

# Teachers Guide

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## “Agate Hounds” Multidisciplinary Classroom Activities

Teachers guide for the Young Naturalists article “Agate Hounds” by Kate Redpath. Published in the July–August 2011 *Minnesota Conservation Volunteer*, or visit [www.mndnr.gov/young\\_naturalists/agates](http://www.mndnr.gov/young_naturalists/agates).

*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 and vocabulary study cards. There is also a practice quiz (with answer key) in Minnesota Comprehensive Assessments format. Materials may be reproduced and/or modified to suit user needs. Users are encouraged to provide feedback through an online survey at [www.mndnr.gov/education/teachers/activities/ynstudyguides/survey.html](http://www.mndnr.gov/education/teachers/activities/ynstudyguides/survey.html).*

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### Summary

In “Agate Hounds,” readers will learn the basics of agate formation, types of agates, and how to collect agates. Teachers may also use this article to address earth science standards (rocks and minerals, volcanoes and glaciers).

### Suggested reading levels:

intermediate through middle/junior high school grades

### Total words:

1,112

### Materials:

rock/mineral samples (agates, quartz, silica, hematite, chalcedony), rock tumbler, paper, poster board, colored pencils, crayons, pens, markers, stone jewelry making supplies (see Web resources), as well as print and online resources your media specialist may provide.

### Preparation time:

One to two hours, not including time for extension activities

### Estimated instructional time:

One or two 50-minute class periods (not including extensions)

[www.mndnr.gov/young\\_naturalists/agates](http://www.mndnr.gov/young_naturalists/agates)

## “Agate Hounds”—Teachers Guide

### Minnesota Academic Standards Applications:

“Agate Hounds” may be applied to the following Minnesota Department of Education standards:

#### **Language Arts**

##### **Reading Benchmarks**

##### **Informational Text K–5; 6–12**

- Key Ideas and Details
- Craft and Structure
- Integration of Knowledge and Ideas
- Range of Reading and Level of Text Complexity

##### **Foundational Skills K–5**

- Phonics and Word Recognition
- Fluency

##### **Writing Benchmarks K–5; 6–12**

- Text Types and Purposes
- Writing Process (6–12: Production and Distribution of Writing)
- Research to Build and Present Knowledge
- Range of Writing

##### **Speaking, Viewing, Listening and**

##### **Media Literacy Benchmarks K–5**

- Comprehension and Collaboration
- Presentation of Knowledge and Ideas
- Media Literacy

##### **Language Benchmarks K–5**

- Conventions of Standard English
- Knowledge of Language
- Vocabulary Acquisition and Use

##### **Reading Benchmarks: Literacy in Science and Technical Subjects 6–12**

- Key Ideas and Details
- Craft and Structure
- Integration of Knowledge and Ideas

Range of Reading and Level of Text Complexity

##### **Writing Benchmarks: Literacy in History/Social Studies, Science and Technical Subjects 6–12**

- Text Types and Purposes
- Writing Process: Production and Distribution of Writing
- Research to Build and Present Knowledge
- Range of Writing

##### **Social Studies Grades 4–8**

Minnesota History: II, E, F and G

##### **Science**

###### **Grade 3**

4.3.1.3.1; 4.3.1.3.2: Earth and Space Science

###### **Grade 5**

5.3.1.2.1; 5.3.1.2.2: Earth and Space Science

###### **Grade 8**

8.3.1.1.3; 8.3.1.2.1; 8.3.1.2.2; 8.3.1.3.2; 8.3.1.3.3: Earth and Space Science

##### **Mathematics Grade 3**

3.4.1.1: Data Analysis

###### **Grade 4**

4.1.1.2: Number & Operation  
4.4.1.1: Data Analysis

###### **Grade 8**

8.1.1.5: Number & Operation

##### **Arts Grades K–12**

1. Artistic Foundations: Visual Arts
2. Artistic Process: Create or Make: Visual Arts
3. Artistic Process: Perform or Present: Visual Arts
4. Artistic Process: Respond or Critique: Visual Arts

Current, complete Minnesota Academic Standards are available at [www.education.state.mn.us](http://www.education.state.mn.us). Teachers who find other connections to standards are encouraged to contact *Minnesota Conservation Volunteer*.

## “Agate Hounds”—Teachers Guide

**Preview** Ask students to survey the article. Examine the photographs. If you have samples of agates and other minerals mentioned in the article, pass them around. Use the **KWL** strategy (Ogle, 1986) to find out what your students already know (**K**) about agates, minerals, and geological processes; what they would like to learn (**W**); and eventually what they learned (**L**) while reading the article and related materials and through participating in extension activities. You might begin by asking small groups to brainstorm their ideas. Then combine the groups’ data to make a class list. Display your **K** and **W** ideas on poster board or paper (see Vocabulary preview). Add to your **L** list as you read and discuss the article. See [www.technology.com/web\\_tools/graphic\\_org/kwl](http://www.technology.com/web_tools/graphic_org/kwl) for a KWL generator that will produce individual organizers for your students, which may be used to record answers to **W** questions. KWL also gives you the opportunity to introduce interdisciplinary connections you will make during extension activities. If you use the article in math, science, or art class, you may wish to focus your prereading discussion on academic standards that apply for that class. Another strategy for accessing prior knowledge is a brainstorming web. You may download a printable web at [http://www.teachervision.fen.com/tv/printables/TCR/0743932080\\_007.pdf](http://www.teachervision.fen.com/tv/printables/TCR/0743932080_007.pdf).

**Vocabulary preview** See the copy-ready vocabulary list included in this guide. You may wish to modify the list based on your knowledge of your students’ needs or the subject you are teaching. Pretesting vocabulary individually, in small groups, or with your entire class can be an effective vocabulary preview strategy. You may then post-test at the conclusion of this activity (see Assessment section below).

You may wish to use the study cards found at the end of this guide. Cut along the horizontal line, fold in the middle, and tape or staple. Study cards (see *Strategic Tutoring*, Hock, Deshler, and Schumaker 2000) can be applied to any subject area. On one side of the card, in large letters, write a key word or phrase students are expected to know. In smaller letters, frame the word or phrase in a question or statement. On the other side of the card, in large letters, write the answer to the question. Finally, in smaller letters, frame the answer in a question or statement. Blanks are provided to allow you or your students to add new words or phrases.

**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). Preview the entire guide with your class before you read the article. You may wish to read the story aloud and complete the study questions in class, in small groups, or as an independent activity. 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). The study questions may be also used as a quiz. Note: Items 3, 4, 5, 6, 8, and 12 and the Challenge require varying degrees of critical thinking.

**Adaptations** Read aloud to special needs students. Abbreviate the study questions or highlight priority items to be completed first. If time allows, remaining items may be attempted. Peer helpers, paraprofessionals, or adult volunteers may lend a hand with the study questions. 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 part of the study guide, combined with vocabulary, as a quiz. Other assessment ideas include: (1) Students may write an essay describing how agates are formed. (2) Have students write multiple-choice, true-false, or short-answer questions, then select the best items for a class quiz. (3) Poster presentations may display one or more of the following: a map of Minnesota indicating where agates are found, how agates are formed, three types of agates, and clues agate hounds use to find agates. (4) Ask students to identify different types of agates, quartz, hematite, and silica in photos or, if possible, in samples.

## “Agate Hounds”—Teachers Guide

### Extension activities

1. Invite a DNR lands and minerals specialist to visit your classroom to present information about one or more of the topics in the article. See [www.dnr.state.mn.us/lands\\_minerals/index.html](http://www.dnr.state.mn.us/lands_minerals/index.html).
2. Many state parks offer information about the geology of the park. Contact park naturalists to schedule visits and programs. See [www.dnr.state.mn.us/education/geology/digging/stateparks.html](http://www.dnr.state.mn.us/education/geology/digging/stateparks.html)
3. “Minnesota’s Rocky Roots” is an excellent companion to this article (see Related Articles). MCV has published many articles on mining you may use to supplement your Minnesota History curriculum, all of which are now available as PDF documents at [www.mndnr.gov/magazine](http://www.mndnr.gov/magazine) (click on past issues).
4. Challenge students to dig deeper into one or more of the topics in this article. See Web resources for links to agates, chalcedony, glaciers, volcanoes, minerals, and mining. Research papers or poster presentations are two ways students can share what they learn.
5. Geologic time deals with big numbers. You may wish to design a math activity around a time line of Minnesota’s geological history. See Web resources for lesson plans.
6. The “Ice Cream” lesson plan in Web resources will give your students a hands-on experience in the behavior of glaciers.
7. Many students will enjoy making stone jewelry, a popular hobby with rock hounds and a good way to learn about semi-precious stones.

### Web resources

#### Minnesota DNR

[www.mndnr.gov/lands\\_minerals/index.html](http://www.mndnr.gov/lands_minerals/index.html)  
[www.mndnr.gov/education/geology/digging/index.html](http://www.mndnr.gov/education/geology/digging/index.html)  
[www.mndnr.gov/education/geology/digging/agate.html](http://www.mndnr.gov/education/geology/digging/agate.html)  
[www.mndnr.gov/geologyrec/index.html](http://www.mndnr.gov/geologyrec/index.html)

#### Lake Superior Agates

[www.dayooper.com/LSAgates.htm](http://www.dayooper.com/LSAgates.htm)  
[lakesuperioragate.com/](http://lakesuperioragate.com/)  
[www.superiortrails.com/rock-hound2.html](http://www.superiortrails.com/rock-hound2.html)

#### Chalcedony

[en.wikipedia.org/wiki/Chalcedony](http://en.wikipedia.org/wiki/Chalcedony)  
[www.minerals.net/mineral/chalcedony.aspx](http://www.minerals.net/mineral/chalcedony.aspx)  
[www.mindat.org/min-960.html](http://www.mindat.org/min-960.html)

#### Glaciers

[mysciencehub.com/Earth%20%26%20Space%20Systems/Resources/MN.History.pdf](http://mysciencehub.com/Earth%20%26%20Space%20Systems/Resources/MN.History.pdf)  
[www.d.umn.edu/~pmorton/4110/notes/001\\_Mn\\_Quaternary.pdf](http://www.d.umn.edu/~pmorton/4110/notes/001_Mn_Quaternary.pdf)  
[serc.carleton.edu/sp/mnstep/activities/26539.html](http://serc.carleton.edu/sp/mnstep/activities/26539.html) (Lesson plan)

#### Volcanoes

[vulcan.wr.usgs.gov/LivingWith/VolcanicPast/Places/volcanic\\_past\\_minnesota.html](http://vulcan.wr.usgs.gov/LivingWith/VolcanicPast/Places/volcanic_past_minnesota.html)  
<https://sites.google.com/a/stumail.hopkins.k12.mn.us/mn-geology/home/northwestern-mn-newdeal.feri.org/guides/mn/ch02.htm>

#### Minerals and Mining

[www.ironrangeresources.org/mining-timber/minerals](http://www.ironrangeresources.org/mining-timber/minerals)  
[www.tigerminerals.com/mn.htm](http://www.tigerminerals.com/mn.htm)  
[www.minnesotamineralclub.org/](http://www.minnesotamineralclub.org/)

## “Agate Hounds”—Teachers Guide

### Web resources continued

#### Geologic Time

[www.enchantedlearning.com/subjects/Geologictime.html](http://www.enchantedlearning.com/subjects/Geologictime.html)  
[geology.com/time.htm](http://geology.com/time.htm)  
[msteacher.org/epubs/science/science16/geo\\_lessons.aspx](http://msteacher.org/epubs/science/science16/geo_lessons.aspx)  
[geology.com/teacher/](http://geology.com/teacher/)

#### Rock Tumblers and Jewelry Making

[geology.com/rock-tumbler/](http://geology.com/rock-tumbler/)  
[www.rocktumblinghobby.com/](http://www.rocktumblinghobby.com/)  
[www.ehow.com/how\\_4777571\\_make-jewelry-rocks.html](http://www.ehow.com/how_4777571_make-jewelry-rocks.html)

### Related articles

Related *Minnesota Conservation Volunteer* Young Naturalists articles are available online at [www.mndnr.gov/volunteer/articles/index.html](http://www.mndnr.gov/volunteer/articles/index.html), including:

#### September-October 1995

“Minnesota’s Rocky Roots”

[www.mndnr.gov/young\\_naturalists/rockyroots/index.html](http://www.mndnr.gov/young_naturalists/rockyroots/index.html) (YN article with teachers guide)

#### March-April 2002

“Geological Wonders”

[www.mndnr.gov/volunteer/marapr02/geological.html](http://www.mndnr.gov/volunteer/marapr02/geological.html)

#### September-October 2003

“Mirrors of Minnesota”

[www.mndnr.gov/young\\_naturalists/symbols/index.html](http://www.mndnr.gov/young_naturalists/symbols/index.html) (YN article with teachers guide)

#### January-February 2004

“A Really Big Nugget”

[www.mndnr.gov/volunteer/janfeb04/fnnugget.html](http://www.mndnr.gov/volunteer/janfeb04/fnnugget.html)

#### March-April 2005

“Living in the Rock”

[www.mndnr.gov/volunteer/marapr05/rock.html](http://www.mndnr.gov/volunteer/marapr05/rock.html)

#### May-June 2005

“Roving Boulders”

[www.mndnr.gov/volunteer/mayjun05/boulders.html](http://www.mndnr.gov/volunteer/mayjun05/boulders.html)

#### July-August 2005

“Adventure Underground”

[www.mndnr.gov/volunteer/julaug05/underground.html](http://www.mndnr.gov/volunteer/julaug05/underground.html)

#### March-April 2008

“Drop into History”

[www.mndnr.gov/volunteer/marapr08/drop\\_into\\_history.html](http://www.mndnr.gov/volunteer/marapr08/drop_into_history.html)

### References

Hock, M.F., Deshler, D.D., and Schumaker, J.B. *Strategic Tutoring*. Lawrence, Kan.: Edge Enterprises, 2000.  
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.

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## Study Questions

Teachers guide for the Young Naturalists article “Agate Hounds” by Kate Redpath. Published in the July–August 2011 *Minnesota Conservation Volunteer*, or visit [www.mndnr.gov/young\\_naturalists/agates](http://www.mndnr.gov/young_naturalists/agates)

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Name \_\_\_\_\_ Period \_\_\_\_\_ Date \_\_\_\_\_

1. Agates are composed primarily of two minerals, \_\_\_\_\_ and \_\_\_\_\_.

2. Agates are 1 billion years old. Where have they been for most of that time? \_\_\_\_\_

\_\_\_\_\_

3. Why do you suppose agates were selected as the Minnesota state gemstone? \_\_\_\_\_

\_\_\_\_\_

4. The events below are mixed up. Put them in the correct order (1, 2, 3, ...).

- \_\_\_\_\_ Hot water filled the spaces left by air bubbles.
- \_\_\_\_\_ A huge crack formed from Kansas to Lake Superior.
- \_\_\_\_\_ Water drained from the spaces left by air bubbles.
- \_\_\_\_\_ Lava poured from the crack.
- \_\_\_\_\_ Air bubbles formed near the surface of the lava.
- \_\_\_\_\_ The lava cooled.
- \_\_\_\_\_ Chalcedony, tinted with iron in colorful bands, was left behind.

5. What makes Lake Superior agates unique? \_\_\_\_\_

\_\_\_\_\_

6. Why is agate collecting a popular hobby? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

7. All Lake Superior agates are found near Lake Superior. True False

8. Explain how glaciers are related to agates. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

9. True or false: If the item is false, provide the correct answer.

Most agates weigh over five pounds. T F \_\_\_\_\_

All agates are red. T F \_\_\_\_\_

Light may shine through some agates. T F \_\_\_\_\_

Agates are layered, like onions. T F \_\_\_\_\_

10. Match the description to the variety of agate:

Eye agate \_\_\_\_\_ a. stacks of parallel lines

Fortification agate \_\_\_\_\_ b. small, circular patterns

Water-level agate \_\_\_\_\_ c. bands like tree rings

11. Name three places where agates may be found. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

12. Why are Rob and his friends keeping a secret? \_\_\_\_\_

\_\_\_\_\_

*Challenge:* What does the process of erosion have to do with agates? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## Study Questions Answer Key

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1. Agates are composed primarily of two minerals, **quartz and hematite**.
  2. Agates are 1 billion years old. Where have they been for most of that time? **Buried under ice, water, or soil.**
  3. Why do you suppose agates were selected as the Minnesota state gemstone? **Responses may vary. Agates are common in Minnesota. They are beautiful, are somewhat rare, and have value.**
  4. The events below are mixed up. Put them in the correct order (1, 2, 3, ...).
    - 5 - **Hot water filled the spaces left by air bubbles.**
    - 1 - **A huge crack formed from Kansas to Lake Superior.**
    - 6 - **Water drained from the spaces left by air bubbles.**
    - 2 - **Lava poured from the crack.**
    - 4 - **Air bubbles formed near the surface of the lava.**
    - 3 - **The lava cooled.**
    - 7 - **Chalcedony, tinted with iron in colorful bands, was left behind.**
  5. What makes Lake Superior agates unique? **Responses may vary. Their most important characteristic is their reddish color.**
  6. Why is agate collecting a popular hobby? **Responses may vary. Collecting anything is fun and challenging. Agates are beautiful. Each one is unique. They can be valuable. They can be used to make jewelry.**
  7. All Lake Superior agates are found near Lake Superior. **False.**
  8. Explain how glaciers are related to agates. **Glaciers are the main reason we can find agates today. Glaciers exposed agates by pushing aside soil and breaking open lava rocks where agates were formed.**
  9. True or false: If the item is false, provide the correct answer.
    - Most agates weigh over five pounds. **F Most agates weigh a few ounces.**
    - All agates are red. **F Agates occur in many colors.**
    - Light may shine through some agates. **T**
    - Agates are layered, like onions. **T**
  10. Match the description to the variety of agate: **Eye agate b. small, circular patterns; Fortification agate c. bands like tree rings; Water-level agate a. stacks of parallel lines**
  11. Name three places where agates may be found. **Agates may be found throughout northeastern and north-central Minnesota and in northwestern Wisconsin.**
  12. Why are Rob and his friends keeping a secret? **Responses may vary. They don't want other agate hounds to compete for agates.**
- Challenge:* What does the process of erosion have to do with agates? **Erosion is the wearing away of the earth's surface by wind, water, and ice. All three forces have worked to expose agates trapped in volcanic rocks. Ice in glaciers scraped away soils, broke lava apart, and exposed lava to the elements. Freezing and thawing broke lava into smaller pieces, while wind and moving water further exposed the agates contained within. Erosion continues, so new agates will appear.**

**Minnesota Comprehensive Assessments Practice Items**

Teachers guide for the Young Naturalists article “Agate Hounds” by Kate Redpath. Published in the July–August 2011 *Minnesota Conservation Volunteer*, or visit [www.mndnr.gov/young\\_naturalists/agates](http://www.mndnr.gov/young_naturalists/agates)

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Name \_\_\_\_\_ Period \_\_\_\_\_ Date \_\_\_\_\_

1. Bull’s-eye might be used as another name for what type of agate?

- A. fortification agate
- B. eye agate
- C. water-level agate
- D. circular agate

2. The Agate and Geological Center is located in

- A. Duluth
- B. Moose Lake State Park
- C. Lake Bemidji State Park
- D. Pipestone Monument

3. Are agate hounds prospecting? Why or why not?

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4. Rock tumblers are used to

- A. locate large Lake Superior agates.
- B. separate agates from other rocks.
- C. polish rocks.
- D. identify agates.

5. What two minerals are responsible for the Lake Superior agate’s reddish color?

- A. iron and chalcedony
- B. iron and silica
- C. iron and silver
- D. iron and gold

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### Minnesota Comprehensive Assessments Answer Key

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1. Bull’s-eye might be used as another name for what type of agate? **B. eye agate**
2. The Agate and Geological Center is located in **B. Moose Lake State Park**
3. Are agate hounds prospecting? Why or why not? **Responses may vary. Rock hounds are searching for minerals of value, which make them prospectors**
4. Rock tumblers are used to **C. polish rocks.**
5. What two minerals are responsible for the Lake Superior agate’s reddish color? **A. iron and chalcedony**

## “Agate Hounds”—Teachers Guide

### Vocabulary

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<b>chalcedony</b>	a type of quartz common in semiprecious gems
<b>erosion</b>	wearing away of rock
<b>geologist</b>	one who studies rocks and minerals
<b>hematite</b>	iron ore
<b>minerals</b>	materials that are mined from the earth
<b>molten</b>	in liquid form; melted
<b>percolate</b>	pass a liquid through a filter slowly
<b>prospector</b>	someone who searches for minerals
<b>quartz</b>	a common crystalline mineral made of silicon and oxygen
<b>rock tumbler</b>	rotating barrel in which rocks are polished
<b>silica</b>	naturally occurring silicon dioxide; most commonly found as sand or quartz

# “Agate Hounds”—Teachers Guide

## Vocabulary Study Cards

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Cut along the horizontal lines, fold in the middle and tape or staple. Blanks are provided to allow you or your students to add new words or phrases.

What is  
**chalcedony?**

FOLD HERE

**A type of quartz common  
in semiprecious gems is called**

**Erosion is**

FOLD HERE

**Wearing away of rock is called**

**A geologist is**

FOLD HERE

**One who studies rocks and  
minerals is a**

What is  
**hematite?**

FOLD HERE

**The scientific name for  
iron ore is**

What are  
**minerals**?

FOLD HERE

**Materials that are mined  
from the earth** are referred to as

**Molten** means

FOLD HERE

**In liquid form or melted** is

What does **percolate** mean?

FOLD HERE

**To pass a liquid through a  
filter slowly** is to

A **prospector** is

FOLD HERE

**Someone who searches  
for minerals** is a

What is  
**quartz**?

FOLD HERE

**A common crystalline mineral  
made of silicon and oxygen  
is called**

What is a  
**rock tumbler?**

FOLD HERE

**A rotating barrel in which rocks  
are polished is a**

What is  
**silica?**

FOLD HERE

**Naturally occurring silicon  
dioxide most commonly found as  
sand or quartz is called**

FOLD HERE

FOLD HERE

FOLD HERE