

Emerald

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Emerald with host rock

General

Category	Beryl variety
Chemical formula	Beryllium aluminium silicate with chromium, $\text{Be}_3\text{Al}_2(\text{SiO}_3)_6::\text{Cr}$

Identification

Color	Green
Crystal habit	Hexagonal Crystals
Crystal system	Hexagonal
Cleavage	Poor Basal Cleavage (Seldom Visible)
Fracture	Conchoidal
Mohs Scale hardness	7.5 - 8.0
Luster	Vitreous
Refractive index	1.576 - 1.582
Pleochroism	Distinct, Blue-Green/Yellow-Green
Streak	White
Specific gravity	2.70 - 2.78

Emeralds are a variety of the mineral beryl ($\text{Be}_3\text{Al}_2(\text{SiO}_3)_6$) colored green by trace amounts of chromium and sometimes vanadium. Beryl has a hardness of 7.5 - 8 on the 10 point Mohs scale of mineral hardness. Most emeralds are highly included, so their brittleness (resistance to breakage) is classified as generally poor. The origin of the word "emerald" is said to be a Sanskrit word meaning "green".

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1. Properties determining value

Emeralds come in many shades of green and bluish green. There is a wide spectrum of clarity, dependent on the inclusions and fractures in the crystal. Clear stones with dark yet vibrant color command the highest prices. Almost all emeralds contain numerous flaws, cracks, and inclusions, which can negatively affect the clarity. These are given the name "jardin", from the French word for garden. The value of an emerald depends on cut, color, clarity, and carat. Currently the best emeralds come from the Muzo mine in Colombia.

2. Treatments

Most emeralds are oiled as part of the post lapidary process, in order to improve their clarity. Cedar oil, having a similar refractive index, is often used in this generally accepted practice. The U.S. Federal Trade Commission requires the disclosure of this treatment when a treated emerald is sold. The amount of oil entering an emerald microfissure is roughly equivalent to the size of a period (full stop) in print. The use of green-tinted oil is generally not considered acceptable by the gem trade.

3. Emerald localities

Emeralds in antiquity were mined by the Egyptians and in Austria, as well as Swat in northern Pakistan.

A rare type of emerald known as a trapiche emerald is occasionally found in the mines of Colombia. A trapiche emerald exhibits a "star" pattern; it has raylike spokes of dark carbon impurities that give the emerald a six-pointed radial pattern. It is named for the *trapiche*, a grinding wheel used to process sugarcane in the region. Colombian emeralds are generally the most prized due to their transparency and fire. Some of the most rare emeralds come from three main emerald mining areas in Colombia: Muzo, Coscuez, and Chivor. Fine emeralds are also found in other countries, such as Zambia, Brazil, Zimbabwe, Madagascar, Pakistan, India, Afghanistan and Russia. In the US, emeralds can be found in North Carolina. In 1998, emeralds were discovered in the Yukon, Canada .

4. Synthetic emerald



Emerald showing its hexagonal structure

Emerald is a rare and valuable gemstone and, as such, it has provided the incentive for developing synthetic emeralds. Both hydrothermal and *flux-growth* synthetics have been produced, and a method has been developed for producing an emerald overgrowth on colorless beryl. The first commercially successful emerald synthesis process was that of Carroll Chatham. Because Chatham's emeralds do not have any water and contain traces of vanadate, molybdenum and vanadium, a lithium vanadate flux process is probably involved. The other large producer of flux emeralds is Pierre Gilson Sr., which has been on the market since 1964. Gilson's emeralds are usually grown on natural colorless beryl seeds which become coated on both sides. Growth occurs at the rate of 1 mm per month and a typical seven-month growth run produces emerald crystals of 7 mm of thickness (Nassau, K. *Gems Made By Man*, 1980).

Hydrothermal synthetic emeralds have been attributed to IG Farben, Nacker, Tairus and others, but the first satisfactory commercial product was that of Johann Lechleitner of Innsbruck, Austria, which appeared on the market in the 1960s. These stones were initially sold under the names "Emerita" and "Symeralds", and they were grown as a thin layer of emerald on top of natural colorless beryl stones. Although not much is known about the original process, it is assumed that Leichleitner emeralds were grown in acid conditions. Later, from 1965 to 1970, the Linde Division of Union Carbide produced completely synthetic emeralds by hydrothermal synthesis. According to their patents (US3,567,642 and US3,567,643), acidic conditions are essential to prevent the chromium (which is used as the colorant) from precipitating. Also, it is important that the silicon containing nutrient be kept away from the other ingredients in order to prevent nucleation and confine growth to the seed crystals. Growth occurs by a diffusion-reaction process, assisted by convection. Typical growth conditions include pressures of 700-1400 bars at temperatures of 500 to 600 °C with a temperature gradient of 10 to 25 °C. Growth rates as fast as 1/3 mm per day can be attained.

Luminescence in ultraviolet light is considered a supplementary test when making a natural vs. synthetic determination, as many, but not all, natural emeralds are inert to ultraviolet light. Many synthetics are also UV inert.

Synthetic emeralds are often referred to as "created", as their chemical and gemological composition is the same as their natural counterparts. The U.S. Federal Trade Commission (FTC) has very strict regulations as to what can and what cannot be called "synthetic" stone. The FTC says: "§ 23.23(c) It is unfair or deceptive to use the word "laboratory-grown," "laboratory-created," "[manufacturer name]-created," or "synthetic" with the name of any natural stone to describe any industry product unless such industry product has essentially the same optical, physical, and chemical properties as the stone named."

Wispy veil-like inclusions are common in flux-grown synthetic emeralds.

5. Emerald in different cultures, and Emerald lore



The Gachala Emerald is one of the largest gem emeralds in the world at 858 carats (172 g). This stone was found in 1967 at La Vega de San Juan mine in Gachalá, Colombia. It is housed at the National Museum of Natural History of the Smithsonian Institution in Washington DC.

Emerald is regarded as the traditional birthstone for May, as well as the traditional gemstone for the astrological signs of Taurus, Cancer and sometimes Gemini. One of the more quaint anecdotes on emeralds was by the 16th century historian Brantome, who referred to the many impressive emeralds the Spanish under Cortez had brought back to Europe from Latin America. On one of Cortez most famous emeralds he had the text engraved *Inter Natos Mulierum non sur-rexit mayor* (Among them borne of woman there hath not arisen a greater Man. XI, 11) which referred to John the Baptist. Brantome considered engraving such a beautiful and simple product of nature sacrilegious and considered this act the cause for Cortez loss of an extremely precious pearl (to which he dedicated a work *A beautiful and incomparable pearl*) and even for the death of King Charles IX who died soon after.

High Priest Breastplate

In Exodus chapters 28 and 39, a number of precious stones are mentioned to be placed in the High Priest's Breastplate, representing the different tribes of Israel. This is generally considered to be (one of) the origin(s) of our present day tradition of birthstones.

According to Rebbenu Bachya, and the King James Version, the Hebrew word *Nofech* in Exodus 28:18 means *Emerald*, and was the stone on the Hoshen representing the tribe of Judah. However, the Septuagint translates the word as *Anthrax*, meaning *coal*, probably in reference to the colour of burning coal, and therefore many rabbinical sources, and most scholars, consider *Nofech* to mean a red garnet - traditionally called a *carbuncle*, which happens to be the Vulgate's translation of the word. There is a wide range of views among traditional sources about which tribe the stone refers to.

There are many complexities to identifying the Emerald as being the third stone or perhaps another stone on the breast plate. Multiple translations of the bible have created confusion about the nomenclature of the different stones. Another important fact is that in actuality there are 2 different breastplates made within a period of 800 years, and where it is assumed the first breastplate did not carry an Emerald but a green Felspar, and a real Emerald in the second breastplate. Finally the 12th stone in the Breastplate (which in the original text was actually listed as the 6th stone) has more generally been identified as *Beryl* which was already included in the group of stones generally referred to as *Smaragdus* by Theophrastus in the Greek era. Further unreferenced claims regarding the possibility of what gemstone the Emerald could really have been include Jasper, and even Rubies.

In some cultures, the emerald is the traditional gift for the 55th wedding anniversary. It is also used as a 20th and 35th wedding anniversary stone.

6.Famous emeralds

- Gachala Emerald (origin: Colombia)
- Chalk Emerald (origin: Colombia)
- Nidvin Emerald (origin: Colombia)
- Duke of Devonshire Emerald (origin: Colombia)
- Mackay Emerald
- Greenshorkire Emerald
- Edward the Confessor Emerald in the Imperial State Crown of Great Britain

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