Pittsburgh Geological Society Presents

The 2004 Spring Field Trip
April 30 – May 1, 2004

Stop 1 - Penn-Dixie Paleontological and Outdoor Education Center:
Jerold C. Bastedo

and

Stop 2 - Niagara Gorge at the Whirlpool:
Chuck Shultz

Organization and arrangements by Wendell Barner
Handout by Chuck Shultz

PGS Spring Field Trip

Tentative Saturday Schedule

8:00	leave Tallyho-Tel
8:15	arrive Penn-Dixie Site (2-3 miles)
10:30	leave quarry
11:45	arrive Whirlpool Park (52 miles)
11:45-12:15	lunch
12:15-12:30	geology talk, edge of the gorge
12:30-4:00	hike to Whirlpool and return (1.7 miles; 300+feet vertical)
4:00	leave Whirlpool Park
4:15	arrive at Goat Island to view the Falls (2 miles)
5:00	leave Goat Island
9:00	arrive at Greentree (250 miles)

PGS Spring Field Trip

Travel Instructions (all mileages and travel times are approximate)

1. Green Tree to Hamburg, NY (209 miles) (3 hr., 10 min.)
    - I 79 to Erie (about 124 miles)
    - I 90 east, becomes New York Thruway (get toll ticket); get off at Exit 57, NY 75 (85 miles) toll = $1.90.

2. Tallyho-Tel (Exit 57) to Penn-Dixie Site (2-3 miles) (15 min.)
    - Leave motel, turn right (north) onto NY 75, go several blocks through commercial strip to U.S. 20 (mega-intersection, long traffic light).
    - Turn right (NE) onto U.S. 20, travel about a mile to U.S. 62 (South Park Avenue) to traffic light.
    - Turn left onto U.S. 62 (north), travel a couple of blocks to second street (Big Tree), which is first traffic light.
    - Turn left onto Big Tree, follow small blue signs (Penn-Dixie) through residential area – several turns required.
    - Turn right through gate at Penn-Dixie Site, drive to building and park.

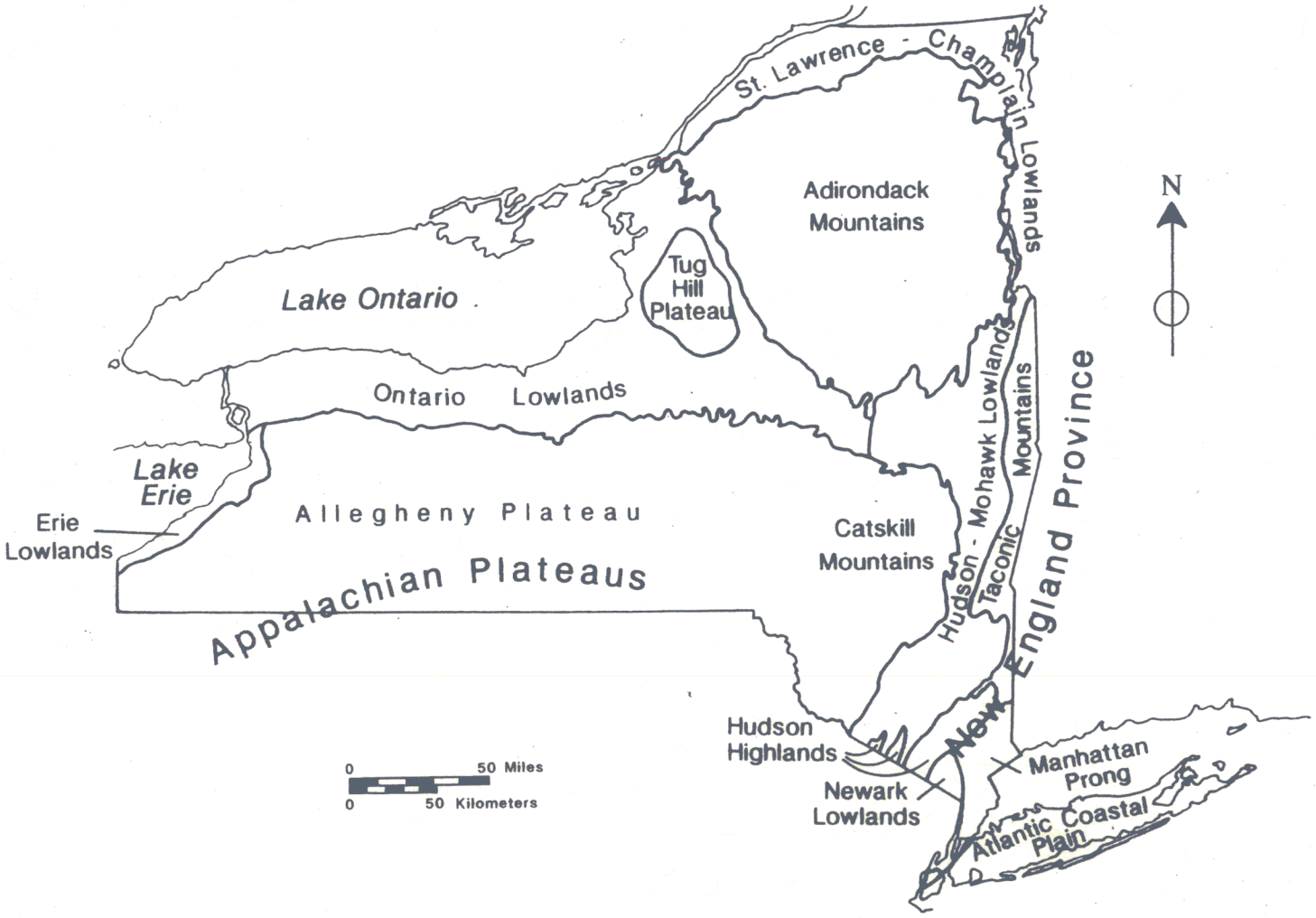
3. Penn-Dixie site to Whirlpool State Park (52 miles)(1 hr., 15 min.)
    - Retrace route to motel, enter Exit 57, N.Y. Thruway I 90 – get toll ticket; go north to Buffalo.
    - At Exit 55 (Lackawana) pay toll ($.25), stay on I 90.
    - Exit 53, I 90-I 190, (tollway to downtown Buffalo) split – stay on I 90.
    - Exit 50, I 90-I 290 split – keep to right, follow I 290 to Niagara Falls.
    - Exit 16, keep to right, I 290 ends, follow I 190 north to Grand Island and Niagara Falls.

- Exit 17, pay bridge toll ($ .50) (South Grand Island Bridge), cross Tonawanda Channel of Niagara River to Grand Island; re-cross Tonawanda Channel (North Grand Island Bridge), keep right.
- Exit 21, at north end of North Grand Island Bridge, take first right onto Robert Moses Parkway.
- Follow the Parkway, which will come to a temporary end in a congested area of entry and parking for the American Falls; proceed straight ahead to Rainbow Bridge ramp and T-intersection with Niagara Street.
- Turn right (no choice) onto Niagara Street; move over to the left lane, go two blocks east to North Rainbow Boulevard.
- Turn left onto North Rainbow Boulevard (one way) and like magic, you will find yourself back on the Robert Moses Parkway; go 2.3 miles to Whirlpool State Park.
- Turn left off the Parkway into the Park; at parking lot, turn right and travel to upper end of lot near picnic pavilion. Lunch.

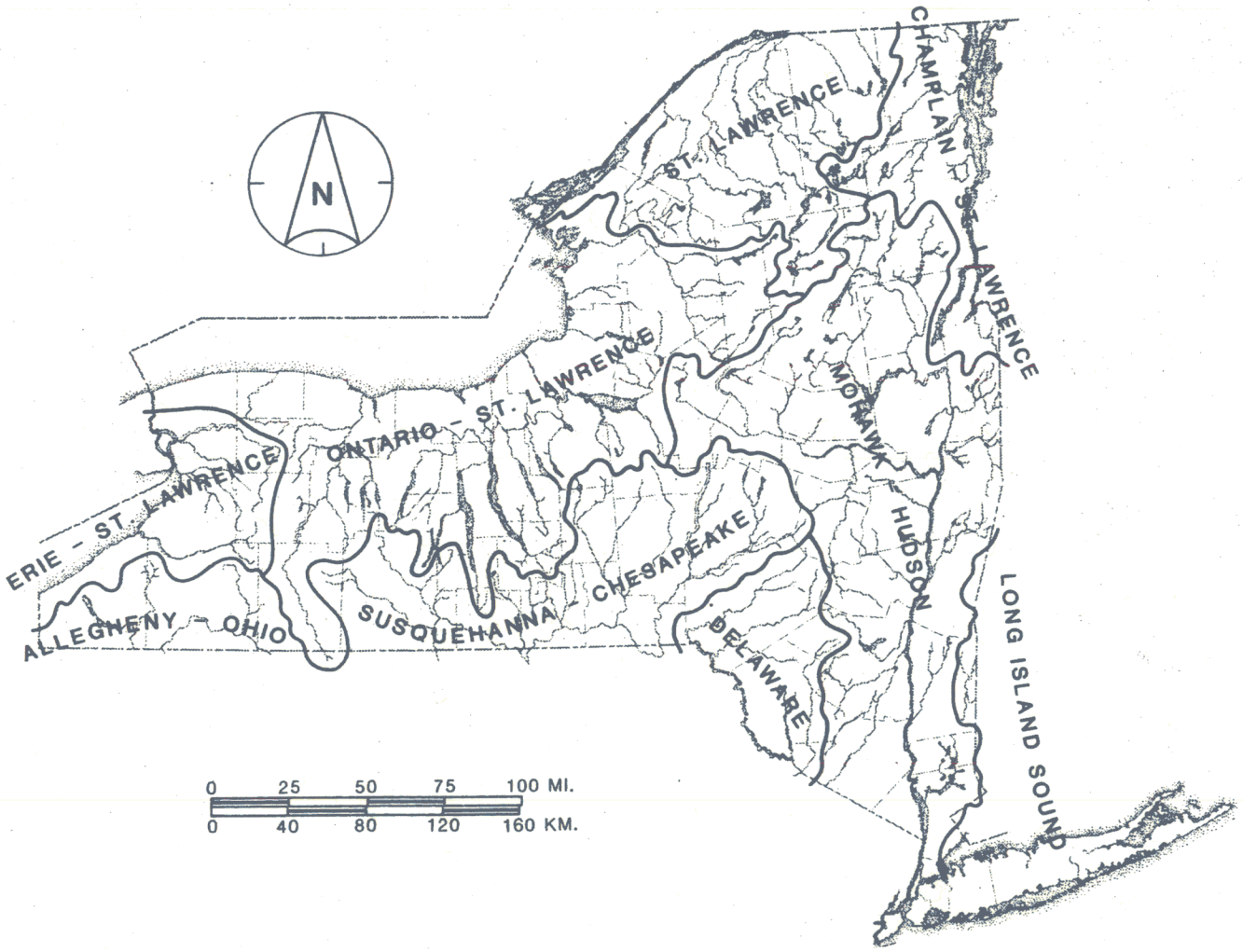
4. Whirlpool State Park to Goat Island (The Falls) (2.5. miles) (15 min.).
    - Leave park, turn right onto Robert Moses Parkway.
    - At first traffic light in town, Parkway becomes South Rainbow Boulevard; proceed straight ahead 3 blocks past Rainbow Centre Outlet Mall to 1st Street. Use right lane.
    - Turn right onto 1st Street, cross bridge over American channel to Goat Island; follow Park roads to huge parking lot ($ 8.00).

5. Goat Island to Green Tree, Pittsburgh (250 miles)(4 hrs.)
    - Leave Goat Island, follow 1st Street to Rainbow Boulevard.
    - Turn right onto Rainbow Boulevard which becomes Buffalo Avenue (NY 384)

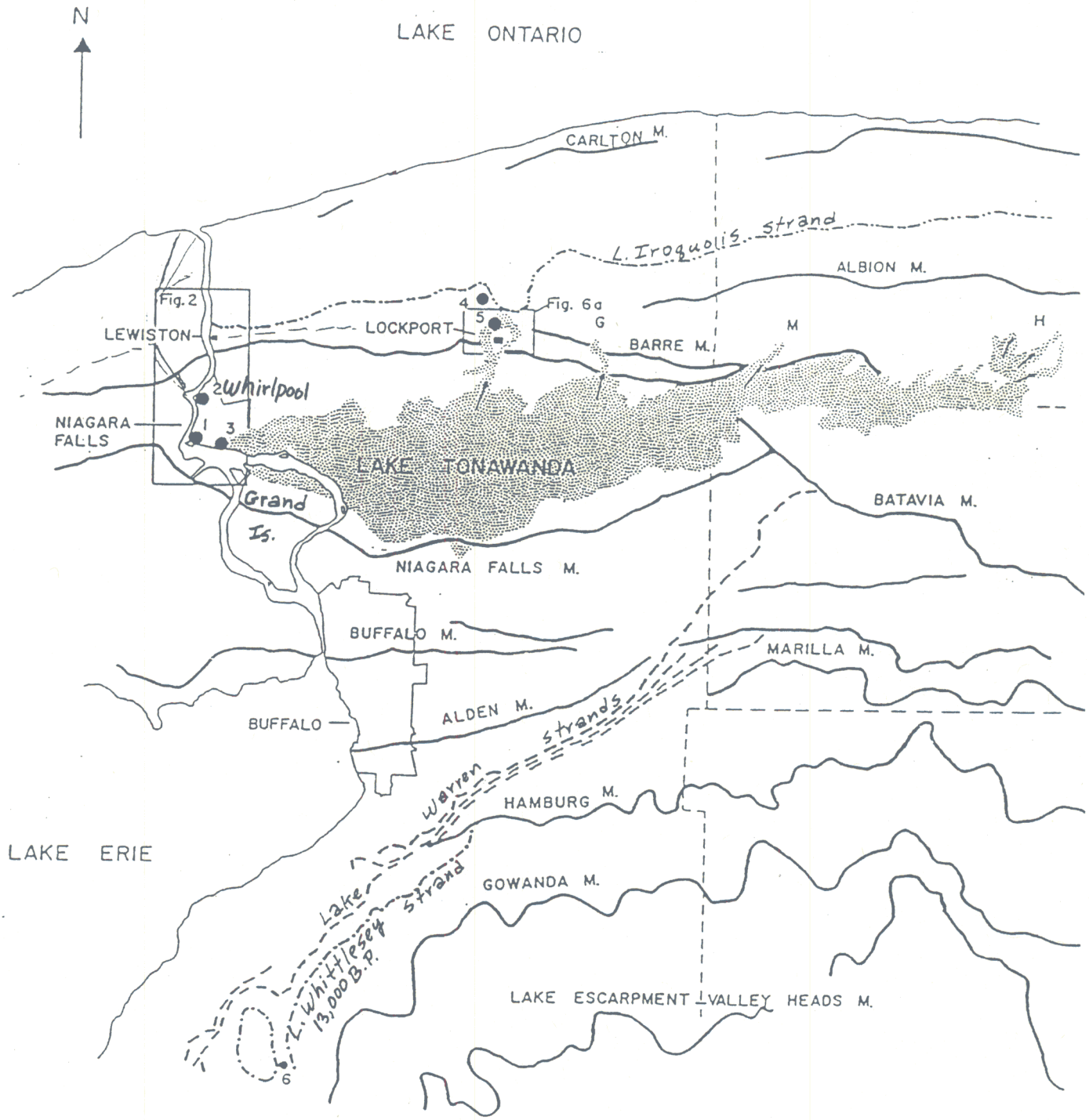
- At interchange, enter I 190 south; at south end North Grand Island Bridge, pay toll ($ .50).
- After crossing South Grand Island Bridge, you have a choice:
    a) stay on I 190 to downtown Buffalo, (shorter but a congested tollway)
    b) retrace route, follow I 290 beltway (free but longer).
- Retrace route to Pittsburgh; toll at PA State Line = $ 2.15.



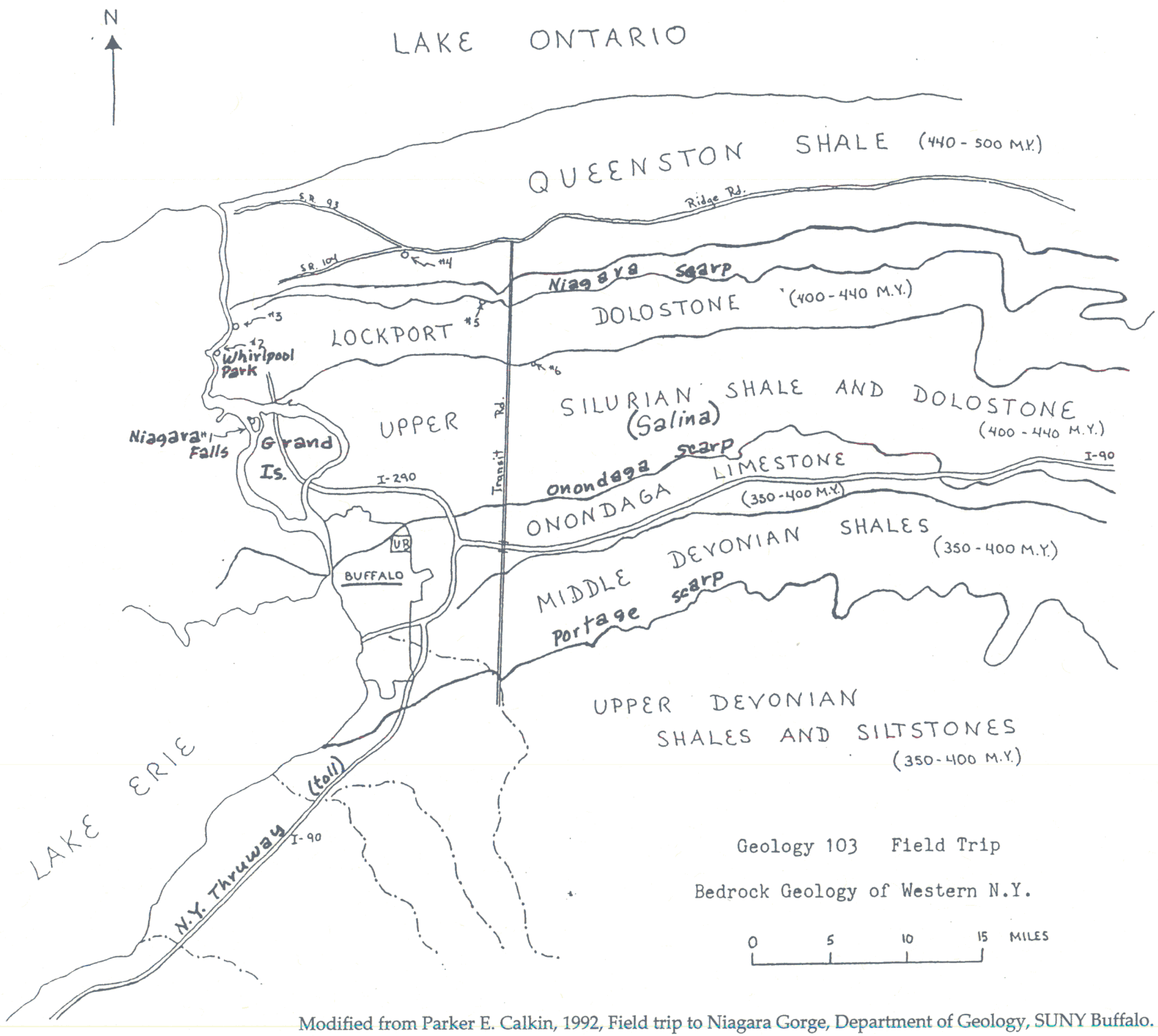
Physiographic provinces of New York (Isachsen et al., 1991, p. 4).



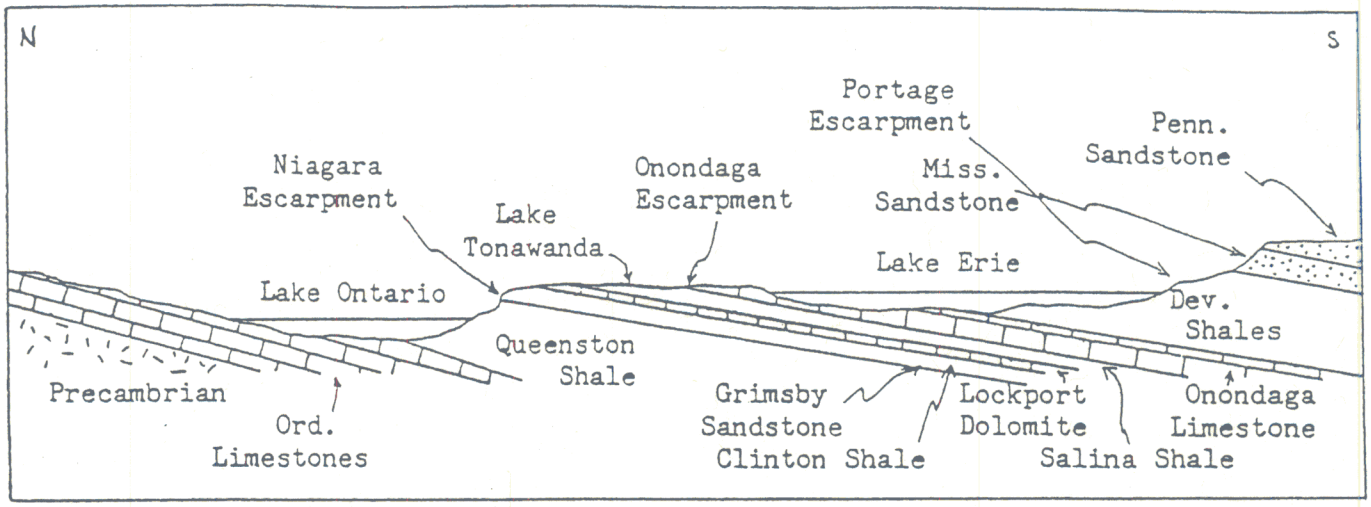
Map showing the present drainage divides and drainage basins in New York State. (Isachsen et al, 1991, p. 226).



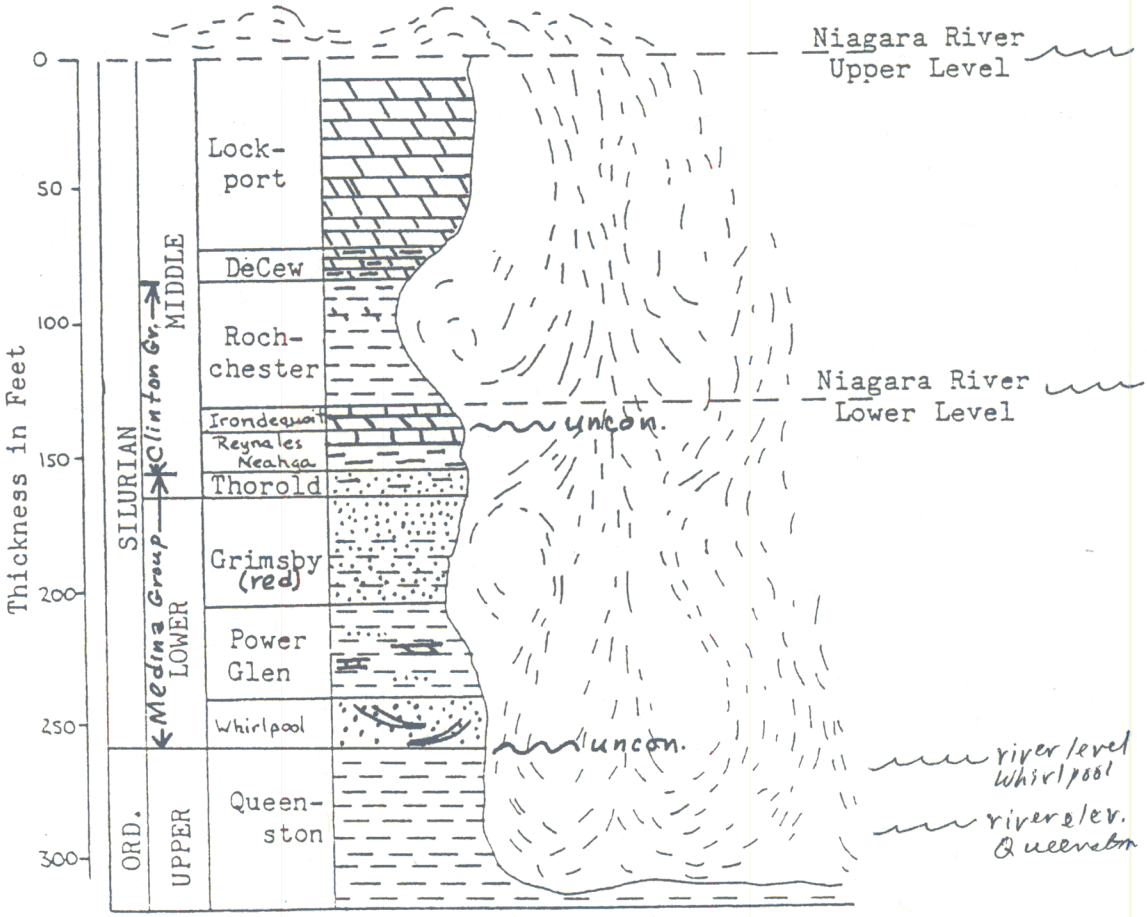
Surficial geology of northwestern New York near Niagara Falls and Buffalo showing recessional moraines (M.) and strands (shores, beaches) of former higher levels of lakes Erie and Ontario (Calkin and Brett, 1978, p. 1141).



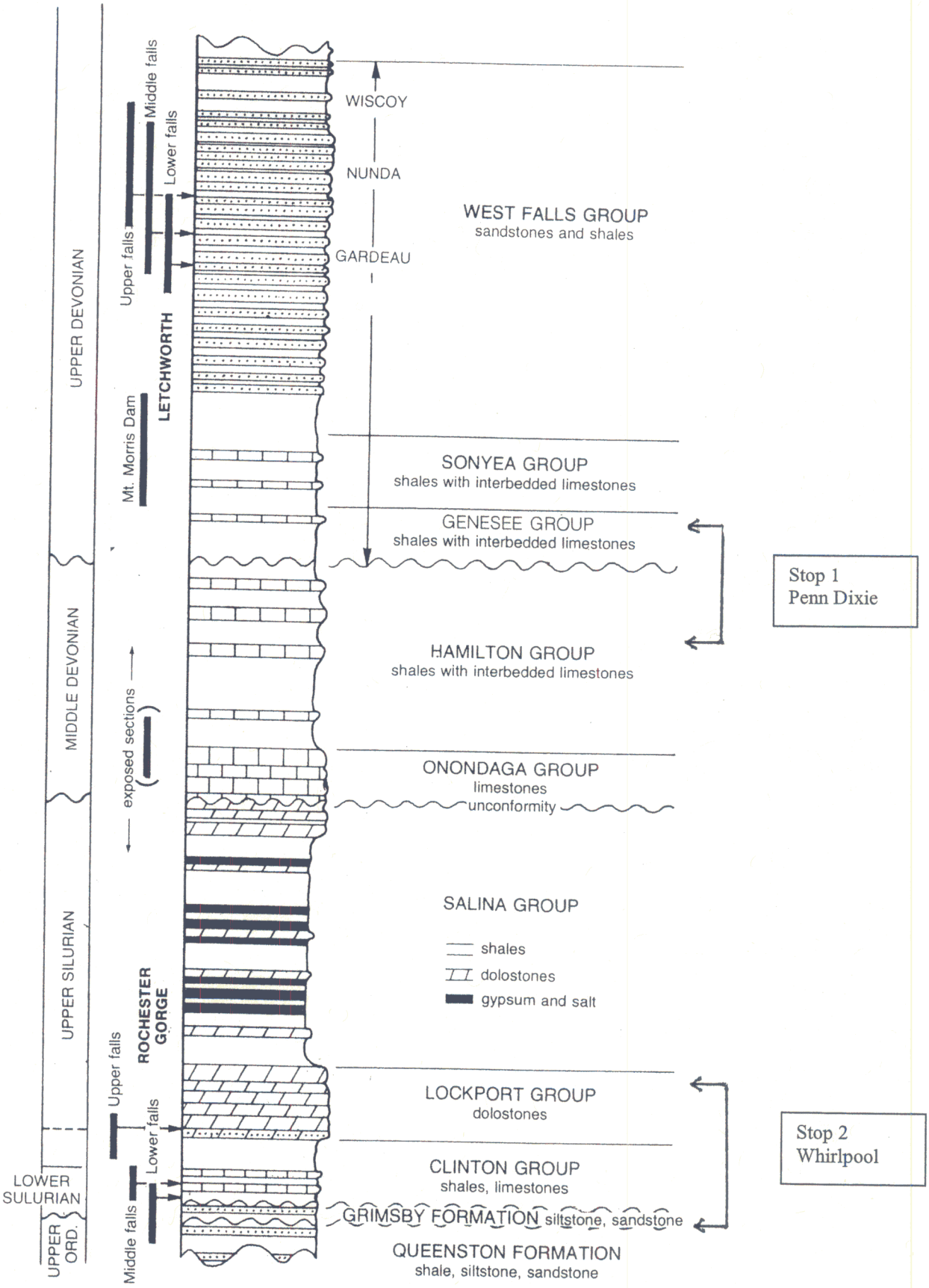
Modified from Parker E. Calkin, 1992, Field trip to Niagara Gorge, Department of Geology, SUNY Buffalo.



Geologic cross section through the western end of the Ontario basin and the eastern end of the Erie basin, showing relations of the basins to weak shales.

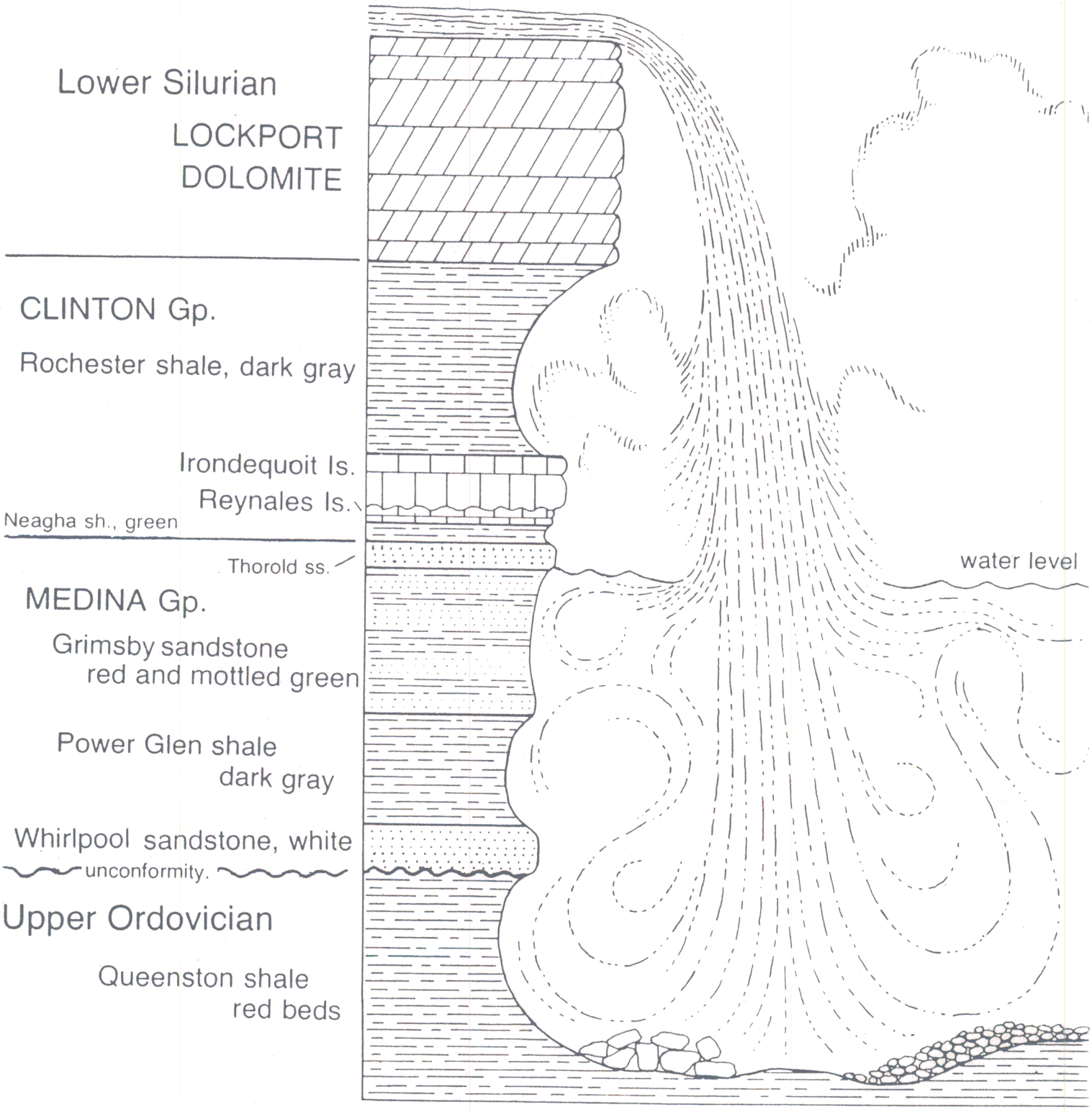


Stratigraphic section at Niagara Falls (Parker E. Calkin, 1992, Field trip notes).



Composite stratigraphic column for the Genesee River between Lake Ontario (base of column) and Portageville at the upper end of Letchworth Gorge, with the falls sections indicated by black bars on the left side.
Courtesy Kendall/Hunt Publishing Co.

(modified from Van Diver, 1985, p. 215)



Stratigraphic section under Horseshoe Falls. Courtesy Kendall/Hunt Publishing; Van Diver, Bradford B., 1985, Roadside Geology of New York: Missoula, MT, Mountain Press, p. 46.

BRIEF LITHOLOGIC DESCRIPTION OF SILURIAN FORMATIONS EXPOSED IN THE NIAGARA GORGE

The total section is about 340 feet thick. The Lockport Dolomite at the top of the section is resistant to erosion and forms the caprock at the top of the gorge. It is the unit that holds up Niagara Falls. The Irondequoit limestone and dolostone is also moderately resistant and forms a ledge about in the middle of the section. Most of these strata are near-shore or shallow-water marine (continental shelf).

LOCKPORT GROUP (Late Silurian)

Lockport Dolomite (5 members): Mostly medium gray; mostly finely crystalline and sugary, some coarsely crystalline; thin to medium bedded but also massive; some shale partings; vuggy, stylolitic, commonly fetid; env. - very shallow marine shelf, carbonate flats; about 138 feet thick.

CLINTON GROUP (Middle Silurian)

Rochester Shale (6 zones): medium to dark gray; mostly clay but some quartz silt; laminated to blocky; bands of light gray carbonate; nodules of calcite and gypsum; scattered pyrite and gypsum partings; env. - open marine shelf; 60 feet thick.

Irondequoit Formation: upper part, pinkish light gray, coarsely crystalline limestone, medium bedded, wavy shale partings; lower part, medium to brownish gray dolostone, finely crystalline and sugary, thin bedded to massive, argillaceous near base, gypsum nodules; unconformity at base; env. - warm, clear, shallow marine shelf; 18 feet thick

Reynales Limestone: light to medium gray; dense to very finely crystalline; highly siliceous; wavy dark gray shale partings produce pseudonodular appearance; env. - marine shelf; 2-3 feet thick.

Neahga Shale: dark greenish gray; pyrite and gypsum partings; slickensides present; soft and easily eroded; 6 feet thick.

MEDINA GROUP (Early Silurian)

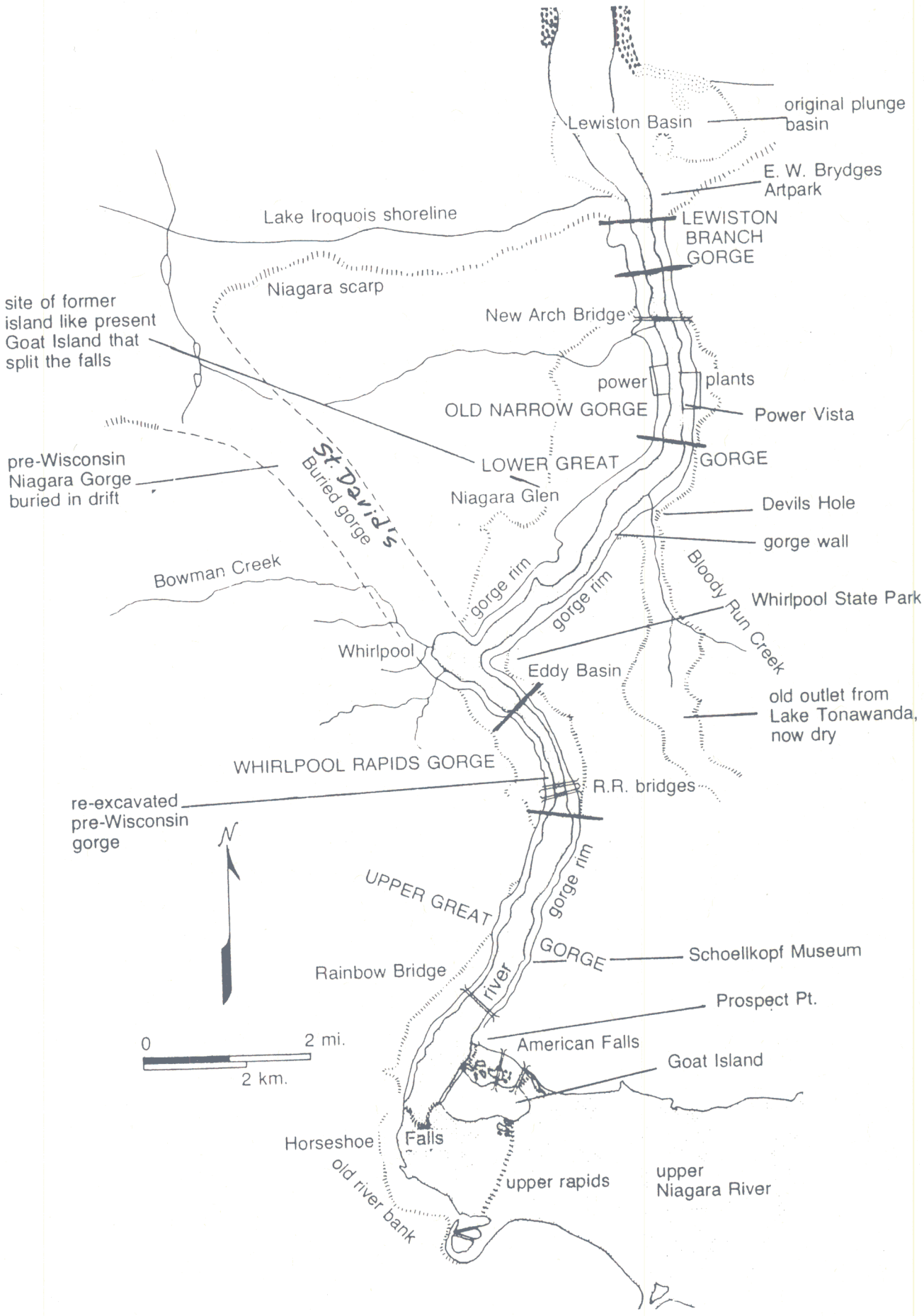
Thorold Sandstone: light gray to greenish gray; very fine grained; orthoquartzitic; medium bedded to massive; irregular green shale partings; very hard, ledgy; env. - near-shore marine; 9 feet thick.

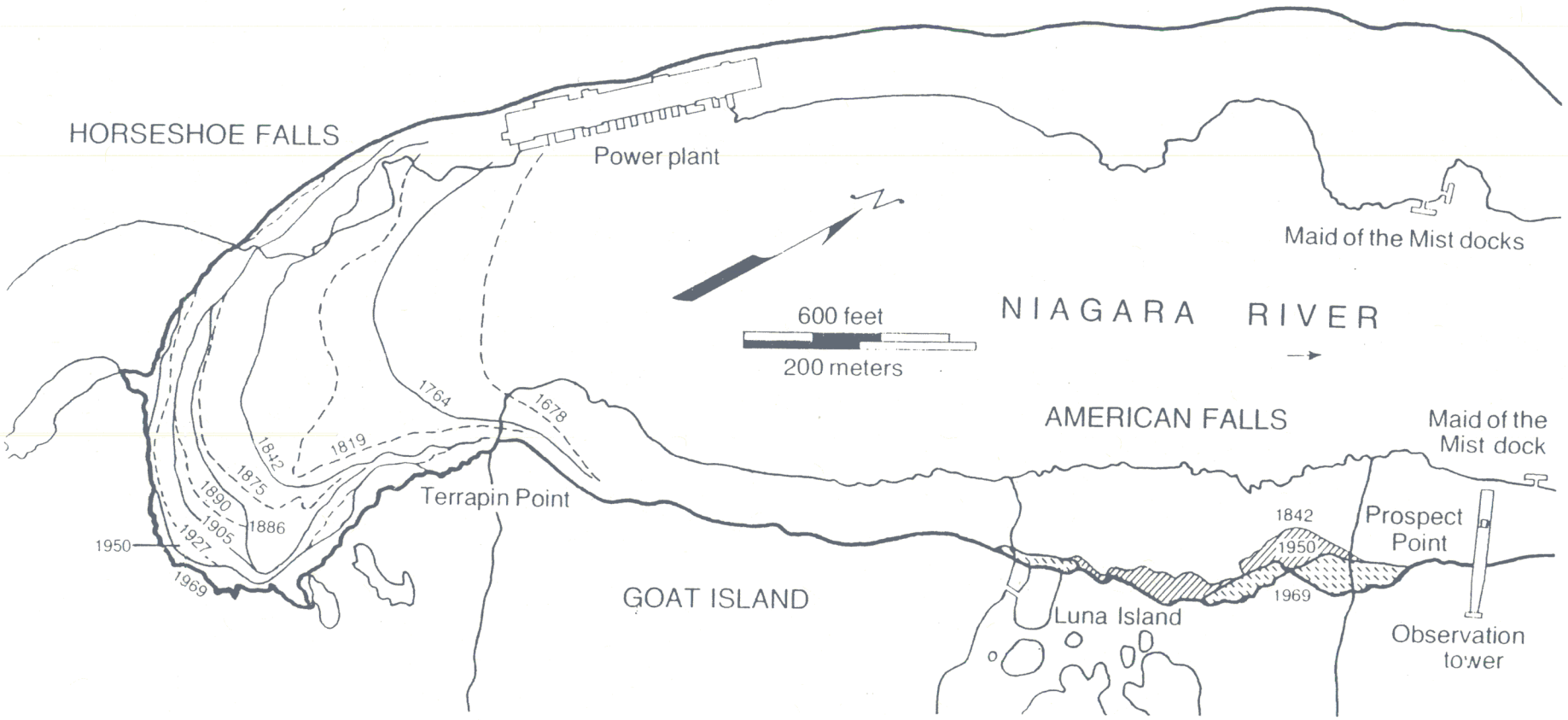
Grimsby Formation: upper part, pink to reddish brown sandstone, fine to medium grained, thin to thick bedded, calcareous; lower part, red to pale green siltstone and sandstone with interbeds of red shale; gypsum partings in shale beds; env. - deltaic, shallow turbid water; 51 feet thick.

Power Glen Shale: dark gray to grayish green; siltstone interbeds and stringers of light gray silty carbonate; laminated to banded; slightly soft; env. - muddy offshore marine; 34 feet thick.

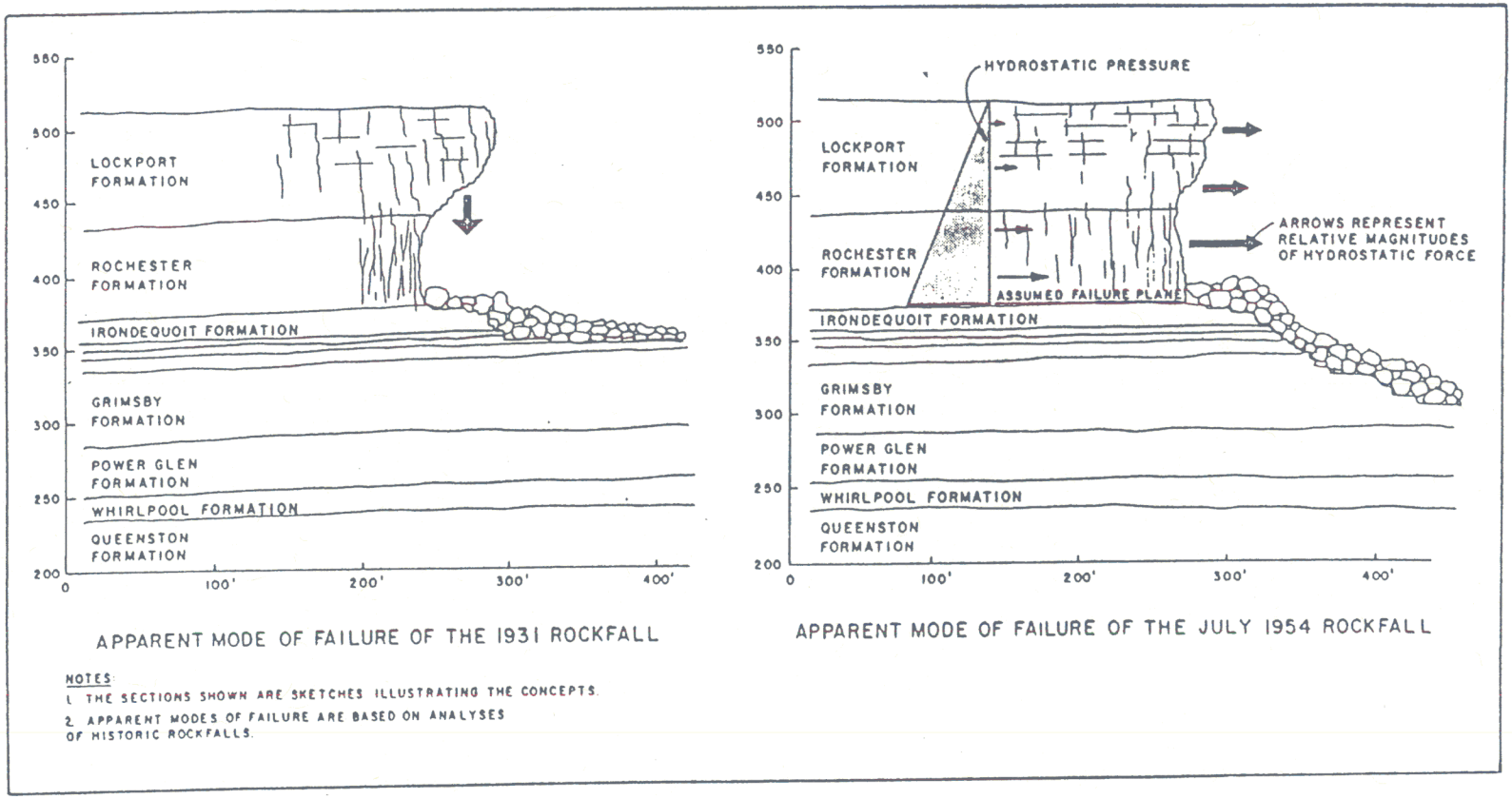
Whirlpool Sandstone: light gray to white; fine to medium grained; medium bedded and cross bedded; frosted and well rounded quartz grains; abundant kaolinized feldspar grains; well cemented with quartz; ripple marks; chloritic shale partings; unconformity at base developed on red Late Ordovician Queenston Shale; env. - braided fluvial, near-shore marine (littoral); 18 feet thick.

Van Diver, Bradford B., 1985, Roadside Geology of New York: Missoula, MT, Mountain Press, p. 48.





Map of Horseshoe and American falls showing historic recession at Niagara. Courtesy Kendall/Hunt Publishing Co.; Van Diver, Bradford B., 1985, Roadside Geology of New York: Missoula, MT, Mountain Press, p. 45.



Modes of failure, American Falls. From American Falls International Board (1974, Plate C45).

What to look for? What can you find?

Lockport Dolomite

1. vugs containing:
    - pink dolomite rhomb crystals
    - dog tooth spar calcite crystals
    - gypsum
    - anhydrite
    - sphalerite
    - fluorite
    - celestite
    - marcasite

2. chert nodules; gypsum nodules
3. stromatolite domes
4. stylolitic partings with carbonaceous material
5. bituminous or fetid odor (petroleum); grease-like gobs

Rochester Shale

1. gypsum masses
2. pyrite and marcasite with carbonaceous material

Neahga Formation (shale)

1. masses of pyrite and gypsum along bedding planes
2. slickensides

Whirlpool Sandstone

1. prominent ripple marks and cross bedding
2. abundant kaolinized feldspar
3. outstanding potholes

SELECTED REFERENCES

American Falls International Board, 1974, Preservation and enhancement of the American Falls at Niagara: Final report to the International Joint Commission, Appendix C (Geology and rock mechanics) and Appendix D (Hydraulics).

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Gilbert, G. K., 1907, Rate of recession of Niagara Falls: U. S. Geological Survey Bulletin 306, p. 5-25.

Isachsen, Y. W. and others, 1991, Geology of New York: A simplified account: New York State Museum/Geological Survey, Educational Leaflet (sic) No. 28, 283 p.

Philbrick, Shailer S., 1970, Horizontal configuration and the rate of erosion of Niagara Falls: Geological Society of America Bulletin, v. 81, p. 3723-3732.

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Spencer, J. W., 1910, Relationship of Niagara River to the glacial period: Geological Society of America Bulletin, v. 21, p. 433-440.

Tesmer, I. H., ed., 1981, Colossal cataract; the geologic history of Niagara Falls: Albany, State University of New York Press.

Van Diver, Bradford B., 1985, Roadside geology of New York: Missoula, MT, Mountain Press Pub. Co., 411 p. (see especially p. 41-54 and p. 191-193).

Very Important Niagara Quiz*

(*No peeking at handout – do it from memory. Do your own work – this is not a group test. Grade your own test and ask for an answer key. What grade did you get?)

1. In what specific direction does the Niagara River flow?_____

2. Is the mouth of the Niagara River in Lake Ontario west or east of the head of the river at Buffalo?_____

3. The rate-of-retreat of Niagara Falls is now a. faster, b. slower, c. the same as hundreds of years ago?_____

4. My explanation for my answer in Q.3 above is_____

   _____

5. The stratigraphic unit holding up Niagara Falls is the a) Lockport Dolomite, b) Irondequoit Limestone, c) Whirlpool Sandstone?_____

6. What stratigraphic unit lies below (older) the Whirlpool Sandstone?_____

7. Why is the Niagara River clear, clean water lacking any sediment?_____

   _____

8. The vertical drop at Niagara Falls is a) 92 ft., b) 174 ft., c) 289 ft.?_____

9. The development of Niagara Gorge and retreat of Niagara Falls took place during the a) Silurian, b) Late Wisconsinan to Recent c) Pre-Wisconsinan._____

10. The best and nicest mineral specimens occur in the a) Medina Group, b) Whirlpool Sandstone, c) Lockport Dolomite?_____