

GRAINGER HALL OF GEMS



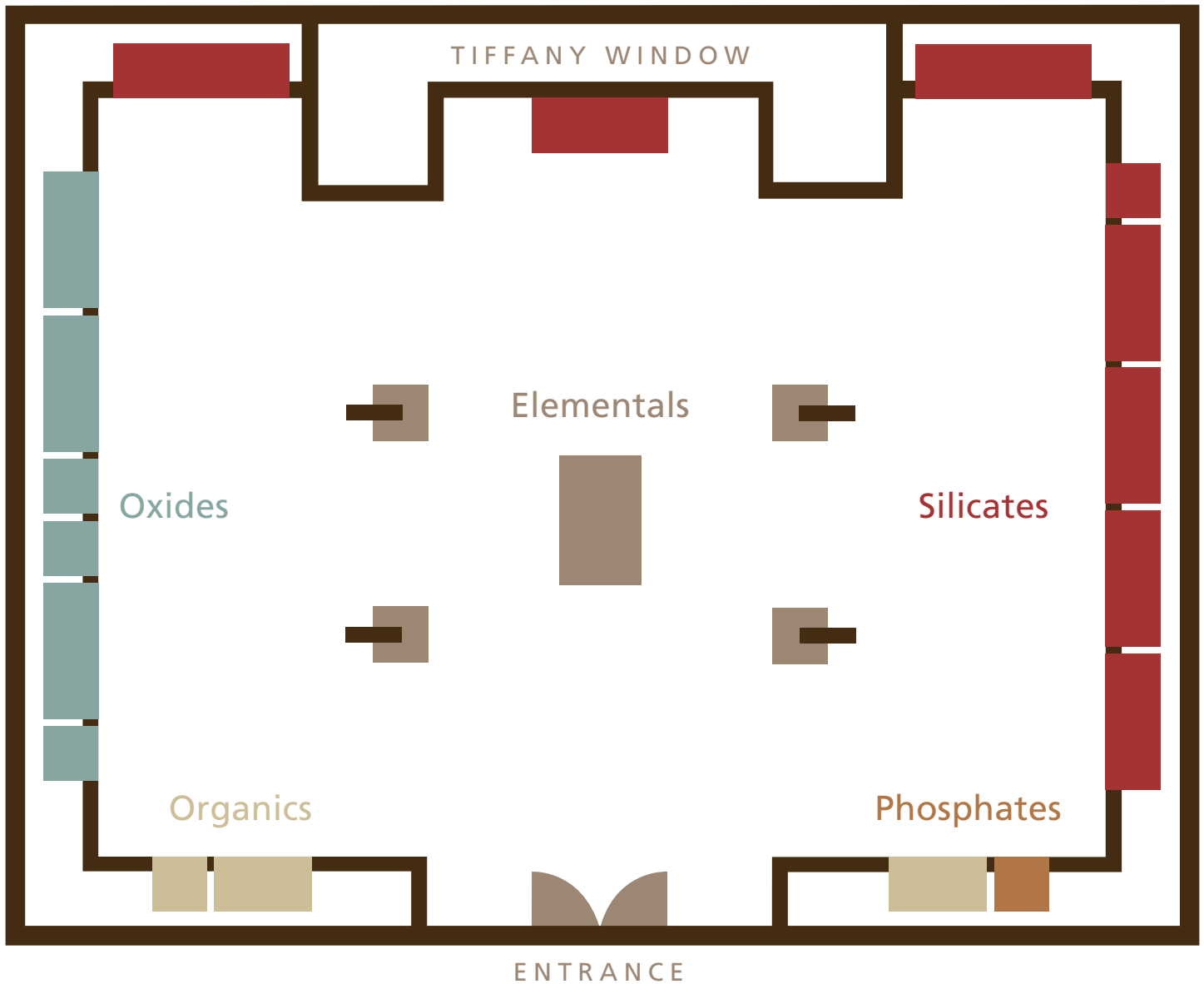
Educator Guide

Presented by The Field Museum Education Department
fieldmuseum.org/gems

INSIDE: Exhibition Introduction & Correlations to ILS
Tips for Planning Your Visit • Gallery Overview & Guiding Questions
Focused Field Trip Activities • Related Exhibitions & Resources

The **Field**
Museum

The Grainger Hall of Gems is generously sponsored by The Grainger Foundation.



The *Grainger Hall of Gems* is located on the Upper Level

Grainger Hall of Gems

The Field Museum's newly renovated *Grainger Hall of Gems* takes a unique approach to understanding the natural history of precious stones. For a greater understanding of their relationships, all of the gems are arranged according to type—from organic gems such as amber, coral, and pearls, to elementals made from one type of atom, such as diamonds (pure carbon).

You'll discover how stones that sometimes appear identical, like garnets and spinels, can come from completely different chemical families. And you'll be surprised to learn that gems that bear no resemblance to one another, like rubies and sapphires, can actually be siblings made of the same material (corundum).

Each display features a gem in its three stages of transformation: as a raw crystal, as a cut and polished stone, and as a jewel mounted in a finished ring, brooch, or necklace. You'll also view gems notable for their size or rarity, including a 341-carat aquamarine and a 97.45-carat Imperial Topaz—the rarest type of topaz and the largest owned by any museum in the world!

By visiting the *Grainger Hall of Gems* and visiting our online Gallery of Gems at fieldmuseum.org/gems, you'll discover why gemstones have captured our hearts and inspired cultures around the world for millennia.

Main Themes

The following themes are threaded throughout the *Grainger Hall of Gems* exhibition and may be useful in framing how the exhibition connects with your curriculum:

- The full natural history of gems includes gems as natural crystal formations, cut gems, and finished jewelry pieces.
- Geologists organize the relationships between gems in classes, species, and varieties.
- Experts generally agree that to be considered a gem, a stone must possess three qualities: durability, beauty, and rarity.

Illinois Learning Standards

The *Grainger Hall of Gems* may be used to meet Illinois Learning Standards (ILS) in Language Arts, Math, Science, Social Science and Fine Arts. However, it is most closely aligned with the following ILS Science and Social Science Goals:

- Goal 12C. Know and apply concepts that describe properties of matter and energy and the interactions between them.
- Goal 12 E. Know and apply concepts that describe the features and processes of the Earth and its resources.
- Goal 13 B. Know and apply concepts that describe the interaction between science, technology and society.
- Goal 17 A. Locate, describe and explain places, regions and features on the Earth.



It's obvious how aquamarine got its water-inspired name when looking at this specimen, still on its matrix. © The Field Museum

Registration

- Pre-registration is required for all Field Museum field trips. Register online at fieldmuseum.org/fieldtrips or call 312.665.7500 for more information.
- The ***Grainger Hall of Gems*** is a permanent exhibition and is included in general admission to the Museum. Students from pre-registered Chicago schools or Chicago-based summer camps receive free general admission. Fees apply to students from non-Chicago schools or summer camps. Download our complete school group pricing structure at fieldmuseum.org/education/plan.htm.
- For more information on registration, lunchrooms and student programs, visit fieldmuseum.org/education.

Planning for Learning

- This educator guide provides an overview of the themes and content presented in the ***Grainger Hall of Gems***. We encourage you to explore the exhibition first-hand before visiting with students. Remember that educators presenting a valid educator ID receive free basic admission to the Museum every day; admission to the ***Grainger Hall of Gems*** is included in basic admission.
- Visit the exhibition website to read more about the ***Grainger Hall of Gems***, access our online photo gallery and view additional resources: fieldmuseum.org/gems.
- We suggest extending your field trip to enhance your students' learning experience by visiting related exhibitions. Focused Field Trip suggestions and information about related exhibitions are provided in this guide.



LEFT: One of many gems on display from the 1893 World's Columbian Exposition is this 16.6 carat golden topaz. © The Field Museum

RIGHT: The ***Grainger Hall of Gems*** shows visitors gems and gemstones in three phases: gemstones in their natural state, cut and polished gems, and finished pieces of jewelry. This diamond on its matrix was first displayed at the 1893 World's Columbian Exposition. © The Field Museum

How to Use this Guide

- For the ***Grainger Hall of Gems***, we provide a Gallery Overview and Guiding Questions – questions that can be answered through exploration in the gallery. Guiding questions are a great way to focus your students' learning. The answers provided are brief and may be expanded by exploring the exhibition website: fieldmuseum.org/gems.
- This guide provides Focused Field Trip activities. A focused field trip includes a pre-visit activity, an activity to do within the exhibition, and a post-visit activity. Use the activities as they are, or modify them to suit your instructional needs.
- Additional resources and key terms are provided at the end of the guide.

Gemstones are durable, beautiful, scarce minerals. Many types of stones are classified as gems, from colorless transparent topaz to multicolored opaque opals. Gems can be naturally produced, like diamonds, or human-made, like cubic zirconia. Some are cut and polished, such as emeralds, while others are left in their natural state, such as pearls. And some gems have been valued for millennia, while others have only recently been discovered. The *Grainger Hall of Gems* presents a comprehensive look at the world of gems, exploring the full natural history of gems as well as the relationships between them. This permanent exhibition explains how we classify gems while displaying natural crystal formations, cut gems, and finished jewelry pieces.

Like animals and plants, gems can be sorted and categorized according to their shared traits, which helps us understand their relationships. For example, gems that possess similar characteristics and origins are clustered into classes. Gems in the same class can be further subdivided into mineral species by their common chemical formulas. And within each species, gems can be grouped into varieties, according to trace impurities that affect their color. Most gems fall into five basic classes according to their mineral composition:

Guiding Questions:

1. How do geologists classify gems? What is an example of a species and variety within a class?

Gems that possess similar characteristics and origins are clustered into classes. Gems in the same class can be further subdivided into mineral species by their common chemical formulas. And within each species, gems can be grouped into varieties, according to trace impurities that affect their color. Oxides are a class, quartz is a species of oxides, and amethyst, citrine, rose quartz are varieties of quartz.

2. There are four states of each gemstone displayed. What are the four states? How do they differ from each other?

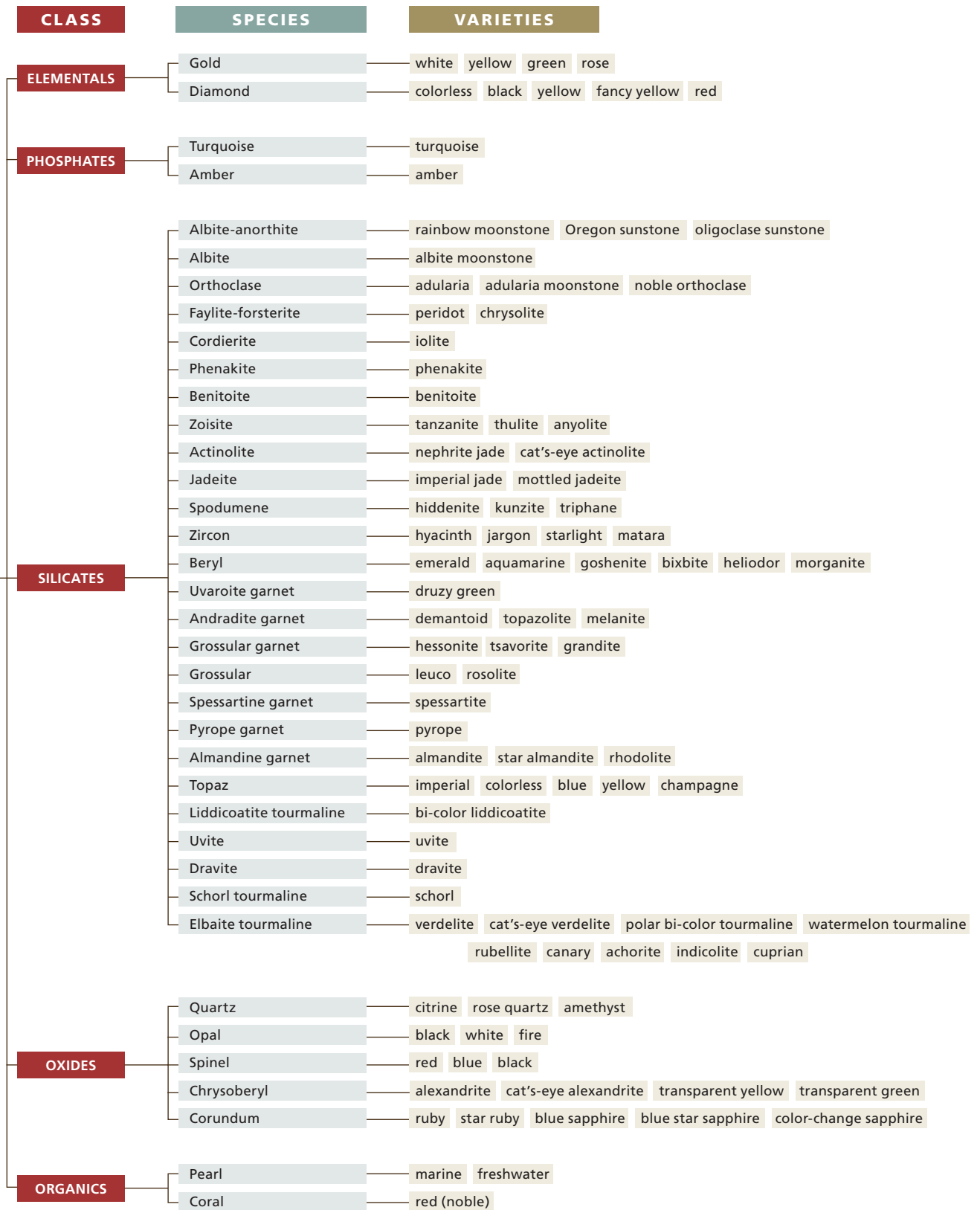
In each case, you will find examples of gemstones as natural crystals, crystals in matrix, cut or carved gemstones, and gemstones in jewelry.



This glittering necklace showcases 13 rubies, totaling 90 carats and hundreds of sparkling round and accent diamonds, set in platinum.

© The Field Museum

FAMILY TREE OF GEMS



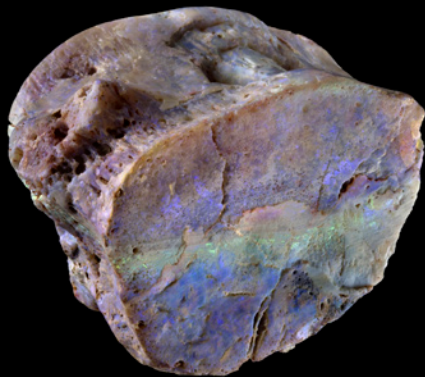
The varieties listed per species are a sampling of those found in the exhibition. Each gem species may have more varieties than represented here. Check our web site for more information: fieldmuseum.org/gems.

A Gem for Every Month



Ruby topaz is the rarest of the topaz family, and this 97.5 carat specimen is one of the world's largest.

© The Field Museum



Amazingly enough, this opal was formed in the fossilized vertebra of a plesiosaur – a marine reptile that became extinct 60 million years ago.

© The Field Museum

Illinois Learning Standards

- 11.A.1e Arrange data into logical patterns and arrange the patterns
- 12.C.1b Compare large-scale physical properties of matter

Pre-Visit Activity

Begin exploring students' knowledge of gems by studying birthstones. Discuss what students already know about their birthstone. What does the gemstone look like? How is the stone different from other birthstones? Where are they found? Gather images of each stone and compare/contrast the birthstones.

Field Trip Activity

While at the Museum in the *Grainger Hall of Gems*, have students find the case that houses their birthstone species. Have students make careful observations and record their findings in the form of sketches and/or written descriptions about the different varieties of their birthstone that they see. Focus students' observations on the different colors, shapes, and textures.

Post-Visit Activity

Back in the classroom, have students draw their birthstone based on their observations and additional information gathered while at the Museum. Create a large pictograph that represents the frequency of birthdays per month. List the months of the year at the bottom of the graph and the number of birthdays along the side; be sure to label each axis. Have students post their birthstone drawings on the pictograph. After posting, ask students: Which month has the most birthdays? Which month has the least? What else can we learn by examining the graph?

Family Tree of Gems

Illinois Learning Standards

- 11.A.2c Construct charts and visualizations to display data
- 12.E.1a Identify components and describe diverse features of the Earth’s land, water and atmospheric system (e.g. rock cycle).

Pre-Visit Activity

Ask students, what is a gem? What are some examples of gems? How are they related to each other? Introduce students to the gem family tree and the relationship among classes, species, and varieties. Tell students that the organization of the *Grainger Hall of Gems* is based on this structure; while at the Museum students will be studying the relationship among gemstones.

Field Trip Activity

When at the Museum in the *Grainger Hall of Gems*, have students examine cases displaying gems from at least two different classes. Students should record information about the gems, carefully noting the species, class, and varieties. Students should sketch the “branch” of the gem family tree they are studying. On the branch, have students illustrate the different varieties of gems they choose to study.

Post-Visit Activity

Back in the classroom, have students select one of the branches they sketched at the Museum to work with during a group activity. Group students together who sketched branches from the same gem species. Have students in each group use their individually-created branches to construct a family tree showing the gem class, its species, and its varieties. Encourage students to include labels and illustrations on their tree. After the groups have created their species-tree, join as a class and assemble a complete family tree of gems. The top level should note the classes, the next level should show the different species of the classes, and the lowest level should show the different varieties within each gem species. Discuss the tree, how gems are related to each other, and the differences among classes, species and varieties of gems.

See page 6 for example gem family tree.

Harris Educational Loan Center

Give students an up-close look at teaching specimens and real artifacts from The Field Museum's collections. The Harris Educational Loan Program lends hands-on kits, known as Experience Boxes, which provide an in-depth look at different cultures, rocks, fossils, and much more. You can also borrow Exhibit Cases, which feature plant and animal specimens in their natural setting.

Learn more about this library of resources by visiting Harris Loan online at fieldmuseum.org/harrisloan or call 312.665.7555.



Materials related to the *Grainger Hall of Gems* exhibition:

- **Rocks and Minerals** (experience box)

Match minerals with the rocks they form and compare samples from three major groups of rocks – igneous, sedimentary, and metamorphic.

- **Gold Mine Model** (exhibit case)

Examine these tiny replications of a typical western gold mine and you'll discover the complicated processes and machinery used to harvest this valuable metal.

Related Exhibitions

Continue your exploration of the concepts in the *Grainger Hall of Gems* by visiting a related exhibition during your visit to the Field Museum.

Malott Hall of Jades (Upper Level)

fieldmuseum.org/exhibits/exhibit_sites/jades

Discover the stone that is so much more in The Field Museum's Malott Hall of Jades. This stunning permanent display of more than 450 objects from the Museum's collection traces the mineral properties of jade, the many methods of carving jade, and jade's role in human cultures over time and around the world.

Earth Sciences, Rocks and Minerals Hall (Upper Level)

Uncover the basics about rocks, minerals, and other earth materials



This emerald necklace, set in 14K yellow gold, features 18 emeralds, totaling 25 carats. The emeralds are set off by the 238 brilliant-cut diamonds, totaling 14.75 carats. © The Field Museum

On-line Resources

The Field Museum's *Grainger Hall of Gems* website: fieldmuseum.org/gems

The Field Museum's *Malott Hall of Jades* website: fieldmuseum.org/exhibits/exhibit_sites/jades/index.html

The Field Museum's *The Nature of Diamonds* website: fieldmuseum.org/diamonds

PBS NOVA: The Diamond Deception website: pbs.org/wgbh/nova/diamond/resources.html

Books for Educators

Augustyn, Allison and Grande, Lance (2009). *Gems and Gemstones: Timeless Natural Beauty of the Mineral World*. University of Chicago Press, Chicago.

Finlay, Victoria (2006). *Jewels: A Secret History*. Random House, Inc., New York.

Phillips, Clare (1996). *Jewelry: From Antiquity to the Present*. Thames and Hudson, London.

Books for Students

Harding, R.R. and Symes, R.F. (2007). *Crystal and Gem* (DK Eyewitness Books). DK Publishing Inc., New York.

Pedersen, Stephen and Rygle, Kathy J. (2008). *Northeast Treasure Hunter's Gem and Mineral Guides to the U.S.A.* Gemstone Press, Vermont.

Squire, Ann O. (2002). *Rocks and Minerals*. Children's Press, New York.

Symes, R.F. (2008). *Rocks and Minerals* (DK Eyewitness Books). DK Publishing Inc., New York.

Ward, Charlotte and Ward, Fred (2008). *Phenomenal Gems*. Gem Book Publishers, Malibu, CA.



Though not an "official" gemstone, coral is considered an organic gem and has been used in jewelry for thousands of years. This gorgeous necklace is actually the remains of living coral. © The Field Museum

The following terms are found within the *Grainger Hall of Gems* exhibition:

- Gems:** Stones that possess three qualities: beauty, durability, and rarity.
- Mineral:** a naturally occurring inorganic solid, usually crystalline in structure, whose composition can be expressed by a chemical formula.
- Species:** Groups of gems within a class that share a common chemical formula. Species are sub-divisions of classes.
- Classes:** Gems that possess similar characteristics and origins are clustered into classes. Most gems fall into five basic classes according to their mineral compositions: elementals, oxides, silicates, phosphates, and organics.
- Elementals:** Minerals made entirely of a single type of atom. In other words, they're made of an element on the periodic table. For example, colorless diamonds are made solely of the element carbon.
- Oxides:** Minerals made of two kinds of atoms—oxygen and another element, typically a metal such as aluminum. Examples of oxide gems include rubies, amethysts, sapphires, and more.
- Silicates:** Minerals with complex chemical structures built around oxygen atoms that have bonded to the element silicon. Some examples of silicate gems include tourmalines, garnets, and emeralds.
- Phosphates:** Minerals that are mostly made of phosphorus. Turquoise is an example of a phosphate gem.
- Organics:** Minerals that are products of a living organism. Coral, pearls, and amber are all examples of organic gems.
- Varieties:** And within each species, gems can be grouped into varieties, according to trace impurities that affect their color.
- Matrix:** the base rock in which a gemstone crystal is found; the parent rock.
- Beauty:** Beauty is subjective; however experts judge gems according to specific scales that measure color, clarity, carat (weight) and cut (how well a gem's shape and faceting reflect and absorb light).
- Durability:** the hardness and toughness of a stone; the harder and tougher the stone, the more resistant it is to damage (scratching, chipping, or fracturing). The experts rank stones according to the Mohs hardness scale, with diamonds scoring a perfect 10.
- Rarity:** the scarcity of stone's occurrence in nature as well as its public popularity. Its rarity affects its perceived value: the more difficult to acquire, the more precious a stone becomes. The difference between precious and semi-precious stones mostly depends upon availability and market conditions.