ACTIVITY 4

# WHAT DO FOSSILS TELL US?

## EXPERIMENT OBJECTIVES AND CONTENT

In this activity, students develop their observational skills and are initiated into the understanding and analysis of the traces left behind by living things and of fossils.

## ESSENTIAL KNOWLEDGE

### MATERIAL WORLD

**Matter:**
- Changes in matter: physical changes

### EARTH AND SPACE

**Matter:**
- Properties and characteristics of matter on Earth: soil; traces of living things and fossils

**Techniques and instrumentation:**
- Use of simple observational and measuring instruments

**Appropriate language:**
- Terminology related to an understanding of Earth and the Universe
- Drawings, sketches

### LIVING THINGS

**Matter:**
- Organization of living things: classification of life forms

## SUGGESTED MATERIALS

**Scientific equipment:**
- Samples or reproductions of fossils
- Rock samples
- Fossil identification photos or program
- Geological time scale
- Magnifying glasses

**Perishable non-scientific materials:**
- Sand and water

**Household materials:**
- Mixing bowls and spoons
- Sprayers
- Plastic gloves
- Wooden sticks
- Vaseline
- Shallow Styrofoam containers
- Cleaned eggshells or bones from cooking

**School supplies:**
- Books about fossils
- Drawing pencils, drawing paper
- Plaster of Paris, old paint brushes
- Modeling clay or clay
- Rulers

## CONTEXT: SITUATIONAL PROBLEM OR RESEARCH QUESTION

*While walking along the riverbank you discover a stone with a strange impression in it. It's the first time you have ever seen this type of design set into a rock. You decide to investigate what these impressions are and understand how they appeared in the rock.*

YOU MAY BE ABLE TO FIND SOME FOSSILS YOURSELF NEAR EXCAVATION SITES OR ALONG RIVERS, OR YOU CAN PURCHASE A COLLECTION OF FOSSIL REPRODUCTIONS FROM A TEACHING MATERIALS SUPPLIER.

## SUGGESTED PREPARATORY ACTIVITIES (INTRODUCTION)

The teacher asks the students what they know about fossils. He or she then shows them some rock samples. Some should contain fossils while others should not. The students examine the samples and, in teams, discuss and try to tell the ones with fossils apart from the ones that do not have fossils. This activity can also be done with photographs or with rocks the students have brought from home. The students are then invited to ask a question that will lead to them learning more about fossils.

## INITIAL IDEAS AND HYPOTHESES

Here are a few examples of hypotheses the students might formulate based on their initial ideas:

**Example 1**
I predict that I can find out which phylum or class my fossil belongs to by using a fossil identification program or by looking in books. I predict this because the program contains all known fossils and books are good sources of information. During my research, I will pay attention to the shape and size of my fossil.

**Example 2**
I predict that I can identify my fossil and learn its age by consulting a time scale and looking at the class's fossil collection. I predict this because I saw a program on TV, and that's what real scientists do.

**Example 3**
I predict that fossils are simply the remains of animals that had hard body parts such as shells or bones. I predict this because my fossil is hard and because soft plants or animals would not be able to make an impression in the rock.

RECORD ALL YOUR IDEAS AND OBSERVATIONS IN YOUR EXPERIMENT WORKBOOK.

## WORK PLAN AND EXPERIMENTATION

Here are a few examples of experiments the students can carry out to verify their hypotheses:

**Example A**
The students examine their fossil, measuring its length and width with a ruler and observing its overall shape. They then consult the fossil identification program.

**Example B**
The students examine their fossils under a magnifying glass to see its particular details then look at the reference collection to see which one most resembles it. They can use tracing paper to try and make hard-to-see details of their specimen appear. After identifying the fossil, they try and determine which era it belongs to, using a geological time scale. They can double check their results by searching the Internet or a fossil encyclopedia.

**Example C**
The students examine all aspects of a fossil and determine if it is a body fossil or a trace fossil. They note the factors that can give them clues as to their fossil's identity: presence or absence of a carapace, signs of feathers, and so on. They discover that fossils can be of plants as well as animals.

### EXPERIMENTAL FACTORS

To ensure scientific rigor, the students should evaluate the experimental factors that might influence the experimental results.

- Quality of reproductions
- Quality of images
- Attention to detail
- Fragmentation of fossil
- Quality of information sources
- Time spent on research
- Type of reference collection

## DISCUSSION: SUGGESTED INTEGRATION ACTIVITIES (CONSOLIDATION)

After the experiment, the teacher invites the students to discuss their findings. They create a concept network and build a fossil classification according to criteria they have determined.

## SUGGESTED ACTIVITIES FOR APPLYING KNOWLEDGE (APPLICATION)

As a way of applying the students' knowledge, the teacher can organize a visit to a museum of natural history, or they can encourage the students to start their own fossil collections.

### Making fake fossils

Here are some instructions to make fake fossils. Spread a thick layer of moist sand in a Styrofoam container. It is important to spray the sand with water regularly to keep it moist at all times. However, it should not be soaked. Next, dig the form of a fossil into the sand, or press a specific shape, such as a shell, into it. Next, pour liquid plaster over it. When the plaster is dry, remove it and sweep any sand off the surface. You can also create fake fossils by putting a layer of clay or smoothed modeling clay at the bottom of a disposable container. For other ways to create your own fossils, consult the links section for this activity.

## SCIENTIFIC CONCEPTUAL CONTENT

### Classification of living things

Living things are classified as a way to organize different species in a logical and ordered manner. If we take human beings, for example, they belong to the kingdom Animalia (animals), the phylum Vertebrata (vertebrates), the class Mammalia (mammals), the order Primates, the family Hominidae (hominids), the genus Homo and the species *H. sapiens*.

### Fossil formation

Fossilization is a rare phenomenon and requires very special conditions for the process to occur. In general, the sequence of fossil formation on land is as follows: An animal dies and is quickly covered by sediments, the soft tissues decompose, and finally, the process of fossilization begins (transformation of hard tissues such as bones and shells into rock). This phenomenon occurs much more frequently in aquatic habitats.

### Fossil categories

There are two main categories of fossils: 1) Body fossils, such as bones, teeth and shells. 2) Trace fossils, which are traces of plants or animals that have disappeared but whose presence has been preserved in sediments. These include tracks or burrows, which are the most common. A single living thing can produce thousands of traces over its life, which increases the chance that one of them will be preserved. However, such fossils are hard to identify.

**Information in fossils**
Fossils provide information about the Earth's past climate, plants and animals, as well as the large-scale changes that have marked its history. We can see what past life was like by literally reading it in stone.

**Where to find fossils**
Fossils are primarily found in sedimentary rocks. Aquatic habitats such as riverbanks and soils that have undergone disturbances (earthquakes, erosion, landslides, etc.) are locations that are likely to contain fossils. Bogs, glaciers, deserts and old marshes also have good conditions for fossil preservation.

**Paleontology**
The study of fossils. Paleobotany is the study of fossilized plants, paleoanthropology is the study of fossil hominids, etc.

## CULTURAL REFERENCES

**Geography**
The provinces of Western Canada are very rich in fossils from the dinosaur age. Québec's Saint Lawrence Lowlands have many fossils from the Champlain Sea, an inland sea created after the retreat of the glaciers about 12,000 years ago.

**History**
Paleontology is a science that is only about 300 years old, which is relatively young compared with botany or astronomy. Hence, in Great Britain, it was once believed that ammonites (shelled cephalopods) were serpents petrified by Saint Hilda. Elsewhere, in Asia, the myth of the dragons probably originated with the discovery of fossilized dinosaur bones.

**People**
The French anatomist Georges Cuvier (1769-1832) is considered the founder of paleontology. After studying the fossilized remains of many specimens, he proposed a classification for fossilized vertebrates. The British geologist Charles Lyell (1797-1875) published a work explaining that rocks could be dated by the fossils they contained. This book took inspiration from work done by the English engineer William Smith (1769-1839).

FOR MORE CULTURAL REFERENCES, VISIT THE ÉCLAIRS DE SCIENCES WEBSITE:
**www.eclairsdesciences.qc.ca**

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# PROCESS OF ACTIVE DISCOVERY

## GENERAL LEARNING PROCESS IN SCIENCE AND TECHNOLOGY (IN ELEMENTARY SCHOOL)

### Context related to everyday life

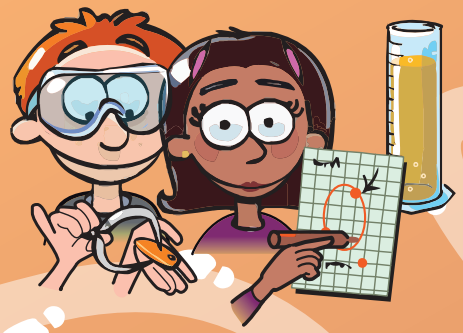
- **Situation problem** or
- **Discovery question** or
- **Need to be fulfilled**
- **Question related to the operation of an object** (how does it work?)

### Initial ideas and hypothesis

**My initial ideas:**
- I share my own ideas.

**My hypothesis:**
- I predict that... I think that because…
- I imagine my prototype.
- I think it works like this…

### Planning and carrying out



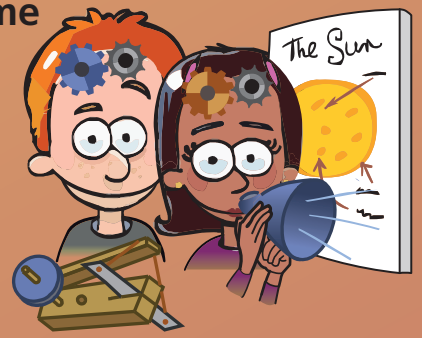
**My equipment:**
- I observe and handle the equipment.
- How could this equipment be useful to me?
- I choose my equipment and my materials.

**Carrying out my process:**
- What will the steps be?
- What precautions should I take?

**My actions:**
- I carry out the steps of my protocol.
- I note or draw what I observe, what I do and what I discover.

**My results:**
- What is my answer to the problem, question or need?

### Outcome




**My outcome:**
- Do my results confirm my hypothesis or not?
- Are my results similar to those of the other teams?
- Can the other teams' results help me to find answers to my problem, my question or my initial need?
- What could I communicate concerning my discoveries?

New question?

**What I learned:**
- What do I retain from this activity?
- What could I communicate concerning my results or my discoveries?

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