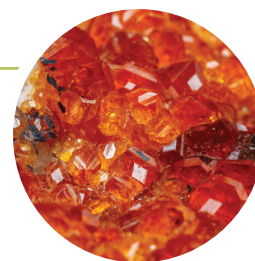


The Relationship Between Geoscience Processes and Mineral Distribution

A Carolina Essentials™ Activity



Overview

Minerals are naturally occurring substances with a definite chemical composition and an ordered atomic arrangement. This unique structure gives many minerals a crystalline shape. Minerals are inorganic, meaning that they are not made up of carbon chains but are usually a metal combined with a nonmetal or polyatomic ion. Minerals are grouped by their chemical composition and include silicates, oxides, sulfates, sulfides, carbonates, native elements, and halides. Generally, minerals have economic value and are used commercially in many manufactured products. Minerals are obtained through a variety of mining processes, and many can be recycled, reclaimed, and reused to minimize the impact on Earth's natural resources. This is a short activity that uses a series of USGS maps to allow students to visually establish the relationships between tectonic boundaries, geologic features such as volcanoes and earthquakes, and mineral deposits. Once relationships are established, students will develop an explanation for the uneven distribution of mineral resources.

Earth and Space Science Grades: 6–8

Phenomenon

Look carefully at the following maps. What patterns do you see in the locations of mountain ranges, earthquakes, and volcanoes? What relationship do the locations have to tectonic plates and boundaries?

Students should notice that mountain ranges, volcanoes, and earthquakes occur near plate boundaries. Volcanoes tend to occur at convergent boundaries, and earthquakes occur at both types of boundaries. Mountain ranges may occur further inland as convergent boundaries cause uplift, folding, and volcanic activity as the less dense plate is lifted and the denser plate is subducted.

Physical Map of the World

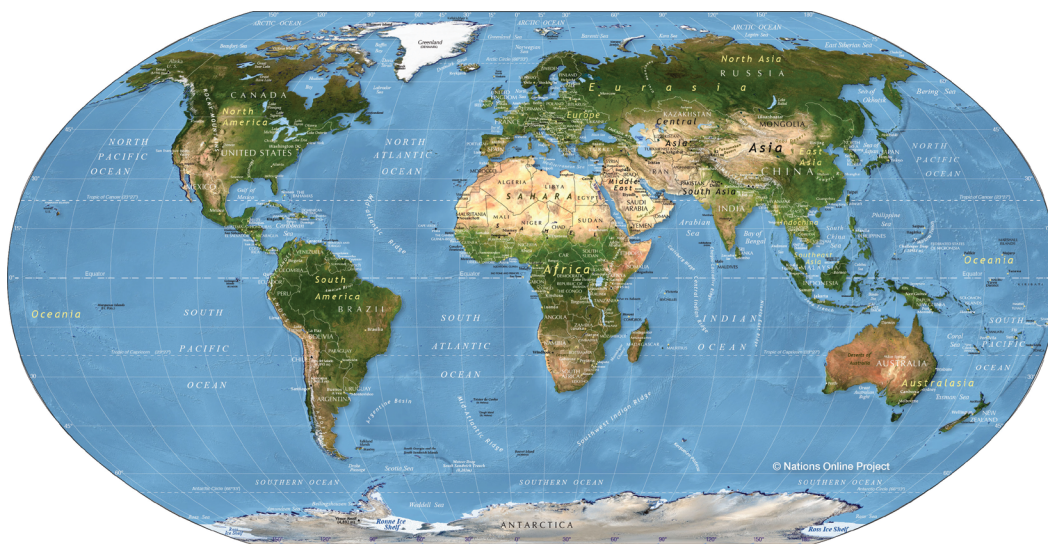


Image courtesy of the Nations Online Project

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TIME REQUIREMENTS



PREP
15 min

ACTIVITY
20–30 min

Teacher Prep: 15 minutes

Student Activity: 20–30 minutes

SAFETY REQUIREMENTS

No PPE required. No disposal precautions.

MATERIALS

Maps included on student activity guide

[“The Dynamic Earth: Plate Tectonics” map](#) (optional, for use as a reference)

HELPFUL LINKS

[Introduction to Minerals Study Kit](#)

[Comprehensive Mineral Collection](#)

[The Classification of Minerals Collection](#)

[Hardness Scale Minerals Collection](#)

[Luster Minerals Collection](#)

[Streak Minerals Collection](#)

[Introduction to Minerals Poster](#)

[Minerals Poster](#)

[Rock/Mineral Test Kit](#)

[Student Investigations, Rocks and Minerals](#)

[The Rock Cycle and Earth Processes](#)

[Volcano in the Classroom](#)

[Rock Candy: An Edible Study of Crystallization](#)

REFERENCE LINK

[USGS Global Maps](#)

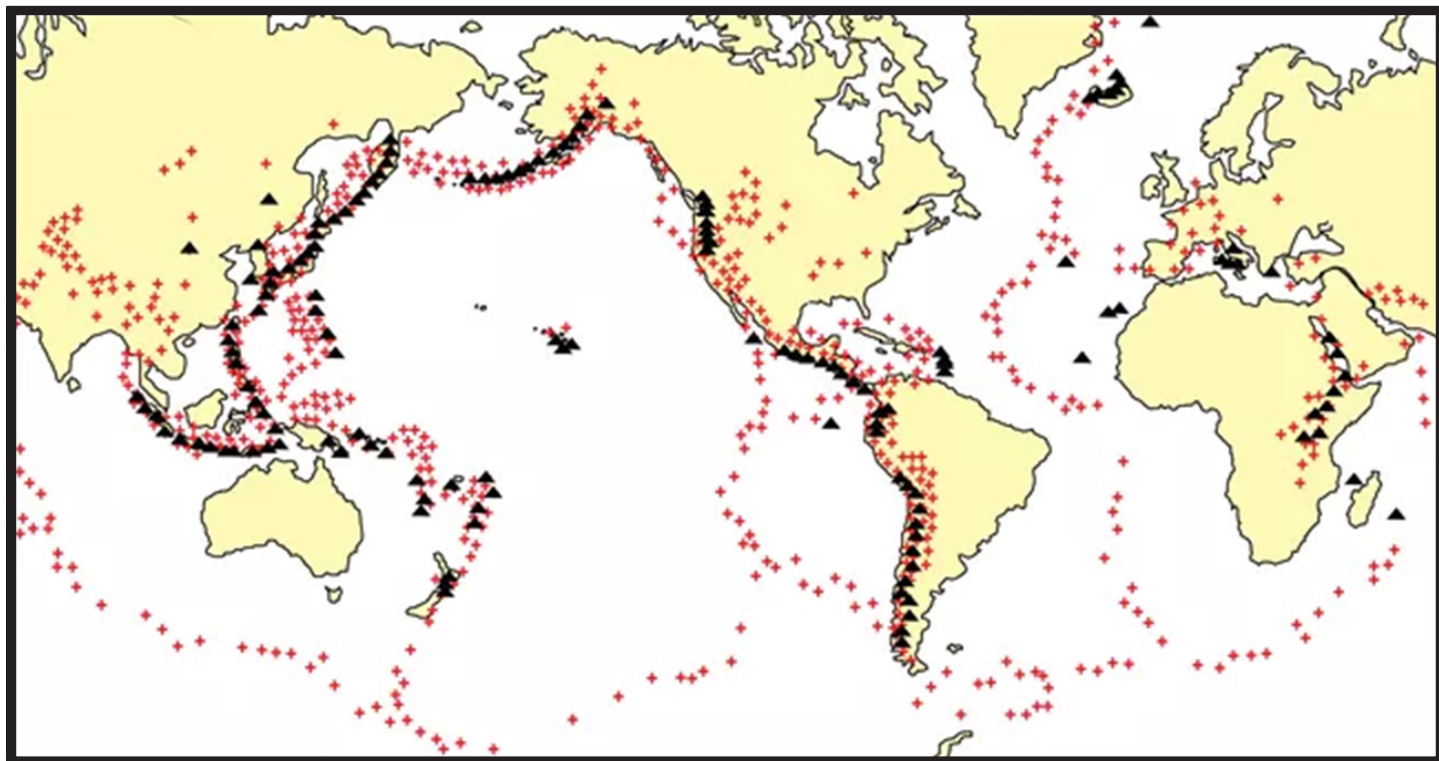
REFERENCE KITS

[Formation of a Native Copper Mineral Deposit Kit](#)

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Map of Earthquakes and Volcanoes



Earthquakes + Volcanoes ▲

Modified from "Parks and Plates: The Geology of Our National Parks, Monuments and Seashores," by Robert J. Lillie, New York, W. W. Norton and Company, 298 pp., 2005, <https://www.amazon.com/Parks-Plates-National-Monuments-Seashores/dp/0393924076>

Essential Question

What is the relationship between global mineral deposit distributions and geoscience processes?

Activity Objectives

1. Explain the distribution of major global mineral deposits and critical mineral deposits.
2. Explain the relationship between mineral deposits and geologic processes.

Continued on the next page.

The Relationship Between Geoscience Processes and Mineral Distribution

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Next Generation Science Standards* (NGSS)

PE: MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distribution of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Constructing Explanations and Designing Solutions Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	ESS3.A: Natural Resources Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.	Cause and Effect Cause and effect relationships may be used to predict phenomena in natural or designed systems.

Safety Procedures and Precautions

No PPE required. No disposal precautions.

Teacher Preparation and Disposal

Copy or upload the student activity guide. No materials disposal required.

Student Procedure

- Place all of the maps in a group on your desk. You need to see all the maps so you can compare them.
- On the volcanoes and earthquakes map, sketch where you think the tectonic plate boundaries are located.
- Use a "D" for divergent (pulling apart) and a "C" for convergent (colliding) to label the plate boundaries.
- Use the volcanoes and earthquakes map as a reference and repeat steps 2 and 3 for both mineral maps.
- On both mineral maps, shade in the locations of major mountain ranges.

Teacher Preparation and Tips

You may want to make copies of the 3 maps and laminate them to serve as resources for additional activities.

Review types of plate boundaries with students. Use the "Dynamic Earth: Plate Tectonics" map as a reference, if needed.

As an extension, assign each student a major mineral and critical mineral and report on the following items:

- Mineral uses
- Mineral value
- Is the mineral found pure or as an ore?
- If the mineral is found as an ore, how is it processed?
- Can the mineral be recycled/reclaimed? If so, how is it reclaimed?
- Identify the mineral location on the maps.

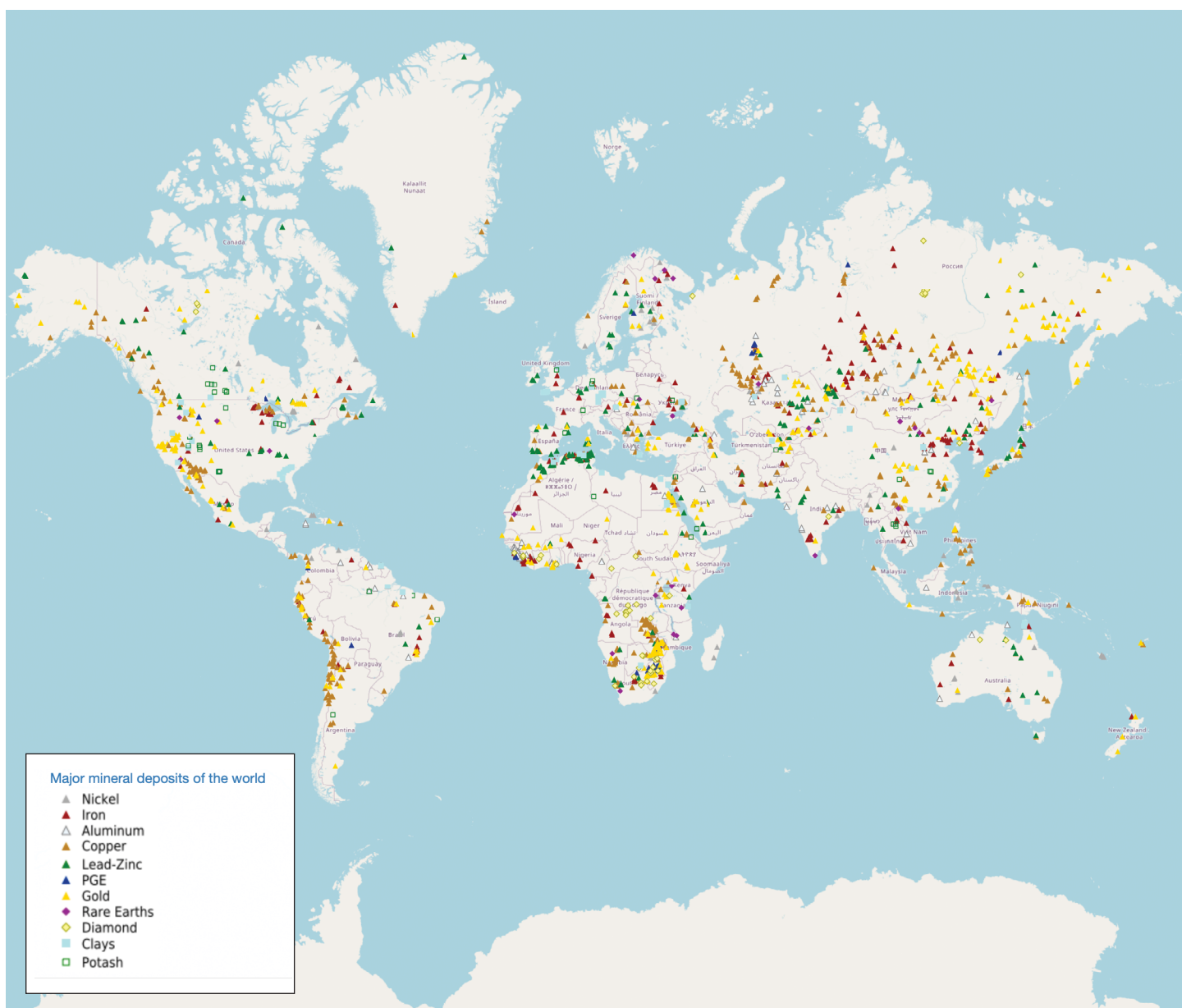
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The Relationship Between Geoscience Processes and Mineral Distribution

A Carolina Essentials™ Activity

Major Mineral Deposits of the World

(<https://mrdata.usgs.gov/general/map-global.html>)



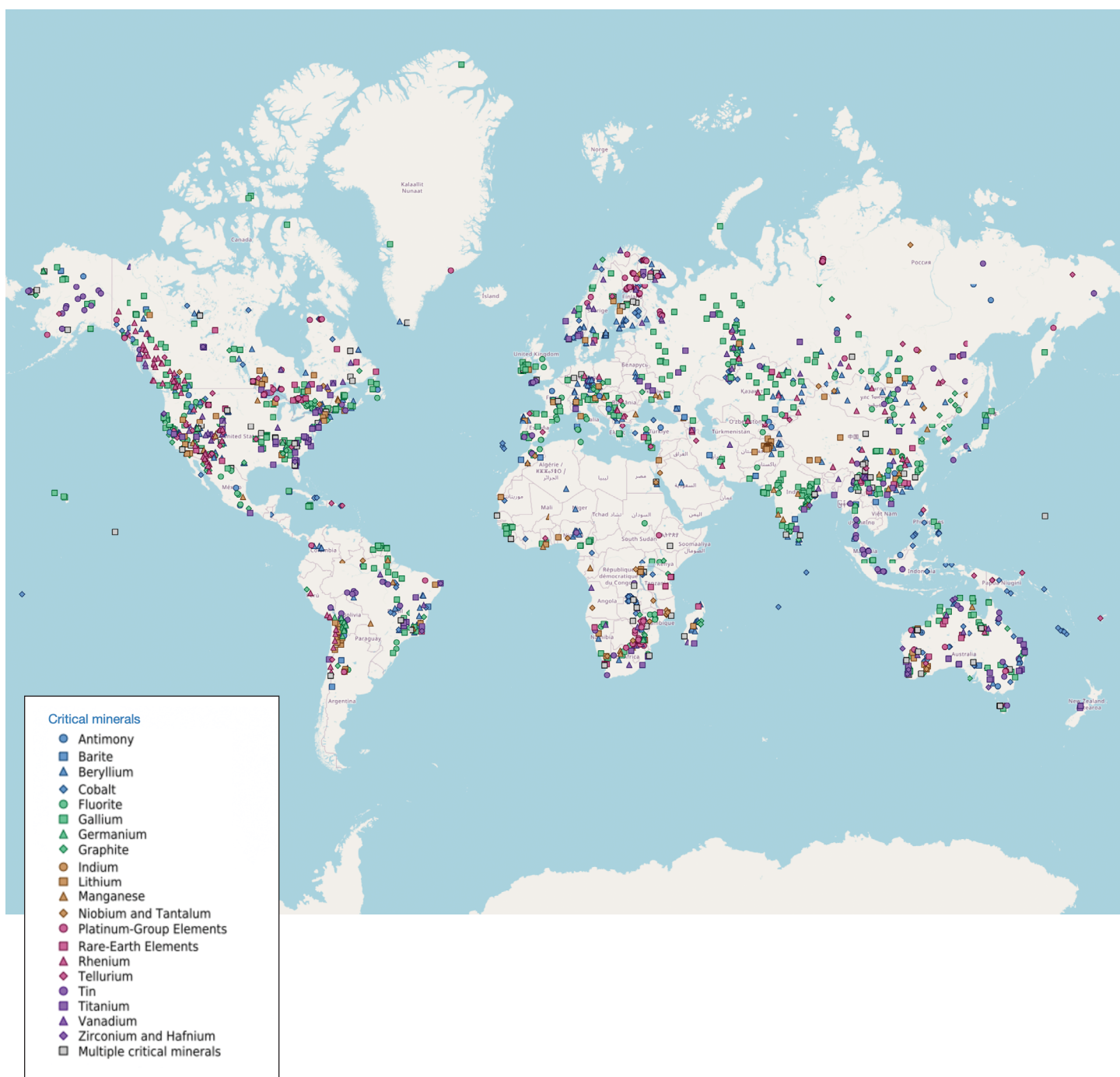
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The Relationship Between Geoscience Processes and Mineral Distribution

A Carolina Essentials™ Activity

Critical Mineral Deposits of the World

(<https://mrdata.usgs.gov/general/map-global.html>)



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The Relationship Between Geoscience Processes and Mineral Distribution

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Analysis

1. In 2–3 sentences, describe the distribution of minerals worldwide and how the distribution is associated with geoscience processes like mountain formation, earthquakes, volcanoes, and tectonic plate boundaries.

Mineral deposits are found worldwide but are not equally distributed. Deposits seem to clump in the mountain ranges. Most of the mountain ranges appear to be on or close to convergent plate boundaries and volcanoes.

2. Explain, based on evidence, how the uneven distribution of Earth's mineral resources is the result of past and current geoscience processes.

The evidence shows that mineral deposits are found worldwide but are not equally distributed. Deposits are found mostly in mountain ranges on or close to convergent plate boundaries and volcanoes. As colliding plates subduct and are uplifted, minerals are ejected by volcanic eruptions, crystalized in magma tubes, or brought nearer the surface through uplift and folding. Mineral deposits are not found in places where these geologic processes do not occur. Greenland, the Sahara Desert, and a large part of China are examples.

TEACHER NOTES