Dinosaur Anatomy- primary- Lesson #1

Materials in the Kit:
Deer vertebra
Book- *National Geographic Dinosaurs*
Book- *Amazing Dinosaurs*
Book- *Dinosaur Dream*
3 Smorgasaurus Ziploc bags
4 Drawing of two dinosaur heads
6 ziploc bags with dinosaur cards
2 pages of background info on paleo artists
2 pages of information about the artist, Eleanor Kish
6 illustrations of Eleanor Kish's work
3 Color storyboards of paleo artists fleshing out a dinosaur

Materials needed by consumers: (depending on the activities chosen)
Cooking Activity:
Bowl and spoon & plates
1 c. of peanut butter
1 c. of dry milk
2 tbl of honey
8 squares of graham crackers, finely crushed

Main Ideas:

1. A vertebrate is an animal that has their skeletal system inside their body.
2. Humans are vertebrates.
3. Dinosaurs usually walked on their toes.
4. Artists turn dinosaur bones into living animals.

Book- *Dinosaur Dream*:
Read the book to the children and discuss.

Hurrah for Vertebrates:
Sample script: Reach around behind you and feel up and down your backbone. You'll find that it feels knobby and bumpy. Actually it isn't one bone. Each bump is a separate little bone called a vertebra. (plural- vertebraes)

A vertebrate animal has a skeletal system inside of their body. An invertebrate does not have a skeletal system inside of its body.

A skeletal system is the bones (including the veterbrae) that make up the skeleton plus the cartilage and ligaments that hold it together. Can you think of an animal that has a skeleton? (Discuss their answers.) Dinosaurs were vertebrates too. What do you think animals and people would look like if they didn't have a skeleton? Without a skeleton, we would simply be a lump of flesh.

Take out the deer vertebra. Ask the children if they can see where the spinal cord ran through it. (Pass it around)

Paleontologists have been finding dinosaur bones for a long time. After they put the bones together, they try to imagine how the muscles would go over the bones. How do you think they know where to put the muscles and what kind of muscles? They can look at the muscles on other animals and on people.

Cooking Activity: Making Dinosaur Bones

1. Gather the ingredients for the dinosaur bones and mix them together, with the exception of the graham cracker crumbs.
2. Prepare a sample of the bone ahead of time. (adjust the recipe for the size of your group.)
3. Pass out portions of the mixture and have the children make individual "bones". When their dinosaur bones are made, pass around the bowl of graham cracker crumbs and let the children sprinkle their "bones".

Another option would be to use pretzel dough, but then you would have to have access to an oven.

Mighty Muscles:

Sample narrative: The structure of a bone provides a lot of information about how that bone was used. To determine the use of a bone, paleontologists study the areas where muscles were attached and the general size and shape of a bone in relation to the other bones in the body. Muscles leave rough places on bones at the points where they attach.

By studying muscle attachment scars, scientists can tell whether the animal was built for speed or strength. When a muscle is attached close to the joint of an arm or leg, the limb has a large range of movement, allowing the animal to move with great speed. When a muscle is anchored farther from the joint, the limb has less range of movement but more strength.

Roll up your sleeve and feel the muscles in your arm. Can you feel where any attach to your bones?

Although most vertebrates have a similar basic framework, each animal has skeletal characteristics that determine how it lives. Running animals tend to have long, slender limbs in relation to the rest of their bodies. Their leg bones are long and thin. Their muscle attachments are close to the joints, allowing good range of motion and speed. In large running animals, the toe bones may have been fused to give the animal stronger feet without added muscle weight.

Why wouldn't a running animal want more weight? Can you think of a present-day animal that is built to run? Name a dinosaur that was built to run.

Dinosaur Locomotion:

(Use pgs 58 & 59 in the *National Geographic Dinosaurs* book and there are also pictures in the Book, *Amazing Dinosaurs*.) Dinosaurs usually walked on their toes. People, bears and crocodiles walk flat-footed.

Some dinosaurs moved around on four legs and some on two legs. Others may have run on 2 legs, but walked and grazed on all 4 legs. Some dinosaurs were slow moving and others were speedy, depending on their anatomy. Dinosaurs probably used their tails for balance while they were moving.

Huge dinosaurs with short legs like Apatosaurus, Diplodocus, Brachiosaurus and other sauropods were probably among the slowest moving dinosaurs. (Have the children locate pictures of these in the books.)

The speediest dinosaurs were the bird-like, bipedal carnivores- theropods- with long, slim hind limbs and light bodies. For example, Ornithomimus ran up to 43mph.

A T-Rex couldn't run faster then 20 mph. If you were a hunter would it be better to be fast or slow? Why?

Smorgasaurus:

Take out the 3 Ziplocs with the smogasaurus parts. Tell the children that they are going to design a dinosaur- a smorgasaurus. Have them choose the parts they want. (Each child will not be using all of the parts. Try not to get the pieces from each baggie mixed up.) Try to lead them in a discussion of what their parts will be good for as far as the dinosaur's survival, e.g. a long neck to eat plants high up, claws for protection, etc.)

I See, You See- Dinosaur Eyes:

Take out the drawing with the 2 dinosaur heads. Ask the children what is different about their eyes. One kind of dinosaur has its eyes positioned at the front of its head. The other has eyes positioned at the sides of its head. Does the position of its eyes make a difference in how and what the dinosaur sees? Are your eyes at the front or on the sides of your head? Can you imagine having eyes on the sides of your head?

Pass out the 6 sets of dinosaur cards and have the children try to sort the cards according to the eye placement- in the front or on the sides. After they have them sorted, let them know that the dinosaurs with their eyes in the front of their heads are the predators, while the animals with eyes at the sides of their head are prey. (Explain predator and prey if the children are not familiar with the terms.)

Paleo Artist Eleanor Kish:

Use the 2 background pages on paleo artists and the 2 pages of information about Eleanor Kish as a preparation for yourself in order to talk about the 6 illustrations that were done by Eleanor Kish. You can also use the color diagram sheet of paleo artists fleshing out a dinosaur.

A mind-blowing fact:

Kids always like to hear gross things, so here is one you can share about dinosaur anatomy. The Brachiosaurus had quite a large nasal passage. When they sneezed, they blew out about ½ galloon of snot!!!!

Extra Resources in the Kit:

Book- *Great Dinosaur Search*
Book- *Dinosaurs Before Dark*
Book- *How to Draw Dinosaurs*
DVD- Allosaurus

Paleontologists and Digs- P/K- Lesson #2

Materials in the Kit:
2 Laminated pictures of paleo artists' depiction of long ago
Diaper
Jar of baby food
Pacifier
Pair of baby socks
4 copies of What Happened Here?
Bag of Plastic dinosaurs
Book- *Dazzle the Dinosaur*
Dinosaur fingerplay – The Dinosaurs
Brushes from the exhibit
3 sets of Dino jigsaw puzzle pieces in envelopes
Bag of shells

Materials Needed by Consumers: (depending upon the activities chosen):
<u>Dino Dig- Making Fossils:</u>
Sand
Paper cups
Plaster of Paris
Waxed paper
<u>Alternate Dino Dig Activity- making fossils</u>
Fossils to imprint: twigs, leaves, clean chicken bones
Salt
Flour
Brewed coffee (cold)
Coffee grounds (used)

Main Ideas:
1. Dinosaurs lived long ago.
2. Paleontologists are like detectives.
3. Paleontologists study what's left of plants and animals from long ago.

Long Ago:
When we say "it was long ago", what do we mean? Does it mean yesterday? Does it mean many years ago before you were born? Before your parents were born? When we say "long ago" we mean a very long time ago. We will be talking about a time that we know very little about. There were no people around to remember it and tell stories about it to their children.

Share the paleo artist's pictures of long ago. Discuss the scenes.

Paleontologists: The only way we know about what went on at that time is that we can dig in the earth and find the remains of the plants and animals that lived a long time ago.

A long time ago plants, bugs and animals left impressions in soft mud, which dried out and eventually became rock. That is how we get clues about long ago. Paleontologists are like detectives.

Detective Work: Sample script: Today you will have to be detectives too because last night something happened here. Someone was here but I don't know who it was. They left some of their things here and I'm hoping that you can help me figure out who was here.

Let's look at all of these things and see what kind of detectives you are. Here are the things I found. Pour them out of the bag- diaper, food, socks, pacifier. The socks are very small. Who do you think the visitor was? A baby! Tell me some more about this baby. Is it big? Oh, the diaper is not the smallest, but medium. O.K. So maybe our baby is a medium sized baby. Do you think it is one year old? What about 5 years old? O.K. Since it's wearing a diaper, it's probably not! It's certainly younger. Is it a girl? You're right. The socks have pink on them, so it's probably a girl. That's a good guess. What color hair does the baby have? You don't want to guess? Is there a clue? You guys are good detectives! You never saw the baby girl, but you think that she was our visitor.

How do you think your guesses have anything to do with the dinosaurs we're studying? Yes, we can make good guesses when we have clues or evidence that helps us guess. That is what paleontologists do; they study clues about the dinosaurs. These clues are called fossils. Let's see how good a detective you can be with this. Pass out the 4 copies of What Happened Here? Have the children try and guess what happened.

Dino Dig- Making Fossils:

In advance, fill paper cups about halfway with damp sand. Have the children make impressions in the sand with the footprints of the plastic dinosaurs or imprint the whole dinosaur if your cup is large enough. Pour Plaster of Paris over each impression and let dry. When the plaster is dry, peel off the paper cup. Have brushes from the exhibit handy so that the children can brush the sand off of their fossils.

Alternate Dino Dig Activity- making fossils

In advance, make "stone dough" or use a homemade recipe for play dough.

Stone dough: ½ c. salt
1 c. flour
½ c. brewed coffee (cold)
1 c. used coffee grounds

(For the fossils to imprint, use twigs, leaves, shells, clean chicken bones, plastic dinos)

1. Stir together until well mixed.
2. Turn the dough out onto a large sheet of waxed paper and knead it until smooth.
3. Break off a piece, roll it into a ball and use the heel of your hand to flatten it out.
4. Press the object you wish to make a fossil imprint of, firmly into the dough. Carefully remove the object to leave the print behind.

This is very much like the way real fossil prints were created. A long time ago, plants, bugs and animals left impressions in soft mud, which dried out and eventually became rock.

Just For Fun:

Dinosaur Fingerplay- The Dinosaurs:

The Dinosaurs lived long ago, when life on Earth began.

Some were tall (gesture high)
Some were small (gesture low)
Some liked water (gesture swimming)
Some like land (gesture walking by alternating palms on your knees)
Pteranodons had leathery wings (gesture flying)
Brontosaurs, long necks 9gesture to neck)
But the meanest dinosaur of all (gesture mean face)
Was Tyrannosaurus Rex (gesture heavy stomping by alternating palms on your knees)

Book- *Dazzle the Dinosaur:*

Read the book *Dazzle the Dinosaur*. Then discuss when Dazzle lived and why the dinosaurs wanted to return to the cave. You can also discuss real dinosaurs versus pretend dragons.

Alternate Paleontologist Activity:

Place the pieces of the dinosaur jigsaw puzzles around the room. Have the children be paleontologists and discover the pieces. They then can work in groups to put together the dinosaur. (Use as many puzzle pieces as you have children. The backs of the puzzle pieces are lettered so that the pieces are easier for the children to put together.)

Extra Resources:
Book- *Detective Dinosaur*
Video- Dinosaurs

Woolly Mammoths and the Ice Age- P/K- Lesson #3

Materials in the Kit:
Picture of a saber-toothed tiger
Picture of a giant ground sloth
Picture of a woolly rhino
Picture of a woolly mammoth
Woolly Mammoth puppet
Transparency of a mammoth hunt
4 Dinosaur templates
Book- *How Do Dinosaurs Say Good Night?*
Mammoth drawing
4 plastic dinosaur fossils for rubbings
Heart doily for rubbing
Netting for rubbing
Book- *The Days of the Dinosaurs Coloring Book*

Materials Needed by the Consumers: (depending on the activities chosen)
Overhead
White paper
Colored paper
Coloring utensils
Scissors
Glue
Brown yarn

Main Ideas:
1. Millions of years ago the Earth was very cold.
2. Many interesting mammals lived during the Ice Age.
3. The woolly mammoth was one animal that had adaptations for living in the ice and the snow.
4. Texture is the element of art that refers to the surface of an object.

Ice Age: sample script…. Who can tell me what ice is? What happens to our rivers and ponds during the winter? Millions of years ago the entire Earth was very cold…all of the time; there wasn't a spring, a summer, or a fall- only winter. When it's that cold, many places on Earth are covered completely with ice. It was called the Ice Age.

All of the dinosaurs were gone by the time of the Ice Age. During the last Ice Age, there were many large, interesting mammals, like saber-toothed tigers, giant ground sloths, woolly rhinos and woolly mammoths. (Display a picture of each animal as you name them.)

We're going to take a close look at one of these giant animals…..the woolly mammoth. Mammoths were elephant-like animals that were adapted to the cold weather. When you are adapted to the cold weather, it means you can live in that weather without a problem. Would you go out in the winter with only your bathing suit on? Right, you probably wouldn't wear a snowsuit in the summertime either.

Well, mammoths had long shaggy fur and underfur to keep them warm. Let's take a look at the other animals again and see if they had a lot of fur too.

Mammoths also had a lot of fat to keep them warm too. Let's take a look at our friend, the mammoth. (Display the woolly mammoth puppet.) Look at how much fur he had! Our elephants today look like woolly mammoths but they aren't covered with fur. Besides its fur to keep it warm, the mammoth had other adaptations to the cold and snow. They had long tusks that helped them find food through the snow and ice. (The tusks may have also been used for protection.)

We also have a picture of a mammoth being hunted. (Use the transparency of the mammoth hunt on an overhead.) Discuss the picture.

Camouflage:
(Make copies of the dino templates.)

Another way that animals can adapt to where they live is by blending in with their surroundings. Explain the idea of camouflage.

Have the children cut out a dinosaur that was copied on a piece of white paper. Then give them a piece of colored paper that will serve as a background. They will them color in their dino so that it blends in with the background.

OR you can have the children cut out the dinosaur from a colored sheet of paper. They can then glue their color dino on a white sheet of paper. They can use the coloring utensils to draw vegetation, water, hills and even other dinos. Make sure they understand that their dino should be camouflaged by something that is the same color, so that it will blend in with its surroundings.

OR feel free to make copies from the Dinosaur Coloring Book

Book- ***How Do Dinosaurs Say Good Night?***

Discuss beforehand how the children say good night in their family or the things that they do to try and stay up later.

Art Project- Texture:

Texture is the element of art that refers to the surface of an object or artwork. Texture is usually created using a rough surface, rather than a smooth one. Discuss how you can find interesting textures all around…in car tires, the soles of athletic shoes, wood, tile floors, tree bark, leaves, cloth, etc. It's fun to collect the different patterns and designs by making rubbings.

Use the 3 brightly colored plastic dinosaur fossils, the heart doily or the netting and have the children create rubbings using pencils or crayons. Or have the children experiment using the soles of their shoes or anything else in the area that draws their interest. Plain white copy paper works best for these rubbings.

Art Project- Mammoths:

Give the children a copy of the woolly mammoth drawing. They can then use glue and brown yarn to make their own mammoth. (You might want to make the copies on cardstock to make it sturdier.)

Extra Resources:
Book- *Detective Dinosaur*
Video- Dinosaurs

Dinosaur Teeth- P/K Lesson #4

Materials in the Kit:
4 Diagrams of 3 dinosaur skulls
T-Rex plastic dino
Brontosaurus plastic dino
Triceratops plastic dino
3 Mirrors
Resin replica of a dinosaur tooth
Photo of T Rex skull
2 Drawings of T Rex jagged tooth.
Book- *Big Book of Dinosaurs*
2 full color art plates of long ago
Four Dinosaur Paper Plate Puppets & storyboard
Book- *Prehistoric Pinkerton*

Materials Needed by the Consumers: (depending on the activities chosen)
Jerky
Lettuce
Plates or paper towels
Paper
Crayons

Main Ideas:

1. Some dinosaurs ate plants.
2. Some dinosaurs ate meat.
3. Different teeth do different jobs when we eat our food.

Dinosaur Teeth:

Most people think of dinosaurs as being ferocious meat eaters. Actually only the theropods ate mostly meat. You can tell this immediately by looking at their teeth. (Pass out the diagrams of the 3 dinosaur skulls and display the 3 plastic dinosaurs. The plastic dinosaurs correspond with the 3 dinosaur skulls.)

Sample script: Look at the teeth in these skulls. Can you tell which animals are meat eaters and which are plant eaters? What kinds of teeth does a dog have? What does a dog eat? What kinds of teeth does a horse have? What kinds of food does it eat?

So if we find a dinosaur skull that has mostly flat teeth, what do you think they ate? What if a skull has mostly pointy teeth, what kind of food would they have eaten? What about yourself? What kinds of food do you eat? Are all of your teeth the same?

Once we know a tooth's job, bingo! We know something about what it ate. Each type of tooth has a special job. We have developed several kinds of teeth. (Point out the different kinds of teeth in your own mouth for the children to see.) We have canines or stabbing teeth. We have incisors for biting off food and cheek teeth or molars, for chewing. Can you find the different kinds of teeth in your mouth? (Pass out the 3 mirrors so the children can take turns identifying the different kinds of teeth in their mouth. Depending upon your group, some of the children may not have all of their teeth and some might be missing some already.)

Activity: The Jobs of Teeth-

Give each child a piece of jerky and some lettuce. Ask which teeth are for tearing off pieces of meat. It's the incisors, which have sharp edges. These are for biting also. What are the back teeth for? For grinding and mashing into smaller pieces so that we can swallow our food. These are called molars. If you had to chew all of your food with your front teeth, just imagine how hard that would be. They would keep cutting the food but they wouldn't grind it up.

Which teeth are we using to eat our "plants"?...We bite first and then we chew, but we don't usually have to bite or tear it first. We have both kinds of teeth because we eat meat and plants.

Take out the resin dinosaur tooth and ask the children if they think it came from a meat eater or a plant eater. Tyrannosaurus Rex had only one kind of tooth. All of his teeth have the same basic shape, although they come in different sizes and thicknesses. There are no flat-top mashing ones. What does this mean? No chewing! No mashing!

(Show the picture on page 14 in The Big Book of Dinosaurs.)

Sample script:

(Show the children the color picture of the T-Rex skull.) Did you notice how uneven the teeth are in the jaw of the Tyrannosaurus Rex? Some are 13" long and some barely break the surface of the jaw. Can you guess why? T-Rex and other meat-eating dinosaurs were always losing their teeth. As T-Rex attacked another animal, it would stab the animal with its teeth and then tear off its flesh. This takes tremendous force and sometimes the teeth came out. But T Rex didn't have to go to the dentist. No matter how many times it lost a tooth, another always grew in its place. The smaller teeth in the jaw are the replacement teeth that are still growing. Do we keep getting one new tooth after another? (Discuss)

Show the diagram of the T Rex tooth. Notice how sharp the tooth is and how its edges are rough, like those on a steak knife. It's perfect for stabbing and slicing through flesh but not good for grinding leaves. It's pretty obvious that T Rex only ate meat.

Art: Show the children the 2 full color art plates that show the dinosaurs from long ago. You can either have them draw their own similar scene or have them act out what is happening in the pictures.

Puppet Play:

Introduce the 4 dinosaur puppets and storyboard. As you read the storyboard, have the children use the plate puppets as actors in the story.

Extra Resources in the Kit:

Book- *Detective Dinosaur*
Video- Dinosaurs

Dinosaur Anatomy- primary- Lesson #1

Materials in the Kit:
Deer vertebra
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Book- *Dinosaur Dream*
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6 ziploc bags with dinosaur cards
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2 pages of information about the artist, Eleanor Kish
6 illustrations of Eleanor Kish's work
3 Color storyboards of paleo artists fleshing out a dinosaur

Materials needed by consumers: (depending on the activities chosen)
Cooking Activity:
Bowl and spoon & plates
1 c. of peanut butter
1 c. of dry milk
2 tbl of honey
8 squares of graham crackers, finely crushed

Main Ideas:

5. A vertebrate is an animal that has their skeletal system inside their body.
6. Humans are vertebrates.
7. Dinosaurs usually walked on their toes.
8. Artists turn dinosaur bones into living animals.

Book- *Dinosaur Dream*:

Read the book to the children and discuss.

Hurrah for Vertebrates:

Sample script: Reach around behind you and feel up and down your backbone. You'll find that it feels knobby and bumpy. Actually it isn't one bone. Each bump is a separate little bone called a vertebra. (plural- vertebraes)

A vertebrate animal has a skeletal system inside of their body. An invertebrate does not have a skeletal system inside of its body.

A skeletal system is the bones (including the veterbrae) that make up the skeleton plus the cartilage and ligaments that hold it together. Can you think of an animal that has a skeleton? (Discuss their answers.) Dinosaurs were vertebrates too. What do you think animals and people would look like if they didn't have a skeleton? Without a skeleton, we would simply be a lump of flesh.

Take out the deer vertebra. Ask the children if they can see where the spinal cord ran through it. (Pass it around)

Paleontologists have been finding dinosaur bones for a long time. After they put the bones together, they try to imagine how the muscles would go over the bones. How do you think they know

where to put the muscles and what kind of muscles? They can look at the muscles on other animals and on people.

Cooking Activity: Making Dinosaur Bones

4. Gather the ingredients for the dinosaur bones and mix them together, with the exception of the graham cracker crumbs.
5. Prepare a sample of the bone ahead of time. (adjust the recipe for the size of your group.)
6. Pass out portions of the mixture and have the children make individual "bones". When their dinosaur bones are made, pass around the bowl of graham cracker crumbs and let the children sprinkle their "bones".

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Roll up your sleeve and feel the muscles in your arm. Can you feel where any attach to your bones?

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Why wouldn't a running animal want more weight? Can you think of a present-day animal that is built to run? Name a dinosaur that was built to run.

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Pass out the 6 sets of dinosaur cards and have the children try to sort the cards according to the eye placement- in the front or on the sides. After they have them sorted, let them know that the dinosaurs with their eyes in the front of their heads are the predators, while the animals with eyes at the sides of their head are prey. (Explain predator and prey if the children are not familiar with the terms.)

Paleo Artist Eleanor Kish:

Use the 2 background pages on paleo artists and the 2 pages of information about Eleanor Kish as a preparation for yourself in order to talk about the 6 illustrations that were done by Eleanor Kish. You can also use the color diagram sheet of paleo artists fleshing out a dinosaur.

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Extra Resources in the Kit:

Book- *Great Dinosaur Search*
Book- *Dinosaurs Before Dark*
Book- *How to Draw Dinosaurs*
DVD- Allosaurus

Geology & Erosion- Primary- Lesson#2

Materials in the Kit:
The Process of Fossilization and Fossil Discovery copy master
2 Aluminum lasagna pans
Watering can
5 pairs of goggles
Bag of 11 Pipettes
Book- *Native American Rock Art*
Book- *Journey Through the Ice Age*
7 Color illustrations of cave paintings
Paleolithic Cave Art transparency
Cro-Magnon Man- the Artist transparency

Materials Needed by Consumers: (depending upon the activities chosen)
Scissors
Stapler
Baking soda & water- limestone rocks
Vinegar, pipettes- acid rain
Sand
Styrofoam cup for a "rain cup"
Hair dryer
Chalk & paper clips-optional chemical erosion
Optional cooking demo: 3 flavors of jello, graham crackers, whipped cream, fruit cocktail, Pyrex dish, measuring cup, plates
Overhead projector
Art activity: bark, leaves, flowers, clay, charcoal
White paper

Main Ideas:

1. Sedimentary rock is a type of rock formed by layers of loose material.
2. Erosion wears away sedimentary rock.
3. Erosion helps paleontologists discover dinosaur bones.
4. The first recorded artists painted on cave walls around the world.

Uncovering Treasures:
(Make copies of the Process of Fossilization and Fossil Discovery sheet.)

(Background or sample script)- Let's learn how erosion helps paleontologists recover dinosaur bones. When a triceratops died, it might have been well preserved if it fell into a creek and became buried by sediment.(washed-off bits of rock) And if the sediment sealed out big and little scavengers and if it had the perfect mix of chemicals and if no flood washed everything away or broke the carcass in little pieces and if no passing T Rex wandered by and made a little snack of our fallen Triceratops-----then nothing would have destroyed the evidence of the triceratops.

After that, years would pass and centuries and then millions of years. Enough rain would fall, washing more and more sediment on top and burying the fossil deeper and deeper. Over all that time, the sediment around the Triceratops finally would harden into rock.

(Pass out copies of the Process of Fossilization and Fossil Discovery sheets so that the children can follow along with the process as you read it. Make sure they know the order their eyes should go in on the sheet….down the first column and then down the second column.)

Pretend you're the fossil remains of the Triceratops. You'd probably want like someone to discover your fossilized bones. But you're buried under all those layers of sediment. How will anyone ever find you? With a little luck, erosion will bring you back to the surface.

The same process that washed all those sediments down and piled them on top of you will wear away the sedimentary rock pile and carry it off to lower land somewhere else.

A paleontologist of the future may find your bones sticking out of the ground. Wow! On the other hand, maybe no one will discover you and your bones will weather and erode away with the rest of the rocks. Tough Luck!

Have the children cut up the booklets and put them in order. Then staple them together and have the children try to tell the story to you.

Erosion Experience: (set up as stations, individual activities or pick & choose)

Chemical erosion: Preparation the day before- make limestone rocks. Tightly pack baking soda into lumps using a minimal amount of water. Let dry overnight.

1. Place a limestone rock in a cup and slowly add 20 drops of water from a pipette. Have the children explain what they see happening.
2. To demonstrate acid rain, have the children add 20 drops of vinegar to a different limestone rock.

Water Erosion: Make a pile of sand in a lasagna pan. Slowly pour water from the watering can and watch the erosion occur. (If you are afraid of the speed and amount of water that might come out of the watering can, then poke 5 small holes in the bottom of a Styrofoam cup and turn it into a "rain cup".

Wind Erosion: Make a small pile of sand in another lasagna pan. Have the children wear goggles for this activity. Have the children either blow gently on the sand to watch the erosion or use a hair dryer to simulate a wind storm.

Another option to demonstrate chemical erosion is to obtain some sticks of white chalk. Have the children carve designs (something like a totem pole) in the chalk using opened paper clips. Then have them stand their chalk carvings on a plate and slowly drip vinegar over it.

Cooking demonstration for erosion:

Prepare in advance>>>>>Mix a batch of limestone using lime gelatin. Put the gelatin in a measuring cup, add a little less boiling water than the directions on the box call for. Let the limestone cool in the mixing cup for about 15 min, then pour it in a clear Pyrex pan, 8" x 12". Place the pan so it is level in the refrigerator and leave it until the gelatin is completely set. This layer will be the bed (stratum) that was formed when the area was under the ocean.

Make a stratum of sandstone, the kind that forms from sand deposited by a river. Fossils are often found in this stratum, so we'll need some fossils too. In this case, the sandstone will be raspberry gelatin and the fossils will be pieces of banana or a well-drained can of fruit cocktail.

Cut the banana into small chunks. Mix the gelatin in the measuring cup as you did before and let it cool for about 12 min. Mix in the banana or fruit cocktail. Pour this mixture into the pan on top of the limestone. Make sure the limestone is completely firm, so the 2 layers don't mix together. Place the pan back in the refrigerator until it is cold and firm.

The third stratum will be a thin layer of coal that formed when the area was part of a huge swamp. Crushed graham cracker crumbs will be the coal. Crumble up 5 or 6 graham crackers and sprinkle them on top of the sandstone.

Mix up half a box of the lemon gelatin. This will be another layer of sandstone. Cool the lemon gelatin for 10 min & then pour it over the graham crackers and return the growing formation to the refrigerator for more cooling.

For the final layer we need siltstone. Make the rest of the lemon gelatin and let it cool in the measuring cup. Then stir in about ½ c. of whipped cream or topping. Pour this mixture evenly over the top of your formation. Put the whole thing back in the refrigerator.

Once your formation has set, take a look through the side of the dish. You've created in an afternoon a series of strata that would take millions of years to form in nature.

One thing you'll notice is that the fossils are hidden away under a number of other layers. Fortunately for paleontologists, sedimentary rocks are constantly being eroded away from above by wind and rain, so fossils are constantly being uncovered. You can demonstrate with a cup of warm water and a square of stratified gelatin.

Actual Demo: Place a square of gelatin on a paper towel on a plate. Tilt the plate over a sink or a bowl and slowly pour a stream of warm water on one edge. Gradually the top layers will melt away, exposing the fossil layer.

The wind also erodes sediments. To show this, take a hair dryer, turn it to warm and aim it at the square of gelatin. In a few minutes, the top layers will begin to dissolve. (Of course, in nature the rocks don't melt. They're just slowly broken down and carried away.)

Notice how small pieces of fruit flow out with the melting gelatin. This happens with real fossils too. When paleontologists find a few small bone or shell fragments lying on the ground, they often find the rest of the fossil by looking in the rocks directly above it.

Cut the remaining gelatin into sections and serve to the children.

Art: Have the 2 art books available for the children to look at: *Native American Rock Art* and *Journey Through the Ice Age*.

Cave Paintings: The first recorded artists painted on cave walls throughout the world. They used the natural products around them like other hard stones, staining with berry juices, using different colored clays and anything else they could find that would leave a mark. The people would draw on the walls and the ceilings of the caves. They drew the types of animals they had seen and killed. They made outline drawings of their hands. If the people needed to move to another location, this left a record for the people following them as to what their life had been like living in this area. As story tellers and communicators, these original artists would tell of their great victories over the mammoth, how they lived or the loss of loved ones.

Share the 7 color illustrations of cave drawings and the 2 transparencies.

Art Activity: Drawing with Natural Materials-

Give each child a piece of white copy paper and make available different natural items. The children can make natural rubbings with actual things from nature. If you use a piece of bark and rub it on a paper, it will leave brown marks on the paper…maybe making the trunk of a tree. If you bunch up a fresh leaf in your fingers and rub it on the paper, it will color green……possibly making leaves for the tree. Flowers petals will leave different colors. Use your imagination and experiment with other natural objects.

Extra Resources in the Kit:

Book- *Great Dinosaur Search*
Book- *Dinosaurs Before Dark*
Book- *How To Draw Dinosaurs*
DVD- Allosaurus

Trilobites- Primary- Lesson #3

Materials in the Kit:
David Smith color plates- 3 sculptures
3 Information sheets about David Smith
Magic Bag with resin Trilobite fossil
1 Drawing of trilobites
3 sets of 4 Copies of trilobite heads
2 Sample trilobite mask shapes #1 & #2
Sample drawing of trilobite eyes
Picture of trilobite cookies
Copy of Trilobite wordsearch and answer key

Materials Needed by Consumers: (depending on the activities chosen)
Paper plates
Coloring Utensils
Pipe cleaners (if you want antenna on your trilobite masks)
Scissors
Hole punch
Bag of plain oval cookies
Bag of chocolate chips
M & Ms
Small microwave safe bowl
Microwave
Waxed paper
Plates
Pencils

Main Ideas:

1. Trilobites were arthropods that lived in the sea millions of years ago.
2. The name trilobite means 3 lobed one because they had 3 parts- head, thorax, and tail.
3. Trilobite fossils have been found on almost every continent.
4. David Smith used a lot of prehistoric images in his metal sculptures.

Artist: David Smith- sculptor

Share the color plates of 3 of David Smith's sculptures. Included are three information sheets about David Smith if you'd like to have some background to share with the children.

The Magic Bag:

Keep the trilobite in the bag so that the children don't see it. Pass the bag around and have the children feel the fossil through the bag. As the children try to imagine what is in the bag, talk about "what is old?' Ask them how they should handle something that is 600 million years old. No Peeking! After everyone has had a chance to feel it, take it out of the bag and display the replica of a trilobite fossil.

Trilobites are extinct, hard-shelled animals that lived in the sea millions of years ago. They belonged to the arthropod class. (Arthropods include crabs, centipedes, spiders, shrimp and insects.) They had a soft body inside and an exoskeleton, which is a skeleton on the outside. (That's why beetles crunch when you step on them.)

The name trilobite means 3 lobed one because their oval shaped body was divided into a head, thorax, and tail.

Trilobites were very common and very diverse; over 15,000 species of trilobites are known. (Display the drawings of trilobites.) Some trilobites crawled along the sea floor, some swam, and others drifted with the ocean currents. The different trilobite species probably had different diets; some were herbivores and ate plant matter; some were scavengers and ate dead and decaying matter.

They had large eyes on the top of their heads, mouths and pairs of jointed limbs. Some had protective spines. Many trilobite fossils have been found curled into a ball. Why do you think they were curled up in a ball? (They are believed to have curled up to protect themselves.) Trilobites were like the "roly poly" bugs that exist today, who curl up in a ball to protect themselves.

Art Project: Trilobite Masks-

By making this mask, the children will be covering their face (soft part) with an exoskeleton (the mask). Pass out the 3 different copies of trilobite heads so that the children can get ideas and see the different possibilities they can have on their masks.

Have the 2 sample head shapes available for the demonstration. Pass out the paper plates and scissors. Have the children cut the plate in half to make a shape for a head. For trilobite heads without spines, a straight cut works well. (sample #1) For heads that have spines attached at the end cut the plate to include the spines. (sample #2) Keep the part of the plate that you aren't using for later use.

Have the children cut a nose notch halfway across the bottom. This will make the mask fit better.

Position the mask on their faces to see where the eye holes should be. Using a hole punch or scissors, cut out small eye holes in the plate.

Using crayons, markers or colored pencils, have the children draw the trilobite "bug-eyes" by making a large circle and making tic-tac-toe, cross-hatch or small circle patterns. (Show sample drawing.) **The mask will fit better if the children draw on the back of the plate. If they draw on the front, the rim of the pate will stick out away from their face.** The children don't have to draw the eyes where the eyeholes are. They will probably look better if they are drawn above the eyeholes. Have them look at the examples for ideas.

Many trilobites had spines and bumps sticking out from their heads for protection. The children can cut spines or antennae out of the half of plate they cut away when they made their mask or you can provide pipe cleaners or other materials.

When they're finished decorating their masks, you can punch a hole on each side for yarn or string. Or they can just hold the mask up to their face.

Food Project- Trilobite Cookies:

(See the picture of the trilobite cookies.)

1. Lay out a sheet of waxed paper on a plate.
2. Place the chocolate pieces in a microwave-safe bowl and melt in a microwave.
3. Take a cookie and place 1/3 to 1/6 of the long end of the cookie in the melted chocolate.
4. Carefully remove the cookie and place on the waxed paper.
5. Place 2 M&Ms on the chocolate-dipped head part to make eyes.

6. If you want, you can dip the back 1/3 also in the chocolate.
7. Let them cool before they are eaten.

Trilobite Wordsearch:

Depending on the age and ability level of the children, give out the trilobite wordsearch. An answer key is included.

Extra resources in the Kit:

Book- *Great Dinosaur Search*
Book- *Dinosaurs Before Dark*
Book- *How to Draw Dinosaurs*
DVD- Allosaurus

Paleo Dig- Primary- lesson #4

Materials in the Kit:
Rope
6 bags with "fossil" remnants
3 Straw hats
3 Envelopes with skeleton pieces.
Copy of jigsaw skeleton
6 Colorplates of Waterhouse Hawkins' dinosaurs
Bag of plastic dinos
Bag of shells

Materials needed by Consumers: (depending upon the activities chosen)
Skeleton activity: copy paper, scissors, glue, dry pasta)
Making Fossils: homemade play dough, clean bones, toy dinosaurs, shells, etc.
Cookie Dig: chocolate chip or raisin cookies, toothpicks, paper towels

Main Ideas:

1. Paleontologists study the fossils of plants and animals.
2. Fossils are the remains of ancient life that are buried in rock.
3. Benjamin Waterhouse Hawkins was the first artist who built life-sized models of dinosaurs.

Paleontologists:
Background or sample script-

Have you ever dreamed about what it would be like to dig for dinosaurs? It's a lot of hard work but it's a cross between finding buried treasure and being a detective. The scientists that dig dinosaurs are called paleontologists. Paleontologists study the fossils of plants and animals, which is called paleontology. Paleontology is packed with mysteries about living things that lived thousands, millions and billions of years ago before the first human beings. To solve these mysteries the paleontologists use fossils.

Fossils are the remains or traces of ancient life that are usually buried in rock. Examples include bones, teeth, shells, leaf impressions, nests, and footprints. This evidence reveals what our planet was like a long time ago. Fossils also show how animals changed over time and how they are related to one another.

While fossils reveal what ancient living things looked like, they keep us guessing about their color, sounds, and most of their behavior.

Most ancient living things never became fossils. When they died scavengers ate them, they decayed, or they were worn away by wind and water until they disappeared. Some were destroyed by Earth's heat and pressure. Luckily for us, some living things were preserved as fossils.

Most of the fossils of living things will never be found. They may be buried too deep, or they may be in the parts of the world where no one is digging. Many species probably left no fossils at all. Still, plenty of fossils have been found, and new ones are being discovered all the time.

Dig Sites:
(Background or sample script)

Let's look at the places paleontologists study which are called sites. The location is divided up on a grid using rope or string. Each area on the grid is given a number so that they know where each fossil was found. (You can display a sample grid using the rope.)

Paleontologists don't dig with a shovel very much; they usually use trowels. (pointed tools used by bricklayers) They have to dig very carefully so they don't miss any clues. The typical tools they use are dental tools, like metal picks and scrapers and brushes. They may work years or even decades excavating a single site.

Small fossils are placed in bags with the number of the area that they were found in. Once they are back at the campsite, they take a closer look and they try to identify the fossil.

Let's see if you can group some objects like the scientists would. Give each group a bag with "fossil" remnants inside. Have them carefully pour out the contents and then separate into like groups.

Site Activity:

Paleontologists dig on their hands and knees in the hot sun. To protect themselves from the sun, they usually have hats on. (Take out the 3 straw hats and assign 3 children to be the first paleontologists.)

Pass out the pieces to the jigsaw dinosaur skeleton and have the children take turns being a fossil (puzzle piece) or a paleontologists (with a hat) and have the paleontologists help the groups put together their fossils.

Art Activity:

Give each child their own jigsaw skeleton. Have them cut the pieces out and form the skeleton into a dinosaur on a piece of paper with some glue.

Alternative activity: After the dinosaur is assembled and glued together, the children can glue dry pasta on the skeleton to represent the different bones.

1. Shells for the skull
2. Rigatoni for the legs
3. Fettucini for ribs
4. Elbow macaroni for the neck, backbone and tail.

Artist: Benjamin Waterhouse Hawkins

Can you imagine a time when almost no one in the world knew what a dinosaur looked like? That was true in the mid-19th century, until a Victorian artist named Waterhouse Hawkins brought these ancient animals to life for all to see. Share the 6 colorplates of his artwork with the children.

Activity: Making Imprint Fossils-

Make some homemade play dough. Give each child a piece of the dough. Have them roll it into a ball and then flatten it like a pancake. Let them press leaves, bones, toy dinosaurs or other objects in the dough to make an impression. The children could then compare their fossils and try to guess what made the imprint.

Activity: Paleo Cookie Dig:

Give each child a paper towel, a cookie and 2-3 toothpicks. Have them work on trying to extract the fossils (chocolate chips or raisins) using only the toothpicks. Discuss what it was like trying to remove the "fossils" from the cookies without breaking them.

Extra Resources in the Kit:
Book- *Great Dinosaur Search*
Book- *Dinosaurs Before Dark*
Book- *How To Draw Dinosaurs*
DVD- Allosaurus

Making Inference- Intermediate- Lesson #1

Materials in the Kit:
Bag of baby items: pair of socks, pacifier, baby food)
Bag of toiletries (toothbrush, toothpaste, soap, shampoo)
Transparency of Tracks in the Snow
Self-check sheet with observations and inferences for Tracks in the Snow
Copy of Modified Mystery Poem
Envelope with cut-up pieces of the Modified Mystery Poem
7 Copies of The Blind Men and the Elephant
2 Colorplates of Dinosaur Trackways

Materials Needed by Consumers: (depending upon the activities chosen)
Overhead projector
Blank sheet of paper
Marker board or large sheet of paper
Pencils

Main Ideas:
1. Paleontologists study evidence and make inferences.
2. Good guesses can be made from careful observations.
3. One's background and experiences may affect the interpretation of your observations.
4. Inferences are educated guesses.

Making an Inference:
Display the baby items. Ask the children if they found these items somewhere, who would they think they belonged to? What do you observe about the socks…pink…so your inference would be that they belonged to a baby girl.

Take out the bag of toiletries. Ask the children if these were found in the ruins of a house, what room would they have been standing in? Discuss.

What do the children think the baby items and toiletries have to do with the dinosaurs we're talking about? ….We make good guesses when we have clues or evidence that helps us guess.

(Background: Observations and inferences are basic process skills that are often taken for granted. Simply put, observation is the use of all the senses to gather data or information about an object or phenomenon. It is considered the most basic process in science, one upon which all of science is built.

Inference is the ability to make an educated guess. We learn to identify patterns, generalities and trends using this skill. Thus inference helps us make sense of our world. You use your observations along with your prior knowledge to come to a conclusion.)

Tracks in the Snow:
Have an overhead projector available. Place the transparency of the tracks in the snow and immediately cover position #2 & #3 with a blank sheet of paper. Ask the children to tell you just what they observe first- not what they're guessing. Then proceed to the guesses or inferences.

Then reveal position #2 and ask the children to again just make observations of what they see. Then ask for their guesses or inferences.

Finally reveal position #3. Discuss the observations and then the inferences.

Artist: Share the 2 colorplates of the dinosaur trackways

Palpating Pachyderms:

1. Divide the group into 6 teams.
2. Read the first part of the poem aloud to the group. (the first 6 lines)
3. Explain that you will be handing out a different part of the poem to each team. One person in each team is to read the part to the team. And then the team decides what animal is being described by that part.
4. Prepare 2 columns on a board or large sheet of paper headed observations and inferences respectively. List the teams responses in the appropriate column.
5. After a few minutes all of the teams should have reached a decision. Ask each team to select a reader, who is to read the team's selection aloud to the group. Begin the readings by re-reading the first 6 lines, then team #1, etc.
6. Ask the children to suggest the identity of the animal by analyzing the data.
7. Hand out copies of the original poem, "The Blind Men and the Elephant", one per team to share.
8. Discuss what this poem has to do with science. Some points might be "scientists can't always see every aspect of a problem", "scientists can reach different interpretations for the same observation"

Dinosaur Jokes:

Give the children a copy of the Dinosaur Jokes to have fun with.

Extra Resources in the Kit:

DVD- Walking with Prehistoric Beasts
Book- *The Magic School Bus*
Book- *Guide to Dinosaurs*
Book- *Encyclopedia Prehistorica Dinosaurs*
Book- *The Disappearance of Dinosaur Sue*
Book- *Tyrannosaurus Sue*
Book- *Dinosaur Tales*

Paleo Dig- Intermediate- lesson #2

Materials in the Kit:
Geological Time and the History of Life in North America chart
Bag of straight pins
Sedimentary Strata diagram
Plaster matrix with bones exhibit
Book- *Bones Rock!*
3 sheets of background info on Paul Wenzel
Scrimshaw Sculpture of a Mammoth
Bag of nails
Bag of cleaning materials for the scrimshaw sculpture

Materials Needed by Consumers: (depending upon the activities chosen)
Paleo Cookie Dig #1: Rice Krispie bars with raisins &/or peanuts, toothpicks, plates
Paleo Cookie Dig #2: hard or soft chocolate chip or raisin cookies, toothpicks, plates
Scrimshaw art: margarine or yogurt lids or styrofoam plates, nails or open paper clips, pencils, blue or black paint, brushes, old rag, white glue

Main Ideas:
1. Scientists believe that life began on Earth about 3 ½ billion years ago.
2. Fossils tell us what plants and animals looked like millions of years ago.
3. Matrix is the rock that surrounds fossils.

How old is old?
Display the geological time chart and have the group point out anything that interests them.
The ages of rocks and fossils prove that Earth is very, very old and that life began on Earth a very, very long time ago. The oldest rocks that scientists have found on Earth are almost 4 billion years old. So Earth was formed some time before that. The oldest fossils are more than 3 billion years old. So scientists believe that life began about 3 ½ billion years ago.
Three and a half billion years ago is a lot of years- almost impossible to imagine. So we'll do a demo.

History of Life Demo:
Give each child a straight pin and ask them to stand up straight and hold the pin high over their head- as high as they can. They are going to imagine that their body is 3 ½ billion years old. Since their body is the total amount of time since life began, the period of one-celled animals and plants stretches from their feet to their elbow. The first dinosaurs lived somewhere around their wrist. The dinosaurs died about the middle of their thumb. And humans didn't come along until the head of the pin. Wow!!

Information from Fossils:

Fossils tell us what plants and animals looked like millions of year ago. In fact, they are the only evidence we have that tells us directly about life in the past. Without fossils we wouldn't know that the first living things appeared more than 3 billion years ago. And we would not know that millions of creatures lived on Earth before people came along. To put it mildly, fossils are important.

Display the sediment strata diagram and discuss how the layers show the oldest creatures on the bottom, up to the most recent closer to the top.

Moving Matrix:

Fossils can be extremely delicate. They are frequently found surrounded by other rock. The surrounding rock is called matrix. The fossils can be removed from the matrix either physically by chipping away the rock or chemically. Physical removal can damage the fossil, so the chemical method is often used.

The principal of chemical removal is to dissolve the surrounding matrix with an acid solution. Any exposed part of the fossil is protected by coating it with an acid-resistant plastic. When the acid solution is applied to the unprotected matrix it begins to dissolve the rock. The dissolved rock is wiped away and the process is repeated until all of the matrix is dissolved and only the fossil is left.

Let the children get a chance to see the display plaster piece with the resin bones.

If you have any children who are interested in learning more, *Bones Rock!* is an excellent book.

Paleo Cookie Dig #1:

In advance make a large pan of Rice Krispie bars, with some non-melting ingredients like raisins or peanuts.

Introduce the concept of the systematic investigation of an area that is used by scientists. Divide the pan of Rice Krispie bars into squares or rectangles called Quadrants.

Each child gets a quadrant on a plate and carefully picks it apart using a toothpick. This simulates the paleontologist removing matrix to get at the fossil. Let the children enjoy their treat when they are finished.

Paleo Cookie Dig #2

Give each child a chocolate chip or raisin cookie on a plate and some toothpicks. Allow them to try and remove the matrix with the toothpicks, leaving just the "fossils- the chips or raisins.

Artist: B. Paul Wenzel-

Scrimshaw is a dying art that was started by sailors on whaling ships. Scrimshaw or carving was done on any scraps of whale bone or ivory found on the ship and the sailors took great interest in passing the time carving little images for gifts to take home to their loved ones.

(Included with this lesson are 3 sheets of background info on Paul Wenzel that you can use for your own information to share or you can read it to the children.

Then let the children get a look at the scrimshaw art done by Paul Wenzel. Please tell the children not to touch the ivory part because it will get worn away. Please also clean the sculpture with the enclosed materials before packing it up again.

Scrimshaw Art Activity:

<u>In advance,</u> collect margarine or yogurt container lids or just use small Styrofoam plates.

Give each child a lid or styrofoam plate. They will also need a pencil and a nail. Make sure they have the inside of the lid facing up. Then have them draw a picture on the lid using a pencil and then fill the picture in using the nail to scratch many lines into the plastic. Next comes the paint. If you have acrylic paint, use that. If you have tempera paint, add a touch of white glue to make it sticky. Spread the paint over the picture with a brush and wipe it with a dry rag to remove the excess. The paint will fill in the scratches and leave the children with a modern scrimshaw.

Extra Resources in the Kit:
DVD- Walking with Prehistoric Beasts
Book- *The Magic School Bus*
Book- *Guide to Dinosaurs*
Book- *Encyclopedia Prehistorica Dinosaurs*
Book- *The Disappearance of Dinosaur Sue*
Book- *Tyrannosaurus Sue*
Book- *Dinosaur Tales*

Pangaea and Pteronodons- Intermediate-lesson #3

Materials in the Kit:
5 Colorplates of Carl Grupp's artwork
Plate tectonics Diagram
Pangaea Drawing
Continental Drift Flip Book copy master
Prehistoric Landmasses copy master
Bags of Pangaea Puzzle Pieces
Tape Measure
Pteronodon Wingspan diagram
Heinrich Harder Pteronodon art print
Book- *Dinosaur Origami*
Pteronodon Puppet
Some Dinosaur Name Roots copy master

Materials Needed by Consumers:
Standard physical map of the world
Continental Drift flipbook: copy paper, scissors, stapler
Pteronodon origami: copy paper
Paper and pencils

Main Ideas:

1. Millions of years ago, all of the land on Earth was joined into one huge continent called Pangaea.
2. Pangaea later divided into 2 big continents called Laurasia and Gondwanaland.
3. This theory is called continental drift or plate tectonics.
4. Pteronodons were flying, meat-eating reptiles.
5. Carl Grupp is an artist who enjoys humor and has a love of the grotesque.

Background Information on Carl Grupp:

Carl Grupp was born in Minnesota and also lived in Sioux Falls. When Carl was growing up, his father worked during the night and slept during the day. To allow her husband some quiet time, Carl's mom would take little Carly to the public library and read books to him, a practice he credits in part for his lifelong love of literature.

Carl's childhood was shaped in part by very poor eyesight. He loved to run, but his eyesight caused him to be miserably inept at catching or hitting balls or other basic athletic skills. He got his first pair of glasses in 5th grade and it revealed a whole new world to him. On the way home on a bus, wearing his first glasses, Carl stared at a woman's face opposite him until she became embarrassed. His attention to detail in his drawings may come from this experience.

Grupp's interest in drawing started early, with his using a dictionary as his first drawing pad. Instead of scolding him for damaging the book, his mother praised him. He continued to receive

encouragement from school, including the students, who loved his cartoons which he drew to order, including boogers and all. At the age of 18, Grupp arranged a meeting with Charles Schultz, the creator of "Peanuts", who told him to go to school for further training.

Over the years, Grupp has discovered many new ideas and ways to express his artistic talents. He has designed the arm patch of the Rapid City National Guard, designed a metal gate for the Lewis and Clark rest stop and information center, and currently is preoccupied by a series of watercolors of mountains, which are unique.

We are going to take a look at some colorgraph prints of fabulous fossils such as "Deinos hopper" and "Silurian Mosquito".

Share the 5 colorplates done by Carl Grupp.

Pangaea:

Begin the lesson by showing the group a standard physical map of the world. Ask them if they think the continents always looked the way they do on the map, or if they have changed shape or location throughout Earth's history.

Two hundred forty five years ago the land on Earth was all joined together in one big mass or continent. This continent was called Pangaea. (Pan-JEE-uh). Scientists believe that Pangaea began to break up and drift apart during the Triassic Time Period just as dinosaurs were increasing in number. As the land was separated by the sea into 2 large continents of Laurasia (lor-AY-shah) and Gondwanaland (gond-WAH-nuh-land), the dinosaurs scattered over both continents. Many kinds of dinosaurs developed and they ruled the entire Earth. Over millions of years the land drifted farther apart, little by little, until the Earth looked as it does now. The dinosaurs had all died by the time the continents were positioned as we know them today. This theory is called plate tectonics or continental drift.

Scientists used many kinds of evidence to form the theory. They found similar fossil remains of plants and animals on different present-day continents. So apparently the continents were connected.

Display or pass around the Plate Tectonics Diagram, so that the children can see the progression of the break up of the continents. You can also show the Pangaea drawing.

Pangaea Activity:

Depending upon the age of your group or your inclinations, choose one or more of the following activities.

1. Continental Drift Flip Book- Make copies of the master. The children can cut out all of the squares. Make sure they keep them in chronological order. Then staple them together and flip them to show how Pangaea broke up into individual continents.
2. Prehistoric Landmasses: Have the children cut out the shapes of the continents. They can then try to arrange them into what they think Gondwanaland looked like.
3. Pangaea Puzzle: Pass out the bags with the puzzle pieces and give the children a chance to try and fit them together into the super continent of Pangaea.

Pteronodons: Have the Pteronodon puppet on display.

Background: Pteronodons were flying, meat-eating reptiles with a wingspan of 25-33 feet. (Have the children use the tape measure to mark off how big the wingspan was.) The Pteronodon weighed about 35 lbs and stood about 6 feet tall. They had no feathers, a long head with a crest and a toothless beak. It was *not* a dinosaur.

Their wings were covered with a leathery membrane. This thin but tough membrane stretched between its body, the top of its legs and its elongated fourth finger forming the structure of the wing. Claws protruded from the other fingers. (Show the diagram of the Pteronodon Wingspan.)

Although they had no teeth, Pteronodons were carnivores. They ate fish, which they caught at the surface of the ocean, mollusks, crabs, insects and scavenged dead animals on the land. They hunted like modern-day pelicans by scooping fish out of the water and swallowing them whole.

This fish lived during the late Cretaceous Period in what is not the USA. Fossils have been found in Kansas.

Display the Pteronodon painting done by Heinrich Harder.

Book- *Dinosaur Origami*:

Use pgs 50-55 to create origami pteronodons.

Dinosaur Names:

Make copies of the dinosaur name roots.

Begin the lesson by asking the children if they know how the dinosaurs were named. Explain that the dinosaurs were named in one of four ways:

1. Where the dinosaur fossil was found, e.g. Edmontosaurus, Albertosaurus, a city and a province in Canada.
2. After a famous scientist, e.g. Lambeosaurus after Lawrence Lambe
3. By the way the animal acted, e.g. Tyrannosaurus Rex- terrible lizard king.
4. How the animal looked, e.g. Stegosaurus- plated lizard, Triceratops- three horns on face.
    a. Pass out copies of the dinosaur name roots master. Have the children make up funny scientific names for common objects in the room, people in their family or friends. Or they can make up new names for dinosaurs and then draw them.

Extra Resources in the Kit:

DVD- Walking with Prehistoric Beasts
Book- *The Magic School Bus*
Book- *Guide to Dinosaurs*
Book- *Encyclopedia Prehistorica Dinosaurs*
Book- *The Disappearance of Dinosaur Sue*
Book- *Tyrannosaurus Sue*
Book- *Dinosaur Tales*

Fossils- Intermediate- lesson #4

Materials in the Kit:
Primitive Art Plates
Cro-Magnon Art Objects Transparency
Color Picture of coprolite (animal poop)
3 Resin Fossil Molds
Sifter
Bag of 2 Plastic Dinosaurs
Bag of shells

Materials Needed by Consumers: (depending upon the activities chosen)
Overhead projector
Fossilization of bones: clean drumstick bones, vinegar & container w/cover
Process of Fossilization demo: plaster of Paris, fine sand, water, shells, waterproof container(small disposable aluminum pan)
Making Fossil Casts: clay, low-relief objects like coins, small sea shells, feathers, buttons, blade of grass, leaf, etc, and either white glue or candles (depending upon the activity you choose)

Main Ideas:
1. There are two types of fossils.
2. Type one fossils are the remains of dead things.
3. Type two fossils were made by the animal while it was still living.
4. We rely on art objects found in archeological digs to help us understand the historical stories of the times.

Artist: Primitive Art-

People decorated their caves and homes as well as their clothes and bodies. They recorded changes in society on the cave walls and ceilings and on the hides of the animals they killed for food.

What would we know about the Egyptians without the Pharaohs tombs being found with the art objects of that time? What historical facts would be available to us if we had not discovered the art of Pompeii which was preserved by the ash and rain following the great volcanic eruptions?

Share the Cro-Magnon Art Objects transparency and the Primitive art plates.

Types of Fossils:

There are 2 types of fossils:
Type 1 is the remains of dead things:

- Bones
- Teeth
- Skin impressions
- Hair
- Hardened shell of an ancient invertebrate like a trilobite
- Impressions of an animal or plant

Type 2 is something that was made while the animal was living that has hardened into stone:

- Footprints (show the 2 color plates of footsteps in time)

- Burrows
- Coprolite or animal poop (Display the picture of coprolite)

Many type one fossils are not rock copies of the plant or animal but the thing itself- the real bone or the real twig or the real scorpion. More often than not the bone material is replaced by different minerals contained in the liquid of the sediments that buried it. This process also takes place with shells, exoskeletons and wood. If the spaces in the bone are filled with liquid minerals, which later harden, it is called permineralization.

Sometimes the organic material is dissolved by the mineral-laden water. The process happens so slowly that each cell is dissolved and replaced by a liquid mineral before it hardens. This is called petrification.

Display the 3 resin dinosaur fossil molds.

Fossilization of Bones:

In advance: Three or four days ahead of time: Place some clean (boiled & scrubbed) chicken drumstick bones in a container filled with vinegar. Make sure to cover it to keep the smell of vinegar from filling the room. Leave the bone(s) in the vinegar for 3-4 days. You can place the bone(s) in water to take for the demo.

When you show the children the bone, it will now bend like rubber. Try tying it in a knot. Explain that the vinegar has dissolved the apatite (mineral in the bone) that makes it hard, leaving only collagen (which makes bones resilient). Because collagen is soft and rubbery, you can literally bend the bone any way you like. Encourage the children to try it at home.

Process of Fossilization Demo:

******This activity seems labor intensive but it is a very effective visual for the children.******

In advance: Mix a small amount of fine sand with the plaster of Paris. Do Not Add Water. Put about a third of the dry mixture in a waterproof container. Separate the remaining mixture into two containers. Mix a small amount of dry tempera paint to create different shades of brown. Mix the colors into the containers to make 2 distinct colors of powdery sand so the layers will show as different "soil" as it is added.

Begin reading: Scientists think that life in the ancient seas might have been similar to modern sea life in many ways. The water would have been salty. There would have been lots of plant life for animals to feed on. There would have been animals that had no backbones or invertebrates. These animals often had skeletons on the outside of their bodies, called exoskeletons. We know about them because of fossilization.

Imagine what would have happened to the animals' bodies when they died. As they fell to the sea floor, their shells would have become buried and filled with the soft sand of the ocean bottoms

(Bring out the prepared container of plaster of paris) This is a model of the ancient sea floor. It is soft, sandy and powdery. The only difference is that it isn't wet. This will be the final resting place of our shellfish. (Place the shells in the dry plaster of Paris.)

(Pour a small amount of water onto the layer of plaster of Paris and the shells.) Adding water reminds us that this is a model of the ancient ocean. The ancient animals' bodies would be exposed to ocean currents and wave movement on the sea floor. As the soft body decomposed or became some other animal's dinner, the hard shell would fill up with sediments and mineral laden water.

(Using the sifter, sift a small amount of the remaining plaster of Paris and sand evenly over the water, allowing it to sink in and cover the shells.) Sand and other sediments would eventually cover the ancient animals' bodies.
(Continue to sift the plaster until a soft mud is formed. Keep adding the plaster until all of the water is soaked up. The plaster will now dry fairly quickly.)

This process could take a day, a week, or even thousands or millions of years. Over time, the ancient sea might begin to dry up. There are lots of reasons this could have happened: movements of the Earth's crust, changes in temperature or volcanic actions could all change the depth of the ancient waters.

(Take a plastic dinosaur and make an imprint of their footsteps.) As the water level got lower and lower, muddy swamps and the thick vegetation they grew made good homes for species that could breathe the air…reptiles. As they walked and crawled through the swamps, their heavy bodies made tracks in the soft mud.

Fossilization is a long slow process. It takes many thousands or millions of years for a fossil to form. Minerals in the water are left in tiny holes or pores in the shell or bone. Eventually one molecule at a time, the minerals replace the original materials. What is left is a stone that looks exactly like the shell or bone that once was.

The plaster dig site that you have made could be added to the exhibit for the children to return to at another time. They will then be able to chisel and pick the fossils out of the plaster.

Making Fossil Casts:

Give each child a small piece of clay and have them flatten it into a pancake. Press a low-relief object into the clay and then slowly and carefully remove it. (A low-relief object, meaning not a lot of depth, is necessary because a deep one will take a long time to dry.) The impression of the object in the clay forms a "mold" of the object even if the object is gone. Here is where you will need to decide whether you want to make the mold using white glue or candle wax.

If you are using the white glue, pour some white glue into the mold and let the glue dry. When it is dry, peel back the glue shape from the clay. The glue shape is a cast.

If you are using candle wax, light the candle and go around to each mold and let it fill with melted wax. Let the wax dry. Later peel back the wax shape from the clay. The wax shape is a cast of the object.

Extra Resources in the Kit:

DVD- Walking with Prehistoric Beasts
Book- *The Magic School Bus*
Book- *Guide to Dinosaurs*
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Book- *The Disappearance of Dinosaur Sue*
Book- *Tyrannosaurus Sue*
Book- *Dinosaur Tales*

Dinosaur Eggs!

(Courtesy of OMSI Magazine)

Oregon is one of the few western states where dinosaur fossils - bones, footprints or eggs - have never been discovered. If you have fingers that itch to touch a dinosaur egg, consider making paper mache casts instead. But don't give up the search...you may yet be the discoverer of the first dinosaur fossil, egg or other dinosaur remnant in the Northwest.

Try the following recipe to make actual size replicas of these late Cretaceous dinosaurs: a hadrosaur, Hypselosaurus; a sauropod; and Mussaurus. A hadrosaur was a duck-billed vegetarian dinosaur, similar to the "good mother lizard," Maisaura, found in Montana. Eggs from the Hypselosaurus, unearthed in France, are considered the largest of any dinosaur eggs. The Mussaurus, a robin-sized dinosaur found in Argentina, probably laid the smallest-known dinosaur eggs.

Since color is not preserved in fossils, free your imagination for the hue and design of your dinosaur eggs. Dinosaur artist Doug Henderson pictures some eggs as white. But your eggs' colors are limited only by your paint supply.

Dinosaur EGG Recipe

1. Materials to make:
2. 5 to 6-inch long hadrosaur egg(s)
3. 10 to 12-inch long Hypselosaurus egg(s)
4. Inch long Mussaurus egg(s)
5. Balloons, one per egg (round or oval when inflated)
6. Newspaper or newsprint cut into l-inch-wide strips
7. Wheat paste (available from art and craft stores)
8. Needle
9. Paint; tempera or latex wall paint (your choice of colors).

Directions

1. Blow up each balloon to a size slightly smaller than the finished egg. For example, the Hypselosaurus egg balloon can be about seven inches long.
2. Cut up newspaper (or, for a cleaner egg, newsprint) into about one-inch-wide strips.
3. Prepare the wheat paste according to the directions on the package.
4. Wrap the paper strips soaked in the wheat paste and water mixture around the balloon. Cross over strips to completely cover it.
5. Let the "egg" dry, preferably overnight.
6. Repeat the process of wrapping strips until the egg is the desired size.
7. When the egg is semi-dry, use your finger or a blunt tool to make bumps and pores, resembling bird eggs, on the surface.
8. Pop the balloon with a needle poked through the paper mache.
9. Paint the eggs when completely dry.
10. Enjoy!

Eggciting Dinosaur Egg Facts:

- The largest recorded dinosaur egg, from a Hypselosaurus, is the size of a basketball.
- One Hypselosaurus egg could make an omelet for 15 people.
- Dinosaur eggs have been found in Mongolia, France, Spain, North America, South America and possibly India. (They have never been found in Oregon.)
- Twenty thousand years ago, Mongolian tribes had collected dinosaur eggs, formed them into squares and placed them in graves. Modern man identified the first of these dinosaur eggs in Mongolia in 1922.
- Dinosaur parents probably dug out a mud nest with their front feet, covered the nest with rotting vegetation and guarded the nest from predators.
- A six-inch hadrosaur egg will hatch a 13-inch baby that grows into a 30-foot adult!
- Dinosaurs made huge nesting colonies. The nests were placed about the body length of an adult apart.
- The adventurer Indiana Jones was probably modeled after Roy Chapman Andrews - who first discovered dinosaur eggs in Mongolia.
- The most valuable dinosaur eggs are those with unborn baby dinosaurs fossilized inside.
- Famous egg paleontologist Jack Horner believes that dinosaur babies were “cute” with high foreheads and big eyes, similar to other young animals.

HOP Guide to Starting a Science, Art & Literature Backpack Program at your Library.

What are Science, Art, & Literature Backpacks?

- This is a backpack filled with books, toys, games, experiences, and activity pages that can be checked out by children. Each backpack has a separate theme. The literature sets the stage for a few simple science and art activities that are related to the theme.

Why add a Backpack program to our library's collection?

- The backpack program is an excellent way for your library to achieve the following goals:
  - Use a variety of literature and media to expose children to science and art concepts.
  - Model to parents and caregivers simple ways to extend a child's reading experiences.
  - Increase circulation of library materials.

Assembling the Backpacks.

1. **Select a topic. Consider the following:**
   a. Traditionally popular topics such as: dinosaurs, bugs, or space
   b. Hot topics: Popular characters, movies or TV shows
   c. Local topics: Lewis & Clark, caves, school mascot
   d. Education Standards: What topics do teachers in your schools need some support on? What is to be taught in science and art to the age level you are targeting with your backpack?
   e. Library resources: Do you have some great books that have not been checked out much? Can you link some popular fiction with some less circulated non-fiction? Do you have a puzzle, video and/or puppet all on the same topic?
   f. Events: Be a part of your community centennial by announcing the creation of new backpacks about important parts of your local culture. Help the volunteer fireman with Fire Prevention Week by adding a backpack about fire safety.

2. **Select the Literature. Consider the following:**
   a. Two to four items are usually sufficient.
   b. Use this as an opportunity to introduce children to new types of literature. Consider picture books, guidebooks, coffee table-type books, how-to books, biographies, poetry books. Don't forget videos, music CD's and computer games.
   c. Add an item or two that will allow the students to become more involved or to retell the story. Examples: related games, puzzles, puppets, felt-board sets, etc. Provide suggestions for using these items.
   d. Select science activities related to the literature. Consider the following:
      i. Two or three science activities are usually sufficient.
      ii. Read the books. Is there any good science activities right in the story? Did the kids in the story make shadow puppets? Did they plant a seed? Did they make

a card house? Put exactly what he kids need to do those activities right in your backpack.

iii. Consider activities that are just somewhat related to the story. For example: "Where's Waldo?" books-activities could include looking at their own home with a magnifying glass. They could also do size comparisons/measurement activities. Or, for "Good Night, Moon"-supply a laminated chart recording the moon phases each night.
iv. Check science websites or science activity books for ideas.
v. Ask a local expert or teacher to help you select activities.
vi. E-mail the SD Discovery Center for ideas: info@sd-discovery.com.
vii. Select activities that use only objects that are in the backpack or are easily found in most homes.

3. Select Art Activities. Consider the following:

a. Consider the style of illustrations on the book: photography, torn papers, black &white.
b. Consider the topic of the book. Examples: shadows-make positive/negative pictures, teach how to add shadow to a drawing. "Where's Waldo"- drawing close-ups (Georgia O'Keefe flowers), or camouflage pictures ala Bev Doolittle.
c. Consider artists who have been chosen the same topic. Degas-ballet.
d. Use art books, art teachers, and local artists as resources for including activities that expose children to art concepts, techniques or art appreciation experiences.
e. Try feature local or South Dakota artists whenever you can. This will help the students understand that art is something that South Dakota can do.

4. Kits Examples: Use the Backpack you received from HOP as an example. Here are some other ideas.

a. Sample 1: Marvelous Music
    i. One or more tuning forks
    ii. Percussion instruments (tambourine, drum, rhythm sticks, maracas, etc.)
    iii. Scarves (to inspire twirling an dancing)
    iv. Picture books with music theme (i.e. "Carnival of Animals" by John Lithgow or Sergei Prokofiev's "Peter and the Wolf", which is available with a fully-orchestrated & narrated CD)
    v. Classical music CD or Cassette
    vi. Instructions for going some experiments with various depths of water in glasses

b. Sample 2: Magnetism
    i. Plastic container full of assorted objects that may or may not be magnetic (i.e. paper clips, plastic beads, wood blocks, canning jar lids, etc.)
    ii. At least one , strong magnet
    iii. Several magnets of various size & strength
    iv. Suggested books:

1. At least one non-fiction book about magnetism (i.e. Magnets "Al Aboard Science Reader" by Anne Schreiber)
2. Twinks Magic Carpet Ride, by Jean Lewis & David Gantz
3. Mr. Fixit's Magnet Machine (Magic School Bus Chapter Book), by Rebecca Carmi
4. Magnetic sculpture toy available from science and novelty stores.

5. Putting It All Together.

a. Containers
   i. Plastic boxes.
   ii. Rawlins Municipal Library in Pierre uses thrift store backpacks with decor that fits their theme.
   iii. HOP orders Take-Home backpacks from www.lakeshorelearning.com. You can order a set of 10 for $47.50 or individually for $4.95 each.

b. Activity Cards: The purpose of the activities cards is to guide the parents and a children's use of the backpacks contents. Some of the activity cards have directions for activities. Some of them may have new activities related to the books.
   i. Keep them simple. Include just one set of instructions or activity per card.
   ii. One of the cards should be an inventory that lists all of the backpack contents. A note to the parents about the purpose of the backpack is nice, too.
   iii. Print them on cardstock then laminate them.
   iv. If you have included activities on the cards that require writing, supply a small pack of wipe-off crayons and wipe-off eraser.
   v. Punch a hole in a top corner of each card. Hold them together with a binder ring.

c. Loading the Contents
   i. Put the name, initials or logo of your library on every item of the backpack. This means everything….each piece of a puzzle, each crayon, each activity card, etc.
   ii. *This will pay off. When mom cleans under the couch and finds a puzzle piece with your logo on it, she will return it to you. If no names are on it, it goes in the garbage and you have to spend $10 on a new puzzle.*
   iii. If something has multiple pieces (such as a puzzle or felt board story), put the contents in small plastic containers or zip-seal bags. Label the outside of each bag with a list of the items that belong inside it.
   iv. If you are including reproducible items such as coloring pages, place those items in a folder so they do not get crumpled.
   v. You might consider including a very brief questionnaire in the backpack that asks the user about the condition of the backpack and their experiences using it. *Only do this if you want to gather this information. Otherwise it's just extra paper and work.*

6. **Maintaining Your Backpacks**
    a. You must thoroughly inventory you pack each time they are checked in. Examples: count puzzle pieces, crayons, survey the condition of each item.
    b. If something is missing or damaged beyond normal wear and tear, contact the most recent borrower to make arrangements for return, repair or reimbursement.
    c. Clean all items as needed or according to a schedule you devise.
    d. Replace any consumable items such as coloring sheets, crosswords, ect.
    e. When items start to get dingy or worn, replace them. Remember, it is a treat for your patrons to take theses backpacks home. It will be a disappointment if the items are missing, dirty, or in disrepair.
    f. Record your evaluation data, if you are keeping it.