
Colombian Emeralds

Formation, Quality, and Value

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Introduction

For over 5000 years, emeralds have been one of the most desirable and highly valued gemstones. Together with rubies and sapphires, emeralds are among the most sought after fine gemstones. The oldest known mines date from Egypt around 3500 BC, and Egyptians, Greeks and Romans viewed emeralds as a rare and precious gemstone for kings and emperors. Several writers of ancient times mention emeralds and their special status. Emeralds are associated with fertility and healing in various cultures. In the Middle Ages, people held the belief that emeralds could be used to treat certain illnesses.

Long before the Spanish arrived in South America, pre-Colombian civilisations like the Muisca (today Colombia) already held emeralds in high regards and used them in ceremonial objects and jewellery. The mines of Muzo have been in operation for over 1,000 years, and this still is where some of the finest known emeralds originate. Muzo ranks among the most famous denominations of origin, alongside sapphires from Cashmere, the legendary ruby mines of Mogok, or diamonds from Golconda.



Fine Quality Muzo Emerald

When the Conquistadores brought Colombian emeralds back to Europe, people were astonished to see such fine qualities of emeralds, never seen before. From Spain, Colombian emeralds then found their way to places as far away as India and Persia.

The principal sources of emeralds today are Colombia, Brazil and Zambia. Other lesser well known deposits exist in Afghanistan, Ethiopia, Pakistan, to name a few. Today, emeralds remain one of the rarest and most valuable gemstones, twenty times rarer than diamonds. Per carat prices of emeralds often match those of the finest diamonds and sometimes exceed them. Pricing of coloured gemstones is complicated. Especially emeralds exhibit such a wide range of qualities, that seemingly minute details can lead to a wide divergence in pricing.

Colour is by far the most important factor affecting emerald quality and value. Brilliance, cut and carat weight also play an important role. Colombian emeralds are regarded as the world's finest, due to their unique hue and clarity. With per carat prices ranging from ten dollars per carat up to in excess of one hundred thousand dollars per carat, buying emeralds is not straightforward.

At Monteverde Emeralds, we try to assist our clients as much as possible with advice and explanation. In this publication, we explore factors that determine quality and value of Colombian emeralds.



Physical Properties and Genesis of Emeralds

Emeralds are part of the beryl family of gemstones, which also includes, for example, blue aquamarine and pink morganite. Their green colour is caused by the presence of the trace elements chromium and vanadium. These absorb certain wavelengths of the visible light, resulting in a green colour. In order to be called emerald, chromium has to be present. Chromium-rich emeralds appear red, when viewed through a Chelsea filter. It has to be noted though, that this effect does not always occur (for example when much iron is present) and the Chelsea filter is an unreliable method of examination.

For the formation of beryl, relatively large amounts of the rare element beryllium are required. These occur mainly in residual magmatic molten rock between 400-700 degrees celsius, usually in rocks of the continental crust.

The formation of emeralds is additionally complicated, because the colour-giving trace element chromium is typically found in completely different types of rock, usually in the oceanic crust and the earth's mantle. Therefore, the formation of emeralds must occur primarily in zones where magmatic beryllium-containing rock comes into contact with magmatic chromium-containing rock - an extremely rare incidence. Emeralds form primarily in mafic metamorphic rock, for example mica schists (a metamorphic rock containing quartz and mica), granites, and in high-temperature hydrothermal veins.

The fusion is only made possible by heat and pressure, therefore introducing stress during crystallisation that causes imperfections and fractures. Emeralds contain inclusions: foreign material, such as

liquid, solid, or gas that is trapped within a gemstone. These are one of the most important microscopic characteristics of emeralds and they are a strong indication of natural origin. The most common inclusions in beryl are hollow tubes and liquids in the form of healing cracks and two-phase inclusions. Solid inclusions in emeralds are typically minerals such as mica, calcite, tremolite and other minerals. It is possible to identify the origin of an emerald by analysing the inclusions present in the crystal.



Emerald crystal in its matrix

A characteristic inclusion in Colombian emeralds is a three-phase inclusion, containing a salt crystal, liquid (water or salty brine) and a gas bubble.

While emeralds are relatively hard gemstones, the presence of inclusions, hollow tubes, healing cracks and natural fissures makes them somewhat brittle and fragile.

Their low density makes emeralds appear larger than, for example a diamonds or rubies of the same weight.



It is actually relatively easy to identify emeralds purely by using a refractometer. The emerald's refraction index is 1,565 - 1,602 with a maximum birefringence of -0.004 to -0.01. It is the only green gemstone in that range. Synthetic emeralds can be difficult to recognise. These are described in our Monteverde Emerald Report: Emerald Treatments.



Hexagonal emerald crystal

Emeralds have been found in Afghanistan, Australia, Austria, Brazil, Colombia, Egypt, Ethiopia, Madagascar, Mozambique, North Carolina, Norway, Pakistan, Russia, South Africa, Tanzania, Zambia, Zimbabwe (Sandawana). Historical reports about emeralds in and from India are today believed to be referring to Colombian emeralds that found their way to India via trading with the Spanish. The long-exhausted mines in Egypt have been known since 3500 B.C., which

makes them the oldest known emerald mines.

Commercially relevant emerald producing countries today are mainly Brazil (15% of world market), Colombia (50% of world market), and Zambia (Kagem mine, Gemfields, 25% of world market), with lesser production volumes emanating from Afghanistan, Ethiopia, and Pakistan.

Most Colombian emeralds are exported to the US (> 50%). Japan is also a very important market. In recent years, demand from China has been on the rise, boosting emerald prices. Europe plays a relatively small role in terms of direct exports from Colombia, but may end up buying in the secondary market through Hong Kong, Thailand, and the US.

Fact Box: Gemological Properties of Emeralds

Chemical Composition: $\text{Be}_3\text{Al}_2(\text{Si}_6\text{O}_{18})$
Crystal: Hexagonal
Pleochroism:
green, blue-green, yellow-green
Transparency:
transparent to intransparent

Hardness: 7^{1/2} - 8 on the Mohs Scale
Density: 2.67 - 2.78 g/cm³
Refractive Index: $n_e = 1.562 - 1.593$
 $n_o = 1.568 - 1.604$
Maximum Birefringence: -0.004 to -0.010



What makes Colombian Emeralds Special?

Normally, emeralds are formed in a (contact-)metamorphic process. Colombian (and Afghan) emeralds have formed in hydrothermal conditions. This makes them a rare exception!

The Cordillera Oriental, where the Colombian emerald mining region is located, is a mountain range that is composed mainly of folded and faulted marine sediments and older schists and gneisses. The mountain range used to be the bottom of a seabed that was folded upwards by the collision of the Nazca-Cocos oceanic plate with the South American continental plate! This gave rise to a hydrothermal process, which uniquely resulted in the formation of emeralds: hydrothermal brine and water infiltrated the numerous vertical cracks and fault lines as a result of pressure, solving numerous elements including chromium and vanadium from the organic-rich sedimentary formations of grey and black shale. This took place at relatively low temperatures (300-400 degrees celsius). When the temperature decreased, the solution settled and emerald began to crystallise within the brine veins and cavities, along with other minerals such as calcite, quartz, albite, and pyrite. These veins look almost bleached in contrast to the rest of the black shales, which is why the miners call these areas "cenicero" (ashtray).

When emeralds form in a contact-metamorphic process, this exerts considerable pressure and stress on the crystals during and after genesis. As a result, these emeralds have fractures and are quite included. Since Colombian emeralds resulted from a hydrothermal process and crystallised relatively undisturbed in veins and cavities, they were

subjected to less stress and pressure. As a result, the crystals can be relatively big, they are homogenous and have fewer fissures and inclusions. In contrast, Brazilian emerald crystals, for example, tend to be more included and display more cracks and fissures.

A typical geological fingerprint of Colombian emeralds is found in the form of three-phase (gas-liquid-solid) inclusions. During the crystallisation process, fluid solutions which played such a big part in the formation of the emeralds became trapped in tiny cavities. As temperature and pressure decreased, gases and elements came out of solution and remain today as a three-phase inclusion. The presence of salt crystals within fluid inclusions in all Colombian emeralds indicates the extremely high salinity of the emerald-forming solutions.

As a result of the special conditions during their formation, Colombian emeralds are naturally clearer and contain mainly chromium, moderate levels of vanadium and almost no iron, giving them a vibrant, beautiful, green colour tone with a hint of blue - which is so desirable. Nature's perfection. Hence, the magic of Colombian emeralds.

Trace amounts of iron will tint emerald a bluish green or a yellowish green colour depending upon its oxidation state. In addition, the presence of iron in the beryl structure lessens the fluorescence, causing the emerald's colour to appear less intense/vibrant.

Emeralds from Zambia have a high iron content, giving them a dark-green / blueish green colour. In addition, Zambian emeralds



contain inclusions of phlogopite mica, which is dark in colour and absorbs light. This often results in Zambian emeralds having a dull appearance and complete lack of brilliance.

Brazilian emeralds typically tend to have a yellow hue, or a more 'grass-green' colour, also due to the presence of iron and they generally contain more fissures and inclusions. However, it is especially the yellow hue that is deemed undesirable.

Colombian emeralds can form relatively large crystals of high transparency and quality, which means that large, fine-quality emeralds often come from Colombia. Big emerald crystals can also be found in other locations such as Zambia or Brazil, but these tend to be less uniform in quality, with only partial transparency.

Every now and then, high quality Afghan emeralds hit the market. They are comparable in quality to Colombian emeralds. There have also been reports of high quality Russian and Ethiopian emeralds, but the amounts are too small to have an impact on the market. While Brazilian and Zambian emeralds are often 30-50% cheaper than Colombian emeralds, these countries occasionally also produce very high quality emeralds. Any gemstone of quality will command a high price, regardless of its specific origin.



"Special Effects"

The Trapiche emerald is a rare special natural phenomenon which almost exclusively occurs in Colombian emeralds. "Trapiche" is the Spanish name for the sugar cane presses that were used widely in the country. Trapiche Emeralds have a cog-wheel-like core with spokes. They occur mainly in the Muzo area, but also in the Eastern region (Chivor). Trapiche emeralds are found in the shale surrounding the "cenicero". They are some of the rarest gemstones in the world, highly desired by collectors.



Geographical Location of Colombian Emerald Deposits



The emerald deposits in Colombia are located in the Cordillera Oriental which formed during the Cretaceous period. Mining takes place primarily in the province of Boyaca, but also in Cundinamarca and Santander. Two main areas of mining can be distinguished, due to the different properties of emeralds found there.

The mining region of Muzo is situated to the North-West of Bogota, in the valley of the Rio Minero and its contributor, Rio Itoco. This is the largest emerald district in Colombia, and it is the most productive and well-known emerald mining region in the world. It is important to note that - contrary to popular belief, Muzo is not one single mine. It rather refers to dozens of mining operations in the vicinity of the town of Muzo. The region

comprises the mines of Cosquez, Cunas, El Chulo, La Pita, Peñas Blancas, Puerto Arturo, Santa Barbara, Tequendama, Yacopí and others. Already mined during pre-hispanic times, they provide sometimes very fine qualities of emeralds of evenly distributed deep green colour. Emeralds here have formed in black carbonaceous shale and limestone shale rock. The emerald-containing veins are composed of calcite, quartz, dolomite, baryte and pyrite.

The second main area is the region of Chivor, to the North-East of Bogota, where emeralds are discovered in grey calcareous shale rock. The emerald-containing veins here are mainly albite and pyrite and to a lesser extent calcite. The mines of Buenavista, Gachalá and Macanal are found



in the same region. Compared to Muzo emeralds, Chivor stones tend to have a less intense green colour, but they have fewer inclusions. This results in a high clarity and brilliance. The colour typically exhibits a marked blueish hue, an electric colour that is reminiscent of Paraíba tourmalines or mint tourmalines. The lack of inclusions makes Chivor emeralds more stable than Muzo emeralds. These mines also pre-date the arrival of the Spanish in Colombia.

The Chivor deposits are thought to date from around 65 million years ago, while the deposits around the Muzo region are thought

to be a bit younger - only 30 to 40 million years.

Emeralds in Colombia are very difficult to mine. They sit in small veins that are difficult to track and follow due to tectonic ruptures and fault lines. Concentration and quality of emeralds in these veins vary significantly. Mining production in any of the Colombian mines is sporadic, due to the unpredictable nature of the emerald deposits. While modern geological prospecting can be helpful, the business still depends to a good degree on luck. Sometimes, a mining operation may go for years or months without finding

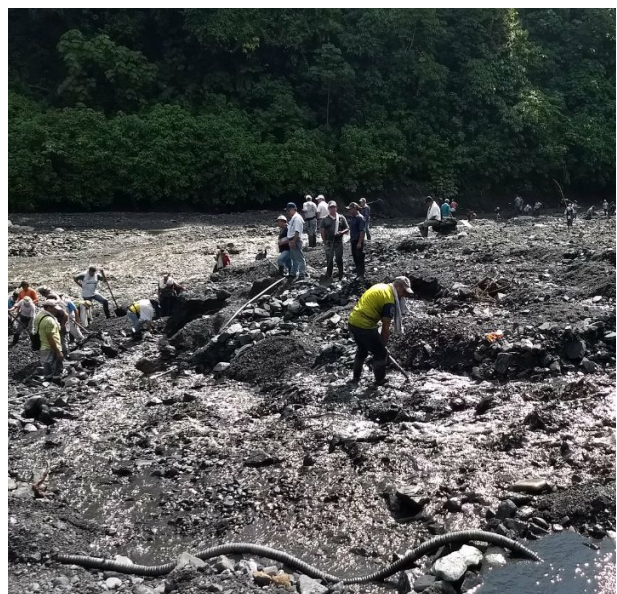


Mining in Colombia (left)

Emerald mining activity is regulated by the government, which awards licenses through the National Mining Agency. Business models between the roughly 400 registered mines differ: The big mines of Puerto Arturo and Cosquez are leased out for a fixed period of years. Many mines are on private land/property, but also require a license. The traditional model has been to have one major license taker who sub-license concessions, or a mine could be run by a cooperative. The size of operations varies considerably, from just a few people to thousands of employees. Historically, a few big families have dominated the industry, but the arrival of foreign multinationals is changing the face of mining in Colombia.

Guaqueros (right)

Guaqueros is the name given to informal miners. They often come from poor families from the region or have come to the area in the hope of finding fortunes. Guaqueros sift through rock discarded from the mines, dig up the riverbed or dig illegally on public land. It is tradition for the mines to offload the rubble extracted from the mines into the riverbed, for the Guaqueros to wash. While an informal activity, this provides a living to whole communities. When a guaquero finds an emerald, he can either try to pay a cutter to re-work and increase the value of the gemstone, or he could sell it to a merchant who trades the gems directly on the streets of Bogota. In the '90s, there were roughly 10,000 guaqueros in the area around Cosquez, apart from 3000 mine workers. Recently, the government has been making efforts to formalise mining and move people into agriculture.





significant emerald pockets. Geologically, there is no way of estimating the existence of emeralds. The two possibilities are to either follow a vein or extract the whole rock formation and sift through huge amounts of rubble in the hope of finding emeralds.

Environmental Considerations

Contrary to gold mining, emerald mining does not involve harmful chemicals and there is no contamination of soil and water through toxins. Open pit mining, which has an adverse effect on the landscape, has been banned in Colombia for considerable time. The tunnels dug by the workers do not leave scars in the landscape. In order to obtain a mining license, operators have to submit an environmental assessment, therefore ensuring that standards are met and no harm is done to one of the most biodiverse countries on earth.

Mining in Colombia is largely artisanal and, since open pit mining is banned, miners dig tunnels into the mountain and try to follow the veins and fault lines. In contrast to that, production in Gemfield's Zambian Kagem mine is heavily mechanised. It takes place in a huge open pit mine with the use of heavy machinery, leading to loss and breakage. The focus there is on quantity rather than quality. Some Brazilian mines, like Belmont, also employ the use of heavy machinery and some state-of-the art scanning equipment to detect emeralds among the rubble extracted.

While the old Muzo mine (Puerto Arturo, now owned by MTC) is famous, Cosquez (now owned by Fura Gems Inc.) was in the 90s the only mine that had a continuously high level of production. In the late 90's Muzo only contributed 15% to the total Colombian emerald production, while Cosquez

accounted for 75%. Chivor had a share of only 10%. These proportions have frequently changed over time. More recently, La Pita, Cunas and Peñas Blancas have contributed sizeable production.

Since middle of the 90s the emerald production in Colombia has reduced. The reasons for this are diverse in nature, but one of the main contributing factors is that in existing mines, artisanal mining methods are reaching their limits and a modernisation is required to reach areas deeper inside the mountains. This required large amounts of capital, that small mining companies do not have. The government is encouraging foreign companies to invest in the sector and bring capital and knowledge to the country. Another important reason is that the mining region has been inaccessible for many decades and not many new mines have been discovered or opened since the period of the Conquista. It is estimated that 80% of Colombian emerald wealth is still untouched under ground.

Responsible mining is of high importance in today's society and buyers want to know that their gemstones come from responsible sources. Colombia is not a perfect place, but it should be noted that all people working in the mines do so voluntarily. Plenty have in the past made a fortune doing so. There is no child labour in Colombian mines. There are workplace safety regulations and people handling explosives must have completed an army safety course. Companies are required to pay a minimum wage. Small scale mining provides a living to thousands who would otherwise not have a source of income.



Emerald Quality Factors

The value of a coloured gemstone is, of course, established by supply & demand. But what factors influence these two sides of the equation?

The coloured gemstone market is very different from the more familiar diamonds market:

The market for diamonds has been characterised by relative stability, not at least because it is dominated by a number of big players who manage supply and keep demand stable by investing significantly in marketing. Diamonds are sorted and standardised, and thus almost have become commoditised, with transparent prices associated to each quality grade.

In contrast, the supply of coloured gemstones depends on mining success, which can be unpredictable and a matter of pure luck. Emeralds are twenty times rarer than diamonds. Moreover, only one third of Colombian emeralds is worth cutting and polishing into gemstones. While diamonds are by far the most popular gemstone, the relative rarity of emeralds makes them one of the most expensive gemstones, achieving prices often in excess of those of diamonds. It is impossible to have normalised coloured gemstone qualities - the rough gemstones are just too different in origin, colour, clarity, size and shape. In coloured gemstones, demand is much more dependent on market trends and perception of beauty. Prices fluctuate accordingly.

Ultimately, the value of emeralds is determined by the combination of relative beauty and rarity. As an example: gem quality material makes up 1% of production of

faceted Colombian emeralds. Add to that the material not worth polishing, stones of gem quality are believed to be 1 in 1000 - and extremely expensive!

It is often said that beauty is in the eye of the beholder. Lighter greens, for example are more common and less expensive, yet culturally, they are preferred in Italy or in China. Some prefer an emerald with visible inclusions and character to one that is clean, yet that gemstone will not be priced highly as it is relatively common to have included emeralds.

Some objective criteria in judging beauty and rarity of faceted coloured gemstones can be found in the 4Cs that are also relevant for diamonds:

Colour, Clarity, Cut, and Carat Weight.

Before exploring these four criteria in the following section, it is worth mentioning, that other factors also play a role in establishing price, for example:

- Exchange rates can be a big factor in a purchase.
- Origin: Colombian emeralds are associated with the unique history of the country and its legendary mines. Beyond beauty, buyers are prepared to pay a premium for being a part of that story.
- Cost of extraction: the tunnel mining in Colombia is much more expensive than the open pit mining in Zambia, thereby increasing the cost of rough emeralds.



1. Colour

Colour is by far the most important criteria in judging the value of an emerald. The colour quality - and hence the price of an emerald - can comprise a wide range. Coloured gemstones pricing is often seen as a bit of a mystery by outsiders and even experienced jewellers find it confusing that seemingly tiny differences in colour tone can result in large differences in price.

The green colour in emeralds is caused by traces of chromium and vanadium. It is the concentration and combination of these elements that gives emeralds their characteristic colour and that can lead to very different hues and intensities of colour.

Chromium is the most important and most frequent colour giving element in emeralds. Often, vanadium is also present, sometimes in equally big or higher concentrations. The colour resulting from the presence of iron is a combination of yellow and blue and the presence of iron will often give emeralds a slightly blue hue (Zambia), or yellow hue (Brazil).

Colombian emeralds are deemed to be the most desirable due to their colour tone, a soft deep pure green with a slight blue hue and no grey at all that would reduce their intensity. They contain chromium and vanadium in varying concentrations, and almost no iron.

Intensity and purity of colour: A strong green colour is far less common, hence more rare and priced more highly, than a pale green. A yellow or blue hue diverge from the ideal emerald colour and will result in lower value. Tiniest nuances, depending whether an additional hint of yellow or blue is present can, together with colour saturation, result in

a price difference of thousands of dollars (per carat!).

Note: Interestingly, despite having a less intense colour, Chivor emeralds are often prized highly by Chinese buyers looking for the clean, bright material sought after in that market.

Within rough gemstones, one can often find areas of concentrated or uneven colouring. With rough emeralds, the green colour is often more intense on the outside of a rough crystal and less intense on the inside, or the rough may be only partially coloured. Evenness in colouration of a faceted gemstone is a key beauty criteria affecting valuation.



Colombian Sugarloaf emerald with a perfect green colour

Colour zoning (distinct dark and light areas within a gemstone, or different hues within a gemstone) will lower the beauty grade and significantly diminish the value of a gemstone.

The light source is very important when judging colour quality. There are three types of light sources: daylight, incandescent light from a light bulb, and fluorescent light. Indirect daylight is known as white light.



Direct sunlight in the morning or afternoon has a slightly red tone, similar to incandescent light of a normal light bulb or halogen light. The majority of fluorescent lamps emit a white-blueish light, low in red and green tones. Diamonds are best bought in indirect daylight. Sapphires, on the other

hand, are best appreciated under fluorescent light. Emeralds are best viewed in indirect daylight or incandescent light. In Bogota, buyers preferably trade in the morning. If there is a north facing window, these offices are very popular.

Colour Grading

Two approaches to a grading system for emeralds deserve a mention:

The Gemological Institute of America (**GIA**) has developed a helpful colour grading system for the assessment of colour. The GIA's colour description of gemstones is based on the three attributes hue, tone (the lightness or darkness of the colour), and saturation (the degree of intensity of the colour).

Hue (here the relevant part for emeralds only!) starts goes from Yellow-Green / Green-Yellow to Green-Blue / Blue-Green, via the intermediate steps strongly yellowish Green, yellowish Green, slightly yellowish Green, Green, very slightly bluish Green, bluish Green, very strongly bluish Green:



Tone is alluded to as the shade, or tint of a shading. Each of the 31 hues exists in a range of tones from almost colourless to almost black (0 = appears colourless, 1 = extremely light, 2 = very light, 3 = light, 4 = medium light, 5 = medium, 6 = medium dark, 7 = dark, 8 = very dark, 9 = extremely dark, 10 = appears black), as can be seen below:



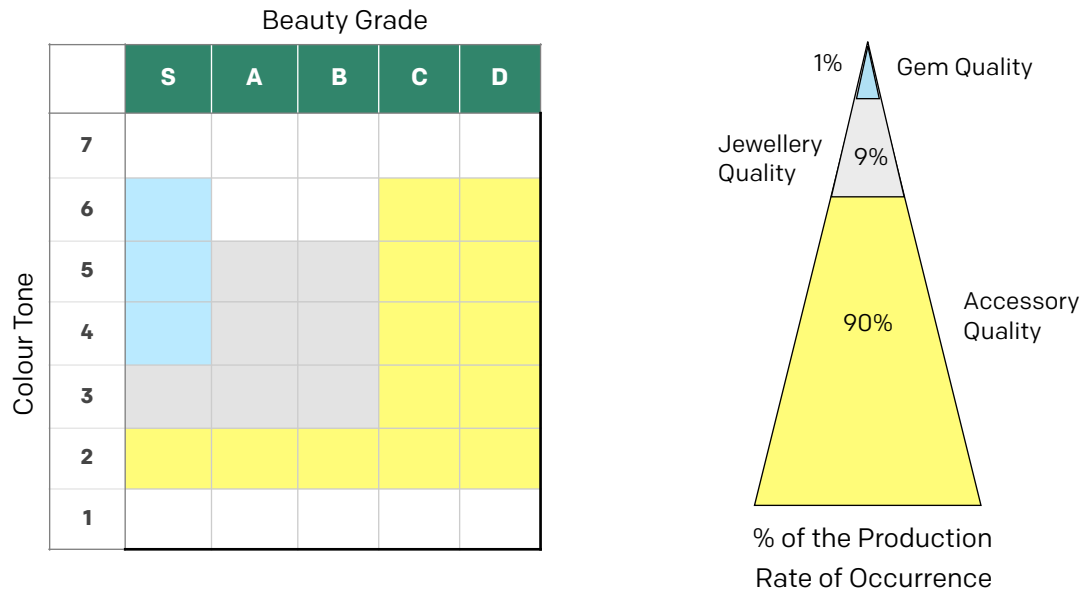
Saturation is how much colour intensity the gem has, from greyish, via slightly greyish, very slightly greyish, moderately strong, strong, to vivid. Saturation is also where any additional colours such as those due to colour change, pleochroism, colour zoning, etc are noted. Saturation has a moderate to strong effect on appearance.

Another approach has been introduced by **Yasukazu Suwa**. Suwa categories gemstones in a matrix, according to their colour tone (7 categories from extremely light to dark) and a five-step scale of beauty grades (S = Brilliant and especially beautiful, A = Very beautiful, B = Beautiful, C = Somewhat lacking in beauty, D = Lacking in beauty). He then divides emerald qualities into three groups: Accessory Quality, Jewellery Quality, and Gem Quality. These groups are completely different in terms of beauty and rarity. He establishes a grid-like system for grading emeralds according to beauty grade, colour intensity and rate of occurrence.



90% of the production is Accessory Quality, with pale colouration, low transparency, or many inclusions. There is abundant material of these qualities, which, additionally, are not very appealing looking and hence less desirable. As a result, prices can be rather low. 9% of the production tends to be Jewellery Quality, and even within this band, we can notice a marked increase in pricing. Gem quality emeralds have exceptional colour saturation and high clarity. They command a significant premium over regular emeralds and are destined for collectors, or high jewellery for the ultra-rich.

Grading System According to Suwa



2. Clarity

All emeralds contain fissures and inclusions that form during the process of genesis of the gemstone. Only the finest qualities of emeralds have few inclusions and high brilliance. The inclusions are referred to as "Jardin" (from French: garden) and give each gemstone a unique character and allure. They are also a proof of natural origin of the gemstone. When the light travels through the gemstone, inclusions scatter the light that travels through the emerald, giving it a velvety richness. As long as there are not too many inclusions, these are not deemed to be defects. However, those that have a negative effect on beauty or durability are considered flaws. The

main factors that might lower the beauty grade of emeralds are low transparency and an abundance of inclusions.

An abundance of inclusions will negatively impact stability of the gemstone and obstruct light from passing through the gemstone. This could result in a dull appearance or grey marks that are deemed undesirable. Most of the time, some inclusions are visible and eye clean emeralds are rare. Normally, a loupe with 10x magnification is used to examine gemstones. Gemstones, where inclusions are clearly prominent and visible, even without magnification, have a considerably lower



value. Poor-quality emeralds are usually cut as cabochons or beads. The absence of inclusions and resulting high brilliance and transparency is relatively rare, hence making such stones more desirable and valuable.

In addition to inclusions, emeralds have surface-reaching fractures. The presence or absence of surface reaching fractures is a key factor in judging quality of emeralds. When they are located near the corners or across facets, they can be a source of instability. In addition, surface-reaching fractures are the means by which stones are oil-treated: The fractures are filled with a colourless oil or resin, making fractures less visible and enabling light to travel unimpeded through the gemstone. Nearly all emeralds are treated to improve their appearance. This practice has been common since the times of the ancient Egyptians and it is widely accepted.

Heavily treated gemstones may appear of deceptively high quality, which is why it is recommended to have valuable emeralds certified by a reputable laboratory. The more fissures and inclusions are present, the more the gemstone's appearance will be improved by the oiling process. On a scale that goes from "no oil", via "insignificant", "minor", "moderate", "significant" to "very significant", a normal emerald would be expected to exhibit "moderate" evidence of clarity enhancement. Finer qualities have minor, or insignificant classifications which can increase their price significantly. "No oil"-emeralds are the finest quality and command much higher prices, provided the colour is right. Surface-reaching fractures on the table of the emerald is a definitely value-reducing feature, because any deterioration in the filler would immediately be visible to the naked eye.

Note that laboratories will not normally indicate whether resins or oils have been used, but only the degree to which the gemstone has been treated (or, in other words, the degree to which its appearance may deteriorate over time). This is because treatments are reversible and the oil/resin could be altered after certification. All filling materials will deteriorate over time, making a renewed oiling necessary.



Emerald viewed in a dark-field loupe with 10x magnification

Unlike heat or radiation treatments on other gemstones, ALL emerald treatments are reversible! The treatment of emeralds is covered in more detail in a separate publication (Monteverde Emeralds Report - Treatment of Emeralds).

Note: Never clean emeralds with acetone, vapour, soap, or in an ultrasonic bath! The former may impact the clarity enhancement while the latter may break the gemstone. Emeralds are best cleaned with a water-dampened, soft cloth. Common sense indicates it is not a good idea to wear an emerald ring during gardening or other intense physical activity.



3. Cut

Cut refers to the accuracy of the angles, proportions, symmetry and polish of the emerald. Facets give gemstones a three-dimensional effect, resulting in darker and lighter tones and brilliance, from refraction and reflection of light from the facets. A sloppy cut with mistakes and bad finish can negatively impact the price of the emerald. Having said that, a bad cut can potentially be corrected with relatively little effort, and its impact on valuation is therefore by far not as important as that of Colour and Clarity.



How the ultimate gemstone will look, depends on the rough material and the cutter will try to cut the rough in such a way to bring out the best in the emerald (not too dark, not too much light). The cut should be proportional and symmetric, without any facet misalignment. The polishing should display exceptional brilliance and luster, there should not be any polishing marks. As few

surface-reaching fractures as possible should be on the table of the gemstone. The gemstone's table should not be too small (darker gemstone), nor too big (lighter). The emerald should look balanced: A deep pavilion is undesirable, as is a very shallow pavilion, as neither will optimally reflect the light. Moreover, an emerald with a deep cut appears small relative to its weight (and price!). So you might end up with an emerald that costs as much as a 2ct emerald, but only has the visual appearance of a 1-carat emerald.

Cutting and polishing emeralds is a difficult task for skilled experts. The Colombian emerald industry has profited significantly from having maintained a sizeable domestic cutting industry that meets the highest international standards. Most Colombian emeralds are cut in the country, and Bogotá's cutters are considered the global experts on cutting emeralds. In contrast, Zambian and Brazilian emeralds are often cut in India or Thailand.

The most popular cut for emeralds is the Emerald Cut. This is an octagonal, step-cut style, whereby the corners are truncated in order to protect the most vulnerable parts of the gemstone from exposure.

Beyond judging the pure quality of the cut, it is important to understand and know some background about cutting and how cutting can affect pricing. Buying rough gemstones is always risky, as you do not know for certain how the interior of the rough will look. When a rough gemstone yields very little good material, or a lot of breakage is incurred during cutting, traders unwilling to materialise losses will sell these stones at higher prices, so that two seemingly very



similar stones may have different prices as a result of the buying and cutting process.

70% of rough may be lost in cutting a faceted emerald. Rough Colombian emeralds often display colour concentrated near the surface of the crystals and Colombian emerald rough tends to have a relatively high value. Colombian emeralds are cut to preserve these areas. This does not have to be a fault, but as a result of this

practice, there are some poorly shaped stones in the market (Ringsrud). Zambian rough or Brazilian rough is much cheaper and hence it costs less to incur a weight loss in order to arrive at a perfectly cut gemstone.

When cutting round emeralds, more material is lost (simply put, the corners have to be cut off), therefore round emeralds tend to be more expensive per carat.

4. Carat Weight

It is unusual to find large emerald crystals, big enough to yield large faceted emeralds, hence the relative rarity of finding a 15 carat emerald versus a 1 carat emerald makes its price increase exponentially. There is no exact conversion table, as prices vary according to demand and supply and also differ for the different qualities of emeralds. As a rough guide, expect to pay 2x-4x as much per carat for a 3ct emerald, compared to a 1ct emerald. For a 5-6ct emerald, this ratio could be 4x-8x. When it comes to 10ct emeralds and bigger,

these are so unique, that they are in a sphere of their own. Per carat prices could be 10x-25x the price of a 1ct emerald of equivalent quality.

Note: Larger gemstones will appear darker or exhibit a deeper tone of green than a smaller stone of the same colour.

“The degree of transparency and depth of colour, overall appearance and shape , lack of or presence of inclusion interact with each other to create the overall beauty of a gemstone.”¹

“There is a unique liveliness in the best Colombian emeralds - a green fire - that is instantly recognisable and highly desirable.”²

¹ Gemstones: Quality and Value, Volume 1, Yasukazu Suwa, Revised English Edition, Sekai Bunka Publishing, 2005

² Emerald: Twenty-One Centuries of Jewelled Opulence and Power. Thames & Hudson, 2016.



EMERALDS, QUALITY & VALUE - SUMMARY

- ❖ **Emeralds are extremely rare and in top qualities, they are one of the most expensive gemstones.**
- ❖ **Colombian emeralds are unique, because they formed in a hydrothermal process, not a (contact-)metamorphic process.**
- ❖ **The quality of an emerald depends mainly on colour, then clarity, cut and carat weight.**
- ❖ **Emeralds are coloured green by the trace elements chromium and vanadium. The presence of iron can result in a blue or yellow hue.**
- ❖ **Colombian emeralds have the ideal colour (intense medium dark green with a slight blue hue) and they are the yardstick for all other emeralds. A near absence of iron means the emerald appears more vibrant.**
- ❖ **Muzo and Chivor are the two main mining areas. Mining goes back over 1000 years. Chivor has lighter green hues, slightly more blue and great transparency.**
- ❖ **Inclusions are common in emeralds, but too many of them are considered a flaw. Oiling is an accepted practice.**
- ❖ **90% of Colombian emeralds are accessory quality, 9% jewellery quality and only 1% gem quality, explaining why prices increase exponentially for good qualities.**

Factors Affecting Beauty	Desirable	Undesirable
Colour	Intense green with a medium dark tone, slightly blue hue, vivid colour, little grey. Green fire, fluorescence (little iron).	Yellow hue (Brazil), too dark (Zambia), colour zoning, weak coloration, dull colour (high iron content)
Clarity	Few inclusions or surface reaching fractures, high transparency and brilliance, little oil treatment	Abundance of inclusions, visible inclusions, dark inclusions (Zambia) opacity (Brazil, Zambia), Surface reaching fractures, significant treatment
Cut	Proportional, symmetric, balanced, good reflection & brilliance	Asymmetric, too deep, too flat, table too small or large, polishing marks, irregular facets



MONTEVERDE
EMERALDS



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