

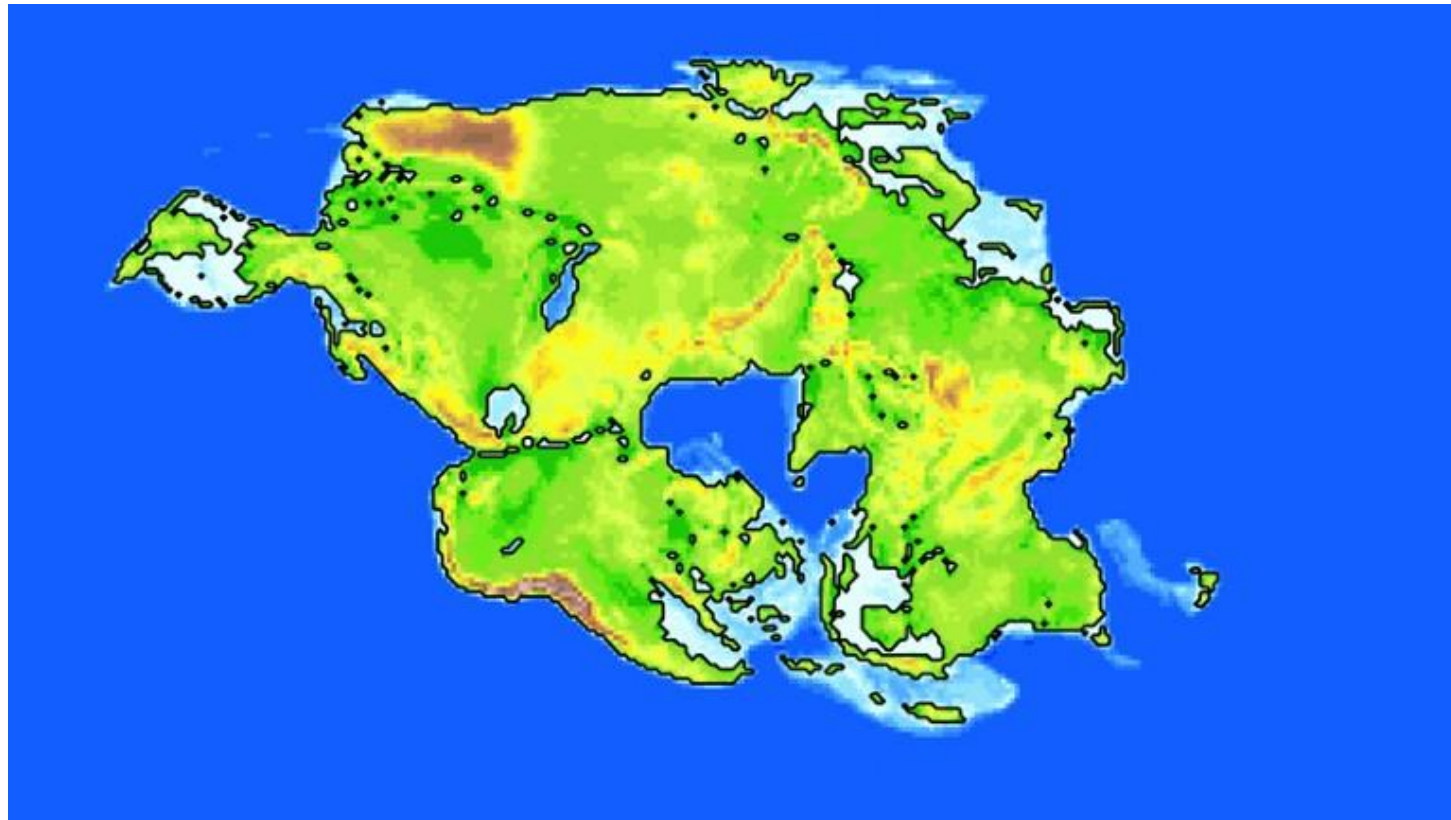
This is what Earth's continents will look like in 250 million years

**Only a fraction of the planet's surface will be habitable to mammals
when the next supercontinent, Pangaea Proxima, forms.**

Paleogeologists have fun with possible scenarios of the future evolution of the earth

- ▶ Christopher Scotese proposed Pangaea Proxima
(Initially called Pangaea Ultima)
- ▶ Roy Livermore suggested Novopangaea
- ▶ Amasia and Aurica are other scenarios
- ▶ I will concentrate on Pangaea Proxima

Pangaea Proxima is expected to have formed by about 250 million years

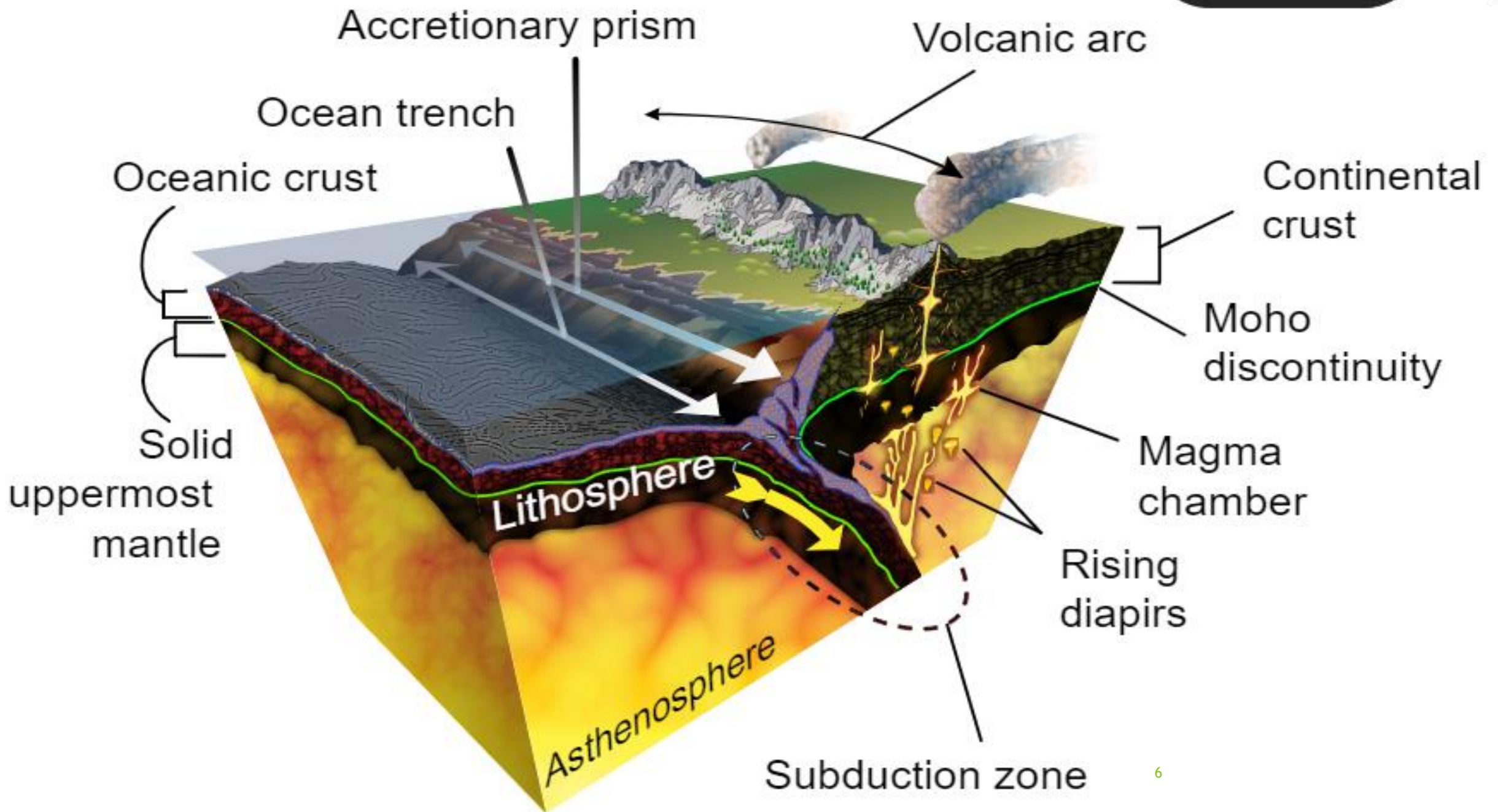


Land mass comprising of Europe, Asia and Africa merges with the Americas

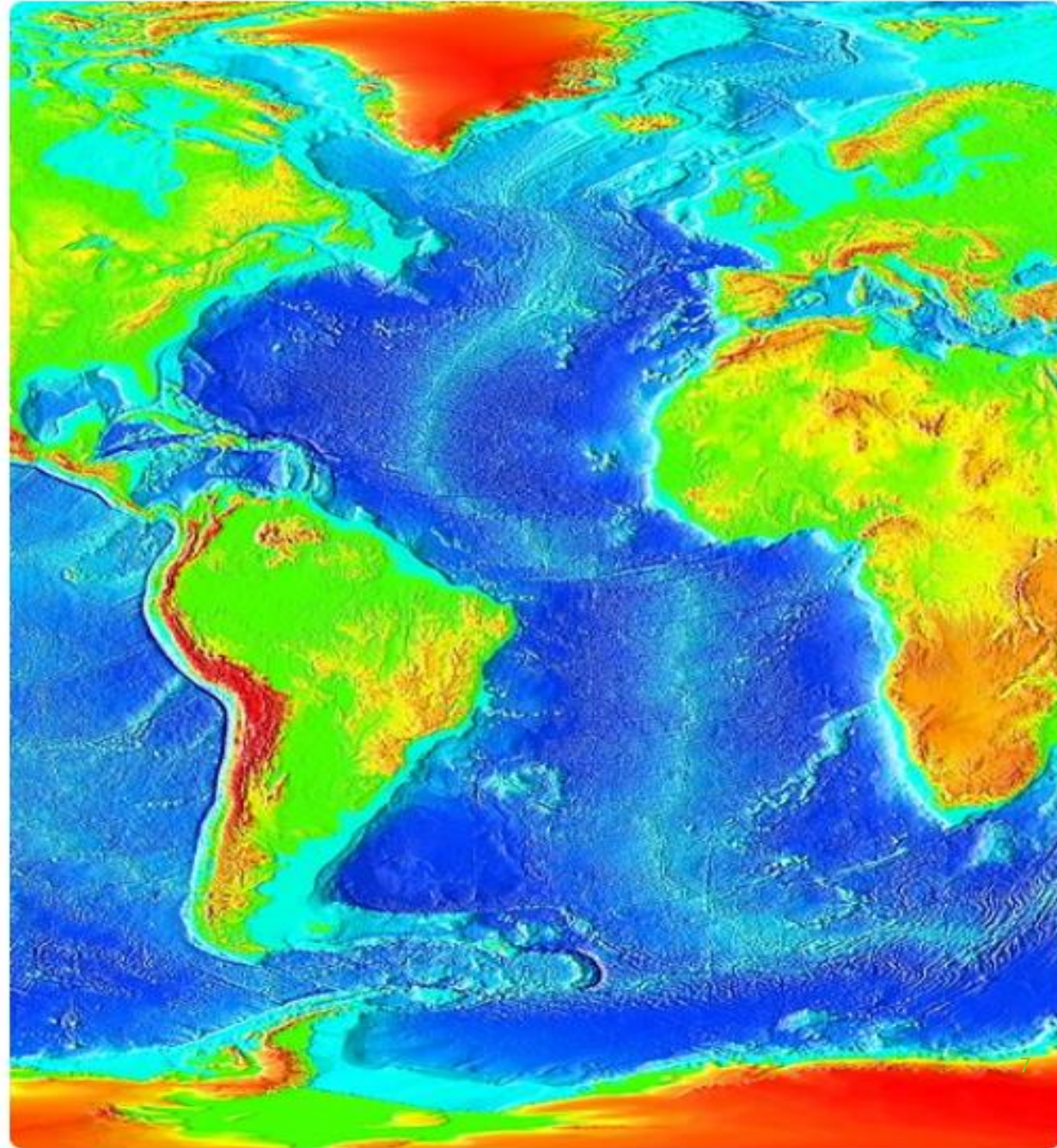


Getting to Pangaea Proxima is an gradual process

- ▶ Continuing current trends for the next 50 million years, North America is predicted to shift west and Eurasia east, and possibly even to the south, bringing Great Britain closer to the North Pole and Siberia southward towards warm, subtropical latitudes.
- ▶ Africa is predicted to collide with Europe and Arabia, closing the Mediterranean Sea (thus completely closing the Tethys Ocean (or Neotethys)) and the Red Sea.
- ▶ A long mountain range (the Mediterranean Mountain Range) would then extend from Iberia, across Southern Europe and into Asia.
- ▶ Some are even predicted to have peaks higher than Mount Everest.
- ▶ Similarly, Australia is predicted to beach itself past the doorstep of Southeast Asia, causing the islands to be compressed inland, forming another potential mountain range.
- ▶ Meanwhile, Southern and Baja California are predicted to have already collided with Alaska with new mountain ranges formed between them.



*A bathymetric o
f the Mid-
Atlantic Ridge
(shown in light
blue in the
middle of the
Atlantic Ocean)*



The further ahead we look the more speculative the ideas become

- ▶ About 125 million years from now, the Atlantic Ocean is predicted to stop widening and begin to shrink as the Mid-Atlantic Ridge seafloor spreading gives way to subduction.
- ▶ In this scenario, the mid-ocean ridge between South America and Africa will probably be subducted first; the Atlantic Ocean is predicted to narrow as a result of subduction beneath the Americas.
- ▶ The Indian Ocean is also predicted to be smaller due to northward subduction of oceanic crust into the Central Indian trench.
- ▶ Antarctica is expected to split in two and shift northwards, colliding with Madagascar and Australia, enclosing a remnant of the Indian Ocean, which Scotese calls the "Medi-Pangaeen Sea".
- ▶ When the last of the Mid-Atlantic Ridge is subducted beneath the Americas, the Atlantic Ocean is predicted to close rapidly.

Supercontinents

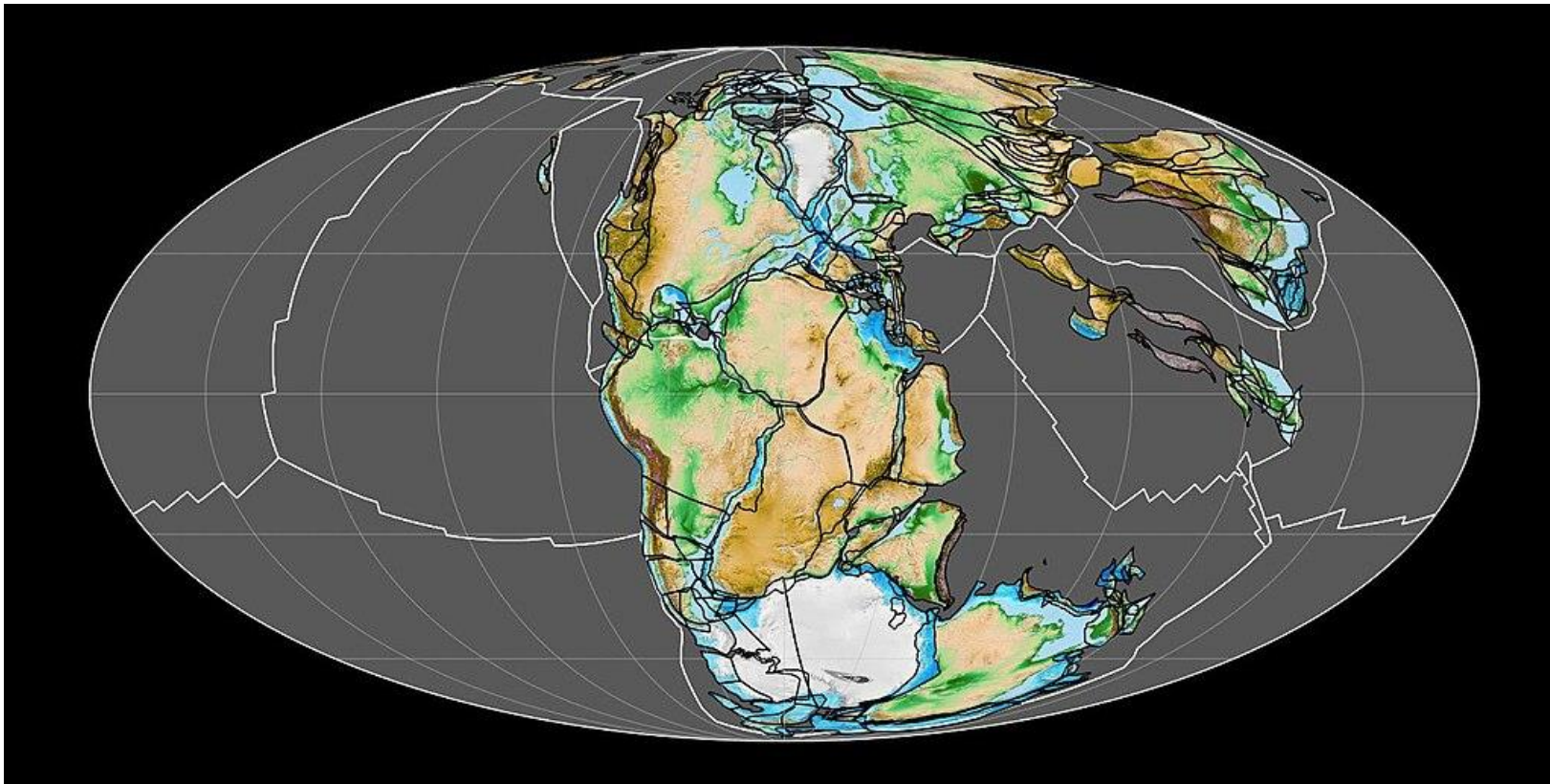
- ▶ Supercontinents describe the merger of all, or nearly all, of Earth's landmass into a single contiguous continent.
- ▶ In the Pangaea Proxima scenario, subduction at the western Atlantic, east of the Americas, leads to the subduction of the Atlantic mid-ocean ridge followed by subduction destroying the Atlantic and Indian basin, causing the Atlantic and Indian Oceans to close, bringing the Americas back together with Africa and Europe.

Super-continent cycles, they happen roughly every 500 million years

- ▶ Earth is currently thought to be in the middle of a supercontinent cycle as its present-day continents drift.
- ▶ The last supercontinent, Pangaea, broke apart about 200 million years ago.



The supercontinent Pangaea in the early Mesozoic (200 m years ago)



Pangaea's climate

- ▶ There is some evidence that Pangaea and other previous supercontinents had large interior deserts.
- ▶ Decreased the area of habitable land and led to extinctions.
- ▶ “You see similar things happening in the end-Triassic extinction event” around 200 million years ago.

The future conditions

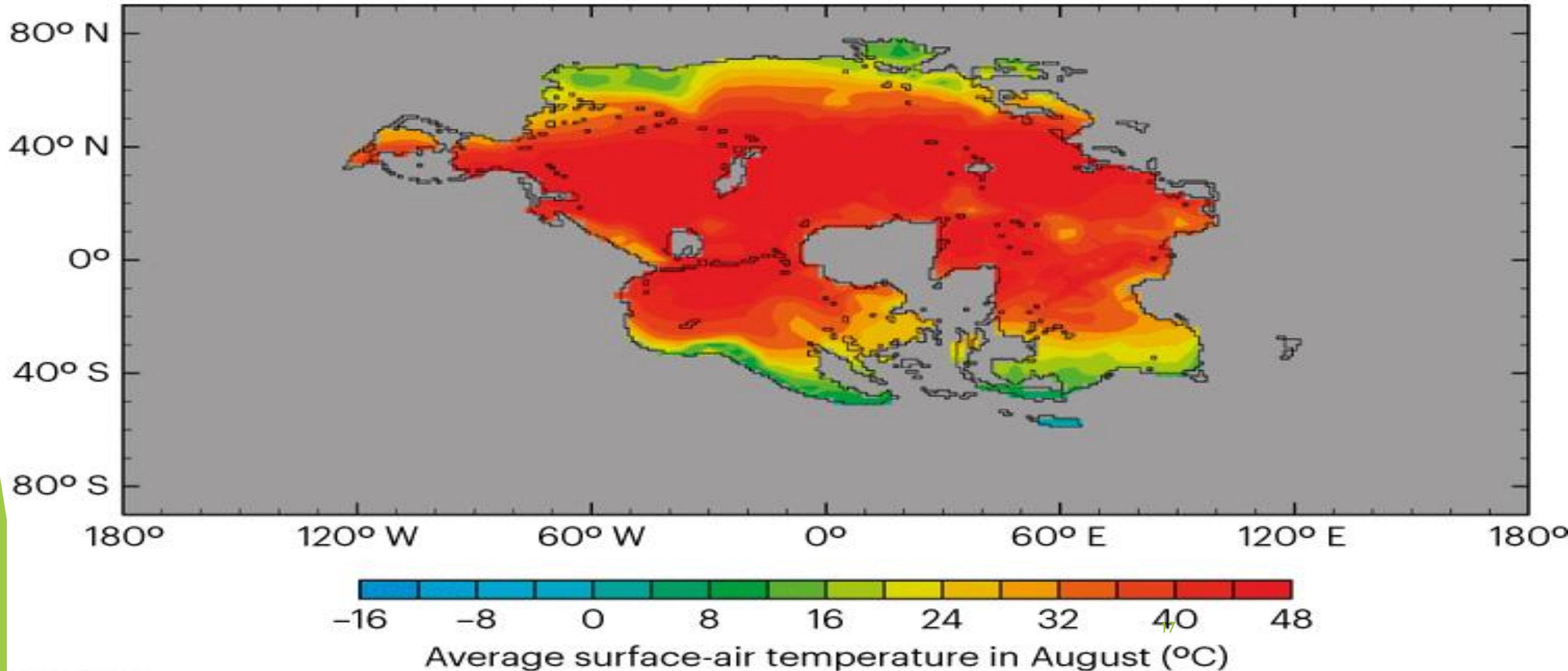
- ▶ Up to 92% of Earth could be uninhabitable to mammals in 250 million years
- ▶ Of course, this is an on-going process

Modelling the climate of the new supercontinent

- ▶ Much of Pangaea Proxima will experience temperatures of higher than 40 °C, making it uninhabitable to most mammalian life.
- ▶ As they merge together and then drift apart, the continents will drive volcanic activity that “spews huge amounts of CO₂ up into the atmosphere”, and that will heat up the planet.
- ▶ *The concept was suggested by extrapolating past cycles of formation and breakup of supercontinents, not on theoretical understanding of the mechanisms of tectonic change, which are too imprecise to make predictions that far into the future.*

DESERT SUPERCONTINENT

Extreme temperatures 250 million years from now will make most of Pangaea Ultima inhospitable to humans and other mammalian life.



Hard for creatures to live elsewhere than the fringes of the supercontinent

- ▶ Regions in the middle of the supercontinent, far from the oceans, would turn into deserts that are unliveable, except for very specialized creatures.
- ▶ The lack of moisture would also diminish the amount of silica that is washed into the oceans, which usually removes CO₂ from the atmosphere.

The sun will be evolving too

- ▶ Increased solar radiation will cause further heating.
- ▶ The Sun is predicted to be 2.5% more luminous at the time of Pangaea Proxima's formation,
- ▶ This is a result of the star having burnt more of its hydrogen fuel and shrunk its core, increasing its rate of nuclear fusion.

Mass extinctions probable

- ▶ In a worst-case scenario, in which CO₂ levels reach 1,120 parts per million, more than double current levels, just 8% of the planet's surface — coastal and polar regions — would be habitable to most mammalian life, compared with about 66% today.
- ▶ This would lead to a mass extinction.
- ▶ It wouldn't just be for mammals.
- ▶ It could be for plant life, as well, and other types of life.
- ▶ What comes out of it is anyone's guess.
- ▶ In other mass extinctions a new species tends to dominate.”

Where in the globe will this super-continent be?

- ▶ It's also not certain where Pangaea Proxima will form.
- ▶ Farnsworth's modelling assumes it will coalesce in the warm tropics.
- ▶ Other scenarios suggest that it could form on top of the North Pole, leading to cooler conditions where life might fare better.

What does the future hold?

- ▶ If humans are still around in 250 million years, Farnsworth speculates that they might have found ways to adapt, with Earth resembling the 1965 science-fiction novel *Dune*.
- ▶ “Do humans become more specialist in desert environments, become more nocturnal, or keep in caves?”
- ▶ It might not be all doom and gloom, however. “There have been extinction events in the past, and will be extinction events in the future,”
- ▶ “I think life will make it through this one. It’s just kind of a grim period.”

New Aurica Animation

