Why did things really change Around 5 Million Years Ago?

The Great Conveyor: Part 1 - The Closing of the Isthmus of Panama

https://earthobservatory.nasa.gov/images/4073/panama-isthmus-that-changed-the-world

We had some good questions while we were grappling with CSSG-2.4's broad look at ancient times. Several folks focussed on the **asserted large impact of the closing of the Isthmus of Panama around 3 million years ago**.

(Actually, I'm grateful for the opportunity to take a bit of a tangent from all that billions of years of PALEO stuff. It makes me feel old!! But never fear, that story will get told in due time.)

How could closing the Isthmus change things much?

[As an aside, the date of this closing has been studied and debated for decades. The consensus moved eventually to around 3 million years ago from 15 million years ago. Some recent research claimed new insights for the closing at around 23 million years ago. More recent work points to 2.7-2.8 million years ago, citing, among many lines of evidence, **the timing of the motion of animals in each direction**. That's how science works.
https://www.tamug.edu/newsroom/2016articles/FormationIsthmusPanama.html#:~:text=A%20relatively%20recent%20date%20for,as%2023%20million%20years%20ago.]

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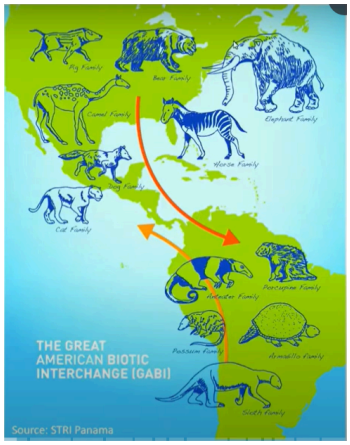

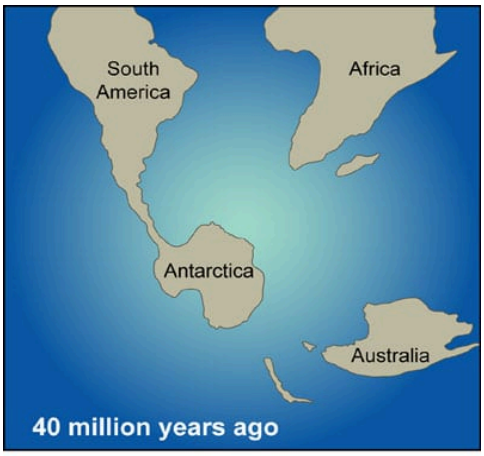

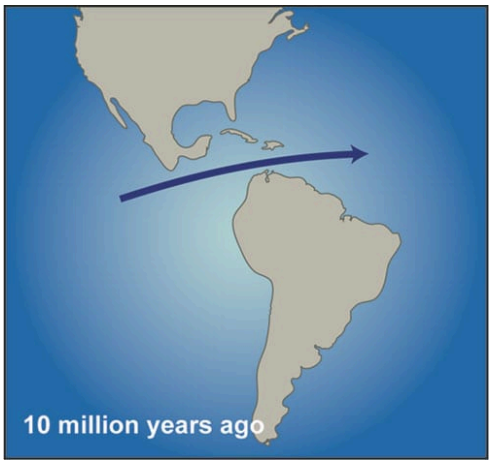

Some context: How Antarctica got its ice sheets—In the continual movement of Earth's tectonic plates, Antarctica was severed from the southern tip of South America about 34 million years ago, creating the Drake Passage. Antarctica became completely surrounded by ocean. The powerful Antarctic Circumpolar Current began to sweep around the continent**, isolating Antarctica from the warmth of the global oceans and provoking large-scale cooling**. This is consistent with the timelines in **CSSG-2.4** where we discussed the formation of the Antarctic ice sheets at around 34 Ma.

Surface waters flowed from the Pacific into the Atlantic 10 million years ago via an ocean gateway called the Central American Seaway, and both oceans had the same salinity.

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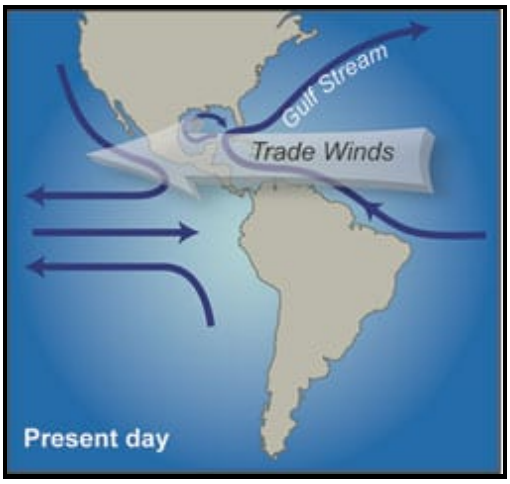
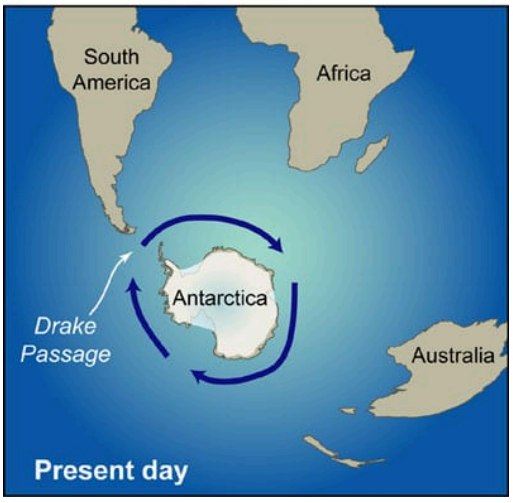
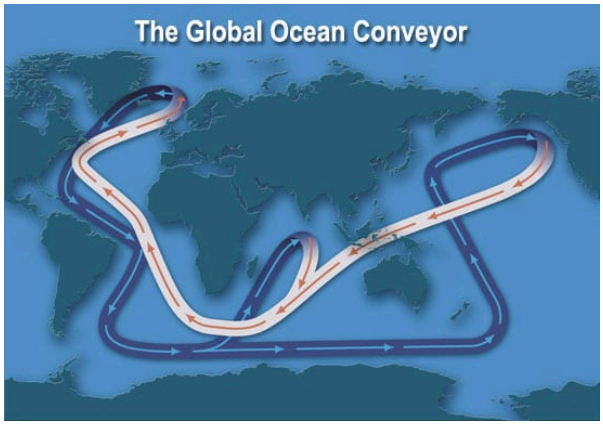


About 5 million years ago, the North American, South American, and Caribbean Plates converged. The rise of the Isthmus of Panama restricted water exchange between the Atlantic and Pacific, and their salinities diverged. The isthmus diverted waters that once flowed through the Seaway. The Gulf Stream began to intensify.

Today, evaporation in the tropical Atlantic and Caribbean leaves behind saltier ocean waters and puts fresh water vapor into the atmosphere. Trade Winds carry the water vapor westward across the low-lying isthmus, depositing fresh water into the Pacific through rainfall. As a result, the Atlantic is saltier than the Pacific. (Illustration by Jack Cook, WHOI)





Next time, we'll look at this circulation around Antarctica. It will not only be a really crazy (cool?) thing to learn about in the context of the Great Conveyor, but it will ultimately make all the talk we hear about potential melting of the "Doomsday Glacier" down there make a lot more sense.

Today's climate system is influenced by the ocean's conveyor-like global circulation. Cold, salty waters sink to drive the conveyor, and warm surface currents complete the loop. (Jayne Doucette.)

We will build an understanding of this Conveyor step-by-step. Closing the Isthmus set up its formation.

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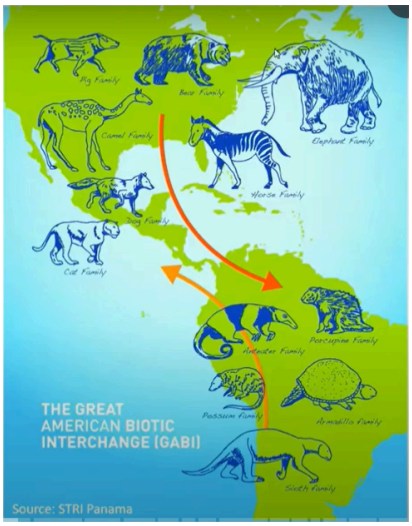
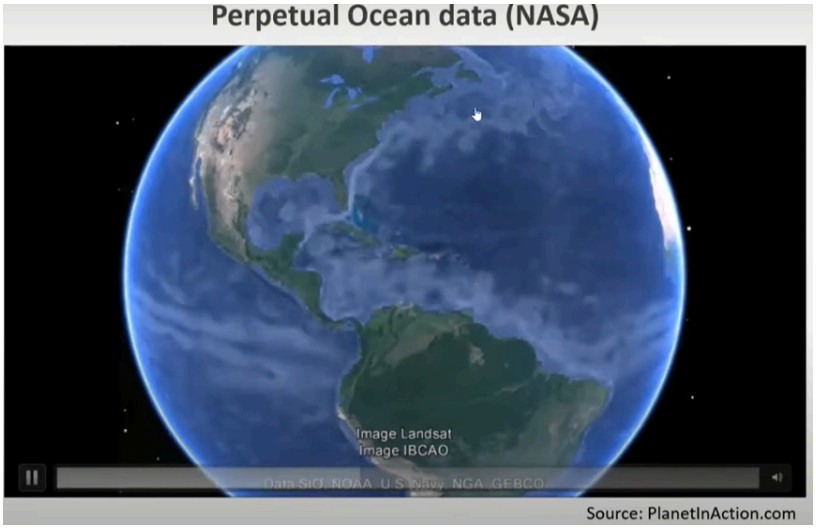
The article in which I found the beautiful picture of the Isthmus at the top of this material was: https://earthobservatory.nasa.gov/images/4073/panama-isthmus-that-changed-the-world. Here is some helpful text from that source:

"Scientists believe the formation of the Isthmus of Panama is **one of the most important geologic events to happen on Earth in the last 60 million years.** Even though it is only a tiny sliver of land, relative to the sizes of continents, the Isthmus of Panama had **an enormous impact on Earth's climate and its environment**. By shutting down the flow of water between the two oceans, the land bridge re-routed currents in both the Atlantic and Pacific Oceans. Atlantic currents were forced northward, and eventually settled into a new current pattern that we call the Gulf Stream today. With warm Caribbean waters flowing toward the northeast Atlantic, the climate of northwestern Europe grew warmer. (Winters there would be as much as 10 degrees C colder in winter without the transport of heat from the Gulf Stream.) The Atlantic, no longer mingling with the Pacific, also grew saltier. Each of these changes helped establish the global ocean circulation pattern we see today. **In short, the Isthmus of Panama directly and indirectly influenced ocean and atmospheric circulation patterns, which regulated patterns of rainfall, which in turn sculpted landscapes."**

Two Big Changes from the Closing of the Isthmus





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A great **stimulation of biodiversity**.	**Diversion of ocean currents**. In this NASA simulation, notice how, prior to the isthmus closing, the central Pacific current would have simply fed into the Atlantic - little warmth flowed north and over to Europe. Today's Gulf Stream, as part of the global Great Conveyor induced by the Isthmus closure, is channeled up the East Coast of North America. This does (at least) two things: 1) brings warmth to Northern Europe, and 2) **brings a lot of moist air up North, where it is now able to feed more snow, allowing development of the northern ice caps and ice ages**.

https://www.youtube.com/watch?v=622CnV33Mco

Some other interesting discussion can be found at:
https://www.smithsonianjourneys.org/blogs/blog/2011/04/13/how-the-isthmus-of-panama-changed-the-world/

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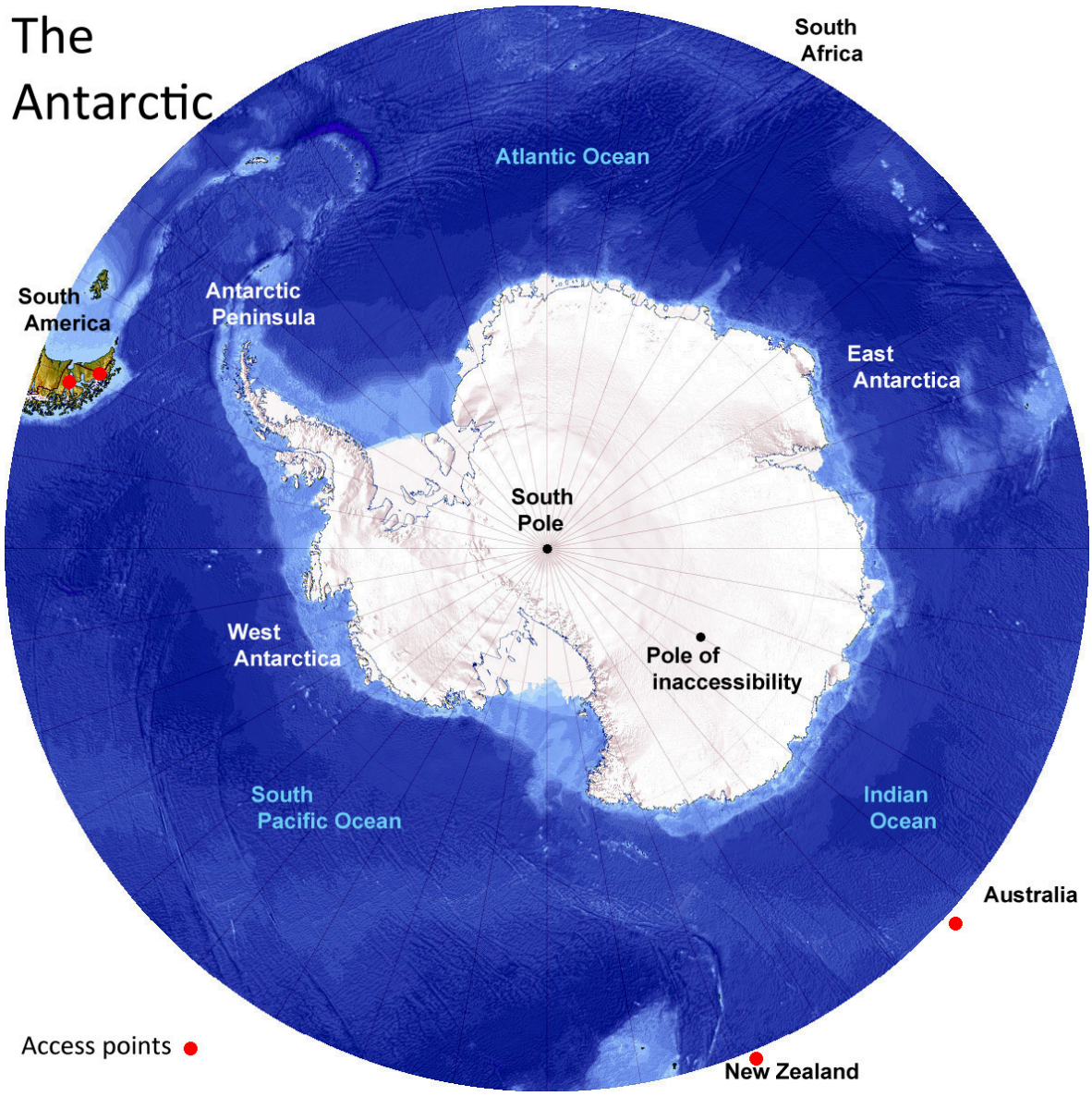
Next time: *The Great Conveyor: Part 2 - The Antarctic Currents*



This is the Antarctic TODAY.