The Critical Zone

“What is a Geophysicist ? A Meeting with Scientist Christinia Kitamikado”

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Objective

This activity aims to help you understand the role of geophysicists in studying Earth's processes, resources, and changes, as well as develop skills in analyzing and interpreting scientific information.

NGSS Standards

MS-ESS3-1:

Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

MS-ESS2-2:

Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.

Part 1: Introduction to Geophysics

Word Analysis

Go to the website https://www.eegs.org/what-is-geophysics- and use the Near Surface Geophysics Glossary to define the following words often used in Geophysics. You will complete the definition with a drawing depicting the word and a definition for the term in your own words.

A. Geophysics

1. Glossary Definition:

_____

_____

_____

_____

_____

_____

_____

2.Definition in Your Own Words:

3.Drawing Related To Definition

B. Soil

4. Glossary Definition:

5.Definition in Your Own Words:

6.Drawing Related To Definition:

C. Weathering

7. Glossary Definition:

8.Definition in your own words:

9.Drawing Related To Definition

D. Anomaly

10. Glossary Definition

11. Definition in Your Own Words

12.Drawing Related To Definition

E. Porosity

13. Glossary Definition

14. Definition in Your Own Words

15.Drawing Related To Definition

F. Refraction

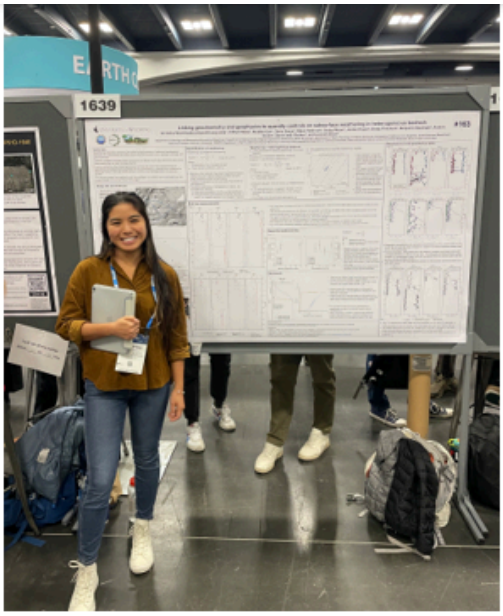
16. Glossary Definition

17. Definition in Your Own Words

18.Drawing Related To Definition

Part 2: Interview with Scientist Christina Kitamikado

Read the following interview about Christina Kitamikado, a renowned geophysicist, and answer the questions in two or more complete sentences.



What is a Geophysicist? An Interview with Scientist Christinia Kitamikado

1.What is the Critical Zone and Why is it important?
Christinia Stated:
According to the Critical Zone Network's website, it says "**The Critical Zone**" is Earth's outer skin, but often defined from bedrock to treetop. This is an environment where rock, soil, water, air, and living organisms interact and shape the Earth's surface. This is an interdisciplinary type of science, which is the key to solving and understanding the Earth's modern issues, such as climate change.

2. As a Critical Zone Scientist what has been your role in research?
Christinia Stated:
I have taken different sets of data from field research. The data sets taken have been chemical (ex: elements found in rocks) or physical (ex: measuring how much rocks resist electric current- which is called resistivity or how much water rocks can hold - which is called porosity), and I use this data in programming languages, such as Python and MATLAB, to code and analyze trends. The trends in data help us as scientists understand their relation to one another.

3. What got you interested in geology?
Christinia Stated:
When I was a student in high school, I enjoyed environmental science class. After graduating I attended community college and took prerequisite science & math courses for transfer to a four-year university. While there I fell in love with Calculus and Physics and my physics professor took notice and suggested I study "Earth Physics" also known as geophysics.
In the summer of 2016, my first internship was with SAGE in Santa Fe, New Mexico. During this internship we investigated a geologic anomaly in this area. The anomaly was that the water temperatures were different when they should have been the same. To solve this scientific mystery, we used different geologic tools to analyze the chemical and physical geologic features underneath the bedrock causing these anomalies. While there I decided this was the field of study that I wanted to work in as a career.

4. Why In Critical Zone science is the weathering of rocks important?
Christinia Stated:
It is important to understand rock weathering for many reasons. In the subsurface, below the earth's surface, rocks that weather produce soil. The relationship between soil production and how much soil is being weathered from the surface indicates to scientists the kind of landscape they should expect. These landscapes indicate other physical and chemical characteristics that are used for studying other things.

5. What scientific tools do you use often in your research?
Christinia Stated:
As a geophysicist, there are several scientific field tools and methods utilized. One method/tool often used in my work is seismic refraction survey. The seismic refraction survey process captures images of the first 100 meters of Earth's subsurface. Analyzing these images allows scientists to calculate the wave speeds traveling through the Earth's subsurface, which help in determining the depth of different subsurface layers.

Another method/tool we use to analyze physical and chemical samples from Earth's subsurface are boreholes. Boreholes are made by drilling into the ground, creating rock chips. In the pictures on this page, we created 4 boreholes, where the deepest borehole was approximately 70 meters. After the boreholes were created, additional geophysical tools were put into the boreholes to collect porosity data. Knowing the porosity of rocks, we were able to identify the weathered rock stage, shape, number of factures and seismic wave velocities.

6. Where are some places you have worked as a geophysicist?
Christinia Stated:
I worked in many places. Some of the places that stand out in my mind are Union, South Carolina & The Canary Islands in Spain. While in The Canary Islands we measured and mapped geothermal activity using a geophysical technique called magnetotellurics.

7. What advice do you have for young people that want to do the type of work you are doing?
Christinia Stated:
Someone once told me that it is important to understand what kind of scientific problem or issue you want to solve using the knowledge you have. Therefore, if you want to go into geophysics, I think it is important to know what kind of tools you have at your disposal and understand how these tools will help solve your chosen scientific problem or issue. This is what I am currently doing, in the field of environmental remediation. My geophysics background allows me to help clean up any environmental spills that occur into the environment or prevent these spills from becoming hazardous.

Questions:

1. **Based on the excerpt, what is one of Christina Kitamikado's main areas of study?**

   _____
   _____
   _____
   _____

2. **How does Christina's work contribute to our understanding of Earth's resources?**

   _____
   _____
   _____
   _____

3. **Describe some techniques Christina uses in her scientific research?**

_____
_____
_____
_____

4. **What elements make up the Critical Zone?**

_____
_____
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5. **Why is it important to study the Critical Zone?**

_____
_____
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_____

Part 3: Scientific Explanation and Modeling

Constructing a Scientific Explanation (CER)

Using the information from the previous read interview **"What is a Geophysicist ? A Meeting with Scientist Christinia Kitamikado"** use your knowledge to construct a scientific explanation for how different geoscience processes influence the chemical & physical properties of Earth's resources.

Claim: Geoscience processes influence the chemical and physical properties of Earth's resources.

Evidence: [List at least two pieces of evidence from the text or your knowledge.]

1._____
_____
_____
_____
_____
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_____

2._____
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_____

Reasoning: [Explain how the evidence supports your claim.]

3._____
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4._____
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CER Assignment Rubric

This rubric is designed to assess students' ability to construct explanations and reason scientifically, aligning with the targeted standards for seventh-grade science education. Adjustments and feedback should be provided based on individual student performance and understanding.

Criteria	Excellent (4)	Proficient (3)	Basic (2)	Needs Improvement (1)
Clarifying Questions	Thoroughly develops the ability to clarify questions and directs them toward specific scientific objects and phenomena.	Adequately develops ability to clarify questions related to scientific investigations.	Minimally develops the ability to clarify questions with partial relevance to scientific investigations.	Fails to develop ability to clarify questions relevant to scientific investigations.
Understanding Scientific Approaches	Clearly explains how scientists differ in their study of phenomena and methodologies.	Explains how scientists differ in their study of phenomena and methodologies with some clarity.	Provides a basic explanation of scientific diversity in study and methods.	Fails to explain how scientists differ in their study of phenomena and methodologies.
Examples of Further Studies	Provides comprehensive examples of when further studies are necessary and thoroughly justifies them.	Provides relevant examples of when further studies are necessary with some justification.	Provides limited examples of further necessary studies with minimal justification.	Fails to provide examples of when further studies are necessary or justifications are unclear.
Questioning Claims	Insightfully questions claims based on vague statements or statements by non-experts.	Adequately questions claims based on vague or non-expert statements.	Provides limited questioning of claims based on vague or non-expert statements.	Does not support the claim or shows misunderstanding.

Part 4: Collaborative Research on the Critical Zone

Directions: Work in pairs to research the Critical Zone and its scientists using the Critical Zone Network Website. Go to criticalzone.org/people and then click on "Investigators". Complete the tasks with your partner, ensuring that all research is conducted using reliable sources and that your findings are well-documented and cited. Use the grading rubric to guide your work and aim for the highest standard.

Research Tasks:

1. **Identify Scientists:**
    - Find at least two scientists who have significantly contributed to the study of the Critical Zone. Provide their names and a brief biography.
2. **Summarize Contributions:**
    - Summarize each scientist's contributions and findings related to the Critical Zone. Include specific studies or experiments they conducted.
3. **Cite Sources:**
    - Ensure all sources of information are cited correctly in your research documentation.

Collaboration Tasks:

- **Tools to Use:**
    - Use shared documents or presentation tools (e.g., Google Slides) to compile your findings. Collaboration should be visible in your document history.
- **Communication:**
    - Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), reasons, and evidence.

Research Approach Tasks:

1. **Use Technology:**
    - Utilize the internet to find reliable sources. Consider academic journals, university publications, and reputable science websites.
2. **Analyze and Link Information:**
    - Analyze the main ideas and supporting details from diverse media and formats. Explain how these ideas clarify the topic of the Critical Zone.
3. **Context Clues:**
    - Use context clues to determine the meaning of any specialized terms used in your research.
4. **Textual Evidence:**
    - Cite several pieces of textual evidence to support your analysis of what the text says explicitly as well as inferences drawn from the text.

Presentation Tasks:

- Compile your findings into a shared document or presentation.
- Ensure clarity and logical flow of information.
- Clearly indicate your sources with proper citations.

Grading Rubric

Criteria	4 - Excellent	3 - Good	2 - Satisfactory	1 - Needs Improvement
Research Completeness	Comprehensive and thorough research with all tasks completed.	Research is complete with minor gaps.	Basic research completed; some tasks missing.	Incomplete research and missing tasks.
Collaboration and Use of Tools	Effective collaboration and use of technology tools.	Good collaboration; minor issues with tools.	Limited collaboration or issues with tool usage.	Poor collaboration and ineffective tool usage.
Analysis and Evidence	Strong analysis with well-cited evidence.	Good analysis with some evidence.	Basic analysis; limited evidence.	Weak analysis and lack of evidence.
Presentation and Organization	Clear, well-organized presentation with proper citations.	Organized presentation with minor citation errors.	Some organization; errors in citation.	Disorganized presentation with improper citations.