Palomar Gem and Mineral Club

VOLUME 60 - ISSUE #5
MAY 2019

BOARD OFFICERS ELECTED	
President	Jef Wright
Vice President	**Justin Engelmeyer**
Secretary	**Fred Floyd**
Treasurer	Toni Floyd
BOARD OF DIRECTORS (APPOINTED)	
CFMS Chairperson:	Toni Floyd
Field Trips:	Melissa Takagi
Parliamentarian:	Chris Toft
Shop Coordinator:	Alan Mazzola
Program Chair	**vacant**
Show Chair	Michele Shepard
Newsletter Editor	**Carol Hiestand**
Website:	Ian Burney
Membership Chair	Lori Goodman
STANDING COMMITTEES (APPOINTED)	
Facebook Page	Jeff Fox
Ways & Means	Dawn Wright
Historian	Barbara Bury
Hospitality & Good Cheer	Judy Jessup
Meeting Displays	Barbara Bury
Picnic Coordinator	Moni Waiblinger
Refreshments	Dawn Wright
Redwood Rep	Barbara Bury
Librarian Calendar	Chris Toft Justin Engelmeyer

NEXT MEETING:

WEDS MAY 15, 7 PM

DITTUS HALL, REDWOOD TERRACE

710 W. 13TH AVE. ESCONDIDO

INFORMATIVE PROGRAM!!!!

BRING A FRIEND!!!

HAPPY BIRTHDAY TO MAY BIRTHDAY MEMBERS!!

Monika Waiblinger

CONTENTS:

BIG THANKSTO:

EVERYONE who set-up, donated, & participated in the successful PADDLE AUCTION LAST MONTH!! It was a fun way to raise money for the club!

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IMPORTANT INFO FOR CLUB MEMBERS:

Show demonstrators can sell their custom product without the normal 20% fee to the club!

Volunteers needed for the gem show; please contact Michele Shepard to volunteer!

PGMC has a new cell phone, (760)743-0809 with a working voice mail. The WIFI hot spot is in! The shop & club will be able to take charges over $10.00 in the future!!

DEL MAR COUNTY FAIR

Open MAY 31- JULY (closed Mondays & Tuesdays in June)

ATTENTION ALL MEMBERS!

FREE TICKETS for the SAN DIEGO COUNTY FAIR!!

Each year, our club is asked to volunteer 2 hours at the INFO BOOTH / SANDBOX at the Gem and Mineral Exhibit at the San Diego County Fair in June. We will be volunteering the first week in June, due to preparations for our club show at the end of June.

Thanks to all members who volunteered at the April meeting!

Please contact Chris Toft at omphalos41@gmail.com or (760) 739-1826 if you have time available to volunteer.

Letter from Christiane Toft:

I would like to extend my thanks to the members of the PGMC for their kind messages of condolences on the passing of my longtime companion, David Epstein. He passed on April 14 after a brief illness. He was buried with full military honors and according to Jewish tradition
- at Miramar National Cemetery.

In my 20 plus years of membership in the PGMC, I value the friendship and support of my fellow "rockhounds"

Sincerely,
Chris Toft, Parliamentarian

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******UPCOMING CLASSES******

Lapidary & Silversmith Workshop

2120 W. Mission, Suite S., Escondido

Cabochon/Lapidary Class & Open Workshops

Tuesday 6:30 – 9:30 pm

Wednesday 11:00 am – 2:00 pm

Thursday 2:00-5:00pm

Learn to cut and polish a rock into a beautiful stone suitable for wire wrapping or fabricating in

metal. A fantastic assortment of material is available for purchase on site.

The workshop is also open for general use. No prior registration needed.

Thursday 6:00 pm – 9:00 pm ***METAL SMITHING only - open for to those students who have had metal smithing instruction or experience and/or have instructor approval.*** *Those students who have attended an introductory class may continue to work on improving their skills in this weekly workshop*. An experienced metalsmith will be available for consultation.

Cost: A $7 shop fee will be collected for regular workshop. Club membership required.

Introduction to Faceting

An informative introduction and hands-on experience in the world of gem cutting. Learn how to

create a gem out of a piece of rough, during a weekend class. No machine required. Return

students welcome with or without their own machine. Each class can accommodate 3 new

students without machines and 3 returning students with their own machines.

Instructor: Bob Johnson

Location: Club Shop

Dates & times: Sat. May 11, and Sunday May 12, 2019 – 9am -5pm

Cost: $80 New students. Club membership required. $70 return students.

Contact Bob Johnson for more info or to register - 760-809-0152 or email Bob at N78532@yahoo.com

Faceting – Continuation Class

This is a class for continuing students who have completed the Introductory Class and is held once per month, from 9 to 5 on the Saturday following the general meeting, (which is always on the third Wed.)

Instructor: Bob Johnson

Location: Club Shop

Cost: $35.

May workshop – May 18, 2019, 9-5

Contact Bob Johnson for approval and to reserve a spot - 760-809-0152 or email Bob N78532@yahoo.com

Introduction to Silversmithing Class

Ring by Mike Mettelka

This is a 10-hour introductory silversmith class. The students will learn to develop their designs, use a jeweler's saw to cut out a pattern, solder a bezel to a backing and add a bale or a ring shank, creating a wearable piece of jewelry. Intermediate students can work on a project of their choosing with instructor approval. At the completion of this introduction the student can continue learning in the Thursday night workshop.

Instructors: Diane Hall & Annie Heffner

Dates & times: July 27 & 28, 2019, 10-4

Cost: $60 (club membership required - $25 fee for single membership)

Materials additional – (Approx. $30) and please bring a cabochon to set in silver or let us know if you need one.

**Call Diane Hall at (760) 741-0433 (leave message for call back) or email dianehall213@gmail.com for more info or to register. *Next class September 28 & 29*.

Chasing & Repoussé Workshop

We are planning a week of chasing & repoussé for those who have had beginning experience, have their own tools and want to get together to create, share ideas, and enjoy time with other chasers.

Dates & times: Monday, August 19 – Friday, August 23, 2019 from 10-4.

Cost: $75

Materials: Bring your own pitch bowl and tools.

**Call Diane Hall at (760) 741-0433 (leave message for call back) or email dianehall213@gmail.com for more info or to register.

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May 15th Program Speaker:

Dr. Don Buchanan, Retired Professor of Geology

Topic: "Minerals Rock"

Minerals are an important component in everyday life, although most of the public is not aware of the critical role mining plays in supplying minerals needed to maintain a growing economy. To help educate the public on the importance of minerals the SanBernardino County Museum opened a new exhibit on July 5, 2018 entitled:

“Minerals Rock - Unearthing the Human Element.” -- Come to the May 15th meeting and see slides of some of the new exhibits at the County Museum in Redlands, CA. Group tours of the exhibits are available at reduced rates. It is truly a fabulous educational exhibit worth visiting, even more than once, as there is so much offered.

Abstract:
Minerals are all around us in modern life; they are a critical component of our cell-phones, roadways, and toothpaste, yet these same minerals can have significant global impact. San Bernardino County has a rich history in mineral production and still has approximately 100 active mines, including the largest rare earth element mine outside of China. They mine sand and gravel, limestone (for cement), decorative rock, gold, trona, saline minerals, talc, and clay, including specialty clays used in cosmetics.

The “Minerals Rock!” exhibit illustrates how vital minerals are to our county, from the colorful history of exploration, scientific discovery, to the mining industry that fuels economic prosperity, to the numerous products that benefit our everyday lives, and the ways in which our choices in the dispersal of these products can have significant impact on our environment.

May Speaker's Biography:

Dr. Don Buchanan received a B.S. Degree in Geology from University of Missouri and completed a one-year Air Force Meteorology Training program at the University of Texas. He also has a MSc in Oceanography/Climatology from the Naval Postgraduate School in Monterey, CA and Doctorate in Education from USC. His career included meteorological work and doing research and applied Earth Sciences for the USAF and other branches of the military until retirement in July 1989.
His second career included, teaching meteorology for Embry Riddle Aeronautical University.
Additionally, he taught geology at several community colleges including San Bernardino Valley, Crafton Hills and Victor Valley. Don has been serving as President of Southern California Friends of Mineralogy Chapter of the nationwide Friends of Mineralogy since January 2015 developing symposiums and field trips around the state of California and into Nevada and Arizona.

[From the March 2019 "Newsletter of the Inland Geological Society" Volume 35 No. 3]

GEOLOGY JOKES:

Q: Why did the geologist get divorced?

A: He took his wife for granite so she left him.

Q: What element is derived from a Norse god?

A: Thorium

Q: What do geologists call a benzene ring with iron atoms replacing the carbon atoms?

A: A ferrous wheel

Q: What did the psychologist tell the geologist?

A: Every decline is a great Break Through

Q: Did you hear that oxygen and magnesium got together? Omg!

Q: Where do geologists relax?

A: In a rocking chair.

For the seniors: Geologists don’t wrinkle, they show

Lineation! Old geologists never die, they recrystallize!

LEPIDOLITE - Did you know?

While surfing the Internet, I came across a little factoid that I did not know. Apparently, "lepidolite" - that purple, micaceous rock that is so
familiar to us, here in San Diego County, is not a valid mineral name. It has been "Discredited" by the International Mineralogical Association
(IMA).
You don't have to believe me. Here is the list of links for reference, that I found on the Internet:

Lepidolite : ClassicGems.net
www.classicgems.net/gem_lepidolite.htm
"Lepidolite was once considered to be a distinct mineral species, but has been redefined by the IMA as a group of minerals and as part of the

Polylithionite-Trilithionite Series. The name Lepidolite is also used loosely as a term for any light colored lithium-bearing mica that has not
been sufficiently analyzed for species determination (ie., some Lepidolite may actually be Muscovite or Phlogopite). Lepidolite is a member of
the Mica Group of minerals that also includes Celadonite, Muscovite, Phlogopite, and Polylithionite.
Lepidolite is an uncommon mica and is an ore of lithium that forms in huge masses that can contain substantial amounts of lithium. Its typical
pink to violet colors are one of the only field tests to distinquish Lepidolite from other micas, because pink Muscovite or very pale Lepidolite
may complicate identification."

Lepidolite: Mineral information, data and localities.
www.mindat.org/min-2380.html
"IMA status: Discredited."
"The name is sometimes incorrectly applied to lithian muscovite. The pink to purple colour typical of lithian muscovite and lepidolite is
usually attributed to manganese rather than lithium."

List of minerals (complete) - Wikipedia
en.wikipedia.org/wiki/List_of_minerals_(complete)
"The merging of the 'ARD List' (approved, revalidated and discredited) with the 'GQN List' resulted in the first 'IMA/CNMNC List of Mineral
Names'. The 2007 draft of the 'IMA/CNMNC List of Mineral Names' was a courtesy of the Materials Data, Inc. (MDI), its 2009 review had
important modifications."

Lepidolite mineral information and data - Dakota Matrix Minerals
www.dakotamatrix.com/mineralpedia/6928/lepidolite
"Lepidolite falls on or close to the Trilithionite - Polylithionite join and is a light mica with substantial lithium. Contain fluorine in the (A)
position. Can be easily distinguished from regular mica by the flame test for lithium."

Lepidolite Mineral Data
webmineral.com/data/Lepidolite.shtml
"Lepidolite Nanpingite. Comments: Hexagonal tabular crystals of pearly colourless lepidolite within massive white pollucite from unknown
rare metal pegmatite.Nanpingite forms the outer zones of these lepidolite crystals (~30-150 µm)."

Lepidolite: Mineral information, data and localities.
www.mindat.org/min-41716.html
"Purple Jade [from China]: A dense mass of fine grained lepidolite, plus ... this material is a rock and not a mineral."

Lepidolite mica: The mineral Lepidolite information and pictures
www.minerals.net/mineral/lepidolite.aspx
"Lepidolite is a lithium-rich mica known for its pink and lilac colors. It is a common matrix mineral to Tourmaline and Quartz, providing them
with a very aesthetic and glittery base. A pink variety of the related mica mineral Muscovite can be identical in appearance to Lepidolite, and
is many times incorrectly labeled as Lepidolite."

Lepidolite - Mineral Auctions
www.mineralauctions.com/.../lepidolite-66786.html
"As of the time I have posted this auction, Lepidolite has been discredited by the IMA. Right now, it's said to be a series between
Polylithionite and Trilithionite. Considering the name has been around since 1792, it's hard to remove it from the common consciousness of
mineral collectors and dealers alike. "

SUBMITTED BY: ROBERT VERISH

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MT. ST. HELENS BLASTS TO LIFE (Part 1)

Gene Ciancanelli

INTRODUCTION

In the late 1960s, I'm employed by Geothermal Resources International, one of four pioneer companies attempting to develop geothermal energy as a new electrical energy resource. The people working on this new resource mainly came from the oil and gas industry, because geothermal energy is produced by drilling deep large diameter wells similar to oil and gas wells. Most geothermal geologists, even today, explore by snuggling up to a hot spring and drilling a well with the usually forlorn hope they will encounter a high temperature (above 350° F) geothermal reservoir. My background was in mining geology and in particular porphyry copper and molybdenum deposits, which form in magma chambers relatively close to the earth's surface. Hot springs exist all over the world, but very few are associated with very high temperature geothermal reservoirs. Porphyry copper deposits form in granitic magma chambers, which produce in close proximity high temperature geothermal reservoirs. I knew that to find reservoir temperatures above 350° Fahrenheit, it would be necessary to drill in close proximity to shallow magma chambers that had not yet completely crystallized and cooled down. The geologic environment to find such reservoirs would be in close proximity to young volcanism and in particular to specific types of volcanoes. In the 1960s, geothermal electric power was being produced at Larderello, Italy; Wairakei, New Zealand, and The Geysers, California. All three areas contain geologically recent volcanic activity. I wrote a report for Geothermal Resources identifying the localities in the United States where high temperature shallow granitic magma chambers might be found. Most of these localities were on federal lands and one of these areas was Mt. St. Helens, but as usual Geothermal Resources did nothing. In 1973, the Federal Government opened all federal lands for geothermal exploration and development. This was timely as that was the beginning of the first "energy crisis" with the long lines at gas stations. Many companies were now suddenly interested in and exploring for geothermal resources. In 1973, I was consulting for a consortium of Canadian Oil Companies to find geothermal resources in the United States. We had the young volcanic areas more or less to ourselves because the big oil companies and others filed for leases on hot springs. A few years later, the big oil companies began to realize that shallow young magma chambers were localities where high temperature geothermal reservoirs could be found. Some back room political shenanigans caused the Federal Government to take back the geothermal leases, held by myself and those Canadian interlopers, and give those leases to the big American oil companies. While that process and lawsuits were going on, I continued exploring the areas the Canadians held under lease application.

In 1979, that work included a reconnaissance field visit to Mt. St, Helens. The area was an extremely beautiful pristine wilderness with the beautiful symmetrical cone of Mt. St. Helens rising above Spirit Lake and the surrounding forests. Mt. St. Helens was known as the Mt. Fuji of America and at that time, I was also working in Japan around Mt. Fuji. It would have been wrong to tear up Mt. St. Helens with wells, roads, power plants, and transmission lines. I recommended the Canadians withdraw their lease applications, which they did do.

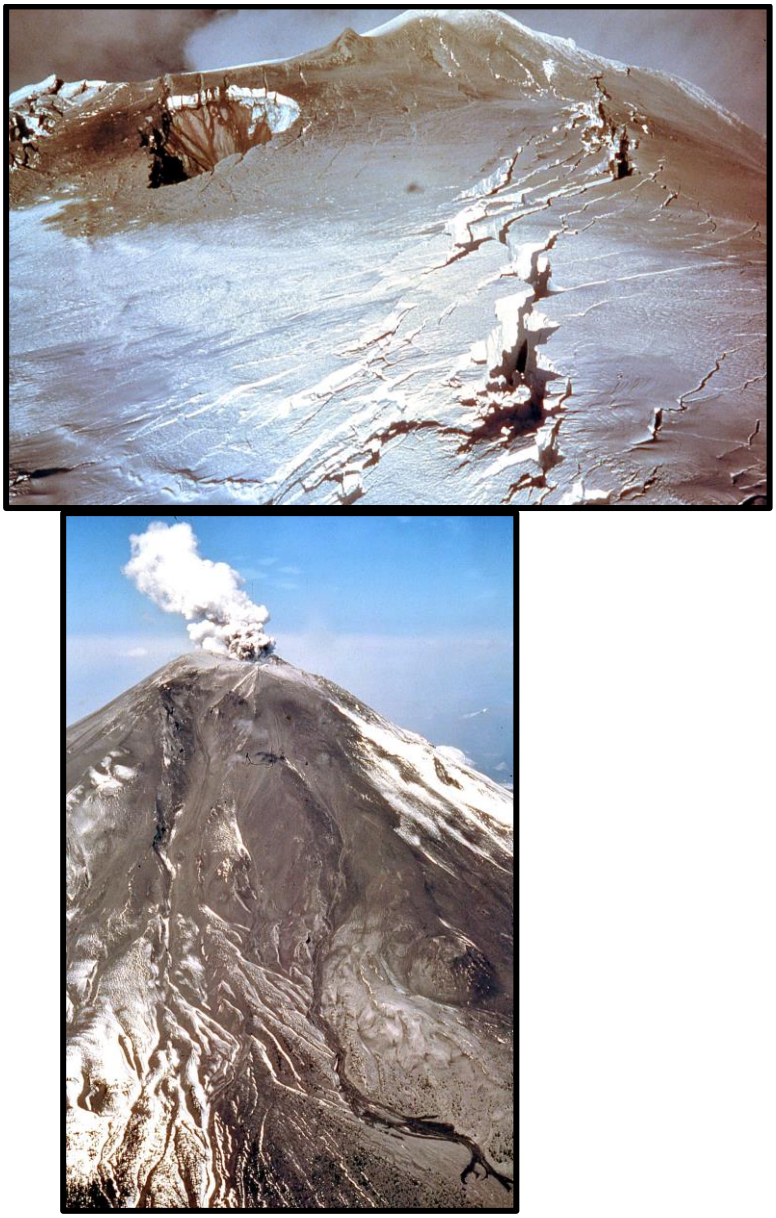
Immediately, Burlington Northern Railroad filed geothermal lease applications on the lands, which the Canadians had vacated. Burlington began a one-man geothermal exploration program conducted by a railroad employee. That would prove to be a fortunate turn of events, because years later Burlington has to prove to the Federal Government that they were exploring the area's geothermal resource potential prior to the volcano's eruption.

THE ERUPTION OF THE VOLCANO

Mt. St. Helens was last active during the 1840's and 1850s. On March 20, 1980, the volcano resumed activity following a few days of seismic activity associated with magma rising inside the volcano. The initial eruptions were relatively unimpressive steam venting ejecting old rock and cinders, but no magma. The venting steam was produced by the heating of overlying groundwater as magma rose into the volcano's central conduit. Geologists assumed a somewhat larger, but still small magmatic eruption might occur and then the volcano would quiet

down. The U.S. Geological Survey began to investigate and monitor the volcano. One of their geologists was David Johnston, a young volcanologist. Two years earlier, we had spent time together studying volcanic areas in the Pacific Northwest. I liked David, who was an enthusiastic and talented geologist, destined for success. David's job was to man an observation post on a ridge top north of the volcano. David's observation post contained equipment, a pickup truck, and an office and living trailer.

Between March 20th and May 18th there were small eruptions of old rock and cinders remobilized by escaping steam. Magma slowly rose into the volcano causing it to swell outward, a condition known as tumescence. Frequent seismic activity accompanied the tumescence process as the rocks expanded outward along fractures. On March 27th large gas eruptions carved a 250-foot diameter crater and sent up three ash columns to heights of 7,000, 10,000, and 11,000 feet. By April 7, the crater was 1,700 by 1,200 feet and 500 feet deep. By late April, a 1.5-mile-diameter section of Mt. St. Helens' north face was displaced outward at least 270 feet with seismic activity quite frequent as the fractured rock expanded. During April and early May this bulge grew five to six feet per day, and by mid-May the volcano extended more than 400 feet to the north. As the bulge moved northward, the summit area sank, forming a down-dropped section of the summit rock, which is called a graben. The U. S. Geological Survey announced on April 30 that sliding of the bulge area was the greatest immediate danger and that such a landslide might trigger an eruption. Volcanic activity became quiet on May 14 and this quiet period lasted for four days. The governor of Washington was under public pressure to allow people, who were evacuated from around the volcano, to return to collect belongings. She set a two-day period for residents to enter the evacuated area on May 17 and 18.



Initial steam venting at Mt. St. Helens in March 1980.

On Sunday May 18 at 7 AM, David Johnson radioed, from his observation post six miles north of the volcano, that he had just taken laser beam measurements, which showed no change in the volcano's bulge. Additionally, there were no changes in gas emissions, ground temperature, and seismic activity to indicate an eruption was about to occur. At 8:32 AM., a magnitude 5 earthquake set off a rapid series of events. The volcano's northern side, above the

bulge, collapsed. This triggered the volcano's north flank to slide downward as one of the largest landslides ever recorded. The volume of landslide rock was acting as a "plug" containing the underlying high pressure superheated hydrothermal system (geothermal reservoir) that had driven the initial steam eruptions. As the landslide released the immense mass of rock above the hydrothermal system, this removed the containment rock plug. Removal of the overlying rock plug released the confining pressure above the superheated hydrothermal system; thus, causing an instantaneous flashing to steam. The massive steam release initiated a hydrothermal blast directed laterally northward through the landslide scarp. The lateral hydrothermal blast overtook the landslide and moved outward across the forest area to the north. The instantaneous blast levitated the sliding landslide rock above the volcano's slope. Later investigations would disclose the shallow roots of grasses and shrubs were not crushed as the top of the volcano moved down the lower flank; thus, proving the levitation of the landslide rock. To the north and northeast, trees were blown down like matchsticks across a 150 square mile fan-shaped area. The devastated area was approximately 18 miles wide extending outward for a distance of 12 1/2 miles. The initial violent high temperature hydrothermal blast immediately killed 57 people including David Johnson. No trace of Johnson, his pickup, trailer, or any of the other 56 people was ever found. Trees were knocked down pointing in parallel patterns in the direction of the outward moving blast "wind". These large trees were stripped of limbs and much of their bark.

Forest of pumice covered trees blown down and stripped of limbs by May 1980 eruption.

Shortly after the eruption, I saw cars that were parked miles eastward of the volcano. These cars were stripped of all paint and glass, the tires were gone, and all the interior plastic, including the steering wheel and dashboard, was melted.

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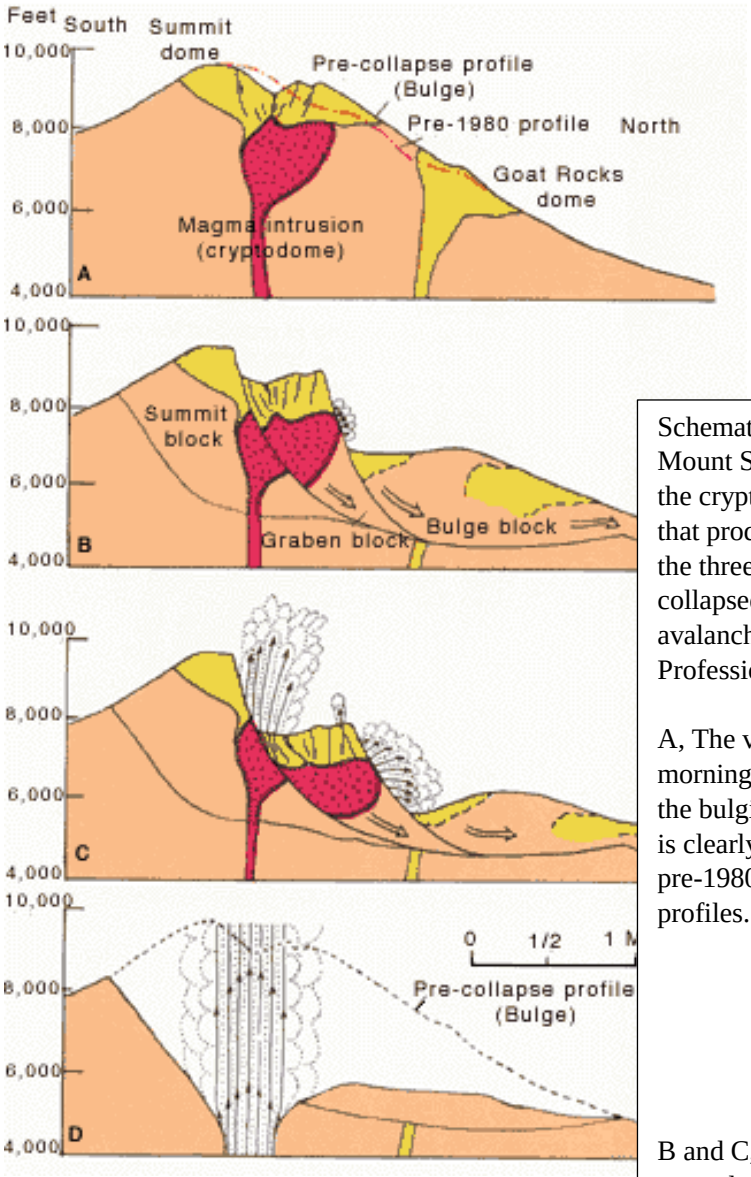

Schematic cross sections of Mount St. Helens showing the cryptodome of magma that produced the bulge and the three major blocks that collapsed to form the debris avalanche (After USGS Professional Paper 1250).

A, The volcano in the early morning of May 18, 1980; the bulging of the north flank is clearly shown by the pre-1980 and pre-collapse profiles.

B and C, (within about 30 seconds after the collapse) show the progressive development of the debris

eruption formed a spectacular vertical Plinian column of rapidly rising magma/ash, water vapor, and gas. The Plinian column rose to a height 12 to 13 miles and then the ash-laden cloud, driven by high-altitude wind, spread eastward. Mt. St. Helens ash eventually was deposited eastward into the Great Plains and even farther to the east. As the volcano erupted, the escaping magma, steam, and gases eroded the vent wider. Ultimately the combined destructive events of the landslide, lateral hydrothermal steam blast, and the Plinian eruption carved out a large stadium shaped crater in the original volcanic

Lahar composed of logs and mud choke the Toutle River. A large building, buried in mud, is in the center of the photo on the right.

The landslide partly filled Spirit Lake, which raised the lake bed about 200 feet. The landslide contained a large quantity of water, which produced large lahars (mudflows) that flowed down the North Fork of the Toutle River to the Cowlitz River.

The landslide and hydrothermal blast removed a large quantity of rock from above the shallow magma rising through the volcano's central conduit. The sudden pressure-release caused the water and various gases dissolved in the magma to be violently released. This

On that Sunday morning, I was working in the yard, when Betty came out saying that Nancy, our secretary, had just telephoned that her mother, who lives in Yakima, Washington has called her in panic. Nancy's mother said the day has turned to night and rocks and "sand" are falling from the sky. I immediately knew what was

happening and I rushed to turn on the television. There, from Portland, Oregon, was a live broadcast of the erupting volcano. At the time, I did not know people had been killed and I was excited, when I said to Betty, **"Wow this is even better than I could have hoped for".** I tried to buy an airline ticket to Portland, but the airport was closed. I flew to Portland the next day, but the eruption had stopped and all roads into the volcanically impacted region were blockaded. I drove to Yakima and collected some ash samples in a Safeway parking lot, where ash was piled 4 to 6 inches deep. I stayed in Portland for five days hoping to see further activity, but the volcano remained dormant. Upon returning to San Diego and just as I exited the plane, Mt. St. Helens had another eruption. Just my luck. I did not know it yet, but my involvement with Mt. St. Helens volcano was about to occupy some of my time for the next 10 years. **(to be continued)**

Mt. St. Helens before May 18, 1980 eruption Mt. St. Helens after May 18, 1980 eruption

Mt. St. Helens Plinian eruption, May 18, 1980. Plinian column of rapidly rising magma/ash, water vapor, and gas.

The combined destructive events of the landslide, lateral hydrothermal steam blast, and the Plinian eruption carved out a large stadium shaped crater on the original volcanic cone.

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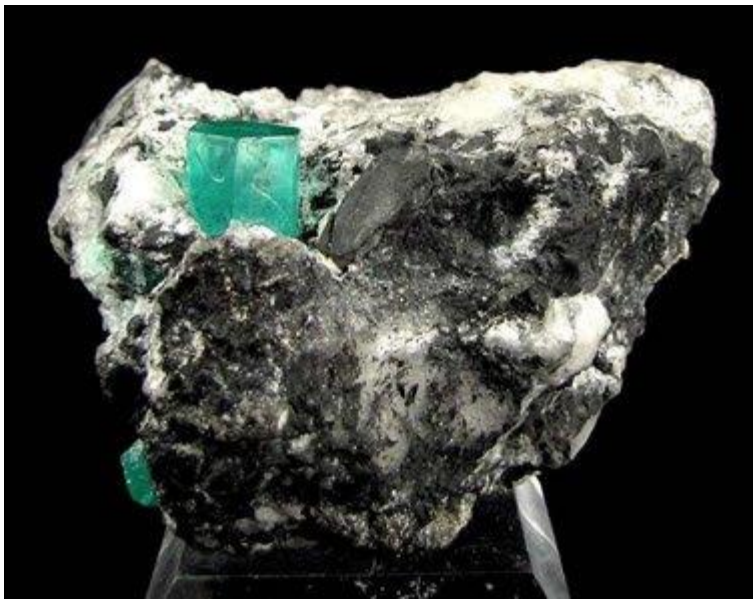
EMERALD - The bright green gem of the beryl mineral family.

Author: Hobart M. King, Ph.D., GIA Graduate Gemologist



Emeralds from Colombia: Emeralds in a calcite and shale matrix from the Coscuez Mine, Muzo, Colombia. The well-formed crystal with an attractive bluish-green color is about 1.1 centimeters tall. Specimen and photo by Arkenstone / www.iRocks.com.

What Are Emeralds?

Emeralds are gem-quality specimens of the beryl mineral family with a rich, distinctly green color. They are found in igneous, metamorphic, and sedimentary rocks in a small number of locations worldwide.

For over 5000 years, emeralds have been one of the most desirable and valuable colored stones. Ancient civilizations in Africa, Asia, and South America independently discovered emeralds and made them a gemstone of highest esteem. In the United States and many other countries, emerald serves as the birthstone for people who were born in the month of May.

Today emerald, together with ruby and sapphire, form the "big three" of colored stones. The "big three" generate more economic activity than all other colored stones combined. In 2015 the value of emeralds imported into the United States exceeded the value of all colored stones outside of the "big three" combined.

Emeralds from Russia: Photograph of emerald crystals in mica schist from the Malyshevskoye Mine, Sverdlovsk Region, Southern Ural, Russia. The large crystal is about 21 millimeters in length. Photograph copyright iStockphoto / Epitavi.

Physical Properties of Emerald

Color	A distinctly green color that ranges between bluish green and slightly yellowish green. Stones with a light tone or a low saturation should be called "green beryl" instead of emerald.
Clarity	Almost every natural emerald has eye-visible characteristics that can be inclusions, surface-reaching fractures, or healed

	fractures. Treatments to fill the fractures with oils, waxes, polymers, flux and other materials to reduce their visibility has been common practice for hundreds of years.
Luster	Vitreous
Diaphaneity	Transparent to translucent
Cleavage	One direction of imperfect cleavage
Durability	Emerald is very hard, but almost all specimens have inclusions and surface-reaching fractures that compromise their durability.
Mohs Hardness	7.5 to 8
Specific Gravity	2.7 to 2.8
Chemical Composition	$Be_3Al_2(SiO_3)_6$ Emerald's green color is caused by trace amounts of chromium or vanadium.
Crystal System	Hexagonal. Often as prismatic crystals.

Emerald's Green Color

Beryl, the **mineral** of which emerald is a variety, has a chemical composition of $Be_3Al_2(SiO_3)_6$. When pure, beryl is colorless and known as "goshenite." Trace amounts of **chromium** or vanadium in the mineral cause it to develop a green color. Trace amounts of iron will tint emerald a bluish green or a yellowish green color depending upon its oxidation state.

Emerald is defined by its green color. To be an emerald, a specimen must have a distinctly green color that falls in the range from bluish green to green to slightly yellowish green. To be an emerald, the specimen must also have a rich color. Stones with weak saturation or light tone should be called "green beryl." If the beryl's color is greenish blue then it is an "aquamarine." If it is greenish yellow it is "**heliodor**."

This color definition is a source of confusion. Which hue, tone, and saturation combinations are the dividing lines between "green beryl" and "emerald"? Professionals in the gem and jewelry trade can disagree on where the lines should be drawn. Some believe that the name "emerald" should be used when chromium is the cause of the green color, and that stones colored by vanadium should be called "green beryl."

Calling a gem an "emerald" instead of a "green beryl" can have a significant impact upon its price and marketability. This "color confusion" exists within the United States. In some other countries, any beryl with a green color - no matter how faint - is called an "emerald."

Be careful if you are buying an "emerald". Make sure that you are getting a gem that has a rich green color instead of a "green beryl". Buying from a website where people from outside of the United States are acting as third-party sellers and photographs might not have representative color can be especially risky.

The Name "Yellow Emerald" Is Incorrect

By definition, emeralds are gem-quality specimens of the beryl mineral family with a rich, distinctly green color. Because of that, it is inappropriate to use the name "emerald" when marketing a beryl of any other color.

The Federal Trade Commission publishes a set of *Guides for the Jewelry, Precious Metals and Pewter Industries*. They use "yellow emerald" as an example of an incorrect name that when used in marketing can be

"unfair", "misleading" and "deceptive" (the words here in quotes are straight from FTC guidance for jewelers). More information **here**.

If you are going to buy a "yellow emerald" it might be a good idea to compare it with an equivalent material that is properly marketed as **heliodor or yellow beryl**. Heliodor is a beautiful gem. It sells for a lot less than emerald and it usually does not suffer from the durability and clarity problems that are common in emeralds.

Emerald from Zambia: Emerald crystal from the Kagem Emerald Mine, Zambia, on a matrix of quartz and mica schist. This specimen is about 6.5 centimeters in height and has the blue-green color and medium dark tone that is common in many emeralds mined in Zambia. Specimen and photo by Arkenstone / **www.iRocks.com**.

Clarity, Treatments, and Durability

Emerald has a **Mohs hardness** of 7.5 to 8, which is normally a very good hardness for jewelry use. However, most emeralds contain numerous **inclusions** or surface-reaching fractures. These can weaken the gem, cause it to be brittle, and make it subject to breakage.

These are expected characteristics of emerald. It is rare to find an emerald that does not have inclusions and surface-reaching fractures that can be seen with the unaided eye. Under low magnification, most emeralds are said to have a "garden" of inclusions.

To improve appearance, most cut emeralds are treated with oils, waxes, polymers, or other substances that enter the fractures and make them less obvious. Although these treatments might improve appearance, they often do not improve the durability of the gem and they may discolor or deteriorate over time.

With that information, emerald should be considered a fragile stone that is best worn as a ring stone on special occasions rather than daily. Emerald is better suited for earrings and pendants that are usually subjected to less impact and abrasion than rings and bracelets. Settings that protect the stone are much safer than those that present the stone to impact and abrasion.

Cleaning emeralds should be done carefully. Steam and ultrasonic cleaning can remove oils and other fracture-filling treatments. A light washing in warm water with a mild soap is safer for cleaning and should be done only when needed.

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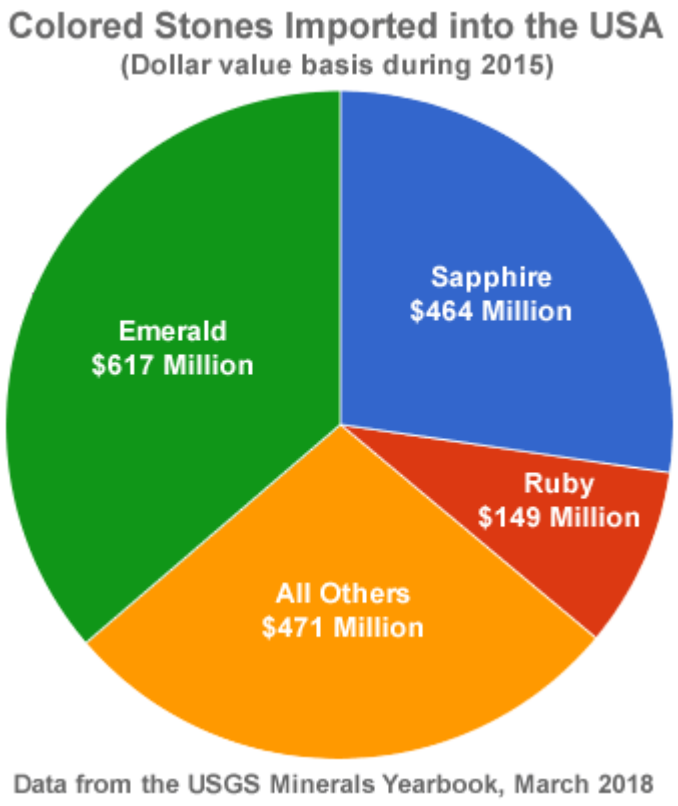


Emerald imports: This graph illustrates the popularity of emeralds in the United States. The pie represents all colored stones imported into the United States during 2015 on the basis of dollar value. As a single gem variety, emerald holds the biggest share of the pie. More dollars' worth of emeralds were imported than any other colored stone. More dollars' worth of emeralds were imported than ruby and sapphire combined. Data from the USGS Minerals Yearbook, March 2018. [1]

Gemstone	Quantity (carats)	Customs Value (Dollars)	Average Cost/carat
Diamond	11,200,000.00	$22,900,000,000	$2,044.64
Emerald	3,650,000.00	$617,000,000	$169.04
Ruby	3,680,000.00	$149,000,000	$40.49
Sapphire	6,640,000.00	$464,000,000	$69.88
Other	NA	$471,000,000	---

Gemstone import value: This chart shows the quantity and value of diamond, emerald, ruby, sapphire, and other colored stones imported into the United States during 2015. This chart shows that, on the basis of cut but unset value, emerald is the most important gemstone import for the United States after diamond. It also has an average per-carat price that is much higher than ruby and sapphire. These amounts are approximately equal to consumption because the amount of domestic production was just several million dollars total. Data from the USGS Minerals Yearbook, March 2018. [1]

Geologic and Geographic Occurrence

Beryl is a rare mineral with a chemical composition of $Be_3Al_2(SiO_3)_6$. It is rare because **beryllium** is an element that occurs in very small amounts in the Earth's crust. It is unusual for enough beryllium to be present in one location to form minerals. In addition, the conditions in which beryllium is present in significant amounts are different from the conditions where chromium and vanadium, the sources of emerald's green color, are expected. This is why emerald is rare and only found in a small number of locations.

Today, most emerald production originates in four source countries: **Colombia**, **Zambia**, **Brazil**, and **Zimbabwe**. These countries reliably produce commercial amounts of emeralds. Minor amounts of

production or irregular production comes from **Madagascar**, **Nigeria**, **Afghanistan**, **Pakistan**, **Canada**, **Russia**, and a few other countries.

Starting in about 2015, significant amounts of emerald with exceptional color and clarity started to be exported from **Ethiopia**. An editorial on the JCK website speculated that these Ethiopian emeralds might be the greatest gem find in 100 years. [2]

Even though the conditions for the formation of emerald are very unlikely, the gem has been found in a diversity of rock types. In Colombia, the country that has supplied most of the world's emeralds, black organic **shale** and carbonaceous **limestone**, both sedimentary rocks, are the ores for many emerald deposits. The shale is thought to be the source of chromium, and the beryllium is thought to have been delivered by ascending fluids.

Many of the world's emerald deposits have formed in areas of contact metamorphism. A granitic magma can serve as a source of beryllium, and nearby carbonaceous **schist** or **gneiss** can serve as a source of chromium or vanadium. These emeralds usually form in schist or gneiss or in the margins of a nearby **pegmatite**. Mafic and ultramafic rocks can also serve as sources for chromium or vanadium.

Emeralds are rarely mined from alluvial deposits. Emerald is usually a fractured stone that does not have the alluvial durability to persist great distances from its source. Emerald also has a specific gravity of 2.7 to 2.8, which is not significantly different from quartz, **feldspar**, and other common materials found in stream sediments. It therefore does not concentrate with high-density grains which are segregated in the stream and more easily recovered by placer mining.

Emerald from North Carolina: A specimen of the Crabtree Pegmatite of western North Carolina. This granitic pegmatite filled a two-meter-wide fracture which contained emerald along the walls of the fracture and yellow beryl in the center. It was mined for emeralds by Tiffany and Company and a series of property owners between 1894 and the 1990s. Many fine clear emeralds were produced, but most of the emerald-bearing rock was sold as "emerald matrix" for slabbing and cabochon cutting. The cabochons displayed emerald and tourmaline prisms in a white matrix of quartz and feldspar. This specimen is about 7 x 7 x 7 centimeters in size and contains numerous small emerald crystals that are up to several millimeters in length and associated with schorl.

Emerald Mining in the United States

Very few emeralds have been mined in the United States. **North Carolina** has been a sporadic producer of emeralds in small quantities from a few tiny mines since the late 1800s. The Crabtree Emerald Mine was once

operated by Tiffany and Company and a series of property owners between 1894 and the 1990s. Many fine clear emeralds were produced, and tons of emerald-bearing pegmatite were sold as "emerald matrix" for slabbing and cabochon cutting. The cabochons displayed emerald and tourmaline prisms in a white matrix of quartz and feldspar. A specimen of the Crabtree Pegmatite is shown on this page.

North American Emerald Mines operates a small mine near Hiddenite, North Carolina. Between 1995 and 2010, over 20,000 carats of emeralds were produced, including a six-inch-long, 1,869-carat crystal that is now in the Houston Museum of Natural Science and valued at $3.5 million. A **crushed stone** quarry on the same property is operated with emploees watching for signs of the hydrothermal veins and pockets that sometimes contain emerald. It is one of the only gemstone mines in the world that sells the country rock. [3]

Trapiche Emerald: A photograph of a trapiche emerald crystal section. The green material is emerald, and the black is particles of the black shale matrix that were included during crystal growth. This photography by Luciana Barbosa is displayed here under a **Creative Commons license**.

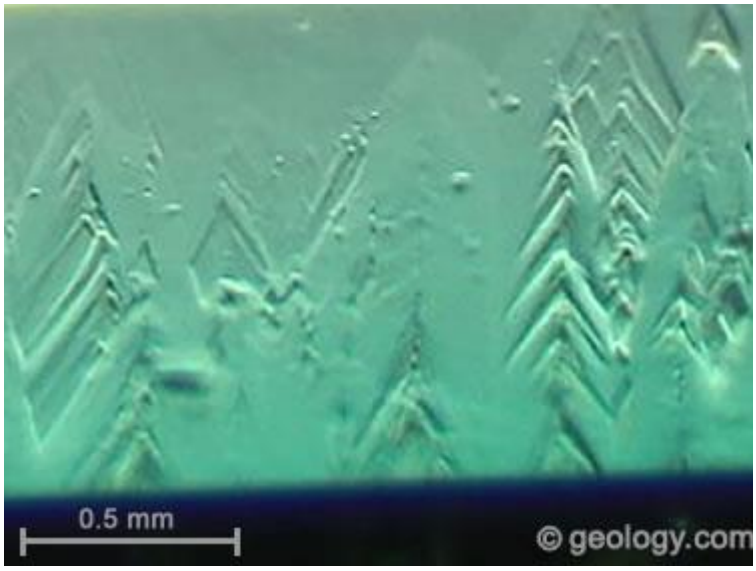
Trapiche Emeralds

Trapiche emeralds are a rare variety of emerald that exhibit a six-sided, zoned morphology. Inclusions of their black shale matrix separate the growth sectors of the crystal. (See accompanying photo.) A cross-section through the trapiche crystals, cut perpendicular to the c-axis of their central core, resembles a wheel with six spokes. [4]

Trapiche emeralds are occasionally found in a few mines on the west flank of the Eastern Cordillera Basin of Colombia. They are thought to form when fluid overpressuring, followed by sudden decompression, causes rapid crystallization of emerald. During this rapid crystal growth, particles of the black shale matrix are trapped between the six growth sectors of the emerald crystals. This is the origin of the six black spokes of the wheel.

Synthetic emerald: The materials in this photo are lab-created or synthetic emerald produced by Chatham. On the left is a faceted synthetic emerald weighing 0.23 carats and measuring

5.1 x 3.0 millimeters. On the right is a synthetic emerald crystal weighing 2.0 carats and measuring 8.1 x 6.1 x 4.9 millimeters.



Evidence of Synthetic Origin: Microscopic examination is the best method for separating synthetic emeralds from natural emeralds. The photo above show chevron-type growth zoning in a synthetic emerald grown by the hydrothermal method.

Synthetic Emerald

The first synthetic emeralds were produced in the mid-1800s, but it was not until the 1930s that Carroll Chatham began producing synthetic emerald in commercial quantities. Once commercial production began, a steady supply of synthetic emeralds began entering the market. To date, several companies including Chatham Created Gems, Gilson, Kyocera Corporation, Lennix, Seiko Corporation, Biron Corporation, Lechleitner, and Regency, have produced synthetic emeralds by flux and hydrothermal processes. [1]

Synthetic emeralds, also known as lab-created emeralds, have the same chemical composition and crystal structure as natural emeralds. They are sold beside natural emeralds in most mall jewelry stores in the United States. When compared to natural emeralds, the synthetics typically have superior clarity and a more uniform appearance than natural stones of equivalent cost.

There is nothing wrong with synthetic emeralds, or synthetic stones of any kind - as long as their synthetic origin is clearly disclosed to the buyer. They are simply another option for the buyer. Many consumers purchase synthetic emeralds and enjoy them because they obtain superior appearance at a substantially lower cost.

The two key tests for separating natural emeralds from synthetic emeralds are refractive index and magnification. Natural emeralds generally have a refractive index that is slightly higher than most hydrothermally produced synthetic emeralds and much higher than most flux-grown synthetic emeralds. These differences are not large enough to be relied upon for important determinations; however, they can serve as a valuable indicator.

Magnification is the most important tool for separation of natural emeralds from synthetic emeralds. Synthetic emeralds can often be identified because they contain visible characteristics that are a product of the techniques used to create them. Hydrothermal synthetic emeralds might display characteristics that include: chevron-type growth zoning, nail-head spicules, and small gold inclusions. Flux-grown synthetic emeralds might display characteristics that include: wispy veil inclusions, tiny platinum crystals, or parallel growth planes. Many gemologists can quickly identify most synthetic emeralds by **microscopic examination**.

Green gemstones: A collection of green faceted stones of various types. Most of them are not emerald. If you want a green gemstone, which one would you choose based upon color and appearance?

Beginning in the back row at left - the name of the stone and its locality, carat weight, and the price that we paid: 1) chrome diopside from Russia, 1.16 carats ($11); 2) green quartz (dyed) from North Carolina, 2.6 carats ($8); 3) green tourmaline from Brazil, 0.77 carats ($58); 4) lab-created emerald manufactured by Chatham Created Gems, 0.23 carats ($37); 5) emerald from the Crabtree Mine, North Carolina, 0.50 carats ($80); 6) emerald from Colombia, 0.53 carats ($112); 7) tsavorite garnet from Tanzania, 0.68 carats ($105).

Notice how some of the least expensive stones are free of eye-visible fractures and obvious inclusions, while costly emeralds have fractures and inclusions that are clearly visible with the unaided eye. Some people have such a high desire for "emerald" that they are willing to pay more for an emerald than for another green stone that is larger, cleaner, and more attractive. Buy what you like!

Emerald Information