Young Naturalists

Teachers Guide

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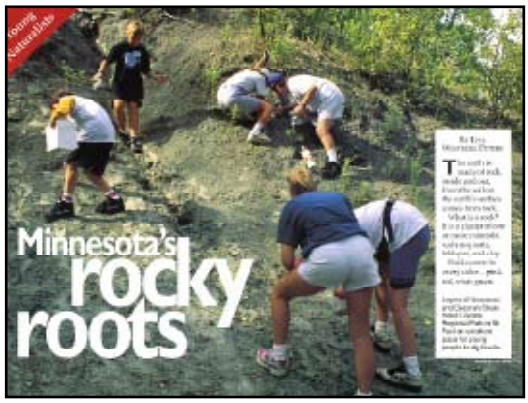
"Minnesota's Rocky Roots" Multidisciplinary Classroom Activities

Teachers guide for the Young Naturalists article "Minnesota's Rocky Roots," by Lisa Westberg Peters. Published in the September–October 1995 *Conservation Volunteer*, or visit www.dnr.state.mn.us/young_naturalists/rockyroots.



Young Naturalists teachers guides are provided free of charge to classroom teachers, parents, and students. This guide contains a brief summary of the article, suggested independent reading levels, word count, materials list, estimates of preparation and instructional time, academic standards applications, preview strategies and study questions overview, adaptations for special needs students, assessment options, extension activities, Web resources (including related Conservation Volunteer *articles), copy-ready study questions with answer key, and a copy-ready vocabulary sheet. There is also a practice quiz in Minnesota Comprehensive Assessments format. Materials may be reproduced and/or modified a to suit user needs. Users are encouraged to provide feedback through an online survey at www.dnr.state.mn.us/education/teachers/activities/ynstudyguides/survey.html.*

Summary

"Minnesota's Rocky Roots" introduces readers to the geology of Minnesota. Through photos, illustrations, graphics, and text, students learn how to identify the most common rocks of our state. Details include how rocks were formed, what they look like, where they are found, and, in some cases, what they are used for. A geologic timeline guides students from the Precambrian era to the present. See Web resources and Extension activities sections for connections to related topics of inquiry, including fossils, single-celled organisms, earthquakes, volcanoes, glaciers, and plate tectonics.

Suggested reading levels:

Fifth through ninth grade

Total words: 1,156

Materials: Print resources from your media center, poster board, colored pencils and markers, samples of the rocks described in the article.

Preparation time: One hour (not including extensions)

Estimated instructional time: Two to three 50-minute class periods (not including extensions)

Minnesota Academic Standards applications: "Minnesota's Rocky Roots" may be applied to the following Minnesota Department of Education Academic Standards:

Language Arts
- **I. Reading and Literature**
  - A. Word Recognition, Analysis and Fluency
  - B. Vocabulary Expansion
  - C. Comprehension
  - D. Literature
- **II. Writing**
  - A. Types of Writing
  - B. Elements of Composition
  - C. Spelling
  - D. Research
  - E. Handwriting and Word Processing
- **III. Speaking, Listening and Viewing**
  - A. Speaking and Listening
  - B. Media Literacy

Science
- **Grade 5**
  - **III. A. Earth and space science**
- **Grade 6**
  - **II. A. Physical science—Structure of matter**
  - **II. E. Physical science—Forces of nature**
- **Grade 8**
  - **III. A. Earth and space science**
- **Grade 9**
  - **IV. A. Life science—Cells**

Social Studies
- **Minnesota History Grades 4–8**
  - **II. A. Pre-contact to 1650**
- **Geography Grades 4–8**
  - A. Physical features of Minnesota
  - B. Maps and globes
  - C. Physical features and processes
  - D. Interconnections
- Geography Grades 9–12
  - B. Essential skills

Mathematics
- **I. Mathematical Reasoning**
- **II. Number Sense, Computation and Operations**

Arts
- Artistic expression—visual arts

Complete Academic Standards are available at www.education.state.mn.us. Teachers who find other connections to Minnesota Academic Standards are encouraged to contact the *Conservation Volunteer.*

Preview

Bring samples of rocks described in the article and pass them around the class. Ask each student to closely examine one rock. After they have handled their rock ask them to describe its texture, color, density, and shape. Explain that rocks have unique characteristics and that the article will help them understand why.

Ask students to preview the photos and timeline. Then use the **KWL** (Ogle, 1986) strategy to find out: (1) what students know **(K)** about rocks and related topics, such as earthquakes, glaciers, volcanoes, and continental drift; (2) what they want **(W)** to learn; and (3) (after you complete the lesson) what they learned **(L)**. Display your **K** and **W** ideas on poster board while you work with the article. Add to your **L** list as you read the article and engage in extension activities. See www.teach-nology.com/web_tools/graphic_org/kwl for a ready-to-use **KWL** organizer.

John Tester's excellent book, *Minnesota's Natural Heritage* (1995), provides a brief, readable description of Minnesota's glacial past and may serve as a good introduction to "Minnesota's Rocky Roots."

Vocabulary preview

Use the transparency-ready vocabulary list to preview geologic terms. You may wish to provide a copy to every student or to small groups. Students may also write the terms and definitions on flashcards to aid short-term recall. Following your preview of the article, and based on your knowledge of your students' needs, you may wish to add words to the vocabulary list. Words defined in the text are presented in the **Key Terms** list at the end of this guide.

Study questions overview

Study questions parallel the story (the answer to the first question appears first in the article, followed by the second, and so on). This is an important organizational tool for students and should be emphasized before you begin working on the study questions. Preview the entire study question section with your class before you read the article. You may wish to read the story aloud and complete the study questions in class or in small groups. The questions may be assigned as homework, depending on the reading ability of your students. Inclusion teachers may provide more direct support to special needs students (see Adaptations section, below). The study questions may also serve as a quiz. Note that questions 1, 5, 6, and 10 require inferential thinking.

Adaptations

Read aloud to special needs students. You may choose to abbreviate the study questions and then, if time allows, complete the remaining questions. For example, do items 1, 3, 7, 8, and 9 first. Peer helpers, paraprofessionals, or adult volunteers may lend a hand with the study questions. Flashcard drill may help students recall key vocabulary terms. With close teacher supervision, cooperative groups can also offer effective support to special needs students, especially for extension activities.

Assessment

You may use all or some of the study questions, combined with vocabulary, as a quiz. Other assessment ideas: (1) Students may create a three-column chart for igneous, sedimentary, and metamorphic rocks. In addition to listing examples of each, students may include descriptions of how each is formed, mineral composition, where it is found, and what it is used for. (2) Ask students to explain in a short essay how igneous, sedimentary, and metamorphic rocks are formed. (3) Students may investigate a Web site from the Web resources list and submit a written or oral report on how the site reinforces or adds to information in the article. (4) Advanced students may be asked to imagine Minnesota's topography if volcanoes, earthquakes, or glaciers had not occurred, and then write about it.

Extension activities

1. "Minnesota's Rocky Roots" provides an excellent opportunity to take your students on a rock-collecting expedition. Since glaciers covered nearly the entire state, you may be able to find examples of moraines, kames, and eskers near your school. You may also wish to arrange a field trip to one of the sites featured in the article. Sketches of the topography could apply not only to art class, but also to projects in science and social studies. Your local DNR office may be able to help arrange field trips and guest speakers.
2. Expand upon the article by investigating a related topic, such as fossils, earthquakes, volcanoes, plate tectonics, glaciers, mining, or single-celled organisms. Poster projects with brief presentations are an excellent vehicle for allowing students to demonstrate what they have learned.
3. Iron mining has long been a major industry in northeastern Minnesota. For schools in that area, a field trip to Iron World in Chisholm would be a great extension activity.
4. Coal mining and burning is a current environmental issue. How does coal mining relate to the article? Split the class into pro and con coal burning groups to debate the topic.
5. The timeline offers an opportunity to work with large numbers. For example, ask students to calculate the difference in age between the oldest and newest rocks in Minnesota. For a greater challenge students may, for each number on the timeline, calculate the percentage of 6 billion years each comprises. Mammals have inhabited Earth for less than 1 percent of Earth's existence.

Web resources

There is a wealth of information about geology online. Web searches of key geologic terms will yield dozens of excellent sites. Many are interactive

Fossils
pubs.usgs.gov/gip/fossils/contents.html

Continental drift/plate tectonics
kids.earth.nasa.gov/archive/pangaea
www.ucmp.berkeley.edu/geology/tectonics.html

Mining
www.ironworld.com

Rocks
www.rocksforkids.com
www.fi.edu/tfi/units/rocks/rocks.html
www.fi.edu/fellows/fellow1/oct98/create
Volcanoes
www.geology.sdsu.edu/how_volcanoes_work/
Earthquakes
www.crustal.ucsb.edu/ics/understanding/
Glaciers
nsidc.org/glaciers
pubs.usgs.gov/fs/2005/3056

Many related *Conservation Volunteer* articles are available online at www.dnr.state.mn.us/volunteer/articles. Some more recent articles related to geology include:

May–June 2005
"Roving Boulders"
www.dnr.state.mn.us/volunteer/mayjun05/boulders.html

September–October 2003
"Mirrors of Minnesota"
www.dnr.state.mn.us/young_naturalists/symbols

July–August 2002
"Life in a Jar"
www.dnr.state.mn.us/young_naturalists/pond_life

September–October 2002
"The Universe Underfoot"
www.dnr.state.mn.us/young_naturalists/soil

November–December 2002
"Conservation Careers"
www.dnr.state.mn.us/young_naturalists/careers

References

Ogle, D.S. *K-W-L Group Instructional Strategy.* In A.S. Palincsar, D.S. Ogle, B.F. Jones, and E.G. Carr (Eds.), Teaching Reading as Thinking (Teleconference Resource Guide, pp.11–17). Alexandria, Va: Association for Supervision and Curriculum Development, 1986.

Tester, John R. *Minnesota's Natural Heritage: An Ecological Perspective.* Minneapolis: University of Minnesota Press, 1995.

Study Questions

"Minnesota's Rocky Roots," by Lisa Westberg Peters
Minnesota Conservation Volunteer, September–October 1995
www.dnr.state.mn.us/young_naturalists/rockyroots

Name_____Period_____Date_____

1. Why are rocks important to life on Earth? _____

_____

_____

_____

2. Matching: Write the corresponding letter in the blank.

_____ minerals	a. black, pillow-shaped
_____ magma	b. rocks are made of
_____ lava	c. hardened mud
_____ igneous rock	d. molten rock underground
_____ metamorphic rock	e. hardened lava
_____ sedimentary rock	f. heated or squeezed
_____ basalt	g. water and basalt
_____ greenstone	h. molten rock above ground

3. Describe the processes through which igneous, metamorphic, and sedimentary rocks are formed. _____

_____

_____

4. The first life form on Earth was: _____

5. Long ago Minnesota was a mountainous place. What happened to the mountains? _____

_____

6. At one time the climate of Minnesota was hot and humid throughout the year. Why? _____

_____

_____

7. Why is Minnesota a good place to look for fossils? _____

_____

_____

8. Describe the role glaciers played in forming present-day Minnesota. _____

_____

_____

9. List at least three ways rocks are used today. _____

_____

_____

10. Why do you think the agate is our state rock? _____

_____

_____

Study Questions Answer Key

"Minnesota's Rocky Roots," by Lisa Westberg Peters
Minnesota Conservation Volunteer, September–October 1995
www.dnr.state.mn.us/young_naturalists/rockyroots

1. Why are rocks important to life on Earth? **Answers will vary, but may include: Earth is made of rock, so without rock there would be no Earth; soil is made of rock and without soil we could not grow the plants we need to survive.**

2. Matching: Write the corresponding letter in the blank.

b minerals
d magma
h lava
e igneous rock
f metamorphic rock
c sedimentary rock
a basalt
g greenstone

3. Describe the processes through which igneous, metamorphic, and sedimentary rocks are formed. **Igneous rock is formed by lava as it cools and hardens. Metamorphic rock is formed deep inside the earth when igneous or sedimentary rock is heated or squeezed. Sedimentary rock forms when layers of sand or mud accumulate on the bottom of the sea and eventually harden.**

4. The first life form on Earth was **bacteria.**

5. Long ago Minnesota was a mountainous place. What happened to the mountains? **Weather and glaciers wore the high places down, and low places filled with sediment.**

6. At one time the climate of Minnesota was hot and humid throughout the year. Why? **The continent was at the equator, where the climate is always hot and humid. [Challenge students to explain why it is so hot at the equator.]**

7. Why is Minnesota a good place to look for fossils? **The land was flooded by seas many times. The remains of plants and animals accumulated in sediments and are now found in sedimentary rocks.**

8. Describe the role glaciers played in forming present-day Minnesota. **Glaciers piled up large rocks and mounds of gravel when they melted. They wore away the soil from the north and left it in the south, and moved soil from high places to low places. Some lakes were formed in holes left by glaciers.**

9. List at least three ways rocks are used today. **Answers will vary and may include building stones, landscape stones and boulders, gravestones, statues, marble floors, and countertops.**

10. Why do you think the agate is our state rock? **Answers will vary and may include: It is beautiful and plentiful in our state. It is not found in many other states.**

Minnesota Comprehensive Assessments Practice Items

"Minnesota's Rocky Roots," by Lisa Westberg Peters
Minnesota Conservation Volunteer, September–October 1995
www.dnr.state.mn.us/young_naturalists/rockyroots

Name _____Period _____Date_____

1. Long ago geologists believe northern Minnesota was
   A. part of South America.
   B. a chain of volcanic islands.
   C. the bottom of a shallow sea.
   D. a rugged mountain range.

2. Minnesota's iron ore was formed
   A. from animal and plant remains.
   B. 100 years ago.
   C. on dry plains.
   D. from volcanic sediments at the bottom of the sea.

3. Six hundred millions years ago the climate of Minnesota was
   A. hot.
   B. cold.
   C. both hot and cold.
   D. much like it is today.

4. Some Minnesota lakes were
   A. formed by glaciers.
   B. formed by volcanoes.
   C. formed by earthquakes.
   D. formed by continental drift.

5. The oldest rock in Minnesota is
   A. sedimentary.
   B. metamorphic.
   C. agates.
   D. sandstone.

Minnesota Comprehensive Assessments Practice Items Answer Key

"Minnesota's Rocky Roots," by Lisa Westberg Peters
Minnesota Conservation Volunteer, September–October 1995
www.dnr.state.mn.us/young_naturalists/rockyroots

1. Long ago geologists believe northern Minnesota was **B. a chain of volcanic islands**.
2. Minnesota's iron ore was formed **D. from volcanic sediments at the bottom of the sea**.
3. Six hundred millions years ago the climate of Minnesota was **A. hot**.
4. Some Minnesota lakes were **A. formed by glaciers**.
5. The oldest rock in Minnesota is **B. metamorphic**.

Vocabulary

"Minnesota's Rocky Roots," by Lisa Westberg Peters
Minnesota Conversation Volunteer, September–October 1995
www.dnr.state.mn.us/young_naturalists/rockyroots

complex	complicated
equator	circle dividing Earth into northern and southern hemispheres
erode	to wear away by the action of water, wind, or glaciers
feldspar	crystalline minerals that consist of aluminum silicates and potassium, sodium, calcium, or barium
fossils	remains, impressions, or traces of plants or animals preserved in Earth's crust
geology	study of Earth's history as recorded in rocks
mineral	solid, crystalline chemical element resulting from the inorganic processes of nature
molten	liquefied by heat
quartz	silicon dioxide

Key Terms

"Minnesota's Rocky Roots," by Lisa Westberg Peters
Minnesota Conservation Volunteer, September–October 1995
www.dnr.state.mn.us/young_naturalists/rockyroots

These terms are defined in "Minnesota's Rocky Roots."

igneous rock	hardened lava
lava	molten rock at Earth's surface
metamorphic rock	heated and squeezed igneous or sedimentary rock
sedimentary rock	hardened layers of sand or mud