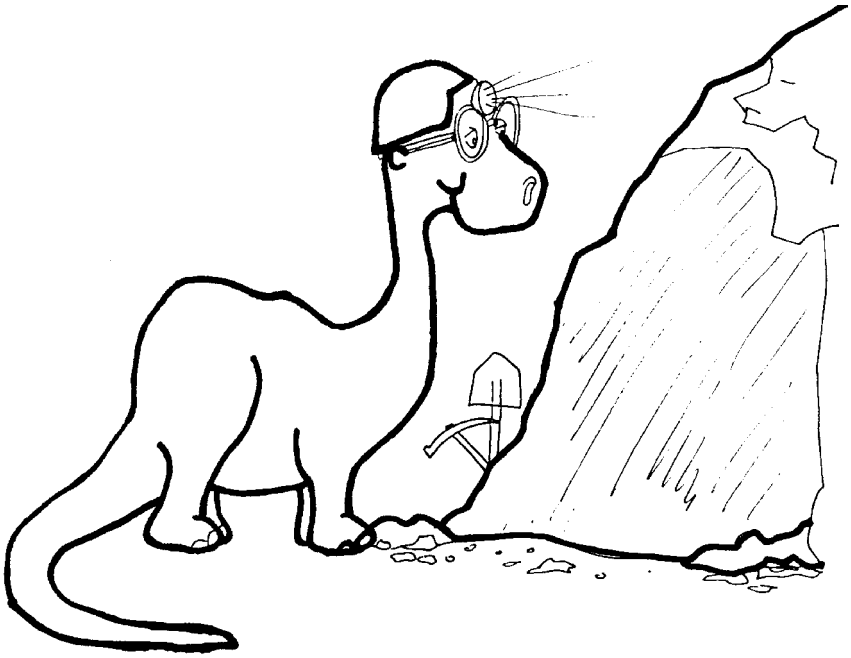
Rock Cycle

Understanding the Earth's Crust

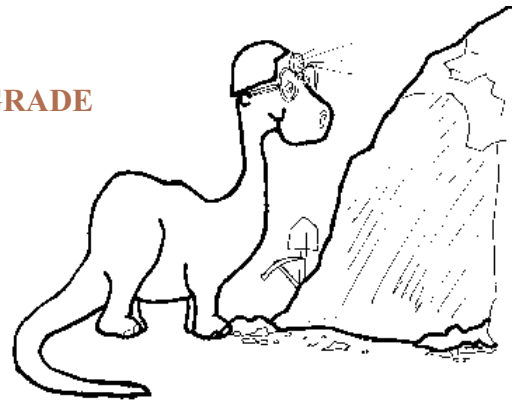
FIRST GRADE

PAST LIFE



2 WEEKS
LESSON PLANS AND
ACTIVITIES

ROCK CYCLE
OVERVIEW OF FIRST GRADE



CHEMISTRY

WEEK 1.
PRE: *Comparing solids, gases, liquids, and plasma.*
LAB: *Exploring how states of matter can change.*
POST: *Introducing the periodic table.*

MINERALS

WEEK 2.
PRE: *Discovering the components of quartz.*
LAB: *Exploring which elements make up minerals.*
POST: *Comparing characteristics of minerals.*

ROCKS

WEEK 3.
PRE: *Comparing how minerals are different than rocks.*
LAB: *Distinguishing minerals from rocks.*
POST: *Discovering where rocks are formed.*

WEEK 4.
PRE: *Describing characteristics of rocks.*
LAB: *Recognizing rock characteristics.*
POST: *Contrasting the three types of rocks.*

PAST LIFE

WEEK 5.
PRE: *Comparing dinosaurs and dragons.*
LAB: *Distinguishing characteristics of dinosaur models.*
POST: *Exploring dinosaurs in books.*

WEEK 6.
PRE: *Analyzing footprints.*
LAB: *Modeling dinosaur tracks.*
POST: *Comparing how dinosaurs moved.*

ROCK CYCLE - PAST LIFE (1A)

PRE LAB

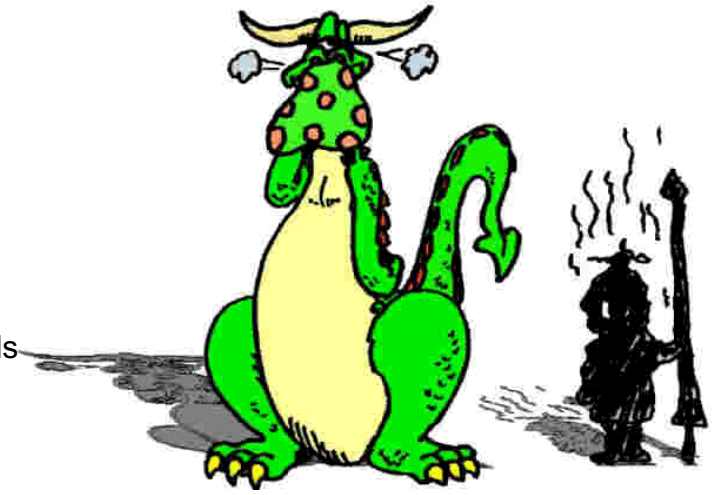
Students examine models to compare dinosaurs and dragons.

OBJECTIVES:

1. Comparing and contrasting dinosaurs and dragons.
2. Learning to distinguish dinosaurs from mythical animals.

VOCABULARY:

dinosaur
dragon
myth
extinct



MATERIALS:

Dinosaur Bones by Aliki
Carnegie Dinosaur Models
crayons
drawing paper

BACKGROUND:

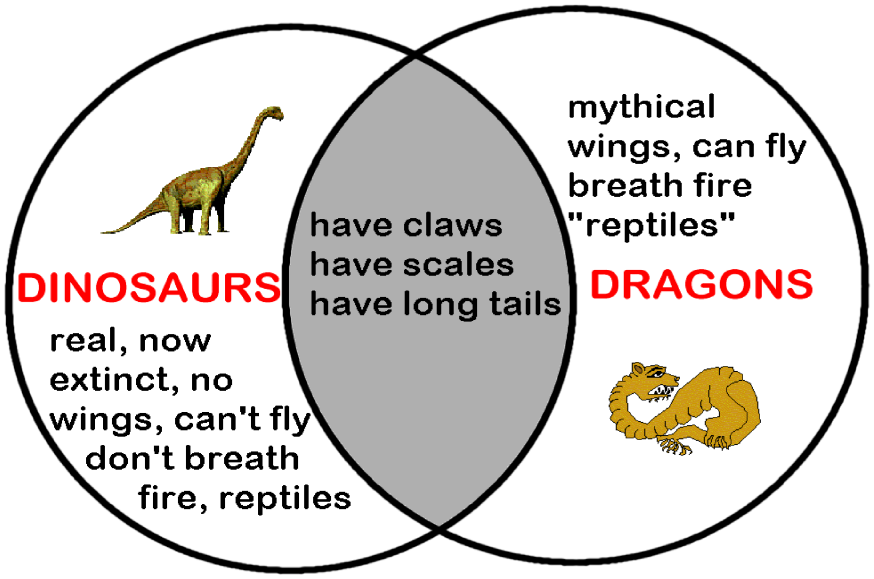
Dinosaurs fascinate little children. It is every child's dream to one day have his very own dinosaur. Ask the students if this could possibly happen. They should realize that dinosaurs have long since been extinct. Children may confuse a "dragon" as a type of dinosaur. Dragons exist only in stories and myths. However, dinosaurs were once real creatures. Discuss the difference between extinct and mythical animals. Mythical are not real and extinct are real, but no longer living.

PROCEDURE:

1. Discuss the difference between extinct and mythical animals with the class. They should understand the difference between animals we can't see anymore that did once exist (*extinct* animals) and animals we can't see that have never existed (*mythical* animals). Ask the students if it would be possible for them to have an actual dinosaur or an actual dragon as a pet. Be sure they realize that both scenarios are impossible. Dinosaurs are unavailable as pets because they've been extinct for 65 million years and dragons cant' be pets because they're make-believe!

2. Made a chart on the board. Label the columns "dinosaur" and dragon". Have the

students brainstorm lists of the differences and similarities of each type of creature. Note that there are both differences and similarities between dragons and dinosaurs: *scales,* for instance, are characteristic of both. Draw the information in a ven diagram to help students visualize the characteristics.



Dinosaurs vs. Dragons

3. Read *Dinosaur Bones* to the students. This story traces how humans derive information from fossils.

4. With this new information, have students make their own drawings of a dragon or a dinosaur. You may want them to "glitter" the dragon to reinforce the idea of "not real." Have the Carnegie Models out to help guide their artistic abilities.

ROCK CYCLE - PAST LIFE (1A).

LAB

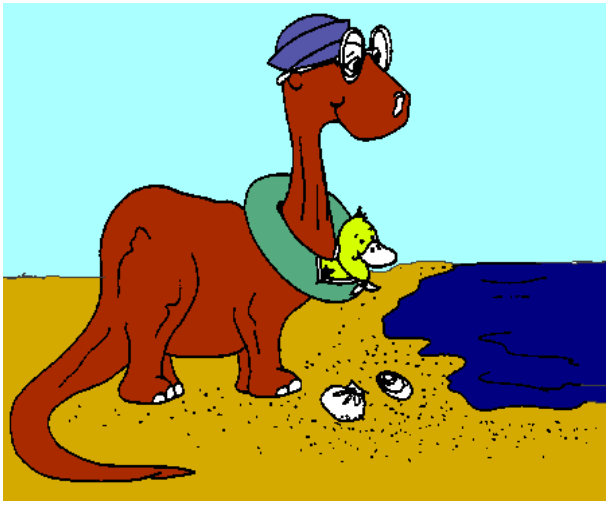
Students use models to observe and interpret physical features of dinosaurs.

OBJECTIVES:

1. Comparing and contrasting dinosaurs.
2. Interpreting how extinct animals may have lived.

VOCABULARY:

dinosaur
armor
reconstruct
extinct
paleontologist



MATERIALS:

dinosaur models
animal placemats

BACKGROUND:

Children may not realize that the appearance of dinosaurs portrayed in paintings, sculptures and models are based on information collected by paleontologists. Fossil bones are usually all that paleontologists have to use in trying to reconstruct a dinosaur's appearance and behavior. Fossil bones contain many types of information, including 1) dinosaur size; 2) how many legs they walked on; 3) what they ate (by teeth and jaw shape); 4) how they defended themselves (by the presence of defensive body armor or weaponry); 5) how big their muscles were (by looking at muscle attachment points on bones); and 6) even how large and where major nerves and blood vessels were located (by looking at openings in and traces on bones).

After collecting all the available information from a dinosaur skeleton, paleontologists compare the features of that skeleton with skeletons of living reptiles, large mammals or any other animal that it resembles. For instance, the three-horned dinosaur *Triceratops* is built and armored much like the modern *Rhinoceros*. We thus infer that *Triceratops*, like *Rhinoceros,* was a plant-eater that was able to defend itself. By using this sort of analogy, paleontologists are able to make educated guesses about the appearance and behavior of dinosaurs, even though dinosaurs are extinct.

In this lab we ask your students to be paleontologists. They will not reconstruct animals from skeletal remains, but they will interpret the shapes and features of dinosaurs. They will instinctively do this by comparing dinosaurs with modern animals without realizing it.

PROCEDURE

1. Mix the extinct animal and dinosaur models and divide them into an appropriate number of groups for the students. Begin a class discussion by saying, "These are all dinosaurs, right?" By now the students should know enough about dinosaurs to immediately disagree with you. Once they do, have them separate the non-dinosaurs from the dinosaurs. Ask the students which of the non-dinosaurs were land-living, which were swimmers, and which were fliers, based on their body shapes.

2. Have the class now look at the dinosaur models. They should work as a group to decide which dinosaurs fit into categories listed below. NOTE: some dinosaurs belong in more than one group. They should also name as many living animals as they can think of that also would fit into each category. Use the animal placemats to help guide their choices. You may want to do one group at a time and check their progress.

A. Fast-moving: dinosaurs (*Velociraptor*, *Tyrannosaurus)* Living animals: cheetahs, ostriches, gazelles, horses, etc.
B. Slow-moving: dinosaurs (*Brachiosaurus, Apatosaurus, Euoplocephalus*) Living animals: elephants, hippopotamuses, turtles, etc.
C. Animals that ate leaves off tall trees: dinosaurs: (*Brachiosaurus and Apatosaurus*). Living animals: giraffe.
D. Animals that had heavy armor for defense from meat eaters: dinosaurs (*Stegosaurus, Triceratops, Euoplocephalus)*. Living animals: rhinos, crocodiles, armadillos, porcupines, hedgehogs, turtles, etc.
E. Animals that killed prey with their claws: dinosaurs: (*Velociraptor*). Living animals: cats (including lions), birds of prey, badgers.
F. Animals that had fancy decorations to attract mates: dinosaurs: (*Parasaurolophus, Pachycephalosaurus*). Living animals: deer, moose, peacocks (and many other types of birds), etc.
G. Animals that defended themselves with their hands: dinosaurs: *(Maiasaura and Parasauralophus)*. Living animals: rabbits, etc.
H. Animals that defended themselves with their heads: dinosaurs: (*Triceratops, Pachycephalosaurus*, maybe *Parasaurolophus*). Living animals: rhinos, horned gazelles, deer, etc.
I. Animals that defended themselves with their tails: dinosaurs:(*Stegosaurus, Euoplocephalus, Apatosaurus and Brachiosaurus)*. Living animals: scorpions, kangaroos, etc.

ROCK CYCLE - PAST LIFE (1A)

POST LAB

Students read a book about fossils in museums.

OBJECTIVES:

1. Learning how to use museums.
2. Using museums to find out more about dinosaurs.

VOCABULARY:

dinosaur
museum
skeleton
paleontologist

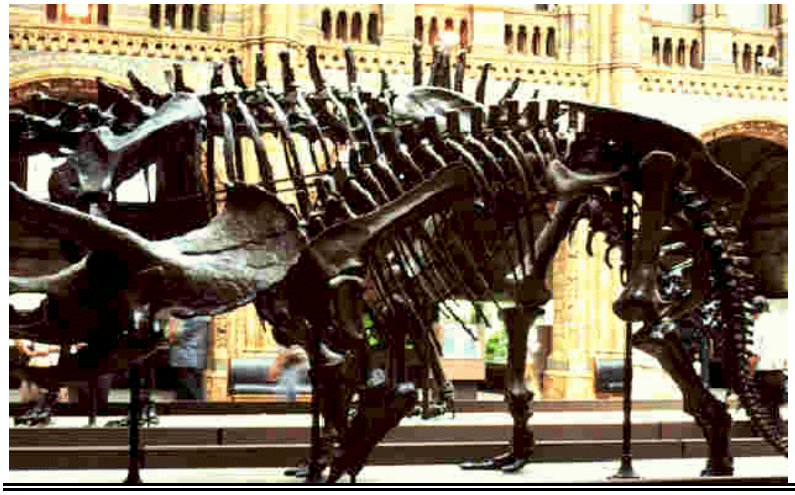
MATERIALS*:*

Digging Up Dinosaurs by Aliki
Internet

BACKGROUND:

Museums are a wonderful resource for students of all ages. For those interested in dinosaurs, they are especially exciting. Where else can you experience the thrill of seeing, smelling, perhaps even touching a dinosaur skeleton that is tens or hundreds of millions of years old? There is no substitute for the sense of awe and connection with the past that you feel when standing at the foot of a *Tyrannosaurus* or *Apatosaurus* skeleton.

We encourage you to organize a trip to your local natural history museum for this post lab. Keep in mind that colleges and universities may have their own paleontology museums or fossil displays that would be fun to visit. Fossils aren't only found in natural history museums!



If a field trip isn't possible, we suggest one of the following alternatives. In this Age of Technology, natural history museums come in two forms: actual and virtual. Most of us have visited an actual museum, but fewer are familiar with the "virtual museum." Virtual

museums are electronic displays of museum exhibits and information on the Internet. They are produced by actual natural history museums and are available for viewing on computers connected to the Internet. A virtual museum field trip doesn't quite provide the excitement of a real museum excursion, but it's cheaper, quicker, and can be thrilling in its own way. If you have Internet access, we suggest you try this option. The electronic addresses of our favorite museum sites are listed below. You may visit these sites to view general dinosaur exhibits or to find out more information about a specific type of dinosaur.

PROCEDURE:

1. Read *Digging Up Dinosaurs* to your class.

2. Have the class make a list on the board of the steps that paleontologists go through to bring dinosaur bones from being buried in the ground to being a museum display. A sample list is given below.

a. Discover bones in/on ground and/or in rocks.
b. Excavate (dig up) bones and take them to a museum.
c. Clean rock and dirt from bones.
d. Glue any broken pieces of bone back together.
e. Mount (make a skeleton from individual) bones using strong metal supports.
f. Fill-in any missing bones with plaster or fiberglass casts.

3. Take the class on a field trip to your local natural history museum, or use the internet to visit one of the virtual museum sites listed below.

University of California at Berkeley, Paleontology Museum
http://ucmp1.berkeley.edu/exhibits.html
Chicago Field Museum
http://www.fmnh.org/sue/
Royal Tyrell Museum (Canada): Dinosaur Hall
http://www.tyrellmuseum.com/
Honolulu Community College: dinosaur exhibit
http://www.hcc.hawaii.edu/dinos/dinos.1.html

4. You may want to work with the class to make a list of facilities in your area that have dinosaur displays. This research will require a local telephone book and newspapers. Leave the finished list with name, address and phone number of each institution up in the classroom so that children and parents may make use of it.

ROCK CYCLE - PAST LIFE (1B)

PRE LAB

Students color dinosaur footprints.

OBJECTIVES:

1. Analyzing footprints.
2. Comparing four different dinosaur footprints.

VOCABULARY:

dinosaur
fossils
footprints
tracks

Tyrannosaur tracks

MATERIALS:

Carnegie Dinosaur Models
crayons

BACKGROUND:

Children often see footprint impressions in mud or sand but are rarely asked to think about deriving information from them. This coloring exercise will help students obtain information from dinosaur tracks. Dinosaur footprints are the impressions that dinosaurs made with their feet. The pattern of footprints that may reveal whether the dinosaur ran or walked, or whether it was two legged or four legged.

PROCEDURE:

1. Tell students that footprints by themselves can provide information on the size of the animal. Ask students how their footprints are different from their mothers' or fathers' footprints. The children should realize that their feet are smaller. Ask them if this pattern would hold true for a dinosaur. Large dinosaurs had large feet and small dinosaurs had small feet. Dinosaur tracks can also tell us if dinosaurs walked, ran, walked in pairs, or if they lived alone or liked the company of other dinosaurs.

2. Ask your students to imagine that they are walking in sand at the beach. Ask them if they would they leave footprints in the sand. They should answer yes, at least until the water washed them away. Ask the students what information they could derive information from their footprints as well as other footprint pattern in the sand. Their answer might include the size of the person, how close together people were walking, and if a person was pigeon-toed or walked like a duck. They could also tell if the person was

wearing shoes and perhaps even distinguish the pattern of the sole of their shoes.

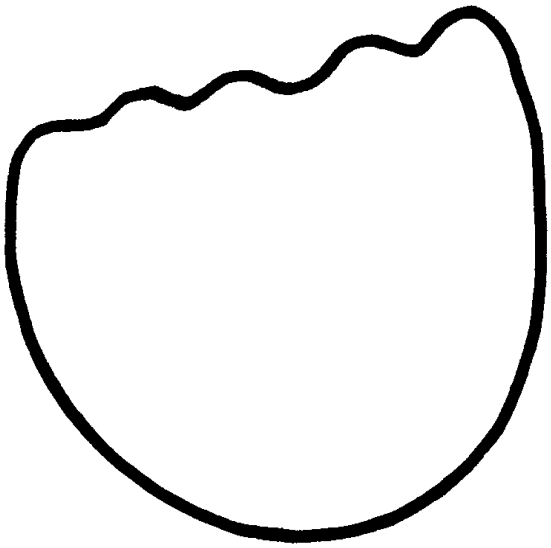
3. On the lab sheet, there are four sets of footprints (please note that these are only sketches). Ask the students the following questions:

a. Which of these footprints might be from a heavy animal? Why do you think so? *Apatosaurus,* because the footprint is large and compact, almost resembling an elephant.

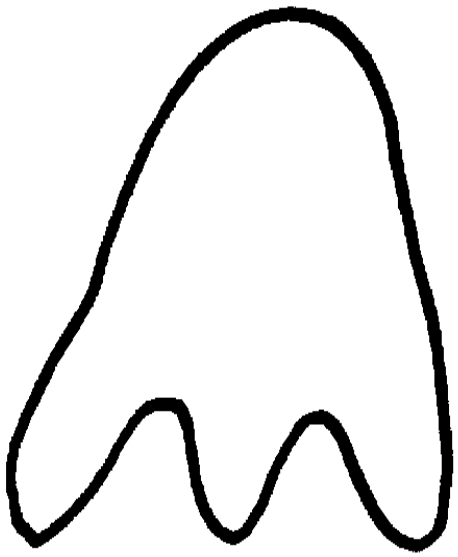
b. Which animal had large claws? *Tyrannosaurus,* because it has long, slender imprints; almost like a big bird.

c. Can you tell if the animal was running or walking? *No, you must be able to view a pattern of footprints to interpret how the animal was moving.*

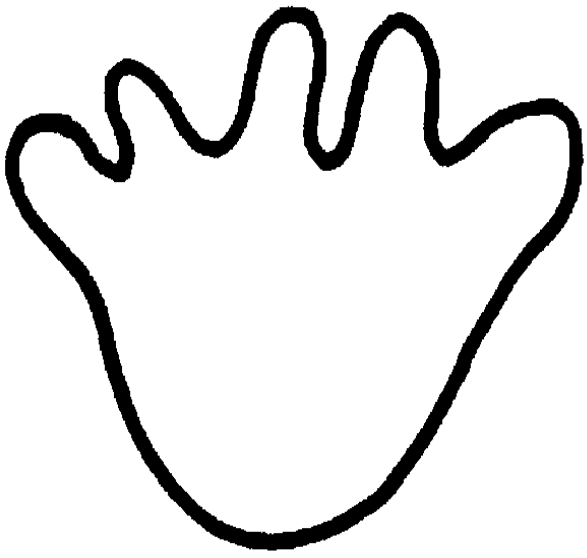
d. Which dinosaurs had five toes? *Stegosaurus and Apatosaurus*.



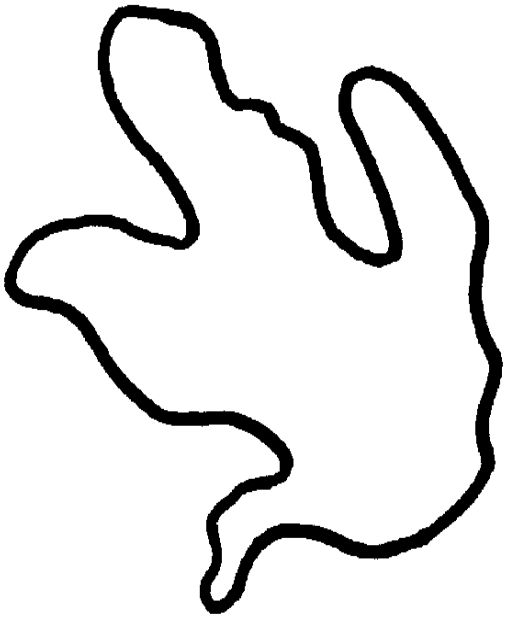
Apatosaurus



Maiasaura



Stegosaurus



Tyrannosaurus

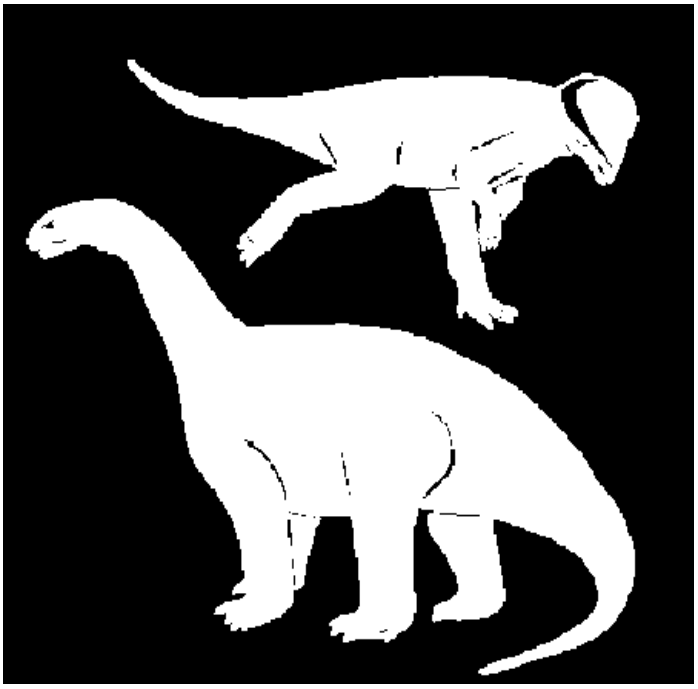
ROCK CYCLE - PAST LIFE (1B)

LAB

Students create tracks using talcum powder and interpret results.

OBJECTIVES:

1. Modeling dinosaur tracks.
2. Comparing footprint patterns.



VOCABULARY:

dinosaur
footprints
tracks
bipedal
quadrupedal

MATERIALS:

workbook or paper
talcum powder or cornstarch
shallow pans
rope
butcher paper (optional)
paper footprints

BACKGROUND:

Like body fossils, trace fossils of extinct animals, such as footprints, can only be interpreted through comparison with living animals. Paleontologists thus try to understand dinosaur track ways by studying the tracks of different types of large mammals in a variety of modern environments. Mammals are the best modern analogs for dinosaurs because they walked erectly, like the dinosaurs. For example, elephant tracks and *Apatosaurus* dinosaur tracks are very similar. In contrast, modern reptiles have a sprawled stance that produces a different type of track way than either dinosaurs or mammals.

Since we are bipedal mammals, we can make tracks that mimic the tracks of quadrupedal (with four legs) and bipedal (two legs) dinosaurs. In this lab students will pretend to be different types of dinosaurs which move at different speeds. They will produce track ways with several distinctive patterns.

PROCEDURE:

1. Students have learned that footprints can give paleontologists information about

how an animal lived or walked. In this activity, students will "play act" that they are four legged animals walking in the mud or sand, leaving behind footprints. This activity is a lot of fun, but it may get the students overexcited. If you have parent helpers, this would be a good day to have them in the classroom. We also highly recommend that you conduct this activity outside.

2. Divide the class into two or three groups. Have the students pretend that they are dinosaurs. Have them walk, run, and jump like they think dinosaurs did before they use the talcum powder or cornstarch.

3. Have the students make footprints on butcher paper (if you remain inside) or outside on the school playground. Put the talcum powder or cornstarch into shallow pans. Demonstrate how to make footprints by having one student step into the powder, and then walk on the paper or playground. Observe the pattern of footprints. Have a teacher or adult do the same thing. See if there is a difference in the size of the print and the length of stride. Would similar differences in dinosaur tracks indicate a difference in the size of the dinosaurs that left the tracks?

4. Now demonstrate these other ways of making footprints:

a) Have another student step into the powder and then walk and drag the rope (which has also been dipped in powder). Now observe the track left by dinosaur that dragged its tail.

b) Have a child dip both hands and feet in the powder and walk four-legged. Try this two ways: 1) moving the right hand, then the left leg, then the left hand, and then the left leg, and 2) moving both right limbs together, then both left limbs together.

5. After you demonstrate, you may want the students to go to separate areas of the playground and have them make their own footprints. Also, you may want them to draw the types of footprints which you demonstrated.

6. Return to the classroom. Using the worksheets, lead a discussion of the results of your track way experiments. Students should be able to answer such questions as:

a. Are footprints farther apart when an animal is walking or when it is running? (Answer: running);

b. How can you distinguish a two-legged animal's prints from a four-legged animal's prints? (Answer: placement and spacing of prints; presence of foot + hand prints);

c. How can you estimate the length of an animal's legs from its tracks? (Answer: distance between footprints is longer for people/dinosaurs with longer legs than for those with shorter legs, for two animals moving at the same speed);

d. How do bipedal dinosaur tracks differ from human tracks? (Answer: distance between prints should be shorter).

7. Have students cut out the footprints and hand prints on the following page. Instruct them to paste them onto the worksheet in three different track ways. Monitor their

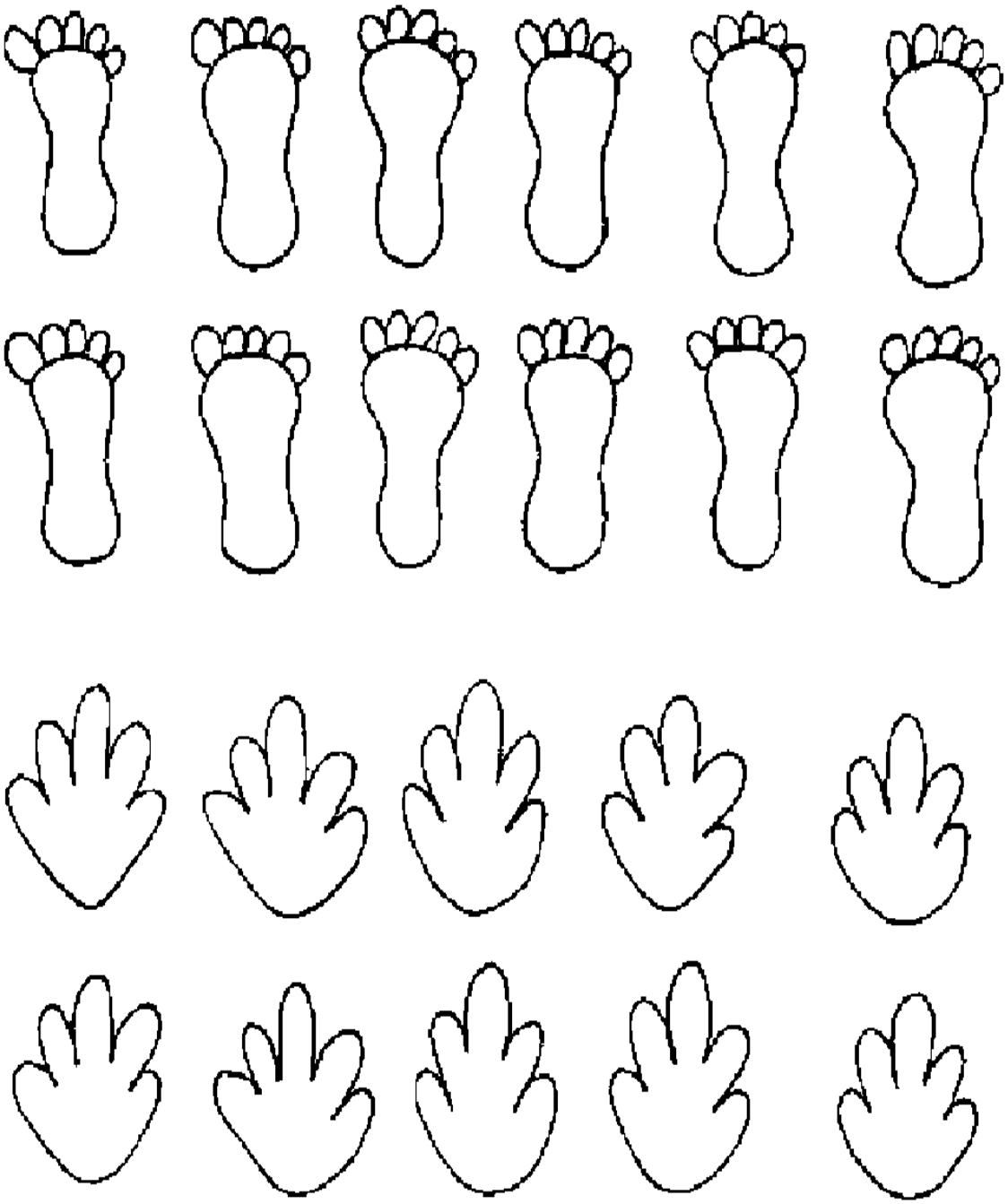
patterns to ensure that they create realistic track ways. Have them add a tail in one of the patterns using a pencil or crayon.

RECORD YOUR FOOTPRINT PATTERNS.

1	2	3

ROCK CYCLE - PAST LIFE (1B) LAB

FOOTPRINTS AND HAND PRINTS



ROCK CYCLE - PAST LIFE (1B)

POST LAB

Students try to analyze data from lab.

OBJECTIVE:

1. Analyzing footprints to derive information.
2. Comparing how dinosaurs moved.

Dinosaur footprints preserved in sandstone

VOCABULARY:

dinosaurs
footprints
impression
tracks

MATERIALS:

worksheet
crayons

BACKGROUND:

Paleontologists recognize two basic categories of fossils: body fossils and trace fossils. Body fossils are pieces or impressions of an ancient plant or animal. Bones, leaves, feathers, eggs, scales, and shells are all body fossils. From these we can learn about the physical appearance of the fossil organism. Trace fossils are remnants of the *activities* of ancient animals. Examples of trace fossils include nests, burrows, trails, footprint track ways, coprolites (fossil dung), and gastroliths (stomach stones). Trace fossils yield unique information about behavior that is not revealed by body fossils.

Study of dinosaur footprints and track ways has contributed significantly to our understanding of dinosaur behavior. From track way sites we have learned that some types of dinosaurs traveled in herds, that some herds protected their young by keeping them in the centers of migrating groups, and that dinosaurs did not drag their tails when they walked (reptiles drag their tails). Paleontologists can also estimate dinosaur gait and speed from some footprint track ways. They can even identify specific behaviors such as hunting, fleeing, or protecting young from others.

All children have seen footprints and tracks, but they may not realize how much you can learn from them. In this postlab exercise, the students will try to use their knowledge from the previous lab to interpret tracks.

PROCEDURE:

1. Students have now looked at footprints and footprint patterns. This activity

reviews their results from the previous two activities.

Ask the students what type of footprint patterns they observed when they made footprints during the lab. First, go over the pattern made if the dinosaur was walking. Have one or two students come to the board and draw this walking pattern. Do the same for a walking 2-legged dinosaur with a tail and 4 legged dinosaur running. The correct patterns are shown below. You wish to demonstrate this with your students by actually walking or running. Remember a four legged animal walking and a four legged animal running are very different. If your students have trouble visualizing the patterns, use some analogies a cat or a dog walking and then running.

2. Have students suggest types of information about dinosaurs (or any animal) we could get from studying footprints, based on their experience making tracks outside. Put a list of the things that they suggest on the board. Your list might include: size of the animal, weight of the animal, number of feet the animal walked on, age of the animal, or number of animals traveling together.

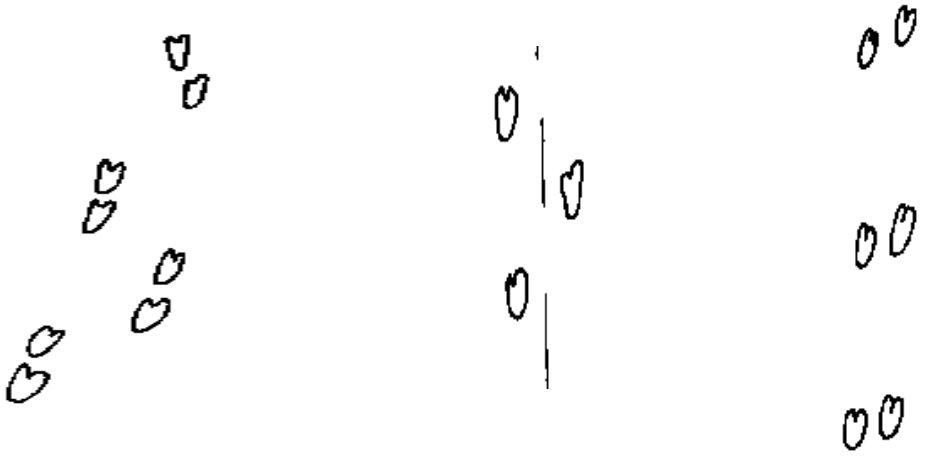
3. Have the students examine the tracks labeled A, B, and C in their worksheet. They are on the following page in this manual. Explain that these are drawings of real dinosaur tracks. Based on the shape and pattern of the tracks and track ways have students answer the following questions:

a. Which tracks were made by a dinosaur with large claws? (Track way C)

b. Which tracks were made by a dinosaur that walked on four legs? (Track way A)

c. Which tracks show a mother and youngster walking together? (Track way B)

4 legged dinosaur walking	2 legged dinosaur with tail (walking)	4 legged dinosaur running



ROCK CYCLE - PAST LIFE (1B) POST LAB