Introduction

Formative Assessment Exemplar - 7.2.6

Introduction:

The following formative assessment exemplar was created by a team of Utah educators to be used as a resource in the classroom. It was reviewed for appropriateness by a Bias and Sensitivity/Special Education team and by state science leaders. While no assessment is perfect, it is intended to be used as a formative tool that enables teachers to obtain evidence of student learning, identify gaps in that learning, and adjust instruction for all three dimensions (i.e., Science and Engineering Practices, Crosscutting Concepts, Disciplinary Core Ideas) included in a specific Science and Engineering Education (SEEd) Standard.

In order to fully assess students' understanding of all three dimensions of a SEEd standard, the assessment is written in a format called a cluster. Each cluster starts with a phenomenon, provides a task statement, necessary supporting information, and a sequenced list of questions using the gather, reason, and communicate model (Moulding et al., 2021) as a way to scaffold student sensemaking. The phenomenon used in an assessment exemplar is an analogous phenomenon (one that should not have been taught during instruction) to assess how well students can transfer and apply their learning in a novel situation. The cluster provides an example of the expected rigor of student learning for all three dimensions of a specific standard. In order to serve this purpose, this assessment is NOT INTENDED TO BE USED AS A LESSON FOR STUDENTS.

Because this assessment exemplar is a resource, teachers can choose to use it however they want for formative assessment purposes. It can be adjusted and formatted to fit a teacher's instructional needs. For example, teachers can choose to delete questions, add questions, edit questions, or break the tasks into smaller segments to be given to students over multiple days.

Of note: All formative assessment clusters were revised based on feedback from educators after being utilized in the classroom. During the revision process, each cluster was specifically checked to make sure the phenomena was authentic to the DCI, supporting information was provided for the phenomena, the SEPs, CCCs, and DCIs were appropriate for the learning progressions, the cluster supported student sensemaking through the Gather, Reason, and Communicate instructional model, and the final communication prompt aligned with the cluster phenomena. As inconsistencies were found, revisions were made to support student sensemaking. If other inconsistencies exist that need to be addressed, please email the current Utah State Science Education Specialists with feedback.

General Format:

Each formative assessment exemplar contains the following components:

1. Teacher Facing Information: This provides teachers with the full cluster as well as additional information including the question types, alignment to three dimensions, and answer key. Additionally, an example of a proficient student answer and a proficiency scale for all three dimensions are included to support the evaluation of the last item of the assessment.
2. Students Facing Assessment: This is what the student may see. It is in a form that can be printed or uploaded to a learning platform. (Exception: Questions including simulations will need technology to utilize during assessment.)

Accommodation Considerations:

Teachers should consider possible common ways to provide accommodations for students with disabilities, English language learners, students with diverse needs or students from different cultural backgrounds. For example, these accommodations may include: Providing academic language supports, presenting sentence stems, or reading aloud to students. All students should be allowed access to a dictionary.

References:

Moulding, B., Huff, K., & Van der Veen, W. (2021). *Engaging Students in Science Investigation Using GRC*. Ogden, UT: ELM Tree Publishing.

Teacher Facing Info

Teacher Facing Information

Standard: 7.2.6

Make an argument from evidence for how the geologic time scale shows the age and history of Earth. Emphasize scientific evidence from rock strata, the fossil record, and the principles of relative dating, such as superposition, uniformitarianism, and recognizing unconformities. (ESS1.C)

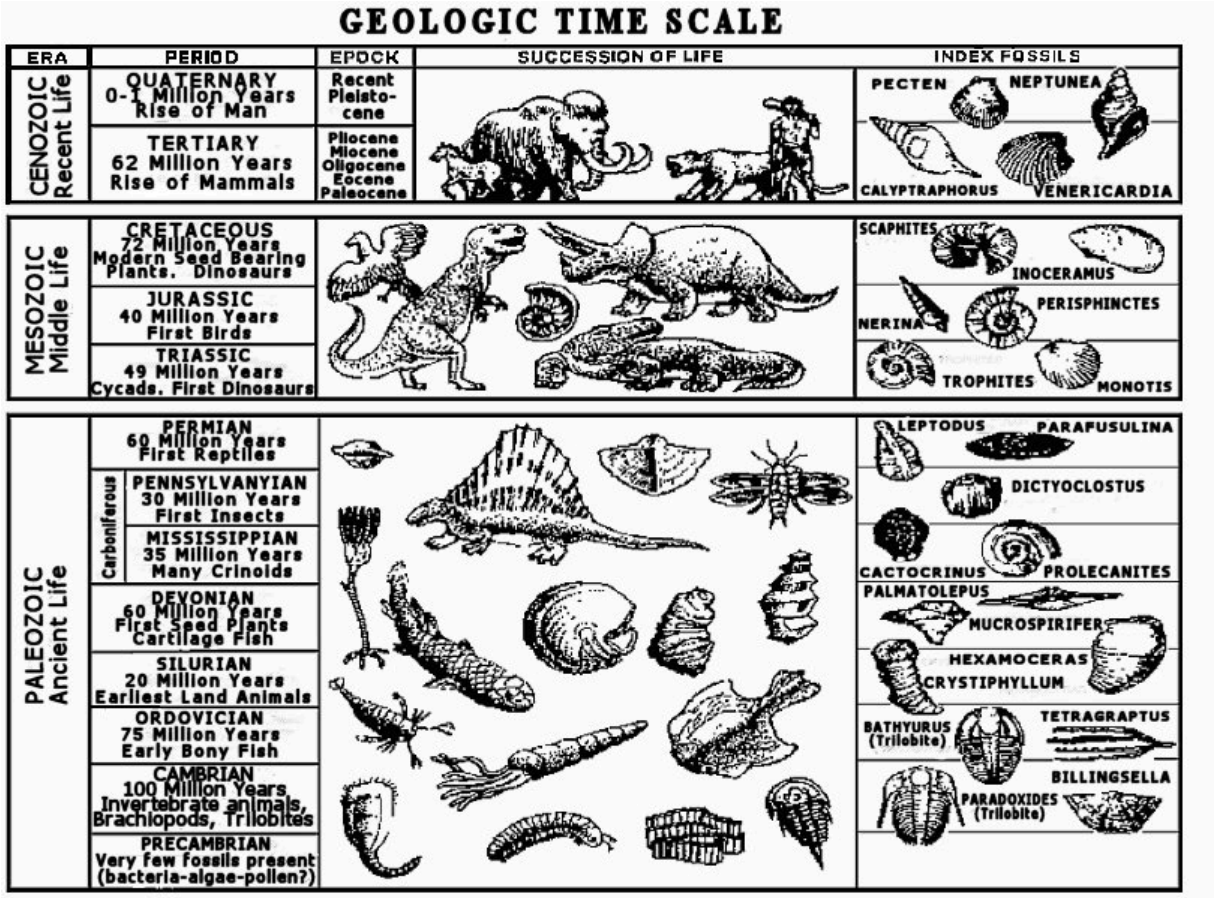
Assessment Format: Printable or Online Format (Does not require students to have online access)

Phenomenon	
A student finds a Gogi Sparillis fossil in Millard, Utah. The student wonders what kind of environment the Gogi organism experienced when it existed. Figure 1 - Gogi Sparillis Fossil  This image shows a picture of a Gogi Sparillis fossil found in Millard, Utah.	Proficient Student Explanation of Phenomenon: The Gogi organisms lived in a marine environment during a time when Utah was mostly underwater. The evidence to support this statement is that these fossils are found in the same rock layer as other known marine organisms called Paradoxides. Because the fossils are found together in the same rock layer, we can say they existed around the same time period.
Cluster Task Statement	
(Represents the ultimate way the phenomenon will be explained or the design problem will be addressed) In the questions that follow, you will make an argument from evidence about the relative age of the Gogi fossil and describe what the environment was like for it when it existed in Utah.	
Supporting Information	
Reading 1 - Utah Fossils Fossils are the remains or traces of living organisms. These remains have been preserved by natural processes over time. Fossils range from spectacular skeletons to tiny sea shells.	

Many fossils of ancient life have been found in Utah. There is a wide variety of information we can gather from studying the fossils that have been found here. These remains give us clues to how life might have been like millions of years ago.

One such fossil is of the *Gogia spiralis*. Gogia are an extinct species of marine (ocean) organisms. They lived attached to the sea floor. The spiral arms, seen in the image, were used to collect food from the sea water as it moved past.

Figure 2 - Fossils by Geologic Time Scale



https://sepetjian.wordpress.com/2011/10/11/the-geologic-column-invented-to-%E2%80%9Cfree-the-science-from-moses%E2%80%9D/

This image shows the three time periods and the index fossils found.

Cluster Questions	
Gather: Cluster Question #__1____ Question Type: Multiple choice Addresses: __x__ DCI (ESS1.C) __x__ SEP Argue from evidence	Question 1: Based on the information from **Reading 1**, what type of environment did the Gogi organisms live in? A. Desert B. Rainforest

__x__ CCC Scale Answer: C. Marine	C. Marine D. Tundra (Artic)
Gather: Cluster Question #__2____ Question Type: Highlight Addresses: __x__ DCI (ESS1.C) __x__ SEP Argue from evidence __x__ CCC Scale Answer: Fossils are the remains or traces of living organisms. These remains have been preserved by natural processes over time. Fossils range from spectacular skeletons to tiny sea shells. Many fossils of ancient life have been found in Utah. There is a wide variety of information we can gather from studying the fossils that have been found here. These remains give us clues to how life might have been like millions of years ago. One such fossil is of the Gogia spiralis. Gogia are an extinct species of marine organisms. They lived attached to the sea floor. The spiral arms, seen in the image, were used to collect food from the sea water as it moved past.	Question 2: Highlight the evidence in the copy of **Reading 1** below that supports your answer for **Question 1**. Fossils are the remains or traces of living organisms. These remains have been preserved by natural processes over time. Fossils range from spectacular skeletons to tiny sea shells. Many fossils of ancient life have been found in Utah. There is a wide variety of information we can gather from studying the fossils that have been found here. These remains give us clues to how life might have been like millions of years ago. One such fossil is of the Gogia spiralis. Gogia are an extinct species of marine (ocean) organisms. They lived attached to the sea floor. The spiral arms, seen in the image, were used to collect food from the sea water as it moved past.
Gather: Cluster Question #___3___ Question Type: Long answer Addresses: __x__ DCI (ESS1.C) __x__ SEP Obtaining and evaluating information __x__ CCC Scale	Question 3: The Gogi fossil was found in the same rock layer as a paradoxides fossil (highlighted in red), in **Figure 2**. Based on the information in **Figure 2**, during which time period did this organism exist? A. Permain B. Quaternary C. Cambrian

Answer: Cambrian	D. Devonian
Gather: Cluster Question #___4___ Question Type: Long Answer Addresses: __x__ DCI (ESS1.C) __x_ SEP Obtaining and evaluating information __x__ CCC Scale Answer: Approximately 100 million years old	Question 4: Based on the information in **Figure 2**, how old is the Gogi fossil?
Reason: Cluster Question #___5___ Question Type: Multiple choice Addresses: __x__ DCI (ESS1.C) __x__ SEP Argue from evidence __x__ CCC Scale Answer: The answer is B	Question 5: Which sentence below best explains how comparing the Gogi fossil to the paradoxides fossil helps us determine the age of the Gogi fossil? A. Rock forms layers with the oldest materials on the bottom and youngest on top B. Both fossils are found in the same layer so they existed at the same time and would be the same age. C. Rock forms layers with the oldest material on top and the youngest material on the bottom D. Each fossil is found in different layers so they did not exist at the same time and would be different ages
Communicate: Cluster Question #___6___ Question Type: Short answer Addresses: __x__ DCI (ESS1.C) __x__ SEP Argue from evidence __x__ CCC Scale Answer: Marine	Question 6: Make a claim about what the environmental conditions were in Utah during the time period when the Gogi organisms existed. Use the sentence frame below to help construct your claim: Utah was experiencing a _____ environment during the time period when the Gogi organisms existed.
Communicate: Cluster Question #___7___ Question Type: Multiple Select Addresses: __x__ DCI (ESS1.C)	Question 7: Now that you have made a claim about the environmental conditions of Utah during the time period when the Gogi existed, select evidence from the previous tasks, and information you have

___X_ SEP Argue from evidence __X__ CCC Scale Answer: A and B	collected to support your claim. Choose two statements below that support your claim: A. Both fossils are found in the same layer rock B. Both of the fossils are of sea-dwelling creatures that needed water to survive C. Both of the fossils were found in Mesozoic era along with several dinosaurs D. Neither fossil was found in the Cenozoic era (recent life)
Communicate: Cluster Question #__8____ Question Type: Long answer Addresses: __x__ DCI (ESS1.C) __x__ SEP Argue from evidence __x__ CCC Scale Answer: Answers may vary. Students should be able to state their evidence is either sufficient or not sufficient and provide an explanation as to why or why not. Students answers may include: ● Discoveries of additional fossils of the same relative age that also were marine organisms. ● Evidence from rock layers that show marine conditions from the same time period. ● Evidence from similar modern day species that are marine organisms.	Question 8: Do you have enough evidence to support your claim? Do you think you need to have more evidence? Why or why not? Use the sentence frames below to help you complete this task: The evidence that was collected _(is/is not)_ sufficient to support the claim because_____
Proficiency Scale	
Proficient Student Explanation: The Gogi organisms lived in a marine environment during a time when Utah was mostly underwater.	

The evidence to support this statement is that these fossils are found in the same rock layer as other known marine organisms called Paradoxides. Because the fossils are found together in the same rock layer, we can say they existed around the same time period.

Additional evidence that would support this claim could be collected, which might include discoveries of additional fossils of the same relative age that also were marine organisms, evidence from rock layers that show marine conditions from the same time period, Evidence from similar modern day species that are marine organisms.

Level 1 - Emerging	Level 2 - Partially Proficient	Level 3 - Proficient	Level 4 - Extending
SEP: Does not meet the minimum standard to receive a 2.	**SEP:** Compare and refine arguments based on an evaluation of the evidence presented. Distinguish among facts, reasoned judgment based on research findings, and speculation in an explanation. Construct and/or support an argument with evidence, data, and/or a model.	**SEP:** Compare and critique two arguments on the same topic and analyze whether they emphasize similar or different evidence and/or interpretations of facts. Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon.	**SEP:** Extends beyond proficient in any way.
CCC: Does not meet the minimum standard to receive a 2.	**CCC:** Recognizes natural objects and/or observable phenomena exist from the very small to the immensely large or from very short to very long time periods.	**CCC:** Observes time, space, and energy phenomena at various scales using models to study systems that are too large or too small.	**CCC:** Extends beyond proficient in any way.

	Uses Standard units to measure and describe physical quantities such as weight, time, temperature, and volume.	Observes phenomena at one scale may not be observable at another scale.	
DCI: Does not meet the minimum standard to receive a 2.	**DCI:** Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed.	**DCI:** The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale.	**DCI:** Extends beyond proficient in any way.

(Student Facing Format on following page)

Student Assessment

Name: _____ Date: _____

Stimulus

A student finds a Gogi Sparillis fossil in Millard, Utah. The student wonders what kind of environment the Gogi organism experienced when it existed.

Figure 1 - Gogi Sparillis Fossil

This image shows a picture of a Gogi Sparillis fossil found in Millard, Utah.

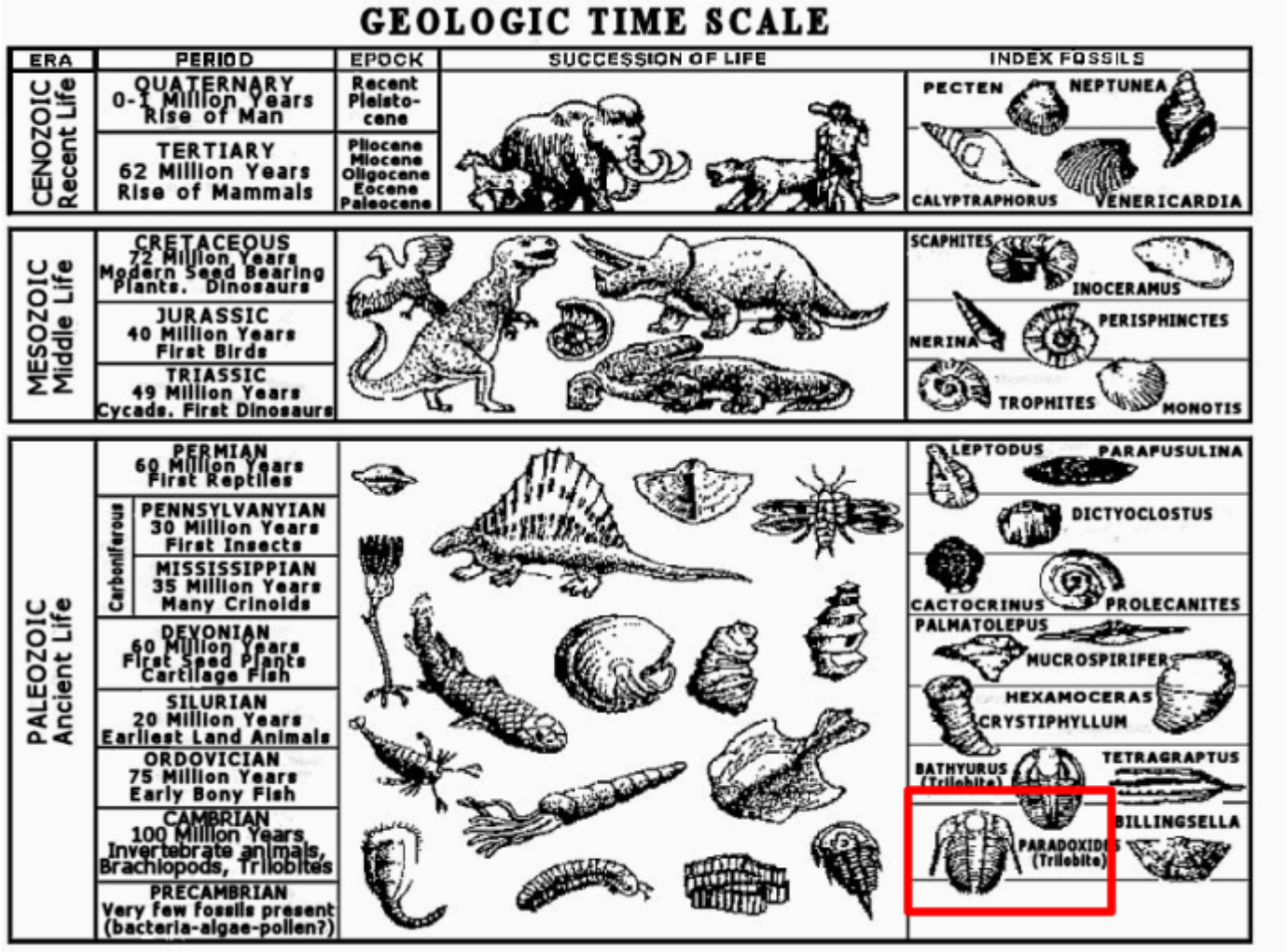
Reading 1 - Utah Fossils

Fossils are the remains or traces of living organisms. These remains have been preserved by natural processes over time. Fossils range from spectacular skeletons to tiny sea shells.

Many fossils of ancient life have been found in Utah. There is a wide variety of information we can gather from studying the fossils that have been found here. These remains give us clues to how life might have been like millions of years ago.

One such fossil is of the *Gogia spiralis*. Gogia are an extinct species of marine organisms. They lived attached to the sea floor. The spiral arms, seen in the image, were used to collect food from the sea water as it moved past.

Figure 2 - Fossils by Geologic Time Scale



https://sepetjian.wordpress.com/2011/10/11/the-geologic-column-invented-to-%E2%80%9Cfree-the-science-from-moses%E2%80%9D/

This image shows the three time periods and the index fossils found.

Your Task

In the questions that follow, you will make an argument from evidence about the relative age of the Gogi fossil and describe what the environment was like for it when it existed in Utah.

Question 1

Based on the information from **Reading 1**, what type of environment did the Gogi organisms live in?

A. Desert

B. Rainforest

C. Marine

D. Tundra (Artic)

Question 2

Highlight the evidence in the copy of **Reading 1** below that supports your answer for **Question 1**.

Fossils are the remains or traces of living organisms. These remains have been preserved by natural processes over time. Fossils range from spectacular skeletons to tiny sea shells.

Many fossils of ancient life have been found in Utah. There is a wide variety of information we can gather from studying the fossils that have been found here. These remains give us clues to how life might have been like millions of years ago.

One such fossil is of the Gogia spiralis. Gogia are an extinct species of marine organisms. They lived attached to the sea floor. The spiral arms, seen in the image, were used to collect food from the sea water as it moved past.

Question 3

The Gogi fossil was found in the same rock layer as a paradoxides fossil (highlighted in red), in **Figure 2**. Based on the information in **Figure 2**, during which time period did this organism exist?

A. Permain
B. Quaternary
C. Cambrian
D. Devonian

Question 4

Based on the information in **Figure 2**, how old is the Gogi fossil?

_____

Question 5

Which sentence below best explains how comparing the Gogi fossil to the paradoxides fossil helps us determine the age of the Gogi fossil?

A. Rock forms layers with the oldest materials on the bottom and youngest on top
B. Both fossils are found in the same layer so they existed at the same time and would be the same age.
C. Rock forms layers with the oldest material on top and the youngest material on the bottom
D. Each fossil is found in different layers so they did not exist at the same time and would be different ages

Question 6

Make a claim about what the environmental conditions were in Utah during the time period when the Gogi organisms existed. Use the sentence frame below to help construct your claim:

Utah was experiencing a _____ environment during the time period when the Gogi organisms existed.

Question 7

Now that you have made a claim about the environmental conditions of Utah during the time period when the Gogi existed, select evidence from the previous tasks, and information you have collected to support your claim.

Choose two statements below that support your claim:

A. Both fossils are found in the same layer rock
B. Both of the fossils are of sea-dwelling creatures that needed water to survive
C. Both of the fossils were found in Mesozoic era along with several dinosaurs
D. Neither fossil was found in the Cenozoic era (recent life)

Question 8

Do you have enough evidence to support your claim? Why or why not? Complete the sentence frames below.

The evidence that was collected _(is/is not)_ sufficient to support the claim because

_____

_____