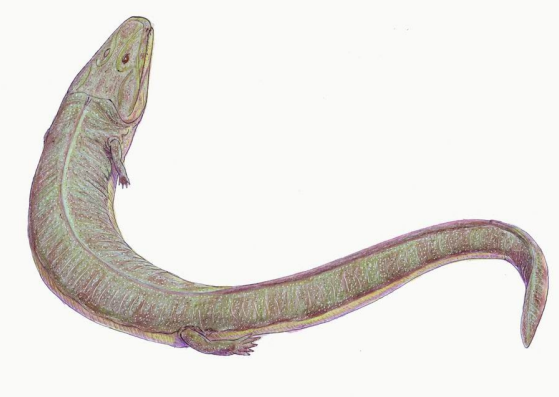
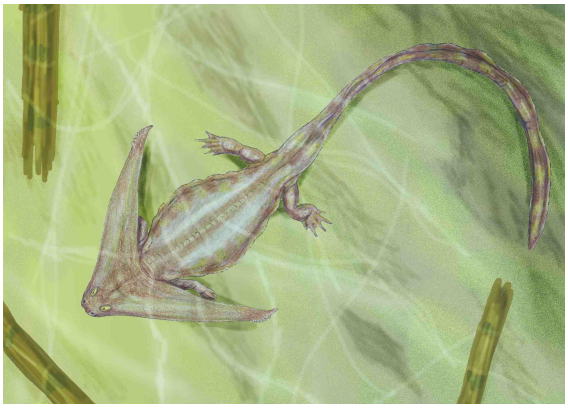




Under the Sea in WV

GOAL

Develop an understanding of West Virginia's origins under an ocean, how it has shaped our economy throughout history, and how we impact the oceans today.

Understandings

- West Virginia's past, present and future is connected to the ocean.
- West Virginia's economy -- past and present -- is rooted in our geological history.
- Our activities in West Virginia impact ocean health worldwide.

Knowledge (K) and Skills (S)

K: West Virginia used to exist under a shallow ocean.
K: Coal, limestone and salt are examples of products of West Virginia from our underwater past.
K: Paleontologists study fossils to understand the development of life in our region.
K: Geologists study rock formations to understand the formation of our landscape.
K: We have an important role in reducing pollution in our oceans.
S: Describe the origins of important products -- coal, limestone and salt -- from our underwater past.
S: Identify fossilized remains in our landscape.
S: Explain how West Virginia is connected to the ocean today.

Introduction

Begin with a guided visualization. Feel free to record answers.

> *Imagine being at the ocean. What does it sound, smell and taste like?*
>
> *Imagine you are barefoot on the beach. What does the ocean bottom feel like?*

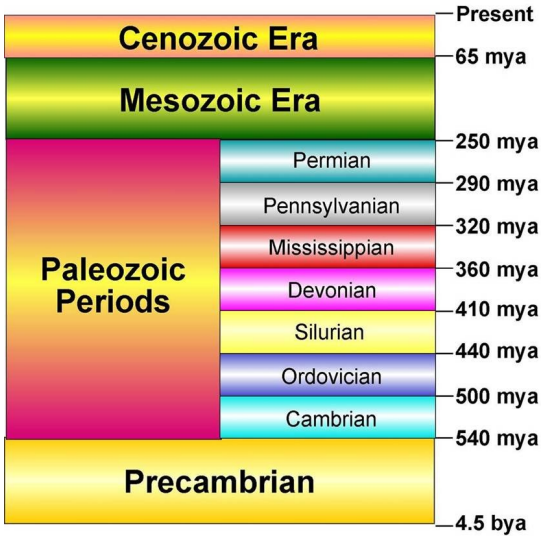
Background Exploration

21st century West Virginia may be hundreds of miles from the ocean, but its history -- *and future!* -- has everything to do with the ocean.

Did you know that West Virginia has been covered by an ocean? In fact, it has been covered by different oceans at different times, and for millions of years!

Not only was West Virginia covered by an ocean, geologists believe that an ancient ocean was *covered by West Virginia*, too.

A general geological timeline:



Optional video: [Continents Collide] (first half on formation of Appalachian Mountains)

Optional roleplay: **Let's Build West Virginia!** *-- about Appalachian geological history*

So what does West Virginia have to do with the ocean now?

1) **Fossils allow us to learn about how life evolved in ancient ecosystems.**

Paleontologists study ancient life forms. Because West Virginia was covered by a shallow sea, followed by very productive, species-rich swamps, many remains of these life forms are preserved in the sedimentary rock that formed around them. We call this kind of ancient evidence **fossils.** Paleontologists study these fossils to come up with a better understanding of how life forms, evolves and adapts to our changing environment.

2) **Our economy is built on remnants of our underwater past -- from fossil fuels, to building materials, to food.**

Fossil fuels -- like coal, oil and natural gas -- come from the compressed, carbon-rich remains of ancient life forms in West Virginia. After the ocean receded most recently, much of West Virginia was covered in rich swamps. (Think of the Amazon rainforest with different, ancient species.) These swamps were slowly filled in with depositing sediments, until the Appalachian Mountains were formed and stopped this process. These ancient life forms were compressed over time to form the fossil fuels that the industrial American economy was built upon.

Show and tell: *Pass around a piece of coal.*

Limestone is a very common sedimentary rock in West Virginia, that is often composed of the skeletal fragments of marine organisms, such as coral and mollusks from the ancient seas. *Have you heard of these creatures?* Limestone is an important building material in West Virginia and around the world -- from structural stones in important buildings, to everyday cement. It is also important in agriculture. *Have you ever heard of a field getting limed? Why do we do this?*

McDowell County Courthouse in Welch, WV.

Show and tell: *Pass around a piece of limestone.*

Salt mines. Before the Civil War, the Kanawha Valley was the largest producer of salt in the United States! Salt was extremely important in preserving food in this period, since commercial refrigeration was not available. These salt wells are several hundred feet under the ground, and bubble up from salt beds about *a mile deep*, from the ancient Iapetus Ocean *(ee-A-petus)*. Salt production continues from these wells today.

Show and tell: *Pass around a container of sea salt.*

Coal, limestone and Appalachian salt have their origins in the ancient oceans.

What do we use here that comes from the ocean?

3) **Everything goes back to the ocean.**

West Virginia is slowly eroding back to the ocean, where it was first formed. Our activities in West Virginia eventually make an impact on the ocean.

What is erosion?

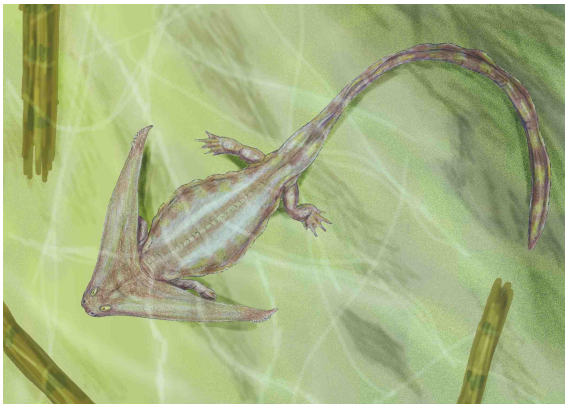
Every day, a little bit of the mountains is eroding, or breaking away, through the action of wind and water and the force of gravity. We call these bits of mountain rock *sediment*. This sediment, and any other materials on it, are carried by water down to the lowest point -- first into streams, then in rivers like the Elk, Coal and New Rivers, then to larger rivers, and finally the ocean. *Refer to lesson on the water cycle.*

When the Appalachian Mountains were formed, they were as tall as the Alps and the Himalayas! Imagine how long it took for the Appalachian Mountains to erode to the beautiful green hills we have today. In fact, this is an important reason why geologists believe the Appalachian Mountains are among the oldest on the Earth. On the other hand, the Himalayas are the one of the youngest mountain ranges on Earth, and are still growing.

The Himalayas

Because our mountains are so ancient, they were already eroding when the dinosaurs lived here. As a result, any dinosaur evidence in West Virginia gradually eroded away towards the ocean. However, we do have evidence from even more ancient creatures in West Virginia, with gnarly names and habits!

Greererpeton ("creeping beast from Greer") was related to the first true amphibians. This middle Carboniferous creature seems to have spent all of its time in the water, leading paleontologists to conclude that it "de-evolved" from recent amphibian ancestors. West Virginia has yielded dozens of Greererpeton fossils, making this one of the state's best-known prehistoric animal



Diploceraspis was an odd-looking amphibian of the Permian period, characterized by its oversized, boomerang-shaped head (which probably kept it from being swallowed whole by predators, or made it look so big from a distance that bigger meat-eaters avoided pursuing it in the first place). Various specimens of Diploceraspis have been discovered in both West Virginia.

Backyard Adventure -- *Fossil Hunt!*

This activity will work as one smaller group, or in breakout groups. Prior to the outing, you may be interested in reviewing common fossils of the region.

Step 1. Pick a location where the sedimentary rock structure is exposed. Good locations to choose are along road cuts, or cliff faces. Practice safety!
Step 2. Divide into groups, if desired.
Step 3. Provide the following to each group, if available:

- A clear container -- to collect rocks and fossils
- A clipboard
- A fossil hunt worksheet
- A few sheets of copy paper
- Pencils
- A magnifying lens
- A fossil guide -- online resources below

Step 4. Explain that each group is comprised of both geologists -- rock scientists -- and paleontologists -- fossil scientists. Groups can name a Lead Geologist and Lead Paleontologist for the purposes of identifying the rock materials and fossils they will find, and feature in a pop-up geology museum. They will need to collect, document and try to identify each rock and fossil specimen. As part of their documentation of the rocks and fossils, they can perform a rubbing.
Step 5. Identify locations for each group to collect from. Review relevant safety and Leave No Trace guidelines.
Step 6. Go fossil hunting!
Step 7. Gather group together and share back your findings. If feasible, invite other groups and collaborators to look at your specimens and test your knowledge.

Fossil Identification Presentation and Quiz
Fossils of WV: Drawings (bottom of page)
Selected Fossils of West Virginia

An alternate, indoor version of this activity:

Step 1. Gather as many buckets as groups for this activity. Pre-fill each bucket half-full with a mixture of loose sediment and different sizes of rocks, as well as 3 or 4 fossils (if available).
Step 2. Provide the following to each group:

- A clear container -- to collect rocks and fossils
- An aluminum tray or second bucket --
- Gloves -- for safety, can be nitrile or woven material
- A clipboard
- A fossil hunt worksheet
- A few sheets of copy paper
- Pencils
- A magnifying lens
- A fossil guide

Step 3. Explain that each group is comprised of both geologists -- rock scientists -- and paleontologists -- fossil scientists. Groups can name a Lead Geologist and Lead Paleontologist for the purposes of identifying the rock materials and fossils they will find, and feature in a pop-up geology museum. Each group will need to collect, document and

try to identify each rock and fossil specimen. As part of their documentation of the rocks and fossils, they can perform a rubbing.
Step 4. Go fossil hunting!
Step 5. Gather group together and share back your findings. If feasible, invite other groups and collaborators to look at your specimens and test your knowledge.

Stewardship in Action

Optional: program opportunity with Ocean Wise.

Not only do our mountains erode into the oceans over time -- our activities on land make an impact on the oceans.

What we leave on the land -- trash, chemicals -- will eventually become part of the water cycle.

Examples: Great Pacific Garbage Patch
Gulf of Mexico Dead Zone

How can we stop this from happening?

What we emit into the air -- including air pollution -- can deposit back on land, or rain on land or water before continuing its journey to the ocean. *Have you heard of acid rain?*

How can we stop this from happening?

Trash survey and cleanup.

The best way for us to know what is making its way towards the ocean is take a good look at the trash around us. *What do you think will be the most common trash we will find?*

What you will need:

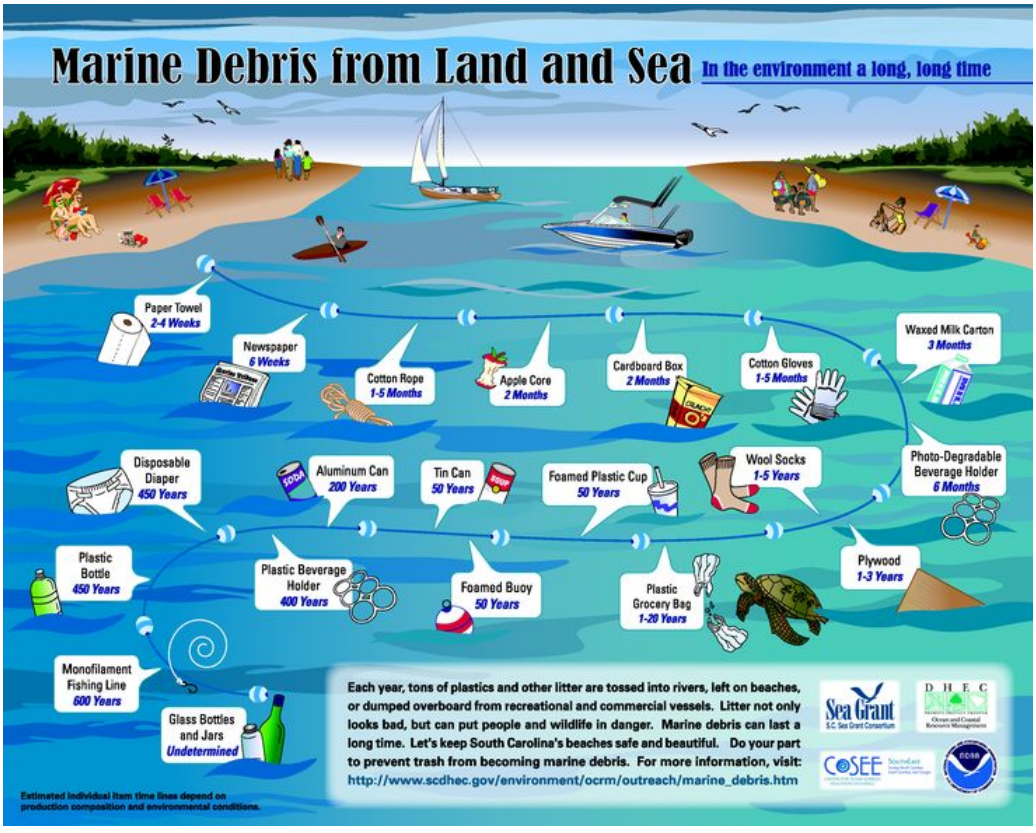
- Gloves -- for each participant
- Litter getters (if available) -- 1 per group
- Durable trash bags -- several per group
  available from the WV REAP program
- 1 trash survey form per group
  Categories can also be developed from group. Ask What kinds of trash can you think of? Decide on 5 or 6 main categories, and have groups write those down to mark tallies by.
- 1 clipboard
- Writing utensil

- Floor scale -- remains at gathering spot

Steps:

- Divide participants into groups and distribute materials.
- Review survey form and safe trash collecting practices. Emphasize that no weapons or rusted material should be gathered.
- Determine survey area limits for each group.
- *Optional: Create incentive for most trash collected.*
- Divide and survey!
- Bring group back together to weigh trash on floor scale, collate results.
- Share back and discuss:
    - *What was the most common piece of trash?*
    - *What was the most surprising?*
    - *How did it get here?*
- Congratulate the group for their effort, and for keeping trash out of the ocean!

What else can we do to keep trash out of the environment in the first place?



Related Activities

- **Create a geological map of West Virginia** -- have participants complete this color-by-number map of West Virginia.
- **Sinkholes in a Cup** -- Project Underground
- **Weathering and Fossil Preservation** -- WV Geological and Economic Survey

Additional Resources

A Geological Transect Across West Virginia
WV and Dinosaurs
WV Geological and Economic Survey
Ocean Wise