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How to Identify

ROCKS & MINERALS

Louise Leslie

author and illustrator

Cliffs of Fundy Geopark

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About this Guide

This guide was developed as a comprehensive classroom resource that is included in the GeoLearns Rock and Mineral Kit. The pebbles shown in the guide were collected from the beaches within the Cliffs of Fundy Geopark. The rock samples, some of which are shown in the guide, were donated by the Nova Scotia Department of Natural Resources and Renewables and originate from mines in Nova Scotia. The creation and design of the Rock Identification Mat and the Rock Identification Table were primarily based on the rock types represented by these pebble and rock samples.

Contents

The Planet Earth

The four systems that make up our planet Earth are the atmosphere, hydrosphere, biosphere and **geosphere**. These systems work together to provide the air, water, food and nutrients that all life needs to live on our planet. The geosphere is the solid, rocky material of the Earth. This includes the dust in the atmosphere, the soil, and **sediments** in the oceans and on land. It also includes what is below the surface, in the Earth's interior.

Knowing what makes up the Earth's interior helps us understand how rocks are formed. Special tools have helped scientists define different layers in the Earth's interior. More than 6,000 kilometres deep, at the centre of the Earth, is the **core**. It is divided into a solid inner core and liquid outer core. Surrounding the core is the thickest layer called the **mantle**. It is made up of a mostly solid lower mantle and a solid upper mantle that has a thin layer within it called the **asthenosphere** that behaves like plasticine (or playdough). The **crust** is the outermost layer of the Earth and it is made up of **continental crust** and **oceanic crust**.

The **brittle**, solid **rock** layer made up of the upper part of the mantle and the crust is called the **lithosphere**. This layer floats on the asthenosphere which acts like a conveyor belt. The movement of the lithosphere caused it to break into several pieces called **tectonic plates**, which are divided into **continental plates** and **oceanic plates**. The heat rising up from the asthenosphere keeps the plates moving at rates of 2 to 10 centimetres per year, similar to how fast your nails grow. Continuous movement of the tectonic plates is what causes new rocks to be created and older rocks to be transformed. This process is referred to as the **rock cycle**.

Earth's Interior

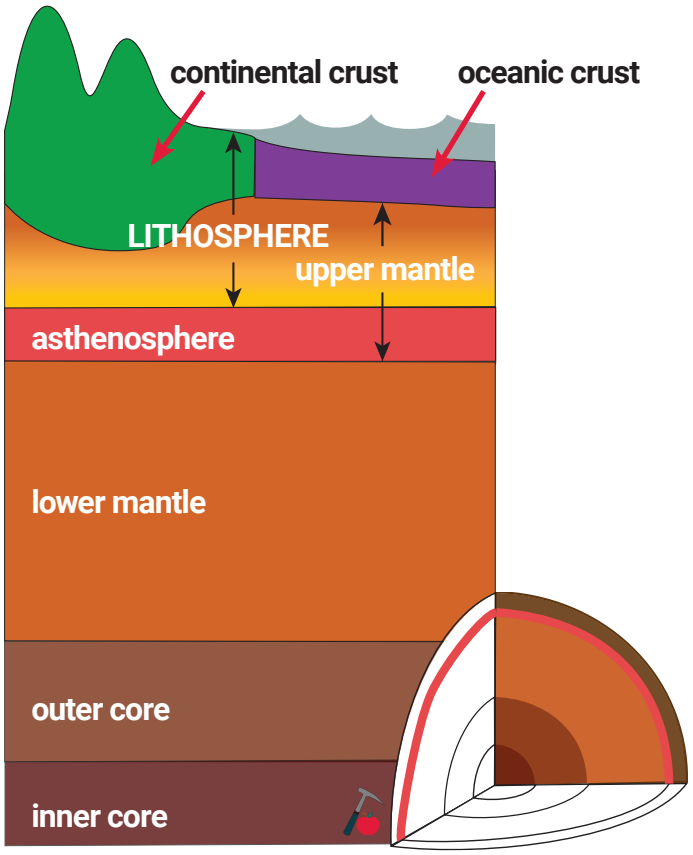
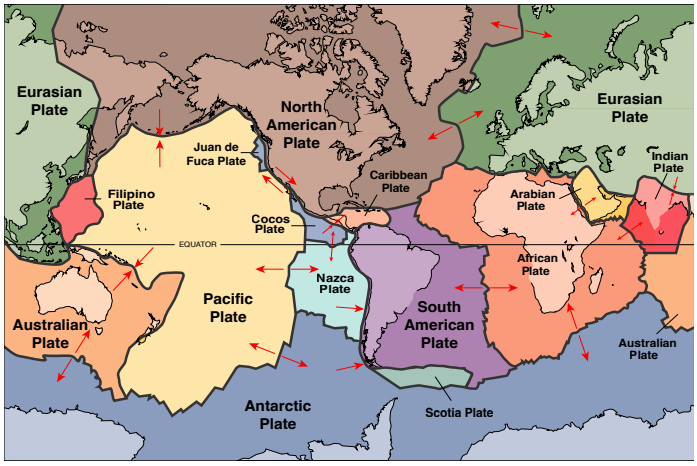


Plate Tectonics



World map of tectonic plates

The different colours in this diagram represent tectonic plates. The red arrows indicate the directions that tectonic plates move. Their boundaries are described as **convergent** (arrows point toward each other), **divergent** (arrows point away from each other) and **transform** (arrows move past each other). The movement of these plates is a process called **plate tectonics**.

Convergent Boundary

When continental and oceanic plates move toward each other, the oceanic plate moves down under the lighter continental plate. This downward movement is called **subduction** and the area is known as a **subduction zone**. As the oceanic plate is pulled downward by gravity it gets closer to the heat of the asthenosphere. This causes some parts of the oceanic plate to be deformed and some of it to melt into **magma**. Much of the western coast of North America is an example of this plate movement.

subduction of an oceanic plate colliding with a continental plate

When two continental plates move toward each other they will collide because they are not heavy enough to be pulled down. The collision pushes the plates together to form mountains. An example of this is the Himalaya mountains.

two continental plates colliding

Divergent Boundary

When two oceanic plates move away from each other an opening is created between them. This allows magma to rise and create new oceanic crust in the opening. An example of this is Iceland and the mid-Atlantic ridge in the Atlantic ocean.

two oceanic plates expanding

When parts of a continental plate move in opposite directions, the movement causes the crust to become thinner. This was how the North Atlantic ocean started to be formed millions of years ago.

continental plate expanding and crust becomes thinner

Transform Boundary

When two plates slide horizontally past each other they rub up against their sides. This movement is referred to as a transform fault. The San Andreas fault in California in the United States is an example of this plate movement.

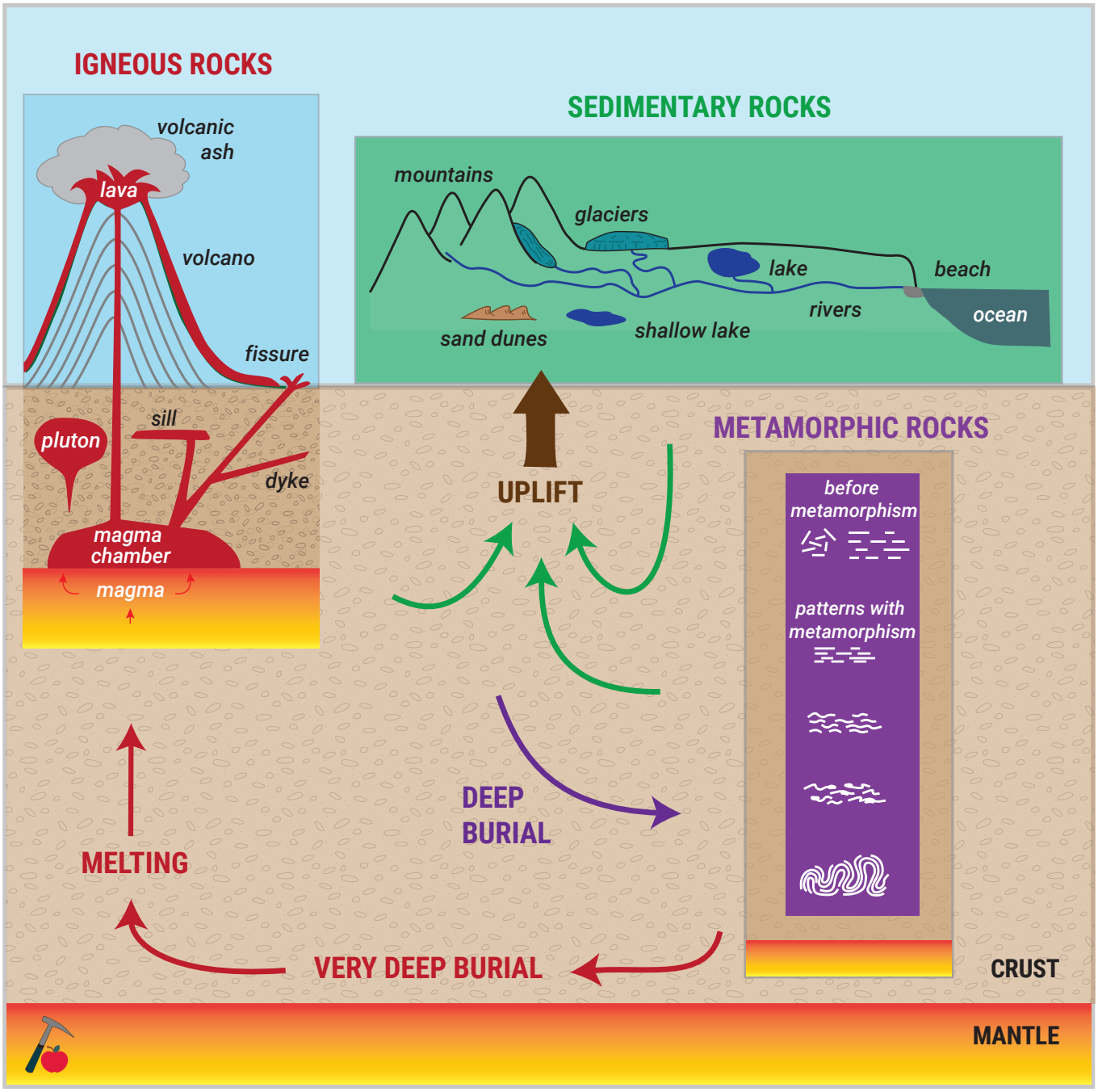
sides of two plates rub together

The Rock Cycle

The Earth's crust continuously changes to form and transform rocks.

New rocks form and old rocks transform to produce a continuous cycle of changing rocks that are categorized into three types.

Igneous rocks are from magma that is formed when solid rock is **melted** by the extremely hot temperature present very deep in the Earth's crust. Since magma is lighter than the surrounding rock, it will rise upwards and become a solid by the processes of cooling and **crystallization** that form **crystals**. Igneous rock are formed shallow



in the Earth's crust and on the Earth's surface.

Sedimentary rocks form on the Earth's surface from processes that form layers of sediment. The weight of the layers buries the sediment at shallow depths in the Earth's crust where they become **cemented** and turn into rocks.

Metamorphic rocks form when they become buried deep in the Earth's crust and are transformed by processes of heat and pressure. All rock types, even metamorphic, can be transformed into a new metamorphic rock.

3 Ps Make a Rock

Rock characteristics are important clues that tell the stories hidden in the rocks. The clues tell us where the rocks were formed and the processes that happened in these places. Think of it as the "**three Ps**".

PLACE + PROCESS = PRODUCT

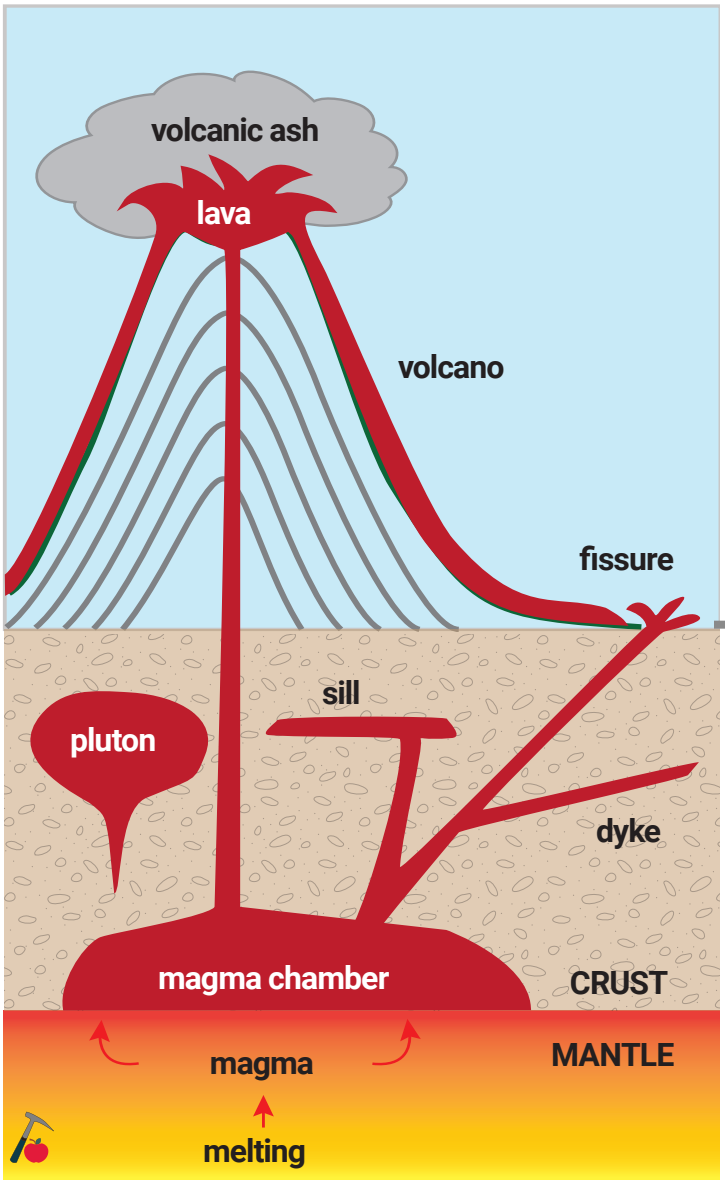
PLACE tells us where the rock has travelled such as, on and below the Earth's surface. Some examples of places on the Earth's surface are volcanoes, **fissures**, mountain slopes, rivers, lakes, beaches, deserts and oceans. Places below the Earth's surface are described as shallow, deep and very deep in the Earth's crust. For example, some of the places shallow in the Earth's crust are **magma chambers**, **plutons**, **sills** and **dykes**.

PROCESS tells us how the rock was formed. Some examples of how things help to form the rock are described as melting, crystallization, **uplift**, **weathering**, **erosion**, **transportation**, **deposition**, **evaporation**, **precipitation**, **burial**, **cementation**, heat and pressure.

Adding the two **Ps** together will lead you to the type of rock (**Igneous**, **Sedimentary** and **Metamorphic**) which is the **PRODUCT**.

Place	Process	Product
on the Earth's surface where there are volcanoes and fissures	rapid cooling and crystallization	**Extrusive Igneous Rock**
shallow in the Earth's crust in magma chambers, plutons, sills and dykes	slow cooling and crystallization	**Intrusive Igneous Rock**
on the Earth's surface on mountain slopes and beaches, in and under glaciers, and in deserts, rivers, lakes and oceans	weathering erosion and transportation deposition	**Clastic Sedimentary Rock**
	evaporation and precipitation	**Chemical Sedimentary Rock**
shallow in the Earth's crust	burial and cementation	**Sedimentary Rock**
deep in the Earth's crust	heat and pressure	**Metamorphic Rock**
very deep in the Earth's crust	melting to form magma	**origin of Igneous Rock**

Igneous Rocks



Place

on Earth's surface

Commonly found in subduction zones that are along coastlines and at divergent oceanic plate boundaries where there are volcanoes and fissures.

Process

rapid cooling

As magma rises up it changes into a **lava**. It will then cool rapidly and crystallize to form crystals that are mostly too small to see and there may be some crystals large enough to see.

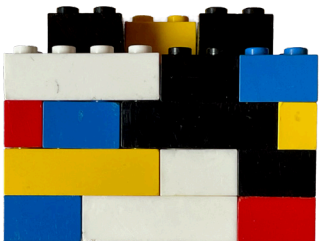
below Earth's crust

Found in magma chambers which crystallize to form plutons, and smaller bodies called sills and dykes.

slow cooling

As magma rises up it is trapped in the crust. It will then cool slowly and crystallize to form crystals that are all large enough to see.

Igneous rocks are made up of crystals that are interlocked together, similar to how building blocks snap together. There are no spaces in between the crystals. This means that water cannot get inside the rock and in between the crystals which makes igneous rocks **impermeable**.



The coloured blocks show how each of the different crystals in an igneous rock are tightly interlocked together.

Product

Extrusive (Volcanic) Igneous Rock

This formed from lava that flowed or erupted and crystallized as a solid rock on the Earth's surface.

Rhyolite

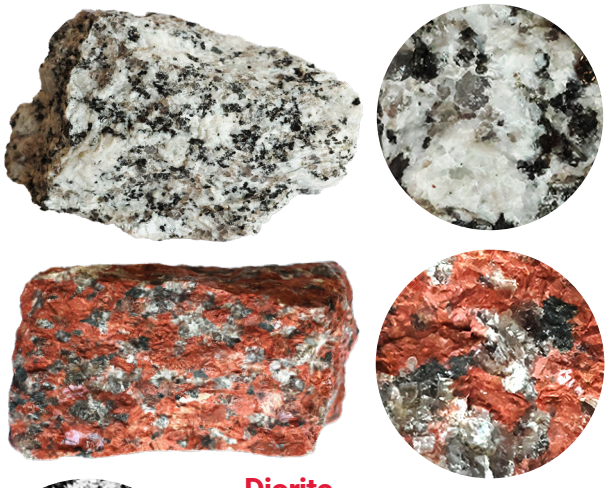
The thin bands represent layers of different compositions within a single lava flow. Some rhyolites can also be made up of a mix of crystals that are too small to see and larger crystals big enough to see. Although these two rocks look different they have the same composition.

Basalt

A unique characteristic found only in igneous extrusive rocks are **vesicles**. This basalt has rounded holes that were formed by trapped gas bubbles in the lava when the rock was cooling. The vesicles often have crystals inside them, like this one.

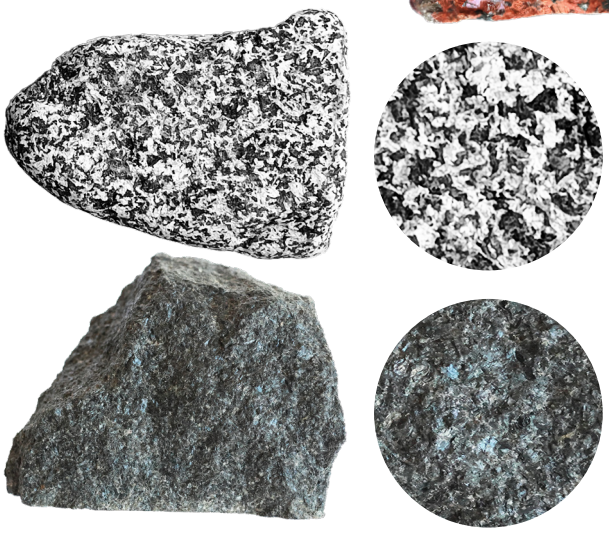
Intrusive (Plutonic) Igneous Rock

This formed from **molten** magma that travelled upward and crystallized as a solid rock within the Earth's crust.



Granite

Granite is composed mostly of feldspar (orange or white crystals), quartz (transparent grey crystals) and biotite (black crystals). Feldspar has shiny, flat, repeating surfaces with square corners like stairs. Quartz has a glassy appearance and biotite is the flaky crystal.



Diorite

Diorite commonly has black and white specks. It is made up of mostly hornblende (black, rod-shaped crystals) and feldspar (white crystals). There are generally a bit more darker crystals than lighter ones. Quartz crystals are usually not present.

Gabbro

Gabbro has mostly dark coloured crystals such as plagioclase (transparent bluish-black feldspar crystals), pyroxene (black crystals) and olivine (transparent green crystals). Crystals become more visible when light reflects off them.

Sedimentary Rocks

Place

on Earth's surface

Found on mountain slopes and beaches, in and under glaciers, and in deserts, rivers, lakes and oceans.

Process

weathering

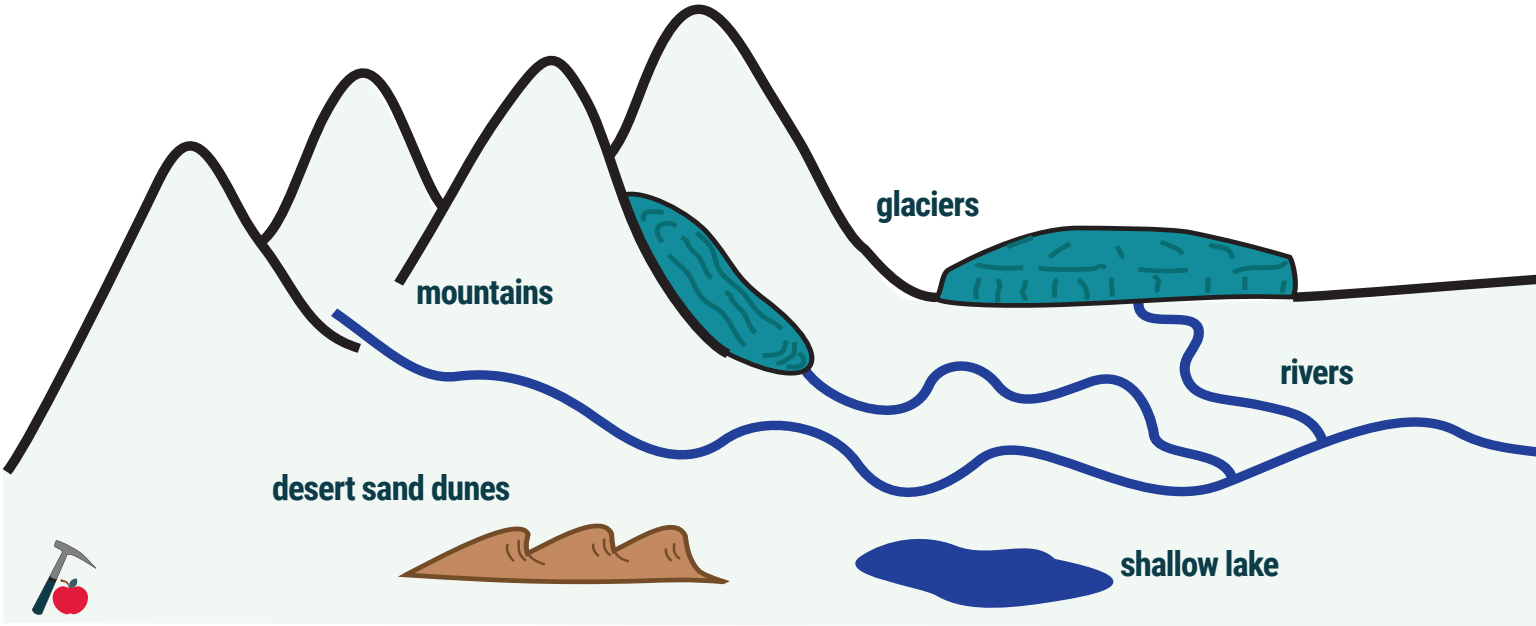
This "**breaks rock**" which is when a solid rock is broken into smaller bits called **clasts** or sediments.

erosion and transportation

This "**moves rock**" which is when water, wind, ice and gravity move sediments and wears them down into smaller sediments.

deposition

This "**dumps rock**" which is when sediments come to rest and are laid down.



on Earth's surface

Found in oceans and shallow lakes.

evaporation and precipitation

Sediments and **solutions** form into a solid material from these two chemical processes.

shallow in Earth's crust

Found under places where sediments are buried.

burial and cementation

Sediments become buried deeper and deeper by the weight of other sediments deposited on top of them and then cemented into a solid sedimentary rock.

Clastic Sedimentary rocks are made up of sediments held together by a glue that acts like a cement. The spaces in between the sediments allow water to get into the rock which makes it **permeable**.

Cereal bits represent sediments and the melted marshmellow is the cement holding sediments together.

Product

Clastic Sedimentary Rock

This rock is made up of clasts.

Conglomerate

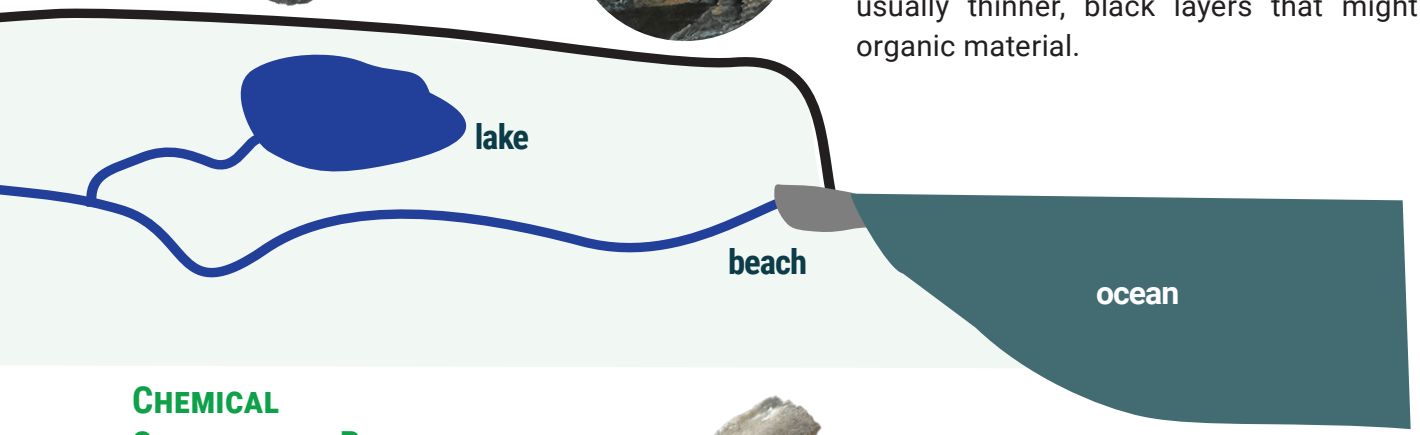
This rock has a mixture of many different sizes and types of rounded sediments. In this example there are different pebble sizes within the rock. Most conglomerates have no **pattern** and are usually all jumbled up, like this one.

Sandstone

This rock is made up mostly of sand-size sediments. This pattern of layers is called **bedding**. Each layer is made up of sediments of similar size and the different layers represent different sizes of sediments. The very thin, darker layers are made up of smaller sediments of clay (or mud) mixed with organic material, such as decomposed plants.

Mudstone

This rock is made up of mostly silt or mud-size sediments that are too small to see. Sedimentary bedding can sometimes be distinguished by darker, usually thinner, black layers that might contain organic material.



Chemical Sedimentary Rock

This rock is formed by the precipitation of **minerals** from solutions either by evaporation or by biological activity.

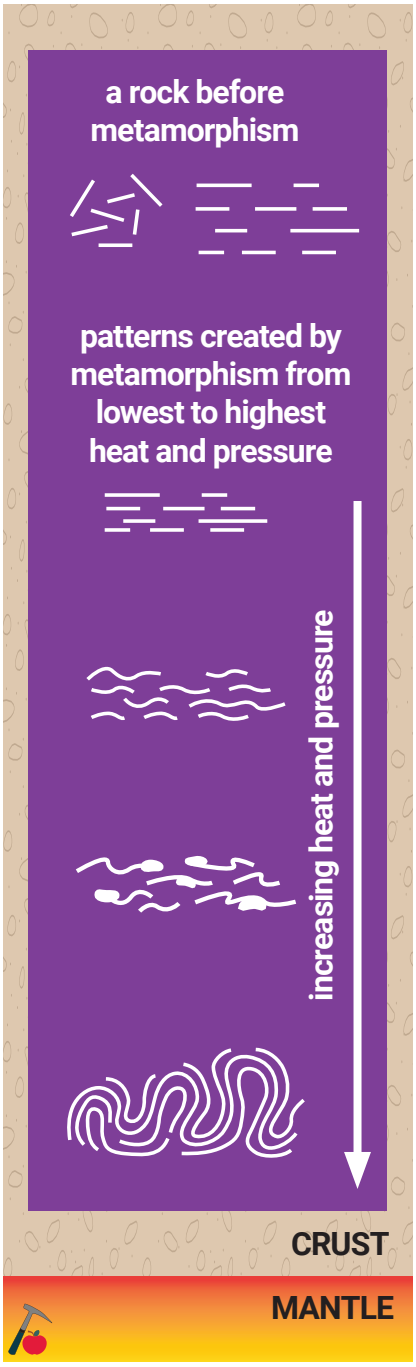
Gypsum rock

Gypsum is formed when water is evaporated out of a specific salt solution (called “seawater”). This rock is soft in comparison to most rocks and can be scratched with a penny (copper coin).

Limestone

Many limestones have shell **fossils**. These are the pieces with a ridged pattern shown in this rock. The powder of this rock will react with vinegar and create tiny bubbles. This is the rock dissolving with vinegar (an acid) and producing carbon dioxide.

Metamorphic Rocks



Place

deep below Earth's surface

Some examples of these are found deep in a subduction zone and in the walls surrounding bodies of trapped magma.

Process

heat and pressure

This is where more and more changes in the solid rock happen as the heat and pressure increases in the Earth's crust.

Product

Slate

This rock will split easily into thin sheets because it is brittle. It has thin and mostly flat layers. A thin sheet of slate will usually make a sharp pinging noise when hit on a hard surface.

Phyllite

This rock generally has thinner and wavier layers, called **foliations**, than slate. This is because there was more heat and pressure which caused more change to the sedimentary layers. The surface can sometimes feel smooth or soapy and it might have glittery specks of mica (flaky) crystals.

Gneiss

This rock has patterns with flat to slightly wavy bands that are different thicknesses and also dark and light colours. The different colours represent the rearrangement of different mineral compositions in the rock. This indicates that high heat and pressure was needed to transform this rock.

Metamorphic rocks are made up of any type of rock that has been changed by heat and pressure. The rock may have been partially melted with the texture and minerals in the rock transformed.

In general, all metamorphic rocks are impermeable.

Identification of Rock Types

The key to identifying rock types is to determine its **texture**. This is done by noticing what the rock is made up of and if there is a pattern. Most rocks are made up of either crystals or sediments. The **Rock Identification Mat** will help sort the rocks into some common rock types by noticing their texture.

Start by placing your rock in one of the three boxes and then choose the circle that best describes the rock. This will lead you to the rock type. Note these observations and add them to the **Rock Identification Form**. Complete the form by adding more observations, including a sketch. Use the observations recorded in the form and follow the clues in the **Rock Identification Key** to determine the rock name.

rocks with crystals **rocks with sediments**

no patterns

patterns

rocks with crystals and sediments too small to see

shell fossils

thin flat layers

Rock Identification Mat

(an example for Elementary school level)

Box 1

Crystals

Pattern

- thin wavy layers
- thick wavy layers

Metamorphic

No pattern

- large enough to see
- too small and some large

Igneous

Box 2

Sediments

- different sizes
- mostly the same size

Sedimentary

Box 3

Crystals and Sediments are too small to see

Metamorphic

- brittle flat thin layers

Igneous

- holes like gas bubbles

Sedimentary

- bedding with flat layers
- fossil fizzes (bubbles)
- scratches with copper coin

Rock Identification Form

Noticing the small details in a rock will help you identify the rock name.

The **Rock Identification Mat** should help you determine the rock type. Now it's time to take a closer look at the details and complete the **Rock Identification Form**. One form is completed for each rock sample.

Record

Start by filling out the upper part of the form. Write your name in the **Collector** box and add today's **date**. Write down the **sample** number of the rock if there is one shown on the rock. You can leave the **location** and its **description** blank if this is not a rock you collected.

If you collected this rock, give it a sample number, for example, AB-01 (two letters for your initials plus a two-digit number). Write down the location and a brief description of where you collected it. Write your sample number on a tag and place it inside the sample bag. Make sure to place your rock in the sample bag for safe keeping once you have completed your rock identification.

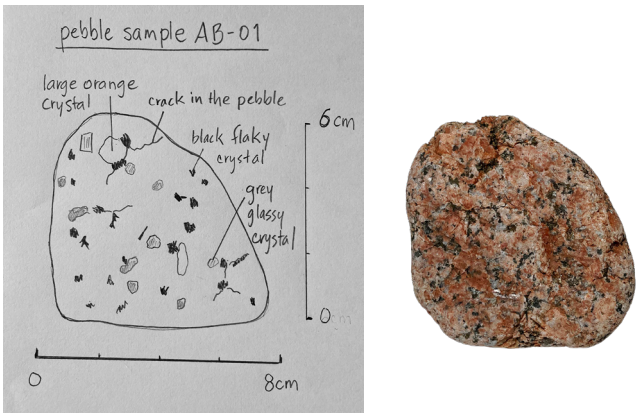
Write neatly and use your best grammar so others will understand what you have written. Sharing your recorded observations with others will help you to learn more about your rocks.

Measure

Fill in the boxes under the **Rock Observations** section. Use your observation skills to measure some of the different characteristics of your rock. This includes **colour**, **dimensions**, **shape**, **texture**, **permeability**, how it **feels** and the **pattern**. In the large box you can add more details about your observations if needed.

Sketch

Use the space in the **Sketches** box to draw what you see and use a magnifier to take a closer look to describe your observations. A helpful tip is to make a trace of the rock outline and then add the details. Each sketch should include a title, the rock's dimensions and labels for the features that are described. An example of a sketch is shown below. A photo of the rock has been included to show what was sketched.



Sketch and photo of pebble sample AB-01

Take Photos

If you are able, it's a good idea to take photos. They can capture details that you might not notice until after you look closely at the photo. It's also helpful to keep a journal of what you photographed and include a brief description so you can go back to remind yourself about the photo and the rock you identified.

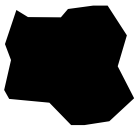
Identify

Complete the form by choosing the **rock type** and identifying the **rock name**.

Rock Identification Form

Collector	Date	Sample #
Location Name	**Location Description**	

Rock Observations

Colour (this can be one or more than one)	**Dimensions** (measure the shortest and longest lengths in centimetres)	**Shape** (choose one of the following) **rounded** **angular**   **subrounded** **subangular**  
Texture (describe crystals, or sediments, or note if they are too small to see)	**Permeability test** (place a drop of water on the rock) water is absorbed = **permeable** water runs off = **impermeable**	
Feels (describe - this could be if surface is smooth or rough and also if it is light or heavy)	**Pattern** (describe the pattern or note if there is no pattern)	

Sketches and more observations (include a title, dimensions and labels with arrows pointing to the sketch)

Rock type: (circle one) **Igneous** **Sedimentary** **Metamorphic**	**Rock name:**

Rock Identification Key

Use observations from the **Rock Identification Form** and the key below to determine the rock name. Start at the left with texture and continue following the clues to the right.

<table>
<tr><th>Texture</th><th>Permeable</th><th>Colour</th><th>Pattern</th></tr>
<tr><td rowspan="3">all or some sediments are visible</td><td>has high permeability</td><td rowspan="5">has light and dark colours</td><td>has no pattern</td></tr>
<tr><td>has medium permeability</td><td rowspan="2">• has no pattern
• has an organized pattern with flat layers (bedding)
• has an organized pattern with flat and wavy layers (bedding)</td></tr>
<tr><td>has low permeability</td></tr>
<tr><td rowspan="4">all sediments and crystals are too small to see</td><td rowspan="6">is impermeable</td><td rowspan="2">has an organized pattern with thin and slightly wavy layers (foliations)</td></tr>
<tr><td rowspan="2">has dark colours</td></tr>
<tr><td>has no pattern</td></tr>
<tr><td>has dark to medium colours</td><td>has an organized pattern with flat to wavy layers</td></tr>
<tr><td rowspan="3">all or some crystals are visible</td><td rowspan="2">has light and dark colours</td><td rowspan="2">has no pattern</td></tr>
<tr><td>has dark colours</td></tr>
<tr><td rowspan="2">has light and dark colours</td><td>has an organized pattern with thin and slightly wavy layers (foliations)</td></tr>
<tr><td>has an organized pattern with thin to thick and flat to wavy layers (foliations)</td></tr>
</table>

Choose one or more boxes that it connects to which could be two or more boxes. The bullets (dots) indicate there is one or more than one choice in the box that is possible.

Other Characteristics		Rock Name	Rock Type
has mix of rounded pebbles and smaller sediments of different types		conglomerate	clastic sedimentary
• has layers that are slanted in one or more directions • has black marks or animal tracks • has fossils of plant material • has ripples or mud cracks	has mostly sand-size sediments	sandstone	
	• surface feels smooth like a powder • surface feels greasy	siltstone, mudstone or shale	
• surface of the rock fizzes (bubbles) with a drop of vinegar • has fossil shells or fragments of dead sea animals		limestone	chemical sedimentary
rock can be scratched with a penny (copper coin)		gypsum	
powder of the rock fizzes (bubbles) with drop of vinegar		marble	metamorphic
• fresh surface has sugary texture • crystals look like they are glued or melted together		quartzite	
has greenish colour and feels smooth		phyllite	
breaks easily between layers and is brittle		slate	
has black to greyish colour with holes shaped like gas bubbles		basalt	igneous extrusive (volcanic)
• has reddish-purple or greenish colour • has holes with some filled in with light coloured crystals • has wavy layers and may have larger-size fragments or crystals		rhyolite	
has black to greyish colour with some holes filled in with light coloured crystals		basalt	
has crystals of grey (quartz), white or pinkish-orange (feldspar) and black (biotite) colours		granite	igneous intrusive (plutonic)
has specks of white (feldspar crystals) and black (hornblende crystals)		diorite	
has mostly black crystals with dark-coloured feldspar crystals		gabbro	
has glittery flakes of mica and may have some larger crystals of different colours		phyllite or schist	metamorphic
has layers (foliations) with different thicknesses that have dark and light coloured crystals		gneiss	

Physical Properties of Minerals

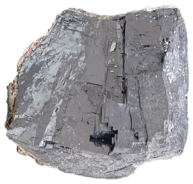
Minerals are the ingredients that make up a rock.

The crystals that make up a rock represent different minerals. The definition of a mineral is a solid, non-living substance that occurs naturally with a specific chemical composition and internal arrangement of **atoms** that determines its physical properties. A rock can be made up of one or more minerals. Gypsum is an example of a rock that is made up of one mineral. So far, scientists have identified over 5,000 minerals.

Minerals can be identified by some of their common physical properties using simple tools and tests. Follow the tests in the order described below.

Lustre

The first property to determine is **lustre**. This is how light is reflected from the surface of the mineral. The two main categories for lustre are metallic and non-metallic. Metallic lustre looks and shines like a metal, such as gold, silver or brass. Words used to describe a metallic lustre can be shiny or dull. Minerals that do not have a metallic lustre have what's called a non-metallic lustre. Glassy is the most common non-metallic lustre which looks and shines like window glass.



shiny metallic lustre

dull metallic lustre

glassy lustre

Hardness

Hardness is the next property to determine. The table below represents a scale of hardness that is based on scratching minerals against each other. This is referred to as the Mohs scale of hardness. This scale was based on 10 minerals which were ranked from softest to hardest on a scale with 1 being the softest and 10 the hardest.

Begin the hardness test with the softest tool and continue with harder tools until it scratches the mineral. For example, if you can scratch the mineral with your fingernail, there is no need to test with the penny or any of the other harder tools.

Hardness	Mineral	Tool
1	talc	
1.5		HB pencil lead
2	gypsum	
2.5		fingernail
3	calcite	
3.5		penny (copper coin)
4	fluorite	
4.5		steel nail
5	apatite	
5.5		glass
6	feldspar	
6.5		steel file
7	quartz	
8	topaz	
9	corundum	
10	diamond	

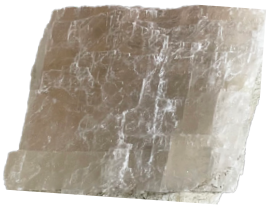
The hardness test is usually not needed for minerals with a metallic lustre since most can be identified by other properties such as its shape and the colour of its streak.

Shape

A mineral's shape can be determine by the **crystal form**, the **cleavage** or both. The crystal form is the outside shape of a mineral. It is determined by the internal orderly arrangement of its atoms. Some common crystal forms are shown here.

cubic

hexagonal



rhombic

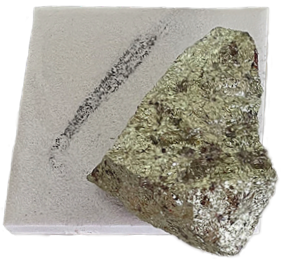
The cleavage appears as weak surfaces where the mineral breaks more easily. These are called planes of weakness and are determined by weak **bonds** present in the internal arrangement of the mineral's atoms. A mineral can have one or more planes of weakness.

a platy cleavage with one plane of weakness

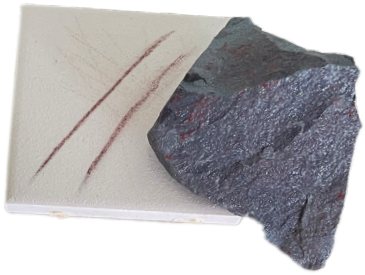
two planes of weakness that meet at 90° (degrees) or the same angle as corners of a cube

Streak

Streak is the colour of the mineral as a powder. Sometimes the colour of the streak is not the same colour as the mineral sample.



a brassy gold-coloured mineral with grey streak



a dark grey-coloured mineral with red streak

Colour

Colour is important to note, but you need to be careful because some minerals can have more than one colour. Here are some examples.

three colours representing the same mineral

two colours representing the same mineral

Magnetic Test

To test if a mineral is magnetic, all you need to do is see if a magnet will stick to it.

Physical Properties of Minerals

Acid Test

NEVER DROP VINEGAR ONTO THE MINERAL! To prevent the mineral from being damaged and help preserve the outer surface of the mineral, scrape it on a streak plate to get a powder. Then drop a sample of vinegar on the powder. Calcite is present if it bubbles. This test can also be used to identify limestone.

acid test with vinegar

All the results from your tests should be recorded in the **Mineral Identification Form** shown below. One form is completed for each mineral.

Fill in your name, date and sample number. Then record your results, starting with the mineral's lustre. Next, perform the hardness test and circle the matching number. Take a closer look at all the different surfaces with your magnifier and determine if the shapes are based on the crystal form or the cleavage. Choose one of the shapes in the form or describe it. Compare your results to the list of common minerals and their properties in the **Mineral Identification Key** to help you identify the mineral.

Mineral Identification Form

Mineral Identification Form

GeoLearns©

Collector	**Date**	**Sample #**

Physical Properties of Minerals

Lustre: describe how the light is reflected off the surface of the mineral (circle one or describe)

metallic		**non-metallic**				
shiny	dull	glassy	earthy	pearly	soapy	other:

Hardness: circle the number that scratches the mineral. If the steel file does not scratch the mineral then it has an H>6

H=1 (lead pencil) **H=2** (fingernail) **H=3** (penny) **H-4** (steel nail) **H=5** (glass plate) **H=6** (steel file) **H>6**

Shape: this is the crystal form (outside shape) or the shape created from planes of weakness (cleavage) (circle one or describe)

cubic	hexagonal	rhombic	platy	massive (no repeating surfaces)
				≥2 weakness surfaces at 90°
				≥2 weakness surfaces NOT at 90°
				other:

Streak: colour of the powder on the streak plate (circle one or describe)						**Colour:** (list one or more)
white	black	grey	red	green	other:	
Magnetic:	yes	no	**Acid Test:**	bubbles	no bubbles	**Mineral Name:**

Mineral Identification Key

Minerals with metallic lustre							
name	**lustre**	**hardness**	**shape or form**	**cleavage**	**streak**	**colour**	**other**
galena	shiny	2.5 to 3	cubic	3 surfaces at 90°	lead grey	silver	heavy for its size
chalcopyrite	shiny	3.5 to 4	massive	poor	green to black	brass yellow	
hematite	dull	5.5 to 6.5	commonly massive	none	reddish brown	reddish brown to grey	
magnetite	dull to shiny	5.5 to 6.5	massive	none	black	grey to black	magnetic
pyrite	shiny	6 to 6.5	cubic	none	greenish black	gold to brass yellow	
Minerals with non-metallic lustre							
talc	pearly to greasy	1	massive	none	white to pale green	greyish-white	feels soapy
halite	glassy	2.5	cubic	3 surfaces at 90°	white	colourless to white	taste salty
selenite	glassy to pearly	2	tabular	good on one surface and poor on 3	white	colourless	might also be called gypsum
biotite	glassy	2 to 2.5	6-sided and platy	one flat surface	colourless	black to dark brown	breaks into thin sheets
calcite	glassy	3	rhombic	3 surfaces at 75°	white	white or colourless	reacts with vinegar
fluorite	glassy	4	cubic and 8-sided	4 surfaces at 90°	white	colourless, violet, green or yellow	
hornblende	dull to glassy	5 to 6	rod-like	2 surfaces at 120°	colourless	deep green to black	
feldspar	dull to glassy	6	cubic	2 surfaces at 90°	white	white to grey and pink	
amethyst	glassy	7	hexagonal **prism**	none	white	purple	**conchoidal** fracture
quartz	glassy	7	hexagonal prism	none	white	colourless and variety	conchoidal fracture

GLOSSARY

*Terms in smaller **bolded text** refer to terms listed in the glossary.*

ASTHENOSPHERE (1) A partially **molten** layer within the upper **mantle** and beneath the **lithosphere**, which flows in a solid state and helps **tectonic plates** move.

ATOM (15) The smallest particle with distinctive properties of a given chemical element.

BED (BEDDING) (8) A layer in a sedimentary rock, originally laid down as a layer of **sediment**.

BOND (16) A force of attraction that holds **atoms** together in a crystal.

BRITTLE (1) A term describing a rock that splits easily.

BURIAL AND CEMENTATION (4) A sedimentary process of burying layers of **sediment** below the Earth's surface and forming a solid rock from the weight of the overlying layers of sediment and precipitation of a **cement**.

CEMENT (4) A material that consists usually of quartz or calcite **minerals** that **crystallize** in the pore spaces of **sediments**.

CLAST (7) Broken fragments of rock.

CLASTIC (7) A sedimentary rock **texture** consisting of broken rock fragments.

CLEAVAGE (16) The tendency of a mineral to break along planes of weak **bonds** determined by the mineral's internal arrangement of **atoms**.

CONCHOIDAL (18) A type of fracture that has a surface that is curved and with a circular ridge pattern similar to a clam shell.

CONTINENTAL CRUST (1) The part of the Earth's **crust** that forms the continents and that is less dense (lighter) and thicker than **oceanic crust**.

CONTINENTAL PLATE (1) A type of **tectonic plate** that contains **continental crust**.

CONVERGENT BOUNDARY (2) The line along which two **tectonic plates** that are moving toward each other meet.

CORE (1) A zone at the Earth's centre consisting mostly of iron with a solid inner core and a liquid outer core.

CRUST (1) The uppermost layer of the Earth that overlies the upper **mantle**, consisting of a **continental crust** and an **oceanic crust**.

CRYSTAL (3) A three dimensional solid with flat, regular, repeated surfaces created from the internal orderly arrangement of **atoms** in a **mineral**.

CRYSTAL FORM (16) The external appearance of a **mineral** as determined by the internal orderly arrangement of its **atoms**.

CRYSTALLIZATION (3) The formation and growth of a solid (**crystal**) from a liquid or gas, such as **magma** cooling into solid rock.

DEPOSITION (4) A process of laying down materials such as **sediments** or **precipitation** of **minerals** from a **solution**.

DIVERGENT BOUNDARY (2) The line along which two tectonic plates are moving away from each other.

DYKE (4) An igneous intrusion that cuts across one or more layers of other rocks.

EROSION AND TRANSPORTATION (4) A sedimentary process that wears down and carries **sediments** by gravity, flowing water, wind, and glaciers (ice).

EVAPORATION (4) The process by which water changes from a solid to a vapour.

FISSURE (4) A narrow fracture or crack in the Earth's crust.

FOLIATION (9) A term for a linear arrangement of **textural** features commonly found in metamorphic rocks.

FOSSIL (8) The remains and traces of animals and plants which have been preserved by natural causes in the Earth's **crust**.

GEOSPHERE (1) Consists of all the solid parts of the Earth, including the **lithosphere**.

HARDNESS (15) A mineral's resistance to scratching and abrasion.

IMPERMEABLE (5) A property of a rock that does not allow water to pass through it.

LAVA (5) A fluid rock originating from **magma** that flows or erupts on the Earth's surface.

LITHOSPHERE (1) An outer rigid shell layer consisting of the **crust** and part of the upper **mantle** and broken into **tectonic plates**.

LUSTRE (15) The appearance or quality of light reflected from the surface of a **mineral**.

MAGMA (2) A **molten** material, or liquid rock, formed very deep below the Earth's surface.

MAGMA CHAMBER (4) A cavity in the Earth's crust filled with **magma**.

MANTLE (1) A zone beneath the **crust** and around the **core** which makes up most of the Earth's volume with mostly solid outer and inner layers separated by the **asthenosphere**.

MELT (3) A process when solid rock is transformed into a fluid rock, or **magma**.

MINERAL (8) Any solid, naturally occurring non-living material that has a characteristic **crystal** structure and chemical composition.

MOLTEN (6) A term to describe partially **melted** or 'liquid' rock.

OCEANIC CRUST (1) The part of the Earth's **crust** that forms the oceans which is more dense (heavier) and thinner than **continental crust**.

OCEANIC PLATE (1) A type of **tectonic plate** that contains **oceanic crust**.

PATTERN (8) A repeated design or arrangement.

PERMEABLE (7) A measure of how quickly a fluid will flow through a rock.

PLATE TECTONICS (2) A theory which proposes that the Earth's outer shell consists of individual plates which interact in various ways.

PLUTON (4) An intrusive igneous body that forms when **magma** cools and **crystallizes** within the Earth's crust.

PRECIPITATION (4) The process of a solid form being deposited from what was originally a solution.

PRISM (18) A form having three or more faces that meet at edges parallel to the length of the crystal.

ROCK (1) A consolidated, naturally occurring material composed of a mixture of **minerals**, rock fragments and **fossils**.

ROCK CYCLE (1) A cycle of processes through which Earth materials are formed and transformed from one rock type to another.

SEDIMENT (1) A material that consists of loose particles created from the processes of **weathering** and **erosion** of rock, by **chemical precipitation** from a **solution** in water, or from material discharged from organisms.

SILL (4) A roughly horizontal tabular igneous body that is forced between layers within a rock.

SOLUTION (7) A change in matter from a solid or gas into a liquid state that mixes together.

STREAK (16) The colour of a **mineral** in its powder form.

SUBDUCTION (2) A process by which a **tectonic plate** plunges down into the **mantle** along a **convergent boundary**.

SUBDUCTION ZONE (2) A long narrow area where a **tectonic plate** descends beneath another one.

TECTONIC PLATES (1) A series of large rigid segments of broken up plates of the **lithosphere** that move relative to one another over the **asthenosphere**.

TEXTURE (10) A property describing the way **crystals** and **sediments** fit together, including shapes, sizes and orientation of crystals and sediments.

TRANSFORM BOUNDARY (2) A boundary between **tectonic plates** that move horizontally past each another.

UPLIFT (4) A process that pushes rocks, of any type, upward towards the surface of the Earth.

VESICLES (6) A series of small holes or cavities in a rock that are formed by trapped gas bubbles in the **lava** as the rock was cooling.

WEATHERING (4) A sedimentary process that breaks, cracks or fractures a rock by physical, chemical and biological action.

About the Author

Louise Leslie is a passionate Earth science educator. She draws on her knowledge and experience as a geologist and outreach specialist to create concise, science-based, visually engaging guides. Her classroom-ready resources encourage hands-on, inquiry-based activities focused on outdoor learning. She strives to create invaluable educational tools for teachers and also for the outdoor enthusiast curious about our planet Earth.

Having recently moved to Nova Scotia, Louise discovered the untapped, resource-rich potential of the beach pebbles found near her home. Who hasn't combed beaches for those one-of-a-kind pebbles? This led her to publishing her first guide, titled Pebble Guide, Learning Rock Names.

This second guide was the result of being gifted a rock collection with the caveat that they were to be used for outreach education. This was an opportunity to write a more comprehensive guide that includes rocks and minerals.

Louise has an MSc in Quaternary Geology and an MA in Environmental Education and Communication in field-based Earth science education. In addition to a geology career, she is a veteran who served in the Medical Branch of the military.

Photo credits

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Plate Tectonics figure (page 2)

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learning earth science by doing

How to Identify ROCKS & MINERALS

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