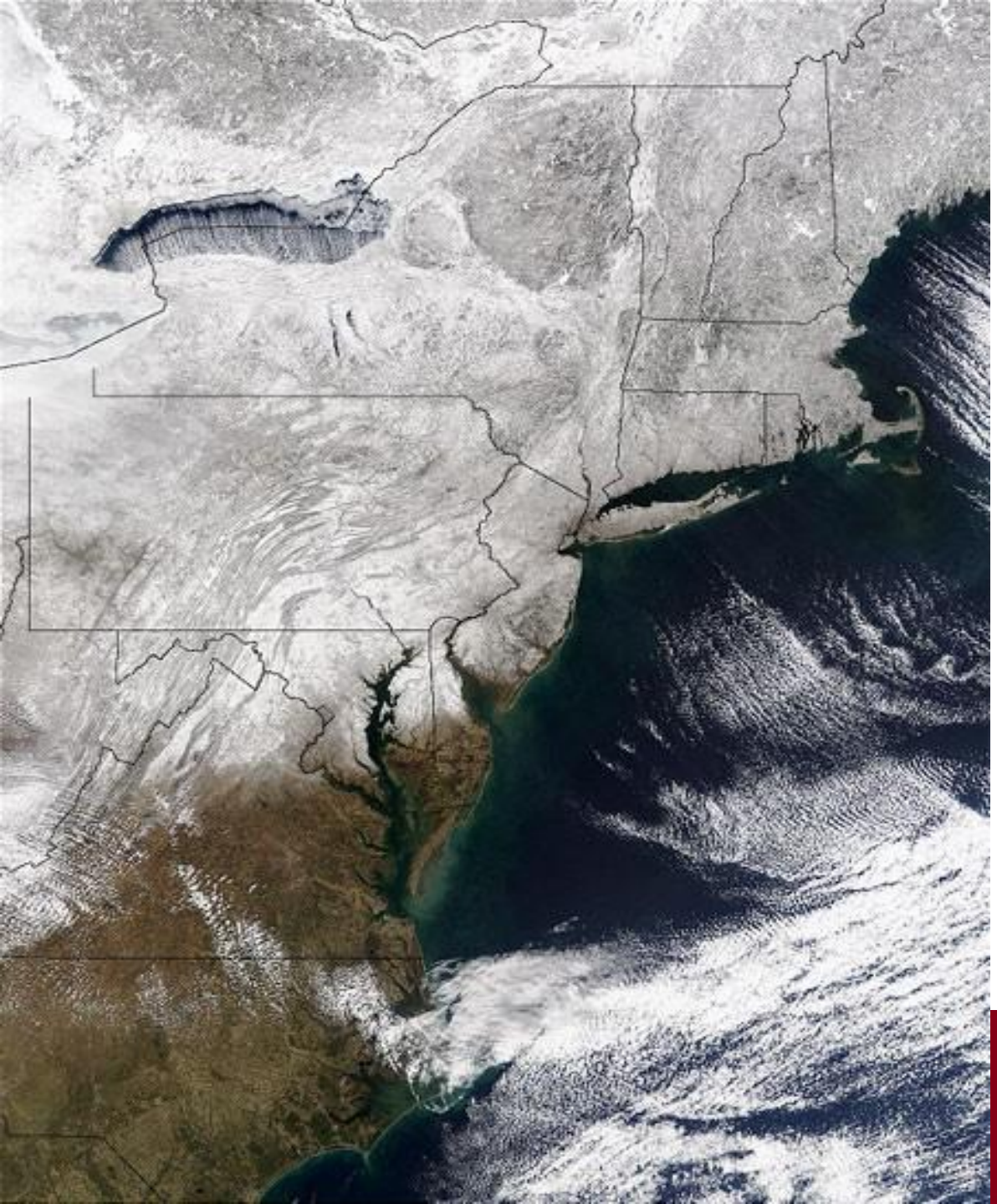


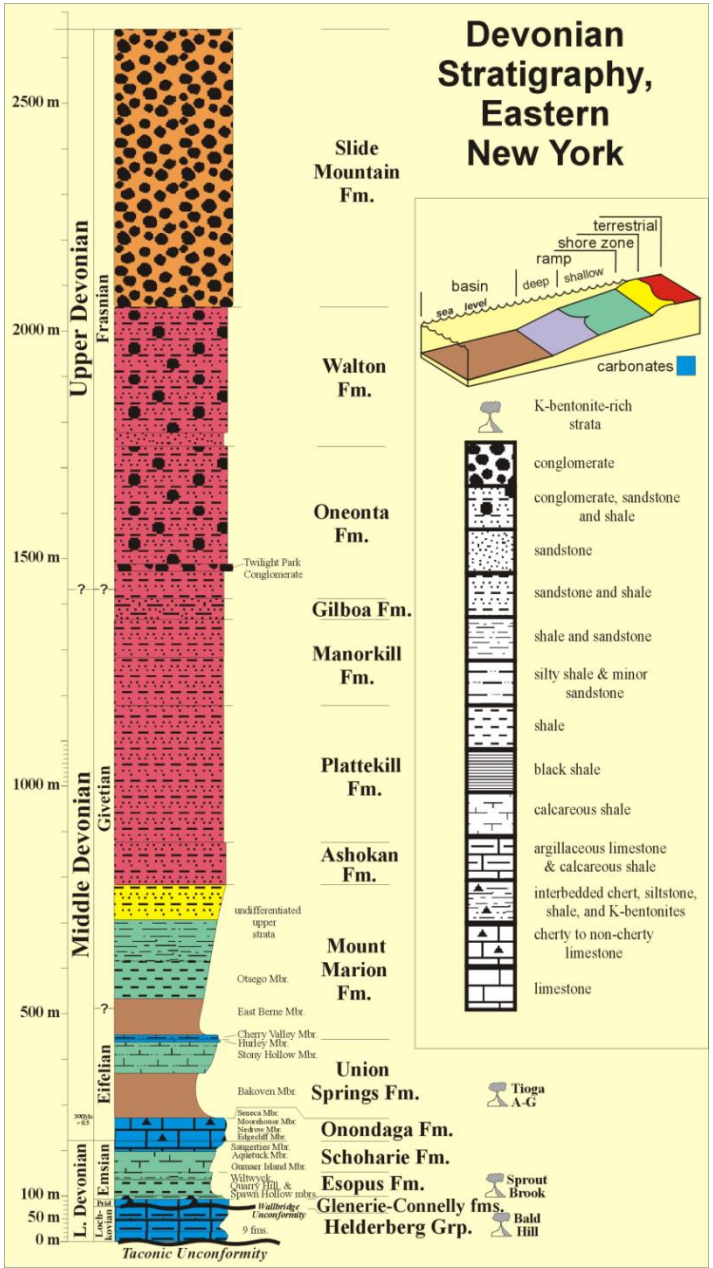
PROVENANCE EVOLUTION DURING ASSEMBLY OF THE ACADIAN/NEOACADIAN OROGEN: DETRITAL ZIRCON DATA FROM THE DEVONIAN OF NEW YORK

SELLECK, Bruce[1], VER STRAETEN, Charles[2], CHIARENZELLI, Jeffrey R.[3] and HOLZMAN, Emily[1], (1)Department of Geology, Colgate University, Hamilton, NY 13346, (2)New York State Museum & Geological Survey, 3140 Cultural Education Center, Albany, NY 12230, (3)Department of Geology, St. Lawrence University, Canton, NY 13617, bselleck@colgate.edu

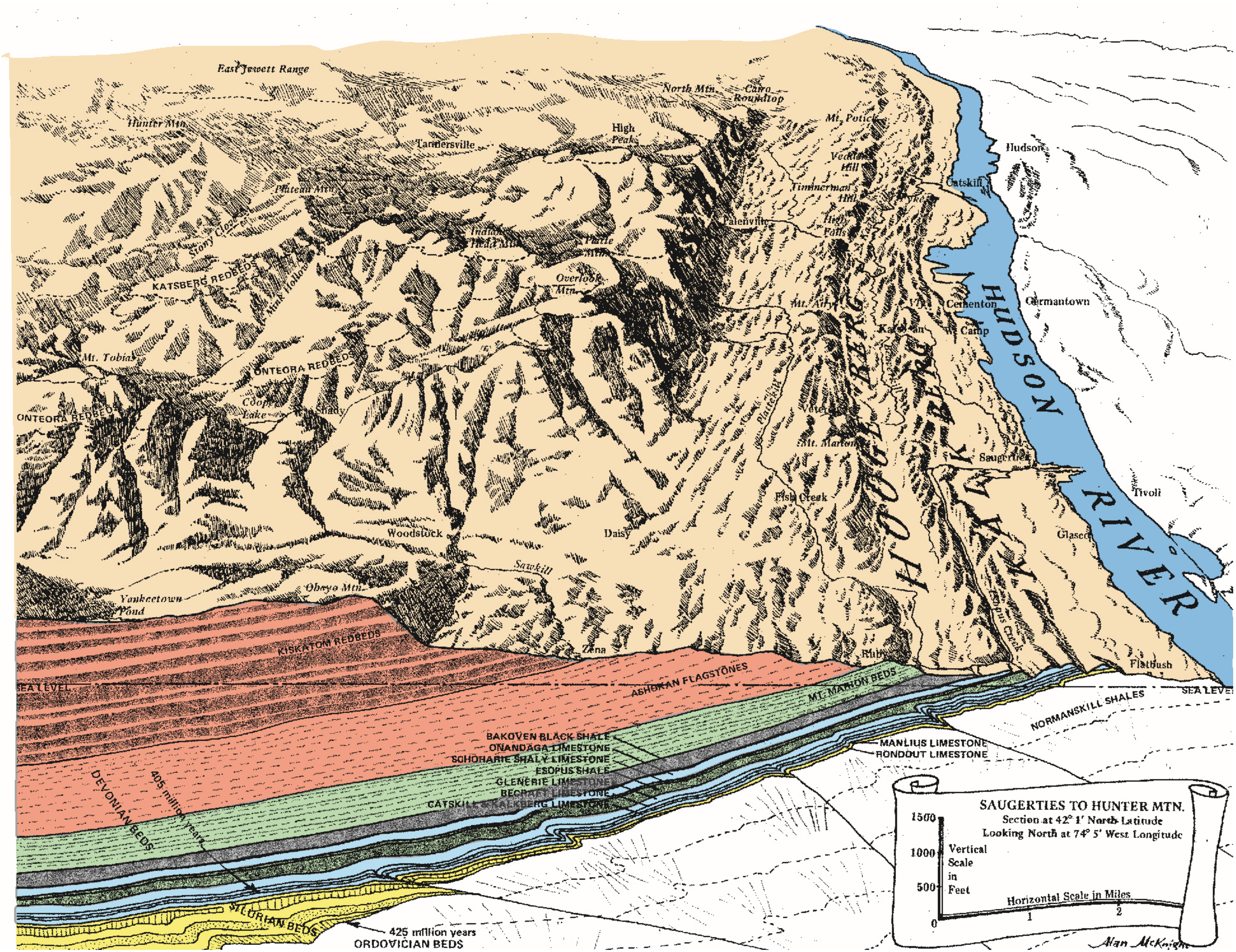
Support: New York State Museum; Boyce Fund, Colgate University

Colgate UNIVERSITY

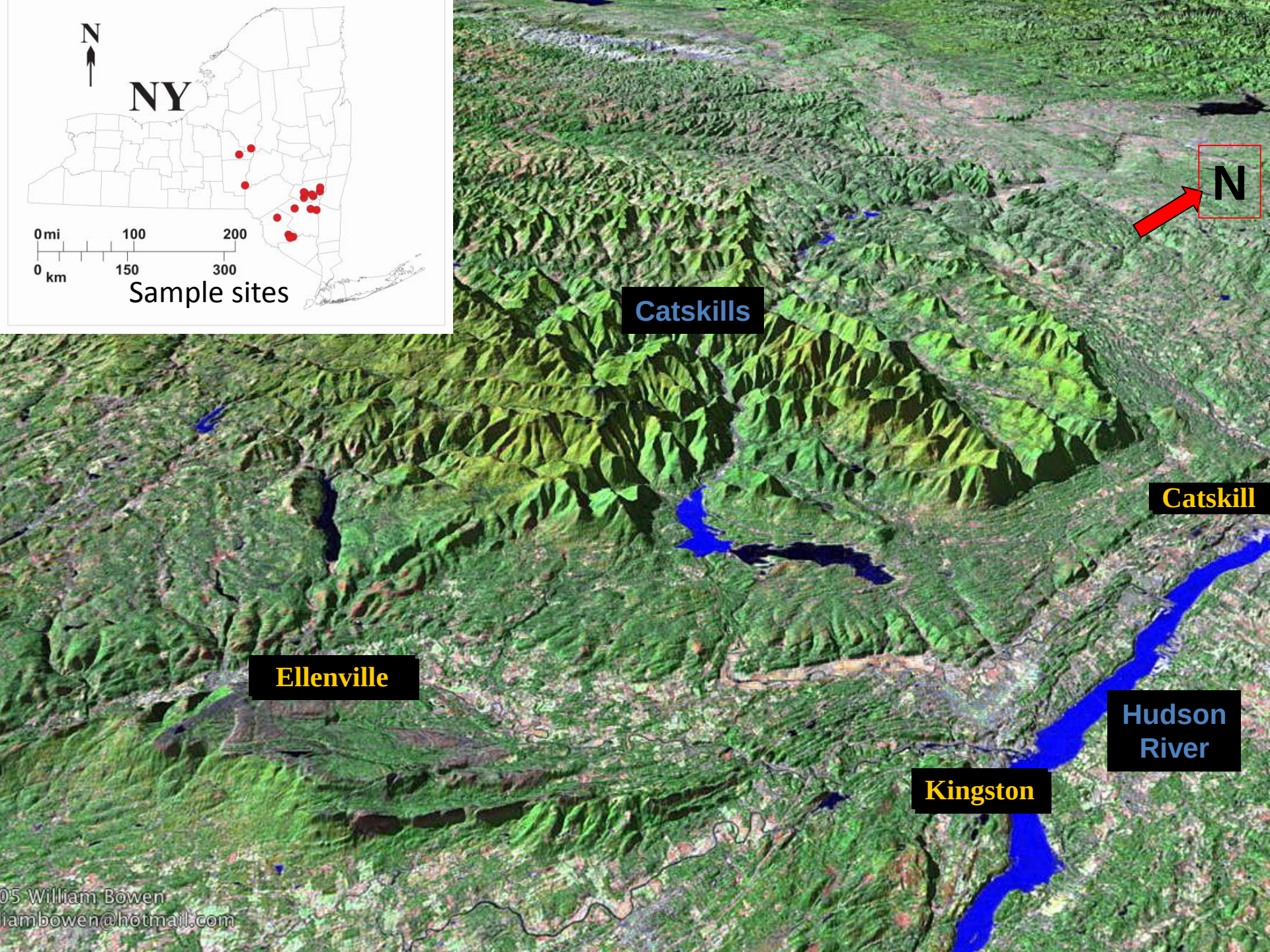
Foreland basin records orogenic history



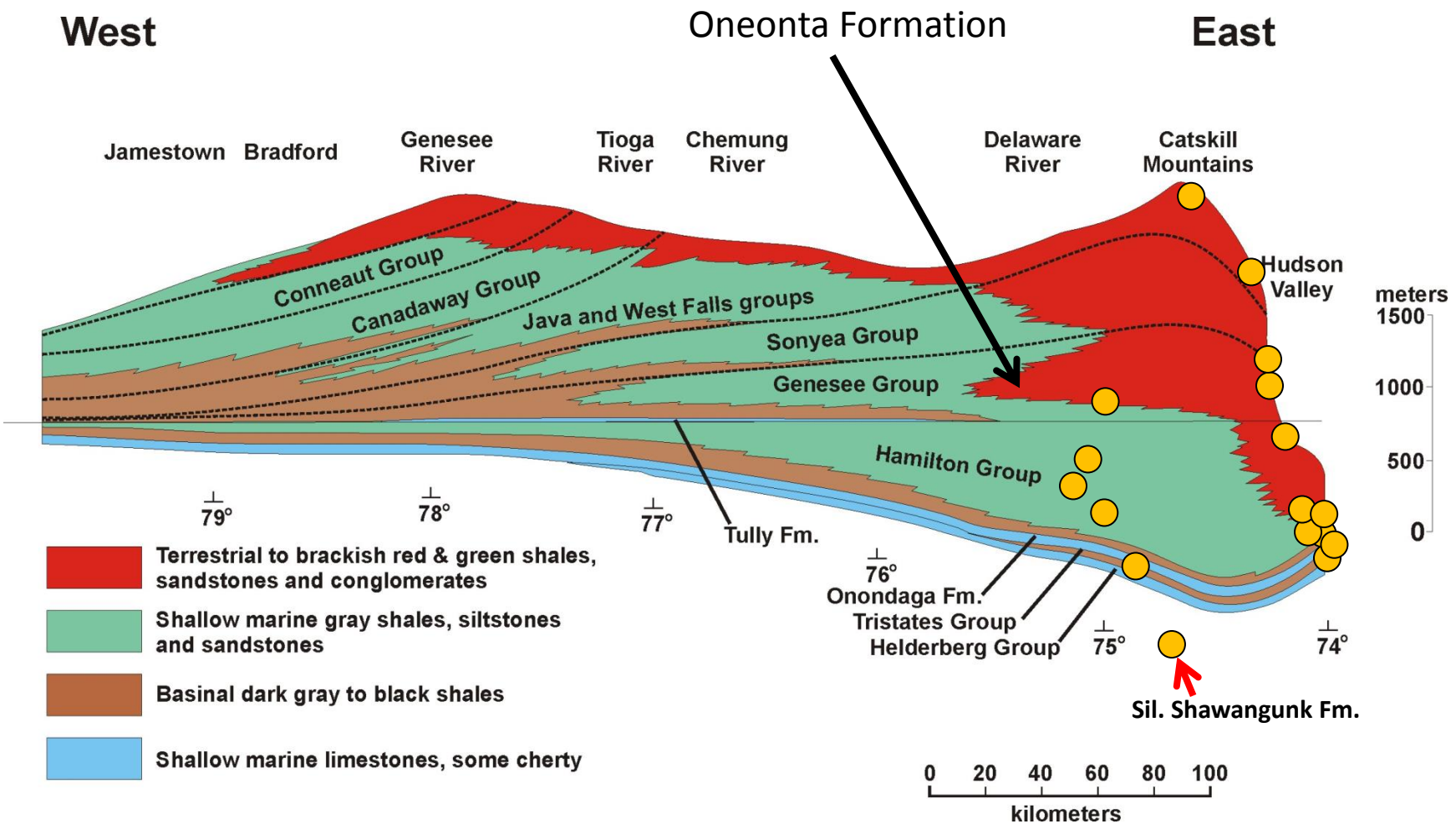
modified after Steven Schimmrich hudsonvalleygeologist.blogspot.com



East Jewett Range
North Mtn.
Cairo Roundtop
Hunter Mtn.
Tannersville
High Peaks
Mt. Potick
Hudson
Catskill
Plateau Mtn.
Palenville
Stony Clove
KATSBERG REDBEDS
Overlook Mtn.
Mt. Airy
Cementon
Germantown
HUDSON
Mt. Tobias
ONTEORA REDBEDS
ONTEORA REDBEDS
Cooper Lake
Shady
Mt. Marion
Saugerties
RIVER
Tivoli
Fish Creek
Woodstock
Daisy
Glasco
Sawkill
Ohayo Mtn.
Yankeetown Pond
KISKATOM REDBEDS
Zena
Ruby
Flatbush
SEA LEVEL
SEA LEVEL
ASHOKAN FLAGSTONES
MT. MARION BEDS
NORMANSKILL SHALES
BAKOVEN BLACK SHALE
ONANDAGA LIMESTONE
SCHOHARIE SHALY LIMESTONE
ESOPUS SHALE
GLENERIE LIMESTONE
BECRAFT LIMESTONE
CATSKILL & KALKBERG LIMESTONE
MANLIUS LIMESTONE
RONDOUT LIMESTONE
DEVONIAN BEDS
405 million years
SILURIAN BEDS
425 million years
ORDOVICIAN BEDS
SAUGERTIES TO HUNTER MTN.
Section at 42° 1' North Latitude
Looking North at 74° 5' West Longitude
1500
1000
500
0
Vertical Scale in Feet
Horizontal Scale in Miles
1
2
Alan McKnight


N
NY
0 mi
100
200
0 km
150
300
Sample sites
Catskills
N
Catskill
Ellenville
Hudson River
Kingston
05 William Bowen
liambowen@hotmail.com

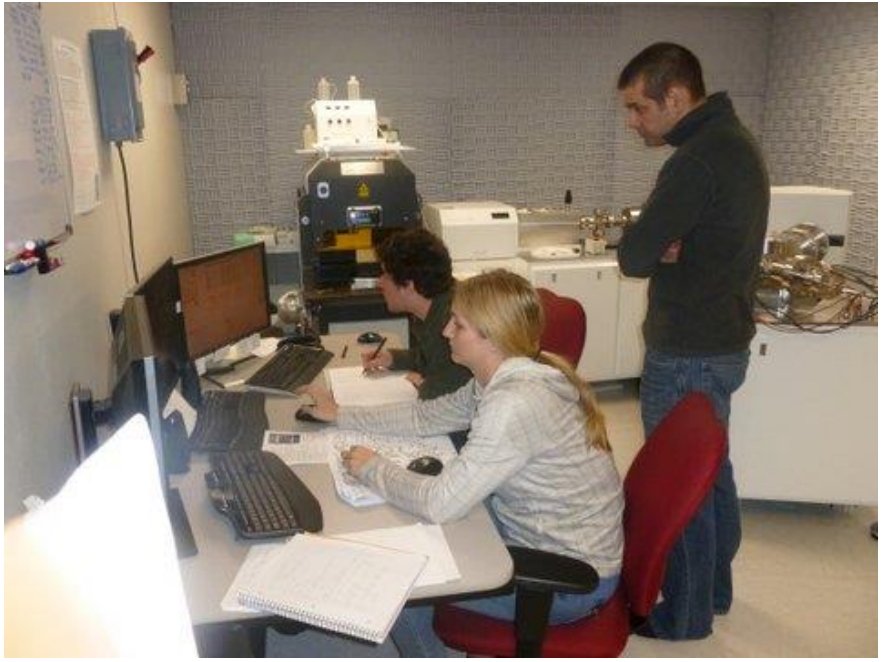
Stratigraphic distribution of samples

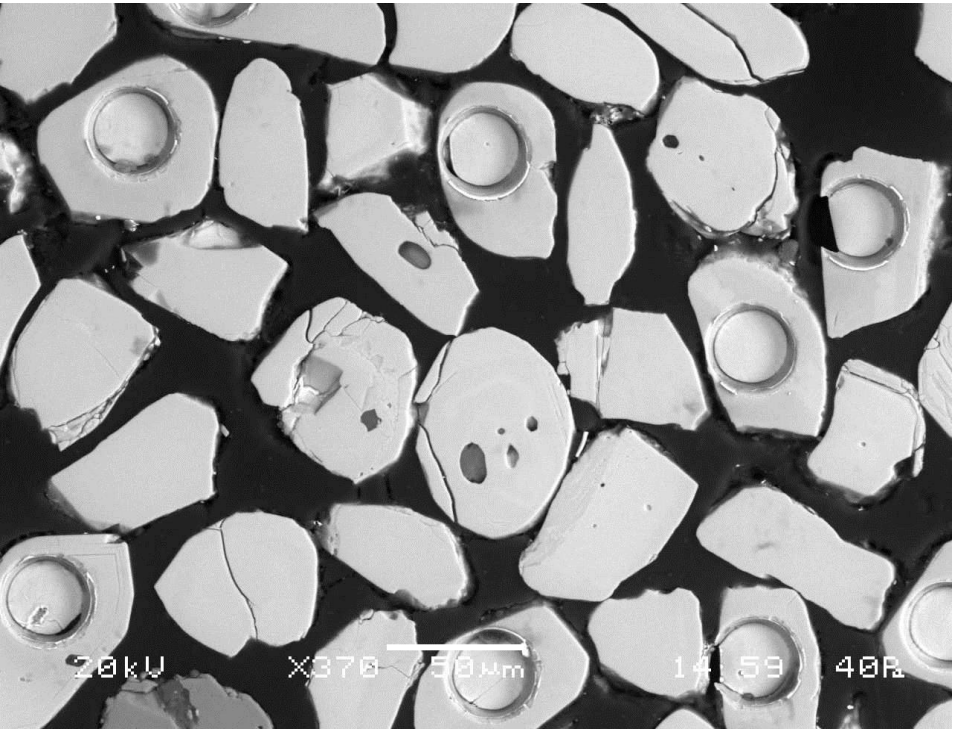


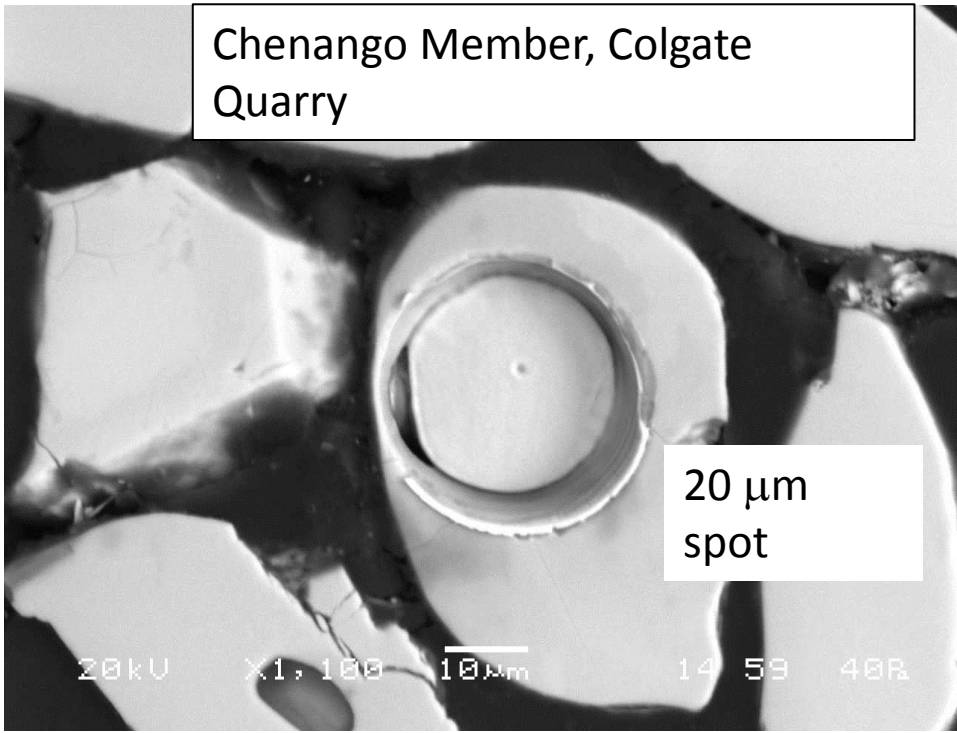
ARIZONA LASERCHRON CENTER

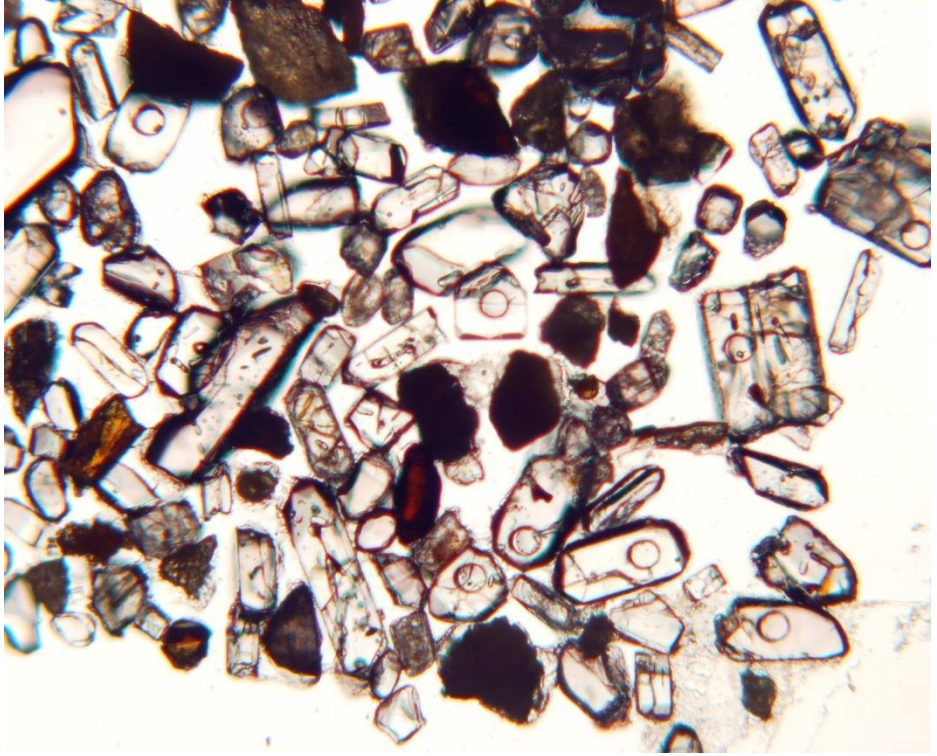
Department of Geosciences
University of Arizona

(Many thanks to Mark Pecha, Dominque Geisler, and other staff at the Laserchron Center)

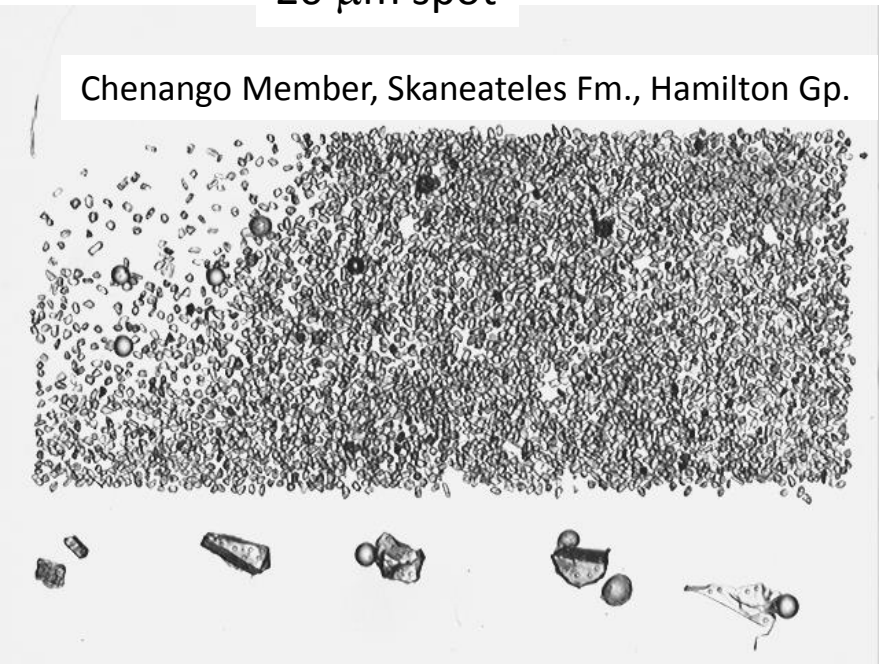




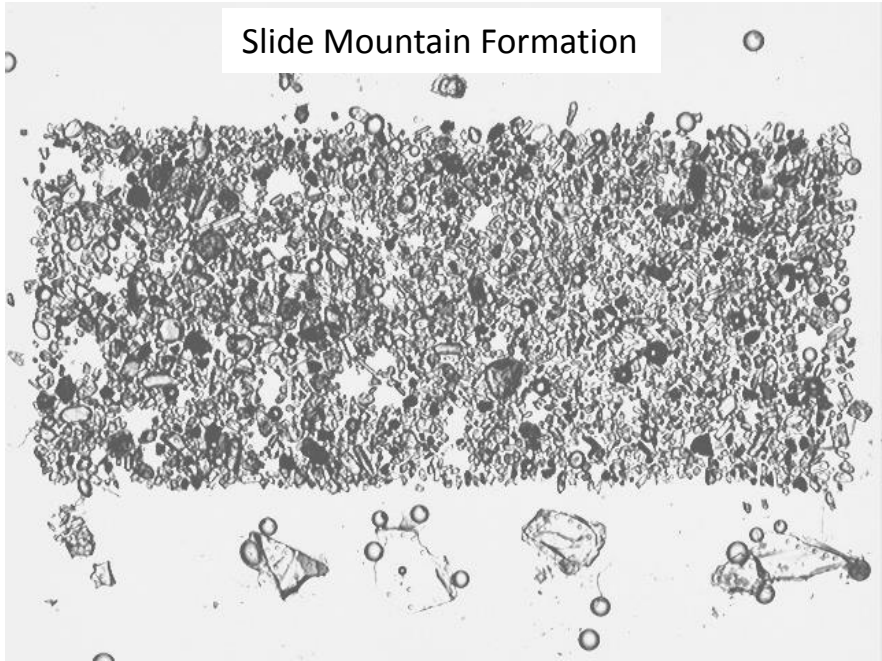


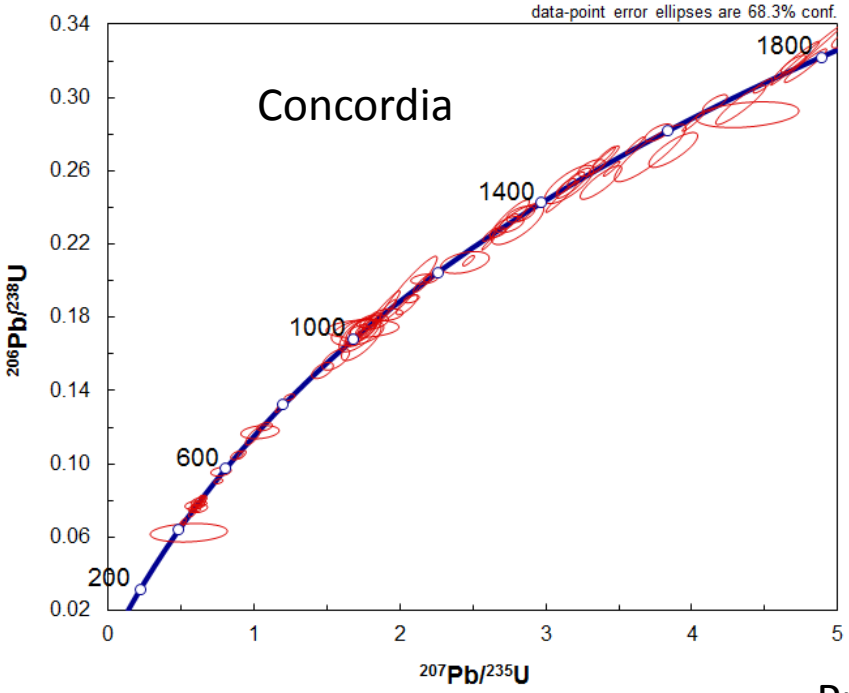


Chenango Member, Skaneateles Fm., Hamilton Gp.



Slide Mountain Formation

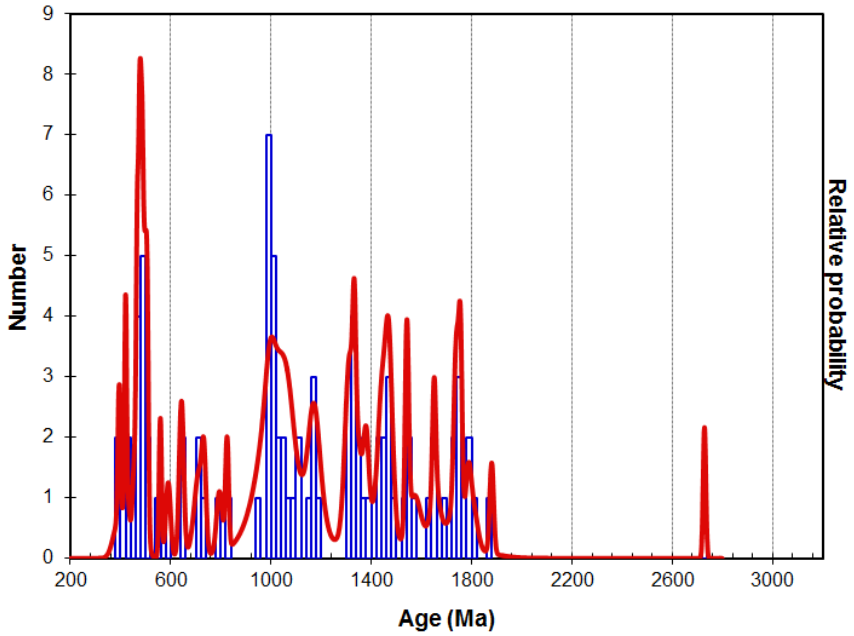


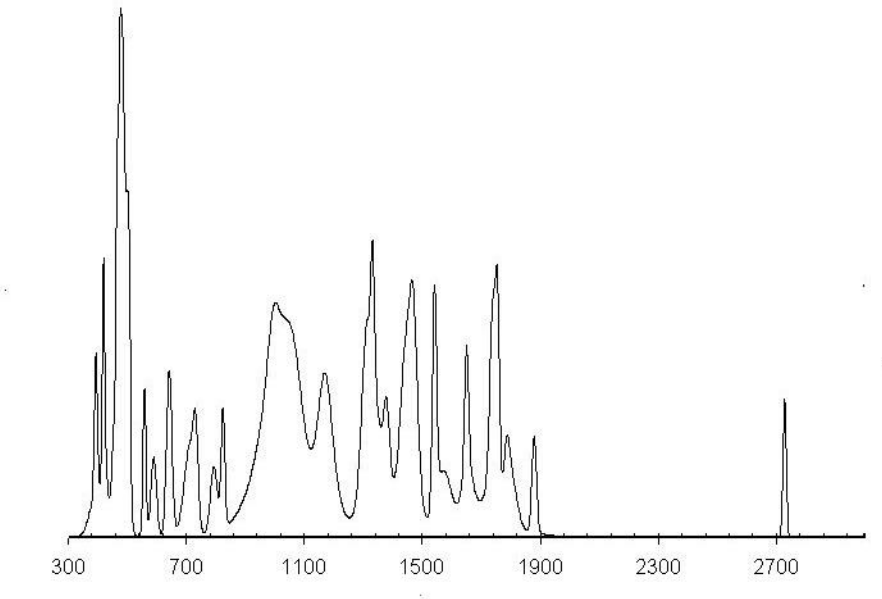


Chenango Member, Skaneateles Formation,
Hamilton Group, Colgate Quarry

Probability-density

n – 100 to 300 grains





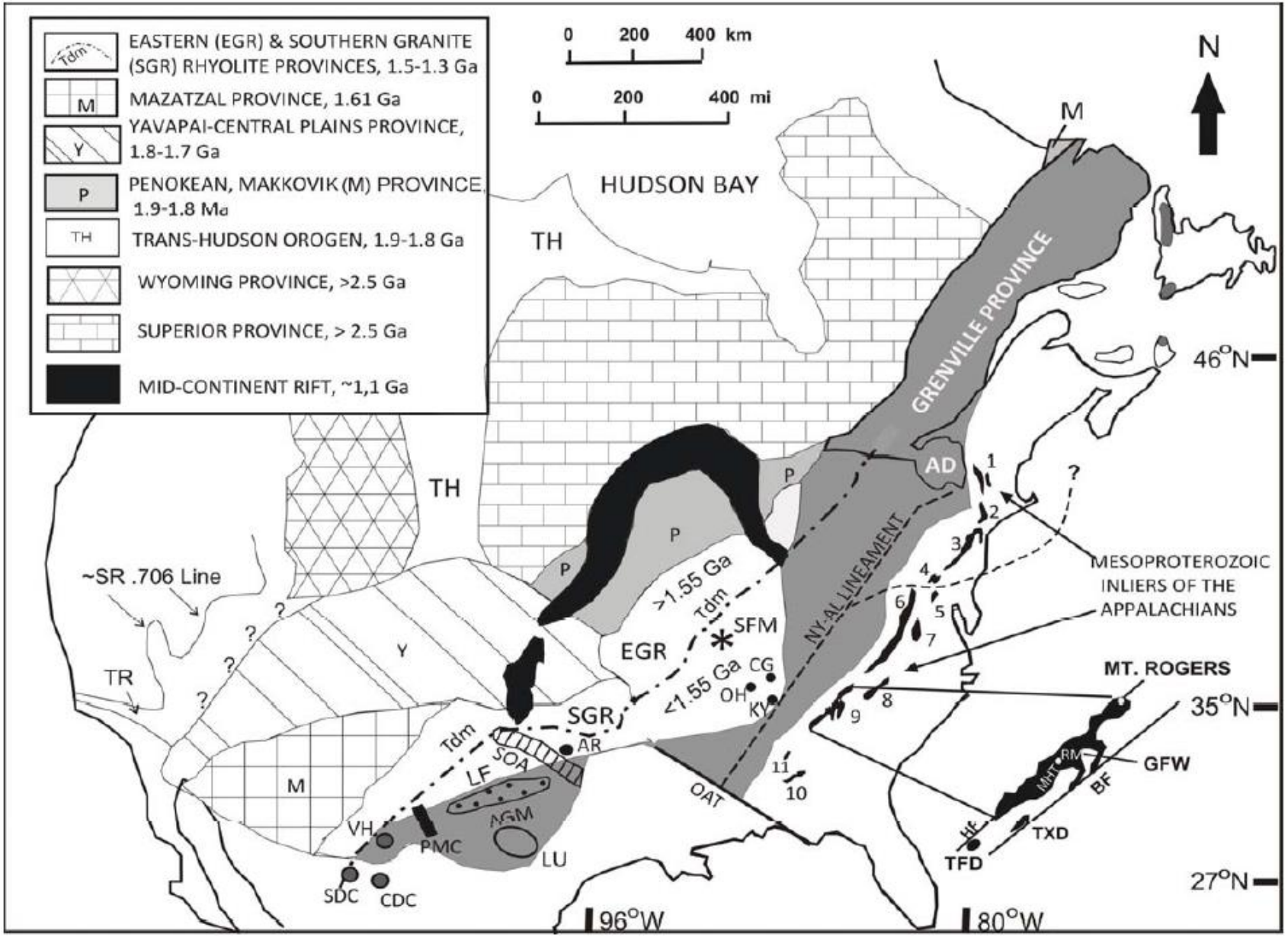
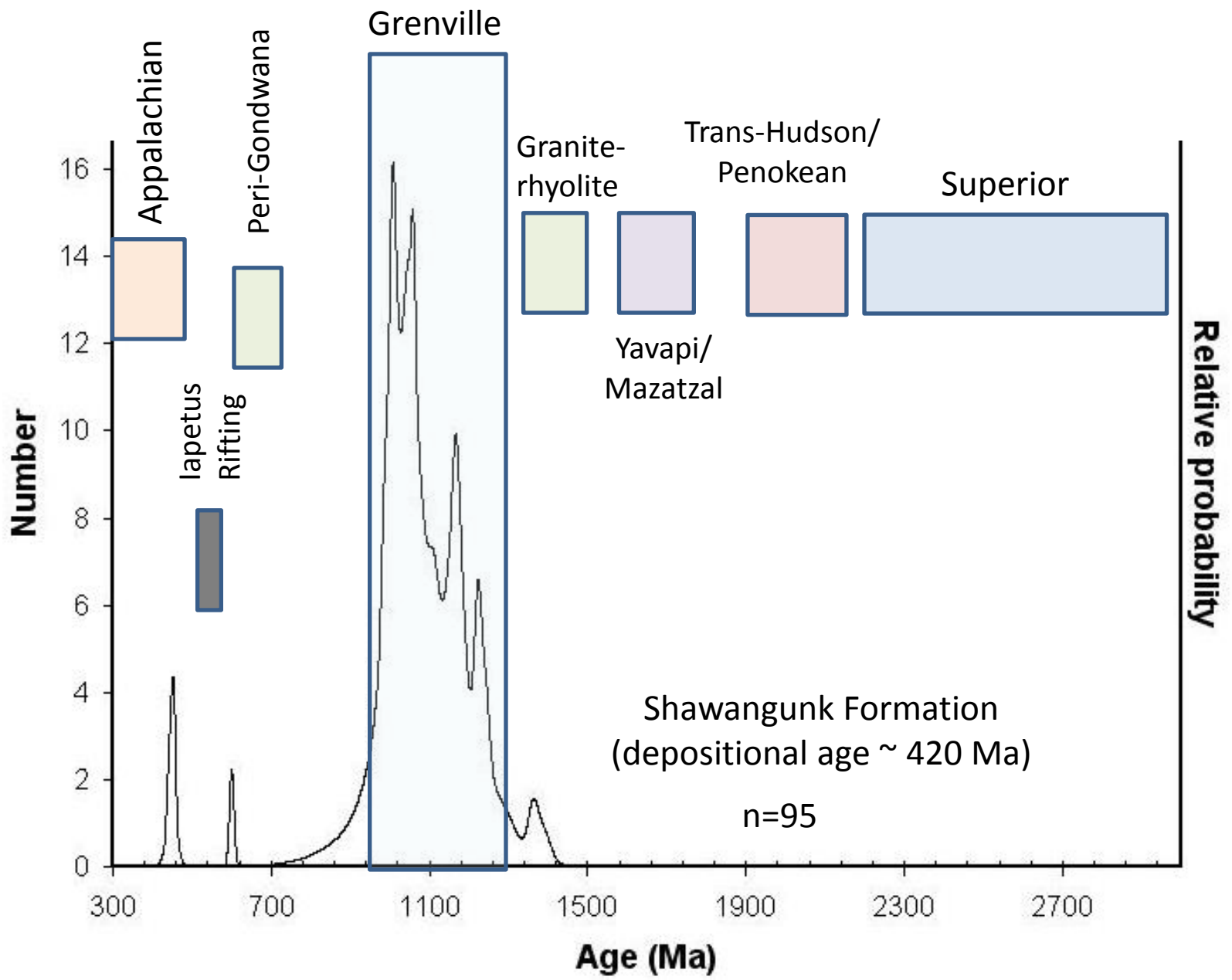
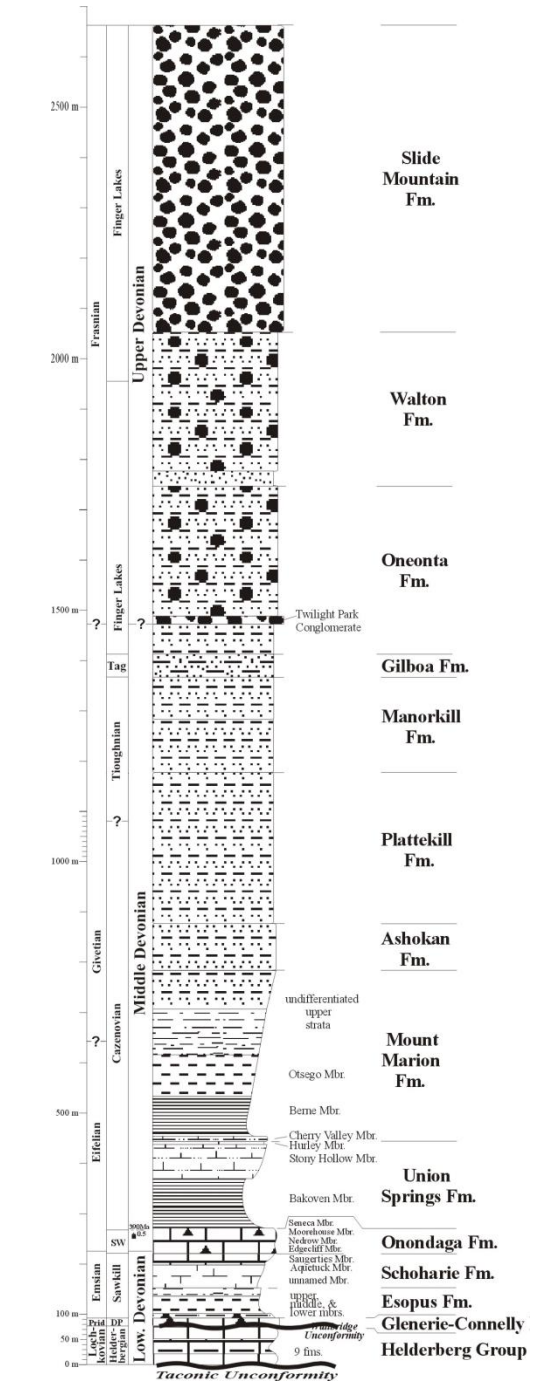
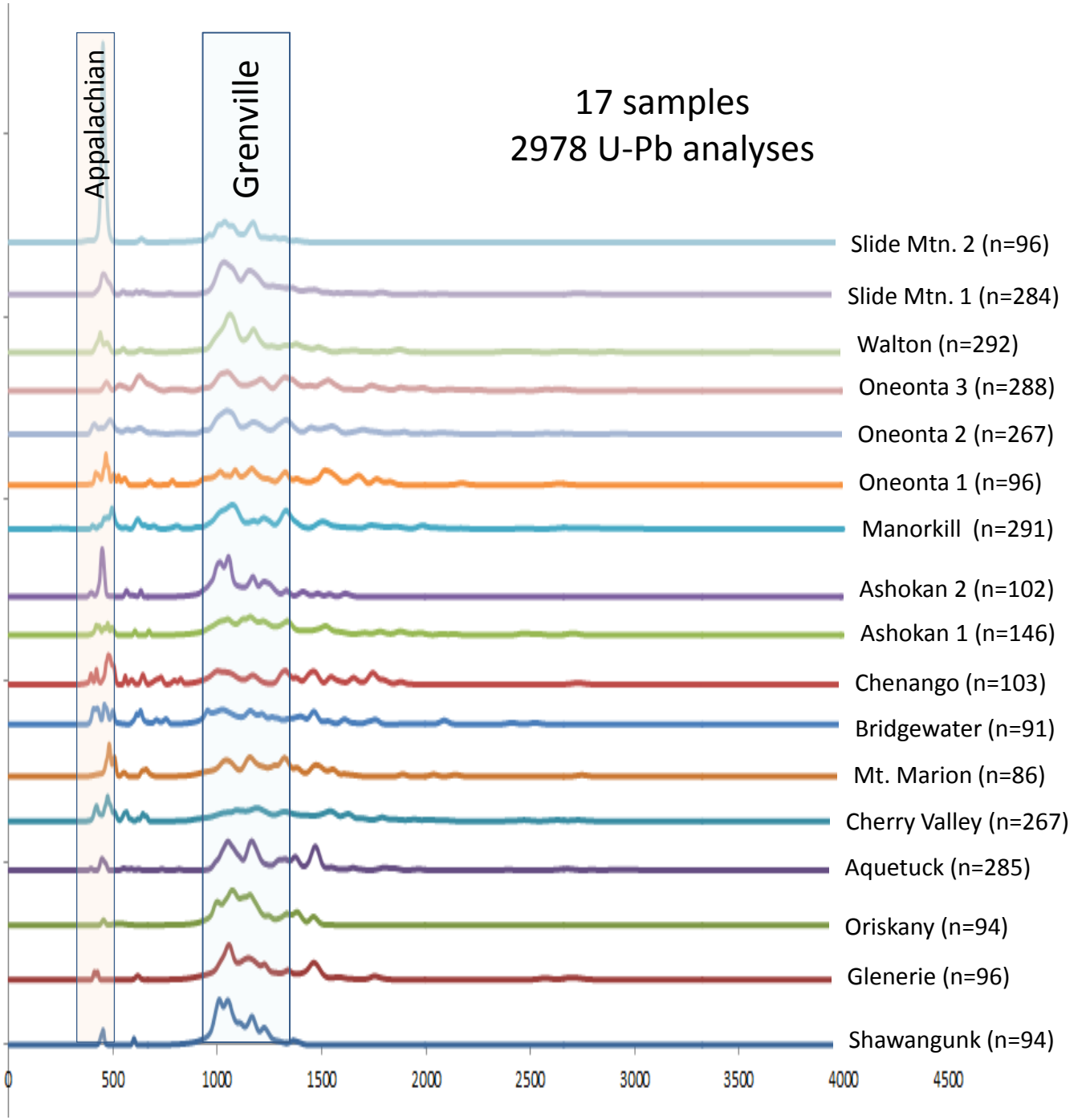


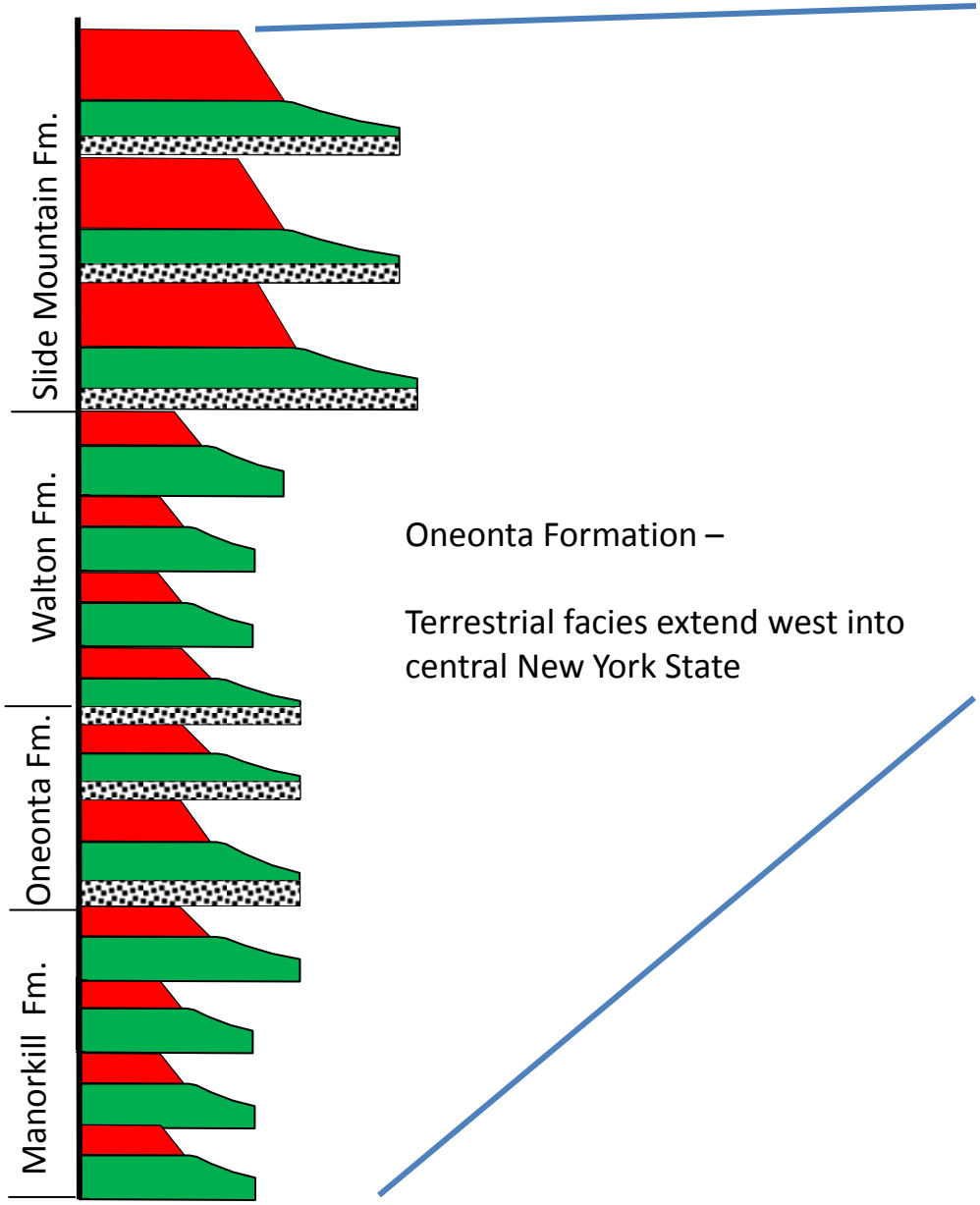
Figure 1. Generalized map depicting major tectonic and geochronological subdivisions in the USA. The Grenville Province is shown in medium gray and its exposed portions are indicated by heavy outlines. **Abbreviations**: AD = Adirondack Mountains,

(from Tectonic Evolution of the Adirondack Mountains and Grenville Orogen Inliers within the USA, McLelland, et al, 2013)


Grenville
Appalachian
Peri-Gondwana
Granite-
rhyolite
Trans-Hudson/
Penokean
Superior
Yavapi/
Mazatzal
Iapetus
Rifting
Number
Relative probability
16
14
12
10
8
6
4
2
0
300
700
1100
1500
1900
2300
2700
Age (Ma)
Shawangunk Formation
(depositional age ~ 420 Ma)
n=95

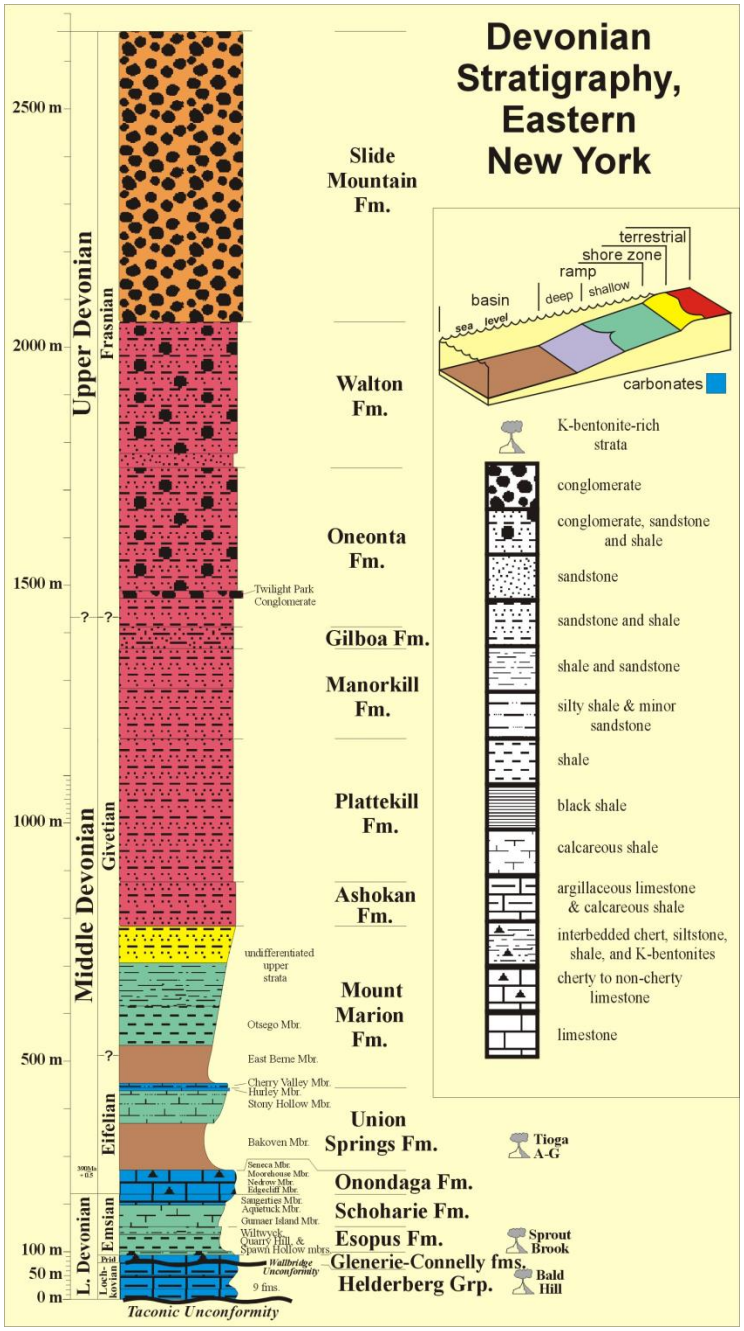

2500 m
2000 m
1500 m
1000 m
500 m
100 m
50 m
0 m
Frasnian
Upper Devonian
Finger Lakes
Givetian
Middle Devonian
Tioughnian
Cazenovian
Eifelian
Emsian
Sawkill
Low. Devonian
Slide Mountain Fm.
Walton Fm.
Oneonta Fm.
Twilight Park Conglomerate
Gilboa Fm.
Manorkill Fm.
Plattekill Fm.
Ashokan Fm.
undifferentiated upper strata
Mount Marion Fm.
Otsego Mbr.
Berne Mbr.
Cherry Valley Mbr.
Hurley Mbr.
Stony Hollow Mbr.
Union Springs Fm.
Bakoven Mbr.
Seneca Mbr.
Moorehouse Mbr.
Nedrow Mbr.
Edgecliff Mbr.
Onondaga Fm.
Sauquoit Mbr.
Aquetuck Mbr.
unnamed Mbr.
Schoharie Fm.
upper, middle, & lower mbrs.
Esopus Fm.
Glenerie-Connelly
Helderberg Group
9 fms.
Taconic Unconformity


Appalachian
Grenville
17 samples
2978 U-Pb analyses
Slide Mtn. 2 (n=96)
Slide Mtn. 1 (n=284)
Walton (n=292)
Oneonta 3 (n=288)
Oneonta 2 (n=267)
Oneonta 1 (n=96)
Manorkill (n=291)
Ashokan 2 (n=102)
Ashokan 1 (n=146)
Chenango (n=103)
Bridgewater (n=91)
Mt. Marion (n=86)
Cherry Valley (n=267)
Aquetuck (n=285)
Oriskany (n=94)
Glenerie (n=96)
Shawangunk (n=94)
0
500
1000
1500
2000
2500
3000
3500
4000
4500

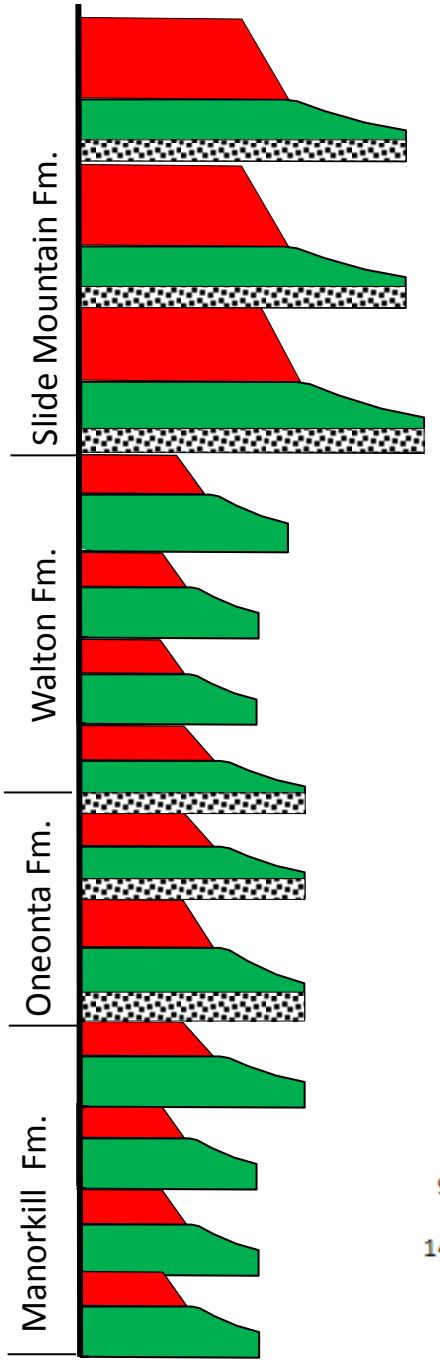


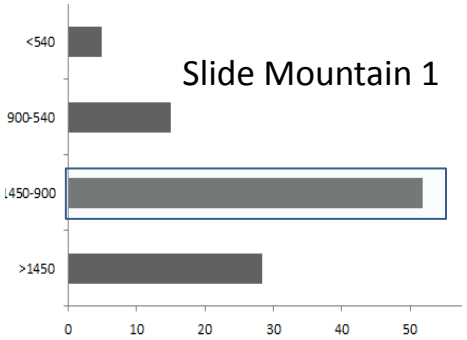
Oneonta Formation –

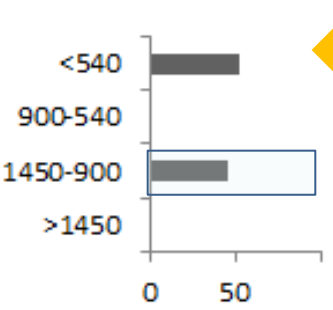
Terrestrial facies extend west into central New York State

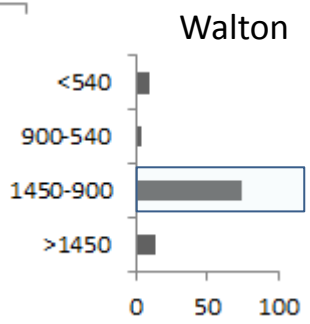


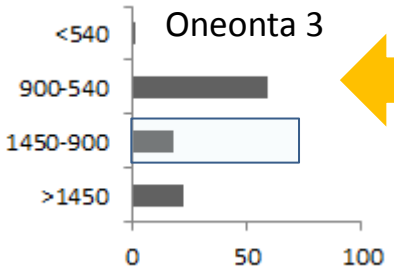
Upper Givetian - Lower Frasnian sequence

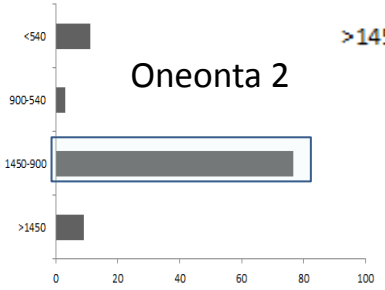

Slide Mountain Fm.
Walton Fm.
Oneonta Fm.
Manorkill Fm.

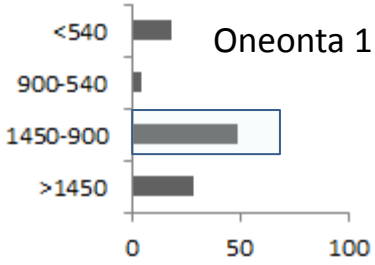

Slide Mountain 1
<540
900-540
1450-900
>1450
0
10
20
30
40
50

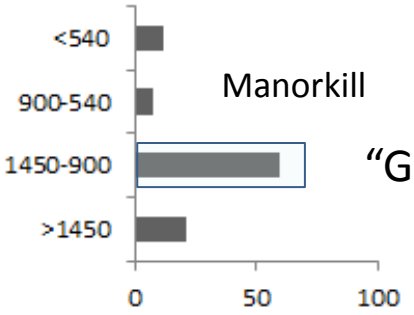

!
Slide Mountain 2
<540
900-540
1450-900
>1450
0
50


Walton
<540
900-540
1450-900
>1450
0
50
100


Oneonta 3
!
<540
900-540
1450-900
>1450
0
50
100

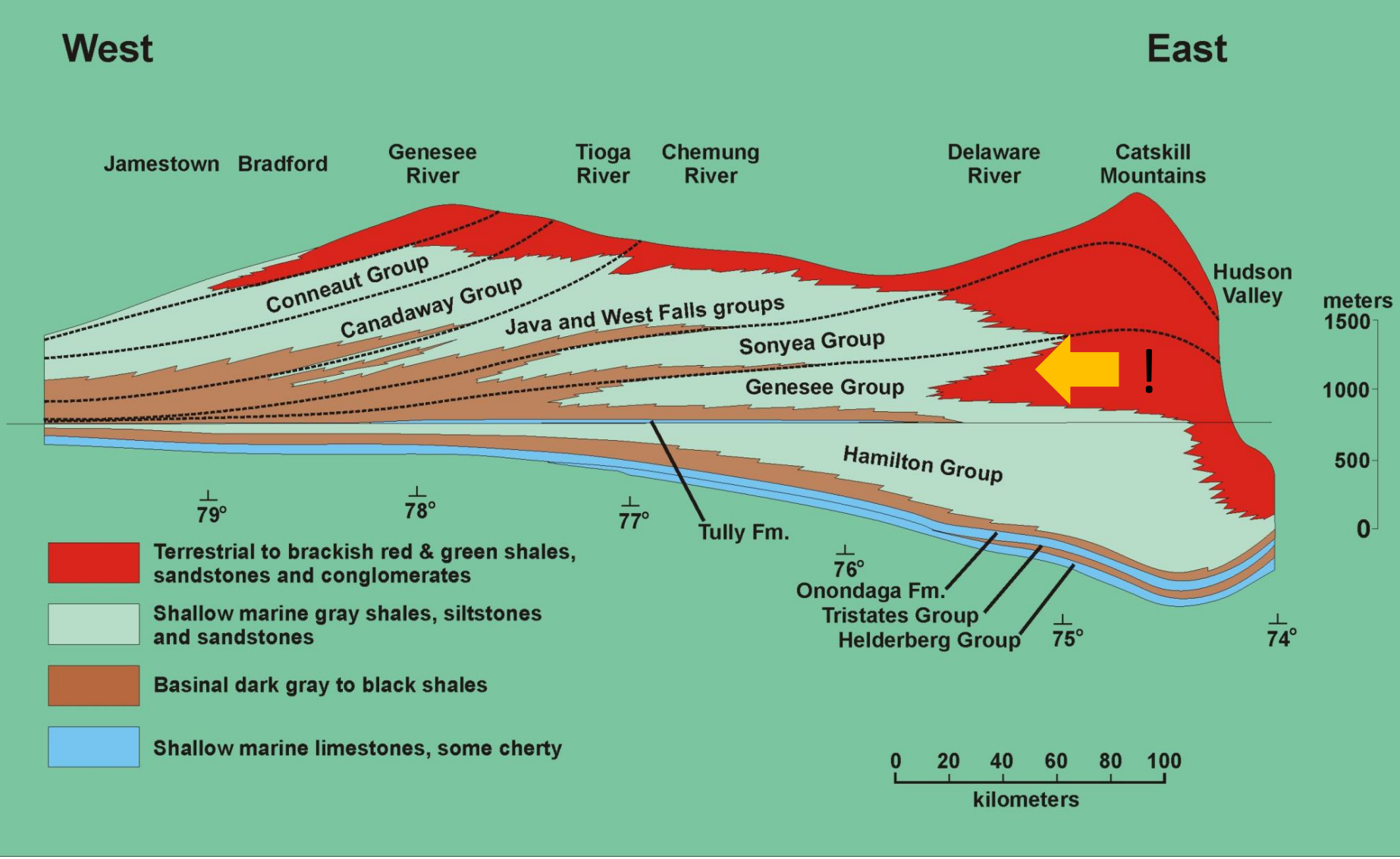

Oneonta 2
<540
900-540
1450-900
>1450
0
20
40
60
80
100


Oneonta 1
<540
900-540
1450-900
>1450
0
50
100

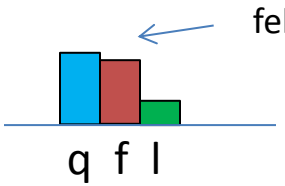

Manorkill
<540
900-540
1450-900
>1450
0
50
100

“Grenville”

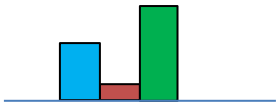
%


West
East
Jamestown
Bradford
Genesee River
Tioga River
Chemung River
Delaware River
Catskill Mountains
Hudson Valley
Conneaut Group
Canadaway Group
Java and West Falls groups
Sonyea Group
Genesee Group
Hamilton Group
Tully Fm.
Onondaga Fm.
Tristates Group
Helderberg Group
79°
78°
77°
76°
75°
74°
meters
1500
1000
500
0
Terrestrial to brackish red & green shales, sandstones and conglomerates
Shallow marine gray shales, siltstones and sandstones
Basinal dark gray to black shales
Shallow marine limestones, some cherty
0 20 40 60 80 100
kilometers

sandstone petrology

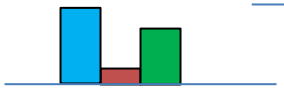


Upper Slide Mountain – feldspathic

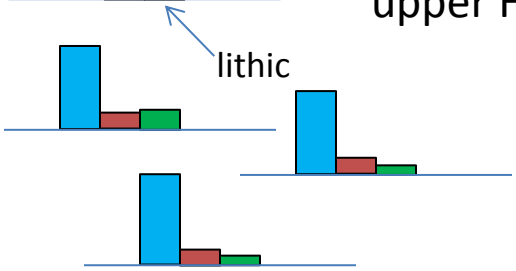


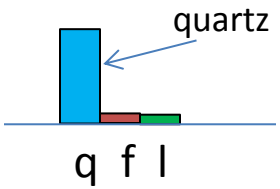
Walton - lithic

Oneonta - lithic

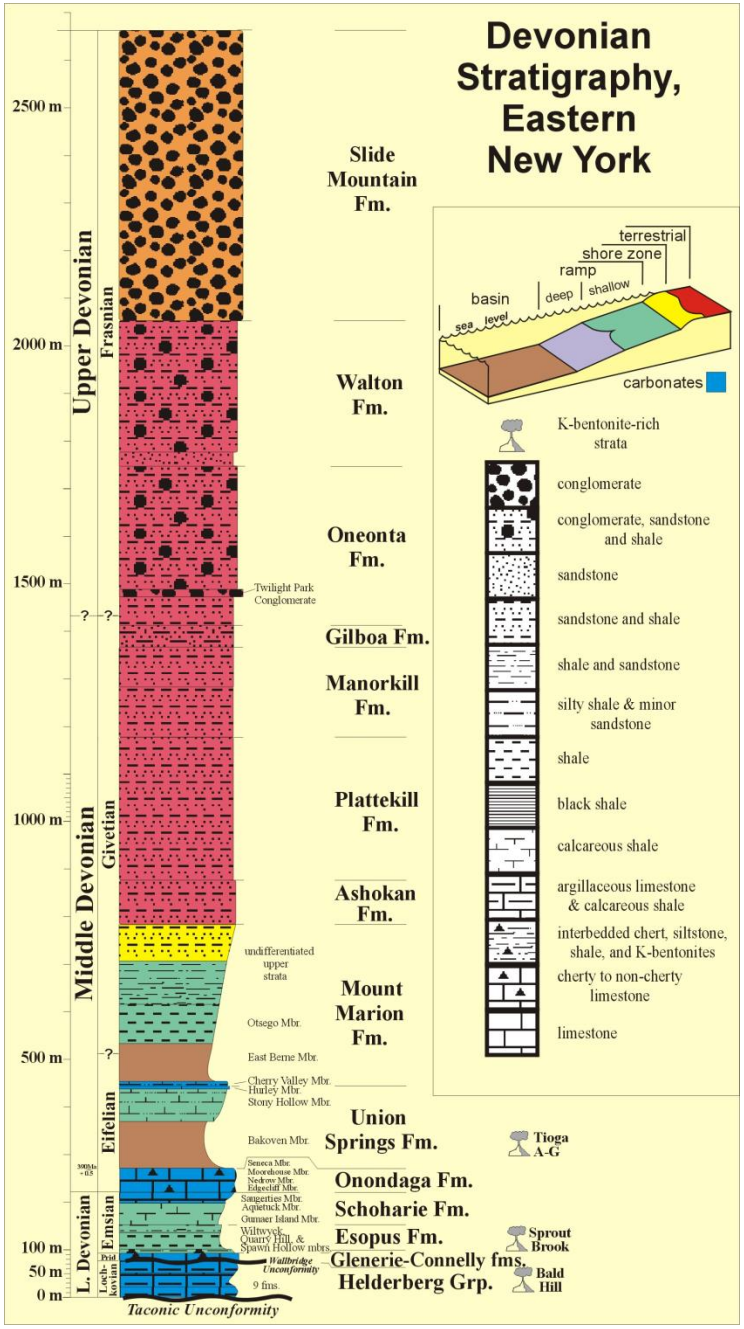


upper Hamilton Group – lithic





Shawangunk and Oriskany quartz arenite



Zircon populations from middle to upper Lower Devonian (Pragian and Emsian Stages) strata are dominated by Grenville (ca. 1400-1000 Ma) and older grains, derived largely from older Paleozoic clastic rocks that were originally sourced from the Laurentian craton.

Lower Middle Devonian (Eifelian to lowest Givetian) siliciclastics, including the Marcellus subgroup, are dominated by Laurentian sources, with younger Grenville (Ottawan, ca. 1080-1020 Ma) zircons most abundant.

Upper Middle Devonian (Givetian) clastics are dominated by Grenville zircons, but include larger ca. 470-420 Ma populations from igneous and metamorphic sources within the Appalachian Orogen.

Lower Upper Devonian (Frasnian) strata contain zircon suites signaling new source terranes including Neoproterozoic 'peri-Gondwana' (ca. 950-540 Ma) source rocks.

Zircon populations from the lower Frasnian Oneonta Formation document an abrupt shift to a provenance with much greater abundance of Neoproterozoic age materials, likely derived from newly-exposed Avalonian/peri-Gondwanan sources.

The later Frasnian strata (Slide Mountain Formation) contain relatively fewer Neoproterozoic zircons, and increased contributions from Paleozoic igneous and metamorphic sources.

Biostratigraphic/age control in terrestrial facies is less than ideal. Next steps: marine units that are better-constrained.