

Geology at Meadowcroft Rockshelter GigaPan Lesson

An exploration of **geoarchaeology** at Meadowcroft Rockshelter

Summary: Students will review the concept of **geoarchaeology** and its application at Meadowcroft Rockshelter. They will identify two areas of **geomorphology**: 1) the formation of the site through geological processes and 2) the study of the processes and composition of deposits that created the **stratigraphy** inside the **rockshelter**. Students will investigate the *First Peoples* GigaPan images to learn more about these processes. Last, students will reflect on the significance of using a **geoarchaeological** approach at Meadowcroft Rockshelter.

Students will:

- Define, Describe, Analyze, and Evaluate the use of **geomorphology** at Meadowcroft Rockshelter
- Identify, describe or evaluate how **stratigraphy** and the **Law of Superposition** can be used to date geologic features
- Explain the geological processes that formed Meadowcroft Rockshelter; Describe the lifecycle of a **rockshelter**
- Identify, Define, Explain or analyze the geological processes that formed the **stratigraphy** inside the Rockshelter
- Define **geoarchaeology** and explain how the study of Meadowcroft Rockshelter benefitted from this **multi-disciplinary** approach

Background Information

After his initial visit to the Meadowcroft Rockshelter, Dr. Adovasio recognized that the site was ideal for applying **geoarchaeological methodologies**. **Geoarchaeology** is a **multi-disciplinary** approach that uses

Page 1 of 7

First Peoples: Archaeology at Meadowcroft Rockshelter
Geology GigaPan Exploration

Timing: 40 minutes

Materials:

Writing Instruments
Paper
Internet Access

Optional Reference Materials:

First Peoples Teachers Guide to Geology

Stratigraphic Profile of Meadowcroft
Rockshelter Table

Michael Collins, [Meadowcroft: Shelter
in a Storm](#)” article

Geologic Time Chart

Geologic Map

Terms

Geoarchaeology
Geomorphology
Matrix
Dripline
Sequence
Strata
Sandstone
Shale
Reentrant

Concepts

Stratigraphy and the Law of Superposition
Geologic time Chart
Geologic Map

Identification Significance

Meadowcroft Rockshelter
Dr. James Adovasio
Morgantown-Connellsville Sandstone

the techniques and subject matter of **geography, geology**, and other earth sciences to examine topics that inform **archaeological** knowledge. Generally, **geoarchaeology** involves studies of the natural processes that impact the area in and around an **archaeological** site.

A major branch of **geoarchaeology** is **geomorphology**, the study of how sites formed through geological processes and the subsequent impact of those processes on **cultural materials** buried within the sites. Geomorphologists at Meadowcroft had two primary goals:

1) Their first task was to understand the evolution of the landscape so they could determine how and when the Rockshelter formed. This information would indicate when the Rockshelter might have first been available for human use. To achieve this goal at the most basic level, they had to date the rock formation of the Rockshelter, and then, using geomorphological surveys of the Cross Creek watershed, they had to estimate how long ago the Rockshelter formed. *For content support, visit the “Geography, Geologic Origins, and Physiography” section of the Geology Teacher’s Guide*

2) Second, **geomorphology** would explain how the **stratigraphy** of the site formed, including the composition of the **matrix, depositional** mode, force, and rate. The depth of the **stratigraphy** and composition of the **matrix** help **archaeologists** anticipate how long people might have used the site, but also any geologic events that may have transported **cultural materials**. Several sampling procedures were used to study the **matrix**. *For content support, visit the “Formation of Meadowcroft Stratigraphy” section of the Geology Teacher’s Guide.*

Stratigraphy also helped **archaeologists** understand the migration of the **dripline**. Rockshelters are not stable and their rooflines retreat over time; the **dripline** indicates the amount of sheltered ground surface available at different times during the prehistoric past. **Archaeologists** can use the **dripline** to decide where to dig to find **cultural materials** since prehistoric people would have occupied the most sheltered portion of the site.

Introduction:

1. Teachers should begin the lesson by offering an introduction, one possible activity suggestion is below. If you have not already done so, provide an introduction to Meadowcroft Rockshelter, identifying the site, explaining its

significance, and why you are studying it. **Icebreaker:** Project the Exterior Image for one minute. Ask students to write down everything they see that might involve **geology**. You may wish to give some categories for recording observations: Rock Cycle, Geologic Structures, Geologic Forces. Review student observations. Ask what they think they are seeing from a geologic standpoint.

2. **Archaeologists** at Meadowcroft employed a **geoarchaeological** approach when they excavated the site. Ask students to see if they can create a definition for **geoarchaeology**.

Use this exercise to launch the following exploration.

Procedure

Geology						
Image	Tab	Point #	Title	Content Description	Multimedia/ Visual	Enrichment
Exterior	Geology	1	Morgantown-Connellsville Sandstone	The rocks that makes up the Rockshelter have different properties that aided in the creation of the Rockshelter.	1m 17s video on the geologic history of the Rockshelter.	Zoom in on the rocks. What characteristics can differentiate the layers in this formation?
Front	Geology	1	Rear Wall	The stone of the Rockshelter was laid in multiple sequences during the Pennsylvania Age of the Carboniferous period. The resulting strata (sandstone over shale) was what enabled the reentrant to form and create the Rockshelter.	A cross-section of the Meadowcroft Rockshelter sandstone showing its stratigraphy .	Explain that chronology is an essential tool for geologists: they can use stratigraphy and the Law of Superposition to help date rocks. Which portion of the Rockshelter formation is oldest? Which is youngest? What does this tell us about the landscape?
Front	Geology	2	Old Fall	Over time the roof continues to weaken as sand and rock spall off. On many occasions, this led to	45s video on roof spalling episodes.	What triggers spalling episodes? What is the likelihood of future spalling episodes at Meadowcroft? What does this tell us about the nature of rockshelters ?

				huge sections like this boulder falling from the overhang above.		
Front	Geology	3	New Fall	As pieces detached from the overhang it covered less area. This created a change in the dripline , where water spills from the roof overhead.	27s video on the change in dripline as the roof receded.	How do archaeologists use the dripline to plan their excavation ? How did the dripline impact Native American use of the site?
Front	Geology	4	Western Profile	Attrition and Sheetwash deposited layer upon layer of sediments on the floor of the Rockshelter, burying evidence as it built up the site's stratigraphy .	22s video on the sedimentation of the Rockshelter.	By now you have established that erosion is a constant force at the Rockshelter. Ask students to brainstorm measures that can reduce the impact of attrition, sheetwash, and erosion at the site today.
Firestack	Archaeology	3	East Face	The physical characteristics of a stratum are called its matrix , and can vary greatly depending on the depositional mode and source material. Those differences can clearly be seen in this photograph of the East face taken in 1976.	A photograph taken in 1976 of the east wall's stratigraphy	Ask students to brainstorm a list of possible sources for depositional materials at Meadowcroft (reference the Stratigraphic Profile table in the Teacher's Guide). How might archaeologists differentiate between the layers during the excavation process?
Lower	Geology	1	Inverted Stratigraphy	Natural forces can make changes to a site's stratigraphy . Here the weight of the new roof fall curled the strata under its immense weight.	Close-up photograph of the soil inversion.	Stratigraphy is not always stable. In at least one location at Meadowcroft, later geologic activity altered the stratigraphy . How can geomorphology help archaeologists interpret what they encounter during the excavation ?

Conclusion

Page 4 of 7

First Peoples: Archaeology at Meadowcroft Rockshelter

Geology GigaPan Exploration

Archaeologists at Meadowcroft Rockshelter used **geomorphology** to explain the **archaeological** process at the site. This process is often referred to as **geoarchaeology**. Ask students to create a definition for **geoarchaeology** based on what they have just learned. What is the value of **geoarchaeology**?

Alternate Delivery Options:

- Use the GigaPoints above to create a worksheet or scavenger hunt for your students. Give them time to explore the images on their own, completing their worksheets as they go.
- After the lesson ask students to write a reflection about the significance of **geology** at Meadowcroft Rockshelter. What are the benefits to using a **geoarchaeological** approach? How does **geomorphology** contribute to our understanding of the site? Use examples from the GigaPan images or resources to support your work.
- Give students KWL charts to complete as you view the images. During the introduction have them record everything they **Know** about the image. Then ask them to write what they **Want** to know. After you view the images, ask them to write what they **Learned**. Address any questions that remain unanswered. What sources can students use to answer these questions?

Post-activity Enrichment:

- Ask students to revisit the images. Instruct them to use the zoom function to explore the rocks. What observations can they make that can help them differentiate the layers in this formation?
- Demonstrate the use of a Geologic Time Scale for dating rock formations. Ask students to identify ancient geologic events that shaped the topography of Western Pennsylvania (Alluvial Deposition during the Pennsylvanian Period, Allegheny Orogeny, Separation of North America from Africa, Emergence of Pennsylvania watersheds, Glaciation). When do the rocks at Meadowcroft date to?
- **Stratigraphy** is a geological concept that can be applied to **archaeology**. Using what you have learned, create a definition for geologic **stratigraphy**. Now create a definition for archaeological **stratigraphy**. How are the two similar? Where do they differ? How can **archaeologists** use each during an **excavation**?
- Explain that **chronology** is an essential tool for geologists: they can use **stratigraphy** and the **Law of Superposition** to help date rocks. Which portion of the Rockshelter formation is oldest? Which is youngest? What does this tell us about the landscape?

Readings

Barnes, John H. and W.D. Sevon. *The Geological Story of Pennsylvania (3rd Edition)*. Harrisburg: Pennsylvania Geological Survey, 2002.

This booklet is produced by the Bureau of Topographic and Geological Survey at the Pennsylvania Department of Conservation and Natural Resources. It provides a complete but concise examination of the geologic history of Pennsylvania. Educators will find it especially useful as the book explores both the natural features of the area and explains how the science of **geology** helps us understand the origins of those **features**. Easy-to-read tri-color line drawings, maps, diagrams, and charts present a variety of representations useful for introducing or practicing concepts in the classroom.