

## Trip C

LOWER UPPER DEVONIAN STRATIGRAPHY FROM THE BATAVIA-WARSAW MERIDIAN TO  
THE GENESEE VALLEY: GONIATITE SEQUENCE AND CORRELATIONS

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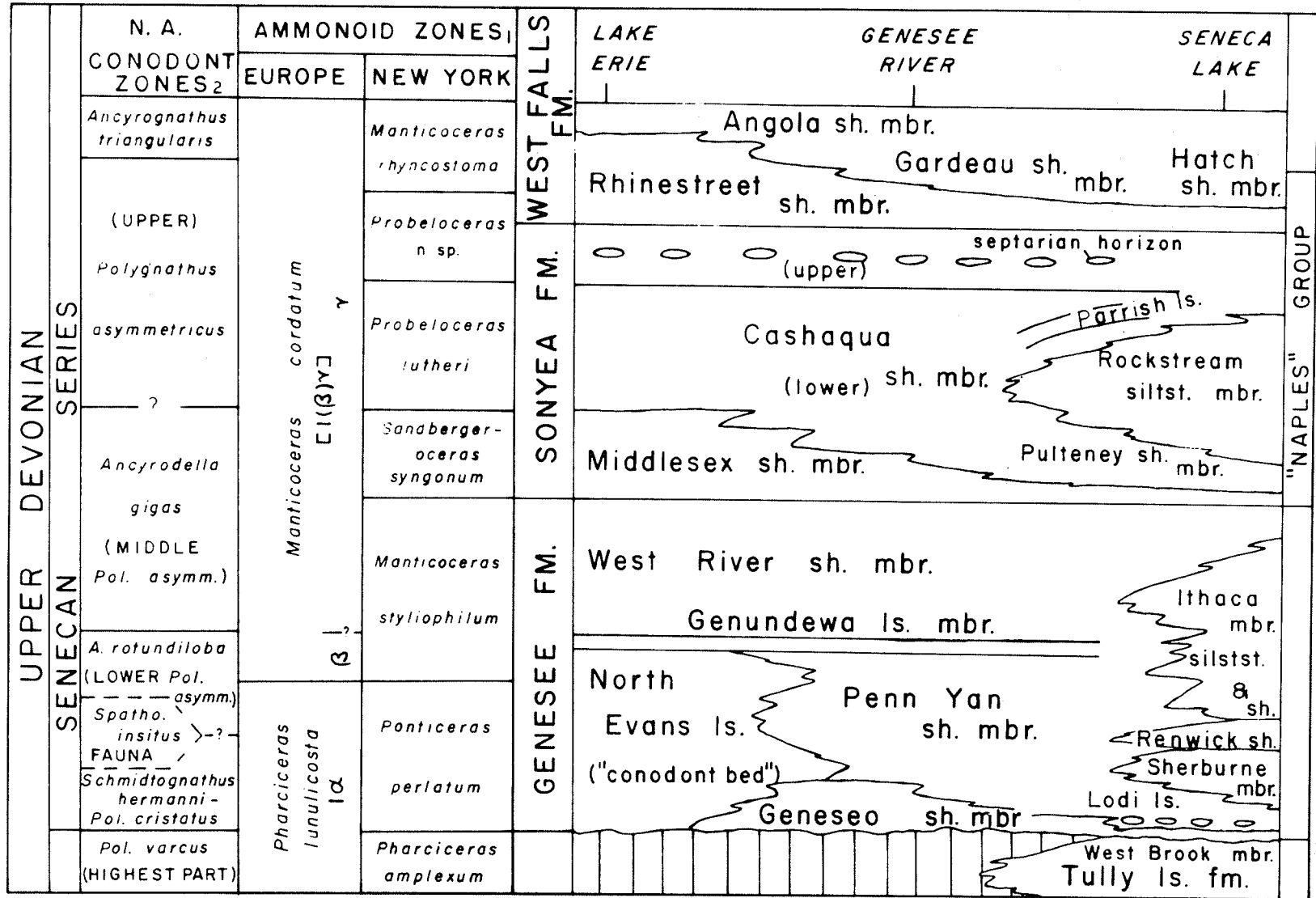
## INTRODUCTION

Previous Work-

The starting point for stratigraphic studies of the Lower Upper Devonian rocks of Western New York is James Hall's (1843) Survey of the Fourth Geological District. In this classic report the names Genesee Slate, Portage Group (with Cashaqua Shale, Gardeau Shales and Flagstones, and Portage Sandstones) became firmly established for the undisturbed and remarkably well exposed sections in and around the Genesee Valley. This far off-shore (basin) succession begins with black and dark gray shales which pass upward into alternating gray, green and black shales, silty gray shales and siltstones, the latter becoming predominant toward the top.

Although little remains of Hall's original subdivision his preliminary observations provided the framework for later detailed stratigraphic studies and the monographs of the rich faunas which these rocks contain (Hall, 1879; Clarke, 1898, 1904). Among the various elements of the chiefly pelagic and molluscan "Naples Fauna" the goniatite cephalopods have received the most attention. Although they lack the diversity of their Eurasian contemporaries, the goniatite faunas from New York have special value because their stratigraphic position and sequence can be rather precisely determined. The correlation of the New York succession with the European standard, by means of goniatites and conodonts, is now generally established (Fig. 1) although a few discrepancies and details still need to be worked out.

FIGURE 1 CORRELATION CHART (Adapted from Rickard, 1964)



1. Modified from House (1962, 1968). 2. Modified from Klapper & others (1971) and Ziegler (1971); European equivalents: ( ).

In nearly a century of study following Hall's report, attempts to correlate units of his subdivision (especially the higher ones) outside the Genesee Valley region were hampered by the complex intertonguing of the shaley succession of westernmost New York with the thicker more arenaceous succession of West-Central New York. The major problems were not resolved until the 1930's (Chadwick, 1933) with the realization that the major facies (for example, black shale, gray shale, and siltstone facies) were contemporaneous (facies equivalents) as well as successive, the more shoreward facies having migrated westward with the seaward progradation of the Catskill Delta.

The subdivision generally accepted at present (Pepper, deWitt, and Colton, 1956; Colton and deWitt, 1958; deWitt and Colton, 1959) is based on recognition of major cyclothemic units of alternating black and gray shale which tongue shoreward into westward thinning wedges of turbidite siltstones and sandstones (slope deposits) (Figs. 1, 2). The widespread black shales (successively: Genesee, Middlesex and Rhinestreet) define the basal members of formations (from oldest to youngest: Genesee, Sonyea and West Falls). The black shales are thought to mark transgressive periods while the siltstones, sandstones and gray shales mark periods of increased rate of delta progradation. By tracing key black shales shoreward into the shelf and non-marine facies, Sutton (1963) was able to extend parts of the subdivision used in the west into the nearshore succession of the delta. These correlations formed the stratigraphic basis for detailed paleo-ecological studies of the shelf faunas (Sutton and others, 1970, Thayer, 1973).

#### Present study -

In 1965 M. R. House (University of Hull, England) with the author as field assistant, began a study of the goniatite sequence of the Upper Devonian of New York, concentrating on the units above the Sonyea Formation; at that time the author was completing a study of the Cashaqua Shale and more recently work has expanded to include details of the lower Genesee Formation.



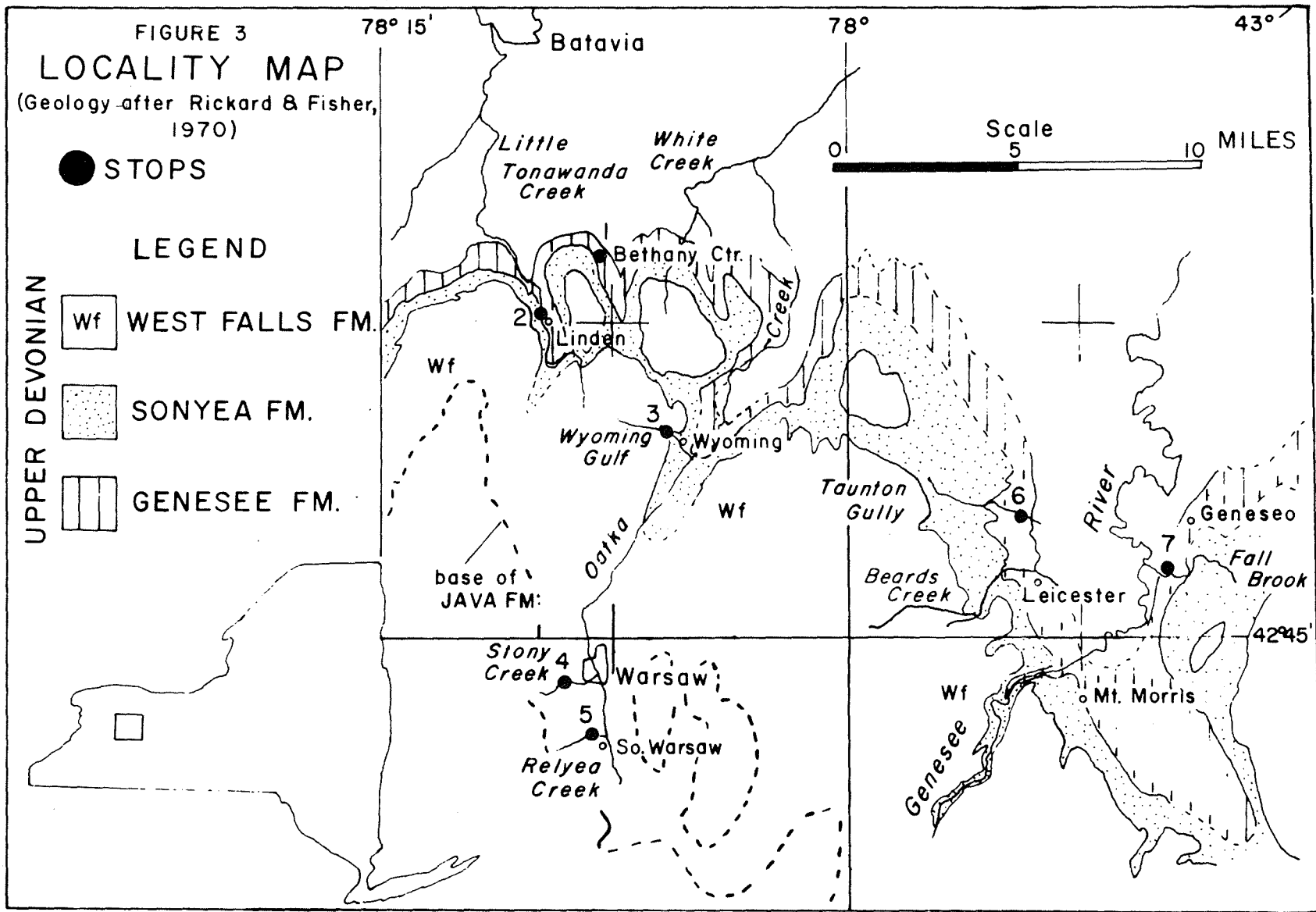
The preliminary results of House's study are available (House, 1966, 1968) and the purpose of this field trip is to demonstrate these and additional findings in sections from the Warsaw Valley to the Genesee Valley (Figs. 2 and 3); this area has been mapped in detail by Clarke and Luther (1908) and Sutton (1951). Of perhaps greatest interest has been the use of thin black shales (within the major cyclothemic units) for intraformational correlations over relatively long distances. Recognition of such units allows one to position the goniatite horizons in the stratigraphic succession, which is an important step in establishing a zonal standard and undertaking phylogenetic and paleoecological studies of the various faunal elements.

#### GENESEEE FORMATION

##### Geneseo and Penn Yan shale members -

In the field trip area the black shales of the Geneseo Member overlies richly fossiliferous gray shales of the Moscow Formation and, locally, the thin lenticular Leicester Pyrite, both of Middle Devonian age (Fig. 4A - B). The so-called dwarfed fauna of the Leicester Pyrite includes bivalves, gastropods, brachiopods, crinoids and ostracods (Loomis, 1903); this is also the type horizon of the goniatite *Tornoceras (T.) uniangulare* (Conrad) (House, 1965, p. 105).

In Western New York the basal black shales of the Geneseo Member are succeeded by dark gray shales with thin limestones and concretion horizons which are followed by black shales interbedded with dark gray shales. The uppermost pair of these black shales, which can be traced from the Cayuga Creek section to the east side of the Genesee Valley, defines the top of the Geneseo Member. DeWitt and Colton (1959, p. 2816) regarded the interval of dark gray shales as a tongue of the Penn Yan Member but since these shales pinch out both east and west of the Genesee Valley they are here assigned to the Geneseo Member. The Penn Yan Member overlies the Geneseo Member and underlies the Genundewa limestone member and is composed of

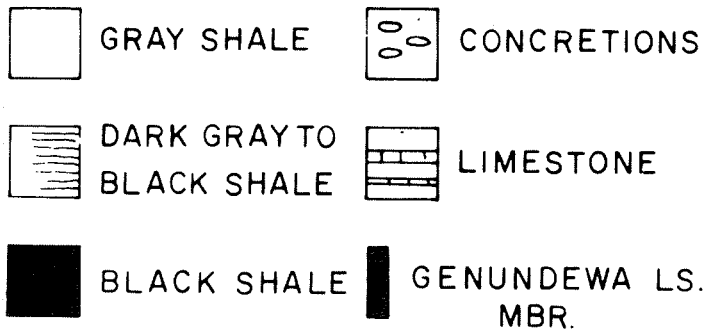
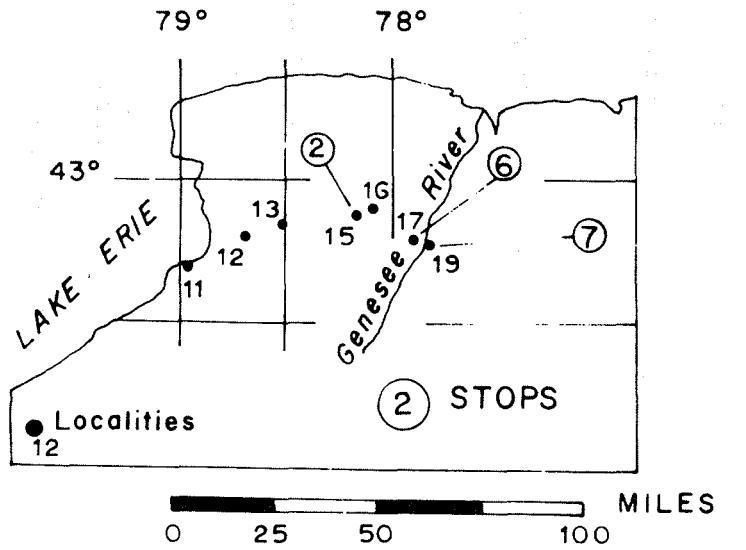


dark gray shales with numerous thin limestones and concretion horizons and a few thin black shales. In the Genesee Valley the combined Genesee and Penn Yan Members are about 80 feet thick. This interval thins rapidly westward and west of Cayuga Creek, where the succession is strongly condensed, the two members cannot be differentiated; at Cazenovia Creek the interval is 2 feet thick and at Eighteenmile Creek it has thinned to less than 0.5 feet thick and the position of the members is occupied by the North Evans Limestone ("Conodont Bed"), a lenticular bone-bed calcarenite.

The rather meager fauna of the Genesee and Penn Yan Members is characterized by the thin shelled bivalve *Pterochaenia fragilis* (Hall) and the small narrow cones of the cricoconarid *Styliolina fissurella* (Hall), the latter sometimes in great abundance. The zone fossil *Ponticeras perlatum* (Hall) and *Tornoceras* occur in both members in the field trip area but neither are common and most specimens are crushed; the best preserved ponticeratids come from the Lodi Limestone in the Penn Yan Member around Seneca Lake (Plate 1). Prior to House's (1968, p. 1065) discovery of *Manticoceras* in the Penn Yan Member east of the Genesee Valley, the zone of *Manticoceras* was thought to begin with the appearance of abundant goniatites in the Genundewa limestone member. House's report is corroborated here with the discovery in the Penn Yan Member of a goniatite horizon with *Manticoceras* in sections from Linden, N.Y. to the Genesee Valley.

Genundewa limestone member -

In the field trip area the Genundewa Member ("*Styliola*" limestone) consists of a series of 4 or 5 irregularly bedded, nodular limestones totaling about 1 to 2.5 feet in thickness and is distinguished by an extraordinary abundance of shells of *Styliolina fissurella*. The Genundewa thickens eastward from 8 to 9 inches around Lake Erie to about 16 feet in the type area at Canandaigua Lake, the thickening due mostly to the increase in thickness of the shales interbedded with



X First *Manticoceras*

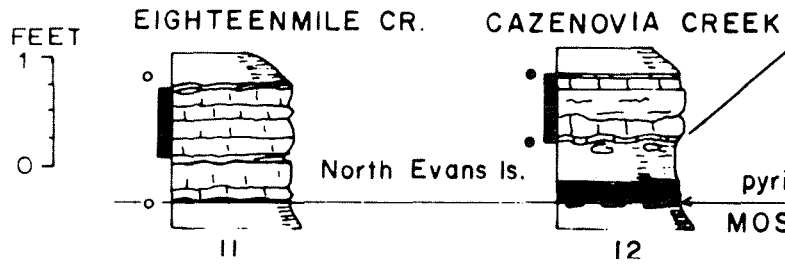


FIGURE 4A  
LOWER GENESEE FORMATION  
WESTERN NEW YORK

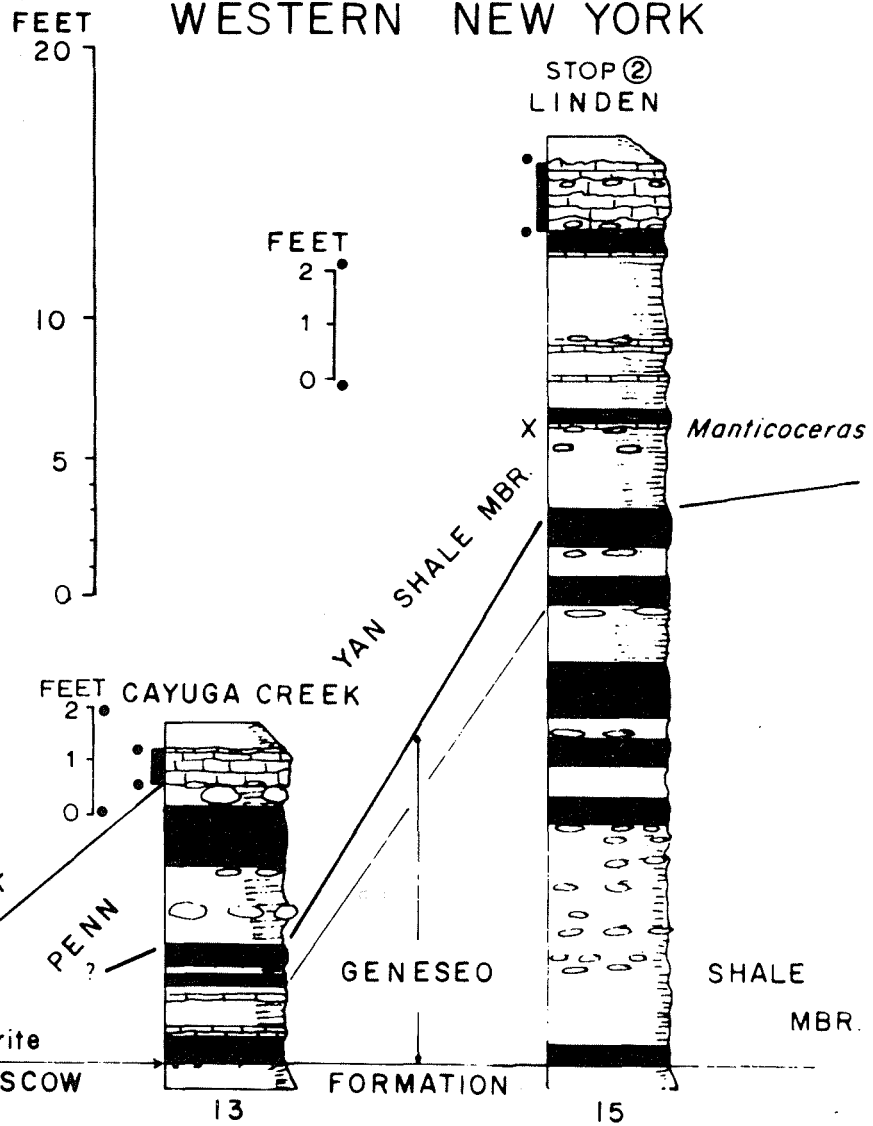
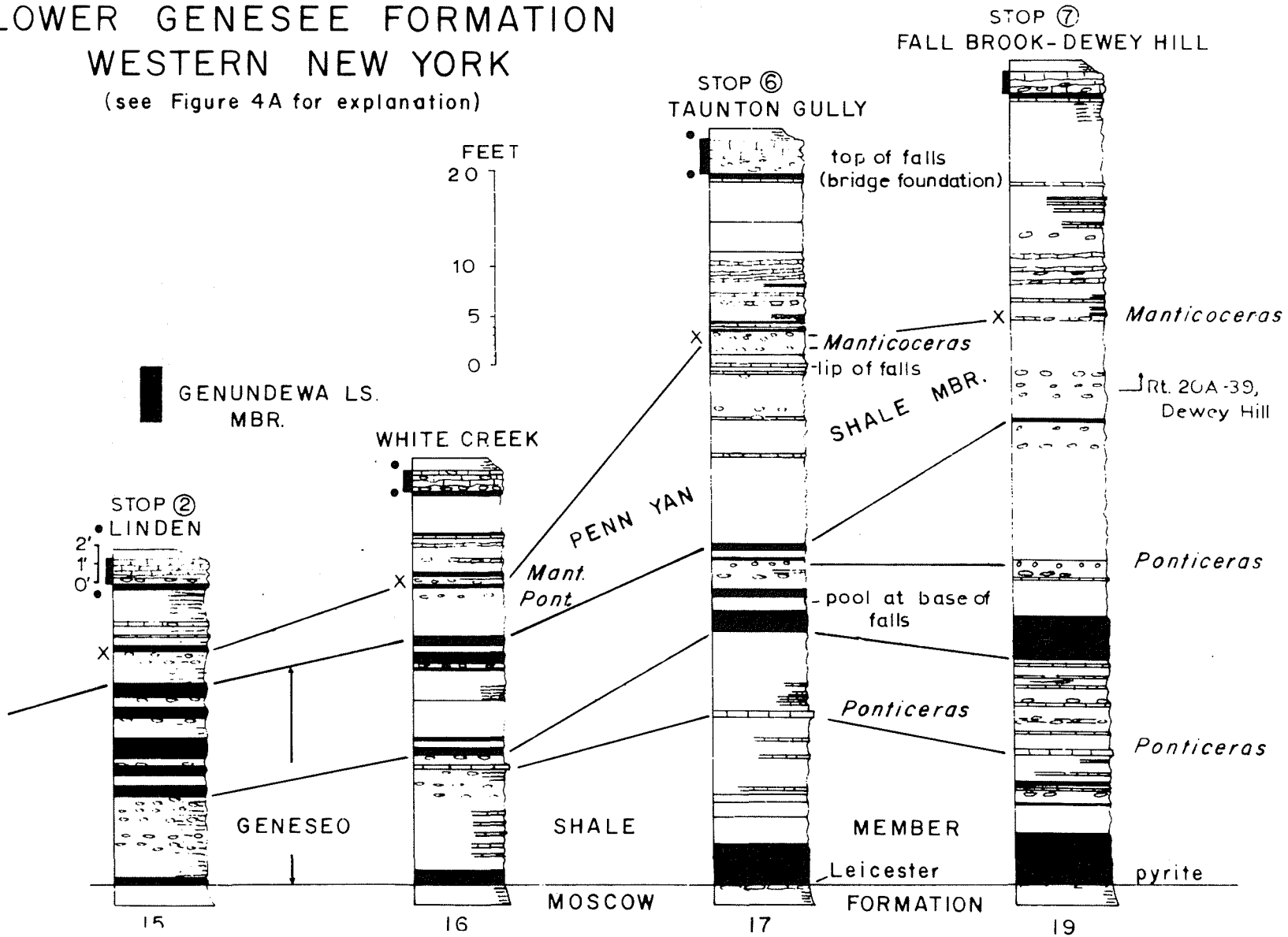




FIGURE 4B  
 LOWER GENESEE FORMATION  
 WESTERN NEW YORK  
 (see Figure 4A for explanation)



the lenses. The Genundewa lithology is one of coarsely crystalline calcite and calcareous shells with variable amounts of pyrite, quartz and accessory glauconite (Sass, 1951).

In addition to the ubiquitous *Styliolina*, the Genundewa fauna ("pronuncial" Naples Fauna of Clarke) includes the bivalves *Pterochaenia fragilis*, *Paracardium doris* (Hall), *Buchiola retrostriata* (v. Buch), species of *Honeoyea*, various gastropods, baccitrid cephalopods, brachiopods, ostracods, conodonts, crinoids and plant fragments (see Sass, 1951 for faunal lists). The Genundewa horizon marks the appearance of an abundant diverse goniatite fauna comparable to the *Manticoceras cordatum* (I ( $\beta$ )  $\gamma$  or I $\beta$ ) zone-fauna of Europe (House, 1962, p. 256). Of the five species of *Manticoceras* reported from the Genundewa (none of which are adequately known), the zone fossil *M. styliophilum* Clarke is the most common. *Tornoceras (T.) uniangulare compressum* Clarke is locally abundant. The Genundewa is also the type horizon of *Probeloceras genundewa* (Clarke) a form which appears to be restricted to the upper part of the member.

The conodont faunas of the lower Genesee Formation, particularly those from the North Evans Limestone and the Genundewa Member are among the earliest to receive intensive study (Hinde, 1879; Bryant, 1921). Conodonts reported from the Genundewa Member include various species of *Polygnathus* and the zone fossil *Ancyrodella rotundiloba* (Bryant).

#### West River Shale member -

The dark concretion-bearing shales of West River Member (above the Genundewa Member) and the overlying black shales of the Middlesex Member (Soneya Formation) have not been studied in detail and are not considered in this report.

## SONYEA FORMATION

Cashaqua shale member -

In Western New York the Middlesex black shale member is overlain by the distinctive soft olive green shales of the Cashaqua Member. It is in this unit that the Naples Fauna attains its richest development. Two major facies are recognized in the member, a concretion facies in the farthest off-shore area between Lake Erie and Honeoye Lake and a nodule facies (Rye Point Shale of Sutton, 1960) extending eastward to Seneca Lake (Kirchgasser, 1967, 1969). The upper part of the Cashaqua is distinguished by an interval of dark gray shales which in turn are overlain, with sharp contact, by the black shales of the Rhinestreet Member of the West Falls Formation.

The concretion facies consists of alternations of olive green shales and discontinuous horizons of concretions and thin argillaceous limestones. East of the Genesee Valley the shales in the lowermost part of the Cashaqua Member interfinger with westward thinning turbidite wedges of siltstones comprising the Pulteney and Rock Stream Members (Walker and Sutton, 1967). The western concretion facies of the Cashaqua correlates eastward with the nodule facies, a condensed sequence of burrowed and current-reworked arenaceous shales and nodule beds believed to have accumulated on submarine swells formed by the siltstones of the Rock Stream Member (Kirchgasser, 1967, 1969).

Scattered through the rocks of the concretion facies are small, thin-shelled molluscs, the most common of which are *Styliolina fissurella*, *Buchiola retrostriata*, *Pterochaenia fragilis* and *Protospirialis minutissima* Clarke, along with minute brachiopods such as *Lingula ligea* Hall and *Chonetes lepidus* Hall. Among the cephalopods *Bactrites aciculum* (Hall), *Manticoceras sinuosum* (Hall) and *Tornoceras (T.) uniangulare obesum* Clarke and the zone fossil *Probeloceras lutheri* (Clarke) frequently occur although they are generally not well preserved. The best preserved goniatite faunas, dominated by *P. lutheri*

or *M. sinuosum*, come from a series of concretion horizons in about the middle of the member west of field trip area and from the nodule facies in the area from Canandaigua Lake to Keuka Lake. It is in this latter area where the bottom conditions were more agitated and shallower that the Naples Fauna is most diverse. In addition to the forms listed above, the fauna there includes much larger bivalves such as species of *Lunulicardium* and *Honeoyea*, *Ontaria suborbicularis*, the gastropods *Loxonema noe* Clarke, *Palaeotrochus praecursor* (Clarke) and *Phragmostoma natator* Hall and auloporida corals. The Naples Fauna is particularly well developed in the nodular Parrish Limestone around Naples, N.Y. (Kirchgasser, 1965).

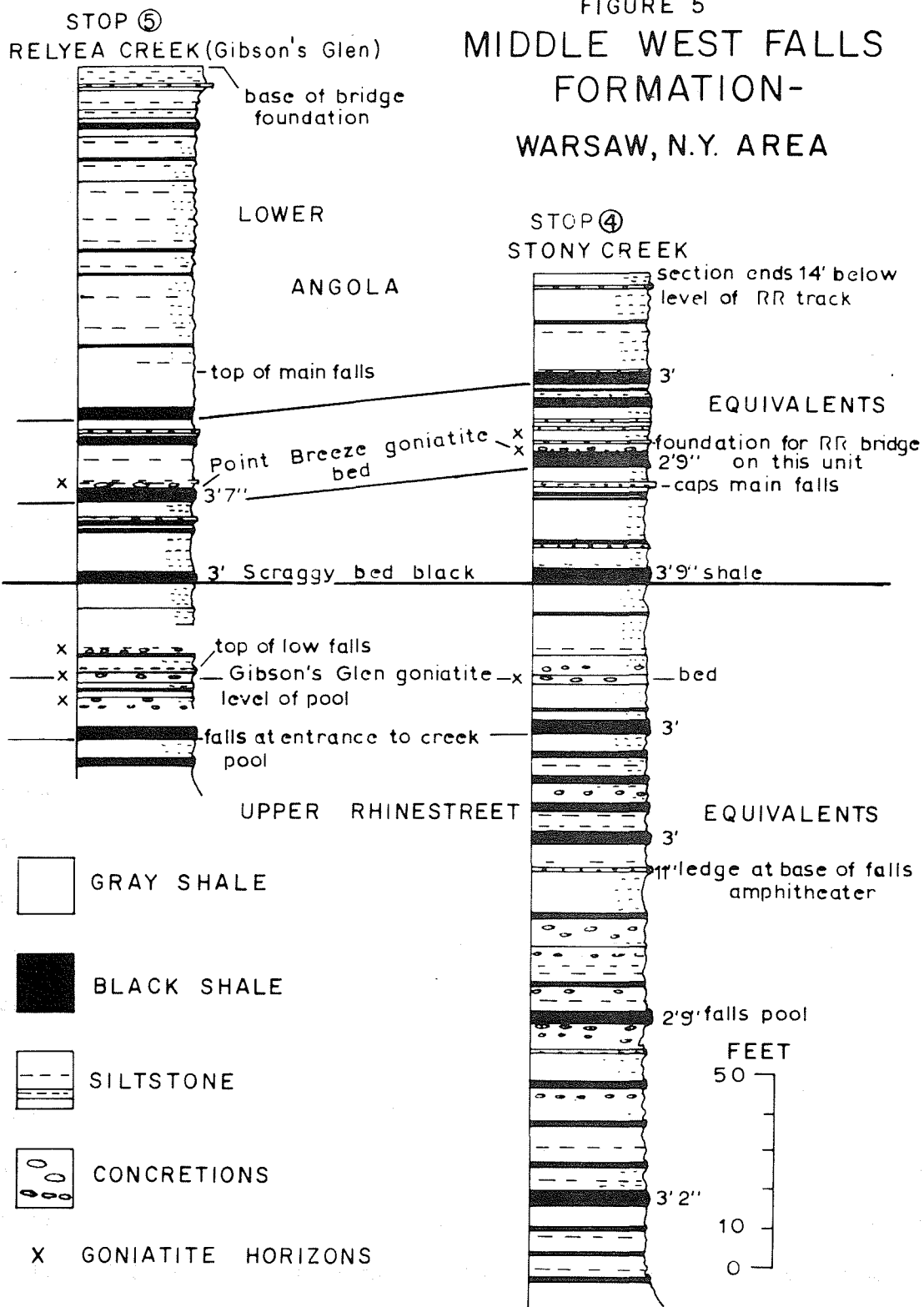
A series of dark shales with a few persistent thin black shales forms a well defined band in the upper Cashaqua from Lake Erie to the Canandaigua Lake area. These dark shales mark a recurrence of a facies comparable to that of the Genesee and Penn Yan shales. The sparse fauna, which includes *Styliolina fissurella*, *Ontaria suborbicularis*, *Buchiola retrostriata*, *Paracardium doris* and *Bactrites aciculum*, and rare goniatites, is distinguished by the common occurrence of *Pterochaenia cashaquae* Clarke. The upper dark shale facies of the Cashaqua is further distinguished by a horizon of septaria with abundant *Styliolina fissurella* which occurs a few feet below the base of the Rhinestreet Shale between Lake Erie and Canandaigua Lake. Around Conesus and Honeoye Lakes this horizon is noted for its well preserved baritic fauna in which *Palaeotrochus praecursor*, *Buchiola retrostriata*, *Loxonema noe*, *Phragmostoma natator*, *Bactrites aciculum*, *Manticoceras sinuosum* and *Tornoceras (T.) uniangulare obesum* are particularly common. This also is the type horizon of *M. neapolitanum* (Clarke) and a new species of *Probeloceras*, to be described in a forthcoming paper, which is distinguished from the common *P. lutheri* lower down in the Cashaqua, by its concave periphery. The conodont fauna of the Cashaqua includes *Ancyrodella nodosa* Ulrich and Bassler and *Palmatolepis punctata* (Hinde) indicating the Upper *Pol. asymmetricus* Zone.

## WEST FALLS FORMATION

Around Lake Erie the West Falls Formation is composed of the black shales of the basal Rhinestreet Member and the overlying gray shales of the Angola Member. The boundary between the Rhinestreet and Angola Members is marked by the Scraggy Bed (Luther, 1903), a horizon of irregular pyritic concretions. The lower Angola Member is characterized by minor cyclothemic units of thin black shale, burrowed gray shale and gray shale with concretions and thin siltstones. Several of the concretion horizons have goniatites, among them Clarke's goniatite horizons from Big Sister Creek, Angola, N.Y. (House, 1966, p. 55; 1968, p. 1065). The West Falls Formation thickens rapidly to the east (shoreward) as the black and gray shale facies of the west intertongue with more arenaceous facies (Fig. 2).

The lowermost minor cycles of the Angola Member have been traced bed-by-bed from Lake Erie shore as far as the Warsaw Valley, where the members of the West Falls Formation are (from oldest to youngest) the Rhinestreet black shales Gardeau gray shales, siltstones and black shales, the West Hill siltstones and gray shales and the Nunda sandstones. The black shale immediately overlying the Scraggy Bed, which to the west marks the Rhinestreet-Angola boundary, occurs in the upper part of the Gardeau Member (Figs. 3, 5). In Stony Creek (Stop 4) and Relyea Creek (Stop 5) the well known Gibson's Glen (Relyea Creek) Goniatite Bed occurs 24 to 25 feet below the Scraggy Bed black shale, in rocks equivalent to the upper Rhinestreet of westernmost New York (House, 1968, p. 1066). Another key goniatite horizon, named the Point Breeze Goniatite Bed (House, 1968, p. 1066) has been traced from its type exposure in the lower Angola on Lake Erie shore into Warsaw succession where it occurs 23 feet above the Scraggy Bed black shale in Relyea Creek and 30 feet above the same shale in Stony Creek. Attempts to trace the above mentioned horizons farther east into the succession

FIGURE 5  
MIDDLE WEST FALLS  
FORMATION-  
WARSAW, N.Y. AREA



in the Genesee Valley (gorge section in Letchworth Park, Mr. Morris) proved unsuccessful but L. V. Rickard (NYS Museum; personal communication, 1973), working with subsurface data, has recently traced several key horizons into the Genesee Valley section and sections farther to the southeast.

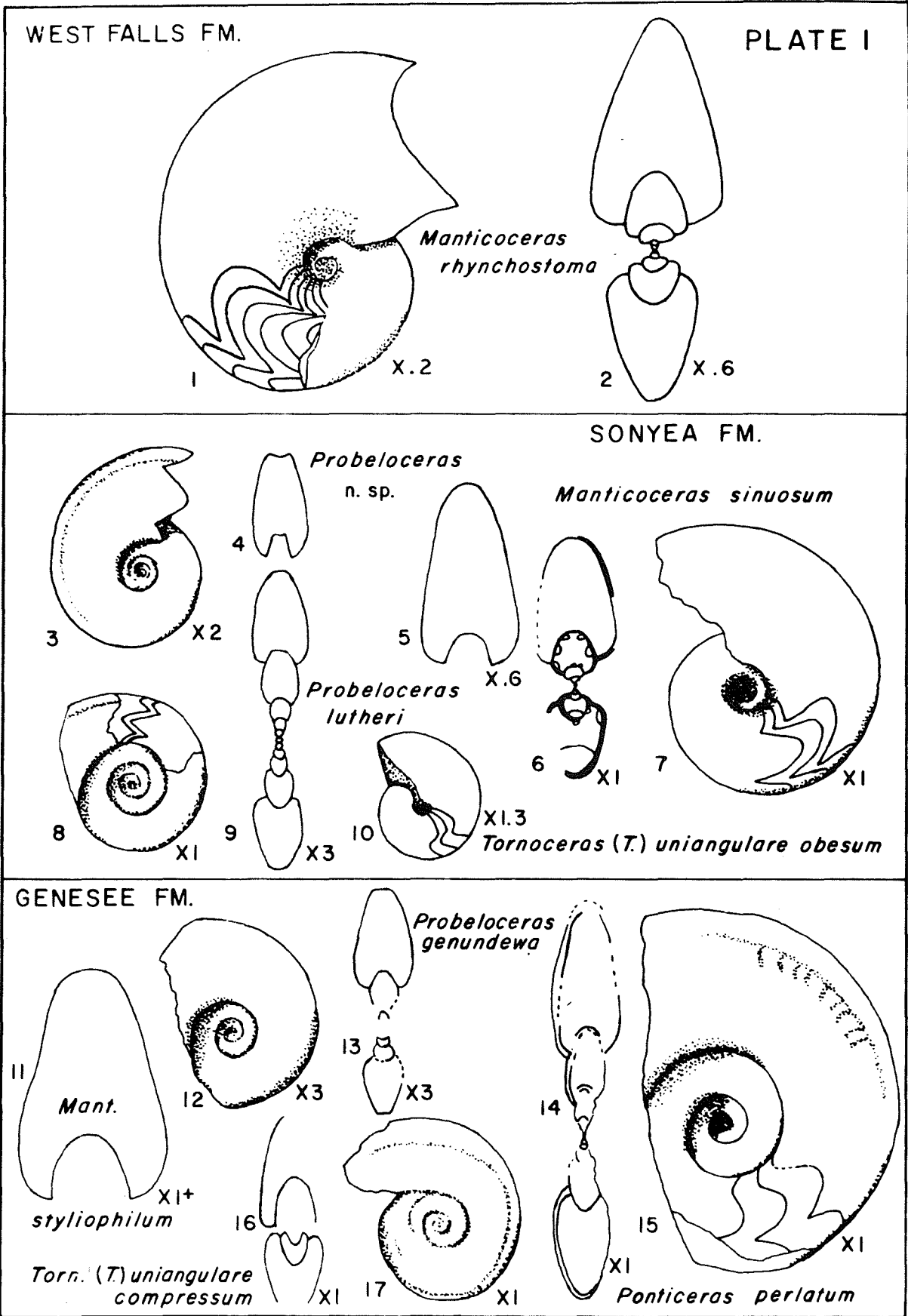
In the field trip area the goniatite-bearing concretion horizons of the Gardeau Member (equivalent to Upper Rhinestreet and Lower Angola to the west) include the zone fossil *Manticoceras rhynchostoma* Clarke, forms like *M. sinuosum* (Hall), large oxyconic manticoceratids (laterally compressed with acute periphery) along with *Tornoceras* and *Aulatornoceras*. In general the fauna of the Gardeau Member is a diminished Naples Fauna with many forms ranging upward from the Cashaqua Shale (see Clarke and Luther, 1908, p. 60-61 for faunal list).

The shales of the lowermost Rhinestreet Member are well known for their conodonts (Ulrich and Bassler, 1926; Huddle, 1968) and the faunas include *Ancyrodella nodosa* and *Palmatolepis punctata*, indicating the Upper *Polygnathus asymmetricus* Zone. The succeeding *Ancyrognathus triangularis* Zone begins in the Gardeau Member (Klapper and others, 1971, p. 302).

Explanation Plate 1 - Lower Upper Devonian goniatites from the Genesee, Sonyea  
and West Falls Formations, Western New York.

- 1-2. *Manticoceras rhynchostoma* Clarke. Angola Shale (West Falls Fm.) 1. Lateral view; Big Sister Creek, Erie Co., N.Y. From Miller, 1938 after Clarke, 1898. 2. Cross-section; Angola, N.Y. From Miller, 1938 after Clarke, 1898.
- 3-4. *Probeloceras* n. sp. Cashaqua Shale (Sonyea Fm.) (Probably from septarian horizon in upper dark shale facies of Cashaqua around Honeoye Lake). 3. Lateral view and 4. Cross-section. Specimen figured (as *P. lutheri*) by Clarke, 1898, pl. 7, fig. 4 and House, 1962, pl. 45, figs. 5, 6; text-fig. 3C-D.
- 5-7. *Manticoceras sinuosum* (Hall). Cashaqua Shale (Sonyea Fm.) 5. Cross-section; baritic specimen from septarian horizon in upper dark shale facies, Cottonwood Point, Conesus Lake. 6. Cross-section; concretion horizon 34.5 feet below top of member, Cayuga Creek, Cowlesville, N.Y. 7. Lateral view; pyritic specimen, shales 35 feet below top of member, Beards Creek, near Pine Tavern, N.Y.
- 8-9. *Probeloceras lutheri* (Clarke). Cashaqua Shale (Sonyea Fm.) 8. Lateral view; concretion horizon 55 feet below top of member, Wyoming Gulf, Wyoming, N.Y. 9. Cross-section; concretion horizon 34.5 feet below top of member, Cayuga Creek, Cowlesville, N.Y.
10. *Tornoceras (T.) uniangulare obesum* Clarke. Cashaqua Shale (Sonyea Fm.) Concretion horizon 22 feet above base of member (top of Rock Stream Siltstone), Randall Gully, near Bristol Center, N.Y.
11. *Manticoceras styliophilum* Clarke. Genundewa Limestone (Genesee Fm.) Near Canandaigua Lake. From Miller, 1938 after Clarke, 1898.
- 12-13. *Probeloceras genundewa* (Clarke). Genundewa Limestone (Genesee Fm.) 12. Lateral view and 13. Cross-section. Top of member, Beards Creek, Leicester, N.Y.
- 14-15,  
17. *Ponticeras perlatum* (Hall). Genesee Formation 14. Cross-section and 15. Lateral view; Lodi Limestone (Penn Yan Shale), Ovid, N.Y. 17. Lateral view; Genesee Shale: Limestone 13 feet above base of member, Fall Brook, near Genesee, N.Y.
16. *Tornoceras (T.) uniangulare compressum* Clarke. Genundewa Limestone (Genesee Fm.). Cross-section; Bethany Center, N.Y. From House, 1965.





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TRIP : Lower Upper Devonian Stratigraphy from the Batavia-Warsaw Meridian to the Genesee Valley: Goniatile Sequence and Correlations.

## ROAD LOG

<u>Cumulative Miles</u>	<u>Miles from last point</u>	<u>Description</u>
(7 1/2' Quadrangle Maps)		
0.0	0.0	Assembly point: Parking lot, Towne House Motor Inn, Rt. 15 and Mt. Hope Street, Rochester, N.Y. Departure time: 8:00 A.M. Turn right (S) out of parking lot onto U.S. Rt. 15 and proceed toward N.Y. Thruway (Interstate 90).
5.4	5.4	Turn left at N.Y. Thruway Entrance (Interchange 46) and proceed WEST BOUND toward Buffalo.
21.7	16.3	Exist Thruway at Interchange 47.
22.3	.6	Turn onto N.Y. Rt. 19 and proceed SOUTH to LeRoy, N.Y.
27.0	4.7	Jct. Rt. 19 and N.Y. Rt. 5, LeRoy, N.Y.; continue SOUTH on Rt. 19.
32.1	5.1	(Stafford) Jct. Rt. 19 and U.S. Rt. 20. Take Rt. 20 WEST.
34.7	2.6	Jct. Rt. 20 and N.Y. 63. Continue West on Rt. 20.
36.1	1.4	West branch White Creek. Continue West on Rt. 20 past East Road (0.6 miles) and Black Creek (1.0 miles) and proceed up the hill.
38.1	2.0	STOP 1: BETHANY CENTER, N.Y. Park below the overpass at right turnoff to Bethany Center. Walk down hill on north side of Rt. 20 and observe loose blocks of Genundewa Limestone on the embankment. Although the rocks are weathered and picked over, this remains one of the best collecting sites for the fauna of the Genundewa Limestone. In addition to the ubiquitous <i>Styliolina</i> , the more common fossils are species of <i>Pterochaenia</i> and <i>Bactrites</i> , <i>Tornoceras (T.) uniangulare compressum</i> and forms referable to <i>Manticoceras styliophilum</i> . The less weathered blocks of limestone yield abundant conodonts when digested in dilute acetic acid.  Continue WEST on Rt. 20; pass under Center Road overpass and continue past Jct. with Marsh Road (on left) (0.9 miles).

<u>Cumulative miles</u>	<u>Miles from last point</u>	<u>Description</u>
39.8	1.7	Turn left (S) onto Silver Road (farm on left with many silos) and enter one of more scenic areas of Genesee and Wyoming Counties.
40.4	0.6	Turn left onto Mill Road and follow valley of Little Tonawanda Creek past Jct. with Smith Road (on left) (0.6 miles).
41.5	1.1	STOP 2: LINDEN, N.Y. Walk to edge of Little Tonawanda Creek and observe section of lower Genesee Formation (Genesee, Penn Yan and Genundewa members) in falls of side creek (Fig. 4A-B) (Private Property).  The contact with the underlying Moscow Formation is at about creek level. At this locality the Genesee-Penn Yan interval is 31 feet thick; at Eighteenmile Creek near Lake Erie this same interval is less than 0.5 feet thick and on the east side of the Genesee Valley (Stop 7) it is 80 feet thick.  The Genesee-Penn Yan contact is drawn at the top of a pair of black shales which outcrop in the face of the falls; the horizon of these shales has been traced westward to Cayuga Creek and eastward to the east side of the Genesee Valley.  <i>Manticoceras</i> first appears in the Penn Yan Member in a concretion horizon 8.5 feet below the base of the Genundewa Limestone, which caps the falls. <i>Tornoceras (T.) uniangulare compressum</i> and forms referable to <i>Manticoceras styliophilum</i> are common in the Genundewa Limestone in this area.  Continue SOUTH on Mill Road and follow left (east) side of the triangular intersection above falls at village of Linden.
41.8	0.3	Turn (E) left at the intersection.
42.0	0.2	Take the right (S) branch of Y-intersection onto Skates Hill-Belknap Road and proceed toward West Middlebury.
43.0	1.0	(Dale) Village of West Middlebury. At T-junction, turn left (E) onto West Middlebury Road.
45.5	2.5	(Wyoming) Turn right (S) at T-junction (Wrights Corner) and proceed SOUTH on East Bethany Road toward Wyoming, N.Y.

<u>Cumulative miles</u>	<u>Miles from last point</u>	<u>Description</u>
47.4	1.9	<p>STOP 3: WYOMING GULF. Park on right (S) side of road at Jct. with Wass Road (on right).</p> <p>Contact between Cashaqua and Rhinestreet Shales occurs in road cut above the intersection.</p> <p>The dark shale facies of the upper Cashaqua is rather poorly exposed here but the characteristic fossil <i>Pterochaenia cashaqua</i> is common at some levels; The horizon of baritic septaria which characterizes the uppermost Cashaqua is not exposed at this locality. A 3 inch thick black shale about 10 feet below the base of the Rhinestreet has been traced in about the same position from Lake Erie to Honeoye Lake.</p> <p>Walk down the hill and observe roadcuts (or stream section) of the concretion facies of the Cashaqua. The following fossils are common in olive green shales and concretions: <i>Styliolina fissurella</i>, <i>Buchiola retrostriata</i>, <i>Paracardium doris</i>, <i>Pterochaenia</i> sp., <i>Protospirialis minutissima</i>, <i>Bactrites aciculum</i> and <i>Probeloceras lutheri</i>. Less common are: <i>Ontaria suborbicularis</i>, <i>Loxonema noe</i>, <i>Palaeotrochus praecursor</i>, <i>Spathiocaris emersoni</i> (crustacean), <i>Tornoceras (T.) uniangulare obesum</i> and <i>Manticoceras sinuosum</i>.</p> <p>In general the fauna is dominated by small shells and is less diverse than the Naples Fauna in the nodule facies of the Cashaqua around Canandaigua and Keuka Lakes where in more arenaceous, current-reworked, and probably shallower water sediments, the larger bivalves such as <i>Lunulicardium</i>, <i>Ontaria</i>, and <i>Honeoyea</i> were important elements.</p> <p>Continue SOUTH on East Bethany Road to Village of Wyoming.</p>
47.9	0.5	Jct. N. Y. Rt. 19. Turn right (S) on Rt. 19 and proceed SOUTH along the Oatka Creek (Wyoming) Valley toward Warsaw, N.Y.
54.7	6.8	Jct. Rt. 19 and U.S. Rt. 20A, Warsaw, N.Y. Turn right (W) on Rt. 20A and proceed up the hill past exposures of the Gardeau Member, West Falls Formation.

(Warsaw)

<u>Cumulative miles</u>	<u>Miles from last point</u>	<u>Description</u>
55.7	1.0	<p>STOP 4 - STONY CREEK. Park beyond RR tracks opposite RR station. Cross Rt. 20A (CAUTION) and walk 0.5 miles SOUTH along RR tracks to Stony Creek. Climb down embankment to left of bridge. CAUTION: STAY OVER TO LEFT, AWAY FROM THE FALLS !!</p> <p>Observe section in middle part of West Falls Formation (Figs. 2, 5). At this meridian, the western Angola shale facies (member) interfingers with the more arenaceous Gardeau facies. The succession consists of silty gray shales interbedded with siltstones black shales and concretion horizons. The siltstones, many of which are crossbedded and ripplemarked, are thicker and more numerous toward the top of the section.</p> <p>The black shale above the Scraggy Bed, which marks the Rhinestreet-Angola contact around Lake Erie, is represented in this section by a 3 foot 9 inch bed of black shale, 22 feet below the top of the 1 foot thick siltstone capping the main falls. The Gibson's Glen Goniatite Bed (Stop 5) occurs lower down, 25 feet below the base of the Scraggy Bed black shale, in rocks equivalent to the Upper Rhinestreet of westernmost New York. The Point Breeze Goniatite Bed, which has been traced from its type exposure on Lake Erie shore, occurs 7.5 feet above the 1 foot thick siltstone in rocks equivalent to the Lower Angola Shale to the west.</p> <p>Return to village of Warsaw.</p>
56.5	0.8	Turn right (opposite school) onto Liberty Street and proceed two blocks.
56.9	0.4	<p>Village Park, Warsaw, N.Y. LUNCH</p> <p>From main park entrance turn left onto Liberty Street, proceed one block and turn right onto Brooklyn Street.</p>
57.3	0.4	Jct. Rt. 19. Turn right (S) onto Rt. 19 and proceed SOUTH toward South Warsaw, N.Y.
58.9	1.6	<p>STOP 5 - RELYEA CREEK. (0.2 miles north of center of Village of South Warsaw).</p> <p>Section commences at edge of farm field, 500 yards west of Rt. 19 at c. 1100 feet altitude. (Private property).</p>



<u>Cumulative miles</u>	<u>Miles from last point</u>	<u>Description</u>
		The Gibson's Glen Goniatite Bed, noted for its well preserved specimens of <i>Manticoceras rhynchostoma</i> , outcrops in the face of the low falls about 100 yards upstream from start of section (Fig. 5).; goniatites are also common in concretions about 5 feet above the top of the falls.
		The Scraggy Bed black shale outcrops about 100 yards farther upstream, about 2 feet above the base of the high falls. The Point Breeze Goniatite Bed occurs in the face of the falls, about 23 feet higher, beneath an 11 inch thick siltstone.
		Return to Warsaw via Rt. 19.
60.8	1.9	Jct. Rt. 19 and Rt. 20A. Turn right (E) onto Rt. 20A.
67.7	6.9	Jct. N.Y. Rt. 246. Continue EAST on Rt. 20A.
		(Mount Morris-Leicester)
71.6	3.9	Jct. Rt. 20A and N.Y. Rt. 39. Turn left (N) on 20A-39 and proceed toward Leicester, N.Y.
73.9	2.3	Jct. Rt. 20A - 39 and N.Y. Rt. 36, Village of Leicester. Turn left (N) onto Rt. 36. Cross Beards Creek (0.2 miles) and continue past Covington Road (left) (0.3 miles), Little Beards Creek (1.1 miles) and New Road (1.3 miles).
75.5	1.6	STOP 6 - TAUNTON GULLY. Park on right side of Rt. 36 and cross the highway (CAUTION). The bus will proceed to rendezvous point at top of section. Those who do not wish to walk the entire creek section (about one mile) may stay on the bus:  Proceed NORTH on Rt. 36.
75.8	0.3	Turn left (W) onto Peoria Road.
76.7	0.9	Turn left (S) onto Starr Road.
76.9	0.2	Bridge over Taunton Gully; rendezvous point.
		Section commences in Geneseo shale member (Genesee Formation) above Leicester Pyrite, about 2000 feet west of RR bridge at 730 feet elevation (Fig. 4B).
		<i>Styliolina fissurella</i> and <i>Pterochaenia fragilis</i> occur in the gray shales and thin argillaceous limestones above the basal black shales of the Geneseo and poorly preserved <i>Ponticeras perlatum</i> and <i>Tornoceras</i> sp. are not uncommon in the most prominent limestone outcropping 17 feet above the base of the member. This limestone is also recognized at White Creek, Beards Creek, and Fall Brook.

<u>Cumulative miles</u>	<u>Miles from last point</u>	<u>Description</u>
		<p>The Geneseo-Penn Yan contact is drawn at the top of a pair of black shales about 4.5 feet above the 10 inch black shale near the level of the pool at the base of the main falls. The bed of small nodules immediately below the lower member of the pair of black shales contains rare <i>Ponticeras</i> in the Beards Creek and Fall Brook sections. Forms referable to <i>Ponticeras perlatum</i> occur in the concretion horizon 3 feet below the 1 foot interval of thin <i>Styliolina</i> limestones which form the lip of the falls; similar limestones are frequent higher in the Penn Yan Member.</p> <p><i>Manticoceras</i> first appears in the section in a 2 foot interval of concretions and nodules beneath a 5 inch black shale, 16 feet below the base of the Genundewa limestone member. <i>Probeloceras genundewa</i> occurs in the topmost beds of the Genundewa which outcrop a few feet upstream from the road bridge.</p> <p>Return to Leicester via Rt. 36.</p>
79.9	3.0	Turn left (E) onto Rt. 20A - 39 and N.Y. Rt. 36.
80.1	0.2	Jct. Rt. 20A - 39 and Rt. 36. Continue straight (E) on Rt. 20 A - 39 toward Geneseo, N.Y.
		(Geneseo)
		Proceed past Cuylerville onto floodplain of the Genesee River.
83.0	2.9	Genesee River
83.3	0.3	Fall Brook.
83.7	0.4	STOP 7 - DEWEY HILL
		Roadcut exposes upper Penn Yan shale and Genundewa limestones members (Genesee Formation) (Fig. 4B)
		The Geneseo and Penn Yan members are well exposed in the classic section in nearby Fall Brook but most of the Penn Yan is inaccessible except in the side creek. In the road section the Penn Yan is characterized by silty gray shales interbedded with many thin argillaceous limestones and a few concretion horizons. Several of the thin limestones are composed almost entirely of <i>Styliolina fissurella</i> .

<u>Cumulative miles</u>	<u>Miles from last point</u>	<u>Description</u>
		Poorly preserved goniatites identified as <i>Manticoceras</i> and <i>Tornoceras</i> occur in a 4.5 inch thick limestone above the interval of concretions near the base of the section, and similar forms occur about 3 feet higher in the lowest member of a set of three <i>Styliolina</i> limestones.
		The Genundewa limestone, which caps the Falls at Fall Brook, outcrops at the crest of the hill.
		Continue (E) on Rt. 20A - 39 to top of hill.
83.9	0.2	Jct. 20A - 39 and N.Y. 63. Turn left (N) and continue on Rt. 20A - 39 into village of Geneseo.
84.9	1.0	Jct. Rt. 39 and Rt. 20A. Proceed EAST on Rt. 20A.
91.0	6.1	Jct. Rt. 20A and N.Y. Rt. 256. Turn left (N) onto Rt. 256.
92.4	1.4	Jct. Rt. 256 and U.S. Rt. 15. Turn left (N) on Rt. 15 and proceed NORTH to Rochester.
106.5	14.1	Entrance to N.Y. Thruway (Interchange 46).
111.9	5.4	Towne House Motor Inn.

