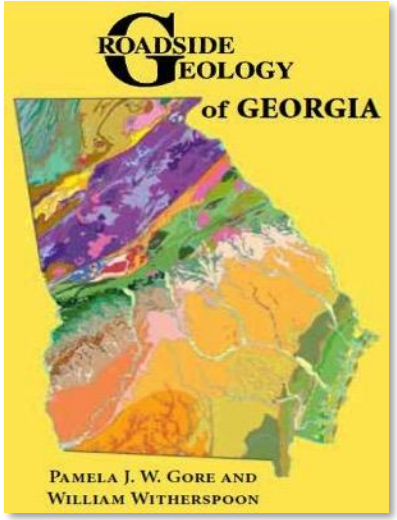
How does Georgia's geology influence soils and streams?

Dr. Bill Witherspoon
georgiarocks.us



Confluence

Georgia Adopt-A-Stream's
Volunteer Conference

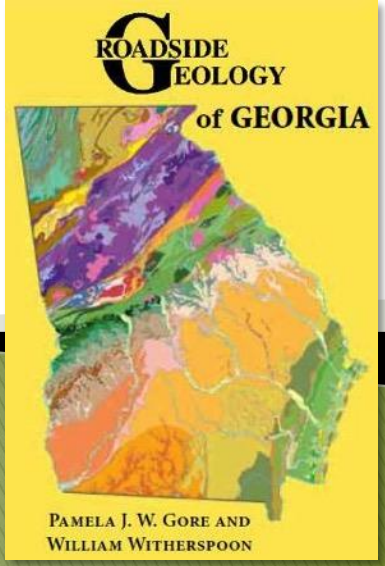
Georgia Adopt-A-Stream

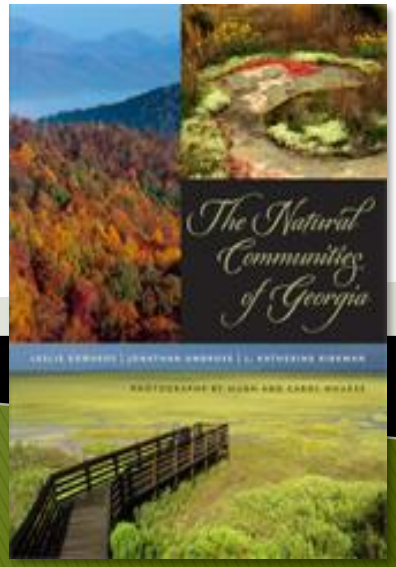
Native Plants Rock!, or, what can geology teach you about preserving Georgia's local flora?

Adapted from past programs with Leslie Edwards

Dr. Bill Witherspoon

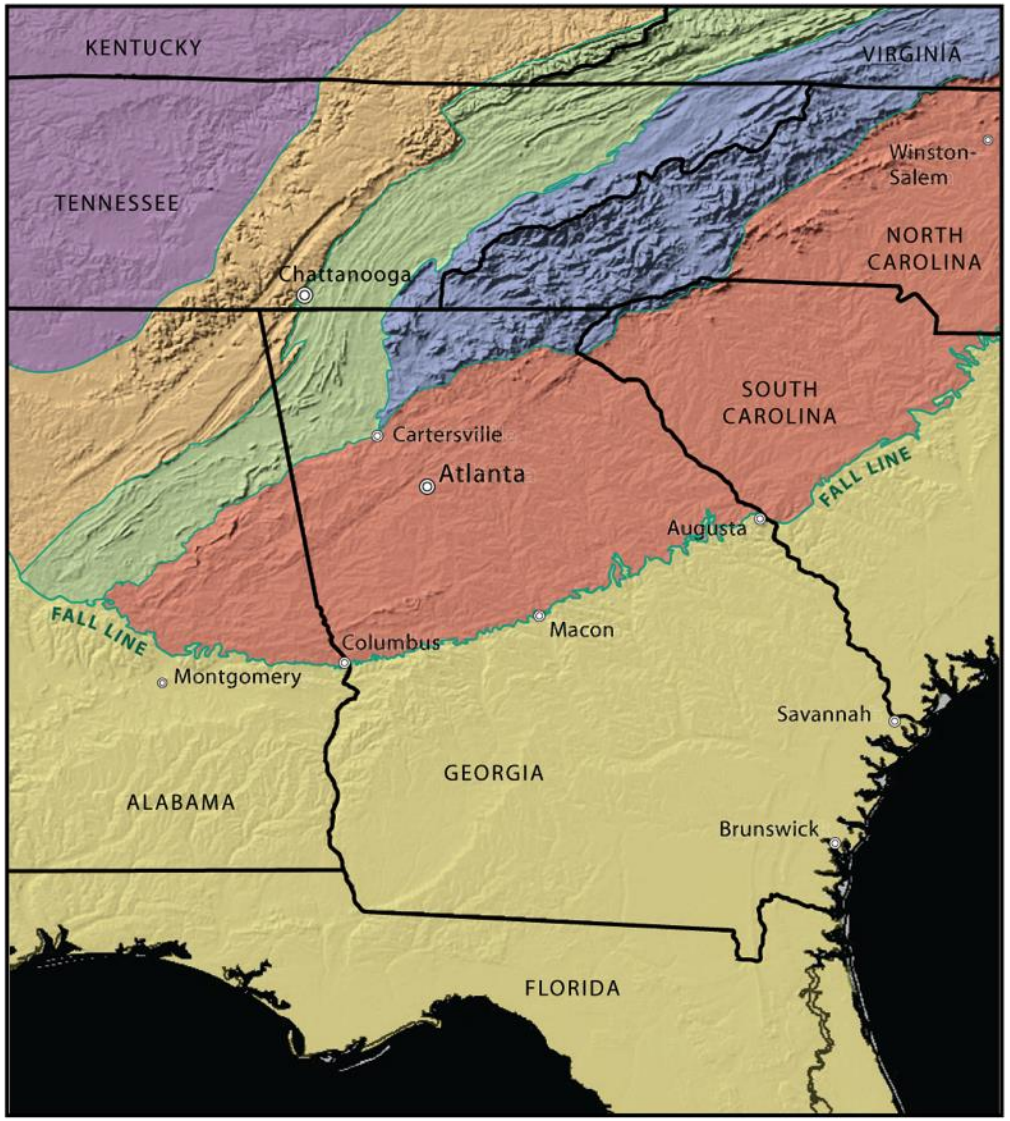
Dr. Leslie Edwards





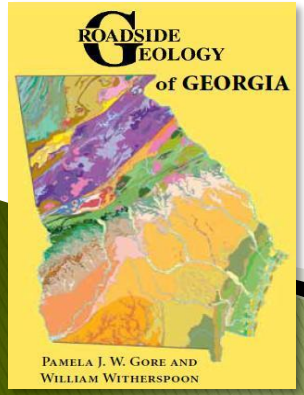
Physical Map of Southeast

- Appalachian Plateau
- Valley and Ridge
- Blue Ridge
- Piedmont
- Coastal Plain

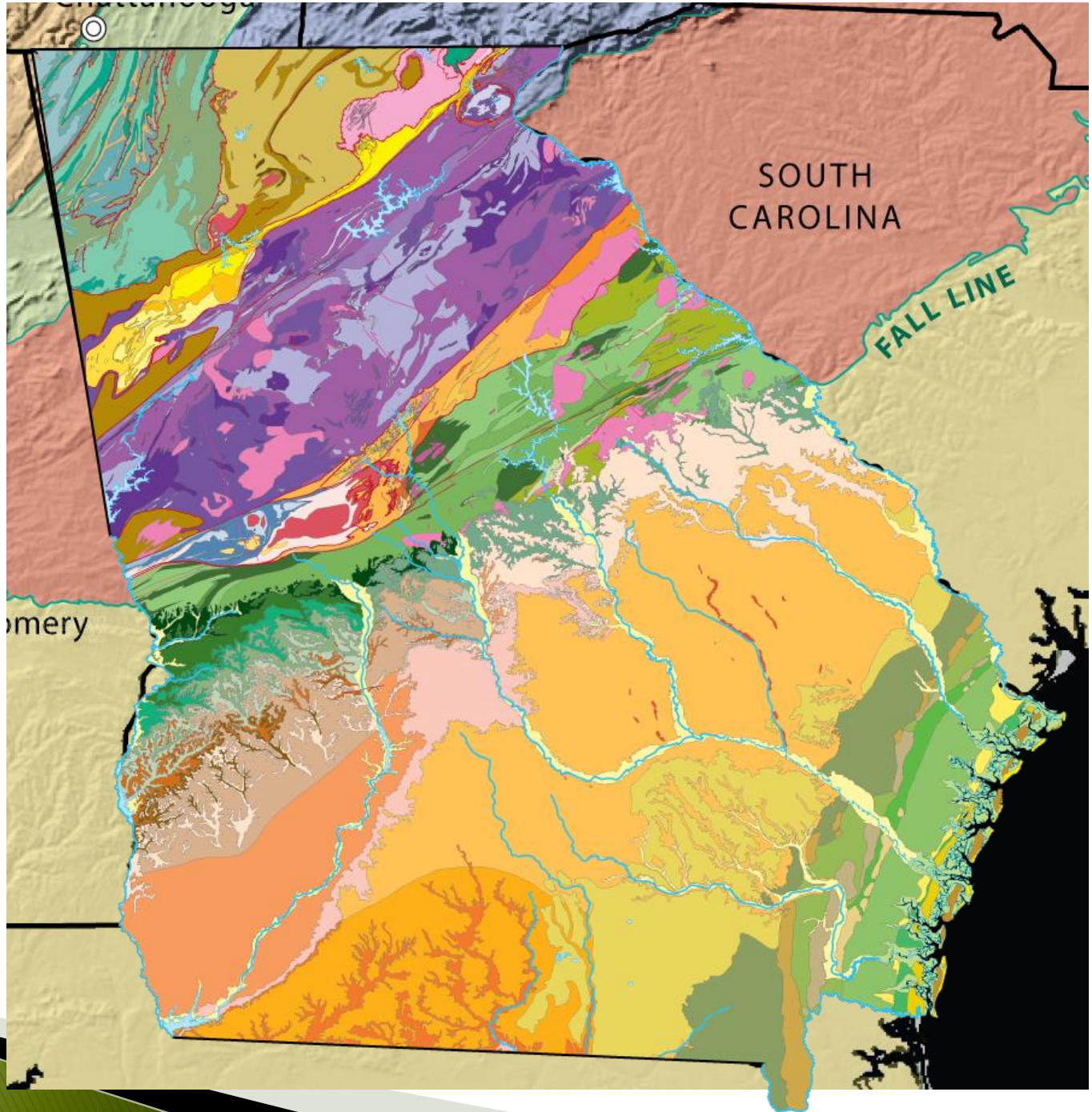


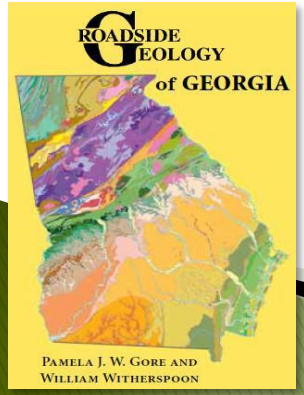
PHYSIOGRAPHIC DISTRICTS

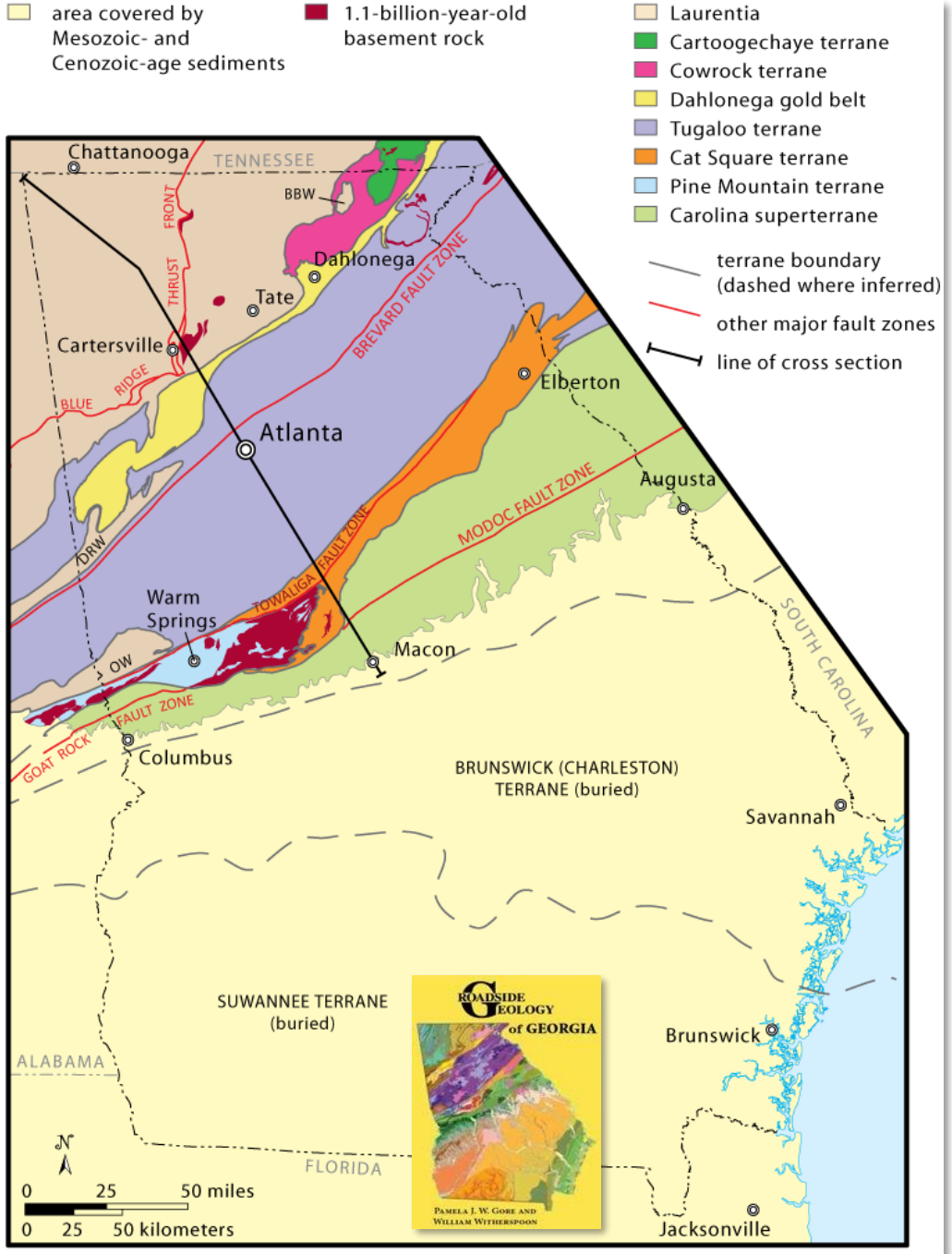
- Interior Low Plateaus
- Appalachian Plateau
- Valley and Ridge
- Blue Ridge
- Piedmont
- Coastal Plain



Georgia's colorful geology has a story to tell

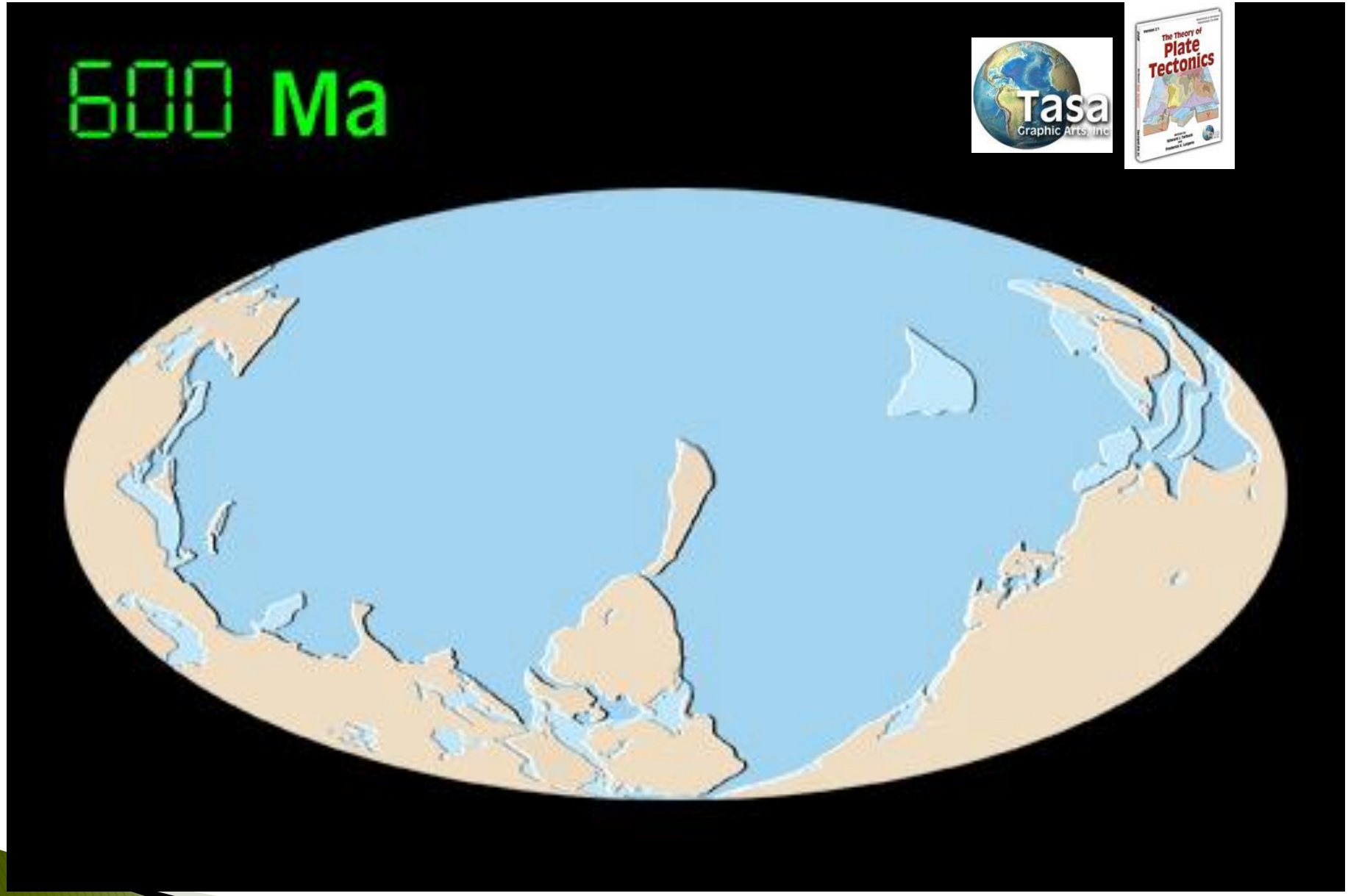






Piedmont & Blue Ridge

- Metamorphic rocks (gneiss, schist…), formerly sedimentary and volcanic rocks
- Intruded by igneous rocks (granite…)
- Collision with Africa assembled terranes – some were volcanic island chains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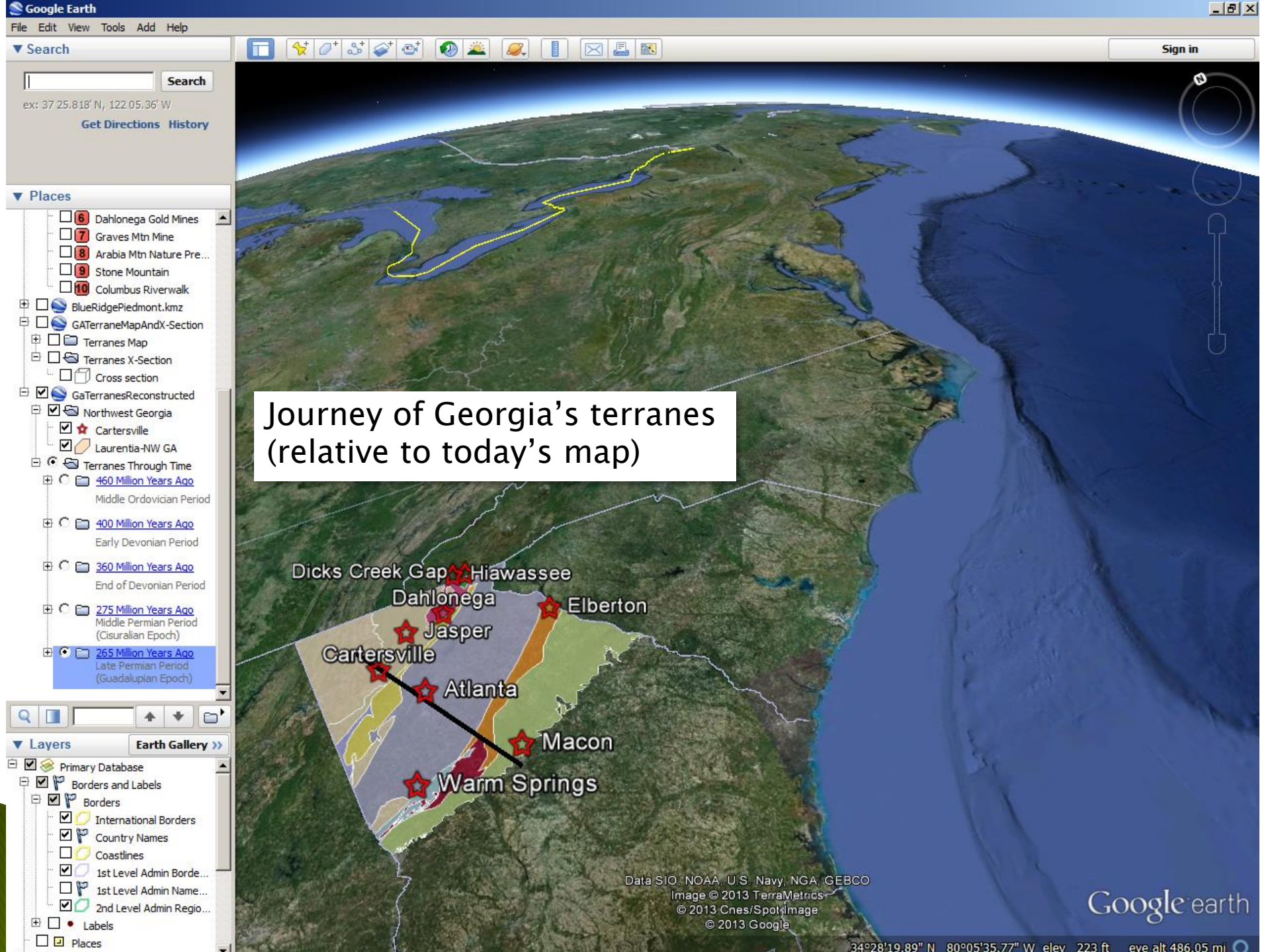
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Terranes Map
Terranes X-Section
Cross section
GaTerranesReconstructed
Northwest Georgia
Cartersville
Laurentia-NW GA
Terranes Through Time
460 Million Years Ago
Middle Ordovician Period
400 Million Years Ago
Early Devonian Period
360 Million Years Ago
End of Devonian Period
275 Million Years Ago
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(Cisuralian Epoch)
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Late Permian Period
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Borders
International Borders
Country Names
Coastlines
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1st Level Admin Name...
2nd Level Admin Regio...
Labels
Places
Journey of Georgia's terranes
(relative to today's map)
Dicks Creek Gap
Hiawassee
Dahlonega
Elberton
Jasper
Cartersville
Atlanta
Macon
Warm Springs
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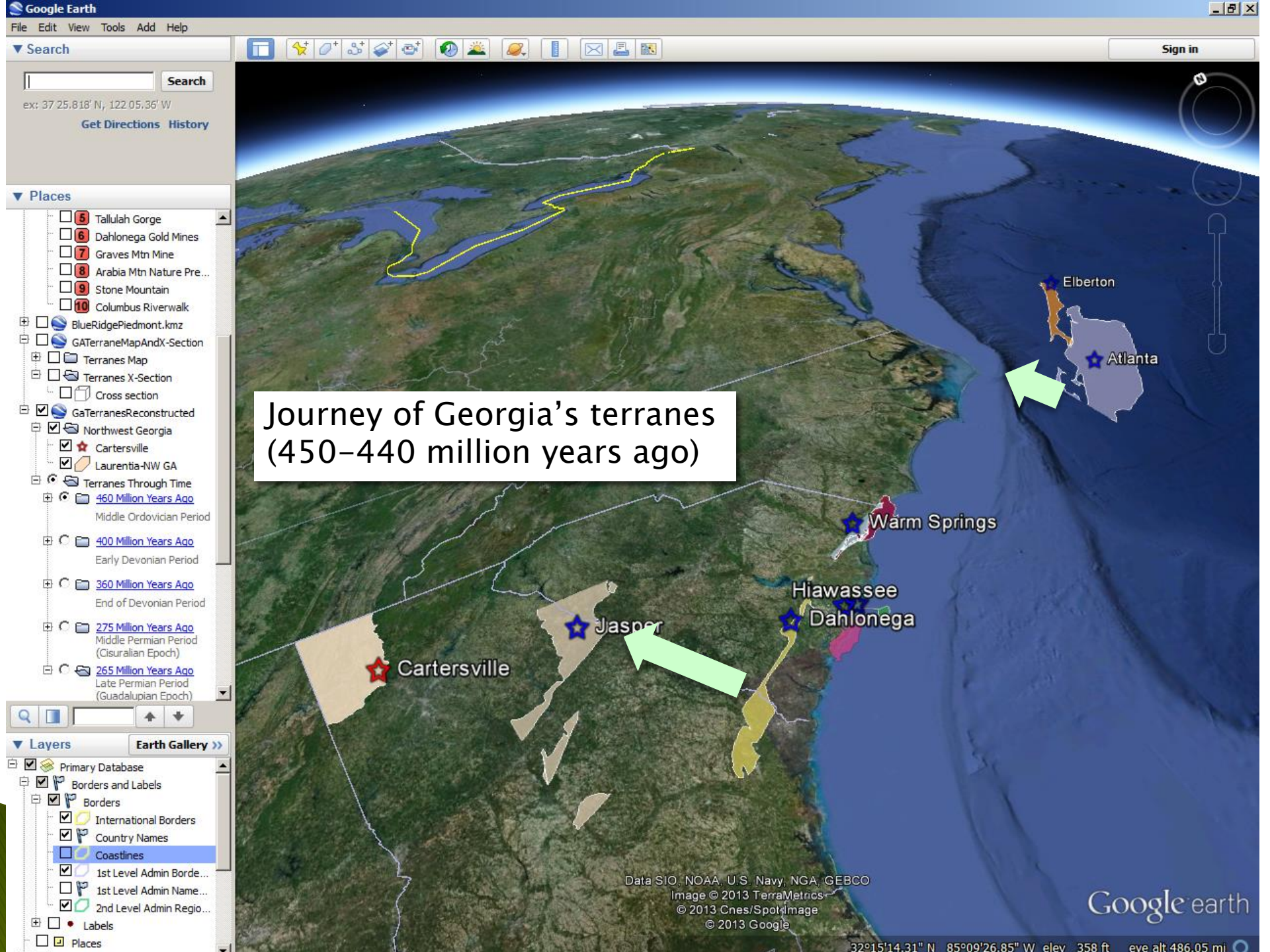
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(450-440 million years ago)
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Atlanta
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Dahlonega
Jasper
Cartersville
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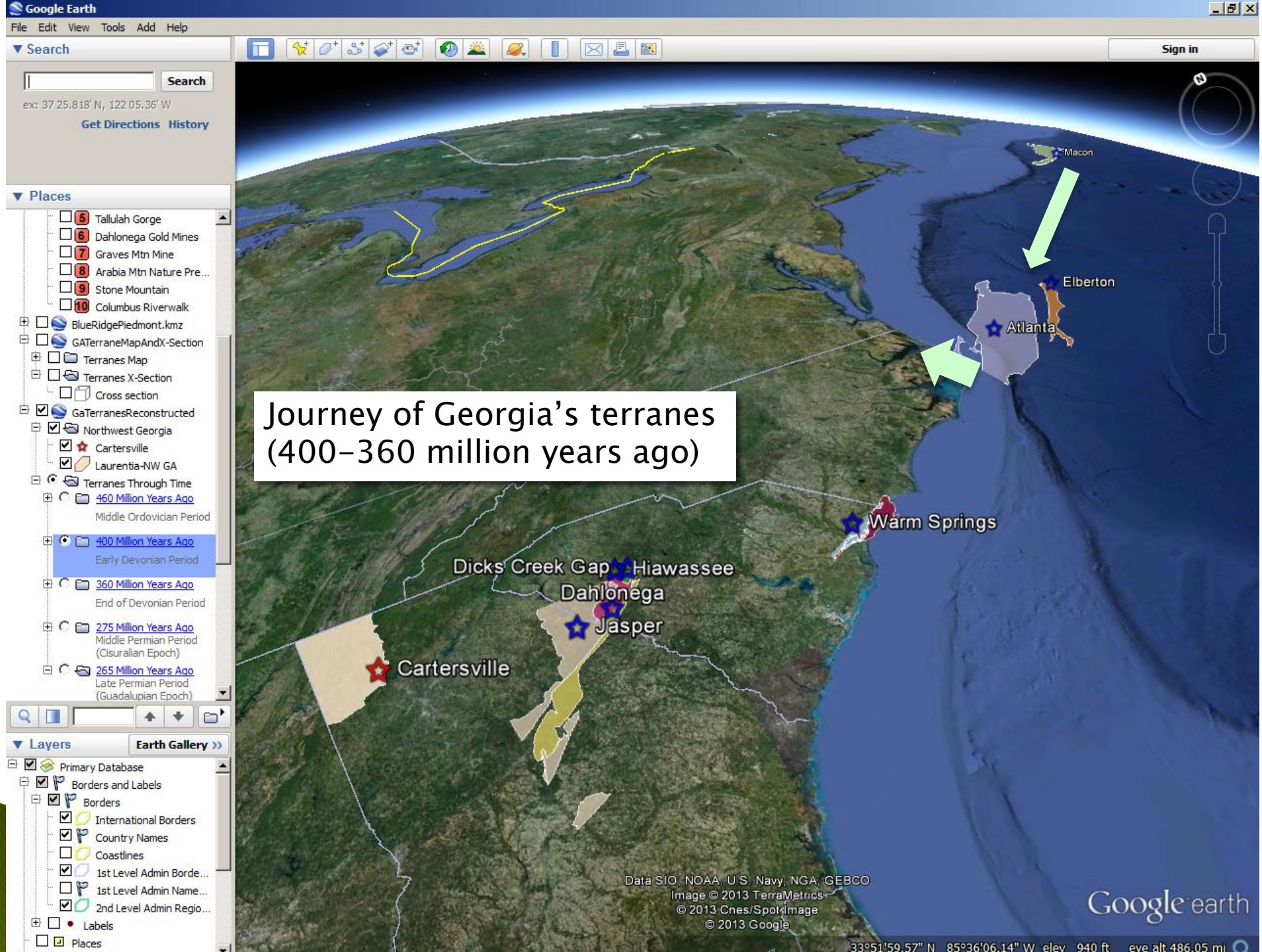
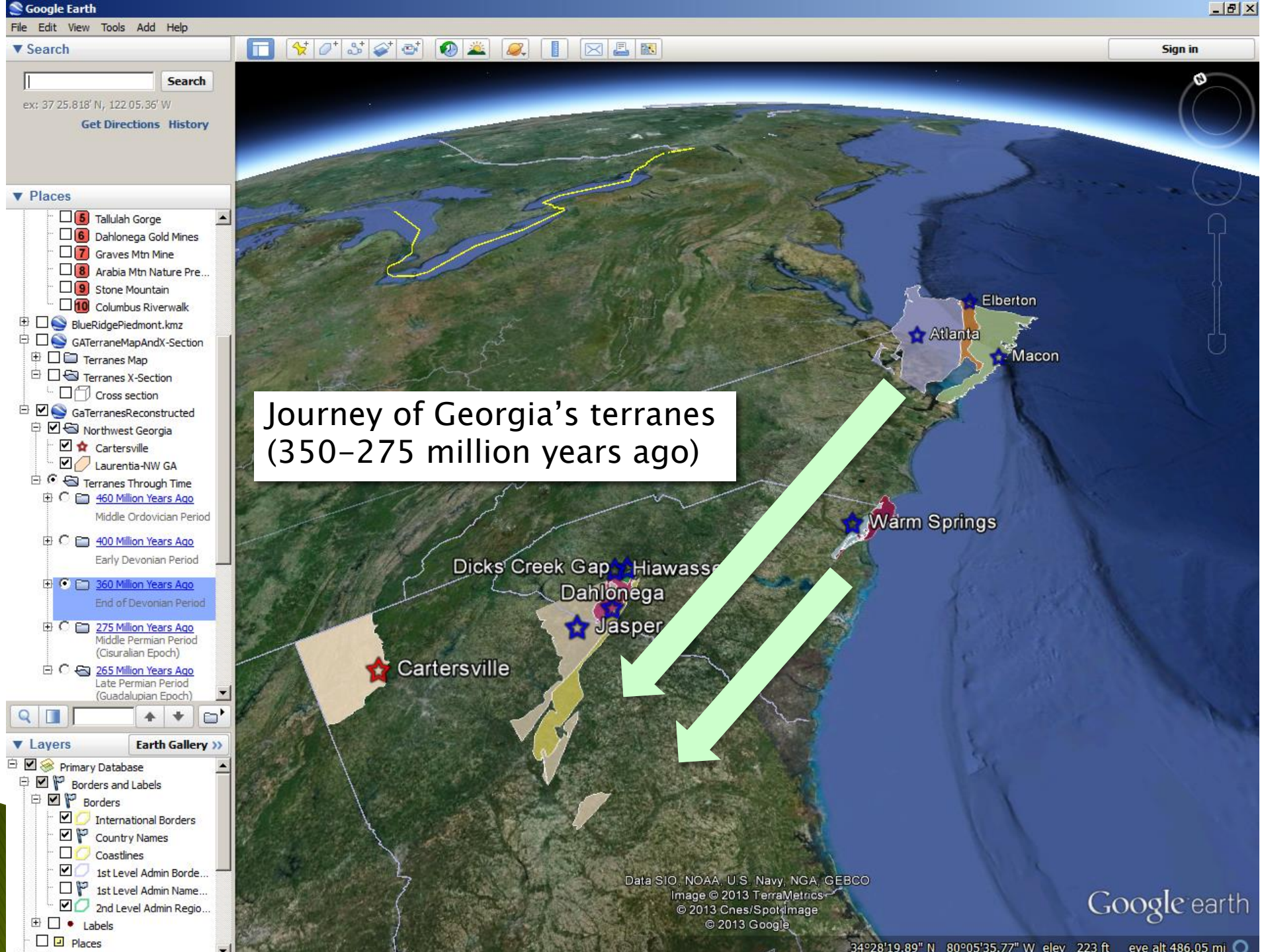


Journey of Georgia's terranes
(400–360 million years ago)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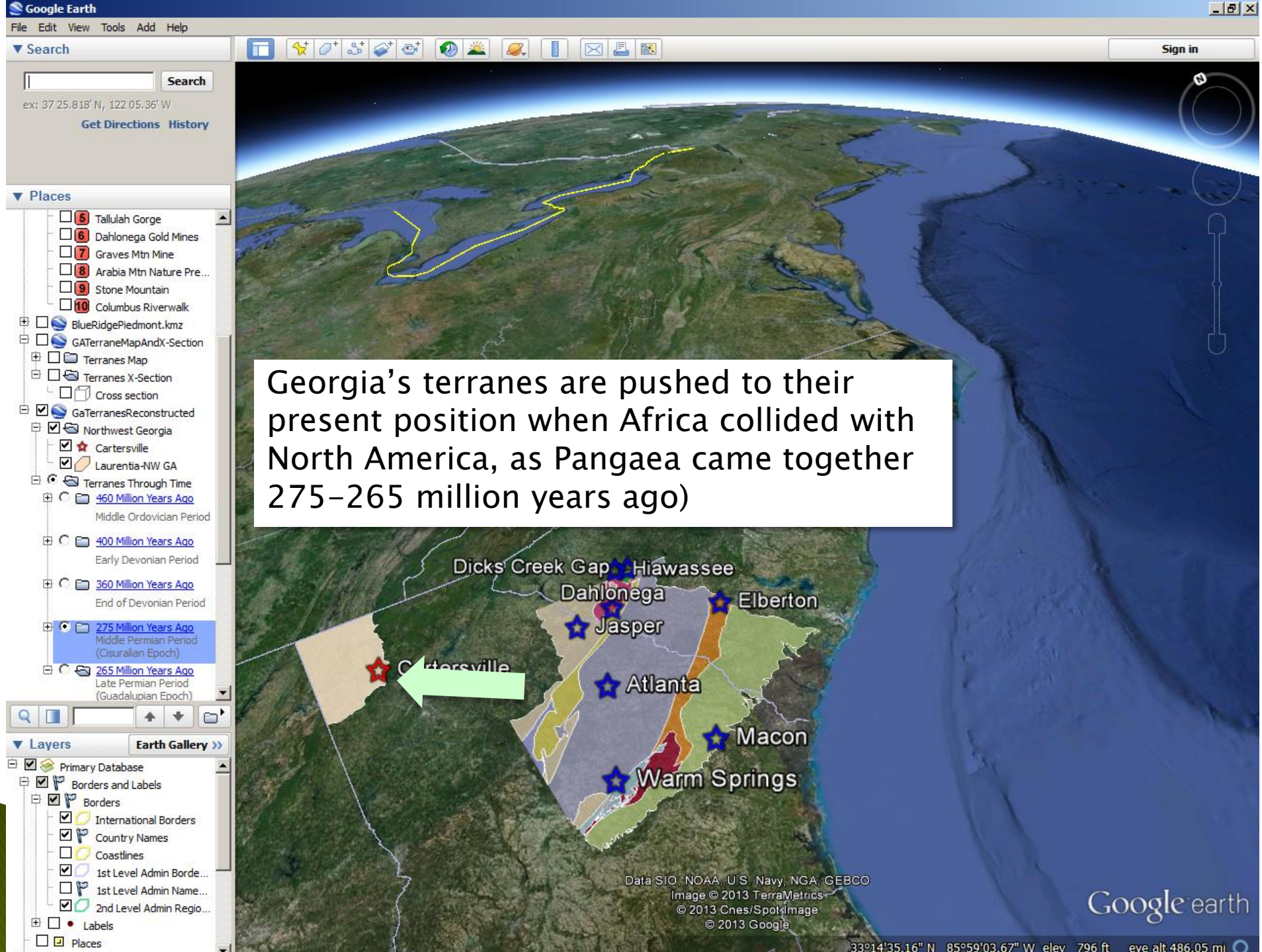
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Georgia's terranes are pushed to their present position when Africa collided with North America, as Pangaea came together 275-265 million years ago)
Dicks Creek Gap
Hiawassee
Dahlonega
Elberton
Jasper
Cartersville
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Macon
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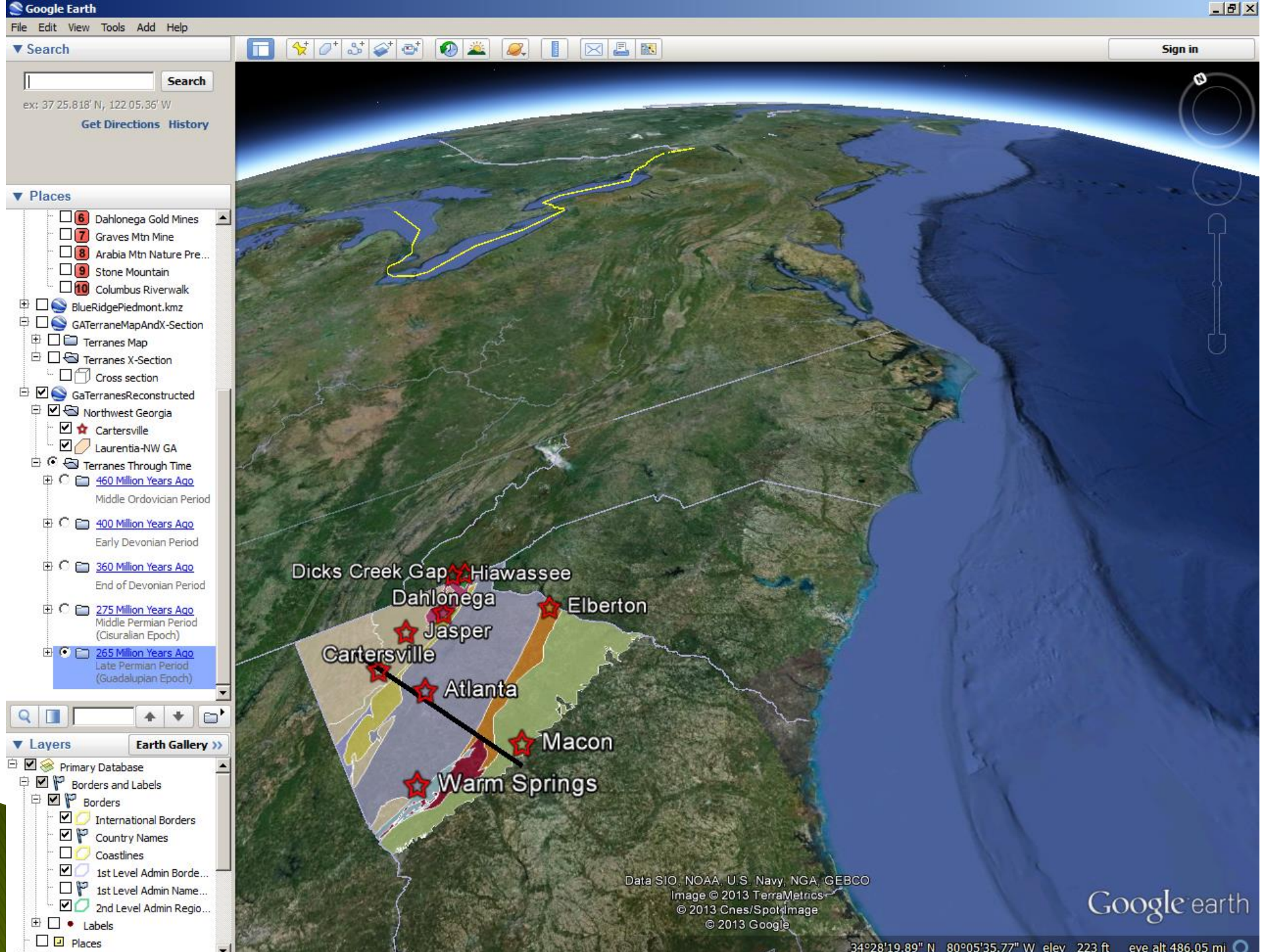
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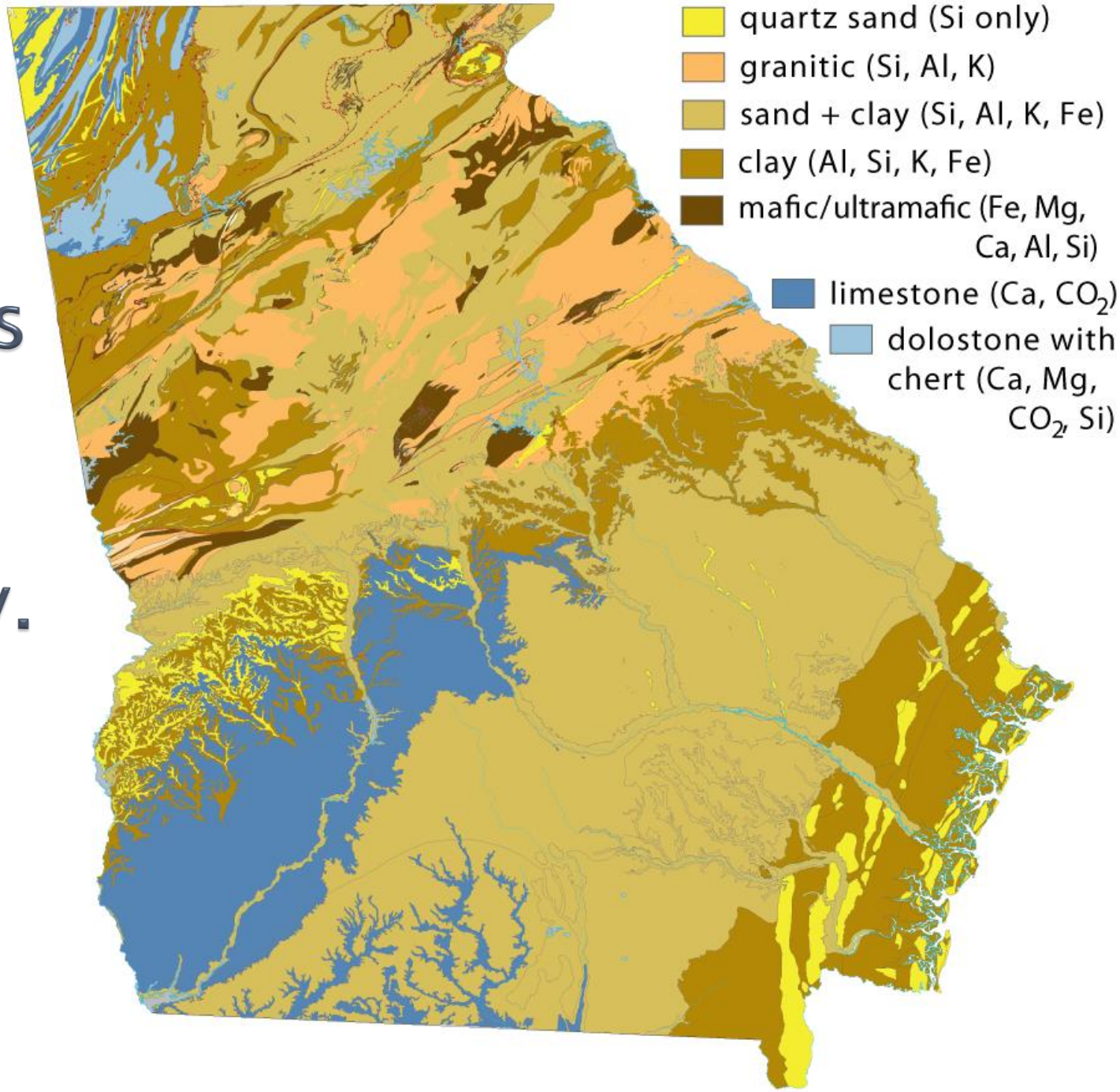
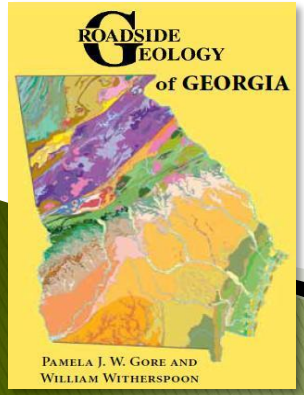
Geologic history influences soil and water chemistry.

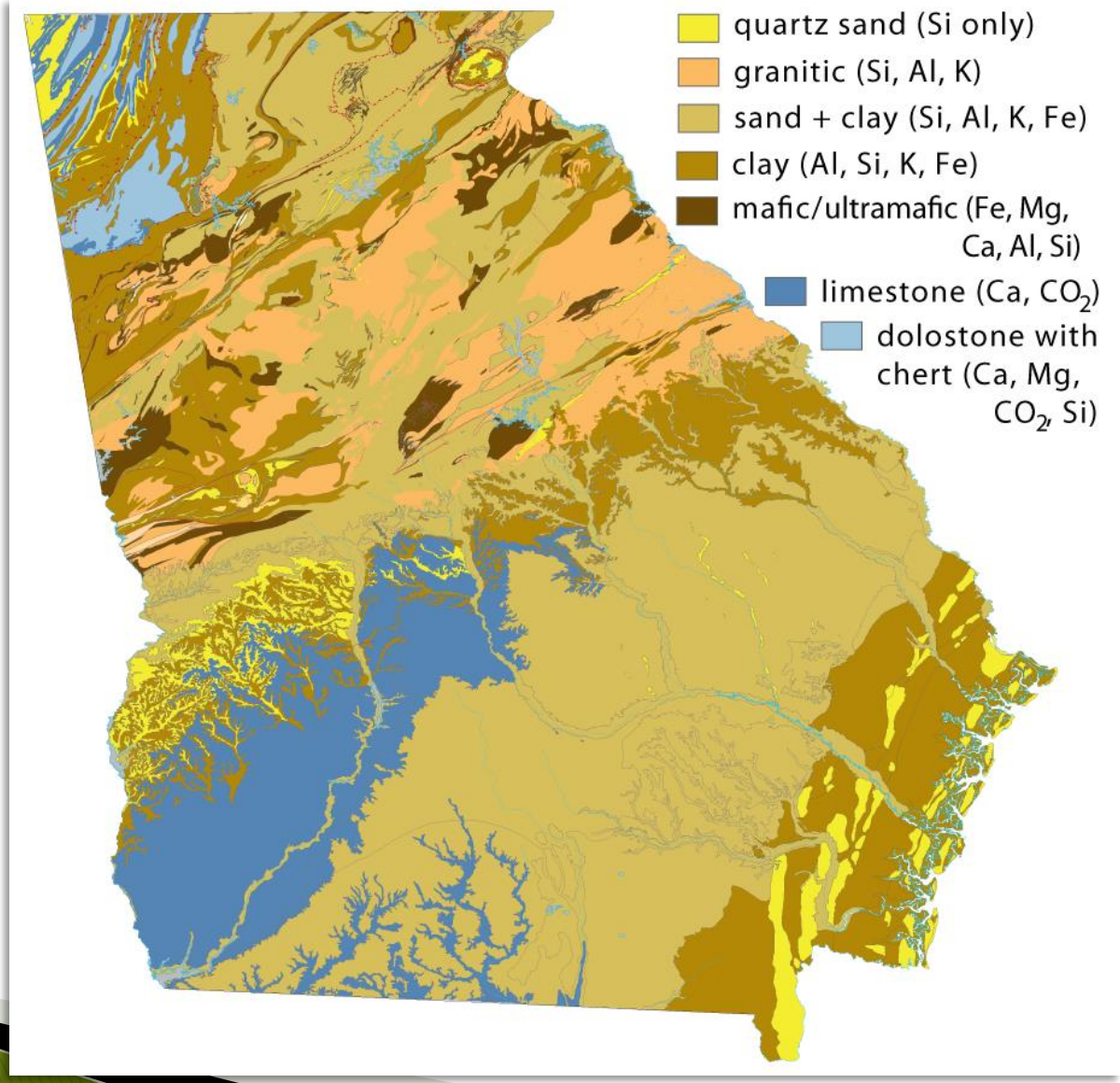




	Coastal Plain	Plateau/Valley & Ridge	Blue Ridge/Piedmont
	sand	sandstone	quartzite
		[dacite, rhyolite not found]	granite, granitic gneiss, metadacite, metarhyolite
	sand + clay (offshore)	[greywacke = “dirty sandstone” not found]	metagraywacke, biotite gneiss
	clay, mudstone	shale	slate, phyllite, schist
		[basalt, gabbro not found]	hornblende gneiss, amphibolite
	limestone	limestone	marble (rare)
		dolostone (->”chert and dirt”)	

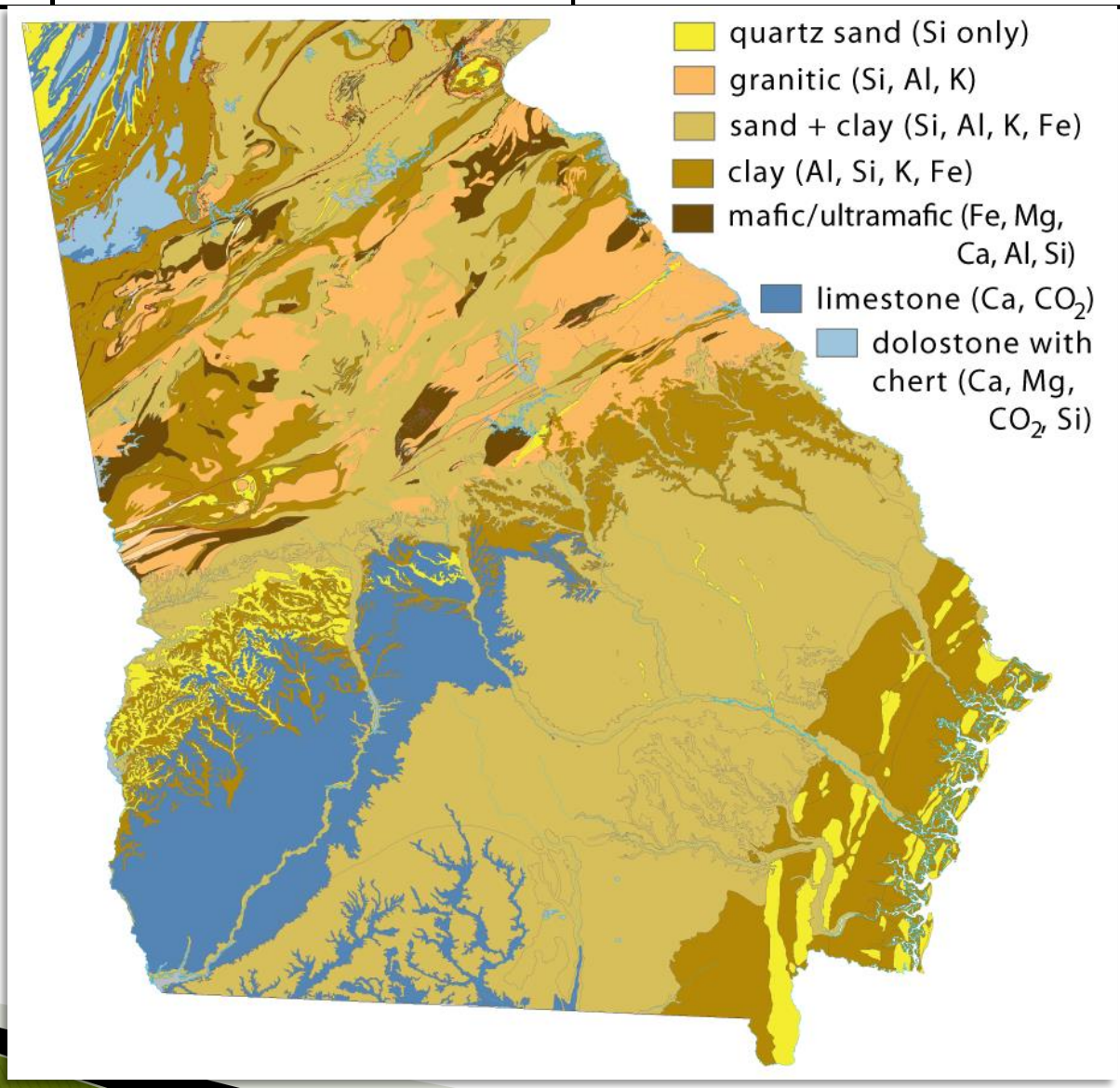
	Coastal Plain	Plateau/Valley & Ridge	Blue Ridge/Piedmont
	sand	sandstone	quartzite

Quartz is SiO_2 – no nutrients

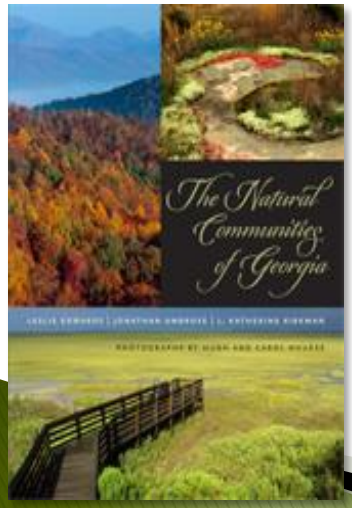


	Coastal Plain	Plateau/Valley & Ridge	Blue Ridge/Piedmont
		[dacite, rhyolite not found]	granite, granitic gneiss, metadacite, metarhyolite

Granite is 90%+ made of feldspar ((K, Na) $AlSi_3O_8$) and quartz

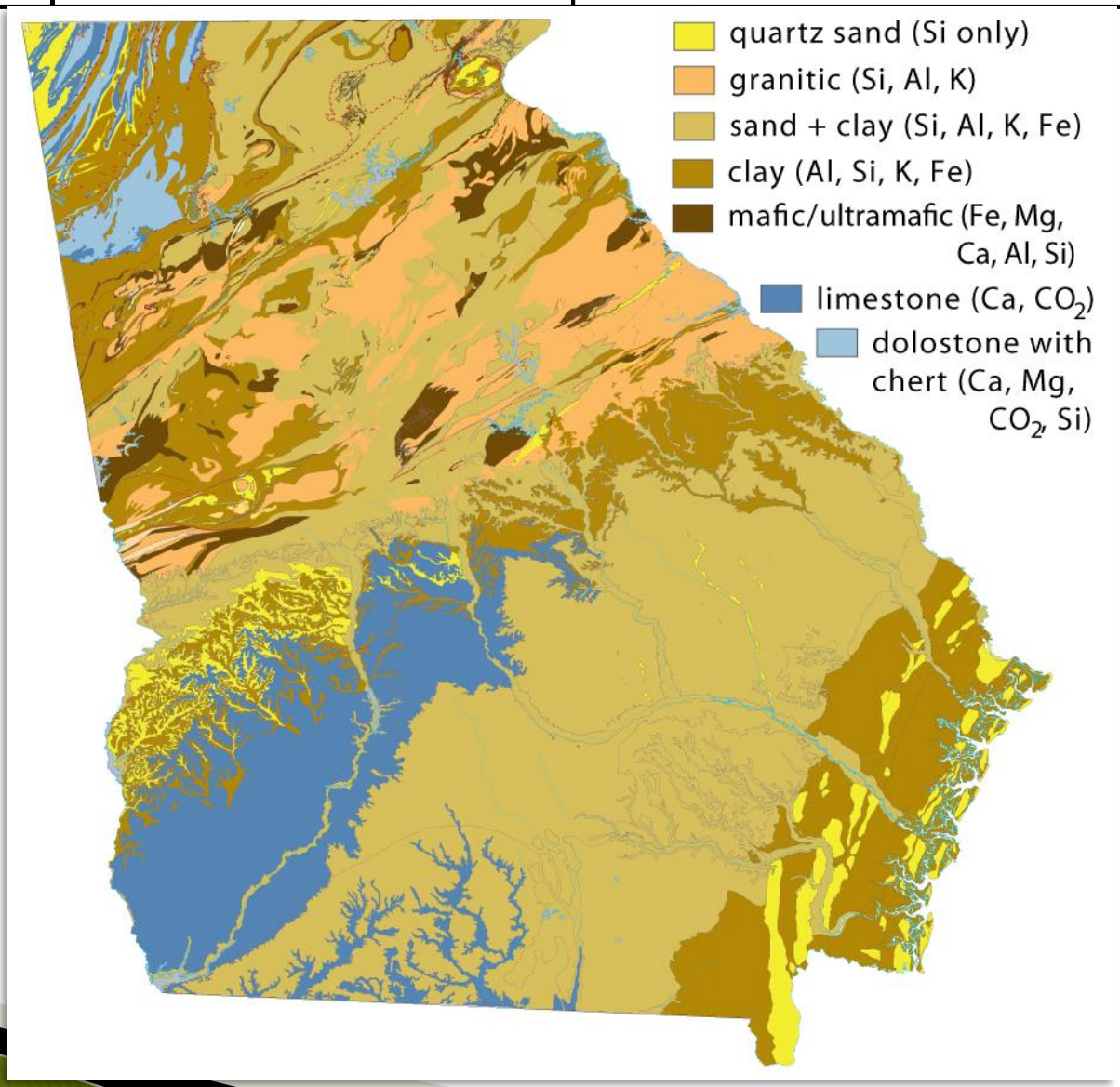


Heaths



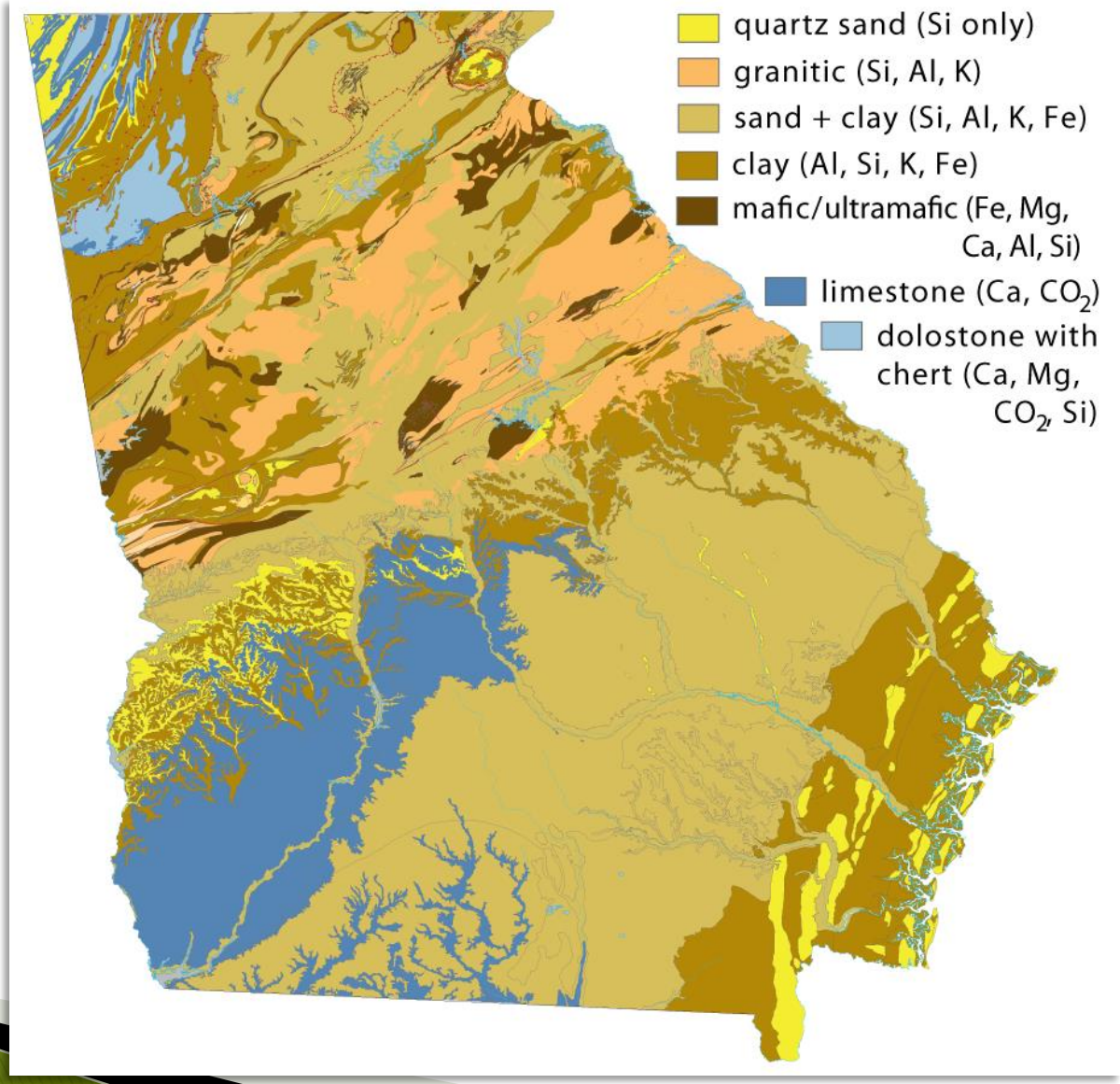
	Coastal Plain	Plateau/Valley & Ridge	Blue Ridge/Piedmont
	sand + clay (offshore)	[greywacke = “dirty sandstone” not found]	metagraywacke, biotite gneiss

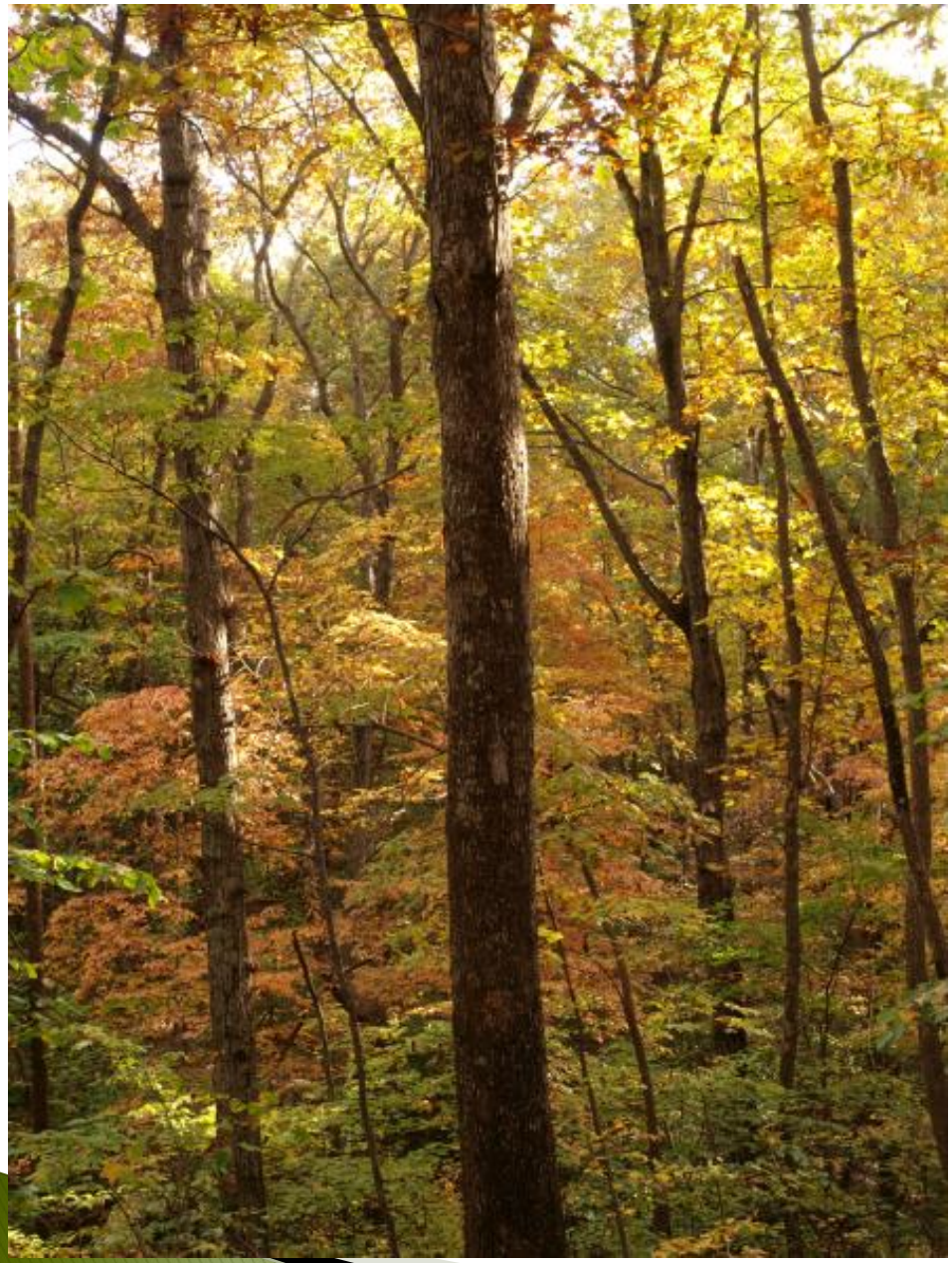
Deepwater setting around ancient terranes – dirty sand



	Coastal Plain	Plateau/Valley & Ridge	Blue Ridge/Piedmont
	clay, mudstone	shale	slate, phyllite, schist

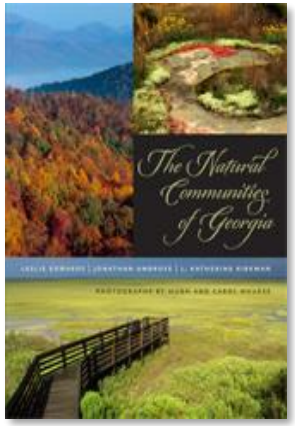
Clay dominates over sand in many ancient settings





The Al Si K and Fe Rocks

"Regular" soils of the Piedmont: somewhat acidic, more clay, more potassium, more iron.

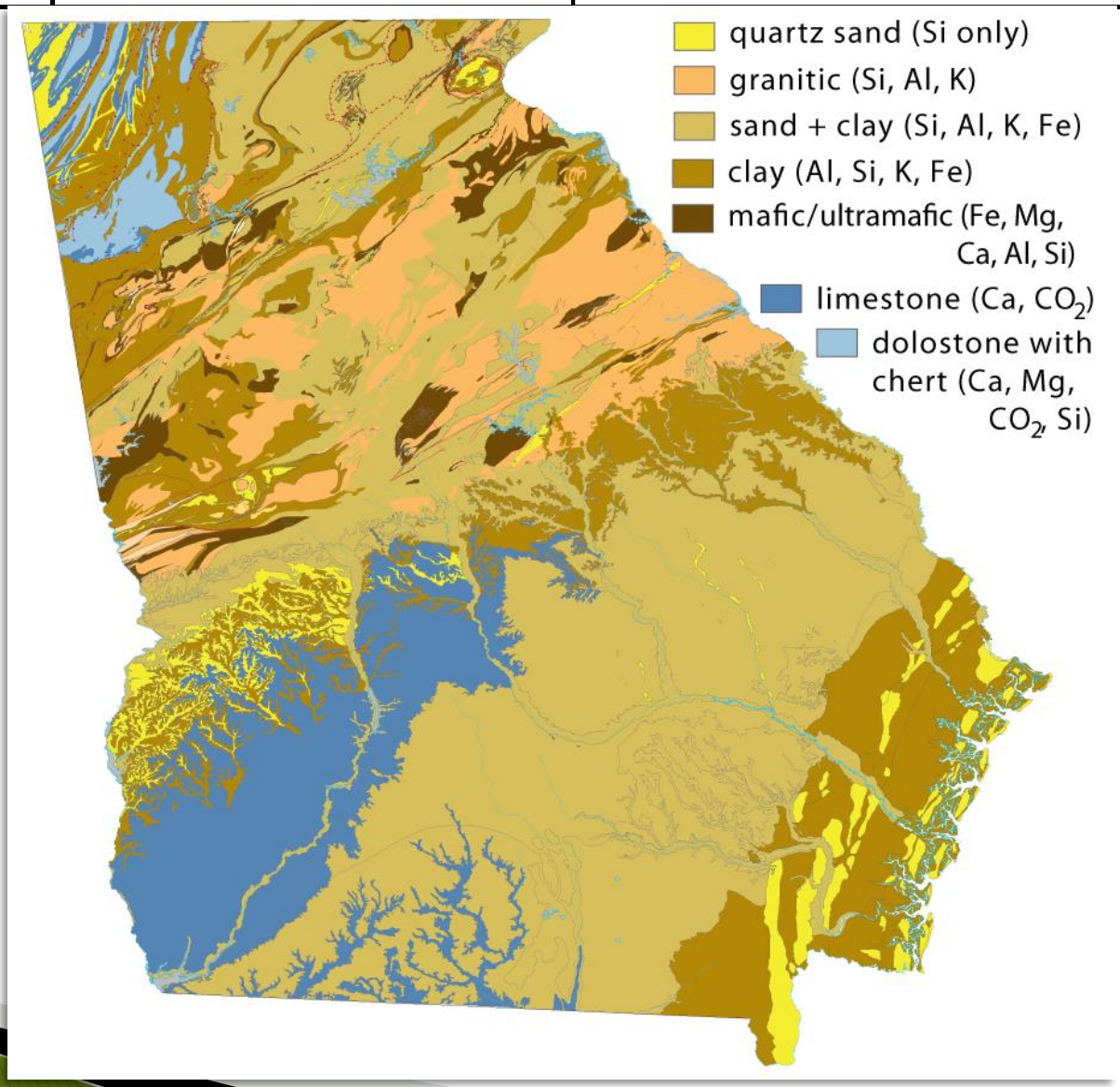


More water and nutrients means:

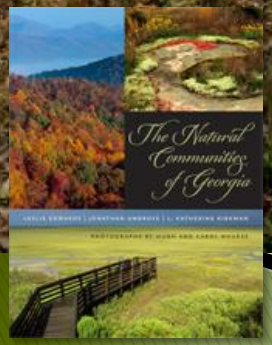
- More biomass (more plants)
- Bigger trees
- Larger leaves
- More biodiversity

	Coastal Plain	Plateau/Valley & Ridge	Blue Ridge/Piedmont
		[basalt, gabbro not found]	hornblende gneiss, amphibolite

Magma rising from mantle brought Mg, Fe, Ca up in deep ocean floor lavas



Mafic/base-rich soils: lots of iron, magnesium, and, often calcium.



"Circumneutral"
"Calcareous"
"Mafic"

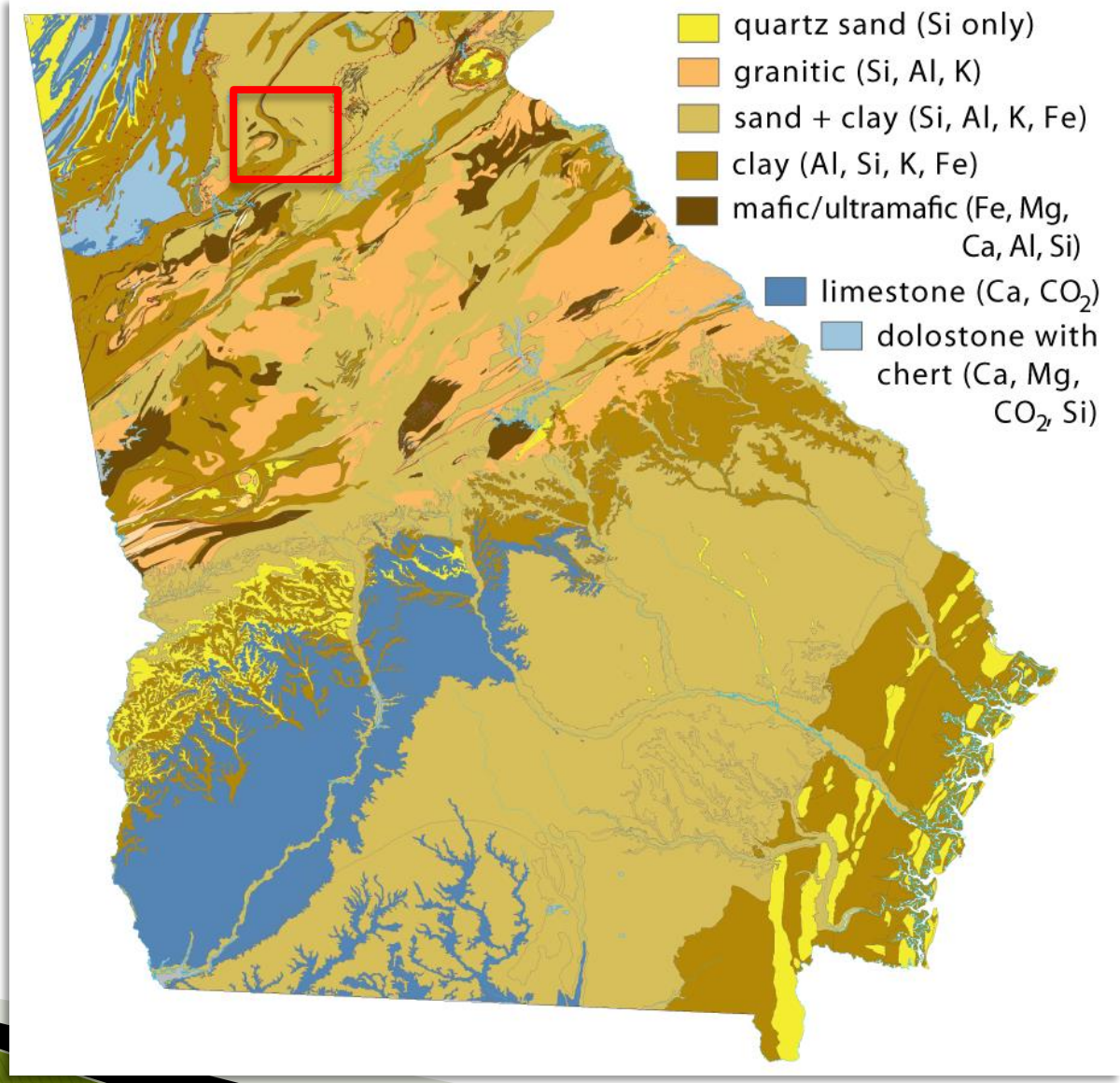
Notable change in plant assemblages within natural communities (sometimes whole new communities)

Trees

Chalk maple
Southern sugar
Hickories
Elms
Ashes
Redbuds
Hawthorns
Hackberries
Cedar
Basswood (upslope)
Ironwood (American hophorn-beam)

	Coastal Plain	Plateau/Valley & Ridge	Blue Ridge/Piedmont
	limestone	limestone	marble (rare)

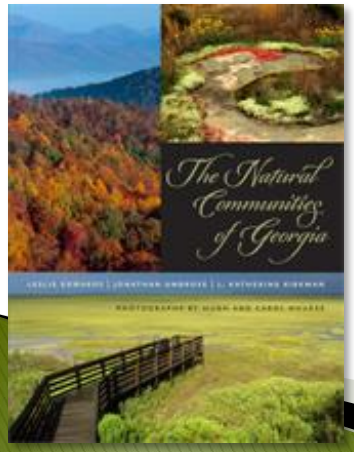
Limestone uncommon in deep water, so rare in Blue Ridge-Piedmont



	Coastal Plain	Plateau/Valley & Ridge	Blue Ridge/Piedmont
	limestone	limestone	marble (rare)

Marble quarry area has calcareous soils more typical of NW or S Georgia

Somewhat calcareous soils (often near concrete)



EPA United States Environmental Protection Agency

Office of Water

Monitoring Water Quality

Geology and Adopt A Stream parameters

5.9 Conductivity

"Conductivity in streams and rivers is affected primarily by the geology of the area through which the water flows. Streams that run through areas with granite bedrock tend to have lower conductivity because granite is composed of more inert materials that do not ionize (dissolve into ionic components) when washed into the water."

Adopt-A-Stream | Confluence | Citizen Monitoring | Data Views | Data Entry | Materials & Resources | Contact us | Sign In

Watershed: Etowah River | View: Sites, Graphs, Map | **46 Watersheds have monitoring events.**

Show ☑ List ☑ Graphs ☑ Map | Save to Excel

1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 All years

Watershed: Etowah River | 45 Sites

#	G
1	Ball Lake
2	Blanket's Creek Project
3	Butler Creek Kennesaw
4	Cass High APES
5	Creek Chimps
6	Devereux Georgia Trea
7	Emerson Unitarian Univ
8	Ford Elementary
9	GA Lake Monitoring
10	GA Lake Monitoring
11	GA Lake Monitoring

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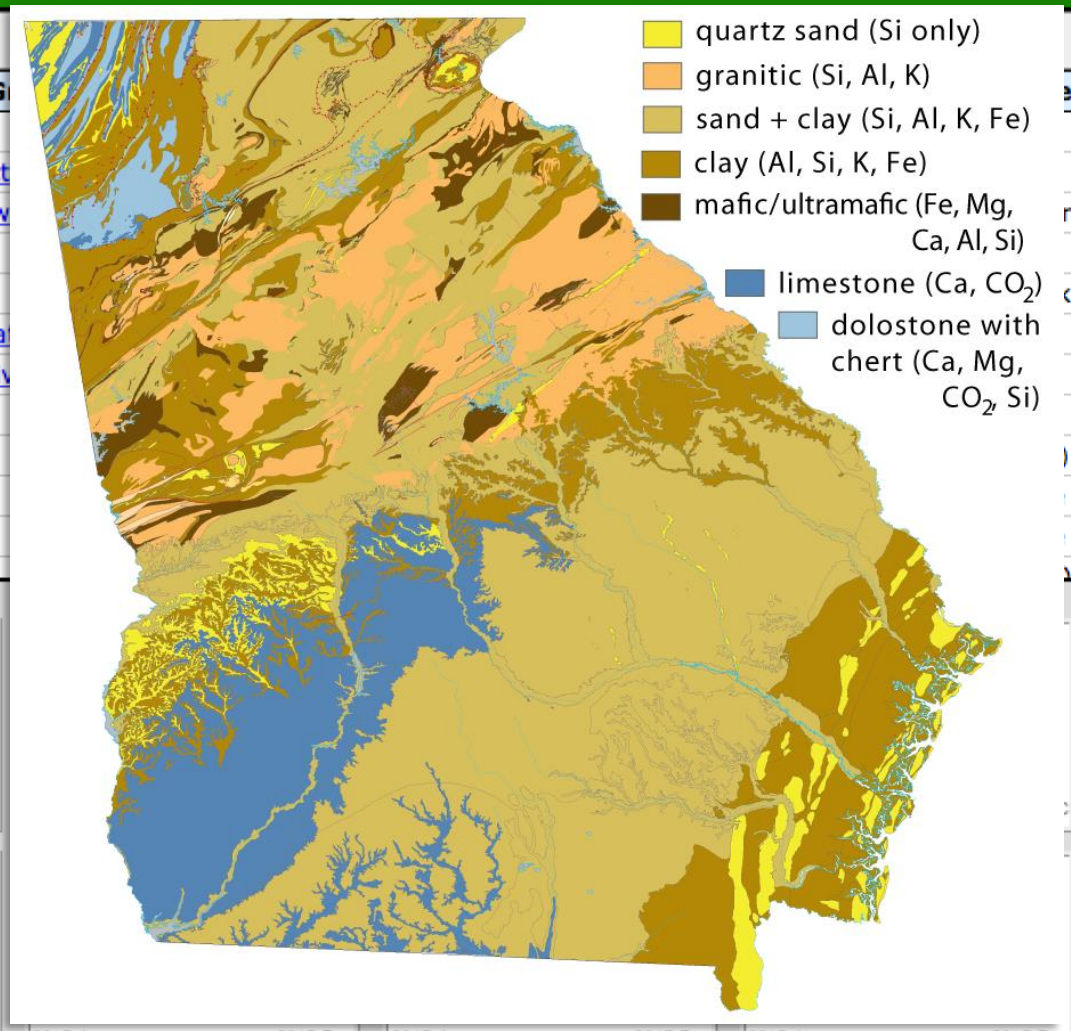
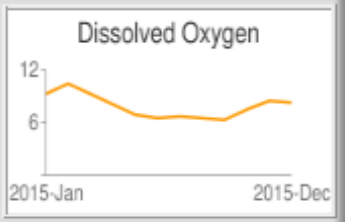
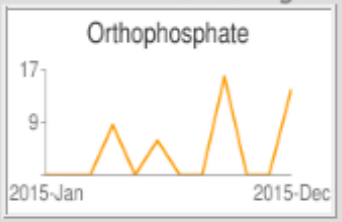
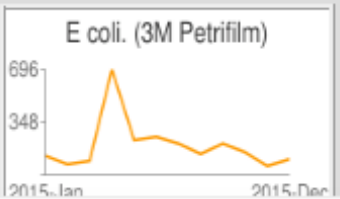
Park)
Boat Launch)



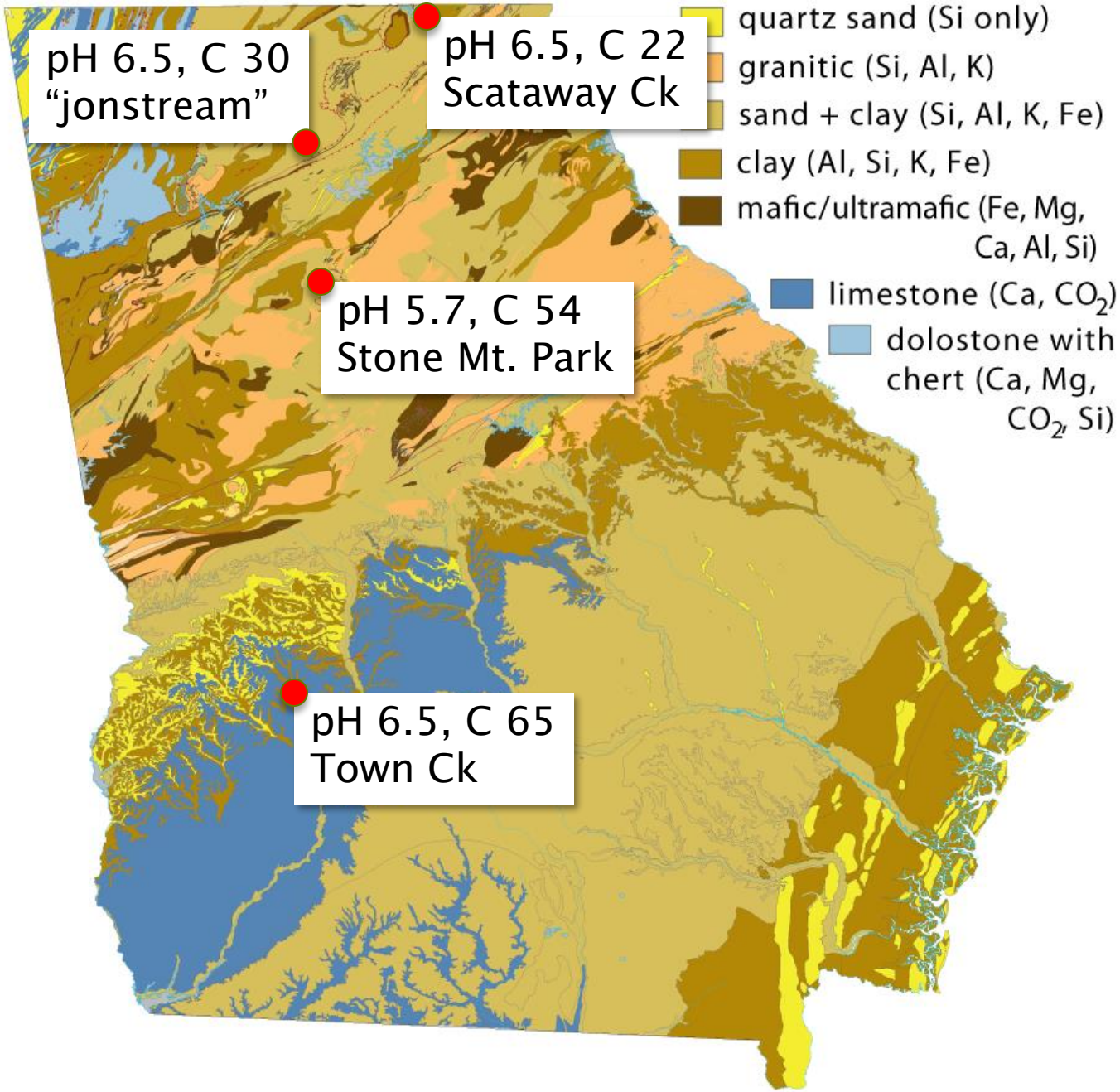
244 monitoring events





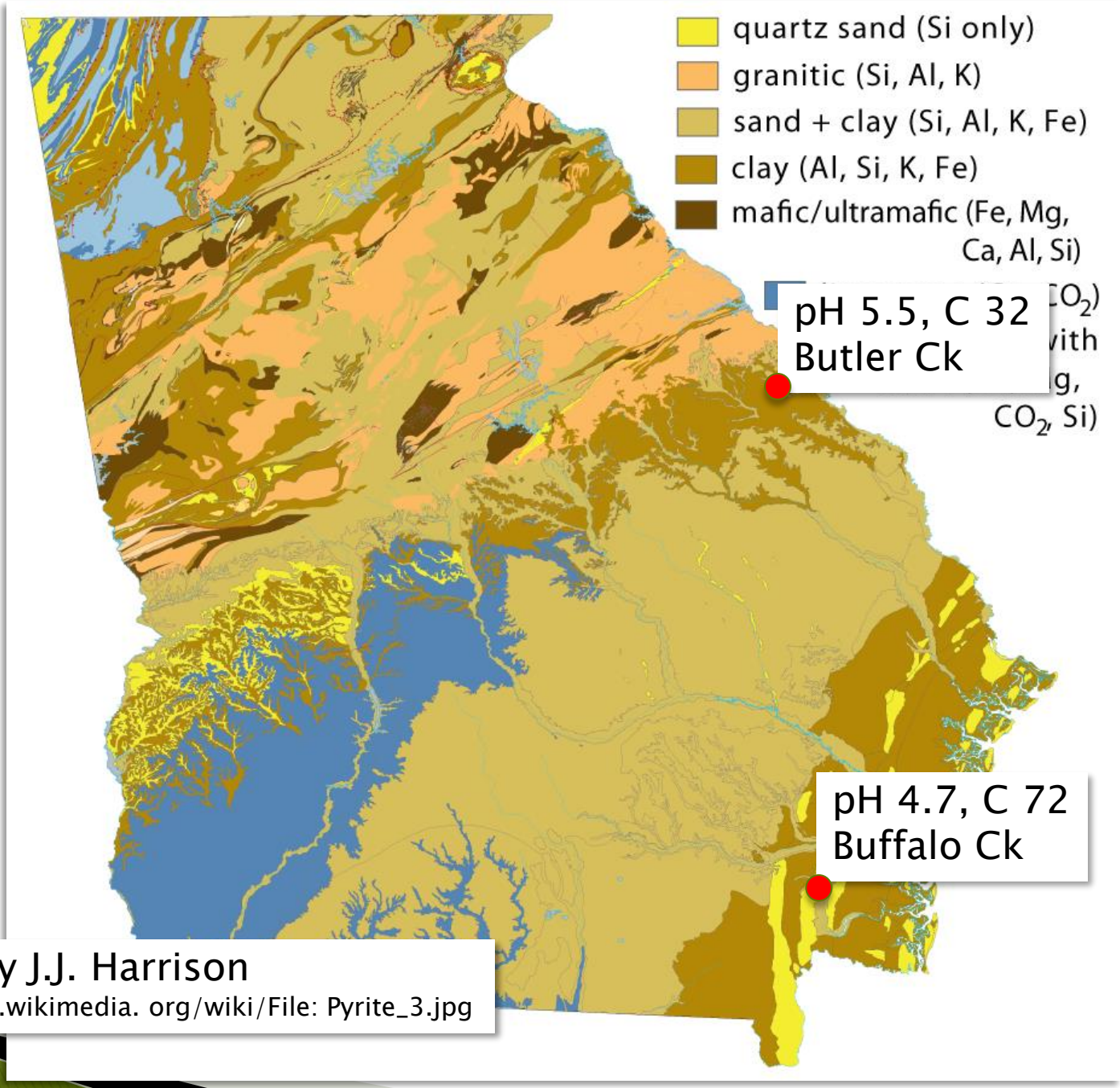


Lowest conductivity and sediment load: runoff from granitic & sand-dominated rocks

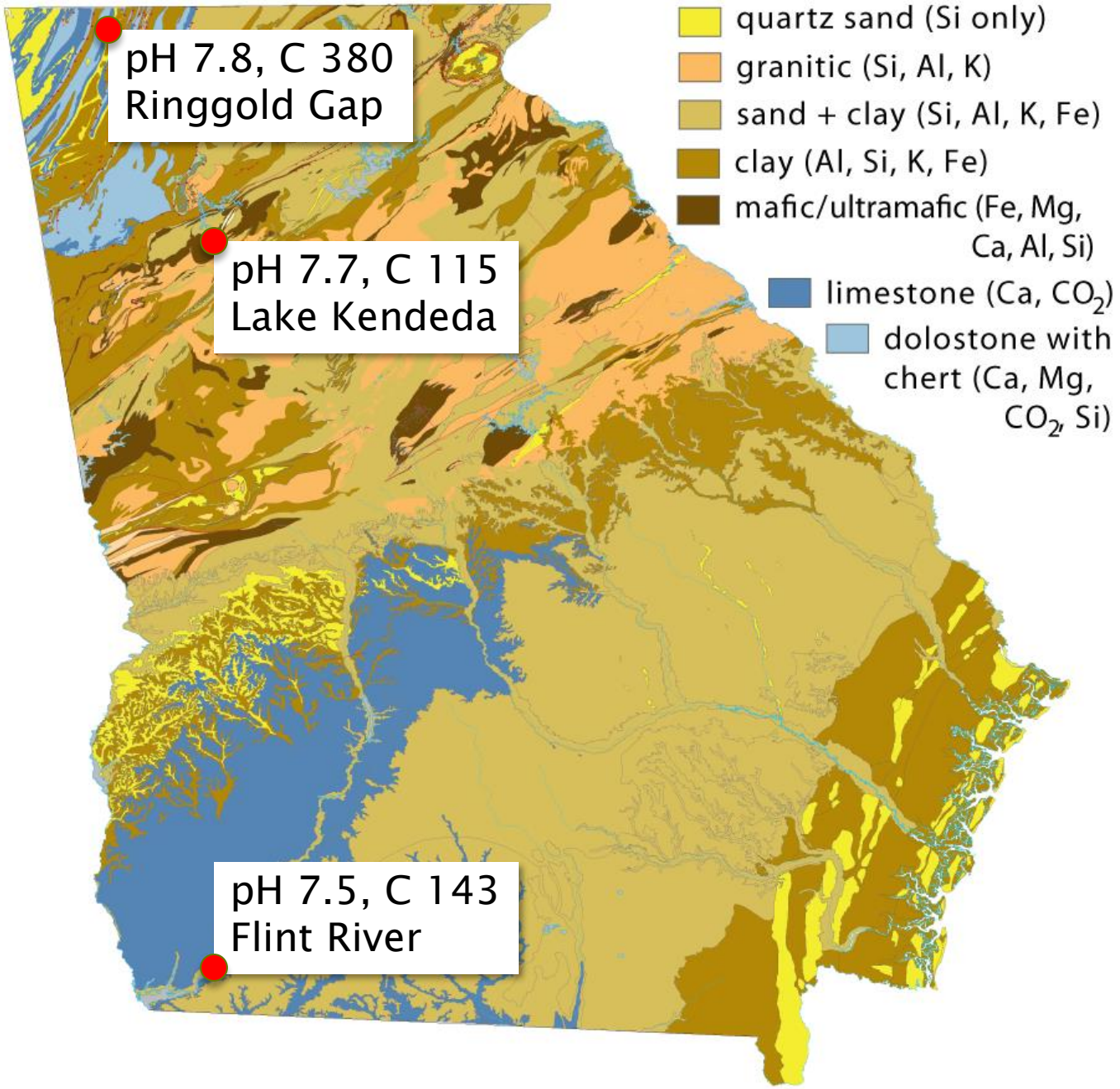


Lowest pH: organic matter in present or past; most often clay-dominated

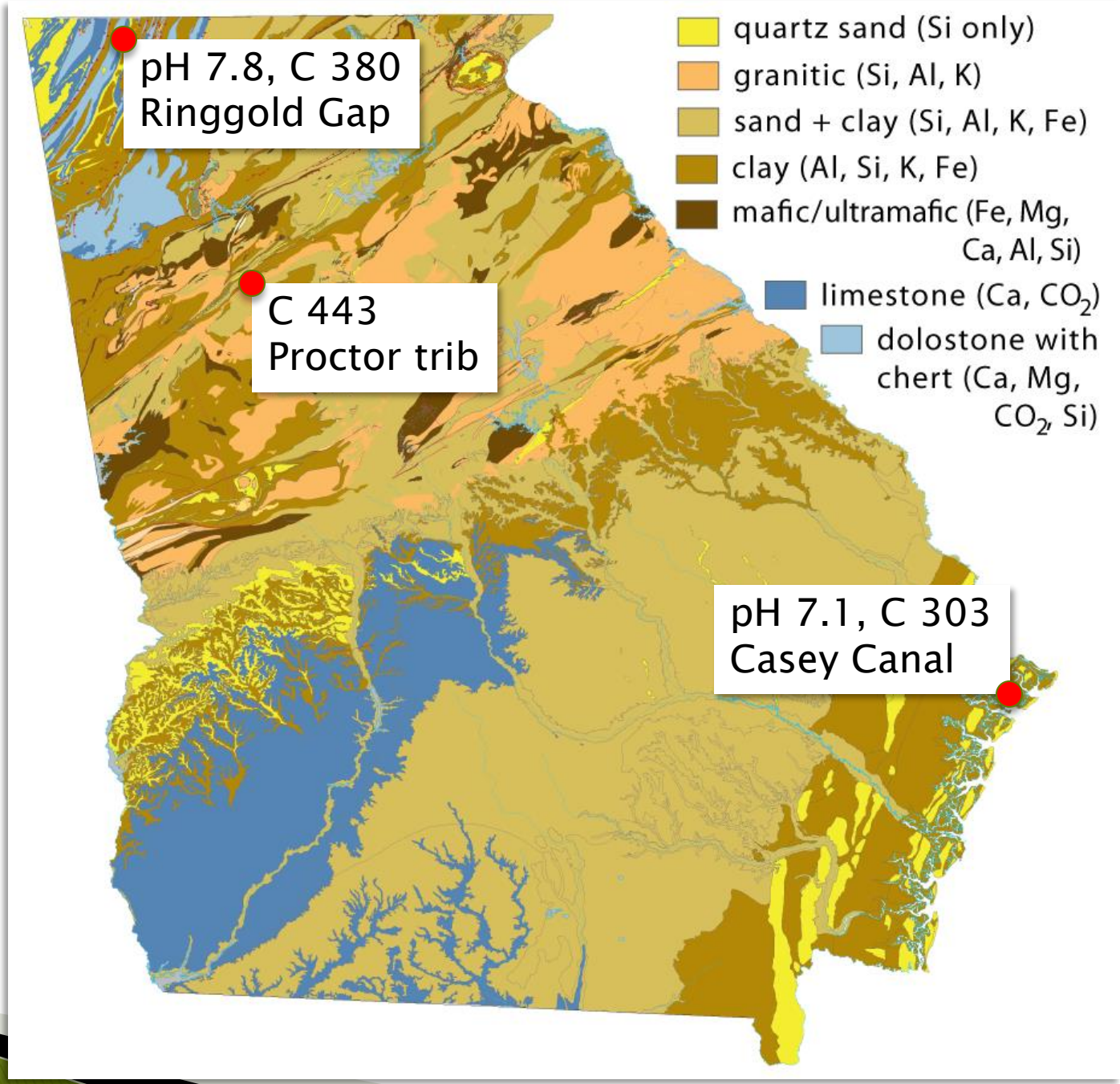
"Pyrite 3" by J.J. Harrison
http://commons.wikimedia. org/wiki/File: Pyrite_3.jpg

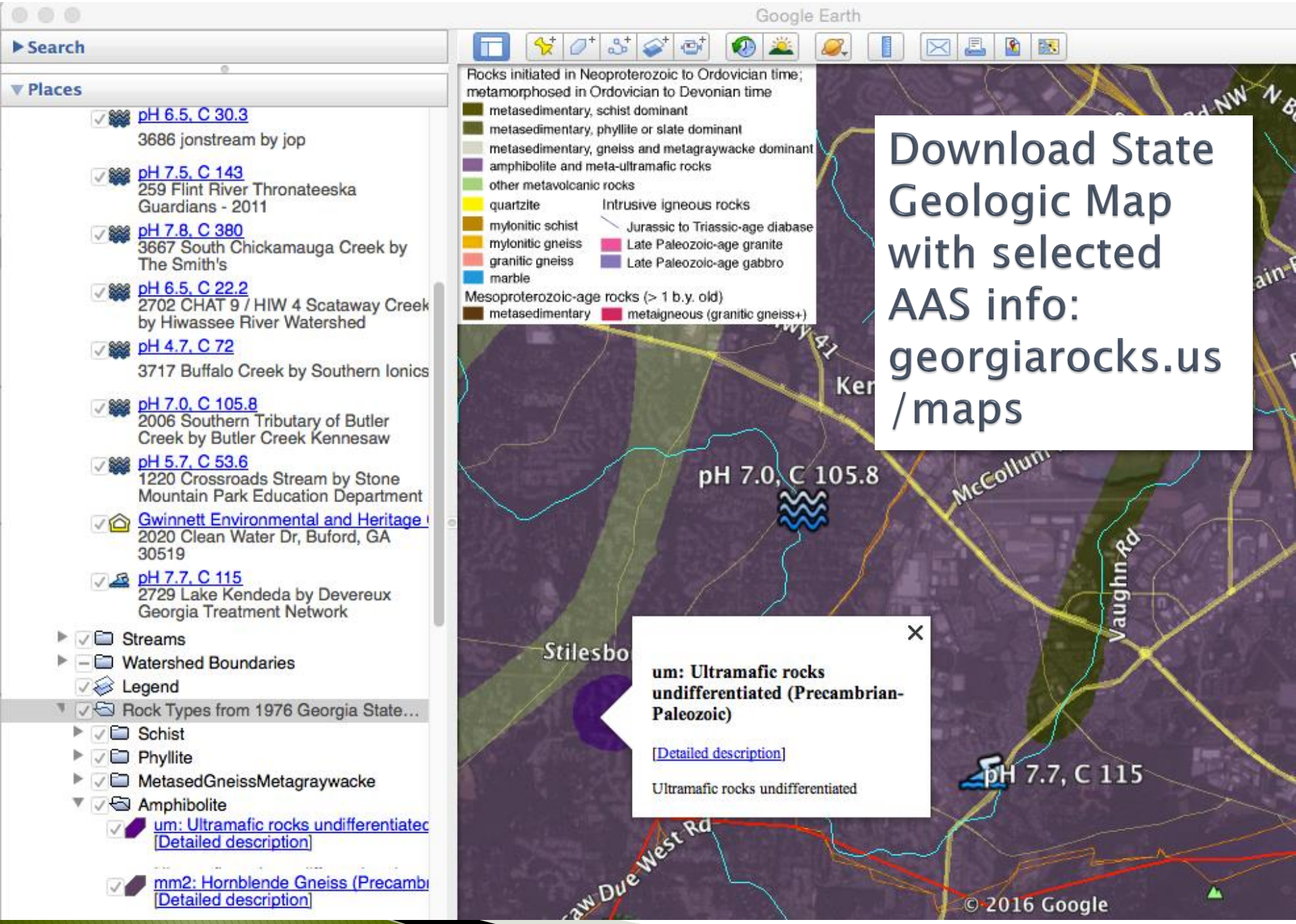


Highest pH: runoff from limestone/ dolostone or mafic rocks



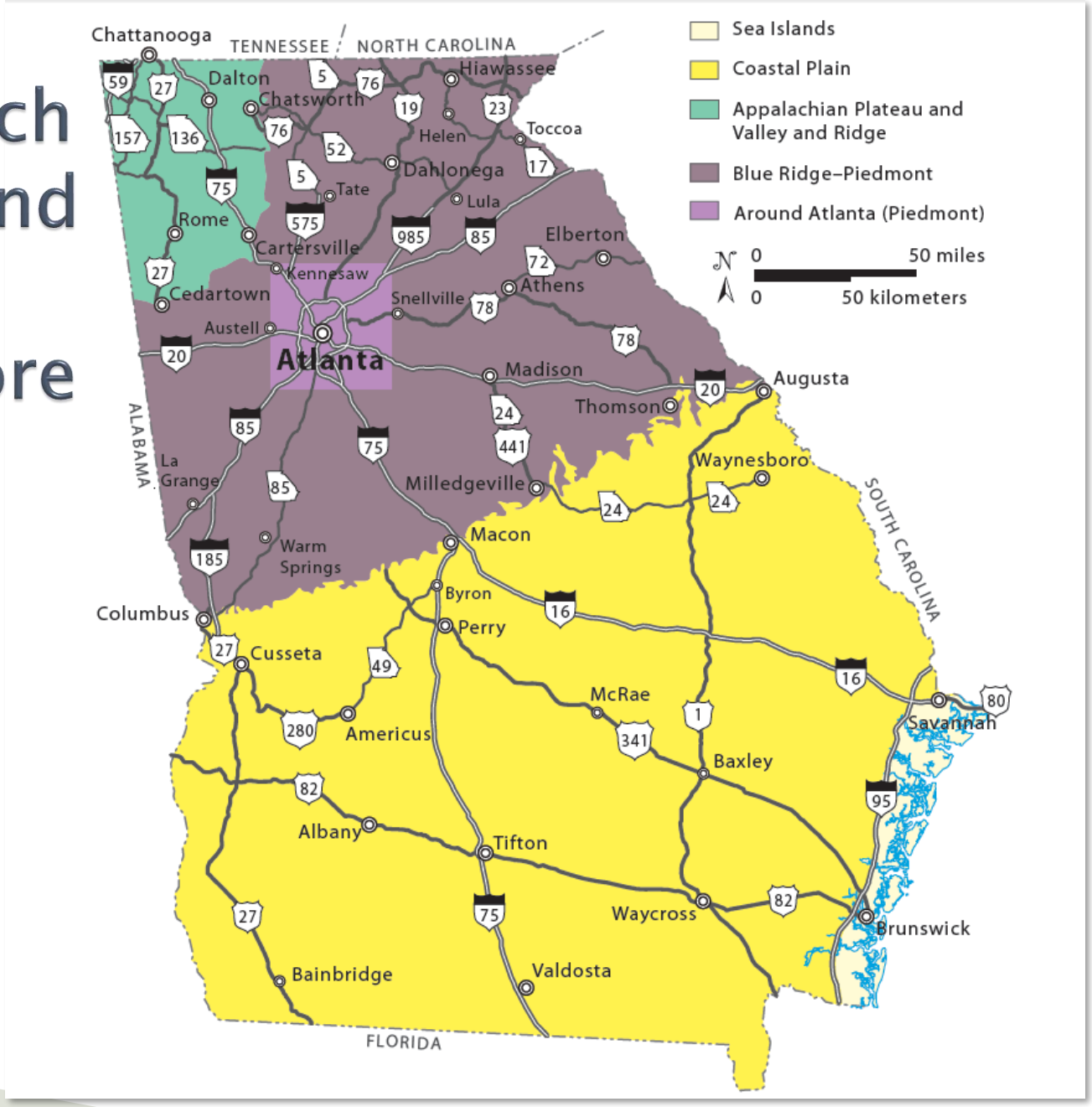
Highest conductivity: same as high pH OR saline OR polluted

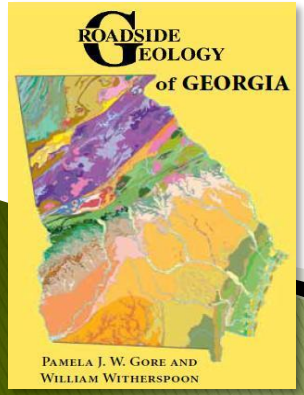




Download State Geologic Map with selected AAS info: georgiarocks.us/maps

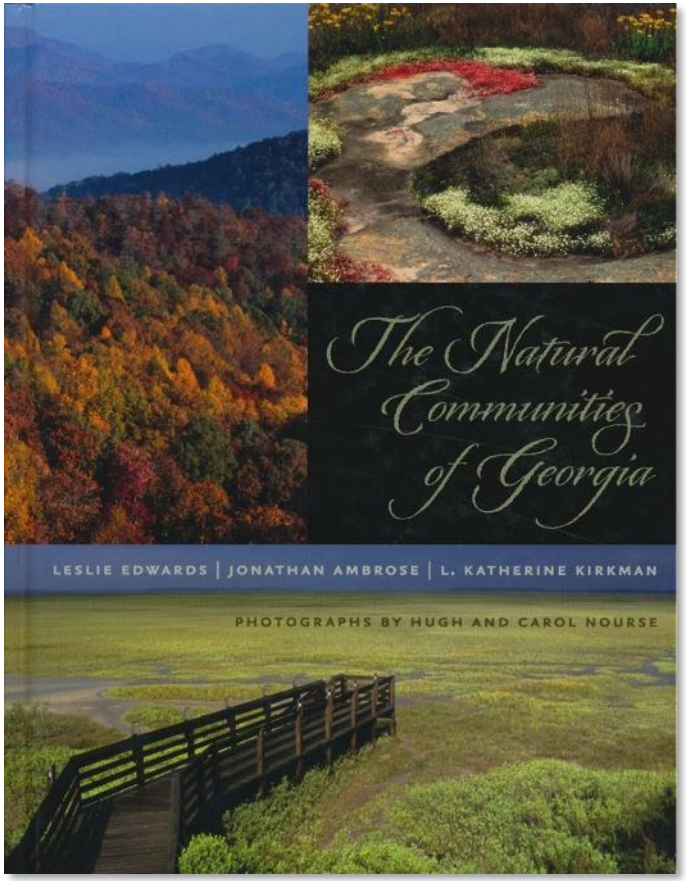
There is much variety around Atlanta, but so much more throughout Georgia. Enjoy!



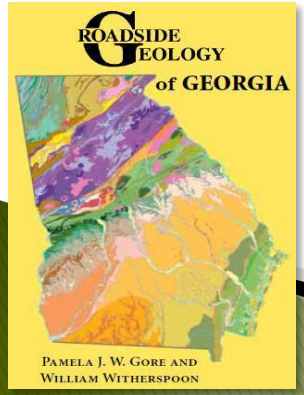


The Natural Communities of Georgia

co-authors:
Jon Ambrose,DNR Chief, non-game conservation
Kay Kirkman, scientist, Jones Center
Photographs: Hugh and Carol Nourse



Many thanks to Roadside Geology of Georgia first author Dr. Pamela Gore, professor at Georgia Perimeter College

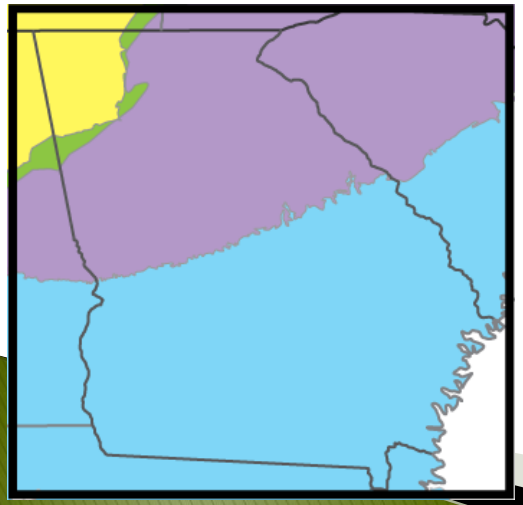


georgiarocks.us/events

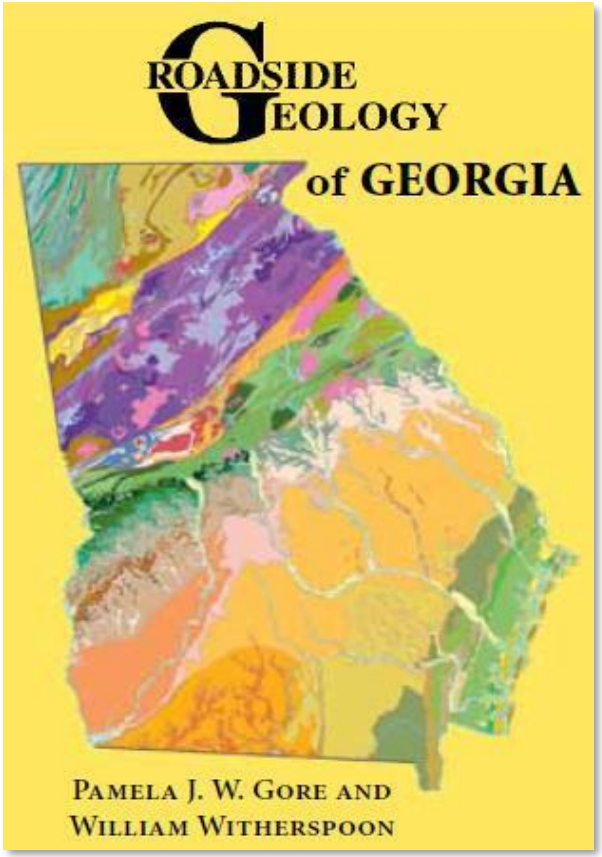
- Midtown walk Mar. 16 &19
- Johns Mountain/Keown Falls walk Apr. 27

Kids Rock! (~~$15~~ as reward for Great Outcrop Hunt)

- Learn your local rocks and minerals
- Four editions depend on region of state



GRANITE Shade: light Pattern: spotted	**GNEISS** Shade: light to medium Pattern: striped
QUARTZ (MINERAL) Shade: light Pattern: none Shine: glassy or milky	**AMPHIBOLITE** Shade: dark Pattern: none, or striped
SCHIST Shade: medium Pattern: layered Shine: glittery Color: gold or silver	learning game Start by placing all five stones here don't peek at the secret number order until all stones are placed! georgiarocks.us/games

Roadside Geology of Georgia ($24)

- georgiarocks.us includes maps, teacher resources, event calendar, and more
- Walks & talks e-newsletter – no more often than once a month