone: Gradually deteriorating conditions for epifaunal filter, microcarnivore, and infaunal filter feeders beginning during later Centerfield time culminated in their complete removal by Ledyard time. Soft muds high in organic matter allowed infaunal deposit feeders (worm tubes common) and vagrant epifaunal deposit feeders (Phacops rana-common) to flourish initially along with the small filter feeding Ambocoelia (common) and Chonetes (common). Perhaps this interval should be set off as a subzone based on the abundance of Phacops rana. Many of the trilobites are complete, a few are enrolled. They are found nearly parallel with the horizontal, dorsal surface up and some reversed with the ventral surface up. This means that Phacops and to a lesser extent Greenops moved on the substrate plowing or occassionally burrowing into it for food. The fine, bituminous, dark shales in which they are found were soft muds high in organic matter an indication perhaps that Phacops was a deposit feeder.

Zone D: Leiorhynchus Zone: Although this interval is nearly covered, some patches of it are exposed for sampling purposes. It is mostly a calcareous, bituminous, black shale with some dark shale interbedded with it. For all intents and purposes the only species found is Leiorhynchus quadricostatum (very abundant).

Anerobic conditions at or above the sediment-water interface existed during the time of deposition of Zone D.

Zone E: (Second Ambocoelia-Chonetes Zone) and Zone F (Phacops rana Zone) are recurrences of Zone C conditions. One unusual addition is a small thin zone at about 75 feet containing the gastropods: Moulonia itys (present), Nauticonema lineata (present), Loxonema hamiltoniae (rare), and Bembexia sulcomarginata (rare), the cephalopod Orthoceras (common), and the infaunal deposit feeding clams Nucula (rare), Paleoneilo (present), and Nuculites triquetor (rare). This deposit feeding assemblage indicates high organic matter in the substrate and oxygen levels high enough to support a diverse molluscan assemblage although composed of mostly small individuals.

Wanakah Member

The Wanakah member is composed of 34 feet of dark gray, bituminous, calcareous shale, succeeded by 1 foot of coarse, silty shale and 11 feet of gray, non-bituminous shale, totalling nearly 46 feet in all.

Zone G: Pleurodictyum americanum Zone: Although no lithologic break separates the Wanakah from the Ledyard Shales, the first appearance of Pleurodictyum americanum is generally taken to represent the lower boundary of the Wanakah (Cooper, 1930). Zone G is a highly fossiliferous zone containing species representative of all feeding groups described. Infaunal deposit feeders are only weakly represented. Well oxygenated conditions must have existed although the bottom sediment was fairly soft. Large epifaunal filter feeders are represented by several forms; Mucrospirifer mucronatus (common); Pterinopecten (very rare); Spinocyrtia granulosa (very rare) being a few.

Stereolasma rectum, the solitary small horn coral is common, apparently the larvae attaching to the shells of other invertebrates (Bray, 1971). Pleurodictyum is present, its larvae attaching to the shells of Loxonema. Aulopora is abundant in a thin layer toward the top of this zone. Small epifaunal filter feeders dominate the assemblage. This assemblage is one adapted to a soft bottom environment; the coelenterates found being those tolerant of turbid water and using the shell of other invertebrates as their "firm substrate" for larval attachment.

Zone H: Modiomorpha subalata Zone: Contained with a thin, coarse, silty, shale bed, capping a small waterfall at 82 feet is the first appearance of abundant infaunal filter feeders. A firmer substrate and increased current activity are probably responsible. The endobyssate bivalve Modiomorpha subalata is common, along with the vagrant gastropod Bellerophon (abundant) and the infaunal bivalve Paleoneilo is common. The silty substrate must have been rich in organic matter to support the infaunal deposit feeders.

Zone I: Mucrospirifer mucronatus Zone: Large numbers of the large epifaunal filter feeder Mucrospirifer mucronatus characterize the succeeding 10 feet of dark bituminous shale on top of the Modiomorpha Zone, Ambocoelia umbonata is common in this interval also. Mucrospirifer mucronatus is characterized by the hinge line extending laterally to form large spines or alae. These presumably functioned like skies to better distribute the weight on a soft substratum. The conspicuous absence of Mucrospirifer from other soft bottom horizons (C, E, & F) leads me to the conclusion that C, E, and F were zones of lower oxygen potentials or less particulate organic matter in suspension and available for food. One other possible explanation is the selective predation of Mucrospirifer larvae during or just before spat fall. This explanation seems to be fairly weak as searching through my mind I cannot conceive of an organism responsible for the selective destruction of just Mucrospirifer larvae.

Zone J: (Second Leiorhynchus Zone): This is a recurrence of Zone D.

Zone K: Third Ambocoelia-Chonetes Zone: This is a recurrence of zones C and E. The Ambocoelia, at least in this zone, seem to occur in clusters. Bray (1969) has dealt with cluster developement in Ambocoelia of the Ludlowville Formation in Erie County. They apparently initiate as a small patch on an otherwise lethal substrate due to their adaptability on soft substrates. Successive generations use the shells of earlier ones to attach the pedicle, thereby increasing the diameter of the cluster. As density increased fecal matter and other toxic substances could have built up to a point inhibiting further spot development and the cluster became extinguished. Other adjacent "immature" clusters would still survive.

Zone L: Stereolasma Zone: The Stereolasma zone represents a trend to more opulent conditions of oxygen, and food supply in the water and substrate. Microcarnivores are represented by Stereolasma rectum (common) vagrants by Phacops rana (abundant) large epifaunal filter feeders by the brachiopods, Athyris spiriferoides (common) Mucrospirifer mucronatus (common).

Zone M: Styliolina fissurella Zone: Bedding planes containing very abundant individuals of the pteropod Styliolina fissurella can be found above Zone L. They appear to represent catastrophic swarm kills with their shells current oriented in a NE-SW direction. Ambocoelia umbonata is abundant in other layers in this zone. A stressed environment of low oxygen, the Styliona zone contrasts markedly with the well aerated waters of the Stereolasma Zone.

Zone N: Nauticonema lineata Zone: This zone represents a recurrence of the gastropod faunal in Zone F. Infaunal filter feeders are most pronouned being represented by Taonurus (present). Infaunal deposit feeding is suggested by the numerous limonite stained worm tubes or trails.

Zone O: Second <u>Mucrospirifer</u> <u>mucronatus</u> Zone: This is a reoccurence of Zone I.

Zone P: <u>Cypricardella</u>-<u>Pseudaviculopecten</u> Zone: At the top of the largest falls in Jaycox Run at 110 feet occurs a foot interval of coarse calcareous silty shale or siltstone. It is characterized by large epibyssate bivalves, endobyssate bivalves, infaunal deposit bivalves, gastropods and brachiopods. This unit presents the highest energy environment of clastic deposition in the Ludlowville Formation of Jaycox Run. Organic material was abundant in suspension, and in the firm substrate. Epibyssates are represented by:

<u>Pseudaviculopecten</u> <u>princeps</u>, (present)
<u>Pterinopecten</u> (rare)
<u>Cyriopecten</u> (rare)
<u>Gosselettia</u> (rare)
<u>Mytilarca</u> (rare)

Endobyssates by:

<u>Cypricardella</u> <u>bellistriata</u> (common)
<u>Actinopteria</u> <u>decussata</u> (present)
<u>Leiorpteria</u> <u>conradii</u> (rare)
<u>Modiomorpha</u> <u>mytiloides</u> (rare)
<u>Modiomorpha</u> <u>concentrica</u> (present)
<u>Actinodesma</u> <u>erectum</u> (rare)
<u>Goniphara</u> <u>hamiltoniae</u> (very rare)

Gastropods by:

Moulonia itys (present)

M. lucina (large) (rare)

Nauticonema lineata (rare)

Brachiopods by:

Stropheodonta demissa (present)

Mucrospirifer mucronatus (common)

Mediospirifer audaculus (common)

Infaunal deposit feeders by:

Paleoneilo (common)

Zone Q: Hamilton Fauna: The uppermost 11 feet of the Wanakah member are the most fossiliferous in terms of numbers of species. All feeding types are represented and many species are common to very abundant. A faunal list would be exhaustive; suffice it to say that every common Hamilton form is represented in these 11 feet. This interval represents opulent conditions of temperature, food, substrate, and oxygen. The fossiliferous horizons are separated by a few inches of less fossiliferous shales indicating successive periods of greater deposition separated by the fossiliferous horizons of little or no deposition.

Tichenor Member

Zone R: Tichenor Fauna: The Tichenor Member, a 1 to 2 foot thick hard limestone represents a recurrence of Zone A of the Centerfield Members.

Deep Run Member

Zone S: Crinoidal-*Phacops* Zone: Zone S emcompasses the entire 7 or 8 feet of the blue gray limey shales of the Deep Run Member.

Large epifaunal filter feeders represented mostly by crinoids stems and microphagous carnivores by bryozoans are abundant, some endobyssate types are present, epibyssates being rare. *Phacops rana* is common but extraordinary in size. Some specimens are two to three times the normal size. This fact together with the abundant worm tubes (limonite tubes) suggest abundant organic matter on and in the substrate.

The absence of abundant corals would indicate an environment too turbid for them to become established.

Moscow Formation

Menteth Member

Zone T: Crinoidal Zone: Zone T contains most large crinoid stems. Other feeding tubes are only slightly represented, *Phacops rana* being the most common vagrant and *Taonurus*, (common) the infaunal filter feeder.

The assemblage suggests a very turbid high energy environment well suited for filter feeders.

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ROAD LOG

Hamilton Group

Total Miles	Miles From Last Point	Route Description
0.0		Start - Towne House - Elmwood Ave. and Mount Hope Ave. Proceed south on Mount Hope Ave.
0.3	0.3	Junction N.Y. 15A - proceed south.
1.0	0.7	Cross Barge Canal
1.0	0.0	Junction River Road - turn right (west).
1.8	0.8	Genesee Valley Park entrance on right. Proceed straight.
4.4	2.6	Railroad Crossing
4.8	0.4	Junction N.Y. 252 (Jefferson Road) Proceed straight (south) on River Road
5.0	0.2	RIT Campus entrance on left.
8.4	3.4	Bridge over New York State Thruway
8.6	0.2	Junction N.Y. 253 on left. Proceed south on River Road
8.8	0.2	N.Y. 253 continues west on right. Proceed straight (south) on River Road.
10.2	1.4	Intersection Rush-Henrietta Town Line Rd. Proceed straight (south)
11.1	0.9	Intersection Telephone Road Bear right on River Road
11.2	0.1	Junction N.Y. 251 Proceed straight (south) on River Road
13.8	2.6	Intersection Woodruff Road on left. Bear right on River Road

16.7	2.9	Small ravine on left exposing 11 feet of Onondaga Limestone.
17.2	0.5	Fork in road. Bear right on River Rd.
17.4	0.2	Enter village of Avon.
18.2	0.8	Junction River Road and U.S. 20; N.Y. 5 Turn right on U.S. 20; N.Y. 5
18.3	0.1	Cross railraod tracks; Junction N.Y. 39 on left (2). Turn left (south) on N.Y. Rt. 39.
19.5	1.2	Ashantee
21.4	1.9	Papermill Road on left. Proceed south on N.Y. 39
22.5	1.1	Triphammer Road on left. Turn left (east) onto Triphammer Road.
22.8	0.3	Gate on left just west of Conesus Creek.
		STOP #1-TRIPHAMMER FALLS (Centerfield Mbr.)
23.3	0.5	Return to N.Y. 39 - turn left (south)
24.6	1.3	Cross North Branch - Jaycox Run
25.7	1.1	Nations Road on right - turn right (west) Proceed on Nations Road to old railroad embankment.
		STOP #2-JAYCOX RUN (See text and plates)
27.9	1.1	Return to N.Y. 39 on Nations Road. Turn left (south) on N.Y. 39
29.1	1.2	Enter Geneseo
30.1	1.0	State University College at Geneseo on right.
30.3	0.2	Junction N.Y. 39 and U.S. 20A Turn right (west) on U.S. 20A; N.Y. 39

31.0	0.7	N.Y. 63 on right. Proceed straight (south) on U.S. 20A; N.Y. 39.
31.2	0.2	Fork in road. Bear right on U.S. 20A; N.Y. 39.
31.5	0.3	Geneseo Black Shale in road cut.
31.9	0.4	Cross Fall Brook.
32.1	0.2	Cross Genesee River
33.1	1.0	Cross Beards Creek
33.1	0.0	Boyd Parker Monument on left. Site of the murder of Lieutenant Boyd and Captain Parker, two members of General Sullivan's campaign of 1779 against the Iroquois Confederacy to end their continual harassment of colonial frontier settlements in New York. The victims' execution was prefaced by the most insidious torture apparently at the direction of the infamous Mohawk Valley Tory, Colonel Walter Butler.
33.4	0.3	Enter village of Cuylerville. Cross line of the old Genesee Valley Canal which connected Olean with the Erie Canal at Rochester. The Genesee Valley Canal was completed in 1856 and abandoned in 1878. Proceed on U.S. 20A, N.Y. 39.
34.6	1.2	Enter village of Leicester.
34.8	0.2	Junction N.Y. 36 - proceed straight (west) on U.S. 20A; N.Y. 39; N.Y. 36.
34.9	0.1	Turn right (north) on N.Y. 36.
35.7	0.8	Trailer Park and Kingston Road on right. Turn right. Turn right on Kingston Road and proceed to dead end.

36.1	0.4	End of Kingston Road.
		STOP #3 - LITTLE BEARDS CREEK
		The Kashong Shale is exposed at this locality and it carries an excellent "Moscow" facies fauna.
36.5	0.4	Return to N.Y. 36 Turn right (north) on N.Y. 36
37.0	0.5	New road on left; "Empire Dragway" sign.
37.2	0.2	Cross Taunton Creek.
37.3	0.1	First white house on left - north of Taunton Creek.
		STOP #4 - TAUNTON GULLY
		The upper 20 feet or so of the Windom Member is exposed at the base of the exposure. Upstream from this point there is nearly a continuous exposure from the Leicester Pyrite to the Genundewa Limestone which caps a waterfall at an elevation of about 850 feet.
		END OF TRIP - Return to Rochester via N.Y. 36; U.S. 20; River Road.