CAUSATION – CATEGORIZING CAUSES

Purpose

One of the most challenging tasks for historians (and scientists) is to make sense of events with multiple causes. In this activity, students are going to capture some causes that led to the development of the Earth's atmosphere, and then categorize them in a couple of different ways. This will help students understand how to organize causes into different categories, and will expand their strategies for using causation as an analytical tool when constructing historical narratives. This might seem like common sense, but critical thinking is key to thinking historically.

Process

In this activity, students will first create lists of causes and effects as related to the development of Earth's atmosphere, then, they'll categorize these causes by scientific disciplines.

Capturing Causes

Have students watch *The Early Atmosphere*, which you'll be discussing in detail later, in Lesson 4.1. Now, hand out the Causation—Categorizing Causes Worksheet. Review the process of how the Earth's atmosphere and the Moon formed, and rewatch the video with your students, if necessary. Once you've reviewed, tell your students that they're going to create a list of at least 10 causes and the resulting effects.

However, it's not as simple as it sounds. As part of their list, they must include:

- Two causes that have multiple effects
- Three causes that are also effects

Categorizing Causes

Invite students to form small groups. Each group should assemble their individual causes and effects into a single list. Tell them to try to remove duplicates, including those that use slightly different language to describe the same thing. Once they've finished combining their lists, ask students to place each cause into one of the following categories:

1. Astrophysics

   Sample answers: These causes might include the results of collisions or star formation.

2. Chemistry

   Sample answers: These causes might include the presence of specific elements or molecules.

3. Biology

   Sample answers: These causes might include the proliferation of specific species.

4. Geology

   Sample answers: These causes might include the movement of the Earth's mantle, or the movement of magma.

Once they've finished, compare the lists of each group. Then, ask students if there were other ways they could have categorized causes, such as short-term/long-term, or Earth-bound/extraterrestrial. Ask students how different categorizations help us understand these events more deeply or broadly, or how they may change our perspective on the events altogether. Grouping things in this way is something historians do all the time, although they might not use these exact categories. It helps them see related causes and how those causes might interact.

CAUSATION – CATEGORIZING CAUSES

Part 1

Have your class review the video The Early Atmosphere from Lesson 4.1. Tell students that while they watch this video, they should keep track of the causes and effects mentioned that led to the formation of the Earth's atmosphere. Instruct them to add all causes and effects in the appropriate categories below. They should make sure that two of their causes have multiple effects, and that they have three causes that are also effects. Have them underline any causes that have multiple effects, and circle the causes that are also effects.

Causes	Effects
Giant hunks of rock, metal, and ice slammed into the Earth's surface.	*These collisions generated heat, thus creating magma and steam.*
This steam thickened over time.	*The Earth's first atmosphere has formed.*
The Earth developed an atmosphere.	*The new atmosphere had an insulating effect on the planet.*
The Earth slowly cooled.	*The surface of the Earth cooled into a crust.*
The Earth slowly cooled.	*The steam of the atmosphere cooled into liquid, which formed the first oceans.*
Something the size of Mars slammed into the Earth.	*Material was blasted outward into space.*
Material from the collision between Earth and this other object was floating in space.	*This material orbited the Earth and became the Moon.*
Something the size of Mars slammed into the Earth.	*The heat from the collision melted the surface of the Earth.*
Something the size of Mars slammed into the Earth.	*The heat from the collision turned the oceans into steam again.*
The heat from the collision turned the oceans into steam again.	*The Earth reformed a steam atmosphere.*
The Earth slowly cooled down again.	*The surface of the Earth cooled into a crust.*
The Earth slowly cooled down again.	*The steam of the atmosphere cooled into liquid, which reformed as oceans.*
The formation of the Moon was complete.	*The Moon stabilized the tilt of the Earth.*
The formation of the Moon was complete.	*The Moon helps to regulate the climate of the Earth.*
Volcanic activity released carbon dioxide and methane.	*There was very little oxygen in the atmosphere.*
Thermal vents generated heat and energy deep in the oceans.	*Early life evolved around these vents.*
Microbes spread through the oceans and some of these produced methane as a waste product.	*Biology began to affect the atmosphere.*
Some microbes evolved that could use sunlight to split water molecules and release oxygen as a waste product.	*Eventually, oxygen flooded the atmosphere.*

CAUSATION – CATEGORIZING CAUSES

Causes	Effects
Eventually, oxygen flooded the atmosphere.	*Many microbes were killed by oxygen while others flourished.*
Eventually, oxygen flooded the atmosphere.	*Oxygen results in reddish and rust colored compounds in the soil.*
Eventually, oxygen flooded the atmosphere.	*The ozone was formed.*
The ozone was formed.	*The Earth was protected from harmful UV rays.*
There was a reduction in the release of methane and carbon dioxide.	*The Earth retained less of the Sun's heat.*
The Earth retained less of the Sun's heat.	*The Earth became significantly cooler.*
The Earth became significantly cooler.	*The Earth was encased in ice.*
The Earth was encased in ice.	*The ice reflected the sunlight.*
The ice reflected the sunlight.	*The Earth got colder and colder.*
Volcanoes punched through the ice.	*Carbon dioxide built up in the atmosphere.*
Carbon dioxide built up in the atmosphere.	*The Earth eventually warmed up and the ice melted.*
Plants and forests covered the Earth.	*Oxygen levels rose even higher.*
Oxygen levels rose even higher.	*A greater diversity of life was possible.*

CAUSATION – CATEGORIZING CAUSES

Part 2

Invite students to form small groups and have them combine their individual lists into a single, larger list. Tell them to try to remove duplicates, including those that use slightly different language to describe the same thing. Once they've finished combining their lists, ask students to place each cause into one of the following categories:

- Astrophysics (A) – These causes might include the results of collisions or star formation.
- Biology (B) – These causes might include the proliferation of specific species.
- Chemistry (C) – These causes might include the presence of specific elements or molecules.
- Geology (G) – These causes might include the movement of the Earth's mantle, or the movement of magma.

Causes	Effects
Giant hunks of rock metal and ice slammed into the Earth's surface. (A)	*Collisions generated heat, thus creating magma and steam.*
Steam thickened over time. (C) (G)	*The Earth's first atmosphere has formed.*
The Earth developed an atmosphere. (C) (G)	*The new atmosphere had an insulating effect on the planet.*
The Earth slowly cooled. (G)	*The surface of the Earth cooled into a crust.*
The Earth slowly cooled. (G)	*The steam of the atmosphere cooled into liquid, which formed the first oceans.*
Something the size of Mars slammed into the Earth. (A)	*Material was blasted outward into space.*
Material from the collision between Earth and this other object was floating in space. (A)	*This material orbited the Earth and became the Moon.*
Something the size of Mars slammed into the Earth. (A)	*The heat from the collision melted the surface of the Earth.*
Something the size of Mars slammed into the Earth. (A)	*The heat from the collision turned the oceans into steam again.*
The heat from the collision turned the oceans into steam again. (G)	*The Earth reformed a steam atmosphere.*
The Earth slowly cooled down again. (G)	*The surface of the Earth cooled into a crust.*
The Earth slowly cooled down again. (G)	*The steam of the atmosphere cooled into liquid, which reformed as oceans.*
The formation of the Moon was complete. (A)	*The Moon stabilized the tilt of the Earth.*
The formation of the Moon was complete. (A)	*The Moon helps to regulate the climate of the Earth.*
Volcanic activity released CO2 and methane. (C)	*There was very little oxygen in the atmosphere.*
Thermal vents generated heat and energy deep in the oceans. (G)	*Early life evolved around these vents.*
Microbes spread through the oceans and some of these produced methane as a waste product. (B)	*Biology began to affect the atmosphere.*

CAUSATION – CATEGORIZING CAUSES

Causes	Effects
Some microbes evolved that could use sunlight to split water molecules and release oxygen as a waste product. (B)	*Eventually, oxygen flooded the atmosphere.*
Eventually, oxygen flooded the atmosphere. (C)	*Many microbes were killed by oxygen while others flourished.*
Eventually, oxygen flooded the atmosphere. (C)	*Oxygen results in reddish and rust colored compounds in the soil.*
Eventually, oxygen flooded the atmosphere. (C)	*The ozone was formed.*
The ozone was formed. (C)	*The Earth was protected from harmful UV rays.*
There was a reduction in the release of methane and carbon dioxide. (C)	*The Earth retained less of the Sun's heat.*
The Earth retained less of the Sun's heat. (G)	*The Earth became significantly cooler.*
The Earth became significantly cooler. (G)	*The Earth was encased in ice.*
The Earth was encased in ice. (G)	*The ice reflected the sunlight.*
The ice reflected the sunlight. (G)	*The Earth got colder and colder.*
Volcanoes punched through the ice. (G)	*Carbon dioxide built up in the atmosphere.*
Carbon dioxide built up in the atmosphere. (C)	*The Earth eventually warmed up and the ice melted.*
Plants and forests covered the Earth. (B)	*Oxygen levels rose even higher.*
Oxygen levels rose even higher. (C)	*A greater diversity of life was possible.*

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One of the most challenging tasks for historians (and scientists) is to make sense of events with multiple causes. In this activity, you'll list some causes that led to the development of the Earth's atmosphere, and then categorize them in a couple of different ways. This activity will help you understand how to organize causes into different categories. This will help you expand your strategies for using causation as an analytical tool when constructing historical narratives.

Process

First, you'll create lists of causes and effects as related to the development of Earth's atmosphere. Then, you'll categorize these causes by scientific disciplines.

Capturing Causes

After watching *The Early Atmosphere* (which you'll have a chance to discuss even further in Lesson 4.1), take out the Causation – Categorizing Causes Worksheet. With your class, discuss the process of how the Earth's atmosphere and the Moon formed. Create a list of at least 10 causes and the resulting effects. In this list, you should include:

- Two causes that have multiple effects
- Three causes that are also effects

Categorizing Causes

Form small groups with your classmates. Combine your individual lists into a single list of causes and effects. Try to remove duplicates, including those that use slightly different language to describe the same things. As you combine your lists, place each cause into one of the following categories:

1. Astrophysics
2. Chemistry
3. Biology
4. Geology

CAUSATION – CATEGORIZING CAUSES

Name: Date:

Part 1

Review the video *The Early Atmosphere* from Lesson 4.1. While watching this video, keep track of the causes and effects mentioned that led to the formation of the Earth's atmosphere. Add all causes and effects in the appropriate categories below. Make sure that two of your causes have multiple effects, and that you have three causes that are also effects. Underline any causes that have multiple effects, and circle the causes that are also effects.

Causes	Effects

CAUSATION – CATEGORIZING CAUSES

Name: Date:

Causes	Effects

CAUSATION – CATEGORIZING CAUSES

Name: Date:

Causes	Effects

CAUSATION – CATEGORIZING CAUSES

Name: Date:

Part 2

Form small groups with your classmates. Combine your individual lists into a single, larger list of causes and effects. Try to remove duplicates, including those that use slightly different language to describe the same things. As you combine your lists, place each cause into one of the following categories.

- Astrophysics (**A**)
- Biology (**B**)
- Chemistry (**C**)
- Geology (**G**)

Causes	Effects

CAUSATION – CATEGORIZING CAUSES

Name: Date:

Causes	Effects

CAUSATION – CATEGORIZING CAUSES

Name: Date:

Causes	Effects