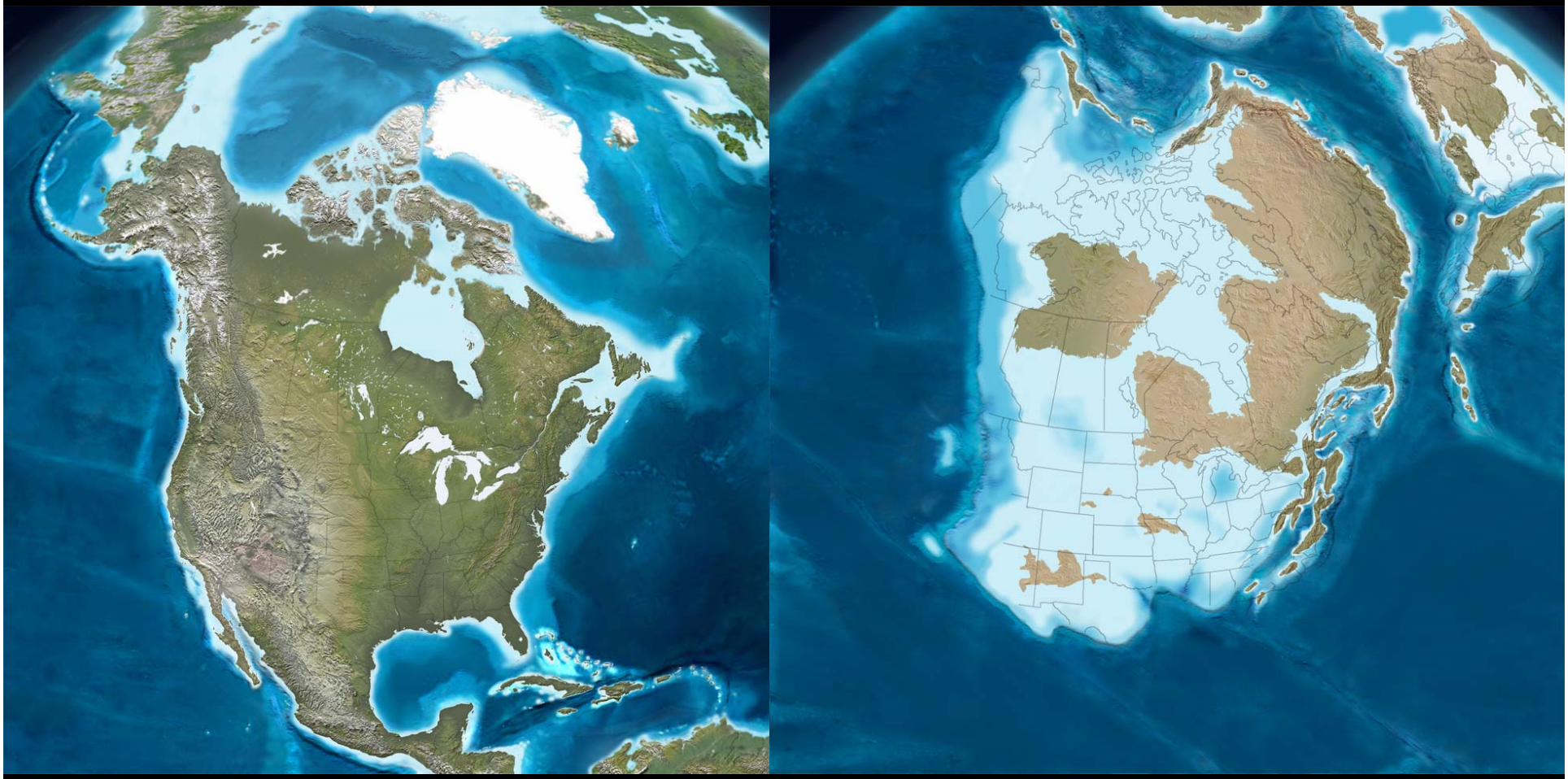
4.0 Billion Years of Earth Environmental Change

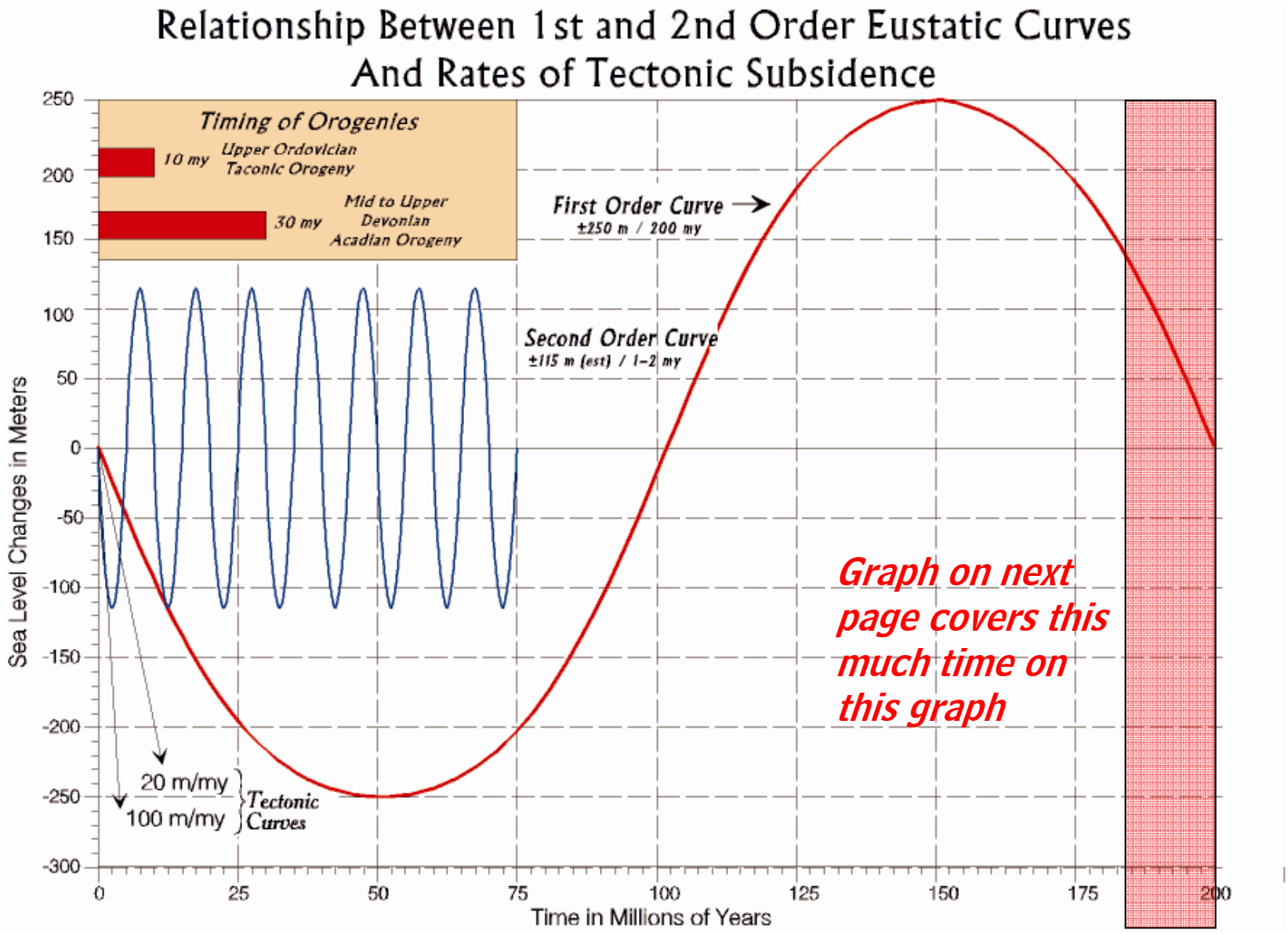
Sea Levels

Sea Level is Always Changing

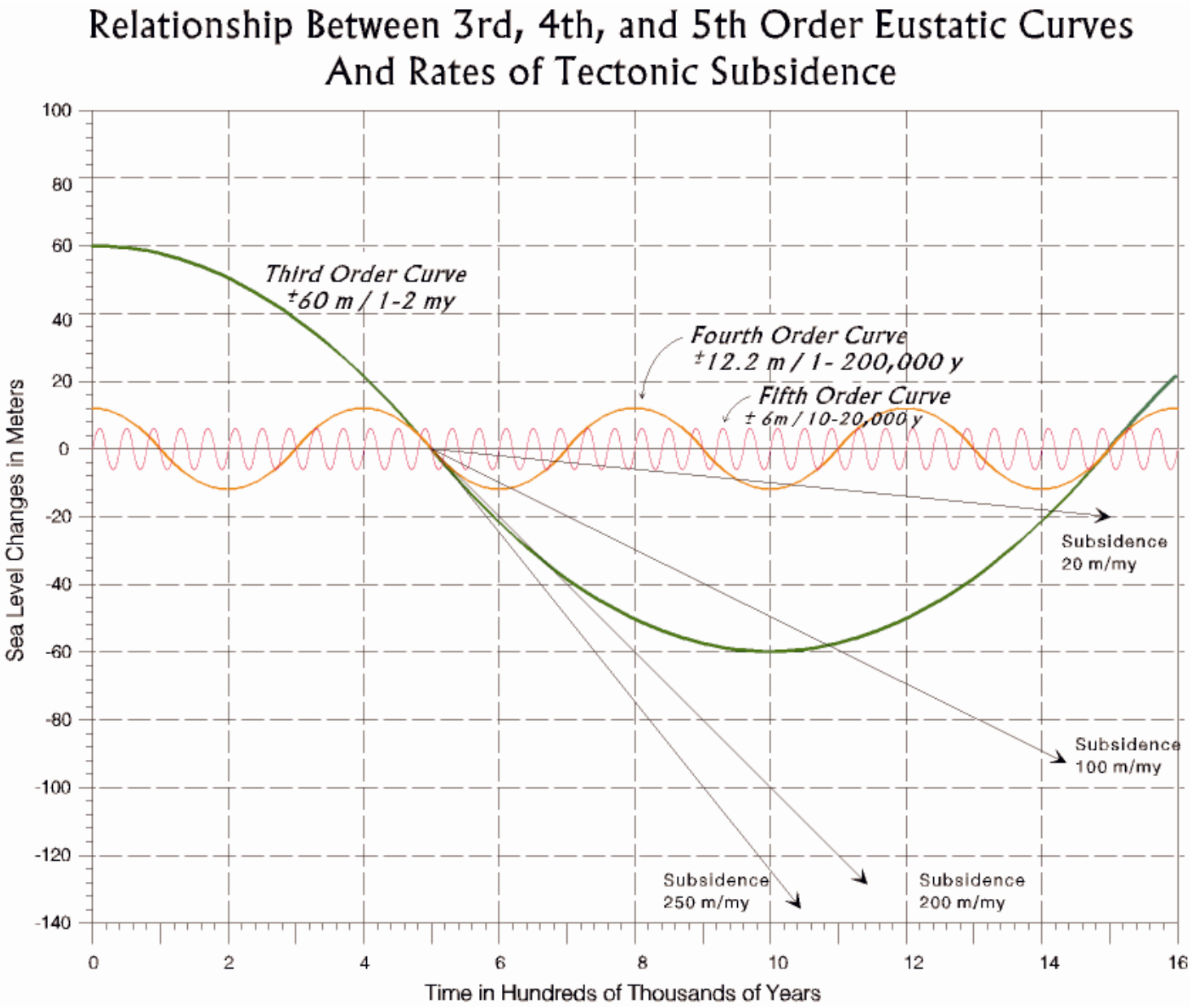


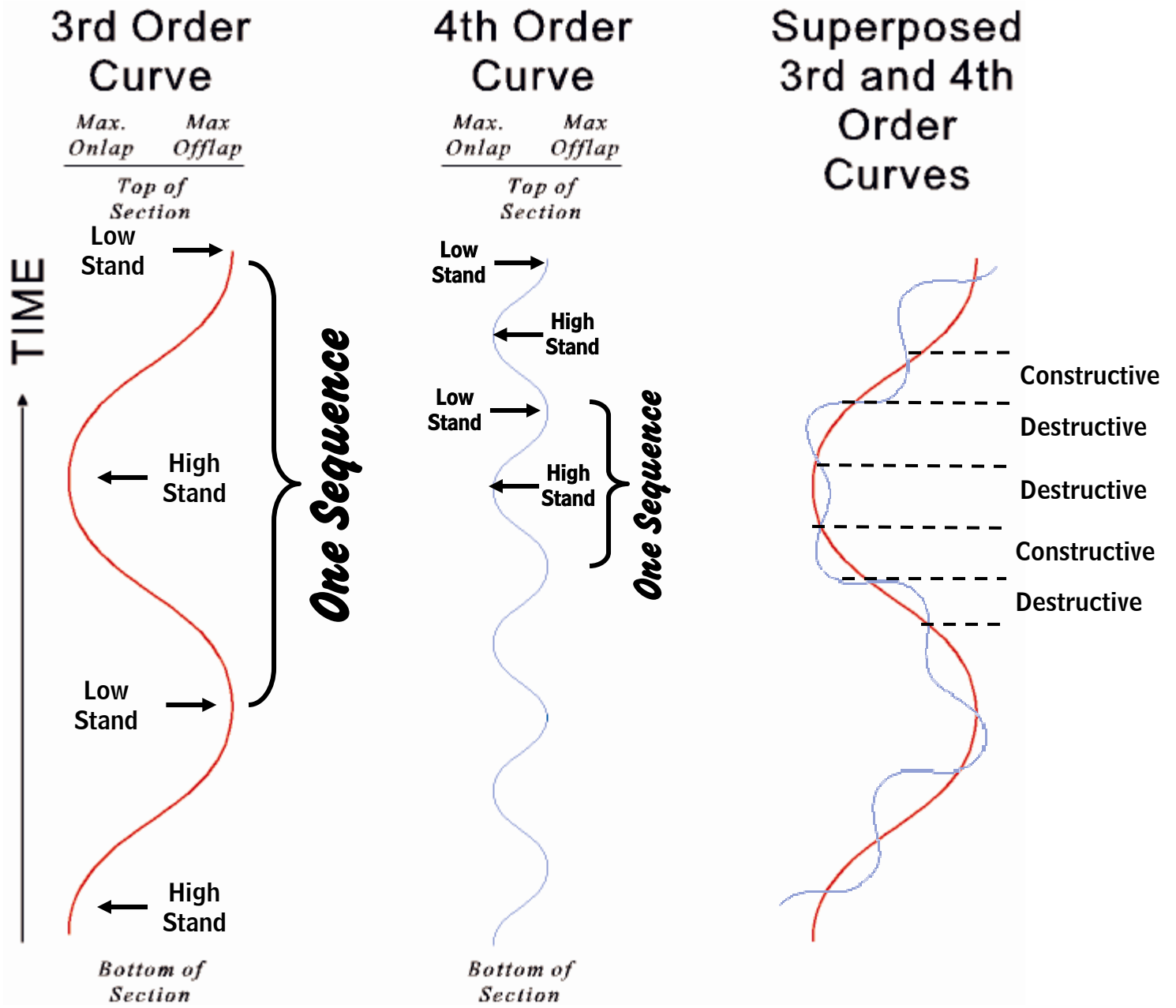
Both land life and marine life is affected by these changes.

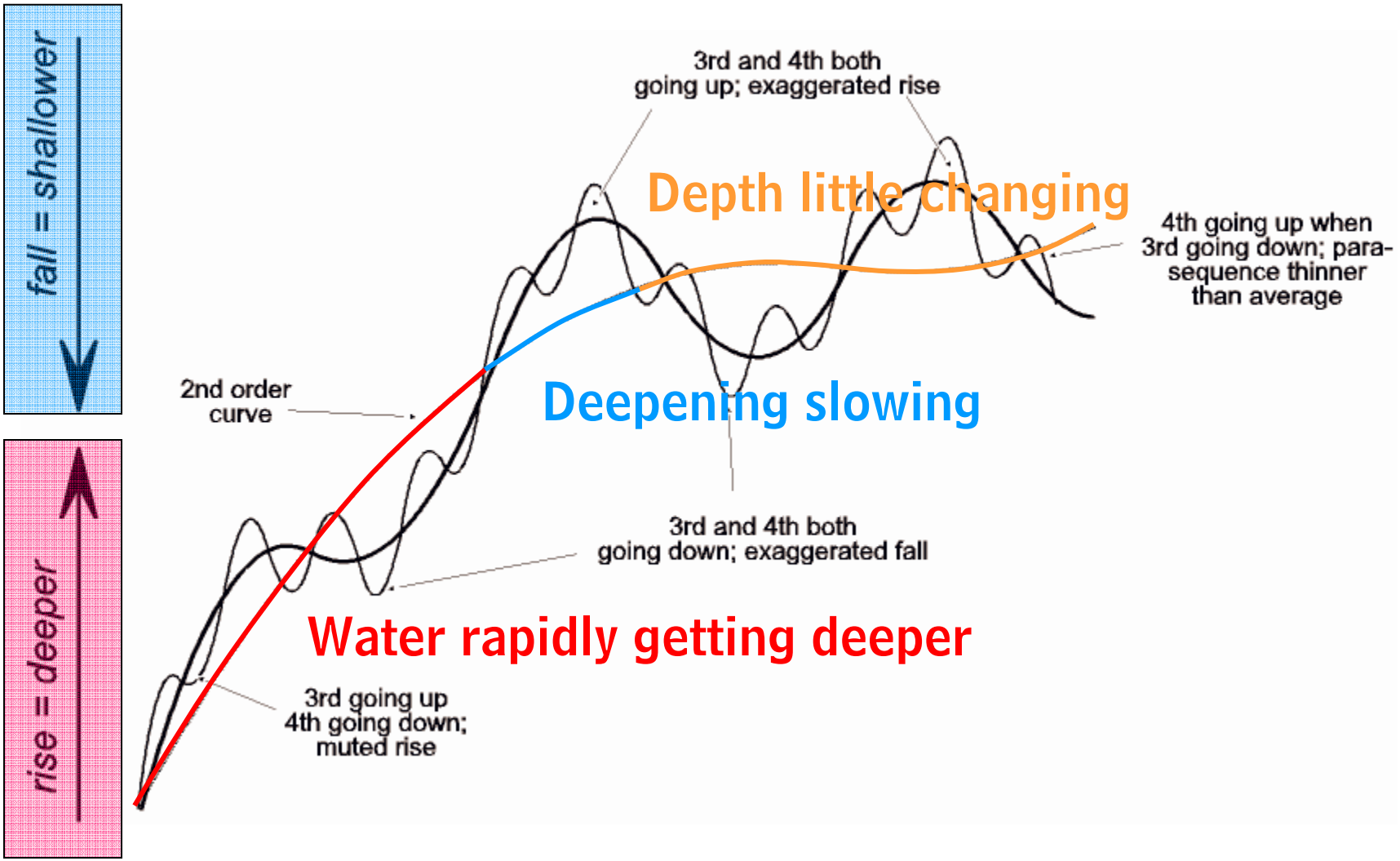
Sea Level Orders

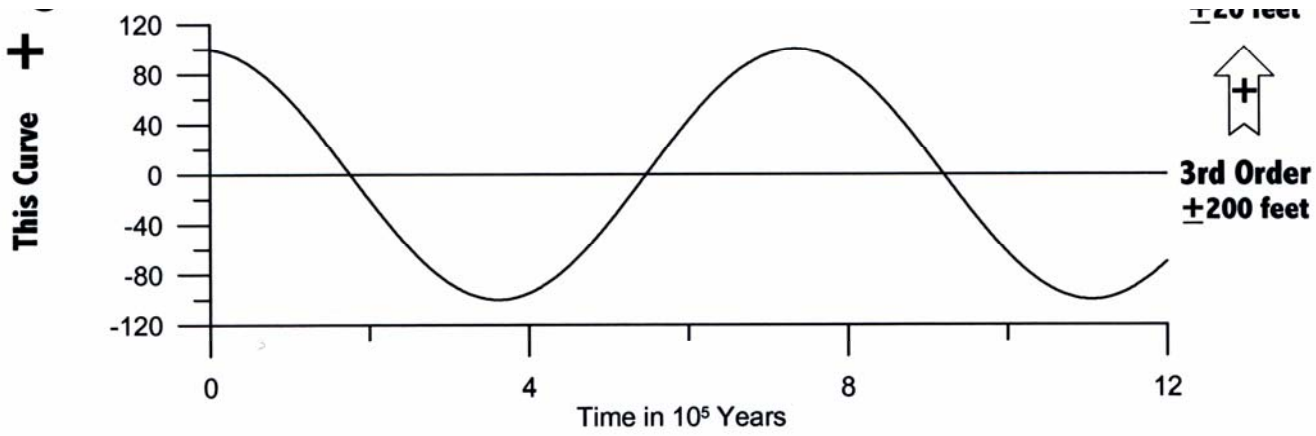


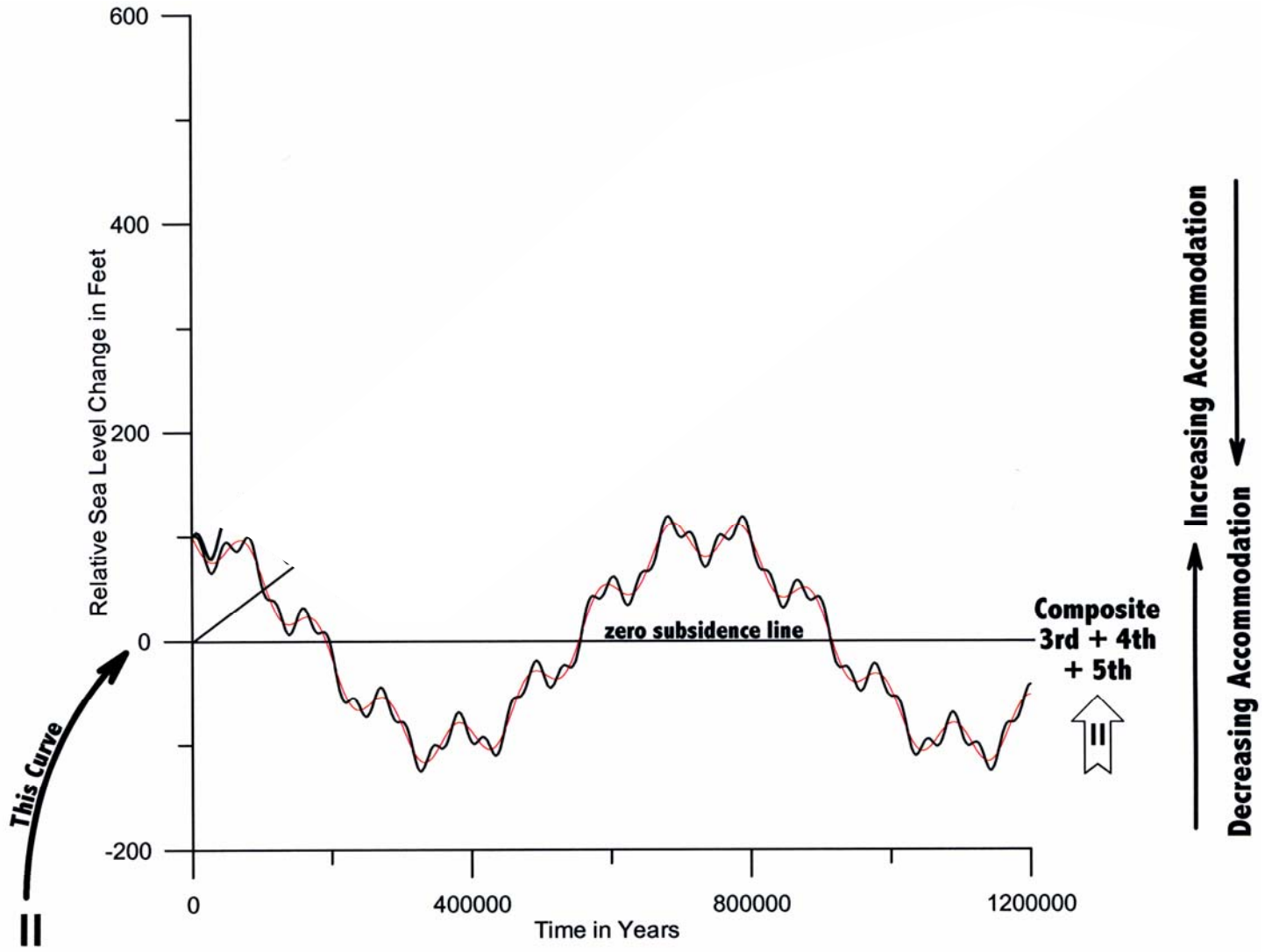
Sea Level Orders




3rd Order Curve
Max. Onlap
Max Offlap
Top of Section
TIME
Low Stand
High Stand
Low Stand
High Stand
One Sequence
Bottom of Section
4th Order Curve
Max. Onlap
Max Offlap
Top of Section
Low Stand
High Stand
Low Stand
High Stand
One Sequence
Bottom of Section
Superposed 3rd and 4th Order Curves
Constructive
Destructive
Destructive
Constructive
Destructive


fall = shallower
rise = deeper
3rd and 4th both
going up; exaggerated rise
Depth little changing
4th going up when
3rd going down; para-
sequence thinner
than average
2nd order
curve
Deepening slowing
3rd and 4th both
going down; exaggerated fall
Water rapidly getting deeper
3rd going up
4th going down;
muted rise

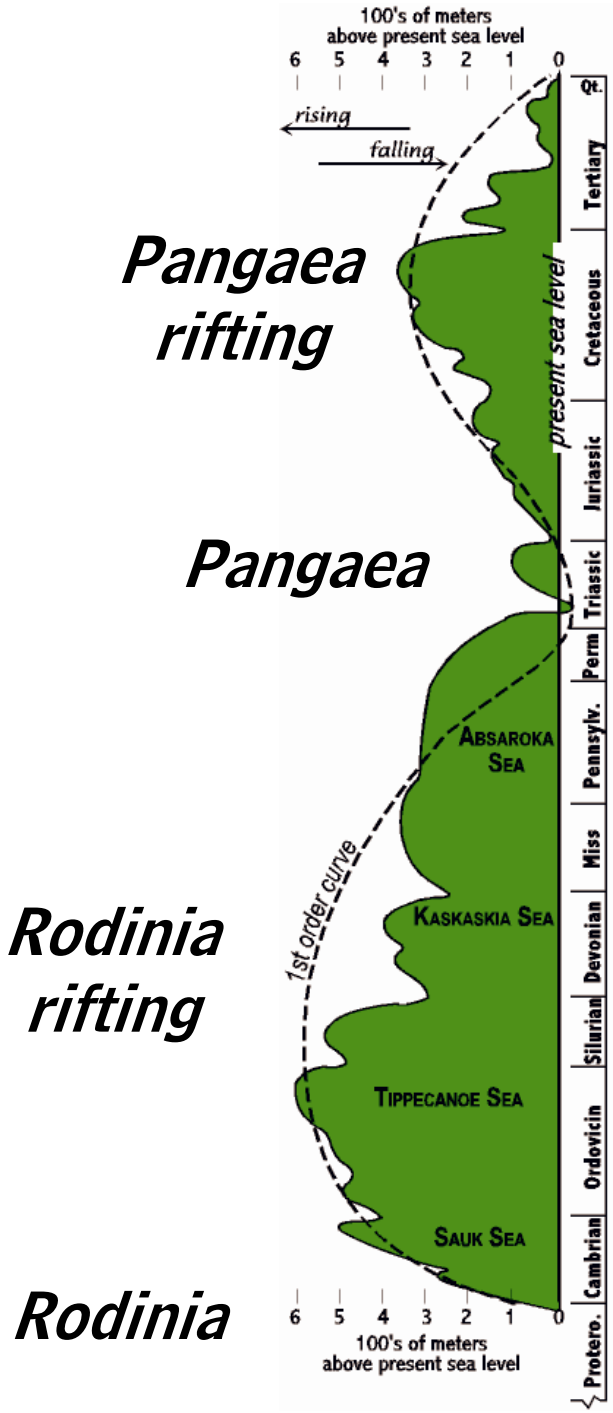

This Curve
+
120
80
40
0
-40
-80
-120
0
4
8
12
Time in 10⁵ Years
+
3rd Order
±200 feet


600
400
200
0
-200
Relative Sea Level Change in Feet
0
400000
800000
1200000
Time in Years
zero subsidence line
Composite
3rd + 4th
+ 5th
This Curve
Increasing Accommodation
Decreasing Accommodation

Causes of Sea Level Changes

1. Tectonics – Wilson and supercontinent cycles

2. Glaciations




du/~rcb7/nam.html

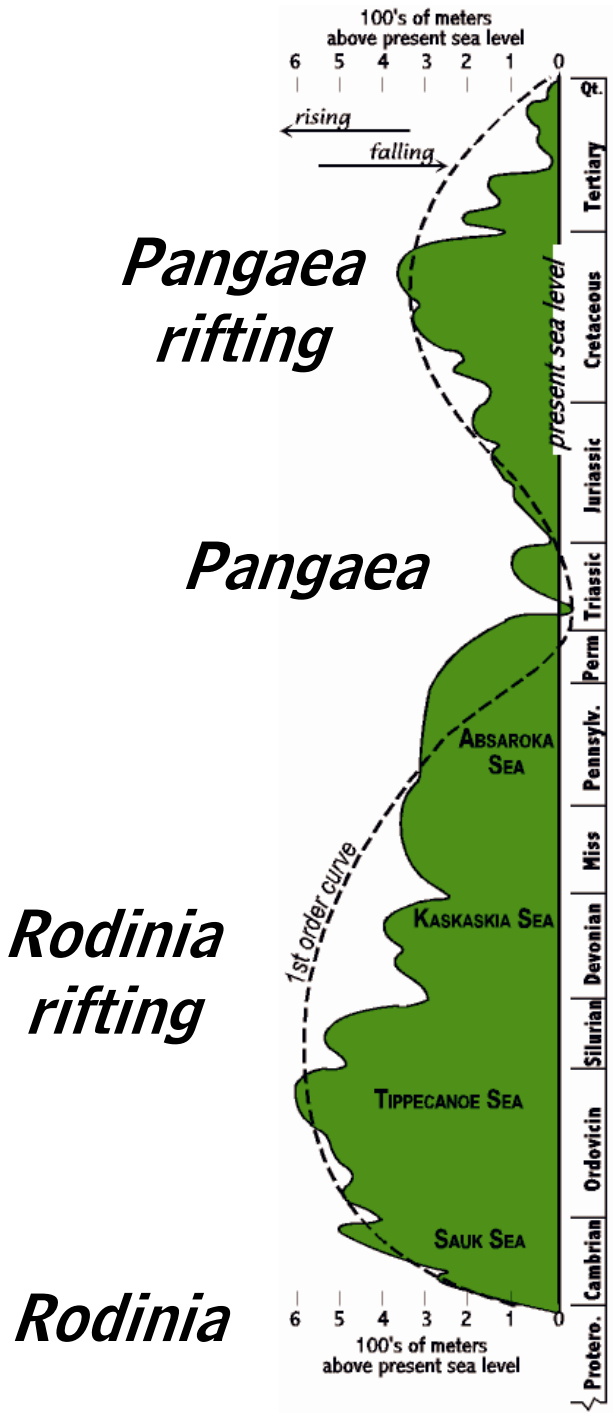

Present– 0.0
http://jan.ucc.nau.edu/~rcb7/nam.html

Causes of Sea Level Changes

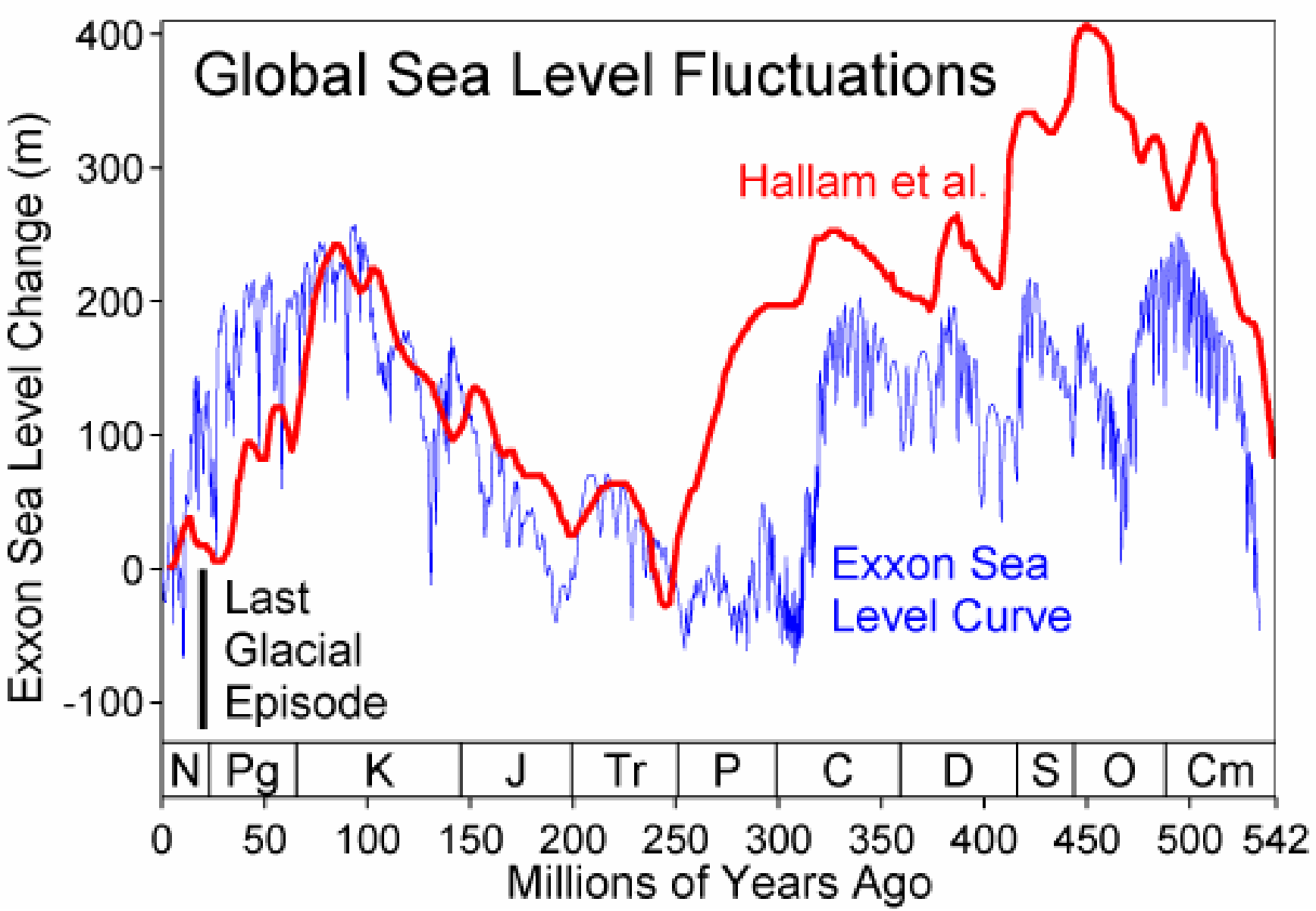
1. Tectonics – Wilson and supercontinent cycles

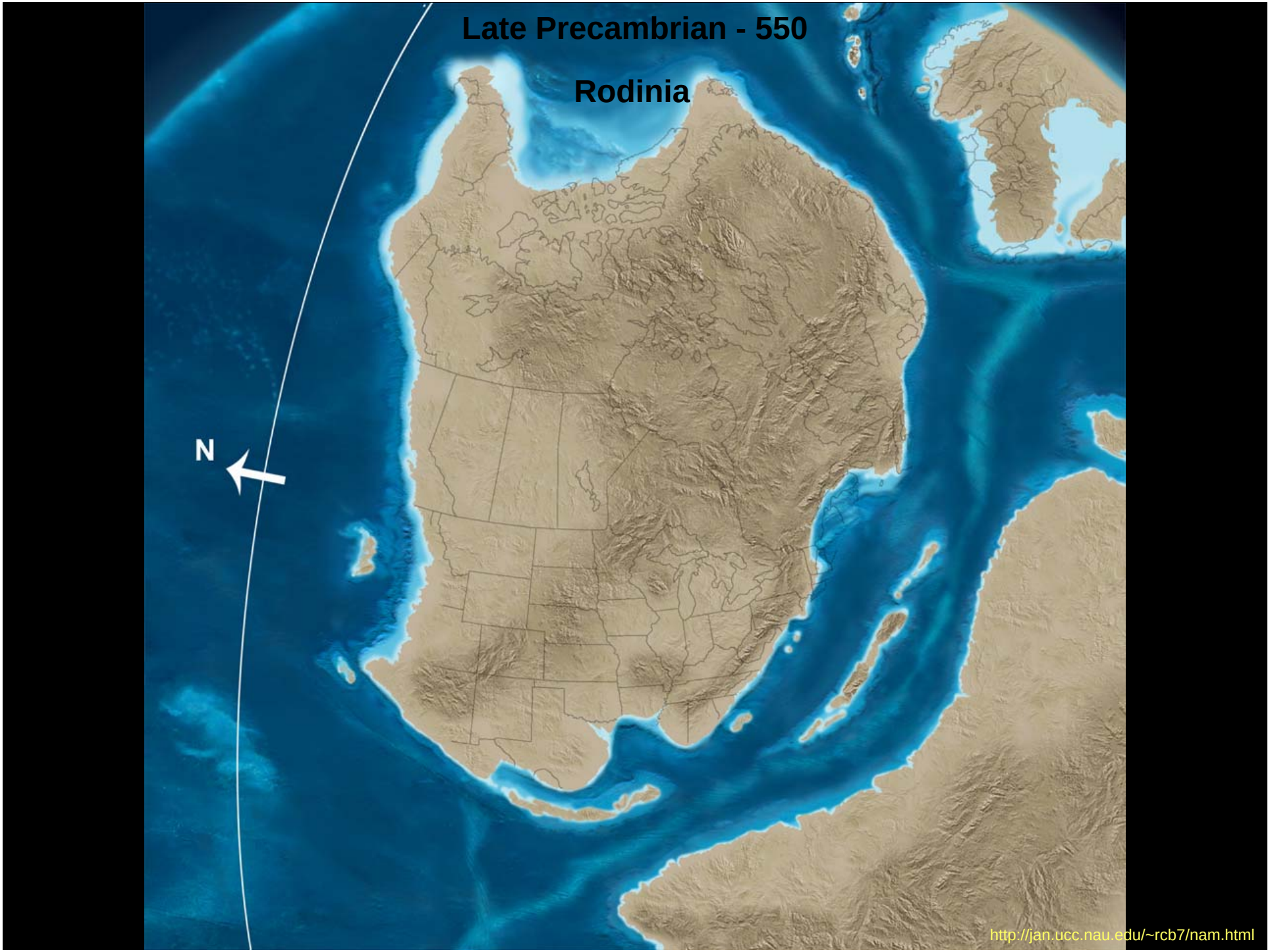
2. Glaciations

3. Shifts in climate from desert to humid.

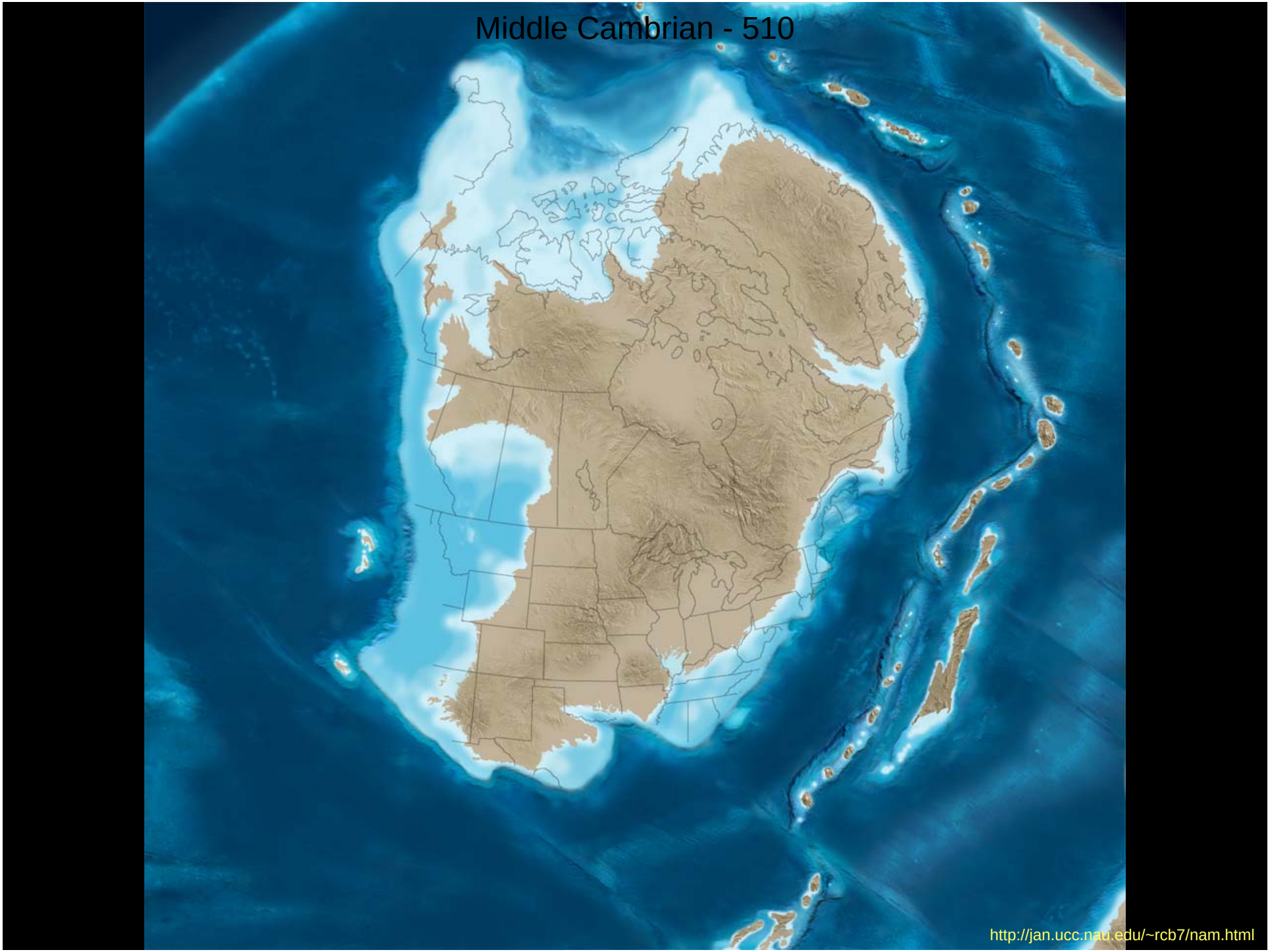


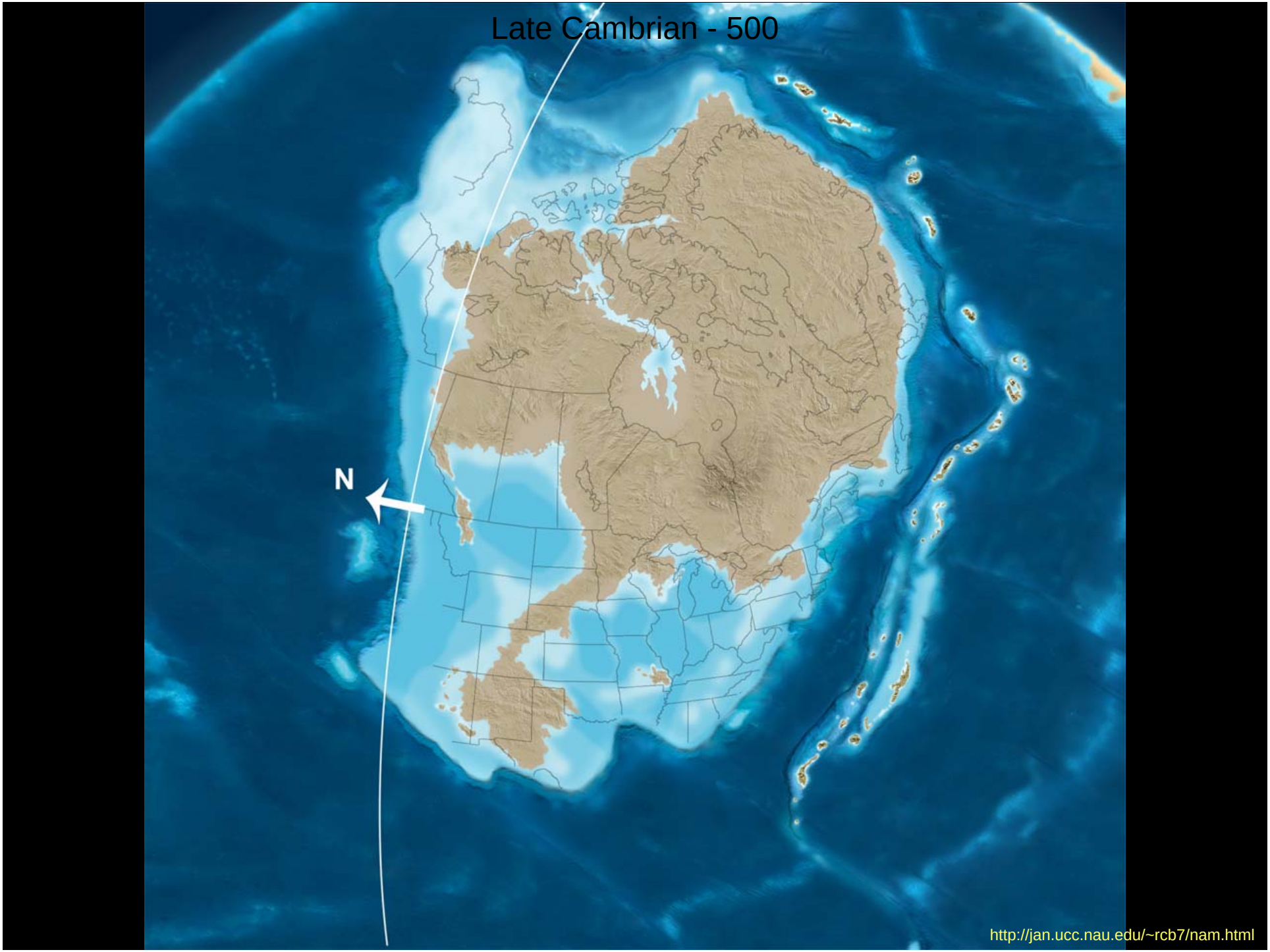
A Variety of Sea Level Curves



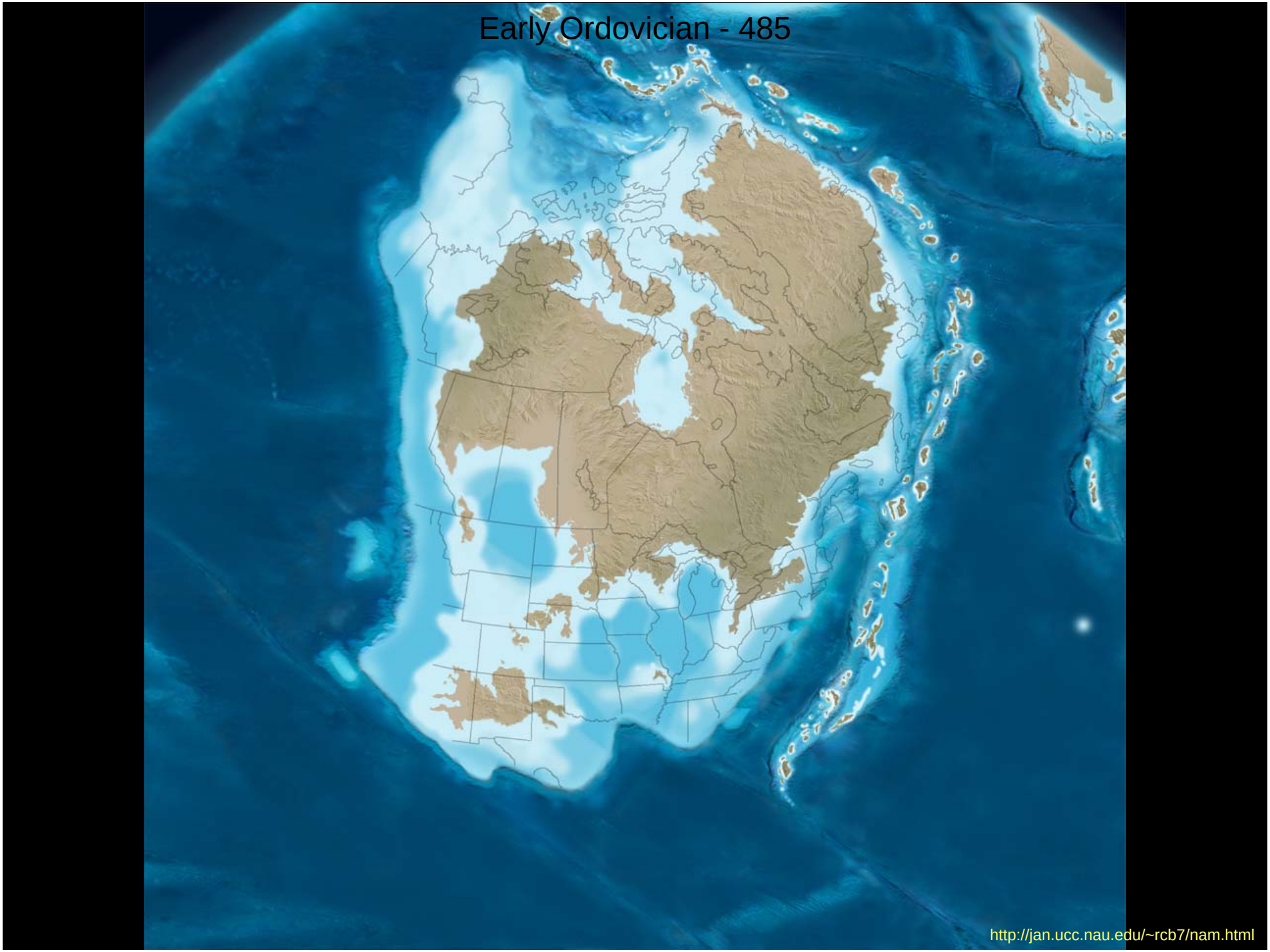

Late Precambrian - 550
Rodinia
N
http://jan.ucc.nau.edu/~rcb7/nam.html

Middle Cambrian - 510



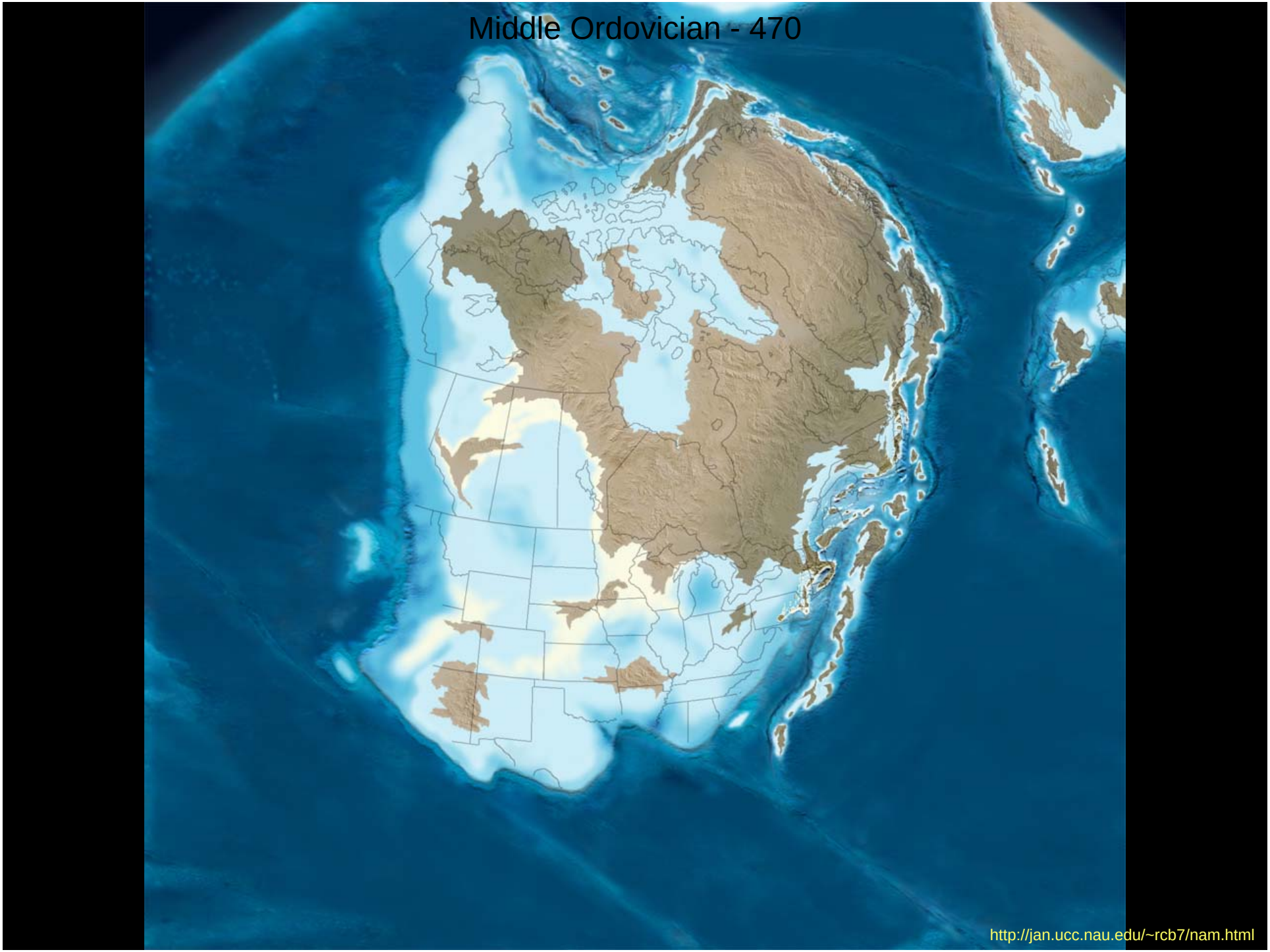

Late Cambrian - 500
N
http://jan.ucc.nau.edu/~rcb7/nam.html

Early Ordovician - 485

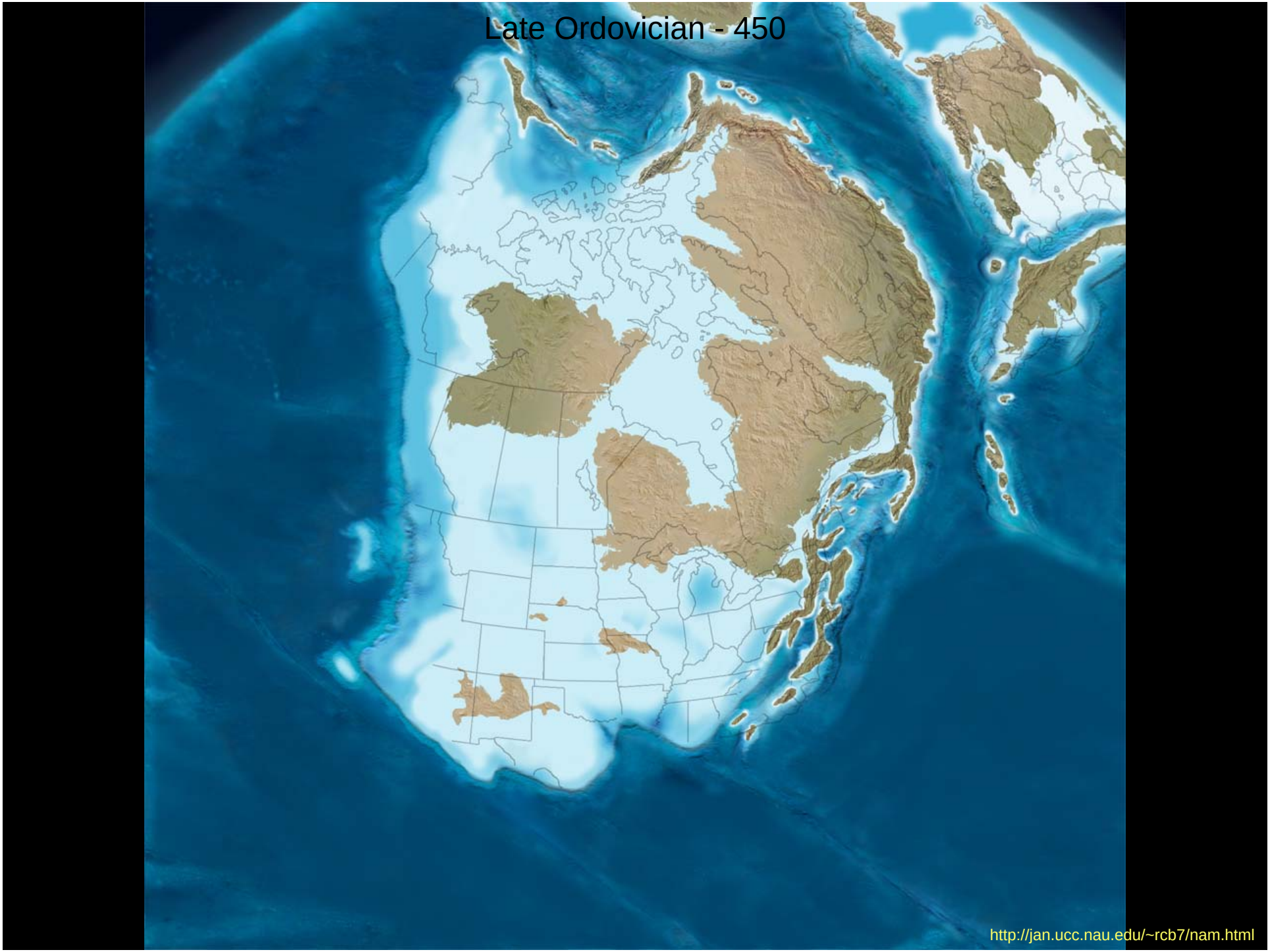


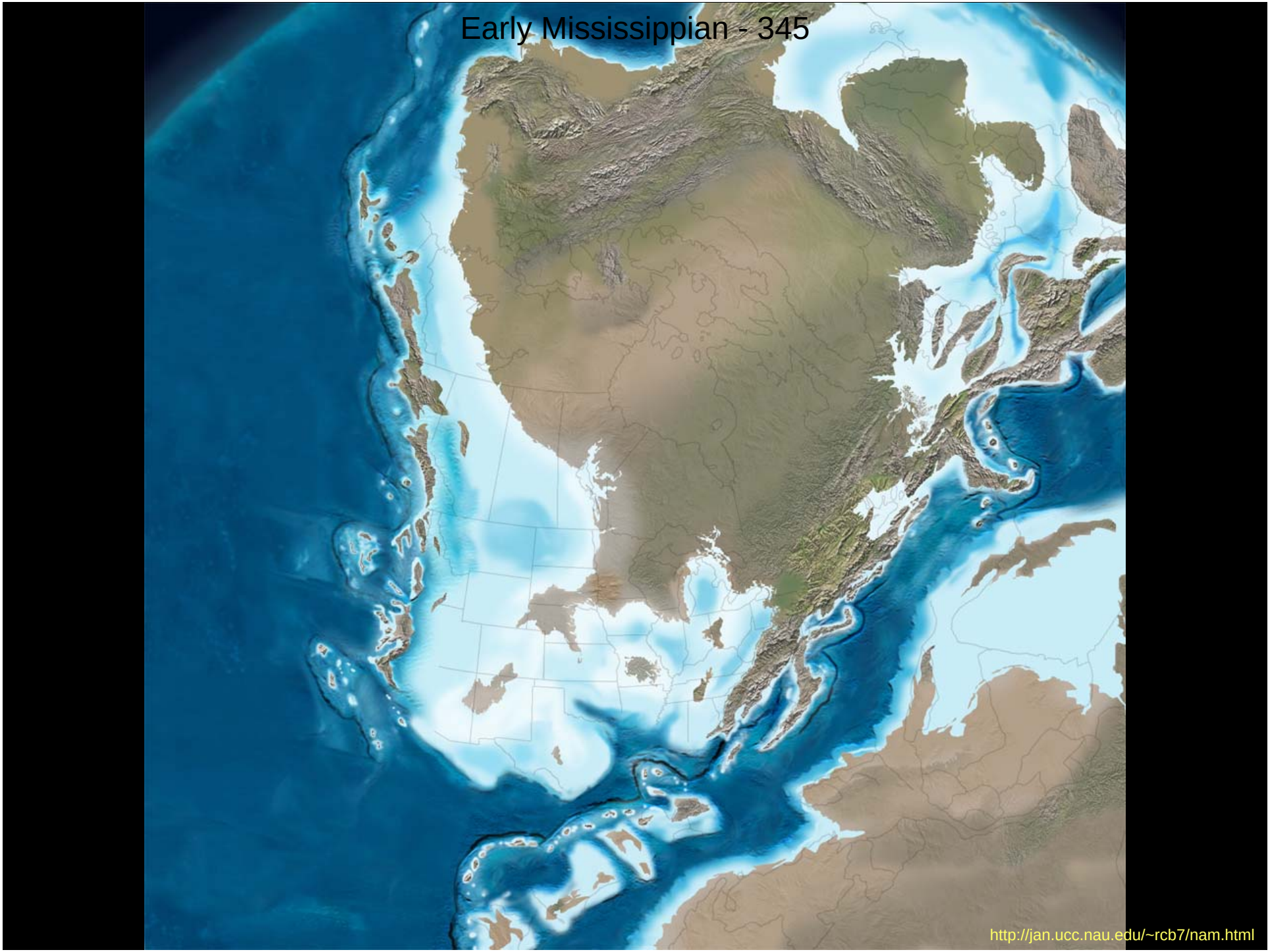
http://jan.ucc.nau.edu/~rcb7/nam.html

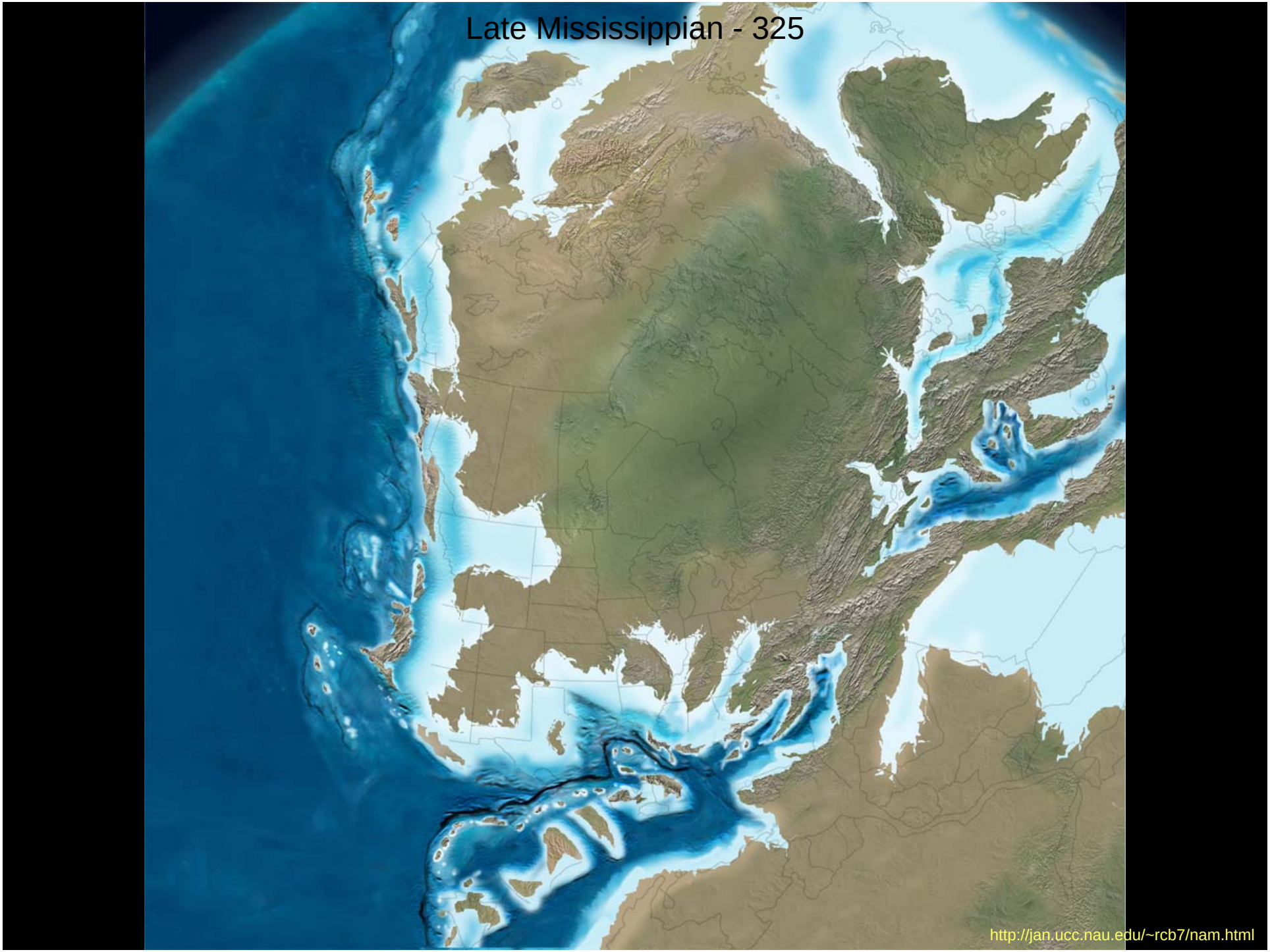
Middle Ordovician - 470

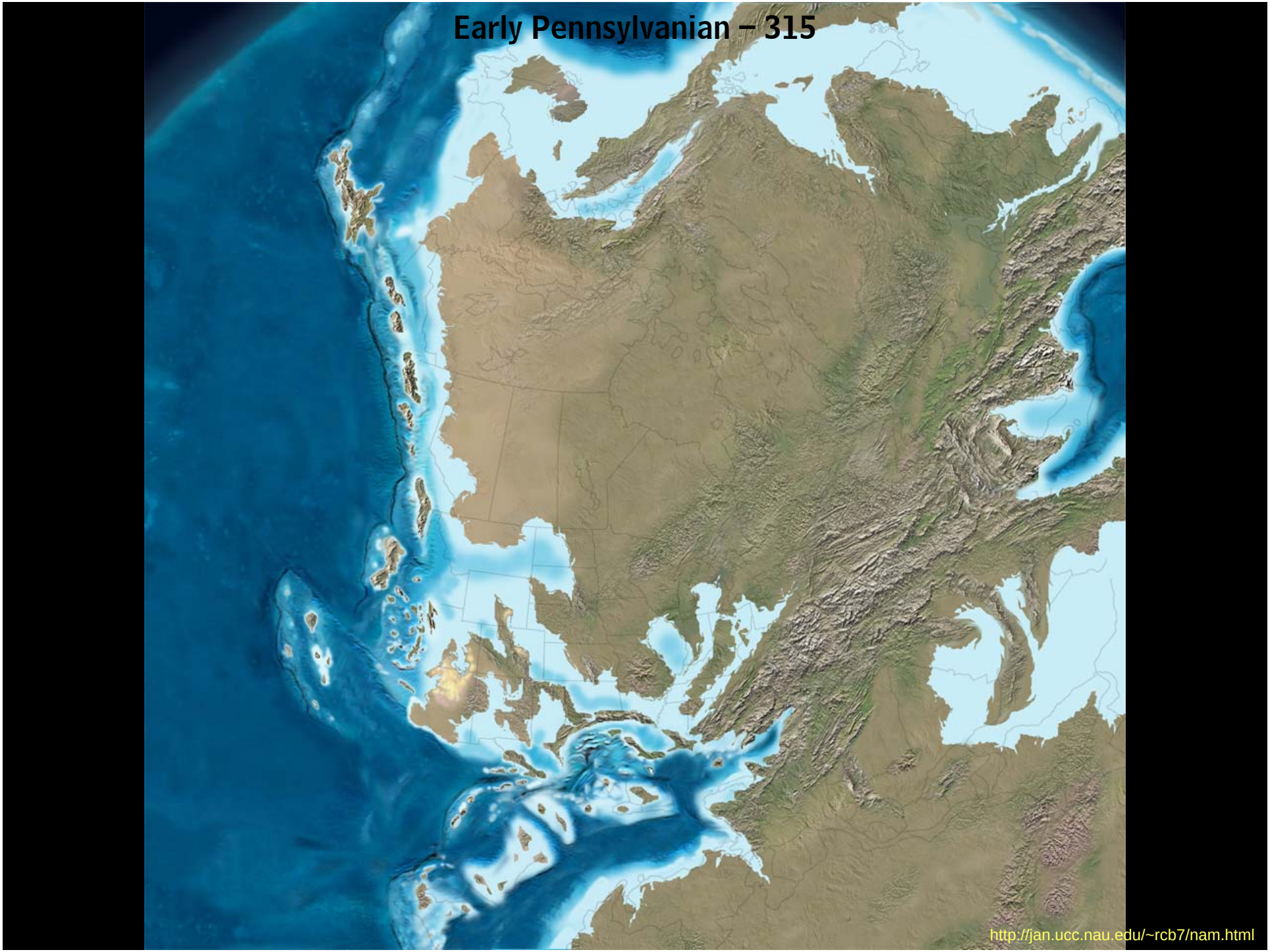


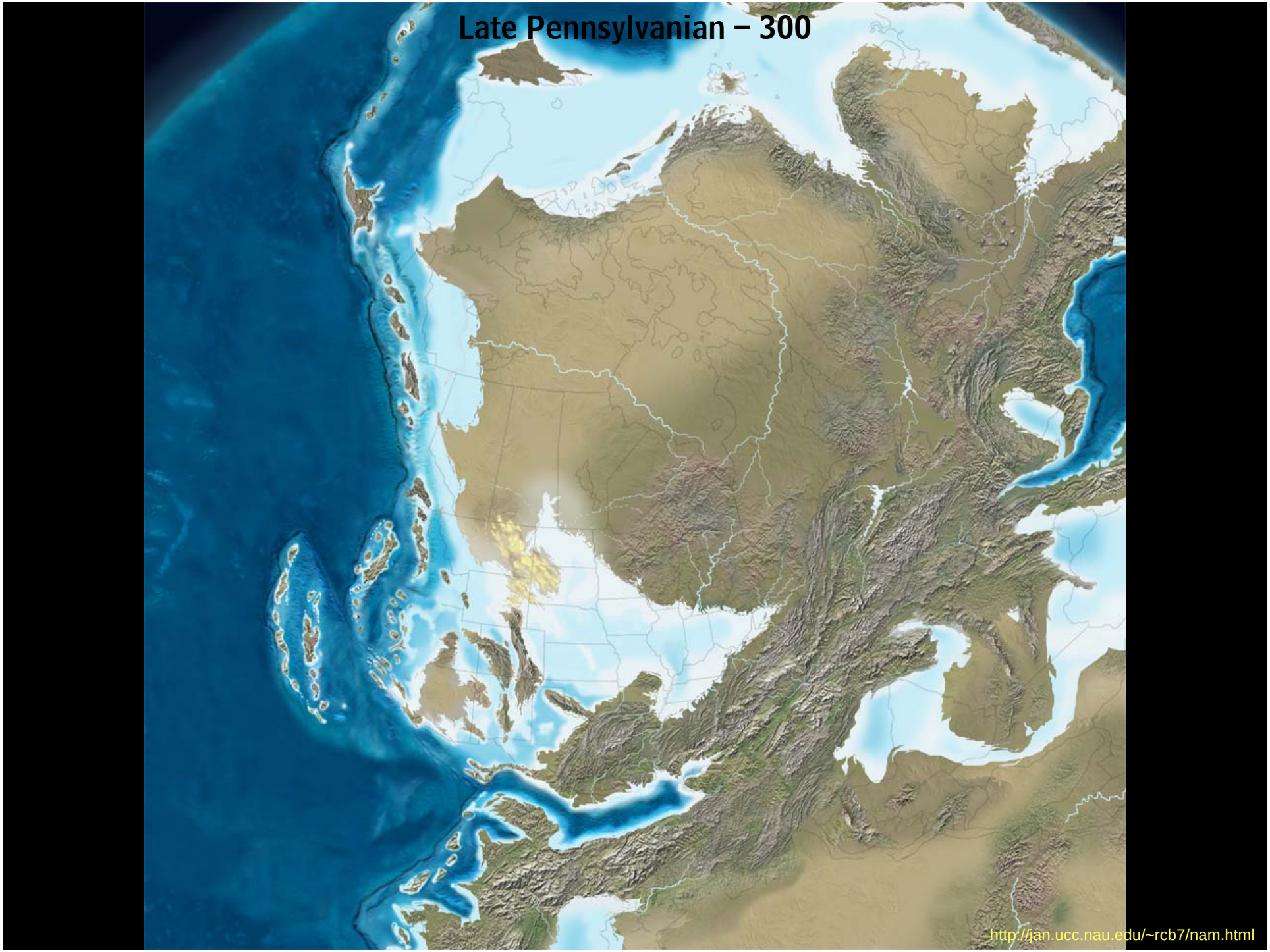
http://jan.ucc.nau.edu/~rcb7/nam.html

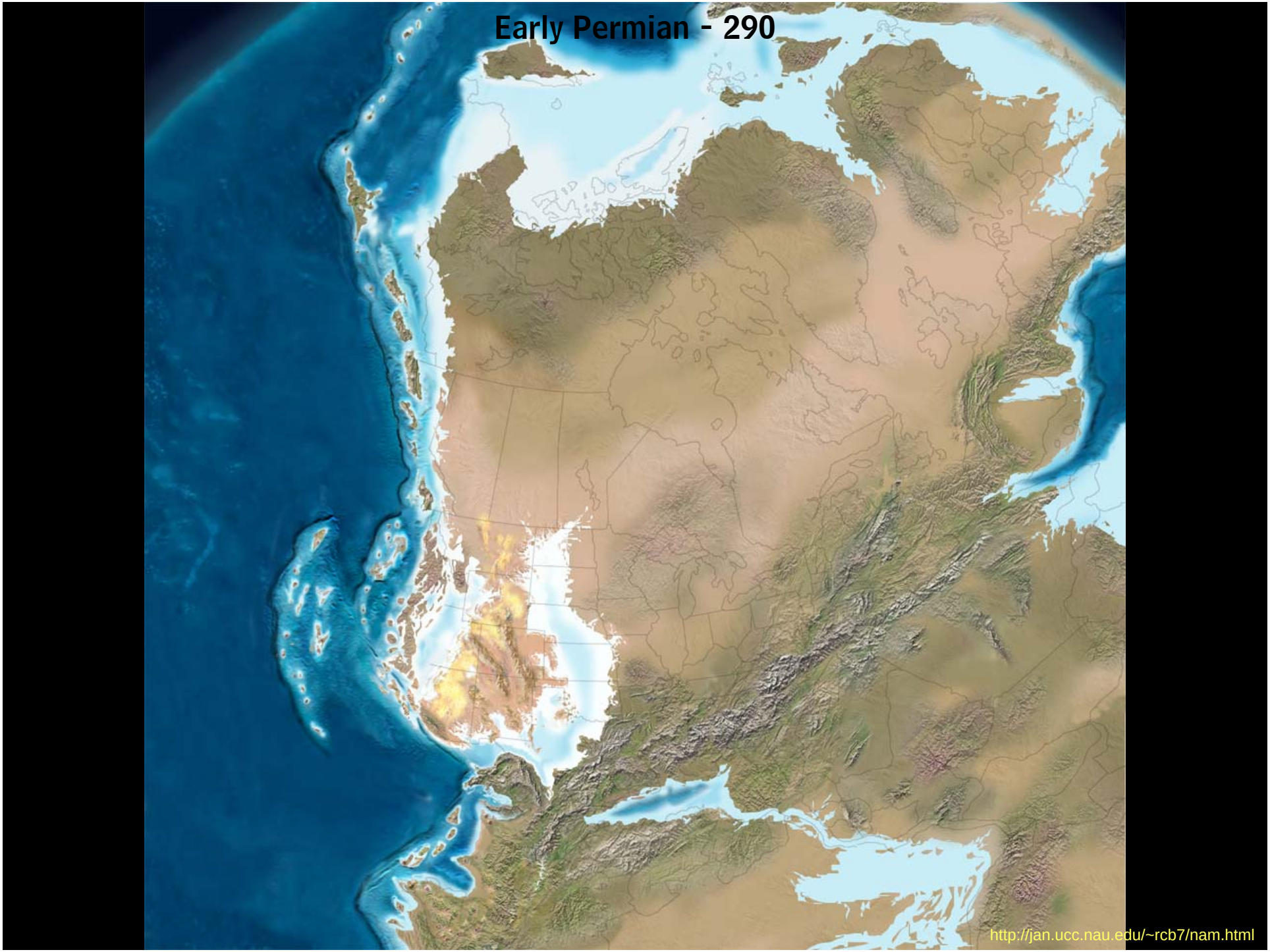

Late Ordovician - 450
http://jan.ucc.nau.edu/~rcb7/nam.html

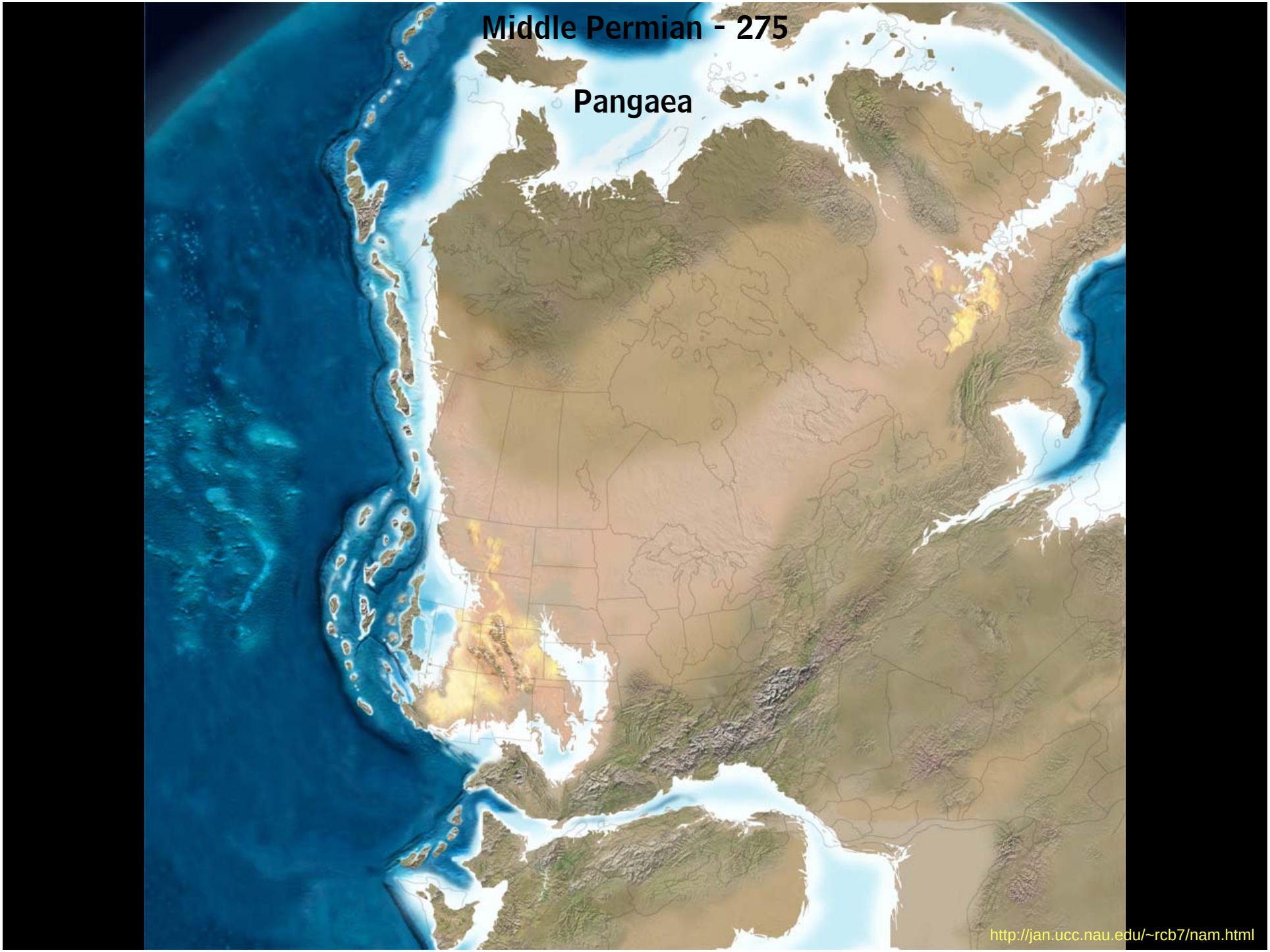

Early Mississippian - 345
http://jan.ucc.nau.edu/~rcb7/nam.html

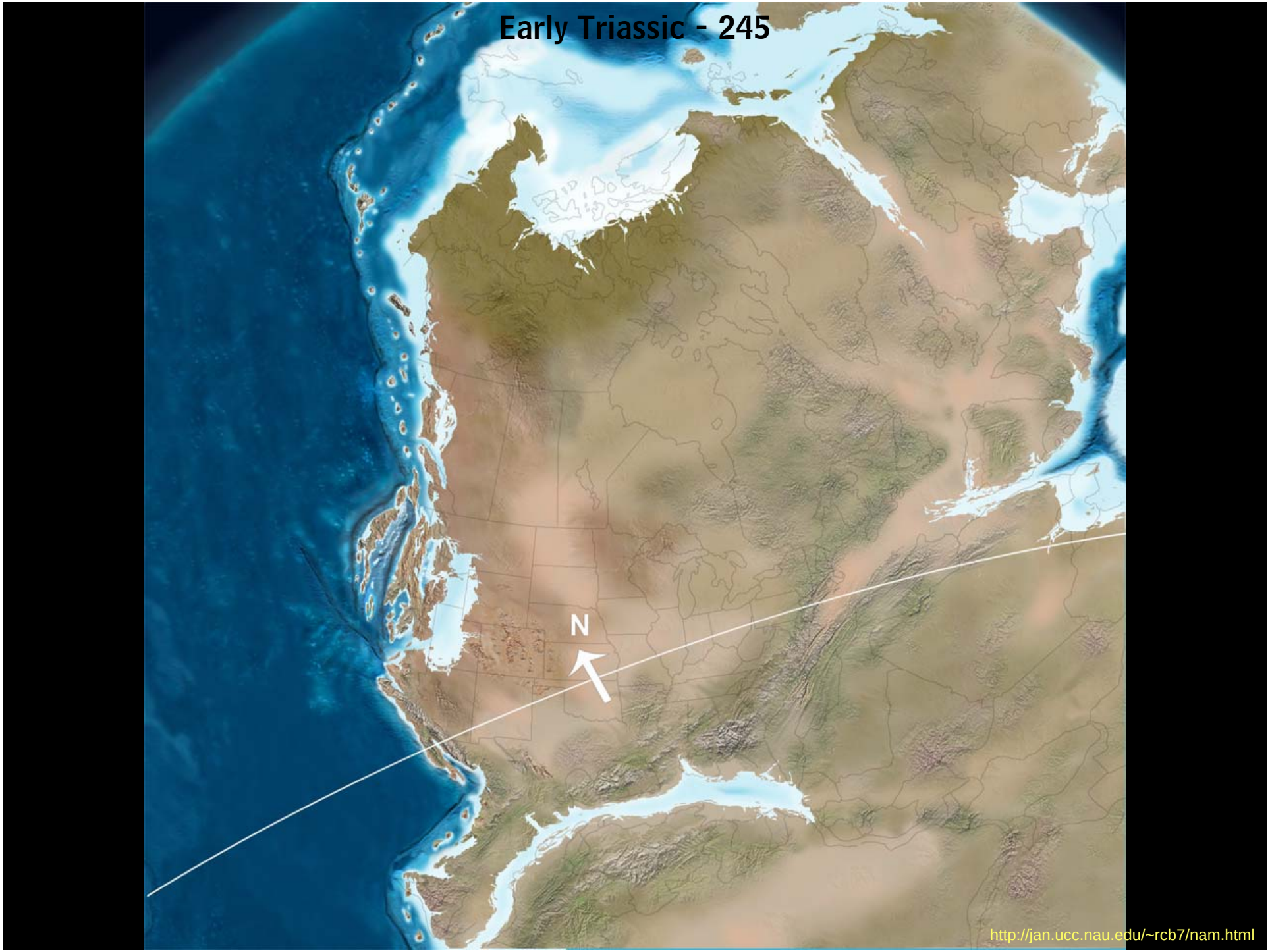

Late Mississippian - 325
http://jan.ucc.nau.edu/~rcb7/nam.html

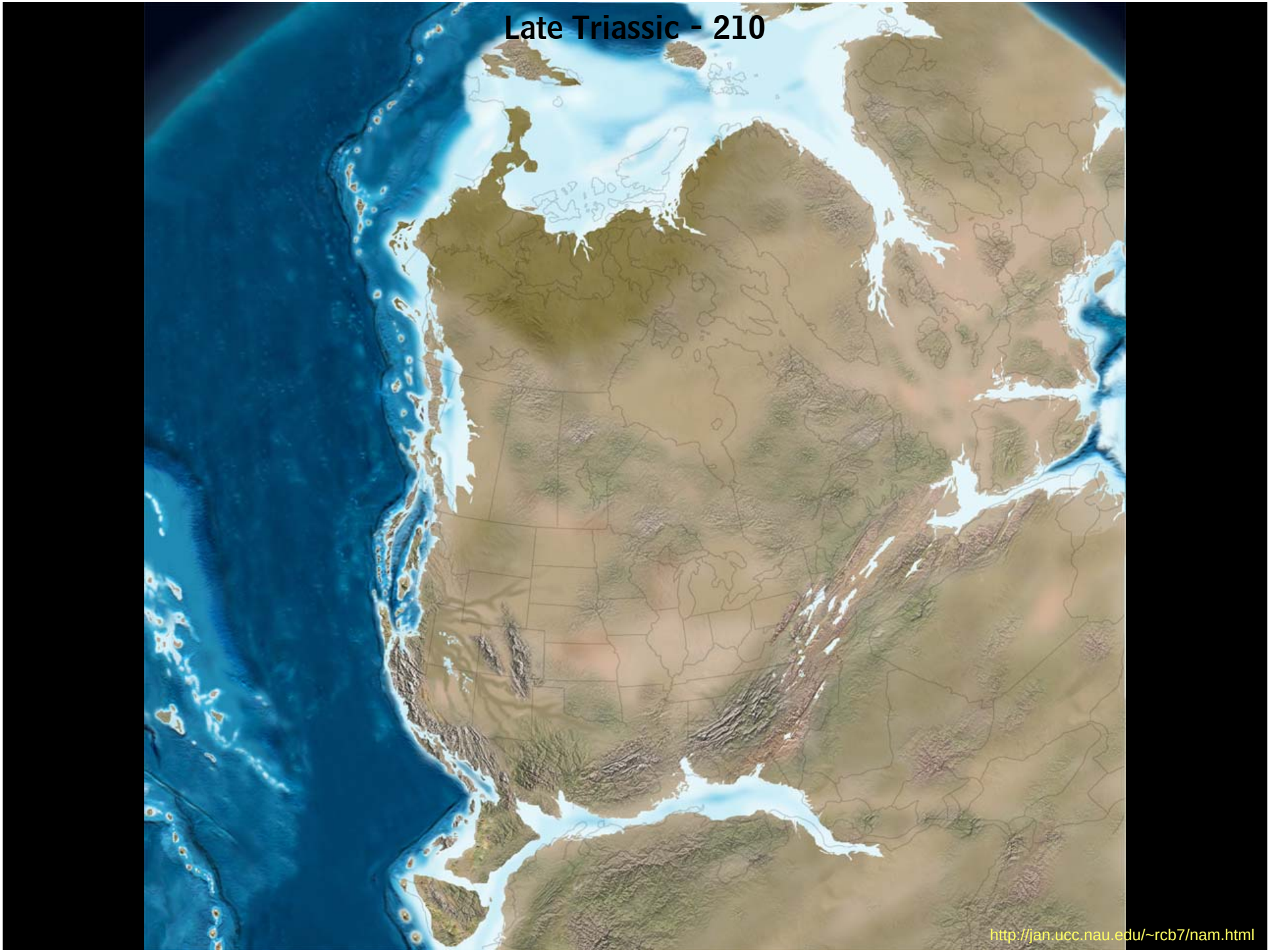

Early Pennsylvanian – 315
http://jan.ucc.nau.edu/~rcb7/nam.html

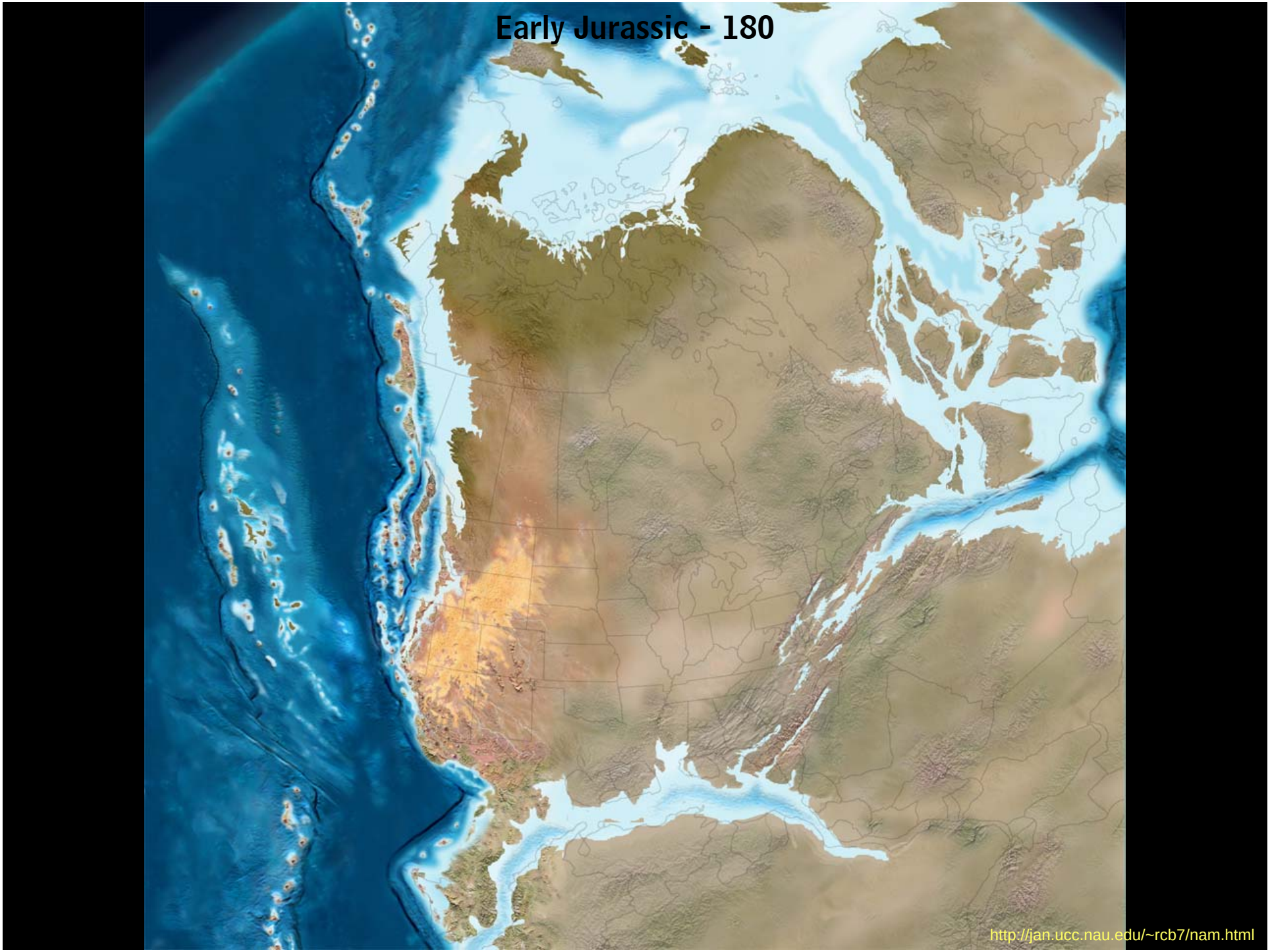

Late Pennsylvanian – 300
http://jan.ucc.nau.edu/~rcb7/nam.html

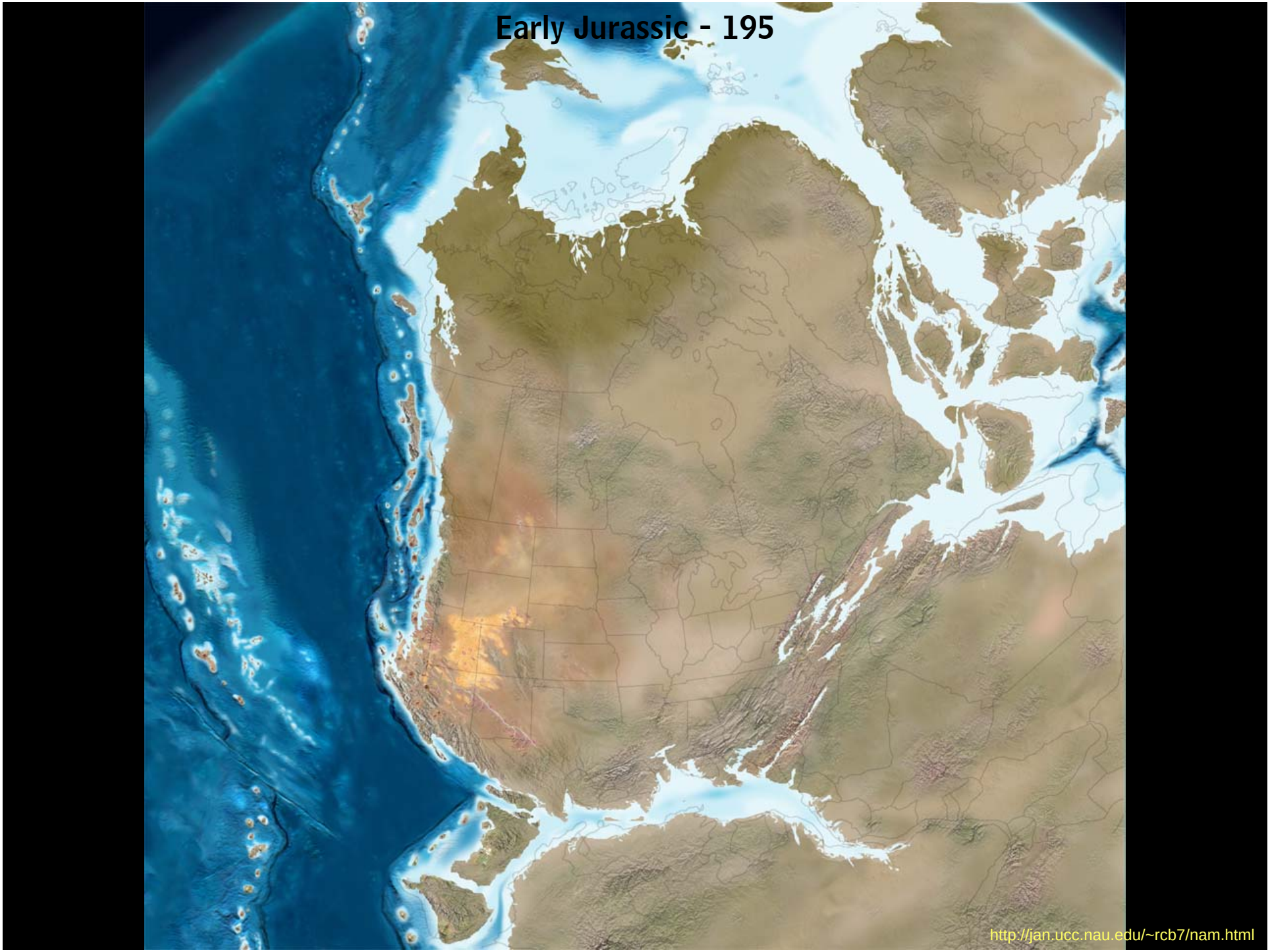

Early Permian - 290
http://jan.ucc.nau.edu/~rcb7/nam.html

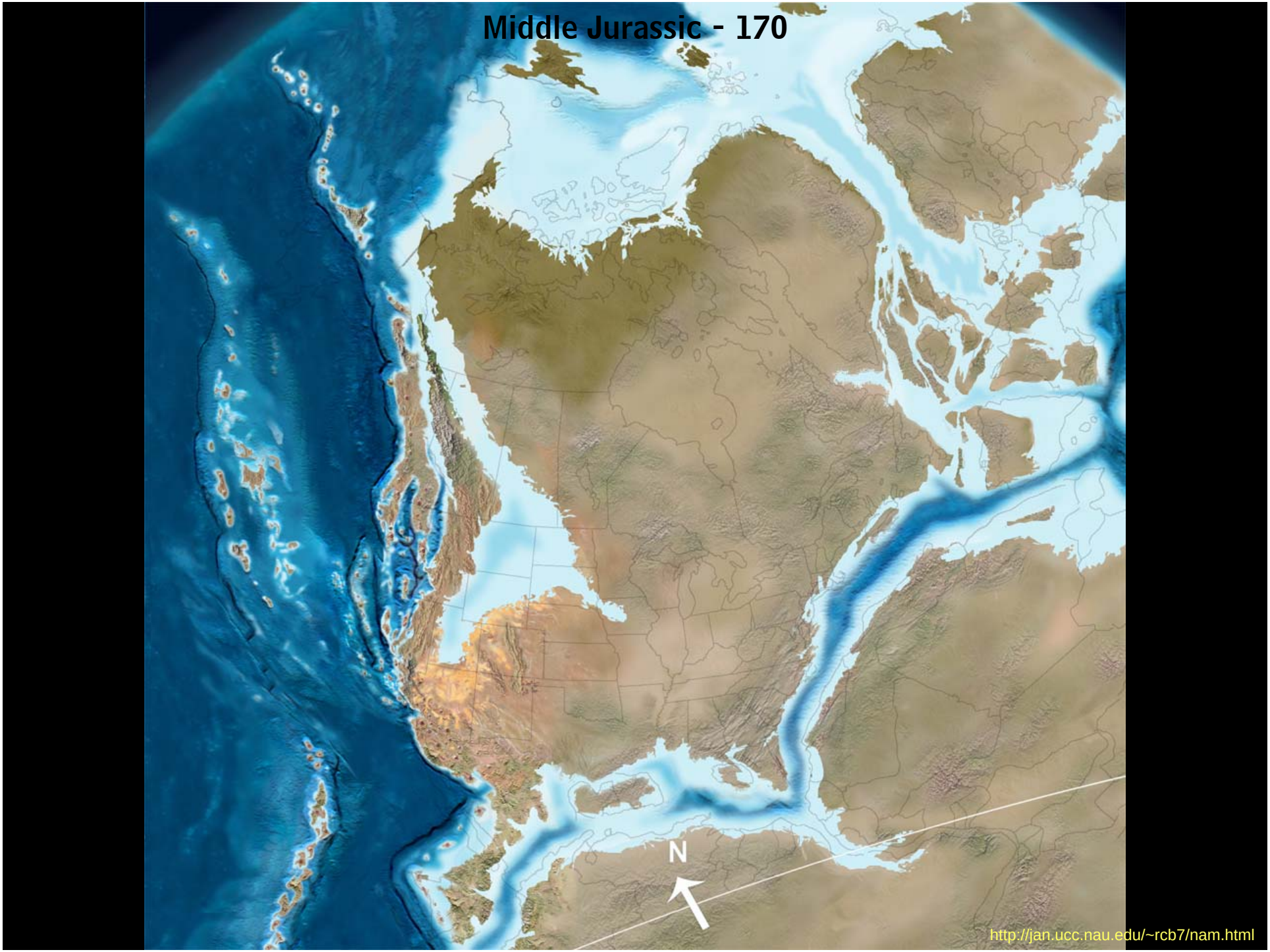

Middle Permian - 275
Pangaea
http://jan.ucc.nau.edu/~rcb7/nam.html

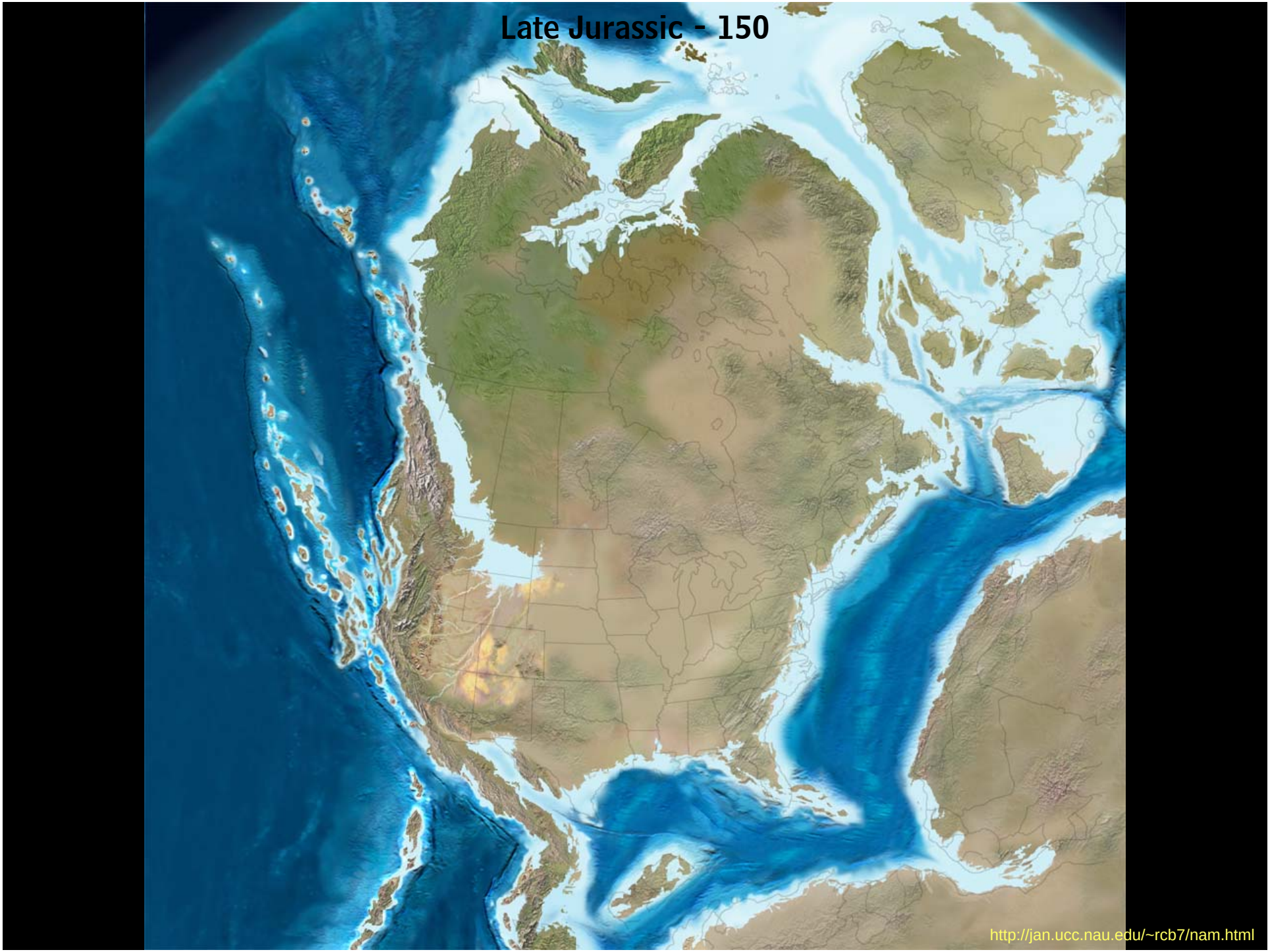

Early Triassic - 245
N
http://jan.ucc.nau.edu/~rcb7/nam.html

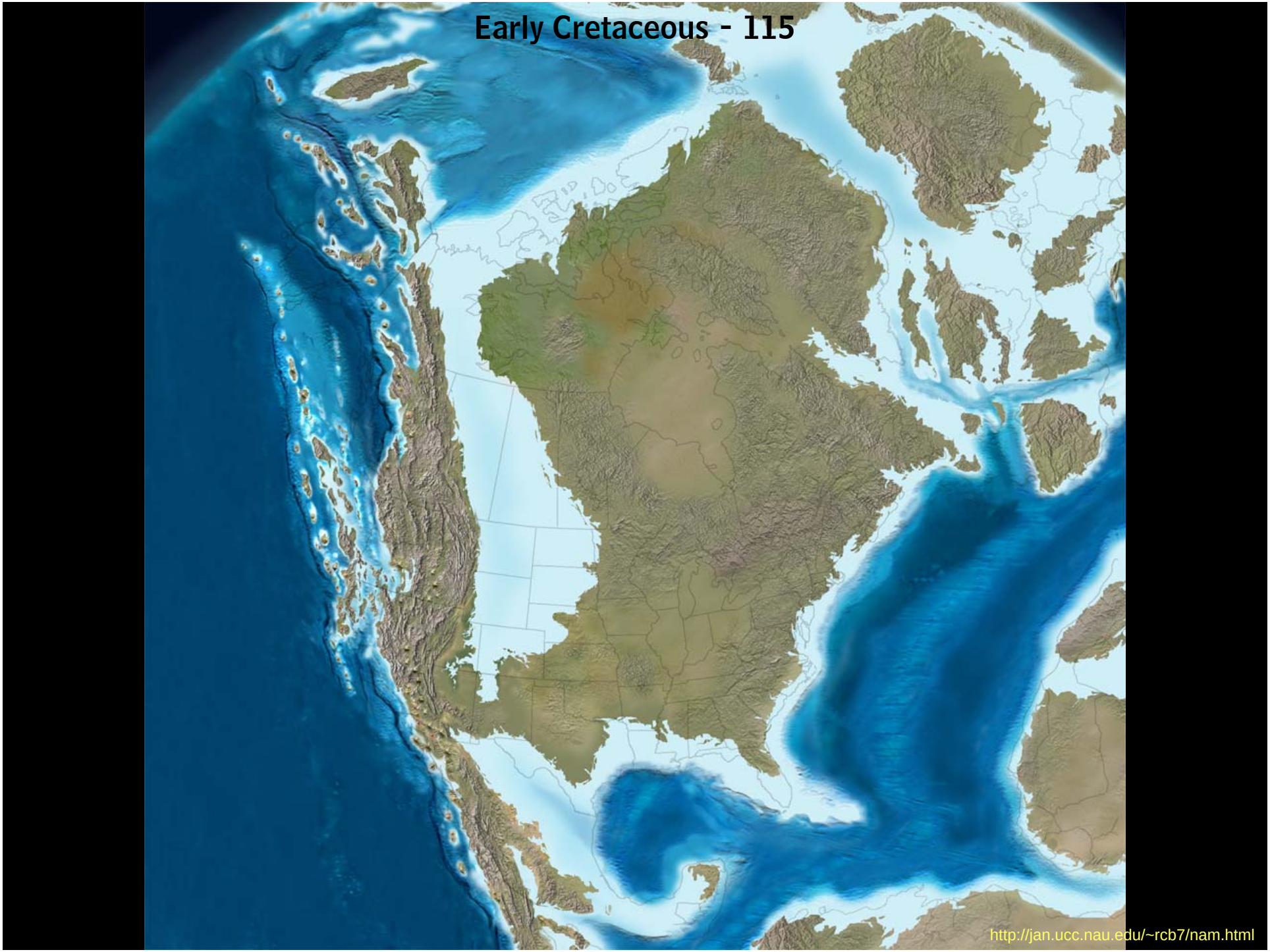

Late Triassic - 210
http://jan.ucc.nau.edu/~rcb7/nam.html

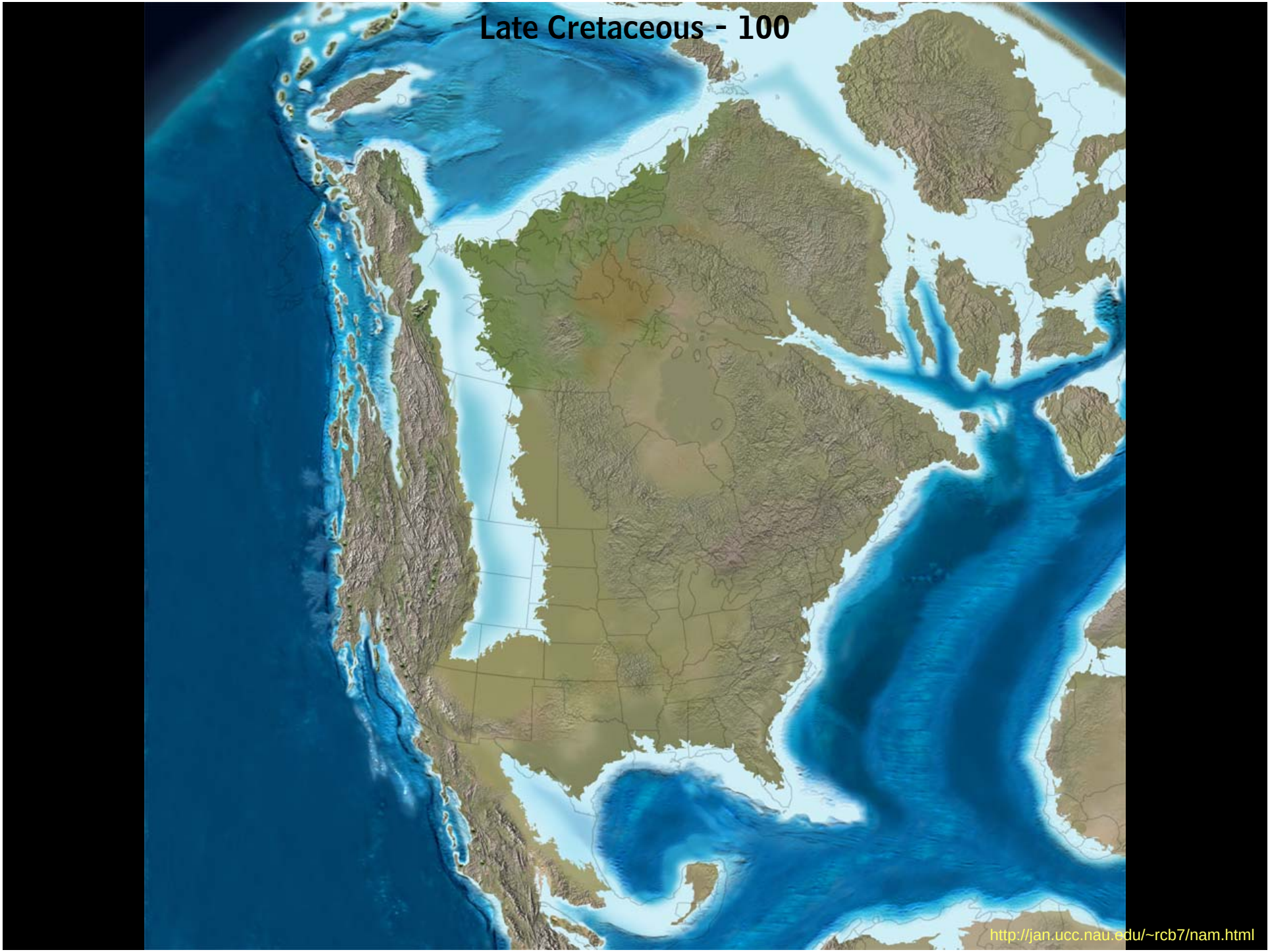

Early Jurassic - 180
http://jan.ucc.nau.edu/~rcb7/nam.html

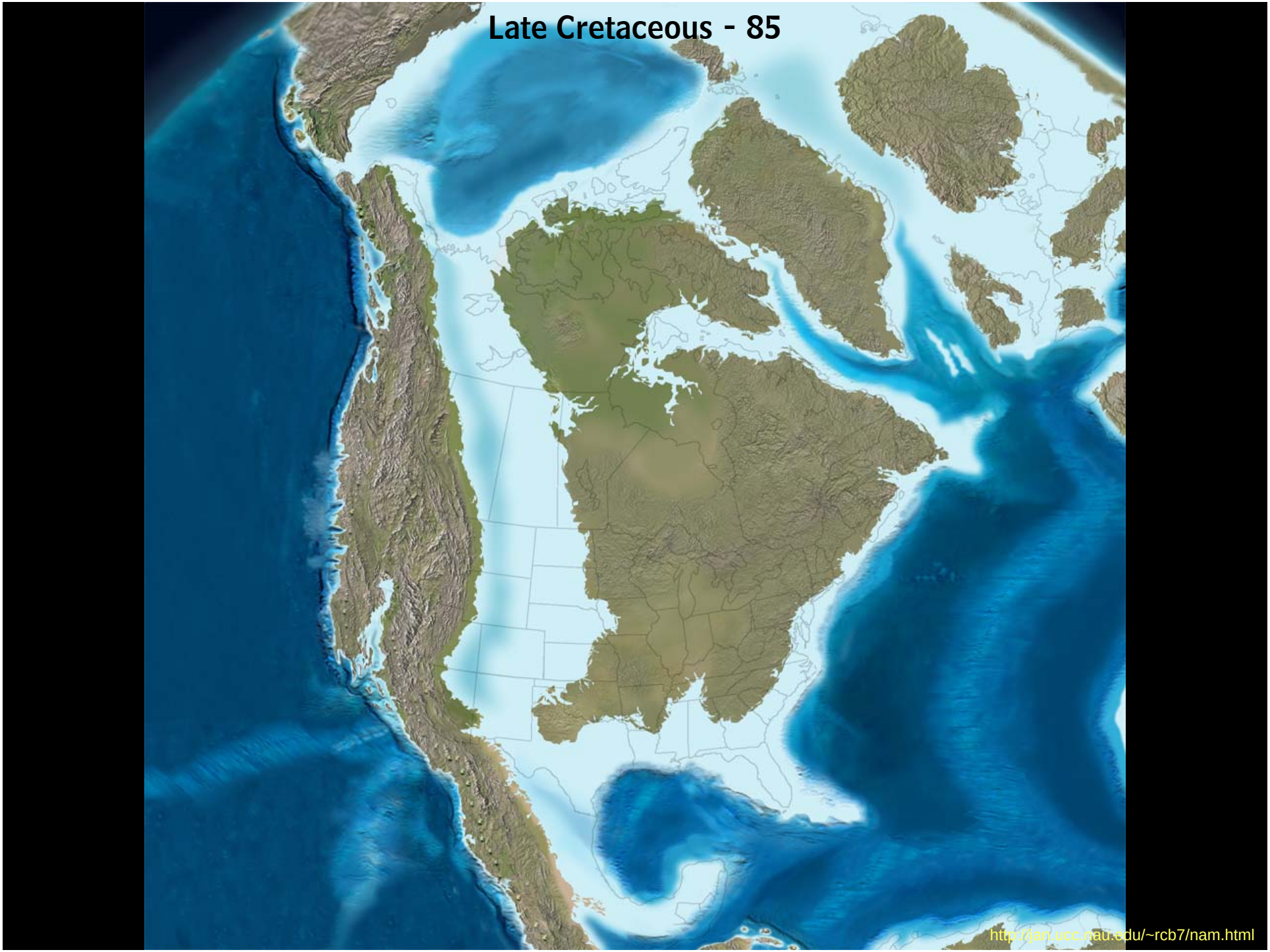

Early Jurassic - 195
http://jan.ucc.nau.edu/~rcb7/nam.html

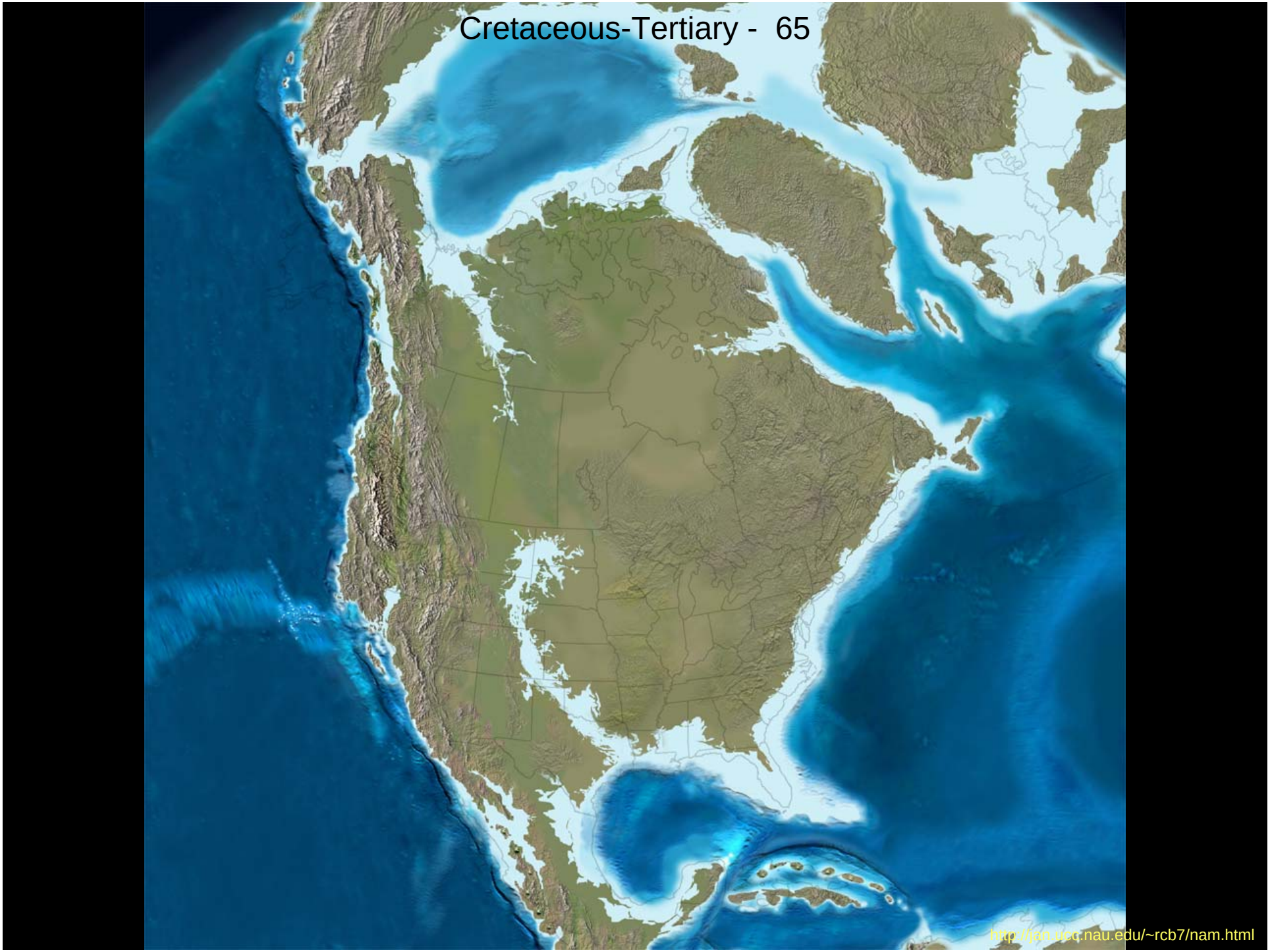

Middle Jurassic - 170
N
http://jan.ucc.nau.edu/~rcb7/nam.html


Late Jurassic - 150
http://jan.ucc.nau.edu/~rcb7/nam.html


Early Cretaceous - 115
http://jan.ucc.nau.edu/~rcb7/nam.html


Late Cretaceous - 100
http://jan.ucc.nau.edu/~rcb7/nam.html


Late Cretaceous - 85
http://jan.ucc.nau.edu/~rcb7/nam.html


Cretaceous-Tertiary - 65
http://jan.ucc.nau.edu/~rcb7/nam.html


Paleocene - 60
http://jan.ucc.nau.edu/~rcb7/nam.html


Miocene - 15
http://jan.ucc.nau.edu/~rcb7/nam.html


Miocene - 8
http://jan.ucc.nau.edu/~rcb7/nam.html


Pliocene - 3
http://jan.ucc.nau.edu/~rcb7/nam.html


Quarternary – 0.126
http://jan.ucc.nau.edu/~rcb7/nam.html


Present– 0.0
http://jan.ucc.nau.edu/~rcb7/nam.html

Historical Sea Level Changes

The Mediterranean and Black Sea Floods

Bosporus straight

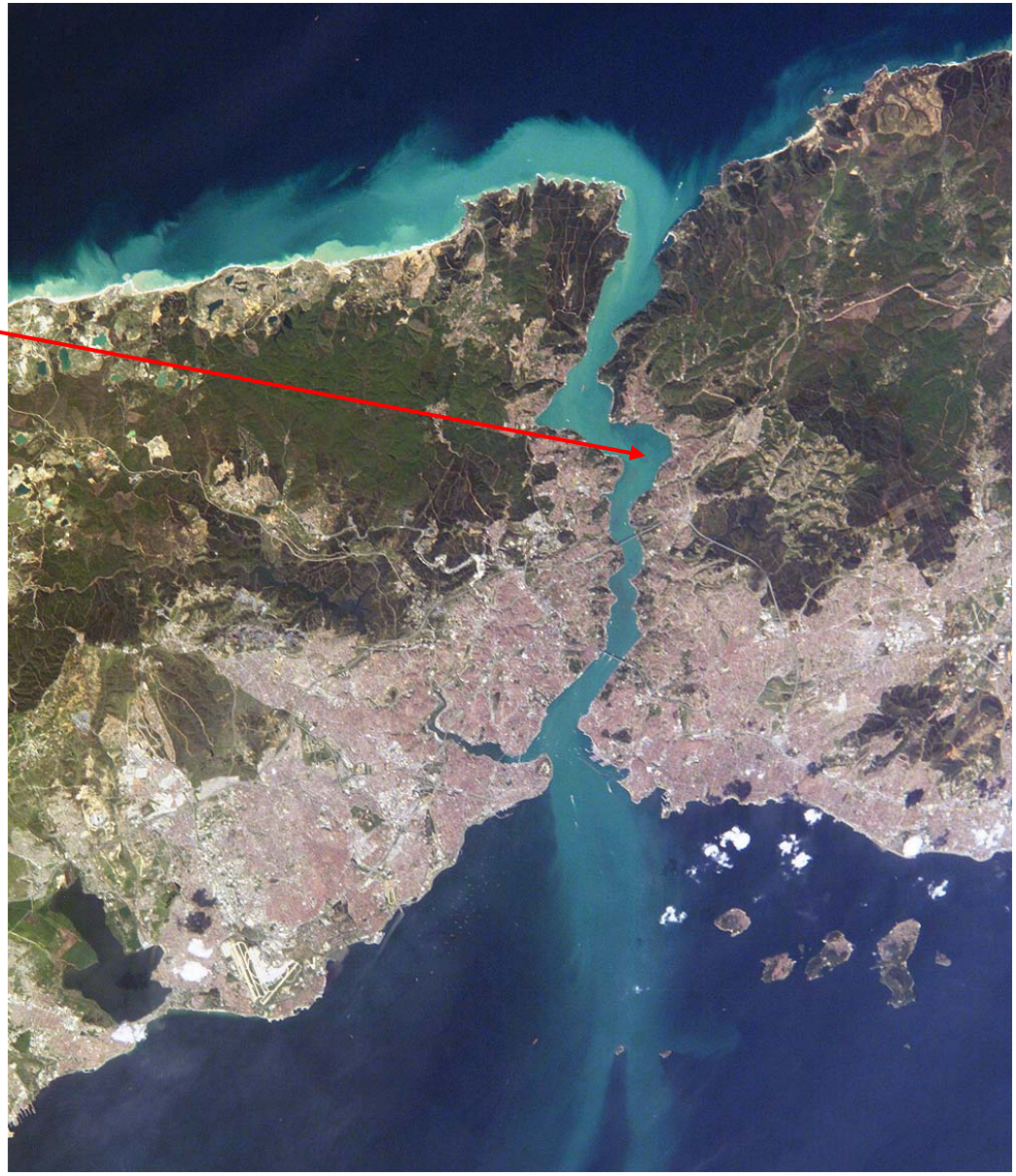
Straights of Gibraltar

A satellite image taken from the side of the Strait of Gibraltar. At right, Africa; at left, Europe

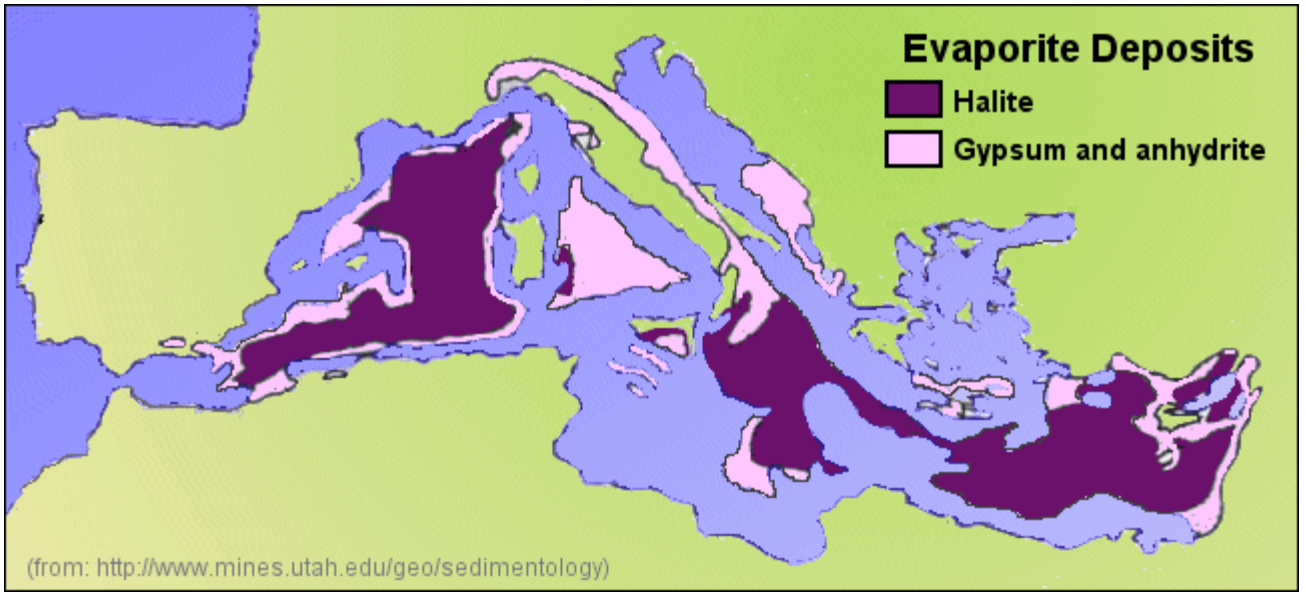
http://www.newworldencyclopedia.org/entry/Mediterranean_Sea

Bosporus Straight

Narrow, shallow passage way



http://www.american.edu/TED/ice/noah.htm

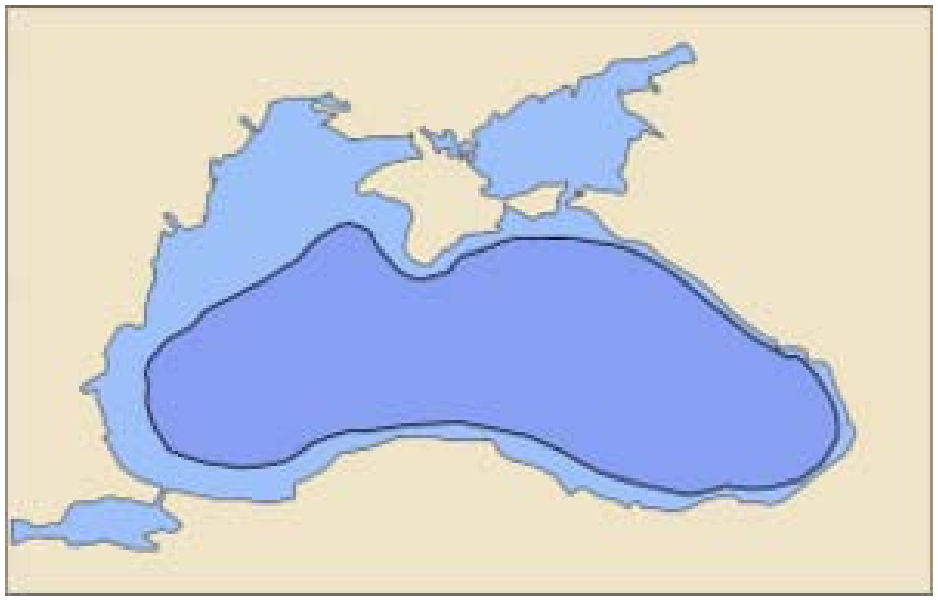


But, the Mediterranean area is hot and dry, with a negative precipitation-evaporation budget, and when sea level was low between 5.96 and 5.33 million years ago the entire basin dried out.

It is now widely accepted that the evaporite (salt) deposits found under the Mediterranean resulted from the closure of the marine passages between the Atlantic and the Mediterranean, and the subsequent (and repeated) complete (or near-complete) desiccation of the Mediterranean Sea.

http://records.viu.ca/~earles/mediter-evapo.gif

At the same time the Mediterranean dried out, the Black Sea area was an isolated valley below sea level with a large freshwater lake, surrounded by early farming villages

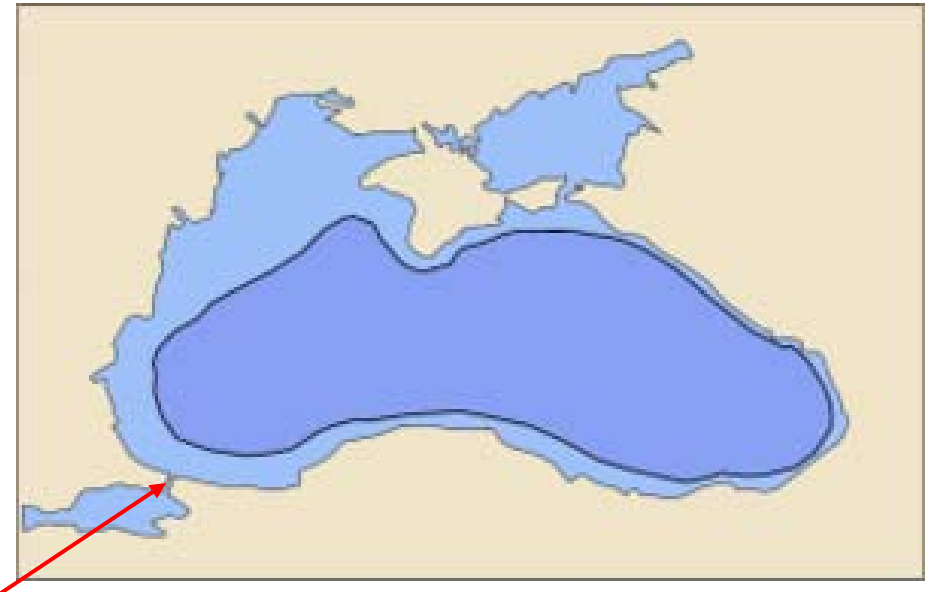


http://en.wikipedia.org/wiki/Black_Sea_deluge_theory

Bosporus straight

Mediterranean Area (dry)

Freshwater Lake

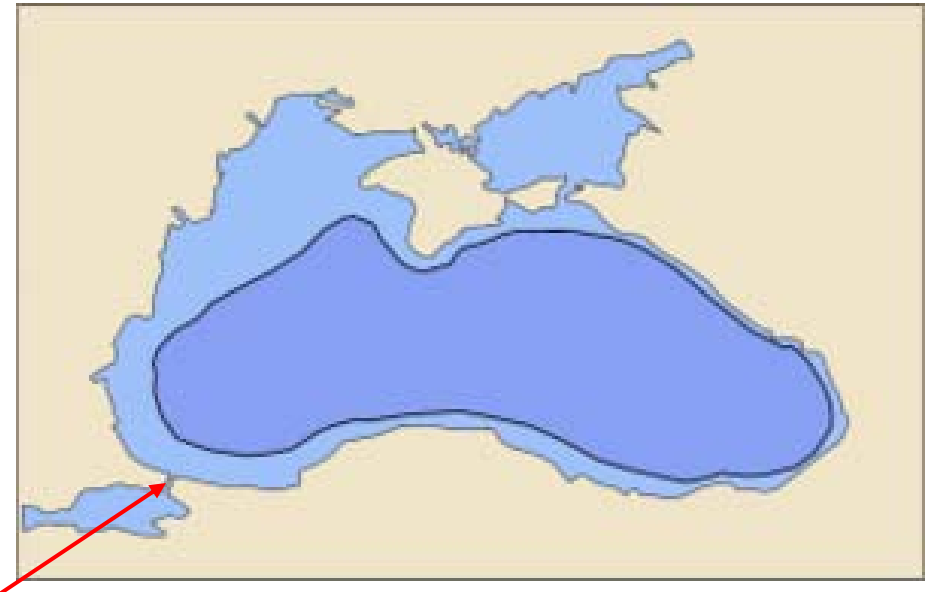


Bosporus straight

Mediterranean floods across Gibralter

Freshwater Lake

About 5 million years ago sea level rose enough for water to pour from the Atlantic ocean into the Mediterranean sea region, flooding it.



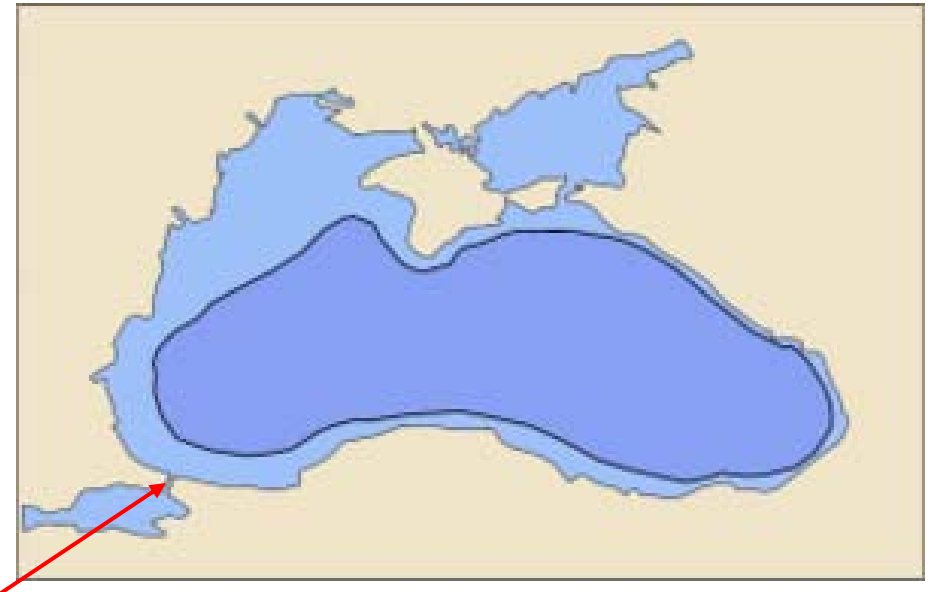
Sea level rises to level of sill

Bosporus straight

Water begins to trickle into the Black sea area

Freshwater Lake

And then 7600 years ago with the melting of the glacial ice the Mediterranean sea level rose enough to flood the Black Sea area



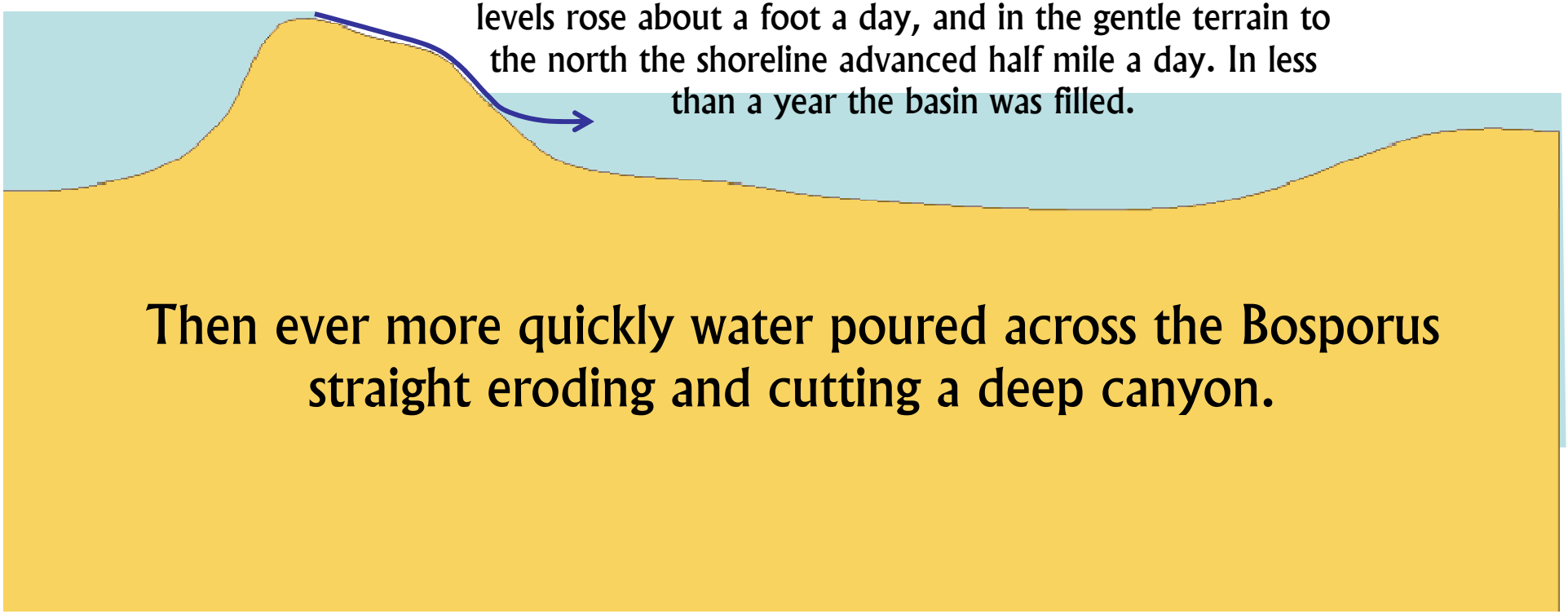
Bosporus straight

Water begins to rush through the straight in a powerful waterfall ten times larger than Niagara falls; erosion cuts a deep canyon.

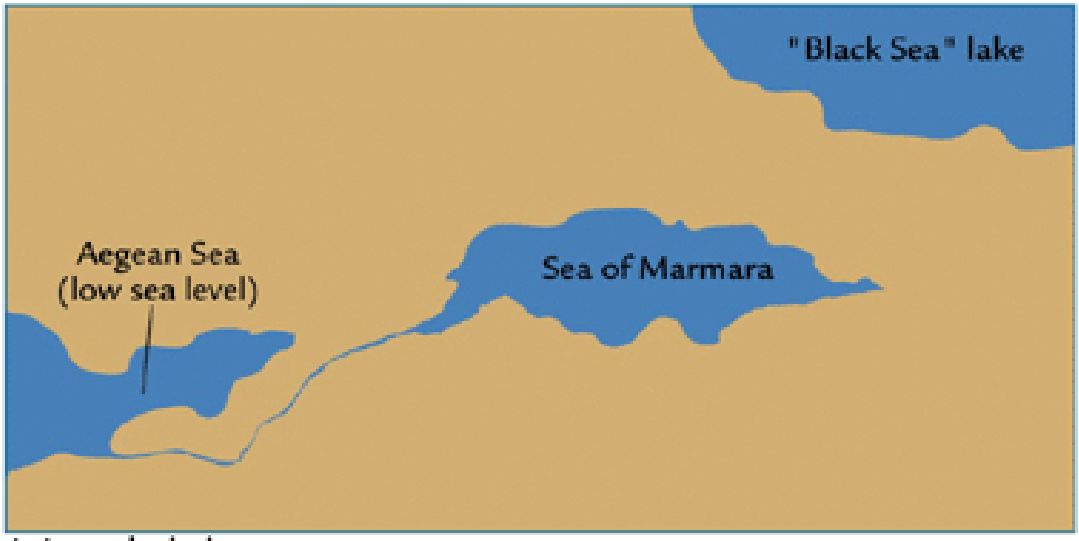
As Black sea area floods and turns brackish

Then ever more quickly water poured across the Bosporus straight eroding and cutting a deep canyon.

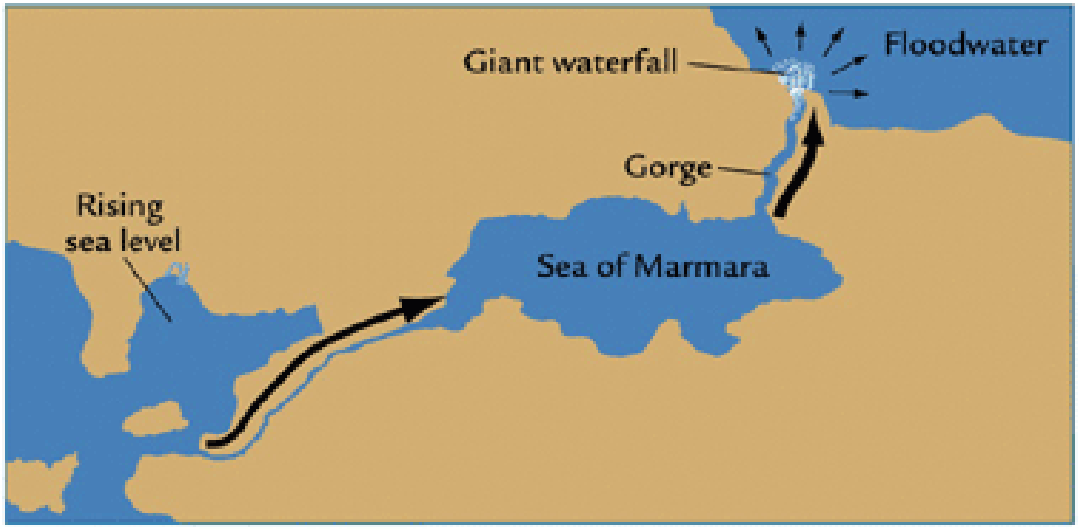
The roar of the water could be heard miles away. Lake levels rose about a foot a day, and in the gentle terrain to the north the shoreline advanced half mile a day. In less than a year the basin was filled.



Then ever more quickly water poured across the Bosporus straight eroding and cutting a deep canyon.



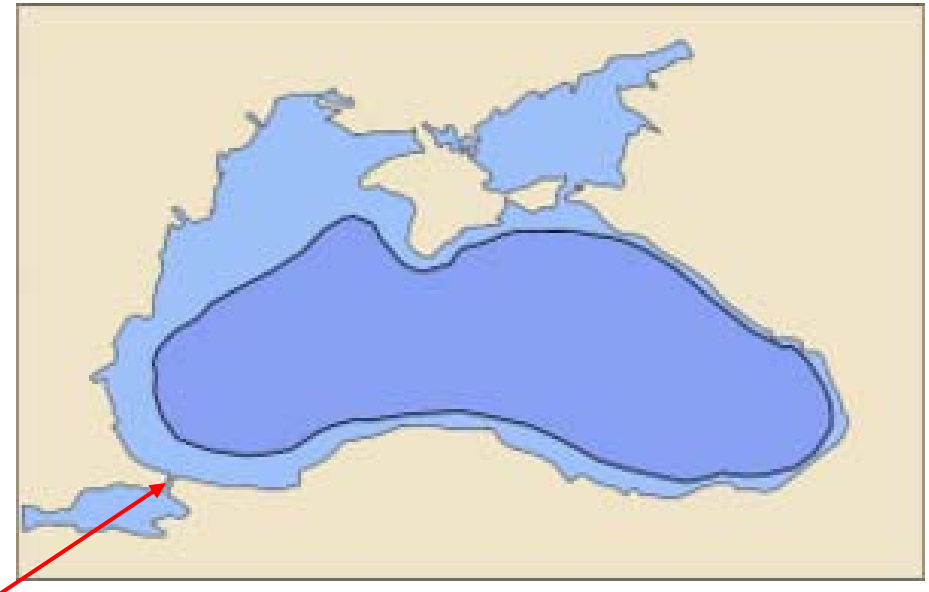
A Last glaciation



B Deglacial flood (7600 years ago)

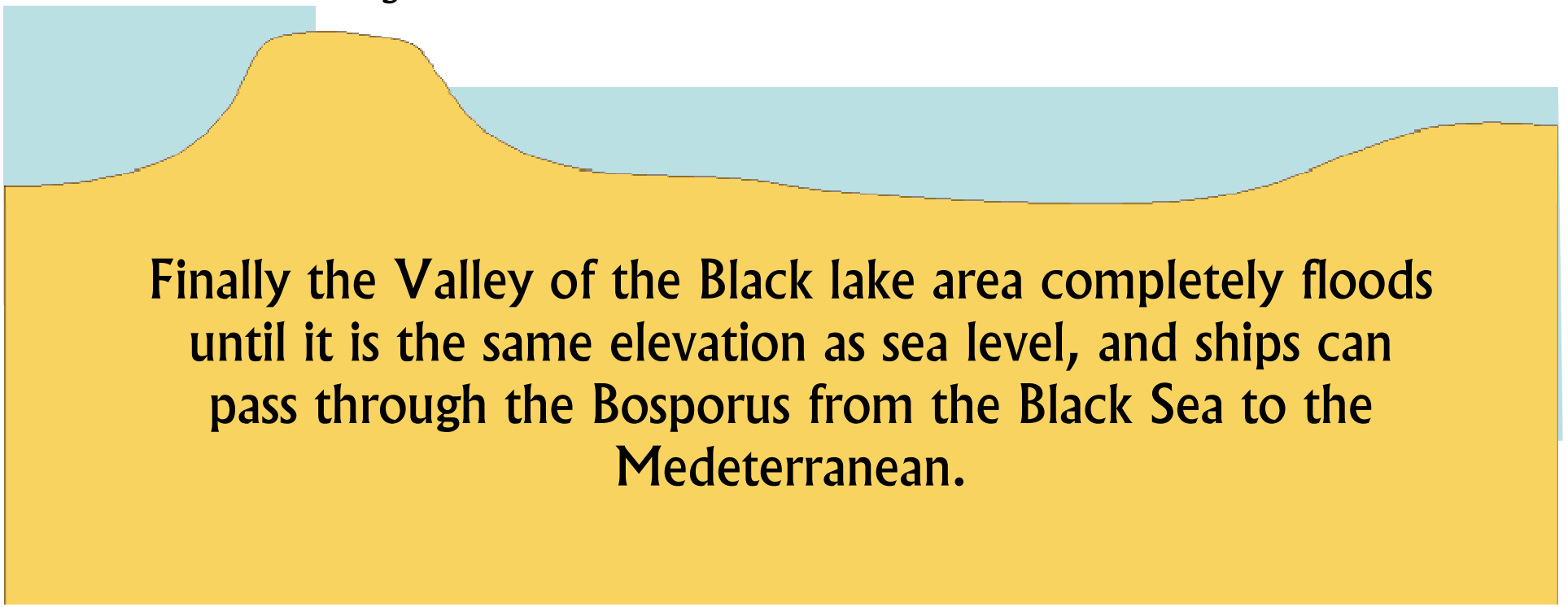
http://www.american.edu/TED/ice/noah.htm

http://emvc.geol.ucsb.edu/Images/animation%20images/BlackSeaFlood.jpg

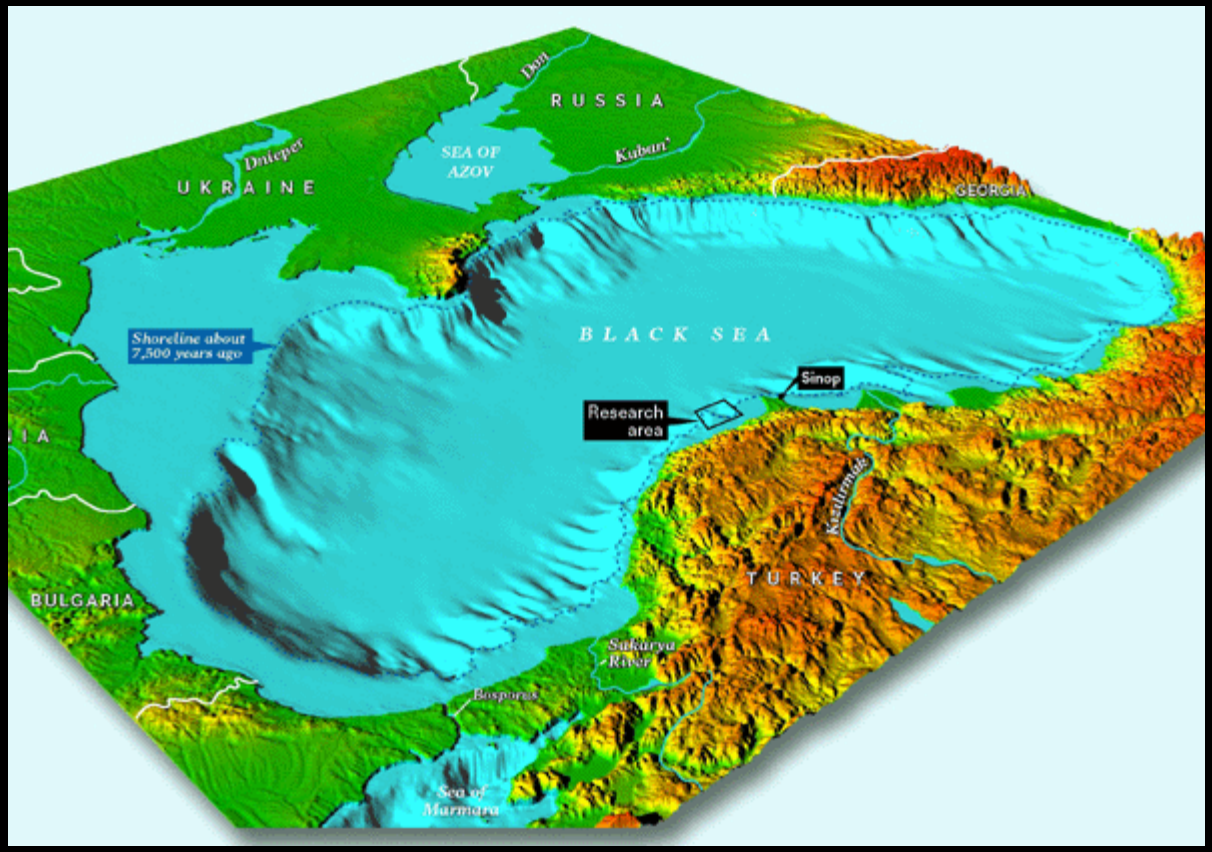


Bosporus straight

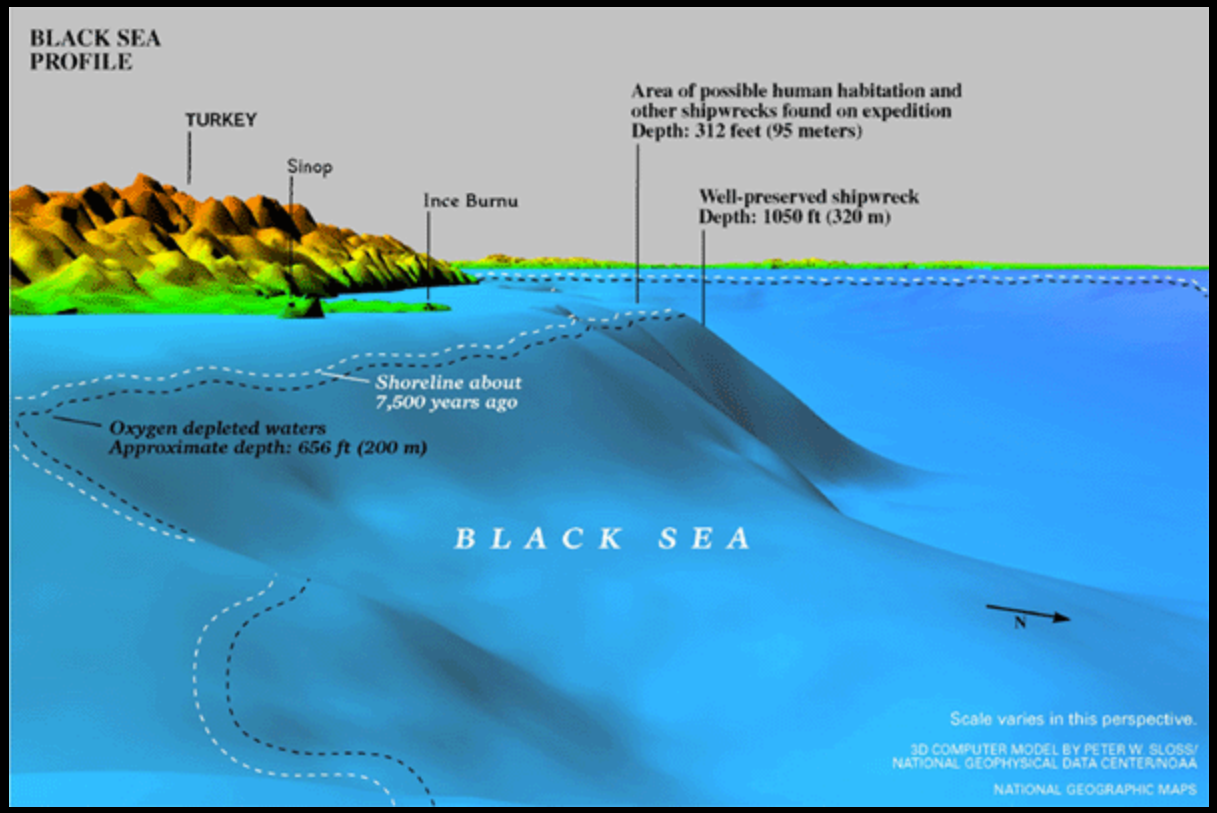
Valley of Black lake completely floods until it is same elevation as sea level



Finally the Valley of the Black lake area completely floods until it is the same elevation as sea level, and ships can pass through the Bosporus from the Black Sea to the Medeterranean.



http://www.pbs.org/saf/1207/features/noah.htm



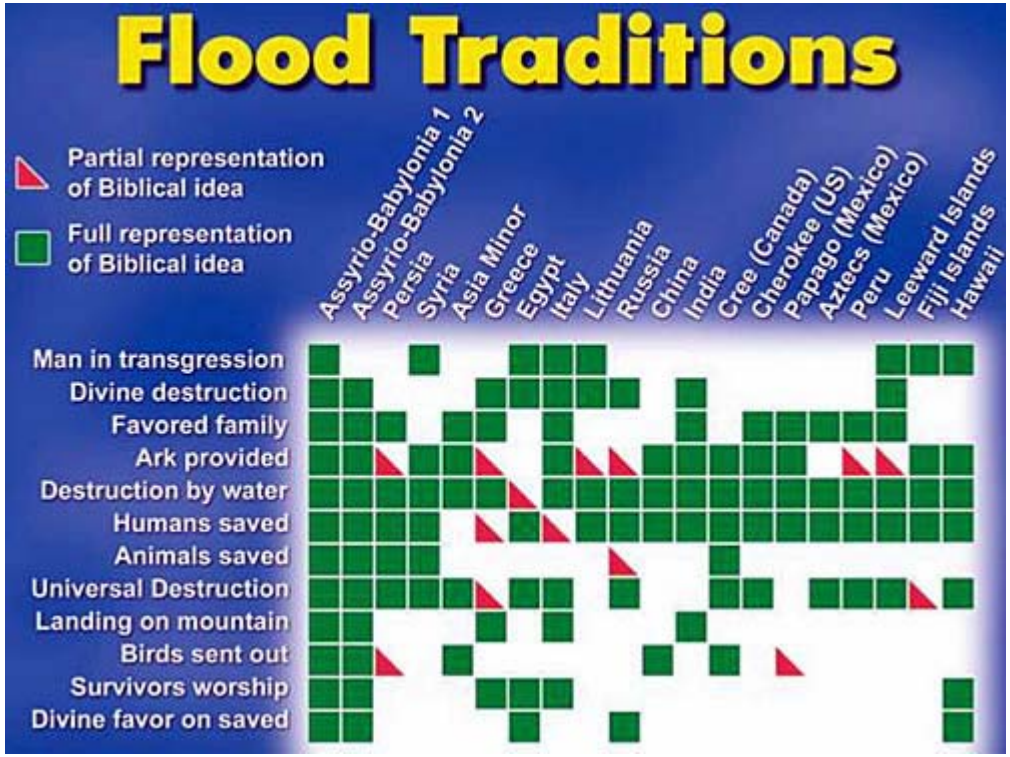
http://www.pbs.org/saf/1207/features/noah.htm

Great Floods In History

Nearly every major civilization has some story of an ancient flood. Two of the most well-known are most likely the Epic of Gilgamesh and the Genesis account. However, a number of other major civilizations have similar flood stories.

http://www.american.edu/TED/ice/noah.htm

Great Floods In History



http://www.answersingenesis.org/docs2004/0329gilgamesh.asp

The Gilgamesh Flood Epic

In reality, it was Utnapishtim's flood, told in the 11th tablet. The council of the gods decided to flood the whole earth to destroy mankind. But Ea, the god who made man, warned Utnapishtim, from Shuruppak, a city on the banks of the Euphrates, and told him to build an enormous boat:

'O man of Shuruppak, son of Ubartutu:

Tear down the house and build a boat!

Abandon wealth and seek living beings!

Spurn possessions and keep alive living beings!

Make all living beings go up into the boat.

The boat which you are to build,

its dimensions must measure equal to each other:

its length must correspond to its width.

'One (whole) acre was her floor space, (660' X 660')

Ten dozen cubits the height of each of her walls,

Ten dozen cubits each edge of the square deck.

I laid out the shape of her sides and joined her together.

I provided her with six decks,

Dividing her (thus) into seven parts.' ...

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'The gods were frightened by the flood,

and retreated, ascending to the heaven of Anu.

The gods were cowering like dogs, crouching by the outer wall.

Ishtar shrieked like a woman in childbirth,

the sweet-voiced Mistress of the Gods wailed:

"The olden days have alas turned to clay,

because I said evil things in the Assembly of the Gods!

How could I say evil things in the Assembly of the Gods,

ordering a catastrophe to destroy my people!!

No sooner have I given birth to my dear people

than they fill the sea like so many fish!"

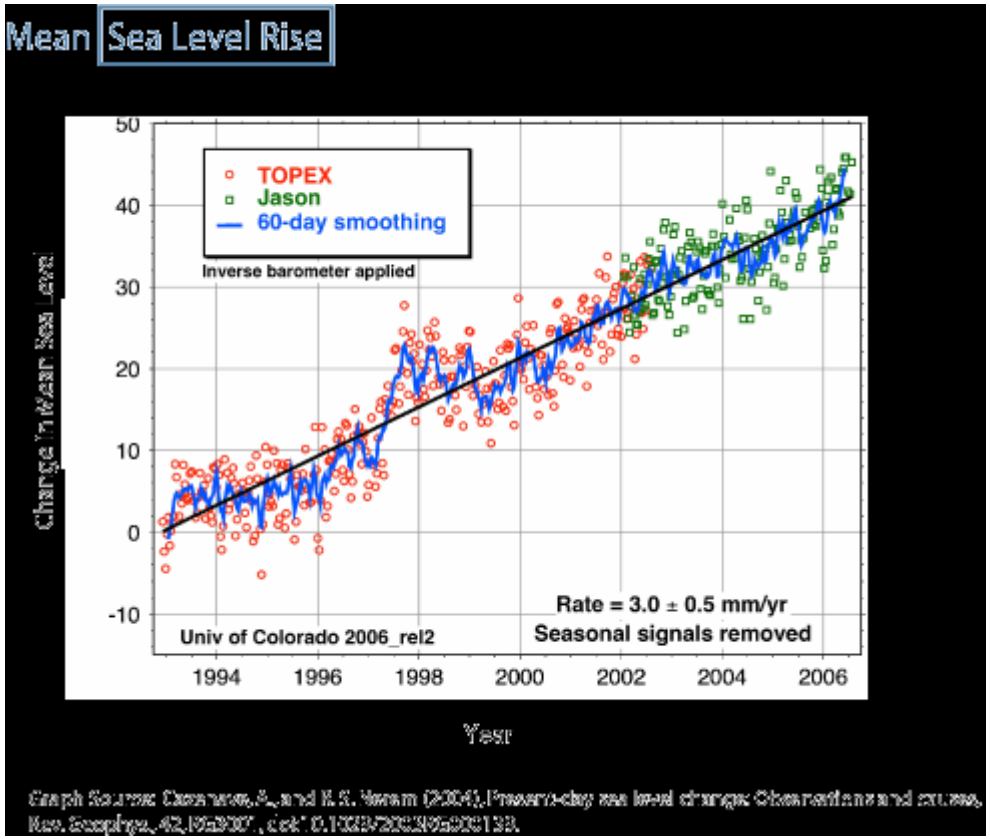
The gods—those of the Anunnaki—were weeping with her,

the gods humbly sat weeping, sobbing with grief(?),

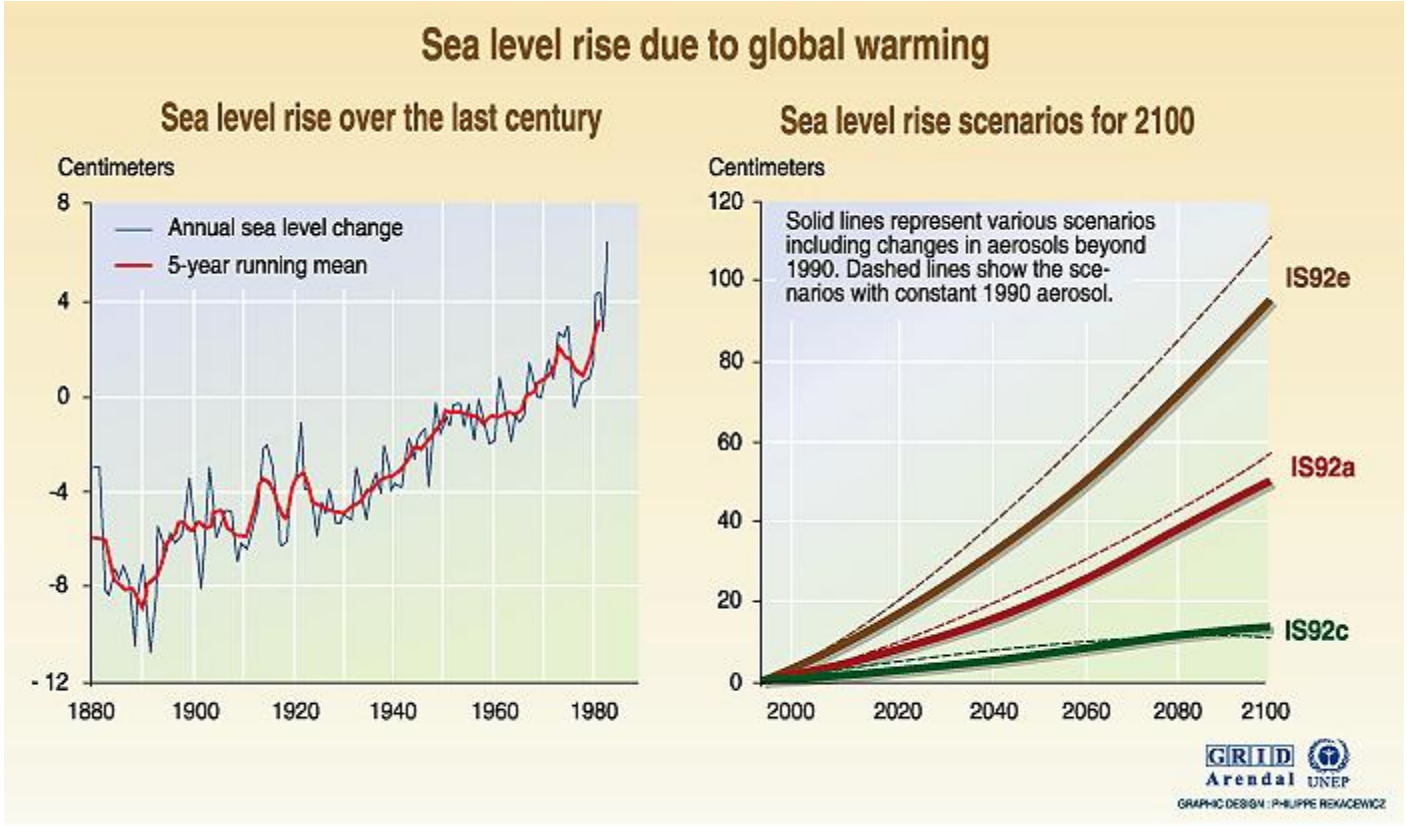
their lips burning, parched with thirst.

http://www.answersingenesis.org/docs2004/0329gilgamesh.asp

The Coming Flood Due to Global Warming

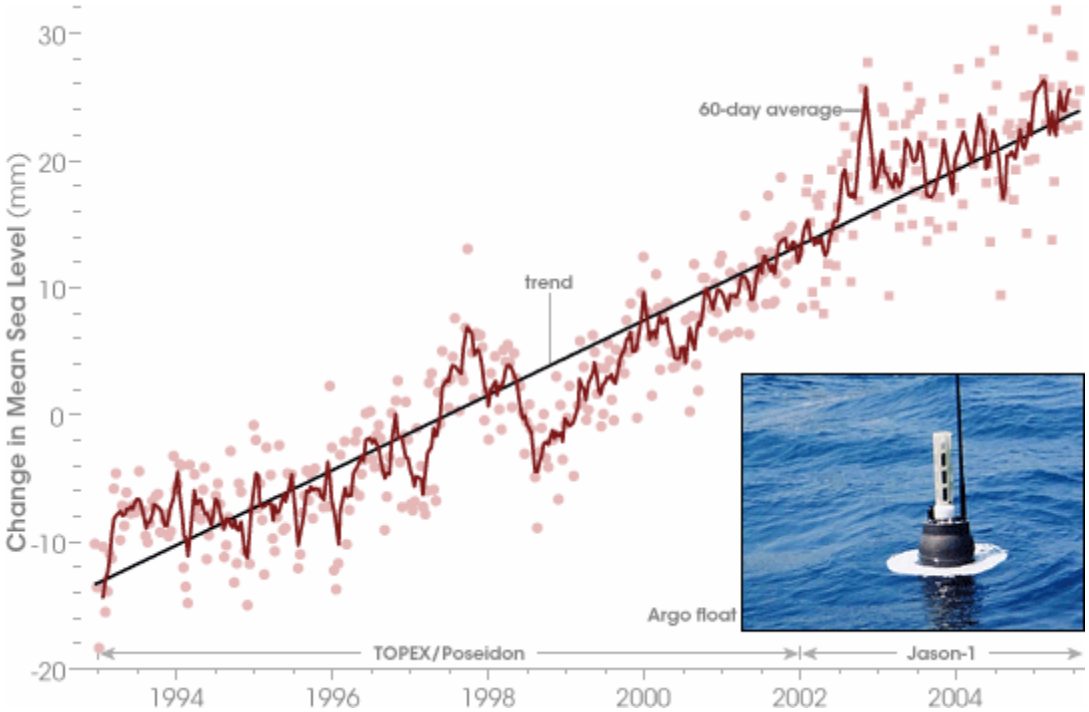


http://www.pewclimate.org/global-warming-basics/facts_and_figures/impacts/slr.cfm



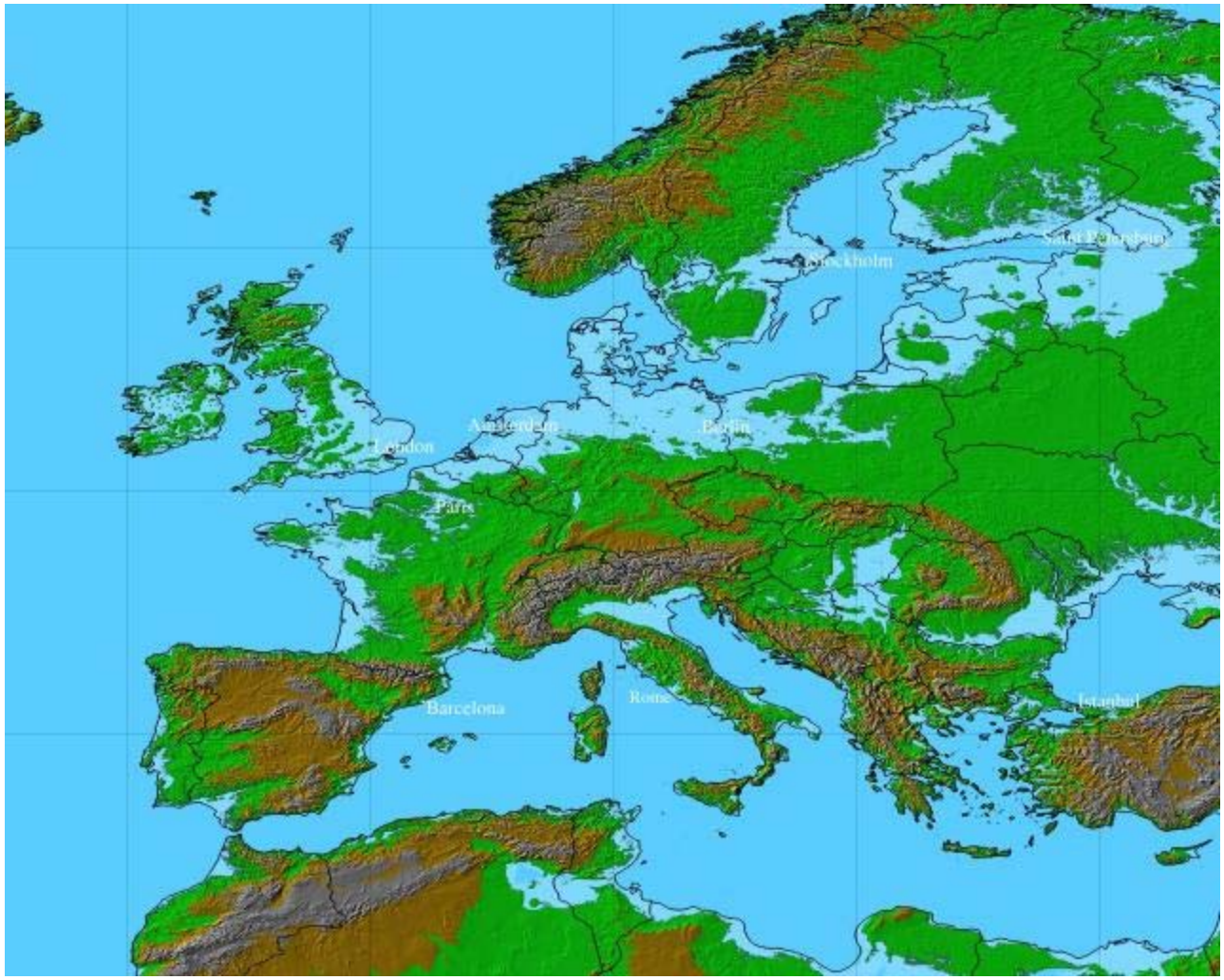
Source: Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996; Sea level rise over the last century, adapted from Gornitz and Lebedeff, 1987.

http://www.grida.no/climate/vital/19.htm



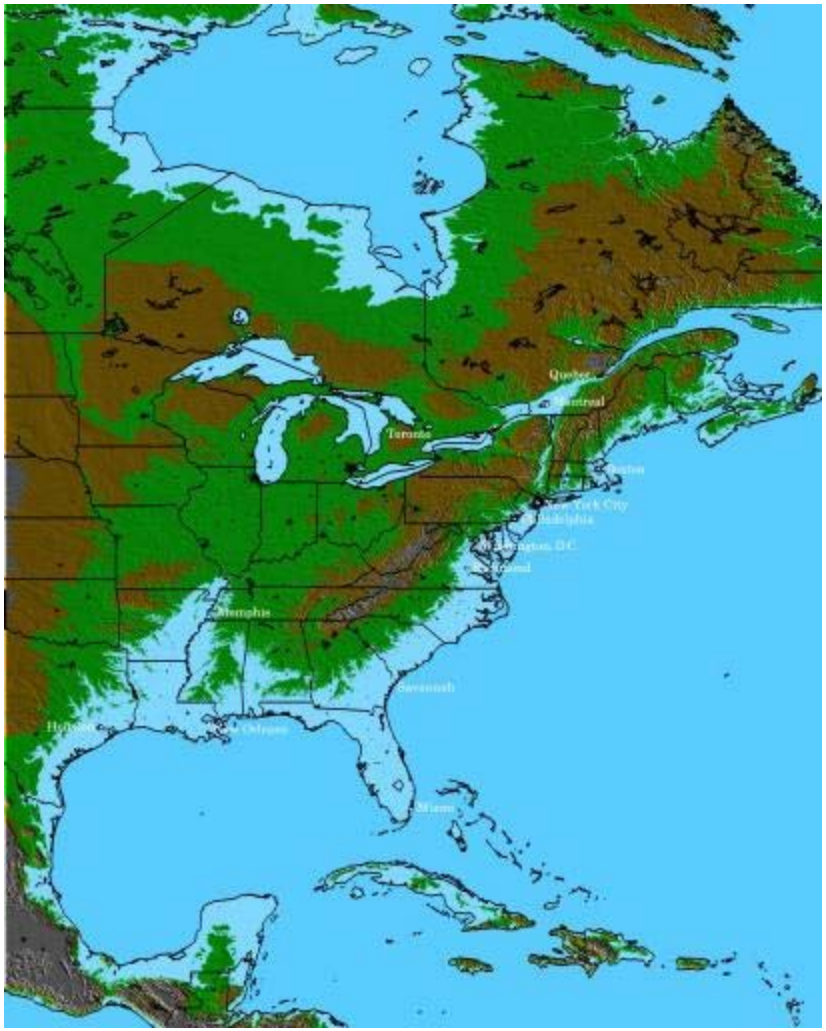
http://www.indybay.org/newsitems/2007/03/16/18377388.php

100 meter rise map



http://resumbrae.com/archive/warming/100meter.html

100 meter rise map



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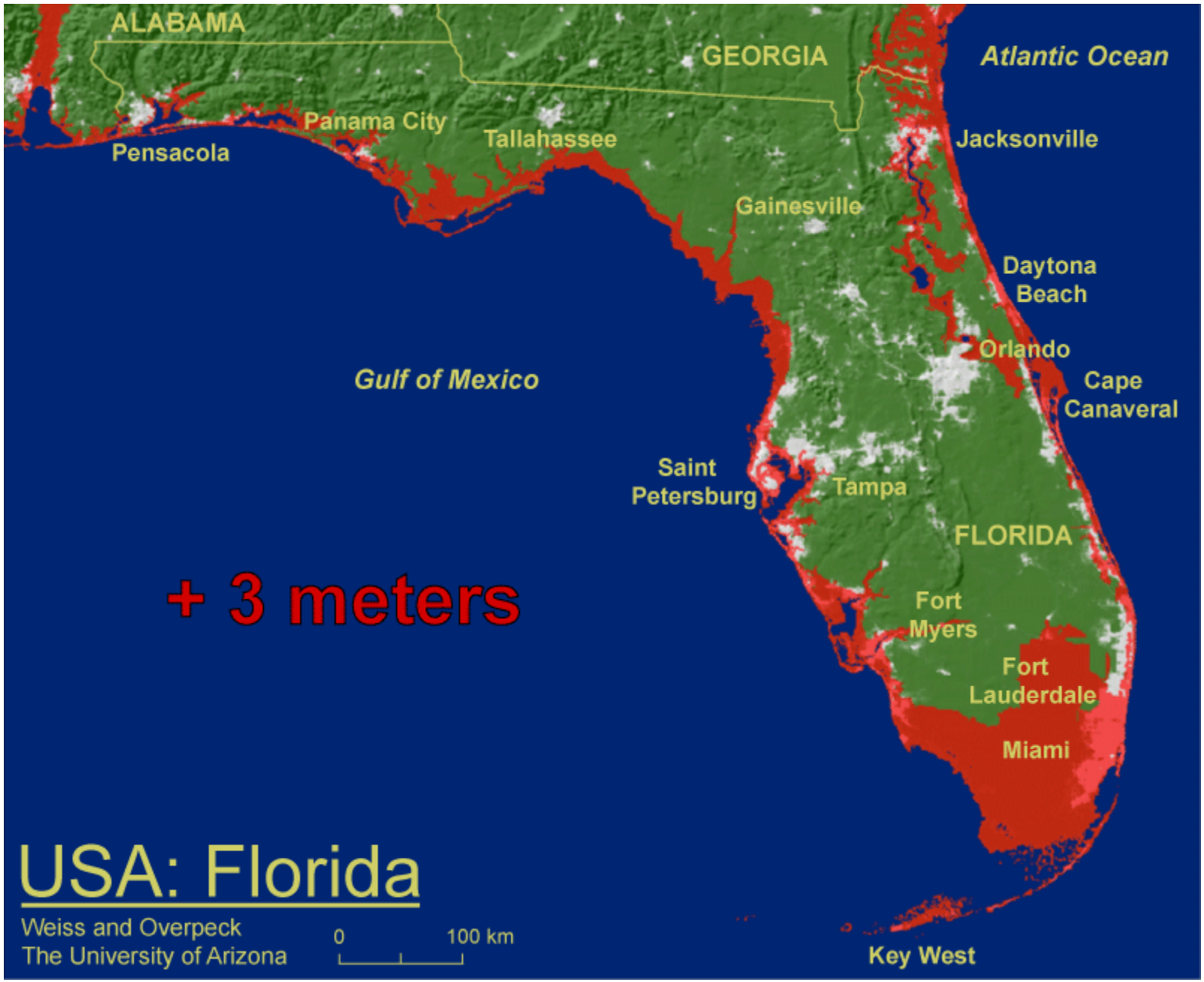
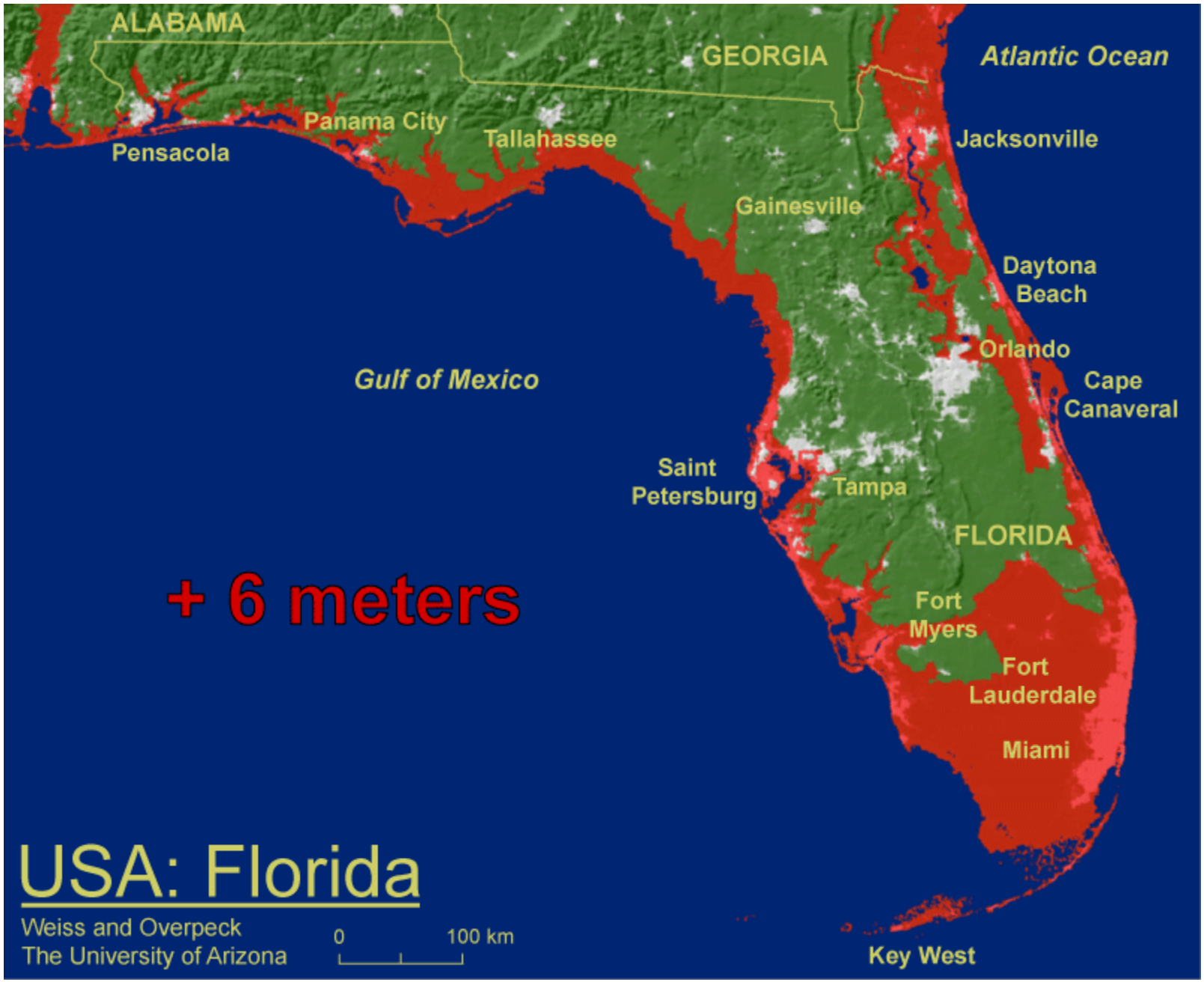


http://www.city-data.com/forum/florida/54952-global-warming-sea-levels.html



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20 feet rise in sea level. If all the ice in the world melted, sea levels would rise 200 to 400 feet and bye bye Florida.

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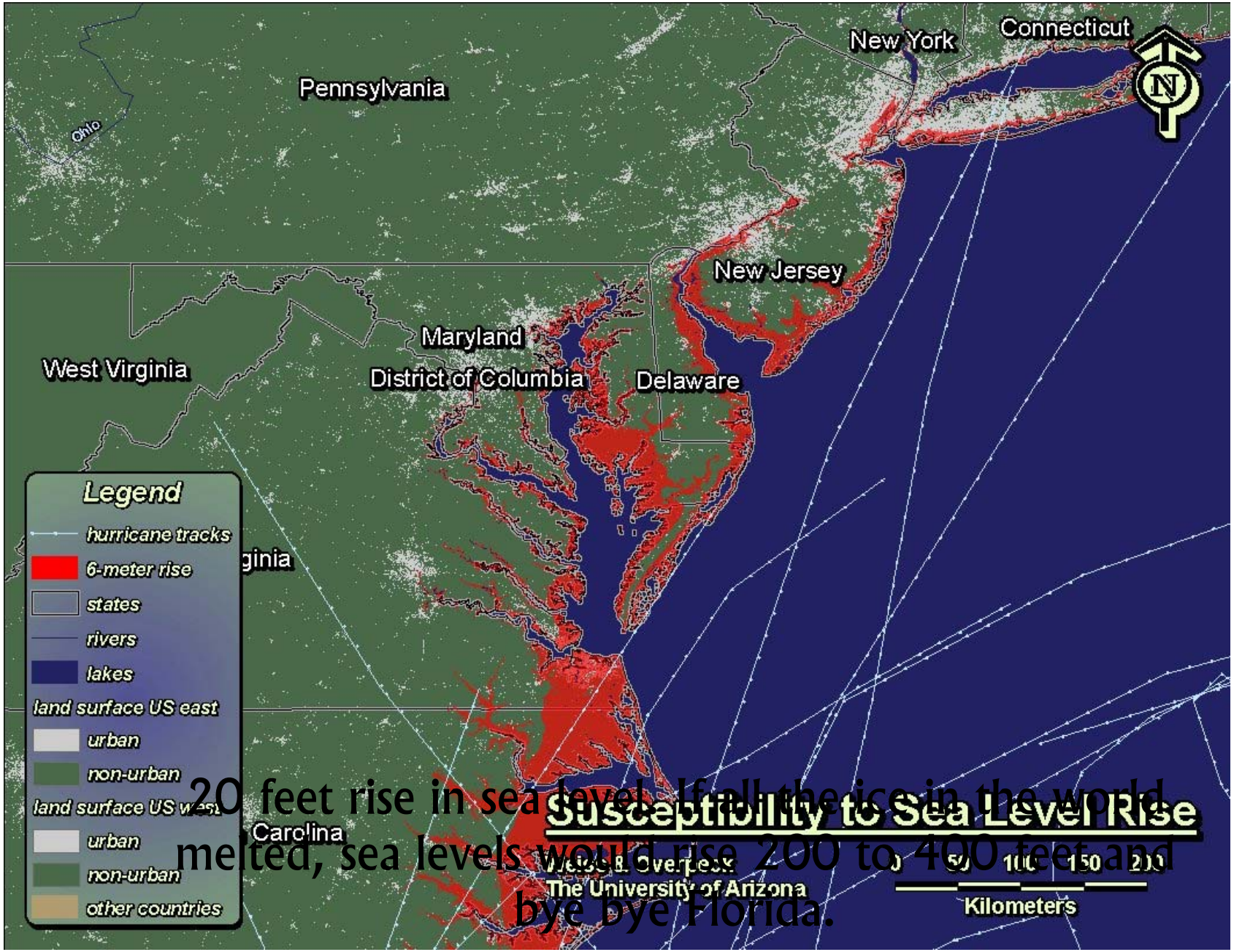

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http://global-fever.org/

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http://thedragonstales.blogspot.com/2007_09_01_archive.html