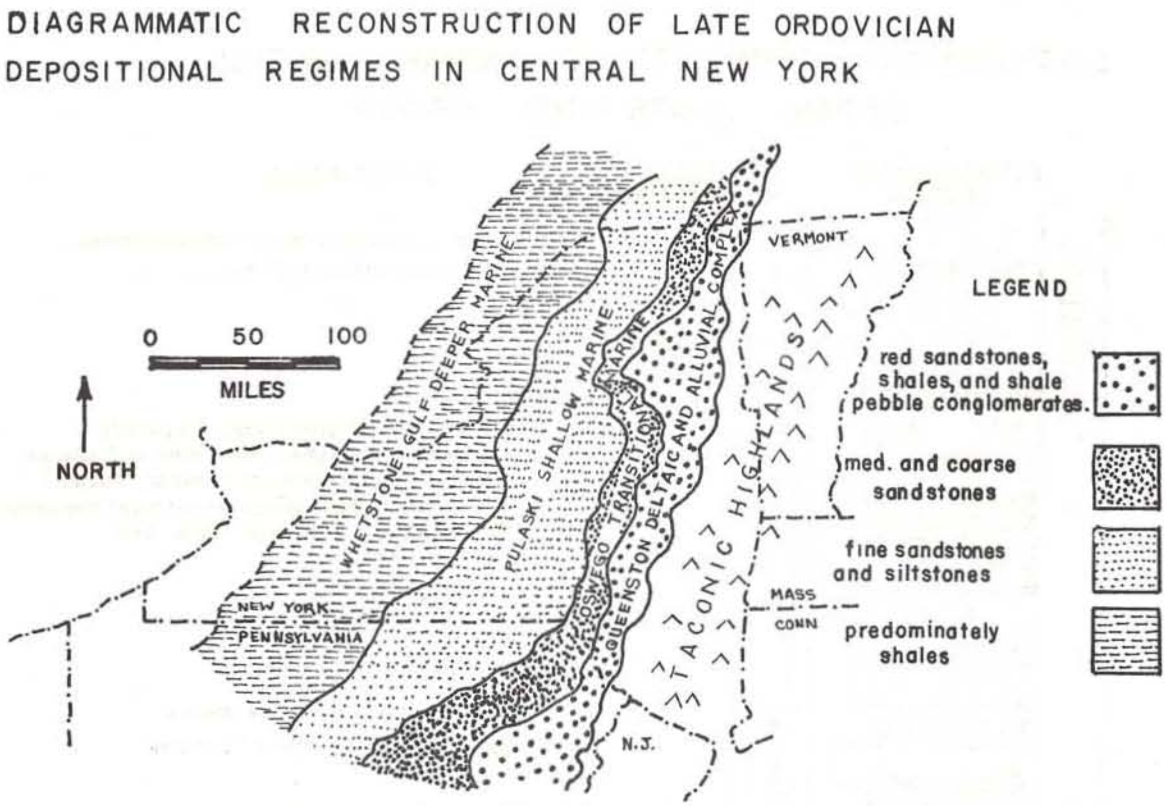

Figure 2. Late Ordovician depositional regimes (from Bretsky, 1970, after Broughton and others, 1962).

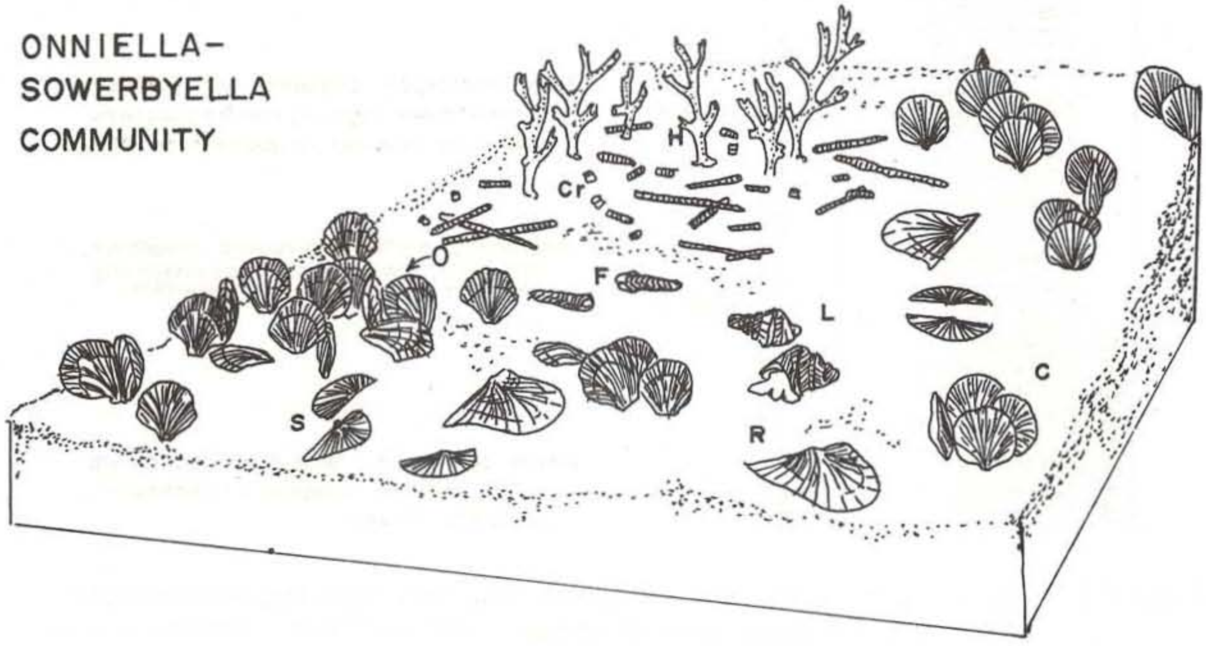

Figure 3. Reconstruction of <u>Onniella-Sowerbyella</u> Community (after Bretsky, 1970).

Nuculites-Colpomya Community

This community is composed of small infaunal detritus and suspension (?) feeding bivalve molluscs (fig. 4). The detritus feeders are Nuculites planulatus, Ctenodonta? cf. pulchella, Praenucula and Palaeoconcha. Infaunal suspension (?) feeders are Lyrodesma poststriatum, Rhytimya, Cuneamya, Cymatonota and Psiloconcha. There are two important epifaunal suspension feeders: Colpomya faba and Glyptorthis crispata.

The fossils are common in the silty shales and siltstones. The faunas extend over a broader stratigraphic range than the Ambonychia-Modiolopsis Community; however, some stratigraphic and zoogeographic differences do exist in the Nuculites-Colpomya Community. Lower in the section there are larger numbers of small (3 to 10 mm) Nuculites, whereas larger (15 to 20 mm) Nuculites are higher up; Lyrodesma and the desmodont bivalves are abundant in the upper part, whereas Glyptorthis is more abundant in the lower Pulaski.

The Nuculites-Colpomya Community occupied the outer and inner infralittoral areas. The substrate was mostly silty mud and the fauna appears to have been normal marine. Some offshore changes in faunal composition occur:

(1) deeper water faunas contain greater numbers of Glyptorthis, Colpomya and Archinacella.
(2) nearer shore faunas (especially those interbedded with the Ambonychia-Modiolopsis Community) have a greater diversity of burrowing, infaunal bivalves (e.g., Rhytimya, Cymatonota, Cuneamya).
(3) Nuculites is small (4mm) in offshore deposits and is larger (17 mm) in nearshore deposits. Is the small size a compensation for decreased substrate firmness because of the increased water content in the muds?

Ambonychia-Modiolopsis Community

This community is dominated by large, epifaunal, suspension-feeding bivalves with fewer numbers of detritus-feeding gastropods and monoplacophorans (fig. 5). Suspension feeders are Modiolopsis modiolaris, Ambonychia praecursa, Cyrtodonta and Ischyrodonta unionoides, while the main detritus feeders are Cyrtolites ornatus and Clathrospira subconica. The fossils are common in thin- to medium-bedded, fine- to medium-grained sandstones. These are interbedded with irregularly crossbedded orthoquartzites and grey-black silty shales that contain a patchy fauna which is the partial remains of the Nuculites-Colpomya Community.

The fossiliferous sandstones and silty shales are cut by shallow channels and commonly filled with crinoid-bryozoan debris. Further, current reworking is evident in the large-scale flattened interference ripples and in the sand-pebble coquinites (disarticulated crinoid stems, worn bryozoan fragments). While the irregularity of bedding and abrupt lithologic change from one rock unit to another is characteristic, the

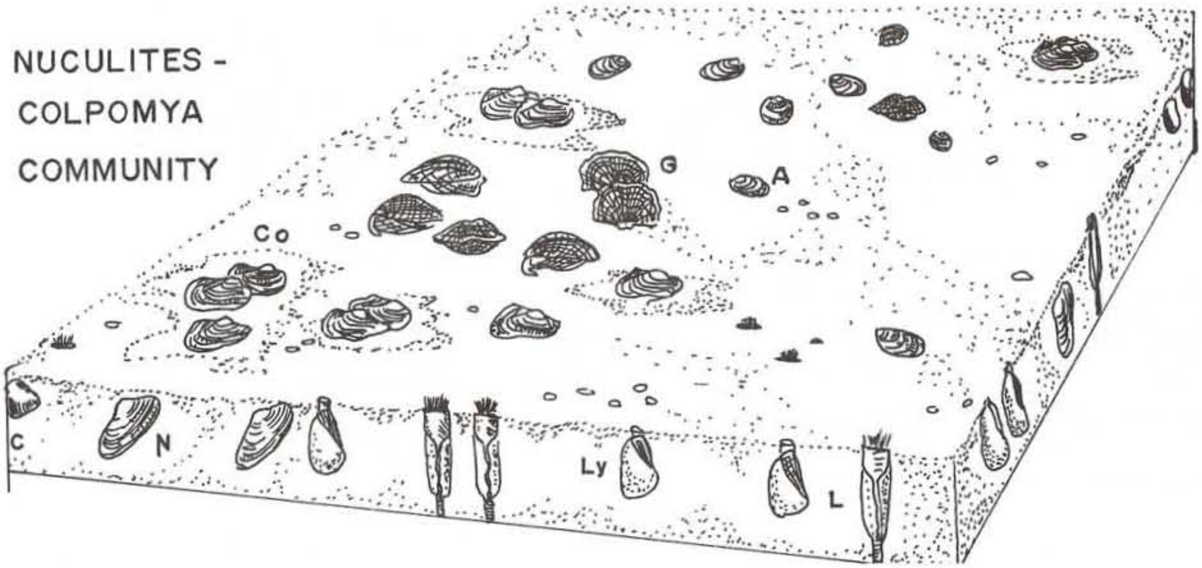

Figure 4. Reconstruction of Nuculites-Colpomya Community (after Bretsky, 1970).

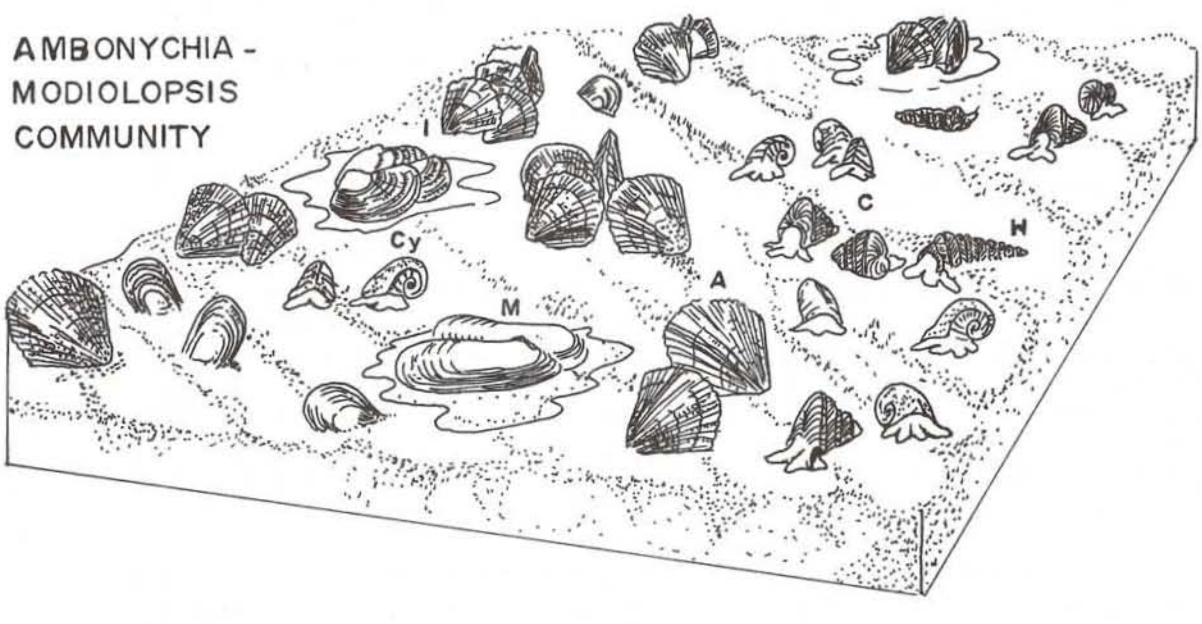

Figure 5. Reconstruction of Ambonychia-Modiolopsis Community (after Bretsky, 1970).

whole sequence grades upward into the unfossiliferous Oswego Sandstone.

The Ambonychia-Modiolopsis Community was the dominant nearshore assemblage. It appears to have been adapted to regions of irregular sedimentation and to areas where mobile bars and barriers existed. The organisms probably existed on a firm but slightly mobile sandy substrate. The high energy nearshore environment is apparent from the cut-and-fill channels, bars, oriented orthocones, crossbedded coquinites and large-scale interference ripples. The fauna was broadly tolerant of salinity fluctuations, of harsh physical regimes (including possibly dessication). Landward this environment graded into transitional nearshore marine and alluvial deposits; seaward into the silts and shales dominated by the members of the Onniella-Sowerbyella Community.

BIOGENIC FEATURES

In the upper part of the Pulaski Shale, numerous burrows, grazing and/or resting tracks are observed. Normally they occur in a particular stratigraphic order and normally within specific lithologies. The first three below are associated with the Ambonychia-Modiolopsis Community; the fourth with the Onniella-Sowerbyella Community.

(1) "Turkey tracks": patterns of 3 or 4 broad, blunt, shallow finger-like projections on bedding planes; common on bedding planes of coarse sandstones that alternate with flattened interference rippled sandstones; probably burrows or grazing tracks.

(2) Longitudinally striated burrows: intersect bedding planes at low angles; 4 to 5 inches long, $\frac{1}{2}$ inch wide; deeper than "turkey tracks"; occasionally filled with crinoid-bryozoan fragments.

(3) "U"-shaped tubes: dumbbell-shaped on bedding plane, usually $2\frac{1}{2}$ to 4 inches apart; found in massive-bedded orthoquartzites (Oswego-like sandstones); tubes filled with dark grey silty shales.

(4) Fine meandering patterns: cover the bedding plane, rarely penetrating from one bed to another; probably a grazing pattern.

SUMMARY

The exposures in the Tug Hill area give a picture of the dynamics of organic change in an offshore-to-onshore depositional regime. Into this general sedimentological framework, three benthic marine communities are placed. They occupied a gently westward sloping shelf that was receiving sediment from the east and that, through time, was experiencing a long, gradual regression. What happened to the faunas in this regression? To explain the exact nature of the faunal transitions in a temporal sense, a detailed bed-by-bed analysis is necessary. For example, the Lorraine Gulf section treated in this manner provides the opportunity to analyze species over a temporal gradient. In these long ranging faunas, species replacements, species additions, species losses and mixing phenomena can be examined throughly. Set in this environmental complex, are the changes in these populations gradual? The exposures in this area are "untapped" with respect to these questions.

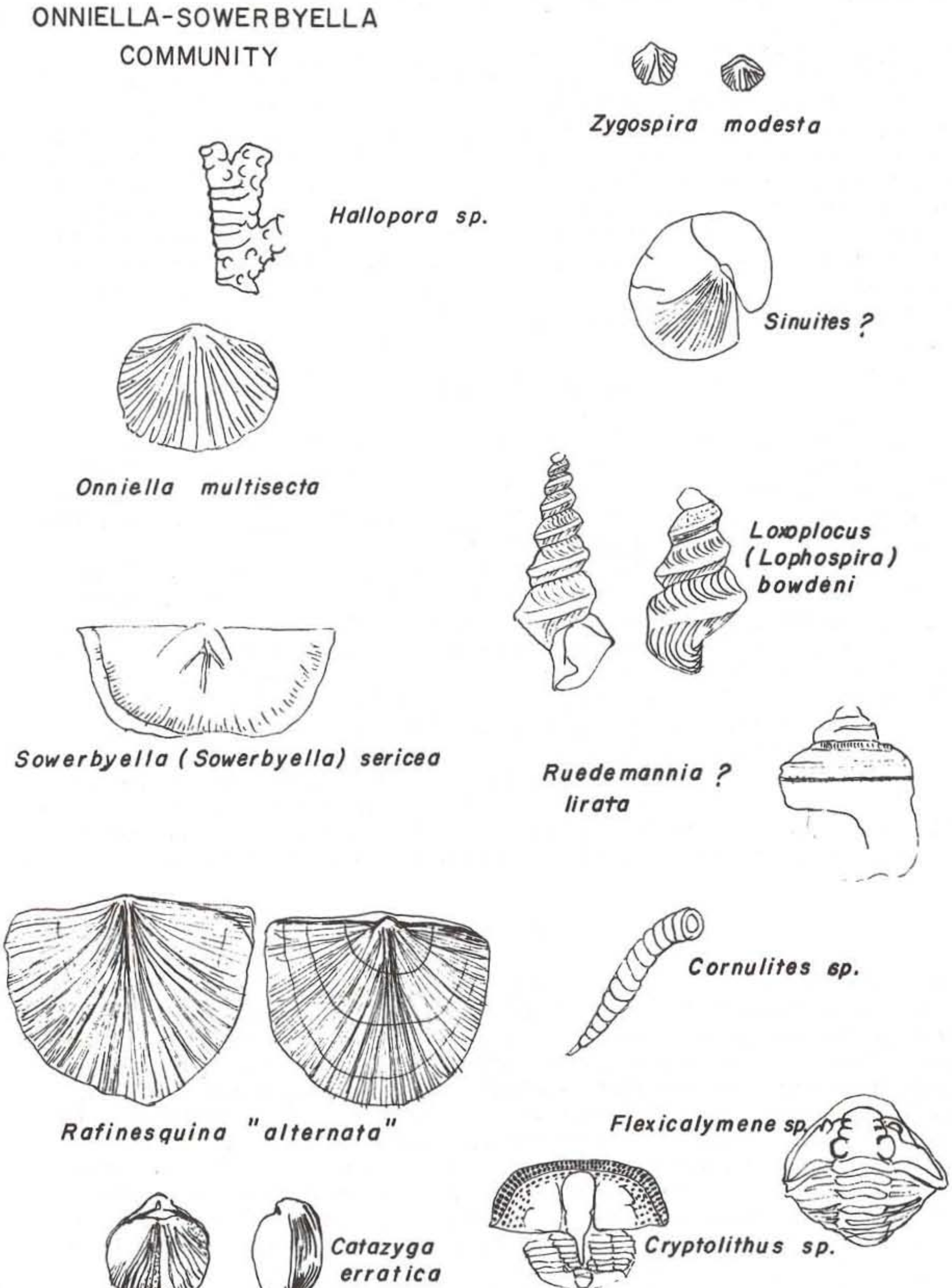

Figure 6. Representative fossils in Onniella-Sowerbyella Community.

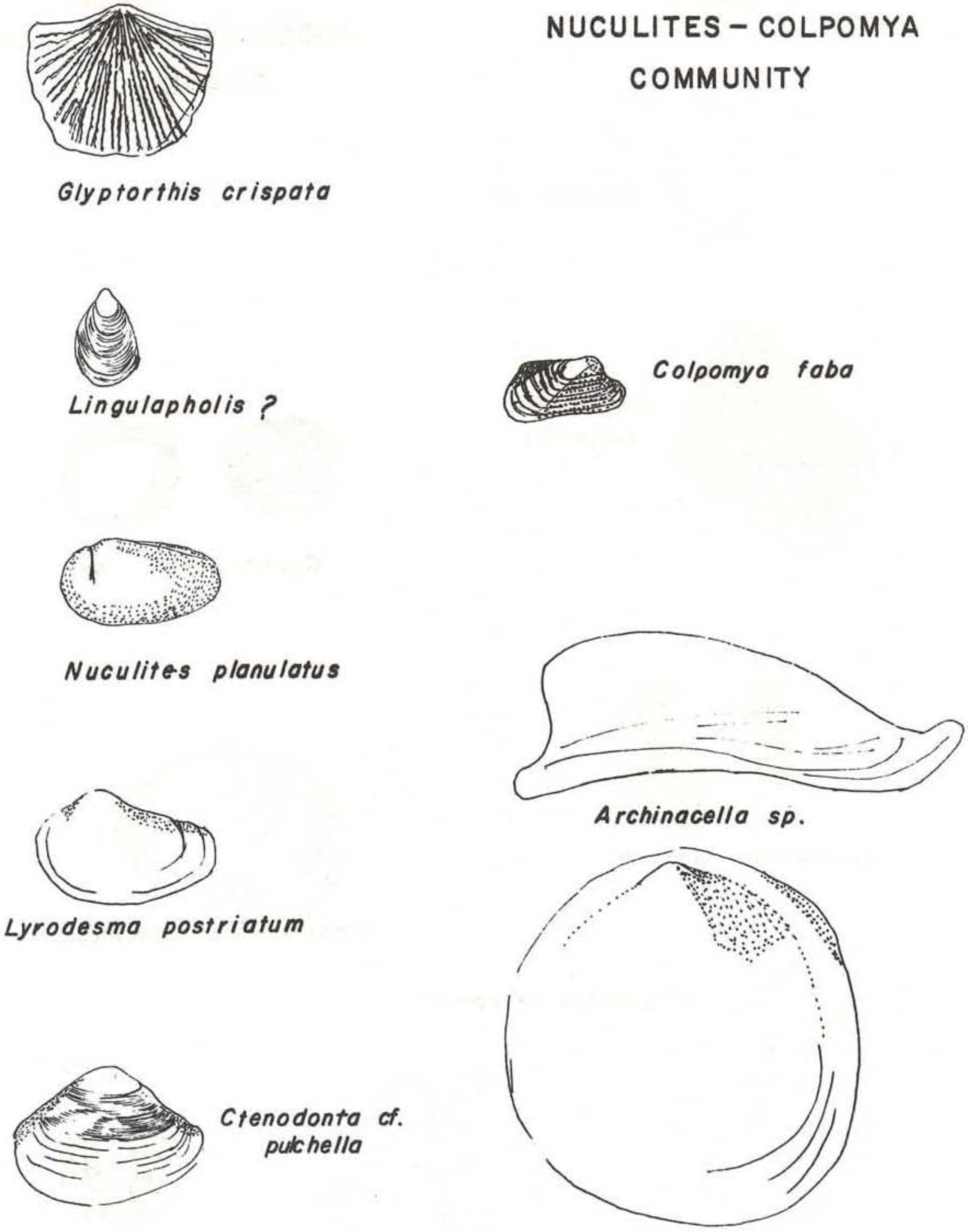

Figure 7. Representative fossils in Nuculites-Colpomya Community.

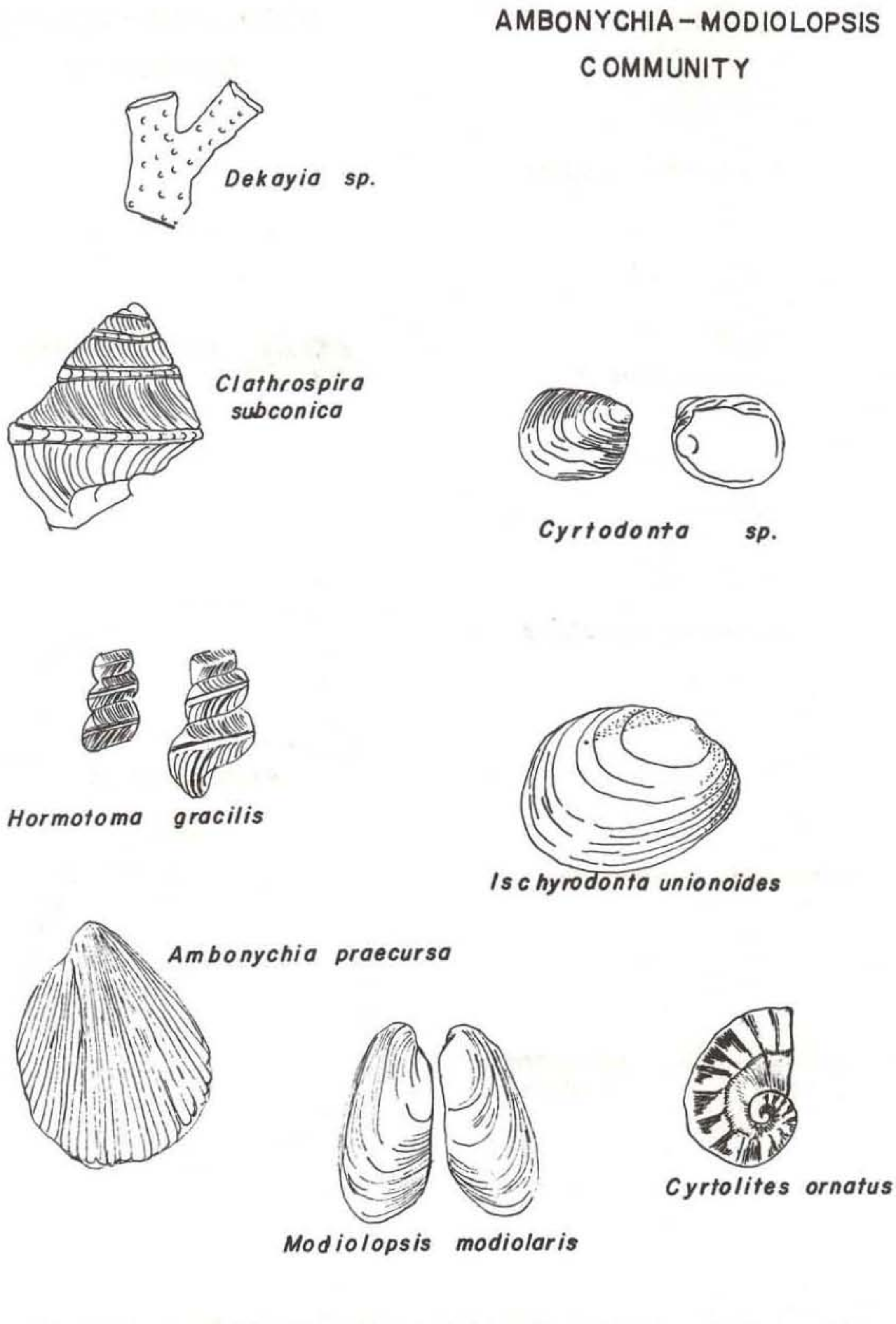

Figure 8. Representative fossils in Ambonychia-Modiolopsis Community.

REFERENCES

Bretsky, P.W., 1969, Central Appalachian Late Ordovician communities: Geol. Soc. America Bull., v. 80, no. 2, p. 193-212.

Bretsky, P.W., 1970, Late Ordovician benthic marine communities in north-central New York: New York State Mus. Bull. 414, 34 p.

Broughton, J.G., Fisher, D.W., Isachsen, Y.W., and Rickard, L.V., 1962, The geology of New York State: New York State Mus. and Sci. Service, Map and Chart Series No. 5, 42 p.

Conrad, T.A., 1839, Second annual report on the paleontological department of the Survey (of New York): State of New York Assembly Document (?) No. 275, 1839, Commun. transmitting reports Geological Survey, Ann. Rept. 3, p. 57-66.

Emmons, E., 1842, Geology of New York; Part II comprising the survey of the second geological district: Albany, (Carroll and Cook), Natural History of New York, 437 p.

Foerste, A.F., 1914, Notes on the Lorraine faunas of New York and the Province of Quebec: Bull. Sci. Lab. Denison Univ., v. 17, p. 247-340.

Foerste, A.F., 1916, Upper Ordovician formations in Ontario and Quebec: Canada Geol. Survey Mem. 83 (No. 70 Geol. Series), 279 p.

Foerste, A.F., 1924, Upper Ordovician faunas of Ontario and Quebec: Canada Geol. Survey Mem. 138 (No. 121 Geol. Series), 255 p.

Hall, J., 1847, Descriptions of the organic remains of the lower division of the New York system: Palaeontology of New York, v. 1, 338 p.

Ruedemann, R., 1925a, The Utica and Lorraine formations of New York: New York State Mus. Bull. 258, Pt. 1, Stratigraphy, 175 p.

Ruedemann, R., 1925b, The Utica and Lorraine formations of New York: New York State Mus. Bull. 262, Pt. 2, Systematic Paleontology No. 1, plants, sponges, corals, graptolites, crinoids, worms, bryozoans, brachiopods, 171 p.

Ruedemann, R., 1926a, Faunal facies differences of the Utica and Lorraine shales: New York State Mus. Bull. 267, p. 61-77.

Ruedemann, R., 1926b, The Utica and Lorraine formations of New York: New York State Mus. Bull. 272, Pt. 2, Systematic Paleontology No. 2, mollusks, crustaceans and eurypterids, 227 p.

Vanuxem, L., 1840, Fourth annual report of the geological survey of the third district: New York Geol. Survey Ann. Rept. 4, p. 355-383.

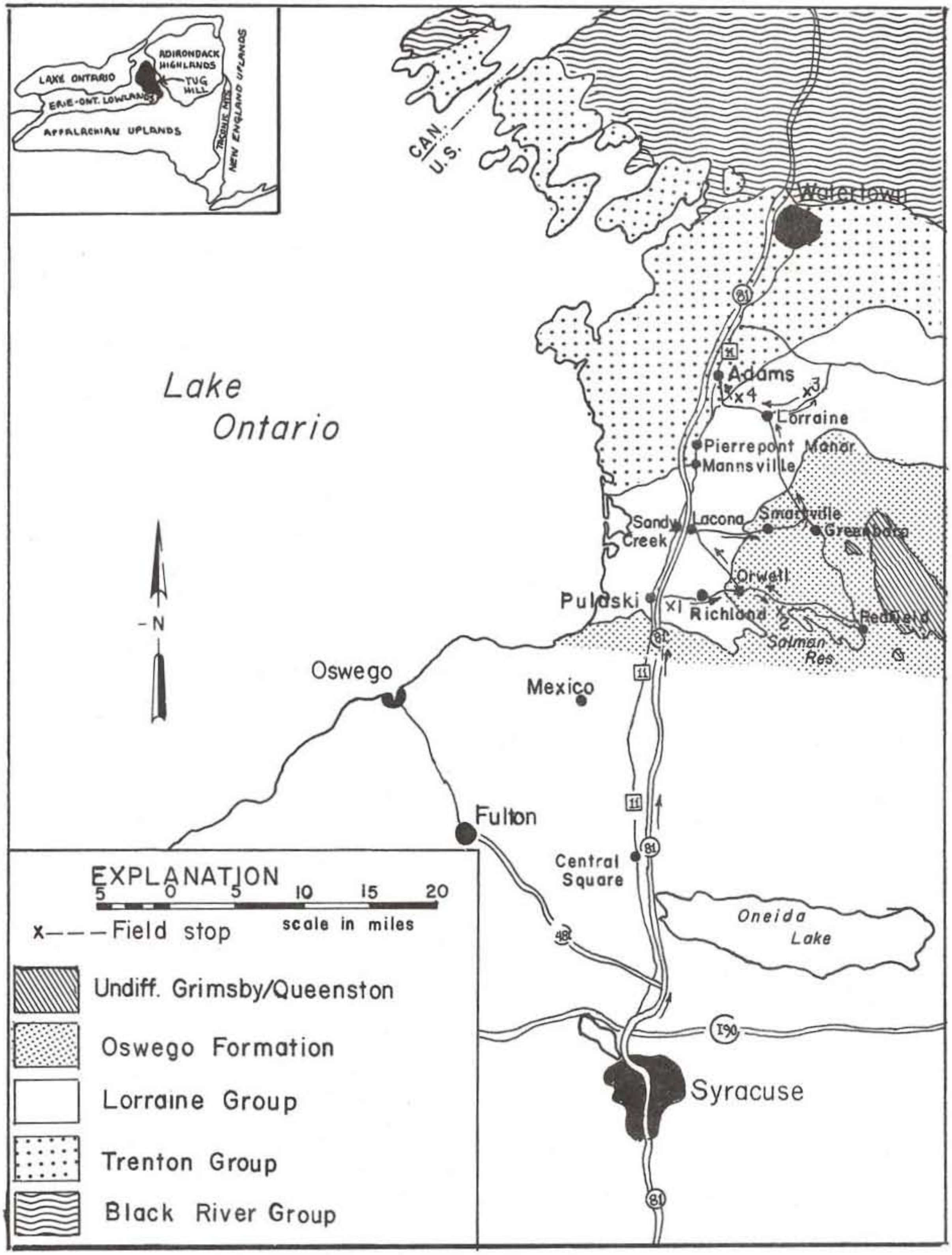

Figure 9. Field trip route with stops.

ROAD LOG

BENTHIC MARINE COMMUNITIES IN THE LATE ORDOVICIAN CLASTICS OF THE TUG HILL REGION, NEW YORK

(All quadrangle references are to the 7.5 minute topographic series)

MILES FROM LAST POINT	CUMULATIVE MILEAGE	ROUTE DESCRIPTION
0.0	0.0	ASSEMBLY POINT: Heroy Hall parking lot, Syracuse University Proceed from university grounds to
0.2	0.2	Crouse Ave.
0.3	0.5	Head north on Crouse Ave., proceed to Harrison St.
0.3	0.8	Turn left (W) on Harrison, proceed to Almond Ave.
0.1	0.9	Turn right (N) on Almond, taking access ramp to I81; follow I81 to Pulaski, New York
4.1	5.0	Cross NYS Thruway
30.7	35.7	Cross Tinker Tavern Road (Exit 35)
3.3	39.0	Take Exit 36 to Pulaski
0.9	39.9	Turn left (W) onto NY13 and follow to intersection with NY11
0.1	40.0	Turn right (N) onto NY11 and proceed thru Pulaski
0.2	40.2	Cross Salmon River
0.2	40.4	Turn right at second stoplight (Maple Ave.)
0.3	40.7	Pass Coho Salmon Collecting Weir on right
0.4	41.1	Cross I81 and take first right, Co. Rt. 2A
1.0	42.1	Proceed to RR tracks which cross highway at Schoeller Paper Company

STOP 1. Salmon River, stream cut exposures near railroad trestle Richland Quadrangle). The organisms here are large, suspension feeding molluscs in the coquinite beds. Note the lack of abrasion and sorting of the shells. The deposition was in the low energy mode on a shallow, gently sloping shelf. Depositional events were episodic but not violent. The mud fauna is made up of infaunal suspension and detritus feeders. Sedimentary structures to be observed here include large dune sets, several sets of ripples and dessication (?) features. "Turkey tracks" and "U"-shaped tubes should also be noted. This outcrop illustrates a proximal facies.

0.3	42.4	Continue SE on Co. Rt. 2A; turn left at fork (Centerville Road)

0.1	42.5	Proceed to Peck Road, turn left and continue
1.7	44.2	Turn right onto Co. Rt. 2 (Richland Rd.)
0.9	45.1	Pass through village of Richland; follow jog in road; proceed to Orwell
2.9	48.0	In Orwell, turn right onto Co. Rt. 22; follow to Falls Road
2.7	50.7	Turn left onto Falls Road
1.4	52.1	Proceed along dirt road to parking area

STOP 2. Salmon River Falls (Orwell Quadrangle). CAUTION !!! This stop involves considerable climbing; footing is poor; do not go near the brink of the falls. This outcrop exhibits the transitional nature of the Oswego -Pulaski boundary. It is the most proximal facies and here we see the last of Upper Ordovician marine sediments. Compare the features of a higher energy regime with those features of STOP 1. Inspect the nature of the fossils and biogenic structures in the Pulaski with the unfossiliferous Oswego Sandstone.

		Turn around; return to Co. Rt. 22; turn right and proceed to Orwell
4.2	56.3	Orwell; continue north on Co. Rt. 22
5.9	62.2	Village of Lacona; turn right (E) onto Co. Rt. 15 (Smartville Road)
8.5	70.7	Proceed to T-intersection; turn left (N) onto Co. Rt.17
8.4	79.1	Village of Lorraine; turn left at intersection with Lorraine-Worth Center Road
0.1	79.2	Pass through village
3.8	83.0	Turn right (E) onto Rt. 178 and proceed to Bullock Corners

STOP 3. Lorraine Gulf (Rodman Quadrangle). Exposures are 0.3 miles north of intersection. Bus will not be able to travel this road. Participants will walk to exposures from here and return to bus at this point. At this outcrop a more distal facies is exhibited. The sediments were deposited early in the regressive phase. Note the taxonomic and preservational changes exhibited here. What is the same when compared to the previous outcrops?

3.8	86.8	Return to Lorraine and continue (W) onto Rt. 178
3.2	90.0	Cross South Sandy Creek
0.2	90.2	Turn right onto Washington Park Road
1.8	92.0	Proceed to parking area in Washington Park

STOP 4. Washington Park (Rodman Quadrangle). Stream cut exposures. This is the most distal sedimentary facies. Stratigraphically, the exposures are lowermost Pulaski, just above the shales of the Whetstone Gulf Formation. Notice the fairly unfossiliferous nature of these beds (what fossils are found?) and the predominance of the shales to siltstones (compare with earlier outcrops).

1.8	93.8	Return to Rt. 178; turn right (N)
1.7	95.5	Proceed to intersection with US11; turn right (N)
0.3	95.8	At first traffic light (Church Street) turn left (W)
0.6	96.4	Pass under I81
0.1	96.5	Take cloverleaf to I81 S
58.3	154.8	Return to Syracuse