

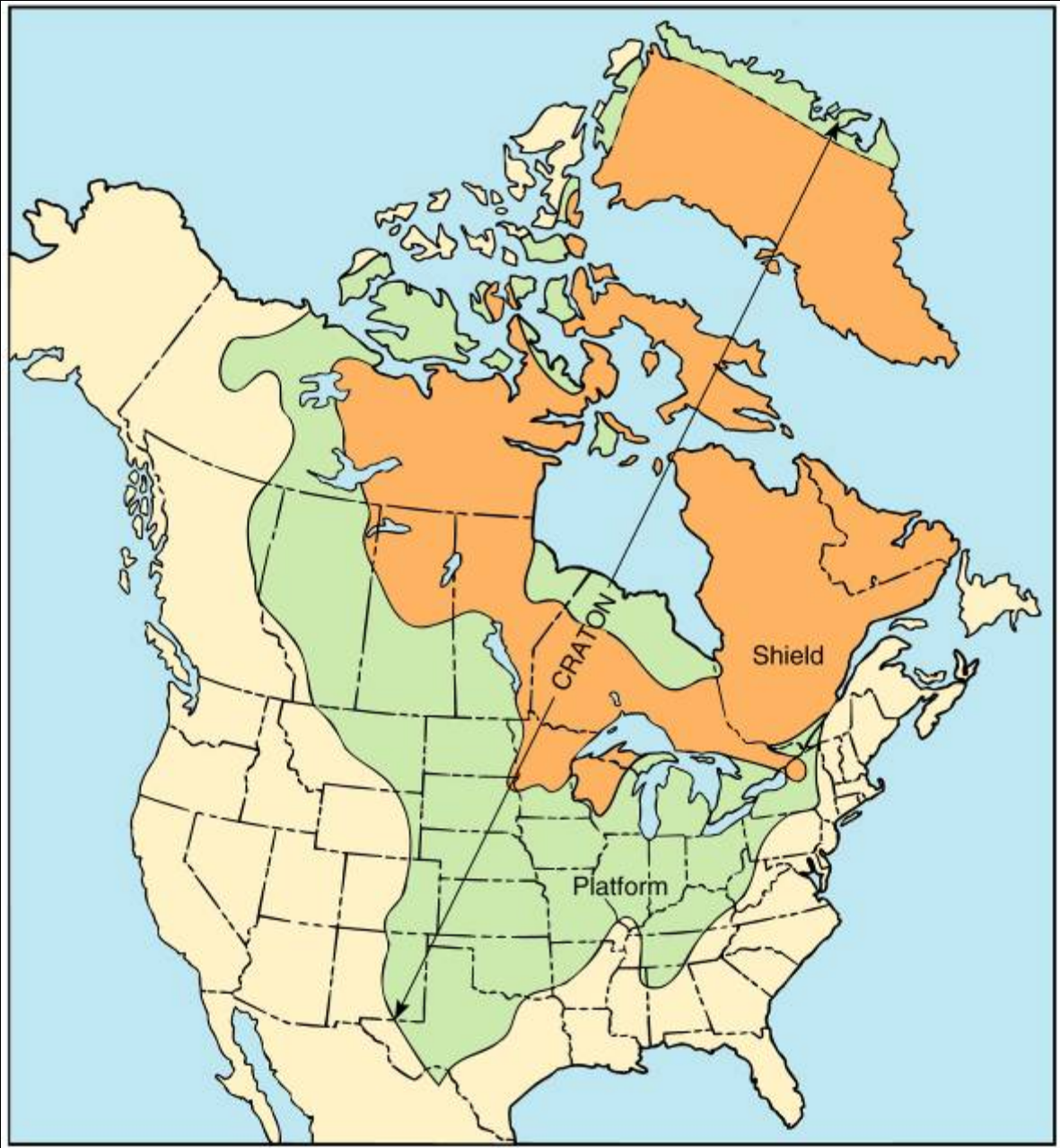
Geology of Shenandoah National Park

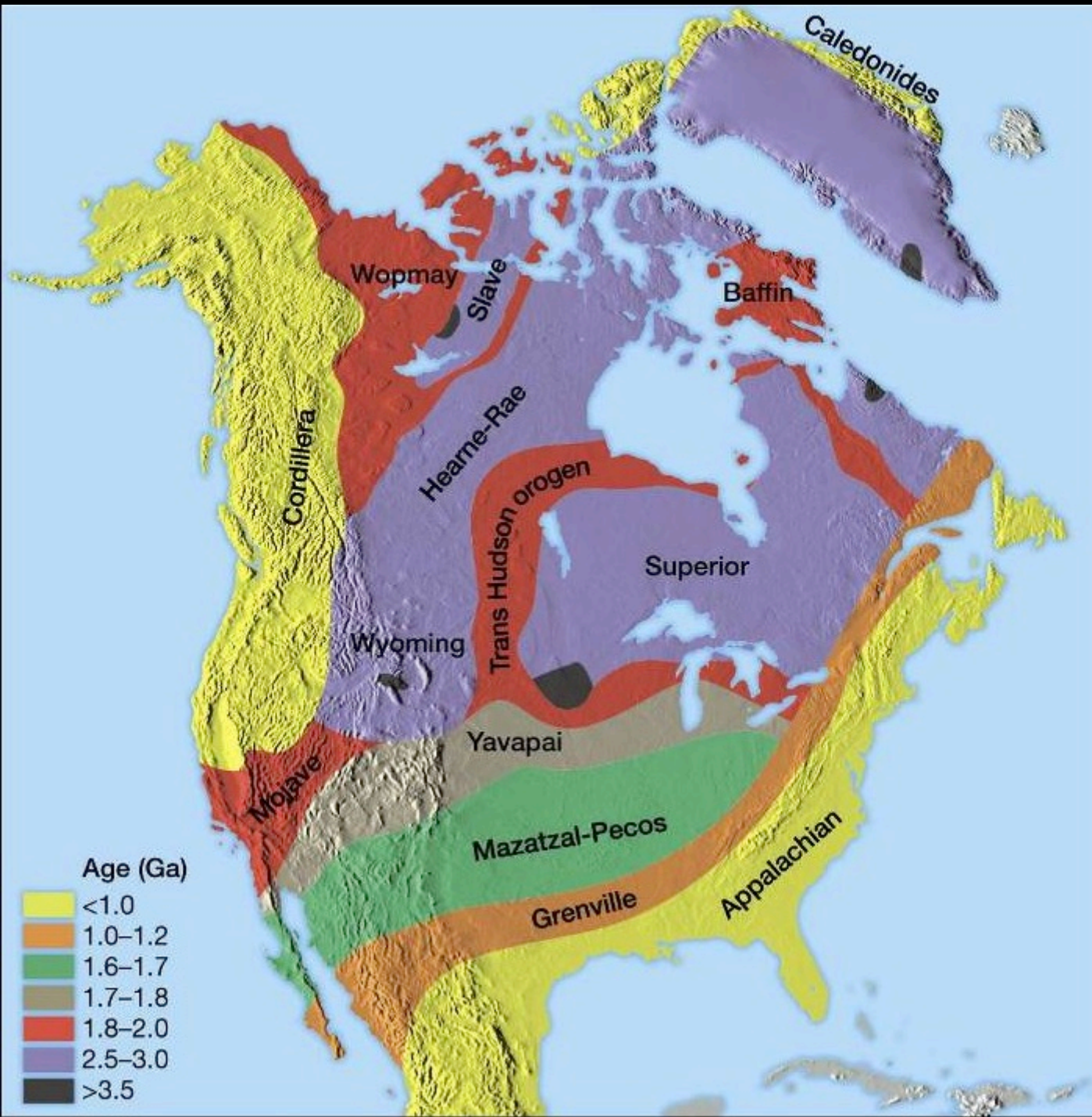
Callan Bentley



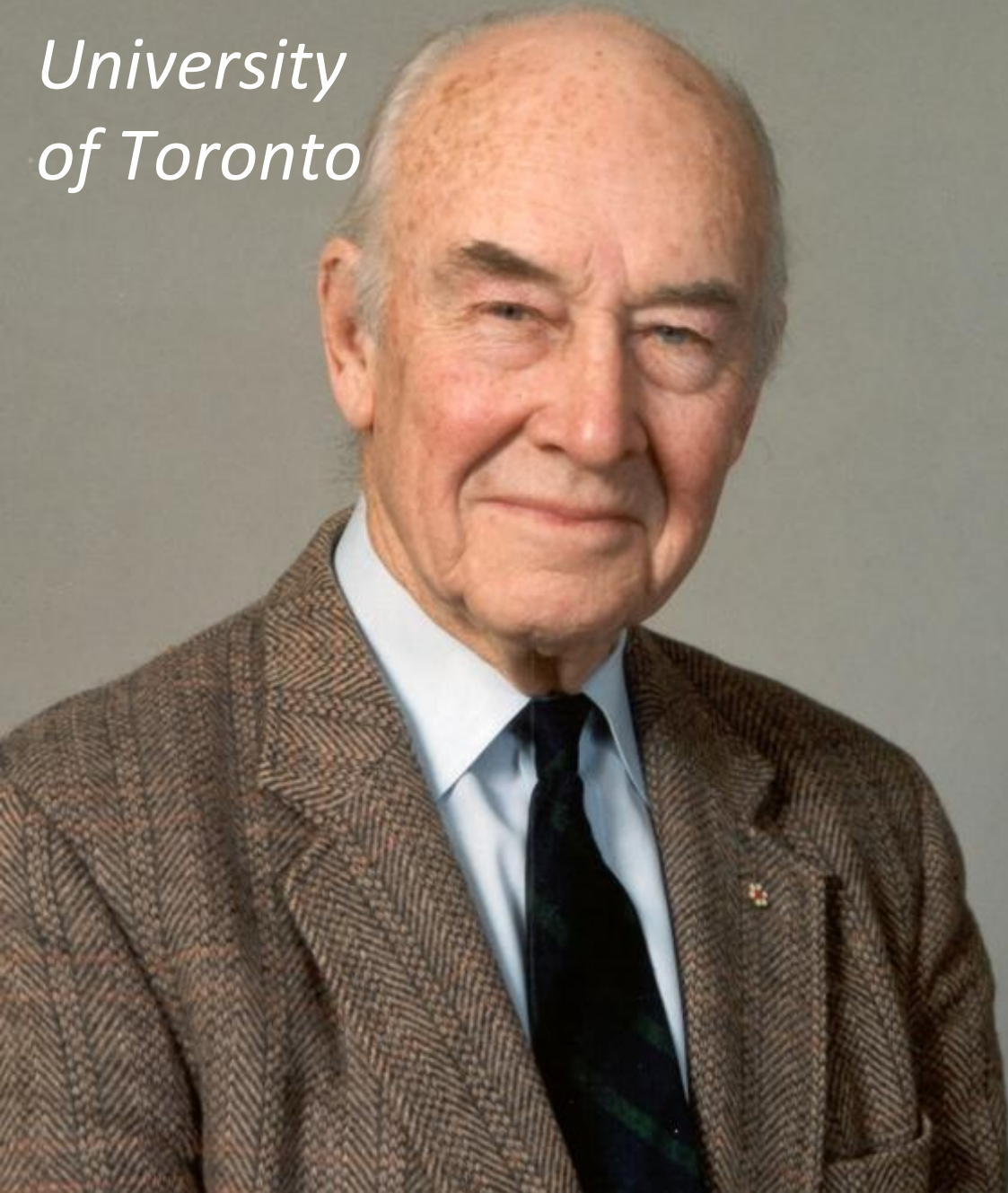






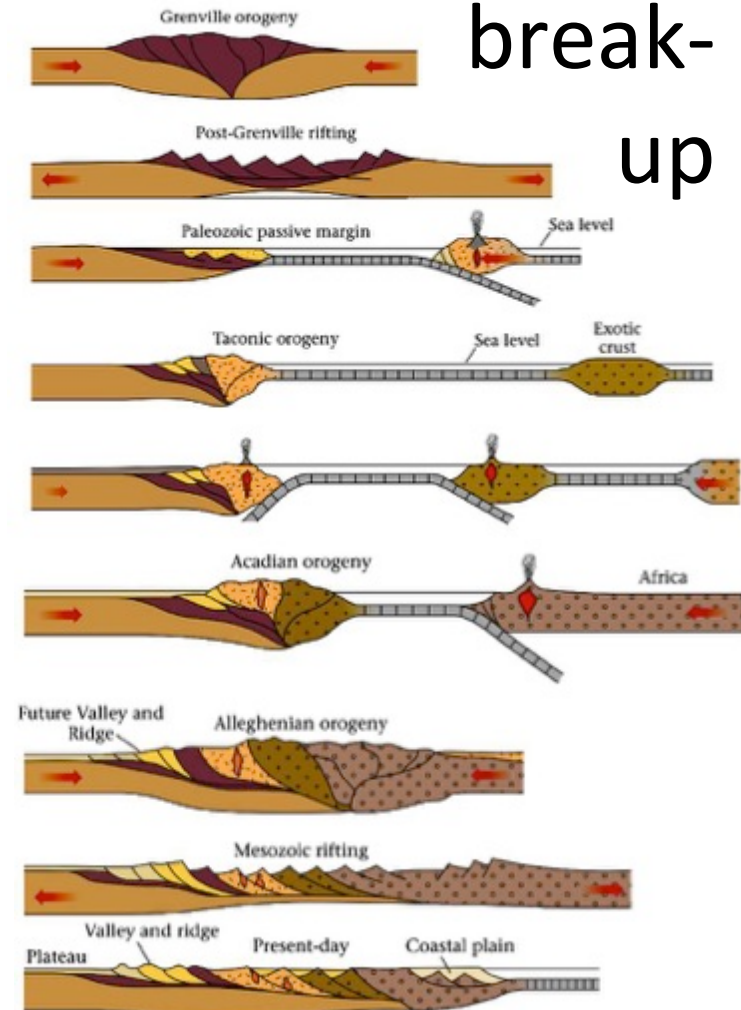


J. Tuzo Wilson
*University
of Toronto*



“Wilson Cycles” of supercontinent formation &

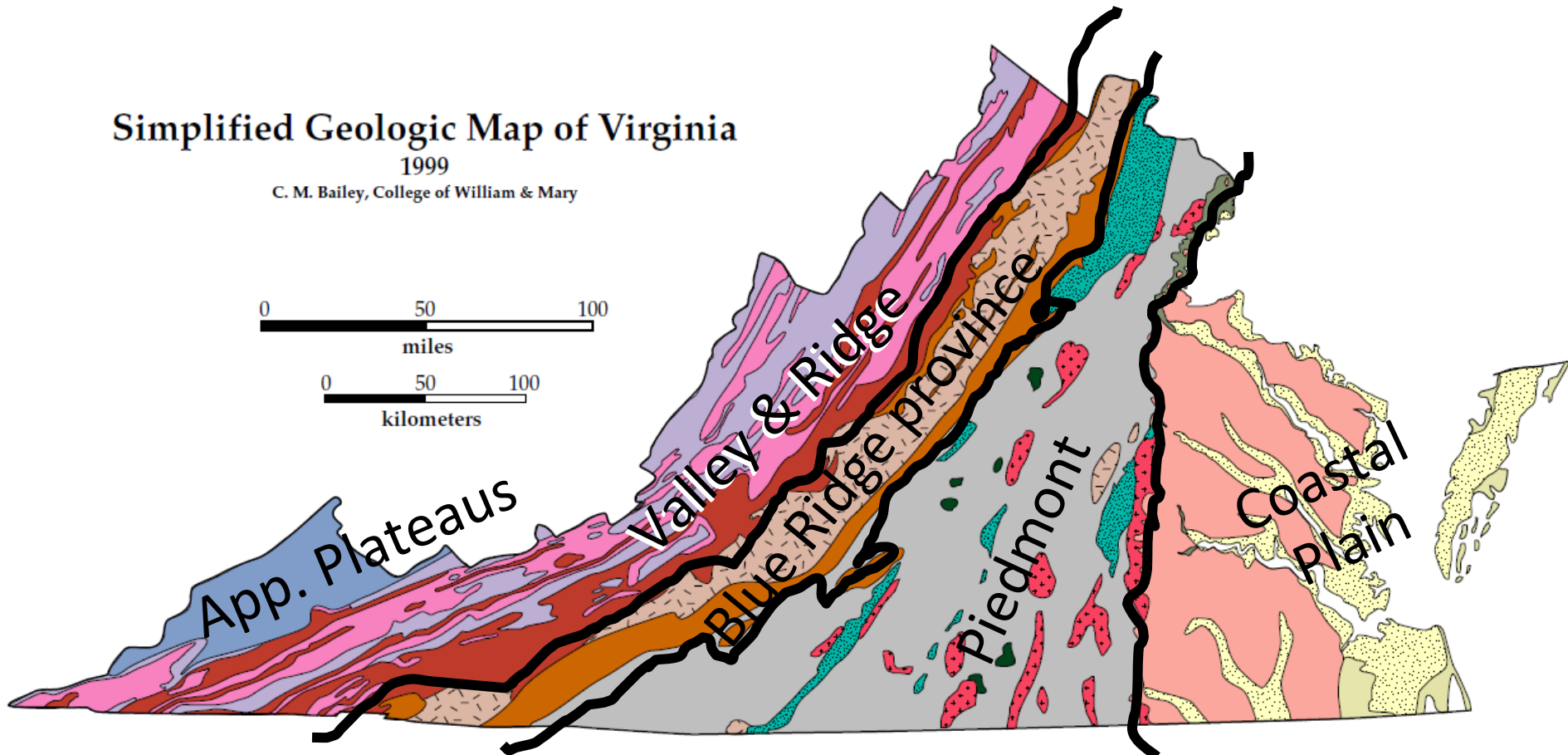
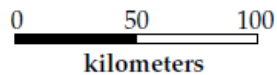
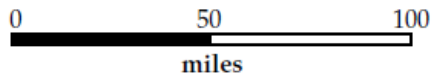
break-
up



Simplified Geologic Map of Virginia

1999

C. M. Bailey, College of William & Mary



Proterozoic



Neoproterozoic
(550-750 Ma)
Metasedimentary rocks,
metarhyolite, & metabasalt



Mesoproterozoic
(980-1400 Ma)
Granite, granitic gneiss,
charnockite, & layered
gneiss



Proterozoic-Paleozoic
(550-750 Ma)
Gneiss, schist, slate, phyllite,
quartzite, & marble



Paleozoic
(300-500 Ma)
Granite & other
felsic igneous
rocks



Paleozoic
(300-500 Ma)
Gabbro & other
mafic igneous
rocks

Paleozoic



Cambrian
(500-550 Ma)
Dolomite, limestone,
shale, & sandstone



Silurian-Ordovician
(410-500 Ma)
Limestone, dolomite,
shale, & qtz sandstone



Mississippian-Devonian
(320-410 Ma)
Sandstone, shale with
minor gypsum & coal



Pennsylvanian
(290-320 Ma)
Sandstone, shale &
coal

Mesozoic



Cretaceous
(65-140 Ma)
Partly lithified sand,
clay, and sandstone



Triassic-Jurassic
(200-225 Ma)
Red & gray shale,
sandstone, & conglomerate
Intruded by diabase &
basalt

Cenozoic



Quaternary
(20 ka - 2 Ma)
Sand, mud, & gravel



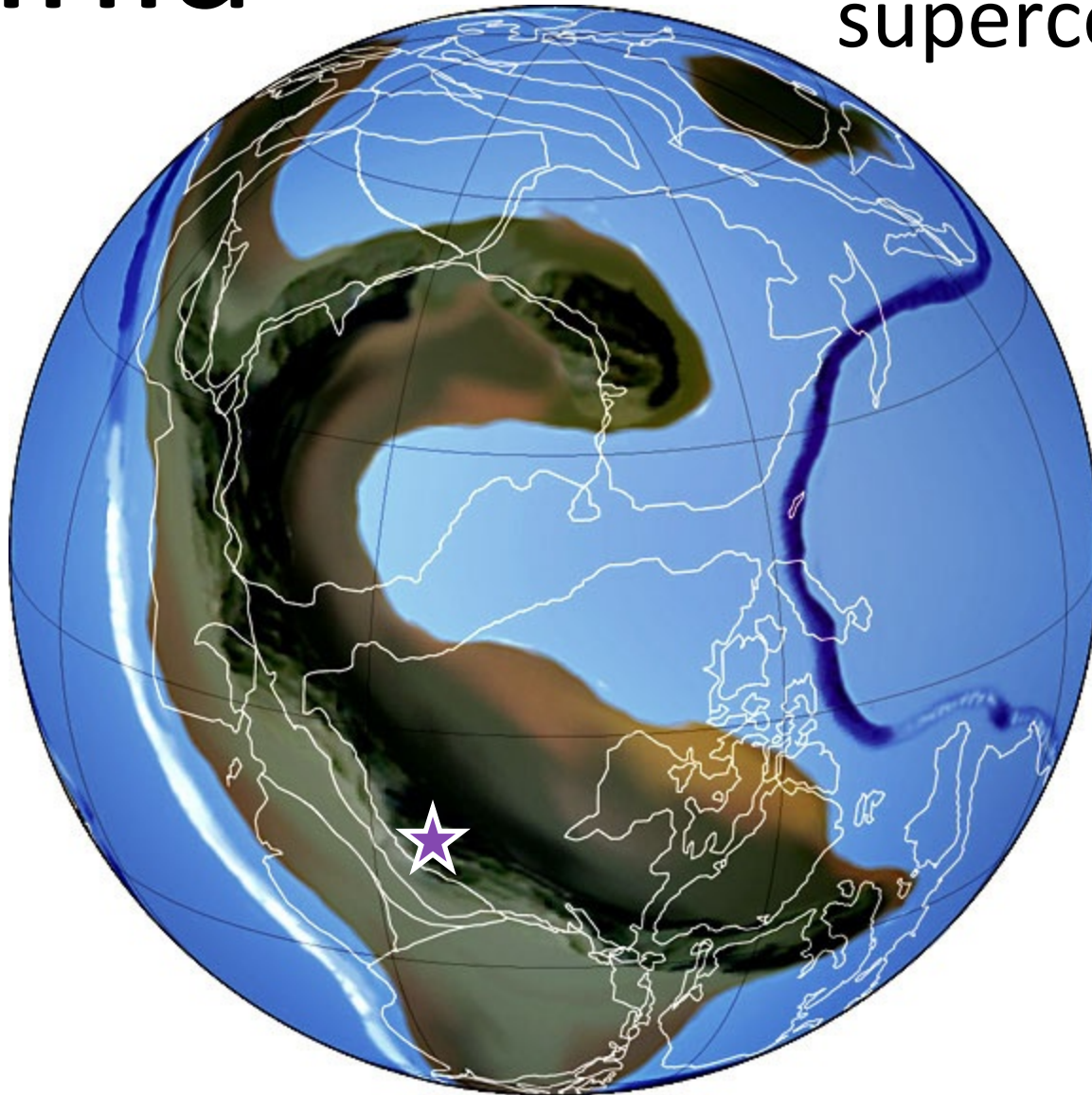
Tertiary
(2-65 Ma)
Sand, mud, limy sand, &
marl.



Holocene
(present- 20 ka)
Sand, mud, & peat
deposited in beaches,
marshes, swamps, &
estuaries

Rodinia

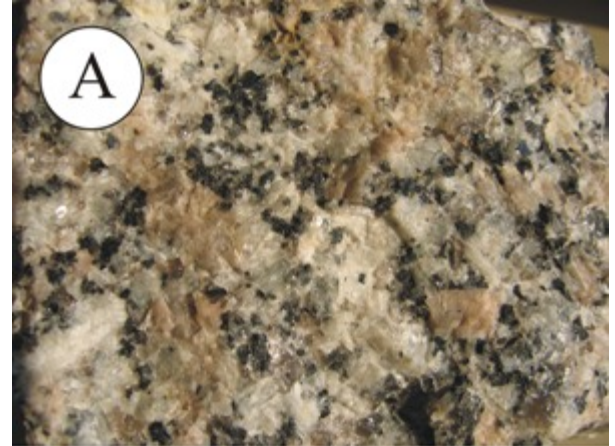
The oldest known
supercontinent



Grenville Orogeny



“Pedlar Formation” granite gneiss, 1.1 Ga,
Shenandoah National Park, Virginia



Granite vs.
granite-gneiss



Grenville Orogeny

“basement complex” (1.2-1.0 Ga)

Grenville Orogeny



(modern Himalayas)

Grenville
Orogeny

weathering 'rind'

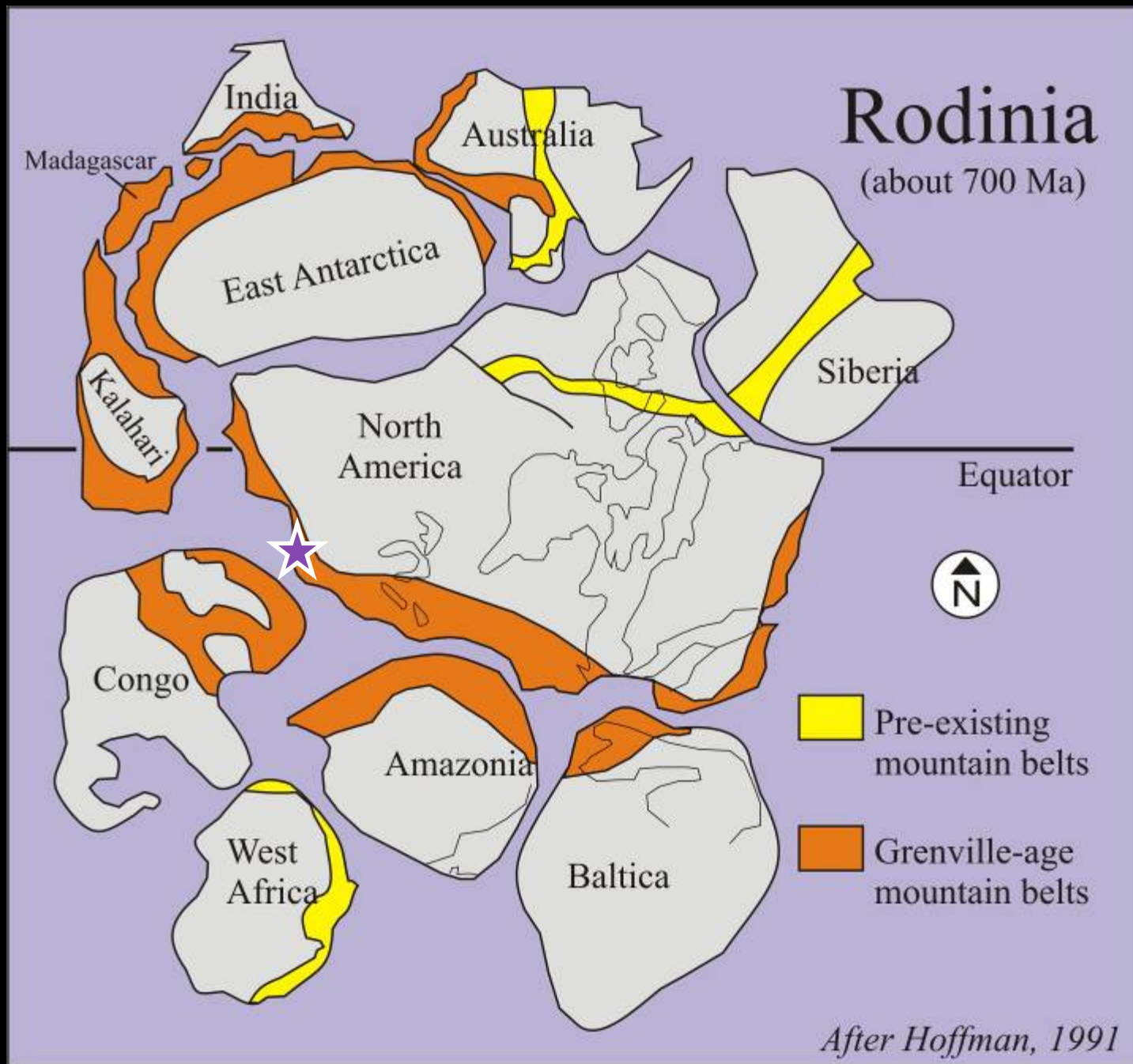
charnockite (~1.1 Ga)

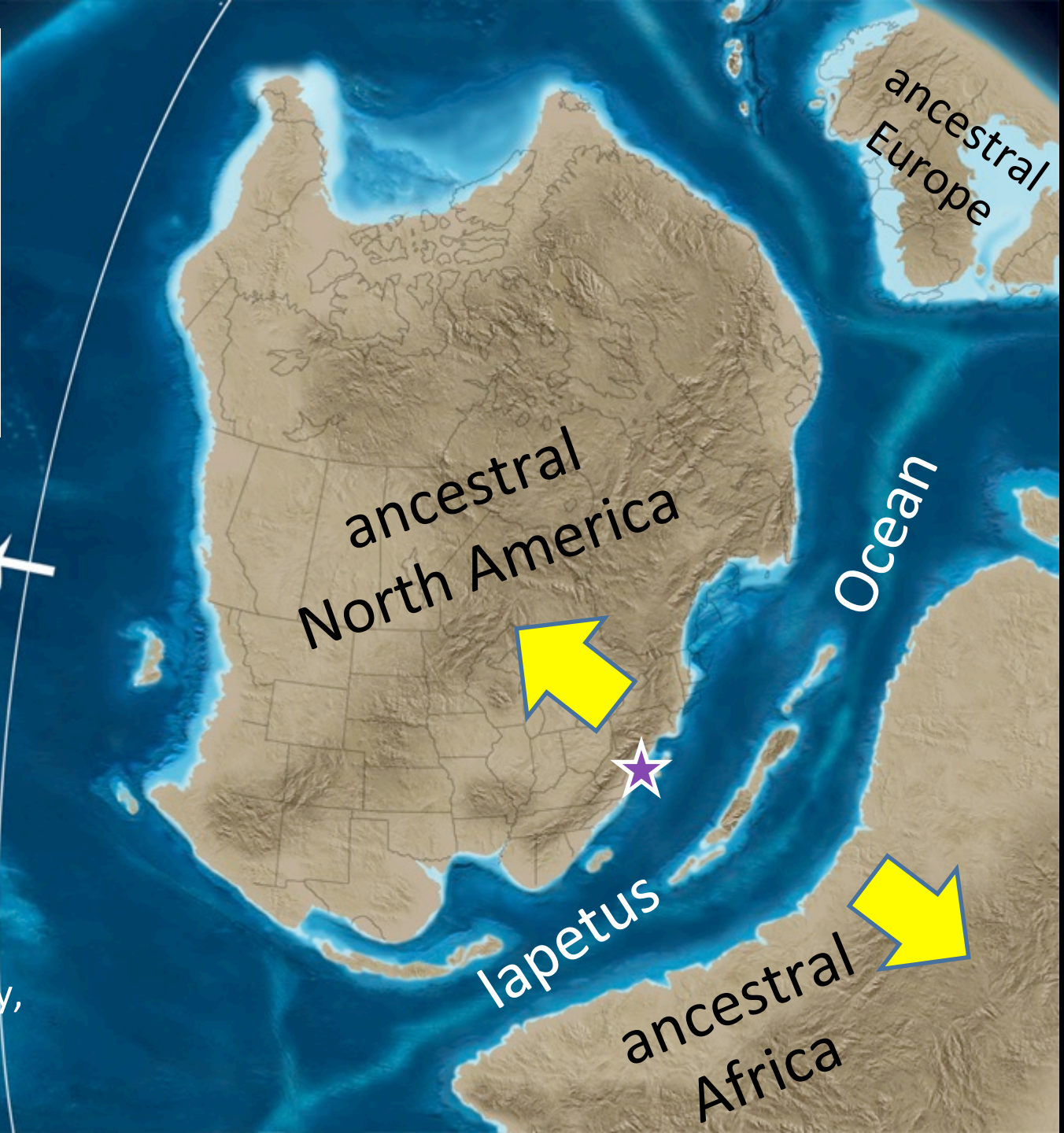




Grenville
Orogeny

Old Rag Granite (1 Ga = 1000 Ma)





Paleogeographic
Map by Ron Blakey,
Northern Arizona
University



Swift Run Formation



Afar triangle region,
northeast Africa

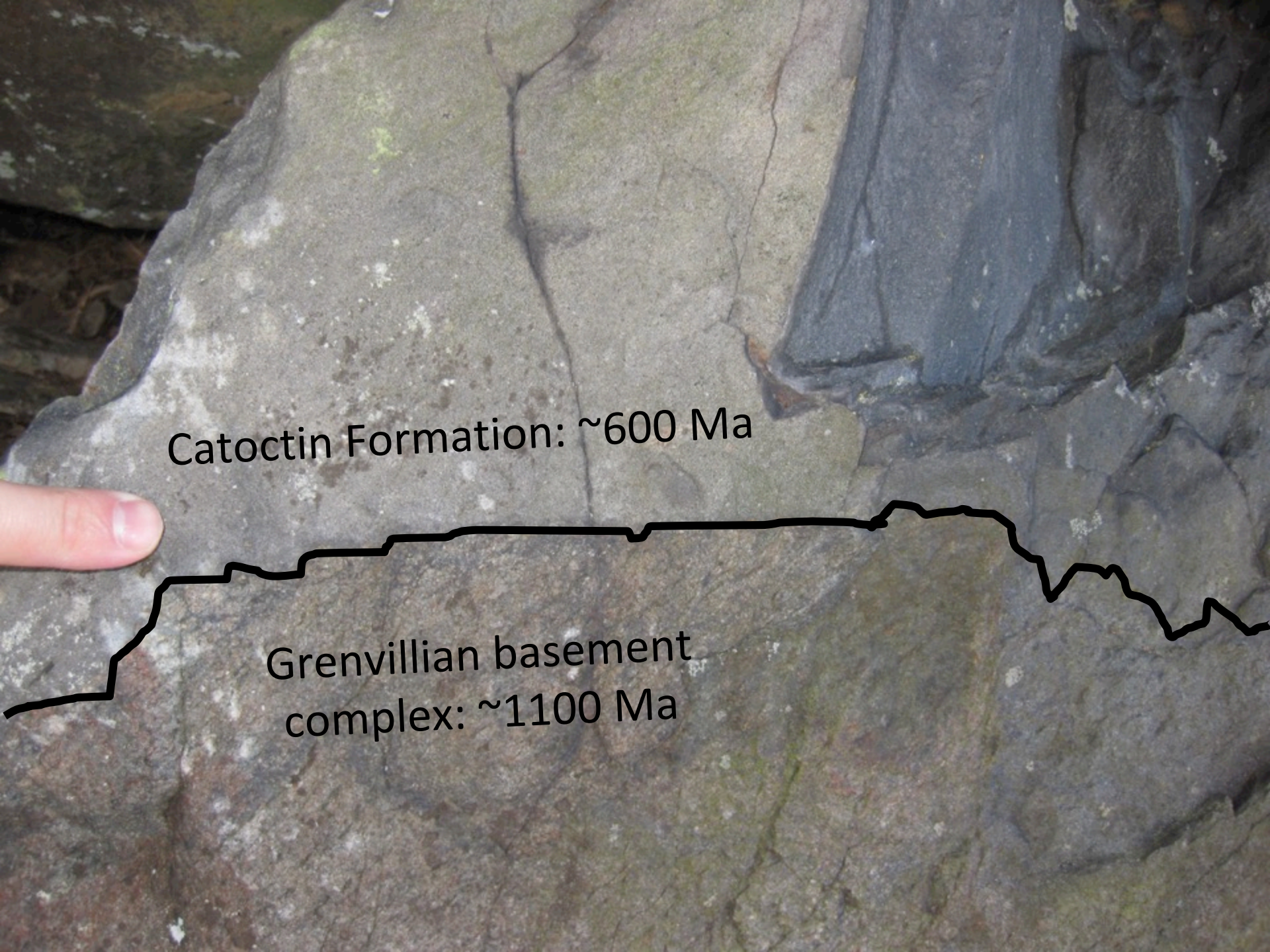






Catoctin Formation:

Neoproterozoic rifting on Laurentia's east coast opens up the Iapetus Ocean (a.k.a. the "proto-Atlantic" Ocean)
Massive extrusion of flood basalts in Virginia, Maryland, Pennsylvania...



Catoctin Formation: ~600 Ma

Grenvillian basement
complex: ~1100 Ma

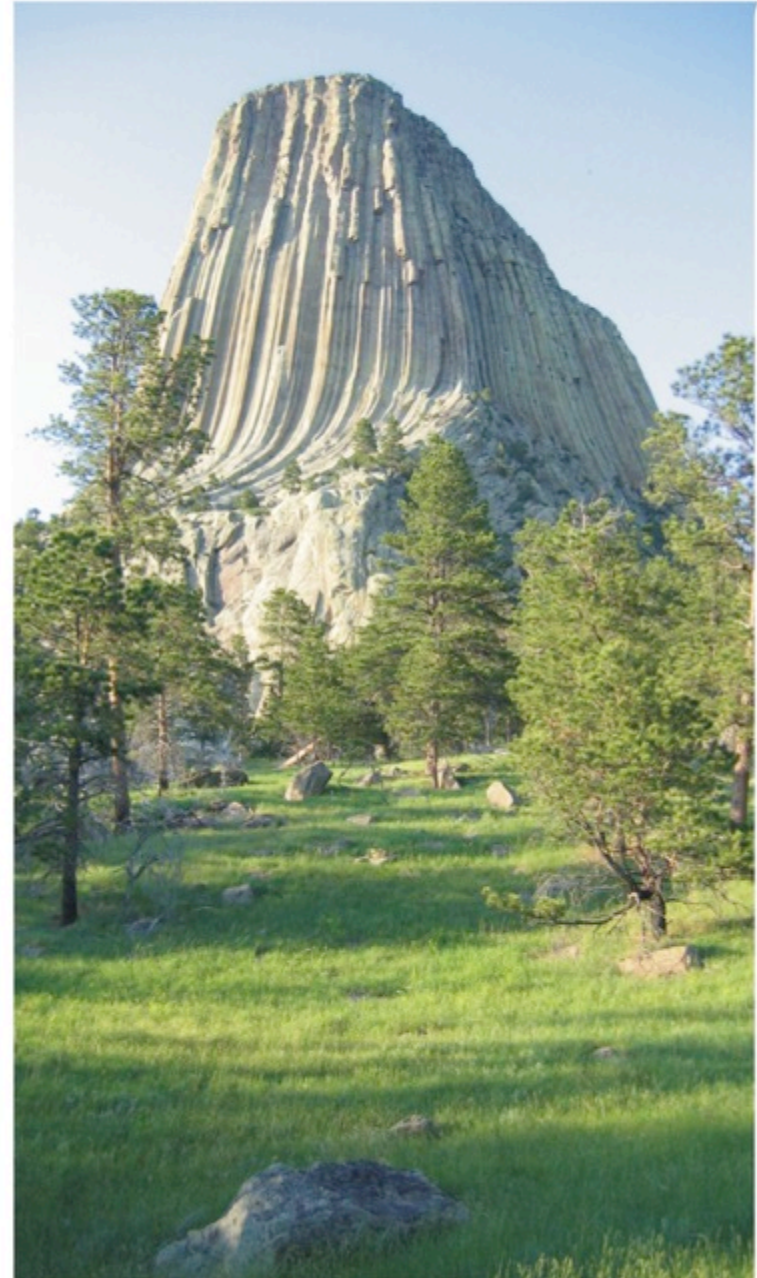
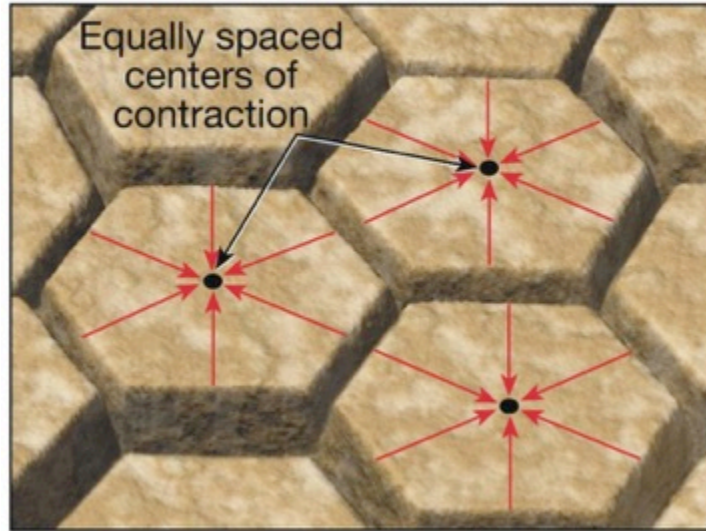
Catoctin Formation: ~600 Ma



Catoctin Formation: ~600 Ma



Columnar jointing in basalt





Little
Devil's
Staircase

Compton Peak



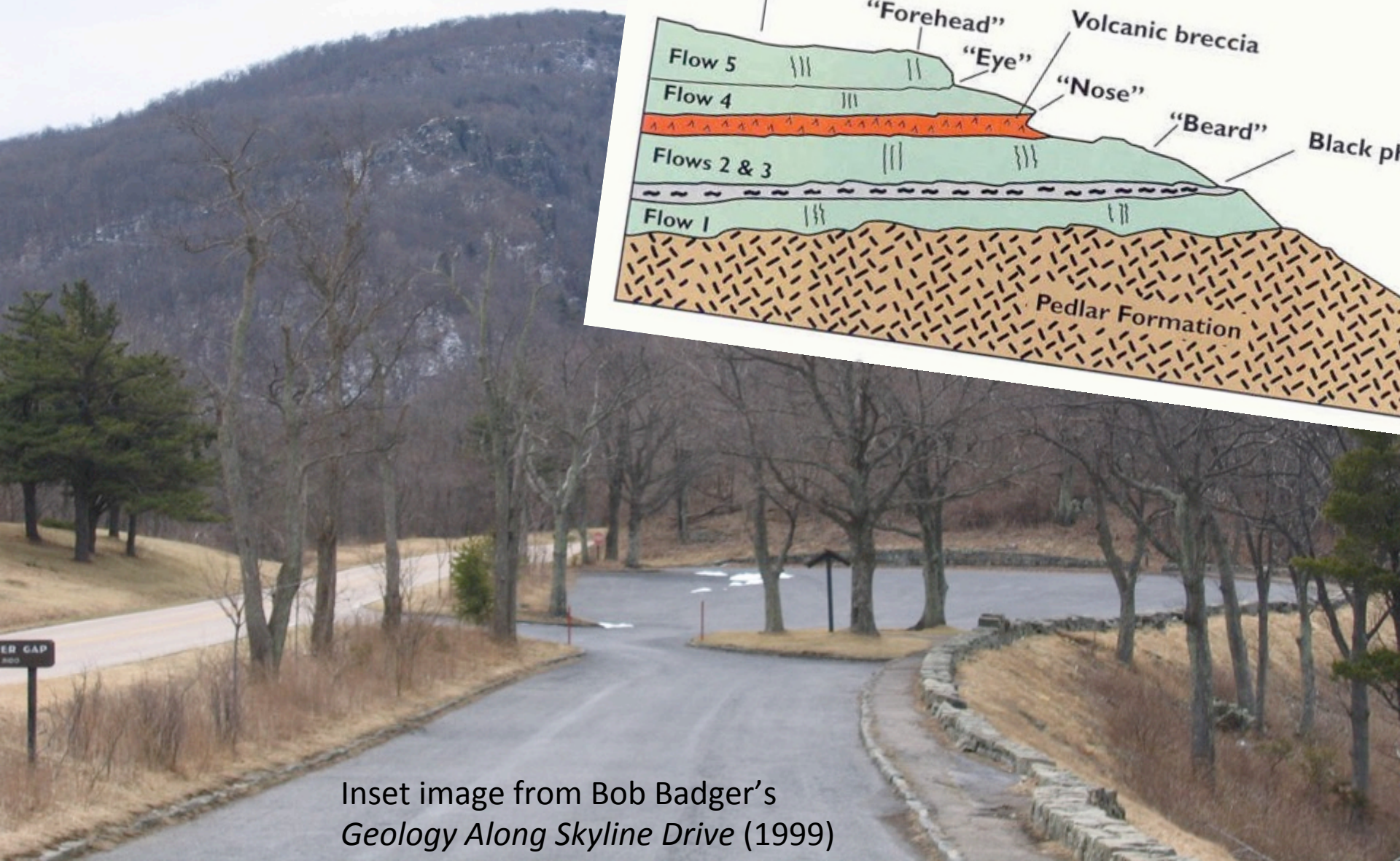
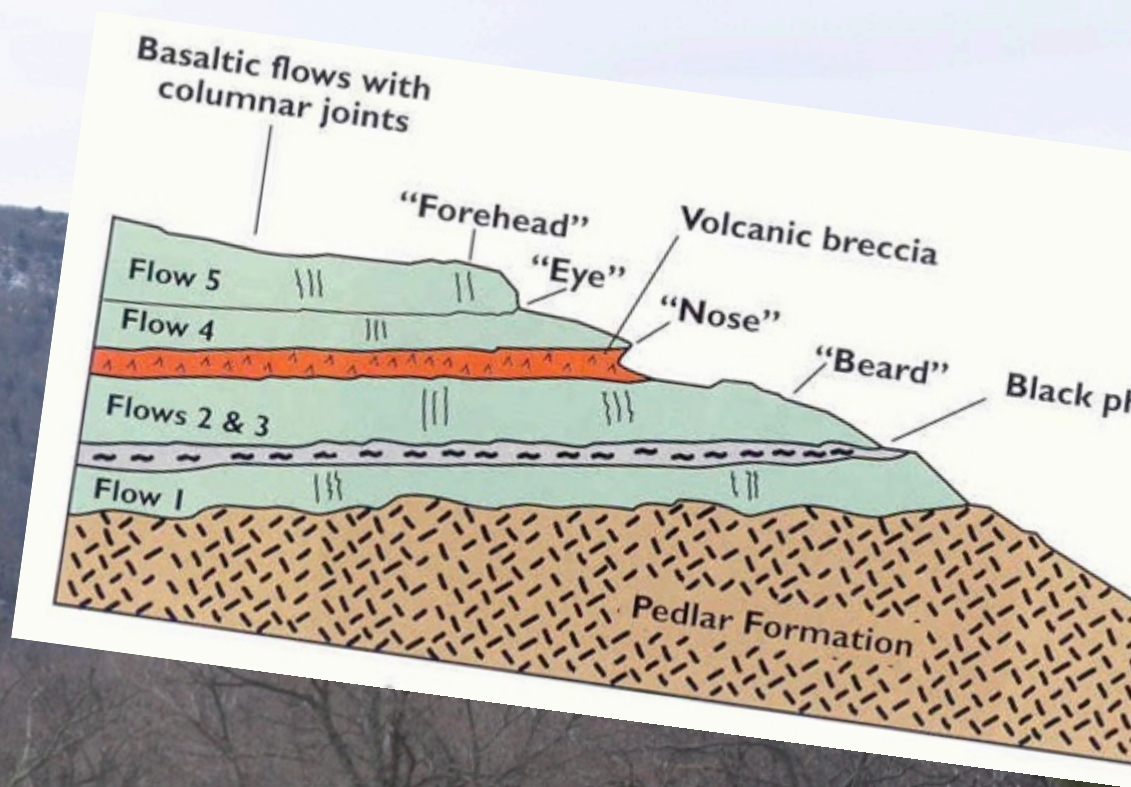


vesicles → amygdules



Volcanic breccia: ancient lahars

Stony Man

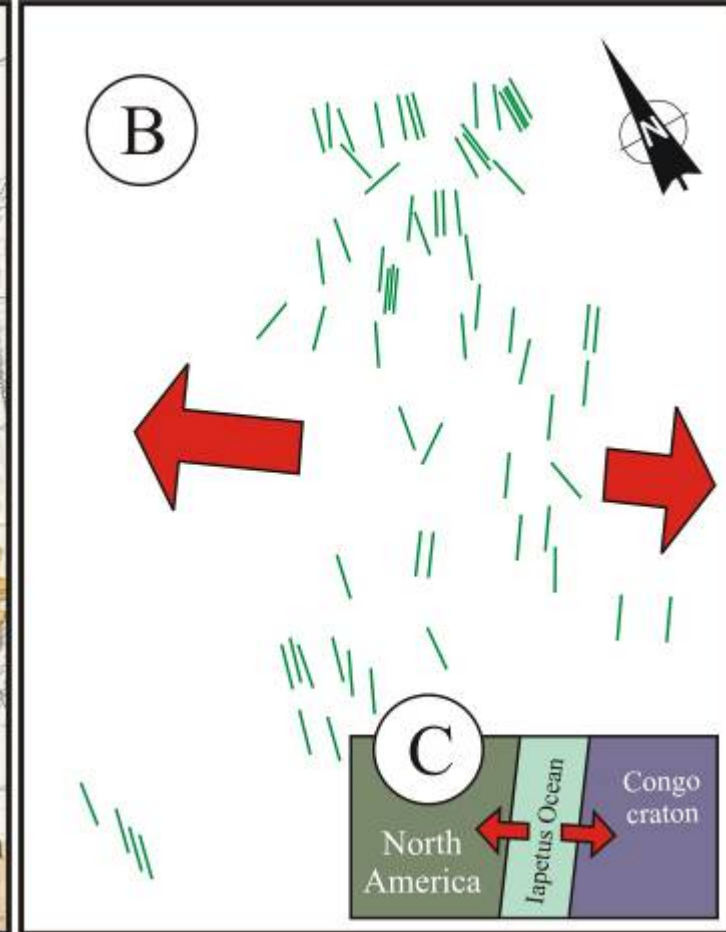
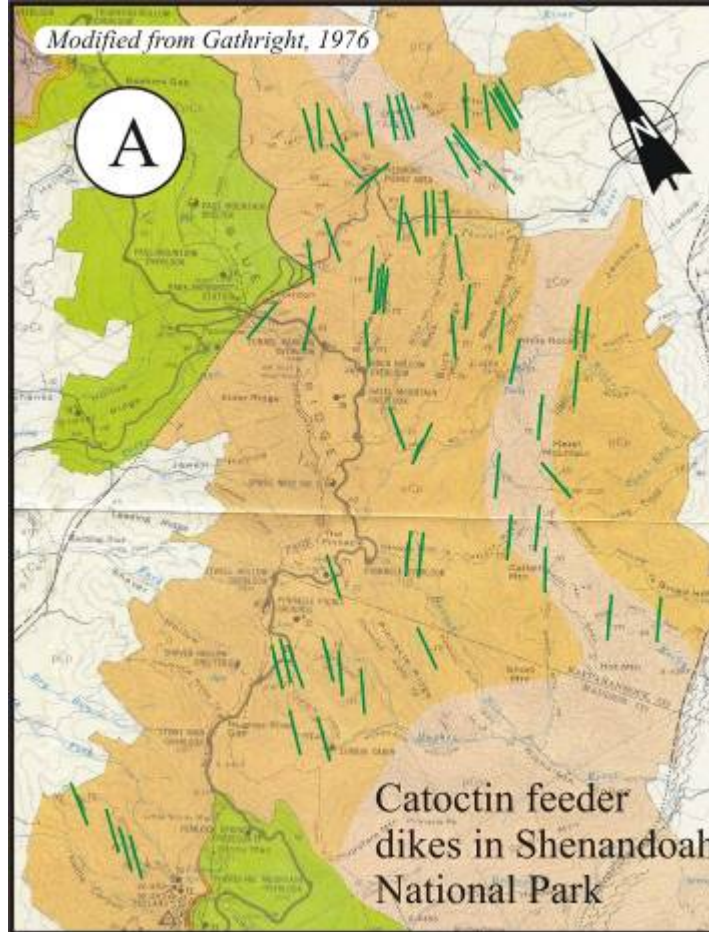


Inset image from Bob Badger's
Geology Along Skyline Drive (1999)



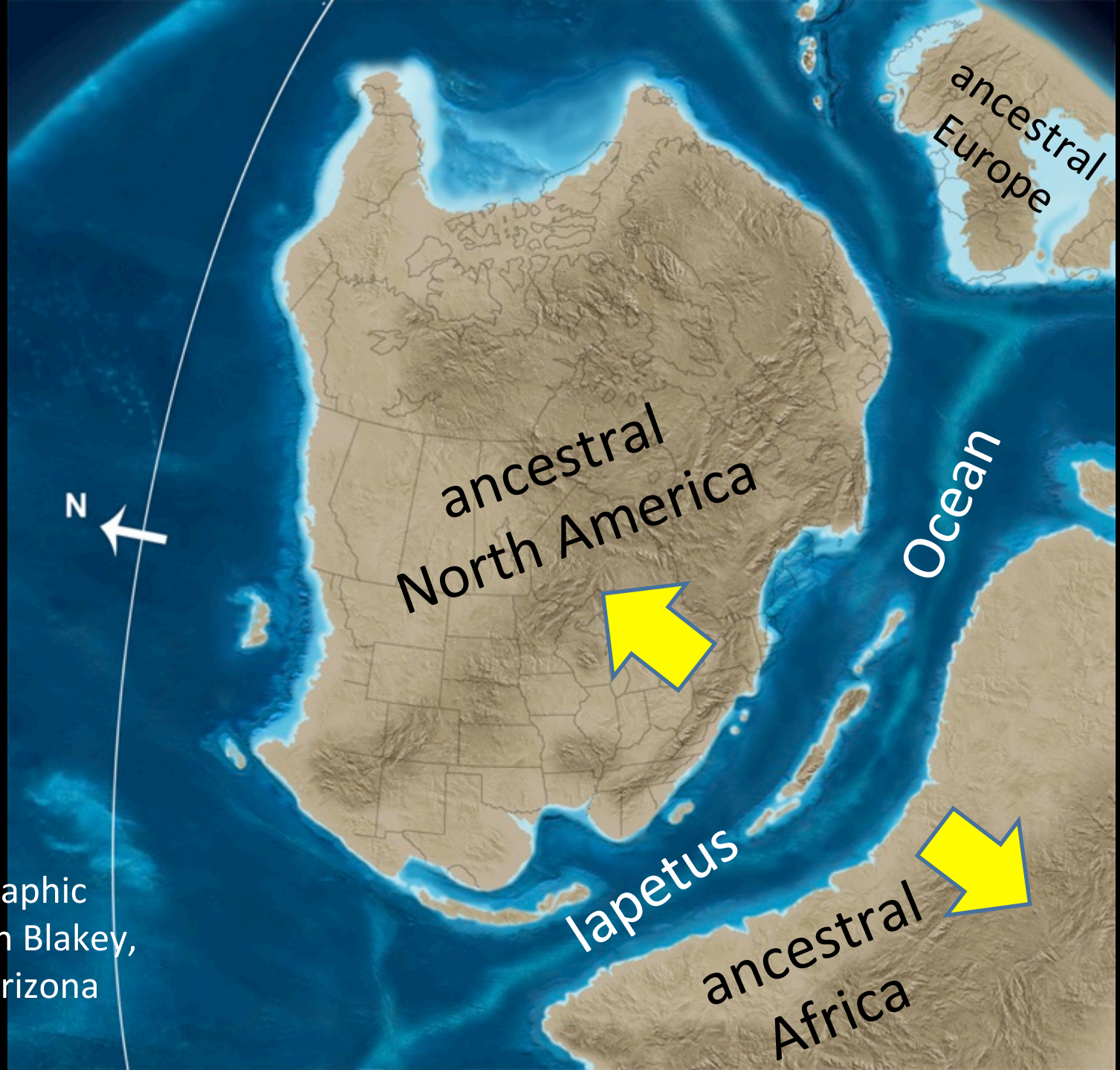
FEEDER DIKE

Feeder dikes of the Catoctin Formation

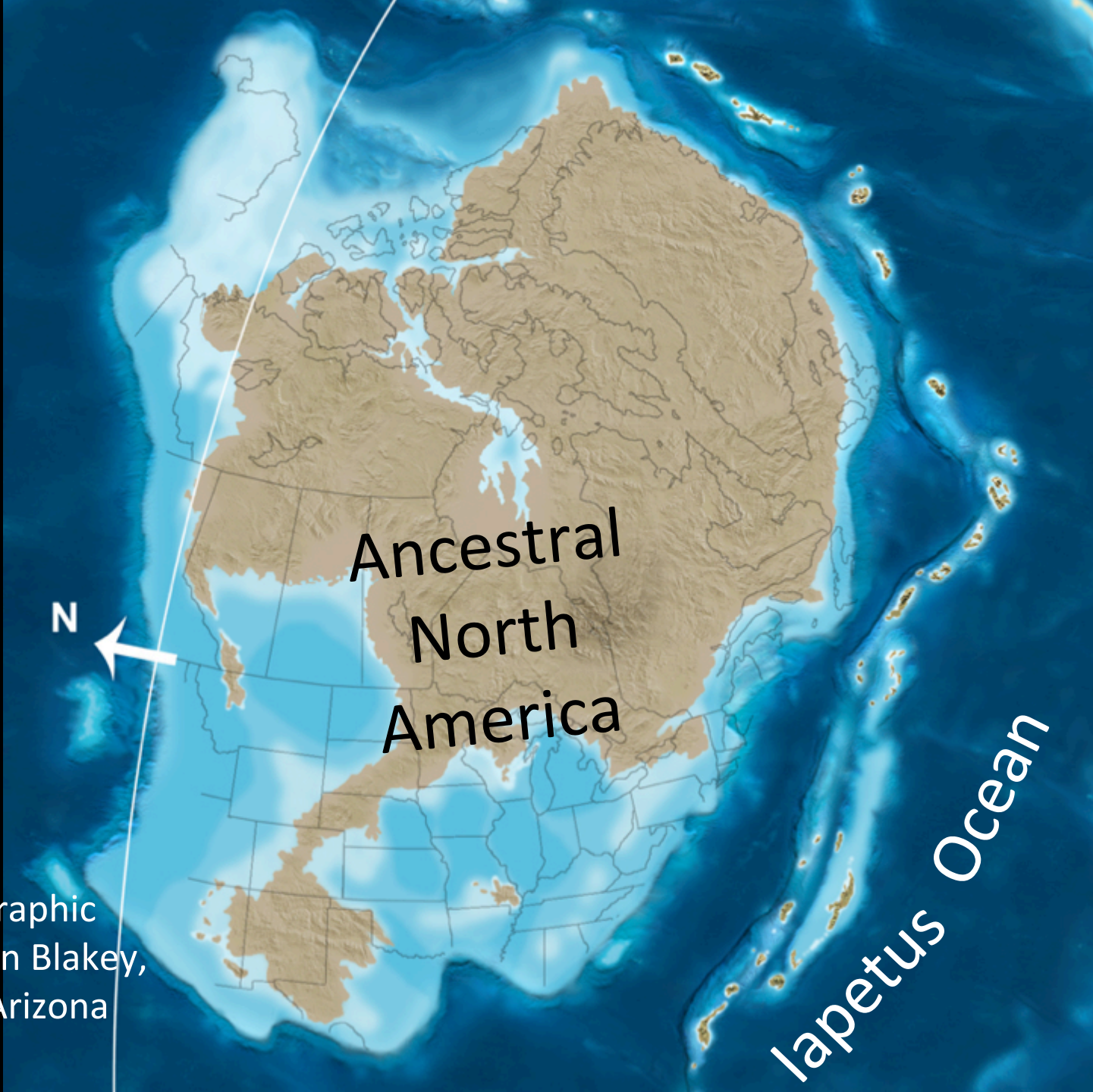






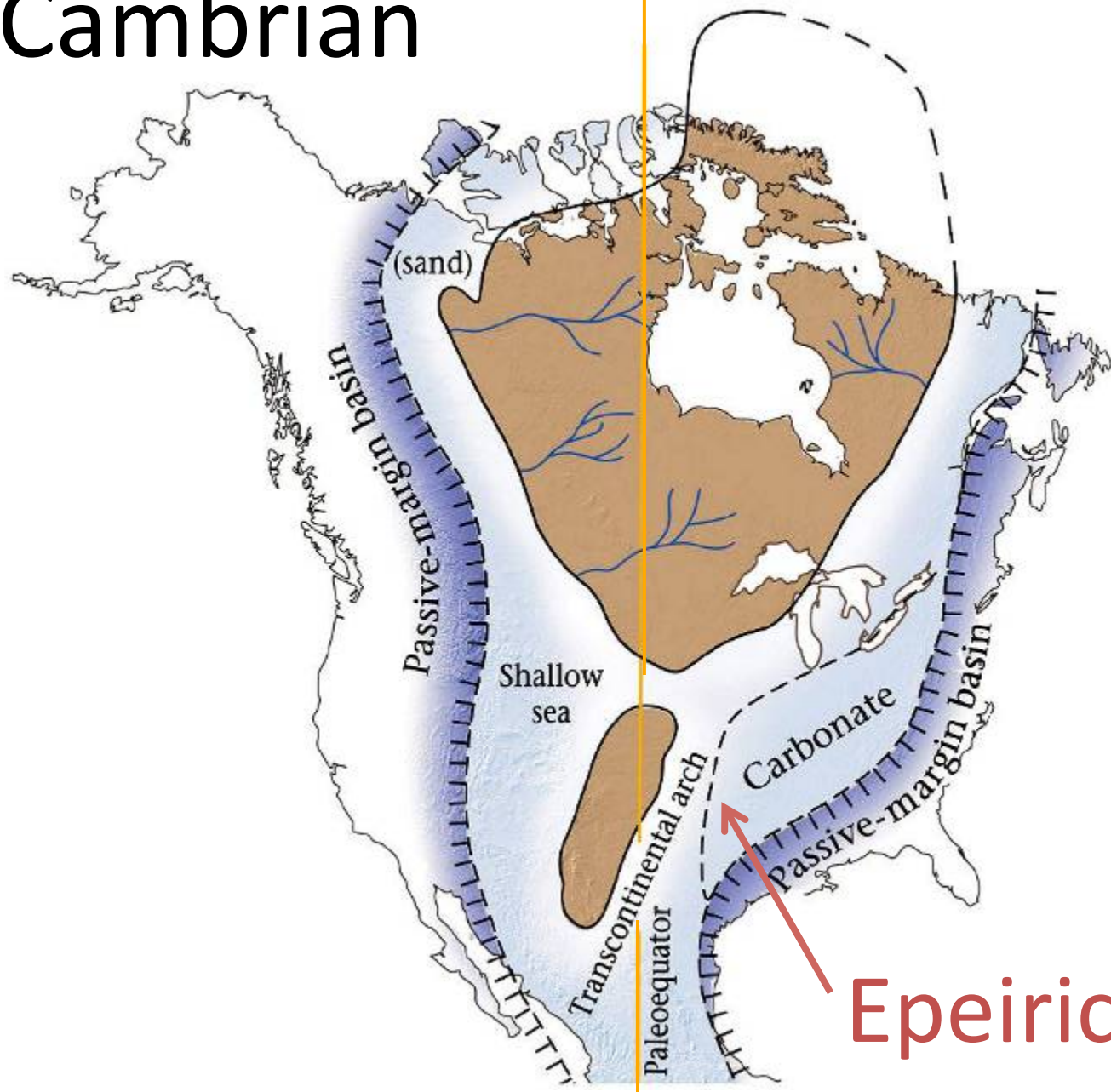


Paleogeographic
Map by Ron Blakey,
Northern Arizona
University



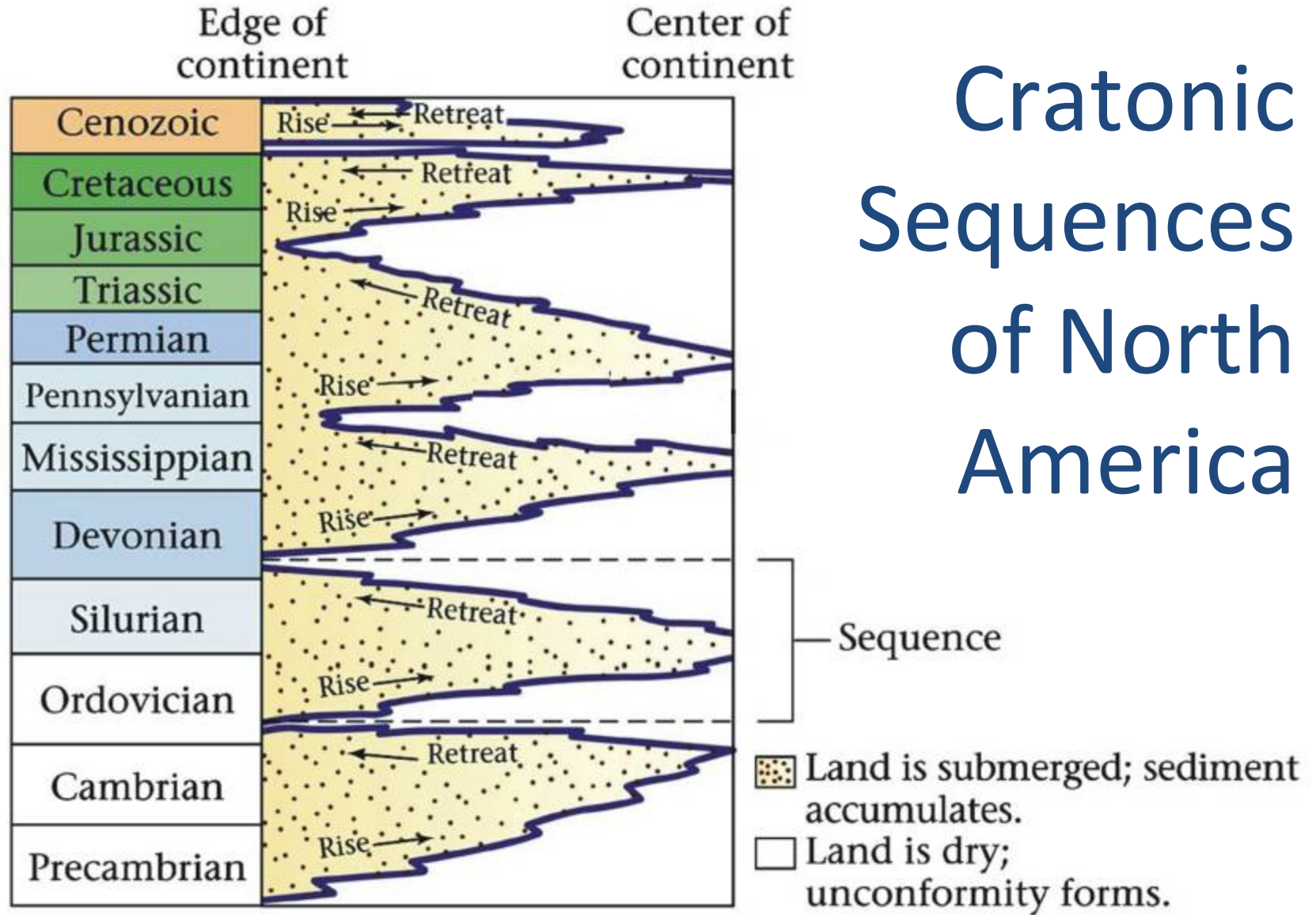
Paleogeographic
Map by Ron Blakey,
Northern Arizona
University

Early Cambrian

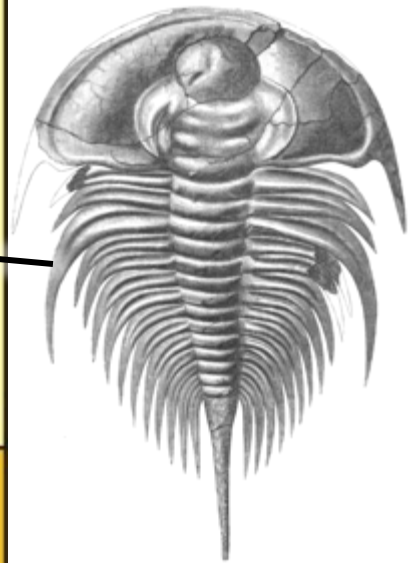
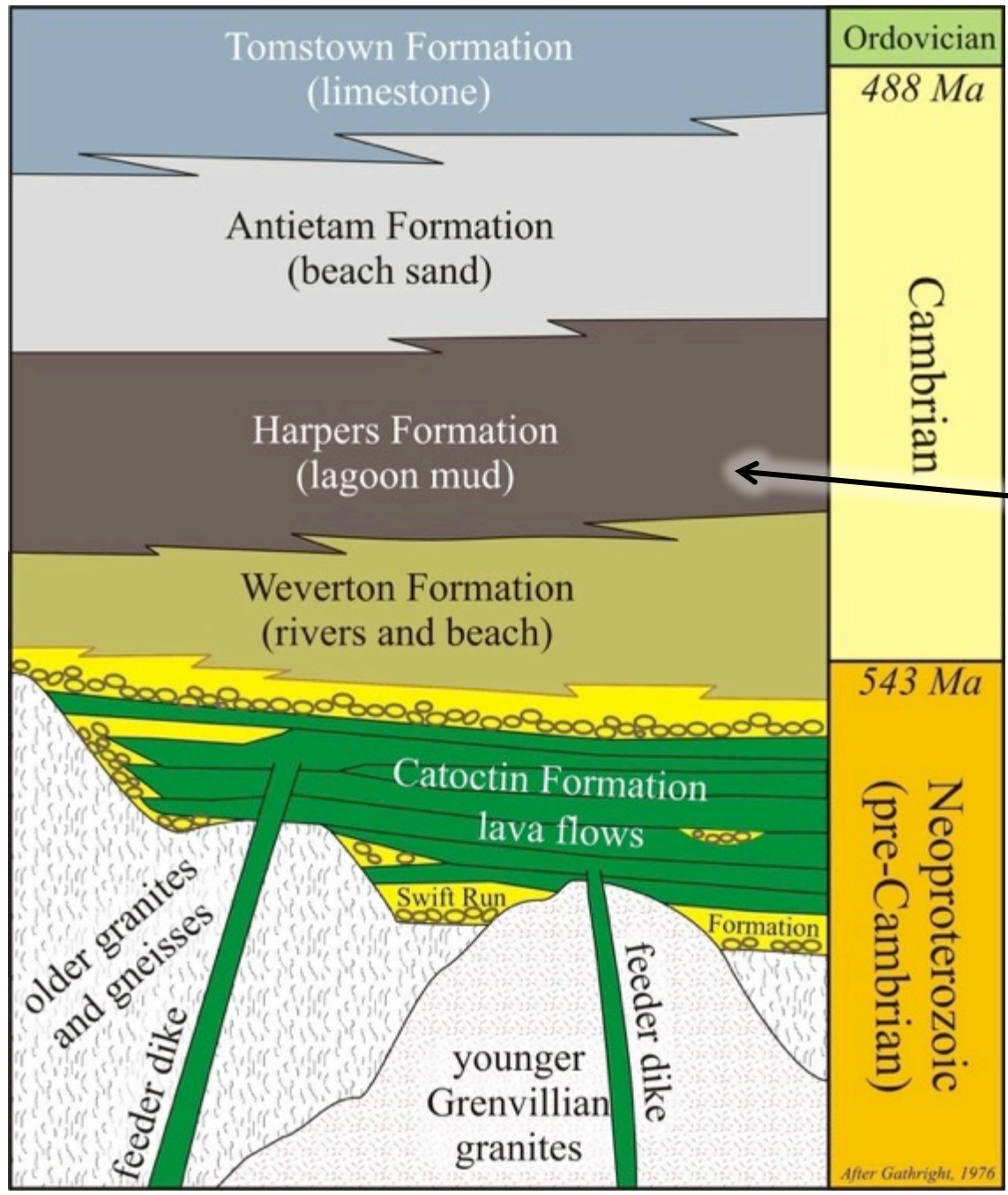


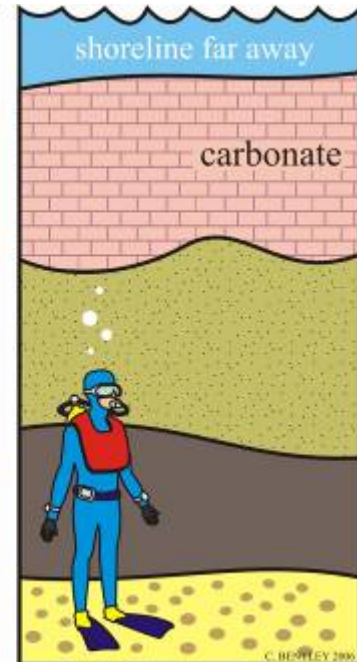
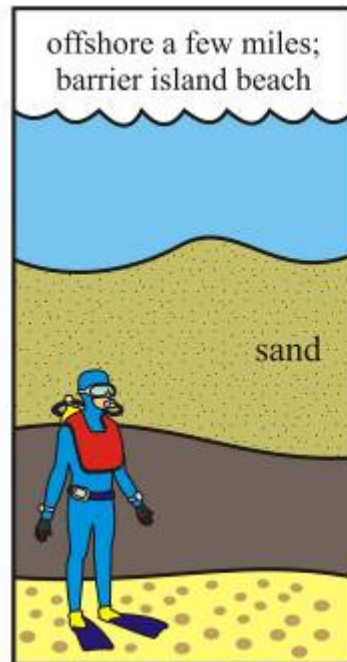
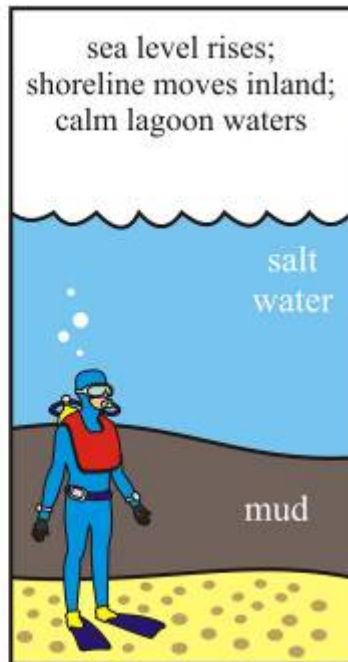
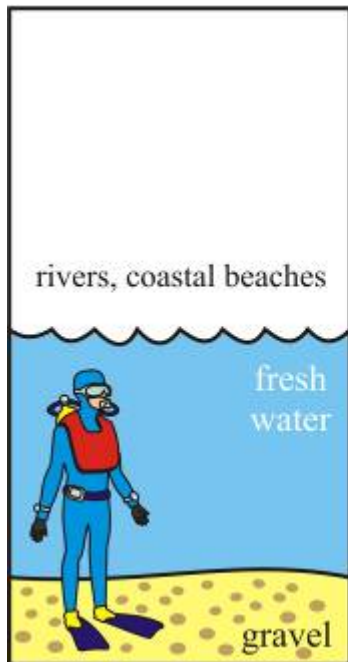
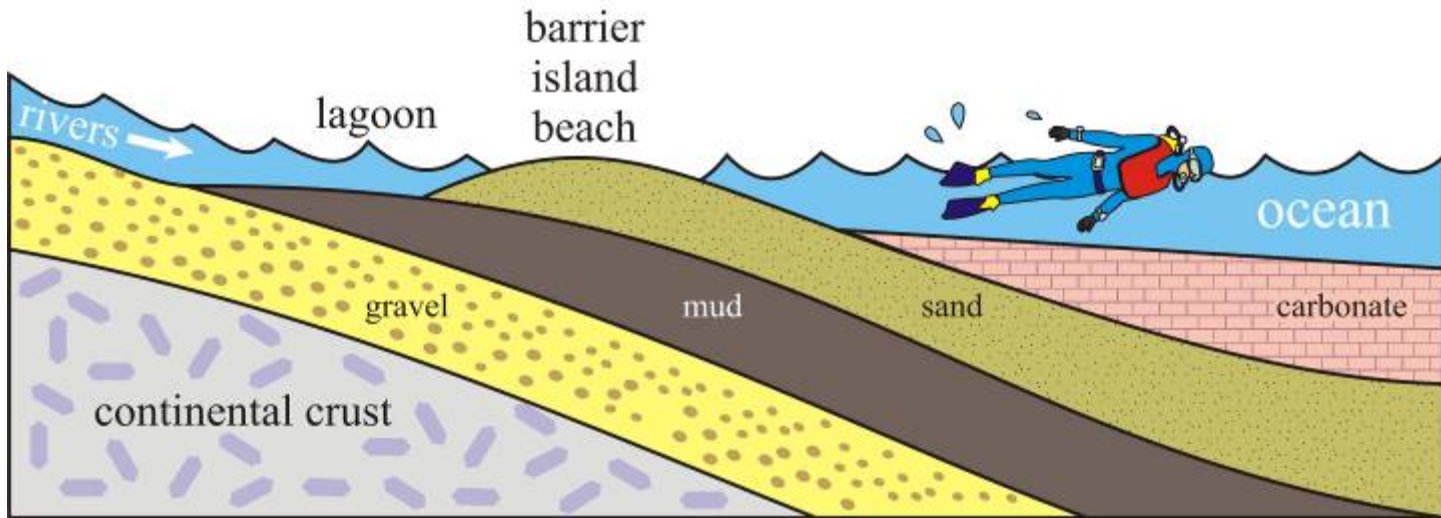
Epeiric sea

Cratonic Sequences of North America

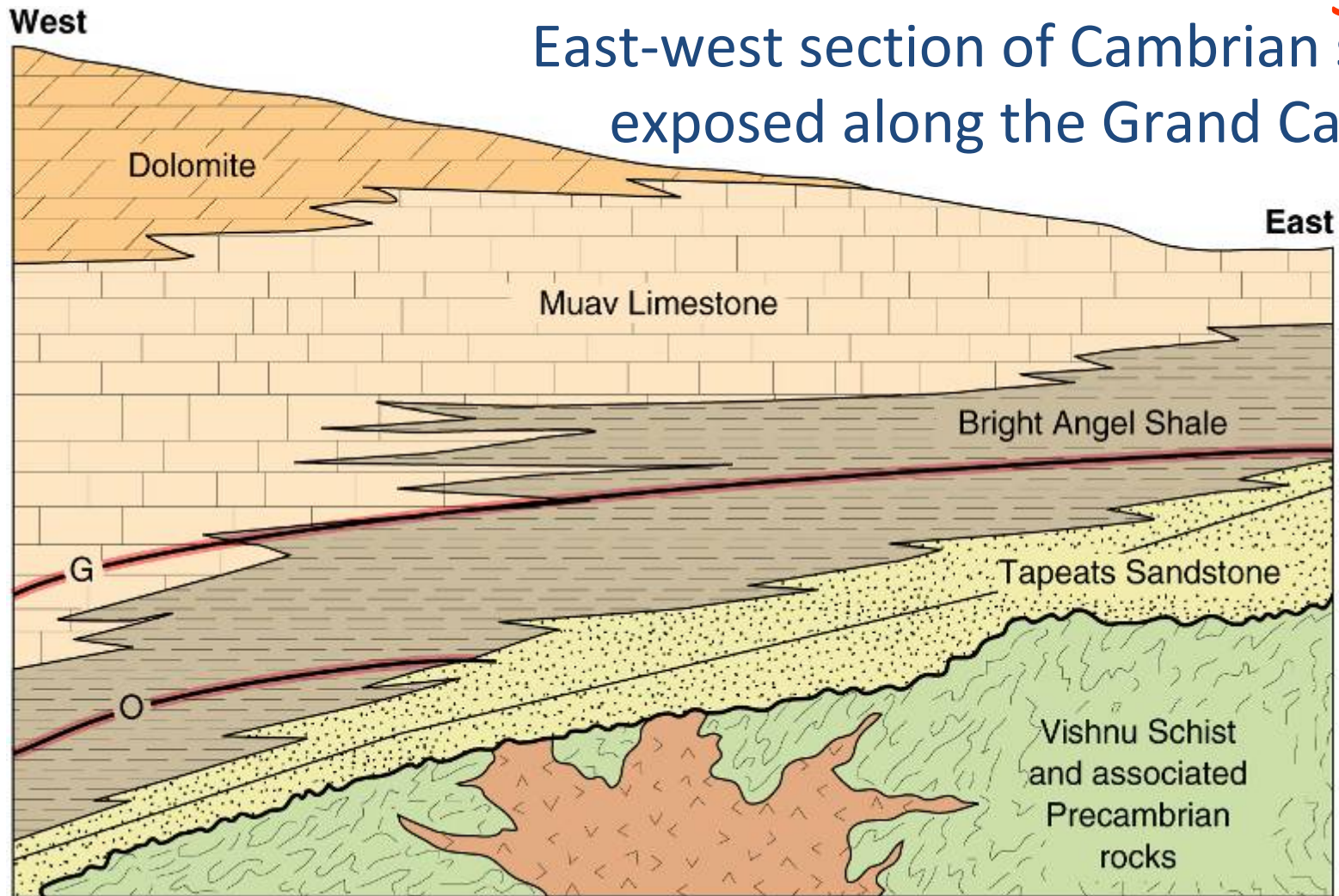


Chilhowee Group





East-west section of Cambrian strata exposed along the Grand Canyon.



O = upper limit of *Olenellus* trilobite genus

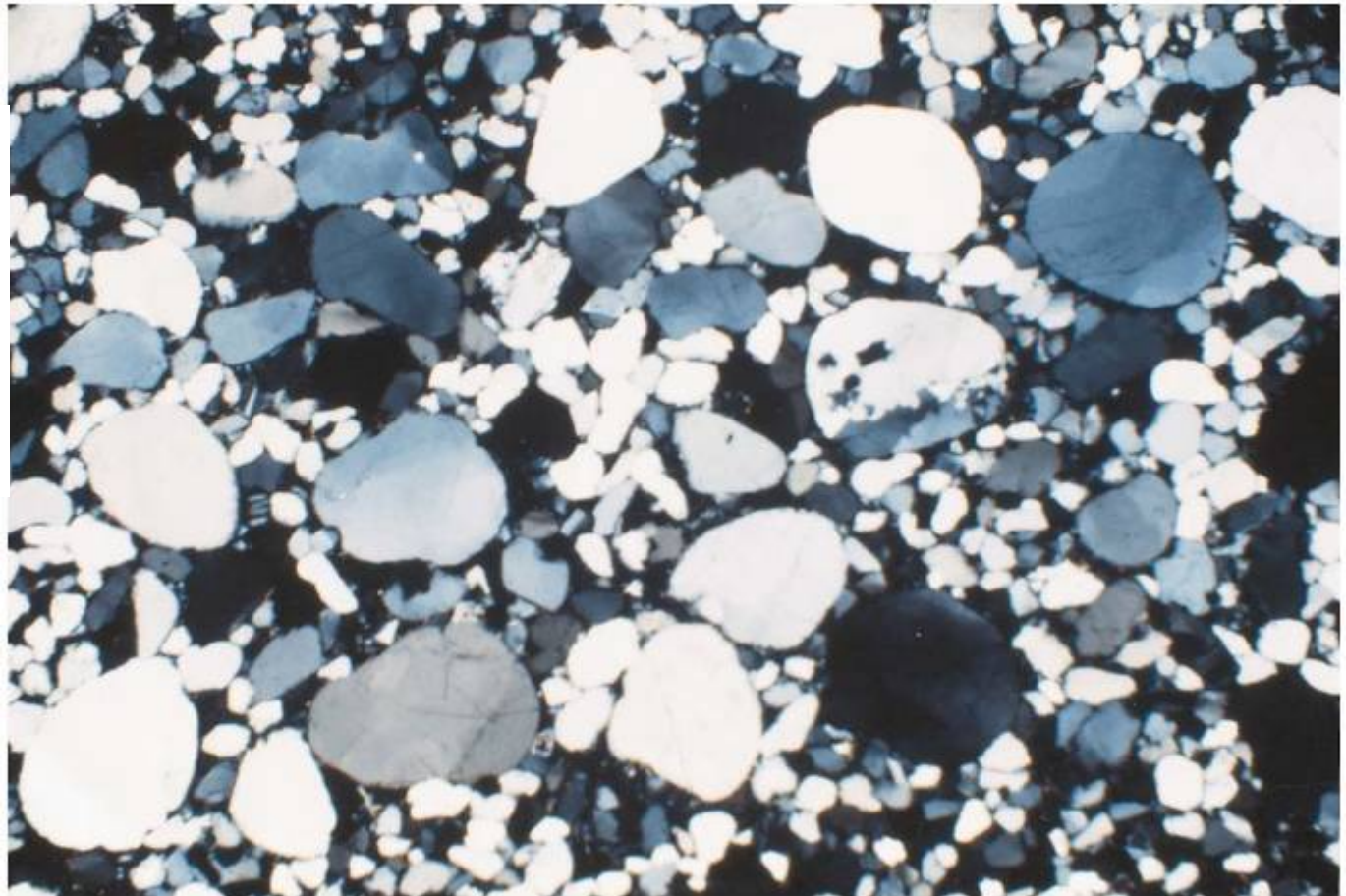
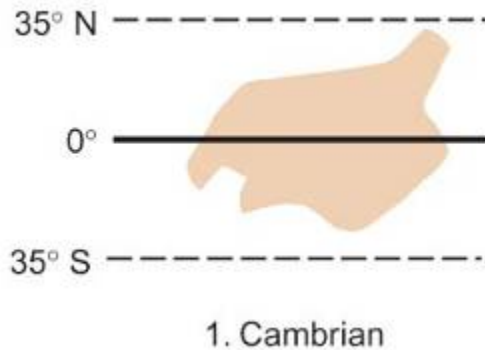
G = upper limit of *Glossopleura* trilobite genus

Sauk sequence:

First sandstones, then carbonates.

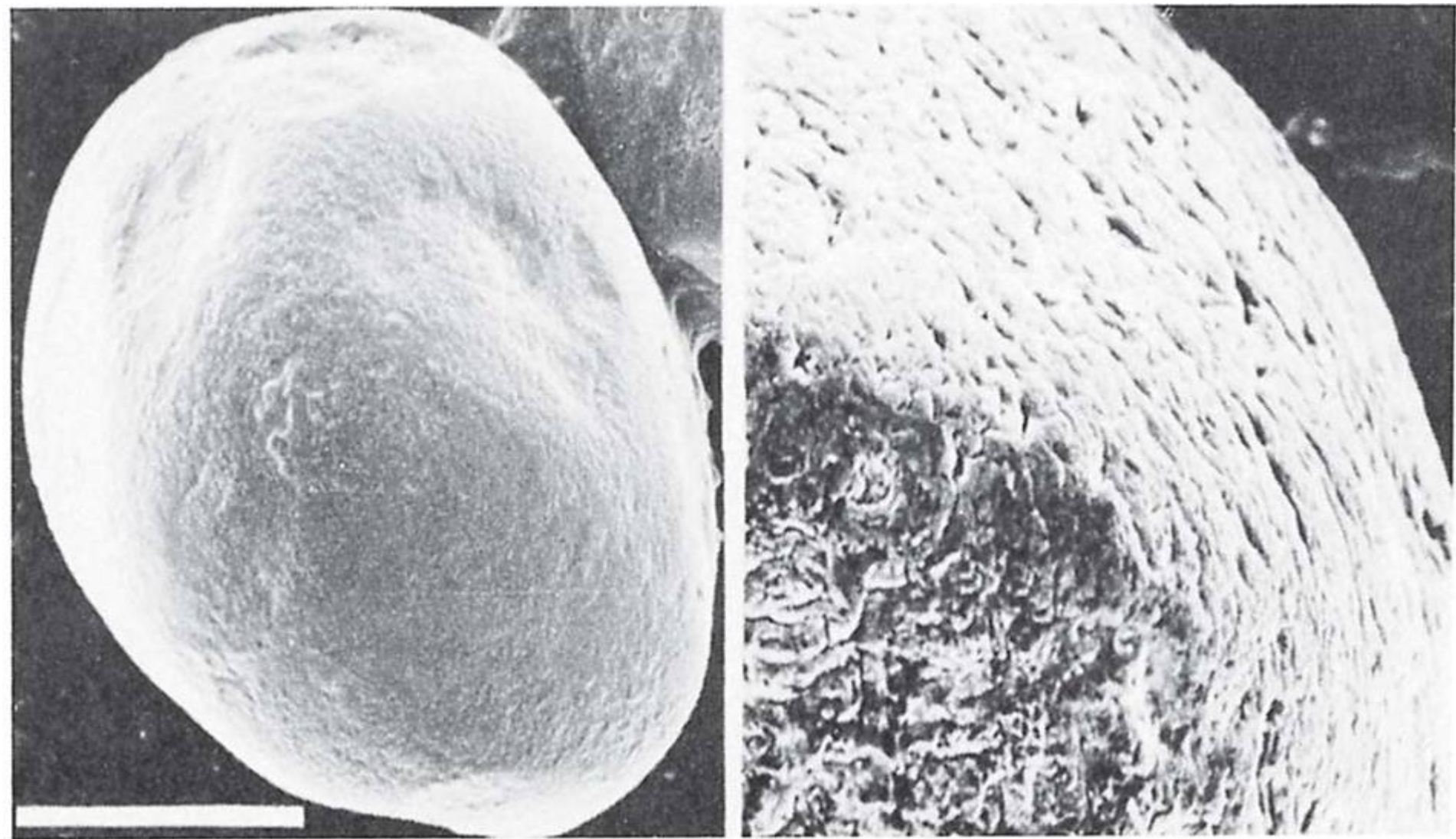
All over North America.

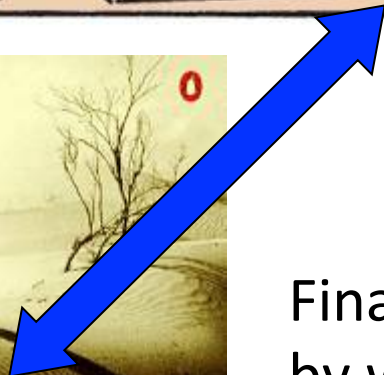
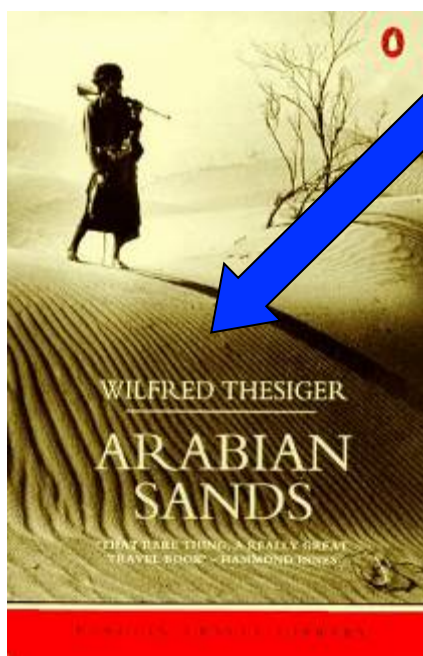
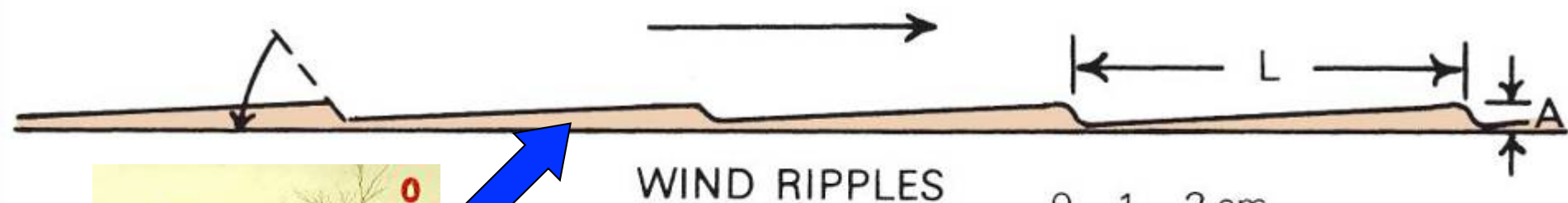
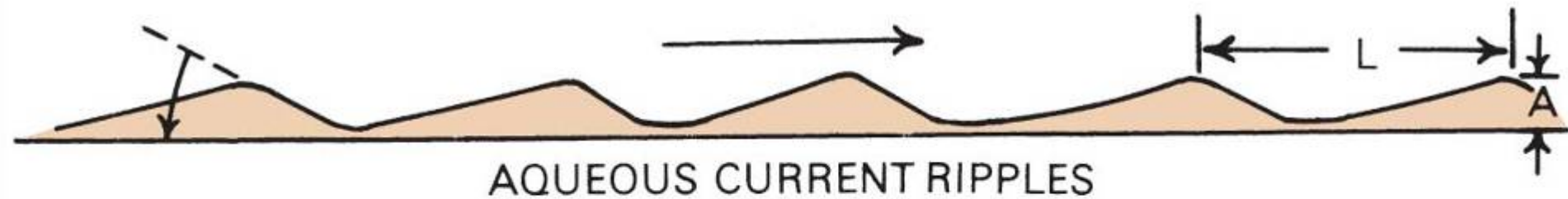
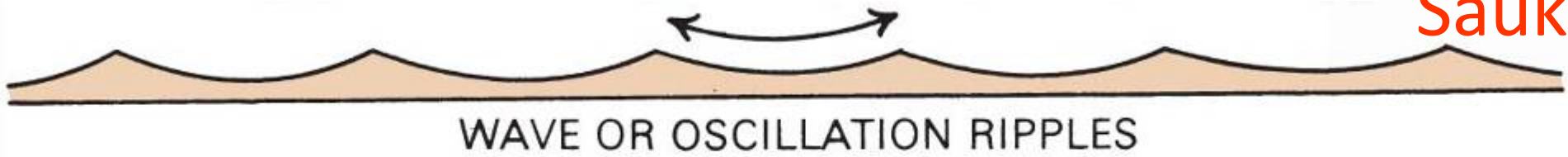
Fig. 7.13



Wind reworked
sediments: why?

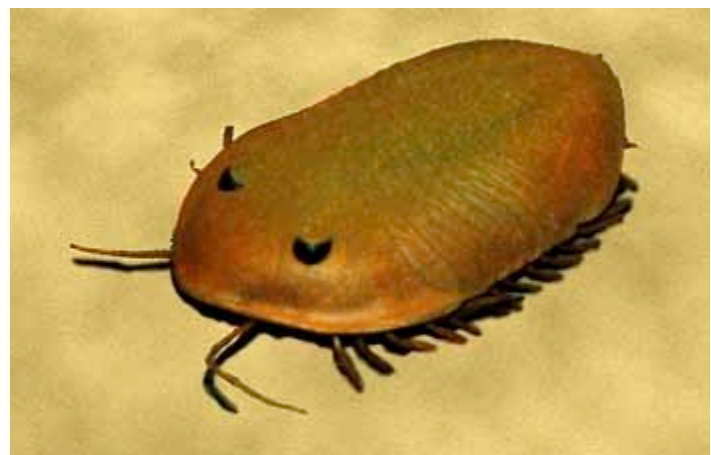
Wind abrasion





Final deposition by water:

Aqueous ripples + trilobites

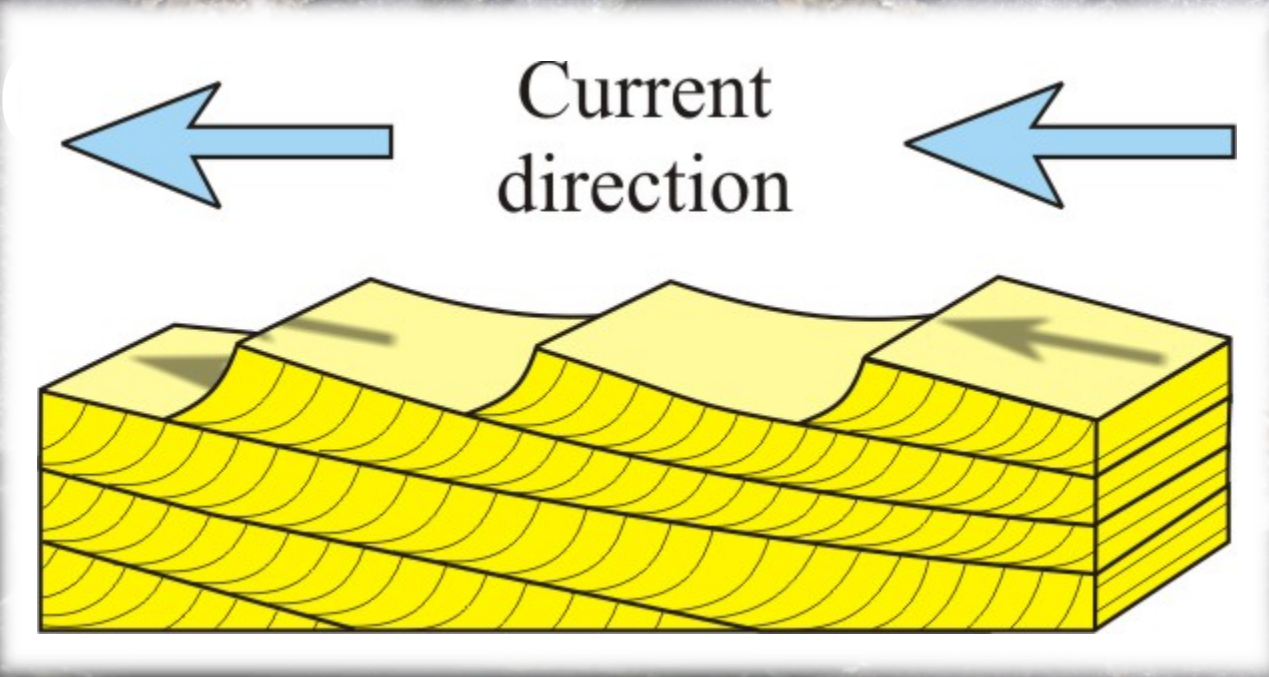


Skolithos trace fossils



Antietam Formation

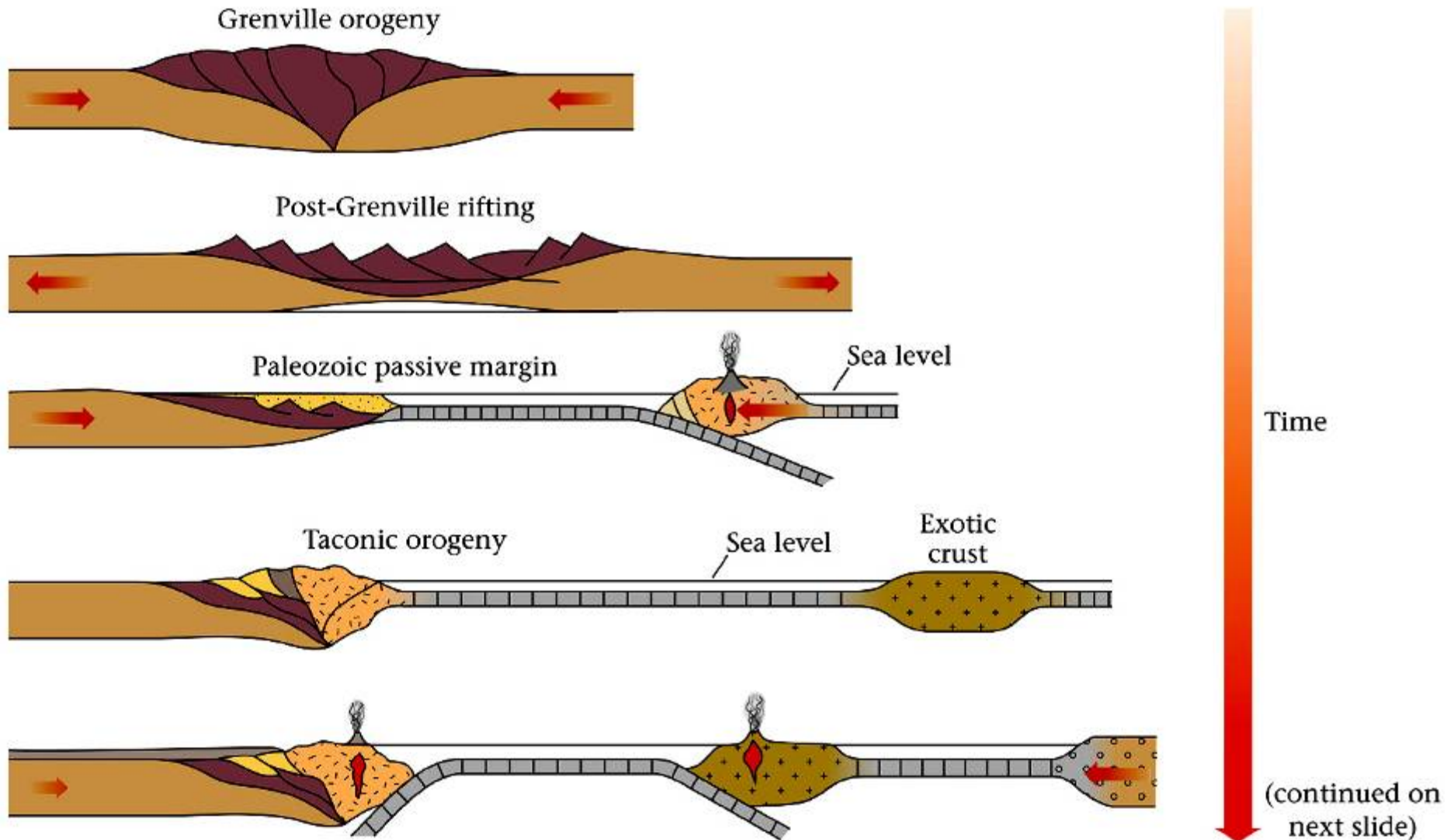




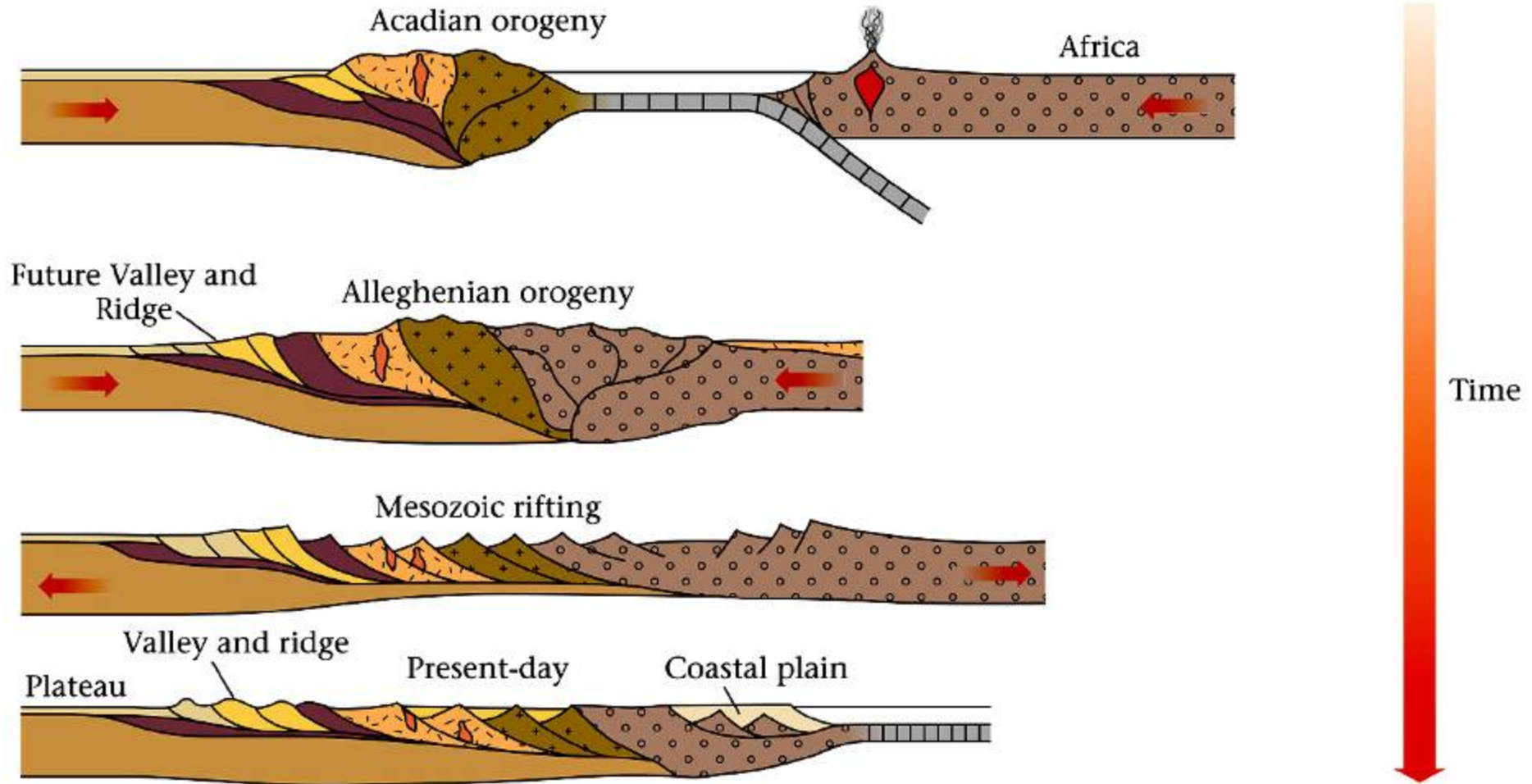
— cross-bedding —
— bedding —

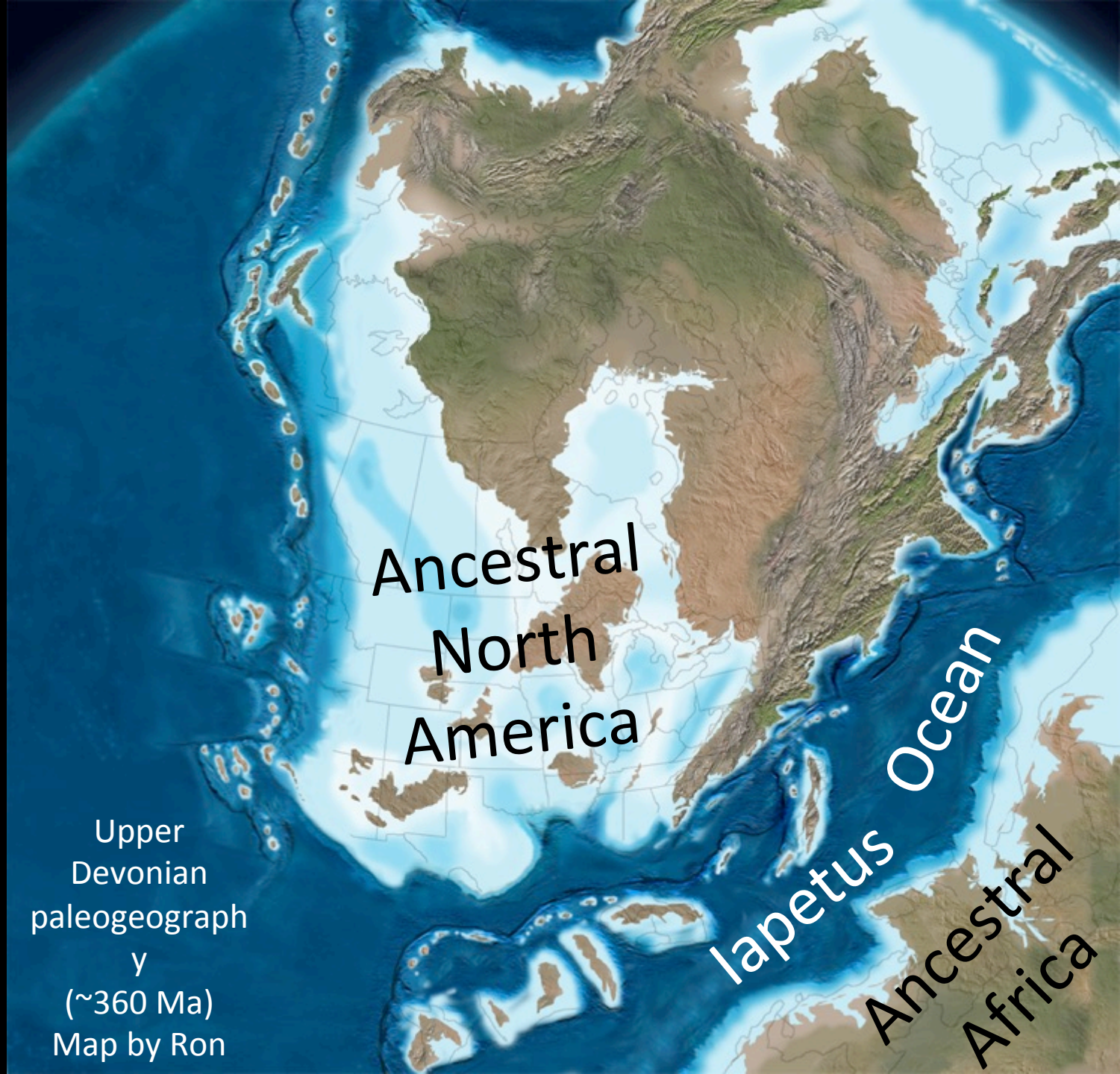
Antietam Formation

Birth & death of the Iapetus Ocean



Birth & death of the Iapetus Ocean





Ancestral
North
America

Iapetus Ocean
Ancestral
Africa

Upper
Devonian
paleogeograph
y
(~360 Ma)
Map by Ron

Middle
Pennsylvanian
paleogeograph
y
(~300 Ma)
Map by Ron

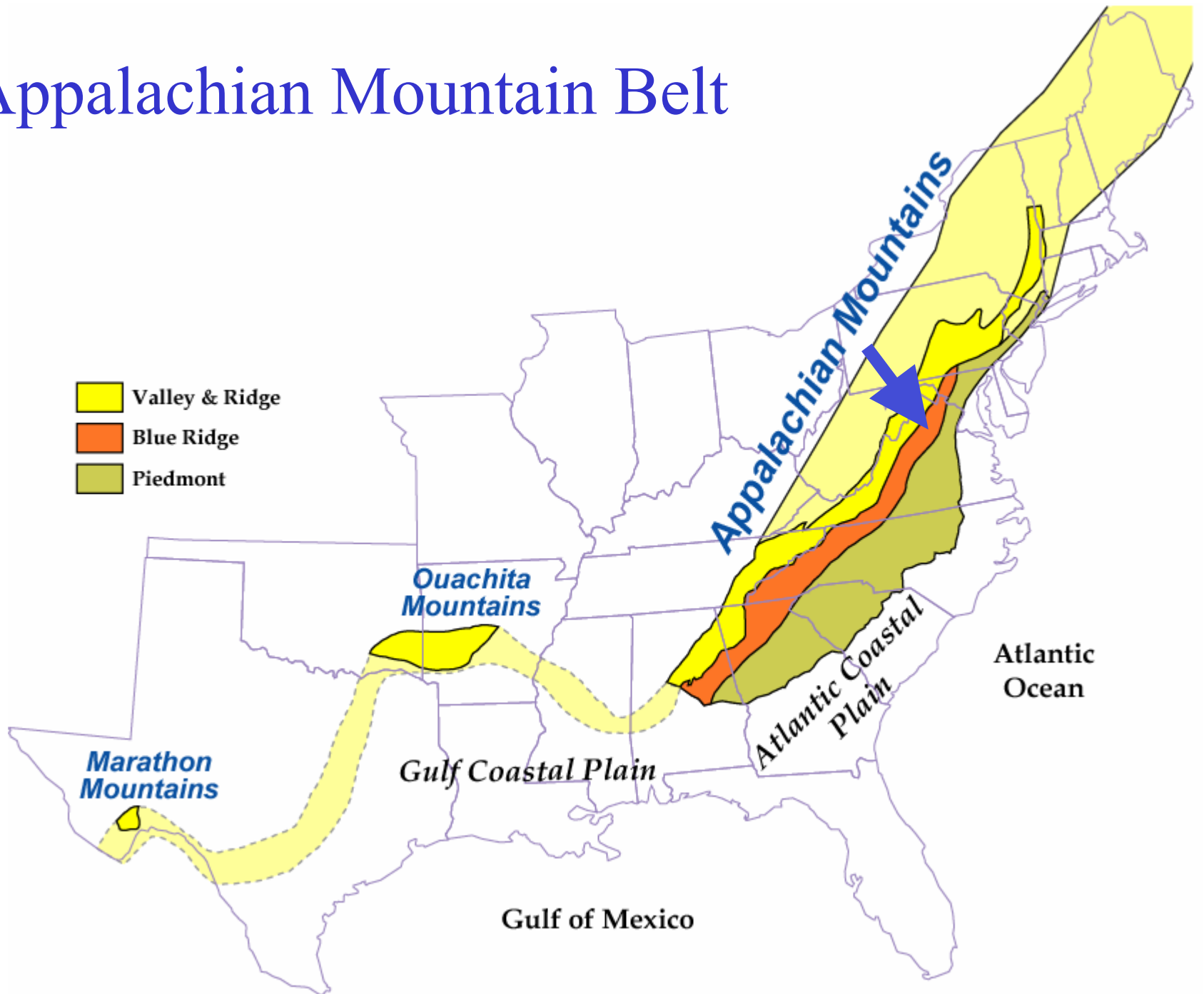
Appalachian Mountains

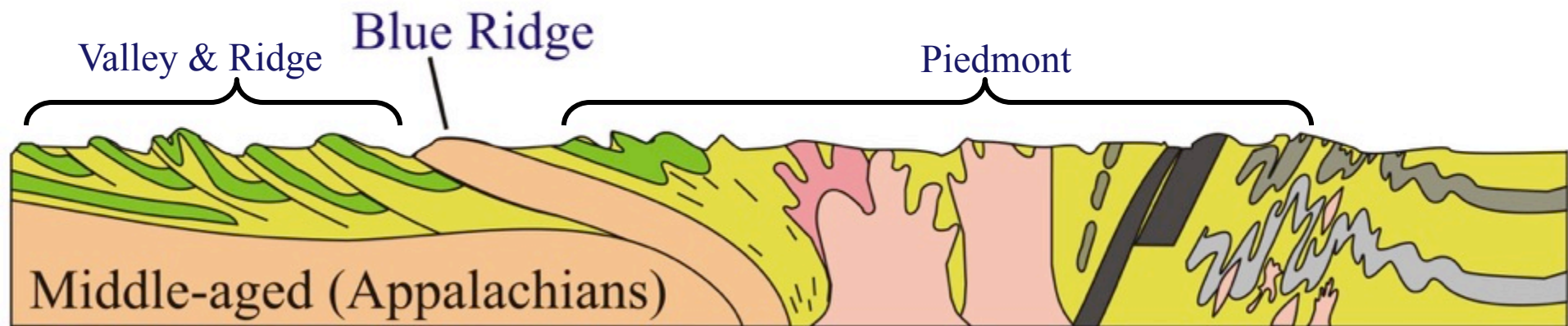


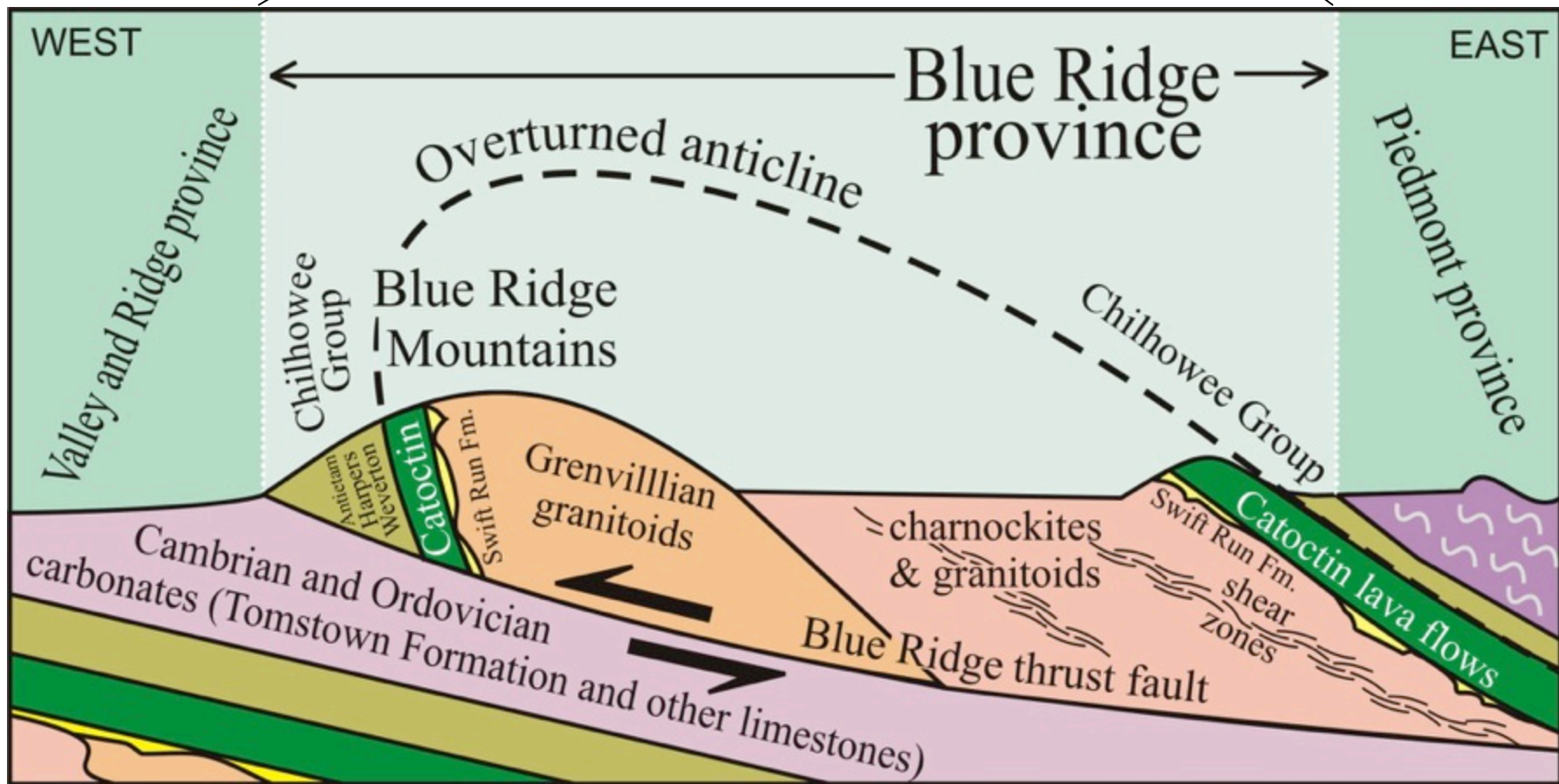
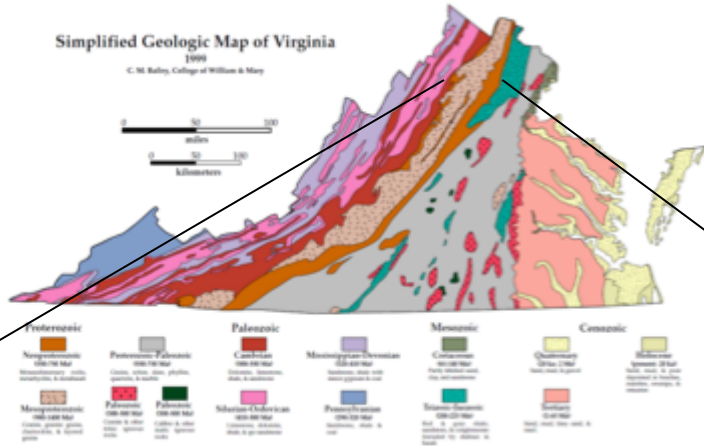


Blue Ridge: "Here we Himalaya again!"

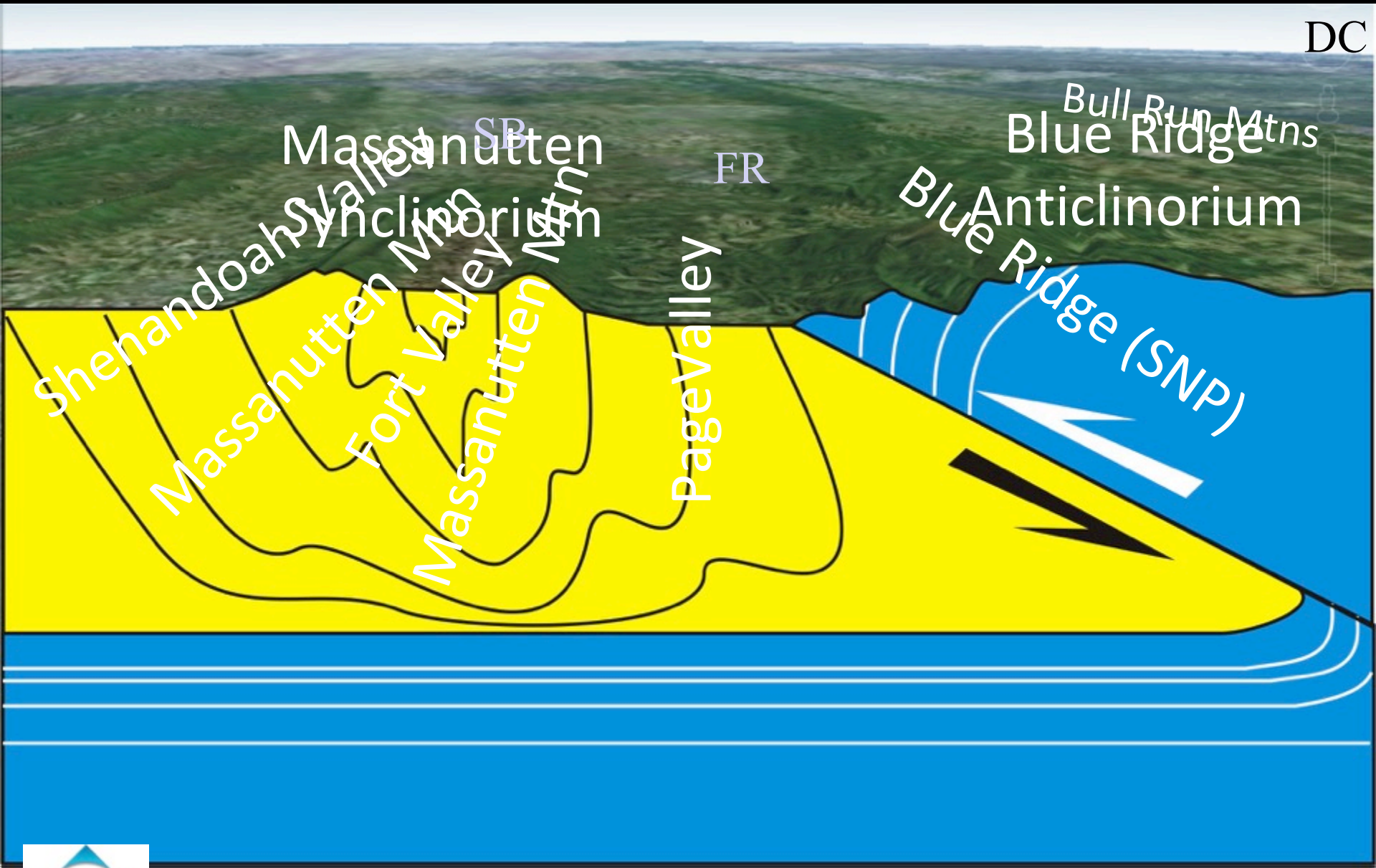
Appalachian Mountain Belt











GigaPan of folding in the Weverton Formation

Fault Breccia from Blue Ridge Thrust Fault





Catoctin Fm.
(now greenstone)

Grenvillian
basement complex

Blue Ridge Parkway near Roanoke, VA



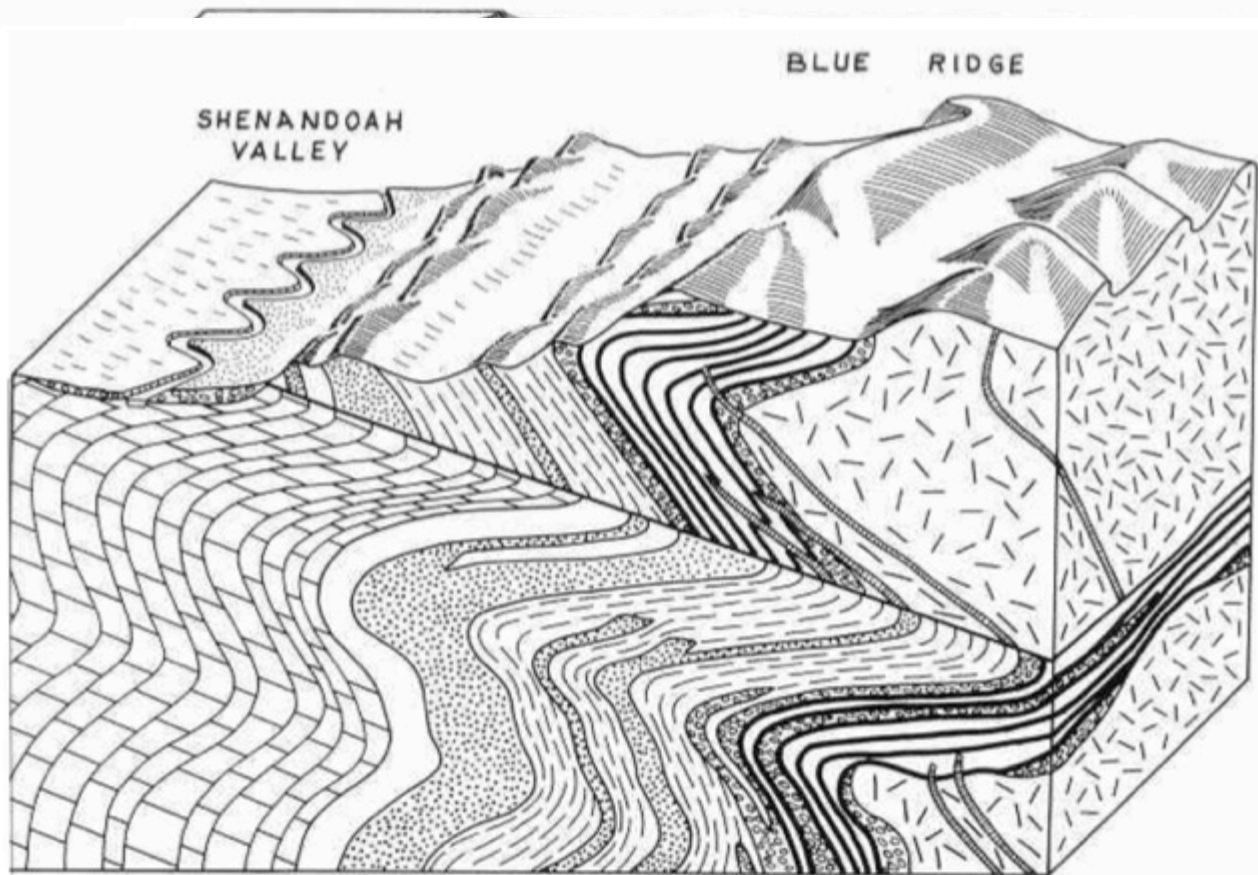
Weverton Formation



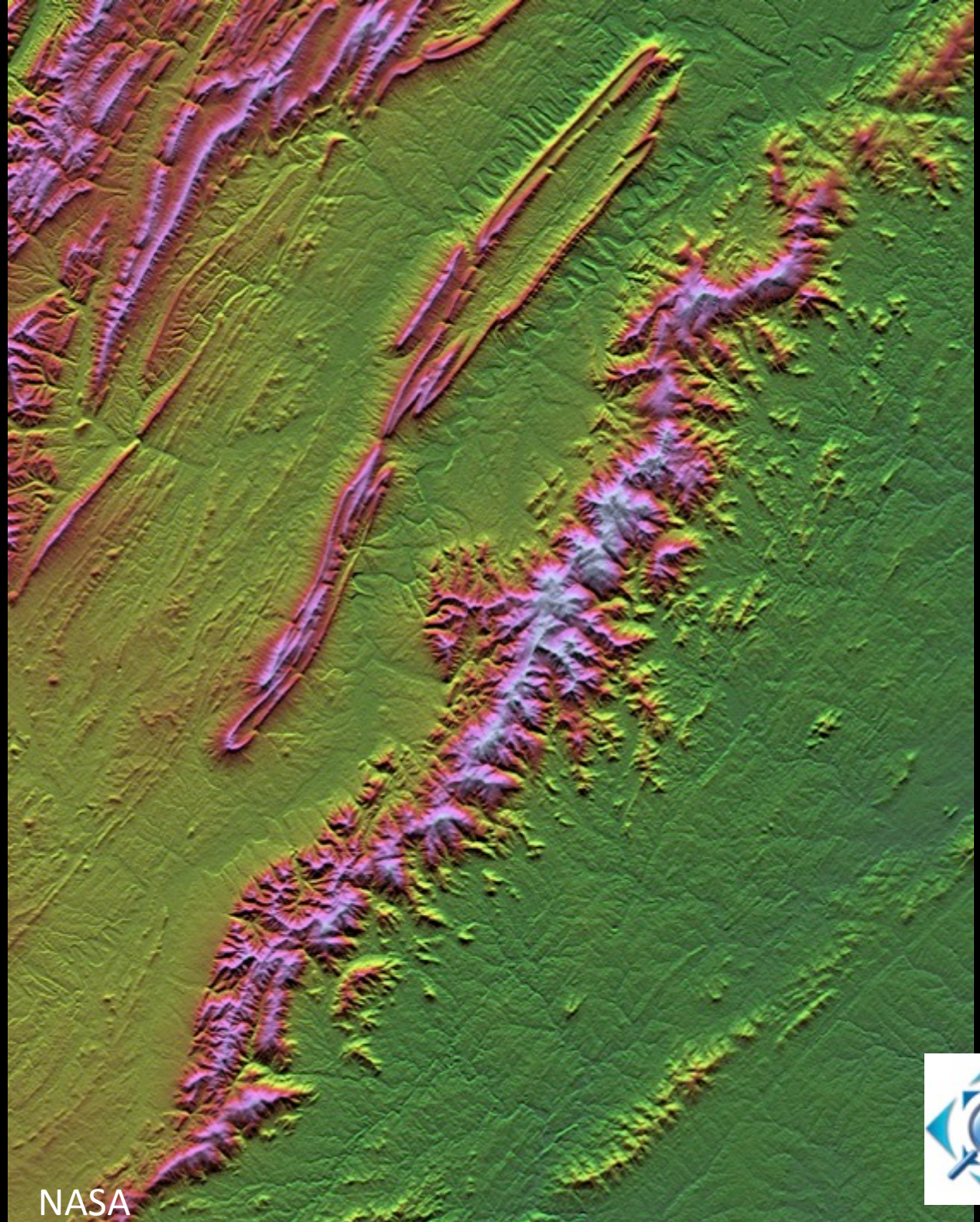
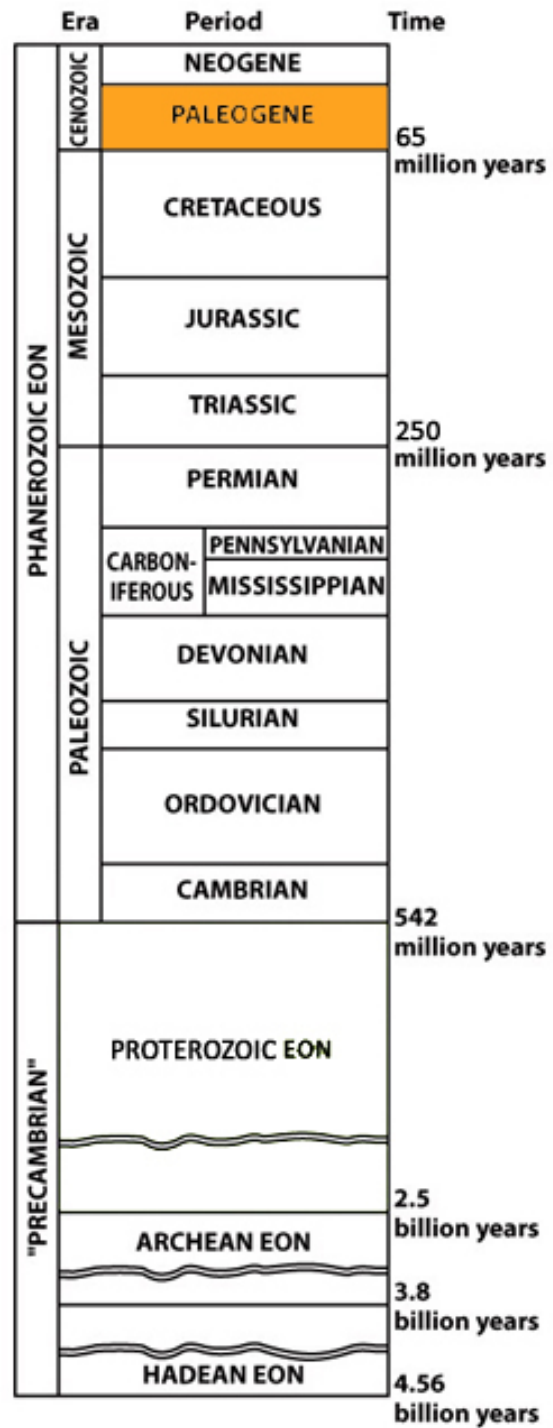
Weverton Formation



Era		Period	Time
CENOZOIC	PHANEROZOIC EON	NEOGENE	65 million years
		PALEOGENE	
MESOZOIC	CRETACEOUS		
	JURASSIC		
	TRIASSIC		
PALEOZOIC	PERMIAN	250 million years	
	CARBON-IFEROUS		PENNSYLVANIAN
		MISSISSIPPIAN	
	DEVONIAN	542 million years	
	SILURIAN		
	ORDOVICIAN		
	CAMBRIAN		
"PRECAMBRIAN"	PROTEROZOIC EON	2.5 billion years	
	ARCHEAN EON		
		3.8 billion years	
	HADEAN EON	4.56 billion years	



Sketches from Tom Gathright's 1976
Geology of the Shenandoah National Park



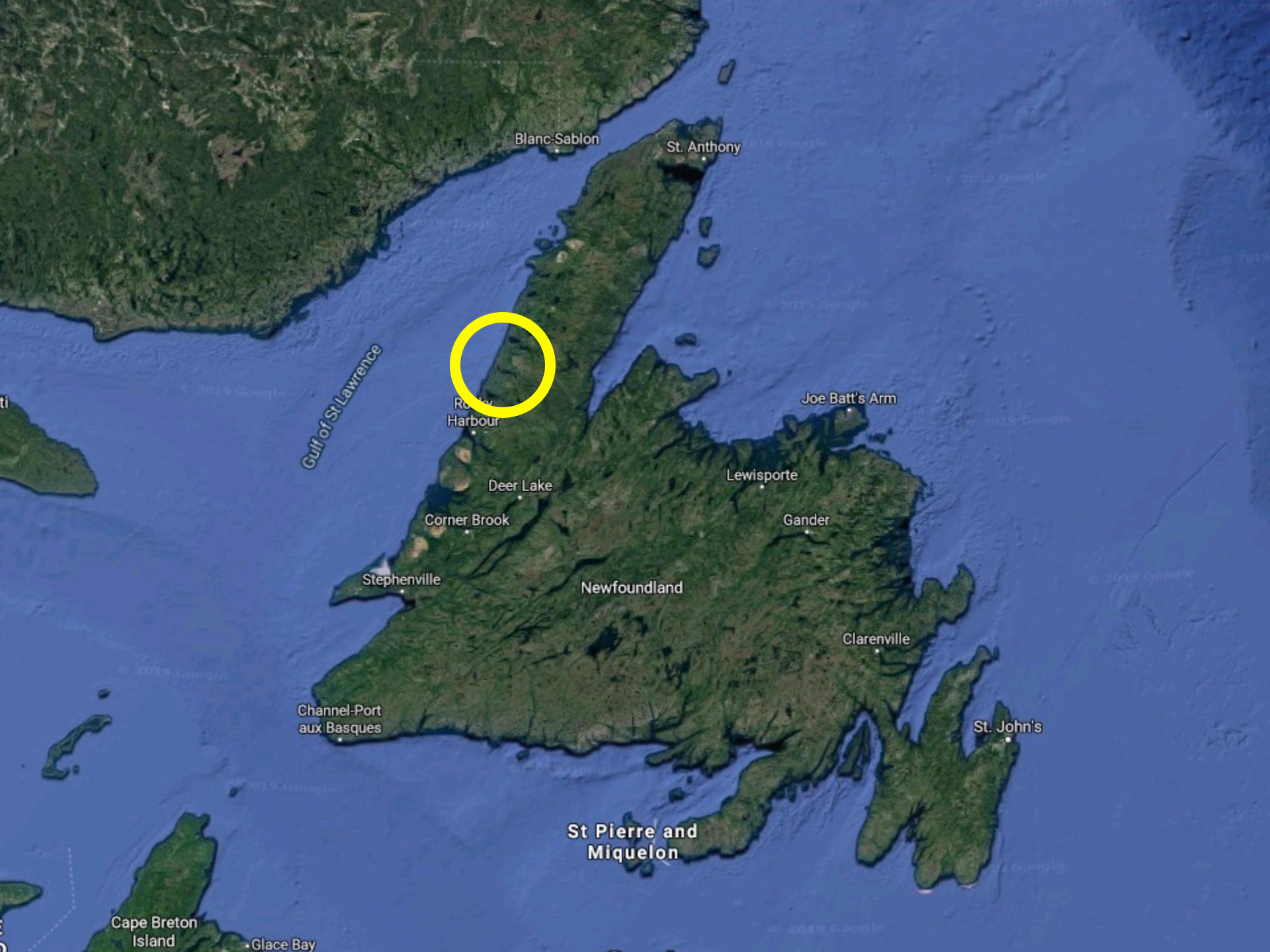
NASA



N

S





Blanc-Sablon

St. Anthony

Gulf of St. Lawrence

Red Bay Harbour

Joe Batt's Arm

Deer Lake

Lewisporte

Corner Brook

Gander

Stephenville

Newfoundland

Clarenville

Channel-Port aux Basques

St. John's

St Pierre and Miquelon

Cape Breton Island

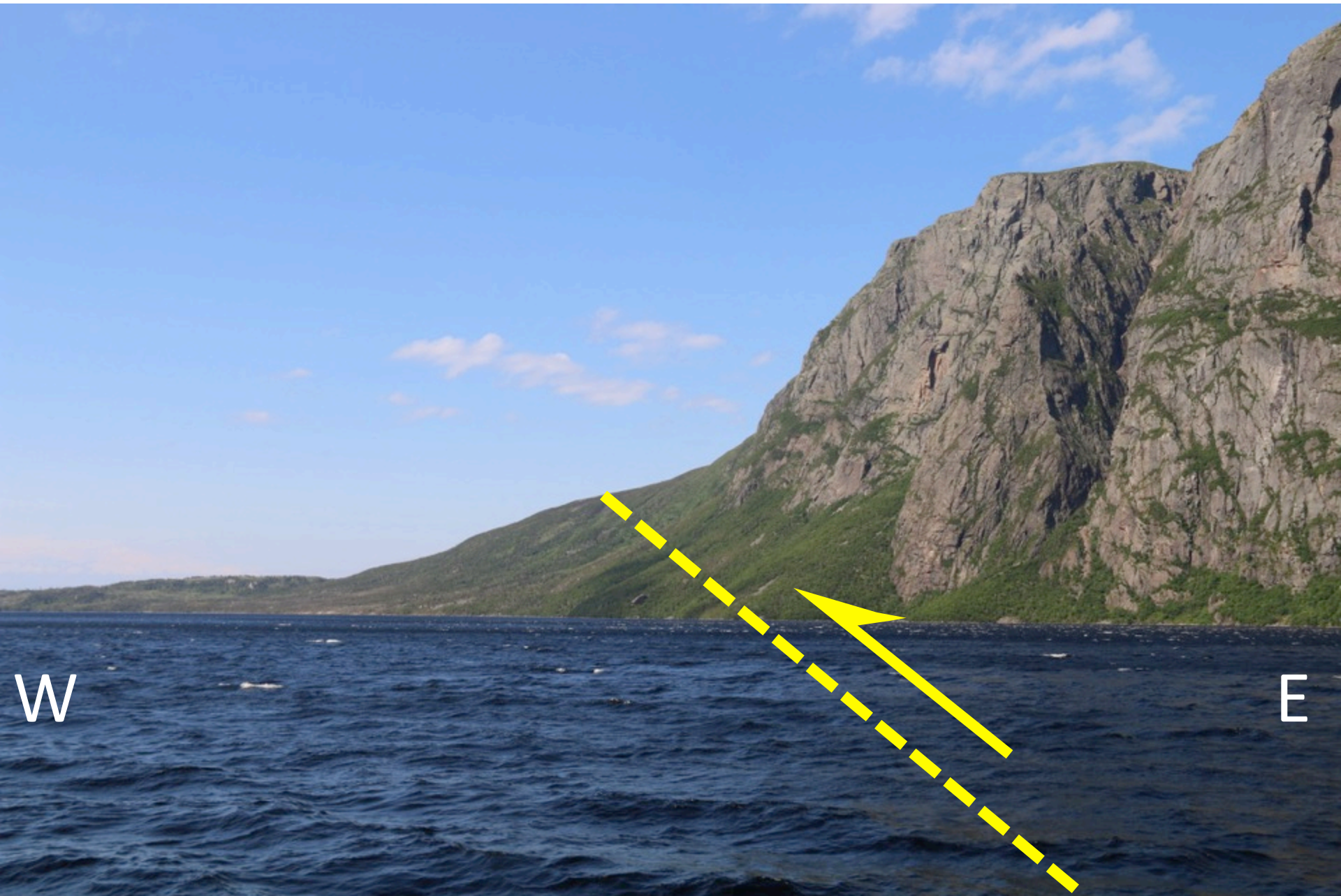
Glance Bay

W

E







W

E