Problem Solving Activity: Solving an Ancient Puzzle

Introduction: All scientists have been trained to deal with problems in an orderly and systematic manner known as the *scientific method.* First the *problem must be stated clearly*, so that everyone understands exactly what they are trying to resolve. Then information relating to the problem is gathered and accurate records must be kept. After the facts or clues of the investigation are known, *a suggested solution or hypothesis is made.* In testing the hypothesis, *experiments help to prove or disprove the suggested hypothesis*, and again, all data and measurements must be recorded accurately. Finally, if and when the hypothesis is supported by the data and tests, the scientists involved *state a conclusion*, their decision regarding the investigation they have just conducted. Sometimes data is unclear or not sufficient and a scientist will be unable to make a definite decision and must go back and repeat the entire investigative procedure.

This is especially true for paleontologists as they study evidence of life that lived millions of years ago. Since there are no written records of those periods in Earth history, they must rely on the evidence at hand: fossils, rocks, ice cores and other clues to the conditions in the environment thousands and millions of years ago. Many times the information they have available is insufficient or misleading and there is no quick way to resolve the problem.

Objective:

- To simulate a scientific investigation of the geologic past;
- To introduce the problem solving tools that scientists use to study the Earth's past;
- To practice active listening;

Important Terms: Paleontologist, inference, evidence, conclusion, scientific method, fossils, ice cores, hypothesis, observation;

Materials: Copy of Student Activity Sheet, paper/pencil;

Procedure:

1. Read over the **Introduction** with the class.
   - Review the basic steps of the scientific method and give examples of each.

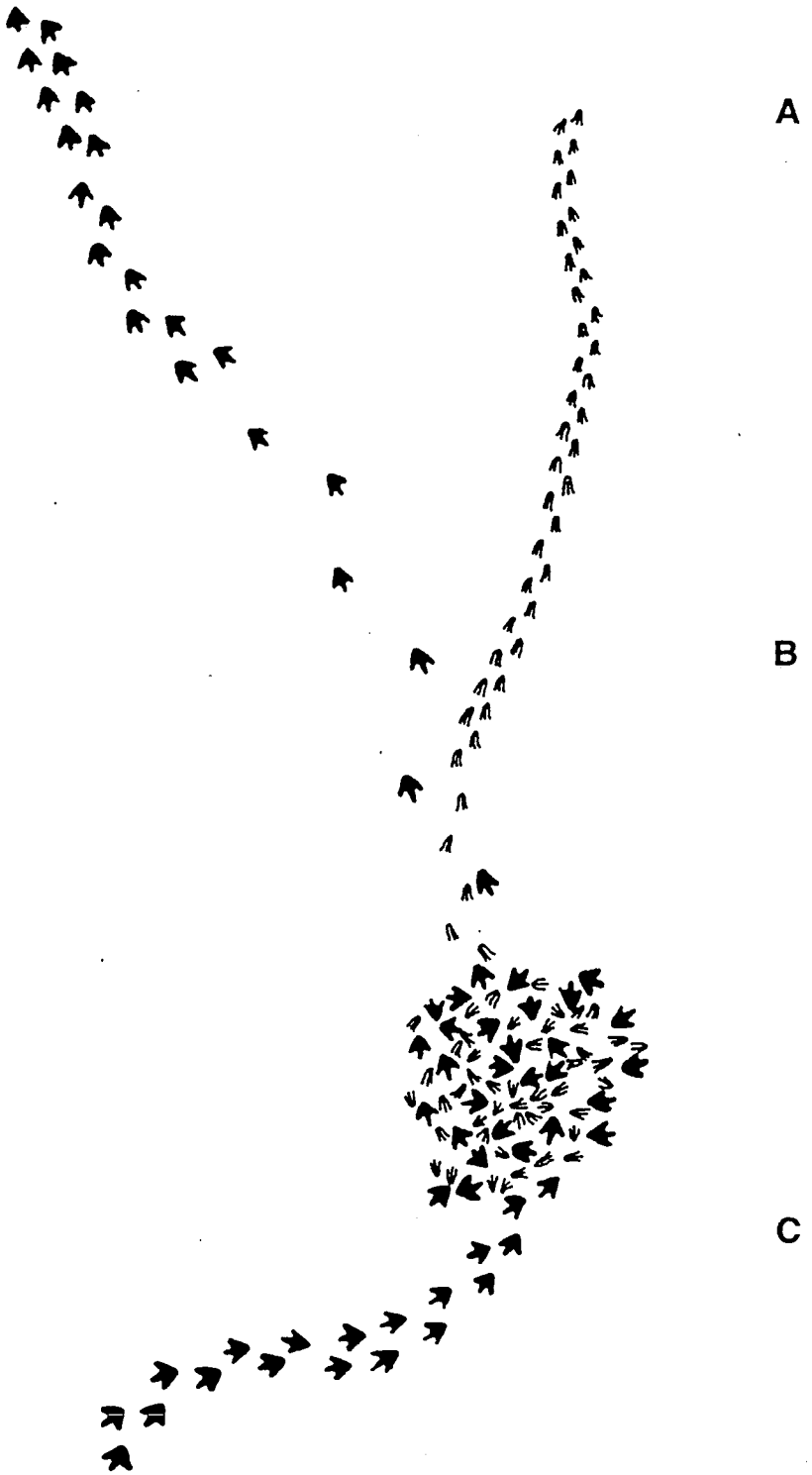
2. Insure that they understand what an observation is and how any or all of their senses can be used to make one.
   - Try to bring in some situations where the available evidence may be insufficient and misleading.
   - Have students practice making inferences from clues you give them.

3. Tell students that they will have the opportunity to share some of the experiences that scientists have as they try to understand and reconstruct the Earth's past.
   - They will be working with sketches of a set of fossil foot prints made by animals more than 100 million years ago.

4. Tell students that you will be reading the instructions aloud to them as they read them to themselves.
   - Be sure they understand that each section of the activity will be timed and carefully monitored.
   - They should not go ahead or back to another section of the activity unless they are told to do so.

5. Begin with Step #1 on the **Student Activity Sheet** and guide the students through the activity.
   - Use your own judgment as to how much time to allow them to complete each step in the activity.
   - When all the active parts of the procedure have been completed, instruct students to go ahead and complete the **Analysis** questions,
   - Students should be prepared to turn in the entire activity packet at the end of the designated time.

DIAGRAM: SOLVING AND ANCIENT PUZZLE



Student Activity Sheet: Solving an Ancient Puzzle

Introduction: All scientists have been trained to deal with problems in an orderly and systematic manner known as the *scientific method*. First the *problem must be stated clearly*, so that everyone understands exactly what they are trying to resolve. Then information relating to the problem is gathered and accurate records must be kept. After the facts or clues of the investigation are known, *a suggested solution or hypothesis is made*. In testing the hypothesis, *experiments help to prove or disprove the suggested hypothesis*, and again, all data and measurements must be recorded accurately. Finally, if and when the hypothesis is supported by the data and tests, the scientists involved *state a conclusion*, their decision regarding the investigation they have just conducted. Sometimes data is unclear or not sufficient and a scientist will be unable to make a definite decision and must go back and repeat the entire investigative procedure.

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Objective:

- To simulate a scientific investigation of the geologic past;
- To introduce the problem solving tools that scientists use to study the Earth's past;
- To practice active listening;

Procedure:

1. Examine the footprint diagram attached. Notice that it is separated into three parts, A to C.

2. Take the bottom part of the page and fold it up to the letter B. Only the part labeled A should be visible.

3. Carefully study the part of the diagram that is exposed.
   - Make 2 observations about this part of the puzzle. Write them in the space provided on your **Activity Sheet** under **PART A OBSERVATIONS.**

4. Take the part of the page that you had folded up to Part A And move it down to the letter C. Fold the page again so that this time parts A and B are visible.

5. Carefully study this new part of the diagram.
   - Make 2 observations about this part of the diagram only.
   - Write them in the spaces provided on the **Activity Sheet** for **PART B OBSERVATIONS.**

6. Remember what you discussed with the teacher about an inference and what it means.
    - Make an inference based on the observations you made for **PARTS A and B.**
    - What do you think might have happened to cause the footprints to show the pattern that they have in **PART A and B.**
    - Write your inference in the space provided on the **Activity Sheet** for **INFERENCE A/B.**

7. Unfold the diagram so that the entire sheet is visible from top to bottom.

8. Study the diagram carefully and write 2 observations for **PART C** on the **Activity Sheet.**

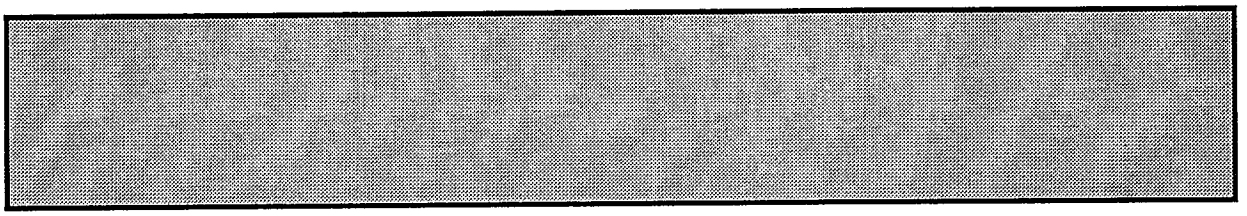
9. Using the information from the 6 observations that you made, write a conclusion to the puzzle that reconstructs the events that could have caused the footprint pattern shown in the diagram.
    - Write your conclusion on the **Activity Sheet** in the space designated **CONCLUSION.**

10. Answer the questions in the **Analysis** section.

Student Activity Sheet #1: Solving An Ancient Puzzle

PART A: OBSERVATIONS

#1



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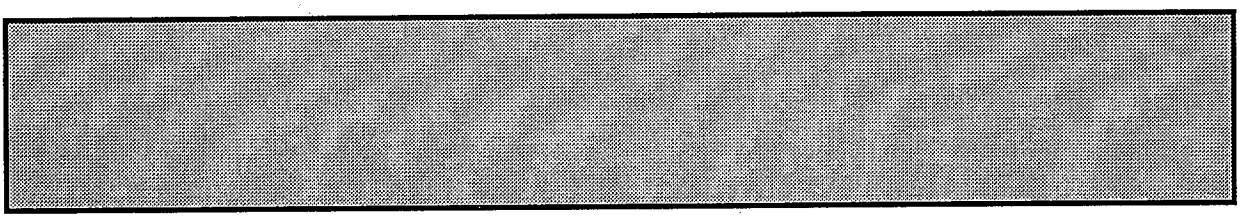
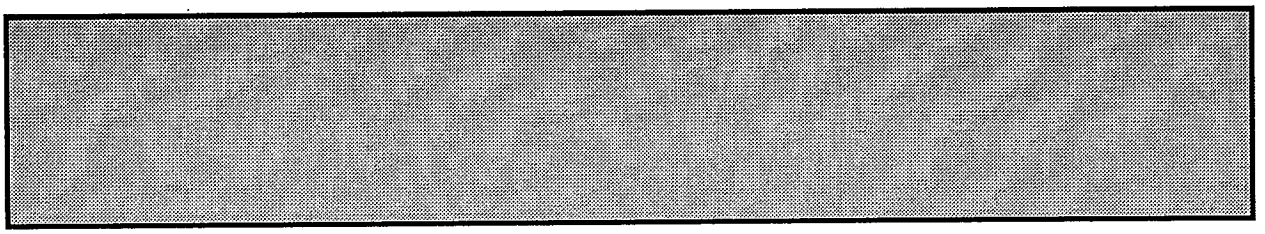


PART B: OBSERVATIONS

#1



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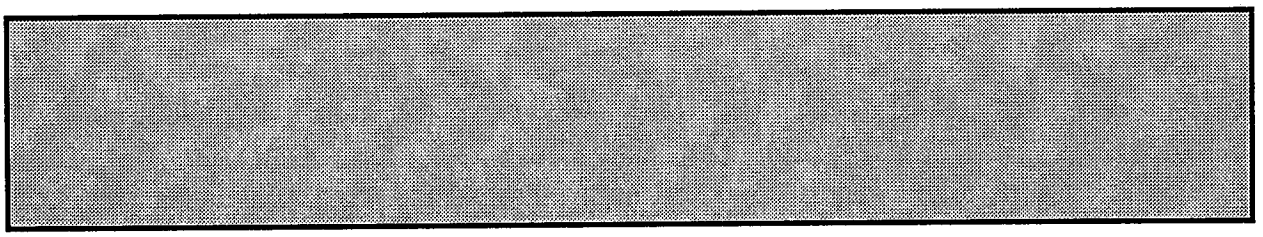
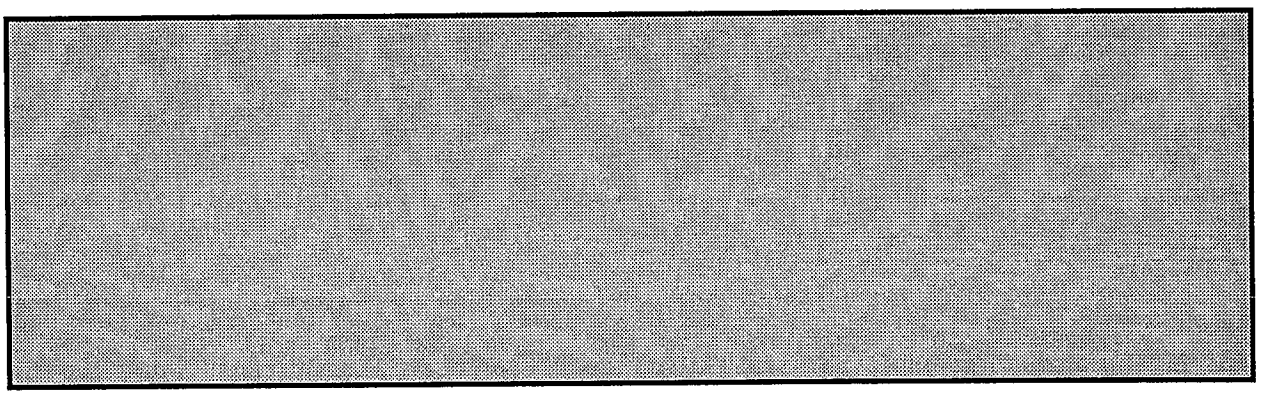


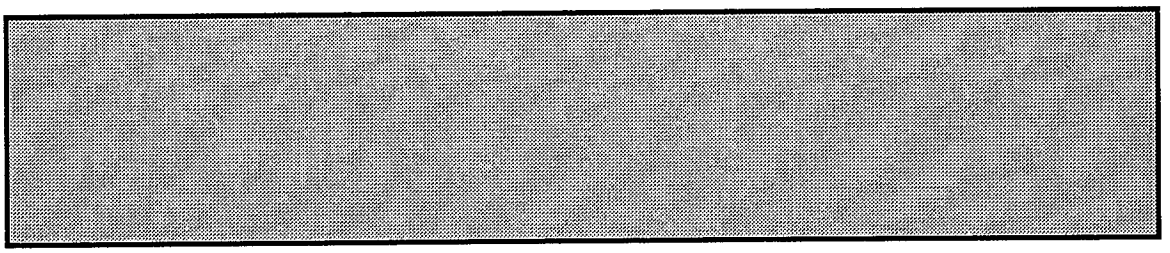
PARTS A/B INFERENCE:



Student Activity Sheet #1: Solving An Ancient Puzzle

PART C: OBSERVATIONS:

#1



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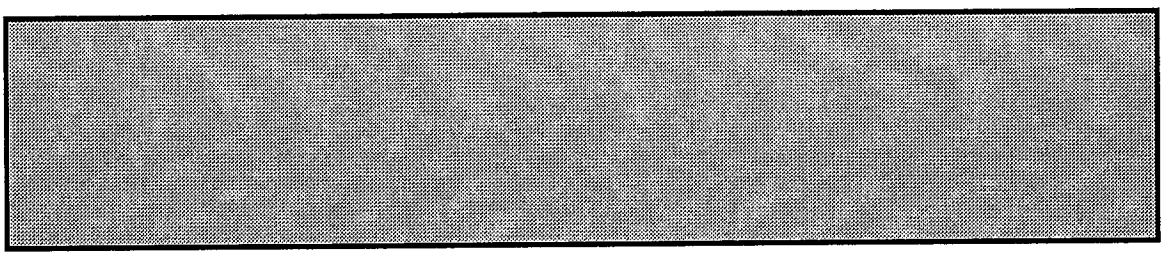
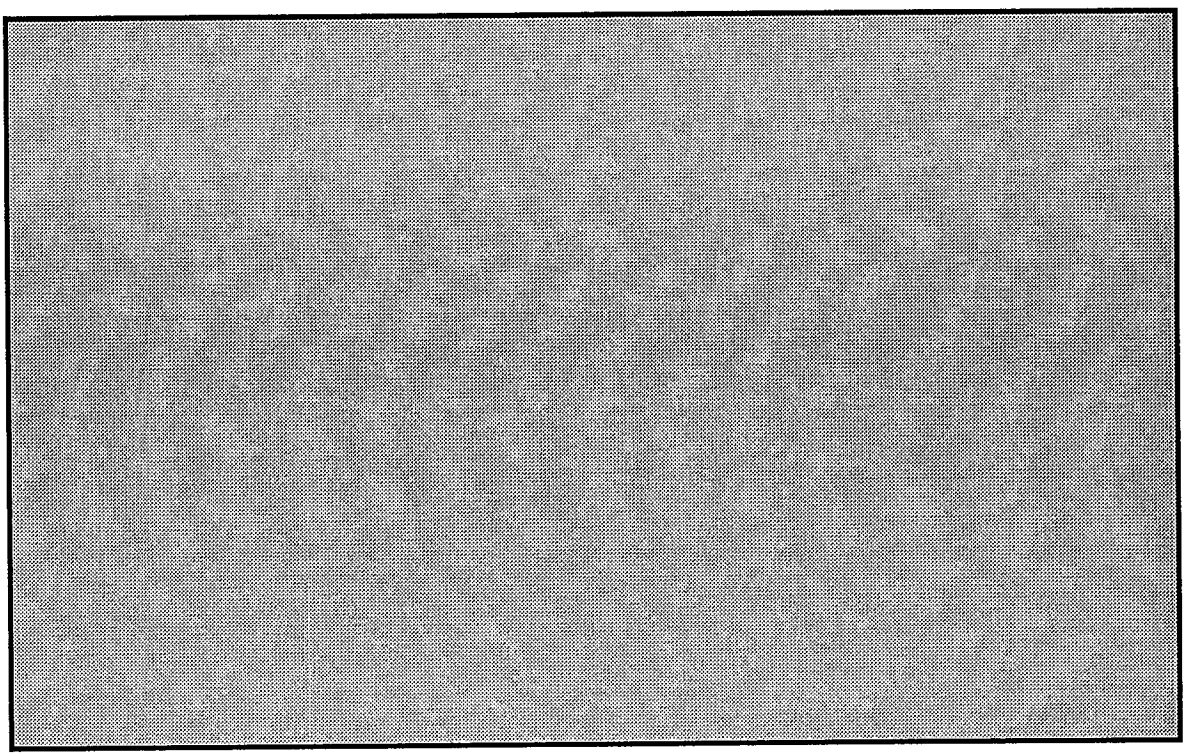


CONCLUSION:



Student Activity Sheet #2

ANALYSIS:

1. How many animals made the footprints in the diagram? _____

2. What information do you have to support this? _____

3. Were they the same type of animal<? Explain. _____

4. Was there a predator-prey interaction taking place? Explain. _____

5. How do you know which was the predator ? The prey? Explain your answer.

6. Was it easier to write an explanation after seeing two-thirds of the diagram or the entire picture? Why? _____

7. Is it possible that the animals who made the footprints in the diagram never really met each other? Explain your reason. _____