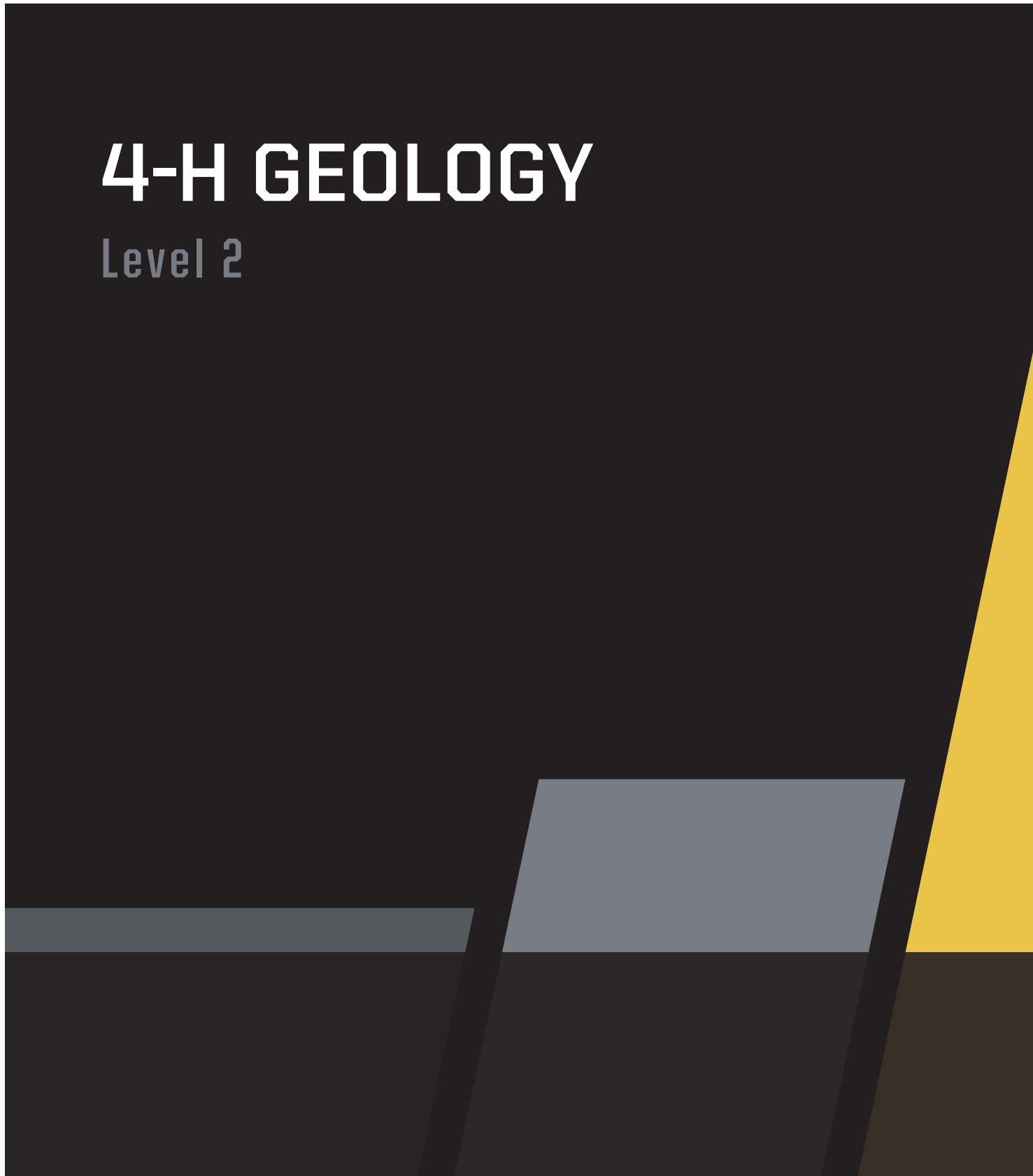




4-H GEOLOGY

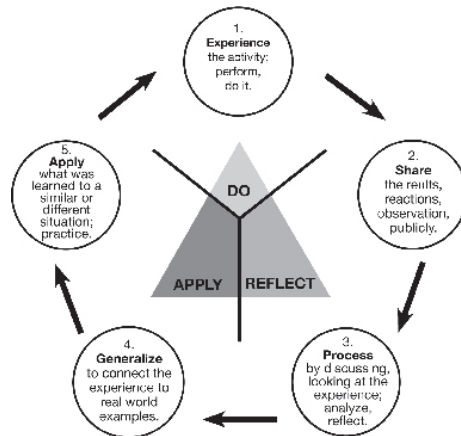
Level 2



Geology Division II

Note to Parents and Leaders

The 4-H Geology project helps youth learn about rocks, fossils, and minerals. Geology offers many exciting experiences, from collecting interesting rocks, fossils, and minerals to cutting and polishing gems. Geology II encourages a continued expansion of individual interests and experiences. Each 4-H member will select the area in which they plan to specialize. They may collect, study, and identify rocks, minerals, or fossils and prepare an exhibit. They can enhance their learning by consulting resources on the Internet, at school, at the library, and especially on the Indiana Geological Survey Web site (<http://igs.indiana.edu/>) for help with identification and background information.



Experiential learning distinguishes 4-H activities from many other educational methods. Activities are designed so youth experience a learning activity, reflect on what they did (explore the meaning of the activity), generalize what they learned (to test the 4-H'ers comprehension and appreciation of the activity), and then think about how they can apply what they learned to other situations (generalize). You can help guide youth as they explore each activity by discussing each section.

Purpose

Geology II encourages youth to

- learn to identify rocks, minerals, and fossils;
- develop the habit of asking questions and searching for answers;
- develop an understanding of earth science;
- make decisions based upon experiences, new knowledge, facts, and observations.

Geology Division II was written for youth interested in broadening their knowledge about rocks, fossils and/or minerals. This project offers the opportunity to

- continue collecting and studying rocks, fossils and/or minerals;
- go on field trips and continue to collect and study specimens (build and expand upon your experiences in Divisions I and II by specializing and expanding your rock, fossil or mineral collection);
- teach others about rocks, minerals, or fossils by doing an Action Demonstration.

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4-H Geology Project Division II

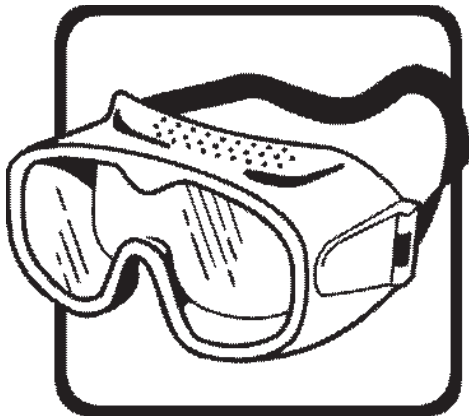
Geology Division II gives you the chance to study fossils and minerals. You should collect, study, and identify fossils or minerals. After you read this manual you should decide if you wish to collect fossils or minerals for your exhibit. You will probably need to locate additional reference books. If you select **fossils**, then you will want to study very carefully the section of the manual on **fossils**. If you select **minerals**, then you will want to read the material on **minerals**.

Collecting Equipment

Equipment can be simple or specialized, depending upon your interest and money available. For a hike or field trip you will want most of the following:

- A geologist's pick or plasterer's hammer for picking and breaking out layers of fossil-bearing rocks or for breaking material containing minerals (An ordinary hammer and cold chisel will work. A metal pry bar is also useful. In bottoms of stream beds, road cuts, stone quarries, and mine dumps, you might not need a hammer.)
- Heavy gloves to protect your hands
- Newspaper, paper towels, plastic, cloth, or paper bags to wrap specimen
- A small magnifying glass to assist in looking at specimens
- A notebook or note pad to write the location where you collect each specimen, date, and specific information about the fossil or mineral
- Safety goggles or glasses to protect your eyes when chipping rocks
- A pocket knife
- A backpack or other strong container to carry equipment and specimens

Safety



If you go on a hike to search for specimens, it is best to take a friend with you—or maybe your mom or dad. Wear comfortable hiking shoes.

When using the hammer to break rocks, wear goggles or safety glasses to protect your eyes from small pieces of rock that might fly off. Be sure to wear gloves to protect your hands.

Minerals

In Division I you learned to identify rocks by their physical properties (color, texture, and structure). We will do the same kinds of things in Division II, except that we will test minerals for properties such as hardness, luster, streak, cleavage, fracture, and color.

In this manual we will examine several of the minerals you might collect or have in your collection. Not all of the minerals in your collection will be discussed in the manual.

What Are Minerals

A mineral is a natural inorganic substance of a definite chemical composition. In its pure form it will have definite hardness, streak, cleavage, and fracture properties.

Properties of Minerals

The classification of minerals sometimes puzzles even the experts. Frequently, experts use special equipment such as ultraviolet light and chemical tests, so don't feel discouraged if you have trouble. Many of the common minerals can be identified easily with a few simple tests. Classification is best done by using the physical properties of minerals.

NOTE: The common minerals described below comprise a small part of the many minerals found in rocks. We suggest you attempt to identify other minerals by using more detailed descriptions found in some of the references listed later in this manual.

Hardness

The hardness of a mineral is one of the best physical properties for classification. A mineral, A, is harder than a mineral, B, if A will scratch B. On this basis, a hardness scale (Mohs scale) has been set up ranging from 1 to 10, with 1 being the softest and 10 the hardest. This scale is shown below. Some common minerals that may be used to make the hardness test are also listed.

1	Talc	6	Orthoclase Feldspar
2	Gypsum	7	Quartz
3	Calcite	8	Topaz
4	Flourite	9	Corundum
5	Apatite	10	Diamond

You may not be able to obtain most of the minerals listed above to check an unknown mineral's hardness. If you can not, you may use the following items for testing hardness:

Fingernail	2.5
Penny	3.0
Window glass	5.5
Knife blade	5.5
Steel file	6.5

To determine the hardness of a mineral, try to scratch a fresh surface of one of the minerals listed in the table or other known materials with the unknown mineral. If there is a definite scratch (try to rub the powder away with your finger to make sure the “scratch” is not a powder left by the unknown), the unknown mineral is harder than the mineral against which you tested it. Repeat the test on different minerals with known hardness until you have determined the hardness of the unknown mineral.

Minerals under 2.5 will leave a mark on paper; those under 5.5 can be scratched by a knife; those over 5.5 will scratch glass.

Luster

The luster of a mineral describes how the surface of a mineral appears in the daylight. No particular color is implied for any given luster. There are two major kinds of luster—metallic and non-metallic. A metallic luster is usually brilliant and looks like metal. Some common types of non-metallic lusters are listed below:

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	some gypsum
Adamantine	hard and brilliant	diamond

Streak

Streak is the color of the powder of a mineral. This color is often lighter than that of large chunks of the same mineral. The color is easily seen by “streaking” or scratching the mineral across the surface of your streak plate, a piece of unglazed porcelain, or the back of a piece of plaster tile. For example, hematite may be either dark red or black in color, but it always has a dark, reddish-brown streak.

Cleavage

Crystalline minerals are said to cleave or have cleavage when they break in definite directions along smooth, flat surfaces. Some minerals such as mica have only one cleavage direction, so the mineral breaks apart in sheets. Others, such as salt and calcite, may have cleavage in three directions so that the broken piece has flat surfaces on all sides of a square, rectangular, or parallelogram shape. Other minerals such as feldspar may only cleave along two directions or four sides.

Cleavage is often confused with an original face. Cleavage is an internal break through the mineral where the face is an outside surface feature. Cleavage is a constant enough property to serve as an excellent means of identifying and classifying minerals.

Fracture

Fracture is the breakage of a mineral specimen in some other way than along cleavage surfaces. Those that break in irregular directions, like shattered glass, are said to fracture instead of cleave. The particular kind of fracture depends upon the new surface. When it is a series of arcs, typical of the growth pattern of shells or chipped glass, it is known as conchoidal, meaning shell like. Quartz and some other minerals have this conchoidal fracture.

Native metals such as copper and silver have a hackly fracture, which gives a jagged surface, uncomfortable to the touch. Other kinds of fractures are simple, even, uneven, earthy, and so forth—ordinary words that describe their appearance.

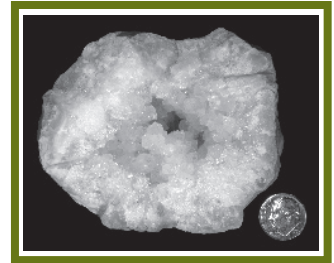
Color

Color is one of the physical characteristics that has to do with the way a mineral looks. In most metallic ores, it is a safe clue in identification. But in quartz, calcite, fluorite, and others, it is often due to impurities and may vary greatly and be quite misleading.

Descriptions of a Few Minerals

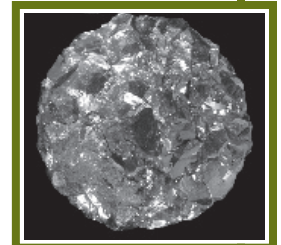
Quartz

Vitreous luster. Can scratch glass easily. Conchoidal fractures. Does not show good cleavage. Color: colorless, white, gray, black, pink, etc.



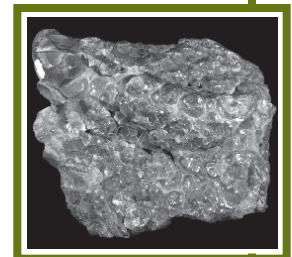
Pyrite

Metallic luster. Can scratch glass. Brass color. Streak: greenish to greenish black. Often found as small cubes or pyramids.



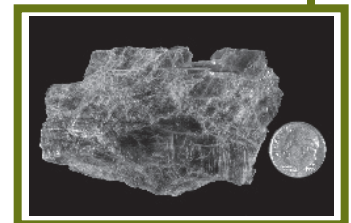
Hematite

Metallic to earthy luster. May or may not scratch glass depending upon the variety. Reddish brown color. Streak: reddish brown. Fracture: uneven.



Mica

Non-metallic luster. Leaves white mark or scratch on streak plate. Shows good cleavage, giving elastic, transparent sheets. Can be scratched by fingernail. Color: white (muscovite variety); black, dark-brown (biotite variety); green (chlorite variety).





Gypsum

Silky luster. Leaves white mark on streak plate. Shows good cleavage in clear variety, no cleavage in the massive white variety. Can be scratched with fingernail. Color: white, gray.



Talc

Pearly luster. Leaves white mark or scratch on streak plate. Shows good cleavage. Can be scratched with fingernail. Color: green, white.



Calcite

Sub-vitreous luster. Leaves white mark on streak plate. Cannot be scratched by fingernail, but can be scratched by copper coin. Color: white, colorless. Fizzes in acid. Has excellent cleavage on all sides of a parallelogram-shaped piece.



Feldspar

Pearly luster. Has a rectangular crystal outline in a rock such as granite. Shows good cleavage on four sides. Can scratch glass and be scratched by quartz. Color: white, pink.

You will find additional reference materials and labels for your mineral exhibit near the back of this manual.