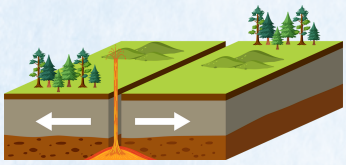
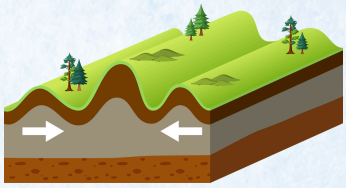
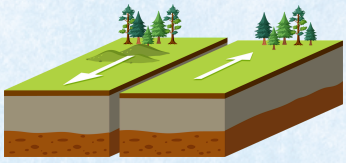
CONTINENTAL DRIFT



Divergent Plate Boundary



Convergent Plate Boundaries



Transform Plate Boundary

Background Information

Pangea is the name of an ancient **supercontinent** that existed 200-300 million years ago, although due to continental drift, the continents have drifted to the configuration we see today. **Continental drift** is the movement of continents due to the motion of the tectonic plates they rest on. **Tectonic plates** are gigantic pieces of the Earth's core and upper mantle; they move due to convection within the **magma** of the Earth's mantle. **Convection** describes the process of transferring heat through air or, in this case, liquid currents. The movement of magma in the mantle slowly pushes the tectonic plates, and thus, the continents that lie on top of them.

Tectonic plates interact with each other at plate boundaries, and there are 3 main classifications; divergent, convergent, and transform plate boundaries. Divergent plate boundaries occur when two plates are moving apart from each other. Currently, divergent boundaries are responsible for the slow separation of Baja California from the rest of. Mexico. Convergent boundaries occur when two plates are moving toward each other. This either results in subduction of a plate, sometimes causing volcanoes, or mountain-building events, termed orogenies. Transform boundaries occur when two plates slide past each other. This is not a smooth process and typically results in earthquakes of varying magnitudes.

Fun Fact: Tectonic plates typically move a few centimeters each year. That's the same speed that fingernails grow!

Next Generation Science Standards (NGSS) Met:

- 4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.

CONTINENTAL DRIFT

Objective

Students will understand continental drift and the pieces of evidence that Alfred Wegener used to justify his theory. Students will use trends in maps of the modern-day continents to understand the ancient supercontinent Pangea. Students will understand convection and its connection to magma under the Earth's crust.

Key Vocabulary:

- **Continent:** a large continuous mass of land
- **Supercontinent:** the assembly of most or all of Earth's continental blocks to form a single large landmass
- **Plate tectonics:** gigantic pieces of the Earth's crust and uppermost mantle
- **Continental drift:** the movement of continents resulting from the motion of tectonic plates
- **Magma:** a mixture of molten and semi-molten rock found beneath the surface of the Earth
- **Convection:** the process of transferring heat through air or liquid currents
- **Pangea:** an ancient supercontinent

Materials Needed:

- Continent/country cut out
- Colored pencils/crayons/markers
- Red warm water in an erlenmeyer flask
- Room temperature water
- A large, clear tote
- Freezer access
- Hot plate access
- Blue ice cubes
- Scissors
- Maps
- Ice cube tray

Preparation:

1. Print a copy of the continent/country cut out for each student.
2. Print a copy of each map per every 3 students as students will share the maps.
3. Mix blue food coloring into water until it is opaque and pour it into the ice cube tray and place into the freezer.
4. Mix red food coloring into water until it is opaque and pour it into the erlenmeyer flask and heat over the hot place, be sure the water does not begin to boil or steam

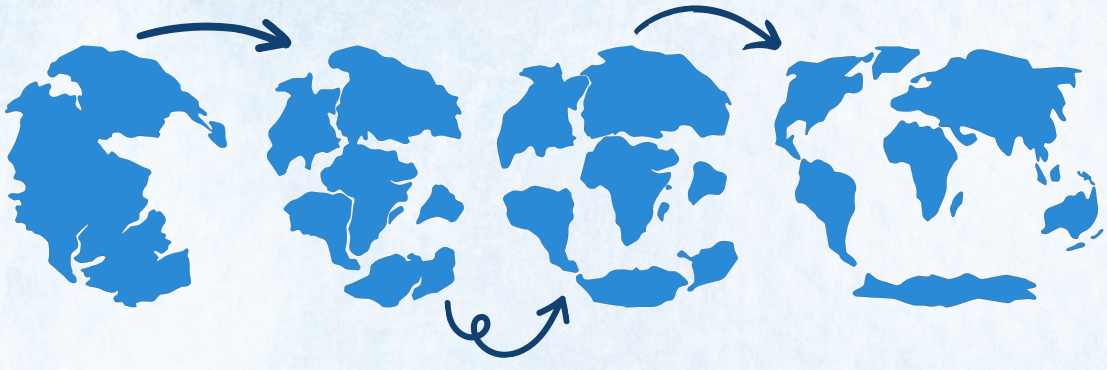
CONTINENTAL DRIFT

Note: For the convection demonstration, use food coloring to dye the water. Fill the tote full of room temperature water. Add the ice cubes to the top right and the same time you add the flask to the bottom left. The cold, blue water should sink and the red, warm water should float, causing a convection current.

Timeline and Procedures:

- 5 minutes - Introduce students to the activity. Pass out the continent/country cut out worksheet and scissors to each student and give them time to cut.
- 2.5 minutes - Encourage students to see if the continents and countries can fit together in any way. They will likely find this to be very difficult.
- 12.5 minutes - Interrupt the students and inform them that the process will be easier if they make use of data on specific maps. Inform them that this is what the real scientist Alfred Wegener used to determine how the continents used to be connected. Pass out coloring utensils for the students to copy the data over to their pieces in a way that makes sense for them. Students should have about 4 minutes with each map before rotating.
- 5 minutes - Now that students have pieces that are full of data, encourage them to try putting the pieces together. Ensure they pay close attention to where the data is on the edge of each piece. At the end, if students have not found the correct orientation show them the correct answer.
- 5 minutes - Prompt students to consider why the continents would move to their current location from this past orientation.
    - Ask, What would make the continents move? Where could the force moving the continents come from?
- 5 minutes - Conduct the convection demonstration for the class. As you do the demonstration, ask students to imagine a continent on top of the water. What would happen to the continent? Where would it move?
- 5 minutes - Connect the content together. Explain to students that the convection they see happening in the water is what happens with magma under the Earth's crust, causing the continental plates to move.

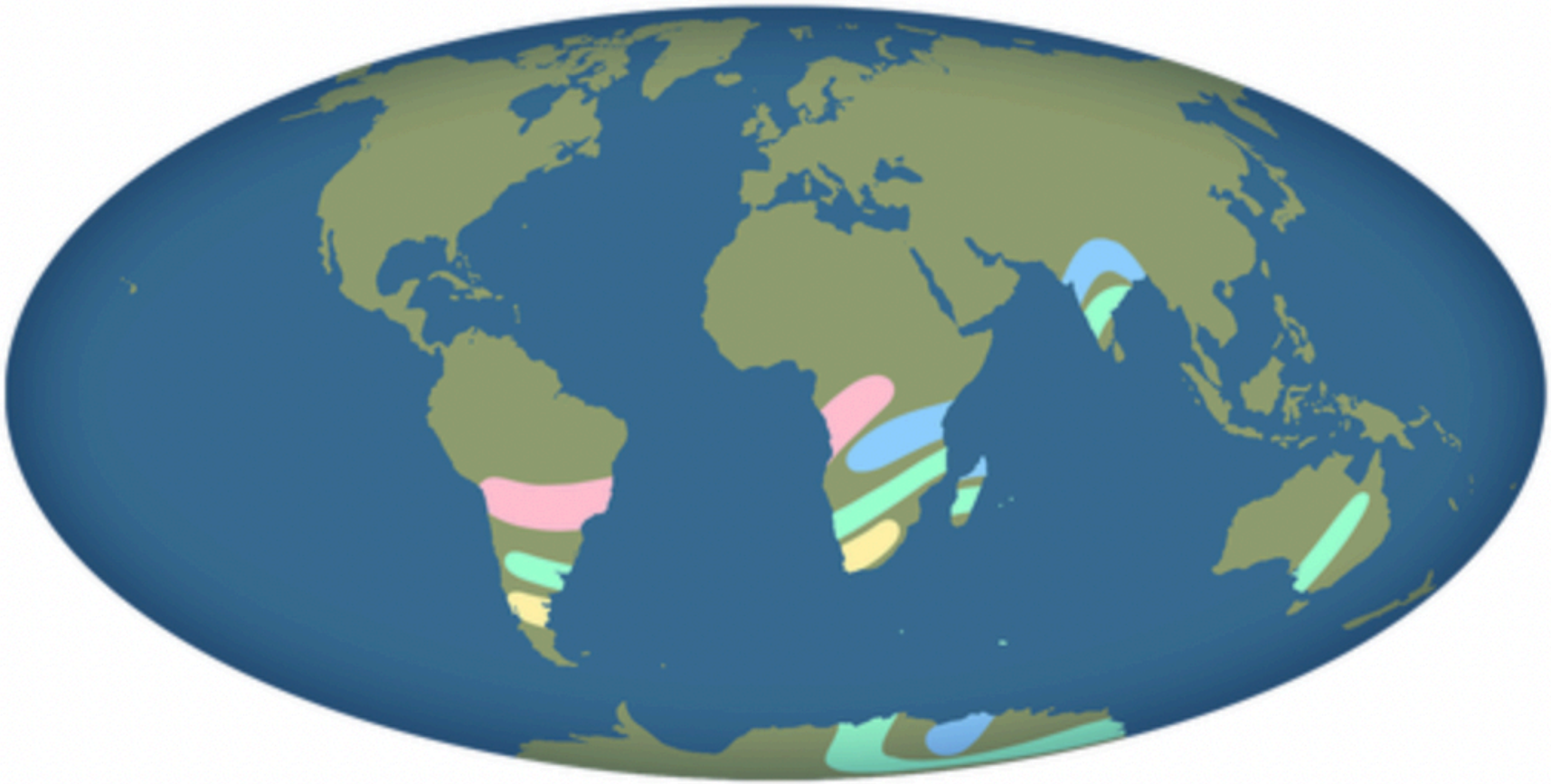
Note: This lesson typically requires about 40 minutes.



Cut Out

200-300 Million Year Old Glaciers

200-300 Million Year Old Fossils



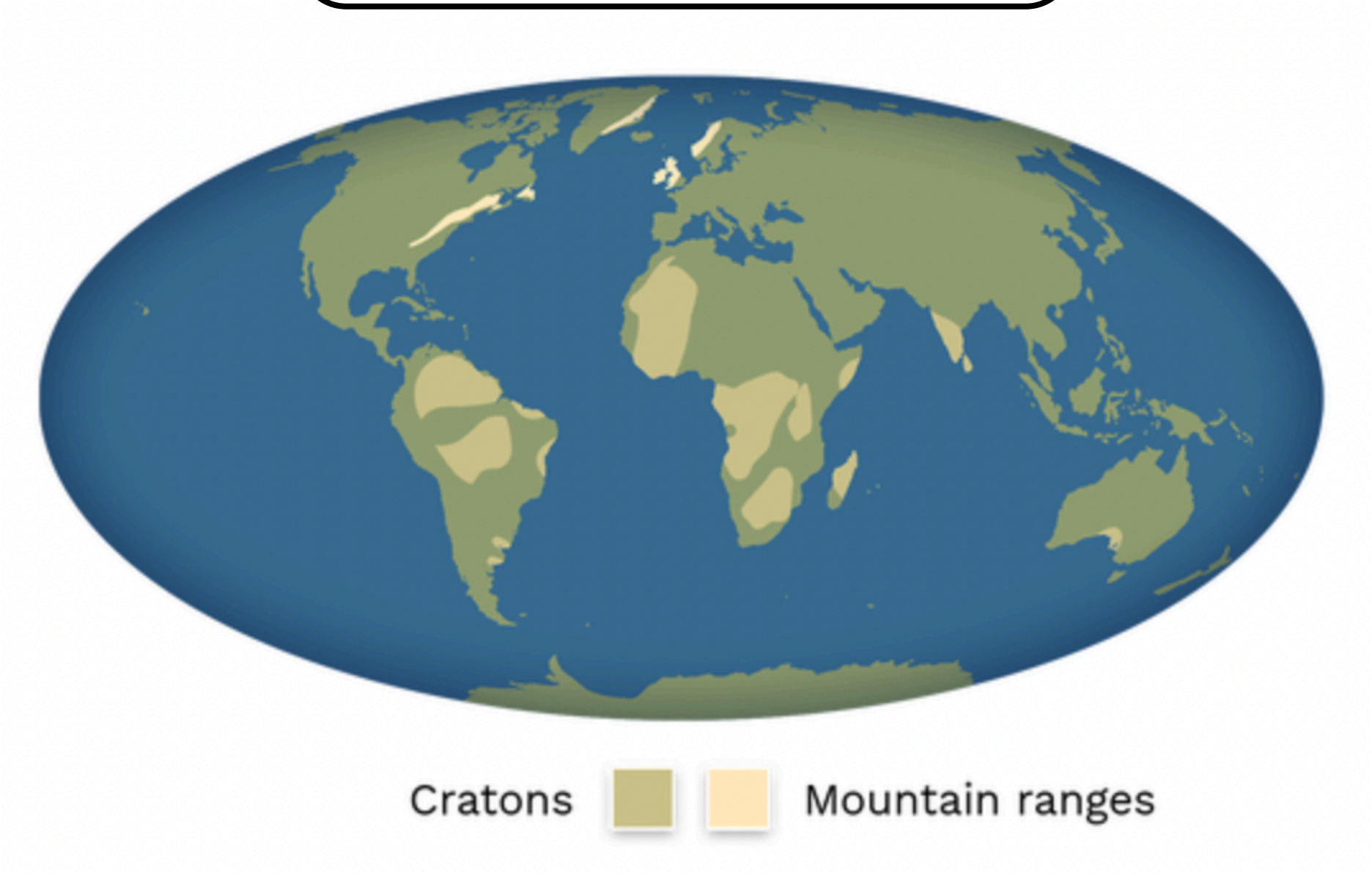
Cynognathus

Glossopteris

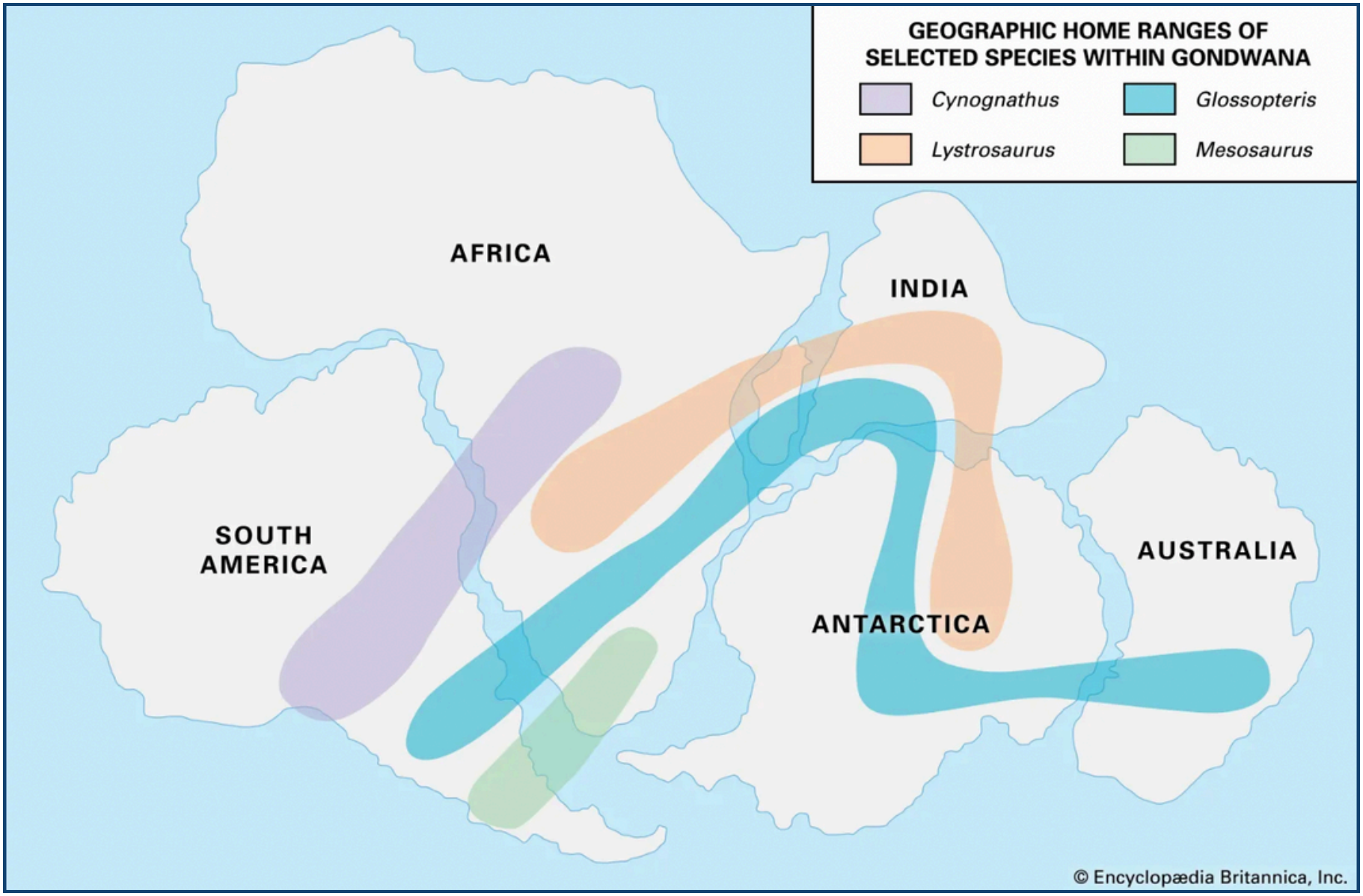
Lystrosaurus

Mesosaurus

200-300 Million Year Old Mountains



Answer Key


GEOGRAPHIC HOME RANGES OF SELECTED SPECIES WITHIN GONDWANA
Cynognathus
Glossopteris
Lystrosaurus
Mesosaurus
AFRICA
INDIA
SOUTH AMERICA
AUSTRALIA
ANTARCTICA
© Encyclopædia Britannica, Inc.

REFERENCES

Content Citations

August, D., Artzi, L., & Mazrum, J. (2010, August). Improving Science and Vocabulary Learning of English Language Learners. CREATE. Retrieved October 2, 2023 from: www.cal.org/create/resources/pubs/CREATEBrief_AcademicLanguage.pdf

The Education Trust-West. (2017). Unlocking Learning: Science as a Lever for English Learner Equity. Oakland, CA: Feldman, S. and Malagon, V.F.

Photo Citations

Using Fossils to Understand Evolution

Antrodemus. (2016). Pakicetus, Ambulocetus, Maiacetus, and Dorudon. Twitter. Retrieved from https://twitter.com/Antrodemus/status/698142476641574912.

Fossil Record. (n.d.). Life Science. Retrieved from http://7gradelifescience.blogspot.ro/2014/04/unit-5-evolution.html.

Figure 1 from Fusco et al. – trilobite moult cycle. (2013). PEGE Journal Club. Retrieved from https://pegejournalclub.wordpress.com/2013/04/22/developmental-trait-evolution-in-trilobites/.

Evolution of the Skull. (2023). Brainly. Retrieved from https://brainly.com/question/30527403.

Continental Drift

5 ways to make continental drift theory more approachable to students. Labster. (n.d.). https://www.labster.com/blog/make-continental-drift-theory-approachable