THINKING AND ACTING LIKE A SCIENTIST

TEACHER'S GUIDE

Fossils: A Key to the Past

What can fossils tell us about plants, animals, and environments of long ago?

GRADE 3

Life Science

VAN ANDEL EDUCATION INSTITUTE

VAEI.ORG

INQUIRY-BASED SCIENCE

Life Science

Fossils: A Key to the Past

Grade Level/Content	3/Life Science
Lesson Summary	In this investigation, students will be classifying plant and animal fossils as either body or trace fossils. They will also be using secondary sources to describe the relationship between fossils and the environment in which the organism lived long ago.
Estimated Time	3, 45-minute class periods
Materials	*Fossil* by Bill Thomson, *Fossils Tell of Long Ago* by Aliki, fossil cards, slips of paper, Observation Form, Investigation Plan, Assessment, journal
Secondary Resources	Trace Fossils Body Fossils Earth Science for Kids: Fossils *Fossils* by Cyril Walker and David Ward
NGSS Connection	**3-LS4-1** Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.
Learning Objectives	• Students identify fossils based on type. • Students describe the relationships between fossils and the environments in which organisms lived long ago.
Cross-Curricular Project Connections	Pick Me!, Fossil Hunters

What can fossils tell us about plants, animals, and environments of long ago?

Fossils have interested people of all ages for centuries. They help unlock the mystery of past life and environments. Fossils have even made their way into the Hollywood scene, with the 1993 movie *Jurassic Park* grossing over 650 million dollars. Although the science was far-fetched, the idea of a fossilized mosquito piqued the interest of millions of people worldwide.

Fossils are plant and animal remains that have been preserved in sedimentary rock. There are many different types of fossils that geologists and biologists analyze to understand how life has changed during Earth's history. In this investigation, students will learn about different types of fossils and use this knowledge to classify them based on their appearance. They will also use secondary sources to discover how fossils truly are a key to understanding the past.

Investigation is based on the Van Andel Education Institute (VAEI) Instructional Model for Inquiry-Based Science. In all investigations:

Students don't know the "answer" they are supposed to get.

Students play a driving role in determining the process for learning.

Teachers and students construct meaning together by journaling.

Students are working as hard as the teacher.

Part 1

INVESTIGATION SETUP

Prepare at least 10 (total) plant and animal fossil cards (or real fossils) of trace and body fossils for each pair of students. Include images (or real specimens) of fossils in rocks, ice, and amber if possible. Also include fossils found in your state. Number the cards in random order.

Create column heading slips for each pair (BODY FOSSIL, TRACE FOSSIL, ANIMAL FOSSIL, PLANT FOSSIL).

- *Fossil* by Bill Thomson
- *Fossils Tell of Long Ago* by Aliki
- Fossil cards (at least 10 per pair of students)
- Column heading slips
- Observation Form
- Investigation Plan
- Assessment
- Journal

Part 2

INVESTIGATION FACILITATION

Question

Introduce the investigation question.

What can fossils tell us about plants, animals, and environments of long ago?

STUDENT ENGAGEMENT

Place various fossils (or images of fossils) around the room. Have students make observations and write down questions they have about the fossils on sticky notes to be placed on a *Wonder Wall*. Have students share their personal experiences with fossils. Some students may choose to bring in fossils from home for further discussion.

Personal Knowledge

Students capture what they already know about plant fossils, animal fossils, and environments of long ago.

- Have students write down ideas they have about plant fossils, animal fossils, and environments of long ago.
- Have students share their responses to generate a class list.

DISCOURSE

Conduct a *Chart Talk* by placing three pieces of chart paper around the room titled "Plant Fossils", "Animal Fossils", or "Environments of Long Ago." Students will write their ideas on sticky notes and place them on the appropriate chart. Encourage students to place their sticky notes next to ideas that are similar. Discuss the list as a class.

Secondary Knowledge

Students use secondary sources to understand fossils and the difference between trace fossils and body fossils.

- As a class, read the picture book *Fossil* by Bill Thomson.
- Have students discuss what the boy in the book observed and what we learn from fossils. Students record the class observations in Part 1 of the Observation Form.
- Provide resources (video, images, slideshow, etc.) to help students understand the differences between body and trace fossils. The images in the book are *body fossils*, actual parts of an organism's bones, shells, or leaf imprints. *Trace fossils* are evidence of life that is not a body fossil such as tracks, burrows, eggs, feces, or nests. Have students record their new knowledge in their journals.

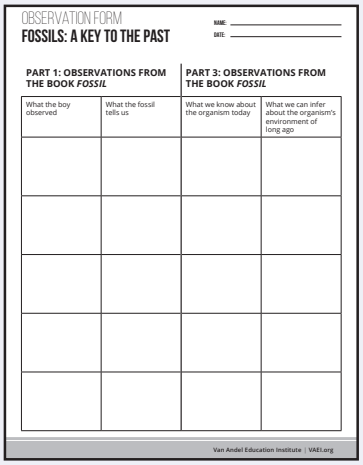
  Possible resources:

  Trace Fossils

  Body Fossils

  Earth Science for Kids: Fossils

  Fossils by Cyril Walker and David Ward



OBSERVATION FORM

FOSSILS: A KEY TO THE PAST

NAME: _____

DATE: _____

PART 1: OBSERVATIONS FROM THE BOOK *FOSSIL*		PART 3: OBSERVATIONS FROM THE BOOK *FOSSIL*	
What the boy observed	What the fossil tells us	What we know about the organism today	What we can infer about the organism's environment of long ago

Van Andel Education Institute | VAEI.org

Observation Example

CRITICAL THINKING

During the shared reading of the book *Fossil*, students actively, persistently, and carefully consider information in light of new evidence.

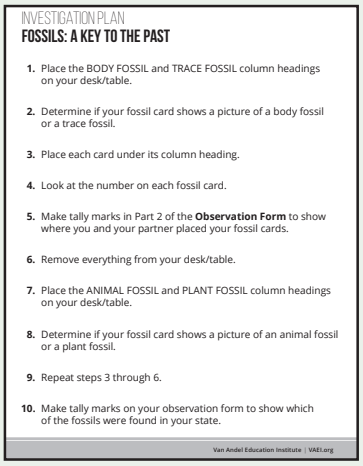
CONSTRUCTION OF MEANING

Work with students to co-construct their knowledge, through stating, clarifying, rephrasing, and confirming concepts and ideas presented in the book, *Fossil*.

Investigation Plan

Students sort fossil cards into different categories: trace or body fossils and animal or plant fossils.

- Have students work in teams of two.
- Give each pair the fossil cards and category heading cut-outs (BODY FOSSIL, TRACE FOSSIL, ANIMAL FOSSIL, PLANT FOSSIL).
- Review the Investigation Plan.
- Have students follow the **Investigation Plan** carefully and record their results in Part 2 of the **Observation Form**.



INVESTIGATION PLAN

FOSSILS: A KEY TO THE PAST

1. Place the BODY FOSSIL and TRACE FOSSIL column headings on your desk/table.
2. Determine if your fossil card shows a picture of a body fossil or a trace fossil.
3. Place each card under its column heading.
4. Look at the number on each fossil card.
5. Make tally marks in Part 2 of the **Observation Form** to show where you and your partner placed your fossil cards.
6. Remove everything from your desk/table.
7. Place the ANIMAL FOSSIL and PLANT FOSSIL column headings on your desk/table.
8. Determine if your fossil card shows a picture of an animal fossil or a plant fossil.
9. Repeat steps 3 through 6.
10. Make tally marks on your observation form to show which of the fossils were found in your state.

Van Andel Education Institute | VAEI.org

Investigation Plan

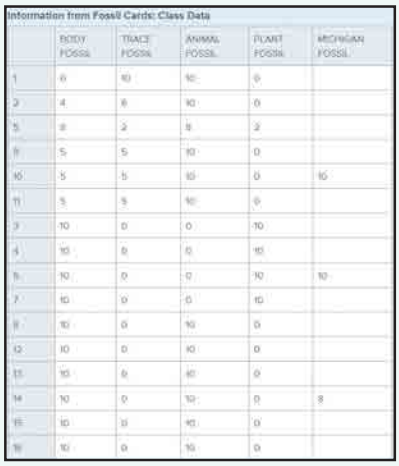
Observation

Students document their findings.

- Have students record their data in the **Observation Form**.
- Then, have each team share their data from Part 2 on a class observation form. The class data will be analyzed together.

PERSEVERANCE

Students may be unsure of what category to place their fossil card. Encourage them to use their best judgement and offer up secondary knowledge as needed. Remind students to write down any challenges they experience or questions they have in their journals to be addressed later.



Information from Fossil Cards: Class Data

	BODY FOSSIL	TRACE FOSSIL	ANIMAL FOSSIL	PLANT FOSSIL	MICHIGAN FOSSIL
1	0	10	10	0	
2	4	6	10	0	
3	8	2	8	2	
4	5	5	10	0	
5	5	5	10	0	10
6	5	5	10	0	
7	10	0	0	10	
8	10	0	0	10	
9	10	0	0	10	10
10	10	0	0	10	
11	10	0	10	0	
12	10	0	10	0	
13	10	0	10	0	
14	10	0	10	0	8
15	10	0	10	0	
16	10	0	10	0	

Class Data Example

Part 3

INVESTIGATION ANALYSIS AND DEVELOPMENT OF CLAIM

Data Analysis

Students make sense of their data by organizing it and representing it visually.

- Have students analyze the class data. They may wish to use the Data Analysis prompt as a guide.
- Have students **evaluate** their data for trustworthiness. Ask students: *How confident are you in your data? What do you wonder about?* Highlight any data the students wonder about. Discuss the highlighted data and encourage students to think critically about their reasoning for supporting their answers.
- Then, have them analyze their data to find patterns and trends. They may **organize** the data and/or **represent** it visually to construct meaning. They may choose to organize the data by cutting the data rows into strips and putting all of the trace fossils together or all of the body fossils together. Representations can include a bar chart showing how many times there was a disagreement between body or trace fossils, or a pie chart showing how many of the trace fossils (or body fossils) were plant or animal remains.
- Have students **interpret** what the identified patterns or trends mean.
- Ensure they have enough data that it can be used as evidence to support a claim.

Secondary Knowledge

Students understand how fossils can be used to provide information about environments of long ago.

- Return to the information from the book *Fossil*, and, as a class, determine what is known about organisms today that is similar to the fossils found in the book. Then, infer about the organism's past environment.
- Have students record this information in Part 3 of the **Observation Form**.
- Let students know that for their claim, they will write a picture story (no words, like the book, *Fossil*).
- Read *Fossils Tell of Long Ago* by Aliki, together. Point out its beginning, middle, and end. The students will construct a similar story with a beginning, a middle, and an end as part of their explanation.

Observation Example

Explanation

Students write a claim as a picture story and provide evidence and reasoning to support it.

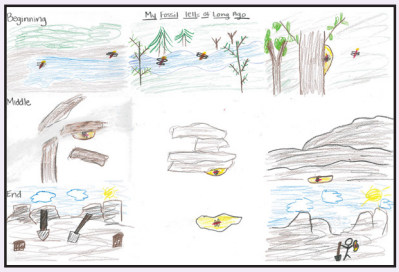
- Have students use what they've discovered from their analyzed data and secondary resources to write an explanation that answers their investigation question. Students may wish to use the Explanation prompt as a guide. Have them write their claim in their journal.
- Have students develop a **Claim** (picture story) to answer the question: What can fossils tell us about plants, animals, and environments of long ago?
- Instruct students to create a beginning, a middle, and an end to their picture story.
  - The beginning of their story will show what happened "once upon a time" long ago. It will show what the environment was long ago.
  - The middle of their story will show how their plant/animal became a fossil. It should show if the fossil is a body fossil or a trace fossil.
  - The end of their story will show the fossil being discovered and how the environment looks today.
- Then, have them add **Evidence** (the analyzed data) to support their claim.
- Finally, have them add **Reasoning** to their claim. Reasoning should include the information obtained from this investigation as well as science principles they have learned.

Claim

We claim that fossils can tell us this story about plants, animals, and environments of long ago (see picture).

Evidence

In our investigation, we found that animal and plant fossils can be either body or trace fossils. We learned that body fossils are actual parts of an organism, like bones and shells. We learned that trace fossils are not actual parts of an organism, like tracks, burrows, and poop.



Fossil Story Example

Continued

Reasoning

Investigation: We followed the investigation plan carefully. We analyzed our data as a class and discussed our findings.

Science: We learned from class discussions, readings, and videos that fossils are formed from plant and animal remains that are preserved in rock over time. Making observations of fossils can help us understand how that fossil formed and what the environment was like when that plant or animal was alive.

- Once the explanation is written, have students discuss their results using a Present and Defend.

DISCOURSE

Have students share their picture stories within a small group using a Present and Defend or conduct a *Gallery Walk*, where students can view the fossil stories placed around the room.

Evaluation

Students reflect on the investigation.

Ask students:

- What surprised you in this investigation?
- What question would you like to investigate next?

Part 4

INVESTIGATION ASSESSMENT AND EXTENSION

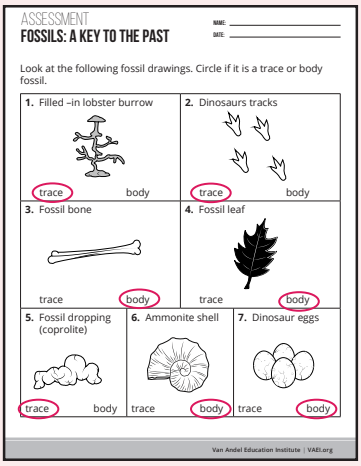
Application

Students demonstrate understanding by applying their learning in a new context.

- Have students work in pairs as paleontologists. Challenge them to classify the fossils that they find in their dig. Use Mine for Fossils as a potential resource.

Assessment

- Evaluate how well students create their fossil story (**claim**) and provide **evidence** and **reasoning** to support it.
- To assess understanding, give students the set of pictures in the Assessment. Have them identify if the drawing represents a trace fossil or body fossil.


ASSESSMENT

FOSSILS: A KEY TO THE PAST

NAME: _____

DATE: _____

Look at the following fossil drawings. Circle if it is a trace or body fossil.

1. Filled –in lobster burrow — trace / body
2. Dinosaurs tracks — trace / body
3. Fossil bone — trace / body
4. Fossil leaf — trace / body
5. Fossil dropping (coprolite) — trace / body
6. Ammonite shell — trace / body
7. Dinosaur eggs — trace / body

Van Andel Education Institute | VAEI.org

Assessment

Take This Lesson Across the Curriculum

Pick Me!

Your school is voting on which fossil should be named your school fossil. You will research and provide reasons why your fossil should be chosen during the next school assembly.

Reading/Language Arts	Math	Science	Social Studies
Honk If You ♡ Fossils! Create a bumper sticker of your fossil to share with your classmates during your presentation. CCSS.ELA-LITERACY.W.4.1	**Count the Votes** When the votes are in, use your understanding of number sense to compare the numbers and determine the winners. CCSS.MATH.CONTENT.3.NBT.A.2	**Fossils: A Key to the Past** Use your knowledge of fossils to create a presentation about your chosen fossil. NGSS: 3-LS4-1	**The Democratic Way** We want the voting to be fair and just, so let's make sure the voting public has the necessary information to vote knowledgeably. NCSS: D2.Civ.2.3-5

Fossil Hunters

You have been invited on a fossil dig at the Montour Fossil Pit in Pennsylvania. Before you leave, you need to make sure you are prepared to bring home some pretty awesome finds!

Reading/Language Arts	Math	Science	Social Studies
Be Informed Research the types of fossils you may be able to dig up at this site, which dates back to the Devonian Period (400 million years ago). CCSS.ELA-LITERACY.RI.3.7	**The Payload** Your goal is to find 24 fossils per day. If you plan to dig for 3 days, how many fossils will you bring home? CCSS.MATH.CONTENT.3.OA.A.3	**Fossils: A Key to the Past** Use your knowledge of fossils to help classify and make observations of the fossils you find on your dig. NGSS: 4-PS3-2	**Places to Visit** Construct a map of the area around the Montour Fossil Pit and identify other places you would like to visit on your trip. NCSS: D2.Geo.1.3-5

For additional lessons or to customize this lesson, go to www.nexgeninquiry.org.

nexgen inquiry®
Empowering Teachers. Engaging Students.

INVESTIGATION PLAN

FOSSILS: A KEY TO THE PAST

1. Place the BODY FOSSIL and TRACE FOSSIL column headings on your desk/table.

2. Determine if your fossil card shows a picture of a body fossil or a trace fossil.

3. Place each card under its column heading.

4. Look at the number on each fossil card.

5. Make tally marks in Part 2 of the **Observation Form** to show where you and your partner placed your fossil cards.

6. Remove everything from your desk/table.

7. Place the ANIMAL FOSSIL and PLANT FOSSIL column headings on your desk/table.

8. Determine if your fossil card shows a picture of an animal fossil or a plant fossil.

9. Repeat steps 3 through 6.

10. Make tally marks on your observation form to show which of the fossils were found in your state.

OBSERVATION FORM

FOSSILS: A KEY TO THE PAST

NAME: _____

DATE: _____

PART 1: OBSERVATIONS FROM THE BOOK *FOSSIL*		PART 3: OBSERVATIONS FROM THE BOOK *FOSSIL*	
What the boy observed	What the fossil tells us	What we know about the organism today	What we can infer about the organism's environment of long ago

OBSERVATION FORM

FOSSILS: A KEY TO THE PAST

NAME: _____

DATE: _____

PART 2: INFORMATION FROM FOSSIL CARDS

	Body Fossil	Trace Fossil	Animal Fossil	Plant Fossil	My State Fossil
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					

ASSESSMENT

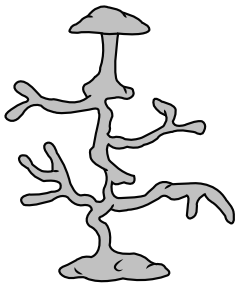
FOSSILS: A KEY TO THE PAST

NAME: _____

DATE: _____

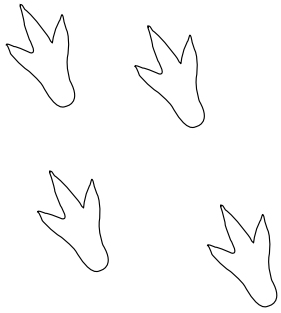
Look at the following fossil drawings. Circle if it is a trace or body fossil.

1. Filled –in lobster burrow



trace body

2. Dinosaurs tracks



trace body

3. Fossil bone

trace body

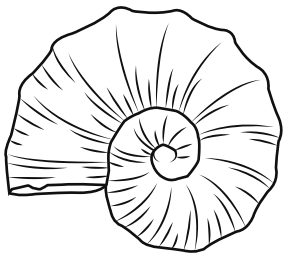
4. Fossil leaf

trace body

5. Fossil dropping (coprolite)

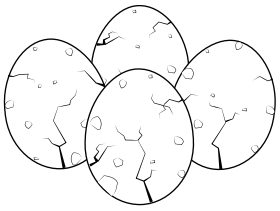
trace body

6. Ammonite shell



trace body

7. Dinosaur eggs



trace body