COLORADO STATE UNIVERSITY EXTENSION

SEA 4-H NEWSLETTER
October 2019

Important 4-H Dates

October

October 1st - New 4-H Year Begins

October 6th-12th - National 4-H Week

October 18th - Prowers Upcycle Your Style Day

October 21st-24th - CSU Extension Forum (Agents out-of-office)

October 26th - Prowers Horsemanship Clinic

November

November 1st-3rd - Colorado Leadership Camp

November 15th-16th - Dare to Be You Camp

November 28th-29th - Extension Offices Closed

Southeast Area Office
27901 CR 21
Rocky Ford, CO 81067
719-254-7608

Baca County
700 Colorado Street
Springfield, CO 81073
719-523-6971
coopext_baca@mail.colostate.edu

Cheyenne County
Box 395
Cheyenne Wells, CO 80810
719-767-5716
coopext_cheyenne@mail.colostate.edu

Kiowa County
Box 97
Eads, CO 81036
719-438-5321
coopext_kiowa@mail.colostate.edu

Prowers County
1001 South Main
Lamar, CO 81052
719-336-7734
coopext_prowers@mail.colostate.edu

Bent County
1499 Ambassador Thompson
Las Animas, CO 81054
719-456-0764
coopext_bent@mail.colostate.edu

Crowley County
613 Main Street
Courthouse Annex
Ordway, CO 81063
719-267-5243
coopext_crowley@mail.colostate.edu

Otero County
Box 190
Rocky Ford, CO 81067
719-254-7608
coopext_otero@mail.colostate.edu

Colorado State University, U.S. Department of Agriculture and Colorado counties cooperating. Extension programs are available to all without discrimination. The information given herein is supplied with the understanding that no discrimination is intended and no endorsement by Colorado State University is implied.

National 4-H Week

National 4-H week is October 6th through 12th, 2019. This is a great week to promote the 4-H program in your community, as well as thank the many individuals and businesses that support the local 4-H members throughout the year. Check your county newsletter for specific county activities.

CLC Camp

This year's CLC camp will be held in Glenwood Springs, November 1st-3rd. This camp is for 6th through 9th grade students and the cost is $135. CLC is designed to help those coming into middle school and high school seek out and hone their leadership skills. It also promotes out of the box and critical thinking skills. In addition, students will participate in a community service activity. This is a great opportunity to meet new people from across the state and share the growth of young adults together.

Be Your Own Hero at Dare to Be You

The South Central District invites members 4-H ages 10-13 to Dare to Be You on November 15th and 16th at the State Fairgrounds in Pueblo. This year's theme is "Be Your Own Hero" and will be on opportunity to learn life skills and gain new knowledge through workshops, recreation, games, community service and other fun activities. This low-cost camp is a great way for youth to expand their horizons and meet 4-H members from around South-Central Colorado.

Dare to Be You costs $45 per camper (plus any additional county fees). Register by going to the following link: https://forms.gle/PdHMnrWvPjDuaJHT8. Registration is open September 23rd-October 14th.

Participants should bring warm clothes, sleeping bag/bedding, pillow, towel, toiletries, water bottle, and snack to share such as pretzels, fruit, or chips. In order to have the current medical form and signed Code of Conduct required for the camp, participants must also go into 4-H Online as soon as it opens and enroll for the 2019-2020 year.

National Western Stock Show Junior Livestock Entries

Junior Livestock Exhibitors, entries for the junior livestock market shows at National Western are due November 1st. Entry information can be found at http://www.nationalwestern.com/livestock-shows/livestock-exhibitors. Please contact your local extension office for additional questions or help.

Catch-a-Calf Contest

Applications are currently being accepted for the 2020 National Western Stock Show Catch-a-Calf Program. The program is open to any 4-H member that is 12 and older by December 31st, 2019. Youth that sign up for the program will compete at a 2019 NWSS rodeo performance to catch a calf. Those that are successful will receive a calf in May 2020. They are responsible for all care and must purchase their own feed and equipment. The deadline to apply is December 1st, 2019. More information and an application can be found online at https://nationalwestern.com/catch-a-calf-program/.

4H Online – Email Blasts

From time to time the State office will be sending emails directly to the 4-H members. It is the easiest and most effective way to communicate important State events and requirements. We know that not everyone particularly enjoys the extra emails and there have been requests to be unsubscribed. It is important to know that if you do that, you would not receive any re-enrollment emails or information the County office sends directly to you. Please do not "unsubscribe."

Bent County 4-H Newsletter

OCTOBER 2019

4-H ENROLLMENT

Enrollment for the upcoming 4-H year begins October 20, 2019. You are welcome to begin your enrollment through 4HOnline any time after that. Please keep in mind that enrollment is a 3-step process. Your family must sign the Bent County 4-H Member Agreement, enroll in 4HOnline through your family account, and pay your $20.00 membership (per member) fee at the Extension Office. If you need any help, please don't hesitate to contact the Bent County Extension Office at 719-456-0764.

OPPORTUNITIES AND DEADLINES

- October 1st-3rd - Bent County Harvest Show
- October 6th - 2019 4-H Banquet
- October 6th-12th - National 4-H Week
- October 14th - Last day to register for Dare to Be You
- October 20th - 4-H Enrollment Begins

RECORD BOOKS

Record books will be available for pickup at the 4-H Banquet on October 6, 2019. If you are not able to attend the banquet, and still need your record book, please pick them up at the Extension Office. Record books will be held at the office until November 1, 2019, but will not be stored after that. Any books not picked up will be purged after November 1, 2019. Feel free to call the Extension Office to make arrangement if needed.

NATIONAL WESTERN STOCK SHOW CATCH-A-CALF

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OCTOBER COUNCIL MEETING

The October council meeting will be held just after the 4-H Banquet on October 6, 2019 for all members who would like to attend. This will be a short meeting to tend to any immediate Council Business that needs addresses, and to pay any bills that need to be paid.

DARE TO BE YOU

Be Your Own Hero at Dare to Be You

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2019 BENT COUNTY HARVEST SHOW

The 78th Annual Bent County Harvest Show, will be October 1-3, 2019 at St. Mary's Hall in Las Animas, located at 714 Elm Avenue. All Bent County residents are eligible to enter exhibits that they have made or grown.

Exhibits may be entered in a wide variety of classes. Two of the largest divisions are Art and Photography, with entries from preschoolers, students and adults. The Harvest Show is known for a large display of beautiful quilts. Last year was the first year for collectibles. The other divisions are: clothing, needle-craft, fancy work, home furnishings, food preservation, baked goods, handicrafts and woodworking, hobbies, collections, antiques, flowers, crops and vegetables. Vegetable decorating classes bring out the fun, creative side of exhibitors. Most divisions offer classes for junior and adult exhibitors. Items are entered on Tuesday afternoon, judging on Wednesday morning, and then the show is open to the public on Wednesday afternoon and Thursday.

Premiums are paid in each class (1st-3rd) place. The Grand and Reserve Grand Champions in each division will also receive $20 and $10, respectively. All premiums will be paid in cash on Thursday, October 3rd at 4:00 pm.

For a complete listing of rules and classes, pick up a book now at the Extension Office located on the Bent County Fairgrounds in Las Animas, or at local businesses throughout Bent County.

For more information, contact the CSU Bent County Extension Office at (719) 456-0764 or General Superintendent Connie Harris at (719) 456-0607.

OCTOBER 1ST

2:30 p.m. – Superintendent's meeting.

3 p.m. – 7 p.m. – Booth set up.

3 p.m. – 6 p.m. – All school

OCTOBER 2ND

8 a.m. – 8:30 a.m. – Entries accepted in CUT FLOWERS and BAKED GOODS only.

8:30 a.m. – Judging begins, all departments. Closed to the public till judging is

completed.

3 p.m. – Release baked goods (1 sample left for exhibit) and all frozen foods.

8 p.m. – Exhibits close.

OCTOBER 3RD

9 a.m. – Exhibits open.

4 p.m. – Awards Ceremony and Premiums paid.

4:15 p.m. – 5 p.m. – Release exhibits and Booth Clean up.

YOU'RE INVITED TO JOIN US AT THE 2019

Awards Banquet

OCT 6

4 PM

COME CELEBRATE OUR 4-H YOUTH, LEADERS, & SUPPORTERS!

BENT COUNTY COMMUNITY CENTER
1214 AMB THOMPSON BLVD.
LAS ANIMAS, CO 81054

PLEASE CALL (719)456-0764 WITH ANY QUESTIONS

COLORADO STATE UNIVERSITY EXTENSION

Dare to Be You

NOVEMBER 15-16
PUEBLO, CO

JOIN US FOR A FUN-FILLED OVERNIGHT OF MAKING NEW FRIENDS AND LEARNING TO BE THE BEST 4-H MEMBER YOU CAN BE!

What to Bring

Warm clothes, sleeping bag/bedding, pillow, towel, toiletries, water bottle, and a snack to share such as pretzels, fruit or chips

Who Can Come

Enrolled Colorado 4-H members ages 10 -13 can attend Dare to Be you. Age is based on the camper's 4-H age (age as of December 31, 2019)

Where It's At

Dare to Be You will be held at the 4-H Buildings and Growing Minds dorms at the Colorado State Fairgrounds in Pueblo

Dare to Be You costs $45 per camper (plus any additional county fees). Register by going to the following link: https://forms.gle/PdHMnrWvPjDuaJHT8 Registration is open from September 23 to October 14.

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ST[EMpower]

"sprouting tomorrow's leaders through golden opportunities"

Paleontology - Basics

VOLUME 9, ISSUE 2, OCTOBER 2019

THIS MONTH

- **Fossilization** page 2
- Where in the World? page 46
- **Stratigraphy** page 49

POWER WORDS

- **fossilization** process of an organism becoming preserved in a hard, petrified form
- **matrix** a mass of fine-grained rock in which gems, crystals, or fossils are embedded
- **stratigraphy** the branch of geology concerned with the order and relative position of strata and their relationship to the geological time scale
- **supercontinent** large landmasses (notably Pangaea thought to have divided to form the present continents in the geological past

CAREERS

- Results of last issue's survey page 50

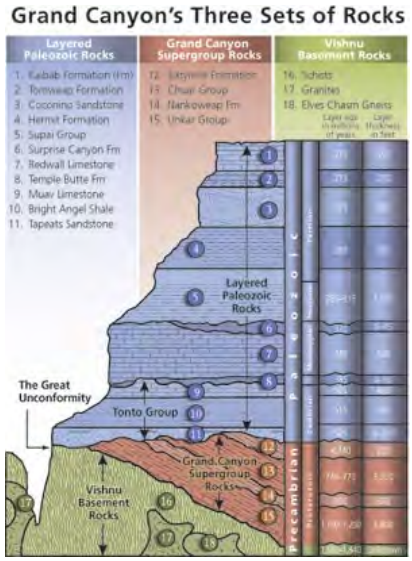
LIFE OF THE PAST

If you have not yet read and done the activities in the last issue, Paleontology Intro, do those first.

Certain conditions favor **fossilization**. Bill Bryson's book, A Short History of Nearly Everything, estimates there is less than 1 billion to 1 (1,000,000,000 to 1) chance a bone becomes a fossil! That doesn't mean that the bone will be found. Most fossils are found as they erode from their rock **matrix**. How many fossils are still buried? How many fossils erode completely and are gone forever?

Where do fossils occur? Recall last month's issue, plate tectonics shift continents slowly. Antarctica was not always centered over the South Pole. In fact, 250 million years ago, all the continents crashed together, forming the **supercontinent** called Pangaea.

Finally, when did an organism live? The USGS Grand Canyon image and diagram below depict the rock layers and age. The bands of different color rock delineate the **stratigraphy** of different layers, laid down at different times. The bottom is the oldest rock, over 550 million years old (Proterozoic Eon). Each layer above is younger.



Scientists who study **taphonomy** analyze how an organism becomes a fossil. There is a fossil bias:

- Organism lived in water
- Organism buried immediately in sediments
- Organism had hard parts

If an organism leaves evidence of its existence (like **coprolites**, **gastroliths**, burrows, footprints, casts and molds) it is called a trace fossil.

The fossilization process can happen in a variety of ways:

- permineralization organic matter is replaced by inorganic minerals
- carbonization the organism decays leaving only carbon stains
- amber organisms trapped in tree sap; oldest known amber fossil is 320 million years
- drying, freezing, bogs, and tar pits organisms are preserved under these conditions

FOSSIL GAME

Set-up Game:

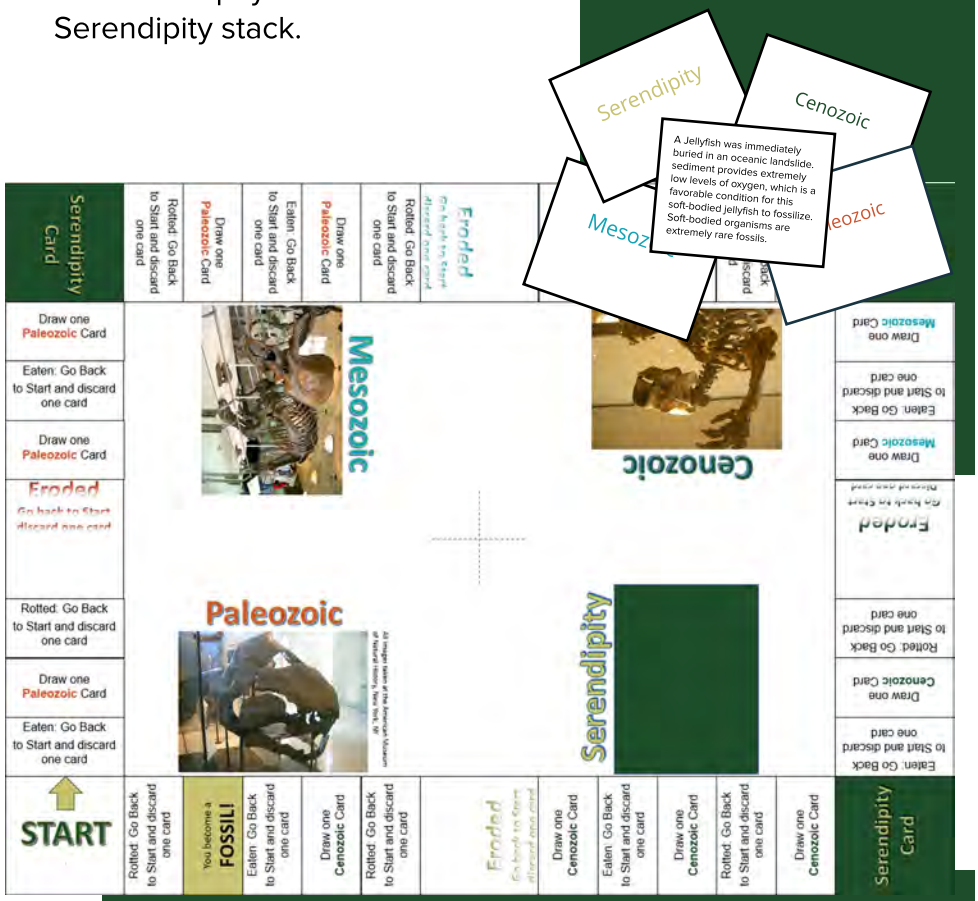
- Print the game board (pages 5-8) single sided.
- Tape the board together. Place the Paleozoic page down first. Place the Serendipity page on the right edge, overlap about 1" and align to the Paleozoic page. Tape. Place the Cenozoic page on the top edge of the Serendipity page, overlap about 1", align, and tape. Place the Mesozoic page to the left of the Cenozoic page and above the Paleozoic page. Align to both pages, and tape everything together.
- Print the playing cards (pages 9-44) two sided. One side will be the title of the card (i.e. Paleozoic), and the other side are the words.

You can optionally print each of the 4 sets on different color paper to make them easier to sort.

- Cut the 6 cards apart on each page. You will have 30 cards for Paleozoic, Mesozoic, Cenozoic, and 18 Serendipity cards.
- Place the Paleozoic Cards on the Paleozoic pile, Mesozoic Cards on the Mesozoic pile, the Cenozoic Cards on the Cenozoic pile, and the Serendipity Cards on the Serendipity stack.

POWER WORDS

- **coprolite** fossilized feces (poop)
- **gastrolith** fossilized gizzard stones
- **taphonomy** the study of the processes (such as burial, decay, and preservation) that affect animal and plant remains as they become fossilized



MATERIALS:

- Print pages 5 - 8 single sided Print pages 9 - 44 double sided, with the title on one side, and the words on the other side (4 sets of 30 cards, 5 pages of cards in each set)
- scissors or paper cutter
- tape
- six-sided dice (one / player) - or make dice from template on page 45 with cardstock paper)
- tokens (different coins, beads, etc.)

FOSSILIZATION - Fossil Game

Directions:

- Use your Timeline (developed last month) to help you with when in time and the different Periods.
- The object of the game is to be the first player to become a fossil. To win, you need:
  - Organism card (Paleozoic, Mesozoic, or Cenozoic)
  - Fossilization 1 card that matches the Period (Paleozoic, Mesozoic, or Cenozoic) of the organism card
  - Fossilization 2 card that matches the Period (Paleozoic, Mesozoic, or Cenozoic) of the Organism card
  - Land directly on the board's gold colored Fossil space
- Game is for two to four players. The player with the lowest roll of the die goes first.
- Roll your die and move your token that number of spaces. Follow the directions on the space.
- If you land on a "Go Back to Start" space, discard one card from your hand if you have a card. Place the card in the correct stack face up at the bottom.
- When you reach the face-up cards in a stack, shuffle, place face down, and continue the game.
- If you land on a Draw a Paleozoic Card space, draw a Paleozoic Card. If you pick an Organism, Fossilization 1 or Fossilization 2 card, keep that card. If you draw a Geology card, follow those directions immediately.
- If you draw a Serendipity Card, follow those directions. Unless otherwise directed, you may keep that card.

Good Luck!

POWER WORDS (game)

- **acrynom** an abbreviation formed from the initial letters of other words, and pronounced as a word (e.g. LASER)
- **amphibian** cold-bloded vertebrate animal that includes frogs, toads, newts, salamanders, and extinct ancestors
- **aquatic** relating to water
- **arthropod** invertebrate animals that include spiders, insects, crustaceans, and a could other groups
- **bipedal** terrestrial locomotion on two rear legs
- **canine** (tooth) the pointed tooth between incisors and premolar in mammals and extinct ancestors
- **carnivorous** meat eating animals
- **Chordata** the phyllum for a group that includes tunicates, cephalochordates, and vertebrates
- **decompose** break down or go into component elements; decay
- **dissolve** become incorporated into a liquid
- **diversity** a range of different things; variety
- **endocast** internal cast of a hollow object, often the inside of a skull
- **extinct** no longer in existence
- **facultative** capable of but not restricted to a particular function
- **herbivorous** plant-eating animals
- **invertebrate** animal that does not have a backbone or spinal column
- **leach** soluble mineral drains away from soil, ask, or an organism
- **mammalian** relating to a mammal
- **MYA** acrynom for million years ago
- **organic** derived from living matter
- **originate** having a specified beginning
- **radiate** diverge or spread from a central point
- **residue** a small amount of something that remains after the main part has gone; a substance that remains after a process like combustion or evaporation
- **sediment** particulate matter that is carried by water or wind and deposited on the surface of the land or the bottom of a body of water
- **soluble** a substance that can be dissolved, especially in water
- **survive** continue to live or exist
- **synapsid** fossil animal of the Permian and Triassic that had many characteristics of reptiles, but show increasing mammalian characteristics through time; mammal ancestor
- **terrestrial** of or relating to the Earth; on dry land
- **vertebrate** animal with a backbone or spinal column
- **voracious** devouring great quantities of food

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Pages 5-8, print single side.

Pages 9-44, print double side.

Paleozoic

All images taken at the American Museum of Natural History, New York, NY

START	Eaten: Go Back to Start and discard one card	Draw one **Paleozoic** Card	Rotted: Go Back to Start and discard one card		
Rotted: Go Back to Start and discard one card	You become a **FOSSIL!**	Eaten: Go Back to Start and discard one card	Draw one **Cenozoic** Card	Rotted: Go Back to Start and discard one card	

Eroded

Go back to Start
discard one card

Draw one
Cenozoic Card

Eaten: Go Back
to Start and discard
one card

Draw one
Cenozoic Card

Rotted: Go Back
to Start and discard
one card

Draw one
Cenozoic Card

Serendipity

Serendipity
Card

Eaten: Go Back
to Start and discard
one card

Draw one
Cenozoic Card

Rotted: Go Back
to Start and discard
one card

Eroded Go back to Start Discard one card						
Draw one **Mesozoic** Card						
Eaten: Go Back to Start and discard one card						
Draw one **Mesozoic** Card						
Serendipity Card	Draw one **Mesozoic** Card	Rotted: Go Back to Start and discard one card	Draw one **Mesozoic** Card	Eaten: Go Back to Start and discard one card	Draw one **Mesozoic** Card	

Cenozoic

Eroded

Go back to Start discard one card

Rotted: Go Back to Start and discard one card

Draw one **Paleozoic** Card

Eaten: Go Back to Start and discard one card

Draw one **Paleozoic** Card

Rotted: Go Back to Start and discard one card

Mesozoic

Serendipity Card

Draw one **Paleozoic** Card

Eaten: Go Back to Start and discard one card

Draw one **Paleozoic** Card

Eroded

Go back to Start discard one card

Paleozoic	*Paleozoic*
Paleozoic	*Paleozoic*
Paleozoic	*Paleozoic*

Paleozoic Card Organism

Trilobites were successful aquatic arthropods in the Paleozoic (550 - 250 MYA - million years ago). They radiated into over 20,000 known species, with the greatest diversity during the Ordovician. Trilobites went extinct at the end of the Permian.

Phylum Arthropods
Class Trilobita
Order Lichida
Family Odontopleuridae
Species *Kettneraspis williamsi*

Paleozoic Card Organism

Dunkleosteus was one of the first vertebrates with a jaw, had tremendous bite force and speed of opening its jaws. This predator was covered with bony armor, measuring up to 33 feet, It lived in the Devonian (380 - 360 MYA).

Phylum Chordata
Class Placodermi
Order Arthrodira
Family Dunkleostedidae
Species *Dunkleosteus terrelli*

Paleozoic Card Organism

Eurypterids (sea scorpions) originated in the Ordovician oceans and survived until the end of the Permian (467 - 250MYA). This group contains over 250 species including the largest known arthropod - over 8 feet (smallest was 1½"). This animal was very common in the Silurian.

Phylum Arthropoda
Order Eurypterida
Family Eurypterida
Species *Eurypterus remipes*

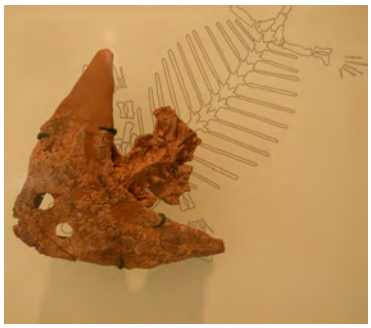
Paleozoic Card Organism

Griffinflies were the largest insects to ever live (Carboniferous to the end of the Permian - 306-250 million years ago). *Meganeuropsis permiana*'s wingspan was 28". This animal looked like an enormous dragonfly.

Phylum Arthropoda
Class Insecta
Order Meganisoptera
Species *Meganeurop. permiana'*

Paleozoic Card Organism

Diplocaulus was a weird 3 foot amphibian with a triangular head. The extensions are called horns. Scientists are not sure of the purpose. It lived in the Carboniferous to the end of the Permian 306 - 250 million years ago.



Phylum Chordata
Order Nectridea
Family Diplocaulidae
Species *Diplocaulus magnicornis*

Paleozoic Card Organism

Gorgonopsia was the 10 foot predatory mammal-like reptile (called synapsid) that lived during the Permian 260-250 million years ago. These animals have some mammalian traits (i.e. different kinds of teeth (e.g. canine).

Phylum Chordata
Order Therapsida
Family Gorgonopsidae
Species *Rubidgea sp.*

Paleozoic	*Paleozoic*
Paleozoic	*Paleozoic*
Paleozoic	*Paleozoic*

Paleozoic Card Geology

Fossil under pressure and heat, and rock undergoes change from Sedimentary to Metamorphic rock. Fossil lost. Discard one organism card.

Paleozoic Card Geology

Fossil under pressure and heat, and rock undergoes change from Sedimentary to Metamorphic rock. Fossil lost. Discard one organism card.

Paleozoic Card Geology

Fossil under pressure and heat, and rock undergoes change from Sedimentary to Metamorphic rock. Fossil lost. Discard one organism card.

Paleozoic Card Geology

Fossil under tremendous heat, and melts the Sedimentary to Igneous rock. Fossil lost. Discard one organism card.

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Paleozoic	*Paleozoic*
Paleozoic	*Paleozoic*
Paleozoic	*Paleozoic*

Paleozoic Card Fossilization 1

If your organism lives in the water, a roll of the die with an even number (2, 4, or means it was immediately buried in sediment.

If your organisms is terrestrial, a roll of the die with "3" (three) means it was immediately buried in sediment.

If you roll any other number, your organism was not preserved. Discard both this card and your organism card.

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Paleozoic	*Paleozoic*
Paleozoic	*Paleozoic*

Paleozoic Card Fossilization 2

Permineralization is the most common type of fossilization of trees and bones. In this process, as the organic matter decomposes, it is replaced by minerals in the water leaching through the organism. The minerals are usually silica, calcite, or pyrite.

Paleozoic Card Fossilization 2

Carbonization is another way an organism can become a fossil. In this process, the organism decays, leaving only a thin residue of carbon. Common carbonization fossils are fish, leaves, and insects.

Paleozoic Card Fossilization 2

Permineralization is the most common type of fossilization of trees and bones. In this process, as the organic matter decomposes, it is replaced by minerals in the water leaching through the organism. The minerals are usually silica, calcite, or pyrite.

Paleozoic Card Fossilization 2

Cast and mold fossils are most common with shelled organisms, like clams and oysters. The original organic matter dissolves, leaving an external mold of the organism. If the internal cavity is filled, this makes an endocast, or an internal cast. When this happens to a skull, the endocast can be a cast of the organism's brain. Very cool!

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Mesozoic	*Mesozoic*
Mesozoic	*Mesozoic*
Mesozoic	*Mesozoic*

Mesozoic Card Organism

Triceretops were huge (26,000 lbs, 30 feet) herbivorous dinosaurs that lived in the late Cretaceous (68-66 MYA) right before dinosaurs went extinct. Evidence supports that these animals lived in small family groups. *Tyrannosaurus rex* scavenged or preyed on these animals.

Phylum Chordata
Clade Dinosauria
Order Ornithischia
Family Ceratopsidae
Species *Triceretops horridus*

Mesozoic Card Organism

Tyrannosaurus *rex* was huge (31,000 lbs, 60 feet) carnivorous dinosaur that lived in the late Cretaceous (68-66 MYA) right before dinosaurs went extinct. Scientists debate if tyrannosaurids were top predators or scavengers. They had tiny arms and two fingers and excellent sense of smell.

Phylum Chordata
Clade Dinosauria
Order Saurischia
Family Tyrannosauridae
Species *Tyrannosaurus rex*

Mesozoic Card Organism

Prestosuchus more closely related to crocodiles than dinosaurs, it lived in Triassic Brazil (242-345 MYA), and grew to 23 feet. Unlike crocodiles sprawling legs, Prestosuchus walked with its legs underneath it - more like a dog. A predator, it had serrated teeth and powerful jaws.

Phylum Chordata
Class Sauropsida (Reptilia)
Family Prestosuchidae
Species *Prestosuchus chiniquensis*

Mesozoic Card Organism

Ammonites are related to squid, octopus, and Nautilus, and they all went extinct the same time as the dinosaurs. They lived in both Paleozoic and Mesozoic (420 - 66 MYA). They ranged in size from 2 mm ("." size of the dot) to 8.5 feet. The ammonite to the right is from Cretaceous found in Argentina (with Hank for scale).

Phylum Molluska
Class Cehphalopoda
Order Ammonitidia
Family Desmoceratidae
Species *Parapuzosia sp.*

Mesozoic Card Organism

Velociraptor lived during the Cretaceous (75-71 MYA) in Mongolia. It was about the size of a turkey, much smaller than depicted in the movie Jurassic Park. It had feathers preserved and a large sickle claw on each hindfoot, thought to be used to disembowel prey. It was probably a lone hunter.

Phylum Chordata
Clade Dinosauria
Order Saurischia
Family Dromaeosauridae
Species *Velociraptor mongoliensis*

Mesozoic Card Organism

Xiphactinus was a large (up to 20 feet) predatory, bony marine fish from the Cretaceous (100 - 66 MYA). It apparently had a voracious appetite at least one dozen fossil specimens of Xiphactinus have been found with remains of partially digested prey. Only adult Xiphactinus have been found, so nothing is known about larval or juvenile stages.

Phylum Chordata
Class Actinopterygii
Order Ichthyodectiformes
Family Ichthyodectidae
Species *Xiphactinus sp.*

Mesozoic	*Mesozoic*
Mesozoic	*Mesozoic*
Mesozoic	*Mesozoic*

Mesozoic Card Geology

Fossil under pressure and heat, and rock undergoes change from Sedimentary to Metamorphic rock. Fossil lost. Discard one organism card.

Mesozoic Card Geology

Fossil under pressure and heat, and rock undergoes change from Sedimentary to Metamorphic rock. Fossil lost. Discard one organism card.

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Mesozoic Card Geology

Fossil under tremendous heat, and melts the Sedimentary to Igneous rock. Fossil lost. Discard one organism card.

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Mesozoic	***Mesozoic***
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Mesozoic Card Fossilization 1

If your organism lives in the water, a roll of the die with an even number (2, 4, or means it was immediately buried in sediment.

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If you roll any other number, your organism was not preserved. Discard both this card and your organism card.

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Mesozoic	***Mesozoic***
Mesozoic	***Mesozoic***
Mesozoic	***Mesozoic***

Mesozoic Card Fossilization 2

Permineralization is the most common type of fossilization of trees and bones. In this process, as the organic matter decomposes, it is replaced by minerals in the water leaching through the organism. The minerals are usually silica, calcite, or pyrite.

Mesozoic Card Fossilization 2

Carbonization is another way an organism can become a fossil. In this process, the organism decays, leaving only a thin residue of carbon. Common carbonization fossils are fish, leaves, and insects.

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Cenozoic	Cenozoic
Cenozoic	Cenozoic
Cenozoic	Cenozoic

Cenozoic Card Organism

Megalotherium was the largest ground sloth (up to 34 feet) that lived in South America from 5 million to 10,500 years ago. During most of this time, all ground sloths were isolated in South America. This mammal could walk on four or two legs. This is called facultative bipedal.

Phylum Chordata
Class Mammalia
Order Pilosa
Family Megalotheriidae
Species *Megalotherium americanum*

Cenozoic Card Organism

Smilodon is the most famous of all the saber-tooth cats, and there are hundreds of specimens from the La Brea Tar Pits. The South American cat pictured below was the largest of the three species, up to 880 pounds and 47" at the shoulder. It lived from 2.5 million to 10,000 years ago.

Phylum Chordata
Class Mammalia
Order Carnivora
Family Felidae
Species *Smilodon populator*

Cenozoic Card Organism

Ernanodon was found in China, and is dated to shortly after all the dinosaurs disappeared at 55 MYA. It was the only specimen found for decades, and falsely thought to be a ground sloth. This rare find is still not established in a known order, although it could belong to an extinct order related to pangolins.

Phylum Chordata
Class Mammalia
Order Palaeanodonta (?)
Family Ernanodontidae
Species *Ernanodon antilios*

Cenozoic Card Organism

Irish elk, one of the largest species of deer, stood almost 7 feet tall at the shoulders. It lived 2 million to 7,700 years ago in Eurasia. It had the largest antlers of any deer. Scientists have proposed that their enormous antlers may have contributed to its own extinction.

Phylum Chordata
Class Mammalia
Order Antiodactyla
Family Cervidae
Species *Megaloceros giganteus*

Cenozoic Card Organism

Terror bird was a flightless carnivorous predator bird that ranged from 62 to 2 MYA. They ranged in height from 3 to almost 10 feet tall. Extremely fast runners, sharp talons and beak plus a powerful neck, they would chase and consume rabbit sized prey.

Phylum Chordata
Class Aves
Order Cariamiformes
Family Phorusrhacidae
Species *Phorusrhacos longissimus*

Cenozoic Card Organism

Megalodon was a shark that lived 23-3.6 MYA. It's maximum length was almost 60 feet long (4 times longer than the Great White Shark) with an amazing bite force. The image compares these two shark species teeth. It swam in warm oceans. Scientists thing that the onset of ice ages and cooling oceans contributed to extinction.

Phylum Chordata
Class Chondrichthyes
Order Lamniformes
Family Otodontidae
Species *Carcharocles megalodon*

Cenozoic	*Cenozoic*
Cenozoic	*Cenozoic*
Cenozoic	*Cenozoic*

Cenozoic Card Geology

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Cenozoic	Cenozoic
Cenozoic	Cenozoic
Cenozoic	Cenozoic

Cenozoic Card Fossilization 2

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Serendipity	*Serendipity*
Serendipity	*Serendipity*
Serendipity	*Serendipity*

Serendipity Card

Free Pass

You may discard this card instead of an Organism, Fossilization 1, or Fossilization 2 card

Serendipity Card

Free Pass

You may discard this card instead of an Organism, Fossilization 1, or Fossilization 2 card

Serendipity Card

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Serendipity	*Serendipity*
Serendipity	*Serendipity*
Serendipity	*Serendipity*

Serendipity Card

Take any card from another player then

Discard this card to the Serendipity Card pile

Serendipity Card

Take any card from another player then

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Take any card from another player then

Discard this card to the Serendipity Card pile

Serendipity	*Serendipity*
Serendipity	*Serendipity*
Serendipity	*Serendipity*

Serendipity Card

Move forward to the next "Draw one Cenozoic Card" then

Discard this card to the Serendipity Card pile

Serendipity Card

Move forward to the next "Draw one Mesozoic Card" then

Discard this card to the Serendipity Card pile

Serendipity Card

Move forward to the next "Draw one Cenozoic Card" then

Discard this card to the Serendipity Card pile

Serendipity Card

Move forward to the next "Draw one Paleozoic Card" then

Discard this card to the Serendipity Card pile

Serendipity Card

Move forward to the next "Draw one Mesozoic Card" then

Discard this card to the Serendipity Card pile

Serendipity Card

Move forward to the next "Draw one Paleozoic Card" then

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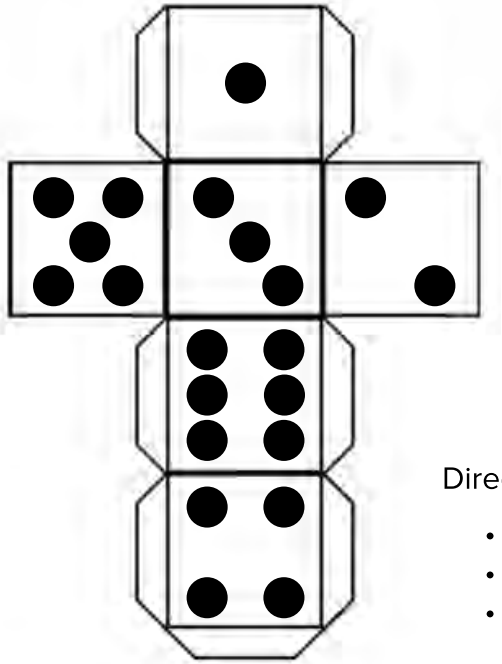
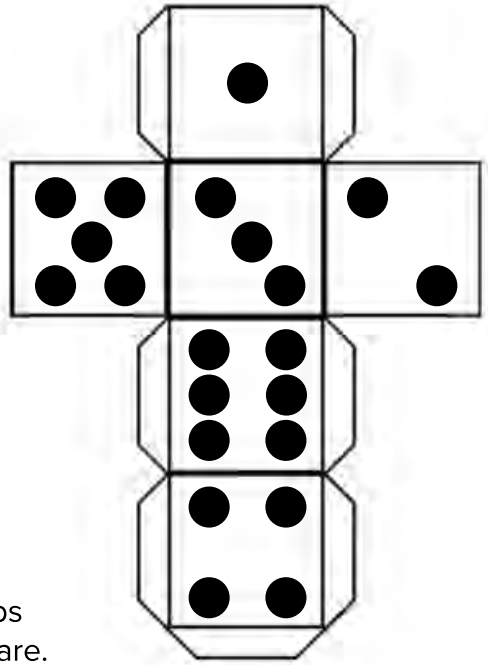
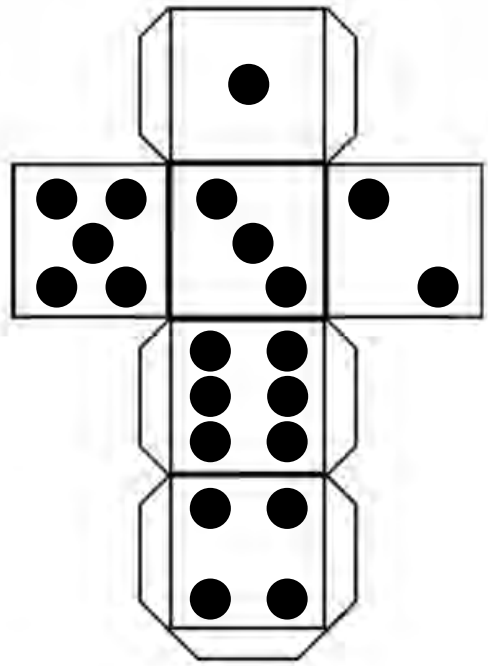


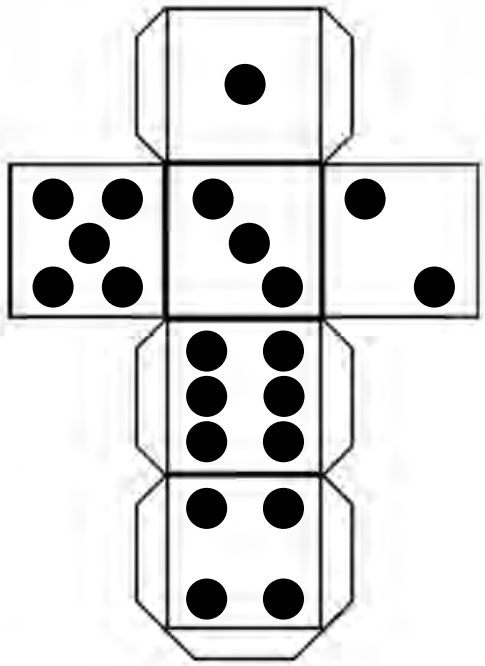


Directions to make your own dice:

- Copy on card stock paper.
- Cut template on outside lines.
- Fold on lines, including the tabs and edges between each square.
- Tape tabs to squares, forming a cube. If possible, tape the tabs on the inside.
- If the dots are partially obscured by the tab, you can color the dot on top of the tab.
- Best if you use exactly the same amount of tape on each side.

Note: Real dice work best.





WHERE IN THE WORLD?

The **dynamic** Earth is constantly changing. Climates have shifted from warm tropical to cold ice ages. With these changes, organisms change.

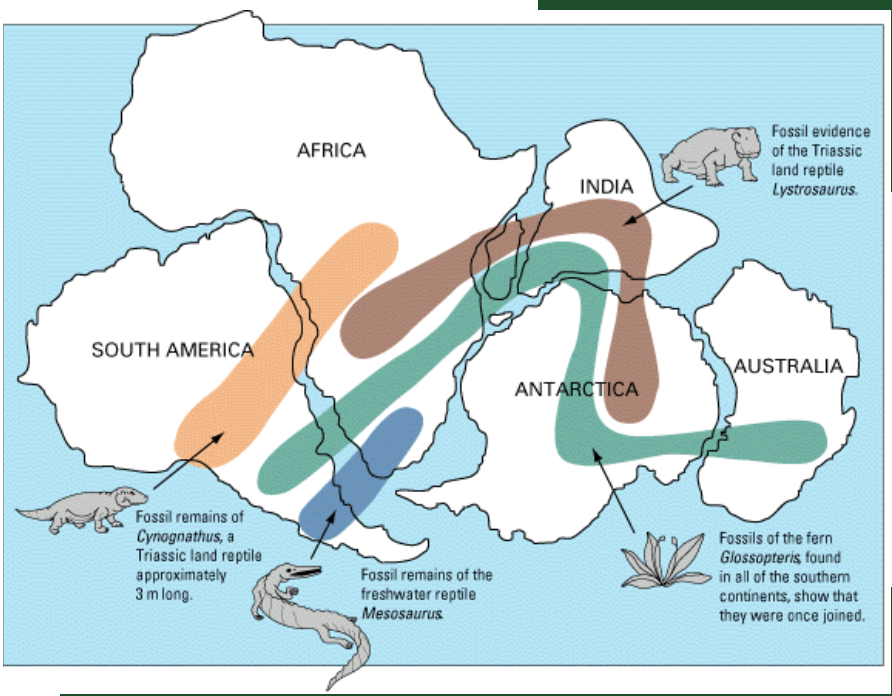
We can follow migrations of animals around the world and they move just to remain in their preferred ecosystem. The fossils and their age help us to identify direction they move, as depicted in the diagram below right.

Directions:

- Make your **Pangaea** Globe, when all continents crashed together, and the Cretaceous Globe, when continents were separating.
- Pangaea separated into **Gondwana (**the Southern Hemisphere) from **Laurasia** (the Northern Hemisphere).
- The USA is outlined. Notice in the **Pangaea** Globe (255 MYA), our country crosses the Equator. The Cretaceous Globe, the USA is moving northwards, about the latitudes it currently resides.
- Marsupials (e.g. kangaroos and koalas) are one of the three distinct groups of living mammals. They are found in South America, Australia, and one species in North America, the Virginia Opossum.
- *Trace the route in **Laurasia** on your Cretaceous Globe*:
  - The first fossil evidence of the ancestor of marsupial is from Northeast China 100 MYA.
  - We found a marsupial fossil in North America from 65 MYA, and assume that they migrated from Asia to North America by the Asian-Alaskan Land Bridge.
  - They made their way into South America, and the oldest found fossil there is ~50 MYA.
  - They then moved through Antarctica to Australia, and the oldest fossil evidence is from 30 MYA.
- Xenarthrans are a group of mammals that include armadillos, glyptodonts, anteaters, tree and ground sloths.
- *Trace the route on your Cretaceous Globe*:
  - Their ancestor is unknown, but DNA evidence supports that it was **Gondwana** in Africa.
  - The first fossil evidence is 66 MYA (armadillo bones) in South America.
  - South America was separated for about 90 million years.

POWER WORDS

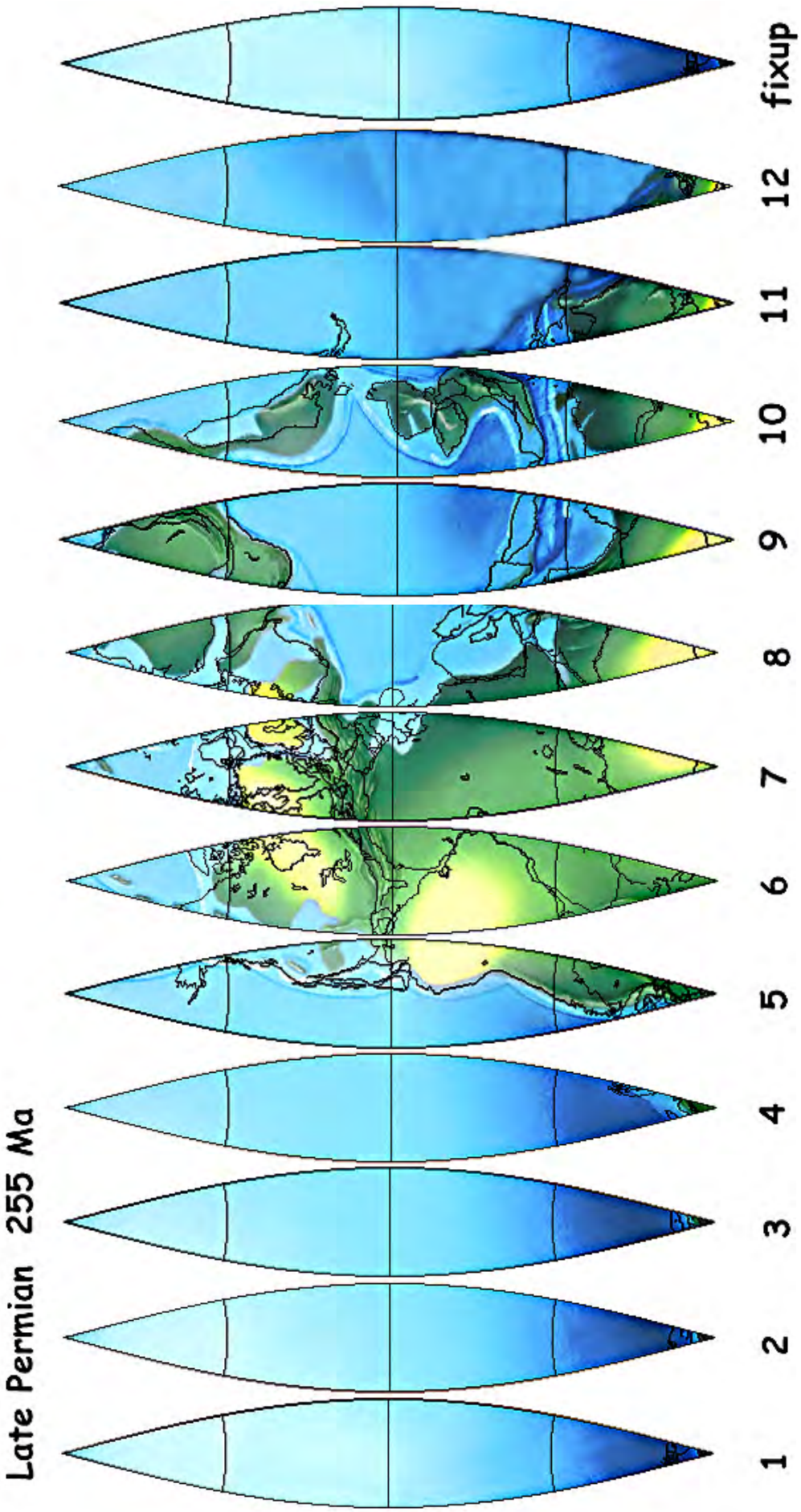
- **dynamic**: constant change
- **Gondwana**: ancient supercontinent that broke up about 180 MYA into Africa, South America, Australia, Antarctica, the Indian subcontinent and the Arabian Peninsula
- **Laurasia**: ancient supercontinent that broke up about 180 MYA into North America, Greenland, Europe, and Asia except for the Indian subcontinent
- **Pangaea**: ancient supercontinent that included all current land masses



MATERIALS:

- sharp scissors
- print page 47 and 48
- tape
- optional - 2 balls or balloons with 8.5"circumference or 2.7" diameter

WHERE IN THE WORLD - Pangaea Globe

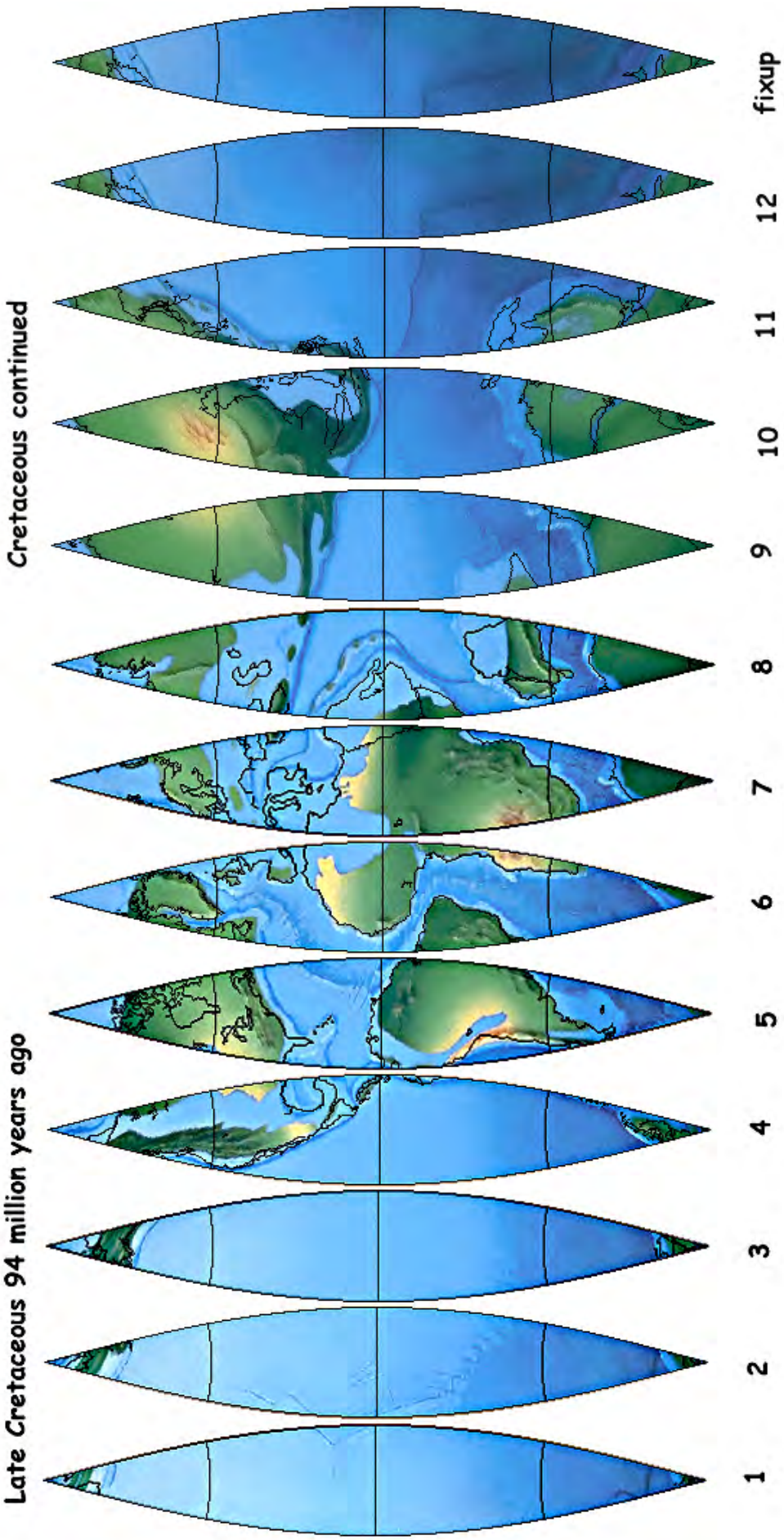


Pangaea Globe:

Dr. Christopher Scotexe developed these globes, and he had it on his website for many years. I looked for it, but couldn't find it. I wrote and asked if he would permit me to use it. Thank you Dr. Scotese!

Directions:

- Print this page.
- Carefully cut out the globe along the edges, but as one piece. You will be cutting the numbers 1-12 and "fix-up away from the globe. Do not cut the sections apart. When you are done, you will have one piece.
- If you use a ball or balloon:
  - Wrap the globe's equator around the center of the ball. The "fix-up" section should be under section "1". Tape to hold in place.
  - Starting with the "fix-up" end of the globe and moving from sections 12 to 1, begin wrapping each section to the poles, and securing with tape.
  - When you are done, you will have a Permian Globe.
- If you do not have a ball or balloon:
  - Carefully make a circle with at the equator with the sections, and overlap "fix-up" under section "1".
  - Gently wrap the poles of each section together and tape.



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  - Gently wrap the poles of each section together and tape.

The Law of **Superposition** was first proposed in the 17th Century by Danish Nicolas Steno. It simply states that in undisturbed **formations**, the youngest layer is on top, and the oldest layer is on the bottom.

Paleontologists use the location of the fossil to determine where it lived, and the **stratigraphy** to determine when the it lived.

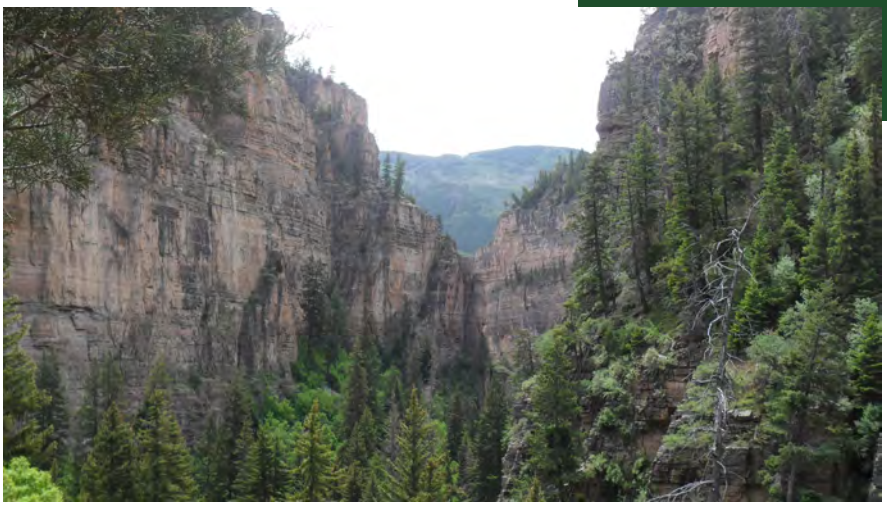
Hwy. 71 cuts through the Glenwood Canyon Colorado. The canyon is a great example of the Law of Superposition. The Canyon's base is Cambrian rock. The upper layers are from the Carboniferous (both the Pennsylvanian and Mississippian. The Colorado River eroded the canyon in the Quaternary. Find these Periods on your timeline.

Directions:

- The process of making this dessert models the same process as our Earth building layers. The gummy bears represent fossils. The brownies represent the Paleozoic. The pudding represents the Mesozoic. The whipping cream represents the Cenozoic.
- Follow the package directions to make the brownies. Allow to completely cool.
- Follow the directions to make the pudding.
- Sort gummy bears by color. Red represents Paleozoic fossils, yellow represents Mesozoic fossils, and green represents Cenozoic fossils.
- With the canning jar mouth, press down on the brownies to make a brownie circle. Turn the jar right side up, and slice the brownie in half - the bottom from the top. Push the brownie bottom into the bottom of the jar. Place several gummy bears into the brownies, and cover with the brownie top.
- Spoon pudding on top of the brownies to cover. Place several yellow gummy bears on top of the pudding, and cover with more pudding.
- Squirt whipping cream on top of the pudding to cover. Place several green gummy bears, and cover with more whipping cream.
- Eat immediately.
- As you eat this dessert (**YUM**), you first find the green gummy bears, which were the last (youngest) you added. Next you find the yellow gummy bears. Finally, you find the red gummy bears, which were the first (oldest) you added.

POWER WORDS

- **formation**: an assemblage of rocks or series of strata having some common characteristics
- **stratigraphy**: the branch of geology concerned with the order and relative position of strata and their relationship to the geological time scale
- **superposition**: the action of placing one thing on or above another
- **yum**: exclamation used to express pleasure at eating, or the prospect of eating a particular food



MATERIALS:

- **brownie package mix (optional lemon bar mix)**
- **eggs**
- **vegetable oil**
- **instant fudge pudding mix (optional vanilla pudding mix)**
- **milk**
- **whipping cream (squirt can)**
- **gummy bears (different colors)**
- **brownie pan**
- **clear cup sized canning jars**
- **mixing bowl, measuring spoons and cup, spoon**

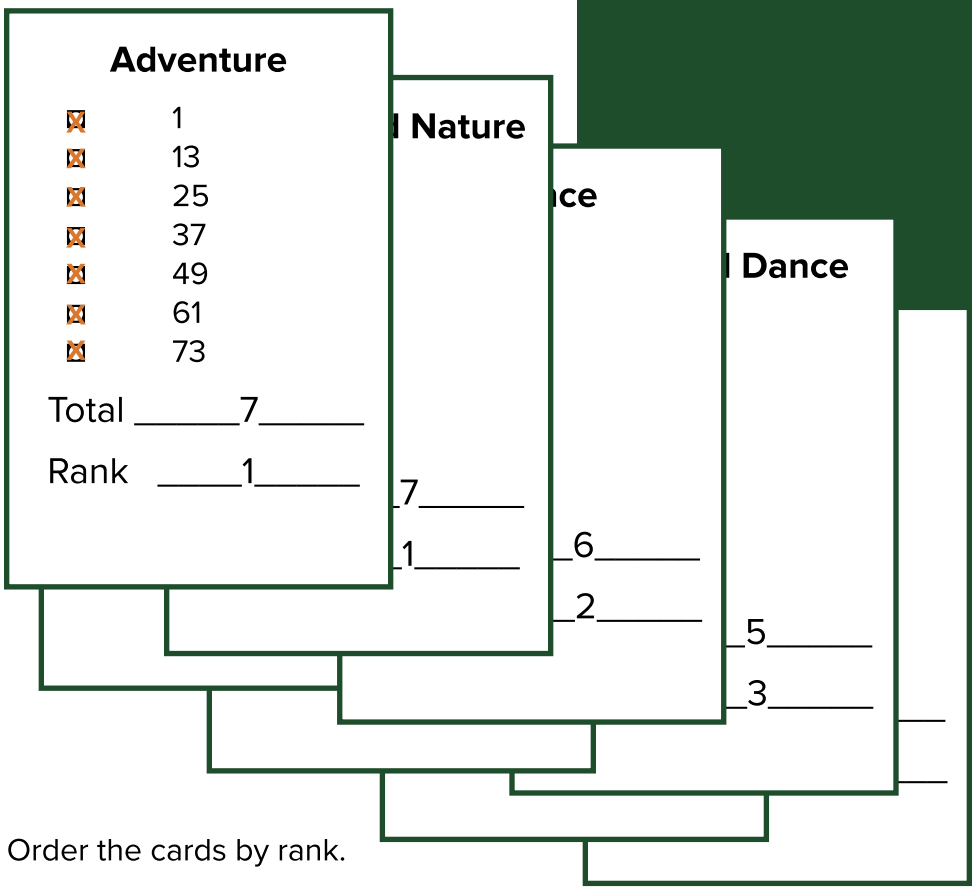
Last month, you took an interest survey about things you like or would like to do. In that quiz, you were careful to only select those things that sounded really interesting. This month, we are going to examine your interests. You need last month's answers. If you cannot find them, or if you did not take it, you can find it, and need to retake the interest survey quiz, you can find it on the website listed in the green box below.

There were 84 questions, and each question can be grouped into 1 of 12 categories. On page 51, you will find the score sheet. To **calculate** your interests

1. Find all of the numbers that you selected on the survey and locate the matching number in the boxes on page 51. Put a check by that number.
2. Count the number of checks in each box, and put that number on the "Total" line in the box.
3. Cut out the 12 cards.
4. Order the cards from the highest total to the lowest total. If two boxes have the same number, they will be assigned the same rank. For example, if both Math and Travel have 7 checks, they will both be ranked as number 1. Continue until all 12 boxes are ranked.
5. What are your top areas of interest?
6. Discuss these interests with your parents, 4-H leader, and close friends. Brainstorm ideas for a project that incorporate at least the three top areas of interest. For example, if your top interests are art, business, and talking, you could design a line of electric t-shirts with the 4-H clover and market them to your 4-H club.
7. Would you like try out your idea for real?

Keep your cards for next month. The real fun begins then!

CALCULATE INTERESTS EXAMPLE



Order the cards by rank.

POWER WORDS

- **calculate** determine the amount or number of something mathematically

MATERIALS:

- Print page 51
- Pencil or pen
- Scissors
- Tri-River 4-H STEM Website 53.Paleontology1 on pages 31-33 https://tra.extension.colostate.edu/stem-k12/stem-resources/
-

After identifying each question from the interest survey that you check in the cards below, cut them out the 12 cards and save them until December's issue.

Adventure	**Animals and Nature**	**Art**	**Business**
☐ 1	☐ 2	☐ 3	☐ 4
☐ 13	☐ 14	☐ 15	☐ 16
☐ 25	☐ 26	☐ 27	☐ 28
☐ 37	☐ 38	☐ 39	☐ 40
☐ 49	☐ 50	☐ 51	☐ 52
☐ 61	☐ 62	☐ 63	☐ 64
☐ 73	☐ 74	☐ 75	☐ 76
Total _____	Total _____	Total _____	Total _____
Rank _____	Rank _____	Rank _____	Rank _____
Computers	**Math**	**Music and Dance**	**Science**
☐ 5	☐ 6	☐ 7	☐ 8
☐ 17	☐ 18	☐ 19	☐ 20
☐ 29	☐ 30	☐ 31	☐ 32
☐ 41	☐ 42	☐ 43	☐ 44
☐ 53	☐ 54	☐ 55	☐ 56
☐ 65	☐ 66	☐ 67	☐ 68
☐ 77	☐ 78	☐ 79	☐ 80
Total _____	Total _____	Total _____	Total _____
Rank _____	Rank _____	Rank _____	Rank _____
Sports	**Talking**	**Travel**	**Writing**
☐ 9	☐ 10	☐ 11	☐ 12
☐ 21	☐ 22	☐ 23	☐ 24
☐ 33	☐ 34	☐ 35	☐ 36
☐ 45	☐ 46	☐ 47	☐ 48
☐ 57	☐ 58	☐ 59	☐ 60
☐ 69	☐ 70	☐ 71	☐ 72
☐ 81	☐ 82	☐ 83	☐ 84
Total _____	Total _____	Total _____	Total _____
Rank _____	Rank _____	Rank _____	Rank _____

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CITATIONS

Information:

- Taphonomy_http://www.bbc.com/future/story/20180215-how-does-fossilisation-happen
- Dr. Christopher Scotese's maps: scotese.com
- Careers Reeves, Diane Lindsey and Clasen, Lindsey (2007) Career Ideas for kids who like Science 2nd Edition. Checkmark Books, New York NY; Pp7-26.
- South America Natural History: Simpson, G. G. (1980). Splendid isolation: The curious history of South American mammals. New Haven: Yale University Press; Barbara J. Shaw (2009) The enigmatic anteaters, sloths, and armadillos: elucidating evolutionary relationships among xenarthran families, *Ernanodon antelios*, and remaining mammals, and Darin A. Croft, Ph.D.https://dcpaleo.org/south-american-fossil-mammals/
- Glenwood Canyon information: Colorado West: Young, Robert Glenn & Young, Joann W. (1984) Land of Geology and Wildflowers; Robert G. Young, publisher, pages 26-33 and 43-50
- Layered Dessert: https://www.oliviascuisine.com/brownie-trifle/
-

Images:

- Unless otherwise noted, images were taken by Barbara J. Shaw, Ph.D. at the *American Museum of Natural History in New York, NY or **Museo de Ciencias Naturales , in La Plata, Argentina. and Hank J. Edmunds (Dr. Shaw's son) at the **Museo de Ciencias Naturales , in La Plata, Argentina.
- Grand Canyon https://www.usgs.gov/media/images/confluence-colorado-and-little-colorado-rivers
- Trilobite https://www.trilobites.info/gallichida.htm
- Eurypterus https://en.wikipedia.org/wiki/Eurypterid#/media/File:Eurypterus_remipes_001.jpg
- Gorgonopsia Peter Ward https://www.goodreads.com/book/show/630160.Gorgon
- *Ernanodon antilios*: Suyin Ting
- Megalodon / great white shark comparason: https://en.wikipedia.org/wiki/Megalodon
- Gondwana map: https://pubs.usgs.gov/gip/dynamic/historical.html
- Glenwood Canyon: https://upload.wikimedia.org/wikipedia/commons/f/ff/Glencan.JPG