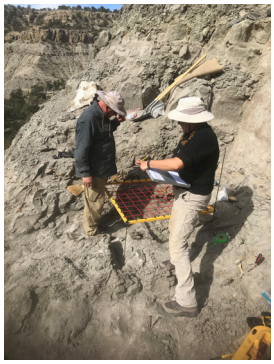
- LAB LEVEL 1 -
Who's got that trait?

1. Mapping a Quarry

Paleontologists carefully map the location and position of the fossils they find. This helps them with future analysis and gives them data and clues that help them know how the dinosaur lived, died, and what happened to their bones after they died.



Expanded Text:

Some of the data that paleontologists record in the field include mapping the orientation and positions of the bones of the fossil as they were found during excavation. This helps us to reconstruct how the bones were preserved and, along with other data from the area, give us clues that may provide evidence that tells us how the dinosaur may have lived, how it died, and what happened to the animal after it died. If the bones are scattered (disarticulated) and not in life position (articulated), it may tell us that the animal was scavenged. This means other animals would have moved the bones as they were feeding on it. Often we can even see tooth marks that are typical of bones that have been scavenged. Or, we see evidence of erosion which tells us the bones were exposed for a while. If we find the bones aligned in one direction it may mean that the animal died in a stream and the current pushed the bones into the same direction the water was running. If all the bones are in order, like when it lived, it can tell us that it wasn't scavenged. And, if those bones don't show signs of erosion we know that the bones were likely buried quickly which would have protected them from forces that cause erosion. Additionally, when these fossils are prepared in the lab, the mapping data can be helpful in reconstructing bones that may have broken.

2. Making a Plaster Jacket

As paleontologists excavate the fossil they make a protective plaster jacket for the fossil so it can be safely transported back to the paleo prep labs at the Natural History Museum of Utah.

Expanded Text:

After we have mapped the fossils, paleontologists need to prepare the fossil for further excavation and transport to the museum. To do this, we make a plaster "jacket" for the fossil. We first start by putting a layer of wet paper towels down over the fossils so the plaster will not stick to the fossils. Next, we place strips of burlap soaked in plaster over the paper towels. We add several layers like this to make a strong protective shell around the fossil. Once the plaster hardens, we carefully remove more of the rock from around and underneath the plaster jacket. As we go we add more plaster to the newly exposed edges. Eventually, the jacketed fossils end up looking like a giant mushroom. At that point, we get as many people as possible to flip the fossil over so we can create a plaster jacket around the bottom of the fossil.

3. Labeling a Fossil

Once a fossil has been encased in plaster it must be labeled so paleontologists can distinguish it from other plaster encased fossils.

Expanded Text:

Once paleontologists have mapped, excavated, and jacketed the fossil, we have to label the specimen. Each jacket has the field number for the site, any mapped bones are labeled, and sometimes sketches of where bones are to make sure that we don't damage them when we open the jackets in the lab. All these notes on the field jackets are vital to preserve as much information as possible about the fossil which helps the fossil preparators back in the lab.

- LAB LEVEL 1 -

(continued)

4. Helicopter Ride

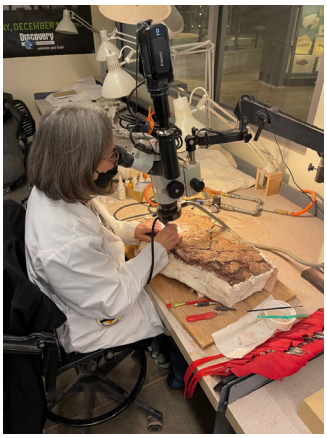
Once the fossils have been jacketed they are quite heavy. In many cases they have to be lifted out of the field using helicopters and taken to a truck that drives them back to the museum.

Expanded Text:

Once everything is collected and labeled, it is time to bring the fossil back to our museum. Often, the fossil is too heavy for us to carry out, so we get helicopters to lift them out. To do this, we place the jacket in a helicopter net and then have a person hook the net to a cable attached to the helicopter. Afterwards, the helicopter will carry the specimen to a waiting truck so we can drive it the rest of the way back to the museum. Back at the museum we have a forklift we use to move it from the truck and into our collections and research spaces.

5. Preparing a Fossil

Back at the museum, fossil preparators use many different tools (air scribes, dental picks, needles, and more) to carefully remove the jackets and rock from the fossil. This is slow work that can take weeks or years to complete.



Expanded Text:

Once the fossil has made its way to the museum more work begins. Preparators will use many tools to free the fossils from the rock that entombs them. Air scribes work like mini jackhammers to chip the rock away. Dental picks and needles help remove rock from more delicate areas of the fossil. And, regular old super glue will hold any cracks or fractures in the fossil together. The preparation process is the part that takes the longest. It can take a preparator several weeks or up to years to finish the work on a fossil.

Natural History Museum of Utah

Catalog #:
Access. #:
Field Number:
Higher Taxon:
Genus:
Species:
Element:
Locality:
Formation:
Member:
Geologic Period:
CM #:

6. Cataloging a fossil

The first step after preparation is finished is to accession, catalog, and house the specimen - i.e., assign it a specimen number, put its info in the database, cut foam to support it or make an archival storage jacket, put it in the right place in the collections, etc.

7. Research: It starts with a question

The specific information paleontologists gather from fossil specimens really depends on the type of research that is being done. For example, describing a new species is very different from looking at growth using histology.

- LAB LEVEL 2 -
What can we learn from phylogentic trees?

Phylogenetic trees help visually organize genetic connections - relationships - between organisms based on shared traits. Developing phylogenetic trees is complicated and requires a great deal of work to organize our data in ways that help us see these relationships. But, through the power of computational mathematics, we can analyze and evaluate huge amounts of data using sophisticated computer algorithms that help us uncover and see patterns in our data.

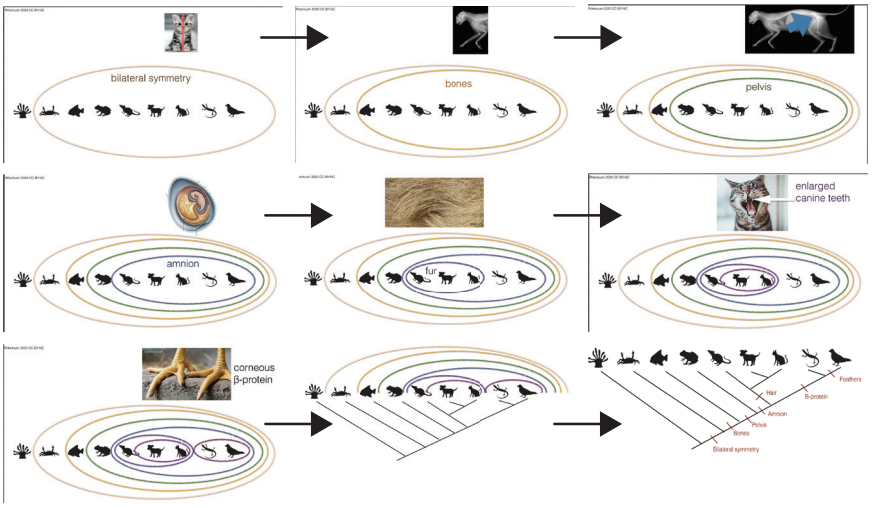
Trait	Anemone	Crab	Fish	Frog	Rat	Dog	Cat	Lizard	Bird
Multicellular	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bilateral symmetry		✓	✓	✓	✓	✓	✓	✓	✓
Bones			✓	✓	✓	✓	✓	✓	✓
Pelvis				✓	✓	✓	✓	✓	✓
Amnion (lining that prevents egg from drying out)					✓	✓	✓	✓	✓
Hair					✓	✓	✓		
Enlarged Canine Teeth						✓	✓		
Retractable Claws							✓		
Stiff parts made of Corneous β-Protein								✓	✓
Feathers									✓

Welcome to the pet shop

Here are a variety of animals whose trait observations have been classified in this chart. What traits do they share?

How are they related?

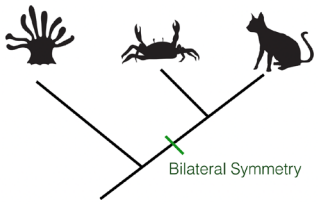
Let's visualize the data.



A phylogentic tree tells a story. How does our tree tell a story?

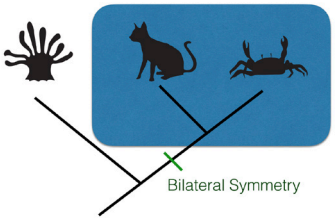
The clades in the tree help us.

Which two are most closely related?

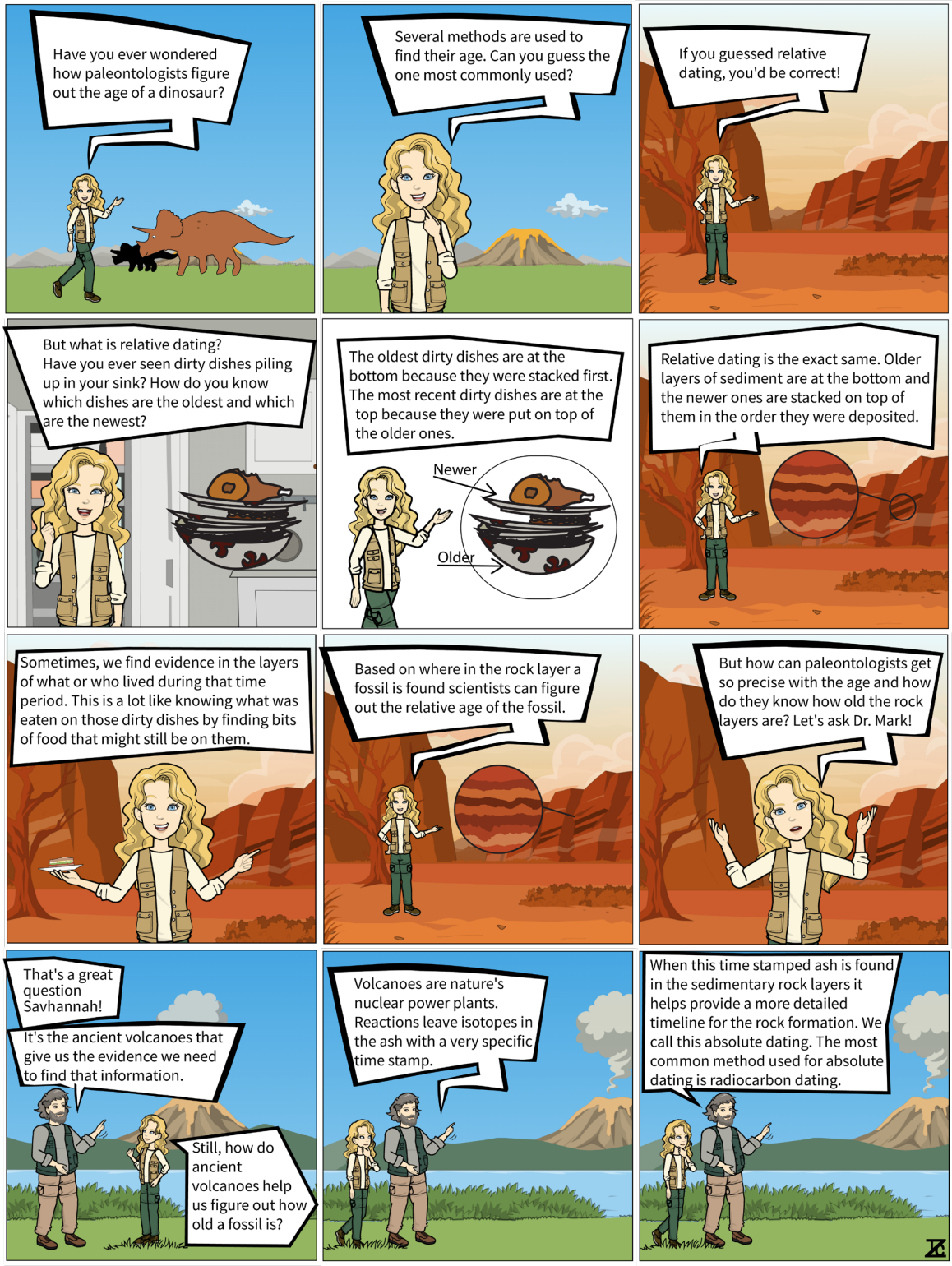


What is a clade?

A group of animals that includes the last common ancestor and all of its descendants in a defined set of taxa (also known as a branch)



- LAB LEVEL 3 -
How do we figure out a fossil's age?

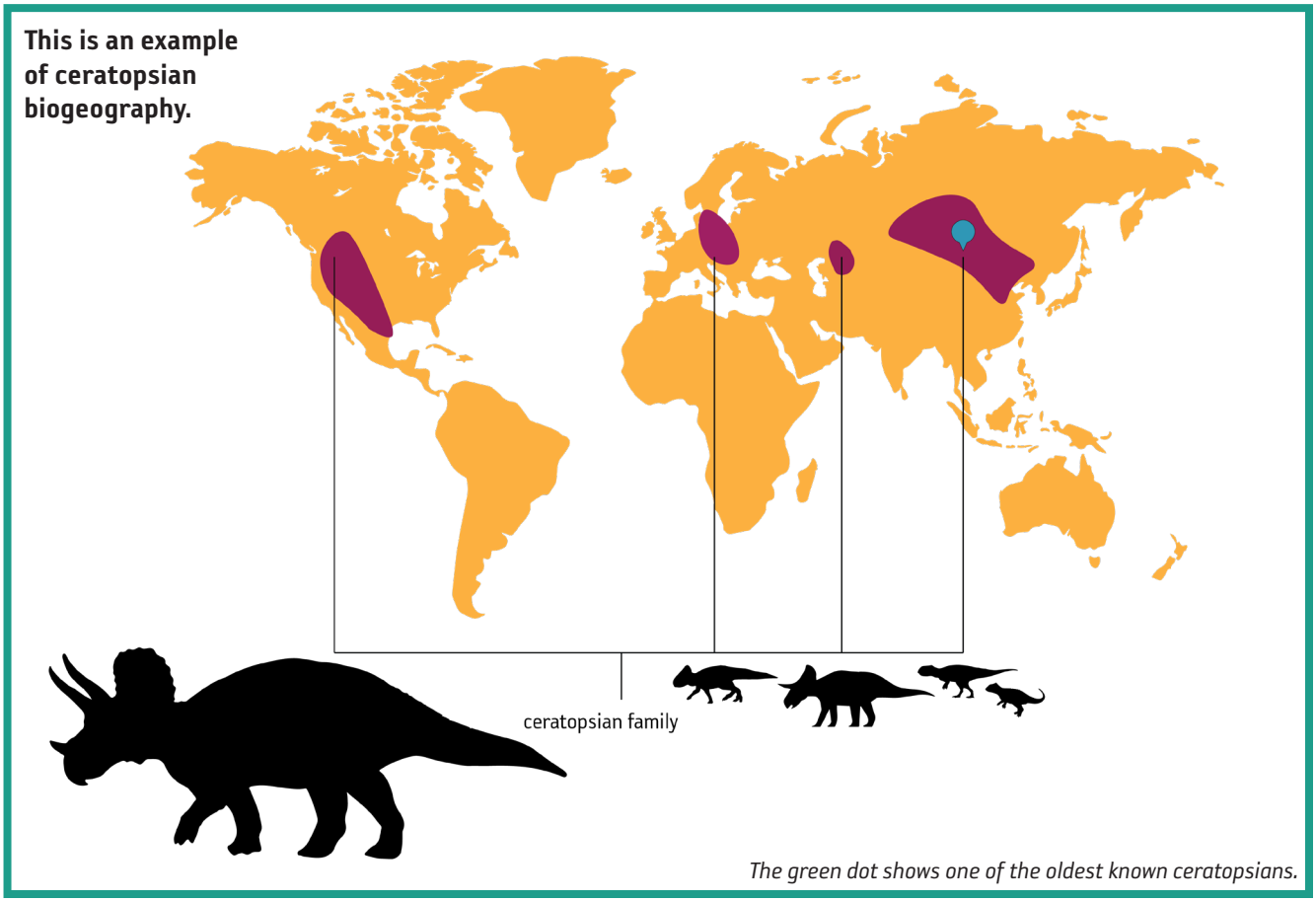


- LAB LEVEL 4 -
How can geographic forces impact trait diversity?

How did ceratopsians spread across multiple continents? What forces could help explain this phenomena?

Biogeography and paleogeography help us answer these questions. **Biogeography** is the study of how species are distributed across the planet while **paleogeography** examines how the earth was changing over time.

This is an example of ceratopsian biogeography.



The green dot shows one of the oldest known ceratopsians.

You'll examine this in more detail throughout Lab Level 4.

As you do, think about these questions:

- Why do places that are far apart sometimes have similar species?
- How did ceratopsians move across Earth several hundred million years ago?
- What do you think are some ways that organisms shape their environment? What do you think are some ways that the environment shapes organisms?
- Which traits and geographical factors allowed *Triceratops* to be one of the last ceratopsians?

- LAB LEVEL 5 -
How do scientists communicate their findings?

How do scientists share their work?

The **three most common** ways (and one that's becoming more accepted) that scientists present their findings:

1. Publishing in journals (academic magazines)
2. Presenting at conferences (often with poster presentations)
3. Presenting at universities (panel discussions, lectures, etc.)
4. Popular media and other online resources (websites such as National Geographic)

Why do scientists share their work?

They do this to help build new knowledge in their areas of expertise. As they share, they also benefit from something called a peer-review process. This process gives other scientists a chance to learn about their research, ask questions and provide feedback. All of this helps scientists reflect on their work and make improvements. Along the way, their reputations as experts in their field grows.

What is a poster presentation?

It is similar to science fair tri-fold posters in that these poster presentations provide a snapshot of the research and findings completed by a scientist (or researchers). These types of presentations are popular because they are quick and make it easy to view many different research projects in a short amount of time.

Tips for presenting a poster presentation:

- **Audience:**

  It's important to know who your audience is so you can identify the most impactful way to present your findings. (Are you presenting to your peers or other professionals?)

- **Storyline:**

  Think about the story your research tells; creating a mind map is one way to connect your audience to your research. (Hint: this mind map could be used as a visual on your poster)

- **Elevator Pitch:**

  Once you know your audience and your story you need to have a conversation starter. During a poster presentation you're not presenting the full scope of your work, but rather providing a snapshot of the most important information about your research.

- **Design:**

  Make it look good by using these basic design principles:

  - Use no more than 2 colors and a neutral color (black or white) on a single page.
  - Keep it simple - don't crowd your poster.
  - Include visually appealing content.
  - Think about your poster as a grid and keep items on your poster aligned.
  - Select one font family to use - be sure you can bold and italicize the font.