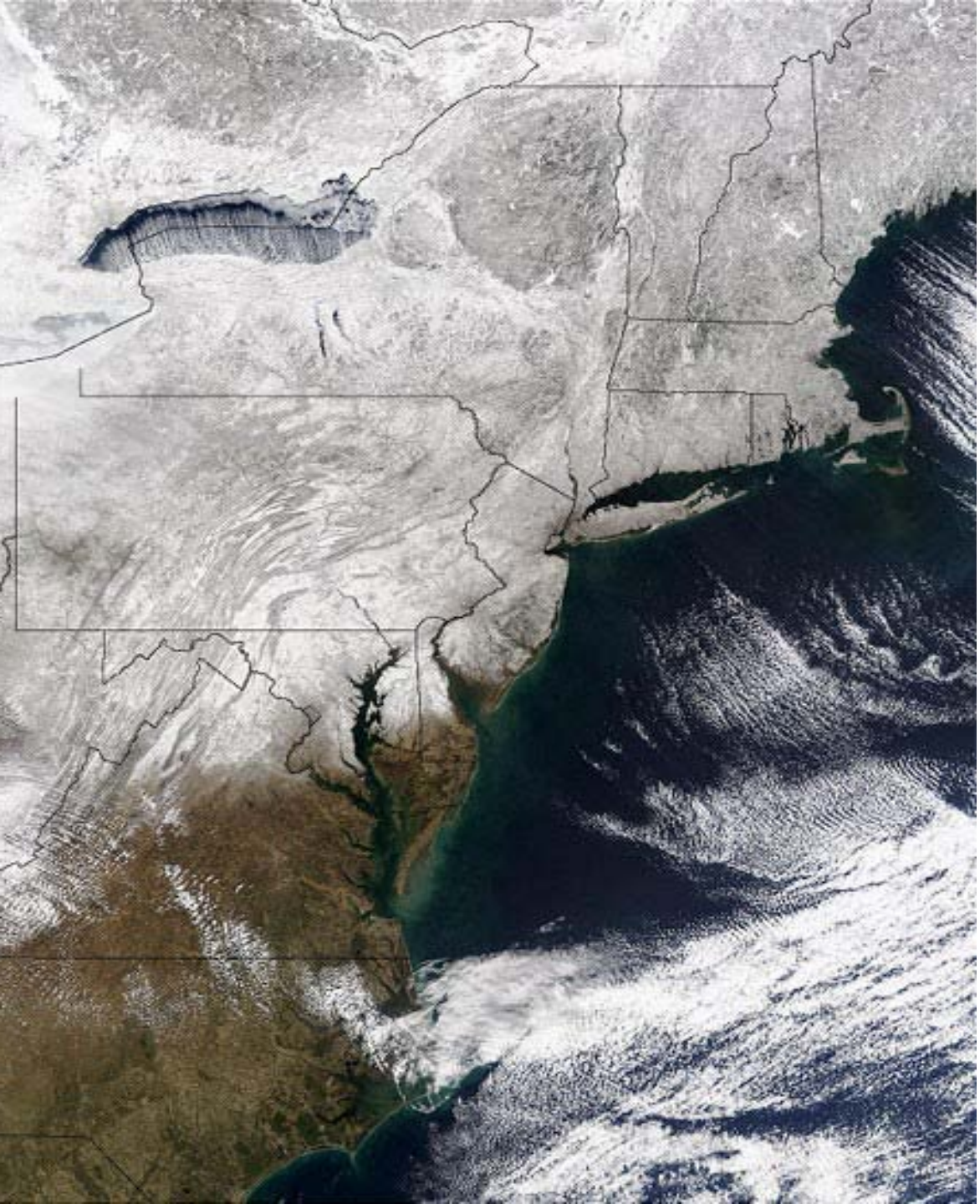
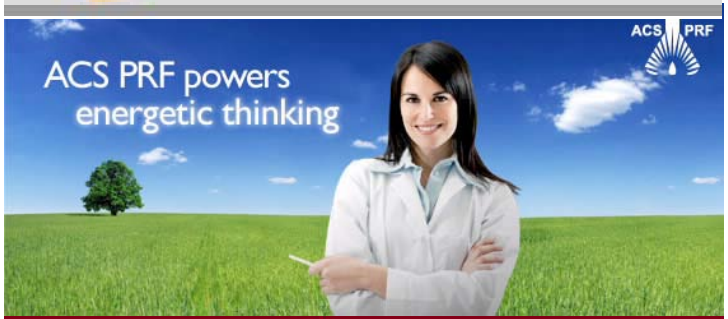
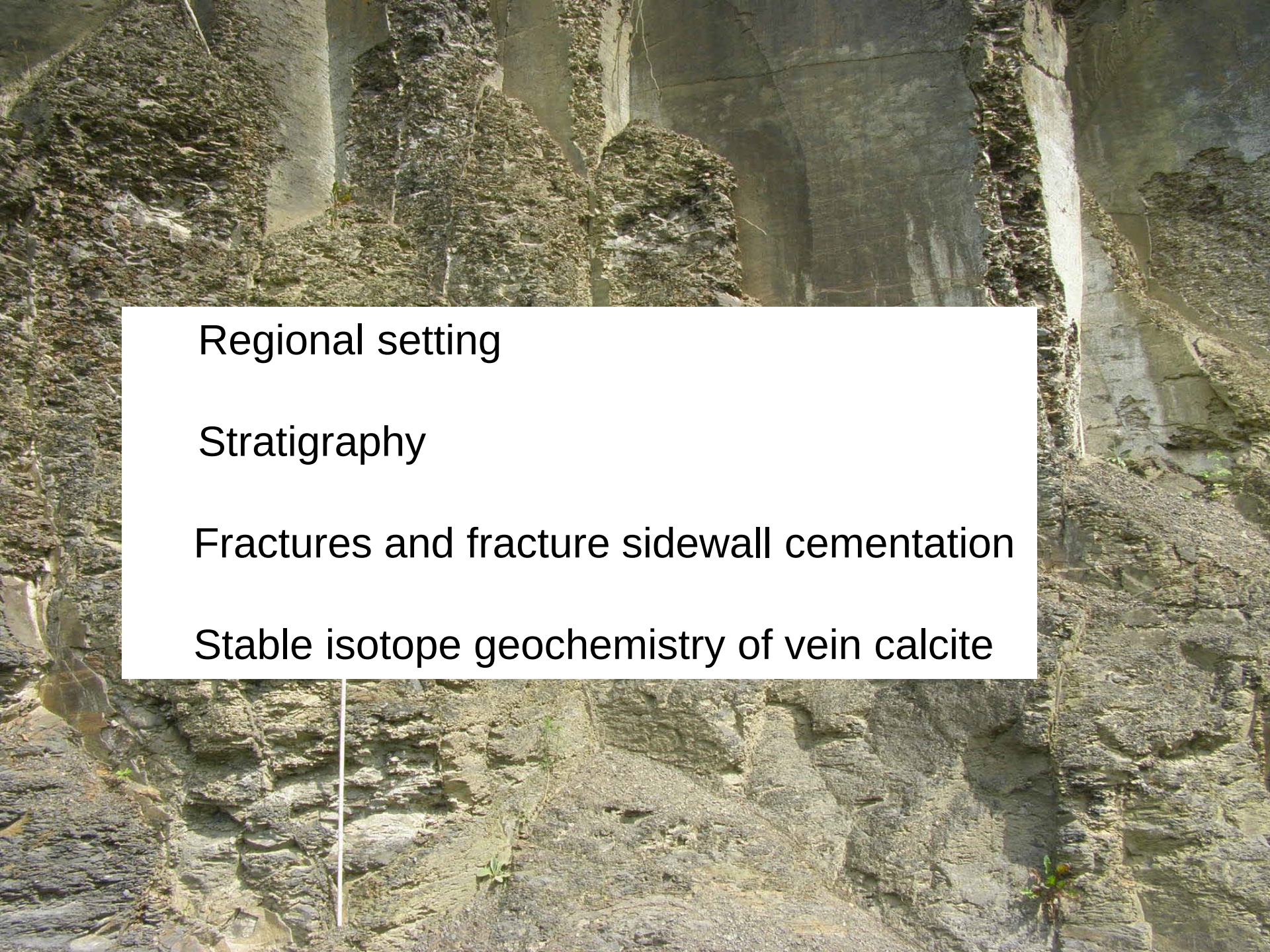


"Vertical Gas Migration and Fracture Sidewall Cementation, Marcellus Formation, Central New York"

Bruce Selleck and Philip Clayton
Department of Geology
Colgate University



Colgate
UNIVERSITY



Regional setting

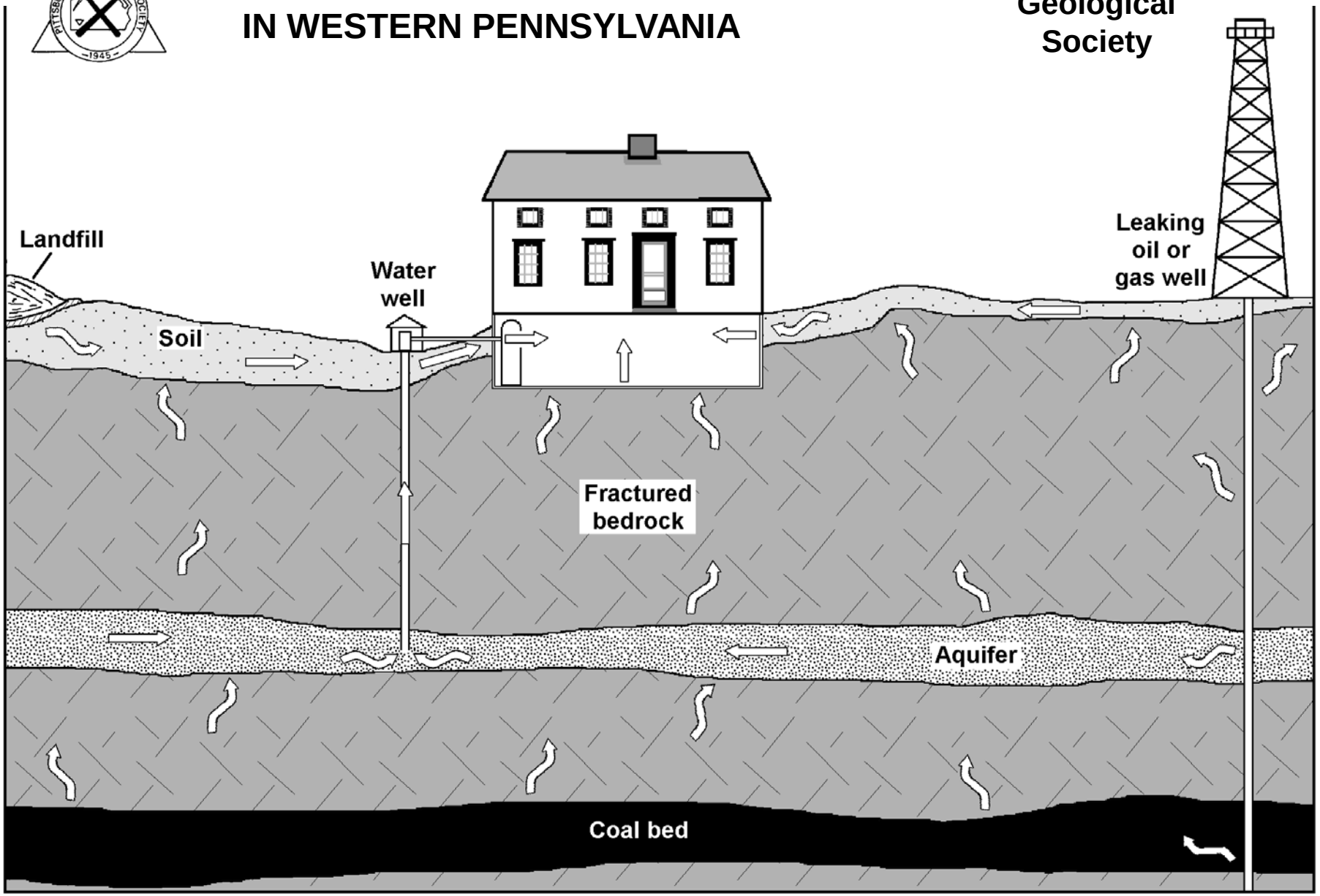
Stratigraphy

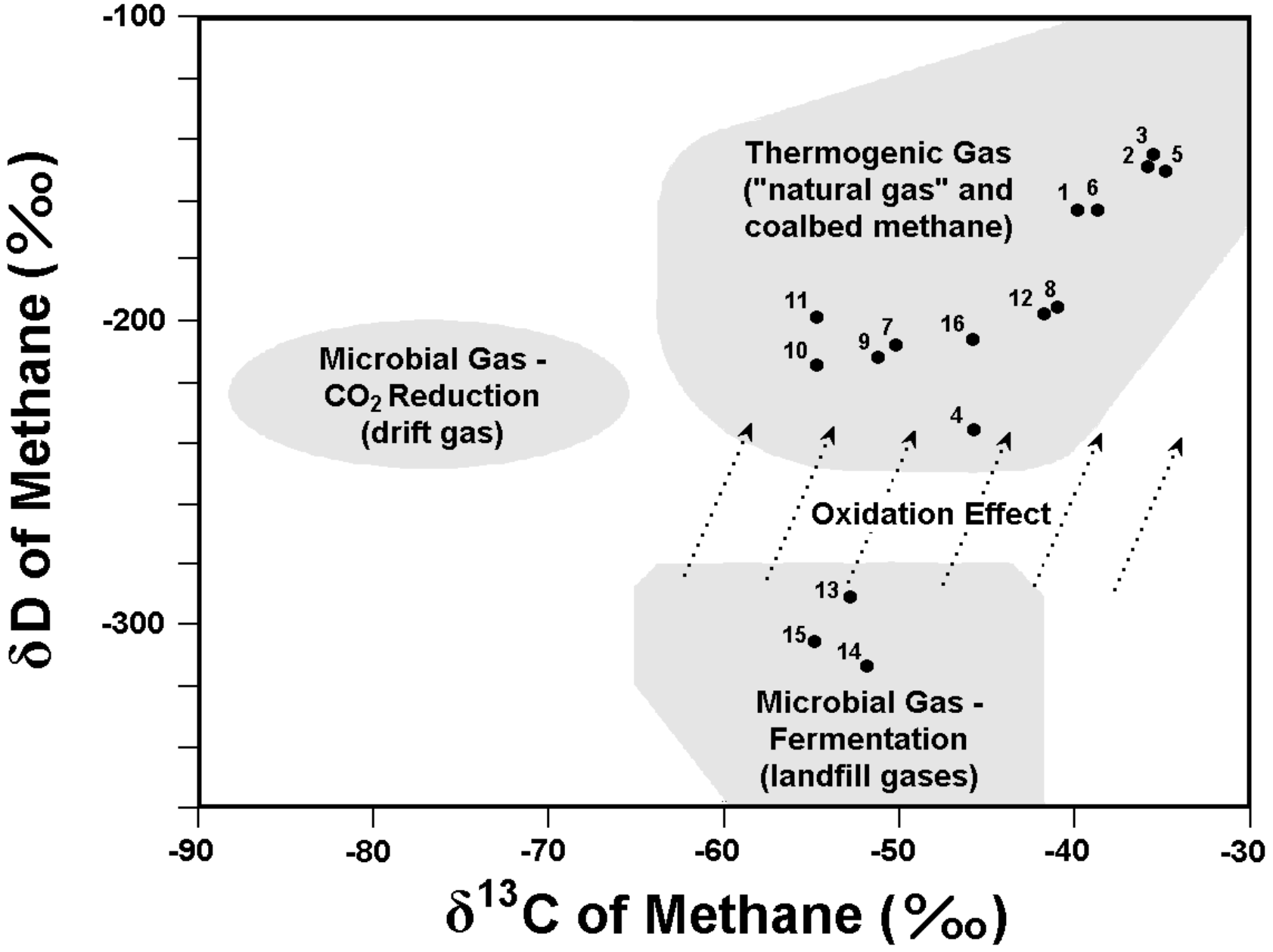
Fractures and fracture sidewall cementation

Stable isotope geochemistry of vein calcite

NATURAL GAS MIGRATION PROBLEMS IN WESTERN PENNSYLVANIA

The Pittsburgh Geological Society




-100
-200
-300
δD of Methane (‰)
-90
-80
-70
-60
-50
-40
-30
δ13C of Methane (‰)
Thermogenic Gas ("natural gas" and coalbed methane)
Microbial Gas - CO2 Reduction (drift gas)
Oxidation Effect
Microbial Gas - Fermentation (landfill gases)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

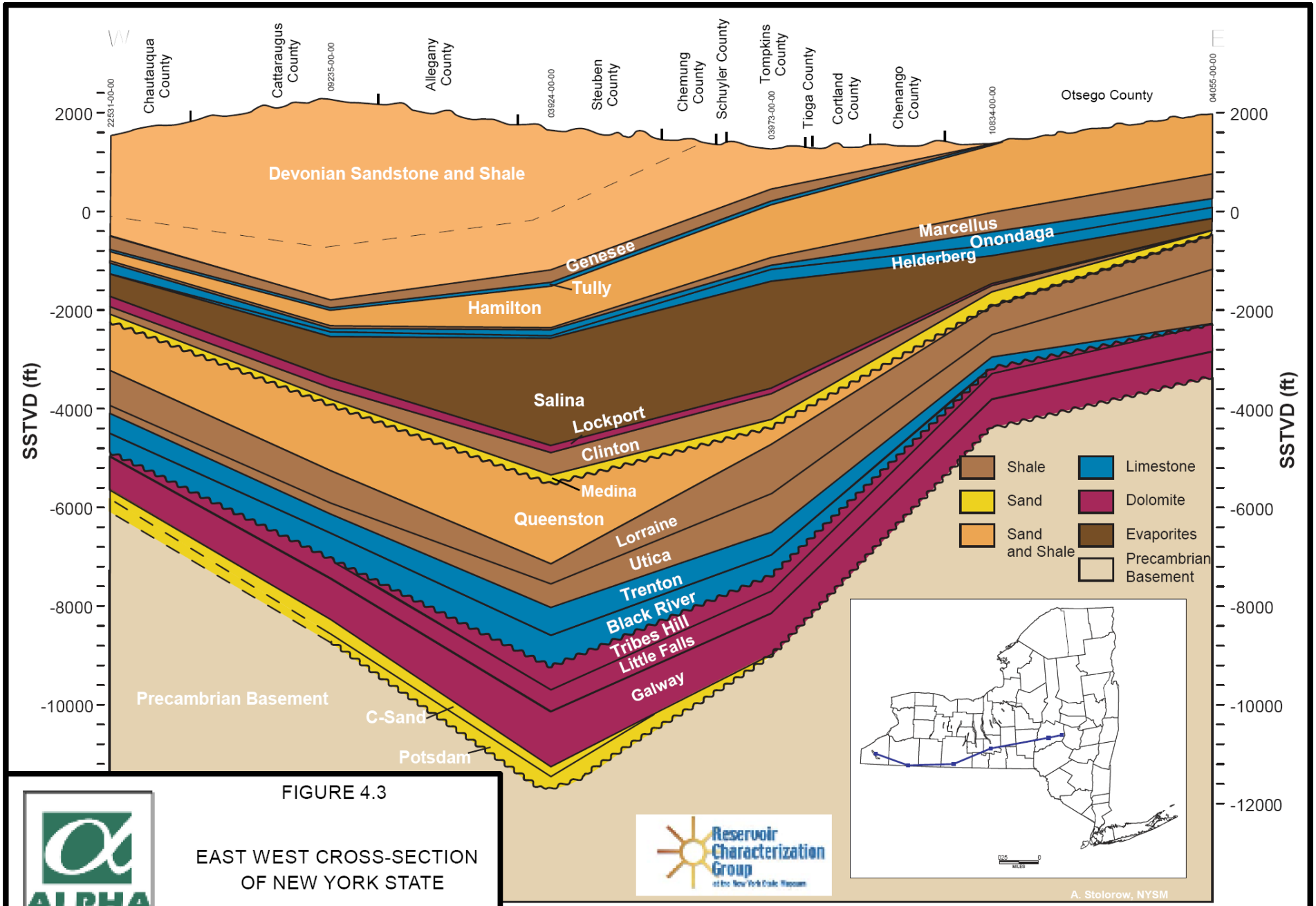


FIGURE 4.3

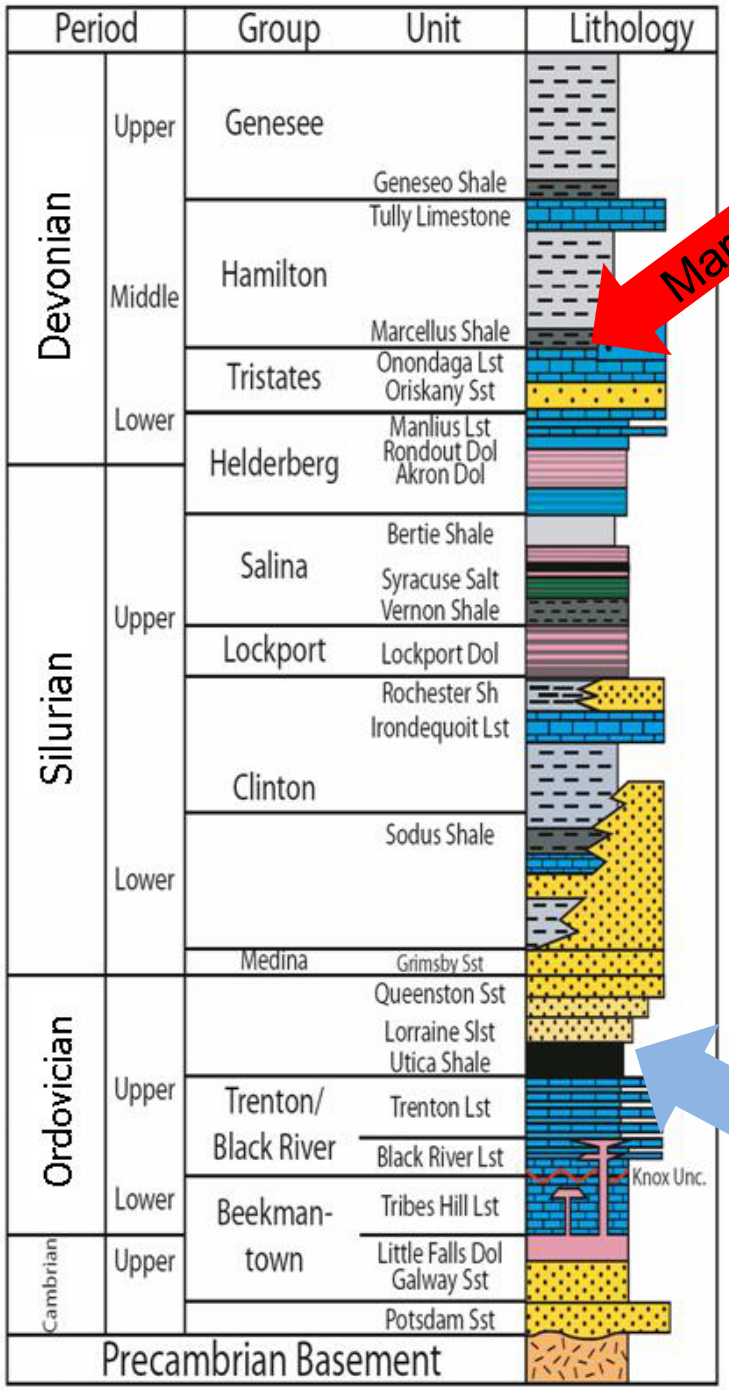
EAST WEST CROSS-SECTION OF NEW YORK STATE

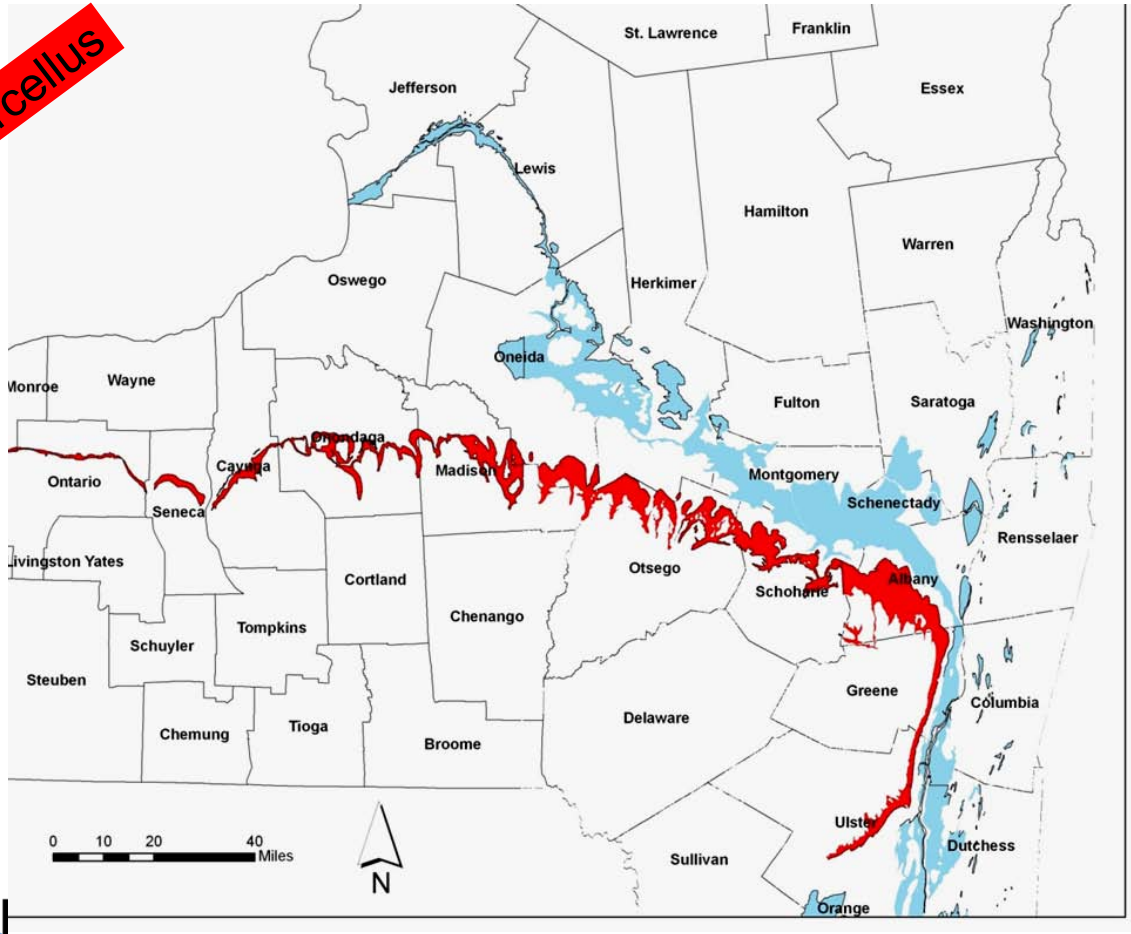
Technical Support Document to the Draft Supplemental Generic Environmental Impact Statement

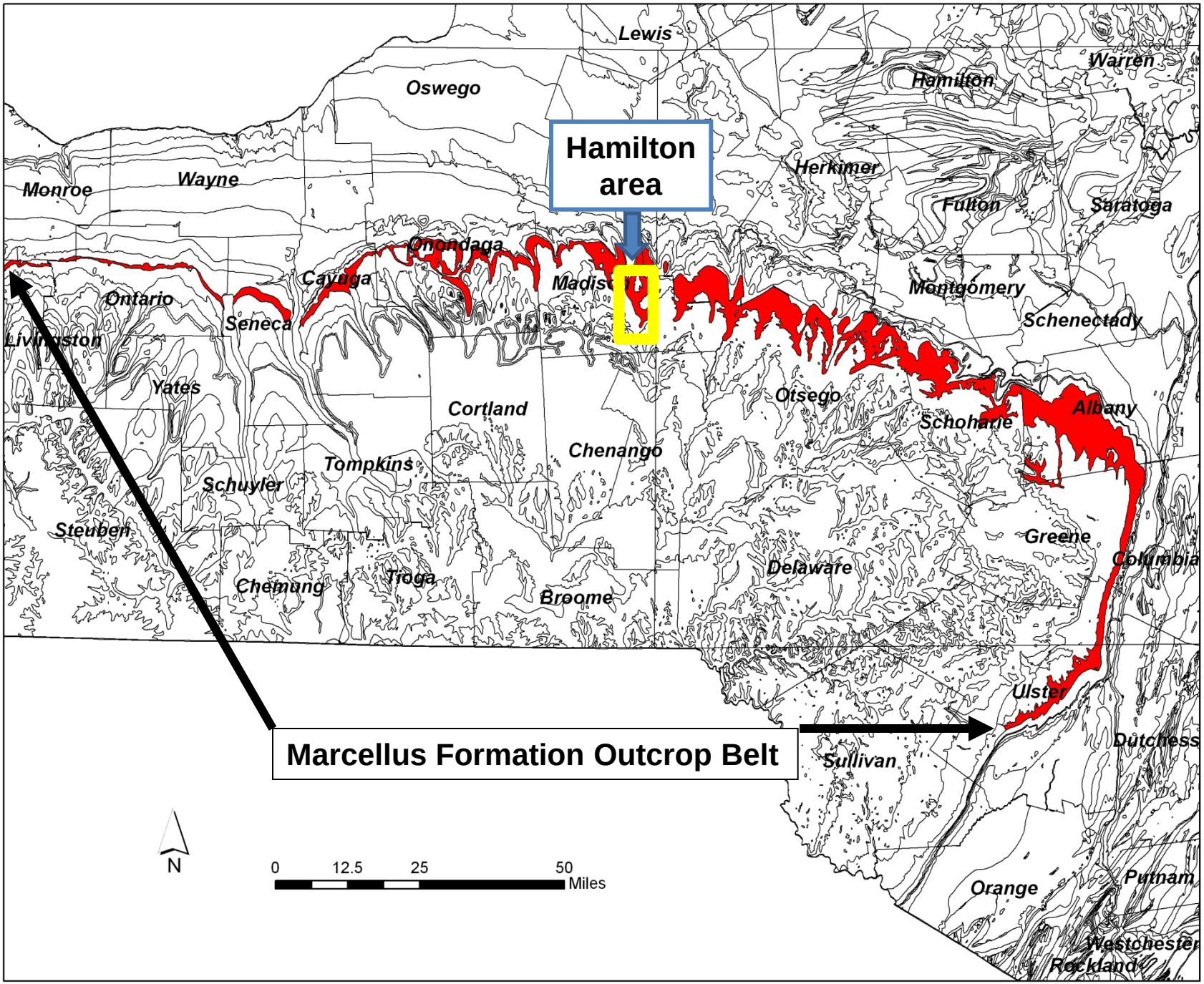
ALPHA GEOSCIENCE
Alpha Project No. 09104

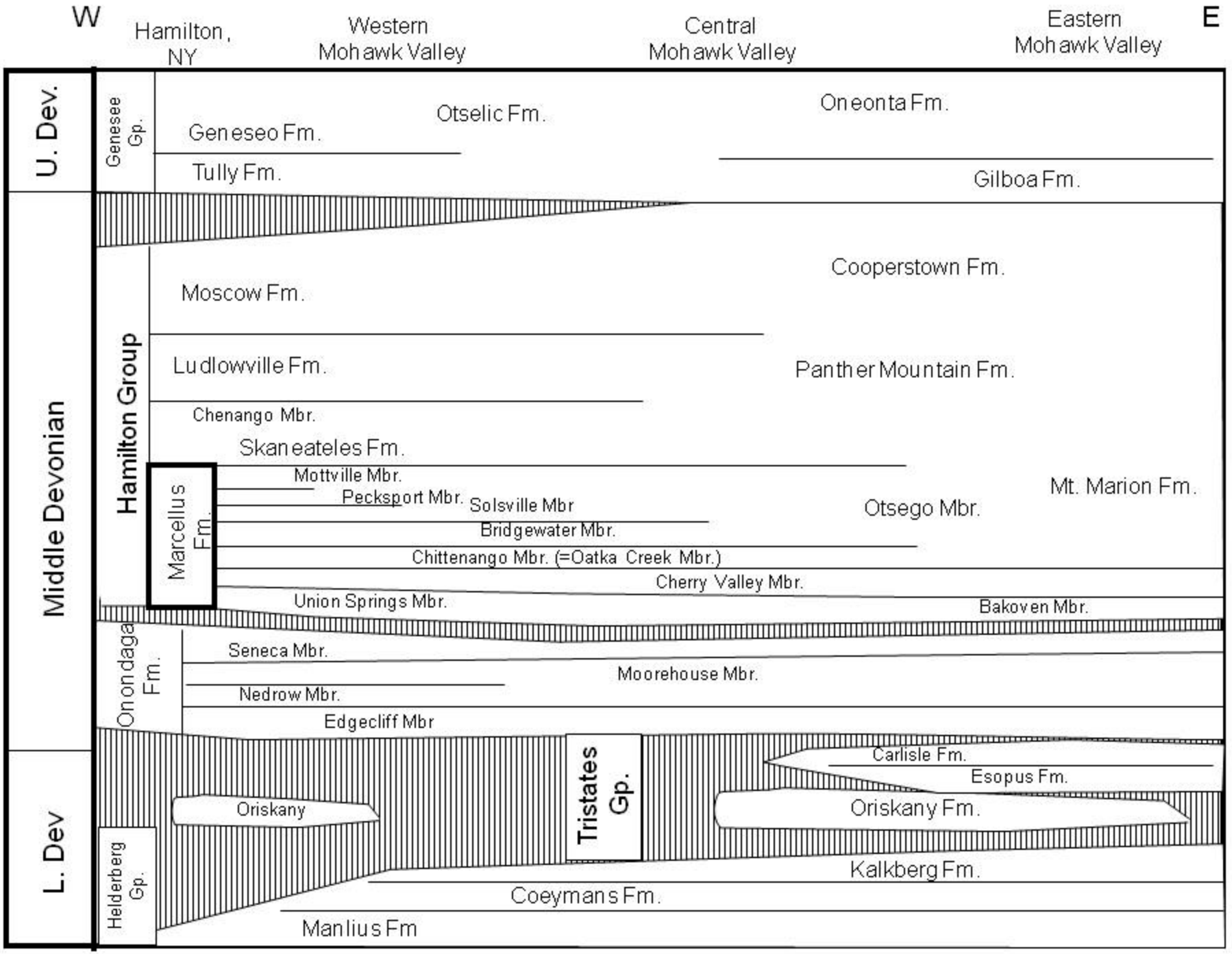
Reservoir Characterization Group

New York's major gas shale units





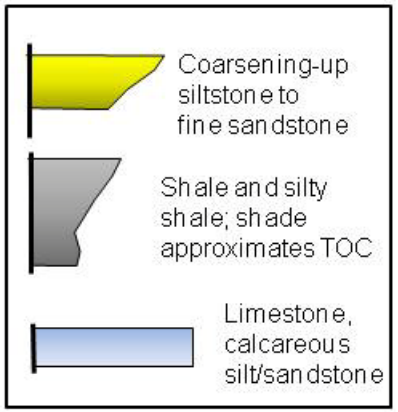

Lewis
Oswego
Warren
Hamilton
Hamilton area
Herkimer
Monroe
Wayne
Fulton
Saratoga
Onondaga
Cayuga
Madison
Montgomery
Ontario
Seneca
Schenectady
Livingston
Yates
Otsego
Albany
Cortland
Schoharie
Chenango
Tompkins
Schuyler
Steuben
Greene
Columbia
Delaware
Chemung
Tioga
Broome
Ulster
Marcellus Formation Outcrop Belt
Dutchess
Sullivan
N
0
12.5
25
50
Miles
Orange
Putnam
Westchester
Rockland

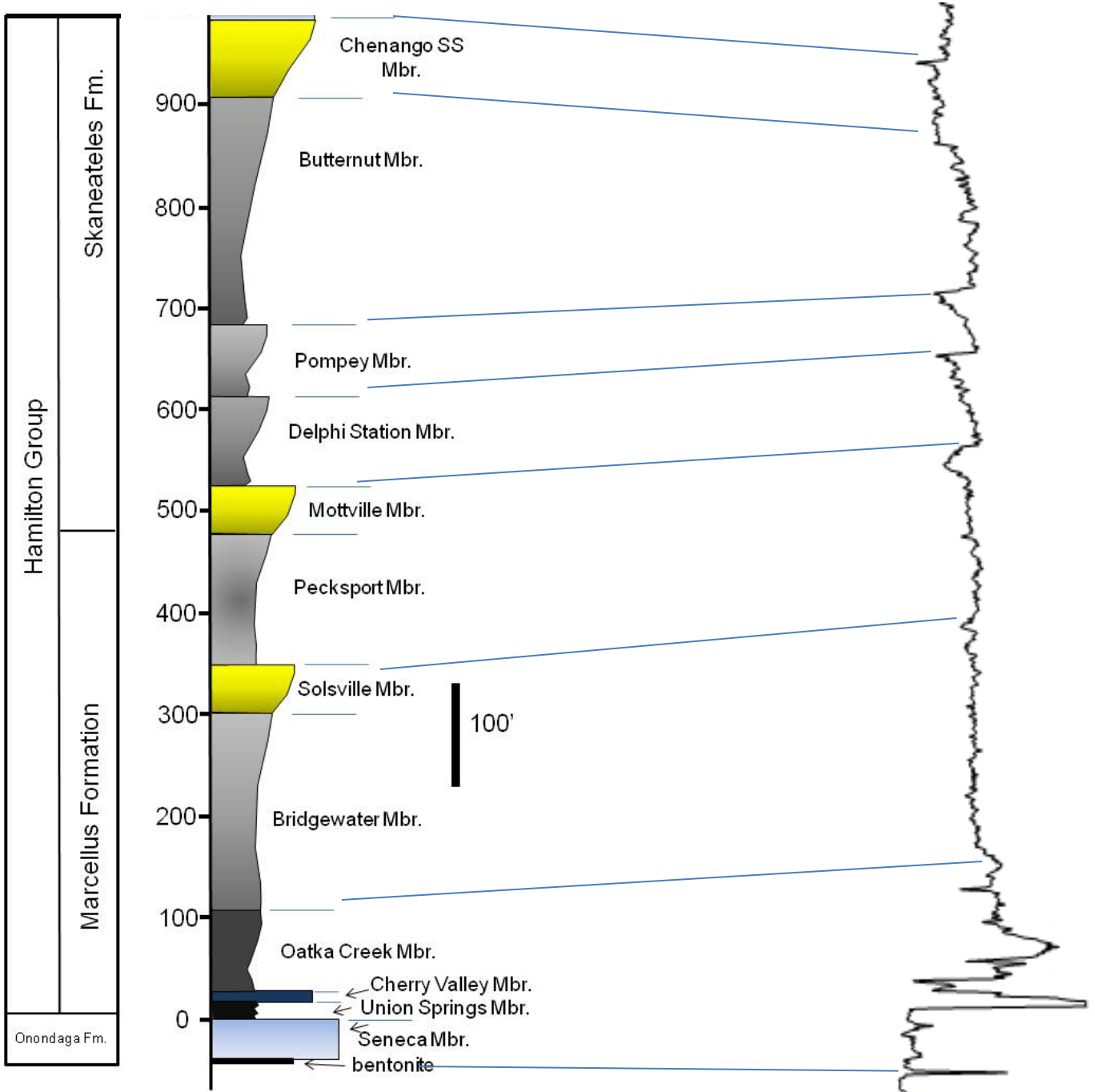

W
Hamilton, NY
Western Mohawk Valley
Central Mohawk Valley
Eastern Mohawk Valley
E
U. Dev.
Middle Devonian
L. Dev
Genesee Gp.
Geneseo Fm.
Tully Fm.
Otselic Fm.
Oneonta Fm.
Gilboa Fm.
Hamilton Group
Moscow Fm.
Ludlowville Fm.
Chenango Mbr.
Skaneateles Fm.
Cooperstown Fm.
Panther Mountain Fm.
Marcellus Fm.
Mottville Mbr.
Pecksport Mbr.
Solsville Mbr
Bridgewater Mbr.
Chittenango Mbr. (=Oatka Creek Mbr.)
Cherry Valley Mbr.
Union Springs Mbr.
Otsego Mbr.
Mt. Marion Fm.
Bakoven Mbr.
Onondaga Fm.
Seneca Mbr.
Moorehouse Mbr.
Nedrow Mbr.
Edgecliff Mbr
Tristates Gp.
Carlisle Fm.
Esopus Fm.
Oriskany
Oriskany Fm.
Helderberg Gp.
Kalkberg Fm.
Coeymans Fm.
Manlius Fm

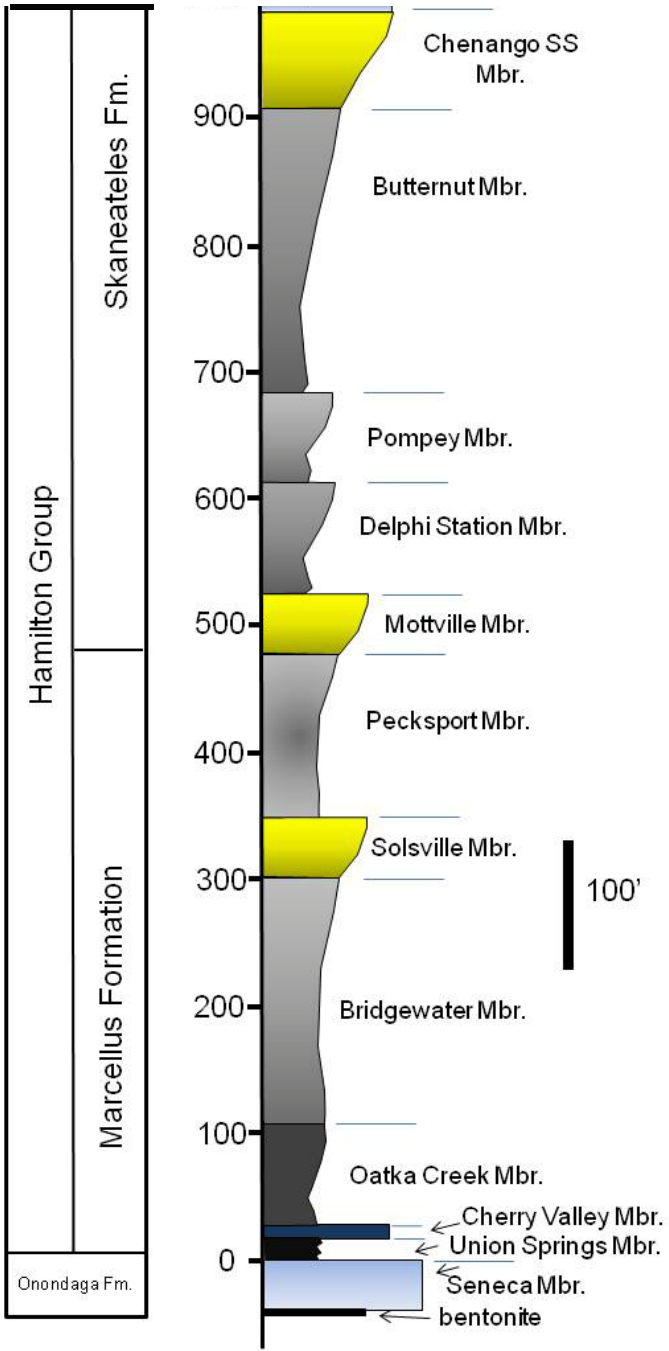
Outcrop (Cooper, 1934)

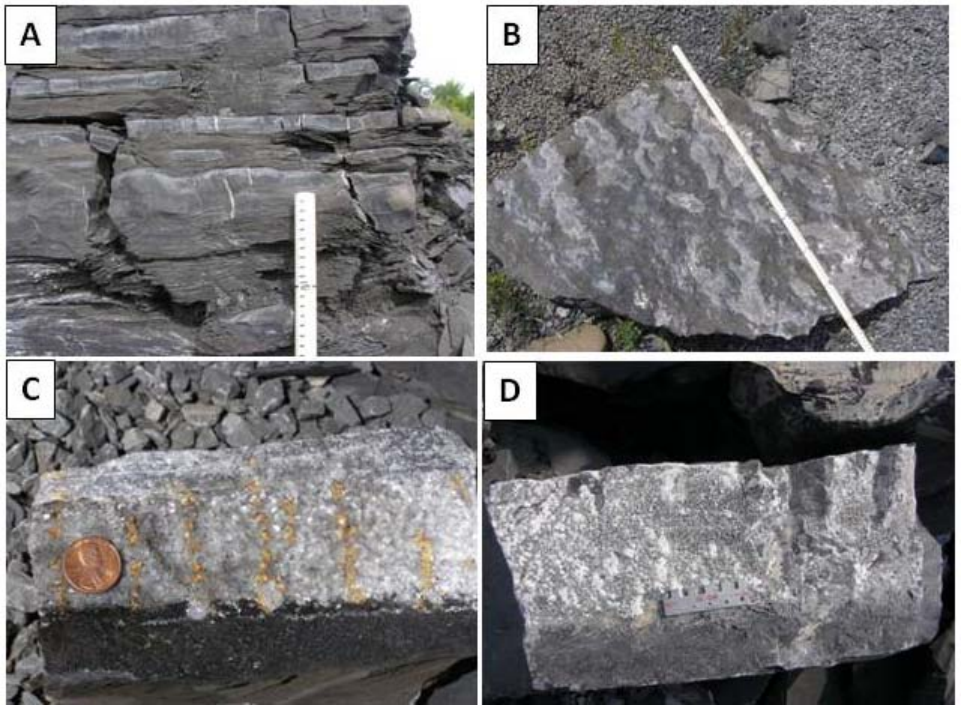
Gapski 1 GR Log

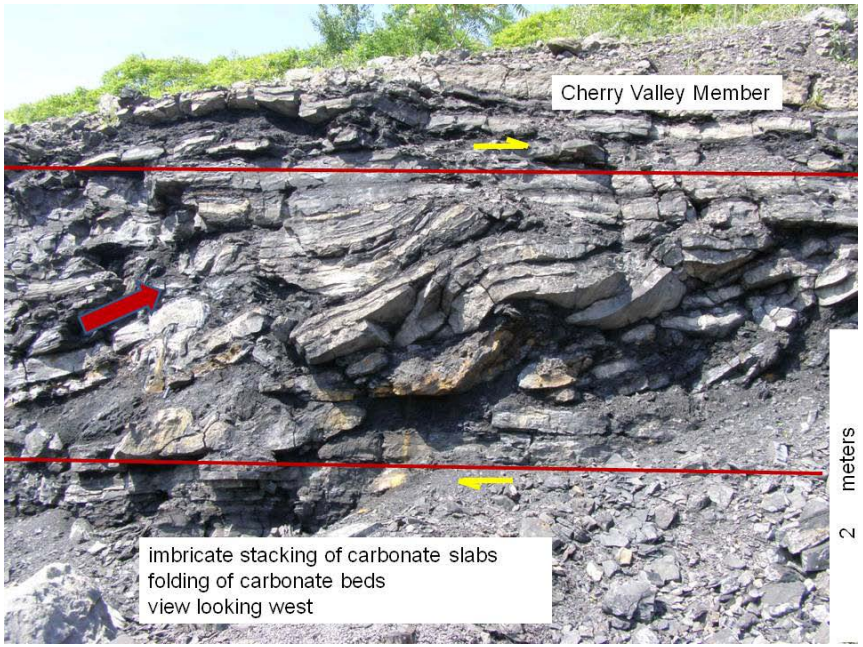
Stratigraphy of the lower Hamilton Group south-central Madison, County NY

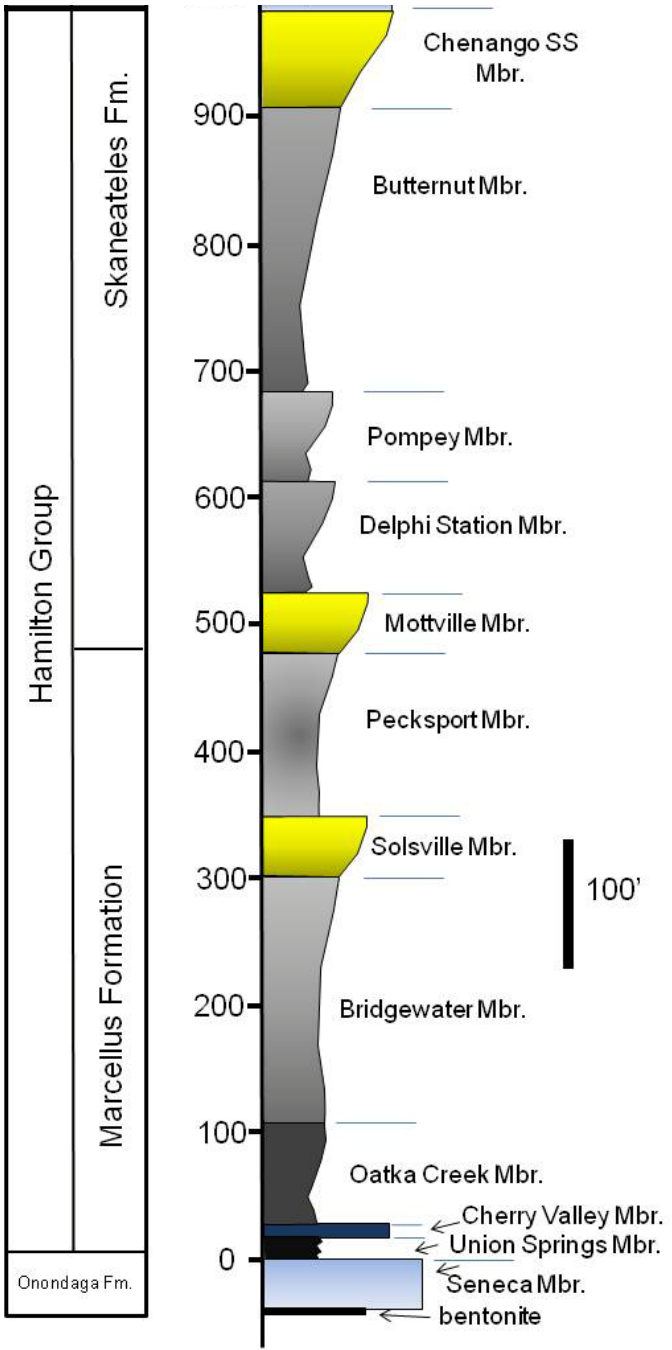





Hamilton Group
Skaneateles Fm.
Marcellus Formation
Onondaga Fm.
Chenango SS Mbr.
Butternut Mbr.
Pompey Mbr.
Delphi Station Mbr.
Mottville Mbr.
Pecksport Mbr.
Solsville Mbr.
Bridgewater Mbr.
Oatka Creek Mbr.
Cherry Valley Mbr.
Union Springs Mbr.
Seneca Mbr.
bentonite
900
800
700
600
500
400
300
200
100
0
100'


A
B
C
D


Cherry Valley Member
imbricate stacking of carbonate slabs
folding of carbonate beds
view looking west
2 meters


Hamilton Group
Skaneateles Fm.
Marcellus Formation
Onondaga Fm.
900
800
700
600
500
400
300
200
100
0
Chenango SS Mbr.
Butternut Mbr.
Pompey Mbr.
Delphi Station Mbr.
Mottville Mbr.
Pecksport Mbr.
Solsville Mbr.
Bridgewater Mbr.
Oatka Creek Mbr.
Cherry Valley Mbr.
Union Springs Mbr.
Seneca Mbr.
bentonite
100'


10 CM

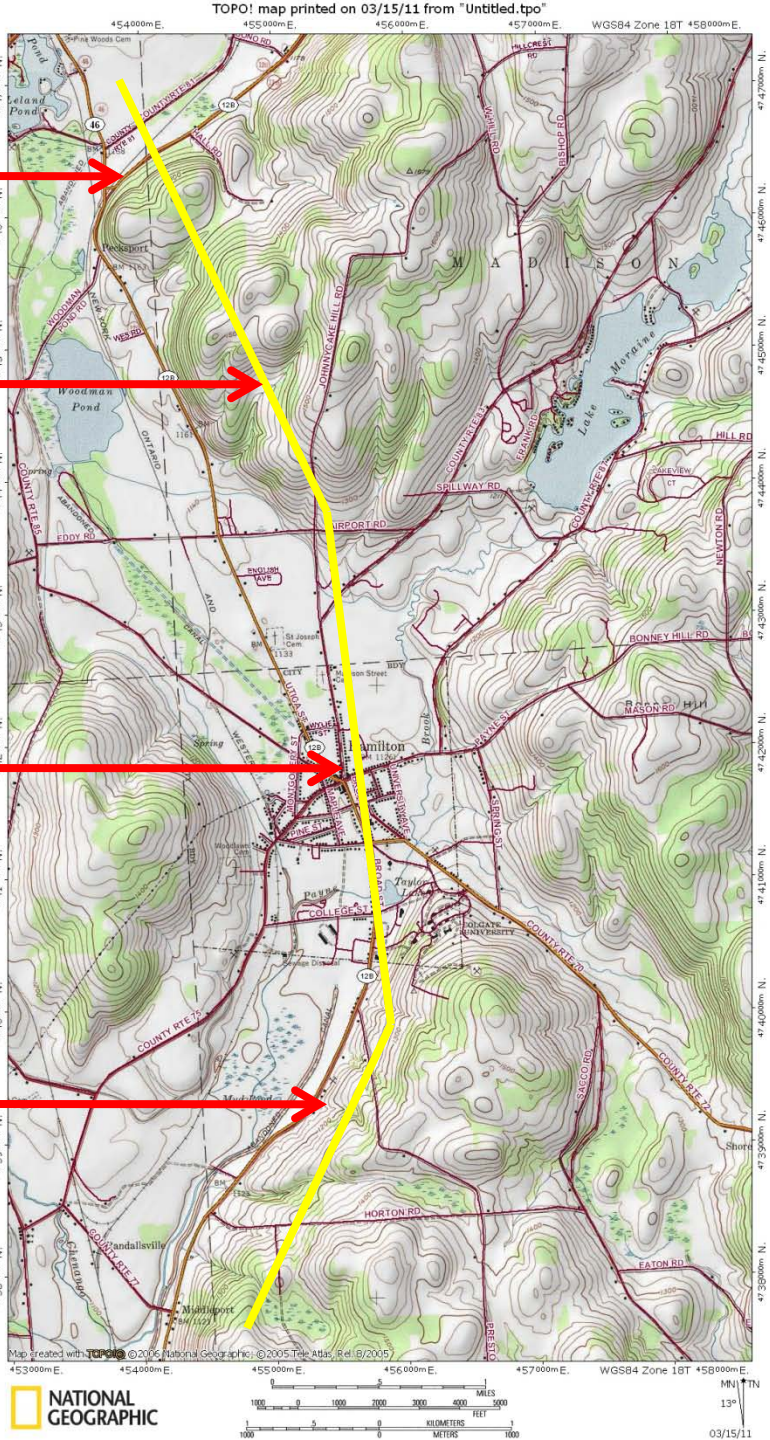

10 CM

Pecksport fracture sidewall cementation; calcite veins

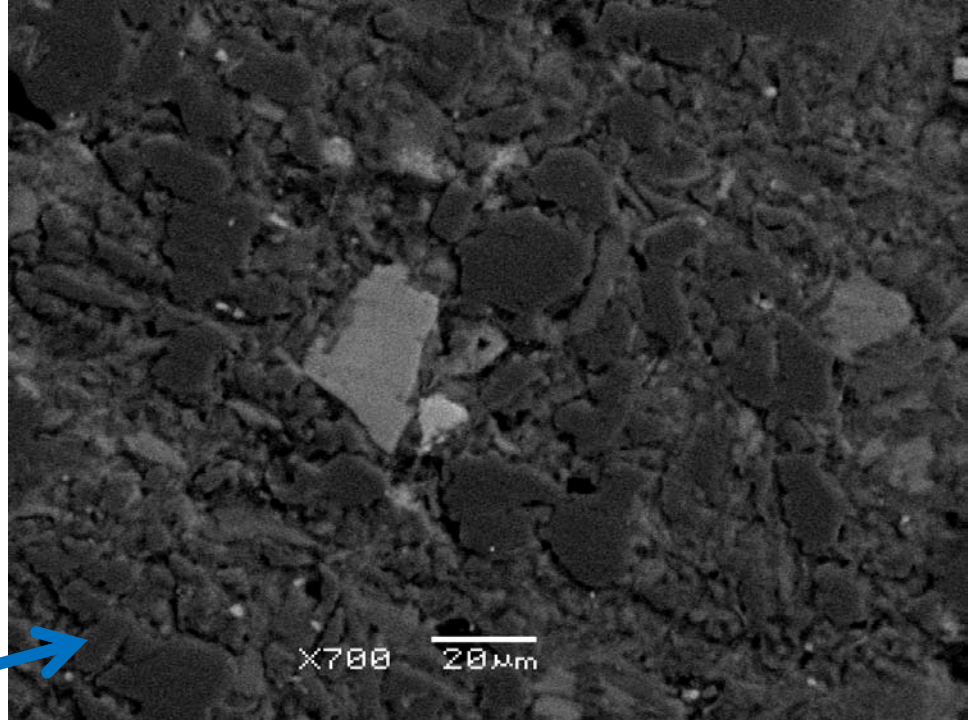
Mottville Mbr. gas seep

Village of Hamilton

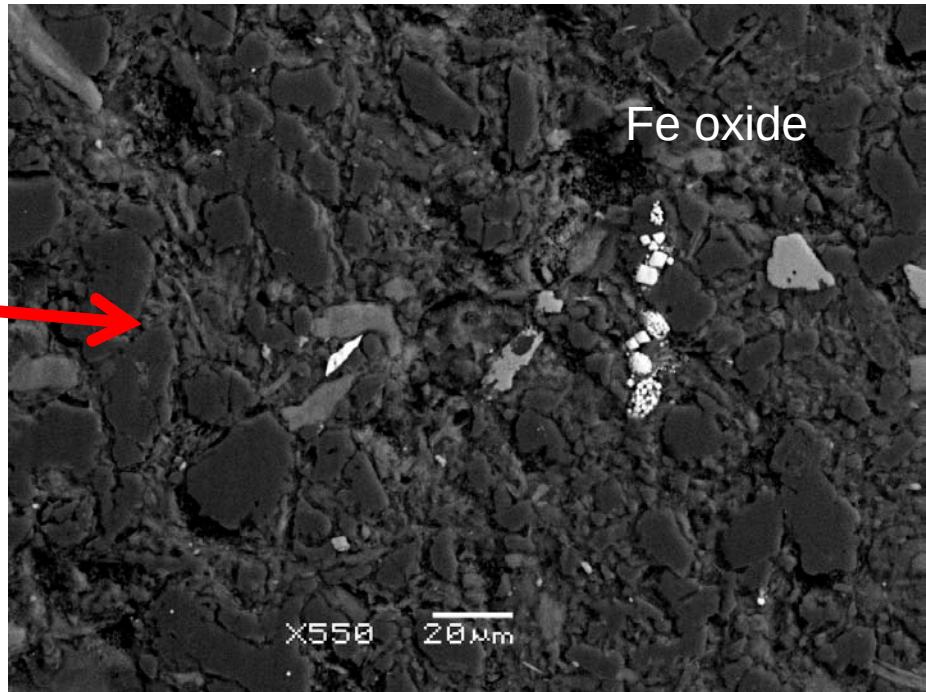
Peck water well

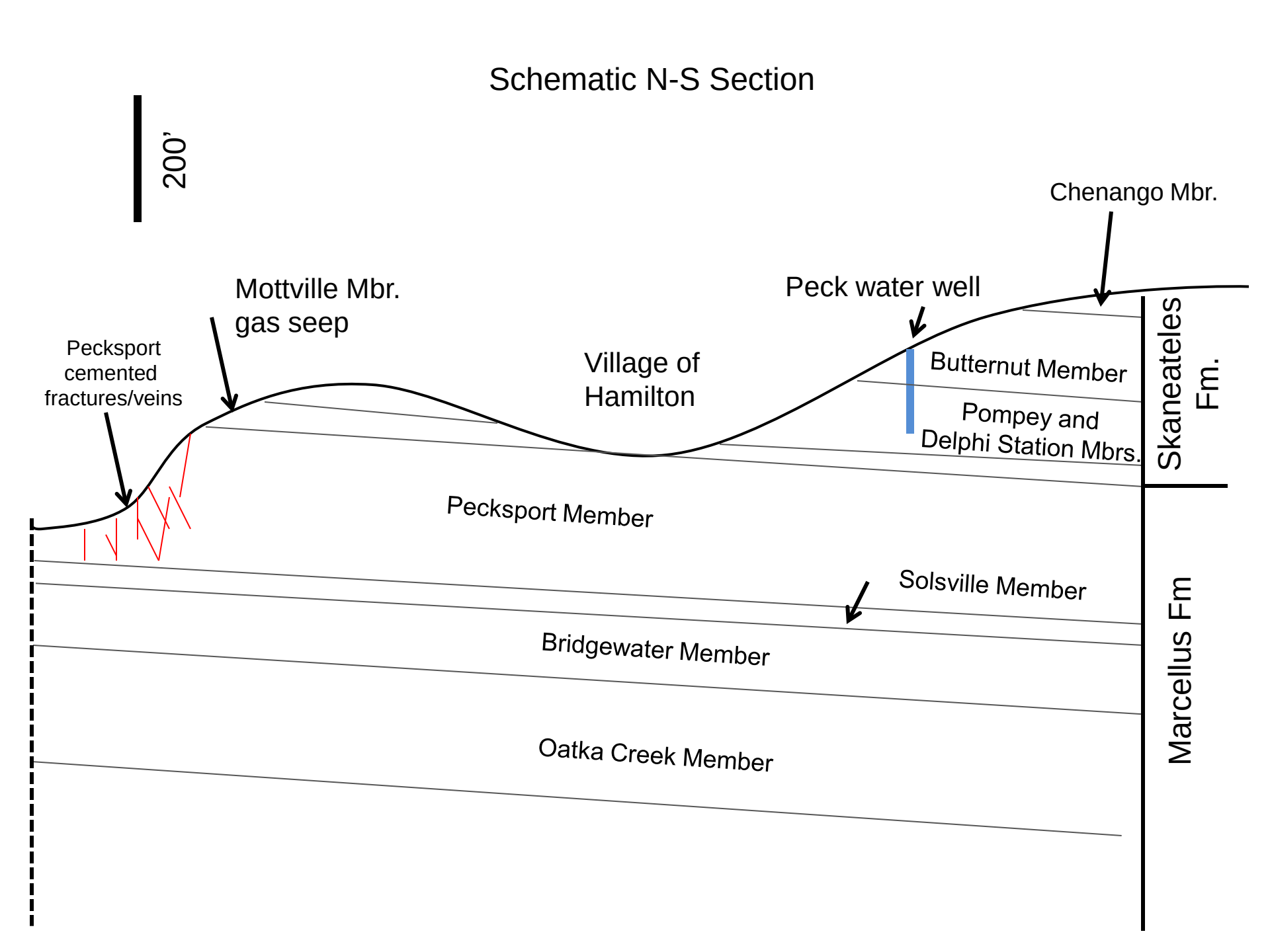


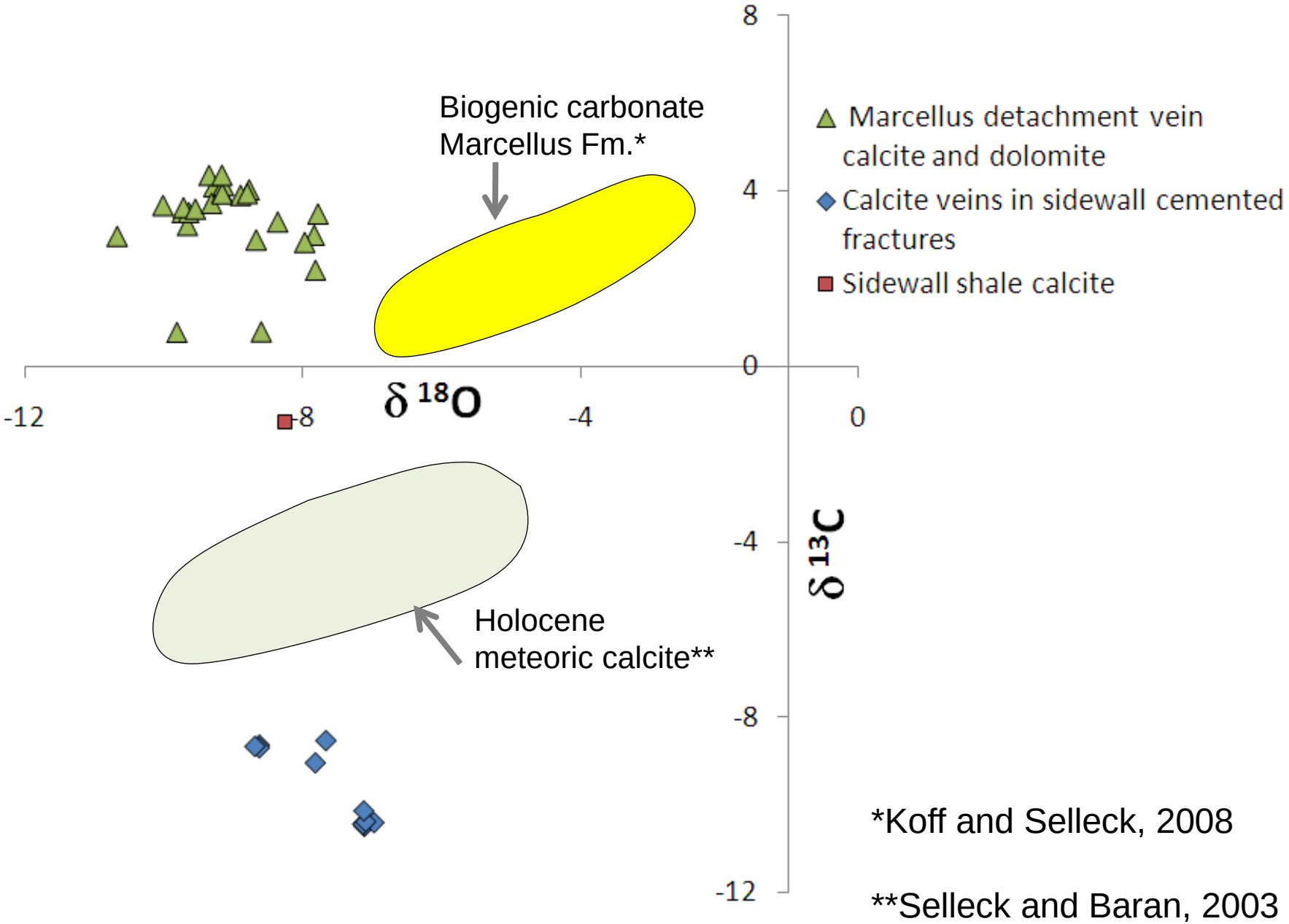

X800 20µm


X700 20µm


10 CM


Fe oxide
X550 20µm


Schematic N-S Section
200'
Chenango Mbr.
Mottville Mbr.
gas seep
Peck water well
Pecksport
cemented
fractures/veins
Village of
Hamilton
Butternut Member
Pompey and
Delphi Station Mbrs.
Skaneateles
Fm.
Pecksport Member
Solsville Member
Bridgewater Member
Oatka Creek Member
Marcellus Fm



*Koff and Selleck, 2008

**Selleck and Baran, 2003