# Gems: Treasures from the Earth

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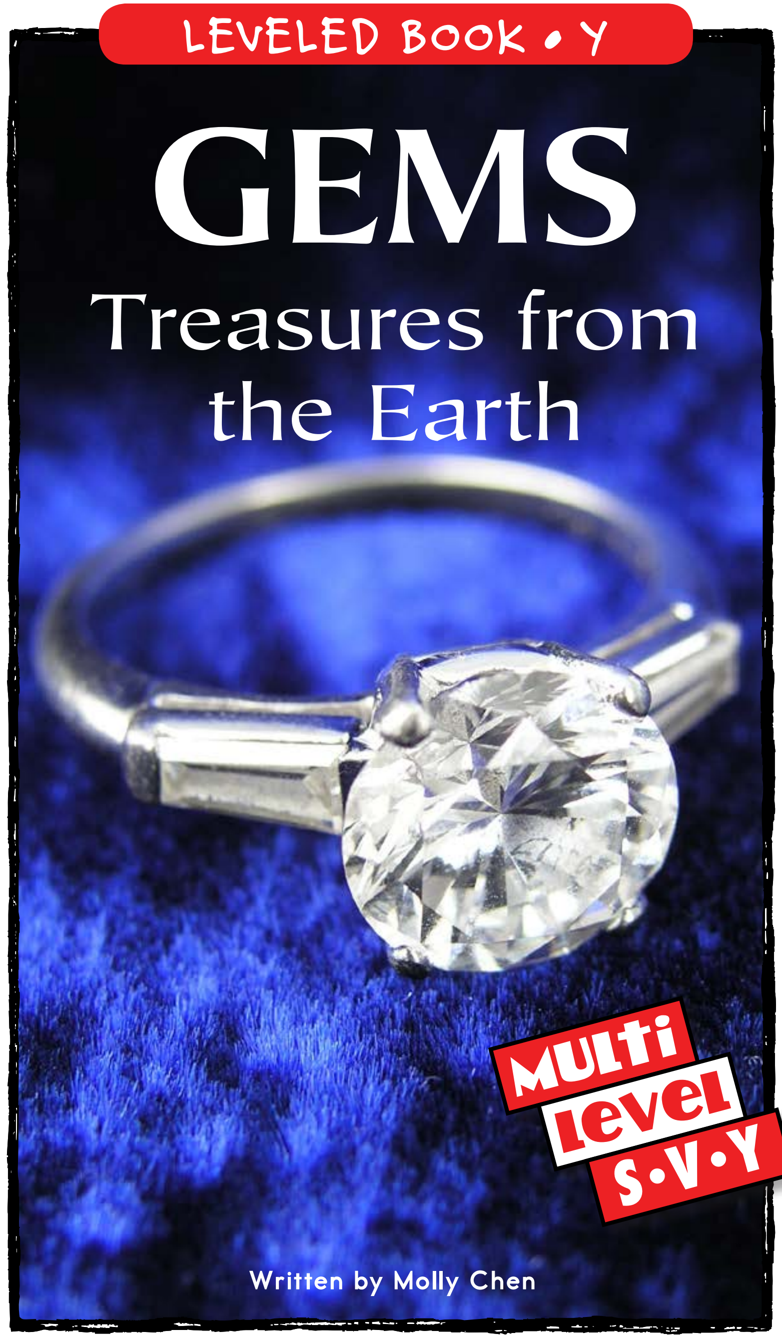

# GEMS

## Treasures from the Earth

Written by Molly Chen

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Gems: Treasures from the Earth
Level Y Leveled Book

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**Correlation**

| LEVEL Y | |
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| Fountas & Pinnell | T |
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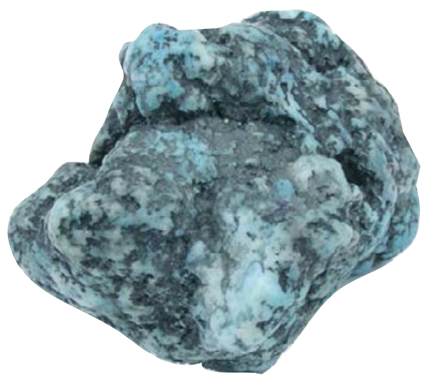
## Introduction

Many people consider gems to be Earth's most beautiful creations. They are willing to spend thousands of dollars for even a small bit of that beauty. Sparkling gems are worn on the fingers, necks, and wrists of people around the world. Families pass them down through generations. They can be found on crowns worn by royalty and on sacred religious objects.

Many gems decorate the most beautiful and valuable jewelry.

A gem is any beautiful stone that can be used in jewelry. Most gems have beautiful colors or sparkle, and they are hard enough to hold up to daily wear. There are three major types of gems. The first two, **crystals** and stones, are made of minerals—the natural, nonliving substances that make up ordinary rocks. Crystals are very pure minerals that form in tight shapes and neat patterns. Stones are mixed minerals that have beautiful colors and patterns, but do not have strict shapes. The third group, **organic gems**, comes from substances made by living things.

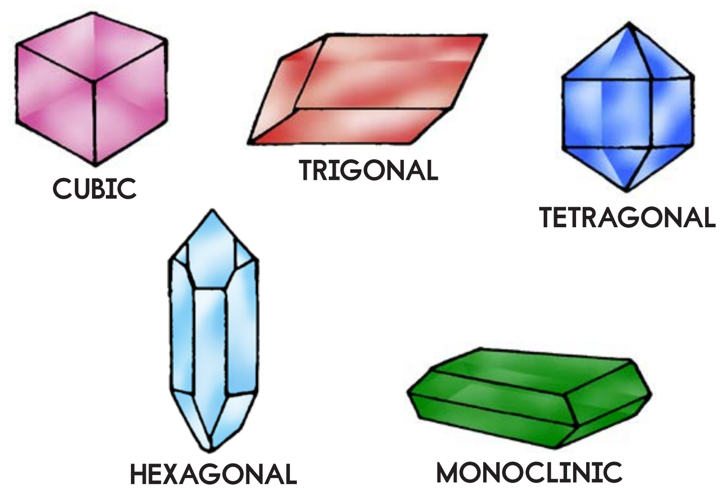


Garnet, a crystal (top); turquoise, a stone (center); natural pearl, an organic gem (bottom)

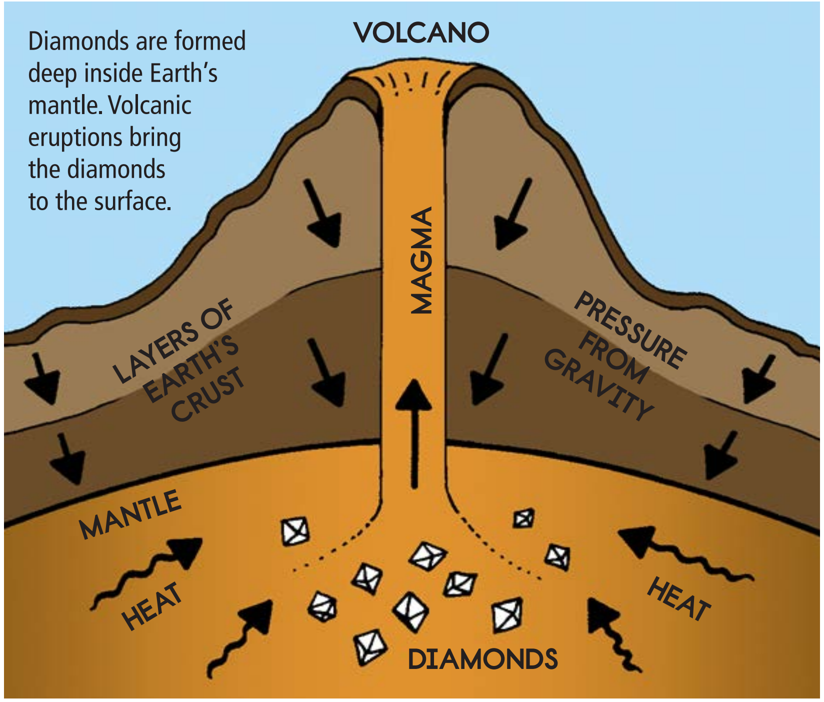


## How Are Gems Formed?

Some of the most famous and expensive gems, including diamonds, emeralds, and rubies, are crystals. Crystals are very pure forms of minerals. Every mineral is made of millions of particles called **atoms**, which are so small they are invisible to the naked eye. In ordinary rocks, many kinds of atoms are thrown loosely together without any kind of pattern or order. But in crystals, the atoms are arranged very precisely in neat, orderly patterns. Crystals have flat sides, called *faces*, which form shapes. Different kinds of crystals form in different shapes, some of which are shown below. Some crystals form cubes, while others form long, six-sided columns.




**Examples of Crystal Shapes**




Most crystals form deep within the earth under very special conditions. Some, such as diamonds, form when the mineral is squeezed under layers of rocks. The squeezing forces the atoms to arrange themselves until they are in the smallest shape possible. Others, such as sapphires, form when a mineral gets so hot inside the earth that it melts. As it slowly cools, the atoms fall into place to make a regular crystal pattern. And still other gems, such as opals, form when minerals dissolve in water. As the water evaporates very slowly, the mineral left behind forms a crystal.



**Try This**

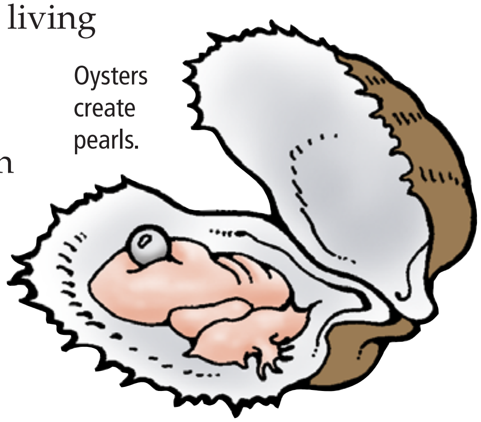
## Make your own crystals!

Rock salt, also known as halite, forms when salty seas evaporate. You can watch a much smaller version of this same process using just water and ordinary salt.

1. Mix a tablespoon of salt into a cup of warm water. Stir it until it dissolves.
2. Keep adding salt, a little at a time, until no more salt will dissolve.
3. Put a clean toothpick in the water.
4. Place the cup somewhere warm in the sun. As the water evaporates, crystals will form on the toothpick and the sides of the cup.
5. Look at the crystals under a magnifying glass. What do they look like?

The minerals in stones do not form orderly patterns, and they may have other minerals mixed in. Stones often form in layers that make streaks and lines, called the **grain**. Grain gives stones beautiful patterns and surfaces.

Organic gems, which include pearls, amber, and coral, come from living things. Pearls begin when a grain of sand gets trapped inside an oyster's shell. The oyster covers the grain with layers of smooth **nacre**, the material it uses to build its shell.



Oysters create pearls.

Coral is made of skeletons left behind by millions of tiny sea creatures called coral **polyps**. Amber began millions of years ago when sticky sap oozed from trees and hardened. Amber often contains the fossils of insects and spiders that got caught in the sap.

A spider in amber



### How Do Gems Get into Jewelry?

Most mineral gems are found deep within the earth. Humans must dig mines to get them. Because gems are so small and rare, mining is often still done by hand. Miners must chip and cut at the rock, looking for individual stones **embedded** within it. It takes a lot of work to find gems, and work costs money. The rarer the gem and the harder it is to find, the more valuable it is.

Opal mines are simple holes in the ground.

## Do You Know?

Opals form when mineral-rich water evaporates from cracks underground. This leaves a streak of mineral crystal in the rock. Streaks of crystal are called veins. The best opals in the world are found in veins under the ground in the Australian desert town of Coober Pedy. In the Australian Aborigine language, *Coober Pedy* means "white man in a hole."

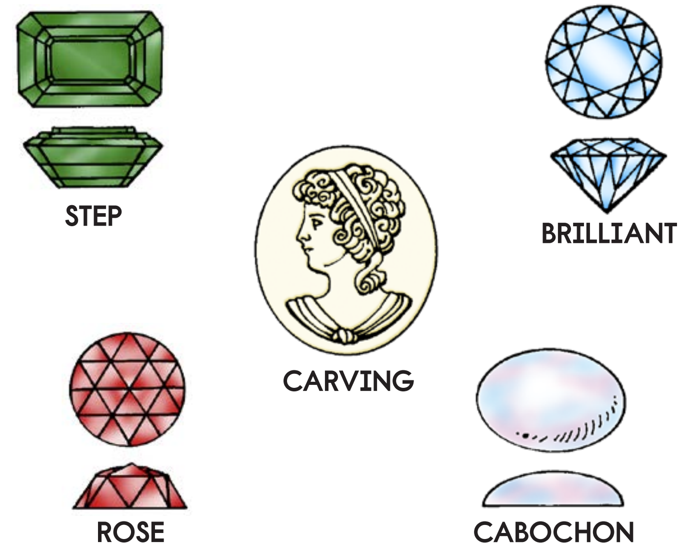
When a miner finds a gem, it looks very different from the one you see in a ring or necklace. The gem often has rough edges. Its surface looks dull. Its shape is bumpy. Gems often have cracks, dark marks, bubbles, and other flaws. Gem cutters, called **lapidaries**, cut gems into regular shapes that show off their best qualities and cover their flaws. Gem cutters once used diamond-edged saws and polishers, but recently they began using lasers to cut gems.

An uncut diamond looks uneven and flawed.

Most crystal gems are cut into flat surfaces called **facets**. Facets show off the gem's color and pattern, and allow it to sparkle with reflected light. Lapidaries cut different gems using several different cutting styles.

A cut diamond reflects lots of sparkle.






Cutting styles (top and side views) show gems' best features.

The popular brilliant-cut style is often used with diamonds, which have more sparkle than color. This style has many facets that reflect light off the gem. Deep green emeralds, in contrast, are often cut into a style called the step cut. This cut, with its rectangular facets, creates a wide, flat top of pure color. The rounded top and triangular facets of another style, the rose cut, are most often found on older gems. The oldest style of cut, the cabochon (KAB-uh-shon), is simply rounded and polished. It is most often used with **opaque** or patterned stones. Other gems, such as jade and coral, can be carved into small sculptures.

## What Makes Gems Valuable?

Gems as a whole are valuable for two reasons: they are beautiful and they are rare. The prices of gems **fluctuate** over time. Certain gemstones have been regarded as "precious" throughout the ages and in many cultures. For example, although diamonds have always been regarded as valuable, their value has dramatically increased in the last century. This increase has occurred even though the supply of diamonds has grown substantially during the same period of time as a result of several large finds in South Africa. Diamonds have become more valuable in the last century partly because of the increasing popularity of diamond engagement rings around the world. Higher prices are also a result of global marketing efforts by companies that sell diamonds.

The value of an individual gem is determined by the gem's hardness and a system called the "four Cs": cut, carat weight, color, and clarity. Cut refers to how well the gem is cut and polished, or how beautiful the natural gem is. A poorly cut gem may look dull or uneven. Carat weight is the size of the stone. One carat weighs about as much as a kernel of unpopped popcorn.



The next of the four Cs, color, is one of the major reasons why gems are considered beautiful. Unlike regular rocks, gems have bright, pure, intense colors. The stronger and purer the color, the more valuable the gem is. Often, the same mineral can form different-colored gems. Red rubies and blue sapphires both contain the same mineral. The different colors come from tiny bits of other chemicals mixed with the main mineral. It only takes one different atom in a thousand to change the color of a gem.

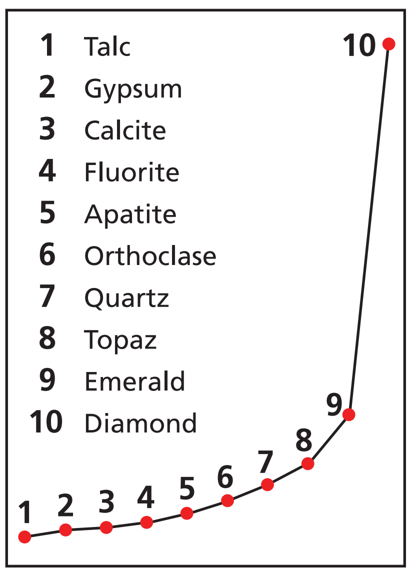
Clarity refers to how flawless the gem is. Gems with dark marks, cracks, and bubbles are less valuable than gems without these flaws. Gems that are cloudy are also less valuable than clearer gems. But clarity is often not as important as the size and rarity of a gem. Emeralds often have many flaws, but because they are so rare, a flawed emerald is more valuable than a flawless diamond.

This uncut emerald shows many cracks and other flaws.

## Hardness and the Mohs Scale

Hardness indicates how pure and tightly structured the mineral is in a gemstone. It tells how well a gem will hold up to daily wear. A geologist named Friedrich Mohs developed a scale to test the hardness of gemstones. He simply scratched one gem with another. A gem can only scratch other gems that are softer than it is.

The softest mineral, talc, which cannot scratch anything else, is a 1 on the Mohs scale. Diamond, the hardest substance on Earth, can scratch anything, but can only be scratched by another diamond. Diamond is a 10 on the Mohs scale. Most gems must be 5 or above to be strong enough for use in jewelry.




The Mohs scale measures the hardness of various gems. For comparison, a fingernail has a hardness of 2.5, and a penknife measures 5.5.



## What Are Some Types of Gems?

Diamonds form very deep in the earth as a result of huge amounts of pressure and high temperatures. Most diamonds form 140 to 190 kilometers (90 to 120 miles) beneath the Earth's surface. **Magma** brings the diamonds close to the surface through volcanic pipes. In a few instances, diamonds have also been found in deposits left behind by melting glaciers. The diamonds that reach the Earth's surface may be up to 3 billion years old.

Diamonds are the hardest natural things in the world. Because diamonds can cut anything, including metal and stone, flawed or unattractive diamonds are often put on saws and drill tips. Most diamonds are almost colorless, but very rare diamonds can be intense yellow, red, or blue. They are most often found in South Africa, Russia, and Australia.

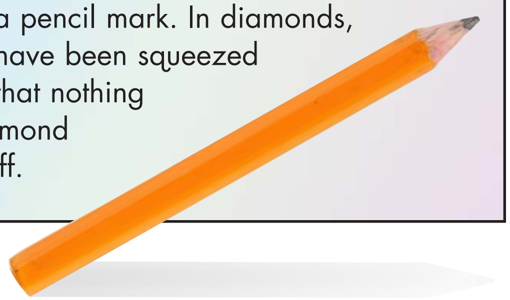
Diamonds are extremely popular for engagement rings.

One of the most famous diamonds, the Hope diamond, is not the largest, but it is an intense sky-blue color. Its long history of theft and ownership by royalty and the rich gave it a legend of being cursed. The largest diamond ever found is the Cullinan diamond, which was discovered in South Africa. It weighed over 3,100 carats and was as large as a pineapple. It was cut into nine gems, one of which, the Greater Star of Africa, weighs 530 carats.

This photo of the Hope diamond shows its actual size.

## Do You Know?

Graphite, or pencil lead, is exactly the same mineral as diamonds. In graphite, the atoms are arranged in loose layers. This makes graphite very soft—so soft that if you rub it on a piece of paper, the atoms break off, leaving a pencil mark. In diamonds, those same atoms have been squeezed together so tightly that nothing except another diamond can scratch them off.





Rubies and sapphires are made of the same mineral, corundum (aluminum oxide). Rubies, one of the rarest gems on Earth, must be truly blood-red or pink to be properly classified as rubies. The name *ruby* comes from the Latin word for red, *ruber*. The famous red color of rubies is caused by the element chromium. Any other form of the mineral corundum, no matter the color, is considered a sapphire. However, sapphires are most famous for their deep blue color.

One feature that can occur in both rubies and sapphires is an **asterism**, or star. An asterism is a bright star-shaped pattern within the stone caused by titanium oxide that reflects light very brilliantly. Star sapphires and star rubies are highly valuable and some of the most sought-after gems in the world.

Red ruby (left) and two sapphires, one blue and one yellow

The quartz family is the most common of all crystals. Quartz is found all over the world, in all colors of the rainbow. Most quartz is so common that anyone can afford it. The largest quartz crystal ever found was about 6 meters (20 ft) long. It weighed more than 44,000 kilograms (48 tons)—more than a loaded eighteen-wheeled truck. The most valuable quartz is a multicolored stone called *opal*. Opals shimmer with white, blue, and red-orange colors. They are most often found in Australia.

Quartz crystals are common and can grow very large.



Emeralds are known for their incredible green color. Gem-quality emeralds are rare and usually small, but people prize their color so much that emeralds are more valuable than diamonds. The finest emeralds are found in Colombia. Beryl, the same mineral that forms emeralds, also forms a blue-green stone called aquamarine.

Jade is one of the most prized stones. It occurs in lavender, white, and almost every shade of green, which is the most valuable. Jade is incredibly tough but easy to carve along its grain. Many civilizations, especially in Asia, used jade to make beautiful knives, swords, and axes.

Jade figurine (above); carving jade (left)

Turquoise is often specked and striped with black.

Blue-green turquoise comes from the deserts of Iran, Tibet, and the southwestern United States. This stone often has pretty spots and streaks running through it. Much of the world's turquoise is set in silver, as the Navajo Native Americans traditionally wore it. The Navajo believed turquoise to be pieces of the sky that had fallen to Earth.

Natural pearls are strangely shaped and extremely rare. It takes an oyster many years to create a pearl from a tiny bit of sand. Almost all of the beautiful round pearls in jewelry stores are **cultured**, or made by people. Pearl farmers insert a round shell bead into an oyster's shell. The oyster covers the bead with nacre, creating a perfectly round pearl. Cultured pearls come in every color of the rainbow, from creamy white to pink to yellow to green and even black.



**Gemologists** are scientists who study the chemical composition of gemstones. Sometimes gemologists are experts in a particular gemstone, such as diamonds or rubies. Gemologists who work in the laboratory can often identify which area of the world a particular gem came from by studying its chemical composition. They can also tell the difference between natural and synthetic gems by studying clues inside the gems themselves that give information about how the gem was formed.

Natural pearls (inset) are rare and oddly shaped; cultured pearls are round.

This strip mine clears an immense area of land.

## Conclusion

Beautiful gems can be found around the world. Many gems symbolize power and wealth. For centuries, people have killed and died for them. In some places, such as West Africa and Colombia, the gem trade is still filled with blood and violence. Mining gems with dynamite and strip mines is often dangerous, damaging both humans and the Earth.

Scientists can grow gems in the lab that are identical to the finest natural gems but cost a thousand times less. In the future, created gems might help fill our desire for gemstones' beauty while preserving Earth and its people.



## Glossary

| | |
|---|---|
| **asterism** *(n.)* | a star-shaped reflective pattern inside a gem (p. 18) |
| **atoms** *(n.)* | the smallest units of a chemical element (p. 6) |
| **crystals** *(n.)* | minerals formed in regular, tight patterns (p. 5) |
| **cultured** *(adj.)* | made with the help of human beings (p. 21) |
| **embedded** *(adj.)* | buried in; surrounded by (p. 10) |
| **facets** *(n.)* | flat surfaces of a cut gemstone (p. 11) |
| **fluctuate** *(v.)* | to change; to shift back and forth or up and down (p. 13) |
| **gemologists** *(n.)* | scientists who study the chemical composition of gemstones (p. 22) |
| **grain** *(n.)* | lines and patterns made by layers of minerals in a stone (p. 9) |
| **lapidaries** *(n.)* | gem cutters (p. 11) |
| **magma** *(n.)* | melted, liquid rock beneath the Earth's surface (p. 16) |
| **nacre** *(n.)* | the material oysters use to make their shells and to make pearls (p. 9) |
| **opaque** *(adj.)* | not see-through (p. 12) |
| **organic gems** *(n.)* | gems made from substances created by living things (p. 5) |
| **polyps** *(n.)* | small sea invertebrates, such as coral, that have a tube-like body and a tentacled mouth (p. 9) |