



ROCK DETECTIVES CAMP GUIDE

A Hands-On Geology Curriculum for
Summer Camps, Schools and Home School



Mini Me Geology / Giverny, Inc.

Rock Detectives Camp Guide

ROCK DETECTIVES CAMP GUIDE

A Hands-On Geology Curriculum for Summer Camps, Schools and Home School

Copyright © 2013 by Tracy DJ Barnhart. All Rights Reserved.

All Rights Reserved. This book may not be reproduced, transmitted, or stored in whole or in part by any means, including graphic, electronic, or mechanical without the express written consent of the author and publisher except in the case of brief quotations of 50 words or less embodied in critical articles and reviews.

The scanning, uploading, and distribution of this book via the Internet or via any other means without the permission of the author and publisher is illegal and punishable by law. Please purchase only authorized electronic editions, and do not participate in or encourage electronic piracy of copyrighted materials.

While the author has made every effort to provide accurate telephone numbers and Internet addresses at the time of publication, neither the publisher nor the author assumes any responsibility for errors, or for changes that occur after publication. Further, the author and publisher do not have control over and does not assume any responsibility for third party websites or their content.

www.MiniMeGeology.com

www.TracyBarnhart.com

www.CrystalCaveAdventures.com

Rock Detectives Camp Guide

INTRODUCTION

Welcome to the Rock Detectives Camp Guide. I designed this guide to allow you to choose a variety of rocks, minerals and activities for a fun, week-long course in geology. You can easily use this curriculum in any camp, school classroom or home school setting and are great for those days after state testing when teachers need fun activities for their students.

I designed the Rock Detectives Camp to interest children ages eight to 14 in geology. During the camp, the children will identify samples and assemble their own rock kit consisting of 10 rock and mineral samples and a hand magnifier. Each day of the camp has a theme, activity, and experiments. During the experiments, children will learn how to form and test a hypothesis. Each day will last approximately two to three hours, depending on the number of children at camp and the number of activities you choose. Children will receive handouts during each session about the day's subject that they can take home and share with their family.

I based camp on the Rock Detectives and My Rockin' Collection lines of kits by Mini Me Geology. It is helpful to have a set of the deluxe My Rockin' Collection kits for the camp; however, it is not necessary to purchase Rock Detectives kits. You can purchase each of those samples individually or in groups and this guide includes all necessary handouts.

Most importantly, if you have any questions about running or teaching your camp, please contact me directly! My email is tracyb@minimegeology.com.

Sincerely,
Tracy Barnhart, Owner
Giverny, Inc. / Mini Me Geology

DAY 1

MINERAL DAY

Rock Detectives Camp Guide

DAY 1: MINERAL DAY

Activity #1: Decorate a rock and mineral kit box and folder

Allow children to decorate a rock and mineral storage box and folder that they will use throughout the camp to store the samples and handouts that they receive each day. Great options for the box include inexpensive bead boxes from craft stores, fishing tackle boxes or clean egg cartons. These types of boxes have individual slots inside to keep the rock and mineral samples separated. Children can paint the boxes and use stickers to complete their decoration. Each child should receive a hand magnifier with their box that they will use throughout the camp. *Guide: Make A Rock Storage Box.*

Activity #2: Mineral Puzzle

Hand out the Mineral Day Word Find as the children complete their rock box decoration. The word find puzzle is a nice way to introduce some of the words that you will be discussing throughout the day. *Handout: Mineral Day Word Find.*

Activity #3: Mineral Short Lesson

Explain to children how to identify minerals using observation and hands-on tests of crystal shape, streak, cleavage, hardness, luster and color. The children will find it helpful to keep all of their papers in a folder throughout the week. *Handouts: All About Minerals Crystal Shapes, Streak, Luster, and Identifying a Mineral Using Mohs Hardness Scale.*

Activity #4: Identification Test Experiment

Perform identification tests on variety of samples including streak and hardness. As you hand out the samples for the streak and hardness tests, allow children to determine the luster of each sample. *Handouts: Streak Test Experiment and Hardness Test Experiment.*

Activity #5: Discovering Unique Mineral Properties Experiment

Some minerals have unique properties that help geologists identify the samples. Some of these include the optical properties of Iceland Spar calcite, the magnetic properties of magnetite, the odor of sulfur and the unique streak of hematite. These experiments will help children learn to identify these unique properties. *Handout: Crystal Experiments.*

Activity #6: Identifying Minerals from My Rockin' Collection Minerals Deluxe Kit

Have children identify the mineral samples from the Mini Me Geology My Rockin' Collection Minerals deluxe kit using the provided flow chart. Show them how to follow the steps of the flow chart to find the name of each sample. Children will write the name of the sample in the corresponding slot on the handout. After the children are done, go over each sample. The names of the samples are under the foam in each kit. The children can also use the identification brochure from the kit to help them identify the samples with pictures. *Handout: Mineral Identification Sheet and Mineral Identification Flow Chart.*

Rock Detectives Camp Guide

Activity #7: Cleavage of Halite

Children will discover the cleavage patterns of salt by breaking halite crystals. Allow each child or group to break a halite crystal using a rock hammer. The children will see the cubic cleavage as the halite breaks into smaller and smaller cubes as they continue to strike the sample.

Activity #8: Identify Mineral Samples to Keep

Give each child two new samples to identify. These are the samples that they will keep for their own rock and mineral kit. Children will use an identification flow chart handout as they perform the tests. Have each child determine the luster, streak and hardness of each sample. Give each child two small stickers to label the slots in their box for their minerals. *Handout: Mineral Identification Flow Chart.*

Supplies for Mineral Day

General Supplies:

- Folders for each child for handouts
- Paper for printing handouts
- Colored pencils or markers
- Stickers for inside kits

Activity #1: Decorate a rock and mineral kit box

- Egg carton, plastic bead box or fishing tackle box
- Paint / Markers / Crayons
- Paintbrushes
- Stickers, glitter, or any other decorations you choose
- Hand magnifiers

Activity #4: Identification Test Experiment

- White Streak Plates
- Black Streak Plates
- Pre-1982 pennies
- Paper clips (uncoated)
- Pyrite samples
- Amazonite samples
- Hematite samples
- Tourmaline samples
- Limonite samples
- Lepidolite samples
- Pencils
- Additional samples for streak, optional

Activity #5: Discovering Unique Mineral Properties Experiment

- Iceland spar calcite samples
- Magnetite Samples
- Sulfur samples
- Hematite Samples
- White streak plate
- Paper clips (uncoated)

Activity #6: Identifying Minerals from My Rockin' Collection Minerals Deluxe Kit

- My Rockin' Collection Minerals kit

Rock Detectives Camp Guide

Activity #7: Cleavage of Halite

- Rock hammer
- Safety glasses
- Halite samples

Activity #8: Identify Mineral Samples to Keep (choose 2 for each child).

- Amethyst
- Lepidolite Mica
- Biotite Mica
- Muscovite Mica
- Fluorite
- Calcite Rhombs
- Iceland Spar Calcite
- Blue Calcite
- Azurite
- Malachite
- Gypsum
- Kyanite
- Feldspar
- Quartz
- Milky Quartz
- Olivine
- Beryl
- Augite
- Halite
- Magnetite
- Sodalite

Guide to Common Mineral Hardness

Mineral	Hardness	Mineral	Hardness
Talc	1	Augite	5 - 6
Sulfur	1½ - 2 ½	Magnetite	5½-6 ½
Gypsum	2	Rhodonite	5½-6 ½
Muscovite Mica	2 - 2 ½	Sodalite	5½-6 ½
Lepidolite Mica	2½ - 4	Steel File	6½
Fingernail	2½	Feldspar	6
Halite	2½	Pyrite	6 - 6 ½
Calcite	3	Garnet	6½ - 7 ½
Penny	3 ½	Olivine	6½ - 7
Azurite	3½ to 4	Quartz	7
Malachite	3½ to 4	Tourmaline	7
Fluorite	4	Amethyst	7
Paperclip	4½	Milky Quartz	7
Kyanite	4 - 5 (along blades) 6 - 7 (across blades)	Quartz	7
Apatite	5	Beryl	7 ½ - 8
Limonite	5 - 5 ½	Topaz	8
Hematite	5 - 6	Corundum	9
Glass/Pocket Knife	5½	Diamond	10



ROCK DETECTIVES CAMP

www.MiniMeGeology.com

Make a Rock Storage Box

Every rock collection needs a special rock storage box. You can buy boxes made of wood, plastic or cardboard and fill it with your samples. Or, you can make your own egg carton box.

You will need:

- Egg carton, plastic bead box or tackle box
- Paint / Markers / Crayons
- Paintbrushes
- Stickers, Glitter, or other decorations you choose



To Make the Box:

Step 1: Make sure your carton/box is clean and dry.

Step 2: Paint the inside and outside of your box in any color you choose. You can also use markers or crayons to color your box. Take care not to glue your box closed with paint.

Step 3: Paint your name on the top.

Step 4: Decorate the rest of the outside of the box.

Step 5: As you gather samples, label each section with the name of your sample with a slip of paper or sticker.

Step 6: Place your samples in their slots and enjoy your new box!



ROCK DETECTIVES CAMP

www.MinimeGeology.com

Mineral Day Word Find



AMETHYST

BIOTITE

CLUSTER

DIAMOND

EPIDOTE

FACETS

HARDNESS

LEPIDOLITE

LUSTER

PLATE

RHOMBIC

ROCK



ROCK DETECTIVES CAMP

www.MinimeGeology.com

All About Minerals – Crystal Shapes

Minerals are all around you! They make up the rocks in the Earth and they have many uses too. Minerals come in many colors and shapes. Some minerals look very different from each other and some look very similar. Each mineral has a unique set of physical properties that geologists use to tell the minerals apart. The most common physical properties that geologists use to identify minerals are crystal shape, color, luster, hardness and streak.

There are many different crystal shapes in the world. In fact, there are too many to list here! Below you see some of the most common minerals and their shapes. The most interesting part about crystal shapes is that a mineral can sometimes be different shapes depending on how it formed.

Shape	Cube	Octahedron	Rhombohedron	Six-sided Prism center with six-side pyramids on both ends	Six-sided Platy
Minerals that can form this shape	Halite, Pyrite	Fluorite, Diamond	Calcite, Rhodochrosite	Quartz, Amethyst	Lepidolite, Mica

Sometimes you will see a mineral that looks like two crystals that have grown together. Geologists call these “**twinned**” crystals. Staurolite is a common twinned crystal.

Minerals can also form as a group or layer of crystals that attached to one another side by side. Geologists call this a mineral “**cluster**” or “**druze**.” Quartz, amethyst and citrine often form druze crystals.



ROCK DETECTIVES CAMP

www.MinimeGeology.com

All About Minerals – Streak

Streak is the color of a mineral in powdered form. Testing the streak color is easy and fun and can be a great clue when looking for a mineral's identity. Geologists use streak plates to test a mineral. A streak plate is an unglazed piece of porcelain tile which can be either black or white.



Black streak plates are typically used to test light colored minerals.



White streak plates are typically used to test dark colored minerals.

A streak plate has a hardness of about 7 on the Mohs Hardness scale which is similar to quartz and amethyst. So, minerals with hardness above 7, like corundum and diamond, will not show a streak on the plate and will actually scratch the tile. To test the streak of a mineral, choose a mineral and a streak plate. Place the streak plate on a table and scratch the mineral across the plate. You may have to scratch really hard to see the color. The streak color is the color of the mineral in powder form. The harder the mineral, the harder you will likely have to scratch.

Some minerals have the same streak color as their sample color.	NAME	MINERAL COLOR	STREAK COLOR
	Azurite	Blue	Blue
	Graphite	Black	Black to Dark Grey
	Limonite	Brown & Yellow	Yellowish-Brown
	Halite	Colorless to White	White

Some minerals have a different streak color than their sample color.	NAME	MINERAL COLOR	STREAK COLOR
	Sulfur	Yellow	White
	Pyrite	Brassy Yellow "fools gold"	Greenish-Black
	Hematite	Gray	Red to Reddish-Brown
	Amethyst	Purple	White

Some minerals have no streak and may scratch the streak plate.	NAME	MINERAL COLOR	STREAK COLOR
	Diamond	Colorless	Will scratch plate
	Ruby	Red	Will scratch plate



ROCK DETECTIVES CAMP

www.MinimeGeology.com

All About Minerals – Luster

Luster is the appearance of a mineral when the light shines on the sample. Minerals can have different lusters which is why it is another clue to a mineral's identity. There are many different mineral lusters. Some of the most common are:



Glassy – a mineral with a glassy luster shines and reflects light just like real glass. Examples of minerals with a glassy luster include quartz, **rhodonite**, tourmaline and epidote. Glassy is the most common luster of all minerals.



Pearly – a mineral with a pearly luster has the appearance of a real pearl. Examples of minerals with a pearly luster include talc, **lepidolite** and gypsum.



Earthy – a mineral with an earthy luster is not shiny and does not reflect light. The minerals appear dull, like soil. Examples of minerals with an earthy luster include **limonite** and azurite.



Metallic – a mineral with a metallic luster looks like metal (think quarter, pennies, and aluminum foil). Examples of minerals with a metallic luster include galena, **pyrite**, graphite and magnetite.



Silky – a mineral with a silky luster has the look of fine silk material. The minerals are often made of many small, thin fibers. Examples of minerals with a silky luster include **malachite** and ulexite.



Greasy – a mineral with a greasy luster looks as though it is covered with grease. Examples of minerals with a greasy luster include **sulfur**, halite and sodalite.



Waxy – a mineral with a waxy luster looks as though it is covered with wax. Examples of minerals with a waxy luster include **turquoise** and agate.



ROCK DETECTIVES CAMP

www.MinimeGeology.com

Identifying a Mineral Using Mohs Hardness Scale

Geologists use the hardness of a mineral to help determine the identity of a sample. German geologist, Friedrich Mohs, developed the Mohs hardness scale in 1812. The Mohs scale is a relative scale that lists the hardness of 10 common minerals. Talc, #1 on the scale, is the softest and diamond, #10, is the hardest. The Mohs scale also gives hardness values to common household items such as glass, your fingernail and a copper penny. The table below lists the minerals and household items on the Mohs hardness scale.

How to perform a hardness test:

To test the hardness of a mineral, try to scratch the surface of your unknown sample with a mineral or object from the hardness scale. If you cannot scratch the unknown sample with a sample from the Mohs scale, then the hardness of your sample is greater. For example, if you try to scratch "Sample A" with fluorite but it didn't scratch, the hardness of "Sample A" is higher than 4. If you can scratch "Sample A" with apatite, the hardness of "Sample A" is less than 5. Since you know "Sample A" is harder than a 4 but softer than a 5, you can guess that the hardness is about 4½.

Mohs Hardness Scale Trivia: The first nine minerals on the Mohs hardness scale have nearly the same relative hardness between them. For example, fluorite is four times harder than talc, quartz is seven times harder than talc and corundum is nine times harder than talc. However, the tenth mineral on the scale, diamond, is 40 times harder than talc!

Hardness	Mineral	Household item
1	Talc	
2	Gypsum	
2.5		Fingernail
3	Calcite	
3.5		Copper Penny (pre-1982)
4	Fluorite	
4.5		Paper Clip
5	Apatite	
5.5		Glass/Pocket Knife
6	Orthoclase Feldspar	
6.5		Steel File
7	Quartz	
8	Topaz	
9	Corundum	
10	Diamond	



ROCK DETECTIVES CAMP

www.MinimeGeology.com

Streak Test Experiment

We love the streak test because it can be really fun to see the different colors show up on the porcelain tile streak plate and is a great test to help identify your minerals. Let's try!

! SAFETY FIRST! A good geologist is always safe. Wear goggles to protect your eyes when scratching the samples and be careful because minerals and rocks can have sharp edges.

You will need:

- 1 white streak plate
- 1 black streak plate
- mineral samples
- pencil (Your pencil lead is actually the mineral graphite. Graphite is very soft and great for a streak test.)

To perform the test:

Place each streak plate on a hard surface. Scratch each mineral and your pencil on both streak plates.

Record the mineral name, mineral color and the color of the streak below. Remember, some minerals will have a colorless streak and others will be too hard to make a streak. Record your findings as the streak color, colorless, or too hard to streak.

Mineral Name	Mineral Color	Streak Color

Does one color of streak plate work better for some samples than others? _____

Is one streak color the most common? _____



ROCK DETECTIVES CAMP

www.MiniMeGeology.com

Hardness Test Experiment

Now that you have learned about the Mohs Hardness Scale, let's test the hardness of some samples.

! SAFETY FIRST! A good geologist is always safe. Wear goggles to protect your eyes when scratching the samples and be careful because minerals and rocks can have sharp edges.



Step 1: Separate the samples into two groups. The samples in one of these groups have almost the same hardness. The samples in the other group have very different hardnesses.

GROUP A	Pyrite	Amazonite	Hematite
GROUP B	Tourmaline	Limonite	Lepidolite

Step 2: Test the hardness by scratching the samples with your fingernail, a penny, paperclip and the other samples. When scratching one sample on another, place one mineral on a table with a piece of paper underneath the sample, then scratch with the second sample.

The samples in the group with the same hardness are roughly a hardness of 6 on the Mohs Hardness Scale. You will not be able to scratch any of the samples with your fingernail. Also, if you try to scratch one sample with another, you will not see a good scratch.

Which group has about the same hardness? Group: _____

Now test the other group. The samples in the other group have hardnesses of about 3, 5 and 7. You should be able scratch the softest sample with your nail, a paperclip, or both of the other samples (hint: you can flake apart layers of this sample).

Which is the softest sample with a hardness of 3? _____

The sample that has the highest Mohs number can scratch both samples in the group.

Which sample is the hardest and can scratch both of the other samples in the group?

Which sample has the middle hardness number? _____



ROCK DETECTIVES CAMP

www.MinimeGeology.com

Crystal Experiments

Every mineral has unique properties that make it special. Let's test several samples to see what makes them unique!

Experiment 1: Magnetite

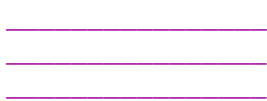
Magnetite's unique property is that it is magnetic. For this experiment, gather a magnetite sample and an uncoated paper clip.

Lay the paper clip on a table. Slowly touch the magnetite to the paper clip and see if you can lift it off of the table. It may take several tries but be patient and it will work!

Experiment 2: Iceland Spar Calcite

Iceland Spar Calcite is special because it can make images look doubled when you look through the crystal.

Place the crystal on top of the lines, words and pictures below. What do you see?



Geology
is
Awesome!



Experiment 3: Sulfur

If you have ever been to a sulfur spring you know that sulfur smells like rotten eggs. Smell the sample and see if you can smell the odor. Scratch your fingernail or a paperclip on the sample and see if the odor is stronger. The rotten egg smell gets stronger when the sample is heated. Try holding the sample in your hands for a few minutes. Does the rotten eggs smell get stronger as the sample warms? Did you also notice that the sulfur is very soft?

Experiment 4: Hematite

Hematite is a great mineral for testing the streak. Most minerals will either streak a white color or the same color as the mineral itself. But hematite will streak a totally different color which is an important clue to its identity. To test the streak, take your hematite and scratch it in the picture below or on a white streak plate. Scratching the mineral will turn some of it into a powder on the paper. This powder color is the streak.



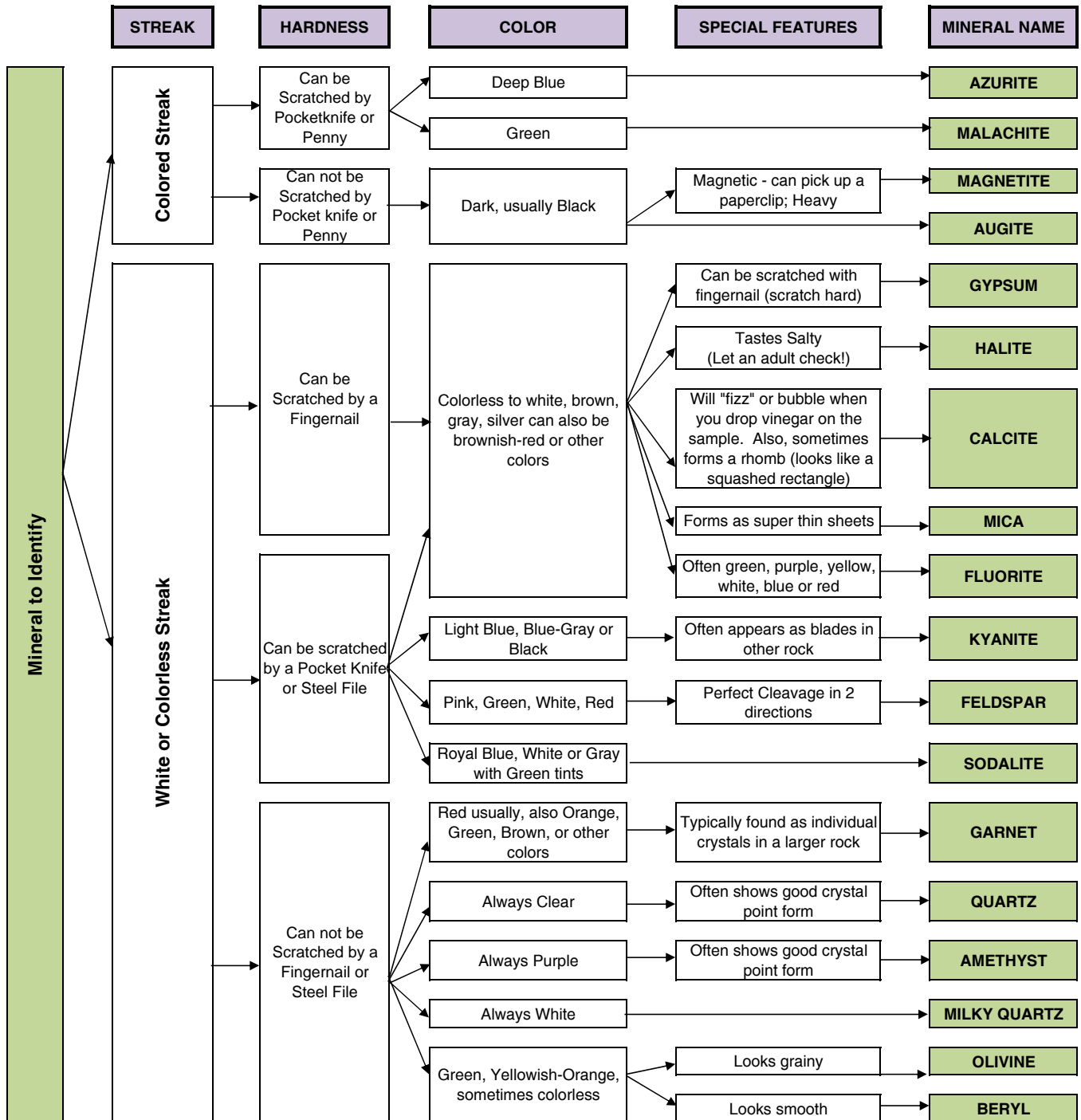
What color is the hematite mineral? _____

What color is the hematite streak? _____

The unique streak color is an important clue for Geologists.



Mineral Identification Flow Chart





Mineral Identification Sheet
