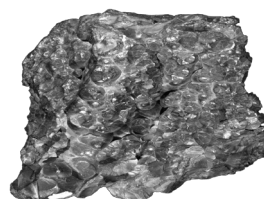


# Geology

## *Helper's Guide*



# 4-H Geology Project

## Note for 4-H Members

Studying and learning about geology is fun for everyone. Since geologic features exist everywhere, you can study geology wherever you live. The Indiana 4-H *Geology* curriculum was written for youth who enjoy studying rocks, fossils, and minerals, especially for those who want to learn more. The first manual, Level 1, introduced you to rocks, fossils, and minerals. Level 2 continues this study in more detail. Level 3 introduces more advanced topics. The key to learning with any 4-H project is for you to enjoy your studies and to learn at your own pace. We hope this study is just the start of a lifetime enjoyment of geology. You can enhance your learning experience by using other resources from the Internet, school, or a local library. See the “Resources” section at the back of the manual for recommended publications.

To complete this project we suggest that you purchase the booklet *Let's Look at Rocks*. It has information about many of the topics introduced in this manual and color pictures that are very helpful with identification. The “Resources” section has information about where you can get the publication.

## Note to Parents and Project Leaders

The 4-H Geology project offers many educational experiences, from collecting and identifying rocks to learning how the earth was formed. Parents can be a big help if they are involved with their children's learning, especially for younger 4-H members. If you can sit in on meetings and ask what they learned and what they did not understand, it will help your child have a much better experience. Kids will be much more excited to learn if they have parental support and interest in what they are doing. As they mature, youth should take on more responsibility. Parent involvement is still important with youth in grades 6-8. Show interest in what they are learning and doing. Your interest will reinforce what they learn at meetings and workshops. The geology experience will be more rewarding for your child at any age if you can take trips to collection sites; gem, mineral, and fossil shows; museums; and other special events. These field trips allow youth to speak with professionals, have hands-on experiences, and obtain specimens for their collections.

General information about the Indiana natural resource projects, including Frequently Asked Questions and exhibit pictures from the Indiana State Fair are available at: [www.four-h.purdue.edu/natural\\_resources/](http://www.four-h.purdue.edu/natural_resources/)

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When looking for rocks – did you think of what you can find at your local building and supply company? You can find marble, sand, gypsum, lava, granite, slate, and others. Take a look at the rock pillars at Menard’s, you might be surprised what you see!

# Learning Goals

## 4-H Geology Level 1

- Begin to learn about rocks, minerals, and fossils
- Develop an understanding of, and an appreciation for, earth science
- Exhibit work to others in an engaging manner

## 4-H Geology Level 2

- Learn more about rocks, minerals, and fossils
- Learn about the importance of keeping records
- Develop an understanding of, and an appreciation for, earth science
- Exhibit work to others in an engaging manner

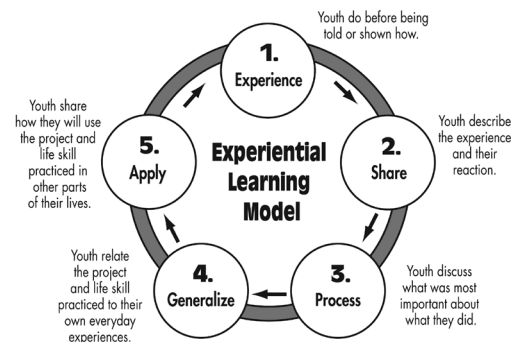
## 4-H Geology, Level 3

- Use resources beyond this manual for in-depth study of geology topics of interest
- Keep accurate records (field notes, journal)
- Expand understanding of and appreciation for earth science
- Educate others about geology through exhibits, presentations, action demonstrations, and mentor younger 4-H members

# 4-H Learning Using the Experiential Model

(Source: Excerpted and Adapted from “Experiential Learning in 4-H Project Experiences 4-H Volunteer Leaders’ Series,” University of Arkansas Cooperative Extension Service, Dr. Darlene Z. Baker. You may view the entire document at: <http://publications.uaex.edu/>. Search using the word – “experiential.”)

The Experiential Learning model is a way of teaching to help youth make the most of any activity that they experience. Experiential learning distinguishes 4-H activities from many other educational methods. Experiential learning is a process that allows youth to first learn by doing, before being told or shown how, and then process the experience. Activities are designed so youth experience a learning activity, share what they did, process what they did (discuss, analyze, reflect), generalize what they learned (to test the 4-H member’s comprehension and appreciation of the activity), and then think about how they can apply what they learned to other situations (generalize).



Pfeiffer, J.W., & Jones, J.E. "Reference Guide to Handbooks and Annuals" © 1983 John Wiley & Sons, Inc. Reprinted with permission of John Wiley & Sons, Inc.

The advantages of using the experiential learning process in group settings include:

- The adult can quickly assess the student’s knowledge of the subject.
- The student builds on past experience or knowledge.
- The adult is a coach rather than a teacher.
- The youth relate the experience to their own lives and experiences.
- Mentors may use a variety of methods to involve the youth in the experience.
- Youth with many different learning styles can be successful.
- Discussions can move from the concrete to the abstract and analytical, which is particularly beneficial for middle and high school students.
- Youth are stimulated to learn through discovery and to draw meaning from the experience.
- Youth can work together, share information, provide explanations, and evaluate themselves and others.
- Youth take responsibility for their own learning.

## Evaluation Rubric

Evaluating youth learning using a simple rubric (such as the one shown) can help 4-H volunteer leaders assess the effectiveness of their teaching methodology and youth interest. Evaluate each step of the experiential model by indicating what you think the 4-H members learned in a particular activity (your best guess). Work on improving any low scores.

<b>Step</b>	<b>Excellent</b>	<b>Average</b>	<b>Minimal</b>
Experience			
Share			
Process			
Generalize			
Apply			

## Youth Development Stages

Understanding the physical, mental, social, and emotional development of youth will help you when working with the 4-H members in your club. No two youth develop at the same rate and transitions are often gradual. Your teaching and involvement helps 4-H club members grow and mature and makes 4-H a rewarding and fulfilling experience.

Activities at 4-H club meetings are not always as successful as you, the volunteer leader, had planned. Sometimes youth talk among themselves rather than listening to you; sometimes no one comes to a planned field trip; or sometimes no one speaks up to answer your questions when you are trying to involve the youth in the discussion. If you are working with a broad age range, the activity may be too simple for the older youth and too difficult for the younger ones. This is very challenging for the 4-H leader. Giving the older 4-H members leadership opportunities can be very effective.

Youth of the same age can vary greatly in physical, mental, social, and emotional growth and interests. These differences are even more marked between age groups. Research has shown that there are some generalities that can help you understand how to plan activities for different age groups.

## **Early Elementary (Mini 4-H)**

This is a very active age, so it is important to keep these children busy. They are concrete thinkers and need to understand what you want them to do and how to do it. They are generally more interested in making something than in completing a project (process is more interesting than product). Youth in this age group tend to seek adult approval and depend upon adults, although the opinions of their peers are beginning to be important. They do best in small groups with set rules and rituals. Competition is inappropriate for this age group.

## **Upper Elementary**

This is also a very physically active age so hands-on activities work best. Youth in the upper elementary grades are still fairly concrete thinkers (things are black/white or right/wrong), but are beginning to think logically and symbolically. Because this age group has a strong need to feel accepted, it is best for an adult to evaluate each product, rather than hold competition among peers with only one winner. This age child prefers to know how much they have improved against past efforts and how to improve in the future.

These youth are beginning to identify with peers, but continue to value adult guidance. They are also beginning to discover the benefits of making other people happy, but more for the benefits to themselves rather than the benefit to others. They begin to take responsibility for their actions at this age and begin to develop an increased independence of thought, which may allow them to try new things. Letting this age group help in the decisions of the club helps them start to learn about leadership.

## **Middle School**

Middle school youth are beginning to move to more abstract thinking. Justice and equality are important to this age. (Therefore, project judging may now be viewed in terms of what is fair, as well as being regarded as a reflection of self-worth.) They prefer to find their own solutions, rather than to be given solutions by adults. Try to provide supervision without interference. Independence of thoughts and actions begins to emerge. Avoid comparing middle school youth with each other's performance should be compared with past accomplishments.

Junior volunteer organizations often are popular with teens toward the end of this age group, particularly if there are opportunities for developing leadership.

## High School

Most high school-aged teens know their abilities, interests, and talents. They tend to be very concerned with themselves and their peer group. While they can understand the feelings of others, they tend to be self-absorbed, particularly in the earlier years of high school. Relationship skills are usually fairly well developed. Getting a driver's license increases both independence and dating. Acceptance by members of the opposite sex is very important.

High school-aged youth begin to think about the future and make realistic plans. They enjoy career exploration and preparation. Their vocational goals influence the activities they select.

Projects requiring research and creativity give teens an opportunity to demonstrate how much they have learned and what they can accomplish. Teens set goals based on their personal needs and priorities – goals set by others are generally rejected.

As teens master abstract thinking, they may try new ideas in ways that confuse adults. Teens can generally initiate and complete tasks without supervision. A leader can help by arranging new experiences in areas of interest to teens but must be sure to allow them plenty of input. Assume the role of advisor/coach for independent workers, rather than teacher/lecturer. Club meetings, rituals, and uniforms do not generally appeal to this group. But many teens enjoy looking back on their achievements in 4-H and appreciate special recognition for leadership activities. By the time they graduate from high school and begin college or a career, youth feel they have reached the stage of full maturity and expect to be treated as such.

## Some Final Thoughts

These guidelines only give a brief overview of child and youth development. They are intended as a resource to help you plan your activities as a volunteer leader. The publication, *Ages and Stages of Child and Youth Development*,\* has more in-depth information and is available from your county Purdue Extension office.

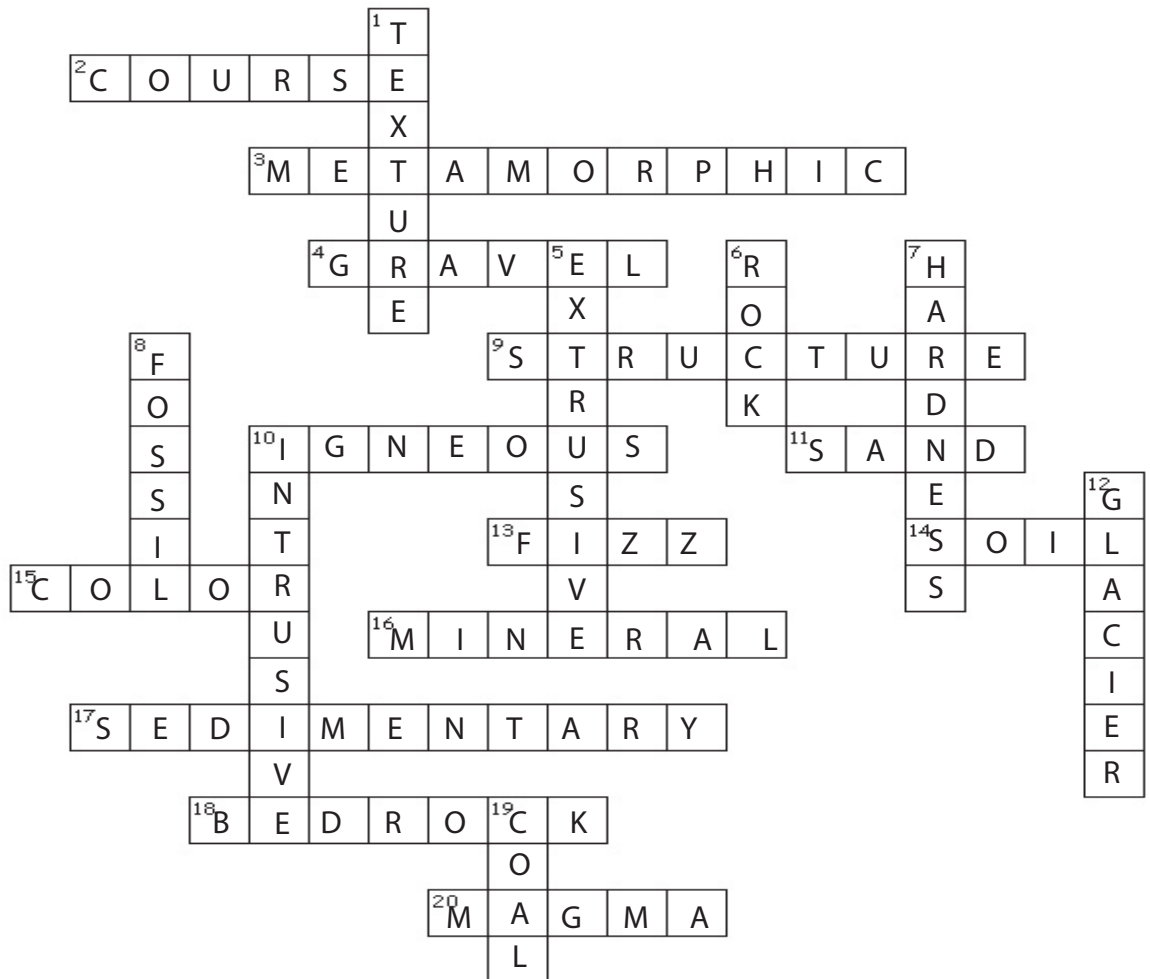
You, as the club volunteer, are a valuable asset to your community and to the members of your club. The guidelines for the stages of child and youth development – in combination with your special skills and interests in youth – will help you plan and carry out a successful 4-H program and make a positive impact on the lives of young people.

\* *Ages and Stages of Child and Youth Development, A Guide for 4-H Leaders, NCR 292*



# Geology Level 1, Answers and Suggestions

## Activity 1 – Rock Crossword Puzzle



Igneous rocks become **metamorphic** rocks through increasing heat and pressure.

Igneous rocks become **sedimentary** rocks through decomposition, erosion, weathering, and deposition.

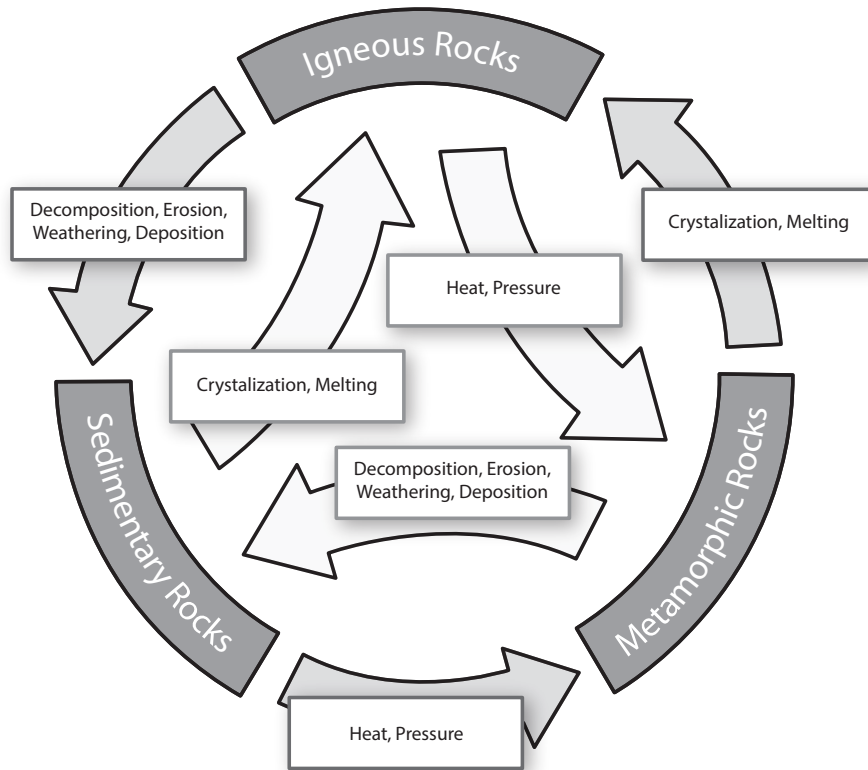
Metamorphic rocks become **igneous** rocks through melting and crystallization.

Metamorphic rocks become **sedimentary** rocks through decomposition, erosion, weathering, and deposition.

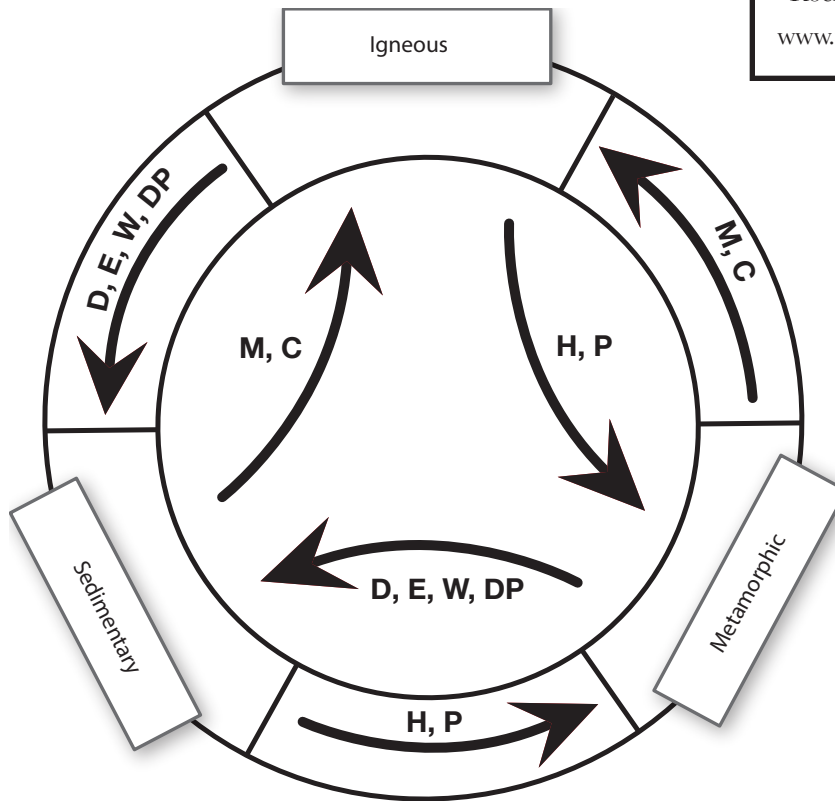
Sedimentary rocks become **metamorphic** rocks through increasing heat and pressure.

Sedimentary rocks become **igneous** rocks through melting and crystallization.

### Activity 3 – Rock Cycle Fill-in



You can find an interactive, computer version of the “Rock Cycle Fill-in” at [www.four-h.purdue.edu/kids/](http://www.four-h.purdue.edu/kids/).



#### Activity 4 – How Rocks Change

This is a coloring activity. 4-H members were instructed to use red for the igneous rock, brown for sedimentary rock, and yellow for metamorphic rock. Let them determine where the colors begin and end and how much blending they want to do. The important thing is that they begin to understand the concept of the three major categories of rock and how they change from one to another.

#### Activity 5 – Earth Processes Matching

Condensation - A process in which water changes from a gas to a liquid.

Evaporation - A process in which water changes from a liquid to a gas.

Ground water - Water that is found below the water table, underneath the surface of the earth.

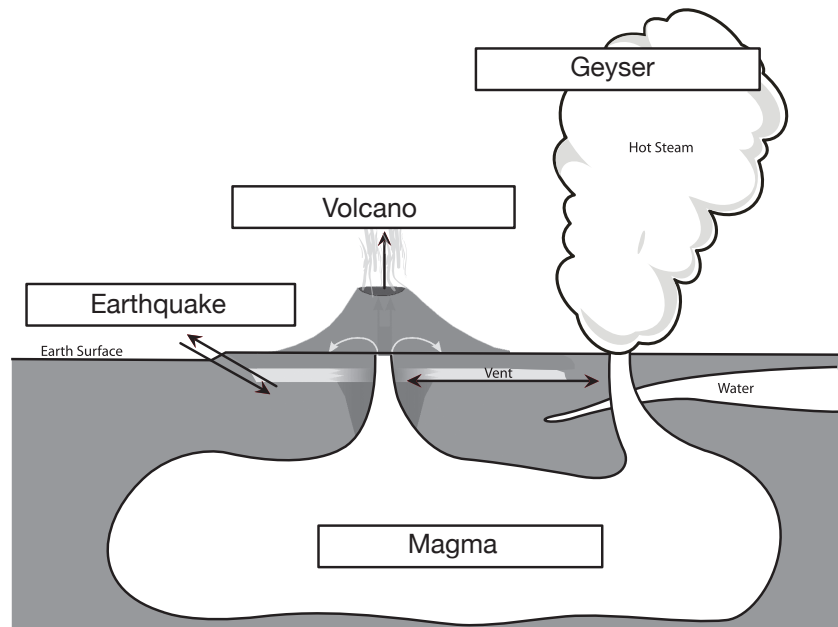
Infiltration - A process in which water enters into the soil.

Precipitation - Water that falls from the sky as snow, rain, hail, or sleet.

Surface water - Examples include lakes, streams, rivers, and oceans.

Transpiration - A process during which water is released from plants to keep them cool.

#### Activity 6 – Earth Process Fill-In



#### Activity 7 – Make a Volcano

This activity uses a chemical reaction (baking soda and vinegar) to simulate lava flowing. Youth can do a simple reaction or make an elaborate diorama with a miniature volcano and landscape. They should understand that this is a model of a volcano and that heat and pressure cause lava flows (question 2), not baking soda and vinegar.

### Activity 8 – The Effects of Pressure

These activities should help 4-H members understand how forces in the earth can cause changes in the terrain.

### Activity 9 – Igneous Mint Fudge

This activity is fun, tasty, and shows kitchen chemistry.

### Activity 10 – Make Your Own Sandstone

Youth can begin to understand how sandstone is formed, although it should be pointed out that actual sandstone is formed by pressure.

### Activity 11 – Rock Collection

4-H members are encouraged to begin a rock collection in this activity. Rock collecting is an important part of the study of geology as youth learn to identify different rocks and to pay attention to differences.

### Activity 12 – Rock Artwork

Youth use their artistic talents and explore different colors and textures of rocks.

### Activity 13 – Geology Equipment Word Search

<b>Word Bank</b>	T C U P P G D G G C M O
Acid	I V H K O L V I O S E N
Chisel	K V I I T O T L C M P E
Collecting bag	D W V D S V L E N A O W
Gloves	N E M I C E P S K T C S
Hammer	H S I A C S L S V C S P
Journal	P R O T E C T I V E O A
Magnifying glass	G N I Y F I N G A M R P
Microscope	X N J O U R N A L P C E
Newspaper	G R E M M A H G T W I R
Pocket Knife	S A F E T Y U S N J M E
Protective Glasses	E F I N K E L U R U U Q
Safety kit	
Specimen box	

Note: The program we used to generate this Word Search only used the first word of two-word phrases.

### **Activity 14 – Making Crystal Models**

Minerals have specific crystalline structure. This activity helps youth to learn about different crystal structures.

### **Activity 15 – Growing Crystals**

4-H members can watch crystals grow.

### **Activities 16 & 17 – Quick Clay Mold and Making a Plaster Fossil Mold**

Youth learn how fossil molds are made by making their own molds of common objects or fossils.

### **Activity 18 – Making a Cast**

A mold is a replica of an object or fossil and is made from a mold. Casts may be made of rare objects (to make replicas of them) and of objects that need to be protected from damage that might be caused by people handling them.

# Geology Level 2, Answers and Suggestions

## Activity 1 – Typing by Texture

- Granite – individual minerals have time to grow large enough to see without a magnifying lens.

**Circle one: intrusive extrusive rock**

- Pumice – porous texture due to gas bubbling into the air from cooling magma.

**Circle one: intrusive extrusive rock**

- Basalt – individual grains of minerals are small because magma cools fairly rapidly.

**Circle one: intrusive extrusive rock**

- Obsidian – no minerals are visible, a smooth, glassy rock.

**Circle one: intrusive extrusive rock.**

## Activity 2 – A Rock’s Story

This activity encourages youth to think about how sand and gravel are formed and to use and develop creative writing skills.

## Activities 3 & 4 – Can You Feel the Difference? Rocks with Different Textures

Texture is an important distinguishing characteristic of rocks. These activities help youth to understand what to look for when comparing textures of rocks.

## Activity 5 – Rock Property Scramble

_____ LAYERING	(G R I N E L A Y)
_____ COLOR	(O O R L C)
_____ FIZZ	(Z I F Z)
_____ MINERAL CONTENT	(two words: A M N R L I E & T T C N O E N)

## Activity 6 – Layering

4-H members can simulate rock layers using modeling clay. They should examine what happens to the layers when they are pushed up and cut as sometimes happens when mountains are formed.

## Activity 7 – A Little of Indiana, All over the United States & Activity 8 – Find Indiana Limestone around You

Indiana limestone has been used all over the United States. These activities encourage youth to identify some of the statues, monuments, and buildings that contain Indiana limestone.

### Activity 9 – Making Crystal Models

Structure and cleavage are important characteristics of minerals. This activity helps youth continue to develop their understanding of structure.

### Activity 10 – Mineral Scramble

Luster	Description	Common Mineral
Earthy	powdery, dull	limonite
Vitreous	glassy	quartz
Resinous	waxy	sphalerite
Pearly	iridescent like pearl	feldspar
Greasy	as if coated with oil	talc
Silky	soft (in appearance) and fibrous	gypsum
Adamantine	hard and brilliant	diamond

### Activity 11 – How Hard Is This Mineral?

Streak, luster, and hardness are also properties that distinguish minerals from one another. 4-H members study and compare streak and hardness for five minerals in this exercise. The answers to this activity are dependent on the minerals chosen. Hardness and streak are given in Appendix A (page 54). Some examples are:

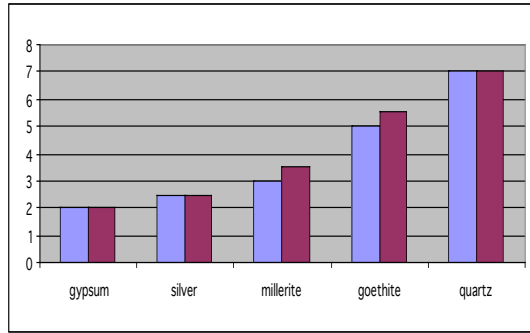
Mineral	Hardness	Streak
1. Quartz	7	Colorless
2. Gypsum	2	Colorless
3. Copper	2.5-3	Hackly, irregular, and jagged
4. Gold	2.5-3	Fracture hackly
5. Diamonds	10	Cleavage octahedral

### Activity 12 – Comparing Mineral Hardness

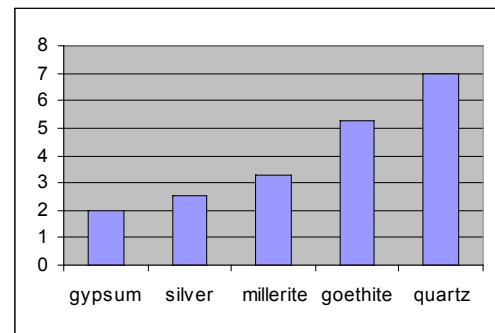
The graph in this activity is dependent on the minerals chosen. Youth should notice the variability in hardness between minerals. Some minerals have a single hardness value and some have a range of hardness. Youth may graph the minimum and maximum values or the averages as shown below. They may also show the average hardness and indicate those minerals that have a range of values (not shown). Example:

Mineral	Min.	Max.
gypsum	2	2
silver	2.5	2.5
millerrite	3	3.5
goethite	5	5.5
quartz	7	7

Bar graph showing minimum and maximum

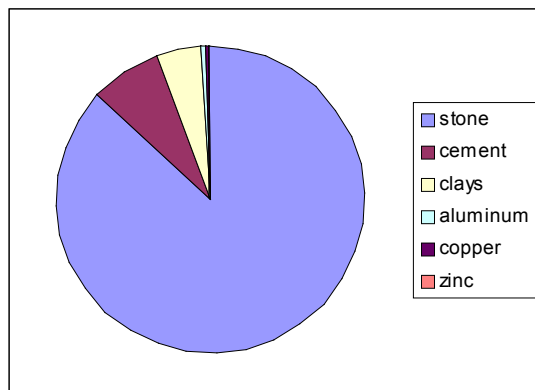


Bar graph showing averaged values



### Activity 13 – Mineral Pie

4-H members should have an understanding of the amount of stone, relative to other minerals, that is used per person each year in the United States. Their pie chart should look like the one shown, below.



### Activity 14 – Minerals in Your Home

This activity encourages youth to think about the minerals used on a daily basis. Answers will depend on the items the 4-H member chooses but will likely come from the list on pages 24 and 25 in the youth manual.



### Activity 15 – Indiana’s Time Periods

This activity is similar to the layering exercise (Activity 6) with the addition of objects to represent fossils buried in the earth.

### Activity 16 – Where in Indiana?

<b>Fossil</b>	<b>Period (s)</b>	<b>Part of Indiana Where Found</b>
Brachiopods	Pennsylvanian	West – mid and south
	Silurian	East – mid to southern and north west
	Mississippian	Northern and mid-west running to south central
	Ordovician	Running from the Northwest to the Southeast
	Devonian	Southeast
Corals	Silurian	East – mid to southern and north west
	Ordovician	Southeast
	Devonian	Running from the Northwest to the Southeast
Early plants	Pennsylvanian	West – mid and south
	Devonian	Running from the Northwest to the Southeast
Trilobites	Ordovician	Southeast
	Devonian	Running from the Northwest to the Southeast

### Activity 17 – Era Timeline

Youth can calculate the number of years or each Era from the information on pages 26, 27, 32, and 33 or page 57.

1. They need to subtract the smaller number from the larger to see how long each Era lasted.

Precambrian era, 4.6 billion – 540 million = 4.060 billion years = 4,060 million years

Paleozoic era, 540 million – 251 million = 289 million years

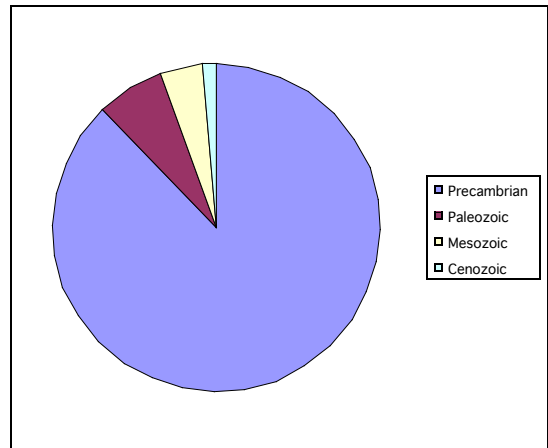
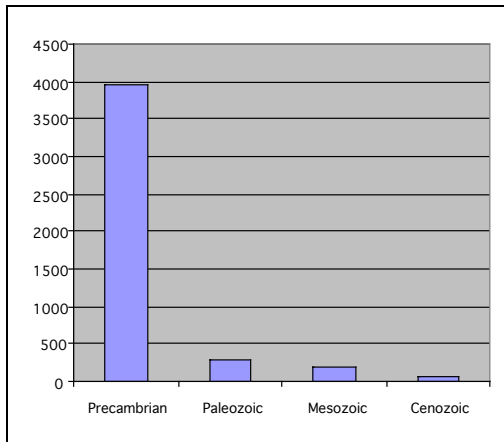
Mesozoic era, 251 million – 65 million = 186 million years

Cenozoic era, 65 million – 0 = 65 million years

2. Next, youth need to figure out how to compare the times shown above to show the relationship between the Eras. The example shown below uses distance for a comparison with the longest periods (Precambrian) set as 1 mile (5,280 feet):

$5280 \text{ ft} / 3956 \text{ million years} = 1.3346 \text{ ft/million years}$

These comparisons can be shown using charts and graphs (as shown below) or by marking the actual distances along a road, with the help of an adult (for safety).



### Activity 18 – Matching Geologic Periods

Ordovician – This is the oldest surface-exposed time period in Indiana.

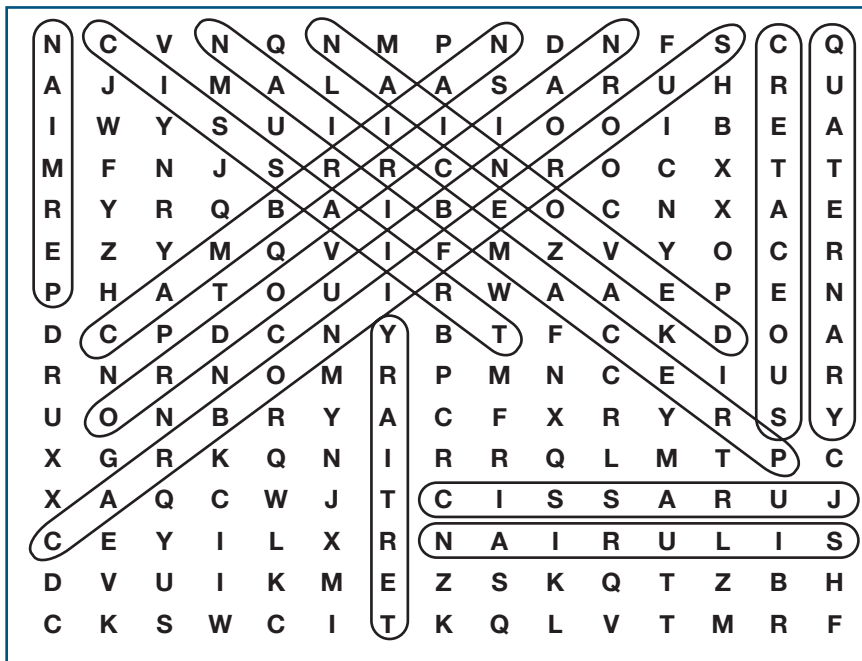
Silurian – The largest variety of invertebrates are found from this period.

Devonian – Amphibians appeared. Vertebrates (creatures with backbones) flourished on land.

Mississippian – Trees began to appear.

Pennsylvanian – The coal age.

### Activity 19 – Geologic Time Word Search

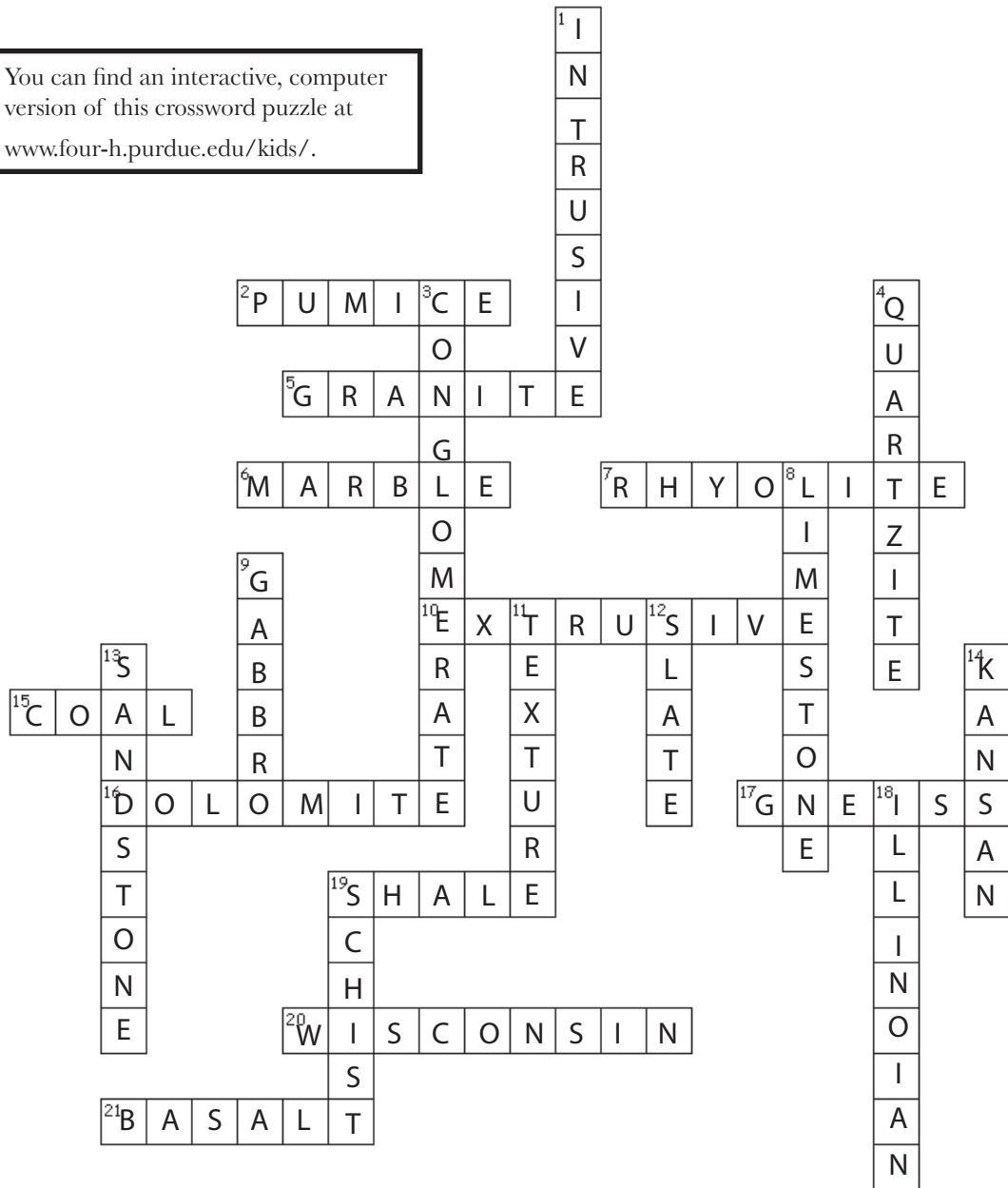


#### Word Bank

- CAMBRIAN
- CRETACEOUS
- JURASSIC
- PERMIAN
- QUATERNARY
- TERTIARY
- CARBONIFEROUS
- DEVONIAN
- ORDOVICIAN
- PRECAMBRIAN
- SILURIAN
- TRIASSIC

## Activity 20 – Geology Crossword Puzzle

You can find an interactive, computer version of this crossword puzzle at [www.four-h.purdue.edu/kids/](http://www.four-h.purdue.edu/kids/).



## Activity 21 – Making a Fossil

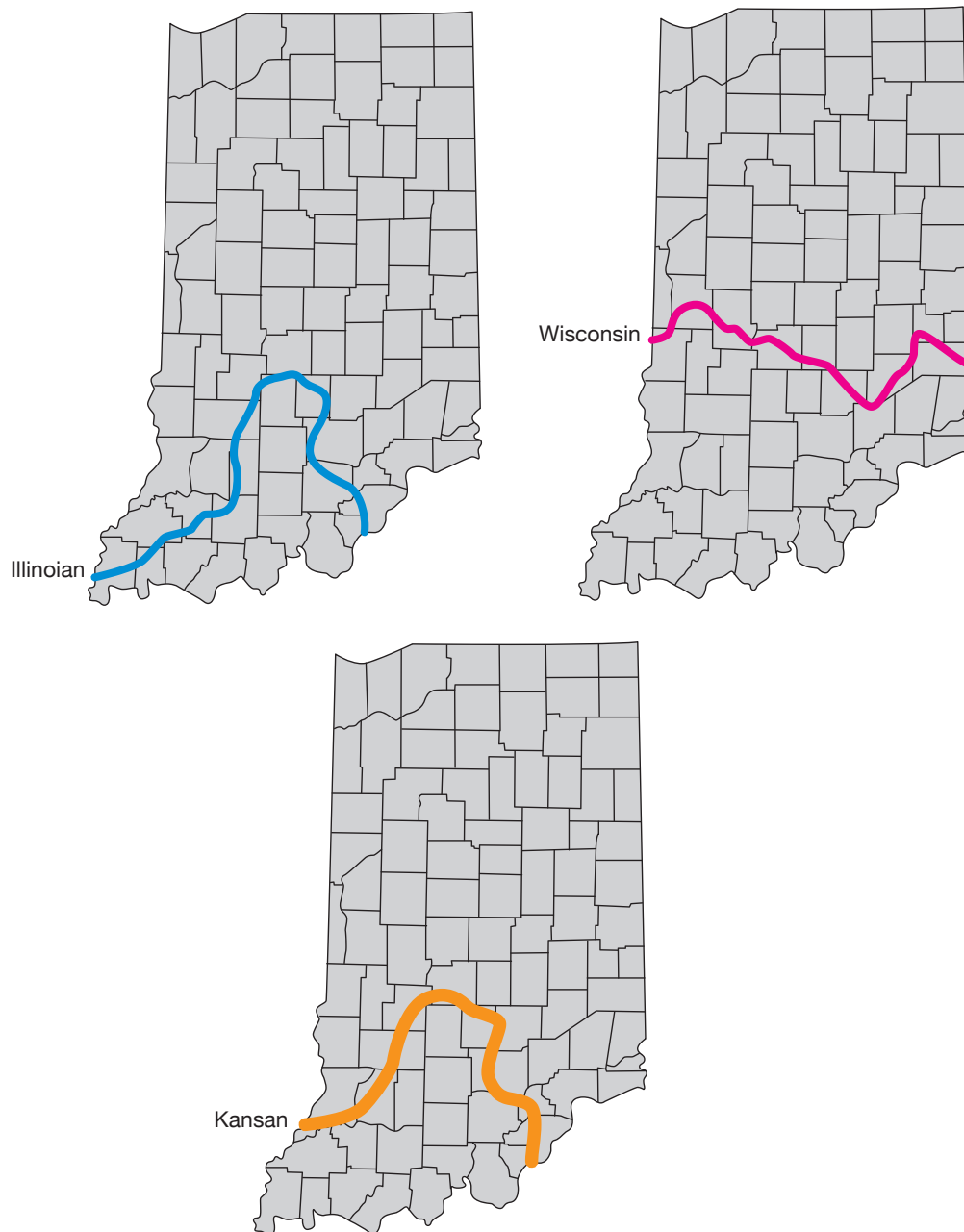
This activity is similar to the Activities 6 and 15 with the focus on developing a better understanding of how plants and animals are buried and become fossils.

### Activity 22 – Collecting Fossils

Collecting fossils can become a lifetime hobby. They can be difficult to find. If 4-H members purchase fossils, they should still carefully identify the specimens themselves. It is not uncommon for purchased fossils to be misidentified.

### Activity 23 – Glaciers in Indiana

Youth need to reproduce the extent that the three major Indiana glaciers traveled. Note that the Wisconsin (#3) covered over half the state, the Kansan (#1) reached further south, particularly on the east and western portions of the state, and the Illinoian (#2) glacier traveled farthest south, again, particularly on the east and western portions of the state.



## Activity 24 & 25 – Glacier National Park and Glacier Research

Youth will do research to find information about glaciers.

## Activity 26 - Indiana Geology

- Karst – Lawrence, Monroe, Orange, Crawford, and other counties.

- Kentland Dome – Benton County

- Wetlands (Kankakee) – LaPorte, Starke, S. Porter, N. Jasper, Lake, Newton, and Pulaski counties

- Indiana Dunes – Lake and Porter counties

- Natural Bridge – Warren County

- Highest free falling Indiana waterfall – Warren County



- Hanging Rock – Wabash County

- Wyandott Caves (dry) – Crawford County

- Marengo Cave (dry) – Crawford County

- Blue Springs Cave (wet) – Lawrence County

- Lost River – Washington, Orange, and Martin counties

- Jug Rock – Martin County

**Activity 27 – Chip Mining**

This is a fun and tasty activity that is intended to help youth think about how we remove minerals from the earth.

**Activity 28 – Plate Tectonics**

Youth will research to learn about plate tectonics.

**Activity 29 – Field Trip**

Youth are encouraged to visit rock shows and exhibits. They can learn a lot by viewing collections and talking with collectors.

# Geology Level 3, Answers and Suggestions

The Level 3, 4-H Geology manual has less information than the previous 4-H manuals. This was purposefully done to require youth to do their own research on advanced geology topics of interest to them. Their work with Levels 1 & 2 should have prepared them to understand basic geology concepts so that they can understand the information that they read. They will probably need some guidance from a 4-H volunteer leader, parent, or other educator. High school youth are expected to be able to obtain and use geology textbooks, magazines, and appropriate Web sites.

## **Activity 1 – Personal Research**

Youth should choose a topic that interests them, collect information, organize their facts, and outline their study. They are not required to write a paper, but if they wish to, a common format would include:

- Title
- Abstract, 250–500 words (1 page or less)
- Research (outline, organize logically)
- Discussion
- Conclusions
- References

## **Activity 2 – Mentoring**

Youth share their geology knowledge with younger 4-H members. They often find that they learn much more by teaching than they do reading about a topic. They should prepare a lesson plan and write a summary to explain what happened, how they thought the activity went, and what they would change in the future. Photographs of the 4-H members (teaching and learning) are recommended.

## **Activities 3 through 6 – Making a Polished Stone, Lapidary, Making Stone Jewelry, Decorating with Stones**

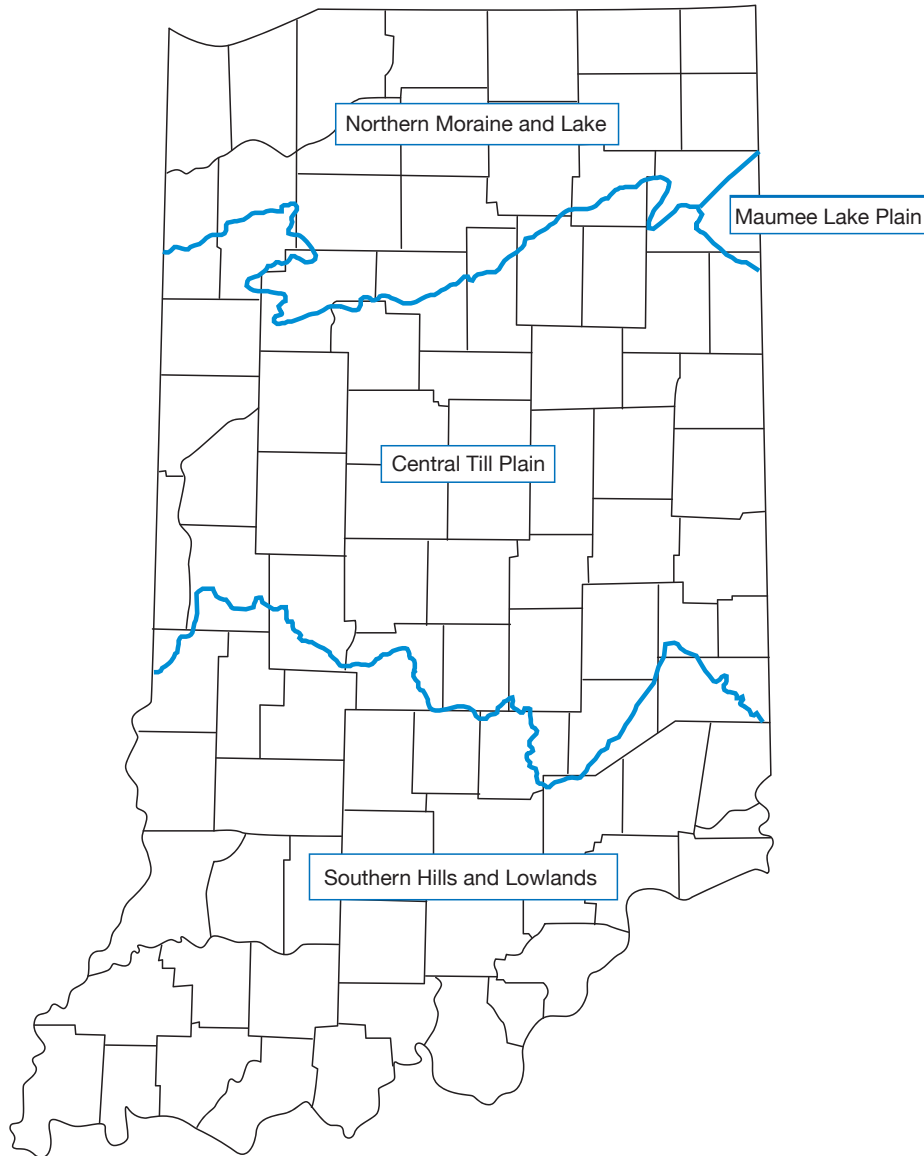
Youth use a mechanized tumbler to polish stones, the art of lapidary – preparing gem stones to be used in jewelry, making jewelry and decorating items with stones and gemstones. These skills can be lifelong hobbies or even a career.

## **Activity 7 – Miniatures**

Miniatures can be space-saving for collectors. They must be carefully made, mounted, and stored for a lifetime of enjoyment.

## Activity 8 – Indiana Physiographic Regions

Youth are to indicate the following physiographic regions: hills, valleys, plains (includes prairies), lowlands, highlands, and wetlands in Indiana. They can try this from memory or find resources to help them. The goal is to understand that different parts of the state have different physiographic characteristics and generally where and what they are. Specific information is available at <http://igs.indiana.edu/>; enter “physiographic” in the search box.





### **Activity 9 – Indiana State Parks**

This activity is intended to encourage youth to study Indiana geology sites that they would like to visit and to make plans to go there. They are expected to include the following information: date of (planned) trip, route, distance, what they will see, costs, etc. If they are able to actually visit the site, they should keep records (mileage, costs, etc.), take pictures, and collect information about the park.

### **Activity 10 – Indiana Geologic Sites**

The 4-H member should study a geologic site of interest to them. Ideas are available in Activity 24 in the Level 2, 4-H Geology manual, the next activity in this manual (11), or the “Resources” section for suggestions of what to see in Indiana.

### **Activity 11 – Indiana’s State Parks**

1.   G  , Pokagon State Park
2.   F  , Mounds State Park
3.   E  , McCormick’s Creek State Park
4.   B  , Charleston State Park
5.   I  , Spring Mill State Park
6.   H  , Shades State Park
7.   D  , Indiana Dunes State Park
8.   A  , Brown County State Park
9.   C  , Clifty Falls State Park
10.   J  , Turkey Run State Park

### **Activity 12 – Indiana Geology Research**

Ideas for conducting research are given in Appendix A. The 4-H member can share what they learned by doing an Action Demonstration (pp 24–25) or writing a report. If they decide to write a report they should include:

- Title
- Abstract (1–2 paragraphs) – what was done, what was found (brief)
- Research – outline or organize logically
- Discussion
- Conclusions
- References

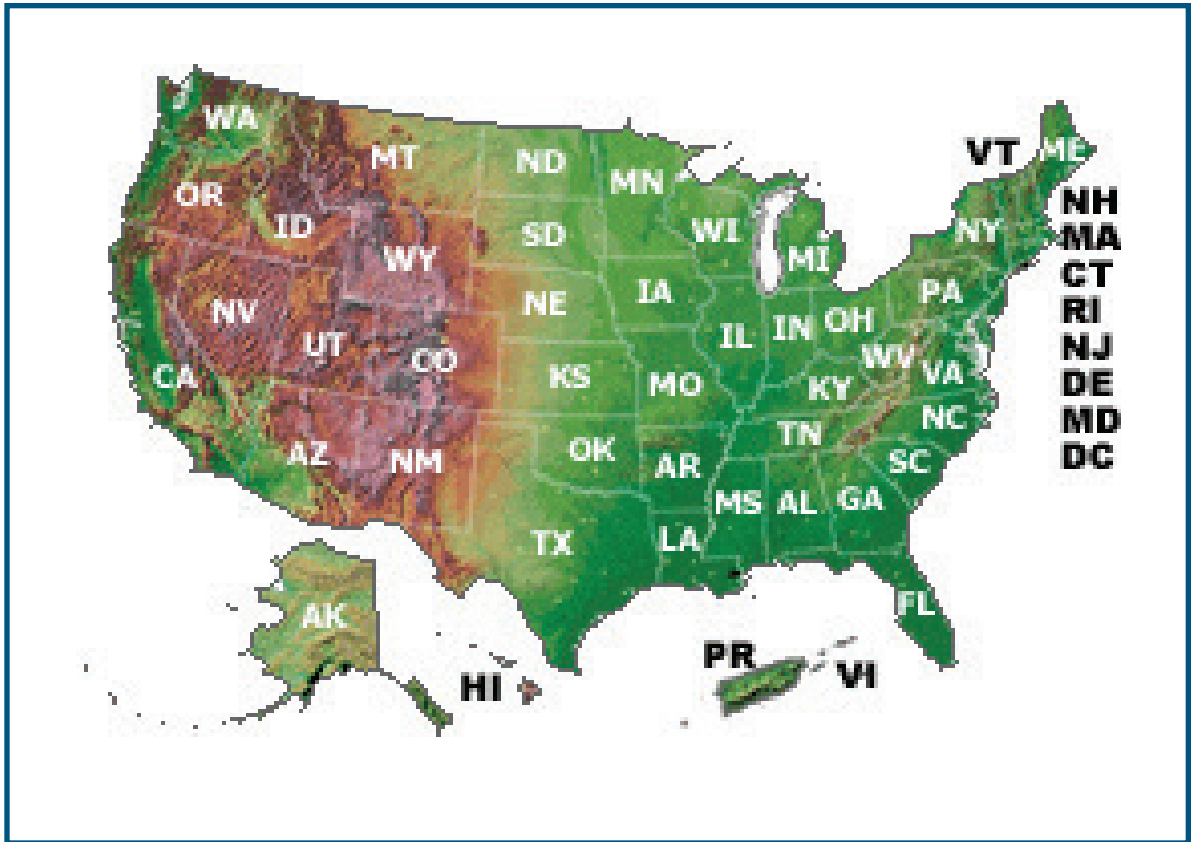
### Activity 13 – Indiana Agriculture

This activity is similar to Activity 12, but with a focus on agriculture. They can share what they learned by doing an Action Demonstration (pp 24–25) or writing a report.

**Note:** Activities 14–16 are the same as activities 8, 10, and 12 but with a focus on U.S. and world geography. Youth should use the Internet, library, or other resources to collect information.

### Activity 14 – Topography and Physiography

Youth are to indicate the major physiographic regions in the United States. They may create a map similar to the one shown below or may show much more detail (lakes, major rivers, etc.).



Map from the USGS homepage ([www.usgs.gov](http://www.usgs.gov)).

### **Activity 15** – U.S. and World Geologic Site

The 4-H member should study and describe a geologic site of interest to them.

### **Activity 16** – U.S. and World Geology Research

Ideas for conducting research are given in Appendix A. The 4-H member can share what they learned by doing an Action Demonstration (pp 24–25) or writing a report. If they decide to write a report they should include:

- Title
- Abstract (1–2 paragraphs) – what was done, what was found (brief)
- Research – outline or organize logically
- Discussion
- Conclusions
- References

### **Activity 17** – Make Your Map

Youth will need to use the Internet to complete this activity. They will have access to a great deal of data available in the Indiana GIS Atlas (<http://igs.indiana.edu/GISatlas>) and be able to print a map of their county with the “layers” (roads, streams and rivers, etc.) that are of interest to them.

### **Activity 18** – Make a Letterbox or Geocache

This activity will help youth learn to give good directions. They should be encouraged to write directions using the compass and to compare that to using a GPS unit (if available). These “hide and seek” games are becoming popular worldwide. It is important that youth understand that there are restrictions on both public and private lands.

Letterboxing and geocaching are outdoor sports that involve navigation and exploring interesting geologic, scenic, and sometimes remote places. Letterboxing had its origins in England in the mid 1800s. Letterbox hunters use clues that may include maps, pacing, and any other directions that the person who placed the letterbox might wish to give. The clues can be straightforward or cryptic. Geochaches are found using Global Position System (GPS) system coordinates. The “treasure” found at the letterbox or geocach site may have a stamp, so youth can stamp their logbook (while noting the clues that led them to the spot, the location, and any additional information that they would like to remember). Experienced searchers often have their own stamp made so they can stamp any logbooks found at the site.

Any person who participates in geocaching activities on state (DNR) property must have a license from the department. More information is available in Information Bulletin # 46, at: [www.in.gov/dnr/parklake/publications/InfoBulletin46\\_Geocaching.pdf](http://www.in.gov/dnr/parklake/publications/InfoBulletin46_Geocaching.pdf).

### **Activity 19 – Geologists**

Youth will learn about the history of geology by studying and writing about a geology pioneer.

### **Activity 20 – Career Investigation**

Youth that enjoy geology may also enjoy a career where they can use this knowledge. This activity is intended to help them explore the types of careers that use the knowledge that they have gained in the 4-H Geology project. They can also research volunteer jobs that require knowledge of geology, 4-H Geology Leader, for example!

### **Activity 21 – Career Interview**

Youth will learn even more about careers that use geology by interviewing someone that uses geology in their daily job (or volunteer position). They will need to contact the geologist (the 4-H Leader may be able to suggest some possible people) to set up an interview and prepare the seven questions given in Geology, Level 3 and any other questions that they have.

### **Activity 22 – Career Web Search**

4-H members do their own research to see what courses they need to take in high school to prepare to study geology in college.

### **Activity 23 – Internship Investigation**

Youth are encouraged to find a job (paid or unpaid) to gain experience in a field requiring geology knowledge. This experience is often invaluable in helping to know what they want to do in their own careers.

### **Activity 24 – Planetary Science**

Some of the most exciting geology research and study is in the area of planetary science. 4-H members research this area and answer six questions about planetary science:

1. What is planetary science? The United States Geology Survey defines planetary sciences as the scientific study of the solid bodies of the solar system, including planets, moons, asteroids, meteorites, and interplanetary materials. ([www.usgs.gov/](http://www.usgs.gov/), search on planetary sciences). This study is also called astrogeology (<http://astrogeology.usgs.gov/>).
2. Why would understanding geology be important to a planetary scientist? Youth may have a variety of answers to this question that basically explain that planetary science is the study of geology in space (outside our atmosphere).

# Poster Exhibit Guidelines and Suggestions

Fair exhibits give youth the opportunity to show the public what they have learned in their geology project work. Indiana State Fair guidelines require the following:

- Exhibits must be displayed horizontally, sized 22" x 28", mounted on a firm backing (foam-core board or other), and covered in clear plastic or other transparent material.
- A display box (18 x 24 inches), orientated horizontally, may be used to make specimens more secure.
- Each exhibit must include a label with name, grade, and county.
- The exhibit title should indicate the level: Geology 1, 2, or 3. The sub-title should be the activity title.
- Youth should include actual specimens in their exhibit whenever possible.
- Possible exhibit topics are given on the 4-H Web site ([www.four-h.purdue.edu](http://www.four-h.purdue.edu), click on "Projects" in the menu bar right under the green "Indiana 4-H"). (Note—pilot exhibits are not listed because only a few counties pilot-test and it is confusing for youth in the other counties. This note is included to have the site listed for state-wide adoption.)

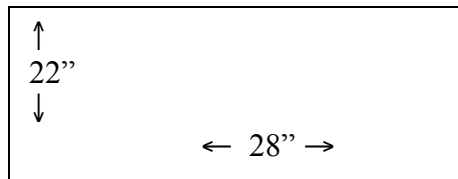
## General Reminders for Youth

- You may purchase your specimens and may display rocks, fossils, and minerals. If you purchase a specimen, indicate where and when you bought it. If you collect a specimen, indicate the county and township where you found it.
- Posters and display boxes will be exhibited "standing up" at the Indiana State Fair. Therefore, you need to secure your specimens securely. Project leaders suggest the following methods: soaking 1/2 cotton ball in Elmer's glue, hot glue, or clear tub sealant. Place the cotton ball in your box and put your rock (or fossil or mineral) on the cotton ball and let sit. It will take 1-2 weeks for Elmer's glue to fully harden. Specimens mounted with Elmer's glue can be removed by soaking the cotton ball in water. Glue remaining on the rock may be brushed off with an old, damp toothbrush.
- Do not identify your specimens any further than phylum and class.

## Exhibit Suggestions

*Adapted from suggestions developed by Roger Sherer, Extension Youth Educator in Wells County.*

1. Poster board – use white when required and experiment with other colors when not required.
2. Mounting adhesives – the best is rubber cement (it leaves no marks and won't wrinkle paper). White glue should be used only in cases where wrinkling or damage will not occur.
3. Colored pencils – the best are soft-leaded – they are easy to color and blend easily – strokes will not show if handled properly – hard-leaded pencils are less expensive, but are more difficult to use. (Soft-leaded pencils can be purchased at art stores.)
4. Labels – plain 3" x 5" file cards work well as they have a smooth finish and are sturdy enough for gluing and removing smudges.
5. Stiff backing – any material that will keep the poster from bending will work. Foam core board works well, if you can find it in the correct size, because it can take the place of poster and backing. Examples of backing include: very stiff cardboard, plywood (which makes the poster heavy), and masonite (1/8" thick works well and can be re-used).
6. Acetate or other clear plastic covering – this is required for most posters to keep them clean before judging and if fairgoers touch them. Coverings generally come in various thickness (3, 5, 7 1/2, and 10 mill) in rolls or sheets.
7. Plastic tape – this is not necessary but it makes attaching poster board to the stiff backing easy. Tape is available in many colors, cloth or plastic, and widths. The 1 1/2" wide tape can give the poster a border. Available at discount stores.
8. Lettering – type their labels and title on a computer or typewriter. Or use stencils, self-adhesive, or press-type letters purchased at discount or art stores.
9. County ID labels – an identification label should be placed in the lower right hand corner of poster projects. Check your county guidelines for requirements.
10. Your poster should read like a dollar bill:



## More Exhibit Suggestions

*Adapted from suggestions developed by Amy Nierman, Extension Educator, Washington County, and Angela Apple (1998 Indiana State Leader's Conference)*

### A Good Poster

- Attracts attention
- Is simple and clear
- Interests someone in an aspect of geology

### Planning

- Know the project requirements.
- Read the manual – look for ideas.
- Brainstorm ideas and make a list.
- Think of titles with alliteration (repeating a sound in words).
- Look at other posters for ideas – but don't copy.

### Tips – Do:

- Use a combination of illustrations and words.
- Be as neat as you can.
- Cut evenly, cement carefully, blend colors when using crayons or colored pencils.
- Leave white space on the poster.
- Make sure the poster is balanced.

### Tips – Don't:

- Use too many words. The poster is not intended to show all that you know, but to teach some aspect of your project.
- Make a vertical poster.
- Use Saran Wrap to cover.
- Use staples, tacks, or tape.
- Use fluorescent posters.
- Create a poster that is all words or a poster that is all pictures.
- Put too much information on the poster. Fairgoers rarely will look at a poster for more than 10-20 seconds, unless it catches their interest right away. Then, they might read it for minute or two.

### Choose colors carefully.

The following are general guidelines.

- Black tends to be more formal, neat, rich, strong.
- Blue is cool, melancholy, or depressed.
- Purple is considered royal, rich, imperial.
- Red stands for love as well as anger and hatred.
- Orange is generally used for Halloween and is festive and gay.
- Yellow tends to be warm, light, or ripe.
- Green is fresh, young, or growing.
- White means pure, clean, and neat.

## **Making a Poster**

1. Read your project manual.
2. Read your county project requirements.
3. Decide on information to include on the poster.
4. Sketch out your idea.
5. Collect supplies.
6. Mark guidelines for lettering and pictures (lightly).
7. Layout letters, pictures, etc., on the poster.
8. Cement (glue, etc.).
9. Clean up the poster so it is neat. Erase any guidelines that are showing. Remove excess rubber cement or glue.
10. Glue poster to backing.
11. Cover poster with plastic.
12. Take your poster to the fair on the right day and time.

## **Poster Judging Suggestions for Judges**

Reminder - The goal for all project work is to give guidance to youth learning about something they have a particular interest in. The goal of a poster is for the 4-H member to share information that they have learned by doing their project work. The poster is not intended to show all that the 4-H member knows, but to teach some aspect of their project. Posters should be eye-catching and attractive. Fairgoers rarely will look at a poster for more than 10–20 seconds, unless it catches their interest right away. Then, they might read it for a minute or two.

Age-appropriate judging is critical so that each youth is treated fairly. Young 4-H members (grades 3–5) should not be expected to have the fine motor coordination or advanced thinking skills of older 4-H members. Older youth should begin to take the concepts they have learned and apply them to particular situations. Originality is expected of high school youth.

- Youth may display a geology exhibit in an insect display box (18 x 24 inches), orientated horizontally. (This reduces the chance of specimens getting stolen at the fair.)
- Youth may purchase their specimens. They should indicate where and when they purchased the specimen.
- Collected specimens should have information to indicate the county and township where it was found.



- Posters and display boxes will be exhibited “standing up” at the Indiana State Fair. Therefore, youth need to mount their specimens securely. Project leaders suggest the following methods: soaking ½ cotton ball in Elmer’s glue, hot glue, or clear tub sealant. Place the cotton ball in your box and put your rock (or fossil or mineral) on the cotton ball and leave it. It will take 1-2 weeks for Elmer’s glue to fully harden. Specimens mounted with Elmer’s glue can be removed by soaking the cotton ball in water. Glue remaining on the rock may be brushed off with an old, damp toothbrush. This is an especially good method for fossils so that they can be “unglued” easily later.
- Do not identify your specimens any further than phylum and class.
- When exhibiting rocks – show a fresh surface to help judges identify the rock.
- Labels – Include the specific geographical location where you would expect to find any specimens as well as where you actually acquired it (found, purchased, etc.).

# Action Demonstration Guidelines

## **What is an Action Demonstration (Action demo)?**

An action demo is a fun way to share with others what you have learned in your 4-H project. It's a kind of "show and tell" but with more action. An action demo is not like a regular demonstration where the audience sits and listens to a prepared talk. An action demo lets the audience get involved.

Action demonstrations can be given anywhere there are a lot of people, such as a county or state fair, shopping mall, street fair, or any 4-H event. Your job as a demonstrator is to interest the audience in your topic so that they stop and learn something new or try their hand at what you are doing.

## **How do I choose a topic for my Action Demo?**

An action demo can be on almost any subject. The topic should be something that you enjoy and are knowledgeable about. Consider the following questions when choosing a topic:

- Can you complete the action demonstration in 3 to 5 minutes?
- Can it easily be repeated over and over again to fill the assigned time?
- Is your action demo showing something that would interest the general public?
- Is there a good way to involve your audience in your action demo (hands-on or answering questions)?
- Can the supplies for the hands-on section be used over and over again, or will they need to be replaced? (Remember, if the materials must be replaced, it will cost more to do the demonstration.)

## **How can I get the audience involved?**

The first thing you need to do is be enthusiastic and attract people's attention as they walk by your table. You might have a colorful tablecloth or poster to spark their interest. You might ask them a question, like: "Would you like to play this game?" or "Have you ever made pretzels? Would you like to try?" The best way to attract their attention is having people around your table doing something. People love to do hands-on activities, so once you get a few people at your table, they will attract others. For more information on action demonstrations, watch the video, V-4-H-28.

Involve your audience by having them:

- Do what you are doing.
- Do a "hands-on activity."
- Judge the quality of various items.
- Play a game.
- Answer questions.

Remember – the key to a good action demo is getting your audience involved.

# Action Demo Checklist

<b>Topic</b>	<b>Yes</b>	<b>No</b>
Was the topic interesting to the general public, causing them to stop, watch, or participate?		
Did the topic stimulate questions from the audience?		
Was the topic of suitable length?		
Did the topic include something “hands-on” for the audience to do?		
<b>Organizing the Content</b>	<b>Yes</b>	<b>No</b>
Was the topic organized into short “show and tell” segments, which were done repeatedly?		
Were segments presented in logical order?		
Were segments explained so that the audience understands “why?”		
Was it evident that the 4-H member was knowledgeable about the subject and could answer questions?		
Did visuals, pictures, posters, or actual objects clarify the important ideas?		
<b>Presenting the Demonstration</b>	<b>Yes</b>	<b>No</b>
Did the 4-H member seem enthusiastic?		
Did the 4-H member encourage the audience to become involved in the demonstration?		
Did the 4-H member speak directly to the audience?		
Did the 4-H member show evidence of practice and experience?		
Did the 4-H member show that she/he enjoys talking to the audience?		
Did the 4-H member show friendliness and a business-like manner?		
Did the 4-H member tell about what they learned through this 4-H project?		
<b>Comments:</b>		

# Resources

Required Publication: *Let's Look at Rocks*. Order from:

- Your local County Extension office (ask for 4-H-CIR5)
- Purdue Media Distribution, <http://secure.agriculture.purdue.edu/store> (order 4-H-CIR5)
- Indiana Geological Society (order C05.1)  
<http://igs.indiana.edu/survey/bookstore/index.cfm>

## Web sites

American Geological Institute, [www.agiweb.org/](http://www.agiweb.org/)

Indiana Geological Survey, <http://igs.indiana.edu/> and  
<http://igs.indiana.edu/GISatlas> Indiana GIS, [www.in.gov/ingisi/](http://www.in.gov/ingisi/)

Earth Science World, [www.earthscienceworld.org/](http://www.earthscienceworld.org/)

Department of Earth & Atmospheric Sciences, Purdue University, [www.purdue.edu/eas/](http://www.purdue.edu/eas/)

U.S. Geological Survey, <http://www.usgs.gov/>

U.S. Geological Survey, Astrogeology, <http://astrogeology.usgs.gov/>

Indiana State Museum, Indianapolis, [www.in.gov/ism/](http://www.in.gov/ism/), (search on Geology)

Indiana Children's Museum, Indianapolis, [www.childrensmuseum.org/](http://www.childrensmuseum.org/)

National Geographic, [www.nationalgeographic.com/](http://www.nationalgeographic.com/)

Smithsonian, [www.si.edu/](http://www.si.edu/)

The Field Museum (in Chicago), [www.fieldmuseum.org/](http://www.fieldmuseum.org/)

## Geology Societies

Visit the Midwest Federation of Mineralogical and Geological Societies Web site  
[www.amfed.org/mwf/](http://www.amfed.org/mwf/), click on Calendar of Events.

## Museums with geology displays

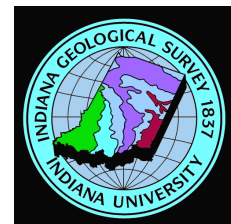
The Indiana State Museum in Indianapolis, [www.in.gov/ism/](http://www.in.gov/ism/)

The Field Museum in Chicago, [www.fieldmuseum.org/](http://www.fieldmuseum.org/)

Royal Tyrrell Museum in Alberta, [www.tyrrellmuseum.com/](http://www.tyrrellmuseum.com/)  
(A museum and field station about 50 miles north of the Montana border.)

## Publications from the Indiana Geology Survey (IGS)

Visit the Web site, <http://igs.indiana.edu/>,  
or call (812) 855-7636 for a publication list.



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